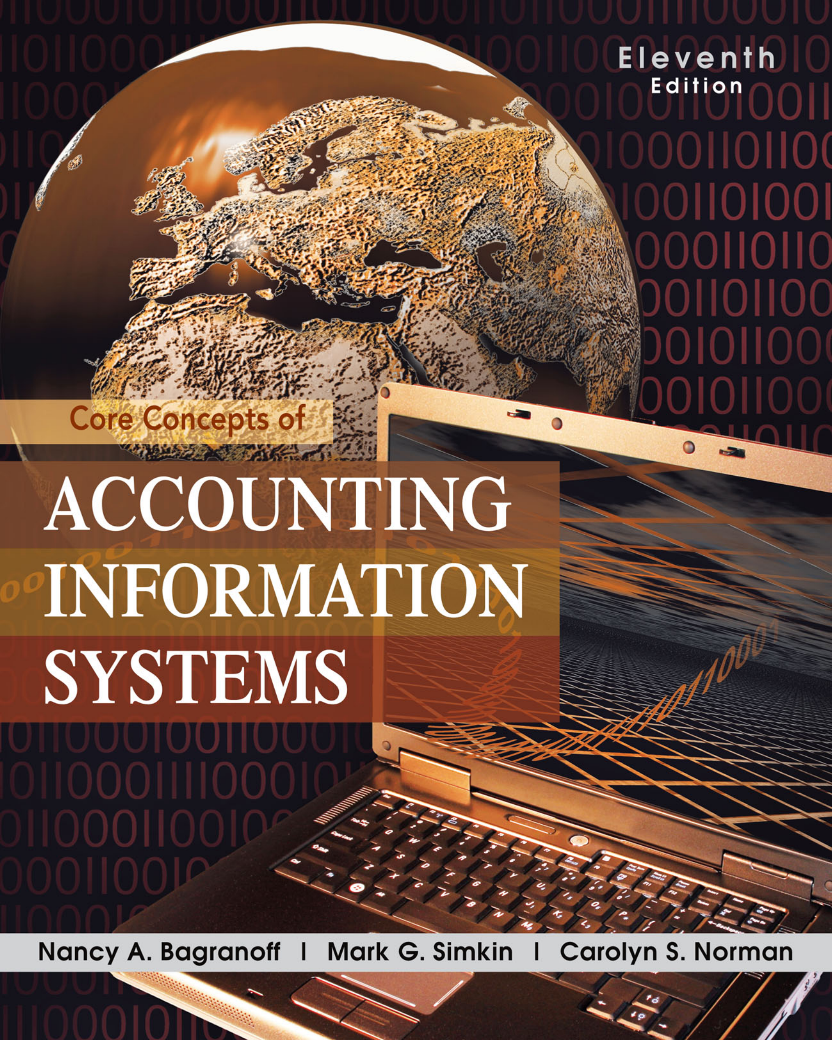

Eleventh Edition

Core Concepts of

ACCOUNTING INFORMATION SYSTEMS

Nancy A. Bagranoff | Mark G. Simkin | Carolyn S. Norman

CORE CONCEPTS OF
Accounting Information Systems

Eleventh Edition

Nancy A. Bagranoff, DBA
Professor
Dean, College of Business and Public Administration
Old Dominion University

Mark G. Simkin, Ph.D.
Professor
Department of Accounting and Information Systems
University of Nevada

Carolyn Strand Norman, Ph.D., CPA
Associate Professor
Department of Accounting
Virginia Commonwealth University

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For Larry (Nancy Bagranoff)

In memory of my father, Edward R. Simkin (Mark G. Simkin)

Thank you to my students—especially the Spring 2009 class who helped select our cover design (Carolyn Strand Norman)

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ABOUT THE AUTHORS

Nancy A. Bagranoff received her A.A. degree from Briarcliff College, B.S. degree from the Ohio State University, and M.S. degree in accounting from Syracuse University. Her DBA degree was conferred by The George Washington University in 1986 (accounting major and information systems minor). From 1973 to 1976, she was employed by General Electric in Syracuse, New York, where she completed the company's Financial Management Training Program. Dr. Bagranoff passed the CPA examination in the District of Columbia in 1982. She spent fall 1995 as Faculty in Residence at Arthur Andersen where she worked for the Business Systems Consulting and Computer Risk Management groups. Professor Bagranoff has published several articles in such journals as *Journal of Information Systems, Journal of Accounting Literature, Computers and Accounting, The Journal of Accounting Education, Behavioral Research in Accounting, Journal of Accountancy*, and *The Journal of Accounting and EDP*. Dr. Bagranoff is also co-author of *Core Concepts of Consulting for Accountants* and *Core Concepts of IT Auditing*. She is currently Professor of Accounting and the Dean of the College of Business and Public Administration at Old Dominion University. She was formerly President of the Information Systems section and Vice President—Education, of the American Accounting Association. She is currently the President of the American Accounting Association.

Mark G. Simkin received his A.B. degree from Brandeis University and his MBA and Ph.D. degrees from the Graduate School of Business at the University of California, Berkeley. Before assuming his present position of professor in the Department of Accounting and Information Systems, University of Nevada, Professor Simkin taught in the Department of Decision Sciences at the University of Hawaii. He has also taught at California State University, Hayward, and the Japan America Institute of Decision Sciences, Honolulu; worked as a research analyst at the Institute of Business and Economic Research at the University of California, Berkeley; programmed computers at IBM's Industrial Development—Finance Headquarters in White Plains, New York; and acted as a computer consultant to business companies in California, Hawaii, and Nevada. Dr. Simkin is the author of more than 100 articles that have been published in such journals as *Decision Sciences, JASA, The Journal of Accountancy, Communications of the ACM, Interfaces, The Review of Business and Economic Research, Decision Sciences Journal of Innovative Education, Information Systems Control Journal*, and the *Journal of Bank Research*.

Carolyn Strand Norman received her B.S. and M.S.I.A. degrees from Purdue University and her Ph.D. from Texas A&M University. Dr. Norman is a Certified Public Accountant, licensed in Virginia. She is a retired Lieutenant Colonel who was a management analyst with the United States Air Force. At the Pentagon, she developed compensation and entitlements legislation, working frequently with House and Senate staffers. Prior to assuming her current position, Dr. Norman taught at Seattle Pacific University where she co-authored the book, *XBRL Essentials* with Charles Hoffman, and was selected as Scholar of the Year for the School of Business and Economics. Dr. Norman has published more than 40 articles in such journals as *Behavioral Research in Accounting, Journal of Accounting and Public Policy, Journal of Information Systems, Advances in Accounting Behavioral Research, Issues in Accounting Education, Journal of Accounting Education*, and *Research in Government and Nonprofit Accounting*.

PREFACE

Information technologies impact every aspect of accounting, including financial reporting, managerial accounting, auditing, and tax. The nature of the work done by accountants continues to evolve as these technologies advance. For example, less than 30 years ago, accountants could have spent much of their day footing ledgers and making hand calculations. Today, of course, accountants use the many helpful functions in spreadsheet software, and update or change calculations instantly, instead of the days it would have taken with paper and pencil. Internet technologies continue to change the way accountants do things. And because most accounting systems are now computerized, accountants must understand software and system processes to effect and evaluate systems of internal control. Business and auditing failures continue to force the profession to emphasize internal controls and to rethink the state of assurance services. As a result, the subject of accounting information systems (AIS) will continue to be an important part of the new vision of the accounting profession.

The purpose of this book is to help students understand basic AIS concepts. Exactly what comprises these AIS concepts is subject to some interpretation, and is certainly changing over time, but most accounting professionals believe that it is the knowledge that accountants will need for understanding and using information technologies and for knowing how an AIS gathers and transforms data into useful decision-making information. In this edition of our textbook, we include the core concepts of accounting information systems indicated by chapter in the table below. The book is flexible enough that instructors may choose to cover the chapters in any order.

ACCOUNTING INFORMATION SYSTEMS
COURSE CONTENT AREA COVERAGE

Content Area	7,8,9
AIS Applications	7,8,9
Auditing	14
Database Concepts	4,5,6
Internal Control	10,11,12
Management of Information Systems	1,2,13
Management Use of Information	1,3,7,8,9,15
Systems Development Work	13
Technology of Information Systems	2, All
Use of Systems Technology	All

About This Book

Despite the commonality of subjects in the AAA study, the content of AIS courses continues to vary widely from school to school. Some schools, for example, use their AIS courses to teach accounting students how to use computers. In other colleges and universities, the course focuses on business processes and data modeling. Other courses emphasize transaction processing and accounting as a communication system, and have little to do with the technical aspects of how underlying accounting data are processed or stored.

Given the variety of objectives for an AIS course and the different ways that instructors teach it, we developed a textbook that attempts to cover only the core concepts of AIS. In writing the text, we assumed that students have completed basic courses in financial and managerial accounting and have a basic knowledge of computer hardware and software concepts. The text is designed for a one-semester course in AIS and may be used at the community college, baccalaureate, or graduate level.

Our hope is that individual instructors will use this book as a foundation for an AIS course, building around it to meet their individual course objectives. Thus, we fully expect that many instructors will supplement this textbook with other books, cases, software, or readings. The arrangement of the chapters permits flexibility in the instructor's subject matter coverage. Certain chapters may be omitted if students have covered specific topics in prior courses.

Part One introduces students to the subject of AIS. In the first chapter, we lay the basic foundation for the remainder of the text and set the stage for students to think about the high degree of technology that is common to the accounting profession. This chapter also includes a section on careers in AIS so that students can understand the career paths that combine accounting with the study of information systems. Students taking the AIS course may or may not have had an earlier course in information technology. Chapter 2 allows those who did not have such a course to learn about the latest technologies and emphasizes their use in accounting. For students who have had earlier courses in computers and/or information systems, this chapter serves as a review. Chapter 3 is about systems documentation, a matter of critical importance to the success of an AIS and also to the understanding of an accounting information system. This chapter describes the various tools that accountants can use to document an AIS for their own and others' understanding of information flows.

Part Two discusses databases and data modeling. Chapter 4 begins our coverage by discussing database concepts in general, describes the steps required to create database tables and records, and emphasizes such database concerns as security, privacy, and concurrency. This chapter also responds to increasing instructor interest in teaching the REA approach to data modeling. Chapter 5 continues these discussions, focusing on such topics as normalization, and using Microsoft Access to illustrate uses of data definition languages and data manipulation languages. Chapter 6 continues the discussion of how to use Microsoft Access to develop database forms and reports. This chapter is more ''how to'' than the other chapters in the book and it allows the instructor to guide students with hands-on experience in using software to implement the database concepts they have learned.

Business processes and software solutions for improving those processes are gaining in importance in today's businesses. Chapters 7 and 8 discuss several core business processes and highlight a number of Business Process Management (BPM) solutions that are currently available in the marketplace. Instructors who focus on transaction cycles in their AIS courses may choose to use supplemental pedagogical tools, such as software and practice sets, to cover this material in more depth. In Chapter 9 we discuss accounting and enterprise software, also providing advice in AIS selection.

Part Four is an overview of the value of internal controls and the consequences when controls are not developed (or are weak). Chapter 10 focuses on computer crime, ethics, and privacy to help students understand the need for internal controls. The next two chapters introduce the students to internal controls that are necessary at each level of the organization. Although the subject of internal control appears repeatedly throughout the book, we examine this subject in depth in Chapters 11 and 12.

The last section of the book examines special topics in AIS. Recognizing that some students in current AIS courses may have taken a prior course in management information systems (MIS) and thus are already familiar with systems development topics, the emphasis in Chapter 13 is on the accountant's role in designing, developing, implementing, and maintaining a system. Information technology auditing is an increasingly important field and represents a great career opportunity for students who understand both accounting and IT. Chapter 14 extends our coverage of internal controls to the general subject of auditing in an IT environment. Finally, although we have integrated Internet technology throughout this book, its influence on accounting information systems is so great that we devoted a special chapter to it. Chapter 15 provides a basic overview of Internet concepts, discusses financial reporting on the Internet, including an expanded section on XBRL, explores the accounting components of ecommerce, and covers the issues of privacy and security.

Special Features

This edition of our book uses a large number of special features to enhance the coverage of chapter material as well as to help students understand chapter concepts. Thus, each chapter begins with an outline and a list of learning objectives that emphasize the important subject matter of the chapter. This edition of the book also includes more real world cases-in-point, which are woven into the text material and illustrate a particular concept or procedure. Each chapter also includes a more-detailed real-world case or concept in an end-of-chapter *AIS-at-Work* feature.

Each chapter ends with a summary and a list of key terms, and also includes multiple-choice questions for self-review with answers, and three types of end-of-chapter exercises to help students understand the material: discussion questions, problems, and cases. This wide variety of questions, Test Yourself multiple choice questions and answers, problems, and cases enables students to examine many different aspects of each chapter's subject matter and also enables instructors to vary the exercises they use each semester. The end-of-chapter materials also include a list of references and recommended readings that allow interested students to explore the chapter material in greater depth. In addition, instructors may wish to assign one or a number of articles listed in each chapter reference section to supplement chapter discussions. These articles are also an important resource for instructors to encourage students to begin reading professional journals. We include articles from *Strategic Finance, The Journal of Accountancy*, and *The Internal Auditor*, which represents the journals of three important accounting professional organizations.

There are two major supplements to this textbook. One is an instructor's manual containing suggested answers to the end-of-chapter discussion questions, problems, and cases. There is also a test bank of true-false and multiple-choice questions.

What's New in the Eleventh Edition

This edition of our book includes a number of changes from prior editions. These include:

- Additional Test Yourself multiple choice questions at the end of each chapter to help students assess their understanding of the chapter material.
- Expanded coverage of topics that are increasingly impacting AIS, including a new discussion of suspicious activity reporting, updated narrative on business continuity planning and disaster recovery, new accounting frauds, the Sarbanes Oxley Act of 2002, an introduction of *COBIT* version 4.1, synergies that are available to organizations (i.e., ERPs, SOX, COBIT, and BPM), emphasis on risk and governance, lean production and lean accounting, and XBRL.
- An expanded section in Chapter 1 on career paths for those majoring in AIS.

- Increased usage of bullets and tables to review or explain material in an efficient format that appeals to students. For example, all of the chapter summaries are now in bullet format.
- Many new *Case-in-Points* that identify examples of the discussion in the textbook. These examples illustrate the topic to give students a better grasp of the material.
- Color! This edition uses color to offset cases and to make the book more interesting to read.
- Chapter reorganization, with database chapters moved closer to the front, as requested by our adopters. Instructors still have the flexibility to integrate the database concepts and database development anywhere in their course.
- An updated glossary of AIS terms at the end of the book.
- One chapter on developing and implementing AISs, with a focus on the role of accountants in these studies. Because many students cover these concepts in other MIS and computer courses, this allows the instructor to assign the chapter as a review, rather than as a major segment of the course.
- New *AIS at Work* features at the end of many chapters to help students better understand the impact of systems in a wide variety of contexts.
- A number of new cases at the end of chapters so that instructors have more choices of comprehensive assignments for students.

ACKNOWLEDGMENTS

We wish to thank the many people who helped us during the writing, editing, and production of our textbook. Our families and friends are first on our list of acknowledgments. We are grateful to them for their patience and understanding as we were writing this book. Next, we thank those instructors who read earlier drafts of this edition of our textbook and provided many useful suggestions for improving the final product. In addition, we are indebted to the many adopters of our book who frequently provide us with feedback. We sincerely appreciate Paula Funkhouser who revised chapters 4, 5, and 6 on this edition as well as helped us with our supplementary materials on this and several previous editions. We also thank our development editor, Chris DeJohn, and our production editor, Joyce Poh, for their contributions to this edition of our book. Finally, we thank all of our many students who have given us feedback when we've used the book. We do listen!

Nancy A. Bagranoff
Mark G. Simkin
Carolyn Strand Norman
February 2009

CONTENTS

PART ONE

AN INTRODUCTION TO ACCOUNTING INFORMATION SYSTEMS

Part One of this book introduces the subject of **accounting information systems (AISs)**. It defines accounting's principal goal, which is to communicate relevant information to individuals and organizations, and describes the strong influence of information technology on this communication process. Chapter 1 defines accounting information systems and then discusses some current events that impact accountants and the profession. This chapter also examines the impact of information technology on financial accounting, managerial accounting, auditing, and taxation. Finally, Chapter 1 describes a number of career opportunities in AISs.

Chapter 2 provides an overview of information technology that is relevant to accounting professionals. It begins by identifying six reasons that make information technology so important to accountants, and then discusses the current AICPA survey on the Top 10 Information Systems Technologies. Of course, the focus of this chapter is on modern technology and its impact on AISs. Hardware technology, including computer input devices, central processing units, secondary storage devices, and output devices, is discussed in detail. Because communication links are so important to AISs, this chapter discusses various communication and network arrangements, including client/server computer and wireless technology. The chapter concludes with descriptions of various types of computer software.

The term ''documentation'' refers to the paper documents that describe how an accounting information system functions as well as the representative computer inputs, outputs, record formats, and files that store this information. Documenting an AIS is critical. It helps managers, systems analysts, and users understand the basic processes and functions of the system. Also, designers use documentation to create new systems, and auditors use documentation of a system to evaluate the AIS of a client. Chapter 3 describes various tools and techniques for documenting AISs, including document and system flowcharts, data flow diagrams, and computer-assisted software engineering (CASE) tools.

Chapter 1

Accounting Information Systems and the Accountant

After reading this chapter, you will:

1. *Be able to distinguish* between such terms as ''systems,'' ''information systems,'' ''information technology,'' and ''accounting information systems.''
2. *Learn* how information technology (IT) influences accounting systems.
3. *Be familiar with* suspicious activity reporting.
4. *Understand* how financial reporting is changing with advances in IT, such as XBRL.
5. *Appreciate* how IT allows management accountants to use business intelligence to create dashboards and scorecards.
6. *Know* why auditors provide a variety of assurance services.
7. *Be more aware of* what is new in the area of accounting information systems.
8. *Be familiar with* career opportunities that combine accounting and IT knowledge and skills.

"The accounting industry has always been paper-driven. Now, it is becoming technology driven."

Maureen Link, "3G Technology Will Change the Way You Work"
Pennsylvania CPA Journal (Spring 2003), p. 19.

INTRODUCTION

The study of **accounting information systems (AISs)** is, in large part, the study of the application of information technology (IT) to accounting systems. This chapter describes the ways that information technology affects financial accounting, managerial accounting, auditing, and taxation. We begin by answering the question "what are accounting information systems" and then look at some new developments in the field. Following this, we will examine some traditional roles of AISs in commerce.

Why should you study accounting information systems? There are many reasons, which we will review briefly in this chapter, but one of the most important is because of the special career opportunities that will enable you to combine your study of accounting subjects with your interest in computer systems. In today's job market, accounting employers expect new hires to be computer literate. In addition, a large number of specialized employment opportunities are available to those students who possess a deeper understanding of computer subjects and can bring advanced computer skills to accounting jobs. The last part of this chapter describes a number of special career opportunities for those with an interest in AISs.

WHAT ARE ACCOUNTING INFORMATION SYSTEMS?

What do the following have in common: (1) a shoebox filled with a lawyer's expense receipts, (2) the monthly payroll spreadsheet in the computer of an auto-repair shop, (3) the *Peachtree* accounting system for a small chain of dry-cleaning stores, and (4) the ERP (Enterprise Resource Planning) system of a large manufacturer? The answer is that they are all examples of accounting information systems. How can such a wide range of accounting applications each qualify as an accounting information system? The answer is that this is the essence of what AISs are—collections of raw and stored data (that together typically serve as inputs), processing methods (usually called "procedures"), and information (outputs) that serve useful accounting purposes. Do such systems have to be computerized? The first example—the shoebox—suggests that they do not. *Can* they be complicated? The last example—an ERP system—illustrates one that is.

Accounting Information Systems—A Definition

Figure 1-1 suggests that accounting information systems (AISs) stand at the crossroads of two disciplines: "accounting" and "information systems." Thus, the study of AISs is often viewed as the study of computerized accounting systems. But because we cannot define

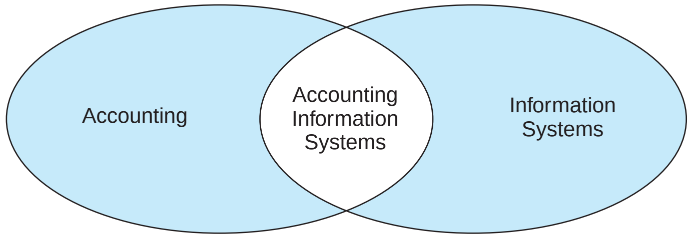

FIGURE 1-1 Accounting information systems exists at the intersection of two important disciplines: (1) accounting and (2) information systems.

an AIS by its size; it is better to define it by what it *does*. This latter approach leads us to the following definition that we will use as a model in this book:

> ***Definition:*** *An* ***accounting information system*** *is a collection of data and processing procedures that creates needed information for its users.*

Let us examine in greater detail what this definition really means. For our discussion, we'll examine each of the words in the term ''accounting information systems'' separately.

Accounting. You probably have a pretty good understanding of accounting subjects because you have already taken one or more courses in the area. Thus, you know that the accounting field includes financial accounting, managerial accounting, and taxation. Accounting information systems are used in all these areas—for example, to perform tasks in such areas as payroll, accounts receivable, accounts payable, inventory, and budgeting. In addition, AISs help accountants maintain general ledger information, create spreadsheets for strategic planning, and distribute financial reports. Indeed, it is difficult to think of an accounting task that is not integrated, in some way, with an accounting information system.

The challenge for accountants is to determine how best to provide the information required to support business and government processes. For example, in making a decision to buy office equipment, an office manager may require information about the sources of such equipment, the costs of alternate choices, and the purchasing terms for each choice. Where can the manager obtain this information? That's the job of the accounting information system.

AISs don't just support accounting and finance business processes. They often create information that is useful to non-accountants—for example, individuals working in marketing, production, or human relations. Figure 1-2 provides some examples. For this information to be effective, the individuals working in these subsystems must help the developers of an AIS identify what information they need for their planning, decision making, and control functions. These examples illustrate why an AIS course is useful not only for accounting majors, but also for many non-accounting majors.

Information (versus Data). Although the terms **data** and **information** are often used interchangeably, it is useful to distinguish between them. *Data* (the plural of *datum*) are raw facts about events that have little organization or meaning—for example, a set of raw scores on a class examination. To be useful or meaningful, most data must be processed into useful *information*—for example, by sorting, manipulating, aggregating, or

Finance—cash forecasts and actual payment and receipt information
Marketing—sales, summary analyses, cost information, and sales forecasts
Human Resources—payroll analyses (including employee benefit information) and projections of future personnel costs
Production—inventory summaries and product cost analyses.

FIGURE 1-2 Examples of useful information that an AIS can generate for selected non-accounting functions of a business.

classifying them. An example might be by taking the raw scores of a class examination and computing the class average.

Do raw data *have* to be processed in order to be meaningful? The answer is ''not at all.'' Imagine, for example, that you take a test in a class. Which is more important to you—the average score for the class as a whole (a processed value) or *your* score (a raw data value)? Similarly, suppose you own shares of stock in a particular company. Which of these values would be *least* important to you: (1) the *average* price of a stock that was traded during a given day (a processed value), (2) the price *you* paid for the shares of stock (an unprocessed value), or (3) the *last* price trade of the day (another unprocessed value)?

Raw data are also important because they mark the starting point of an **audit trail**—i.e., the path that data follow as they flow through an AIS. In a payroll system, for example, an employee's time card for a given pay period indicates how many hours he worked, and therefore (when combined with his hourly pay rate), his gross pay. An auditor can verify the information on a paycheck by following the audit trail backwards—for example, to make sure that the final value reflects the correct payment for the number of hours worked.

> ***Case-in-Point 1.1*** At one American university, an employee in the payroll department was able to steal thousands of dollars by manipulating the payroll records of student workers. When students quit their jobs, she would delay inputting their termination dates in her computer, continue to submit time cards in their behalf, and cash the subsequent payroll checks generated by the system. She was caught when one student complained that his W-2 tax form showed he had earned more money than he had in fact been paid. Auditors then examined his payroll records and were able to uncover the fraud.[1]

Despite the potential usefulness of some unprocessed data, most end users need financial totals, summary statistics, or exception values—i.e., processed data—for decision-making purposes. Figure 1-3 illustrates a model for this—a three stage process in which (1) raw and/or stored data serve as the primary inputs, (2) processing tasks process the data, and (3) meaningful information is the primary output. Modern AISs, of

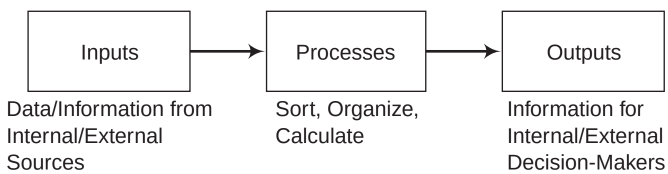

FIGURE 1-3 An information system's components. Data or information is input, processed, and output as information for planning, decision-making, and control purposes.

[1]Source: from the authors.

course, harness information technology to perform the necessary tasks in each step of the process. For example, a catalog retailer might use some web pages on the Internet to gather customer purchase data, then use central file servers and disk storage to process and store the purchase transactions, and finally employ other web pages and printed outputs to confirm and distribute information about the order to appropriate parties.

Although computers are wonderfully efficient and useful tools, they also create problems. One is their ability to output vast amounts of information quickly. Too much information, and especially too much trivial information, can overwhelm its users, possibly causing relevant information to be lost or overlooked. This situation is known as **information overload**. It is up to the accounting profession to determine the nature and timing of the outputs created and distributed by an AIS to its end users.

Another problem with computerized data processing is that computers do not automatically catch the simple input errors that humans make. For example, if *you* were performing payroll processing, you would probably know that a value of ''-40'' hours for the number of hours worked was probably a mistake—the value should be ''40.'' A computer can be programmed to look for (and reject) bad input, but it is difficult to anticipate all possible problems.

Yet a third problem created by computers is that they make audit trails more difficult to follow. This is because the path that data follow through computerized systems is electronic, not recorded on paper. However, a well-designed AIS can still document its audit trail with listings of transactions and account balances both before and after the transactions update the accounts. A major focus of this book is on developing effective internal control systems for companies, of which audit trails are important elements. Chapters 11, 12, and 14 discuss these topics in detail.

In addition to collecting and distributing large amounts of data and information, modern AISs must also organize and store data for future uses. In a payroll application, for example, the system must maintain running totals for the earnings, tax withholdings, and retirement contributions of each employee in order to prepare end-of-year tax forms. These data-organization and storage tasks are major challenges, and one of the reasons why this book contains three chapters on the subject (see Chapters 4, 5, and 6).

Besides deciding *what* data to store, businesses must also worry about how best to *integrate* the stored data for end users. An older approach to this problem was to maintain independently the data for each of its traditional organization functions—e.g. finance, marketing, human resources, and production. A problem with this approach is that even if all the applications are maintained internally by the same IT department, there will be separate data-gathering and reporting responsibilities within each subsystem, and each application will store its data independently of the others. This often leads to a duplication of data-collecting and processing efforts, as well as conflicting data values when specific information (e.g., a customer's address) is changed in one application but not another.

Organizations today recognize the need to integrate the data associated with their functions into large, seamless data warehouses. This integration allows internal managers and possibly external parties to obtain the information needed for planning, decision making, and control, whether or not that information is for marketing, accounting, or some other functional area in the organization. To accomplish this task, many companies are now using large (and expensive) **enterprise resource planning (ERP)** software packages to integrate their information subsystems into one application. An example of such a software product is *SAP R/3*, which combines accounting, manufacturing, and human resource subsystems into an enterprise-wide information system—i.e., a system that focuses on the *business processes* of the organization as a whole. (We discuss these systems in Chapter 9.)

Case-in-Point 1.2 Accountants and other managers are using **predictive analytics**, a technique that takes advantage of data stored in data warehouses, to create systems that allow them to use their data to improve performance. FedEx uses these tools to determine how customers will react to proposed price changes or changes in service. The police force in Richmond, Virginia uses predictive analysis tools and a database of police calls and crime incident data to predict where and when crimes are most likely. Their system even includes information about weather and local events.[2]

Systems. Within the accounting profession, the term ''systems'' usually refers to ''computer systems.'' As you probably know, IT advances are changing the way we do just about everything. Just a few years ago, the authors never imagined that people could someday purchase a book from a ''virtual bookstore'' on the Internet using a wireless laptop, while sipping on a latte in a Starbucks! The explosion in electronic connectivity and commerce are just some of the many ways that IT influences how people now access information or how firms conduct business. In fact, as suggested by the quote at the beginning of this chapter, IT is a vital part of what accountants must now know to be employable.

Returning to our definition, you probably noticed that we did *not* use the term ''computer,'' although we did use the term ''processing procedures.'' You already know the reason for this—not all AISs are computerized, or even need to be. But most of the ones in businesses today are automated ones and thus the term ''processing procedures'' could be replaced by the term ''computerized processing'' for most modern AISs.

In summary, it is convenient to conceptualize an accounting information system as a set of components that collect accounting data, store it for future uses, and process it for end users. This abstract model of data inputs, storage, processing, and outputs applies to almost all the traditional accounting cycles with which you are familiar—e.g., the payroll, revenue, and expenditure cycles—and is thus a useful way of conceptualizing an AIS. Again, we stress that many of the ''end users'' of the information of an AIS are not accountants, but include customers, investors, suppliers, financial analysts, and government agencies.

Accounting Information Systems and Their Role in Organizations

Information technology (IT) refers to the hardware, software, and related system components that organizations use to create computerized information systems. IT has been a major force in our current society and now influences our lives in many personal ways—for example, when we use digital cameras to take pictures, access the Internet to make a purchase or learn about something, or make phone calls to friends and family. It is perhaps less clear that computer technology has also had profound influences on commerce. In this **information age**, for example, fewer workers actually make products, and more of them produce, analyze, manipulate, and distribute information *about* business activities. These individuals are often called **knowledge workers**. Companies find that their success or failure is often dependent on the uses or misuses of the information that knowledge workers manage.

Case-in-Point 1.3 The United States has lost over 3 million jobs to overseas competition—many of them in the manufacturing sector. Yet, Air Products and Chemicals (a supplier of industrial gases to the steel industry) has not only managed to survive, but to

[2]Source: Rick Whiting, ''Predict the Future—Or Try, Anyway,'' *InformationWeek*, May 29, 2006, Issue 1091, pp. 38–43.

thrive, in the face of this trend. Over the last 30 years, in fact, sales have increased tenfold (from $600 million to $6 billion) and the company's work force has more than doubled (to 18,500 employees). What's its secret? The answer was to follow steel production to offshore manufacturing sites, and to become a *local supplier* in each of the developing countries in which the new business developed. Says John Jones, its CEO: "The competitive weapon is speed, moving knowledge around the world as rapidly as possible." Jones' attitude reflects the modern thinking of others: a knowledgeable worker is often a company's most valuable asset.[3]

The information age has important implications for accounting because that is what accountants are—knowledge workers. In fact, accountants have always been in the ''information business'' because their role has been, in part, to communicate accurate and relevant financial information to parties interested in how their organizations are performing. The information age also includes the increasing importance and growth of **e-business**, conducting business over the Internet or dedicated proprietary networks, and **e-commerce**, a subset of e-business, which refers mostly to buying and selling transactions.

In many ways, accounting is itself an information system—i.e., a communicative process that collects, stores, processes, and distributes information to those who need it. For instance, corporate accountants develop financial statements for external parties and such other reports as *accounts receivable aging analyses* for internal managers. But users of accounting information sometimes criticize AISs for only capturing and reporting *financial* transactions. They claim that financial statements often ignore some of the most important activities that influence business entities. For example, the financial reports of a professional basketball team would not include information about hiring a new star because this would not result in journal entries in the franchise's double-entry accounting system.

Today, however, AISs are concerned with non-financial as well as financial data and information. Thus, our definition of an AIS as an enterprise-wide system views accounting as an organization's primary producer and distributor of many different types of information. The definition also considers the AIS as *process focused*. This matches the contemporary perspective that accounting systems are not only financial systems.

WHAT'S NEW IN ACCOUNTING INFORMATION SYSTEMS?

The last few years have witnessed some of the most startling changes in the uses and applications of accounting information systems, causing us to reassess our understanding and uses of accounting data. Below are a few examples.

Suspicious Activity Reporting

A number of **suspicious activity reporting (SAR)** laws now require accountants to report questionable financial transactions to the U.S. Treasury Department. Examples of such transactions are ones suggestive of money laundering, bribes, or wire transfers to terrorist organizations. Federal statutes that mandate SARs include sections of the Annunzio-Wylie Anti-Money Laundering Act (1992), amendments to the Bank Secrecy Act

[3]Source: Jyoti Thottam, ''Inside Business: What Can America Make'' *Time Magazine* (January 12, 2004), pp. 77 ff.

of 1996, and several sections of the Patriot Act (2001). Institutions affected by these laws include (1) banks, (2) money service businesses such as currency traders, (3) broker dealers, (4) casinos and card clubs, (5) commodity traders, (6) insurance companies, and (7) mutual funds. Over the years, such filings have enabled the federal government to investigate a wide number of criminal activities, gather evidence, and in some cases, repatriate funds sent overseas. Testimony to the importance of suspicious activity reporting is the growth of SAR filings—from about 62,000 reports in 1996 to over 1.6 million of them in 2008.

Case-in-Point 1.4 In 2005, a cooperating witness indicated that a pharmaceutical network was selling controlled drugs through affiliated websites to customers without authorized prescriptions. To evade U.S. laws, the owners located their headquarters in Central America and their web servers in the Middle East. A federal investigation and a SAR filed by a financial institution involved in the matter documented almost $5 million in suspicious wire transfers. The result: indictments against 18 individuals and the repatriation of over $9 million from overseas accounts as part of the forfeiture proceedings.[4]

Suspicious activity reporting impacts AISs in several ways. Because so much of the information within AISs is financial, these systems are often used to launder money or conduct criminal activities. A corollary to this fact is that AISs document financial activities in the course of daily transaction processing, and therefore become important sources of SAR evidence and subsequent legal action. Finally, SAR can act as a deterrent to criminal or terrorist activities—and therefore an important control for AISs.

Figure 1-4 contains a classification of SAR reports for ten years of filings from banks and other depository institutions—one of the most important sources of these filings. In this figure, note the importance of money laundering and check frauds.

Countering Terrorism

On September 11, 2001, terrorist agents commandeered four separate commercial U.S. jetliners, crashing two of them into the twin towers of the Word Trade Center in New York City and a third into a side of the Pentagon building in Washington, DC. Over 3,000 lives were lost in this one event, and the economic, social, and political impacts of these events are still being felt today. You have probably seen many of their effects first hand, including the creation of a new Presidential cabinet position entitled ''Homeland Security,'' increased security at major airports, and stricter controls over immigration and visitor passages into the United States (and many other countries as well).

Case-in-Point 1.5 Operation Safe Commerce (OSC) is an initiative by the federal government to thwart terrorists wishing to use innocent commercial cargo to transport weapons or dangerous chemicals through West Coast ports. The major thrust of OSC is to enhance security along the entire supply chain of a ship's cargo. Besides using "smart seals" to guard against tampering with shipping containers while in transit, OSC also focuses on standardizing computerized documentation such as bills of lading that will help government officials identify pallets from "countries of interest."[5]

Although countering terrorism might seem like a governmental matter having little to do with accounting, just the opposite is true. One example of the use of accounting

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[4]Source: FinCen website at www.fincen.gov/law_enforcement/ss/html/Issue14-story5.html.
[5]Source: Lara L. Sowinski, ''Port Security Is a Sink or Swim Proposition'' *World Trade* (January 2004), pp. 20–24.

Rank	Suspicious Activity Type	Filings (Overall)	Percentage (Overall)
1	BSA/Structuring/Money Laundering	1,503,003	48.28%
2	Check Fraud	333,862	10.72%
3	Other	270,152	8.68%
4	Counterfeit Check	155,141	4.98%
5	Credit Card Fraud	154,506	4.96%
6	Mortgage Loan Fraud	113,071	3.63%
7	Check Kiting	101,107	3.25%
8	Identity Theft	69,325	2.23%
9	False Statement	67,902	2.18%
10	Defalcation/Embezzlement	63,392	2.04%
11	Unknown/Blank	63,069	2.03%
12	Consumer Loan Fraud	53,588	1.72%
13	Misuse of Position or Self Dealing	30,899	0.99%
14	Wire Transfer Fraud	29,574	0.95%
15	Mysterious Disappearance	26,465	0.85%
16	Debit Card Fraud	17,480	0.56%
17	Commercial Loan Fraud	16,524	0.53%
18	Counterfeit Instrument (Other)	13,542	0.43%
19	Computer Intrusions	12,307	0.40%
20	Counterfeit Credit/Debit Card	12,177	0.39%
21	Terrorist Financing	3,178	0.10%
22	Bribery/Gratuity	2,932	0.09%
	Total:	3,113,196	100.00%

FIGURE 1-4 A classification of suspicious activity report filings using Form TD F 90-22.47 from depository institutions, April 1, 1996–December 31, 2006. Source: Website of the U.S. Treasury Department (2008).

information systems for this purpose is using banking systems to trace the flow of funds across international borders. Other examples include: (1) identifying and denying financial aid to terrorist groups and their sympathizers, (2) tracing arms and chemical orders to their final destinations, thereby identifying the ultimate—perhaps unauthorized—purchasers, (3) using spreadsheets to help plan for catastrophic events, (4) using security measures to control cyber terrorism, and (5) installing new internal controls to help detect money laundering and illegal fund transfers.

Corporate Scandals and Accounting

Although corporate frauds and scandals are hardly new, the latest set of them has set records for their magnitude and scope. Figure 1-5 provides a list of some examples. Sadly, this list is neither complete nor particularly current, as new discoveries involving the misrepresentation of assets and incomes continue to surface.

Of particular note on this list are the Enron scandal and the case against Bernard Madoff. The Enron scandal is important because of the amount of money and jobs that were lost, and also because so much of it appears to be directly related to the adroit manipulation of accounting records. Although the details of these manipulations are complex, the results were to understate the liabilities of the company as well as to inflate its earnings and net worth. The opinion of most experts today is that the mechanics of these

Company Date fraud became public Industry	Event	Names of Primary Executives
Adelphia 2002 Cable television provider	Adelphia, led by the controlling Rigas family, used off–balance sheet financing to hide $2.3 billion in debt from the eyes of shareholders and creditors. The company also fraudulently increased earnings by exaggerating cable subscriptions. The SEC charged Adelphia and various members of the Rigas family with violating federal antifraud regulations.	John Rigas—Company founder, former chairman and CEO Timothy, Michael and James Rigas—Sons of John Rigas, Members of the Board and also held executive positions with Adelphia
Arthur Andersen 2001 Accounting firm	As Enron's auditor, Andersen aided and abetted Enron's use of off–balance sheet financing arrangements. When it became clear that Andersen would be investigated by the SEC, employees shredded evidence of Andersen's involvement. Andersen, once a huge accounting firm, was ordered to cease operations by a Texas court in June 2002.	David Duncan—Senior audit partner for Enron
Bernard Madoff 2008 Investments	In late 2008, Madoff confesses to running an elaborate Ponzi scheme involving between $50 and $65 billion.	Bernard Madoff and perhaps members of his family
Enron 2001 Energy trader	Enron, once a star performer in the ''new economy,'' used off–balance sheet financing to hide large amounts of debt from investors and creditors. The company's implosion resulted in many lost jobs and evaporation of workers' and investors' pensions. Enron's downfall spurred demand for accounting reform.	Andrew Fastow—Former CFO Kenneth Lay—Former Chairman of the Board Jeff Skilling—Former CEO Arthur Andersen—Enron's auditor
Global Crossing 2002 Telecom networks	In 2002, the company filed for bankruptcy. Following this filing, allegations were directed toward the company that executives artificially increased revenues, shredded accounting documents, and took part in insider trading. To date, no charges have been filed against Global Crossing or its employees.	Gary Winnick—Former Chairman of the Board Arthur Andersen—WorldCom's auditor
HealthSouth 2003 Health care service provider	The company defrauded investors by artificially increasing earnings and assets to the tune of $1.4 billion over a 5-year period. Numerous company insiders were charged with selling stock while they knew that the company's stock value was artificially high.	Richard Scrushy—Chairman of the Board
ImClone 2001 Biopharmaceutical company	CEO Waksal learned *privately* that ImClone's main product, a cancer drug, would soon be rejected by the FDA. Before this information became public, he sold most of his shares and convinced family members to sell their shares of ImClone. Martha Stewart learned of these sales from her broker and subsequently sold her shares in the company prior to the FDA's official announcement. All were charged with insider trading.	Samuel Waksal—CEO Aliza Waksal—CEO's daughter and major shareholder Martha Stewart—Television celebrity as well as founder and CEO of Martha Stewart Living, Inc.
Merrill Lynch 2002 Investment brokerage	Analysts at the firm recommended the stock of Merrill Lynch clients to individual investors that the analysts disparaged privately. The firm was also implicated for producing biased, rather than objective, research reports on companies.	David Komansky—CEO Stanley O'Neal—President Henry Blodget—Former analyst
New York Stock Exchange (NYSE) 2003 Stock exchange	Following frequent calls for corporate reform in the post-Enron era, it came to light that Grasso, CEO of the NYSE, was being compensated very handsomely for his work at the exchange. Once news of his $180 million retirement package became public knowledge, Grasso was forced to resign from his post.	Dick Grasso—Former CEO
Parmalat 2003 Dairy foods producer	Considered by some to be the ''Enron of Europe,'' the Italian company Parmalat used massive financial fraud to hide its true financial position. Executives inflated assets by around $13 billion, and CEO Tanzi redirected $640 million of company funds for private use in Tanzi's other businesses.	Calisto Tanzi—Founder and former CEO Fausto Tonna—Former CFO
Tyco 2002 Diversified manufacturing	Tyco executives used funds from company loan programs for inappropriate personal use. These loans were not disclosed to shareholders. Also, executives misused company funds as evidenced by the scandalous birthday party former CEO Kozlowski threw for his wife in the amount of $2 million.	Dennis Kozlowski—Former CEO and Chairman of the Board Mark Swartz—Former CEO Mark Belnick—Former Chief Legal Officer
WorldCom 2003 Telecommunications	On the heels of Enron's downfall, it came to light that the company had systematically overstated its revenues by $9 billion to meet Wall Street earnings expectations. Investors lost huge amounts of capital and thousands of workers were laid off.	Bernard Ebbers—Former CEO Scott Sullivan—Former CFO David Myers—Former Controller

FIGURE 1-5 Examples of recent accounting frauds and problems.

adjustments might not have been illegal, but the intent to defraud was clear and therefore criminal.

Accounting rules allow for some flexibility in financial reporting. Unfortunately, some financial officers have exploited this flexibility to enhance earnings reports or present rosier forecasts than reality might dictate—i.e., have ‘‘cooked the books.’’ Examples are Scott Sullivan, former Chief Financial Officer at WorldCom, Inc., Mark H. Swartz, former Chief Financial Officer at Tyco International, Inc., and Andrew Fastow, Enron’s former Chief Financial Officer. Just as some accountants have been guilty of criminal and unethical behavior, there are also others who have emerged from the scandals as heroes. These include Sherron Watkins, who tried to tell Ken Lay that the numbers at Enron just didn’t add up, and Cynthia Cooper, an internal auditor at WorldCom, who blew the whistle on the falsified accounting transactions ordered by her boss, Scott Sullivan.

As the credit crunch worked its way through the economy in 2008, a number of financial institutions either collapsed or narrowly avoided doing so, and accounting was in the news once again. Some questioned whether there was enough regulation and others whether perhaps there was too much. There was controversy about fair value accounting rules and some questioned the strength of Securities and Exchange Commission oversight, particularly as one of the biggest financial frauds of all time came to light. This was the *Ponzi scheme* constructed by Bernard Madoff, a well-known investment fund manager. Ponzi schemes are named for Charles Ponzi, a scam artist who created a pyramid fraud in which the perpetrator uses new investment funds to pay returns to current investors. The fraud relies on new money continuously entering the system so that investors believe their money is actually earning returns. The problem is that when the new money stops flowing, the pyramid collapses.

Bernard Madoff appears to have taken this common fraud technique to a new high, creating a house of cards in excess of $50 billion. The SEC was tipped to the questionability of Madoff’s investments many times over a period of years, but never investigated enough to discover the fraud. You would expect that investment funds of the size managed by Madoff would be overseen by an army of highly-trained and experienced accountants and auditors. Rather, Madoff employed a little known three-person firm, Friehling & Horowitz. At the time of this writing, the American Institute of Certified Public Accountants, among other organizations, was investigating the auditor.

The Sarbanes-Oxley and Patriot Acts

In response to the corporate frauds discussed above, the U.S. Congress passed the **Sarbanes-Oxley Act of 2002**. Highly publicized and hurriedly passed, the SOX act has many requirements that affect accounting information systems. One section, for example, forbids corporations from making personal loans to executives—a requirement that outlaws the former practice of transferring funds to officers who never pay back the money. Another section requires the chief executive officers (CEOs) of companies to personally vouch for the accuracy and completeness of its financial statements. Yet a third section requires public companies to hire independent, *new* auditors to review their internal controls and determine their compliance with other financial regulations.

Perhaps the most important part of SOX to accountants is Section 404, which requires managers to implement and assess internal controls and auditors to evaluate those assessments. This portion of the bill has created the most work for accountants and information systems auditors. We discuss the details of this act in several chapters of this book.

Case-in-Point 1.6 In order to make sure they are fully compliant with the requirements of the Sarbanes-Oxley Act, many companies are acquiring specialized software packages that collect financial information and help auditors verify that they are fully compliant with the data-gathering and retention requirements of the law. The Sarbanes-Oxley Act has thus been a boon to the developers of such software—i.e., Interwoven, PeopleSoft, and Oracle. The estimated market for such products: between $1 and $4 billion.[6]

The **U.S. Patriot Act—** an acronym for ''Providing Appropriate Tools Required to Intercept and Obstruct Terrorism''—was signed into law shortly after the terrorist attacks of September 11, 2001. Although those sections of the law permitting search, wire-tapping, and seizure actions without legal warrants have attracted the most attention, a number of less-publicized articles directly affect accounting systems. Section 352 of the Act, for example, requires auditors to verify that their organizations have adequate risk assessment and prevention systems. Other sections of the law require financial institutions to have an anti-money laundering officer, professional training for employees, and independent audits of financial programs. Of special interest: the requirement that banks monitor their accounts in foreign institutions for possible fraudulent uses, and perform due diligence in high-risk (but unnamed) countries known for corruption, money laundering, or terrorist activities. The Act also includes penalties for those organizations that do not comply with these requirements.

ACCOUNTING AND IT

Information technology strongly influences the way most accountants work. Instantaneous access to the Internet via mobile communication devices such as cell phones, for example, enables managerial accountants to complete important work tasks while traveling in the field, auditors to communicate with each other from remote job sites (but auditing the same client), staff accountants to text message one another from alternate locations, and tax experts to download information on tax rulings that are even more current than their latest CDs.

Figure 1-6 provides an overview of the major areas within the general field of accounting. This section of the chapter considers the impact of IT on each of them.

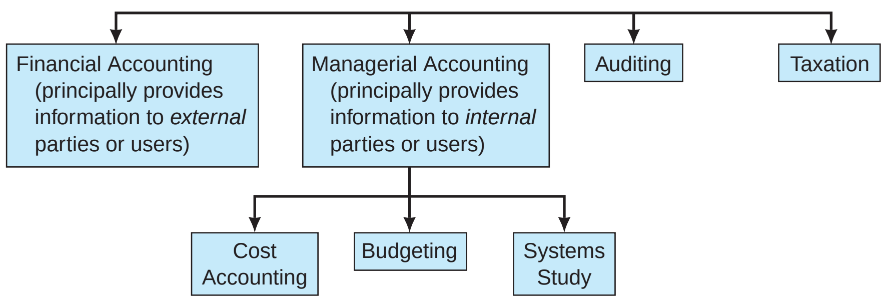

FIGURE 1-6 An overview of systems. The financial and managerial accounting components are not mutually exclusive: information from the financial accounting component is used within the managerial accounting component, and vice versa.

[6]Source: Jim Kerstetter, ''Sarbanes-Oxley Sparks a Software Boom'' *Business Week* (January 12, 2004), p. 94.

Financial Accounting

The major objective of **financial accounting information systems** is to provide relevant information to individuals and groups *outside* an organization's boundaries—e.g., investors, federal and state tax agencies, and creditors. Accountants achieve these informational objectives by preparing such financial statements as income statements, balance sheets, and cash flow statements. Of course, many managers *within* a company can also use financial reports for planning, decision-making, and control activities. For example, a manager in charge of a particular division could use such profitability information to make decisions about future investments or to control expenses.

Figure 1-7 is an example of a financial accounting audit trail. This trail traces an organization's financial **accounting cycle**, which begins with transaction data (e.g., captured at the point of sale) and ends with its periodic financial statements. Accounting clerks, store cashiers, or even the customers themselves input relevant data into the system, which stores these data for later use. In financial AISs, the processing function also includes posting these entries to general and subsidiary ledger accounts and preparing a trial balance from the general ledger account balances.

Non-Financial Data. The basic inputs to, and outputs from, traditional financial accounting systems are usually expressed in monetary units. This can be a problem if the AIS ignores non-monetary information that is also important to users. For example, an investor might like to know what the prospects are for the future sales of a company, but many financial AISs do not record such information as unfulfilled customer sales because such sales are not recognizable financial events—even though they are important ones. This is the basic premise behind **REA accounting**—the idea of also storing important non-financial information about resources, events, and agents in databases precisely because they are relevant to the decision-making processes of their users. We discuss the REA framework in greater detail in Chapter 4.

> ***Case-in-Point 1.7*** A friend of one of the authors of this book recently received a call from the local hospital's accounting office, urgently requesting to speak to his wife. The clerk was very insistent because the wife had thousands of dollars in unpaid bills and the hospital was anxious to settle the account. It took the friend several minutes to get a word in. Finally, he

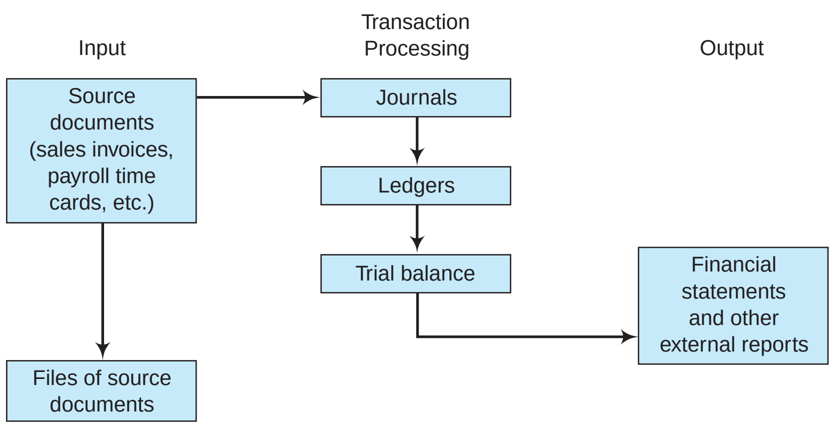

FIGURE 1-7 A financial accounting audit trail.

was able to reveal the one piece of information lacking in the hospital's financial computer records: *his wife had died at the hospital*.[7]

Several professional associations now formally recognize that non-financial performance measures enhance the value of purely-financial information. For example, in 1994 a special committee of the American Institute of Certified Public Accountants (AICPA) recommended several ways that businesses could improve the information they were providing to external parties, including management-analysis data, forward-looking information such as opportunities and risks, information about management and shareholders, and background information about the reporting entity. Similarly, in 2002, the American Accounting Association (AAA) Financial Accounting Standards Committee recommended that the *Securities and Exchange Commission (SEC)* and the *Financial Accounting Standards Board (FASB)* encourage companies to voluntarily disclose more non-financial performance measures.

Real-Time Reporting. Another impact of IT on financial accounting concerns the timing of inputs, processing, and outputs. Financial statements are periodic and most large companies traditionally issue them quarterly, with a comprehensive report produced annually. With advances in IT that allow transactions to be captured immediately, accountants and even the AIS itself can produce financial statements almost in real-time. Of course, some of the adjustments that accountants must make to the records are not done minute-by-minute, but a business can certainly track sales and many of its expenses continuously. This is especially useful to retailing executives.

Interactive Data and XBRL. A problem that accountants, investors, auditors, and other financial managers have often faced is that data used in one application are not easily transferable to another. This means that accountants may spend hours preparing spreadsheets and reports that require them to enter the same data in different formats over and over. **Interactive data** are data that can be reused and carried seamlessly among a variety of applications or reports. Consider for example a data item such as total assets. This number might need to be formatted and even calculated several different ways for reports, such as filings with the Securities and Exchange Commission (SEC), banks, performance reports, and so on. With interactive data, the data are captured once and applied everywhere needed.

Interactive data require a language for standardization that ''tags'' the data at its most basic level. (For total assets, this would be at the detail level for each asset.) **Extensible business reporting language (XBRL)** is emerging as the language of choice for this purpose. At present, the SEC has a voluntary filing program whereby public companies may file their financial reports in XBRL format. Many companies, software programs, and industries are beginning to incorporate XBRL for creating, transforming, and communicating financial information. The case-in-point below provides an example of its benefits. We discuss XBRL in some detail in Chapter 15 and you can learn about its status at www.xbrl.org.

Case-in-Point 1.8 The Federal Deposit Insurance Corporation (FDIC) insures bank deposits over a specific amount. FDIC wanted to create an Internet-based Central Data Repository that stored all the call (quarterly) data they received from more than 7,000 banks. They convinced their software vendors to incorporate XBRL language to standardize the data.

[7]Source: from the authors.

The tagged data the FDIC received from the banks now has improved accuracy and can be published and made available to users much more quickly than before.

Managerial Accounting

The principal objective of **managerial accounting** is to provide relevant information to organizational managers—i.e., users who are internal to a company or government agency. Figure 1-8 summarizes some of the most important features of this accounting area. As suggested by Figure 1-8, cost accounting and budgeting are two typical parts of a company's managerial accounting system. Let us examine each of them in turn.

Cost Accounting. Due to globalization, decentralization, deregulation, and other factors, companies are facing increased competition. The result is that companies must be more efficient and better control costs. The **cost accounting** part of managerial accounting specifically assists management in measuring and controlling the costs associated with an organization's various acquisition, processing, distribution, and selling activities. In the broadest sense, these tasks focus on the *value added* by an organization to its goods or services, and this concept remains constant whether the organization is a manufacturer, a bank, a hospital, or a police department.

Activity-Based Costing. One example of an AIS in the area of cost accounting is an **activity-based costing (ABC) system**. Traditionally, cost accountants assigned overhead (i.e., indirect production costs) on the basis of direct labor hours because the number of labor hours was usually directly related to the volume of production. The problem with this traditional system is that, over time, increasing automation has caused manufacturers to use less and less direct labor. Thus, managers became frustrated using this one method of assigning overhead costs when a clear relationship between labor and these overhead expenses no longer seemed to exist. Instead, managers in a variety of manufacturing and service industries now identify specific activities involved in a manufacturing or service task, and then assign overhead costs based on the resources directly consumed by each activity.

Although activity-based costing techniques have been available for over 20 years, they are more common now that computerized systems track costs. Moreover, these systems can move an organization in new strategic directions, allowing corporate executives to

- Managerial accounting focuses on providing accounting information for internal parties, such as management, rather than for external investors and creditors.
- Managerial accounting information is mostly forward-looking.
- Managerial accounting information is not regulated by generally accepted accounting principles, nor is it mandatory to prepare it.
- Managerial accounting reports include both non-monetary and financial data.
- Managerial accounting is influenced by many business and non-business disciplines, such as economics, behavioral science, and quantitative methods.
- Managerial accounting information is flexible and frequently involves non-routine reporting.

FIGURE 1-8 A summary of features characterizing managerial accounting.

examine fundamental business processes and enabling them to reengineer the way they do business. ABC systems can also play an essential strategic role in building and maintaining a successful e-commerce business because they can answer questions about production costs and help managers allocate resources more effectively.

Case-in-Point 1.9 Art.com, with its collection of prints, posters, and photographs, combined with its custom framing service, offers consumers unlimited opportunities to find "just the right piece of artwork." It's a dot-com success story. When the start-up company turned to professionals to help it build a long-term successful business, the consultants used ABC to identify 12 key activities. By focusing on the most costly activities, company executives find that they can do a better job of managing resources.[8]

Corporate Performance Measurement and Business Intelligence. Another example of an AIS used in the area of cost accounting is in **corporate performance measurement (CPM)**. In a **responsibility accounting system**, for example, managers trace unfavorable performance to the department or individuals that caused the inefficiencies. Under a responsibility accounting system, each subsystem within an organization is only accountable for those items over which it has control. Thus, when a particular cost expenditure exceeds its standard cost, managers can take immediate corrective action.

In addition to the traditional financial measures, cost accountants also collect a variety of non-financial performance measures to evaluate such things as customer satisfaction, product quality, business innovation, and branding effectiveness. The **balanced scorecard** measures business performance in four categories: (1) financial performance, (2) customer knowledge, (3) internal business processes, and (4) learning and growth. A company may choose to rank these categories to align with their strategic value. For example, a company may stress ''customer knowledge'' because customer satisfaction is important to its market position and planned sales growth.

Balanced scorecards and corporate performance measurement aren't new ideas. But with the Internet, integrated systems, and other advanced technologies, balanced scorecards and other approaches to CPM are becoming increasingly valuable **business intelligence** tools. Businesses use **key performance indicators (KPIs)** to measure and evaluate activities in each quadrant of the balanced scorecard. For example, a financial KPI might be return on investment. In the customer area, a company might track the number of new customers per month.

Also new is the use of **dashboards** (Figure 1-9) to monitor key performance metrics. Dashboards usually appear in color, so that red, for example, might indicate a failure to meet the goal. Another indicator might be up and down arrows to show how a key activity performs for a certain time period. Dashboards are especially useful to managers who appreciate the presentation of important performance data in easy-to-understand graphic formats.

Case-in-Point 1.10 Health care entities, such as St. Luke's Episcopal Health System, are using scorecards and dashboards to monitor financial and operational performance. By using a balanced scorecard, and channeling data through a single portal, St. Luke's managers can look at KPIs such as supply expenses and patient waiting times on several visual dashboards. Hospitals and other health care organizations are monitoring metrics such

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[8]Source: T. Zeller, D. Kublank, and P. Makris, ''Art.com Uses ABC to Succeed'' *Strategic Finance* (March 2001), pp. 24–31.

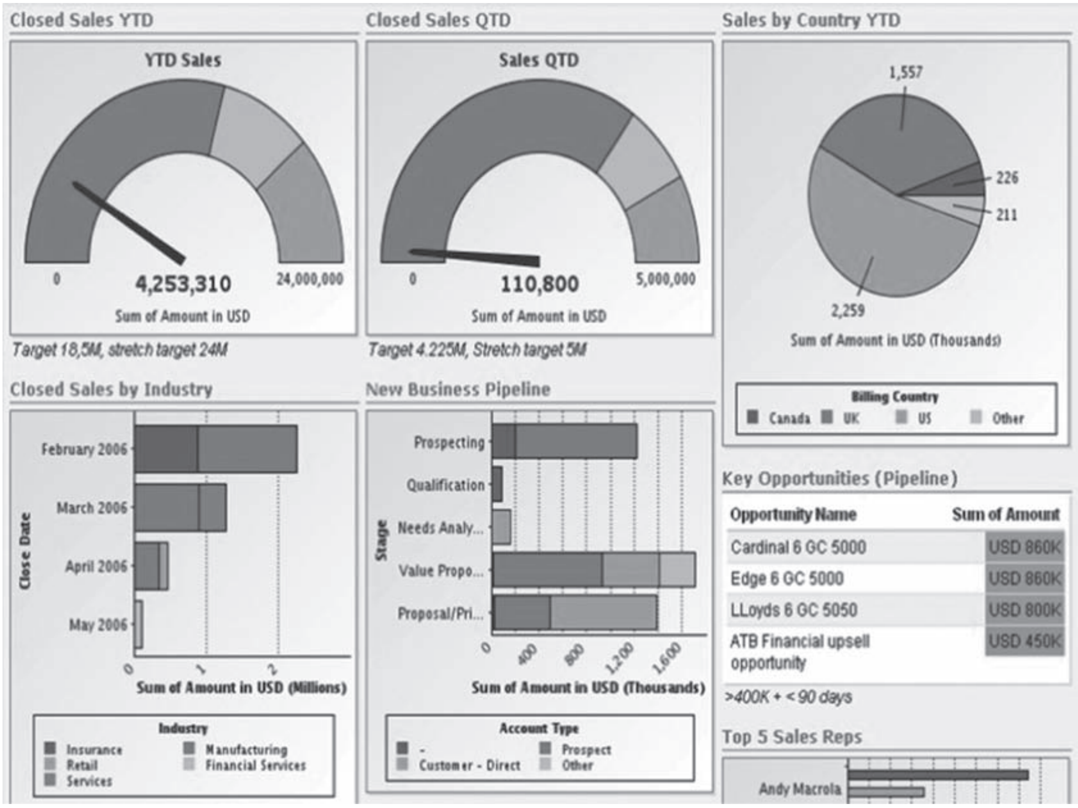

FIGURE 1-9 An example of an executive dashboard courtesy of Salesforce.com Corporation.

as numbers of surgical cases, inpatient and outpatient revenues, departmental margins, and bed occupancy rates with dashboards that managers can regularly access through Internet browsers.[9]

Budgeting. A budget is a financial projection for the future and is thus a valuable managerial planning aid. Managerial accountants develop both short- and long-range budget projections. Short-range budget projections disclose detailed financial plans for a 12-month period, whereas long-range budgets are less-detailed financial projections for five or more years into the future.

A good budgetary system is also a useful *managerial control* mechanism. Because budgets attempt to predict future financial expectations, a company's managers can compare the causes of significant variations between *actual* and *budgeted* results during the budget period. Through timely performance reports that compare actual operating results with prescribed norms, mangers are able to identify and investigate significant negative variations. Similarly, favorable budget variations enable managers to reward outstanding performance or make investment decisions on specific activities that promise to benefit future operating performance.

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[9]Source: Jamie Wyatt, ''Scorecards, Dashboards, and KPIs Keys to Integrated Performance Measurement,'' *Healthcare Financial Management*. Westchester: February 2004, Vol. 58, Iss.2, p. 76–80.

Auditing

The traditional role of auditing has been to evaluate the accuracy and completeness of a corporation's financial statements. In recent years, however, the individuals working in CPA firms would probably argue that they are actually in the assurance business—i.e., the business of providing third-party testimony that a client complies with a given statue, law, or similar requirement. Historically, the growth of such assurance services can be traced to a conference of the American Institute of Certified Public Accountants in 1993, which created a Special Committee on Assurance Services to identify and formalize some other areas (besides financial audits) in which accountants could provide assurance services. Figure 1-10 describes the first six areas identified by the committee.

Today, there are several new areas in which auditors now perform assurance work, many involving accounting information systems. One example is to vouch for a client's compliance with the new HIPAA laws—e.g., the privacy requirements of the Health Insurance Portability and Accountability Act. Another example is ***CPA Trust Services***, a set of professional service areas built around a set of common principles and criteria related to the risks and opportunities presented by IT environments. Trust services include online privacy evaluations, security audits, testing the integrity of information processing systems, assessing availability of IT services, and systems confidentiality testing.

Despite the rise in ancillary assurance services, auditors mainly focus on traditional financial-auditing tasks. As noted earlier, computerized AISs have made these tasks more challenging. For example, automated data processing also creates a need for auditors to evaluate the risks associated with such automation. Chapter 14 discusses the audit of computerized accounting information systems and the ways in which auditors use information technology to perform their jobs.

In addition to the auditing and assurance businesses mentioned above, many CPA firms also perform management consulting tasks—e.g., helping clients acquire, install, and use new information systems. The AIS at Work feature at the end of this chapter describes one

Risk Assessment

Provide assurance that an organization's set of business risks is comprehensive and manageable.

Business Performance Measurement

Provide assurance that an organization's performance measures beyond the traditional measures in financial statements are relevant and reasonable for helping the organization to achieve its goals and objectives.

Information Systems Reliability

Provide assurance that an organization's information system has been designed to provide reliable information for decision making.

Electronic Commerce

Provide assurance that organizations doing business on the Internet can be trusted to provide the goods and services they promise, and that there is a measure of security provided to customers.

Health Care Performance Measurement

Provide assurance to health care recipients about the effectiveness of health care offered by a variety of health care providers.

Eldercare Plus

Provide assurance that various caregivers offering services to the elderly are offering appropriate and high-quality services.

FIGURE 1-10 Assurance services identified by the American Institute of Certified Public Accountants Special Committee on Assurance Services.

such consulting area. However, the corporate accounting scandals mentioned earlier have led members of the Securities and Exchange Commission and the U.S. Congress to question whether a CPA firm can conduct an independent audit of the same systems it recently assisted a client in installing and using—a concern intensified when audit staff at Arthur Andersen LLP apparently deliberately destroyed auditing papers for the Enron corporation that many believe would have documented such doubts. Thus, the Sarbanes-Oxley Act of 2002 expressly forbids such potential conflicts of interest by disallowing CPA firms from simultaneously acting as a ‘‘management consultant’’ and the ‘‘independent auditor’’ for the same firm.

Despite this requirement, however, there are still many areas in which CPA firms provide consulting services to clients. Examples include business valuations, litigation support, systems implementation, personal financial planning, estate planning, strategic planning, health care planning, making financing arrangements, and performing forensic (fraud) investigations.

Taxation

Although some individuals still complete their income tax returns manually, many now use computer programs such as *TurboTax* for this task. Like spreadsheets, tax preparation software is an example of an AIS that enables its users to create and store copies of trial tax returns, examine the consequences of alternate tax strategies, print specific portions of a return, and even transmit complete copies of a state or federal tax return to the appropriate government agency.

Information technology can also help tax professionals research challenging tax questions—for example, by providing access to electronic tax libraries on CDs or online that cost less and that can provide more up-to-date tax information than traditional paper-based libraries. Thus, a tax professional may subscribe to an online tax service by paying a fee for the right to access databases of tax information stored at centralized computer locations. Online services or CD-ROMs can provide tax researchers with databases of federal and state tax laws, tax court rulings, court decisions, and technical advice.

CAREERS IN ACCOUNTING INFORMATION SYSTEMS

Our introductory remarks to this chapter suggest a variety of reasons why you should study accounting information systems. Of them, perhaps the most interesting to new students in AIS courses is the employment opportunities available within the discipline. Career opportunities abound for those with a solid foundation in AIS, including traditional accounting vocations in financial and managerial accounting, as well as careers in consulting and information systems auditing and security.

Traditional Accounting

Certainly a number of traditional accounting jobs are also available to those who choose to major in accounting information systems. After all, what accounting system is not also an accounting information system? Also, because technology now plays such a strong role in accounting, AIS majors enjoy the advantage of understanding both traditional accounting concepts and information systems concepts. Recognizing the importance to accountants of knowledge about information systems, the AICPA recently developed a new designation: **Certified Information Technology Professional (CITP)**, which accountants can earn with business experience and by passing an examination.

Systems Consulting

A consultant is an outside expert who helps an organization solve problems or provides technical expertise on an issue. **Systems consultants** provide help with issues concerning information systems—for example, by helping an organization design a new information system, select computer hardware or software, or reengineering business processes (so that they operate more effectively).

One of the most important assets a consultant brings to his or her job is an objective view of the client organization and its processes and goals. AIS students who are skilled in both accounting and information systems make particularly competent systems consultants because they understand how data flow through accounting systems as well as how business processes function. Systems consultants can help a variety of organizations, including professional service organizations, private corporations, and government agencies. This broad work experience, combined with technical knowledge about hardware and software, can be a valuable asset to CPA clients. Because it is likely that a newly-designed system will include accounting-related information, a consultant who understands accounting is particularly helpful. Many systems consultants work for large professional service organizations, such as Accenture or Cap Gemini Ernst & Young. Others may work for specialized organizations that focus on the custom design of accounting information systems.

Consulting careers for students of accounting information systems also include jobs as **value-added resellers (VARs)**. Software vendors license VARs to sell a particular line of software products and provide consulting services to companies, such as help with their software installation, training, and customization. A VAR may set up a small one-person consulting business or may work with other VARs and consultants to provide alternative software solutions to clients.

Case-in-Point 1.11 Martin and Associates is a regional consulting firm in the Midwest, started by Kevin Martin in 1983. Kevin, a CPA, left a job with a large accounting firm to open an accounting business that would help companies implement AISs. Today the company describes itself as a "firm dedicated to delivering accounting, ERP, and CRM solutions to our clients and alliances." The staff at Martin and Associates are professionals with CPA and IT experience—many have dual degrees or double majors.[10]

Information Technology Auditing and Security

Information technology (IT) auditors concern themselves with analyzing the risks associated with computerized information systems. These individuals often work closely with financial auditors to assess the risks associated with automated AISs—a position in high demand because so many systems are now computerized. Information systems auditors also help financial auditors decide how much time to devote to auditing each segment of a company's

[10]See www.martinandassociates.com.

business. This assessment may lead to the conclusion that the controls within some portions of a client's information systems are reliable and that less time need be spent on it—or the opposite.

IT auditors are involved in a number of activities apart from assessing risk for financial audit purposes. Many of these auditors work for professional service organizations, such as Ernst & Young, PricewaterhouseCoopers, or KPMG. (See Figure 1-11 for a partial listing of the types of services offered by Ernst & Young.)

IT auditors might be CPAs or be licensed as **Certified Information Systems Auditors (CISAs)**—a certification given to professional information systems auditors by the **Information Systems Audit and Control Association (ISACA)**. To become a CISA, you must take an examination and obtain specialized work experience. Many CISAs have accounting and information systems backgrounds, although formal accounting education is not required for certification. IT auditors are in more demand than ever today, in part because of the Sarbanes-Oxley legislation, specifically Section 404, which requires documenting and evaluating IT controls.

Case-in-Point 1.12 While efficiencies in compliance with requirements of the Sarbanes-Oxley Act of 2002 will help in the future, the numbers of hours necessary to document and evaluate internal controls, including IT controls, means more work for those with IT audit skills. According to 2004 and 2005 surveys by the Controllers' Leadership Roundtable research, audit fee increases for the Big Four, in complying with Section 404, ranged from 78% for Deloitte and Touche to 134% for PricewaterhouseCoopers. Complying with SOX costs the average large company $7.8 million and 70,000 hours of employee time[11]

Sometimes the best way to assess the risks associated with a computerized system is to try to penetrate the system, which is referred to as **penetration testing**. These tests are usually conducted within a system's security audit, in which the organization attempts to determine the level of vulnerability of their information systems and the impact such weaknesses might have on the viability of the organization. If any security issues are discovered, the organization will typically work swiftly to correct the problems or at least mitigate the impact they might have on the company.

Assurance Services:
- Financial statement attestation
- Internal control reporting
- Assess procedures and controls concerning privacy and confidentiality, performance Measurement, systems reliability, outsourced process controls, information security

Business Risk Services
Fraud Investigation and Dispute Services
Technology and Security Risk Services
Specialty Advisory Services

FIGURE 1-11 A sample of the many types of services offered by Ernst and Young LLP, one of the largest international professional service organizations.

[11]Source: John Goff, ''Fractured Fraternity,'' *CFO Magazine*, September 01, 2005, pp. 1, and Sarah Lacey, ''The Sarbantes-Oxley Software Race'' *Business Week Online* (7/12/2005), no page number.

AIS AT WORK
Consulting Work for CPAs

Businesses and government entities have always been concerned about disaster recovery or continuity planning. However, the events of September 11, 2001, and Hurricane Katrina made everyone even more aware of the necessity of preparing for disaster. Auditors can help. Continuity planning is an internal control devised to ensure that operations, including IT functions, can continue in the event of a natural or man-made disaster, including terrorism and acts of nature. IT—especially Internet technologies—is vulnerable to man-made attacks, such as viruses and worms. An online retailer, for example, can not afford to compromise system availability. The absence of a continuity plan is a reportable condition under Statement on Auditing Standards No. 60, *Communication of Internal Control Related Matters Noted in an Audit*.

A CPA can help a business to draw up a business continuity plan. As noted in a recent article in *New Accountant*, some Fortune 500 companies will pay $40,000 or more for such a disaster recovery planning engagement.[12] These plans include sections on backup and recovery procedures for all IT, offsite locations for data storage, and information about hot (fully equipped for immediate use) or cold (leased facilities that do not include hardware and software) sites available for use should current physical facilities become inaccessible or damaged. The plans also include contact information for the management recovery team. Copies of the plan, of course, must be stored off-site themselves. Ideally, each member of the management recovery team has at least one copy at their home or in another easily-accessible location off-site.

A disaster recovery plan is of no use if it is not tested regularly. Such testing is vital to learn where there may be weaknesses. As an example, during an early Internet worm crisis, many managers found that they were actually storing information regarding who to contact in a systems emergency on their own computers! Naturally, when the computers went down, so did this vital information. Full-blown testing of a disaster recovery plan is expensive and time consuming. Sometimes it is difficult for managers to understand the importance of it because they can't see a direct link to enhancing their income. The auditor may need to make the case. Unfortunately, there are many, many examples available to use for this purpose.

SUMMARY

- Computerized information systems collect, process, store, transform, and distribute financial and non-financial information for planning, decision-making, and control purposes.
- Data are raw facts; information refers to data that are meaningful and useful.
- By law, the accountants in many specific financial institutions must now file suspicious activity reports that document potential instances of fraud, money laundering, or money transfers to terrorist organizations.
- Accounting information systems can help to thwart terrorism.
- Some of the recent corporate scandals involved manipulation of accounting data, which has led to the passage of legislation to protect investors.

[12]Reed, Randy M., ''Enhancing Consulting Revenues with Disaster Recovery Planning,'' *New Accountant*, 2006, p. 13.

- The Sarbanes-Oxley Act of 2002 is a sweeping piece of financial legislation with implications for auditors as it requires management to develop and assess internal control systems.
- The U.S. Patriot Act contains a number of provisions that directly affect AISs, including sections that focus on money laundering, auditing, and conducting business with correspondent banks abroad.
- Information technology affects virtually every aspect of accounting, including financial and managerial accounting, auditing, and taxation.
- Financial accounting information is becoming increasingly relevant and important as advances in IT allow for creation of new reporting systems.
- Managerial accounting is impacted by IT, specifically with development of activity-based costing systems and corporate performance measures (CPM) based on the balanced scorecard.
- Auditors perform many types of assurance services, in addition to financial statement attestation.
- The availability of tax software and extensive tax databases influences both tax preparation and tax planning.
- There are many reasons to study accounting information systems, and one of the most important is the availability of many exciting career opportunities. These include traditional accounting careers as well as jobs in consulting and information systems auditing and security.

KEY TERMS YOU SHOULD KNOW

accounting cycle
accounting information system (AIS)
activity-based costing systems
audit trail
balanced scorecard
business entity
business intelligence
Certified Information Systems Auditors (CISAs)
Certified Information Technology Professionals (CITP)
computer-based information systems
cost accounting
CPA Trust Services
dashboards
data
e-business
e-commerce
enterprise resource planning (ERP) system
extensible business reporting language (XBRL)
financial accounting information system
information
information age
information overload
Information Systems Audit and Control Association (ISACA)
information technology (IT)
information technology (IT) auditors
interactive data
key performance indicators (KPIs)
knowledge workers
managerial accounting
performance measurement
predictive analytics
REA accounting
responsibility accounting system
Sarbanes-Oxley Act of 2002
systems consultant
suspicious activity reporting (SAR)
value-added resellers (VARs)

TEST YOURSELF

Q1-1. Which of the following is NOT true about accounting information systems (AISs)?

a. All AISs are computerized

b. AIS may report both financial and non-financial information

c. AIS, in addition to collecting and distributing large amounts of data and information, also organize and store data for future uses

d. A student who has an interest in both accounting and IT will find many job opportunities that combine these knowledge and skills areas

Q1-2. Which of the following is likely to be information rather than data?

a. Sales price

b. Customer number

c. Net profit

d. Employee name

Q1-3. With respect to computerized AIS, computers:

a. Turn data into information in all cases

b. Make audit trails easier to follow

c. Cannot catch mistakes as well as humans

d. Do not generally process information more quickly than humans

Q1-4. A dashboard is:

a. A computer screen used by data entry clerks for input tasks

b. A physical device dedicated to AIS processing tasks

c. A summary screen typically used by managers

d. A type of blackboard used by managers to present useful information to others

Q1-5. The Sarbanes-Oxley Act of 2002:

a. Enables U.S. officers to wire tap corporate phones if required

b. Has lead to a decrease in the amount of work done by auditors and accountants

c. Forbids corporations from making personal loans to executives

d. Requires the Chief Executive Officer of a public company to take responsibility for the reliability of its financial statements

Q1-6. The acronym SAR stands for:

a. Simple accounting receipts

b. Suspicious accounting revenue

c. Suspicious activity reporting

d. Standard accounts receivable

Q1-7. Which of the following is NOT true regarding assurance services?

a. Auditors of public companies are no longer allowed to provide assurance services to any public company as a result of the Sarbanes-Oxley Act of 2002

b. Assurance services include online privacy evaluations

c. Activity-based costing is not a type of assurance service

d. Only CPAs can provide assurance services to clients

Q1-8. Assigning overhead costs based on the resources, rather than only direct labor, used in manufacturing is an example of:

a. Activity-based costing (ABC)

b. Budgeting

c. Cost-plus accounting

d. Financial, rather than managerial, accounting

Q1-9. Which of these acronyms represents a law involving health assurance and privacy?

a. ABC **b.** HIPAA **c.** CPA
d. SOX **e.** XBRL

Q1-10. Which of these acronyms stands for a computer language used for reporting business activities?

a. ABC **b.** HIPAA **c.** CPA
d. SOX **e.** XBRL

Q1-11. Which of these acronyms is a certification for information professionals?

a. ABC **b.** HIPAA **c.** CBA
d. CITP **e.** XBRL

DISCUSSION QUESTIONS

1-1. Take a survey of the students in your class to find out what jobs their parents hold. How many are employed in manufacturing? How many are employed in service industries? How many could be classified as knowledge workers?

1-2. Hiring an employee and taking a sales order are business activities but are not accounting transactions requiring journal entries. Make a list of some other business activities that would not be captured as journal entries in traditional AIS. Do you think managers or investors would be interested in knowing about these activities? Why or why not?

1-3. Advances in IT are likely to have a continuing impact on financial accounting. What are some changes you think will occur in the way financial information is gathered, processed, and communicated as a result of increasingly sophisticated information technology?

1-4. XBRL is emerging as the language that will be used to create interactive data that financial managers can use in communication. How do you think the use of interactive data might enhance the value of a company's financial statements?

1-5. Discuss suspicious activity reporting. For example, do you think that such reporting should be a legal requirement, or should it be just an ethical matter? Do you think that the majority of SAR activity is illegal or are they mostly false alarms?

1-6. Managerial accounting is impacted by IT in many ways, including enhancing corporate performance measurement (CPM). How do you think a university might be able to use a scorecard or dashboard approach to operate more effectively?

1-7. Look again at the list of assurance services shown in Figure 1-10. Can you think of other assurance services that CPAs could offer that would take advantage of their AIS expertise?

1-8. Interview a sample of auditors from professional service firms in your area. Ask them whether or not they plan to offer any of the assurance services suggested by the AICPA. Also, find out if they offer services other than financial auditing and taxation. Discuss your findings in class.

1-9. This chapter described several career opportunities available to students who combine a study of accounting with course work in accounting information systems, information systems, and/or computer science. Can you think of other jobs where these skill sets would be desirable?

1-10. This chapter stressed the importance of information technology for understanding how accounting information systems operate. But is this the only skill valued by employers? How important do you think ''analytical thinking skills'' or ''writing skills'' are? Discuss.

PROBLEMS

1-11. What words were used to form each of the following acronyms? (Hint: each of them can be found in the chapter.)

a.	AAA	i.	CPM	q.	PATRIOT Act
b.	ABC	j.	ERP	r.	REA
c.	AICPA	k.	FASB	s.	SAR
d.	AIS	l.	HIPAA	t.	SEC
e.	CFO	m.	ISACA	u.	SOX
f.	CISA	n.	IT	v.	VAR
g.	CITP	o.	KPI	w.	XBRL
h.	CPA	p.	OSC		

1-12. The accounting profession publishes many journals such as the *Journal of Accountancy, Internal Auditor, Strategic Finance*, and *Management Accounting*. Choose three or four issues of each of these journals and count the number of articles that are related to information technology. In addition, make a list of the specific technology discussed in each article (where possible). When you are finished, decide whether you believe information technology is influencing the field of accounting.

1-13. Nehru Gupta is the controller at the Acme Shoe Company, a large manufacturing company located in Franklin, Pennsylvania. Acme has many divisions, and the performance of each division has typically been evaluated using a return on investment (ROI) formula. The return on investment is calculated by dividing profit by the book value of total assets.

In a meeting yesterday with Bob Burn, the company president, Nehru warned that this return on investment measure might not be accurately reflecting how well the divisions are doing. Nehru is concerned that by using profits and the book value of assets, division managers might be engaging in some short-term finagling to show the highest possible return. Bob concurred and asked what other numbers they could use to evaluate division performance.

Nehru said, "I'm not sure, Bob. Net income isn't a good number for evaluation purposes. Because we allocate a lot of overhead costs to the divisions on what some managers consider an arbitrary basis, net income won't work as a performance measure in place of return on investment."

Bob told Nehru to give some thought to this problem and report back to him.

Requirements

1. Explain what managers can do in the short run to maximize return on investment as calculated at Acme. What other accounting measures could Acme use to evaluate the performance of its divisional managers?
2. Describe other instances in which accounting numbers might lead to dysfunctional behavior in an organization.
3. Search the Internet and find at least one company that offers an information system (or software) that might help Nehru evaluate his company's performance.

1-14. In a recent article in the *New York Times*, Jeff Zucker—CEO of NBC-Universal—described the digital age as one "trading analog dollars for digital pennies."[13] Discuss this comment from the viewpoint of each of the following:

a. A music company executive

[13]Tim Arango, "Digital Sales Exceed CDs at Atlantic" *New York Times* (November 26, 2008), p. B7.

b. A consumer

c. A TV executive

1-15. What's new in the field of accounting information systems today? Select one new trend that was not mentioned in the chapter, but that you feel is important. Write a short report describing your findings. Be sure to provide reasons why you feel that your choice of topics is important, and therefore of interest to others in your class.

1-16. The participants of such recreational activities as hang gliding, soaring, hiking, rock collecting, or skydiving often create local ''birds-of-a-feather'' (affinity) organizations. Two examples are the Chicago sky divers (www.chicagoskydivers.com) or the soaring club of western Canada (www.canadianrockiessoaring.com). Many of these clubs collect dues from members to pay for club activities as well as the printing and mailing costs of monthly newsletters. Some of them maintain only minimal accounting information on manual pages or, at best, in spreadsheets.

a. What financial information are such clubs likely to collect and maintain?

b. Assuming that the club keeps manual accounting records, would you consider such systems ''accounting information systems?'' Why or why not?

c. Assume that the club treasurer of one such organization is in charge of all financial matters, including collecting and depositing member dues, paying vendor invoices, and preparing yearly reports. Do you think that assigning only one person to this job is a good idea? Why or why not?

d. What benefits would you guess might come from computerizing some or all of the club's financial information, even if there are less than 100 members? For example, do you think that such computerization is likely to be cost effective?

1-17. Many companies now provide a wealth of information about themselves on their websites. But how much of this information is useful for investment purposes? To help you answer this question, imagine that you have $10,000, which you *must* invest in the common stock of a publicly-held company.

a. Select a company as specified by your instructor and access its online financial reports. Is the information contained in the reports complete? If not, why not? Is the information contained in these reports sufficient for you to decide whether or not to invest in the company? If not, why not?

b. Now select an online brokerage website such as E*Trade and look up the information of that same company. Does the information provided by the brokerage firm differ from that of the company itself? If so, how? Again, answer the question: Is the information contained in these reports sufficiently detailed and complete for you to decide whether to invest in it? If not, why not?

c. Access the website of an investment rating service such as Value Line. How does the information on this third site differ from that of the other two? Again, answer the question: ''Is the information contained on the site sufficiently detailed and complete for you to decide whether invest in the stock? If not, why not?''

d. What do these comparisons tell you about the difference between ''data'' and ''information?''

1-18. The website of FinCen—the Financial Center Crimes Enforcement Center Network (a department of the U.S. Treasury)—can be found at www.fincen.gov. On the left side of its home page, you will find links to information for various types of companies including banks, casinos, money service businesses, insurance companies, security and futures traders, and dealers in precious metals and jewelry—i.e., the companies mandated by various federal laws to file suspicious activity reports (SARs). Select three of these types of companies, and for each type, use the information provided on these secondary pages to list at least two types of financial transactions or activities that should be considered ''suspicious.''

CASE ANALYSES

1-19. The Annual Report (Communicating Accounting Information)

The annual report is considered by some to be the single most important printed document that companies produce. In recent years, annual reports have become large documents. They now include such sections as letters to the stockholders, descriptions of the business, operating highlights, financial review, management discussion and analysis, segment reporting, and inflation data as well as the basic financial statements. The expansion has been due in part to a general increase in the degree of sophistication and complexity in accounting standards and disclosure requirements for financial reporting.

The expansion also reflects the change in the composition and level of sophistication of users. Current users include not only stockholders, but financial and securities analysts, potential investors, lending institutions, stockbrokers, customers, employees, and (whether the reporting company likes it or not) competitors. Thus, a report that was originally designed as a device for communicating basic financial information now attempts to meet the diverse needs of an expanding audience.

Users hold conflicting views on the value of annual reports. Some argue that annual reports fail to provide enough information, whereas others believe that disclosures in annual reports have expanded to the point where they create information overload. The futures of most companies depend on acceptance by the investing public and by their customers; therefore, companies should take this opportunity to communicate well-defined corporate strategies.

Requirements

1. The goal of preparing an annual report is to communicate information from a company to its targeted users. (a) Identify and discuss the basic factors of communication that must be considered in the presentation of this information. (b) Discuss the communication problems a company faces in preparing the annual report that result from the diversity its users.
2. Select two types of information found in an annual report, other than the financial statements and accompanying footnotes, and describe how they are useful to the users of annual reports.
3. Discuss at least two advantages and two disadvantages of stating well-defined corporate strategies in the annual report.
4. Evaluate the effectiveness of annual reports in fulfilling the information needs of the following current and potential users: (a) shareholders, (b) creditors, (c) employees, (d) customers, and (e) financial analysts.
5. Annual reports are public and accessible to anyone, including competitors. Discuss how this affects decisions about what information should be provided in annual reports.

1-20. Universal Concrete Products (Information for Performance Evaluation)

Jack Merritt is the controller for Universal Concrete Products (UCP), a manufacturing company with headquarters in Columbus, Ohio. UCP has seven concrete product plants located throughout the Midwest region of the United States. The company has recently switched to a decentralized organizational structure. In the past, the company did not try to measure profitability at each plant. Rather, all revenues and expenses were consolidated to produce just one income statement.

Under the new organizational structure, each concrete manufacturing plant is headed by a general manager, who has responsibility for operating the plant like a separate company. Jack has asked one of his accountants, Scott McDermott, to organize a small group to be in charge of performance analysis. This group is to prepare monthly reports on performance for each of the seven plants. These reports consist of budgeted and actual income statements. Written explanations and appraisals are to accompany variances. Each member of Scott's group has been assigned to one specific plant and is encouraged to interact with management and staff in that plant in order to become familiar with operations.

After a few months, the controller began receiving complaints from the general managers at several of the plants. Common to many of these complaints is the observation that Scott's staff members are interfering with operations and, in general, are ''getting in the way.'' In addition, the managers worry that someone is constantly ''looking over their shoulders'' to see if they are operating in line with budget. Two plant managers have pointed out that the work the performance analysis staff is trying to do should be done by them (i.e., explain the variances). As Andrew Boord, one of the most vocal plant managers, stated, ''How can these accountants explain the variances when they don't know anything about the industry? They don't know what's happening with our suppliers or our labor unions, and they haven't got a clue about our relationships with our customers.''

The president of Universal Concrete Products, Hector Eschenbrenner, has also complained about the new system for performance evaluation reporting. He claims that he is unable to wade through the seven detailed income statements, variances, and narrative explanations of all variances each month. As he put it, ''I don't have time for this and I think much of the information I am receiving is irrelevant!''

Requirements

1. Do you think it is a good idea to have a special staff in charge of performance evaluation and analysis?
2. In a decentralized organization such as this one, what would seem to be the best approach to performance evaluation?
3. What information would you include in a performance evaluation report for Mr. Eschenbrenner?

1-21. Ross, Sells, and Young, LLP (Information Technology and Auditing)

Carrie Ross is the Managing Partner of Ross, Sells, and Young, LLP, a mid-sized CPA firm. She has just finished reviewing the firm's detailed income statement for the previous quarter. The statement showed that auditing revenues were about 4% below last year's value and tax revenues were about the same. Carrie also noted that the income from financial auditing was 10% less than that of the same quarter for the previous year. She is dismayed, but not surprised, by the figures. During the past few years, competition for new audit clients has been intense and Ross, Sells, and Young has cut its hourly billing rates. The client base of the organization consists mostly of small- and medium-sized retailers and wholesalers besides several midsize property management companies.

Carrie and the other partners have been discussing ways to expand the revenue base of the organization. Knowing that information technology is a tool that the firm can use to develop new lines of business, Ross, Sells, and Young hired several college graduates during the past few years with dual majors in accounting and information systems or computer science. Given the recent financial results, Carrie thinks now is the time to begin offering other professional services.

Requirements

1. Would it make the most sense for Carrie to consider developing new clients or to consider offering different types of services to existing clients?
2. Carrie knows that the AICPA has developed a list of various types of assurance services that auditing firms might consider offering. Describe three of these assurance services that might be a good fit for this organization. (*Hint:* Visit the AICPA's web page or a website of a large accounting firm for a listing of assurance services.)
3. How can Ross, Sells, and Young capitalize on its new hires' combined strengths in accounting and information systems/computer science?

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ANSWERS TO TEST YOURSELF

1. **a** 2. **c** 3. **c** 4. **c** 5. **c** 6. **c** 7. **d** 8. **a** 9. **b** 10. **e** 11. **d**

Chapter 2

Information Technology and AISs

After reading this chapter, you will:

1. *Be able to describe* why information technology is important to accounting information systems, and why accountants should know about this technology.
2. *Understand* why computer processor speeds are not particularly important to most accounting information systems.
3. *Be familiar with* source documents and why they are important to AISs.
4. *Know* some common AIS uses for POS input, MICR media, and OCR.
5. *Be able to explain* in general terms the value of secondary storage devices to AISs.
6. *Understand* why data communications are important to AISs.
7. *Be able to describe* some advantages of client/server computing.
8. *Be able to explain* the advantages and disadvantages of cloud computing.

Business does not operate independently of technology. It never did . . . Business analysis cannot operate without considering the impact of technology. It never could . . .

Robert Scott, ''Knowing the Tech Talk'' *Accounting Technology* Vol. 20, No. 3 (April 2004), p. 4.

INTRODUCTION

In automated accounting systems, **information technology (IT)** serves as a platform upon which other system components rely. The purpose of this chapter is to discuss IT subjects in detail, especially as they relate to AISs. Because most students in AIS courses have already taken a survey computer class, the discussions here are brief. This chapter may nonetheless be useful as a review of computer hardware and software concepts, or as a study of how IT helps organizations accomplish strategic accounting goals.

It is helpful to view an accounting information system as a set of five interacting components: (1) hardware, (2) software, (3) data, (4) people, and (5) procedures. Computer hardware is probably the most tangible element in this set, but ''hardware'' is only one piece of the pie—and not necessarily the most important piece. For example, most organizations spend more money on people (in wages and salaries) than they do on computer hardware and software combined. Similarly, computer hardware must work together with the other system components to accomplish data processing tasks. Without computer software, for example, the hardware would stand idle. Without data to process, both the hardware and the software would be useless. Without procedures, accounting data could not be gathered accurately or distributed properly. And finally, without people, it is doubtful that the rest of the system could operate for long or be of much use.

What all this means is that ''information technology'' is a fuzzy term that includes more than computer hardware. In this chapter, we concentrate on computer hardware (in the next three sections of the chapter) and software (in the final section). But you should remember that these items must interact with all the other system components to create successful AISs.

Case-in-Point 2.1 CPA Crossings is a small consulting company in Rochester, Minnesota, that provides IT services to both CPA firms and the organizations they serve. In helping companies install document management systems, general partner John Higgins notes that such matters as (1) defining work flow policies and procedures, and (2) understanding the difference between document management systems and electronic documents themselves are the keys to successful implementations—not "technology."[1]

THE IMPORTANCE OF INFORMATION TECHNOLOGY TO ACCOUNTANTS

Although it may be tempting to dismiss ''information technology'' as more important to computer people than accountants, this would be a mistake. In fact, most of the references at the end of this chapter make clear that ''IT'' and ''accounting systems'' are intimately related. Here are six reasons why IT is important to accountants.

[1] Source: John H. Higgins, ''Street Talk: Reader Views'' *Accounting Technology* Vol. 22, No. 3 (April 2006), p. 7.

Six Reasons

One reason for IT's importance is because information technology must be compatible with, and support, the other components of an AIS. For example, to automate the accounting system of a dry-cleaning business, the owners will have to consider what tasks they'll want their system to accomplish, identify what software package or packages can perform these tasks, and perhaps evaluate several different computer hardware configurations that might support these packages. These concerns are the subject of ''systems analysis''—the topic covered in Chapter 13.

A second reason why information technology is important is because accounting professionals often help clients make hardware and software purchases. For example, large expenditures on computer systems must be cost-justified—a task usually performed with accounting expertise and assistance. For this reason, many consulting firms now specialize in, or have departments for, management advisory services to perform these consulting tasks. Understanding IT is critical to these efforts.

A third reason why information technology is important to accountants is because auditors must evaluate computerized systems. Today, it is no longer possible for auditors to treat a computer as a ''black box'' and audit around it. Rather, auditors now commonly audit through or with a computer. This means that auditors must understand automation and automated controls, and also be able to identify a computerized system's strengths and weaknesses. We discuss these matters in Chapter 14.

A fourth reason why IT is important to accountants is because they are often asked to evaluate the efficiency (for example, costliness and timeliness) and effectiveness (usually strategic value) of an existing system. This is a daunting task, requiring a familiarity with the strengths and weaknesses of the current system, as well as an understanding of what alternate technologies might work better.

A fifth reason why information technology is important to accountants is because IT profoundly affects the way they now work, and how they will work in the future. This includes new ways of gathering and recording information, new types of systems that accountants will use (both to perform personal tasks and to communicate their work to others), new types of hardware, software, and computer networks upon which these systems will run, and even new ways to audit these systems.

Case-in-Point 2.2 Target is a retailer with 1,591 stores in the United States (in 2008) and over $65 billion in retail sales. Many of its suppliers claim that the chain's sophisticated technology is "the best in the business," enabling managers to make fast, accurate decisions on its many merchandising operations. Attention to detail is also important, including color-coding department areas within the store and automating operations at checkout stands. Says Target president Kenneth Woodrow, "If people have to wait in line, it means we don't respect their time."[2]

A final reason why information technology is important to accountants is because understanding how IT affects accounting systems is vital to passing most accounting certification examinations. For example, sections of both the CPA and CMA examinations contain questions about information technology.

[2]Source: Jim Frederick, ''Target Adheres to Core Strategy in Midst of Tough Economy'' *Drug Store News* Vol. 30, No. 5 (April 21, 2008), p. 130.

The Top Ten Information Technologies

Annually, the AICPA conducts a voluntary annual survey of its members to identify the ''top 10 information system technologies'' affecting the study and practice of accounting. Figure 2-1 provides the set for 2008. For the fifth year in a row, ''information security'' tops the list, although the general topic of ''security'' involves almost all the other items in the list as well.

Because of their importance, we discuss many of the items in Figure 2-1 in various chapters of the text itself. For example, Chapters 10, 11, 12, and 15 discuss the topic of ''information security'' (item 1 on the list). Similarly, we discuss ''assurance and compliance standards'' in Chapter 14, ''identity and access management'' in Chapter 12, ''mobile and remote computing'' here, and ''disaster recovery'' in Chapter 12.

INPUT, PROCESSING, AND OUTPUT DEVICES

Figure 2-2 suggests that the hardware of a computer system includes the computer itself—for example, a microcomputer—as well as the keyboards, printers, hard disks, and similar devices that help the computer perform input and output tasks. These devices are commonly called **peripheral equipment** because they typically surround the computer and help it process data.

One way to classify peripheral equipment is by the tasks they perform. Thus, *input equipment* (such as computer mice and keyboards) enable users to enter data into a computer system, *output equipment* (such as monitors and printers) enable users to see processed results, *secondary storage devices* (such as hard disks) enable users to store data for future reference, and *communications equipment* (such as internal networking cards) enable users to transmit data over data networks. Like any other system, these distinct pieces of computer equipment must work together to accomplish data processing tasks.

Most accounting transactions are processed in a three-phase operation called the **input-processing-output cycle**. For convenience, we shall look at technologies that assist AISs in each of these areas in this order.

Input Devices

The starting point of the input-processing-output cycle—especially when processing accounting data—is input. Thus, even where the amount of data is small, most AISs require input methods and procedures that ensure complete, accurate, authentic, timely, and cost-effective ways of gathering and inputting accounting data. Usually, there are several ways of capturing accounting data, so system designers must pick those input procedures and devices that best meet these system objectives.

Source Documents and Data Transcription. The starting point for collecting accounting data in most AISs is a **source document**. Manual examples include time cards, packing slips, survey forms, employee application forms, patient intake forms, purchase

Rank	Item	Explanation
1	Information Security	The ability to protect the components of an AIS from such threats as viruses, password intrusions, and physical harm.
2	Identity and Access Management	The hardware, software, and procedural tools that enable organizations to identify and authenticate individuals uniquely. Examples include passwords, digital certificates, and biometrics.
3	Conforming to Assurance and Compliance Standards	Software tools that enable organizations to create, document, monitor, assess, test, and report on their compliance with specified controls. This encompasses risk management, risk assessment, and continuous auditing.
4	Privacy Management	Protecting the rights and meeting the responsibilities of collecting, storing, using, and disclosing personal information—especially information in digital formats.
5	Disaster Planning and Recovery	The ability to continue business operations in the event that a disaster (such as an earthquake) occurs.
6	IT Governance	Relationships and processes that help organizations achieve strategic goals while balancing risks and returns in IT operations.
7	Securing and Controlling Information Distribution	Protecting and securing the transmission and distribution of digital data—for example, using encryption systems.
8	Digital Identity and Authentication Technologies	Methods that verify users are who they say they are, and also non-repudiation techniques.
9	Wireless Technology	The ability to transmit voice and data via airwaves, thus avoiding the need for physical connectivity.
10	Mobile and Remote Computing	Hardware, software, and procedures that enable users to connect securely to computer systems remotely, using such technologies as wireless PDAs, Bluetooth, WiFi, and WiMax.
11	Electronic Archiving and Data Retention	Technologies that enable organizations to archive and retrieve digital information efficiently and securely—for example, using Direct Attached Storage (DAS), Network Attached Storage (NAS), and Storage Area Networks (SANs), or optical devices such as DVDs, CDs, and Blu-Ray. This includes policies for both the backup and destruction of archived data.
12	Document, Content, and Knowledge Management	Methodologies for capturing, storing, indexing, retrieving, searching, and managing digital information, including database information and video files. The term ''knowledge management'' means organizing this information so that employees can use it intelligently.

FIGURE 2-1 The AICPA's Top 10 Information Technologies for 2008. Source: www.AICPA.org

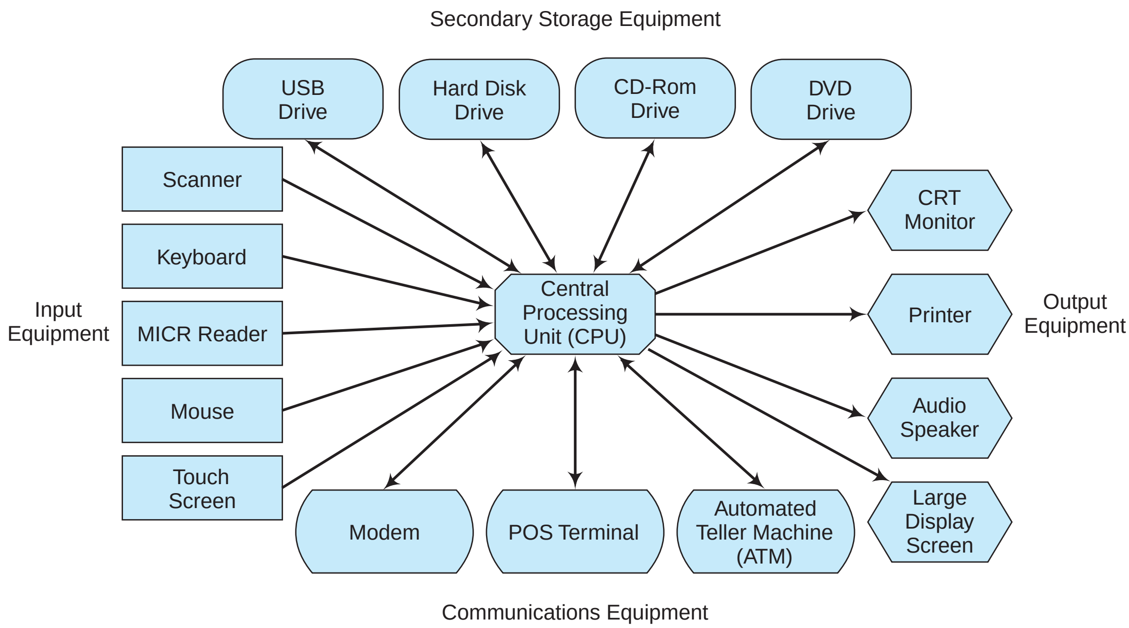

FIGURE 2-2 A central processing unit and examples of peripheral equipment.

invoices, sales invoices, cash disbursement vouchers, and travel reimbursement forms. Computerized examples include airline reservation screens, bank deposit screens, and web-based customer-order forms.

Source documents are important to AISs because (1) they are human readable, and (2) they can be completed by the user. Source documents also important because they provide evidence of a transaction's authenticity (e.g., a signed cash disbursement voucher authorizes a cash disbursement), are the starting point of an audit trail, and (in emergencies) can serve as backup in the event that the computer files created from them are damaged or destroyed.

The greatest disadvantage of manually-prepared source documents is that they are not machine-readable. Thus, in order to process source-document data electronically, the data must first be transcribed into machine-readable media. This **data transcription** is mostly an inefficient, labor-intensive, time-consuming, costly, and non-productive process that has the potential to bottleneck data at the transcription site, embed errors in the transcribed data, and provide opportunities for fraud, embezzlement, or sabotage. Is it any wonder, then, that most AISs capture data that are already in machine-readable formats? The paragraphs that follow describe some devices that overcome these problems.

POS Devices. Because most of the information required by retailers can be captured at the point at which a sale is made, retail businesses now commonly use automated **point-of-sale (POS) devices** to gather and record pertinent data electronically at that time. One example is the ''smart cash registers'' that are connected to offsite computers. Another example is the **bar code readers** that interpret the *universal product code (UPC)* commonly printed on supermarket and variety store items (Figure 2-3). Non-UPC bar codes are used extensively in transportation and inventory applications to track shipments (e.g., Federal Express), by warehouse employees to log received merchandise, by universities

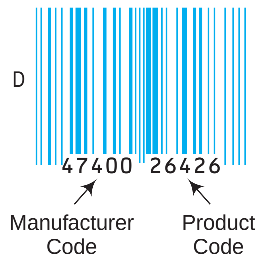

FIGURE 2-3 An example of the universal product code (UPC), which is often preprinted on the labels of retail products for merchandise identification and computerized checkout.

to identify equipment, by the U.S. Post Office to route mail, and by publishers to identify books using ISBN numbers (see the bar code on the back of this book for an example).

POS systems allow retailers to centralize price information in online computers, avoid the task of affixing price stickers to individual items on retail store shelves, and update prices easily when required. With such systems, for example, the sales data obtained at the checkout-station of a convenience store can be transmitted directly to a computer where they can be verified for accuracy, reasonableness, and completeness, and also stored for later uses—for example, preparing sales reports. Figure 2-4 lists other advantages of POS data collection systems, which are actually growing in use despite the maturity of the technology.

Case-in-Point 2.3 Independent dealers operate the 1,370 Mac's Convenience Stores in Canada, but the company provides the accounting and systems support. Saddled with extra steps required to consolidate information using its old system and a need for tighter inventory control, corporate managers decided to install a new Catapult POS system. The new system fully integrates debit/credit card purchases, uses touch screen technology that is "10 times faster" than the old system, and enables store owners to identify supplier problems more quickly.[3]

1. Clerical errors, such as a salesperson's incorrect reading of a price tag, are detectable, and even potentially correctable, automatically.
2. Such standard procedures as the computation of a sales tax, the multiplication of prices times quantities sold, or the calculation of a discount can be performed using the register-terminal as a calculator.
3. Processing errors caused by illegible sales slips can be reduced.
4. Credit checks and answers to questions about customers' account balances are routinely handled by using the cash register as an inquiry terminal.
5. The inventory-disbursements data required for inventory control are collected as a natural part of the sales transaction.
6. A breakdown listing by the computer of sales by type of inventory item, dollar volume, sales clerk, or store location is possible because the data required for such reports are collected automatically with the sales transaction and may be stored for such use.
7. Sales and inventory personnel levels can be reduced because the manual data processing functions required of such personnel have largely been eliminated.

FIGURE 2-4 Advantages of POS systems.

[3]Source: Tammy Mastroberte, "A Perfect Connection" *Convenience Store News* Vol. 39, No 13 (October 12, 2003), pp. 216–218.

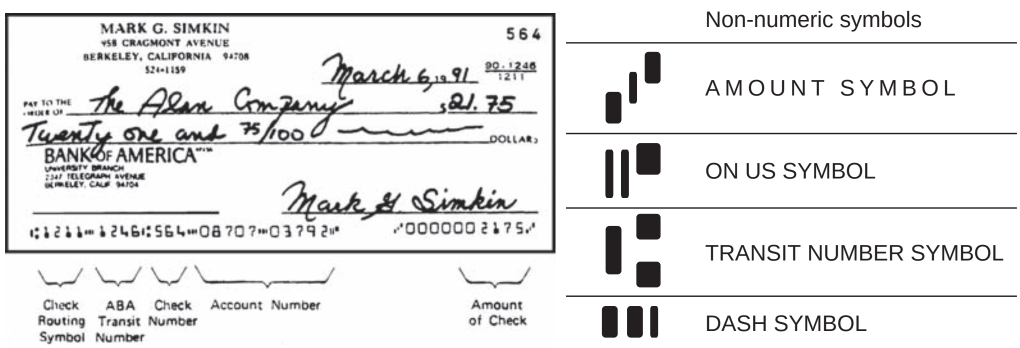

FIGURE 2-5 The MICR symbols of the American Banking Association (ABA).

Magnetic Ink Character Recognition. The banking industry pioneered the development of magnetically-encoded paper, commonly called **magnetic ink character recognition (MICR)**. You are probably familiar with MICR characters—the odd-looking numbers printed on the bottom of your checks (Figure 2-5). This type font has been standardized for the entire country by the American National Standards Institute (ANSI). Thus, a check you write anywhere in the United States or Canada is machine-readable by any bank.

One advantage of MICR coding is that it is both machine readable and human readable. Another advantage is that MICR coding is quite flexible: documents of varying sizes, thicknesses, or widths may be used. The chief disadvantage of MICR is that the magnetic strength (called the ''magnetic flux'') of the characters diminishes over time. This makes MICR documents unreliable when they must be input repeatedly.

Optical Character Recognition. **Optical character recognition (OCR)** uses optical, rather than magnetic, readers to interpret the data found on source documents. Typical OCR devices use light-sensing mechanisms and laser technology to perform the character-recognition function required to interpret recorded data. **Mark-sense media** (such as the type used in computerized exams) use simple rectangles or ovals as ''characters'' that you blacken with a pencil. More sophisticated versions of OCR can read complete character sets of numbers and letters (Figure 2-6), and are therefore more versatile as input.

Accounting uses of OCR include the billing statements of public utility companies, credit card issuers, and insurance companies, mortgage payment coupons, telephone bills, subscription renewal forms, and airline tickets. Most of these forms are **turnaround documents**—i. e., documents that are initially prepared by a company, then sent to individuals, and finally returned to the organization for further data processing. Like MICR encoding, the chief advantage of OCR is a source document that is both human-readable and machine-readable.

Plastic Cards with Magnetic Strips. Many plastic cards have a magnetic strip attached to one side of them that can store permanent information and therefore provide input data when required. Typically, the ''mag strip'' stores information about the user—for example, a checking account number, credit-card number, room number, or security-clearance code. In the United States, the magnetic strip on these cards has been divided into distinct physical areas and, by agreement, each major industry using these

FIGURE 2-6 This versatile optical character reader from Scan Corporation can read OCR characters, barcodes, and magnetic stripes.

cards has its own assigned space. Thus, the International Airline Transport Association (IATA), the American Banking Association (ABA), and the savings and loan industry each encode information pertinent to their individual needs on such plastic cards without fear that, by accident, these cards will be misused in another application.

AISs use mag-strip cards to capture data at the time these cards are used. For example, credit cards can include passwords that ATM machines can examine every time someone uses the card. This also facilitates data gathering because reliable electronic equipment reads the strip, thus eliminating human error.

Case-in-Point 2.4 In the United States, many gambling casinos issue mag-strip "club cards" to their customers, who use them as internal credit cards for playing slot machines, poker machines, and so forth. These cards free customers from the task of cashing checks or getting change. But these same cards also enable casinos to gather data on player activities—information that managers can subsequently use to make better decisions about extending credit limits or providing complimentary meals and hotel rooms.[4]

Microcomputer Input Devices. Many specialized devices now help users input data to their microcomputers. *Keyboards* are perhaps the most common input device. *Computer mice, touch pads, joy sticks* and similar devices enable users to control a screen cursor, create graphic images, reposition screen objects, or select items from display menus. *Touch screens* enable users to make menu choices simply by touching a display screen with a finger or stick. *Web cams* provide live video input to a computer. *Computer pens or styluses* permit users to enter data on video screens and are especially popular with **PDA (personal data assistant) devices** such as Blackberries. These PDAs enable their users to make phone calls as well as maintain such personal data as address books, appointment calendars, and check registers. Most models also incorporate

[4]Source: From the authors.

wireless technology that provide access to the Internet—a practical feature for email users.

Digital Cameras. Although many people only use digital cameras in recreational settings, accountants also use them for documenting (1) inventories of large assets such as trucks, cranes, and buildings, (2) damage to vehicles or offices due to accidents, vandalism, or natural disasters for insurance purposes, and (3) new or existing employees for identification and security purposes. As suggested by the following case-in-point, the benefits of digital photographs—i.e., the ability to store, display, reproduce, and transmit them electronically—must be weighed against their potential social costs.

Case-in-Point 2.5 Red-light cameras automate the process of ticketing motorists who drive through red traffic lights (Figure 2-7). Such cameras enable municipalities to enforce driving laws at important traffic intersections and often substantially increase revenues from traffic violations. Proponents of red-light cameras argue that red-light cameras reduce accidents and that the funds they generate can be used to pay for other important police work. Critics counter that the cameras are *only* revenue generators and that they pose an important threat to an individual's right to privacy.[5]

FIGURE 2-7 An example of a red-light camera (*Source*: istockphoto).

[5]Source: no author, ''California City to Transform Red Light Cameras into Spy Cameras'' *The* Newspaper.com: *A Journal of the Politics of Driving*, accessed at www.thenewspaper.com/news/18/1886.asp, November 23, 2008.

(a) fingerprint scanner (b) iris scanner

FIGURE 2-8 (a) An inexpensive USB fingerprint scanner, courtesy of BioEnable, and (b) an inexpensive iris scanner, courtesy of LG Electronics.

Biometric Scanners. Many accounting applications must verify that a user has legitimate access to a system—for example, can view corporate personnel files. Authentication systems based on *what you know* require you to input codes, account numbers, passwords, or similar values. These are low-security systems because users can easily forget, lose, or guess such information, making such systems vulnerable to attack and misuse. Systems based on *what you have* require physical keys, magnetic cards, or similar physical media—but suffer many of the same problems as password-based authenticating systems.

Biometric scanners authenticate users based on *who they are. Behavioral systems* recognize signatures, voices, or keystroke dynamics. *Physiological systems* recognize fingerprints, irises, retinas, faces, and even ears. Most of these devices connect directly to computer USB ports or are integrated in computer keyboards, mice, or web cams. The two most reliable biometric systems use fingerprint or iris scanners to authenticate users (Figure 2-8). Fingerprints are unique, and experts have yet to discover two people with the same minute details since 1892 when records were kept. Iris scans record vein patterns in the colored portion of the eye, and are even more accurate than fingerprints because of the wider variability in vein patterns and the fact that even the right and left eye of the same person are not identical.

Biometric authentication begins with *enrollment*—the process of creating digital templates for legitimate users. Template files are small, requiring about 256 bytes for a fingerprint and 512 bytes for an iris scan. To authenticate a user, the scanner takes a new sample from the individual and compares it to known templates. Unlike passwords, the new samples will not perfectly match the template. The *hamming distance* measures how close the two match.

Case-in-Point 2.6 One interesting use of biometric scanning was recently mandated by the Maritime Transportation Security Act. Workers, such as longshoremen and truck drivers who need access to secure U.S. ports or marine vessels, must now apply for a Transportation Worker Identification Credential (TWIC) card. Over 1.1 million port workers already have such smart cards, each of which includes a picture, a magnetic stripe, and a bar code. The information in the card includes the cardholder's fingerprints to establish a secure biometric connection between the cardholder and the card.[6]

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[6]Source: www.tsa.gov/what_we_do/layers/twic.

Central Processing Units

Once data have been captured (and perhaps transcribed into machine-readable formats), they usually must be processed to be valuable to decision-makers. These processing tasks are performed by the **central processing unit (CPU)** of a computer system (Figure 2-9). In the computer industry, the terms *computer* and *CPU* are often used interchangeably.

The processing power of CPUs starts with the most limited microcomputers (aka ''personal computers'' or ''PCs'') and increases in such capabilities as speed, multi-user support, and peripheral equipment with **minicomputers, mainframe computers**, and **supercomputers**. A growing segment of the microcomputer market is the portable systems—i.e., *laptop computers, netbook computers*, and the even more-compact *personal digital assistants (PDAs)* and cell phones. The accounting systems of the smallest businesses—for example, that of a bicycle-repair shop—can often be implemented entirely on a desktop microcomputer. In contrast, the inventory control systems of the nation's largest vendors—for example, Wal-Mart—require multi-user systems that may employ several centralized mainframes working in tandem.

One of the biggest challenges facing businesses today is identifying the right combination of computing technologies—i.e., computers of various sizes, networks, and related software—that best meet their IT needs. Dollar for dollar, organizations usually get the most processing power and the cheapest software with microcomputers, which helps explain why modern organizations buy so many of them. Reasons to retain older mainframe systems include (1) the need to support multi-user processing capabilities that work best on such systems, (2) the advantages of centralized processing—for example, simplified control over hardware, software, and user accesses to databases, and (3) the huge costs that organizations typically incur when replacing these **legacy systems**.

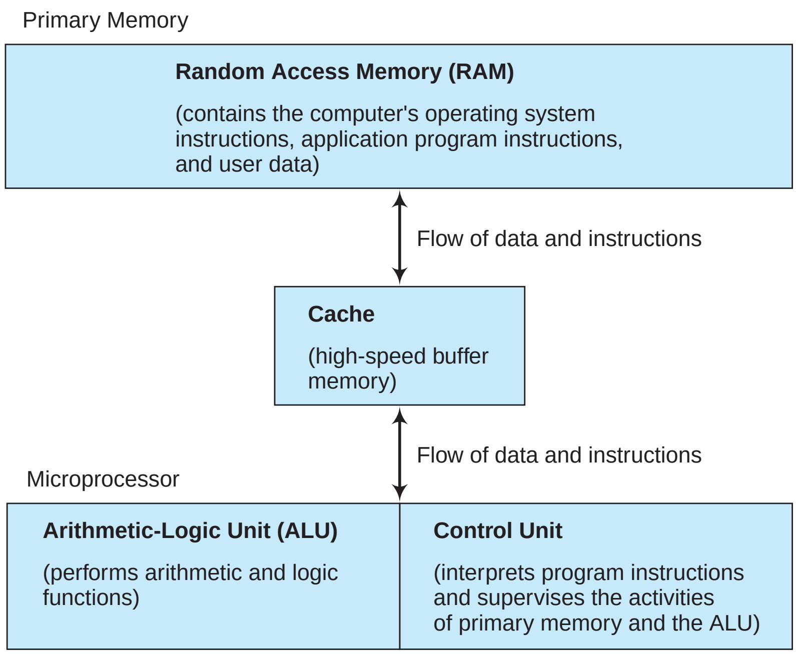

FIGURE 2-9 A schematic of a central processing unit. In some computers, the ''Level 2'' (high-speed buffer) cache is part of the microprocessor unit.

Primary Memory. Figure 2-9 indicates that the two main components of a CPU are its primary memory and its microprocessor, with *cache*, or buffer, memory serving as the interface between these components. The purpose of **primary memory** is to store data and program instructions temporarily for immediate processing and execution. In microcomputers, this primary or *random access memory* (*RAM)* consists of individual *bytes*, each capable of storing a single character of data—e.g., a letter or punctuation mark. RAM capacities are typically measured in *gigabytes* (billions of bytes). Most accounting software requires minimum amounts of primary memory to operate properly, so ''RAM size'' is often a key concern when matching computer hardware to software requirements for smaller AIS applications.

Microprocessors. Computers cannot manipulate data or execute instructions directly in primary memory. Rather, these tasks are performed by the CPU's **microprocessor**. Examples include Intel Corporation's Atom or Core 2 Quad chips. The *arithmetic-logic unit (ALU)* portion of these microprocessor chips performs arithmetic tasks (such as addition and multiplication), as well as logic tasks (such as comparisons). In contrast, the *control unit* of the processor supervises the actual data processing—for example, transferring data from primary memory to the ALU, performing the required task (e.g., adding two numbers together), and transferring the answer back to primary memory.

Computers, Processor Speeds, and AISs. The most important thing to know about processor speeds is that they are rarely important in accounting applications. This is because the input-processing-output cycle characteristic of most accounting tasks requires input and output operations as well as processing procedures in order to perform specific tasks. An example is a payroll application, which must input, process, and output the data from each time card. The speeds of the input/output (I/O) operations involved in this application are orders of magnitude slower than the internal speeds of the processor, thus explaining why most computers are **I/O bound**, not process bound. What this means to accounting applications is that designers must typically look elsewhere for ways to speed computer *throughput*—i.e., the time it takes to process business transactions such as payroll time cards—for example, by employing faster data transmissions.

Output Devices

Accounting data are meaningless if they cannot be output in forms that are useful and convenient to end users. Printed, **hard-copy output** is one possibility, but video or **soft-copy output** on monitor screens, audio output, and file output to secondary storage devices such as hard disks are other possibilities that we explore here. Outputs are especially important to AISs because the information in these outputs is usually the basis of managerial decision making, and therefore the goal of the entire system.

Printers. The hope for a *paperless office* has yet to be realized and most AISs still produce many types of printed outputs—for example, transaction summaries, financial statements, exception reports, spreadsheet-based budget reports, word processing documents, and graphs. Many printers now also perform the functions of fax machines, copiers, and scanners, enabling these devices to serve as input devices, transmission devices, and standalone copying devices.

Printers fall into three general categories: (1) dot-matrix, (2) ink-jet, and (3) laser. **Dot-matrix printers** are impact printers that employ tiny wires in a print head to strike an inked ribbon and create tiny dots on a print page. These printers are popular with small-business users because they are inexpensive and can print multipart (‘‘carbon’’) paper—an important feature commonly used in commercial cash registers to print multiple copies of credit-card receipts.

Ink-jet printers create characters by distributing tiny bubbles or dots of ink onto print pages. The print resolutions of these printers (commonly measured in *dots per inch* or *dpi*) tend to be higher than dot-matrix printers, while printing speeds (commonly measured in *pages per minute* or *ppm*) tend to be lower than laser printers. But most ink-jet printers can print in colors—a capability lacking in many dot-matrix and laser printers—enabling them to print graphics and colored pictures as well as text documents.

Laser printers create printed output in much the same way as duplicating machines. The costs of laser printers are higher than dot-matrix or ink-jet printers, but print quality is usually superior and output speeds are much faster. Laser printers are often the printer of choice for commercial users because of this speed advantage. Many laser printers can now also print in color.

Video Output. Because hard-copy outputs clutter offices with paper and take time to print, many AISs use fast, *soft-copy* video screen displays instead. Computer monitors are perhaps the most common type of video output, but the airport display screens showing arrivals and departures, stadium scoreboards, highway billboards, and the signage of many private stores are also forms of computerized video outputs.

The monitors of most laptop and desktop computers use flat-panel, *liquid crystal display (LCD) screens* to create video outputs the same way that televisions do. The **picture elements (pixels)** in both types of screens are tiny, discrete dots arranged in a matrix. SVGA (for super video graphics adapter) refers to a pixel matrix of about 1200 by 800 pixels (the exact dimensions are not standardized and vary with the manufacturer).

Multimedia. Multimedia combines video, text, graphics, animation, and sound to produce multidimensional output. By definition, multimedia presentations also require advanced processor chips, sound cards, and fast video cards to work properly. One accounting use of multimedia is storing the pictures of employees in personnel files. Another is recording verbal interviews with audit clients. A third is preparing instructional disks for tax accountants. Accounting uses of multimedia are likely to grow as the cost of producing multimedia applications becomes cheaper and new applications are found for this stimulating form of output. Multimedia applications are now also becoming common on the Internet.

SECONDARY STORAGE DEVICES

Primary memory is **volatile memory**, meaning memory that loses its contents when electrical power is lost. In contrast, AISs must store data on permanent media that maintain their accuracy and integrity, yet permit these systems to access and modify information quickly and easily. This is the purpose of **secondary storage** (also called *mass storage* or *auxiliary storage*). Like primary memory, the basic unit otf secondary storage is a *byte*, and secondary storage capacities are measured in *kilobytes* (1,024 bytes), *megabytes* (1,024 kilobytes), *gigabytes* (1,024 megabytes), or *terabytes* (1,024 gigabytes).

In this section, we examine several types of secondary storage: magnetic (hard) disks, CD-ROMs, DVD disks, and USB flash disks. Common to all these media is the concept of

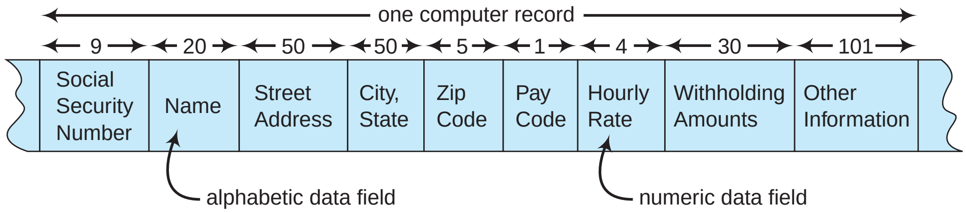

FIGURE 2-10 The format for the computer record of an employee on a payroll file.

a computer record. Like manual systems, computerized AISs must maintain information about payroll activities, warehouse inventories, and accounts receivable data in permanent files. In each such file, a **computer record** is a collection of information about one file entity—for example, one employee on a payroll file (Figure 2-10).

Magnetic (Hard) Disks

A **magnetic (hard) disk** (Figure 2-11) consists of one or more spinning platters, each surface of which has an iron oxide coating that can be magnetized to record information. The smallest hard disks use only a single, double-sided platter, whereas larger-capacity hard disks use multiple platters. The disk system can access (or write) records from any portion of the platter by moving its read/write heads in toward the center of the disk platters, or outward to their outer edges. To avoid contamination from dust or smoke particles, most hard disks are permanently sealed in their boxes.

To further guard against disk failures as well as increase storage capacities, manufacturers now also offer **redundant arrays of inexpensive disks (RAIDs)**— see Figure 2-12. In effect, these are stacks of hard disks, each similar to the disk system shown in Figure 2-11.

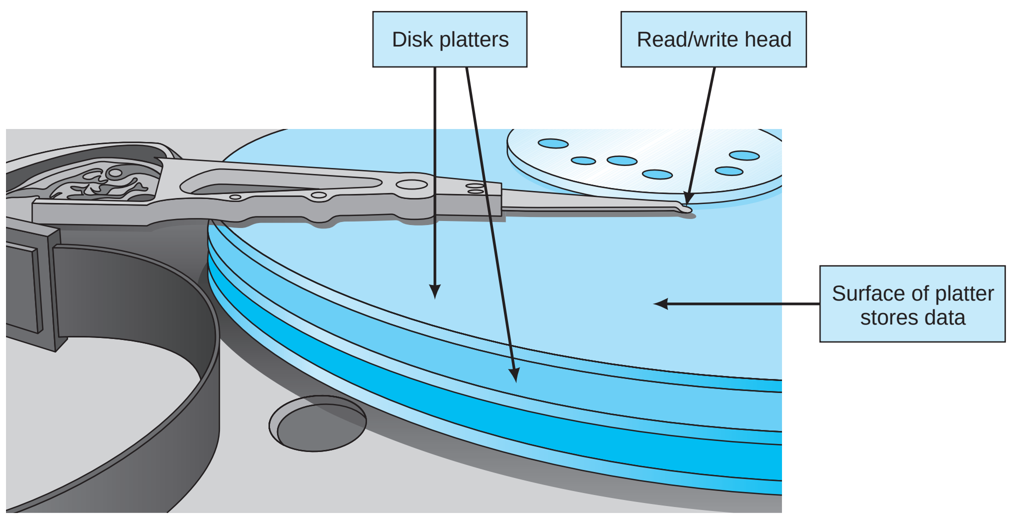

FIGURE 2-11 A schematic of a multiplatter hard disk. The read/write head assembly moves the read/write heads inward (toward the central spindle) or outward as needed, allowing the system to access the data on any portion of any platter.

FIGURE 2-12 A redundant array of inexpensive disks (RAID).
Source: OrbitMicro at www.orbitmicro.com

RAIDs are also commonly used for archiving functions—and therefore critical to AISs in the event of an unforeseen disaster.

One advantage of magnetic disk media is their large storage capacities—now commonly measured in *gigabytes* for microcomputers and *terabytes* for commercial AISs. Another advantage is their fast data transfer rates, which now can exceed 100 million characters per second. Finally, perhaps their most important advantage is their ability to directly access any specific record without sequential searching—a capability made possible by the fact that disk data are assigned individual addresses (like postal addresses). This accessing capability is useful for such online applications as airline reservations or bank account inquiries, when users require immediate access to specific records, and explains why magnetic disks are also called *direct access storage devices (DASDs)*.

CD-ROMs and DVDs

Two types of secondary storage devices currently popular with microcomputer users are CD-ROMS and DVDs. Both media store data digitally and are read optically.

CD-ROMs. The term **CD-ROM** is an acronym for ''compact disk-read only memory.'' The name is appropriate because CD-ROMs are the same size and appearance as audio CDs. CD-ROMs contain microscopic pits that are etched along a spiraling track in their substrate surfaces. Laser beams interpret the presence or absence of a pit as the ''one'' or ''zero'' of binary codes.

CD-ROMs come in three types. The oldest, prerecorded versions are similar to those on which music or software is distributed. Newer, ''CD-r'' media are blank CD-ROMs that can be recorded (only once) with inexpensive CD encoding devices. These are **worm (write-once, read-many) media**. Finally, the newest ''CD-rw'' media are rewritable, allowing AISs to use them as low-capacity hard disks.

One advantage of CD-ROMs is the fact that they are a removable medium with storage capacities in excess of 650 megabytes per disk—the equivalent of 300,000 pages of text! This makes CD-ROMs ideal for storing large amounts of accounting data or reference materials. Because CD-ROMs are read with laser beams, data transfer rates are also very fast, and wear and tear is minimal, even with continuous usage. Finally, the worm characteristic of CD-ROMs and CD-r's make them useful for archiving files securely (i.e., storing files on a medium that cannot be changed). But CD-ROMs suffer from at least one drawback—the fact that that worm media cannot be updated (because new information cannot be written on them once they have been encoded).

DVDs. A digital video disk or **DVD** closely resembles a CD-ROM in that it too is a 5-inch plastic disk that uses a laser to encode microscopic pits in its substrate surface. But the pits on a DVD are much smaller and encoded much closer together than those on a CD-ROM. Also, a DVD can have as many as two layers on each of its two sides (compared to the single-layered, single-sided CD-ROM). The end result is a medium that can hold as much as 17 gigabytes of data—over 25 times the capacity of a standard CD-ROM disk. The two greatest advantages of DVDs are therefore (1) a huge storage capacity that enables users to archive large amounts of data, and (2) a single, light-weight, reliable, easily-transportable medium. Newer DVDs are writeable and even re-writeable.

Flash Memory

Flash memory is solid state memory that comes in various forms. Examples include the flash drives that use the USB ports of microcomputers (Figure 2-13), the PCMCIA memory cards used with laptops, the memory sticks used in digital cameras, and the memory cards used with video games. The term ''solid state'' means that there are no moving parts (unlike the hard disk in Figure 2-11)—everything is electronic rather than mechanical.

USB drives can store gigabytes of data in an erasable format. Because data transfer rates are high and the devices themselves compact, they are particularly useful to accountants for creating backups of important files and transporting them offsite. Costs are low—under $20 for smaller-capacity USB drives.

Image Processing and Record Management Systems

The life cycle of business documents begins with their creation, continues with their storage and use, and ends with their destruction. Two important tools that can help managers with such tasks are image-processing systems and record management systems.

FIGURE 2-13 This Flash memory from San Disk plugs into a standard USB microcomputer connector. It can write data at 13 mb per second, read data at 15 mb per second, and store up to 4 gigabytes of data.

Image Processing. **Image processing** allows users to store graphic images in digital formats on secondary storage media (e.g., the images now taken by digital cameras). Thus, image processing systems are able to capture almost any type of document electronically, including photographs, flowcharts, drawings, and pages containing hand-written signatures. Commercial users of image processing include: (1) insurance companies that use image processing to store claims forms and accident reports, (2) banks that use image processing to store check images, (3) hospitals that use image processing to store medical-diagnostic scans, and (4) the Internal Revenue Service, which uses image processing to capture and store tax return data.

Case-in-Point 2.7 Lloyd's of London is the world's largest insurer. It processes over 90,000 new claims annually and handles over 1.5 million paper documents each year. To speed claims processing as well as reduce the costs associated with all this paper handling, the company is developing an £11m system to store new claims information digitally as well as process the transactions associated with them. Estimated annual savings: £50 million.[7]

Image processing offers several advantages. One is the fast speeds at which images can be captured—a benefit of special importance to high-volume users such as banks. Another advantage is the reduced amount of physical storage space required (compared to paper storage). A third advantage is the convenience of storing images in computer records, which can then be sorted, classified, retrieved, or otherwise manipulated as needs require. A final advantage is the ability to store images in central files, thus making copies available to many users at once, even at the same time. (This last advantage is an important benefit to business and medical offices, where personnel no longer have to ask ''who's got the file?'' This is the topic of the AIS at Work at the end of Chapter 8.)

Record Management Systems. Simple record management systems enable businesses to systematically capture and store documents. Newer **electronic document and record management systems (EDRMs)** extend such capabilities by helping organizations manage the workflow of electronic documents during document development, provide collaborative tools that enable several users to work on the same document, and allow organizations to create and store multiple versions of documents.

It is easy to understand why business and government organizations use EDRM tools. For legal reasons, for example, businesses may need to retain both current and old policy manuals, contracts, or employment records. Similarly, it is convenient to automate the termination of documents when contracts expire, employees quit, or new policies replace them.

DATA COMMUNICATIONS AND NETWORKS

Data communications refers to transmitting data to and from different locations. Many accounting applications use data communications in normal business operations. For example, banking systems enable individual offices to transmit deposit and withdrawal information to centralized computer locations, airline reservation systems enable travel agents to book flights from remote locations, and stock brokerage systems enable brokers

[7]Source: Nick Huber, ''Lloyd's Moves to End Paper-Based Transactions'' *Computer Weekly* (February 17, 2004), p. 5.

to transmit buy and sell orders for their customers. Accountants must understand data communication concepts because so many AISs use them and also because so many clients acquire AISs that depend upon them. In addition, auditors must sometimes audit the capabilities of a network—for example, evaluate its ability to transmit information accurately and to safeguard the integrity of the data during such transmissions.

Communication Channels and Protocols

A *communication channel* is the physical path that data take in data transmissions. Examples include: (1) the twisted-pair wires of telephone lines, (2) coaxial cables, (3) optical fibers, (4) microwaves, and (5) radio (satellite) waves. Local area networking applications (discussed shortly) typically use the first three of these, while Internet applications often use all five of them.

To transmit data over these communications channels, the digital pulses of the sending computer must be translated into the sound patterns, light pulses, or radio waves of the communications channel. Over voice-grade telephone lines, this translation is performed by a **modem** (an acronym for ''modulator-demodulator''). The transmission rates are commonly measured in *bits per second (bps)*.

ISDN (integrated services digital network) is an international data communications standard that transmits data, voice message, or images at a standard rate of 128k bps over the Internet. A similar data transmission service is a **digital subscriber line (DSL)**, which supports data communications rates up to 9 megabits per second. Finally, large data communications installations using fiber optic cables and similar wide-band channels can currently transmit data up to 266 million bps. Future optic fiber transmission rates will transmit data at speeds up to 2.2 billion bps—speeds high enough to transmit motion-picture images in real time.

In all data communications applications, the sending and receiving stations must use a compatible transmission format. A **data communications protocol** refers to the settings that provide this format. Two common protocols are *TCP (transmission control protocol)*, which networks commonly use for emails, and *HTTP (hypertext transmission protocol)*, which networks commonly use for web pages.

Local and Wide Area Networks

One important use of data communications is in **local area networks (LANs)**. Figure 2-14 shows that a LAN consists of microcomputers, printers, terminals, and similar devices that are connected together for communications purposes. Most LANs use **file servers** to store centralized software and data files, and also to coordinate data transmissions among the other LAN devices and users. Most local area networks occupy a single building, although LANs covering several buildings are also common. In the past, installers hard-wired LAN devices together. Today, many LANs are wireless—a convenience to users, who no longer need to worry about where to place computer equipment in their offices, but an added security hazard to network administrators.

LANs provide several users access to common hardware, software, and computer files, as well as to each other. Some advantages of LANs are:

1. **Facilitating communications:** The number one reason why businesses install LANs today is to support email and/or provide access to the Internet.

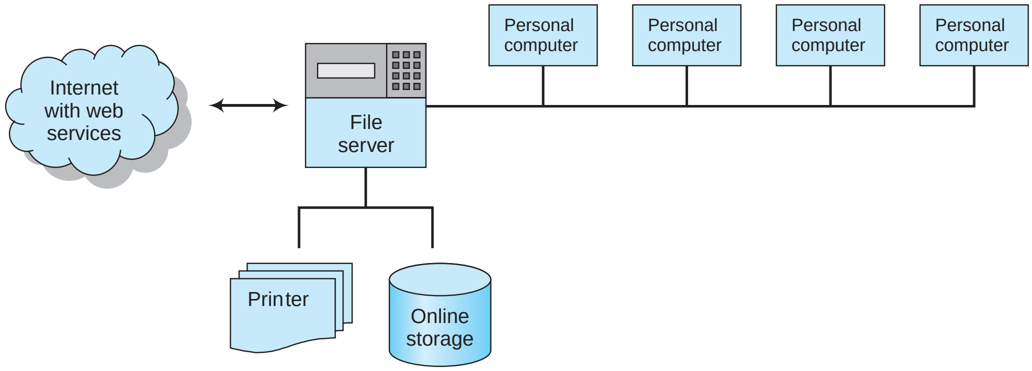

FIGURE 2-14 A local area network with representative devices.

2. **Sharing computer equipment:** For example, a LAN can provide users access to the same printers or Internet servers.
3. **Sharing computer files:** LANs enable several users to input or output data to or from the same accounting files.
4. **Saving software costs:** It is often cheaper to buy a single software package for a local area network than to buy individual packages for each of several workstations.
5. **Enabling unlike computer equipment to communicate with one another:** Not all computers use the same operating system or application software. LANs enable different computers using different software to communicate with one another.

Wide area networks (WANs) are computer networks spanning regional, national, or even global areas. For example, a WAN enables a national manufacturing company to connect several manufacturing, distribution, and regional centers to national headquarters, and therefore to each other, for communications purposes (see Figure 2-15). WANs typically

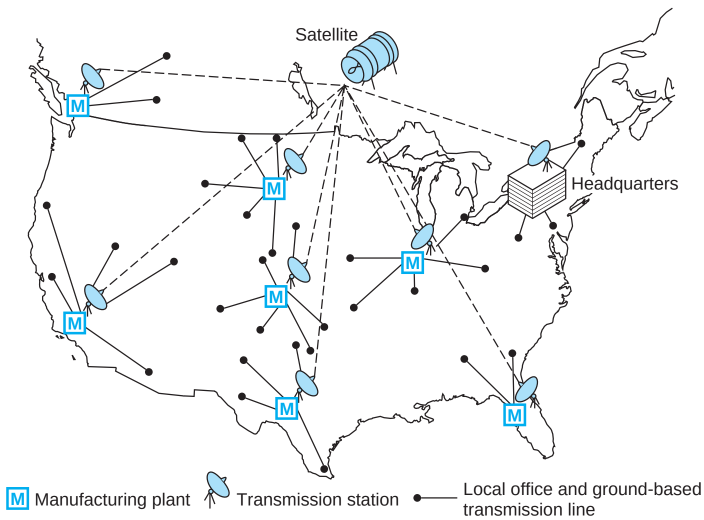

FIGURE 2-15 A wide area network that a large organization might use to connect regional users and computers.

use a multitude of communications channels for this purpose, including leased phone lines, microwave transmitters, and perhaps even satellite transmissions. Rather than developing and maintaining their own WANs, many organizations employ public carriers, the Internet, or third-party network vendors to transmit data electronically.

Case-in-Point 2.8 IGT is the world's largest slot machine manufacturer, but nearly half its profits derive from another product—its Megabucks ® system. Megabucks is, in effect, a WAN of progressive slot machines that are located on the floors of participating casinos in the state of Nevada. The company links the machines together over private communications lines, enabling the company to both monitor its slot machines and display the growing jackpots in real time as customers play. (You can view the current jackpot: www.igtonline.com/megajackpots/nevada/systems/flash9_99. html). To date, Megabucks has created more than 1,000 millionaires and paid more than $3.8 billion in major jackpots. On March 21, 2003, it set a new jackpot record: $39 million. Only one lucky player has ever won the Megabucks jackpot twice—once for $4.6 million in 1989 and again for $21.1 million in 2005 (when he was 92).[8]

AISs use WANs to gather financial data from remote sites, distribute accounting information to and from headquarters, and support email communications among users. WANs are therefore typically complex, multifaceted systems that serve many users for many purposes. For example, the wide area networks of large *Internet service providers (ISPs)* such as America Online allow subscribers to access centralized databases through local phone lines. Similarly, regional supermarket chains use WANs to gather inventory data, cash receipts data, and sales information from the many stores in their chains. WANs can also be dedicated to specific tasks. For example, most bank ATM machines are connected to WANs for the purpose of centralizing account information.

Many WANs are organized in a hierarchy, in which the individual microcomputers of a specific branch office are connected to a file server on a local area network, the file servers of several LANs are connected to a regional computer, and several regional computers are connected to a corporate mainframe. This hierarchical approach allows a large company to gather, store, and distribute financial and non-financial information at the appropriate geographic level of the company.

Client/Server Computing

Client/server computing is an alternate technology to mainframe and/or hierarchical networks. Depending on the type of client/server system, the data processing can be performed by any computer on the network. The software application, such as a spreadsheet program, resides on the client computer—typically, a microcomputer. The database and related software are stored on networked file servers. Although mainframe systems normally centralize everything (including the control of the system), client/server applications distribute data and software among the server and client computers of the system. As a result, client/server computing is a way to achieve the overall objective of an **enterprise network**. In so doing, more computing power resides in user desktops, yet all organizational computers are linked together.

[8]Source: The IGT website at www.igt.com/Content (2006).

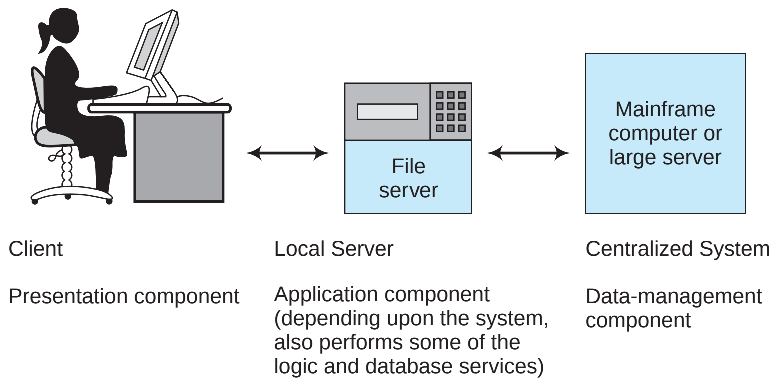

FIGURE 2-16 Components of a client/server system.

Components of Client/Server Systems. Figure 2-16 shows that a client/server system may be viewed as a set of three interacting components: (1) a presentation component, (2) an application-logic component, and (3) a data-management component. The *presentation component* of a client/server system is the user's view of the system—i.e., what the user sees onscreen. This view may resemble the familiar screens of the user's home computer, or may differ considerably from them. Simple client/server systems that focus on this presentation task are called *distributed presentation systems*. Most Internet applications illustrate this category.

The *application-logic component* of a client/server system refers to the processing logic of a specific application—for example, the logic involved in preparing payroll checks. Thus, client/server computing differs from simple ''host/terminal computing'' in the user's new ability to (1) query or manipulate the warehoused data on the server, (2) ask what-if questions of the server's data, (3) process a transaction that may affect data stored on both client and server computers, or (4) alter data stored elsewhere on the network. Some systems enable users to write their own data queries (that ask for specific information from the server database), and also to store such queries on local files for later uses.

The processing tasks involved in each application are typically shared unequally between the client computer and the server, with the division of labor depending upon the particular application. For example, in a payroll application, the client's contribution may be limited to validating the data entered into the system, while in a word-processing application the client computer might perform nearly all the processing tasks required.

Finally, the *data-management component* of a client/server system refers to its databases and data-storage systems. Some applications rely on a centralized mainframe for this task. More typically, however, multiple copies of the databases reside on large, regional file servers, thereby speeding user access to the data they contain. These systems are also the most complex, and therefore pose the greatest challenges to accountants for control and audit tasks.

Advantages and Disadvantages. The advantages of client/server computing include the flexibility of distributing hardware, software, data, and processing capabilities throughout a computer network. A further advantage can be reduced telecommunications costs—an advantage that enabled Avis Rent-a-Car to save a half-minute on each of its 23 million annual customer calls, and therefore $1 million. A third advantage is the ability to install *thin-client systems*, which use inexpensive or diskless microcomputers, instead of more expensive models, to save money on system acquisition and maintenance costs. The managers of

Mr. Gatti's, a Texas chain of 300 pizza restaurants, for example, estimate that it will save about 45% on its maintenance costs using such a system.

One disadvantage of a large client/server system is that it must maintain multiple copies of the same databases, which it then stores on its various regional servers. This makes backup and recovery procedures more difficult because multiple copies of the same file (or several parts of a single file) now exist on several different computers. This multiple-copy problem also causes difficulties in data synchronization (i.e., the need to update all copies of the same file when a change is made to any one of them).

Changing from one version of an application program to another is also more difficult in client/server systems because the system usually requires consistency in these programs across all servers. User access and security are also more difficult because access privileges may vary widely among employees or applications. Finally, the need for user training is often greater in client/server systems because employees must not only know how to use the data and application programs required by the jobs, but also understand the system software that enables them to access these databases and programs from local workstations.

Wireless Data Communications

A recent survey by Intuit revealed that over 70% of the small businesses in the U.S. have mobile employees, and by all accounts that number is growing. The term **wireless communications**, also called **Wi-Fi** (for ''wireless fidelity''), means transmitting voice-grade signals or digital data over wireless communication channels. Wi-Fi creates a wireless Ethernet network using access hubs and receiver cards in PCs, cell phones, and PDAs, thereby turning cell phones and similar wireless devices into cordless, multi-function ''web appliances.''

Wireless devices have become important tools for business professionals, helping accountants in particular stay in touch with fellow employees, clients, and corporate networks. Early, emailing uses of wireless communications have now been joined by such job-dependent financial functions as recording sales orders, entering time and billing information, and—as suggested by the following case-in-point—even preparing the payroll.

Case-in-Point 2.9 It wasn't until the middle of his son's little league game that Eddie Elizando realized he hadn't prepared the payroll for the employees at his small CPA company. Mr. Elizando was nowhere near his corporate office, but this wasn't a problem. Using his new iPhone, Mr. Elizando called his payroll service, entered data by clicking through the appropriate payroll program, and accomplished the task remotely between innings of the game. An added bonus: one of Mr. Elizando's employees was his wife, who still wanted to be paid![9]

The two key dimensions of Wi-Fi applications are ''connectivity'' and ''mobility.'' The connectivity advantage means the ability to connect to the Internet, LAN, or WAN without physical wires or cables. To accomplish this, Wi-Fi devices use **wireless application protocol (WAP)**, a set of communications standards and *wireless markup language* (a subset of XML optimized for the small display screens typical of wireless, Internet-enabled appliances). Two important types of wireless communications are RFID applications and NFC communications.

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[9]Source: Alexandra Defelice, ''Working in a Wireless World'' *Accounting Technology* Vol. 23, No. 10 (November 2007), pp. 30–34.

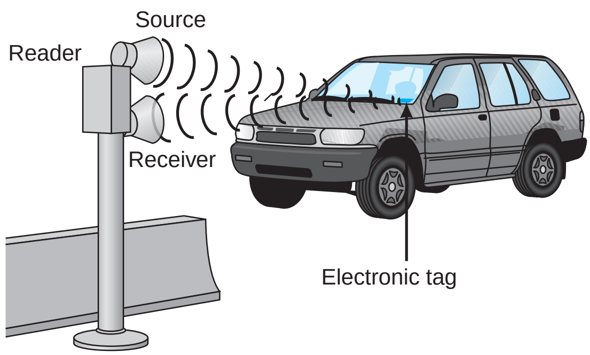

FIGURE 2-17 Reading an RFID at a toll both.

RFID. **Radio frequency identification (RFID)** enables businesses to identify pallets and even individual items without unpacking them from shipping crates. *Passive RFID tags* have no power source (and therefore cannot wear out), but can nonetheless ''answer'' inquiries from energized sources. *Active RFID tags* are actually chips with antennas, have their own power source, enjoy ranges of more than 100 meters, and are generally more reliable than passive tags.

Perhaps the most noticeable use of RFID tags is as user identifiers in transportation systems (Figure 2-17). For example, the subway systems of New York City, Moscow, and Hong Kong use them, as do some of the toll roads and parking lots in the states of New York, New Jersey, Pennsylvania, Massachusetts, Georgia, Florida, and Illinois. Similar systems may be found in Paris, the Philippines, Israel, Australia, Chile, and Portugal. To toll-road travelers, RFID systems represent a convenient way of paying user fees and reducing wait times in tollbooth lines. To their operators, these systems are a convenient way of gathering accounting data and updating customer accounts.

> ***Case-in-Point 2.10*** Recent RFID applications include employee ID badges, library books, credit cards, and even tire-tread sensors. Similarly, many retailers now require their suppliers to include tags that identify merchandise. Wal-Mart, Target, and Albertsons are three of a growing list of large retailers that now require their largest suppliers to include RFID tags in the cases and pallets sent to their various distribution centers. The tags are superior to bar codes, which require a line of sight for reading, must appear on the outside of cartons, and can be lost or defaced.[10]

NFC. **Near field communication (NFC)** enables mobile devices such as cell phones, PDAs, and laptop computers to communicate with similar devices containing NFC chips (Figure 2-18). With NFC devices, for example, you can make travel reservations on your PC, download airline tickets to your mobile phone or PDA, and check in at a departure gate kiosk with a swipe of your mobile device—all with no paper or printing.

In effect, NFCs represents RFID communications for the masses. But the operating range of NFC devices is limited to 20 cm or about 8 inches—a limitation that helps avoid unintentional uses. The transit systems in China, Singapore, and Japan now use NFC

[10]Doug Desjardins, ''Implementation Easier as No. 2'' *DSN Retailing Today* Vol. 44, No. 7 (March 11, 2005), p. 34.

FIGURE 2-18 Near field communication devices.

systems, as do Visa International's credit card system and chip-enabled posters of the Atlanta Hawk's basketball team.

NFC technology is a joint product development of Sony, Philips, and Nokia. Three possible communication modes are (1) *active* (bidirectional), (2) *passive* (one way), and (3) *transponder* (battery-less and therefore only powered by an external communication source). Current NFC standardized communication speeds are between 106k and 424k bps—considerably less than the 1–7 mbps speeds of Bluetooth or Wi-Fi data transmissions. But passive NFC chips cost as little as 20 cents and are currently considerably cheaper than these alternate communications devices.

Cloud Computing

The term **cloud computing** refers to a range of computing services on the Internet—for example, access to computer software programs, backup and recovery file services, and even web-page development and hosting. The term gets its name from the common use of a cloud symbol to represent the Internet itself—refer back to Figure 2-14. Most commercial applications of cloud computing are types of outsourcing—i.e., situations in which one company hires another to perform a vital service. An accounting application is the use of tax preparation software, which the customer accesses over the Internet from the vendor for a fee. Many cloud service vendors have familiar names, including Amazon, Google, Yahoo, IBM, Intel, Sun Microsystems, and Microsoft. The first cloud computing conference took place in May 2008, and attracted over 1,000 attendees.

Cloud computing offers several advantages. One is that it gives even the smallest customer access to supercomputing capabilities. Another is that it enables organizations of any size to avoid investing in the technology required to perform the outsourced tasks in-house. A third is that customers only pay for services actually used. A fourth is the ability to avoid preparing for peak loading—e.g., times when transaction volumes are high. Finally, when companies purchase archiving services, backup files can be created automatically and by definition, are stored offsite for security. This last advantage might also be of particular interest to students, who can subscribe to one of several services at nominal costs, or even for free—see Figure 2-19.

Cloud computing also has several drawbacks. One is that cloud subscription fees can be high and may not always be cost effective. Another is that many cloud services require customers to trust their service providers with sensitive data and to stay operational at all times—uncomfortable risks to some. Finally, backup service providers typically require large bandwidths, and the timing of automatic backups is not always convenient to individual subscribers.

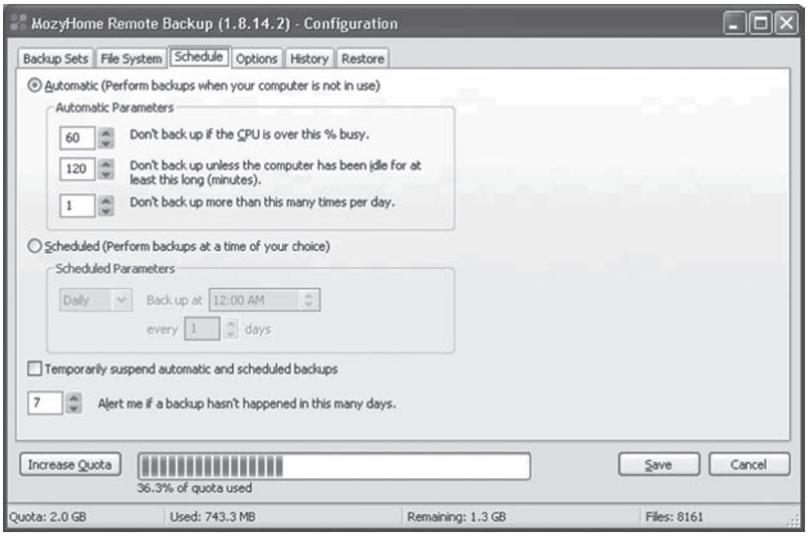

FIGURE 2-19 Mozy is a cloud service provider of backups for both individual and corporate users. This configurations screen allows a user to schedule backups.

COMPUTER SOFTWARE

As noted in the introduction to this chapter, it is impossible to discuss information technology without also recognizing the importance of **computer software**. Computer hardware serves as a base, or platform, upon which two types of computer software typically reside: (1) operating systems, and (2) application software. This chapter concludes by briefly discussing each of these types of software.

It is difficult to overstate the importance of software to AISs. Both in industry and in private homes, computer software performs such tasks as computing spreadsheets, paying corporate bills, routing parcels on conveyor belts, answering telephones, and reserving airline seats. Automated AISs depend on software to function properly. But this dependency also presents important challenges to accountants. For example, every system that influences cash accounts or affects other corporate resources must also contain automated controls to ensure the reliability, completeness, and authenticity of computer inputs, processing, and outputs. Similarly, all AIS software must initially be designed, acquired, and installed by someone. These facts help explain why accountants are often such an integral part of the teams that shop for, test, and audit such systems.

Operating Systems

An **operating system (OS)** is a set of software programs that helps a computer, file server, or network run itself and also the application programs designed for it. Examples of operating systems for microcomputers include MacOS, Windows Vista, and Linux. Operating systems for larger computers include UNIX, Windows.Net server, and OS2. Some of these operating systems are designed as single-user operating systems (e.g., Windows XP), while others are designed as multi-user operating systems for LANs (e.g., Windows NT Server and Novell Netware). Operating systems for very small systems such as PDAs and cell phones include Windows Mobile, Blackberry, Bluetooth, Palm OS, and Symbian OS. Most of these operating systems combine many convenient software tools in one package and use **graphical user interfaces (GUIs)** with menus, icons, and other graphics elements (instead of instruction commands) to identify system components and launch processing programs.

On computers of any size, the operating system is typically the first piece of software loaded (booted) into primary memory when the computer powers up. System tasks for single-user OS's include testing critical components on boot-up, allocating primary memory among competing applications (i.e., managing the multitasking demands of several Windows sessions), managing system files (such as directory files), maintaining system security, and (in larger computers) gathering system performance statistics. The system tasks for multi-user OS's are even more complicated than for single-user systems because more users are involved and more coordination of system resources is required. These multi-user OS's maintain job queues of programs awaiting execution, create and check password files, allocate primary memory to several online users, apportion computer time in time-sharing (**multiprocessing**) environments, and accumulate charges for resource usage.

Application (end-user) programs are designed to work with (''run under'') a particular operating system. An operating system helps run application programs by coordinating those programs' input and output tasks, by managing the pieces of a large application program that is too large to fit entirely in RAM, and by monitoring their execution.

The **utility programs** that come with operating systems help users perform such tasks as copying files, converting files from one format to another, compressing files, performing system diagnostics, and building disk directories. Another task is to manage **virtual storage—** i.e., disk memory that a computer system uses to augment its limited primary memory. Finally, today's operating systems also run **antivirus software**. As explained more fully in Chapter 12, a **virus** is a destructive program that, when active, damages or destroys computer files or programs. Today's operating systems include antivirus software routines that guard against the virus programs a user might accidentally introduce into his or her computer system from external sources. However, because new viruses continue to appear, users should update this software at least monthly.

Application Software

The term **application software** refers to computer programs that help end users such as accountants perform the tasks specific to their jobs or relevant to their personal needs. One category of application software is the **personal productivity software** familiar to most accountants—i.e., word processing software (for creating documents and reports), spreadsheet software (for creating worksheets of rows and columns and also for graphing the data), database software (for creating files and databases of personal information), and personal finance software (for paying bills, creating personal budgets, and maintaining investment portfolio data).

Another category of application software is the personal productivity software designed for commercial uses. Examples include *project management software* (for coordinating and tracking the events, resources, and costs of large projects such as construction projects or office moves), *computer-aided design (CAD) software* (for designing consumer products, fashion clothing, automobiles, or machinery), and *presentation graphics software* (for creating slides and other presentations).

A third category of application software is the accounting software that performs such familiar tasks as preparing payrolls, maintaining accounts receivable files, executing accounts payable tasks, controlling inventory, and producing financial statements. Often, developers integrate these tasks in complete accounting packages. Because of the particular relevance of such software to AISs, Chapter 9 discusses such packages in greater detail.

Yet a fourth type of application software is *communications software* that allows separate computers to transmit data to one another. Microcomputer examples include communications packages (for simple data transmissions between computers), web browsers (for accessing and displaying graphics information on the Internet), backend software (that enables web servers to communicate with large, commercial databases of customer and product information), and email software (for creating, transmitting, displaying, and deleting email messages).

Finally, a fifth type of application software is the relatively-new **enterprise resource planning (ERP) software** that enables businesses and government agencies to transmit and manipulate financial data on an organization-wide basis. An example is SAP. These systems are particularly important to electronic commerce (e-commerce) applications—for example, because a simple sale over the Internet simultaneously affects accounts receivable, inventory, and marketing subsystems.

Programming Languages

To develop application software, developers must write detailed instructions in **programming languages** that computers can understand and execute. FORTRAN, COBOL, and RPG are examples of older programming languages that developers used to create minicomputer and mainframe AISs (i.e., the older but still-viable legacy systems). Newer computer languages include C++ (favored for its ability to manipulate data at the bit level), Visual Basic (favored for creating Windows-like user interfaces), HTML (an editing language favored for creating web pages), and Java (favored for its ability to run on many different types of computers).

Most of the newer programming languages are **object-oriented**, meaning that they encourage programmers to develop code in reusable modules called *objects*, which are easier to develop, debug, and modify. Both Visual Basic and C++ are **event-driven programming languages**— i.e., programming languages where code responds to events such as a user clicking on a menu item with a mouse.

Figure 2-20 illustrates how developers create application programs using these programming languages. The process begins when computer programmers write instructions in a *source* programming language such as Visual Basic. In a second step, the developers use another program called a **compiler to** translate this *source code* into the machine language (*object code*) that a computer understands. This translation process is called a *compilation*. The output from the compilation is the object code that a computer can then load and execute in a third step. When end users buy application software packages, they buy compiled programs in machine language that are ready to execute on their specific computers.

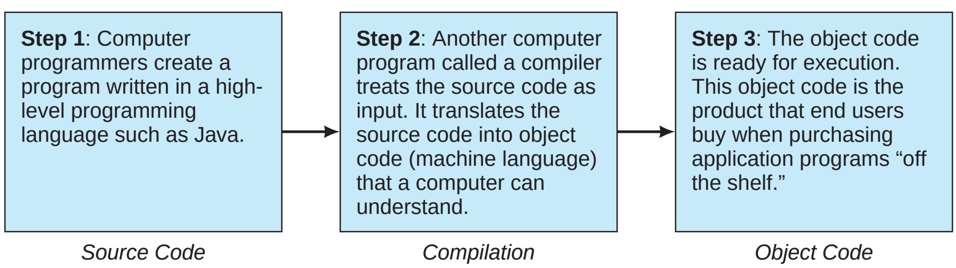

FIGURE 2-20 How computer programmers create application software.

AIS AT WORK
Delivering Packages is High-Tech at UPS

Most people recognize UPS as the company that picks up or delivers packages with brown delivery trucks—not exactly a high-tech business. But UPS has gone high-tech. The company's annual spending on IT is now about $1 billion—one of the largest in the world—and the company's IT division alone employs 4,700 employees, maintains 8,700 web servers and 15 large mainframe computers, and helps the company deliver about 15 million packages each day to customers around the world.

Why does a company in a ''low-tech business'' spend all that money on IT resources? One of its newest initiatives is its automated delivery system. That system starts with a ''smart label'' that customers can create for themselves on UPS's website for each of their packages. Even before a driver picks up the package, the company forwards a copy of the label to the distribution center closest to the final delivery point, where special software begins building a delivery schedule for each of 66,000 UPS drivers. When the package finally arrives at the center, the system creates a separate label with delivery instructions that also indicate where to place the package in the truck and when to drop it off. (Express deliveries go in the front, afternoon deliveries go in the back.) The system also creates a customized route for each driver each day.

The gains from all this automation are also impressive. In one month, for example, the new routing system reduced almost 2 million miles in delivery and pickup travel, and enabled drivers to make an additional seven to nine pickups or drop-offs per day. The new system also interfaces with a global positioning system (GPS), enabling managers to precisely locate the position of any truck and, perhaps estimate more precisely pickup times for customers waiting with packages.

UPS executives note that the most important problem they've had with their new systems has been a lack of familiarity with the new software and an unanticipated need for more employee training. This reminds us that, like any large information system, ''people'' play an important role in high-tech applications.

Source: Corey Dade ''Moving Ahead: How UPS Went from Low-Tech to an IT Power'' *Wall Street Journal* (July 24, 2006), pp. R4, R7.

SUMMARY

- It is useful to view an AIS as a collection of hardware, software, data, people, and procedures that must all work together to accomplish processing tasks.
- Information technology will become even more important to accountants as AISs continue to incorporate technological advances in their designs, and also as this technology becomes more important to their daily professional and personal tasks.
- To achieve their objectives, computerized AISs must input, process, store, and output information, and often, utilize data communications.
- The starting point for most AIS data processing is either an electronic or a manual source document. Electronic source documents eliminate many errors that are introduced by human input. POS devices, MIRC readers, OCR readers, and magnetic strip readers enable AISs to capture data that are already in machine-readable formats.
- Biometric scanners help AISs limit access to legitimate users. Two of the most reliable types of scanners read fingerprints or irises.

- The central processing unit (CPU) of a computer system performs the data-manipulating tasks required of the system. In order of increasing power, these units are micro- or personal computers, minicomputers, mainframe computers, and supercomputers. All CPUs have primary memories and microprocessors. However, most AISs are I/O bound, not process bound.
- Two major output devices are printers and video monitors. Three important types of printers are dot matrix printers, ink-jet printers, and laser printers. Businesses usually prefer laser printers because they are the fastest and have the highest print resolutions.
- Secondary storage devices enable AISs to store and archive data on permanent media. Magnetic disks, CD-ROMs, DVDs, and flash memories are the most common secondary storage devices.
- Image processing allows users to capture and store visual graphs, charts, and pictures in digital formats on such media.
- Data communications enable AISs to transmit data over local and wide area networks. Many AISs now use LANs or WANs for email, sharing computer resources, saving software costs, gathering input data, or distributing outputs. Wi-Fi technology such as RFID and NFC applications significantly increases our ability to access information accurately as well as communicate efficiently with others.
- Cloud computing refers to the use of service providers over the Internet. Applications include access to computer software programs, backup and recovery file services, and web-page development and hosting.
- The software of an AIS performs the specific data processing tasks required. Operating systems enable computers to run themselves, and also to execute the application programs designed for them.
- Application software enables end users to perform work-related tasks. Categories of such software include personal productivity software, integrated accounting packages, and communication packages. Programming languages enable IT professionals to translate processing logic into instructions that computers can execute.

KEY TERMS YOU SHOULD KNOW

antivirus software
application software
audio input
bar code reader
CD-ROM
central processing unit (CPU)
client/server computing
cloud computing
compiler
computer record
computer software
data communications
data communications protocol
data transcription
digital subscriber line (DSL)
dot-matrix printer
electronic data interchange (EDI)
enterprise network
enterprise resource planning (ERP) software
event-driven programming language
extranet
file server
graphical user interface (GUI)
hard-copy output
I/O-bound computer
image processing
information technology (IT)
ink-jet printer
input-processing-output cycle
ISDN line
laser printer
legacy system
local area network (LAN)
magnetic (hard) disk
magnetic ink character recognition (MICR)
mainframe computer
mark-sense media
microprocessor
minicomputer
modem (modulator/demodulator)
multimedia

near field communications (NFC)
object-oriented programming language
operating system
optical character recognition (OCR)
peripheral equipment
personal data assistant (PDA) devices
personal productivity software
picture elements (pixels)
point-of-sale (POS) device
primary memory
programming language
radio frequency identification (RFID)
redundant array of independent disks (RAIDs)
secondary storage
soft-copy output
source document
supercomputer
turnaround document
utility program
virtual storage
virus
voice recognition system
volatile memory
wireless application protocol (WAP)
wide-area network (WAN)
wireless communications
Wi-Fi (wireless fidelity)
worm (write-once, read many)

TEST YOURSELF

Q2-1. All of the following are reasons why IT is important to accountants *except:*

a. Accountants often help clients make IT decisions
b. Auditors must evaluate computerized systems
c. IT questions often appear on professional certification examinations
d. The costs of IT are skyrocketing

Q2-2. Data transcription is best described as:

a. An efficient process
b. Always necessary in AISs
c. Labor-intensive and time-consuming
d. An important way to limit fraud and embezzlement

Q2-3. The acronyms POS, MIC, and OCR are most closely associated with:

a. Input devices
b. Processing devices
c. Output devices
d. Communication devices

Q2-4. Purchasing backup services from an Internet vendor is an example of:

a. OCR
b. Modem services
c. Virtual storage
d. Cloud computing

Q2-5. The term ‘‘enrollment’’ is most closely associated with:

a. PDAs
b. Biometric scanners
c. Printers
d. Modems

Q2-6. The RAM of a computer is associated with:

a. Primary memory

b. Secondary storage

c. Arithmetic-logic unit

d. Modem

Q2-7. The term ''I/O bound'' means that:

a. Computers must input and output data when executing accounting applications

b. AISs are headed for the land of I/O

c. Computers can ''think'' faster than they can read or write

d. Computers are obligated to make inferences and oversights

Q2-8. Video output can also be called:

a. Hard-copy output

b. Soft-copy output

c. Image output

d. Pixilated output

Q2-9. Which of these devices is capable of storing the most data?

a. CD-ROM disk

b. DVD disk

c. USB (flash memory) drive

d. Magnetic (hard) disk

Q2-10. All of these are components, or layers, of a client/server computing system *except:*

a. Presentation layer

b. Application/logic layer

c. Client layer

d. Data management layer

Q2-11. All of these are terms associated with programming languages *except:*

a. Object-oriented

b. Event-driven

c. Compiler

d. Server

DISCUSSION QUESTIONS

2-1. Why is it important to view an AIS as a combination of hardware, software, people, data, and procedures?

2-2. Why is information technology important to accountants?

2-3. Why do most AISs try to avoid data transcription?

2-4. Name several types of computer input devices, and explain in general terms how each one functions.

2-5. How do you feel about red light cameras? Should cities be allowed to use them? Why or why not?

2-6. Identify the three sections of a CPU, and describe the functions of each component. How are microprocessor speeds measured? Why are such speeds rarely important to AISs?

2-7. Identify several types of printers. What are the advantages and disadvantages of each type?

2-8. What is the function of secondary storage? Describe three types of secondary storage media, and describe the advantages and disadvantages of each type.

2-9. What is image processing? How is image processing used in AISs?

2-10. What are data communication protocols? Why are they important?

2-11. What are local area networks? What advantages do LANs offer accounting applications?

2-12. What is client/server computing? How does it differ from host/mainframe computing? What are some of the advantages and disadvantages of client/server systems?

2-13. What are the names of some current cloud computing vendors other than those discussed in the text? Do you think that all firms should use cloud vendors, or are there some reasons why they should be avoided?

2-14. What are windowing operating systems, multitasking operating systems, and graphical user interfaces? Why are they useful to AISs?

2-15. Name some general classes of application software. What tasks do each of the software classes perform?

2-16. What are computer programming languages? Name some specific languages and describe briefly an advantage of each.

PROBLEMS

2-17. Are the following input equipment, output equipment, CPU components, secondary storage devices, or data-communications related?
(a) CRT screen, (b) ALU, (c) CD-ROM, (d) keyboard, (e) modem, (f) dot-matrix printer, (g) audio speaker, (h) POS device, (i) MICR reader, (j) laser printer, (k) magnetic tape, (l) flash memory, (m) OCR reader, (n) magnetic (hard) disk, (o) ATM, (p) primary memory, (q) ALU.

2-18. All of the following are acronyms discussed in this chapter. What words were used to form each one and what does each term mean?
(a) POS, (b) CPU, (c) OCR, (d) MICR, (e) ATM, (f) RAM, (g) ALU, (h) MIPS, (i) OS, (j) MHz, (k) pixel, (l) RGB, (m) CD-ROM, (n) worm, (o) modem, (p) LAN, (q) WAN, (r) ERP, (s) WAP, (t) Wi-Fi, (u) ppm, (v) dpi, (w) NFC, (x) RFID.

2-19. Which of the following holds the most data?
(a) One DVD disk (b) One hard disk (capacity: 160 gigabytes), or (c) Ten CD-ROMs

2-20. Brian Fry Products manufactures a variety of machine tools and parts used primarily in industrial tasks. To control production, the company requires the information listed below. Design an efficient record format for Brian Fry Products. (Hint: see Figure 2-10.)

a. Order number (4 digits)

b. Part number to be manufactured (5 digits)

c. Part description (10 characters)

d. Manufacturing department (3 digits)

e. Number of pieces started (always less than 10,000)

f. Number of pieces finished

g. Machine number (2 digits)

h. Date work started

i. Hour work started (use 24-hour system)

j. Date work completed

k. Hour work completed

l. Work standard per hour (3 digits)

m. Worker number (5 digits)

n. Foreman number (5 digits)

2-21. Go to the AICPA website at www.aicpa.org. What are the top ten information technologies for the current year? How do these items compare with the list in Figure 2-1? Is it common for new items to appear, or do you think this list is ''stable'' from year to year?

2-22. Your state has recently decided to install an RFID system for its toll roads. The current plan is to sell non-refundable transponders for $20 and allow users to deposit up to $1,000 in their accounts. To assist the IT personnel, the system's planners want to develop a list of possible accounting transactions and system responses. Using your skills from earlier accounting classes, what debit and credit entries would you make for each of the following activities? (Feel free to develop your own accounts for this problem.)

a. A user buys a new transponder for $20.

b. A user adds $100 to his account.

c. A user discovers that a data entry clerk charges his credit card $1,000 instead of $100 when adding $100 to his account.

d. An individual leaves the state, turns in his transponder, and wants a cash refund for the $25.75 remaining in his account.

e. A good Samaritan turns in a transponder that he finds on the side of the road. There is a $10 reward for this act, taken from the owner's account.

2-23. Select a type of computer hardware that interests you and write a one-page report on three possible choices of it. Examples include monitors, USB drives, external hard drives, or even new laptops. Your report should include a table similar to the one shown here that includes: (1) embedded pictures of your choices, (2) major specifications (e.g., storage capacities, pixel sizes, data transfer rates, etc.), (3) the suggested retail price of each item, (4) the likely ''street price'' of the item, and (5) the name of the vendor that sells the item at the street price.

The major deliverable is a one-page report that includes (1) the table identified above, (2) an explanation of why you chose to examine the hardware you did, and (3) an indication of which particular item you would buy of your three choices.

		
Sushi USB	Cruzer USB	Squid USB
spec	spec	spec
spec	spec	spec

CASE ANALYSES

2-24. Savage Motors (Software Training)

Savage Motors sells and leases commercial automobiles, vans, and trucks to customers in southern California. Most of the company's administrative staff works in the main office. The company has been in business for 35 years, but only in the last 10 years has the company begun to recognize the benefits of computer training for its employees.

The company president, Arline Savage, is thinking about hiring a training company to give onsite classes. To pursue this option, the company would set up a temporary ''computer laboratory'' in one of the meeting rooms, and the trainers would spend all day teaching one or more particular types of software. You have been hired as a consultant to recommend what type of training would best meet the firm's needs.

You begin your task by surveying the three primary corporate departments: sales, operations, and accounting. You find that most employees use their personal computers for only five types of software: (1) word processing, (2) spreadsheets, (3) database, (4) presentations, and (5) accounting. The accompanying table shows your estimates of the total number of hours per week used by each department on each type of software.

Department (number of employees)	Hours per week				
	Word Processing	Spreadsheet	Database	Presentation	Accounting
Sales (112)	1,150	750	900	500	700
Operations (82)	320	2,450	650	100	500
Accounting (55)	750	3,600	820	250	2,500

Requirements

1. Create a spreadsheet illustrating each department's average use of each application per employee, rounding all averages to one decimal point. For example, the average hours of word processing for the Sales department is 1,150/112 = 10.3 hours.
2. Suppose there were only enough training funds for each department to train employees on only one type of application. What training would you recommend for each department?
3. What is the average number of hours of use of each application for all the employees in the company? What training would you recommend if funds were limited to only training one type of application for the entire company?
4. Using spreadsheet tools, create graphs that illustrate your findings in parts 1 and 2. Do you think that your graphs or your numbers better ''tell your story?''
5. What alternatives are there to onsite training? Suggest at least two alternatives and discuss which of your three possibilities you prefer.

2-25. Backwater University (Automating a Data Gathering Task)

Backwater University is a small technical college that is located miles from the nearest town. As a result, most of the students who attend classes there also live in the resident dormitories and purchase one of three types of meal plans. The ''Full Plan'' entitles a student to eat three meals a day, seven days a week, at any one of the campus's three dining facilities. The ''Weekday Plan'' is the same as the Full Plan, but entitles students to eat meals only on weekdays—not weekends. Finally, the ''50-Meal'' plan entitles students to eat any 50 meals during a given month. Of course, students and visitors can always purchase any given meal for cash.

Because the school administration is anxious to attract and retain students, it allows them to change their meal plans from month to month. This, in fact, is common, as students pick plans that best serve their needs each month. But this flexibility has also created a nightmare at lunch times, when large numbers of students attempt to eat at the dining facilities simultaneously.

In response to repeated student complaints about the long lines that form at lunchtime, Barbara Wright, the Dean of Students, decides to look into the matter and see for herself what is going on. At lunch the next day, she observes that each cashier at the entrance to the dining facilities requires each student to present an ID card, verifies that the picture on the card matches the student presenting it, and then consults a long, hard-copy list of students to determine whether the student is eligible for the current meal. A cashier later informs Barbara that these tasks are regrettable, but also mentions that they have become necessary because many students attempt to eat meals that their plans do not allow.

The cashier also mentions that, at present, the current system provides no way of keeping a student from eating *two of the same meals* at two different dining facilities. Although Barbara thinks that this idea is far-fetched, the cashier says that this problem is surprisingly common. Some students do it just as a prank or on a dare, but other students do it to smuggle out food for their friends.

Barbara Wright realizes that one solution to the long-lines problem is to simply hire more cashiers. She also recognizes that a computerized system might be an even more cost-effective solution. In particular, she realizes that if the current cashiers had some way of identifying each student quickly, the computer system could immediately identify a given student as eligible, or ineligible, for any given meal.

Requirements

1. Suggest two or more ''technology solutions'' for this problem.
2. What hardware would be required for each solution you named in part 1?
3. What software would be required for each solution you named in part 1? What would this software do?
4. How would you go about showing that your solutions would be more cost effective than simply hiring more cashiers? (You do not have to perform any calculations to answer this question, merely outline your method.)

2-26. Bennet National Bank (Centralized versus Decentralized Data Processing)

Bennet National Bank's credit-card department issues a special credit card that permits credit-card holders to withdraw funds from the bank's automated teller machines (ATMs) at any time of the day or night. These machines are actually smart terminals connected to the bank's central computer. To use them, a bank customer inserts the magnetically-encoded card in the automated teller's slot and types in a unique password on the teller keyboard. If the password matches the authorized code, the customer goes on to indicate, for example, (1) whether a withdrawal from a savings account or a withdrawal from a checking account is desired and (2) the amount of the withdrawal (in multiples of $10). The teller terminal communicates this information to the bank's central computer and then gives the customer the desired cash. In addition, the automated terminal prints out a hard copy of the transaction for the customer.

To guard against irregularities in the automated cash transaction described, the credit-card department has imposed the following restrictions on the use of the credit cards when customers make cash withdrawals at ATMs.

1. The correct password must be keyed into the teller keyboard before the cash withdrawal is processed.
2. The credit card must be one issued by Bennet National Bank. For this purpose, a special bank code has been encoded as part of the magnetic strip information.

3. The credit card must be current. If the expiration date on the card has already passed at the time the card is used, the card is rejected.
4. The credit card must not be a stolen one. The bank keeps a computerized list of these stolen cards and requires that this list be checked electronically before the withdrawal transaction can proceed.
5. For the purposes of making withdrawals, each credit card can only be used twice on any given day. This restriction is intended to hold no matter what branch bank(s) are visited by the customers.
6. The amount of the withdrawal must not exceed the customer's account balance.

Requirements

1. What information must be encoded on the magnetic-card strip on each Bennet National Bank credit card to permit the computerized testing of these policy restrictions?
2. What tests of these restrictions could be performed at the teller window by a smart terminal and what tests would have to be performed by the bank's central processing unit and other equipment?

2-27. Prado Roberts Manufacturing (What Type of Computer System to Implement?)

Prado Roberts Manufacturing is a medium-sized company with regional offices in several western states and manufacturing facilities in both California and Nevada. The company performs most of its important data processing tasks, such as payroll, accounting, marketing, and inventory control, on a mainframe computer at corporate headquarters. However, almost all the managers at this company also have microcomputers, which they use for such personal productivity tasks as word processing, analyzing budgets (using spreadsheets), and managing the data in small databases.

The IT manager, Tonya Fisher, realizes that there are both advantages and disadvantages of using different types of systems to meet the processing needs of her company. Although she acknowledges that many companies are racing ahead to install microcomputers and client/server systems, she also knows that the corporate mainframe system has provided her company with some advantages that smaller systems cannot match. Tonya knows that American companies annually purchase over $5 billion in used computers, primarily mainframes.

Requirements

1. Identify several advantages and disadvantages of operating a mainframe computer system that is likely to be present at Prado Roberts Manufacturing. Are these advantages and disadvantages likely to parallel those at other manufacturing companies?
2. Identify at least two factors or actions that companies experience or do to prolong the lives of their legacy systems. Are these factors or actions likely to apply to Prado Roberts Manufacturing?

3. Identify several advantages and disadvantages of microcomputer/client server systems. Would these advantages apply to Prado Roberts Manufacturing?
(CMA Adapted)

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ANSWERS TO TEST YOURSELF

1. **d** 2. **c** 3. **a** 4. **d** 5. **b** 6. **a** 7. **c** 8. **b** 9. **d** 10. **c** 11. **d**

Chapter 3

Documenting Accounting Information Systems

After reading this chapter, you will:

1. *Understand* why documenting an AIS is important.
2. *Be able to draw* simple document flowcharts and explain how they describe the flow of data in AISs.
3. *Be able to draw* simple document flowcharts, system flowcharts, process maps, and data flow diagrams.
4. *Know* how program flowcharts and decision tables help document AISs.
5. *Be able to explain* the importance of end-user documentation.
6. *Be aware of* software available for documenting AISs and helping companies comply with the Sarbanes-Oxley Act.

"Although documentation of [business] processes needs to be detailed, it also must be clear and easy to follow . . . .If people cannot easily explain it, or someone can't pick up the documentation and understand it, you have not successfully completed the task."

Regina Baraban, ''Look Out for SOX'' *Meetingsnet.com*
Vol. 24, No. 2, (February 2005), pp. 23–24.

INTRODUCTION

Documentation explains how AISs operate and is therefore a vital part of any accounting system. For example, documentation describes the tasks for recording accounting data, the procedures that users must perform to operate computer applications, the processing steps that AISs follow, and the logical and physical flows of accounting data through the system. This chapter explains in greater detail why accountants need to understand documentation and describes some tools for diagramming complex systems.

Accountants can use many different types of logic charts to trace the flow of accounting data through an AIS. For example, document flowcharts describe the physical flow of order forms, requisition slips, and similar hard-copy documents through an AIS. These flowcharts pictorially represent data paths in compact formats and therefore save pages of narrative description. System flowcharts are similar to document flowcharts, except that system flowcharts usually focus on the electronic flows of data in computerized AISs. Other examples of documentation aids include process maps, data flow diagrams, program flowcharts, and decision tables. This chapter describes all of these documentation aids, as well as some computerized tools for creating them.

Today, many end users develop computer applications for themselves. This end-user programming is very helpful to managers, who consequently do not require IT professionals to develop simple word processing, spreadsheet, or database applications. But end-user programming can also be a problem because many employees do not know how to document their work properly or simply don't do so. The final section of this chapter examines the topic of end-user programming and documentation in greater detail.

WHY DOCUMENTATION IS IMPORTANT

Accountants do not need to understand exactly how computers process the data of a particular accounting application, but it is important for them to understand the documentation that describes how this processing takes place. In fact a recent survey of practitioners found that system documentation has become increasingly important as organizations seek to better understand their own business processes and also comply with legislation that requires this understanding, such as the Sarbanes-Oxley Act.[1] **Documentation** includes all the flowcharts, narratives, and other written communications that describe the inputs,

[1] Bradford, Marianne, Sandra B. Richtermeyer, and Douglas F. Roberts, ''System Diagramming Techniques: An Analysis of Methods Used in Accounting Education and Practice,'' *Journal of Information Systems* Vol. 21, Iss. 1 (Spring 2007), p. 173.

processing, and outputs of an AIS. Documentation also describes the logical flow of data within a computer system and the procedures that employees must follow to accomplish application tasks. Here are nine reasons why documentation is important to AISs.

1. Depicting how the system works. Simply observing large AISs in action is an impractical way to learn about them, even if they are completely manual. In computerized systems, this task is impossible because the processing is electronic and therefore invisible. On the other hand, studying written descriptions of the inputs, processing steps, and outputs of the system make the job easier, and a few graphs or diagrams of these processing functions makes things easier still. This is one purpose of documentation—to help explain how an AIS operates. Documentation helps employees understand how a system works, assists accountants in designing controls for it, and gives managers confidence that it will meet their information needs.

The Internet contains many examples of flowcharts or logic diagrams that help individuals understand unfamiliar tasks or processes. For example, some universities use them to show students what classes to take and when they should take them to complete their majors in a timely manner. The University of Washington has flowcharts that show how to obtain grants and other types of funding. The University of Illinois at Urbana-Champaign uses elaborate diagrams to depict what happens when a faculty member's employment terminates. Figure 3-1 is a logic diagram from the University of Arizona website that shows employees how to file a claim for reimbursement. If the employee would like additional information for any step in the process, a click of the mouse on the appropriate flowchart symbol reveals additional information.

2. Training users. Documentation also includes the user guides, manuals, and similar operating instructions that help people learn how an AIS operates. Employees usually do not like to read the user manuals that typically accompany application software, but these instructional materials are invaluable reference aids when they are needed. Whether distributed manually in hard-copy format or electronically in the familiar Help files or ''get-started tours'' of microcomputer applications, these documentation aids help train users to operate AIS hardware and software, solve operational problems, and perform their jobs better.

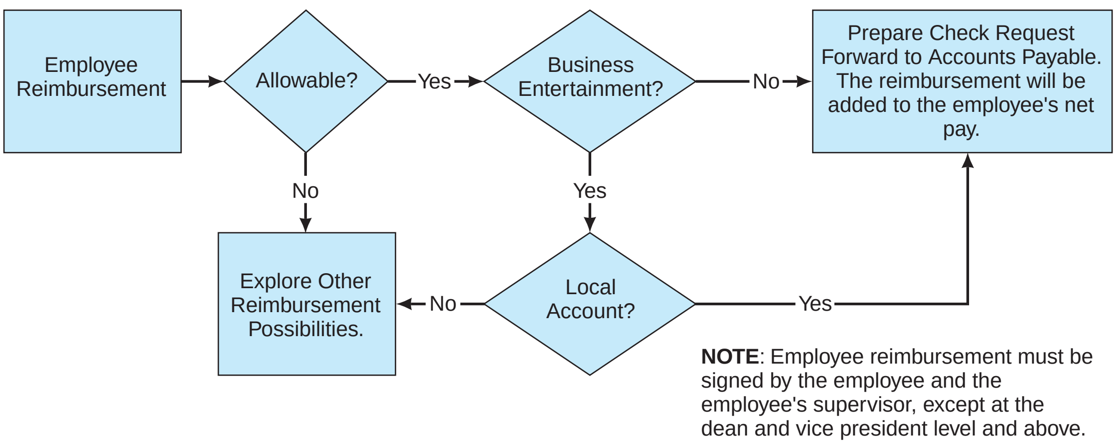

FIGURE 3-1 Example of a flowchart used at the University of Arizona to help employees file a reimbursement claim. For additional information, individuals simply click on the appropriate symbol.

3. Designing new systems. Documentation helps system designers develop new systems in much the same way that blueprints help architects design buildings. For example, professional IT personnel commonly hold structured walkthroughs in which they review system documentation to ensure the integrity and completeness of their designs, and to identify design flaws. Well-written documentation, along with other systems-design methodologies, often plays a key role in reducing systems failures and decreasing the time spent correcting ''emergency errors'' in computer systems. Conversely, poorly-designed systems usually lead to critical mistakes and expensive write-offs.

4. Controlling system development and maintenance costs. Personal computer applications typically employ prewritten, off-the-shelf software that is relatively reliable and inexpensive. In contrast, custom-developed business systems often cost millions of dollars and can be less reliable. Good documentation helps system designers develop **object-oriented software**, that is, programs that contain modular, reusable code. This object-orientation helps programmers avoid writing duplicate programs and facilitates changes when programs must be modified later. If you have ever replaced a specialized part in your car, you have some idea of how frustrating, time-consuming, and expensive ''non-standardization'' can be, and therefore how useful object-oriented programming might be to business organizations.

5. Standardizing communications with others. The usefulness of narrative descriptions can vary significantly, and a reader can interpret such descriptions differently from what the writer intended. Documentation aids such as system flowcharts or data flow diagrams are standard industry tools, and they are more likely to be interpreted the same way by all parties viewing them. Thus, documentation tools are important because they help describe an existing or proposed system in a ''common language'' and help users communicate with one another about these systems.

> ***Case-in-Point 3.1*** The fourth largest public healthcare system in the United States, Carolinas HealthCare System (CHS), uses business process management software from Staffware to automate and streamline its revenue cycle processes and improve customer service for their patients and doctors. As a result of using this software, CHS can now service patient accounts much faster and has increased the speed and accuracy of their billing office operations.[2]

6. Auditing AISs. Documentation helps depict audit trails. When investigating an AIS, for example, the auditors typically focus on internal controls. In such circumstances, documentation helps auditors determine the strengths and weaknesses of a system's controls, and therefore the scope and complexity of the audit. Similarly, the auditors will want to trace sample outputs to the original transactions that created them (e.g., tracing inventory assets back to original purchases). System documentation helps auditors perform these tasks.

7. Documenting business processes. Accounting systems automatically create a record of some organization's processes because they capture financial data as they occur. A study of these processes can lead to better systems. Thus, in mapping these processes, documentation can help managers better understand the ways in which their businesses

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[2] ''Carolinas HealthCare System Uses Staffware Software to Streamline Business Processes,'' *Business Wire* February 23, 2004, p. 53.

operate, what controls are involved or missing from critical organizational activities, and how to improve core business processes.

8. Complying with the Sarbanes-Oxley Act. Section 404 of the Sarbanes-Oxley Act of 2002 (SOX) requires publicly-traded companies to identify the major sources of business risks, *document their internal control procedures*, and hire external auditors to evaluate the validity and effectiveness of such procedures. Documentation is therefore crucial for analyzing the risks of errors, frauds, omissions, and similar mistakes in important business processes, as well as helping auditors evaluate the controls used to mitigate such risks—i.e., some of the major tasks required by SOX.

Almost everyone acknowledges that the costs of complying with SOX are enormous, and many also believe that SOX gave documentation ''a new life.'' To save money, many companies now use software packages to help them automate SOX documentation tasks. We describe some examples of such software in a later section of this chapter.

Case-in-Point 3.2 FirstEnergy Corporation in Akron, Ohio, generates and distributes electrical energy to customers in a 36,100-square-mile area of Ohio, Pennsylvania, and New Jersey. Certus Governance Suite, a software package, helps company managers comply with many SOX documentation requirements, better understand the company's internal controls, and saves ''looking at hundreds of spreadsheets.''[3]

9. Establishing accountability. Manual signatures on business and government documents allow employees and government agents to execute their responsibilities, create audit trails, and establish accountability for their actions. An example is a **signed checklist** that outlines the month-end journal entries an accountant must perform. Such checklists verify that the accountant performed these tasks, that a reviewer approved them, and that both individuals are accountable for the accuracy of the work. Similar comments apply to the checklists for preparing financial statements, tax returns, auditing papers, budgets, and similar accounting documents. Including such checklists with the statements themselves both documents the work that the employees performed as well as the procedures and controls *involved* in the work.

Case-in-Point 3.3 In a parallel universe, the master accountant for the great warlord took on an apprentice. One day, the apprentice approached his mentor and asked ''Master, is it always necessary to document accounting systems?''

The master accountant answered ''No. Such documentation is only needed by those who cannot feel the complete tao and beauty of such systems.''

The apprentice replied ''Who *can* feel such beauty?''

The master accountant responded ''I do not know anyone with such abilities.''

DOCUMENT AND SYSTEM FLOWCHARTS

Despite the many reasons why documentation is important, most organizations find that they document less than they should. One explanation for this deficiency is that organizations often create or implement large AISs under tight deadlines. In such cases, the urgency to develop ''a system that works'' overrides the need for ''a system that

[3]Thomas Hoffman, ''Calibrating Toward Compliance'' *Computerworld* Vol. 40, No. 6 (February 6, 2006), pp. 21–24.

is well-documented.'' Another reason is that most IT professionals much prefer creating systems to documenting them. Thus, many developers actively resist it, arguing that they will ''get around to it later'' or that documenting is a job for non-existent assistants.

The record suggests that insufficient or deficient documentation costs organizations time and money and that good documentation is as important as the good software it describes. What tools are available to document AISs? Two examples are document flowcharts and system flowcharts.

Document Flowcharts

A **document flowchart** traces the physical flow of documents through an organization—i.e., from the departments, groups, or individuals who first create them to their final dispositions. Figure 3-2 illustrates common document flowcharting symbols, and the examples below illustrate how to use them to create simple document flowcharts.

Constructing a document flowchart begins by identifying the different departments or groups that handle the documents of a particular system. The flowcharter then uses the symbols in Figure 3-2 to illustrate the document flows. Let us first examine two simple cases and then discuss some general flowcharting guidelines.

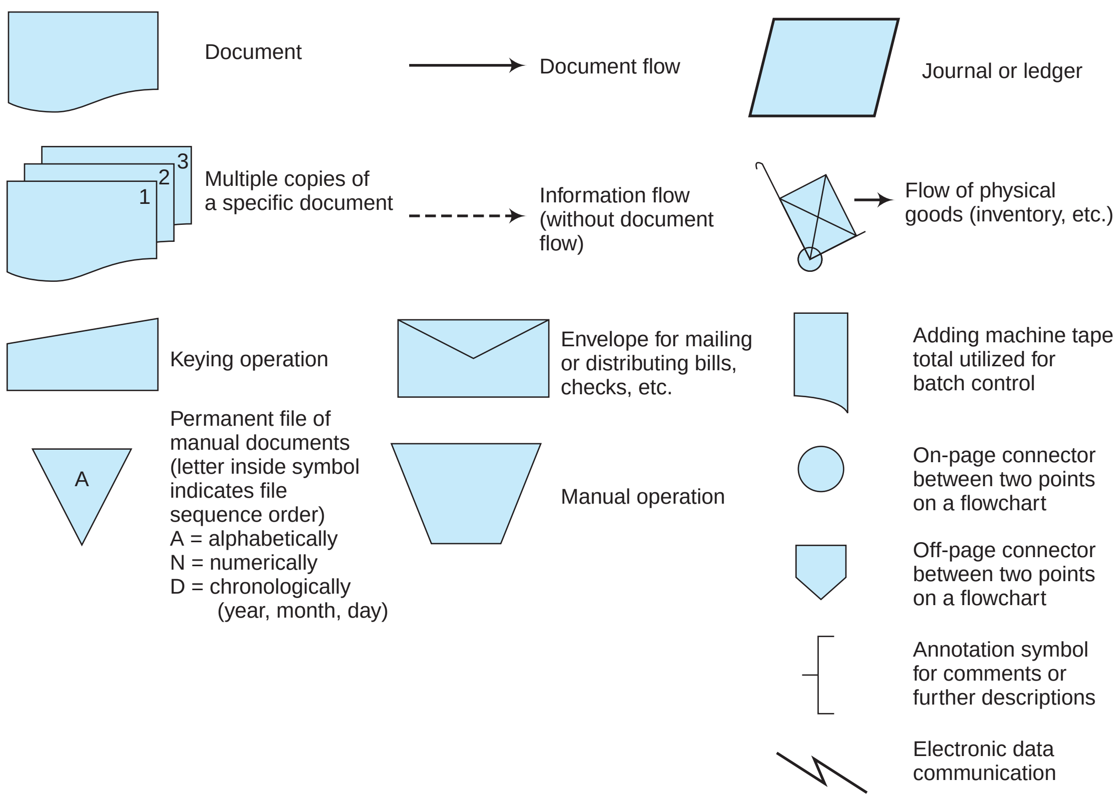

FIGURE 3-2 Common document flowcharting symbols.

Example 1. Your boss asks you to document the paperwork involved in acquiring office supplies from your company's Central Supplies Department. Your administrative assistant explains the process as follows:

Reordering supplies requires a requisition request. When I need more stationery, for example, I fill out two copies of a goods requisition form (GRF). I send the first copy to central supplies and file the second copy here in the office.

There are two departments involved in this example—your department (which we shall call the Requesting Department) and the Central Supplies Department. Thus, you should begin by naming these departments in headings on your document flowchart (Figure 3-3). Next, you draw two copies of the GRF under the heading for the Requesting Department because this is the department that creates this form. You number these copies 1 and 2 to indicate two copies.

Finally, you indicate where each document goes: copy 1 to the Central Supplies Department and copy 2 to a file in the Requesting Department. A document's first appearance should be in the department that creates it. A solid line or the on-page connectors shown here indicates its physical transmittal from one place to another. You should then redraw the transmitted document to indicate its arrival at the department that receives it. Figure 3-3 illustrates the completed flowchart for this narrative.

Example 2. Let us now consider a slightly more complex example—the task of hiring a new employee at your company. The process begins when a department develops a vacancy. The Human Resources (HR) director explains the process as follows:

The department that develops a vacancy must first complete a job vacancy form, which it forwards to my department. We then advertise for the position and, with the help of the requesting department, interview applicants. When the vacancy is filled, the HR Department prepares a position hiring form (PHF) in triplicate. We file the first copy in a manual file, which is organized by employee Social Security

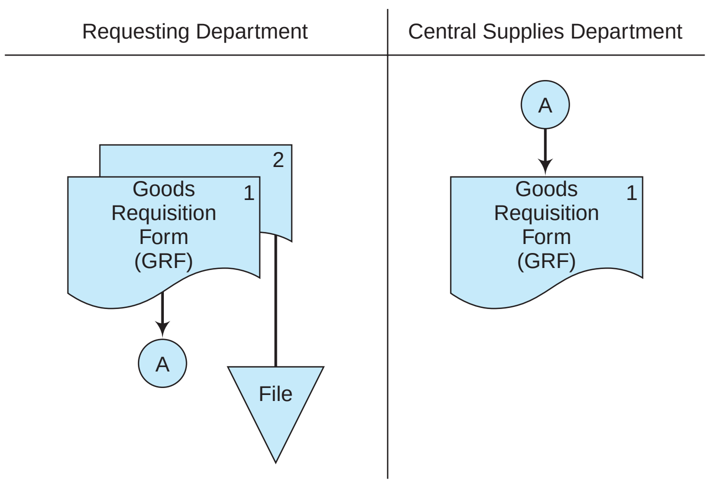

FIGURE 3-3 A simple document flowchart.

number. We staple the third copy to the job vacancy form and return it to the Requesting Department, where clerks file it alphabetically by employee last name.

The HR Department forwards the second copy of the PHF to the Payroll Department. The Payroll Department uses the form as an authorization document to create a payroll record for the new employee. Thus, the information on the form is keyed directly into the company's computer system using an online terminal located in the payroll office. This copy of the PHF is then filed numerically for reference and also as evidence that the form has been processed.

Figure 3-4 is a document flowchart for this example. To draw it, your first step is the same as before—to identify the participants. In this case there are three of them: (1) the department with the job vacancy (i.e., the Requesting Department in Figure 3-4), (2) the Human Resources Department, and (3) the Payroll Department. You identify each of these departments in separate columns at the top of the document flowchart.

Your next step is to identify the documents involved. There are two major ones: (1) the Job Vacancy form, which we presume is prepared as a single copy, and (2) the Position Hiring form, which we are told is prepared in triplicate. In practice, multiple-copy forms are usually color-coded. However, in document flowcharts, usually these are simply numbered and a separate page is attached to explain the color-number equivalencies.

Your third step is to indicate where the documents are created, processed, and used. This is probably the most difficult task, and a document flowchart designer must often use considerable ingenuity to represent data flows and processing activities

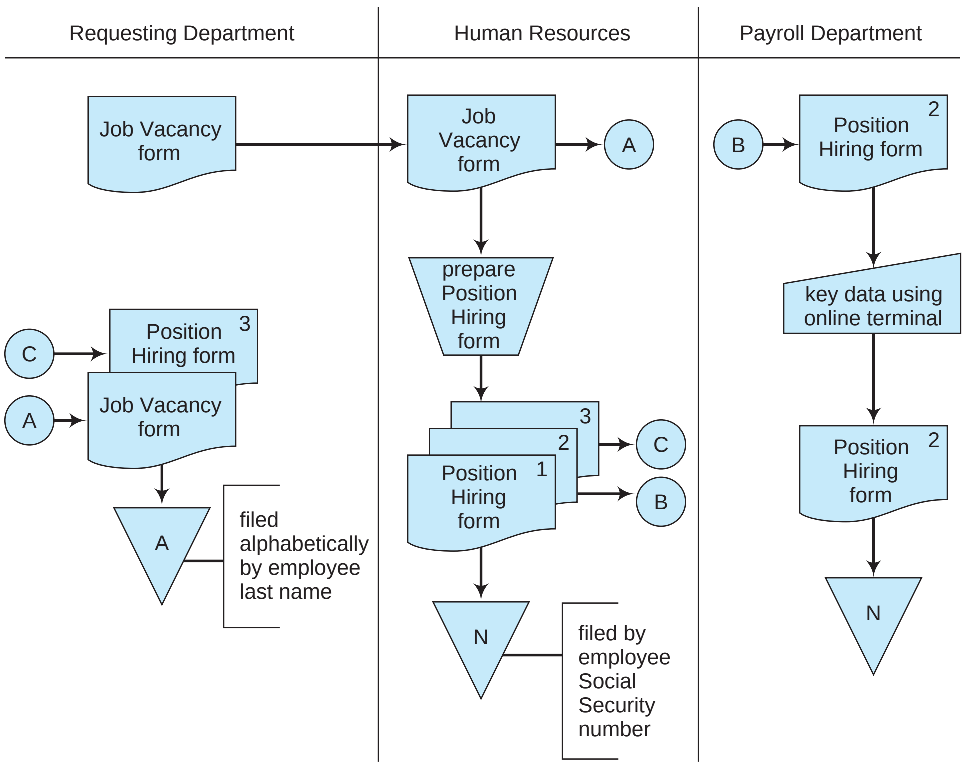

FIGURE 3-4 A document flowchart illustrating the flow of documents involved in the hiring of a new employee.

accurately. Figure 3-4 illustrates these flows for the hiring procedures just described. Where there are a large number of document transmittals, you can use on-page connectors (circles) to connect document flows from one place on a page to another and avoid complicated flow lines. Thus, Figure 3-4 uses several on-page connectors (with letters A, B, and C) to avoid cluttering the drawing and shows the completed document flowchart. You should use a unique identifier in each connector (such as a letter) for identification purposes. You can also use off-page connectors (to connect data flows to other pages) if necessary.

Guidelines for Drawing Document Flowcharts

Document flowcharts concentrate on the physical flow of reports and similar documents. When constructing them, some analysts also include any movement of physical goods in their document flowcharts—e.g., moving inventory from a receiving department to an inventory storeroom. (Document flowcharts typically use hand-truck symbols for this task.) Some document flowcharts also illustrate information flows that do not involve documents (for example, a sales clerk telephoning to check a customer's account balance before approving a credit sale). Thus, the term ''document'' broadly includes all types of organizational communications and data flows.

Unlike other types of symbols—for example, the system and program flowcharting symbols discussed later in this chapter—document flowcharting symbols are not standardized. But even though creating document flowcharts is more an art than a science, you can use the following guidelines to make these flowcharts clearer.

1. Identify all the departments that create or receive the documents involved in the system. Use vertical lines to create ''swim lanes'' to separate each department from the others.
2. Carefully classify the documents and activities of each department, and draw them under their corresponding department headings.
3. Identify each copy of an accounting document with a number. If multiple-copy documents are color-coded, use a table to identify the number-color associations.
4. Account for the distribution of each copy of a document. In general, it is better to over-document a complicated process than to under-document it.
5. Use on-page and off-page connectors to avoid diagrams with lines that cross one another.
6. Each pair of connectors (a ''from'' and a ''to'' connector in each pair) should use the same letter or number.
7. Use annotations if necessary to explain activities or symbols that may be unclear. These are little notes to the reader that help clarify your documentation.
8. If the sequence of records in a file is important, include the letter ''A'' for alphabetical, ''N'' for numeric, or ''C'' for chronological in the file symbol. As indicated in guideline 7, you can also include a note in the flowchart to make things clearer.
9. Most employees reference forms with acronyms (e.g., GRF or PHF in the preceding examples). To avoid confusion, use full names (possibly with acronyms in parentheses) or create a table of equivalents to ensure accuracy in identifying such forms.
10. Consider using automated flowcharting tools. See the section of this chapter on CASE tools.

Case-in-Point 3.4 Accountants disagree about the usefulness of document flowcharts relative to other documenting tools, but one manuscript reviewer of this book wrote: "Flowcharting is one of the most essential skills, in my opinion, for a student to learn in a systems course. During my tenure at a CPA firm, I had the opportunity to document several accounting information systems, and document flowcharting was the key skill. When word got around the office that I was a good flowcharter, I got placed on more important clients, furthering my career."

System Flowcharts

Whereas document flowcharts focus on tangible documents, **system flowcharts** concentrate on the computerized data flows of AISs. Thus, a system flowchart typically depicts the electronic flow of data and processing steps in an AIS. Figure 3-5 illustrates some common

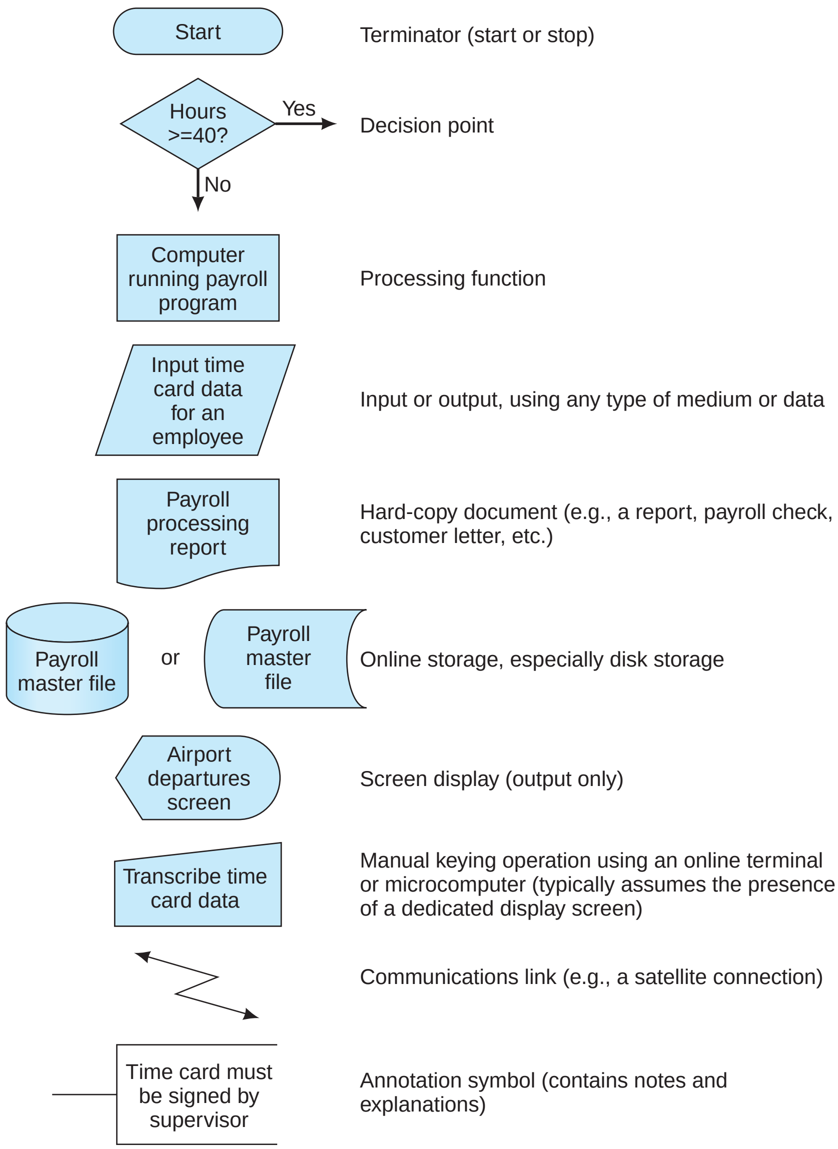

FIGURE 3-5 Some common system and programming flowcharting symbols.

system flowcharting symbols. Most of these symbols are industry conventions that have been standardized by the National Bureau of Standards (Standard × 3.5), although additional symbols are now necessary to represent newer data transmission technologies—for example, wireless data flows.

Some system flowcharts are general in nature and merely provide an overview of the system. These *are high-level system flowcharts*. Figure 3-6 is an example. The inputs and outputs of the system are specified by the general input and output symbol, a parallelogram. In more detailed system flowcharts, the specific form of these inputs and outputs would be indicated—for example, by magnetic disk symbols.

Figure 3-6 refers to only one process—preparing a payroll. A more detailed system flowchart would describe all the processes performed by the payroll program and the specific inputs and outputs of each process. At the lowest, most-detailed level of such documentation are program flowcharts that describe the processing logic of each application program. We will examine program flowcharts later in this chapter.

Like document flowcharts, the process of drawing system flowcharts is probably best understood by studying an illustration. Figure 3-7 is a system flowchart for the following example.

The Sarah Stanton Company is a magazine distributor that maintains a file of magazine subscribers for creating monthly mailing labels. Magazine subscribers mail change-of-address forms or new-subscription forms directly to the company, where input personnel key the information into the system through online terminals. The computer system temporarily stores this information as a file of address-change or new-subscription requests. Clerical staff keys these data into computer files continuously, so we may characterize it as "daily processing."

Once a week, the system uses the information in the daily processing file to update the subscriber master file. At this time, new subscriber names and addresses are added to the file, and the addresses of existing subscribers who have moved are changed. The system also prepares a Master File Maintenance Processing Report to indicate what additions and modifications were made to the file. Once a month, the company prepares postal labels for the magazine's mailing. The subscriber master file serves as the chief input for this computer program. The two major outputs are the labels themselves and a Mailing Labels Processing Report that documents this run and indicates any problems.

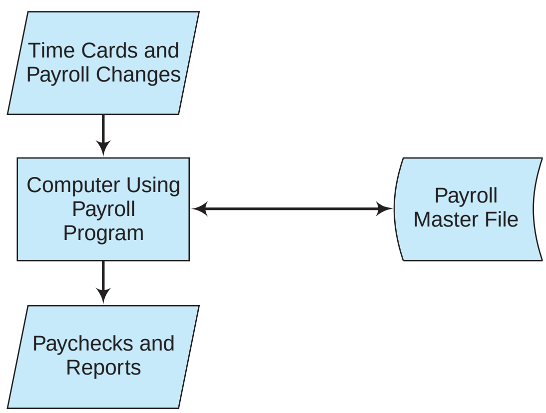

FIGURE 3-6 A high-level system flowchart for payroll processing.

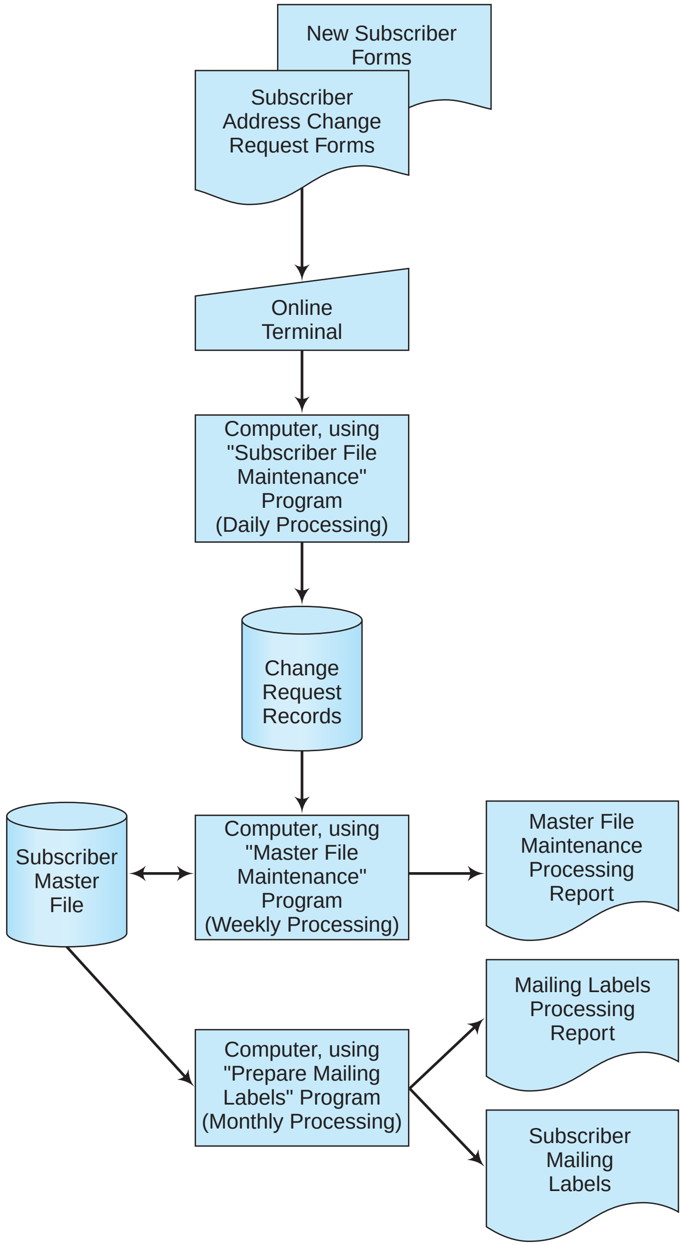

FIGURE 3-7 A system flowchart illustrating the computer steps involved in maintaining a subscriber master file and creating monthly mailing labels.

The system flowchart in Figure 3-7 documents the flow of data through the company's computerized system. Thus, it identifies sources of data, the places where data are temporarily stored, and the outputs on which processed data appear. In Figure 3-7, for example, the system flowchart begins with the subscriber request forms and documents the flow of data on these forms through the keying phase, master-file-maintenance phase, and finally, the monthly mailing phase.

Indirectly, system flowcharts also indicate processing cycles (daily, weekly, or monthly), hardware needs (e.g., disk drives and printers), areas of weak or missing application controls, and potential bottlenecks in processing (e.g., manual data entry). In Figure 3-7, we can also identify the major files of the system (a temporary log file of change-request records and a subscriber master file) and the major reports of the system. Finally, note that each processing phase of a system flowchart usually involves preparing one or more control reports. These reports provide processing-control information (e.g., counts of transactions processed) for control purposes and exceptions information (e.g., the identity of unprocessed transactions) that helps employees correct the errors detected by the system.

Guidelines for Drawing System Flowcharts

System flowcharts depict an electronic **job stream** of data through the various processing phases of an AIS, and therefore also illustrate audit trails. Each time the records of a file are sorted or updated, for example, a system flowchart should show this in a separate processing step. Generally speaking, this is the way processing proceeds in almost all AISs, one step at a time, and is therefore the way system flowcharts must portray processing phases. In recognizing the usefulness of system flowcharts, both the American Institute of Certified Public Accountants (AICPA) and the Institute of Management Accountants (IMA) consistently include test questions in their professional examinations, which require a working knowledge of system flowcharts.

Although no strict rules govern exactly how to construct a system flowchart, the following list provides some guidelines.

1. System flowcharts should read from top to bottom and from left to right. In drawing or reading such flowcharts, you should begin in the upper-left corner.
2. Because system flowcharting symbols are standardized, you should use these symbols when drawing your flowcharts—do not make up your own.
3. A processing symbol should always be found between an input symbol and an output symbol. This is called the **sandwich rule**.
4. Use on-page and off-page connectors to avoid crossed lines and cluttered flowcharts.
5. Sketch a flowchart before designing the final draft. Graphical documentation software tools (discussed shortly) make this job easier.
6. Add descriptions and comments in flowcharts to clarify processing elements. You can place these inside the processing symbols themselves, include them in annotation symbols attached to process or file symbols, or add them as separate notes on your system's documentation.

PROCESS MAPS AND DATA FLOW DIAGRAMS

Like system and document flowcharts, process maps and data flow diagrams (DFDs) document the flow of data through an AIS. We examine both types of diagrams in this section of the chapter.

Process Maps

A *business process* is a natural group of business activities that create value for an organization. **Process maps** document business processes in easy-to-follow diagrams. Did you understand the logic diagram in Figure 3-1 at the beginning of the chapter? It's an example of a process map. Studies suggest that process maps are among the easiest to draw and are also among the easiest for novices to follow.

In businesses, a major process is usually the sales or order fulfillment process. A process map for this process (Figure 3-8) shows such activities as customers placing orders, warehouse personnel picking goods, and clerks shipping goods. Managers can create similar maps that show just about any other process—for example, depict how an organization processes time cards for a payroll application, how a business responds to customer returns, or how a manager deals with defective merchandise.

Case-in-Point 3.5 Increased competition and tighter profit margins have forced companies to look for places where they might be able to save money. One large accounting firm has used process mapping software to assist clients in evaluating and redesigning their business processes. For example, the firm's business reengineering practice helped a financial services company cut its costs and become more efficient. The company was able to cut in half the time it took to approve a loan—and it needed 40% fewer staff to do it.

Internal and external auditors can use process maps to help them learn how a department or division operates, assist them in documenting what they have learned, and help them identify internal control weaknesses or problems in existing operations. An additional benefit is to use such maps as training aids. Consultants frequently use process maps to help them study business processes and redesign them for greater productivity. Accountants and managers can also use this tool to help them describe current processes to others.

Like most other types of documentation, you can draw process maps in multi-level versions called *hierarchical process maps* that show successively finer levels of detail. Such maps are especially popular on the web because viewers can click on individual symbols to

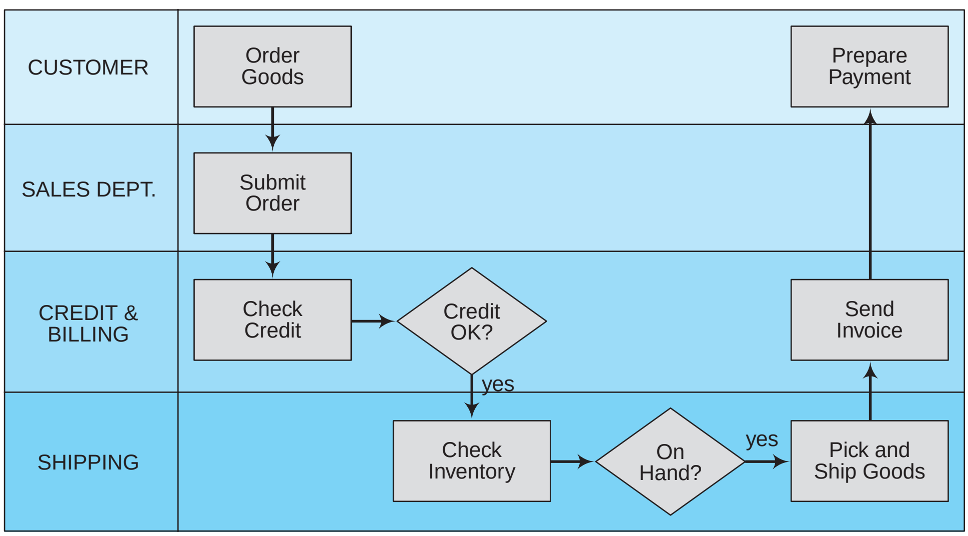

FIGURE 3-8 A process map for the order fulfillment process (created with Microsoft Word).

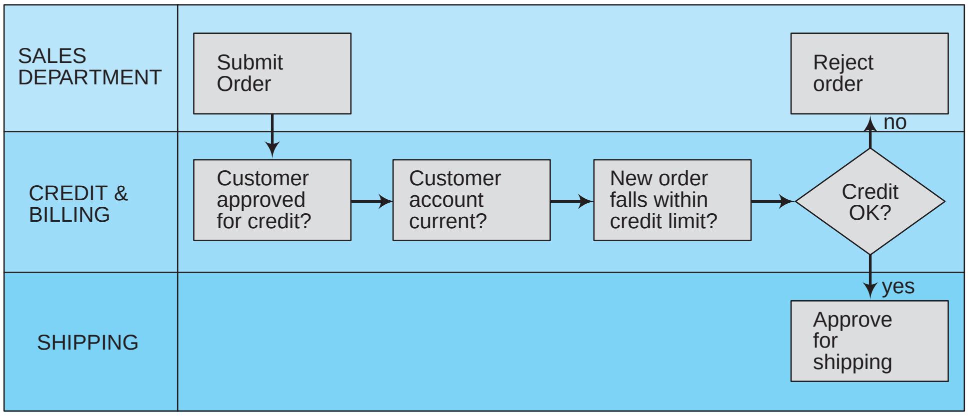

FIGURE 3-9 A second-level process map for the credit approval process of Figure 3-8.

see more information for any given process or decision. Figure 3-9, for example, illustrates a secondary-level process map for checking credit that might link to the ''Check Credit'' box in Figure 3-8.

Guidelines for Drawing Process Maps

Process maps vary considerably and the symbols found in web versions are remarkably inconsistent. Nonetheless, it is possible to use the symbols that you already know from drawing flowcharts to create process maps, including: a rectangle (to represent a process), a diamond (to represent decisions), an oval (to depict the starting and ending points for a process), an off-page connector, and a document symbol. Creating a good process map requires a blend of art, science, and craftsmanship, all of which mostly comes with practice. Here are some guidelines to use when drawing process maps.[4]

1. Identify and define the process of interest. The goal is to stay focused on the scope of the process you are trying to map.
2. Understand the purpose for the process map. Is it to identify bottlenecks? To discover redundancies?
3. Meet with employees to get their ideas, suggestions, and comments. Don't hesitate to ask challenging or probing questions.
4. Remember that processes have inputs, outputs, and enablers. An input could be an invoice; an output could be a payment check for a supplier, and an enabler helps a process achieve results. In AISs, information technology is itself a common enabler.
5. Show key decision points. A process map will not be an effective analytical tool without decision points (the intellectual or mental steps in a process).
6. Pay attention to the level of detail you capture. Did you capture enough detail to truly represent the process and explain it to others?
7. Avoid mapping the ''should-be'' or ''could-be''. Map what is.
8. Practice, practice, practice.

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[4]Joe Paradiso, ''The Essential Process: The Quick and Painless Path to Successful Process Mapping,'' *Industrial Engineer*, (April 2003), Vol. 35, p. 46–49.

Data Flow Diagrams

Data Flow Diagrams (DFDs) are used primarily in the systems development process—for example, as a tool for analyzing an existing system or as a planning aid for creating a new system. Because documented data flows are important for understanding an AIS, many of the remaining chapters of this book use DFDs to illustrate the flow of data in the AISs under discussion.

Data Flow Diagram Symbols. Figure 3-10 illustrates the four basic symbols used in DFDs. A rectangle or square represents an external data source or data destination—for example, a customer. To show this, a DFD would include the word ''customer'' inside a data source or destination symbol. In Figure 3-10, the term ''external entity'' means ''an entity outside the system under study,'' not necessarily an entity that is external to the company. Thus, for example, a ''customer'' might be another division of the same company under study.

Data flow lines are lines with arrows that indicate the direction of data flow. Thus, data flow lines indicate the paths that data follow into, out of, or through the system under study. For this reason, every data source symbol will have one or more data flow lines leading away from it, and every data destination symbol will have one or more data flow lines leading into it. For clarity, you should label each data flow line to indicate exactly what data are flowing along it.

A circle or ''bubble'' in a DFD indicates a system entity or process that changes or transforms data. (Some authors prefer to use squares with rounded corners for this symbol.) In physical DFDs (discussed shortly), the label inside a bubble typically contains the title of the person performing a task—for example, ''cashier.'' In logical DFDs (also discussed shortly), the label inside the bubble describes a transformation process—for example, ''process cash receipts.''

Finally, DFDs use a set of parallel lines or an open rectangle to represent a store or repository of data. This is usually a file of some sort. If data are permanently stored, a data store symbol is mandatory. If data are collected over time and stored in some temporary

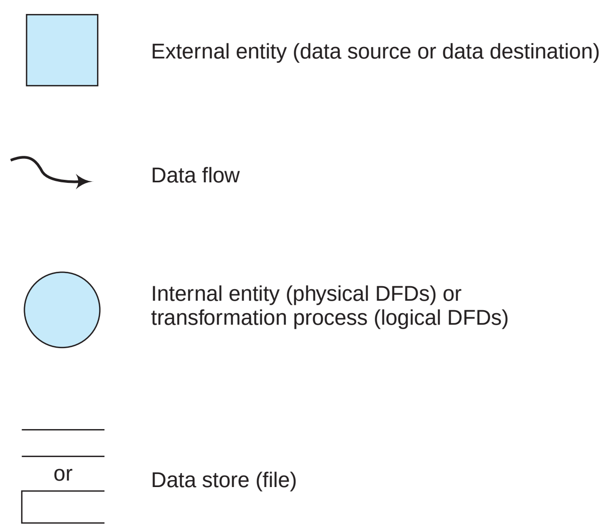

FIGURE 3-10 Symbols for data flow diagrams.

place, you are not required to use a file symbol for this (although experts recommend including one for clarity).

Context Diagrams. As with system flowcharts and process maps, we typically draw DFDs in levels that show increasing amounts of detail. Designers first prepare a high-level DFD called a **context diagram** to provide an overview of a system. Figure 3-11 is an example of a context diagram for the payroll processing of Figure 3-6.

The DFD in Figure 3-11 shows the inputs and outputs of the application (payroll processing) as well as the data sources and destinations external to the application. Thus, this context diagram uses rectangles to identify ''Timekeeping'' and ''Human Resources'' as external entities, despite the fact that these departments are internal to the company. This is because these entities are external to the payroll processing system under study. The data flow lines connecting these entities to and from the system (e.g., time card data) are called system interfaces.

Physical Data Flow Diagrams. A context diagram shows very little detail. For this reason, system designers usually elaborate on the elements in context DFDs by **decomposing** them into successively more detailed levels. These subsequent DFDs show more particulars, such as the detailed processes of the application, and the inputs and outputs associated with each processing step.

The first level of detail is commonly called a **physical data flow diagram**. Figure 3-12 is an example for our payroll illustration. A physical DFD closely resembles the document flowcharts discussed earlier in this chapter; that is, it focuses on physical entities such as the employees involved in the system under study, as well as the tangible documents, reports, and similar hard-copy inputs and outputs that flow through the system. Thus, for example, the bubbles in the physical DFD of Figure 3-12 identify the data-entry clerk who enters payroll information into the computer, the payroll cashier who distributes paychecks to employees, and the tax accountant who sends tax information to the Internal Revenue Service of the federal government.

Figure 3-12 illustrates several important characteristics of physical DFDs. First, we observe that each bubble contains a number as well as a title. Including a number in each bubble makes it easier to reference it later. This also assists designers in the decomposition tasks discussed shortly. Second, we notice that a physical DFD includes the same inputs and outputs as its predecessor context diagram in Figure 3-11—i.e., the context DFD and the physical DFD are balanced. This *balancing* is important because unbalanced DFDs are

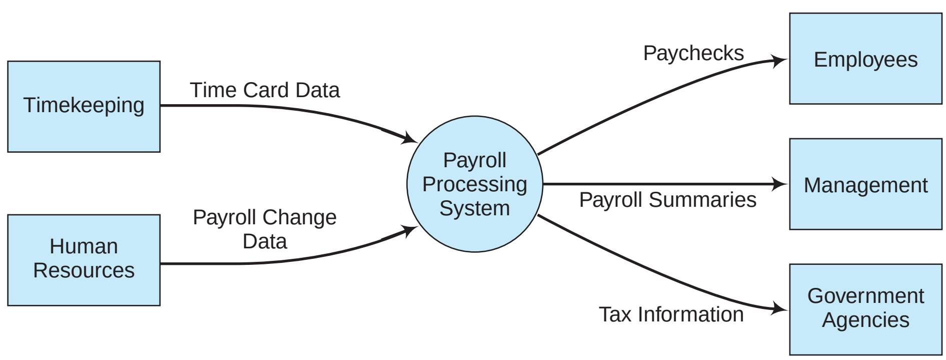

FIGURE 3-11 A context diagram for a payroll processing system.

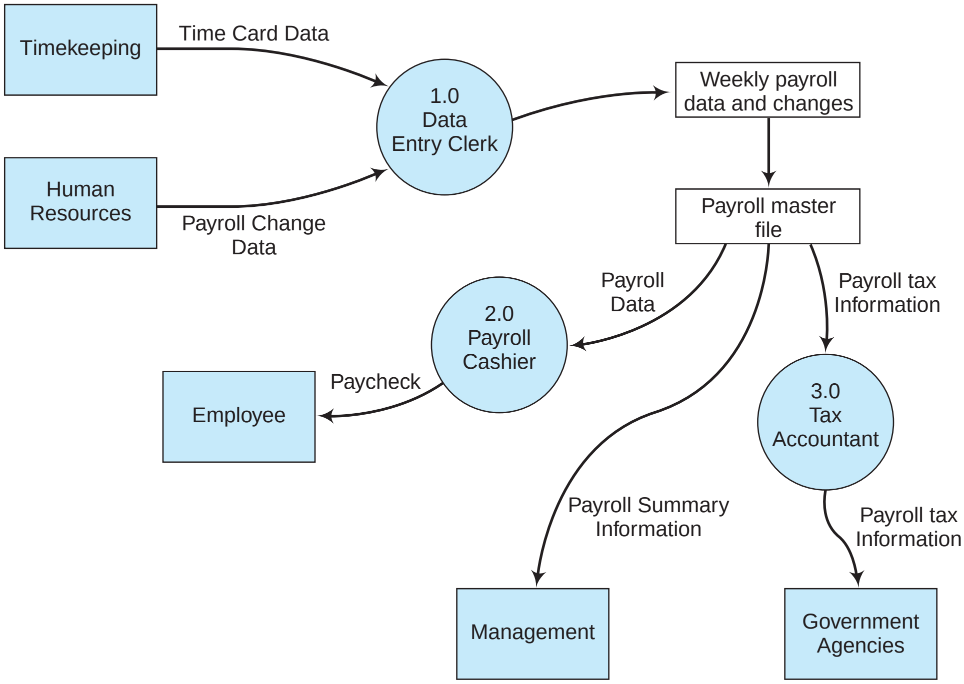

FIGURE 3-12 A physical data flow diagram.

inconsistent and therefore probably contain errors. Third, we find that all the bubbles in the physical DFD contain the names of system entities (i.e., the titles of employees). These titles should correspond to the titles in an official organization chart.

Finally, we see that a physical DFD lists the job title of only one typical employee in an entity symbol, despite the fact that several employees may perform the same task—for example, several data-entry clerks or payroll cashiers. This last characteristic also applies when several employees perform the same task at different locations—for example, a company has several payroll cashiers who distribute paychecks at each of its manufacturing facilities. This keeps the DFD simple, more readable, and therefore more easily understood.

Logical Data Flow Diagrams. A physical DFD illustrates which internal and external entities participate in a given system but does not give the reader a good idea of what these participants do. For this task, we need one or more **logical data flow diagrams** that address this requirement.

Figure 3-13 is a logical DFD for the payroll illustration in Figure 3-12. In Figure 3-13, note that each bubble no longer contains the name of a system entity, but instead contains a verb that indicates a task the system performs. For example, instead of a single bubble with the title ''data-entry clerk,'' as in Figure 3-12, the logical DFD in Figure 3-13 shows two bubbles with the titles ''process employee hours worked'' and ''process payroll change data'' because these are separate data processing tasks such clerks perform.

From the standpoint of good system design and control, describing system processes is important because how a system performs its tasks is often more important than what tasks it performs. For example, all payroll systems prepare paychecks, but not all payroll systems do this exactly the same way. The differences may require different hardware, software,

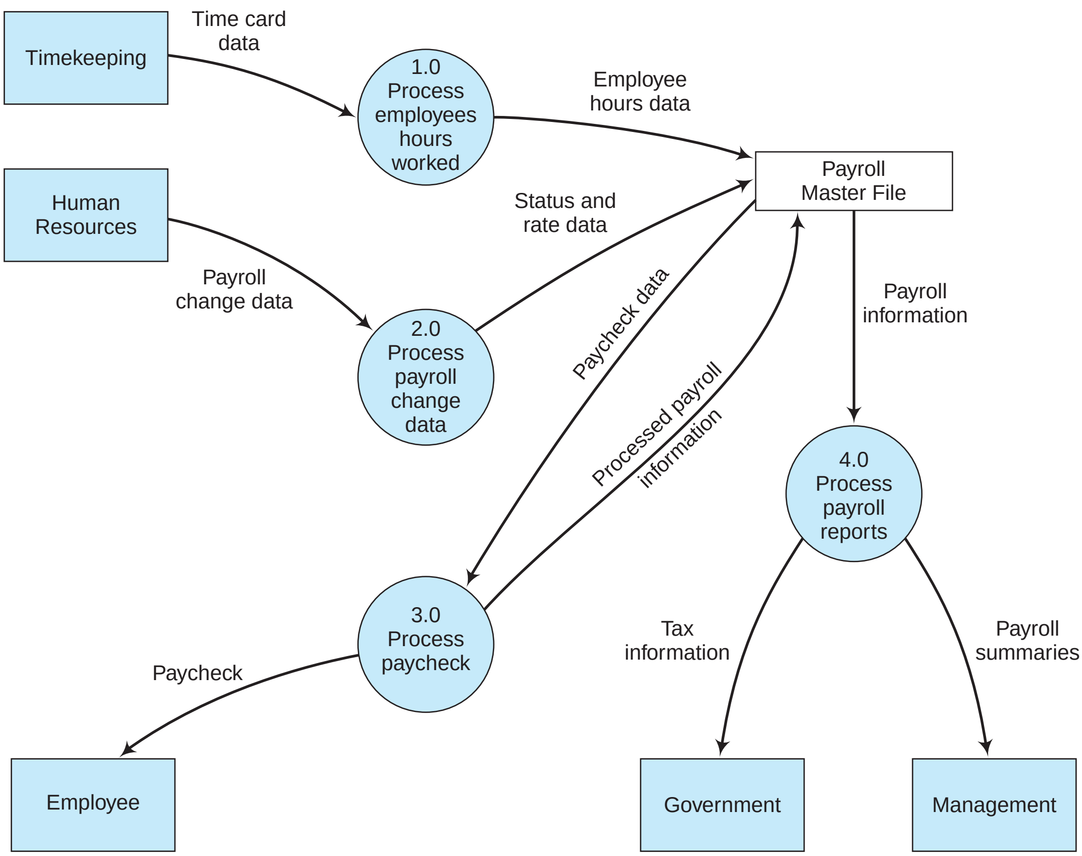

FIGURE 3-13 A logical data flow diagram for a payroll processing system.

procedures, or controls. Logical DFDs help designers decide what system resources to acquire, what activities employees must perform to run these systems, and how to protect and control these systems after they are installed.

Figure 3-13 is a **level 0 data flow diagram** because it shows only in broad terms what tasks a system performs. Most systems are more complex than this and therefore require more detail to describe them completely. The task of creating such detail is called **decomposition**, which becomes necessary because DFD designers try to limit each level diagram to between five and seven processing symbols (bubbles).

Figure 3-14 shows an example of a **level 1 data flow diagram**— an ''explosion'' of symbol 3.0 (in Figure 3-13) with caption ''process paycheck.'' Here, we see that ''processing paychecks'' entails computing gross pay, determining payroll deductions, and calculating net pay. If necessary, you can also show ancillary computer files at this level.

To fully document the system, you would continue to perform these decomposition tasks in still further DFDs. For example, you might decompose the procedure ''compute payroll deductions'' in bubble 3.2 of Figure 3-13 into several additional processes in lower-level DFDs—for example, separate DFDs for ''compute medical deductions,'' ''compute savings plan deductions,'' ''compute tax deductions,'' and so forth. In this way, a set of DFDs become linked together in a hierarchy.

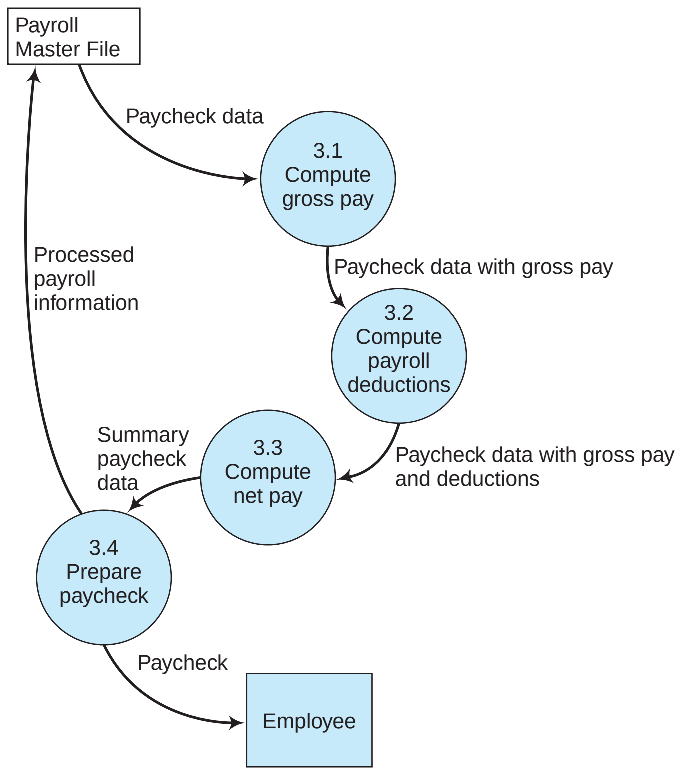

FIGURE 3-14 An exploded view of the ''process paycheck'' bubble of Figure 2-11.

Guidelines for Drawing Data Flow Diagrams

Data flow diagrams use fewer symbols than system flowcharts, and to some people are therefore easier to prepare and understand. Many companies use both types of documentation, with the choice often hinging on the preference of the designer. But like creating other types of system documentation, creating DFDs is as much art as science. The following rules can help you design them better, make them clearer, and assist you in avoiding simple errors.

1. Avoid detail in high-level DFDs (i.e., in levels 0 and 1). Where appropriate, combine activities that are performed at the same place, at the same time, or that are logically related.
2. As a general rule, each logical DFD should contain between five and seven processing bubbles. This guideline helps keep things simple, and again helps you avoid showing too much detail in high-level DFDs.
3. Different data flows should have different names. This avoids confusion about what data are flowing where.
4. Unless they are outside the system or used for archiving, all data stores should have data flows both into them and out of them. Thus, an internal file symbol that lacks both of these data flow lines is usually in error.
5. Even if a file is temporary, it is usually desirable to include it in a DFD.

6. Classify most of the final recipients of system information as external entities.
7. Classify all personnel or departments that process the data of the current system as internal entities.
8. Display only normal processing routines in high-level DFDs. Avoid showing error routines or similar exception tasks in them.
9. Where several system entities perform the same task, show only one to represent them all. This rule also applies when system personnel perform the same task at different locations of the organization—for example, at different plants.

OTHER DOCUMENTATION TOOLS

There are many other tools for documenting AISs besides document flowcharts, system flowcharts, process maps, and data flow diagrams. Two of them are (1) program flowcharts, and (2) decision tables. Because these tools are used mostly by consultants and IT professionals rather than accountants, we will describe them only briefly. Accountants should have some familiarity with these tools, however, because they may see them—for example, when reviewing the design for a revised accounting system.

Program Flowcharts

Because large computer programs today involve millions of instructions, they require careful planning and the coordinated work of hundreds of systems analysts and programmers. Typically, organizations use **structured programming** techniques to create these large programs in a hierarchical fashion—that is, from the top down. This means that the developers design the main routines first and then design subroutines for subsidiary processing as major processing tasks become clear.

To help them plan the logic for each processing routine, IT professionals often create one or more **program flowcharts** (Figure 3-15). Program flowcharts outline the processing logic for each part of a computer program and indicate the order in which processing steps take place. After designing such program flowcharts, the developer typically presents them to colleagues in a **structured walkthrough** or formal review of the logic. This process helps the reviewers assess the soundness of the logic, detect and correct design flaws, and make improvements. Upon approval, the program flowchart then becomes a ‘‘blueprint’’ for writing the instructions of the computer program itself, and of course serves to document the program as well.

Program flowcharts use many of the same symbols as system flowcharts (refer back to Figure 3-5). A few specialized symbols for program flowcharts are the diamond symbol (which indicates a decision point in the processing logic) and the oval symbol (which indicates a starting or stopping point).

Like system flowcharts and data flow diagrams, program flowcharts can be designed at different levels of detail. The highest-level program flowchart is sometimes called a **macro program flowchart** and provides an overview of the data processing logic. A lower-level program flowchart would indicate the detailed programming logic necessary to carry out a processing task. Figure 3-15 is a detailed (lower-level) program flowchart for a sales report application.

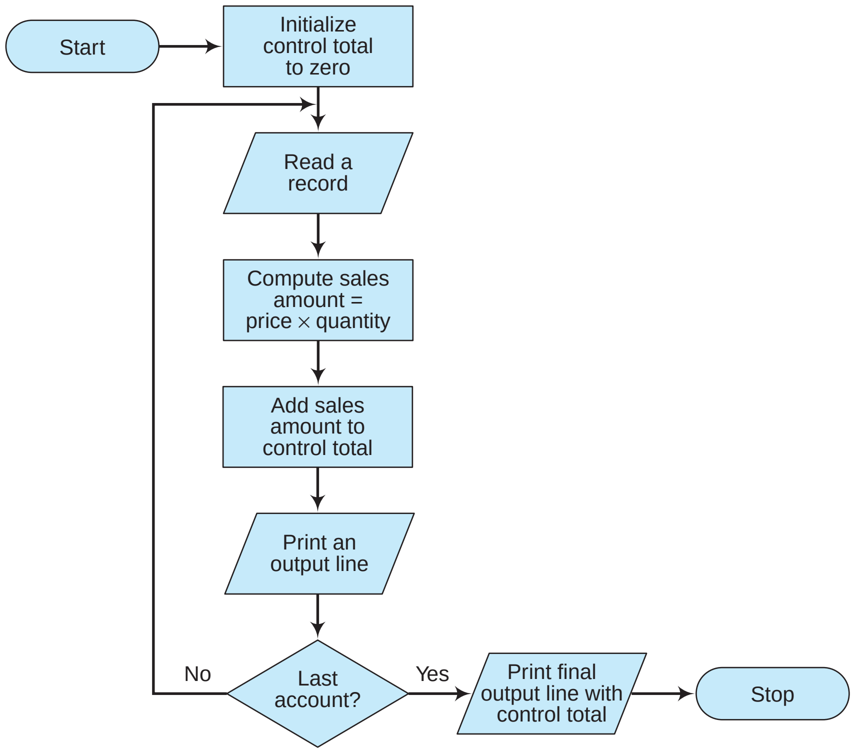

FIGURE 3-15 A program flowchart for a sales application.

Decision Tables

When a computer program involves a large number of conditions and subsequent courses of action, its program flowchart tends to be large and complex. A **decision table** (Figure 3-16) is a table of conditions and processing tasks that indicates what action to take for each possibility. Sometimes, decision tables are used as an alternative to program flowcharts. More commonly, they are used in addition to these flowcharts. To illustrate decision tables, consider the following scenario:

> *A credit union pays interest to its depositors at the rate of 5% per year. Accounts of less than $5 are not paid interest. Accounts of $1,000 or more that have been with the credit union for more than one year get paid the normal 5 percent, plus a bonus of. 5 percent.*

Figure 3-16 illustrates a decision table to help the credit union decide how much interest to pay each account. Note that the decision table consists of four parts: (1) the condition stub outlines the potential conditions of the application, (2) the action stub outlines the available actions that can be taken, (3) the condition entries depict the possible combinations of conditions likely to occur, and (4) the action entries outline the action to be taken for each combination of conditions.

The rules at the top of the decision table set forth the combination of conditions that may occur, and the action entries show what to do for each of them. For the illustration at hand, three conditions affect the data processing of each account: (1) an account balance less than $5, (2) an account balance less than $1,000, and (3) an account one year old or less. As defined, each of these conditions can now be answered "yes" or "no." Figure 3-15

		Rules				
		1	2	3	4	
	Conditions					
Condition stub	Account balance less than $5	Y	N	N	N	Condition entries
	Account balance less than $1,000	*	Y	*	N	
	Account 1 year old or less	*	*	Y	N	
	Actions					
Action stub	Pay no interest	X				Action entries
	Pay 5 percent interest		X	X		
	Pay 5.5 percent interest				X	

FIGURE 3-16 This is a decision table to help a credit union decide how much interest to pay each account. An asterisk (*) means that the condition does not affect the course of action.

is a decision table for the illustration at hand, in which Y stands for ''yes'' and N stands for ''no.'' The combination of Ys and Ns in each column of the table illustrates each possible condition the system might encounter. Using Xs, the decision table also shows what course of action should be taken for each condition (i.e., how much interest should be paid to each account).

The major advantage of decision tables is that they summarize the processing tasks for a large number of conditions in a compact, easily understood format. This increases system understanding, resulting in fewer omissions of important processing possibilities. Decision tables also serve as useful documentation aids when new data processing conditions arise or when changes in organizational policy result in new actions for existing conditions. This advantage is particularly important to AISs because of organizational concern for accuracy and completeness in processing financial data.

One drawback of decision tables is that they do not show the order in which a program tests data conditions or takes processing actions, as do program flowcharts. This is a major deficiency because the order in which accounting data are tested or processed is often as important as the tests or processing themselves. A second drawback is that decision tables require an understanding of documentation techniques beyond flowcharting. Finally, decision tables require extra work to prepare, and this work may not be cost effective if program flowcharts must be prepared anyway.

Software Tools for Graphical Documentation and SOX Compliance

Accountants, consultants, and system developers can use a variety of software tools to create **graphical documentation** of existing or proposed AISs. The simplest tools include presentation software, such as Microsoft PowerPoint, as well as word processing and spreadsheet software such as Microsoft Word and Excel. The advantages of using such tools closely parallel those of using word processing software instead of typewriters (e.g., easily revised documents, advanced formatting capabilities and coloring options, and a variety of reproduction capabilities). For example, the authors used Microsoft Word to create the process maps in Figures 3-8 and 3-9.

Microsoft Word, Excel, and PowerPoint. Using the ''AutoShapes'' option in the Drawing Toolbar of Microsoft Word, Excel or PowerPoint, you can reproduce most of the graphics symbols and logic diagrams in this chapter. (The connectors in Excel are different from, as well as better than, simple lines because they adjust automatically when you reposition symbols in your charts.) Two additional advantages of using Excel to create graphical documentation are the ability to create large drawings (that exceed the margins of word-processing documents) and the option to embed computed values in flowcharting symbols. Problem 3–21 at the end of the chapter describes how to use Excel to create such graphical documentation.

CASE Tools. The capabilities of specialized graphical documentation software exceed those of word-processing or spreadsheet packages. These **CASE tools** (an acronym for computer-assisted software engineering) automate such documentation tasks as drawing or modifying flowcharts, drawing graphics and screen designs, developing reports, and even generating code from documentation. Thus, CASE tools are to flowcharts what word processors are to text documents. Figure 3-17 is an example of a CASE package in use, drawing a data flow diagram.

Most CASE products run on personal computers. Examples include *iGrafx* (Micrografx, Inc.), *allCLEAR* (SPSS, Inc.), *SmartDraw* (SmartDraw Software, Inc.), and *Visio* (Microsoft Corp.). These products are especially popular with auditors and consultants, who use them to document AISs using the techniques discussed above, as well as to analyze the results. Graphical documentation software enables its users to create a wide array of outputs, including data flow diagrams, entity-relationship diagrams (described in Chapter 7), system flowcharts, program flowcharts, process maps, and even computer network designs.

More complex CASE products enable their users to do even more. Examples include *Application Factory* (Cortex Corporation), *Excelerator II* (Intersolv), and *Pacbase* (CGI Systems, Inc.). These CASE tools enable system designers to create process models, data-entry screens, report formats, menu screens, structure charts, and customized user interfaces. Most CASE packages also include modules for creating data dictionaries and word

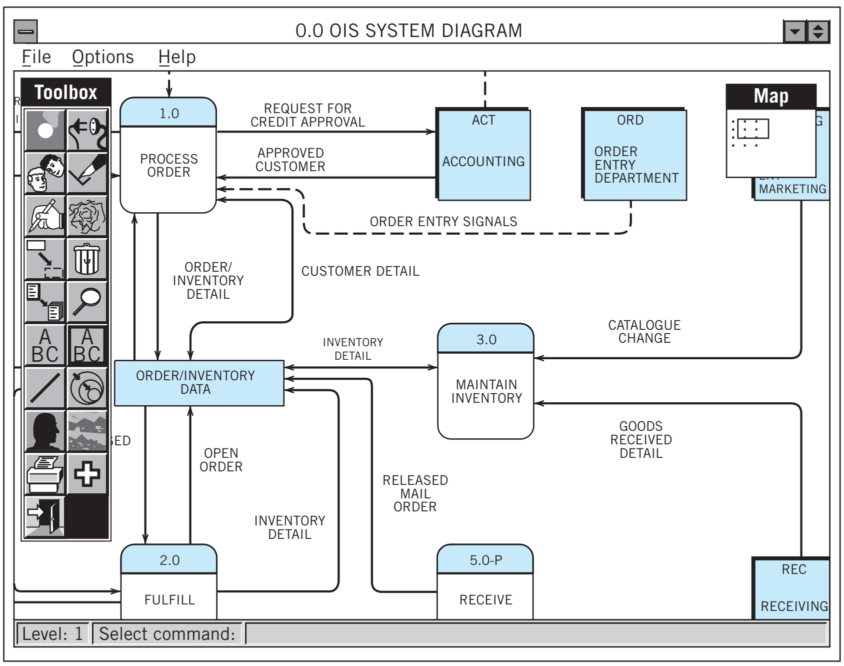

FIGURE 3-17 This CASE tool is a software program called Excelerator™, which is used here to create a data flow diagram. The toolbox on the left contains symbols that the user can select for his or her diagram.

processors for creating written documentation. Top-end packages include project management modules, and also support client/server applications, encourage object-oriented programming, and provide visual tools for workflow analyses and process redesigns.

Front-end CASE tools focus on the early (''front end'') tasks of systems design—for example, requirements-design activities. *Backend CASE tools* automate the detailed design tasks required in the later stages of a project—for example, developing detailed program flowcharts. Integrated CASE (I-CASE) packages enable users to perform both types of tasks and perhaps even generate computer code directly from logic diagrams. As a result, these tools help support **rapid application development (RAD)** and help organizations save money.

Graphical documentation software tools enable their users to generate documentation quickly and consistently, as well as to automate modifications to this documentation later as changes are required. They include templates and models that allow users to document almost any business and system environment. But these packages only create what they are told to create. Like word processors, they lack imagination and creativity, and they also require training to use them efficiently.

SOX Compliance. Many businesses now use specialized software packages to automate the tasks required by Section 404 of the Sarbanes-Oxley Act of 2002. Just as word processing software makes document revisions easier, these ''compliance software packages'' enable businesses to reduce the time and costs required to satisfy SOX requirements. *BlindView* (Symatec Corporation), for example, monitors servers to determine which applications each employee can access, identifies financial information stored on these servers, determines whether adequate segregation of duties are in place, and even restricts employee access to selected information as dictated by SOX. Similarly, *Movaris Certainty* (Movaris, Inc.) is another software tool that companies can use for compliance purposes:

> ***Case-in-Point 3.6*** The Chicago Mercantile Exchange creates markets in which customers buy and sell futures contracts for such products as corn, wheat, soybeans, and pork bellies—and uses Movaris Certainty 8.0 to help it meet SOX requirements. The software enables the exchange to centralize all its compliance documentation in one Oracle database, document, report, and review its internal controls, and analyze workflow capabilities.[5]

Some software focuses on risk identification and management. *Certus Governance Suite* (Certus Software, Inc.) is one example. This suite includes SOX compliance and risk software that enables organizations to identify the risks tied to various accounting applications, and to map these risks back to the controls that govern them. The software also enables businesses to identify which divisions and controls involve multiple financial systems or operations, and to consolidate such reviews in a single application.

OpenPages FCM (OpenPages, Inc.) and *BizRights* (Approva Corp.) provide somewhat similar capabilities. *OpenPages FCM* includes a compliance database, workflow management tools, and provides a software dashboard that enables executives to verify that specific managerial controls are now in place as well as to identify control deficiencies that might affect financial reports. *BizRights* software enables users to focus on separation of duties in an ERP environment. Using a rule book, the software determines whether such separations are appropriate, and therefore enables companies to reduce their reliance on external auditors for such work.

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[5]Hoffman, Thomas, ''Calibrating Toward Compliance'' *Computerworld* Vol. 40, No. 6 (February 6, 2006), pp. 21–24.

END-USER COMPUTING AND DOCUMENTATION

End-user computing refers to the ability of non-IT employees to create computer applications of their own. Today, we take much of this ''computing'' for granted—for example, when employees manipulate data with word processing, spreadsheet, database management systems, or tax packages—because all of these programs were developed expressly so that end users can develop applications for themselves.

The Importance of End-User Documentation

End-user applications often require substantial resources or perform mission-critical functions for busy organizations. Thus, end users should document their applications for many of the same reasons that professionals must document their applications. One rationale for this is that end users require complete, easy-to-follow training manuals, tutorials, and reference guides to help them use computer software and perform application tasks. New software always seems to place us at the ''low end of the learning curve'' (i.e., in unfamiliar territory), thus making documentation important for learning how to accomplish things or undo mistakes.

Documentation is also important when end users develop their own applications (for example, spreadsheet models or database applications). This self-development places the responsibility for documenting these applications on the same employees who created them. Unfortunately, this documentation task is often overlooked or is performed so poorly that it might as well be overlooked. Such oversight can be costly. For example, time is wasted when other employees must alter the system but lack the basic documentation to accomplish this task. Thus, even if the developer is the only one in the office who uses a particular application, managers should insist that he or she document it—for example, in case of sickness or dismissal.

The specific items that should be used to document any particular end-user application will, of course, vary with the application. For example, businesses often find it convenient to use systematic file names to identify word processing documents and to embed these file names within the reports to help others find them later. Figure 3-18 provides some ideas for documenting spreadsheet applications.

1. Name of the developer.
2. Name of the file where the application is stored.
3. Name of the directories and subdirectories where the application is stored.
4. Date the application was first developed.
5. Date the application was last modified, and the name of the person who modified it.
6. Date the application was last run.
7. Name and phone number of person to call in case of problems.
8. Sources of external data used by the system.
9. Important assumptions made in the application.
10. Important parameters that must be modified in order to change assumptions or answer ''what-if'' questions.
11. Range names used in the application and their locations in the spreadsheet.

FIGURE 3-18 Examples of information to include when documenting spreadsheets.

Policies for End-User Computing and Documentation

Besides finding that some applications are poorly documented, organizations sometimes also discover that the end-user applications of one department duplicate those of another. Then, too, a lack of corporate-wide documentation standards can penalize both the developer and the organization in the long run. Finally, many firms find that end-user applications are not well tested and that internal controls are either weak or non-existent. To avoid such problems, businesses should establish and follow the guidelines outlined here to control end-user applications development:

1. *Formally evaluate large projects.* Employees should be allowed to create a large application only after it has withstood the scrutiny of a formal review of its costs and benefits. When projects are large, higher-level management should be involved in the go-ahead decision.
2. *Adopt formal end-user development policies.* Employees usually do not develop poor applications because they wish to do so, but because no organizational policies exist that restrict them from doing so. Policy guidelines should include procedures for testing software, examining internal controls, and periodically auditing systems.
3. *Formalize documentation standards.* At this point in the chapter, the importance of formal documentation should be self-evident. What may be less obvious is the need to create procedures for ensuring that these documentation standards are met.
4. *Limit the number of employees authorized to create end-user applications.* This restricts applications development to those employees in whom management has confidence, or perhaps who have taken formal development classes.
5. *Audit new and existing systems.* The more critical an end-user system is to the functioning of a department or division, the more important it is for organizations to require formal audits of such systems for compliance with the guidelines outlined previously.

Case-in-Point 3.7 In a parallel universe, the apprentice had yet one more question for the master accountant. "Master," he said, "I now understand why documenting end-user applications is so important. Is it not correct, therefore, that all companies require such documentation?"

The master accountant shifted his weight and cleared his throat. "The lesson is over for today," he said.

AIS AT WORK
Flowcharts Help Recover Embezzled Assets

In August 2001, a forensic team of two CPAs and an IT professional were hired by a law firm to help investigate the suspected siphoning of large sums of money from government offices of a Persian Gulf sovereignty. The team only had about seven weeks to collect as much relevant information as possible, analyze this information, and then make it easy to understand (in the event that the case went to court).

The assets were allegedly hidden in investment banks and brokerage firms in a number of European countries. Therefore, the biggest challenges were to determine what information should be collected and then what information was still available—the concern was that this embezzlement had been going on for more than a decade. The search for transactions and data required extensive information technology and data-mining skills, because the money trail was hidden in databases at financial institutions. The team quickly realized the value of understanding databases, particularly Microsoft Access database software.

But tracing the cash flows became a difficult task because the number of transactions was large and the flow of monies both inside and outside the country was complicated. The forensic team quickly decided that the most efficient and effective method for keeping track of these cash flows (and how they fit into the whole picture) was to use flow charts and decision tables. Understanding how the money was moving inside and outside the organization provided the basis for the team to identify the transactions where assets were misappropriated. As a result, the team could also identify existing controls that could be thwarted, and suggest how the investigation should proceed. In the end, the team found hundreds of suspect transactions that led to an out-of-court settlement.

Source: Marc Siegel, ''Recovery of Embezzled Assets Half a World Away,'' *Journal of Accountancy*, (August 2001), Vol. 192, No. 2, p. 45–49.

SUMMARY

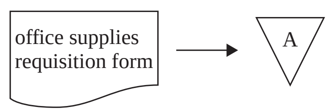
- Nine reasons to document an AIS are: (1) to explain how the system works, (2) to train others, (3) to help developers design new systems, (4) to control system development and maintenance costs, (5) to standardize communications among system designers, (6) to provide information to auditors, (7) to document a business's processes, (8) to help a company comply with the Sarbanes-Oxley Act of 2002, and (9) to establish employee accountability for specific tasks or procedures.
- A document flowchart describes the physical flow of documents through an AIS—for example, by providing an overview of where documents are created, sent, reviewed, and stored, and what activities they trigger.
- A system flowchart describes the electronic flow of data through an AIS, indicates what processing steps and files are used and when, and provides an overview of the entire system.
- Process maps also describe the flow of information through an organization, use only a few symbols, and (to many) are among the easiest to draw and understand.
- Data flow diagrams provide both a physical and a logical view of a system, but concentrate more on the flow and transformation of data than on the physical devices or timing of inputs, processing, or outputs.
- Two additional documentation tools are program flowcharts and decision tables. Accountants do not need to be programmers to evaluate or design an accounting information system, but they should understand in general terms how these tools work.
- A variety of software tools exist for documenting AISs. These include standard personal productivity tools such as word processing and spreadsheet software, specialized CASE tools, and software packages designed to help companies comply with SOX.
- End-user computing is important because many employees do it and also because such applications often contribute significantly to the efficiency of specific departments or divisions. But many employees do not document their applications very well, and this often costs time and money.

KEY TERMS YOU SHOULD KNOW

CASE (computer-assisted software engineering) tools
context diagram
data flow diagrams (DFDs)
decision table
decomposition
document flowchart
documentation
end-user computing
graphical documentation software
job stream
level 0 data flow diagram
level 1 data flow diagram
logical data flow diagram
macro program flowchart
object-oriented software
physical data flow diagram
process map
program flowcharts
rapid application development (RAD)
sandwich rule (system flowcharts)
signed checklists
structured programming
structured walkthrough
system flowchart

TEST YOURSELF

The first three questions refer to this diagram:



Q3-1. The diagram here is most likely a:

a. Document flowchart
b. System flowchart
c. Data flow diagram
d. Program flowchart

Q3-2. In the diagram here, the symbol with the letter A represents:

a. An on-page connector
b. An off-page connector
c. A file
d. An answering machine

Q3-3. In this diagram, the arrow represents:

a. A wireless transmission
b. A telephone call
c. An information flow
d. A management order to a subordinate

Q3-4. Document flowcharts would not be able to represent:

a. The flow of information when ordering office supplies
b. The flow of information when hiring new employees
c. The flow of information when creating orders for new magazine subscriptions
d. The logic in performing payroll processing

Q3-5. Which of the following is *not* true about system flowcharts?

a. They can depict the flow of information in computerized AISs

b. They use standardized symbols

c. They cannot show how documents flow in an AIS

d. They often document an audit trail

Q3-6. Which of the following is *not* true about process maps?

a. They depict the flow of information in computerized AISs

b. They use standardized symbols

c. Government agencies as well as businesses often use them

d. Web pages often depict hierarchical versions of them

Q3-7. The *sandwich rule* states that:

a. You should only create logic diagrams that have some ''meat'' in them

b. Every diagram should have a cover page and a summary page

c. A processing symbol should be between an input and an output symbol

d. In DFDs, there should always be data flow lines leading to and from files

Q3-8. Which of these is *not* a good guideline to follow when creating DFDs?

a. Avoid detail in high-level DFDs

b. Avoid drawing temporary files in DFDs

c. Classify most of the final recipients of system outputs as external entities

d. Avoid showing error routines or similar exception tasks

Q3-9. A meeting in which computer programmers outline their logic to others is called a:

a. Decision meeting

b. RAD meeting

c. Mythical event

d. Structured walkthrough

Q3-10. A decision table shows:

a. The possible conditions and processing alternatives for a given situation

b. Who sat where at a board meeting

c. The rules for drawing DFDs

d. The local outsourcing vendors in the area for documentation tasks

DISCUSSION QUESTIONS

3-1. Why is documentation important to accounting information systems? Why should accountants be interested in AIS documentation?

3-2. Distinguish between document flowcharts, system flowcharts, data flow diagrams, and program flowcharts. How are they similar? How are they different?

3-3. What are document flowcharts? How does a document flowchart assist each of the following individuals: (1) a systems analyst, (2) a systems designer, (3) a computer programmer, (4) an auditor, and (5) a data security expert?

3-4. Although flowcharting is an art rather than a science, some guidelines can be used to make better flowcharts. What are these guidelines for document, system, and data flow diagram flowcharts?

3-5. What are the four symbols used in data flow diagrams? What does each mean?

3-6. Why are data flow diagrams developed in a hierarchy? What are the names of some levels in the hierarchy?

3-7. Look at the process map in Figure 3-13. Trace the steps in the order fulfillment process. Do you think this figure is more helpful than a narrative would be in understanding the flow of events in the process?

3-8. What is the purpose of a decision table? How might decision tables be useful to accountants?

3-9. What are CASE tools? How are they used? How do CASE tools create documentation for AISs? If you were a systems analyst, would you use a CASE tool?

3-10. What is end-user computing? Why is documentation important to end-user computing? What guidelines should companies develop to control end-user computing?

PROBLEMS

3-11. To view the Drawing ToolBar of Microsoft Excel, select the following options from the main menu: View\Toolbars\Drawing. (You can also click directly on the Drawing icon in the Standard Toolbar.) After the Drawing Toolbar appears, select Autoshapes\Flowchart and observe the symbols that appear in the selection list. There should be approximately 28 of them (using Office 2000). If you allow your mouse to hover over a specific symbol, its title and meaning will appear in a tool-tip box. Finally, if you click on a specific symbol, your mouse icon will change to a cross-hair and you will be able to draw this symbol on your spreadsheet. Create a list with items similar to the one below that contains all the symbols in your version of Excel.

Predefined Process

3-12. Draw a document flowchart to depict each of the following situations.

a. An individual from the marketing department of a wholesale company prepares five copies of a sales invoice, and each copy is sent to a different department.

b. The individual invoices from credit sales must temporarily be stored until they can be matched against customer payments at a later date.

c. A batch control tape is prepared along with a set of transactions to ensure completeness of the data.

d. The source document data found on employee application forms are used as input to create new employee records on a computer master file.

e. Delinquent credit customers are sent as many as four different inquiry letters before their accounts are turned over to a collection agency.

f. Physical goods are shipped back to the supplier if they are found to be damaged upon arrival at the receiving warehouse.

g. The data found on employee time cards are keyed onto a hard disk before they are processed by a computer.

h. The data found on employee time cards are first keyed onto a floppy diskette before they are entered into a computer job stream for processing.

i. A document flowchart is becoming difficult to understand because too many lines cross one another. (Describe a solution.)

j. Three people, all in different departments, look at the same document before it is eventually filed in a fourth department.

k. Certain data from a source document are copied into a ledger before the document itself is filed in another department.

3-13. Develop a document flowchart for the following information flow. The individual stores in the Mark Goodwin convenience chain prepare two copies of a goods requisition form (GRF) when they need to order merchandise from the central warehouse. After these forms are completed, one copy is filed in the store's records and the other copy is sent to the central warehouse. The warehouse staff gets the order and files its copy of the GRF form in its records. When the warehouse needs to restock an item, three copies of a purchase order form (POF) are filled out. One copy is stored in the warehouse files, one copy goes to the vendor, and the third copy goes to the accounts payable department.

3-14. The Garcia-Lanoue Company produces industrial goods. The company receives purchase orders from its customers and ships goods accordingly. Assuming that the following conditions apply, develop a document flowchart for this company:

a. The company receives two copies of every purchase order from its customers.

b. Upon receipt of the purchase orders, the company ships the goods ordered. One copy of the purchase order is returned to the customer with the order, and the other copy goes into the company's purchase order file.

c. The company prepares three copies of a shipping bill. One copy stays in the company's shipping file, and the other two are sent to the customer.

3-15. The data-entry department of the Ron Mitchell Manufacturing Company is responsible for converting all of the company's shipping and receiving information to computer records. Because accuracy in this conversion is essential, the firm employs a strict verification process. Prepare a document flowchart for the following information flow:

a. The shipping department sends a copy of all shipping orders to the data-entry department.

b. A data-entry operator keys the information from a shipping order onto a diskette.

c. A supervisor checks every record with the original shipping order. If no errors are detected, the diskette is sent to the computer operations staff and the original shipping order is filed.

3-16. Amanda M is a regional manufacturer and wholesaler of high-quality chocolate candies. The company's sales and collection process is as follows. Amanda M makes use of an enterprise-wide information system with electronic data interchange (EDI) capability. No paper documents are exchanged in the sales and collection process. The company receives sales orders from customers electronically. Upon receipt of a sales order, shipping department personnel prepare goods for shipment, and input shipping data into the information system. The system sends an electronic shipping notice and invoice to the customer at the time of shipment. Terms are net 30. When payment is due, the customer makes an electronic funds transfer for the amount owed. The customer's information system sends remittance (payment) data to Amanda M. Amanda M's information system updates accounts receivable information at that time.

Draw a context diagram and a level 0 logical data flow diagram for Amanda M's sales and collection process.

3-17. The order-writing department at the Winston Beauchamp Company is managed by Alan Most. The department keeps two types of computer files: (1) a customer file of authorized credit customers and (2) a product file of items currently sold by the company. Both of these files are direct-access files stored on magnetic disks. Customer orders are handwritten on order forms with the Winston Beauchamp name at the top of the form, and item lines for quantity, item number, and total amount desired for each product ordered by the customer.

When customer orders are received, Alan Most directs someone to input the information at one of the department's computer terminals. After the information has been input, the computer program immediately adds the information to a computerized "order" file and prepares five copies of the customer order. The first copy is sent back to Alan's department;

the others are sent elsewhere. Design a system flowchart that documents the accounting data processing described here. Also, draw a data flow diagram showing a logical view of the system.

3-18. The LeVitre and Swezey Credit Union maintains separate bank accounts for each of its 20,000 customers. Three major files are the customer master file, the transaction file of deposits and withdrawal information, and a monthly statement file that shows a customer's transaction history for the previous month. The following lists the bank's most important activities during a representative month:

a. Customers make deposits and withdrawals.

b. Employers make automatic deposits on behalf of selected employees.

c. The bank updates its master file daily using the transaction file.

d. The bank creates monthly statements for its customers, using both the customer master file and the transactions file.

e. Bank personnel answer customer questions concerning their deposits, withdrawals, or account balances.

f. The bank issues checks to pay its rent, utility bills, payroll, and phone bills.

Draw a data flow diagram that graphically describes these activities.

3-19. The Jeffrey Getelman Publishing Company maintains an online database of subscriber records, which it uses for preparing magazine labels, billing renewals, and so forth. New subscription orders and subscription renewals are keyed into a computer file from terminals. The entry data are checked for accuracy and written on a master file. A similar process is performed for change-of-address requests. Processing summaries from both runs provide listings of master file changes.

Once a month, just prior to mailing, the company prepares mailing labels for its production department to affix to magazines. At the same time, notices to new and renewal subscribers are prepared. These notices acknowledge receipt of payment and are mailed to the subscribers. The company systems analyst, Bob McQuivey, prepared the system flowchart in Figure 3-19 shortly before he left the company. As you can see, the flowchart is incomplete. Finish the flowchart by labeling each flowcharting symbol. Don't forget to label the processing runs marked computer.

3-20. The Bridget Joyce Company is an office products distributor that must decide what to do with delinquent credit-sales accounts. Mr. Bob Smith, the credit manager, divides accounts into the following categories: (1) accounts not past due, (2) accounts 30 days or less past due, (3) accounts 31 to 60 days past due, (4) accounts 61 to 90 days past due, and (5) accounts more than 90 days past due. For simplicity, assume that all transactions for each account fall neatly into the same category.

Mr. Smith decides what to do about these customer accounts based on the history of the account in general and also the activity during the account's delinquency period. Sometimes, for example, the customer will not communicate at all. At other times, however, the customer will either write to state that a check is forthcoming or make a partial payment. Mr. Smith tends to be most understanding of customers who make partial payments because he considers such payments acts of good faith. Mr. Smith is less understanding of those customers who only promise to pay or who simply ignore follow-up bills from the company.

Mr. Smith has four potential actions to take in cases of credit delinquency. First, he can simply wait (i.e., do nothing). Second, he can send an initial letter to the customer, inquiring about the problem in bill payment and requesting written notification of a payment schedule if payment has not already been made. Third, he can send a follow-up letter indicating that a collection agency will be given the account if immediate payment is not forthcoming. Fourth, he can turn the account over to a collection agency. Of course, Mr. Smith prefers to use one of the first three actions rather than turn the account over to a collection agency, because his company only receives half of any future payments when the collection agency becomes involved.

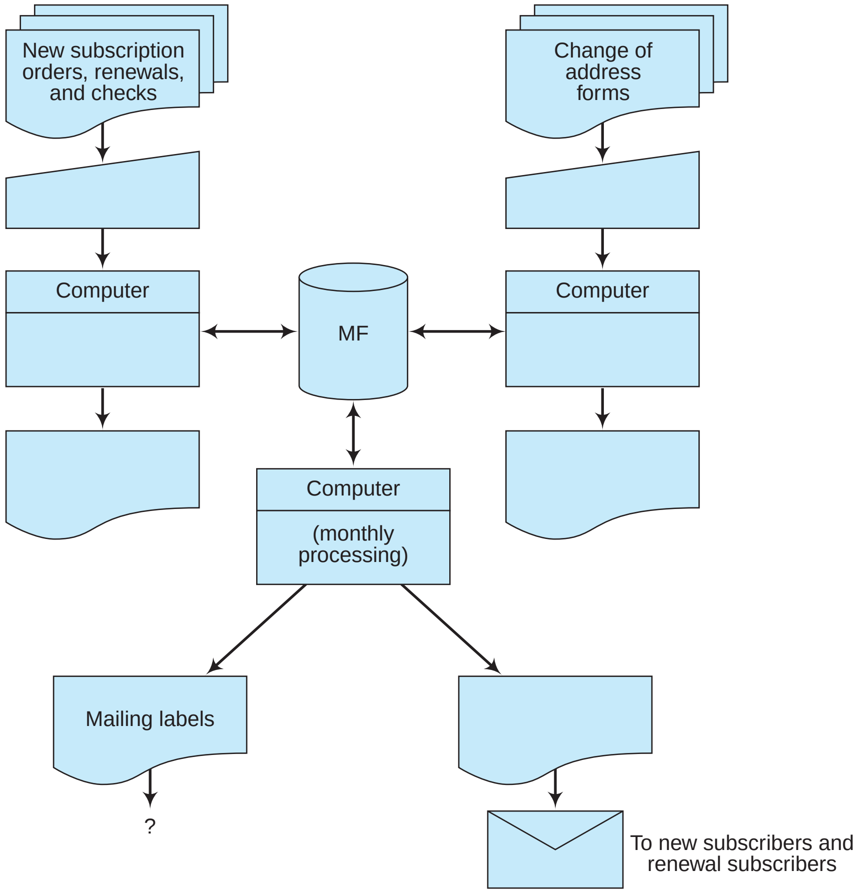


FIGURE 3-19 System flowchart for processing the subscription orders and changes for the Jeffrey Getelman Company.

a. Create a decision table for the Bridget Joyce Company and provide a set of reasonable decision rules for Mr. Smith to follow. For now, ignore the influence of a customer's credit history.

b. Expand the decision table analysis you have prepared in question ''a'' to include the credit history of the customer accounts. You are free to make any assumptions you wish about how this history might be evaluated by Mr. Smith.

3-21. Follow the directions in Exercise 3-11 to access Excel's drawing tools and then recreate the two program flowcharts shown in Figure 3-20. Draw each flowchart on a separate work sheet. Rename the first sheet ''Main'' and the second sheet ''Sub.'' To embed text inside a symbol, right-click on that symbol with your mouse and then choose ''Add Text'' from the dropdown menu that appears. To center text inside a symbol, highlight the text and then click on the centering icon in the main toolbar.

Create the words ''Yes'' and ''No'' that appear in this flowchart using Text Box symbols from the drawing toolbar. To eliminate the black (default) borders around these words, right-click on a Text Box *border* (*not* the text inside the symbol). When the context menu appears, select the ''Colors and Lines'' tab, and then ''No Line'' from the ''Line\Color'' section of that tab. Finally, you can fine-tune the position of any object by clicking on its border and then using the Ctrl key plus an arrow key to reposition it as desired.

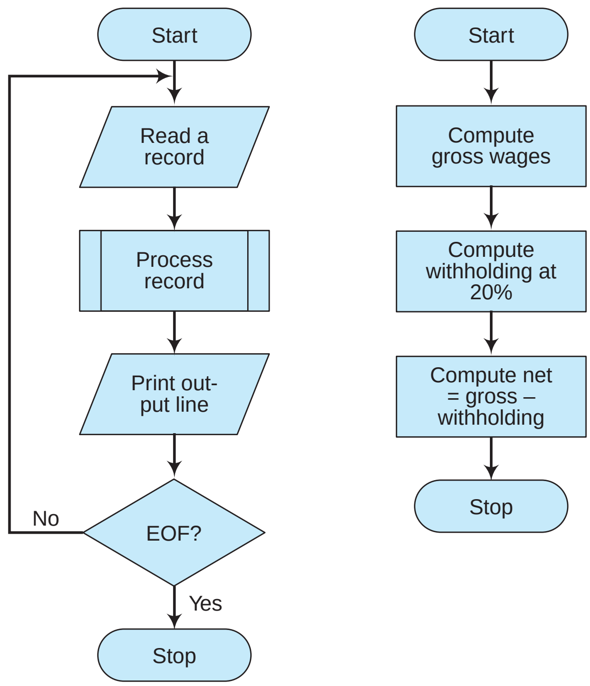


FIGURE 3-20 Draw the flowchart on the left on one Excel sheet and the flowchart on the right on a second sheet.

After drawing these two flowcharts, we want to link them together. In this case, we want the user to click on the ''Process Record'' symbol in the main flowchart and then be able to view the second spreadsheet you've created on the alternate sheet. To create this link, click on the border of the ''Process Record'' symbol, and then select Insert\Hyperlink from the main menu. Again, be sure to click on a symbol border—not the text inside the border.

When the Insert Hyperlink dialog box appears, first select ''Place in this Document'' from the choices on the left side of the box, and then click on the name of the sheet in which you've drawn the second flowchart (''Sub'') in the lower box on the right. If you wish, you can also select a particular cell for linking in the top box—a handy feature if you've drawn your flowchart in a lower portion of the Sub sheet. That's it! Now, when you move your mouse over the ''Process Record'' symbol in the ''Main'' sheet, your mouse icon should turn into a hand, indicating that clicking on this symbol links you to the supporting document's sheet.

Using Excel software and the skills described above, recreate the documents from the list below or the ones required by your instructor:

a. The document flowchart in Figure 3-3.

b. The system flowchart in Figure 3-6.

c. The process map in Figure 3-8.

d. The context diagram in Figure 3-11.

e. The physical DFD in Figure 3-12.

f. The logical data flow diagram shown in Figure 3-13.

g. Link the DFD in part ''e'' to a new DFD similar to Figure 3-14.

h. The program flowchart shown in Figure 3-15.

CASE ANALYSES

3-22. The Berridge Company (Drawing Document Flowcharts)

The Berridge Company is a discount tire dealer that operates 25 retail stores in a metropolitan area. The company maintains a centralized purchasing and warehousing facility and employs a perpetual inventory system. All purchases of tires and related supplies are placed through the company's central purchasing department to take advantage of the quantity discounts offered by its suppliers. The tires and supplies are received at the central warehouse and distributed to the retail stores as needed. The perpetual inventory system at the central facility maintains current inventory records, which include designated reorder points, optimum order quantities, and balance-on-hand information for each type of tire or related supply.

The participants involved in Berridge's inventory system include (1) retail stores, (2) the inventory control department, (3) the warehouse, (4) the purchasing department, (5) accounts payable, and (6) outside vendors. The inventory control department is responsible for maintenance of the perpetual inventory records for each item carried in inventory. The warehouse department maintains the physical inventory of all items carried by the company's retail stores.

All deliveries of tires and related supplies from vendors are received by receiving clerks in the warehouse department, and all distributions to retail stores are filled by shipping clerks in this department. The purchasing department places every order for items needed by the company. The accounts payable department maintains the subsidiary ledger with vendors and other creditors. All payments are processed by this department. The documents used by these various departments are as follows:

Retail Store Requisition (Form RSR). The retail stores submit this document to the central warehouse whenever tires or supplies are needed at the stores. The shipping clerks in the warehouse department fill the orders from inventory and have them delivered to the stores. Three copies of the document are prepared; two of which are sent to the warehouse, and the third copy is filed for reference.

Purchase Requisition (Form PR). An inventory control clerk in the inventory control department prepares this document when the quantity on hand for an item falls below the designated reorder point. Two copies of the document are prepared. One copy is forwarded to the purchasing department, and the other is filed.

Purchase Order (Form PO). The purchasing department prepares this document based on information found in the purchase requisition. Five copies of the purchase order are prepared. The disposition of these copies is as follows: copy 1 to vendor, copy 2 to accounts payable department, copy 3 to inventory control department, copy 4 to warehouse, and copy 5 filed for reference.

Receiving Report (Form RR). The warehouse department prepares this document when ordered items are received from vendors. A receiving clerk completes the document by indicating the vendor's name, the date the shipment is received, and the quantity of each item received. Four copies of the report are prepared. Copy 1 is sent to the accounts payable department, copy 2 to the purchasing department, and copy 3 to the inventory control department; Copy 4 is retained by the warehouse department, compared with the purchase order form in its files, and filed together with this purchase order form for future reference.

Invoices. Invoices received from vendors are bills for payment. The vendor prepares several copies of each invoice, but only two copies are of concern to the Berridge Company: the copy that is received by the company's accounts payable department and the copy that is retained by the vendor for reference. The accounts payable department compares the vendor invoice with its file copy of the original purchase order and its file copy of the warehouse receiving report. Based on this information, adjustments to the bill amount on the invoice are made (e.g., for damaged goods, for trade discounts, or for cash discounts), a check is prepared, and the payment is mailed to the vendor.

Requirements

1. Draw a document flowchart for the Berridge Company using the symbols in Figure 3-2.
2. Could the company eliminate one or more copies of its RSR form? Use your flowchart to explain why or why not.
3. Do you think that the company creates too many copies of its purchase orders? Why or why not?

3-23. FreezeTime, Inc. (Drawing Systems Flowcharts)

Carly Riccardi and her mother Nancy own and operate FreezeTime, Inc., a company specializing in freeze-drying flowers from clients' memorable events, such as proms and weddings. The company not only freezes the flowers, but also presents them in a variety of display packages. Each of these packages includes materials such as glass and frames that FreezeTime purchases from local suppliers. In addition to supplies for display, the company purchases office supplies and packaging materials from several vendors.

FreezeTime uses a low-end accounting software package to prepare documents and reports. As employees note a need for supplies and materials, they inform Carly or Nancy, who act as office manager and company accountant. Either Carly or Nancy enters order information into the accounting system and creates a purchase order that they fax to the supplier. Occasionally, Carly or Nancy will also call the supplier if there is something special about the product ordered. When ordered materials and supplies arrive at FreezeTime's small factory, either Carly or Nancy checks the goods received against a copy of the purchase order and enters the new inventory into the computer system.

Nancy pays bills twice each month, on the first and the fifteenth. She checks the computer system for invoices outstanding, and verifies that the goods have been received. She then enters any information needed to produce printed checks from the accounting system. FreezeTime mails checks and printed remittance advices (portions of the vendor bill to be returned) to suppliers.

Requirements

1. Create a systems flowchart for FreezeTime's purchase and payment process.
2. Comment on the value, if any, that having a systems flowchart describing this process would have to Carly or Nancy.

3-24. The Dinteman Company (Document Analysis)

The Dinteman Company is an industrial machinery and equipment manufacturer with several production departments. The company employs automated and heavy equipment in its production departments. Consequently, Dinteman has a large repair and maintenance department (R&M department) for servicing this equipment.

The operating efficiency of the R&M department has deteriorated over the past two years. For example, repair and maintenance costs seem to be climbing more rapidly than other department costs. The assistant controller has reviewed the operations of the R&M department and has concluded that the administrative procedures used since the early days of the department are outmoded due in part to the growth of the company. In the opinion of the assistant controller, the two major causes for the deterioration are an antiquated scheduling system for repair and maintenance work, and the actual cost to distribute the R&M department's costs to the production departments. The actual costs of the R&M department are allocated monthly to the production departments on the basis of the number of service calls made during each month.

The assistant controller has proposed that a formal work order system be implemented for the R&M department. With the new system, the production departments will submit a service request to the R&M department for the repairs and/or maintenance to be completed, including a suggested time for having the work done. The supervisor of the R&M department will prepare a cost estimate on the service request for the work required (labor and materials) and estimate the amount of time for completing the work on the service request. The R&M supervisor will return the request to the production department that initiated the request. Once the production department approves the work by returning a copy of the service request, the R&M supervisor will prepare a repair and maintenance work order and schedule the job. This work order provides the repair worker with the details of the work to be done and is used to record the actual repair and maintenance hours worked and the materials and supplies used.

Production departments will be charged for actual labor hours worked at a predetermined standard rate for the type of work required. The parts and supplies used will be charged to the production departments at cost. The assistant controller believes that only two documents will be required in this new system—a Repair/Maintenance Service Request initiated by the production departments and a Repair/Maintenance Work Order initiated by the R&M department.

Requirements

1. For the Repair/Maintenance Work Order document:
   a. Identify the data items of importance to the repair and maintenance department and the production department that should be incorporated into the work order.
   b. Indicate how many copies of the work order would be required and explain how each copy would be distributed.
2. Prepare a document flowchart to show how the Repair/Maintenance Service Request and the Repair/Maintenance Work Order should be coordinated and used among the departments of Dinteman Company to request and complete the repair and maintenance work, to provide the basis for charging the production departments for the cost of the completed work, and to evaluate the performance of the repair and maintenance department. Provide explanations in the flowchart as appropriate.

(CMA Adapted)

3-25. Lois Hale and Associates (Drawing Data Flow Diagrams)

Lois Hale and Associates is a medium-size manufacturer of musical equipment. The accounts payable department is located at company headquarters in Asbury Park, New Jersey, and it consists of two full-time clerks and one supervisor. They are responsible for processing and paying approximately 800 checks each month. The accounts payable process generally begins with receipt of a purchase order from the purchasing department. The purchase order is held until a receiving report and the vendor's invoice have been forwarded to accounts payable.

At that time, the purchase order, receiving report, and invoice are matched together by an accounts payable clerk, and payment and journal entry information are input to the computer. Payment dates are designated in the input, and these are based on vendor payment terms. Company policy is to take advantage of any cash discounts offered. If there are any discrepancies among the purchase order, receiving report, and invoice, they are given to the supervisor for resolution. After resolving the discrepancies, the supervisor returns the documents to the appropriate clerk for processing. Once documents are matched and payment information is input, the documents are stapled together and filed in a tickler file by payment date until checks are issued.

When checks are issued, a copy of the check is used as a voucher cover and is affixed to the supporting documentation from the tickler file. The entire voucher is then defaced to avoid duplicate payments. In addition to the check and check copy, other outputs of the computerized accounts payable system are a check register, vendor master list, accrual of open invoices, and a weekly cash requirements forecast.

Requirements

Draw a context diagram and data flow diagram similar to those in Figures 3-11 and 3-12 for the company's accounts payable process, using the symbols in Figure 3-10.

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ANSWERS TO TEST YOURSELF

1. **a** 2. **c** 3. **c** 4. **d** 5. **c** 6. **b** 7. **c** 8. **d** 9. **d** 10. **a**

PART TWO

DATABASES

CHAPTER 4
Data Modeling

CHAPTER 5
Organizing and Manipulating the Data in Databases

CHAPTER 6
Database Forms and Reports

A major task for an accounting information system is to collect, record, store, and manipulate financial data, and to covert these data into meaningful information for management decision making. The chapters in Part Two discuss various techniques for accomplishing these tasks using relational databases.

Chapter 4 discusses database concepts in general, and explains the importance of databases to AISs. The chapter also explains data hierarchy concepts, record structures, and record keys. The chapter then outlines in detail the steps needed to design the database files and relationships needed to support important business functions using the REA framework. The final section of the chapter explains how to use these theoretical tools to create database records and tables in Microsoft Access 2007.

Chapter 5 explains how to organize, validate, and manipulate the data in databases. The first section describes normalization of data in databases—a classical design approach compatible with the REA model. The second section discusses methods for validating the data entered into databases—important controls that safeguard the accuracy, completeness, and integrity of the data stored in them. The third section describes procedures for extracting data from existing database tables. This section also explains how to create ''select'' queries in Access 2007 as well as such other extraction techniques as online analytical processing and data mining. The chapter concludes with a discussion of object-oriented databases, multimedia databases, and data warehouses.

Chapter 6 focuses on the development of database forms and reports. The first section of the chapter explains why database forms are important, describes how to create simple forms as well as forms with subforms, and provides guidelines for creating such database objects. The second section of the chapter explains why database reports are important, describes how to create simple reports as well as complex reports based on multi-table queries using Access 2007, and provides guidelines for creating professional outputs.

Chapter 4

Data Modeling

After reading this chapter, you will:

1. *Appreciate* the importance of databases to AISs.
2. *Be able to describe* the concepts of the data hierarchy, record structures, and record keys.
3. *Understand* the uses of data dictionaries.
4. *Be able to explain* why such design concerns as processing accuracy, concurrency, and security are important to multiuser databases.
5. *Know* how to model a database with REA.
6. *Be able to name* three database structures commonly used to create databases.
7. *Know* how to create tables, records, and relationships using Microsoft Access.

No one likes data integration. It's painstaking to automate and hard to measure in terms of ROI. Yet it's required for making systems work together. . . .

Galen Gruman, ''Whipping Data Into Shape'' *Infoworld* Vol. 28, No. 6 (February 6, 2006), p. 27.

INTRODUCTION

Civilizations have stored accounting data in systematic fashion for at least 6,000 years. The ancient Babylonians, for example, stored clay tablets in their temples that recorded such information as inventory receipts and disbursements, payroll information, and real estate transactions. Modern AISs use computers rather than clay tablets, but much of the same organizing requirements remain—the systematic recording of data, convenient and useful formats, and easy access to required information. This chapter examines how to *design* a database, while the next two chapters look at how to *use* a database effectively. We begin by examining some database concepts and then describe database design and data modeling techniques in depth.

AN OVERVIEW OF DATABASES

In some ways, not much has changed since ancient Babylonian days. For example, even the most basic AIS needs to record accounting data in systematic fashion and to organize accounting records in logical ways. Usually, this is done in a database.

What is a Database?

A **database** is a large collection of related data that are typically stored in computerized, linked files and manipulated by specialized software packages called **database management systems (DBMSs)**. Examples of databases include the repositories of information and related files for inventory systems, general ledger systems, and production scheduling systems. In most applications, these systems are complex combinations of data, processing software, and perhaps separate hardware that interact with one another to support the specific storage and retrieval tasks required of them.

Technically, not every collection of data is a database. For example, the time-card data from a weekly payroll system might be stored in a computer, but a single file containing such data *alone* is generally too simplistic to be called a ''database.'' Similarly, the budget or other financial information typically created in spreadsheet programs such as Excel is not a database. Most commercial databases are very large, invaluable collections of proprietary data that developers carefully design and protect, and that often form the core of efficient accounting information systems.

The Importance of Databases to AISs

It is difficult to overstate the importance of computerized databases to AISs. For example, accounts receivable applications must store information about customers, accounts payable applications must store information about suppliers, and payroll applications must store information about employees. Here are several other reasons why databases are important.

- *Valuable information.* The information stored in an organization's databases is sometimes its most important asset. Equifax, for example, is one of the nation's largest credit bureaus, maintaining credit information about millions of Americans. Its credit files *are* its business.
- *Volume.* Some of the nation's largest databases are truly spectacular. For example, the U.S. Internal Revenue Service maintains records on over 75 million taxpayers. Ford Motor Company maintains a customer database of 50 million records. Citicorp uses a database of 30 million records. For General Foods, the number is 25 million. Organizing and managing databases of such great size are enormous and often daunting tasks.
- *Complexity.* The databases of some organizations are centralized (i.e., stored in a single location at corporate headquarters or maintained on a single file server in a local area network). Many other databases, however, are distributed (i.e., duplicated in local or regional computers as processing needs dictate). But distributing information makes it harder to (1) ensure data accuracy, consistency, and completeness, (2) secure information from unauthorized access, and (3) recreate files with backups in the event of system failures.
- *Privacy.* Databases often contain sensitive information—for example, employee pay rates or customer credit card numbers. This information must be protected from those unauthorized to have it. Some of the most important control procedures for an AIS are those that protect databases from unwarranted access.

> ***Case-in-Point 4.1*** According to a recent GAO report, over 200 agencies of the federal government now have data mining initiatives designed to collect and analyze personal information about U.S. citizens. Many of these projects use data purchased from commercial database sources. Agencies such as the Department of Homeland Security defend such actions as part of the war against terrorism, but civil rights organizations challenge such activities, partly because the accuracy of the information is not known.[1]

- *Irreplaceable data.* The information of most AISs is necessarily unique to the organization that created it and, therefore, often priceless. This is why a special dimension of database management is again file security.
- *Need for accuracy.* The data stored in commercial databases must be complete, comprehensive, and numbingly accurate. This is especially true for government databases. It is also vital that such systems are easy to use and serve their strategic missions.

> ***Case-in-Point 4.2*** The U.S. Army maintains separate payroll, medical, and personnel databases which investigators say are antiquated, complex, and overtaxed. A recent GAO internal audit of the system estimated that as many as 4,000 U.S. soldiers who were seriously wounded in Iraq were either overpaid or underpaid, and found that even trained finance officers often couldn't unravel the mess.[2]

- *Internet uses.* As you might imagine, databases are critical components for both internal and external corporate web systems. These databases store such things as product information for online catalog sales, emails, product registration data, and current corporate

[1]Caron Carlson, ''GAO Reports Rampant Federal Data Mining'' *eWeek* Vol. 21, No. 23 (June 7, 2004), p. 31.
[2]Alex Kingsbury, ''Of Insult and Injury'' *U.S. News and World Report*, Vol. 140, No. 16 (May 1, 2006), p. 31.

data about employment opportunities, stock prices, and executive officers. Internet applications often also store customer-entered data such as online product orders, credit card numbers, subscription information, airline reservations, and university-student registration data.

Storing Data in Databases

To be useful, the data in an organization's databases must be stored efficiently and organized systematically. Three important ideas along these lines are the concepts of (1) the data hierarchy, (2) record structures, and (3) record keys.

The Data Hierarchy. Storing accounting data in computer files means organizing the data into a logical structure. In ascending order, this **data hierarchy** is:

bit → character → data field → record → file → database

To illustrate, imagine a payroll file. The lowest level of information in this file is a binary digit or bit. At the second level, a computer combines eight bits to create a byte of data that can represent a single character—for example, a letter of the alphabet or a special symbol such as a plus sign. The third level combines several characters to form a **data field**—for example, an account balance. Other names for a data field are ''attribute,'' ''column,'' or simply ''field.''

At the fourth level, data fields combine to form a complete record. A database **record** stores all the information about one file entity—for example, one inventory part in an inventory file, one employee in a payroll file, or one customer in a customer file. At this level, it may be helpful to liken the structure of a database to the data in a spreadsheet. Each column defines an individual data field, and each row defines a separate record or *tuple*.

At the fifth level of the data hierarchy, a set of common records forms a file, or in Access parlance, a *table*. Thus, a file or table contains a set of related records—for example, a set of inventory records or customer records. **Master files** typically store permanent information—for example, part number, part description, and location code for the individual records in an inventory parts master file. **Transaction files** typically store transient information—for example, inventory disbursements and replenishments for a specific time period.

Finally, at the highest level, several tables and related files create a complete database (i.e., a collection of files that contain all the information for an accounting application). In an inventory application, for example, this database might contain a part-number master table, a supplier table, a price table, an order transaction table, and so forth, as well as several other files (that we shall identify shortly) that might help end users organize, access, or output inventory information efficiently.

Record Structures. The specific data fields in each record of a database table are part of what is called the **record structure**. In many accounting applications, this structure is fixed, meaning that each record contains the same number, same type, and same-sized data fields as every other record on the file. This would probably be the case for the payroll record illustrated in Figure 4-1. In other applications, either the number of data fields in each record might vary, or the size of a given data field in each record might vary. For example, in a file of customer complaints, the memo field in each record might vary in length to accommodate different-sized descriptions of customer problems.

Social Security number	Last name	First name	Dept. code	Pay rate	Date of hire	Over-time OK?	Other info.
575-64-5589	Smythe	Teri	A	12.85	10-15-2001	yes	....

FIGURE 4-1 Some of the data fields in a computerized payroll record.

Record Keys. The **primary record key**, or just ''primary key'' for short, is the data field in each record that uniquely distinguishes one record from another in a database table. For the payroll record in Figure 4-1, for example, the primary record key might be the employee's Social Security number. End users and computer programs use primary record keys to find a specific record—for example, the record for a particular employee, inventory item, or customer account. Businesses sometimes combine two or more data fields to serve as the record key for a computer record. For example, a bank might combine its branch code with a customer's account number to serve as the record key. Another example would be a ten-digit phone number for a customer, separated into an area code and a local phone number. End users often create a primary key field as the first field in a record, but this is not a requirement.

It is also possible for a computer record to have more than one record key. For the payroll file of Figure 4-1, some examples are the employee's last-name field or the department-code field. These data fields, which are typically not unique across records but can also be used to search records for specific information, are examples of **secondary record keys**.

Finally, some accounting records contain data fields called **foreign keys** that enable them to reference one or more records in other tables. For example, in addition to the payroll table in Figure 4-1, a firm might have a department table with the data fields shown in Figure 4-2. The primary key for the department table is the department code (e.g., ''A,'' ''B,'' and so forth). With this arrangement, the department code field in the payroll record of Figure 4-1 would be a foreign key that the database system could use to reference the appropriate department record from the department table. These foreign keys enable a database system to combine the information from both tables to produce a report such as the one in Figure 4-3.

Note that each line of this report contains information from the records in two tables: the employee records in Figure 4-1 and the department records in Figure 4-2. To create this report, the designers for the entire application must examine the data carefully and organize them efficiently. The following sections of the chapter explain this analysis in detail.

Additional Database Concerns

Small database systems such as the kind used by very small businesses or sole proprietorships tend to be fairly straightforward and manageable. However, large, multiuser databases pose

Department code (primary key)	Manager	Number of employees	Location	Secretary phone	Other info.
A	B. Wright	45	Bldg. 23	x8734	...

FIGURE 4-2 A sample record from a department file.

Employee Roster
Friday, July 28, 20XX

Last Name	First Name	Dept.	Manager	Location	Secretary Phone
Garadis	Sue	B	Garadis	Bldg. 23	ext. 9330
Gold	Karen	A	Wright	Bldg. 23	ext. 8734
Hale	Lois	C	Hale	Bldg. 24	ext. 8655
Smythe	Teri	A	Wright	Bldg. 23	ext. 8734
Wright	Barbara	A	Wright	Bldg. 23	ext. 8734

FIGURE 4-3 A formatted report that uses data from two tables.

special challenges for their designers because of their size and complexity. Here, we describe some database design concerns that are of special importance to accounting applications.

Administration. Without an overall supervisor, a large commercial database is somewhat akin to a rudderless ship—i.e., an entity without cohesion or direction. Similarly, it does not make sense to permit database designers to work unsupervised, or to develop large databases of critically important information without also creating accountability for subsequent changes. A **database administrator** supervises the design, development, and installation of a large database system, and is also the person responsible for maintaining, securing, and revising the system's data.

> ***Case-in-Point 4.3*** "A qualified database administrator must be a jack of all trades," says Ed Tittel of iLearning.com, a training institute. Skill requirements include designing database systems from scratch, maintaining and updating database information, backing up and restoring database systems, creating user reports, and assisting users with data mining tasks. And as valuable as training is for such jobs, "experience beats certification hands down" he says.[3]

Documentation. Database developers often change database elements during the design phase, as well as later to an operating database system. This makes documentation critical. Descriptions of database structures, contents, security features, E-R diagrams (discussed later in this chapter), and password policies are other examples of important documentation materials. In addition to all these items, it is usually vital to document ''what stores what.'' The **data dictionary** of a database describes the data fields in each database record. In other words, a data dictionary is a data file about data. Although a data dictionary can be manual, it is usually a separate computer file that database administrators create and maintain.

Figure 4-4 identifies some generic information that a data dictionary might contain (listed under the ''Entry'' column) and an example of such information for a Social Security number (listed under the ''Example'' column). In this figure, the data dictionary indicates that the Social Security number data field must be nine characters, is a ''text'' data field (rather than a ''number'' data field because it is not manipulated mathematically), has no

[3]Source: Ed Tittel, ''Certified Expert: Working as a Database Administrator'' Vol. 5, No. 1 (January 2003), p. 44

Item	Entry	Example
1	Field name	Social Security number
2	Field size	9 characters
3	Type of data field	text
4	Default value	none
5	Required?	yes
6	Validation rule(s)	all digits must be numeric characters
7	Range	none
8	Source document	employee application form
9	Programs used to modify it	payroll X2.1
10	Individuals allowed access	payroll personnel
11	Individuals not allowed access	non-payroll personnel

FIGURE 4-4 Examples of information that might be stored in a data dictionary for the Social Security number data field of a payroll database.

default value, and so forth. From this illustration, it should be clear that the entries in the data dictionary describe each data field in each record of each table (file) of an AIS database. When developers add a new data field to the record structure of an existing table, they also add the appropriate information about the new field to the data dictionary.

Data dictionaries contain **metadata or** data *about* data, and have a variety of uses. One is as a documentation aid for those who develop, correct, or enhance either the database or the computer programs that access it. As suggested in items 10 and 11 of Figure 4-4, an organization can also use a data dictionary for security purposes—for example, to indicate which users can or cannot access sensitive data fields in a database.

Case-in-Point 4.4 How can you store a database on a mobile device like a cell phone? One way is to compress the data. An alternate approach by the WindSprings corporation is to use a data dictionary with index pointers. Using this technology, the company was able to shrink a 125k byte map of San Diego to 24k—small enough to fit most mobile devices—while still enabling the user to pan and zoom without further calls to an Internet server.[4]

Accountants can also make good use of a data dictionary. For example, a data dictionary can help establish an audit trail because it identifies the input sources of data items, the potential computer programs that use or modify particular data items, and the managerial reports on which the data items are output. When accountants help design a new computer system, a data dictionary can help them trace data paths in the new system. Finally, a data dictionary can serve as a useful aid when investigating or documenting internal control procedures because the basis for data-entry tests, methods of data security, and so forth, can be stored in the data dictionary.

Data Integrity. IT professionals estimate that it costs about ten times as much to correct information that is already in a database as it does to enter it correctly initially. Then, too, even simple errors in databases can lead to costly mistakes, bad decisions, or disasters. (Think about air traffic controllers as an example!) For these reasons, the software used to create databases should also include edit tests that guard databases from erroneous

[4]Source: John R. Quain, ''Sizing Down and Speeding Up'' *PC Magazine* Vol. 24, No. 12 (July 1, 2005), p. 22.

data entries. These **data integrity controls** are designed by the database developers and are customized for the application at hand. Examples include tests for data completeness, conformance to the data type specified for the data field, valid code tests (e.g., a state code such as ''CA''), and reasonableness tests (e.g., regular payroll hours worked must be between ''0'' and ''40''). We shall return to this point in Chapter 5.

Processing Accuracy and Completeness. Within the context of database systems, *transaction processing* refers to the sequence of steps that a database system uses to accomplish a specific processing task. AISs need **transaction controls** to ensure that the database system performs each transaction accurately and completely. To illustrate, imagine an inventory application with two types of inventory records: raw materials records and work-in-process records. An inventory manager wishes to subtract 200 units from a particular raw materials record and add the same number of units to a corresponding work-in-process record.

Now suppose that the database system executes the first part of this transaction (i.e., subtracts 200 units from the raw materials record) and then stops operating for some reason. This is a problem because the transaction has not been executed completely and the balance-on-hand field in the current work-in-process record is wrong. To overcome this problem, databases should either process a transaction entirely or not at all. To achieve this goal, database systems maintain an auditable log of transactions. When a specific transaction only partially executes, the system is now able to recover by verifying that a problem has happened, reversing whatever entries were made, and starting anew. In accounting applications, therefore, the ability to audit any particular transaction to ensure processing accuracy and completeness is critical.

Concurrency. In multiuser systems, it is possible for more than one user to access the same database at the same time. Without **concurrency controls**, it is also possible for two or more users to access the same *record* from the same table at the same time. This creates problems. To illustrate, imagine the same inventory file as the one discussed previously and suppose that ''user A'' and ''user B'' access the same inventory record at the same time. The initial balance-on-hand field for this record is 500 units. When User A accesses this record, the system transfers the entire record to A's work area. User A wants to add 100 units to the balance-on-hand field. The result is a new balance of 600 units. User A completes this transaction, the system writes the new record back on disk, and the new balance on hand in this record is now ''600 units.''

When User B accesses this same record, the system also transfers the same initial record to B's work area. User B wants to decrease the balance on hand by 200 units. This results in a balance of 300 units because this user also starts with an initial balance on hand of 500 units. Because B completes this transaction after A is done, the system replaces the current record in the database with the new one. The end result is an inventory record with a balance on hand of 300 units, not the correct value of 400 ($= 500 + 100 - 200$). To guard against this problem, database systems must prevent multiple-user access to the same file record. Rather, these systems must execute transactions serially (i.e., sequentially).

Backup and Security. As noted earlier, the information in many accounting databases is both invaluable to the day-to-day operations of a company and, because it is unique, irreplaceable. It must be protected. A key security feature of any database, therefore, is backup procedures that enable an organization to recreate its data if the original copies are lost or damaged.

Case-in-Point 4.5 Several companies found out just how complete their disaster recovery and backup procedures were when terrorists attacked the World Trade Center on September 11, 2001. For many, the damage included the loss of (1) data, (2) personnel most knowledgeable about that data, and (3) the building in which the data were stored. Dean Witter and Company, a large brokerage house, had prepared for such a contingency and resumed business within two days in makeshift quarters across the Hudson River from the WTC towers in New Jersey. In contrast, Visa was among the 25 companies in the WTC that had subscribed to an elite, EDS "hot-site service." For these companies the delay was much shorter—in the case of Visa, three minutes![5]

In addition to backup security, an organization must also protect databases from unauthorized access. Another security feature, therefore, is a system's ability to assign, maintain, and require employees to use passwords and guard against unwarranted intrusions. Similarly, database systems can use encryption techniques to scramble data into unintelligible formats, thereby protecting file data even if an unauthorized user obtains access to the company's database.

Case-in-Point 4.6 A recent survey by Cisco Systems, Inc., found that, over 67% of the (more than 2,000) respondents had performed at least one act that threatened their company's database security. The most common breach, at 37%, was failing to log off before stepping away from a personal computer with access to corporate data.[6]

A final database security feature is to use **view controls** that limit each user's access to information on a need-to-know basis. In an inventory application, for example, a defense contractor might limit employee access to its supplier files, inasmuch as information about supplier identities and perhaps part prices might be sensitive information. We cover intrusion detection systems and controls in Chapter 12.

STEPS IN CREATING A DATABASE USING REA

At a state department of social services, the director wants to know how many inquiries were made for a certain type of medical assistance last month. At the headquarters of a department store chain, a vice president wants to know how many credit customers made partial payments to their accounts last month. At a local university bookstore, a manager wants to know how many book orders went unfilled last month.

In each case above, the decision-maker needs information. AISs must gather pertinent data and store the information in formats that enable managers to obtain timely answers to important organizational questions. The challenge of creating large, useful databases is to determine what data to collect, and how to gather, record, organize, and store the data in ways that satisfy a number of objectives. One obvious goal is to satisfy the informational output requirements of the system. A second task is to find hardware and software solutions that can adequately perform the data-gathering, storage, and reporting tasks involved. Another goal is to keep the databases manageable—for example, keep them from becoming too large, complex, and unwieldy. A fourth goal is to protect the privacy of

[5]Source: David O. Stephens, "Protecting Records in the Face of Chaos, Calamity, and Cataclysm" *Information Management Journal* Vol. 37, No. 1 (2003), pp. 33–40.
[6]Source: No author, "Worker's Circumventing IT Security, Putting Company Data at Risk" *Security Director's Report* Vol. 8, No. 12 (December 2008), p. 8.

sensitive information. A fifth goal is to reduce data redundancy, which means storing the same data repeatedly in different tables. These goals make it obvious that databases must be carefully designed to serve their intended uses. The question is, ''How do we do this?''

When a company wants to create a database, it normally hires a database consultant to help it design a new database that meets the organization's needs. Based on the information obtained from managers and end users, the expert then uses a process called **data modeling** to design the database. This is usually the most challenging step in the process of creating a database because the designer must collect a considerable amount of information by investigation and interviews, and then integrate the needs of all stakeholders as accurately and completely as possible.

Although there are a number of different models that may be used to design a database, the one we will describe and use here is the **REA Model**. This model is an acronym for resources (R), events (E), and agents (A). The REA model requires the following steps: (1) identify business and economic events, (2) identify entities, (3) identify relationships among entities, (4) create entity-relationship diagrams, (5) identify the attributes of data entities, and (6) create database tables and records to populate the database. The following discussions describe each of these steps in detail, using the sales process as an example.

Identify Business and Economic Events

Chapters 7 and 8 will discuss business processes and explain that these processes involve a series of events or identifiable activities. There are primarily two types of events: economic events and business events. **Economic events** impact an organization's financial statements, and AISs therefore record data about them in accounting transactions. An example would be a sale on account. This economic event increases an entity's accounts receivable and revenue accounts on its financial statements.

As noted previously, critics sometimes claim that financial accounting systems often ignore organizational activities and events that are important to managers, investors, and creditors. Such **business events** do not affect financial statements but can impact an organization in a value-added way. One example of such an event is a *sales order* from a customer. Because sales orders do not require journal entries, they do not appear anywhere in a company's financial statements. However, suppose that a company received a sales order from a customer that was equal to all its revenues for the previous quarter. This would certainly be important information that many individuals, both inside and outside the firm, would want to know. Another example is when a firm hires a new CEO. Again, this event does not require a journal entry, but is important information for stakeholders.

When creating a database using an REA approach, a systems designer will try to record all events in the database, whether they are business or economic ones. By including both types of events in the database, users can access important information about both business and economic activities.

Identify Entities

Databases contain data about objects of interest called **entities**. Database entities include business and economic events, plus information about ''who'' and ''what'' were involved in those activities—i.e., the system's agents and resources. **Agents** are the ''who'' associated with events. For example, both a salesperson and a customer participate in creating a merchandise sale. We would classify both of them as ''agents.''

Events use or generate **resources**. For example, a merchandise sale may require an inventory resource and generate a cash resource. Resources are very similar to accounting assets, but they are more all-inclusive. For instance, we might classify a contract as a resource, but it would not appear as an asset on a financial statement. To determine whether or not something constitutes a resource associated with an event, the resource should pass two tests. First, it should be an object of value associated with an event. Second, it should be an object of sufficient interest that you would want to collect information about it.

The REA model helps identify database entities because each resource, event, and agent is an entity in a relational database. Figure 4-5 provides several additional examples of each type of entity. You may notice that Figure 4-5 does not list accounts receivable as a resource. This is because the REA model does not recognize ''receivables'' or ''payables'' as resources. Rather, receivables and payables are by-products of an information event and only represent *claims* on resources rather than resources themselves. Similarly, the REA model does not treat ''billing'' as a business or economic event because a bill really just conveys information about an economic event such as a sale or purchase.

Identify Relationships Among Entities

A database should contain a table for each entity. The table consists of rows of records, each containing data fields that describe the entity's attributes. Figure 4-6 shows four database tables for our merchandise sale example: (1) an event table (Customer Order), (2) a resource table (Inventory), (3) an agent table (Customer), and (4) another agent table (Salesperson).

Entities are usually related to each other. For instance, a sale may be *of* merchandise inventory and made *to* a customer. The relationship between a sale and inventory or between a sale and a customer is a *direct relationship*. Inventory and customer also share a relationship, but it is an *indirect relationship*. Typically, events have direct relationships with resources and agents, and also with other events. The links between resources and agents are *through* events.

Data modelers need to know about entity relationships so that they can create links between database tables. Without these links, database users could not access data from more than one table at a time. Referring again to the tables in Figure 4-6, in the absence of any database links, users could obtain reports about order data, inventory data, or customer data. But the database system would not be able to show the customer name on a customer invoice because it would require information from more than one table for this task.

Before we can decide on the best way to link database tables, we must first understand the nature of the relationships among entities. We describe these relationships in terms of **cardinalities**. Cardinalities are a notation showing the nature of relationships among

Resources:	Events:	Agents:
Cash	Sales Order	Employee
Contracts	Sales	Customer
Inventory	Purchase Order	Vendor
Equipment	Purchase	Manager
Plant Facilities	Receive Goods	Stockholder
	Hire an Employee	Creditor

FIGURE 4-5 Examples of resource, event, and agent entities.

Customer Order Table (Event)

Order #	Employee #	Customer #	Date	Comments
1003	M24SP	B104	01/03/02	
1004	R63SP	P202	01/03/02	Ship ASAP
1005	M24SP	S200	01/03/02	
1006	W11SP	C100	01/03/02	

Inventory Table (Resource)

Item #	Description	Unit Cost	Sales Price	Beg QOH
1400	Goodie Bar	$0.20	$0.40	13025
1500	Almond Delight	$0.25	$0.45	5010
1600	Gummy Lions	$0.60	$0.95	20109
1700	Pecan Bar	$0.70	$1.09	4508
1800	Milky Bars	$0.18	$0.30	2207

Customer Table (Agent)

Customer #	Name	Address	City	State	Zip Code	Credit Limit
A101	Amanda Wills	22 Yellow Ln.	Charlotte	NC	79803	$20,000.00
B104	Boris Bailey	321 Church St.	Oxford	OH	45056	5,000.00
C100	Carly Riccardi	1899 Green St.	Dayton	OH	43299	10,000.00
P202	Peggy Martin	1260 Main St.	Columbus	OH	43320	10,000.00
S200	Bill Safer	860 Broad St.	Fairfax	VA	22030	5,000.00

Salesperson Table (Agent)

Employee #	Name	Address	City	State	Zip Code	Dept ID	Date Hired
A06SP	Sally Anderson	3026 Skye Ln.	Columbus	OH	43213	247	1/31/1989
M24SP	Randy Merit	262 Main St.	Bexley	OH	43209	182	7/2/1999
R63SP	Barry Rogers	80 N. Long St.	Gahanna	OH	43215	247	1/16/2001
R73SP	Jim Rudolph	64 Lantern Ave.	Columbus	OH	43213	76	8/15/2000
W11SP	John Walker	1028 Fields Ln.	Lancaster	OH	43307	182	9/1/1992

FIGURE 4-6 Four sample tables in a relational database.

entities as *one-to-one, one-to-many, none-to-one, none-to-many*, or *many-to-many*. A one-to-one relationship between two entities, shown as (1,1), means that the entities relate to each other a minimum of one time and a maximum of one time. An example of a one-to-one relationship is the relationship between sales and customers. In a particular organization, the relationship might be that a sale is to a minimum of one customer (a sale cannot exist without a customer) and a maximum of one customer (an individual sale can be to only one customer).

Entity relationships are two-way. Not only does a sale relate to a customer, but customers also have relationships to sales. The relationship between a customer and a sale may be none-to-many (0,N). This would be the case if a customer could exist without a sale (for example, you first research the credit ratings of potential customers before selling them goods). There are also many sales to each customer (the usual case). The two-way relationship between a sale and a customer, then, can be shown as:

(Sale 1,1; Customer 0,N)

We would read this cardinality as: each sale is to a minimum of one customer and a maximum of one customer, and each customer has a minimum of zero sales and a maximum of many sales.

Cardinalities are sometimes difficult to grasp at first but they become easier to understand with practice. So let's try another one. What does the following cardinality tell us?

(Inventory 0,N; Sale 1,N)

Part of the answer is that inventory relates to a sale a minimum of zero times and a maximum of many times. This makes sense in a business organization that keeps inventory on hand to meet future sales. It is also likely that in most businesses, each type of inventory item can be involved in more than one sale. (Think about, for instance, a retail clothing store that stocks several white shirts in a specific size and style.) The rest of the answer is that a sale relates to inventory a minimum of one time and a maximum of many times, or each sale must be for at least one inventory item and may be for many inventory items. (So you would have to buy something in order to have a sale and you could be buying a white shirt plus some jeans and a jacket.)

Cardinal relationships are not fixed across organizations, but vary according to the rules or controls of the specific enterprise. To illustrate using our sales example, recall that a company could have a customer with no sales or a customer with many sales (0, N). This is probably true for some businesses, but not for others. For example, a video rental store will usually collect information about customers before renting movies to them. In contrast, a retail clothing shop may not consider someone a customer until it sells something to this person. Thus, cardinalities can be helpful in describing an organization's rules and thus can also tell us something about the controls for a given business process.

There is just one more point to make about cardinalities. In the case of a sequence of events, you will nearly always have a situation where subsequent events require a minimum cardinality of 1, and earlier events have a minimum of 0. This would be the case between Customer Order (0,N) and Sale (1,N). What these cardinalities mean is that each order relates to a sale (signified by a shipment of goods) a minimum of zero times and a maximum of many times. In plain English, this says that an order may result in no sales or many sales. This makes sense because a customer may place an order that is never shipped or, perhaps due to backorders, requires several shipments.

The other side says that each sale relates to an order a minimum of one time and a maximum of many times. Again, plainly stated, this means that you cannot have a sale without an order, but you could ship several orders at once. Do you see why you could have an earlier event that might not result in a later event but, as a rule, would require an earlier event to take place before a later one was possible? It would be bad business to ship goods without an order.

Create Entity-Relationship Diagrams

Database designers use a graphical documentation technique called the **entity-relationship (E-R) diagram** to depict the entities and their direct relationships. The model consists of four symbols: rectangles, diamonds, ovals, and connecting lines. Rectangles represent entities; diamonds describe the nature of relationships; ovals denote an entity's attributes; and connecting lines depict relationships. Figure 4-7 provides examples of these symbols. For the sake of convenience, we may drop the diamonds and ovals, thus showing only entities and relationships.

Figure 4-8 is an E-R diagram that includes cardinalities for a sample business enterprise. Remember that these cardinalities could change, depending on an organization's rules or

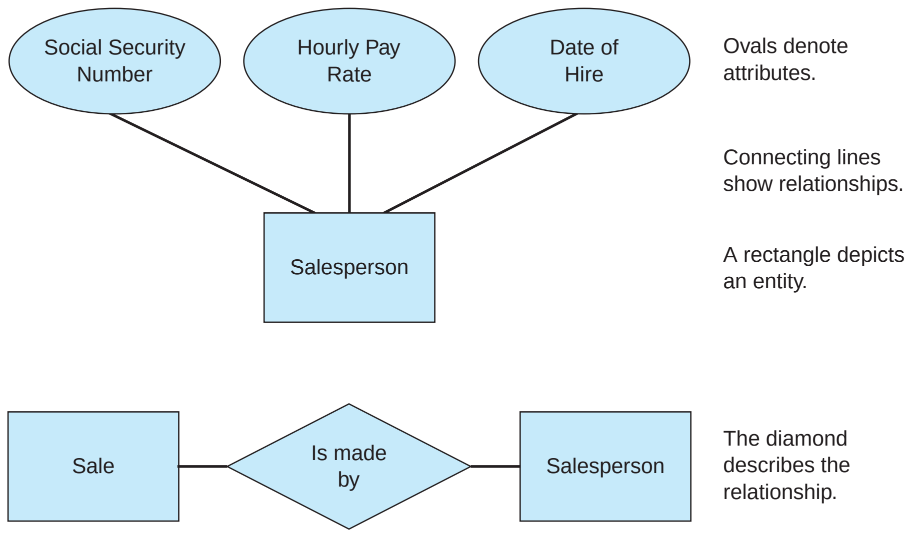


FIGURE 4-7 Examples of entity-relationship (E-R) diagram symbols.

policies. For example, suppose a business starts selling services in addition to products. The cardinality between sale and inventory could change from (Inventory 0,N; Sale 1,N) to (Inventory 0,N; Sale 0,N). Do you see the difference? The cardinality now specifies that each sale can be for no inventory items, in the case of selling a service, or for many inventory items.

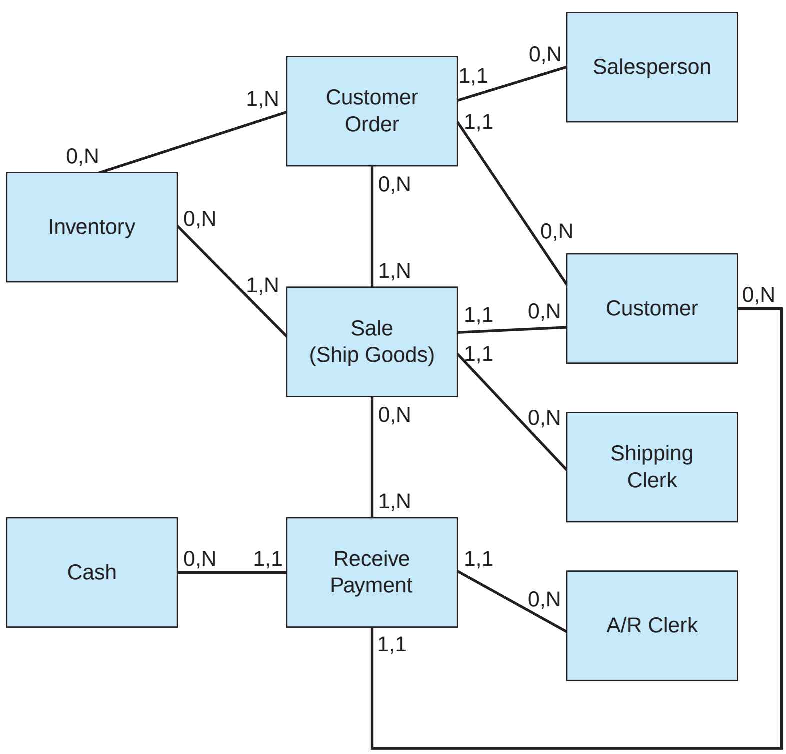


FIGURE 4-8 A sample E-R diagram for the sales process, including cardinalities.

Identify Attributes of Entities

Entities have characteristics or **attributes** that describe them. We know that in a database model, a database table represents each entity. But what data appears in the table? The data within a table will be based on the attributes. For example, a salesperson is an agent, which is an entity. The attributes are the data fields *describing* each salesperson. What data should you collect about a salesperson? Because each salesperson within the Salesperson database table is a unique record, one attribute should be unique to that record. This is the database primary key that we discussed earlier. The salesperson's identification number, which could be the employee's social security number, would be a likely attribute of a salesperson entity. Other attributes might be last name, middle name, first name, phone, address, email, date of birth, date hired, department assignment, salary, and so on.

It is not always easy to decide what to include as attributes of an entity. There are, however, two guidelines you can use. First, the attributes should describe one entity and that entity only. For example, if you have an inventory table, you would not include information about the vendor in this table. You can reference the vendor, but the name, address, and other information about the vendor belongs in a separate Vendor table. A second guideline for determining entity attributes is to keep in mind that the attributes included in the tables will *determine* the outputs of the database system. What you fail to include as an attribute is data that you will not collect and cannot report. For instance, have you ever been asked for your Zip code while shopping in a retail store? If so, the store is collecting an attribute of a sales transaction that can also be of value—for example, data that can help the store determine where to advertise or perhaps where to build another store.

Organizing Database Records

There are several ways to organize the individual records in a database. The particular method used is called the **database structure**. As with other design elements, the objective is to develop an efficient structure that enables users to access data quickly and store data efficiently. Three types of database structures are (1) hierarchical, (2) network, and (3) relational.

Hierarchical Structures. Accounting data are often organized in a hierarchy. For example, a sales office will have several salespersons, each salesperson will have several customers, each customer can make several purchases, and each customer invoice can have several line items. The result is a natural **hierarchical structure**, with successive levels of data in an inverted, tree-like pattern. For this reason, hierarchical database structures are also known as **tree structures**.

Typically, hierarchical data structures have a genealogy that naturally organizes the data into a series of one-to-many relationships. For any two adjacent records, the ''elder'' or higher-level record is called the **parent record**, while the ''younger'' or lower-level record is called the **child record**. Two records on the same level (e.g., two line items on the same purchase invoice) are called **sibling records**.

Network Structures. Often, the data stored in an AIS are interrelated in several ways (i.e., in many-to-many relationships), and thus a single hierarchical structure cannot capture their relationships adequately. At a university, for example, students each take several classes, and each class has many students. In such instances, AIS databases can use a **network structure** to link related records together and capture these relationships. This linking is usually accomplished with pointer fields embedded in each record that contain the disk addresses of related records. For example, the payroll record of Figure 4-1 could contain a pointer field for another employee working in Department A. The pointers maintain the data relationships, thereby enabling an AIS to prepare familiar reports—for example, a list of all employees working in Department A.

Relational Structures. Hierarchical and network database structures require advanced planning. This means that, if accounting data of one type (e.g., employee information) must be used with accounting data of another type (e.g., payroll information), the database must be planned to create these linkages. But many relationships can exist among data items, and it is difficult to anticipate all of them at the time designers first create a database. Thus, hierarchical and network data structures afford little additional flexibility once further data processing needs are discovered.

This problem is overcome with a **relational database structure**, which enables designers to identify relationships at the time the database is first created, or later, as users discover new informational requirements in the future. Each entity in the E-R diagram will be a table in the database. However, a database is likely to contain more tables than those representing entities. This is because we must provide links among the database tables to represent relationships among tables. As noted earlier, without these links a user would be unable to produce any database outputs that use information contained in more than one table.

The rows of a database table are individual records for database entities and the columns are entity attributes. Two important features of records are: (1) within a record, there should be no attributes that are a result of a mathematical computation, and (2) there should be no repeating attributes. The reason that attributes should not be mathematical computations is because the system itself can recalculate them as needed. For example, in a student-records database, there is no reason to store a student's grade point average (GPA)—this can be calculated from other information in the database about that student.

Repeating attributes typically occur when you attempt to store too much data in the same table, or too much data in the data field of the same record of one table. For example, suppose a charity creates a ''Contributors'' table in a database and uses a single data field in each record in that table for an individual's donation. How would you store the information for a donor who made two donations? Creating duplicate records for the *same* contributor table doesn't make sense (because it duplicates the contributor information), and neither does storing the two donation values in the single donation field of the *same* record (because this isn't possible).

The solution to this problem is to create two tables: one table for contributors and a separate table for donations. Then, the problem is how to link the two tables together. There are two ways to do this within a relational database. The first uses foreign keys as described earlier. For example, in Figure 4-6, the Customer Number in the Customer Order table is a foreign key that references the primary key of a particular customer in the Customer table. As noted earlier, therefore, this value enables database software to link the two tables together—for example, to create a customer orders report that shows the *name of the customer* associated with each order.

Linking tables with foreign keys is only appropriate when you do not have a many-to-many relationship between two entities. Looking at the sample E-R diagram for a sales process in Figure 4-8, for example, we see that the cardinality between Customer Order and Salesperson is (Customer Order 1,1; Salesperson 0,N). This is not a many-to-many relationship, so we can use a foreign key to link the tables to one another. In deciding which key to use as a foreign key, the general rule is to use the primary key from the table closest to a relationship (nearest the cardinality in the E-R diagram) containing a ''many'' or N, as the foreign key in the other table. In our example, this means that we would use the primary key from the Salesperson table as the foreign key in the customer order table. Looking at Figure 4-6, this is the case. The primary key for the Salesperson table, Employee #, appears in the Customer Order table.

A second way to represent relationships between two database tables is by creating a separate **relationship table**. Relationship tables are necessary when you have many-to-many relationships between database entities. The reason for this is that, without them, you would need to have repeating fields in a database table. For example, there is a many-to-many relationship between Sale and Inventory in Figure 4-8: (Inventory 0,N; Sale 1,N). Because a sale can be for multiple inventory items, if we posted inventory items in the Sale table, we would have to leave many fields available for the primary key for inventory.

Alternatively, because a company can sell each inventory item many times, there would have to be repeating fields for the sales number field in the Inventory table to allow for this. To avoid these repeat fields, data modelers use relationship tables. A simple relationship table just lists the primary keys of the two tables that it joins. More complex relationship tables may include other data, such as quantity. Figure 4-9 shows a relationship table joining the Customer Order and Inventory tables. Notice that some of the orders are for more than one type of inventory item.

How many tables, including join tables, will we have for a complete database and the sales process described in Figure 4-8? Looking at the diagram, we see that there are nine entities. If we have a table for each entity, the database would require nine tables. There are also three many-to-many relationships: (1) Inventory and Customer Orders, (2) Inventory and Sales, and (3) Sales and Receive Payment. Therefore, we might have as many as twelve tables in the finished database: nine tables for entities and three additional ''joining'' tables. There is another possibility, though: three of the entities are employees. It might be possible therefore to use just one database table for employees if we include a field or identifier that specifies the employee type. For instance, we could have a column or attribute for employee classification, and within that you would specify salesperson, cashier, and so on. This reduces the table count to ten.

Figure 4-10 lists all the database tables and their attributes for our sales-process example. Because data modeling is a creative effort, there are many other possible sets of database tables and other attributes that you might include in a database for a sales process. Figure 4-10 is only an example.

Sale #	Item #	Quantity
1003	1400	230
1004	1400	430
1005	1600	180
1005	1800	200
1005	1900	360
1006	1400	80
1006	1800	100

FIGURE 4-9 A relationship table joining the Customer Order and Inventory tables.

Inventory Table
Item#, Description, Unit Cost, Sales Price, Beginning Quantity on Hand, Beginning Quantity on Hand Date

Cash Table
Account#, Account Type, Bank, Beginning Balance, Beginning Balance Date

Customer Order Table
Order#, [Employee#], [Customer#], Date, Comments

Sales Table
Sale#, [Employee#], [Customer#], Ship Date, [Order#]

Receive Payment Table
Cash Receipt#, Amount Received, Date, [Employee#], [Account#]

Employee Table
Employee#, First Name, Middle Name, Last Name, Address, City, State, Zip Code, [Department#], [Job Classification Code], Date of Birth, Date Hired, Last Date of Review

Customer Table
Customer#, Company Name, Address[1], City, State, Zip Code, Contact Person, Credit Limit

Inventory/Order Relationship Table
Order#, Item#[2], Quantity

Inventory/Sale Relationship Table
Sale#, Item#, Quantity

Sale/Receive Payment Relationship Table
Sale#, Cash Receipt#

Order/Sale Relationship Table
Order#, Sale#

[1] May use multiple addresses for different departments or for shipping versus billing.
[2] Relationship tables require two fields together to represent a primary key. Either field alone would not be unique to a record.

FIGURE 4-10 A schematic of database tables for the Sales Process. (*Note:* Underlining signifies a primary key and brackets denote foreign keys.)

CREATING DATABASE TABLES AND RECORDS

It is only after system designers have gone through the steps outlined above that they can begin to create database tables with records. This section of the chapter explains how to perform these tasks using Microsoft Access. The procedures for creating tables and records in alternate database systems are similar.

An Introduction to Microsoft Access

Microsoft Access is a popular relational database that many businesses and individuals use for small database applications. Although this software has many of the same tools, dialog boxes, and menu options as Microsoft Word or Excel, there are some important differences. In Access 2007, tabs and buttons have replaced many of the menus. One capability of

FIGURE 4-11 Opening screen for Access Database Program.

Access 2007 is the ability to use predefined templates. Some of them are Assets, Contacts, Issues, and Events (Figure 4-11). If you click on one of these, you can name your database and download the template from the web. These templates are ready to use and allow you to add fields, delete fields, or use pre-made queries or reports.

Figure 4-12 shows the starting screen for Access 2007. If you click on the ''Blank Database'' icon in the top portion of the screen in Figure 4-11, you will launch the option to open a new blank database (Figure 4-12). A panel will appear on the right side of your screen asking you to name your database. The default name is ''Database1.accdb.'' The ''accdb'' suffix stands for ''Access database'' and Access will attach it automatically if you rename your database (which you should!)—you don't need to add it.

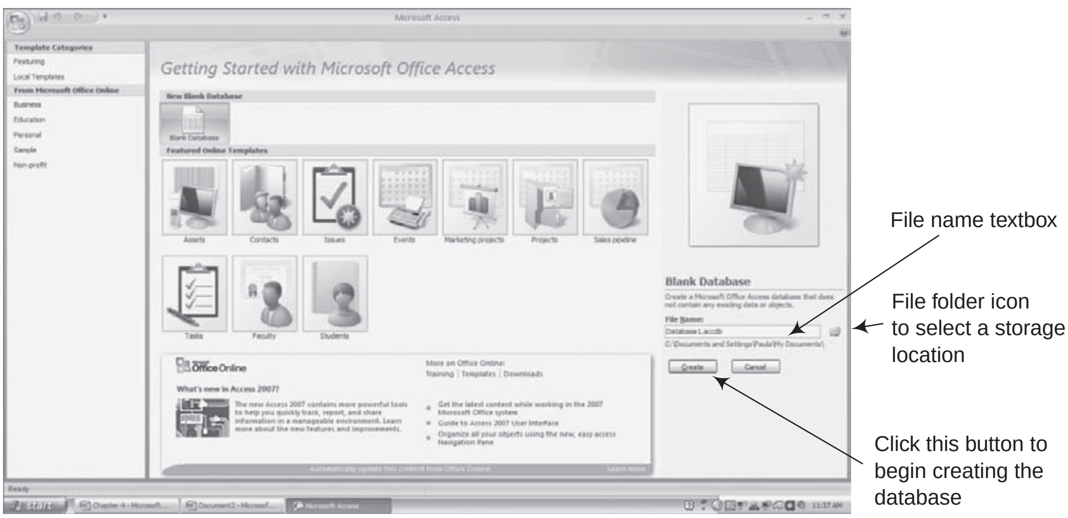


FIGURE 4-12 The screen for getting started with Microsoft Access.

Creating Database Tables

As you already know, database tables store data about specific table entities—e.g., customers, vendors, or employees. To illustrate how to create tables in Access, let's create a table of payroll records similar to the one in Figure 4-1.

Getting Started. Your first task is to rename your database something more meaningful—for example, ''My First Database.'' (Blanks are permitted in Access database names.) Type your new name in the filename box. Your next task is to decide where to store it. To do this, note the file folder icon with an arrow to the right of the filename textbox. Clicking on this icon will display a Microsoft ''Save As'' dialog box (not shown) that enables you to select where to store your database. After you have done this, click on the ''Create'' button in the lower-right portion of Figure 4-12. A larger version of the screen shown in Figure 4-13 will appear.

Defining a Record Format. The Ribbon across the top of the screen in Figure 4-13 shows five tabs: Home, Create, External Data, Database Tools, and Datasheet. The figure also shows two important components. First, Access assumes that your next job is to create a table of records, and accordingly supplies the default name ''Table1'' in the left portion of the screen in Figure 4-13. Second, the system assumes that each record will have at least one data field with default name ''ID'' as shown in the right side of the screen.

Before you enter data in your new database, you must first define the record structure for your table. *It is much easier to spend time developing this format prior to entering data than to spend hours changing it later*. Figure 4-14 displays the form for developing your database. To get to this screen, right click on the table name ''Table1: Table'' and select ''Design View'' from the set of choices in the drop-down menu that subsequently appears.

The screen in Figure 4-14 is a template for creating the record format (i.e., the data fields) of your records. To define a record format, begin typing the name of the first data field you wish to create—e.g., the term ''SocSecNum''—in the upper right portion of the screen in Figure 4-14. When you do, the following three columns will appear in that area of the screen: (1) Field Name (which is required), (2) Data Type (also required), and (3) Description (optional). Let's look at each of these items separately.

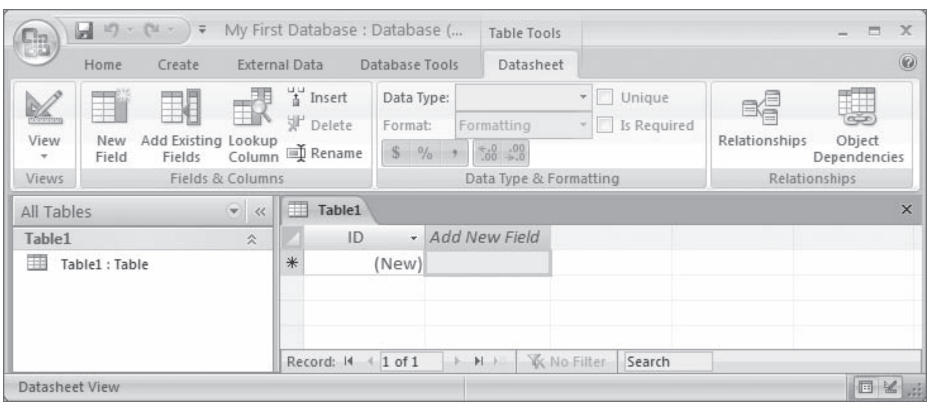


FIGURE 4-13 The opening screen for creating a table in Access.

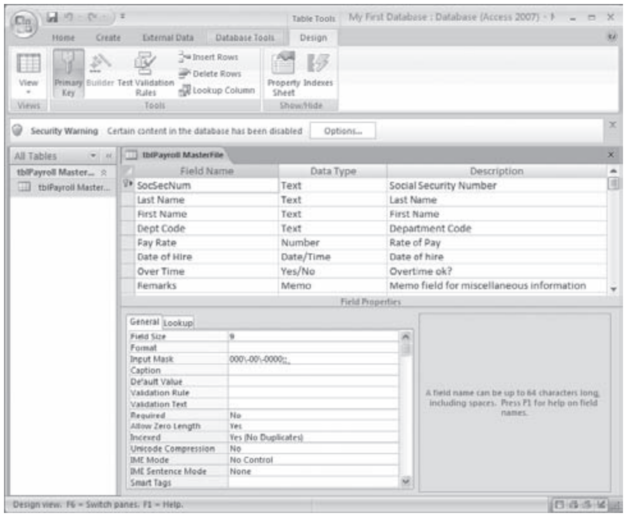


FIGURE 4-14 Payroll Master File table displaying field name, data type, description, and field properties for SocSecNum.

Field Name. Field names are the names you assign to the data fields in your record. As illustrated in Figure 4-14, you can embed blanks in field names and capitalize selected letters in names as desired. Two general rules to follow when naming data fields are (1) use mnemonic names (that help you remember their use such as ''Zip code''), and (2) do not use long names (which are cumbersome to use).

Although it isn't obvious from Figure 4-14, you can use the same field name in each of two tables—the field names in tables are completely independent of one another. In fact, using the same field names for the same data—for example, ''VendorNumber''—in both a Vendor table and a Vendor Invoices table often makes sense because this makes it easy to identify the data field (foreign key) that can link the tables together. We'll look at this shortly.

Data Type. For each data field you create in a table, you must also specify a **data type**. This tells Access how to store the data—for example, as text, a number, or a date. Several examples of such data are, ''text'' data types for an employee's First Name and Last Name, a ''currency'' data type for the employee's pay rate, a ''date'' data type for the employee's date of hire, a ''Yes/No'' data type for the employee's qualifications to earn overtime pay, and a ''Memo'' data type (that stores variable-length text) for the Remarks data field.

Each data field you specify in a table also includes a set of **field properties**, whose values show in the lower portion of the screen in Figure 4-14. These include such settings as ''field size'' (e.g., a length of 9 bytes), ''format'' (e.g., a number with a percent sign), and ''input mask'' (e.g., a template for entering a phone number). Figure 4-14 shows the field properties for the SocSecNum field in our table. Note the Input Mask entry, which you can select from a drop down set of items if you click on this property. You might also be curious why we defined this as a ''text'' field rather than a ''number'' field. The reason is because this data value is not really a number that we will mathematically manipulate, but rather a code. Thus, we create it as a text field and limit its Field Size property to 9 characters (see the bottom portion of Figure 4-14).

Finally, if you use a ''number'' data type, you must also select the type of number you wish to use—for example, Integer, Long Integer, Single (a small decimal value), or Double (a large decimal value). These choices are important when using numeric data fields to link tables together—the field types must match exactly for the join to work.

Description. The last item that you can create for each data field in a table is its description. This is an optional field that you can ignore when defining record structures. However, as you can see from the figure, data field descriptors help document the table itself, and can also describe exception conditions or contain special notes.

Identifying a Primary Key. Recall that a primary key is the data field in each record that uniquely identifies the record. After you have defined the data fields in your table, you can also designate a primary key. This is optional but usually a good idea. For our payroll file example, we will use the employee's Social Security number (SocSecNum) for the primary key. One way to designate this field as the primary key is to click on the name of this field and then select ''Primary Key'' icon ( ) from banner at the top of the screen. An alternate way is to right click on the field with your mouse and select ''primary key'' from the set of choices in the drop down list. The end result in either case will be the same—a little key icon appearing in the first column opposite the data field you selected, as illustrated in Figure 4-14.

Finally, some tables such as join tables do not have an obvious primary key. In such instances, you can ask Access to assign an artificial one by creating a Transaction Number or similar data field name and use an *AutoNumber* data type for it (see the first column in Figure 4-9). In so doing, Access will automatically assign sequential numbers to each record you create, which can also act as a primary key.

Saving a Table. Because you named your database when setting it up, it already has a name. However, if you look at the left of your screen (Figure 4-13) you will see that the table is still named Table1: Table. If you attempt to close your table at this point, Access will prompt you for a name. You can of course use the default name ''Table1,'' but it is better to create your own name for it—for example, ''Payroll Master File.'' You should also include the conventional *tbl* prefix in any name you create for a table. Thus, for example, we used the name ''tblPayroll Master File'' for our table name in Figure 4-14.

Creating Records

After specifying the names, data types, sizes, descriptions, and perhaps primary key for the data fields in your table, you can create individual records for it. To do so, you must switch to ''datasheet'' (or run) view. An easy way to do this is to close the design view of this table and then select the ''Datasheet'' view from the View menu in the upper-left portion of the Access screen in Figure 4-14.

After making these choices, you should see a screen similar to Figure 4-15. This is a table in *datasheet view*, and you are now free to input the data for individual records. Begin by entering data in the row with the asterisk (*) and use the tab key to transition from data field to data field. Every time you complete the data entry for a new record, Access will save the record in the appropriate table automatically.

If you make a mistake while entering data, you can use your backspace key or delete key to correct it just as you would when correcting text in a word processor. Also, if you wish, you can delete an entire record by clicking on the first column to select an entire row (record) and then hitting the delete key. Because Access saves changes immediately, it

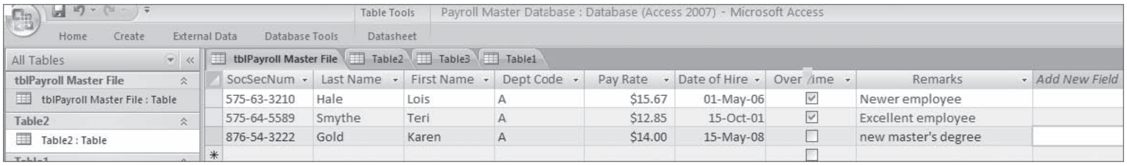


FIGURE 4-15 Dataview sheet for Payroll Master File table.

will first remind you (via a small dialog box) that such a change will be permanent. If you indicate that this is your intent, Access will proceed to delete the record.

Creating Database Relationships

Lastly, it is important to know how to create relationships between database tables. As you've seen from earlier discussions, these relationships link tables together. They also enable users to create multi-table reports, such as the one in Figure 4-3. To illustrate how to create relationships in Access, assume that you have created a department table with records similar to the one in Figure 4-2. Figure 4-16 illustrates the record structure for this table, which you name ''tblDepartments.'' The department code is the primary key for this table.

You now have two tables—''tblDepartments'' and ''tblPayroll Master File.'' They are related in a one-to-many relationship because each department has many employees, but each employee belongs to only one department. The department code is common to both sets of records, although its name differs slightly from one table to another. (We purposely used different names to demonstrate the fact that the names do not have to match exactly to link tables.) This field will act as the foreign key in the Payroll Master File table. To create a relationship between the two tables, follow these steps:

Step 1: Select Tables. First, select the choices Relationships/Show Table from the main menu in Figure 4-13. From the tables listed on the left of your screen, right click on the table you wish to link (tblPayroll Master File: Table) and drag it into the Relationships

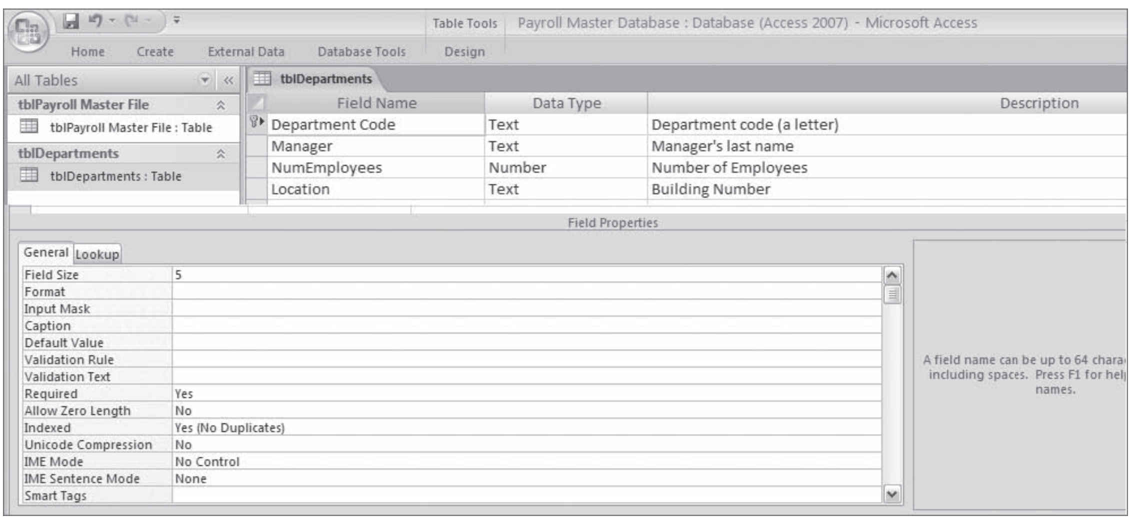


FIGURE 4-16 Departments table with properties for the department code.

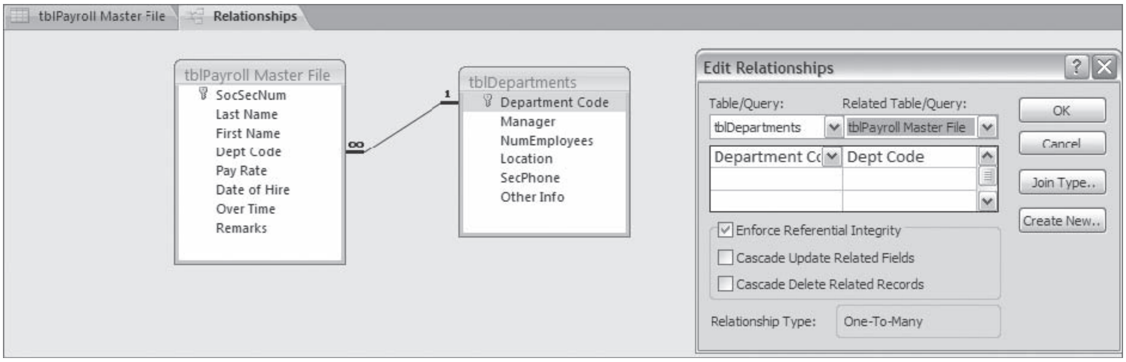
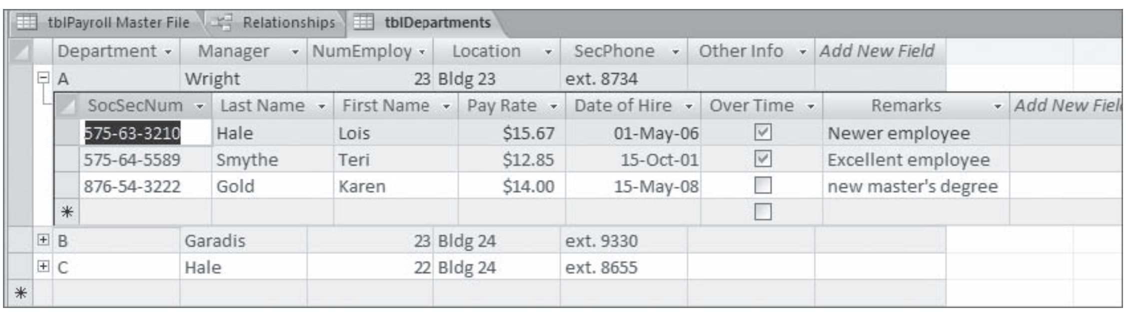


FIGURE 4-17 Linking tables and enforcing referential integrity of table relationships.

window and release the mouse. Now do the same with the tblDepartments: Table. As a result, you should see boxes for the two tables in the Relationships window of Figure 4-17, but there will not be a line drawn between the two tables. That's our next task.

Step 2: Link the Tables. To link the two tables together, drag and drop the department code name from either table to the similar name in the other table. When you do, you should also see the Edit Relationships dialog window of Figure 4-17. This window enables you to enforce **referential integrity**. Check this box. In the context of this example, referential integrity is a control that prohibits users from creating employee records with references to non-existent departments. (It does not affect your ability to create a department with no employees, however.)

If you follow these steps successfully, you should end up with a Relationships window with linked tables as shown in Figure 4-17. What you've done is link the tables together, using the department code as a foreign key. One dramatic way to see this linkage is to open the Departments table in run view (Figure 4-18). Note that there are now plus marks to the left of each department, indicating linked records. If you click on one of these plus marks with your mouse, you'll be able to see them, as illustrated for department A in Figure 4-18. Although it isn't obvious, the relationship you've created for your two tables will also enable you to create the multi-table report illustrated in Figure 4-3. We'll explain how to do that in Chapter 6.



Department	Manager	NumEmploy	Location	SecPhone	Other Info	Add New Field
A	Wright	23	Bldg 23	ext. 8734		

SocSecNum	Last Name	First Name	Pay Rate	Date of Hire	Over Time	Remarks	Add New Field
575-63-3210	Hale	Lois	$15.67	01-May-06	☑	Newer employee	
575-64-5589	Smythe	Teri	$12.85	15-Oct-01	☑	Excellent employee	
876-54-3222	Gold	Karen	$14.00	15-May-08	☐	new master's degree	
*					☐		

Department	Manager	NumEmploy	Location	SecPhone	Other Info	Add New Field
B	Garadis	23	Bldg 24	ext. 9330		
C	Hale	22	Bldg 24	ext. 8655		
*						

FIGURE 4-18 Showing subordinate data for multi-table relationships.

Guidelines for Creating Database Tables and Records

The preceding discussions both described how to design databases and how to create individual tables and records *within* a database. There are many things that can go wrong when performing these tasks. Here are some guidelines to help you avoid them.

1. Design first; create tables and records last. Some people don't have time to do things right—only time to do things over. Don't be one of them. A careful definition of database entities and their relationships can avoid many problems later.

2. Name tables systematically and use conventional *tbl* prefixes. Even small databases contain many tables, queries, forms, and reports. Using conventional prefixes such as ''tbl'' for tables and ''qry'' for queries enables database designers to distinguish among them. You may also find it useful to name related tables systematically—e.g., use names like ''tblCustomer_MasterFile'' or ''tblCustomer_Returns'' for different types of customer files.

3. Use mnemonic names for data fields. Each data field within a record must have a name, and mnemonic names help you remember what each field means. For example, the name ''State'' is better than ''Address Line 3'' to represent the data field for the customer's state. Similarly, the names ''State Abbreviation'' or ''State Code'' may even be better if you allocate just 2 digits for this field.

4. Assign correct data types to data fields. If you plan to manipulate a data field mathematically, you must define this field as a number—not a text field. Alternately, you should use text data types for such fields as Social Security, credit card, or phone numbers. These numbers are really codes that are too long to store as numbers, but ones that Access can store easily as text values.

5. Data fields that link tables together must be the same data type. If you use the data fields from separate tables to link two tables together, these fields *must* be of the exact same data type. Thus, you cannot link tables together if the foreign key in one table is a text field and the other is a date field. As noted earlier, when using ''number'' data fields, the *type* of number must also match—e.g., each data field must be a Long integer. Violating this rule is one of the most common errors novices make when creating database tables and relationships in Access.

6. Limit the size of data fields to reasonable lengths. Access assigns a default size of ''255'' characters to text fields. If, for example, you designate a state code of only two digits, you should change the default size to two digits. This will limit users to entering no more than two digits. A similar guideline applies to Social Security numbers, telephone numbers, product numbers, and similar values of predetermined, fixed length.

7. Use input masks. An **input mask** is a template that outlines the expected values for a data field. An example of a phone number input mask is (999) 000-0000, which limits the values in a phone number field to 10 numeric digits. Input masks help ensure accurate data input and help reduce mistakes.

AIS AT WORK
Retailers Now Save Questions as well as Answers to Improve Customer Service

Retailers throughout the world know that fast responses to customer questions help them provide better customer service—a hallmark of profitable retailing. For some time, therefore, large organizations such as department stores and airlines have maintained large banks of computer-enabled agents and more recently, sophisticated websites, to answer customer questions quickly, and, hopefully, sell these same customers goods and services on the spot.

These retailers are now also learning that saving the *questions* these customers ask—for example, using the search engines these organizations provide on their websites—can also help sell merchandise. Thus, several companies such as *Ask Jeeves, Vality Technology*, and *SAS* are developing ''natural language software tools'' that can detect patterns in customer inquiries and alert such users as Dell, E-Trade, Nike, and Williams Sonoma to customer search patterns or difficulties using websites. ''If lots of people are asking questions on something and they're not finding information, the search engine will tell us'' says Joan Broughton, director of web publishing at Office Depot.

One retailer that is benefiting from such analyses is Amazon.com. By examining what products a website user requests, the e-commerce retailer's website can match that user to a specific ''customer profile'' and therefore suggest similar products that ''others like you have bought.'' Similarly, Nordstroms (a department store chain) now uses website monitoring software from DigiMine to analyze customer ''clickstream data'' and detect patterns. The company was surprised to learn that one of the top-ten search phrases entered by customers was ''Kate Spade,'' a shoe and handbag maker. The company responded to this discovery by redirecting these customers to offline phone personnel to provide more personal service and sell these products.

Etown.com sells electronic products on the web. The company's *Ask Ida* software asks consumers questions to determine desired features and price-feature tradeoffs. In one analysis, the company learned that buyers of upgraded, feature-rich HD-TVs preferred smaller TV screens to save money. Finally, when Office Depot web designers examined web customer inquiries, they found that many asked about ''next-day delivery''—information that was already on their website, but not easily found. The discovery helped this company redesign its website.

''You get in one question an entire snapshot of what's going on in that person's mind,'' says Michael Callahan, director of advance development at *Ask Jeeves*. And the better a retailer understands its customers, the better it can make a sale.

Source: L. Scott Tillett, ''A 24-Hour Focus Group—Sites Dig Into Search Queries to Learn Customer Preferences'' *Internetweek* (April 10, 2000).

SUMMARY

- Almost every AIS uses databases to store accounting data. The hierarchy of data in such databases is ''bit, character, data field, record, file, and database.''
- Primary, secondary, and foreign record keys enable database systems to identify database records uniquely as well as link records to one another.

- Large, multiuser accounting databases pose additional design concerns. These include the administration and supervision of database development and maintenance, the need for documentation, the importance of data integrity, data processing accuracy and data completeness, database security and backup, and the usefulness of concurrency controls to safeguard data when two users wish to access the same record.
- Databases must be designed carefully. The REA model is a methodology that encourages designers to think of database components in terms of resources, events, and agents.
- Using E-R diagrams, the REA model graphically depicts the entities involved in a database application and the types of relationships between them. The ultimate goal is to determine what to store in sets of records, and how to organize these records efficiently.
- Three database structures are hierarchical, network, and relational. The relational model is most commonly used today.
- Microsoft Access is a popular database management system that small businesses can use to create complete accounting systems. The final section of the chapter illustrated the techniques you can use to create database tables, records, and relationships with this software.

KEY TERMS YOU SHOULD KNOW

agent (REA model)
business events (REA model)
cardinalities
child record
concurrency controls
data dictionary
data field
data hierarchy
data integrity controls
data modeling
data redundancy
data type (Access data field)
database
database administrator
database management system
database transaction
economic events (REA model)
entity (REA model)
entity-relationship (E-R) diagram
foreign key
hierarchical data structure
input mask
master file
metadata
network data structure
parent record
primary record key
REA model
record
record structure
referential integrity
relational data structure
relationship table
resources (REA model)
secondary record key
sibling record
table
transaction controls
transaction file
view controls

TEST YOURSELF

Q4-1. Which of these does *not* characterize a typical database?

a. Large number of records
b. Irreplaceable data
c. High need for accuracy
d. Simple systems

Q4-2. Which of these is *not* part of the ''data hierarchy'' (within the context of databases)?

a. Record **b.** Bit **c.** Character **d.** Data type

Q4-3. Which of these would *not* be a good primary key for a file of employee records?

a. Social security number

b. Last name

c. Company employee number

d. All of these would make equally good primary keys

Q4-4. In the REA model, the ''A'' stands for:

a. Agents **b.** Additions **c.** Accounts **d.** Associations

Q4-5. In the REA model, which of these would *not* be classified as an event?

a. Cash sale **b.** Credit sale

c. Hiring a new chief executive **d.** Date of the office picnic

Q4-6. Which of these is *not* a cardinality between two database entities?

a. One-to-one **b.** None-to-none **c.** One-to-many **d.** Many-to-many

Q4-7. E-R diagrams use all the following symbols *except:*

a. Ovals **b.** Rectangles **c.** Circles **d.** Diamonds

Q4-8. A parent-child relationship between two records is characteristic of:

a. Pyramid databases **b.** Network databases

c. Hierarchical databases **d.** Family databases

Q4-9. To link the records in a many-to-many relationship within a relational database:

a. You must create an intermediate ''relationships'' table

b. You must instead use a network database

c. You must use foreign keys and a spreadsheet system

d. You cannot link records together under these circumstances

Q4-10. Within the context of databases, the term ''concurrency'' refers to the possibility that:

a. A customer of one store might also be a customer of another store

b. Two database users might want to access the same record at the same time

c. A credit entry for a customer requires a debit entry for a matching account

d. None of these

DISCUSSION QUESTIONS

4-1. Why is the storage of accounting data important to an accounting information system? Describe some important concerns, and explain why each one is important.

4-2. What is the hierarchy of data in databases? Provide an example for a particular accounting application.

4-3. Describe some generic types of record keys in typical accounting databases. Are such keys simple or complicated?

4-4. Name some specific accounting files and a potential primary key for each one.

4-5. Describe each of the following database concerns, and give an example of each: (1) data integrity, (2) transaction accuracy and completeness, (3) concurrency processing, and (4) security.

4-6. What is the REA model of database design? How does REA differ from more traditional accounting views of data collection and storage? Hint: would a traditional accounting database store data about personnel matters?

4-7. What are database cardinalities? Give some examples of such cardinalities for an accounting application other than sales.

4-8. What is an entity-relationship diagram? Describe some symbols used in ER modeling, and explain the function of each one.

4-9. Suppose that a data modeler creates a database that includes a Sales table and a Salesperson table. Would you be likely to need a relationship table to link these two entities? Why or why not?

4-10. Why is it important to store primary key values consistently within different tables of the same database?

4-11. Access has five choices on the Menu bar. One of them is Create. What are the other four?

PROBLEMS

4-12. An internal auditor should have a sound understanding of basic data processing concepts such as data organization and storage in order to adequately evaluate systems and make use of retrieval software.

- **a.** Define the following terms as used in a data processing environment (all are nouns): (1) field, (2) record, (3) file.
- **b.** (1) Define a database. (2) List two advantages and two disadvantages of a database system. (CIA adapted)

4-13. What attributes (database table columns) would you be likely to include in a Cash table? In a Cash Receipts table?

4-14. Describe the meaning of each of the entity-relationship diagrams shown in Figure 4-19.

4-15. Draw entity-relationship diagrams for each of the following:

- **a.** The attributes of a customer in an accounts receivable database include name, address, and charge card number.
- **b.** The attributes of a student in a student database include student number (primary key), name, and class rank.
- **c.** The attributes of an asset in a general ledger database include inventory number (primary key), description, and date of purchase.
- **d.** The relationship between an employee and ''is assigned parking'' is one-to-many.
- **e.** The relationship between an employee and ''completes training program'' is many-to-many.
- **f.** The relationship between ''employee'' and ''health plan'' is many-to-one.
- **g.** A customer can be a cash customer or a credit customer. If the customer is a credit customer, an attribute is his or her credit card number.
- **h.** A patient is either an outpatient or an inpatient. If the patient is an inpatient, he or she is assigned a bed (one-to-one).
- **i.** An investment asset could be cash, a stock, a bond, or a certificate of deposit (CD).
- **j.** An account at a bank could be a checking account, a savings account, or a loan account. Each type of account requires an account or loan number. If it is a loan account, another attribute is the monthly payment amount.

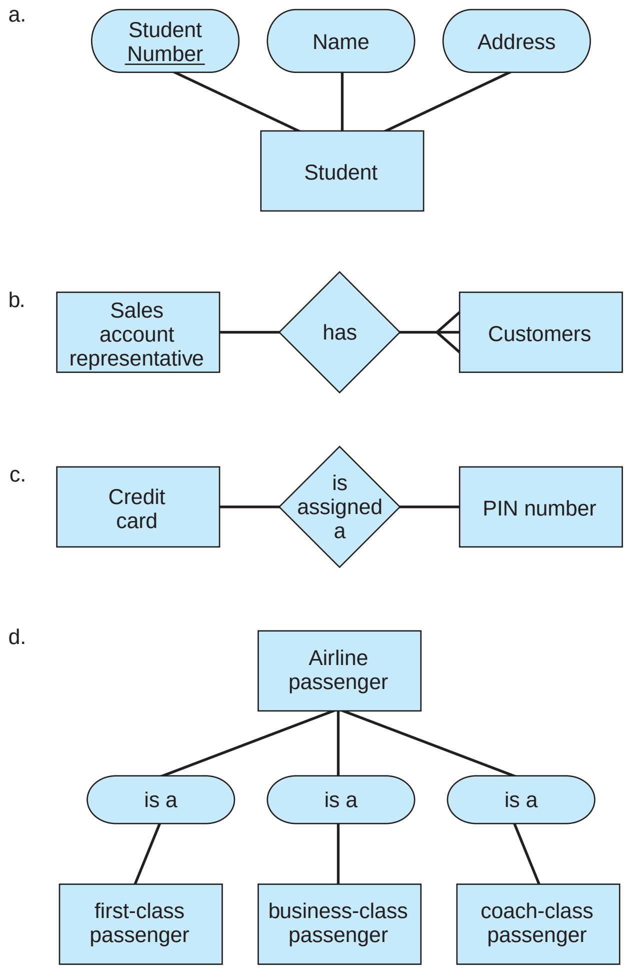


FIGURE 4-19 Entity-relationship diagrams for Problem 4-14.

4-16. Guido Geerts at the University of Delaware has created a website tool for learning more about database cardinalities. You can access the site, *Stevie*, at www.aisvillage.com/stevie. There are two sets of exercises. Use the entries basicpatterns/public as the username/password for one set, and the entries intro/public for the other set.[7]

4-17. This chapter described how to create tables and records in Microsoft Access. What other database management systems are available? Use the Internet to determine their current retail prices.

4-18. Give some examples of field names that you would use for the Customer table in Figure 4-6. What data type would you assign to each field using Microsoft Access, and how large would you make each text field? Would you use one data field or two for the customer name? Why?

4-19. Identify the different data types available for creating data fields in Microsoft Access. Similarly, identify the different types of numbers (e.g., Long integer) you can use if you define a field as a ''number'' data type. (Hint: create a data field in a throwaway database table, assign it a ''number'' data type, and examine the possibilities for the Field Size property as shown in Figure 4-14).

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[7] Instructors who are interested in creating their own problems and customized assignments can send an email to Professor Geerts at **geertsg@lerner.udel.edu** to obtain a User ID and Password to enter the system.

4-20. Create a Salesperson table and a Customer Order table using the data in Figure 4-6. Create records for each table using the data provided. Add one more Salesperson record with your own name and an employee number of your choosing. Also add at least one customer order with your number as the salesperson. Finally, create a relationship for the two tables. Create hard-copy documentation of your work.

CASE ANALYSES

4-21. Furry Friends Foundation I (Creating a New Database from Scratch)

The Furry Friends Foundation is a non-profit organization that finds homes for abandoned animals that are suitable for adoption. FFF began operations with a bequest from a wealthy gentleman who lived his life taking care of stray animals and wanted to be sure that such animals were looked after once he was gone. Although the amount the foundation started with was sufficient to set up an office and begin operations, it depends upon continuing donations to run daily operations.

FFF has been keeping its records on 4×6 cards. Over the years, the foundation has had requests from contributors for year-end statements that document their donations to the Foundation for tax purposes. (Usually, donations are given with a particular type of animal in mind—for example, ‘‘for dogs.’’) Now that the number of contributors exceeds 500, the president has decided to develop a database to handle the foundation’s accounting and reporting needs. The following is a sample of some of the records at FFF.

FFF Contributor File

Contributor ID	Last Name	First Name	Street Address	City	State	Zip	Phone Number
13456	Smythe	Jonathan	1845 Backpack Lane	Franktown	NV	55655	501 666-1234
13480	Lawrence	Marie	9190 Teepee Road	Doolittle	NV	54984	501 767-1114
13484	Funky	Robert	5815 Pearly Gate Lane	Happiness	NV	53887	502 995-7654

FFF Donation File

Donation Date	Animal Code	Amount	Contributor ID
September 30, 2009	C	25	13456
September 20, 2009	D	125	13456
October 15, 2009	C	25	13456
October 15, 2009	D	10	13456
October 31, 2009	C	20	13456
October 31, 2009	D	20	13456
November 30, 2009	D	250	13456
November 15, 2009	C	25	13456
December 1, 2009	O	70	13456
December 10, 2009	C	100	13480
September 10, 2009	C	250	13480
October 10, 2009	C	500	13480
November 11, 2009	C	150	13480
December 14, 2009	D	100	13484
September 5, 2009	C	100	13484
October 10, 2009	O	100	13484
November 8, 2009	O	100	13484
December 15, 2009	D	50	13484

FFF Animal Code Table

Contribution for	Code
Dogs	D
Cats	C
Hamster	H
Guinea Pig	G
Rabbit	R
Other	O

Requirements

1. Using Access or a similar relational database, create the tables needed to set up a database for contributors, contributions, and animals.
2. What data field did you use for the primary record key of the FFF contributor table? Why did you use it?
3. Using *Access* or similar software as required by your instructor, add yourself as a contributor.
4. Create relationships for the tables.
5. Document your work by printing hard copies of each table in datasheet view and the relationships report that shows how they are related.

4-22. Carl Beers Enterprises (Using a Relational Database)

Carl Beers Enterprises manufactures and sells specialized electronic components to customers across the country. The tables in Figure 4-20 illustrate some of the records in its accounting databases. Thus, for example, the ''Sales by Inventory Number'' records show detailed sales data for each of the company's inventory items, and the ''Customer Payments'' records indicate customer cash payments, listed by invoice number. Use the information in these tables to answer the following questions.

Requirements

1. The ''Sales by Inventory Number'' records are listed by inventory item number. How is this useful? Why might this information also be useful if it were listed by invoice number instead of inventory number?
2. In the ''Sales by Invoice Number,'' invoice V-3 shows a sales amount of $16,000. What was the name of the customer that made this purchase? What specific inventory items did this customer purchase? How much did this customer pay for each item?
3. Customers can choose among one of three payment options: (1) 5% discount if immediate cash payment, (2) 2% discount off list amount if total invoice paid by the fifteenth day of the month following purchase, or (3) deferred payment plan, using six monthly payments. Which option does J. P. Carpenter appear to be using for invoice V-2?
4. Using just the information provided, what are the quarterly sales amounts for salespeople S-10, S-11, and S-12?
5. Assume that customers C-1 through C-5 began this quarter with net accounts receivable balances of zero. What are their balances now?

4-23. Martin Shoes, Inc. (Planning a Database Using REA and E-R Methodology)

Martin Shoes, Inc. manufactures and distributes orthopedic footwear. To sell its products, the marketing department requires sales personnel to call on the shoe retailers within their assigned geographic territories. Each salesperson has a laptop computer, which he

Sales by Inventory Number

Item Number	Invoice Number	Quantity	Price Each
I-1	V-1	1	2,000
	V-3	1	2,000
	V-6	3	1,575
I-2	V-5	2	3,000
	V-6	10	3,500
I-3	V-3	6	1,000
I-4	V-1	2	600
	V-5	2	300
I-5	V-3	2	4,000
	V-7	3	3,000
I-6	V-2	2	5,000
	V-4	2	5,000
	V-5	2	5,000
	V-7	2	7,000

Sales by Invoice Number

Invoice Number	Amount	Customer Number	Date	Salesperson Number
V-1	7,200	C-1	July 1	S-12
V-2	10,000	C-2	July 12	S-10
V-3	16,000	C-5	July 22	S-10
V-4	10,000	C-2	July 26	S-10
V-5	16,600	C-5	July 31	S-10
V-6	35,000	C-3	Aug 1	S-10
V-7	23,000	C-4	Aug 2	S-11

Sales by Salesperson

Salesperson Number	Quarterly Sales	Commission Rate
S-10	?	.10
S-11	?	.10
S-12	?	.12
S-78	0	.08

Customer Payments

Invoice Number	Remittance Advice Number	Amount
V-1	R-3	7,200
V-2	R-1	1,666
V-2	R-5	1,666
V-3	R-4	16,000
V-4	R-2	10,000
V-5	R-4	16,600

Customer Data

Customer Number	Customer Name	Accounts Receivable Amount	Sales-person
C-1	Dunn, Inc.	?	S-12
C-2	J. P. Carpenter	?	S-10
C-3	Mabadera Corp.	?	S-10
C-4	Ghymn and Sons	?	S-99
C-5	D. Lund, Inc.	?	S-10

FIGURE 4-20 Sample of some of the records in the Beers Enterprise Accounting databases.

or she uses to record sales orders during the day and to send these sales orders to Martin's network nightly for updating the company's sales order file.

Each day, warehouse personnel review the current sales orders in its file, and where possible, pick the goods and ready them for shipment. (Martin ships goods via common carrier, and shipping terms are generally FOB from the shipping point.) When the shipping department completes a shipment, it also notifies the billing department, which then prepares an invoice for the customer. Payment terms vary by customer, but most are ''net 30.'' When the billing department receives a payment, the billing clerk credits the customer's account and records the cash received.

Requirements

1. Identify the resources, events, and agents within Martin's revenue process.
2. Develop an E-R diagram for this process.
3. With a particular DBMS in mind, design the tables for this revenue process. Note that you will need tables for each resource, event, and agent, as well as tables for each many-to-many relationship.

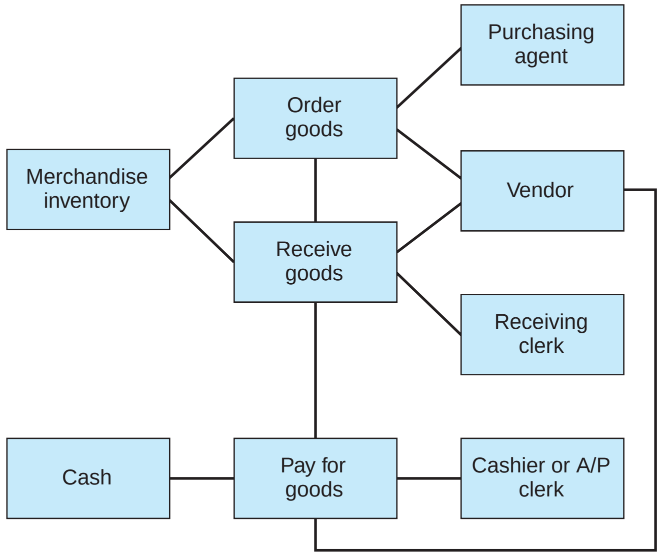


FIGURE 4-21 An E-R diagram for the purchasing system of Souder, Oles, and Franek LLP.

4-24. Souder, Oles, and Franek LLP (Data Modeling with REA)

Souder, Oles, and Franek is an international consulting firm headquartered in Chicago, Illinois. The Entity-Relationship diagram in Figure 4-21 shows a simplified version of the company's process for purchasing and paying for equipment and supplies.

Requirements

1. Insert appropriate pairs of cardinalities for the relationships in the Entity-Relationship model developed with the REA data modeling approach.
2. Describe the database table attributes for this model. You will need a table for each entity, as well as one or more relationship tables. First identify the table name and then indicate the primary key by underlining it. Show any foreign keys by framing them in brackets (e.g., [Vendor#]). Include at least three fields in each table. Below is an example for the Vendor table and the Order Goods table:

   Vendor#, Name, Street Address 1, Street Address 2, City, State, Zip Code, Phone, Email, Fax, Contact, Comments.
   Order#, Date, [Vendor#], [Employee#], Shipping Instructions, Comments.

4-25. BSN Bicycles (Creating a Database from Scratch with Microsoft Access)

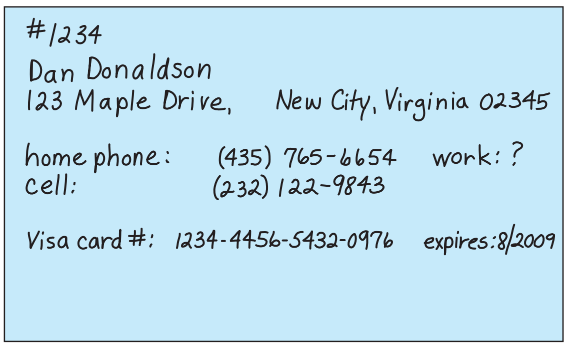
Bill Barnes and Tom Freeman opened their BSN bicycle shop in 2005. Not counting Jake—a friend who helps out occasionally at the store—Bill and Tom are the only employees. The shop occupies a small commercial space that was once a restaurant. The former kitchen now stores spare parts and provides space for bicycles repairs, while the former dining area in the front is now the retail sales area. The ''corporate office'' is just a desk and file cabinet in the back corner of the retail area.

Bill and Tom are more friends and bicycling enthusiasts than businessmen. They've pretty much sunk their life savings into the shop and are anxious that it succeed. In the first year of operations, they worked hard to convert the space into its present condition, which includes an old-timey sign above the door with their name ''BSN Bicycles.''

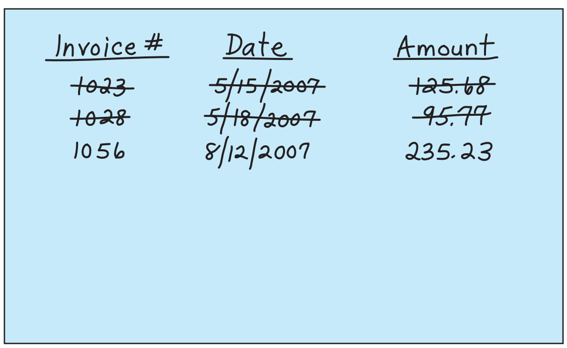
With all the other work that had to be done the first year, marketing efforts have been limited to chatting with friends, distributing flyers at bicycle races and similar sporting events, and placing a few ads in the local newspaper. Similarly, the owners haven't paid much attention to accounting tasks. Who has time with all the other things that had to get done? But at least two things are now clear to the owners: (1) some of their loyal customers prefer to buy items on credit, and (2) all of their suppliers want to be paid on time.

Right now, BSN's ''customer credit system'' is a box of 3x5 cards. Each hand-written card contains customer information on the front and invoice information on the back (Figure 4-22). When a customer pays an invoice, one of the owners simply crosses off the invoice information on the card. The ''supplier accounts system'' is similar, except that the vendor box of 3x5 cards is green whereas the customer box is grey.

Jake is a part-time student at the local community college. He recently completed a course on microcomputer applications that included a segment on Microsoft Access. He doesn't know very much about database theory, but thinks that converting the shop's current ''accounting systems'' to a DBMS might be a good idea. He thinks, for example,



(*a*) The front of a 3x5 BSN customer card.



(*b*) The back of a 3x5 BSN customer card.

FIGURE 4-22 A customer record for the BSN company.

that BSN needs a customer table and a vendor (supplier) table. He also thinks that BSN will need an inventory table to keep track of inventory, but that even more tables might be required. Can you help them?

Requirements

1. Identify the resources, events, and agents for BSN's accounting systems. Draw one or more E-R diagrams that illustrate the relationships between these items.
2. Identify the tables that you would need to create a working database for the company's receivables, payables, and inventory.
3. Using Access or similar software as required by your instructor, create at least three records for each of the tables you identified in part 2. Hints: (1) Use the information on the front of the 3x5 card in Figure 4-22 for the customer record structure. (2) The data fields for the Vendors table should include the vendor ID, vendor name and address information, phone number, fax number, and contact person. (3) The data fields for the Inventory table should include item number, item description, units (e.g., dozen, each, etc.), unit cost, unit retail sales price, and quantity on hand.
4. Create relationships for your various tables.
5. Document your work by printing hard copies of each table in data sheet view and each relationship.

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ANSWERS TO TEST YOURSELF

1. **d** 2. **d** 3. **b** 4. **a** 5. **d** 6. **b** 7. **c** 8. **c** 9. **a** 10. **b**

Chapter 5

Organizing and Manipulating the Data in Databases

After reading this chapter, you will:

1. *Understand* the process of normalization.
2. *Be familiar with* database techniques for validating data inputs.
3. *Understand* the importance of extracting data from databases and AIS uses of such extractions.
4. *Know how to* create simple and multi-table queries using Microsoft Access.
5. *Understand* object-oriented and multimedia databases.
6. *Be familiar with* data warehouses and their uses in accounting applications.

"Why let valuable information remain untouched within your company databases? Data mining has a wide range of uses, from searching for unknown patterns in company databases to identifying fraudulent activity."

Raymond Landry Jr., et. al., ''Grab your Picks and Shovels: There's Gold in Your Data'' *Strategic Finance* Vol. 85, No. 7 (January 2004), p. 28.

INTRODUCTION

In theory, system developers should first design databases, using the techniques described in Chapter 4, and then construct them later. In practice, organizations create many commercial databases from collections of preexisting manual files, nonintegrated computerized files, personal or informal files, or the databases of acquired companies. Thus, the key databases of a company are typically in a state of continuous evolution, reevaluation, and revision.

The previous chapter introduced the concept of databases and discussed data modeling—the process of designing database records and tables. This chapter focuses on ways to use databases in AISs. We begin with a discussion of normalization and then look at several methods of querying Access database tables in practice. Finally, we examine a few special types of databases: object-oriented databases, multimedia databases, and data warehouses.

NORMALIZATION

Chapter 4 made clear that, without advanced planning, accounting data are likely to wind up in **flat files**—i.e., files with no sequence or order to them, except perhaps a chronological sequence. An example would be a file in which a professor enters the student grades of an examination in random order. Flat files make it almost impossible to find a particular record easily (because the records are not stored systematically), to link files to one another to provide information from related records, or to store file data efficiently. The databases of most AISs require more discipline than this.

Normalization is the process of examining and arranging file data in a way that helps avoid problems when organizations use or modify them later. Consider, for example, the long waiting period that a university student may encounter when applying for financial aid. If student records are not integrated in a complete database, the scholarship director will have to request a copy of the student's transcript from one source, financial records from other sources, and perhaps additional information from other sources—a time-consuming process.

In commercial applications, an organization generally knows what data are involved in a specific application. The challenge is to organize the data intelligently. Normalization is a methodology for accomplishing this objective. There are several levels of normalization, but we shall only examine the first three of them: first normal form, second normal form, and third normal form.

Social Security Number	Last Name	First Name	Phone Number	License Plate State	License Plate Number	Ticket Number	Date	Code	Fine
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD	10151	10/15/10	A	$10
						10152	10/16/10	B	$20
						10121	11/12/10	B	$20
134-56-7783	Macon	Richard	(916)563-7865	CA	253 DAL	10231	10/23/10	C	$50
						12051	12/5/10	A	$10

FIGURE 5-1 A set of unnormalized parking ticket data.

First Normal Form

A database is in **first normal form (1 NF)** if all the record's attributes (data fields) are well defined and the information can thus be stored as a flat file. Interestingly enough, not every set of data automatically satisfies this requirement. For example, Figure 5-1 shows a set of university parking ticket data with repeating groups in its rightmost four columns. (Real parking tickets will contain many more data fields than shown here, but we will keep things simple to focus on normalization tasks.) Databases cannot store more than one value in the same data field (i.e., column) of the same record, so we must do something to overcome this limitation.

One solution to this problem is to use a separate record to store the information for each parking ticket. Figure 5-2 illustrates the results. For this file, the ticket number serves as the primary key. There are no repeating groups for any one column, so we can now store these records in a conventional computer file. Our data are now in first normal form.

Although we now have a well-defined file of student data, several problems remain. One difficulty is a large amount of *data redundancy* (i.e., the fact that much of the information in this file is repetitive). Another problem is that we have created an *insertion anomaly*—the fact that this database only stores information about students with parking tickets. Students with registered cars but no parking tickets will have no records in this file—a difficulty if school administrators also want to use this file for car-registration purposes. A third problem is a *deletion anomaly*—the fact that those students who pay their ticket fines will no longer have a car registration record on file.

Social Security Number	Last Name	First Name	Phone Number	License Plate State	License Plate Number	Ticket Number	Date	Code	Fine
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD	10151	10/15/10	A	$10
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD	10152	10/16/10	B	$20
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD	10121	11/12/10	B	$20
134-56-7783	Mason	Richard	(916)563-7865	CA	253 DAL	10231	10/23/10	C	$50
134-56-7783	Mason	Richard	(916)563-7865	CA	253 DAL	12051	12/5/10	A	$10

FIGURE 5-2 The data of Figure 5-1 in first normal form.

Second Normal Form

To solve these problems, let us redesign our database into **second normal form (2 NF)**. A database is in second normal form if it is in first normal form and all the data items in each record depend on the record's primary record key. To satisfy this requirement for our student-parking ticket example, let us split our student information into two files—a "Car Registration File" and a "Ticket File"—as shown in Figure 5-3. This approach not only results in a more efficient design but also eliminates much of the first file's data redundancy.

In our new Car Registration File (or table), what should serve as the primary key? At first glance, you might guess "social security number." If students are only able to register one car, then this choice might be satisfactory. If students can register more than one car, then it makes more sense to use the license plate number as the primary key. Remember: the primary key must uniquely identify a record, and this would not be possible if one person (with one Social Security number) had two records in this table. Finally, we note that in an actual application, it is more likely that the license's "State" and "Number" data fields together would serve as the primary record key, but again we shall keep things simple here.

What about a primary key for our new Ticket File? In this table, the "ticket number" serves this purpose, while the student's license plate number serves as the foreign key. Again, recall from Chapter 4 that a foreign key enables a database to link appropriate records together—for example, to trace a particular parking ticket to the car's registered owner. It also enables database users to answer such questions as "Does a particular student have any outstanding parking tickets?"

Car Registration File

Social Security Number	Last Name	First Name	Phone Number	License Plate State (primary key)	License Plate Number (primary key)
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD
134-56-7783	Mason	Richard	(916)563-7865	CA	253 DAL
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

Ticket File

(primary key) Ticket Number	(foreign key) License Plate State	(foreign key) License Plate Number	Date	Code	Fine
10151	CA	123 MCD	10/15/10	A	$10
10152	CA	123 MCD	10/16/10	B	$20
10231	CA	253 DAL	10/23/10	C	$50
10121	CA	123 MCD	11/12/10	B	$20
12051	CA	253 DAL	12/5/10	A	$10
.	.	.	.	.	.
.	.	.	.	.	.

FIGURE 5-3 The data of Figure 5-2 in second normal form.

Third Normal Form

Although we are making headway in our database design, our goal is to create a database that is in **third normal form (3 NF)**. A database is in third normal form if it is in second normal form and contains no **transitive dependencies**. This means that the same record does not contain two data fields in which data field *A* determines data field *B*. A simple example is a student record that stores both the number of credits taken at a university and his or her class standing of ''junior'' or ''senior'' (assuming ''credits taken'' dictates ''class standing''). The Ticket File of Figure 5-3 also suffers from this problem because the ticket code data field (e.g., a code of ''A'') determines the amount of the fine (e.g., ''$10'').

One way to solve this problem is to store the data for parking fines in a new ''Parking Violations Code File'' as shown in Figure 5-4. This enables us to eliminate the redundant information (the Fine data field) in the Ticket File of Figure 5-3 and streamline our data. Figure 5-4 illustrates the results. The ticket codes (A, B, and so forth) in the Ticket File

Car Registration File

Social Security Number	Last Name	First Name	Phone Number	License Plate State (primary key)	License Plate Number (primary key)
123-45-6789	Curry	Dorothy	(916)358-4448	CA	123 MCD
134-56-7783	Mason	Richard	(916)563-7865	CA	253 DAL
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

Ticket File

Ticket Number (primary key)	License Plate State (foreign key)	License Plate Number (foreign key)	Date	Code (foreign key)
10151	CA	123 MCD	10/15/10	A
10152	CA	123 MCD	10/16/10	B
10231	CA	253 DAL	10/23/10	C
10121	CA	123 MCD	11/12/10	B
12051	CA	253 DAL	12/5/10	A
.	.	.	.	.
.	.	.	.	.

Parking Violations Code File

Code (primary key)	Fine	Explanation
A	$10	meter expired
B	$20	parking in no-parking zone
C	$50	no parking sticker
.	.	.
.	.	.

FIGURE 5-4 The data of Figure 5-3 in third normal form.

serve as foreign keys that link the information in the Ticket File to an entry in the Parking Violations Code File. We now have a database in third normal form.

Chapter 4 noted that databases tend to become complicated, with multiple files that are linked together with foreign keys. The database in Figure 5-4, for example, is more complex than our data in Figure 5-1, but it is also more efficient. For example, this database design will allow its users to (1) store the car registration information of all students, even if they do not have any parking tickets, (2) alter a student's name, phone number, or license plate by altering only one record in the Car Registration file—not several of them, as would be required using the flat file of Figure 5-2, and (3) easily change the fine amount for a parking ticket. Finally, this database design allows us to eliminate a lot of redundant information and therefore makes file storage more efficient.

VALIDATING THE DATA IN DATABASES

After data have been normalized, it remains to actually create database tables and records. Typically, this is done with a database management system.

Database Management Systems

A **database management system (DBMS)** is a separate software system that enables users to create database records, delete records, access specific information, query (select subsets of) records for viewing or analysis, alter database information, and reorganize records as needed. This section of the chapter explains how to perform some of these tasks in greater detail.

A DBMS is not a database. Rather, a DBMS is a set of separate computer programs that enable users to create, modify, and utilize database information efficiently, thus allowing businesses to separate their database system operations from their accounting system applications. This enables organizations to change record structures, query and report formats, video displays, and similar items without also having to reprogram the accounting software that accesses these database items. It also enables businesses to upgrade either system independently of the other one.

Examples of microcomputer DBMS packages include Access, Alpha 5, dQuery, Filemaker Pro, and Lotus Approach. Examples of DBMSs that run on client/server systems or mainframes include ADABAS, Microsoft SQL Server, DB2, Oracle, MySQL, Sybase, Ingrus, and Supra. Most microcomputer DBMSs are single-user systems, whereas others (for larger applications) are multiuser systems. Most of these larger systems are limited in how many concurrent users they support, the maximum number of transactions per day they can process, and so forth. Also, not every accounting package can interface with every database, so managers should make sure that any new accounting software they acquire can also read their existing databases, and vice versa.

Case-in-Point 5.1 IDC Company, a research company specializing in IT, estimates that the annual market for relational database management systems in the U.S. is $14.6 billion—and growing by nearly 10% per year. Reasons for such demand and growth include expanding international economies, new data warehousing applications, and increasing demand for such software by U.S. companies.[1]

[1]Source: Penny Crosman, ''Database Bubble?'' *Intelligent Enterprise* Vol. 9, No. 7 (July 2006), p. 15.

Data Validation

The data definition language (DDL) of a DBMS enables its users to define the record structure of any particular database table (i.e., the individual fields that each record will contain). For example, to create the record structure for the car registration file shown in the top portion of Figure 5-4, you might define the following data fields and characteristics:

Data Field	Date Type	Size	Required?
Social Security number	text	9	yes
Last name	text	50	yes
First name	text	30	yes
Home phone number	text	14	no
License plate state	text	2	yes
License plate number	text	10	yes

Chapter 4 explains how to define this record structure using Microsoft Access. Here, we will focus on the data-validation capabilities DBMSs.

Case-in-Point 5.2 Geographic information systems (GISs) rely heavily on databases to store information about streams, roads, utility installations, and similar geographic information. In regional planning environments—for example, water-resource planning—local districts often need to share data from different databases. One of the biggest problems: disparate proprietary record structures, which sometimes cost local governments hundreds of thousands of dollars to convert to consistent formats. Members of the Northern Kentucky GIS standards task force spent more than 600 hours grappling with this problem and developing new formatting standards.[2]

Mistakes in the important data fields of AIS databases are costly to a company in terms of the time and trouble required to correct them, as well as the potential inconvenience and confusion caused by such errors *until* they are corrected. Simple examples include typing ‘‘4)’’ instead of ‘‘40’’ for hours worked, ‘‘NU’’ instead of ‘‘NY’’ for the state code in a mailing address, or ‘‘UPC’’ instead of ‘‘UPS’’ for the shipper code. Although it is impossible to guard against every possible type of error, database designers can use the following tools of a typical DBMS to catch many of them.

Proper Data Types for Fields.

Using Microsoft Access, one input control is inherent in the data type that you assign to a particular data field. For example, if you create a data field as a ‘‘number’’ data type, Access will reject all character inputs that are not numbers. Similarly, if you declare a data field as a ‘‘date’’ data type, Access will reject all input values (including alphabetic letters or punctuation marks) that cannot be part of a date. This is why it is often better to use data types *other than text* for data fields.

Input Masks.

Input masks limit users to particular types of data in specific formats—for example, ‘‘123-45-6789’’ for a Social Security number,‘‘(123) 456-7890’’ for a telephone number, or ‘‘8/9/10’’ for a date. Although system designers use special symbols for the mask, the DBMS interprets these symbols as input requirements and acts accordingly. At data-entry time, the user will see just the formatted part of the mask—for example, ‘‘___-__-___’’ (see the ‘‘Input Mask’’ row in Figure 4-14 of the previous chapter). Input masks

[2]Source: Lisa Martin, et al., ‘‘Sharing Data’’ *Geospatial Solutions* Vol. 15, No. 3 (February 2005), pp. 26–31.

help users input data correctly in databases by indicating a general input format, thereby reducing data-entry errors. Such masks also enable the system to reject incompatible data—for example, a letter character mistakenly input in a numeric field.

Default Values. A third input control is to specify a **default value** for the data fields of new records. Examples include the number ''40'' for an hours-worked data field or a ''coach'' seating code of ''Y'' for an airline passenger. Again, such default values help guard against input errors as well as speed data entry.

Drop-Down Lists. You probably have already seen combo boxes on web pages that contain drop-down lists of choices. Databases like Access enable you to use similar boxes for your tables or forms (Figure 5-5). Although such boxes are convenient alternatives to typing data manually, they also control data-entry because they limit user entries to valid inputs. In Access, another advantage of using a combo box is that you can store the choices for it as the values of a separate table, adding to the flexibility of the database itself.

Validation Rules. One of the most versatile data entry controls is the ability to create custom validation tests using a **validation rule**. Using Microsoft Access, for example, you create such rules as a record-structure property of a data field. Figure 5-6 illustrates an example for the ''Fine Amount'' data field of the Parking Violations Code table in Figure 5-4. This (numeric) data field shows the amount of money that a person must pay for a particular parking violation. In Figure 5-5, the expression *Between 1 And 100* that appears in the properties window on the left side specifies the acceptable range of values. The error message in the message box on the right displays the ''Validation Text'' that you specify in this field's properties window. This is what will appear in a message box when a user attempts to enter a value (such as ''200'') that falls outside the allowable range.

Validation rules can be simple, such as the one in Figure 5-6, or much more complex. For example, Access also enables you to use mathematical computations, predefined functions, and logical operators to create more complex validation rules. An example is *Between 1 And 100 AND Not 77*, which means that the entry value must fall in the specified range and cannot be ''77.'' Another example is *Between [fldStartDate] and [fldEndDate]*, which means that the date entered must be between an employee's hire date and his or her termination date.

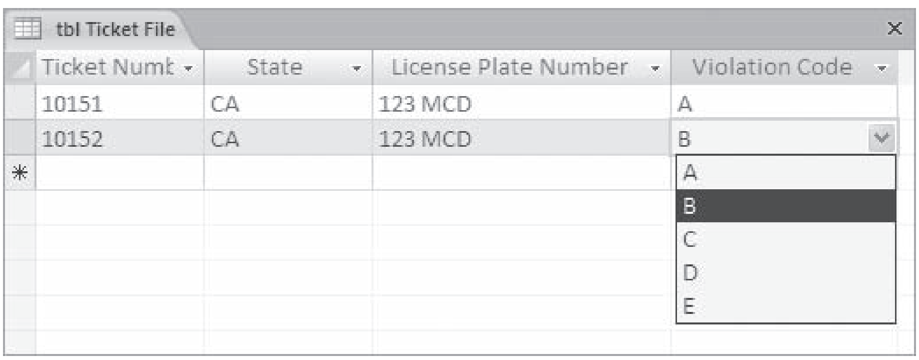


FIGURE 5-5 An example of a combo box at run time for the violation code of the Ticket file table.

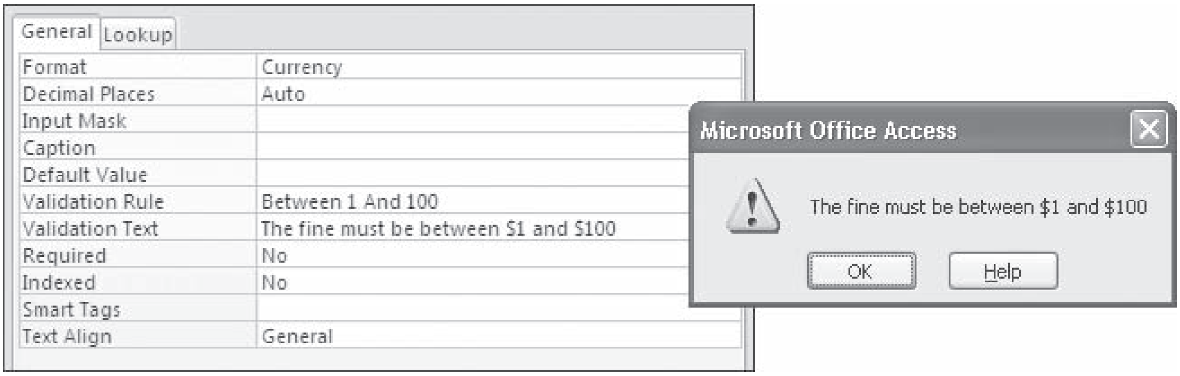


FIGURE 5-6 Left: The properties window for the Fine Amount data field of the Parking Violations table. Right: The error message that a user would see if he or she attempts to enter a value for this field that falls outside the specified range.

Case-in-Point 5.3 The consulting team had a massive task: consolidating the payroll records of 110,000 employees stored in five different systems into the database of a grocery chain's ERP system. Because the project was over budget, company executives instructed the team to ignore validating taxes for terminated employees. But some of those employees didn't *stay* terminated, and the validation costs that the team would have incurred for such validation was "chump change" compared to the cost of correcting the erroneous tax records for the rehires.[3]

Referential Integrity. A final data-entry control is to enforce **referential integrity** in relational database tables. This feature controls certain inconsistencies among the records in relational tables. Consider, for example, the possibility of *deleting* a parking violations code record from the third database table in Figure 5-4 (e.g., deleting the record for Code A—meter expired). We can't allow such a deletion because this would disrupt all the *references* to that record in the Tickets table. For the same reason, we can't allow new records in the ticket table to reference nonexistent codes in the parking violations code file—for example, a ticket with code "Z" (if such a code didn't exist). This would be a parking ticket for a nonexistent violation.

Database management systems make it easy to enforce referential integrity. In Access, for example, you simply check a box in the Edit Relationships dialog window at the time that you create the relationship—see Figure 5-7. This enforcement performs two vital functions. First, it does not allow record deletions in the "one" table of a one-to-many relationship. Second, it does not allow a user to create a new record in the "many" table of a one-to-many relationship that references a nonexistent record on the "one" side. Case 5 – 25 illustrates these concepts in more detail.

In Figure 5-7, note that the Edit Relationships window in Access provides two additional boxes that you might check: one that allows "cascade update related fields" and one that allows "cascade delete related records." These options enable you to override the referential integrity rules just described for parent records (although Access will warn you first). If you chose the first of these options, for example, you could delete a record in the

[3]Source: No author, "Anonymous Tales from the Front Lines: Do It Fast or Do It Right," *Infoworld* Vol. 28, No. 9 (February 26, 2006), p. 46.

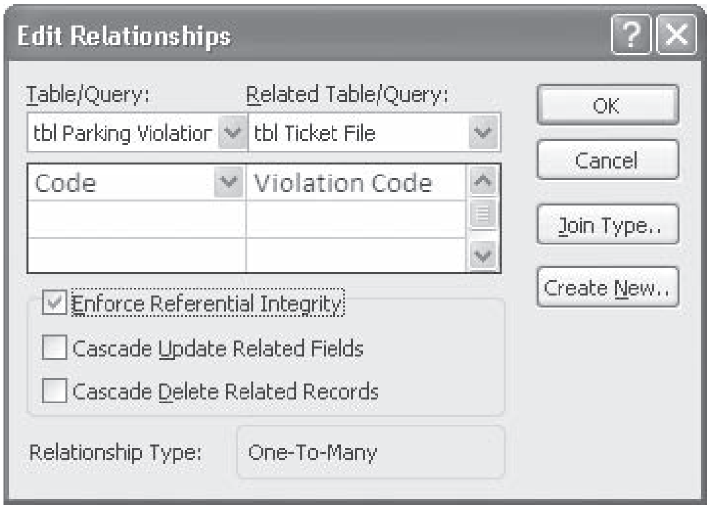


FIGURE 5-7 This dialog box appears when you first create a relationship in Microsoft Access. Clicking the check box to Enforce Referential Integrity does just that.

Parking Violations Code File, and Access would also delete the reference to that record in the records of the Ticket File. (This would not be desirable here, however—it would leave you with tickets in the Tickets File with no violation code in them.) The second option allows you to delete a parent record, even if there are matching child records for it. For example, if you delete a record in the Car Registration table, Access will then delete all the ticket records associated with that record (car) in the Ticket File table.

EXTRACTING DATA FROM DATABASES: DATA MANIPULATION LANGUAGES (DMLs)

The totality of the information in a database and the relationships of its tables is called the database **schema**. Thus, the schema is a map or plan of the entire database. Using the previous student-parking example, the schema would be all the information that a university might store about car registrations and parking tickets.

Any particular user or application program will normally be interested in (or might be limited to) only a subset of the information in the database. This limited access is a **subschema**, or *view*, in database parlance. For example, one subschema for our parking database might be the information required by the university registrar—e.g., the student's name, Social Security number, and outstanding parking tickets. (Many universities do not allow students to graduate with outstanding parking tickets.) Subschemas are important design elements of a database because they dictate what data each user needs, and also because they protect sensitive data from unauthorized access. This is one reason why a university might design several subschemas for its parking database that purposely exclude student Social Security numbers.

The terms *schema* and *subschema* describe a simple idea—the distinction between the design of a database on one hand and the uses of a database on the other. The goal is to design a database schema that is flexible enough to satisfy the subschema uses required of it. This design can make the difference between an AIS that barely works and an AIS that provides a very real competitive edge to a profit-seeking business. Here are some ways of creating subschemas.

Creating Select Queries

The purchasing agent of a manufacturing company needs to know what inventory parts balances are now below their reorder points. A payroll manager wants to know which employees are eligible to receive year-end bonuses. A tax assessor is interested in those areas of the city that have experienced the most real estate appreciation.

What these applications have in common is the need for selective information from one or more database tables. **Queries** allow database developers to create customized subschemas. For example, using the student car registration database, you might want to (1) look up something about a specific student (e.g., the license plate number of his or her car), (2) change the information in a specific record (e.g., update a student's phone number), (3) delete a record (e.g., because a student sells his or her car), or (4) list file information selectively (e.g., prepare a list of all students with California license plates). A **dynaset** is a dynamic subset of a database that you create with such queries, and the purpose of a **data manipulation language** (DML) is to help you create such dynasets.

One-Table Select Queries. A **select query** creates a dynaset of database information based on two types of user-specified criteria: (1) criteria that determine which records to include, and (2) criteria that determine which data fields to include *from* those records. Figure 5-8 illustrates a simple select query that displays particular information from a single table using Microsoft Access. This example asks the system to display the last name, first name, phone number, license plate state, and license plate number for all cars with California license plates.

You can create several types of queries with Access 2007. One is a simple *filter query* that references only one table. Another combines the information from several tables. A third type is an action query. We look at each of these queries in order.

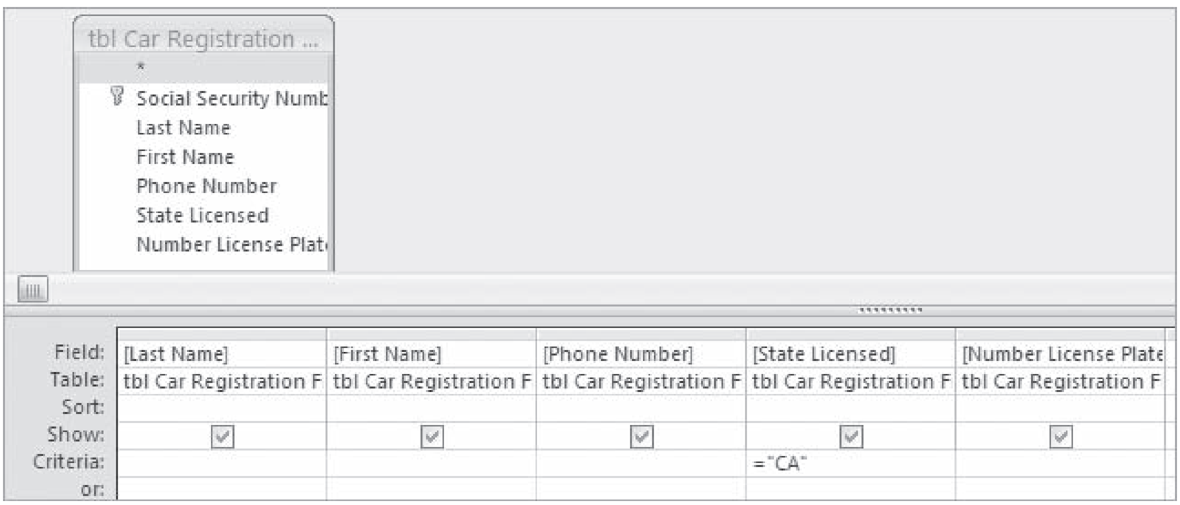


FIGURE 5-8 A simple query to select all car registrations with CA (California) license plates.

Single Criterion. To create a simple filter query, first click the Create option on the main menu bar. In the Create menu, click ''Query Design.'' Access will display a small dialog box that allows you to select the table(s) on which to base your query. To create the query in Figure 5-8, we only need the tbl Car Registrations File. The bottom portion of Figure 5-8 shows the layout in which to enter your data fields and the selection criteria for them.

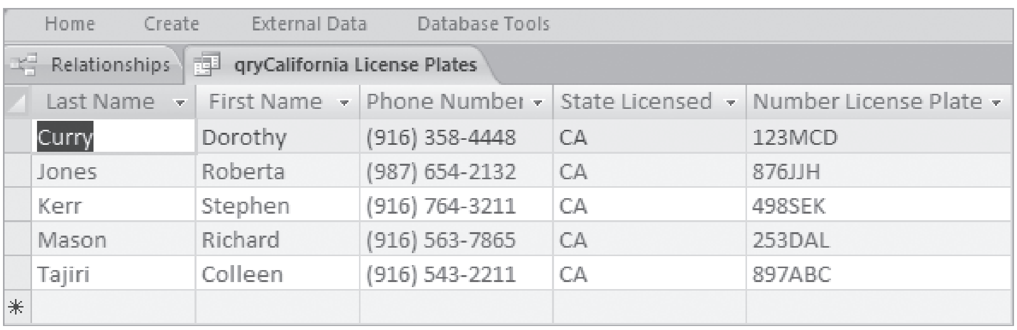
Your next task is to select the data fields in each record you wish to display. One way to do this is to click on the first (left-most) cell in the Field row in the lower portion of the Query panel. An arrow will appear in this cell. Click on this arrow and a drop-down list of available data fields will appear. Select the field from this list that you wish to display in the current column (we selected Last Name in the figure). Continue across the panel until you have selected all the fields you need. Alternate methods of selecting data fields for queries in Access 2007 are (1) double clicking on the desired field name in the table list of the upper panel or (2) dragging the field name in the table list to the column.

Next, you must specify the selection criteria for the query. For example, to display only those records with California licenses enter ''=CA'' in the criteria box under ''State Licensed.'' You will see CA is now enclosed with quotation marks, which Access automatically adds for you. To specify criteria in general, all basic comparison operators are available—i.e., =(equals), <(less than), >(greater than), >=(greater than or equal to), <=(less than or equal to), and <>(not equal to).

You are now ready to run the filter. To do this, click the exclamation point with the word ''Run'' on the left portion of the main menu. The results of your query will appear as shown in Figure 5-9. You can toggle back and forth between design and run modes by clicking on the View option in the Results section of the left side of the main menu.

After you have created a query, most DBMSs enable you to save it in a separate file for later use, thus eliminating the need to rewrite it. This saves developer time as well as spares end users the work of creating such queries in the first place. The letters ''qry'' are the standard naming prefix for queries. Thus, as you can see on the tab in Figure 5-9, we named our query ''qryCalifornia License Plates.''

Multiple Criteria. It is also possible to specify multiple criteria in a query. For example, suppose you wanted a list of all car registrants whose cars had California license plates *and* whose last names were ''Curry.'' To create such a query in Access, simply type the name ''Curry'' in the ''Last Name'' column and in the *same* Criteria row as the ''CA.'' Access interprets criteria appearing in the same row as an ''and'' operation. The results will be all those records with last name ''Curry'' *and* whose license plate state is ''CA.'' Similarly, if you specify three criteria in the same row, then Access will find database records in the table satisfying all three requirements.



Last Name	First Name	Phone Number	State Licensed	Number License Plate
Curry	Dorothy	(916) 358-4448	CA	123MCD
Jones	Roberta	(987) 654-2132	CA	876JJH
Kerr	Stephen	(916) 764-3211	CA	498SEK
Mason	Richard	(916) 563-7865	CA	253DAL
Tajiri	Colleen	(916) 543-2211	CA	897ABC

FIGURE 5-9 The result of the query in Figure 5-8.

Sometimes, you might want to search for records that satisfy alternate requirements—for example, car registrants whose cars have California license plates *or* whose last names are ''Curry.'' To create such a query in Access, use multiple lines at the bottom of the Query dialog box in Figure 5-8. The result of this query will be all records that satisfy *either* requirement. (The system will also include records satisfying both requirements.)

Multi-Table Select Queries. Many accounting applications require information that must be drawn from more than one database table. For example, suppose you wanted to create a report similar to the following:

Ticket Number	License Plate	Registered Car Owner	Listed Phone Number	Amount of Ticket
10151	CA 123 MCD	Dorothy Curry	(916) 358-4448	$10.00
10152	CA 123 MCD	Dorothy Curry	(916) 358-4448	$20.00
10231	CA 253 DAL	Richard Mason	(916) 563-7865	$50.00
etc.				

Notice that the information in this report comes from three different tables: the ticket number and license plate number come from the Tickets table, the registered car owner's name and phone number come from the Car Registrations table, and the amount of each ticket comes from the Parking Violations Code table. To create such a report, you must first join the tables using the Relationships window. Chapter 4 explains how to perform this task.

Your next step is to construct the query. Follow the steps outlined above for creating simple queries, being careful to select the data fields shown in Figure 5-10. The results should be similar to those shown in Figure 5-11.

The tasks performed by the query shown in Figure 5-10 are nontrivial. To appreciate this, imagine that you had to create the report above manually, using the information shown in Figure 5-4. If there were hundreds of parking tickets in a given week and thousands of car registration records, the work required for this job would be enormous. But a computerized DBMS using a DML can do this quickly and automatically in just a few seconds—an amazing feat if you think about it!

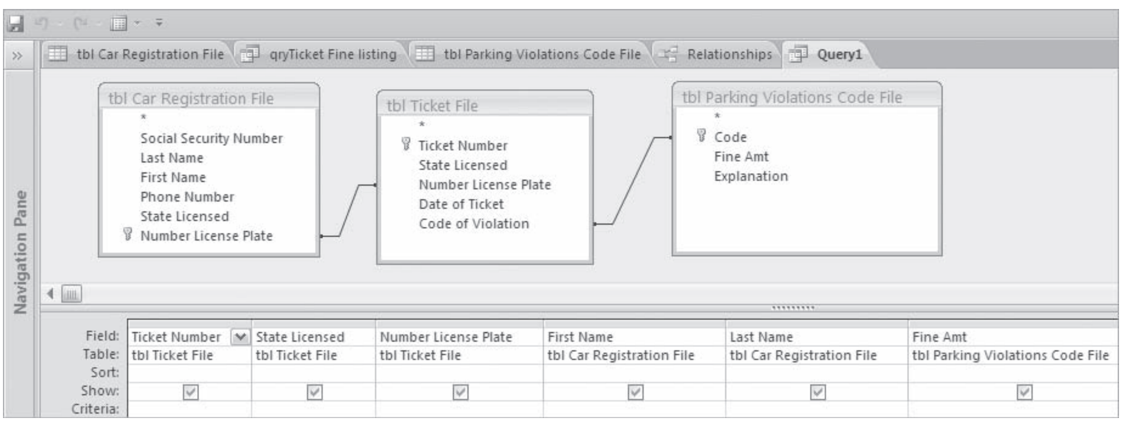


FIGURE 5-10 A multiple-table query.

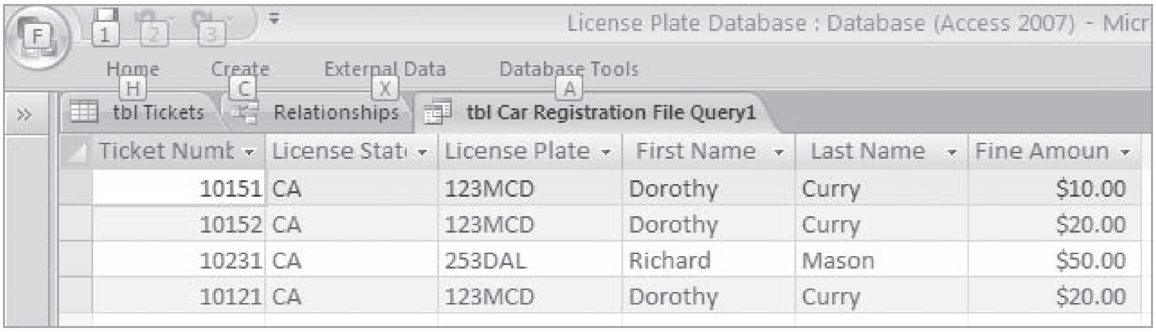


FIGURE 5-11 The results of the multiple-table query in Figure 5-10.

Creating Action Queries

Although most queries simply extract information from database tables, some accounting tasks require users to update, match, or delete multiple records in a single operation. Microsoft Access supports the **action queries** listed below. You can create any of these queries by selecting the appropriate choice from the New Query dialog box shown in Figure 5-12. (To launch this dialog box, select ''Query Wizard'' from the Query dialog box in the Access database main menu.)

1. ***Simple query Wizard*** does the same thing as described previously under ''One-table Select Queries.''
2. ***Crosstab queries*** enable you to perform a statistical analysis of the data in a table and provide the cross-tabulation results in a row-and-column format similar to a pivot table in a spreadsheet. For example, a crosstab query might show the average invoice amount for each vendor in a vendor table, or the average credit purchase for each customer living in a specified zip code.

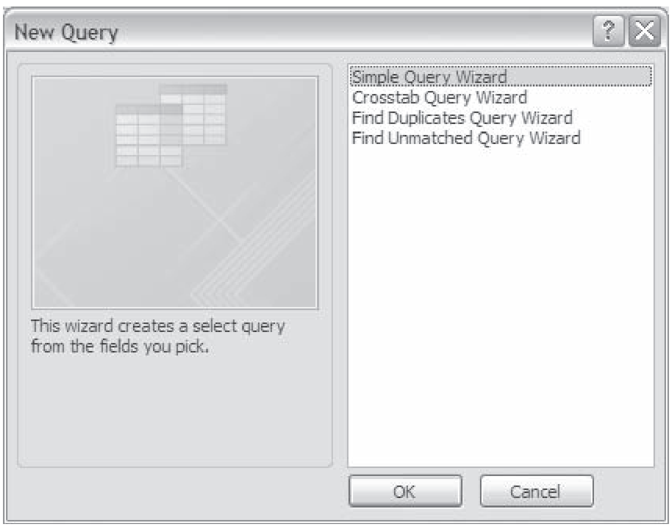


FIGURE 5-12 The Query Wizard screen of options available in Access.

3. ***Find-Duplicates queries*** enable you to find those records with duplicate entries in a specified field. Many common auditing tasks require such queries—for example, finding duplicate customer orders, finding employees with the same employee or Social Security number, or searching for different vendor records with the same address. Note that a simple select query might enable you to find *one example* of such duplicates. A find-duplicates query enables you to find *all duplicates* with a single query.
4. ***Find-unmatched queries*** enable you to find the records in one table with no matching record in another table. For example, such queries enable auditors to identify those payroll records with no matching employee records or identify those vendor invoices with no matching supplier record.
5. ***Delete queries*** enable you to delete table records selectively. Applications include the ability to delete the records of (1) employees who quit the organization, (2) students who drop out of school or graduate from school, or (3) inventory products no longer sold by the company.
6. ***Append queries*** enable you to append records from one table to the end of another table. Accounting examples include the ability to add the payroll records for the current period to a year-to-date table or to consolidate the employees from two departments into a single table.
7. ***Sum a column*** by clicking the Sum figure. The word ''Total'' will be added in the first column, and click under the ''Fine'' amounts and the column will be added together.
8. ***Update queries*** enable you to alter selected table records systematically. Accounting applications include the ability to raise all suggested retail prices of a particular product line by 10%, lower the salaries of all those employees with a low performance rating by 5%, or delete shipping charges for all customer purchases over a set limit.
9. ***Make-table queries*** enable you to create a new table from the records that you select in an existing table. For example, a university might want to create a separate table of all graduating seniors. A common accounting application is to create a separate table of all the records you are about to delete using a delete query.

Guidelines for Creating Queries

The preceding discussions explained various kinds of select queries and action queries. Here are some guidelines to help you create error-free queries using Microsoft Access:

1. ***Spell accurately and be sensitive to capitalization.*** The criteria for Access select queries are case sensitive. For example, you will not get matches if you specify California licenses as ''Cal'' or ''Ca'' in a criteria line if the entries in the underlying database table are ''CA.''
2. ***Specify AND and OR operations correctly.*** If you want a query to satisfy two conditions simultaneously (i.e., perform an AND operation), enter the criteria on the *same line* of your query. If you want a query to satisfy *either* of two conditions (i.e., perform an OR operation), place them on successive criteria lines.
3. ***Tables must be joined properly.*** If you wish to construct a multi-table query, the tables must first be joined properly in Access' Relationships window.
4. ***Name queries systematically.*** Query names should begin with the standard ''qry'' prefix. It also helps to assign mnemonic query names—for example, ''qryCustomers_in_California,'' ''qryGraduating_Seniors'' and so forth.

5. ***Choose data fields selectively.*** Double-clicking on the asterisk (*) in the data field list of a table (e.g., the first symbol in each of the three table lists in Figure 5-10) enables you to include *all* the data fields from that table in your query. Because most commercial database tables have many data fields, using this option can result in a large number of data fields (i.e., columns in the lower portion) of your query. This makes query design unwieldy.

Structured Query Language (SQL) and HyperText

In addition to using a DML in a DBMS, you can also access selected information from a database using a *data query language*. The American National Standards Institute (ANSI) has adopted standards for one such query language: **structured query language (SQL)**. This language is important because many relational databases such as *Access* support it. Figure 5-13 shows how you might construct the request for records with California license plates using SQL.

SQL is a useful tool for auditors. In Microsoft Access, the user points to a database table to include in a query. With SQL, the user specifies a table and fields, using commands such as FROM, SELECT, and WHERE. FROM identifies the table source, and SELECT chooses the data fields to include in the query. The WHERE command can specify criteria, such as ‘‘State = CA.’’ An auditor could select files for review using these commands. For example, the WHERE command could refer to sales orders in excess of a specified dollar amount.

Yet another way of finding such information is with **hypertext**. DBMSs use hypertext by highlighting key words or display text in different-colored characters. Clicking on a keyword with your mouse directs the DBMS to move directly to that entry. One hypertext example is Apple’s Hypercard for Macintosh microcomputers. Another example is **Hypertext Markup Language (HTML)**, the language for creating web pages. Hypertext systems are especially useful for researching technical materials in which you find it convenient to jump from subject to subject or web page to web page.

Case-in-Point 5.4 Wikipedia.org hosts one of the largest encyclopedias or compendiums of online information, containing (for example) almost 3 million articles in English. Most articles explain a term or concept such as “accounting information systems” in simple language, and include hyperlinks (in blue) to explanations of the technical terms contained in each article.[4]

It is also possible to store hypertext entries directly *in* databases. For example, you might want to store a ‘‘live’’ web address or email address *within* the records of a table.

```
SELECT (LastName, FirstName, PhoneNumber, LicPlateState, LicPlateNo)
FROM CarRegistrationFile
WHERE LicPlateState = CA;
```

FIGURE 5-13 An example of SQL instructions for the example of Figure 5-7. These instructions will list the last name, first name, phone number, license plate state, and license plate number of all cars with license plate state code ‘‘CA.’’

[4]Source: from the authors.

Conversely, you might want to store hypertext links within the body of database forms or other screen objects. Modern databases such as Access provide tools for performing such tasks. An additional version of hypertext is **eXtensible Markup Language (XML)**, which allows end users to create their own tagging standards as well. We discuss XML in greater detail in Chapter 12.

Sorting, Indexing, and Database Programming

In addition to accessing or listing records selectively, a DBMS also enables you to reorganize an entire table. One way to do this is by sorting records, which means physically rewriting records on a disk in the desired order. This is both time consuming and usually unnecessary. It is faster and easier to index your records (refer back to the last row of Figure 5-5), which merely creates a table of record keys and disk addresses that accomplishes the same purpose as sorting. Thus, when users specify ''sort'' in queries, Access does not physically reorder records but instead merely temporarily assembles the information for display purposes.

Finally, even the best DBMS software cannot anticipate every user's processing needs. For this reason, advanced DBMSs include programming tools that enable users to develop their own processing applications. One common requirement is for customized data-entry screens, which enable users to include better data descriptions and more detailed instructions on input screens. Similarly, programming languages (such as VBA for Microsoft Access) enable users to create custom processing routines—for example, to create their own data-validation routines. This end-user programming is important because it enables users to perform their own data processing without the technical assistance of IT professionals.

Online Analytical Processing (OLAP) and Data Mining

Although SQL enables users to extract data from one or more database tables, **online analytical processing (OLAP)** allows users to extract complex information that not only describes ''what'' happened, but helps explain *why* it happened. Several software developers now market OLAP packages. Examples include *Integration Server* (Arbor Software), *Holos* (Seagate Technology), *PowerDimensions* (SyBase), *Plato* (Microsoft), and *WhiteLight* (WhiteLight Systems). Some of these tools only work with specific databases, while others interface with several of them. Most allow end users to perform their own database analyses, including data mining (discussed shortly).

OLAP Features. An important feature of OLAP is the ability to conduct multidimensional analyses (Figure 5-14). One dimension may be ''time.'' Other dimensions might be ''customer,'' ''product,'' or ''geography.'' For example, OLAP can help you examine sales over time for a particular product in a specific geographical region. Another feature of OLAP is a ''drill-down'' capability. This allows you to examine data at increasing levels of detail. As an example, you can take sales for one quarter shown by geographical region and drill down to see sales for each state, and then for each major city within that state. Similarly, you can drill down sales from a product line to a specific product, and then to a specific product size or color. This type of analysis can provide the ''why'' behind what has happened.

OLAP has a variety of other helpful features. One is the ability to create **pivot tables**, which are two-dimensional statistical summaries of database information (and similar to the pivot tables of Microsoft Access or Excel). The example in Figure 5-14 is a two-dimensional

Sales Report—Best Multimedia
2nd Quarter 20xx

	Northeast	Northwest	Southeast	Southwest	Midwest	TOTAL
Total Sales						
CDs	**$50,000**	**$45,000**	**$37,000**	**$34,100**	**$34,000**	**$200,100**
Pop Rock	$30,500	$20,000	$22,000	$17,000	$19,000	$108,500
Jazz	$4,200	$7,500	$5,000	$4,100	$2,200	$23,000
Show Tunes	$8,200	$10,000	$4,800	$6,000	$4,700	$33,700
Rap	$7,100	$7,500	$5,200	$7,000	$8,100	$34,900
DVDs	**$80,800**	**$92,000**	**$78,000**	**$56,000**	**$60,200**	**$367,000**
Action	$12,000	$13,000	$11,000	$9,700	$9,000	$54,700
Classics	$14,000	$18,000	$25,000	$ 11,000	$7,000	$75,000
Comedy	$16,000	$17,000	$16,200	$13,400	$17,600	$80,200
Drama	$15,900	$17,100	$16,100	$13,400	$17,600	$80,100
Horror	$14,900	$17,900	$1,700	$1,500	$1,000	$37,000
Mystery	**$8,000**	**$9,000**	**$8,000**	**$7,000**	**$8,000**	**$40,000**
Suspense	$2,000	$3,800	$1,800	$3,000	$2,000	$12,600
Thrillers	$4,000	$4,000	$5,000	$3,000	$5,000	$21,000
True Crime	$2,000	$1,200	$1,200	$1,000	$1,000	$6,400
Software	**$22,000**	**$20,800**	**$19,700**	**$20,000**	**$25,000**	**$107,500**
Total	$152,800	$157,800	$134,700	$110,100	$119,200	$674,600

FIGURE 5-14 A pivot table showing a drilldown of sales totals by product type and region.

analysis of sales by product (on the vertical axis) and region (along the horizontal axis). Pivot tables enable users to choose what type of summary information to display (e.g., total sales, average sales, or maximum sales), as well as to change an overall selection category (e.g., change the period in which to view sales data). Further information about OLAP features, products, and reviews about OLAP software can be found at www.altaplana.com/olap and www.olapreport.com.

Data Mining. Closely connected to OLAP is the concept of **data mining**, which means using a set of data analysis and statistical tools to detect relationships, patterns, or trends among stored data. For example, data mining tools might enable an auditor to reveal suspicious payments by a governmental agency. Data mining also helps advertisers in cross-selling products or offering tie-in promotions, retailers decide product placements in their stores (e.g., placing snacks near the frozen pizza section), and sales managers increase customer satisfaction. Because data-mining tools can sift through massive amounts of corporate data to detect patterns, they can be particularly effective tools for firms seeking to better understand their customers and what they want or need.

Case-in-Point 5.5 Talbots is a leading retailer of women's wear whose legacy batch reporting system was unable to provide managers with timely information. To address this problem, the company recently installed SQL Server 2005—a data warehouse system from Microsoft—and additional software that transfers POS data such as purchases directly into the warehousing system in real time. The new software provides managers with up-to-the-minute information on sales and inventory, thereby enabling them to make better staffing decisions as well as respond more quickly to changing market conditions.[5]

A wide variety of software tools now provide data mining capabilities. One possibility is to use the data-mining tools that already exist in OLAP software, database software, or artificial intelligence algorithms. Alternately, users can purchase specific software packages for data-mining tasks—for example, Darwin (Oracle), Intelligent Miner (IBM), Enterprise Miner (SAS), or Clementine (SPSS).

Although the most popular uses of data mining are related to sales and marketing, there are many accounting applications as well. One possibility is for auditors to use data mining to detect credit-card anomalies or suspicious behavior. For example, fraudulent credit card transactions may follow a pattern, such as an increase in the total amount of purchases immediately following a credit card theft or products with special characteristics (such as ones that can easily be sold). Another application is for investors to use data-mining tools to predict corporate bankruptcies. A third application is for government workers to use such tools to identify fraudulent claims for worker's compensation or excessive uses of welfare services.

OBJECT-ORIENTED DATABASES, MULTIMEDIA DATABASES, AND DATA WAREHOUSES

The databases that we have discussed so far are traditional ones that mostly handle text data (i.e., data that can be neatly organized and categorized according to the values stored in text or numeric data fields). Not all databases are this simple.

Object-Oriented and Multimedia Databases

An **object-oriented database (OODB)** is a database that contains both the text data of traditional databases and information about the set of actions that can be taken on these data fields. For example, a payroll file might contain not only traditional information about an employee, but also instructions that indicate how to compute an employee's net pay.

Case-in-Point 5.6 Geotagging means using an object-oriented database to store geographic information about entities of interest using a digital geographic map. In a typical application, the system allows users to indicate where they live or work, thereby helping individuals arrange for car pools. Flickr (flickr.com/map) allows camera users to upload pictures to indicate where the pictures were taken. Marketers suggest that such systems will soon allow advertisers to better target their customers.[6]

Many OODBs are **multimedia databases** that include graphics, audio information, and animation. These databases also typically store information about how to display graphics, how to play audio clips, and so forth. Multimedia databases are used by real estate brokers to store pictures and perhaps narrated tours of listed properties, by companies to train

[5]Source: (No author), ''Talbots to Boost Efficiency with Microsoft-based Retail Data Warehouse'' *Apparel Magazine* Vol. 47, No. 6 (February 2006), p. 18.

[6]Source: Rubel, Steve ''Location, Location, Location'' *Advertising Age* Vol. 77, No. 39 (September 25, 2006), p. 29.

FIGURE 5-15 The employee records of this security database contain both text data and the picture of each employee.

employees, by police departments to store "mug shots" and voice prints of prisoners, and by publishing houses to enhance the descriptions of everything from cookbooks to encyclopedias. Your employer might even use such a database to store your picture in an employee file (Figure 5-15).

Specialized accounting applications of multimedia databases include those that store the audio portions of audit interviews, pictures of important assets, or images of critical financial contracts. These "unstructured objects" require a new definition of what we mean by "data" and how we organize them. But OODB records can still be manipulated. For example, a speech still has such characteristics as "speaker," "subject," and "length," and these characteristics can be used to search a database table and retrieve the desired object, whatever that might be.

Like multimedia databases, **multidimensional databases** store large quantities of data. The ultimate goal of such databases is to enable employees at various levels of an organization to define their own tables and reports in formats that are most useful to them. Some multidimensional databases accomplish this goal by combining data from several independent data sources. Others do so with unique data schemas, while still others do so by enabling users to scale existing data fields or otherwise define their own data fields. Because it is not clear how best to deliver quality data to organizational users, the subject of multidimensional database development is an active area of research.

Data Warehouses

Where feasible, it often makes sense to pool the data from separate applications into a large, common body of information called a **data warehouse**. The data in a data warehouse are rarely current. Rather, they are typically "older information" that were initially collected for other reasons during the conduct of normal operations and daily activities of an organization. For example, a sales transaction creates data that help management make decisions about production, cash availability, and so on. The sales transaction data also impact financial statements. Managers are learning, though, that much of the data gathered about sales and other operational activities can also be useful strategically. For example, in recording a sale, an AIS collects data about the customer, the product, the timing of the sale, and so on. This information can be helpful in predicting future sales of specific products or by a certain category of customers. To obtain these benefits from the data collected, the data must be amassed in a central location—the data warehouse.

To be useful, the data in data warehouses should have the following characteristics: (1) free of errors, (2) defined uniformly, (3) span a longer time horizon than the company's transaction systems, and (4) optimized data relationships that allow users to answer complex questions—for example, queries requiring information from several diverse sources.

One advantage of a data warehouse is to make organizational information available on a corporate-wide basis. For example, with such an approach, the marketing representatives of a company might then gain access to the company's production data and thereby be better able to inform customers about the future availability of desired, but as yet unmanufactured, products. This idea is also central to the concept of an **enterprise-wide database** (i.e., a large repository of organizational data that comes from, and is available to, a wide range of employees). Another advantage is to facilitate data mining.

Case-in-Point 5.7 With more than 9 million customers, KeyBank (www.key.com) is the thirteenth largest bank in the United States. To help market financial products, the bank created a million-dollar DB2 data warehouse that allows its managers to determine what investments its customers prefer (e.g., CDs or mutual funds), and how best to sell products (e.g., direct mail or Internet). Bank officials credit the data warehouse, the decision tools that mine it, and the ability of different departments to share data for increasing customer contacts by 200%, and a 100% return on the investment in 14 months.

Building a data warehouse is a difficult job. The developers must first decide what data to collect, how to standardize and **scrub** (clean) the data to ensure uniform accuracy and consistency, and how to deal with computer records that typically begin in a non-normalized form. One reason for these difficulties is that the data in data warehouses may come from several sources—for example, an AIS in one case and a production application in another case. As a result, the same data element could have two different representations or values—for example, an eight-digit numeric product code in the AIS and a six-digit alphabetic character code in the production application. Similarly, one corporate division might capture sales daily while another collects the same data weekly. The developers must determine data standards in both cases, reconcile any discrepancies, and account for missing fields and misspellings. Another challenge is to build the data warehouse in such a way that users can access it easily and find answers to complex questions.

If data warehouses are so costly, difficult, and time consuming to develop, why do companies bother with them? The answer is that they generate many benefits in return, including increased employee access to valuable information, the ability to answer complex questions, and a potential return on investment that can exceed 400%.

Case-in-Point 5.8 Provident Central Credit Union is one of the largest credit unions in the United States. Recently, it created a data warehouse to make use of the rich transaction and customer data it gathers. The company plans to use the data in the warehouse to conduct one-to-one marketing campaigns for custom products and to improve its pricing and responsiveness to its membership of almost 96,000 customers. The data warehouse holds the answers to many complex questions such as, "Who are the most profitable customers?" and "How can we improve our customer relationships through product and service offerings?"[7]

Where corporate executives believe the rewards for building a data warehouse are not high, they can opt instead to build a **data mart**. Data marts are smaller than data

[7]Source: www.taborcommunications.com/dstar/01/0508/103021.html.

warehouses in storage size and typically focus on just one application area—for example, marketing data. However, in most other ways, they are similar to data warehouses.

AIS AT WORK
Run Your Data Warehouse Like a Fine Restaurant

What do a data warehouse and a fine restaurant have in common? According to Margy Ross and Ralph Kimball of the Kimball Group—a consulting company specializing in data warehousing—quite a bit. Here are several ideas:

In the restaurant:	Restaurant staffers create meal plans and then develop customer menus based on these offerings.
In the data warehouse:	Data warehouse developers provide menus of what data are available, typically through online display screens.
In the restaurant:	The physical layout is highly efficient, with concern for high levels of throughput.
In the data warehouse:	Thus, the same concern for efficiency and high levels of throughput applies. Patrons don't want to wait for data any more than restaurant patrons want to wait for their meals. This is why the data warehouse was created in the first place—to streamline the delivery of information to end-users.
In the restaurant:	Good meals depend upon quality raw materials.
In the data warehouse:	Good outputs also depend upon quality inputs. Thus, the system validates incoming data for such factors as (1) reasonableness, (2) integrity, and (3) value to end-users.
In the restaurant:	Professional employees staff the restaurant and use professional tools in their jobs.
In the data warehouse:	Professionals create, monitor, and develop the policies that govern operations—not patrons. This is no place for amateurs.
In the restaurant:	''Hard work'' and ''high quality'' are the watchwords of the operation, because what gets delivered to the customer can make or break the restaurant. Delivering consistent, high-quality meals is important because the restaurant's reputation depends on them.
In the data warehouse:	The same requirements of high data quality, integrity, and consistency are the order of the day. Consumers don't want half-baked (incomplete or flawed) information any more than they want half-baked food.
In the restaurant:	The kitchen itself is off limits to patrons. Security is important both for the safety of the customers and the kitchen staff.
In the data warehouse:	The same security concerns apply. Customers stay outside the preparation area, and are confined to the ''eating area.''
In the restaurant:	Managers often check with diners to ensure their satisfaction.
In the data warehouse:	Customer needs are also very important, and monitoring user satisfaction is just as desirable.

Source: Margy Ross and Ralph Kimball. ''Data Warehouse Dining Experience'' *Intelligent Enterprise* Vol. 7, No. 1 (January 1, 2004), pp. 12–14.

SUMMARY

- Databases must be designed carefully. The process of normalization enables designers to minimize data redundancy, insertion and deletion anomalies, and transitive dependencies. The goal is to develop a database that is at least in third normal form.
- Database management systems (DBMSs) enable users to create their own databases using data definition languages (DDLs) and to manipulate file data using data manipulation languages (DMLs).
- Designers use a variety of data-validation techniques to help ensure data accurancy and integrity. Examples include choosing data types carefully for data fields, using input masks, using default values, creating a wide variety of validation rules, and enforcing referential integrity.
- An important use of databases is to extract selected information, and Access provides a number of tools for constructing select queries and action queries. These tools allow users to extract data from a single table or from multiple tables. Following the guidelines in this chapter can help you avoid errors when creating such queries.
- Three additional ways of extracting information from databases are to use structured query language (SQL), online analytical processing (OLAP) tools, or hypertext.
- Users can also manipulate database information by sorting, indexing, using data mining tools, or performing specialized tasks with end-user programming languages.
- Object-oriented databases (OODBs) enable users to store both data and instructions on how the data should be displayed or computed. Multimedia databases are OODBs that enable users to store graphics, pictures, sound clips, and animation clips in addition to text data.
- Data warehouses typically combine the information from separate databases into large sets of cross-functional data repositories that can help businesses increase data-retrieval efficiency, output productivity, and long-term profitability.

KEY TERMS YOU SHOULD KNOW

action query
data definition language (DDL)
data manipulation language (DML)
data mart
data mining
data warehouse
database management system (DBMS)
default value
dynaset
enterprise-wide database
first normal form (1 NF)
flat file
hypertext
hypertext markup language (HTML)
multidimensional database
multimedia database
normalization
object-oriented database (OODB)
online analytical processing (OLAP)
pivot table
query
query wizard
referential integrity
schema
second normal form (2 NF)
select query
structured query language (SQL)
subschema
third normal form (3 NF)
transitive dependencies
validation rule
XML (extensible markup language)

TEST YOURSELF

Q5-1. A database is in third normal form (3 NF) if it is second normal form and:

a. All the data attributes in a record are well defined

b. All the data attributes in a record depend upon the record key
c. The data contain no transitive dependencies
d. The data can be stored in two or more separate tables

Q5-2. The difference between (1) a database management system (DBMS) and (2) a database, is:
a. Nothing—these terms are synonyms.
b. The first is hardware, the second is software
c. The first is program software, the second is proprietary data and related files
d. The first refers to a complete accounting system, the second refers to a subset of that

Q5-3. An example of a *validation rule* is:
a. An input value must be an integer
b. An input value must also have a default value
c. An input value must be between 0 and 40
d. You cannot delete parent records that have child records associated with them

Q5-4. To construct a select query in Microsoft Access in which you want to satisfy two conditions simultaneously—i.e., implement an *and operation*—you should:
a. Specify both criteria in *separate fields* of the same Criteria line of the query
b. Specify both criteria in the *same field* of the Criteria line of the query
c. Specify each criteria in *separate fields and in separate Criteria lines* of the query
d. Give up; this is not possible in Microsoft Access

Q5-5. To adjust the minimum wage of all payroll employees to the current federal level, you should use a(n):
a. Update query
b. Append query
c. Find minimums query
d. Tax expert

Q5-6. To identify all those employees receiving payroll checks but who have no matching record in a payroll master file, you should use a(n):
a. Auditor
b. Find unmatched records query
c. Cross-tabs query
d. Update query

Q5-7. All of the following are examples of DBMSs *except*:
a. Access
b. Oracle
c. DB2
d. SQL

Q5-8. All of the following are examples of action queries *except:*
a. Update query
b. Append query
c. Delete query
d. Find missing data query

Q5-9. The difference between (1) using an update query and (2) updating a single record is:
a. Nothing—these are the same thing

b. The first updates all selected records, the second only affects one record

c. The first updates more than one table, the second updates only one record

d. None of these is correct.

Q5-10. Which of these database tools is an accounting manager most likely to use to perform online, ''drill-down'' analyses?

a. Creating pivot tables

b. OLAP

c. HTML web pages

d. SQL

Q5-11. SQL is an example of:

a. A tool to perform online analytical processing

b. A database management system

c. A query language

d. A multimedia database

DISCUSSION QUESTIONS

5-1. What is the process of normalization? What levels are there, and why do database developers seek to normalize data?

5-2. What are database management systems? Are they the same as databases? Why are DBMSs classified as software and not hardware?

5-3. What are data definition languages (DDLs)? How are they related to DBMSs?

5-4. What is a record structure? When defining a record's structure, what is meant by the term ''data type?'' Give some examples of data types.

5-5. Why do database developers link tables together? How is this done using Access?

5-6. What is data validation? Why is it important? Give some examples of how to validate data inputs using Access.

5-7. What is a database schema? What is a database subschema? Give some examples of database schemas and subschemas for the payroll file of Figure 5-1.

5-8. What are data manipulation languages? How are these languages related to database management systems? How are these languages related to databases?

5-9. What is SQL? How is SQL like an Access query? How is it different?

5-10. What is online analytical processing? How is OLAP related to databases? What is a pivot table, and how are pivot tables and OLAP related?

5-11. What is the difference between ''sorting records'' and ''indexing records'' in a database?

5-12. What is ''data mining?'' How is data mining useful to profit-seeking companies? What are some accounting uses of data mining?

5-13. What are object-oriented databases? What are multimedia databases? How are these two types of databases alike? How are they different?

5-14. What are data warehouses? How are they like databases? How do they differ from databases?

5-15. Why would a company be interested in creating a data warehouse? Why would a company n*ot* be interested in creating a data warehouse?

PROBLEMS

5-16. Discuss both the advantages and disadvantages of using a computerized database system rather than a manual system for storing and processing accounting data. In your discussion, provide some specific accounting examples that illustrate your advantages and disadvantages.

5-17. What words are used to form each of the following acronyms?
(a) DBMS (b) DDL (c) DML (d) SQL (e) OLAP (f) OODB

5-18. The Wilmer Ruiz Corporation employs the individuals listed in the data shown in Figure 5-16. Use a DBMS to create a database of this information.

a. What record structure did you use for this database? Identify the names, widths, and other characteristics of each field you created.

b. List all employees in Department 5. Print this list.

c. List all employees with first name ''Brenda.'' Print this list.

d. List all those employees with pay rates over $6.50. Print this list.

e. List all those employees eligible for overtime (T = yes; F = no). Print this list.

5-19. Use the web to find business applications of data warehousing. Why do companies create data warehouses, and what are some accounting uses of such warehouses?

5-20. Use the web to find business applications of online analytical processing (OLAP). Why do companies use OLAP? What is the connection between OLAP and databases?

Record Number	Last Name	First Name	Social Security Number	Dept	Pay Rate	Over-time
1	ADCOX	NORMAN	901795336	1	6.50	Yes
2	KOZAR	LINDA	412935350	1	6.50	Yes
3	MCLEAN	KAY	405751308	1	7.50	No
4	CUNNINGHAM	TOM	919782417	3	7.50	Yes
5	DANIELS	PATRICIA	517351609	3	5.50	Yes
6	MCGUIRE	ANNE	201891647	3	5.50	Yes
7	REEDER	BRENDA	619294493	3	5.50	Yes
8	BLOOM	BRENDA	513321592	4	6.25	Yes
9	DAVIS	DENISE	517351608	4	5.50	Yes
10	DUFFY	LESLIE	314532409	4	8.50	No
11	HARPER	LINDA	615824130	4	5.75	Yes
12	MORGAN	MEREDITH	704563903	4	6.25	Yes
13	WELSH	KAREN	216253428	4	8.25	No
14	CHAPIN	GEORGE	203767263	5	7.50	Yes
15	FINN	JOHN	715386721	5	6.25	Yes
16	HALPIN	MARSHA	913541871	5	6.50	Yes
17	LAURIN	PHILIP	514484631	5	6.50	Yes
18	MIAGLIO	PEGGY	414224972	5	6.25	Yes
19	TURNER	BRENDA	713589164	5	8.50	No
20	ZORICH	MILDRED	504455827	5	6.50	Yes

FIGURE 5-16 Employees of the Wilmer Ruiz company.

Personnel File
Date: October 10, 20xx

	Employee Number	Score on Aptitude Test	Department ID	Current Pay Rate	Sex
BAKER, JEFFREY L.	1692	73	A	$7.50	M
BARRETT, RAYMOND G.	3444	53	B	7.45	M
BLISS, DONALD W.	6713	55	D	6.80	M
BOWERS, PAUL D.	2084	42	B	5.90	M
BUCHANAN, CINDY	3735	41	E	7.80	F
CHEUNG, WAI KONG	8183	55	C	7.80	F
CONRAD, MARK E.	8317	58	D	9.60	M
DAILY, REBECCA E.	2336	45	D	8.90	F
DRISCOLL, DAVID M.	5210	47	D	7.70	M
ERICKSON, KURT N.	2217	53	B	8.50	M
FRANTZ, HEIDI L.	6390	55	A	6.90	F
GARROW, SCOTT D.	8753	61	A	7.40	M
HARDENBROOK, LISA A.	7427	40	C	6.70	F
JACKSON, GREG W.	4091	67	D	8.90	M
LANGLEY, JERRY W.	3262	86	E	9.40	M
LUBINSKI, TRAVIS M.	3865	37	D	7.50	M
LYNCH, SHERENE D.	7857	66	D	8.90	F
MARKHAM, KYLE R.	6766	62	A	7.90	M
MCGUIRE, TANA B.	4052	55	A	9.20	F
MONACH, SHERI L.	8082	48	B	9.10	F
MOORE, MICHAEL S.	2431	67	E	8.50	M
NELSON, JOHN R.	5873	46	B	7.40	M
PAPEZ, PETER M.	7799	41	E	8.30	M
PETTINARI, DARIN M.	1222	56	B	8.40	M

FIGURE 5-17 Employee data for the Marcia Felix Corporation.

5-21. The information in Figure 5-17 is for the employees of the Marcia Felix Corporation. Use a DBMS software package to create a database for it.

- **a.** What record structure did you design? Identify the names, widths, and other characteristics of each field in a typical record.
- **b.** Sort these employees by department. Print this list.
- **c.** Sort these employees by pay rate. Print this list.
- **d.** Sort these employees by test score. Print this list.
- **e.** Sort these employees by department and alphabetically by last name within department.
- **f.** What is the average test score for these employees?
- **g.** What is the average score for females? What is the average score for males?
- **h.** What is the average pay rate for these employees?
- **i.** What is the average pay rate for females? What is the average for males?
- **j.** What females scored over 70 on their examinations? What males scored over 50?

5-22. Bonadio Electrical Supplies distributes electrical components to the construction industry. The company began as a local supplier 15 years ago and has grown rapidly to become a major competitor in the north central United States. As the business grew and the variety of components to be stocked expanded, Bonadio acquired a new computer and implemented an inventory control system and a computerized accounting sysem. Because of its operational importance, the inventory system has been upgraded to an online system, while all the other applications are operating in batch mode. Over the years, the company has developed or acquired more than 100 application programs and maintains hundreds of files.

Bonadio faces stiff competition from local suppliers throughout its marketing area. At a management meeting, the sales manager complained about the difficulty in obtaining immediate, current information to respond to customer inquiries. Other managers stated that they also had difficulty obtaining timely data from the system. As a result, the controller engaged a consulting firm to explore the situation. The consultant recommended installing a database management system (DBMS), and the company complied, employing Jack Gibbons as the database administrator.

At a recent management meeting, Gibbons presented an overview of the DBMS. Gibbons explained that the database approach assumes an organizational, data-oriented viewpoint, as it recognizes that a centralized database represents a vital resource. Instead of being assigned to applications, information is more appropriately used and managed for the entire organization. The operating system physically moves data to and from disk storage, and the DBMS is the software program that controls the data definition library that specifies the data structures and characteristics. As a result, both the roles of the application programs and query software, and the tasks of the application programmers and users are simplified. Under the database approach, the data are available to all users within security guidelines.

a. Explain the basic difference between a file-oriented system and a database management system.

b. Describe at least three advantages and at least three disadvantages of the database management system.

c. Describe the duties and responsibilities of Jack Gibbons, the database administrator.

(CMA Adapted)

CASE ANALYSES

5-23. Swan's Supplies (Normalizing Data)

Swan's Supplies is a wholesaler of sporting goods equipment for retailers in a local metropolitan area. The company buys sporting goods equipment direct from manufacturers and then resells them to individual retail stores in the regional area. The raw data in Figure 5-18 illustrate some of the information required for the company's purchase order system. As you can see, this information is characteristic of accounting purchase order

Purchase Order Number	Date	Customer Number	Customer Name	Customer Phone Number	Item Number	Item Description	Unit Cost	Unit	Quantity Ordered
12345	8/19/03	123-8209	Charles Dresser, Inc.	(752) 433-8733	X32655	Baseballs	$33.69	dozen	20
					X34598	Footballs	53.45	dozen	10
					Z34523	Bball Hoops	34.95	each	20
12346	8/19/03	123-6733	Patrice Schmidt's Sports	(673) 784-4451	X98673	Softballs	35.89	dozen	10
					X34598	Footballs	53.45	dozen	5
					X67453	Soccer balls	45.36	dozen	10

FIGURE 5-18 Some purchasing data for Swan's Sports Supplies.

systems but is not well organized. In fact, because of the repeating groups in the right-most columns, it cannot even be stored in a computer system.

Requirements

Store this data in a spreadsheet to make it easy to manipulate. Then perform each of the following tasks in turn:

1. Reorganize the data in first normal form and print your spreadsheet. Why is your data in first normal form?
2. Reorganize the data from part 1 into second normal form and print your spreadsheet. Why is your data in second normal form?
3. Reorganize the data from part 2 into third normal form and print your spreadsheet. Why is your data in third normal form?

5-24. Bonnie P Manufacturing Company (Data Validation Using a DBMS)

The payroll department at the Bonnie P Manufacturing Company has defined the following record structure for employee records.

Date Field	Data Type	Example
Last Name	Text	Kerr
First Name	Text	Stephen
Social Security number	Text	123-45-6789
Home phone number	Text	(987) 456–4321
Work phone extension	Number	123
Payrate	Currency	$12.34
Number of tax exemptions	Number	3
Department	Text	A

All fields are required. The employee's Social Security number serves as the record key. Work phone extensions are always greater than ''100'' and less than ''999.'' Pay rates are always at least $7.75 and no more than $29.85. The maximum number of tax exemptions allowed is ''10.'' Finally, there are only three departments: A, B, and C.

Requirements

1. Using a DBMS such as Access, create a record structure for the company.
2. Create data validation rules for as many data fields as you can. For each data validation rule, also create validation text that the system can use to display an appropriate error message. Create a list of such rules on a separate piece of paper.
3. Create employee records for yourself, and employees with the last names Anderson, Baker, and Chapman using data that you make up. Print this information.
4. Attempt to create one more record that violates a data validation rule. Create a screen capture of one or more violations, as suggested by your instructor.

5-25. Clifford Cohen University (Enforcing Referential Integrity)

Clifford Cohen University was founded as a small, liberal arts school just three years ago. Since that time, the institution has grown to the point where parking on campus is difficult and parking in illegal areas is common. Accordingly, the Board of Directors has reluctantly approved a policy requiring campus police to issue parking tickets.

Currently, the university requires students and faculty to register their cars with the parking office, which issues them parking decals that registrants must display inside the front windshield of their cars. At present, all record keeping at the parking office is done manually, severely limiting the ability of office personnel to create reports or perform meaningful statistical analyses about parking on campus. For example, it is currently not known how many students of each class (freshman, sophomore, etc.) register their cars or how many full-time faculty, part-time faculty, or clerical staff register their cars. The new policy of writing parking tickets will only add to this problem because it will require office staff to match parking tickets to student or faculty names. In addition, the Board of Directors would like an end-of-semester report indicating how many parking violations of each type (meter violation, invalid parking sticker, etc.) are issued by the campus police.

To help solve these problems, the University Board of Directors has hired you to create a computerized system for them. You realize that a database system might work for this, and accordingly propose a database of tables with record structures similar to those in Figure 5-4. The Board of Directors approves your plan, but asks that you create a small system to demonstrate its features before creating a full-blown system.

Requirements:

1. Use Microsoft Access (or an alternate DBMS designated by your instructor) to create the three tables illustrated in Figure 5-4. What data type did you specify for each data field in each table?
2. Create at least three records in the car registration table. Be sure to use your own name as one of the registrants. Also, create at least three records for the Parking Violations Code File. Make up your own fine amounts instead of using the ones shown in the figure.
3. For each record you create in the car registration file in step 2 above, create at least three parking tickets and input this information to the Tickets File. Thus, you should have at least nine records in this file. Be sure that at least one record in the Tickets File contains a reference to each of the records in the Parking Violations Code File (i.e., at least one person breaks every possible parking violation). Print copies of the records in each table for your instructor.
4. Attempt to create a record in the Ticket File that contains a nonexistent ticket code in the parking Violations Code File. Were you successful?
5. Link the tables together, following the directions in Chapter 4. (Be sure to check ''enforce referential integrity'' when you see the dialog box illustrated in Figure 4-19.) When you finish, your relationships window should resemble the one shown in Figure 5-10. What are the relationships among the records in the three tables? Print a copy of this window as documentation for your project.
6. Now return to the Tables portion of Access and display the Car Registration table. You should now see the plus symbols illustrated in Figure 4-18. Click on one of these symbols. Are you able to view the linked records?

7. Now again attempt to create a record in the ticket file that contains a nonexistent ticket code in the parking Violations Code File. Were you successful this time?
8. Finally, attempt to delete a record in the Parking Violations Code File. Why can't you do it?
9. If required by your instructor, create an example of the parking-violations-by-type report desired by the Board of Directors using the database you just created.

5-26. BSN Bicycles II (Creating Queries in Access)

Business has been growing at BSN Bicycles, and the store owners have been using their Access database to store information about their customers. Now that the store is a little more established, the owners are thinking more about how best to attract more customers to their store. One idea is to see where their current customers live. The owners also want a complete list of their credit customers.

Requirements:

1. If you have not already done so, create a database for BSN and the customer's table described in Case 4–25 in Chapter 4. Be sure to create at least 10 customer records for the company, including one with your name. Several of the customers should also live in the state of Virginia (VA) and several customers should have zip code ''12345.'' The Virginia customers and the customers with zip code 12345 do not have to be the same.
2. If you have not already done so, create several invoices for your customers.
3. Create a query that selects all customers living in Virginia. Print your results.
4. Create a query that selects all customers living in zip code 12345. Print your results.
5. Create a query that selects all customers living in Virginia who also have zip code 12345. Print your results.
6. Create a query that selects all credit customers. (Hint: use the word ''Yes'' for the criteria in this query.) Print your results.

5-27. Furry Friends Foundation II (Creating Queries for Databases)

Recall from Case 4–21 in Chapter 4 that the Furry Friends Foundation is a nonprofit organization that finds homes for abandoned animals. The foundation has recently computerized some of its operations by storing its accounting data in a relational database. One reason for this was to enable it to more easily answer questions about donations. This portion of the case provides some examples of such questions and gives you practice creating database queries to answer them.

Requirements:

1. If you have not already done so, create the tables and relationships described in Case 4–21.

2. Using *Access* or similar software as required by your instructor, create three donations for yourself. You should donate to dogs in one contribution, cats in the second contribution, and unspecified (''other'') in the third contribution.
3. Create a query that selects all customers donating to cats. Print your results.
4. Create a query that selects all contributors who donated over $50. Print your results.
5. Create a query that selects all contributors who donated over $100 to dogs. Print your results.

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ANSWERS TO TEST YOURSELF

1. **c** 2. **c** 3. **c** 4. **a** 5. **a** 6. **b** 7. **d** 8. **d** 9. **b** 10. **b** 11. **c**

Chapter 6

Database Forms and Reports

After reading this chapter, you will:

1. *Understand* how to create simple forms in Access.
2. *Understand* the difference between a bound control and an unbound control on an Access form or report.
3. *Know how to* create advanced forms in Access with subforms.
4. *Understand* how to create simple reports in Access.
5. *Know how to* create reports based on queries.
6. *Know how to* create reports that contain calculated fields and understand why databases do not store such fields in their tables.
7. *Know how to* create reports containing grouped data with control breaks in them.

. . . accountants have a greater opportunity to support corporate strategy when they are involved in developing IT databases. . . .

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INTRODUCTION

The previous chapters illustrated how to design a database with several tables and also how to construct queries to select information from these tables. Two additional database tools are those that help you create forms and those that help you create hard-copy reports. The first section of this chapter discusses how to create forms, and also how to use forms for input and output tasks. The second section of this chapter discusses how to create reports. Both sections illustrate these tasks using Microsoft Access, but almost all the skills discussed here have counterparts in other database software such as FoxPro or Oracle.

FORMS

Figure 6-1 illustrates an example of a database **form**—i.e., a custom-designed screen for entering new records in, or displaying existing records from, a database table. As you can see in Figure 6-1, a form has three major sections: (1) a **heading section**, which appears at the top of the form, (2) a **detail section**, which usually occupies the most room on the form and which typically displays the record information, and (3) a **navigation bar**, which always appears at the bottom of the form.

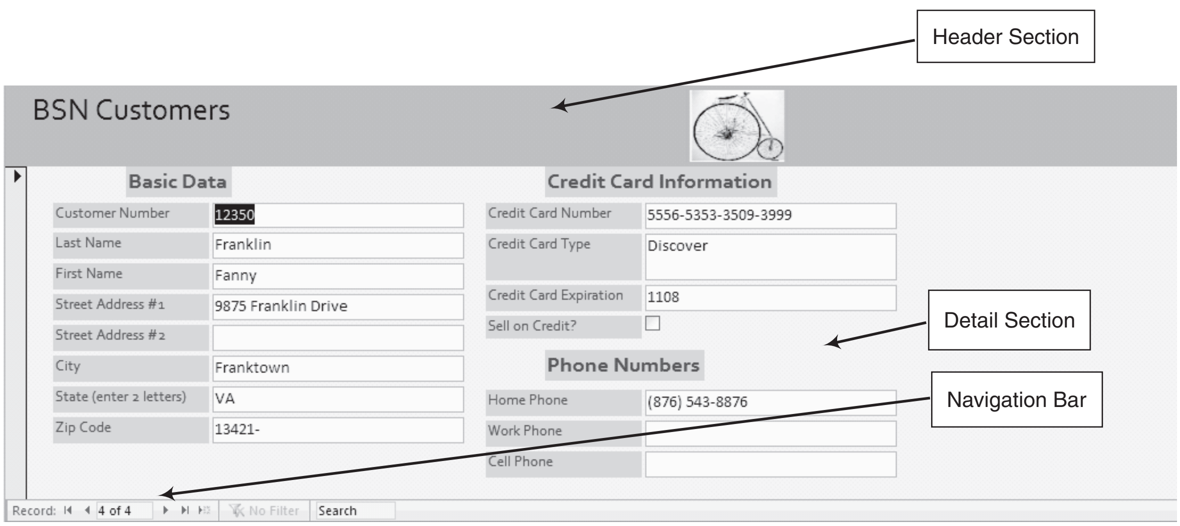


FIGURE 6-1 An example of a database form.

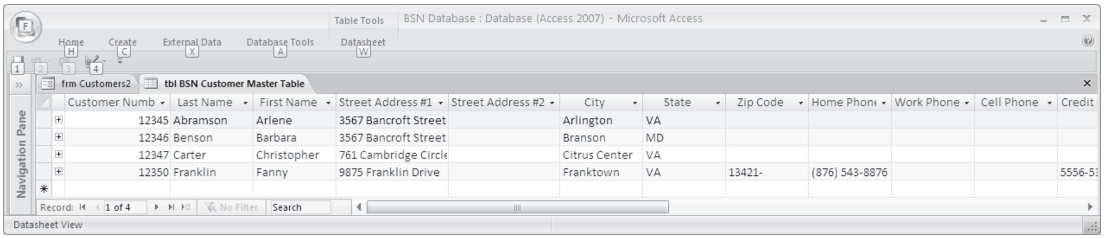


FIGURE 6-2 A portion of the customers table (in datasheet view) from the BSN Database.

Although there is no requirement to use a form for entering data into a database table, there are several reasons why using a form is better than using a default, **datasheet screen** such as the one in Figure 6-2 for this task. One is that a datasheet displays many records at once, making it possible to accidentally type over existing information instead of creating a new record. Another is that a form can display all the data-entry textboxes for an entire record in one screen, whereas a datasheet typically requires users to keep tabbing to the right to enter data for off-screen items (see again Figure 6-2).

A third advantage of forms is that you can customize them. Figure 6-1 illustrates several examples of such customization, including: (1) custom header information (e.g., the label with the words ''BSN Customers'') at the top of a form, (2) text, logos, artwork, and (as shown) pictures for graphic interest, (3) more complete names (instead of the default database names) to identify each field in the database table (e.g., ''Customer Number'' instead of ''CustNo''), (4) the ability to group similar fields together in the form (e.g., the phone numbers in Figure 6-1), (5) the ability to add explanations or special instructions in the form to help users understand how to enter data (e.g., see the label for the State field), and (6) customized tab ordering that governs the order in which textboxes become active on the form.

Creating Simple Forms

To create a custom form for a database table in Access, first select ''More Forms'' from the ''Create'' tab (Figure 6-3). You can design a form from scratch by selecting *Blank Form*

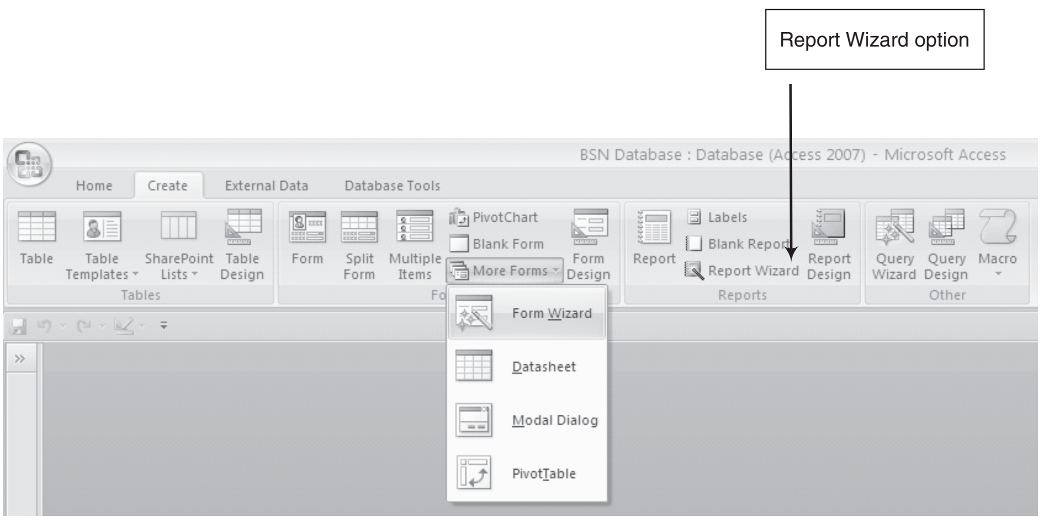


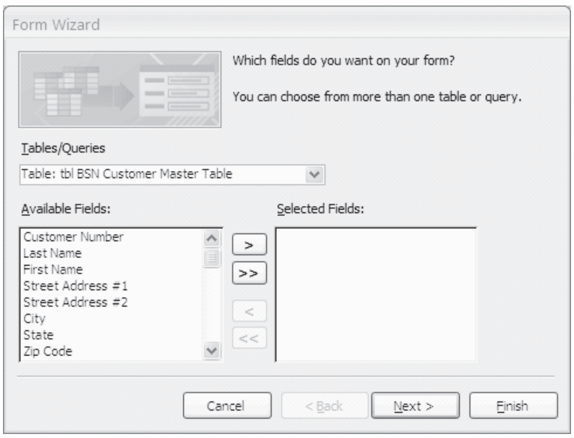
FIGURE 6-3 Create menu showing the Form Wizard in Access 2007.

from the Form menu in Figure 6-3, but it is usually easier to use the **Form Wizard** for this. When you select the second option click on ''More Forms'' and then *Form Wizard*.

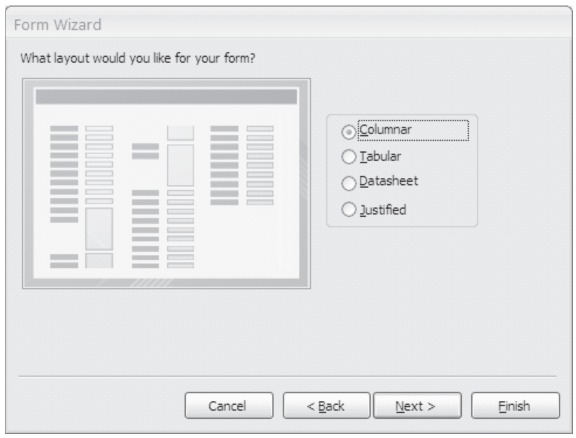
You will see dialog boxes similar to the ones in Figure 6-4. Follow these steps to create a form in Access:

Step 1. Enter the appropriate settings in the Form Wizard dialog boxes. In the drop down option on the left side of Figure 6-4a, select the table you want your form to reference (e.g., *tbl BSN Customer Master Table*). You will also need to select the fields you want to display *on* the form. Clicking on the button with the >> symbol selects all the fields from your table in your form—a typical choice. You can also click on individual field names with your mouse and then click on the> button to select data fields one by one.

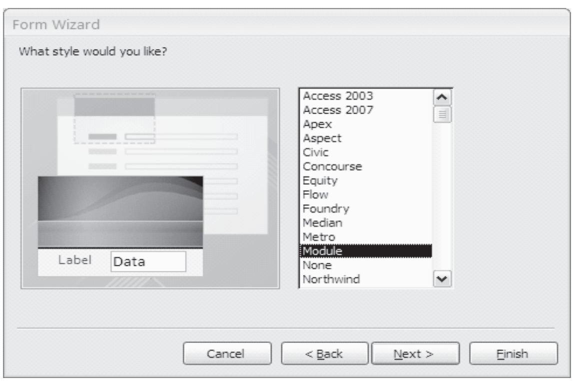
Use the second dialog box in Figure 6-4b to select a layout for your form—typically ''Columnar'' because this setting enables you to include all the data fields on one form. The third dialog box of the Form Wizard enables you to choose from several alternate preformatted styles for a form—i.e., different settings for the overall appearance of the form that dictate the back color of labels, the font sizes of the text in textboxes, and



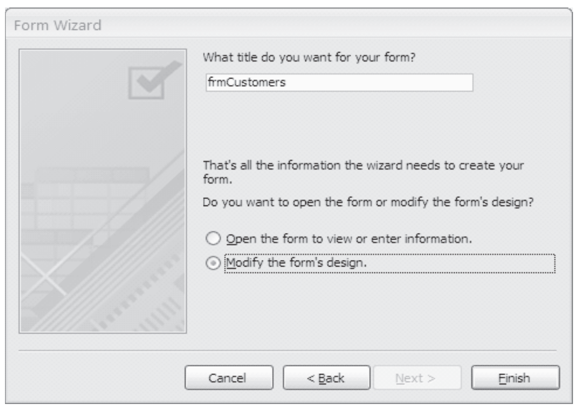
(a) First screen.



(b) Second screen.



(c) Third screen.



(d) Fourth screen.

FIGURE 6-4 The four dialog boxes in the Form Wizard.

so forth. The dialog box in Figure 6-4c illustrates some of the different choices. You can experiment with different ones to find one that suits your application.

Finally, in the fourth dialog box of the Form Wizard (Figure 6-4d), you will need to create a name for your form. As with the many other database objects, you should use the conventional prefix for a form name—*frm*—and then create a name that helps you remember the form's application.[1] In Figure 6-4d, for example, we have named the form *frm Customers*. At this point, you can click on the Finish button in the last dialog box—you're done. Access' Form Wizard will then create the form with the settings you've indicated and list the completed form among those available for use in the main menu for forms.

Step 2: Customize the Form. If you open your form in design view, you will see something like the one in Figure 6-5. This figure helps make clear that a form has two modes—Form or **run mode**, which looks like Figure 6-1, and **design mode**, which looks like Figure 6-5. In fact, the form in Figure 6-5 was the starting point for the completed form in Figure 6-1. This screen contains form objects such as labels and textboxes that you can delete (by first clicking on the object and then hitting the Del key on your keyboard), reposition (by dragging them with your mouse), or customize in many other ways.

The objects such as textboxes and labels that appear on a form are examples of **form controls**. When customizing a form, it is important to distinguish between bound

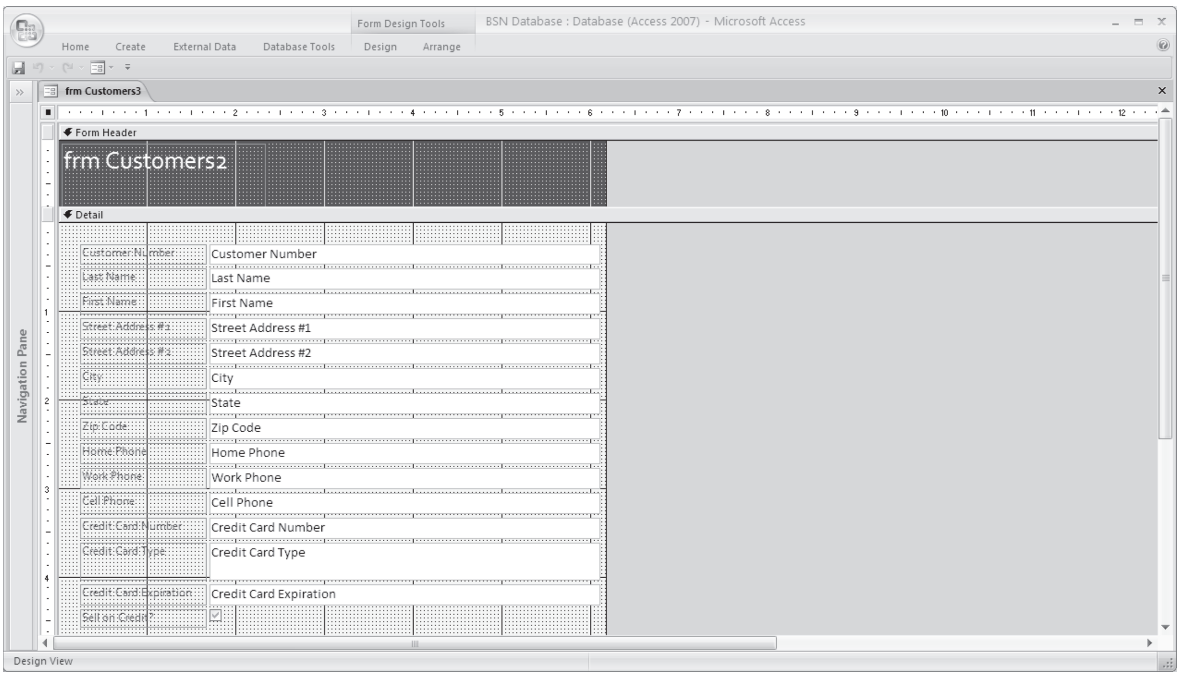


FIGURE 6-5 The starting format for the form in Figure 6-1.

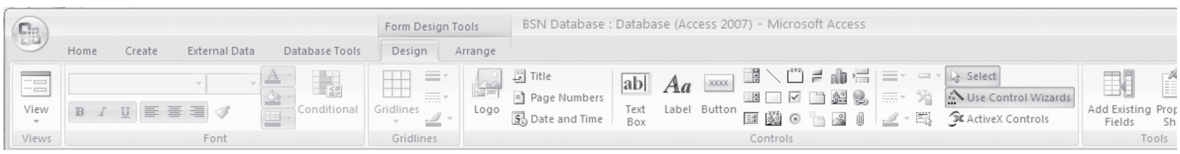
[1]Thoughout Chapters 4, 5, and 6 we have recommended prefixing all files with tbl, frm, and rpt. However, if you use Access 2007 and prefer, you can look at the icon on the left side of each file name and see the different icons provided by Microsoft. Therefore, it is your choice how to indicate what each database item represents.

controls and unbound controls. **Bound controls** are textboxes, drop down boxes, and similar controls that depend upon the underlying data and therefore change from record to record. In contrast, **unbound controls** are labels, pictures, and similar items that are consistent from record to record in a form and do not display underlying database information. On Access forms, labels and textboxes typically appear in pairs, but they are, in fact, separate objects. Thus, for example, you can delete the label for a particular data field on a form and the accompanying (bound) textbox will continue to display database information.

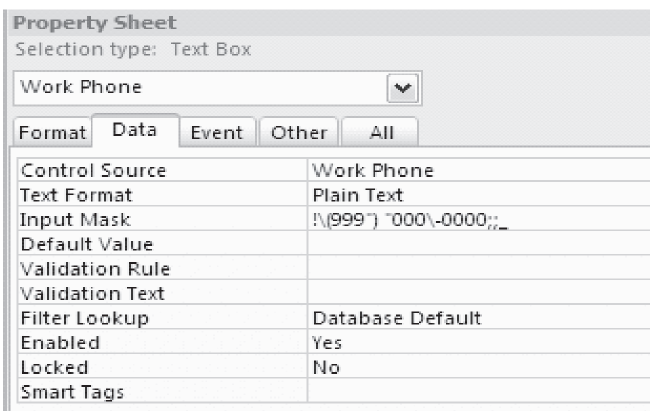
You can include additional controls to your form by selecting them from the Form Design Tools (Figure 6-6a). Typical objects that you'll use for this task are labels and picture boxes, but you can also add bound control such as textboxes if you wish. You can only view the Toolbox when your form is in design mode.

To add a control to your form, left click on the control in the Toolbox and then use your mouse to draw the selected object on your form. For example, in Figure 6-1, you can see additional labels (e.g., the heading ''BSN Bicycles'' in the header portion of the form or the label ''Phone Numbers'' in the detail portion of the form) and also a picture of a bicycle (which we created with an Image object from the Toolbox). The size of the object depends upon how large you drew it when you first created it, but you can resize any control on your form using the dots, or **sizing handles**, that appear on the border of your control when you click on it in the form.

Finally, to customize a control on a form, use the object's **Property Sheet window** (Figure 6-6b) to make individual settings for control objects. In effect, each form object has separate settings and therefore, its own Property Sheet window. To view the one for a particular control, right click on an object in your form and select ''Properties'' from the drop-down list of choices that appears. This window allows you to make a wide range of



(a) Selected controls in Design Tools.



(b) An example of a Properties window. Note the "Control Source" and "Input Mask" settings for this particular control—a textbox that displays a work phone number.

FIGURE 6-6 An example of (a) the Forms Controls window, and (b) a Properties window.

settings—for example, the font size, font weight, italics, or boldness of the text in labels. Of particular importance is the **Control Source property** of an object, which you will find among the settings in the Data tab portion of the Property Sheet window and which links the control to an underlying data field. Bound controls have a Control Source setting, whereas unbound objects do not.

Step 3: Refine your Design. You can toggle back and forth between run mode and design mode by clicking on the *Form* and *Design* options—for example, from the View portion of the Design option of the main screen. Form (Run) mode allows you to see how your form looks at run time, and therefore what further work you need to perform to complete your form's design. For example, in design mode, you can select multiple form objects at once (by depressing the Ctrl key and clicking on several objects successively) and then use the formatting options from Access's Format menu (on the main menu bar) to resize, align, and consistently space objects on your form.

Step 4: Reset the Tab Order. If you rearrange objects in your form in design mode, there is a good chance you will also want to reset the **tab order** of your form controls—i.e., the order in which each control becomes active in run mode. To do so, click on the Arrange tab in Figure 6-6a. One of the options you will see there is ''Tab Order.'' If you click on this choice, Access will provide a small dialog window that enables you to reset this order. Here, you can create a custom order for the objects in your form or, more simply, click on the ''Auto Order'' button at the bottom of this window to have Access automatically reset the tab order. The new, auto-order sequence makes form controls become active sequentially from top to bottom and left to right.

Using Forms for Input and Output Tasks

As noted earlier, database forms provide a convenient tool for inputting data into, and displaying data from, a database table. Both tasks require use of the navigation bar at the bottom of the form—i.e., the portion of the screen that looks like this:

You can use this navigation bar for both the input and output tasks explained here.

Displaying Information. The number in the middle of the navigation bar (e.g. ''2'') indicates which record currently displays in your form. Clicking on the |◀ symbol causes Access to display the first record in the underlying database table, and clicking on the ▶| symbol displays the last record in the table. Clicking on the ◀ symbol displays the record just before the current one, and clicking on the ▶ symbol displays the next record after the current one. You can also access the ''previous record'' or ''next record'' using the ''Page Up'' and ''Page Down'' keys on your keyboard.

Forms also enable you to *change* the information already in a database table. For example, if a customer moves to a new address or changes his or her phone number, you would want to update this information in the appropriate table. It is a simple matter to enter the new information for the appropriate record using a form for this task. Changing data in a form causes Access to automatically update the information in the underlying table.

Using Forms to Create New Records. If you wish to add a new record, you can use a form for this task as well. First, click on the ►* symbol in the navigation bar. The system will then display the first available empty record (i.e., the one at the end of the underlying table) and allow you to enter the information for a new table entity—for example, the data for a new customer.

A nice feature about Access is that any data field that you include in a form automatically inherits all the properties that you set for that field at the time you initially created it in a table. This means that the same edit tests and data restrictions apply to the field for data entry, whether you enter the data in datasheet view or in form view. For example, if you create an input mask for a phone number that looks like this: (999) 000-0000, Access will display the mask for this data field when you start entering data for this field in your form at run time. Similarly, if you restrict a certain field to Integer data (e.g., a zip code), the system will not allow you to enter alphabetic text for that field. Finally, if you create a range test in your form (e.g., limit input to values between ''0'' and ''40'' hours), Access will not allow you to enter a value of ''50'' for that field in your form.

Case-in-Point 6.1 A growing use of database forms is to conduct survey research. Respondents enter the answers to questions in a form customized to the needs of the survey, often not realizing that the form itself is simply the front end of a database system. Each response is stored as a record, which the researchers can then combine with others for data analysis.[2]

Printing Forms. You can print a form just as easily as you print any other Microsoft document—i.e., by using the familiar ''Print'' option from the Office button on the main screen. When you click this button and select ''Print,'' Access will display a familiar Print dialog box that enables you to print a single form, print several forms (pages), or print selected records. Be careful *not* to select ''All'' from the dialog choices—you will print separate forms for *each record* in your underlying table, even if there are thousands of them!

Subforms: Showing Data from Multiple Tables

A **subform** is a form within a form—i.e., a display of data that is related to the information in the main form. Figure 6-7 is an example—the original customer form from Figure 6-1 with a new subform showing a list of invoices for a particular customer. This explains why there are two navigation bars in the figure—the initial one at the bottom of Figure 6-1 and a new one in the subform of Figure 6-7. If you advance through the records of the customer table using the lower navigation bar, you will see the information for each customer of the main form. Conversely, if you advance through the records of the subform, you will see the invoices for a particular customer—if they exist.

Some Advantages of Subforms. One advantage of subforms is their ability to display subordinate information related to the information in the main form. This reflects the parent-child or one-to-many relationship of the underlying data. In Figure 6-7, for example, each customer might have several invoices, but each invoice is related to only one customer. Other examples for the BSN Company include invoices with many detail lines, vendors with many purchase orders, or purchaser orders with many detail lines.

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[2]Source: Bonometti, Robert J. and Jun Tang. ''A Dynamic Technique for Conducting Online Survey-Based Research'' *Competitiveness Review* Vol. 16, No. 2 (2006), pp. 97–105.

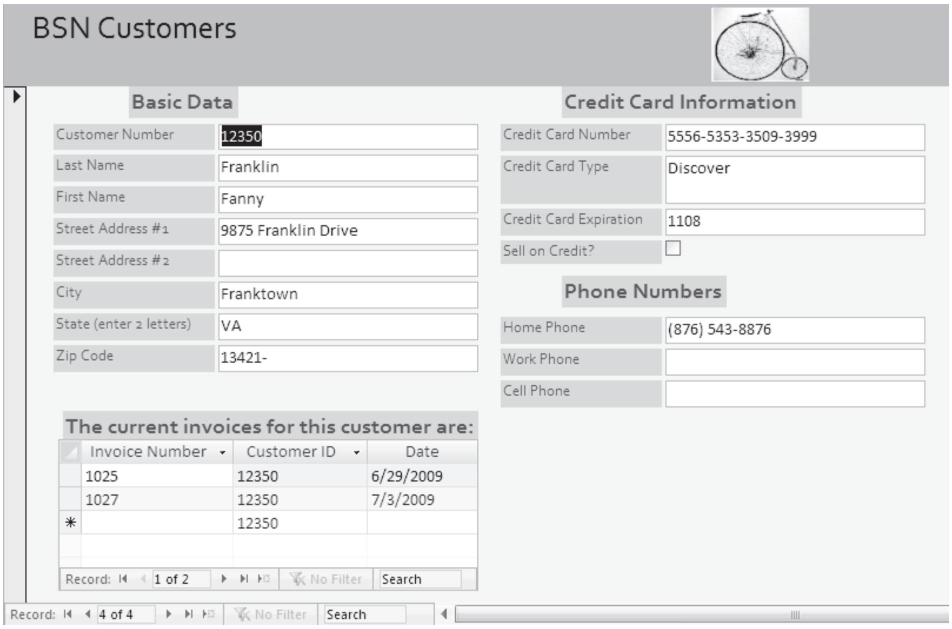

FIGURE 6-7 A form with a subform.

Another advantage of subforms is that you can use them for data entry in the same manner that you use regular forms. Thus, if you wish, you could create the data for a new invoice in the subform of Figure 6-7. An advantage of entering data in this manner is that it helps ensure that you create an invoice for the right customer.

Creating Subforms. As noted above, a key requirement of a subform is that the data in it must be in a one-to-many relationship with the data in the main form. For example, in Figure 6-7, this requires that ''customers'' and ''invoices'' have a one-to-many relationship. Thus, to create a form with a subform in Access, your first task is to make sure that the data in the two tables are related via the Relationships window. Chapter 4 explains the tasks for creating such relationships using the Relationships window.

In Access, there are two principle ways of creating a form with a subform. One way is to identify the subform at the time you use the Form Wizard. To use this option, you would use the dialog box in Figure 6-4a to select the data for the main form as explained above. But before continuing to the next form, you would also click on the drop down menu in this dialog box and select a second table from this list. If a one-to-many relationship exists between the two tables, the Form Wizard will recognize your wish to create a subform within your main form and will create one for you.

A second way to create a subform is to add one to an existing form *after* you've created it. This is what we did here. To duplicate our work, open the form of Figure 6-1 in design view and use your mouse to extend the size of the details section of the form (to make room for the subform). Then, click on the Subform icon in Toolbox shown in Figure 6-6a and use your mouse to draw a rectangle in the detail section of your form. This procedure causes Access to launch the Subform Wizard, which will ask you for setting information similar to those shown in Figure 6-4—e.g., ''which table do you want to use for the subform,'' ''how do you want the data to appear in the subform,'' and so forth.

In design mode, your resulting form and subform will not look exactly like the one in Figure 6-7. For example, you will probably have to resize the outer dimensions of the subform to fit the data and perhaps reword the text in the heading in the label at the top of the subform. With a little bit of work, however, you should be able to design things to look like Figure 6-7. If you need to resize the column widths of your subform, however, you can do that at run time rather than at design time—a helpful advantage because you can see live data at run time.

Concluding Remarks about Forms

Database forms enable you to add records to a database table, modify the data in existing records of a table, and simply view the data in a table. Although forms are not needed for such tasks, the ability to customize a form, provide explanations for data-entry fields within forms, and create convenient tab orderings are especially useful features of them. In commercial environments, the database developer is rarely the same person who enters data in database tables on a daily basis. Anything that developers can do to make this job more convenient and straightforward for an hourly worker helps avoid errors, streamlines the data-entry process, and saves money. Experts estimate that it costs about ten times as much to *correct* an error in a database as it does to enter the data initially. Get the picture?

Case-in-Point 6.2 CheckPoint is a company that provides background screening, authentication, and criminal record identification services for its clients. To avoid errors, the company uses database forms with very exacting definitions and safeguards that help data entry personnel avoid mistakes. A key finding is the idea that the data stored in a database about an individual can be consistent, but still be wrong![3]

REPORTS

Database **reports** provide custom information to database users. Reports can be simple documents that only output the contents of a table, or complex outputs that combine the information from several tables and show selected subsets of database information. If you're using Access to print something to paper, the chances are high that you are using a report to perform this task. This means that many items that you might not consider a ''report'' are treated as one by Access—for example, an invoice for a particular customer or a document that shows the name and address of only one vendor.

Case-in-Point 6.3 The National Motor Vehicle Title Information System requires all insurance companies and salvage yards to forward the VIN numbers of vehicles that have been totaled to a national database. The reports from this database will enable consumers to obtain such information as a car's odometer reading or theft report, as well as the reason for its condition—e.g., a flood.[4]

Unlike forms, reports are strictly outputs and do not allow users to input data into databases. This section of the chapter explains how to create simple reports, how to create reports containing calculated fields, how to create reports based on queries instead of tables, and how to create reports containing grouped data.

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[3]Source: Carr, David F. ''Gotcha! Pitfalls in Personal Profiles'' *Baseline* Vol. 45 (June 2005), p. 41.
[4]Source: Jones, Candice Lee. ''Used Car Blacklist'' *Kiplinger's Personal Finance* Vol. 63, No. 1 (January 2009), p. 17.

BSN Customers

Thursday, July 09, 2009

Customer Number	Last Name	First Name	Street Address	City	State	Zip Code	Sell on Credit?
12345	Abramson	Arlene	3567 Bancroft Street	Arlington	VA	12345-6789	☑
12346	Benson	Barbara	3567 Bancroft Street	Branson	MD	23456-7890	☐
12347	Carter	Christopher	761 Cambridge Circle	Citrus Ce	VA	12345-6543	☐
12350	Franklin	Fanny	9875 Franklin Drive	Franktow	VA	12345-6321	☐

Page 1 of 1

FIGURE 6-8 A print preview of a portion of a simple Access report.

Creating Simple Reports

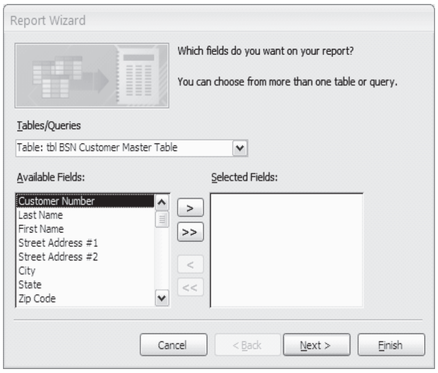
Figure 6-8 illustrates the print preview of a simple report—a listing of selected information about the customers in BSN's Customers table. The first step in creating such reports is *not* to use your database system at all, but rather to decide what information to include in the report and how best to display that information in a printed document. We stress again that spending a few minutes designing the general format of a report on the back of an old envelop may save you hours of redesign work later.

A typical report has seven major components: (1) report header, (2) page header, (3) group header, (4) detail or body, (5) group footer, (6) page footer, and (7) report footer. Figure 6-9 describes these items in greater detail. Perhaps the most important is the Detail section, which is similar to the detail section of a form, and which repetitively displays information from the records of database tables. After you have a general idea of the format for your report, you can develop the report itself using these components. An easy way to do so is by using the Report Wizard in Access, following these steps:

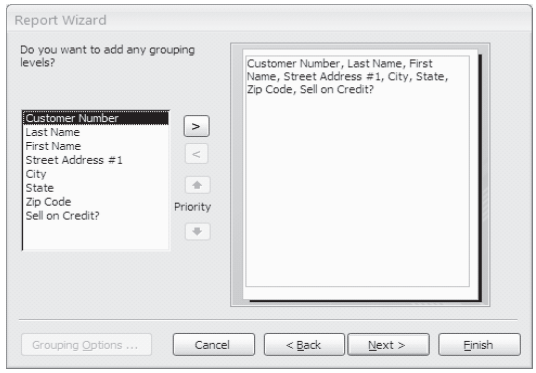
Step 1: Launch the Report Wizard. To launch the **Report Wizard**, select the Create option from the main menu and then select ''Report Wizard'' (see again Figure 6-3). The first dialog box you will see is the one in Figure 6-10a.

Component	Where it appears	Typical content
Report Header	First page of the report	Company name and address, date prepared or relevant time period, company logo
Page Header	Top of each page	Identification of each data field below it
Group Header	Beginning of each group of records	Identification of a new group of data
Detail Lines	Body of the report	The individual data fields of, and computed data fields from, underlying database tables
Group Footer	End of each group	Control totals or other statistics such as maximums, minimums, or averages for the group
Page Footer	Bottom of each page	Page number, report number
Report Footer	Last page of the report	End-of-report identifier, grand totals

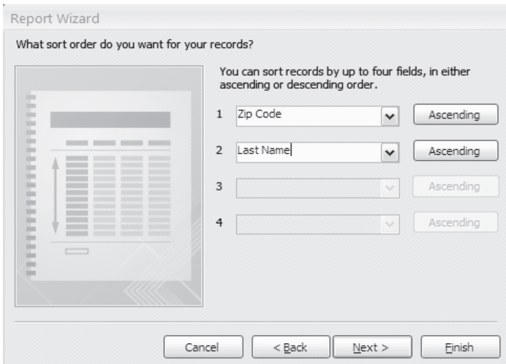
FIGURE 6-9 The components of a database report.



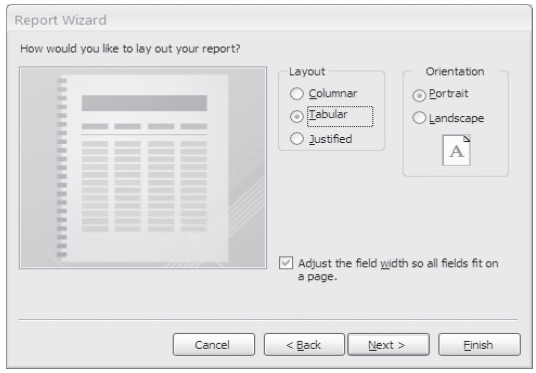
(a) The first screen in the Report Wizard.



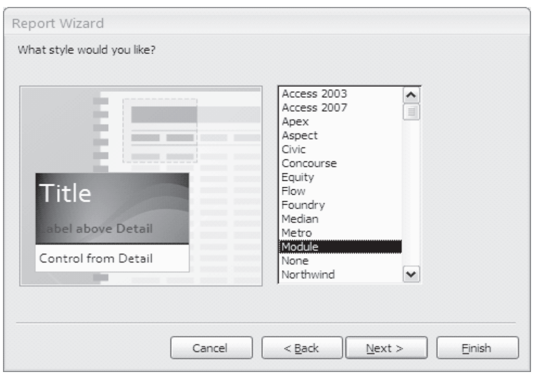
(b) The second screen in the Report Wizard.



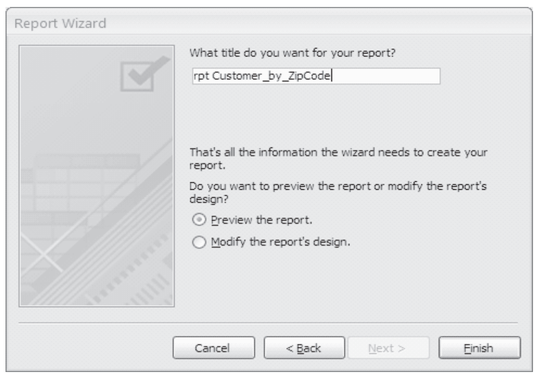
(c) The third screen in the Report Wizard.



(d) The fourth screen in the Report Wizard.



(e) The fifth screen in the Report Wizard.



(f) The sixth screen in the Report Wizard.

FIGURE 6-10 The Report menu in *Access* and the dialog boxes of the Report Wizard.

Step 2: Select the Underlying Data Source and Desired Fields. You can base a report on a table, as we will do in this case, or a query (which in turn might integrate the data from several tables). To create the report in Figure 6-8, however, we will only need the Customers table. Thus, to replicate our work, select *tbl BSN Customer Master Table* from the drop-down list in Figure 6-10a and then select the appropriate fields using the data field selector buttons (> and >>) as needed.

Notice that not all the information in the Customers table appears in the Customer report of Figure 6-8. For example, the customer's home and cell phone numbers are missing. This is typical of output reports—only selected information from underlying tables appears in them. The more information you include, the more complete the report, but also the more crowded the report becomes and the harder it is to format properly or read. As you know from Chapter 1, sometimes ''less is more,'' and this is one reason to ''plan before you program.''

Step 3: Indicate any Grouping Levels. When you click ''Next'' in Figure 6-10a, you will see the dialog box of Figure 6-10b. This is where you tell the Report Wizard how you would like to group your data. For example, if you wish, you can group your customers by zip code. For the simple report in Figure 6-8, however, we do not need any such groupings and you can simply click the Next button in this dialog box.

Step 4: Indicate any Sort Fields and Select the Desired Report Format. The Report Wizard also allows you to sort up to four different fields. For example, Figure 6-10c indicates the settings to create a report of customers sorted by customer last name within zip code. After you have selected the sort fields, click Next in the dialog box. The fourth screen in the Report Wizard appears (Figure 6-10d) and allows you to select a particular report layout. For line-by-line listings—the typical choice in simple reports—select ''Tabular.'' You can also choose either ''Portrait'' or ''Landscape'' print options here.

Step 5: Select a Desired Report Style and Name the Report. After clicking Next in the dialog box of Figure 6-10d, you will see the dialog box in Figure 6-10e. This screen of the Report Wizard enables you to select a report style, which determines the color of the text, the default font sizes for data fields and labels, and similar design elements. Select the one you want by clicking on the desired style in the menu box. In Figure 6-10e, we selected ''Module,'' for example.

Finally, when you click Next in the dialog screen of Figure 6-10f, you will see the final screen of the Report Wizard. Here, you have the opportunity to name your report. The standard prefix for a report is *rpt*, which is the reason why we've named our report *rptCustomers_by_ZipCode*.

Step 6: Modify the Design of the Report as Desired. When you finish with the Report Wizard, you will probably need to modify the report design still further. If you open your new report in design view, you will see a screen similar to the one in Figure 6-11.

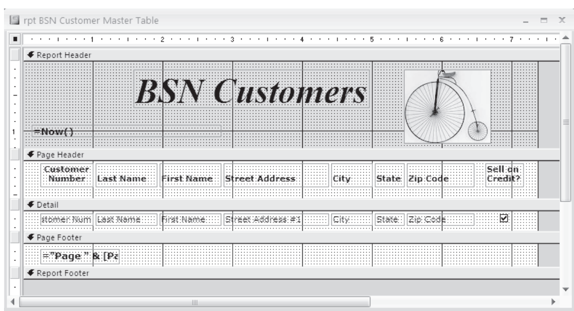


FIGURE 6-11 An *Access* report at design time.

This interactive screen enables you to modify the height or width of labels or textboxes (using their sizing handles), change the font size, italics, or boldness of headings (using the Properties Window for each element), or reposition items (as we did for the second line of the address). You can also change your mind and delete any element in the report by left clicking on it and hitting the Del key on your keyboard.

In design view, the bar of any section of your report will darken to indicate which section of the report is active for design purposes. There are many additional things you can do to modify your report's appearance. For example, you can cut and paste (or copy and paste) elements from one portion of your report to another. Thus, we moved the date (with content '' = *Now( )*'') from the footer section of the report to the header section using this cut-and-paste method. As with designing forms, you can also add charts, pictures, or logos to your report. To do so, select the Image tool in the Toolbox control section by left clicking on this tool with your computer mouse and drawing it in the desired portion of your report. When adding figures, you will probably also have to change the Size Mode (in the Properties Window of your Image control) to ''Stretch'' in order to expand or shrink your image properly.

Finally, you should be careful when moving anything into the ''Detail'' section of the report because the report will repeat any element in this section for each line of the report. For this same reason, you should try to make the detail section of the report as small as possible—it will save room on lengthy reports.

Creating Reports with Calculated Fields

A common task when creating reports is to include **calculated fields** in them. For example, a report of employee information might also include a field entitled ''years of service,'' which the system can calculate from the employee's date of hire. Sometimes, you want a calculated field to appear in the detail section of a report, and at other times you want group or grand totals to appear in the group footer or the report footer sections of your report. In this section of the chapter, we review the steps needed to accomplish the first task—creating a calculated field for the detail section of a report. In the following section, we review the steps needed to accomplish the second task—creating group summaries.

In AISs, a common task is to multiply prices by quantities in order to compute an extension (line total) in an invoice. There is no reason to *store* such values in the records of a relational database because we can *recompute* such values whenever we need them. This is why we only stored prices and quantities in the Customer_Invoice_Details table. However, when we print customer invoice information on a report, we need to show such computations.

It is usually easiest to create calculated fields using queries rather than tables for the underlying data. To illustrate, suppose we wanted to create the report shown in Figure 6-12—a report that shows invoice extensions for all current invoices for BSN. To create such a report, follow these steps:

Step 1: Create the Query with a Calculated Field. Figure 6-13 shows the query for our report. To create this query, we begin by selecting the tables needed for this task. One such table is the Customer_Invoice_Details table. The records in this table contain the item number and the quantity ordered, but not the *name* of the item purchased or its *price*. For this information, we need the Products_And_Services table.

Figure 6-13 is the design view for our query. We have selected the two tables we need for our task and also the desired fields—i.e., the item number and the description of

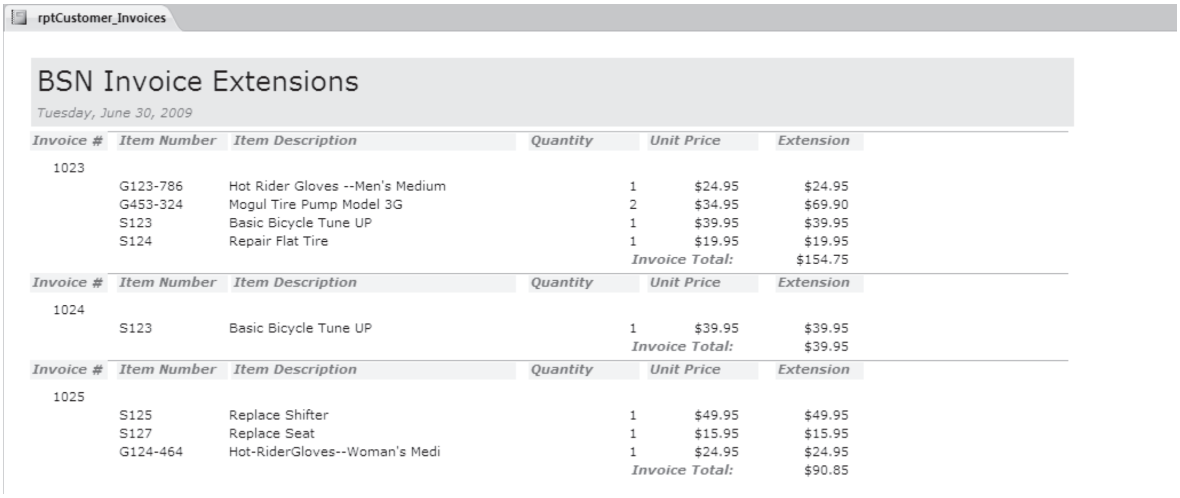


FIGURE 6-12 The print preview of a report that contains a calculated field (in the last column of the report).

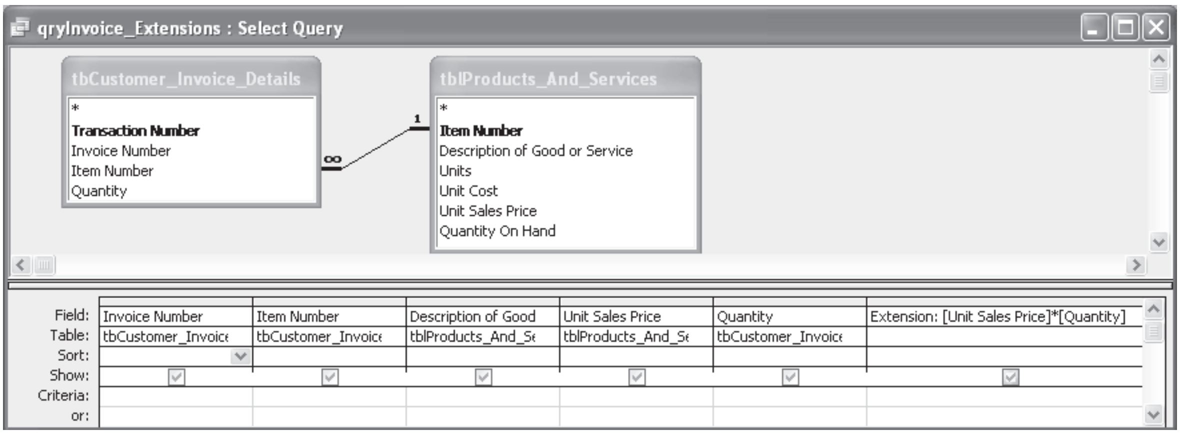


FIGURE 6-13 A query with a calculated field.

the good or service (both taken from the Products_And_Services table), and the quantity (taken from the Customer_Invoice_Details table). For convenience, it is a good idea to select these items in the order in which you want them to appear in your final invoice, but this isn't required.

To create the calculated field, select the first available column in the query design screen and type the *name* of your calculated field. We chose the name ''Extension'' but this choice is arbitrary. You can also choose a name with more than one word (e.g., ''Extension Calculation''), but be careful *not* to choose a term with the same name as an existing data field.

Type a colon following your calculated field name and then input the formula for your calculated field. Use an asterisk for a multiplication sign and a forward slash (/) for a division sign. Also, be careful to spell the field names in your formulas exactly as they appear in your underlying database tables. (If you misspell a field name, Access will not indicate that you've made an error, but instead will assume you're creating a parameter qryInvoice_Extensions

Item Numbe	Item Description	Unit Price	Quantity	Ext
G124-464	Hot-RiderGloves--Woman's Medi	$24.95	1	$24.95
S127	Replace Seat	$15.95	1	$15.95
S125	Replace Shifter	$49.95	1	$49.95
S124	Repair Flat Tire	$19.95	1	$19.95
S123	Basic Bicycle Tune UP	$39.95	1	$39.95
G453-324	Mogul Tire Pump Model 3G	$34.95	2	$69.90
G123-786	Hot Rider Gloves --Men's Medium	$24.95	1	$24.95
S123	Basic Bicycle Tune UP	$39.95	1	$39.95
*				

FIGURE 6-14 Partial results for the query in Figure 6-13 at run time.

query and ask you for the data at run time.) Finally, place square brackets around your field names to indicate that you are referencing existing data fields.

When you have completed your query, you can test it by clicking on the Run button (with exclamation point icon) in the main menu. If things work properly, you will see something like the screen in Figure 6-14. Note that although the data in Figure 6-14 is from a query, the screen in Figure 6-14 is interactive. Thus, if you change the item number of a given line, for example, Access will look up the new product description and the new price, change the new extension, and display everything as quickly as you can enter the new item number in the screen.

Step 2: Create the Report Based on Your Query. It now remains to create the report. Using the steps outlined above, you can use the Report Wizard to create the final report in Figure 6-13. Base your report on the query you created in Step 1 above and select all the fields offered.

The second screen of the Report Wizard will ask you if you wish to group your data (refer back to Figure 6-10b). Access will recognize that you have a one-to-many relationship between ''invoice numbers'' and ''invoice details'' and should show you this possibility by default. If it does not, however, select this option so that all your invoice details for the same invoice will be grouped together. Then continue with the remainder of the Report Wizard questions. Be sure to name your report something appropriate—for example, rptInvoice-Details. When you finish answering questions in the Report Wizard, you should then reformat your report as needed. The results should look similar to Figure 6-12.

Creating Reports with Grouped Data

The report in Figure 6-12 contains useful data, but obviously lacks some critical information. What is the name of the customer associated with each invoice? What is his or her address? What is the total for each invoice? A typical manager might also want this information to appear in an invoice report, but it is missing in Figure 6-12. Finally, he or she might want the report organized by customer last name rather than by invoice number.

A **control break** is the technical term for the point at which a group changes from one type to the next in a report. Examples of control breaks include a change in zip code for the addresses in customer listings, a change in the department number for a listing of employees, and a change in a service classification for the yellow pages of a phone book.

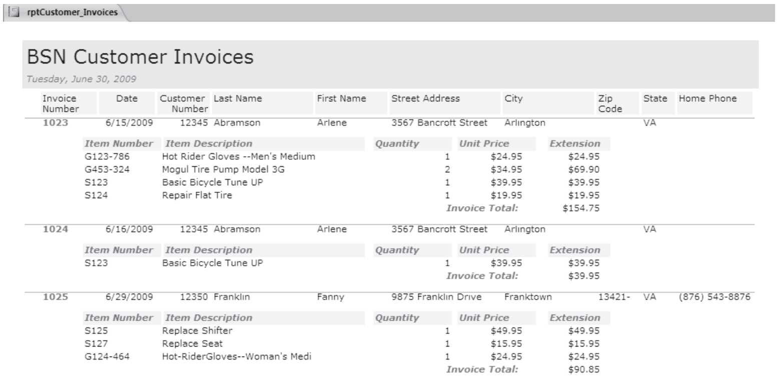


FIGURE 6-15 The invoice report of Figure 6-12, expanded to include customer information and invoice totals.

Control breaks are often the point at which managers want to see subtotals, maximums, minimums, averages, or similar subgroup summaries.

To create control breaks for the report in Figure 6-12, we need to modify its design to include group totals for each invoice. Figure 6-15 illustrates the format for the final report, which includes new information and provides totals for each invoice. To create it, we will follow the steps outlined above for creating reports with calculated fields—i.e., (1) create a query to generate the desired information, (2) use the Report Wizard to create an initial report based on this query, and (3) reformat our report as needed to achieve the desired end product. Here are the detailed steps:

Step 1: Create the Underlying Query. Our first task is to create the underlying query for this report. Figure 6-16 shows a part of this query at design time, but not the entire set of fields—there were too many of them to fit conveniently in the figure.

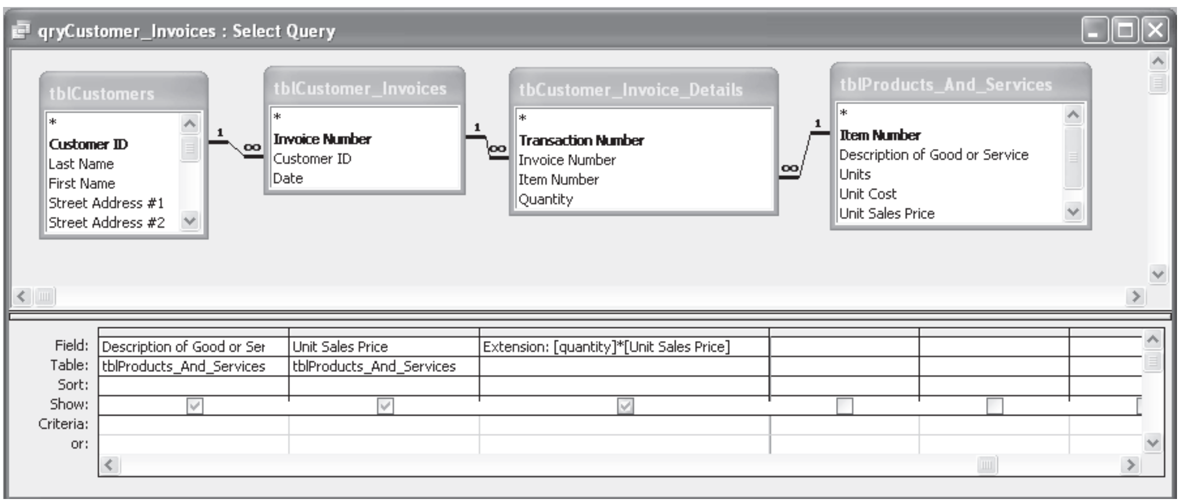


FIGURE 6-16 Part of the query used to create the report illustrated in Figure 6-15.

The upper portion of the query screen in Figure 6-15 identifies the four tables required to build it. If you study the information contained in the final report of Figure 6-15, you will realize *why* we needed four tables for this task. We needed the *Customers* table to provide the name and address information for each customer. We needed the *Invoice* table to provide the customer number for each invoice. We needed the *Customer Invoice Details* table to provide the item number and the order quantity for each detail line of an invoice. We needed the *Products and Services* table to provide the item description and sales price per unit for each item purchased. Finally, we had to create a calculated field—the extension of quantities times prices for each detail line—as described in the previous section of this chapter.

When queries become as complex as this one, it is a good idea to run them and make sure they work, even though the only reason you've created them is for a report. Again, you can perform this task by clicking on the exclamation point (run icon) in Access main menu. (You must be working on a query, however, and not working on a form, table, or report.)

Step 2: Use the Report Wizard to Create the Initial Report. After creating our initial query, we will then go the Reports portion of Access and use the Report Wizard to create an initial report. You already know how to perform such a task so we will not describe the process again here. The result is a report whose format will not look very much like the finished product in Figure 6-16, so we have additional work to do!

Step 3: Reformat the Report as Desired. It remains to reformat our report. Because we have also reviewed the activities for this step, we will not repeat them here. Again, it is useful to remember the following items: (1) you should expand the size of unbound labels so that their entire text shows, (2) you can delete any control you don't need, (3) you can move both bound and unbound controls from one part of a report to another, and (4) the Format menu enables you to resize, align, and reposition multiple objects consistently on your report.

Concluding Remarks about Reports

Although experts had high hopes for paperless offices and a society that only used softcopy (screen) reports, it appears that hardcopy reports will be with us for some time. This section of the chapter illustrated how to create reports in Access, including reports that contain calculated fields and reports that calculate subtotals for grouped data.

One additional point is that you can modify the underlying queries for reports that further restrict what gets printed *on* them. For example, suppose we included a Yes-No logic field in our Invoice records that indicated whether or not a customer has paid a given invoice. Then, we could modify the underlying query for the Invoice report in Figure 6-13 to only print line information in Figure 6-15 for unpaid customer invoices.

Finally, forms and reports are related in that many of the formatting techniques that you can use for the one you can also use for the other. For example, you can create a *form* based on a query instead of a table, just as you can create a *report* based on a query instead of a table. As a result, you can create *calculated fields* in forms as well as in reports. For example, if an employee table contained a ''Date of Hire'' field, you could compute the years of service for this employee as part of your form. Similarly, you can create unbound data fields in reports as well as in forms.

Case-in-Point 6.4 If you think about it, Access is a great tool for creating a name-and-address book for yourself. Each record contains the name and address of one of your friend, and you can use a Yes/No field to indicate whether or not to send a Christmas card. Birthday lists become easy to create using an underlying query to determine the birthday list (report) for each month. Finally, you can print your entire name and address book (formatted, of course!) once a year as a hard-copy backup of your database table.

AIS AT WORK
Mother Lode Bicycles

Although the BSN Bicycle Company is fictitious, Mother Lode Bicycles in Sparks, Nevada, is not. Founded in 1996 by two friends—Dave McDonald and Mark Kennedy—the 2,400-square-foot shop sells road and mountain bikes to local customers as well as out-of-towners visiting the area. Bike prices range from $200 to $5,000. Sales of bikes, clothing, and biking accessories are 90% of the store's income; repairs make up the rest.

In many ways, running a bike shop is similar to running any small business. One partner manages the inventory, stocks the store shelves, and deals with the marketing and advertising parts of the business. The other partner deals with employees, supervises repairs, and interacts with customers. Their biggest problems: (1) making enough money to cover the overhead (especially during the months after Christmas and prior to spring cycling) and (2) the fact that the store must stay open seven days a week.

For accounting tasks, the store's owners rely on QuickBooks™ from Intuit and the bookkeeping expertise of Mark's wife. With the exception of employees, the store does not sell items on credit, so there are no receivables. Mark personally supervises payables, taking advantage of cash discounts where possible and negotiating longer payment schedules with suppliers during the slower-selling seasons of the year.

Most of the shop's inventory consists of items that sit on shelves and racks in the retail portion of the store, with just a few parts and unassembled bikes stored in the back room—a combination storeroom-warehouse-office-dining room. ''Inventory control'' is also a combination of elements, including ''visual inspection,'' working with sales representatives to keep merchandise levels up, and the expertise of the owners for ordering or not ordering items for the slower or busier season to follow. Mark is considering acquiring a point-of-sale system with a backend database, which he thinks will help the company become better aware of its best sellers as well as keep closer tabs on stock on hand.

Source: From the authors.

SUMMARY

- You can use database forms both to input data to, and to view data from, the records in tables.
- If you use forms to create new records, the data fields in the customized forms automatically inherit the same properties, attributes, and input restrictions that were created for them in the design of the table.
- The navigation bar at the bottom of a form enables you to view the first, last, next, and previous record in the underlying table.
- You can use subforms to display those ''many'' records related to the record in the main form in a one-to-many relationship—for example, the outstanding invoices for a specific customer.

- You typically design and develop reports to create hard-copy outputs. In Access, reports are either based directly on tables, or on queries that in turn reference tables.
- A typical report has seven major components: (1) report heading, (2) page headings, (3) group headings, (4) detail or body, (5) group footer, (6) page footer, and (7) report footer.
- You should name forms and reports systematically. The standard prefix for a form is *frm* and the standard prefix for a report is *rpt*.
- Most databases do not store calculated fields such as invoice line extensions (prices times quantities) in them. Instead, we calculate these fields with queries.
- Many reports contain grouped data in them—for example, the set of lines for a given invoice, or the set of invoices for a given customer. It is also possible to require a report to show control totals, averages, maximum, or minimum values for each such group. In Access, you can create such tasks using the Report Wizard and its grouping options.

KEY TERMS YOU SHOULD KNOW

bound control
calculated field
control break
control source property (form control)
datasheet screen
design mode
detail section (form or report)
form
Form Wizard
heading section (form or report)
navigation bar
Property Sheet window
report
Report Wizard
run mode
sizing handles
subform
tab order
unbound control

TEST YOURSELF

Q6-1. In Access, you can use a *form* to perform all the following tasks *except*:

a. Create a new record in a specific table

b. Change the information in an existing record of a table

c. View the information from many different records sequentially

d. All of these are tasks that can be performed with an Access form

Q6-2. Each record in a database table of student records contains the name, address, total university credits, and total quality points for a specific student. The student's grade point average (GPA) is equal to total quality points divided by total university credits. Where would a database typically store a student's GPA information?

a. In the same table as the student's other information

b. In a new table of student details

c. In a report stored in the Reports section of the database

d. Nowhere. This is a calculated field that is typically created by a query at run time

Q6-3. A form control that does not change from record to record is probably:

a. A design-time control

b. A bound control

c. An unbound control

d. A mistake

Q6-4. The database of a veterinary clinic has records for the pets it treats in one table, records for pet owners in another table, and records for employees in a third table. Which of these is most likely to describe a database form and subform for this application?

a. Employees in the main form and pets in the subform

b. Pets in the main form and owners in the subform

c. Owners in the main form and pets in the subform

d. Owners in the main form and employees in the subform.

Q6-5. If the form onscreen appears with grid lines and you can view the Toolbox, this form is mostly likely in:

a. Design mode

b. Run mode

c. Sleep mode

d. Wizard mode

Q6-6. What happens when you click on this symbol ▶| on a form's navigation bar?

a. You will transition from run mode to design mode

b. You will transition from design mode to run mode

c. You will go to the first record in the table

d. You will go to the last record in the table

Q6-7. Which of these best identifies the underlying data source for an Access report?

a. Only tables

b. Only queries

c. Both tables and queries

d. Tables, queries, and forms

Q6-8. The term ''control break'' most closely associates with which of the following terms in Access?

a. Groups of data

b. Bathroom break

c. Form control

d. Report header

Q6-9. Which of these is *not* a typical part of a printed report using Access?

a. Report header

b. Report footer

c. Navigation bar

d. Detail line

Q6-10. A column in an employee report contains the number of years each employee has worked for the company. This value is most likely:

a. A raw value stored in a database table for each employees

b. An unbound value that was created in the report itself

c. A value that was calculated from each employee's date of hire

d. A group summary value

DISCUSSION QUESTIONS

6-1. What are some of the advantages and disadvantages of database forms?

6-2. Would you rather use a form or a datasheet for entering data into a database table? Why?

6-3. To create a form, would you rather use the Form Wizard in Access or create the form from scratch? Why?

6-4. What is a subform? Why do forms have subforms? How do you create subforms in Access?

6-5. Why do database developers customize forms? Why isn't it sufficient to use the form as initially created by the Form Wizard?

6-6. What is the purpose of a database report? What information do such reports contain?

6-7. The chapter suggested that it is important to design the format of a report before creating the report itself. Do you agree with this suggestion? Why or why not?

6-8. Do you think that we will still use hardcopy reports in the future, or will they be replaced with softcopy ones? Defend your answer.

6-9. Would you rather use the Report Wizard to create the format of a report or design one yourself from scratch? Why?

6-10. What is a calculated field in a report? Provide some examples. Why do reports contain calculated fields?

6-11. Why don't databases store calculated fields as normal fields in database tables? Do you think they should?

6-12. Why are calculated fields created with database queries? Why not create them directly with reports?

PROBLEMS

6-13. A form's navigation bar has five symbols on it. Identify each one and indicate its use.

6-14. A database report has seven major sections in it.

- **a.** Identify each one and provide a short explanation of each section.
- **b.** Identify a report that might be generated in a database application and indicate what data might be found in each section of the report for your example.

6-15. Provide a short explanation of the difference between each of the following sets of terms:

- **a.** bound control versus unbound control
- **b.** design mode versus run mode
- **c.** ◀ symbol versus ▶ symbol on a form's navigation bar
- **d.** form versus subform
- **e.** normal data field versus calculated data field
- **f.** page header versus page footer
- **g.** report header versus report footer
- **h.** a report based on a table versus a report based on a query

6-16. Using the Customers table in the BSN database that accompanies this book and following the directions in this chapter, create the form in Figure 6-1. Make sure that you reformat the default positions of the various textboxes as shown in the figure.

- **a.** Add a label in the heading portion of your form that contains the term ''Prepared by:'' and add your name. Print a single copy of your completed form.

b. Use the navigation bar at the bottom of your form. What is the first record? What is the last record?

c. Add a new record to this form with your name as the customer. Print a copy of this form.

d. Close your form, go to the Tables portion of the database, and open the Customers table in datasheet view (see Figure 6-2). Verify that your new record is there. Now, add a second record with your name again. Are you surprised that you can do this?

6-17. If you have not done so already, use the Customers table in the BSN database that accompanies this book and the directions in this chapter to create the form in Figure 6-1. Make sure that you reformat the default positions of the various textboxes as shown in the figure. Now add a subform of customer invoices to your form so that it looks like Figure 6-7. To do this, open your initial form in design view, select the subform tool from the Toolbox Controls, and add a subform. Answer the questions for the Subform Wizard to select the Invoices table. When you have completed these tasks, also do the following:

a. Use the navigation bar of the main form to go to the last record in the Customers table. Print the form for this record.

b. Use the navigation bar of the main form to find a record with invoices. Then use the navigation bar of the subform to select a particular invoice. Which one did you select? Print this form.

6-18. Using the Customers table in the BSN database that accompanies this book and following the directions in this chapter, create the report in Figure 6-8. Note that you will have to reformat and perhaps reposition several labels in the detail section of the report. You will also have to add both labels and a graphic to the header portion of the report.

a. Add a label in the heading portion of your report that contains the term ''Prepared by:'' and add your name. Print a single copy of your completed report.

b. Who is the first customer in your report? Who is the last customer in your report?

6-19. Use the Customers table in the BSN database that accompanies this book and the Report Wizard to create the report in Figure 6-15. Note that you will have to reformat and perhaps reposition several labels, and add both labels and a graphic in the header portion of the report. Note that you will first have to create the underlying query for this report. Use Figures 6-12 through 6-16 as guides for this task. Print the final report.

CASE ANALYSES

6-20. A Form for BSN Suppliers (Creating a Simple Form in Access)

The BSN Company requires a form with which to view its existing suppliers conveniently and also to create records for new suppliers. Figure 6-17 contains a suggested format for this form.

Requirements:

a. Using the Vendors table in the BSN database that accompanies this book, create the initial form using the Form Wizard. Note that you will have to reposition some of the data fields in the form, add the term ''Abbrev.'' to the label for the State field, and add the following items in the heading of the form: (1) a label with text ''BSN Vendors,'' (2) a label with your name, and (3) a graphic (which can be different than the one shown in the figure).

b. Run your completed form to make sure it works. What is the first record that shows in your form? What is the last record?

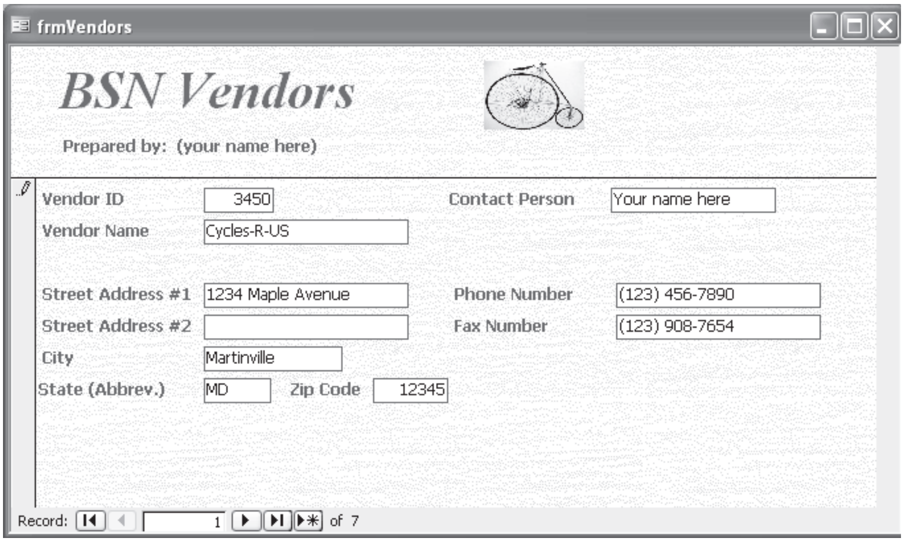


FIGURE 6-17 A form for entering and viewing vendor information in the BSN database.

c. While in run mode, tab through the individual data fields of any particular record and note that you do *not* tab through the data fields column by column. Return to design view and adjust the tab order by selecting View/Tab Order from the main menu and make the necessary adjustments. What is the correct Tab Order and how did you make these adjustments?

d. Go back to run mode for your form and click on the ▶∗ symbol to add the information in Figure 6-17 to the Vendors table. Note that you should use your own name as the Contact Person for this vendor.

e. Print just this form to document your work, following the steps in the text for this task.

f. Now that you have used your new form, what additional improvements would you make to further streamline data entry tasks?

6-21. A Form and Subform for BSN Suppliers (Creating Forms with Subforms in Access)

Create the form in Figure 6-17 and then add a subform to it that shows purchase orders for each vendor. Figure 6-18 provides a suggested format. To accomplish this task, follow these steps: (1) start with the Vendor form of Figure 6-17 in design mode, (2) click on the subform control in the Toolbox, and (3) follow the steps in the Subform Wizard to complete your work.

Requirements:

a. Run your new form to make sure it works properly and then print a copy of your new form to document your work. Make sure your name is in the header portion of the form.

b. Select a vendor for which there are outstanding purchase orders. Click on the ▶ symbol in the navigation bar of the main form. What happens?

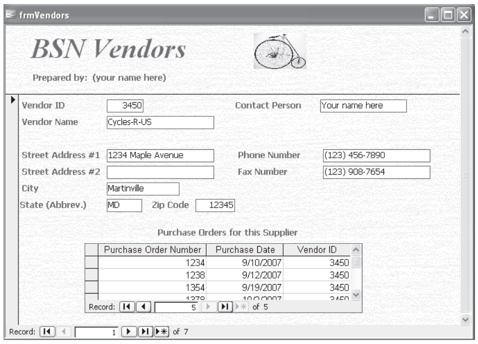


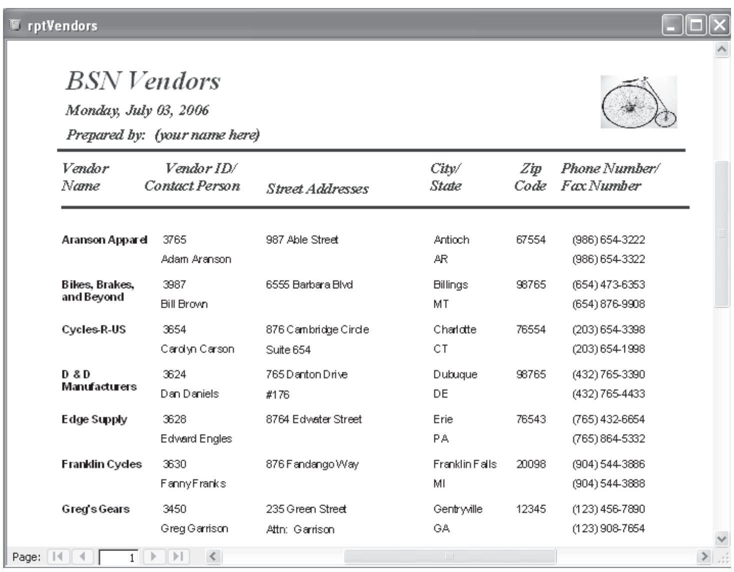
FIGURE 6-18 A suggested format for the form and subform of Problem 6-21.

c. Click on the ▶ symbol in navigation bar of the subform. What happens?

d. Create a new purchase order for your current vendor using your new subform. Do you think it makes sense to be able to create a new purchase order that has no detail lines? Why or why not?

6-22. A Listing of BSN Suppliers (Creating Simple Reports in Access)

The BSN Company would like a hard copy report of all the current vendors in its database. Figure 6-19 provides a suggested format for the report. Note that your report header should include the company title, the current date, your name, and a graphic. Also note that the detail section contains multiple lines. Create a similar report for this assignment.


rptVendors

BSN Vendors

Monday, July 03, 2006

Prepared by: (your name here)

Vendor Name	Vendor ID/ Contact Person	Street Addresses	City/ State	Zip Code	Phone Number/ Fax Number
Aranson Apparel	3765	987 Able Street	Antioch	67554	(986) 654-3222
	Adam Aranson		AR		(986) 654-3322
Bikes, Brakes, and Beyond	3987	6555 Barbara Blvd	Billings	98765	(654) 473-6353
	Bill Brown		MT		(654) 876-9908
Cycles-R-US	3654	876 Cambridge Circle	Charlotte	76554	(203) 654-3398
	Carolyn Carson	Suite 654	CT		(203) 654-1998
D & D Manufacturers	3624	765 Danton Drive	Dubuque	98765	(432) 765-3390
	Dan Daniels	#176	DE		(432) 765-4433
Edge Supply	3628	8764 Edwater Street	Erie	76543	(765) 432-6654
	Edward Engles		PA		(765) 864-5332
Franklin Cycles	3630	876 Fandango Way	Franklin Falls	20098	(904) 544-3886
	Fanny Franks		MI		(904) 544-3888
Greg's Gears	3450	235 Green Street	Gentryville	12345	(123) 456-7890
	Greg Garrison	Attn: Garrison	GA		(123) 908-7654

Page: 1

FIGURE 6-19 A suggested format of the report required by Problem 6-22.

Requirements:

a. Print the complete report.

b. Who is the first supplier and who is the last supplier?

6-23. Furry Friends Foundation III (Creating Forms and Reports)

Recall from Case 4–21 in Chapter 4 and Case 5–27 in Chapter 5 that the Furry Friends Foundation is a nonprofit organization that finds homes for abandoned animals. The foundation has created a relational database to help it store data more easily and answer questions about donations. This portion of the case requires you to create database forms and reports for the organization.

Requirements:

1. If you have not already done so, create the tables and relationships described in Case 4–21.
2. Create an intake form for the Contributor's Table. The form should be similar to Figure 6-1 and contain two columns for data entry. Make sure that the system tabs properly, so that data entries proceed logically from left to right and from top to bottom. To document your work, provide a screen capture of your report at run time, which includes your name as the entered contributor.
3. Create an intake form for the Donation's Table. Again, the form should be similar to Figure 6-1 and contain two columns for data entry. Make sure that the system tabs properly, so that data entries proceed logically from left to right and from top to bottom. Provide a screen capture of your report at run time.
4. Create a report that contains a current list of contributors (including yourself as a one of them). The report should include the following information in the header: Foundations Title, a graphic of a furry pet, your name as the developer, and the current date. The body of the report should contain the name, address, and phone number of all contributors, listed alphabetically by contributor's last name. The information for each contributor should all be on one line. Print the complete report.
5. Expand the set of contributors to include at least 10 individual records, and then change the entries in the donations file to include donations from each of them. Create reports for both tables and then print complete lists. Finally, create a report that contains a complete list of all contributors who gave donations during the months of November and December 2009. (Hint: base your report on a query instead of a table.) The report should include a header with the Foundations Title, a graphic of furry pets, your name as the developer, and the current date. The body of the report should list donations in order of the donator's last name and should include the donator's address and phone number. An example set of lines is as follows:

Date	Contributor	Phone Number	Animal Code	Amount
November 11, 2009	Lawrence, Marie 9190 Teepee Road Doolittle, NV 54984	(501) 767–1114	C	150

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ANSWERS TO TEST YOURSELF

1. **d** 2. **d** 3. **c** 4. **c** 5. **a** 6. **d** 7. **c** 8. **a** 9. **c** 10. **c**

PART THREE

USING ACCOUNTING INFORMATION

CHAPTER 7
Accounting Information Systems and Business Processes: Part I

CHAPTER 8
Accounting Information Systems and Business Processes: Part II

CHAPTER 9
Accounting and Enterprise Software

This section of the book is about business processes—what they are, why they are important, and what you need to know about these processes. First, we identify the fundamentals of a business process: journals, coding systems, and the basics of collecting and reporting accounting information. Chapter 7 identifies characteristics of the two core business processes that are most common to all businesses: the sales process and the purchasing process. Chapter 7 concludes with a discussion of a major trend that is occurring in today's businesses as a result of networked enterprises and globalization—it's called ''business without boundaries.'' To support this trend, companies use Business Process Management solutions to help maximize the efficiency and effectiveness of their processes.

Chapter 8 continues our discussion of core business processes. In this chapter we examine resource management processes, production processes, and financing processes, especially the events associated with these processes. Chapter 8 also considers the accounting information needs of specialized industries.

Regardless of the size of a business, it is hard to imagine any successful business that does not use information technology (IT). Managers and accountants at all levels of today's organization must be familiar with the hardware and software tools that are available to help make the firm more effective and efficient. Furthermore, as business entities globalize their operations, they typically find it useful to integrate the systems that track and control these operations. As a result, many firms now use an enterprise-wide systems approach. Accordingly, in Chapter 9 we focus on the accounting and enterprise software options that are available to firms—everything from entry-level accounting software to enterprise resource planning (ERP) systems.

Chapter 7

Accounting Information Systems and Business Processes: Part I

After reading this chapter, you will:

1. *Know* the steps in the financial accounting process.
2. *Understand* the use of journals and ledgers in processing accounting transactions.
3. *Recognize* different types of coding systems used by AISs.
4. *Understand* why planning an AIS begins with the design of outputs.
5. *Recognize* the objectives, inputs, and outputs of the sales and purchasing processes.
6. *Understand* why businesses choose outsourcing and offshoring of business processes.

"Purchasing isn't just a supply chain activity—it's a value-adding market activity that can make a significant contribution to profitability."

Richard Gerardo and Andrew Spanyi, "The CFO's Best Friend,"
Strategic Finance, December 2008, pp. 25.

INTRODUCTION

In this chapter and the following chapter, we introduce the fundamentals of a business process and then focus on several core business processes that are common to almost every business. We begin with a brief refresher of the basics of financial accounting. Although you may be wondering why we talk about the "bookkeeping" process in this textbook, these concepts are actually at the heart of an AIS. That is, these fundamental elements are embedded in the accounting information system and they are the basis for a company's annual financial statements. These fundamental elements include journals, ledgers, accounts, trial balances, and financial statements.

The nature and types of business processes vary, depending on the information needs of a specific organization. Nevertheless, a number of business processes are common to every organization. In this chapter, we examine business transactions related to the sales process (sales and cash collection) and the purchasing process (expenditures for materials and supplies, and cash payment).

Modern businesses are under tremendous pressure to cut costs, reduce capital expenditures, and become as efficient as possible at their core competencies. As a result, companies search globally to achieve efficiencies—it's called "business without boundaries." In the final portion of this chapter, we give examples of business processes that are commonly outsourced or offshored. We then examine some business process management solutions that are available to improve business processes regardless of their location.

BUSINESS PROCESS FUNDAMENTALS

An accounting cycle can begin in a number of different ways. For instance, accounting personnel can create a transaction from a source document, or a customer may order products online. Regardless of how the process starts, at the end of the process we issue annual financial reports and close the temporary accounts in preparation for a new cycle.

Overview of the Financial Accounting Cycle

Based on the preparation of source documents, an AIS records each transaction or business event affecting an organization's financial condition in journals or ledgers.

Journals. Accounting personnel record transactions in a journal. Of course, this is rarely an actual paper journal anymore—it's more likely an electronic entry in an accounting information system. The journal is a chronological record of business events by account. A journal may be a special journal or a general journal. Special journals capture a specific type of transaction. They are usually reserved for transactions occurring frequently within an organization. In a computerized system, special journals may take the form of special modules with their own files. For example, an accounting clerk would likely record a credit sale in an accounts receivable module.

Companies can set up a special journal for virtually any type of transaction. Common ones are sales journals, purchase journals, cash receipts journals, and cash disbursements journals. If you think about it, almost all accounting transactions a business organization records fall into one of these categories. Special journals include entries for all but a few types of transactions and adjusting journal entries, such as for depreciation. The general journal records these entries.

Ledgers. Journal entries show all aspects of a particular transaction. Each entry shows debit and credit amounts, the transaction date, the affected accounts, and a brief description of the event. Once an AIS records a journal entry, it next posts the entry in the general ledger. Within an AIS, a general ledger is a collection of detailed monetary information about an organization's various assets, liabilities, owners' equity, revenues, and expenses. The general ledger includes a separate account (often called a ''T account'' because of its shape) for each type of monetary item in an organization. Although journal entries record all aspects of business transactions, an AIS separately posts the monetary amounts in each account to the various accounts in the general ledger. A company's chart of accounts provides the organizational structure for the general ledger. The chart of accounts makes use of a block coding structure (discussed in the next section of this chapter).

Trial Balances and Financial Statements. Once an AIS records journal entries and posts them to the general ledger, it can create a trial balance. The trial balance is a listing of all accounts and their debit and credit balances. After debit and credit dollar amounts in this trial balance are equal, an accountant will record any necessary adjusting journal entries. Adjusting entries include journal entries for depreciation and other unrecorded expenses, prepaid expenses, unearned revenues, and unrecorded revenue. Once the debit and credit amounts in this trial balance are equal, an AIS is ready to produce financial statements.

Financial statements are the primary output of a financial accounting system. These financial statements include an income statement, balance sheet, statement of owners' equity, and cash flow statement. The accounting cycle does not end when an AIS generates financial statements. The computerized system must close temporary accounts, such as revenue and expense accounts, so that a new cycle can begin. This is necessary because users are interested in income information for a specific period of time. Because balance sheet accounts show financial performance at a specific point in time, they are permanent and need not be closed. Thus, an AIS will carry these amounts forward to the next accounting cycle. Figure 7-1 summarizes the steps in the accounting cycle.

Coding Systems

Accounting information systems depend on codes to record, classify, store, and retrieve financial data. Although it is possible in a manual system to use simple alphabetic descriptions when preparing journal entries, computerized systems use **numeric codes** (codes that use numbers only) or **alphanumeric codes** (codes that use numbers and letters) to record accounting transactions systematically. For example, a manual journal entry might include a debit to the ''Direct Materials Inventory'' account. In a computerized system, the debit might be to account ''12345.'' Alphanumeric codes are important in

1. Record transaction in a journal.
2. Post journal entries to a ledger.
3. Prepare an unadjusted trial balance.
4. Record and post adjusting journal entries.
5. Prepare an adjusted trial balance.
6. Prepare financial statements.
7. Record and post closing journal entries.
8. Prepare a post-closing trial balance.

FIGURE 7-1 A summary of the steps in the accounting cycle.

computerized systems, as they help to ensure uniformity and consistency. Suppose that a clerk entered a debit to ''Direct Materials Inventory'' one time and another time entered the debit to ''Dir. Materials Inventory.'' A computer would set up a new account the second time, rather than recognizing the intended account.

Types of Codes. AISs typically use several types of codes: (1) mnemonic codes, (2) sequence codes, (3) block codes, and (4) group codes. **Mnemonic codes** help the user remember what they represent. The product codes S, M, L, and XL are examples of mnemonic codes describing apparel sizes. As the name implies, a **sequence code** is simply a sequential set of numbers used to identify customer accounts, employee payroll checks, customer sales invoices, and so forth. **Block codes** are sequential codes in which specific blocks of numbers are reserved for particular uses. In a typical application, the lead digit, or two lead digits, in the sequence code acts as the block designator and subsequent digits are identifiers. AISs use block codes to create a chart of accounts (Figure 7-2). Combining two or more subcodes creates a **group code**, which are often used as product codes in sales catalogs.

Major Accounts	
100-199	Current assets
200-299	Noncurrent assets
300-399	Current liabilities
400-499	Long-term liabilities
500-599	Owners' equity
600-699	Revenue
700-799	Cost of goods sold
800-899	Operating expenses
900-999	Nonoperating income & expenses

Current Assets Detail	
100	Cash
110	Marketable securities
120	Common stock
121	Preferred stock
122	Bonds
123	Money market certificates
124	Bank certificates
125	Accounts receivable
130	Prepaid expenses
140	Inventory
150	Notes receivable

FIGURE 7-2 A block code used for a company's chart of accounts.

Design Considerations in Coding. There are a number of important factors to consider when designing an accounting code. First, it must serve some useful purpose. For example, if a product code in a manufacturing firm is part of a responsibility accounting system, at least one portion of the code must contain a production department code. Second, it must be consistent. Using Social Security numbers as employee identifiers is a good example of this design consideration. Third, managers must plan for future expansion (e.g., the creation of extra accounts).

COLLECTING AND REPORTING ACCOUNTING INFORMATION

As you might imagine, most of the accounting data collected by an organization ultimately appear on some type of internal and/or external report. Thus, the design of an effective AIS usually begins with the outputs (reports) that users will expect from the system. Although this might seem counterintuitive, we discuss the reasons for this in Chapter 13.

Among the outputs of an AIS are: (1) reports to management, (2) reports to investors and creditors, (3) files that retain transaction data, and (4) files that retain current data about accounts (e.g., inventory records). Perhaps the most important of these outputs are the reports to management because these reports aid decision-making activities. As you might imagine, the formats of these various reports might be very different. These reports might be hard-copy (paper) reports, soft-copy (screen) reports, e-copy (CD and other electronic media) reports, or audio outputs. If a manager queries a database system, the monitor shows the requested data and the system produces a hard-copy report only upon demand. Graphics enhance reports in any form. Many reports today appear on company websites. Although web page design is beyond the scope of this book, it is important to recognize that the rules for preparing good reports apply to web page reports as well as hard-copy and other multimedia reports.

Designing Reports

Users need many different types of accounting reports—some might be every hour and others not as often. An AIS might issue some reports only when a particular event occurs. For example, an AIS might issue an inventory reorder report only when the inventory for a certain product drops below a specified level. Such an event would probably generate an **exception report**, which is a list of exceptional condition(s). As another example, suppose that a purchase order has an authorization signature but contains some inaccurate or missing information. In this case, the AIS would generate an exception report. The report would include a table that identifies the error or errors, and would suggest a possible solution to fix the error. After correcting the error, the purchase order would require a new authorization signature. This signature would clear the exception from the report.

Characteristics of Good Reports. Good output reports share similar characteristics regardless of their type, such as: (1) useful, (2) convenient format, (3) easy to identify, and (4) consistent. For example, summary reports should contain financial totals, comparative reports should list like numbers (e.g., budget versus actual figures) in adjacent columns, and descriptive reports (e.g., marketing reports) should present results systematically.

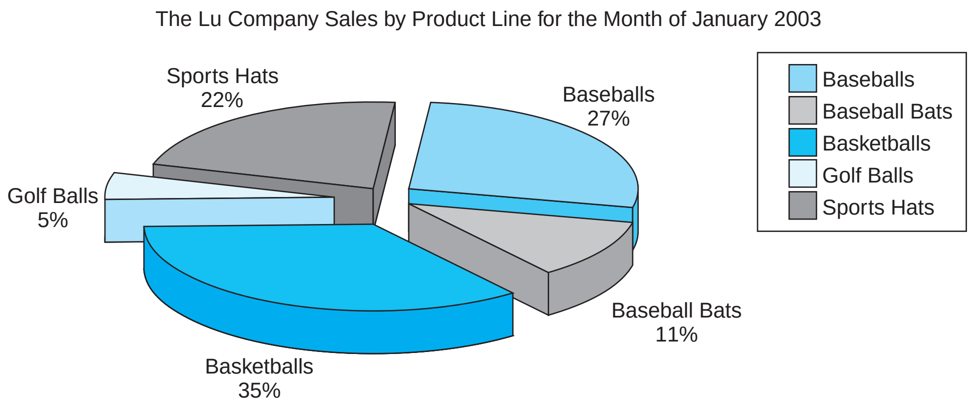


FIGURE 7-3 A pie chart showing the percentage of sales from various product lines.

Sometimes the most convenient format is graphical, such as a pie chart (Figure 7-3). Other graphical formats include bar charts and trend lines.

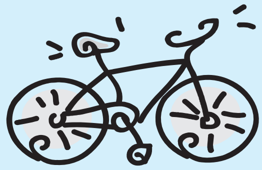
Identification and Consistency. Good managerial reports always contain fundamental identification, including headings (company name, organizational division or department, etc.), page numbers, and dates. For example, a report loses its information value if you do not know the time period it covers. Balance sheets and similar reports should show the date as of a specific point in time. Reports such as lists of current employees, customers, and vendors should also indicate a specific date. Income statements and similar reports should show a span of dates for the reporting period (e.g., for the month ended January 31, 2010).

AIS reports should be consistent: (1) over time, (2) across departmental or divisional levels, and (3) with general accounting practice. Consistency over time allows managers to compare information from different time periods. For example, a manager might want to compare a sales report for June with a similar report for the month of May of the same year. This manager might also look at sales for June of prior years to evaluate whether performance is improving or deteriorating. Similarly, reports should be consistent across departmental levels so that supervisors may compare departmental performance. Finally, report formats should be consistent with general accounting practice so that managers and investors can understand and use these reports.

From Source Documents to Output Reports

Companies use a variety of source documents to collect data for the AIS. The chief concerns in the data collection process are accuracy, timeliness, and cost-effectiveness. An example of a source document is the *purchase order* in Figure 7-4. This source document represents a computer-generated purchase order by BSN Bicycles, a bicycle shop, to purchase goods from the Lu Company, a sporting goods distributor. Typically, employees prepare several copies of a purchase order for internal use (these may be hard copies or computer images). For instance, the purchasing department keeps one copy to document the order and to serve as a reference for future inquiries. Accounting and receiving departments also receive copies. The purchase order number is 36551. Purchase orders are normally sequentially numbered for easy reference at a later date.

ORDERED BY
BSN BICYCLES
1 Sports Lane
Sports Shop, XX 12345



Purchase
Purchase Order No:
36551

To:
Lu Company
222 Main Street
Pleasantville, XX 23456

Date	Good Through	Account No.	Terms
3/1/2010	3/30/2010		2/10, n/30

Item	Description	Quantity	Unit Price	Total
G124-464	Hot Rider Gloves-Women	15.00	24.95	374.25
G453-324	Mogul Tire Pumps	20.00	34.95	699.00
			Total	$1,073.25

Authorized Signature ______________________________

FIGURE 7-4 A sample purchase order.

Based on this purchase order, the Lu Company ships merchandise and sends a sales invoice to BSN Bicycles. Figure 7-5 illustrates the *sales invoice* document. The sales invoice duplicates much of the information on the original purchase order. New information includes the shipping address, a reference to the purchase order number, the shipping date, due date, the sales invoice number, and the customer identification number. The Lu Company might produce as many as six copies of the sales invoice. Two (or more) copies are the bill for the customer. The shipping department keeps a third copy to record that it filled the order. A fourth copy goes to the accounting department for processing accounts receivable. The sales department retains a fifth copy for future reference. Finally, the inventory department receives a sixth copy to update its records on the specific inventory items sold.

Source documents of the types illustrated here help manage the flow of accounting data in several ways. First, they dictate the kinds of data to be collected and help ensure legibility, consistency, and accuracy in recording data. Second, they encourage the completeness of accounting data because these source documents clearly enumerate the information required. Third, they serve as distributors of information for individuals or departments. Finally, source documents help to establish the authenticity of accounting data. This is useful for such purposes as establishing an audit trail, testing for authorization of cash disbursement checks or inventory disbursements, and establishing accountability for the collection or distribution of money.

Invoice
Invoice Number:
15563
Invoice Date:
3/3/2010
Page:
1

Voice:
Fax:

Duplicate

Sold To:	**Ship To:**
BSN BICYCLES 1 Sports Lane Sports Shop, XX 12345	BSN BICYCLES 1 Sports Lane Sports Shop, XX 12345

Customer ID	**Customer PO**		**Payment Terms**
BSN001	36551		2/10, n/30
Sales Rep	**Shipping Method**	**Ship Date**	**Due Date**
W. Loman	Rail	3/30/2010	4/3/2010

Quantity	**Item**	**Description**	**Unit Price**	**Total**
15.00	G124-464	Hot Rider Gloves-Women	$24.95	374.00
20.00	G453-324	Mogul Tire Pumps	$34.95	699.00

Check No.

Subtotal	$1,073.25
Sales Tax	
Total Invoice Amount	$1,073.25
Payment Received	0.00
TOTAL	$1,073.25

FIGURE 7-5 A sample sales invoice.

Both manual and computerized AISs use source documents extensively. In many AISs today, source documents are still written or printed on paper. However, large companies are moving to paperless offices via the Internet, electronic data interchange, or scanning documents and saving them electronically. Improving the design of source documents prepared online can save a business money, as in the following case.

Case-in-Point 7.1 Woerner Turf is a company that produces turf grass and sod for landscaping. The company recently implemented a new software package by *Microsoft Great Plains Business Solutions* that consolidated its sales order screen. It eliminated or condensed data entry fields to create a single screen. It is not uncommon for a sales person to enter orders as often as 50–100 times each day. The new design, which is similar to the paper form used previously, reduces order entry time from three minutes to one. This increased efficiency allows sales staff to spend more time selling and less time entering data.[1]

[1]Source: www.greatplains.com/solutions.

THE SALES PROCESS

A **business process** is a collection of activities and work flows in an organization that creates value. An AIS collects and reports data related to an organization's business processes. The nature and type of business processes might vary from industry to industry, but most businesses and government agencies have some common core processes. Two core business processes that are common to almost every business are *sales* and *purchasing*. Information processing requires recording, maintaining, grouping, and reporting business and economic activities that make up a business process. For example, the sales process includes such activities as taking sales orders, filling orders, managing customer inquiries, and receiving payment. The AIS collects and stores data for each of these activities as part of the sales process.

An **economic event** is an activity that involves an increase and/or decrease in dollar amounts on the financial statements. An example would be collecting cash from a customer on account. Because economic events impact financial statements, they are often called accounting transactions. A **business event** is an activity that does not impact the financial statements, but is nevertheless important to the business. A sales order from a customer is an example of a business event. Although accountants do not record all business events in journals, they most likely record this information to support decision-making (e.g., customer relationship management, discussed later in this chapter).

The **sales process** begins with a customer order for goods or services and ends with the collection of cash from the customer. Figure 7-6 summarizes the AIS objectives, inputs, and outputs related to the sales process, assuming that sales are on credit and for merchandise rather than services.

Objectives of the Sales Process

Revenues result from an organization's sale of goods or services. They may also result from donations or gifts, as in the case of many nonprofit organizations. An organization that generates revenues, but fails to collect these revenues regularly, may find it cannot

The Sales Process

OBJECTIVES

Tracking sales of goods and/or services to customers
Filling customer orders
Maintaining customer records
Billing for goods and services
Collecting payment for goods and services
Forecasting sales and cash receipts

Inputs (Source Documents)

- Sales order
- Sales invoice
- Remittance Advice
- Shipping Notice
- Debit/Credit Memoranda

Outputs (Reports)

- Financial Statement Information
- Customer Billing Statement
- Aging Report
- Bad Debt Report
- Cash Receipts Forecast
- Customer Listing
- Sales Analysis Reports

FIGURE 7-6 Objectives, inputs, and outputs associated with processing revenue transactions.

pay its bills. Many people unfamiliar with accounting make the incorrect assumption that companies with positive incomes cannot go out of business. The reality is that bankruptcy results from inadequate cash flow, not from insufficient income. The primary objective in processing revenues is to achieve timely and efficient cash collection.

To process sales in a timely and efficient manner, an organization must be able to track all revenues that customers owe the firm. Once the AIS recognizes these revenues, the revenue portion of the system needs to monitor the resulting cash inflows. A good AIS matches each revenue with a valid transaction. Maintaining customer records is an important function of the AIS for the revenue process. This includes validating a customer's bill-paying ability and payment history, assigning credit limits and ratings to customers, and tracking all customers' outstanding invoices. Processing revenues includes filling customers' orders. This requires an interface with the inventory control function. The AIS should bill customers only for products shipped. The sales process must also allow for certain exceptions—for example, sales returns.

Forecasting is another objective of the AIS to help management in its planning function. The AIS must analyze sales orders, sales terms, payment histories, and other data. For example, sales orders are a good indicator of future revenues, and the terms of sale provide information about likely dates of collection on accounts.

Events in the Sales Process. Figure 7-7 illustrates an AIS for the sales process in a systems flowchart. This view assumes an online sales order. Notice that emails and electronic images replace many of the paper documents. The flowchart also assumes that the AIS uses a centralized database that integrates all the data files (discussed in Chapters 4, 5, and 6). The following fictitious example describes the sales process shown in Figure 7-7.

Example. Hiroshi Ajas needs to purchase books for his classes this semester. He decides to buy the books online from textbooks.com. In verifying the order, textbooks.com's AIS also verifies Hiroshi's credit card and checks its inventory to make sure the books are available. The company then sends Hiroshi an email confirmation, verifying the transaction. Textbooks.com's AIS notifies its warehouse via email to pack and ship the books. The warehouse processes the shipment information and creates a packing slip. Warehouse personnel then package the packing slip with the books and send them to Hiroshi. The day that textbooks.com ships the books, it also charges Hiroshi's credit card.

The major events in textbooks.com's sales process are the sales order, the shipment of goods, and the customer payment. The company will record information about each of these events. This information allows them to produce a variety of reports, such as book sales by regions of the country. The next two sections describe the information inputs and outputs of the sales process.

Inputs to the Sales Process

Figure 7-8 shows a data flow diagram of the sales process, which identifies the data inputs and information outputs of the process. As noted in the example, an AIS typically creates a *sales order* at the time a customer contracts for goods or services. In this example, an accounts receivable clerk uses this sales order to prepare a sales invoice or the customer might generate one herself using the web page of an online retailer. The *sales invoice* reflects the product or products purchased, the price, and the terms of payment. When the customer makes a payment, a *remittance advice* may accompany the payment. When

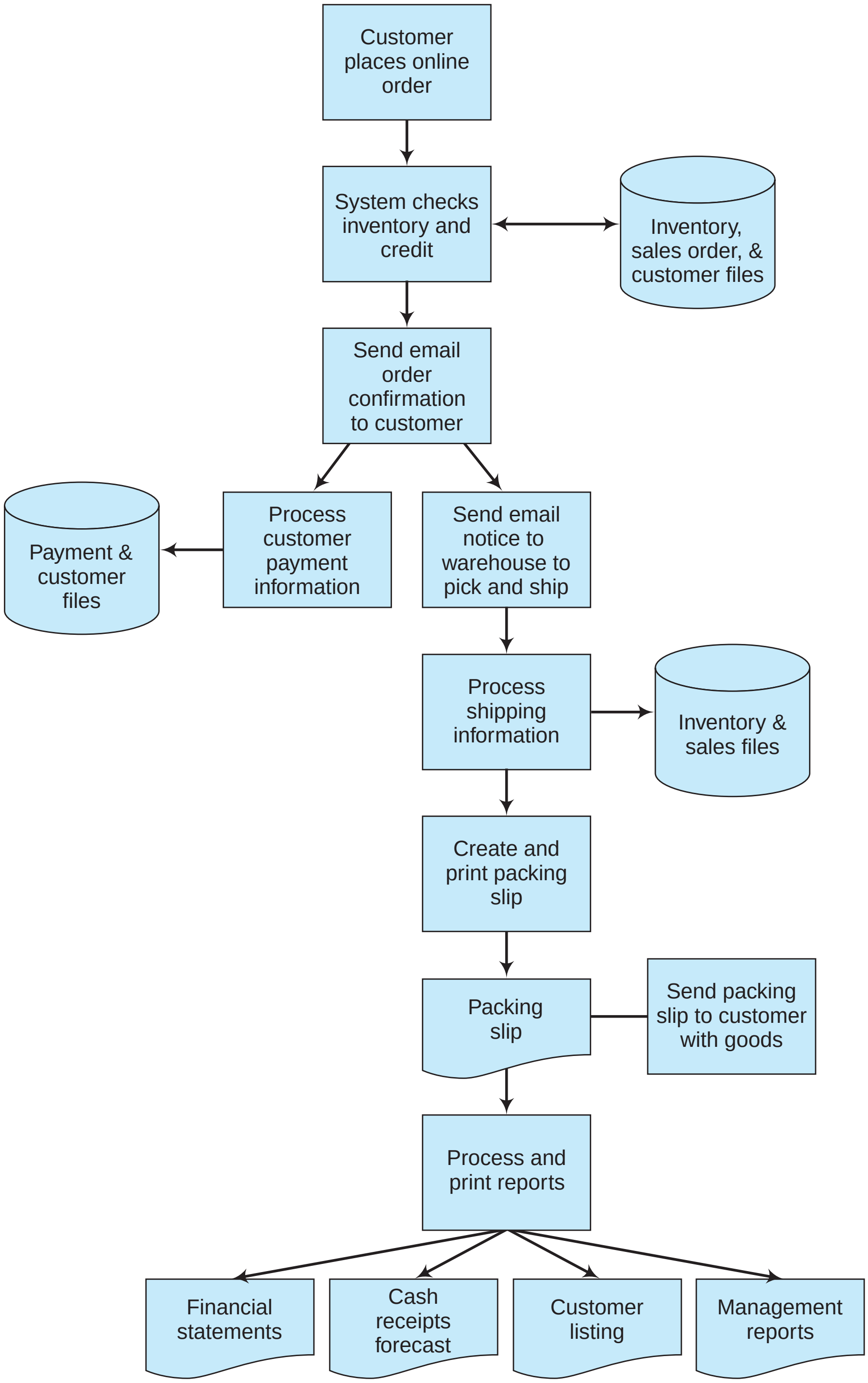


FIGURE 7-7 High-level systems flowchart of the sales process in an online environment.

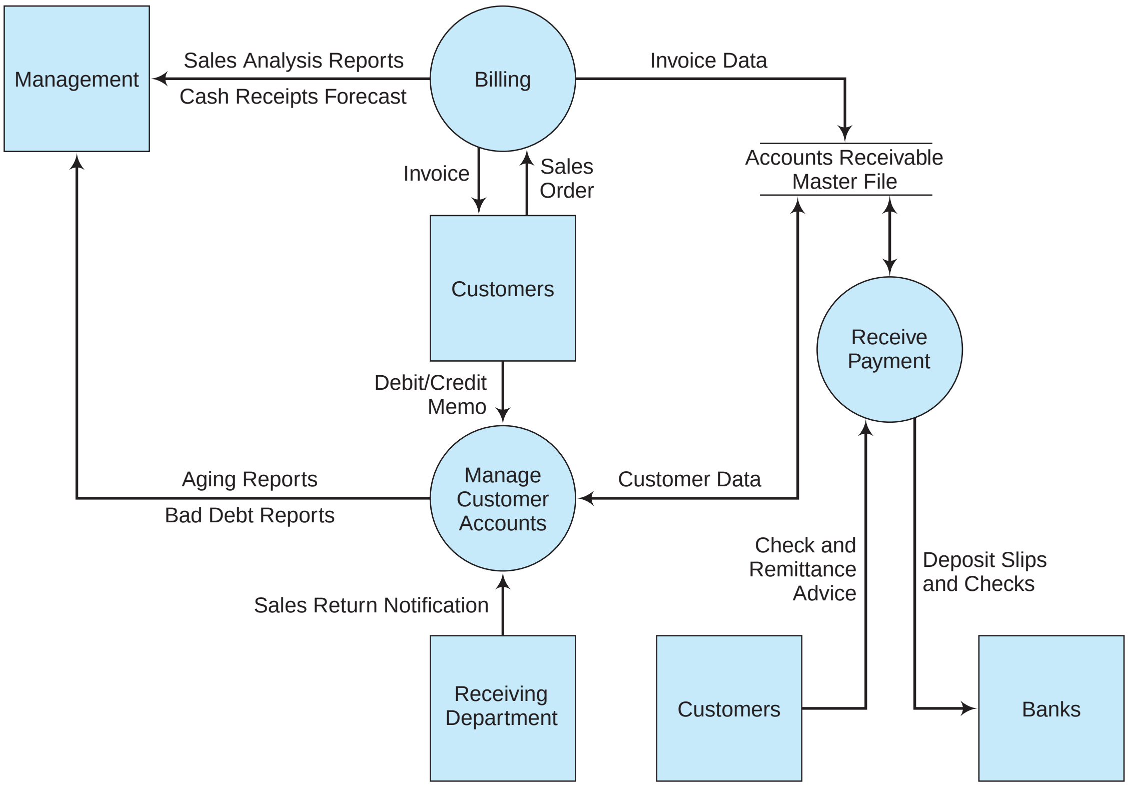


FIGURE 7-8 Data flow diagram of the sales process.

you pay your Visa or MasterCard bill, for example, the portion of the bill you return with your check is a remittance advice.

In addition to sales orders, sales invoices, checks, and remittance advices, *shipping notices* are another input to sales processing. When the warehouse releases goods for shipment, the warehouse clerk prepares a shipping notice. A copy of this notice may serve as a *packing slip* and would be included in the package with the goods. A copy of this document is also sent to the accounts receivable department and is used as a prompt for the department to bill the customer.

Debit/credit memoranda are source documents affecting both the sales and purchasing processes. An organization issues these memoranda to denote the return of damaged goods or discrepancies about the amount owed. For example, let's assume that Hiroshi's package with the textbooks arrived, but two of the books were damaged and two were the wrong textbooks. Of course, Hiroshi returned the four books (worth $400) to textbooks.com. However, Hiroshi must wait until the company receives the books and processes the return before he will be issued a *credit* to his account (credit card) for the $400.

If a company finds that it has charged a customer too little for goods sold, the company would issue a *debit* memorandum. This debit memorandum signifies a debit to the customers account receivable with the company to reflect the amount not charged originally. The customer now owes more to the company.

Business organizations use the data they collect about their customers and sales transactions to improve customer satisfaction and increase profitability. As a result, they are purchasing or developing **customer relationship management (CRM)** software to gather, maintain, and use these data to provide better customer service and customer loyalty. However, think broadly here about potential uses of CRM software. For example, many universities are now purchasing CRM solutions to help them better manage their current and potential customers (i.e., students). These software packages help various schools and colleges within a university manage course enrollments, communications, invoice and payment processing, and perhaps most importantly, stay connected with graduates who will hopefully become donors!

Case-in-Point 7.2 FedEx purchased CRM technology and combined information from all of their business units. This allowed the company to offer new customer services. For example, a customer can now track a package, regardless of whether the package is traveling express, ground, or freight. FedEx also captures data at the customer level, and can determine whether a customer needs a scheduled pickup. In one instance, FedEx told a customer that it couldn't deliver a package on time because the president was in town and streets were blocked.[2]

Outputs of the Sales Process

Processing sales transactions creates several outputs. An AIS uses some of these outputs to produce external accounting reports (such as financial statements) as well as internal reports (such as management reports). Management reports can be in any format and contain the information they need for decision-making. In this and the following sections of the chapter, we discuss a few of the many reports that may be created by AISs.

One output of the sales process is a *customer billing statement*. This statement summarizes outstanding sales invoices for a particular customer and shows the amount currently owed. Other reports generated by the sales revenue process include aging reports, bad debt reports, cash receipts forecasts, approved customer listings, and various sales analysis reports. The *aging report* shows the accounts receivable balance broken down into categories based on time outstanding. The *bad debt report* contains information about collection follow-up procedures for overdue customer accounts. In the event that a customer's account is uncollectible, the account is written off to an allowance account for bad debts. A detailed listing of the allowance account may be another output of the sales process.

All of the data gathered from source documents in processing sales transactions serve as inputs to a *cash receipts forecast*. Data such as sales amounts, terms of sale, prior payment experience for selected customers, and information from aging analysis reports and cash collection reports are all inputs to this forecast.

We previously indicated that maintaining customer records is an important function of the AIS in the sales process. The billing or accounts receivable function should approve new customers, both to ensure that the customers exist and to assess their bill-paying ability. This may require obtaining a credit report from a reputable credit agency such as Dun and Bradstreet. The billing function assigns each new customer a credit limit based on credit history. From time to time, the AIS produces an *approved customer listing* report. This report is likely to show customer ID numbers (for uniquely identifying each customer), contact name(s), shipping and billing addresses, credit limits, and billing terms.

[2]Kathleen Hickey, ''A Winning Combination: Integration of CRM,'' *Traffic World*, (January 5, 2004) p. 18.

If an AIS captures (or converts) appropriate sales data electronically, it can also produce various *sales analysis reports*. These include sales classified by product line, type of sale (cash, credit, or debit card), or sales region. However, the sales process can only produce effective sales analysis reports if the AIS captures appropriate sales data. Again, customer relationship management solutions help managers take advantage of this data to maximize revenue and to provide better customer service.

THE PURCHASING PROCESS

The **purchasing process** begins with a request (or an order) for goods or services and ends with payments to the vendor. Figure 7-9 shows the objectives, inputs, and outputs associated with purchasing events. Our discussion assumes that credit purchases are for goods (i.e., manufacturing inventory) rather than for services. But in general, purchases may be for either goods or services and for cash or on credit.

Objectives of the Purchasing Process

Credit transactions create accounts payable. Accounts payable processing closely resembles accounts receivable processing; it is the flip side of the picture. With accounts receivable, companies keep track of amounts owed *to* them from their customers. An accounts payable application tracks the amounts owed *by* a company to vendors. The objective of accounts payable processing is to pay vendors at the optimal time. Companies want to take advantage of cash discounts offered, and also avoid finance charges for late payments.

Maintaining vendor records is as important to the purchasing process as maintaining customer records is for the sales process. The purchasing department is responsible for maintaining a *list of authorized vendors*. This entails ensuring the authenticity of vendors as well as finding reputable vendors who offer quality goods and services at reasonable prices. Vendor shipping policies, billing policies, discount terms, and reliability are also important

The Purchasing Process

OBJECTIVES

Tracking purchases of goods and/or services from vendors
Tracking amounts owed
Maintaining vendor records
Controlling inventory
Making timely and accurate vendor payments
Forecasting purchases and cash outflows

Inputs (Source Documents)

- Purchase Requisition
- Purchase Order
- Vendor Listing
- Receiving Report
- Bill of Lading
- Packing Slip
- Debit/Credit Memoranda

Outputs (Reports)

- Financial Statement Information
- Vendor Checks
- Check Register
- Discrepancy Reports
- Cash Requirements Forecast
- Sales Analysis Reports

FIGURE 7-9 Objectives, inputs, and outputs associated with the purchasing process.

variables in the approval process. Businesses today are strengthening their relationships with their vendors or suppliers, recognizing that they are partners in a **supply chain**. Probably one of the most successful supply chain management ''partnerships'' is that of Wal-Mart and Procter & Gamble.

Case-in-Point 7.3 Wal-Mart and P&G started collaborating in the 1980s, at a time when retailers shared very little information with manufacturers. But these two companies decided to build a software system to connect P&G to Wal-Mart's distribution centers. When P&G's products run low at the distribution centers, the information system sends an automatic alert to P&G to ship more. In some cases, the system communicates at the individual store level, which allows P&G to monitor the shelves through real-time satellite link-ups. Just recently, P&G and Wal-Mart started using RFID technology to achieve even more efficiencies in the supply chain.[3]

The purchase of goods affects *inventory control*. The objective of inventory control is to ensure that an AIS records all goods purchased for, and dispensed from, inventory. The inventory control component of the purchasing process interfaces with production departments, the purchasing department, the vendor, and the receiving department.

A final objective of the purchasing process is forecasting cash outflows. The addition of outstanding purchase requisitions, purchase invoices, and receiving reports provides an estimate of future cash requirements. With the forecast of cash receipts produced by the sales process, this estimate allows an organization to prepare a cash budget.

Events in the Purchasing Process. Figure 7-10 shows a systems flowchart that describes the purchasing process. As with the sales process, the flowchart assumes a centralized database and a mix of paper documents and electronic images. The following fictitious example describes the purchasing process shown in Figure 7-10.

Example. Sandra Michaels is an employee at textbooks.com who needs to purchase a new computer. She pulls up the purchase requisition form from the company's intranet and fills in the appropriate information. She then sends the completed form to her supervisor for approval, who approves the request and clicks the ''Submit'' button to forward Sandra's request electronically to the purchasing department. A purchasing agent creates an electronic purchase order based on the information Sandra provided. The agent consults the vendor file to locate an authorized vendor for the requested computer. The AIS then sends an electronic version of the order to the receiving department and another copy to the vendor. When the computer arrives from the vendor, a receiving clerk consults the AIS system to verify that a purchase order exists for the goods received. The clerk then enters information about the receipt (e.g., date, time, count, and condition of merchandise) to create an electronic receiving report. Upon receipt of an electronic vendor invoice and the receiving report, the accounts payable system remits payment to the vendor.

The economic and business events in textbooks.com's purchasing process are the purchase request, purchase order, receipt of goods, and payment to the vendor. The company's AIS records information about each of these events and produces a variety of reports. The next two sections describe the information inputs and some of the reports associated with the purchasing process.

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[3]Source: http://www.cio.com/article/40940/Supply_Chain_Management_Definition_and_Solutions?page = 3.

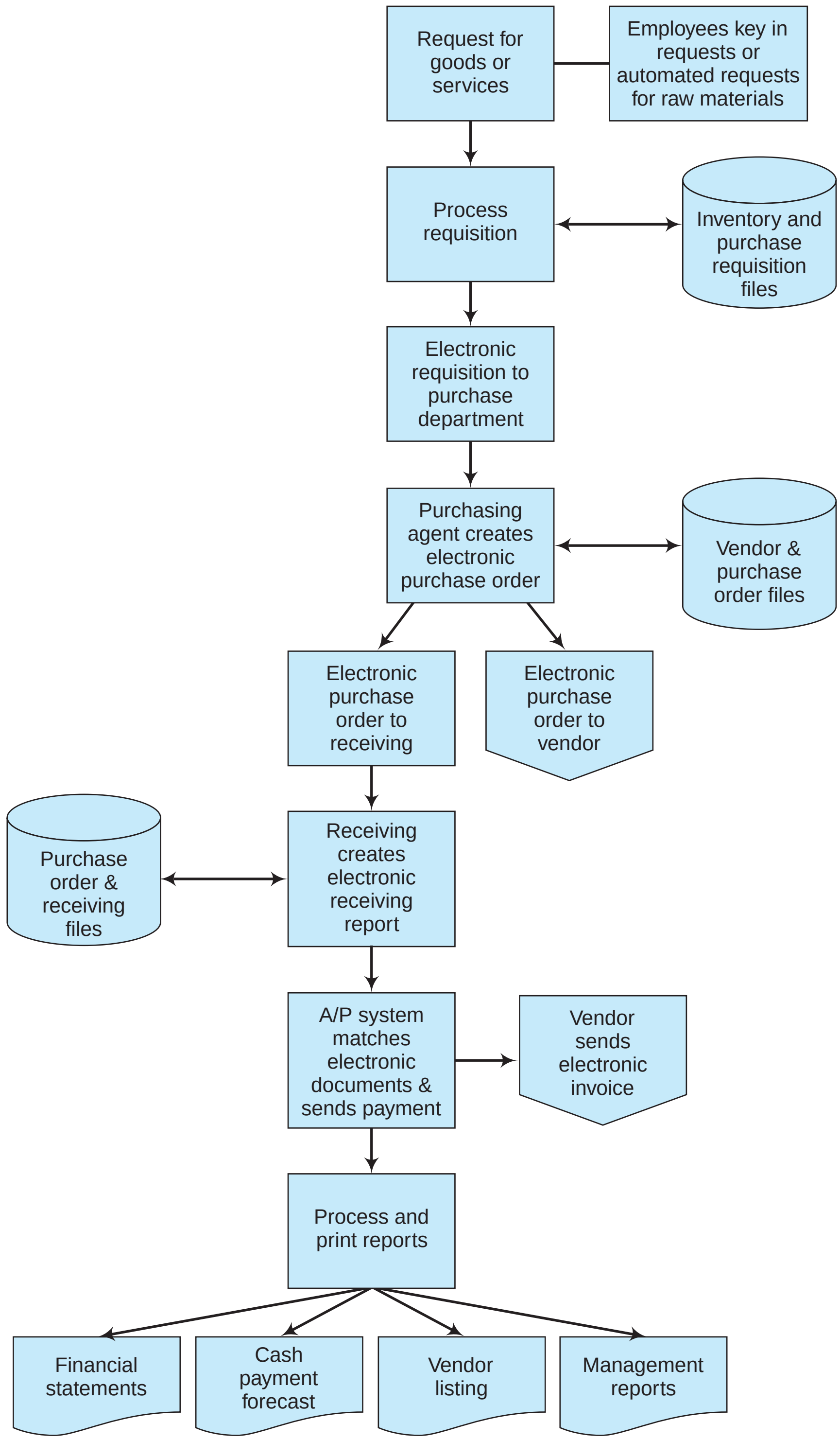

FIGURE 7-10 High-level Systems flowchart of the purchasing process in an online environment.

Inputs to the Purchasing Process

As explained earlier, the purchasing process often begins with a requisition from a production department for goods or services. Sometimes, an AIS triggers purchase orders automatically when inventories fall below pre-specified levels. The *purchase requisition* shows the item requested and may show the name of the vendor who supplies it.

In Figure 7-11, the accounts payable system matches three source documents before remitting payment to the vendor: the purchase order, the receiving report, and the purchase invoice. A *purchase invoice* is a copy of the vendor's sales invoice. The purchasing organization receives this copy as a bill for the goods or services purchased. The purpose of matching the purchase order, receiving report, and purchase invoice is to maintain the best possible control over cash payments to vendors. For example, the absence of one of these documents could signify a duplicate payment. A computerized AIS can search more efficiently for duplicate payments than a manual system. For example, auditors can instruct an AIS to print a list of duplicate invoice numbers, vendor checks for like dollar amounts, and similar control information.

The purchase requisition initiates the purchase order. Besides the information on the requisition, the purchase order includes vendor information and payment terms (see Figure 7-4). The purchasing department typically prepares several copies (or images) of the purchase order. In a paper-based system, the purchasing clerk sends one copy of the purchase order to the receiving department to serve as a receiving report or, preferably, to prompt the receiving department to issue a separate receiving report. This copy of the

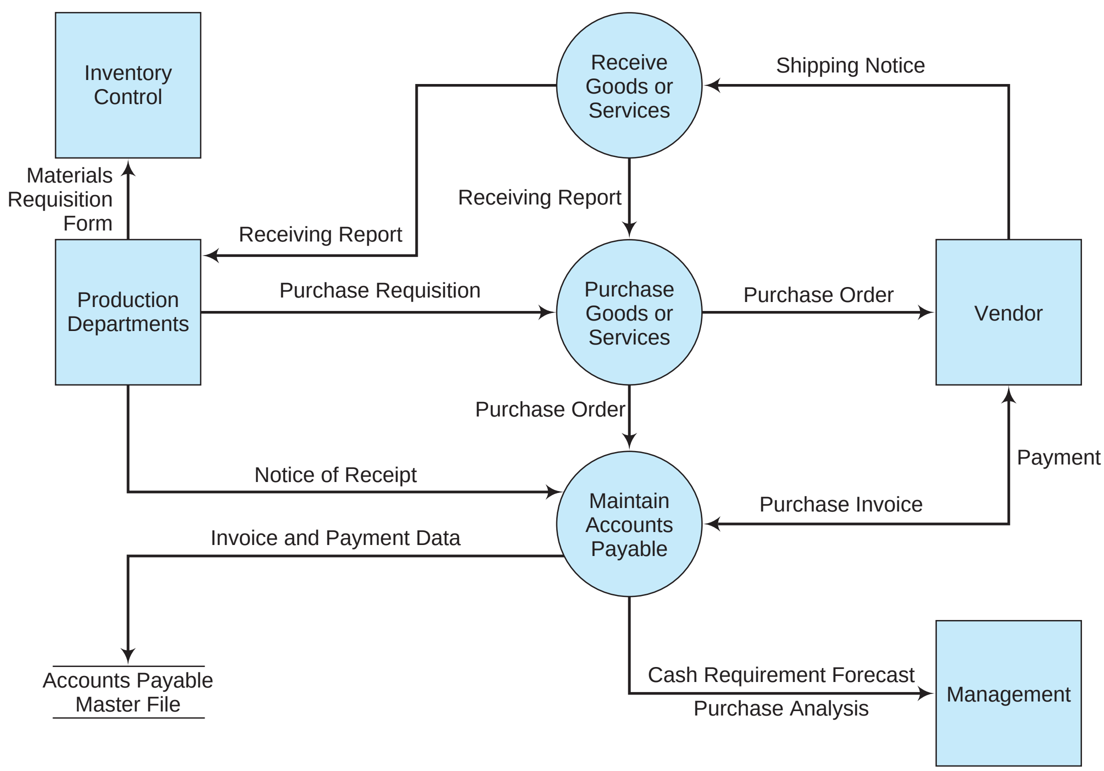

FIGURE 7-11 Data flow diagram of the purchasing process.

purchase order is specially coded (or color-coded) to distinguish it from other copies of the purchase order if there is no separate receiving report. The receiving department copy might leave out the quantities ordered that are identified in the purchase order. This is done for control purposes, so that workers receiving the goods must do their own counts, rather than simply approving the amounts shown on the purchase order.

Another source document, a bill of lading, accompanies the goods sent. The freight carrier gives the supplier a bill of lading as a receipt, which means the carrier assumes responsibility for the goods. It may contain information about the date shipped, the point of delivery for freight payment (either shipping point or destination), the carrier, the route, and the mode of shipment. The customer may receive a copy of the shipping notice with the purchase invoice. This is important to the accounts payable subsystem, because accounts payable accruals include a liability for goods shipped free on board (FOB) from the shipping point. Goods shipped this way have left the vendor, but the customer has not yet received them. Another source document, the packing slip, is sometimes included in the merchandise package. This document indicates the specific quantities and items in the shipment and any goods that are on back order. The next time you order goods through a catalog or over the Internet, look for a packing slip, such as the one shown in Figure 7-12, in the container with your merchandise.

Outputs of the Purchasing Process

Typical outputs of the purchasing process are vendor checks and accompanying check register, discrepancy reports, and a cash requirements forecasts. The check register lists all checks issued for a particular period. Accounts payable typically processes *checks* in batches and produces the *check register* as a byproduct of this processing step. **Discrepancy reports** are necessary to note any differences between quantities or amounts on the purchase order, the receiving report, and the purchase invoice.

The purpose of a discrepancy report is to ensure that no one authorizes a vendor check until the appropriate manager properly reconciles any differences. For example, assume that a receiving report indicates the receipt of twelve units of product, whereas the purchase order shows that a company ordered twenty units and the purchase invoice bills the company for these twenty units. The accounts payable function records the liability for twenty units and notes the situation on a discrepancy report for management. This report would trigger an investigation. For example, it is possible that the vendor made two shipments of merchandise, and one shipment has yet to be received. If this is the case, receipt of the second shipment clears this discrepancy from the next report. However, it this is not the case, it is important for management to determine the cause of the discrepancy as soon as possible.

The purchasing process produces a *cash requirements forecast* in the same manner that the sales process produces a cash receipts forecast. By looking at source documents such as outstanding purchase orders, unbilled receiving reports, and vendor invoices, an AIS can predict future cash payments and their dates. Naturally, this forecast is easier to make with a computerized system than with a manual system.

Information Technology (IT) Used in the Sales and Purchasing Processes.

Much of the input and output related to business processes is now electronic, and that includes the sales and purchasing processes. For instance, inputs (sales order or purchase requests) can be voice inputs, touch-tone telephone signals, bar codes, video signals, magnetic ink characters (as on checks), scanned images, or keystrokes from a computer.

BOOKS, MUSIC & MORE
amazon.com

http://www.amazon.com
orders@amazon.com

Amazon.com
Coffeyville Ind. Park
2654 N. Highway 169
Coffeyville, KS 67337
USA

Toll–Free: (800) 201-7575
Voice: +1 (206) 266—2992
FAX: +1 (206) 266—2950

Carolyn S. Norman
10906 River Terrace
Richmond, VA 23284
United States

BOOKS, MUSIC & MORE
amazon.com

Coffeyville Ind. Park
2654 N. Highway 169
Coffeyville, KS 67337
US +1 (206) 266—2992

Carolyn S. Norman
10906 River Terrace
Richmond, VA 23284
United States

UPS_GR

hhvv8429/4b/11414/std-us/1304086/513 524–1154

Your order of June 29, 2010 (Order ID 102–4721982–4436814)

Qty	Item	Description	Format	Our Price	Total
	In This Shipment				
1	Rough Draft (P—2—A25B23)	Hall, James W.	Hardcover	$17.47	$17.47
1	The Brethren (R—1—O43A1)	Grisham, John	Hardcover	$16.77	$16.77
1	The Business of Consulting : The Basics and Beyond (P—2—D4E5)	Biech, Elaine	Hardcover	$39.95	$39.95
1	Flawless Consulting: A Guide to Getting Your Expertise Used (Second Edition) (P—5—K56F3)	Block, Peter	Hardcover	$39.95	$39.95

Subtotal	$114.14
Shipping & Handling	6.96
Order Total	121.10
Paid via Visa	121.10
Balance Due	0.00

This shipment completes your order.

You can always check the status of your orders from the "Your Account" link on our homepage.

Thanks for shopping at Amazon.com, and please come again!

FIGURE 7-12 A packing slip from amazon.com.

Salespeople in the field typically use laptop computers, portable bar code scanners, or other types of input devices to enter data. With a wireless capability, they can also enter the information in real-time.

Case-in-Point 7.4 If you have moved lately, you probably watched a moving company representative walk through your home with a barcode scanner and a sheet of paper with various barcodes for different pieces of furniture and other items in your home. After the walkthrough, the representative can quickly download the information to a laptop, print out an estimate of the cost of your move, and discuss the estimate with you—all in the same visit![4]

Automated data-entry technology helps companies save money as well as provide better customer service. For example, bar code scanners that are commonly used in most retail stores gather essential inventory data (and help to avoid human error) for the retailer, and they also can help expedite the checkout process for customers. In addition, some retailers are using biometric technology that offers customers convenience and faster-checkouts, and offers retailers savings in transaction costs. Here's how biometric payment works: To set up an account, customers scan their fingerprint at an in-store kiosk, enter their phone number, and then submit checking and credit card account information. To make a purchase, they place their finger on a scanner at the register, enter their phone number, and choose how they want to pay (credit, debit, or checking).[5]

Case-in-Point 7.5 In 1916, Clarence Saunders (a very innovative businessman in Memphis, TN) opened the first Piggly Wiggly® grocery store—the very first self-service grocery store. Saunders recently decided to be innovative again and started a pilot program to test the use of biometric payments. Within three months of starting the pilot program at four Piggly Wiggly grocery stores, 15% of its customers who normally did not pay by cash enrolled in the Pay By Touch system. Those users increased their store visits by 15%, which translates into an additional 7,350 transactions a year. Not only did they come more often, those shoppers also spent 12% more on groceries.[6]

IT supports the purchasing process in a variety of ways. For example, an organization might determine that some inventory items can be reordered automatically and electronically when the company reaches a predetermined minimum quantity of those inventory items. An automatic reorder can be generated by the computer system, sent electronically to the vendor, and the vendor can be paid electronically by using EDI. We discuss this aspect of e-commerce more in depth in Chapter 15. After purchases arrive, our next concern is inventory management. To effectively manage inventory, we might use different technologies. Below, we describe two cases where organizations decided to use **RFID tags** (a computer chip with a tiny antenna) to manage inventory. The first is the Boeing Company and the second is the Department of Defense. In both cases, the vendors of the manufactured goods place the RFID tags on the items. The interesting point about RFID tags is that they can contain a complete history of the individual part, and then the purchaser can add or delete information to or from the tag as the part proceeds through the supply chain.

Case-in-Point 7.6 The Boeing Co. uses RFID tags to track between 1,700 and 2,000 mission-critical parts on each of its new 787 jetliners, but that's really not very many when

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[4]Source: from the authors.

[5]Source: http://money.cnn.com/2006/01/24/magazines/fortune/pluggedin_fortune_biometrics.

[6]Sources: http://www.pigglywiggly.com/cgi-bin/customize?aboutus.html and http://money.cnn.com/2006/01/24/magazines/fortune/pluggedin_fortune_biometrics.

you consider that each of these jetliners has about 6 million parts. The parts that are tagged with RFID are those that are either very expensive or frequently require maintenance and replacement. Information stored on the RFID tag helps trace parts and reduces cycle time to solve service problems. For example, before RFID, if one of the three computers in the cockpit of a 747 needed to be replaced, a mechanic would have to get on his back with a flashlight and a mirror to search for a serial number. Now, the mechanic can walk into a cockpit with an RFID reader and locate the faulty computer with just a couple of clicks.[7]

Case-in-Point 7.7 The Department of Defense (DOD) requires its largest suppliers to attach RFID tags to all pallets of merchandise shipped to the DOD. The DOD wants to use RFID tags to improve business functions, all aspects of the defense supply chain, and inventory management. This is particularly important because the DOD has more than 43,000 suppliers, and 100 of these suppliers account for 80% of the dollar value of supplies.[8]

CURRENT TRENDS IN BUSINESS PROCESSES

Organizations frequently divide business processes into ''core processes'' and ''other processes.'' In the past, managers and management accountants focused on cost management, while managers and internal auditors primarily focused on improving core processes. In all cases, the goal was typically to make these processes as efficient as possible. Now, organizations are critically examining their processes to determine which ones to keep and which ones to outsource. Results from a 2008 Accenture survey suggest that companies outsource for strategic advantages as much as for cost savings, as we highlight in the following case-in-point.

Case-in-Point 7.8 The senior executives who responded to the Accenture survey credit outsourcing with increasing their sense of control over business performance, and the most common control gains that they mentioned are:

- Improved planning (47%)
- Greater reliability of business information (39%)
- A stronger grasp of business outcomes (37%)
- More effective implementation of ideas (33%)
- Increased revenue (32%)[9]

Business Processes Outsourcing (BPO)

Companies outsource such business processes as human resources, finance and accounting, customer services, learning services and training, and information technology. A recent survey estimated the global BPO market for human resources services to be $50 billion. See Figure 7-13 for examples of outsourcing.

[7]Source: http://epsfiles.intermec.com/eps_files/eps_cs/Boeing_cs_web.pdf
[8]Sullivan, Laurie, ''Department of Defense Turns to IBM for RFID Expertise,'' *InformationWeek* (March 17, 2004). RFID tags are similar to bar codes, but can store more information. Both require a transmitter gun to collect the data.
[9]Accenture. ''High Performance Outsourcing: Gaining Control through Outsourcing in the Manufacturing and Consumer Industries,'' (2008), at http://accenture.com.

Company/Industry	Business Process Outsourced
Proctor & Gamble	HR function to IBM
EarthLink Inc.	Most of its billing, sales, tech-support calls, and other customer-support functions
Many banks and other corporations	General and Specialty Printing (expected to grow from $30B in 2002 to $35B in 2007)
Owens & Minor	Information Technology to Perot Systems
Sun Microsystems, Inc.	Training for Sun employees and Sun's customers to Accenture
City of Copenhagen	Payroll and HR function to Accenture
University of Texas Health Science Center at Houston	Physician billing and collection services to Atlanta-based Per-Se Technologies
Sprint	Call center operations to IBM Corp.

FIGURE 7-13 Examples of Business Process Outsourcing (BPO).

Case-in-Point 7.9 CNA is one of the largest insurance company in the United States, providing such services (core processes) as risk management, information services, underwriting, and claims administration. Rather than develop training programs for their employees, CNA outsourced this business process to another company. Similarly, many universities outsource a number of operations they used to perform themselves—for example, landscaping, food services, or janitorial services—so that they can focus on core functions more directly related to educating students.

Today's combination of networked enterprises and globalization has given rise to a business model called ''**business without boundaries**.'' Companies no longer have all of their employees in one location, working on various business processes such as HR, accounting, production, and others. Employees may be located anywhere in the world, and they are. The result is a new dimension to outsourcing called **offshoring**—moving jobs offshore—to countries like India, China, Canada, Mexico, or Malaysia.

Of course, not all outsourced business processes are accomplished by employees in foreign countries. Many of these processes are still accomplished by businesses in the United States. Nevertheless, all business processes are under a great deal of scrutiny by managers and management accountants as companies become more strategically oriented toward revenue generation and more vigilant about managing costs.

The important point for accountants is that, at some point, you will most likely be on a team of professionals in your organization that will study the costs and benefits of either keeping a business process in-house or outsourcing the function. If the team decides that the organization should keep the process, then the next task might be to decide what business process management (BPM) software the company should use to automate that process. Software companies are developing a wide variety of business process solutions to help managers integrate their existing data and applications into efficient and effective business systems. If the decision is to outsource the process, then accountants will most certainly be involved in analyzing the many costs and benefits/concerns associated with the decision.

Business Process Management Software

Business Process Management (BPM) software packages help companies collect corporate knowledge, data, and business rules into a business system to improve core business processes. Think of BPM as a combination of software tools and management practices that enable entities to accomplish business processes more efficiently. As a result, managers have timely access to performance data related to clients, projects, financials, and people to improve company performance—and these benefits are available even to smaller businesses, as the following case-in-point describes. The market for these software packages is substantial—over $1 billion.[10]

Case-in-Point 7.10 The Sleeter Group is a nationwide community of experts who provide QuickBooks consulting services to small business owners—and they also announce their Annual Award List of "Awesome Add-ons for QuickBooks". For 2009, this list includes **Attitude Positive** (a Point of Sale BPM solution for the retailer and restaurant industries); **Bill.com** (a web-based service to automate accounts payable processes); **Right Networks ASP** (for remote hosting of desktop applications); and a number of other very innovative BPM solutions![11]

AIS AT WORK
Will Offshoring Change to Onshoring?[12]

For the past decade, we read one story after another of yet another company that had outsourced or offshored a business process to another firm. Most troubling to Americans were the business processes and the many jobs associated with those functions that were moved to other countries, especially India, China, and the Philippines. Management of these firms claimed that such business decisions were necessary for their companies to remain competitive and to generate value for shareholders.

However, some companies are beginning to reconsider earlier decisions to offshore, and may bring those jobs back to the United States. One such company, DESA Heating Products (DHP) of Bowling Green, Kentucky, is doing just that. In July 2008, DHP announced that the company would move their manufacturing production from China back to Bowling Green. Although DHP had outsourced hundreds of manufacturing jobs to China, management decided to reverse that decision and bring those jobs back to its Kentucky factory. The rationale for this decision focuses on two factors: quality and cost. And when you think about it, these are both critical factors for a company's success because today's customers demand the best quality products at the lowest price.

The Governor of Kentucky claimed that DHP's decision to bring their production back to the United States is a strong indicator of evolving outsourcing trends in the global economy. So what exactly are these trends? A recent report from a global consulting firm contains a number of clues: transportation costs, wage inflation, currency fluctuations, and quality issues.

Perhaps DHP's experience with offshoring can help us understand the Governor's claim. First, Chinese workers are now demanding higher wages for their labor, which means that Chinese workers are no longer an economical solution to labor costs in the US (19% increase in China compared to 3% in the US since 2003). Second, significant

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[10]Business Editors, "Business Process Management Engine Markets Expected to Reach $1.1 Billion by 2008," *M2Presswire* (February 19, 2004).

[11]Business Editors, "Awards Announced for QuickBooks Add-ons," *PR Newswire* (November 11, 2008).

[12]Sources: "Is the Practice of Offshoring Jobs Headed for an About-Face?" HR Focus (December 2008), pp. 3–4; Denise Dube, "Could Onshoring become the New Offshoring?" http://www.networkworld.com/news/2007/081707-study-onshoring.html; http://www.bgchamber.com/media_room/blog/2008/07/desa-to-expand-bowling-green.php.

fluctuations in oil prices cause great difficulty in budgeting the costs of transportation of goods produced in China—especially for the large, heavy products that DHP produces.

Third, Kentucky's central location in the United States means that DHP is only one day's drive from 70% of the population in the US. That translates to products in the hands of DHP's customers in 12 hours instead of the 6–8 weeks to ship from China. And finally, DHP expects to save money in warranty repairs and replacement costs—manufacturing costs that tripled on the products made in China.

SUMMARY

- The fundamentals of any business process include journals, ledgers, accounts, trial balances, and financial statements.
- When planning a new AIS, developers usually start by designing the outputs from the system.
- The fundamental instrument for collecting data in a typical AIS is the source document.
- Two business processes that are common to every business organization are the sales process and the purchasing process.
- The sales process begins with a customer order and ends with the collection of cash from the customer.
- Important source documents associated with the sales process are sales orders, sales invoices, remittance advices, shipping notices, and customer checks.
- The primary outputs of the sales process are reports such as a cash receipts report, a bad debt report, and a customer listing report.
- For the purchasing process, the AIS is concerned with timely payment for purchased goods and services.
- Source documents common to the purchasing process include purchase requisitions, purchase orders, receiving reports, purchase invoices, and bills of lading.
- The primary output of the purchasing process is the checks for vendors.
- Although companies still outsource to better manage costs, they now outsource and offshore business processes for strategic advantages.
- Some of the business processes that are most likely to be outsourced or offshored are human resources, finance and accounting, customer services, learning services and training, and information technology.

KEY TERMS YOU SHOULD KNOW

alphanumeric codes
block codes
business event
business process
Business Process Management (BPM) software
business process outsourcing (BPO)
business without boundaries
customer relationship management (CRM)
discrepancy reports
economic event
exception reports
group code
mnemonic codes
numeric codes
offshoring
purchasing process
RFID tags
sales process
sequence code
supply chain

TEST YOURSELF

Q7-1. Which of the following provides the organizational structure for the general ledger?

a. Special journals

b. A source document

c. General journals

d. The chart of accounts

Q7-2. AISs depend on codes to record, classify, store, and retrieve financial data. Which of the following codes is a group of numbers reserved for particular uses?

a. Block codes

b. Mnemonic codes

c. Alphanumeric codes

d. Numeric codes

Q7-3. AIS reports should be consistent in at least three ways. Which of the following is NOT one of those ways?

a. Over time

b. Across product lines

c. Across departmental or divisional levels

d. With general accounting practice

Q7-4. ________ is (are) a collection of activities or flow of work in an organization that creates value.

a. An economic event

b. Accounting transactions

c. A business process

d. A chart of accounts

Q7-5. Which of the following is NOT an objective of the sales process?

a. Controlling inventory

b. Tracking sales of goods and/or services to customers

c. Billing for goods and services

d. Forecasting sales and cash receipts

Q7-6. Which of the following report(s) is (are) common to both the sales and the purchasing processes?

a. Cash receipts forecast and cash requirements forecast

b. Financial statement information

c. Discrepancy reports and bad debt report

d. None of the above

Q7-7. Which of the following source document(s) is (are) common to both the sales and the purchasing processes?

a. Debit/credit memoranda

b. Financial statement information

c. Discrepancy reports and bad debt report

d. None of the above

Q7-8. Which of the following business processes is most often targeted for offshoring?

a. Janitorial services

b. Landscaping maintenance

c. Information technology

d. Employee training

Q7-9. If a manager wanted to sort out any differences between quantities or amounts on the purchase order, the receiving report, and the purchase invoice, which of the following AIS reports would be most useful?

a. A purchase analysis report

b. An inventory control report

c. A check register report

d. A discrepancy report

DISCUSSION QUESTIONS

7-1. As you might imagine, the chart of accounts for a manufacturing firm would be different from that of a service firm. Not surprisingly, service firms differ so much that software now exists for almost any type of firm that you could name. Think of yourself as an entrepreneur who is going to start up your own business. Now, go to an Office Depot, Staples, or similar office supply store (or search online) to find at least two different software packages that you might use for the type of firm you are going to start up. What does the Chart of Accounts include? Are both software packages the same? What differences are there?

7-2. What are the purposes of accounting codes? How are they used? Bring to class some examples of codes used by manufacturing firms, accounting firms, and merchandising firms.

7-3. What are some typical outputs of an AIS? Why do system analysts concentrate on managerial reports when they start to design an effective AIS? Why not start with the inputs to the system instead?

7-4. What are some criteria that systems designers should consider when developing managerial reports for an AIS? Can you think of any others beyond those described in the chapter? If so, what are they?

7-5. Visit a local business and collect some examples of source documents used in an AIS. For each source document example you collect, discuss its purpose(s). Are different source documents required for manufacturing firms versus merchandising organizations? Are all the business' source documents paper based?

7-6. This chapter discussed many inputs to an organization's sales process. What are the specific data items needed to add a new customer and record a sales order?

7-7. How does a data flow diagram for the sales process differ from a system flowchart describing that process?

7-8. How are the inputs and outputs of the purchasing process likely to be different for a restaurant versus an automobile manufacturer?

7-9. Explain the term ''business without boundaries.'' How is this changing the nature of organizations and who accomplishes various business processes?

7-10. What do we mean when we say companies are offshoring business processes?

7-11. Some businesses choose offshoring to solve the issue of expertise, especially for IT personnel. These companies claim they simply cannot find enough qualified employees in the United States to do certain technology jobs. Do you agree with this assessment? Why or why not?

7-12. Search the web for unusual and interesting uses of RFID tags. Find at least two that are unusual and share those with your classmates.

7-13. How do you feel about RFID tags? Do you think they offer more advantages or disadvantages? Identify the various advantages and disadvantages. Do you support the use of RFID tags for personal ID? Why or why not?

PROBLEMS

7-14. Listed below are several types of accounting data that might be coded. For each data item, recommend a type of code (mnemonic, sequence, block, or group) and support your choice.

a. Employee identification number on a computer file
b. Product number for a sales catalog
c. Inventory number for the products of a wholesale drug company
d. Inventory part number for a bicycle manufacturing company
e. Identification numbers on the forms waiters and waitresses use to take orders
f. Identification numbers on airline ticket stubs
g. Automobile registration numbers
h. Automobile engine block numbers
i. Shirt sizes for men's shirts
j. Color codes for house paint
k. Identification numbers on payroll check forms
l. Listener identification for a radio station
m. Numbers on lottery tickets
n. Identification numbers on a credit card
o. Identification numbers on dollar bills
p. Passwords used to gain access to a computer
q. Zip codes
r. A chart of accounts for a department store
s. A chart of accounts for a flooring subcontractor
t. Shoe sizes
u. Identification number on a student examination
v. Identification number on an insurance policy

7-15. Novelty Gadgets is a marketer of inexpensive toys and novelties that it sells to retail stores, specialty stores, and catalog companies. As an accountant working for the company, you have been asked to design a product code for the company. In analyzing this problem, you have discovered the following:

a. The company has three major product lines: (1) toys and games, (2) party and magic tricks, and (3) inexpensive gifts. There are major subproducts within each of these product lines, and the number of these categories is 25, 18, and 113, respectively.

b. The company has divided its selling efforts into five geographic areas: (1) the United States, (2) the Far East, (3) Europe and Africa, (4) South America, and (5) International (a catchall area). Each major geographic area has several sales districts (never more than 99 per area). Between 1 and 20 salespeople are assigned to each district.

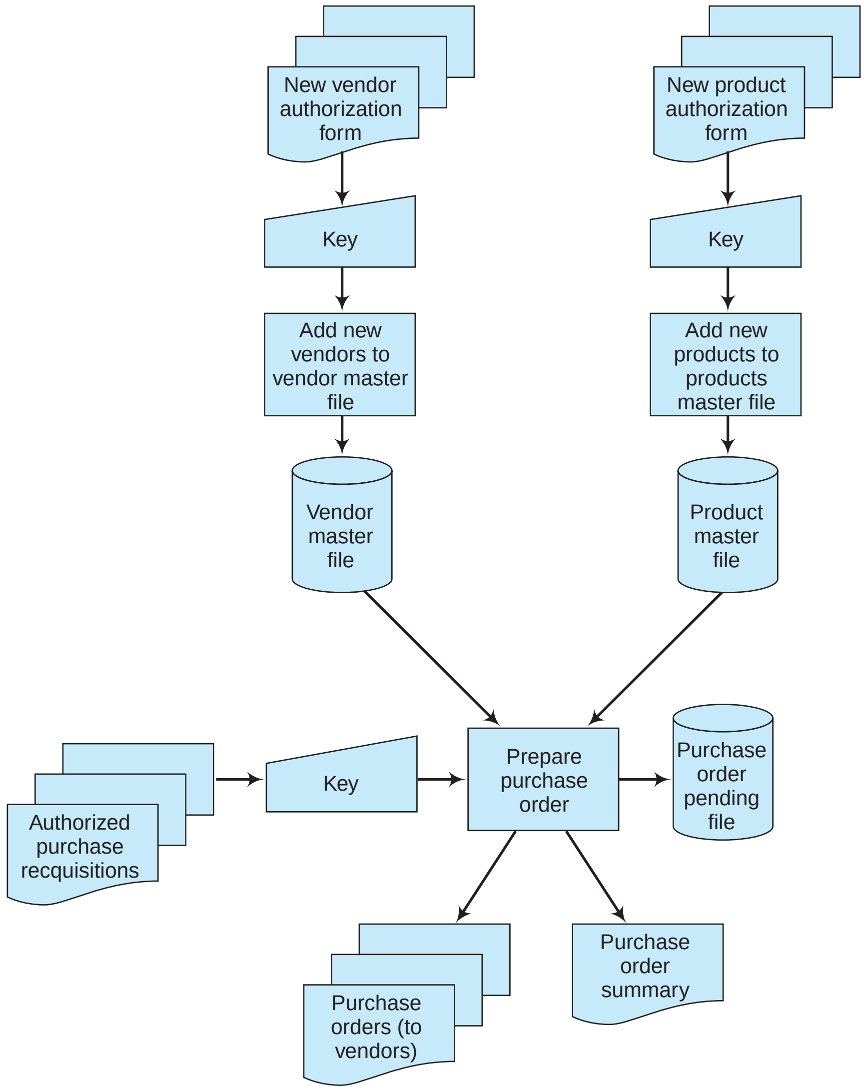

FIGURE 7-14 System flowchart illustrating the preparation of purchase orders for P. Miesing and Company.

c. As noted earlier, there are three major categories of customers, and certain customers can also purchase goods on credit. There are five different classes of credit customers and each rating indicates the maximum amount of credit the customer can have. Design a group code that Novelty Gadgets could use to prepare sales analysis reports. Be sure to identify each digit or position in your code in terms of both use and meaning.

7-16. Figure 7-14 is a system flowchart for P. Miesing and Company's purchase order event. Prepare a narrative to accompany the flowchart describing this purchase order event. Include in your narrative the source documents involved, the computerized data processing that takes place, data inputs used to prepare purchase orders, and the outputs prepared from the processing function.

7-17. SSR-Save is a national discount retail store chain with annual revenues of more than $1 billion. It's a typical bricks-and-mortar operation with accounting software that records sales transactions in real time and tracks inventories on a perpetual basis. Management is considering an online store and will sell the same products as in the stores. Customers will be able to use credit cards only for online payments (vs. cash, credit card or debit card in the stores). The marketing manager is interested in learning about customers and using the information to improve both in-store and online sales.

a. Contrast the sales process of their retail store operation with the sales process in an online store environment. Would any of the events in the process change?

b. At what points do you collect data about customers and sales transactions in the retail store? In the online environment?

c. What data might you collect about retail store and online customers to improve your profitability? What data might you collect to improve customer satisfaction?

d. How is the sales process different for a public accounting firm? What data can they collect to improve customer relationships and grow revenues?

CASE ANALYSES

7-18. The Caribbean Club (Customer Relationship Management)

The Caribbean Club is one of the Virgin Island's hottest night spots. It's a great place for locals to meet after work and relax with friends, it's a popular destination for tourists who stay on the island, and it's always on the list of fun entertainment choices for the crowds from the cruise ships that dock in the harbor.

The reason the Club is so popular with such a variety of customers is because the founder of the club, Ross Stewart, always has such innovative and visionary ideas that delight the patrons. For example, every night of the week the Club features different activities or shows, including beach volleyball, Caribbean shows with calypso singers, world-class musicians who play steel drums, and other island delights.

Because Ross was a former accountant and auditor with one of the largest public accounting firms in New Zealand, he is very accustomed to brainstorming sessions to generate ideas and surface concerns. He brought this practice with him to the Caribbean and holds brainstorming sessions with his ''club associates'' (which is what he calls all of the employees at the club) once every month to identify new and novel ideas to increase the popularity and profitability of the club.

As you might imagine, the patrons of a night club are there to relax and enjoy themselves. Therefore, the associates thought it would be a great idea to somehow be able to recognize their regular patrons so that they wouldn't have to trouble them with a bill every time a server came to their table with another round of drinks. After all, if the Club wanted these people to ''feel like they were at home with friends'', the patrons shouldn't have to bother with trying to decide who owed what to pay the bill. What a nuisance!

So Ross and his associates came up with the idea to implant their regular customers with an implantable microchip. The idea was to make the chip ''fun''—to give it an elite status so that their regular patrons would want to be implanted. To dramatize the elite status of the chip, Ross decided that the Club would have a special area where only those with chips, the ''VIPs'', would be admitted. And of course, this area would have various exclusive services for these members. The chip would allow the VIPS to be ''recognized'' and to be able to pay for their food and drinks without any ID—they would simply pass by a reader and the Club would know who they are and their credit balance. Ross also wanted the information system supporting the chip to be a customer relationship management tool.

Requirements:

1. What do you think of this idea? That is, what are the advantages and disadvantages of this idea for the Caribbean Club?
2. If you were Ross, what information would you want the CRM to collect? Search the Internet to see if you can find a CRM software package that seems appropriate for the Club. Why did you select this particular software?
3. What are the advantages and disadvantages for the patrons?
4. If you were a passenger on a cruise ship, or staying at a resort on the island, would you get the chip implanted? Why or why not?

7-19. Larkin State University (Purchasing Process)

Larkin State University is a medium-sized academic institution located in the Southeastern United States. The university employs about 250 full-time faculty and 300 staff personnel. There are 12,000 students enrolled among the university's four colleges.

The Purchase Process

The university's budget for purchases of equipment and supplies is about $25 million annually. Peter Reese is in charge of the Purchasing Department. He reports directly to the Vice President of Finance for the university. Pete supervises four purchasing clerks and three receiving personnel. The office is responsible for purchases of all equipment and supplies except for computer equipment and software, and plant purchases or additions.

The Payment Process

The various departments across campus manually fill out hard copy purchase requisition forms when there is a need for equipment/supplies. Each department forwards these forms to the Purchasing Department. If the request is for computer equipment or software, the requisition is forwarded to the Department of Information Technology for action.

Purchase requisitions are assigned to one of the three purchasing clerks by department. For instance, one purchasing clerk makes purchases for all university departments beginning with the letters A through G (Accounting—Geology). Purchasing clerks check the requisition to make sure it is authorized and then consult the Approved Vendor Listing to find a supplier. The clerk may contact a supplier for pricing and product specification. Once this task is complete, the purchasing clerk enters the purchase requisition and vendor and price information into the computer system, which prints out a multiple-part purchase order. Clerks send copies of the purchase order to Central Receiving, to the vendor, and to the Accounts Payable Department. (The university considered using EDI for its purchases, but chose not to adopt it due to the large number of vendors used.)

When Central Receiving receives an order, a receiving clerk consults the Purchase Order file to make sure the correct product and quantity have been delivered. The clerk also checks the product for damage. Central receiving does not accept any over-shipments. Receiving clerks forward accepted shipments to the adjacent warehouse for distribution to the appropriate department. Clerks file one copy of the Receiving Report, send one copy to the Purchasing Department, and forward a third copy to Accounts Payable.

George Vaughn is the Supervisor of Accounts Payable. Two accounting clerks report to him. He assigns invoices to them for payment based on vendor name. One clerk processes payments for vendors A – M and the other clerk handles payments to all vendors with names beginning with letters N – Z. The clerks match each vendor invoice with a copy of the receiving report and purchase order before entering it into the computer for payment by due date. There are often discrepancies among the three documents. This requires frequent phone calls to the vendor, the Receiving Department, or Purchasing for resolution. As a result, the company frequently makes payments late and loses out on cash discounts.

Requirements:

1. Identify the important business events that occur within Larkin's purchase/payment process.
2. What changes would you suggest to the current process to take advantage of information technology?

7-20. Uptown Bucks (Sales Process)

Uptown Bucks (UB) is an off-campus meal plan business in Oxford, Ohio. Students or their families buy debit cards with fixed amounts that they can use to purchase food at more than 18 local restaurants. Customers can buy the cards at UB's office in the center of town, or they may purchase the cards online. The following paragraph describes the online card sale process.

A customer enters their credit card information online and then the amount of purchase. UB's software automatically checks the card number to determine that it is a valid credit card number; for instance, there are certain digits that indicate Visa cards. The software displays an error message if the number is not valid. The usual cause of these errors is typographical. Once the customer completes the card order screen, the software sends the data in an encrypted form to UB's host computer. Periodically, the UB accountant retrieves transactions from the server. This is done by clicking on the ''Get Transactions'' screen button.

For each online transaction, the accountant then manually copies down the credit card number on a scrap of paper, walks across the office to the credit card machine, and keys in the credit card number, the amount, and the numerical portion of the address. The credit card software checks to see if the card is valid and charges it for the amount. The accountant next writes down the validation number, returns to the host computer, and enters it. She prints a receipt for the transaction and puts it in a file. The customer database now reflects the new customer. When a customer purchases a card off-line with a credit card, the accountant swipes the card directly, checks its validity, charges the card, and then writes down the validation number and enters it in the host computer.

UB is considering the purchase of credit card software that can reside on the host computer and interact with their accounting software. The credit card software costs about $400. The credit card company rates are likely to increase by about. 5% because cards could no longer be swiped directly—all credit card purchases would need to go through the online software. The rate UB has to pay the credit card company is based on this mix. Credit card companies typically charge more if card numbers are punched rather than swiped because they have more chance of invalid transactions due to theft. It's easier to steal a number than a card. Currently about half of UB's sales transactions arise from online sales; the other half result from sales through the office.

Requirements:

1. Should UB buy the credit card software?
2. Use the skills you developed from Chapter 3 to develop a flowchart for UB's online sales process.
3. What are the business risks associated with this process?

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ANSWERS TO TEST YOURSELF

1. **d** 2. **a** 3. **b** 4. **c** 5. **a** 6. **b** 7. **a** 8. **c** 9. **d**

Chapter 8

Accounting Information Systems and Business Processes: Part II

After reading this chapter, you will:

1. *Appreciate* the many ways technology is changing management's ability to monitor and control business processes across the organization.
2. *Know* the objectives, inputs, and outputs of the resource management, production, and financing processes.
3. *Understand* how business strategy affects the data that are collected in the firm's AIS and how that impacts performance measures.
4. *Be able to explain* why some organizations have special accounting information needs.
5. *Recognize* the special information needs of several different types of organizations.
6. *Understand* how companies use business process reengineering (BPR) to cut costs and improve their operational efficiency.

"Companies using lean accounting have better information for decision-making; have simple and timely reports that are clearly understood by everyone in the company; understand the true financial impact of lean changes; and focus the business around the value created for the customers."

Brian Maskell and Frances Kennedy, ''Why Do We Need Lean Accounting and How Does it Work?'' *The Journal of Corporate Accounting & Finance*, (March/April 2007), p. 59.

INTRODUCTION

In the previous chapter we identified two processes that are common to almost every organization: the sales process and the purchasing process. This chapter continues the discussion of business processes by exploring three additional processes: resource management, production, and financing. The resource management process includes human resources and fixed assets. The production manufacturing cycle entails the conversion of raw materials (another resource) into finished goods available for sale. Finally, the financing process involves the ways that organizations fund their operations. Because organizations must finance activities either through borrowing or by selling shares of ownership, we discuss the objectives, inputs, and outputs of the financing process.

Many organizations, such as government agencies, have specialized information needs, apart from the typical AIS requirements for information about revenues, purchases, and resources. The second section of this chapter considers the unique aspects of such organizational entities that need different accounting information.

Maximizing the efficiency of every business process is critical to business success in today's ''business without boundaries'' operating environment. Sometimes managers decide that a current business process just isn't working and must be replaced. This is usually the case when a firm decides to implement a new enterprise-wide IT system. As a result, they turn to business process reengineering, which is the topic of the final section of this chapter.

THE RESOURCE MANAGEMENT PROCESS

Two resources that managers must closely manage, and therefore capture data for an AIS, are an organization's human resources and its fixed assets. Because the inputs, processing, and outputs for human resources and fixed assets are quite different, we examine them separately (see Figure 8-1).

Human Resource Management

The ''economic meltdown'' in the fall of 2008 has been one of the most challenging times for resource managers as they try to deal with cash flow problems, bankruptcies, plant closings, and layoffs. An organization's **human resource (HR) management** activity includes the personnel function, which is responsible for hiring or laying off employees. HR must properly maintain the personnel and payroll records for employees, as well as

The Human Resource Management Process

OBJECTIVES

Hiring, training, and employing workers
Maintaining employee earnings records
Complying with regulatory reporting requirements
Reporting on payroll deductions
Making timely and accurate payments to employees
Providing an interface for personnel and payroll activities

Inputs (Source Documents)

- Personnel Action Forms
- Time Sheets
- Payroll Deduction Authorizations
- Tax Withholding Forms

Outputs (Reports)

- Financial Statement Information
- Employee Listings
- Paychecks
- Check Registers
- Deduction Reports
- Tax (Regulatory) Reports
- Payroll Summaries

FIGURE 8-1 Objectives, inputs, and outputs for the human resource management process.

handle the many actions associated with employee terminations. Nevertheless, the primary objective of the personnel function is to hire, train, and employ appropriately qualified people to do an organization's work.

In the past, HR professionals used technology to handle such administrative tasks as time clocking and payroll. However, many **business process management (BPM) software packages** are now available to automate the core processes that normally occur in an HR office. For example, HR departments are increasingly turning to technology to help with such diverse responsibilities as recruitment, oversight of legal and regulatory compliance, benefits administration, training, performance evaluation, and safeguarding confidential employee information.

Case-in-Point 8.1 Merix, a global supplier of advanced technology and printed circuit boards, focuses on the financial performance of its recruiting process. Using a cost-per-hire calculation, Merix determines whether its recruiting process is functioning at peak efficiency. Goals for this measure are set to assure that HR is financially responsive to the organization and is an efficient support service. Further, tracking this measure allows Merix to more effectively budget human resources expenditures for the coming year based on projections of staffing needs.[1]

Although the main purpose of **payroll processing information systems** is to pay employees for their work, such systems also maintain employee earnings records (a payroll history), comply with various government tax and reporting requirements, report on various deduction categories (e.g., pension funds and group insurance), and interact with other personnel functions. Figures 8-2 and 8-3 show system flowcharts for the personnel function and for the payroll function.

Inputs to Human Resource Management Processing. The source documents used in payroll processing are personnel action forms, time sheets, payroll deduction authorizations, and tax withholding forms. The personnel department sends *personnel*

[1]Source: http://www.merix.com.

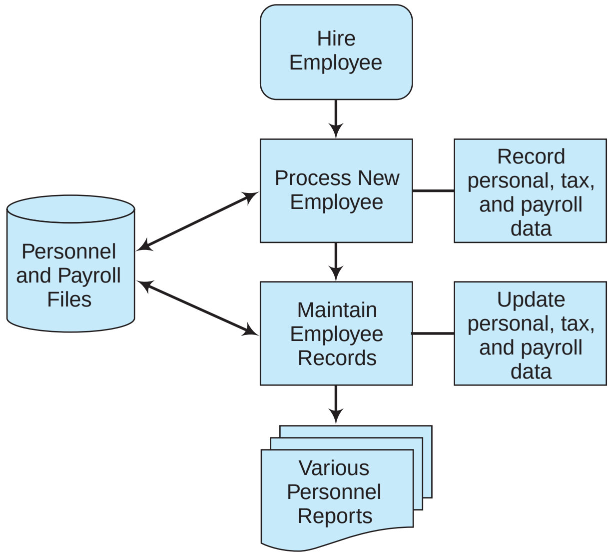

FIGURE 8-2 Systems flowchart of the AIS for the personnel function.

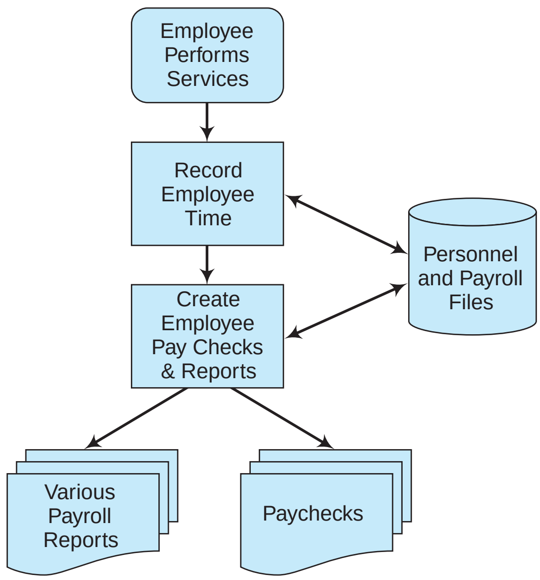

FIGURE 8-3 Systems flowchart of the AIS for the payroll function.

action forms to payroll that document the hiring of new employees or changes in employee status. For example, payroll receives a personnel action form when an employee receives a salary increase. This document is very important for control purposes. For example, auditors will detect an employee who increases his or her own salary when they fail to find a personnel action form authorizing the increase.

Many companies use *time sheets* to track the hours that employees work. The source of information for these time sheets varies widely with the level of technology that the organization employs. For example, some companies use a time clock that requires employees to ''punch in'' (on time cards) when they arrive for work. Others use picture ID cards or RFID-enabled ID cards that record the time and verify employees when they enter and leave the workplace. To guard against employees having their friends punch in for them, some organizations now use various biometric devices (e.g., fingerprints or iris scans) to identify employees and capture their entry and departure from workplaces.

At the end of the pay period, the employee's supervisor verifies the number of hours worked and authorizes payment. Next, either a payroll clerk (or an internal control embedded in the payroll processing information system) looks for the appropriate authorization before processing these hours. Companies that use a job cost information system can cross-reference employee time sheets with time recorded on individual jobs.

Employees fill out *payroll deduction authorizations* that direct the payroll processing system to deduct amounts from gross pay for items such as health and life insurance, parking fees, retirement plan contributions, and union dues. An authorization form should document each deduction. In the U.S., every employee must also complete tax-withholding forms, which authorize the payroll system to reduce gross pay by the appropriate withholding tax. The information system uses each employee's W-4 withholding form to calculate the correct withholding for federal income taxes.

Outputs of Human Resource Management Processing. The outputs of human resource management processing include employee listings, check registers, paychecks, deduction reports, tax reports, and payroll summaries. As you might imagine, the processing of paychecks should include very strict internal control procedures (covered in Chapters 11 and 12). *Employee listings* show current employees and may contain addresses and other demographic information. *Check registers* accompany each printing of paychecks and list gross pay, deductions, and net pay. Payroll clerks use the check register information to make journal entries for salary and payroll-tax expenses. *Deduction reports* can contain summaries of deductions for all employees in a department, a division, or company-wide. Finally, the payroll function issues various *payroll summaries* that help managers analyze expenses. A typical payroll summary report might classify payroll expenses by department or job, or show total overtime hours worked in each department.

> ***Case-in-Point 8.2*** The city of Reno, Nevada, is one of many cities in the U.S. seeking ways to lower its expenditures. Recently, the issue of overtime pay for firemen came to the attention of the city council because reports showed there was so much of it. Apparently, the number of firemen that the city could hire was limited, but not the amount of overtime pay these individuals could earn.[2]

The U.S. government requires various *tax reports* for income tax, Social Security tax, and unemployment tax information. Employees pay some taxes in their entirety, but employers share others. For instance, both the employee and the employer pay equal amounts of Social Security taxes. The payroll system allocates shared taxes to the appropriate accounts. Taxes paid by employees are allocated to payroll expense, but employer taxes are part of the employer's tax expense.

Because manual payroll processing can be tedious, repetitive, and error-prone, the payroll function was one of the first accounting activities to be computerized in many organizations. Today, some companies find it easier and more cost-effective to outsource the process for paychecks and payroll reports.

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[2]Source: from the authors.

Case-in-Point 8.3 Automatic Data Processing, Inc., or ADP, is the world's largest payroll service provider. Almost a half-million companies in fifteen countries outsource their payroll processing and, in some cases, their human resource administration to ADP. The company has been in business for more than 50 years and pays more than one-in-six private sector employees in the U.S.[3]

Fixed Asset Management

Even small organizations generally own many fixed assets, which management must track as they are purchased and used. The objective of the **fixed asset management (FAM)** function is to manage the purchase, maintenance, valuation, and disposal of an organization's fixed assets (also called ''long-term assets'' because they last more than one year).

In thinking about how complex it might be to track fixed assets, consider all the fixed assets found in a typical college classroom. There are desks, chairs, computers, projectors, podiums, and so on. A university must record each of these fixed assets on its books when it purchases the asset. In addition, the university must maintain depreciation schedules for its fixed assets. Not only can an AIS calculate the depreciation for a company's financial statements, it can also prepare separate depreciation schedules for income tax reporting purposes. Employees often move fixed assets around within an organization, and although an AIS should keep track of all asset locations, this can be quite difficult in practice. Bar codes affixed to physical assets make this job easier.

Because fixed assets often require repairs, an AIS should also track repair costs, and distinguish between revenue expenditures and capital expenditures. (Revenue expenditures are ordinary repair expenses, whereas capital expenditures add to the value of assets.) Finally, the AIS calculates the amount of gain or loss upon disposal of individual fixed assets. By comparing the amount received for the asset with the asset's book value, the AIS can compute a gain or loss. Fortunately, software companies offer a variety of solutions to help managers.

Case-in-Point 8.4 Some **Fixed Asset Management (FAM) software** helps enterprises record and track details about their fixed assets before placing them into service (e.g., Best Software). Depreciation Solution[R] offers a "Method/Life Wizard" so a company can select a depreciation method and estimate the life of an asset. FixedAssets∗32 allows companies to automate and monitor depreciation of fixed assets.

Increasingly, organizations are adopting **enterprise asset management (EAM) systems** to automate the management of a broad spectrum of assets. For example, Green Bay Packaging, Inc. is using an EAM solution to streamline purchasing, reduce inventory, and trim machine downtime and maintenance costs. Because of reduced overall operating expenses, the company expects the software to pay for itself in six months. Avantis makes a global EAM solution that focuses on maintenance, inventory, procurement, and invoicing efficiencies. Finally, the U.S. government purchased a $1.9 million EAM system to integrate data and coordinate logistics for the 5,000-plus major rebuilding projects underway in Iraq.

Inputs to Fixed Asset Management Processing. Fixed asset processing begins with a request for a fixed asset purchase. The individual making the request enters the appropriate information on a purchase requisition form (typically an e-form). *Fixed asset requests* usually require approval by one or more managers, especially where purchases

[3]Source: http://www.adp.com/corporate/adp_corpoverview_main.html

require substantial investments. Other documents associated with fixed asset purchases are receiving reports, supplier invoices, and repair and maintenance records. The receiving department either scans in the information electronically to the AIS or fills out a *receiving report* upon receipt of a fixed asset. The asset's supplier sends an *invoice* when it ships the asset. Sometimes a company builds a fixed asset, for example, a warehouse, rather than acquiring it from an outside vendor. Here, processing fixed assets requires a *work order* detailing the costs of construction.

There is no source document that prompts depreciation expense. However, there may be documentation dictating the appropriate depreciation method or methods for this allocation. AISs often allocate fixed asset costs using multiple depreciation methods. Companies commonly use a separate depreciation method for tax versus financial reporting purposes. In addition, government or industry regulations may require businesses to use still other depreciation methods for special reports.

Those responsible for a particular fixed asset should complete a *fixed asset change form* when transferring fixed assets from one location to another. The fixed asset change form also records the sale, trade, or retirement of fixed assets. Fixed asset management requires maintaining repair and maintenance records for each asset individually or for categories of fixed assets. The department performing this service should record these activities on a *repair and maintenance form*. This form notifies the AIS to update expense or asset accounts. Figure 8-4 is a systems flowchart that shows fixed asset acquisition, maintenance, and disposition.

Outputs of Fixed Asset Management Processing. One output of the fixed asset processing system is a listing of all fixed assets acquired during a particular period. A *fixed asset register* lists the identification number of all fixed assets held by a company

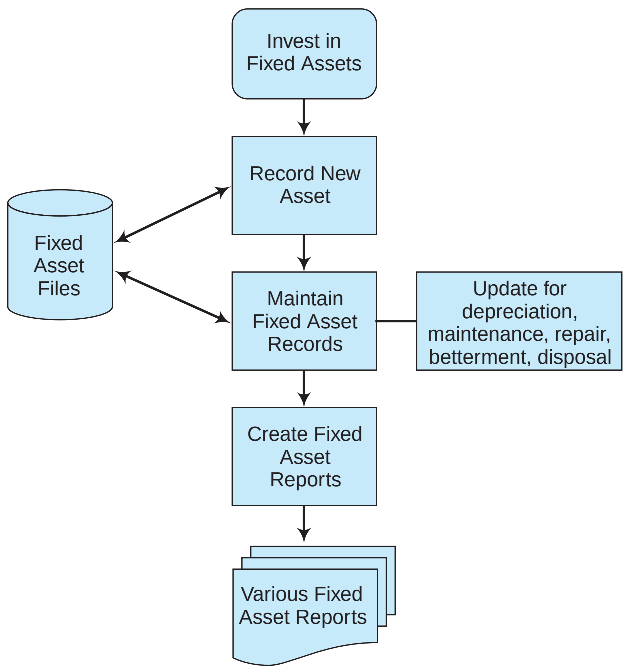

FIGURE 8-4 Systems flowchart of the AIS for the fixed asset management function.

The Fixed Asset Management Process

OBJECTIVES

Tracking purchases of fixed assets
Recording fixed asset maintenance
Valuing fixed assets
Allocating fixed asset costs (recording depreciation)
Tracking disposal of fixed assets

Inputs (Source Documents)

- Purchase Requisition
- Receiving Reports
- Supplier Invoices
- Construction Work Orders
- Repair & Maintenance Records
- Fixed Asset Change Forms

Outputs (Reports)

- Financial Statement Information
- Fixed Asset Register
- Depreciation Register
- Repair & Maintenance Reports
- Retired Asset Report

FIGURE 8-5 Objectives, inputs, and outputs for the fixed asset management process.

and each asset's location. The *depreciation register* shows depreciation expense and accumulated depreciation for each fixed asset. *Repair and maintenance reports* show the current period's repair and maintenance expenses, as well as each fixed asset's repair and maintenance history. Finally, a *report on retired assets* reflects the disposition of fixed assets during the current period. Figure 8-5 summarizes the objectives, inputs, and outputs of the fixed asset management process.

THE PRODUCTION PROCESS

The production process (sometimes called the conversion process) begins with a request for raw materials and ends with the transfer of finished goods to warehouses.

Objectives of the Production Process

The objective of a manufacturing organization's production process is to convert raw materials into finished goods as efficiently as possible. Today's production of goods and services often requires expensive factory machinery, such as computer-assisted design (CAD) technology or robotics (used in the manufacture of automobiles).

Accounting for the acquisition and use of production machinery is part of the fixed asset management process described in the previous section of this chapter. Another important objective of an AIS's production process is collecting cost accounting data for operational managers, who then can make informed decisions with respect to the products produced in their departments. Figure 8-6 identifies the objectives, inputs, and outputs associated with the production of goods and services.

Cost Accounting Subsystem. Because the cost of goods sold is likely to be the largest expense on a manufacturing firm's income statement, an important part of the production process is an AIS's **cost accounting subsystem**. The cost accounting subsystem provides important control information (e.g., variance reports reflecting differences between actual

The Production Process

OBJECTIVES

Track purchases and sales of inventories
Monitor and control manufacturing costs
Control inventory
Control and coordinate the production process
Provide input for budgets

Inputs (Source Documents)	Outputs (Reports)
• Materials Requisition Form	• Financial Statement Information
• Bill of Materials	• Material Price Lists
• Master Production Schedule	• Periodic Usage Reports
• Production Order	• Inventory Status Reports
• Job Time Cards	• Production Cost Reports
	• Manufacturing Status Reports
	• Value Stream Reports

FIGURE 8-6 Objectives, inputs, and outputs commonly associated with the production process.

and standard production costs) and varies with the size of the company and the types of product produced. As you might guess, a bakery producing baked goods would collect very different data in its AIS than that of an automobile manufacturer. Cost accounting subsystems for manufacturing organizations will most likely be job costing, process costing, or activity-based costing systems.

A **job costing information system** keeps track of the specific costs for raw materials, labor, and overhead associated with each product or group of products, called a ''job.'' This type of costing system is most appropriate for manufacturers of large-scale or custom products, such as home-builders or book publishers. Manufacturers of homogeneous products (such as soft drinks or toothbrushes) that are produced on a regular and continuous basis use a **process costing information system**. In this system, it is not feasible or practical to keep track of costs for each item or group of items produced. Instead, process costing systems use averages to calculate the costs associated with goods in process and finished goods produced.

Activity-based costing systems help managers describe processes, identify cost drivers of each process, and then determine the unit costs of products created in each process. By studying their business processes, managers are in a better position to recognize opportunities to improve those processes. Thus, activity-based costing gives managers a better understanding of their processes, an improved ability to allocate indirect costs to those processes, and a better understanding of the true cost of each product. The systems flowchart in Figure 8-7 shows the information flow for production in a manufacturing firm.

Just-in-Time (JIT) Inventory Systems. Inventory control ensures that the production process handles inventory transactions appropriately so that the financial statements correctly state the value of the inventory and cost of goods sold accounts. Carrying inventory has a number of costs associated with it, including storage, obsolescence, shrinkage, or reduction in sales value.

Toyota (of Japan) popularized the use of **just-in-time (JIT) inventory** systems. Some managers refer to a JIT system as a ''make-to-order inventory system.'' This phrase indicates that the organization produces goods to fill an order rather than to fill inventory. The objective of a JIT system is to minimize inventories at all levels. Each stage in the production operation manufactures (or acquires) a part just in time for the next process to

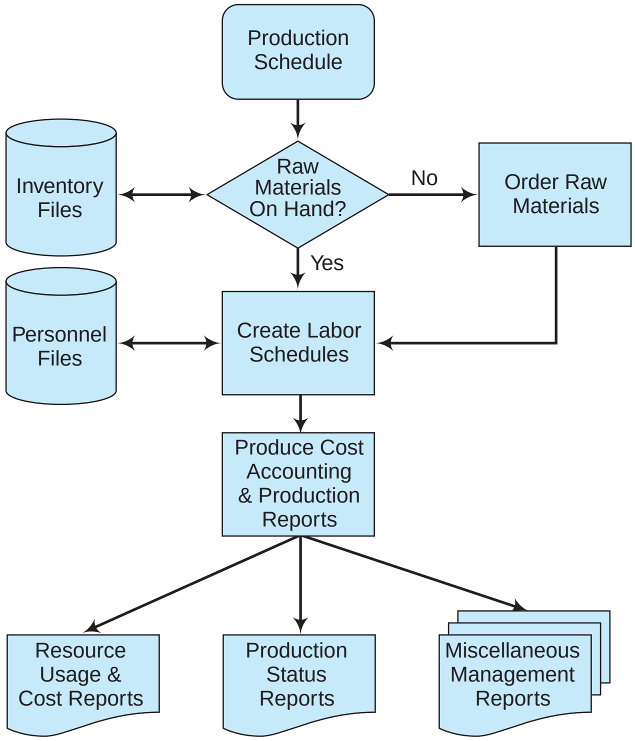

FIGURE 8-7 Systems flowchart of the AIS for the production process in a manufacturing organization.

use it. Although the best possible JIT system would maintain zero inventory balances, this is often not practical in real-world applications. Manufacturing organizations need some inventories to protect against interruptions in supply from manufacturers and fluctuations in demand for their finished goods that are beyond the manufacturers' control.

A JIT system depends on an AIS. If the AIS does not process transactions on a timely and accurate basis, manufacturing processes may lack the raw materials inventory necessary to maintain a constant work flow. Inefficient processing of transactions can also lead to shortages of finished goods that in turn translate into lost sales. This leads some organizations to be proactive and reengineer the process.

Case-in-Point 8.5 JIT is a great concept for a company that is intent on efficiently managing stock, but it makes life difficult for the accounts payable department that is responsible for paying all those JIT invoices. For example, Dell Computer Company found itself ordering certain parts as frequently as 12 times a day. The A/P department was inundated with paper invoices. GE Capital dispatched several of its Six Sigma analysts, known as "black belts," to Dell to analyze its A/P process. The consultants mapped out the entire process and then recommended that Dell change to an Internet-based electronic filing process. The move saves Dell about $2.4 million per year.[4]

[4]Source: http://www.ge.com/sixsigma.

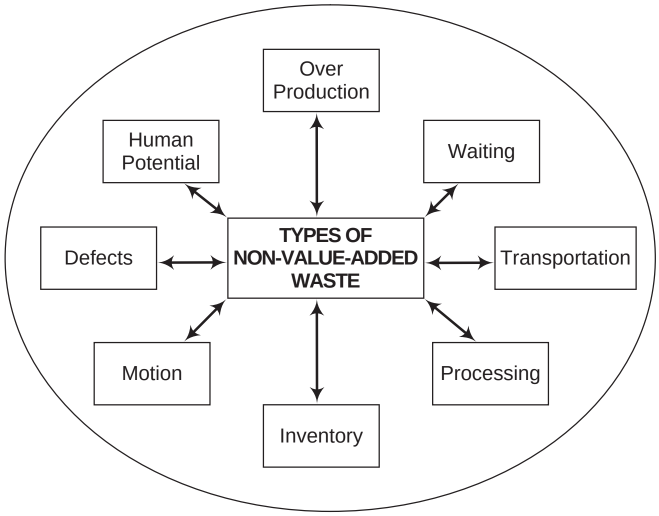

FIGURE 8-8 Categories of waste that are the focus of lean operations management.

Sources: Daniel Tracy & John Knight, ''Lean Operations Management,'' *Journal of American Academy of Business* (March 2008), pp. 8–14; Burton, T. and S. Boeder, *The lean extended enterprise: Moving beyond the four walls to value stream excellence* (2003), Boca Raton, FL: J. Ross Publishing.

Lean Production/Manufacturing. Although JIT inventory systems are an important step for manufacturing companies to control costs associated with inventory, the truth is that companies must learn to eliminate waste throughout the manufacturing process—indeed, throughout the organization, if they hope to become a world-class organization. The concept of lean manufacturing is that a company makes the commitment to eliminate waste throughout the organization (not just in production), which is a philosophy that is often attributed to the *Toyota Production System (TPS)*. The TPS essentially focuses on elimination or reduction of **non-value-added waste** to improve overall customer value and to increase the profitability of the products or services that the organization offers. So we might say that lean manufacturing developed through the concepts of JIT as well as Total Quality Management.

Figure 8-8 depicts eight different categories of waste that companies hope to reduce or eliminate. In the figure, *overproduction* means producing more than your customers want to purchase. *Waiting* refers to the time that is lost when employees, products, services, or machines wait for the next step in a process to occur. *Transportation* identifies the unnecessary movement of materials or information around a firm or organization. Excessive *processing* can be the result of an organization that has poor products, defective inputs, or an inefficient business process. From JIT principles, we know that it is wasteful to store more *inventory* than the minimum required to produce the goods or services of the company. Excess (or unnecessary) *motion* of people, materials, products, or anything should be avoided. Whenever substandard products are produced, companies end up with *defects*, scrap, rework, and/or paperwork errors. Finally, when organizations do not fully engage the skills, talents, and abilities of their employees, they lose some of the *human potential* that is available to the firm.

Lean Accounting. Accountants are quick to point out that you cannot have lean manufacturing without **lean accounting**. A company that follows lean manufacturing concepts must identify value from the perspective of their customers, organize production (and data collection) in value streams, empower employees to make decisions, and then continually pursue excellence in all areas of the organization. Thus, you can't use the same old performance measures—you need new ones. Why is that the case? Because the goal of performance measures is to communicate, motivate, clarify, and evaluate. Management accountants use performance measures to give managers information and feedback for decision-making. Traditional performance measures typically support only managers as decision-makers. The premise behind lean manufacturing is that empowered team members (also called continuous operational improvement leaders) are also decision-makers, which means they need timely information to be effective.

Although reengineering the traditional performance measures would be ideal, this is usually not possible. However, management accountants, managers, and empowered team members can work together to identify critical data that the AIS must collect to support lean production. As a minimum, these data should include metrics that will help managers and team members make wise decisions regarding methods to reduce or eliminate waste that is identified in Figure 8-8 (overproduction, waiting, transportation, processing, inventory, motion, defects, and human potential).

Jan Brosnahan, the controller for Watlow Electric Manufacturing Co. (WEM) describes how her team adopted lean accounting, which means measuring and evaluating results by **value stream management** rather than by *traditional departments* (such as customer service, purchasing, etc.). For example, an order fulfillment value stream includes all metrics from the sales/order entry point, through manufacturing, all the way to after-sales support. Each value stream has a leader who is responsible for coaching and profitability of the specific metrics identified for that value stream. Standard costs, variances and overhead allocations are not used—rather, only directly-incurred costs are used for decision-making.

Case-in-Point 8.6 In 2005, 17 of the finance and continuous operational improvement leaders at WEM attended a Lean Accounting Summit. They learned how to transform their AIS from a traditional system to a lean accounting system. This process included (1) identifying the company's main value streams, (2) mapping out key metrics to monitor achievement, (3) organizing into three or four value streams per site, (4) changing the chart-of-accounts structure to a few value stream groupings rather than by traditional departments, (5) zeroing out labor and overhead rates from the system and stopping collection of these data, (6) splitting out material costs from other conversion costs, and (7) using a memo line in internal financial statements to increase visibility of inventory purchases.[5]

Clearly, we can see the implications that lean accounting might have throughout organizations of the future. Based on the many changes that WEM implemented in their company to support lean accounting, we can quickly see that two areas might need to be evaluated by management accountants—the collection of data in the AIS and the chart-of-accounts that the company uses. Fortunately, AISs that are built upon a relational database (see Chapters 4 and 5) can be modified to support lean accounting. Regarding the chart-of-accounts (covered in Chapter 7), apparently the accountants at each organization will need to work with managers and team leaders to determine the most appropriate coding system to use, based on the value streams that are identified.

Inputs to the Production Process

When a production manager needs raw materials, he or she issues a *materials requisition form* to acquire more material from a storeroom or warehouse where the raw materials

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[5]Source: Jan Brosnahan, ''Unleash the Power of Lean Accounting,'' *Journal of Accountancy* (July 2008), pp. 60–66.

are kept. If the level of inventory falls below a certain predetermined level, the inventory control clerk issues a purchase requisition to the purchasing department (probably an e-form, but this might also be an automatic determination that is transmitted electronically to the vendor). Finished goods consist of a complex array of parts or subassemblies. For example, an armchair consists of four legs, a seat, two arms, and a back. The *bill of materials* shows the types and quantities of parts needed to make a single unit of product.

An important input to the production process is the *master production schedule*, which shows the quantities and the timing of goods needed to meet quantities required for anticipated sales. The marketing department's sales projections, combined with desired inventory levels, are inputs to the production order, which authorizes the manufacture of goods and dictates the production schedule. Tracking labor time is important to a job costing system because one employee may work on many jobs and one job might require the work of many employees. An input to a job costing system is the *job time card*. This card shows the distribution of labor costs to specific jobs or production orders. Each worker completes a job time card (usually daily or weekly), detailing the hours worked on specific operations and jobs.

Typically, large and medium-sized firms use enterprise resource planning (ERP) systems to collect essential data about their production operations so that they can better manage these processes. ERPs are multi-module application software packages that help a manufacturer effectively track, monitor, and manage product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. We discuss ERP software in more depth in Chapter 9.

In conjunction with ERPs, manufacturers are also replacing manual data entry with such automated technologies as bar code readers, radio frequency (RF) technology, RFIDs, or other advanced electronic tags. These input technologies can be used individually or combined in innovative ways to significantly reduce input errors (compared to human data entry) and support fast, accurate, real-time production and data collection.

Case-in-Point 8.7 Mail-order fulfillment of drug prescriptions is a booming business for the U.S. Veteran's Administration, CVS, Kaiser Permanente, and others. When mail-order prescription centers first started, a worker would stand next to a printer, wait for a label to be printed, wrap the label around the bottle, and put it in a box. The box traveled to the next worker who read the label, found the correct pill-counter station, held the bottle under the counter as the bottle filled, replaced the lid on the bottle and sent the prescription down the line for final packing. It took 20–30 people to complete the operation. Now, a computer system using plastic transport carriers (called "pucks") with RFID tags in the base automates this entire process. The prescription and the puck are linked in the system and travel along the conveyor automatically, eliminating the need for human intervention until the prescription is ready to be placed in the mailing envelope.[6]

Other technologies are being combined in innovative ways to improve management's ability to track and monitor production. For example, the production of United Parcel Service (UPS) is to effectively and accurately collect, track, and deliver packages, not only for the benefit of management information, but also for customers who demand almost real-time tracking ability. Rather than use RFID technology, UPS uses a mix of Bluetooth and Wi-Fi technology.

Case-in-Point 8.8 UPS made a $120 million investment in Bluetooth-equipped ring scanners (worn on an individual's finger), paired with belt-worn terminals (wireless receivers) to more quickly and efficiently scan the bar codes on over 14 million parcels daily. This

[6]www.intermec.com/eprise/main/Intermec/Content/Technology/DataCapture/DataCapture?section = casestudies

technology was approved for each of the 55,000 sorting workers at 1,700 worldwide facilities. UPS estimated that the new equipment would pay for itself within 16 months of full deployment.[7]

Outputs of the Production Process

Examples of output reports for the production process include materials price lists, periodic usage reports, inventory reconciliation reports, detailed inventory status reports, production cost reports, and manufacturing status reports. The *materials price list* shows the prices charged for raw materials. The purchasing department updates this list. Cost accountants use price lists to determine the standard costs needed to budget production costs. *Periodic usage reports* show how various production departments use raw materials. Managers scrutinize these reports to detect waste by comparing raw material usage to output (finished goods) produced.

A company using a perpetual inventory system issues an inventory reconciliation report. When auditors take a physical inventory, the accounting subsystem compares the physical inventory results with book balances, and notes discrepancies on this *inventory reconciliation report*. Another report important for inventory control purposes is the periodic detailed *inventory status report*. This report allows purchasing and production managers to monitor inventory levels.

Cost accountants use *production cost reports* to calculate budget variances. Some manufacturing organizations use standard costing systems that allow them to compare standard costs with actual costs and compute variances for materials, labor, and overhead. The production cost report details the actual costs for each production operation, each cost element, and/or each separate job. *Manufacturing status reports* provide managers with information about the status of various jobs. Because manufacturing a product usually requires coordination of many operations, it is important to report on production status regularly.

Of course, as more companies move to lean production and manufacturing methods, some of these production reports will be replaced with value stream management metrics that will be more useful for decision-making.

THE FINANCING PROCESS

The financing process describes how a company acquires and uses such financial resources as cash, other liquid assets, and investments. Cash and liquid assets are an organization's working capital. The financing process interfaces with the revenue, purchasing, fixed asset, and human resource processes. Much of the capital available in an organization comes from sales revenue and is used to pay expenses and personnel, and to buy fixed assets.

Besides obtaining financial resources through the sales of goods and services, most organizations also acquire funds by borrowing cash or selling ownership shares. The financing process includes managing these activities. Figure 8-9 is a data flow representation of the financing process.

[7]Source: Mashbert, Tom, ''Brown Goes Bluetooth,'' *Technology Review* (June 2005), p. 42.

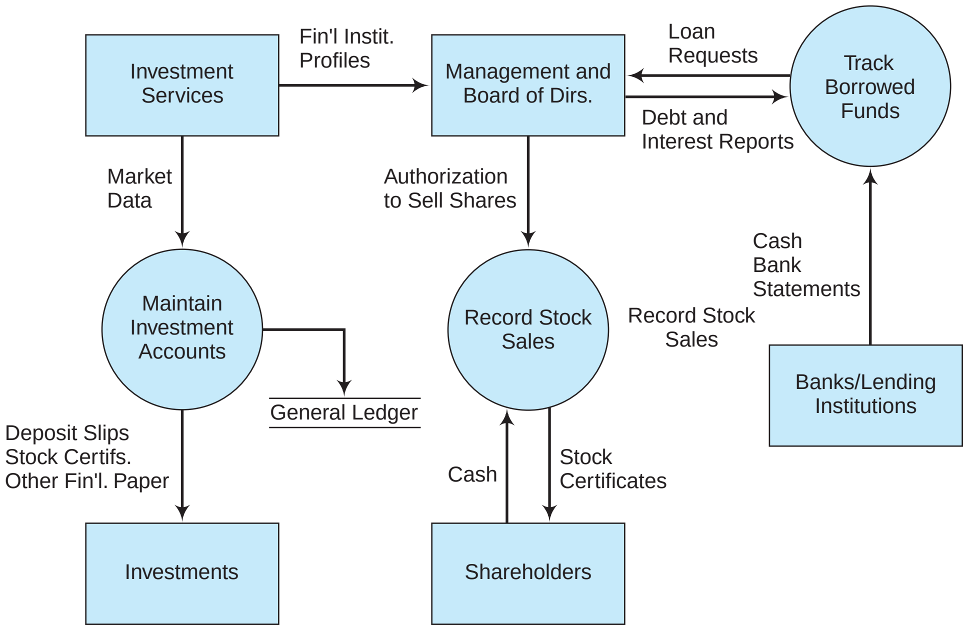

FIGURE 8-9 A data flow diagram of the financing process. This data flow diagram does not include cash management related to sales revenue, purchases, payroll, or fixed assets.

Objectives of the Financing Process

The financing process has a number of objectives. These include managing cash effectively, minimizing the cost of capital, investing for maximum returns, and projecting cash flows. Effective cash management requires collecting cash as soon as possible and spending it carefully. To collect cash quickly, an organization's AIS can provide useful information about how quickly customers pay their bills. An AIS can also show trends in cash collections.

Organizations can use **lockbox systems** to reduce the float period during which checks clear the bank. A lockbox system is an effective cash management tool because banks typically require several days, and sometimes a full week, to provide an organization with credit for out-of-state checks. With a lockbox system, a company directs its customers to mail their checks on account to a lockbox in their home state. A local bank collects the checks in the lockbox, clears the checks, sends the customer payment data in an electronic format, and deposits the cash into the company's account. In this way, cash is available for use more quickly. Figure 8-10 identifies additional benefits that companies might realize by using a lockbox system.

Electronic funds transfer (EFT), or electronic payment, is another cash management technique. Using EFT, business organizations eliminate paper documents and instead transfer funds electronically. Similarly, most companies today pay their employees electronically by directly depositing the funds to each employee's bank account directly rather than issuing a paper check.

Managing cash on the expenditure side means paying cash as bills come due and taking advantage of favorable cash discounts. Although an organization wants to make sure there is cash available for timely payments to vendors and employees, it is also possible to have too

- Better-managed large-volume deposit customers
- Capture market share with lockbox services
- Process any coupon payment format
- Reduce operating costs
- Increase efficiencies
- Cross-selling opportunities through daily access
- Online home page marketing capabilities
- Flexible implementation options
- Archive all check payment information online
- Research images for all lockbox transactions
- Capture greater share of wallet

FIGURE 8-10 Additional benefits firms may realize by using a lockbox system.
Source: website for ImageWay® Payment Processing.

much cash on hand. Idle cash is an unproductive asset and short-term investments typically earn less of a return than long-term investments. Effective cash management means cash balances are not unreasonably high and managers invest excess cash wisely. Managers in large companies monitor excess cash and invest it for very short times, sometimes less than a day.

Minimizing the cost of capital (i.e., the cost of obtaining financial resources) requires management to decide how much cash to borrow and how many shares of ownership (stock) to sell. Borrowed funds require interest payments. Although businesses do not pay interest to shareholders, they do pay dividends. Financial managers frequently use **financial planning models** to help them select an optimum strategy for acquiring and investing financial resources. These models require an information system that can make complex calculations and consider alternative investment, borrowing, and equity (sales of stock) strategies.

A final objective of the financing process is to project cash flows. An output of the revenue process is a cash receipts forecast, and the purchasing and human resource processes contribute to a forecast of cash disbursements. The financing process makes use of these forecasts to invest excess funds and decide debt and equity strategies. The AIS for the financing process contributes to cash flow predictions through estimates of interest and dividend payments and receipts. Figure 8-11 summarizes the objectives, inputs, and outputs of this process.

The Financing Process

OBJECTIVES

Effective cash management
Cost of capital optimization
Earn maximum return on investments
Project cash flows

Inputs (Source Documents)

- Remittance Advices
- Deposit Slips
- Checks
- Bank Statements
- Stock Market Data
- Interest Data
- Financial Institution Profiles

Outputs (Reports)

- Financial Statement Information
- Cash Budget
- Investment Reports
- Debt and Interest Reports
- Financial Ratios
- Financial Planning Model Reports

FIGURE 8-11 Objectives, inputs, and outputs associated with the financing process.

Inputs to the Financing Process

Many inputs to the financing process originate outside an organization. Externally-generated data or source documents might include remittance advices, deposit slips, checks, bank statements, stock market data, interest data, and data about financial institutions. Chapter 7 explained that a *remittance advice* accompanies a customer's payment on account. Banks provide *deposit slips* to document account deposits. For example, you receive a deposit slip when you make a cash deposit to your account through an automated teller machine and a credit slip when you purchase gasoline with your debit card.

Regardless of whether companies transfer funds electronically or receive/issue paper checks, accountants use the company's *bank statement* to reconcile any account discrepancies and as proof of payment. Accountants use bank statements to reconcile the cash account balance in the company's ledger against the cash balance in the bank account. Discrepancies between these two accounts arise from outstanding checks, deposits in transit, and various other transactions. Sometimes, of course, discrepancies are due to errors or even fraud. Because cash is a company's most liquid asset, AISs use control procedures to help protect against misappropriations.

Outputs of the Financing Process

Like all other business processes, the financing process provides general ledger information to help an AIS produce periodic financial statements. Examples include interest revenue and expense amounts, dividend revenue and expense reports, and summaries of cash collections and disbursements. It also provides information about balances in debt, equity, and investment accounts. Besides providing general ledger information, the financing process of an AIS produces a *cash budget* showing projected cash flows.

The AIS for the financing process can produce a variety of reports about investments and borrowings. Investment reports may show changes in investments for a period, dividends paid, and interest earned. Reports on borrowings could show new debt and retired debt for a period. These reports should list the lending institutions, interest rates charged, and payments of principal and/or interest for the period.

Managers perform *ratio analyses* to manage an organization's capital effectively. Significant ratios, such as return on investment and debt to equity, help management decision-making regarding investment and borrowing strategies. A company's financial planning model calculates and reports these ratios. The planning model also prepares recommendations regarding the appropriate mix of debt versus equity financing, and short- versus long-range investments. Figure 8-12 is a systems flowchart of an AIS for the financing process.

BUSINESS PROCESSES IN SPECIAL INDUSTRIES

The term **vertical market** refers to markets or industries that are distinct in terms of the services they provide or the goods they produce. When you think about it, most organizations fit into a vertical market category. For example, an accounting firm is a professional service organization, and a grocery store is in the retail industry. However, large conglomerates may operate in several different vertical markets—for instance, many large manufacturers have branched out to also provide professional and financial services.

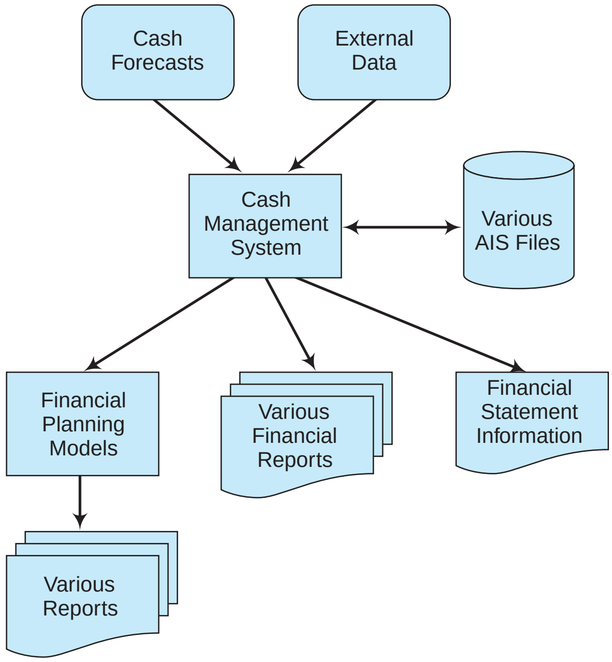

FIGURE 8-12 Systems flowchart of the AIS for the financing process.

The same is true of retail firms. Consider, for example, Sears and Roebuck. While still known primarily as a retailer, a large share of the company's profit comes from providing consumer credit.

Vertical markets with specialized AIS-related needs include professional services, not-for-profit, health care, retail, construction, government, banking and financial services, and hospitality. This section describes a few of these organizations in terms of their unique characteristics and AIS needs.

Professional Service Organizations

Professional service organizations are business establishments providing a special service to customers, such as accounting, law, engineering, consulting, and architectural firms. Compared with organizations that provide tangible goods (such as automobile manufacturers), professional service organizations have several unique operating characteristics: (1) no merchandise inventory, (2) emphasis on professional employees, (3) difficulty in measuring the quantity and quality of output, and (4) small size. These are common characteristics, although not every organization in this industry segment has all of them. For instance, some accounting and consulting firms are not small. They have hundreds of partners and international offices in cities around the world.

Because professional service organizations do not maintain a product inventory, they do not need an AIS that tracks inventory levels. Instead, the primary accounting information needed by professional service organizations relates to time and billing for their professional staff. **Time and billing information systems** are similar to job order costing systems—they track hours and costs associated with each job (i.e., each client) and each employee (i.e., professional staff). There are two major outputs of the time and billing

MARTIN & ASSOC.

10385 Spartan Dr.
Cincinnati, OH 45215
Office 513/772-7284
Fax 513/772-4529

Invoice #	7031
Invoice Date	4/14/2010
Terms	Net 15 Days
Due Date	4/29/2010
Customer Number	WMI

Mr. Richard Wilson
WMI, Inc.
5917 Hamilton Ave.
Cincinnati, OH 45224

FOR SERVICES RENDERED

Work Type	Date	Comments/Description	Staff	Hours
Chargeable	2/04/10	Connectivity Planning	ADB	0.50
No Charge	2/09/10	F9 issues/set-up	KMM	0.25
Chargeable	2/10/10	AP processing Error	KMM	0.25
Chargeable	2/17/10	AP and ODBC errors	KMM	0.50
Chargeable	2/18/10	Bank lock/GL detail/plan	KMM	3.00
Chargeable	2/19/10	Drive to and from WMI	KMM	1.00
Chargeable	2/19/10	Hard drive reformat	KMM	0.50
Chargeable	2/22/10	Training on GL and AP	ADB	1.25
No Charge	2/22/10	Shipping	CLP	0.25
Chargeable	2/24/10	GL recap file/Adrian	KMM	0.25
			WMI Total Hours:	**7.75**
			Not Charged Hours:	**0.50**
			Chargeable Hours:	**7.25**
			Invoice Dollar Total:	**$1,087.50**

FIGURE 8-13 A sample client bill for a software consulting firm. (Printed with permission from Kevin Martin and Associates)

system: (1) the client bill and (2) the professional staff member's record of billable hours (hours actually spent working on client business).

Figure 8-13 shows an example of a software consulting firm's client bill. The client bill may detail the number of hours worked by every professional staff member and the rate charged by each. For example, an audit client might incur charges for audit staff, supervisors or seniors, managers, and partners. An AIS multiplies the hours worked by each staff member by his or her respective billing rate to compute the total charge. Time and billing systems can also show other charges on the bill or client invoice—for example, charges for overhead and detailed charges for phone, fax, mail, support staff, and copy costs.

Billable hours are important in a professional service organization. Law firms, for example, stress the importance of accumulating an accurate accounting of the number of billable hours. Nonbillable hours are hours spent in training, marketing, and general research. Although these latter activities are important, they do not directly generate revenue for a law firm. A time and billing system can track each staff member's hours in many ways. The increments of time recorded vary by firm. Some professional service firms record every fifteen minutes spent working on a client job. Some law firms may record time in six-minute increments. Because time is literally money, it is important to keep records as detailed and accurate as possible.

Automation helps professional service organizations keep accurate records on billable hours. For example, phone systems can record the amount of time spent on calls to client numbers and can enter values directly into the time and billing system. A copy machine in which users enter client numbers for each job is another tool that helps assign copy costs to client accounts. Finally, as professional staff members rely increasingly on their computers for their work, special computer programs can automatically record the time spent on each job as the staff member logs on to different programs with client-oriented passwords.

Not-for-Profit Organizations

Not-for-profit organizations provide services for the protection and betterment of society. Examples include public schools, museums, churches, and governmental agencies. Not-for-profits differ from for-profit businesses in that they: (1) are usually staffed by volunteers as well as professional employees, (2) are usually not as affected by market forces, and (3) sometimes have a political emphasis.

As with other vertical markets, not-for-profit organizations have special accounting information needs that reflect their unique characteristics. For example, public schools (such as a university) must keep records of students' schedules, grades, health records, and so on. Religious organizations, on the other hand, must track members and account for donations. The federal government (certainly the largest not-for-profit organization) must value various unique assets that are not traded in a market. How much, for instance, is the Lincoln Memorial worth, and how would you determine the annual depreciation for this national landmark? As daunting as this task may sound, the Commonwealth of Virginia did undertake such a task in 2004 to estimate deferred maintenance costs for all state-owned facilities, as described in the following case-in-point. Not surprisingly, the State Auditors turned to a facility asset management software package.

Case-in-Point 8.9 After a period of budget difficulties, the Virginia state legislature asked the Auditor of Public Accounts (APA) to estimate the total cost of deferred maintenance for public buildings so that the cost of these repairs could be included in the upcoming budget. The APA quickly determined that there was no complete inventory of all Commonwealth-owned buildings and no current information on the condition of any of the buildings. That is, no data were available to make the estimate! The APA quickly researched the available software packages available for this task and recommended a Facility Asset Management System (FAMS), which included a phased approach to collect the necessary data. In May 2006, the responsibility for FAMS was turned over to the Department of General Services.[8]

In general, it is the lack of a profit goal that most influences the special AIS needs of not-for-profit organizations. Accounting standards, such as the Financial Accounting Standards Board's Statement No. 117, Financial Statements of Not-for-Profit Organizations, now require the financial statements to more closely resemble those of profit-seeking entities. However, the internal reporting systems of not-for-profit organizations focus on funds, rather than income. Fund accounting systems show the resources available for carrying out an organization's objectives. Funds may be restricted for special purposes (e.g., funds donated to a university for student scholarships) or available for general use. To reconcile the internal and external accounting systems, an AIS of a not-for-profit institution must be able to reconcile between these two different reporting structures.

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[8]Source: http://www.apa.state.va.us/deferred_maintenance.htm.

Although not-for-profit organizations cannot be evaluated using profit measures, some mechanism for performance evaluation is still desirable. A frequently used mechanism is a budgetary AIS. By comparing actual performance against planned activity, the managers in not-for-profit entities can determine how well they met their goals. Many not-for-profit entities (especially governmental organizations) employ formal long-range budgetary techniques. These budgets include projections of future activity that may serve as performance measures when compared with actual data. One difficulty often encountered in not-for-profit budgetary systems is the lack of a monetary measure of performance output. Consequently, managers must often use *process measures* (i.e., nonmonetary measures) to measure performance. In a police department, for example, the process measures might be number of arrests, number of homicides, or burglary rates. Public universities might use the number of students graduating each academic year or persistence rates.

A good short-range budgetary planning and controlling system is typically more important to a not-for-profit entity than to a profit-oriented company. The reason is the fixed, rather than flexible, nature of these organizations' annual budgets. In a not-for-profit organization, budgetary revisions are difficult, if not impossible, to carry out once the budget year begins. For example, at publicly-financed state universities, biannual state legislators approve annual operating budgets years in advance—budgets that cannot be changed in off years. Thus, in those not-for-profit organizations subject to fixed or static budgets, good short-range planning is necessary to obtain accurate budget projections for the coming year.

Health Care Organizations

The dollars spent for the health care industry have made this vertical market segment the target of much controversy and concern as the United States struggles to contain health care costs. As a result, health care reform remains a very important political issue. Interestingly, the AISs associated with health care are a large part of the controversy. Paperwork has been a major bottleneck in delivering efficient health care, and it is also a major cost. Figure 8-14, which shows the many subsystems in a health care organization's AIS, demonstrates part of the problem.

Health care entities share many characteristics with professional service organizations and not-for-profit institutions. Like these entities, health care organizations do not provide tangible goods to their customers (except for drugs). In addition, health care organizations also count professional staff as their most important asset resource. Some health care organizations are public and operate on a not-for-profit basis. Finally, output is exceptionally difficult to measure for this industry. For example, a patient may get well due to the quality of health care received, or the patient may simply get well due to his or her body's ability to overcome an illness. On the other hand, some patients die despite excellent health care and heroic measures.

The special accounting information needs of health care organizations primarily relate to **third-party billing**. Health care organizations usually do not bill their customers directly for services received. Rather, they bill insurance companies or government agencies who in turn reimburse these service providers. Typically, bills to third-party payers (insurance companies) use standardized codes for both the medical diagnosis and the procedures performed by medical personnel. Although standardized codes promote efficiency in processing information, coding can still be difficult. For example, sometimes a diagnosis is hard to pinpoint, and medical personnel often do procedures for multiple purposes. Reimbursement from an insurance company depends on the codes used. In addition, one

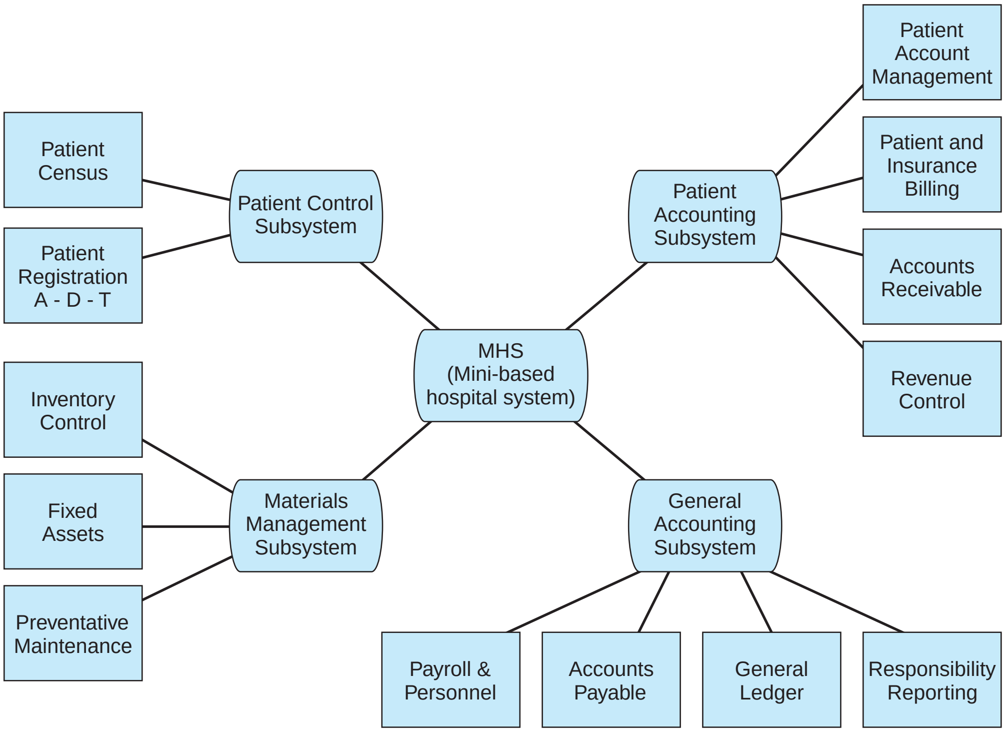

FIGURE 8-14 Mini-based hospital system. (Used with the permission of McDonnell Douglas Corporation, Hazelwood, Missouri)

plan may cover a particular procedure, and another may not. Because doctors often have discretion in making a diagnosis or prescribing a procedure, the accounting staff needs to understand the nuances of the codes and general classifications. Errors in coding can be costly, and not just in terms of the processing costs associated with them. Errors can also lead to fraud charges by insurance carriers.

Payment policies and filing forms may vary among third-party insurers. Government insurance (Medicare and Medicaid) presents another problem in terms of claim forms. These health care programs are state administered and each state has special filing requirements. The several hundred medical insurance carriers in the United States all use the same coding base. However, clerical personnel and AISs do not uniformly apply these codes. As previously mentioned, special AIS needs for the health care industry relate mostly to third-party billing, but other features of the industry also require special processing.

Health care AISs generally need to maintain patient information. Hospitals, doctors' offices, and nursing homes all need systems to efficiently schedule patients. Home health care services need to keep track of travel costs for employees. Information needs may be unique to very specific industry segments. For instance, physical therapy offices, chiropractic practices, ophthalmologists, optometrists, and dental offices each have some very special information needs. For example, physical therapy offices are different from other medical offices in that a patient may spend an hour in therapy on many different kinds of equipment. An AIS might charge differently for ten minutes spent in the whirlpool versus ten minutes on exercise equipment. The following case describes one specialized health care software program.

Case-in-Point 8.10 Chiropractic software programs help chiropractors with many of their business processes. For example, Advantage Software includes scheduling, medical records management, accounting, insurance claims, and other features that are desirable for this industry. The software tracks patient histories, treatments, payments, appointments, and claims.[9]

BUSINESS PROCESS REENGINEERING

Business process reengineering (BPR) is about redesigning business processes that are no longer efficient or effective. As an example, consider the order process that begins with inquiries from a customer about the products available for sale and ends when the customer pays cash to complete a sale. In many organizations, several individuals handle the order process. Each person has responsibility for a particular function: a receptionist or secretary may handle inquiries, a salesperson follows up on product inquiries, warehouse personnel assume responsibility for filling the order, an accounts receivable clerk bills the customer, and so on. This division of responsibility makes it difficult for some organizations to fill customer orders quickly. The result: dissatisfied customers.

Reengineering the order process may result in an integration of functional activities so that one specified individual handles customers from start to finish. This redesign means a customer knows who to talk to when an order is late and the customer is not passed around from one person to another when problems occur. As we discussed earlier in this chapter, this might be an opportunity for the firm to evaluate the possibility of *value stream management*.

Case-in-Point 8.11 Approving an insurance application at Mutual Benefit Life previously included 30 steps performed by 19 people in five departments. Because paperwork moved among so many workers, an approval took from 5 to 25 days. When the insurance company reengineered its system, it abolished existing job descriptions and departmental boundaries. In their place, the company created the position of "case manager" and provided each manager with the authority to perform all application approval tasks. Because every case manager is in charge of the entire process associated with approving applications, files are not passed around. The results have been fewer errors, decreased costs, and a significantly reduced turnaround time for approval. A new application can now be processed in approximately four hours, with an average approval turnaround time of two to five days.

Why Reengineering Sometimes Fails

Despite the best efforts of their managers, some BPR initiatives fail. There are several reasons for these failures, including unrealistic expectations, employee resistance, and lack of top management support. Some organizations that contract with consultants for BPR services expect significant improvements in their products and services, and expect significantly lower costs. Successful BPR projects can result in increased profit and more satisfied customers, but often not to the extent envisioned. Employees frequently dread hearing the term "BPR" because it has become synonymous with "downsizing." It is often a challenge to get employees to embrace change, especially change that may make what they do unnecessary or possibly more difficult.

[9]Source: http://www.advantagesoftware.com/chiropractic.html.

Although employee resistance is often fatal to BPR efforts, management support can help overcome some of the obstacles. BPR needs champions in top management who are willing to push projects forward despite potential employee resistance. Successful BPR efforts also need top managers who are good communicators and are willing to give employees both good and bad news. Managers who try to mask the downside of change are likely to run into difficulty. Finally, managers should consider the professional help of **change management consultants** to facilitate this complex process and overcome potential negative behavioral aspects.

AIS AT WORK
Reengineering the Doctor's Office[10]

Imagine if you still went to the grocery store and the clerk at the register had to manually enter the price of every item you purchased. Imagine if airlines still used only paper tickets—the ones with the carbon paper on the back of each flight segment. Imagine . . . well, you get the point. But, isn't that still the way business is accomplished at most doctors' offices? At almost every visit, you're handed a clipboard with a form (or several forms) and must fill out the exact same information you did the last time you came for an appointment!

According to Charles Fishman, the information systems at any McDonald's are far more advanced, and more useful, than those in your doctor's office or any hospital, although the stakes couldn't be more different. Estimates suggest that fewer than 25% of all hospitals and health care providers in the United States use electronic medical records or digitized clinical systems. Even fewer physician practices use such technology.

However, there are exceptions. Take for example, a gynecologist in Missouri who decided to move from his paper-based practice to a digital, paperless medical office. He took out a loan to buy the necessary hardware and software and, with his staff of three, switched everything over to the new system. Patient information is now electronic, rather than paper-based, and the doctor takes notes using a tablet PC.

After several months of complete chaos, the doctor is finally reaping the benefits of his investment in technology. The cost of dictation services dropped from $1200 per month to $60; claims are filed electronically and the doctor gets paid by insurance companies in 10 to 14 days instead of 1 to 2 months. The doctor can access patient charts from home at night, view office records from the hospital, and can always find patient charts because they're safe on a server rather than being misplaced, misfiled, or left on the wrong counter.

Of course, doctors (or the medical profession) are not the only ones who benefit from digital medical records—patients benefit, too. One study estimated that 100,000 people in the United States die each year because of preventable medical errors that digital medical records can help eliminate. For example, if a particular drug is pulled off the market, a doctor could quickly and easily identify the patients who need to be notified. That's a great use of BPR!

[10]''Computerized Records Help UNC Health Care Doctors Treat Patients,'' *InformationWeek* (June 1, 2006): NA; Charles Fishman, ''Record Time,'' *Fast Company* (April 2006), pp. 63–66.

SUMMARY

- This chapter discusses three additional business processes: resource management, production, and financing.
- The resource management process actually includes two areas of interest: human resource management and fixed asset management. Human resource management encompasses both the personnel activities in an organization and the payroll events.
- The production process includes the events related to converting raw materials into finished goods inventories. Controlling all costs is an important objective of today's firms.
- The concept of lean manufacturing is a commitment to eliminate waste throughout the organization (not just in production).
- A company that follows lean manufacturing concepts must identify value from the perspective of their customers, organize production (and data collection) in value streams, empower employees to make decisions, and then continually pursue excellence in all areas of the organization.
- To support lean manufacturing concepts, the firm must also adopt lean accounting concepts, which means measuring and evaluating results by value stream management rather than by traditional departments.
- The financing process overlaps all the other processes because it is concerned with the acquisition and use of funds needed for operations.
- The financing process also includes investing, borrowing, and stock-selling activities.
- Cash management is an important part of the financing process. Sound cash management requires companies to constantly monitor cash balances, investing any excess and covering temporary shortfalls with bank loans.
- There are many other business processes unique to specific industries. Each industry, or vertical market segment with specialized processes, has associated custom AIS needs.
- This chapter only described three of these AISs: professional services, not-for-profits, and health care organizations.
- Current technology, combined with management scrutiny of business processes, provides opportunities to reengineer business processes in ways that help organizations achieve their objectives.
- Business process reengineering (BPR) is the practice of examining business processes and redesigning them from scratch.
- Many companies today are engaged in BPR as a way to improve customer service and satisfaction, increase profitability, and decrease costs.
- Accounting processes and procedures are also being reengineered to make them more efficient and cost-effective.

KEY TERMS YOU SHOULD KNOW

activity-based costing systems
business process reengineering (BPR)
business process management software
change management consultants
cost accounting subsystems
electronic funds transfer (EFT)
enterprise asset management (EAM)
financial planning models
financing process
fixed asset management
human resource management
JIT information systems
job costing information systems
lean accounting

lean production/manufacturing
lockbox systems
non-value-added waste
payroll processing information systems
process costing information systems
third-party billing
time and billing information systems
value stream management
vertical market

TEST YOURSELF

Q8-1. All of the following activities are common to the Human Resource Management function except:

a. Hiring, training, and employing workers

b. Reporting on payroll deductions

c. Maintaining employee earnings records

d. Certified financial planning for employees

Q8-2. Which of the following outputs (reports) is common to all of the processes described in this chapter?

a. Financial statement information

b. Deduction reports

c. Supplier invoices

d. Budget reports

Q8-3. What is the objective of the fixed asset management function?

a. To track purchases of fixed assets

b. To manage the purchase, management, valuation, and disposal of an organization's fixed assets

c. To record maintenance and depreciation of fixed assets

d. To keep a current listing of approved vendors

Q8-4. Why do companies use BPM solutions for the fixed asset management function?

a. Decrease machine downtime and maintenance costs

b. Reduce inventory

c. Integrate data and coordinate logistics

d. All of the above

Q8-5. Which of the following automated systems help minimize inventory costs?

a. JIT systems

b. ABC systems

c. Job order costing systems

d. Process costing systems

Q8-6. Automated point-of-sale technology offers many advantages to retailers as well as customers. Which of the following is the most commonly used POS technology?

a. Cell phones

b. RFID

c. Bar code scanners

d. None of these

Q8-7. The concept of lean production or manufacturing includes all of the following, except:

a. Commitment to eliminate "waste" throughout the manufacturing process

b. Eliminate or reduce non-value added waste

c. Improve overall customer value and the profitability of products or services

d. There are 12 categories of waste that companies hope to reduce or eliminate

Q8-8. Lean accounting is:

a. An AIS that is generally considered low cost (i.e., an entry-level system)

b. Designed to support traditional financial performance measures

c. New performance measures that support decision-making by managers and operational improvement leaders

d. None of these

Q8-9. Business process reengineering:

a. Is an incremental approach to redesigning business processes

b. Involves redesigning business processes from scratch

c. Is rarely successful in cutting an organization's costs

d. Is usually welcomed by an organization's employees

DISCUSSION QUESTIONS

8-1. The resource management process includes events associated with both personnel and payroll functions. Describe four data items that could be used by both functions. Describe two data items for each function that would not necessarily be needed by the other (e.g., spouse name for personnel but not payroll).

8-2. Why are accounting transactions associated with payroll processing so repetitive in nature? Why do some companies choose to have payroll processed by external service bureaus rather than in-house?

8-3. In this chapter, we discussed many data inputs to an organization's production process. What are the specific data items to input to a system when adding a new raw materials inventory item? What specific data items need to be input when a worker records time spent on the production line?

8-4. What non-financial information would be important for an AIS to capture about a manufacturing firm's production process?

8-5. What are the basic concepts of lean manufacturing? What concepts are the ''root'' of lean production and lean manufacturing?

8-6. Find an example of a firm that is using lean manufacturing concepts. Has the company realized any improvements? What are they?

8-7. Can you find an example (other than the one described in case-in-point 8-6) of a firm that is using lean production concepts that are supported by lean accounting? How are they doing?

8-8. Are the inputs and outputs of a production process likely to be different for a home builder than for a cement company? How?

8-9. There are many vertical market industries with special accounting information needs apart from the industries discussed in this chapter. Identify three additional vertical market industries. What are the unique characteristics of these industries that affect their AISs?

8-10. Discuss specific steps you would take as a manager to ensure that a business process reengineering effort is successful.

PROBLEMS

8-11. Choose an industry described in this chapter and find out what vertical market accounting software is available for that industry. You may use resources such as the library, trade associations, interviews with organizations within the industry, or interviews with software consultants.

8-12. Literally thousands of business process management (BPM) solutions are available to help managers accomplish tasks in a more effective, efficient manner. Assume that you work in a payroll processing function and your supervisor asked you to select a BPM for your company. Which BPM software would you select and why? Identify the vendor, the name of the software package, and several of the features that you thought would be most beneficial to your company.

8-13. Now, assume that you work in the internal audit function at a company that is considering a software package to help automate the process of complying with the requirements of the Sarbanes-Oxley Act of 2002. Which BPM software would you select and why? Identify the vendor, the name of the software package, and several of the features that you thought would be most beneficial to your company.

8-14. Assume that you started your own law practice ten years ago, specializing in estate planning, and you currently employ five attorneys, two legal assistants, one legal secretary, and a bookkeeper/receptionist. The firm has always used a manual accounting system, which includes procedures for time and billing. How could an automated time and billing system help your firm? Search the Internet for a specific technology to automatically capture a professional employee's time spent on a particular client engagement. What is the name of the software package and what are the primary features of this BPM software?

8-15. Search the Internet for a picture of a dashboard (save the picture to include in your report). Next, prepare a single-spaced one-page report that (1) describes the content of the dashboard and (2) identifies at least 3–4 reasons this dashboard would help a manager make decisions.

CASE ANALYSES

8-16. Hammaker Manufacturing I (AIS for New Manufacturing Firm)

Dick Hammaker has been fascinated with Corvette cars, especially convertibles, since he was a teenager. Dick grew up in Michigan and worked part-time through his high school and college years at a car manufacturer, so he knew the business well. Not surprisingly, when he graduated from college he bought his first car, a used Corvette convertible, and became a member of the local Corvette Club of America.

As an accounting graduate, Hammaker was hired by one of the large automobile manufacturers in Michigan and was selected for the ''fast-track'' management training program. After five years, Hammaker decided to leave Michigan and start a specialty parts manufacturing company strictly for Corvettes. Before he even left Michigan, a potential customer contacted him—the repair shop was replacing the black convertible top on a 1967 Corvette that the owner was going to sell for $76,995!

Hammaker decided to locate his company, Hammaker Manufacturing Co. (HMC), in Northern Virginia because this is the site of the oldest Corvette Club of America. Dick knows he will need the appropriate technology to support his company, so he decided to focus on this aspect of his company prior to starting any production activities. His first action was to hire a CFO (Denise Charbonet) who could work with Lloyd Rowland (a software consultant) to determine the inputs and outputs needed for an AIS for the new company. Of particular concern is the data the AIS will need to collect regarding inventories. As Dick, Denise, and Lloyd know, inventory management will be a key factor for the success of HMC because Corvette cars are unique—parts are needed for these cars since the 1960s!

Dick believes that an AIS will give him the data and information needed for good decision-making, especially to manage inventory investments. HMC's customers are primarily Corvette specialty repair shops and they typically demand parts only as needed, but exactly when needed. Inventory can be very costly for HMC if they must stockpile many specialty parts to be able to quickly meet customer orders.

Hammaker knows from his work experience in Michigan that there are a number of costs associated with holding inventories (warehousing, obsolescence, and insurance costs)—money that could be put to better use elsewhere. Dick knows that he will need to buy raw materials from suppliers and hold raw materials inventories plus make-to-stock parts, or customers will find other parts suppliers.

Denise and Lloyd meet to discuss the issues. They decide that they need to do two things. First, they need to determine what AIS software package would be best for the new company, one that is particularly focused on inventory control, or one with an inventory control module that would be well-suited for HMC. Second, they need to decide what data elements they need to capture about each inventory item to optimize inventory management and control. Denise notes that though some inventory descriptors are easy to determine, such as item number, description, and cost, others are more difficult. For instance, inventory on hand and inventory available for sale could be two different data items because some of the inventory on hand might be committed but not yet shipped.

Requirements:

1. Explain how an AIS could help HMC optimize inventory management and control.
2. What data elements should HMC include in the new AIS to describe each inventory item?

8-17. Hammaker Manufacturing II (Business Process Reengineering or Outsource)

Implementation of a new AIS went smoothly, for the most part. It is 15 years later, and now HMC is interested in mapping a variety of their business processes to determine whether improvements can be made and whether business process reengineering should be considered. Hammaker asked Denise to work with the consulting firm analysts to determine the feasibility of these two options and also to consider the possibility of outsourcing. Denise does not know much about outsourcing and she is not sure which process (or processes) Dick might want to outsource.

Denise discovers that a number of developing countries have the capacity and the labor to make the parts that HMC is currently producing, and at much cheaper prices. Further, Denise discovers that many companies are outsourcing and offshoring a number of processes that used to be accomplished by company employees. Denise makes a note to herself to check the number of employees in each of the following departments: HR, computer support, accounting, and janitorial services. She also decides to query the AIS to determine what performance measures are available to assess the efficiency and effectiveness of each of these departments. Denise places a call to Lloyd Rowland to discuss this issue with him.

HMC is not unionized, but Denise ponders the legal and social issues associated with outsourcing jobs, because many of the 365 employees at Hammaker Manufacturing have been with the company for well over a decade.

Requirements:

1. Identify tools that would help Denise and Rowland map HMC's business processes. Which processes do you think they should work on first? Why those processes?
2. Identify at least six reasons why companies choose to outsource or offshore a business process. Which of these reasons might Dick use to make his decision to outsource or to attempt BPR?
3. Is producing automotive parts a ''core'' business process for Hammaker manufacturing? Explain.
4. Do companies ever outsource ''core'' business processes? Search the Internet to see if you can find an example of a company or an industry that oursources core business processes. What are they? Why are they doing this?
5. What social or legal issues might Denise consider? Be specific and explain why these issues might be important to Hammaker manufacturing.
6. What would you recommend if you were one of the analysts at the consulting firm? Explain.

8-18. Hammaker Manufacturing III (Lean Production/Lean Accounting)

HMC continues to be profitable. Although Denise and Lloyd Rowland mapped several business processes five years ago to determine whether HMC should work on process improvements or consider business process reengineering, they never really finished that effort, nor did HMC decide whether to outsource any processes. Hammaker still thinks that HMC could be more efficient and more profitable, but he's not really sure how the company can achieve this ''next level'' of excellence.

About a year ago, Denise started reading books and trade journals on the topics of business strategy, lean production, and lean manufacturing. So when Dick approached her regarding his intent to improve the company, she began to share with him some of the insights she had gained over the past year on business strategy and how their current AIS might not be capturing the most useful metrics for optimal decision-making. Denise mentioned that the next Lean Accounting Summit will be in September and suggested that she and her three financial analysts go to the four-day conference to gain a better understanding of lean production and accounting concepts to determine how they might be able to better support HMC and Dick's goal of improving the company.

Requirements:

1. If Dick decided to adopt the business strategy of lean production, what changes might he and his managers consider?
2. Explain how HMC might benefit from implementing lean production/manufacturing concepts.

3. Why would it be important for Denise and her financial analysts to attend the Lean Accounting Summit? What benefits would you expect them to acquire from this conference that would be useful at HMC?

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ANSWERS TO TEST YOURSELF

1. **d** 2. **a** 3. **b** 4. **d** 5. **a** 6. **c** 7. **d** 8. **c** 9. **b**

Chapter 9

Accounting and Enterprise Software

After reading this chapter, you will:

1. *Know* the evolution of accounting and enterprise software.
2. *Understand* the differences among various types of accounting and enterprise software.
3. *Be able to explain* how various functions in enterprise software work together.
4. *Understand* the architecture of enterprise systems, including their use of a centralized database.
5. *Be able to describe* the relationship between business process reengineering and enterprise system implementation.
6. *Be able to assess* the costs and benefits associated with enterprise systems.
7. *Recognize* when an organization needs a new AIS.
8. *Understand* how organizations go about selecting accounting and enterprise software.

Accounting software packages are standard tools in today's business environment. Selecting the right software, however, can be challenging.

F. Elikai, D. Inancevich, and S. Ivancevich,
''Accounting Software Selection and User Satisfaction,''
The CPA Journal (May 2007), p. 26.

INTRODUCTION

Because of the repetitive nature of many tasks in accounting, it is not surprising that these tasks have been automated. With advances in hardware and software technology, accounting software has become increasingly sophisticated and customized for specific industry needs. This chapter describes various types of accounting and enterprise software for today's business environments. Initially, accounting software packages were very basic. Typically they simply processed bookkeeping transactions for businesses. Now, accounting and enterprise-wide software are incredibly powerful, complex, and are capable of collecting a wide variety of data to support business decisions for multinational firms that operate globally and require information in various foreign languages and currencies. Further, specialized accounting software packages can accommodate specific industry information needs driven by some of the unique business processes described in the previous chapter.

Today, accounting software is evolving into yet another phase as these business solutions become a part (module) of integrated enterprise software called *enterprise resource planning (ERP) systems*. Examples include financial functions interfaced with manufacturing, sales and distribution, human resources applications, and others. The largest enterprises today, realizing the benefits of integrating their information systems, extend their ERP systems up and down their supply chains. This chapter discusses various aspects of integrated accounting software and enterprise-wide systems in some detail, including their functionality, architecture, impact on business processes, and associated costs and benefits. Because the impact of enterprise-wide software packages is so important to accountants, we cover this software in depth.

Knowing when to upgrade to a new accounting information system can be a challenge. In some cases, changes in an organization's external environment, such as increased competition, may force an upgrade. In other cases, management must identify and assess problem symptoms to make a decision. Because the software market has experienced a considerable number of consolidations and mergers since the mid-1990s, software selection can be even more complicated. As we point out with the opening quote for this chapter, selecting the right software for an organization can be very challenging. The last section of the chapter discusses the topic of software selection in detail.

INTEGRATED ACCOUNTING SOFTWARE PROGRAMS

Integrated accounting software programs process all types of accounting transactions. These include transactions affecting accounts in both general and special journals, such as sales and purchases. Integrated accounting software programs organize transaction

- Audit trails
- Budgeting capability
- Check and invoice printing
- E-commerce features
- Financial analysis tools
- Graphic reports
- Inventory management
- Recurring journal entries
- Ability to handle multiple users
- Ability to handle multiple companies
- Customizable financial reporting
- Cash-based and accrual-based accounting options
- Scalability (accommodates business growth)
- Variance analysis (budget to actual)

FIGURE 9-1 A sample of features commonly found in integrated accounting software programs.

processing in modules and provide links among these modules. The general ledger module, which includes the chart of accounts, is the foundation for the system. Using the accounting software, personnel record the general journal transactions in this module. Other modules typically found in integrated accounting software programs include accounts receivable, accounts payable, inventory, and payroll. These modules correspond to the business processes we discussed in the previous two chapters.

Journal entries recorded in accounting software modules update the general ledger module on a periodic or real-time basis. Depending on an accounting program's level of sophistication, it may include additional modules such as job costing, purchasing, billing, invoicing, and fixed assets. Figure 9-1 lists several features commonly found in integrated accounting software programs.

Small Business Accounting Software

At the low end, commercial programs are available for about $100, or even for free! For example, Microsoft now offers a small business program, *Microsoft Small Business Accounting*, bundled with selected versions of its Microsoft Office Suite. Currently, the free version of MS Accounting (called MS Accounting Express) is included in certain editions of MS Office 2007, and can also be downloaded free from their website.[1] The latest version of Microsoft Office Accounting (2008) is intended to serve small businesses that have approximately 25 employees or fewer.

As you might imagine, these accounting software packages are fully integrated with all other Microsoft Office programs. This means, for example, that you can easily import data from an *Excel* spreadsheet into the accounting program. Small business owners are usually most concerned with cash flows and determining if they have been profitable. This package and other low-end accounting software programs focus on this information.

Two other popular examples of inexpensive small business accounting software are *Quickbooks* by Intuit, and *Peachtree* products. These packages are really a set of **scalable** products, meaning that the software can grow as the business grows (i.e., the organization can add modules to the software or upgrade to a more powerful software without reinstalling or reconfiguring data). For example, the *Quickbooks* product line includes a low-end package with very basic financial accounting features for about $100. However, a company that becomes comfortable with the package and grows the business can choose

[1]Source: http://office.microsoft.com/en-us/accountingexpress/FX101729681033.aspx.

from the *Quickbooks* product line that includes an enterprise-wide software package selling for several thousand dollars.

Even the lowest end programs typically include a chart of accounts and process general ledger, accounts receivable, and accounts payable transactions. They produce many kinds of accounting reports, including basic financial statements and budget reports as well as bar graphs and pie charts. Even low-end accounting software is quite sophisticated and generally has several sample charts of accounts for different types of organizations. Users can select one of these charts of accounts and then customize the selection to match their organizations' account structures.

A trend in low-end and mid-level accounting software has been the consolidation of vendors and the availability of more extensive product lines. For example, Intuit sells over twenty different versions of its accounting software, and you can select among ten Peachtree offerings. The variety of features offered in these software packages continues to grow. One feature that even low-end packages incorporate today is **Internet connectivity**, which permits small businesses to create websites and engage in electronic commerce. For example, *Peachtree Accounting* has a special link that allows companies to take orders and receive payments over the Internet.

Low-end accounting software is typically a good AIS solution for businesses with less than $5 million in revenue and few employees. The number of transactions processed monthly is another factor impacting the choice between low-end software and more sophisticated programs. For example, if a company processes only a few accounts receivable transactions daily, an inexpensive package should handle this processing satisfactorily. However, scalability is important because the cost of the software package itself is small in comparison to the costs associated with implementing and using the package. Each time a company changes software, employees must enter historical and current transaction data, and create new codes for customers, employees, products, and so on. Cost savings are significant when the software vendor offers programs that allow data to be transferred automatically to higher-end packages.

Because there are so many low-end accounting software packages readily available to small businesses, you would think that all small businesses have already adopted one. However, even though the software is cheap, the challenge is for the owner and employees to learn how to get the greatest value from the product. For example, how many features are there in MS Word that you don't use—or don't even know are available? Similarly, to gain the most benefit from any accounting software, a business owner should consider the firm's CPA firm or a local software consultant who can help select the software, train employees, help the firm identify useful reports for decision-making, or maybe even help with rescue and recovery needs should a disaster occur.

Mid-Range and Large System Accounting Software

When transaction processing needs grow in volume and complexity, a mid-range or large system software package may be a better choice. Some examples of accounting software packages of this type are Microsoft's *Dynamics GP, SAP Business One, Epicor*, Sage software's *MAS 90 and MAS200, Everest, Made2Manage*, and *Accpac*. These software packages, ranging in cost from $2,000 to well over $300,000, offer many features needed by mid-size and larger companies. For example, many large companies do business internationally and need software to handle transactions in multiple currencies. Some software packages can convert transactions from one currency to another and can even write checks in foreign currencies. Another example of a specialized feature that may

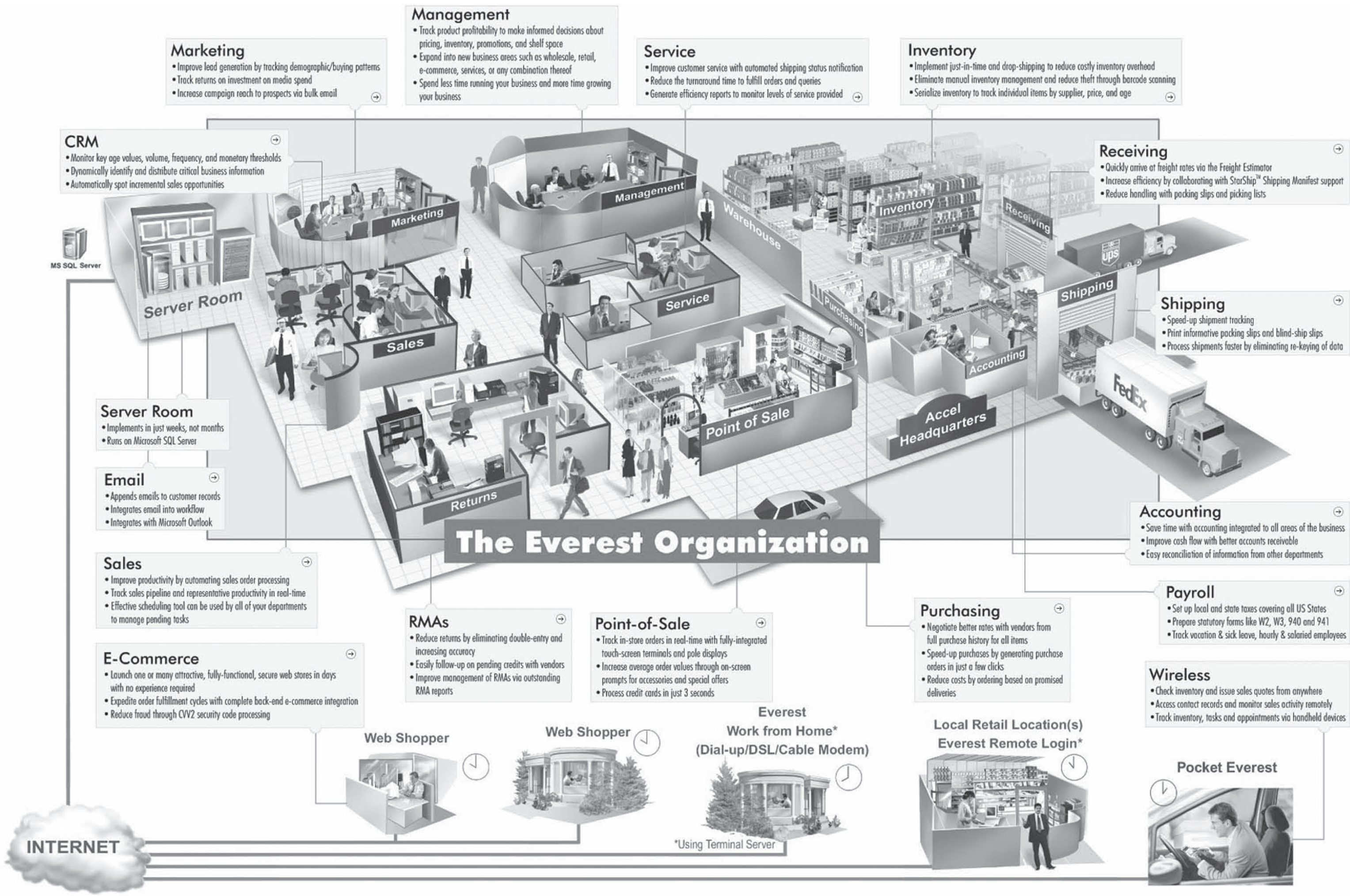

FIGURE 9-2 An example of mid-range Accounting Software's integration of business processes. (Used with permission, Everest Software, Inc.)

be included in higher-end accounting software is the ability to split commissions among multiple salespersons. Mid-range and large system accounting software also may handle more than just accounting functions.

Case-in-Point 9.1 Sage software's *Accpac* product line includes modules for financial accounting, purchasing, sales and receivables, inventory management, project management, and payroll. The software can integrate with other solutions, extending its usefulness for customer relationship management (CRM), business intelligence, e-commerce, human resource management, point-of-sale, management of fixed assets, and supply chain (warehouse) management. Accpac's Extended Enterprise Suite now includes dashboards, a fixed asset management module, and other desirable features.[2]

In addition to offering a variety of modules and interfaces, mid-level and large accounting systems software vendors also allow customers to choose from an array of deployment options. For example, the software can be made available on a desktop computer, through a web-browser, or a hosted solution. Accounting software can be expensive. Even low-end packages require a significant investment to install the software, convert old data for the new system, customize features, and train users. Although the software itself is not the major cost component, some companies are choosing to purchase cloud computing services rather than buy the software outright. This arrangement is called a **hosted solution** and is available from several vendors, including *Peachtree* and *Accpac*. Two advantages of a hosted solution are that it is easily scalable and the programs and data are accessible anywhere, anytime.

Specialized Accounting Information Systems

In addition to vendors serving general industry categories, there are literally thousands of vendors that sell accounting software specially designed to fit a particular industry or even a very small niche within an industry. Some examples of these packages are accounting software programs for dental offices, pet retailers, video stores, and schools. In addition, many integrated accounting software package developers offer add-on modules that firms can use to process special information. These extra modules might be job-cost modules that are useful to construction companies or point-of-sale features tailored to retailers. For instance, the hotel industry needs software that includes many specialized functions. *Hotel*™, by Execu/Tech, integrates property management functions, reservations systems, housekeeping management, sales and marketing, online booking, event management, dining reservations, phone call and in-room movie accounting, with a back office accounting system that processes general ledger, payroll, and accounts payable transactions.

Case-in-Point 9.2 Not-for-profit accounting software allows users to track records by individual fund, which is sometimes required by donors or contributors. They also allow users to track projects and grants. *Cougar Mountain Fund Suite*[3] is an example of this type of software. This package features the ability to handle transfers among funds, multiple grants with varying year-ends, and the ability to track restricted, temporarily restricted, and unrestricted contributions and assets in separate categories.

Some vendors of general integrated accounting packages offer programs written by independent developers to interface with their packages and provide features needed

[2]Source: http://www.sageaccpac.com.
[3]Source: http://www.cougarmtn.com.

by customers in specialized industries. Other software vendors include the source code with their programs so that businesses can customize the software to fit their specialized processing needs. Customizing software is a good business for value-added resellers or consultants who have programming ability and an understanding of the specialized needs of some businesses.

ENTERPRISE-WIDE INFORMATION SYSTEMS

An organization's information system must do much more than process strictly financial data. The capabilities of accounting software programs to process enterprise-wide data expand with the price and complexity of the software. Examples of software in this category, known as **enterprise resource planning (ERP) systems, enterprise software**, and **business application suites** include *Microsoft Dynamics AX, SAP All-in-One, Sage MAS 500, NetSuite Enterprise Solution, Exact Synergy, Infor Enterprise Solutions, Epicor*, and *Oracle*. Two important features of this type of technology are its integration and a central database. Typically, the software integrates the financial or accounting subsystem with customer relationship management (CRM), business services, human resources (HR), and supply chain management (SCM).

Because *SAP*'s high-end products can cost millions of dollars to implement, they are mostly used by the world's largest business organizations. Large-scale ERP software forces companies to reengineer or redesign their business processes for maximum efficiency. Such multinational corporations as Eastman Kodak Company, Owens-Corning Fiberglass Corporation, and Procter and Gamble have spent millions of dollars implementing *SAP* for its potential cost savings. Cost savings (discussed in detail later in the chapter) often come from streamlining, speeding, or consolidating processes.

Case-in-Point 9.3 Kimball Electronics, an electronics manufacturing services provider, spent five years deploying an SAP ERP solution at all six of its facilities. The new system gave managers access to information not previously available to them in a number of separate systems. As a result, they can collect and analyze information about spending in a variety of views, such as by supplier, product, and customer. The new software has allowed the company to reduce its cost of materials by about 4%.[4]

Enterprise System Functionality

Basic ERP Functions. Today's ERP systems provide integration among many of an organization's major business processes—e.g., order processing and fulfillment, manufacturing, purchasing, and human resources functions—all of which provide data to each other and to the financial system. This integration means, for example, that a salesperson taking an order in a manufacturing company is able to check inventory availability immediately. If inventory exists, the information system will notify shipping to pick the goods and fill the order. If no inventory is on hand, the ERP system can trigger the manufacturing subsystem to make more of the product. The integration between the customer order and manufacturing subsystems can result in a revision to production schedules to accommodate the new orders. Human resources may also be involved if the new order requires extra

[4]Carbone, James, ''Consolidation Is the Key,'' *Purchasing* (January 12, 2006), pp. 62–63.

workers or workers to be reassigned. In short, all functional areas of the organization can use the same information to perform their tasks efficiently to meet customer needs.

Extended ERP Systems. The business processes integrated by ERP systems are known as **back-office** functions because they primarily concern an enterprise's internal systems. Traditional ERP systems focus on internal data, generated for use primarily by internal processes (e.g., human resources and manufacturing) and an enterprise's own decision-makers. Today's ERP systems are extended with e-business and other **front-office** capabilities. Extended enterprise systems bring customers, suppliers, and other business partners, such as investors and strategic business relations, into the picture.

Today's ERP systems interface with suppliers and customers through **supply chain management (SCM)** applications. The supply chain for a single enterprise extends from the suppliers, from whom it purchases raw materials, to its end customers. However, the supply chain of one company is but part of a *linked* supply chain. Figure 9-3 demonstrates this concept for an automotive manufacturer. Note that goods and money are not the only commodities exchanged by partners along the chain. Information flows backward from customers to suppliers. SCM applications provide suppliers with access to the buyer's internal data, including inventory levels and sales orders. These data allow a business to reduce the cycle time for procuring goods for manufacture and sale. At the same time, the customer is able to view the supplier's information related to his or her order.

Case-in-Point 9.4 Catholic Healthcare West (CHW) spent almost 10 years implementing an ERP solution that integrated systems among 40 hospitals and medical centers. CHW's $54 million ERP software outlay consolidated 200 applications that used approximately 20 different databases. By sharing information, CHW can now close its books in a day, versus two weeks, and units can run their own departmental reports, rather than waiting for a regional

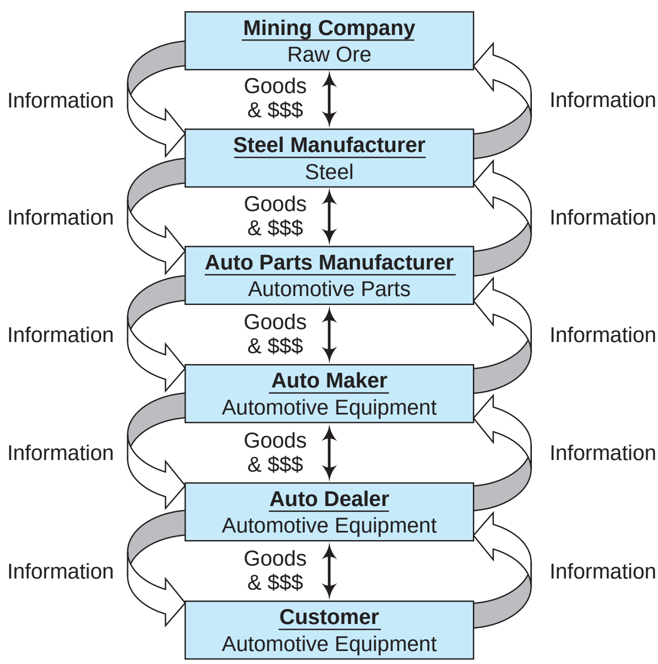

FIGURE 9-3 The supply chain for a component of the automotive industry.

office to do so. The organization expects to realize a 144% return on investment from reduced supply costs, cost savings in IT and paper support, and consolidated systems.[5]

Another tool that helps companies optimize their supply chain is **customer relationship management (CRM)**. CRM is not an application per se, but rather a collection of applications, including databases, sales order and customer service systems, and financial packages. The integrated CRM collects the data from these disparate applications and integrates them for use in decision-making. Businesses use CRM to analyze customer data—for example, looking for trends and buying patterns. This analysis can improve customer relations when the business uses the information to better meet customer needs.

Business intelligence (BI) tools are data analysis software that help managers get the most information from their CRM. CRM combined with BI analysis enables businesses to serve their customers better and also impact the bottom line. For example, CRM combined with BI can help a company learn which of their customers are most profitable and can then direct sales efforts towards those customers. Analysis of buying trends and special customer features can increase revenues and cut costs, as demonstrated in the following case-in-point.

Case-in-Point 9.5 A key to repeat sales for an auto dealer is bringing customers back for repairs and maintenance. At a Hyundai dealership in Florida, managers note that the sales department sells the first car, and the service department sells the customer their next ones. To compete against national chains, the company uses Autobytel's Retention Performance Marketing software. This product sends customers mail and email offers that match the dates and mileage with their cars' schedule for maintenance. The CRM solution also targets inactive customers and allows all customers to schedule appointments online. Online scheduling creates cost savings through better scheduling and workflow planning.[6]

Other ERP applications link strategic partners to an enterprise. Of course, many of these partners are suppliers and customers, but others include investors, creditors, and other channel partners with whom the enterprise might ''team up with'' to offer special services. **Collaborative business partnerships** are becoming more common as organizations find that there are often advantages to working with other businesses, even their competitors, to increase their power to meet customer demands. **Partner Relationship Management (PRM)** software enhances the working relationship of partners, particularly when they use the Internet.

Case-in-Point 9.6 Cartridge World, the leader in printer cartridge refilling and recycling, is the fastest-growing franchise in the $80 billion printer cartridge industry. Recently, it successfully integrated NetSuite into its operations to oversee hundreds of its 1,650 worldwide franchise locations and manage a rapidly growing business. The company saved about $200,000 in annual IT and administrative costs. Their B2B e-commerce capabilities supported a 200% increase in sales across their 1,650 stores worldwide, which helped grow sales to $425 million in 2007.[7]

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[5] Havenstein, Heather, ''Health Care Provider Nears End of 10-Year ERP Journey,'' *Computerworld* (December 19, 2005), pp. 1–2.
[6] Britt, Phillip, ''Autobytel's Key to Automotive Success,'' *Customer Relationship Management* (June 2006), p. 44.
[7] Source: http://www.netsuite.com/portal/customers/main.shtml.

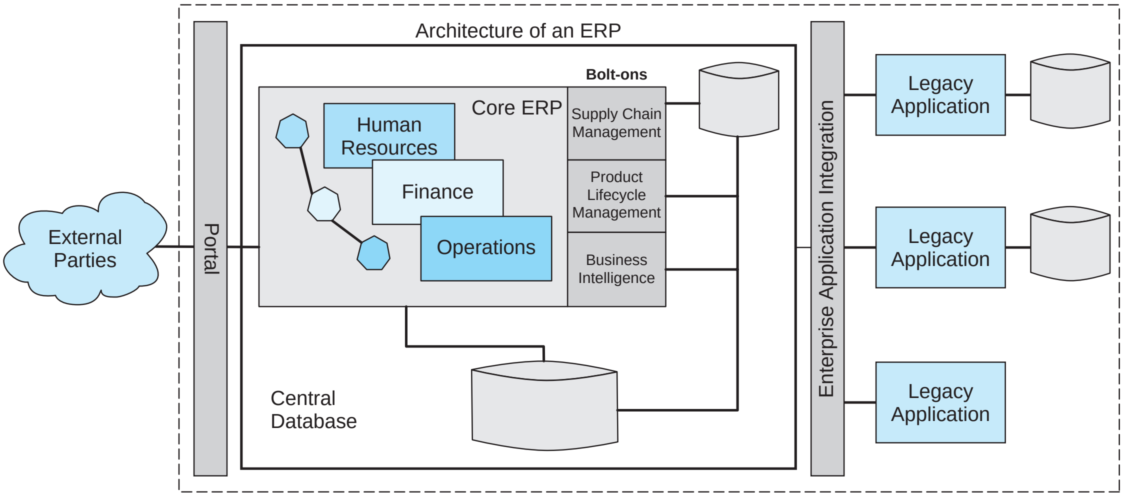

FIGURE 9-4 A diagram of the architecture of enterprise resource systems.

Source: Adapted from www.army.mil/armybtkc/focus/sa/erp_ent_i1.htm.

The Architecture of Enterprise Systems

Four components that form an ERP's architecture or technical structure are the (1) systems configuration, (2) centralized database, (3) application interfaces, and (4) Internet portals. Please refer to Figure 9-4 as we examine each of these components in greater detail.

Systems Configuration. Although ERP systems are most often licensed software that run on a company's computer system, some organizations are choosing the hosted solution we discussed earlier. Organizations with concerns about the high cost of ERP and uncertain benefits may choose to purchase ERP services on the Internet. The customer doesn't own the software, and saves on the high purchase price, hardware costs, and maintenance and upgrade expenses.

In addition, there may be security advantages of the hosted option because the software provider assumes the responsibility for security and disaster recovery. A business that operates in a region at risk for natural disaster, such as hurricanes and earthquakes, may find that the hosted solution provides a greater comfort level regarding business continuity because the hardware and software are off-site. However, organizations in some industries where data security is especially important (e.g., healthcare and banking), may be concerned about a hosted solution because they give up control over their data and information.

Case-in-Point 9.7 Thermos, Inc. needed better information than they were getting from their current ERP system. However, the IT staff and others who had invested heavily in the current system were reluctant to upgrade. Management decided to take a risk and move to a hosted system, *Oracle On Demand*. The switch led to a downsize in IT staffing, and an increase in productivity. Estimated benefits from the hosted solution are expected to exceed \$6 million.[8]

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[8]Edwards, John, ''Pay-per-View ERP,'' *CFO Magazine*, (February 2, 2006); access at: http:// www.cfo.com.

A Centralized Database. To accomplish integration, ERP systems architecture is configured around a **central database**. The database stores information about each data item just once (thus avoiding data redundancy) and makes it immediately available to all the various functions in an organization. Having a central database means that the data in an ERP system have data integrity, are collected just once, are accurate, and are current. To appreciate the value of a central database, consider the following example.

> ***Example:*** *Most businesses maintain price lists of product selling prices. The marketing department, which sets the prices, creates and maintains a price list. Accounts receivable also has a price list to reference for invoicing. The production department will have a price list for reference purposes. Finally, the web master uses a price list to update the selling prices displayed at the company's online store site. Suppose the marketing department makes a price change. Will all the other price lists also be updated? The point is that in an information system where various departments keep their own files or databases, a change by one requires a change by all.*

Application Interfaces. Although an ERP system has the capacity to integrate data from many business units within one organization, the flexibility of choosing the best software in different categories may argue for a **best-of-breed** approach. For instance, a company might implement an ERP system from SAP and then choose to interface it with a supply chain management, a customer relationship management, or business intelligence product from another software manufacturer (these products are commonly called **bolt-ons**). Cost might be another reason for an organization to forego the ''one-system'' approach. For example, a company might run out of money during the implementation of an ERP and choose to complete its system with a module or two from another vendor.

> ***Case-in-Point 9.8*** Virginia Commonwealth University in Richmond, Virginia, implemented an ERP system called Banner in 2006 that is widely used in higher education. This ERP has modules to support student registrations and payments, faculty course management, financial aid, finance, HR, and advancement. However, when the School of Business moved into its new building in the spring of 2008, decision-makers determined that the CRM module in Banner did not have the functionality desired. Accordingly, they selected a bolt-on CRM called Intelliworks Program Management. This CRM is a comprehensive solution to help current and prospective students through the initial exploration and inquiry stages, and also allows them to register for courses and submit payments online.[9]

Another useful interface to businesses is **enterprise application integration (EAI)**. EAI allows companies with legacy applications and databases to integrate and continue to use those systems. This is particularly beneficial if these firms decide to implement an ERP or acquire new applications that exploit the Internet, e-commerce, extranet, and other new technologies. EAI can accomplish this integration so that companies do not incur the cost of building their own custom interfaces to tie their multiple applications together.

Internet Portals. Extended ERP systems interface with individuals inside and outside an organization through **portals**. A portal is a gateway to other websites or services to enhance communication and productivity among employees, customers, partners, and suppliers. For example, a company can allow its suppliers to see its price lists and also to learn the payment status of its invoices on a real-time basis. University portals allow

[9] Source: http://www.intelliworks.com/news/press_releases/2008/VCU

students and faculty to access a wide variety of university resources, such as university calendars, course information, and online databases through the library. Company portals provide users access to corporate-wide systems, data, and information from across the enterprise to connect people for meaningful collaboration.

Business Processes and Enterprise Systems

Accountants and others record an organization's accounting transactions in the finance module of an ERP system, and this module can interact with any subsystems that are supported by the ERP (e.g., human resources, manufacturing, customer relationship management, or distribution). For example, the finance module can exchange payroll and tax data with the human resources subsystem. When a customer places an order, the distribution subsystem can check the customer's credit limit and accounts receivable balance in the finance module. A salesperson can check inventory levels, and better manage the customer account through the CRM. In a manufacturing environment, if an order requires additional inventory to be made, the customer order can impact the production schedule.

Business Process Reengineering and ERPs. Buying an ERP system can be akin to buying a new way of doing business. It entails reengineering an organization, hopefully to conform to the best practices of the industry.

> ***Case-in-Point 9.9*** When the University of Wisconsin-Superior (UWS), a small liberal-arts college, decided to implement an ERP, the biggest lesson it learned was that an organization needs to be proactive with reengineering and should plan for changes to business processes before implementing each module. In addition, many more processes had to be reengineered even after the system went live. Some of the benefits include the fact that students and faculty now have access to many more web-based services than before. For example, students can enroll for courses online, check on financial aid, fees, holds, and many other services.[10]

Clearly, implementing an ERP and reengineering business processes can be very demanding on employees throughout an organization. Knowing the lessons learned from those who have been through the process should be very useful. Although the above case-in-point identifies several key points about the business processing reengineering (BPR) efforts of one small university, a recent survey of 327 organizations (including over 13 major industry sectors) offers a more comprehensive understanding of BPR. The survey respondents identified the following as the most critical success factors in their BPR: (1) planning, where scope and roles were decided, (2) high-level review of current process, and (3) support from top management. Figure 9-5 lists several additional key aspects that should be considered to help ensure successful BPR initiatives.[11]

Sometimes multiple business units within one company do the same thing in many different ways. For instance, their accounts payable processes may differ. Another advantage of implementing an ERP system is that it encourages, if not demands, that the separate units conform. If all units standardize to adopt the best practice, the company should be more productive overall.

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[10] Yakovlev, Ilya, "An ERP Implementation and Business Process Reengineering at a Small University," *Educause Quarterly* (2002), pp. 52–57.
[11] Source: http://www.prosci.com/bprbestpractices.htm.

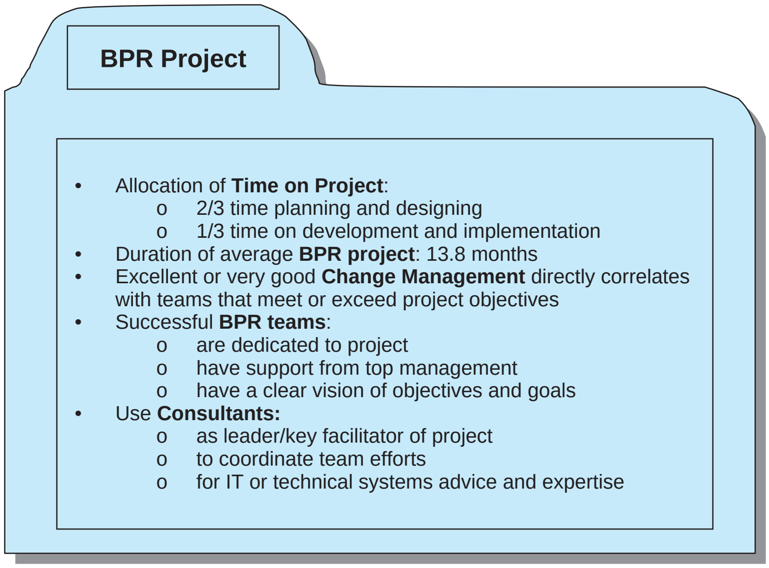

FIGURE 9-5 Key aspects of a successful BPR project.

Source: http://www.prosci.com/bprbestpractices.htm.

A company considering an ERP system may choose to conduct a business process reengineering (BPR) initiative before implementing the software, or it may undertake BPR concurrent with the implementation. The choice depends on how unique the business may be. For enterprises operating in a fairly straightforward industry, it's likely that the ERP software incorporates the best ways of doing business. This means that the organization can change its own processes to conform to those incorporated in the software and there may be no need for up-front BPR work. However, many companies may choose to conduct BPR first to figure out what processes they already have that incorporate best practices. Doing the BPR work at this time will help management to understand what kinds of process changes it needs, and this can also dictate which ERP software is best.

When an organization's practices and the processes dictated by the ERP system don't agree, a business must either change its processes or change its software. Usually, you want to change the process. Customizing ERP software should be done as a last resort because it can introduce bugs into the system and it also creates problems with software upgrades. Each time the software vendor issues an upgrade, the company must recreate the customized features.

Sometimes changing processes is desirable but not feasible, or at least problematic, for political or behavioral reasons. An enterprise that has had a nonintegrated legacy system for some time may struggle quite a bit during the ERP implementation. People who are used to doing their job in a certain way might resist the changes brought about by redesigned processes. This is sometimes true even when everyone knows the change is for the better. For instance, employees may be used to filling out travel request forms in a certain way. It may be a great improvement for them to be able to complete these forms online and in a new improved format that speeds up their reimbursement. However, if they're used to doing it the old way, they must learn how to do it the new way. This learning takes time and almost always meets with some resistance. To obtain the most benefits from a new ERP system, employees often have to learn to accept changes. This is why change management activities are such a critical aspect of an ERP implementation.

Risks and Benefits of Enterprise Systems

Because ERP systems are so expensive, require training and consultation with change management specialists, and take so long to implement, the potential risks and rewards associated with these systems are substantial. Unfortunately, there are many examples of failed ERP implementations, and these failures often have a disastrous impact on the financial statements of a business—if the business even survives.

Case-in-Point 9.10 Waste Management was looking for a new revenue management system and selected SAP's ERP software. After two years and over $100 million in project expenses, Waste Management discovered that their ERP software had significant gaps between its functionality and Waste Management's business requirements. So the implementation that should have been completed by December 2007 is now projected for sometime in 2010, without any assurance of success.[12]

Risks and Costs of ERPs. As depicted in the preceding case-in-point, one risk is that the system won't work. Besides the risks from failed implementations, ERP systems have many costs associated with them. Figure 9-6 identifies the costs and benefits normally associated with ERP systems. Implementation costs include hardware, software, and professional services. There are also costs for training, data conversion, and reengineering. Training costs involve technical training as well as training for those employees who are impacted by the new business processes. Data conversion can be very expensive. Imagine a multinational corporation that is replacing more than 100 legacy systems with an ERP system. It's possible, for example, that each of the 100 systems represented an employee number in a different format. The new system will have just one uniform employee number. Management must agree on the format of the new employee number, and staff working on the implementation will have to convert all employee data to the new standard. For very large firms, the cost of a software conversion program may be a wise investment to guarantee an efficient and error-free conversion of the data.

Costs	Benefits

• Hardware
• Software
• Training:
  – technical
  – business processes
• Data conversion
• Interfaces and customization
• Professional services
• Reassigned employees
• Software maintenance
• Software upgrades
	• Reduced inventory investment
	• Improved asset management (e.g., cash and receivables)
	• Improved decision-making
	• Resolved data redundancy and integrity problems
	• Increased flexibility and responsiveness
	• Improved customer service and satisfaction
	• Global and supply chain integration

FIGURE 9-6 A summary of costs and benefits typically associated with ERP systems.

[12]Source: http://www.cio.com/article/205852/Waste_Management_Sues_SAP_Over_ERP_Implementation.

There are also many costs that don't always make it into the cost/benefit equation. These include internal staff costs. An ERP implementation will need some inside help, even if an organization hires specialized consultants for various aspects of the implementation. Company employees who are dedicated to the project cannot do their normal jobs. If they are assigned to the implementation, their salaries should be too.

Many ERP costs will continue even after implementation. These include software maintenance and upgrade costs. One company noted that it had not realized how much it would cost for the highest level of vendor support, to constantly send their IT staff to training on the software, and to continually upgrade the system. ERP operating costs can vary from a hundred thousand to hundreds of millions of dollars.

Benefits of ERPs. Despite the high costs, there are many compelling reasons to implement an ERP system. These benefits can sometimes be difficult to quantify. For example, how can you estimate precisely what dollar benefit arises from improved decision-making or more satisfied customers? On the other hand, management might decide the business imperative to integrate an organization's IT systems is to match competitors.

Typically, most organizations make an attempt to identify the benefits they expect from the new ERP system. Many of the benefits are from cost reductions, such as reductions in inventory and employees. **Spend management** describes an approach to cutting expenses to their bare minimum. These include reducing employee travel expenses, procurement expenses, and even the costs associated with invoice processing.

Case-in-Point 9.11 Microsoft, one of *Purchasing* magazine's Spend Analysis award winners, created its own in-house software tool to capture and report procurement data. The software links to Microsoft's *SAP* enterprise system and captures data every time an employee places an order. A feature of the system is that buyers must select a United Nations Standard Products and Services Code (UNSPSC) for each transaction. This categorization allows for tracking and analysis that cut several weeks from the time needed to analyze spending.[13]

Another benefit from ERP systems is the wealth of information collected in the transactional data. Most ERP systems offer predefined reports, but do not offer the ability to analyze the data to provide managers a decision-making advantage. However, strategic companies use software tools to extract data directly from the ERP system, analyze the data instantly, and get any kind of report desired.[14]

Yet another benefit of ERP systems is the ability to monitor business processes in new and different ways—with dashboards and enterprise mashups. In Chapter 1, we introduced the idea of dashboards and how they are used by senior management to monitor corporate performance with respect to the balanced scorecard. However, the use of dashboards is actually one of the biggest trends in business intelligence, and they can be used successfully throughout the organization.[15]

Digital dashboards and scorecards are essential tools for organizations to monitor a wide variety of business processes. For example, a sales dashboard would probably monitor key sales activities so that managers could identify sales trend information, such as best customers, products, and salespeople (and measure these by revenue, units, margin, or region). Figure 9-7 shows an example of a sales dashboard that managers might use. Production dashboards are used to monitor and compare real-time production figures with

[13]Porter, Anne, James Carbone, Susan Avery, & David Hannon, ''Super Spend Analysis,'' *Purchasing* (March 18, 2004), pp. 28–39.

[14]Menninger, David, ''Information on Demand,'' *Strategic Finance* (September 2003), pp. 50–53.

[15]Curt Hall, ''Dashboards & Scorecards Chart Business Performance,'' (http://softwaremag.com), December 2004.

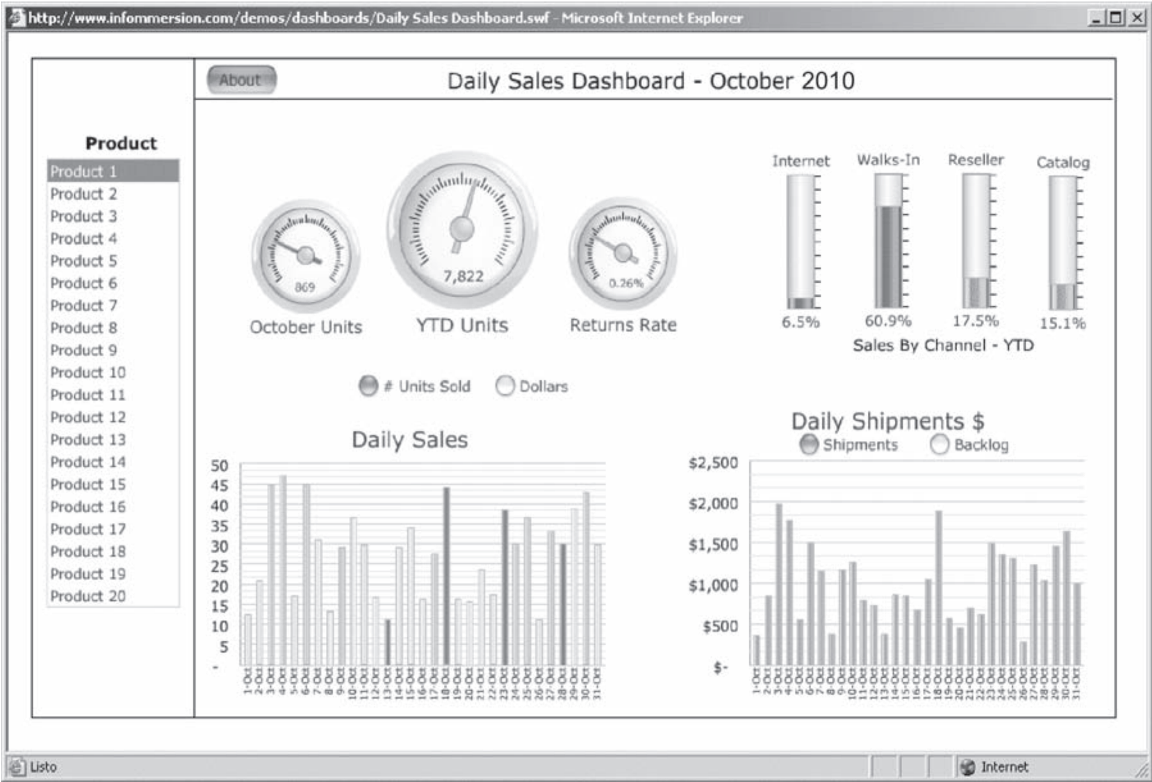

FIGURE 9-7 Example of a sales dashboard. Source: http://www.infommersion.com/demos/dashboards.

historical trends to put current events in perspective. Dashboards are used in universities by deans and department chairs to monitor processes, such as assessment data for reporting to accrediting bodies, student enrollments, budget status, and others.

The examples just cited indicate how managers might use dashboards that are based on data collected from within the organization. However, the VP for Emerging Internet Technologies at IBM is encouraging managers to experiment with **enterprise mashups**.[16]

Visualize a dashboard that collects data from a variety of sources—both inside and outside the firm—that's a mashup. In a recent pilot of a mashup, IBM developed such a content-oriented application for one of the national home improvement retail chains. The idea was to merge weather reports with inventory management. For instance, if a Category 3 or higher hurricane is predicted, it makes sense to transfer inventories of plywood to stores near the area of the storm. Normally, weather reports of a possible hurricane would not be an event that would trigger a transfer of inventory in most ERP systems. And, unlike more formal corporate applications, mashups do not take as much time to develop. Figure 9-8 illustrates the anatomy of a digital dashboard.

Quantifying the Business Value. The decade of the 1990s will probably be remembered for large investments in IT. However, many IT departments were unable to quantify the business value of these huge expenditures, and managers did not agree as to how

[16]Tony Baer, ''IBM Pushes Enterprise Mashups,'' (www.computerwire.com), June 16, 2006.

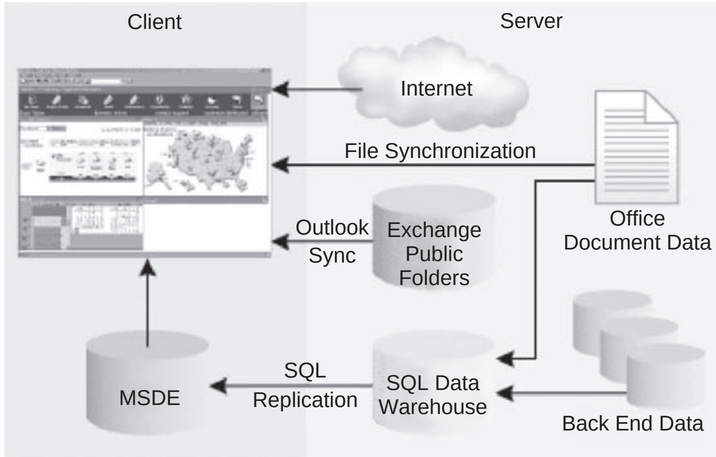

FIGURE 9-8 **The anatomy of a digital dashboard**. This dashboard has three possible data sources: the Internet, Microsoft Exchange, and relational data in a SQL Server table. All of these sources are available offline as well as online.

Source: http://msdn.microsoft.com/msdnmag/issues/0700/Dashboard

1. Determine how you will measure success.
2. Set up specific metrics based on your industry.
3. Perform regular post-implementation audits.
4. Analyze your performance numbers.
5. Set up universal processes.
6. Create a continuous learning loop.
7. Prepare for inevitable security failures.

FIGURE 9-9 Methodology for measuring the value of an ERP.

technology should be measured. Erik Keller, research fellow in residence at AMR Research, suggests a measure of business value—productivity—which is an increase in a given output at a constant or declining cost.[17] This means that a company holds the line on IT spending but increases the business benefit received from it, or decreases IT spending for a business function. Trish Saunders is a contributing author to *Customer Insights*, a Microsoft newsletter for midsize businesses in the US. She claims that whatever methodology a company uses to measure the value of an ERP, it should be applied consistently across the organization at specific points following the implementation.[18] Saunders offers guidelines to help a typical organization conduct such an audit. Figure 9-9 includes the steps she recommends—if a

[17]Source: http://www.informationweek.com/shared/printableArticle.jhtml?articleID = 18201406.
[18]Source: http://www.microsoft.com/dynamics/community/mbs_measuring_your_erp.mspx.

company does not establish specific performance metrics, it will be very difficult to gauge how well the ERP meets organizational objectives or how to correct any performance gaps.

SELECTING A SOFTWARE PACKAGE

It should be clear from reading this chapter so far that an organization has many choices when selecting accounting information systems. The table in Figure 9-10 summarizes these choices. In this section we briefly discuss how managers and owners can recognize when they need a new AIS, and how they might go about selecting one. Chapter 13 covers the process of developing new systems and selecting hardware and software in more detail.

When is a New AIS Needed?

Believe it or not, there are still many small businesses that keep their accounting systems in a shoebox, a filing cabinet, or similar storage. Small business entrepreneurs often begin with an idea to sell goods or services. They likely do not have accounting degrees, and therefore they need to rely on others for expertise in keeping their books. It is not unusual for

Software Type	Business Characteristics	Cost Range	Examples
Entry-Level	Smaller businesses Revenues < $5 million, up to 20 employees	$100–$4,500	*ACCPAC Simply Accounting, Peachtree, QuickBooks, Microsoft Small Business Accounting*
Small–Medium Business (SMB)	Sales up to $100 million, up to 100 employees	$3,000–$100,000	*Sage ACCPAC Advantage Series, Sage MAS 90 and MAS 200, Macola ES, Cougar Mountain, NetSuite, Microsoft Dynamics GP*
Small–Medium Enterprise (SME)	Sales up to $500 million, up to 500 employees	$20,000–$500,000	*Sage MAS 500, e by Epicor, Lawson, Microsoft Dynamics AX, mySAP All-in-One*
High-End Enterprise Resource Planning (ERP)	Sales > $500 million, more than 500 employees	$400,000–$300 million*	*SAP, PeopleSoft, J.D. Edwards, Oracle*
Special Industry Not-for-profit, retail, construction, banking, health care, insurance, government, and many others		$300–$300,000+	*Peachtree Nonprofit, Cougar Mountain Fund* (NFP), *AccuBuild* (construction), *Everest POS* (retail), *Phoenix* (insurance)
Custom-Built Medium–large firms with very specific information needs	Sales > $20 million	$100,000–hundreds of millions of dollars	Available from software developers and consultants

*Based on a survey by Meta Group of 63 companies. Total cost of ownership (TCO) of ERP includes hardware, software, professional services, and internal staff costs. TCO includes getting the software installed and the two years following installation.

Source: Adapted from R. Johnston, ''A Strategy for Finding the Right Accounting Software'' (September 2003), pp. 39–46, www.ctsguides.com, www.findaccountingsoftware.com and www.2020software.com.

FIGURE 9-10 A summary of types of accounting and enterprise software.

1. Late payment of vendor invoices, which means late fees and lost cash discounts.
2. Late deliveries to customers.
3. Growth in inventories, accompanied by an increase in stockouts.
4. Slowdown in inventory turnover.
5. Increased time in collecting on receivables.
6. Late periodic reports.
7. Increasing length of time to close out books at the end of a period.
8. Managers concerned about cash flows and financial picture of organization.
9. Manager complaints about lack of information needed for decision-making.
10. Owner worries about cash flows, taxes, and profitability.

FIGURE 9-11 Indicators that a company needs a new (or upgraded) AIS.

these businesses to use paper for receipts, invoicing, and reporting. The owner may deliver financial records to a bookkeeper or accountant periodically to see how well their business is doing. Of course, this is not likely to be the most ideal way to run even a small business, but small business owners who are largely preoccupied with sales and keeping customers and vendors satisfied may feel that implementing and using an accounting software package is just not something they can afford to take the time to do. The problem with manual accounting systems is that they cannot easily classify sales by customers, amount of sale, or product line, do not automatically alert their owners to impending deadlines for purchase discounts, and of course are incapable of generating even the simplest financial statements.

For those already using computer-based AISs, there are many signals to business owners and managers that a new accounting software package, or an upgrade in software, is a good idea. Often, these signs concern cash and operating a business better. Figure 9-11 lists ten such signals. When a business owner or manager recognizes that it is time to purchase new (more powerful) software, the next question is, ''Which software should I select?'' or ''How do I know which software package is the best fit for my company?''

Sometimes owners and managers of companies observe external warning signs that alert them to their need for a new AIS. These signs may have nothing to do with the company itself, or its vendors or customers. One example might be new regulations or legislation that changes the way companies must operate. Compliance with rules or laws, such as the Sarbanes-Oxley (SOX) Act of 2002, is often a reason to move to new software, or to purchase a bolt-on to an ERP. Compliance with SOX calls for built-in controls, visible audit trails, workflow and documentation software features, and management alerts.

Selecting the Right Accounting Software

The approach to buying accounting software varies with the complexity of the business and the software. At the low end, for small businesses, the approach is much quicker and less expensive than when a large company decides on an ERP system. Large organizations with specialized accounting information needs may decide to build a custom AIS from scratch. Although custom systems are difficult and expensive to develop, they are becoming less so with advances in object-oriented programming, client/server computing, and database technology. Custom systems are likely to be costly and take longer to develop than management anticipates, which is why most firms retain consultants to help with the selection and implementation of AISs. Consultants usually find that packaged software can handle about 80% of a client's processing needs. A company can either ignore the other 20%, meet their needs with such other software as spreadsheet or database programs, or develop its own modules.

Today's accounting software is easy to use and feature-rich. Internet research and discussions with other business owners in a similar industry may be enough to help a business owner select a software package. A number of helpful sites are available on the Internet to help with this selection process.

Case-in-Point 9.12 Two websites, www.2020software.com and www.ctsguides.com, list features in accounting software packages, describe these features, and allow individuals to compare the various features in the software packages. The first, 2020 software, provides software demos, offers purchase discounts, and includes a free software evaluator. If the individual gives 2020 contact information and software specifications, 2020 will email the person a software recommendation. The second, CTS, offers detailed online software reviews and other services to business owners—once the owner answers questions, such as type of business, annual sales, server operating system, desired functions, and software budget.

Shopping mall software retailers typically do not sell middle-range or high-end accounting software packages. Instead, business owners and managers at larger firms are most likely to purchase them from a **value-added reseller (VAR)** or a qualified installer. VARs and qualified installers make special arrangements with the software's vendor to sell the programs. They also provide buyers with services such as installation, customization, and training. These services are necessary due to the complexity of the middle-range accounting programs. A VAR offers a broader array of services for more software programs than a qualified installer. Chapter 13 elaborates further on this topic and discusses tools available to help in making software selection decisions.

Because ERP systems can cost millions of dollars and take years to implement, it is always advisable to get the help of an expert in choosing among them. Consultants conduct a thorough analysis of your organization and its processes to determine not only which software vendor has the best solution, but also what customization might be needed. There are many types of ERP consultants, including those who work for the vendors, professionals who work in IT consulting firms, and specialists within large accounting and professional service firms. The best way to choose a consultant is to look for someone who has experience with your industry, and who is familiar with more than one package in some depth. As you would expect, vendor consultants are unlikely to suggest any solution other than the one or ones offered by their employer.

AIS AT WORK
Sheldon Needle and CTS Guides

In 1983, Sheldon Needle left his full-time accounting job to start his own business, Computer Training Services (CTS). He knew a lot about accounting software and decided to create a company that would evaluate software and publish guides for various businesses. He published a paperback book that compared five small business software programs, advertised the book in the *Journal of Accountancy*, and waited for the orders. His phone quickly began ringing off the hook, and he knew that the service he offered was in high demand.

Sheldon next developed a spreadsheet rating system that compared the major features of top-selling accounting software programs. The program, called *Requirements Analyst*, also allowed users to determine whether a software feature was necessary, desirable, or optional. The program user, usually a software consultant, could then use *Requirements Analyst* to choose the best software for a given client. CTS grew, adding guides for special industries and different levels of accounting software. Competition came from other consultants and services that also offered software comparisons. But CTS had an advantage in that the evaluations were performed by Sheldon or the independent contractors he hired. Other comparison programs typically used vendors to supply the data about what their programs could and could not do.

The Internet began to impinge on the value proposition for CTS as search engines and vendor websites decreased the value of the software guides to users. For example, a decade ago, a business in the construction industry would need to do exhaustive research to find the top industry accounting software packages, and lists of their features. Now Internet search engines make this information accessible to anyone. Also, some consultants began to offer their services in helping companies select software for a low fee, over the Internet. A small business owner could answer a few questions about the company, such as number of users, annual sales dollars, numbers of customers, employees, and suppliers, industry niche, and so on—and the website would instantly recommend a software package.

In 2003, CTS changed their business model so that now most information is available at no cost to visitors at www.ctsguides.com. Rather than earning profits from customers, the company now receives income from software vendors. The vendors use CTS for advertising and distributing information about their product. Sheldon shares his expertise personally and talks with clients, either on the phone or via email. His company also continues to sell guides, tips on software selection, and tools such as one that helps users create a Request for Proposal (RFP). The new business model is working well and CTS has successfully navigated the constantly changing world of technology and accounting software.

SUMMARY

- Categories of integrated accounting software include entry-level, small to medium business, ERP, special industry, and custom-built software.
- Integrated accounting software packages may include modules or transaction groupings for general ledger, accounts receivable or sales, accounts payable or purchasing, inventory, and payroll.
- Entry level accounting programs usually include a chart of accounts that users can customize, along with the ability to produce a variety of accounting reports, including financial statements and budgets.
- Mid-range and large system accounting software packages include special features and options, such as international currency translation.
- Deployment options for accounting software and high-end ERP systems include hosted solutions, where users lease software as a service and customer data resides on the vendors' hardware.
- ERP systems integrate both financial and non-financial information from an organization's business processes.
- Traditional ERP systems are back-office information systems, integrating financial, manufacturing, sales and distribution, and human resource systems. Extended ERP systems add front-office features to the traditional systems, helping an organization to integrate its supply chain.
- ERP systems have a central database that allows them to reduce data redundancy, enhance the integrity of the data, and make more information available for decision-making.

- There are many costs and benefits associated with ERP systems, and managers need to consider all of them in making a decision about implementing such a large system. Savings often accrue from redesigned and more efficient business processes that lead to increases in revenues and cost savings.
- There are several warning signals that indicate when a company needs to upgrade its AIS, including dissatisfied vendors, customers, or employees. Sometimes the impetus is external, such as with Sarbanes-Oxley legislation or other regulations.
- The Internet provides many tools to help in selecting a new AIS, but consulting or VAR help is usually needed to select and implement a new system.

KEY TERMS YOU SHOULD KNOW

application interface
back-office
best-of-breed
bolt-ons
business application suites
business intelligence (BI) tools
central database
collaborative business partnerships
customer relationship management (CRM)
enterprise application integration (EAI)
enterprise mashups
enterprise resource planning (ERP) systems
enterprise software
extended ERP systems
front-office
hosted solution
integrated accounting software programs
Internet connectivity
partner relationship management (PRM)
portals
scalable
spend management
supply chain management (SCM)
value-added reseller (VAR)

TEST YOURSELF

Q9-1. Low-end accounting software is increasingly complex and sophisticated. However, software costing only a few hundred dollars is not likely to:

a. Provide information to multiple stores where a company operates more than one

b. Include a chart of accounts that users may customize to suit their industry

c. Provide all the information needed to optimize customer and supplier relationships

d. Provide information for budgeting decisions

Q9-2. Which of the following reasons might explain why a small business owner would hire a CPA firm or a software consultant to help select accounting software?

a. To train employees to use the software

b. To help the firm identify useful reports for decision-making

c. To help with rescue/recovery needs should a disaster occur

d. All of the above

Q9-3. Which of the following accounting software programs would be appropriate for a small business (e.g., a sole proprietorship with 20 employees)?

a. SAP

b. QuickBooks

c. NetSuite

d. Oracle

Q9-4. Mid-level accounting software:

a. Can only be deployed through a server networked with desktop computers

b. May be purchased in modules that match various business processes

c. Will not be appropriate for a multinational company because these programs cannot handle foreign currencies

d. Is generally inappropriate for a company operating in a specialized industry, such as retail or not-for-profit

Q9-5. Which of the following is NOT a distinguishing characteristic of an enterprise-wide (ERP) system?

a. Hosted solution

b. A central database

c. Integration

d. Best practices for business processes included in the software

Q9-6. Which of the following is correct regarding ERP systems?

a. Early ERP systems focused on back-office functions

b. ERP systems evolved largely from a manufacturing environment

c. ERP systems do not include CRM or SCM functionality

d. Both a and b are true

Q9-7. An organization will always need to upgrade to a new AIS if:

a. A major competitor buys a new package

b. Customers complain about late deliveries

c. The company wants to begin doing business over the Internet

d. None of the above are necessarily reasons to buy new accounting software

Q9-8. Accounting and enterprise software can be expensive. Which of the following is likely to be the highest cost associated with a new AIS?

a. The cost of new hardware

b. The cost of implementing and maintaining the new system

c. The cost of the software

d. The cost of converting old data for the new system

Q9-9. In selecting a new AIS, a company's management should:

a. Always hire a consultant

b. Always consult with your accountant during the decision process

c. Never rely on your accountant for help in this decision

d. Always use an Internet software service to make the decision

Q9-10. Components of an ERP's architecture typically include:

a. A centralized database and application interfaces

b. Internet portals and multiple databases

c. A centralized database running on a mainframe computer

d. Business intelligence and multiple databases

DISCUSSION QUESTIONS

9-1. Which accounting software features are likely to be most important for the following businesses? Search the Internet for an example of an AIS that you would recommend for each of these owners and include your rationale for that product.

a. a boutique shop that sells trendy ladies clothing

b. a small business specializing in custom golf clubs, replacement shafts for clubs, replacement grips for clubs, and similar repairs

c. a local CPA firm with 3 partners, 5 associates, and 2 administrative employees

d. a pet breeder that specializes in Burmese kittens

e. a business that sells and rents Segways in Washington, DC, that is located on Constitution Avenue, near the Lincoln Memorial

f. a high-end men's clothing business that has 4 stores that are all located in the same large metropolitan city (56 employees), and the owner is contemplating additional locations for stores in nearby cities

9-2. The difference between the price tag for middle-market accounting software versus an ERP system can be millions of dollars. What can these high-end systems do that the less expensive enterprise accounting packages cannot?

9-3. Discuss the differences between traditional ERP and extended enterprise systems.

9-4. Discuss some of the basic features of an ERP. How do these features distinguish an ERP from an integrated accounting software program?

9-5. What are some of the benefits of a centralized database architecture? What are some of the difficulties in moving from multiple databases or files to a centralized database structure?

9-6. A new company will have no business processes in place. How would the owner go about selecting an appropriate AIS for the new company? Should the owner consider acquiring an ERP package immediately?

9-7. Find an article about a company that has adopted a business application suite. Identify the company and its basic characteristics (such as location, products, number of employees). What are some cost savings realized by the company? Were there specific efficiencies identified as a result of the ERP implementation? Were there problems implementing the system? How long did it take for the company to complete the implementation? Were there cost or time over-runs?

9-8. Although you are likely to purchase a middle-end accounting software package from a value-added reseller (VAR), why should you be cautious about hiring one to recommend a software package for your business?

9-9. What are some of the consequences to a company that makes a poor decision in selecting a new AIS?

9-10. Why do businesses typically need to engage in business process reengineering when they adopt an ERP? Identify at least 5 key aspects of a successful BPR project.

9-11. Assume that your company is considering the purchase of an ERP. In anticipation of this purchase, you must identify some processes that the company should target for BPR. But first, your supervisor asked you to suggest a ''framework'' that the company should use for these BPR projects. Explain the steps that should be included in this framework. HINT: search the internet for information to answer this question.

PROBLEMS

9-12. Visit the software websites of two low-end accounting software package vendors and then two ERP vendors. Do you see a relationship between the complexity of the website and the price of the software? Identify a number of differences.

9-13. Define the concept of ''scalability''. Explain why it might be a good idea for owners of small businesses—and managers in larger businesses—to understand this concept.

9-14. Tom O'Neal always wanted to own his own business. When he was in high school, he worked evenings and most weekends at a neighborhood bicycle shop. When Tom went to college at the nearby State University, he still came home in the summers and worked at the bike shop. Upon graduation from college, with his accounting degree in hand, the sole proprietor (Steven Judson) of the bike shop invited Tom to become a full partner in the bike shop. Steven told Tom that he really wanted to grow the business and thought that Tom was just the person to help him do this. Tom decided to join Steven.

Over time the business grew and they opened two more bike shops in neighboring cities. Sales increased to more than $3.5 million dollars during the past year and the three bike shops now employ 14 full-time workers and another six part-time employees. Although Steven and Tom hired an accountant who was keeping their books for them and producing the financial statements each year, the partners thought they needed much more information to really run their business efficiently. They thought that they might need to make an investment in information technology to take their business to the next level.

a. Would you recommend that Steven and Tom consider an investment in IT?

b. Visit the websites of the vendors that offer the appropriate-sized software packages for this business. What are some of the features of possible software packages that Steven and Tom should consider?

c. Would you advise Steven and Tom to hire a consultant? Support your recommendation with appropriate research citations (e.g., business articles that offer this type of advice—what rationale do they give?).

9-15. B&R, Inc. is one of the world's largest manufacturers and distributors of consumer products, including household cleaning supplies and health and beauty products. Last year, net sales revenues exceeded $5 billion. B&R has multiple information systems, including an integrated accounting system, a computerized manufacturing information system, and a supply chain management software system. The company is considering an ERP system to be able to conduct more of its business over the Internet.

B&R hired National Consulting Firm (NCF), and NCF recommended the move to an ERP system, which would have electronic commerce interfaces that will allow B&R to sell its products to its business customers through its website. The cost/benefit justification for the new software, which comes with an estimated price tag of $100 million (including consultant fees, all implementation, and training costs) shows that B&R can expect great cost savings from improved business processes that the ERP system will help the company to adopt. NCF implements the ERP, adopting the industry's *best practices* for many of the business processes.

a. What are the likely advantages of an ERP system for B&R?

b. Visit the websites of the major ERP vendors. What are some of the characteristics you notice about their customers?

c. B&R has heard some horror stories from other CEOs about ERP implementations. What are some of the concerns B&R should address as they move forward with this project?

CASE ANALYSES

9-16. The RETAIL Cooperative (Enterprise Portal)

Over the past decade, The RETAIL Cooperative (TRC) successfully acquired a number of smaller retailers. These strategic acquisitions enabled TRC to grow significantly. In fact, TRC is now one of the largest retailers in Europe, and employs over 230,000 people in 25 countries. The company has three primary business units: Department Stores, Hardware Stores, and Food Stores. TRC has many cross-division service companies in both Europe and Asia to support the three primary business units. These support companies provide a variety of services, such as purchasing, information technology, advertising, human resources, and others.

In early 2007, the CEO scheduled a full-day strategy session with the vice-presidents of the business units. By the end of the day, these senior managers decided on a set of specific strategic objectives to continue the growth of the company. In particular, the CEO and vice-presidents of TRC determined that the company needed to: (1) attract well-educated, skilled managers to succeed in future expansions, and (2) focus on optimizing distribution channels so that managers at all levels of the organization would have immediate access to information for decision-making. The goal was to link TRC's management expertise with the geographic area of operation so that the company would continue to be dynamic and responsive to customers 24/7. Essentially, the senior managers wanted TRC mid-level managers in each of the business units to have the ability to "Coordinate Globally—Act Locally."

The consensus was that the Human Resources support company would develop and implement appropriate procedures to find the quality managers that TRC requires. However, the VPs of the business units wanted to be directly involved in the distribution channel optimization. As a result of TRC's rapid growth, the VPs of the business units were encountering a number of recurring problems, such as lapses in customer service, inability to respond to customer queries, and coordination problems with product availability and delivery dates. In addition, the manager for the travel department of the company noticed a significant increase in travel expenses for each of the business units and sent each of the VPs a memo. Based on these concerns, the VPs decide to meet with the Controller and Chief Information Officer (CIO) to discuss these problems and to identify possible options to resolve these issues.

To prepare for the meeting, Robin Frost (the CIO) talked with several top-level managers to collect their ideas and suggestions of the features that might be required of any new technology the firm might purchase. Each of the managers agreed that TRC would need an e-business application(s) that would give its managers a detailed online view of the status of the purchasing process that is shared among TRC's employees, suppliers, and customers. For example, each purchasing agent would like to access all the purchase prices, inventories, and selling prices that are in place in any store no matter where it is located. He/she should also be able to see TRC's manufacturing prices for its own brands, the bids made by TRC's suppliers, and the comments or complaints made by TRC's customers.

In addition, the new technology would have to link TRC's suppliers, distributors, and resellers with the company's Logistic, Production, and Distribution departments. The Accounting and Finance departments would need access to information so they could track the status of TRC's sales, inventory, shipping, and invoicing in any TRC store, worldwide. And finally, the Marketing and Sales departments would also need access to manage and update the company's product catalogs, price lists, and promotional information for any TRC outlet, regardless of its geographic location.

At the meeting with the VPs, Robin made a 10-minute presentation on Internet portals. Her research on this new technology leads her to believe this might help the VPs solve the problem of information asymmetries—that is, information not being readily available to mid-level managers working with customers. At this point, Robin just knows that software packages exist that can make information available to company employees. She's not able to articulate all the pros and cons of the technology, and has not yet called any outside consultants for advice. Robin believes that the primary challenge for this new technology will be to create a real-time ''retail connectivity'' that will allow vendor collaboration, multi-channel integration, and public and private trading exchanges across the globe.

Requirements:

NOTE: Research is required to properly respond to the following case questions, which could include journal articles on enterprise portals, and Internet research that could include online journal articles as well as vendor websites for product information.

1. Assume you are a consultant with one of the application platform vendors (e.g., IBM, Oracle, SAP, Microsoft) and Robin called you for information regarding Enterprise Portals. Prepare a one-page summary of the advantages TRC might be able to achieve if they used an Enterprise Portal for each of the business units (and for TRC-wide operations).
2. After preparing the one-page summary, now prepare a 10-minute PowerPoint presentation on Enterprise Portals, focusing on the advantages for TRC of implementing this technology. (HINT: As a minimum, be sure to address such issues as scalability of the portal, reliability, performance, and fault-tolerance.)
3. What sort of implementation schedule would you recommend for TRC, that is, what steps are important in an orderly implementation of this technology? Explain.
4. Based on your research, which system do you recommend for TRC? Prepare a matrix that compares the different features of the different Enterprise Portal solutions that you considered.

9-17. Linda Stanley and State University (Legacy Systems to an ERP)

Linda Stanley is the Vice President for Computing and Information Services at State University (SU), a large, urban university that has experienced a 3% growth in enrollments every year for more than a decade. The university how has almost 27,000 students, just under 12,000 faculty and staff, nearly $1 billion in revenues, and can currently accommodate 5,000 students in residence halls. In addition, the state legislature has financially supported infrastructure development for SU to help accommodate the sustained growth in enrollments. The campus has significantly and positively impacted the visual appearance and the economy of the city where it is located.

The number of legacy systems across campus has adequately served SU in the past, but with the growth in enrollments, the university has also increased the number of faculty, support staff, and services. Currently, the core applications at SU include Blackboard, Lotus Domino, web self service, and legacy administrative applications for all other purposes.

In recent meetings with the Provost of the university, Linda and her staff have responded to a number of concerns and problems from the Deans of academic departments on campus, as well as a number of the support departments, such as payroll, student financial aid, and HR. As Linda pointed out to the Provost and Deans, universities have unique technology challenges, such as an open technology environment 24 hours a day, 7 days a week, and that is 365 days a year, not just when school is in session. She also mentioned that SU has other factors that impact the effectiveness of IT services, such as their urban location and the rapid growth of the university over the past decade. Linda reminded the Provost that she and her staff were diligently working on a number of major technology initiatives for SU, including network reengineering, email consolidation, telephony modernization, helpdesk/customer care redesign, and classroom technology.

Last week, the Provost called Linda and asked her to meet him at the coffee shop in the Student Commons—he wanted to ask her opinion about a technology issue. In the discussion, the Provost reflected on the growth of SU and wondered aloud if the university might be at a stage of maturity where they really should consider the entire technology infrastructure of the university. He pointedly asked Linda what she thought—should they consider purchasing an ERP?

Of course, Linda was not prepared to discuss this question in great depth and told the Provost that she would do some research and make an appointment in a couple of weeks to have a more meaningful discussion of the issue. When she returned to her office, she scheduled a meeting with her staff for the next day so that she could go over the Provost's request with them and then assign different parts of this research project to them. Linda reminded everyone that they had a limited amount of time to pull the information together, and that she needed to deliver the Executive Summary to the Provost in the next few weeks.

Requirements:

NOTE: Some Internet research is required to properly respond to the following case questions.

1. Search the Internet and find ERP solutions that might be suitable for a university, such as SU. What are the primary modules for this type of ERP? Briefly describe the functions of each module.
2. What business processes would most likely be affected if SU implemented an ERP?
3. Because this is a state university, the Board of Visitors and the State Legislature will need to see a report on the expected costs and benefits of an ERP, both tangible and intangible. Although you don't have any dollar amounts, identify some typical costs and benefits that Linda should include in her executive summary.
4. Should Linda use consultants? If so, what types of support should she expect from them?
5. Search the Internet—can you find an expected timeline for implementation of an ERP at a university? Do you think Linda should include a possible timeline in her report to the Provost? Why or why not?

9-18. Springsteen, Inc. (Enterprise Resource Planning System)

Springsteen, Inc. is a large furniture manufacturer, located in Asbury Park, New Jersey. They sell to furniture wholesalers across the United States and internationally. Revenues last year exceeded $500 million. Currently, the company has over 100 legacy information systems. Recently Wendy Stewart, the Chief Information Officer (CIO), met with Bruce Preston, Chief Financial Officer (CFO), and CEO Patricia Fisher, to discuss some technical problems occurring in these systems. Patricia noted that several competitors have implemented ERP systems and she wondered if maybe it wasn't time for Springsteen to do the same. Wendy and Bruce agreed, with some reservations. Each had heard that Hershey couldn't ship its candy bars one Halloween because of problems with an SAP implementation. They'd heard other horror stories as well. Bruce thought maybe a Best of Breed solution would be less costly. Patricia suggested that they all meet with a consulting team from Warren-Williams (WW), a global consulting firm.

The meeting takes place the next week. Present are: Wendy Stewart—CIO; Bruce Preston—CFO; Patricia Fisher—CEO; Clarence Martin—Analyst, WW; Rosalita Jones—Analyst, WW; and Steve Johnson—Analyst, WW.

Patricia opens the meeting. Her role is to manage the discussion and look for a decision. She talks about what she thinks an ERP might be able to do in terms of providing competitive advantages, particularly with respect to business processes.

Bruce discusses what the dollar costs and benefits of an ERP are and the expected effect on the bottom line.

Wendy explains the architecture of an ERP and explains the technical issues associated with implementing these systems.

Clarence tries to sell the project any way he can. He also tells the company representatives what his firm will do for them, the expected cost of the system, and the implementation schedule to be expected.

Rosalita explains the potential risks and benefits of such a system for Springsteen, focusing on the benefits.

Steve describes the functionality of an ERP—what the various modules are, etc. He also talks about options for extending the ERP through the Internet to integrate the supply chain.

Requirements:

This case is designed for in-class role play. Each actor and assigned support staff have 20 minutes to prepare for the meeting. The support staff are the other class members. During the meeting one support staff member for each role will capture the main points brought out during the meeting, relative to that role. For example, a scribe for Wendy Stewart would make a list of every technical issue brought out in the meeting. The meeting is scheduled to last approximately one-half hour.

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ANSWERS TO TEST YOURSELF

1. **c** 2. **d** 3. **c** 4. **b** 5. **a** 6. **d** 7. **c** 8. **b** 9. **b** 10. **a**

PART FOUR

CONTROLS, SECURITY, PRIVACY, AND ETHICS FOR ACCOUNTING INFORMATION SYSTEMS

Managers have many responsibilities within an organization and one of the most important is to safeguard the assets of the firm. This is no small task. Although people normally think first about safeguarding cash and other physical assets, the huge electronic data repositories of most firms might well be their most valuable assets. Protecting this sensitive information is critical.

Chapter 10 discusses the important topic of computer crime and fraud. This is a growing problem that requires the attention of management at all levels in an organization. We include examples of real world cases of computer crime in this chapter and also describe procedures that organizations can implement to protect their assets. For example, to prevent and detect fraudulent acts within the environment of computerized AISs, firms can perform audit procedures, train employees to recognize symptoms of fraud, and implement stronger security measures.

In practice, organizations with computerized AISs may encounter difficulties with their internal control systems. Chapter 11 introduces the subject of internal control by analyzing the components and control activities within organizations' internal control systems. We provide examples of control procedures throughout this chapter. We also introduce the concept of enterprise-wide risk management, which must be considered first to determine what controls are necessary to mitigate the risks that are identified.

Chapter 12 examines various types of computer controls that are commonly used within AISs: general controls for organizations, general controls for IT, and application controls for transaction processing. This chapter also includes a discussion of business continuity planning. In light of the fact that natural and man-made disasters are becoming more frequent, firms and organizations of all sizes must now become more intentional about developing and testing a disaster recovery plan in support of general controls.

Chapter 10

Computer Crime, Ethics, and Privacy

After reading this chapter, you will:

1. *Understand* why it is difficult to define computer crime.
2. *Know* why there is an absence of good data on computer crime.
3. *Be able to provide reasons* why computer crime might be growing.
4. *Be familiar with* several computer crime cases and the proper controls for preventing them.
5. *Be able to describe* a profile of computer criminals.
6. *Understand* the importance of ethical behavior within the environment of computerized AISs.

"Our personal experiences, along with a host of anecdotal evidence . . . [indicates that occupational fraud has] a massive impact on all sectors of the economy . . . .—approximately $994 billion in fraud losses."

James D. Ratley, President, Association of Certified Fraud Examiners,
2008 Report to the Nation on Occupational Fraud and Abuse,
available at: www.acfe.com/resources/publications.asp.

INTRODUCTION

The connection between AISs and computer crime and fraud is both straightforward and important. Managers, accountants, and investors all use computerized information to control valuable resources, help sell products, authenticate accounting transactions, and make investment decisions. But the effectiveness of these activities can be lost if the underlying information is wrong, incomplete, or seriously compromised. This is why digital information is itself a valuable asset that must be protected. The more managers and accountants know about computer crime and fraud, the better they can assess risks and implement controls to protect organizational assets.

This chapter describes computer crime, fraud, and other irregularities that have occurred in the past and that may also occur in the future. In the first section, we take a closer look at computer crime, abuse, and fraud. In the second section, we examine three specific cases involving computer crime. The third section of this chapter identifies what organizations can do to protect themselves from computer crime and abuse. For example, this section describes ways of recognizing potential problems and what organizations can do to control them.

Not all computer-related offenses are illegal—some are simply unethical. Because of the importance of ethical behavior within the environment of computerized AISs, we also discuss the topic of computers and ethical behavior here. Finally, the last section of our chapter addresses the importance of privacy and identity theft. The dramatic increase in the number of individuals, companies, and organizations using the Internet draws our attention to the question of personal privacy. What information is collected about us and how much of it is authorized? We focus on the issue of collection and protection of this information.

COMPUTER CRIME, ABUSE, AND FRAUD

Articles in *Fortune, Business Week, The Wall Street Journal, Computerworld, Security Focus*, and *WIRED* all testify to the high level of public interest in computer crime, abuse, and fraud. Although data on computer crime and fraud are limited, at least three reputable organizations conduct surveys that help us understand the breadth and depth of these crimes. First, the **Computer Security Institute (CSI)** conducts an annual survey to help determine the scope of computer crime in the United States. The respondents to this survey are computer security practitioners in U.S. corporations, government agencies, financial institutions, medical institutions, and universities.

Second, KPMG, a global network of professional firms providing audit, tax, and advisory services, conducts surveys on fraud and business integrity. Survey participants are the business professionals who work for one of the top 2,000 companies listed in Dun and Bradstreet. Third, the **Association of Certified Fraud Examiners (ACFE)**—an international professional organization committed to detecting, deterring, and preventing fraud and white-collar crime—conducts a biannual survey and publishes the results in its *Report to the Nation on Occupational Fraud and Abuse*. The participants in this survey are its members, each of whom provides detailed information on one occupational fraud case he or she had personally investigated within the past two years.

Distinguishing Between Computer Crime, Computer Abuse, and Fraud

Although the terms ''computer crime'' and ''computer abuse'' seem to describe the same problem, there is a subtle difference between them. C**omputer crime** involves the manipulation of a computer or computer data, by whatever method, to dishonestly obtain money, property, or some other advantage of value, or cause a loss. In contrast, **computer abuse** means the unauthorized use of, or access to, a computer for purposes contrary to the wishes of the computer's owner.[1] Thus, a perpetrator commits a computer crime when he or she gains an illegal financial advantage or causes measurable loss to a person, company, or organization, and computer abusers are mischievous pests with such motives as ''revenge'' or ''challenge.''

Case-in-Point 10.1 In September 2003, armed with an arrest warrant, the FBI searched for Adrian Lamo. The 22-year old had become well-known for exposing gaping security holes at large corporations and then voluntarily helping the companies fix the vulnerabilities he exploited. At the *New York Times* site, Lamo obtained access to the names and Social Security numbers of employees, as well as confidential information on customers and business operations at the *Times*. Lamo told the *Times* of their vulnerability through a *SecurityFocus* reporter. Unfortunately for Lamo, the *New York Times* was not grateful and initiated an investigation.[2]

The term ''computer crime'' is really a misnomer because *computers* do not commit crimes—people do. Figure 10-1 describes several cases that might qualify as computer crimes or abuses. In the first case, the primary objective was to disrupt a computer network—not personal gain. The second case is neither a computer crime nor an abuse. Rather, ''misrepresentation'' would probably more accurately describe the problem. In the third case, a computer screen was damaged but the loss would probably not be a criminal charge. In the fourth case, the attempt to sell credit information would be a criminal offense. In the fifth case, no computer was used, so it is difficult to call this a ''computer crime.'' Finally, although the sixth case involved a computer and resulted in personal gain, it is perhaps more accurate to describe this as ''fraud.''

Another example of a computer offense that could be either a crime or an abuse is a **logic bomb**. This is a computer program that remains dormant until some specified circumstance or date triggers the program to action. Once ''detonated,'' a logic bomb program sabotages a system by destroying data and/or disrupting computer operations.

Case-in-Point 10.2 Donald Burleson was a disgruntled computer programmer who set off a logic bomb that erased 168,000 sales commission records at his former company.

[1]Vogon International website: www.vogon-international.co.uk.
[2]Kevin Poulsen, *Security Focus*, September 2003.

1. A graduate student infected a computer network with a virus that eventually disrupted over 10,000 separate systems.
2. A company accused a computer-equipment vendor of fraudulently representing the capabilities of a computer system, charging that the full system was never delivered and that the software was inadequate.
3. In a fit of resentment, a keyboard operator shattered an LCD screen with her high-heeled shoe.
4. Some employees of a credit bureau sent notices to some of the individuals listed as bad risks in its files. For a fee, the employees would withhold the damaging information, thereby enhancing the credit worthiness of the applicants.
5. A computer dating service was sued because referrals for dates were few and inappropriate. The owner eventually admitted that no computer was used to match dates, even though the use of a computer was advertised.
6. A programmer changed a dividends-payment program to reduce the dividends of selected stock-holders, and to issue a check to himself for the sum of the reductions—$56,000.

FIGURE 10-1 Examples of computer crimes.

Consequently, company paychecks were held up for a month. He embedded the logic bomb in a legitimate program, which he designed to go off periodically to erase still more records. But a fellow programmer who was testing a new employee bonus system discovered the bomb before it could execute again. The company's computers were shut down for two days while the bomb was located and diffused.

The type of computer crime with which most professional accountants are familiar is financial fraud. Statement on Auditing Standards No. 99 identifies two types of such fraud: (1) fraudulent financial reporting and (2) misappropriation of assets.[3] *Fraudulent financial reporting* (''cooking the books'') happens when corporate officials such as senior-ranking executives intentionally falsify accounting records to mislead analysts, creditors, or investors. As a result, the annual financial statements do not fairly represent the true financial condition of the firm. The corporate scandals discussed in Chapter 1 are examples of this type of fraud.

Misappropriation of assets is usually committed by employees within an organization, although individuals can collude with outside conspirators to perform such acts as well. The ACFE calls this type of crime *occupational fraud* and has developed a ''fraud tree'' to describe the many ways that employees can misappropriate assets from an organization. Examples (Figure 10-2) include skimming, larceny, payroll tampering, and check tampering. Most of these activities directly involve accounting information systems.

Case-in-Point 10.3 Computer programmers use the **salami technique** to steal small amounts of money from many accounts over time. In one instance, the frustrated chief accountant for a California produce grower systematically increased each of the company's production costs by a fraction of a percent, which he subsequently raised over time. Because all business expenses were rising during the same period, no single account or expense called attention to the fraud, and the accountant was able to enter these small amounts into the accounts of dummy customers, which he then pocketed. He was eventually caught when an alert bank teller brought a check to her manager's attention that the accountant tried to cash because she did not recognize the payee's name on it.

[3] Statement on Auditing Standards (SAS) No. 99, *Consideration of Fraud in a Financial Statement Audit* (AICPA 2003).

Asset Class	Type of Fraud	Example
Cash	Larceny	Direct theft or removal from bank deposit
	Skimming	Non-reporting or under-reporting of sales
		Write-offs of legitimate receivables as bad debts
		Lapping schemes
	Fraudulent disbursements	Payments to ghost companies or employees
		Payments for fictitious goods or services
		Multiple payments for the same bill
		Forged checks
		Altered payee on legitimate check
		False refunds
Inventory and all other assets	Misuse	Use of corporate limousine or jet for personal travel
	Larceny	Theft of raw materials or finished goods
		Fictitious inventory adjustments
		Non-reporting or under-reporting of received goods

FIGURE 10-2 Examples of asset misappropriation.

Computer Crime Legislation

A strict definition of computer crime must be found in the law. Such definitions are important because they determine what law enforcement officials can prosecute as well as how statistics on such crimes are accumulated. Both federal and state statutes govern computer usage.

Federal Legislation. Figure 10-3 lists some important federal legislation governing activities involving computers. Of these acts, the most important is probably the **Computer Fraud and Abuse Act of 1986** (CFAA), which was amended in 1994 and 1996. This act defines computer fraud as any illegal act for which knowledge of computer technology is essential for its perpetration, investigation, or prosecution. The following paragraphs identify the fraudulent acts found in the Computer Fraud and Abuse Act and give examples of each type of crime.

1. ***Unauthorized Theft, Use, Access, Modification, Copying, or Destruction of Software or Data.*** The PC manager at a King Soopers supermarket in Colorado was called repeatedly to correct computer errors that were thought to be responsible for a large number of sales voids and other accounting errors. Eventually, the company discovered that this manager was in fact the cause of these problems. Over the course of five or more years, officials estimate that he and two head clerks used a number of simple methods to steal more than $2 million from the company—for example, by voiding sales transactions and pocketing the customers' cash payments.
2. ***Theft of Money by Altering Computer Records or the Theft of Computer Time.*** To commit an inventory fraud, several employees at an east coast railroad entered data into their company's computer system to show that more than 200 railroad cars were scrapped or destroyed. These employees then removed the cars from the railroad system, repainted them, and sold them.

Fair Credit Reporting Act of 1970. This act requires that an individual be informed why he or she is denied credit. The act also entitles the individual to challenge information maintained by the credit-rating company and to add information if desired. Seven years after this law was put into effect, the annual number of complaints filed under it exceeded 200,000.

Freedom of Information Act of 1970. This is a federal ''sunshine law'' guaranteeing individuals the right to see any information gathered about them by federal agencies.

Federal Privacy Act of 1974. This act goes further than the Freedom of Information Act of 1970 by requiring that individuals be able to correct federal information about themselves, by requiring that agency information not be used for alternate purposes without the individual's consent, and by making the collecting agency responsible for the accuracy and use of the information. Under this act, an individual may ask a federal judge to order the correction of errors if the federal agency does not do so.

Small Business Computer Security and Education Act of 1984. This act created an educational council that meets annually to advise the Small Business Administration on a variety of computer crime and security issues affecting small businesses.

Computer Fraud and Abuse Act of 1986. This act makes it a federal crime to intentionally access a computer for such purposes as (1) obtaining top-secret military information, personal financial or credit information; (2) committing a fraud; or (3) altering or destroying federal information.

Computer Fraud and Abuse Act (1996 amendment). This act prohibits unauthorized access to a protected computer, and illegal possession of stolen ''access devices,'' which includes passwords and credit card numbers.

Computer Security Act of 1987. This act requires more than 550 federal agencies to develop computer security plans for each computer system that processes sensitive information. The plans are reviewed by the National Institute of Standards and Technology (NIST).

USA Patriot Act of 2001. This act gives federal authorities much wider latitude in monitoring Internet usage and expands the way such data is shared among different agencies. However, a judge must oversee the FBI's use of an email wiretap and the FBI must disclose what was collected, by whom, and who had access to the information that was collected.

Cyber Security Enhancement Act of 2002. This act permits the United States Sentencing Commission to review, and if appropriate, amend guidelines and policy statements applicable to persons convicted of a computer crime to reflect the serious nature of (1) the growing incidence of computer crimes, (2) the need for an effective deterrent, and (3) appropriate punishment to help prevent such offenses.

CAN-SPAM Act of 2003. This act requires unsolicited commercial email messages to be labeled, to include opt-out instructions, and to include the sender's physical address. It prohibits the use of deceptive subject lines and false headers in messages. This law took effect on January 1, 2004.

FIGURE 10-3 Federal legislation affecting the use of computers.

3. ***Intent to Illegally Obtain Information or Tangible Property Through the Use of Computers.*** One case of industrial espionage involved Reuters Analytics, whose employees were accused of breaking into the computers of their competitor, Bloomberg, and stealing lines of programming code. These instructions were supposedly used in software that provides financial institutions with the capability to analyze historical data on the stock market.
4. ***Use or the Conspiracy to Use Computer Resources to Commit a Felony.*** Paul Sjiem-Fat used desktop publishing technology to perpetrate one of the first cases of computer forgery. Sjiem-Fat created bogus cashier's checks and used these checks to buy computer equipment, which he subsequently sold in the Caribbean. He was caught while trying to steal $20,000 from the Bank of Boston. The bank called in the Secret Service, which raided his apartment and found nine bogus checks totaling almost $150,000. Sjiem-Fat was prosecuted and sent to prison.

5. ***Theft, Vandalism, or Destruction of Computer Hardware.*** A disgruntled tax payer became enraged over his tax bill. He was arrested for shooting at an IRS computer through an open window of the building.
6. ***Trafficking in Passwords or Other Login Information for Accessing a Computer.*** Two former software developers of Interactive Connection (now known as Screaming Media) were arrested for breaking into Interactive's computer system one night. They allegedly stayed on the system for about four hours and copied proprietary files and software.
7. ***Extortion that Uses a Computer System as a Target.*** A disgruntled employee of a European company removed all of the company's tape files from the computer room. He then drove to an off-site storage location and demanded half a million dollars for their return. He was arrested while trying to exchange the data files for the ransom money.

State Legislation. Every state now has at least one computer crime law. Most of the laws have provisions that (1) define computer terms (many of which vary from state to state), (2) define some acts as misdemeanors (minor crimes), and (3) declare other acts as felonies (major crimes). These laws also require willful intent for convictions. Thus, words like *maliciously, intentionally*, or *recklessly* often appear in the wording of the computer-crime laws, and willful intent must be established for a successful prosecution. The National Center for Computer Crime Data (NCCCD), a collector of computer-crime statistics, reports that 77% of computer cases brought to state courts end in guilty pleas and that another 8% of the defendants are found guilty at trials.

Computer Crime Statistics

No one really knows how much is lost each year as the result of computer crime and abuse. One reason for this is the fact that a large proportion of computer crime and abuse takes place in private companies, where it is handled as an internal matter. We have no laws that require organizations to report computer offenses. According to the 2005 Computer Crime and Security Survey, fewer than 40% of the respondents who had experienced computer intrusions in the past 12 months reported them. The principal reason managers gave for not reporting intrusions was negative publicity that might negatively impact their stock price or image (43%), and the next most important reason was their fear that competitors would use the information to advantage (33%). The 2008 ACFE Report to the Nation suggests that the number of occupational fraud cases referred to law enforcement is somewhat higher—almost 69%.[4]

The most important reason we know so little about computer offenses is because we believe that most of it is not discovered. Recently, for example, the FBI estimated that only 1% of all computer crime is detected. Other estimates of computer crime detection are between 5–20%. We mostly catch computer criminals through luck, chance, or accident. This is why experts believe the computer crime that is detected is only the tip of the iceberg.

Despite our lack of complete statistics, there are several reasons why we believe computer crime is growing. One reason is the exponential growth in the use of computer resources—e.g., microcomputers, computer networks, and the Internet. As more people become knowledgeable about how to use computers, more people are in a position to compromise computer systems.

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[4]Source: http://www.acfe.com/fraud/report.

Another reason why we believe computer crime is growing is because of continuing lax security. There are millions of microcomputer users in the world, but many of them are not aware of, or conscientious about, computer security. Then, too, some users are dishonest and have a new tool with which to commit frauds. Lastly, many websites now give step-by-step instructions on how to perpetrate computer crimes. For example, an Internet search found more than 17,000 matches for ''denial of service,'' and there are now thousands of websites that detail how to break into computer systems or disable web servers.

Case-in-Point 10.4 Dan Farmer, who wrote SATAN (a network security testing tool), tested 2,200 high-profile websites at governmental institutions, banks, newspapers, and so forth. Only three of these websites detected his probes and contacted him to find out what he was trying to do. His conclusion: two out of every three websites have serious vulnerabilities and most of the control procedures at these sites are ineffective.[5]

The FBI, in partnership with the National White Collar Crime Center, established the Internet Fraud Complaint Center (IFCC) in May 2000 to provide cyber crime victims a point of contact for reporting computer crime and abuses. The IFCC changed its name in December 2003 to the Internet Crime Complaint Center (IC3—see www.ic3.gov) to reflect the broad nature of complaints that it handles, including international money laundering, online extortion, intellectual property theft, identity theft, online scams, and computer intrusions. In 2008, almost 275,300 online fraud complaints were reported, compared to only 75,000 in 2002. The majority of the complaints in 2008 concerned non-delivered merchandise purchased on the Internet (32.9% of complaints), followed by auction fraud (25.5% of complaints).[6]

The Importance of Computer Crime and Abuse to AISs

The absence of good computer-crime statistics does not detract from the importance of computer crime and abuse on accounting information systems. One reason for this is because AISs help control financial resources and thus are often the favored targets of external crooks or dishonest employees. Also, as noted previously, AISs are prized targets for disgruntled employees seeking to compromise computer systems for revenge. A third reason is because accountants are responsible for designing, selecting, or implementing the control procedures that protect AISs.

Finally, computer crime is important because both the government and the investing public can be misled if such crime compromises the accuracy and completeness of corporate financial statements. Using a computer, fraud perpetrators are able to steal more, in much less time, with much less effort, and leave little or no evidence. Consequently, computer fraud is typically much more difficult to detect than other types of fraud. At any point in time, the FBI is investigating approximately 800 separate incidents of economic espionage.

Computer crime and abuse are also significant because of the large proportion of firms that suffer million-dollar losses due to frauds, computer viruses, unauthorized access, and denial of service attacks. As stated in the opening quote of this chapter, the 2008 ACFE Report to the Nation estimates that the annual total losses from occupational fraud are almost $1 trillion (not all of which is computer-based). The 2008 annual survey of the Computer Security Institute estimates that the average cost to target organizations from a computer-abuse incident is about $500,000—an amount whose financial impact can range from ''substantial'' to ''catastrophic'' to the victim.

[5]Source: http://www.g4tv.com/techtvvault/features/3392/Interview_SATANs_Dan_Farmer.html.
[6]Source: http://www.ic3.gov/media/annualreports.

THREE EXAMPLES OF COMPUTER CRIME

Computer crime is perhaps best understood by studying selected cases. As one reads the fascinating accounts of different computer crimes, a pattern begins to emerge. One type of crime depends mostly on the falsification of input data, while others depend on unauthorized access to computerized files. This section of the chapter examines three specific cases of computer crime.

Compromising Valuable Information: The TRW Credit Data Case

A major class of computer crime involves illegal access to, or misuse of, the information stored in an AIS, and is thus valuable-information computer crime. In the TRW Credit Data case, the valuable information involved was computerized credit data. TRW (now called Experian) was one of several large credit-rating companies in the United States. When the fraud was discovered, the company was collecting and disseminating credit information on approximately 50 million individuals. Clients of TRW included banks, retail stores, and such credit-conscious concerns as Diner's Club, American Express, MasterCard, Visa, Sears, and several leasing establishments.

TRW advised its clients of bad credit risks on the basis of the information maintained in its databases. However, that information could be changed. The fraud began when six company employees, including a key TRW clerk in the consumer relations department, realized this fact and began selling good credit to individuals with bad credit ratings. The names and addresses of the bad credit risks were already on file. It merely remained to contact these individuals and inform them of a newfound method of altering their records. Accordingly, the perpetrators approached individuals with bad credit ratings and offered them a clean bill of health in return for a ''management fee.''

Those people who decided to buy good credit ratings paid TRW employees ''under the table,'' and the clerk in the consumer relations department then inserted into TRW's credit files whatever false information was required to reverse the individual's bad credit rating. In some cases, this required deleting unfavorable information that was already stored in the individual's credit record. In others, it required adding favorable information. Fees for such services varied from a few hundred dollars to $1,500 per individual. Ironically, the TRW clerk who ultimately input the false information to the computer system received only $50 for each altered record. However, the losses resulting from these activities were not so inconsequential. Independent estimates have placed this figure at close to $1 million.

The principal victims of the fraud were TRW's clients who acted on credit information that ultimately turned out to be inaccurate. Exactly how many file records were altered is difficult to say. Lawyers for the prosecution documented 16 known cases of altered file records, but had reason to believe the number exceeded 100 cases. Paradoxically, the prosecution had difficulty acquiring testimonies because the buyers of good credit standing as well as the TRW sellers were technically in violation of the law by conspiring to falsify credit-rating information.

Analysis.

Data diddling means changing data before, during, or after they are entered into a computer system. The change can delete, alter, or add important system data, especially the data stored in corporate databases. This is a problem because most such data are (1) proprietary, (2) may give a firm a competitive advantage, and (3) are sometimes an organization's most valuable asset (think eBay, for example). Finally, because the data processing tasks in most computerized AIS job streams are automated, the data that are input manually to a system are particularly vulnerable to compromise.

There have been many cases of computer crime involving the alteration of corporate data. In one instance, a clerk for a Denver brokerage altered a transaction to record 1,700 shares of Loren Industries stock worth about $2,500, as shares in Long Island Lighting worth more than $25,000. In a second case, a ring of travel agents in California received prison sentences for compromising an American Airlines reservations system and stealing $1.3 million worth of frequent-flier tickets.

The TRW case involves two key issues: (1) the propriety of the input information used in updating a specific AIS, and (2) the protection afforded both consumers and users in the accuracy and use of credit information that is gathered by a private company. With regard to the first point, it is clear that the fraud was successful only because the perpetrators were able to enter false information into the computer system. This observation points to the importance of control procedures (e.g., the authorization and validation of credit changes) that safeguard the accuracy and completeness of file information. As with many cases of computer crime, the six TRW employees involved in the fraud were caught only by chance: an individual approached with an offer to buy a good credit rating for $600 became angry and called the FBI. Later, the TRW clerk in the consumer relations department decided to turn state's evidence.

The second point involving the protection of the consumer and user of credit information encompasses a much larger issue. In 1970, Congress passed the **Fair Credit Reporting Act**, which requires that an individual be told why he or she is denied credit. The consumer also has the right to contest the information maintained by the credit-rating company, although there is clearly a vast difference between the right to *challenge*, versus the right to *change*, credit information.

Directly after the Fair Credit Reporting Act went into effect, TRW reported consumer inquiries increased a hundred fold, and at the time the fraud was detected, approximately 200,000 consumers annually were complaining about their credit ratings. The fact that, by TRW's own admission, fully one third of these inquiries resulted in a file change or update is unsettling. Moreover, it is not known how much more information collected by TRW is still inaccurate but simply not challenged—for example, because an individual is not aware of an inaccuracy, or because the consumer does not know his or her rights under the law.

Wire Fraud and Computer Hacking: Edwin Pena and Robert Moore[7]

Voice over Internet Protocol (VoIP) is a technology that allows you to make telephone calls using a broadband Internet connection instead of a regular telephone line. This technology converts your voice signal into digital ones that travel over the Internet and are then converted back to audio ones at the receiver's end.

Edwin Pena, who owned two Florida VoIP wholesale companies, was arrested on June 7, 2006 for hacking into other providers' networks, routing his customers' calls onto those platforms, billing those companies, and then pocketing the proceeds. He was charged with one count of wire fraud and one count of computer hacking. The government claimed that Pena embezzled over $1 million from this scheme, which he used to purchase real estate, cars, and a 40-foot boat. To avoid attention, Pena apparently purchased these items in someone else's name.

[7]Source: http://www.technologynewsdaily.com/node/3252.

The federal government also filed a criminal complaint against Robert Moore of Spokane, Washington, the professional **hacker** who penetrated the networks for Pena. However, Moore admitted his part in the fraud, disclosing that Pena paid him $20,000 for his work. Apparently, Moore scanned a lot of other companies' computer networks searching for vulnerable network ports with which to route calls. For instance, he made over 6 million scans of just AT&T ports between June and October of 2005. After Moore obtained proprietary codes (known as prefixes), he and Pena allegedly flooded providers with test calls until they were able to match up prefixes. Once they matched prefixes, Pena programmed the networks of other companies to use his prefix to route his customers' calls.

Analysis. Hacking is a widespread problem. This is due, in part, to the fact that many computer applications now run on local and wide area networks, where computer files become accessible to unauthorized users. Then, too, the Internet enables users to log onto computers from remote sites, again increasing vulnerability to hacking.

Computer hacking is common in universities, where students often view the activity as a harmless game of ''beating the system.'' Recently, for example, a group of student hackers called the ''Legion of Doom'' stole data from the BellSouth Telephone Company and disrupted its 911 emergency phone system just to see if they could do it. Educational institutions view hacking as a particularly perplexing problem because the need for tight system security conflicts with the objective of providing easy and simple computer access to bona fide users.

Many hackers brag that they can compromise any type of file information once they have successfully logged into a computer system. One way they achieve this is to elevate their system status to that of a ''privileged user'' or ''network manager,'' which is a security level that gains the hackers access to password files, system control data, and other high-security information. These activities are thwarted by using system programming routines that test for, and deny, such bootstrapping and that also immediately communicate such attempts to computer supervisors as possible security violations.

> ***Case-in-Point 10.5*** When hackers invaded NDA (a consulting firm in Woburn, Massachusetts), the hackers installed a program that enabled them to record users' passwords and access the network freely. The invaders copied files containing ID codes for cellular phones, gathered sensitive information on NDA's business customers, and then launched similar attacks on those companies.[8]

The maximum penalty for wire fraud is 20 years in prison and a $250,000 fine, and the penalty for computer hacking is a maximum of 5 years in prison and a $250,000 fine. Provisions of the USA Patriot Act of 2001 may help discourage computer hacking by helping federal authorities locate and prosecute hackers. However, the most effective deterrents are likely to be preventive rather than punitive. One helpful tactic is user education—i.e., making potential hackers aware of the ethics of computer usage and the inconvenience, lost time, and costs incurred by victim organizations. Another safeguard is to require user passwords, which limit computer access to bona fide users. But passwords are not foolproof mechanisms, because at present, computers cannot distinguish between authorized employees using their own passwords and unauthorized users entering compromised passwords. Thus, until bio-authorizations such as retina or fingerprint scanners or other cost-effective intrusion detection systems replace them, protecting passwords is paramount. We will review some methods for this in the next section of the chapter.

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[8]Source: http://findarticles.com/p/articles/mi_m1154/is_n11_v85/ai_19969629.

Denial of Service: The 2003 Internet Crash[9]

A number of computer viruses and computer worms have gained media attention, but none have been as swift or as ''deadly'' as the Slammer worm. In 2003, this computer worm nearly shut down the Internet in less than 15 minutes. Internet service providers (ISPs) on the east coast of the United States were the first to recognize the problem, but the full impact of this computer worm quickly spread to other countries.

How did this happen? The Slammer worm took advantage of a weakness in Microsoft's SQL Server 2000 software—a weakness that allowed applications to automatically find the right database. As a result, just after midnight on January 25, 2003, over 55 million meaningless database server requests were crossing the globe. The Slammer worm was able to spread hundreds of times faster than any prior worm attack. The unfortunate part is that the total cost to fix the problem was estimated at over $1 billion, and we still do not know who did it or when it might happen again.

Analysis. **Denial of service (DOS) attacks** take many forms, including (1) computer viruses, (2) computer worms, or (3) distributed systems. A **computer virus** is an attachment to other files or programs that destroys computer files, disrupts operating system activities, or damages program software. A computer worm is a separate entity (often considered a type of virus program) that makes working replicas of itself to infect more systems and/or to flood computer networks with excessive email traffic.[10] As suggested by Figure 10-4, ''viruses'' continue to be the number one security problem for modern organizations. A recent survey of 300 private and public computer sites conducted by the International Computer Security Association, in Carlisle, Pennsylvania, found viruses in more than 3% of the survey sites.

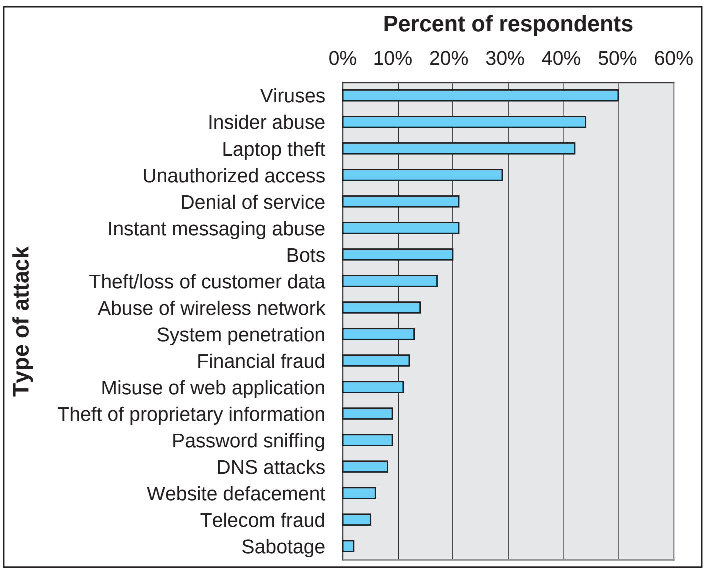

FIGURE 10-4 Percentage of respondents experiencing common types of computer crime and abuse. (Source: 2008 CSI Survey).

[9]Source: P. Boutin, *WIRED*, Issue 11.07, July 2003 (www.wired.com).
[10]Source: J. Elizabeth Strohm, *The America's Intelligence Wire*, August 25, 2003.

Computer worms do not actually destroy data, but merely replicate themselves repeatedly until the user runs out of internal memory or disk space. Unfortunately, the Internet facilitates the spread of virus and worm programs from one system to another, making them the most popular form of computer crime or abuse. Finally with **distributed denial-of-service (DDoS) attacks**, a single virus or worm program manages to enlist the aid of innocent ''zombie computers'' which then send email messages to, or request services from, the target system. The barrage of incoming mail or service requests then overwhelms the target system, typically requiring its owners to disable it.

Most computer viruses reside on secondary storage media, where they hide until finding an opportunity to execute. There are several variations of these viruses. **Boot-sector viruses** hide in the boot sectors of a disk, where the operating system accesses them every time it accesses the disk itself. **Trojan horse programs** reside in legitimate copies of computer programs, for example, spreadsheet programs. Logic bomb programs are similar to Trojan horse programs, except that they remain dormant until the computer system encounters a specific condition, such as a particular day of the year or a particular Social Security number in a file. (Trojan horse and logic bomb programs are termed ''programs'' rather than ''viruses'' because they sometimes contain code to defraud users rather than viruses that destroy or disrupt computer resources.)

The Internet is a perfect environment for computer viruses because so many people use it for email, conducting research, and downloading files or software. For example, a virus might be stored in a java **applet** (i.e., a small program that is stored in a web page and designed to run by web browser software). Friendly applets animate web pages, allow users to play games, or perform processing tasks. But unfriendly applets contain viruses that can infect other computers and cause damage.

Once a programmer stores a computer virus program on the file server of a computer network, the program can affect thousands of other computers or disks before it is detected and eradicated. Estimating the business costs of recovering from a virus infection is difficult. The costs can be small—for example, limited to the inconveniences of reformatting a hard disk and reloading a few software programs. On the other hand, some experts estimate such costs in the billions of dollars annually.

There are a number of ways to thwart computer viruses. These include, but are not limited to: (1) **firewalls**, which limit external access to company computers, (2) anti-virus software, and (3) anti-virus control procedures. **Anti-virus software** are computer programs that scan computer inputs for virus-like coding, identify active viruses that are already lodged in computer systems, clean computer systems already infected, or perform some combination of these activities. Recent versions of Microsoft's Windows operating system incorporate software of this type. Generally speaking, however, anti-virus programs provide less than complete protection because misguided individuals continuously write new, more powerful viruses that can avoid current detection schemes. Even worse, some older anti-virus programs have themselves contained virus routines.

Perhaps one of the most vulnerable areas for many firms and universities is email. Consider the number of emails you send and receive every day, and then multiply that by the number of people at your university—the risk of passing a virus around is very high. Unfortunately, viruses can hide in emails from friends and colleagues because their computer systems have been infected. To help mitigate this problem, your university most likely uses an anti-spam software solution in addition to anti-virus software.

For many microcomputer users, anti-virus control procedures are often better safeguards. These include: (1) buying shrink-wrapped software from reputable sources, (2) avoiding illegal software copying, (3) not downloading suspicious Internet files, (4) deleting email messages from unknown sources before opening them, and (5) maintaining complete backup files in the event you must rebuild your system from scratch. Additional safeguards include loading operating systems only from your own disks, being wary of public-domain software available on Internet bulletin boards, and being suspicious of unusual activity on your computer system—for example, spontaneous disk writing that you did not initiate.

In organizational settings, effective control procedures against computer viruses include educating users about viruses and encouraging computer users to follow the virus prevention and detection techniques just discussed. Additional control procedures include (1) adopting policies that discourage the free exchange of computer disks or externally acquired computer programs, (2) requiring strong passwords that limit unauthorized access to computing resources, and (3) using anti-virus filters on local and wide-area networks.

MITIGATING COMPUTER CRIME AND FRAUD

What can organizations do to protect themselves against computer abuse? Experts note that, for all their intricacy and mystique, we can protect computer systems from crimes, abuses, and fraud just as well as we can manual systems, and sometimes better. For example, computers can be programmed to automatically search for anomalies and to print exception conditions on control reports. These computerized monitoring systems are often superior to manual surveillance methods because they are automatic and can screen 100%, instead of merely a sample, of the target population data. An illustration is the New York Stock Exchange, which now uses an **Integrated Computer-Assisted Surveillance System (ICASS)** to search for insider trading activities. This section of the chapter discusses several methods for thwarting computer crimes, abuses, and fraud.

Enlist Top-Management Support

Most experts agree that computer security begins with top management and security policies. Without such policies, for example, organizations can only expect limited employee (1) compliance with security procedures, (2) sensitivity to potential problems, or (3) awareness of why computer abuse is important. Unfortunately, many top managers are not fully aware of the dangers of computer crime, abuse, and fraud, and therefore are not sufficiently concerned about this type of offense. Computer safeguards are only effective if management takes computer crime seriously and chooses to financially support and enforce control procedures to stop, or at least minimize, computer crimes. The complaint of many mid-level security managers is that they must justify their funding requests for investments in appropriate levels of computer security for a firm. Thus, the importance management places on computer safeguards might be measured by the level of funding allocated to IT security.

Increase Employee Awareness and Education

Ultimately, controlling computer crime means controlling people. But which people? The idea that computer crimes are ‘‘outside jobs’’ is a myth. With the exception of hackers, most computer abusers are the employees of the same companies at which the crimes take place. Many retail firms have clear prosecution policies regarding shoplifting. In contrast, prosecution policies associated with other types of employee fraud are notable for their absence in most organizations. Yet, the evidence suggests that prosecuting computer crimes may be one of the most effective restraints on computer crime.

In fairness, employees cannot be expected to automatically understand the problems or ramifications of computer crime. Thus, another dimension of preventing computer crime is employee education. Informing employees of the significance of computer crime and abuse, the amount it costs, and the work disruption it creates helps employees understand why computer offenses are serious matters. Studies suggest that informal discussions, periodic departmental memos, and formal guidelines are among the most popular educational tools for informing employees about computer crime and abuse. Requiring new hires to sign security statements indicating that they have received, read, and understand policy statements can also help.

According to the 2005 – 2006 KPMG Integrity Survey,[11] companies with comprehensive ethics and compliance programs have more favorable results across the board than companies without such programs. For example, organizations with these programs reported fewer observations of misconduct and higher levels of employee confidence in management's integrity. These programs were also cited as mitigating a number of conditions that might foster misconduct, such as: (1) pressure to do whatever it takes to meet targets, (2) belief that policies and procedures are easy to bypass or override, and (3) belief that rewards are based on results, regardless of the method used.

One final idea regarding employee conduct comes from the 2008 Association of Certified Fraud Examiners *Report to the Nation*. This survey revealed that almost half of all the fraud discussed in the report was first discovered by tips from fellow employees, customers, or vendors. Providing formal channels through which individuals can inform management of suspect activity—for example, through company websites—as well as rewarding those who provide such information, seem to be two of the most effective things that organizations can do to curb occupational fraud and embezzlement.

Assess Security Measures and Protect Passwords

Common sense dictates that organizations should regularly survey their computer security measures and assess potential areas of vulnerability. Nearly all organizations use firewalls, anti-virus software, and access controls, but many are not as conscientious about performing periodic security reviews. An important security process that organizations should consider is evaluating employee practices and educating users to protect their own computers. Figure 10-5 provides a list of ten recommended steps for safeguarding personal computers.

Protecting passwords is an important dimension of computer security because they are the ''keys to the kingdom'' (of valuable corporate data). Hackers use a variety of tactics to steal such passwords, including (1) posing as a legitimate user and ''borrowing'' them from unsuspecting employees, (2) creating phishing websites that pose as surveys that ask users to input their passwords for security purposes, or (3) using simulation programs that try all the words in a standard dictionary as potential passwords. To thwart these strategies, users should (1) be trained to not ''loan'' their passwords to others or tape them to their monitors, (2) understand that most businesses will not ask for their passwords on a web screen, and (3) use **strong passwords**—i.e., passwords that are difficult to guess. Examples are long passwords (e.g., 20 characters), nonsense words (e.g., non-English words not found in dictionaries) or words with embedded capitals or random numbers. Another control is to require employees to change their passwords periodically. A third control is to install password-checking software in file servers that test passwords for such requirements.

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[11] KPMG Forensic Integrity Survey 2005 – 2006, http://www.us.kpmg.com/news/index.asp?cid = 2051.

1. **Keep your firewall turned on**. Firewalls help protect your computer from hackers who might try to gain access to it, delete information, or steal passwords or other sensitive information.
2. **Install or update your anti-virus software**. Anti-virus software helps protect your computer from such malicious code as viruses or worms, and can be set to update automatically.
3. **Install or update your anti-spyware technology**. Spyware is just that—software that is secretly installed on your computer and that allows others to observe your activities on it. Inexpensive anti-spyware software is readily available for download on the Internet or at local computer stores.
4. **Keep your operating system up to date**. Software developers regularly update their operating systems to stay current with technology requirements and fix security holes.
5. **Do not provide personal information online**. Hackers create phishing websites to lure visitors into providing their personal information and therefore steal their identity. Most companies will not ask you to provide your login name, password, account number, or similar personal information online.
6. **Be careful what you download**. Downloading email attachments can thwart even the most vigilant anti-virus software. Never open an email attachment from someone you don't know, and be wary of forwarded attachments from anyone.
7. **Turn off your computer at night**. Although it's nice to always have your computer ready for action, the downside of ''always on'' is that it makes it more susceptible to hacker attacks. The safest computer is one that isn't on.
8. **Create backups often**. Computers are not infallible, and all hard disk drives eventually fail. Creating duplicate copies of your important files and storing them offsite enables you to easily recover from such problems. The authors recommend the automated backup services of a cloud service provider, as discussed in Chapter 2.
9. **Use surge protectors**. Power surges can ''fry'' your computer, but even the least-expensive surge protector can guard against most such events.
10. **Protect passwords**. Many websites and computer systems now require logon names and passwords, but writing them on sticky notes stuck to your computer's monitor or keyboard is not a good idea. Try to find safer places to store the ones you can't commit to memory.

FIGURE 10-5 Ten simple steps to safer personal computers.

Hackers often use a tactic called **social engineering** to gain access to passwords (i.e., posing as bona fide employees and convincing network administrators to give them passwords over the phone). In general, the practice of giving passwords to unknown employees over the telephone compromises standard security procedures, and therefore should not be allowed.

Two additional password safeguards are lock-out systems and dialback systems. **Lock-out systems** disconnect telephone users after a set number of unsuccessful login attempts, thereby thwarting microcomputer users from using dictionary programs. Similarly, **dialback systems** first disconnect all login users but reconnect legitimate users after checking their passwords against lists of bona fide user codes. Dialback systems may be even more effective than lock-out systems because only authorized users at already-recognized stations are reconnected. Dialback security is also a useful strategy against social engineering, because hackers are unwilling to reveal their identities when making bogus requests for passwords.

Implement Controls

Most computer crime and abuse succeeds because of the absence of controls rather than the failure of controls. There are many reasons why businesses do not implement control procedures to deter computer crime. One is the all-too-common belief of those managers who have not suffered a computer crime that they have nothing to fear. Further, charities and not-for-profit organizations often believe that their missions somehow insulate them from such crimes. Then, too, those businesses that do not have a specific computer security officer have no one to articulate this concern or to argue for specific control procedures. Finally, at least some businesses do not feel that security measures are cost-effective—until they incur a problem!

Case-in-Point 10.6 To execute a disbursement fraud, one man used a desktop publishing package to prepare fictitious bills for office supplies that he then mailed to companies across the country. He kept the dollar amount on each bill less than $300, and found that an amazingly large percentage of the companies paid the bills without question—probably because many organizations automatically pay vendor invoices for small amounts.

The solution to the computer-security problems of most organizations is straightforward: design and implement controls. This means that organizations should install control procedures to deter computer crime, managers should enforce them, and both internal and external auditors should test them. Experts also suggest that employee awareness of computer controls and the certainty of prosecution may also act as deterrents to computer crime. Certainly, the enactment of the Sarbanes-Oxley Act of 2002 has placed a much greater emphasis on strong internal controls, including criminal offenses for senior executives who knowingly disregard such precautions. We talk more about internal controls in Chapters 11 and 12, and cover the Sarbanes-Oxley Act in more depth in Chapter 14.

In the United States, a disproportionate amount of security break-ins occur during the end-of-the-year holiday season. Reasons for this include: (1) extended employee vacations and therefore fewer people to ''mind the store,'' (2) students are out of school and consequently have more free time on their hands, and (3) counterculture hackers get lonely at year-end and increase their attacks on computer systems. Thus, it is especially important to make sure that effective control procedures are in place during the holidays.

Identify Computer Criminals

To prevent specific types of crimes, criminologists often look for common character traits that can be used to screen potential culprits. What are the characteristics of individuals who commit computer crimes or abuse, and what can be done to create a composite profile that organizations can use to evaluate job applicants?

Non-Technical Backgrounds. A company's own employees—not external hackers—perpetrate most computer crime and abuse. How technically competent are such employees? Figure 10-6 identifies the job occupations of computer criminals and abusers from a survey performed by Hoffer and Straub. Although this figure suggests that some computer offenses are committed by those with strong technical backgrounds, this study found that almost as many computer offenses are perpetrated by clerical personnel, data-entry clerks, and similar individuals with limited technical skills. A similar study by the U.S. Sentencing Commission (USSC) found that most of the 174 computer criminals convicted under the Computer Crime and Abuse Act of 1986 were corporate insiders with only ''pedestrian levels'' of computer expertise. There is good reason for this. It is usually easier and safer to alter data before they enter a computer than midway through automated processing cycles. Then too, input data can often be changed anonymously, whereas most computerized data cannot. These facts explain why many computer criminals are not even computer literate, and also why computer security must extend beyond IT personnel.

Programmers and systems analysts	27%
Clerical, data entry, and machine operators	23%
Managers and top executives	15%
Other system users	14%
Students	12%
Consultants	3%
Other information processing staff	3%
All others	3%
Total	100%

FIGURE 10-6 Occupations of computer-abuse offenders.

Non-Criminal Backgrounds. The USSC study also found that most of the convicted computer criminals had no prior criminal backgrounds. In addition, most computer criminals tend to view themselves as relatively honest. They argue, for example, that ''beating the system'' is not the same as stealing from another person or that they are merely using a computer to take what other employees take from the supply cabinet. Furthermore, many perpetrators think of themselves as long-term borrowers rather than thieves, and several have exercised great care to avoid harming individuals when committing their computer offenses.

Education, Gender, and Age. Although most media reports suggest that computer offenders are uniformly bright, motivated, talented, and college-educated individuals, the average computer criminal often does not fit this profile. In the ACFE 2008 Report to the Nation, for example, over half of the perpetrators did not have a college degree. But, according to the report, highly-educated fraudsters were able to steal more—see Figure 10-7. Because we believe that most computer crime and abuse are not detected—or prosecuted when it is detected—we do not know how representative these observations are for the ''general population'' of computer offenders.

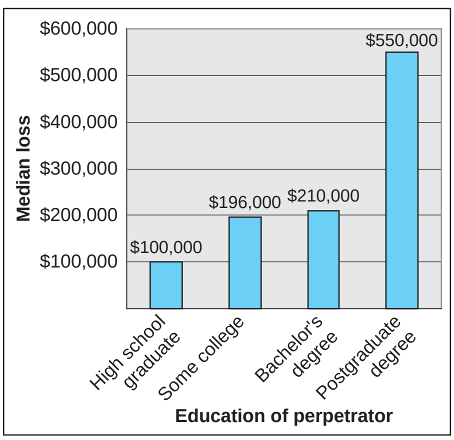

FIGURE 10-7 Median fraud losses, classified by the education level of the perpetrator. Source: *2008 ACFE Report to the Nation*.

Don't Forget Physical Security

An old adage in the computer security industry is that ''a good hammer beats a strong password every time.'' What this means is that physical safeguards can be even more important than logical ones in deterring computer crime and abuse. Examples of physical security include protecting LAN servers and administrative work stations, enforcing ''clean-desk policies'' for employees, and protecting employee laptops against theft (see again Figure 10-4).

Case-in-Point 10.7 The administrators at one university believed that their desktop computers were safe as long as employees locked their individual office doors at night. But the university usually kept the buildings unlocked. The folly of this thinking became clear one morning when officials discovered that thieves had simply brought a ladder that allowed them to climb through the false ceiling of a building to steal over 30 PCs from one of the computer labs on campus.[12]

Organizations must also be able to recover from computer security breaches or losses when they do occur. One safeguard is to implement backup procedures, which we cover in more detail in the next chapter. Another safeguard is to develop and test a disaster recovery plan that enables a business to replace its critical computer systems in a timely fashion, which we discuss more comprehensively in Chapter 12. As suggested by the Case-in-Point above, monitoring cameras, motion detectors, and ''insurance'' are also important security measures.

Finally, organizations should be careful about how they dispose of outdated computers. Although state and federal environmental laws affect such disposals, our primary concern is the sensitive data stored on the hard drives of these PCs. Reformatting these drives is usually not enough—the data may still be retrieved with software tools available on the web. A better approach is either to use specialized file deletion software programs or to physically destroy the disk drives themselves.

Case-in-Point 10.8 In 2003, two MIT graduate students reported in an industry journal that, after purchasing 129 used hard drives, they found more than a third of them still contained "significant personal information," such as credit card numbers and a year's worth of transactions and account numbers from an ATM.[13]

Recognize the Symptoms of Employee Fraud

The clues that signal some computer offenses can be subtle and ambiguous, but many are rather obvious. For example, the study conducted by KPMG concluded that nearly half the employee fraud would have been detected more quickly if obvious telltale symptoms had not been ignored. Although recognizing the symptoms of computer offenses will not prevent computer crime, knowing the telltale signs may help individuals detect and report it, which will help minimize the potential damage to the victim organization. Consider, for example, Case-in-Point 10.9.

Case-in-Point 10.9 The Elgin Corporation was a manufacturing company that had created its own health care plan for its employees. The plan was self-insured for medical claims under

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[12]Source: From the authors.
[13]Source: http://www.whitecanyon.com/used-hard-drives-pc-05-2003.php.

$50,000, which it handled internally, but plan administrators forwarded claims for larger amounts to an independent insurance company. The managers of Elgin Corporation believed that the company had excellent control procedures for its system, which included both internal and external audits. Yet, over a period of four years, the manager of the medical claims department was able to embezzle more than $12 million from the company.

Although the ''Elgin'' name is fictitious, the events described above are not. How can such events be avoided? Here are five typical symptoms of computer fraud that actually occurred at the Elgin Corporation.

Accounting Irregularities. To embezzle funds successfully, employees commonly alter, forge, or destroy input documents, or perform suspicious accounting adjustments. An unusually high number of such irregularities are cause for concern. At the Elgin Corporation, no one noticed that payments to 22 of the physicians submitting claims to the company were sent to the same two addresses.

Internal Control Weaknesses. Control procedures are often absent, weak, or ignored in computer fraud. At the Elgin Corporation, the medical claims manager had not taken a vacation for years, those employees submitting claims were never sent confirmation notices of the medical payments made in their behalf, and the physicians receiving these payments were never first investigated or approved.

Unreasonable Anomalies. Perhaps the most important clue to computer fraud is the presence of many odd or unusual anomalies that somehow go unchallenged. Examined critically, such anomalies are unreasonable and require observers to suspend common sense. At the Elgin Corporation, for example, why were 100% of the medical payments to those 22 physicians all paid from the self-insured portion of the company program? Why were checks to those 22 physicians always endorsed by hand and deposited in the same two checking accounts? And why did some of the medical claims include hysterectomies for male employees?

Lifestyle Changes. Employees who miraculously solve pressing financial problems or suddenly begin living extravagant lifestyles are sometimes merely broadcasting fraud. At the Elgin Corporation, why did the medical claims manager announce that she had inherited a lot of money but never took a vacation? And why did she treat her employees to lunches in chauffeured limousines?

Behavioral Changes. Employees who experience guilt or remorse from their crimes, or who fear discovery, often express these feelings in unusual behavior. At the Elgin Corporation, employees joked that the medical claims manager had recently developed a ''Jekyll and Hyde personality,'' including intense mood swings that were unusual even for her.

Employ Forensic Accountants

When an organization suspects an ongoing computer crime or fraud, it can hire **forensic accountants** to investigate its problems, document findings, and make recommendations. Many such individuals are professional accountants who have passed the two-day certified fraud examiner (CFE) examination administered by the ACFE.

Forensic accountants have the required technical and legal experience to research a given concern, follow leads, establish audit trails of questionable transactions, document their findings, organize evidence for external review and law enforcement bodies, and (if necessary) testify in court. Most use specialized software tools to help them perform their tasks—for example, **Audit Command Language (ACL)** for auditing tasks, and **EnCase** for file copying, custody documentation, and other forensic activities. Forensic accounting is one of the fastest-growing areas of accounting, and there are now more than 27,000 CFEs working in organizations such as the FBI, CIA, law firms, and CPA firms.

ETHICAL ISSUES, PRIVACY, AND IDENTITY THEFT

Computerized AISs often raise ethical issues that we did not have to face under manual AISs. An example is the practice of unauthorized software copying. Thus, thwarting computer crime, abuse, or fraud is sometimes more dependent on ethical behavior than observing legal restrictions. Ethics is a set of moral principles or values. Therefore, ethical behavior involves making choices and judgments that are morally acceptable and then acting accordingly. Ethics can govern organizations as well as individuals. In the context of an organization, an underlying ethical principle is that each individual in the organization has responsibility for the welfare of others within the organization, as well as for the organization itself. For example, the managers of a company should make decisions that are fair to the employees as well as beneficial to the organization.

Ethical Issues and Professional Associations

Ethical concerns are often a part of of computer abuse. In cases involving hacking, for example, ''ignorance of proper conduct'' or ''misguided playfulness'' may be the problem. To some, the challenge of defrauding a computer system and avoiding detection is irresistible because success brings recognition, notoriety, and even heroism. In these cases, ethical issues are overlooked and the costs of recovering from the abuse are ignored. The acceptability of these motives comes down to issues of morality. But ''morality'' in corporate cultures is typically a relative value. In one case, for example, a man named Fred Darm stole a computer program from a rival firm through his computer terminal. At his trial, the defense argued that it was common practice for programmers of rival firms to ''snoop'' in each other's data files to obtain competitive information. Thus, when he was apprehended for his offense, Darm was not only surprised, he was quite offended!

Such professional associations as the Institute of Management Accountants (IMA), the American Institute of Certified Public Accountants (AICPA), the Institute of Internal Auditors (IIA), the Information Systems Audit and Control Association (ISACA), the Association of Informaton Technology Professionals (AITP), and the Association for Computer Machinery (ACM) have developed codes of ethics or codes of professional conduct. These codes are self-imposed and self-enforced rules of conduct. One of the most important goals of a code of ethics or conduct is to aid professionals in selecting among alternatives that are not clear-cut. Included within professional association codes are rules pertaining to independence, technical competence, and proper practices during audits and consulting engagements involving information systems. The certification programs of these associations increase awareness of the codes of ethics and are essential in developing professionalism. Figure 10-8 provides a few examples of ethical issues in computer usage.

Ethical Issue	Example in Computer Usage
Honesty	Organizations expect employees to perform their own work, to refrain from accessing unauthorized information, and to provide authentic results of program outputs.
Protecting Computer Systems	Examples include tying up network access ports with multiple logins, sending voluminous (but useless) emails and computer files to others, complaining to system administrators about fictitious hardware or software failures, introducing computer viruses into networks, or giving unauthorized users access to private computer systems.
Protecting Confidential Information	Allowing unauthorized individuals to view private information—for example, financial data on a mortgage loan application or the results of diagnostic medical tests stored in the files of local area networks.
Social Responsibility	Sometimes, social responsibility conflicts with other organizational goals. For example, suppose a programmer discovers a possible error in a software program that controls a missile guidance system. His boss tells him to ignore it—the design team is already over budget and this is only a possible error.
Acceptable Use	The availability of computer hardware and software in workplaces does not automatically convey unrestricted uses of them. At universities, for example, ethical conduct forbids downloading microcomputer software for personal applications or using free mainframe time for personal gain.
Rights of Privacy	Do organizations have the right to read the personal email of their employees? Do employees have the right to use their business email accounts for personal correspondence? In 2002, the state of Montana decided that monitoring computer activity on state-owned computers at state universities is legal. Officials at colleges and universities in Montana are hoping to decrease the incidence of illegal activity by individuals who are using campus property.

FIGURE 10-8 Examples of ethical issues in computer usage.

In recent years, professional accounting associations at both the national and state level have established ethics committees to assist practitioners in the self-regulation process. These ethics committees provide their members with continuing education courses, advice on ethical issues, investigations of possible ethics violations, and instructional booklets covering a variety of ethics case studies. Some of the ethics committees provide their members with a ''hot line'' to advise them on the ethical and moral dilemmas experienced in the workplace. These committees also encourage the instruction of ethics in accounting curricula at colleges and universities.

Meeting the Ethical Challenges

Because a significant amount of business activity and data communications now takes place on the Internet, it is not surprising that an increasing amount of computer crime and abuse also happens within the Internet's environment. Examples include thieves supplying fake credit card numbers to buy everything from investment securities to Internet access time itself, copying web pages without permission, denying legitimate users Internet access, and posing as someone else for any number of illegal or dishonest purposes.

How we respond to the ethical issues above is determined not so much by laws or organizational rules as by our own sense of ''right'' and ''wrong.'' Ethical standards of behavior are a function of many things, including social expectations, culture, societal norms, and even the times in which we live. More than anything else, however, ethical behavior requires personal discipline and a commitment to ''do the right thing.''

How can organizations encourage ethical behavior? Some argue that morals are only learned at an early age and in the home—they cannot be taught to adults. However, others suggest that it helps to (1) inform employees that ethics are important, (2) formally expose employees to relevant cases that teach them how to act responsibly in specific situations, (3) teach by example, that is, by managers acting responsibly, and (4) use job promotions and other benefits to reward those employees who act responsibly.

Case-in-Point 10.10 The ethical principles that apply to everyday community life also apply to computing. At the University of Northern Colorado, every member has two basic rights: privacy and a fair share of resources. It is unethical for any other person to violate these rights. This code of ethics lays down general guidelines for the use of computing and information resources. Failure to observe the code may lead to disciplinary action.

Privacy

Although Americans are concerned about various privacy issues, the events of September 11, 2001, changed our focus in some respects. For example, we are willing to accept less privacy at airports, and to submit to increased security measures at various points in airport terminals. On a day-to-day basis, we freely give our name, address, phone number and similar information to receive **value cards** at a variety of retail establishments. In return, we receive discounts, points that may be exchanged for goods or services, or advance information about upcoming sales. But these credit-card-size or key-ring-size cards have a barcode on the back side that also enables merchants to track our purchases.

Privacy also affects our use of the Internet. For example, when we order a book from Amazon.com and the next time we visit that site, we're greeted by name and told about other books we might enjoy. A remarkable marketing tool, but how do they know? They know because most commercial websites deposit a **cookie** on your computer, which is a small text file that stores information about your browsing habits and interests, as well as other information that you may supply by logging onto the site. Of course, cookies are not necessarily bad. If you frequently purchase items from a particular online vendor, it is very convenient to have your credit card and shipping information automatically recalled so that you are not required to enter this information for every purchase.

Some individuals even claim that computers and privacy are mutually exclusive—and that you can't have both. The defining issue is probably whether the invasion of our privacy is with or without our permission. That is, did we agree or authorize the information to be collected? Few object to (for example) Amazon.com tracking their browsing habits on its website, but if we ordered a book or other item from that website, we would most certainly object to unauthorized uses of our credit card information.

Company Policies with Respect to Privacy

Because of the widespread use of computers in business, coupled with the fact that many employees travel and use laptops, employers should develop and distribute a company-wide policy with respect to privacy. The Fair Employment Practices Guidelines suggest that these policies cover such issues as (1) who owns the computer and the data stored on it, and (2) what purposes the computer may be used (e.g., primarily for business purposes), and (3) what uses are unauthorized or prohibited. Further, employers should specifically identify the types of acceptable and unacceptable uses with some examples. Another idea is to have a screen pop-up each time an employee signs on that reminds the employee of the company policy.

Case-in-Point 10.11 In Oklahoma, police obtained a search warrant to look for downloaded pornography on a professor's computer at Oklahoma State University. As a result, the professor was arrested, prosecuted, and given a 51-month sentence. Although the professor appealed, the court affirmed the sentence based on the University's policy barring employees from using university computers to access obscene materials and stating that such misuse could result in discipline or legal action. In addition, the University used a screen pop-up with a warning that using the system to break the law or university policies was prohibited.[14]

Most commercial websites have a **privacy policy**, although they are sometimes difficult to find. For example, at Amazon.com you need to click on the ''Privacy Notice'' link at the very bottom of its home page. There, you will find a comprehensive list of information that is covered by its privacy policy—including information you provide, cookies it uses, email communications, and information Amazon.com receives about you from other sources. Another online merchant, Lands' End, provides an easy-to-find link to the privacy policy on its home page. Its privacy policy identifies the information it does and does not collect, and offers advice about managing cookies.

An important point to remember is that companies typically are very careful about protecting your personal information. They understand that the future viability of the organization might depend on security of both your information as well as their proprietary data.

Identity Theft

Identity theft refers to an act in which someone wrongfully obtains and uses another person's personal data for fraud or deception. Unlike your fingerprints, which are unique to you and cannot be used by someone else, your personal data can certainly be used by another individual if they have a mind to use it. Your personal data may be any one or a combination of the following pieces of information: your Social Security number, your bank account, your debit card number, your credit card number, your birth date, or your mailing address. It was not until 1998 that Congress passed legislation making identity theft a crime.

Thieves steal identities in a number of ways including **dumpster diving** (stealing personal information from garbage cans), taking delivered or outgoing mail from house mail boxes, or telephone solicitations that ask for personal information. **Phishing** scams use an email or website that claims to be legitimate but that ask you to provide or ''update'' your personal information such as account number, credit card number, or password. **Smishing** is a similar scam using text messages on cell phones.

In the United States and Canada, many people have reported that unauthorized persons have taken funds out of their bank or financial accounts. Even worse, some unscrupulous individuals have gone so far as to take over an individual's identity, incurring huge debts and committing all sorts of crimes. Victims can incur enormous costs attempting to restore their reputation in a community or correcting erroneous information. It is still the case that many individuals do not realize how easily criminals can obtain their personal data. Figure 10-9 identifies a number of ways you can become a victim of identity theft if you are not careful.

[14]Source: A Legal Posting in *Workforce*, June 2002, p. 102.

Method	Examples
Shoulder surfing	• Watching you from a nearby location as you punch in your debit or credit card number • Listening to your conversation if you give your debit or credit card number over the telephone to a hotel or rental car company
Dumpster diving	• Going through your garbage can or a communal dumpster or trash bin to obtain copies of your checks, credit card or bank statements, or other records that typically have your name, address, and telephone number
Applications for ''preapproved'' credit cards	• If you discard them without tearing up the enclosed materials, criminals may retrieve them and try to activate the cards • If your mail is delivered to a place where others have access to it, criminals may simply intercept and redirect your mail to another location
Key logging software	• Loading this type of software on computers in general use areas, such as university computer labs or public libraries to obtain your personal data and other identifying data, such as passwords or banking information
Spam and other emails	• Many people respond to unsolicited email that promises some benefit but requests identifying data, which criminals use to apply for loans, credit cards, fraudulent withdrawals from bank accounts, or other goods

FIGURE 10-9 Examples of methods used by criminals to obtain your personal data.

The news media continues to report instances of compromised personal data. Some of these describe breaches in the computer system of an organization. Other reports suggest that a stolen laptop might have the personal data of hundreds or thousands of individuals. For example, in the summer of 2006, two universities reported incidents in which outsiders may have gained access to personal information, including Social Security numbers, on nearly a quarter-million students.

Case-in-Point 10.12 In June 2006, Western Illinois University announced that a hacker may have copied the Social Security or credit card numbers of 200,000 to 240,000 current or former students. The credit cards had been used to purchase textbooks online or for stays in a university hotel. The University immediately notified the individuals and advised them to monitor their credit records for any attempts at identity theft.

AIS AT WORK
Fighting Computer Crime at the Bank[15]

When the judge asked Willie Sutton—a habitual bank robber—more than one hundred years ago why he stole from banks, his answer became famous: ''because that's where the money is.'' In some ways, little has changed. Banking frauds in the U.S. total an estimated $39 billion in 2006—and are growing. Credit card fraud touches one out of every 20 credit-card users.

[15]Source: Tommie Singleton, Aaron Singleton, & Geoff Gottlieb, ''Cyber Threats Facing the Banking Industry'' *Accounting and Finance* Vol. 19, No. 2 (February 2006), pp. 26–32.

Having read this chapter, you are already familiar with the major types of computer crimes perpetrated against banks—phishing, identity theft, worms and Trojan horses, spyware, and denial-of-service attacks. Banks can fight computer crime by first performing risk assessments that analyze potential risks and then implementing policies and procedures to mitigate or prevent potential losses. One important control is the development *and test* of a disaster recovery plan, especially a test of a general computer system failure. Another is to develop an incident response plan that includes identifying who should do what in the event of a breach of computer security.

Phishing is an especially important problem for banks because hackers often create bogus websites that trick bank customers into revealing their account numbers and passwords. Raising customer awareness to this problem—for example, in brochures that accompany monthly bank statements—is one possibility. Providing similar information on bank home pages, along with examples of spoofed emails, links to the FTC website on identify theft, and consumer alerts about new threats are more ways to counter this problem.

Because ‘‘people’’ are often the weakest link in computer security, banks should pay special attention to employee safeguards. One important practice is ‘‘employee education,’’ which includes periodic training and monthly reminders to employees about specific computer security issues—especially guarding against social engineering attacks. Another safeguard is stringent employee hiring practices, including drug and credit checks and requiring employees to acknowledge and follow current security policies. Memos that encourage employees to follow the simple security steps listed in Figure 10-5 to protect individual computers from harm can also help. Finally, of all factors to successfully fight computer crime, none is more important than identifying a security officer to champion and proactively manage all the activities discussed here.

SUMMARY

- We know very little about computer crime because few cases are reported and we believe many more cases go undetected.
- Computer crime is growing and is likely to be expensive for those organizations that suffer from it.
- This chapter discussed cases of real-world computer crime. The subjects of these cases included compromising valuable information, wire fraud and computer hacking, and computer viruses.
- Organizations can use the following methods to protect themselves against computer offenses: (1) solicit top management support, (2) educate users about computer crime and abuse, (3) conduct a security inventory and protect passwords, (4) design and implement control procedures, and (5) recognize the symptoms of computer crime and abuse.
- Organizations can help themselves by knowing which employees are most likely to become computer offenders and by employing forensic accountants to investigate suspected problems.
- Managers can implement a program that focuses on ethical behavior. Examples of ethical behavior include protecting confidential information, being socially responsible, respecting rights of privacy, avoiding conflicts of interest, and understanding unacceptable uses of computer hardware and software.
- Organizations can encourage ethical behavior by educating employees about it, rewarding it, and encouraging employees to join professional associations with ethical codes of conduct.
- Identity theft is a growing problem. Both individuals and organizations must adopt reasonable precautions to protect personal data.

KEY TERMS YOU SHOULD KNOW

anti-virus software applet
Association of Certified Fraud Examiners (ACFE)
Audit Command Language (ACL)
boot-sector virus
computer abuse
computer crime
Computer Fraud and Abuse Act of 1986
Computer Security Institute (CSI)
computer virus
cookie
data diddling
distributed denial of service (DDoS) attack
dialback systems
disposal of outdated computers
dumpster diving
firewall
forensic accounting
hacker
Integrated Computer-Assisted Surveillance System (ICASS)
lock-out systems
logic bomb program
Encase
Patriot Act of 2001
Phishing
privacy policy
salami technique
social engineering
smishing
strong passwords
Trojan horse programs
value cards
voice over Internet protocol (VoIP)
worm program

TEST YOURSELF

Q10-1. A computer program that remains dormant until some specified circumstance or date triggers the program to action is called a ______.

a. Trojan horse

b. Logic bomb

c. Data diddling

d. Cookie

Q10-2. Which of the following is NOT an example of computer fraud?

a. Entering invoices in the AIS for services that were not provided, and depositing the check in a private bank account

b. Sending an email to everyone in your address book asking for a $1 donation

c. Programming a change to decrease the dividend payment to stockholders of a firm and issuing a check to your friend for the total change

d. Using a university computer to set up a realistic looking virtual ''store front'' to sell toys, although you don't have any merchandise to sell.

Q10-3. Which of the following pieces of computer legislation is probably the most important?

a. Cyber Security Enhancement Act of 2002

b. Computer Security Act of 1987

c. The Computer Fraud and Abuse Act of 1986

d. Federal Privacy Act of 1974

Q10-4. A computer program that is used to steal small amounts of money from many accounts over a period of time is called a ______.

a. Salami technique

b. Logic bomb

c. Data diddling

d. Cookie

Q10-5. What is it called when someone intentionally changes data before, during, or after they are entered into the computer (with the intent to illegally obtain information or assets)?

a. Trojan horse

b. Logic bomb

c. Data diddling

d. A cookie

Q10-6. Which legislation might help discourage computer hacking?

a. Federal Privacy Act of 1974

b. Computer Fraud and Abuse Act of 1986

c. USA Patriot Act of 2001

d. CAN-SPAM Act of 2003

Q10-7. The TRW Case is notable because:

a. The amount of dollars involved was not significant

b. No one got caught

c. The fraud was detected by a surprise audit

d. The real victims were TRW customers

Q10-8. Which of these is not an acronym?

a. ACFE

b. Byte

c. Worm

d. DOS

e. VoIP

Q10-9. Which of these is not helpful in attempting to thwart computer crime and abuse?

a. Enlist the support of top management

b. Keep employees in the dark so that they cannot perpetrate them

c. Use strong passwords

d. Design and test disaster recovery programs

Q10-10. A local area network administrator receives a call from an employee, requesting his password. The administrator asks for his name and phone number and tells him that he will call back. This is an example of a:

a. DOS system

b. Bad computer security

c. A worm system

d. Dialback system

e. Bad security policy

Q10-11. Most computer criminals:

a. Have non-technical backgrounds

b. Have non-criminal backgrounds

c. Have little college education

d. Are young and bright

e. Have probably not been caught, so we don't really know much about them

Q10-12. Which of these is the common name for a computer file that is written onto your personal computer by a website?

a. Applet
b. web file
c. Cookie
d. Worm

Q10-13. Which of these is a software tool often used by forensic accountants?

a. MS-DOS
b. ACFE
c. Computer Spy
d. Logic bomb
e. Encase

Q10-14. Smishing is a form of:

a. Dialback system
b. Local area network.
c. Computer worm
d. Identity theft

DISCUSSION QUESTIONS

10-1. The cases of computer crime that we know about have been described as just ''the tip of the iceberg.'' Do you consider this description accurate? Why or why not?

10-2. Most computer crime is not reported. Give as many reasons as you can why much of this crime is purposely downplayed. Do you consider these reasons valid?

10-3. Why have most computer experts suggested that computer crime is growing despite the fact that so little is known about it?

10-4. Does a company have the right to collect, store, and disseminate information about your purchasing activities without your permission?

10-5. What enabled the employees at TRW to get away with their crime? What controls might have prevented the crime from occurring?

10-6. What is hacking? What can be done to prevent hacking?

10-7. What is a computer virus?

10-8. How can educating employees help stop computer crime?

10-9. What computer crimes are committed on the Internet? What assets are involved? What can be done to safeguard these assets?

10-10. How would you define ''ethics?'' What types of ethical issues are involved in computerized accounting information systems? How can organizations encourage their employees to act ethically?

10-11. The Rivera Regional Bank uses a computerized data processing system to maintain both its checking accounts and its savings accounts. During the last three years, several customers have complained that their balances have been in error. Randy Allen, the information systems bank manager, has always treated these customers very courteously and has personally seen to it that the problems have been rectified quickly, sometimes by putting in extra hours after normal quitting time to make the necessary changes. This extra effort has been so helpful to the bank that this year, the bank's top management is planning to give Mr. Allen the Employee-of-the-Year Award. Mr. Allen has never taken a vacation. Comment.

PROBLEMS

10-12. Comment on each of the following scenarios in light of chapter materials. Hint: use the references at the end of this chapter to help you.

a. A legitimate student calls the computer help desk from her cell phone because she has forgotten her password to the university system. The ''tech'' on duty refuses to give it to her as a matter of university policy. The student is unable to complete her assignment and proceeds to file a formal complaint against the university.

b. An employee at a building supply company is caught downloading pornographic materials to his office computer. He is reprimanded by his boss, asked to remove the offending materials, and told never do it again. The employee refuses on the grounds that (1) there is no company policy forbidding these activities, (2) he performed all his downloads during his lunch breaks, (3) his work reviews indicate that he is performing ''above average,'' and (4) the discoveries themselves were performed without a search warrant and therefore violate his right to privacy.

c. The local community college installed a new, campus-wide local area network that requires all staff members to enter a login name and password. Users can choose their own passwords. Some pick the names of their pets or spouses as passwords, while others tape their passwords to their computer monitors to help remember them.

d. An employee in a hospital was hardly ever at his desk, but almost always reachable through his cell phone. When the department replaced his old computer with a new one, his boss scanned the old hard drive and made the startling discovery that this employee had a full-time second job as a beer distributor.

e. A routine audit of the computer payroll records of the local manufacturing plant reveals that the address of over 20 employees in different departments is the same empty lot in the city.

f. An analysis of online bidding on eBay reveals that one seller has bid on several of his own merchandise in an effort to increase the final sales price of his items.

g. A retailer sues a web hosting company when it discovers that the employees of the web company have been visiting sites on which the retailer advertises. The retailer pays a fee of $1 every time someone clicks on these advertising links.

10-13. (Library or Online Journal Research) Newspapers and such journals as *Datamation* and *Computerworld* are prime sources of computer-crime articles. Find a description of a computer crime not already discussed in this chapter and prepare an analysis of the crime similar to the ones in the second section of this chapter.

10-14. Recall that the salami technique means using a computer to skim a small amount of money from hundreds or thousands of accounts, and then diverting the proceeds for personal gain. Suppose that a computer programmer uses this technique to skim a penny from each customer's account at a small bank. Over the course of three months, he takes $200,000 and is never caught. Assuming that this hacker took only one penny per month from each customer, how many accounts did the bank have? If the bank had 100,000 accounts and the hacker stole one penny from each account's interest (which was computed daily), how much could the hacker steal in three months?

10-15. What company policies or procedures would you recommend to prevent each of the following activities?

a. A clerk at the Paul Yelverton Company faxes a fictitious sales invoice to a company that purchases a large quantity of goods from it. The clerk plans to intercept that particular payment check and pocket the money.

b. The bookkeeper at a construction company has each of the three owners sign a different paycheck for her. Each check is drawn from a separate account of the company.

c. A clerk in the human relations department creates a fictitious employee in the personnel computer file. When this employee's payroll check is received for distribution, the clerk takes and cashes it.

d. A clerk in the accounts receivable department steals $250 in cash from a customer payment, then prepares a computer credit memo that reduces the customer's account balance by the same amount.

e. A purchasing agent prepares an invoice for goods received from a fictitious supplier. She sends a check for the goods to this supplier, in care of her mother's post-office box.

f. A hacker manages to break into a company's computer system by guessing the password of his friend—Champ, the name of the friend's dog.

g. An accounts receivable clerk manages to embezzle more than $1 million from the company by diligently lapping the accounts every day for three consecutive years.

h. The company's local area network administrator traces a virus to an individual who accidentally introduced it when he downloaded a computer game from the Internet.

i. A clerk at a medical lab recognizes the name of an acquaintance as one of those patients whose lab tests are ''positive'' for an infectious disease. She mentions it to a mutual friend, and before long, the entire town knows about it.

10-16. Download a copy of the Association of Certified Fraud Examiners Fraud Prevention Checkup, which is available at www.acfe.com/documents/Fraud_Prev_Checkup_IA.pdf. On a separate piece of paper, list the seven areas, and the maximum number of points suggested for each one. An example is:

1. Fraud Risk Oversight (20 points).

Do you think that this check list is likely to enable organizations to prevent most types of fraud? Why or why not?

10-17. Download a copy of the *ACFE Compensation Guide for Anti-fraud Professionals*, which is available at no charge at: www.acfe.com/documents/2008-comp-guide.pdf. Based on this resource, answer the following questions:

a. How many people participated in the 2008 survey?

b. What is the median total compensation for certified forensic examiners (CFEs) and for non-CFEs?

c. What is the modal years of experience for CFEs and for non-CFEs?

d. What is the modal highest level of education completed for CFEs and for non-CFEs?

e. What is the median total annual compensation for females and males holding CFE certification, and for CFEs versus non-CFEs? How can you explain these differences?

f. Do fraud examiners earn more if they work in one type of industry (e.g., healthcare) than another? How about internal auditors?

g. Do anti-fraud practitioners tend to earn more in some areas of the country than in others? If so, what explains these differences?

CASE ANALYSES

10-18. Ashley Company (Diskless PC System and Security Threats)

To address the need for tighter data controls and lower support costs, the Ashley Company has adopted a new diskless PC system. It is little more than a mutilated personal computer described as a ''gutless wonder.'' The basic concept behind the diskless PC is simple: A

LAN server-based file system of high-powered diskless workstations is spread throughout a company and connected with a central repository or mainframe. The network improves control by limiting user access to company data previously stored on desktop hard disks. Because the user can destroy or delete only the information currently on the screen, an organization's financial data are better protected from user-instigated catastrophes. The diskless computer also saves money in user support costs by distributing applications and upgrades automatically, and by offering online help.

Requirements:

1. What threats in the information processing and storage system do the diskless PC minimize?
2. Do the security advantages of the new system outweigh potential limitations? Discuss.

10-19. Mark Goodwin Resort (A Valuable-Information Computer Offense)

The Mark Goodwin Resort is an elegant summer resort located in a remote mountain setting. Guests visiting the resort can fish, hike, go horseback riding, swim in one of three hotel pools, or simply sit in one of the many lounge chairs located around the property and enjoy the spectacular scenery. There are also three dining rooms, card rooms, nightly movies, and live weekend entertainment.

The resort uses a computerized system to make room reservations and bill customers. Following standard policy for the industry, the resort also offers authorized travel agents a 10% commission on room bookings. Each week, the resort prints an exception report of bookings made by unrecognized travel agents. However, the managers usually pay the commissions anyway, partly because they don't want to anger the travel agencies and partly because the computer file that maintains the list of authorized agents is not kept up to date.

Although management has not discovered it, several employees now exploit these facts to their own advantage. As often as possible, they call the resort from outside phones, pose as travel agents, book rooms for friends and relatives, and collect the commissions. The incentive is obvious: rooms costing as little as $100 per day result in payments of $10 per day to the ''travel agencies'' that book them. The scam has been going on for years, and several guests now book their rooms exclusively through these employees, finding these people particularly courteous and helpful.

Requirements:

1. Would you say this is a ''computer crime?'' Why or why not?
2. What controls would you recommend that would enable the resort's managers to thwart such offenses?
3. How does the matter of ''accountability'' (tracing transactions to specific agencies) affect the problem?

10-20. The Department of Taxation (Data Confidentiality)

The Department of Taxation of one state is developing a new computer system for processing state income tax returns of individuals and corporations. The new system features direct data input and inquiry capabilities. Identification of taxpayers is provided by using the Social Security numbers of individuals and federal identification numbers for corporations. The new system should be fully implemented in time for the next tax season. The new system will serve three primary purposes:

- Data will be input into the system directly from tax returns through computer terminals located at the central headquarters of the Department of Taxation.
- The returns will be processed using the main computer facilities at central headquarters. The processing includes (1) verifying mathematical accuracy; (2) auditing the reasonableness of deductions, tax due, and so forth, through the use of edit routines as well as a comparison of the current year's data with prior years' data; (3) identifying returns that should be considered for audit by revenue agents of the department; and (4) issuing refund checks to taxpayers.
- Inquiry service will be provided to taxpayers on request through the assistance of Tax Department personnel at five regional offices. A total of 50 computer terminals will be placed at the regional offices.

A taxpayer will be able to determine the status of his or her return or to get information from the last three years' returns by calling or visiting one of the department's regional offices. The state commissioner of taxation is concerned about data security during input and processing over and above protection against natural hazards such as fires or floods. This includes protection against the loss or damage of data during data input or processing, and the improper input or processing of data. In addition, the tax commissioner and the state attorney general have discussed the general problem of data confidentiality that may arise from the nature and operation of the new system. Both individuals want to have all potential problems identified before the system is fully developed and implemented so that the proper controls can be incorporated into the new system.

Requirements:

1. Describe the potential confidentiality problems that could arise in each of the following three areas of processing and recommend the corrective action(s) to solve the problems: (a) data input, (b) processing of returns, (c) data inquiry.
2. The State Tax Commission wants to incorporate controls to provide data security against the loss, damage, or improper input or use of data during data input and processing. Identify the potential problems (outside of natural hazards such as fires or floods) for which the Department of Taxation should develop controls, and recommend possible control procedures for each problem identified.
(CMA adapted)

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ANSWERS TO TEST YOURSELF

1. **b** 2. **b** 3. **c** 4. **a** 5. **c** 6. **b** 7. **d** 8. **b** 9. **b** 10. **d** 11. **e** 12. **c** 13. **e** 14. **d**

Chapter 11

Introduction to Internal Control Systems

After reading this chapter, you will:

1. *Be familiar with* the primary control frameworks commonly used in organizations.
2. *Be familiar with* an internal control system and the components of this system.
3. *Understand* the importance of enterprise-wide risk assessment and the impact this has on internal controls.
4. *Be familiar with* the importance of COSO and COBIT with respect to internal control systems.
5. *Understand* the difference between preventive, detective, and corrective controls.
6. *Be aware of* some of the control activities that should be included in an organization's internal control system.
7. *Understand* the reason an organization might be willing to let customers shoplift some of its merchandise inventory.

"Ultimately, all stakeholders in the company should share the same high-level goal of establishing a strong system of internal controls."

Robert Mueller, "Mending Broken Controls," *Internal Auditor* (August 2008), p. 85.

INTRODUCTION

Protecting the assets of an organization has always been an important responsibility of management. However, the incredible advancements in IT, as well as the pervasive use of IT across firms of all sizes, have dramatically changed how managers establish and monitor internal controls. Indeed, the pervasiveness of IT also has a profound impact on internal and external auditors, and how they assess the strength of the internal control environment. Protecting such assets requires organizations to develop and implement an effective internal control system—a system that can also perform such other functions as helping ensure reliable data processing and promoting operational efficiency in an organization.

This chapter and the next cover the topic of internal controls—i.e., the controls established to protect the assets of an organization. This chapter defines corporate governance, IT governance, and internal controls. We also identify the components of an internal control system, the different types of controls, and various control activities. Finally, we illustrate a cost-benefit analysis, which is a method managers use to determine which control procedures are cost effective.

INTERNAL CONTROL SYSTEMS

An internal control system consists of the various methods and measures designed into and implemented within an organization to achieve the following four objectives: (1) safeguard assets, (2) check the accuracy and reliability of accounting data, (3) promote operational efficiency, and (4) enforce prescribed managerial policies. An organization that achieves these four objectives is typically one with good **corporate governance**. This means managing an organization in a fair, transparent, and accountable manner to protect the interests of all the stakeholder groups.[1] The 1992 COSO Framework is widely used by managers to organize and evaluate their corporate governance structure. This framework was developed to improve the quality of financial reporting through business ethics, effective internal controls, and corporate governance.[2]

Definition of Internal Control

Internal control describes the policies, plans, and procedures implemented by management of an organization to protect its assets. Usually the people involved in this effort are the entity's board of directors, the management, and other key personnel in the firm.

[1] "Corporate Governance: The New Strategic Imperative," a White Paper from the Economist Intelligence Unit, sponsored by KPMG International, http://www.eiu.com.
[2] Source: http://www.coso.org.

The reason this is important is that these individuals want reasonable assurance that the goals and objectives of the organization can be achieved (i.e., effectiveness and efficiency of operations, reliability of financial reporting, protection of assets, and compliance with applicable laws and regulations).[3]

Figure 11-1 identifies key laws, professional guidance, and reports that focus on internal controls.

In 2001, the AICPA issued Statement on Auditing Standards **(SAS) No. 94**, ''The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit.'' This SAS cautions the external auditors that the way firms use IT might impact any of the five internal control components (discussed in the next section). That is, auditors must realize internal controls are both manual and automated, and therefore, auditors might need to adopt new testing strategies to obtain sufficient evidence that an organization's controls are effective. Because of the complexity of IT environments, auditors will most likely need to use computer-assisted auditing techniques (CAATs) to test the automated controls in an organization. We discuss these techniques in depth in Chapter 14.

An important piece of legislation with respect to internal controls is the **Sarbanes-Oxley Act of 2002**. One key provision of this law is **Section 404**, which reaffirms that management is responsible for establishing and maintaining an adequate internal control structure, and at the end of each fiscal year must attest to the effectiveness and completeness of the internal control structure, thus making managers personally liable for this structure within the firm. We cover the Sarbanes-Oxley Act in more depth in Chapter 14.

1992 COSO Report—Components of Internal Control

The **1992 COSO Report** (see Figure 11-1) is important because it established a common definition of internal control for assessing control systems, as well as determined how to improve controls. According to the report, controls can serve many important purposes, and for this reason many businesses look at internal control systems as a solution to a variety of potential problems (such as dealing with rapidly changing economic and competitive environments, as well as shifting customer demands and priorities). According to the COSO report, an internal control system should consist of these five components: (1) the control environment, (2) risk assessment, (3) control activities, (4) information and communication, and (5) monitoring.

Control Environment. The **control environment** establishes the tone of a company and influences the control awareness of the company's employees. It is the foundation for all the other internal control components and provides discipline and structure. Factors include:

- the integrity, ethical values, and competence of an organization's employees
- management's philosophy and operating style
- the way management assigns authority and responsibility as well as organizes and develops its employees
- the attention and direction provided by the board of directors

[3]Committee of Sponsoring Organizations of the Treadway Commission (CSOTC), *Internal Control—Integrated* Framework (COSO Report), 1992.

Date	Act/Report	Significant Provisions Pertaining to Internal Controls
1977	Foreign Corrupt Practices Act	• Requires publicly-owned companies to implement internal control systems • Only applies to publicly-owned corporations registered under Section 12 of the 1934 Securities and Exchange Act
1977	Treadway Commission Report	• Recommends development of a common definition for internal control, guidance for judging the effectiveness of internal control, and methods to improve internal controls
1988	SAS No. 55	• Management should establish an internal control structure that includes the following three components: the control environment, the accounting system, and the control procedures
1992	Committee of Sponsoring Organizations (COSO) Report	• Title: *Internal Control—Integrated Framework* • Defines internal control and describes its components • Presents criteria to evaluate internal control systems • Provides guidance for public reporting on internal controls • Offers materials to evaluate an internal control system
1992	COBIT—Control Objectives for Business and IT	• A Framework (set of best practices) for IT management • Provides managers, auditors, and IT users a set of generally accepted measures, indicators, processes, and best practices to maximize the benefits of IT and develop appropriate IT governance and control
1995	SAS No. 78	• Replaces definition of internal control structure in SAS No. 55 with the definition of internal control given in the 1992 COSO report
2001	SAS No. 94	• Provides guidance to auditors about the effect of IT on internal controls • Describes benefits and risks of IT to internal controls and how IT affects the components of internal controls
2002	Sarbanes-Oxley Act, Section 404	• Requires publicly-traded companies to issue an "internal control report" that states management is responsible for establishing and maintaining an adequate internal control structure • Management must assess the effectiveness of internal controls annually • The independent auditor for the firm must attest to and report on managements' assessment annually
2004	Committee of Sponsoring Organizations (COSO) Report	• Focuses on enterprise risk management • Includes the five components of ICIF (control environment, risk assessment, control activities, information and communication, and monitoring) and adds three components: objective setting, event identification, and risk response
2005	COBIT, Ver. 4.0	• Includes 34 high-level objectives that cover 215 control objectives categorized in four domains: Plan and Organize, Acquire and Implement, Deliver and Support, and Monitor and Evaluate
2006	SAS No. 112	• Establishes standards and provides guidance to auditors of non-public entities on communicating matters related to an entity's internal control over financial reporting observed during a financial statement audit • To properly apply SAS No. 112, the auditor must have a working knowledge of the COSO framework
2007	COBIT, Ver. 4.1	• Better definitions of core concepts; improved control objectives • Application controls reworked; business and IT goals improved

FIGURE 11-1 Background information on internal controls.

Case-in-Point 11.1 A commonly-used source of information on reported cases of material weaknesses for publicly-traded companies is Audit Analytics (www.auditanalytics.com). One of the categories in this database is "senior management, tone, or reliability." A recent study of this particular category shows that audit firms issued adverse internal control opinions to 93 public companies (2005 to early 2008) because of weaknesses in "tone at the top."[4]

The personnel policies and practices that management adopts are an important aspect of the control environment. For example, an important control procedure is employee training programs that inform new hires about the company's various policies, outline individual responsibilities, and explain how to perform duties efficiently. Similarly, an organization should also conduct regular reviews of its operations to determine if they conform to desired operating policies. Many large and medium-sized enterprises have separate internal audit departments, whose internal auditors test existing internal controls for proper functioning and use. Small enterprises usually cannot afford their own internal audit departments, but they can hire outside consultants or ask managers to test compliance with operating policies.

Risk Assessment. It is not possible or even desirable to install controls for every possible risk or threat. The purpose of **risk assessment** is to identify organizational risks, analyze their potential in terms of costs and likelihood of occurrence, and implement only those controls whose projected benefits outweigh their costs. A general rule is: The more liquid an asset, the greater the risk of its misappropriation. To compensate for this increased risk, stronger controls are required. The COSO report recommends the use of a *cost-benefit analysis* (discussed and illustrated later in this chapter) to determine whether the cost to implement a specific control procedure is beneficial enough to spend the money. We expand on the topic of risk management in the next section.

Control Activities. These are the policies and procedures that the management of a company develops to help protect all of the different assets of the firm. Control activities include a wide variety of activities throughout the firm and are typically a combination of manual and automated controls. Some examples of these activities are approvals, authorizations, verifications, reconciliations, reviews of operating performance, and segregation of duties. Through properly designed and implemented *control procedures*, management will have more confidence that assets are being safeguarded and that the accounting data processed by the accounting system are reliable. This chapter provides several examples of control procedures, and also illustrates control activities that should be included in every company's internal control system.

Information and Communication. Managers must inform employees about their roles and responsibilities pertaining to internal control. This might include giving them documents such as *policies and procedures manuals* (discussed later) or posting memoranda on the company's intranet. This could also include training sessions for entry-level personnel and then annual refresher training for continuing employees. Regardless of the method, all employees need to understand how important their work is, how it relates to the work of other employees in the firm, and how that relates to strong internal controls. It is equally important that management understand the importance of keeping good working

[4]Hermanson, D., Ivancevich, D., and Ivancevich, S., "Tone at the Top," *Internal Auditor* (November 2008), pp. 39–45.

relationships between all layers of management so that employees feel safe communicating any possible problems they may find. When this is the case, employees at all levels can actually enhance the effectiveness of good internal controls. Also, they will be much more likely to point out any problems they may detect, and corrective action can be initiated.

Case-in-Point 11.2 Whistle-blowing systems help employees feel safe communicating problems or suspected wrongdoing to management. However, many potential whistleblowers continue to struggle with reporting problems that they witness because they are not sure how to report what they know, or fear possible consequences of doing so. One solution to this problem is to outsource the whistle-blower system—in fact, a recent survey of Chief Audit Executives reports that 60% of the organizations included in the survey have already outsourced their reporting systems."[5]

Monitoring. Evaluation of internal controls should be an ongoing process. Managers at various levels in the organization must evaluate the design and operation of controls and then initiate corrective action when specific controls are not functioning properly. This could include daily observations and scrutiny, or management might prefer regularly-scheduled evaluations. The scope and frequency of evaluations depend, to a large extent, on management's assessment of the risks the firm faces.

2004 COSO Report—Enterprise Risk Management

The 2004 COSO *Enterprise Risk Management – Integrated Framework* focuses on **enterprise risk management (ERM)** and builds upon the 1992 COSO *Internal Control – Integrated Framework* (ICIF). The ERM Framework (Figure 11-2) includes the five components of ICIF (control environment, risk assessment, control activities, information and communication, and monitoring) and adds three additional components: objective setting, event identification, and risk response.[6]

Objective Setting. ERM offers management a process for setting objectives for the firm—that is, the purposes or goals the firm hopes to achieve. ERM helps an organization determine if the objectives are aligned with the organizational strategy and that goals are consistent with the level of risk the organization is willing to take. An enterprise's objectives are viewed from four perspectives: (1) Strategic: the high-level goals and the mission of the firm, (2) Operations: the day-to-day efficiency, performance, and profitability of the firm, (3) Reporting: the internal and external reporting of the firm, and (4) Compliance: with laws and regulations.

Event Identification and Risk Response. Organizations must deal with a variety of uncertainties because many events are beyond the control of management. Examples include natural disasters, wars, unexpected actions of competitors, and changing conditions in the marketplace. However, it is critical for management to identify these external risks as quickly as possible and then consider internal and external factors regarding each event

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[5]Baker, N., ''See No Evil, Hear No Evil, Speak No Evil,'' *Internal Auditor* (April 2008), pp. 39–43.

[6]Sources: COSO website (www.erm.coso.org); F. Martens and L. Nottingham, Enterprise Risk Management: A Framework for Success, *RE: Business*, September 2003; and C. Chapman, Bringing ERM into Focus, *Internal Auditor Magazine*, June 2003.

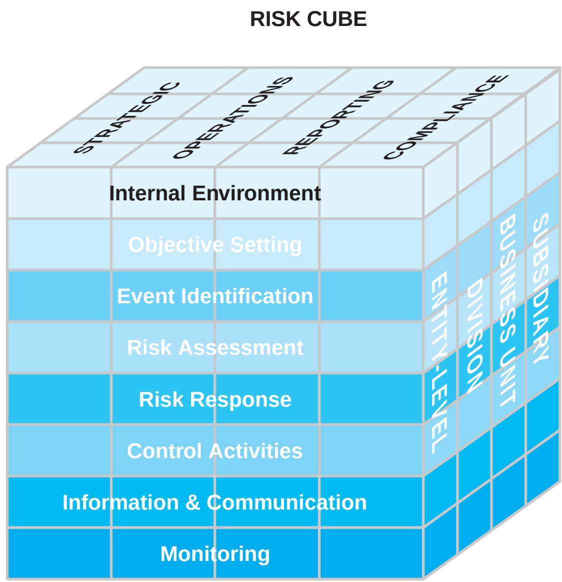

FIGURE 11-2 2004 COSO Enterprise Risk Management—Integrated Framework.

that might affect its strategy and achievement of objectives. Depending on the type or nature of events, management might be able to group some of them together and begin to detect trends that may help with risk assessment.

Case-in-Point 11.3 The responsibility of the Director of the Arkansas Department of Finance and Administration (DFA) is to ensure that state agencies operate uniformly and efficiently. To help the Director achieve these DFA objectives, each state agency is required to perform a risk assessment once every two years, and must complete a "Risk Assessment and Control Activities Worksheet."[7] This worksheet (Figure 11-3) helps department managers across the state to think about their operations through a risk-assessment lens.

The objective of risk assessment is to manage and control risk by identifying threats, analyzing the risks, and implementing cost-effective countermeasures to avoid, mitigate, or transfer the risks to a third party (through insurance programs). As they identify and categorize these risks, management will be in a better position to determine the probable effects on the organization. Management can then formulate and evaluate possible response options for the organization. In developing options, managers need to consider the level of risk they are willing to assume, as well as the trade-offs between costs and benefits of each choice. A number of computerized risk assessment software tools already exist to help managers with this task.

Case-in-Point 11.4 Managers need to ask themselves about the possible impact of certain risks—would it be minimal, significant, serious, or catastrophic?[8] RiskPAC, a business risk software solution, helps organizations detect and eliminate vulnerabilities in information systems and data security. CPACS, the company that developed RiskPAC, defines risk assessment as identification of the major risks and threats to which an organization's reputation, business

[7]Source: http://www.arkansas.gov/dfa/accounting/acc_ia_risk.html.
[8]Source: http://www.cpacsweb.com/riskpac.html (business continuity planning software products)

Risk Assessment and Control Activities Worksheet

Department: ____________________ Prepared By: ____________________

Activity: ____ Date Prepared: ____________________

	Risk Assessment			
Goals & Objectives	Risks	Significance/Impact	Likelihood	Actions to Manage Risks/ Control Activities
(1)	(2)	(3)	(4)	(5)

1. List all operations, financial reporting and compliance objectives associated with the activity. Goals should be clearly defined, measurable and attainable.
2. List all identified risks to the achievement of each goal and objective. Consider both internal and external risk factors. For each goal and objective, several different risks can be identified.
3. For each risk, estimate the potential impact on operations, financial reporting or compliance with laws and regulations, assuming that the risk occurs. Consider both quantitative and qualitative costs. Use **Large**, **Moderate** or **Small**.
4. For each risk, assess the likelihood of the risk occurring. Use **probable**, **reasonably possible**, or **remote**. Alternatively use **High**, **Medium** of **Low**.
5. For each risk with large or moderate impact and probable (high) or reasonable (medium) likelihood of occurrence, list both the actions to mitigate the risk to an acceptable level and the control activities that help ensure that those actions are carried out properly and in a timely manner. If no action is present to manage the risk and/or no control activity is present, an action plan to address the risk and an associated timeline should be included.

FIGURE 11-3 An example of a risk assessment and control activities worksheet.

Source: http://www.arkansas.gov/dfa/accounting/acc_ia_risk.html.

processes, functions, and assets are exposed. RiskPAC helps organizations determine the possibility that a harmful incident will occur (very likely, possible, probable, very unlikely).

2007 COBIT, Version 4.1[9]

The first edition of Control Objectives for Information and related Technology (COBIT) was issued in 1996, and the latest edition, version 4.1, was issued in 2007. The COBIT framework was created to be business focused, process oriented, controls based, and measurement driven. If we examine the mission statement for COBIT, we can quickly understand why this framework is widely used in corporate environments.

> *"To research, develop, publicize, and promote an authoritative, up-to-date, international set of generally accepted information technology control objectives for day-to-day use by business managers, IT professionals, and assurance professionals."*[10]

The COBIT framework takes into consideration an organization's business requirements, IT processes, and IT resources to support COSO requirements for the IT control environment. This suggests, rightfully so, that managers must *first* tend to the requirements outlined in the 1992 COSO Report and set up an internal control system that consists of these five components: (1) the control environment, (2) risk assessment, (3) control activities, (4) information and communication, and (5) monitoring. The next step managers should take is to work through the guidelines contained in the 2004 COSO Report (perhaps using a worksheet like the one in Figure 11-3) to set objectives, identify possible risk events, and then consider appropriate risk responses the organization might need to take should an event occur.

Once the internal control system is in place (i.e., managers have worked through the 1992 and the 2004 COSO Frameworks), IT managers work with operational managers throughout the organization to determine how IT resources can best support the business processes. To achieve appropriate and effective governance of IT, senior managers of the organization will typically focus on five areas. First, managers need to focus on strategic alignment of IT operations with enterprise operations. Second, they must determine whether the organization is realizing the expected benefits (value) from IT investment. Third, managers should continually assess whether the level of IT investments is optimal. Fourth, senior management must determine their organization's risk appetite and plan accordingly. And finally, they must continuously measure and assess the performance of IT resources. Here again is an opportunity for managers to consider a "dashboard" to have access to key indicators of these five focus areas to support timely decision-making.

Perhaps it was the Sarbanes-Oxley Act, and the many governance lapses prior to the enactment of this legislation, that prompted the IT Governance Institute (ITGI) to recognize a need for and to develop a framework for IT governance. This governance framework, called Val IT, is a formal statement of principles and processes for IT management. **Val IT** is tightly integrated with COBIT. Although COBIT helps organizations understand if they are doing things right from an IT perspective, Val IT helps organizations understand if they are making the right investments and optimizing the returns from them. So, COBIT focuses on

[9]Source: IT Governance Institute, http://www.itgi.org.
[10]Source: IT Governance Institute, http://www.itgi.org.

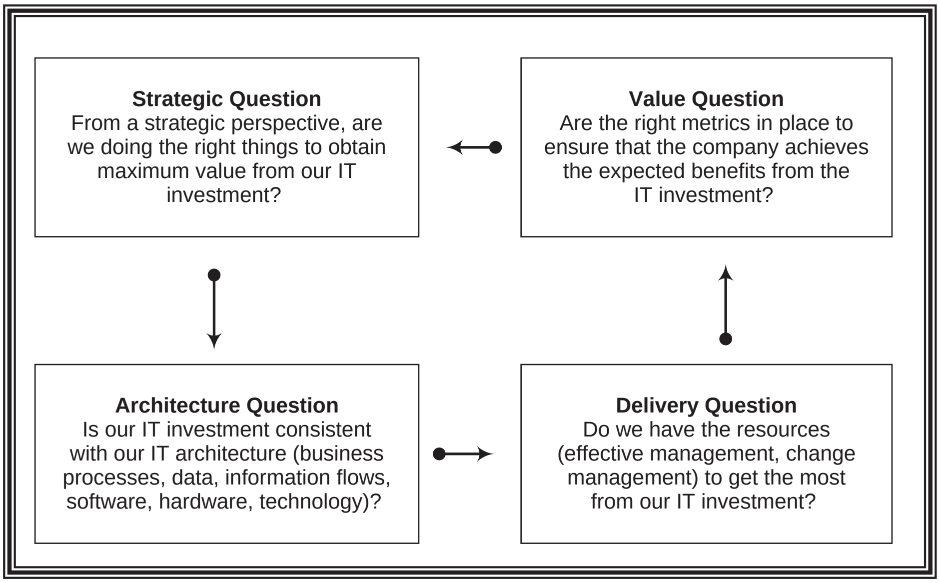

FIGURE 11-4 The integration of COBIT and Val IT.

Source: Adapted from the ISACA website (http://www.isaca.org).

the execution of IT operations, and Val IT focuses on the investment decision. Figure 11-4 diagrams the integration of COBIT and Val IT, which is described in considerable depth in ''The Val IT Framework 2.0 Extract.''[11] In essence, this is also a model for continuous improvement for an organization's IT governance program.

Val IT includes three very helpful publications that may be downloaded for free at the ISACA website (www.isaca.org), and these documents are: (1) Val IT Framework 2.0, (2) Val IT Getting Started with Value Management, and (3) Val IT The Business Case.

TYPES OF CONTROLS

A company's control procedures are often classified into three major types: *preventive controls*, *detective controls*, and *corrective controls*. This section examines each of these types of control procedures in more detail.

Preventive Controls

Preventive controls are controls that management puts in place to prevent problems from occurring. For example, a company might install a firewall to prevent unauthorized access to the company's network, thereby safeguarding the disclosure, alteration, or destruction of sensitive information from external hackers. Enterprise Risk Management (discussed earlier) helps managers identify areas where preventive controls should be in place. Under the section called ''Event Identification'' we said that management must identify possible

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[11] Source: http://www.isaca.org.

events that represent a problem to the firm and then identify appropriate responses to those problems. James Cash calls this **scenario planning**, and it means management identifies scenarios of minor concern to major disasters that could occur.[12] Management should include a number of informed individuals in these brainstorming sessions, such as the IS team, IT auditors, external auditors, and perhaps risk-management consultants. First, management documents each scenario. Then, management must establish preventive controls to minimize the likelihood of each problem they identify. As Cash points out, preventive controls are never fail-safe, so a firm always needs detective controls to help discover when preventive controls fail. We'll talk more about the relationship of these two controls later in this chapter.

Detective and Corrective Controls

Because preventive controls cannot stop every possible problem from occurring, organizations also need strong **detective controls** that alert managers when the preventive controls fail. As an example, assume that a company's information system prepares daily responsibility accounting performance reports for management that computes variations of actual production costs from standard production costs. If a significant variance occurs, a manager's report signals this problem and the manager can initiate corrective action. Examples of *detective security controls* are log monitoring and review, system audits, file integrity checkers, and motion detection.[13]

Organizations can initiate corrective action only if corrective controls are in place. A company establishes corrective controls to remedy problems it discovers by the detective controls. Let's assume, based on the above detective control example, that performance reports repeatedly disclose that the company's actual direct labor hours for production work significantly exceed the standard direct labor hours. A corrective control procedure might be training programs that teach employees to perform their job functions more efficiently and effectively.

Corrective controls are procedures a company uses to solve or correct a problem. An example of this type of corrective control procedure might be a change to the company's procedures for creating backup copies of important business files. More than ever before, companies realize the importance of this corrective control since 9/11 and the many natural disasters that have occurred over the past few years.

Case-in-Point 11.5 Faced with many instances of fraud, hotels considered possible corrective controls to protect themselves from litigation and protect their guests from identity theft, without sacrificing customer service. Let's assume a guest calls, claiming that she forgot to pick up her folio (the record of charges and payments). She politely asks the hotel's accounting department to fax a copy. Hotels used to oblige the customer and fax the folio, which of course includes such information as the guest's name, address, signature, and credit card number. This seems like a nice service to a customer, but what if the person who called was not the guest? Many hotels now use the following procedures: (1) computers do not print the entire credit card number on the folio, and (2) folios are not faxed to anyone for any reason. Instead, hotels typically mail a folio only to the address on the reservation.[14]

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[12] James Cash, ''It's Reasonable to Prepare,'' *Information Week*, No. 654 (October 27, 1997), p. 142.
[13] Source http://www.giac.org/resources/whitepaper/operations/207.php.
[14] Michael Barrier, ''Unmasking Hotel Fraud,'' *Internal Auditor*, Vol. 58 (April 2001), p. 28.

Interrelationship of Preventive and Detective Controls

Management should not treat preventive control procedures and detective control procedures separately. As we discussed earlier, these two controls work together to protect a company's internal control system.

CONTROL ACTIVITIES

Because each organization's accounting system is unique, there are no standardized control procedures that will work for every company. This means that each organization designs and implements specific controls based on its particular needs. However, certain control activities are common to every organization's internal control system. The ones that we will examine here are: (1) a good audit trail, (2) sound personnel policies and practices, (3) separation of duties, (4) physical protection of assets, (5) internal reviews of controls, and (6) timely performance reports.

Good Audit Trail

The basic inputs to an organization's AIS are business transactions that are monetarily measured. Organizations must keep an **audit trail** (initially discussed in Chapter 1) of these transactions within the organization's AIS. A good audit trail enables managers and auditors to follow the path of the data recorded in transactions from the initial source documents (for instance, a sales invoice) to the final disposition of the data on a report. In addition, managers and auditors can trace data from transactions on reports (such as expenses on an income statement) back to the source documents. In both of these processes, individuals can verify the accuracy of recorded business transactions. Without a good audit trail, errors and irregularities are more likely to happen and not be detected. To establish its audit trail, a company needs a *policies and procedures manual*. These documents should include the following items:

- A chart of accounts that describes the purpose of each general ledger account so that employees enter the debits and credits of accounting transactions in the correct accounts.
- A complete description of the types of source documents individuals must use to record accounting transactions. Also, include the correct procedures to prepare and approve the data for these documents.
- A comprehensive description of the authority and responsibility assigned to each individual. For example, who authorizes credit limits to customers?

Sound Personnel Policies and Practices

The employees at every level of a company are a very important part of the company's system of internal control. This is becoming increasingly obvious as managers downsize and right-size their organizations to streamline operations and cut costs. Consequently, there are fewer employees and these employees have more responsibility and oversight than in the past. The obvious result is that the opportunity for misappropriation is greater than before.

In addition, the capabilities of a company's employees directly affects the quality of the goods and services provided by the company. In general, competent and honest employees are more likely to help create value for an organization. Employees work with organizational assets (e.g., handling cash, acquiring and issuing inventory, and using equipment). Competent and honest employees, coupled with fair and equitable personnel policies, lead to efficient use of the company's assets. Most organizations post their personnel policies and procedures on their website so that they are easily accessible to all employees at any time.

Case-in-Point 11.6 Employees at the University of Arizona have ready access to a wealth of information regarding the university's personnel policies by searching the Human Resources Policy Manual (HRPM). The HRPM is available on the university website and includes policies on employment, benefits, compensation, employee relations, training and employee development, and additional university policies (e.g., conflict of interest, code of research ethics, and others).[15]

In general, little can be done to stop employees who are determined to embarrass, harm, or disrupt an organization. For example, several employees may conspire (*collude*) to embezzle cash receipts from customers. But, companies can encourage ethical behavior among employees in several ways. First, review the rules and the Code of Conduct. A number of organizations have too many ''picky'' rules that employees do not understand. To avoid this type of problem, managers should create rules that make a positive contribution to the productivity and effectiveness of a company, and then explain the rationale for these rules to employees. Secondly, managers should always lead by example. Figure 11-5 identifies some examples of personnel policies that firms might adopt.

All employees should be required to take their earned vacations (personnel policy 6). This is important for two reasons. First, if an employee is embezzling assets from an organization, the employee will probably not want to take a vacation. When an individual must go on vacation, another employee performs that person's job responsibilities and this increases the likelihood of detecting an embezzlement. Second, required vacations help employees to rest, enabling them to return refreshed and ready to perform their job functions more efficiently.

1. Specific procedures for hiring and retaining competent employees.
2. Training programs that prepare employees to perform their organizational functions efficiently.
3. Good supervision of the employees as they are working at their jobs on a daily basis.
4. Fair and equitable guidelines for employees' salary increases and promotions.
5. Rotation of certain key employees in different jobs so that these employees become familiar with various phases of their organization's system.
6. Vacation requirement that all employees take the time off they have earned.
7. Insurance coverage on those employees who handle assets subject to theft (fidelity bond).
8. Regular reviews of employees' performances to evaluate whether they are carrying out their functions efficiently and effectively, with corrective action for those employees not performing up to company standards.

FIGURE 11-5 Examples of personnel policies that firms might adopt.

[15]Source: http://www.hr.arizona.edu/09_rel/clsstaffmanual.php.

For employees who handle assets susceptible to theft, such as a company's cash and inventory of merchandise, it is a good personnel policy (number 7) to obtain some type of insurance coverage on them. Many organizations obtain **fidelity bond** coverage (from an insurance company) to reduce the risk of loss caused by employee theft of assets. The insurance company investigates the backgrounds of the employees that an organization wants to have bonded. When an insurance company issues one of these bonds, it assumes liability (up to a specified dollar amount) for the employee named in the bond.

Separation of Duties

The purpose of **separation of duties** is to structure work assignments so that one employee's work serves as a check on another employee (or employees). When managers design and implement an effective internal control system, they must try to separate certain responsibilities. If possible, managers should assign the following three functions to different employees: *authorizing* transactions, *recording* transactions, and maintaining *custody of assets*.

Authorizing is the decision to approve transactions (e.g., a sales manager authorizing a credit sale to a customer). *Recording* includes functions such as preparing source documents, maintaining journals and ledgers, preparing reconciliations, and preparing performance reports. Finally, *custody of assets* can be either direct, such as handling cash or maintaining an inventory storeroom, or indirect, such as receiving customer checks through the mail or writing checks on a company's bank account. If two of these three functions are the responsibility of the same employee, problems can occur.

We describe three real-world cases that demonstrate the importance of separating duties. Immediately following each case is a brief analysis of the problem.

Case-in-Point 11.7 The controller of a Philippine subsidiary confessed to embezzling more than $100,000 by taking advantage of currency conversions. The controller maintained two accounts—one in Philippine pesos to deposit funds collected locally and the other account in U.S. dollars so he could transfer funds from the Philippine account to the US account. The auditor became suspicious when he noticed that each transfer was rounded to the nearest thousand in pesos and dollars. For example, one day the statements showed an $885,000 (pesos) transfer from the local-currency account and a transfer of exactly $20,000 into the U.S.-dollar account. Further investigation revealed that the controller was actually withdrawing cash from the peso account, keeping some of the money, and depositing only enough pesos in the U.S. currency account to show a transaction of exactly $20,000. Because the withdrawal and the deposit took place almost simultaneously, the U.S. controller never suspected any wrongdoing.[16]

Analysis. The control weakness here is that the controller had responsibility for both the *custody* of the cash (depositing the locally-collected funds in pesos) and the *recording* of the transactions (the deposit of the funds in the local account and the transfer of funds to the U.S. account). Consequently, he had control of the money throughout the process and was able to manipulate cash transfers to embezzle small amounts of money each time and then falsify the transactions that were recorded in each of the bank accounts to conceal the embezzlement activity.

Case-in-Point 11.8 The utilities director of Newport Beach, California, was convicted of embezzling $1.2 million from the city of Newport Beach over an 11-year period. The utilities

[16]Source: J. Mike Jacka, ''Rounding Up Fraud,'' *Internal Auditor*, April 2001, p. 65.

director forged invoices or easement documents that authorized payments, for example, to real or fictitious city property owners for the rights to put water lines through their land. Officials within the Finance Department gave him the checks for delivery to the property owners. The utilities director then forged signatures, endorsed the checks to himself, and deposited them in his own accounts.

Analysis. The control weakness here is that the utilities director had physical *custody* of checks for the transactions he previously *authorized*. Due to the lack of separation of duties, the director could authorize fictitious transactions and subsequently divert the related payments to his own accounts.

Case-in-Point 11.9 The executive assistant (EA) to the president of a home improvement company used a corporate credit card, gift checks, and an online payment account to embezzle $1.5 million in less than three years. The EA arranged hotel and airline reservations and coordinated activities for the sales team. She was also responsible for reviewing the corporate credit card bills and authorizing payment. The president gave her the authority to approve amounts up to $100,000. When the EA realized that no one ever asked to look at the charges on the corporate credit card bill, she began making personal purchases with the card.[17]

Analysis. The control weakness here is that the EA was responsible for both *recording* the expenses and then *authorizing* payment of the bills. As a result, she quickly realized that she had nearly unlimited access to a variety of sources of funds from the company, and then found other ways to have the company pay for the things she wanted (i.e., gift checks and a Paypal account that she set up).

The *separation of duties* concept is very important in IT environments. However, the way this concept is applied in these environments is often different. In today's information systems, for example, the computer can be programmed to perform one or more of the previously mentioned functions (i.e., authorizing transactions, recording transactions, and maintaining custody of assets). Thus, the computer replaces employees in performing the function (or functions). For example, the pumps at many gas stations today are designed so that customers can insert their debit or credit cards to pay for their gas. Consequently, the computer performs all three functions: authorizes the transaction, maintains custody of the ''cash'' asset, and records the transaction (and produces a receipt if you want one).

Physical Protection of Assets

A vital control activity that should be part of every organization's internal control system is the physical protection of its assets. Beyond simple protection from the elements, the most common control is to establish accountability for the assets with custody documents. Three application areas for this are (1) inventory controls, (2) document controls, and (3) cash controls.

Inventory Control. To protect inventory, organizations keep it in a storage area accessible only to employees with custodial responsibility for the inventory asset. Similarly, when purchasing inventory from vendors, another procedure is to require that each shipment of inventory be delivered directly to the storage area. When the shipment arrives, employees prepare a *receiving report* source document. This report, as illustrated in Figure 11-6, provides documentation about each delivery, including the date received,

[17]Source: Paul Sutphen, ''Stealing Funds for a Nest Egg,'' *Internal Auditor*, (August 2008), pp. 87–91.

Sarah's Sporting Goods
Receiving Report — **No.** 7824

Vendor: Richards Supply Company	**Date Received:** January 26, 2010
Shipped via: UPS	**Purchase Order Number:** 4362

Item Number	**Quantity**	**Description**
7434	100	Spalding basketballs
7677	120	Spalding footballs
8326	300	Spalding baseballs
8687	600	Penn tennis balls

Remarks:
Container with footballs received with water damage on outside, but footballs appear to be okay.

Received by:	**Inspected by:**	**Delivered to:**
Mark Langley	Mark Langley	Judy Phillips

FIGURE 11-6 Example of receiving report (items in boldface are preprinted).

vendor, shipper, and purchase order number. For every type of inventory item received, the receiving report shows the item number, the quantity received (based on a count), and a description.

The receiving report also includes space to identify the employee (or employees) who received, counted, and inspected the inventory items, as well as space for remarks regarding the condition of the items received. By signing the receiving report, the inventory clerk (Mark Langley in Figure 11-6) formally establishes responsibility for the inventory items. Any authorized employee can request inventory items from the storage area (for instance, to replenish the shelves of the store) and is required to sign the inventory clerk's *issuance report*, which is another source document. The clerk is thereby relieved of further responsibility for these requisitioned inventory items.

Document Control. Certain organizational documents are themselves valuable and must therefore be protected. Examples include the corporate charter, major contracts with other companies, blank checks (the following case-in-point), and registration statements required by the Securities and Exchange Commission. For control purposes, many organizations keep such documents in fireproof safes or in rented storage vaults offsite.

Case-in-Point 11.10 The Finance Office in Inglewood, California did not have adequate controls over important documents. As a result, a janitor who cleaned the Finance Office had access to blank checks that were left on someone's desk. The janitor took 34 blank checks, forged the names of city officials, and then cashed them for amounts ranging from $50,000 to $470,000.

Organizations that maintain physical control over blank checks may still be at risk of embezzlement. You might be wondering how this could happen—it's due to the fact that so many banking transactions are electronic, and the method is known as a **demand draft**. If you write a check to your 12-year-old babysitter, she has all the information needed to clean out your account, because all she needs is your account number and bank routing number. Originally, demand drafts were used to purchase items over the phone (i.e., from telemarketers). Now, they're commonly used to pay monthly bills by having money debited automatically from an individual's checking account. Not surprisingly, due to the limited amount of information needed to make a demand draft, the potential for fraud is substantial. The irony of the demand draft system is that it may mean that paper checks are ultimately more risky to use than e-payments.

Case-in-Point 11.11 The Urban Age Institute, a nonprofit organization that focuses on planning new urban sustainability initiatives, received an email from a would-be donor who asked for instructions on how to wire a $1,000 donation into the agency's account. Not thinking anything unusual about the request, the group sent its account numbers. The "donor" used this information to print $10,000 worth of checks, which the "donor" cashed and then used Western Union to wire the money to her new Internet boyfriend in Nigeria. The Director at the Institute later discovered that the "donor" used the Institute's account number and bank routing number to obtain checks at Qchex.com. Fortunately, the Institute discovered the fraud and was able to close its checking account before money was withdrawn to cover the $10,000 in checks, which had already been deposited into the donor's Bank of America account.[18]

Cash Control. Probably the most important physical safeguards are those for cash. This asset is the most susceptible to theft by employees and to human error when employees handle large amounts of it. In addition to fidelity bond coverage for employees who handle cash, companies should also (1) make the majority of cash disbursements for authorized expenditures by check rather than in cash, and (2) deposit the daily cash receipts (either received in the mail from credit customers or through cash sales) intact at the bank.

If a company has various small cash expenditures occurring during an accounting period, it is usually more efficient to pay cash for these expenditures than to write checks. For good operating efficiency, an organization should use a *petty cash fund* for small, miscellaneous expenditures. To exercise control over this fund, one employee, called the *petty cash custodian*, should have responsibility for handling petty cash transactions. This employee keeps the petty cash money in a locked box and is the only individual with access to the fund.

Cash Disbursements by Check. A good audit trail of cash disbursements is essential to avoid errors and irregularities in the handling of cash. Accordingly, most organizations use pre-numbered checks to maintain accountability for both issued and unissued checks.

When paying for inventory purchases, there are two basic systems for processing vendor invoices: *nonvoucher systems* and *voucher systems*. Under a *nonvoucher* system, every approved invoice is posted to individual vendor records in the accounts payable file and then stored in an open invoice file. When an employee writes a cash disbursement check to pay an invoice, he or she removes the invoice from the open-invoice file, marks it

[18]Source: http://www.msnbc.msn.com/id/7914159/, Bob Sullivan, "Easy Check Fraud Technique Draws Scrutiny".

Sarah's Sporting Goods **Disbursement Voucher**		**No.** 76742
Date Entered: February 9, 2010	**Debit Distribution**	
Prepared by: GM	**Account No.**	**Amount**
Vendor Number: 120	27-330 27-339 28-019 29-321	$750.00 450.00 300.00 425.00
Remit to: Valley Supply Company 3617 Bridge Road Farmington, CT 06032		

Vendor Invoice					
Number	**Date**	**Amount**	**Returns & Allowances**	**Purchase Discount**	**Net Remittance**
4632	6/30/2010	$1250.00	$150.00	$22.00	$1078.00
4636	7/5/2010	675.00	0.00	13.50	661.50
Voucher Totals:		$1925.00	$150.00	$35.50	$1739.50

FIGURE 11-7 Example of disbursement voucher (items in boldface are preprinted).

paid, and stores it in the paid-invoice file. Under a *voucher* system, the employee prepares a *disbursement voucher* that identifies the specific vendor, lists the outstanding invoices, specifies the general ledger accounts to be debited, and shows the net amount to pay the vendor after deducting any returns and allowances as well as any purchase discount. Figure 11-7 illustrates a disbursement voucher.

As Figure 11-7 discloses, the disbursement voucher summarizes the information contained within a set of vendor invoices. When the company receives an invoice from a vendor for the purchase of inventory, an employee compares it to the information contained in copies of the *purchase order* and *receiving report* to determine the accuracy and validity of the invoice. An employee should also check the vendor invoice for mathematical accuracy. When the organization purchases supplies or services that do not normally involve purchase order and receiving report source documents, the appropriate supervisor approves the invoice.

A voucher system has two advantages over a non-voucher system: (1) it reduces the number of cash disbursement checks that are written, because several invoices to the same vendor can be included on one disbursement voucher, and (2) the disbursement voucher is an internally-generated document. Thus, each voucher can be pre-numbered to simplify the tracking of all payables, thereby contributing to an effective audit trail over cash disbursements.

Cash Receipts Deposited Intact. It is equally important to safeguard cash receipts. As an effective control procedure, an organization should *deposit intact* each day's accumulation of cash receipts at a bank. In the typical retail organization, the total cash receipts for any specific working day come from two major sources: checks arriving by mail from credit-sales customers and currency and checks received from retail cash sales.

Because cash receipts are deposited intact each day, employees cannot use any of these cash inflows to make cash disbursements. Organizations use a separate checking account for cash disbursements. When organizations ‘‘deposit intact’’ the cash receipts, they can easily trace the audit trail of cash inflows to the bank deposit slip and the monthly bank statement. On the other hand, if employees use some of the day’s receipts for cash disbursements, the audit trail for cash becomes quite confusing, thereby increasing the risk of undetected errors and irregularities.

Internal Reviews of Controls

As a result of the Sarbanes-Oxley Act (often referred to as SOX), the internal audit function of an organization typically reports directly to the Audit Committee of the Board of Directors. This makes the internal audit department independent of the other corporate subsystems and enhances objectivity when reviewing the operations of each subsystem. The internal audit staff makes periodic reviews, called **operational audits**, of each department (or subsystem) within its organization. These audits focus on evaluating the efficiency and effectiveness of operations within a particular department. Upon completion of such an audit, the internal auditors make recommendations to management for improving the department’s operations.

A company’s internal auditors may also be asked to perform a *fraud investigation* if managers suspect fraud within the organization. However, such an investigation requires specialized forensic accounting skills. If the audit department personnel do not have the requisite experience or skill to do such an investigation, the firm’s external auditors may be able to help. In addition, internal auditors might need specialized information technology (IT) skills for their work, because they are often involved in IT auditing, which we discuss in Chapter 14.

In performing regular reviews of their company’s internal control system, the internal auditors may find that certain controls are not operating properly. For example, the corporate policy manual might state that separate individuals should receive and record customer payments. However, that does not guarantee that this is what actually happens. If practice is not according to policy, it is the internal auditor’s job to identify such problems and to inform management.

EVALUATING CONTROLS

Once controls are in place, it is a wise practice for management to evaluate them. We introduced several frameworks at the beginning of this chapter that companies might use to evaluate their internal controls, but regardless of *how* management chooses to evaluate their internal controls, it is clear that they *must* do this. Based on requirements contained in SOX, the New York Stock Exchange (NYSE) adopted rules that require all companies listed on this exchange to maintain an internal audit function to provide management and the audit committee ongoing assessments of the company’s risk management processes and system of internal control.

Requirements of Sarbanes-Oxley Act

As previously discussed, the Sarbanes-Oxley Act of 2002 significantly changed the way internal auditors and management view internal controls within an organization. In particular, Section 404 contains very specific actions that the management of a publicly-traded company must perform each year with respect to the system of internal controls within the organization. Specifically, the annual financial report of the company must include a report on the firm's internal controls. This report must include the following:

- A statement that management acknowledges its responsibility for establishing and maintaining an adequate internal control structure and procedures for financial reporting.
- An assessment, as of the end of the fiscal year, of the effectiveness of the internal control structure and procedures for financial reporting.
- An attestation by the company's auditor that the assessment made by the management is accurate.

A number of experts believe that some interesting synergies may have happened as a result of companies becoming SOX compliant. Recall that the purpose of SOX was to improve transparency and accountability in business processes and financial accounting. For this to happen, internal auditors and the management of companies had to study their processes very carefully. However, if these same firms already implemented an ERP, then most likely they already have reengineered some of their business processes to fit the ERP. During the evaluation of those processes, it is likely that the appropriate internal controls were considered and included, enabling SOX compliance. In addition, for management to comprehensively consider the requirements of SOX, they most likely used the Enterprise Risk Management framework in the 2004 COSO Report.

Illustrations of Cost-Benefit Analyses

Companies develop their own optimal internal control package by applying the cost-benefit concept. Under this concept, employees perform a cost-benefit analysis on each control procedure considered for implementation that compares the expected cost of designing, implementing, and operating each control to the control's expected benefits. Only those controls whose benefits are expected to be greater than, or at least equal to, the expected costs are implemented.

To illustrate a cost-benefit analysis, let's assume that the West End Boutique sells fashionable high-end ladies' clothing, jewelry, and other accessories. The owner is concerned about how much inventory customers have shoplifted during the last several months, and is considering some additional controls to minimize this shoplifting problem. If no additional controls are implemented, the company's accountant estimates that the total annual loss to the boutique from shoplifting will be approximately $120,000. The company is considering two alternative control procedures to safeguard the company's inventory (Figure 11-8).

Based on the owner's goal of reducing shoplifting, Alternative #1 (hiring six security guards) is the ideal control procedure to implement. Shoplifting should be practically zero, assuming that the guards are properly trained and perform their jobs in an effective manner. Even if shoplifting is completely eliminated, however, Alternative #1 should not be implemented. Why not? It costs too much. The control's expected cost ($240,000 a year) is greater than the control's expected benefit ($120,000 a year, which is the approximate annual shoplifting loss that would be eliminated).

Alternative #1

Hire six plain-clothed security guards to patrol the boutique. Based on the annual salaries that would have to be paid to the security guards, this control would cost West End Boutique an estimated $240,000 a year.

Alternative #2

Hire two plain-clothed security guards who would patrol the aisles, and install several cameras and mirrors throughout the company's premises to permit managers to observe any shoplifters. The estimated annual cost of this control would be $80,000.

FIGURE 11-8 Internal control alternatives for West End Boutique.

If the owner implements Alternative #2 (hiring two security guards plus installing cameras and mirrors), the boutique's accountant estimates that the total annual loss from shoplifting could be reduced from $120,000 to $25,000. The net benefit is $95,000 (=$120,000—$25,000). Because the second alternative's expected benefit ($95,000 a year reduction of shoplifting) exceeds its expected cost ($80,000 a year), the boutique's owner should select Alternative #2.

The point of this cost-benefit analysis example is that in some situations, the design and implementation of an *ideal control procedure* may be impractical. We are using the term **ideal control** to mean a control procedure that reduces to practically zero the risk of an undetected error (such as debiting the wrong account for the purchase of office supplies) or irregularity (such as shoplifting). If a specific control's expected cost exceeds its expected benefit, as was true with the Alternative #1 control procedure discussed above, the effect of implementing that control is a decrease in operating efficiency for the company. From a cost-benefit viewpoint, therefore, managers are sometimes forced to design and implement control procedures for specific areas of their company that are less than ideal. These managers must learn to live with the fact that, for example, some irregularities may occur in their organizational system that will not be detected by the internal control system.

Another approach to cost-benefit analysis attempts to quantify the risk factor associated with a specific area of a company. *Risk assessment*, as discussed earlier, is an important component of an internal control system. In general, the benefits of additional control procedures result from reducing potential losses. A measure of loss should include both the *exposure* (that is, the amount of potential loss associated with a control problem) and the *risk* (that is, the probability that the control problem will occur). An example of a loss measure is **expected loss**, computed as follows:

$$\text{expected loss} = \text{risk} \times \text{exposure}$$

The expected loss is based on estimates of risk and exposure. To determine the cost-effectiveness of a new control procedure, management estimates the expected loss both with and without the new procedure. On completing these calculations, the estimated benefit of the new control procedure is equal to the reduction in the estimated expected loss from implementing this procedure. Employees compare the estimated benefit to the incremental cost of the new control procedure. Whenever the estimated benefit exceeds this incremental cost, the company should implement the newly designed control procedure.

	Without Control Procedure	With Control Procedure	Net Expected Difference
Cost of payroll reprocessing	$10,000	$10,000	
Risk of data errors	15%	1%	
Reprocessing cost expected ($10,000 × risk)	$ 1,500	$ 100	$1,400
Cost of validation control procedure (an incremental cost)	$ 0	$ 600	$ (600)
Net estimated benefit from validation control procedure			$ 800

FIGURE 11-9 Cost-benefit analysis of payroll validation control procedure.

To demonstrate this method of cost-benefit analysis, assume that a company's payroll system prepares 12,000 checks biweekly. Data errors sometimes occur that require reprocessing the entire payroll at a projected cost of $10,000. The company's management is considering the addition of a data validation control procedure that reduces the error rate from 15% to 1%. This validation control procedure is expected to cost $600 per pay period. Should the data validation control procedure be implemented? Figure 11-9 illustrates the analysis to answer this question.

Figure 11-9 indicates that the reprocessing cost expected (=expected loss) is $1,500 without the validation control procedure and $100 with the validation control procedure. Thus, implementing this control procedure provides an estimated reprocessing cost reduction of $1,400. Because the $1,400 estimated cost reduction is greater than the $600 estimated cost of the control, the company should implement the procedure: the net estimated benefit is $800.

A Risk Matrix

Cost-benefit analyses suffer from at least three problems. One is that not all cost considerations can be expressed easily in monetary terms, and that *nonmonetary* (or *qualitative*) items are often as important in evaluating decision alternatives in a cost-benefit analysis. For example, when an airport contemplates whether or not to install a control that might save lives, it might be difficult to quantify the benefits. Admittedly, this is an extreme example, but the point remains: often qualitative factors exist in a decision-making situation, which requires a degree of subjectivity in the cost-benefit analyses.

Another problem with cost-benefit analyses is that some managers are not comfortable with computations involving probabilities or averages. What does it mean, for example, to state that on average 2.5 laptops are lost or stolen each year? Finally, a third problem with cost-benefit analyses is that they require an evaluation of all possible risks, and a case-by-case computation of possible safeguards. Typically, companies will run out of money for controls long before they run out of risks to mitigate.

A possible solution to this third problem is to develop a **risk matrix**, such as the one in Figure 11-10—a tool especially useful for prioritizing large risks. As you can see, a risk matrix classifies each potential risk by mitigation cost and also by likelihood of occurrence. As a result, highly-likely, costly events wind up in the upper-right corner of the matrix, and events with small likelihoods of occurrence or negligible costs wind up in the lower left corner. This helps managers see which events are most important (the upper-right ones), and therefore how to better prioritize the money spent on internal controls.

Likelihood of Occurrence	Cost to Organization: Negligible	Marginal	Critical	Catastrophic
Certain	Busy Street			
Likely		Hit by car		
Possible			Hit by piano	
Unlikely			Burst Dam	
Rare	Locust Swarm			Stampede

FIGURE 11-10 Example of a risk matrix.

AIS AT WORK
Using the Company Credit Card as a Nest Egg?[19]

Laura Jones, 22-years old, was very excited! She just got hired at a regional home improvement company as the executive assistant to the president. The company was eagerly planning an aggressive expansion of operations and was looking for ambitious and eager employees willing to work hard as team players. To realize growth, the president of the company knew they had to be very active in the industry, so the company sponsored booths at trade shows, attended industry conferences, and had morale-building events for its sales team in exciting places such as Hawaii.

Jones' responsibilities included making all the arrangements for these activities. She made hotel and airline reservations and coordinated activities for the sales team. She was also responsible for reviewing the corporate credit card bills and authorizing payments. The president gave her the authority to approve amounts up to $100,000. However, when Jones realized that no one ever asked to look at the charges on the corporate credit card bill, she began making personal purchases with the card. If total charges exceeded $100,000, she simply forged the president's signature on the approval form. When she learned that the accounts payable department accepted approvals from the president by email, she would slip into the president's office when he was at a meeting or out of town, access his computer, and send herself an ''approval'' email.

But the temptation was so great that she began to find additional ways the company could pay for things she wanted. For example, she soon discovered that she could also purchase gift checks with the corporate credit card, and over a two year period she bought more than $150,000 in gift checks to buy items for herself, her family, and some friends.

When Jones had been with the firm for slightly less than three years, her scheme was discovered. An agent at the credit card company noticed some questionable transactions involving Jones and the corporate credit card. When the internal auditors investigated the transactions, they discovered that Jones had embezzled more than $1.5 million.

[19]Source: Paul Sutphen, ''Stealing Funds for a Nest Egg,'' *Internal Auditor*, (August 2008), pp. 87–91.

SUMMARY

- An organization's internal control system has four objectives: (1) to safeguard assets, (2) to check the accuracy and reliability of accounting data, (3) to promote operational efficiency, and (4) to encourage adherence to prescribed managerial policies.
- It is management's responsibility to develop an internal control system.
- The control environment, risk assessment, control activities, information and communication, and monitoring are the five interrelated components that make up an internal control system.
- Six control activities to include in each organization's internal control system are: (1) a good audit trail, (2) sound personnel policies and practices, (3) separation of duties, (4) physical protection of assets, (5) internal reviews of controls by internal audit subsystem, and (6) timely performance reports.
- Within these six activities, specific control procedures should be designed and implemented for each company based on its particular control needs.
- To develop an optimal internal control package, management should perform a cost-benefit analysis on each potential control procedure.
- A company should only implement those controls whose expected benefits exceed, or at least equal, their expected costs.

KEY TERMS YOU SHOULD KNOW

audit trail
control activities
control environment
COBIT
corporate governance
corrective controls
COSO Report, 1992
COSO Report, 2004
demand draft
detective controls
enterprise risk management (ERM)
event identification
expected loss
fidelity bond
ideal control
internal control
objective setting
operational audits
preventive controls
risk assessment
risk matrix
risk response
SAS No. 94
scenario planning
separation of duties
SOX, Section 404
Val IT

TEST YOURSELF

Q11-1. This term describes the policies, plans, and procedures implemented by a firm to protect the assets of the organization.

a. Internal control
b. SAS No. 94
c. Risk assessment
d. Monitoring

Q11-2. Which of the following is not one of the four objectives of an internal control system?

a. Safeguard assets

b. Promote firm profitability

c. Promote operational efficiency

d. Encourage employees to follow managerial policies

Q11-3. Section 404 affirms that management is responsible for establishing and maintaining an adequate internal control structure. This Section may be found in which of the following?

a. The 1992 COSO Report

b. The 2004 COSO Report

c. The Sarbanes-Oxley Act of 2002

d. COBIT

Q11-4. Which of the following would a manager most likely use to organize and evaluate corporate governance structure?

a. The 1992 COSO Report

b. The 2004 COSO Report

c. The Sarbanes-Oxley Act of 2002

d. COBIT

Q11-5. Which of the following would a manager most likely use for risk assessment across the organization?

a. The 1992 COSO Report

b. The 2004 COSO Report

c. The Sarbanes-Oxley Act of 2002

d. COBIT

Q11-6. An internal control system should consist of five components. Which of the following is not one of those five components?

a. The control environment

b. Risk assessment

c. Monitoring

d. Performance evaluation

Q11-7. COSO recommends that firms ______ to determine whether they should implement a specific control.

a. Use cost-benefit analysis

b. Conduct a risk assessment

c. Consult with the internal auditors

d. Identify objectives

Q11-8. Which of the following is not one of the three additional components that was added in the 2004 COSO Report?

a. Objective setting

b. Risk assessment

c. Event identification

d. Risk response

Q11-9. Separation of duties is an important control activity. If possible, managers should assign which of the following three functions to different employees?

a. Analysis, authorizing, transactions

b. Custody, monitoring, detecting

c. Recording, authorizing, custody

d. Analysis, recording, transactions

DISCUSSION QUESTIONS

11-1. What are the primary provisions of the 1992 COSO Report? The 2004 COSO Report?

11-2. What are the primary provisions of COBIT?

11-3. Why are the COSO and COBIT frameworks so important?

11-4. Briefly discuss the interrelated components that should exist within an internal control system. In your opinion, which component is the most important and why?

11-5. Why are accountants so concerned about their organization having an efficient and effective internal control system?

11-6. Discuss what you consider to be the major differences between preventive, detective, and corrective control procedures. Give two examples of each type of control.

11-7. Why are competent employees important to an organization's internal control system?

11-8. How can separation of duties reduce the risk of undetected errors and irregularities?

11-9. Discuss some of the advantages to an organization from using a voucher system and pre-numbered checks for its cash disbursement transactions.

11-10. What role does cost-benefit analysis play in an organization's internal control system?

11-11. Why is it important for managers to evaluate internal controls?

PROBLEMS

11-12. You have been hired by the management of Alden, Inc. to review its control procedures for the purchase, receipt, storage, and issuance of raw materials. You prepared the following comments, which describe Alden's procedures.

- Raw materials, which consist mainly of high-cost electronic components, are kept in a locked storeroom. Storeroom personnel include a supervisor and four clerks. All are well trained, competent, and adequately bonded. Raw materials are removed from the storeroom only upon written or oral authorization from one of the production foremen.
- There are no perpetual inventory records; hence, the storeroom clerks do not keep records of goods received or issued. To compensate for the lack of perpetual records, a physical inventory count is taken monthly by the storeroom clerks, who are well supervised. Appropriate procedures are followed in making the inventory count.
- After the physical count, the storeroom supervisor matches quantities counted against a predetermined reorder level. If the count for a given part is below the reorder level, the supervisor enters the part number on a materials requisition list and sends this list to the accounts payable clerk. The accounts payable clerk prepares a purchase order for a predetermined reorder quantity for each part and mails the purchase order to the vendor from whom the part was last purchased.
- When ordered materials arrive at Alden, they are received by the storeroom clerks. The clerks count the merchandise and see that the counts agree with the shipper's bill of lading. All vendors' bills of lading are initialed, dated, and filed in the storeroom to serve as receiving reports.

a. List the internal control weaknesses in Alden's procedures.

b. For each weakness that you identified, recommend an improvement(s).

11-13. Listed below are 12 internal control procedures or requirements for the expenditure cycle (purchasing, payroll, accounts payable, and cash disbursements) of a manufacturing enterprise.

For each of the following, identify the error or misstatement that would be prevented or detected by its use.

a. Duties segregated between the cash payments and cash receipts functions

b. Signature plates kept under lock and key

c. The accounting department matches invoices to receiving reports or special authorizations before payment

d. All checks mailed by someone other than the person preparing the payment voucher

e. The accounting department matches invoices to copies of purchase orders

f. Keep the blank stock of checks under lock and key

g. Use imprest accounts for payroll

h. Bank reconciliations performed by someone other than the one who writes checks and handles cash

i. Use a check protector

j. Periodically conduct surprise counts of cash funds

k. Orders placed with approved vendors only

l. All purchases made by the purchasing department

11-14. Rogers, North, & Housour, LLC is a large, regional CPA firm. There are 74 employees at their Glen Allen, SC office. The administrative assistant at this office approached Mr. Rogers, one of the partners, to express her concerns about the inventory of miscellaneous supplies (e.g., pens, pencils, paper, floppy disks, and envelopes) that this office maintains for its clerical workers. The firm stores these supplies on shelves at the back of the office facility, easily accessible to all company employees.

The administrative assistant, Sandra Collins, is concerned about the poor internal control over these office supplies. She estimates that the firm loses about $350/month due to theft of supplies by company employees. To reduce this monthly loss, Sandra recommends a separate room to store these supplies, and that a company employee be given full-time responsibility for supervising the issuance of the supplies to those employees with a properly approved requisition. By implementing these controls, Sandra believes this change might reduce the loss of supplies from employee misappropriation to practically zero.

a. If you were Mr. Rogers, would you accept or reject Sandra's control recommendations? Explain why or why not.

b. Identify additional control procedures that the firm might implement to reduce the monthly loss from theft of office supplies.

11-15. Ron Mitchell is currently working his first day as a ticket seller and cashier at the First Run Movie Theater. When a customer walks up to the ticket booth, Ron collects the required admission charge and issues the movie patron a ticket. To be admitted into the theater, the customer then presents his or her ticket to the theater manager, who is stationed at the entrance. The manager tears the ticket in half, keeping one half for himself and giving the other half to the customer.

While Ron was sitting in the ticket booth waiting for additional customers, he had a ''brilliant'' idea for stealing some of the cash from ticket sales. He reasoned that if he merely pocketed some of the cash collections from the sale of tickets, no one would ever know. Because approximately 300 customers attend each performance, Ron believed that it would be difficult for the theater manager to keep a running count of the actual customers entering the theater. To further support his reasoning, Ron noticed that the manager often has lengthy conversations with patrons at the door and appears to make no attempt to count the actual number of people going into the movie house.

a. Will Ron Mitchell be able to steal cash receipts from the First Run Movie Theater with his method and not be caught? Explain.

b. If you believe he will be caught, explain how his stealing activity will be discovered.

11-16. The Palmer Company manufactures various types of clothing products for women. To accumulate the costs of manufacturing these products, the company's accountants have established a computerized cost accounting system. Every Monday morning, the prior week's production cost data are batched together and processed. One of the outputs of this processing function is a production cost report for management that compares actual production costs to standard production costs, and computes variances from standard. Management focuses on the significant variances as the basis for analyzing production performance.

Errors sometimes occur in processing a week's production cost data. The cost of the reprocessing work on a week's production cost data is estimated to average about $12,000. The company's management is currently considering the addition of a data validation control procedure within its cost accounting system that is estimated to reduce the risk of the data errors from 16% to 2%, and this procedure is projected to cost $800/week.

a. Using these data, perform a cost-benefit analysis of the data validation control procedure that management is considering for its cost accounting system.

b. Based on your analysis, make a recommendation to management regarding the data validation control procedure.

CASE ANALYSES

11-17. Gayton Menswear (Risk Assessment and Control Procedures)

The Gayton Menswear company was founded by Fred Williams in 1986 and has grown steadily over the years. Fred now has 17 stores located throughout the central and northern parts of the state. Because Fred was an accounting major in college and worked for a large regional CPA firm for 13 years prior to opening his first store, he places a lot of value on internal controls. Further, he has always insisted on a state-of-the art accounting system that connects all of his stores' financial transactions and reports.

Fred employs two internal auditors who monitor internal controls and also seek ways to improve operational effectiveness. As part of the monitoring process, the internal auditors take turns conducting periodic reviews of the accounting records. For instance, the company takes a physical inventory at all stores once each year and an internal auditor oversees the process. Chris Domangue, the most senior internal auditor, just completed a review of the accounting records and discovered several items of concern. These were:

- Physical inventory counts varied from inventory book amounts by more than 5% at two of the stores. In both cases, physical inventory was lower.
- Two of the stores seem to have an unusually high amount of sales returns for cash.
- In 10 of the stores gross profit has dropped significantly from the same time last year.
- At four of the stores, bank deposit slips did not match cash receipts.
- One of the stores had an unusual number of bounced checks. It appeared that the same employee was responsible for approving each of the bounced checks.
- In seven of the stores, the amount of petty cash on hand did not correspond to the amount in the petty cash account.

Requirement

1. For each of these concerns, identify a risk that may have created the problem.
2. Recommend an internal control procedure to prevent the problem in the future.

11-18. Cuts-n-Curves Athletic Club (Analyzing Internal Controls)

The Cuts-n-Curves Athletic Club is a state-wide chain of full-service fitness clubs that cater to the demographics of the state (about 60% of all adults are single). The clubs each have an indoor swimming pool, exercise equipment, a running track, tanning booths, and a smoothie café for after-workout refreshments. The Club in Rosemont is open seven days a week, from 6:00 a.m. to 10:00 p.m. Just inside the front doors is a reception desk where an employee greets patrons. Members must present their membership card to be scanned by the bar-code reader, and visitors pay a $16 daily fee.

When the employee at the desk collects cash for daily fees, he or she also has the visitor complete a waiver form. The employee then deposits the cash in a locked box and files the forms. At the end of each day the Club accountant collects the cash box, opens it, removes the cash, and counts it. The accountant then gives a receipt for the cash amount to the employee at the desk. The accountant takes the cash to the bank each evening. The next morning, the accountant makes an entry in the cash receipts journal for the amount indicated on the bank deposit slip.

Susan Richmond, the General Manager at the Rosemont Club, has some concerns about the internal controls over cash. However, she is concerned that the cost of additional controls may outweigh any benefits. She decides to ask the organization's outside auditor to review the internal control procedures and to make suggestions for improvement.

Requirements:

1. Assume that you are the outside (staff) auditor. Your manager asks you to identify any weaknesses in the existing internal control system over cash admission fees.
2. Recommend one improvement for each of the weaknesses you identified.

11-19. Emerson Department Store (Control Suggestions to Strengthen a Payroll System)

As a recently hired internal auditor for the Emerson Department Store (which has approximately 500 employees on its payroll), you are currently reviewing the store's procedures for preparing and distributing the weekly payroll. These procedures are as follows.

- Each Monday morning the managers of the various departments (e.g., the women's clothing department, the toy department, and the home appliances department) turn in their employees' time cards for the previous week to the accountant (Morris Smith).
- Morris then accumulates the total hours worked by each employee and submits this information to the store's computer center to process the weekly payroll.
- The computer center prepares a transaction tape of employees' hours worked and then processes this tape with the employees' payroll master tape file (containing such things as each employee's social security number, exemptions claimed, hourly wage rate, year-to-date gross wages, FICA taxes withheld, and union dues deducted).
- The computer prints out a payroll register indicating each employee's gross wages, deductions, and net pay for the payroll period.
- The payroll register is then turned over to Morris, who, with help from the secretaries, places the correct amount of currency in each employee's pay envelope.

- The pay envelopes are provided to the department managers for distribution to their employees on Monday afternoon.

To date, you have been unsuccessful in persuading the store's management to use checks rather than currency for paying the employees. Most managers that you have talked with argue that the employees prefer to receive cash in their weekly pay envelopes so that they do not have to bother going to the bank to cash their checks.

Requirements:

1. Assume that the store's management refuses to change its current system of paying the employees with cash. Identify some control procedures that could strengthen the store's current payroll preparation and distribution system.
2. Now assume that the store's management is willing to consider other options for paying employees. What alternatives would you suggest?

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ANSWERS TO TEST YOURSELF

1. **a** 2. **b** 3. **c** 4. **a** 5. **b** 6. **d** 7. **a** 8. **b** 9. **c**

Chapter 12

Computer Controls for Organizations and Accounting Information Systems

After reading this chapter, you will:

1. *Be familiar with* the term ''general computer control objectives'' and *understand* how these objectives are achieved.
2. *Be able* to identify general controls for an organization and understand why they are essential for corporate governance.
3. *Understand* general controls for information technology (IT) and why these should be considered when designing and implementing accounting information systems.
4. *Be familiar with* IT general security and control issues for wireless technology, networked systems, and personal computers.
5. *Understand* the value of the COBIT framework and the part this guidance can play in helping IT managers in an organization.
6. *Know* what input controls, processing controls, and output controls are, and *be familiar with* specific examples of control procedures for each of these categories of controls.

"One way organizations can manage security risks from insiders is to implement centralized and automated identity and access management (IAM) controls."

Georg Aldhizer, III, "The Insider Threat,"
Internal Auditor (April 2008), p. 71.

INTRODUCTION

This chapter continues the discussion of internal controls from Chapter 11 by focusing on specific security and control procedures that organizations use at three different levels. The highest level takes the perspective of "enterprise-wide," which encourages organizations to use resources efficiently. At the next level, we discuss general controls for information technology (IT) that the organization uses. As we know, IT is pervasive, as are the networks that may be used to access information—anytime, anywhere. One of the primary challenges associated with all this connectivity is security. How do we protect sensitive data and information that is stored or transferred from one device to another? The answer is that organizations must have the appropriate security and control procedures in place. Although no organization can be 100% confident that its assets are protected 24/7, the goal is to obtain a reasonable level of assurance.

Application controls are the third level of controls that we cover in this chapter. Because these controls are designed to protect transaction processing (i.e., to ensure complete and accurate processing of data), they are automatically performed by the information system. We discuss the various categories of application controls near the end of the chapter.

GENERAL CONTROLS FOR ORGANIZATIONS

General controls begin with a **security policy**, a comprehensive plan that helps protect an enterprise from both internal and external threats. Figure 12-1 contains issues that organizations should consider when developing this policy.

In developing its security policies, an organization should also consider ISO 17799, the international information security standards that establish information security best practices.[1] This Standard includes ten primary sections: security policy, system access control, computer and operations management, system development and maintenance, physical and environmental security, compliance, personnel security, security organization, asset classification and control, and business continuity management. ISO certification is becoming an important consideration as more businesses maintain a web presence. The first step to becoming certified under ISO 17799 is to comply with the Standard, and one way to measure and manage compliance is to use a risk analysis tool such as the COSO enterprise risk management (ERM) framework that we discussed in Chapter 11.

[1]Source: http://iso-17799.com

Issue	Example/Explanation
Identify and evaluate assets	• What assets need to be protected?
Identify threats	• What are the sources of potential security problems? • Examples of **external threats** are viruses, worms, retaliation from former employees. • Examples of **internal threats** are misuse of assets by employees and embezzlement.
Assess risk	• Loss of data, privacy, legal liability, loss of customers, etc.
Assign responsibilities	• Choose a development team to help identify potential threats in all areas of the enterprise.
Establish security policies	• Outline security responsibilities, and who owns the specific systems and data. • Be sure to document these relative to computing and technology platforms.
Implement across the organization	• To ensure compliance; appoint individuals to monitor compliance; allot necessary funds.
Manage the security program	• Top-level management oversight is critical.

Source: enterprisesecurity-symantec.com, Article ID: 1128.

FIGURE 12-1 Issues that should be considered when developing a security policy.

Integrated Security for the Organization

A current trend in security practice is to merge **physical security** and **logical security** across an organization. Physical security refers to any measures that an organization uses to protect its facilities, resources, or its proprietary data that are stored on physical media. Logical security uses technology to limit access to the organization's systems and information to only authorized individuals. Figure 12-2 identifies a number of examples of physical security and logical security measures that firms commonly use. The IT Governance Institute published a document that is specifically targeted at this task, called *Information Security Governance: Guidance for Boards of Directors and Executive Management*, 2nd Edition (2006).

Physical Security	Logical Security
▪ facility monitoring (surveillance systems, cameras, guards, exterior lighting) ▪ access controls to facilities/data center/computers (biometrics, access cards) ▪ alarm systems (fire, burglar, water, humidity, power fluctuations) ▪ shred sensitive documents ▪ proper storage/disposal of hard drives and other electronic storage media ▪ secure storage of backup copies of data and master copies of critical software	▪ e-IDs and passwords ▪ system authentication ▪ biometrics ▪ logs of logon attempts ▪ application-level firewalls ▪ anti-virus and anti-spyware software ▪ intrusion detection systems ▪ encryption for data in transit ▪ smart cards

FIGURE 12-2 Examples of physical security and logical security measures.

Many firms now use an integrated approach to security by combining a number of logical and physical security technologies, including firewalls, intrusion detection systems, content filtering, vulnerability management, virus protection, and virtual private networks. An **integrated security** system, supported by a comprehensive security policy, can significantly reduce the risk of attack because it increases the costs and resources needed by an intruder. According to security experts, convergence (of physical and logical security) is the single most overlooked gap in enterprise-wide security—that is, the most insidious security risks are those that slip between physical and logical security systems.[2] Figure 12-3 and the following example illustrate this.

Case-in-Point 12.1 Assume Greg Smith is authorized to scrap inventory. He also has an access badge for the warehouse where the scrapped inventory is located and could enter the warehouse after hours. Although independently these actions are not particularly interesting,

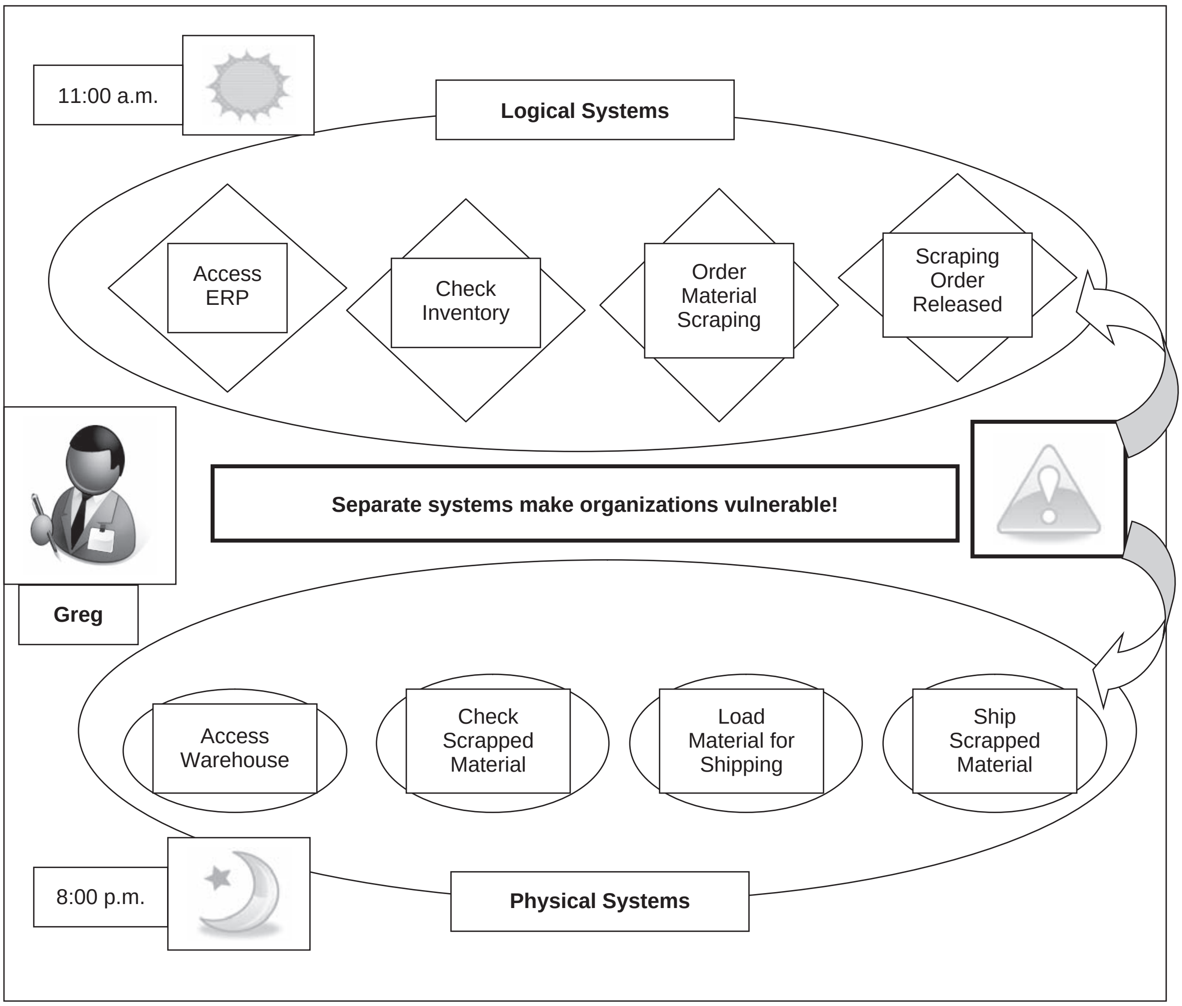

FIGURE 12-3 Diagram of the example in Case-in-Point 12-1.

[2]Source: http://www.alertenterprise.net/

when combined they create a wide variety of problems that could go unnoticed if the physical and logical security systems are not integrated, such as fraud, which could lead to misstated financial statements.

Organization-Level Controls

As we discussed in the previous chapter, management's philosophy, operating style, integrity, policies, and procedures are all important characteristics that influence the tone of a company. These characteristics help to establish the level of security and control consciousness in the organization, which is the basis for the **control environment**. Organization-level controls are particularly important because they often have a pervasive impact on many other controls, such as IT general controls and application-level controls.

In 2007, the Public Company Accounting Oversight Board (PCAOB) released Auditing Standard No. 5, ''An Audit of Internal Control over Financial Reporting that is Integrated with an Audit of Financial Statements.'' This Standard introduces a three-level framework describing entity-level controls at varying levels of precision (direct, monitoring, and indirect).[3] Certainly, if the external auditor must evaluate these controls, then management of the organization must also attend to these controls. We identified a number of these controls in Chapter 11: management's ethical values, philosophy, assignment of authority and responsibility, and the effectiveness of the board of directors. Additional controls that are also very important include the following:

- Consistent policies and procedures, such as formal codes of conduct and fraud-prevention policies. For example, a company may require all employees to periodically sign a formal code of conduct stipulating that computer resources are to be used only for appropriate business purposes, and any acts of fraud or abuse will be prosecuted.
- Management's risk assessment process.
- Centralized processing and controls.
- Controls to monitor results of operations.
- Controls to monitor other controls, including activities of the internal audit function, the audit committee, and self-assessment programs.
- The period-end financial reporting process.
- Board-approved policies that address significant business-control and risk-management practices.

In addition to these controls, management must have controls over the human resources and data resources of the firm. We examine five types of general controls for IT environments within the organization: (1) personnel policies; (2) file security controls; (3) business continuity planning; (4) computer facility controls; and (5) access to computer files.

Personnel Policies

An AIS depends heavily on people for creating the system, inputting data into the system, supervising data processing during computer operations, distributing processed data to

[3]Source: http://www.pcaobus.org/Rules/Docket_021/2007-05-24_Release_No_2007-005.pdf

authorized recipients, and using approved controls to ensure that these tasks are performed properly. General controls within IT environments that affect personnel include: separation of duties, use of computer accounts, and informal knowledge of employees.

Separation of Duties. Within IT environments, separation of duties should be designed and implemented by requiring *separate* accounting and IT subsystems or departments, and also by *separate* responsibilities within the IT environment.

Separate Accounting and Information Processing from Other Subsystems. An organization's accounting and information processing subsystems are support functions for the other organizational subsystems and should be independent, or separate, from the subsystems that *use* data (accumulated by the accounting function and processed by the information processing subsystem) and *perform* the various operational activities. To achieve this separation, the functional design identified in Figure 12-4 should exist within organizations.

Separate Responsibilities within IT Environment. Highly integrated AISs often combine procedures that used to be performed by separate individuals. Consequently, an individual who has unlimited access to the computer, its programs, and live data also has the opportunity to execute and subsequently conceal a fraud. To reduce this risk, a company should design and implement effective *separation of duties* control procedures. Figure 12-5 describes several functions within a company's IT environment where it is essential to divide the *authority* and *responsibility* for these two functions.

The design and implementation of effective separation-of-duties control procedures make it difficult for any one employee to commit a successful fraudulent activity. However, detecting fraud is even more challenging when two or more individuals *collude* to override separation-of-duties control procedures. A recent survey by the Association of Certified Fraud Examiners (ACFE) reports that over 36% of all fraud cases are committed by two or more individuals who work together to embezzle organizational assets. The median loss in these cases is $500,000, compared to a median loss of $115,000 in fraud cases that involve only one person.[4]

Case-in-Point 12.2 The former D.C. tax manager, Harriette Walters, was able to embezzle more than $48 million over two decades largely because the culture in the finance office in the District of Columbia was one of apathy and silence. As a result, Walters and 10 accomplices,

1. User subsystems initiate and authorize all systems changes and transactions.
2. Asset custody resides with designated operational subsystems.
3. Corrections for errors detected in processing data are entered on an error log, referred back to the specific user subsystem for correction, and subsequently followed up on by the *data control group* (discussed shortly).
4. Changes to existing systems as well as all new systems require a formal written authorization from the user subsystem.

FIGURE 12-4 Functional design to separate accounting and information processing subsystems from other subsystems.

[4]Source: 2008 ACFE Report to the Nation; http://www.acfe.com/documents/2008-rttn.pdf

Function	Explanation of Function/Division
Systems Analysis Function	• Analyze information; process needs; design/modify application programs. • The person performing this function should not perform other related functions. For example, do not allow a programmer for a bank to use actual data to test her program for processing loan payments (she could conceivably erase her own car loan balance).
Data Control Function	• **Use a data control group**; maintain registers of computer access codes; help acquire new accounting software (or upgrades); coordinate security controls with specific computer personnel (e.g., database administrator); reconcile input/output; distribute output to authorized users. • Should be independent of computer operations. This function inhibits unauthorized access to computer facility and contributes to more efficient data processing operations.
Programming Function	• Require formal authorizations for program changes; submit written description of changes to a supervising manager for approval; test changes to programs prior to implementation.
Computer Operations Function	• Rotate computer operators among jobs to avoid any single operator always overseeing the same application. • Do not give computer operators access to program documentation or logic. • Two operators in the computer room during processing of data; maintain a processing log and periodically review for evidence of irregularities. • Without these control procedures a computer operator could alter a program (e.g., to increase his salary).
Transaction Authorization Function	• For each batch of input data, user subsystems submit signed form to verify input data are authorized and proper batch control totals are compiled. • Data control group personnel verify signatures and batch control totals before processing data. • These procedures help prevent errors (e.g., a payroll clerk cannot submit unauthorized form to increase pay rate).
AIS Library Function	• Maintain custody of files, databases, and computer programs in separate storage area called the AIS library. • Limit access to files, databases, and programs for usage purposes to authorized operators at scheduled times or with user authorization; maintain records of all usage. • The librarian does not have computer access privileges. (Regularly, data control group personnel review records for evidence of unauthorized computer access.)

FIGURE 12-5 Divide certain authority and responsibility functions within an IT environment.

who did not work for the city, pleaded guilty to creating and laundering bogus tax refund checks. The embezzlement scheme is the largest involving a city or state government.[5]

Use of Computer Accounts. Most computer networks maintain a system of separate *computer accounts*. Each user has an account and each account has a unique password. When the user logs onto the computer, the system checks the password against a master list of accounts. Only users with current passwords can access computer resources. Some organizations also use account numbers to allocate computer charges to departments. This control procedure is important to protect scarce computer resources from unauthorized use.

[5]Source: D. Nakamura and H. Harris, ''Report on Embezzlement Blames 'Culture of Apathy and Silence',''
washingtonpost.com (December 16, 2008), p. B04

Although passwords have been the most used security method to grant users access, IT administrators have a variety of problems with them. Individuals paste their passwords on their monitors, share them with others, or choose simple passwords that are relatively easy for a hacker to guess. As a result, many firms now use **biometric** identification instead (see Chapter 2).

Informal Knowledge of Employees. The 2008 ACFE survey notes that employees who are defrauding their organizations often display certain behaviors (**red flags**) that can alert co-workers and supervisors to trouble. Examples include lavish spending or becoming very irritable or secretive. In particular, the survey results indicate that in over 38% of the cases of fraud the fraudsters were living beyond their means, 34% had financial difficulties, 20% had ''wheeler-dealer'' attitudes, 19% were unwilling to share duties (control issues), and 17% had family problems or were in the middle of a divorce. Sadly, the survey results indicate that the highest percentage of fraud involved employees in the accounting department (29% of all cases reported by survey participants).

Although it might be difficult for co-workers or supervisors to know intimate details of co-workers personal lives, some of these behaviors may be observed without directly confronting the ''suspicious'' co-worker. The threats to an organization by its own employees should never be underestimated. To add emphasis to the need to be alert, PWC's Global State of Information Security Study estimated that people inside organizations were the culprits in 69% of database breaches, and new technologies (e.g., ERPs, B2B processes, mobile devices) make organizational data even more vulnerable to potential misappropriation.[6] Accordingly, it is essential for organizations to safeguard computer files in an AIS from both intentional and unintentional errors. Figure 12-6 describes several reasons for these safeguards.

1. The computer files are not human-readable. Controls must be installed to ensure that these files *can* be read when necessary.
2. The typical computer file contains a vast amount of data. In general, it is not possible to reconstruct such files from the memories of employees.
3. The data contained on computer files are in a very compact format. The destruction of as little as one inch of recording medium means the loss of thousands of characters of data.
4. The data stored on computer files are permanent only to the extent that tiny bits have been recorded on the recording tracks. Power disruptions, power surges, and even accidentally dropping a disk pack, for example, may cause damage.
5. The data stored on computer files may be confidential. Information such as advertising plans, competitive bidding plans, payroll figures, and innovative software programs must be protected from unwarranted use.
6. The reconstruction of file data is costly no matter how extensive a company's recovery procedures. It is usually more cost-effective to protect against file abuse than to depend on backup procedures for file protection.
7. File information itself should be considered an asset of a company. As such, it deserves the same protection accorded other organizational assets.

FIGURE 12-6 Reasons for safeguarding computer files from both accidental and intentional errors.

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[6]Source: James Roth & Donald Espersen. ''The Insider Threat,'' *Internal Auditor* (April 2008), pp. 71–73.

File Security Controls

The purpose of file security controls is to protect computer files from either accidental or intentional abuse. For example, this requires control procedures to make sure that computer programs use the correct files for data processing. Control procedures are also needed for the purpose of creating backup copies of critical files in the event that original copies of a file are lost, stolen, damaged, or vandalized. Figure 12-7 provides examples of file security control procedures to verify that the correct file is being updated and to prevent accidental destruction of files.

Business Continuity Planning

Organizations develop and test business continuity plans to be reasonably sure that they will be able to operate in spite of any interruptions, such as power failures, IT system crashes, natural disasters, supply chain problems, and others. Although the distinction between business continuity plans and disaster recovery is not always obvious, they are different. **Business continuity planning** is a more comprehensive approach to making sure organizational activities continue normally, whereas **disaster recovery** is the process and procedures that organizations follow to resume business after a disruptive event such as an earthquake, a terrorist attack, or a serious computer virus. In this section, we discuss disaster recovery controls, controls to ensure fault-tolerant systems, and controls to back up data.

Disaster Recovery. Examples of natural disasters include such events as fires, floods, hurricanes, and earthquakes, as well as man-made catastrophes (such as terrorist attacks). An organization's disaster recovery plan describes the procedures to be followed in the event of an emergency, as well as the role of every member of the *disaster recovery team* (which is made up of specific company employees). The company's management should appoint one person to be in charge of disaster recovery and one person to be second-in-command.

An important part of any disaster recovery plan is the designation of a specific backup site(s) to use for alternate computer processing. These backup sites may be other locations

File Security Control	Purpose of File Security Control
External file labels	• Identify contents of a computer file and help prevent an individual from accidentally writing over a disk file.
Internal file labels	• Record name of a file, date file created, and other identifying data on the file medium that will be read and verified by the computer. • Internal file labels include *header labels* and *trailer labels*. ○ Header label is a file description at the beginning of a file. ○ Trailer label indicates end of a file and contains summary data on contents of file.
Lockout procedures	• Use to prevent two applications from updating the same record or data item at the same time.
Read-only file designation	• Use to earmark data on floppy disks so that data is available for reading only, data cannot be altered by users, nor can new data be stored on the file.

FIGURE 12-7 Examples of file security control procedures.

owned by the company, such as another branch of the same bank, or a site that is owned by other organizations that can be used for short-term periods in the event of a disaster. It is a good idea for the various hardware locations for data processing to be some distance away from the original processing sites in case a disaster affects a regional location. An example would be companies located in flood zones.

Case-in-Point 12.3 USAA, a large insurance company in San Antonio, TX, engaged outside consultants to help determine where the company should locate an alternate data processing center for operations in the event of an emergency. The consulting firm suggested the company build a second data center in the area as a backup. After weighing the costs and benefits of such a project, USAA initially concluded that it would be more efficient to rent space on the East Coast. Ironically, USAA was set to sign the lease contract the week of September 11, 2001. Instead, USAA built a center in Texas, only 200 miles away from its offices—close enough to drive to, but far enough away to pull power from a different grid and water from a different source.[7]

Disaster recovery sites may be either hot sites or cold sites. A **hot site** has a computer system with capabilities similar to the system it will replace. A hot site that also includes up-to-date backup data is called a **flying-start site** because it can assume full data processing operations within a matter of seconds or minutes. A **cold site** is a location where power and environmentally controlled space are available to install processing equipment on short notice. If a disaster recovery plan designates a cold site, then arrangements are also necessary to obtain computer equipment matching the configuration of equipment lost in the disaster. In practice, the type of disaster recovery site used by a company should be determined by a cost-benefit analysis. Finally, simply preparing a disaster recovery plan does not provide assurance that the plan will work when needed. It is also important to periodically test the disaster recovery plan by simulating a disaster, thereby uncovering weaknesses in the plan as well as preparing employees for such emergencies.

Copies of a disaster recovery plan will not be of much use if they are located only in computer systems that are destroyed by a disaster. For this reason, members of a company's disaster recovery team should each keep current copies of the plan at their homes. Finally, in addition to periodic testing, a disaster recovery plan should be reviewed on a *continuous* basis and revised when necessary. This process is an integral part of business continuity planning.

Case-in-Point 12.4 The Deloitte & Touche 2005 Business Continuity Survey was designed to measure the business continuity management (BCM) program initiatives in both the public and private sectors. BCM programs are being elevated and extended to the enterprise level as executives become more involved in BCM governance, most likely due to their overall accountability for risk management. Further, 70% of all respondents reported that most or all functions of their organization have a developed and documented business continuity plan; almost one third of the respondents reported that their organization budgeted over $1 million annually for BCM[8]

Fault tolerant systems. Organizations use **fault-tolerant systems** to deal with computer errors and keep functioning so that data is accurate and complete. Fault-tolerant systems are often based on the concept of *redundancy*. Computer systems can be made

[7]Source: http://www.csoonline.com/article/print/204450.
[8]Source: http://www.deloitte.com/dtt/cda/doc/content/us_assur_2005%20BCM%20SURVEY%20REPORT.pdf.

fault-tolerant with duplicate communication paths or processors. Two major approaches are as follows: (1) Systems with **consensus-based protocols** contain an odd number of processors; if one processor disagrees with the others, it is thereafter ignored. (2) Some systems use a second **watchdog processor**. If something happens to the first processor, the watchdog processor then takes over the processing work.

Disks can be made fault-tolerant through a process called **disk mirroring** (also known as **disk shadowing**). This process involves writing all data in parallel to two disks. Should one disk fail, the application program can automatically continue using the good disk. At the transaction level, a fault-tolerant system can use **rollback processing**, in which transactions are never written to disk until they are complete. Should there be a power failure or should another fault occur while a transaction is being written, the database program, at its first opportunity, automatically *rolls* itself back (reverts) to its pre-fault state.

Backup. Backup is similar to the redundancy concept in fault-tolerant systems. For example, if you write a research paper on a computer, you would be wise to back up your work on a flash drive. As we know, a variety of unfortunate events could occur and you might lose all of your work! If you used a computer in a lab on campus, you are probably aware of the fact that the hard drives are automatically ''cleaned'' every night, so your paper would not be on the hard drive of that computer the next day. And of course other events such as a power failure or human error might occur and—poof!—your paper is gone. However, if you copied your paper on a flash drive, you created *redundancy* so that a problem will not cause you to lose your work.

Because of the risk of losing data before, during, or after processing, organizations have an even greater need to establish backup procedures for their files. The backup and reconstruction procedure typically used under batch processing is called the grandfather-parent-child procedure. Very large organizations might store more than three such copies (i.e., great-grandfather, great-great-grandfather) and banks typically keep many more copies because of the nature of their business.

Three generations of reference data (i.e., previously processed data stored on master files) are retained with the transaction data used during the general ledger updating process. If the most recent master file, the ''child'' copy, is destroyed, the data are reconstructed by rerunning the pertinent transaction data against the prior copy of the reference data (the ''parent'' master file). Should a problem occur during this reconstruction run, there is still one more set of backup data (the ''grandfather'' master file) to reconstruct the parent. The ''parent'' master file is then used to reconstruct the ''child'' master file. Figure 12-8 depicts this procedure.

With the sophisticated real-time systems widely used today, online backups are common. A **hot backup** is a backup performed while the database is on-line and available for read/write, whereas a **cold backup** is performed while the database is off-line and unavailable to its users. During processing, the reference data (master file) are periodically copied on a backup medium. A copy of all transaction data is stored as a *transaction log* as these data are entered into the system. The backup copies are stored at a remote site, which allows data to be recovered in the event a disaster occurs. Through a process called **electronic vaulting**, the data on backup media can be electronically transmitted to a remote site. Should the master file be destroyed or damaged, computer operations will *roll back* to the most recent backup copy of the master file. Recovery is then achieved by reprocessing the contents of the data transaction log against this master file backup copy.

A good disaster recovery plan also includes backups for hardware. With regard to electrical power backup, surge protectors provide protection in the case of short, intermittent power shortages or failures. However, large data processing centers may

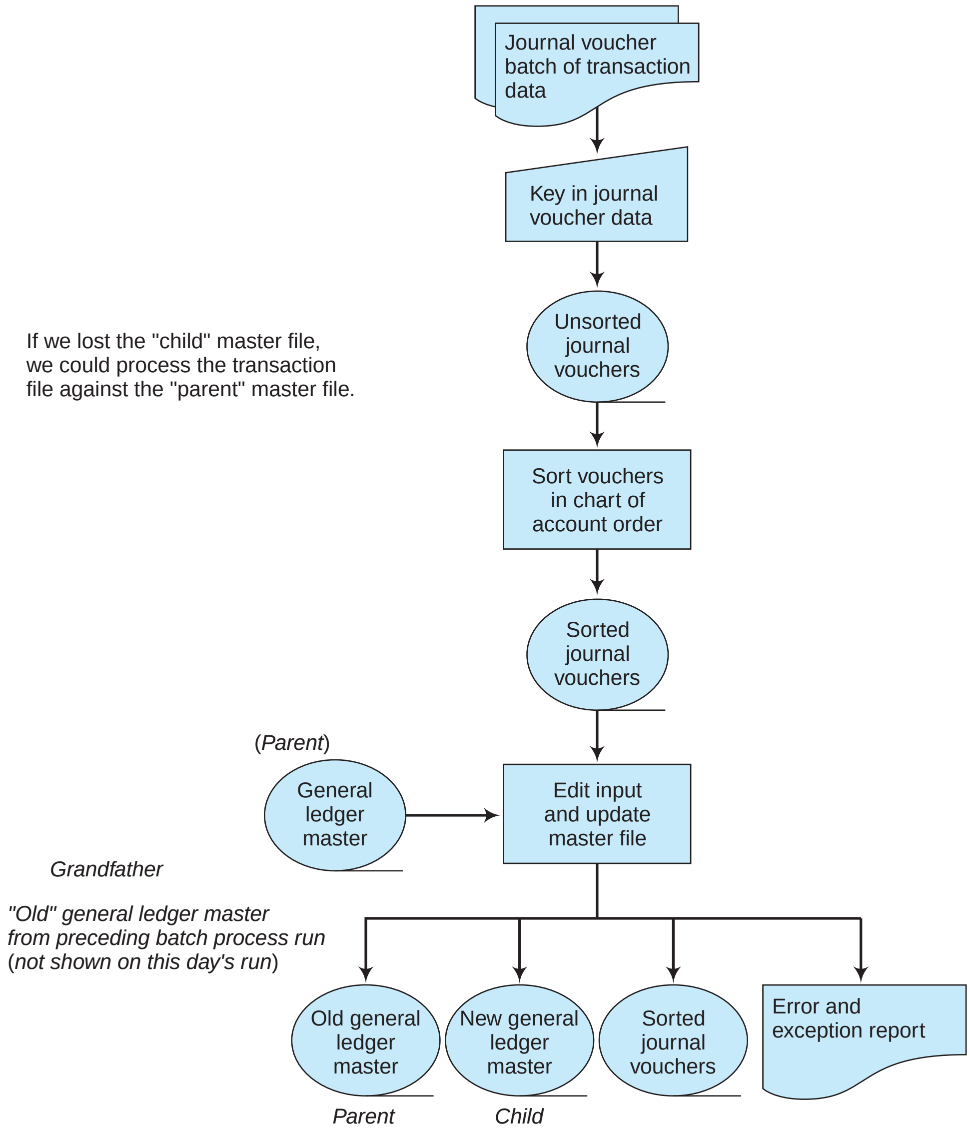

FIGURE 12-8 Grandfather-parent-child procedure under batch processing.

require additional generators for backup power. An **uninterruptible power system (UPS)** is an auxiliary power supply that can smooth the flow of power to the computer, thereby preventing the loss of data due to momentary surges or dips in power. Should a complete power failure occur, the UPS provides a backup power supply to keep the computer system functioning.

Computer Facility Controls

Computer security experts point out that a blunt hammer trumps a strong password every time. What this means is that the physical assets of the data processing center (such as the web servers, the peripheral devices, and the disk files of the computer library) must be protected. Here are some **computer facility controls** that prevent both unintentional and intentional physical harm.

Locate Data Processing Centers in Safe Places. Usually, organizations locate data processing centers where the public does not have access. Locations away from public scrutiny and guarded by personnel are obviously preferred, especially when the location has a secured entrance. The location of a data processing center should also take into consideration natural disasters. Although it is impossible to protect data processing centers completely from such hazards, advanced planning can minimize exposure to them. For example, companies can increase their protection from fires by locating computer facilities away from boiler rooms, heating furnaces, or fuel storage areas. Similarly, locating computer facilities on high ground or the upper stories of office buildings provides protection from floods. Finally, locating computer facilities in single-story buildings or in heavily reinforced ones can limit earthquake damage.

Limit Employee Access. Few people have reason to be inside a data processing center. Thus, another facility control is to limit access to those company personnel who wear *color-coded identification badges* with full-face pictures. Security badges typically have embedded magnetic, electronic, or optical codes that can be read only by special badge-reading devices. With advanced identification techniques, it is possible to have each employee's entry into and exit from the data processing center automatically recorded in a computer log, which should be periodically reviewed by supervisory personnel.

Another facility control is to place a guard at the entrance to the data processing center. A **man trap** is a small antechamber room between a public corridor and a controlled room. The inner door to the center is self-locking and can be ''buzzed'' open only by the control person, who permits only authorized personnel to enter. Finally, issuing keys to authorized personnel or using dial-lock combinations limits access to the data processing center. With regard to this last control, it is also a good idea to change locks or lock combinations often and to use keys that cannot easily be duplicated.

Buy Insurance. Although insurance is usually thought to be an important method of protection for computer systems, it is actually the protection of last resort. Insurance does not protect the purchaser from loss, it merely compensates for losses if they occur. Insurance policies for computer damages are usually limited in coverage which means that not all instances of loss may be recoverable by the policyholder. Furthermore, compensation usually is restricted to the actual losses suffered by a company. As you might imagine, a fair estimate of what these actual losses entail is not an easy matter. Of special difficulty is placing dollar values on a company's computer equipment that has long since lost any real market value, yet performs vital data processing services for the company.

Computer Access Controls

Regulating who is permitted logical access to computers and files is an important general control in terms of safeguarding sensitive organizational data and software. Remote terminals may be placed anywhere in the country and hooked up to a company's computer by means of ordinary telephone lines or Internet connection. As a result, it is difficult to safeguard logical computer access with direct physical surveillance of terminals. Most computer systems therefore use passwords to restrict access. Such codes vary in length and type of password information required, but all have the same intent: to limit logical access to the computer only to those individuals authorized to have it.

Organizations should encourage employees to create **strong passwords**. Each character that is added to a password increases the protection that it provides. Passwords should be 8 or more characters in length; 14 characters or longer is ideal. For instance, a 15-character password composed only of random letters and numbers is about 33,000 times stronger than an 8-character password composed of characters from the entire keyboard.[9] An ideal password combines both length and different types of symbols. The greater the variety of characters (letters, numbers, and symbols) that are included in a password, the harder it is to guess.

As we discussed earlier, passwords can be a problem because they can be lost, given away, or stolen. Thus, security can be increased significantly by using biometrics and/or integrated security measures. **Biometric identification** devices *identify* distinctive user physical characteristics such as voice patterns, fingerprints, facial patterns and features, retina prints, body odor, signature dynamics, and keyboarding methods (i.e., the way a user types certain groups of characters). When an individual wants to access a company's computer system, his or her biometric identifications are matched against those accumulated within the computer. A match must occur for the individual to be given access to the computer system.

GENERAL CONTROLS FOR INFORMATION TECHNOLOGY

The major objectives of an organization's IT controls are to provide reasonable assurance that (1) development of, and changes to, computer programs are authorized, tested, and approved before their usage, and (2) access to programs and data is granted only to authorized users to increase the likelihood that processed accounting data are accurate and complete. These **IT general controls** apply to all information systems. Accordingly, the controls at this level are critical for reliance on application controls. For example, if an employee is allowed to change a program, and that change was not properly authorized or tested, the reliability of company data may be jeopardized.

Firms design and implement cost-effective controls for computers and computer network systems to minimize known vulnerabilities to help protect the data and information contained in these systems. In the process of designing and implementing a system of computer controls for a company's accounting system, the consistency, speed, and flexibility of a computer raise a number of control concerns (see Figure 12-9).

Ironically, sensitive data can sometimes be compromised by the companies who hold the data, although that was not the intent at all, as is illustrated in the following case-in-point.

Case-in-Point 12.5 In violation of its own privacy policy, JetBlue gave about 5 million passenger records to Torch Concepts (a Defense Department contractor). The CEO for JetBlue said the decision to provide the data was a well-intentioned attempt to help the DoD in a national security matter. Subsequently, JetBlue hired Deloitte & Touche to review the airlines' privacy policy implementation. Unfortunately, the lack of controls over this data may cost the airline a lot of money because of class action suits that have been filed against the company for releasing private information.[10]

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[9]Source: http://www.microsoft.com/athome/security/privacy/password.mspx.

[10]A. Compart. ''JetBlue Rues the Day it Shared its PNR Data.'' *Travel Weekly*, September 29, 2003,Vol. 62, p. 69.

Control Concern	Explanation
Errors may be magnified	For example, a computer prepares sales invoices by taking the quantity input and multiplying this input by a price from the sales price master file. But, if the computer selects incorrect sales prices, all sales invoices will likely be incorrect.
Inadequate separation of duties	Due to decreased manual involvement within the accounting system
Audit trails	May be reduced, eliminated, or exist only for a brief time in computer-readable form
Unauthorized changes	By individuals who lack sufficient understanding of control procedures and accounting policies, or such changes made without adequate testing or without the consent of management
Greater access to data	Data are a critical organizational resource. When entities have online computer systems and computer networks, individuals can access data from various points where terminals and online PCs are located. Knowledgeable but unauthorized persons might access important files.
Characteristics of magnetic or optical media	Data are invisible. Data (except for read-only memory) are erasable; thus, valuable data may be lost. Data are stored in compressed form—a single magnetic disk can hold as much data as several file cabinets. A single CD-ROM has the storage capacity of 700 floppy disks, which is equivalent to approximately 300,000 pages of text. Thus, damage to a single disk can result in the loss of a large quantity of valuable accounting data.

FIGURE 12-9 The consistency, speed, and flexibility of computers raise control concerns.

The U.S. government also considers computer security a critical issue that should be addressed. In 2005, the National Institute of Standards and Technology (NIST) issued final guidelines on computer security controls for federal information systems. NIST believes that these security guidelines will play a key role in helping federal agencies effectively select and implement security controls and, by using a risk-based approach, do so in a cost-effective manner.[11] This document, which is mandatory for most federal systems, will probably influence controls for systems at all governmental levels, businesses, and other entities. Security controls (management, operational, and technical safeguards) are critical to protect the confidentiality, integrity, and availability of a computer system and its information.

Security for Wireless Technology

As we mentioned in Chapter 1, an important change in today's business environment is the desire for instantly connecting with one another and rapidly exchanging ideas and data. Wireless fidelity (Wi-Fi) technology is based on radio wave transmissions, which makes the transmitted information vulnerable to interception. As a result, organizations that rely on wireless technology must understand the vulnerabilities that exist and explore the various methods of compensating for this risk.

Probably one of the largest users of wireless technology is education. Worldwide, colleges and universities are installing wireless local area networks (WLANs) for a variety of

[11] Source: http://www.nist.gov/public_affairs/releases/computer_security.htm.

reasons: a technologically savvy and highly mobile audience (students and faculty); older, often historic buildings (which cannot be wired); as well as innovative curricula that make use of wireless applications. Probably the most important control for wireless technology is installing a virtual private network **(VPN)**, which is a security appliance that runs behind a university's (or a company's) firewall and allows remote users to access entity resources by using wireless, handheld devices.

Case-in-Point 12.6 The University of Michigan's network infrastructure connects more than 200 departmental LANs on three geographically dispersed campuses spanning 3177 acres and 538 major buildings. The University recently contracted with a firm that provides Wi-Fi security so that authorized users can easily access the University's network with whichever mobile device they choose (PDAs, laptops, digital mobile phones). This type of security is known as a virtual private network.[12]

The risk of unauthorized access to data through electronic eavesdropping is minimized by using **data encryption**. It can be used to prevent a company's competitors from electronically monitoring confidential data transmissions. Through an encryption technique, data are converted into a scrambled format prior to their transmission and converted back in a meaningful form once data transmission is finished. The encrypted data can be read only by a person with a matching decryption key. Data encryption is relatively inexpensive.

Case-in-Point 12.7 Lancaster, California is an example of a whole city that decided to adopt wireless communications technology. The initial installation included high-speed Internet access and has the capacity to transmit voice, data, and video over the same line simultaneously with exceptional speed. All of the transmissions are guarded by military grade security.[13]

Controls for Networks

When desktop computers became economically feasible, firms began placing them throughout the organization and linked them to a centralized computer to form a *distributed data processing (DDP) system*. The basic objective of each remote computer was to meet the specific processing needs of the remote location and communicate summary results to the centralized (host) computer.

DDP systems are still viable in today's business organizations. Large volumes of data are regularly transmitted over long-distance telecommunications technologies. As with wireless technology, the routine use of systems such as DDP and client/server computing increases the potential control problems for companies. These problems include unauthorized access to the computer system and its data through **electronic eavesdropping** (which allows computer users to observe transmissions intended for someone else), hardware or software malfunctions causing computer network system failures, and errors in data transmission. Managers use data encryption to protect information. For example, many companies are encrypting all of their email messages on Local Area Networks (LANs) and Wide Area Networks (WANs).

To reduce the risk of computer network system failures, companies design their network capacity to handle periods of peak transmission volume. Redundant components,

[12]Website: www.bluesocket.com and ''Interworks and Bluesocket Supply University of Michigan with Wireless Security,'' *Business Wire*, January 26, 2004.

[13]''City of Lancaster, California First to Install Revolutionary New Wireless Communications Technology,'' *PR Newswire*, February 18, 2004.

such as servers, are used so that a system can switch to a backup unit in the event of hardware failure. To recover from such a failure, a control procedure, such as a **checkpoint**, helps. Under a *checkpoint control procedure*, which is performed at periodic intervals during processing, a company's computer network system temporarily does not accept new transactions. Instead, it completes updating procedures for all partially processed transactions and then generates an exact copy of all data values and other information needed to restart the system. The system records the checkpoint data on a separate disk file and repeatedly executes this process several times per hour. Should a hardware failure occur, the system is restarted by reading in the last checkpoint and then reprocessing only those transactions that have occurred since the checkpoint.

Two control procedures that reduce the risk of errors in data transmission are routing verification procedures and message acknowledgment procedures. **Routing verification procedures** help to ensure that no transactions or messages are routed to the wrong computer network system address. They work in the following manner: any transaction or message transmitted over a network should have a *header label* that identifies its destination. Before sending the transaction or message, the system should verify that the transaction or message destination is valid and is authorized to receive data. Finally, when the transaction or message is received, the system should verify that the identity of the receiving destination is consistent with the transaction's or message's destination code.

Message acknowledgment procedures are useful in preventing the loss of part or all of a transaction or message on a computer network system. For example, if messages contain a *trailer label*, the receiving destination (or unit) can check to verify that the complete message was received. Furthermore, if large messages or sets of transactions are transmitted in a batch, each message or transaction segment can be numbered sequentially. The receiving destination can then check whether all parts of the messages or transactions were received and were in the correct sequence. The receiving unit will signal the sending unit regarding the outcome of this evaluation. Should the receiving unit detect a data transmission error, the data will be retransmitted once the sending unit has been signaled about this error.

Controls for Personal Computers

Developing control procedures for an organization's portable laptops and desktop PCs begins by taking an inventory of them throughout the organization. The various applications for which each PC is used should also be identified. This should be followed by classifying each PC according to the types of *risks* and *exposures* associated with its applications. To discourage outright theft of desktop PCs, many companies bolt them in place or attach monitors to desks with strong adhesives. A control procedure for laptops is to lock them in cabinets before employees leave at night. Additional control procedures for laptops are identified in Figure 12-10.

PCs are relatively inexpensive. Therefore, it may not be cost-effective for a company to go to elaborate lengths to protect them. What companies should do is use inexpensive, yet effective, control procedures for PCs. It should be noted that because of the compact nature of laptop PCs, theft of these assets has become a big problem for both corporate entities and government agencies.

Case-in-Point 12.8 Recently, an insurance company handled $1 billion in claims for stolen laptops in a single year. In a survey of major corporations and large government agencies conducted a few years ago by the Computer Security Institute and the FBI computer crime squad, 69% of the respondents acknowledged incidents of laptop theft. One hundred fifty

Identify your laptop	• Which model? What configuration? What is the serial number? Are there any other unique identifiers? Without these details, law enforcement agencies, airlines, hotels, and so on, have little chance of retrieving your company's stolen laptop. • Keep a copy of all relevant information about your laptop in a safe place. Leave it in your desk at the office or at your home. Never tape the relevant information to the laptop or store the information electronically on the laptop's hard disk.
Use nonbreakable cables to attach laptops to stationary furniture	• For example, in a hotel room be sure to use a cable or other security device to attach the laptop to some stationary object such as a desk or some other piece of heavy furniture.
Load anti-virus software onto the hard disk	• Automatically perform an anti-virus scan whenever the laptop is turned on or whenever a diskette is inserted. • Have anti-virus scanning software check all changed or new files. • Keep anti-virus software current. Keep virus definitions current.
Back up laptop information	• Never keep backups in the laptop case. • While traveling, keep backup diskettes in a pocket or briefcase. • If possible, back up to your company's internal network via modem, when you are out of the office. • Back up frequently and test regularly to ensure data integrity.

FIGURE 12-10 Additional control procedures for laptops.

organizations cited a total of over $13 million in financial losses. The average annual price tag of losses per organization was $86,920.

As laptops become more sophisticated, people are using them as primary PCs and are saving large amounts of critical data on portable drives. Three simple safeguards are (1) back up important laptop data often, (2) password protect them, and (3) encrypt sensitive files. Organizations can also install anti-theft systems in them—for example, software that uses the integrated web cam to take a picture of whoever uses it next, or GPS systems to track the equipment itself.

Case-in-Point 12.9 "Laptops hardly ever get backed up," laments Scott Gaidano, president of DriveSavers, "and because laptops are portable, they get into more adventures." Among the many disasters he has seen regarding laptop computers include: one fell into the Amazon River, one melted in a car fire, one run over by a bus, and four dumped in bathtubs. In each case, although the machine was trashed, the data were salvaged.

IT Control Objectives for Sarbanes-Oxley[14]

The Sarbanes-Oxley Act of 2002 (SOX) profoundly impacts public companies, their managers, the internal auditors, and the external auditors as they each assess internal controls throughout the company to comply with the provisions of the Act. Companies must also consider the requirements of the PCAOB Standard No. 2 (discussed at the

[14] Sources of information for this section: Cook, Lynn, "IT control objectives for Sarbanes-Oxley: New guidance on IT control and compliance," (October 31, 2003) at www.deloitte.com; and www.itgi.org (resource center—entire document available as a pdf file).

beginning of this chapter) and PCAOB Standard No. 5. To help organizations comply with SOX and the PCAOB requirements, the IT Governance Institute (ITGI) issued ''IT Control Objectives for Sarbanes-Oxley'' in April 2004.

Neither the SOX legislation, nor the PCAOB Standards, includes detailed guidance for organizations. The ITGI publication provides that detail by starting with the IT controls from COBIT and linking those to the IT general control categories in the PCAOB standards, and then the control objectives are linked to the COSO framework. As we discussed in Chapter 11, COBIT is an IT governance framework that provides company-level objectives and controls around those objectives, as well as activity-level objectives and controls. It is important to point out that COBIT identifies controls that may be used for both operational and compliance objectives; however, the ITGC document only focuses on controls that support financial reporting.

APPLICATION CONTROLS FOR TRANSACTION PROCESSING

General controls focus on organization-level issues, while IT general controls apply to all information systems. The purpose of **application controls** is to prevent, detect, and correct errors and irregularities in processing transactions. The ITGI document discussed in the previous section states that IT general controls and application controls are becoming more integrated—that IT general controls support application controls and together they ensure complete and accurate information processing. The point is that organizations process information 24/7, and the typical manager cannot afford to wait several weeks for manual reconciliation of an error.

Application controls are those controls that are embedded in business process applications. The three major stages of data processing work are accumulating the input data, processing the data, and reporting the processed data in some form of output (e.g., a performance report). We discuss various application control procedures for AISs based on these three stages. First, we examine application controls over data input (called *input controls*). Next, we identify application controls that are intended to protect the processing of data (called *processing controls*), and finally, we survey application controls related to data output (called *output controls*).

Figure 12-11 emphasizes the important point that a company's application controls consist of input, processing, and output controls. Because every company's system is somewhat different, each company must consider the risk of errors and irregularities going undetected in processing its accounting data. The company must then design and implement its own cost-effective combination of input, processing, and output application controls.

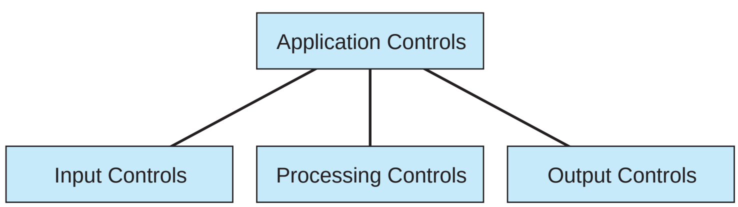


FIGURE 12-11 The composition of a company's application controls.

Input Controls

Although many organizations are now using automated systems to collect data (e.g., barcode scanners), some applications still require employees to manually enter data in the information system. As a result, the risk of undetected errors and irregularities is typically higher in this stage compared to the processing and output stages. In an attempt to reduce this risk factor, the strongest application controls are commonly found in the input stage of data processing.

Input controls help ensure the validity, accuracy, and completeness of the data entered into an AIS. It is usually cost effective to test input data for the attributes of validity, accuracy, and completeness as early as possible. There are at least five reasons for this:

1. Data that are rejected at the time they are input can be more easily corrected—for example, by reference to a source document.
2. Data that have been transcribed accurately are not necessarily good data, merely data that have been copied correctly. Further data testing is useful.
3. It is not cost-effective to screen accounting data continuously throughout the processing cycles of an AIS. Past some point in the job stream, all data are considered valid and error-free.
4. It is vital that an AIS use accurate data in later data processing operations. This protects master files from inaccuracies and safeguards computer processing in subsequent stages of the data processing work.
5. An AIS cannot provide good outputs if it does not start with good inputs.

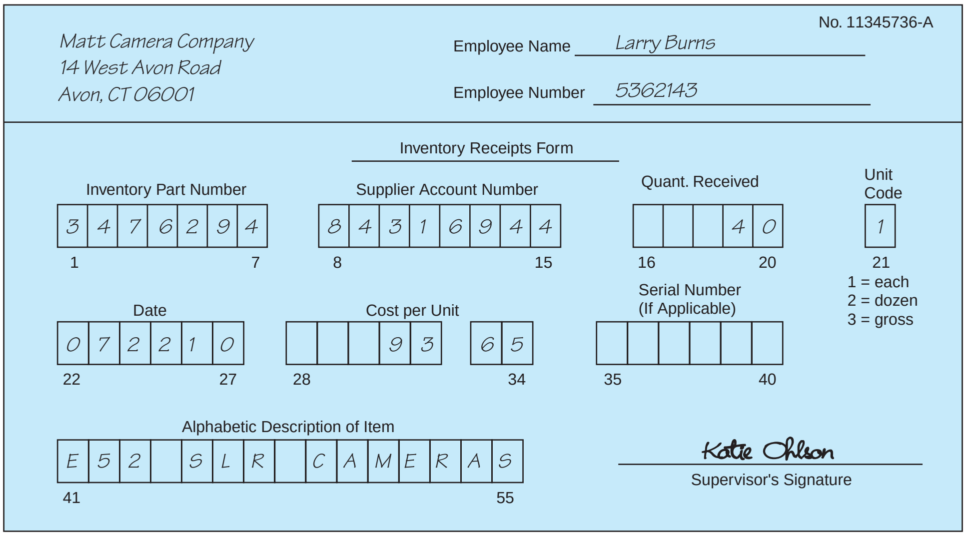
For discussion purposes, it is convenient to divide the topic of input application controls into three categories: (1) observation, recording, and transcription of data; (2) edit tests; and (3) additional input controls.

Observation, Recording, and Transcription of Data. In general, data enter an AIS when business transactions are recorded. An organization often finds it useful to install one or more observation control procedures to assist in collecting data that will be recorded. One such control procedure is the introduction of a *confirmation mechanism*—for example, requiring a customer to sign, and therefore confirm, a sales order.

The data observation process can also make use of *dual observation*. Under this control procedure, the accuracy of the data observation process is enhanced because more than one employee participates in the process. In some organizations, the dual observation control procedure is *supervisory*. Here, the supervisor of the employee (or employees) involved in collecting data is required to confirm the accuracy of the data gathered by the employee.

Once accounting data have been collected, they must be recorded. Data collection and the subsequent recording of these data are areas in which a great deal of automation has taken place. For example, the use of *point-of-sale (POS) devices* (such as *bar code readers* that interpret the universal product code—UPC—commonly printed on store products and *smart cash registers* that are connected to offsite computers) to encode data have been found to substantially decrease error rates in the recording process as well as to eliminate the expense involved in rekeying data.

In some instances, automated data collection and recording are not feasible, and an initial source document must be prepared manually. To encourage accuracy in the data collection and recording processes in these situations, several control procedures are


No. 11345736-A

Matt Camera Company
14 West Avon Road
Avon, CT 06001

Employee Name Larry Burns

Employee Number 5362143

Inventory Receipts Form

Inventory Part Number: 3 4 7 6 2 9 4 (1–7)

Supplier Account Number: 8 4 3 1 6 9 4 4 (8–15)

Quant. Received: 4 0 (16–20)

Unit Code: 1 (21)
1 = each
2 = dozen
3 = gross

Date: 0 7 2 2 1 0 (22–27)

Cost per Unit: 9 3 6 5 (28–34)

Serial Number (If Applicable) (35–40)

Alphabetic Description of Item: E 5 2 S L R C A M E R A S (41–55)

Katie Ohlson
Supervisor's Signature

FIGURE 12-12 A preprinted recording form for inventory receipts.

possible. One example is to use *preprinted recording forms*, such as the inventory receipts form illustrated in Figure 12-12. In general, these forms ensure that all the data required for processing have been collected and also enhance accuracy in the recording process. For example, the exact number of spaces required for such field items as the inventory part number and the supplier account number is clear because a box has been provided for each numerical digit, thus guarding against the loss or addition of digits in these fields. Organizations can use similar controls on web pages.

When using transcription, the data on source documents should be organized to facilitate the transcription process. Thus, well-designed, preprinted source-document forms are an important input control because they encourage adherence to the general principle of source-document and computer-input compatibility. Specially-designed input forms are the most commonly used method to enter data in a database. The person who designs the form can make the electronic version look just like the old paper version of the form that employees are accustomed to using. A big advantage of a database form is that it can be designed to lock certain fields to prevent changes, to control certain fields so that a user cannot enter an unreasonable value, to limit data values in certain fields, and a variety of other useful input controls.

Edit Tests. Programs or subroutines that check the validity and accuracy of input data after the data have been entered and recorded on a machine-readable file are called **input validation routines** (or **edit programs**). The specific types of validity and accuracy checks that input validation routines perform are called *edit tests* (or *edit checks*). **Edit tests** examine selected fields of input data and reject those transactions (or other types of data input) whose data fields do not meet the preestablished standards of data quality. Real-time processing systems perform edit tests during the data-entry process. Batch processing systems (illustrated in Figure 12-13) execute edit tests before regular data processing.

Edit tests can also be coordinated in what is called a *redundant data check* to ensure data accuracy. The idea is to encode repetitious data on a file or transaction record, thereby enabling a later processing test to compare the two data items for compatibility. For example, the reason you are always asked for the expiration date of your credit card is

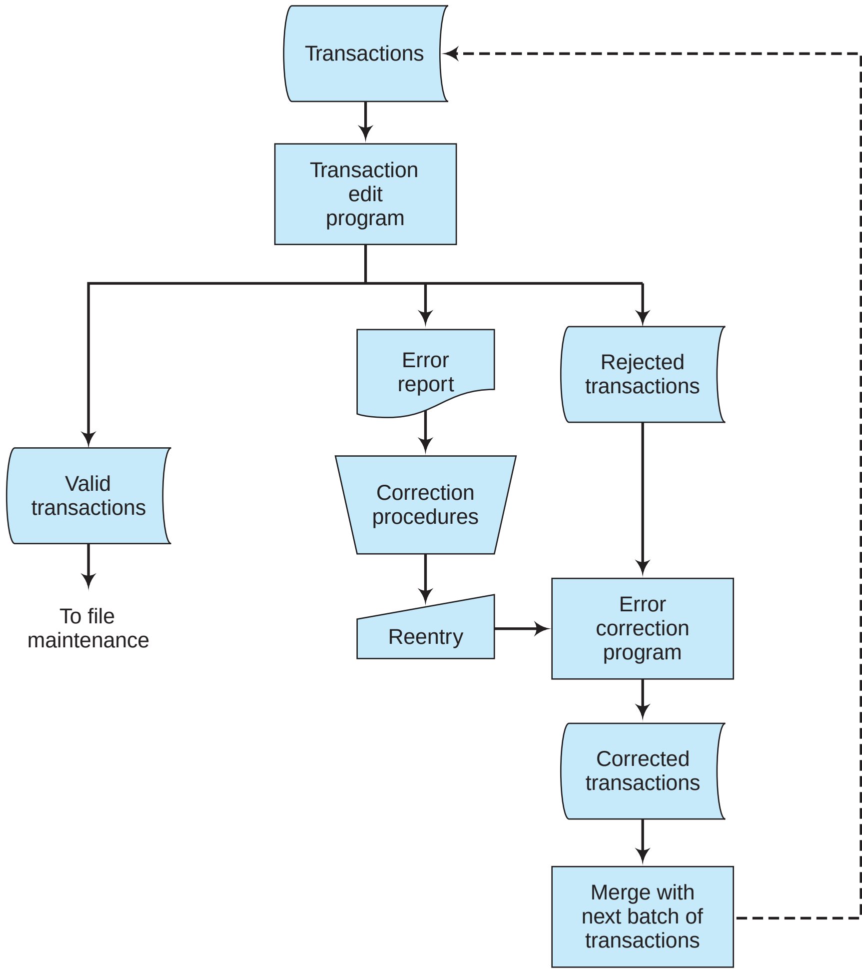


FIGURE 12-13 Use of edit program to execute edit tests under batch processing.

because that value is also encoded in the credit card number as well. Examples of edit tests are listed in Figure 12-14.

Additional Input Controls. It is possible for a data field to pass all of the edit tests previously described and still be invalid. To illustrate, a bank might use the incorrect account number 537627 (instead of the proper account number 537621) when processing a customer's transaction. When the incorrect account number is keyed into a remote terminal and submitted to edit tests, it will, for example, (1) pass a test of numeric field content ensuring that all digits were numeric, (2) pass a test of reasonableness ensuring that the account number itself fell within a valid range of values (e.g., account number greater than 100,000 and less than 800,000), (3) pass a test of sign (i.e., account number positive), and (4) pass a test of completeness (i.e., no blanks in fields).

Thus, additional control procedures are required for this error to be detected. One control procedure is to incorporate an *unfound-record test* into the data processing

Tests of:	Purpose
Numeric field content	To make sure that such data fields as Social Security number, sales invoice number, and date contain only numbers
Alphabetic field content	To make sure such fields as customer name contain only alphabetic letters
Alphanumeric field content	To make sure that fields such as inventory parts descriptions contain letters and/or numbers, but no special characters
Valid codes	e.g., 1 = cash sale; 2 = credit sale
Reasonableness	e.g., total hours worked by an employee during a weekly pay period does not exceed 50
Sign	e.g., paycheck amounts always positive
Completeness	To check that there are no blanks in fields that require data
Sequence	To make sure that successive input data are in some prescribed order (e.g., ascending, descending, chronological, alphabetical)
Consistency	e.g., all transactions for the same sales office have the same office code number

FIGURE 12-14 Examples of edit tests.

routine used to update the master file of bank records. With this approach, any transaction for which there is no corresponding master file record would be recognized as invalid and rejected from the transaction sequence (it would be returned for correction). But what if a master file record did exist for account 537627—the incorrect account number? This would indeed be unfortunate because our ''unfound-record'' control procedure would not detect the error, and, even worse, the legitimate master file record with account number 537627 would be updated with the transaction data generated by another customer.

Continuing with our bank example, an alternative to this unfound-record test is to expand the six-digit data field of customer bank account numbers to seven digits with *a check-digit control procedure*. Normally, the check digit is computed as a mathematical function of the other digits in a numeric field, and its sole purpose is to test the validity of the associated data. To illustrate, consider the original (correct) account number 537621. The sum of these six digits is $5 + 3 + 7 + 6 + 2 + 1 = 24$. One type of check digit would append the low-order digit of this sum ''4'' to the account number. The seven-digit value 5376214 would be used instead of the six-digit series 537621 to represent the account number. The computer program would duplicate this computational procedure at the time of data access, and therefore validate the accuracy of the data before the transaction data were used to update a master file record.

A check digit does not guarantee data validity. For example, the check-digit procedure described here would be unable to distinguish between the correct account number 5376214 and the transposed number 5736214 because the transposition of digits does not affect the sum. There are, however, check-digit techniques that do include ''ordering of digits'' in the construction of check-digit values. An example of one of these techniques is the *Modulus 11 technique*. Through this technique, the check digit is calculated by subtracting the sum of the digit products from the next highest multiple of 11. An example to illustrate the calculation of a check digit under the Modulus 11 technique is provided in Figure 12-15.

Let's assume that in preparing the Alan Company's biweekly payroll, two of the employees have the following payroll numbers: 3478 and 3748. To utilize the Modulus 11 technique for our check-digit control procedure, we determine the check-digit value for an employee's payroll number by applying an algorithm based on each employee's four digits. The calculation below shows under the Modulus 11 technique how we arrived at the check-digit value of 9 to append to the payroll number 3478 to come up with the employee's new payroll number using the Modulus 11 technique.

Four digits of employee number:	3	4	7	8
Weighting factors:	5	4	3	2
Digit products:	15	16	21	16
Sum of digit products:				68
Next higher multiple of 11 (11×7):				77
Check digit (difference of above two numbers):				9
Employee's new payroll number:				34789

Validation involves having the computer recompute the check digit, using the same algorithm by which this digit was predetermined. The computer then compares the result of the recomputation to the original keyed-in value. If a particular payroll transaction involves the correct employee number 34789 and this number was properly keyed into the system, the algorithm will generate a 9 as the check digit. Since the digit 9 is the same as the last digit on the employee payroll number, the computer accepts the number as correct. On the other hand, if the incorrect number 37489 is entered by mistake for the above payroll transaction (the digits 3748 represent the four digits of the other employee's payroll number before a check digit is added), the check digit generated by the algorithm will be 6, computed as follows: $(3 \times 5) + (7 \times 4) + (4 \times 3) + (8 \times 2) = 71$. The next highest multiple of 11 is 77:77 minus 71 = 6. Since this check digit of 6 is not the same as the last digit on the entered number (which is a 9), the employee payroll number 37489 will be rejected by the computer as incorrect.

FIGURE 12-15 Illustration of Modulus 11 technique for calculating a check digit.

Processing Controls

Processing controls focus on the manipulation of accounting data after they are input to the computer system. An important objective of processing controls is to contribute to a good audit trail. A clear audit trail is essential, for example, to enable individual transactions to trace, to provide documentation for changes in general ledger account balances, to prepare financial reports, and to correct errors in transactions. To achieve a good audit trail, require a printed *transaction listing* during each file-update by batch processing systems and at the end of every day by online processing systems.

Furthermore, use a unique and sequentially assigned transaction reference designator to identify each transaction in a listing. These transaction reference designators should be posted to the general ledger account records and recorded on the specific source documents pertaining to the transactions. Figure 12-16 illustrates an audit trail for a computer-based system, showing how source documents can be easily located by tracing back from an activity (or proof) listing, which is discussed shortly under output controls.

Control Totals. Suppose you were the data processing manager at a bank that processed over 100,000 bank checks per day. How would you make sure that all these checks are

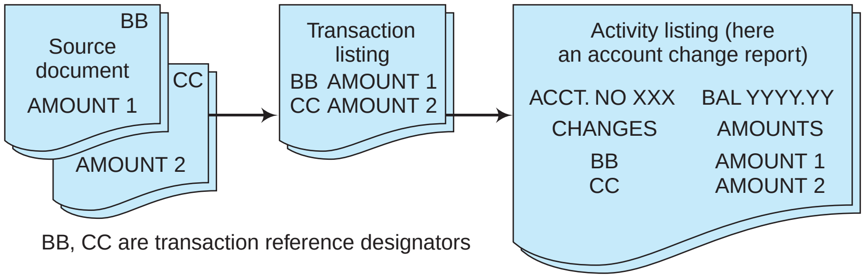


FIGURE 12-16 An audit trail for a computer-based system.

correctly processed by the computer? One procedure is to batch the checks in separate bundles of, say 200 checks, and prepare a special *batch control document* to serve as a control on the contents of each bundle. The information on this document might include the bundle number, today's date, and the total dollar amount for the checks themselves. The total dollar amount represents the **batch control total**. When computer processing commences, the special information on the lead control record (i.e., the batch control document) is accessed first and the batch control total is stored in computer memory. As the checks are accessed individually, their amounts are also accumulated in computer memory. Once all the checks in the batch are read, the accumulated total is compared with the batch control total. A match signals acceptable processing. A non-match signals an error, which may then be traced either to an error in the batch control total or to some difficulty in processing—e.g., the inability of the MICR reader to understand the data on one or more checks.

In fact, MICR readers are themselves a form of control. An original check has a line of magnetic ink with specific information that is recognized by highly reliable MICR readers. Even the best printers do not use this magnetic ink and copied checks can therefore be detected immediately.[15]

A control total that involves a dollar amount is called a *financial control total*. Other examples of financial control totals include the sum of cash receipts in an accounts receivable application, the sum of cash disbursements in an accounts payable application, and the sum of net pay in a payroll application.

AISs also use *nonfinancial control totals*, which compute nondollar sums—for example, the sum of the total number of hours worked by employees in a payroll application. A similar control is a *record count*. With this control procedure, the number of transaction items is counted twice: once when preparing transactions in a batch and again when actually performing the data processing. Yet a third example is the exact byte count of a legitimate computer program, which IT personnel can use to detect tampering.

Control totals do not have to make sense to be useful. For example, when cash receipts from customers are processed, the manual sum of the customers' account numbers in a batch of transactions might be computed to form a **hash total**. This sum is meaningless, but is useful as a check against an ''internal'' tally of this same hash total by the computer at the time of data access.

Data Manipulation Controls. Once data have been validated by earlier portions of data processing, they usually must be manipulated (i.e., processed) in some way by computer programs to produce decision-useful information, such as a report. One

[15]www.pointofsale.com

processing control procedure is to make sure that the computer programs are complete and thorough in their data manipulation. Ordinarily, this is accomplished by examining *software documentation*. System flowcharts, program flowcharts, data flow diagrams, and decision tables can also function as controls because they help systems analysts do a thorough job in planning data processing functions.

After computer programs have been coded, they are translated into machine language by an error-testing *compiler*. The compiler controls the possibility that a computer program contains programming language errors. A computer program can also be tested with specially designed *test data* that expose the program to all the exception conditions likely to occur during its actual use.

Output Controls

Once data have been processed internally by a computer system, they are usually transferred to some form of output medium for storage, screen display, or in the case of printed output, prepared as a report. The objective of **output controls** is to ensure the output's validity, accuracy, and completeness. Two major types of output application controls within IT environments are (1) validating processing results and (2) regulating the distribution and use of printed output.

Validating Processing Results. The validity, accuracy, and completeness of computerized output in AISs can be established through the preparation of *activity* (or proof) *listings* that document processing activity. (A simplified activity listing was illustrated in Figure 12-16.) These listings provide complete, detailed information about all changes to master files, and thus contribute to a good audit trail. Organizational employees use such activity listings to trace file changes back to the events or documents that triggered these changes and thereby verify current file information or printed information as valid, accurate, and complete output.

Regulating Distribution and Use of Printed Output. One of the more compelling aspects of output control deals with the subject of *forms control*. Perhaps the most interesting situations involve computerized check-writing applications in which MICR forms or perforated printer forms become the encoding media for preparing a company's checks. Usually, these forms are preprinted with the company's name, address, and bank account number. Control over the forms associated with check writing is vital.

The most common type of control used with computer-generated check-writing procedures is the coordination of a preprinted check number on the printer form with a computer-generated number that is printed on the same form at run time. The numbers on these *pre-numbered forms* advance sequentially and are prepared by the forms' supplier according to the specifications of an organization. The computer-generated numbers also run sequentially and are initialized by adding 1 to the check sequence number stored from the last processing run. The numbers on the pre-numbered forms and the computer-generated numbers should match during normal processing. Discrepancies should be examined carefully and the causes fully resolved. Other examples of forms that enjoy a special control advantage when pre-numbered include reports containing sensitive corporate information and computer-generated lottery and athletic event tickets.

Computer reports often contain sensitive information, and it is important that such information be restricted. Thus, for example, a payroll register, indicating the earnings of each employee during a given pay period, is a type of report whose distribution should be restricted. The most common approach to distributional control is through an *authorized distribution list*. For each output report (hard copy or electronic), distribution is limited to authorized users only. Where data processing activities are centralized, it is sometimes the case that the user will physically visit the computer facility to pick up a copy of a sensitive report. In these instances, a notebook, or log, of pickups can be maintained and the pickup employee asked to sign the book. The employee's identification number is recorded for security purposes at the time the report is taken.

In situations where it is not possible to have representatives from user groups pick up reports, bonded employees can be authorized to deliver the reports to users. Subsequently, random checks on the distribution of these reports can be made by the bonded employees' supervisors to verify distribution. After sensitive reports are no longer needed, it is important to properly destroy them (i.e., use a document shredder). Shredding reports is a stronger control than throwing them away because discarded reports can be retrieved from trash bins.

AIS AT WORK
Biometrics Are Opening Many Eyes[16]

Databases are one of the most critical assets of any Global 2000 enterprise and are often overlooked by managers when assessing and ensuring the appropriate levels of IT security. An increasing number of serious attacks by hackers and viruses, and the frequent security-related patches and service packs, continue to vex security and database administrators. And no wonder! A perfect example of this is the Internet Crash in 2003 that we discussed in Chapter 10. The attacker was able to achieve such widespread havoc by taking advantage of a weakness in Microsoft's SQL Server 2000 software. According to Davoll at PentaSafe, ''What we are seeing from customers is that while they are methodically locking down operating systems and Web servers, they are not consistently taking the same steps to secure their underlying databases.''

A variety of integrated security solutions are available that specifically address the security issues that concern database security managers. These include vulnerability assessments, database auditing, and intrusion protection through passwords and biometrics.

United Bankers' Bank (UBB) is one of the largest banks in the Federal Reserve's 9th District, with more than 1,200 community banks. After a considerable amount of investigation into various biometric options, UBB determined that fingerprint authentication was the most trusted, practical, and affordable. In 2004, UBB changed to fingerprint authentication to eliminate the hassles and security vulnerabilities associated with employee and customer-driven password management. The fingerprint system is used to authenticate employees' entry into the bank as they arrive in the morning and to access other applications during their workday.

Attacks on databases can (and do) occur from both inside and outside the company's firewalls. Biometrics can be used in conjunction with other security measures to help protect databases. After all, even Kevin Mitnick (probably still the most widely known hacker in the U.S.) is quick to point out that the end-user is the weakest link in the security chain.

[16]Sources: ''Biometrics are Opening Many Eyes,'' *Banking Wire* (2004) Vol. 8, p.54. ''PentaSafe Extends Database Security to Microsoft SQL Server,'' *PR Newswire* (November 5, 2002).

SUMMARY

- Firms are using an integrated approach to security by combining a number of technologies, including: firewalls, intrusion detection systems, content filtering, vulnerability management, virus protection, and virtual private networks.
- An integrated security system, supported by a comprehensive security policy, can significantly reduce the risk of attack because it increases the costs and resources needed by an intruder.
- Organization-level controls are so important because they often have a pervasive impact on many other controls, such as IT general controls and application-level controls.
- At the organization level, examples of important controls are: management's ethical values, philosophy, assignment of authority and responsibility, and the effectiveness of the board of directors.
- In addition, senior management must have controls over human resources and data resources. These controls include: (1) personnel policies; (2) file security controls; (3) business continuity planning; (4) computer facility controls; and (5) computer access controls.
- Business continuity planning and management are becoming an organization-level concern due to the many natural disasters and other business disruptions over the recent past.
- IT general controls are controls that are embedded in IT processes and are applied to all IT service activities. These controls are critical for reliance on application controls.
- Organizations are increasingly relying on wireless networks and must recognize the need for a virtual private network (VPN) so that users may safely access entity data and other online resources.
- Due to increased mobility of employees, organizations must also develop controls for laptop computers to protect those assets as well as the data that resides on them.
- At the transaction processing level, application controls are critical for preventing, detecting, and correcting errors and irregularities.
- Three major types of application controls are: (1) input controls, (2) processing controls, and (3) output controls.

KEY TERMS YOU SHOULD KNOW

application controls
backup
batch control total
biometric identifications
business continuity plan (BCP)
checkpoint
cold backup
cold site
computer facility controls
consensus-based protocols
control environment
data encryption
data manipulation controls
disaster recovery
disk mirroring
disk shadowing
edit programs
edit tests
electronic eavesdropping
electronic vaulting
fault-tolerant systems
flying-start site
hash total
hot backup
hot site
input controls
input validation routines
integrated security
IT general controls
logical security
man trap
message acknowledgment procedures
organization-level controls
output controls
physical security
processing controls

red flags
rollback processing
routing verification procedures
security policy
strong passwords
uninterruptible power system (UPS)
watchdog processor
virtual private network (VPN)

TEST YOURSELF

Q12-1. A ________ is a comprehensive plan that helps protect the enterprise from internal and external threats.

a. Firewall **b.** Security policy **c.** Risk assessment **d.** VPN

Q12-2. According to PCAOB Standard No. 2, which of the following is an example of a company-level control?

a. Controls to monitor results of operations
b. Personnel controls
c. Access to computer files
d. All of the above

Q12-3. Fault-tolerant systems are designed to tolerate computer errors and are built on the concept of ________.

a. Redundancy
b. COBIT
c. COSO
d. Integrated security

Q12-4. A ________ site is a disaster recovery site that includes a computer system like the one the company regularly uses, software, and up-to-date data so the company can resume full data processing operations within seconds or minutes.

a. Hot **b.** Cold **c.** Flying-start **d.** Backup

Q12-5. Disaster recovery plans may not be of much use if ________.

a. They are not fully documented
b. The organization does not have a cold site for relocation purposes
c. The organization does not expect any natural disasters to occur
d. They are not tested periodically and revised when necessary

Q12-6. Which of the following is not a computer facility control?

a. Place the data processing center where unauthorized individuals cannot gain entry
b. Limit access to the data processing center to all employees of the company
c. Buy insurance to protect against loss of equipment in a computer facility
d. Use advanced technology to identify individuals who are authorized access to the data processing center

Q12-7. A ________ is a security appliance that runs behind a firewall and allows remote users to access entity resources by using wireless, hand-held devices.

a. Data encryption
b. WAN
c. Checkpoint
d. VPN

Q12-8. Organizations use ________ controls to prevent, detect, and correct errors and irregularities in transactions that are processed.

a. Specific **b.** General **c.** Application **d.** Input

Q12-9. All of the following are considered organization-level controls except:

a. Personnel controls
b. Business continuity planning controls
c. Processing controls
d. Access to computer files

DISCUSSION QUESTIONS

12-1. What is a security policy? What do we mean when we say organizations should have an integrated security plan?

12-2. What do we mean when we talk about convergence of physical and logical security? Why might this be important to an organization?

12-3. What guidance or framework would you use to establish IT governance if you were a senior executive in a firm? If you were a mid-level IT manager who was designing IT general controls? A manager who was responsible for identifying the appropriate application controls?

12-4. Discuss the major differences between wireless LANs and hard-wired LANs. What controls must be used to protect data that is transmitted over these networks?

12-5. Why is business continuity planning so important? What is it? Identify several reasons why testing the plan is a good idea.

12-6. What is backup, and why is it important when operating an accounting system?

12-7. Discuss some of the unique control risks associated with the use of PCs and laptop computers compared to using mainframes. List what you consider to be three of the most important control procedures that should be implemented for PCs. For each control procedure, give your reason for including this procedure as an important control.

12-8. Jean & Joan Cosmetics has a complete line of beauty products for women and maintains a computerized inventory system. An eight-digit product number identifies inventory items, of which the first four digits classify the beauty product by major category (hair, face, skin, eyes, etc.) and the last four digits identify the product itself. Identify as many controls as you can that the company might use to ensure accuracy in this eight-digit number when updating its inventory-balance file.

12-9. Explain how each of the following can be used to control the input, processing, or output of accounting data: (a) edit tests, (b) check digits, (c) passwords, (d) activity listings, and (e) control totals.

12-10. What is the difference between *logical* access to the computer and *physical* access to the computer? Why is the security of both important?

12-11. Discuss the following statement: ''The separation of duties control is very difficult in computerized accounting information systems because computers often integrate functions when performing data processing tasks. Therefore, such a control is not advisable for those organizations using computers to perform their accounting functions.''

12-12. Discuss the role of the *control total* in accounting information systems. Why are control totals insufficient to guard against data inaccuracies?

PROBLEMS

12-13. E. Wilson & Sons, Inc. hired a consulting team from Chesapeake and Associates to discuss application controls for the company's accounting data processing. In one of the workshops, the seminar leader stated, ''We can classify all errors in processing accounting data as either accidental or intentional. Controls such as edit tests are primarily aimed at the former type of error, whereas personnel controls are primarily aimed at the latter type of error.'' Comment.

12-14. Mark Goodwin, a computer programmer, had a grudge against his company. To get even, he coded a special routine in the mortgage loan program that erased a small, random number of accounts on the disk file every time the program was run. The company did not detect the routine until almost all of its records had been erased. Discuss what controls might have protected this company from its own programmer.

12-15. Jack Drucker, an accountant working for a medium-size company, set up several dummy companies and began directing the computer to write checks to them for fictitious merchandise. He was apprehended only when several of the company executives began to wonder how he could afford a ski vacation in the Alps every year. What controls might have prevented this fraudulent activity?

12-16. Identify one or more *control procedures* (either *general* or *application* controls, or both) that would guard against each of the following errors or problems.

a. Leslie Thomas, a secretary at the university, indicated that she had worked 40 hours on her regular time card. The university paid her for 400 hours worked that week.

b. The aging analysis indicated that the Grab and Run Electronics Company account was so far in arrears that the credit manager decided to cut off any further credit sales to the company until it cleared up its account. Yet, the following week, the manager noted that three new sales had been made to that company—all on credit.

c. The Small Company employed Mr. Fineus Eyeshade to perform all its accounts receivable data processing. Mr. Eyeshade's 25 years with the company and his unassuming appearance helped him conceal the fact that he was embezzling cash collections from accounts receivable to cover his gambling losses at the racetrack.

d. The Blue Mountain Utility Company was having difficulty with its customer payments. The payment amounts were entered directly onto a terminal, and the transaction file thus created was used to update the customer master file. Among the problems encountered with this system were the application of customer payments to the wrong accounts and the creation of multiple customer master file records for the same account.

e. The Landsford brothers had lived in Center County all their lives. Ben worked for the local mill in the accounts payable department, and Tom owned the local hardware store. The sheriff couldn't believe that the brothers had created several dummy companies that sold fictitious merchandise to the mill. Ben had the mill pay for this merchandise in its usual fashion, and he wrote off the missing goods as ''damaged inventory.''

12-17. Identify one or more *control procedures* (either *general* or *application* controls, or both) that would guard against each of the following errors or problems.

a. A bank deposit transaction was accidentally coded with a withdrawal code.

b. The key-entry operator keyed in the purchase order number as a nine-digit number instead of an eight-digit number.

c. The date of a customer payment was keyed 2001 instead of 2010.

d. A company employee was issued a check in the amount of $135.65 because he had not worked a certain week, but most of his payroll deductions were automatic each week.

e. A patient filled out her medical insurance number as 123465 instead of 123456.

f. An applicant for the company stock option plan filled out her employee number as 84-7634-21. The first two digits are a department code. There is no department 84.

g. A high school student was able to log onto the telephone company's computer as soon as he learned what telephone number to call.

h. The accounts receivable department sent 87 checks to the computer center for processing. No one realized that one check was dropped along the way and that the computer therefore processed only 86 checks.

12-18. To achieve effective separation of duties within a company's IT environment, the company's accounting and information processing subsystems should be separate from the departments that use data and perform operational activities. Discuss some of the ways this ''separation of duties'' is achieved.

12-19. Bristol Company has a high turnover rate among its employees. It maintains a very large computer system that supports approximately 225-networked PCs. The company maintains fairly extensive databases regarding its customers. These databases include customer profiles,

Application	Field Name	Field Length	Example
Invoicing	Customer number	6	123456
	Customer name	23	Al's Department Store
	Salesperson number	3	477
	Invoice number	6	123456
	Item catalog number	10	9578572355
	Quantity sold	8	13
	Unit price	7	10.50
	Total price	12	136.50
Salesperson activity	Salesperson number	3	477
	Salesperson name	20	Kathryn Wilson
	Store department number	8	10314201
	Week's sales volume	12	1043.75
	Regular hours worked	5	39.75
	Overtime hours worked	4	0.75
Inventory control	Inventory item number	10	9578572355
	Item description	15	Desk lamp
	Unit cost	7	8.50
	Number of units dispersed this week	4	14
	Number of units added to inventory	4	20
Purchasing	Vendor catalog number	12	059689584996
	Item description	18	Desk pad
	Vendor number	10	8276110438
	Number of units ordered	7	45
	Price per unit	7	8.75
	Total cost of purchase	14	313.75

FIGURE 12-17 Data for the Blatz Furniture Company's applications.

past purchasing patterns, and prices charged. Recently, Bristol Company has been having major problems with competitors. It appears that one competitor seems to be very effective at taking away the company's customers. This competitor has visited most of Bristol Company's customers, and identical products have been offered to these customers at lower prices in every case.

a. What do you feel is the possible security problem at Bristol Company?

b. What can be done about this problem?

12-20. The Blatz Furniture Company uses an online data input system for processing its sales invoice data, salesperson data, inventory control, and purchase order data. Representative data for each of these applications are shown in Figure 12-17. Identify specific editing tests that might be used to ensure the accuracy and completeness of the information in each data set.

CASE ANALYSES

12-21. Simmons Corporation (Problems with Computer-based Information System)

Simmons Corporation is a multi-location retailing concern with stores and warehouses throughout the United States. The company is in the process of designing a new, integrated, computer-based information system. In conjunction with the design of the new system, the management of the company is reviewing the data processing security to determine what new control features should be incorporated. Two areas of specific concern are (1) confidentiality of company and customer records, and (2) safekeeping of computer equipment, files, and data processing center facilities.

The new information system will be employed to process all company records, which include sales, purchases, the financial budget, customer, creditor, and personnel information. The stores and warehouses will be linked to the main computer at corporate headquarters by a system of remote terminals. This will permit data to be communicated directly to corporate headquarters or to any other location from each location within the terminal network.

At the current time, certain reports have restricted distribution because not all levels of management need to receive them or because they contain confidential information. The introduction of remote terminals in the new system may provide access to these restricted data by unauthorized personnel. Simmons's top management is concerned that confidential information may become accessible and be used improperly.

The company's top management is also concerned with potential physical threats to the system, such as sabotage, fire damage, water damage, or power failure. Should any of these events occur in the current system and cause a computer shutdown, adequate backup records are available so that the company could reconstruct necessary information at a reasonable cost on a timely basis. However, with the new system, a computer shutdown would severely limit company activities until the system could become operational again.

Requirements:

1. Identify and briefly explain the problems Simmons Corporation could experience with respect to the confidentiality of information and records in the new system.
2. Recommend measures Simmons Corporation could incorporate into the new system that would ensure the confidentiality of information and records in this new system.
3. What safeguards can Simmons Corporation develop to provide physical security for its (a) computer equipment, (b) files, and (c) data processing center facilities?

12-22. MailMed Inc. (Control Weaknesses and a Disaster Recovery Plan)

MailMed Inc. (MMI), a pharmaceutical firm, provides discounted prescription drugs through direct mail. MMI has a small systems staff that designs and writes MMI's customized software. Until recently, MMI's transaction data were transmitted to an outside organization for processing on its hardware.

MMI has experienced significant sales growth as the cost of prescription drugs has increased and medical insurance companies have been tightening reimbursements in order to restrain premium cost increases. As a result of these increased sales, MMI has purchased its own computer hardware. The data processing center is installed on the ground floor of its two-story headquarters building. It is behind large, plate-glass windows so that the state-of-the-art data processing center can be displayed as a measure of the company's success and attract customer and investor attention. The computer area is equipped with halon gas fire suppression equipment and an uninterruptible power supply system.

MMI has hired a small computer operations staff to operate its data processing center. To handle MMI's current level of business, the operations staff is on a two-shift schedule, five days per week. MMI's systems and programming staff, now located in the same building, has access to the data processing center and can test new programs and program changes when the operations staff is not available. Because the systems and programming staff is small and the work demands have increased, systems and programming documentation is developed only when time is available. Periodically, but not on a scheduled basis, MMI backs up its programs and data files, storing them at an off-site location.

Unfortunately, due to several days of heavy rains, MMI's building recently experienced serious flooding that reached several feet into the first-floor level and affected not only the computer hardware but also the data and program files that were on-site.

Requirements:

1. Describe at least four computer control weaknesses that existed at MailMed Inc. prior to the flood occurrence.
2. Describe at least five components that should be incorporated in a formal disaster recovery plan so that MailMed Inc. can become operational within 72 hours after a disaster affects its computer operations capability.
3. Identify at least three factors, other than the plan itself, that MailMed Inc.'s management should consider in formulating a formal disaster recovery plan.

12-23. Bad Bad Benny: A True Story (Identifying Controls for a System)[17]

In the early twentieth century, there was an ambitious young man named Arthur who started working at a company in Chicago as a mailroom clerk. He was a hard worker and very smart, eventually ending up as the president of the company, the James H. Rhodes Company. The firm produced steel wool and harvested sea sponges in Tarpon Springs, Florida for household and industrial use. The company was very successful, and Arthur decided that the best way to assure the continued success of the company was to hire trusted family members for key management positions—because you can always count on your family. Arthur decided to hire his brother Benny to be his Chief Financial Officer (CFO), and placed other members of the family in key management positions. He also started his eldest son, Arthur Junior (an accountant by training) in a management training program, hoping that he would eventually succeed him as president.

As the company moved into the 1920s, Benny was a model employee; he worked long hours, never took vacations, and made sure that he personally managed all aspects of the cash function. For example, he handled the entire purchasing process—from issuing purchase orders through the disbursement of cash to pay bills. He also handled the cash side of the revenue process by collecting cash payments, preparing the daily bank deposits, and reconciling the monthly bank statement.

The end of the 1920s saw the United States entering its worst Depression since the beginning of the Industrial Age. Because of this, Arthur and other managers did not get raises, and in fact, took pay cuts to keep the company going and avoid lay-offs. Arthur and other top management officials made ''lifestyle'' adjustments as well—e.g., reducing the number of their household servants and keeping their old cars, rather than purchasing new ones. Benny, however, was able to build a new house on the shore of Lake Michigan and purchased a new car. He dressed impeccably and seemed impervious to the economic downturn. His family continued to enjoy the theatre, new cars, and nice clothes.

[17] Source: Professor Constance Lehmann, Department of Accounting, University of Houston-Clear Lake.

Arthur's wife became suspicious of Benny's good fortune in the face of others' hardships, so she and Arthur hired an accountant to review the books. External audits were not yet required for publicly-held companies, and the Securities and Exchange Commission (SEC) had not yet been formed (that would happen in 1933–1934). Jim the accountant was eventually able to determine that Benny had diverted company funds to himself by setting up false vendors and having checks mailed to himself. He also diverted some of the cash payments received from customers and was able to hide it by handling the bank deposits and the reconciliation of the company's bank accounts. Eventually, Jim determined that Benny had embezzled about $500,000 (in 1930 dollars).

If we assume annual compounding of 5% for 72 years, the value in today's dollars would be about $17.61 million! Arthur was furious, and sent Benny ''away.'' Arthur sold most of his personal stock holdings in the company to repay Benny's embezzlement, which caused him to lose his controlling interest in the company, and eventually was voted out of office by the Board of Directors.

Jim, the accountant, wrote a paper about his experience with Benny (now referred to as ''Bad Bad Benny'' by the family). Jim's paper contributed to the increasing call for required annual external audits for publicly-held companies. Arthur eventually reestablished himself as a successful stockbroker and financial planner. Benny ''disappeared'' and was never heard from again.

Requirements:

1. Identify the control weaknesses in the revenue and purchasing processes.
2. Identify any general controls Arthur should have implemented to help protect the company.
3. From Chapter 11, identify the internal control activities that Arthur should have considered (or implemented) that would have thwarted Benny's bad behavior.

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ANSWERS TO TEST YOURSELF

1. **b** 2. **a** 3. **a** 4. **c** 5. **d** 6. **b** 7. **d** 8. **c** 9. **c**

PART FIVE

SPECIAL TOPICS IN ACCOUNTING INFORMATION SYSTEMS

The primary emphasis throughout this textbook has been the impact of technology on AISs. These next three chapters of the book highlight specific areas of technology that impact accountants, and should therefore be particularly interesting to accounting students.

Chapter 13 describes the process of developing and implementing effective AISs. The process is not that much different from implementing any type of IT, and it often follows the traditional systems development life cycle. The chapter describes each phase of this cycle, emphasizes the special nature of AISs, and identifies the accountant's role in systems development and implementation.

Chapters 10, 11, and 12 of this book emphasized information systems security and control. Chapter 14 continues that discussion, analyzing some of the important auditing activities associated with computerized AISs and discussing the role of the IT auditor. The chapter also describes important topics of interest to IT auditors today, including IT governance, auditing for fraud, the Sarbanes-Oxley Act of 2002, and third-party information systems reliability assurances.

Chapter 15 discusses the impact of the Internet and electronic commerce on accountants. As an increasing number of business organizations engage in electronic commerce, it becomes critical for accountants to understand the fundamentals of doing business electronically. Chapter 15 describes the technology that underlies the Internet and electronic commerce, including a comprehensive discussion of XBRL and how this reporting language is changing financial reporting. The chapter also discusses intranets and extranets as well as general categories of electronic commerce, such as retail sales. The chapter concludes by identifying a number of privacy and security issues for business enterprises engaged in electronic commerce.

Chapter 13

Developing and Implementing Effective Accounting Information Systems

After reading this chapter, you will:

1. *Understand* the roles of accountants, analysis teams, and steering committees in systems studies.
2. *Understand* why systems analysts must understand the strategic and operational goals of a company.
3. *Become familiar with* the deliverables in systems analysis work, especially the systems analysis report.
4. *Be able to* help plan and complete the analysis and design phases of a systems study.
5. *Know* what a feasibility evaluation is and how to conduct it.
6. *Understand* some of the costs, benefits, tools, and techniques associated with systems design work.
7. *Be able to* evaluate alternative systems proposals and make a selection or choose to outsource.
8. *Be familiar with* the activities required to implement and maintain a large information system.

"Analysts, programmers, and other IT specialists frequently refer to 'my system.' This attitude has, in part, created an 'us versus them' conflict between technical staff and their users and management."

Jeffrey L. Whitten and Lonnie D. Bentley, *Systems Analysis and Design Methods*, 7E, McGraw-Hill Irwin, 2007, p. 72.

INTRODUCTION

IT governance, part of an organization's overall mission, goals, policies, and procedures, is the process of ensuring that IT is used effectively, efficiently, and strategically. A comprehensive IT strategy requires careful systems study and should prioritize the acquisition or development of various information systems, including operating and application systems, such as accounting information systems.

The IT systems study includes planning and analysis through development, implementation, and a feedback loop for each new IT application. Some systems will be designed in-house, while others may be purchased or leased. Selecting a system among alternatives is part of the IT systems study process. In some cases, a company may decide to outsource part or all of their IT.

As the quote at the top of this page suggests, a systems study should not just be conducted by ''systems people.'' Developing effective, strategic information systems is the job of systems programmers, analysts, designers, users, and managers. Accountants, as auditors and general information users, should be involved with all IT studies, especially accounting information systems.

SYSTEMS DEVELOPMENT LIFE CYCLE

As you might imagine, studying a large AIS is a large and difficult task. A **systems study** (also called *systems development work*) begins with a formal investigation of an existing information system. Who actually performs a systems study? This varies from company to company as well as among projects. Many large organizations have in-house professionals to perform this work. In contrast, smaller organizations with limited technical expertise as well as larger organizations with other priorities for their internal experts are more likely to hire a team of outside consultants for this work. (Note: The Sarbanes-Oxley Act of 2002 expressly forbids CPA firms from performing such systems work for a client with whom it already has an audit relationship.) Our discussion assumes that most of the work is performed by a generic ''study team'' of experts, who may or may not be outside consultants.

Four Stages in the Systems Development Life Cycle

Traditionally, we can identify four major steps or phases of a systems study:

1. **Planning and Investigation** This step involves performing a preliminary investigation of the existing system, organizing a systems study team, and developing strategic plans for the remainder of the study.

2. **Analysis** This step involves analyzing the company's current system in order to identify the information needs, strengths, and weaknesses of the existing system.
3. **Design** In this step, an organization designs changes that eliminate (or minimize) the current system's weak points while preserving its strengths.
4. **Implementation, Follow-up, and Maintenance** This phase includes acquiring resources for the new system as well as training new or existing employees to use it. Companies conduct follow-up studies to determine whether the new system is successful and, of course, to identify any new problems with it. Finally, businesses must maintain the system, meaning correcting minor flaws and updating the system as required.

These four phases are the **system development life cycle (SDLC)** of a business information system. Figure 13-1 illustrates that this life cycle spans the time during which a company's system is operating normally and is subsequently revised as a result of some problem (or problems). Each time a newly revised system takes over the company's daily operating activities, a new life cycle begins.

The dashed arrows in Figure 13-1 emphasize that follow-up studies of a system should be a continuous process. An organization reevaluates systems regularly to confirm they are still working well. If follow-up studies indicate that previous problems have recurred or new ones have developed, an organization should take the dashed-arrow route from the follow-up studies to the recognition of systems problems and begin a new systems study. In practice there is usually much overlap between phases in the life cycle, and the steps in a systems study don't necessarily occur in sequence. Often, system developers will perform two or more stages simultaneously or in parallel with each other.

Systems Studies and Accounting Information Systems

A systems study looks at all IT in an entity's **applications portfolio**. This portfolio may include an enterprise system, along with other specialized information systems, or it may consist of many separate systems for functional areas such as accounting, marketing, and human resources. Accounting information systems (AISs) are prime targets for systems

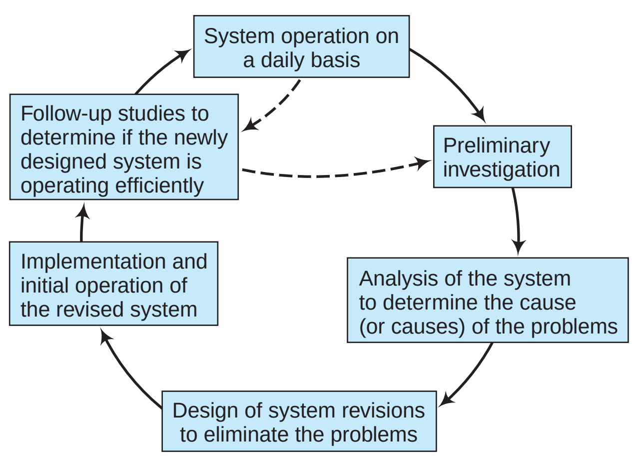

FIGURE 13-1 System development life cycle of a business information system.

studies—for example, because they may not currently support electronic commerce or do not integrate data efficiently in data warehouses. But in general, a systems study means more than just replacing or modifying existing information systems. Typically, altering an information system also affects work flows, data gathering and recording tasks, employee responsibilities, and even the way an organization rewards its managers. Thus, one reason why organizations perform systems studies is because such studies are part of the greater task of reengineering one or more of its core systems.

SYSTEMS PLANNING

The first phase of a systems study involves systems planning and an initial investigation.

Planning for Success

In large organizations, system redesigns (or new development work) typically involve millions of dollars, making mistakes very costly. In smaller organizations, major errors can be catastrophic, leading a firm to bankruptcy. What else can happen when organizations do not plan carefully? Here are some examples:

- Systems do not meet users' needs, causing employee frustration, resistance, and even sabotage.
- Systems are not flexible enough to meet the business needs for which they were designed and are ultimately scrapped.
- Project expenditures significantly overrun what once seemed like very adequate budgets.
- The time required to complete the new system vastly exceeds the development schedule—often by years.
- Systems solve the wrong problems.
- Top management does not approve or support the new systems.
- Systems are difficult and costly to maintain.

Studies of unsuccessful information systems projects suggest that mistakes made at the outset of a systems study are the most common reason why such projects ultimately fail. Careful systems planning and an initial investigation can avoid critical missteps that lead to disaster. ''Planning for success'' means beginning a systems study with a focused investigation that: (1) approaches specific organizational problems from a broad point of view, (2) uses an interdisciplinary study team to evaluate an organization's information systems, and (3) makes sure the company's study team works closely with a steering committee (described below) in all phases of the work.

Case-in-Point 13.1 In a recent study of why systems development projects fail, the Standish Group found that only about half the components initially specified for a new system were actually created, and that about the same percentage of the functionality that *was* created was actually used. The most common problem: poorly defined requirements. "If a project can't get a handle on the basic system requirements," the report concluded, "it is doomed to fail."[1]

[1]Charles Babcock. ''The Art of Defining Software Requirements,'' *Information Week* (March 15, 2004).

Broad Viewpoint in a Systems Study. When performing a systems study, the participants should use a **systems approach**, that is, a broad point of view. This approach aligns the systems study with the organization's mission and strategic planning goals and objectives. For example, if a company plans to consolidate divisions or discontinue unprofitable product lines, new IT systems will need to reflect these plans. In another scenario, a company that is embarking on a growth strategy through merger and acquisition should think twice about implementing a new enterprise system that could be incompatible with newly acquired companies. Also, management should think strategically about whether a potential new system could accommodate acquired businesses operating in different industries.

The Study Team and the Steering Committee. Using an interdisciplinary study team follows from the need for a broad viewpoint when performing a systems study. It also serves to correct the problem identified in our chapter quote—thinking that the system belongs only to the IT staff. Because most accounting and computer professionals are specialists, it is unlikely that any one or two people will have the broad background and experience necessary to understand and change a large AIS. For this reason, the recommended approach is to form (or hire) a team of specialists—a ''study team''—to perform the system's study.

It is important that the study team communicate closely and meaningfully with the company's top managers. To provide this continuous interface, the company's top management should also appoint a **steering committee** to work with each study team as it performs its tasks. Ideally, the committee will include top management personnel—for example, the controller, the vice president of finance, the top-level information systems manager (information systems vice president or chief information officer), perhaps one or more staff auditors, and (for very important projects) even the chief executive officer of the company. The rationale for such involvement is straightforward: *top management commitment is critical to the ultimate success of a new or revised system*.

Investigating Current Systems

Planning for IT includes constant monitoring of current systems. When any appear to have problems, the systems study team performs a **preliminary investigation** of the system in question and advises the steering committee of its findings. One important part of this work is to separate symptoms from causes. In its deliberations, the study team may consider alternatives to the current system, attempt to estimate the costs and benefits of its proposed solutions, or make recommendations for desired alternatives. In this phase of the project, the study team enjoys wide latitude in what it can choose to examine, and it is usually encouraged to ''think outside the box'' (i.e., to consider vastly different and innovative approaches to address current problems).

The duration of a preliminary investigation is comparatively brief—typically, a matter of a few weeks. The ''deliverable'' from this phase of the systems study is a preliminary investigation report describing the problems or objectives the study team identified, solutions or alternatives it investigated, and further course(s) of action it recommends. The study team submits this report to the company steering committee for a final determination. The steering committee may decide to: (1) disband the study team and do nothing, (2) perform further preliminary investigations, or (3) proceed to the formal systems analysis stage of the systems study.

SYSTEMS ANALYSIS

The basic purpose of the **systems analysis** phase is to examine a system in depth. The study team will familiarize itself with the company's current operating system, identify specific inputs and outputs, identify system strengths and weaknesses, and eventually make recommendations for further work. Figure 13-2 shows the logical procedures that the team should follow.

In performing its work, the study team should strive to avoid overanalyzing a company's system. Instead, the team should try to identify and understand the organization's goals for the system, perform a systems survey, and prepare one or more reports that describe its findings.

Understanding Organizational Goals

For the study team to do an adequate job—for example, determine the real problems within a company's information system—its members must first understand the system's goals. Of special importance is determining which goals are not being achieved under the present system and why this happens. Organization goals include: (1) general systems goals, (2) top management systems goals, and (3) operating management systems goals.

General Systems Goals. General systems goals apply to most organization's information systems and help an AIS contribute to an efficient and effective organization. Principles contributing to these goals are: (1) awareness that the benefits of the new system should exceed the costs, (2) concern that the output of the system helps managers make better decisions, (3) commitment to designing a system that allows optimal access to information, and (4) flexibility so that the system can accommodate changing information needs.

The study team must determine whether the current information system helps to achieve general systems goals. For example, if an AIS has excessive costs associated with using traditional paper documents (e.g., purchase orders, receiving reports, and vendor invoices), this will violate goal number one (cost awareness), and the study team might recommend that the company use a web-based system instead.

Top Management Systems Goals. AISs typically play key roles in satisfying top management goals. For instance, AISs usually provide top managers with long-range budget planning data so they can make effective strategic decisions regarding future product-line

Understand the systems goals
↓
Systems survey to acquire sufficient information relating to current systems problems
↓
Suggest possible solutions to solve the systems problems through a systems analysis report

FIGURE 13-2 Systems analysis procedures.

sales or comparable business activities. Similarly, periodic performance reports provide top management with vital control information about corporate operations, such as how sales of new product lines are doing. Finally, top management needs to know about the short-range operating performance of its organization's subsystems—for example, summary information about individual department operating results and how these results compare with budgetary projections.

Operating Management Systems Goals. Compared to top management, the information needs of operating managers (i.e., managers working within specific organizational subsystems) are normally easier to determine. This is because the decision-making functions of operating managers typically relate to well-defined and narrower organizational areas. In addition, the majority of operating managers' decisions are for the current business year (in contrast to top management's long-range decision-making functions). Much of the information required for operating managers' decisions is generated internally as a by-product of processing a company's accounting data.

Case-in-Point 13.2 Grupo Financiero Bital is a Mexican bank with almost 1,200 branches, 3 million customers, and $9 billion in assets. To work effectively, branch managers need access to information about customer accounts at other branches. At one point in time, managers could ask Bital's massive databases for information, but the output was sometimes a 500-page report instead of the specific information a manager required. A redesign of this information system resulted in a corporate intranet. The intranet lets branch managers and top managers access exactly the data they needed to view performance measures of the individual branches. The company is realizing many indirect benefits from the new system and saves almost $6,000 per month in printing costs alone![2]

Systems Survey Work

The objective of a **systems survey** is to enable the study team to obtain a more complete understanding of the company's current operational information system and its environment. Of special importance is identifying the strengths and weaknesses of the current system. The overall objective is to retain the system's strengths while eliminating the system's weaknesses, especially those weaknesses causing problems in the current system. These weaknesses will likely relate to specific goals that the current system does not now accomplish.

Understanding the Human Element and Potential Behavioral Problems. Because the appearance of a study team on the work scene usually signals change, employees are often resistant to help. Unless the study team deals directly with this problem at the beginning, there is a good chance that employees will oppose the changes that the team recommends. In short, a systems study must gain the full cooperation and support of those employees who are crucial to the effectiveness of a new system. The best designed system ''on paper'' is likely to cause behavioral problems when implemented if the system does not have wide user support.

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[2]http://itmanagement.earthweb.com/erp/article.php/602201 (Intranets Give New Life, Accessed December 8, 2008).

Data Gathering. A systems survey requires the study team to gather data about the existing system. There are several ways of doing this, including:

- **Review Existing Documentation.** This documentation includes descriptive data such as organizational charts, strategic plans, budgets, policy and procedure manuals, job descriptions, and charts of accounts, as well as technical documentation such as flowcharts, process diagrams, and training manuals.
- **Observe the Current System in Operation.** Visiting various parts of the operation on a surprise schedule and asking workers questions about their jobs can be extremely helpful in learning whether the systems work as described, as well as discovering the morale of employees, occurrence of down-time, and workload cycles and distribution.
- **Use Questionnaires and Surveys.** These can be anonymous so that respondents share their views openly about sensitive issues. *Open-ended questionnaires* provide an unstructured free-flow of ideas that may bring new issues to light. *Close-ended questionnaires* (Figure 13-3), on the other hand, are efficient and allow for easy tabulation of results.
- **Review Internal Control Procedures.** In earlier chapters of this book, we discussed the importance of internal control systems. Weaknesses in these procedures can cause major problems for a company. The study team should identify high-risk areas, strengths, and weaknesses of the specific procedures.
- **Interview System Participants.** Face-to-face interviews allow the study team to gather system information in the greatest depth and sometimes reveal surprises. For example, an interview might reveal that a manager's decisions don't really require input from several existing reports.

Data Analysis

Once the study team completes its survey work, they must analyze the results. Often, this means nothing more than creating summary statistics, but it can also involve developing flowcharts and/or process maps that can highlight bottlenecks in information flows, redundant reporting, and missing information links.

Systems analysis work necessarily takes longer than a preliminary investigation, typically months. Where required, the study team will provide interim reports to the steering

Example of an Open-Ended Question on a Systems Survey Questionnaire:

Please explain why you are either satisfied or dissatisfied with the current general ledger system.

Example of a Closed-Ended Question on a Systems Survey Questionnaire:

Please indicate your level of satisfaction with the current general ledger system by checking the appropriate response below:

_________ Very satisfied
_________ Somewhat satisfied
_________ Neither satisfied nor dissatisfied
_________ Somewhat dissatisfied
_________ Very dissatisfied

FIGURE 13-3 Sample questions on a systems survey questionnaire.

committee about its progress. The most important deliverable from the analysis portion of the systems study, however, is the *final systems analysis report*, which signals the end of the analysis phase of the systems study. Like other reports, the study team submits this report to the steering committee, which then considers the report's findings and debates the recommendations it contains.

As representatives of top management, the steering committee has, within limits, the ability to make a decision. The committee could abandon the project, ask for additional analyses and a set of revised recommendations, or vote to proceed to the systems design phase of the project.

Evaluating System Feasibility

After obtaining a positive response from the steering committee, the design team must perform a detailed investigation of different potential systems. Figure 13-4 shows that this work involves five major procedures or activities. The first of these is a **feasibility evaluation** in which the design team determines the practicality of alternative proposals. Only after this step is completed can the design team tackle the other steps. For each system alternative, the design team must examine five feasibility areas: (1) technical feasibility, (2) operational feasibility, (3) schedule feasibility, (4) legal feasibility, and (5) economic feasibility.

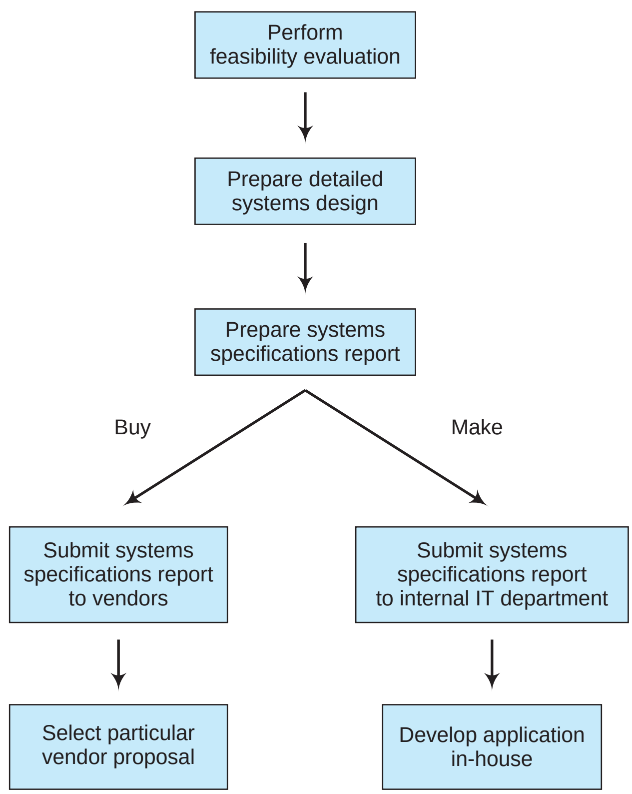

FIGURE 13-4 Steps in the systems design phase of a systems study.

Technical Feasibility. The **technical feasibility** of any proposed system attempts to answer the question, ''What technical resources are required by a particular system?'' Hardware and software are obvious components. A proposed system that can interface with critical existing software is more desirable than one requiring the organization to buy new software. Experts in computer systems typically work on this phase of the feasibility evaluation because a thorough understanding of IT is essential.

In addition to developing a preliminary hardware configuration for a proposed system, the design team must also determine whether current employees have the technical skills to use it. If a specific computerized system is too sophisticated for a company's employees, it is unlikely that using it in subsequent daily operations will be successful without appropriate training.

Operational Feasibility. The **operational feasibility** of a proposed system examines its compatibility with the current operating environment. That is, how consistent will the tasks and procedures required by the new system be with those of the old system? The design team must analyze the capabilities of current employees to perform the specific functions required by each proposed system and determine to what extent employees will require specialized training.

Operational-feasibility analysis is mostly a human relations study because it is strongly oriented toward ''people problems.'' For this reason, the participation of human-relations specialists is critical. As noted earlier, employees commonly have negative attitudes toward changes that might affect their organizational duties. If managers encourage employees to suggest changes and keep them well-informed about how any new system will affect their job functions, an organization can limit employee resistance.

Schedule Feasibility. Timeliness is important. **Schedule feasibility** requires the design team to estimate how long it will take a new or revised system to become operational and to communicate this information to the steering committee. For example, if a design team projects that it will take 16 months for a particular system design to become fully functional, the steering committee may reject the proposal in favor of a simpler alternative that the company can implement in a shorter time frame.

Legal Feasibility. Are there any conflicts between a newly proposed system and the organization's legal obligations? A new or revised system should comply with all applicable federal and state statutes about financial reporting requirements, as well as the company's contractual obligations.

> ***Case-in-Point 13.3*** Nevada is one of five states in the United States that does not have a state income tax. You would think, therefore, that any payroll system a Nevada company chose to implement would not need a module to withhold state income taxes from employee paychecks. But Reno, Nevada, is only ten miles from the California border, and California does have a state income tax. As a result, Reno employees who live in California must pay state income taxes even though they work in Nevada. So, companies in Reno, Nevada, must have state withholding modules in their payroll systems for employees who live in California.

Economic Feasibility. Through **economic feasibility** evaluation, the design team attempts to assess whether the anticipated benefits of the system exceed its projected costs. This requires accountants to perform a cost-benefit analysis. This analysis takes into account all costs, including indirect costs such as time spent by current employees on implementing the new system. It also considers benefits, which are sometimes difficult to foresee or estimate. A mistake frequently made in thinking about new systems is underestimating costs for implementation and continuing operations. Accountants conducting the analysis need to separately identify one-time costs versus those that will be recurring. The point of the economic feasibility analysis is to get a ''best estimate'' of the worthiness of a project.

SYSTEMS DESIGN

Once the steering committee approves the feasibility of a general system plan (project), the design team can begin work on a **detailed systems design**. This involves specifying the outputs, processing procedures, and inputs for the new system. Just as construction blueprints create the detailed plans for building a house, the detailed design of a new system becomes the specifications for creating or acquiring a new information system. Figure 13-5 provides examples of the detailed requirements that the design team must create, and these requirements in turn explain specifically what the proposed system must produce.

From an accounting standpoint, one of the most important elements in a new system is its control requirements. In this matter, the design team should have a ''real-time'' mentality when designing control procedures for a system. In other words, rather than adding controls after a system has been developed and installed, the team should design cost-effective general and application control procedures into the system as integrated components. The Committee of Sponsoring Organizations (COSO) of the Treadway Commission (introduced in Chapter 8) emphasizes the importance of this view:

> *Whenever management considers changes to its company's operations or activities, the concept that it's better to "build-in" rather than "build-on" controls, and to do it right the first time, should be the fundamental guiding premise.*[3]

Requirements	Discussion
Processes	Descriptions of the various processes to be performed in the revised system, stressing what is to be done and by whom.
Data elements	Descriptions of the required data elements, including their name, size, format, source, and importance.
Data structure	Preliminary data structure that indicates how the data elements will be organized into logical records.
Inputs	Copies of system inputs and descriptions of their contents, sources, and who is responsible for them.
Outputs	Copies of system outputs and descriptions of their purpose, frequency, and distribution.
Documentation	Descriptions of how the revised system and each subsystem will operate.
Constraints	Descriptions of constraints such as staffing limitations and regulatory requirements.
Controls	Controls to reduce the risk of undetected errors and irregularities in the input, processing, and output stages of data processing work.
Reorganizations	Necessary changes such as increasing staff levels, adding new job functions, and terminating certain existing positions.

FIGURE 13-5 Examples of detailed requirements for a system proposal.

[3]Summarized from Committee of Sponsoring Organizations of the Treadway Commission (CSOTC), Internal Control-Integrated Framework (COSO Report), New York: 1992.

Designing System Outputs, Processes, and Inputs

Once the design team finds a system feasible and creates a general design, it can focus on developing the system's input, processing, and output requirements. When performing design tasks, it is perhaps curious that the design team first focuses on the outputs—not the inputs or processing requirements—of the new system. The reason for this is that the most important objective of an AIS is to satisfy users' needs. Preparing output specifications first lets these requirements dictate the inputs and processing tasks required to produce them.

During the analysis phase and general system design, the study team develops boundaries for the new system. These boundaries define the project's scope. However, as the design team works with users, they are likely to be asked to do additional work. Outside consultants often handle these requests by drafting proposals showing the additional costs associated with them. These costs can include delays in meeting the schedule for delivering the project.

Case-in-Point 13.4 Universities are large, complex organizations with many specialized processes. These entities are good candidates for enterprise systems, but **scope creep** and other problems can send these projects off track. To implement a Lawson Software system, the University of Wisconsin spent $25 million and six years, but they still were not ready for a system-wide rollout. One problem was customization, which required 251 programs and eight additional large applications to be added to the Lawson software. The North Dakota University System also had troubles as they worked to implement *PeopleSoft ERP*. The software project cost was $49 million ($14 million over budget) and over three years behind planned rollout. Extensive customized computing needs appear to be one source of the overruns for North Dakota's ERP.[4]

System Outputs. The design team will use the data gathered from the prior systems analysis work to help it decide what kinds of outputs are needed as well as the formats that these outputs should have. Although it is possible for the design team to merely copy the outputs of an older system, this would make little sense—the new system would be just like the old one. Instead, the team will attempt to create better outputs—that is, design outputs that will better satisfy their users' information needs than did the old system.

Outputs may be classified according to which functional area uses them (e.g., marketing, human resources, accounting, or manufacturing) as well as how frequently they must be produced (e.g., daily or weekly). Where a specific report is not needed on a regular basis, the system should be able to provide it when requested (a *demand report*) or triggered when a certain condition is met (an *exception report*). For example, an accounts receivable report on a specific customer's payment history might be issued on demand, or generated automatically when a customer owes more than a specified amount. Although many organizations still rely heavily on hard-copy (printed) reports, systems designers should also consider the possibility of creating soft-copy (screen) reports as an alternative.

Process Design. Until now, the system designers have focused on *what the system must provide* rather than *how the system can provide it*. After designing the outputs, their next step is to identify the processing procedures required to produce them. This involves deciding which application programs are necessary and what data processing tasks each program should perform.

[4]Sources: Songini, Marc, ''Delays, Added Costs Threaten University's ERP Apps Rollout,'' *Computerworld* (August 1, 2005), pp. 1–2 and Songini, Marc, ''PeopleSoft Apps Vex N.D. Colleges,'' www.computerworld.com (June 23, 2006).

There are a large number of tools for modeling computer processes. Among them are the system flowcharts, data flow diagrams, program flowcharts, process maps, and decision tables discussed in Chapter 3. Another popular tool is the entity-relationship (E-R) diagram discussed in Chapter 4. Common to all these design methodologies is the idea of structured, top-down design, in which system designers begin at the highest level of abstraction and then ''drill down'' to lower, more detailed levels until the system is completely specified.

Designing System Inputs. Once the design team has specified the outputs and processing procedures for a new project, its members can think about what data the system must collect to satisfy these output and processing requirements. Thus, the team must identify and describe each data element in the systems design (e.g., ''alphabetic,'' ''maximum number of characters,'' and ''default value'') as well as specify the way data items must be coded. This is no easy task, because there are usually a large number of data items in even a small business application. Chapter 4 discusses the subject of data modeling in detail.

After the design team identifies and describes the input data, it can determine the source of each data element. For example, customer information such as name, address, and telephone numbers may be gathered directly from web screens, and the current date can be accessed from the computer system itself. Wherever possible, the design team will attempt to capture data in computer-readable formats, as noted in Chapter 2. This avoids costly, time-consuming data transcription as well as the errors such transcription typically introduce into the job stream.

Finally, system designers try to create systems that streamline data entry tasks because this facilitates the process and helps users avoid errors. Examples include substituting system default values, screen menus, and mouse clicks for system commands or other inputs that must otherwise be entered manually. Additional examples include using dialogue boxes for special user inputs and message boxes that help explain why a particular input value is unacceptable (Figure 13-6).

Prototyping

Prototyping means developing a simplified model of a proposed information system. A prototype is a scaled-down, experimental version of a nonexistent information system that a design team can develop cheaply and quickly for user-evaluation purposes. The prototype model does not run, but presents users with the ''look and feel'' of a completed system. By allowing users to experiment with the prototype, the designers can learn what users like and dislike in the mockup. They can then modify the system's design in response

FIGURE 13-6 An AIS might display this error message if the user made a mistake entering a Social Security number in a dialogue box.

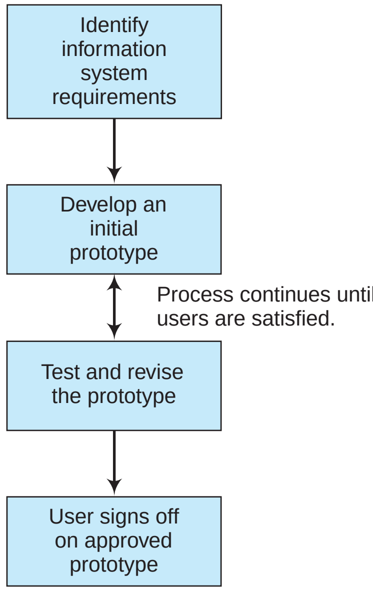

FIGURE 13-7 Steps in prototyping an accounting information system.

to this feedback. Thus, prototyping is an iterative process of trial-use-and-modification that continues until users are satisfied. Prototyping has four steps, as illustrated in Figure 13-7. The following case-in-point describes how it works in practice.

> ***Case-in-Point 13.5*** A company hired a consulting firm to develop a large-scale student management information system to manage its training and continuing education programs. The consulting firm developed a prototype that showed the primary input screens and reports. This prototype was used to obtain input to modify the inputs and outputs. For instance, users experimented with the screens, thinking about how easy it would be to input data through them. Users also considered whether the reports would give them the information they needed, such as a listing of all students in a class and all classes taken by a student. The programming to activate the screens and enable the processing, along with the database functionality, came later. This prototyping approach ensured that the completed system would satisfy user needs.

Prototyping has various advantages and disadvantages compared to the traditional design approach. In general, the procedure is useful when end users do not understand their informational needs very well, system requirements are hard to define, the new system is mission-critical or needed quickly, past interactions have resulted in misunderstandings between end users and designers, and/or there are high risks associated with developing and implementing the wrong system.

However, prototyping is not always the best systems design approach. For example, both managers and IT professionals can distrust it—the managers, if they perceive prototyping as ‘‘too experimental’’ and the IT professionals, if they harbor fears that the results lead to poor design solutions. Then, too, a design team can be misled if it relies on a small portion of the user population for developing its models and thus satisfies the informational needs of non-representative employees. For this reason, prototyping is not normally appropriate for designing large or complex information systems that serve many users with significantly different informational needs. Finally, IT professionals do not recommend prototyping for developing traditional AIS applications such as accounts receivable, accounts payable, payroll, or inventory management, where the inputs, processing, and outputs are already well known and clearly defined.

The Systems Specifications Report

After the design team completes its work of specifying the inputs, outputs, and processing requirements of the new system, the members will summarize their findings in a (typically large) **systems specifications report**. Figure 13-8 provides some representative information that might be included in such a report. The design team submits this report to the steering committee for review, comment, and approval.

The Make or Buy Decision. The project is now at a critical juncture. If the steering committee approves the detailed design work, it now faces a make-or-buy decision. In large organizations, one possibility is to use internal IT staff to develop the project. This choice offers the tightest control over project development, the best security over sensitive data, the benefits of a custom product that has been tailor-made for the exact requirements of the application, the luxury of replacing the old system piecemeal as modules become available, and a vote of confidence for the organization's IT staff. But this choice also uses valuable

1. *Historical background information about the company's operating activities.* Included here would be facts about the types of products manufactured and sold by the company, the financial condition of the company, the company's current data processing methods, the peak volume of data processing activities, and the types of equipment currently being used in the company's data processing system.
2. *Detailed information about the problems in the company's current system.* By understanding the present systems problems, the computer vendors should have a better idea of what type of specific computer application will eliminate the company's system weaknesses. The design team may also include information about how soon they would like to receive the vendors' recommendations and the approximate date that the final decision will be made by their client regarding which computerized system will be purchased (or leased).
3. *Detailed descriptions of the systems design proposals.* For every design proposal, information should be included about such things as the data input and output of specific computer processing runs, the types of master files needed and the approximate volume of each file, the frequency of updating each master file, the format of each output report, the approximate length of each output report, the types of information included in each report and how often the various reports will be prepared, the organizational managers to whom every report will be distributed, and the company's available space for computer facilities.
4. *Indication of what the vendors should include in their proposals to the company.* This section of the systems specifications report, in effect, tells the vendors how detailed they should make their proposals. The company might request information regarding the speed and size of the central processing unit needed, the type of PCs needed for the company's local area network, the type and quantity of input and output devices as well as the capabilities of these devices, the availability of prewritten software packages for specific processing activities, the training sessions offered by the vendors on the operating details of the new system, the help provided by the vendors in implementing and testing the new system, the maintenance services available from the vendors, and the vendors' provisions for backup data processing facilities.
5. *Time schedule for implementing the new system.* This final section of the report will request the computer vendors to estimate the number of weeks, months, or years that will be necessary to implement their recommended computer systems within the company.

FIGURE 13-8 Systems specifications report information.

employee time and can divert the organization's resources from its main objectives—for example, manufacturing products.

Another possibility is to outsource the project's development to a contractor. This choice is useful when an organization lacks internal expertise to do the work or simply wishes to avoid the headaches of internal project development.

Finally, the steering committee can purchase prewritten software (commonly called **canned software**) and perhaps modify it to suit the firm's needs. If the organization requires both hardware and software, the committee may also choose to shop for a complete, ''ready-to-go'' **turnkey system**. The steering committee can ask the computer vendors to submit bid proposals for such a complete system, or alternatively, can ask each vendor to provide separate bids for hardware and software.

Choosing an Accounting Information System

Because internal project management and systems development are beyond the scope of this text, we'll assume here that the steering committee opts to acquire most of its system resources from outside vendors. This is the most common choice. If the committee takes this course of action, the systems specifications report helps them create a **request for proposal (RFP)** outlining the specific requirements of the desired system. Upon finalizing the system's specifications, the committee (with the help of the design team and perhaps outside consultants) will send a copy to appropriate vendors. Typically, the RFP also contains a deadline for bidding, the length of which varies—for example, just a few weeks for hardware, and longer periods of time for systems requiring custom development tasks.

After the deadline has passed, an evaluation committee supervised by the steering committee will review vendor submissions and schedule separate meetings with those vendors who provide viable system proposals. The participants at each meeting include representatives from the vendor, representatives from the steering committee, and representatives from the design team. The vendor's role is to present its proposal and to answer questions from the other participants. The evaluation committee's role is to listen to the vendor proposals, provide input to the steering committee about the pros and cons of each one, and perhaps make a recommendation for a preferred provider.

Selection Criteria. The steering committee's responsibility is to make a final selection and it is not restricted in its choices. It can accept one bid totally, negotiate with one vendor for specific resources, or spread its purchases among two or more providers. Here are some key factors that a steering committee should consider when evaluating vendor proposals:

- **The Performance Capability of Each Proposed System.** A vendor system must be able to process the organization's data so that management will receive outputs when they need them. There are many measures of performance, including speed, response time, number of users supported, and system testing. One way to examine the operating efficiency of a particular system is to use a **benchmark test**. With this approach, the vendor's system performs a data processing task that the new system must perform (e.g., payroll processing), and representatives of the organization then examine the outputs for accuracy, consistency, and efficiency.
- **Costs and Benefits of Each Proposed System.** The accountants on the design team will analyze the costs of every vendor's proposed system in relation to the system's anticipated performance benefits. They will also consider the differences between

purchasing and leasing each vendor's system. If the steering committee elects to purchase a system, the accountants should then advise the committee on a realistic depreciation schedule for the new system.

- **Maintainability of Each Proposed System.** This refers to the ease with which a proposed computer system can be modified. For example, this flexibility enables a firm to alter a portion of a payroll system to reflect new federal tax laws. Because the costs of maintaining a large information system are typically five times as much as the costs of initially acquiring or developing a system, the evaluators should place considerable emphasis on this dimension.
- **Compatibility of Each Proposed System with Existing Systems.** The new system must interface and work with existing computer hardware, software, and operating procedures. In some instances, this comes down to hardware issues. For example, it may not be possible to run specific software modules of the new system on some of the company's older local area network servers, which will consequently have to be upgraded. But compatibility issues can also involve the operating system, existing application software, or operational concerns as well—for instance, the requirement that employees learn a whole new set of procedures for inputting data.
- **Vendor Support.** Vendor support includes such things as (1) training classes that familiarize employees with the operating characteristics of the new system, (2) help in implementing and testing the new system, (3) assistance in maintaining the new system through a maintenance contract, (4) backup systems for temporarily processing company data if required, and (5) telephone assistance for answering user questions. The availability of ''business-hours-only'' versus ''round-the-clock'' support and the availability of domestic versus offshore customer support are other considerations. Most vendors charge extra for enhanced services.

Making a Final Decision. Because this book is about accounting information systems, our focus here will be on acquiring accounting software. Selecting an accounting system is a major responsibility that requires careful planning. After all, a software package that fails to meet the needs of a company or its accounting staff can throw an organization into turmoil, losing time and money. We discussed choosing software in some detail in Chapter 9. Here we discuss an analytical approach to choosing hardware and software vendors or AISs.

Point-Scoring Analysis. A technical approach for evaluating hardware or software that meets most of a company's major requirements is a **point-scoring analysis** such as the one illustrated in Figure 13-9. To illustrate, assume that in the process of selecting an accounts payable system, an organization finds three independent vendors whose packages appear to satisfy current needs. Figure 13-9 shows the results of the analysis. Because the cost to purchase or lease each vendor's accounts payable software package is about the same, ''cost'' is not an issue in this selection process.

When performing a point-scoring analysis, the evaluation committee first assigns potential points to each of the evaluation criteria based on its relative importance. For example, the committee feels that ''adequate controls'' (10 possible points) is more important than whether other users are satisfied with the software (8 possible points). After developing these selection criteria, the evaluation committee proceeds to rate each vendor or package, awarding points as it deems fit. The highest point total determines the winner. In Figure 13-9, the evaluation indicates that Vendor B's accounts payable software

Software Evaluation Criteria	Possible Points	Vendor A	Vendor B	Vendor C
Does the software meet all mandatory specifications?	10	7	9	6
Will program modifications, if any, be minimal to meet company needs?	10	8	9	7
Does the software contain adequate controls?	10	9	9	8
Is the performance (speed, accuracy, reliability, etc.) adequate?	10	7	8	6
Are other users satisfied with the software?	8	6	7	5
Is the software well documented?	10	8	8	7
Is the software compatible with existing company software?	10	7	9	8
Is the software user-friendly?	10	7	8	6
Can the software be demonstrated and test-driven?	9	8	8	7
Does the software have an adequate warranty?	8	6	7	6
Is the software flexible and easily maintained?	8	5	7	5
Is online inquiry of files and records possible?	10	8	9	7
Will the vendor keep the software up to date?	10	8	8	7
Totals	123	94	106	85

FIGURE 13-9 A point-scoring analysis for evaluating three independent vendors' accounts payable software packages.

package has the highest total score (106 points) and the committee should therefore acquire this vendor's system.

Although point-scoring analyses can provide an objective means of selecting a final system, many experts believe that evaluating accounting software is more art than science. There are no absolute rules in the selection process, only guidelines for matching user needs with software capabilities. Even for a small business, evaluators must consider such issues as the company's data processing needs, its in-house computer skills, vendor reputations, software costs, and so forth.

Selecting a Finalist. After each vendor presents its proposal to the organization, the steering committee must select the best one. Although a vendor's reputation is relative, a buyer can obtain clues by checking with the Better Business Bureau and speaking with some of the vendor's other clients. It is also possible that, say, because of the cost factor, none of the computer vendors' proposals is satisfactory. For example, perhaps at the time the design team performed their economic feasibility study, the results were favorable, but the subsequent detailed design specifications result in actual costs that are considerably higher than anticipated. At this point, the organization's steering committee can (1) request the design team to obtain additional systems proposals from other vendors, (2) abandon the project, or (3) outsource needed services.

Outsourcing

An alternative to developing and installing internal accounting information systems is to outsource them. As we discussed in Chapter 7, outsourcing occurs when a company hires an outside organization to handle all or part of the operations for a specific business function. Accounting tasks have long been a target for outsourcing, including accounts payable, accounts receivable, payroll, general ledger, accounting for fixed assets, and financial reporting. Interestingly, U.S. tax returns are even being outsourced to workers in other countries, including India.

In the accounting area, the degree to which a company outsources its processing operations can range from routine assistance with a single application such as payroll or tax compliance to performing almost all the accounting functions of the organization. Outsourcing contracts are typically signed for five to ten years. Annual costs depend on the amount of data processing work to be performed and range from ''thousands'' to ''millions'' of dollars. When a large company decides to outsource its IT functions, it is not uncommon for the vendor to purchase all of its clients' hardware and software, and hire almost all of that company's IT employees. The outsourcing organization then operates and manages the client company's entire information systems, either on the client's site or by migrating the client's systems to its own computers.

Advantages and Disadvantages of Outsourcing. Often, making a decision to outsource a process is not an easy one. One advantage is that an organization can focus on its core competencies while ''experts'' do the other work. For example, hospitals often outsource their data processing functions so they can focus on better patient care. Outsourcing also frees managerial time, financial assets, and related resources for other purposes, and an organization doesn't need to worry about keeping up with technology in-house.

A primary motivator for outsourcing is cost savings. These come from economies of scale where the process-provider is able to spread costs among several clients and achieve high volumes for purchases. Another cost savings can come from moving selected operations to areas where real estate prices, building rents, or labor costs are less—for example, to offshore sites. This also enables a company to reduce its own labor force, save money, and remain competitive.

Although the advantages of outsourcing are compelling, outsourcing is not always the best alternative. One disadvantage is inflexibility. The typical outsourcing contract requires a company to commit to services for an extended time period—ten-year contracts are common. Should the contracting company become dissatisfied with the services it receives during this period of time, however, it is usually difficult to break the agreement. Even with a termination clause, the company may still be locked into outsourcing itself—for example, because it has already sold its data processing centers and terminated its IT staff.

Loss of control is another potential disadvantage. When an outsourcing vendor performs a significant portion of an organization's data processing, that organization loses control of its information systems. For example, the contracting company can no longer control its data, data errors, or other processing irregularities that occur from the outsourcer's processing work. Finally, outsourcing can cause an organization to lose competitive advantage. That is, when a company outsources its IT functions, it can also lose a basic understanding of its own information system needs or how its information systems could provide it with competitive advantages.

IMPLEMENTATION, FOLLOW-UP, AND MAINTENANCE

Systems implementation is often called the ''action phase'' of a systems study because the recommended changes from the prior analysis, design, and development work are now put into operation. But systems implementation can also be a stressful time. As the time draws near for installing a new system, end users and clerical personnel become nervous about their jobs, middle managers wonder if the new system will deliver the benefits as promised, and top managers become impatient when installations run longer than anticipated or go over budget. Even if an organization did a perfect job of analyzing, designing, and developing a new system, the entire project can fail if its implementation is poor.

Implementation Activities

Implementing a new accounting information system involves many activities and tasks that will vary in number and complexity depending on the scale of the system and the development approach. Some of the steps that may be involved are:

1. **Prepare the Physical Site.** An organization must have physical space for any new hardware and personnel.
2. **Determine Functional Changes.** Whenever a company makes changes to a major accounting system, it must also consider the effects of such changes on its reporting structure and personnel relationships.
3. **Select and Assign Personnel.** Because the design team has developed detailed specifications for the new system, the organization should now have a firm idea about the job descriptions of system users.
4. **Train Personnel.** Both the implementation team and computer vendors can help train company employees to work with the new system, and seminars can acquaint other employees with the new system's advantages and capabilities. Vendors may provide technical training for free, or at reduced costs, to corporate users as incentives to use their products.
5. **Acquire and Install Computer Equipment.** After preparing the physical site for the new computer system, the company must acquire computer equipment such as PCs, web servers, routers, modems, and printers from outside vendors.
6. **Establish Internal Controls.** Chapters 11 and 12 described why an organization must install control procedures that safeguard its assets, ensure the accuracy and reliability of accounting data, promote operating efficiency, and encourage employee compliance with prescribed managerial policies. Again, these controls should be built into a system rather than added later.
7. **Convert Data Files.** When converting to a new system, an organization may have to convert its data files to alternate, more-useful formats. This activity is also common when merging two systems—for example, when consolidating formerly separate divisions of a company or merging the systems from two separate companies into one.
8. **Acquire Computer Software.** The implementation team must also install the software that was acquired or developed for the project. The software from independent vendors is often called canned software, which sometimes comes bundled (i.e., combined) with hardware in complete turnkey systems. In general, the process of acquiring (and possibly making modifications to) computer software from an independent vendor takes considerably less time than developing the programs in-house.
9. **Test Computer Software.** Programs must be tested regardless of where they came from to ensure day-to-day processing accuracy and completeness.
10. **Convert to the New System.** In switching to the new system, the firm may choose to make a **direct conversion** by immediately discontinuing use of the old system and

letting the new system ''sink or swim.'' An alternative is **parallel conversion**, where the organization operates both the new and the old system for some period of time. Another choice is **modular conversion**, where the new system is implemented in stages, one process or module at a time. An example would be first implementing the inventory module, then order processing, and so on.

The most difficult issue in implementing a new system is **change management**. The new system will bring with it changes to employee job descriptions and, in some cases, new jobs and no jobs. Members of the implementation team and steering committee should communicate openly with affected workers about how the new system will impact them. Organizations should give those employees whose jobs are either eliminated or materially altered an opportunity to apply for the new jobs and obtain retraining, if necessary. Similarly, terminated employees should receive ample notice to enable them to apply for other jobs before their employment ends. Some companies even set up internal outplacement offices for displaced employees or create early retirement plans for qualified employees.

Managing IT Implementation Projects

The preceding section made clear that there are many tasks involved in implementing a new accounting system. Moreover, an organization cannot perform these tasks randomly, but rather must complete them in a logical sequence. A good analogy is the process of building a house, which requires completing the foundation, sub-floors, and load-bearing walls before putting on the roof. Similarly, if an organization does not plan its systems implementation in an orderly fashion, the project's coordination is almost sure to suffer and its completion may be prolonged unreasonably.

There are many tools available to help manage projects. Two of these, **Program Evaluation and Review Technique** (PERT) and **Gantt charts**, help managers schedule and monitor the activities involved in large projects, such as implementation of a large-scale information system. There are also software solutions that may be used for project management, which we discuss below.

Program Evaluation and Review Technique. With PERT, a project leader first prepares a list of systems implementation activities, identifies the prerequisite activities that must be completed before others can start, and estimates the amount of time required to complete each activity. Figure 13-10 shows what a PERT diagram might look like for the implementation tasks outlined above. In the chart, Activity A might take 17 weeks and must be completed before Activity E. The activities A-E-H-I-J together, would take 55 weeks. The lines with arrows in this diagram conventionally flow from left to right and represent the activities required to implement the system. The circles (called *nodes*) in the diagram represent project milestones—i.e., the starting points or completions of specific activities—and therefore do not require any time.

Top managers may not be interested in PERT analyses, but they are usually very concerned about the time required to finish the entire project. The project leader can estimate this completion time by examining the various paths in the PERT network. Because PERT diagrams in actual practice are so large (often covering entire walls), project leaders normally use a computer to identify the longest paths through such networks. Within a PERT diagram, the longest path to project completion is called the **critical path**, which is also the shortest completion time of the entire project. The project leader will closely

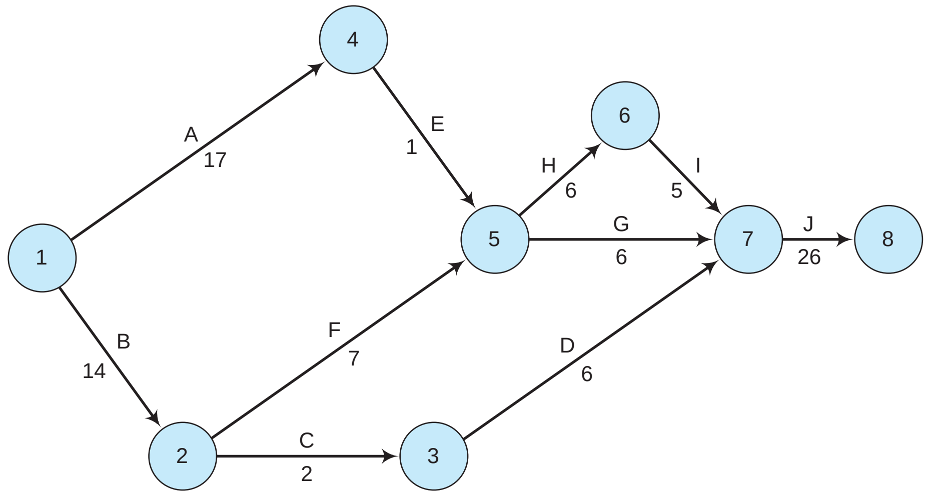

FIGURE 13-10 PERT network diagram for a systems implementation project.

monitor the work on each critical-path activity to avoid setbacks. **Slack time** describes the amount of delay time that can occur in each non-critical activity and still not delay the project. Slack time along the critical path is zero because delays in activities on this path automatically delay the entire project. PERT is a useful project management tool because of its ability to help managers identify critical paths and areas where slack time occurs.

As the implementation team performs specific activities, it also provides feedback reports to the steering committee that compare actual implementation times with planned times. These reports enable both parties to focus on delays in completing specific activities and to estimate what effect these delays may have on the entire installation project. If a specific critical activity is behind schedule, the project leader may allocate additional resources to speed its completion. Alternately, if another activity is ahead of schedule, the project leader may reduce the resources assigned to it and use them elsewhere.

Gantt Charts. Another tool that an organization can use in planning and controlling a systems implementation project is a **Gantt chart** (Figure 13-11). Gantt charts are useful for both scheduling and tracking the activities of systems implementation projects because actual progress can be indicated directly on the Gantt chart and contrasted with the planned progress.

Gantt charts are straightforward, easy to understand, and can be used with PERT to compare estimated completion times against actual ones. A disadvantage of Gantt charts is that they do not indicate the precedence of activities for the project, as do PERT charts. Rather, a Gantt chart treats each activity as if it were independent of the others, which of course is not really the case. For this reason, Gantt charts are better suited for systems implementation projects that are not complex and have relatively few interrelationships among implementation activities.

Project Management Software. As noted above, PERT diagrams can become complex, making the calculations required to compute and re-compute critical paths and slack times difficult. **Project management software** that runs on desktop or notebook computers can perform these tasks easily and quickly, can enable a project leader to plan and

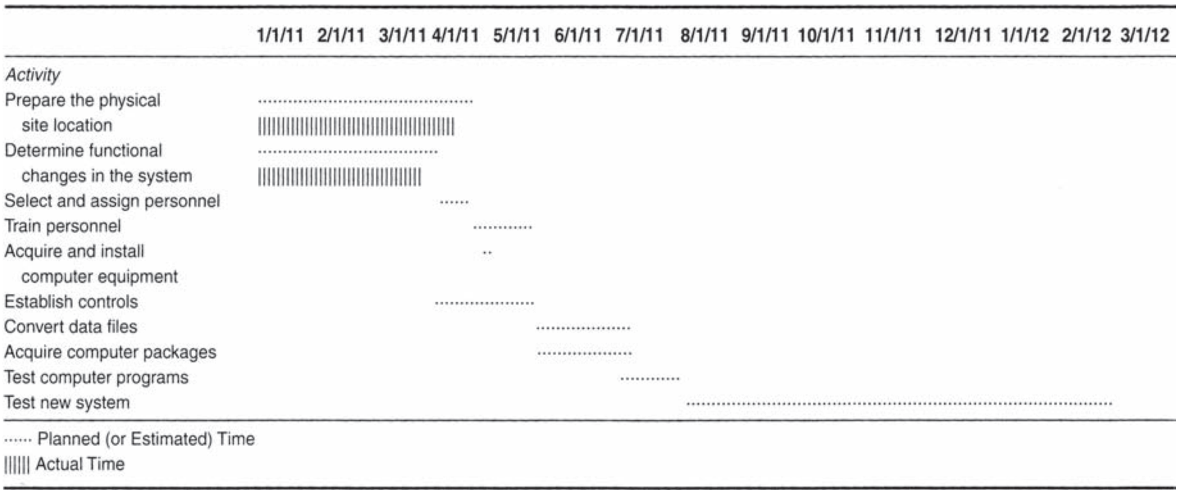

FIGURE 13-11 Gantt chart for systems implementation activities.

control implementation tasks, and can help a team install a new system on time and within budget. Examples of project management software solutions include *eProject, Microsoft Project, PlanBee*, and *Time Line*.

Project management software requires users to break down complex projects into smaller, simpler activities and to estimate the time, cost, and other resources required for each of them. The project leader then enters these estimates into the computer running the project software, along with the priority of the various activities of the project. The software can then schedule tasks, identify critical and non-critical activities, compute slack times, and so forth. Project management software also allows the project leader to perform what-if analyses—for example, to experiment with different systems implementation work schedules or determine how delays in specific activities are likely to affect other project tasks.

Interestingly, some of the more current project management information systems are much more complex than some of the earlier software solutions. These new systems are not limited to just scheduling and resource management—they are now much more comprehensive and can support the entire life-cycle of projects.[5]

Post-Implementation Review

Regardless of which conversion method used, the new system will eventually become the sole system in operation. This brings us to the final, **follow-up and maintenance phase** of our systems development life cycle. The purpose of this phase is to monitor the new system and make sure that it continues to satisfy the three levels of organizational goals discussed at the beginning of this chapter: (1) general systems goals, (2) top management systems goals, and (3) operating management systems goals. When these goals are not adequately satisfied, problems normally occur and the system requires further modifications.

[5]Source: F. Ahlemann, ''Towards a conceptual reference model for project management information systems,'' *International Journal of Project Management* (January 2009), pp. 19–30.

After the new system has been in operation for a period of time, the implementation team should reevaluate the new system's effectiveness by:

- Talking with top management personnel and operating management personnel about their satisfaction with the new system.
- Talking with end users to determine their satisfaction.
- Evaluating the control procedures of the system to verify whether they are functioning properly.
- Observing employee work performance to determine whether they are able to perform their job functions efficiently and effectively.
- Evaluating whether computer processing functions, including data capture and preparation, are performed efficiently and effectively.
- Determining whether output schedules for both internal and external reports are met with the new computer system.

At the conclusion of the initial follow-up study, the team prepares a report called a *post-implementation review report* for the steering committee that summarizes the implementation team's findings. If the implementation team is satisfied that the new system is working satisfactorily, no further revisions are required. If follow-up studies reveal that problems still exist in the new system, the team will communicate these findings to the steering committee and perhaps recommend further systems studies. Upon receiving approval from the steering committee, the organization will then perform the systems study steps again with the objective of making revisions to the system.

A post-implementation review is also beneficial to the implementation team. At this point in the systems development life cycle, the team members are now in a position to evaluate their own work, learn from the mistakes they made or successfully avoided, and become more skilled ''systems people'' in future engagements.

System Maintenance

In practice, implementation teams do not normally perform follow-up studies of their company's new information system. Instead, the team turns over control of the system to the company's IT function, which now shoulders the responsibility for maintaining it. In effect, **system maintenance** continues the tasks created by the initial follow-up study, except that experts from the company's IT subsystem now perform the modifications exclusively. For example, when users complain about errors or anomalies in the new system, it becomes the IT subsystem's responsibility to respond to these needs, estimate the cost of fixing them, and (often) perform the necessary modifications. The IT departments of even medium-size companies typically have forms for such requests, policies for prioritizing maintenance tasks, and formulas for allocating maintenance costs among the various user departments.

It is common for business systems to require continuous revisions. Some of the common reasons include: increased competition, new governmental regulations, or the information needs of top management (or other levels of management) change. In fact, studies show that, over the life of a typical information system, organizations spend only about 20–30% of the total system costs developing and implementing it. They spend the remaining 70–80% maintaining it, typically on further modifications or software updates. In other words, ''maintenance'' may not be the most glamorous part of a systems development life cycle,

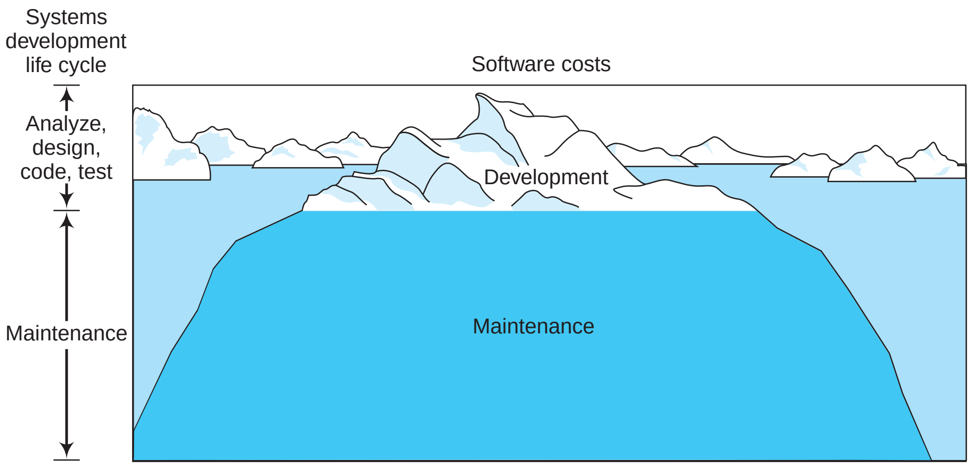

FIGURE 13-12 In the systems development life cycle, the costs of analysis, design, development, and implementation are often just the tip of the iceberg: software maintenance costs are the most expensive part.

but it is almost always the most expensive part. For this reason, organizations try to develop or acquire *flexible systems*—that is, systems that are easily modified—because such systems save businesses money in the long run (even if they cost more in the short run).

AIS AT WORK
Outsourcing and Offshoring IT

A recent research survey of 420 IT professionals found cost savings to be the primary reason companies choose to outsource their IT. Some cost savings stem from increased business flexibility, and some from avoiding personnel costs (i.e., health care, pensions, and other benefits). Companies that use outsourced IT services have the ability to be more flexible and can adapt quickly to ebbs and flows in business and demands for IT services. Cost savings for labor is achieved by sending IT work to countries with lower wages. One quarter of all outsourced IT dollars is spent on offshore IT, with much of that work going to service providers in India.

In evaluating IT service providers domestically, ''reliability'' is the most important criterion. Domestic US companies including IBM and Accenture are benefiting from the trend to increased outsourcing of IT services.

When choosing an offshore vendor, it's all about cost. Indian companies, such as Satyam Computer Services, Tat Consulting Services (TCS), and Cognizant Technology Solutions (CTS) are often selected for IT services.

CTS will soon reach the $1 billion revenue mark. Its fast growth may be partly due to its ''Americanism.'' CTS is not purely an American company, nor is it Indian. It's a hybrid company that may be considered either American-Indian, or Indian-American. The CEO resides in the company's New Jersey headquarters and the company uses an American approach to developing customers in that it develops strategic solutions. CTS emphasizes specialization in business applications, primarily in the financial services and health care industries.

CTS, one of the NASDAQ 100, demonstrates the complex relationships that are becoming more common in global business. The company was founded to take advantage of India's labor pool and low labor costs. Just as US companies once moved among states, now it is the case that American, Indian, Chinese, and European companies look at earth's whole map—and they do the work where it can be done best and/or costs the least.[6]

SUMMARY

- The four stages in a systems development life cycle are: (1) planning and investigating, (2) analysis, (3) design, and (4) implementing, follow-up, and maintenance.
- Planning requires creating a team to investigate the current system and make recommendations to a steering committee.
- Systems analysis requires identifying general systems goals, top management systems goals, and operating management systems goals.
- A systems survey uses a variety of data gathering techniques to understand and document the system.
- The systems analysis report contains the study team recommendations.
- The components of a feasibility evaluation are technical, operational, legal, and economic feasibility.
- Detailed systems design begins with the design of outputs, and then inputs and processes. Designers may choose a prototyping approach to create the new system.
- A systems specifications report contains detailed information about the organization and its desired system.
- Choosing a system requires evaluating system performance capabilities, costs and benefits, system maintainability, system compatibility with other systems, and vendor support.
- An organization may choose to outsource its IT operations or accounting processes.
- Organizations use PERT, Gantt charts, and project management software to manage the implementation of information systems.
- Organizations need to follow-up to find out if new systems are working as planned.

KEY TERMS YOU SHOULD KNOW

applications portfolio
benchmark test
canned software
change management
critical path
detailed systems design
direct conversion
economic feasibility
feasibility evaluation
follow-up and maintenance phase
Gantt chart
legal feasibility
modular conversion
operational feasibility
parallel conversion
PERT
point-scoring analysis
preliminary investigation
project management software
prototyping

[6]Sources: Paul McDougall. "Cost Conscious, But Demanding," *InformationWeek*, June 19, 2006, pp. 43–48, and Nitya Varadarajan. "Its New Billion Dollar Baby; Cognizant Technology Solutions, Soon to Reach $1 Billion in Revenues Will Be the Youngest Company to Enter Indian IT's Exclusive Club. What Is Its Secret?" *Business Today*, New Delhi, India, February 10, 2006, p. 70.

request for proposal (RFP)
schedule feasibility
scope creep
slack time
steering committee
system development life cycle (SDLC)
system maintenance
systems analysis
systems approach
systems implementation
systems specifications report
systems study
systems survey
technical feasibility
turnkey system

TEST YOURSELF

Q13-1. Which of the following statements is NOT true:

a. A preliminary investigation of a current system is conducted by the steering committee

b. Implementation, follow-up, and maintenance of IT includes acquiring resources for the new system

c. In designing an AIS, the design team will begin with outputs

d. The more work done during planning and analysis, the less likely the new system will fail

Q13-2. The feasibility evaluation:

a. Is completed prior to detailed systems design

b. Includes economic, schedule, technical, legal, and operational feasibility

c. Both a and b are true

d. Neither a nor b is true

Q13-3. In developing and implementing IT, the study team and steering committee must consider organizational goals. These include:

a. General, technical, and top management goals

b. General, operating management, and technical goals

c. Top management, operating management, and economic goals

d. Top management, operating management, and general systems goals

Q13-4. Prototyping, as an IT development approach, has both advantages and disadvantages. In general, prototyping is most appropriate when:

a. The design team is not pressed for time in creating a new system

b. Users have a thorough understanding of their information needs

c. There are high risks associated with developing and implementing an ineffective system

d. System requirements are easily defined

Q13-5. In selecting a new accounting information system, the steering committee should consider:

a. All expected costs and benefits of the new systems, including maintenance and operating costs

b. Support that a vendor can provide, including training, maintenance, and backup

c. Compatibility of a new system with existing systems

d. All of the above are considerations in selecting a new system

e. Only a and b are important considerations in selecting the new system

Q13-6. A point-scoring analysis:

a. Is a useful tool in conducting a feasibility analysis

b. Helps the systems study team to decide whether or not to outsource their AIS

c. Provides a systems study team with an objective means for selecting a final AIS

d. Is a tool used for managing IT projects

Q13-7. Which of the following statements is NOT true with respect to managing IT projects:

a. Program evaluation and review technique (PERT) allows management to determine the shortest time it will take to implement a new system, and any slack time that might exist between implementation activities

b. An advantage of PERT is that it allows managers to identify the critical path in implementation

c. Both PERT and Gantt charts are manual techniques used in managing IT implementations

d. Gantt charts are useful in scheduling and implementing IT because they allow you to indicate actual progress versus planned progress directly on the chart

Q13-8. When converting to a new system, which of the following conversion alternatives would be the most risky for a financial services firm?

a. Direct conversion

b. Modular conversion

c. Parallel conversion

d. Turnkey conversion

Q13-9. Which one of the four stages in the Systems Development Life Cycle is likely to be the most costly for a new system?

a. Planning and Investigation

b. Analysis

c. Design

d. Implementation, Follow-up, & Maintenance

DISCUSSION QUESTIONS

13-1. Discuss the major differences between the planning, analysis, and design phases of a systems study.

13-2. What is a steering committee? Discuss its role in a systems study performed by a consulting firm.

13-3. A systems study team should understand three levels of corporate goals: general systems goals, top management systems goals, and operating management systems goals. If you had to select one of these categories of systems goals as the most important to the effective operation of an organization's information system, which one would you choose? Explain the reasons for your choice.

13-4. What is the purpose of a systems feasibility evaluation? Should this activity precede or follow the preparation of a systems specifications report for computer vendor evaluation? Explain.

13-5. Discuss some of the annual cash benefits and annual cash costs that a company might have when it creates an online ordering system on the World Wide Web.

13-6. What is prototyping? Under what circumstances should prototyping be used? Under what circumstances should it not be used?

13-7. What is the purpose of a systems specifications report? In what ways, if any, do the data included in this report differ from the data accumulated by the design team during their feasibility evaluation work?

13-8. When implementing a new computer system, two activities required are (1) establish controls and (2) convert data files. What is the rationale for performing activity 1 before activity 2?

13-9. Three methods for implementing a new system in an organization are direct conversion, parallel conversion, and modular conversion. Discuss the advantages and disadvantages of using each of these three systems implementation methods.

13-10. What is a PERT chart? What is a Gantt chart? Discuss the advantages and disadvantages of using PERT network diagrams versus Gantt charts for planning and controlling the activities involved in implementing an information system.

13-11. What is the purpose of follow-up in a systems study? Describe some of the specific activities that the management implementation team would perform in their follow-up work.

13-12. Discuss the two major ways that a company's software can be acquired. Which of these ways for acquiring software do you recommend? Explain your reasoning.

13-13. What is business process outsourcing and why do firms outsource their IT functions?

PROBLEMS

13-14. The Valaria V Company manufactures and distributes low-priced bottled wines to retailers. You are hired as a management consultant to help this company solve some of its systems problems. Describe the types of decision-making information that probably would be needed by the company's (a) supervisor of the production plant, (b) top management, and (c) marketing manager.

13-15. Stevenson Apparel is a manufacturer of fashion clothing that has just opened its first large retail store for selling in-season clothes at regular prices. The company's competitive strategy depends on a comprehensive point-of-sale (POS) system supporting online, up-to-the-minute sales totals, day-to-day tracking of stock information, and quick checkout of customer purchases. Because cashiers were already familiar with electronic cash registers, management decided that only minimal training was required. Cashiers enter four-digit stock tracking numbers (STNs) into one of the POS terminals that retrieves price and description data, computes the tax and total amount due, accepts the type of payment, and controls the cash drawer. A unique STN identifies each of the 9,500 pieces of merchandise. The central computer server maintains stock information.

In the first month of operation, new cashiers were awkward using the new system. They eventually became proficient users but were frustrated with the slow printing of sales tickets and the unpredictable action of their cash drawers. Each checkout stand has a telephone that cashiers use to call for approval of credit-card transactions. Customers became impatient when credit approvals delayed the checkout process or when the computer was down, thus stopping all sales, including cash sales. Identify four problems with the system and describe how you would remedy each of them.

13-16. Jay Beck works for the NSR Consulting Firm. His friend, Hank Henley, is the general manager and majority stockholder of the Pacific Worldwinds, a professional football team. Hank asked Jay to design an online, real-time computer system for ''the efficient operation of the football franchise.'' Jay was quite confused because he could not think of any possible uses for an online, real-time system within the operational activities of a football team (or any other type of athletic team). Assume that you are also employed at the consulting firm. Provide several suggestions to Jay concerning specific areas of athletic teams' (football teams, baseball teams, etc.) information systems where an online, real-time computer configuration might be beneficial to managerial decision making.

13-17. Cook Consultants is currently in the process of completing the systems implementation activities for converting The Samuel Company's old system to a new one. Because of unexpected delays in performing specific implementation activities, Jerry Hazen, the project manager, is concerned about finishing the project on time. The one remaining activity is testing the new computer system and subsequently eliminating the old one. Jerry's assistant, Jan Kramer, suggests that they can still meet their completion deadline if they use ''direct conversion'' rather than ''parallel conversion.'' Assuming that you are the CIO of the company, how would you react to Jan's suggestion? Discuss.

13-18. With the help of your instructor, identify a particular information system that is not working very well and perform a preliminary investigation of it. In your work, be sure to talk to (1) at least one external ''customer'' who is affected by the system, (2) one employee who uses the system daily, and (3) one person who manages this type of employee. For example, at a university, you might study the student parking information system. The ''customers'' are those car owners who purchase parking permits (e.g., students, faculty, and university staff members), data input clerks are the employees who use the system daily, and the parking manager is the person who supervises these employees. Ask each such person what he or she feels are the problems of the system, and what they think should be done to address these problems.

Prepare a preliminary investigation report that describes your system and outlines the following items: (a) the problems that each person experiences with the system, (b) the actions that each person thinks might solve the problems, and (c) your opinion of which difficulties are the ''real problems'' and which are just symptoms of these problems. Also include some recommendations. Should the present system be replaced, are minor modifications required, or is the system mostly acceptable as it is?

CASE ANALYSES

13-19. Wright Company (Analyzing System Reports)

Wright Company employs a computer-based data processing system for maintaining all company records. The current system was developed in stages over the past five years and has been fully operational for the last 24 months.

When the system was being designed, all department heads were asked to specify the types of information and reports they would need for planning and controlling operations. The systems department attempted to meet the specifications of each department head. Company management specified that certain other reports be prepared for department heads. During the five years of systems development and operation, there have been several changes in the department head positions due to attrition and promotions. The new department heads often made requests for additional reports according to their specifications. The systems department complied with all of these requests. Reports were discontinued only on request by a department head, and then only if it was not a standard report required by top management.

As a result, few reports were discontinued. Consequently, the information processing subsystem was generating a large quantity of reports each reporting period. Company management became concerned about the quantity of report information that was being produced by the system. The internal audit department was asked to evaluate the effectiveness of the reports generated by the system. The audit staff determined early in the study that more information was being generated by the information processing subsystem than could be used effectively. They noted the following reactions to this information overload:

- Many department heads would not act on certain reports during periods of peak activity. The department heads would let these reports accumulate with the hope of catching up during subsequent lulls.
- Some department heads had so many reports they did not act at all on the information, or they made incorrect decisions because of misuse of the information.

- Frequently, actions required by the nature of the report data were not taken until the department heads were reminded by others who needed the decisions. These department heads did not appear to have developed a priority system for acting on the information produced by the information processing subsystem.
- Department heads often would develop the information they needed from alternative, independent sources, rather than use the reports generated by the information processing subsystem. This was often easier than trying to search among the reports for the needed data.

Requirements:

1. Indicate whether each of the foregoing four reactions contributes positively or negatively to the Wright Company's operating effectiveness. Explain your answer for each of the four reactions.
2. For each reaction that you indicated as negative, recommend alternative procedures the Wright Company could employ to eliminate this negative contribution to operating effectiveness.

(CMA adapted)

13-20. Kenbart Company (Redesigning Profit Plan Report)

The managers at Kenbart Company have decided that increased emphasis must be placed on profit planning and comparing ''results'' to ''plans.'' A new profit planning system has been implemented to help with this objective. The company uses contribution margin reporting for internal reporting purposes and applies the concept of flexible budgeting for estimating variable costs. Kenbart's executive management uses the following terms when reviewing and analyzing actual results and the profit plan.

- **Original Plan:** profit plan approved and adopted by management for the year
- **Revised Plan:** original plan modified as a consequence of action taken during the year (usually quarterly) by executive management
- **Flexed Revised Plan:** the most current plan (i.e., either original plan or revised plan, if one has been prepared) adjusted for changes in volume and variable expense rates
- **YTD Actual Results:** the actual results of operations for the year
- **Current Outlook:** the summation of the actual year-to-date results of operations plus the flexed revised plan for the remaining months of the year

Executive management meets monthly to review the actual results compared with the profit plan. Any assumptions or major changes in the profit plan usually are incorporated on a quarterly basis once the first quarter is completed. Figure 13-13 provides an outline of the basic Profit Plan Report designed by the information processing subsystem. The current system produces this report at the end of the month and whenever executive management initiates a change or modification in its plans. Consequently, many different versions of the firm's profit plan exist, which makes analysis difficult and confusing.

Several members of executive management have voiced disapproval of the Profit Plan Report because the ''Plan'' column is not well defined and varies in meaning from one report to another. Furthermore, the report does not include a current-outlook column.

Kenbert Company Profit Plan Report
Month, Year-to-Date

	Month				Year-to-Date			
			Over/ (Under)				Over/ (Under)	
	Actual	Plan	$	%	Actual	Plan	$	%
Sales								
Variable manufacturing costs								
Raw materials								
Direct labor								
Variable overhead								
Total variable manufacturing costs								
Manufacturing margin								
Variable selling expenses								
Contribution margin								
Fixed costs								
Manufacturing								
Sales								
General administration								
Income before taxes								
Income taxes								
Net income								

FIGURE 13-13 Basic profit plan report outline.

Therefore, the accounting subsystem has been asked to work with the information processing subsystem in modifying the report so that users can better understand the information being conveyed and the reference points for comparison of results.

Requirements:

1. Redesign the layout of the Profit Plan Report so that it will be more useful to Kenbart's executive management in its task of reviewing results and planning operations.
2. Explain the reason for each modification you make in the report.

13-21. Stephen Kerr Cosmetics (Point-Scoring Analysis)

Kerr Cosmetics distributes cosmetic products to large retailers across the country. The firm was started in 1975 by its first president, Stephen Kerr, who still serves as chairman of the board. Over the years, the company has grown in size and complexity. As the company has prospered, Richard Mason, the controller, has acquired and installed new accounting software to accommodate the increasing demands on the firm's accounting systems.

This year, Richard has convinced Stephen that it is time to upgrade their payroll system, which is now 7 years old. The company hires an outside consultant, who examines their situation and concludes that either one of two systems can meet their requirements. Richard therefore asks two of his most competent employees, Fritz Bauman and Meg Chrisman, to help him perform a point-scoring analysis and make a final choice.

The three individuals meet as a study team and agree upon five qualities for rating the two vendors: (1) need for further modifications, (2) ease of use, (3) strength of internal controls, (4) flexibility for updating and Internet options, and (5) vendor support. To help them rate the two vendors on these five criteria, the committee invites representatives from each vendor to visit the company and make a presentation. Fritz makes arrangements for the presentation team from Vendor A to present on a Friday morning, and a similar team from Vendor B to visit that same afternoon. Unfortunately, an emergency makes it impossible for Richard to attend either presentation. Meg and Fritz attend both sessions, but come away with very different impressions of the competing software. The table below provides some relevant data.

Requirements:

1. To start their analysis, Meg and Fritz decide to use their own ratings to perform separate point scoring analyses. For this part, use equal weightings of 0.2 for each category. Perform similar analyses using a spreadsheet. Which vendor does each person prefer?
2. Both Meg and Fritz decide that using equal weight for each category doesn't make sense. After some discussion, they agree to the ''compromise weights'' shown below. They again perform their analyses. Which vendor does each person prefer now?
3. Fritz and Meg show their results to Richard, who suggests that they use their compromise weights but use combined averages for their grades for each vendor. They perform yet a third analysis. Which vendor receives the highest total now?
4. What do these exercises suggest about point scoring analyses? Does this method still seem ''objective'' to you? Why or why not?

			Fritz's Weights		Meg's Weights	
	Equal Weights	Compromise Weights	Vendor A	Vendor B	Vendor A	Vendor B
Required Modifications	0.2	0.2	3	2	3	3
Ease of Use	0.2	0.3	8	3	4	6
Internal Controls	0.2	0.1	3	4	2	4
Flexibility	0.2	0.1	4	5	3	7
Vendor Support	0.2	0.3	7	5	3	9

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ANSWERS TO TEST YOURSELF

1. **b** 2. **c** 3. **d** 4. **c** 5. **d** 6. **c** 7. **c** 8. **a** 9. **d**

Chapter 14

Information Technology Auditing

After reading this chapter, you will:

1. *Know* how external auditing differs from internal auditing.
2. *Understand* the information technology audit process and types of careers in technology auditing.
3. *Understand* the software and people skills needed by information technology auditors.
4. *Know* how to determine the effectiveness of internal controls over specific information systems.
5. *Be familiar with* various techniques auditors use to evaluate computerized information systems.
6. *Understand* that IT governance is not just about security.
7. *Appreciate* how auditors can use IT to prevent and discover fraudulent activities.
8. *Know* how the Sarbanes-Oxley Act of 2002 influences the role of IT auditors.
9. *Be familiar with* various types of third assurance services related to IT.

"Information Systems auditors, who evaluate how a company's computer systems safeguard assets and maintain data integrity, are in hot demand in the wake of corporate scandals in recent years."

Sarah E. Needleman, ''Sarbanes-Oxley Creates Special Demand; Need for Veteran IT Auditors Intensifies Amid Tightened Financial-Reporting Rules,'' *Wall Street Journal* (Eastern edition). New York, NY, May 16, 2006, p. B8.

INTRODUCTION

Chapters 11 and 12 stressed the importance of control procedures in the efficient operation of an AIS. To make sure that these controls are functioning properly and that additional controls are not needed, business organizations perform examinations or audits of their accounting systems. Auditing is usually taught in one or more separate courses within the typical accounting curriculum, and a single chapter of a book is not sufficient to cover the spectrum of topics involved in a complete audit of an organization. This chapter will be merely introductory and limited to areas of immediate consequence to AISs and the IT audit.

The discussion in this chapter is likely to complement, rather than repeat, the coverage within a financial auditing course. An accountant who specializes in auditing computerized AISs is referred to as either an *information systems (IS) auditor* or an *information technology (IT)* auditor. Both designations imply the same work, but we will use IT auditor in this chapter as we describe the tasks done by such a person.

We begin our discussion with introductory comments about the nature of auditing, including a discussion that emphasizes the distinction between internal and external auditing. We then describe the relationship between an IT audit and a financial audit. Next, we discuss tools an IT auditor uses. Perhaps surprisingly, people and social skills are as important as technical ones. The chapter next describes a variety of approaches for evaluating internal controls in a computerized AIS.

We end Chapter 14 with several topics related to IT auditing today. These include discussion of information technology governance, fraud auditing, the impact of Sarbanes-Oxley on IT audits, and discussion of third party and systems reliability assurance services.

THE AUDIT FUNCTION

To audit is to examine and to assure. The nature of auditing differs according to the subject under examination. We can differentiate auditing in other ways as well. This section discusses internal, external, and IT auditing.

Internal versus External Auditing

Conventionally, we distinguish between two types of audits: an internal audit and an external audit. In an *internal audit*, a company's own accounting employees perform the audit, whereas accountants working for an independent CPA firm conduct an *external* *audit*. Generally, internal auditing positions are staff positions reporting to top management and/or the Audit Committee of the Board of Directors. Whereas an audit might be internal to a company, it is invariably *external* to the corporate department or division being audited. Thus, the auditing function preserves its objectivity and professionalism.

An internal audit investigates two matters: (1) employee compliance with organizational policies and procedures, and (2) the development and evaluation of internal controls. It is relatively broad in scope, including such activities as auditing for fraud and ensuring that employees are not copying software programs illegally. Internal auditors can provide assurance to a company's top management about the efficiency and effectiveness of almost any aspect of its organization.

The emphasis on internal control resulting from recent corporate scandals creates more demand for internal auditors. These auditors often work as consultants, helping their organizations to develop effective internal control systems and to comply with various regulations.

Case-in-Point 14.1 A 2005/2006 survey conducted by the Institute of Internal Auditors found that subsequent to the Sarbanes-Oxley Act of 2002, audit committees of Boards of Directors are relying on internal auditors to tell them more about a company's finances and operations. The survey also showed that internal auditors act as in-house consultants and are helping management to detect fraud, design information systems, and develop control systems. As a result, internal auditor salaries have increased significantly each year between 2004 and 2006.[1]

In contrast to the broad perspective of internal auditors, the chief purpose of an external audit is the attest function,—i.e., giving an opinion on the accuracy and fairness of financial statements. This fairness evaluation is conducted in the context of generally accepted accounting principles (GAAP) and requires application of generalized auditing standards. In the past few years, the external auditor's role has expanded with respect to auditing for fraud. *Statement on Auditing Standards (SAS) No. 99 Consideration of Fraud in a Financial Statement Audit*, requires auditors working for public accounting firms to undertake a number of specific actions to ensure that an organization's financial statements are free of erroneous or fraudulent material misstatements. (We discuss SAS 99 later in the chapter.)

Today there are specialized auditors called fraud auditors or forensic accountants (described in Chapter 10). These auditors specialize in investigating fraud, and they often work closely with internal auditors and attorneys. The fraud investigation units of the FBI, large public accounting firms, the IRS, insurance organizations, and other types of large corporations employ fraud auditors.

As mentioned in Chapter 1, external auditors are expanding the services they offer to include a variety of *assurance services*. Many of these services involve IT in some way. However, the attest function remains the external auditor's main responsibility. Although the primary goals of external and internal audits differ, they are complementary within the context of an AIS. For example, the controls that internal auditors examine within a company's IT environment are in part designed to increase the accuracy of the external financial reports of interest to the external auditors. Similarly, the use of an acceptable method of inventory valuation, as required by the external auditors, is likely to be an important corporate policy falling under the domain of the internal auditors.

[1]Oxner, Tom & Karen Oxner. ''Boom Time for Internal Audit Professionals,'' *The Internal Auditor* Vol. 63, Iss, 3 (June 2006), pp. 50–57.

Despite the difference in purpose between internal audits and external audits, internal auditors and external auditors perform a number of similar functions in the area of auditing computerized AISs. Therefore, most of the following discussion applies to both internal and external auditors. We use the term *auditor* broadly to encompass both types of auditors. Even though internal and external auditors perform a number of similar functions, this is not to say that much audit work is duplicated. Instead, a large degree of cooperation and interaction often exists between a company's internal auditors and a public accounting firm's external auditors. For example, external auditors frequently review, and often rely upon, the work of internal auditors as they assess an organization's financial statements.

Information Technology Auditing

Information technology (IT) auditing involves evaluating the computer's role in achieving audit and control objectives. The assurance aspect of IT auditing means proving that data and information are reliable, confidential, secure, and available as needed. Traditional financial audit objectives are also present in information technology auditing. These include attest objectives such as the safeguarding of assets and data integrity, and management objectives such as operational effectiveness.

The Information Technology Audit Process. As illustrated in Figure 14-1, the IT audit function encompasses all the components of a computer-based AIS: people, procedures, hardware, data communications, software, and databases. These components are a system of interacting elements that auditors examine to accomplish the purposes of their audits described above.

External auditors examine an organization's computer-based AIS primarily to evaluate how the organization's control procedures over computer processing affect the financial statements (attest objectives). The controls in place will directly influence the scope of the audit. For instance, if computer controls are weak or nonexistent, auditors will need to

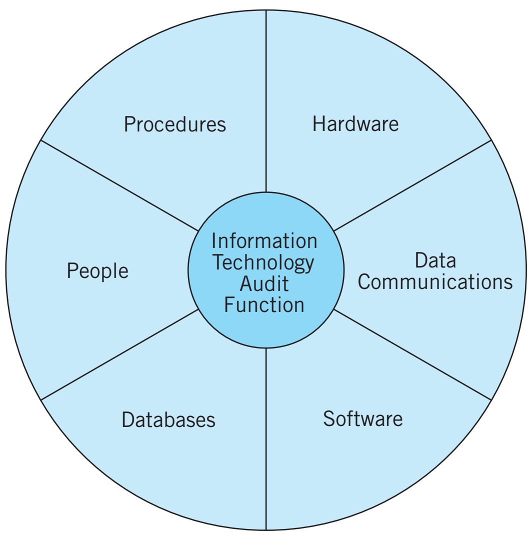

FIGURE 14-1 The six components of a computer-based AIS examined in an information technology audit.

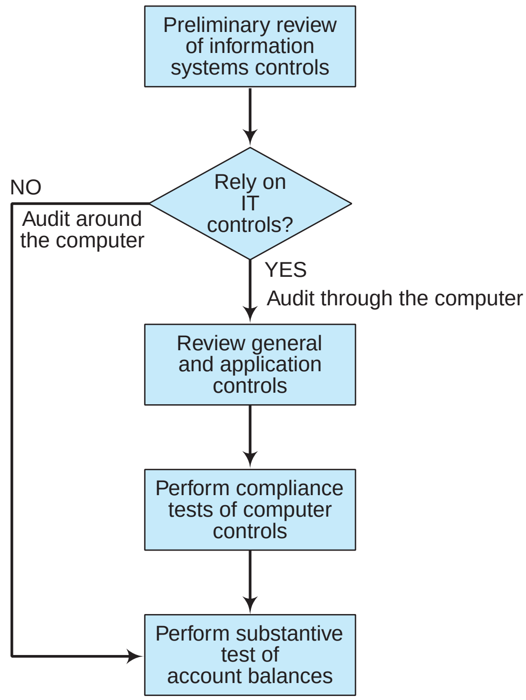

FIGURE 14-2 Flowchart of information technology audit process. Auditing *through* and *around* the computer are discussed later in the chapter.

do more *substantive testing*—i.e., detailed tests of transactions and account balances. An example of substantive testing is the confirmation of accounts receivable with customers. If the control procedures over a company's computerized financial accounting system are strong, the auditors may limit the scope of their audit by examining fewer transactions underlying accounts receivable account balances. For our example, this would mean contacting fewer customers to confirm accounts receivable than would be the case if little or no reliance could be placed on the computer-based controls.

Figure 14-2 shows a flowchart of the steps that generally take place in IT auditing. These steps are similar to those performed in any financial audit. What is different is that the auditor's examination in this case concerns a *computer-based* AIS. In Figure 14-2, the process begins with a preliminary evaluation of the system. The auditor will first decide if computer processing of accounting data is significant or complex enough to warrant an examination of the computer-based information system itself. Sometimes, if the system is neither large nor complex, the audit might proceed as it would in a manual data processing environment. Most often, computer-based processing warrants a preliminary review by the IT auditor to make a quick assessment of the control environment.

Typically, an auditor will find enough computer-based controls in place to warrant further examination. In this situation, an auditor will want to make a more detailed analysis of both *general* and *application controls* (discussed in Chapter 11). After examining these controls in some detail, the auditors will perform *compliance testing* to ensure that the controls are in place and working as prescribed. This may entail using some **computer-assisted audit techniques (CAATs)** to audit the computerized AIS. These involve the use of computer processes or controls to perform audit functions, such as sorting data to detect duplicate accounts payable invoice numbers. Finally, the auditor will need to substantively test some account balances. As explained earlier, the results of the previous analysis and testing affect the scope of this testing. Auditors often make use of CAATs at this stage in auditing *with* the computer. Auditing *through* and *with* the computer are discussed later in this chapter.

Careers in Information Technology Auditing. As organizations increasingly rely on computer-based AISs and as these systems become more technologically complex, the demand for IT auditors is growing. The recent passage of the Sarbanes-Oxley bill has also created a need for more IT auditors. IT auditing requires a variety of skills. Some information technology auditors have college degrees in computer science or information systems, and others have accounting degrees with perhaps some general audit experience. The ideal background includes a combination of accounting and information systems or computer science skills.

As Chapter 1 noted, IT auditors may choose to obtain a professional certification such as **Certified Information System Auditor (CISA)**. Applicants achieve this certification by successfully completing an examination given by the Information Systems Audit and Control Association a (ISACA), meeting specific experience requirements, complying with a Code of Professional Ethics, undergoing continuing professional education, and complying with the Information Systems Auditing Standards. Figure 14-3 describes the content areas covered on the CISA examination. Notice that they not only concern evaluation of IT, but also IT governance and the protection of IT assets.

A more general certification for experienced information security professionals is the *Certified Information Security Manager (CISM)*, also granted by ISACA. Those seeking a CISM designation need to have a business orientation and to understand risk management and security from a conceptual viewpoint. The CISM evaluates knowledge in information security governance, information security program management, risk management, information security management, and response management. The CISA designation has been granted since 1978, but the CISM is only a few years old.

IT auditors may be employed as either internal or external auditors. In both cases, these professionals focus on evaluating control procedures rather than substantive testing. Evaluating controls over information systems hardware and various AIS applications requires a high level of expertise. As an example, an IT auditor evaluating controls that limit access to certain information needs to be familiar with the way a particular application organizes its access security. Compared to external auditors, internal auditors can more easily specialize in knowledge about their particular organization's hardware, operating system platform, and application programs.

Job Practice Domains	Coverage
IS Audit Process	10%
IT Governance	15%
Systems and Infrastructure Lifecycle Management	16%
IT Service Delivery and Support	14%
Protection of Information Assets	31%
Business Continuity and Disaster Recovery	14%

FIGURE 14-3 Job practice domains covered on the Certified Information Systems Auditor examination (www.isaca.org, effective 2006).

An external auditor is likely to audit the information systems of many different client organizations, Alternately, however, an external auditor may specialize in a particular operating system platform, security software package, or mainframe system. To perform IT auditing effectively requires both specialized skills and a broad-based set of technical knowledge. The external information systems auditor may or may not be part of the regular financial audit team. In some cases, the financial audit team only calls on external information systems auditors when a special risk assessment appears warranted. The Big Four public accounting firms all employ IT auditors, and perform a variety of assurance-related IT services for clients.

Case-in-Point 14.2 An IT auditor at Ernst & Young LLP may work within the Technology and Security Risk Services (TSRS) practice within the Assurance and Business Advisory Services area. These professionals help clients to evaluate their IT risk, improve the value of IT, and provide IT security. Ernst & Young also offers specialized services that protect data and systems from threats, such as cyber terrorism.

Evaluating the Effectiveness of Information Systems Controls

The more confidence auditors have (as a result of strong controls) that data are input and processed accurately in a computer-based system, the less substantive testing they perform. On the other hand, a computer-based system with weak controls over data input and processing will call for more detailed testing of financial transactions.

Risk Assessment. An external auditor's main objective in reviewing information systems control procedures is to evaluate the *risks* (associated with any control weaknesses) to the integrity of accounting data presented in financial reports. Control strengths and weaknesses will affect the scope of the audit. A secondary objective of the external auditor's review is to make recommendations to managers about improving these controls. This secondary objective is also an objective of internal auditors.

Under a **risk-based audit approach** to evaluating a company's internal control procedures, the following four steps provide a logical framework for performing the risk-based audit of the company's AIS:

1. Determine the threats (i.e., errors and irregularities) facing the AIS.
2. Identify the control procedures that should be in place to minimize each of these threats and thereby prevent or detect the errors and irregularities.
3. Evaluate the control procedures within the AIS. The process of reviewing system documentation and interviewing appropriate personnel to determine whether the necessary control procedures are in place is called a *systems review*. In addition, auditors investigate whether these control procedures are satisfactorily followed. The tests include such activities as observing system operations; inspecting documents, records, and reports; checking samples of system inputs and outputs; and tracing transactions through the system.
4. Evaluate weaknesses (i.e., errors and irregularities not covered by control procedures) within the AIS to ascertain their effect on the nature, timing, or extent of auditing procedures. This step focuses on the *control risks* and whether a company's control system as a whole adequately addresses the risks. If a control deficiency is identified, the auditor should determine whether there are compensating controls or procedures that

make up for the deficiency. Control weaknesses in one area of an AIS may be acceptable if control strengths in other areas of the AIS compensate for them.

The risk-based audit approach provides auditors with a good understanding of the errors and irregularities that can occur in a company's AIS environment and the related risks and exposures. This understanding provides a sound basis for the auditors' development of recommendations to the company's management on how its AIS control system should be improved.

The desirability of an internal control procedure is a function of its ability to *reduce business risk*. In fact, it is the business risk itself that is important, not the internal control system. For example, natural disasters such as floods or earthquakes pose a risk to an organization's ability to continue its business without interruption. A *disaster recovery* or *business continuity plan* is an internal control procedure designed to reduce this risk. Focusing on business risk ensures implementing only those controls that are absolutely necessary and also cost-effective. One method by which an auditor can evaluate the desirability of IT-related controls for a particular aspect of business risk is through an **information systems risk assessment**. (Chapter 9 introduced the subject of risk assessment and described the Enterprise Risk Management Framework.)

In addition to the risk of fraud or intentional manipulation, auditors must also consider risk with respect to errors or accidents. Not only are assets vulnerable as a result of intentional fraud, but mistakes impact them too. For instance, inputting data incorrectly can lead to misrepresentation on financial statements in the form of incorrect asset valuations. An information systems risk assessment should take into account the risks associated with errors or accidents as well as fraud.

The loss of company secrets, unauthorized manipulation of company files, and interrupted computer access are all business risks in an IT environment. Although it is easier to value a tangible asset, such as cash, than to place a value on information, it must be done. Auditors make their best judgments about the probability of losses. For those areas where estimated costs of protection are less than anticipated losses, the auditor recommends implementing control procedures. In areas in which the costs of protection are greater than anticipated losses, the auditor may recommend against installing the specific controls.

Sometimes companies assess their information systems risks by employing ethical hackers to conduct **penetration testing**. We discussed hacking in Chapter 10 as a computer crime. However, when an IT auditor employs ''white hat'' hacking techniques, the purpose is to evaluate risk and design controls to protect against unauthorized access. We call this type of ethical hacking penetration testing because the auditor is trying to penetrate the system to gain access to resources or sensitive information.

Guidance in Designing and Evaluating IT Controls. Two guides are available to IT auditors for designing and evaluating internal controls related to IT. The Institute of Internal Auditors first issued the **Systems Auditability and Control (SAC) report** in 1977. Advances in IT led to revisions in 1991 and 1994, and the 2001 issuance of a new model, **Electronic Systems Assurance and Control (*e*SAC)**, that provides a framework for evaluating e-business controls. The SAC report identifies important information technologies and the specific risks related to these technologies. It also recommends controls to mitigate risks and suggests audit procedures to validate the existence and effectiveness of these controls. The SAC report consists of a set of reference volumes that identify risk, controls, and audit techniques for a variety of areas, such as telecommunications, end-user systems, and emerging technologies. The 1994 SAC report added object technology, document management, and multimedia technologies sections.

Both internal and external auditors rely on the SAC report for guidance on controls over IT and in auditing computer-based applications.

Chapter 11 pointed out that the Information Systems Audit and Control Foundation developed the **Control Objectives for Information and Related Technology (COBIT)** framework. This framework provides auditors and businesses with guidance in managing and controlling for business risk associated with IT environments. COBIT, version 4.1, includes control objectives and control outcomes tests for evaluating the effectiveness of controls. Using the framework, management and auditors can design a cost-effective control system for IT resources and processes. COBIT benefits business and IT managers, as well as auditors. For auditors, the model helps in advising management on internal controls and can provide substantive support for audit opinions. The next case describes one company's use of COBIT.

Case-in-Point 14.3 Sun Microsystems is a world-wide provider of hardware and software solutions. In order to improve the strategic value of IT and to comply with Sarbanes-Oxley, Sun's IT department decided to use the COBIT framework to evaluate and measure the relationship of IT to corporate strategy. The framework enabled Sun to successfully evaluate six data centers and more than 600 IT applications, and enabled senior IT executives to create a Sun IT/COBIT Activities Listing that mapped Sun's IT processes and activities to COBIT.[2]

THE INFORMATION TECHNOLOGY AUDITOR'S TOOLKIT

Auditors can use *computer-assisted audit techniques (CAATs)* to help them in various auditing tasks. In an automated AIS, **auditing with the computer** (i.e., using the computer itself as an audit tool) is virtually mandatory because data are stored on computer media and manual access is impossible. However, there are many reasons for auditing with the computer beyond the need to access computerized accounting data. One of the most important is that computer-based AISs are rapidly increasing in sophistication. Another is that CAATs save time. Imagine footing and cross-footing large spreadsheets or schedules without using a computer.

Auditing Software

Auditors can use a variety of software when auditing with the computer. Examples include *general-use software* such as word processing programs, spreadsheet software, and database management systems. Other software that we discuss here such as *generalized audit software (GAS)* and *automated workpaper software* is more specifically oriented toward auditor tasks

General-Use Software. Auditors employ **general-use software** as productivity tools that can improve their work. For instance, word processing programs improve effectiveness when writing reports because built-in spell checks can significantly reduce spelling errors. Similarly, an auditor can write a customer confirmation letter with a word processing program and mail-merge it with an address file so that each letter appears to have been individually prepared.

[2]Source: www.isaca.org (COBIT and IT Governance Case Study: Sun Microsystems) Accessed: September 6, 2008.

Spreadsheet software allows both accountants and auditors to make complex calculations automatically. It also allows the user to change one number and update all related numbers at the click of a mouse. One of the most common uses of electronic spreadsheets by accountants and auditors is for making mathematical calculations, such as interest and depreciation. Spreadsheet software can also be used to perform analytical procedures, such as computing ratios. Different presentation formats for data contained in spreadsheets contribute to the usefulness of these data for management decision-making and other managerial functions.

Accountants and auditors can use a *database management system (DBMS)* to perform some of the same functions as spreadsheet software. For instance, DBMSs can sort data and make certain mathematical computations. However, they are distinguished from spreadsheet software by their ability to manipulate *large* sets of data in fairly simple ways. As a general rule, accountants and auditors use spreadsheet software to make complex calculations with relatively small sets of data, whereas they will use DBMSs for simpler calculations or manipulations, such as sorting, on large data sets.

A DBMS controls almost all organizational accounting systems. The auditor can select subsets of a client company's data for manipulation purposes. This can be done either on the client's computer system, or, after the data are downloaded, on the auditor's computer. A valuable tool for retrieving and manipulating data is **Structured Query Language (SQL)**, a popular data manipulation language. Auditors can use SQL to retrieve a client's data and display these data in a variety of formats for audit purposes. As an example, an auditor may use the SELECT command to retrieve inventory items meeting certain criteria, such as minimum dollar amount. Other data manipulation capabilities of SQL include: (1) selecting records matching specified criteria, (2) deleting records from a file based on established criteria, (3) generating customized reports based on all or a subset of data, and (4) rearranging file records in sequential order.

Generalized Audit Software. **Generalized audit software (GAS)** packages (or programs) enable auditors to review computer files without continually rewriting processing programs. Large CPA firms have developed some of these packages in-house; many other programs are available from various software suppliers. GAS packages are available to run on microcomputers, minicomputers, or mainframes. GAS programs are capable of the basic data manipulation tasks that spreadsheet or DBMS software might also perform. These include mathematical computations, cross footing, categorizing, summarizing, merging files, sorting records, statistical sampling, and printing reports. The advantage GAS packages have over other software is that these programs are specifically tailored to auditor tasks. Auditors can use GAS programs in a variety of ways in specific application areas, such as accounts receivable, inventory, and accounts payable. Figure 14-4 shows some of the ways auditors might use GAS to audit inventory applications.

Case-in-Point 14.4 Benford's Law is based on the observation that the lead digit in a set of naturally-ocurring numbers is not uniform, but actually varies in frequency. For example, Frank Benford noticed in 1938 that the digit "1" was likely to occur about 30% of the time—much greater than the 10% you might expect. The other digits decline in probability of occurrence, with the digit "2" occurring about 17% of the time and the digit "9" occurring less than 5% of the time. GAS software can examine huge sets of such number sequences as vendor payments to determine if they conform to this law.

Two popular GAS packages used by auditors are *Audit Command Language (ACL)* and *Interactive Data Extraction and Analysis (IDEA)*. These programs allow auditors to examine a company's data in a variety of formats. They include commands such as

- Merge last year's inventory file with this year's and list those items with unit costs greater than a certain dollar amount and that have increased by more than a specified percentage.
- List inventory quantities on hand in excess of units sold during a specified period and list those inventory items with a last sales date prior to a specified date to identify possible obsolete inventory items.
- Select a sample of inventory tag numbers and print the sample selection.
- Scan the sequence of inventory tag numbers and print any missing or duplicate numbers.
- Select a random sample of inventory items for price testing on a dollar-value basis, and list all items with an extended value in excess of a specified amount.
- Perform a net-realizable-value test on year-end inventory quantities, and list any items where inventory cost exceeds net-realizable value.

FIGURE 14-4 Various ways to use generalized audit software packages to audit inventory.

STRATIFY, EXTRACT, and JOIN. Each of these commands provides an auditor with a different view of the data. For example, the *stratify* command lets an auditor group data into categories. This is useful, for example, in sorting inventories into various classes based on their cost. Stratification lets an auditor concentrate on high-dollar-value inventory items.

Another example of data stratification is in auditing accounts receivable. Auditors will want to verify balances of customers owing large dollar amounts in greater proportion than small accounts receivable balances owed by customers. Most GAS packages allow auditors to *extract* data according to some specification. This capability is an invaluable audit tool. Auditors can extract data to detect a variety of exception conditions, such as duplicate invoice numbers, inventory items that have not been sold in more than one year, and customers with negative accounts receivable balances. By *joining* files, auditors can compare data. For example, combining the employee file with the vendor file may show that an employee has perpetrated a fraud by creating a fictitious vendor. The following case describes how an accounting firm used ACL to uncover a significant fraud.

Case-in-Point 14.5 Summerford Accountancy employs fraud examiners who help organizations discover and deter fraudulent activities. The Los Angeles Unified School District hired them to examine a construction project for a high school, the Belmont Learning Complex. The fraud experts used ACL software to discover duplicate payments to vendors, fake vendors, and fraudulent transactions. One specific example of the software's use is that it found 48 budget transfers an employee authorized that were for $49,999. This allowed the employee to avoid the school district policy that required Board of Education approval for any spending greater than $50,000.[3]

Automated Workpaper Software. **Automated workpaper software** is similar to general ledger software. The difference is that automated workpaper software handles accounts for many organizations in a flexible manner. The functions of automated workpaper software vary with specific programs. Some of the features of this software are its ability to: (1) generate trial balances, (2) make adjusting entries, (3) perform consolidations, and (4) conduct analytical procedures. The advantage of using automated workpaper software is that it automates footing, cross footing, and reconciliation to schedules. Auditors can use this software to prepare consolidated trial balances and financial statements (that combine accounts of multiple companies). Automated workpaper software can also help auditors

[3]Source: www.acl.com – Success Stories – Summerford Accountancy PC (accessed June 8, 2006).

create common-size income statements and balance sheets that show account balances as percentages. In addition, automated workpaper software can easily calculate financial statement ratios and measurements, such as the *current ratio*, the *working capital*, the *inventory turnover rate*, and the *price-earnings ratio*.

The Internet can also be a valuable resource for IT auditors. There are many websites that offer useful advice and guidance. These include software vendor sites with patches for software security holes, sites with alerts about security threats, and websites that have special tools that may be used free of charge or purchased.

Case-in-Point 14.6 *AuditNet* (wwww.auditnet.org) describes itself as a "global resource for auditors." Registered users can subscribe to download audit programs for a variety of application areas, such as accounts payable. These programs include detailed audit procedures. There is a Sarbanes-Oxley resource center, a discussion forum, a virtual library, and a list of audit terminology and definitions.

People Skills

Arguably the most important skills that auditors need are people skills. After all, they must work as a team as well as be able to interact with clients. For example, to understand the organizational structure of the IT function, the IT auditor will need to interview the CIO. Interviews are a mainstay of IT auditing. Similarly, they are also likely to find that many of the audit steps in their evaluation of internal controls have more to do with human behavior than technology. For example, one of the best protections against programmed threats such as viruses and worms is regularly updated anti-virus software. Although it may be important to understand the capabilities of the software, it is even more important to see if the security administrator is checking for virus updates and patches on a regular basis.

Case-in-Point 14.7 The MyDoom worm, unleashed in early 2004, posed a particularly serious threat to systems, as it had the potential to launch denial-of-service attacks from infected computer systems. Shortly after the virus was launched, several anti-virus software vendors updated their software to protect against it. However, many IT security personnel do not monitor security sites or take the time to update anti-virus software regularly. An IT auditor should check to see that the IT function is scanning alerts, applying patches, and updating security software regularly.

AUDITING COMPUTERIZED ACCOUNTING INFORMATION SYSTEMS

When computers were first used for accounting data processing functions, the typical auditor knew very little about automated data processing. The basic auditing approach, therefore, was to follow the *audit trail* up to the point at which accounting data entered the computer and to pick these data up again when they reappeared in processed form as computer output. This is called **auditing around the computer**. It assumes that the presence of accurate output verifies proper processing operations. This type of auditing pays little or no attention to the control procedures within the IT environment. Auditing around the computer is not generally an effective approach to auditing a computerized environment, in part because it tests normal transactions but ignores the exceptions. It is the exceptions that are of primary interest to the auditor.

When auditing the computerized AIS, an auditor usually follows the *audit trail* through the internal computer operations phase of automated data processing. This approach, **auditing through the computer**, attempts to verify that the processing controls involved in the AIS programs are functioning properly. It also attempts to verify that the accounting data processed are accurate. Because this type of auditing tests the existence and functioning of control procedures, it normally occurs during the compliance phase of the flowchart in Figure 14-2.

Auditing through the computer usually assumes that the CPU and other hardware are functioning properly. This leaves the auditor the principal task of verifying processing and control logic as opposed to computer accuracy. Five techniques that auditors use to audit a computerized AIS are: (1) use of test data, integrated test facility, and parallel simulation to *test programs*, (2) use of audit techniques to *validate computer programs*, (3) use of logs and specialized control software to *review systems software*, (4) use of documentation and CAATs to validate user accounts and access privileges, and (5) use of embedded audit modules to achieve *continuous auditing*.

Testing Computer Programs

In testing computer programs, the objective is to ensure that the programs accomplish their goals and that the data are input and processed accurately. Three techniques that auditors may employ to test computer programs are: (1) test data, (2) integrated test facility, and (3) parallel simulation.

Test Data. It is the auditor's responsibility to develop a set of transactions that tests, as completely as possible, the range of exception situations that might occur under normal processing conditions. Conventionally, these transactions are called **test data**. Possible exception situations for a payroll application, for example, include out-of-sequence payroll checks, duplicate time cards, negative hours worked, invalid employee numbers, invalid dates, invalid pay rates, invalid deduction codes, and use of alphabetic data in numeric codes.

Once an auditor has assembled appropriate sample data (usually transactions of some type), these data are arranged into test sequence in preparation for computerized data processing. To complete the audit test, an auditor will compare the results obtained from processing test data with a predetermined set of answers on an audit work sheet. If processing results and worksheet results do not agree, further investigation is necessary. A sample set of program edit tests and test data appears in Figure 14-5.

Program Edit Test	Required by Program	Test Data
Completeness	6 characters required	12345
Numeric Field	Numeric characters only	123C45
Sign	Positive numbers only	−123456
Reasonableness	Hours worked should not exceed 80 per week	110
Valid Code	Accept only I (invoice), P (payment), M (memo)	C
Range	Accept only dates between 01/01/01 and 12/31/02	09/07/99

FIGURE 14-5 Program edit tests and test data.

Integrated Test Facility. Although test data work well in validating an application's *input controls*, they are not so effective in evaluating integrated online systems or complex programming logic. In these situations, it may be better to use a more comprehensive test technique such as an **integrated test facility (ITF)**. The purpose of an ITF is to audit an AIS in an operational setting. This involves: (1) establishing a fictitious entity such as a department, branch, customer, or employee, (2) entering transactions for that entity, and (3) observing how these transactions are processed. For example, an auditor might create a number of fictitious credit customers and place appropriate accounts receivable master records on the company's accounts receivable computer files. From the standpoint of the auditor, of course, the information contained on these records is for test purposes only. To most of the employees of the company, however, these records represent bona fide customers entitled to purchase company merchandise inventory or services on credit.

To use the ITF, an auditor will introduce *artificial transactions* into the data processing stream of the AIS and have the company routinely handle the business involved. In a truly integrated test facility, this may mean actually shipping merchandise (not ordered by anyone) to designated addresses or billing customers for services not rendered. Because of the amount of work involved, however, it may be necessary to intercept the ordered merchandise at the shipping department and reverse the billing transactions at the managerial level.

Parallel Simulation. With **parallel simulation**, the auditor uses *live* input data, rather than test data, in a program actually written or controlled by the auditor. The auditor's program *simulates* all or some of the operations of the real program that is actually in use. In order for this method to be effective, an auditor must thoroughly understand the audited organization's computer system and know-how to predict the results. The latter is necessary to intelligently compare the results of processing data using the test programs with those results from using the real programs.

As you might imagine, it can be very time-consuming and thus cost-prohibitive for an auditor to write computer programs entirely replicating those of the client. For this reason, parallel simulation usually involves replicating only certain critical functions of a program. For example, a program that replicates payroll processing might just calculate net pay for employees rather than making all the payroll distributions that exist in the entire payroll program.

Validating Computer Programs

A clever programmer can thwart the use of test data by substituting a legitimate, but unused, program for a dishonest one when an auditor asks for the processing routine(s) required for the audit. Therefore, an auditor must validate any program with which he or she is presented. Although there is no 100% foolproof way of validating a computer program, several procedures may be used to assist in this task, including tests of program change control and program comparison.

Tests of Program Change Control. The process by which a newly developed program or program modification is put into actual use should be subject to **program change control**. It is a set of internal control procedures developed to protect against unauthorized program changes. Sound program change control requires documentation of every request for application program changes. It also requires computer programmers to develop and implement changes in a separate test environment rather than a live processing environment.

Depending on the size of an organization, the change control process might be one of many duties performed by one individual. Alternatively, responsibility might be assigned to more than one individual. The basic procedures in program change control include testing program changes and obtaining proper authorizations as programs move from a testing stage to actual production (live) use. The auditor's responsibility is to ensure that a company's management establishes and executes proper authorization procedures and that the company's employees observe these procedures.

A test of program change control begins with an inspection of the documentation maintained by the information processing subsystem. It is not unusual for an organization to have on hand a flowchart of its change control process. The organization should also have special forms that authorize a change to an existing program or development of new programs. Included on these *program authorization forms* should be the name of the individual responsible for the work and the signature of the supervisor responsible for approving the final programs. Similarly, there should be forms that show the work has been completed and a signature authorizing the use of the program(s) for present data processing. These authorizing signatures affix responsibility for the data processing routines and ensure accountability when problems arise. We call this a **responsibility system of computer program development and maintenance**. Figure 14-6 describes the processes in this system that an auditor should validate.

The chief purpose of a responsibility system at the computer center is not to affix blame in the event of program failures but to ensure accountability and adequate supervisory controls in the critical area of data processing. Tighter control over both the development of new programs and changes to existing programs is likely to result in better computer software, because individuals tend to do better when they are responsible for a given piece of work.

Program Comparison. To guard against unauthorized program tampering, such as the insertion of a Trojan Horse (see Chapter 10), it is possible to perform certain *control total tests* of program authenticity. One is a *test of length*. To perform this test, an auditor obtains the latest version of an accounting computer program to be verified and compares the number of bytes of computer memory it requires with an entry in a security table of length counts of all valid accounting programs. If the accounting program's length count fails to

- Programmers document all program changes on the proper change-request forms.
- Users and accountants properly cost all program change requests and the planning committee reviews high-cost projects.
- Both computer development committee personnel and users sign the outline specification form, thereby establishing authorization for the programming work.
- Program changes match those in the programs in the production load library (where currently used programs are stored).
- Documentation matches the production version of a computer program.
- Information systems personnel property carry out librarian functions, especially a review of the paperwork involved with the documentation of program change requests.

FIGURE 14-6 Each of the above processes is checked by an auditor in reviewing a responsibility system of computer program development and maintenance.

match its control total, the program is then further scrutinized. (This process is similar to comparing the word count in two similar documents produced by Microsoft Word.)

Another way to ensure consistency between the authorized version of an accounting computer program and the program version currently in use is to compare the code directly on a line-by-line basis using a *comparison program*. A comparison program will detect any changes that a programmer might have made, even if the programmer has been clever enough to ensure that the program length for the two versions is the same. Auditors must evaluate the tradeoff between efficiency and effectiveness in choosing whether to use control totals, perform detailed program comparison, or rely on general controls over program changes to prevent unauthorized tampering with computer programs.

Review of Systems Software

Systems software controls include: (1) operating system software, (2) utility programs that do basic ''housekeeping'' chores such as sorting and copying, (3) program library software that controls and monitors storage of programs, and (4) access control software that controls logical access to programs and data files.

When auditing through the computer, auditors will want to review the systems software documentation. In addition, auditors will request management to provide certain output or runs from the software. For instance, the auditor, in reviewing how passwords within the system are set, will ask the information systems manager for a listing of all *parameters* or password characteristics designated in the system. Figure 14-7 lists some of the characteristics of passwords that the auditor will examine.

Parameter	Definition	Sample Setting	Risk
Minimum password length	Minimum number of characters required	6 digits	Short passwords are more easily guessed
Required password change	Require users to change passwords at specific intervals	60 days	Compromised passwords can be used forever
Minimum interval before password change	Minimum number of days before user can change password	1 day	If a user believes someone has learned the password, how much time must pass before it can be changed?
Maximum number of repeating characters allowed	Specifies how many characters may be repeated within the password	2 characters	Passwords such as ''AAAAAA'' are easily guessed
Alphabetic characters	Passwords may not consist of only numbers	Alpha	Protects against use of birthdates or other easily guessed numbers
Dictionary entries	Passwords cannot be dictionary words	ROOTTOOT	Hackers use standard dictionaries to find passwords
Assignment	Only bona fide users are given passwords	Employee	Passwords ensure accountability in addition to providing access

FIGURE 14-7 Examples of parameters that might be set to control passwords.

Auditors may choose to use software tools to review systems software. A number of tools are available, ranging from user-written programs to commercial packages such as *CA-Examine*. There are also general analysis types of software tools, such as *SAS, SPSS*, and *FOCUS*. These software tools can query operating system files to analyze the system parameters.

Systems software usually generates automatic outputs that are important for monitoring a company's computer system. In auditing the company's system, an auditor will want to inspect these outputs, which include logs and incident reports. The company's management uses *logs* for accounting purposes and for scheduling the use of computer resources efficiently. Auditors will make use of these logs to evaluate system security. Unusual occurrences, such as programs run at odd times or programs run with greater frequency than usual, are noted and subsequently investigated. Management may manually maintain *incident reports*, or systems software may automatically generate these reports. The reports list events encountered by the system that are unusual or interrupt operations. Incidents typically recorded are security violations (such as unauthorized access attempts), hardware failures, and software failures.

Validating Users and Access Privileges

An IT auditor needs to make sure that all computer-system users are valid and that each has access privileges appropriate to his or her job responsibilities. Systems software generally includes access control software that determines how the system administrator sets up and controls User IDs, user profiles, and passwords. The IT auditor should verify not only that the software parameters are set appropriately, but that IT staff are using them appropriately. For example, one audit task is to make sure that employee accounts are closed immediately after someone leaves the organization. To accomplish this, the IT auditor might request a list of current personnel from Human Resources. Another approach would be to obtain a current phone directory and compare names with those in the listing of user accounts.

IT Auditors should also look at user listings to see if there are any Group IDs assigned. For example, there may be an ID named AP_Clerk. Sometimes managers decide to issue these IDs to cut down on paperwork when making personnel changes. However, this type of ID prevents assigning responsibility to an individual. If one AP clerk were to make a mistake or commit fraud, the use of a Group ID would make it difficult to identify which of the accounts payable clerks was responsible.

An IT auditor can visually inspect printouts from databases and software documentation to verify users, appropriateness of passwords, and spot Group IDs. However, a variety of auditor software tools are available to make the work more efficient. As an example, such software might examine login times. If a user has not logged in for several months, it may be that the account should have been deleted. Users logging on at odd hours may also provide information that something is not quite right. As we noted earlier in the chapter, it is the exception conditions or irregularities that the IT auditor wants to identify.

Continuous Auditing

Some audit tools can be installed within an information system itself to achieve **continuous auditing** or real-time assurance. Continuous auditing is increasingly important as we move toward real-time financial reporting. There is also increasing pressure to reduce the time span between the production of financial information and the audit of the information, known as the audit cycle. Stakeholders want audited information quickly as decision time frames are becoming shorter. Many businesses report their financial information over the Internet and many more are likely to do so as XBRL enhances this form of reporting.

Five specific approaches for continuous auditing are: (1) embedded audit modules or audit hooks, (2) exception reporting, (3) transaction tagging, (4) snapshot technique, and (5) continuous and intermittent simulation. These tools allow auditing to occur even when an auditor is not present. With *embedded audit modules*, application subroutines capture data for audit purposes. These data usually are related to a high-risk area. For example, an application program for payroll would include a code that causes transactions meeting pre-specified criteria to be written to a special log. Possible transactions that might be recorded in a log include those affecting inactive accounts, deviating from company policy, or involving write-downs of asset values. For payroll applications, these transactions could reflect situations where, for instance, employees worked more than a predetermined number of hours. Another example might be recording related transactions occurring in a particular sequence.

The practice of *exception reporting* is also a form of continuous auditing. If the information system includes mechanisms to reject certain transactions that fall outside predefined specifications (such as an unusually large vendor check), then the ongoing reporting of exception transactions allows the system to continually monitor itself.

Using *transaction tagging*, auditors can tag certain transactions with a special identifier so that they can be recorded as they pass through the information system. For example, a specific number of employees can have tags attached to their transaction records so that an auditor can verify the processing logic in the payroll system. Tagging in this instance could also check to see that controls within the system are operating. Suppose that a control procedure requires rejection of payroll transactions if the number of hours worked during a pay period is too high. Auditors can review tagged transactions to make sure that this control procedure is functioning properly.

The *snapshot technique* examines the way transactions are processed. Selected transactions are marked with a special code that triggers the snapshot process. Audit modules in the computer program record these transactions and their master file records before and after processing activities. Snapshot data are recorded in a special file and reviewed by the auditor to verify that all processing steps have been properly performed.

Continuous and intermittent simulation (CIS) embeds an audit module in a database management system (DBMS). The CIS module examines all transactions that update the DBMS. If a transaction has special audit significance, the audit module independently processes the data (in a manner similar to *parallel simulation*), records the results, and compares them with those results obtained by the DBMS. If any discrepancies exist, the details of these discrepancies are written onto an audit log for subsequent investigation. If serious discrepancies are discovered, the CIS may prevent the DBMS from executing the update process. A challenge for continuous auditing is that the data in complex organizations may be located in multiple DBMS. To effectively conduct real-time assurance, auditors may need to create a data mart or subset of the data warehouse, specifically for audit purposes.

An example of continuous auditing on a smaller scale is embedding audit modules in spreadsheets. For example, the Excel payroll spreadsheet in Figure 14-8 computes the regular and overtime earnings for the employees of a construction company. Most such spreadsheets would only include the first few lines shown in the figure, plus perhaps the ''Total'' line in row 11. But this spreadsheet includes several additional rows, an auditing module that can help an accountant audit the application and check its validity and accuracy. The figure in the ''Counts'' row uses Excel's COUNTIF function to count the number of positive values in columns B, C, and D of the spreadsheet. An auditor can

Microsoft Excel - Excel Example.xls

	A	B	C	D	E	F	G
1	Choi Construction Company						
2	Payroll for Week Ending: 3/15/XX						
3							
4		Payrate	Regular Hours	Overtime Hours	Regular Pay	Overtime Pay	Total
5	Adams	8.90	40	3	356.00	40.05	396.05
6	Baker	12.55	35	0	502.00	0.00	502.00
7	Carlton	9.60	40	2	384.00	38.80	422.80
8	Daniels	10.20	35	0	408.00	0.00	408.00
9	Englert	9.60	40	5	384.00	72.00	456.00
10	Franklin	11.55	40	0	462.00	0.00	462.00
11	Griffin	10.80	35	0	432.00	0.00	432.00
12	Hartford	9.90	40	10	396.00	148.50	544.50
13							
14	Totals:		305	20	$3,324.00	$ 299.35	$3,623.35
15							
16	Totals:						
17	Counts:	8	8	4			
18	Maximums:	12.55	40.00	10.00			
19	Sum: Reg + O'time						$3,623.35
20	Max Regular Pay:				$4,016.00		
21	Max Overtime Pay:					$ 753.00	

FIGURE 14-8 This simple spreadsheet to compute regular and overtime payments contains several errors.

compare the largest of these numbers to the total number of employees known to work for the company. If we assume that this company has upper limits for the pay rate ($13), regular hours (40), and overtime hours (10), an auditor can also compare the values in the ''Maximums'' row against these upper limits to determine if any entries are too large.

INFORMATION TECHNOLOGY AUDITING TODAY

IT auditing is actually a component of information technology (IT) governance. In this section, we discuss the issue of IT governance and other important recent developments that impact IT auditing. These include the use of technology to deter fraud, the impact of the 2002 Sarbanes-Oxley legislation on IT auditing, and third party and systems reliability assurance.

Information Technology Governance

IT governance is the process of using IT resources effectively to meet organizational objectives. It includes using IT efficiently, responsibly, and strategically. The IT Governance Institute, an affiliation of the Information Systems Audit and Control Association (ISACA), was created in 1998 in recognition that IT was more than a tool an organization could use to meet objectives. Rather, strategic use of IT can drive a business and make the difference between success or failure.

The objectives of IT governance are really twofold. The first set of objectives focus on using IT strategically to fulfill the organizational mission and to compete effectively. Top management and the Board of Directors are responsible for ensuring these IT governance objectives. The second set of IT governance objectives involves making sure that the organization's IT resources are managed effectively and that management controls IT-related risks. Meeting these objectives is the concern of the Chief Information Officer (CIO), the auditors, and often top management.

Case-in-Point 14.8 The City of Mesa, Arizona provides government services to almost 400,000 people. The city has an IT steering committee that prioritizes IT projects for all departmental units. The committee uses techniques such as portfolio management to create the priorities. The IT governance program helps to facilitate communication between the IT function and the departmental users of IT. The governance structure also creates interdisciplinary teams that make sure IT projects fulfill the city's strategic objectives.[4]

Auditing for Fraud: Statement on Auditing Standards No. 99

The financial statement audits mandated by the Securities and Exchange Commission require auditors to attest to the fairness of a company's financial statements. They do not require auditors to detect fraudulent activities. This has long been seen as a problem by many investors and other business stakeholders who believe that an auditor report meant that a company was ''clean,'' or that there was no fraud taking place by management or other employees. As a result, the AICPA's Auditing Standards Board issued Statement on Auditing Standards (SAS) No. 99 *Consideration of Fraud in a Financial Statement Audit*.

SAS No. 99 superseded SAS No. 82. Although the earlier rule had the same name, the 2002 fraud standard provides more guidance for auditors to proactively prevent and deter fraud. The standard is part of a corporate responsibility and anti-fraud initiative of the AICPA. It encourages auditors to adopt a professional skepticism that will make them alert for signs of fraud, such as those in the **fraud triangle** depicted in Figure 14-9. This triangle

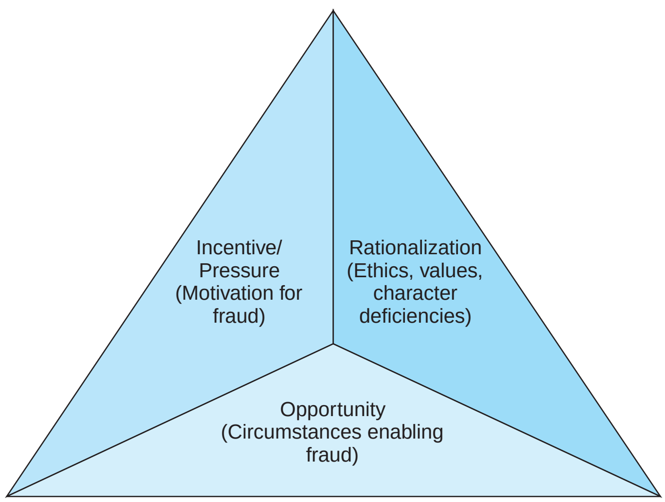

FIGURE 14-9 The fraud triangle. Three conditions required for fraud.

[4]Source: www.itgi.org–Case Studies. (March 19, 2004)

includes three elements that create a fraud. These are the motive for committing the fraud, the opportunity that allows the fraud to occur, and the rationalization by the individual perpetrating the fraud that the behavior is appropriate or justified.

One of the ways in which IT impacts on fraud is that fraudulent activity tends to be more costly than it would in a manual environment. An employee with a criminal bent and a high level of IT skills may have access to liquid assets and also the ability to cover his or her tracks electronically. An IT auditor might assist a fraud investigator or forensic accountant in many ways. One situation is where an IT auditor helps reconstruct an audit trail. Another case where IT audit skills are useful is in retrieving computerized records.

The Sarbanes-Oxley Act of 2002

In 2002, Congress passed the **Sarbanes-Oxley Act** (sometimes called SOX or Sarbox for short), the most sweeping piece of legislation to impact financial reporting and the accounting profession since the SEC Acts of 1933 and 1934. As noted in Chapter 1, the bill was a response to the wave of corporate accounting scandals that took down many long-time business icons, including Enron and Arthur Andersen. Figure 14-10 describes several of the major provisions of the act. For example, *Section 201*: *Services Outside the Scope of Practice of Auditors; Prohibited Activities* prohibits public accounting firms from offering non-audit services to a client at the same time they are conducting an audit. This means that, for example, one Big Four firm might be the external auditors of Company A and a different Big Four firm could be the outsourced internal auditors for Company A. (They may, however, provide these services to non-audit clients.)

Section 201: Services Outside the Scope of Practice of Auditors: Prohibited Activities

- Bookkeeping or other services related to accounting records of financial statements
- Financial information systems design and implementation
- Appraisal or valuation services, fairness opinions, or contribution-in-kind reports
- Actuarial services
- Internal audit outsourcing services
- Management functions or human resources
- Broker or dealer, investment adviser, or investment banking services
- Legal services and expert services unrelated to the audit
- Any other service determined by the Public Company Accounting Oversight Board as unallowable

Section 302: Corporate Responsibility for Financial Reports

The CEO and CFO of each public company issuing financial reports must prepare a statement that accompanies the audit report to certify the ‘‘appropriateness of the financial statements and disclosures contained in the periodic report, and that those financial statements and disclosures fairly present, in all material respects, the operations and financial condition of the issuer.’’ The CEO and CFO must knowingly and intentionally violate this requirement in order to be liable.

Section 404: Management Assessment of Internal Controls

Public company annual reports must contain an internal control report, which should state the responsibility of management for establishing and maintaining an adequate internal control structure and procedures for financial reporting; and contain an assessment, as of the end of the issuer’s fiscal year, of the effectiveness of the internal control structure and procedures of the issuer for financial reporting. Each issuer’s auditor must attest to, and report on, management’s assessment.

FIGURE 14-10 A summary of key provisions of the Sarbanes-Oxley Act of 2002.

SOX has four basic groups of compliance requirements: (1) audit committee/corporate governance requirements, (2) issues regarding certification, disclosure, and internal controls, (3) rules about financial statement reporting, and (4) regulations governing executive reporting and conduct. However, Section 302 and Section 404 of the Act are sometimes called full-employment acts for IT auditors! The cost of complying with the legislation, particularly the requirement to document and attest to internal controls, runs into millions of dollars for the largest public companies.

When Jeffrey Skilling, Enron's onetime Chief Executive Officer (CEO), testified before the Senate Banking and Commerce Committee in 2002, he claimed ignorance with respect to Enron's accounting. Later, Bernie Ebbers, CEO of WorldCom, claimed a similar lack of knowledge about his company's financial records. Shocked that corporate heads might not understand the financial activities of their own companies, lawmakers included Section 302. This SOX provision requires both Chief Financial Officers (CFOs) and CEOs to certify personally that their company's financial statements are accurate and complete, and also that internal controls and disclosures are adequate. So SOX requires top management in public companies to understand their internal controls, and makes them legally liable if they knowingly misrepresent the condition of these controls.

Section 404 of SOX requires both the CEO and CFO to assess their organization's internal controls over financial reporting and attest to them. They do so in an internal control report that is filed with the annual report. This section also requires that the external auditors report on management's internal control assessment. This is the work that is really keeping management and a company's internal and external auditors the busiest.

To assess internal financial controls requires documenting business processes and internal controls. Large public companies are likely to make heavy use of IT in their processes and financial reporting, which means that they'll need an IT auditor to document the processes and controls. This can be a daunting task, but a good one for companies to undertake. Consider that you may have a large financial services firm, for example, with literally hundreds of software applications and very complex business processes. Who has the big picture? Probably no one, unless the internal audit staff takes the time to fit the pieces together and create a ''map'' of the entire company's processes and applications.

The auditors can use this map to examine the internal controls in general and for each application. For example, one general type of internal control is separation of duties (see Chapter 8). Who does what should be clearer from the documentation of processes. Various applications will each have internal controls unique to them as well, such as a control over a procurement application concerning who may enter invoices. The AIS at Work feature at the end of this chapter describes how the internal auditors at a Big Four firm might approach a ''404'' review for an internal audit client.

An interesting by-product of SOX is the emergence of software to facilitate compliance with the new rules. The main uses of software for SOX are for managing communication, workflow, and documentation. Many accounting software packages, such as ACCPAC or PeopleSoft include features to document internal controls. However, there are also specialized programs designed specifically to adhere to the requirements of Sarbanes-Oxley.

Case-in-Point 14.9 S-O Comply®, a product of DoubleCheck LLC and one of the earliest software tools created to assist with Sarbanes-Oxley compliance, includes document management and audit tools. One of the primary requirements of the act is for companies to disclose all material information that might affect the company's financial performance over time. The software includes a Compliance Manager that manages controls, issues, and tasks, discloses documents and work flow, and maintains an audit trail.[5]

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[5]Source: www.onproject.com/soa

SOX regulations do not require companies to automate their controls or processes in order to be compliant. So a company may have many manual processes and manual controls over those processes in addition to the computerized processes and controls that are of primary interest to the IT auditor. IT auditors must work closely with financial auditors to complete the thorough internal control review mandated by Section 404.

Third-Party and Information Systems Reliability Assurances

Auditing electronic commerce is a specialized field—in part because of the skill level involved, and in part because many of the safeguards found in non e-commerce systems are absent. One problem is the lack of hard-copy documents with which to verify the existence of accounts, purchases, or payments—a characteristic of electronic communications. Similarly, the arrival of an electronic transaction on a server does not guarantee its validity or authenticity—only that something was transmitted. As an increasing number of companies publish their financial statements online, auditors need to attest to this type of format. An audit report or digital signature can provide those viewing online financial information with the same assurances as found in a traditional audit report.

The importance of the Internet and electronic commerce impacts auditors' work in other ways. In recent years auditors have shifted away from audits of transactions to examinations of business risks. Because Internet systems and websites are sources of such risks, specialized audits of these systems, particularly in terms of security and privacy, are becoming commonplace. In fact, the risks introduced by a business' Internet presence have created a market for **third-party assurance services**.

Independent third parties may provide business users and individual consumers with some level of comfort over their Internet transactions. The comfort level varies with the type of assurance services offered. In some cases, third-party assurance is limited to data privacy. The TRUSTe assurance seal is an example of privacy assurance. TRUSTe is a nonprofit organization that issues a privacy seal.

Case-in-Point 14.10 Monster® offers online career connection services. It matches employers with prospective employees, and also offers career advice. Because job seekers post personal information at the site, privacy is particularly important. Monster displays the TRUSTe privacy seal at its website, along with a privacy statement that includes information about how the company uses the data it collects. The seal is a symbol of assurance to the site users that Monster complies with TRUSTe's privacy practice requirement.[6]

Other assurance services offer different kinds of protection. Consumers and business partners are not just concerned about privacy and security of data transmissions. They also worry about the business policies of an Internet company, its ability to deliver goods and services in a timely fashion, its billing procedures, and its integrity in using a customer's email address. The Better Business Bureau's BBBOnline seeks to verify the business policies of Internet businesses. CPA WebTrust, offered by the AICPA, is a third party assurance seal that promises data privacy and security, in addition to reliable business practices and integrity in processing transactions. BetterWeb, offered by PricewaterhouseCoopers, provides customers engaged in online transactions with assurance regarding a business' sales terms, privacy, security, and handling of complaints. Concerns about email spamming and phishing (discussed in Chapter 9), have led to development of email assurance or accreditation. In addition to privacy protection, TRUSTe now offers a specialized seal to businesses that assures customers that a company will not spam them or misuse their email address.

[6]Source: www.truste.org–TRUSTe Case Study (Accessed September 6, 2008)

Auditors must take risks associated with information systems into account with respect to their possible impact on financial statements. In addition, many businesses seek assurance as to the *reliability* of their information systems. AICPA members may offer **Trust Services** that include both WebTrust and SysTrust, an assurance service that evaluates the reliability of information systems with respect to their availability, security, integrity, and maintainability. CPAs offering SysTrust services to their clients may evaluate all or some of these reliability characteristics. For instance, a company may have concerns about the security of its information systems. A CPA would evaluate that client's system in terms of its controls over unauthorized access. As increasing numbers of parties rely on organizations' information systems, assurance over the reliability of those systems is likely to grow in importance.

The principles of the AICPA's Trust Services are: (1) security (protection against unauthorized access), (2) availability (the information system is available for use), (3) processing integrity (processing is complete, timely, authorized, and accurate), (4) online privacy (protection of personal information), and (5) confidentiality (protection of information designated as secret or confidential). Trust Services consists of these principles, together with specific criteria and illustrative controls. The structure provides guidance to practitioners who are evaluating organizations in terms of their reliability, privacy, and security.

AIS AT WORK
An Internal Audit ''404'' Review

One Big Four public accounting firm developed a methodology for its internal auditors to use to help comply with Sarbanes-Oxley Section 404 requirements. As a first step, the auditor must identify the business processes associated with financial statement line items. These include typical processes such as revenue and expenditures, and sometimes nonstandard cycles, depending on the nature of the client's business or particular footnote disclosures. In addition to documenting the business process controls, management must document the IT controls for auditors to access. These include general, application, and database controls.

Identifying applications in the scope of 404 can be a difficult task, especially when a company has a ''best of breed'' approach that involves multiple, highly customized application interfaces. SOX states that financial data must be controlled from their point of origin, so mapping the path of a transaction from instigation to the financial statement can be difficult with complex integrated systems.

At one large company, auditors applied both a *top-down* and a *bottom-up* approach to mapping transaction and data flows. The auditors determined that an application processed an average of more than one thousand journal entries each month into the general ledger. For each of those journal entries the auditor identified the system of origin where the transaction cycle began. The bottom-up approach involved identifying the system that originated a transaction and working in the opposite direction toward the general ledger system. These two approaches, working concurrently, expedited the process of scoping applications or determining which applications affect the financial statements. Auditors could then start the rigorous process of documenting the controls around these financial applications, leading to management's assertion of a proper control environment.

After identifying all business cycles and applications and documenting the controls surrounding them, the auditor compares these documented controls against a set of standard controls and identifies any gaps and remedies or compensates for them. Management then tests these controls to verify that they are performing as documented. If this is the case, management can attest to the control environment and the process is complete.

SUMMARY

- Although both the internal and external auditors are concerned with computerized systems, there are important differences in the goals of each type of auditor.
- IT auditing may complement the financial audit, by providing a basis for determining the appropriate scope of the financial audit.
- Knowledge of both accounting and information systems makes for the best IT auditors because these two areas are so closely related.
- Auditors today have some special tools available to them in designing and evaluating internal controls in IT environments, including general-use software and generalized audit software (GAS).
- People skills, including team-building and interpersonal skills, are important for an IT auditor.
- IT auditors use a risk assessment approach in designing their audit programs to ensure that the costs of control procedures do not outweigh their value.
- Auditing through the computer involves both testing and validating computer programs, as well as review of systems software and validating user accounts and access privileges.
- Embedded audit modules are an example of one tool available to perform a continuous audit.
- Proper IT governance mandates that managers not only control risks associated with IT, but that they also use IT strategically.
- An increase in attention to fraud and internal controls, as mandated by SAS No. 99 and the Sarbanes-Oxley Act of 2002 will increase the need for the type of work done by IT auditors.
- IT auditors may also offer assurance services unrelated to financial audits, such as third party and systems reliability assurance.

KEY TERMS YOU SHOULD KNOW

auditing around the computer
auditing through the computer
auditing with the computer
automated workpaper software
Certified Information Systems Auditor (CISA)
computer-assisted audit techniques (CAATs)
continuous auditing
Control Objectives for Information and Related Technology (COBIT)
CPA WebTrust
Electronic Systems Assurance and Control (*e*SAC)
fraud triangle
generalized audit software (GAS)
general-use software
information technology (IT) auditing
information systems risk assessment
integrated test facility (ITF)
IT governance
parallel simulation
penetration testing
program change control
responsibility system of computer program development and maintenance
risk-based audit approach
Sarbanes-Oxley Act
Structured Query Language (SQL)
Systems Auditability and Control (SAC) report
test data
third-party assurance services
Trust Services

TEST YOURSELF

Q14-1. An IT Auditor:

- **a**. Must be an external auditor
- **b**. Must be an internal auditor
- **c**. Can be either an internal or external auditor
- **d**. Must be a Certified Public Accountant

Q14-2. Which of the following is NOT true with respect to forensic accountants?

- **a**. They specialize in fraud investigation
- **b**. They are always external auditors
- **c**. They may work for the FBI
- **d**. Forensic accounting is an example of an assurance service

Q14-3. In determining the scope of an IT audit, the auditor should pay most attention to:

- **a**. Threats and risks
- **b**. The cost of the audit
- **c**. What the IT manager asks to be evaluated
- **d**. Listings of standard control procedures

Q14-4. Auditing around the computer:

- **a**. Is the approach to auditing that is recommended in most cases to reduce IT audit costs
- **b**. Focuses on computerized control procedures
- **c**. Assumes that accurate output is sufficient evidence that processing operations are appropriate
- **d**. Follows the audit trail through internal computer operations

Q14-5. COBIT is:

- **a**. A control framework developed by the Institute of Internal Auditors
- **b**. A control framework developed specifically for organizations involved in e-business
- **c**. An internal control model that covers both automated and manual systems
- **d**. An internal control framework and model that encompasses an organization's IT governance and information technologies

Q14-6. Which of the following is NOT true with respect to generalized audit software (GAS)?

- **a**. They require auditors to rewrite processing programs frequently while reviewing computer files
- **b**. They are specifically tailored to auditor tasks
- **c**. They may be used for specific application areas, such as accounts receivable and inventory
- **d**. They allow auditors to manipulate files to extract and compare data

Q14-7. Which of the following is NOT an audit technique for auditing computerized AIS?

- **a**. Parallel simulation
- **b**. Use of specialized control software
- **c**. Continuous auditing
- **d**. All of the above are techniques used to audit computerized AIS

Q14-8. In auditing program change control, the IT auditor will:

- **a**. Make sure that only computer programmers have tested the changes they made to programs

b. Ensure an organization is following the process described in their documentation for program change control

c. Not need to inspect program authorization forms for signatures

d. Make sure that only computer programmers move their own changes into a production environment

Q14-9. Continuous auditing:

a. Has been talked about for years but will never catch on

b. Will likely become popular if organizations adopt XBRL in their financial reporting

c. Does not include techniques such as embedded audit modules

d. Will never allow IT auditors to provide some types of assurance on a real-time basis

Q14-10. With respect to changes in IT auditing today, which of the following is NOT true?

a. IT governance, which ties IT to organizational strategy, is increasingly important

b. Section 404 of the Sarbanes-Oxley Act of 2002 created an increase in demand for both IT auditors and internal auditors

c. IT auditors are concerned only with supporting financial auditors and should not investigate fraud cases

d. Third-party assurance seals may provide some comfort to e-business customers regarding the security of online transactions

DISCUSSION QUESTIONS

14-1. Distinguish between the roles of an internal and an external auditor. Cite at least two examples of auditing procedures that might reasonably be expected of an internal auditor but not an external auditor. Which type of auditor would you rather be? Why?

14-2. How does information technology auditing differ from financial auditing? Make a list of the skills you think are important for financial auditors and for IT auditors. Do you think all auditors should have all the skills on both lists? Why or why not?

14-3. Describe the differences between general-use software and generalized audit software. How might you use spreadsheet software, database software, and word processing software in conducting an audit of fixed assets?

14-4. IT auditors need people skills as well as technical skills. One such skill is the ability to interview effectively. Discuss some techniques or tools that might help an interviewer get the best information from an interviewee, including sensitive information.

14-5. The Pan Pacific Computer Company purchases independent computer components, which it then uses to manufacture custom-made computer hardware. Because it deals with a number of vendors, it has computerized the accounting procedures for its accounts payables. Describe how an auditor might use through-the-computer techniques such as test data, integrated test facility, parallel simulation, or validation of computer programs to accomplish audit objectives relative to accounts payable.

14-6. How does an auditor evaluate the control procedures of an automated AIS? How is the element of uncertainty handled in the audit examination?

14-7. Jose Rodriguez was the only internal auditor of a medium-sized communications firm. The company used a computer for most of its accounting applications, and recently, several new software packages had been implemented to handle the increased volume of the company's business. To evaluate the packages' control capabilities, Jose performed a cost-benefit analysis and found that many of the control procedures were potentially useful but not clearly cost-effective. The problem, therefore, was what to say in his report to management.

After pondering this question for some time, he decided to recommend almost all the controls based on the idea that a company was ''better to be safe than sorry.'' Comment.

14-8. The Sarbanes-Oxley Act of 2002 may impact auditing more than any legislation enacted since the Securities and Exchange Acts in the 1930's. It will also likely significantly increase the cost of an audit. Discuss what specific elements of the new law will add to auditing costs.

14-9. This chapter described several third party assurance seals, including CPA WebTrust, BBB Online, and TRUSTe. Explain the differences among them. Identify at least one other third party assurance seal available for companies that allows them to demonstrate to their customers that they may be trusted in business transactions.

PROBLEMS

14-10. The Espy Company recently had an outside consulting firm perform an audit of its information systems department. One of the consultants identified some business risks and their probability of occurrence. Estimates of the potential losses and estimated control costs are given in Figure 14-11.

a. Using the Figure 14-11 information, develop a risk assessment for the Espy Company.

b. If you were the manager responsible for the Espy Company's information processing system, which controls would you implement and why?

14-11. Visit www.isaca.org, the website for the Information Systems Audit and Control Association, and examine two case studies of organizations that use COBIT. Explain how these entities obtain value by using COBIT as a control framework.

14-12. Information systems auditors sometimes use tools or information they can download from the Internet. These tools or information may include software, audit guides, or computer security advisories. Locate some examples from the Internet of audit tools, audit guides, or computer security advisories that you would find useful in conducting an audit of a client's computer system.

14-13. Continuous auditing has the potential to reduce labor costs associated with auditing. It also can provide audit assurance closer to the occurrence of a transaction, which improves the reliability of frequent or real-time financial reports. Using an Internet search engine, find an example of an organization's usage of continuous auditing.

		Losses		
Hazard	**Probability That Loss Will Occur**	**Low Estimate**	**High Estimate**	**Estimated Control Costs**
Equipment failure	.08	$50,000	$150,000	$2,000
Software failure	.10	4,000	18,000	1,400
Vandalism	.65	1,000	15,000	8,000
Embezzlement	.05	3,000	9,000	1,000
Brownout	.40	850	2,000	250
Power surge	.40	850	2,000	300
Flood	.15	250,000	500,000	2,500
Fire	.10	150,000	300,000	4,000

FIGURE 14-11 A risk analysis for the Espy Company.

CASE ANALYSES

14-14. IT Auditing at Merriman, Davenport, and Walker, P.C. (IT Audit Function)

Merriman, Davenport, and Walker, P.C. is a regional public accounting firm located in Norfolk, Virginia. The firm specializes in audits of small to mid-size businesses and serves clients throughout Virginia, the District of Columbia, and North Carolina. Connie Merriman, the founding partner, started the firm in 1985, and now employs forty audit staff and four tax accountants.

During the past twenty years, Merriman, Davenport, and Walker's clients have become increasingly sophisticated in their computerized accounting applications. Most of the auditing staff members have developed IT auditing skills and employ them as deemed appropriate when conducting financial audits. However, Connie Merriman has felt for some time that hiring one or two specialized IT auditors would be a good idea and might reduce audit costs, and could also increase firm revenues.

Requirements:

1. Explain how the IT auditors might be able to reduce the cost of an annual audit for a mid-sized client?
2. How would the IT auditors most likely interface with the financial audit team on a specific client engagement?
3. What are some new services the firm might be able to offer that would help them to increase revenues?
4. What limitations on services that the IT auditors might perform are imposed by the Sarbanes-Oxley Act?

14-15. Basic Requirements (Systems Reliability Assurance)

Kara and Scott Baker own a small retail company, Basic Requirements, with one store located in a small college town and a website through which customers can make purchases. The store sells traditional but up-to-date clothing for young women such as tee-shirts, jeans, chinos, and skirts. The store has been open for ten years and the owners added the online shopping capability just last year. Online business has been slow, but Kara and Scott believe that as student customers graduate from the university they will use the online site to continue to have access to their favorite store from their college days.

The store's website has many features. It classifies clothing by type and customers can view items in various colors. To purchase an item, the user clicks on the icon depicting the desired product and adds it to an individual online shopping basket. The customer can view the basket and make a purchase at any time while browsing the site. When checking out at the site, a new customer must first register, providing billing and shipping information, as well as credit card data. Returning customers log in with the identification code and password they created when they registered. They also use that method to check on an order status. If a customer forgets their login information, they can simply click on a link to have it emailed to them. Once a user registers, Basic Requirements' system will automatically add their email address to a file that they use to regularly send out emails about sales and other promotions.

Kara and Scott are concerned about internal controls in their business. They especially worry because they know that their web access creates some special risks. They have asked one of their customers who is an accounting student at the university to evaluate the reliability of their information system, with respect to security, availability, and privacy.

Requirements:

1. Identify two security, availability, and privacy risks that Basic Requirements faces.
2. For each risk identified above, describe two internal controls Basic Requirements should use to protect against these risks.
3. The accounting student who is evaluating the reliability of Basic Requirements' information system is interested in becoming an IT auditor. Describe some of the specific actions an IT auditor would take to verify that Kara and Scott have adequate controls in place concerning privacy.

14-16. Tiffany Martin, CPA (Information Technology Audit Skills)

Tiffany Martin is an audit manager in a medium-sized public accounting firm. Tiffany graduated from college seven years ago with a degree in accounting. She obtained her CPA certification soon after she joined the firm where she currently works. Tiffany is a financial auditor; she has had little training in auditing computerized information systems.

The current engagement Tiffany is working on includes a complex information processing system with multiple applications. The financial accounting transactions are processed on server. The IT department employs 25 personnel, including programmers, systems analysts, a database administrator, computer operators, technical support personnel, and a director. Tiffany has not spoken with anyone in the department because she is fearful that her lack of technical knowledge relative to IT will cause some concern with the client.

Because Tiffany does not understand the complexities of the computer processing environment, she is unable to determine what risks might result from the computerized system's operations. She is particularly worried about unauthorized changes to programs and data that would affect the reliability of the financial statements.

Tiffany has spoken to Dick Stanton, the partner who has responsibility for this audit client, about her concerns. Dick has suggested that Tiffany conduct more substantive testing than she would undertake in a less complex processing environment. This additional testing will hopefully ensure that there are no errors or fraud associated with the computer processing of the financial statements.

Requirements:

1. Do you think that Dick Stanton's suggested approach is the most efficient way to control risks associated with complex computer environments?
2. How should Tiffany respond to Dick's suggestion?

3. What can a public accounting firm, such as the one in which Tiffany works, do to ensure that audits of computerized accounting information systems are conducted efficiently and effectively?
4. Should Tiffany be allowed to conduct this audit given her limited level of skills? How might she acquire new skills?

14-17. The Linz Company (Audit Program for User Accounts)

Jack Herron is an IT auditor with McGee LLP, a large national public accounting firm. His manager, Amanda McDermott, has assigned him to the Linz Company audit. The McGee financial auditors have requested that the IT auditors complete several auditing steps so that they may make a decision about the scope of their audit work. The IT auditors also need to evaluate IT controls to provide the financial auditors with information in order to garner an opinion on internal controls as part of Sarbanes-Oxley compliance.

The Linz Company manufactures automotive parts and supplies them to the largest auto-makers. The company has approximately 600 employees and has manufacturing operations and offices in three locations. Linz uses a mid-sized ERP software program for manufacturers that they acquired and implemented two years ago.

Amanda has asked Jack to develop an audit program to examine logical access to the ERP system. According to the Security Administrator at Linz, each employee is assigned a unique User ID and password when they join the company. The company is very concerned about security, so there is no remote access to the ERP system. The ERP system requires that users change their passwords every six months. System and group settings assigned to each User ID determine what parts of the ERP systems are available to each user.

Requirements:

1. Explain how a deficiency in controls over User IDs and passwords might impact Linz's financial statements.
2. Explain why auditing User IDs and passwords should be part of the overall IT audit program for Linz.
3. Describe at least four control procedures that Linz could have in place to ensure that only authorized users access the system and that user access is limited according to their responsibilities.

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ANSWERS TO TEST YOURSELF

1. **c** 2. **b** 3. **a** 4. **c** 5. **d** 6. **d** 7. **d** 8. **b** 9. **b** 10. **c**

Chapter 15

Accounting on the Internet

After reading this chapter, you will:

1. *Understand* some of the basic concepts of the Internet, such as TCP/IP, URLs, and web page addresses.
2. *Appreciate* why electronic communication is useful to accountants.
3. *Know* why XBRL is important to financial reporting.
4. *Understand* electronic data interchange (EDI), and why it is important to AISs.
5. *Know* the differences between business-to-consumer and B2B e-commerce.
6. *Appreciate* the privacy and security issues associated with e-commerce.
7. *Know* why businesses use firewalls, proxy servers, and encryption techniques.
8. *Understand* digital signatures and digital time-stamping techniques.

"It is important to understand that e-commerce is simply a tool to conduct business efficiently, so you still need a sound business model. It doesn't really change what you do, but rather the way you do it."

Heather Douglas, "E-Commerce and the Home Business"
NZ Business (June 2006), p. 63.

INTRODUCTION

Most accountants use the Internet for research, education, and email on a daily basis. Auditors regularly evaluate their client's internal controls to ensure complete, accurate, and authentic transmissions of transactions over the Internet. In fact, it's nearly impossible to imagine how accountants would accomplish their various job responsibilities without the many technologies that support today's businesses.

This chapter describes the Internet and some of its accounting uses in detail. The first section describes Internet components such as Internet addresses and software. This section also discusses some Internet concepts of special importance to accountants (i.e., intranets and extranets). We also discuss XBRL, a financial reporting language, in this section.

One of the most important uses of the Internet is for electronic commerce (e-commerce)—the topic of the next section of this chapter. Although the terms e-commerce and e-business are often used interchangeably, there *is* a difference. E-commerce involves buying and selling electronically, and can be between two businesses, between a for-profit company and a governmental entity, between a business and a customer, and other similar combinations. We use the term e-business to describe the electronic infrastructure that supports e-commerce. Here, we discuss such vital concepts as retail sales, e-payments, electronic data interchange (EDI), and virtual PBXs.

As more organizations conduct at least some business on the Internet, it is only natural that managers increasingly recognize the importance of Internet privacy and security. This includes protecting consumers' personal privacy, protecting proprietary data from hackers, and safeguarding information that businesses send to one another over the Internet. The final section of this chapter discusses these topics in detail.

THE INTERNET AND WORLD WIDE WEB

The **Internet** is a collection of local and wide-area networks that are now connected together via the Internet backbone—i.e., the main electronic connections of the system. Describing the Internet as an "information superhighway" makes sense because over 1 billion people from around the world now use it, just as a set of state, interstate, and international highways connect people physically. Almost all universities are connected to the Internet, as are most commercial information services, businesses, government agencies, and not-for-profit organizations. This section of the chapter discusses Internet basics, including Internet addresses and software, intranets and extranets, the World Wide Web, IDEA, groupware, electronic conferencing, and weblogs.

Internet Addresses and Software

To transmit data over the Internet, a computer uses an Internet address and a forwarding system that works much the same way as the post office system. On the Internet, the initial computer transmits a message to other computers along the Internet's backbone, which in turn relay the message from site to site until it reaches its final destination. If the message is large, Internet computers can divide it into smaller pieces called *data packets* and route each of them along different routes. The receiving computer then reassembles the packets into a complete message at the final destination.

An Internet address begins as a **domain address**, which is also called a **uniform resource locator (URL)**. This is a text address such as ''www.Name.com.uk.'' As suggested by this generic example, the lead item indicates the World Wide Web. The second entry designates the site name, and the third entry (''com'' for commercial user) is the organization code. Other organization codes are ''edu'' (education), ''gov'' (government), ''mil'' (military), ''net'' (network service organization), ''org'' (miscellaneous organization), and ''int'' (international treaty organization). Finally, a domain address can include a country code as well—for example, ''ca'' for Canada, ''uk'' for the United Kingdom, or ''nz'' for New Zealand.

For transmission purposes, Internet computers use tables of domain names that enable them to translate a text-based domain address such as www.Wikepedia.org into a numeric **Internet protocol (IP)** address such as 207.142.131.248. The elements in this address contain a geographic region (''207''), an organization number (''142''), a computer group (''131''), and a specific computer (''248''). The IP address enables Internet computers to deliver a specific message to a specific computer at a specific computer site—for example, send an email message to a friend at another university using the standard **Transmission Control Protocol (TCP)/Internet protocol**. IP addresses are useful to auditors because they help identify the sender, which is an important control in e-commerce applications.

Intranets and Extranets

Because Internet software is so convenient to use, many companies also create their own **intranets** for internal communications purposes. These computer networks use the same software as the Internet but are internal to the organization that created them. Thus, outsiders cannot access the information on intranet networks—a convenient security feature.

Companies, governmental entities, military organizations, and educational institutions are all finding many uses for intranets. These systems allow users to access and interact with a range of internal databases. Advanced search engine technology coupled with an intranet can deliver user-defined information when needed. For example, a purchasing agent can access a centralized listing of approved vendors using his or her web browser and a local area network.

Another valuable use of an intranet is for gathering and disseminating information to internal users. For example, employees can collaborate with each other by posting messages and data on the internal network, updating records, checking out job postings, completing forms to request office supplies, and entering travel expenses through their organization's intranet. Universities offer many of the same services to their employees, as well as a similar variety of services and educational opportunities to students.

Case-in-Point 15.1 Students at Baylor University's Hankamer School of Business have direct access to *The Wall Street Journal Online* through the university's intranet. Baylor was one of the first academic institutions to implement intranet-based access to the journal through a recently launched Journal-in-Education service. Although students do not need to register, they still have access to all of the online journal's regular personalization features, including company and industry tracking, email alerts, portfolio and interactive tools, and special reports with interactive graphics.[1]

Extranets enable selected outside users to access corporate intranets. Users connect through the Internet itself via passwords or private data communications channels. The following is an example.

Case-in-Point 15.2 Chamberlain Group, Inc., distributes door operators, gate operators, and telephone entry systems. The firm's extranet helps the independent dealers who sell its products place orders, view invoices, obtain return authorizations, track warranty claims, and download manuals in PDF format. The company is particularly proud of its "resource center"—a separate portion of its website—which allows dealers to obtain advertising assistance, download high-resolution logos and pictures of products, and even TV and radio commercials.[2]

The World Wide Web and HTML

The multimedia portion of the Internet is commonly called the World Wide Web or just "the web." As you probably already know, you view these graphics using a web browser such as Microsoft's Internet Explorer. A typical entity on the web is a web page—i.e., a collection of text, graphics, and links to other web pages stored on Internet-connected computers.

HTML. Developers typically create web pages in an editing language such as **hypertext markup language (HTML—** see Figure 15-1a). Web designers store these instructions in one or more files and use the Internet to transfer these pages from a source computer to a recipient computer using a communications protocol such as **hypertext transfer protocol (HTTP)**. Your web browser then deciphers the editing language and displays the text, graphics, and other items of the web page on your screen (Figure 15-1b).

Because HTML is an editing language, many of its instructions are simply pairs of tags that instruct a web browser how to display the information bracketed by these tags. Thus, in Figure 15-1a, note that the entire file begins with an <html> tag and ends with a closing </html> tag. Similarly, the and tags bold and unbold text, and the <i> and </i> tags begin and end italicized text. Using Figure 15-1b, you can probably guess the purpose of anchor tags (beginning with <a>), ordered-list tags (beginning with <ol>), and list-item tags (beginning with <li>). Problem 15–18 is an exercise to help you understand HTML tags.

Groupware, Electronic Conferencing, and Blogs

Groupware allows users to send and receive email, collaborate on work tasks, make revisions to the same document, schedule appointments on each other's calendars, share files and databases, conduct electronic meetings, and develop custom applications.

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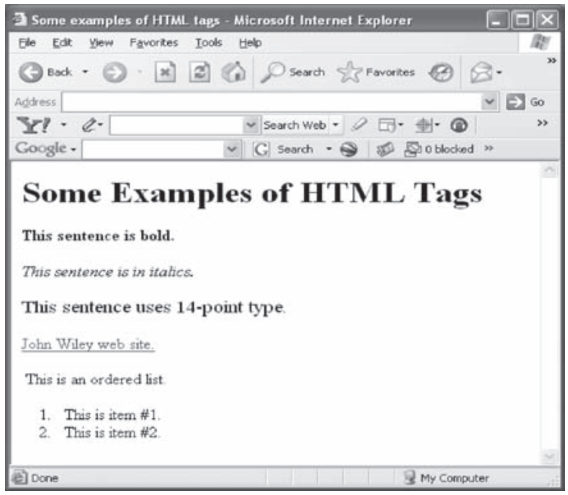
[1]Source: P. Li. "Baylor University offers business students intranet access to the Wall Street Journal Online," *College Planning & Management* (January 2004), p. 8.
[2]Source: no author. "The Chamberlain Group Updates its Extranet", *Security Distributing and Marketing* Vol. 37, No 10 (October 2007), pp. 26–27.

```
<html>
<title>Some examples of HTML tags</title>
<body lang=EN-US style='tab-interval:.5in'>
<h1>Some Examples of HTML Tags</h1>
<p><b>This sentence is bold.</b></p>
<p><i>This sentence is in italics.</i></p>
<p><span style=font-size:14.0pt>
This sentence uses 14-point type
</span>
</p>
<p><a href="http://www.wiley.com">John
   Wiley web site</a></p>
<p>This is an ordered list.</p>
<ol><li>This is item #1.</li>
<li>This is item #2.</li>
</body>
</html>
```

(a) HTML code



(b) What the code in part (a) displays

FIGURE 15-1 An example of HTML code and what that code displays in a web browser. Note the anchor tag <a>, which allows you to create a link to another web page—in this case, the Wiley website.

Examples of such software include Exchange (Microsoft), Groupwise (Novell), Lotus Notes (Lotus Development Corporation) and Outlook (Microsoft).

Instant messaging software enables remote users to communicate with each other in real time via the Internet. You are probably already familiar with such software if you use MSN Messenger, Yahoo Messenger, or Internet Relay Chat (IRC) to chat with distant friends. Many of these packages also support audio, video, and **electronic conferencing** (enabling several users to join a discussion instead of just two). Accounting applications include the ability to interview job applicants remotely, consult with clients about tax or audit problems, discuss projects from several remote sites, or plan corporate budgets.

Large consulting and accounting firms have access to a wealth of information within their organizations. Groupware is one of the technologies behind **knowledge management** that many professional service firms (such as accounting and consulting firms) use to distribute expertise within the organization (frequently on its intranet). This information includes descriptions of clients' best practices, research findings, links to business websites, and customized news. For example, an employee with a client issue can access the knowledge database to learn how others handled similar issues.

Weblogs or **blogs** are collaboration tools that allow users with web browsers and easy-to-use software to publish a personalized diary online. Blogging introduces a new way to create, share, and leverage knowledge in an organization, and therefore can be valuable to accountants. Enterprise blogs provide companies with easy-to-use tools to manage internal and external information, which in turn affects relationships with customers, partners, and investors, as well as internal decision-makers.

Case-in-Point 15.3 The U.S. Department of Defense's Naval Undersea Warfare Center (NUWC) in Newport, R.I., uses TeamPage enterprise blogging software to create a secure communications hub for a project to evaluate night-vision technology. The blog is part of a pilot project to speed up communications within the DOD's test and evaluation programs. NUWC will blog information about its tests of the night-vision technology so the information is available in real time to its partners (Ford Motor Co. and the U.S. Army's night-vision lab).[3]

[3]Source: Linda Rosencrance, ''Blogs Bubble into Business,'' *Computerworld* (January 26, 2004), p. 23–4.

XBRL: FINANCIAL REPORTING ON THE INTERNET

Although the Internet supports general financial reporting, exchanging financial information between trading partners often requires more detailed specifications. XML or **eXtensible Markup Language** is similar to HTML in that it also uses tags such as and to format data. But there are two important differences between HTML and XML. One is that XML tags are ‘‘extensible,’’ allowing users to define their own tags such as <SalesRevenue>. The other difference is that the XML tags actually describe the data rather than simply indicate how to display it. For example, if a business wants to report sales revenue of $1 million, it could use the XML tags: <SalesRevenue> $1,000,000 </SalesRevenue>. Now, this data item has meaning.

A problem with XML tags is a potential lack of consistency among users. For example, your company might use the XML tag <SalesRevenue> but another company might choose <Revenues>. Without standardized markers (tags), users cannot exchange financial information or extract data from XML files for comparison purposes. **XBRL** or **eXtensible Business Reporting Language** solves this problem by standardizing the tags that describe financial information in documents for both profit and not-for-profit organizations. In short, XBRL is a specialized subset of XML for reporting financial information. Figure 15-2 provides an example of XBRL code and what that code creates.

The XBRL International Consortium (discussed below) creates XBRL standards that anyone can use, license-free. In addition, many accounting software packages are now *XBRL-enabled*, meaning that they can insert appropriate XBRL tags automatically in user financial files.

XBRL Instance Documents and Taxonomies

XBRL documents are called **XBRL instance documents** because they are examples (‘‘instances’’) of a class of documents defined by a standard or specification. Figure 15-2 shows an example—a portion of an income statement in XBRL. In this example, note that

XBRL code:

```
<ifrs-gp:CashCashEquivalents contextRef=‘‘Current_AsOf’’ unitRef=‘‘U-Euros’’
      decimals=‘‘0’’>1000000</ifrs-gp: CashCashEquivalents>
<ifrs-gp:OtherAssetsCurrent contextRef=‘‘Current_AsOf’’ unitRef=‘‘U-Euros’’
      decimals=‘‘0’’>200000</ifrs-gp: OtherAssetsCurrent>
<ifrs-gp:AssetsCurrentTotal contextRef=‘‘Current_AsOf’’ unitRef=‘‘U-Euros’’
      decimals=‘‘0’’>1200000</ifrs-gp:AssetsCurrentTotal>
```

What the XBRL code displays in a web browser:

Current Assets:	
Cash and Cash Equivalents	1,000,000
Other Assets, Current	200,000
Current Assets, Total:	1,200,000

FIGURE 15-2 An example of XBRL code and what that code creates.

XBRL tags follow conventional HTML and XML coding rules that use a beginning tag such as <ifrsgp:OtherAssetsCurrent> and an ending tag such as </ifrsgp:OtherAssetsCurrent> to define a value. The number itself sits between these two tags. XBRL tags identify financial values uniquely. For example, the term ''CashCashEquivalents'' within a tag unambiguously defines ''cash and cash equivalents.'' Finally, you can use optional entries in each tag to identify currency units (e.g., ''Euros'') and the number of decimal places (e.g., ''0'').

To create an XBRL instance document, you need to know: (1) the standard tags that define such familiar items as net revenues and operating expenses, and (2) the rules that govern how to use these tags. XBRL Specification 2.1 currently defines the rules and syntax for XBRL taxonomies and XBRL documents. XBRL taxonomies define the tags that represent accounting and financial terms used in XBRL instance documents. With standard tags for each piece of common financial data, accounting software can create instance documents for income statements, balance sheets, and similar financial statements in a straightforward manner. Figure 15-3 lists a number of ways that XBRL affects accountants.

The Benefits of XBRL

The business potential of XBRL seems great. One obvious benefit is the ability to transmit financial information in a standard format. This facilitates communications between suppliers and their buyers, companies and their shippers, and retailers and their customers. The same standardization applies to financial filings. For example, the Securities and Exchange Commission (SEC) now requires XBRL-formatted financial statement reports, which businesses can also use to help complete loan applications.

Another important advantage of XBRL is that it defines data items uniquely. Consider, for example, how a spreadsheet stores financial information. The only way we know that a particular number *in* a spreadsheet is, say, ''net revenue'' is because we also see a label that identifies it as such. Move the number somewhere else in the spreadsheet and you also lose its meaning. In contrast, a ''net revenue'' figure remains ''net revenue'' no matter where it appears in XBRL instance documents as long as it remains within its tags.

XBRL's standardized tags also make searching for items in XBRL financial documents relatively easy. If you know the standard tag for an item of interest, you can unambiguously

- Due to corporate scandals, shareholders, analysts, and reporters are demanding more transparent reporting. XBRL allows readers to quickly access the information they need.
- XBRL permits the automatic and reliable exchange of financial information across all software formats and technologies, including the Internet.
- XBRL does not require a change to existing accounting standards of corporate disclosure policies.
- XBRL improves access to financial information because data is in a digital, reusable form.
- XBRL eliminates the need to reenter financial data for different users, which reduces risks associated with data entry and lowers the cost to prepare and distribute financial statements.
- XBRL improves investor and analyst access to information.
- XBRL allows accountants to more quickly and easily consolidate and scrutinize internal data for use in financial reports.
- XBRL allows CEOs and CFOs to deliver more transparent information to investors and analysts, and allows a vehicle for control within the firm.

Source: Charles Hoffman and Carolyn Strand, *XBRL Essentials* (New York: AICPA), 2001; and www.xbrl.org

FIGURE 15-3 How does XBRL affect accountants?

find and extract the number in question from those documents. One repository of such financial information is the Security and Exchange Commission's new **interactive data and electronic applications (IDEA)**, which the agency unveiled in August of 2008 and now contains XBRL data for over 10,000 companies—a particularly important source of financial information and a particularly important reason why standardized reporting is useful.

In business environments, the term *semantic meaning* refers to the fact that the financial data are related to one another through such formulas as ''Assets = Liabilities + Equity.'' An additional advantage of XBRL is its ability to express such relationships in formulas, thereby making the data self-checking. This is important because organizations often need to transmit financial data to others, and XBRL provides a means of internal control.

Case-in-Point 15.4 The Federal Deposit Insurance Corporation (FDIC) insures banks and similar financial institutions throughout the United States. The FDIC exchanges financial information with member institutions all the time, and uses a set of 1,800 rules to validate such data. The FDIC was an early adopter of XBRL in part because this language has the ability to perform data-validation tasks automatically.[4]

Companies using XBRL-enabled software can save their financial information in standard XBRL format, thus avoiding the errors that may come from reentering data multiple times from multiple sources. Companies can then directly upload their business information in this format onto their websites. This is important because a recent study by Forrester Research estimated the cost of re-keying information at $402 billion per year.[5]

Another advantage is that XBRL permits the automatic and reliable exchange of financial information across all software platforms and technologies, including the Internet. Thus, anyone interested in comparing the cash and cash equivalents of several companies can search for the data and export it to a spreadsheet for analysis purposes.

Finally, it is important to note that XBRL does not constrain companies to a particular *format* for their financial reports. To the contrary, the language is flexible, and therefore intentionally constructed to support financial reporting by companies in different industries or from different countries. The hope is that both the extensible capabilities of the language as well as this flexibility are great enough to meet business and governmental needs at all levels. Problem 15–20 invites you to explore the benefits of XBRL in further detail.

XBRL also has several disadvantages. Perhaps the most important is the fact that a common reporting language requires its users to learn, and conform to, the standards of that language. Another problem is that evolving XBRL standards require users to learn new rules for changing specifications.

The Current Status of XBRL

The **XBRL International Consortium** has about 450 members and is in charge of developing XBRL standards. Many U.S. accounting firms are members of this consortium, as is the American Institute of Certified Public Accountants and parallel accounting organizations around the world. The specifications for version 2.1 of XBRL were issued in July of 2008. The website at www.xbrl.org provides additional information on both current and proposed standards.

[4]Source: http://www.ubmatrix.com/Documents/XBRLComparedToXML-2005-07-06%20(4).pdf.
[5]Source: http://accounting.smartpros.com/x37643.xml; ''How XBRL Is Transforming Financial Reporting''.

As you might imagine, developing Internet standards for financial reporting is a massive undertaking. The language specifications require classification systems for different countries, different reporting segments (e.g., different industries), and even different organizational standards such as U.S. generally accepted accounting standards (GAAP). For example, oil and gas companies require specialized tags to identify reserve balances, casinos require specialized tags to identify allowances for unclaimed gambling chips, and so forth. Then too, the language requires standard tags for formulas (e.g., a Price/Earnings ratio) and different functions. For this reason, XBRL is best viewed as a dynamic language still in development.

Most accounting software vendors now support XBRL in one or more of their software packages, and the world-wide adoption of XBRL is moving along quickly. For example, in Germany, it's universal—XBRL is already built into a software package used by 80% of the accountants in that country. The XBRL International consortium publishes a progress report three times a year, available on its website, to offer the most current information about XBRL.

ELECTRONIC COMMERCE

The term **electronic commerce** refers to conducting business with computers and data communications. Often, e-commerce is done over the Internet, but businesses can also conduct e-commerce over proprietary data transmission lines. Recent surveys estimate the total annual revenues for e-commerce in the United States exceeds $1 trillion, and the FBI estimates that the banking industry transfers over $1 trillion *each week* by electronic means. Some general categories of electronic commerce are (1) retail sales, (2) e-payments and e-wallets, and (3) electronic data interchange, each of which we examine briefly in the paragraphs that follow.

Retail Sales

The World Wide Web offers businesses the opportunity to create virtual stores (''shopping cart applications'') for selling merchandise directly to customers. At the retail level, it is clear that such websites are really automated AISs that allow customers to create their own order forms, shipping forms, and payment documents. Testimony to the success of such retail e-commerce abounds. The number of online shoppers has increased steadily over the past decade. More than 90% of the U.S. population is now connected to the Internet, many of whom now purchase items over the Internet on a regular basis. For example, consumers now reserve most of their domestic airline tickets, rental cars, and hotel rooms over the Internet. Figure 15-4 lists some of the advantages of virtual stores. Note how many of these advantages relate directly to AISs.

Internet retail sales also introduce special issues. One problem is that customers usually cannot determine whether a retail website is legitimate. Similarly, consumers must usually rely on emails to voice their complaints (rather than speaking to someone in person) and returns are sometimes problematic. A third problem is that online stores frequently rely on suppliers rather than their own shelves for merchandise to satisfy orders, creating the potential for stock-out and backorder problems. Finally, a growing e-commerce problem is **click fraud**, in which dishonest managers inflate the number of clicks viewers make on an advertisement on a web page, and therefore bill the linked company for more referrals than actually occurred.

1. Web pages are much cheaper to create than creating and mailing catalogs.
2. Distribution is global.
3. Sales can occur around the clock.
4. Customers can search for specific products or services electronically, either within a particular website or as a ''hit'' from another site.
5. A business can easily outsource its web business to others, enabling it to focus on core processes.
6. The websites themselves can use automated tools to verify customer credit cards.
7. Businesses can send emails to confirm orders or advise customers about shipping dates.
8. Businesses can update product descriptions, sales prices, and information on merchandise availability immediately.
9. Customers create their own sales orders online.
10. Customers can track their own orders, freeing business personnel for other tasks.
11. The sales and customer-relations personnel required for virtual stores is minimal, thus reducing labor costs per dollar of sales.

FIGURE 15-4 Some advantages of virtual stores on the Internet.

Internet retail sales also provide retailers with a wealth of data *about* their customers, raising issues about privacy. For example, you might be concerned about the fact that your web purchase also means that a retailer now has (1) your email address, which it can use to send additional, annoying emails or sell to others, (2) your credit card information, which it may or may not protect as well as you would like, and (3) sensitive information about your purchase patterns—for example, prescription drugs. A later section of this chapter addresses these privacy and security issues in greater detail.

E-Payments and E-Wallets

Most customers pay for the merchandise they order over the Internet with a credit card, requiring vendors to use third-party affiliates to authenticate user credit-card numbers. This is a problem because such credit card verification systems only indicate that a card is valid, not that the online customer is authorized to use it. A related problem with online payments is that although online customers might not mind giving their credit card numbers to trusted merchants, they may not wish to share the number with unfamiliar businesses or unknown sellers on mass auction sites.

Some merchants and auction sites solve these problems with **electronic payments (e-payments)**, which proponents claim is a faster, easier, and safer way for both customers and sellers to handle online transactions. The e-payment service acts as a trusted intermediary because it collects a payment from a buyer and pays that amount to the seller.

Case-in-Point 15.5 Consumers who buy products on E-bay or other online auction sites may be familiar with Paypal (www.paypal.com), an e-payment system that operates via the Internet. Customers who want to bid for items in online auctions, but who don't wish to share their credit card number with unknown sellers, may open an account with Paypal. Account-holders can deposit cash in their Paypal account using credit cards, debit cards, or bank checks. When consumers purchase items, Paypal acts as an intermediary bank, withdrawing money from the purchaser's account and depositing similar funds into the seller's account (or sending a check).[6]

[6]To learn more about PayPal, log onto its website at www.paypal.com and click on ''How PayPal works.''

Businesses are not the only entities that can enjoy the convenience of e-payments. The U.S. government has its own system to conduct financial transactions online:

Case-in-Point 15.6 Pay.gov (Figure 15-5) enables businesses and individuals to make payments to the U.S. government electronically. Developed by the U.S. Treasury Department's Financial Management Services (FMS), Pay.gov is a central location through which businesses and individuals can make payments, submit forms, and send bills to federal agencies. This portal provides authentication services for secure transactions. FMS expects Pay.gov to handle approximately 80 million transactions worth over $125 billion a year, reduce paperwork, and save agencies over 5% in processing costs.[7]

Another Internet payment option is an **e-wallet**. E-wallets are software applications that store a consumer's personal information, including credit card numbers, email addresses, and shipping addresses. Shoppers pay for online purchases by providing their e-wallet account numbers to online vendors that also subscribe to the system.

An advantage of an e-wallet is that you can use it whenever you visit subscriber websites. These systems spare you the trouble of entering your personal information each time you make an online purchase. Also, because your e-wallet information is usually stored on your own hard drive, you control it. This maintains your email privacy as well. E-wallets may be as important for retailers as they are for consumers because many consumers cancel e-commerce transactions before they complete them, often because of frustration with online forms.

Case-in-Point 15.7 *AOL Wallet* is America Online's e-wallet application. The system enables users to store up to ten credit card numbers and 50 shipping addresses in a single account. AOL partners with a number of online retail merchants such as Macy's and Eddie Bauer, and shoppers can use AOL Wallet at any of them. When you visit an affiliated retailer,

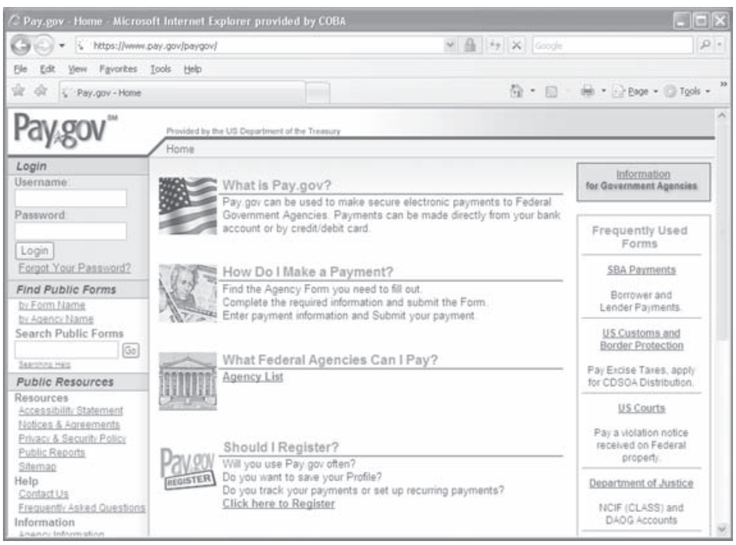


FIGURE 15-5 The home page for Pay.gov—an e-payment system supported by the U.S. government.

[7]Source: Nicholas Morehead. ''Treasury Antes up E-Payments,'' (April 3, 2004) at www.fcw.com/articles.

the software enters your name, address, phone, credit card number, and other relevant information automatically in the payment form.[8]

Business-to-Business E-Commerce

Although there has been tremendous growth in retail e-commerce, it is dwarfed by **business-to-business (or B2B) e-commerce**—i.e., businesses buying and selling goods and services to each other over the Internet. Buying goods online shortens the time from purchase to delivery and also allows businesses to shop from vendors all over the world. Like retail consumers, corporate purchasing agents using B2B e-commerce tools can select items from online catalogs, confirm purchases, track shipments, and pay bills electronically. E-commerce software can also expedite internal paperwork by first sending purchase orders to the appropriate managers for approvals and then forwarding them to the vendor, thus reducing the costs of processing purchase requisitions.

Case-in-Point 15.8 BASF is one of the world's largest chemical, plastics, and energy companies, with sales of $81.8 billion in 2008 and 94,000 employees on five continents. Company managers credit much of its recent 75% growth in revenues to its new e-commerce initiatives. Says Herbert Fisch, head of global e-commerce, "In addition to order management, e-commerce provides our customers with information and service tools. Customers benefit from greater transparency and we gain valuable time to better serve them."[9]

Further back the supply chain, the Internet affects accounting activities just as strongly. Another feature of B2B e-commerce is the wider availability of real-time data that allows managers to view up-to-the-minute information. Take, for instance, a distributor whose business customers in turn sell products to end users. With current data about its customers' retail sales, the supplier could quickly increase or decrease its operations as required. Similar online information can determine the location of specific trucks (using GPS systems), check the estimated arrival date of incoming cargo ships, or determine the current status of finished products, parts inventories, or even working assembly lines.

Even vendors of inexpensive accounting software now include an e-commerce interface with their products. An example is Peachtree software's Peachlink feature, which provides users with tools to create and use a shopping-cart website and accept Internet orders.

Although the Internet has streamlined procurement and inventory tracking operations, it has been slow to impact accounts payable or accounts receivable. In part, this is because companies like to hold their money as long as possible. However, delayed bill payment works *against* these same businesses who want to *collect* on their own accounts receivable. Software from such companies as Time Capital allows vendors and customers to view purchase and shipping documents so that they can resolve discrepancies quickly and cut checks or make electronic payments as needed.

Electronic Data Interchange and Virtual PBXs

Two further uses of Internet technology are electronic data interchange and virtual PBXs. We examine each of them in the following paragraphs.

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[8]Source: www.AOL.com.

[9]Source: Elaine Burridge. ''E-commerce Revenues Boost Achieved by BASF'' *European Chemical News* Vol. 83, No. 2174 (December 5, 2005), p. 14.

Electronic Data Interchange (EDI). Literally thousands of companies use **Electronic Data Interchange (EDI)** to electronically exchange billions of dollars every year as well as many business documents. EDI means transmitting information over high-speed data communications channels. Examples of EDI business documents include requests for quotes (RFQs), purchase orders, bills of lading, freight bills, sales invoices, customs documents, payment remittance forms, and credit memos. Thus, EDI automates the exchange of business information and permits organizations to conduct many forms of commerce electronically.

> ***Case-in-Point 15.9*** Pressured by budget cuts, British libraries are turning to RFID and EDI technologies to reduce costs instead of closing libraries. Staffordshire library is an example, which uses EDI for vendor quotes, catalogue services, acknowledgements, and invoicing to help it streamline its acquisition processes. As a result, the stock manager reports that vendor replies to requests have improved, new stock arrives more quickly, and staffing costs have been reduced by 42%. She estimates that EDI saves the library over $155,000 per year.[10]

Government agencies also depend heavily on EDI. One example is the U.S. Customs Service:

> ***Case-in-Point 15.10*** Before EDI, imported goods could wait on docks for weeks while officials processed the paperwork. But information about some imports can be sent weeks before the merchandise itself arrives. The U.S. Customs Service now uses EDI to process almost 95% of all customs declarations. This usage has lowered error rates from 17% before EDI, to about 1.7% now. This improvement translates into annual savings of $500 million in processing costs, and about 10% in productivity gains.[11]

One potential advantage of EDI compared to Internet e-commerce is that many business documents are simply faxed over telephone lines, avoiding computers completely. Another advantage is that many EDI documents include hand-written signatures, providing assurance of their authenticity. A third advantage is that EDI includes the exchange of graphic and photographic documents—media that *can* be scanned and captured electronically, but at additional time or cost.

Virtual PBXs. The acronym PBX stands for ''private branch exchange''—the phone system that most businesses use in their offices. The primary motivator is cost—these systems enable a business to lease a smaller number of external lines from telephone service providers than if each office had its own outside line. Because modern PBXs are computer-based, additional benefits include the use of passwords for system access, the ability to classify long-distance phone charges by handset or by password account, and the availability of answering-machine services, call-forwarding, call recording, caller ID, and internal call conferencing.

Virtual PBXs are Internet-based PBX systems that enable organizations to outsource their PBX services. Most of these systems use **VoIP** (voice over Internet protocol) to transmit digitized versions of voice-grade messages over the Internet. In addition to such common advantages of outsourcing as lower costs, greater reliability, and perhaps enhanced capabilities, virtual PBXs become invaluable in emergencies or disasters. At such times, for

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[10]Source: Hannah Davies, ''The Electronic Chain to Cost Cutting'' *Bookseller* (February 2009), pp. 6–7.

[11]Source: Theodore Prince. ''EDI Outlook: Good Technology, Problematic Results'' *Journal of Transportation Law, Logistics, and Policy* Vol. 71, No. 4 (Summer 2004), pp. 440–446.

example, a virtual PBX can reroute toll-free calls to alternate landlines or cell phones, as well as redirect ''internal calls'' from one employee to another. Thus, managers can work at home but still use their ''office phone'' as conveniently as ever.

PRIVACY AND SECURITY ON THE INTERNET

The most important advantage of the Internet and World Wide Web—*accessibility*—is also its greatest weakness—*vulnerability*. This means that someone who *poses* as an authorized user may be able to access any email, web page, or computer file that an authorized user can access through the Internet. This section of the chapter discusses Internet privacy and security in detail.

Privacy and Identity Theft

Do organizational managers have the right to view the emails of their employees? Do businesses have the right to use the personal information collected from their online retail customers? These are some of the privacy issues first discussed in Chapter 10. Both state governments and such groups as the Electronic Frontier Foundation and the Online Privacy Alliance continue to work on legislation to protect the privacy of data transmitted over the Internet.

Of particular concern is **identity theft**, in which someone uses another person's personal data in some way that involves fraud or deception (usually for economic benefit).[12] The most current statistics released by the FBI indicate that almost 10 million Americans were identity-theft victims and experienced losses totaling $52.6 billion.[13] The most common complaint related to identity theft is credit card fraud. The Department of Justice prosecutes ID theft violations under the **Identity Theft and Assumption Deterrence Act (ITADA) of 1998**. The punishment can be a prison term of 15 years, a fine, and forfeiture of any personal property used to commit the crime.

Although companies need strong preventive controls to help protect customer information, individuals should also exercise reasonable caution in protecting personal information. Unscrupulous individuals, posing as a company or bank employee, might call or send email messages to solicit personal information. Use your professional skepticism. If you are uncertain about the authenticity of the request, ask the person to send the request in writing on company letterhead. If you question the authenticity of a particular website, do more research on the company before purchasing goods or services through it—especially if you must give your credit card number. Figure 15-6 outlines some additional steps that you can take to better protect your personal information—almost all of them accounting-related.

Security

Security policies and procedures safeguard an organization's electronic resources and limit their access to authorized users. As noted in Chapter 1, **information security** has been the number one technology in each of the last five years in the AICPA's survey of the ''Top 10 Technologies'' expected to have a powerful influence over business.

[12] Source: www.usdoj.gov/criminal/fraud/idtheft.html.
[13] Source: http://www.identitytheftsecurity.com/stats.shtml.

1. Only give personal information such as Social Security numbers and dates of birth to those absolutely needing it.
2. Mail checks, credit applications, and similar materials directly in locked outgoing mail boxes, not in front-yard mail boxes with red, ''steal me'' flags on their sides.
3. Do not leave purses, wallets, or similar carrying cases unattended—for example, in unlocked gym lockers.
4. When asked by a legitimate business person such as a bank teller for your personal information, write it down for them—do not recite it verbally.
5. Be wary of unsolicited calls from individuals claiming to be bank representatives, credit-card issuers, or others, especially if they ask for personal information. A similar rule applies to emails from unknown agents.
6. Do not ''lend'' personal information to others—for example, a password.
7. Do not simply toss sensitive information in trash cans where others can retrieve it. Shred or burn it first.
8. Be wary of relatives in financial difficulties. Sadly, family members who are well known by the victims account for a high percentage of identity theft.
9. *Phishing* describes a website that appears to be from a well-known company, but that gathers personal data for illegal purposes. Don't fall for them.
10. *Key-logging software* is software that captures your keystrokes—usually for illicit purposes. Use security software to guard against it.

FIGURE 15-6 Steps that you can take to safeguard your personal data from identity theft.

Case-in-Point 15.11 Richard Farina of AirTight Networks was traveling on an American Airlines flight in October of 2008 that supported Internet access for its passengers. As an experiment, he used some of his company's intrusion protection software and found that he could view all his fellow passenger's Internet activities due to the airline's poor security.[14]

Of special importance to AISs is **access security**—e.g., restricting access to bona fide users. *Access authentication* requires individuals to prove they are who they say they are. The three types of authentication are based on: (1) what you *have*, (2) what you *know*, and (3) who you *are*. What you *have* may be a plastic card that provides you physical access to information or a restricted area. Examples are your ATM card, debit card, or employee card that gives you access to certain premises. What you *know* refers to unique information you possess, such as a password or your mother's maiden name. You can authenticate *who you are* with a unique physical characteristic such as your fingerprint or the pattern of the retina in your eye. As you might guess, using security that forces a user to prove who they are is the highest level of authentication. Some security systems require a combination of authentication techniques—for example, using both your debit card and your password to withdraw cash from an ATM.

Spam and Phishing

A current Internet problem is the increasing amount of **spam**—those annoying, unsolicited email messages that clog your email inbox. However, spam is more than a simple bother—it is distracting, often illegal, and increasingly costly to organizations. AOL and Microsoft, two of the biggest Internet service providers, estimate that they each block over 2 billion spam emails per day.

[14]Source: Taylor Buley. ''Phishing at Gate B22'' *Forbes* Vol. 182, No. 12 (December 8, 2008), pp. 52–52.

Although about 35% of spam messages are harmless advertising, a greater percentage contains pornographic solicitations, attempts to steal identities, or fictitious stories asking recipients for money. Clicking on the ''unsubscribe button'' in such messages usually accomplishes the exact opposite effect because it tells the sender that you are a legitimate user who actually reads such emails. Spammers sell lists of such prized, active email accounts to one another, furthering the problem.

Case-in-Point 15.12 The Radicati Group has 21 Exchange email servers, of which five handle nothing but junk mail. The company estimates that it spends almost half a million dollars annually on such server capacity to process spam transmissions.[15]

Although some spam email contains legitimate sales offers, many more are bogus. In such cases, the spammers advertise products at ''too-good-to-believe prices,'' take credit-card orders, collect the money, and then quickly fold up shop before consumers realize they've been victimized.

Case-in-Point 15.13 At the time this book was written, New Zealand brothers Shane and Lance Atkinson were in federal court as a result of a suit filed by the Federal Trade Commission (FTC) for "deceptive and fraudulent practices." The FTC claim is that, in less than nine months in 2007, the team used a botnet-driven spam network to defraud victims of more than $7 million.[16]

As we described in Chapter 10, **phishing** websites trick users into providing such personal information as Social Security numbers, debit-card PIN numbers, or similar personal information—for example, for ''routine security purposes'' or even ''because we believe your account has been compromised.'' Phishing activity is growing. For 2007, the Gartner research group estimated that 3.6 million Americans were victims of phishing—a 40% increase over the previous year—and that total losses were more than $3.2 billion. According to a banking group in the United Kingdom, the comparable growth figure is 180%. These statistics are especially relevant to accounting information systems because most phishers want personal information that in turn provides access to financial resources. In 2007, for example, the Anti-Phishing Working Group found that over 90% of the targeted companies were financial service companies.

Firewalls, Intrusion Detection Systems, Value-Added Networks, and Proxy Servers

To gain access to a company's files, a computer hacker must first obtain access to that company's computers. The firewalls, intrusion detection systems, and proxy servers discussed here protect against unwarranted intrusions from external parties.

Firewalls. A **firewall** (Figure 15-7a) guards against unauthorized access to sensitive file information from external Internet users. On networked systems, firewalls are often stand-alone devices with built-in, protective software (Figure 15-7b). On mainframe or host systems, firewalls are usually software.

The two primary methods of firewall protection are *by inclusion* or *by exclusion*. When firewalls protect internal systems by *inclusion*, the software examines packets of

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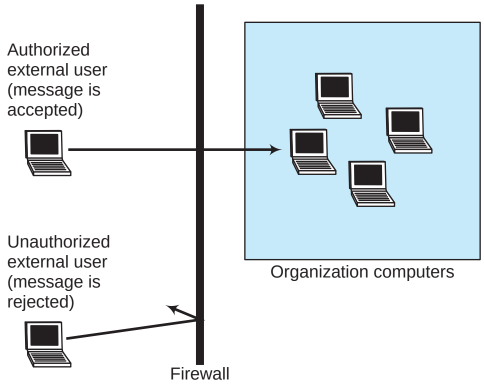
[15]Source: no author, ''Spam Wars Cost'' *Controller's Report* Vol. 2004, No. 9 (September 2004), p. 15.
[16]Source: http://www.scmagazineus.com/SC-World-Congress-Anatomy-of-a-spam-business/article/122708/.



(a) Firewalls accept messages from bona fide users but reject messages from unauthorized users.

(b) This hardware-based firewall from Sonicwall can support an unlimited number of users and 8 gigabytes of traffic per second.

FIGURE 15-7 A firewall acts as a barrier between unauthorized external users and organizational (internal) computers and files.

incoming messages and limits entry to authorized (''included'') users. To do this, the software maintains an **access control list (ACL)** of bona fide IP addresses that network administrators create for this purpose. If the software does not recognize the IP address of an external user, it refuses that user access to the files he or she requested. When firewalls protect internal systems by *exclusion*, the software compares the incoming packet IP address to a list of known threat addresses, rejecting messages from these sources but accepting all others.

Firewalls are useful Internet security controls but (like most security features) are not foolproof. One problem is that they cannot protect against **denial-of-service attacks**, which overwhelm system resources with a volume of service requests. Another problem is **spoofing** (i.e., masquerading as an authorized user with a recognizable IP address). A similar, but less obvious, problem is the ability of a determined hacker to alter the contents of the access control list itself—a security breach that is especially difficult to overcome. A final problem is that most firewalls can only protect against external attacks, not internal (authorized) users bent on mischief.

Intrusion Detection Systems. Whereas firewalls simply reject unauthorized users from access, **intrusion detection systems (IDSs)** create records of such events. *Passive IDSs* create logs of potential intrusions and alert network administrators to them either via console messages, alarms, or beepers. *Reactive IDSs* have the ability to detect potential intrusions dynamically (e.g., by examining traffic flows), log off potentially malicious users, and even reprogram a firewall to block further messages from the suspected source.

Perhaps the most important advantage of an IDS is its ability to both prevent unauthorized access to sensitive information and to alert system administrators to potential violations. This may also increase the perceived risk of discovery, dissuading would-be hackers. IDSs may also be able to detect preambles to attacks, forestalling their effectiveness. Finally, an IDS is an important tool for *documenting* an attack, thereby generating invaluable information to both network administrators and investigators.

Value-Added Networks. Message-routing is important to accountants because the security of a data transmission partially rests on the security of all the intermediate computers along a given communications pathway. Thus, the greater the distance between the sending station and the destination computer, the more intermediary routing computers there are and the more vulnerable a message becomes to interception and abuse. This is one reason why businesses often prefer to create their own (proprietary) networks to transmit data electronically.

Value-Added Networks (VANs) are private, point-to-point communication channels that large organizations create for themselves—usually for security reasons (Figure 15-8). When it first implements a VAN, the business assigns each user a unique account code that simultaneously identifies the external entity and authenticates the organization's subsequent electronic transactions.

There are at least three ways to create VANs. One way is to start with a blank slate and create everything from scratch—an approach first used by the military and later by Wal-Mart. A second way is to lease secure, dedicated transmission lines from conventional long-distance carriers such as AT&T—the approach used by IGT's Megabucks system (see Chapter 2).

A third alternative is to create a **virtual private network (VPN)** on the Internet. As the name suggests, a VPN mimics a VAN in many of its security features, but enjoys the benefit of transmitting messages cheaply over existing Internet connections. A VPN creates secure data transmissions by (1) using ''tunneling'' security protocols embedded in the message frames sent to, and received by, the organization, (2) encrypting all transmitted data, and (3) authenticating the remote computer, and perhaps also the individual sender as well, before permitting further data transmissions. Most AIS VANs use this approach.

Proxy Servers. Given the large amount of information now available on the web, some organizations seek to limit the number of sites that employees can access—for example, to ensure that employees do not use web-access privileges for frivolous or counterproductive purposes. A **proxy server** is a network server and related software that creates a transparent gateway to and from the Internet and controls web access. In a

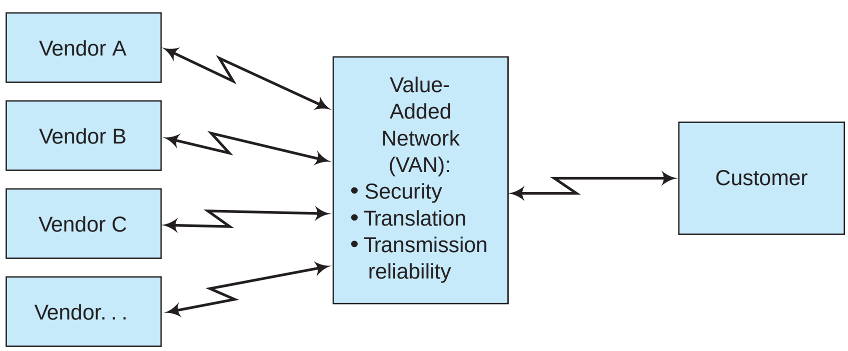


FIGURE 15-8 A VAN-based EDI system.

typical application, users log onto their familiar file server as before. But when they attempt to access a web page, the initial network server contacts the proxy server to perform the requested task.

One advantage of using a proxy server is the ability to funnel all incoming and outgoing Internet requests through a single server. This can make web access more efficient because the proxy server is specifically designed to handle requests for Internet information. A second advantage is the proxy server's ability to examine all incoming requests for information and test them for authenticity (i.e., the ability to act as a firewall). A third advantage is that a proxy server can limit employee Internet access to approved websites (i.e., to only those IP addresses contained in an access control list). This enables an organization to deny employees access to gambling, pornographic, or game-playing websites that are unlikely to have any productive benefits.

A fourth advantage is the ability to limit the information that is stored on the proxy server to information that the company can afford to lose. If this server fails or is compromised by hackers, the organization is only marginally inconvenienced because its main servers remain functional. To recover, the company can simply restart the system and reinitialize the server with backup data.

Netscape Communications estimates that between 30–60% of Internet requests are redundant. A final advantage of proxy servers is the ability to store (''cache'') frequently-accessed web pages on its hard drive—for example, the web pages of preferred vendors. This enables the server to respond quickly to user requests for information because the web-page data are available locally. This feature also enables managers to obtain some idea of what information employees need most and perhaps take steps to provide it internally (rather than through web sources).

Data Encryption

To safeguard transmitted data, businesses often use **data encryption** techniques that transform plaintext messages into unintelligible cyphertext ones. The receiving station then decodes the encrypted messages back into plaintext for use. There are many encryption techniques and standards. The simple method shown in Figure 15-9 uses a *cyclic substitution* of the alphabet with a displacement value of ''5'' to transform the letters of a plaintext message into alternate letters of the alphabet. To decode the message, the recipient's computer performs the encryption process in reverse, decrypting the coded

Encryption Scheme:

Letters of the alphabet:	A	B	C	D	E	F	G	H	I	J	. . .
Numerical equivalent:	1	2	3	4	5	6	7	8	9	10	. . .
Plus displacement key:	5	5	5	5	5	5	5	5	5	5	
New values:	6	7	8	9	10	11	12	13	14	15	
Letters to use in code:	F	G	H	I	J	K	L	M	N	O	. . .

Example:

Plaintext message:	HI, ABE!
Cyphertext message:	MN, FGJI

FIGURE 15-9 A simple data encryption method.

message back into readable text. To make things more secure, the sender can use a different displacement value for each coded message.

The method that computers use to transform plaintext into cyphertext is called the **encryption key**. This is typically a mathematical function that depends on a large prime number. The **data encryption standard (DES)** system used by the U.S. government to encode documents employs such a system. DES uses a number with 56 binary digits to encode information, a value equal to approximately 72 quadrillion. Thus, to crack the code, a hacker must guess which of 72 quadrillion values was used to encrypt the message.

The data encryption method illustrated in Figure 15-9 uses a single cryptographic key that is shared by the two communicating parties and is called **secret key cryptography**. This system derives its name from the fact that its users must keep the key secret and not share the key with other parties. The most common encryption methods today use **public key encryption**, a technique that requires each party to use a pair of public/private encryption keys. Two examples are SSL (Secure Socket Layer) and S-HTTP (Secure Hypertext Transport Protocol).

To employ public key encryption, the sending party uses a public key to encode the message and the receiving party uses a second, private key to decode it. A major advantage of public key encryption is that the same public key cannot both encode and decode a message. Data transmissions using public key encryption are likely to be secure because the transmitted message itself is scrambled and because neither party knows the other's key. This is the main reason why most web applications use public key encryption systems.

Digital Signatures and Digital Time Stamping

Many businesses want proof that the accounting documents they transmit or receive over the Internet are authentic. Examples include purchase orders, bids for contracts, and acceptance letters. To authenticate such documents, a company can transmit a complete document in plaintext, and then also include a portion of that same message or some other standard text in an encrypted format—that is, can include a **digital signature**.

In 1994, the National Institute of Standards and Technology adopted Federal Information Processing Standard 186—the **digital signature standard (DSS)**. The presence of the digital signature authenticates a document. The reasoning is straightforward: if a recipient's private key decodes a message, then an authentic sender must have created the message. Thus, some experts consider digital signatures even more secure than written signatures (which can be forged). Further, if the sender includes a complete message in both plaintext and cyphertext, the encrypted message provides assurance that no one has altered the readable copy. If someone has altered the plaintext, the two copies will not match.

Another authentication technique is a **digital certificate**—an authenticating document issued by an independent third party called a **certificate authority** (e.g., Thawte or VeriSign). The certificates themselves are signed documents with sender names and public key information. Certificates are generally encoded, possibly in a certificate standard such as the X.509 certificate format. Customers can also use digital certificates to assure themselves that a website is real.

Case-in-Point 15.14 In the future, each U.S. citizen may have a taxpayer's digital certificate within a smart card. Citizens could use the smart card for all their transactions with the federal government. The government program responsible for developing this card is called Access Certificates for Electronics Services project, or ACES. Although ACES is meant to ensure secure communications, privacy advocates are afraid that maybe the cards are *too* smart. This is because they contain *all* your personal information in one place. ACES does include safeguards to ensure that the data on the cards can't be used in the private sector and are available only to a federal or authorized agency. But those concerned with privacy worry that the existence of the card will lead to unintended uses.

Many important business documents are time sensitive. Examples include bidding documents that must be submitted by a deadline, deposit slips that must be presented to banks before the close of business, buy orders for stock purchases that depend on the date and time of issue, and legal documents that must be filed in a timely fashion. Then, too, most businesses also want to know when customers ordered particular purchases, when they paid particular bills, or when specific employees entered or modified data items in important databases. Finally, a good way to protect intellectual property such as computer software is to clearly establish the date and time it was first created or distributed.

What these items have in common is the need for a time stamp that unambiguously indicates the date and time of transmission, filing, or data entry. PGP Digital Time Stamping Service and Verisign are two of several **digital time-stamping services (DTSSs)** that attach digital time stamps to documents either for a small fee or for free. In a typical application, the user sends the document to the service's email address along with the Internet address of the final recipient. When the service receives the document, it performs its time-stamping task and then forwards the document as required.

Digital time stamping performs the same task electronically that official seals and other time stamps perform manually: authenticate the date, time, and perhaps place of a business transaction. This can be important over the Internet. Although most documents are transmitted almost instantaneously, time delays can occur when file servers temporarily falter or power failures disrupt wide area networks. DTSSs enable businesses to overcome these problems.

AIS AT WORK
The Benefits of Online Accounting Outsourcing

The advantages of outsourcing such accounting functions as payroll processing or tax preparation are well known, but outsourcing additional accounting tasks to online providers is a different matter. Can an external or offshore provider perform general ledger or deprecation computations as well? A growing number of businesses say ''yes!''

The most common reason organizations outsource a given business process is ''reduced cost,'' and this applies to accounting outsourcing as well. Additional benefits include faster turnaround, improved quality, enhanced access to expertise, reduced variability in accounting costs caused by peak processing volumes, and reduced capital expenditures (e.g., in computers and software). Experts note that online outsourcing enables the clients to reduce in-house labor costs, pay only for the services they need, and focus on their core businesses.

Perhaps the most commonly-cited objection to outsourcing is a loss of control. In a recent survey of over 800 businesses by Accenture, however, over 85% of the respondents said that outsourcing actually gave them more control—especially in the ability to plan. In addition, over 55% thought that accounting outsourcing enabled them to implement strategic changes faster and at more controlled rates. But the biggest benefit of outsourcing may be the increased business for those accounting companies providing these services—yet one more opportunity made possible by the Internet.

Source: ''Why Outsourcing is a Good Idea for You'' *Articlesbase*, www.articlesbase.com/outsourcing-articles/why-outsourcing-accounting-is-a-good-idea-for-you-591876.html.

SUMMARY

- The Internet is a collection of local, wide-area, and international networks that accountants can use for communication, research, and business purposes. Most accountants also use the World Wide Web—the multimedia portion of the Internet—for similar purposes.
- Intranets are private networks that businesses create for such internal purposes as distributing email. Extranets are similar to intranets, except that they allow external parties to access internal network files and databases.
- Groupware is software that supports email on business networks, plus allows users to share computer files, schedule appointments, video conference, and develop custom applications.
- To exchange financial information on the Internet, businesses can use XBRL—a form of XML that provides a common format for financial data and allows searches of the data and extractions for comparison purposes. The XBRL International Consortium develops XBRL standards.
- Electronic commerce includes retail sales on the Internet, electronic data interchange (EDI), and business-to-business (B2B) applications. In addition to credit and debit cards, consumers use e-payment and e-wallet systems to pay for Internet purchases.
- For security reasons, some businesses prefer to use expensive, but private, value-added networks (VANs) rather than the Internet to support e-commerce applications.
- Authentication requires users to prove they are who they say they are—for example, with something they have (a plastic card), something they know (a password), or something they are (a retina scan). Privacy concerns also include the need to protect users' private information and the growing threat of identity theft.
- Internet privacy and security concerns include hacking, identity theft, spam, and phishing, all of which impact AISs. These concerns prompt many businesses to use firewalls, intrusion detection systems, proxy servers, data encryption techniques, digital signatures, and digital time stamping to achieve control objectives.

KEY TERMS YOU SHOULD KNOW

access control list
access security
certificate authority
click fraud
data encryption
data encryption standard (DES)
digital certificate
digital signature
digital signature standard (DSS)
digital time stamping service (DTSS)
domain address
e-commerce
electronic conferencing
Electronic Data Interchange (EDI)
electronic payments (e-payments)
electronic procurement
encryption key
e-wallet
Extensible Business Reporting Language (XBRL)
Extensible Markup Language (XML)
extranets
firewall
groupware
hyperlinks
hypertext markup language (HTML)
hypertext transfer protocol (HTTP)
IDEA
identify theft
Identity Theft and Assumption Deterrence Act (ITADA) of 1998
information security
instant messaging
Internet protocol (IP)
intranets

intrusion detection system (IDS)
knowledge sharing
phishing
proxy server
public key encryption
secret key cryptography
spam
spoofing
TCP/IP
uniform resource locator (URL)
value-added network (VAN)
virtual PBX
virtual private network (VPN)
Voice over Internet protocol (VoIP)
XBRL instance documents
XBRL International consortium

TEST YOURSELF

Q15-1. Which of the following is most likely to contain only numbers?
a. Domain address **b.** URL address **c.** IP address **d.** Postal address

Q15-2. Which of the following enables users to view data with a web browser?
a. Intranet **b.** Extranet **c.** Internet **d.** All of these

Q15-3. All of the following are protocols for transmitting data over the Internet except:
a. IP
b. HTTP
c. XML
d. All of these are protocols

Q15-4. All of the following are markup languages (that use edit tags) except:
a. HTML **b.** XOR **c.** XML **d.** XBRL

Q15-5. Which of these is *not* an acronym?
a. HTML **b.** Blog **c.** PBX **d.** Firewall

Q15-6. Which of the following is true?
a. XBRL is a subset of XML
b. XML is a subset of TCP
c. PBX is a subset of HTML
d. None of these is true

Q15-7. A document file containing XBRL tags is a(n):
a. Extranet document
b. Intranet document
c. Instance document
d. URL

Q15-8. Which of these identifies a private, point-to-point network?
a. EDI **b.** DES **c.** IP **d.** VAN

Q15-9. Which of these statements is correct?
a. A VPN is a type of VAN
b. DES stands for ‘‘data entry system’’
c. An IDS is the same as a firewall
d. All of these statements are correct

Q15-10. Spoofing means:
a. Kidding someone about their firewall
b. Simulating a disaster to test the effectiveness of a disaster recovery system
c. Posing as an authentic user to gain access to a computer system
d. Encrypting data for security purposes

DISCUSSION QUESTIONS

15-1. What are intranets? What are extranets? Why are intranets and extranets important to accountants?

15-2. What are blogs? How are they used? Who is using them?

15-3. What is hypertext markup language? How does it differ from XML and XBRL? (Note: for a more comprehensive description of the differences, you may want to search the Internet.)

15-4. What is the relationship between XBRL and IDEA?

15-5. Describe some important uses of electronic commerce and explain why it is important to accountants.

15-6. What are electronic payments? How are they different from credit card payments?

15-7. What is electronic data interchange? Why do companies use EDI?

15-8. Most retail-sales websites require customers to use their credit cards to make purchases online. How comfortable are you in providing your credit card number in such applications? Why do you feel this way?

15-9. What is click fraud? Who benefits and who loses when click fraud occurs?

15-10. What is spamming? How is spam related to accounting information systems? Should all spamming be illegal? Why or why not?

15-11. What are Internet firewalls and proxy servers? How are they created? How do businesses use them for Internet security?

15-12. What is data encryption? What techniques are used for data encryption?

15-13. Describe and contrast the three types of authentication. Can you think of a business situation where someone would need to use a combination of all three levels to gain access to information?

15-14. What are digital signatures? Why do businesses use them? How can businesses use a digital certificate for Internet security?

15-15. Analysts claim that businesses can increase sales on the Internet, but not profits. What evidence does this chapter provide to support or refute this claim? Discuss.

PROBLEMS

15-16. The Internet uses many acronyms. Within the context of the present chapter, what words were used to form each of the following?

a. EC	b. EDI	c. email	d. HTTP	e. IDS	f. ITADA
g. IP address	h. blog	i. URL	j. VANs	k. VPN	l. WWW
m. XBRL	n. XML	o. IDEA			

15-17. In Discussion Question 15-1 above, you discussed intranets and extranets, and identified the importance of each to accountants. Now, assume that you are a partner in a medium-sized, local CPA firm. Your firm has 4 partners, 10 staff accountants, 1 research assistant, and an administrative assistant. Your firm is considered a technology leader in the local area and you consider this a competitive advantage for your firm. At the weekly staff meeting next Friday you want to discuss the topic of developing an intranet for the firm. To be sure everyone is prepared to discuss this topic, you want to develop a ‘‘talking paper,’’ which is a one page summary of salient points that you want to be sure you cover in your presentation to everyone. Assume you are the research assistant and the partner asks you to prepare this one-page discussion aid.

15-18. Create an HTML document of your own, using the example in Figure 15-1 to guide you. Put the name of this assignment in the <h1> tag for the heading. Put your name in bold. Include at least one hyperlink to a favorite web page using the anchor <a> tag. Finally, include an ordered list in your web page with at least three items—for example, a list of your favorite books, favorite restaurants, or the courses you're taking this semester. You will find it easiest to work in Notepad for this problem, but you can also use a word processor—as long as you save your document as ''text.'' Also, be sure to add the extension ''html'' to the end of your file name. View your completed document in your web browser—for example, by selecting File/Open in Microsoft Internet Explorer—and screen capture your work.

15-19. At the time this book was written, the U.S. Securities and Exchange Commission still supported Edgar—a depository of corporate accounting filings. Log onto Edgar at www.sec.gov/edgar.shtml, click on ''Search for Company Filings,'' click on ''Company or Fund Name,'' and finally, select two companies in the same industry (either your instructor's choice or your choice) so that you can compare various financial data. Note that you can select either ''text'' or ''html'' formats. Compare these formats to Figure 15-1. Are they similar? Looking at either image, can you download the financial information into a spreadsheet? Can you easily do financial comparisons such as ratio analysis? What do you have to do if you want to make financial comparisons?

15-20. Visit the XBRL home page at www.XBRL.org, and read the section entitled ''What is XBRL.'' Then, do each of the following:

a. Select the option ''Latest News'' from the home page, which lists several articles that describe recent developments. Choose one of these and write a one-page summary of your findings.

b. Select ''Benefits Across Business'' at www.xbrl.org/BenefitsAcrossBusiness/. This site contains a set of articles describing the various benefits of XBRL to different types of businesses. Select one article from this list and write a one-page summary of it.

15-21. Write a one-page paper on each of the following topics as they relate to XBRL:

a. What is the history of XBRL? What professional accounting organization helped in the early stages of this concept?

b. What is an XBRL specification and what is the latest version? When was it released? By whom?

c. How could XBRL help a company engage in ''continuous reporting?'' Find a website or an e-journal (an article) that discusses XBRL and continuous reporting. What are the main points of the article?

d. Find at least two other companies (other than Microsoft) that are publishing their financial statements on the Internet using XBRL. What business are they in (what industry)?

15-22. Examine the data encryption technique illustrated in Figure 15-9. Use a displacement value of ''8'' to encrypt the following message:

''Those who ignore history are forced to repeat it.''

15-23. The message below was encrypted using the technique illustrated in Figure 15-9 (using a displacement key other than 5). Using trial and error, decode it:

OZ OY TUZ CNGZ CK JUTZ QTUC ZNGZ NAXZY AY
OZ OY CNGZ CK JU QTUC ZNGZ PAYZ GOTZ YU

15-24. A number of accounting journals now post back issues, or even publish their entire journals, online. Access the *Journal of Accountancy* website at www.aicpa.org (or another website selected by your instructor). Select an article that pertains to a topic in this chapter and write a one-page report on it. Be careful to correctly cite any information that you use from this article!

15-25. The following stated policies pertain to the e-commerce website for Small Computers, Inc., a (fictitious) personal and handheld computer manufacturer and seller.

Privacy Statement

- We will only use information collected on this web for legitimate business purposes. We do not give away or rent any information to third parties.
- We will only contact you for legitimate business purposes, possibly from time to time, as needed. Please be 100% assured that we hold all transactions between you and our company in the strictest confidence.

Disclosure of Business Practices, Shipping, and Billing

- We will ship all items at the earliest possible date.
- We will not require you to accept items that you did not order.
- We will accept any returns from you of damaged or defective merchandise.
- In the event that we should accidentally bill you more than once for the same item, we will immediately issue you a refund.

Evaluate these stated policies in terms of how well they promote customer trust and confidence in Small Computers, Inc.'s electronic business operations.

CASE ANALYSES

15-26. Hammaker Manufacturing IV (XBRL-Enabled Software)

Recall, from Chapter 8, the Hammaker Manufacturing Company (HMC) is located in Burke, Virginia, and manufactures specialty parts for Corvettes. The company implemented a new AIS with the help of a consulting firm. At the time, Hammaker was especially interested in collecting data about inventories. Then, HMC decided to accept the consulting firm's recommendation to reengineer some processes in the production departments, rather than outsource these processes. Generally speaking, the BPR project is considered a success, based on the results that have been achieved—increased profits and more satisfied customers. To Denise's credit, she kept the employees informed throughout the study phase so that they understood the need for change. As a result of employee involvement, many useful changes were made and no employees were terminated.

Now, with increased profits and a very optimistic view of future growth, Hammaker meets with Denise and Lloyd to discuss the advantages and disadvantages of a new, more powerful AIS. Lloyd's area of expertise is implementing ERPs, and he is eager to inform HMC about the advantages of selecting an XBRL-enabled software solution for the firm.

Requirements:

1. What does it mean when software is ''XBRL-enabled''?
2. Identify at least five advantages that Lloyd might discuss with Dick and Denise regarding an XBRL-enabled software solution. Identify any disadvantages that might also be relevant for HMC.
3. Assume that you are Lloyd's research assistant. Draft a memo for Lloyd to give to HMC that explains how XBRL works. Remember to keep in mind your audience. This should be an executive-level piece of correspondence.

4. Now, as the research assistant, develop a PowerPoint presentation for Lloyd to give to Dick and Denise explaining exactly what sorts of benefits they could realize with an XBRL-enabled software solution. Be creative, and use diagrams and examples where appropriate.

15-27. DeGraaf Office Supplies (Business Websites and Security)

DeGraaf Office Supplies is a national retailer of office supplies, equipment, and furnishings. The company opened its first store in 1932, in Columbus, Ohio. Currently, DeGraaf has 300 stores nationwide. Owner-managers purchase and run franchised stores. Kim DeGraaf, the founder's daughter, currently is President and CEO of the corporation.

Sales revenues grew steadily during the past decade, but 2009 sales were quite disappointing, down 8% from 2008. The company's stock price has also taken a big hit during the past few months. Kim resisted developing an Internet presence for the company, and it appears now that this was a mistake. Online sales of office supplies are growing rapidly, particularly in the business-to-business sector as business organizations are finding it faster and more efficient to enter their office supply orders electronically. The following is a conversation between Kim and Peter Brewer, Vice President of Marketing.

Peter: ''Kim, I warned you that we were going to see sales decline if we didn't hurry up and get on the Internet. The established brick-and-mortar businesses in many industries are suffering.''

Kim: ''You were right, Peter. I think I've been overly concerned about security and privacy issues. I also didn't really believe that online sales in our industry would take off the way they have. I hope we're not too late, because I want to move ahead immediately in developing a website. I know other companies have a jump start but hopefully our brand name recognition and reputation for quality will help us. I have contracted with a consulting firm to start the website development and am going to give a press release this afternoon about our plans. Fortunately, our current enterprise software has electronic commerce features and the consultants tell me that our Internet site should be ready for business in about six months. I need you to have your staff prepare an analysis of our competitor websites. I would also like as much information as possible related to providing retail and business customers with security and privacy over online transactions with us.''

Peter: ''This is great news! I will get my staff busy at once providing you and the consulting team with the information they need. There will be a lot of decisions to make. I've studied all the office supply websites and they are organized in a variety of ways. For instance, some sites provide customers with the option to select a type of product such as ballpoint pens and then show the vendor options in that category, while other sites are organized around the vendors. This type of site allows customers to select a vendor name, such as PaperMate, and then lists all the product offerings from that vendor. Hopefully, the consultants have a lot of experience with business websites and they can help us with many of these issues.''

Requirements:

1. Visit the websites of two office supply stores on the Internet. Develop a set of four to five criteria for evaluating their website.
2. Evaluate DeGraaf's chances for catching up to competitors in the online marketplace.
3. Discuss the privacy and security concerns for companies doing business electronically. Make recommendations to DeGraaf Office Supplies for addressing these concerns.

15-28. Barra Concrete (XOR Encryption)

Barra Concrete specializes in creating driveways and curbs for the residential market. Its accounting software uses exclusive OR (XOR) operations to convert the individual bits of a plaintext message into cyphertext. The rules are as follows:

	Exclusive OR rules			
	Rule 1	Rule 2	Rule 3	Rule 4
Plaintext bit	0	0	1	1
Bit in key	0	1	0	1
Cypertext result	0	1	1	0

In other words, exactly one of the bits must be a "1" and the other a "0" for the result of an exclusive OR operation to be a "1." To illustrate, suppose that the bits representing a single plaintext character were 1010 0101 and the secret key used just the four bits 1110. Here are the results of the XOR operation, using this key:

Plaintext bits	1010	0101
Key (repeated)	1110	1110
Cypher text result	0100	1011

The encrypted bits are the cypher text, or 0100 1011 as shown. These (encrypted) bits are what the software would transmit to the recipient.

Requirements:

1. Decrypting the cipher text created by an XOR operation is easy—just use the same XOR operation on the encrypted bits! Demonstrate this for the example above.
2. Suppose the secret key were longer—the eight bits 1100 0011. Using this key and an exclusive OR, what is the cipher text for the plaintext message "Go, team" if the bit configuration for these letters is as shown below. (Hint: the final answer consists of seven sets of data, each containing eight bits.)

Message	G	O	,	T	E	A	M
Binary	0100 0111	0100 1111	0010 1100	0101 0100	0100 0101	0100 0001	0100 1101

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ANSWERS TO TEST YOURSELF

1. **c** 2. **d** 3. **c** 4. **b** 5. **d** 6. **a** 7. **c** 8. **d** 9. **a** 10. **c**

Glossary

Access control list a list of bona fide IP addresses in devices such as firewalls.

Access security a restriction of AIS access to bona fide users.

Accounting information system (AIS) the information subsystem within an organization that accumulates and processes information (both financial and non-financial) from the entity's various subsystems and communicates this information to the organization's users.

Action query (Microsoft Access) a query that manipulates, and typically alters, one or more tables in an Access database.

Activity-based costing systems help managers in describing processes, identifying cost drivers of each process, and then determining the unit costs of products associated with drivers.

Advanced electronic tags input technologies that replace manual data entry with automated technologies, such as barcode scanners, radio frequency(RF) technology, and RFIDs. These input technologies can be used individually or combined to significantly reduce input errors and support fast, accurate, real-time production and data collection.

Advanced planning and scheduling systems (APS) systems that work to synchronize the flow of materials within the supply chain.

Alphanumeric codes codes that use numbers and letters.

Analysis paralysis the condition where a problem is studied to the point that the study overshadows the problem.

Antivirus software computer programs such as Norton Antivirus or MacAffee that end users typically install in their computers to guard against computer viruses.

Applet a small program that is stored in a Web page and is designed to run by Web browser software. Friendly applets animate Web pages, allow users to play games, or perform processing tasks.

Application controls a major category of computer controls that are designed and implemented to prevent, detect, and correct errors and irregularities in transactions as they flow through the input, processing, and output stages of data processing work.

Application service provider (ASP) a source through which companies can rent rather than buy software.

Application software computer software that performs specific tasks such as accounting tasks, spreadsheet tasks, marketing tasks, or word-processing tasks.

Applications portfolio a set of software applications belonging to an organization.

Association of Certified Fraud Examiners (ACFE) an international professional organization committed to detecting, deterring, and preventing fraud and white-collar crime.

Attributes the characteristics of entities, or the data fields describing them.

Audio input computer inputs that use sound frequencies. An alternate term is ''speech recognition system.''

Audit Control Language (ACL) specialized software for auditing tasks used in forensic accounting.

Audit trail enables information users within a company's system to follow the flow of data through the system.

Auditing around the computer audit approach whereby an auditor follows a company's audit trail up to the point where accounting data enter the computer and then picks these data up again when they reappear in processed form as computer output.

Auditing through the computer audit approach whereby an auditor follows a company's audit trail through the internal computer operations phase of automated data processing.

Auditing with the computer audit approach whereby the auditor uses the computer to aid in performing various auditing procedures (e.g., selecting a sample of accounts receivable data for confirmation).

Automated workpaper software software that aids an auditor in performing such accounting functions as generating trial balances, recording adjusting journal entries, and preparing income statements and balance sheets.

Back-office a reference to internal functions and processing within an organization, such as human resources and accounting.

Backup additional copies of data that may be used to restore computer operations (e.g., after a disaster or in the event that files are accidentally deleted or corrupted).

Balanced scorecard an approach to performance measurement that uses measures in four categories (financial performance, customer knowledge, internal business processes, and learning and growth) to evaluate and promote certain activities and behaviors.

Bar code reader a device that interprets the familiar barcode stripes printed on merchandise packages, shipping labels, and similar documents, and inputs the data into a computer.

Batch control total (BCT) typically, a manual total that is compared to a computer total to determine whether data were processed correctly.

Benchmark test an approach for examining the operating efficiency of a particular system whereby a computer vendor's system performs a data processing task that a company's new system must perform and company representatives then examine the processing outputs for accuracy, consistency, and efficiency.

Best-of-breed an approach to systems development where each application may be acquired from a separate vendor and represents the best program in that category of need.

Biometric scanners a method of authenticating system users based on who they are. Examples include voice and fingerprint recognition systems.

Block codes sequential codes in which specific blocks of numbers are reserved for particular uses.

Blogs (or Web logs) collaboration tools that allow users with Web browsers and easy-to-use software to publish a personalized diary online.

Bolt-ons software from a variety of suppliers when employing a ''best-of-breed'' approach.

Boot-sector virus a virus that hides in the boot sector of a disk, where the operating system (OS) accesses the virus every time the OS accesses the disk itself.

Bound control (databases) a form control such as a textbox or label that displays the underlying data from a database table.

Business continuity plan (BCP) management's policies and procedures to continue the organization. This includes risk identification, scenario planning, and practicing the plan.

Business event an activity that may or may not impact financial statements, but is important to the business.

Business intelligence (BI) tools data analysis software that helps managers obtain the most information from their customer relationship management systems.

Business process a collection of activities or flow of work in an organization that creates value.

Business process management software software solutions that help companies collect corporate knowledge, data, and business rules into a business system to improve core business processes.

Business process outsourcing (BPO) an approach where an organization chooses to have some of its basic functions, often related to IT, performed by an external organization.

Business process reengineering (BPR) techniques used by organizations to redesign their business processes from scratch.

Business-to-business (or B2B) e-commerce businesses buying and selling goods and services to each other over the Internet.

Business-without-boundaries a new business model that arose from the combination of networked enterprises and globalization.

CAATs (computer-assisted audit techniques) used by auditors when auditing through the computer. CAATs can aid in the performance of compliance testing to ensure that a company's controls are in place and working as prescribed.

Canned software software acquired from independent vendors.

Cardinalities a notation reflecting the nature of relationships among entities as one-to-one, one-to-many, none-to one, none-to-many, or many-to-many.

CASE tools computer-assisted software engineering tools that automate documentation tasks such as drawing or modifying flowcharts, generating graphics and screen designs, and developing report formats.

Cash control physical safeguards for cash, which is especially susceptible to theft by employees, and to human error when employees handle large amounts of it.

CD-ROM an acronym for ''compact disk-read only memory.'' CD-ROM disks can store approximately 640 megabytes of data.

Central database a comprehensive database that holds all the data for multiple applications or processes.

Central processing unit (CPU) the component of a computer that performs the processing tasks of the system. The processor part of the CPU is typically a single silicon chip that can manipulate data—e.g., perform mathematical functions such as addition, as well as logic operations such as comparing text or number values.

Certificate authority an entity that issues digital certificates—for example, to authenticate the legitimacy of a bid or financial purchase.

Certified Information Systems Auditor (CISA) a professional information systems auditor who meets certification requirements of the Information Systems Audit and Control Association.

Certified Information Technology Professional a designation given by the AICPA for CPAs who meet specified additional requirements related to information technologies.

Change management a systematic approach to introducing dynamic change or disruption in an organization.

Chart of accounts what provides the organizational structure for the general ledger. The chart of accounts makes use of a block coding structure.

Checkpoint a control that is performed at periodic intervals during processing. A company's computer network system temporarily does not accept new transactions. Instead, it completes updating procedures for all partially processed transactions and then generates an exact copy of all data values and other information needed to restart the system. The checkpoint is recorded on a separate tape or disk file. This process is executed several times per hour. Should a hardware failure occur, the system is restarted by reading in the last checkpoint and then reprocessing only those transactions that have occurred since the checkpoint.

Child record the lower-level record of two adjacent records in a hierarchical data structure.

Client/server computing an alternate to mainframe computing in which processing tasks are shared between a centralized host computer called the ''server'' and a smaller microcomputer called the ''client.''

COBIT Control Objectives for Information and Related Technology (COBIT) is a project undertaken by the Information Systems Audit and Control Foundation to develop a definition of internal control.

Cold backup a backup that is performed while the database is off-line and unavailable to its users.

Cold site a location where power and environmentally controlled space are available to install processing equipment on short notice. If a disaster recovery plan designates a cold site, then separate arrangements are also necessary to obtain computer equipment matching the configuration of equipment lost in the disaster.

Collaborative business partnerships situations in which organizations work with other businesses, even their competitors, to increase their power to meet customer demands.

Computer abuse the unauthorized use of, or access to, a computer for purposes contrary to the wishes of the owner of the computer.

Computer crime the manipulation of a computer or computer data, by whatever method, to dishonestly obtain money, property, or some other advantage of value, or to cause loss.

Computer facility controls policies and procedures that prevent both unintentional and intentional harm to the firm's computer assets.

Computer Fraud and Abuse Act of 1986 the act that defines computer fraud as any illegal act for which knowledge of computer technology is essential for its perpetration, investigation, or prosecution.

Computer record a set of data fields about one file entity—for example, one employee, one inventory item, or one sales transaction.

Computer Security Institute (CSI) the organization that conducts an annual survey to help determine the scope of computer crime in the United States.

Computer virus a computer program that rogue programmers embed in other programs, emails, or computer files, and that (when executed) typically perform such destructive acts as erasing files, disrupting emails, or interfering with operating system functions.

Computer worms reproducing programs that do not actually destroy data, but replicate themselves repeatedly until the user runs out of internal memory or disk space.

Computer-assisted audit techniques (CAATs) used by auditors when auditing through the computer; CAAT's can aid in the performance of compliance tests to ensure that a company's controls are in place and working as prescribed.

Concurrency controls controls that prevent two or more users of a database from accessing the same record from the same file at the same time.

Consensus-based protocols a fault tolerant system that contains an odd number of processors. If one processor disagrees with the others, it is thereafter ignored.

Context diagram high-level data flow diagram that provides an overall picture of an application or system.

Contingency planning the process of planning for events that could impede a company's data processing function.

Continuous auditing the use of tools (such as embedded audit modules) that allow auditing to occur even when an auditor is not present; it is particularly effective when most of an application's data are in electronic form.

Control Activities the policies and procedures that the management of a company develops to help protect all of the different assets of the firm.

Control break (databases) a change of value in an important data field (e.g., department number) of the records of a database table that requires additional computations in an output listing—for example, a subtotal.

Control environment a component of internal control that establishes the tone of a company, which influences the control awareness of the company's employees.

Control Objectives for Information and Related Technology (COBIT) a project undertaken by the IT Governance Institute to develop a framework for internal control relative to information technology.

Cookie a small text file that stores information about your browsing habits and interests, as well as other information that you may supply by logging onto a website.

Corporate governance managing an organization in a fair, transparent, and accountable manner to protect the interests of all the stakeholder groups.

Corrective controls control procedures within a company's internal control system that are designed to remedy problems discovered through detective controls.

COSO Report: 1992 a committee established by the Treadway Commission to develop a common definition for internal control and to provide guidance for judging the effectiveness of internal control as well as improving it.

COSO Report–2004 ''Enterprise Risk Management—Integrated Framework'' focuses on enterprise risk management (ERM). The ERM Framework includes the five components of internal control (control environment, risk assessment, control activities, information and communication, and monitoring) and adds three additional components: objective setting, event identification, and risk response.

Cost accounting subsystem generally associated with manufacturing firms, this subsystem provides important control information (such as variance reports) and is usually either job costing or process costing.

CPA WebTrust a set of services offered through the AICPA where auditors provide third-party assurance over a client's Web site and Internet services.

Critical path the longest path to project completion within a PERT diagram, which is also the shortest completion time of the entire project.

Customer relationship management (CRM) employed to gather, maintain, and use data about a company's customers with the objective of improving customer satisfaction and company profitability.

Dashboards a graphic technique that shows an organization's performance metrics and compares actual data with planned.

Data communications protocol the settings that create a communications standard for a specific data communications application. Examples of such settings include the transmission speed, parity bit, duplex setting, or synchronous-versus-asynchronous transmission type.

Data definition language (DDL) part of a DBMS that enables its users to define the record structure of any particular database table.

Data dictionary a description of the data fields in each database record of a database system.

Data diddling changing data before, during, or after they are entered into a computer system.

Data encryption scrambling the data in a message in a systematic way in order to prevent competitors from electronically monitoring confidential data transmissions.

Data encryption standard (DES) an encryption methodology initially adopted in 1976 and enjoying widespread usage. It is now considered insecure because of a small (56-bit) key size.

Data flow diagram primarily used in the systems development process to document the flow of data through an AIS.

Data hierarchy storing data electronically in the following ascending order: bit, character, data field, record, table, database.

Data integrity controls edit tests contained in the software used to create databases that guard databases from erroneous data entries.

Data manipulation controls methods of controlling data processing, such as examining software documentation, system flowcharts, program flowcharts, data flow diagrams, and decision tables because they help systems analysts do a thorough job in planning data processing functions.

Data manipulation language (DML—databases) commands that allow an end-user to perform queries and similar tasks on the records in a database.

Data mart a form of data warehouse that allows users to perform predefined analytical tasks on the data.

Data mining a set of data analysis and statistical tools that enables companies to detect relationships, patterns, or trends among stored data within a database.

Data modeling a term used to describe the process of designing databases.

Data raw facts about events that have no organization or meaning.

Data transcription the task of converting manually-prepared source documents such as credit-card application forms to computer-readable file records. Where possible, AIS developers try to avoid data transcription because it is costly, labor intensive, time-consuming, and likely to introduce errors into the data.

Data type similar to data format, this term specifies whether data is, for example, numerical, text, or currency

Data validation rule a custom edit test that enables a spreadsheet or database to reject entries—e.g., regular hours worked that exceed 40.

Data warehouses large collections of historical data that organizations use to integrate their functions, thus allowing managers (and to some extent external parties) to obtain the information needed for planning, decision making, and control.

Data-access controls processing controls that are used at the time of data access, such as batch control totals, hash totals, and financial control totals.

Database a large collection of related data that are typically stored in computerized, linked files and manipulated by specialized software packages called database management systems.

Database administrator the person responsible for supervising the design, development, and installation of a large database system; this person is also responsible for maintaining, securing, and revising the data within the database system.

Database management system (DBMS) a separate software system that enables users to create database records, delete records, access specific information, query records for viewing or analysis, alter database information, and reorganize records as needed.

Database structure the particular method used to organize the records in a database.

Decision table a matrix of conditions and processing tasks for a computer program that indicates the appropriate action to take for each possibility.

Decomposition (documentation) the creation of finer levels of detail in flowcharts and data flow diagrams.

Default value specifying a value, such as the number ''40'' for an hours-worked data field, as an input control on the data fields of new records.

Denial of service attack an attack on an online company (such as eBay) when hackers ''flood'' the company's Web site with bogus traffic.

Detailed systems design the systems design work that involves specifying the outputs, processing procedures, and inputs for a new system.

Detective controls control procedures within a company's internal control system that provide feedback to management regarding whether or not operational efficiency and adherence to prescribed managerial policies have been achieved.

Dialback systems a password safeguard that initially disconnects all login users but reconnects users after checking their passwords against lists of bona fide user codes.

Digital certificate an authenticating document issued by an independent third party called a certificate authority used, for example, to authenticate documents (such as purchase orders) by including a portion of a document's message in an encrypted format (which reflects the digital signature).

Digital signature standard (DSS) Federal Information Processing Standard 186 by which the presence of a digital signature authenticates a document.

Digital subscriber line (DSL) a set of technologies that enable users to send and receive digital messages over telephone lines. Transmission rates range between 128 and 24,000 kbits per second.

Digital time stamping the process of attaching time stamps to business transactions to authenticate the time and possibly the place of individual transactions.

Digital video disk (DVD) an optically read disk similar in size and shape to a CD but that is capable of storing as much as 17 gigabytes of data.

Direct conversion method of systems implementation in which a company's old system is immediately dropped and the new system takes over the complete processing of the company's transactions.

Disaster recovery plan part of contingency planning that describes the procedures to be followed if a company's data processing center becomes disabled.

Discrepancy report a way to note any differences between quantities or amounts on the purchase order, the receiving report, and the purchase invoice.

Disk mirroring also known as disk shadowing. This process involves writing all data in parallel to two disks. Should one disk fail, the application program can automatically continue using the good disk.

Disk shadowing also known as disk mirroring. This process involves writing all data in parallel to two disks. Should one disk fail, the application program can automatically continue using the good disk.

Distributed denial-of-service attacks a single virus or worm program which manages to enlist the aid of innocent ''zombie computers'' that then send email messages to, or request services from, the target system.

Document Control when certain organizational documents are valuable and must be protected by such means as fireproof safes or storage in rented vaults offsite.

Document flowchart a means of tracing the physical flow of documents through an organization.

Documentation all the flowcharts, narratives, and other written communications that describe the inputs, processing, and outputs of an AIS.

Domain address an Internet address, also referred to as a universal resource locator (URL).

Dot-matrix printer an impact printer that uses a print head of tiny wires, arranged in a grid (e.g., 5 wires in each of 7 rows) to create our familiar letters and other printing characters. Many cash registers still use dot-matrix printers today.

Dumpster diving stealing personal information from garbage cans.

Dynaset a subset of database information typically selected dynamically with a query. A dynaset can be a set of selected records from a single, large table, a limited number of data fields selected from each record in a table, a set of related data fields from the records in several tables, or a combination of these items.

E-business conducting business over the Internet or dedicated proprietary networks.

E-commerce largely buying and selling transactions within e-business.

E-wallet software applications that store a consumer's personal information, including credit card numbers, allowing them to pay for online purchases by providing their associated account numbers to online vendors.

Economic events those events that impact an organization's financial statements and AISs therefore record data about them in accounting transactions.

Economic event an activity that involves an increase and/or decrease in dollar amounts on financial statements.

Economic feasibility the process of analyzing the cost-effectiveness of a proposed system.

Edit programs also called ''input validation routines.'' These are programs or subroutines that check the validity and accuracy of input data after the data have been entered and recorded on a machine-readable file.

Edit tests tests that examine selected fields of input data and reject those transactions (or other types of data input) whose data fields do not meet the preestablished standards of data quality.

Electronic commerce conducting business (often over the Internet) with computers and data communications.

Electronic conferencing a means of enabling accountants and others to use computers and phone lines to communicate with clients, etc., through the use of high-end groupware communications packages.

Electronic Data Gathering and Retrieval (EDGAR) database the database that contains the financial report filings of U.S.publicly held companies.

Electronic Data Interchange (EDI) a communications technique that allows organizations to transmit standard business documents over high-speed data communications channels.

Electronic eavesdropping unauthorized access to a computer system and its data to observe transmissions intended for someone else.

Electronic funds transfer (EFT) a cash management technique whereby the transfer of funds is electronic or computer-to-computer.

Electronic mail (email) creating a message on your microcomputer and then sending it electronically to someone else using the recipient's email address.

Electronic payments (e-payments) the use of a third party to act as an intermediary in an online transaction, thereby eliminating credit card use.

Electronic procurement the use of modern computer technology to purchase goods and raw materials electronically (e.g., over the Internet).

Electronic Systems Assurance and Control (*e*SAC) a framework developed by the Institute of Internal Auditors for evaluating controls over e-business.

Electronic vaulting creating backup copies of files that are electronically transmitted to a remote site rather than physically delivered to an off-site storage location.

Encryption key a (typically long) set of bits that is used to encrypt a message for transmission over public data transmission lines.

End-user computing the ability of non-computer employees to create computer applications of their own.

Enterprise application integration (EAI) a useful interface to businesses that allows companies with legacy applications and databases to integrate and continue to use those systems.

Enterprise asset management (EAM) systems a means of automating the management of a broad spectrum of assets.

Enterprise-wide database a large repository of organizational data that comes from, and is available to, a wide range of a company's employees.

Enterprise mashups a dashboard that managers use to quickly view critical business information that collects data from a variety of sources—both inside and outside the firm.

Enterprise resource planning (ERP) systems software (e.g., *Oracle*) that provides for integration among all of an organization's major business processes through the use of a central database; ERP II systems are extended with e-business and other front-office capabilities.

Enterprise risk management (ERM) also called the 2004 COSO Framework. ERM helps an organization determine if their objectives are aligned with their strategy and that goals are consistent with the level of risk the organization is willing to take.

Entities data about objects of interest contained in databases including business and economic events, plus information about ''who'' and ''what'' were involved in those activities.

Entity-relationship (E-R) diagram a graphical documentation technique used by database designers to depict database elements and their direct relationships.

Event-driven programming language a computer programming language such as Visual Basic, that enables a computer to respond to specific events (e.g., clicking on a menu choice).

E-wallet also known as a ''digital wallet,'' e-wallets function like conventional wallets, but enable their users to buy and sell merchandise over the Internet.

Exception report a report that lists exceptional condition(s) that typically draw management's attention to a potential problem.

Expected loss an example of a loss measure, computed as: expected loss = risk x exposure

Extended application interfaces (EAI) software application interfaces that allow different software applications to share information among them.

Extensible business reporting language see XBRL.

Extranets a means of enabling selected outside users to access organizations' intranets.

Fault-tolerant systems systems designed to tolerate faults or errors that are often based on the concept of redundancy.

Feasibility evaluation the first major procedure in systems design work whereby the design team determines the practicality of alternative proposals.

Fidelity bond organizational coverage (from an insurance company) to reduce the risk of loss caused by employee theft of assets.

Field properties settings as ''field size'' and ''format'' in each data field specified in a table.

File server a computer whose principle task is to store and output the contents of computer files. For example, most Internet applications use file servers to store and output Web page files.

Financial accounting information system the component of an AIS in which the major objective is to provide relevant information (primarily economic) to individuals and groups outside an organization's boundaries.

Financial planning models information systems that aid financial managers in selecting an optimum strategy for acquiring and investing financial resources.

Financing process the process by which a company acquires and uses financial resources such as cash, other liquid assets, and investments.

Firewall a software program or hardware device designed to prevent unauthorized data communications between hackers and the information resources within an internal, trusted network.

First normal form (1 NF) when all the record attributes (data fields) within a database are well defined and the information can thus be stored as a flat file.

Fixed asset management management of the purchase, maintenance, valuation, and disposal of an organization's fixed assets.

Flat files files with no sequence or order to them, except perhaps a chronological sequence.

Flying-start site a disaster recovery location that includes everything contained in a hot site plus up-to-date backup data and software.

Follow-up and maintenance phase the continued monitoring of a newly implemented system to ensure that the system continues to operate properly and meets the organization's information needs.

Foreign keys data fields within some accounting records that enable these records to reference one or more records in other tables.

Forensic accountants also called fraud auditors. These individuals concern themselves with the prevention and detection of fraud and white-collar crime.

Form (databases) a user interface that typically uses text boxes, labels, and similar form controls to create or display records in a database table

Fraud triangle three elements that create a fraud. These are motive, opportunity, and the rationalization by the individual perpetrating the fraud that the behavior is appropriate or justified.

Front-office a reference to external functions and processes of an organization, such as those that involve customers, suppliers, and other business partners.

Gantt chart a tool for planning and controlling a systems implementation project.

Generalized audit software (GAS) computer packages that enable auditors to review computer files without continually rewriting processing programs.

General-use software the software used by auditors as productivity tools for improving their work; e.g., the use of a word processing program by an auditor when writing an audit report.

Gigabyte a unit of disk storage approximately equal to one billion bytes.

Graphical documentation the depiction, through the use of symbols and logic diagrams, of existing or proposed AISs by accountants, consultants, and system developers.

Graphical user interface (GUI) one or more visual computer screens that enable an end-user to communicate with a computer—typically by selecting items from menus or clicking on choices using a computer mouse. Computer programs that did not use GUIs typically were command-driven systems that required users to memorize and type in system commands and instructions.

Group code is the combination of two or more subcodes creating a group code, which is often used as a product code in sales catalogs.

Groupware a means of allowing users to send and receive email, plus perform a wide range of other document-editing tasks.

Hacker a person who breaks into the computer files of others for fun or personal gain.

Hash total the manual and perhaps meaningless sum of the customers' account numbers in a batch of transactions that is used for comparison purposes to control for missing or transposed numerical data.

Hierarchical structures the way accounting data may be organized, with successive levels of data in an inverted, tree-like pattern.

HIPAA the privacy requirements of the Health Insurance Portability and Accountability Act.

Hosted solution an approach to acquisition of software where the package is rented over the Internet, rather than purchased.

Hot backup a backup performed while the database is online and available for read/write.

Hot site a disaster recovery location that includes a computer system configured similarly to the system currently in use by a company for its data processing activities.

HTML an acronym for hypertext markup language—the editing language that tells a Web browser how to display information from the World Wide Web.

Human resource management an activity of an organization that includes the personnel function and the payroll function.

Hyperlink a word, phrase, or graphic that allows users to display new information in a Web browser or computer screen, typically by clicking on the hypertext element with a mouse.

Hypertext a text retrieval system enabling a user to access specific document locations

Hypertext Markup Language (HTML) a language used to create Web pages.

Hypertext transfer protocol (HTTP) a communications protocol designed to transfer information on the World Wide Web.

I/O-bound computer a computer whose input speeds and/or output speeds are slower than its computational speed.

Ideal control a control procedure within a company's internal control system that reduces to practically zero the risk of an undetected error or irregularity.

Identity theft the intentional misuse of someone else's personal information with the intent to deceive another.

Identity Theft and Assumption Deterrence Act (ITADA) of 1998 the law under which the Department of Justice prosecutes ID theft violations.

Image processing storing, manipulating, or outputting the graphical information that usually first appear on hard-copy documents such as contracts, architectural plans, machinery schematics, or real-estate photos.

Information Systems Audit and Control Association (ISACA) the professional association of information technology auditors.

Information systems risk assessment method used by an auditor to evaluate the desirability of IT-related controls for a particular aspect of business risk.

Information technology (IT) the hardware and software used in computerized information systems.

Information technology (IT) auditing process that involves evaluating the computer's role in achieving audit and control objectives.

Information technology (IT) auditors auditors who concern themselves with analyzing the risks associated with all aspects of information technologies.

IT governance the process of using IT resources effectively to meet organizational objectives.

Ink-jet printer a printer that uses very small nozzles to spray ink onto blank pages to create printed outputs. An advantage of ink-jet printers over dot matrix printers is their ability to print in color. But ink-jet printers are slower and more costly, per-page, than laser printers.

Input controls computer application controls that attempt to ensure the validity, accuracy, and completeness of the data entered into a company's AIS; e.g., edit tests.

Input mask a set of characters that dictate the required format for input data. For example, in Microsoft Access, the mask "(###) ###-####" specifies the sequence of numeric digits (represented by # signs) required for a phone.

Input validation routines programs or subroutines that check the validity and accuracy of input data after the data have been entered and recorded on a machine-readable file.

Input-processing-output cycle the three steps that a computer uses to process computer records—i.e., inputting a record, processing the information it contains, and outputting the results. A classic example is creating payroll checks from time-card data.

Instant Messaging (IM) the use of special software to communicate with others over the Internet in real time. Many IM programs such as MSN IM and Yahoo IM also support audio and video conferencing as well as text messaging.

Integrated accounting software programs software packages that can process all types of accounting transactions and provide a variety of reports, including financial statements and budgets.

Integrated Computer-Assisted Surveillance System (ICASS) designed to protect computer systems from crimes, abuses, and fraud by automatically searching for anomalies and printing exception conditions on control reports.

Integrated security an integrated approach to security involves managers combining a number of key security technologies to protect the organization. This might include the following: firewalls, intrusion detection systems, content filtering, vulnerability management, virus protection, and virtual private networks.

Integrated services digital network (ISDN) lines high-speed data transmission lines, typically using fiber optics, that end users can rent from phone companies and that support transmission rates up to 1.5 million bits per second (Mbps).

Integrated test facility (ITF) used by auditors to test a company's computer programs; particularly useful for auditing in an operational setting and/or for evaluating integrated online systems or complex programming logic.

Interactive data and electronic applications (IDEA) managed by the Securities and Exchange Commission, IDEA is a particularly important source of financial information, containing XBRL data for over 10,000 companies.

Internal control defined by the COSOas a process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories—effectiveness and efficiency of operations, reliability of financial reporting, and compliance with applicable laws and regulations.

Internet a global collection of tens of thousands of interconnected business, government, military, and education networks that communicate with each other.

Internet connectivity software that permits small businesses to create Web sites and engage in electronic commerce.

Internet protocol (IP) address the numeric address into which a text-based domain address is converted for transmission purposes.

Internet service provider (ISP) the means of enabling users to connect to the Internet; examples are America Online, AT&T, and Sprint.

Intranets networks using the same software as the Internet, but which are in ternal (for communications purposes) to the companies that created them.

Intrusion detection system (IDS) computer software that enables users to identify, document, and perhaps mislead hackers attempting to access a protected system.

Inventory Control a means of protecting inventory by keeping it in a storage area accessible only to employees with custodial responsibility.

IT general controls controls over data processing to provide reasonable assurance that (1) development of, and changes to, computer programs are authorized, tested, and approved before their usage, and (2) access to data files is restricted to authorized users and programs to increase the likelihood that processed accounting data are accurate and complete.

IT governance ensuring that information technology risks are controlled and also that IT in an organization is deployed strategically to meet objectives.

Job-costing information system a system of costing that keeps track of the specific costs for raw materials, labor, and overhead associated with each product or group of products.

Job stream the flow of electronic data through a computer system.

Just-in-Time System an inventory system whose objective is to minimize inventories at all levels of production.

K(kilobytes) exactly 1,024 bytes of computer storage.

Key performance indicators (KPIs) important metrics that convey information about operational performance against plans or budgets.

Knowledge management distribution of expertise within an organization via technologies such as groupware.

Knowledge process outsourcing (KPO) an approach where an organization chooses to have some of its functions and activities related to research and acquisition of knowledge performed by an external organization.

Laser printer a type of printer that uses a laser to sensitize portions of a rotating drum. These sensitized portions attract small graphite particles called toner that can then be transferred to a blank piece of paper and permanently "fixed" to the page with heat.

Lean Accounting performance measurement systems used in lean manufacturing.

Lean production/manufacturing the concept that a company makes the commitment to eliminate waste throughout the organization (not just in production).

Legacy system a business's older, customized computer system that typically runs on a mainframe computer and is often too large and expensive to replace.

Legal feasibility determining whether or not there will be any conflict between a newly proposed system and a company's legal obligations.

Level 0 data flow diagram the least detailed data flow diagram, showing only in broad terms what tasks a system performs.

Level 1 data flow diagram the decomposition of a single symbol from within a level 0 data flow diagram to more fully document the system.

Local area network (LAN) a collection of microcomputers, printers, file servers, and similar electronic components that are physically located near one another—for example, in the same building—and connected together for communication purposes.

Lock-box system a tool used by a company to reduce the float period during which checks clear the bank.

Lock-out system a password safeguard that disconnects telephone users after a set number of unsuccessful login attempts.

Logic bomb program computer programs that remain dormant until some specified circumstance or date triggers them.

Logical data flow diagram the depiction of the tasks conducted by participants within a systems development process.

Logical security the use of technology to limit access by authorized individuals only to the organization's systems and information.

Macro program flowchart the highest-level program flowchart, providing an overview of the data processing logic.

Magnetic (hard) disk a secondary storage device that enables a computer to store billions of bytes of information. Unlike primary (RAM) memory, whose information is lost when its computer loses power, magnetic disk memory is permanent.

Magnetic ink character recognition (MICR) the technology used primarily by banks to encode magnetically readable symbols at the bottom of checks or similar financial documents. Because the magnetic flux of the ink used in these symbols loses strength over time, MICR is not widely used elsewhere.

Mag-strip card a credit card, hotel ''key,'' employee badge, or similarly-sized plastic card with a magnetic stripe on one side that has been encoded with information about the user and/or account.

Mainframe computer a large, multi-user computer that enables large companies to centralize processing power in a single device.

Make-or-buy decision determining whether it is more cost effective to purchase an AIS or develop one in-house.

Man trap a small antechamber room between a public corridor and the entrance to a data processing center, set up for security purposes.

Manufacturing resource planning (MRPII) system a more complex version of the material requirements planning system that not only coordinates the purchase and use of raw material inventories in production, but also integrates with the purchasing and revenue processes.

Mark-sense media documents such as academic test forms, surveys, and similar papers that users complete with simple pencils or pens but that can be read and evaluated by computerized input devices.

Master file a file that stores permanent information about file entities (e.g., employees, customers, or financial assets). Its opposite is a transaction file, which typically stores temporary information about the transactions for a limited period of time.

Material requirements planning (MRPI) system a system that monitors the acquisition and use of raw materials needed by production processes.

Megabyte a unit of computer storage approximately equal to one million bytes.

Message acknowledgment procedures a control for computer network systems that is useful in preventing the loss of part or all of a company's transactions or messages on a computer network system.

Metadata data about data, contained in data dictionaries.

Microprocessor the portion of a CPU that performs the arithmetic and logic tasks of a computer, and that also interprets and executes computer instructions.

Minicomputer a multi-user computer with less processing power than a mainframe but typically more power than a personal, or microcomputer.

Mnemonic codes designed to help the user remember what they represent.

Modem (modulator/demodulator) a device for converting the digital data that a computer uses into sound pitches that can be transmitted over phone lines.

Modular conversion a method of systems implementation whereby the users involved in specific data processing tasks are divided into smaller units or modules; the data processing system is then installed module by module.

Multidimensional databases a means of storing large quantities of data, with the goal of enabling employees at various levels of an organization to define their own tables and reports in formats most useful to them.

Multimedia databases object-oriented databases that include graphics, audio information, and animation.

Near field communication (NFC) a means of enabling mobile devices such as cell phones, PDAs, and laptop computers to communicate with similar devices containing NFC chips.

Network structure used with AIS databases to link related records together and adequately capture the records' relationships.

Non-value added waste eliminated or reduced to improve overall customer value and to increase the profitability of the products or services that the organization offers.

Normalization the process of examining and arranging file data in a way that helps avoid problems when these files are used or modified later; data can be in first, second, or third normal form.

Numeric codes codes that use numbers only.

Object-oriented database (OODB) a database that contains both the text data of traditional databases and information about the set of actions that can be taken on these data fields.

Object-oriented programming (OOP) languages computer programming languages that have strict rules (particularly ''inheritance'' and ''encapsulation'') that govern the properties, attributes, and operations of language objects (such as variables and form controls). OOP also includes the developer's ability to create new objects with these characteristics that can be used by other procedures and programs.

Object-oriented software programs that contain modular, reusable code helping programmers avoid writing duplicate programs and facilitating changes when needed.

Offshoring moving jobs offshore (e.g., to countries like India, China, Canada, Mexico, or Malaysia).

Online analytical processing (OLAP) a way to allow database users to extract multidimensional information from one or more database tables for the purpose of making complex decisions.

Operating System (OS) a set of software programs that helps a computer run itself as well as the application programs designed to run under it. Examples include Windows 2000,Windows XP, and Unix.

Operational audits are audits performed by a company's internal audit staff that focus on evaluating the efficiency and effectiveness of operations within a particular department.

Operational feasibility the examination of a proposed system's compatibility with the current operating environment (e.g., ensuring that the organizational structure would support the new system).

Optical character recognition (OCR) an older technique that enables computer input devices to interpret machine-printed (and to a limited extent, hand-written) data using optical technology.

Organization-level controls management's philosophy, operating style, integrity, policies, and procedures that influence the tone of a company. These characteristics help to establish the level of security and control consciousness in the organization, which is the basis for the control environment.

Output controls computer application controls that are designed to assure the validity, accuracy, and completeness of the output from a company's computer systems; e.g., regulating the distribution and use of printed output.

Parallel conversion a method of systems implementation where both the old and new system of a company operate simultaneously for a period of time.

Parallel simulation technique used by auditors to test a company's computer programs; the auditor uses live input data, rather than test data in a program that simulates all or some of the operations of the working program.

Parent record the higher-level record of two adjacent records in a hierarchical data structure.

Partner relationship management (PRM) software applications that track and coordinate various contacts and partners of an organization, including customers, suppliers, and other entities, such as not-for-profit organizational relationships.

Password codes general computer controls designed to limit access to a company's computers only to those individuals authorized to have this access.

Payroll processing information systems a means of paying employees for their work, maintaining employee earnings records, complying with government tax and reporting requirements, reporting on various deduction categories, and interacting with other personnel functions.

Penetration testing also sometimes called ethical hacking, auditors may use this approach to see if they can access resources within an information system.

Performance measurement the use of metrics and data to evaluate the efficiency and effectiveness of people, technologies, or processes.

Peripheral equipment devices such as keyboards, display monitors, and printers, that typically physically surround a computer processor.

Personal data assistant (PDA) device a computerized device that includes such functions as calculator, address book, memo storage, daily planner, and perhaps even provides wireless Internet access.

Personal productivity software software that typically runs on microcomputers (e.g., word processing and spreadsheet programs) and that helps individuals perform their jobs faster, easier, and more accurately.

PERT (Program Evaluation and Review) a technique for scheduling and monitoring the activities in large systems implementation projects.

Phishing an email from someone who falsely claims to be an established, legitimate company.

Physical data flow diagram the depiction of the first level of detail within a system, focusing on physical entities such as employees involved in the system, and hard-copy inputs and outputs.

Physical security any measures that an organization uses to protect its facilities, resources, or its proprietary data that are stored on physical media.

Pivot tables a feature that enables a database user to create two dimensional statistical summaries of database information.

Pixels (picture elements) the tiny dots that a monitor uses to create a complete screen image. For example, a monitor might have a pixel resolution of 1024 x768, meaning the ability to display 1,024 pixels across the screen by 768 pixels down the screen.

Point-of-sale (POS) device an input device such as a barcode reader that enables a user to input data directly into a computer from a checkout stand in a supermarket or merchandise store and avoid manual keystrokes.

Point-scoring analysis an approach used to evaluate accounting software packages (as well as hardware) of vendors that meet most of a company's major IT requirements.

Portals Web sites that allow outsiders with authorized access to view a company's internal information systems.

Predictive analytics a technique using data stored in data warehouses to improve performance.

Preliminary investigation the first task performed by a systems study team whereby the team, for example, investigates current needs or problems in a company's present system and reports findings to the steering committee.

Preventive controls control procedures that are designed and implemented within a company's internal control system to *prevent* some potential problem from occurring when an activity is performed.

Primary memory the internal random access memory or RAM that a computer uses to temporarily store computer programs and immediate data.

Privacy policy a Web sites' policy that states the information it does and does not collect about you and how they might use that information.

Process-costing information system a system that uses averages to calculate the costs associated with goods in process and finished goods produced.

Process map a special type of flowchart used to better understand and communicate a company's current business processes.

Processing controls computer application controls that focus on the manipulation of accounting data after they are input to a company's computer system—for example, data-access controls.

Production process (sometimes called the conversion process) begins with a request for raw materials and ending with the transfer of finished goods to warehouses.

Program change control a set of internal control procedures developed to ensure against unauthorized program changes.

Program flowchart graphical documentation that outlines the processing logic for each part of a computer program and also indicates the sequence of processing steps.

Programming language a language such as Java or Visual Basic that enables a programmer to create instructions (called ''code'') that a computer can understand.

Project management software software that can aid in planning and controlling the tasks involved in a systems implementation project.

Prototyping an approach to systems design work that involves developing a simplified model of a proposed information system that is experimented with by the system's users.

Proxy server a computer and related software that creates a transparent gateway to and from the Internet that can be used to control Web access.

Public key encryption encrypting messages using a scrambling key assigned by a public entity.

Purchasing process the process that begins with a request (or an order) for goods or services and ends with payment to the vendor.

Queries the means of allowing database users to create subschemas of interest to them.

Radio frequency technology an emerging technology that uses RFID tags (attached to products or pallets of products) for identification. These tags (transponders) can hold much more information than barcodes.

Rapid application development (RAD) the use of CASE tools to speed the planning and development of computer information systems.

REA model an approach to data modeling that focuses on resources (R), events (E), and agents (A).

Record keys may or may not be unique identifiers of individual or associated records.

Record structure the specific data fields in each record of a database table; this structure is fixed in many accounting applications.

Redundant array of independent disks (RAID) a set of magnetic disks that act as a single hard drive.

Reengineering business processes starting from scratch to redesign major processes in an organization (e.g., such as sales orders or purchasing).

Referential integrity (databases) a control that denies a user the ability to create a child record with no parent, or to delete a parent record that has child records.

Relational database structure a means of enabling database users to identify relationships either at the time the data are initially created or at a future time as new informational requirements are ascertained.

Relationship table an approach to represent relationships between two database tables when you have many-to-many relationships between database entities.

Request for proposal (RFP) report sent to computer vendors in systems design work that outlines the specific requirements of a company's desired system.

Responsibility system of computer program development and maintenance a series of steps that comprise a test of program change control. It is designed to ensure accountability and adequate supervisory controls.

RFID tags are computer chips and tiny antennas that are used to manage inventory.

Right Networks ASP an add-on for QuickBooks, enabling remote hosting of desktop applications.

Risk assessment a component of internal control that considers the risk factor when designing controls for a company.

Risk matrix a tool especially useful for prioritizing large risks that classifies each potential risk by mitigation cost and also by likelihood of occurrence.

Risk-based audit approach used by auditors to evaluate a company's internal control procedures.

Rollback processing a fault-tolerant system, at the transaction level, in which transactions are never written to disk until they are complete.

Routing verification procedures a control for computer network systems that helps to ensure that no transactions or messages of a company are routed to the wrong computer network system address.

Salami technique a computer crime whereby computer programmers steal small amounts of money from many accounts over a period of time.

Sales process a process that begins with a customer order for goods or services and ends with the collection of cash from the customer.

Sandwich rule (flowcharting) a rule that states that a processing symbol should always appear between an input symbol and an output symbol.

Sarbanes-Oxley Act of 2002 sweeping financial legislation that emphasizes organizational internal controls and accountability.

SAS No. 94 ''The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit.'' a SAS rule that cautions external auditors that the way firms use IT might impact any of the five internal control components.

Scalable the ability for a software user to migrate easily to packages that handle increasingly large volumes of data and transactions.

Scenario planning found under ''Event Identification'' (of ERM) is a way for management to identify scenarios (from minor concern to major disasters) that could occur.

Schedule feasibility an evaluation that involves estimating the time frame for a new or revised system to become operational.

Schema a reflection of the totality of the information in a database and the relationships of its tables (i.e., records).

Scope creep a situation where the size of a task or project gradually becomes larger, and perhaps more complex and costly.

Second normal form (2 NF) when a database is in first normal form and all the data items in each record depend on the record's primary record key.

Secondary record keys data fields that are typically not unique among records but that can also be used to search records for specific information.

Secondary storage computer equipment that stores data permanently (e.g., hard disks, CD Roms, and USB drives).

Secret key cryptography a data encryption method that uses a single cryptographic key that is shared by the communicating parties.

Security policy a comprehensive plan that management must develop to help protect the enterprise from internal and external threats.

Select query the creation of a dynaset of database information based on two types of user-specified criteria: those that determine which records to include, and those that determine which data fields to include *from* those records.

Separation of duties an activity of an internal control system that focuses on structuring work assignments among employees so that one employee's work activities serve as a check on those work activities of another employee.

Sequence code a sequential set of numbers used to identify customer accounts, employee payroll checks, customer sales invoices, and so forth.

Sibling records two records on the same level in a hierarchical data structure.

Signed checklists an example of establishing accountability by verifying that an accountant performed certain tasks, that a reviewer approved them, and that both individuals are accountable for their accuracy.

Slack time a description of the amount of delay time that can occur in each non-critical activity and still not delay a project.

Smishing a scam similar to phishing using text messages on cell phones in an attempt to get you to provide or ''update'' your personal information such as account number, credit card number, or password.

Social engineering a tactic hackers use to gain access to passwords, such as posing as a bona fide employee to convince a network administrator to give passwords over the telephone.

Soft copy output computer output on video screens, billboards, and similar devices; the opposite of hard copy (printed) output.

Source code the program commands that underlie a software application.

Source document a piece of paper or an electronic form that becomes the source of subsequent computer records and processing activities. Examples of source documents include time cards in payroll systems, employee application forms, doctor medical diagnoses, insurance claim forms, and personal bank checks.

SOX, Section 404 a statement that management is responsible for establishing and maintaining an adequate internal control structure and at the end of each fiscal year must attest to the effectiveness and completeness of that structure.

Spam annoying, unsolicited email messages that are often illegal and increasingly costly to organizations.

Spend management a systematic approach to controlling an organization's expenses.

Spoofing masquerading as an authorized Internet user.

Steering committee a group consisting of a company's top management personnel and possibly one or more staff auditors that works with the systems study team throughout all phases of system development activities.

Strong passwords passwords that contain a variety of characters (letters, numbers, and symbols) and are 14 characters or longer. A 15-character password composed of random letters and numbers is about 33,000 times stronger than an 8-character password composed of characters from the entire keyboard.

Structured programming techniques used to develop large computer programs in a hierarchical fashion.

Structured query language (SQL) a popular data manipulation language for retrieving and manipulating data; auditors can use SQL to retrieve a client's data and display these data in a variety of formats for audit purposes.

Structured walkthrough a meeting in which the attendees review the logic of a computer program.

Supercomputer a computer that is faster and more powerful than a mainframe, and capable of performing trillions of operations per second.

Supply chain management (SCM) applications that enable an ERP system or other software to interface with a company's suppliers and customers.

System development life cycle (SDLC) comprised of the planning, analysis, design, and implementation phases of acquiring or developing a new information system.

System flowchart graphical documentation that depicts the logical flow of data and processing steps in an AIS.

System maintenance ensuring the continuing operations of a system.

Systems analysis the phase of a systems study in which the study team thoroughly familiarizes itself with a company's current operating system by focusing on strengths and weaknesses within the system.

Systems approach using a broad point of view in performing a systems study.

Systems Auditability and Control (SAC) report a guide developed by the Institute of Internal Auditors that provides auditors with guidance in the evaluation of IT-related internal controls.

Systems implementation the phase of a systems study in which the recommended changes from analysis, design, and development work are now put into operation.

Systems specification report a document that summarizes the findings of a design team regarding the needs for a new information system.

Systems study a formal investigation of a company's existing information systems.

Systems survey part of systems analysis in which the study team obtains a more complete understanding of a company's current operation information system and its environment.

SysTrust an assurance service introduced by the AICPA that evaluates the reliability of information systems with respect to their availability, security, integrity, and maintainability.

Table (databases) a set of related records that are stored together in a file using a database management system such as Microsoft Access.

Technical feasibility an analysis of the technical resources required by a particular information system.

Test data a set of transactions that examine the range of exception situations that might occur under normal processing conditions.

Third normal form (3 NF) a database that is in second normal form and that contains no transitive dependencies.

Third party assurance services audit and assessment services offered by independent third parties to provide business users and individual consumers with some level of comfort over Internet transactions.

Time and billing information systems similar to job order costing systems, tracking hours and costs associated with each job (i.e., each client) and each employee (i.e., professional staff).

Transaction controls needed by AISs to ensure that the database system performs each transaction accurately and completely.

Transaction file a temporary file of accounting records that typically stores the transactions for a specific period of time.

Transitive dependencies when the same record does not contain two data fields in which data field *A* determines data field *B*.

Trojan horse program a destructive or deceptive computer program hidden inside an accepted program.

Trust services third party assurance services offered through the AICPA that provide guidance to practitioners to evaluate organizations in terms of their reliability, privacy, and security.

Turnaround document a hard-copy document such as a bank check or confirmation slip that a business creates, sends to a second party for completion or approval, and then receives back for further processing. For convenience, most turnaround documents are computer readable.

Turnkey system a computer system acquired from independent vendors that includes both software and hardware.

Uninterruptible power system (UPS) an auxiliary power supply that can smooth the flow of power to the computer, thereby preventing the loss of data due to momentary surges or dips in power.

Universal resource locator (URL) a text Internet address such as www.Wiley.com.

Utility programs computer programs that are typically included with computer operating systems, but which perform specific end-user tasks. Examples include programs that format disks, transfer file data from one medium to another, or test emails for viruses.

Val IT a governance framework developed by IT Governance Institute (ITGI) as a formal statement of principles and processes for IT management; it is tightly integrated with COBIT.

Validation rule see data validation rule.

Value cards credit-card size or key-ring size cards from retailers that have a barcode on the back side for the merchant to track purchases. In some cases, the merchant offers discounts or points that may be exchanged for goods or services. In other cases customers simply receive advance information for upcoming sales before the general public.

Value-added networks (VANs) proprietary networks that large IT organizations design and maintain for their customers in order to implement EDI or intranet applications.

Value-added resellers (VARs) special type of systems consultants who are licensed to sell particular software packages and provide organizations with consulting services related to those packages.

Value stream management a management process that controls activities that generate value in a product or service rather than by functional area.

Vertical market markets or industries that are distinct in terms of the services they provide or the goods they produce.

View controls a security feature within a database system that limits each user's access to information on a need-to know basis.

Virtual PBXs are Internet-based PBX systems that enable organizations to outsource their PBX services.

Virtual private network (VPN) a mimic of a value-added network in many of its security features, but enjoys the benefit of transmitting messages cheaply over existing Internet connections.

Virtual storage a computer operating system technique that uses magnetic disk storage as a virtual extension of primary storage.

Virus a computer program that rogue programmers embed in other programs, emails, or computer files, and that (when executed) typically perform such destructive acts as erasing files, disrupting emails, or interfering with operating system functions.

Voice over Internet Protocol (VoIP) a technology that allows you to make telephone calls using a broadband Internet connection instead of a regular telephone line.

Voice recognition system computer hardware and software that enables a computer to hear and interpret voice commands.

Volatile memory computer memory that becomes inoperative when it loses power.

VPN a security appliance that runs behind an organization's firewall and allows remote users to access entity resources by using wireless, hand-held devices.

Watchdog processor a fault-tolerant system that uses two processors. If something happens to the first processor, the second processor takes over the processing work.

Web browser a software application that enables a user to display and interact with sites on the World Wide Web.

Wide area network (WAN) computer networks spanning regional, national, or global geographic areas.

Wi-fi technology technology that allows transmission and receipt of voice and data messages remotely and without hard-wired connections to a phone line.

Wireless application protocol (WAP) a data communication protocol mostly used by mobile phones and PDAs to connect to the Internet.

World Wide Web the graphics portion of the Internet.

Worm program a program that disrupts normal data processing and is usually able to replicate itself onto other files, computer systems, or networks. Examples of these viruses are boot sector viruses, worm programs, Trojan horse programs, and logic bomb programs.

XBRL an acronym for "extensible business reporting language"—a standardized set of markup (editing) tags and rules created with XML used by the financial reporting industry.

XBRL instance document an XML document that was created using XBRL standards.

XBRL International Consortium an organization of about 450 members, including many U.S. accounting firms; it is in charge of developing XBRL standards.

XML an acronym for extensible markup language—an extension of HTML that allows users to create their own markup (editing) tags.

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