## Objectives

- Information Technology (IT): is the design, development, implementation, support, and management of computer hardware and software applications. An IT professional is knowledgeable about computer systems and operating systems.

- In this session, you will learn to:
  - Identify the major components of personal computers.
  - Identify the major components of the system unit.
  - Identify the various types of storage devices used in personal computers.
  - Identify personal computer connection methods.

## Categories of Personal Computer Components

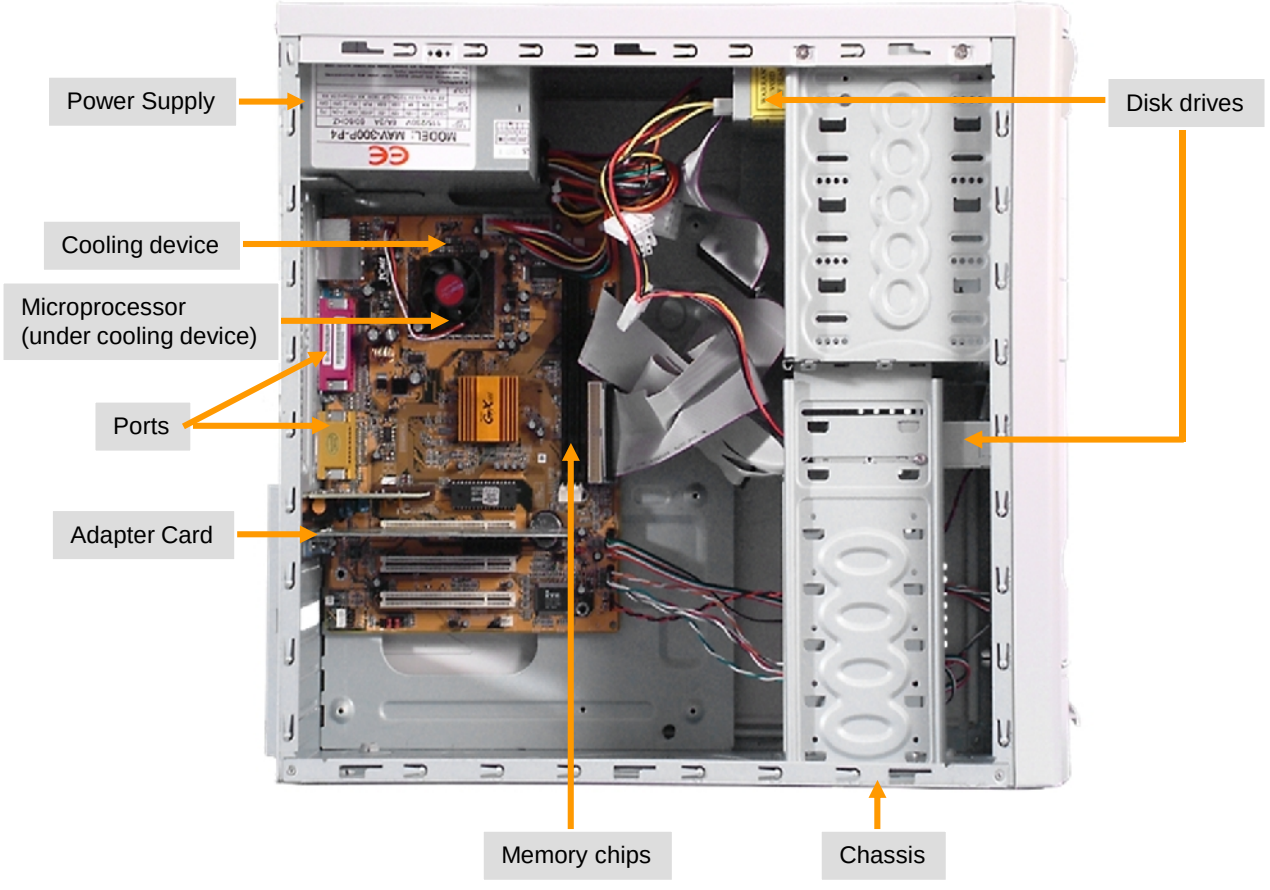
- A *personal Computer (PC)* is a computing device made up of many distinct electronic components that all function together in order to accomplish some useful task (such as adding up the numbers in a spreadsheet or helping you write a letter).
- There are four primary categories of components in a typical personal computer:
  - System unit
  - Display device
  - Input devices
  - External devices

# A Typical Personal Computer

- The following figure shows a typical personal computer:

# The System Unit

- A ***system unit*** is a personal computer component that houses other devices necessary for the computer to function.



## Display Device

- A ***display device*** is a personal computer component that enables users to view the text and graphical data associated with a computer program.

## Input Devices

- An ***input device*** is a personal computer component that enables users to enter data or instructions into a computer.

# External Devices

- There are several categories of external devices:
  - Microphone
  - Digital camera
  - Scanner
  - Speakers
  - Printer
  - Network device
  - External drive

## System Unit Components

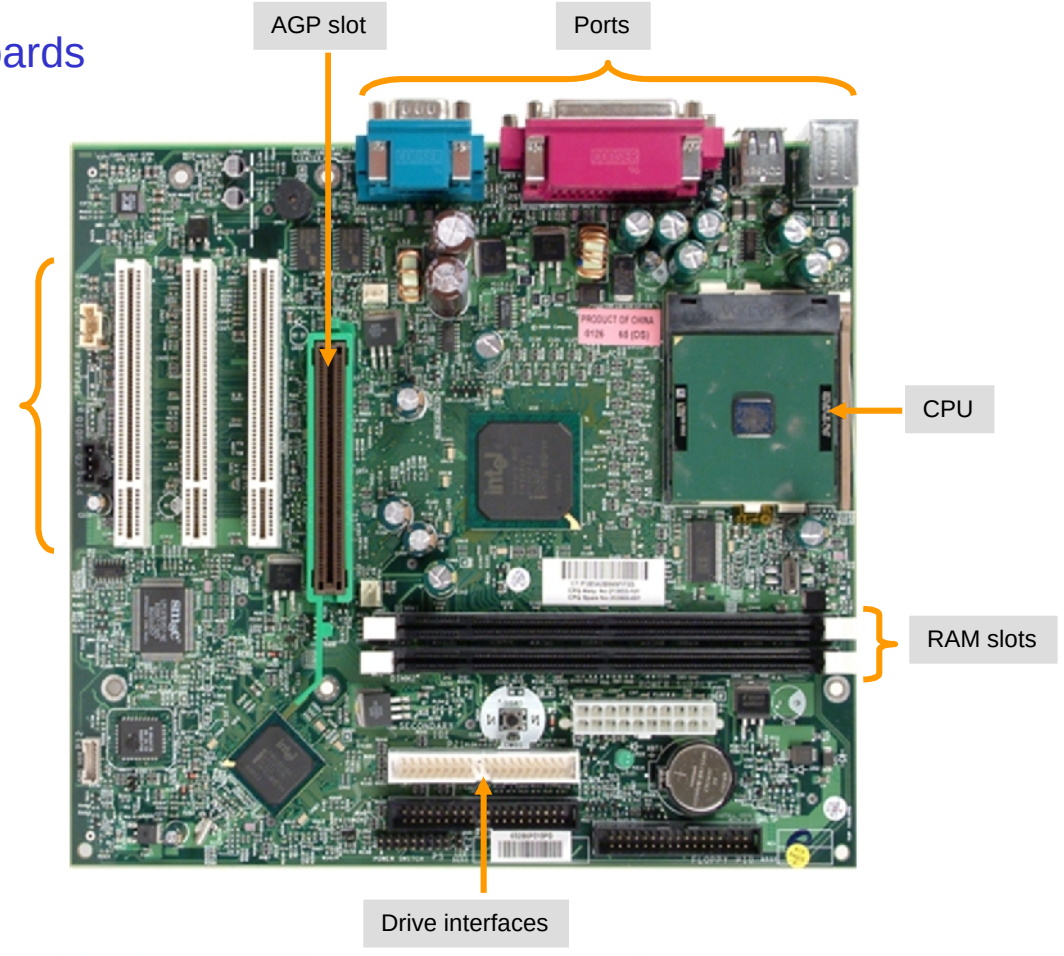
- The system unit itself has several important sub-components, such as:
  - System Board
  - Central Processing Unit (CPU)
  - Memory
  - System Bus
  - Storage devices

# The System Board

- The ***system board*** is the personal computer component that acts as the backbone for the entire computer system.

Types of System Boards

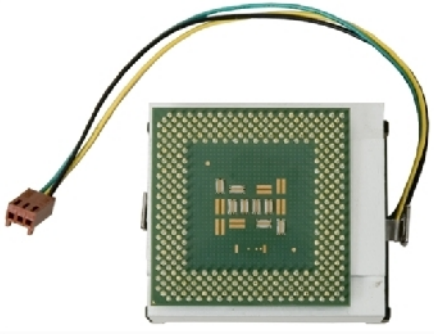
- Nonintegrated
- Integrated



## The Central Processing Unit (CPU)

- The ***central processing unit (CPU)***, sometimes called microprocessor or just processor, is the real brains of the computer and is where most of the calculations take place.

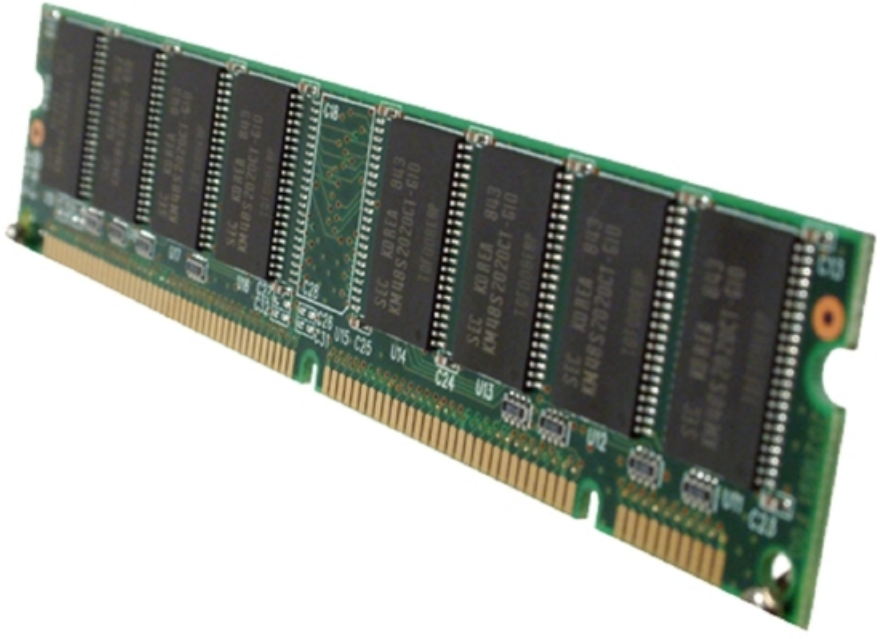

SECC Single Edge Contact Cartridge



PGA Pin Grid Array

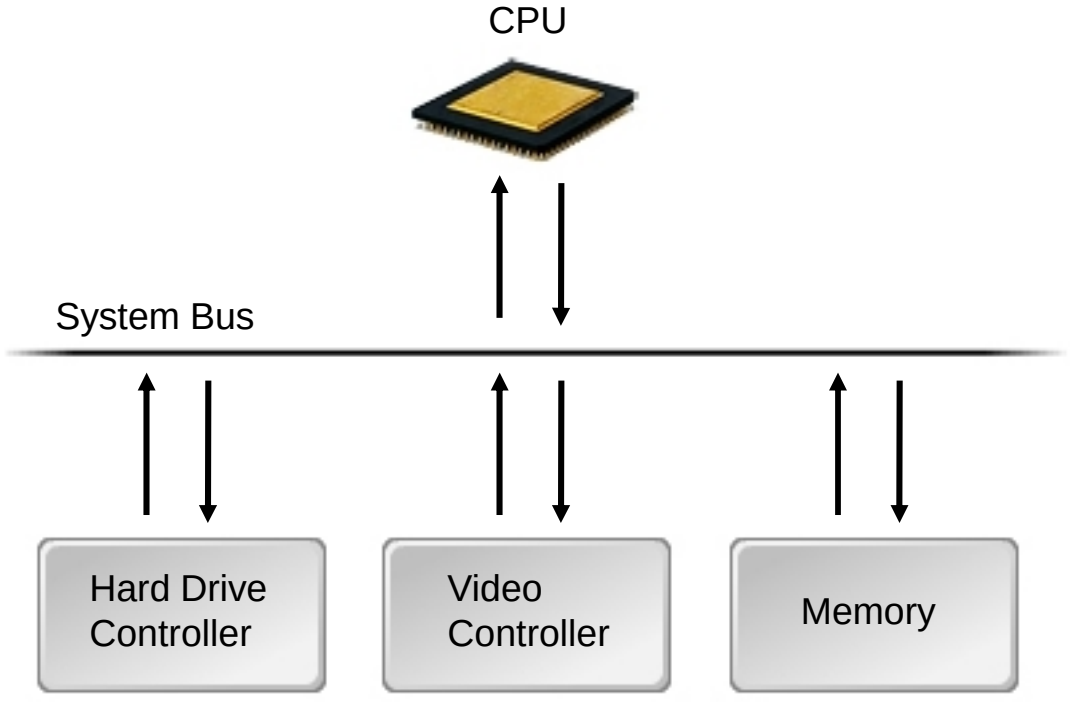
## Memory

- ***Memory*** is the personal computer component that comprises the electronic storage areas in the computer. It can be considered either volatile or non-volatile.



## The System Bus

- The ***system bus*** is the main communication path between the CPU and memory.

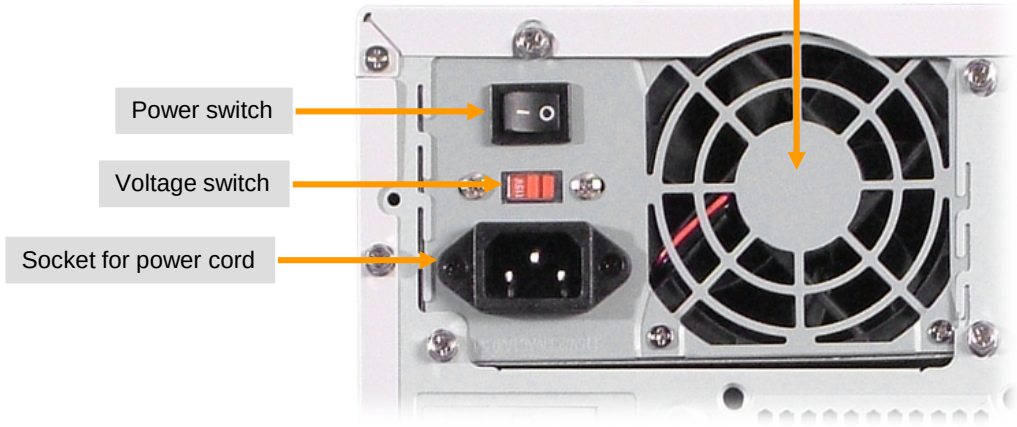


## Storage Devices

- A ***storage device*** is a system unit component, such as a hard drive, that enables users to save data for reuse at a later time, even after the personal computer is shut down and restarted.

# Power Supplies

- A ***power supply*** is an internal computer component that converts AC power from an electrical outlet to the DC power needed by system components.

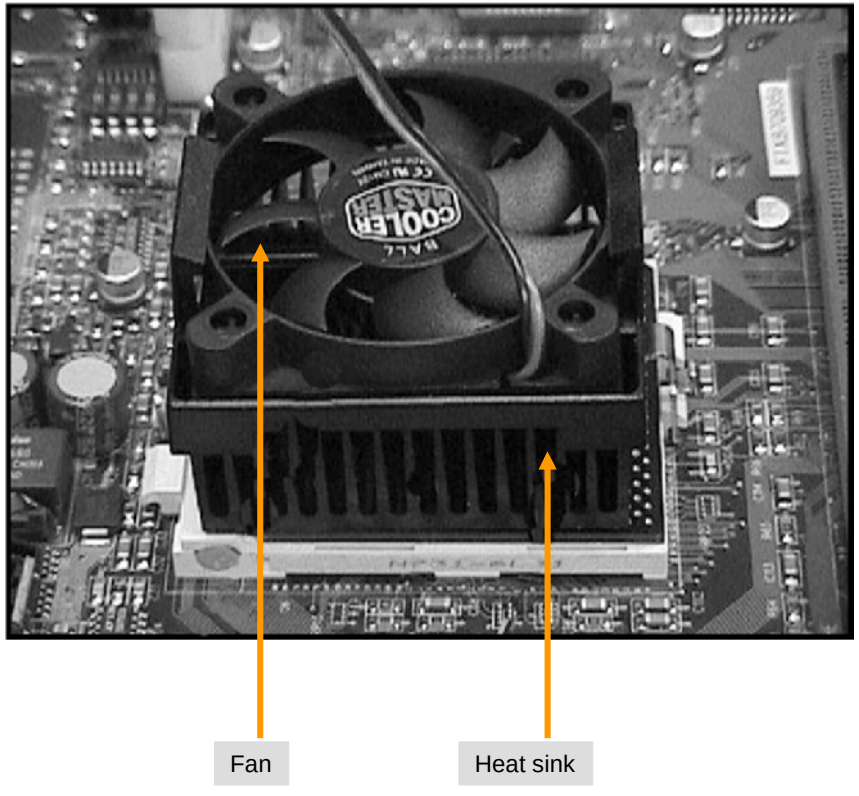



External view


Internal view

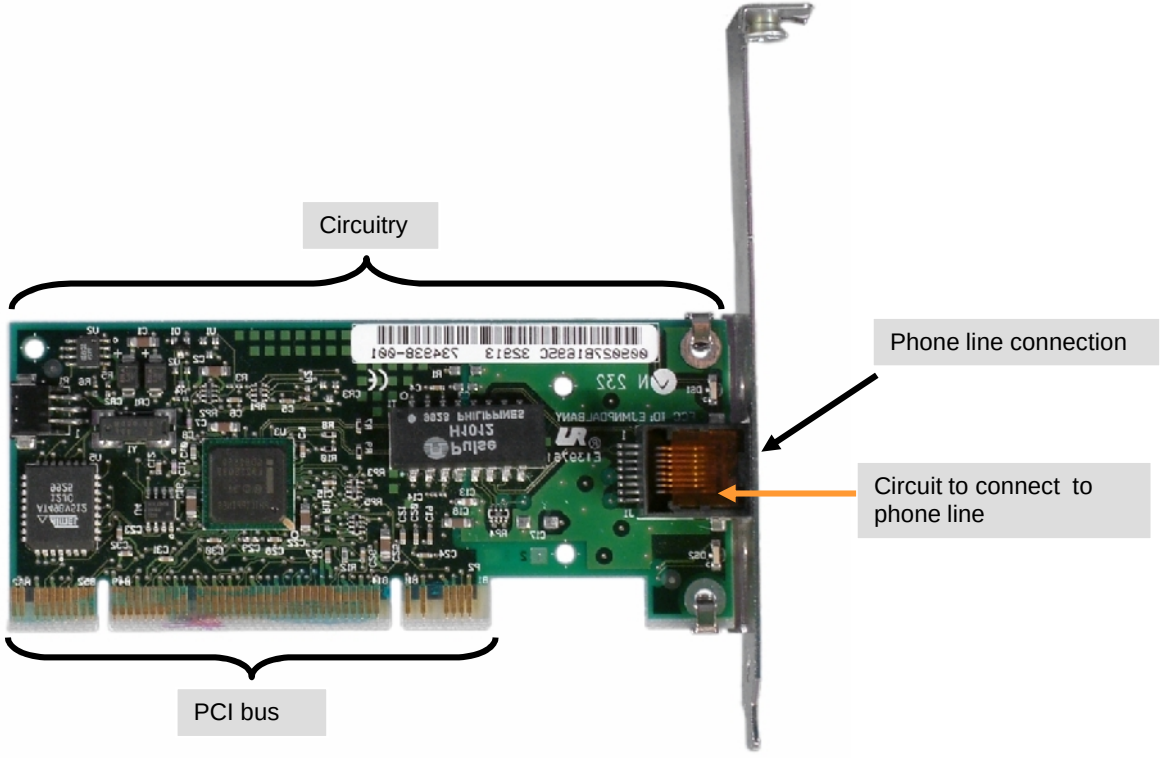
## Cooling Systems

- Computer systems contain several components that require cooling:
  - The computer case
  - The CPU
  - The power supply
  - Some adapter cards
  - Some hard disk drives



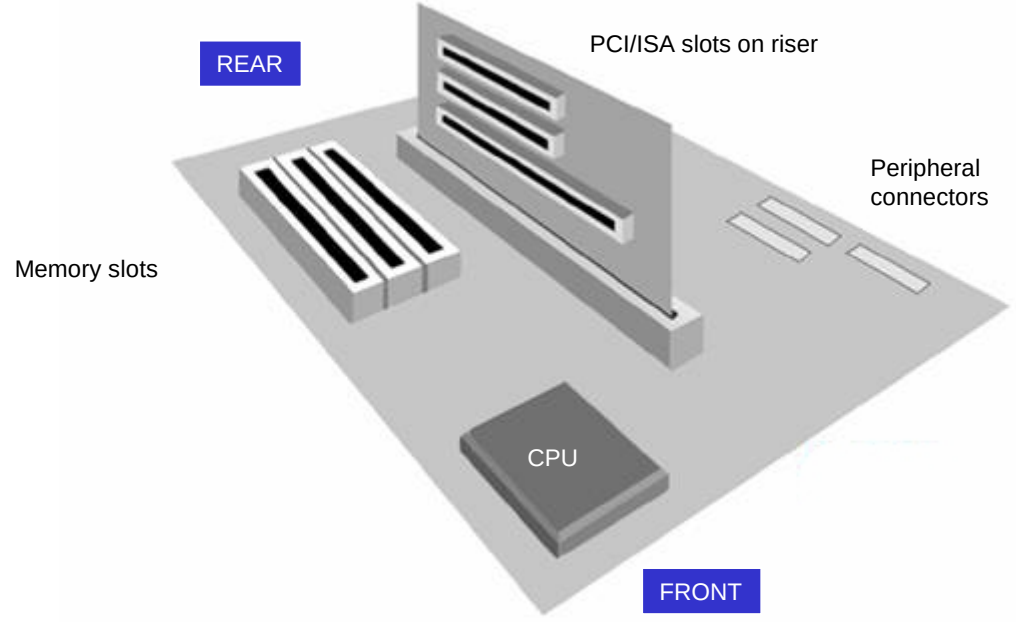
# Adapter Cards

- An ***adapter card*** is a printed circuit board that you install into a slot on the computer's system board to expand the functionality of the computer.



# Riser Cards

- A ***riser card*** is a board that plugs in to the system board and provides additional slots for adapter cards..



## System Board Form Factors

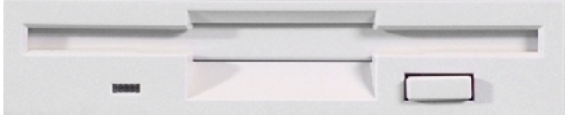
- The form factor describes the size and shape of the system board.
- Common System Boards are:
  - Full size AT
  - Baby AT
  - ATX (Advanced Technology Extended)
  - microATX
  - LPX (Low-Profile Extended)
  - NLX (New Low-Profile Extended)
  - BTX (Balanced Technology Extended)

## Storage Devices

- The various types of storage devices used in personal computers are:
  - Floppy Disk Drives (FDD)
  - Hard Disk Drives (HDD)
  - Optical Drives
  - Tape Drives
  - Solid State Storage devices

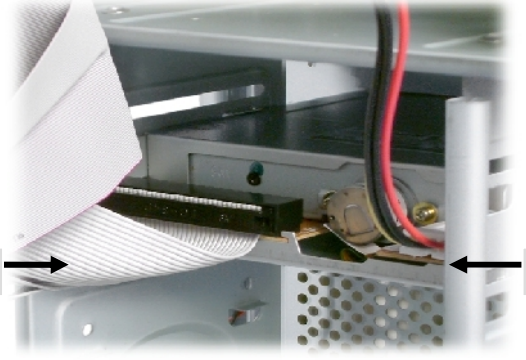
# Floppy Disk Drives (FDD)

- ***FDD*** is a personal computer storage device that reads data from, and writes data to, removable disks made of flexible Mylar plastic covered with a magnetic coating and enclosed in a stiff, protective, plastic case.



Front view 3.5-inch floppy disk drive

3.5-inch floppy disk




Rear view of floppy disk drive

## Hard Disk Drives (HDD)

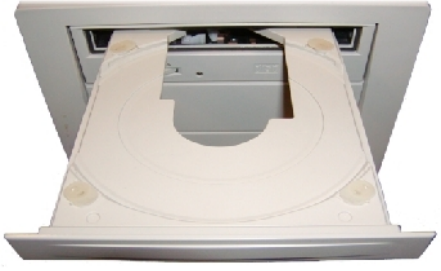
- ***HDD*** is a personal computer storage device that uses fixed media, which means that the disk is built into the drive and the drives are not removed from the computer unless you are performing an upgrade or a repair.

# Optical Disks

- An ***optical disk*** is a personal computer storage device that stores data optically, rather than magnetically.

An external DVD drive


A CD-R disc



An internal CD-ROM drive

## Types of Optical Disks and Drives

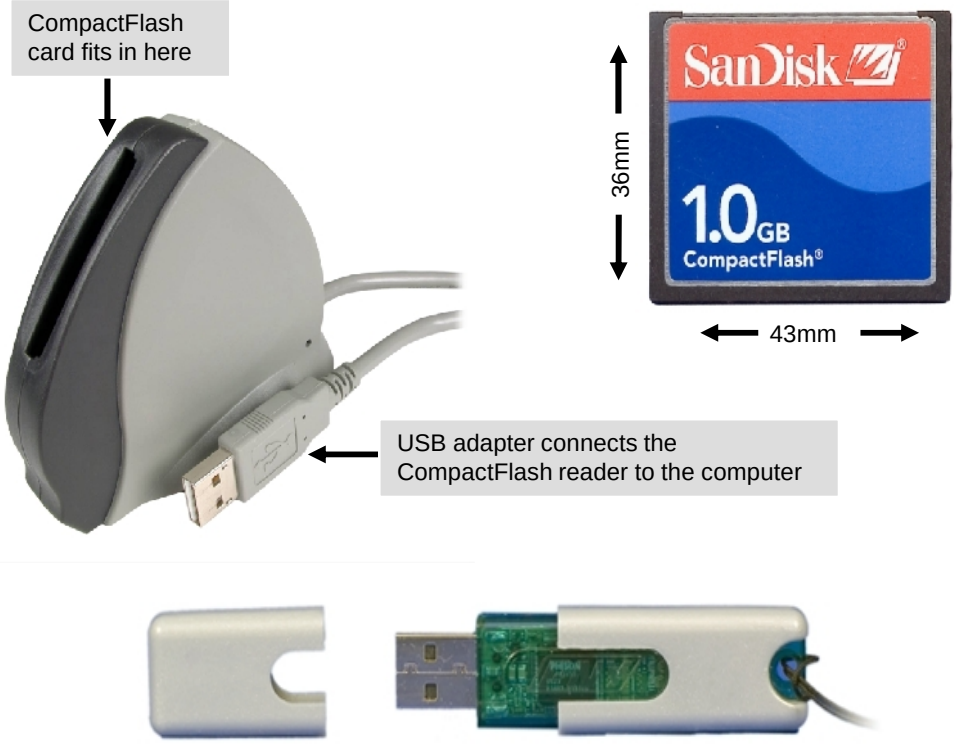
- Optical disks and drives come in several types, such as:
  - CD-ROM
  - CD-R
  - CD-RW
  - DVD-ROM
  - DVD-R
  - DVD+R
  - DVD+R DL
  - DVD-RW
  - DVD+RW
  - DVD-RAM

# Tape Drives

- A tape drive is a personal computer storage device that stores data magnetically on a removable tape that is enclosed in a tape cartridge.

## Solid State Storage

- ***Solid state storage*** is a personal computer storage device that stores data in special types of memory instead of on disks or tape.

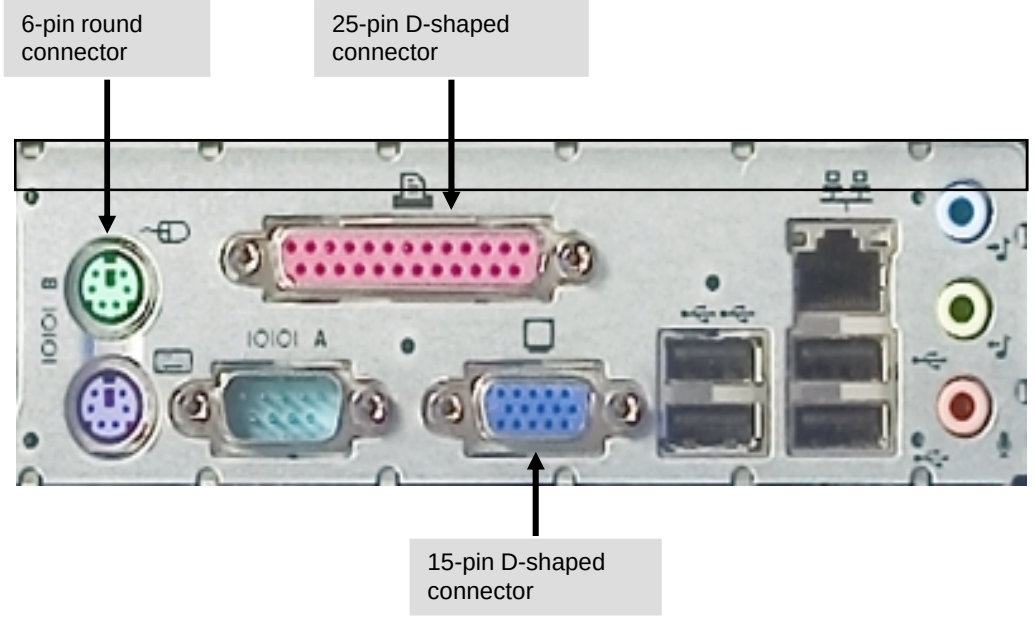


## Personal Computer Connection Methods

- The various PC connection methods are:
  - Ports
  - Personal Computer Connections
  - Serial Connections
  - Parallel Connections
  - Universal Serial Bus (USB) Connections
  - IEEE 1394 and FireWire Connections
  - Small Computer Systems Interface (SCSI) Connections
  - Parallel ATA (PATA) Connections
  - Serial ATA (SATA) Connections

## Ports

- A port is a hardware connection interface on a personal computer that enables devices to be connected to the computer.



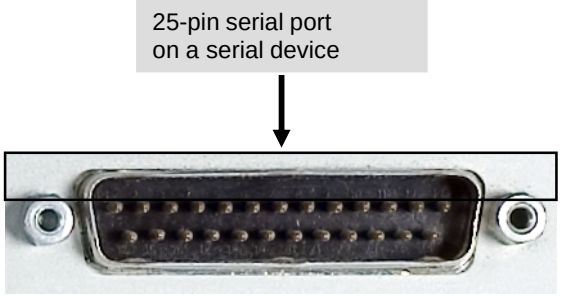

Enable devices to be connected to a personal computer.

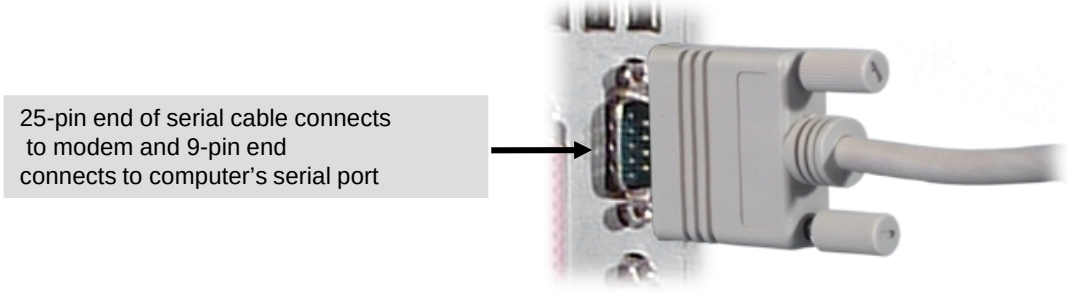
## Personal Computer Connection

- A ***personal computer connection*** is a means by which a personal computer component is attached to other components to provide computing capabilities.

# Serial Connections

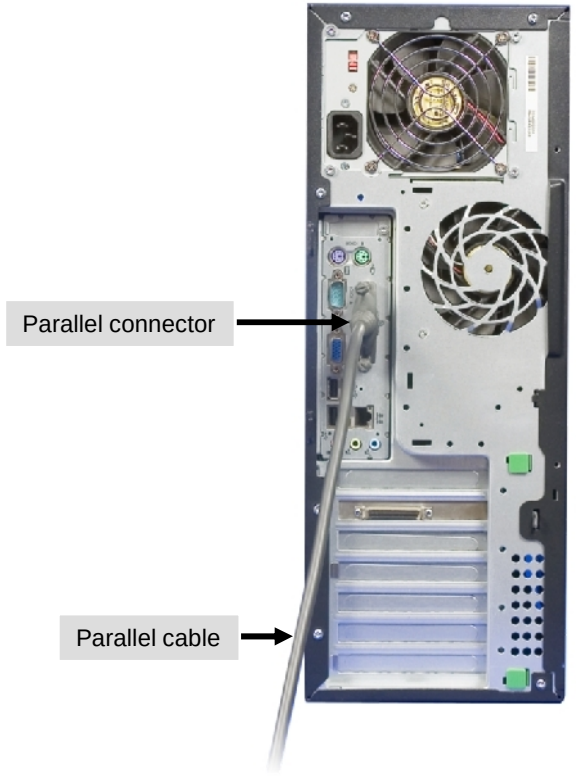
- A ***serial connection*** is a personal computer connection that transfers data one bit at a time over a single wire.



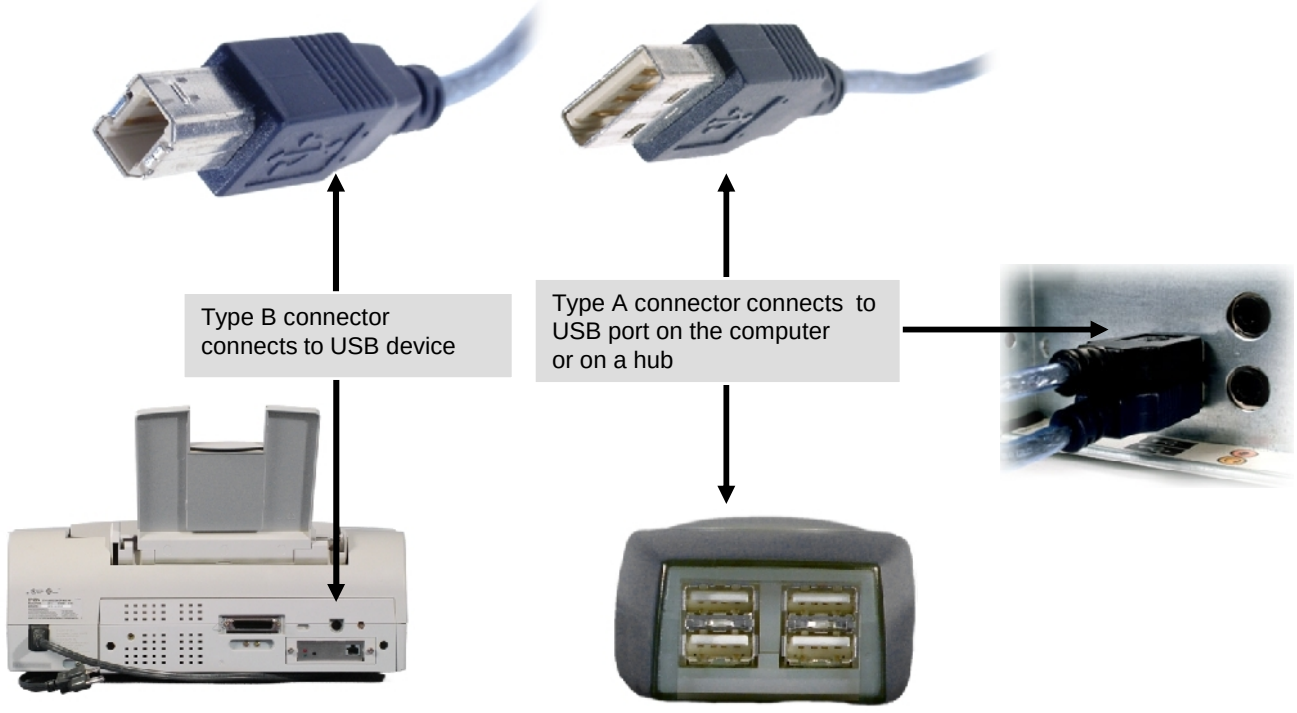
# Parallel Connections

- A ***parallel connection*** is a personal computer connection that transfers data eight bits at a time over eight wires and is typically used to connect a printer to a system unit.



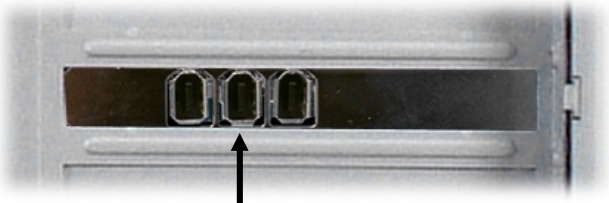
# USB Connections

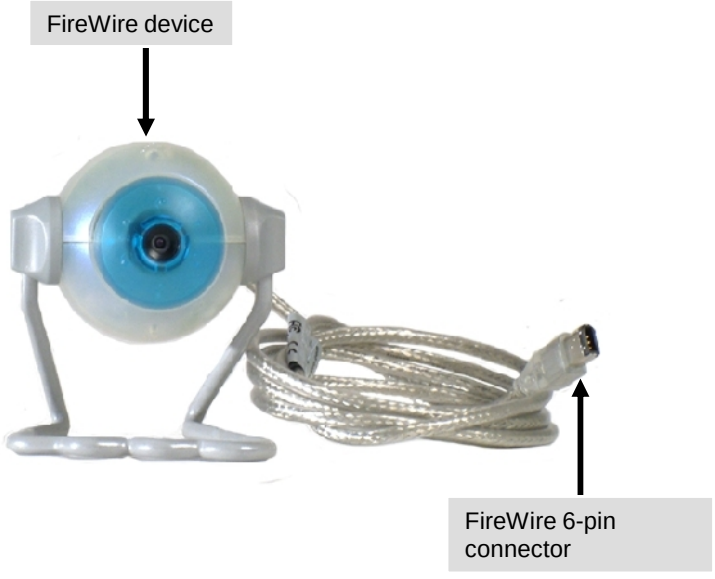
- A ***USB connection*** is a personal computer connection that enables you to connect multiple peripherals to a single port with high performance and minimal device configuration.



## IEEE 1394 and FireWire Connections

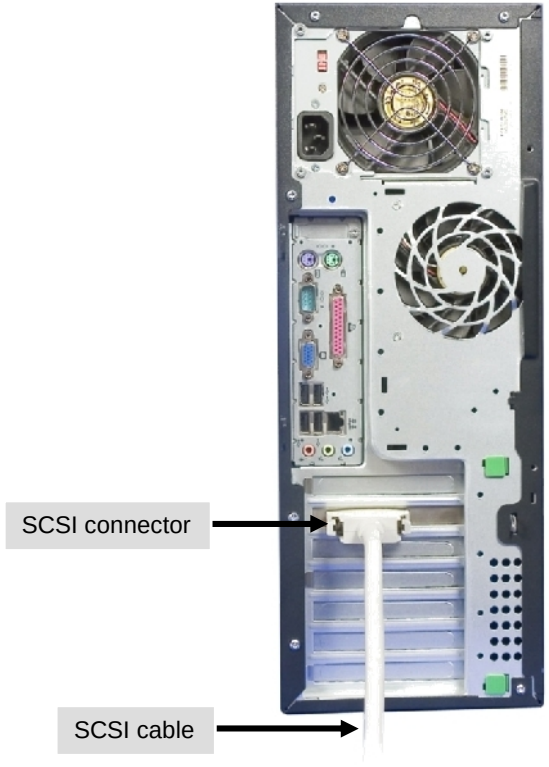
- A ***FireWire connection*** is a personal computer connection that provides a high-speed interface for peripheral devices that are designed to use the IEEE 1394 standard.



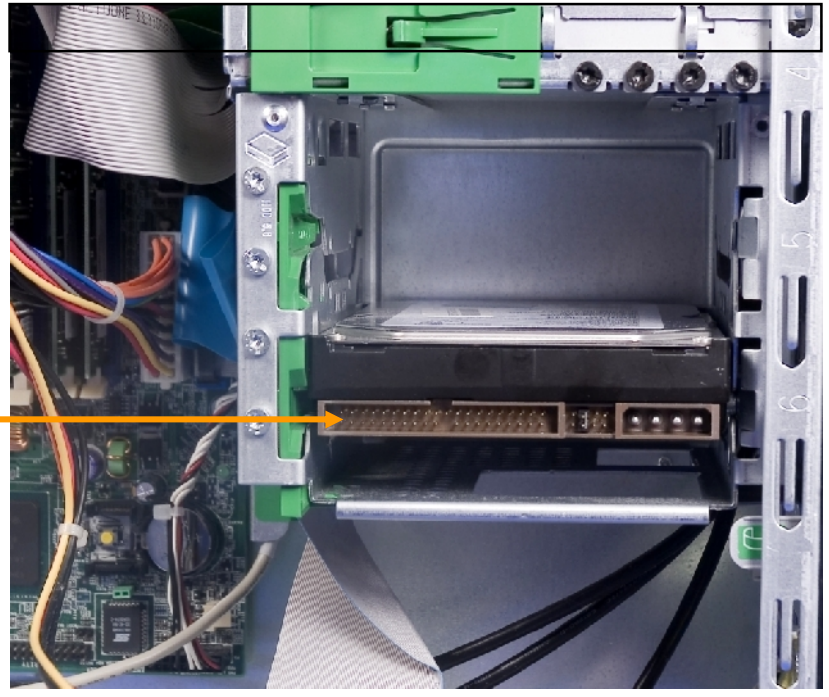
# Small Computer Systems Interface (SCSI) Connections

- A ***SCSI connection*** is a personal computer connection that connects internal and external components to the system unit and provides for high-speed data transfer.



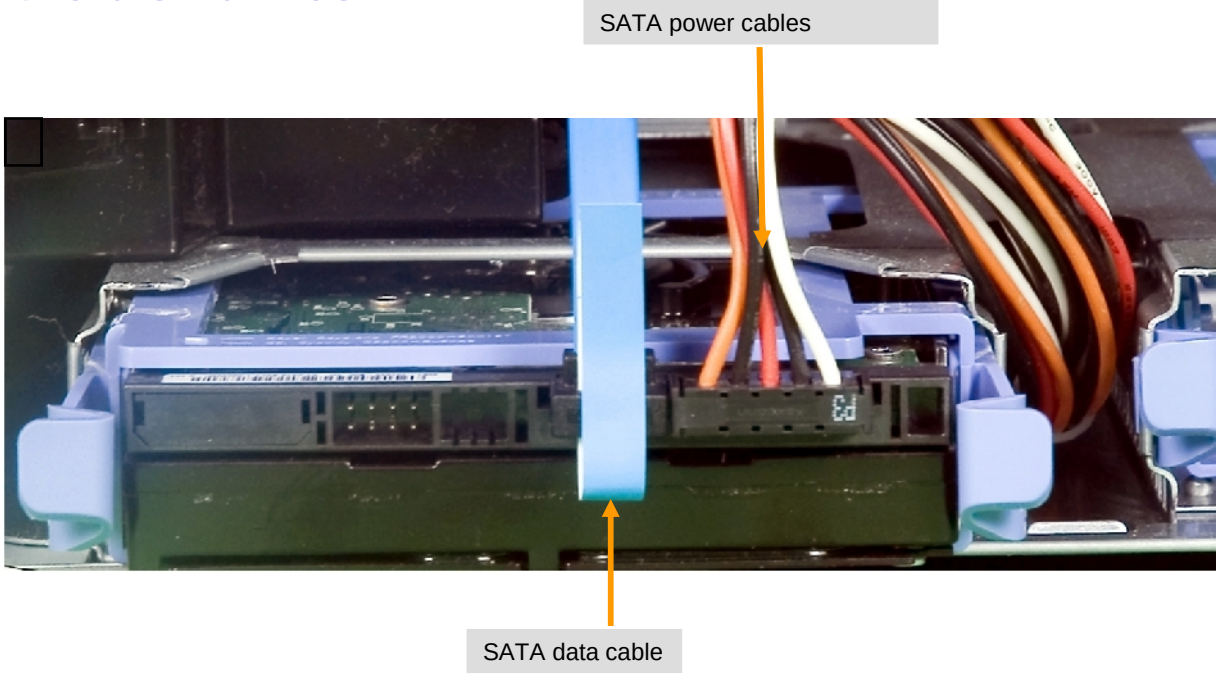
# Parallel ATA (PATA) Connections

- A ***PATA connection*** is a personal computer connection that provides a parallel data channel from a disk controller to the disk drives.



# Serial ATA (SATA) Connections

- A ***SATA connection*** is a personal computer connection that provides a serial data channel between the drive controller and the disk drives.



## Summary

- In this session, you learned that:
  - The four primary components of a typical personal computer are system unit, display device, input devices, and external devices.
  - The major components of the system unit are system board, CPU, memory, system bus, and storage devices.
  - The various types of storage devices used in personal computers are FDD, HDD, optical drives, tape drives, and solid state storage devices.
  - The various PC connection methods are ports, PC connections, serial connections, parallel connections, USB connections, IEEE 1394 and FireWire connections, SCSI connections, PATA connections, and SATA connections.

## Objectives

- In this session, you will learn to:
  - Identify common hardware and software tools used by professional personal computer technicians.
  - Identify the best practices for PC technicians to follow to promote electrical safety.
  - Identify the best practices for PC technicians to follow to promote environmental safety and proper handling of materials.
  - Identify and apply the general preventative maintenance best practices that PC technicians should employ.
  - Identify the general diagnostics and troubleshooting best practices that PC technicians should employ.
  - Identify best practices for PC technicians to use to communicate appropriately with clients and colleagues and conduct business in a professional manner.

## Tools of the Trade

- The common hardware and software tools used by professional personal computer technicians are:
  - Multimeters
  - Loopback plugs
  - Hardware toolkit
  - Software diagnostic tools

## Multimeters

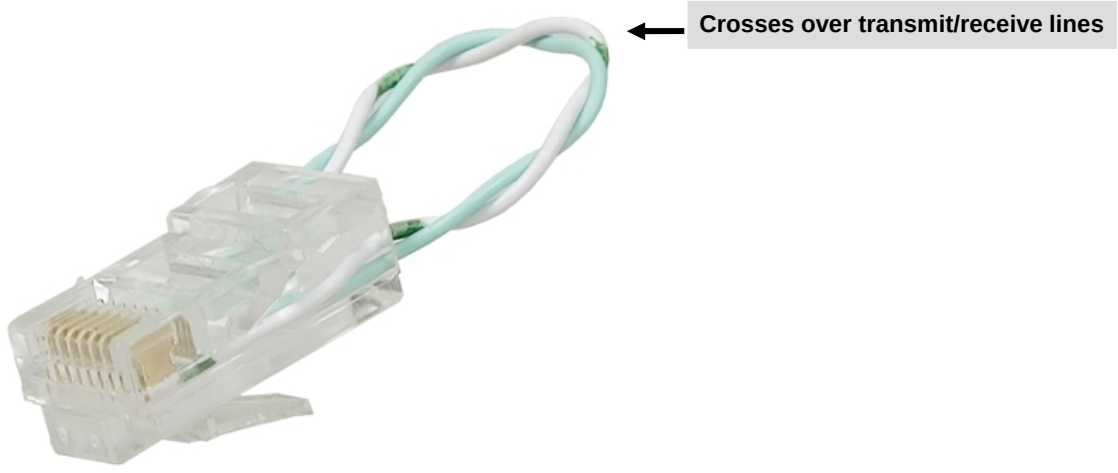
- A ***multimeter*** is an electronic instrument used to measure voltage, current, and resistance.


Digital multimeter

Analog multimeter

# Loopback Plugs

- A ***loopback plug*** is a special connector used for diagnosing transmission problems that redirects electrical signals back to the transmitting system.

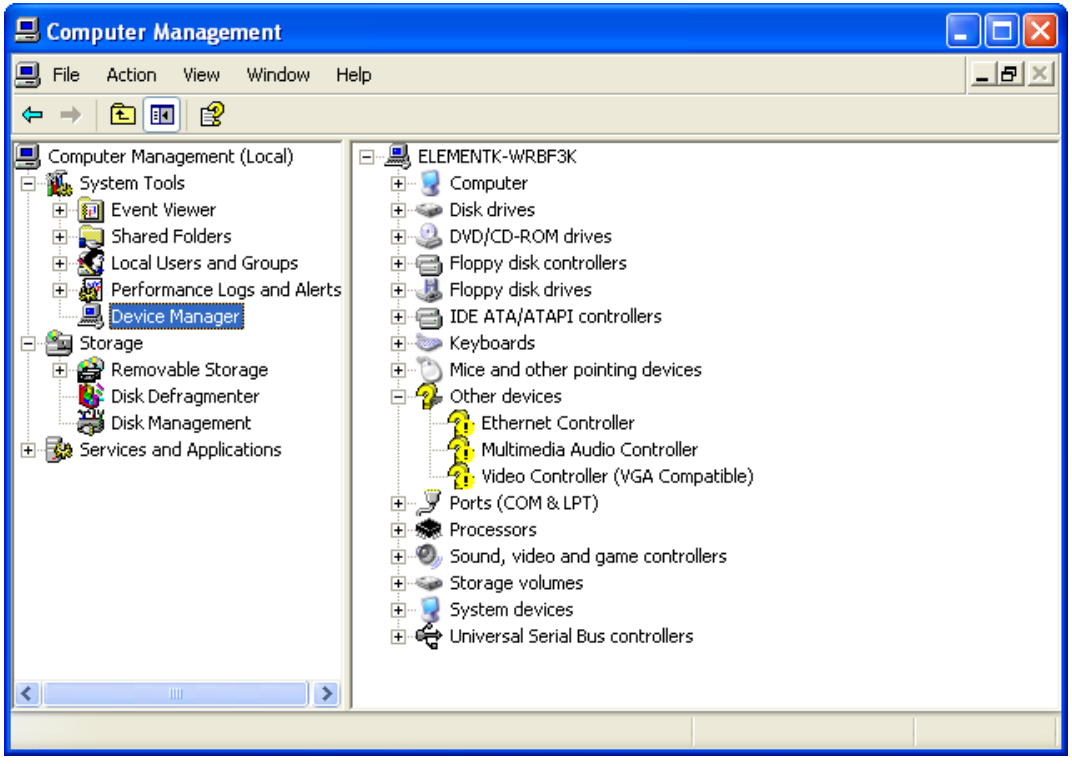


# Types of Hardware Toolkits

- The different types of hardware toolkits that are commonly used in PC maintenance and repair are:
  - Basic
  - Network
  - Circuit board

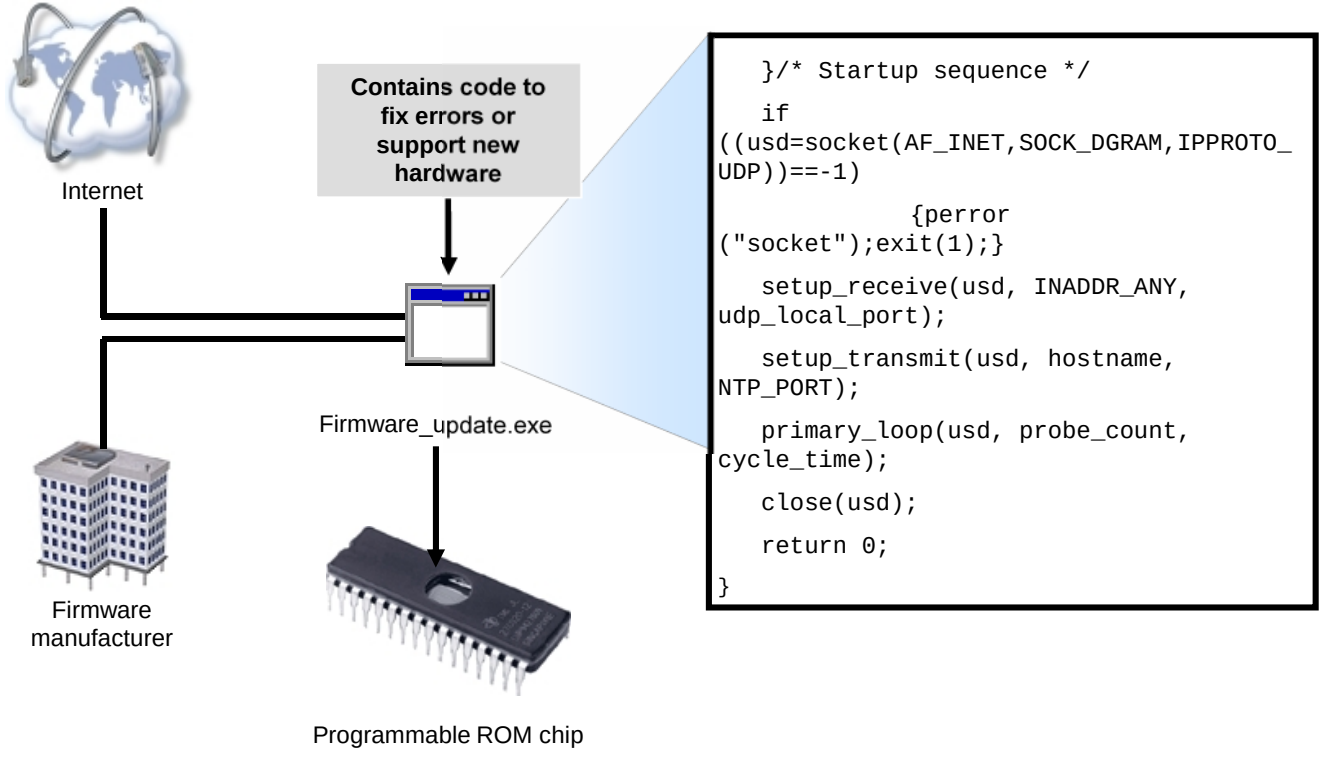
# Software Diagnostic Tools

- A ***software diagnostic tool*** or ***utility*** is a computer repair tool that contains software routines that test hardware and software components for problems.



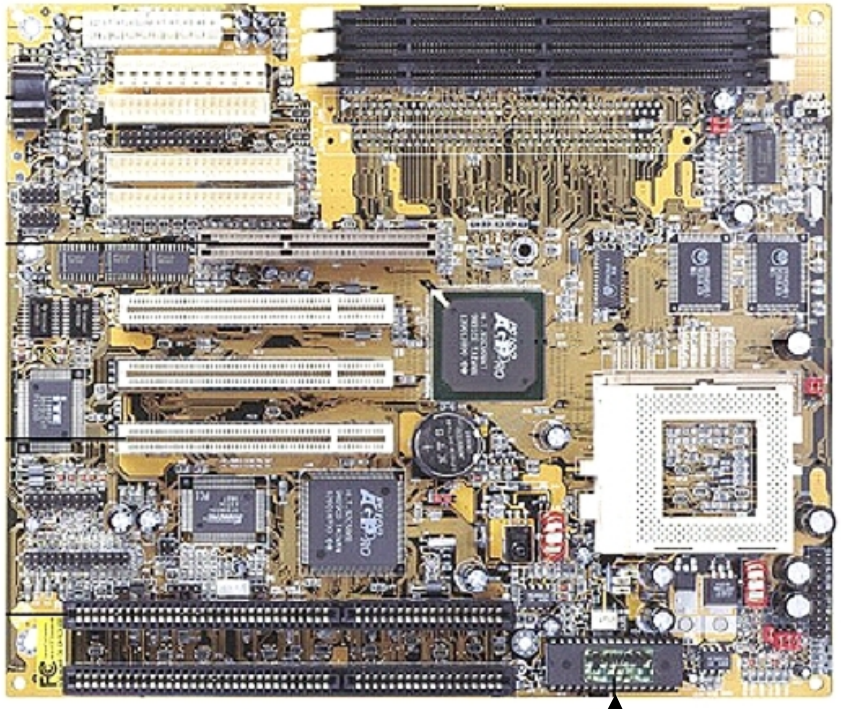
# Firmware

- ***Firmware*** is software stored in memory chips that retains data whether or not power to the computer is on.



## The System BIOS

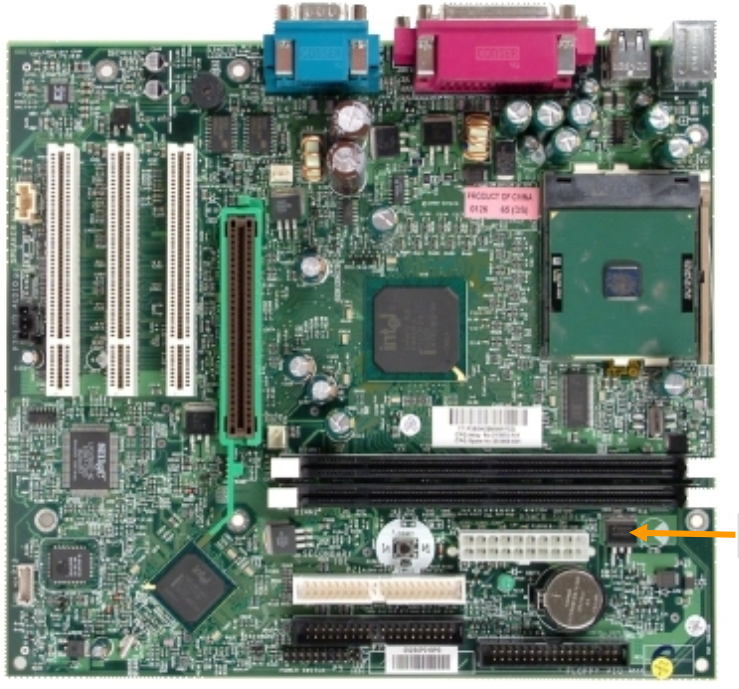
- A ***Basic Input/Output System*** (***BIOS***) is a set of instructions that is stored in Read Only Memory and that is used to start the most basic services of a computer system.



ROM BIOS chip

# CMOS RAM

- ***Complementary Metal Oxide Semiconductor RAM*** ***(CMOS RAM)*** is special memory that has its own battery to help it keep track of its data even when the power is turned off.



## The Power-On Self Test (POST)

- ***POST*** is a built-in diagnostic program that is run every time a personal computer starts up.
- The following hardware components are checked during POST:
  - Power supply
  - CPU
  - BIOS
  - CMOS RAM
  - Memory
  - I/O bus or I/O controller

## Hard Drive Self Tests

- HDD manufacturers provide a diagnostic tool that enables a hard disk drive to test itself when the computer starts.
- HDD self test can be:
  - Built into drive's firmware
  - Separate utility available for download from the drive manufacturer's website

## Software Diagnostic Tests

- Software diagnostics tests assist you in detecting, repairing, and preventing hardware and software problems.

## Electrical Safety

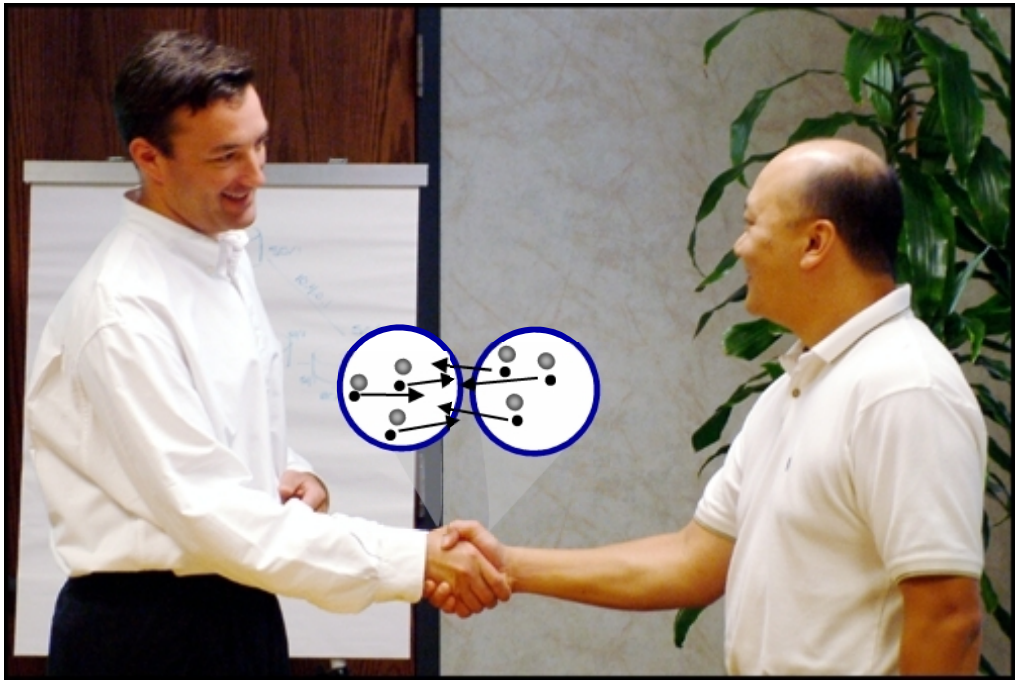
- The most common electrical states and electrical hazards which PC technicians face are:
  - Static Electricity
  - Electrostatic Discharge (ESD)
  - Electrical Hazards
    - Electrocution
    - Electric shock
    - Burns
    - Collateral injuries

## Static Electricity

- Static electricity is a build-up of a stationary electrical charge on an object.

## Electrostatic Discharge

- Electrostatic discharge (ESD) occurs when electrons rush from one body with a static electrical charge to another with an unequal charge.



## ESD Prevention Techniques

- You can protect against ESD in your work environment by:
  - Eliminating unnecessary activities that create static charges.
  - Removing unnecessary materials that are known charge generators.
  - Using anti-static vacuums for cleaning computer components.
  - Using anti-static materials.
  - Grounding conductive materials.
  - Using anti-static bags to store computer components.
  - Using an air ionizer, which releases negative ions into the air.
  - Humidifying the air to speed up static discharge from insulators.
  - Grounding yourself before touching electronic equipment.

# An ESD Toolkit

- An ESD-protection equipment includes:
  - Wrist or ankle strap
  - Grounded floor mat or grounded work-surface mat
  - Anti-static bags
  - ESD smock

# Electrical Hazards

- The following are some potential electrical hazards you should be aware of when servicing a PC:
  - Electrocution (fatal)
  - Electric shock
  - Burns
  - Collateral injuries

## Environmental Safety and Materials Handling

- Some potential environmental hazards you might face as a PC technician are:
  - Atmospheric Hazards
  - Situational Hazards
  - Physical Hazards
  - Chemical Hazards
  - Liquid Hazards

## Safety Precautions for Physical Hazards

- To minimize the physical hazards associated with computing environments, you should understand the following recommendations:
  - Use cord protectors to prevent tripping
  - Laser
    - Never point a laser beam in someone's eyes.
    - Never look directly at a laser beam.
    - Never disable safety mechanisms when servicing a device with an embedded lasers.

## Safety Precautions for Physical Hazards (Contd..)

- Eyestrain
  - Special glasses
  - Artificial tears
- Noise
  - Keep printers separate
  - Noise reduction hoods

## Chemical Hazards

- To minimize the chemical hazards associated with computing environments, you should understand the following recommendations:
  - If you spill laser printer toner avoid cleaning it up with regular vacuum cleaner. Do not use warm water to wash toner off from hands.
  - Thoroughly wash your hands after handling capacitors.
  - Handle batteries carefully as they contains dangerous chemicals.

## Liquid Hazards

- Hazardous liquids are used sometimes to clean or condition computing equipments. Always read the labels carefully and follow instructions of using hazardous liquids.

## The Materials Safety Data Sheet (MSDS)

- ***MSDS*** give users and emergency personnel information about the proper procedures of storage and handling of a hazardous substance.
- MSDS includes the information about the following items:
  - The name of the material
  - The physical properties of the material
  - Any hazardous ingredients contained in the material
  - Reactivity data, such as fire and explosion data
  - Procedures for spills or leaks
  - Special precautions
  - Health hazards
  - Special protection requirements

## Incident Reports

- An ***incident report*** is a record of any instance where a person is injured or computer equipment is damaged due to environmental issues.

## Hazardous Material Disposal Procedures

- Proper disposal of hazardous materials is an essential part of maintaining a safe work environment.
  - Display devices, Liquid cleaners and empty containers
    - Follow your company's guidelines for disposing of CRT tubes and liquid cleaning materials & containers.
  - Toner
    - Empty toner cartridges should not be tossed into the trash because of the damage the residual chemicals can do to the environment.
  - Ozone filter
    - Follow the manufacturer's recommendations for replacement and disposal of a laser printer's ozone filter.
  - Batteries
    - Used batteries should not be tossed into the trash, but should be disposed of following your company's guidelines.

## Perform Preventative Maintenance

- Some general considerations for preventive maintenance that apply to virtually all components are:
  - Visual/audio inspection
  - Driver/firmware updates
  - Scheduling preventative maintenance
  - Using appropriate repair tools and cleaning materials
  - Ensuring proper environment

## Computer Component Maintenance Techniques

- The following are some preventative maintenance techniques you can use to maintain personal computer components:
  - Use a power strip, surge protector, or Uninterruptible Power Supply (UPS)
  - Clean peripheral components
  - Clean internal system components

## Cleaning Compounds and Materials

- The following are the cleaning materials for computers:
  - Monitor and keyboard wipes
  - Lint-free cloths
  - Rubbing alcohol
  - Household cleaners
  - Cotton swabs
  - Window cleaners
  - Toothpicks
  - Artist's paint brush
  - Compressed air
  - Computer vacuum
  - Toner cloth
  - Latex gloves

## Activity 3-4

**Activity on Performing Preventative Maintenance**

## Activity 3-5

**Activity on Using a UPS**

## Troubleshooting Theory

- The following are the general factors that will apply in any troubleshooting situation:
  - Backups
  - Assessment
  - Simple solutions
  - Research
  - Documentation

## The Troubleshooting Process

- The troubleshooting process moves through the following logical stages:
  - Identify the problem.
  - Analyze the problem, including potential causes (hardware, software, or both).
  - Test related components to solve the problem or identify a likely solution.
  - Implement the identified solution.
  - Evaluate results.
  - Document activities and outcomes.
  - Verify user satisfaction.

## Communication Skills

- Using the proper communication skills when dealing with clients and colleagues provides professional environment that is conducive to solving the problem at hand.
  - Verbal communication includes:
    - Use test and discretion in communication
    - Use clear, concise, and direct statements
    - Avoid using jargons
    - Use timing to set the pace of conversation
  - Non-verbal communication includes:
    - Use proper body language
    - Use the proper level of eye contact
    - Use facial expressions to reinforce the spoken message
    - Be aware of physical positioning and gesture
    - Be aware of the effect of tone and voice

## Communication Skills (Contd.)

- Listening skill includes:
  - Listen to the user
  - Allow the user to complete statments
  - Employ passive listening techniques
  - Employ active listening techniques

## Professional Conduct

- Acting in a professional manner when dealing with colleagues and clients provides a work environment where problems can be solved efficiently. The following
  - Appearance
  - Respect
  - Accountability
  - Confidentiality
  - Ethics
  - Honesty
  - Prioritizing
  - Verbal communication

## Summary

- In this lesson, you learned that:
  - The common hardware and software tools used by professional personal computer technicians are:
    - Multimeters
    - A loopback plug
    - Hardware toolkit
    - Software diagnostic tools
  - The most common electrical states and electrical hazards which PC technicians face are:
    - Static Electricity
    - Electrostatic Discharge (ESD)
    - Electrical Hazards
      - Electrocution
      - Electric shock
      - Burns
      - Collateral injuries

## Summary (Contd.)

- Some potential environmental hazards you might face as a PC technician are:
  - Atmospheric Hazards
  - Situational Hazards
  - Physical Hazards
  - Chemical and Liquid Hazards
- Using the proper communication skills when dealing with clients and colleagues.
- Acting in a professional manner when dealing with colleagues and clients.

## Objectives

- In this session, you will learn to:
  - Install and configure display devices.
  - Install and configure input devices.
  - Install and configure adapter cards.
  - Install multimedia devices.

# Install and Configure Display Devices

- In order to install and configure display devices, you would need to:
  - Identify various types of display devices
  - Identify various display settings
  - Identify LCD characteristics
  - Identify different types of connectors
  - Configure the device driver

# Display Devices Types

- The following are some common display devices:
  - CRT monitor
  - LCD monitor
  - Projection system

## Display Settings

- The following are some display characteristics for each video output device, which you can configure either through a dialog box in Windows, or through controls on the physical monitor.
  - Resolution
  - Refresh rate (The refresh rate is how often per second the image is rebuilt)
  - Color depth/color quality
  - Brightness (Intensity of the image)
  - Contrast (Ratio of light to dark)
  - Image position (Vertical and horizontal location of image on the screen )
  - Reset (Returns the monitor settings to factory settings)

## LCD Characteristics

- The following are some unique characteristics of LCD devices:
  - Screen type (Active or Passive Matrix)
  - Resolution
  - Contrast ratio
  - Backlighting
  - Pixelation

# Connector Types

- The following are some of the connector types used by display devices:

VGA

DVI

HDMi

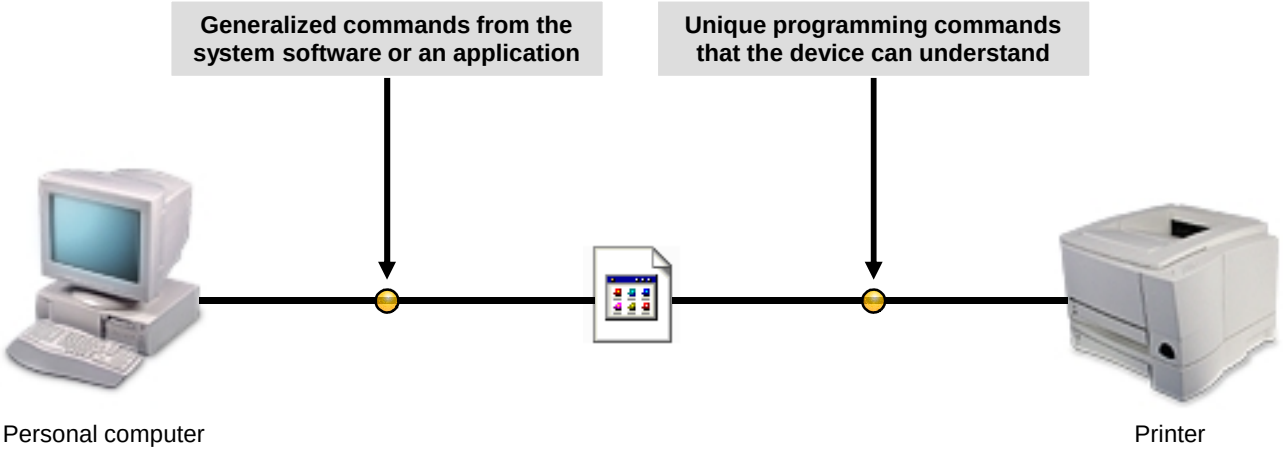
Component/RGB

S-Video

Composite video

## Device Drivers

- A ***device driver*** is a type of software that enables the operating system and a peripheral device to communicate with each other.



## Display Device Selection Tips

- CRT monitors offer more features and potentially better resolution.
- CRT monitors are also less expensive than flat-panel monitors.
- Many users simply prefer flat-panel monitors because they take up less space.

# Display Device Installation Considerations

- When you're ready to install a display device, keep the following considerations in mind:
  - Drivers
  - Digital Video Interfaces
  - Video Adapters

## Activity 4-1

**Activity on Installing Display Devices**

## Activity 4-2

**Activity on Configuring Display Devices**

# Standard Input Device Types

- The following are some common input devices which fall under mice and keyboards:

Ergonomic keyboard

Standard keyboard

Dvorak keyboard

Mouse

Trackball

Touch pad

## Biometric Input Devices

- ***Biometrics*** is an automated method of recognizing a person based on a physiological or behavioral characteristic.

## Specialized Input Devices

- The following are some specialized input devices that you might encounter in your workplace:
  - Bar code readers
  - Touch screens

# Input Device Selection Tips

- For keyboards, consider ergonomics and additional features such as wireless connectivity.
- For pointing devices, consider optical mice, wireless mice, and user preference.

## Input Device Installation Considerations

- You should consider following factors before attempting to install input devices:
  - Drivers
  - Ports
  - Manufacturer's instructions

## Activity 4-3

# Activity on Installing Input Devices

## Activity 4-4

# Activity on Configuring Input Devices

# Internal Bus Architectures

- System boards include several buses, or data paths, to transfer data to and from different computer components, including all adapter cards. The various internal bus architectures are:
  - 8-bit (legacy)
  - ISA (Industry Standard Architecture)
  - PCI (Peripheral Components Interconnect)
  - AGP (Accelerated Graphics Port)
  - PCI-E (Peripheral Components Interconnect-Express)
  - AMR (Audio Modem Riser)
  - CNR (Communication and Networking Riser)

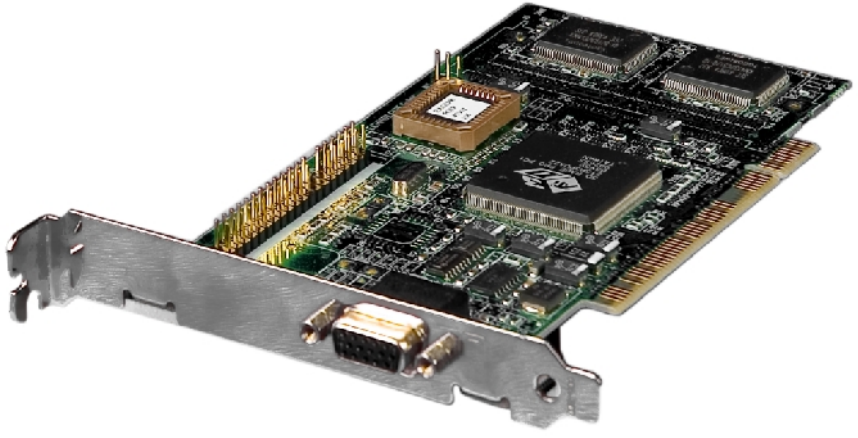
# Adapter Card Types

- The following figure lists the various adapter card types:

| Adapter Card Type | Description |
|---|---|
| Video adapters | A video adapter provides the interface necessary to connect a monitor for visual output. Generally, these adapters connect to the system board through PCI, AGP, or PCI-E slots. |
| Multimedia adapters | Multimedia adapters provide the interfaces necessary to connect microphones, speakers, electronic musical devices, and some gaming devices for audio input and output. |
| Input/output adapters | Input/output adapters provide the interfaces necessary to connect SCSI, serial, USB, and parallel devices for data input and output. |
| Network adapters | Network adapters provide the interface necessary for network communications. |
| Modem adapters | Modem adapters provide the interface necessary for remote communications over phone or data lines. |

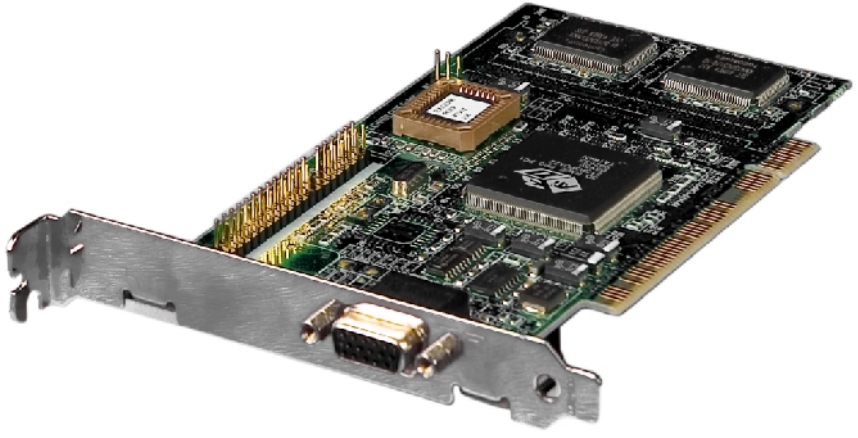
## Adapter Card Selection Tips

- Verify that its bus type is compatible with the computer.
- Make sure that the adapter card's drivers are compatible with the computer's operating system.
- Use PnP to automatically configure the card's hardware resources, but make sure that the computer's BIOS and operating system supports PnP.



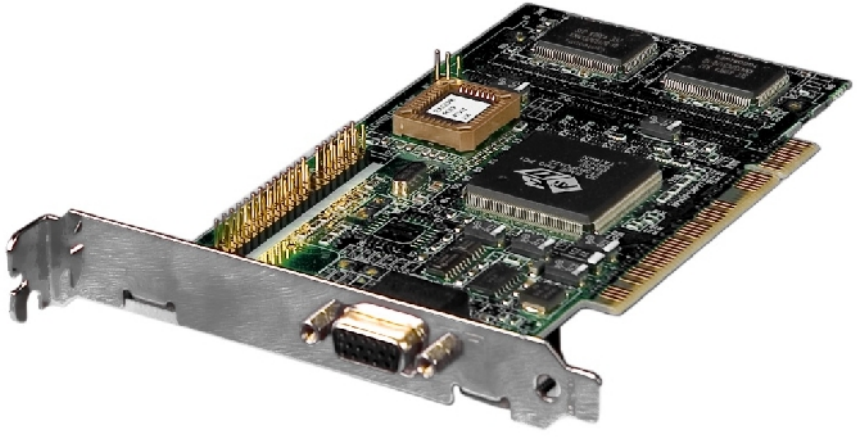
# Adapter Card Installation Considerations

- You should consider the following before installing adapter cards.
  - Available slot
  - Latest drivers
  - Unplug the computer and discharge electricity



## Adapter Card Configuration and Optimization Requirements

- Some of the requirements while configuring adapter card are:
  - Plug and Play support in the system should automatically detect the adapter card
  - If, not get the driver for the adapter card from the manufacturer
  - Use Add Hardware Wizard to manually select the adapter card from the device list



## Hardware Resources

- The following are the various categories of hardware resources:
  - Interrupt Request (IRQ) lines
  - I/O address
  - Direct Memory Access (DMA)
  - Base memory address

## Activity 4-5

# Activity on Identifying System Parameters

## Activity 4-6

# Activity on Installing Adapter Cards

## Multimedia Devices

- A ***multimedia device*** is a computer peripheral or internal component that transfers sound or images to or from a personal computer.

MIDI instruments can be connected to each other with MIDI connectors

Speakers and headphones connect to the line out port

MIDI cables or to the computer through a device that connects to a computer port

MIDI connections

Joystick port connections

A microphone connects to the MIC port

# Multimedia Devices (Contd.)

Game controller connects to the game port


1/8” jack connects to the line in port

Cable with 1/8” jacks

## Common Multimedia Devices

- Some of the common multimedia devices are:
  - Digital cameras
  - Webcams
  - Video-conferencing systems
  - MIDI devices
  - Microphones
  - Speakers

## Multimedia Device Selection Tips

- Digital Camera: What type of output does the user need from the camera?
- Sound Cards: Responsible for translating digital music into analog signals.
- Microphones: Use microphones to complete tasks such as making phone calls via the internet and to dictate to the computer using voice recognition software.
- Speakers: If users plan to listen to music or play games on a computer, it's important to help them select higher-quality speakers.

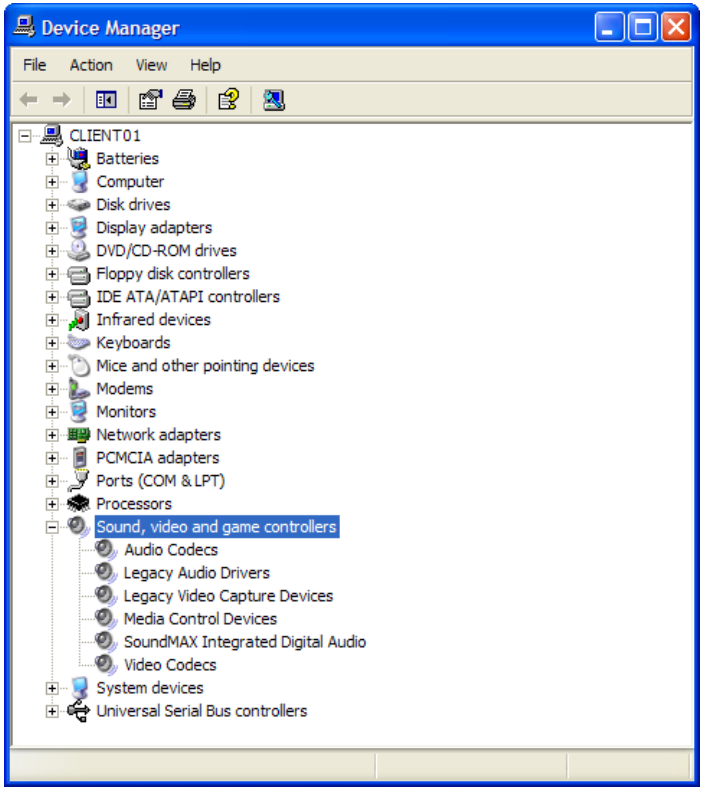
## Multimedia Device Installation Considerations

- Some of the considerations that need to be taken while installing multimedia devices are:
  - Is there a slot available on the motherboard for installing a sound card?
  - Are the appropriate device drivers available for the computers operating system?
  - Are the necessary cables to connect multimedia devices available?
  - Do you have a memory card reader available?



## Multimedia Device Configuration and Optimization Requirements

- The following can be configured using the Device Manager for multimedia devices:
  - Enabling and disabling audio features
  - Updating drivers
  - Specifying hardware resources



## Activity 4-7

**Activity on Installing Multimedia Devices**

## Summary

- In this session, you learned that:
  - The prerequisites for installing and configuring the display devices are:
    - Identification of various types of display devices
    - Identification of various display settings
    - Identification of  LCD characteristics
    - Identification of different types of connectors
    - Configuring the device driver
  - The prerequisites for installing different input devices are:
    - Drivers
    - Ports
    - Manufacturer's instructions
  - The adapter cards are used to extend the capabilities of a computer.
  - Video adapter, multimedia adapter, Input/output adapter, network adapter and modem adapter as some of the types of adapter cards.

## Summary (Contd.)

- A multimedia device is a computer peripheral or internal component that transfers sound or images to or from a personal computer.
- Some of the common multimedia devices are:
  - Digital cameras
  - Webcams
  - Video-conferencing systems
  - MIDI devices
  - Microphones
  - Speakers

# Infomation Technology Essentials

## COMP106


*Instructor :*

*Asaad Alhijaj*


## Chapter 5

## Installing and Configuring System Components

# Objectives

- In this session, you will learn to:
  - Select, install, and configure storage devices.
  - Install and configure power supplies.
  - Install and configure memory.
  - Install and configure CPUs.
  - Install and configure system boards.

# Install and Configure Storage Devices

- Before installing and configuring storage devices, you need to understand the following:
  - Drive types
    - HDD, FDD, Tape, Optical, Solid State
  - Power connectors
  - Hot swapping
  - Drive images and Disk partitions
  - Windows Disk Management
  - Internal device installation considerations
  - Configuration and optimization requirements

# Hard Disk Drive Types

- The various types of hard disk drives are:
  - Parallel ATA (also known as IDE, EIDE, and ATA)
  - SCSI
  - Serial ATA

Parallel ATA hard drive

# Floppy Disk Drives

- A floppy disk drive is a read/write drive that uses removable disks:

Front view 3.5-inch floppy disk drive

3.5-inch floppy disk


Rear view of floppy disk drive

# Tape Drive Formats

- Tape drives come in several formats.
  - Quarter-inch cartridge (QIC)
  - 4 mm Digital Audio Tape
  - 8 mm tape (Exabyte)
  - Digital linear tape (DLT)
  - Linear Tape Open (LTO)


DAT tape

# Optical Drive Types

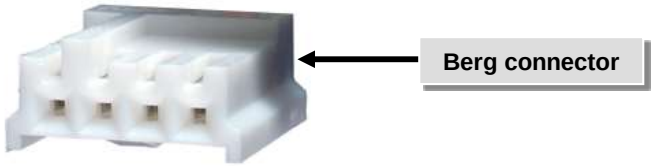
- Optical drives include CD and DVD drives.
  - CD
    - Hold 650 MB to 1 GB
    - Minimum 150 KB/sec data transfer rate, multipliers up to 64X
    - CDFS or UDF file system
  - DVD
    - Hold 4.7 GB on one side, up to 9.4 GB if both surfaces are used
    - 600 KB/sec to 1.3 MB/sec data transfer rate
    - UDF file system


# Solid State Storage Types

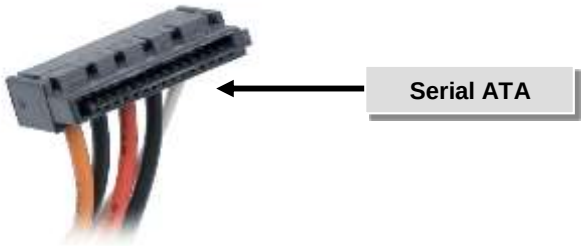
- Solid state storage comes in several formats.
  - USB flash drives
  - Flash drives
  - CompactFlash cards
  - SmartMedia cards
  - xD-Picture Cards
  - Memory Sticks
  - Secure Digital (SD) cards
  - MultiMediaCards (MMC)

# Storage Device Power Connectors

- Every internal storage devices uses one of several types of power connectors to get electrical power from the computer's power supply.
  - Berg connector
  - Molex connector
  - SATA Power Connector

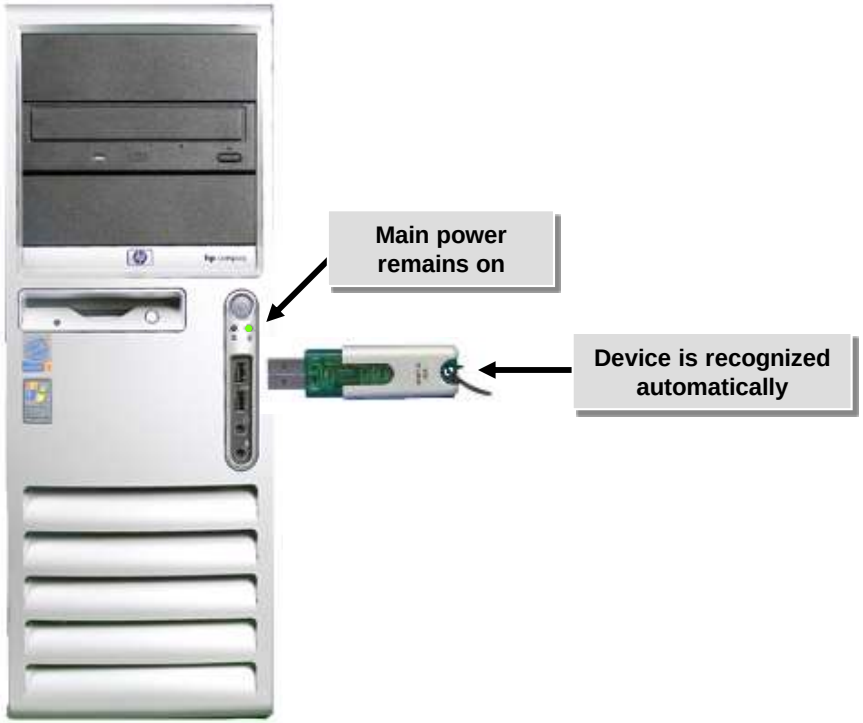






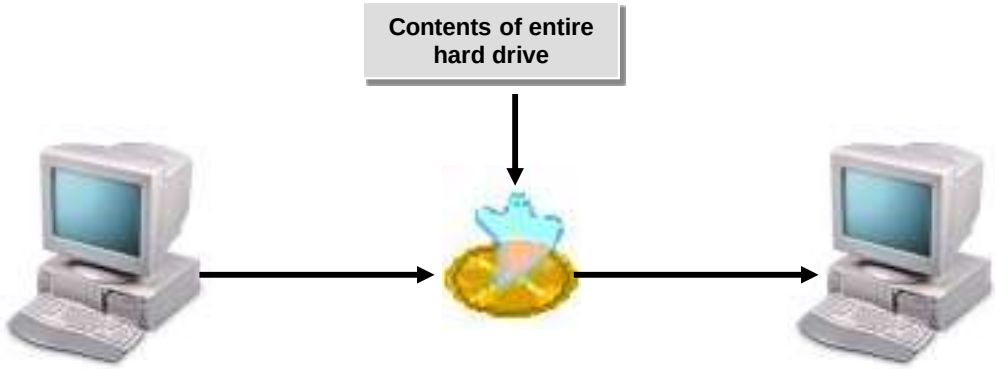
# Hot Swapping

- ***Hot swapping*** is a type of hardware replacement procedure where a component can be replaced while the main power is still on.



# Drive Images and Disk Partitions Types

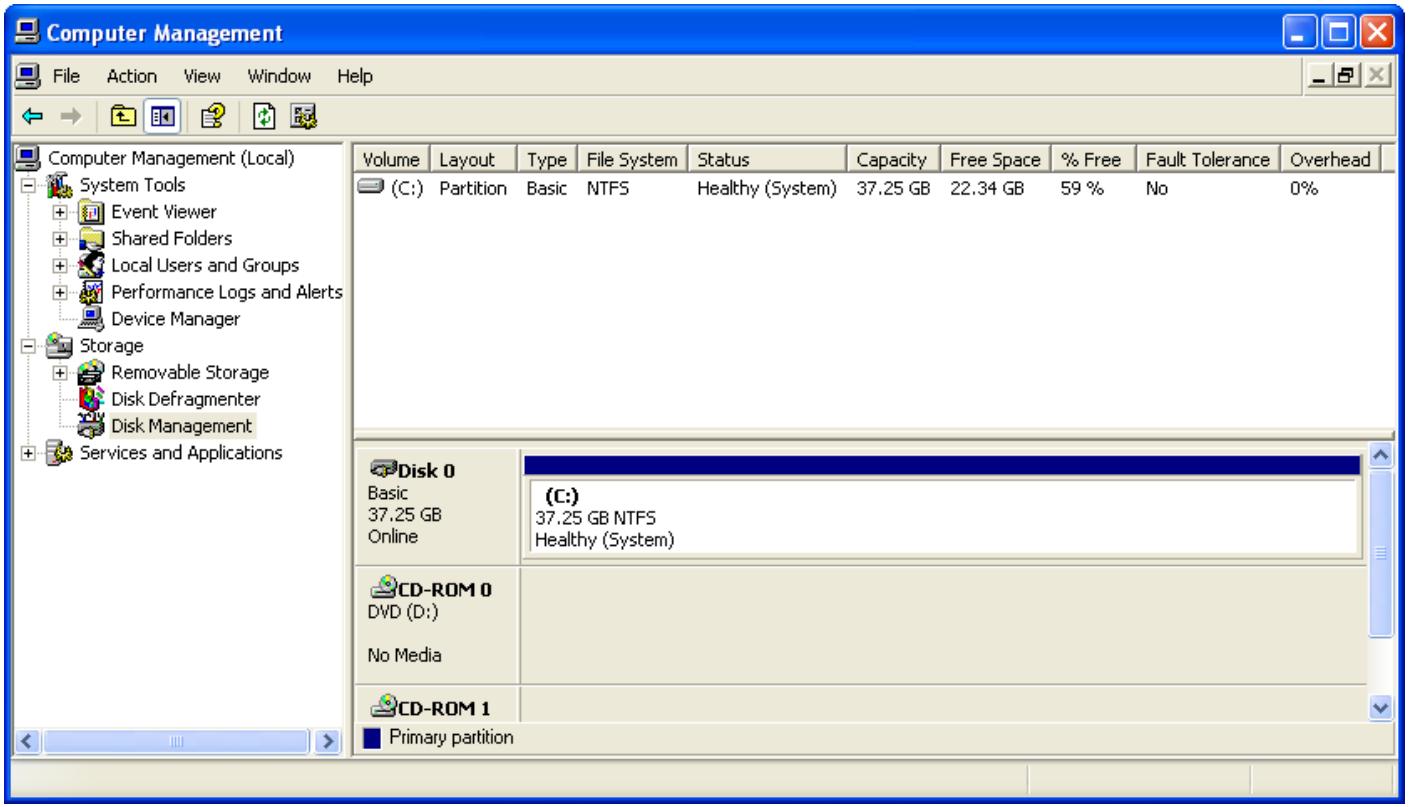
- A ***drive image*** is a computer file containing the complete contents and structure of a data storage medium or device.




- A ***disk partition*** is an isolated section of a disk that functions like a separate physical drive.
- There are several types of disk partitions.
  - Primary
  - Active
  - Extended
  - Logical

# The Windows Disk Management Utility

- The Windows Disk Management utility enables you to create, view, and manage disks.



# Internal Storage Device Installation Considerations

- There are a number of factors you should keep in mind when attempting to install an internal storage device.
  - Placement
  - Air flow
  - Power
  - Device Drivers

# Storage Device Configuration and Optimization Requirements

- There are several configuration and optimization requirements you must review before installing a storage device.
  - External USB devices
    - Use USB 2.0 if possible
  - Internal PATA hard disk drives
    - Verify jumpers properly configured
  - SCSI devices
    - IDs and termination
  - Any storage device
    - CMOS setup for recognition

# Activity 5-2

## Activity on Installing Internal Storage Devices

# Install and Configure Power Supplies

- Before installing and configuring power supplies, you need to understand the following:
  - Power supply form factors
  - Voltage requirements

# Power Supply Form Factors

- Like system boards and other components, there are several form factors available for power supplies, such as:

| Power Supply Form Factor | Description |
|---|---|
| AT | Used in AT form factor cases and with AT or Baby AT system boards. Dimensions are 213 x 150 x 150 mm. Found in older desktops and towers. |
| ATX | Used in ATX and NLX cases and with ATX and NLX system boards. Dimensions are 150 x 140 x 86 mm. Found in desktops and towers. |
| Proprietary | Some computer manufacturers use system board form factors that do not conform to standards such as ATX, NLX, and BTX. It's likely that these proprietary system boards will require nonstandard power supply form factors as well, although it is possible that an ATX power supply might be able to be used. |

# Power Requirements

- Each component in a personal computer has different power requirements.
  - ISA bus: 5 V, 12.1 W
  - PCI bus: 3.3 or 5 V, 56.1 W
  - AGP bus: 3.3 or 5 V, 25, 50, or 100 W
  - PCI card: 3.3 or 5 V, 5 W
  - AGP card: 3.3 or 5 V, 20 to 30 W
  - SCSI PCI card: 3.3 or 5 V, 20 to 25 W
  - Floppy drive: 5 V, 5 W
  - RAM: 10 W per 128 MB of RAM
    - SIMMs: 5 V
    - DIMMs: 3.3 V
  - 7200 RPM hard drive: 5 V for logic, 12 V for motor, 5 to 15 W

# Power Requirements (Contd.)

- CPU Voltage requirements:
  - 1 GHz Pentium III CPU: 3.3 V, 34 W
  - 1.7 GHz Pentium 4 CPU: 3.3 V, 65 W
  - 300 MHz Celeron CPU: 3.3 V, 18 W
  - 600 MHz AMD Athlon CPU: 3.3 V, 45 W
  - 1.4 GHz AMD Athlon CPU: 3.3 V, 70 W

# Power Supply Safety Recommendations and Selection Tips

- Consider the following before installing power supplies:
  - Check for UL certification.
  - Replace instead of repairing.
  - Keep the computer case closed during normal operation.
  - Protect the power supply.
- The following criteria you should consider when selecting a power supply for a computer:
  - Power supply rating
  - Form factor
  - Cooling

# Activity 5-3

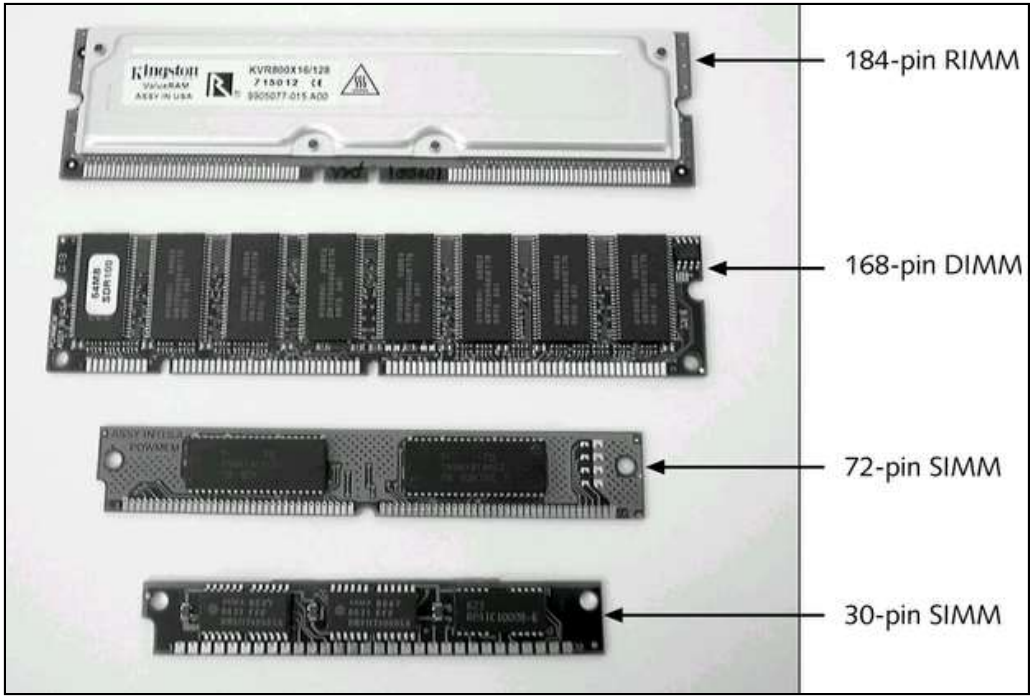
## Activity on Replacing a Power Supply

# Install and Configure Memory

- Before installing and configuring memory modules, you need to understand the following:
  - Memory Form Factors and Slot Types
  - Types of Memory

# Memory Form Factors and Slot Types

- Memory modules come in several form factors, such as:
  - SIMM (30 Pin, 72 Pin)
  - DIMM (64 bit, 168 pin SDRAM, 184 Pin DDR, 240 pin DDR2)
  - RIMM (16-32 bit 184 Pin)



# Memory Types

- There are several types of RAM, such as:
  - SRAM (Static Random Access Memory for Cache))
  - DRAM (Dynamic Random Access Memory)
  - RDRAM (Rambus Direct RAM)
  - SDRAM (Synchronous Dynamic RAM)
  - DDR SDRAM (Double Data Rate)
  - DDR2 SDRAM
  - SoDIMM (Small outline DIMM 32 bit, 72 Pin, 64 bit, 144 Pin, 200 Pin DDR/DDR2)
  - MicroDimm (64 bit, 144 Pin, 172Pin DDR/DDR2)

# Memory Selection Tips

- Consider the following before purchasing RAM for a computer:
  - Size
  - Speed
  - System board configuration

# Activity 5-5

## Activity on Adding RAM to a Computer

# Install and Configure CPUs

- Before installing and configuring CPUs, you need to understand the following:
  - CPU Chip Types
  - Instruction Sets
  - Cache memory
  - CPU Operational Characteristics
  - Processor Connections

# CPU Chip Types

- CPU chips are developed by several different manufacturers, such as:
  - Intel
  - AMD
  - Cyrix

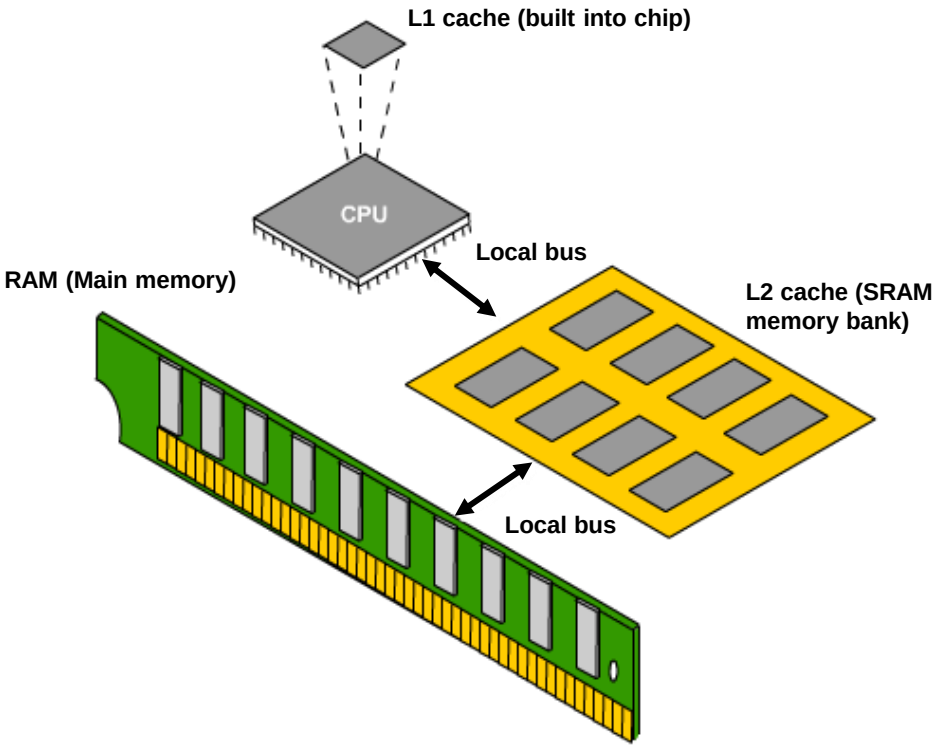


# Instruction Sets

- An ***instruction set*** is the collection of commands that is used by a CPU to perform calculations and other computing operations.
- The following are the two categories of instruction sets used by manufacturers:
  - CISC (Complex Instruction Set Computer Architectures use a broad set of instructions, resulting in fewer steps per operation)
  - RISC (Reduced Instruction Set Computer Architectures use a relatively small set of instructions, and RISC chips are designed to execute these instructions very rapidly)

# Cache Memory

- Cache memory, or CPU cache, is a type of memory that services the CPU.

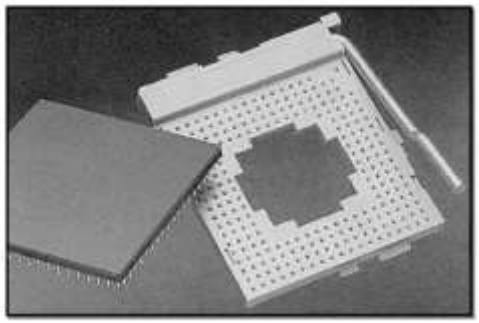


# CPU Operational Characteristics

- The following characteristics and technologies can affect a CPU's performance:
  - Bus width
  - Clock speed
  - Overclocking
  - CPU speed
  - Throttling
  - Hyperthreading
  - Dual core
  - Cache
  - Voltage Regulator Mode (VRM)
  - Multimedia Extensions (MMX)

# Processor Connections

- Different CPUs use different connection methods to connect to the system board, including various sockets, slots, and connection methods.
- Slot-based processors plug into a system board in much the same way as an expansion board.
- Socketed processors plug into a system board using a grid array of pins.

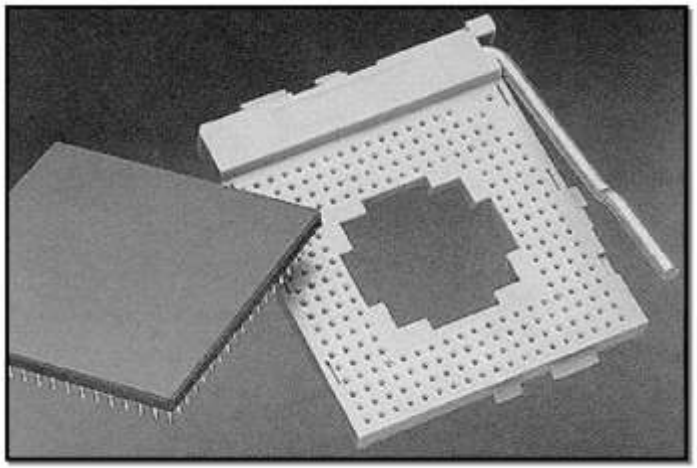


# CPU Selection Tips

- Consider the following before purchasing a CPU for a computer:
  - System board type
  - Budgetary constraints

# CPU Installation Considerations

- Consider the following when installing a CPU in a computer:
  - Power requirements
  - Proper removal and installation
  - Heat sink and fan



# CPU Configuration and Optimization Requirements

- Consider the following when configuring and optimizing a CPU after installation on a computer:
  - Voltage settings on older systems
  - Jumpers
  - CMOS Setup

# Activity 5-6

## Activity on Upgrading the CPU

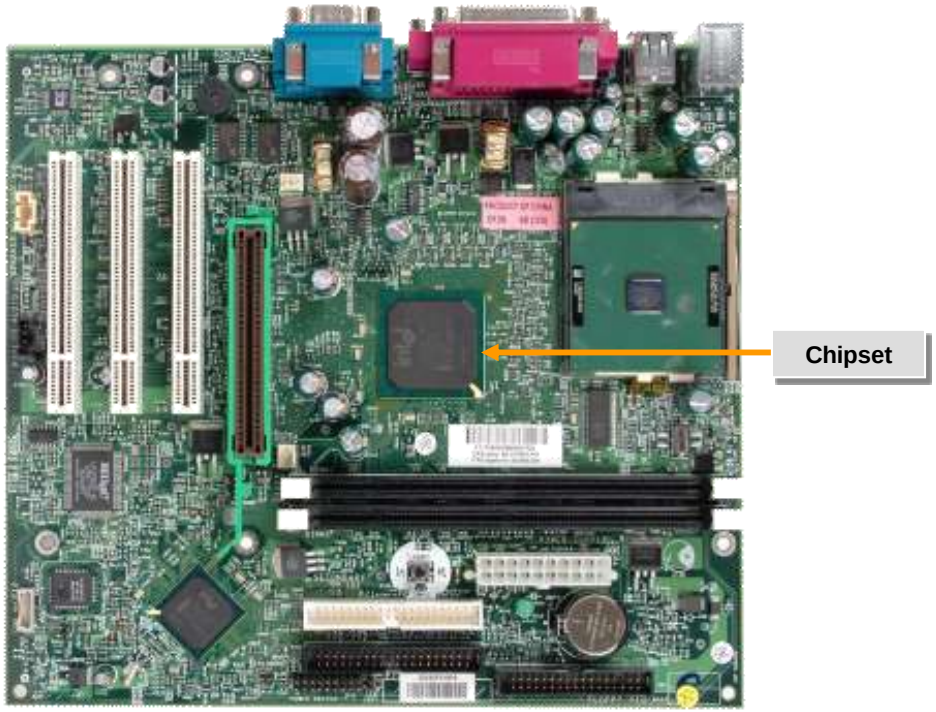
# Install and Configure System Boards

- Before installing and configuring system boards, you need to understand the following:
  - Integrated I/O Port Types
  - Chipsets
  - BIOS types
  - CMOS settings

# Integrated I/O Port Types

- System boards can include any or all of a number of integrated controllers or ports:
  - Sound
  - Video
  - Network
  - Modem
  - USB
  - Serial
  - FireWire
  - Parallel

- A ***chipset*** is a system board component that includes the CPU and other chips that support basic functions of the computer.
- The two main chips in the chipset are:
  - Northbridge
  - Southbridge



# BIOS Types

- System BIOS types include:
  - American Megatrends
  - Award BIOS
  - Phoenix BIOS
  - IBM SurePath BIOS
  - Microid Research
  - BootControl Pro
  - MicroFirmware
  - SystemSoft
  - Unicore

# Complementary Metal Oxide Semiconductor (CMOS) Memory Settings

- You can configure the following settings from the keyboard by using the CMOS Setup program:
  - System date and time
  - Password
  - Boot sequence
  - Memory
  - Floppy drive
  - Display
  - Parallel ports
  - Serial/COM ports
  - Power management

# System Board Selection Tips

- Consider the following before you choose a motherboard for a computer:
  - RAM
  - CPU
  - Ports
  - Expansion slots
  - Drive interfaces
  - Form factor
  - Clock speed

# System Board Installation Considerations

- Consider the following before you install or replace a motherboard for a computer:
  - Computer case
  - Connectors to fasten system board to computer case
  - Close cover properly

Full-size tower

Mid-size tower

Micro-size tower

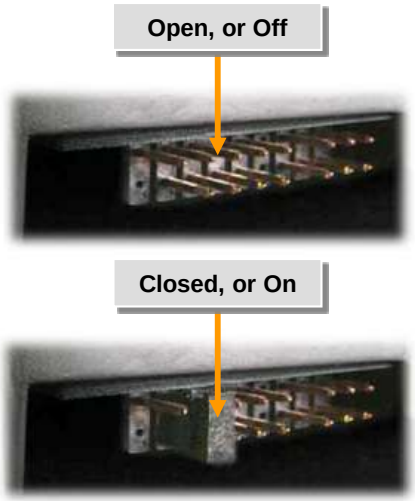
Desktop

# System Board Configuration and Optimization Requirements

- Consider the following after you install the motherboard on a computer:
  - Match CPU frequency
  - DIP switches and jumpers
  - CMOS Setup


Switch or switch block

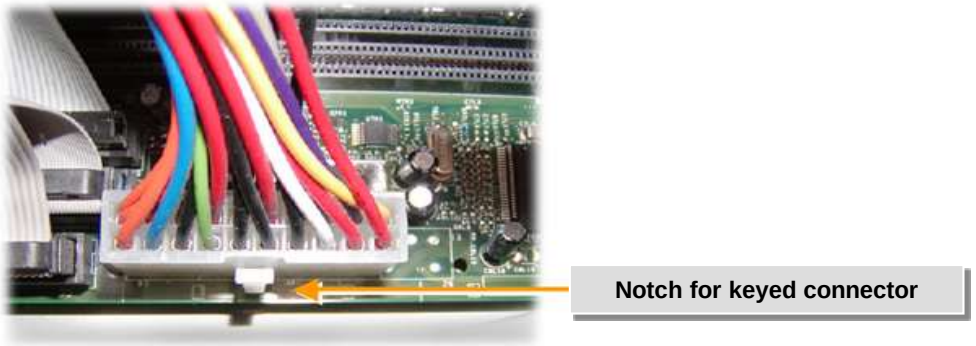
Closed=on
Open=off



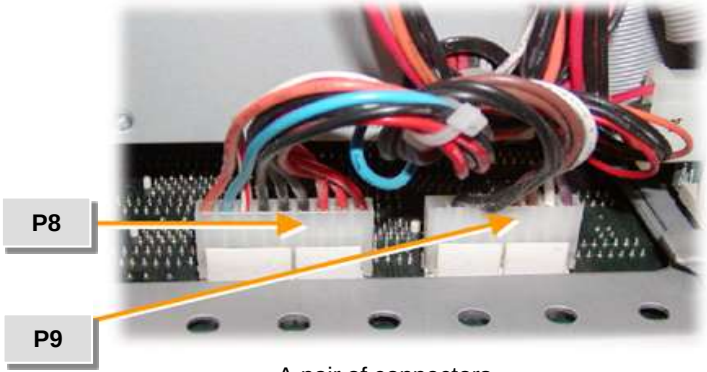

Jumper block

# System Board Power Supply Connectors

- The power supply connection to the system board is a keyed or unkeyed connection.




A single keyed connector




A pair of connectors

# Activity 5-7

## Activity on Upgrading the System Board

# Summary

- In this session, you learned that:
  - You need to consider various factors while installing and configuring the different types of storage devices so that you can provide the users with the optimized data storage capabilities.
  - You need to provide adequate power supply to the system so as to prevent system power problems and keep the number of support calls down.
  - You can also enhance the computer performance by upgrading the memory of your system and this is the most frequent task that can be performed.
  - You can also enhance the performance of the computer by installing a second processor or by upgrading an existing processor.

# Summary (Contd.)

- You must know the factors that should be considered for either installing or configuring a new system board or for repairing an existing system board as this is the most important system component in a computer.

## Objectives

- In this session, you will learn to:
  - Test and troubleshoot display devices.
  - Maintain and troubleshoot input devices.
  - Test and troubleshoot adapter cards.
  - Troubleshoot multimedia devices.
  - Troubleshoot storage devices.

## Troubleshoot Display Devices

- Following are the common display device issues:
  - Monitor is dark or power indicator light is not lit.
  - No image displayed on the monitor.
  - Monitor flickers or is distorted.
  - Monitor turns itself off.
  - Screen goes blank, flickers, or acts bizarrely when a specific application is active.
  - Monitor is on, but display is all white.
  - Monitor crackles or whines.
  - Physical damage, internal or external.

## Activity 6-1

**Activity on Troubleshooting Display Devices**

## Maintain and Troubleshoot Input Devices

- Before maintaining and troubleshooting input devices, you need to understand the following:
  - Common input device issues
  - Input device maintenance techniques

## Common Input Device Issues

- Following are the keyboard issues:
  - Keys stick.
  - User with physical limitations is currently unable to use the standard keyboard.
  - No input is sent when keys are pressed.
  - Keyboard-related message or beep codes given during computer boot.
  - Wrong characters are displayed on the screen when user inputs information.
  - Multimedia buttons not working properly.
  - New keyboard won't plug into the same port as the old keyboard.

## Common Input Device Issues (Contd..)

- Following are the pointing device issues:
  - Mouse pointer jumps around on the screen.
  - Mouse works sometimes, but not others.
  - Mouse is not working.
  - USB mouse is not working properly.

## Input Device Maintenance Techniques

- Following are the various techniques for input device maintenance:
  - Occasionally disconnect keyboards and mice and gently wipe them clean.
  - Clean loose debris from inside a trackball or mouse.
  - Gently shake an upside-down keyboard to remove debris.
  - Provide a clean, flat mouse pad or other mousing surface.
  - To avoid spills that can damage input devices, keep food and liquids away from computer systems.
  - Replace cordless device batteries regularly.

## Activity 6-2

**Activity on Maintaining And Troubleshooting Input Devices**

## Troubleshoot Adapter Cards

- Following are the common adapter card issues:
  - Adapter seems to work fine until you replace the system case.
  - Card works fine in another slot, but not in particular slot.
  - Card tests fine and slot tests fine, but services are unavailable.
  - Services provided by the adapter or a device connected to the adapter work intermittently.

## Activity 6-3

**Activity on Troubleshooting Adapter Cards**

## Troubleshoot Multimedia Devices

- Following common multimedia device issues:
  - No sound when speakers worked fine before.
  - No sound when speakers never worked.
  - Microphone won't work.

## Activity 6-4

**Activity on Troubleshooting Multimedia Devices**

## Troubleshoot Storage Devices

- Before troubleshooting storage devices, you need to understand the following:
  - Common storage device issues
  - Parallel ATA drive troubleshooting tips
  - SCSI drive troubleshooting tips

## Common Storage Device Issues

- Following are the hard disk drives issues:
  - Error message at booting time.
  - POST error codes.
  - Can’t read from or write to the drive.
  - Drive is making grinding noises.
  - Data is frequently being corrupted.
  - Utilities are not running properly.
  - Hard drive is slow.

## Common Storage Device Issues (Contd.)

- Following are the optical drives issues:
  - Can’t insert or remove disk.
  - Disk tray stuck.
  - Cannot read disk.
  - No sound.
  - Intermittent problems.
  - Can’t view DVD movies.
- Following are the floppy disks and tape drives issues:
  - Read/write problems.
  - Unable to insert a floppy into an internal tape drive.
  - Unable to insert a tape into an internal tape drive.

## Parallel ATA Drive Troubleshooting Tips

- Following are the tips for troubleshooting PATA drive:
  - For one drive on a channel, configure as Single or Cable Select.
  - For two drives per channel, configure as Master and Slave, or Cable Select.
  - When removing a drive, configure remaining drive as Single.
  - Use compatible drive modes.

## Parallel ATA Drive Troubleshooting Tips (Contd..)

- Following are the tips for troubleshooting SATA drive:
  - Make sure controller card is supported.
  - Make sure controller driver is latest version.
  - Install driver manually if not detected.
  - Load controller to bypass drive size limitation.
  - Use jumpers to limit transfer rate if drive transfer rate higher than controller rate.

## SCSI Drive Troubleshooting Tips

- Following are the tips for troubleshooting SCSI drive:
  - Always check IDs and termination.
  - Handle SCSI cable carefully.
  - For a bootable SCSI disk, enable the SCSI BIOS.
  - Use proper cables.
  - Use proper connectors.

## Activity 7-1

**Activity on Troubleshooting Hard Drive Problems**

## Activity 7-3

**Activity on Troubleshooting Optical Drive Problems**

## Summary

- In this session, you learned that:
  - Following are the common adapter card issues:
    - Card won't work in one slot.
    - Card and slot test fine, but services unavailable.
  - Following are the common display device issues:
    - Power issue.
    - Connection or settings issue.
    - Driver, magnetism, or interference issue.
    - Color quality or resolution issue.
  - Following are the input device maintenance techniques:
    - Clean loose debris from inside a trackball or mouse.
    - Gently shake an upside-down keyboard to remove debris.

## Summary (Contd.)

- Following are the common multimedia device issues:
  - No sound when speakers worked fine before.
  - No sound when speakers never worked.
  - Microphone won't work.
- Following are the common storage device issues:
  - Boot problems in hard disk drive.
  - Disk tray stuck in optical drives.
  - Read/write problems in floppy and tape disk drive
- Following are the parallel ATA drive troubleshooting tips:
  - When removing a drive, configure remaining drive as Single.
  - Use compatible drive modes.
  - Install driver manually if not detected
- Following are the SCSI drive troubleshooting tips:
  - Check IDs and termination.
  - Handle SCSI cable carefully.

## Objectives

- In this session, you will learn to:
  - Test and troubleshoot power supplies.
  - Test and troubleshoot memory.
  - Test and troubleshoot CPUs.
  - Test and troubleshoot system boards.

# Troubleshoot Power Supplies

- Before troubleshooting power supplies, you need to understand the following:
  - Common power problems
  - Common power supply issues

## Common Power Problems

- Following are the various common power problems:
  - Line noise
  - Power sag
  - Brownouts
  - Frequency variations
  - Overvoltage
  - Power failure

## Common Power Supply Issues

- Following are the various common power supply problems:
  - Fan doesn't work.
  - Computer won't start.
  - Noise coming from power supply.

## Power Supply Wire Color Conventions

- The Power Supply wire color conventions are:
  - Yellow wire +12 (Disk drive motor, fans. Cooling Systems, & system bus slots)
  - Blue wire -12 (Some types of serial port circuits, and early PROM)
  - Orange +3.3 (Most newer CPUs, some types of system memory and AGP Video cards)
  - Red wire +5 (Motherboards, Baby AT, and earlier CPUs, and many motherboards components)
  - White wire -5 (ISA bus cards and early PROMs)
  - Black 0 (Ground)
  - Motor +/-12
  - Circuitry +/-5

# Testing Power Supply

- To test the Power Supply:
  - Locate a spare Molex connector, and remove it from the bundle if necessary so that
  - Measure the 5 volt output from the power supply using a multimeter
  - Measure the 12 volt output from the power supply using a multimeter

## Activity 7-4

# Activity on Troubleshooting Power Supplies

## Troubleshoot Memory

- Before troubleshooting memory, you need to understand the following:
  - Error checking
  - Common memory issues

## Error Checking

- Following are the error-checking mechanisms, which helps save the data used in memory modules:
  - The ***Parity*** is an error correction method that is used for electronic communications.
  - The ***Error Correction Code (ECC)*** is an error correction method that uses several bits for error-checking.

## Common Memory Issues

- Following are the common memory issues:
  - Computer crashes
  - Application data is corrupted.
  - Memory errors displayed
  - Computer seems to boot, but screen is blank
  - Computer won't boot, and beep codes are heard
  - New memory not recognized by the system

## Troubleshooting Memory Issues

- Some common steps to troubleshoot memory issues:
  - Perform a virus scan. Viruses can cause symptoms that mimic those of a memory problem.
  - Verify that the correct memory modules were installed in the system. Verify this with the system documentation.
  - Verify that the memory was installed and configured properly.
  - Try swapping the memory between slots.
  - Check for BIOS upgrades. If there are known problems, then a fix has probably been issued.

## Troubleshoot CPUs

- Following are the common CPUs issues:
  - Overheating
  - Chip creep
  - Failure

## Troubleshoot CPUs

- To troubleshoot Overheating problems with CPUs
  - Verify that the air vents in the computer chassis are not blocked.
  - Move the system further from the wall if airflow is not sufficient.
  - Use compressed air to remove dust and dirt from fan components and the CPU heatsink.
  - Verify that the fan blades are turning freely; remove debris or obstructions.
  - Make sure the heat sink is securely clipped to the CPU.
  - If a cooling component has failed, replace it.
  - Configure the processor to eliminate overclocking.

## Troubleshoot CPUs (contd.)

- To troubleshoot chip creep problems with CPUs
  - Reseat the processor
- If a processor has failed, replace the processor

## Troubleshoot System Boards

- Following are the common system board issues:
  - Computer viruses
  - Loose connections
  - Out-of-date BIOS
  - CMOS battery failure
  - Overheating
  - Electrical short-circuits
  - Physical damage

## Troubleshoot System Boards

- To troubleshoot system board problems:
  - If the computer displays error messages, research the messages to determine a possible cause.
  - Eliminate problems with all other system components.
  - Perform a virus scan.
  - Reseat all components on the system board, including both cables and connector pins.
  - Update the system BIOS.
  - Update device drivers.
  - Replace the CMOS battery.

## Summary

- In this session, you learned that:
  - There are various common power problems, such as line noise, power sag, brownouts, and frequency variations.
  - Common power supply issues are fan doesn't work, computer won't start and noise coming from power supply.
  - Parity and ECC are the error checking mechanism.
  - Computer crashes, memory errors display, and computer seems to boot, but screen is blank are common memory issues.
  - Overheating, chip creep, and failure are the common CPU issues.
  - Computer viruses, loose connections, out-of-date BIOS, and CMOS battery failure are the common system board issues.