

# APPLIED IT FOR BUSINESS

**Chapter**

**3**

**Computer Hardware**

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# Learning Objectives

- Understand the history and evolution of computer hardware
- Identify the major types and uses of microcomputer, midrange, and mainframe computer systems
- Outline the major technologies and uses of computer peripherals for input, output, and storage

# Learning Objectives

- Identify and give examples of the components and functions of a computer system
- Identify the computer systems and peripherals you would acquire or recommend for a business of your choice, and explain the reasons for your selection.

# Case 1: Mobile and Wireless Technology

- The challenge...
  - Provide mobile computing capabilities
  - Deliver applications for use on small LED screens
- Common applications...
  - Police work
  - Anti-terrorism
  - Global employee communication and collaboration

# Case Study Questions

- What are some of the benefits that organizations could realize by connecting all of their employees by mobile devices?
- Are the CIOs in the case saying that ROI is not important when deploying mobile computing devices?
- The case suggests that an increasingly popular mobile device is the Black Berry. What is it about the BlackBerry that makes it so popular?

# Pre-Computer Calculations

- Counting on fingers and toes
- Stone or bead abacus
  - Calculate comes from calculus, the Latin word for stone
- 1642: first mechanical adding machine
  - Invented by Blaise Pascal
  - Wheels moved counters
  - Modified in 1674 by Von Leibnitz
- Age of industrialization
  - Mechanical loomed used punch cards

# Early Computing

- 19th Century
  - Charles Babbage proposed the Analytical Engine, which could calculate, store values in memory, perform logical comparisons
  - Never built because of lack of electronics
- 1880s
  - Hollerith's punched cards used to record census data using On/Off patterns
  - The holes turned sensors On or Off when run through tabulating machine
  - This company became the foundation for IBM

# Electronic Computers

- 1946 - First Generation Computer
  - ENIAC
  - Programmable
  - 5000 calculations per second
  - Used vacuum tubes
  - Drawbacks were size and processing ability
- 1950s
  - ENIAC replaced by UNIVAC 1, then the IBM 704
  - Calculations jumped to 100,000 per second



# Waves of Computing

- Late 1950s - Second Generation
  - Transistors replaced vacuum tubes
  - 200,000 to 250,000 calculations per second
- Mid-1960s - Third Generation
  - Integrated circuitry and miniaturization
- 1971 - Fourth Generation
  - Further miniaturization
  - Multiprogramming and virtual storage
- 1980s - Fifth Generation
  - Millions of calculations per second

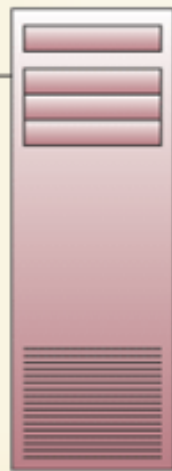
# Microcomputers

- 1975
  - ALTAIR flicking switches
- 1977
  - Commodore and Radio Shack produce personal computers
- 1979
  - Apple computer, the fastest selling PC thus far
- 1982
  - IBM introduced the PC, which changed the market

# Categories of Computer Systems



- **Microcomputer Systems**  
Personal computers, network computers, technical workstations, personal digital assistants, information appliances, etc.



- **Midrange Systems**  
Network servers, minicomputers, Web servers, multiuser systems, etc.



- **Mainframe Systems**  
Enterprise systems, superservers, transaction processors, supercomputers, etc.

# Microcomputer Systems

- Usually called a personal computer or PC
- Computing power now exceeds that of the mainframes of previous generations
- Relatively inexpensive
- Are the networked professional workstations used by business processions
- Versions include hand-held, notebook, laptop, tablet, portable, desktop, and floor-standing

# Recommended PC Features

<b>Business Pro</b>	<b>Multimedia Heavy</b>	<b>Newcomer</b>
2-3 GHz processor	Mac G4 or 2-3 GHz Intel processor	1-2 GHz Celeron processor
512MB RAM	512MB RAM	256MB RAM
80GB hard drive	120GB+ hard drive	40GB hard drive
18-inch flat-panel display	18-inch or larger CRT, flat-panel LCD, or plasma display	17-inch CRT or 15-inch flat panel LCD
CD-RW/DVD drive or portable hard drives for backup	CD-RW/DVD+RW drive	CD-RW/DVD drive
Network interface card (NIC)	High-end color printer	Internal, 56K modem
Basic speaker system	Deluxe speaker system	Basic inkjet printer

# Microcomputer Uses

- **Workstations**
  - Supports have mathematical computer and graphics display demands
  - CAD, investment and portfolio analysis
- **Network Servers**
  - More powerful than workstations
  - Coordinates telecommunications and resource sharing
  - Supports small networks and Internet or intranet websites

# Corporate PC Criteria

- Solid performance at a reasonable price
- Operating system ready
- Connectivity
  - Network interface cards or wireless capabilities



# Information Appliances

- Hand-held microcomputer devices
- Known as personal digital assistants (PDAs)
  - Web-enabled PDAs use touch screens, handwriting recognition, or keypads
  - Mobile workers use to access email or the Web, exchange data with desktop PCs or servers
  - Latest entrant is the BlackBerry
- PDAs include
  - Video-game consoles
  - Cellular and PCS phones
  - Telephone-based home email appliances



# Midrange Systems

- High-end network servers that handle large-scale processing of business applications
- Not as powerful as mainframes
  - Less expensive to buy, operate, and maintain
- Often used to manage
  - Large Internet websites
  - Corporate intranets and extranets
  - Integrated, enterprise-wide applications
- Used as front-end servers to assist mainframes with telecommunications and networks

# Mainframe Computer Systems

- Large, fast, powerful computer systems
  - Large primary storage capacity
  - High transaction processing
  - Handles complex computations
- Widely used as superservers for...
  - Large client/server networks
  - High-volume Internet websites
- Becoming a popular computing platform for...
  - Data mining and warehousing
  - Electronic commerce applications

# Supercomputer Systems

- Extremely powerful systems designed for...
  - Scientific, engineering, and business applications
  - Massive numeric computations
- Markets include...
  - Government research agencies
  - Large universities
  - Major corporations
- Uses parallel processing
  - Billions to trillions of operations per second (gigaflops and teraflops)
  - Costs \$5 to \$50 million

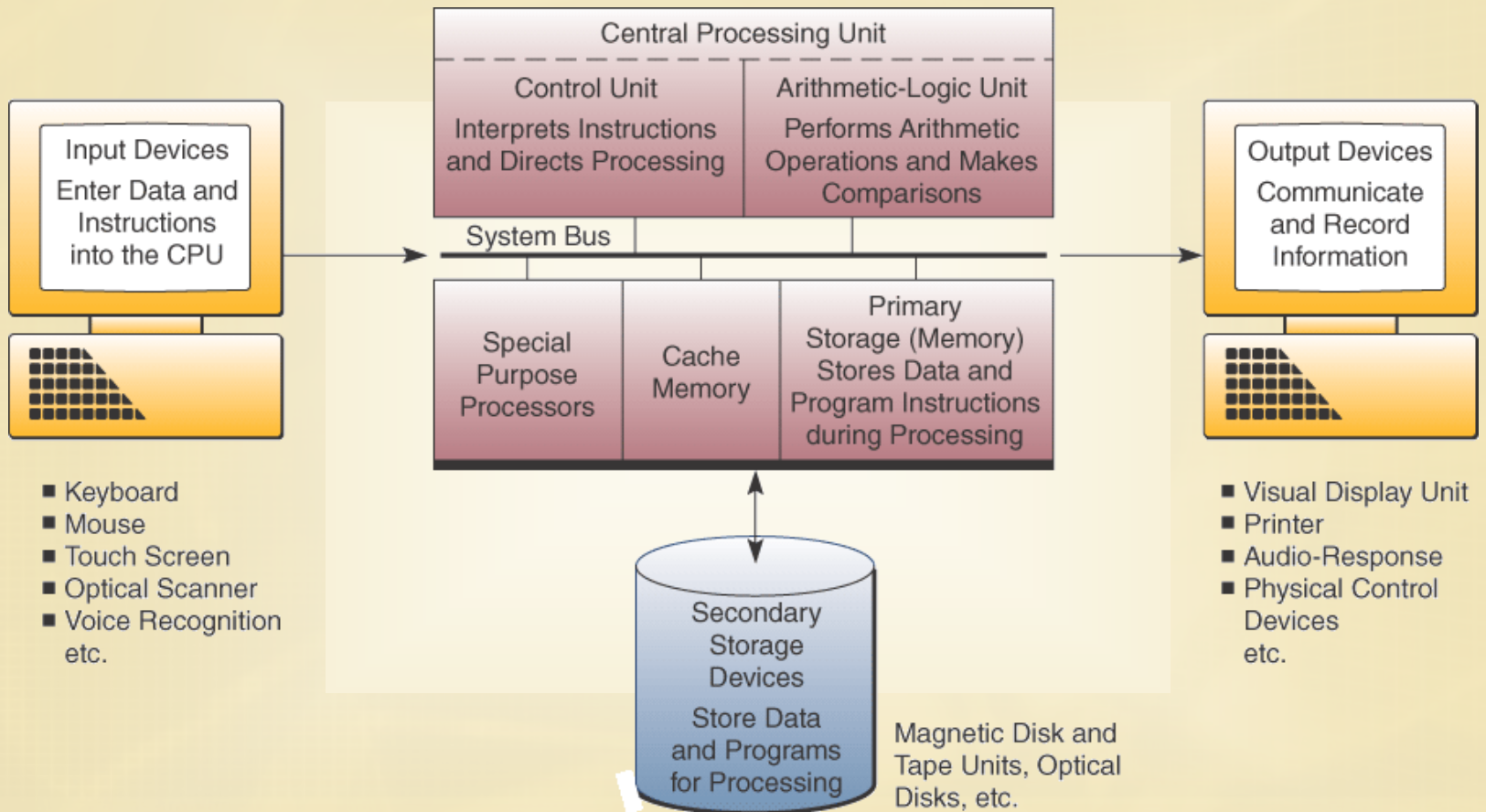
# Computer System Concept

- A system of hardware devices organized by function
  - **Input**
    - Keyboards, touch screens, pens, electronic mice, optical scanners
    - Converts data into electronic form for entry into computer system
  - **Processing**
    - Central Processing Unit (CPU)
    - CPU subunits: arithmetic-logic and control unit

# Computer System Concept

- **Output**
  - Video display units, printers, audio response units, and so on
  - Converts electronic information into human-intelligible form
- **Storage**
  - Primary storage (memory)
  - Secondary storage (disk drives)
- **Control**
  - CPU controls other components of the system

# Computer System Concept



# Computer Processing Speeds

- Early computers
  - Milliseconds (thousandths of a second)
  - Microseconds (millionths of a second)
- Current computers
  - Nanoseconds (billionth of a second)
  - Picoseconds (trillionth of a second)
- Program instruction processing speeds
  - Megahertz (millions of cycles per second)
  - Gigahertz (billions of cycles per second)
    - Commonly called the “clock speed”

# Computer Processing Speeds

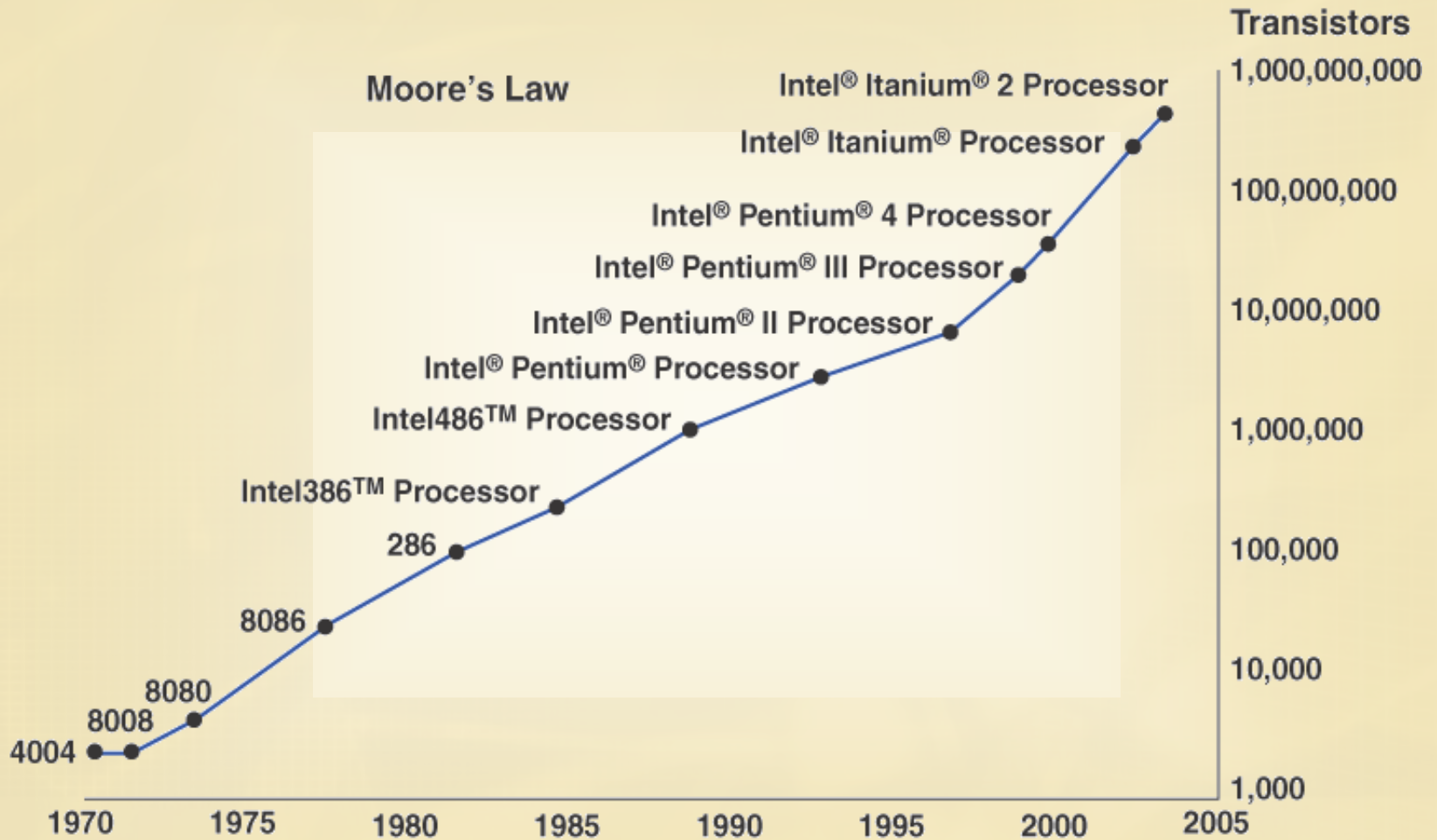
- **Throughput**
  - The ability to perform useful computation or data processing assignments during a given period
- Speed is dependant on...
  - Size of circuitry paths (buses) that interconnect microprocessor components
  - Capacity of instruction processing registers
  - Use of high-speed cache memory
  - Use of specialized microprocessor, such as math coprocessor



# Moore's Law

- A doubling in the number of transistors per integrated circuit every 18 to 24 months
  - Originally observed in 1965, it holds true today
- Common corollary of Moore's Law...
  - Computing prices will be cut in half every 18 to 24 months
  - This has been consistently accurate
  - Applies to cost of storage as well

# Moore's Law



# Peripherals

- **Peripheral** is a generic name for all input, output, and secondary storage devices
  - Parts of the computer system, but not the CPU
  - Are all online devices
- **Online devices**
  - Separate from the CPU, but electronically connected to and controlled by it
- **Offline devices**
  - Separate from and not under the control of the CPU

# Peripherals Advice

## Peripherals Checklist

- **Monitors.** Bigger is better for computer screens. Consider a high-definition 19-inch or 21-inch flat screen CRT monitor, or LCD flat panel display. That gives you much more room to display spreadsheets, Web pages, lines of text, open windows, etc. An increasingly popular setup uses two monitors that allow multiple applications to be used simultaneously.
- **Printers.** Your choice is between laser printers or color inkjet printers. Lasers are better suited for high-volume business use. Moderately priced color inkjets provide high-quality images and are well suited for reproducing photographs. Per-page costs are higher than for laser printers.
- **Scanners.** You'll have to decide between a compact, sheet-fed scanner and a flatbed model. Sheet-fed scanners will save desktop space, while bulkier flatbed models provide higher speed and resolution.
- **Hard Disk Drives.** Bigger is better; as with closet space, you can always use the extra capacity. So go for 40 gigabytes at the minimum to 80 gigabytes and more.
- **CD and DVD Drives.** CD and DVD drives are a necessity for software installation and multimedia applications. Common today is a built-in CD-RW/DVD drive that both reads and writes CDs and plays DVDs.
- **Backup Systems.** Essential. Don't compute without them. Removable mag disk drives and even CD-RW and DVD-RW drives are convenient and versatile for backing up your hard drive's contents.

# Input Technologies

- **Keyboard**
  - Still most widely used input device
- **Graphical User Interface (GUI)**
  - Icons, menus, windows, buttons, bars
  - Selected with pointing devices
- **Electronic Mouse**
  - Most popular pointing device
  - Pressing mouse buttons initiates activity represented by the icon selected



# Input Technologies

- Trackball
  - Stationary device, similar to mouse
  - Roller ball moves cursor on screen
- Pointing Stick
  - Small eraser-head device embedded in keyboard
  - Cursor moves in the direction of the pressure placed on the stick



# Input Technologies

- Touchpad
  - Small, rectangular, touch-sensitive surface
  - Usually on keyboard
  - Cursor moves in direction your finger moves
- Touch Screen
  - Use computer by touching screen
  - Screen emits a grid of infrared beams, sound waves, or electric current
  - Grid is broken when screen is touched



# Pen-Based Computing

- Used in Tablet PCs and PDAs
  - Pressure-sensitive layer, similar to touch screen, under liquid crystal display screen
  - Software digitizes handwriting, hand printing, and hand drawing





# Speech Recognition Systems

- Speech be the future of data entry
  - Easiest, most natural means of human communication
- Recognizing speech patterns
  - Discrete required pauses between each word
  - Continuous speech recognition software (CSR) recognized continuous, conversationally paced speech

# Speech Recognition Software

- Speech recognition systems digitize, analyze, and classify speech and sound patterns
  - Compares to a database of sound patterns in its vocabulary
  - Passes recognized words to the application software
  - Typically requires voice recognition training
- Speaker-independent voice recognition systems
  - Allows computer to recognize words from a voice it has never heard before
  - Typically used in voice-messaging computers

# Optical Scanning

- Devices read text or graphics and convert them into digital input for a computers
  - Enables direct entry of data from source documents
- A document management library system
  - Scans documents, then organizes and stores them for easy reference or retrieval

# Optical Scanning

- **Scanners**
  - Compact desktop models are popular for low cost and ease of use
  - Larger, more expensive flatbed scanners are faster and provide high-resolution color scanning
- **Optical Character Recognition (OCR)**
  - Software that reads characters and codes
  - Used to read merchandise tags, sort mail, score tests
  - Optical scanning wands read bar codes

# Other Input Technologies

- **Magnetic Stripe**
  - Reads the magnetic stripe on credit cards
- **Smart Cards**
  - Microprocessor chip and memory on credit card
  - Use more in Europe than in the U.S.
- **Digital Cameras**
  - Allows you to shoot, store, and download photos or full-motion video with audio into the PC
  - Images and audio can then be edited or enhanced

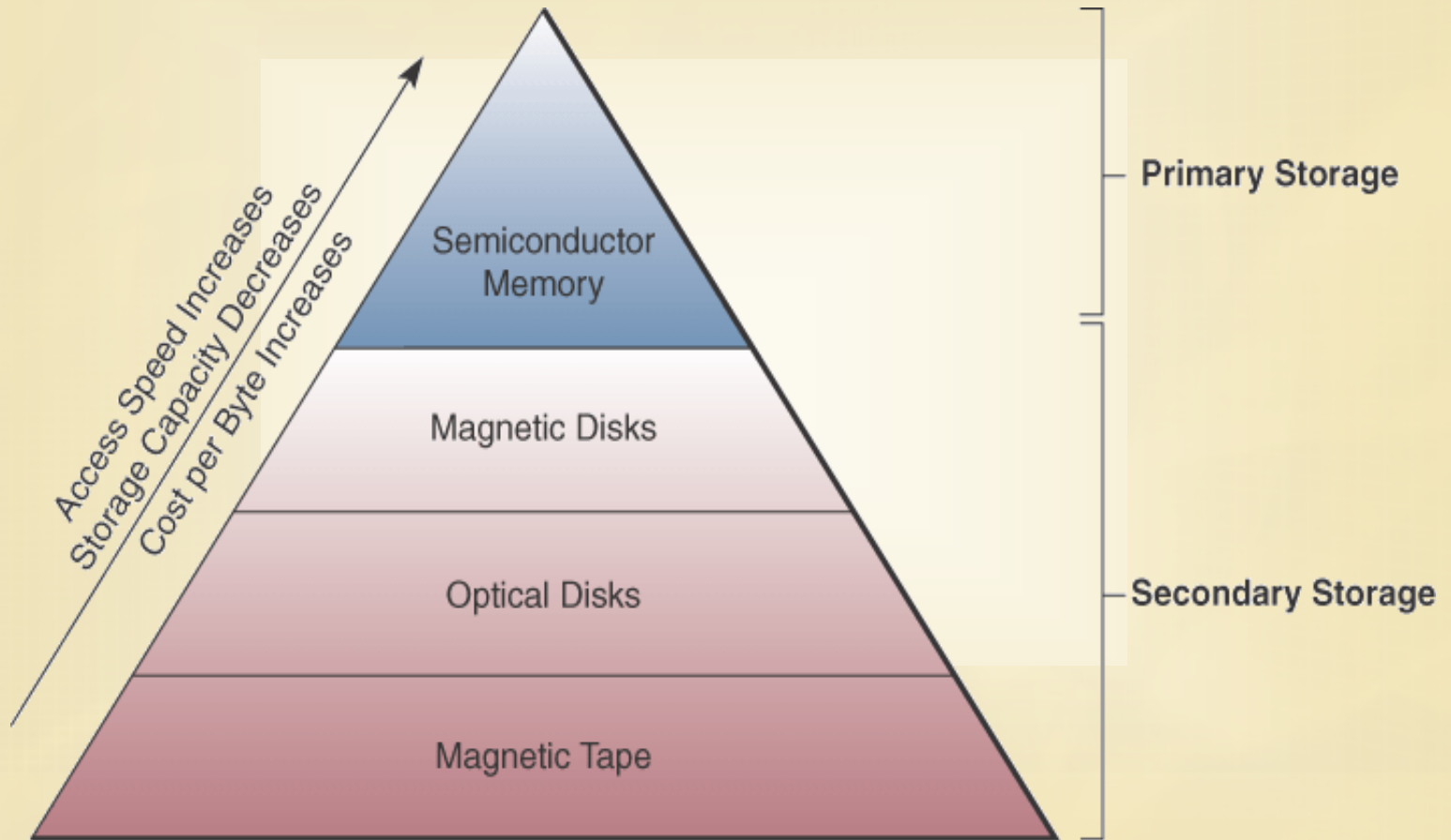
# Other Input Technologies

- Magnetic Ink Character Recognition (MICR)
  - Used by banks to magnetically read checks and deposit slips
  - Requires an iron oxide-based ink
  - Reader-sorter equipment magnetizes the ink, then passes it under a reading head to sense the signal

# Output Technologies

- Video Displays
  - Cathode-ray tube (CRT)
  - Liquid crystal displays (LCDs)
    - Active matrix and dual scan
  - Plasma displays
    - Used in large TVs and flat-panel monitors
- Printed Output
  - Inkjet printers spray ink on a page
  - Laser printers use an electrostatic process similar to a photocopying machine

# Storage Tradeoffs





# Computer Storage Fundamentals

- Uses a two-state or binary representation of data
  - On or Off
  - On represents the number 1
  - Off represents the number 0
- Data are processed and stored in computer systems through the presence or absence of On/Off signals

# Bit and Byte

- **Bit**
  - Short for binary digit
  - Smallest element of data
  - Either zero or one
- **Byte**
  - Group of eight bits, which operate as a single unit
  - Represents one character or number

# Representing Characters in Bytes

Character	ASCII Code	Character	ASCII Code	Character	ASCII Code
0	00110000	A	01000001	N	01001110
1	00110001	B	01000010	O	01001111
2	00110010	C	01000011	P	01010000
3	00110011	D	01000100	Q	01010001
4	00110100	E	01000101	R	01010010
5	00110101	F	01000110	S	01010011
6	00110110	G	01000111	T	01010100
7	00110111	H	01001000	U	01010101
8	00111000	I	01001001	V	01010110
9	00111001	J	01001010	W	01010111
		K	01001011	X	01011000
		L	01001100	Y	01011001
		M	01001101	Z	01011010

# Using Binary Code to Calculate

$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$
128	64	32	16	8	4	2	1
0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

To represent any decimal number using the binary system, each place is simply assigned a value of either 0 or 1. To convert binary to decimal, simply add up the value of each place.

Example:

$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$
1	0	0	1	1	0	0	1
128	0	0	16	8	0	0	1

$$128 + 0 + 0 + 16 + 8 + 0 + 0 + 1 = 153$$

$$10011001 = 153$$

# Storage Capacity Measurement

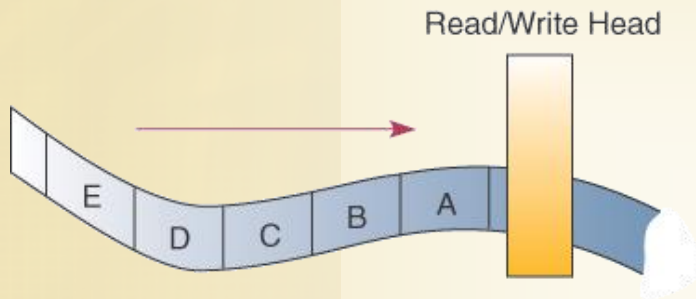
- **Kilobyte (KB):** one thousand bytes
- **Megabyte (MB):** one million bytes
- **Gigabyte (GB):** one billions bytes
- **Terabyte (TB):** one trillion bytes
- **Petabyte (PB):** one quadrillion bytes

# Direct and Sequential Access

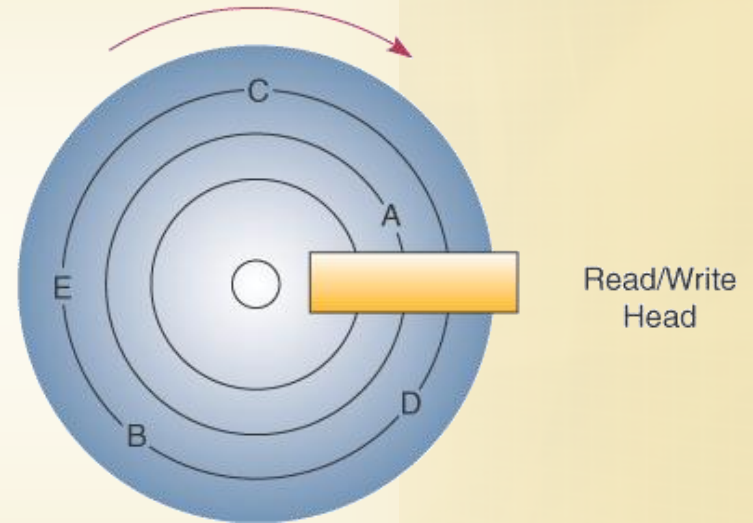
- **Direct or Random Access**
  - Directly store and retrieve data
  - Each storage position has a unique address and can be accessed in the same length of time
  - Semiconductor memory chips, magnetic disks
- **Sequential Access**
  - Data is stored and retrieved sequentially
  - Must be accessed in sequence by searching through prior data
  - Magnetic tape

# Direct and Sequential Access

Sequential Access Storage Device



Direct Access Storage Device



# Semiconductor Memory

- Microelectronic semiconductor memory chips are used for primary storage
  - **Advantages:** small size, fast, shock and temperature resistance
  - **Disadvantages:** volatility; must have uninterrupted electric power or loses memory



# Types of Semiconductor Memory

- Random Access Memory (RAM)
  - Most widely used primary storage medium
  - Volatile memory
  - Read/write memory
- Read-Only Memory (ROM)
  - Permanent storage
  - Can be read, but not overwritten
  - Frequently used programs burnt into chips during manufacturing process
  - Called firmware

# Flash Drives

- Sometimes referred to as a **jump drive**
  - Uses a small chips containing thousands of transistors
  - Can store data for virtually unlimited periods without power
  - Easily transported and highly durable
  - Storage capacity of up to 1 GB
  - Plugs into any USB port



# Magnetic Disks

- Used for secondary storage
  - Fast access and high capacity
  - Reasonable cost



# Types of Magnetic Disks

- Floppy Disks (diskettes)
  - Magnetic disk inside a plastic jacket
- Hard Disk Drives (hard drives)
  - Magnetic disk, access arms, and read/write heads in sealed module for stable environment
  - Fixed or removable
  - Capacity from several hundred MBs to hundreds of GBs

# RAID Storage

- Redundant Arrays of Independent Disks
  - Disk arrays of hard disk drives
  - Provides virtually unlimited online storage
  - Combines from 6 to more than 100 small hard disk drives into a single unit
  - Data are accessed in parallel over multiple paths from many disks
  - Redundant storage of data on several disks provides fault-tolerant capacity
  - Storage area networks can interconnect many RAID units

# Magnetic Tape

- Secondary storage
  - Tape reels, cassettes, and cartridges
  - Used in robotic, automated drive assemblies
  - Archival and backup storage
  - Lower-cost storage solution

# Optical Disks

## Optical Disk Drive Capabilities

- **CD-ROM**  
A CD-ROM drive provides a low-cost way to read data files and load software onto your computer, as well as play music CDs.
- **CD-RW**  
A CD-RW drive allows you to easily create your own custom data CDs for data backup or data transfer purposes. It will also allow you to store and share video files, large data files, digital photos, and other large files with other people that have access to a CD-ROM drive. This drive will also do anything your CD-ROM drive will do. It reads all your existing CD-ROMs, Audio CDs, and CDs that you have created with your CD burner.
- **CD-RW/DVD**  
A CD-RW/DVD combination drive brings all the advantages of CD-RW, CD-ROM, and DVD-ROM to a single drive. With a CD-RW/DVD combo drive, you can read DVD-ROM disks, read CD-ROM disks, and create your own custom CDs.
- **DVD-ROM**  
A DVD-ROM drive allows you to enjoy the crystal clear color, picture, and sound clarity of DVD video on your PC. It will also prepare you for future software and large data files that will be released on DVD-ROM. A DVD-ROM drive can also read CD-ROM disks, effectively providing users with full optical read capability in one device.
- **DVD+RW/+R with CD-RW**  
A DVD-RW/R with CD-RW drive is a great all-in-one drive, allowing you to burn DVD-RW or DVD-R disks, burn CDs, and read DVDs and CDs. It enables you to create DVDs to back up and archive up to 4.7GB of data files (that's up to 7 times the capacity of a standard 650MB CD) and store up to to 2 hours of MPEG2 digital video.

Source: Adapted from "Learn More—Optical Drives," [www.dell.com](http://www.dell.com).

# Uses of Optical Disks

- Image processing
  - Long-term storage of historical image files
  - Storage of scanned documents
- Publishing medium
  - Allows fast access to reference materials
  - Catalogs, directories, and so on
- Interactive multimedia applications
  - Video games, educational videos, and so on



# Radio Frequency Identification (RFID)

- One of the newest and fastest growing storage technologies
  - System for tagging and identifying mobile objects
  - Used with store merchandise, postal packages, casino chips, pets
  - Special reader allows objects to be tracked as they move from place to place
  - Chips half the size of a grain of sand
- Passive chips derive power from reader signal
  - Active chips are self-powered

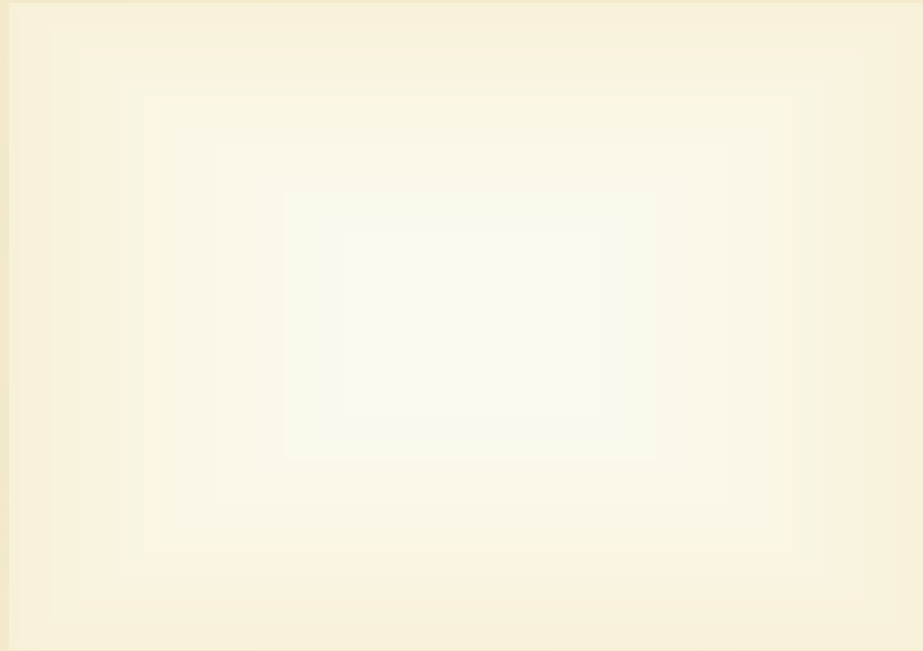
# RFID Versus Bar Coding

- **RFID**
  - Scans from greater distance
  - Can store data
  - Allows more information to be tracked
- **Privacy concerns**
  - Invisible nature of the system
  - Capacity to transmit fairly sophisticated messages

# Self-Service Kiosk Technology

- Networked special-purpose microcomputer terminals
  - Video touch screens
  - Built-in thermal printers
  - Magnetic-stripe card readers

# End Of Chapter



- Thank You