

Computer Systems

Lecture 3 : Computer Assembly





Case



**CD-ROM
DVD-ROM
CDRW
DVD +RW**



CPU or processor



Case Fan



**CPU
Fan**



**Hard
Drive**



**Keyboard
Mouse**



Memory



Modem



Monitor



**Power
Supply**



Motherboard



**Network card
NIC**



Sound card



Video Card



Speakers



Zip Drive



Floppy drive

**There are numerous other devices on the market
but this is the general list of parts**

Preparation

- Prepare the workspace before opening the computer case:
 - There should be adequate lighting, good ventilation, and a comfortable room temperature.
 - The workbench or table should be accessible from all sides.
 - Avoid cluttering the surface with tools and computer components.
 - An antistatic mat on the table will help prevent physical and ESD damage to equipment.
 - Small containers can be used to hold screws and other small parts as they are being removed.

Open the Case

- Computer assembly is a large part of a technician's job.
- Prepare the workspace before opening the computer case.
- There are different methods for opening cases. Consult the user manual or manufacturer's website.



Install the Power Supply

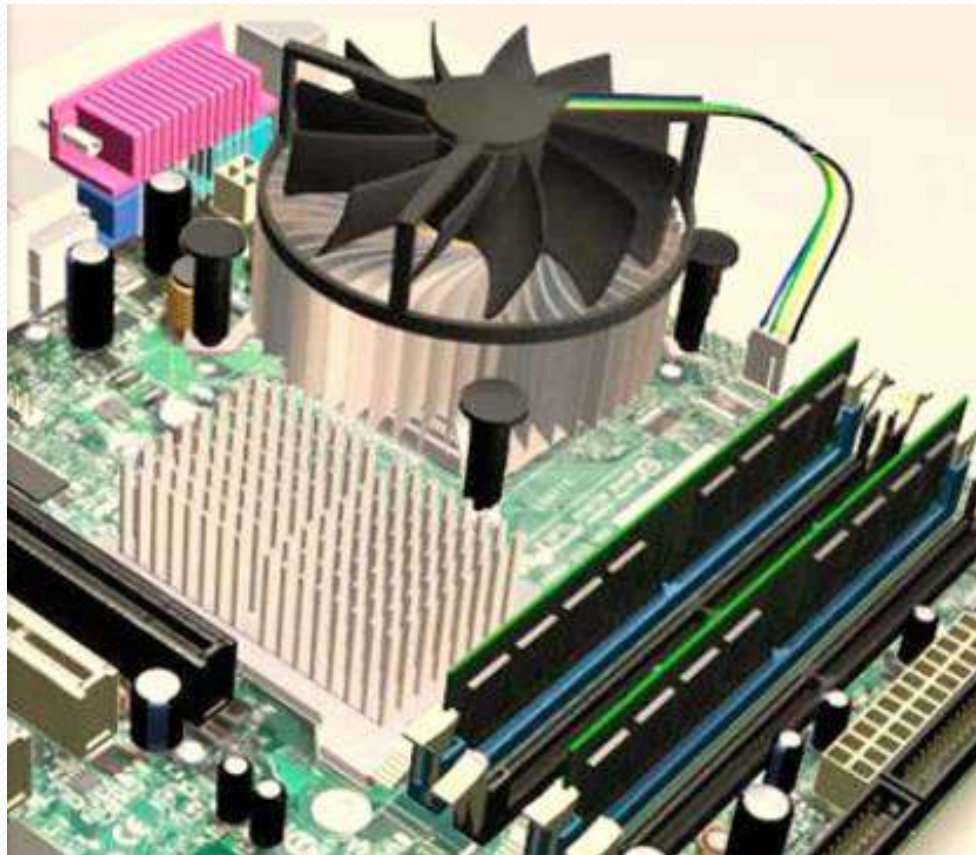
Power supply installation steps include the following:

1. Insert the power supply into the case.
2. Align the holes in the power supply with the holes in the case.
3. Secure the power supply to the case using the proper screws.



Attach Components to the Motherboard

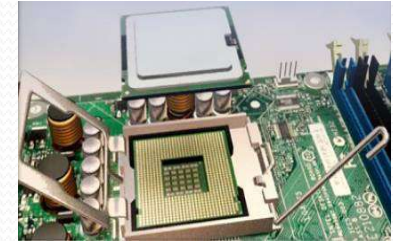
- As part of an upgrade or repair, you may need to attach components to the motherboard, and then install the motherboard.



Attach Components to the Motherboard

- **CPU on Motherboard**

- The CPU and **motherboard** are sensitive to electrostatic discharge.
- The CPU is secured to the **socket** on the motherboard with a **locking assembly**.
- **CAUTION:** When handling a CPU, do not touch the CPU contacts.



- **Thermal compound**

- Helps keep the CPU cool.
- To install a used CPU, clean it and the base of the heat sink with isopropyl alcohol to remove the old thermal compound.



- **Heat Sink/Fan Assembly**

- The **Heat Sink/Fan Assembly** is a two-part cooling device.
- The heat sink draws heat away from the CPU.



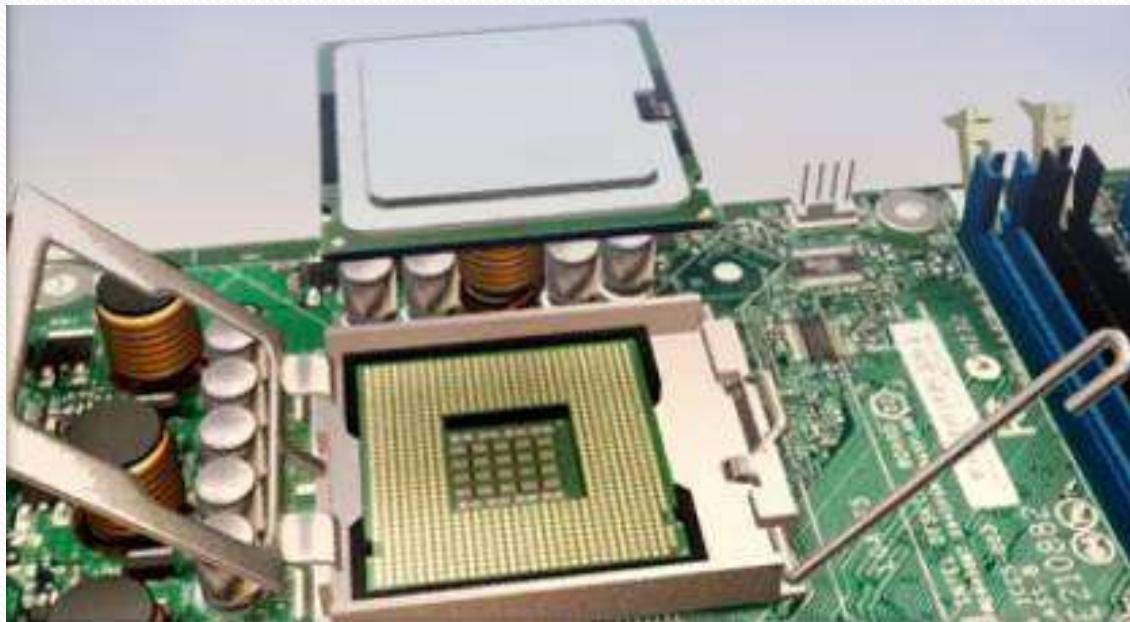
- **Install RAM**

- **RAM** provides temporary data storage for the CPU and should be installed in the motherboard before the motherboard is placed in the computer case.



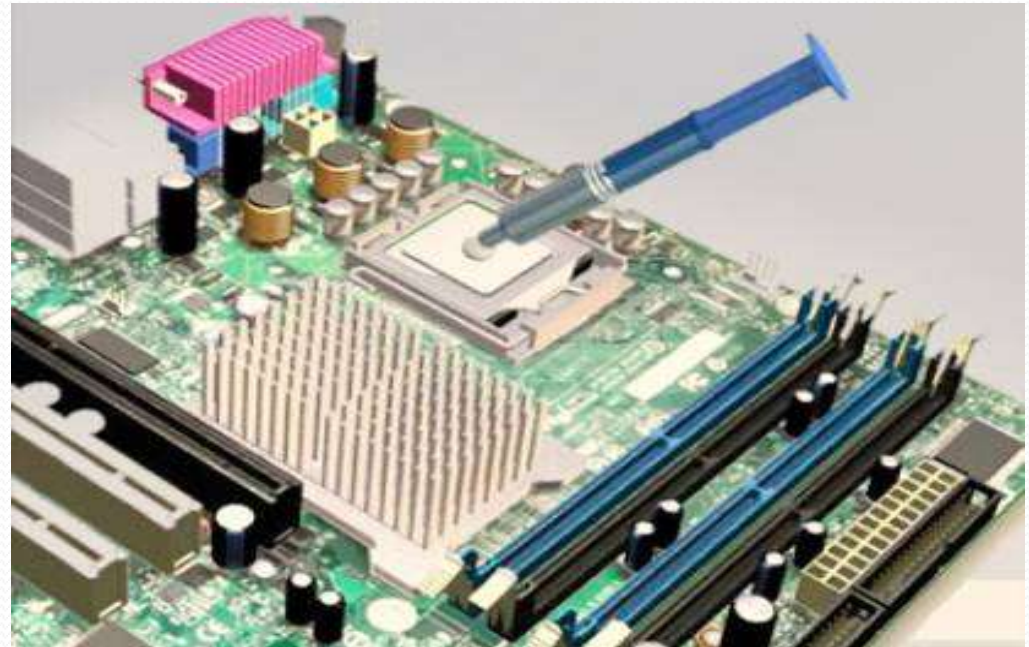
CPU on Motherboard

- The CPU and **motherboard** are sensitive to electrostatic discharge so use a grounded antistatic mat and wear an antistatic wrist strap.
CAUTION: When handling a CPU, do not touch the CPU contacts.
- The CPU is secured to the **socket** on the motherboard with a **locking assembly**.



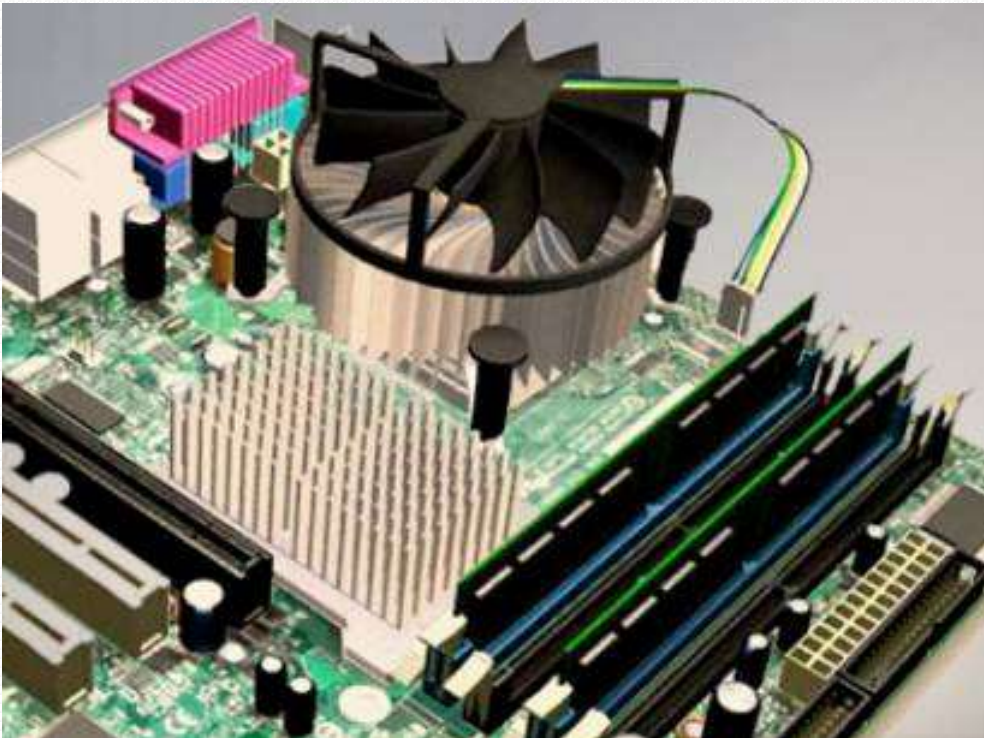
Thermal Compound

- **Thermal compound** helps to keep the CPU cool.
- To install a used CPU, clean it and the base of the heat sink with isopropyl alcohol to remove the old thermal compound.
- Follow manufacturer's recommendations about applying the thermal compound.



Heat Sink/Fan Assembly

- The **Heat Sink/Fan Assembly** is a two-part cooling device.



The heat sink draws heat away from the CPU.

The fan moves the heat away from the heat sink.

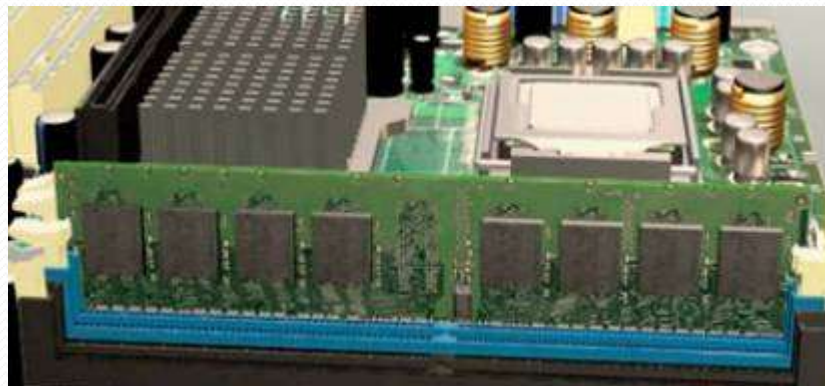
The heat sink/fan assembly usually has a 3-pin power connector.

Install CPU and Heat Sink/Fan Assembly

1. Align the CPU so that the Connection 1 indicator is lined up with Pin 1 on the CPU socket.
2. Place the CPU gently into the socket.
3. Close the CPU load plate and secure it by closing the load lever and moving it under the load lever retention tab.
4. Apply a small amount of thermal compound to the CPU and spread it evenly. Follow the application instructions provided by the manufacturer.
5. Line up the heat sink/fan assembly retainers to the holes on the motherboard.
6. Place the heat sink/fan assembly onto the CPU socket, being careful not to pinch the CPU fan wires.
7. Tighten the heat sink/fan assembly retainers to secure the assembly in place.
8. Connect the heat sink/fan assembly power cable to the header on the motherboard.

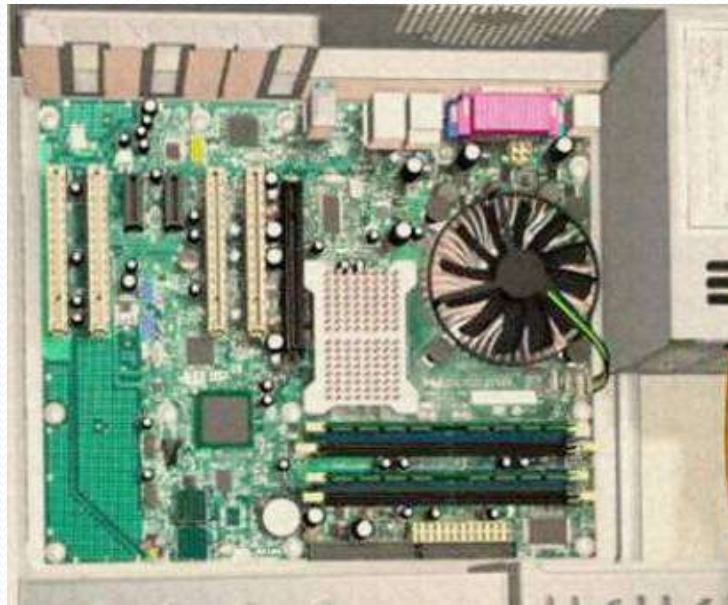
Install RAM

- **RAM** provides temporary data storage for the CPU while the computer is operating.
- RAM should be installed in the motherboard before the motherboard is placed in the computer case.
- RAM installation steps:
 1. Align the notches on the RAM module to the keys in the slot and press down until the side tabs click into place.
 2. Make sure that the side tabs have locked the RAM module and visually check for exposed contacts.

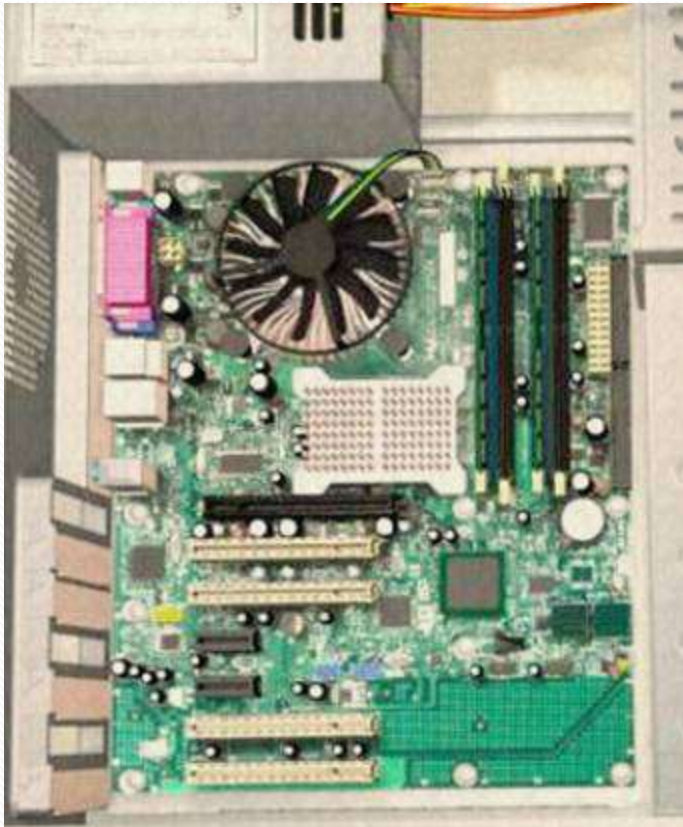


The Motherboard

- After installing the previous components, the motherboard is now ready to install in the computer case.
- Plastic and metal **standoffs** are used to mount the motherboard and to prevent it from touching the metal portions of the case.



Install Motherboard



1. Install standoffs in the computer case.
2. Align the I/O connectors on the back of the motherboard with the openings in the back of the case.
3. Align the screw holes of the motherboard with the standoffs.
4. Insert all of the motherboard screws.
5. Tighten all of the motherboard screws.

Install Internal Drives

- Drives that are installed in internal bays are called **internal drives**.
- A **hard disk drive (HDD)** is an example of an internal drive.
- HDD installation steps:
 1. Position the HDD so that it aligns with the 3.5-inch drive bay.
 2. Insert the HDD into the drive bay so that the screw holes in the drive line up with the screw holes in the case.
 3. Secure the HDD to the case using the proper screws.



Install Drives in External Bays



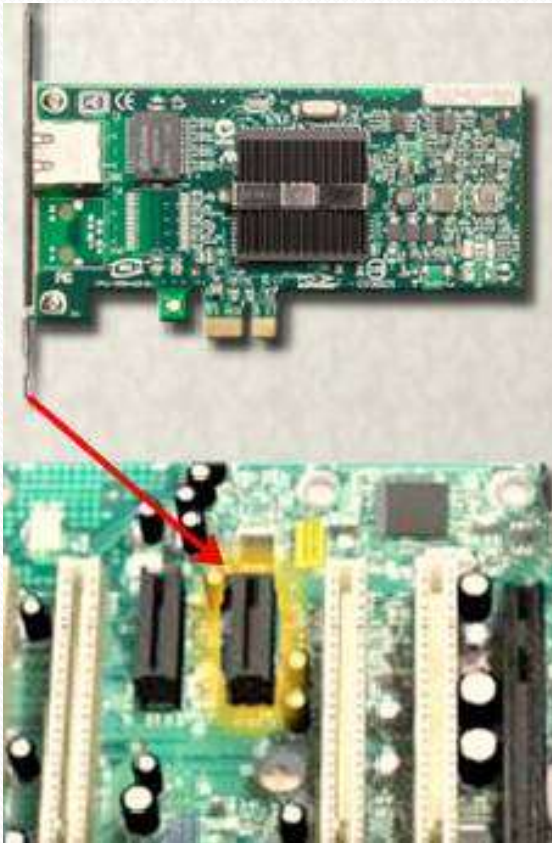
- Drives in **external bays** allow access to the media without opening the case.
- Some devices that are installed in this type of drive are:
 - An **optical drive** is a storage device that reads and writes information to CDs, DVDs, or BDs.
 - A **floppy disk drive (FDD)** is a storage device that reads and writes information to a floppy disk.

Install Adapter Cards

- Adapter cards are installed to add functionality to a computer.
- Some examples of these adapters are:
 - A **Network Interface Card (NIC)** which enables a computer to connect to a network. It uses **PCI** and **PCIe** expansion slots on the motherboard.
 - A **wireless NIC** enables a computer to connect to a wireless network. Wireless NICs use **PCI** and **PCIe** expansion slots on the motherboard. Some wireless NICs are installed externally with a **USB** connector.
 - A **video adapter card** is the interface between a computer and a display monitor. An upgraded video adapter card can provide better graphic capabilities for games and graphic programs. Video adapter cards use **PCI**, **AGP**, and **PCIe** expansion slots on the motherboard.

Install the Network Interface Card (NIC)

- A NIC enables a computer to connect to a network.
- NICs use **PCI** and **PCIe** expansion slots on the motherboard.



- NIC installation steps:
 1. Align the NIC to the appropriate slot on the motherboard.
 2. Press down gently on the NIC until the card is seated.
 3. Secure the NIC PC mounting bracket to the case with the appropriate screw.

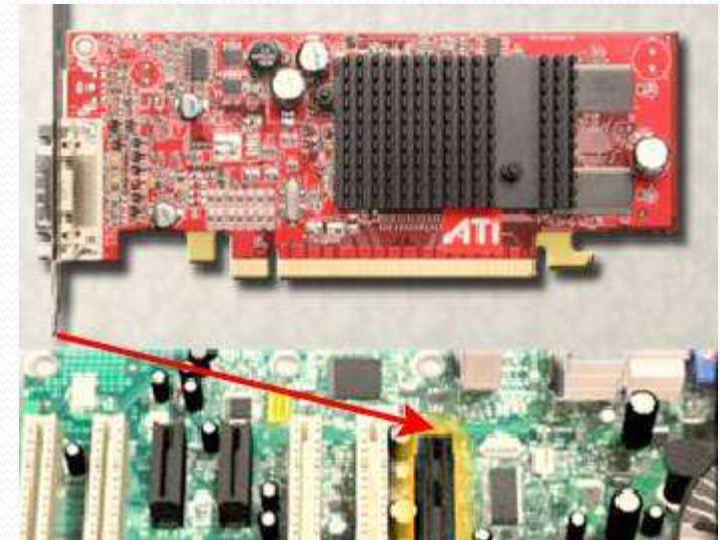
Install the Wireless NIC

- A wireless NIC enables a computer to connect to a wireless network.
- Some wireless NICs are installed externally with a USB connector.
- Wireless NIC installation steps:
 1. Align the wireless NIC to the appropriate expansion slot on the motherboard.
 2. Press down gently on the wireless NIC until the card is fully seated.
 3. Secure the mounting bracket to the case with the appropriate screw.

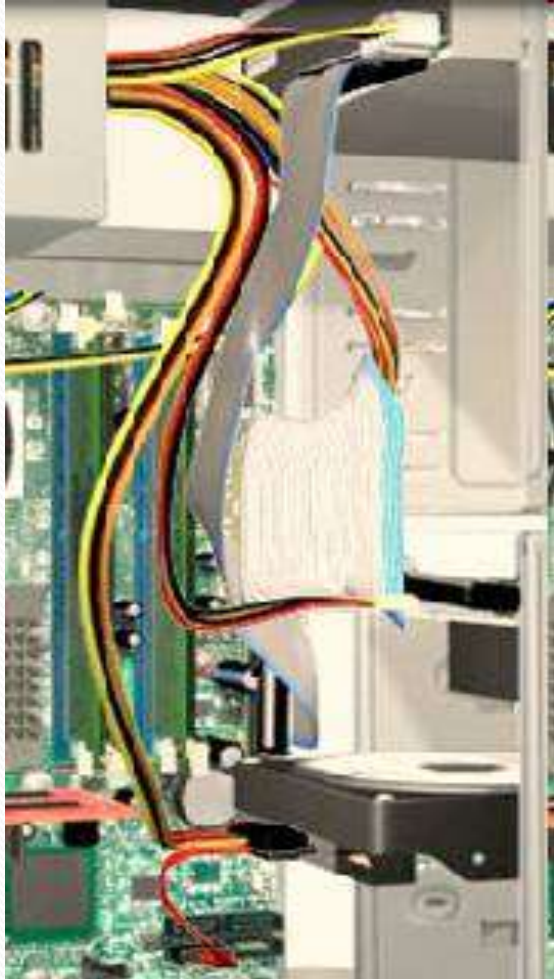


Install the Video Adapter Card

- A video adapter card is the interface between a computer and a display monitor.
- An upgraded video adapter card can provide better graphic capabilities for games and graphic programs.
- Video adapter card installation steps:
 1. Align the video adapter card to the appropriate expansion slot on the motherboard.
 2. Press down gently on the video adapter card until the card is fully seated.
 3. Secure the video adapter card PC mounting bracket to the case with the appropriate screw.



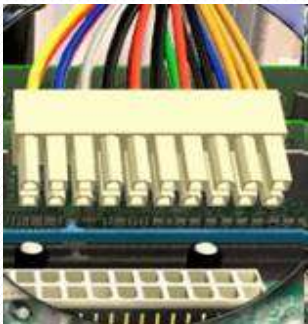
Connect Internal Cables



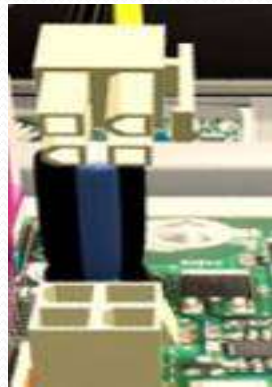
- **Power cables** are used to distribute electricity from the power supply to the motherboard and other components.
- **Data cables** transmit data between the motherboard and storage devices, such as hard drives.
- Additional cables connect the buttons and link lights on the front of the computer case to the motherboard.

Connect Internal Cables

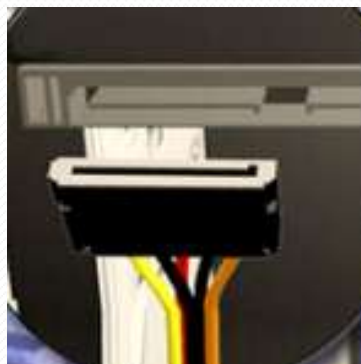
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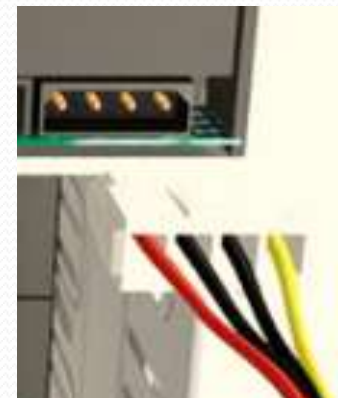
ATX



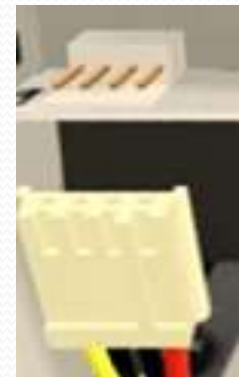
AUX



SATA



Molex

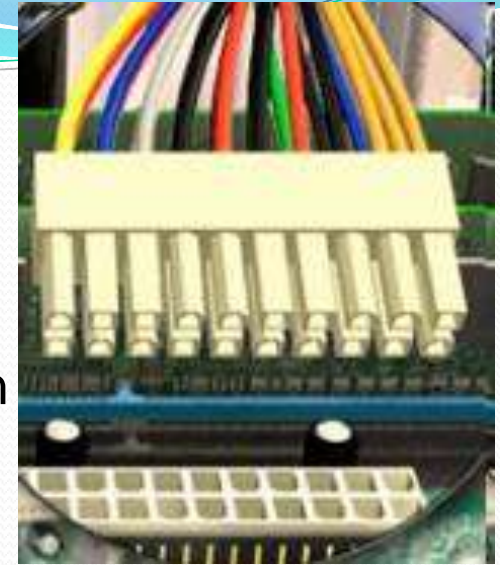


Berg

Connect Power Cables

Motherboard Power Connections

- The Advanced Technology Extended (**ATX**) main power connector has either 20 or 24 pins.



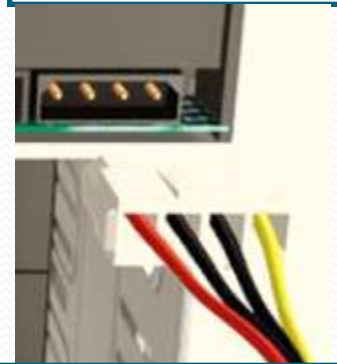
- The power supply may also have a 4-pin or 6-pin Auxiliary (**AUX**) power connector that connects to the motherboard.
- A 20-pin connector will work in a motherboard with a 24-pin socket.

Connect Power Cables

- **SATA** Power Connectors use a 15-pin connector to connect to hard disk drives, optical drives, or any devices that have a SATA power socket.
- **Molex** Power Connectors are used by hard disk drives and optical drives that do not have SATA power sockets.
- **CAUTION:** Do not use a Molex connector and a SATA power connector on the same drive at the same time.
- 4-pin **Berg** Power Connector supplies power to a floppy drive.



SATA



Molex



Berg

Connect Internal Cables

- **Data cables** transmit data between the motherboard and storage devices, such as hard drives. Some of examples of this type of cables are:
 - PATA cable
 - *(ATA, PATA and IDE are all different names for the same thing.)*
 - SATA cable
 - Floppy drive data cable
- Additional cables connect the buttons and link lights on the front of the computer case to the motherboard.



PATA Cables

- Drives connect to the motherboard using data cables.

Types of data cables are PATA, SATA, and floppy disk.

- The **PATA** cable (sometimes called a **ribbon** cable) is wide and flat and can have either 40 or 80 conductors.

A PATA cable usually has three 40-pin connectors.

If multiple hard drives are installed, the **master** drive will connect to the end connector. The **slave** drive will connect to the middle connector.

- Many motherboards have two PATA cable sockets, which provides support for a maximum of four PATA drives.

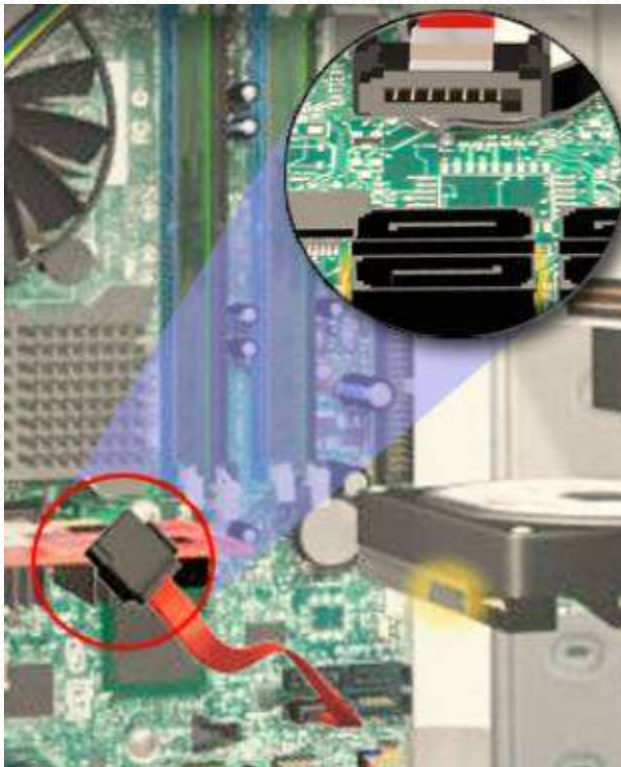


SATA Cables

- The **SATA** data cable has a 7-pin connector.

One end of the cable is connected to the motherboard.

The other end is connected to any drive that has a SATA data connector.



Floppy Drive Cables

- The floppy drive data cable has a 34-pin connector and it has a stripe to denote the location of pin 1.
- Motherboards have one floppy drive controller which provides support for a maximum of two floppy drives.

One connector at the end of the cable connects to the motherboard. The other two connectors connect to drives.

If multiple floppy drives are installed, the A: drive will connect to the end connector. The B: drive will connect to the middle connector.

Complete Physical Installation

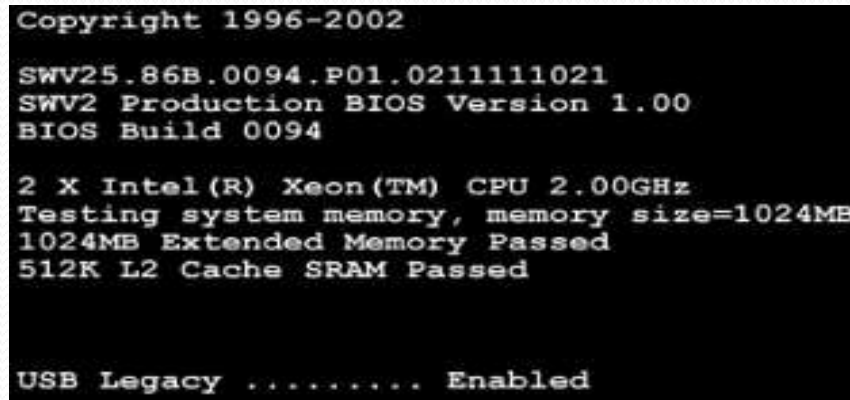
- Now that all the internal components and the power supply have been installed and connected to the motherboard, the following tasks should be completed:
 - **Re-Attach the side panels:** Most computer cases have two panels, one on each side. Some computer cases have one three-sided cover that slides down over the case frame.
 - **Connect the External Cables:** These cables are normally connected to the back of the computer. Here are some common external cable connections: Monitor, Keyboard, Mouse, USB, Ethernet, Power.

Boot Computer for the First Time

- When the computer is booted, the basic input/output system (**BIOS**) will perform a power-on self test (**POST**) to check on all of the internal components.
- The **BIOS** contains a setup program used to configure settings for hardware devices. The configuration data is saved to a special memory chip called a **complementary metal-oxide semiconductor (CMOS)** or can be saved in **nonvolatile memory** which does not need power to retain settings.
- **POST** checks to see that all of the hardware in the computer is operating correctly. If a device is malfunctioning, an error or a beep code alerts the user that there is a problem.

Boot Computer for the First Time

- The BIOS is a set of instructions stored in a **nonvolatile** memory chip.
- When the computer is booted, the basic input/output system (**BIOS**) will perform a power-on self test (**POST**) to check on all of the internal components.



```
Copyright 1996-2002

SWV25.86B.0094.P01.0211111021
SWV2 Production BIOS Version 1.00
BIOS Build 0094

2 X Intel(R) Xeon(TM) CPU 2.00GHz
Testing system memory, memory size=1024MB
1024MB Extended Memory Passed
512K L2 Cache SRAM Passed

USB Legacy ..... Enabled
```

- A special key or combination of keys on the keyboard is used to enter the **BIOS setup** program.
- The BIOS setup program displays information about all of the components in the computer.

Identify Beep Codes

- POST checks to see that all of the hardware in the computer is operating correctly.
- If a device is malfunctioning, an error or a beep code alerts the user that there is a problem.
- Typically, a single beep denotes that the computer is functioning properly.
- If there is a hardware problem, the computer may emit a series of beeps.
- Each BIOS manufacturer uses different codes to indicate hardware problems.
- Consult the motherboard documentation to view beep codes for your computer.

BIOS Setup

- The BIOS contains a setup program used to configure settings for hardware devices.
- The configuration data is saved to a special memory chip called a complementary metal-oxide semiconductor (**CMOS**).
- CMOS is maintained by the battery in the computer.
- If this battery dies, all BIOS setup configuration data will be lost.
- Replace the battery and reconfigure the BIOS settings.

BIOS Setup Program

BIOS settings are configured in the BIOS setup program.



BIOS Configuration

- **We can use the BIOS information to learn about installed components:**
 - **CPU** – Manufacturer and speed
 - **RAM** - Manufacturer and speed
 - **Hard Drive** - Manufacturer, size, and type
 - **Optical Drive** - manufacturer and type
- **We can use the BIOS to:**
 - Set Time and Date
 - Disable Devices
 - Set Boot Order
 - Adjust Clock Speed
 - Enable Virtualization

BIOS Configuration

- We can set the following BIOS security features :

BIOS passwords

Drive encryption

Trusted Platform Module (TPM)

Lojack

- Lock the computer remotely.
- Display a message so that a lost computer can be returned to the owner.
- Delete sensitive data on the computer if stolen.
- Locate the computer using geotechnology.

BIOS Configuration

Bios Built-in Hardware Monitoring

- **Temperatures**
- **Fan Speeds**
- **Voltages**
- **Clock and Bus Speeds**
- **Intrusion Detection**
- **Built-in Diagnostics**
 - Start test, Hard drive test, Memory test