

# Unit 2

## Digital Devices

### Computer Concepts 2016

ENHANCED EDITION



## 2 Unit Contents

- Section A: Device Basics
- Section B: Device Options
- Section C: Processors and Memory
- Section D: Storage
- Section E: Input and Output

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## 2 Section A: Device Basics

- Computers
- Circuits and Chips
- Components
- Maintenance

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## 2 Computers

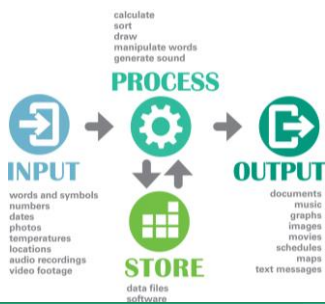
- At its core, a **computer** is a multipurpose device that accepts input, processes data, and produces output, all according to a series of stored instructions
- **Input** is whatever is typed, submitted, or transmitted to a computer
- **Output** is the result produced by a computer

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## 2 Computers

FIGURE 2-1: THE IPO MODEL DEFINES COMPUTERS



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## 2 Computers

- The instructions that tell a digital device how to carry out processing tasks are referred to as a **computer program**, or simply a program
- Programs form the **software** that sets up a computer to do a specific task

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## 2 Computers

- When a computer “runs” software, it performs the instructions to carry out a task
- The first computers were “programmed” to perform a specific task by connecting wire circuitry in a certain way
- The term **stored program** means that a series of instructions for computing a task can be loaded into a computer’s memory

## 2 Computers



The stored program concept allows you to use a computer for one task, such as word processing, and then easily switch to a different type of computing task, such as editing a photo or playing music. It is the single most important characteristic that distinguishes computers from other simpler and less versatile digital devices, such as digital clocks, calculators, and cameras.

FIGURE 2-2: STORED PROGRAMS MAKE COMPUTERS VERSATILE MACHINES

## 2 Computers

- Computers run three main types of software:
  - **Application software**
  - **System software**
  - **Development tools**



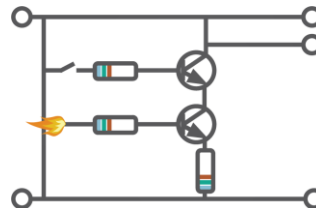
## 2 Computers

- **Application Software** is a set of computer programs that helps a person carry out a task
- The primary purpose of **system software** is to help the computer system monitor itself in order to function efficiently (an example of system software is a **computer operating system** or OS)
- **Development tools** are used for creating software applications, Web sites, operating systems, and utilities

## 2 Circuits and Chips

- The small circuit boards and integrated circuits you see when you open up a digital device are the essence of digital electronics
- Digital electronics represent data bits as electrical signals that travel over circuits in much the same way that electricity flows over a wire when you turn on a light switch

## 2 Circuits and Chips



This little circuit is composed of electrical pathways (lines), transistors (circles), and resistors (rectangles). The electronics for digital devices require millions of similar circuits. Constructing these circuits from wires would produce gigantic devices.

FIGURE 2-4: A SIMPLE CIRCUIT

## 2 Circuits and Chips

- An integrated circuit (IC) is a set of microscopic electronic circuits etched onto a thin slide of semiconducting material
- The terms *computer chip*, *microchip*, and *chip* are commonly used to refer to integrated circuits
- **Semiconductors**, such as silicon and germanium, are substances with properties between those of a conductor (like copper) and an insulator (like wood)

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## 2 Circuits and Chips

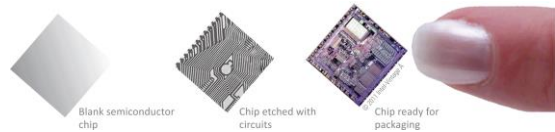


FIGURE 2-5: COMPUTER CHIPS ARE MADE FROM SEMICONDUCTORS

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## 2 Circuits and Chips

FIGURE 2-6: CHIPS ARE HOUSED IN CERAMIC PACKAGES



DIPs have two rows of pins that connect the chip to a circuit board.

An LGA is a square chip package, typically used for microprocessors, with pins arranged in concentric squares.

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## 2 Circuits and Chips

- The electronic components of most digital devices are mounted on a circuit board called a system board, motherboard, or main board
- The **system board** houses all essential chips and provides connecting circuitry between them

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## 2 Circuits and Chips

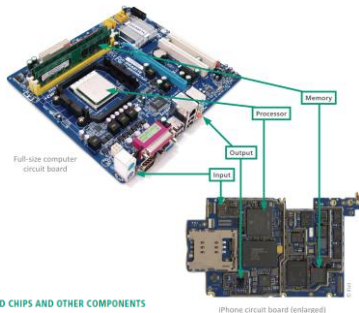


FIGURE 2-7: SYSTEM BOARDS HOLD CHIPS AND OTHER COMPONENTS

(iPhone circuit board (enlarged))

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## 2 Components

- In the computer industry the term **form factor** refers to the size and dimensions of a device or components, such as circuit boards and system units
- The term **system unit** is tech speak for the part of a digital device that holds the system board
- Some popular form factors include: component, clamshell, and slate

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## 2 Components

FIGURE 2-8: A TYPICAL COMPONENT SYSTEM



## 2 Components

FIGURE 2-9: A TYPICAL CLAMSHHELL DEVICE



## 2 Components

FIGURE 2-10: A TYPICAL SLATE DEVICE



## 2 Maintenance

- You can extend the life of your digital devices with regular maintenance
- There are four components of digital devices that require maintenance:
  - System unit
  - Keyboard
  - Screen
  - Battery

## 2 Maintenance

FIGURE 2-11: CLEANING GUIDELINES



Don't use harsh cleaning products; follow manufacturer recommendations.



Never immerse a device in liquid; water and electronics don't mix.



Do not allow cleaning agents to drip on keyboards or touchpads.



Do not spray cleaning agents directly on the device; spray them onto a cleaning cloth.

## 2 Maintenance

- Basic system unit maintenance is simple; keep the unit clean, prevent it from overheating, shield it from damage and protect it from electrical surges



Dust with a clean microfiber cloth and disinfect with antibacterial wipes.



Use a low vacuum setting to remove dust from fan vents.



Use a protective case or carrying bag.



Only plug into a surge-protected outlet.

FIGURE 2-12: BASIC SYSTEM UNIT MAINTENANCE

## 2 Maintenance

- Touchscreens collect fingerprints and are a breeding ground for bacteria, so it's a good idea to clean them periodically
- Many touchscreens are made from Gorilla Glass, which is designed to resist scratching and cracking, and **oleophobic** coating, designed to repel oils from fingertips
- A plastic screen protector is a good defense against scratches and cracks

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## 2 Maintenance

- Most of today's battery-powered digital devices contain a **lithium ion** (Li-ion) battery
- Li-ion batteries can overheat and in the worst case, they can explode
- Smart consumers don't operate devices that are hot to the touch

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## 2 Maintenance

FIGURE 2-14: EXTEND THE LIFE OF THE BATTERIES IN YOUR DEVICES

- 1 Charge when the low battery indicator comes on.
- 2 Avoid totally discharging the battery.
- 3 Remove the device from the charger when it's fully charged.
- 4 If your device becomes hot while in use, turn it off.
- 5 Disable unused apps that constantly connect to the Internet.
- 6 Switch to airplane mode when in an area with no cell coverage.

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## 2 Section B: Device Options

- Enterprise Computers
- Personal Computers
- Niche Devices
- Choosing a Digital Device

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## 2 Enterprise Computers

- The most powerful computers are generally used in businesses and government agencies
- These computers have the ability to service many simultaneous users and process data at very fast speeds
- Types of "Big" computers are:
  - Supercomputers
  - Mainframes
  - Servers



FIGURE 2-15: "BIG" COMPUTERS

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## 2 Enterprise Computers

- **Supercomputers:** considered the fastest computers in the world at the time of construction; can tackle complex tasks other computers cannot; typical use includes breaking codes, modeling weather systems, and simulating nuclear explosions
- **Mainframes:** a large and expensive computer capable of simultaneously processing data for hundreds or thousands of users; looks like a closet sized cabinet; used to provide centralized storage, processing and management for large amounts of data
- **Servers:** "serves" data to computers in a network; Google search results are provided by servers; about the size of a desk draw and mounted in racks of multiple servers

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## 2 Personal Computers

- A personal computer is designed to meet the computing needs of an individual
- The term *personal computer* can be abbreviated as *PC*
- Personal computers can be classified as:
  - Desktop
  - Portable
  - Mobile devices

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## 2 Personal Computers

- **Desktop:** fits on a desk and runs on power from a wall outlet; keyboard is typically separate from the monitor; popular in offices and schools
- **Portable:** runs on battery power; its components are contained in a single case for easy transportation
- **Laptop:** also referred to as a notebook computer; small and lightweight with a clamshell design and keyboard at the base



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## 2 Personal Computers

- **Tablets:** a **tablet computer** is a portable computing device featuring a touch-sensitive screen used for input and output; uses a specialized OS; a **slate tablet** configuration has a narrow frame screen that lacks a physical keyboard; Apple iPad is a slate tablet
- **Smartphones:** mobile devices with features similar to a tablet computer; provide telecommunications capabilities over cell phone networks



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## 2 Niche Devices

- Niche devices all have one thing in common: They contain a microprocessor
  - **Ebook readers:** designed for displaying the content of digital publications; NOOK and Kindle are eBook readers
  - **Portable media players:** a handheld device that can store and play music; iPod touch is a portable media player
  - **Game consoles:** devices for playing computer games such as Sony's PlayStation and Nintendo's Wii



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## 2 Niche Devices

- **Smartwatches:** multifunctional devices that include a camera, thermometer, compass, calculator, cell phone, GPS, media player, and fitness tracker
- **Smartglasses:** include Google Glass; controlled by voice commands or a touchpad on the rim; has a camera and display device that essentially beams an image toward the wearer's eye
- **Activity trackers:** monitors your steps and heart rate
- **Smart appliances:** Modern refrigerators, washing machines, and other appliances are controlled by integrated circuits called microcontrollers that combine sensors with processing circuitry



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## 2 Choosing a Digital Device

- The following activities can get you started on choosing the right digital device:
  - Consider how you plan to use your device
  - Choose the type of device
  - Decide on a budget and stick to it
  - Select a platform
  - Check out the device's specifications

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## 2 Choosing a Digital Device

USAGE PLAN	PURCHASE RECOMMENDATION
You plan to use your computer for email and Facebook, browsing the Web, playing games, managing finances, downloading digital music, and writing school papers.	A mid-priced computer with standard features might meet your needs.
You're buying a new computer to replace an old one.	If you have a big investment in software, you should select a new computer that's compatible with the old one.
You plan to work on accounting and budgeting for a small business.	Consider one of the business systems offered by a local or an online computer vendor.
You spend lots of time playing computer games.	Buy a computer with the fastest processor and graphics card you can afford.
You plan to work extensively with video editing or desktop publishing.	Select a computer system with a fast processor, lots of hard disk capacity, a large screen, and a graphics card loaded with memory.
Someone who will use the computer has special needs.	Consider purchasing appropriate adaptive equipment, such as a voice synthesizer or one-handed keyboard.
You plan to use specialized peripheral devices.	Make sure the computer you purchase can accommodate the devices you plan to use.
Your work at home overlaps your work at school or on the job.	Shop for a computer that's compatible with the computers you use at school or work.
You want to work with specific software, such as a 3-D graphics tool.	Select a computer that meets the specifications listed on the software box or Web site.

FIGURE 2-19: USAGE GUIDELINES

## 2 Choosing a Digital Device

- The most popular digital devices are desktops, laptops, tablets, and smartphones

**Desktop**  
 • Can make reports and manage spreadsheets  
 • Large screen for editing photos and spreadsheets  
 • Affordable (prices of under \$500)  
**Bottom line** → The choice for desktops is between desktops and laptops.

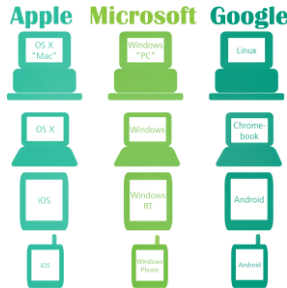
**Laptop**  
 • Portable  
 • Can make reports and manage spreadsheets  
 • Large screen for editing photos and spreadsheets  
 • Affordable (prices of under \$500)  
**Bottom line** → The choice for laptops is between desktops and laptops.

**Tablet**  
 • Portable  
 • Can make reports and manage spreadsheets  
 • Large screen for editing photos and spreadsheets  
 • Affordable (prices of under \$500)  
**Bottom line** → The choice for tablets is between desktops and laptops.

**Smartphone**  
 • Portable  
 • Can make reports and manage spreadsheets  
 • Large screen for editing photos and spreadsheets  
 • Affordable (prices of under \$500)  
**Bottom line** → The choice for smartphones is between desktops and laptops.

## 2 Choosing a Digital Device

- Computers that operate essentially the same way and use the same software are said to be **compatible** or having the same "platform"
- You can assess whether two computers are compatible by checking their operating systems



## 2 Choosing a Digital Device

- Prices for digital devices can vary and depend on screen size, microprocessor size, and memory:
  - The price tag for a smartphone is \$200-\$500
  - Tablet computer prices range from \$200 - \$1,200
  - Desktop and Laptop computers usually cost a little more, with price points roughly grouped into three categories:
    - Above \$1,200
    - \$500 - \$1,200
    - Under \$500

## 2 Choosing a Digital Device

- Computer ads are loaded with jargon and acronyms, such as RAM, ROM, GHz, GB, and USB

**Nimbus 2000 Series**  
 DO EVERYTHING YOU LOVE.

- 4th Generation Intel Core i7 processor 3.1 GHz 1098 MHz FSB
- 4 MB cache
- 8 GB DDR3-1600 MHz 2 DIMM memory
- 750 GB SATA HD (7200 rpm)
- 8x DVD/DVD burner (Dual Layer DVD+R)
- 15.6" High FHD (1080p) LCD display screen
- 4 GB NVIDIA GeForce graphics card
- Integrated speakers
- Integrated 1.3 megapixel webcam
- 4 USB 3.0 ports
- 1 IEEE 1394 port
- 1 HDMI graphics port
- 5-in-1 media card reader
- Wireless networking 802.11 BGN
- 1 GB Ethernet
- 68 Whr. 4-cell battery
- Windows 10 64-bit operating system
- Home/Small business software bundle
- 1-year limited warranty

FIGURE 2-22: COMPUTER ADS ARE FULL OF JARGON

## 2 Section C: Processors and Memory

- Microprocessors
- How Processors Work
- Performance
- Random Access Memory
- Read-Only Memory

## 2 Microprocessors

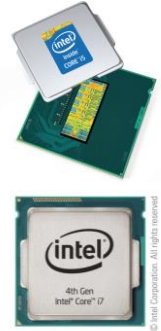
- A **microprocessor** is an integrated circuit designed to process instructions
- It is the *most important*, and usually the most expensive, component of a digital device
- Intel Corporation is the world's largest chipmaker and supplies a sizeable percentage of the microprocessors that power desktops and laptops

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## 2 Microprocessors

- Intel's 8086 family of microprocessors powered the original IBM PC
- The 8086 chip family set the standard for processors used today
- This standard is sometimes referred to as **x86**
- Processors found in today's desktops and laptops are x86 compatible



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## 2 Microprocessors

- Processors based on **ARM** technology dominate tablet computers and smartphones
- ARM technology was originally designed by ARM Holdings, a British technology company founded by Acorn Computers, Apple Inc., and VLSI Technology
- ARM processors are energy efficient – an important characteristic for battery powered devices
- ARM processors are found in iPads, iPhones, and Surface tablets

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## 2 Microprocessors

- Finding the microprocessor that's best for you depends on your budget and the type of work and play you plan to do
- If you know the make and model of a digital device, you can generally find processor specifications by searching online

FIGURE 2-24: FIND THE PROCESSOR SPECIFICATIONS FOR A DESKTOP OR LAPTOP



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## 2 How Processors Work

- Microprocessor technology is fascinating in its ability to perform an astounding variety of tasks based on a set of really simple instructions
- These instructions are referred to as an **instruction set**
- An instruction set contains a collection of instructions for actions that the circuitry in a microprocessor can perform

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## 2 How Processors Work

- Microprocessors can't directly understand **programming language**, such as C++, BASIC, or Java, so programs have to be converted into **machine language** that corresponds to the microprocessor's instruction set

```

Add          0000 0000
Input       0110 0011
Compare     0011 1100
Move        1010 0000
Multiply    1111 0110
Output      1110 1110
Subtract    0010 1100
Halt        1111 0100
  
```

FIGURE 2-25: COMMON COMMANDS FROM THE X86 INSTRUCTION SET

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## 2 How Processors Work

- Operational units of the microprocessor are:
  - The **ALU** (arithmetic logic unit) is part of the microprocessor that performs arithmetic operations, such as addition and subtraction
  - The ALU uses **registers** to hold data that is being processed
  - The microprocessor's **control unit** fetches each instruction

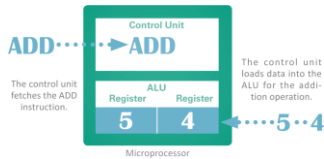
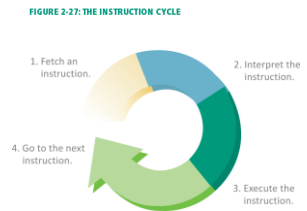


FIGURE 2-26: THE MICROPROCESSOR'S CONTROL UNIT AND ALU

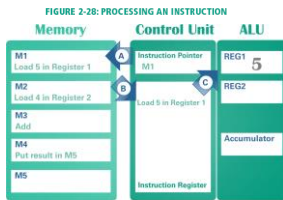
## 2 How Processors Work

- The term **instruction cycle** refers to the process in which a computer executes a single instruction



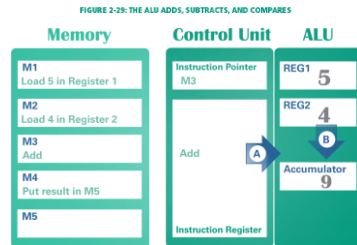
## 2 How processors Work

- Machine language instructions for programs are held in memory; when the program begins, the memory address of the first instruction is placed in a part of the microprocessor's control unit called an **instruction pointer**



## 2 How processors Work

- The ALU is responsible for performing arithmetic and logical operations

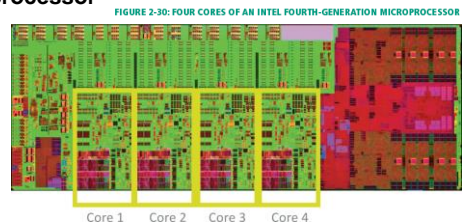


## 2 Performance

- A microprocessor's performance is affected by several factors, including clock speed, number of cores, processing techniques, cache size, word size, and instruction set
  - A processor specification, such as 3.4 GHz, indicates the speed of the **microprocessor clock** – a timing device that sets the pace for executing instructions
  - A cycle is the smallest unit of time in a microprocessor's universe; every action a processor performs is measured by cycles
  - Gigahertz** (GHz) means a billion cycles per second

## 2 Performance

- A microprocessor that contains circuitry for more than one processing unit is called a **multicore processor**



## 2 Performance

- Some processors execute instructions “serially” – or one instruction at a time
- With **serial processing**, the processor must complete all steps in the instruction cycle before it begins to execute the next instruction
- When a processor begins to execute an instruction before it completes the previous instruction, it is using **pipeline processing**
- **Parallel processing** executes more than one instruction at a time and works well with today’s multicore microprocessors

## 2 Performance

- Pipeline and parallel processing offer better performance than serial processing

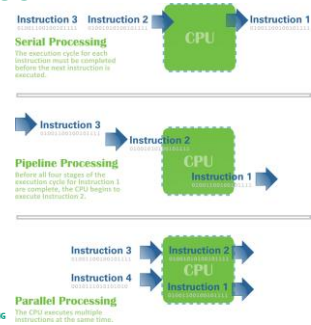


FIGURE 2-31: SERIAL, PIPELINE, AND PARALLEL PROCESSING

## 2 Performance

- What affects performance?:
  - **CPU cache** (pronounced “cash”) is a special high-speed memory that allows a microprocessor to access data more rapidly
  - **Word size** refers to the number of bits that a microprocessor can manipulate at one time; it limits the amount of memory that the processor can access
  - A **RISC** (reduced instruction set computer) processor performs instructions faster than a **CISC** (complex instruction set computer) processor

## 2 Random Access Memory

- **RAM** (random access memory) is a temporary holding area for data, application program instructions, and the operating system
- Higher RAM capacity adds to the expense of a device
- In RAM, microscopic electronic parts called **capacitors** hold the bits that represent data
- Most RAM is **volatile**, meaning it needs electrical power to hold data

## 2 Read-Only Memory

- **ROM** (read-only memory) is a type of memory circuitry that is housed in a single integrated circuit on the system board
- ROM contains a small set of instructions and data called the boot loader which tell a digital device how to start

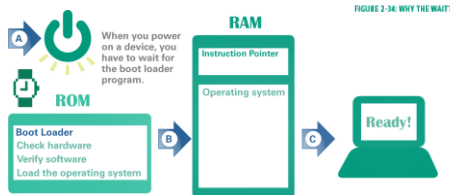


FIGURE 2-34: WHY THE WAIT?

## 2 Read-Only Memory

- There are several reasons why you might want to change the contents of ROM and boot loader instructions, including:
  - Repair
  - User modification
  - Forensics
  - Updates

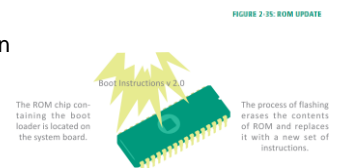


FIGURE 2-35: ROM UPDATE

## 2 Section D: Storage

- Storage Basics
- Magnetic Storage Technology
- Optical Storage Technology
- Solid State Technology
- Cloud Storage
- Backup

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## 2 Storage Basics

- *Storage* is a term used for the components of a digital device designed to hold data permanently
- A data storage system has two main components: a **storage medium** and a **storage device**
  - Storage medium – the disk, tape, CD, or DVD that contains data
  - Storage device – the mechanical apparatus that records and retrieves data from a storage medium

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## 2 Storage Basics

- Each storage technology has its advantages and disadvantages so review their durability, dependability, speed, capacity, and cost before buying

**FIGURE 2-36: EVALUATING STORAGE OPTIONS**

**Durability**  
Resistance to damage from handling and environmental factors such as dust, humidity, heat, and cold. Can be measured in lifespan or in write cycles (the number of times data can be written and revised).

**Dependability**  
Available when needed; not subject to breakdown, malfunction, network outages, or service interruptions. Can be measured by mean time between failures (MTBF is the time a device is expected to function before failing). Cloud storage service dependability can be measured by uptime (the percent of time the service is accessible).

**Speed**  
The rate at which data can be stored or accessed. Faster is better. Can be measured by data transfer rate (the number of megabytes per second that are read or written by the storage device).

**Capacity**  
The amount of data that can be stored, usually measured in gigabytes (GB) or terabytes (TB).

**Cost**  
The price of the storage device and media, usually expressed per gigabyte (GB).

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## 2 Storage Basics

**FIGURE 2-37: ARE YOU RUNNING OUT OF STORAGE SPACE?**

**OS X (Mac)**

1. Use the Finder icon to locate the icon for Macintosh HD.
2. Right-click the Macintosh HD option and select Get Info.

**Windows**

1. Use the File Explorer icon to locate the drive labeled with (C:).
2. Right-click the C: drive icon and select Properties.
3. Look for the Used space and Free space specifications on the General tab.

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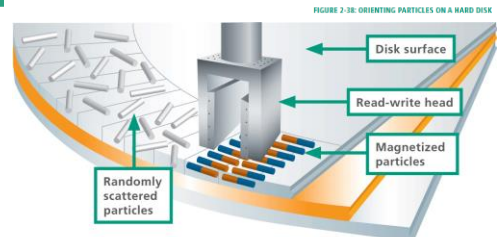
## 2 Magnetic Storage Technology

- Magnetic storage technology is used for desktop and laptop hard disk drives, as well as the storage devices used in enterprise computing installations and cloud services
  - **Magnetic storage** represents data by magnetizing microscopic particles on a disk or tape surface
  - A **hard disk drive** contains one or more platters and their associated read-write heads
  - A hard disk platter is a flat, rigid disk made of aluminum or glass and coated with magnetic iron oxide particles
  - A read-write head mechanism in the disk drive magnetizes particles to write data, and senses the particles' polarities to read data

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## 2 Magnetic Storage Technology



Before data is stored on a hard disk, particles on the disk surface are scattered in random patterns. The disk drive's read-write head orients them in a positive (north) or negative (south) direction to represent 0 and 1 bits, respectively.

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## 2 Magnetic Storage Technology

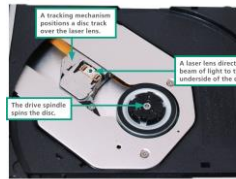
- Hard disk drive specifications include:
  - **Access time** – the average time it takes a computer to locate data on the storage medium and read it
  - **Data transfer rate** – the amount of data a storage device can move per second from the storage medium to RAM

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## 2 Optical Storage Technology

- CD, DVD, and Blu-ray (BD) technologies are classified as **optical storage**, which represents data as microscopic light and dark spots on the disc surface
- The dark spots are called **pits**; the lighter, non-pitted surface areas of the disc are called **lands**



Components of an optical drive

FIGURE 2-40: HOW DOES OPTICAL TECHNOLOGY WORK?



As seen through an electron microscope, the pits on an optical storage disc look like small craters. Each pit is less than 1 micron (one-millionth of a meter) in diameter—1,500 pits lined up side by side are about as wide as the head of a pin.

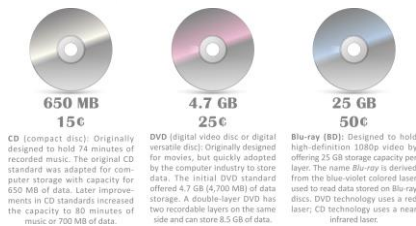
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## 2 Optical Storage Technology

- A single optical drive typically handles CDs, DVDs, and Blu-ray discs, but the costs and capacities of these discs vary

FIGURE 2-41: CDS, DVDS, AND BLU-RAY DISCS



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## 2 Optical Storage Technology

- Optical technologies are grouped into three categories: read-only, recordable, and rewritable
  - **ROM. Read-only** technology stores data permanently on a disc, which cannot be later added to or changed; can potentially store data for 100 years
  - **R. Recordable** technology uses a laser to change the color in a dye laser sandwiched beneath the clear plastic disc surface; the laser creates dark spots that are read as pits
  - **RW. Rewritable** technology uses phase change technology to alter a crystal structure on the disc surface; altering this structure creates patterns of light and dark spots resembling pits and lands

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## 2 Solid State Storage Technology

- **Solid state storage** (sometimes called flash memory) stores data in erasable, rewritable circuitry, rather than on spinning disks or streaming tape
- Once the data is stored it is **non-volatile**, meaning the circuits retain data without an external power source

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## 2 Solid State Storage Technology

- A **memory card** is a flat, solid state storage medium commonly used to transfer files from digital cameras and media players to computers

FIGURE 2-42: SOLID STATE MEMORY CARDS



Memory cards are available in several formats and capacities.

Many digital devices are equipped with a card reader for transferring data to and from solid state memory cards.

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## 2 Solid State Storage Technology

- A **solid state drive (SSD)** is a package of flash memory that can be used as a substitute for a hard disk drive
- A **USB flash drive** is a portable storage device that plugs directly into a computer's system unit using a built-in USB connector

FIGURE 2-43: SOLID STATE DRIVES



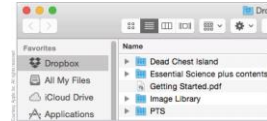
**45¢ cost per GB**

SSDs are widely used as the main storage device in smartphones and tablet computers. Some laptops also include an SSD instead of a hard disk drive.

## 2 Cloud Storage

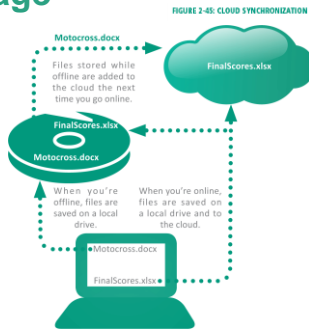
- **Remote storage** is housed on an external device that can be accessed from a network
- Remote storage can also be available as an Internet service, in which case it is called **cloud storage**
- Cloud storage is provided to individuals by services such as Apple iCloud, Microsoft OneDrive, Google Drive, and Dropbox

FIGURE 2-44: DROPBOX IS IN THE CLOUD BUT ACCESSED JUST LIKE A LOCAL DRIVE



## 2 Cloud Storage

- Some cloud implementations offer a synchronization feature that automatically duplicates files stored on a local device by also saving them in the cloud



## 2 Cloud Storage

- **Cloud Storage basics:**
  - **Security and privacy risks** – the more places your data is stored and the more networks on which it travels, the more susceptible it becomes to hackers and spying agencies
  - **Service outages** – when a cloud storage site has an outage, all the data stored there become temporarily inaccessible
  - **Discontinuation of service** – some cloud storage providers have closed down their services with little warning

## 2 Backup

- A backup is a copy of one or more files that is made in case the originals become damaged or lost
- Figuring out what to backup is important; backing up everything isn't always practical

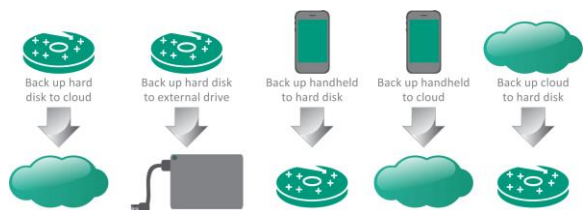
FIGURE 2-46: WHAT CAN YOU AFFORD TO LOSE?

- Operating system:** The operating system is required to start your device, but a backup copy might not run if it is unauthorized.
- Software:** Most devices are populated with preinstalled software, and you've probably downloaded and installed many additional apps. If these are wiped out when a storage device fails, the process of downloading and reinstalling them can be time consuming.
- Data files:** Your documents, photos, music, videos—all the goodies that you've created and gathered—can be difficult or impossible to reconstruct from scratch.
- Settings, accounts, and profiles:** How much time did you spend customizing your home screen, entering contacts, choosing passwords, and setting preferences for your favorite apps? No one wants to have to do that all over again!

## 2 Backup

- When deciding on what to backup, know what's important and ensure that current versions exist on more than one storage device

FIGURE 2-47: BACKUP PAIRINGS



## 2 Backup

- Tools you'll need for backups:
  - **Recovery drive** (system repair disc) – contains parts of the OS necessary to boot your computer and diagnose system problems
  - **Copy command** – allows you to make copies of essential files
  - **File History** – allows for automated data backup and **file synchronization** to make copies of files from your Documents, Music, Picture, etc.
  - **System image** – Windows includes a **disk image** option called System image; a bit-for-bit copy of the data from all sectors of a hard disk

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## 2 Backup

- Macs with OS X offer a comprehensive file synchronization utility called Time Machine, which backs up the entire hard disk



FIGURE 2-50: TIME MACHINE BACKUPS

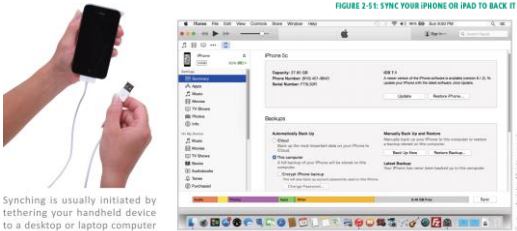
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## 2 Backup

- Owners of iOS devices can backup to a local computer using iTunes or to iCloud

FIGURE 2-51: SYNC YOUR IPHONE OR IPAD TO BACK IT UP



Syncing is usually initiated by tethering your handheld device to a desktop or laptop computer using a USB cable.

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## 2 Section E: Input and Output

- Add-on Gadgets
- Expansion Ports
- Bluetooth
- Display Devices
- Printers
- Things

Unit 2: Digital Devices

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## 2 Add-on Gadgets

- There are lots of options available for gadgets that accompany your digital devices

FIGURE 2-52: PERIPHERAL DEVICES



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## 2 Expansion Ports

- Many digital devices have ports in the system unit for connecting cables and various add-ons; these ports are called **expansion ports** because they expand the options for input, output, and storage
- When you plug in a USB flash drive or insert a memory card, you are using an expansion port

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## 2 Expansion ports



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## 2 Expansion Ports

- If you want to connect more devices than the available number of USB ports, you can use a USB hub



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## 2 Bluetooth

- A common wireless technology for connecting peripherals is **Bluetooth**
- Bluetooth is a low-power technology, so it is ideal for mobile devices that don't have big batteries
- Bluetooth is used to connect wireless headsets to smartphones and is built into many smartphones, tablets, laptops, and desktops

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## 2 Device Drivers and Apps

- A **device driver** is software that helps a peripheral device establish communication with its host device
- For example, the device driver for an HP printer sets up data streams from RAM to the printer and makes sure that the data is formatted in a way that the printer can work

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## 2 Display Devices

- A computer display device that simply displays text and images is classified as an output device
- Touchscreens, however, can be classified as both input and output devices because they accept input and also display output
- **LCD** (liquid crystal display) technology produces an image by filtering light through a layer of liquid crystal cells

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## 2 Display Devices

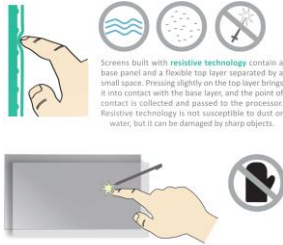
- Factors that affect image quality are:
  - **Screen size** – the measurement in inches from one corner of the screen diagonally across to the opposite corner
  - **Response rate** – the time it takes for one pixel to change from black to white then back to black
  - **Dot pitch (dp)** – The LED's that form an image on the screen are spaced in a grid; dp is the distance in millimeters between like-colored LEDs
  - **Screen resolution** – The number of horizontal and vertical pixels that a device displays on the screen

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## 2 Display Devices

- Tablet computers, handheld devices, retail store self-checkouts, and ATMs display output and collect input from a **touchscreen**
- They can also display a virtual keyboard for devices that are not connected to a physical keyboard

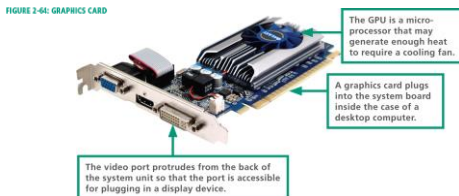


## 2 Display Devices

- Display devices require graphics circuitry to generate and transport the signals for displaying an image on the screen
- One type of graphics circuitry, referred to as **integrated graphics**, is built into a computer's system board

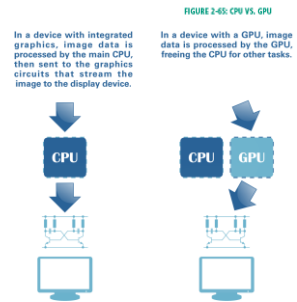
## 2 Display Devices

- A second option, called **dedicated graphics**, is graphics circuitry mounted on a small circuit board called a graphics card (or video card)



## 2 Display Devices

- A graphics card contains a graphics processing unit (GPU) and a special video memory, which stores screen images as they are processed but before they are displayed



## 2 Printers

- Today's best-selling multifunction printers use ink jet or laser technology and can also serve as scanners, copiers, and fax machines
- An **ink jet printer** has a nozzle-like print head that sprays ink onto paper to form characters and graphics

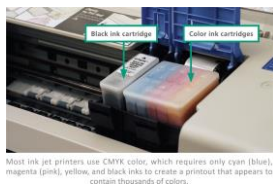


FIGURE 2-66: INK JET CMYK CARTRIDGES

## 2 Things

- The utopian vision for the Internet of Things (IoT) is a busy hive of **smart sensors** that work behind the scenes to collect data and use it to improve just about anything





*NEW PERSPECTIVES*

# Unit 2 Complete

## Computer Concepts 2016

