

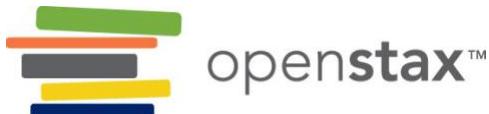


# Foundations of Information Systems

# Foundations of Information Systems

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# Preface

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## About *Foundations of Information Systems*

*Foundations of Information Systems* provides students with the ability to understand the concepts of IS, including hardware, software, database management systems, and data networks. The teaching is based on the ACM/IEEE/AIS curriculum standards for information systems (IS2020) that allow institutions to use the

content for the purposes of accreditation for ABET, AACSB, and ACBSP. The openly licensed resource is grounded in concepts that cross both functional and operational areas to develop student knowledge in transactional, decisional, and collaborative business processes. Specifically, students will be able to understand and apply basic concepts associated with the collection, processing, storage, distribution, and value of information—and how IS professionals provide support to management, customers, and suppliers of the enterprise. Driven by competencies that correlate to knowledge, skills, and dispositions, the book is an asset for 2-year and 4-year information systems programs and to use in general education courses in business and computing.

*Foundations of Information Systems* is intended to be a high-quality, introductory text that provides students with foundational knowledge of global information systems while preparing them to engage with more complex problems and digital technologies. The IS resource appeals to multiple audiences of learners and instructors teaching courses in information technology and those teaching in a comprehensive program in any specialty, including health information systems and business information systems. The book is designed to closely align with international standards and real-life skills needed by employers, while providing a scholarly perspective that encourages students to explore the digital world from a systems design perspective.

## Coverage and Scope

*Foundations of Information Systems* provides a cohesive narrative flow that brings content to life through application, examples, and exercises. The text is based on the recommended Foundations of Information Systems 2020 Curriculum. The topics and format are aligned with the suggested first course in the program of IS2020 and include additional topics organized and recommended by instructors across in 2-year, 4-year, and general education programs around the world. Content is organized under headings and subheadings to allow for structured reading and comprehension, with pedagogical features placed to provide breaks and reinforce concepts. Appropriate visuals complement and illustrate key points in the narrative and draw students into the material.

*Foundations of Information Systems* begins with an overview of hardware, software, and system identification, and ends with ethical considerations in using such technology as machine learning, artificial intelligence, and other newly developed technologies.

## Pedagogical Foundation and Features

*Foundations of Information Systems* is designed to engage students through a combination of practical, real-world applications and thought-provoking scenarios that promote critical thinking and a deeper understanding of core concepts. The pedagogical approach is centered on making information systems relevant and accessible for students from diverse backgrounds. To support this vision, the textbook incorporates several key features:

- **Future Technology** features present newer, emerging, and rapidly changing technologies such as artificial intelligence, machine learning, virtual reality, and augmented reality, and how these technologies fit into the information systems domain.
- **Global Connections** features highlight information systems and technology on a global scale. This feature highlights real IS cases from organizations around the world and describes global technology.
- **Ethics in IS** features highlight ethical issues related to the concepts, skills, and activities being taught in the course. These discuss real-world cases, dig deeper into ethical considerations, and present ethical dilemmas for students to think through.
- **Careers in IS** features introduce students to careers in information systems, including those in high demand, such as health care, data analytics, cybersecurity, cloud computing, business analytics, financial analytics, and more. In addition, this feature offers insight into specialty areas, certifications, and other learning and experience opportunities to enhance career options.
- **Link to Learning** features provide a very brief introduction to online resources—videos, interactives,

articles, and other engaging resources that are pertinent to students' exploration of the topic at hand.

Overall, these features are integrated throughout the textbook to foster active learning, critical thinking, and an appreciation for the practical applications of information systems. By connecting theory to practice and encouraging students to explore real-world issues, *Foundations of Information Systems* provides a meaningful and supportive learning experience that equips students with the knowledge and skills necessary for success in their academic and professional journeys.

### Answers to Questions in the Book

The end-of-chapter Check Your Understanding and Application Questions are intended for homework assignments or classroom discussion; thus, student-facing answers are not provided in the book. For end-of-chapter Review Questions, the book's Answer Key provides students with answers to about half of the assessments so they can self-check their work as they study. All assessment answers and sample answers are provided in the Instructor Answer Guide, for instructors to share with students at their discretion, as is standard for such resources.

## About the Author

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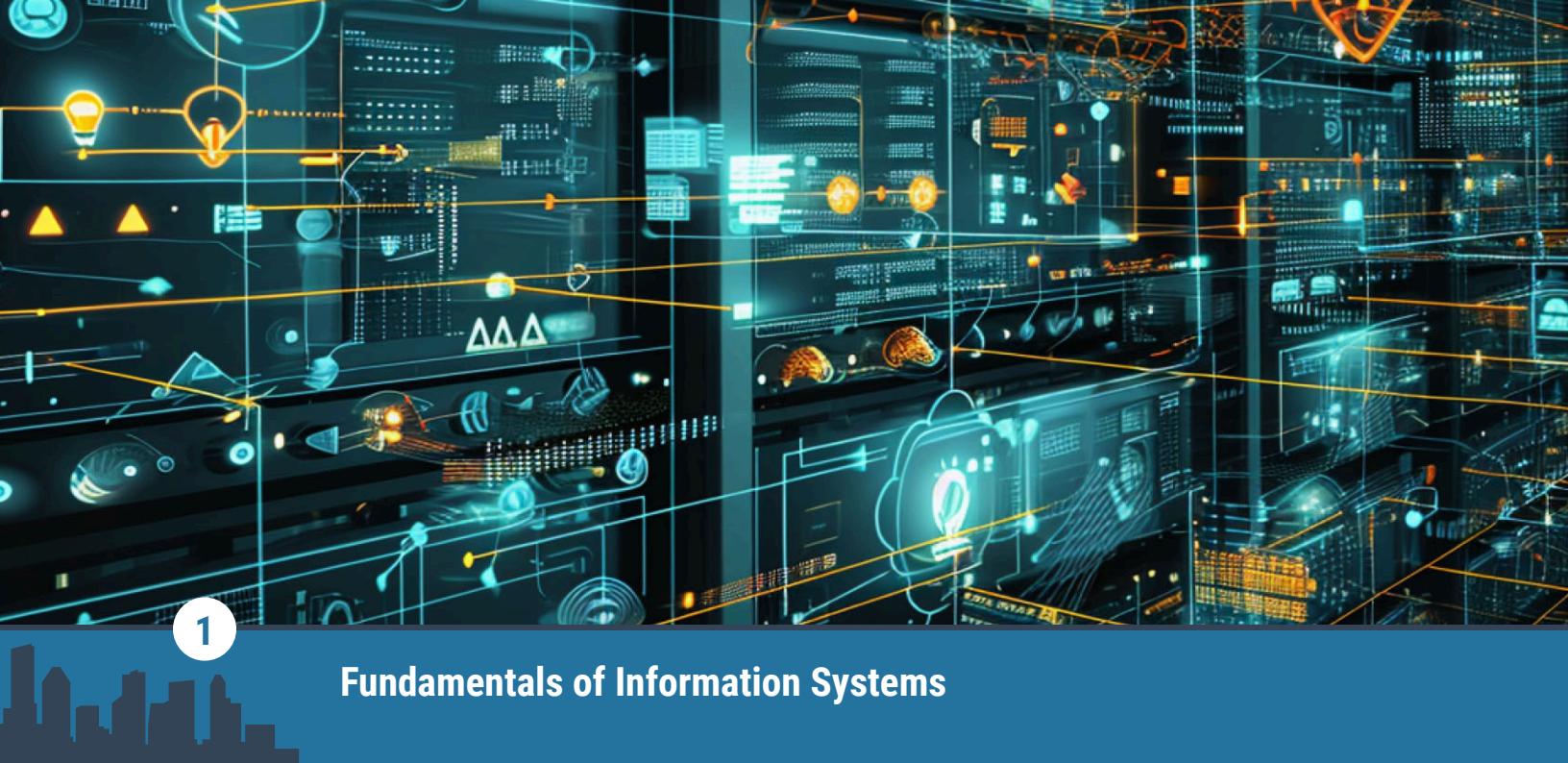
At OpenStax we are also developing resources supporting authentic learning experiences and assessment. Please visit this book's page for updates. For an in-depth review of academic integrity strategies, we highly recommend visiting the International Center of Academic Integrity (ICAI) website at <https://academicintegrity.org/> (<https://academicintegrity.org/>).

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# 1

## Fundamentals of Information Systems

**Figure 1.1** Information systems are an integral part of our lives. Organizations rely on them to manage data, produce goods and services, and compete successfully in marketplaces big and small. (credit: modification of work "Infoeko2" by "Deeply"/Wikimedia Commons, CC0 1.0)

### Chapter Outline

- [\*\*1.1\*\* Introduction to Information Systems](#)
- [\*\*1.2\*\* Frameworks of Knowledge and Industry Standards](#)
- [\*\*1.3\*\* Connections between Information Systems and Information Technology](#)
- [\*\*1.4\*\* The Global Importance of Information Systems](#)



### Introduction

What comes to mind when you think about information systems? In what ways do you think they affect your life? You might be surprised to find out that information systems have an impact on your life and career whether you realize it or not.

In general, an information system is a set of components that helps gather, analyze, maintain, and distribute data. The components of information systems include people, the system's hardware and software, networks, data, and the procedures used to process the data and maintain the system.

The fields of information systems (IS) and information technology (IT) overlap, and sometimes the terms are used interchangeably. However, the sole focus of the field of IT is technology, meaning the processes necessary to establish and maintain computer systems, networks, and applications. Although the field of IS is concerned with technology, the focus is broader to include the people who are part of system processes. It is a vital tool used by all types of organizations to conduct business and participate in the marketplace, whether local or global.

To put this in perspective, consider the village of Pathanamthitta in Kerala, India. The village has limited resources, and during the COVID-19 pandemic, residents' access to health care was even more limited. To improve the health of the vulnerable geriatric population and protect them from the disease, researchers created a mobile phone app for symptom reporting, telehealth, and assessments. Approximately 60 percent of the geriatric population used the app, and the mobile health project thereby allowed for improved health care for the community.<sup>1</sup> This is information systems in action, using technology and information to help address concerns from the COVID-19 pandemic.

## 1.1 Introduction to Information Systems

### Learning Objectives

By the end of this section, you will be able to:

- Define the key concepts in information systems
- Discuss the historical evolution of information systems
- Describe the components, elements, and operations of information systems

It's helpful to understand the relationship between information systems and related fields. Computer science is the discipline that provides foundations for the theories and technology necessary for computing systems. Information technology (IT) implements and maintains those computer systems. Information systems, our area of focus, uses those systems to process and manage information.

### Key Concepts in Information Systems

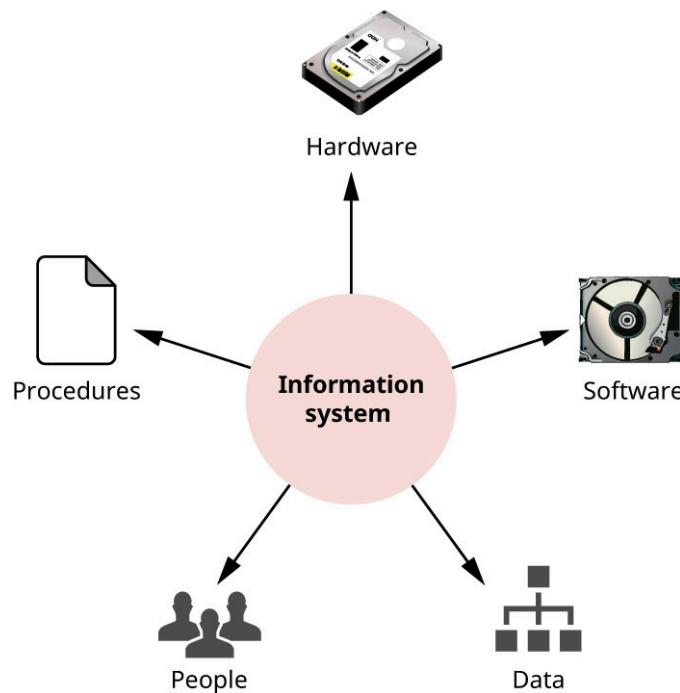
An **information system** is a set of interconnected components that integrate the collection, processing, storage, and distribution of data, information, and digital products in order to support decision-making, coordination, control, analysis, and visualization in an organization. These systems play an important role in managing and facilitating various business processes and can also be used in individuals' personal lives.

The **field of information systems (IS)** is a dynamic industry, evolving and depending on technological advancements. It intersects with business, computer science, and management, playing a critical role in enhancing organizational efficiency, productivity, and competitiveness. When organizations have robust information systems, they are more capable of planning strategically to gain a competitive edge and achieve success.

### Components of an Information System

As shown in [Figure 1.2](#), an information system typically consists of five key components: hardware, software, data, people, and procedures.

<sup>1</sup> Geethu Mathew, Nooh Bava, Aby Dany Varghese, Abey Sushan, and Anoop Ivan Benjamin, "Project Vayoraksha: Implementation of Novel mHealth Technology for Healthcare Delivery during COVID-19 in Geriatric Population of Kerala," *Indian Journal of Medical Research*, 159, 3–4 (July 19, 2024): 289–297, [https://doi.org/10.25259/IJMR\\_62\\_23](https://doi.org/10.25259/IJMR_62_23)



**Figure 1.2** Typically, an information system includes people, as well as hardware, software, data, and procedures. (credit: modification of work from *Introduction to Computer Science*. attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Before looking closely at each component to understand what it entails and why it is important in IS, let's start with a brief overview of the five components.

- The physical devices, such as computers, servers, networks, and storage devices, that are used to collect, process, and store data are called **hardware**.
- The programs and applications that run on the hardware, enabling users to perform specific tasks, are called **software**. Software can range from operating systems and database management systems to specialized business applications.
- The raw facts and figures that are processed and turned into meaningful information are called **data**. The facts that we use to learn and understand people, places, and things make up **information**. Information is raw data that have been processed and manipulated to give context and meaning. Once data are processed into information, we can use that information personally and professionally. We read or listen to books, watch videos on social media, stream a television show, follow road signs, browse online shopping sites, and interact with information we find on the internet or in the world around us. We use databases to organize and store this data efficiently.
- A Set of instructions and rules that governs the use of the hardware, software, and data components is known as a **procedure**. Standard operating procedures ensure consistency and reliability in the use of information systems.
- Individuals who use the information system, including end users who input and retrieve data in the system, as well as information technology (IT) professionals who design, develop, and maintain the system, are the people who make up an information system.

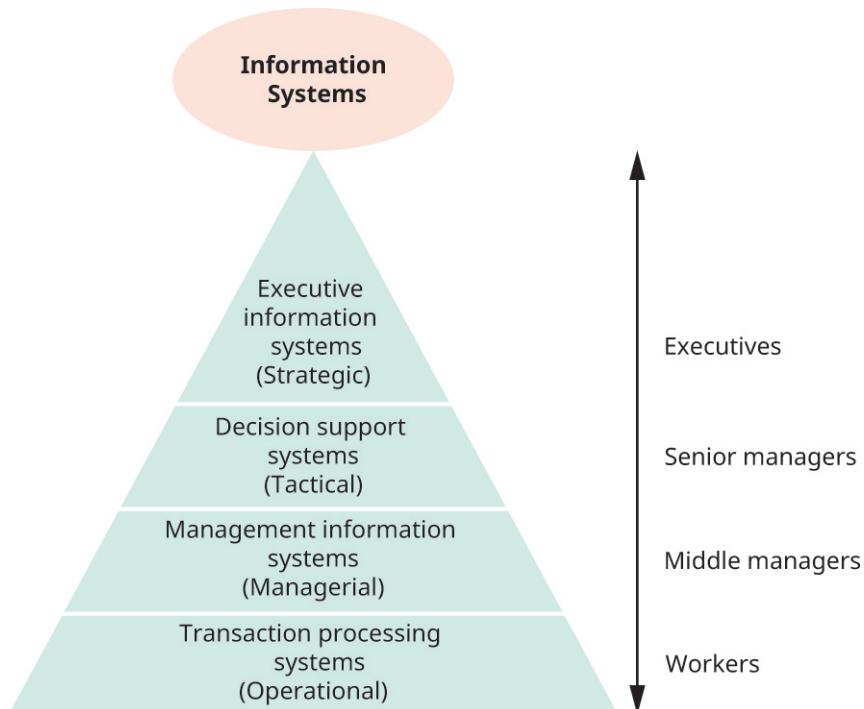
#### LINK TO LEARNING

If you are interested and want to learn more about career opportunities in IS, search “information systems careers” online and explore the dozens of websites with IS career details. This article provides information about [career paths and salary \(<https://openstax.org/r/109ISCareers>\)](https://openstax.org/r/109ISCareers) and includes links to online higher education institutions that have related degrees. An online search can find other websites that provide

helpful information about IS careers, including the general skills required, types of organizations that hire IS professionals, and what students can expect if they pursue a career in IS.

## Types of Information Systems

As shown in [Figure 1.3](#), information systems can be categorized into different types based on their scope and functionality. Executive information systems are used by an organization's executive staff, decision support systems are used by senior managers, management information systems are used by middle managers, and transaction processing systems are used by frontline workers.



**Figure 1.3** Information systems include several types of systems with distinct purposes. (credit: modification of work from *Introduction to Computer Science*. attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Let us take a closer look at each type of information system and explore their purposes.

- An **executive information system (EIS)** supports the strategic information needs of top executives, providing the information needed to handle executive functions, such as developing an organization's strategic goals and objectives and plans for achieving them. This includes providing the information needed for managers to understand and manage their organization's supply chain and value chain, which can be helpful to streamline production processes and provide better customer service. Supply chain management is an example of how an EIS can be used as an interorganizational information system, which occurs when two or more organizations use IS to conduct business electronically.
- A **decision support system (DSS)** assists in decision-making by providing interactive tools and access to data analysis. Typically, senior managers use a DSS to obtain tactical information that helps them make routine, short-term decisions about an organization's operations. This helps ensure that organizations stay on track to achieve long-term goals and objectives. Interactive tools available through a DSS enhance these efforts by providing information and technology needed for activities such as project management and employee training.
- A **management information system (MIS)** provides middle managers with reports and summaries to support decision-making and managerial functions. For example, middle managers may use an MIS to generate reports, such as budgeting documents and cash flow statements, to understand an

organization's financial status. In many organizations, this type of system provides the data for an organization's balanced scorecard (BSC), which is a performance metric used by strategic managers to identify an organization's various functions and monitor outcomes. By providing the data necessary for the BSC, an organization's MIS function provides invaluable support.

- A **transaction processing system (TPS)** handles day-to-day transactions, such as order processing and payroll. For frontline staff, a TPS provides information necessary to handle an organization's daily operations, such as inventory reports and customer service records.

In addition to these four types of information systems, an **enterprise resource planning (ERP) system** is a software system that helps an organization manage various types of information systems within the organization, and integrate business processes and functions across the organization. For example, large organizations may rely on an ERP system to handle human resource management throughout the organization. An ERP is also a useful tool for functions such as project management, accounting and financial management including payroll, and tracking customer service.

## Application of Information Systems in Business

Think about a visit to a coffee shop, from ordering to receiving the order, through the lens of IS. First, think about how a barista takes an order at the register. That's the point-of-sale (POS) system at work. The POS system is an information system that streamlines transactions, helping businesses track sales, manage inventory, and even understand customer preferences when tracked with tools such as customer loyalty cards. When a customer switches from their regular black coffee to a caramel macchiato, the system takes note and updates their preferences, contributing to a personalized customer experience.

Now, imagine if the coffee shop had no system to track sales, manage its supplies, and keep track of customer preferences. What do you think might be some of the challenges a business would face if they did not have a way to gather, track, and analyze this data? This is where ERP systems come into play. ERP systems integrate various business processes, ensuring that everything from bean procurement to milk deliveries is synchronized. This not only prevents the coffee shop from running out of their most popular blend, but also helps them manage costs and operate more efficiently.

The POS and ERP systems are not the only information systems in a coffee shop. Most coffee shops have Wi-Fi, which is another information system that includes hardware, software, and the networks that connect them. The coffee shop's Wi-Fi is a small-scale example of how businesses use IS to stay ahead of the competition, whether it be locally, nationally, or globally.

In essence, information systems are about more than simply computers and gadgets. They are the invisible architects that shape our daily experiences, whether we're grabbing a coffee or navigating the complexities of a global market.

### CAREERS IN IS

#### Careers in IS

Students who are interested in the field of IS have a variety of career options. There are technical jobs that require in-depth knowledge of computers, such as software developers who design, create, and test the software applications necessary to develop and maintain an information system. Cloud computing engineers also fall into this category, and they must have the skills to guide and support organizations as they connect their systems to the cloud and use it to conduct business.

But not all IS jobs are technical. Students who find the field intriguing but want a less technical job also have career options. For example, systems analysts explore an organization's operations to identify areas where technology can be used to help an organization be more efficient and cost-effective. Information