

SHELLY CASHMAN SERIES®



# Systems Analysis and Design

**ELEVENTH EDITION**

**TILLEY | ROSENBLATT**

**Systems Analysis and Design, Eleventh Edition****Scott Tilley and Harry Rosenblatt**SVP, GM Skills & Global Product Management:  
Dawn Gerrain

Product Director: Kathleen McMahon

Product Team Manager: Kristin McNary

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Bellegarde

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Senior Content Project Manager: Stacey  
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Designer: Diana Graham

Cover Template Designer: Lisa Kuhn, Curio  
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# DEDICATION

*To Harry*



## FOREWORD

Harry Rosenblatt was a teacher, a mentor, and textbook author. His dedication to writing the previous editions of this book was grounded in the desire to help students understand the material, and to provide the foundation for becoming future systems analysts and designers. He sought input from students on how to make the textbook better, even going as far as putting together a team of students to help him. Harry's work has enabled thousands of students to gain an understanding of systems analysis and design.

While Harry was writing the previous editions of this text, he was actively teaching at several colleges. Harry's experience with teaching this material led him to develop an extensive selection of supplemental resources to assist instructors who used the text in their courses. The format of each edition was an iterative revision of his pedagogical views of the subject matter stemming from his teaching experience.

Farewell, Harry. Your legacy will live on through the continued publication of this text. Systems analysis and design is a timeless topic in the field of information technology, and thousands of students will continue to be touched by your work.

Ronald R. Savilla, MBA  
Carolinas Healthcare System  
Former student and textbook assistant



## PREFACE

The Shelly Cashman Series® offers the finest textbooks in computing education. We are proud that our previous editions of *Systems Analysis and Design* have been so well received by instructors and students. *Systems Analysis and Design, Eleventh Edition* continues with the innovation, quality, and reliability you have come to expect.

The Shelly Cashman Series development team carefully reviewed our pedagogy and analyzed its effectiveness in teaching today's student. Contemporary students read less, but need to retain more. As they develop and perform skills, students must know how to apply the skills to different settings. Today's students need to be continually engaged and challenged to retain what they're learning. With this book, we continue our commitment to focusing on the user and how they learn best.

Facing a challenging global marketplace, companies need strong IT resources to survive and compete effectively. Many of today's students will become the systems analysts, managers, and IT professionals of tomorrow. This textbook will help prepare them for those roles.

### Overview

*Systems Analysis and Design, Eleventh Edition* offers a practical, streamlined, and updated approach to information systems development. The book emphasizes the role of the systems analyst in a dynamic, business-related environment. Throughout the book, real-world examples emphasize critical thinking and IT skills in a dynamic, business-related environment.

Many two- and four-year colleges and schools use this book in information systems, computer science, and ecommerce curriculums. The *Eleventh Edition* includes expanded coverage of emerging technologies, such as agile methods, cloud computing, and mobile applications. This new material compliments the updated treatment of traditional approaches to systems analysis and design.

Using this book, students learn how to translate business requirements into information systems that support a company's short- and long-term objectives. Case studies and assignments teach analytical reasoning, critical thinking, and problem-solving skills. Numerous projects, assignments, and end-of-chapter exercises are accessible online, along with detailed instructor support material.

### Objectives of This Textbook

*Systems Analysis and Design, Eleventh Edition* is intended for a three credit-hour introductory systems analysis and design course. This textbook is designed to:

- Explain systems analysis and design using an appealing full-color format, numerous screen shots and illustrations, and an easy-to-read style that invites students to learn.
- Introduce project management concepts early in the systems development process, with a new chapter that explains project management tools and techniques.
- Challenge students with a Question of Ethics mini-case in each chapter that asks them to respond to real-life ethical issues in an IT environment.
- Provide multi-method coverage, including a comparison of structured, object-oriented, and agile systems development methods.
- Explain how IT supports business requirements in today's intensely competitive environment, and describe major IT developments and trends.



## New and Updated Features in This Edition

*Systems Analysis and Design, Eleventh Edition* offers these exciting new and expanded features:

- Streamlined presentation of material throughout the book, helping students focus on the main content quickly and easily. There is less visual distraction and a clearer flow of topics. Much of the additional material has been moved online.
- Expanded coverage of emerging technologies, such as agile methods, cloud computing, and mobile applications, making topics more aligned with today's business environments and student interests. New developments are placed in historical context.
- Updated examples of CASE tools reflecting web-based and/or open source offerings. These tools are often free and are representative of modern systems analysis solutions.
- Revised Toolkits reflecting changes in systems analysis tools and resources.
- Glossary of key terms now appears at the end of each chapter, helping students remember concepts in context.

## Organization of This Textbook

*Systems Analysis and Design, Eleventh Edition* contains 16 learning units in twelve chapters and a four-part Systems Analyst's Toolkit that teaches valuable cross-functional skills. The twelve chapters are organized into five phases: planning, analysis, design, implementation, and support and security.

### Phase 1: Systems Planning

- **Chapter 1 – Introduction to Systems Analysis and Design:** Chapter 1 provides an introduction to systems analysis and design by describing the role of information technology in today's dynamic business environment.
- **Chapter 2 – Analyzing the Business Case:** Chapter 2 explains how systems projects get started and how to evaluate a project proposal to determine its feasibility.
- **Chapter 3 – Managing Systems Projects:** Chapter 3 describes how to use project management tools and techniques, and how to plan, schedule, monitor, and report on IT projects.

### Phase 2: Systems Analysis

- **Chapter 4 – Requirements Modeling:** Chapter 4 describes the requirements modeling process: gathering facts about a systems project, preparing documentation, and creating models that will be used to design and develop the system.
- **Chapter 5 – Data and Process Modeling:** Chapter 5 discusses data and process modeling techniques that analysts use to show how the system transforms data into useful information.
- **Chapter 6 – Object Modeling:** Chapter 6 discusses object modeling techniques that analysts use to create a logical model.
- **Chapter 7 – Development Strategies:** Chapter 7 considers various development strategies for the new system, and plans for the transition to the systems design phase.

### Phase 3: Systems Design

- **Chapter 8 – User Interface Design:** Chapter 8 explains how to design an effective user interface, and how to handle data security and control issues.
- **Chapter 9 – Data Design:** Chapter 9 focuses on the data design skills that are necessary for a systems analyst to construct the physical model of the information system.
- **Chapter 10 – System Architecture:** Chapter 10 describes system architecture, which translates the logical design of an information system into a physical blueprint.

### Phase 4: Systems Implementation

- **Chapter 11 – Managing Systems Implementation:** Chapter 11 describes application development, documentation, testing, training, data conversion, and system change-over.

### Phase 5: Systems Support and Security

- **Chapter 12 – Managing Systems Support and Security:** Chapter 12 describes systems support and security tasks that continue throughout the useful life of the system, including maintenance, security, backup and disaster recovery, performance measurement, and system obsolescence.

### Toolkits

- **Toolkit Part A – Communication Tools:** Part A of the Toolkit discusses communication tools that can help the analyst write clearly, speak effectively, and deliver powerful presentations.
- **Toolkit Part B – CASE Tools:** Part B describes CASE tools that be can used to design, construct, and document an information system.
- **Toolkit Part C – Financial Analysis Tools:** Part C demonstrates financial analysis tools that can used to measure project feasibility, develop accurate cost-benefit estimates, and make sound decisions.
- **Toolkit Part D – Internet Resource Tools:** Part D describes Internet resource tools that can be used to locate information, obtain reference material, and monitor IT trends and developments.

## FOR THE STUDENT

The Shelly Cashman Series wants all students to have a valuable learning experience that will provide the knowledge and skills you need to be successful. With that goal in mind, the presentation of material has been significantly streamlined throughout the book. There is now less distraction on the page and a clearer flow of topics. This should help students focus on the main content quickly and easily.

## CHAPTER LEARNING TOOLS AND HOW THEY WILL HELP YOU

**Dilbert:** There is a saying that a picture is worth a thousand words. To illustrate this concept, each phase of the textbook begins with an eye-catching Dilbert® cartoon. If you're not familiar with Scott Adams' characters, you will quickly recognize their behavior in the workplace.

**Case In Point:** Each chapter includes four brief cases that focus on key issues.

**A Question of Ethics:** A realistic ethical issue is presented at the end of each chapter. These examples force you to examine your reactions and how you would respond to common workplace situations.

**Chapter Exercises:** Your answers to the ten Questions will show that you understand the key points. Five Discussion Topics and five Projects offer opportunities to dig deeper and learn even more.

**Learn Online:** CengageBrain.com is the premier destination for purchasing or renting Cengage Learning textbooks, eBooks, eChapters, and study tools at a significant discount. In addition, CengageBrain.com provides direct access to MindTap, which gives you the tools you need to get better grades, all in one place, all there when you need them.

## FOR THE INSTRUCTOR

The Shelly Cashman Series is dedicated to providing you all of the tools you need to make your class a success. Information on all supplementary materials is available through your Cengage Learning representative or by calling one of the following telephone numbers: Colleges, Universities, Continuing Education Departments, Post-Secondary Vocational Schools, Career Colleges, Business, Industry, Government, Trade, Retailer, Wholesaler, Library, and Resellers, call Cengage Learning at 800-354-9706; K-12 Schools, Secondary and Vocational Schools, Adult Education, and School Districts, call Cengage Learning at 800-354-9706. In Canada, call Nelson Cengage Learning at 800-268-2222.

## INSTRUCTOR COMPANION SITE

The Instructor Companion Site for this textbook includes both teaching and testing aids, and all are available for download at [sso.cengage.com](http://sso.cengage.com). The Instructor Resources include:

- **Instructor's Manual:** Includes lecture notes summarizing the chapter sections, figures and boxed elements found in every chapter, teacher tips, classroom activities, lab activities, and quick quizzes in Microsoft Word files.
- **Syllabus:** Easily customizable sample syllabus that covers policies, assignments, exams, and other course information. Also included is a Microsoft Project file used to create the five Phase Opener Gantt charts. An instructor can use this project file to create a visual syllabus that could include additional tasks, quizzes, and projects. The file also can be used to track class progress through the course. Instructors are welcome to distribute this file to students, and show them how to manage tasks, resources, and deadlines for team projects that might be assigned.
- **PowerPoint Presentations:** A multimedia lecture presentation system provides slides for each chapter, based on chapter objectives.
- **Figure Files:** Illustrations for every figure in the textbook in electronic form.
- **Solutions to Exercises:** Includes solutions for end-of-chapter exercises.
- **Test Bank & Test Engine:** Test Banks include questions for every chapter, and featuring objective-based and critical thinking question types, page number references, and figure references when appropriate. Cengage Learning Testing powered by Cognero is a flexible, online system that allows you to:



- **Author, edit, and manage test bank content from multiple Cengage Learning solutions.**
- **Create multiple test versions in an instant.**
- **Deliver tests from your LMS, your classroom, or wherever you want!**
- **Additional Activities for Students:** The forms that students can use to complete the Case Studies are included. Two additional case studies are also provided for every chapter, to be assigned as homework, extra credit, or assessment tools. Chapter Reinforcement Exercises, which are true/false, multiple-choice, and short answer questions that help students gain confidence in the material learned are included.
- **Additional Faculty Files:** Several sample solutions to case study tasks also are included. To install this program, you follow a simple registration process that entitles you to use the software and obtain support. Detailed instructions are provided on the Instructor Companion Site. Also included are Word document versions of the email and voice mail messages posted for students on the SCR website and the Interview Summaries for the New Century Case Study.

## MINDTAP

MindTap is a personalized teaching experience with relevant assignments that guide students to analyze, apply, and improve thinking, allowing you to measure skills and outcomes with ease.

- **Personalized Teaching:** Becomes yours with a Learning Path that is built with key student objectives. Control what students see and when they see it. Use it as-is or match to your syllabus exactly—hide, rearrange, add, and create your own content.
- **Guide Students:** A unique learning path of relevant readings, multimedia and activities that move students up the learning taxonomy from basic knowledge and comprehension to analysis and application.
- **Promote Better Outcomes:** Empower instructors and motivate students with analytics and reports that provide a snapshot of class progress, time in course, engagement, and completion rates.

The MindTap for *Systems Analysis and Design* includes study tools, critical thinking challenges, and interactive quizzing, all integrated into an eReader that contains the full content from the printed text.

## AUTHOR'S NOTE

Systems analysis and design is a disciplined process for creating high-quality enterprise information systems. An information system is an amalgam of people, data, and technology to provide support for business functions. As technology evolves, so does systems analysis.

A systems analyst is a valued team member who helps plan, develop, and maintain information systems. Analysts must be excellent communicators with strong analytical and critical thinking skills. They must also be business-savvy and technically competent, and be equally comfortable working with managers and programmers.

With the eleventh edition of *Systems Analysis and Design*, I have striven to cover the fundamental aspects of modern systems analysis and design, including both technical and non-technical issues. By far the most significant change with the eleventh edition of this textbook has been the streamlining of subject coverage, helping students focus on the

main content quickly and easily. There is less distraction and a clearer flow of topics. That said, there is still a lot of material to cover, so students and faculty should not be surprised if they have to be judicious in their selection of topics to discuss in a typical semester.

On personal note, I would be remiss if I did not express my sincere gratitude to Harry Rosenblatt for involving me in this project several years ago. Our talks at the local coffee shop led to plans for co-authorship of the eleventh edition. Little did I know that Harry would be cruelly taken from us before work on the eleventh edition could begin. While writing this book I didn't have access to Harry's experience or wisdom to advise me, but I did have his enduring vision to guide me. Any errors or omissions in this edition of the textbook are purely my responsibility.

## PUBLISHER'S NOTE

With the eleventh edition we are thrilled to welcome Scott Tilley to The Shelly Cashman Series author team. Scott is a professor at the Florida Institute of Technology (FIT), where he is director of computing education. He has a Ph.D. from the University of Victoria. He is an ACM Distinguished Lecturer. He writes the weekly "Technology Today" column for the *Florida Today* newspaper (Gannett). In addition to this book, he is the author of *Software Testing in the Cloud: Migration & Execution* (Springer, 2012), *Hard Problems in Software Testing: Solutions Using Testing as a Service* (Morgan & Claypool, 2014), *Testing iOS Apps with Hadoop Unit: Rapid Distributed GUI Testing* (Morgan & Claypool, 2014). Scott recently taught the Systems Analysis and Design course in the College of Business at FIT and used *Systems Analysis and Design, Tenth Edition*. He incorporated his students' feedback from this offering of the course to help shape his revision of the textbook.

## ACKNOWLEDGMENTS

A book like *Systems Analysis and Design* would not be possible without the help and support of a great many people. First and foremost, I want to thank Harry Rosenblatt for providing the solid foundation upon which the eleventh edition of this textbook was built.

A very special "Thank You" to Deb Kaufmann, the textbook's development editor, whose insight and suggestions were extremely valuable. Thanks also to the reviewers who provided feedback that shaped each chapter: Melisa "Joey" Bryant, Forsyth Technical Community College; Paul Dadosky, Ivy Technical Community College; Barbara Myers, Dakota State University; and Teresa Shorter, Guilford Technical Community College.

The support of the entire production team is greatly appreciated. Thanks to Kate Mason, Alyssa Pratt, and Stacey Lamodi at Cengage Learning, and Arul Joseph Raj at Lumina Datamatics.

Finally, sincere thanks to the instructors and students who offered feedback and comments. I have tried to address your concerns and incorporate your suggestions. I will certainly continue to listen carefully. Feel free to contact me via email at [scott@srtilley.com](mailto:scott@srtilley.com).

## ABOUT OUR COVERS

The Shelly Cashman Series is continually updating our approach and content to reflect the way today's students learn and experience new technologies. This focus on student success is reflected on this textbook's cover, which features imagery informed by new technologies, such as apps and mobile devices, cloud computing, and ubiquitous networks. When you use the Shelly Cashman Series, you can be assured that you are learning computing skills using the most effective courseware available.

# PHASE

## SYSTEMS PLANNING

### DELIVERABLE

Preliminary investigation report

### TOOLKIT SUPPORT

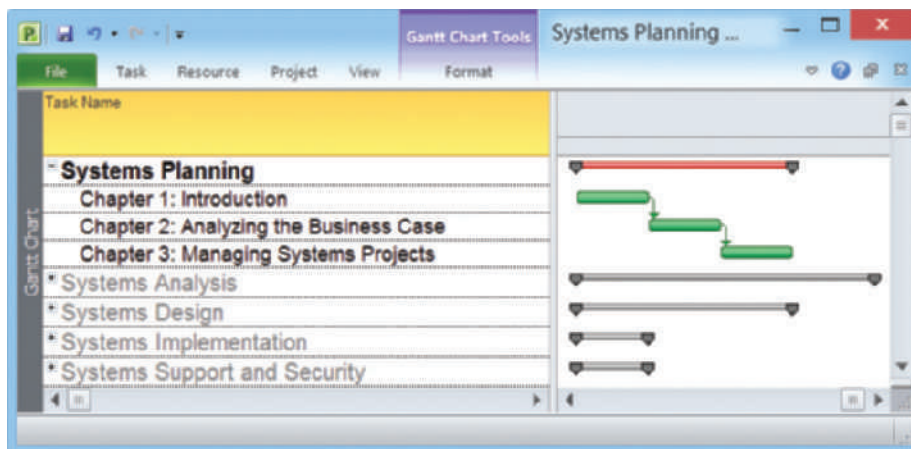
Communications and financial analysis tools



DILBERT © 2005 Scott Adams. Used By permission of UNIVERSAL UCLICK. All rights reserved.

As the Dilbert cartoon suggests, it is always a good idea to know whether a project fits the company's overall strategy. A systems project that does not align with corporate strategies should not be approved. The role of an information system is to support business goals.

Systems planning is the first of five phases in the systems development life cycle. Chapter 1 provides an introduction to systems analysis and design by describing the role of information technology in today's dynamic business environment. Chapter 2 explains how systems projects get started and how to evaluate a project proposal to determine its feasibility. Chapter 3 describes how to use project management tools and techniques, and how to plan, schedule, monitor, and report on IT projects.





## CHAPTER

# Introduction to Systems Analysis and Design

**Chapter I** is the first of three chapters in the systems planning phase. This chapter describes the role of information technology in today's dynamic business environment. This chapter describes the development of information systems, systems analysis and design concepts, and various systems development methods. This chapter also describes the role of the information technology department and its people.

The chapter includes four “Case in Point” discussion questions to help contextualize the concepts described in the text. The “Question of Ethics” invites examination of the ACM's code of ethics and those of a developing systems analyst.

## LEARNING OBJECTIVES

*When you finish this chapter, you should be able to:*

- Describe the impact of information technology
- Define systems analysis and design and the role of a systems analyst
- Define an information system and describe its components
- Explain how to use business profiles and models
- Explain Internet business strategies and relationships, including B2C and B2B
- Identify various types of information systems and explain who uses them
- Distinguish among structured analysis, object-oriented analysis, and agile methods
- Explain the waterfall model, and how it has evolved
- Discuss the role of the information technology department and the systems analysts who work there

## CHAPTER CONTENTS

- 1.1** Introduction
- 1.2** What Is Information Technology?  
Case in Point 1.1: Cloud Nine Financial Advisors
- 1.3** Information System Components
- 1.4** Business Today
- 1.5** Modeling Business Operations
- 1.6** Business Information Systems
- 1.7** What Information Do Users Need?
- 1.8** Systems Development Tools
- 1.9** Systems Development Methods
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Case in Point 1.4: Just-in-Time Airfreight, Inc.
- 1.12** Trends in Information Technology  
A Question of Ethics
- 1.13** Chapter Summary  
Key Terms  
Chapter Exercises



## 1.2 What Is Information Technology?

### 1.1 INTRODUCTION

The headlines in Figure 1-1 offer dramatic examples of how information technology affects our society. Companies use information as a way to increase productivity, deliver quality products and services, maintain customer loyalty, and make sound decisions. In a global economy with intense competition, information technology can mean the difference between success and failure.

### 1.2 WHAT IS INFORMATION TECHNOLOGY?

**Information technology (IT)** refers to the combination of hardware, software, and services that people use to manage, communicate, and share information. Although fictitious, the bold headlines in Figure 1-1 illustrate the huge impact of IT on our society.

More than ever, business success depends on information technology. IT is driving a new digital economy, where advances in hardware, software, and connectivity can provide enormous benefits to businesses and individuals. Although economic trends affect IT spending levels, most companies give IT budgets a high priority, in good times or bad. The reason is simple: During periods of growth, companies cannot afford to lag behind the IT curve. Conversely, when the economy slows down, firms often use IT to reduce operating costs and improve efficiency.

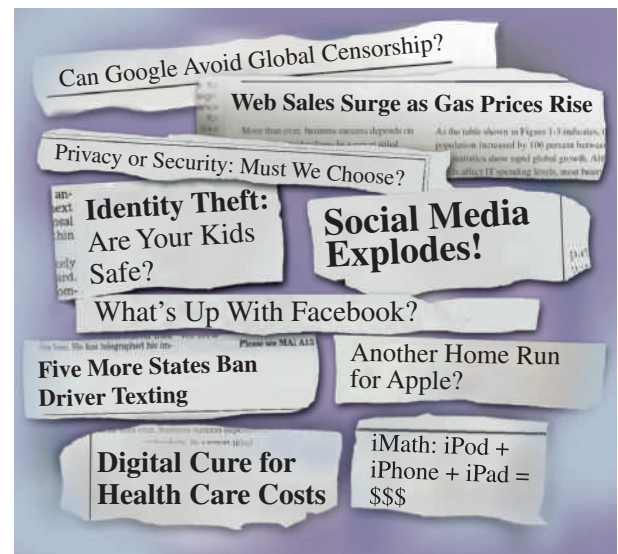
The following sections provide a sense of IT history, an overview of systems analysis and design, and a description of the system analyst's role.

#### 1.2.1 The Changing Nature of Information Technology

The history of IT is a fascinating study of human progress and achievement. We are dazzled by the latest and greatest technology, just as our parents and grandparents were astonished by the arrival of television, space flight, and personal computing. It is important for IT professionals, who live and work in this exciting world, to realize that each technology advance is part of a long-term process that often brings dramatic change, but never really ends. The story of IBM is a good example.

As its name suggests, International Business Machines was a major supplier of office equipment and typewriters long before the modern computer era. Herman Hollerith, who invented a card that identified characters by the location of punched holes, founded IBM's predecessor company in 1896. A deck of hundreds or even thousands of these cards could store data that was easily sorted, queried, and printed by machines. This system sounds archaic now, but punch card technology was a huge advance that revolutionized the business world, and was in use into the 1960s and beyond.

Today, IBM is a globe-spanning company with several hundred thousand employees. It has succeeded in part by constantly adapting to its changing business environment. For example, while it was once known primarily as a hardware company, today IBM makes a significant part of its revenue from software and services. It also invests



**FIGURE 1-1** These headlines illustrate the enormous impact of information technology on our lives.



**FIGURE 1-2** An employee clocking in with a punch card in 1953.

ClassicStock.com/Superstock

in its people and tries to hire the best talent available. It has more patents and more Noble Prize winners than any other IT company in history.

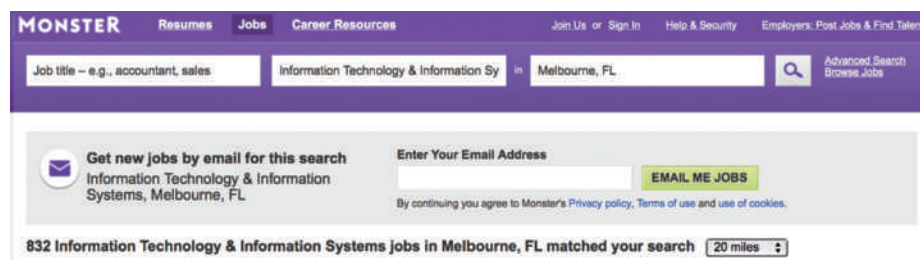
Figure 1-2 shows an employee clocking in with a punch card in 1953. Nowadays, most forward-thinking IT firms do not require their employees to “punch in” at all. Working from home, “hoteling” using random offices as needed, and global contracting has dramatically changed the definition of “being at work.” No doubt future students will view our current technology the same way we smile at punched cards.

### 1.2.2 Systems Analysis and Design

**Systems analysis and design** is a step-by-step process for developing high-quality information systems. An **information system** combines technology, people, and

data to provide support for business functions such as order processing, inventory control, human resources, accounting, and many more. Some information systems handle routine day-to-day tasks, while others can help managers make better decisions, spot marketplace trends, and reveal patterns that might be hidden in stored data.

Talented people, including a mix of managers, users, network administrators, web designers, programmers, and systems analysts, typically develop information systems. Capable IT professionals like these are always in demand, even in a slow economy. For example, notice how many positions related to information technology and information systems are available in the Melbourne, Florida area, as shown on Monster.com’s job search website in Figure 1-3.



**FIGURE 1-3** Monster.com is an example of an online job search website that IT professionals can use.

Source: Monster.com

### 1.2.3 What Does a Systems Analyst Do?

A **systems analyst** is a valued member of the IT department team who helps plan, develop, and maintain information systems. Analysts must be excellent communicators with strong analytical and critical thinking skills. Because systems analysts

### 1.3 Information System Components

transform business requirements into IT projects, they must be business-savvy as well as technically competent, and be equally comfortable with managers and programmers, who sometimes have different points of view.

Most companies assign systems analysts to the IT department, but analysts also can report to a specific user area such as marketing, sales, or accounting. As a member of a functional team, an analyst is better able to understand the needs of that group and how IT supports the department's mission. Smaller companies often use consultants to perform systems analysis work on an as-needed basis.

On any given day, an analyst might be asked to document business processes, test hardware and software packages, design input screens, train users, and plan e-commerce websites. A systems analyst may occasionally manage IT projects, including tasks, resources, schedules, and costs. To keep managers and users informed, the analyst conducts meetings, delivers presentations, and writes memos, reports, and documentation.

The last section in this chapter lists typical skills and education requirements, certifications, career opportunities, and the possible impact of future IT trends for systems analysts.

## CASE IN POINT 1.1: CLOUD NINE FINANCIAL ADVISORS

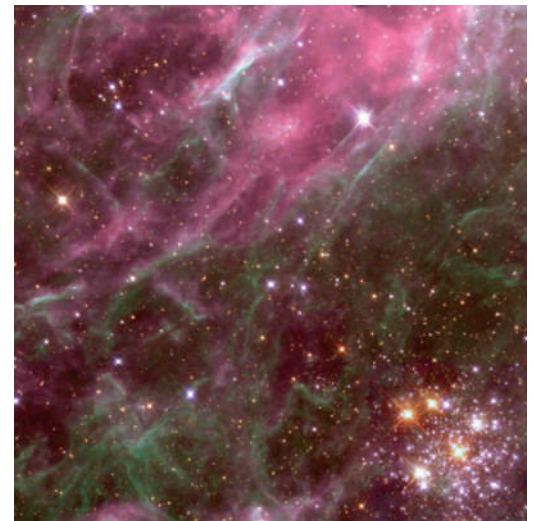
Cloud Nine provides its clients with a monthly newsletter that offers recommendations about stocks to buy or sell. Doug Layton, Cloud Nine's president, has asked your opinion on whether dot-com stocks might be good investments for the future. He specifically mentioned Google, eBay, Amazon.com, and Yahoo!, but he said you could suggest other companies. Doug wants you to do some Internet research to learn more about these web-based companies and their future prospects. You can use a search engine or start by visiting the websites of publications such as *Forbes*, *Fortune Magazine*, *Business Week*, or *The Wall Street Journal*, among others.

### 1.3 INFORMATION SYSTEM COMPONENTS

A **system** is a set of related components that produces specific results. For example, specialized systems route Internet traffic, manufacture microchips, and control complex entities like the Hubble Telescope, which took the amazing image shown in Figure 1-4. A **mission-critical system** is one that is vital to a company's operations. An order processing system, for example, is mission-critical because the company cannot do business without it.

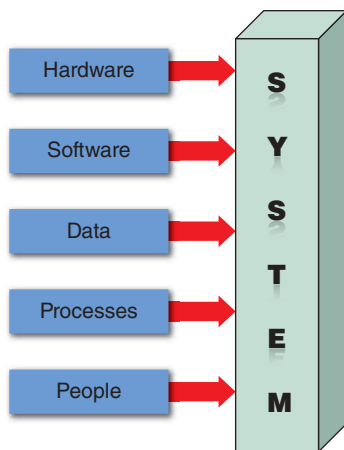
Every system requires input data. For example, a computer receives data when a key is pressed or when a menu command is selected. In an information system, **data** consists of basic facts that are the system's raw material. **Information** is data that has been transformed into output that is valuable to users.

An information system has five key components, as shown in Figure 1-5: hardware, software, data, processes, and people.



**FIGURE 1-4** Consider the amazing technology that enabled the Hubble telescope to capture this image.  
Courtesy of The Hubble Heritage Team (AURA/STScI/NASA)





**FIGURE I-5** An information system needs these components.

### 1.3.1 Hardware

**Hardware** consists of everything in the physical layer of the information system. For example, hardware can include servers, workstations, networks, telecommunications equipment, fiber-optic cables, mobile devices, scanners, digital capture devices, and other technology-based infrastructure. A large concentration of servers working together is called a **server farm**. As new technologies emerge, manufacturers race to market the innovations and reap the rewards.

Hardware purchasers today face a wide array of technology choices and decisions. In 1965, Gordon Moore, a cofounder of Intel, predicted that the number of transistors on an integrated circuit chip would double about every 24 months. His concept, called **Moore's Law**, has remained valid for 50 years. Fortunately, as hardware became more powerful, it also became much less expensive. Large businesses with thousands or millions of sales transactions require company-wide information systems and powerful servers, which are often now in the cloud, such as those shown in Figure 1-6.



**FIGURE I-6** Server farms provide the enormous power and speed that modern IT systems need.

dotshock/Shutterstock.com

### 1.3.2 Software

**Software** refers to the programs that control the hardware and produce the desired information or results. Software consists of system software and application software.

**System software** manages the hardware components, which can include a single computer or a global network with many thousands of clients. Either the hardware manufacturer supplies the system software or a company purchases it from a vendor. Examples of system software include the operating system, security software that protects the computer from intrusion, device drivers that communicate with hardware

## 1.3 Information System Components

such as printers, and utility programs that handle specific tasks such as data backup and disk management. System software also controls the flow of data, provides data security, and manages network operations. In today's interconnected business world, network software is vitally important.

**Application software** consists of programs that support day-to-day business functions and provide users with the information they need. Examples of company-wide applications, called **enterprise applications**, include order processing systems, payroll systems, and company communications networks. On a smaller scale, individual users can boost productivity with tools such as spreadsheets, presentation software, and database management systems.

Application software includes horizontal and vertical systems. A **horizontal system** is a system, such as an inventory or a payroll application, that can be adapted for use in many different types of companies. A **vertical system** is designed to meet the unique requirements of a specific business or industry, such as an online retailer, a medical practice, or an auto dealership.

Most companies use a mix of software that is acquired at various times. When planning an information system, a company must consider how a new system will interface with older systems, which are called **legacy systems**. For example, a new human resources system might need to exchange data with a legacy payroll application.

### 1.3.3 Data

Data is the raw material that an information system transforms into useful information. An information system can store data in various locations, called tables. By linking the tables, the system can display the specific information that the user needs—no more, and no less. Figure 1-7 shows a payroll system that stores data in four separate tables. Notice that the linked tables work together to supply 19 different data items to the screen. A user can display any or all data items and filter the data to fit defined limits. In this example, the user requested a list of employees who live in a certain city and worked more than 40 hours in the last pay period. Jane Doe's name was the first to display.

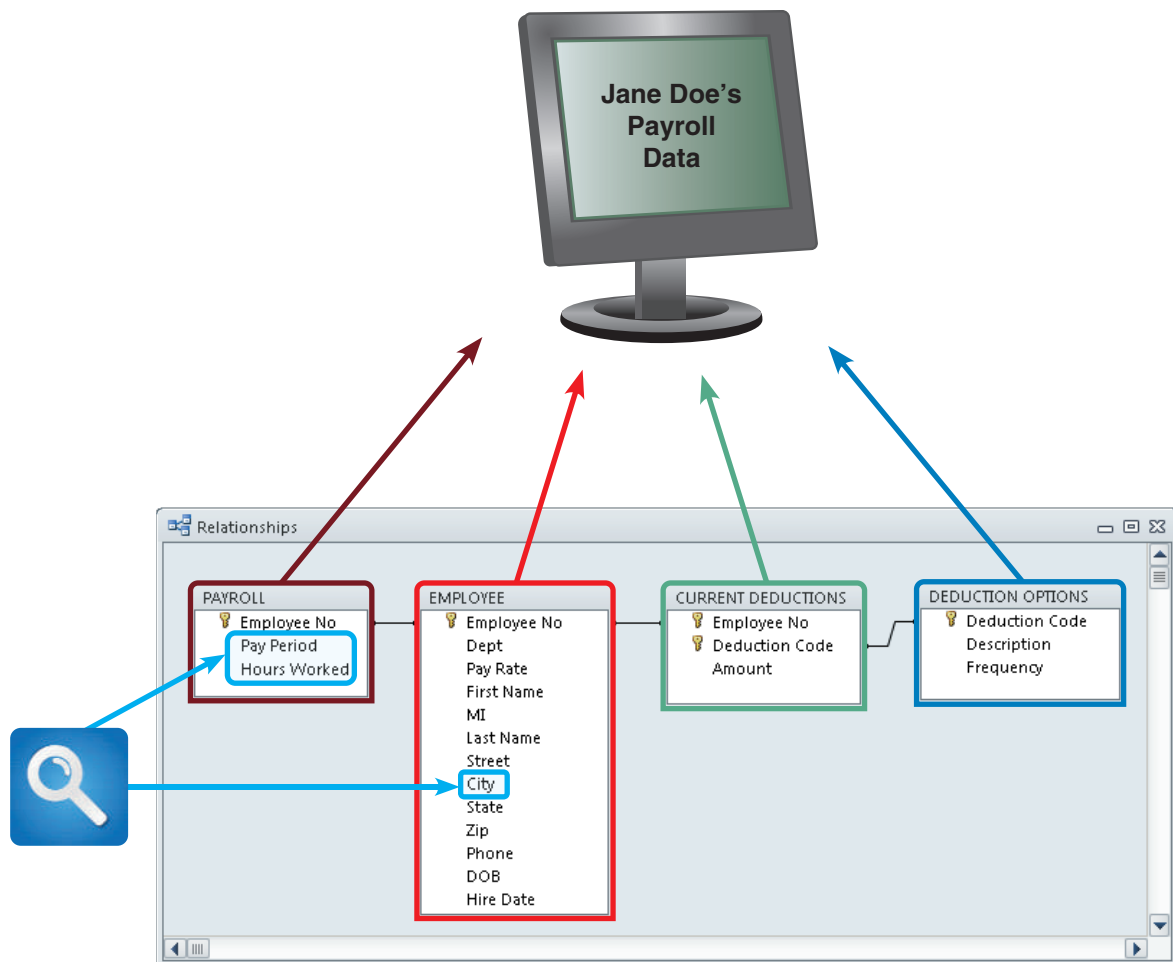
### 1.3.4 Processes

**Processes** describe the tasks and business functions that users, managers, and IT staff members perform to achieve specific results. Processes are the building blocks of an information system because they represent actual day-to-day business operations. To build a successful information system, analysts must understand business processes and document them carefully.

### 1.3.5 People

People who have an interest in an information system are called **stakeholders**. Stakeholders include the management group responsible for the system, the **users** (sometimes called end users) inside and outside the company who will interact with the system, and IT staff members, such as systems analysts, programmers, and network administrators who develop and support the system.

Each stakeholder group has a vital interest in the information system, but most experienced IT professionals agree that the success or failure of a system usually depends on whether it meets the needs of its users. For that reason, it is essential to understand user requirements and expectations throughout the development process.



**FIGURE 1-7** In a typical payroll system, data is stored in separate tables that are linked to form an overall database.

## 1.4 BUSINESS TODAY

To design successful systems, systems analysts must understand a company's business operations. Each situation is different. For example, a retail store, a medical practice, and a hotel chain all have unique information systems requirements. As the business world changes, systems analysts can expect to work in new kinds of companies that will require innovative IT solutions.

Business today is being shaped by three major trends: rapidly increasing globalization, technology integration for seamless information access across a wide variety of devices such as laptops and smartphones, and the rapid growth of cloud-based computing and software services. These trends are being driven by the immense power of the Internet.

### 1.4.1 The Internet Model

Internet-based commerce is called **ecommerce (electronic commerce)**. Internet-based systems involve various hardware and software designs, but a typical model is a series of webpages that provides a user interface, which communicates with database management software and a web-based data server. On mobile devices, the user interacts

with the system with an **app**, but the same back-end services are accessed. As Internet-based commerce continues to grow, career opportunities will expand significantly for IT professionals such as web designers, database developers, and systems analysts.

Ecommerce includes two main sectors: **B2C (business-to-consumer)** and **B2B (business-to-business)**. Within these broad categories, competition is dynamic, extreme, and global. Every day brings new ideas, new players, and new ways to involve customers, suppliers, and hordes of social network participants. The following sections discuss this rapidly changing environment.

### **I.4.2 B2C (Business-to-Consumer)**

Using the Internet, consumers can go online to purchase an enormous variety of products and services. This new shopping environment allows customers to do research, compare prices and features, check availability, arrange delivery, and choose payment methods in a single convenient session. Many companies, such as airlines, offer incentives for online transactions because web-based processing costs are lower than traditional methods. By making flight information available online to last-minute travelers, some airlines also offer special discounts on seats that might otherwise go unfilled.

B2C commerce is changing traditional business models and creating new ones. For example, a common business model is a retail store that sells a product to a customer. To carry out that same transaction on the Internet, the company must develop an online store and deal with a totally different set of marketing, advertising, and profitability issues.

Some companies have found new ways to use established business models. For example, eBay.com has transformed a traditional auction concept into a popular and successful method of selling goods and services. Other retailers seek to enhance the online shopping experience by offering gift advisors, buying guides, how-to clinics, and similar features. In the ecommerce battles, the real winners are online consumers, who have more information, better choices, and the convenience of shopping at home.

### **I.4.3 B2B (Business-to-Business)**

Although the business-to-consumer (B2C) sector is more familiar to retail customers, the volume of business-to-business (B2B) transactions is many times greater. Industry observers predict that B2B sales will increase sharply as more firms seek to improve efficiency and reduce costs.

Initially, electronic commerce between two companies used a data sharing arrangement called **electronic data interchange (EDI)**. EDI enabled computer-to-computer data transfer, usually over private telecommunications lines. Firms used EDI to plan production, adjust inventory levels, or stock up on raw materials using data from another company's information system. As B2B volume soared, company-to-company transactions migrated to the Internet, which offered standard protocols, universal availability, and low communication costs. The main advantage of the web is that it offers seamless communication between different hardware and software environments, anywhere and anytime.

Because it allows companies to reach the global marketplace, B2B is especially important to smaller suppliers and customers who need instant information about prices and availability. In an approach that resembles an open marketplace, some B2B sites invite buyers, sellers, distributors, and manufacturers to offer products, submit specifications, and transact business.