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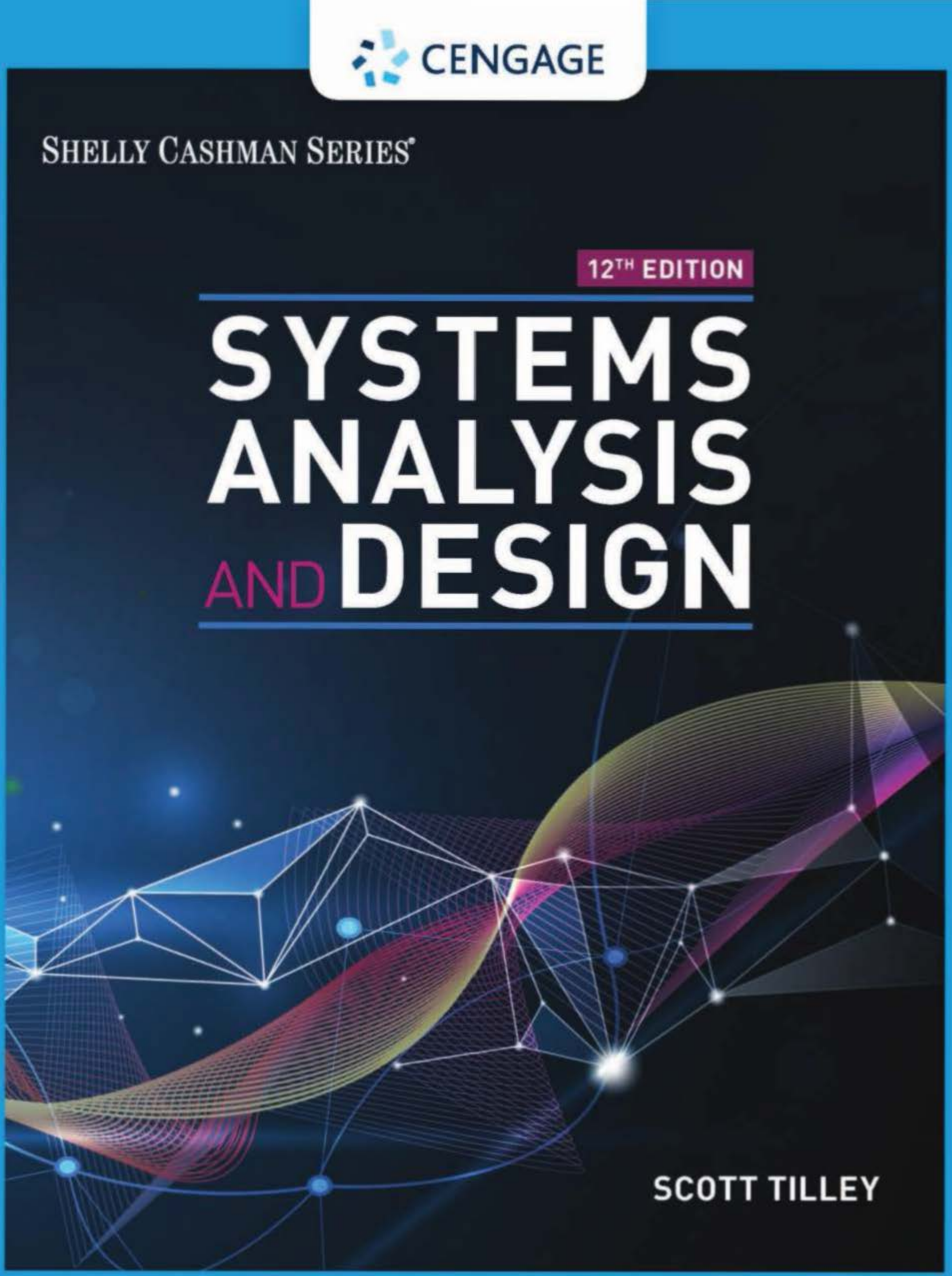
SHELLY CASHMAN SERIES®

12TH EDITION

SYSTEMS ANALYSIS AND DESIGN



SCOTT TILLEY

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12TH EDITION

SYSTEMS ANALYSIS AND DESIGN

CENGAGE

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Systems Analysis and Design, Twelfth Edition
Scott Tilley

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DEDICATION

To all of my students – past, present, and future

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PREFACE

The Shelly Cashman Series® offers the finest texts in computer 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, 12th 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 text will help prepare them for those roles.

Overview

Systems Analysis and Design, 12th edition offers a practical, streamlined, and updated approach to information systems development. 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. The book emphasizes the role of the systems analyst in a dynamic, business-related environment. 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, technically competent, and be equally comfortable working with managers and programmers. Throughout the book, real-world examples emphasize critical thinking and IT skills.

Many two- and four-year colleges and schools use this book in information systems and computer science curriculums. The 12th edition includes expanded coverage of emerging technologies, such as agile methods, cloud computing, and mobile applications. This new material complements 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 strategic objectives. Case studies and assignments teach analytical reasoning, critical thinking, and problem-solving skills. Numerous projects, assignments, and end-of-chapter exercises are provided, along with detailed instructor support material.

Objectives of This Text

Systems Analysis and Design, 12th edition is intended for a three credit-hour introductory systems analysis and design course. This text is designed to:

- explain systems analysis and design using an appealing full-color format, numerous screenshots and illustrations, and an easy-to-read style that invites students to learn.
- introduce project management concepts early in the systems development process.
- 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, 12th edition offers these exciting new and updated features:

- Reexamined structure and subject coverage to ensure students can identify and focus on the main content readily. Confirmed that related content has been aligned under comprehensive section headings to maintain a clear flow of topics and reduce distraction.
- A renewed emphasis on aligning learning objectives with chapter content and assessments. The learning objectives have been updated and carefully reworded so that instructors know what to focus on, and students know what is expected of them. The questions, discussion topics, and projects have all been updated to better assess student mastery of the material.
- Updated or replaced many *Case in Point* mini-cases to ensure learners are exposed to relevant and current examples of real-world business applications of key concepts.
- 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.
- Updated screenshots to Microsoft Office 2019 products and Visible Analyst 2016.

Organization of This Text

Systems Analysis and Design, 12th edition contains 12 chapters that teach valuable cross-functional skills. The chapters are organized into five phases: planning, analysis, design, implementation, and support and security. A four-part Systems Analyst's Toolkit, now available as an online appendix, reflects the most recent changes in today's systems analysis tools and also includes invaluable resources. Cross-functional toolkits provide students with the basic skills sought after by organizations hiring systems analysts.

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 Engineering:** Chapter 4 describes the requirements engineering 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 changeover.

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 retirement.

Online Appendix: The Systems Analyst's Toolkit

- **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.

FEATURES

CHAPTER LEARNING TOOLS AND HOW THEY WILL HELP YOU

Case In Point: Each chapter includes three brief cases that provide a contextual business example for students focused on the key issues covered in the chapter.

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: The chapter exercises are directly related to the learning objectives. Your answers to the 10 questions will show that you understand the key points. Five discussion topics and five projects offer opportunities to dig deeper and learn even more.

MINDTAP FOR SYSTEMS ANALYSIS AND DESIGN

MindTap for *Systems Analysis and Design, 12th edition* is a personalized, fully online, digital learning platform of content, assignments, and services that engages students and encourages them to think critically while allowing instructors to easily set their course through simple customization options.

MindTap is designed to help students master the skills they need in today's workforce. Research shows employers need critical thinkers, troubleshooters, and creative problem-solvers to stay relevant in our fast paced, technology-driven world. MindTap helps students achieve this with assignments and activities that provide hands-on practice and real-life relevance. They are guided through assignments that help them master basic knowledge and understanding before moving on to more challenging problems.

MindTap is designed around learning objectives and provides the analytics and reporting to easily see where the class stands in terms of progress, engagement, and completion rates. Students can access eBook content in the MindTap Reader, which offers highlighting, note-taking, search and audio, and mobile access. Learn more at www.cengage.com/mindtap.

ConceptClips: ConceptClip videos focus learners on a key concept in each chapter and are designed to deepen their understanding of the topic.

Running Case: Based on feedback from readers and instructors, we've created a new running case to replace the SCR Case from previous editions. The case challenges learners to apply key systems analysis and design concepts and skills to a realistic scenario they would encounter in the workplace. The case brings the key concepts and skills of the chapter together in an authentic assignment. The look and feel of the case tool has also been updated to be an authentic, immersive experience for students.

INSTRUCTOR RESOURCES

We are dedicated to providing you all the tools you need to make your class a success. Information on all supplementary materials can be found on the password-protected website at *login.cengage.com*. If you need help accessing this page, please contact your Cengage representative.

The Instructor Resources include the following:

- **Online Appendix: The Systems Analyst's Toolkit:** A 4-part online appendix reflects the most recent changes in today's systems analysis tools.

- **Instructor's Manual:** Contains lecture notes summarizing the chapter sections, figures and boxed elements found in every chapter, teacher tips, classroom activities, and quick quizzes in Microsoft Word files.
- **PowerPoint Presentations:** A multimedia lecture presentation system provides slides for each chapter, based on chapter objectives.
- **Figure Files:** Illustrations for every figure in the text in electronic form.
- **Solutions to Exercises:** Includes solutions for end-of-chapter exercises.
- **Test Bank and Test Engine:** Test banks include questions for every chapter, 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.

ABOUT THE AUTHOR

With the 12th edition, Scott Tilley becomes the sole author of *Systems Analysis and Design* in the Shelly Cashman Series. Dr. Tilley is an emeritus professor at the Florida Institute of Technology, president and founder of the Center for Technology & Society, president and co-founder of Big Data Florida, president of the Space Coast chapter of the International Council of Systems Engineering (INCOSE), and a Space Coast Writers' Guild Fellow. In addition to this book, he is the author or editor of numerous other publications, including *Software Testing in the Cloud: Migration & Execution* (Springer, 2012), *Testing iOS Apps with Hadoop Unit: Rapid Distributed GUI Testing* (Morgan & Claypool, 2014), *The Vicious Swans (And Other Tall Tales)* (Precious Publishing, 2017), *Dreams* (Anthology Alliance, 2018), and *Technical Justice* (CTS Press, 2019). He wrote the weekly "Technology Today" column for Florida Today (Gannett) from 2010 to 2018. He holds a Ph.D. in computer science from the University of Victoria.

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A book like *Systems Analysis and Design* would not be possible without the help and support of a great many people, both past and present. Harry Rosenblatt's contributions to previous editions of the book provided the foundation for the current edition. His foresight made updating the material much easier than it might otherwise have been.

Textbooks these days are much more than just printed books; they are educational platforms that have many moving parts. This means putting together an updated edition of a book like this, particularly on an aggressive schedule, is a challenge. I'm pleased to say that the entire production team rose to the occasion. Thanks to Jaymie Falconi, Michele Stulga, Emily Pope, and Maria Garguilo at Cengage for all of their help. Thanks to John Freitas for providing new screenshots of programs and applications. Any errors or omissions in this edition of the text are purely my responsibility.

Finally, sincere thanks to the instructors and students who offered feedback and comments. We have tried to address your concerns and incorporate your suggestions. As this field is constantly evolving, we strongly encourage your participation in helping us provide the freshest, most relevant information possible. We will certainly continue to listen carefully. If you have any questions or comments, please contact us through your local representative.

PHASE | SYSTEMS PLANNING

DELIVERABLE
Preliminary investigation report

Systems planning is the first of five phases in the systems development life cycle. It's 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.

Chapter 1 focuses on an introduction to systems analysis and design by describing the role of information technology in today's dynamic business environment. This includes information systems, Internet business strategies, modeling business operations, business information systems, organizational information models, systems development, the information technology department, and the role of the systems analyst.

Chapter 2 focuses on analyzing the business case, explains how systems projects get started, and describes how to evaluate a project proposal to determine its feasibility. This includes strategic planning and strategic planning tools, the business case, systems requests, factors affecting systems projects, processing systems requests, assessing request feasibility, setting priorities, and the preliminary investigation.

Chapter 3 focuses on managing systems projects. This includes an overview of project management, creating a work breakdown structure, task patterns, the critical path, project monitoring and control, reporting, project management software, risk management, and managing for success.

CHAPTER 1

Introduction to Systems Analysis and Design

Chapter 1 is the first of three chapters in the systems planning phase. This chapter explains 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 summarizes the role of the information technology department and its people in the enterprise.

The chapter includes three "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:

1. Describe the impact of information technology on society
2. Describe the five main components of an information system
3. Explain Internet business strategies and relationships, including B2C and B2B
4. Explain how to use business profiles and models
5. Understand the seven types of information systems used in business
6. Describe the types of information the four classes of users need
7. Distinguish among structured analysis, object-oriented analysis, and agile systems development methods
8. List the tools that enable the systems analyst to develop, manage, and maintain large-scale information systems
9. Explain the seven main functions of the information technology department
10. Describe the roles and responsibilities of a systems analyst within the enterprise

CONTENTS

1.1 Information Technology

Information technology (IT) refers to the combination of hardware, software, and services that people use to manage, communicate, and share information. 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.

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.

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

Information technology also has profound influence on modern life. Although fictitious, the headlines in Figure 1-1 offer dramatic examples of how information technology issues such as data privacy, mobile devices, and social media affects our society. We live in a world where we can be traced, analyzed, and surveilled without our knowledge. This raises many important questions, such as how to secure personal data while still providing useful functionality and business value.

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

1.1.1 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 in its people and tries to hire the best talent available. The result is that IBM has more patents and more Noble Prize winners than any other IT company in history.

1.1.2 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 1-2.

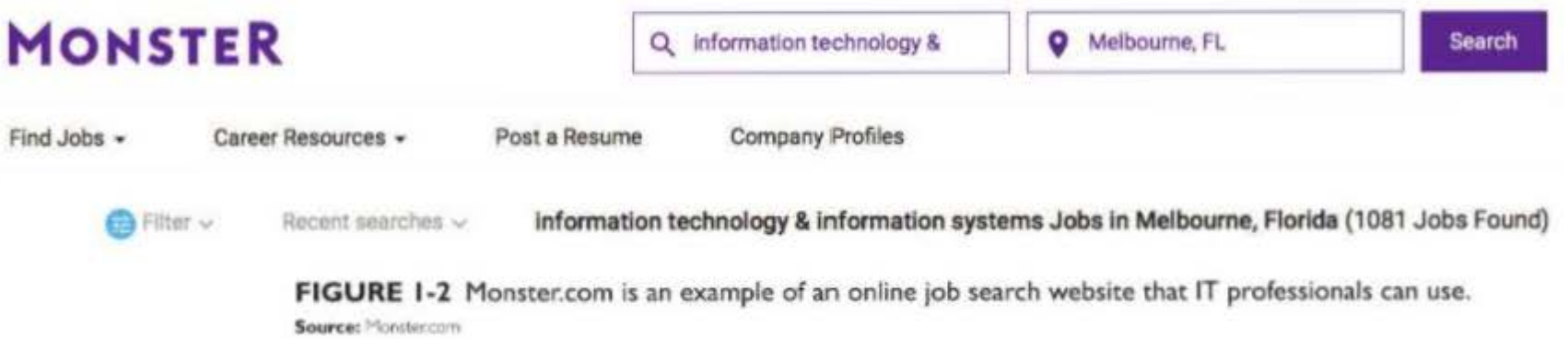

FIGURE 1-2 Monster.com is an example of an online job search website that IT professionals can use.
Source: Monster.com

1.1.3 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 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 can also 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.

Section 1.9 lists typical skills and education requirements, certifications, career opportunities, and the possible impact of future IT trends for systems analysts.

1.2 Information Systems

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 1-3. 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 1-4: hardware, software, data, processes, and people.

FIGURE 1-3 Consider the amazing technology that enabled the Hubble telescope to capture this image.

Source: Courtesy of the Hubble Heritage Team (AURA/STScI/NASA)

1.2.1 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 networked computers working together is called a **data center**. 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 over 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 1-5.

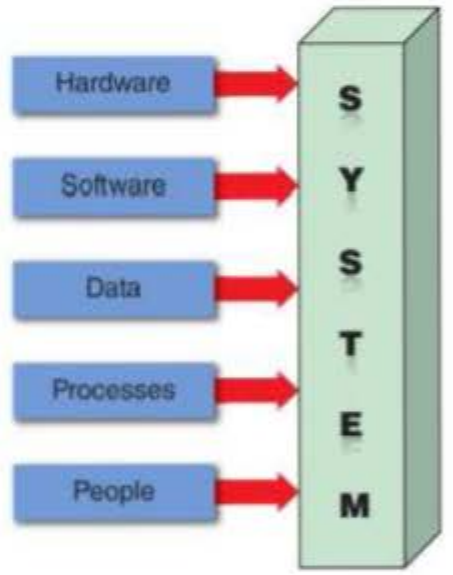

FIGURE 1-4 An information system needs these components.

1.2.2 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 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.

FIGURE 1-5 Cloud computing provides the enormous storage and speed that modern IT systems need.
Oleksiy Mark/Shutterstock.com

Application software includes horizontal and vertical systems. A **horizontal system** is a system, such as an inventory or 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.

1.2.3 Data

Data is the raw material that an information system transforms into useful information. For example, an information system using a relational database 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 1-6 shows a payroll system that stores data in four separate tables. Notice that the linked tables work together to supply 19 different data items. 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.

The growth of **big data** has given rise to new ways of storing, searching, and managing data. Traditional relational models are still used, but so-called **NoSQL databases** are gaining in popularity due to their ability to scale to extremely large and unstructured datasets.

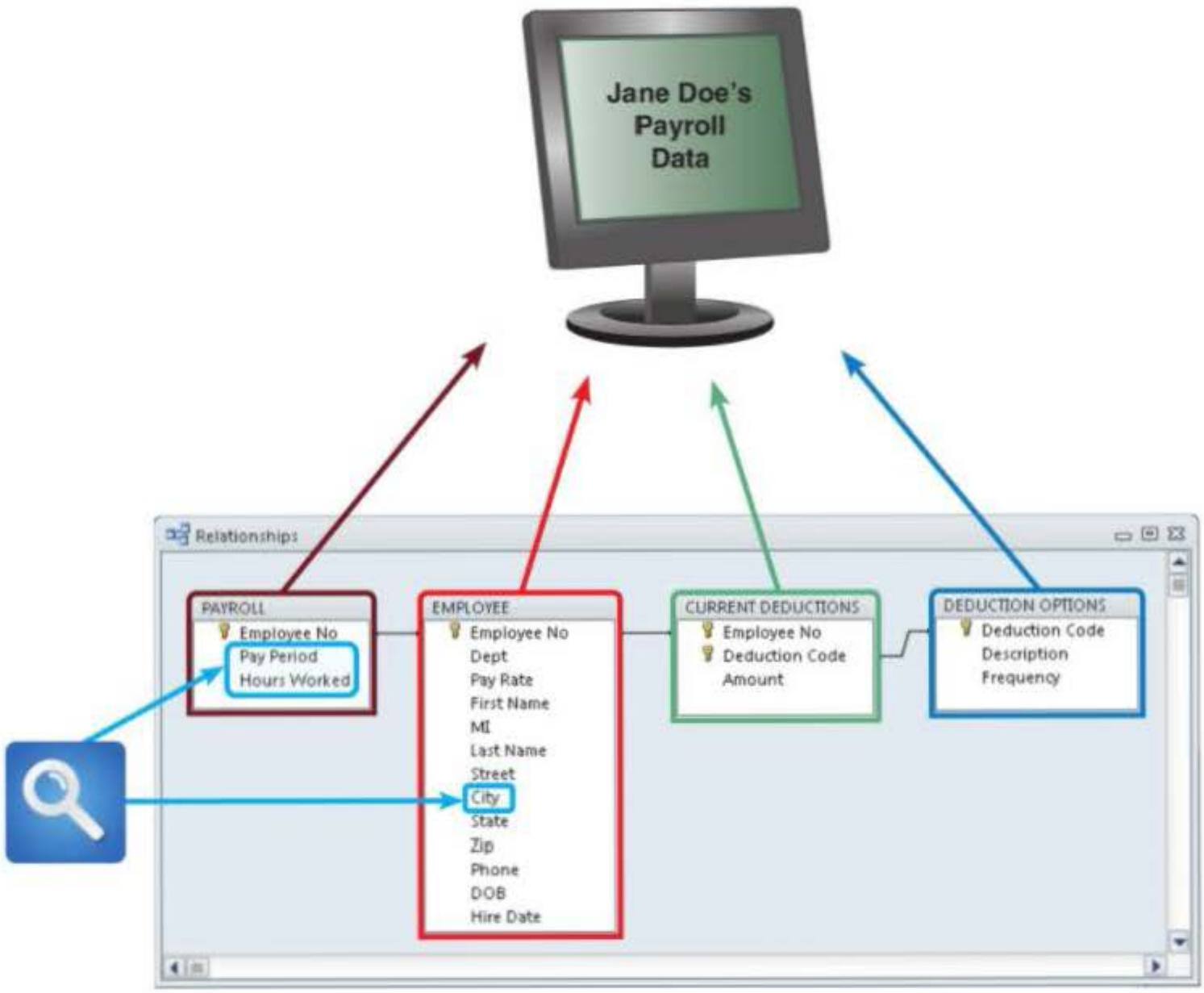

FIGURE 1-6 In a typical payroll system using a relational model, data is stored in separate tables that are linked to form an overall database.

1.2.4 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.

1.2.5 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.

CASE IN POINT 1.1: Data Breaches

A data breach occurs when a hacker gains illegal access to a system and steals personal data, such as credit card numbers or home addresses. With more of our information stored in the cloud, data breaches are becoming increasingly common. Research recent news articles about large-scale data breaches, summarize why they occurred, and suggest how they might be prevented in the future.

1.3 Internet Business Strategies

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.

1.3.1 The Internet Model

Internet-based commerce is called e-commerce (electronic commerce). Internet-based systems involve various hardware and software designs, but a typical model is a series of web pages 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.

1.3.2 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 (business-to-consumer) 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, Airbnb and VRBO have transformed the traditional hospitality service industry into a popular and successful way for individuals to rent their properties. Other retailers seek to enhance the online shopping experience by offering gift advisors, buying guides, how-to clinics, and similar features. In the e-commerce battles, the real winners are online consumers, who have more information, better choices, and the convenience of shopping at home.

1.3.3 B2B (Business-to-Business)

Although the business-to-consumer (B2C) sector is more familiar to retail customers, the volume of **B2B (business-to-business)** 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.

Most large firms and government agencies use **supply chain management (SCM)** software. A **supply chain** refers to all the companies who provide materials, services, and functions needed to provide a product to a customer. For example, a Sherwin-Williams customer who buys a gallon of paint is at the end of a chain that includes the raw material sources, packaging suppliers, manufacturers, transporters, warehouses, and retail stores. Because SCM is complex and dynamic, specialized software helps businesses manage inventory levels, costs, alternate suppliers, and much more.

1.4 Modeling Business Operations

Systems analysts use modeling to represent company operations and information needs. **Modeling** produces a graphical representation of a concept or process that systems developers can analyze, test, and modify. A systems analyst can describe and simplify an information system by using a set of business, data, object, network, and process models.

A **business profile** is an overview of a company's mission, functions, organization, products, services, customers, suppliers, competitors, constraints, and future direction. Although much of this information is readily available, a systems analyst usually needs to do additional research and fact-finding to fill out missing or incomplete information. A business profile is the starting point for the modeling process, and a systems analyst can describe and simplify an information system by using a set of business models and business process models.

A **business model** describes the information that a system must provide. Analysts also create models to represent data, objects, networks, and other system components. Although the models might appear to overlap, they actually work together to describe the same environment from different points of view.

Business process modeling involves a business profile and a set of models that document business operations. **Model-based systems engineering (MBSE)** is one of the leading methods used by systems analysts to develop information systems.

A **business process** is a specific set of transactions, events, and results that can be described and documented. A **business process model (BPM)** graphically displays one or more business processes, such as handling an airline reservation, filling a product order, or updating a customer account. The sales order example in Figure 1-7 shows a simple model that includes an event, three processes, and a result.

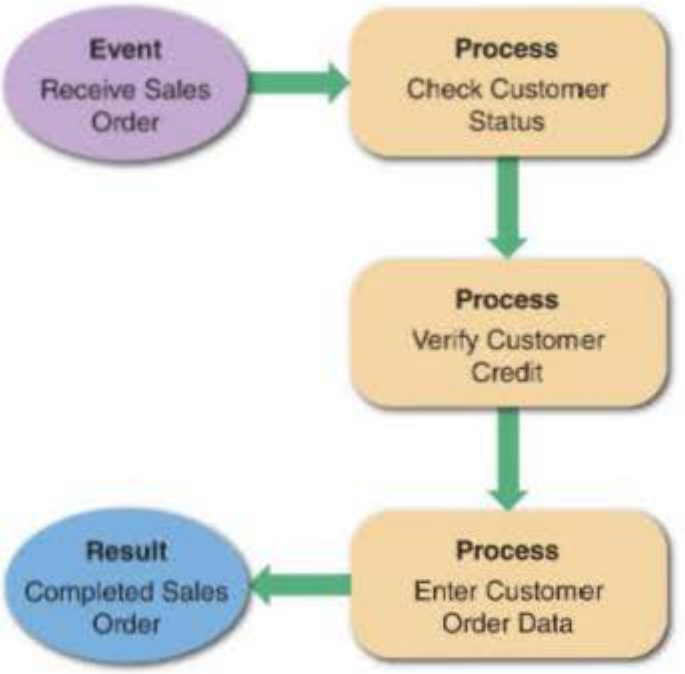

FIGURE 1-7 A simple business model might consist of an event, three processes, and a result.

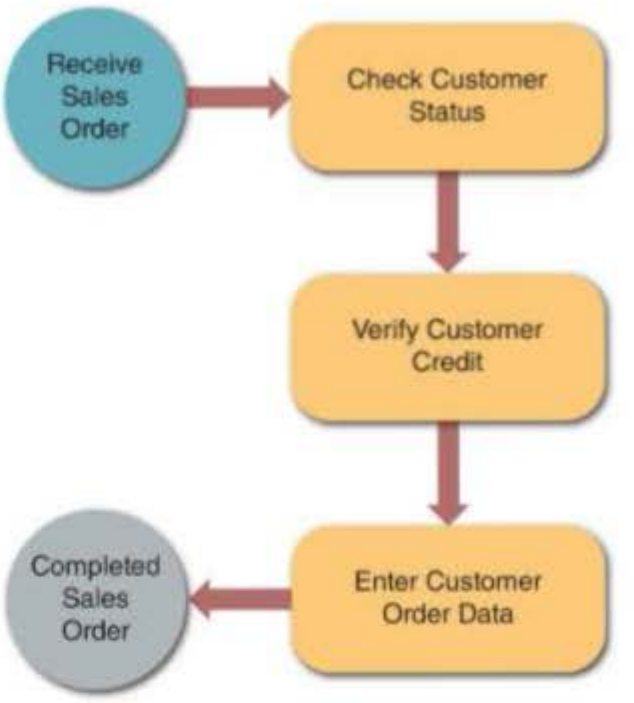

FIGURE 1-8 This sample uses business process modeling notation (BPMN) to represent the same events, processes, and workflow shown in Figure 1-7.

Source: Drawio.com

A rough sketch might be sufficient to document a simple business process. For complex models, analysts can choose computer-based tools that use **business process modeling notation (BPMN)**. BPMN includes standard shapes and symbols to represent events, processes, workflows, and more. Multipurpose application such as Microsoft Visio or online diagramming tools such as draw.io can be used to create BPMN models. Notice that the draw.io model in Figure 1-8 uses BPMN symbols to represent the same sales order process shown in Figure 1-7.

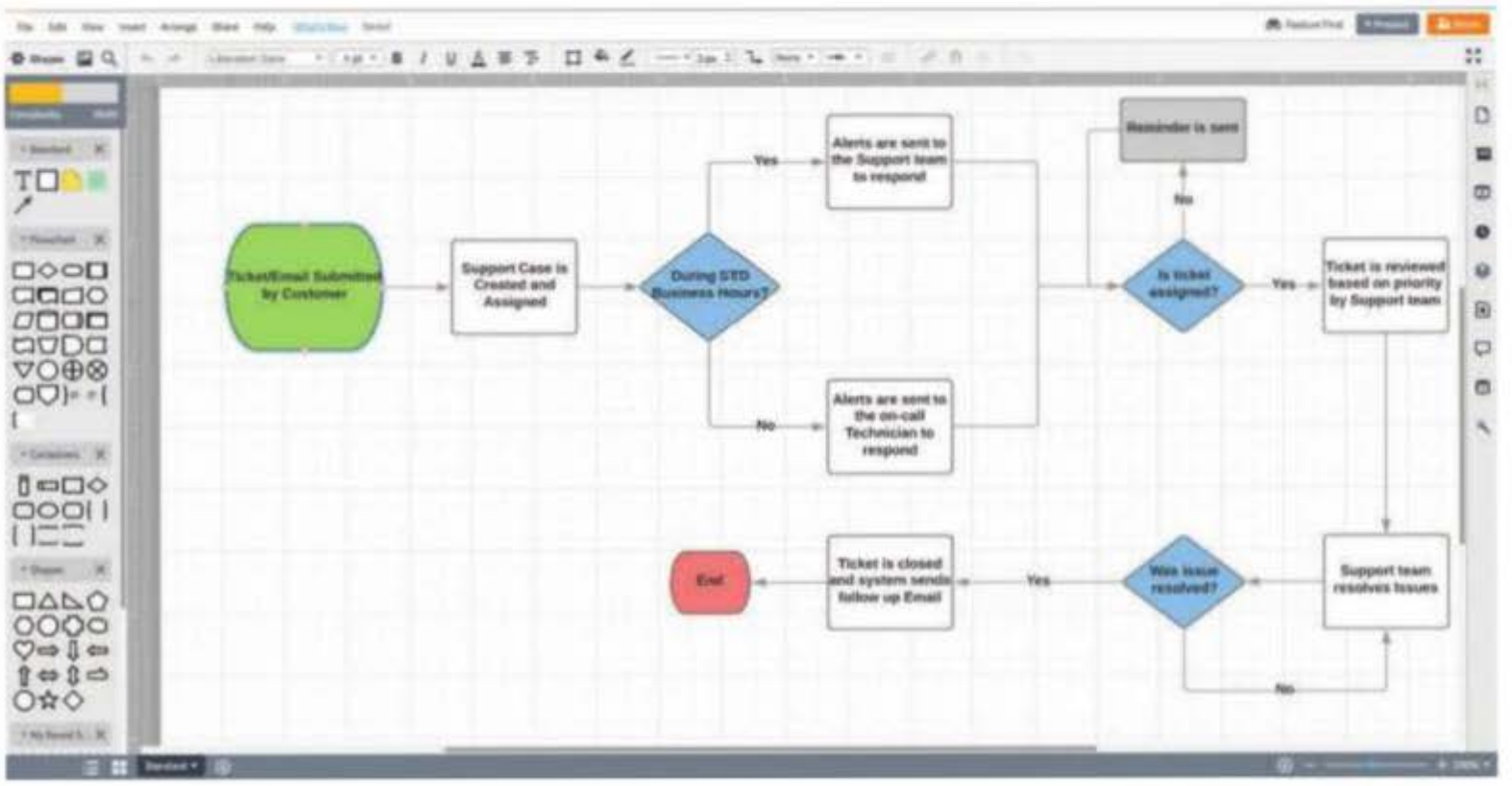

FIGURE 1-9 Lucidchart allows you to drag and drop various symbols and connect them to model a business process.

Source: Lucid Software Inc.