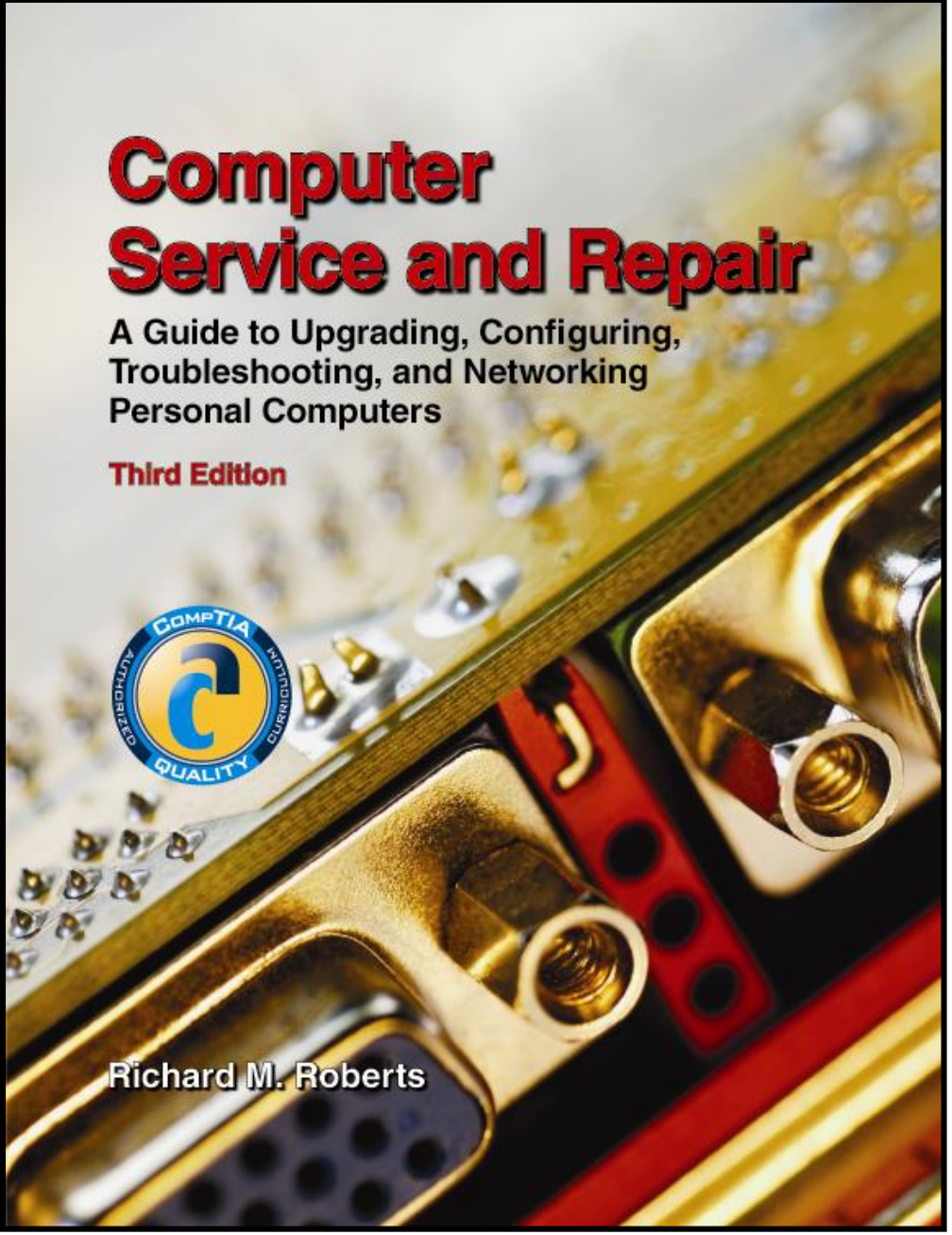


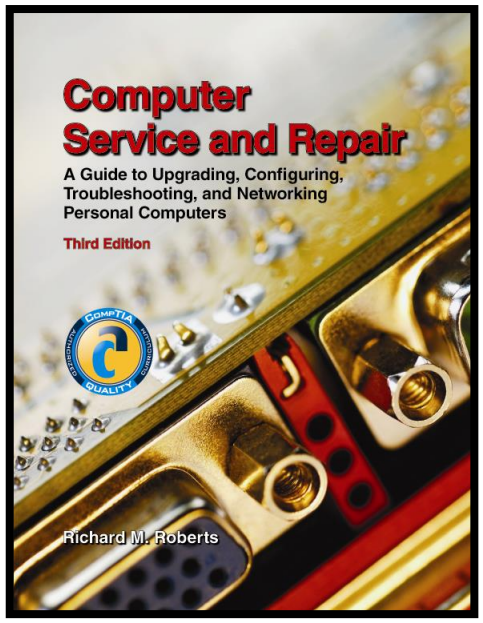
PowerPoint for

Computer Service and Repair

by

JoAnne Keltner

Goodheart-Willcox Publisher
18604 West Creek Drive
Tinley Park, IL 60477
www.g-w.com



Chapter 1
Introduction to a Typical PC

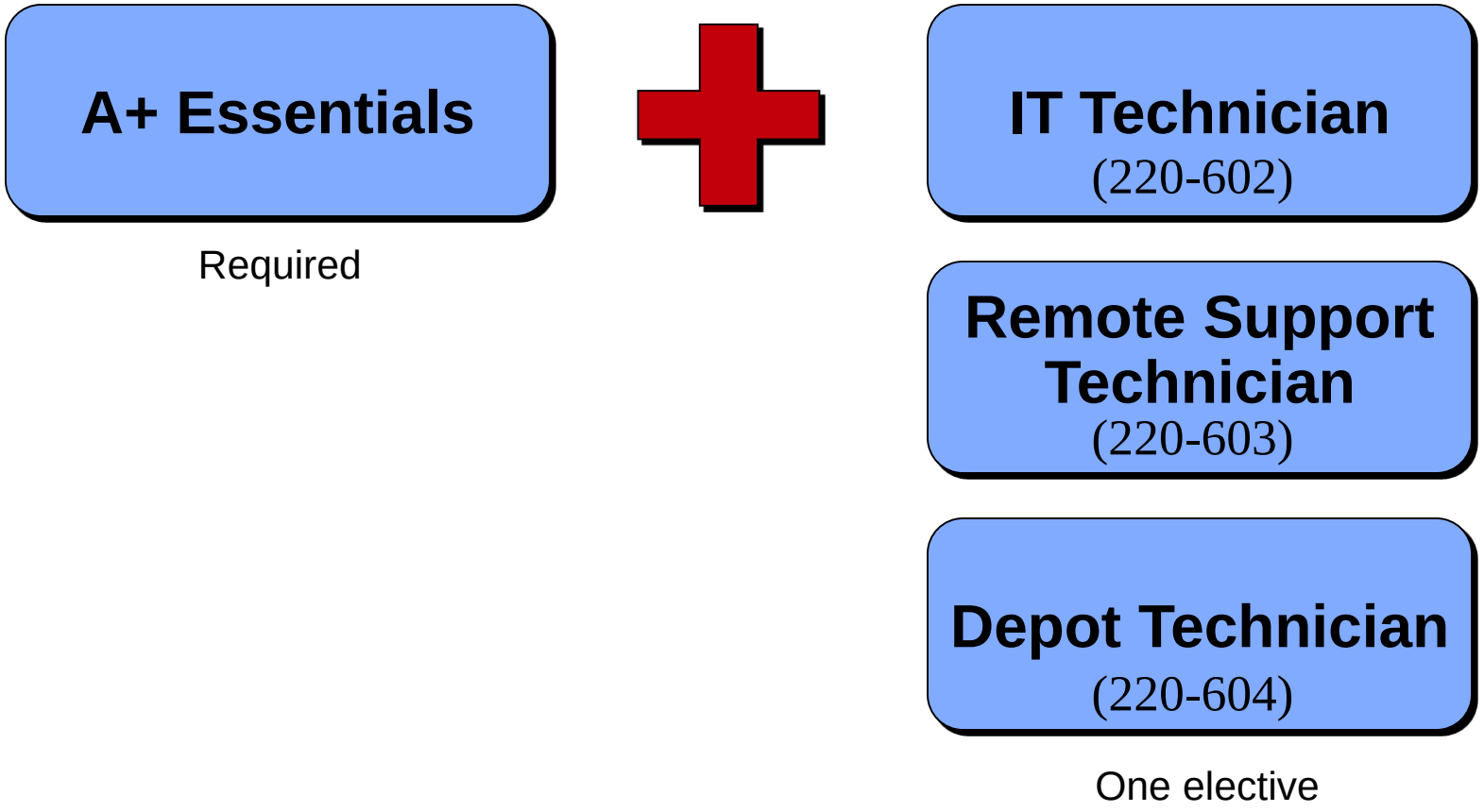
Textbook Purpose

- To provide you with the basic skills needed to be proficient in PC repair.
- To prepare you for the CompTIA A+ Certification exams.

Who Is CompTIA?

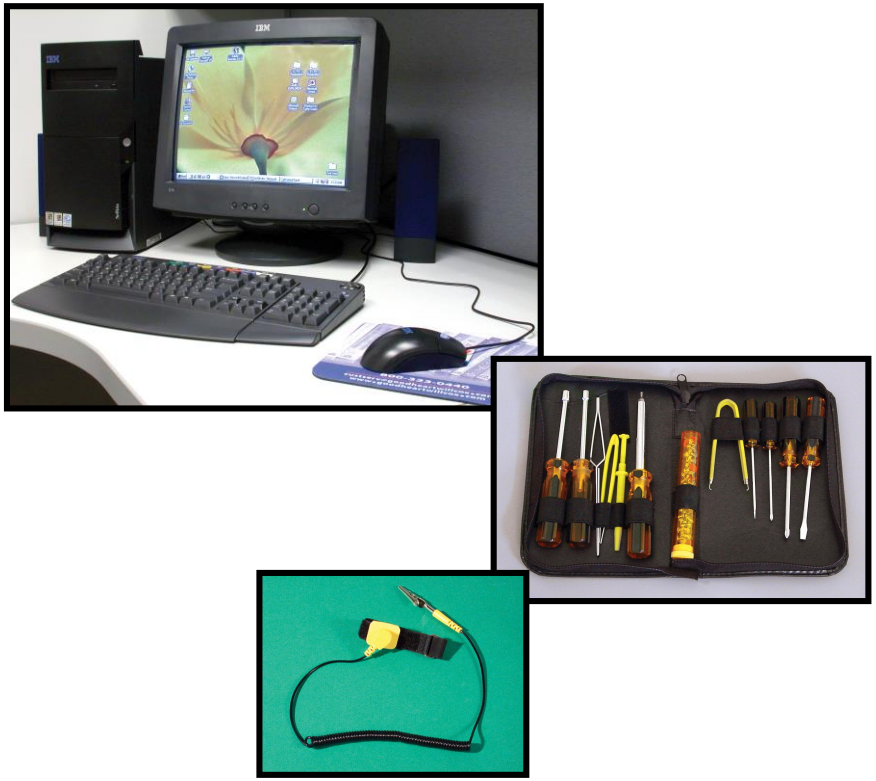
- CompTIA is a vendor-neutral, not-for-profit organization that provides certification in various areas of the IT industry.
- CompTIA A+ Certification is awarded on successful completion of two exams: A+ Essentials and one elective.

CompTIA A+ 2006 Exams



Chapter Purpose

- To provide an overview of the PC.
  - Inside/outside components.
  - How computers communicate internally.
- To introduce you to the common tools used by the PC technician.



Importance to the PC Technician

- This chapter provides introductory knowledge and an overview of the computer system before going in depth at a technician level.
- This overview will give you the “big picture.”

Objectives

- Explain the role of computers.
- Explain what a computer is.
- Describe computer data.
- Identify the major components of a typical PC.
- Describe the power-on sequence of a typical PC.

Objectives

- Explain how the major components interact with each other.
- Interpret the common prefixes associated with the computer's size and speed.
- Define electrostatic discharge.
- Identify common tools used to service a PC.

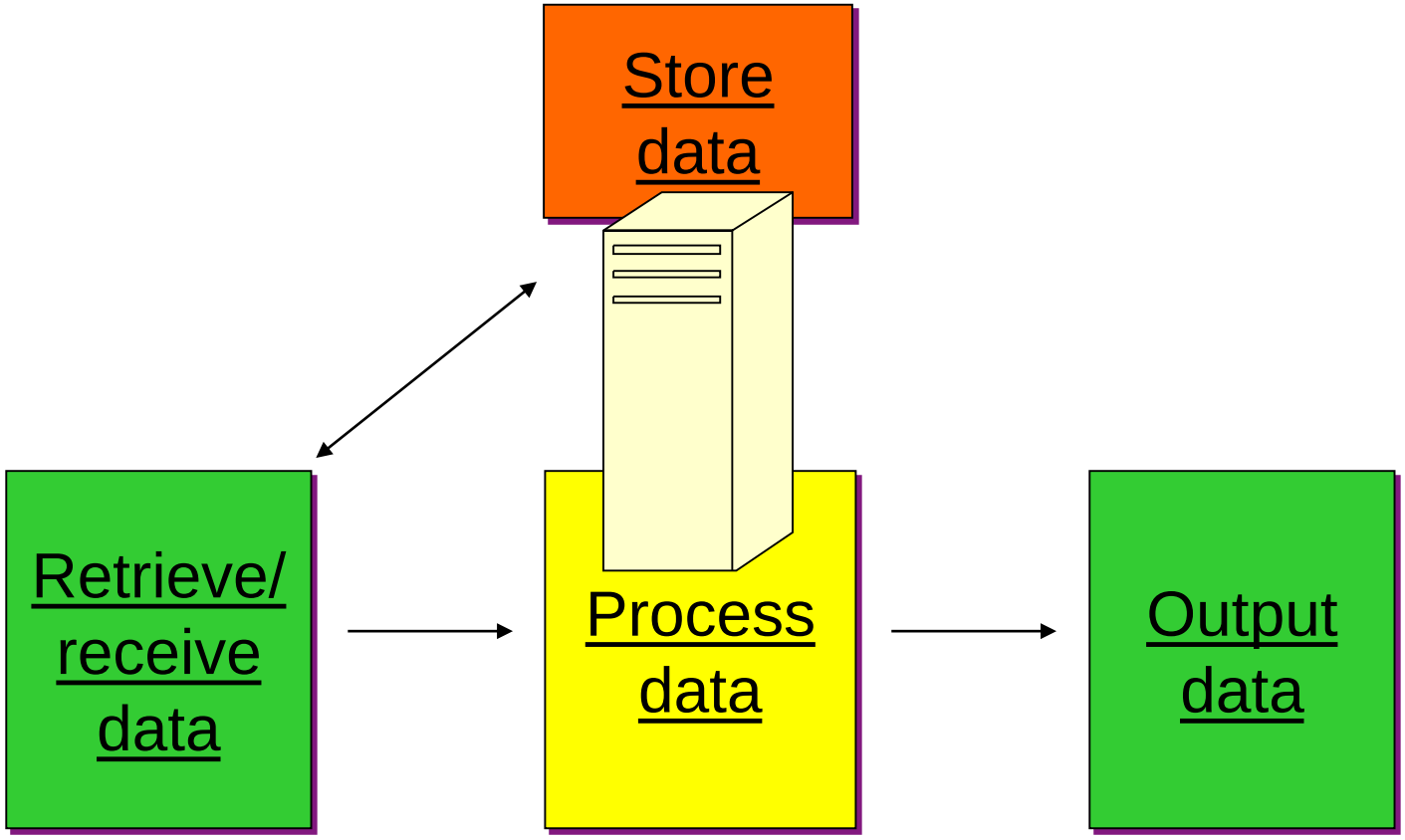
Presentation Outline

1. What Is a Computer?
2. Outside Tour
3. Inside Tour
4. How Computers Communicate
5. The PC Technician’s Toolkit
6. Integrated Circuits

1

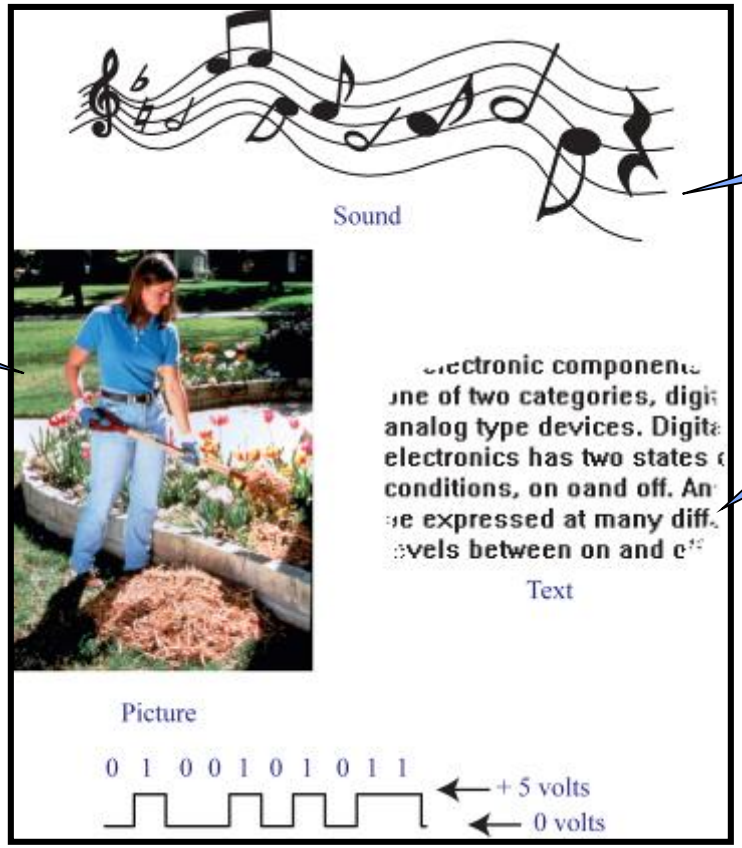
What Is a Computer?

Computer Functions



Click each link for details.

Data



MP3, WAV, MIDI

PNG, TIF, JPG

TXT, DOC

(Courtesy of Union Tools, Inc.)

Examples of Computers

Handheld

(Reprinted with permission from ViewSonic Corporation.)

Tablet

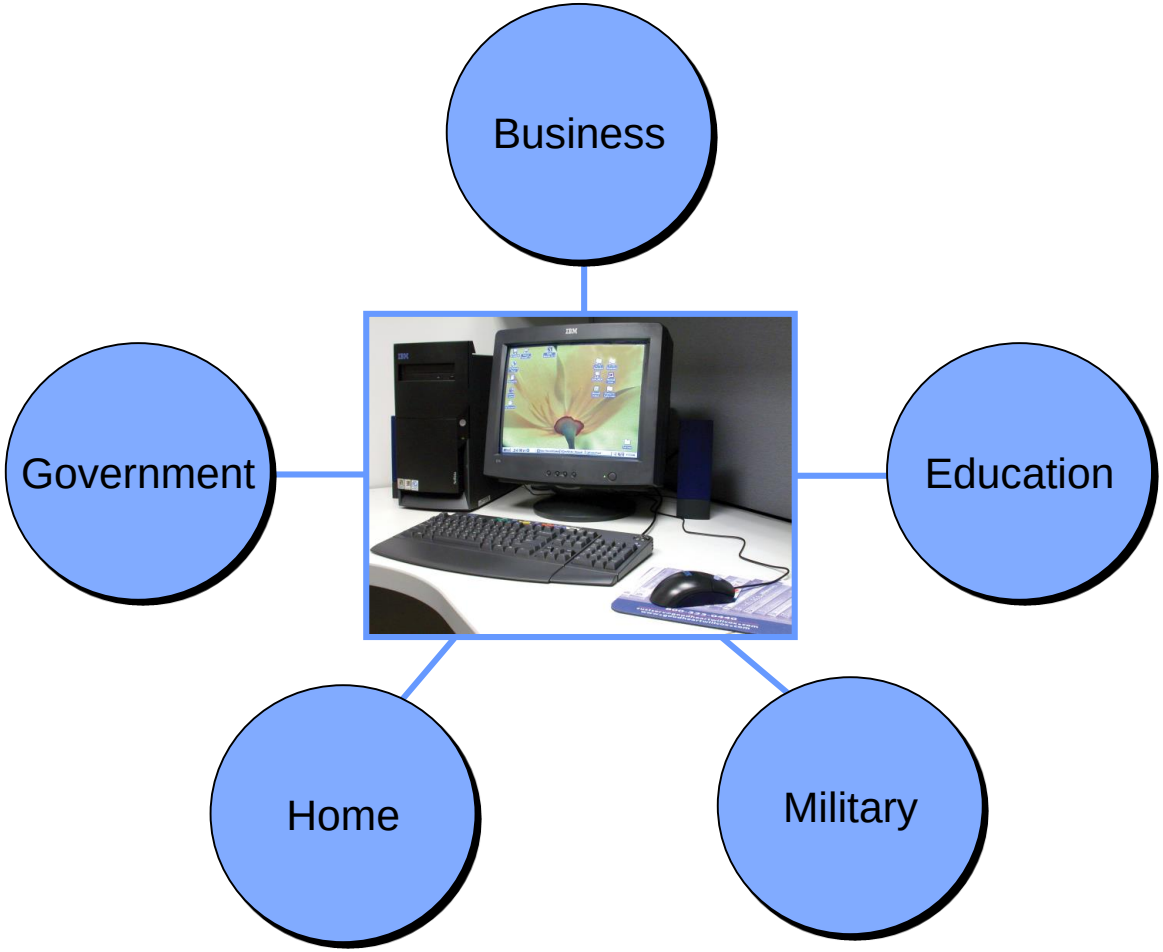
(Reprinted with permission from ViewSonic Corporation.)

Mainframe

(Courtesy of International Business Systems Corporation.)

Personal Computer

Computers Can Be Found In …



Review

- List the four basic functions of a computer.
  - Retrieve/receive data.
  - Store data.
  - Process data.
  - Output data.

Review

- List three forms of computer data.
  - Text
  - Sound
  - Graphics

Review

- List at least three devices from which computers can retrieve or receive data.

  Some devices are …
  - Keyboard.
  - Mouse.
  - Digital pen.
  - Memory.
  - Hard drive.

Review

- List at least three devices to which computers can store data.

  Some devices are …
  - Hard drive.
  - Floppy drive.
  - CD-ROM drive.
  - DVD drive.

Review

- List at least three devices to which computers can output data.

  Some devices are …
  - Printer.
  - Monitor.
  - Speakers.

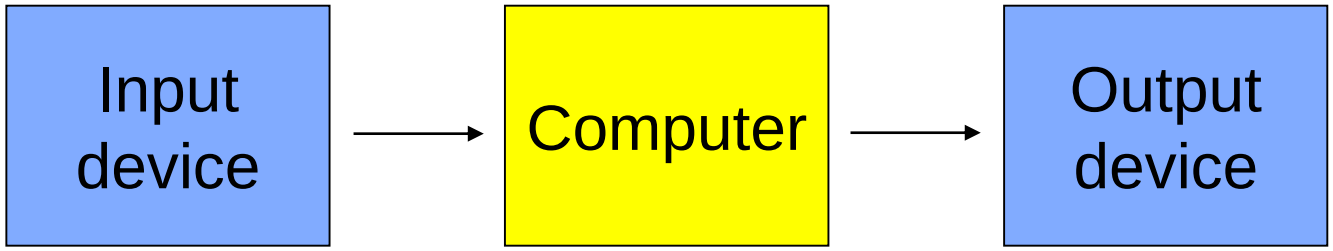
Review

- List at least four ways in which data is processed.
  - Sorting
  - Comparing
  - Computing
  - Locating

2

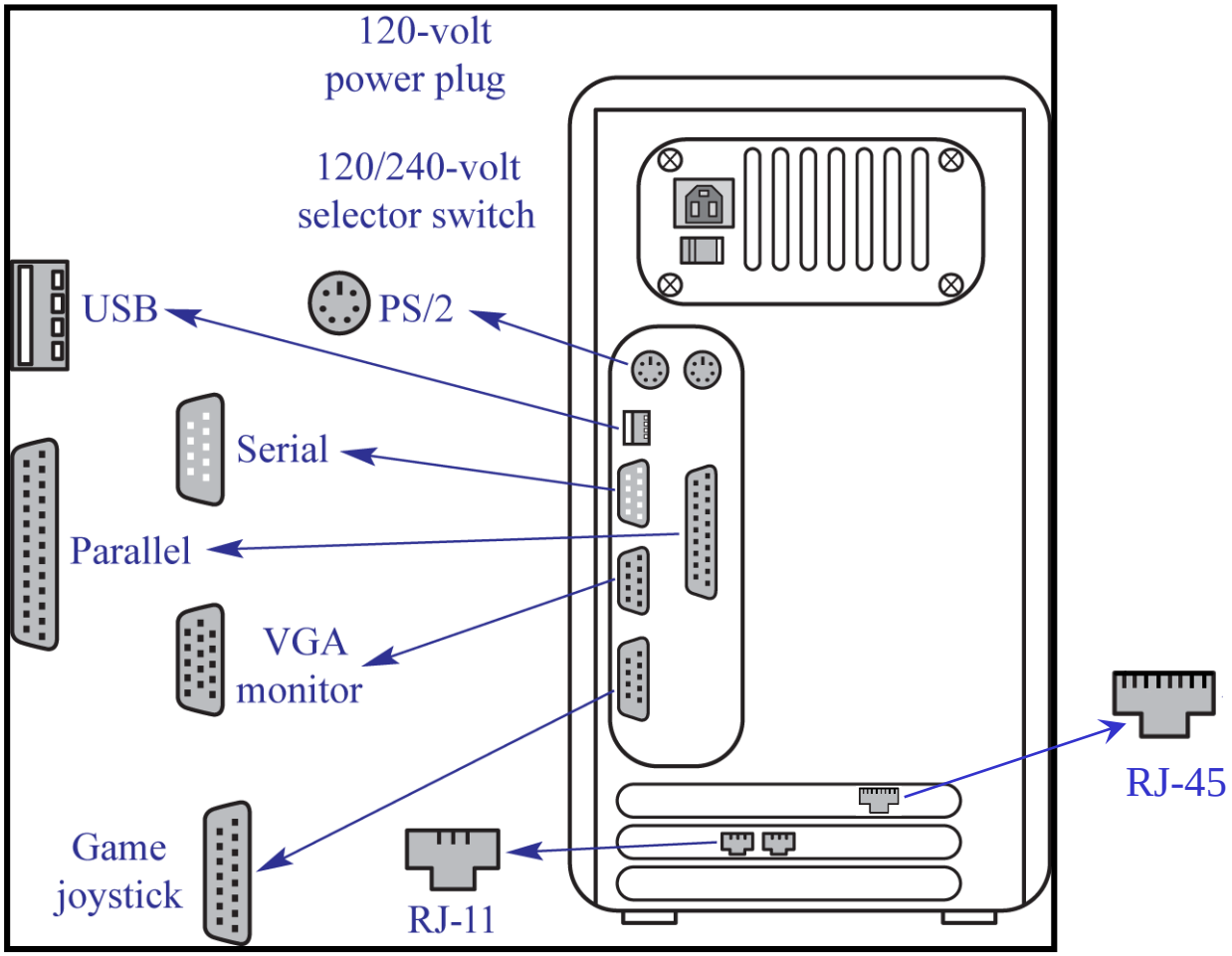
Outside Tour

Minimal Workstation Components



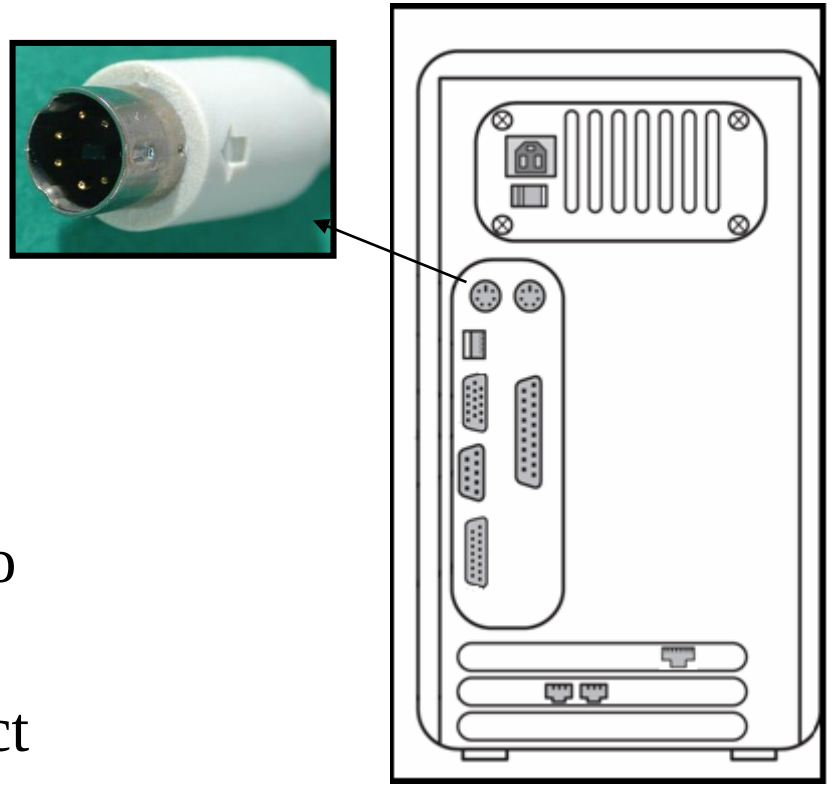
- Input and output devices are called peripherals.

Exterior Connections



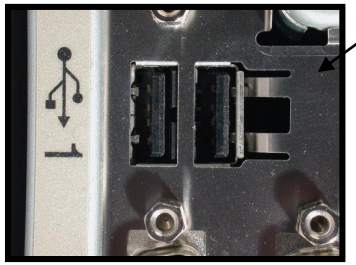
PS/2

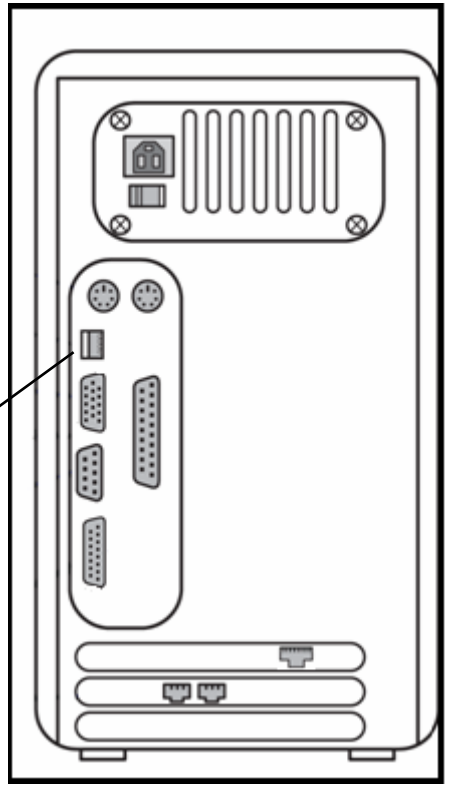
- Referred to as the mini-DIN or PS/2 connector.
- Used for mouse and keyboard.
  - Mouse must connect to mouse PS/2 port.
  - Keyboard must connect to keyboard PS/2 port.



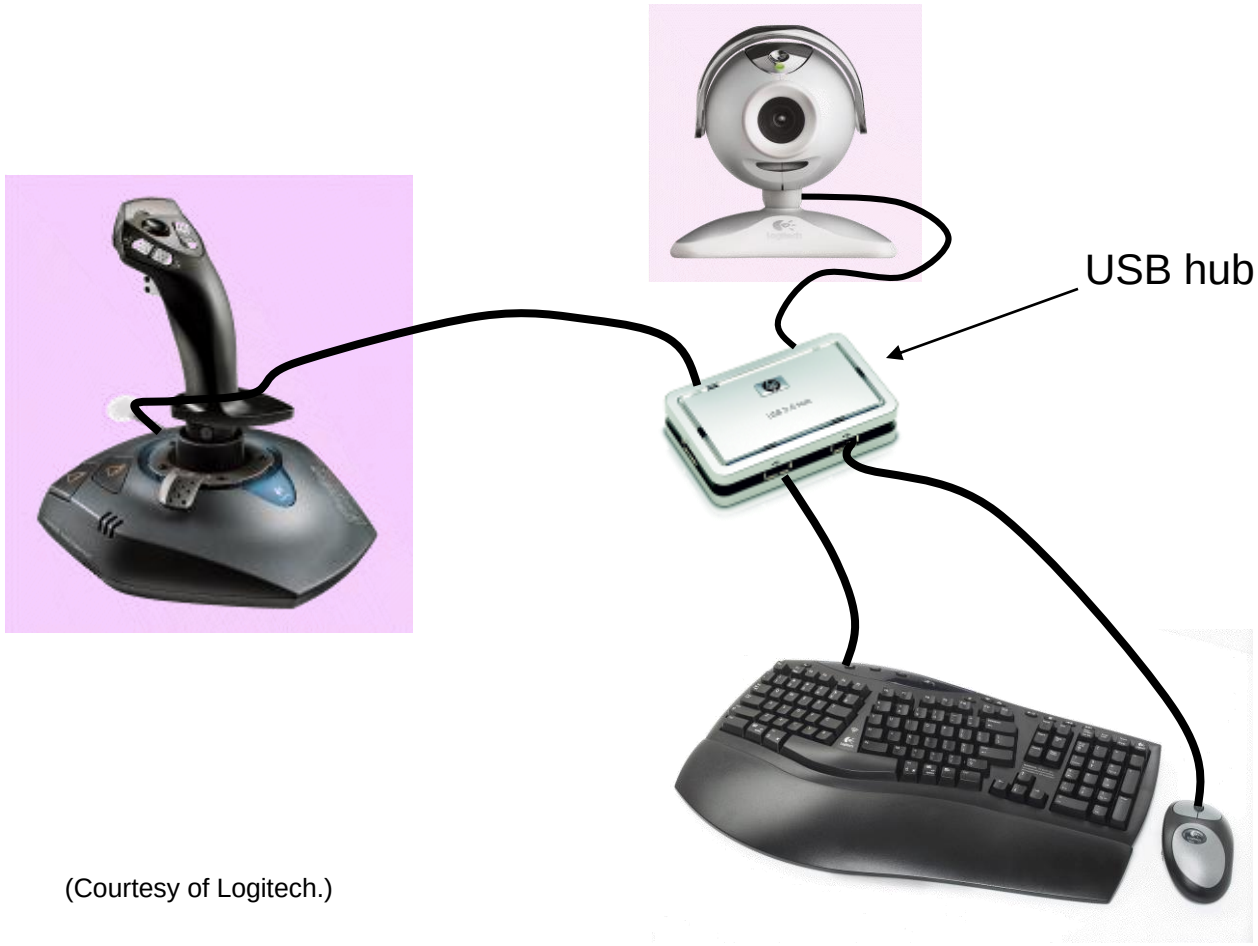
USB

- Allows USB devices to connect to PC in a daisy chain fashion or through a USB hub.
- Can connect up to 127 devices.
- Eliminates need to open case to install the device.





USB Hub



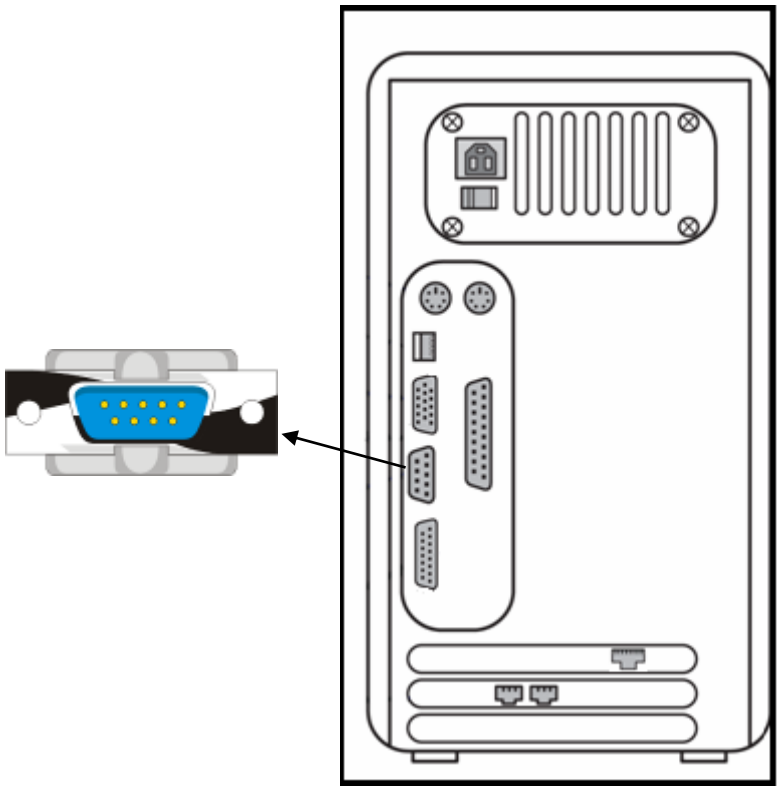
(Courtesy of Logitech.)

FireWire

- Designed for Apple computers by Lucent Technologies.
- Also known as IEEE 1394.
- Can connect up to 63 devices that can be hot swapped.
- Device bay is designed to accommodate hot-swap devices.

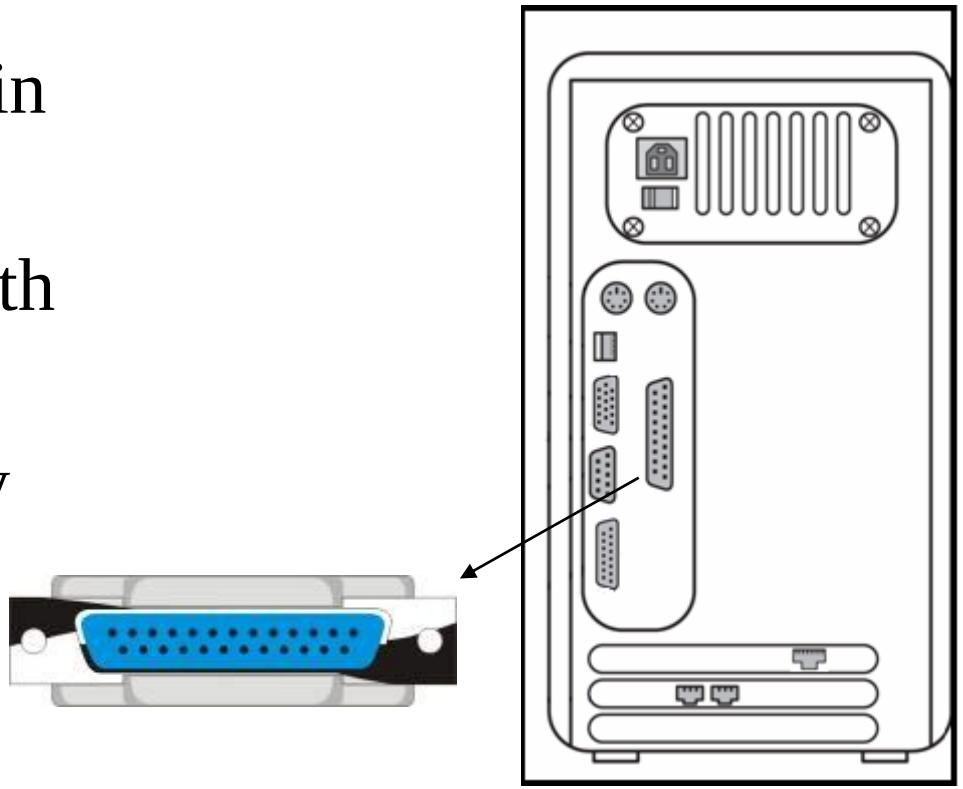
Serial

- D-shell with 9 pins.
- Used to connect to external modems, and some printers and digital cameras.
- Being replaced by USB and FireWire.



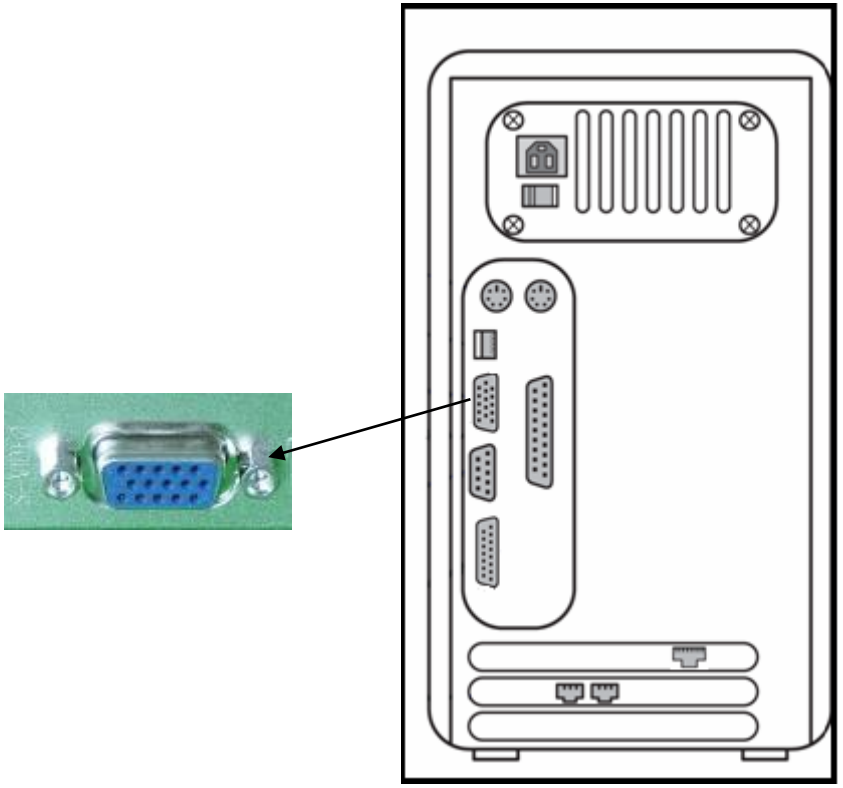
Parallel

- D-shell with 15 pin connections.
- Typically used with printers.
- Being replaced by USB.



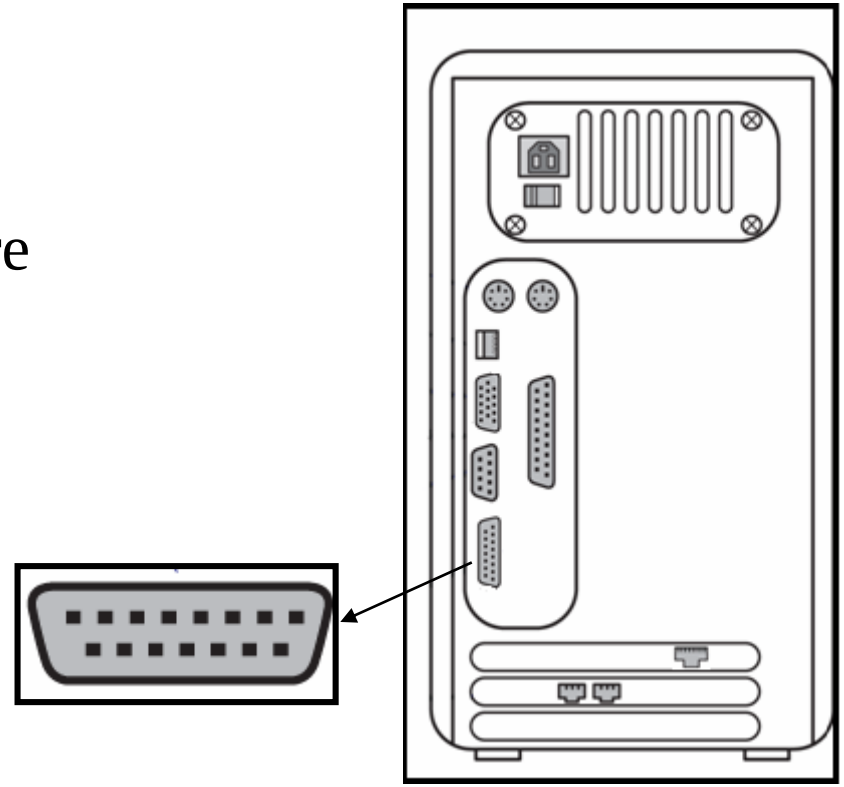
VGA

- Stands for video graphics array.
- HD-15 connection.



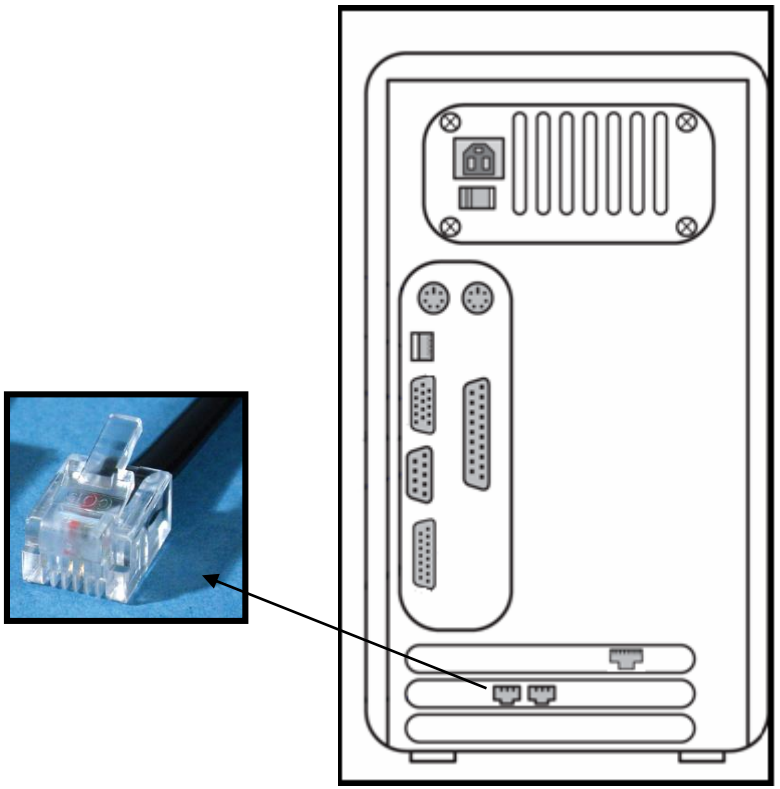
Game Joystick Port

- D-shell, 15-pin, 2-row connection.
- Most game peripherals are USB or wireless devices.



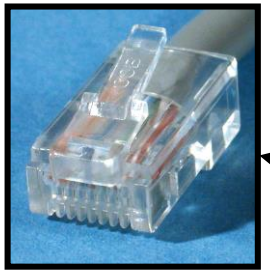
RJ-11

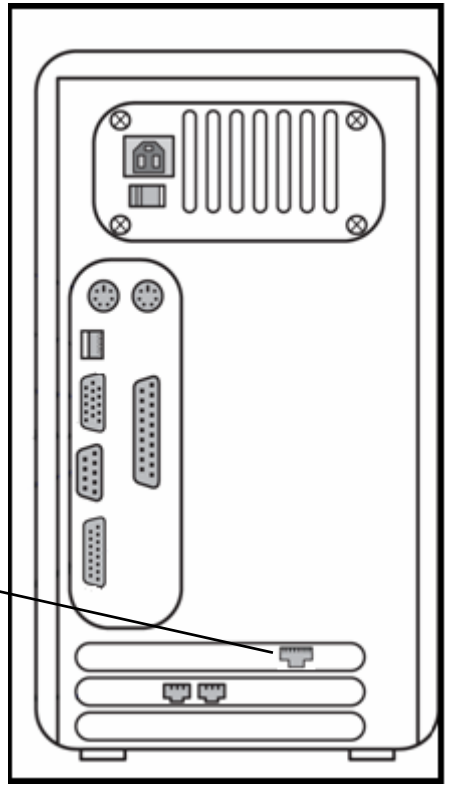
- Used for telephone modem connections.
- Uses four conductors and four pins.



RJ-45

- Used for network connections.
- Uses eight conductors and eight pins.





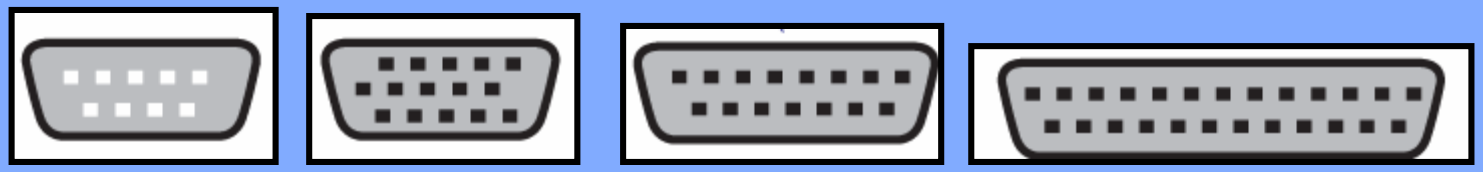
Review

- List the three minimal workstation components.
  - Input device
  - Computer
  - Output device

Review

- Identify the following DB connectors.

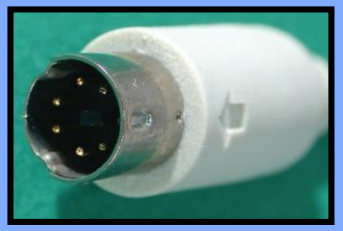
□ = Pin ■ = Hole



Serial VGA Game Parallel

Review

- Name the following port and list the two devices which use this port.



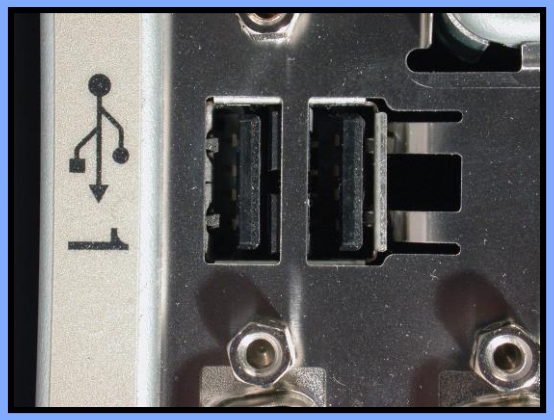
  - The port is called a mini-DIN or a PS/2.
  - The keyboard and mouse connect to this port type; however, keyboard and mouse ports are not interchangeable.

Review

- Identify the following port.
  - FireWire, *or* IEEE 1934

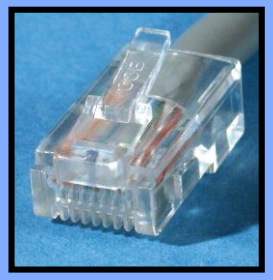
Review

- Identify the following port.
  - USB

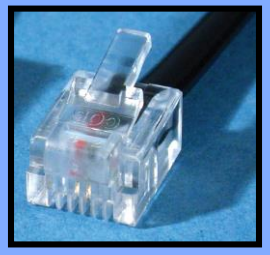


Review

- Identify the following connectors and their purpose.



- RJ-45, used for network connections.

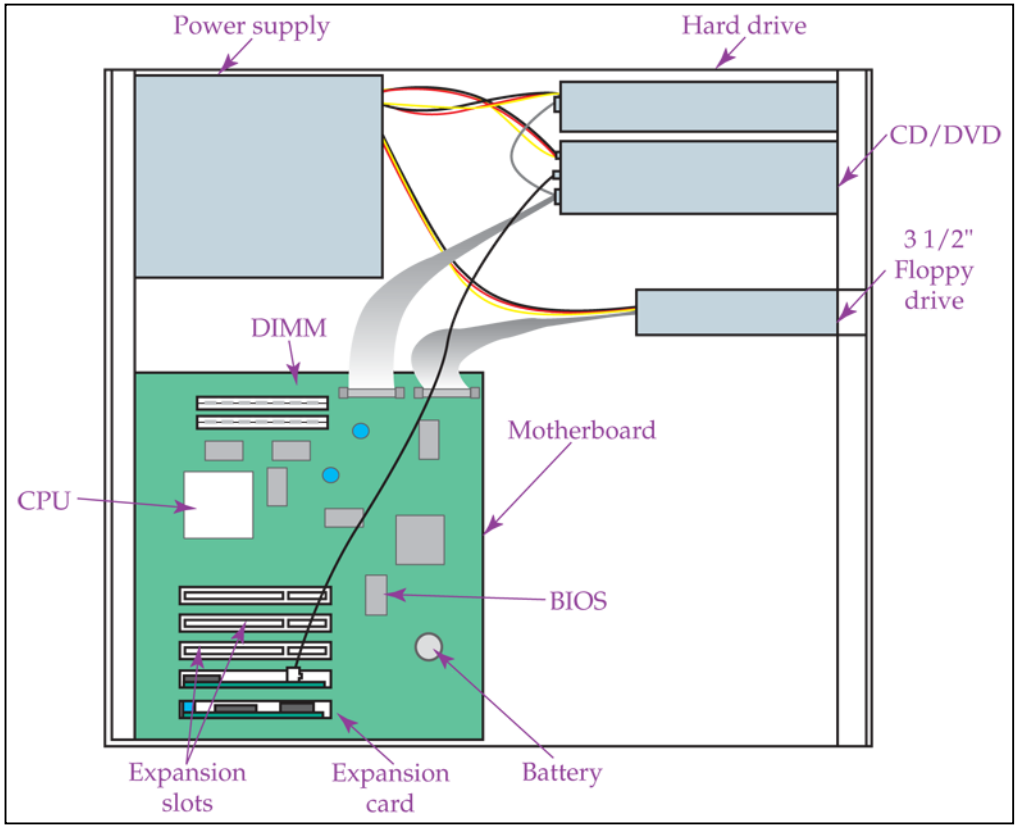


- RJ-11, used for telephone modem connections.

3

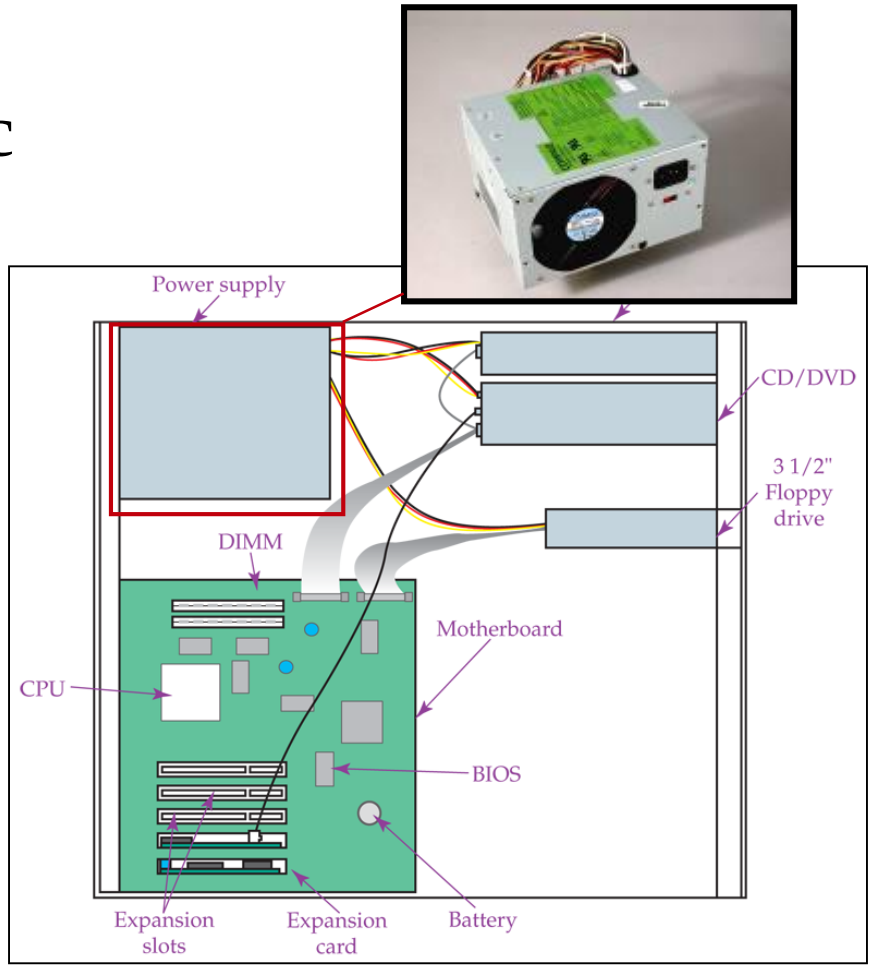
Inside Tour

Inside Components



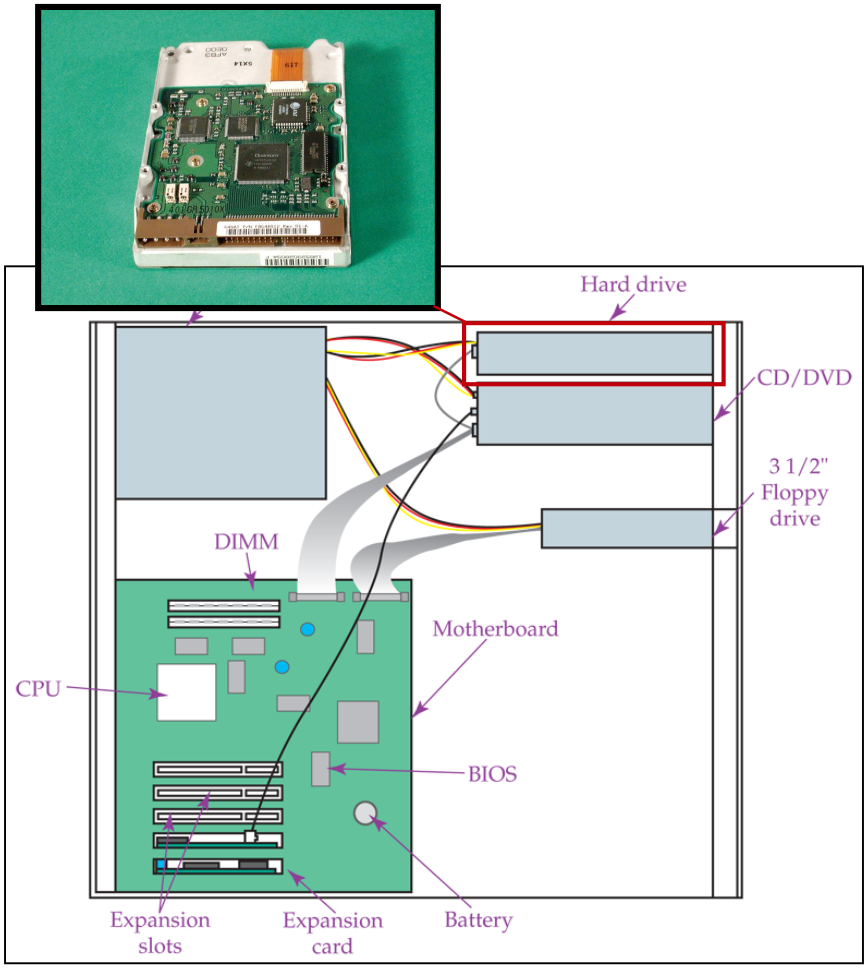
Power Supply

- Converts 120 volts of ac power to dc voltage levels used by various PC components.
- DC voltage levels are usually 3.3, 5, and 12.



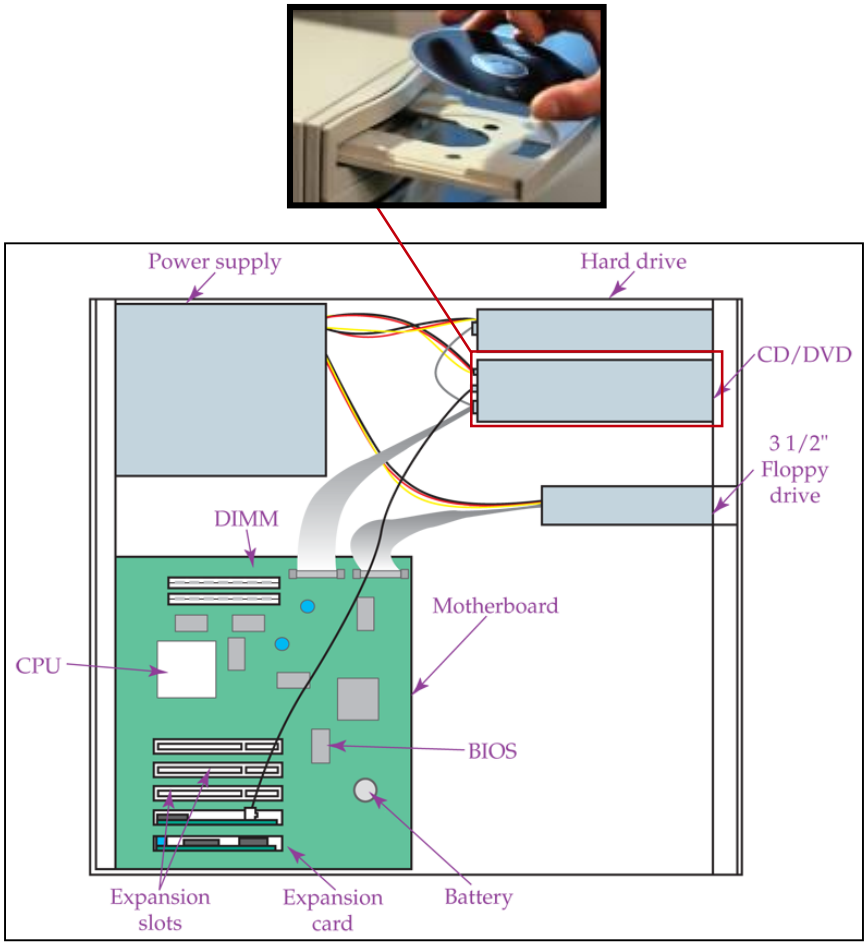
Hard Drive

- The hard drive is used to store computer programs and data.
- Made of several disks which are stacked inside a sealed box.
- Data is transmitted through a data cable.



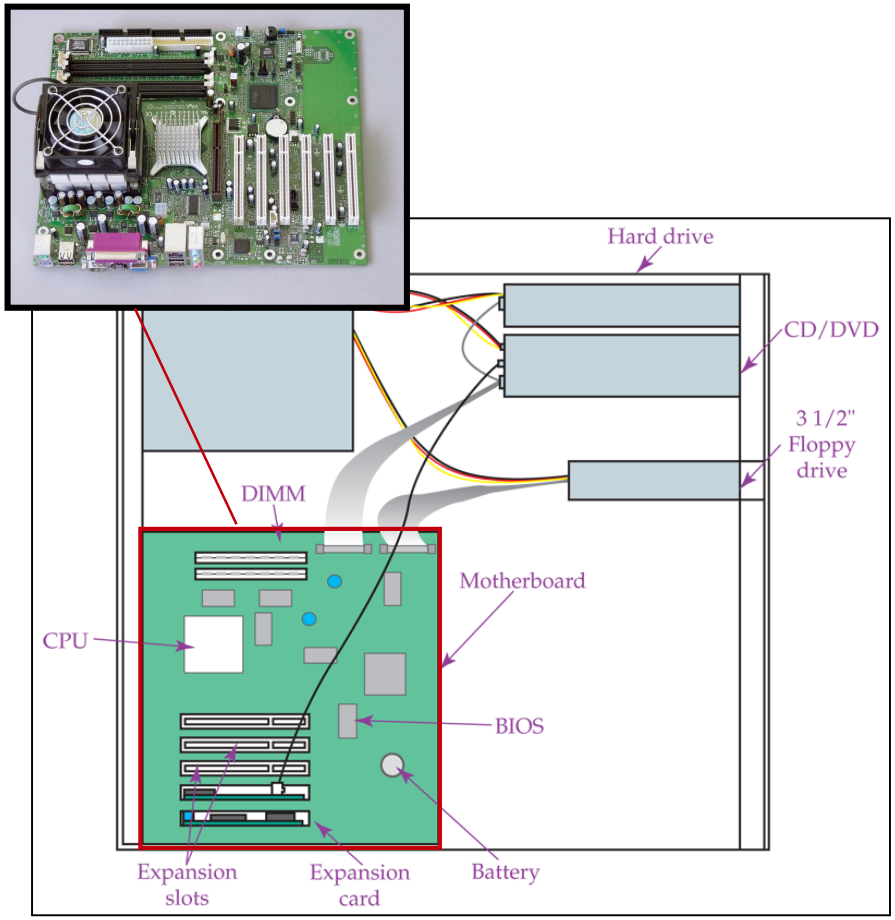
CD-ROM / DVD Drive

- CD-ROM and DVD drives use the same types of data cable as the hard drive.



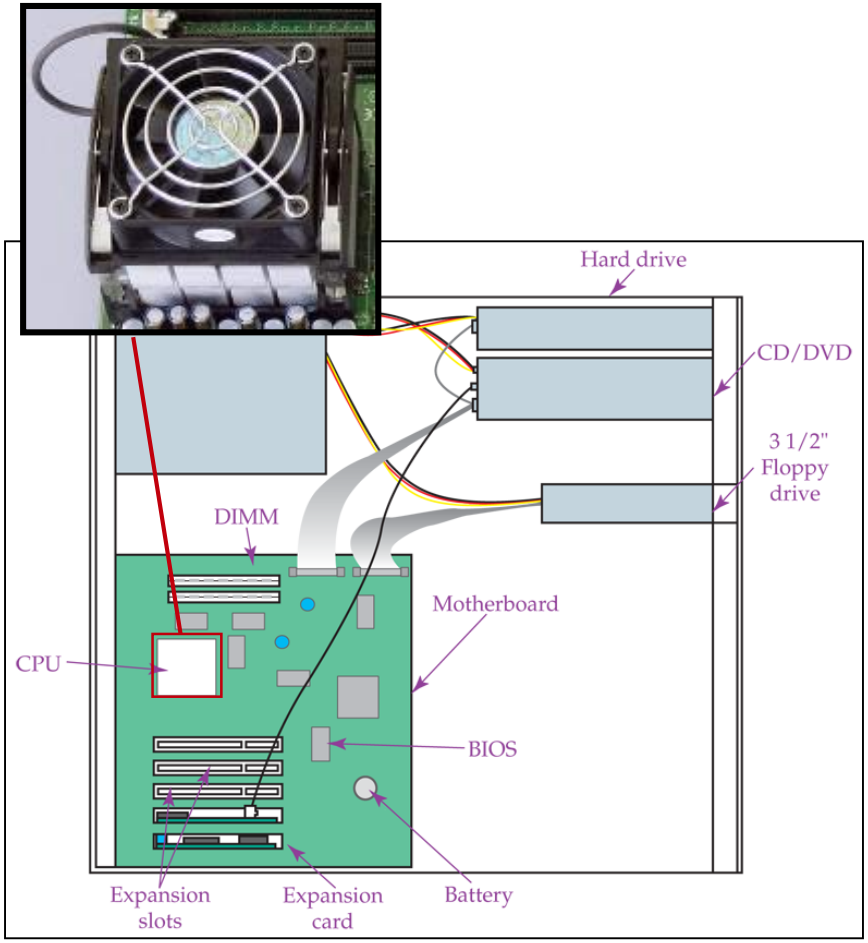
Motherboard

- The motherboard provides the electrical energy paths to the computer components and expansion slots.



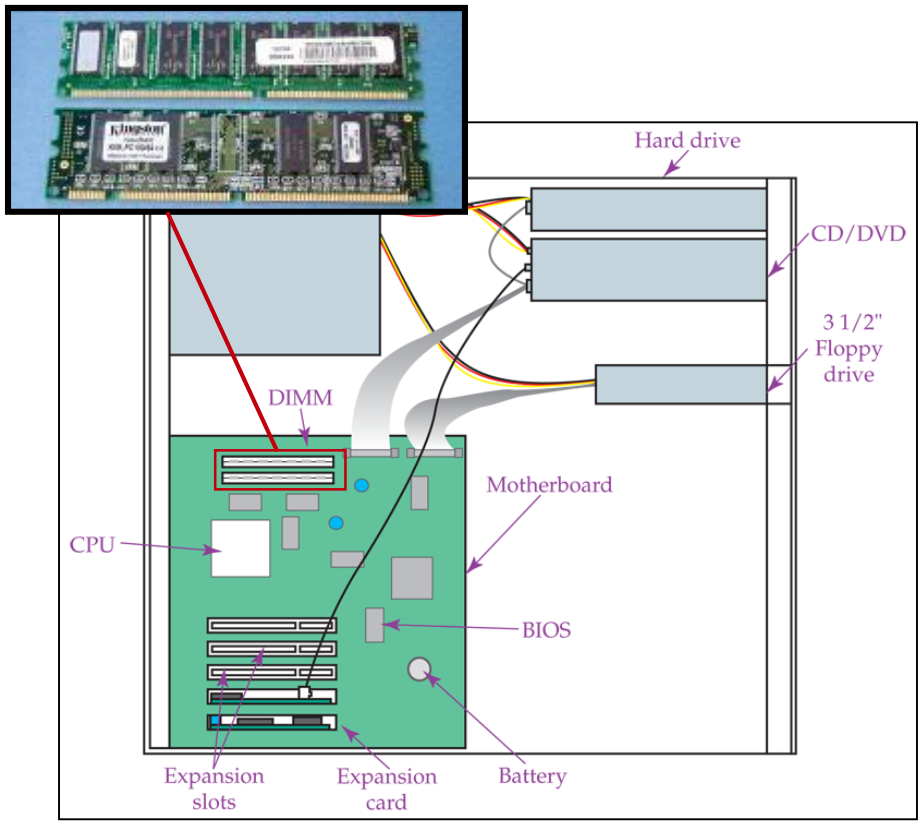
CPU

- The central processing unit (CPU) carries out program code.
- The cooling fan mounts to CPU to assist in cooling.



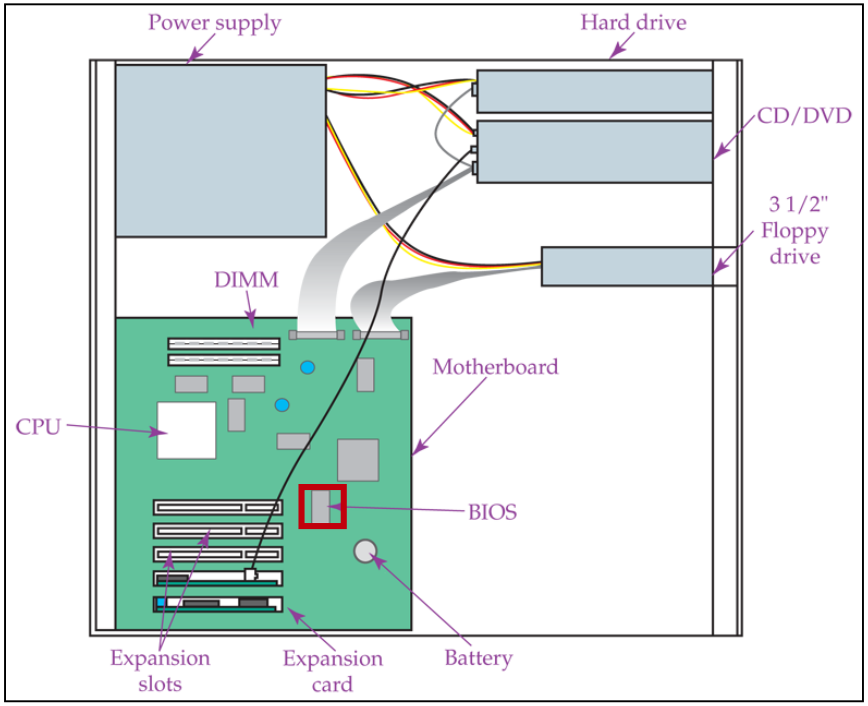
Random Access Memory

- Random access memory (RAM) is …
  - Classified as volatile memory.
  - The location where programs are loaded to from the hard drive.
  - Mounted into several parallel slots on the motherboard.



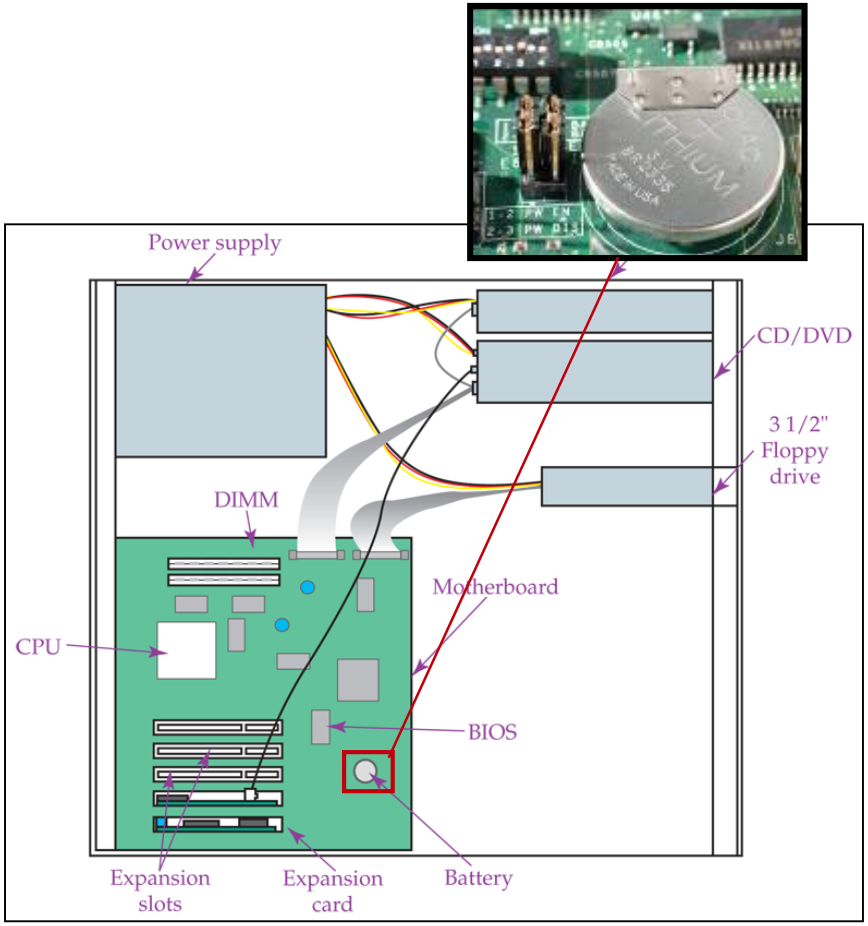
BIOS

- Basic input/output system (BIOS) is a non-volatile memory chip called an EEPROM or Flash ROM.
- Consists of software programs that support the compatibility between the CPU and computer hardware.
- Includes the BIOS Setup program.



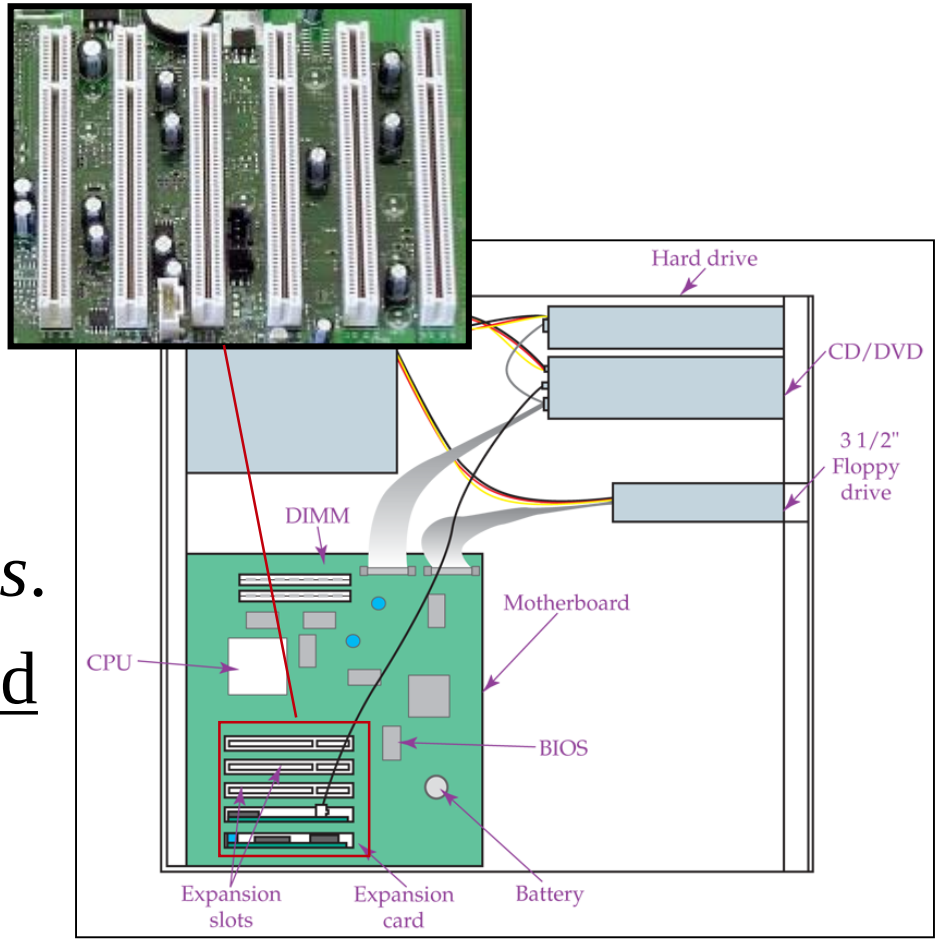
CMOS

- A complementary metal oxide semiconductor is …
  - A volatile storage area, which stores the BIOS Setup program data.
  - Located in the motherboard's chipset.
  - Powered by a battery.



Expansion Cards and Slots

- Expansion cards enhance or expand a computer's capabilities.
- Also called *interface cards* or *adapter cards*.
- Fit into expansion card slots.

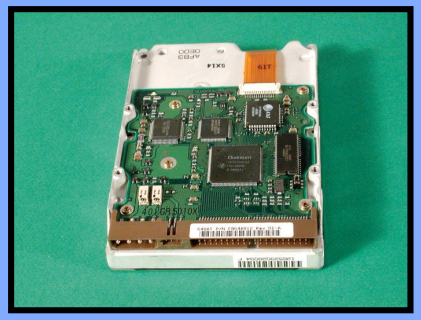


Review

- Identify the following component.
  - Power supply

Review

- Identify the following component.
  - Hard drive



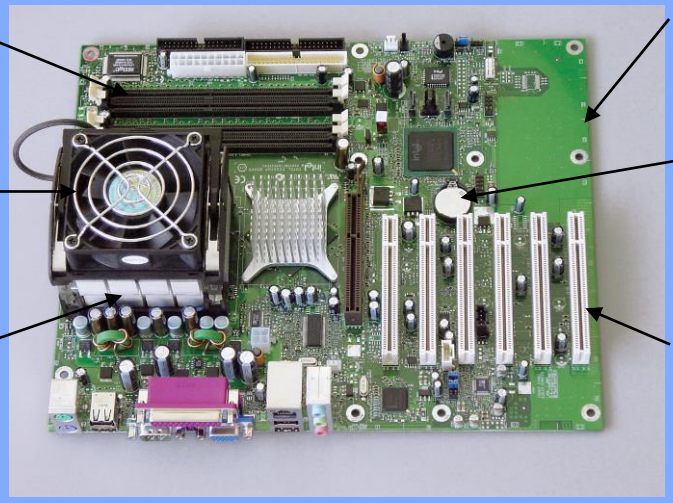
Review

- Identify the following components.

Memory slots 1.

Cooling fan 2.

CPU 3.



4. Motherboard

5. Battery

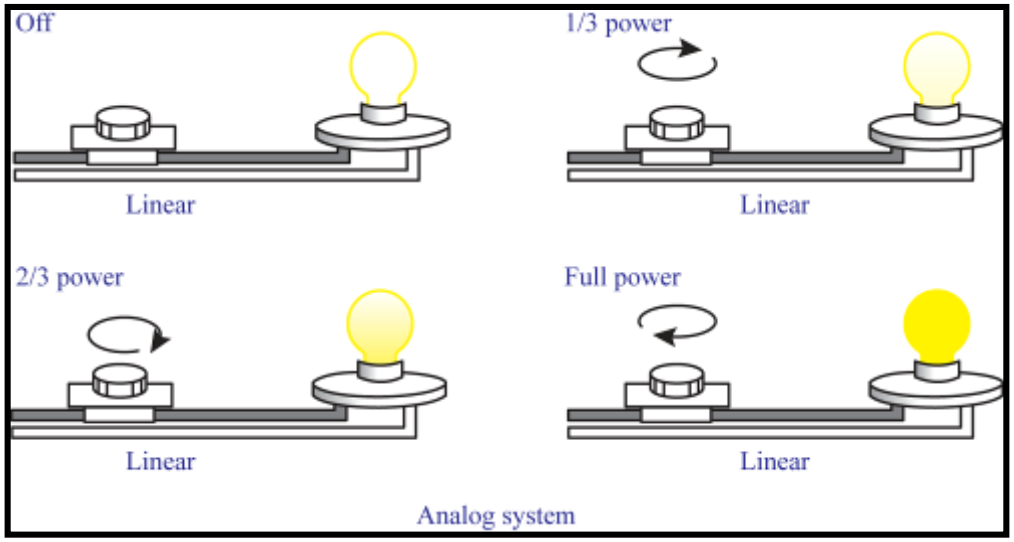
6. Expansion card slots

4

How Computers Communicate

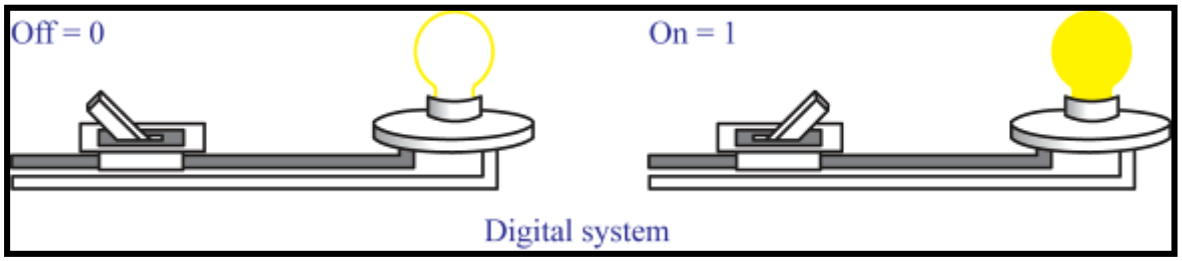
Analog

- Analog electronics use and produce varying voltage levels.



Digital

- Digital electronics use and produce discrete voltage levels.



Computer Data

- Can be expressed by voltage levels, numeric systems, and symbolic codes.
- Numeric systems:
  - Binary number system.
  - Hexadecimal number system.
- Symbolic codes:
  - ASCII.

Binary Number Code

Base	128	64	32	16	8	4	2	1
Binary Code	0	1	1	1	0	0	1	0

$$0 + 64 + 32 + 16 + 0 + 0 + 2 + 0 = 114$$

Binary = 01110010

Decimal = 114

Hexadecimal Number Code

- Based on the number base 16.
- Uses 16 characters.
- Uses numerals *0*–*9* and characters *A*–*F*.
- Matches the hardware system of most computers.
  - Data lines in a computer are 8, 16, 32, or 64 lines wide.
  - Memory sizes are in increments of 8 and 16.

Hexadecimal Numbers

Hex	Decimal	Hex	Decimal	Hex	Decimal	Hex	Decimal
1	1	9	9	11	17	19	25
2	2	A	10	12	18	1A	26
3	3	B	11	13	19	1B	27
4	4	C	12	14	20	1C	28
5	5	D	13	15	21	1D	29
6	6	E	14	16	22	1E	30
7	7	F	15	17	23	1F	31
8	8	10	16	18	24	20	32

Hexadecimal Conversion

Base	64	32	16	1
Hex Code			2	0

Hex = 20

Decimal = 32

(16 x 2) + (1 x 0) = 32

Base	64	32	16	1
Hex Code			A	4

Hex = A4

Decimal = 164

(16 x A) + (1 x 4) = 164

ASCII Code

- American Standard Code for Information Interchange.
- First attempt to standardize computer character codes.
- Unique to certain systems, such as IBM.
- Must be used with compatible software.

ASCII Code Chart

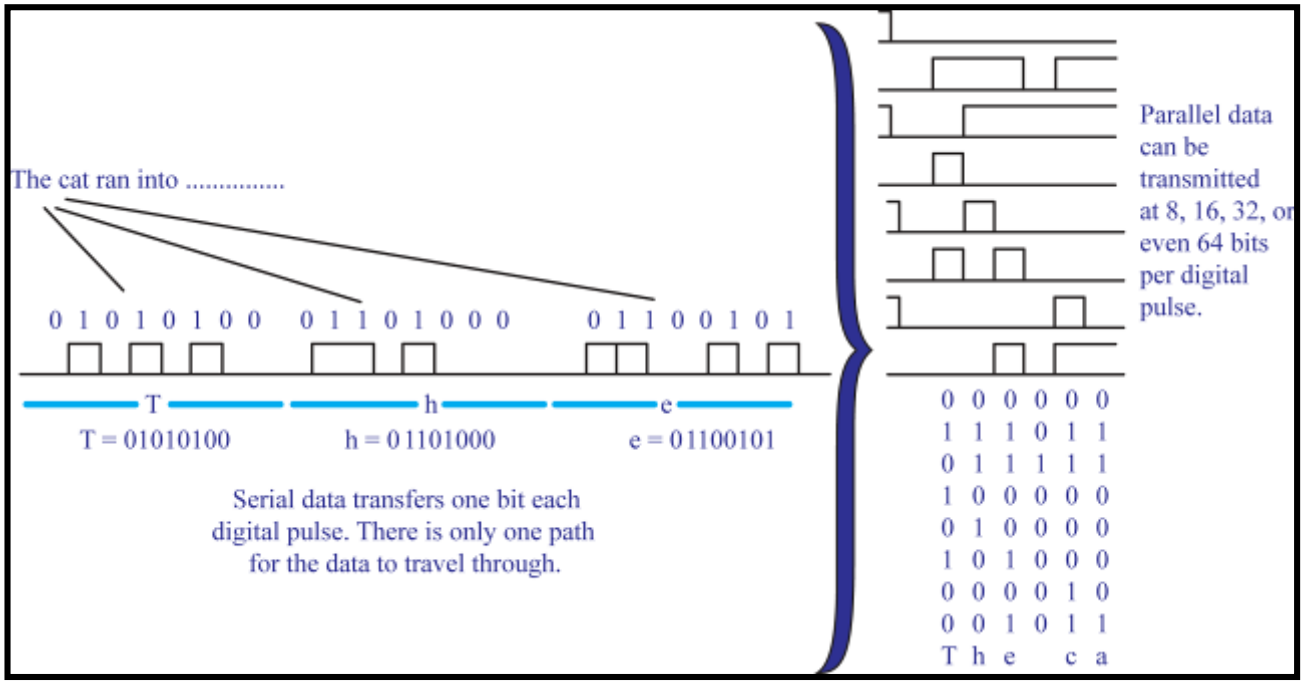
Table of Standard ASCII Characters		
0	NUL	Null
1	SOH	Start of header
2	STX	Start of text
3	ETX	End of text
4	EOT	End of transmission
5	ENQ	Enquiry
6	ACK	Acknowledgment
7	BEL	Bell
8	BS	Backspace
9	HT	Horizontal tab
10	LF	Line feed
11	VT	Vertical tab
12	FF	Form feed
13	CR	Carriage retu
14	SO	Shif

Bits, Bytes, and Words

Unit	Definition	Example
Bit	0 or 1	1
Byte	8 bits	01011100
Word	1 to 8 bytes	01011100 11001101 01111101 11010100

Serial and Parallel Data Transfer

- Serial transfers one bit at a time.
- Parallel transfers multiple bits at a time.



Computer Numerical Values

- Metric prefixes are commonly used to express speed and size of computer systems and hardware.
- Used in combination with the words bit (b) and byte (B):
  - bps (bits per second).
  - Bps (bytes per second).
  - 256 MB (256 Megabytes).

Metric Prefixes

Metric Name	Symbol	Number Base 10	Number Base 2	Common Name	Numeric Equivalent for the Base 10 Number System
Pico	p	10^{-12}	10^{-40}	trillionth	0.000 000 000 001
Nano	n	10^{-9}	10^{-30}	billionth	0.000 000 001
Micro	μ	10^{-6}	10^{-20}	millionth	0.000 001
Milli	m	10^{-3}	10^{-10}	thousandth	0.001
Base unit		1			1
Kilo	K	10^{3}	10^{10}	thousand	1,000
Mega	M	10^{6}	10^{20}	million	1,000,000
Giga	G	10^{9}	10^{30}	billion	1,000,000,000
Terra	T	10^{12}	10^{40}	trillion	1,000,000,000,000
Peta	P	10^{15}	10^{50}	quadrillion	1,000,000,000,000,000
Exa	E	10^{18}	10^{60}	quintillion	1,000,000,000,000,000,000

Base 10 and Base 2 Comparisons

- Use base 2 number system when referring to bits and bytes.

Prefix	Base 2 Number System	Base 10 Number System
Kilobyte	1,024	1,000
Megabyte	1,048,576	1,000,000
Gigabyte	1,073,741,824	1,000,000,000
Terabyte	1,099,511,627,776	1,000,000,000,000
Petabyte	1,125,899,906,842,624	1,000,000,000,000,000
Exabyte	1,152,921,504,606,846,976	1,000,000,000,000,000,000

Power-On Sequence

1. Ac power is converted to dc and distributed to the major components of the computer system.
2. BIOS checks components in the system to ensure they are in working order. This is called the power-on self-test (POST).
3. The operating system takes control of the system.
4. The CPU waits for activity.

Major Parts Working Together Example

1. CPU waits for activity.
2. When a user opens a program, the program shares control with the CPU.
3. When a user saves data, the program issues the save command, and the operating system takes over and works with the BIOS to complete the operation.
4. The BIOS translates the save instructions to the disk system.
5. Control is returned to the operating system.

Review

- Name three ways with which data can be expressed.
  - Voltage levels.
  - Number systems, such as binary and hexadecimal.
  - ASCII code.

Review

- Describe the power-on sequence.

1. Ac power is converted to dc and distributed to the major components of the computer system.
2. BIOS checks components in the system to ensure they are in working order. This is called the power-on self-test (POST).
3. The operating system takes control of the system.
4. The CPU waits for activity.

Review

- Describe what happens when a user saves data.

1. The program issues the save command, and the operating system takes over and works with the BIOS to complete the operation.
2. The BIOS translates the save instructions to the disk system.
3. Control is returned to the operating system.

Review

- What is the nominal value of 1 MB?
  - 1,000,000

Review

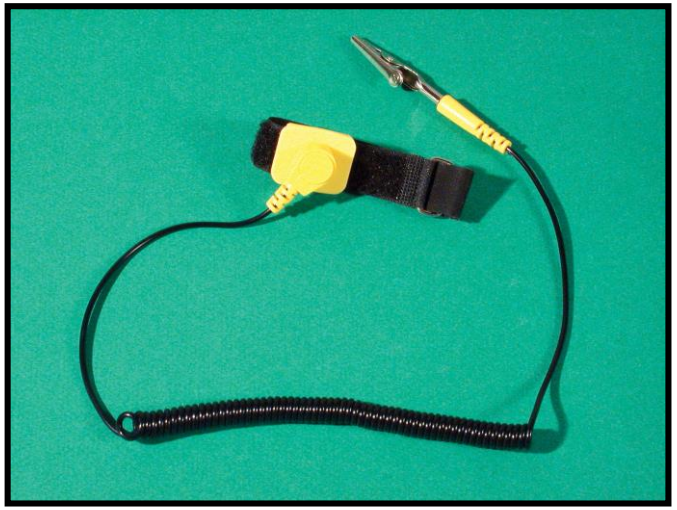
- What is the value of 1 MB based on the binary system?
  - 1,048,576 (2^{20})

5

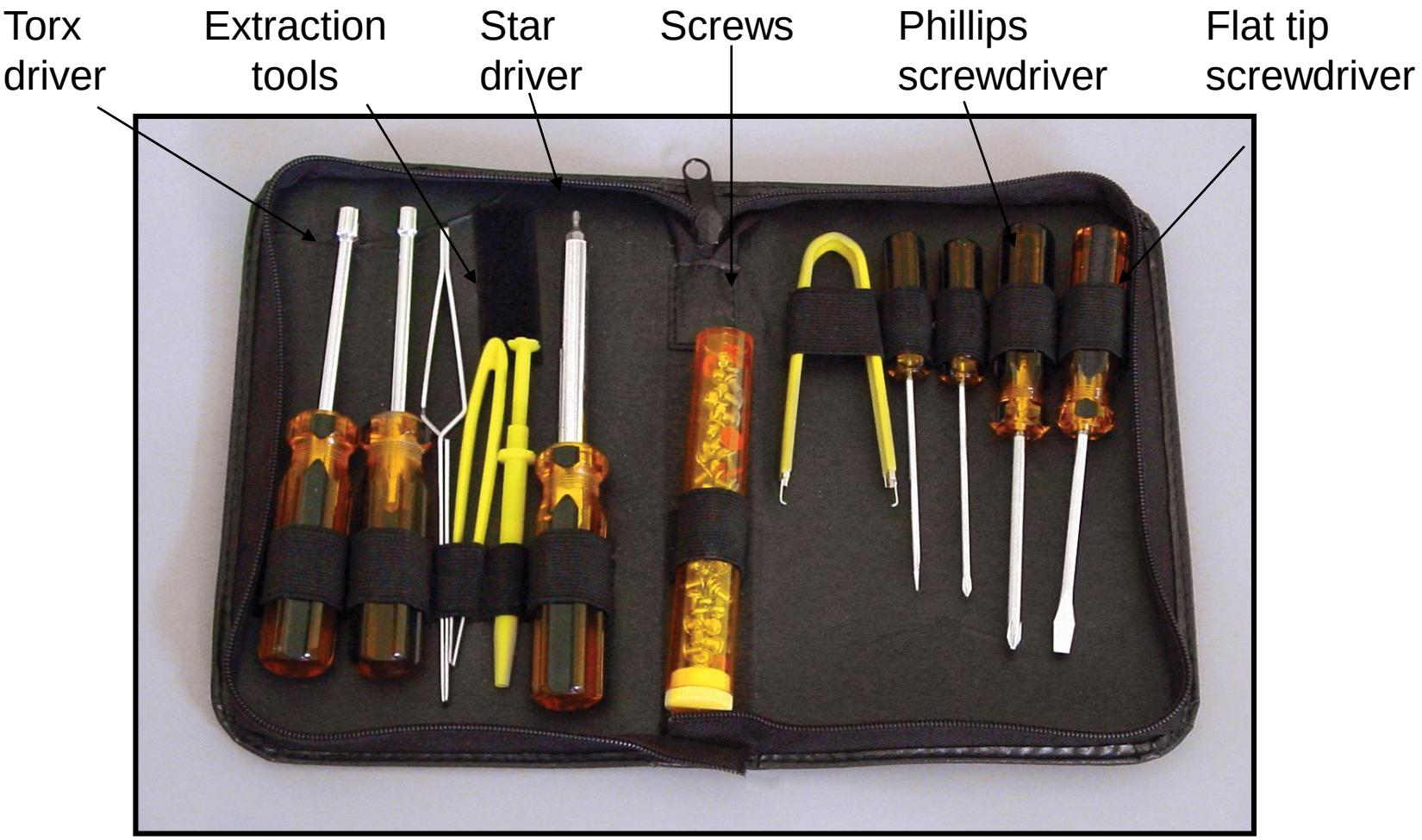
The PC Technician's Toolkit

Anti-Static Wrist Strap

- Anti-static wrist strap protects against electrostatic discharge (ESD).
- One end of the strap is worn around the wrist—the other, the clip, is grounded.



Tool Kit



Software Tool Kit

- Diagnostic software.
- Boot disks.

Review

- What is electrostatic discharge?
  - Electrostatic discharge is the transfer of static electrical energy from one object to another.

Review

- Identify the following tools:

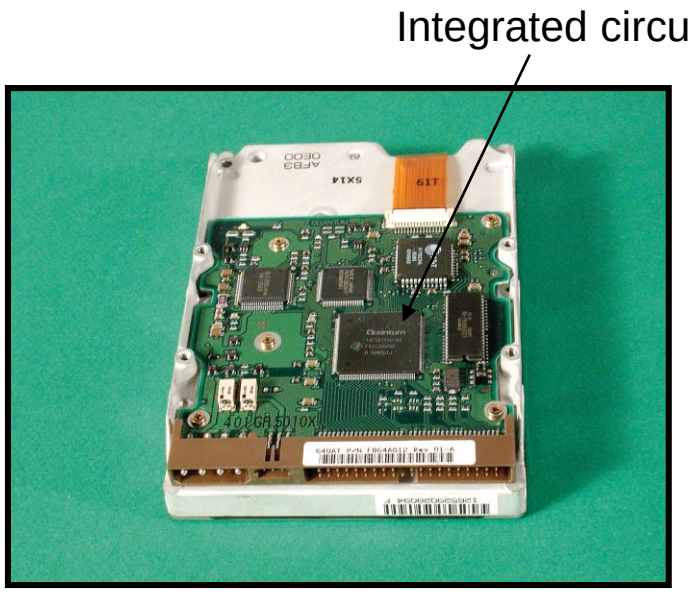
1. Torx driver
2. Extraction tools
3. Star driver
4. Screws
5. Phillips screwdriver
6. Flat tip screwdriver

6

Integrated Circuits

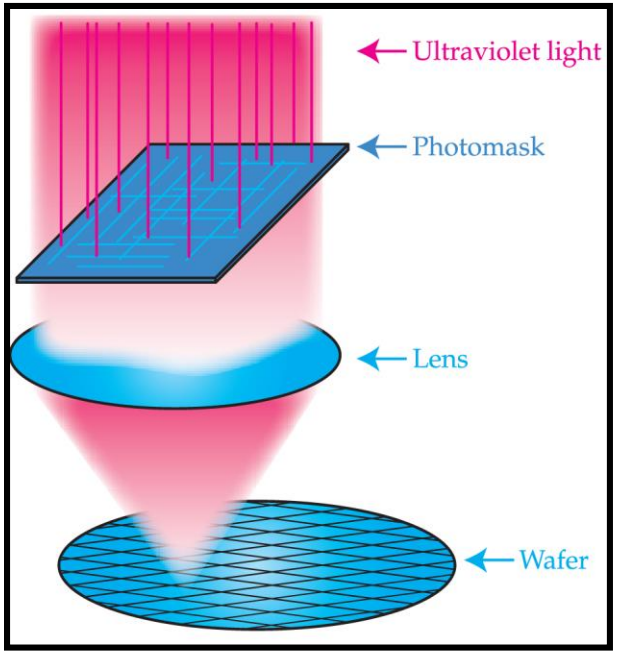
Integrated Circuit (IC)

- An integrated circuit is often referred to as a chip.
- A collection of transistors, resistors, and other electronic components on a piece of semiconductor material.
- Commonly found on circuit boards.



IC Manufacturing Process

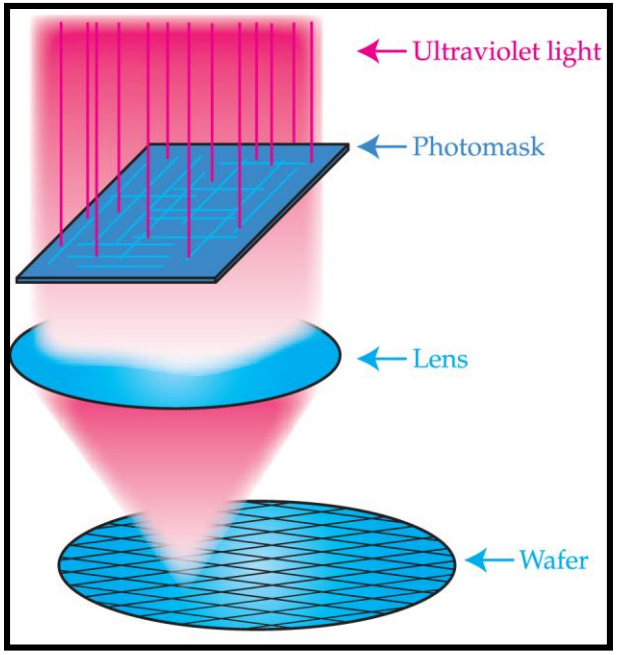
1. Circuit is drawn on a large scale.
2. The drawing is photographed.
3. The negative of the photograph, called a photomask, is used in the IC manufacturing process.



(Courtesy of International Business Systems Corporation.)

IC Manufacturing Process (Cont.)

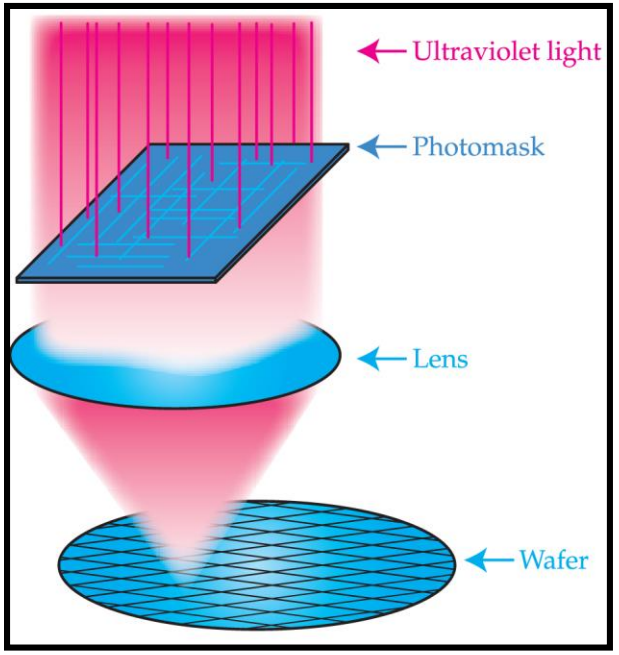
4. An ingot of pure silicon is sliced into thin wafers.
5. A series of layers are produced over the silicon wafer using a process called photolithography.



(Courtesy of International Business Systems Corporation.)

IC Manufacturing Process (Cont.)

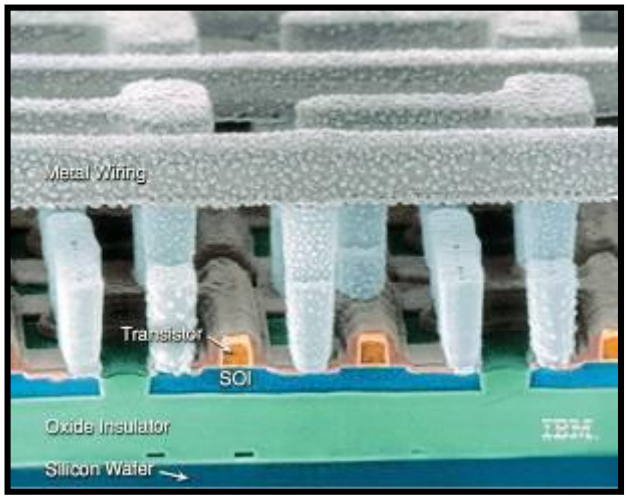
6. The negative of the photograph and an ultraviolet light are used to leave a pattern of the circuit on the photoresist of the wafer.
7. The photoresist is washed away leaving an etched pattern on the wafer.



(Courtesy of International Business Systems Corporation.)

IC Manufacturing Process (Cont.)

8. The valleys of the etched pattern are filled with conductive material.
9. This process is repeated until 20 or more layers are developed over the surface of the wafer.
10. The wafer is cut into individual integrated circuits and then packaged.



(Courtesy of International Business Systems Corporation.)

Review

- What is an integrated circuit (IC)?
  - A collection of transistors, resistors, and other electronic components on a piece of semiconductor material.

Review

- What is a photomask?
  - The negative of the photograph used in the IC manufacturing process.

Review

- What is a photoresist?
  - A chemical applied to the surface of a silicon wafer during the photolithography process that reacts when exposed to ultraviolet light.