

Principles of Management Information Systems

Lecture 3

MGM331

Hardware and Mobile Devices

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Chapter 3

- Organizations invest in computer hardware to improve worker productivity, increase revenue, reduce costs, provide better customer service, speed up time to market, and facilitate collaboration among employees.
- Organizations that don't make wise hardware investments are often stuck with outdated equipment that is unreliable and that cannot take advantage of the latest software advances.
- Such old hardware can serve as an anchor to progress and can place an organization at a competitive disadvantage.

Chapter 3

- Managers, no matter what their career field and educational background, are expected to help define the business needs that hardware must support.
- In addition, managers must be able to ask relevant questions and evaluate options when considering hardware investments for their areas of the business.
- This need is especially true in small organizations, which might not employ information system specialists.

Chapter 3

- Managers in marketing, sales, and human resources often help IS specialists assess opportunities to apply computer hardware and evaluate the options and features specified for the hardware.
- Managers in finance and accounting must keep an eye on the bottom line—guarding against overspending—yet be willing to invest in computer hardware when and where business conditions warrant it.

Principles

- The computer hardware industry is rapidly changing and highly competitive, creating an environment ripe for technological breakthroughs.
- Computer hardware must be carefully selected to meet the evolving needs of the organization and its supporting information systems.
- The computer hardware industry and users are implementing green computing designs and products.

Learning Objectives

- Identify and briefly describe the functions of the primary components of a computer.
- Give an example of recent innovations in computer processor chips, memory devices, and input/output devices.
- Identify the characteristics of various classes of single user and multiuser computer systems, and discuss the usage of each class of system.
- Define the term “Green Computing” and identify the primary goals of this term.

Chapter 3 Hardware and Mobile Devices

Anatomy of a Computer

Processor

Single Processor
Multiprocessing
Parallel Processing

Memory

Random Access Memory
Magnetic Secondary Storage
Solid State Secondary Storage
Optical Secondary Storage

Input and Output Devices

Keyboard
Mouse
Scanner
Smart Cards
Touch Screens
Display Screen
Printers

Computer System Type

Portable Computers

Desktops and Workstations

Servers, Mainframes, and Supercomputers

Anatomy of a Computer

Computer system hardware components include devices that perform input, processing, data storage, and output, as shown in Figure 3.1. These include the processor, memory, and input/output devices, all of which are discussed in this section.

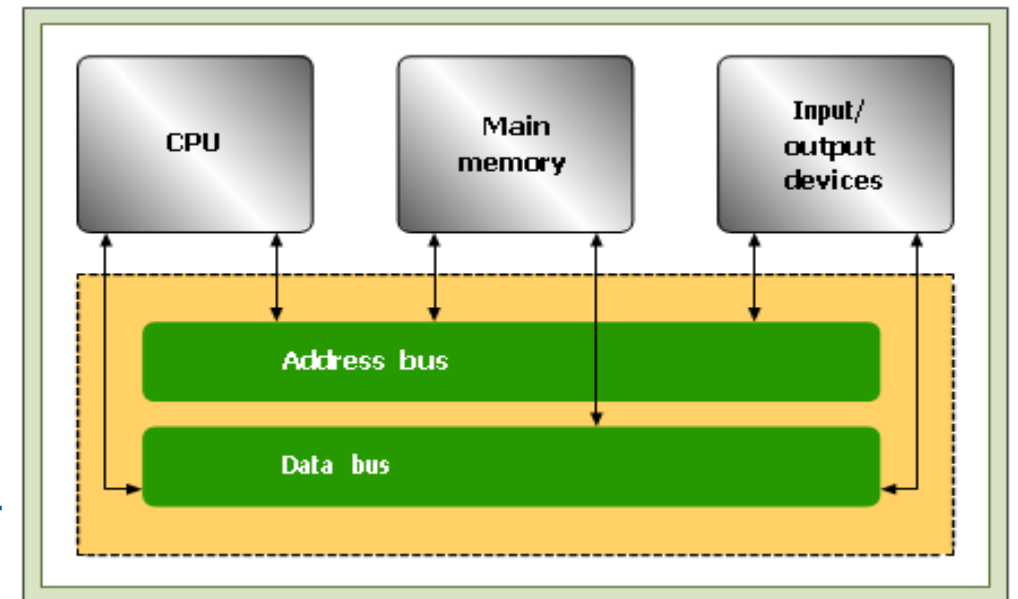


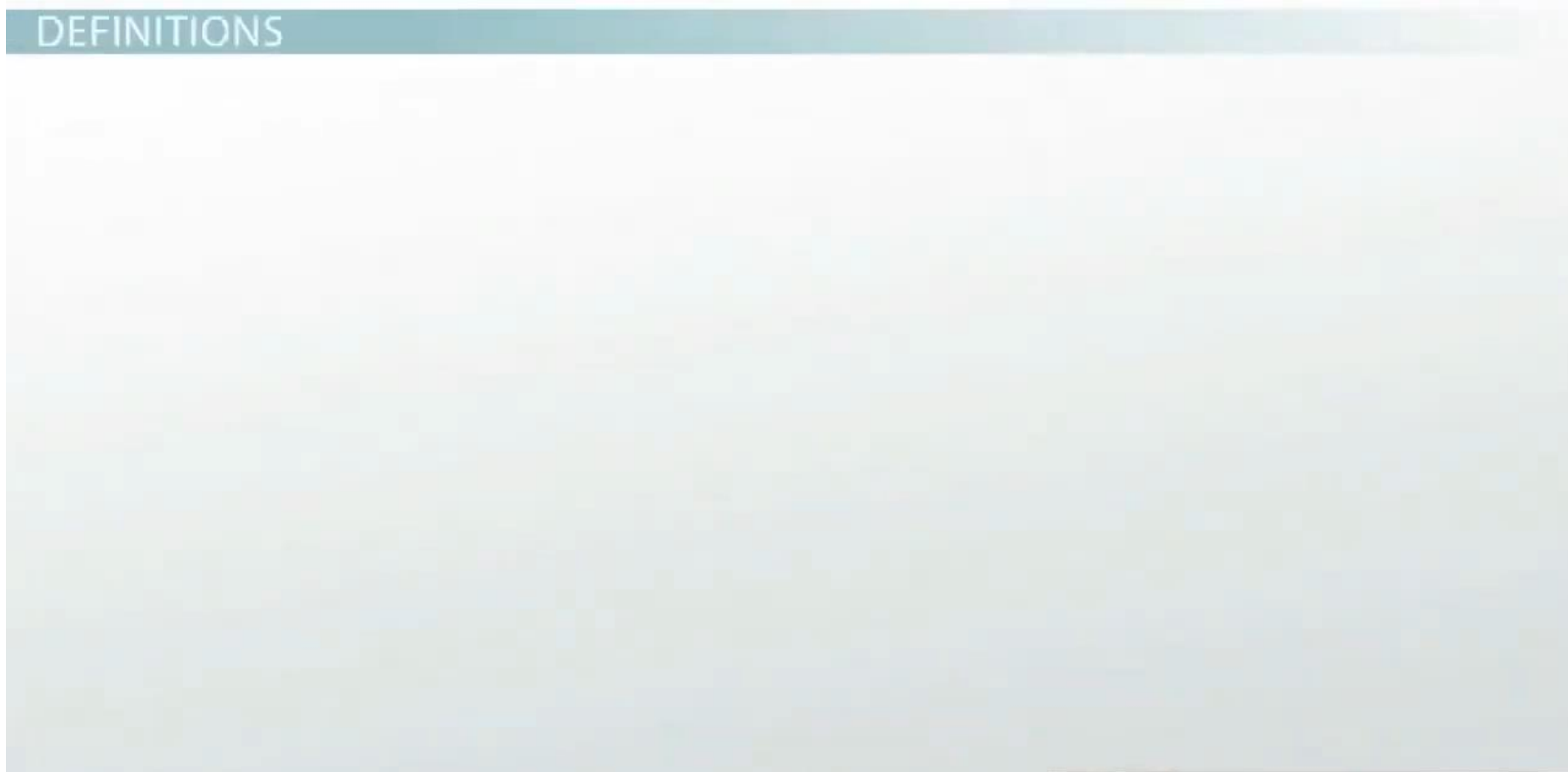
FIGURE 3.1
Basic anatomy of a computer

Processor

- The *central processing unit* (CPU) or simply processor is the part of a computer that sequences and executes instructions.
- *Memory* provides the processor with a working storage area to hold program instructions and data. It rapidly provides data and instructions to the processor.
- *Input/output devices* provide data and instructions to the computer and receive results from it.
- Data and instructions are routed to and from the various components over the *bus*, a set of electronic circuits.

Processor

DEFINITIONS



Processing Techniques for Increased Efficiency

Single Processor

- Multitasking: The ability of an operating system to have more than one program (task) open at one time:
 - CPU rotates between tasks.
 - Switching is done quickly.
 - Appears as though all programs executing at the same time.

Processing Techniques for Increased Efficiency

Multiprocessing and parallel processing

- Multiple processors (or multiple cores) are used in one computer system to perform work more efficiently.
 - Multiprocessing: Each CPU (or core) typically works on a different job.
 - Used with personal computers with multi core processors.
 - Parallel processing: CPUs or cores typically works together to complete one job more quickly.
 - Used with servers and mainframes.

CPU vs. Core

- The main difference between CPU and Core is that the CPU is an electronic circuit inside the computer that carries out instruction to perform arithmetic, logical, control and input/output operations while the core is an execution unit inside the CPU that receives and executes instructions.

Memory

- *Main memory* provides the CPU with a working storage area for program instructions and data.
- The chief function of memory is to rapidly provide data and instructions to the CPU.
- In order for their systems to run efficiently, organizations must invest in a sufficient amount of main memory.
- Organizations also need large amounts of secondary storage to hold the huge quantities of data that cannot fit within the limits of main memory.
- Usually, 8 bits (a Byte) are used to represent a character, such as the letter *A*

How computer memory works

Memory

Random Access Memory

- As currently designed, RAM chips are volatile storage devices, meaning they lose their contents if the current is turned off or disrupted, which can be caused by a power surge, a brownout, or electrical noise generated by lightning or nearby machines.
- RAM chips are mounted directly on the computer's main circuit board
- These RAM chips consist of millions of switches that are sensitive to changes in electric current.

Secondary Data Storage Devices

- Storing data safely and effectively is critical to an organization's success.
- For most organizations, the best overall data storage solution is likely a combination of different secondary storage options that can store large amounts of data more permanently than allowed with main memory.
- Compared with memory, secondary storage offers the advantages of nonvolatility, greater capacity, and is considerably less expensive than primary memory.
- The selection of secondary storage media and devices requires understanding their primary characteristics: access method, capacity, and portability.

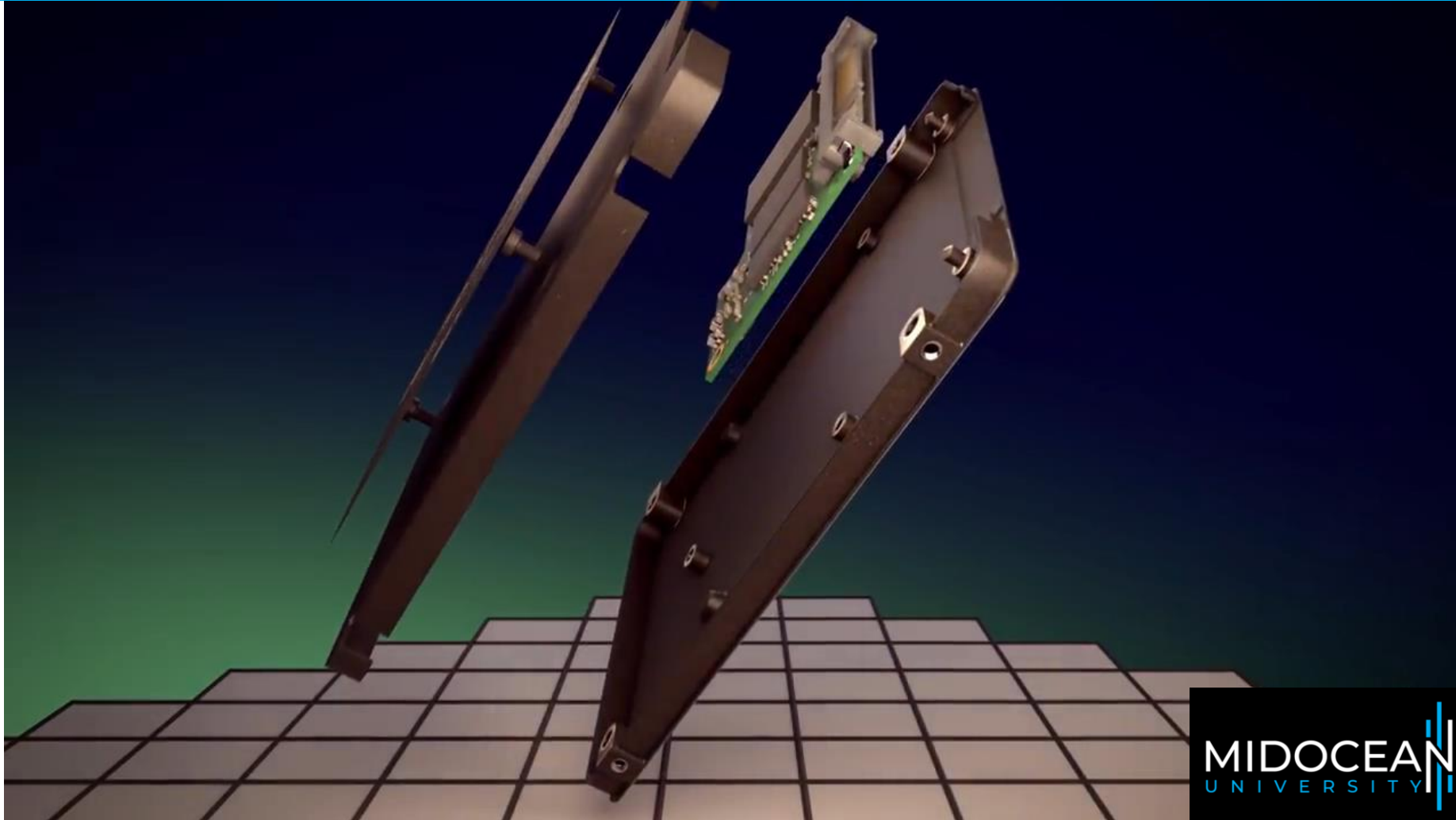
Magnetic Secondary Storage Devices



Magnetic Secondary Storage Devices

- A hard disk drive (HDD) is a direct access storage device used to store and retrieve data from rapidly rotating disks coated with magnetic material.
- A hard disk represents bits of data with small magnetized areas and uses a read/write head to go directly to the desired piece of data.
- The concern is that the most critical mechanical components inside a HDD storage like the motor, the disks, and read/write heads—can fail. Thus, organizations now require that their data storage devices be fault tolerant, that is, they can continue with little or no loss of performance if one or more key components fail.

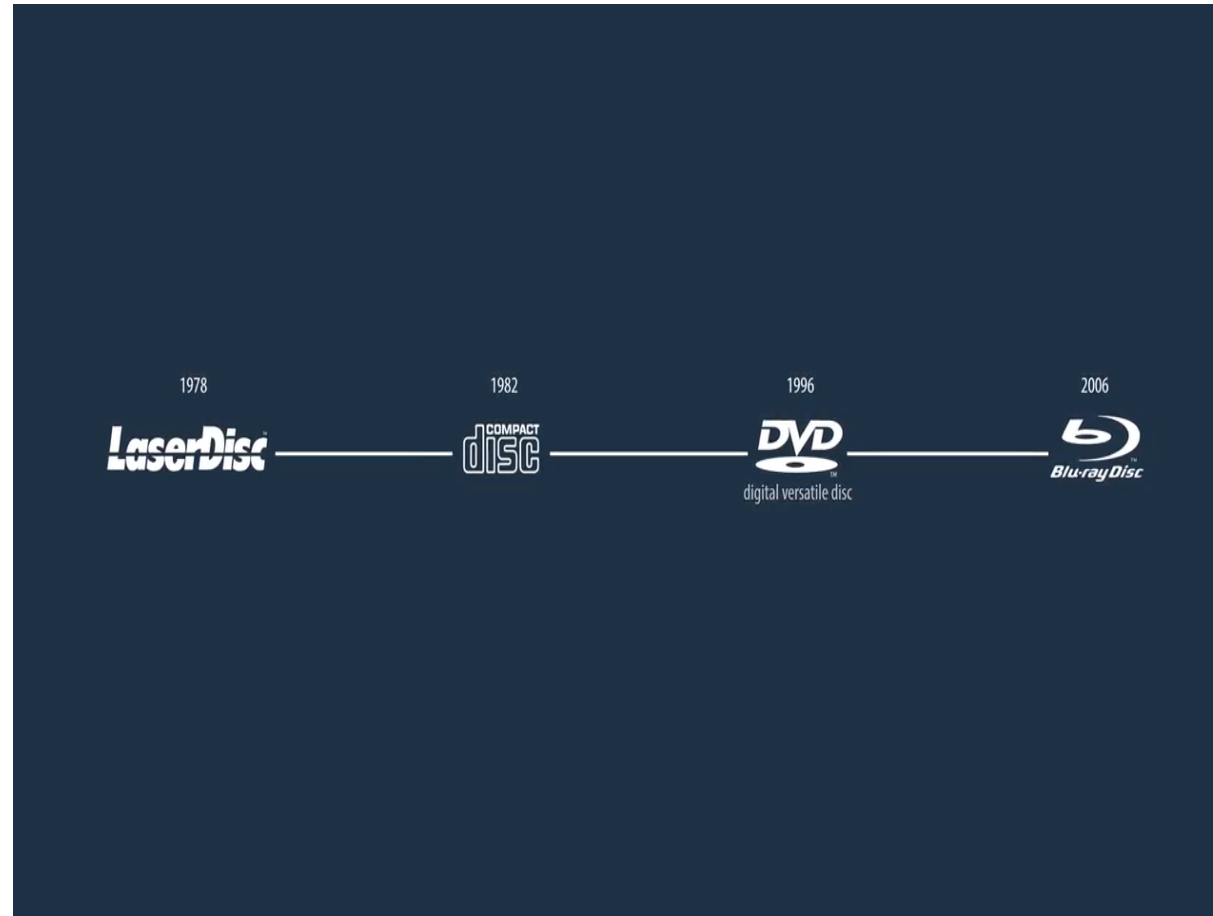
Solid State Secondary Storage Devices



Solid State Secondary Storage Devices

- A solid state storage device (SSD) stores data in memory chips rather than on hard disk drives or optical media.
- These memory chips require less power and provide much faster data access than magnetic data storage devices.
- In addition, SSDs have no moving parts, so they are less fragile than hard disk drives.
- All these factors make the SSD a preferred choice over hard disk drives for portable computers.

Optical Secondary Storage Devices



Optical Secondary Storage Devices

- An *optical storage device* uses special lasers to read and write data.
- The lasers record data by physically burning pits in the disc.
- Data is directly accessed from the disc by an optical disc device.
- This optical disc device uses a low power laser that measures the difference in reflected light caused by a pit (or lack thereof) on the disc.

Input and Output Devices

- Input and output devices are the gateways to the computer system you use them to provide data and instructions to the computer and receive results from it.
- Input and output devices are part of a computer's user interface, which includes other hardware devices and software that allow you to interact with a computer system.
- As with other computer system components, an organization should keep its business goals in mind when selecting input and output devices.

Input and Output Devices

- Restaurant chains use handheld input devices or computerized terminals that let food servers enter orders and transfer them to the kitchen efficiently and accurately.
- These systems have also cut costs by helping restaurants track inventory and market to customers.

Input and Output Devices

- In general, businesses want input devices that let them accurately and rapidly enter data into a computer system, and they want output devices that let them produce timely results.
- Some organizations have very specific needs for input and output, requiring devices that perform specific functions.
- The more specialized the application, the more specialized the associated system input and output devices.

Input and Output Devices

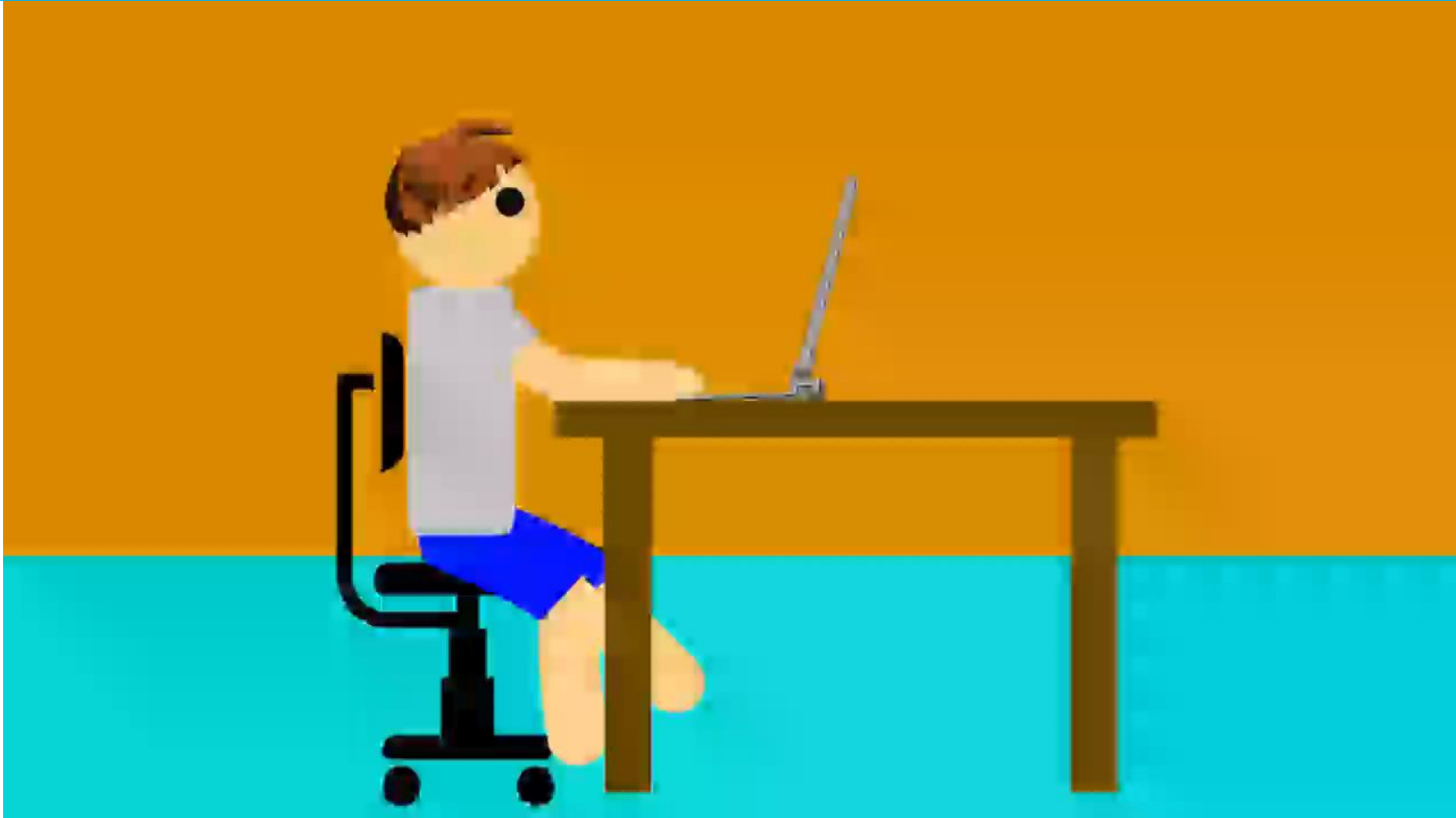
- A **keyboard** and a computer mouse are common devices used for entry and input of data, such as characters, text, and basic commands.
- Some companies manufacture keyboards that are more comfortable, more easily adjusted, and faster to use than standard keyboards.
- These keyboards, such as the split keyboard, are designed to help users avoid wrist and hand injuries caused by hours of typing.



Input and Output Devices

- A *mouse* is used to point to and click symbols, icons, menus, and commands on the screen. The computer takes a number of actions in response, such as entering data into the computer system.
- Wireless mice and keyboards help keep a physical desktop free from clutter.

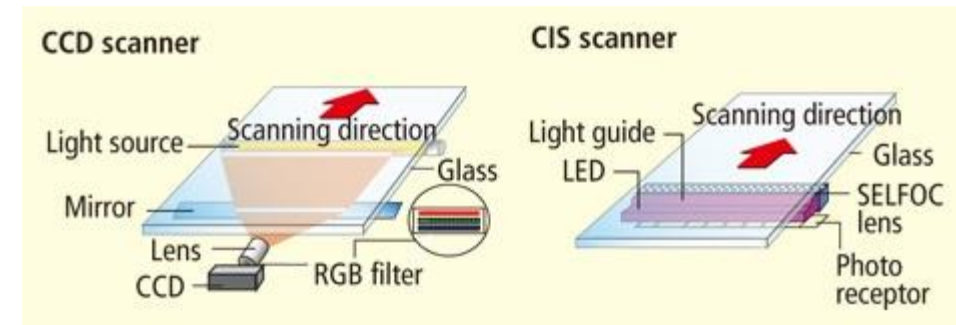
How Mouse works



Input and Output Devices

Scanning Devices

- Scanners operate by shining light at the object or document being digitized and directing the reflected light (usually through a series of mirrors and lenses) onto a photosensitive element.
- In most scanners, the sensing medium is an electronic, light sensing integrated circuit known as a charged coupled device (CCD).
- CIS (Contact Image Sensor) is a newer technology that allows scanners to be smaller and lighter, but sacrifices dynamic range, depth of field, and resolution.



Input and Output Devices

- *Smart cards* are embedded with computer chips containing key consumer and account data. Smart card users must either enter their PIN (chip and PIN) or sign (chip and sign) for each transaction to be approved.
- *Contactless payment cards* contain an embedded chip and antenna that enables the consumer to simply hold the card close to a terminal to transfer the data necessary to make a payment.
- Typically, no signature or PIN entry is required for purchases less than \$25, making transactions speedier than payments made by conventional credit or debit card or even cash.
- Contactless payment cards are ideal in situations where the consumer must make a fast payment, such as when boarding a form of mass transportation; however, some observers are concerned that it is relatively easy to scan details from contactless cards.

How smart card work



Input and Output Devices

Touch Screens

- Advances in screen technology allow display screens to function as input as well as output devices.
- By touching certain parts of a touch sensitive screen, you can start a program or trigger other types of action.
- Touch screens removed the need for a keyboard, which conserves space and increases portability.
- 3D Touch uses a pressure sensitive touchscreen that measures how forcefully you press down on the screen.
- The new feature adds “peek” and “pop” gestures to the tap, swipe, and pinch gestures with which most smartphone users are familiar.

Touch Screens



Output Devices

- The *display screen* is a device used to show the output from the computer. Today a variety of flat panel display screens are far lighter and thinner than the traditional cathode ray tubes (CRTs) associated with early computers.
- Table 3.4 compares types of flat panel display screens.

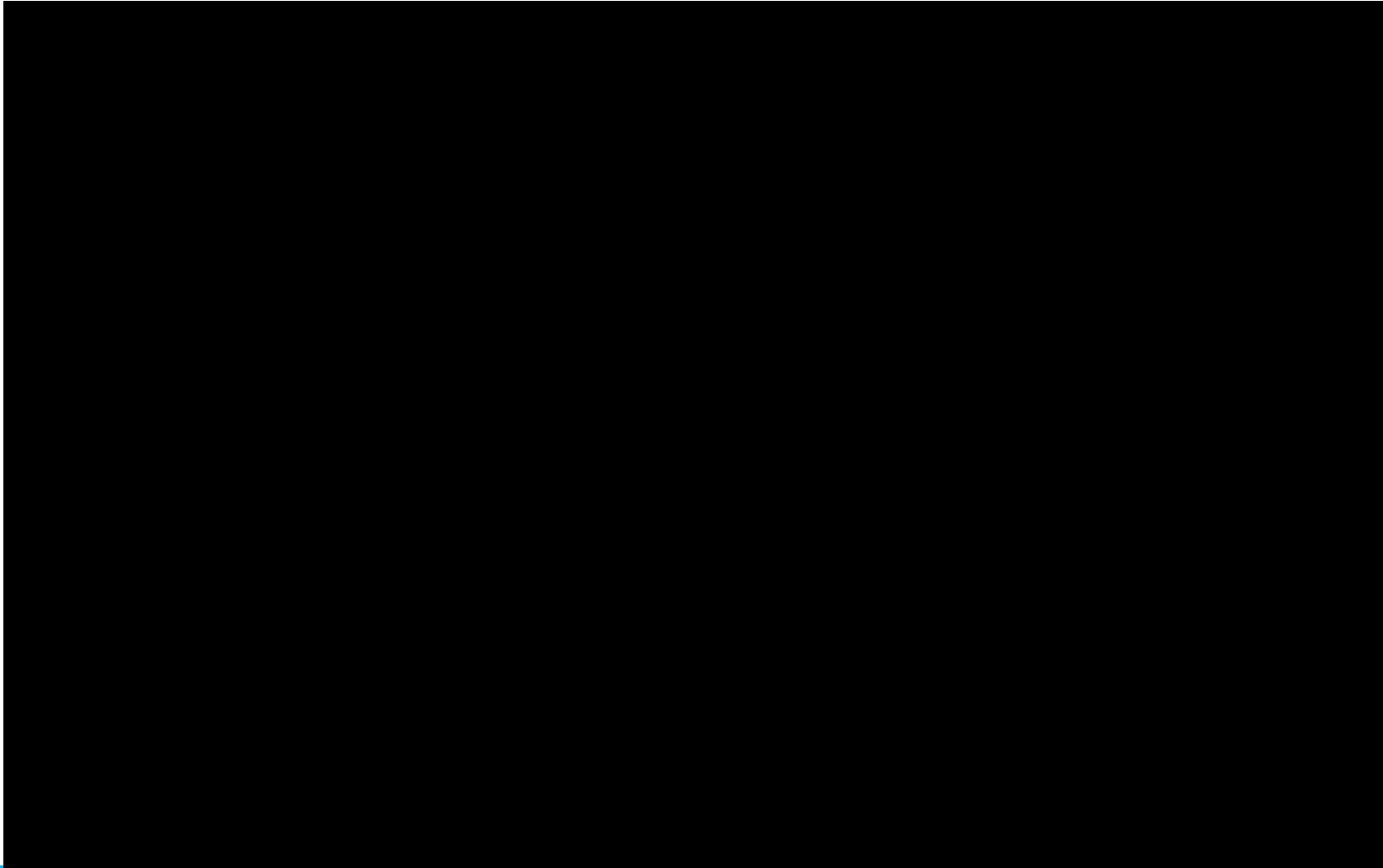
Type	Description	Noteworthy Feature
Liquid crystal display (LCD)	Uses several layers of charged liquid crystals placed between clear plates that are lit from behind by a fluorescent light to create light and images	The viewing angle tends to be worse than that of plasma displays
Light emitting diode (LED)	An LCD display that uses light emitting diodes (LEDs) as backlight on the screen rather than a fluorescent lamp	Provides better contrast and lower energy consumption than LCDs
Organic light emitting diode (OLED)	Functions by exciting organic compounds with electric current to produce bright, sharp images	Does not employ a backlight, which enables improved contrast and lower power consumption than LCD and LED LCD displays
Plasma	Uses electricity to excite gas atoms to light up appropriate phosphors on the screen to emit light and color	Performs well in dark conditions but not as well in well lit rooms

Screen Resolution Explained



RESOLUTION

Types of Printers



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Computer System Type

Portable Computers

Desktops and Workstations

Servers, Mainframes, and Supercomputers

Computer System Type

- In general, computers can be classified as either special purpose or general purpose.
- Special purpose computers are used for limited applications, for example, by military, government, and scientific research groups such as the CIA and NASA.
- Other applications include specialized processors found in appliances, cars, and other products. For example, automobile repair shops connect special purpose computers to your car's engine to identify specific performance problems.

Computer System Type

Portable Computers

- Many computer manufacturers offer a variety of portable computers, those that are small enough to carry easily.
- Portable computers include wearable computers, smartphones, laptops, notebooks, and tablets.

Portable Computers

- A *wearable computer* is an electronic device capable of storing and processing data that is incorporated into a person's clothing or personal accessories.
- Health tracking wrist bands or smart watches that can capture a wide range of data, including distance covered, elevation climbed, pace, calories burned, continuous heart rate, and quality of sleep.
- Most can also display call and text notifications and enable one to control songs from a mobile playlist.

Portable Computers

Smartphones

- smartphones calls, download and run apps, send and receive text messages and email, view documents and files, take and send photos and videos, get driving directions via GPS, browse Web sites, and create a playlist of digital tunes.

Portable Computers

A **laptop** is a personal computer designed for use by mobile users, being small and light enough to sit comfortably on a user's lap.

- Laptops use a variety of flat panel technologies to produce lightweight and thin display screens with good resolution.
- Most personal computer users now prefer a laptop over a desktop because of its portability, lower energy usage, and smaller space requirements.

Computer System Type

Desktops, and Workstations: Nonportable single user

- Named for their size, desktop computers can provide sufficient computing power, memory, and storage for most business computing tasks.
- Workstations are more powerful than personal computers but still small enough to fit on a desktop.
- They are used to support engineering and technical users who perform heavy mathematical computing, computer assisted design (CAD), video editing, and other applications requiring a high end processor.
- Such users need very powerful CPUs, large amounts of main memory, and extremely high resolution graphic displays.
- Workstations are typically more expensive than the average desktop computer.

Computer System Type

Servers, Mainframes, and Supercomputers are designed to support workgroups from a small department of two or three workers to large organizations with tens of thousands of employees and millions of customers.

- A **server** is a computer employed by many users to perform a specific task, such as running network or Internet applications.
- While almost any computer can run server operating system and server applications, a server computer usually has special features that make it more suitable for operating in a multiuser environment.
- These features include greater memory and storage capacities, faster and more efficient communications abilities, and reliable backup capabilities.

Computer System Type

- A *mainframe* computer is a large, powerful computer shared by dozens or even hundreds of concurrent users connected to the machine over a network.
- Mainframe computers provide the data processing power and data storage capacity that enables banks and brokerage firms to deliver new mobile services, credit card companies to detect identity theft, and government agencies to better serve citizens.

Computer System Type

- *Supercomputers* are the most powerful computers with the fastest processing speed and highest performance.
- They are special-purpose machines designed for applications that require extensive and rapid computational capabilities.
- Originally, supercomputers were used primarily by government agencies to perform the high-speed number crunching needed in weather forecasting, earthquake simulations, climate modeling, nuclear research, study of the origin of matter and the universe, and weapons development and testing.

Green computing

- Green computing is concerned with the efficient and environmentally responsible design, manufacture, operation, and disposal of IS related products, including all types of computing devices (from smartphones to supercomputers), printers, printer materials such as cartridges and toner, and storage devices.
- Many business organizations recognize that going green is in their best interests in terms of public relations, safety of employees, and the community at large.

Green computing

- They also recognize that green computing presents an opportunity to reduce total costs over the life cycle of their IS equipment.
- Green computing has three goals: reduce the use of hazardous material, allow companies to lower their power related costs, and enable the safe disposal or recycling of computers and computer related equipment.

Summary

- ❖ The computer hardware industry is rapidly changing and highly competitive, creating an environment ripe for technological breakthroughs.
- ❖ Computer hardware should be selected to meet specific user and business requirements. These requirements can evolve and change over time.
- ❖ The central processing unit, memory, input/output devices, and the bus cooperate to execute program instructions

Summary

- ❖ A multicore processor is one that combines two or more independent processors into a single computer so that the independent processors can share the workload.
- ❖ Parallel computing is the simultaneous execution of the same task on multiple processors to obtain results more quickly.
- ❖ Main memory provides the CPU with working storage for program instructions and data.

Summary

- ❖ Random access memory or RAM is volatile; loss of power to the computer erases its contents.
- ❖ RAM comes in many different varieties, including dynamic RAM or DRAM
- ❖ Cache memory is a type of high speed memory that CPUs can access more rapidly than RAM.

Summary

- ❖ Computer systems can store larger amounts of data and instructions in secondary storage, which is less volatile and has greater capacity than memory.
- ❖ The primary characteristics of secondary storage media and devices include access method, capacity, portability, and cost.
- ❖ Common forms of secondary storage include magnetic storage devices such as hard disk drives, optical storage devices and solid state storage devices (SSDs) such as flash drives.

Summary

Data is placed in a computer system in a two stage process:

- ❖ Data entry converts human readable data into machine readable form
- ❖ Data input then transfers machine readable data into the system.
- Common input devices include a keyboard, a mouse, scanning devices, smart cards, and touch sensitive screens.

Summary

- ❖ Flat panel display screens, including liquid crystal display (LCD), light emitting diode (LED), organic light emitting diode (OLED), and plasma devices.
- ❖ Display screen quality is determined by the computer graphics card, aspect ratio, size, color, and resolution. Other output devices include printers, digital audio players.

Summary

- ❖ Computer hardware must be carefully selected to meet the evolving needs of the organization and its supporting information systems.
- ❖ Computer systems are generally divided into two categories: single user and multiple users.
- ❖ Single user systems include portable computers, such as wearable computers, smartphones, laptops, and tablets.
- ❖ Nonportable single user systems include, desktop, and workstation computers.

Summary

- ❖ Multiuser systems include servers, mainframes, and supercomputers.
- ❖ A mainframe computer is a large, powerful computer shared by dozens or even hundreds of concurrent users connected to the machine over a network.
- ❖ Supercomputers are the most powerful computers with the fastest processing speed and highest performance.

Reference

