



MANAGEMENT INFORMATION SYSTEMS

PART 1

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PREFACE

Creating this ebook has been a collaborative endeavor, made possible by the contributions of numerous experts and practitioners in the field of MIS. We extend our heartfelt thanks to our contributors for their valuable insights, our reviewers for their meticulous feedback, and our editorial team for their unwavering support.

We hope that "Management Information Systems" will serve as a valuable resource, inspiring readers to explore the vast potential of MIS in driving business success. As you embark on this journey, we encourage you to think critically about the role of information systems in your own context and to engage deeply with the material.

Happy learning!

ABSTRACT

In the dynamic and fast-paced world of business today, the efficient management of information is not merely an operational necessity but a strategic asset. "**Management Information Systems**" is designed to provide readers with a robust understanding of how information systems underpin organizational success. This first part of our comprehensive series focuses on foundational elements that are crucial for anyone looking to grasp the essentials of Management Information Systems (MIS).

Chapter 1: Overview of Management Information Systems

Our journey begins with a broad overview of Management Information Systems. This section lays the foundation by exploring the historical evolution and fundamental concepts of MIS. We will delve into the pivotal role MIS plays in

modern organizations, aiding in decision-making, improving efficiency, and fostering innovation. By examining various real-world examples and case studies, readers will understand how MIS integrates into different business processes and contributes to achieving strategic goals. This section serves as a critical primer for appreciating the broader context and significance of MIS in today's digital economy.

Chapter 2: Management Information Systems Basics: Hardware, Software, and Networking

The second section transitions from theory to the essential components that make up MIS. Here, we dissect the core elements: hardware, software, and networking. Understanding these basics is fundamental to comprehending how information systems operate and support organizational functions. We will explore

ABSTRACT

various types of hardware, the software that drives business applications, and the networking technologies that connect systems and enable seamless communication. This comprehensive overview ensures that readers have a solid technical grounding, which is necessary for navigating more advanced topics in MIS.

Chapter 3: Information Systems Security

The final section of this part addresses one of MIS's most critical aspects: information systems security. In an era where cyber threats are increasingly sophisticated, ensuring the security of information systems is paramount. This section covers the principles of information security, including risk management, cybersecurity strategies, and techniques for safeguarding data integrity and confidentiality. We will also discuss ethical and legal considerations, providing a

holistic view of the challenges and best practices in information system security. This section aims to equip readers with the knowledge to protect organizational assets in a continually evolving threat landscape.

How to Use This Ebook

The ebook's first part builds a solid foundation in MIS by progressing from conceptual overviews to technical details and security concerns. While it is beneficial to read sequentially, the modular format allows readers to focus on specific topics as needed. Each chapter concludes with exercises and discussion questions designed to reinforce learning and provoke thoughtful analysis.

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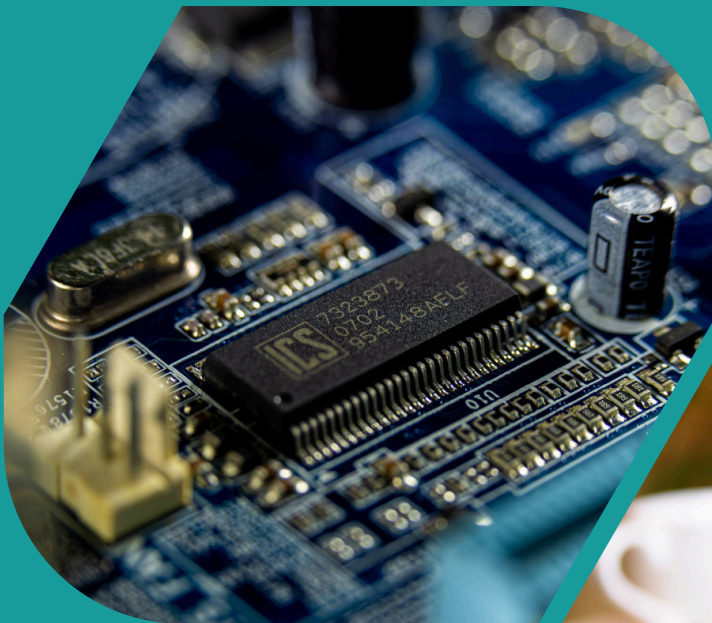
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CHAPTER 1

OVERVIEW OF MANAGEMENT INFORMATION SYSTEMS



LEARNING OBJECTIVES

After completing this chapter, you will be able to answer the following questions:

- ① Define Information Technology
- ② Define Information System
- ③ Define Management Information Systems
- ④ Explain the differences between data and information?
- ⑤ Explain the history of Management Information Systems
- ⑥ Explain the functions of Information Systems
- ⑦ Explain the dimensions of Information Systems
- BONUS** ⑧ The current trends in computer hardware platforms
- BONUS** ⑨ Discuss how Information Systems improved business processes
- BONUS** ⑩ Discuss the new things in Management Information Systems

Definition of terms



Let's begin by defining what this course is about.

Information Technology

Information technology (IT) encompasses the complete set of hardware and software required by a company to accomplish its business goals. This includes not only computer hardware such as workstations, storage devices, and portable mobile devices, but also software such as the Windows or Linux operating systems, the Microsoft Office desktop productivity suite, and a multitude of computer programs commonly found in large organizations. Understanding "information systems" necessitates a thorough examination of their technological and business aspects, as they are inherent in complexity.

Information Systems

An **information system (IS)** is a complex network of interconnected components that are responsible for the collection, retrieval, processing, storage, and distribution of information inside an organisation. Its primary purpose is to facilitate decision-making and control. Information systems not only assist in decision-making, coordination, and control, but they also aid managers and workers in problem analysis, visualisation of complicated subjects, and the creation of new products.

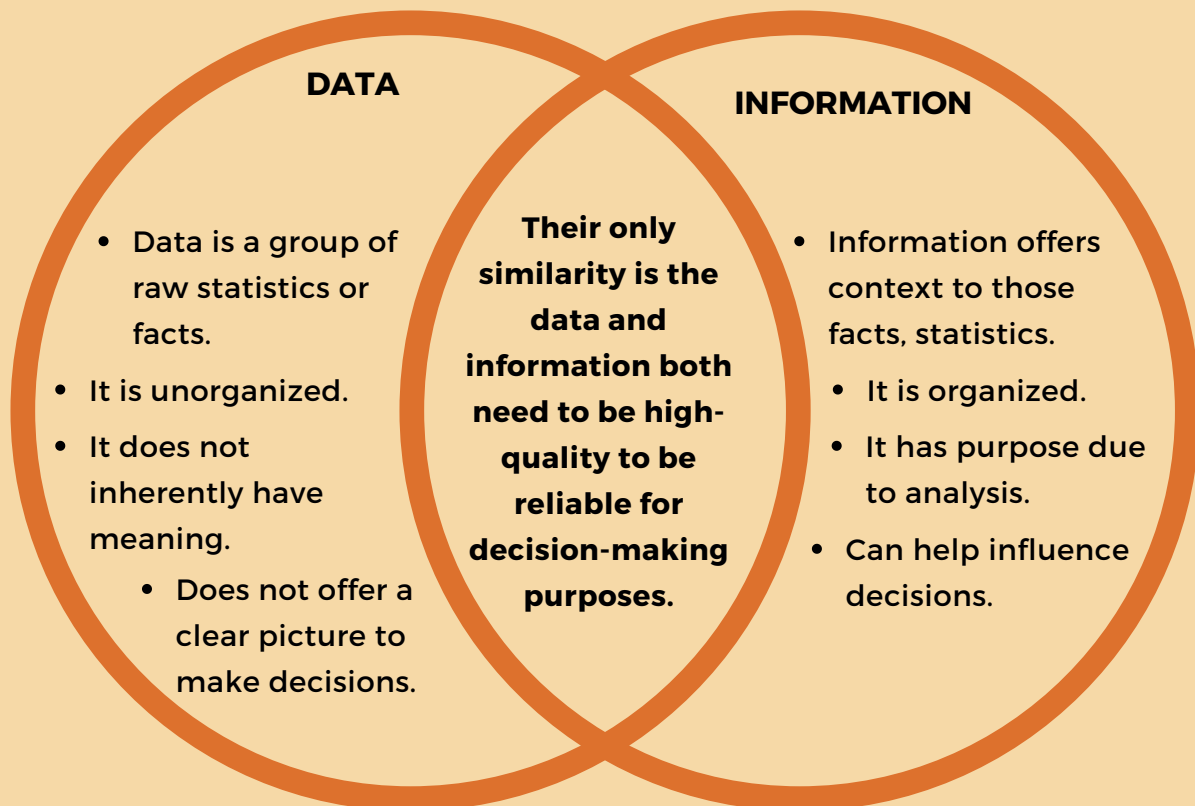
Information systems store data about important individuals, locations, and objects within the organization or its external surroundings. Information transforms data into a format that is relevant and valuable to humans. On the other hand, data are unprocessed facts that represent events occurring in organisations or the physical environment, before they undergo structuring and presentation to make them comprehensible and applicable to people.

Management Information Systems

Management Information Systems (MIS) is a field that focuses on using information technology and systems to facilitate an organization's management and decision-making processes. It encompasses the creation, advancement, execution, and upkeep of computerised information systems that assist organisations in gathering, manipulating, storing, and distributing data and information.

The main objective of Management Information Systems (MIS) is to furnish pertinent, prompt, and precise information to managers and decision-makers at different hierarchical levels within an organisation. This knowledge enables them to make well-informed decisions, resolve issues, and develop strategies that are in line with the organisation's aims and objectives. Management Information Systems (MIS) are essential for optimising operations, enhancing productivity, and attaining a competitive edge in today's business landscape.

What is the difference between data and information?



Example of data

- Each student's test score is one piece of data.
- A list of dates.
- The history of temperature readings all over the world for the past 100 years.
- The number of visitors to a website by state.

Example of information

- The average score of a class or of the entire school is information that can be derived from the given data.
- Dates of public holiday.
- If this data is organized and analyzed to find that global temperature is rising, then that is information.

So, how does data become information?

1. **Processing** – This includes collecting, recording, organizing, and storing your information (such as in your CRM for safekeeping).
2. **Interpreting** – This involves the process of making sense of facts and statistics. Then, giving them context to become meaningful in a business context.
3. **Organizing** – It's essential to store data to enable your company to use it to make decisions. You can do this, for example, by syncing it with other applications.

History of Management Information Systems

According to Kenneth and Aldrich Estel, the technology and tools used in MIS have evolved over time. They have identified six eras in the field.



Mainframes

- The mainframe and its associated systems executed operations.
- Operators were responsible for executing queries, processing them collectively with other requests (often using punch cards), and providing the information later.



Minicomputers

- Smaller than a mainframe.
- Terminals handled the entry of information retrieval requests. The procedure still required operators and did not yield instantaneous results.



Personal computers

- Individual users had personal computers on their desks, but there was often a lack of interconnectivity between them.



Client / Server Networks

- Clients utilise local networks to retrieve data from servers.
- The clients, typically a personal computer (PC), and the server frequently divide the processing tasks between them.
- Users have the ability to independently submit queries and promptly receive information in almost real-time.
- A client typically establishes a connection with a single server.



Enterprise Computing

- Clients have the ability to access data stored on servers located anywhere within the organisation's network.



Cloud computing

- A dispersed network of hardware stores data and allows Internet access.
- A provider owns cloud servers that businesses lease to store their data.

The Functions of an Information System

An information system contains information about an organization and its surrounding environment. Three basic activities -- input, processing and output -- produce the information organization need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Environmental actors, such as customers, suppliers, competitors, stockholders and regulatory agencies, interact with the organization and its information systems.

Figure 1.1 Functions an Information System

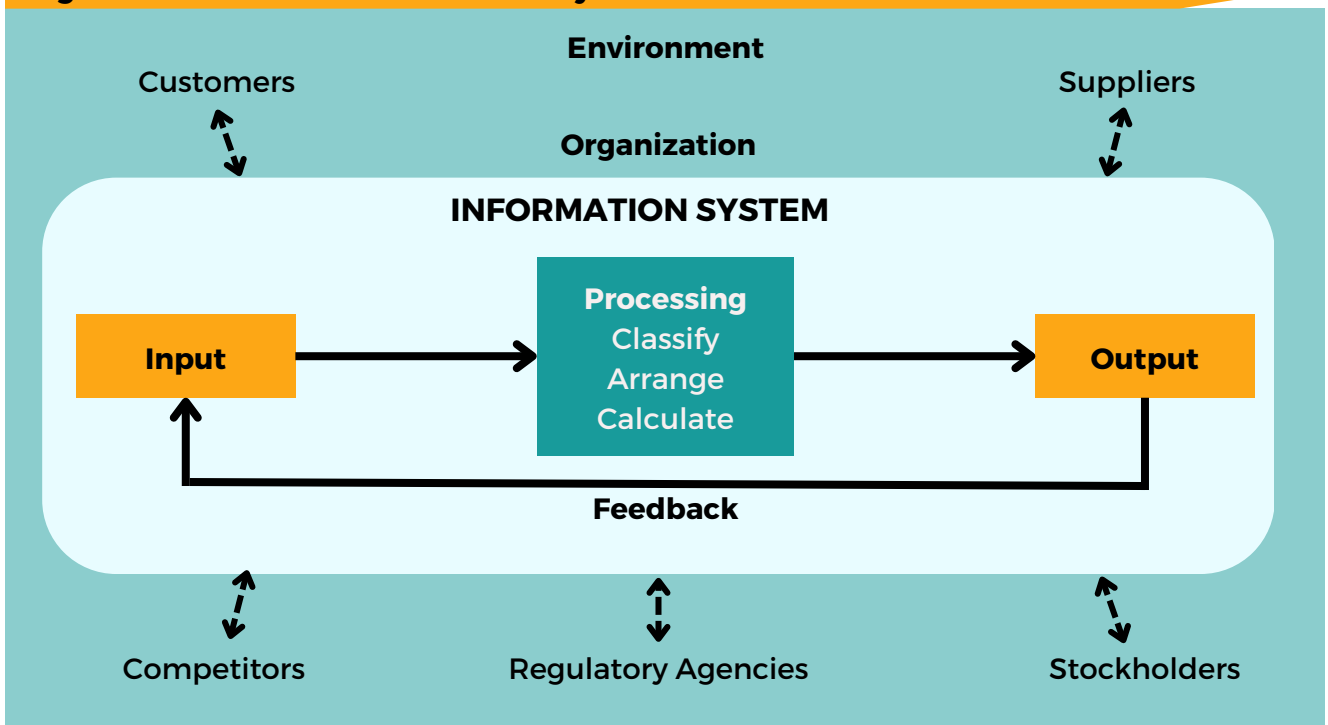
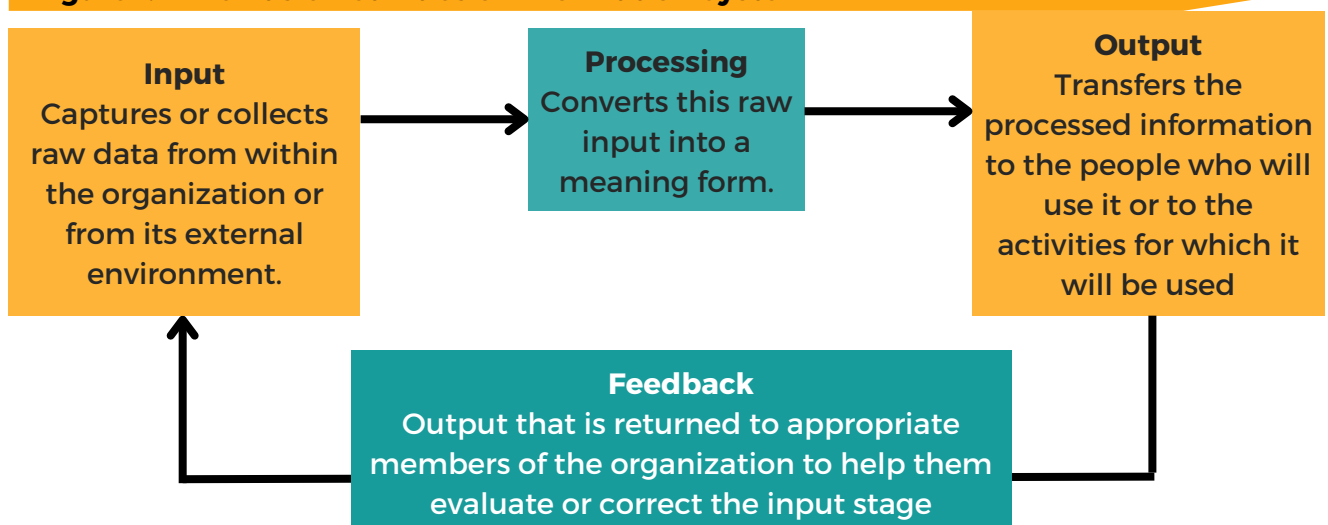


Figure 1.2 The Basic Activities of Information System



The Components of Information Systems

Information systems are composed of several interrelated components that work together to collect, process, store, and disseminate information. The key components of information systems include:

Hardware

- Physical devices such as computers, servers, storage devices, networking equipment, and peripherals.

Software

- Programs and applications that provide instructions for the hardware to perform specific tasks. This includes operating systems, database management systems, and application software.

Data

- Raw facts and figures that are processed and organized to create meaningful information. Data can be in various forms, such as text, numbers, images, and multimedia.

People

- Individuals who interact with the information system, including users, administrators, and IT professionals. People are essential for designing, implementing, and maintaining information systems.

Process

- The set of instructions and rules that govern the use and operation of the information system. This includes guidelines for data entry, processing, storage, and retrieval.

The Components of Information Systems

Computer hardware encompasses the technological components responsible for computer processing, data storage, input, and output. This component encompasses a wide range of equipment, including mainframes, servers, desktop and laptop computers, and mobile devices, used for accessing both business data and the Internet. Furthermore, it includes tools for collecting and entering data, tangible means for storing data, and mechanisms for disseminating the processed information as output.

STORAGE TECHNOLOGY

- Magnetic disks
- Optical discs
- Magnetic tape
- Storage Networking

INPUT TECHNOLOGY

- Keyboard
- Computer mouse
- Touch screen
- Optical character recognition
- Magnetic ink character recognition (MICR)
- Pen-based input
- Digital scanner
- Audio input
- Sensors

OUTPUT TECHNOLOGY

- Monitor
- Printers
- Audio Output

The Components of Information Systems

Computer software encompasses both system software and application software. System software controls the allocation and operation of the computer's resources. Application software utilises the capabilities of a computer to do a particular task for a user, such as handling an order or creating a mailing list. Nowadays, external suppliers acquire most system and application software instead of developing it specifically for individual needs.

OPERATING SYSTEM

- Windows 8
- Windows 7
- Windows Server 2008
- UNIX
- LINUX
- Mac OS X
- Chrome OS
- Android

APPLICATION PROGRAMMING LANGUAGES

- C
- C++
- Visual Basic
- Common Business Oriented Language (COBOL)

SOFTWARE PACKAGES AND DESKTOP PRODUCTIVITY TOOLS

- Word Processing Software
- Spreadsheet Software
- Data Management Software
- Presentation Graphics
- Software Suites
- Web Browsers

SOFTWARE FOR THE WEB

- Java
- Hypertext Markup Language (HTML)
- HTML5
- Web Services

FOURTH-GENERATION LANGUAGES

- PC software tools
- Query language
- Report generator
- Graphic language
- Application generator
- Application software package

SOFTWARE TRENDS

- Open Source Software
- Cloud-Based Software Services and Tools

Contemporary Developments in Computer Hardware Platforms

The rapid advancement of computer hardware and networking technologies has significantly transformed the way businesses manage their computing resources. This has resulted in a shift towards distributing computing power over networks and mobile devices, as well as acquiring computing capabilities through service-based models.

THE MOBILE DIGITAL PLATFORM

- The iPhone and Android smartphones have assumed numerous features of personal computers, such as data transmission, online browsing, email and instant messaging, digital content presentation, and data exchange with internal corporate systems. Compact, lightweight netbooks, specifically designed for wireless communication and Internet connectivity, are part of the new mobile platform. It also includes tablet computers like the iPad, as well as digital e-book readers such as Amazon's Kindle, which offer limited web browsing capabilities.
- Both commercial and consumer users are increasingly using smartphones and tablets as their primary Internet access devices.
- Wearable computing devices are a recent addition to the realm of mobile digital technology.

CONSUMERIZATION OF IT AND BYOD

- The widespread appeal, user-friendly nature, and extensive range of practical uses for smartphones and tablet computers have generated a significant surge in the desire to permit employees to utilise their personal mobile devices in a professional setting, sometimes referred to as "bring your own device" (BYOD). BYOD is a part of the consumerization of IT, which refers to the introduction of innovative information technology from the consumer sector into corporate organisations.
- The consumerization of IT encompasses not just personal mobile devices, but also the adoption of software services originally developed for the consumer market, such as Google and Yahoo search, Gmail, Google Maps, Dropbox, and even Facebook and Twitter.

QUANTUM COMPUTING

- Quantum computing leverages the fundamental principles of quantum physics to encode and manipulate data. Conventional computers represent data as either 0 or 1, while quantum computing may handle data units that are simultaneously 0, 1, or both.
- The capacity of a quantum computer to exist in numerous states simultaneously would result in a significant increase in processing capability. This would enable the computer to tackle scientific and business problems millions of times faster than current methods allow.

The Current Trends in Computer Hardware Platforms

VIRTUALIZATION

- The virtualisation method makes a group of computing resources, such as processing power or data storage, accessible without physical setup or location limitations. Virtualization allows for the presentation of several logical resources to the user, even when there is only one physical resource, such as a server or storage device.
- Virtualization allows for the consolidation of numerous physical resources, such as storage devices or servers, into a unified logical resource. Software-defined storage (SDS) exemplifies this by separating the software responsible for data storage from the underlying storage hardware

CLOUD COMPUTING

- Cloud computing enables enterprises and individuals to carry out their computing tasks using a virtualized IT infrastructure located remotely. Cloud computing is a computing model that offers computer processing, storage, software, and other services as a shared pool of virtualized resources across a network, primarily the Internet. You can access these computer resources, also known as "clouds," whenever needed from any connected device or location.

EDGE COMPUTING

- Edge computing is an approach to enhancing the efficiency of cloud computing systems by conducting certain data processing tasks on a group of interconnected servers located at the network's edge, in close proximity to the data source. This approach reduces the amount of data transferred between local PCs, other devices, and the central cloud data centre.

GREEN COMPUTING

- Green computing, sometimes known as green IT, encompasses strategies and technology aimed at reducing the environmental impact of computers, servers, and related equipment, including monitors, printers, storage devices, and networking systems, throughout their lifecycle.

HIGH-PERFORMANCE AND POWER-SAVING PROCESSORS

- A multicore processor is a type of integrated circuit that has two or more processor cores, resulting in improved performance, lower power consumption, and more efficient handling of several activities simultaneously. This technique allows for the use of several processing engines that have lower power requirements and generate less heat. As a result, these engines can accomplish tasks more quickly compared to a single processing core that requires a lot of resources. Currently, the market offers personal computers (PCs) equipped with processors with two, four, six, and eight cores. Additionally, there are servers that have processors with 16 and 32 cores.

How Information Systems Improved Business Processes

How precisely do information systems enhance company processes? Information systems automate several manual tasks in corporate operations, like verifying a customer's credit or creating an invoice and shipping order.



Business Transformation

- A change management strategy which has the aim to align people, process and technology initiatives of a company more closely with its business strategy and vision.
- Helps to support and innovate new business strategies.
- Changes in technology, and new innovative business models, have transformed social life and business practices.
- Businesses are using information technology to sense and respond to rapidly changing customer demand, reduce inventories to the lowest possible levels, and achieve higher levels of operational efficiency.
- Supply chains have become more fast-paced, with companies of all sizes depending on just-in-time inventory to reduce their overhead costs and get to market faster.



Globalization Opportunities

- A global information system supports the operations and decision making of an enterprise's multi-country strategy.
- Internet has drastically reduced cost of operating on global scale.
- Present both challenges and opportunities.
- E-commerce and Internet advertising continue to expand.



Digital Firm

- Significant business relationship are digitally enabled and mediated.
- Core business processes are accomplished through digital networks.
- Key corporate assets are managed digitally.
- Digital firm offer greater flexibility in organization and management.
- Time shifting, space shifting.
- Businesses are starting to use social networking tools to connect their employees, customers, and managers worldwide.
- Many Fortune 500 companies now have Facebook pages, Twitter, now X accounts, and Tumblr sites.

What are the latest developments in the field of Management Information Systems?

Lots! What makes management information systems the most exciting topic in business is the continual change in technology, management use of the technology, business models and the impact on business success. New businesses and industries appear, old ones decline, and successful firms are those that learn how to use the new technologies.

TECHNOLOGY

- The emergence of cloud computing platforms has become a significant area of innovation in the commercial world.
- An adaptable network of computers on the Internet begins to perform functions previously performed on company systems. The internet provides business applications of significant importance as a service known as Software as a Service (SaaS).
- Large-scale data
- Enterprises seek valuable information from vast amounts of data derived from internet traffic, email communications, social media posts, and machine-generated data (sensors). To effectively acquire, store, and analyse this data, businesses require innovative data management systems.
- A new mobile digital platform arises as a contender to the PC as a business system.
 - The Apple iPhone, tablet PCs, and Android mobile devices have the capability to download a vast number of applications that facilitate collaboration, location-based services, and communication with peers. Compact tablet devices, such as the iPad and Kindle Fire, present formidable competition to traditional laptops in both consumer and corporate computing.

MANAGEMENT

- Managers utilise online collaboration and social networking technologies to enhance coordination, collaboration, and the exchange of knowledge.
- More than 100 million business professionals worldwide use Google Apps, Google Sites, Microsoft Windows SharePoint Services, and IBM Lotus Connections to facilitate blogging, project management, online meetings, personal profiles, social bookmarks, and online communities.
- Business intelligence applications expedite.
- Enhanced data analytics and interactive dashboards offer managers real-time performance information, empowering them to make more informed decisions.
- The prevalence of virtual meetings is increasing rapidly.
 - Managers utilise telepresence videoconferencing and Web conferencing technology to decrease the amount of time and money spent on travel while enhancing cooperation and decision-making.

What are the latest developments in the field of Management Information Systems?

ORGANIZATIONS

- A social business is one that aims to address social or environmental issues while also generating profits.
- Businesses utilise social networking sites such as Facebook, Twitter, and internal corporate social tools to enhance and strengthen connections with employees, consumers, and suppliers. Employees utilise blogs, wikis, e-mail, texting, and SMS messaging as means of engaging in online communities.
- Remote work is becoming increasingly popular in the professional environment.
- The proliferation of the Internet, wireless laptops, smartphones, and tablet computers has facilitated the ability of an increasing number of individuals to engage in remote work away from the conventional office setting.
- Collaboratively generating economic worth within a corporate context
 - The origins of company value are transitioning from products to solutions and experiences, as well as from internal sources to networks of suppliers and engagement with customers. Supply chains and product development are increasingly globalised and collaborative, with customer interactions playing a crucial role in shaping enterprises' creation of new products and services.

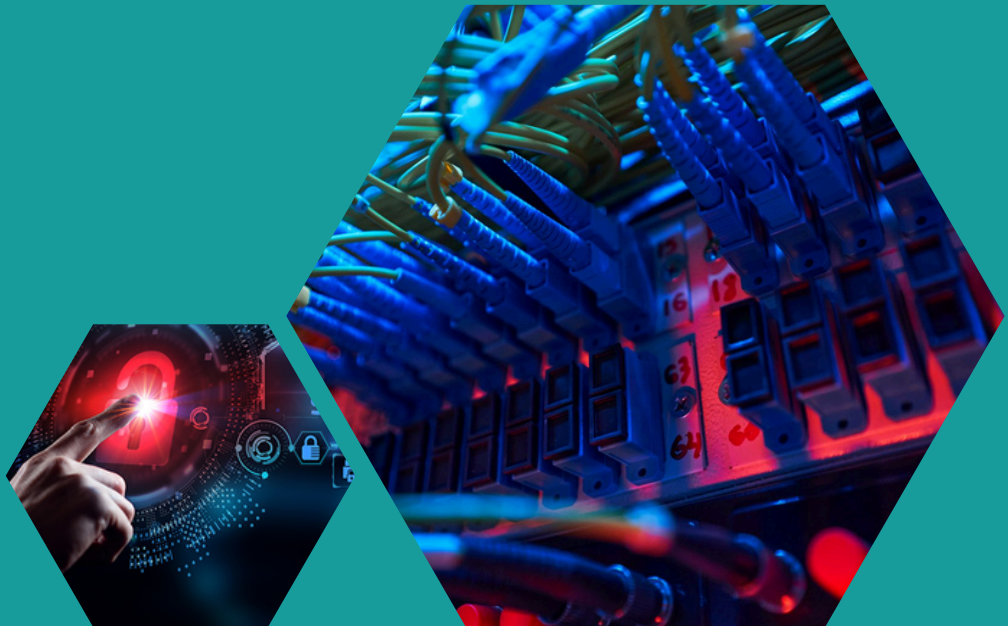
**Scan here to get the
review questions for
Chapter 1**

SCAN ME





MANAGEMENT INFORMATION SYSTEMS BASIC: HARDWARE, SOFTWARE AND NETWORKING



LEARNING OBJECTIVES

After completing this chapter, you will be able to answer the following questions:

- ① Identify computer hardware
- ② Identify computer software
- ③ Identify types of networks

Computer Hardware

Computer hardware refers to the physical components that make up a computer system.

There are many different kinds of hardware that can be installed inside, and connected to the outside, of a computer.

Computer hardware may sometimes be seen abbreviated as computer hw.

The four primary categories of computer hardware include input devices, output devices, processing devices, and storage devices.

The physical parts of a computer system





INPUT DEVICES



Keyboard

The primary means of inputting textual and numerical information.



Computer mouse

A portable device equipped with point-and-click functionality, used to manipulate the position of a cursor on a computer screen and execute commands. Trackballs and touch pads are frequently utilised as alternative pointing devices to the mouse on laptop PCs.



Touch screen

A touch-sensitive display panel that enables people to interact with a computer by directly touching its surface. Utilised in kiosks located in airports, retail establishments, and restaurants, as well as in multitouch devices like the iPhone, iPad, and multitouch personal computers.



Optical character recognition

A device is capable of converting specifically designed marks, letters, and codes into a digital format. The bar code is the most commonly used optical code.



Magnetic ink character recognition (MICR)

The banking industry primarily uses technology for check processing. The characters located at the bottom of a check serve the purpose of identifying the bank, checking account, and check number. Preprinting these characters involves using a special type of ink with magnetic properties. This enables a computer to easily translate the characters into a digital format.



Pen-based input

Devices for handwriting recognition transform the motion of an electronic stylus pressing on a touch-sensitive tablet screen into a digital format.



Digital scanner

The device converts images, like pictures or documents, into digital format.



Audio input

These are input devices that convert voice, music, or other sounds into digital form for processing by the computer.



Sensors

These are devices that directly collect data from the environment for input into a computer system. For instance, farmers can use sensors to monitor the moisture of the soil in their fields.

PROCESSING DEVICES

One or more central processing units and primary storage interact to process data, making the **central processing unit (CPU)** a crucial component of a computer system.

Memory devices contain thousands of circuits imprinted on a silicon chip. Each circuit is either conducting electrical current (on) or not (off). Memory stores data as a combination of on- and off-circuit states.

Random access memory (RAM) temporarily stores instructions or data. RAM is temporary and volatile; chips lose their contents if the current is turned off or disrupted (as in a power surge, brownout, or electrical noise generated by lightning or nearby machines).

Read-only memory (ROM), another type of memory, is usually nonvolatile. ROM maintains a fixed combination of circuit states, ensuring its contents remain intact even in the event of power loss. The ROM provides permanent storage for data and instructions that do not change, such as programs and data from the computer manufacturer, as well as instructions that tell the computer how to start up when power is turned on.

OUTPUT DEVICES

Display

Often, a flat-panel (LCD) display screen.

Printers

These devices produce a printed hard copy of the information output. They include impact printers (such as dot matrix printers) and nonimpact printers (such as laser, inkjet, and thermal transfer printers).

Audio output

These are output devices that transform digital output data into audible speech, music, or other sounds.

STORAGE DEVICES

Traditional storage technologies include magnetic discs, optical drives, magnetic tape, and storage networks, which connect multiple storage devices on a separate high-speed network dedicated to storage.

Large and midrange computers, as well as some PCs, still use magnetic disc drives for secondary storage. However, data storage in many PCs, as well as smartphones and tablets, is based on solid-state drives (SSDs), which use an array of semiconductors organised as a very fast internal disc drive.

Portable USB flash drives use similar technology for external storage. Optical drives (CD, DVD, and Blu-ray) use laser beaming technology to store enormous quantities of data, including sound and images, in compact form.



COMPUTER SOFTWARE

Think of system software and application software as a set of nested boxes that interact closely with each other. The system software surrounds and controls access to the hardware. The system software is the conduit through which application software operates. End users work primarily with application software. We must design each type of software for a specific machine to ensure its compatibility.

The operating system is the system software responsible for managing and controlling the computer's activities. Computer language translation programmes translate programming languages into machine language that the computer can understand, while utility programmes carry out common processing tasks like copying, sorting, and computing a square root. The operating system allocates and assigns system resources, schedules the use of computer resources and computer jobs, and monitors computer system activities. The operating system provides primary memory locations for data and programs and controls the input and output devices, such as printers, displays, and telecommunication links. The operating system also manages the scheduling of tasks across different computer areas, enabling simultaneous work on various parts of different jobs.



COMPUTER SOFTWARE

Graphical user interface (GUI), which makes extensive use of icons, buttons, bars, and boxes to perform tasks.

Multitouch technology is increasingly making conventional client operating system software more natural and intuitive. The multitouch interface on smartphones, tablet computers, and some PC models allows you to use one or more fingers to perform special gestures to manipulate lists or objects on a screen without using a mouse or a keyboard.

The **Microsoft Windows** family of operating systems has both client and server versions, a streamlined GUI that now works with touch screens and mobile devices, as well as keyboards and traditional PCs. At the client level, most PCs use some form of the Microsoft Windows or Apple operating systems. Windows 10 is the most recent Windows client version. Windows operating systems for servers provide network management functions, including support for virtualization and cloud computing. Windows Server has multiple versions for small, medium, and large businesses.

Google's Chrome OS provides a lightweight operating system for cloud computing using a web-connected computer or mobile device. Users access and use programmes over the Internet through the Chrome web browser, rather than storing them on their computing device. User data resides on servers across the Internet.

Android is an open-source operating system for mobile devices such as smartphones and tablet computers, developed by the Open Handset Alliance led by Google. It has become the most popular smartphone platform worldwide, competing with iOS, Apple's mobile operating system for the iPhone, iPad, and iPod Touch.

UNIX is a multiuser, multitasking operating system developed by Bell Laboratories in 1969 to connect various machines. It is highly supportive of communications and networking. Workstations and servers often use UNIX, which offers the reliability and scalability needed to run large systems on high-end servers. UNIX can run on many kinds of computers and can be easily customized. You can port application programmes running under UNIX from one computer to another with minimal modification. People have developed graphical user interfaces for UNIX.

You can download **Linux**, a UNIX-like operating system, for free from the Internet or purchase it for a small fee from companies that provide additional tools for the software. It is free, reliable, compactly designed, and capable of running on many hardware platforms, including servers, handheld computers, and consumer electronics. Linux has become popular as a robust, low-cost alternative to UNIX and the Windows operating systems.

APPLICATION SOFTWARE AND DESKTOP PRODUCTIVITY TOOLS

Common programming languages used for commercial applications comprise C, C++, Visual Basic, and Java.

Developed in the early 1970s, **C** is a powerful and efficient language that combines machine portability with tight control and efficient use of computer resources. Professional programmers primarily use it to create operating systems and application software, particularly for PCs.

C++ is a newer version of C that has all of C's capabilities plus additional features for working with software objects. A software object combines data and procedures, in contrast to traditional programmes that separate data from their actions.

Visual Basic is a widely used visual programming tool and environment for creating applications that run on Microsoft Windows operating systems.

A **visual programming language** allows users to manipulate graphic or iconic elements to create programs. Large legacy systems in banking, insurance, and retail still use **COBOL (Common Business Oriented Language)**, developed in the early 1960s for business processing.

Java has become the leading interactive programming environment for the web. The Java platform has migrated into mobile phones, smartphones, automobiles, music players, game machines, and finally, into set-top cable television systems serving interactive content and pay-per-view services. Any computer or computing device, regardless of its specific microprocessor or operating system, can run Java software. A Java Virtual Machine interprets Java programming code specifically for each computing environment that uses Java. This way, you can write the code once and use it on any machine that has a Java Virtual Machine.

Other popular programming tools for web applications include Ruby, Python, and PHP. Ruby, an object-oriented programming language, is renowned for its speed and ease of use in web application development, while cloud computing applications utilize Python, praised for its clarity.

APPLICATION SOFTWARE AND DESKTOP PRODUCTIVITY TOOLS

A **software package** is a prewritten, precoded, commercially available set of programs that eliminates the need for individuals or organizations to write their own software programs for certain functions. Software packages that run on mainframes and larger computers usually require professional programmers for their installation and support, but desktop productivity software packages for consumer users can easily be installed and run by the users themselves.

Software Suites

The major desktop productivity tools are bundled together as a software suite. Microsoft Office is an example. Core office tools include Word processing software, Excel spreadsheet software, Access database software, PowerPoint presentation graphics software, and Outlook, a set of tools for email, scheduling, and contact management. Microsoft now offers a hosted cloud version of its productivity and collaboration tools as a subscription service called **Office 365**. Competing with Microsoft Office are low-cost office productivity suites such as the open-source OpenOffice (downloadable free over the Internet) and cloud-based Google Docs and G Suite.

Web Browsers

Easy-to-use software called web browsers is used for displaying web pages and for accessing the web and other Internet resources. Browsers can display or present graphics, audio, and video information as well as traditional text, and they allow you to click (or touch) on-screen buttons or highlighted words to link to related websites. Web browsers have become the primary interface for accessing the Internet or for using networked systems based on Internet technology. The leading web browsers today are **Microsoft Internet Explorer, Microsoft Edge, Mozilla Firefox, Apple Safari, and Google Chrome**.

Hypertext Markup Language (HTML) is a page description language for specifying how text, graphics, video, and sound are placed on a web page and for creating dynamic links to other web pages and objects. Using these links, a user need only point at a highlighted keyword or graphic, click it, and immediately be transported to another web page.

Web services refer to a set of loosely coupled software components that exchange information with each other using universal web communication standards and languages. They can exchange information between two systems regardless of the operating systems or programming languages on which the systems are based. They can be used to build open-standard, web-based applications linking systems of different organizations, and they can be used to create applications that link disparate systems within a single company. Different applications can use them to communicate with each other in a standard way without time-consuming custom coding.

TYPES OF NETWORKS

There are many kinds of networks and ways of classifying them. one way of looking at network is in terms of their geographic scope.

Local Area Networks (LAN)

- Designed to connect personal computers and other digital devices within a half-mile or 500-meter radius.
- LANs typically connect a few computers in a small office, all the computers in one building, or all the computers in several buildings in close proximity.
- LANs also are used to link to long-distance wide area networks (WANs) and other networks around the world, using the Internet.

Campus Area Networks (CAN)

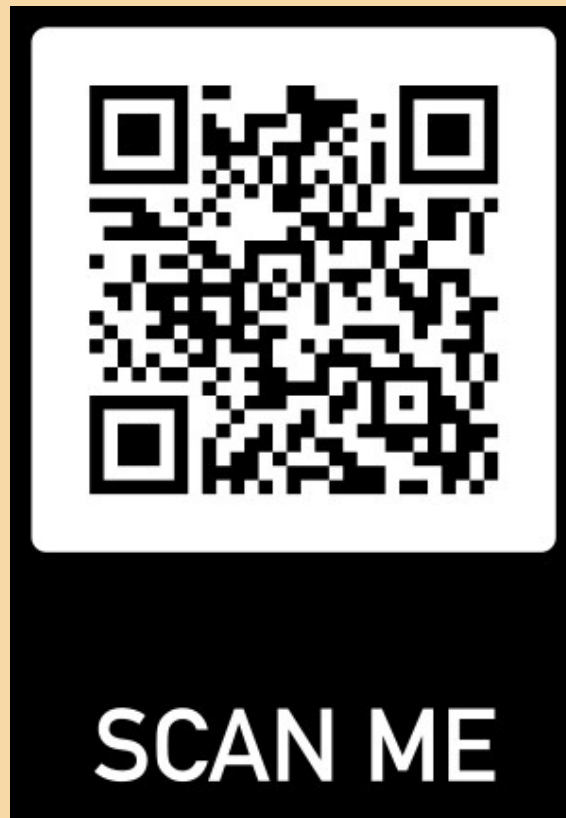
- A computer network that linked the buildings and consists of two or more LANs within the limited geographical area.
- It can be the college campus, enterprise campus, office buildings, military base and industrial complex.
- Up to 1000 meters (a mile).

Metropolitan Area Networks (MAN)

- A network that spans a metropolitan area, usually a city and its major suburbs.
- Its geographic scope falls between a WAN and a LAN.

Wide Area Networks (WAN)

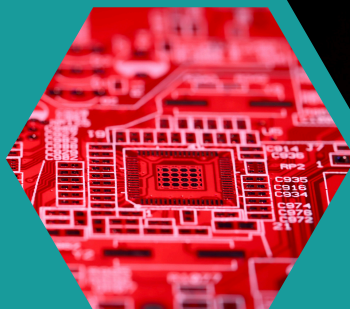
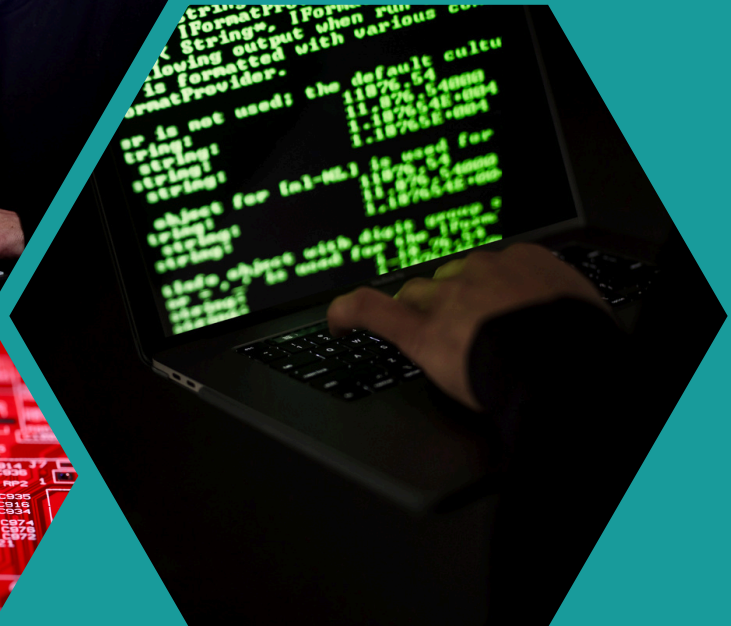
- Span broad geographical distances - regions, states, continents or the entire globe.
- The most universal and powerful WANs is the Internet.
- Computers connect to a WAN through public networks, such as the telephone system or private cable systems, or through leased lines or satellites.



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INFORMATION SYSTEMS SECURITY



LEARNING OBJECTIVES

After completing this chapter, you will be able to answer the following questions:

- ① Identify the types of malicious software
- ② Identify the types of computer crimes
- ③ Identify information systems controls
- ④ Identify information resources controls

TYPES OF MALICIOUS SOFTWARE

Malicious software programs are referred to as malware and include a variety of threats such as computer viruses, worms, and Trojan horses. It is estimated that 350,000 new malware variants are discovered every day (Akamai, 2019).

COMPUTER VIRUS

- A rogue software program that attaches itself to other software programs or data files to be executed, usually without user knowledge or permission. Most computer viruses deliver a payload.
- The payload may be relatively benign, such as instructions to display a message or image, or it may be highly destructive—destroying programs or data, clogging computer memory, reformatting a computer's hard drive, or causing programs to run improperly.
- Viruses typically spread from computer to computer when humans take an action, such as sending an email attachment or copying an infected file.

WORMS

- Independent computer programs that copy themselves from one computer to other computers over a network.
- Unlike viruses, worms can operate on their own without attaching to other computer program files and rely less on human behavior to spread rapidly from computer to computer.
- Worms destroy data and programs as well as disrupt or even halt the operation of computer networks.

TROJAN HORSE

- A software program that appears to be benign but then does something other than expected.
- The Trojan horse is not itself a virus because it does not replicate, but it is often a way for viruses or other malicious code to be introduced into a computer system.
- The term Trojan horse is based on the huge wooden horse the Greeks used to trick the Trojans into opening the gates to their fortified city during the Trojan War.

SPYWARE

- Also act as malicious software.
- These small programs install themselves surreptitiously on computers to monitor user web-surfing activity and serve up advertising.
- Thousands of forms of spyware have been documented. Many users find such spyware annoying and an infringement on their privacy.
- Some forms of spyware are especially nefarious.

TYPES OF COMPUTER CRIMES

HACKER

- An individual who intends to gain unauthorized access to a computer system.
- Hackers gain unauthorized access by finding weaknesses in the security protections websites and computer systems employ.
- Hacker activities have broadened beyond mere system intrusion to include theft of goods and information as well as system damage and cybervandalism, the intentional disruption, defacement, or even destruction of a website or corporate information system.

SPOOFING AND SNIFFING

- **Spoofing** may also involve redirecting a web link to an address different from the intended one, with the site masquerading as the intended destination.
- For example, if hackers redirect customers to a fake website that looks almost exactly like the true site, they can then collect and process orders, effectively stealing business as well as sensitive customer information from the true site.
- A **sniffer** is a type of eavesdropping program that monitors information traveling over a network. When used legitimately, sniffers help identify potential network trouble spots or criminal activity on networks, but when used for criminal purposes, they can be damaging and difficult to detect. Sniffers enable hackers to steal proprietary information from anywhere on a network, including email messages, company files, and confidential reports.

DENIAL OF SERVICE (DOS) ATTACKS

- Hackers flood a network server or web server with many thousands of false communications or requests for services to crash the network.
- The network receives so many queries that it cannot keep up with them and is thus unavailable to service legitimate requests.
- A distributed denial-of-service (DDoS) attack uses numerous computers to inundate and overwhelm the network from numerous launch points.

TYPES OF COMPUTER CRIMES (cont.)

IDENTITY THEFT

- A crime in which an imposter obtains key pieces of personal information, such as Social Security numbers, driver's license numbers, or credit card numbers, to impersonate someone else.
- The information may be used to obtain credit, merchandise, or services in the name of the victim or to provide the thief with false credentials. Identity theft has flourished on the Internet, with credit card files a major target of website hackers (see the chapter-ending case study).
- **Phishing** involves setting up fake websites or sending email messages that look like those of legitimate businesses asking users for confidential personal data.
- **Evil twins** are wireless networks that pretend to offer trustworthy Wi-Fi connections to the Internet.
- **Pharming** redirects users to a bogus web page, even when the individual types the correct web page address into his or her browser.

CLICK FRAUD

- Occurs when an individual or computer program fraudulently clicks an online ad without any intention of learning more about the advertiser or making a purchase.
- Click fraud has become a serious problem at Google and other websites that feature pay-per-click online advertising.

CYBER TERRORISM AND CYBER WARFARE

- The cyber criminal activities we have described—launching malware, DoS attacks, and phishing probes—are borderless.
- **Cyberwarfare** is a state-sponsored activity designed to cripple and defeat another state or nation by penetrating its computers or networks to cause damage and disruption.

INFORMATION SYSTEMS CONTROLS

Information systems controls are both manual and automated and consist of general and application controls.

A) GENERAL CONTROLS

- Govern the design, security, and use of computer programs and the security of data files in general throughout the organization's information technology infrastructure.
- On the whole, general controls apply to all computerized applications and consists of a combination of hardware, software, and manual procedures that create an overall control environment.
- General controls include software controls, physical hardware controls, computer operations controls, data security controls, controls over the systems development process, and administrative controls.
- The functions of each of these controls.

Type of General Control	Description
Software controls	Monitor the use of system software and prevent unauthorized access and use of software programs, system software and computer programs.
Hardware controls	Ensure that computer hardware is physically secure and check for equipment malfunction. Organizations that are critically dependent on their computers also must make provisions for backup or continued operation to maintain constant service.
Computer operations controls	Oversee the work of the computer department to ensure that programmed procedures are consistently and correctly applied to the storage and processing of data. They include controls over the setup of computer processing jobs and backup and recovery procedures for processing that ends abnormally.
Data security controls	Ensure that valuable business data files maintained internally or by an external hosting service are not subject to unauthorized access, change or destruction while they are in use or in storage.
Implementation controls	Audit the systems development process at various points to ensure that the process is properly controlled and managed.
Administrative controls	Formalize standards, rules, procedures, and control disciplines to ensure that the organization's general and application controls are properly executed and enforced.

INFORMATION SYSTEMS CONTROLS (CONT')

B) APPLICATION CONTROLS

- Application controls are specific controls unique to each computerized application, such as payroll or order processing.
- They include both automated and manual procedures that ensure that only authorized data are completely and accurately processed by that application.
- Applications controls can be classified as (1) input controls, (2) processing controls, and (3) output controls.

Type of Application Control	Description
Input controls	Check data for accuracy and completeness when they enter the system. There are specific input controls for input organization, data conversion, data editing, and error handling.
Processing controls	Processing controls establish that data are complete and accurate during updating.
Output controls	Ensure that the results of computer processing are accurate, complete, and properly distributed.

INFORMATION RESOURCES CONTROLS

Businesses have an array of technologies for protecting their information resources. They include tools for managing user identities, preventing unauthorized access to systems and data, ensuring system availability, and ensuring software quality.

A) AUTHENTICATION

- Refers to the ability to know that a person is who he or she claims to be. Authentication is often established by using passwords known only to authorized users.

New authentication technologies	Description
Token	A physical device, similar to an identification card, that is designed to prove the identity of a single user. Tokens are small gadgets that typically fit on key rings and display passcodes that change frequently.
Smart cards	A device about the size of a credit card that contains a chip formatted with access permission and other data. Smart cards are also used in electronic payment systems. A reader device interprets the data on the smart card and allows or denies access.
Biometric authentication	Uses systems that read and interpret individual human traits, such as fingerprints, irises, and voices to grant or deny access. Biometric authentication is based on the measurement of a physical or behavioural trait that makes each individual unique.
Two-factor authentication	Increases security by validating users through multistep process. To be authenticated, a user must provide two means of identification, one of which is often a physical token, such as smartcard or chip-enabled bank card, and other of which is typically data, such as password or personal identification number (PIN).

INFORMATION RESOURCES CONTROLS (CONT')

B) FIREWALLS

- Firewalls prevent unauthorized users from accessing private networks.
- a firewall is a combination of hardware and software that controls the flow of incoming and outgoing network traffic.
- It is generally placed between the organization's private internal networks and distrusted external networks, such as the Internet, although firewalls can also be used to protect one part of a company's network from the rest of the network.
- The firewall acts like a gatekeeper that examines each user's credentials before it grants access to a network.
- The firewall identifies names, IP addresses, applications, and other characteristics of incoming traffic.
- It checks this information against the access rules that the network administrator has programmed into the system.
- The firewall prevents unauthorized communication into and out of the network.
- There are a number of firewalls screening technologies, including static packet filtering, stateful inspection, Network Address Translation (NAT), and application proxy filtering.

C) INTRUSION DETECTION SYSTEMS

- Commercial security vendors now provide intrusion detection tools and services to protect against suspicious network traffic and attempts to access files and databases.
- Intrusion detection systems feature full-time monitoring tools placed at the most vulnerable points or hot spots of corporate networks to detect and deter intruders continually.
- The system generates an alarm if it finds a suspicious or anomalous event.
- Scanning software looks for patterns indicative of known methods of computer attacks such as bad passwords, checks to see whether important files have been removed or modified, and sends warnings of vandalism or system administration errors.
- The intrusion detection tool can also be customized to shut down a particularly sensitive part of a network if it receives unauthorized traffic.

INFORMATION RESOURCES CONTROLS (CONT')**D) ANTIVIRUS AND ANTI SPYWARE SOFTWARES**

- Defensive technology plans for both individuals and businesses must include anti-malware protection for every computer.
- Anti-malware software prevents, detects, and removes malware, including computer viruses, computer worms, Trojan horses, spyware, and adware.
- However, most anti-malware software is effective only against malware already known when the software was written.
- To remain effective, the software must be continually updated.
- Even then it is not always effective because some malware can evade detection.
- Organizations need to use additional malware detection tools for better protection.

E) UNIFIED THREAT MANAGEMENT (UTM) SYSTEMS

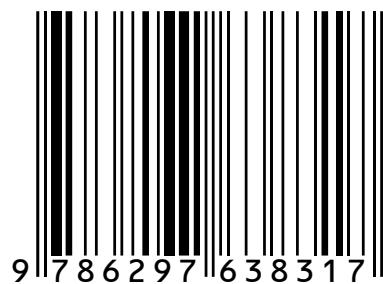
- To help businesses reduce costs and improve manageability, security vendors have combined into a single appliance various security tools, including firewalls, virtual private networks, intrusion detection systems, and web content filtering and anti-spam software.
- These comprehensive security management products are called unified threat management (UTM) systems.
- UTM products are available for all sizes of networks.
- Leading UTM vendors include Fortinet, Sophos, and Check Point, and networking vendors such as Cisco Systems and Juniper Networks provide some UTM capabilities in their products.



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