

## **Unit-1 Inside Pc Core**

### **What's a Computer?**

- A computer is an electronic machine that takes input from the user, processes the given input and generates output in the form of useful information.
- **Input: data, programs, user reply**
  - Data: the raw details that need to be processed to generate some useful information.
  - Programs: the set of instructions that can be executed by the computer in sequential or non-sequential manner.
  - User reply: the input provided by the user in response to a question asked by the computer.
- **A computer includes various devices:**
  - Central Processing Unit (CPU)
  - Monitor
  - Keyboard and Mouse
- **The unique capabilities and characteristics of a computer:**
  - Speed
  - Storage capacity
  - Accuracy
  - Reliability
  - Versatility
  - Diligence

## ■ **Hardware:**

- Computer Hardware is the physical part of the computer system, the machinery and equipment.

## ■ **Firmware**

- Firmware is a software program permanently etched into a hardware device such as a keyboards, hard drive, BIOS, or video cards. It is programmed to give permanent instructions to communicate with other devices and perform functions like basic input/output tasks. Firmware is typically stored in the flash ROM (read only memory) of a hardware device. It can be erased and rewritten.

## ■ **Software:**

- Computer Software are programs that tell the computer what to do.

## ■ **Evolution of Computers**

- Manual Computing Devices: Sand table, Abacus, ...
- Automated Computing Devices: difference engine, analytical engine, Colossus, ...
- Charles Babbage: A professor of mathematics at the Cambridge University is considered to be the father of modern computer.

## Generations of Computers

### ■ **First Generation Computers**

- Employed during the period 1940-1956

- Used the vacuum tubes technology for calculation as well as for storage and control purpose.
- Advantages: (1) Fastest computing devices of their time; (2) These computers were able to execute complex mathematical problems in an efficient manner.
- Disadvantages:
  - (1) The functioning of these computers depended on the machine language.
  - (2) They were generally designed as special-purpose computers.
  - (3) The use of vacuum tube technology make these computers very large and bulky.
  - (4) They were not easily transferable from one place to another due to their huge size and also required to be placed in cool places.
  - (5) They were single tasking because they could execute only one program at a time.
  - (6) They generated huge amount of heat and hence were prone to hardware faults.

### ■ Second Generation Computers

- Employed during the period 1956-1963
- Use transistors in place of vacuum tubes in building the basic logic circuits.
- Advantages: (1) Fastest computing devices of their time; (2) Easy to program because of the use assembly language; (3) Could be transferred from one place to other very easily because they were small and light; (4) Require very less power in carrying out their operations; (5) More reliable, did not require maintenance at regular intervals of time.

- **Disadvantages:**

- (1)The input and output media were not improved to a considerable extent
- (2) Required to be placed in air-conditioned places
- (3) The cost of these computers was very high and they were beyond the reach of home users
- (4) Special-purpose computers and could execute only specific applications

### ■ Third Generation Computers

- Employed during the period 1964-1975
- Use of Integrated Circuits
- Advantages: (1) Fastest computing devices; (2) Very productive; (3) Easily transportable from one place to another because of their small size; (4) Use high-level languages; (5) Could be installed very easily and required less space; (6) Can execute any type of application. (7) More reliable and require less frequent maintenance schedules.
- **Disadvantages:**
- (1)The storage capacity of these computers was still very small;
- (2) The performance of these computers degraded while executing large applications, involving complex computations because of the small storage capacity;
- (3) The cost of these computers was very high;
- (4) They were still required to be placed in air-conditioned places.

### ■ Fourth Generation Computers

- Employed during 1975-1989
- Use of Large Scale Integration technology and Very Large Scale Integration technology

- The term Personal Computer (PC) became known to the people during this era.

### **Advantages:**

- (1) Very powerful in terms of their processing speed and access time;
- (2) Storage capacity was very large and faster;
- (3) Highly reliable and required very less maintenance;
- (4) User-friendly environment;
- (5) Programs written on these computers were highly portable;
- (6) Versatile and suitable for every type of applications;
- (7) Require very less power to operate.

### **■ Fifth Generation Computers**


- The different types of modern digital computers come under this category.
- Use Ultra Large Scale Integration technology that allows almost ten million electronic components to be fabricated on one small chip.

## **Classification of Computers**

- We can classify the computers according to the following three criteria:

- (1) Based on operating principles
- (2) Based on applications
- (3) Based on size and capability

### **1) Based on operating principles:**

-  **Analog computers:** represent data in the form of continuous electrical signals having a specific magnitude

- ✚ **Digital computers:** store and process data in the digital form.
- ✚ **Hybrid computers:** a combination of analog computer and digital computer because it encompasses the best features of both.

## **2)Based on applications:**

- ✚ **General purpose computers:** can work in all environments.
- ✚ **Special purpose computers:** can perform only a specified task.

## **3) Based on size and capability**

- ✚ **Microcomputers:** Designed to be used by individuals.
- ✚ **Mini Computers:** Can handle more data and more input and output than micro computers.
- ✚ **Mainframe Computers:** A very large computer
- ✚ **Super Computers:** The fastest type of computer that can perform complex operations at a very high speed.

# **THE COMPUTER MOTHERBOARD AND ITS COMPONENTS**

## **1)Main Components of Motherboard**

- CPU Socket
- Memory Slots
- CMOS Battery
- ISA, PCI and AGP Slots
- Power Connectors
- Chipset
- Graphical Devices
- Back Panel and Ports

## 2) What is a Motherboard?

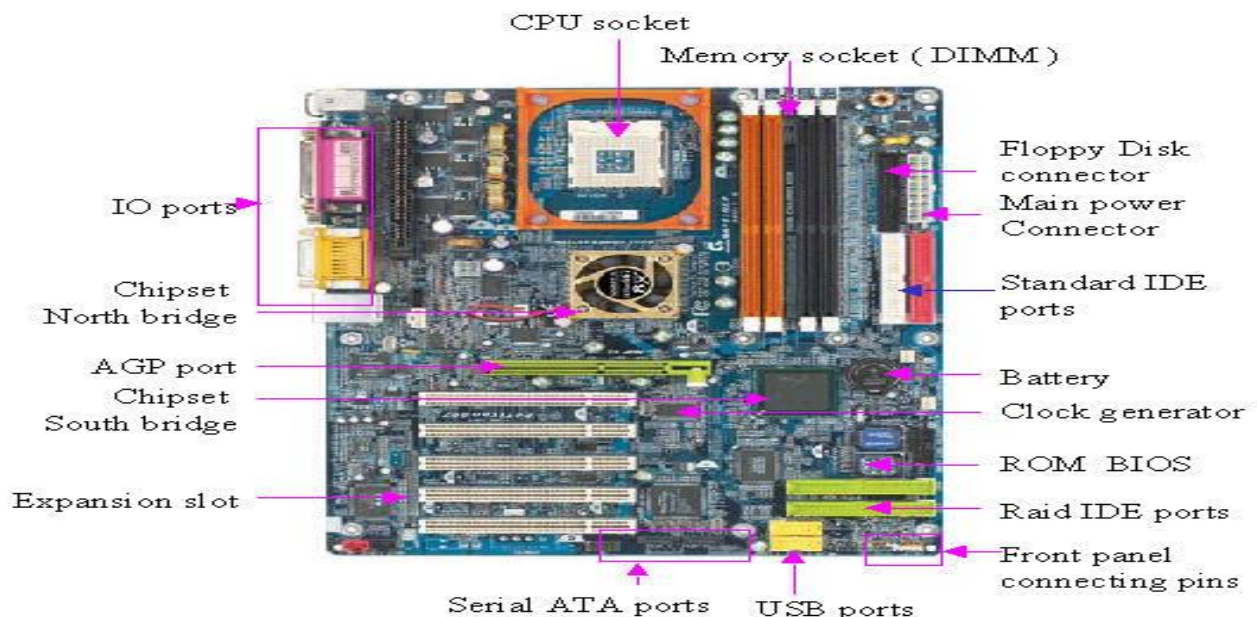
A motherboard (sometimes alternatively known as the mainboard, system board or mobo) is the main printed circuit board (PCB) found in computers and other expandable systems. It holds many of the crucial electronic components of the system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.



- A motherboard, also known as the primary circuit inside the computer, and where the central processing unit(CPU), Memory slots, drives and other peripherals.
- A motherboard provides the electrical connections by which the other components of the system communicate. it also connects the central processing unit and hosts other subsystems and devices.
- An important component of a motherboard is the microprocessor's supporting chipset, which provides the supporting interfaces between the CPU and the various buses and external components. This chipset determines, to an extent, the features and capabilities of the motherboard

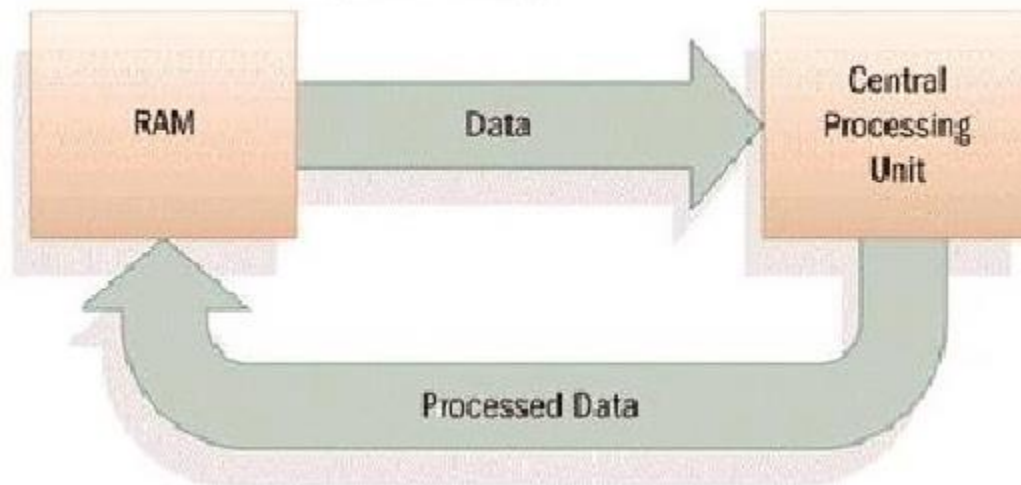
## ➤ Motherboard Components:

1. Clock Generator
2. CPU socket
3. Memory Socket Memory error checking
4. ROM Bios
5. CMOS Ram
6. Battery
7. Chipset
8. Expansion Slot
9. AGP Port
10. IDE Ports
  - 10.1 IDE Port continue
  - 10.2 IDE Port continue
  - 10.3 IDE Port with Raid
  - 10.4 Serial ATA
11. Floppy Disk port
12. IO Connectors/USB ports USB port add more printer ports
13. Main Power Connector
14. Front Panel Connecting Pin





### ➤ The CPU and RAM Communication



### ➤ MEMORY SLOTS:

A memory slot, memory socket, or RAM slot is what allows computer memory (RAM) to be inserted into the computer. Depending on the motherboard, there will usually be 2 to 4 memory slots (sometimes more on high-end motherboards) and are what determine the type of RAM used with the computer. The most common types of RAM are SDRAM and DDR for desktop computers and SODIMM for laptop computers, each having various types and speeds. In the below picture, is an example of what memory slots may look like inside a desktop computer. In this picture, there are three open available slots for three memory sticks.



Computer Memory Slots

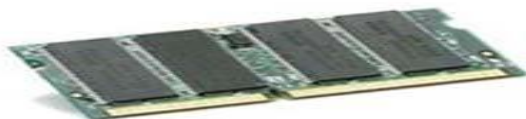


<http://www.computerhope.com>

## TYPES OF RAM:



72 Pin SIMM



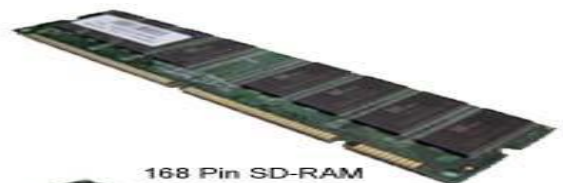
144 Pin SO-DIMM for SD-RAM



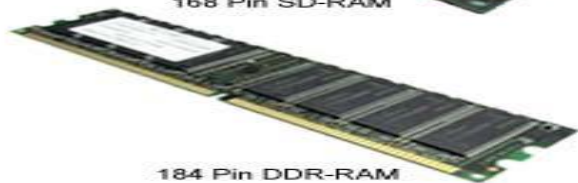
184 Pin RD-RAM



168 Pin DIMM



168 Pin SD-RAM



184 Pin DDR-RAM



240 Pin DDR2-RAM



240 Pin DDR3-RAM

## Memory Socket( DIMM socket):

- There are 3 types of memory that currently popular used in the PC,
  1. RD RAM
  2. DDR RAM
  3. SD RAM

Memory socket  
( DIMM )



### **RDRAM Memory**

- Used in Pentium 4 motherboard
- 2 Notches
- highest performance and is most expensive.

### **DDR ram**

- 128 MB, 256 MB, 512 MB.
- medium high performance and medium price.

### **SDRAM**

- lowest performance and lowest price.





## CMOS BATTERY:

Nonvolatile BIOS memory refers to a small memory on PC motherboards that is used to store BIOS settings. It was traditionally called CMOS RAM because it used a volatile, low-power complementary metal-oxide-semiconductor (CMOS) SRAM (such as Motorola MC146818 or similar) powered by a small battery when system power was off.



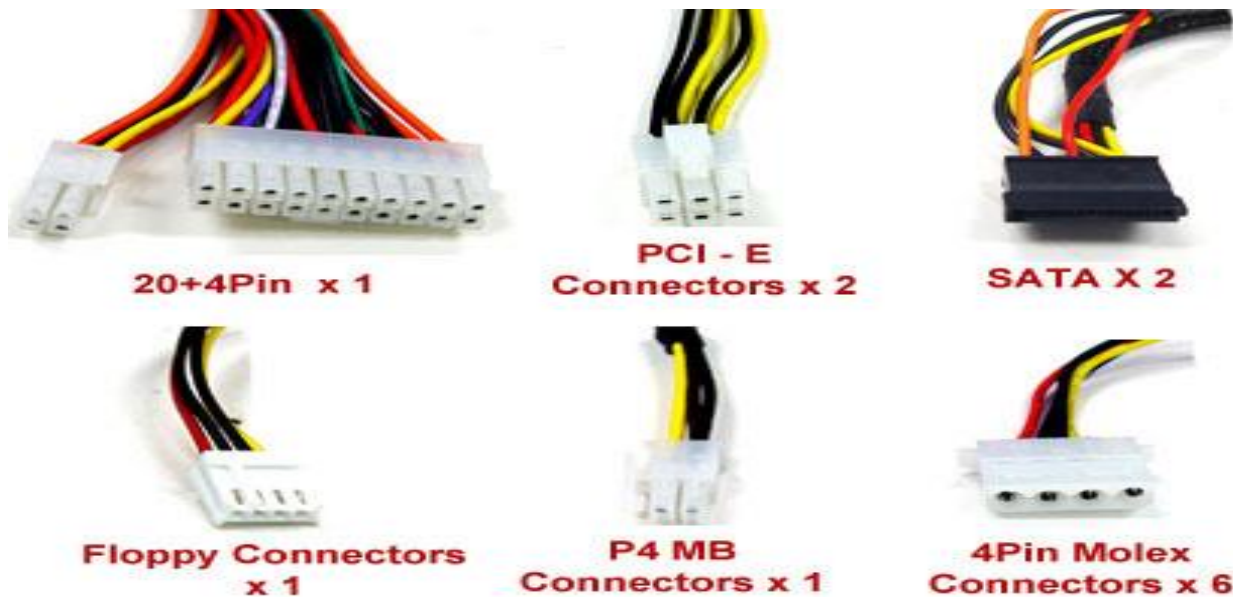
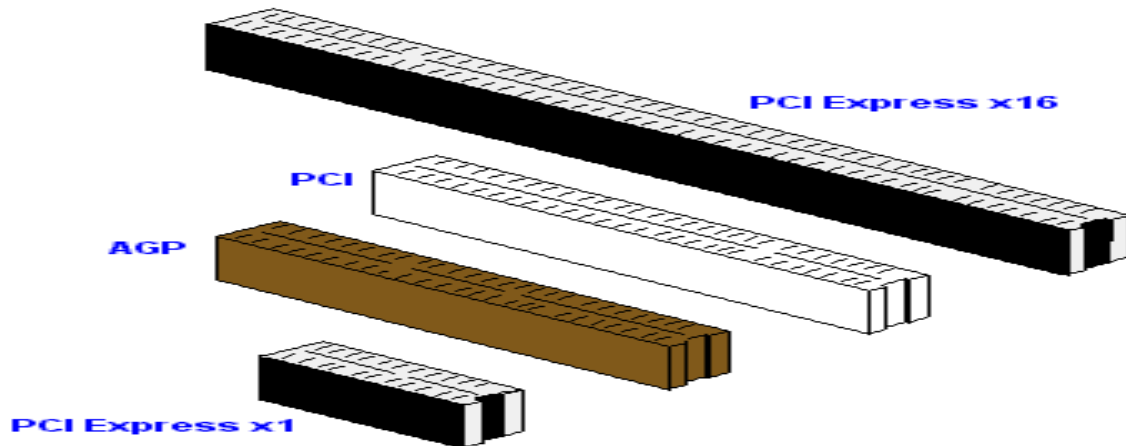
## **ISA, PCI & AGP SLOTS**

**ISA**, or Industry Standard Architecture, is an 8bit or 16bit parallel bus system that allowed up to 6 devices to be connected to a PC. Virtually all IBM-compatible PCs made before the Pentium were based on the ISA (IBM's PC AT) bus. This asynchronous bus architecture uses 16-bit addresses and an 8-MHz clock and handles a maximum data throughput of 2 MB/s to 3 MB/s.



**AGP**, Accelerates Graphics Port is a high-speed point-to-point channel for attaching a video card to a computer's motherboard. The primary advantage of AGP over PCI is that it provides a dedicated pathway between the slot and the processor rather than sharing the PCI bus.

**PCI**, Peripheral Component Interconnect bus uses a local bus system; this system is independent of the processor bus speed. The PCI architecture incorporates its own chip set which link the local bus to the main bus, these links are called bridges, there are two bridges which "north and south bridge"



## CHIPSET:

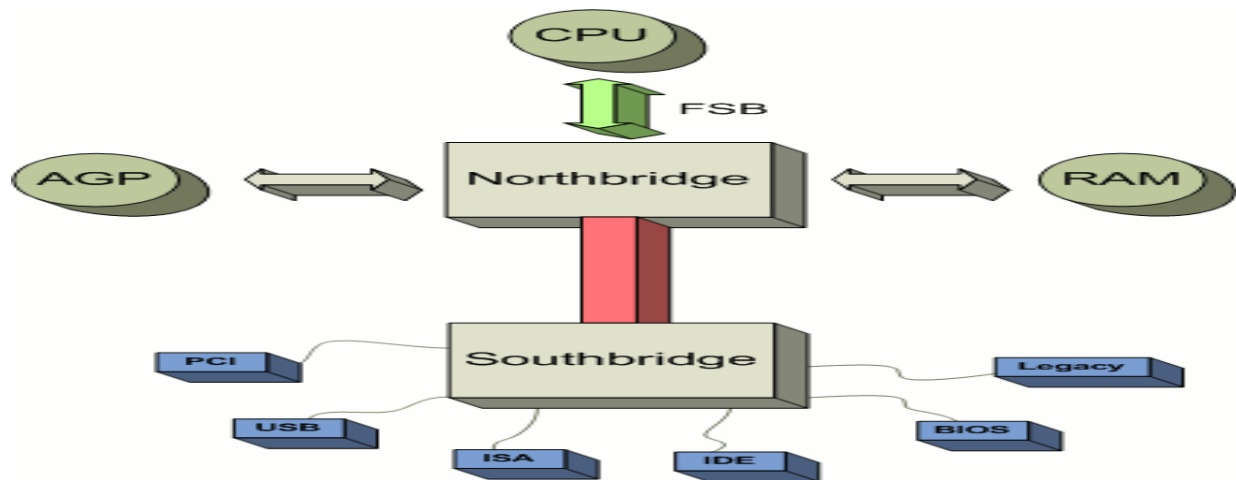
A chipset is a set of electronic components in an integrated circuit that manages the data flow between the processor, memory and peripherals. It is usually found in the motherboard of a computer. Chipsets are usually designed to work with a specific family of microprocessors. Because it controls communications between the processor and external devices, the chipset plays a crucial role in determining system performance.





## SOUTHBRIDGE:

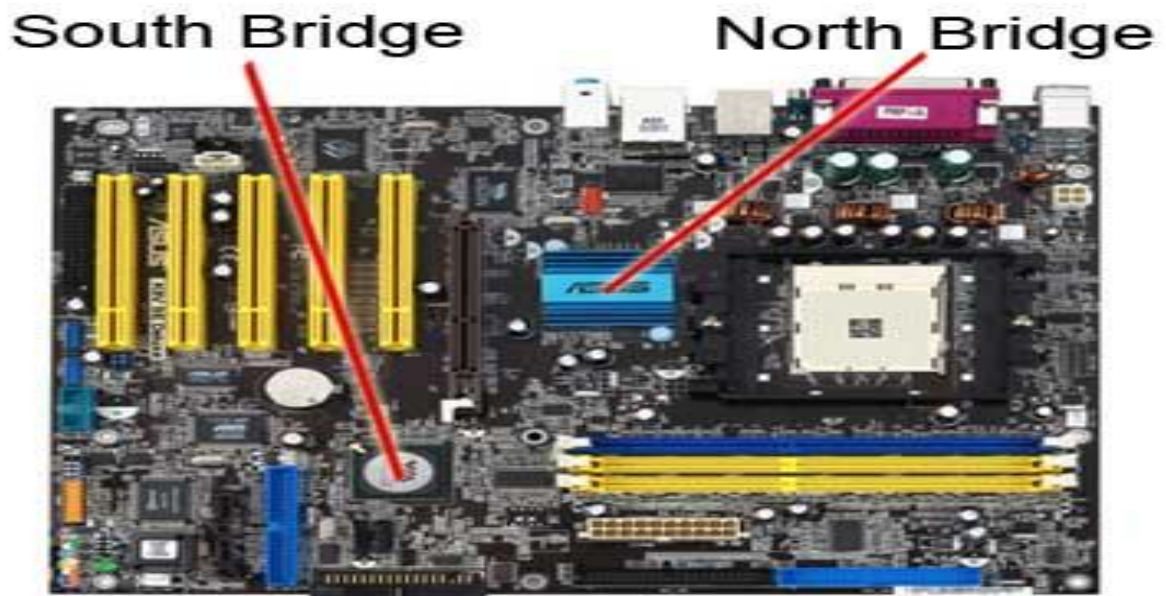
The southbridge is one of the two chips in the core logic chipset on a personal computer (PC) motherboard, the other being the northbridge. The southbridge typically implements the slower capabilities of the motherboard in a northbridge/southbridge chipset computer architecture.



## NORTHBRIDGE:

The northbridge typically handles communications among the CPU, in some cases RAM, and PCI Express (or AGP) video cards, and the southbridge.[4][5] Some northbridges also contain integrated video controllers, also known as a Graphics and Memory Controller Hub (GMCH) in Intel systems. Because different processors and RAM require different signaling, a given northbridge will typically work with only one or two classes of CPUs and generally only one type of RAM.





## GRAPHICAL DEVICES:

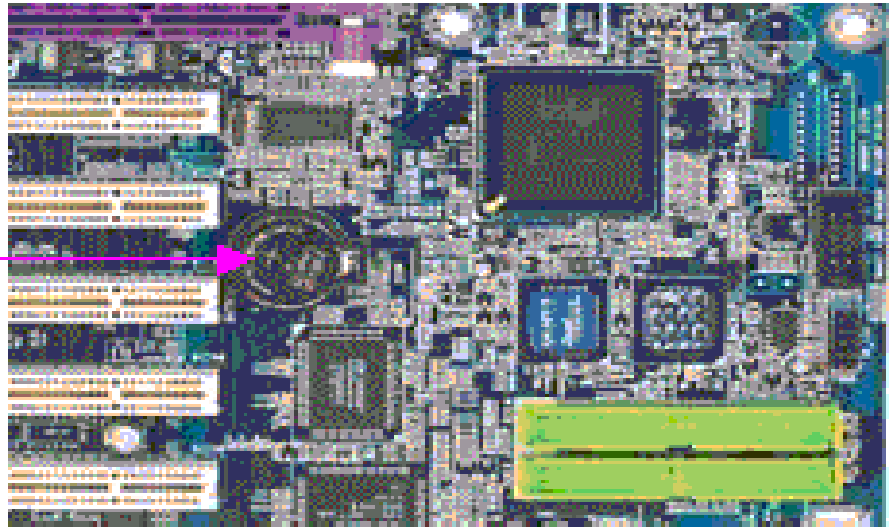
A video card (also called a video adapter, display card, graphics card, graphics board, display adapter or graphics adapter and sometimes preceded by the word discrete or dedicated to emphasize the distinction between this implementation and integrated graphics) is an expansion card which generates a feed of output images to a display (such as a computer monitor).



## CMOS Battery:

This is a 3 volt battery, this battery supplies the power to CMOS ram for CMOS ram to retain the information during system powered off, the battery may be last for 5 or 6 years

Battery



## ROM Bios:

Read-Only Memory can be read but *not changed*.

It is *non-volatile* storage: it remembers its contents even when the power is turned off.

ROM chips are used to store the instructions a computer needs during start-up, called *firmware*.

Some kinds of ROM are PROM, EPROM, EEPROM, and CD-ROM.

## Expansion Slot ( PCI type )

Expansion slot or Expansion bus is the slot that enable the user to add the adapter card for additional function to the system

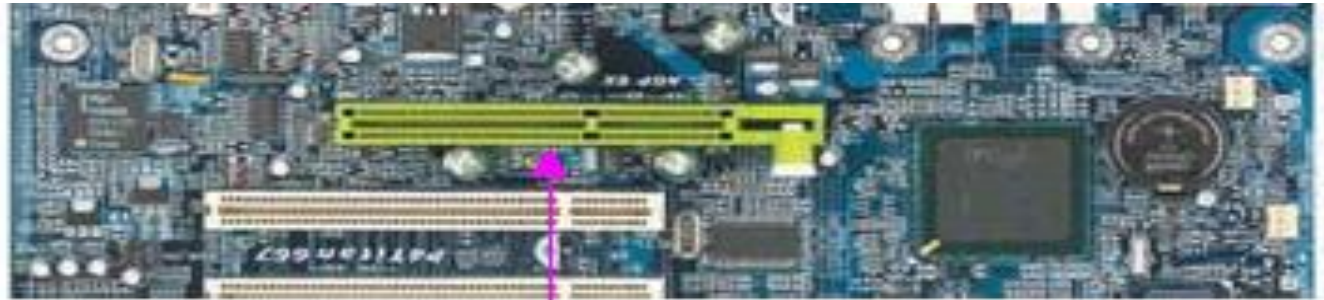
Ex.

- Sound card or Multimedia
- LAN card.
- SCSI controller card.
- Internal Modem card.
- TV tuner card.
- Additional hard disc controller card.



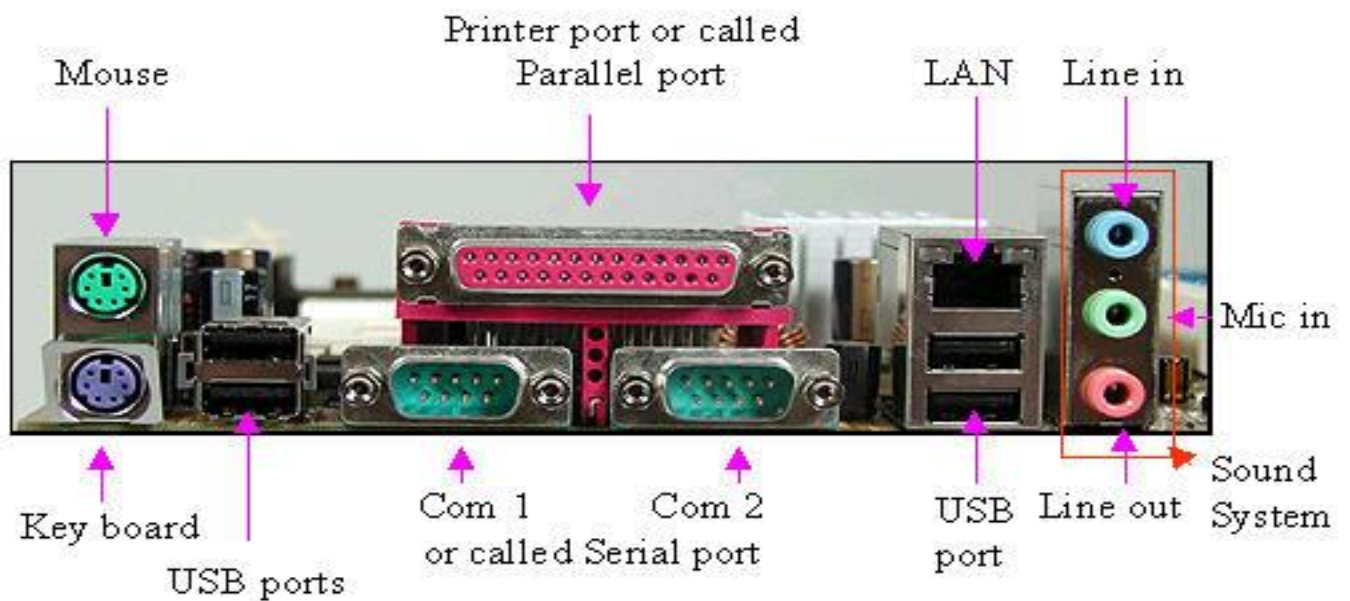
AGP Port :

AGP ( Accelerated Graphic Port ) port is a high speed data transfer port, this port is used by the display adapter card that demands so much data with in short period of time.



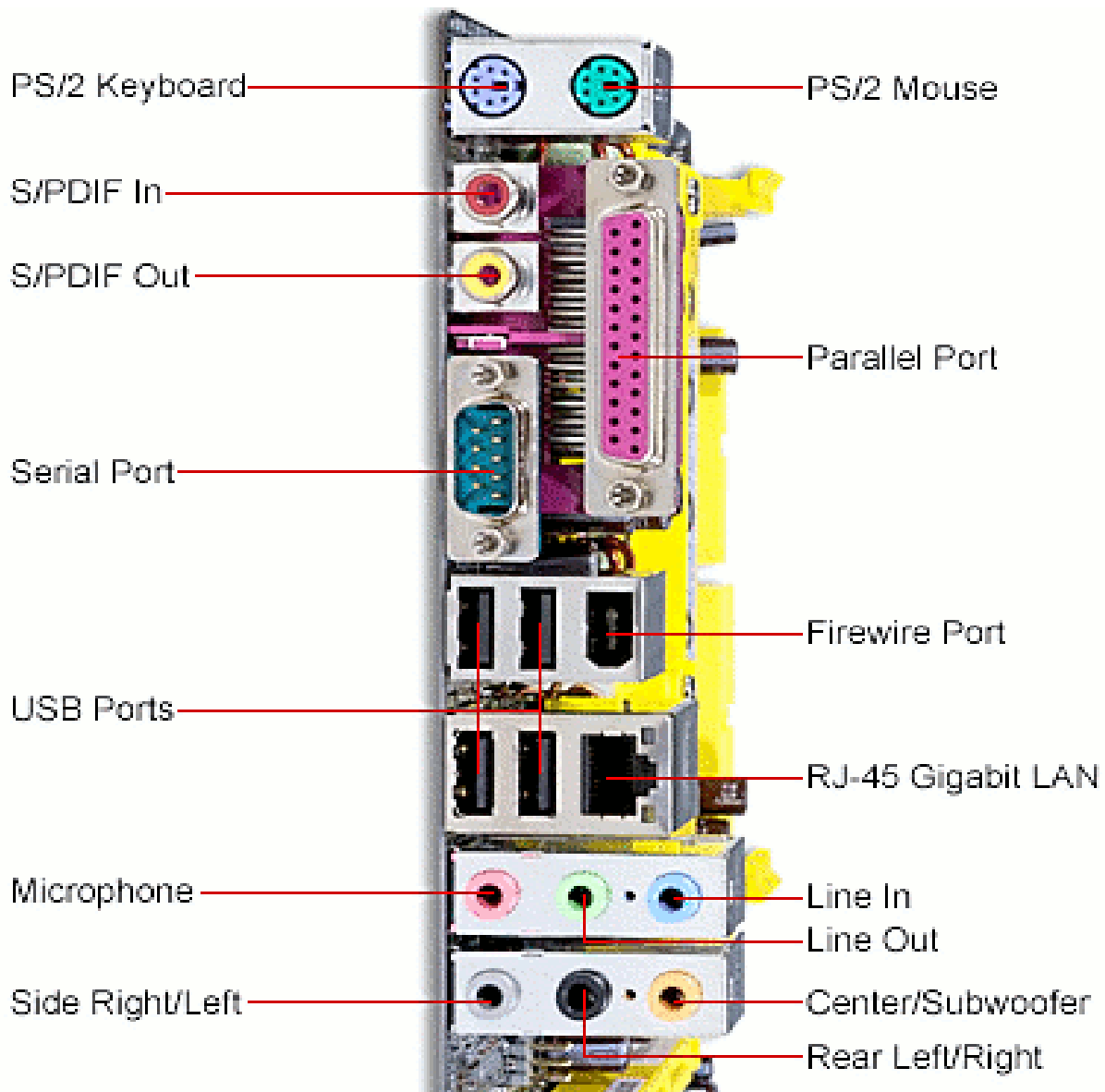
AGP port

### IO Connector/ ports



## **BACK PANEL CONNECTORS AND PORTS**





## 1.Serial Port:

serial communication physical interface through which information transfer serial ports to devices such as modems, terminals and various peripherals.

## **2. Parallel Port:**

It is also known as a printer port or Centronics port. It was an industry de facto standard for many years, and was finally standardized as IEEE 1284 in the late 1990s, which defined the Enhanced Parallel Port (EPP) and Extended Capability Port (ECP) bi-directional version

## **3. PS/2 port**

The PS/2 connector is a 6-pin mini-DIN connector used for connecting some keyboards and mice to a PC compatible computer system. Its name comes from the IBM Personal System/2 series of personal computers

## **4. USB Port**

It is play Port is a digital display interface developed by the Video Electronics Standards Association (VESA). The interface is primarily used to connect a video source to a display device such as a computer monitor,

## **5. VGA Port**

A Video Graphics Array (VGA) connector is a three-row 15-pin DE-15 connector. The 15-pin VGA connector is found on many video cards, computer monitors, and high definition television sets. On laptop computers or other small devices, a

mini-VGA port is sometimes used in place of the full-sized VGA connector.

## **6. Firewire Port**

IEEE 1394 is an interface standard for a serial bus for high-speed communications and isochronous real-time data transfer. It was developed in the late 1980s and early 1990s by Apple, who called it FireWire.

## **7. Modem Port**

Digital Visual Interface (DVI) is a video display interface developed by the Digital Display Working Group (DDWG). The digital interface is used to connect a video source, such as a display controller to a display device, such as a computer monitor. It was developed with the intention of creating an industry standard for the transfer of digital video content.

## **8 . DVI Port**

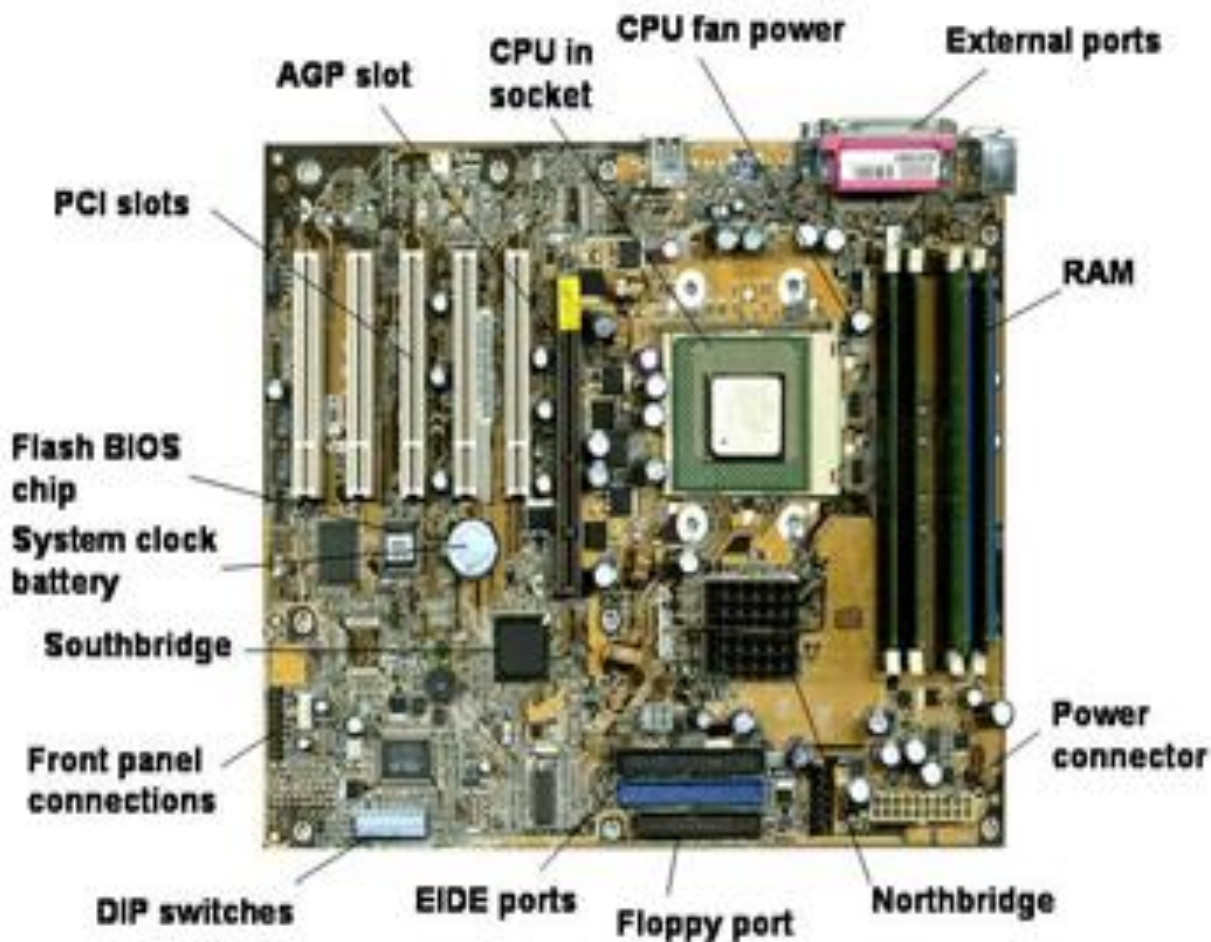
Digital Visual Interface (DVI) is a video display interface developed by the Digital Display Working Group (DDWG). The digital interface is used to connect

a video source, such as a display controller to a display device, such as a computer monitor.

### **Form Factor:**

- An important component of a motherboard is the microprocessor's supporting chipset, which provides the supporting interfaces between the CPU and the various buses and external components. This chipset determines, to an extent, the features and capabilities of the motherboard.
- Motherboard form factor
  - Determines the size of the board
  - Drives selection of power supply, case, CPU, cards
- ATX: most popular motherboard form factor
- BTX: the latest motherboard form factor
- Three types of motherboards you can select:
  - A board providing the most room for expansion
  - A board suiting the computer's current configuration
  - A board falling in between current and future needs





- There are two commonly known form factors AT and ATX.
- In AT “Baby AT” and in ATX “Mini ATX”, “Micro ATX” and “Flexi ATX” are different variants available.
- They differ mainly in size, type of power connector and switch.  
There are three parameters to be taken care.
  - ❑ First is the size of the motherboard should be compatible with Cabinet.

- ❑ Second, the motherboard should have suitable power socket to match the power supply.
- ❑ Third, the size of the Power supply should fit into the cabinet and have suitable power switch.

### **Types of FORM FACTORS:**

1. AT (Advanced Technology).
2. ATX(Advanced Technology Extension).
3. LPX.
4. NLX.
5. BTX(Balanced Technology Extension).

### **Form Factor Comparison**

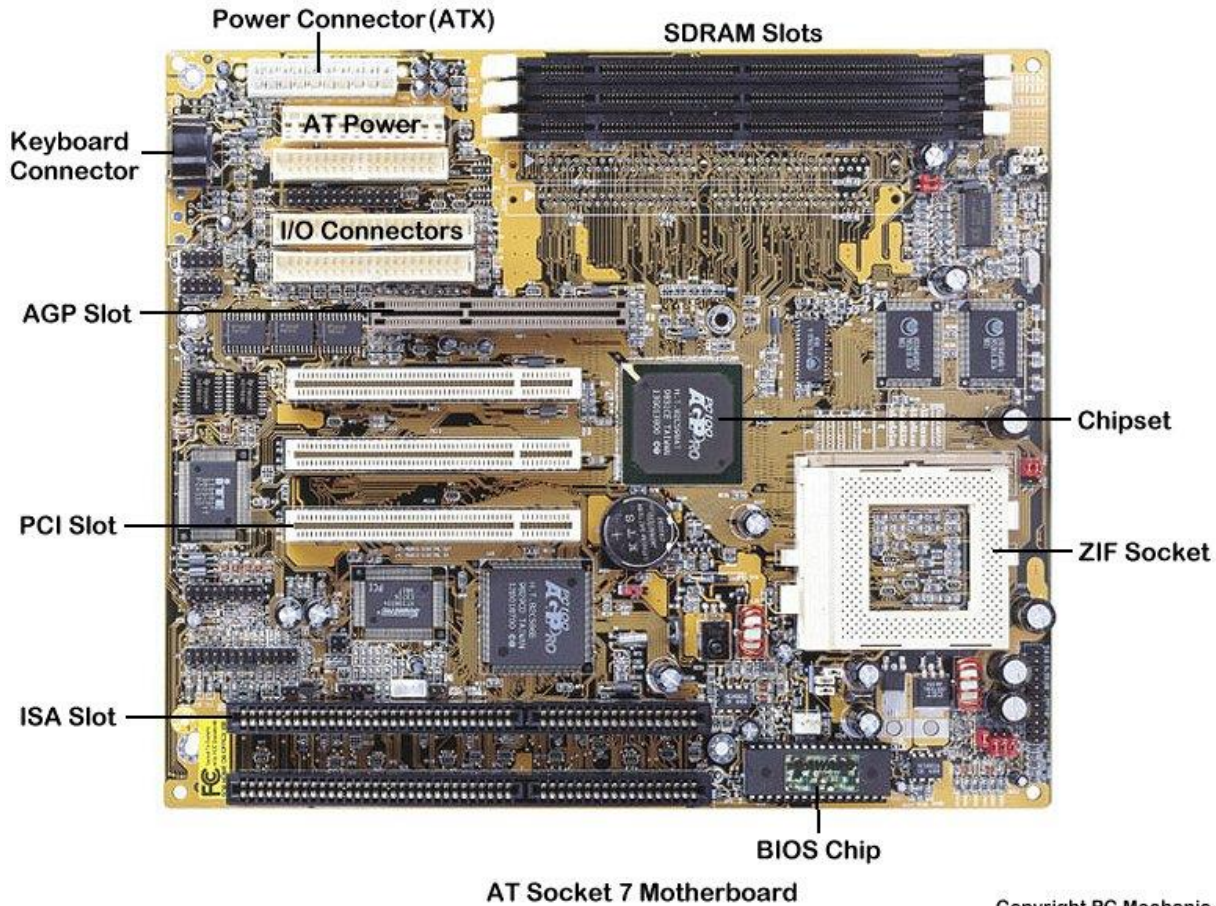
- NLX motherboard ( 340\*230\*10mm)
- BTX motherboard ( 325\*267\*10mm)
- ATX motherboard (305\*244\*10mm)
- Micro BTX motherboard (264\*267\*10mm)
- Micro ATX motherboard (244\*244\*10mm)

### **AT(Advanced Technology):**

1. Earlier IBM PC/XT used large Motherboards.
2. AT replaced PC/XT by reducing its size.
3. Its size is 12 inches (305 mm) wide and 13.8 inches (350 mm) deep.

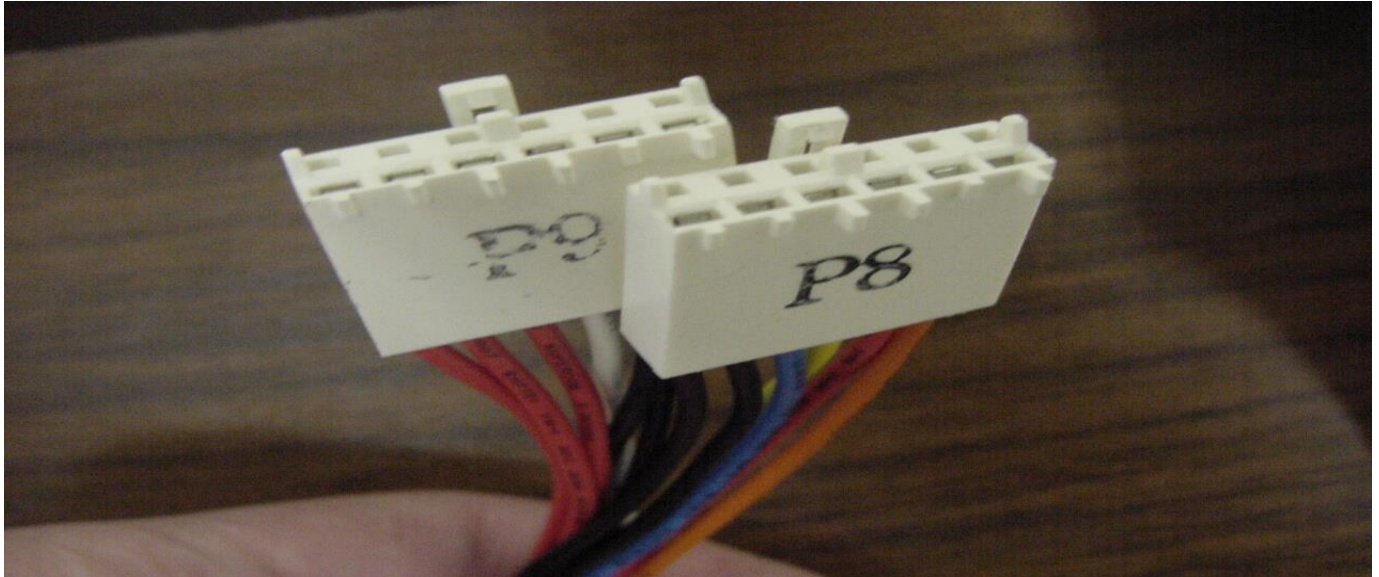
4. It belongs to family class 386 or earlier.
5. The AT had only a keyboard connector .
6. Expansion slots for add-on card backplates.

### AT Motherboard:

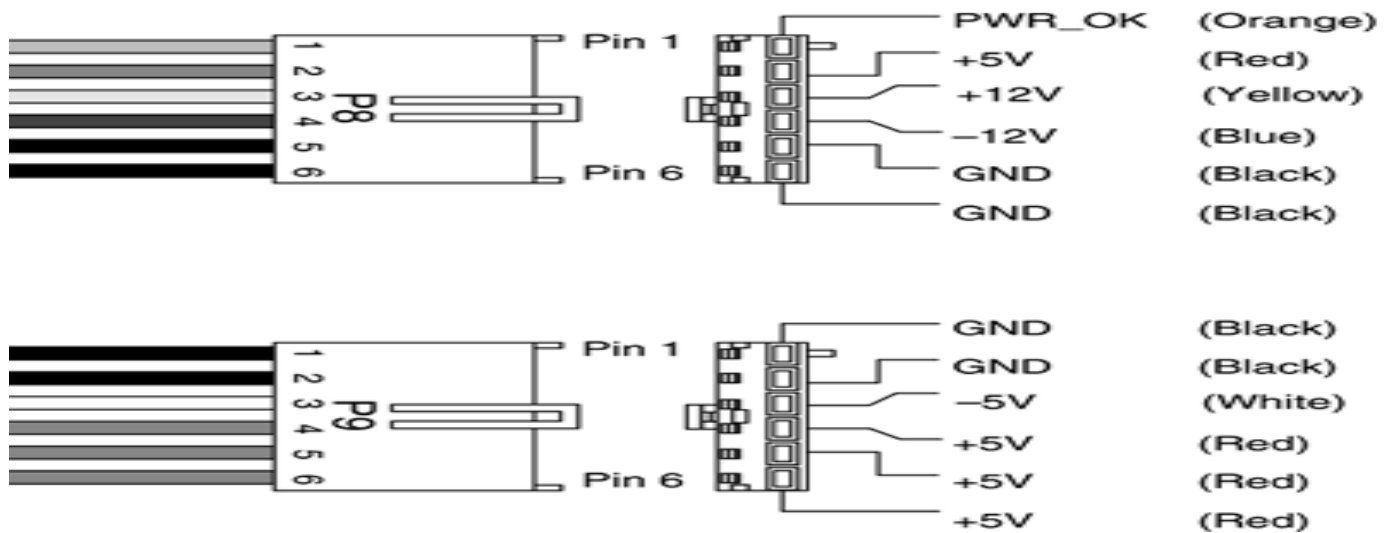


Copyright PC Mechanic

### Power Supply



## P8 and P9



## ATX form factor

- Advanced Technology Extension
- Standardized by Intel in 1995.
- See many update over the years



- Power
  - 20 pin connector
  - 24 pin connector, additional 4/8 pin connector.
- Port Type
  - Optional I/O back plate.
  - Add and remove as needed.
- 90 degree

### **ATX Specifications**

- Integrated I/O Port Connectors.
- Integrated PS/2 Mouse Connector.
- Reduced Expansion Card Interference.
- Better Power Supply Connector.
- "Soft Power" Support.
- 3.3V Power Support:
- Better Air Flow.
- Improved Design for Upgradability.

### **ATX Connectors**

- PS/2 port Connector.
- 25-pin Parallel port.
- 9-pin serial port.
- On-board peripheral ports are

Ethernet

FireWire

e-sata, audio (both analog and S/PDIF),

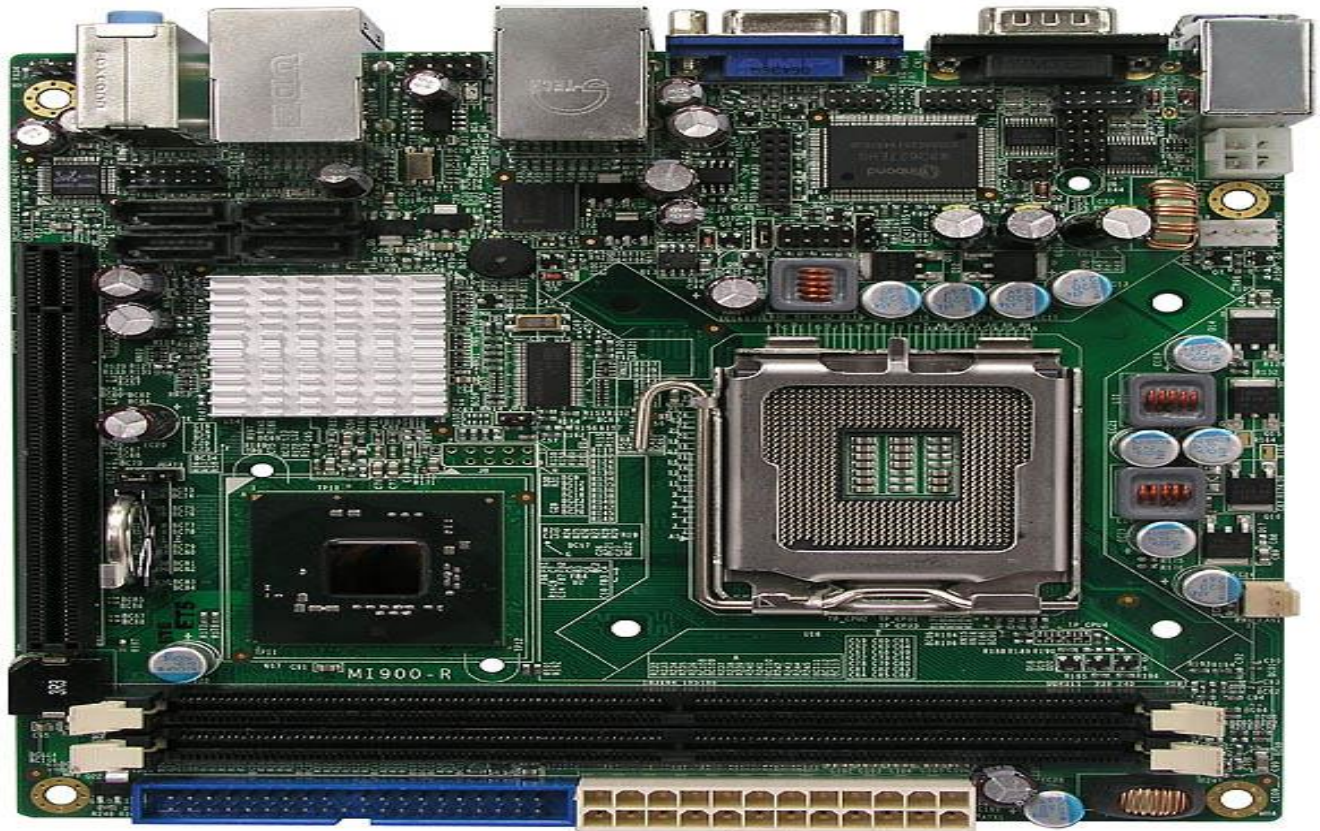
Video (analog D-sub, DVI, or HDMI),

USB ports.

### **Mini-ATX:**

- "Mini ATX" slightly smaller than ATX specification.
- It use same ATX form factor power supplies and cases.
- Main difference is in their size.
- Its size is 11.2"x8.2".
- Dimensions, and the placement of mounting holes.
- It is mainly intended for mini-PCs.

### **Mini-ATX Motherboard**



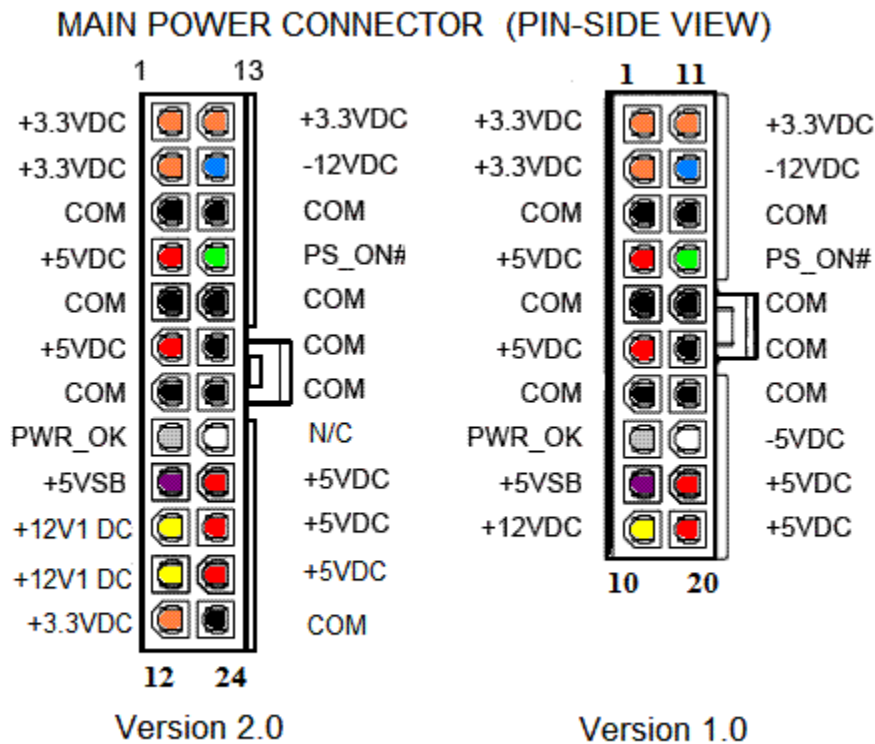
### **microATX motherboard:**

- Laptop computers generally use highly integrated, miniaturized and customized motherboards. This is one of the reasons that laptop computers are difficult to upgrade and expensive to repair.
- Often the failure of one laptop component requires the replacement of the entire motherboard, which is usually more expensive than a desktop motherboard due to the large number of integrated components.



## Power Supply for ATX





<http://www.smpspowersupply.com/>

## LPX

- LPX stands for Low Profile extension.
- Most distinguishing feature:

The *riser card* that is used to hold expansion slots.

- It has been updated and modernized to allow support for the latest technologies
- Its size is 9” wide and 11-13“ long.

### **Advantages of LPX**

- Inbuilt video display adapter cards .
- Their cost is low.
- They have onboard components like ATX.
- Adaption of raiser card.

### **Disadvantages of LPX**

- Non-standardization.
- Poor expandability.
- Poor upgradability.
- Poor cooling .
- Two or three expansion slots.
- Restricted air-flow

### **NLX**

- NLX stands for New Low Profile Extended.
- NLX still uses the same general design as LPX.
- It is designed to support larger memory modules and modern DIMM memory packaging.
- Support for the newest processor technologies, including the new Pentium II .
- Support for AGP video cards.

- Better thermal characteristics.
- Easy to maintain – Motherboard replacement without screws.
- More optimal location of CPU on the board to allow easier access and better cooling.
- More flexibility in how the motherboard can be set up and configured.
- Enhanced design features, such as the ability to mount the motherboard so it can slide in or out of the system case easily.
- Cables, such as the floppy drive interface cable, now attach to the riser card instead of the motherboard itself, reducing cable length and clutter.
- Support for desktop and tower cases.



## **BTX**

- It stands for Balanced Technology Extended .
- design strategies are

1. Power dissipation,
  2. Structural integrity,
  3. Motherboard design.
- Many straight lines.
  - Good Airflow.

## **Selecting a Motherboard**

### **Some questions to ask when picking a motherboard**

- What form factor does the motherboard use?
- Does the motherboard provide proper CPU support?
- What type of BIOS does the motherboard use?
- Does the board fit the case you plan to use?
- What is the warranty on the board?

### **Embedded (on-board) component**

- Component located on the board
- Avoid board with too many embedded components
- Such boards do not easily accept add-on devices

## **TYPE OF MOTHERBOARD:**

## 1. Non-Integrated Motherboards:

- Non-integrated Motherboards have assemblies such as the I/O port connectors (serial and parallel ports), hard drive connectors, floppy controllers and connectors, joystick connections etc installed as expansion boards
- This takes up one or more of the motherboard's expansion slots and reduces the amount of free space inside the computer case.
- Most of the older motherboards were Non-Integrated.
- Some of the later system boards began to integrate some of these assemblies right onto the circuit board.

## 2. Integrated Motherboards:

- Integrated Motherboards have assemblies that are otherwise installed as expansion boards, integrated or built right onto the board.
- The serial and parallel ports, the IDE and floppy drive, and joystick all connect directly to the motherboard.
- This is now standard on any latest model 486 and above.
- It tends to free up some space inside the case and allows for better accessibility and airflow

## 3. Embedded Motherboard:

- In an effort to reduce the cost (and size) of a computer system even more, manufacturers began integrating (or embedding) technologies such as video, sound, networking and modems right onto the system board.
- This dramatically increases the cost of the main board but reduces the cost of the overall system.

## RISC AND CISC

The main characteristics of CISC microprocessors are:

- Extensive instructions.
- Complex and efficient machine instructions.
- Microencoding of the machine instructions.
- Extensive addressing capabilities for memory operations.
- Relatively few registers.

In comparison, RISC processors are more or less the opposite of the above:

- Reduced instruction set.
- Less complex, simple instructions.
- Hardwired control unit and machine instructions.

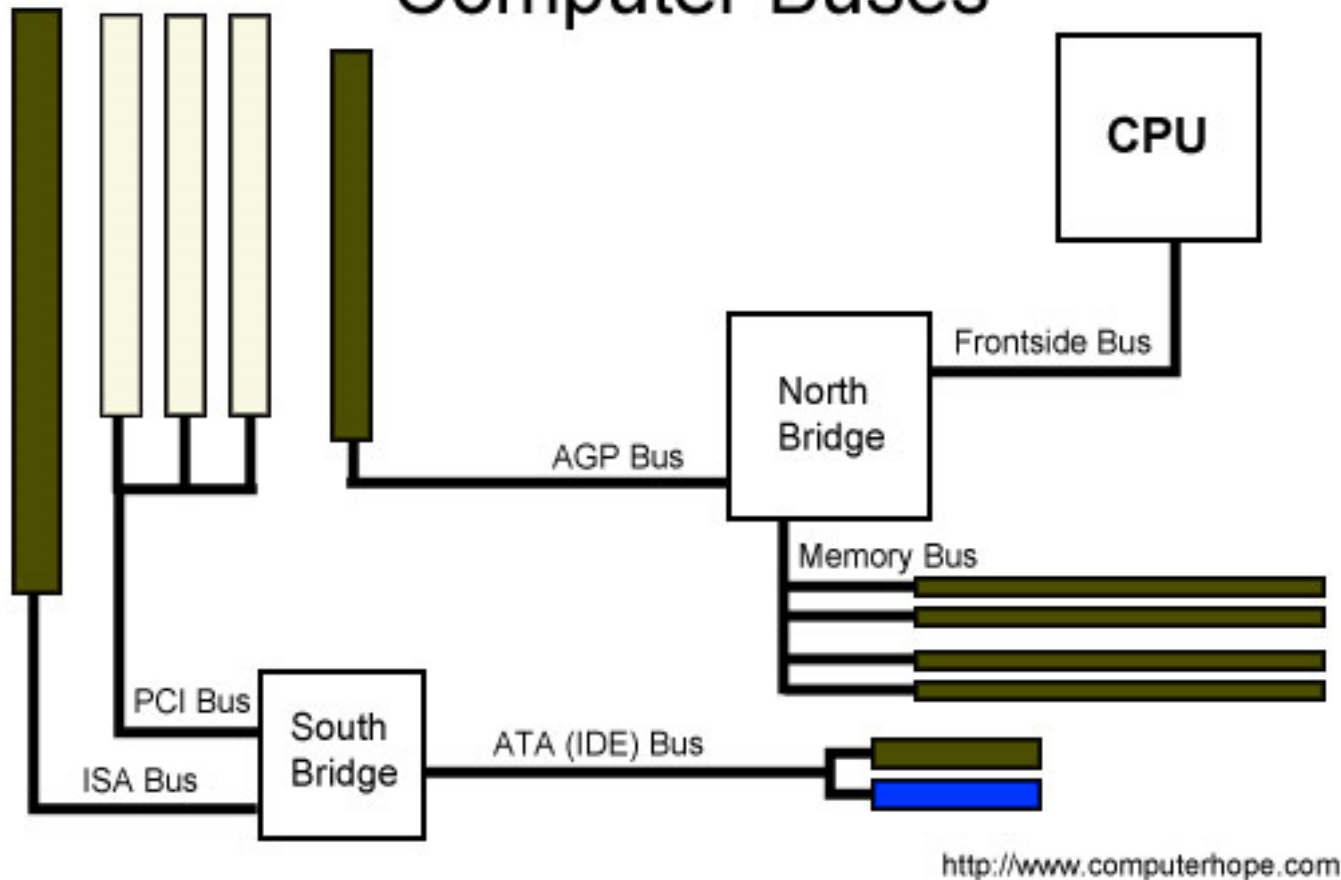
- Few addressing schemes for memory operands with only two basic instructions, LOAD and
- STORE
- Many symmetric registers which are organised into a register file.

<b>CISC</b>	<b>RISC</b>
Emphasis on hardware	Emphasis on software
Includes multi-clock complex instructions	Single-clock, reduced instruction only
Memory-to-memory: "LOAD" and "STORE" incorporated in instructions	Register to register: "LOAD" and "STORE" are independent instructions
Small code sizes, high cycles per second	Low cycles per second, large code sizes
Transistors used for storing complex instructions	Spends more transistors on memory registers

## **BUS**

- A data connection between two or more devices connected to the computer.
- For example, a bus enables a computer processor to communicate with the memory or a video card to communicate with the memory.
- A bus is capable of being a parallel or serial bus

## Computer Buses



## ISA (Industry Standard Architecture)

- An Industry Standard Architecture bus (ISA bus) allows additional expansion cards to be connected to a computer's motherboard.
- It is a standard bus architecture for IBM compatibles.



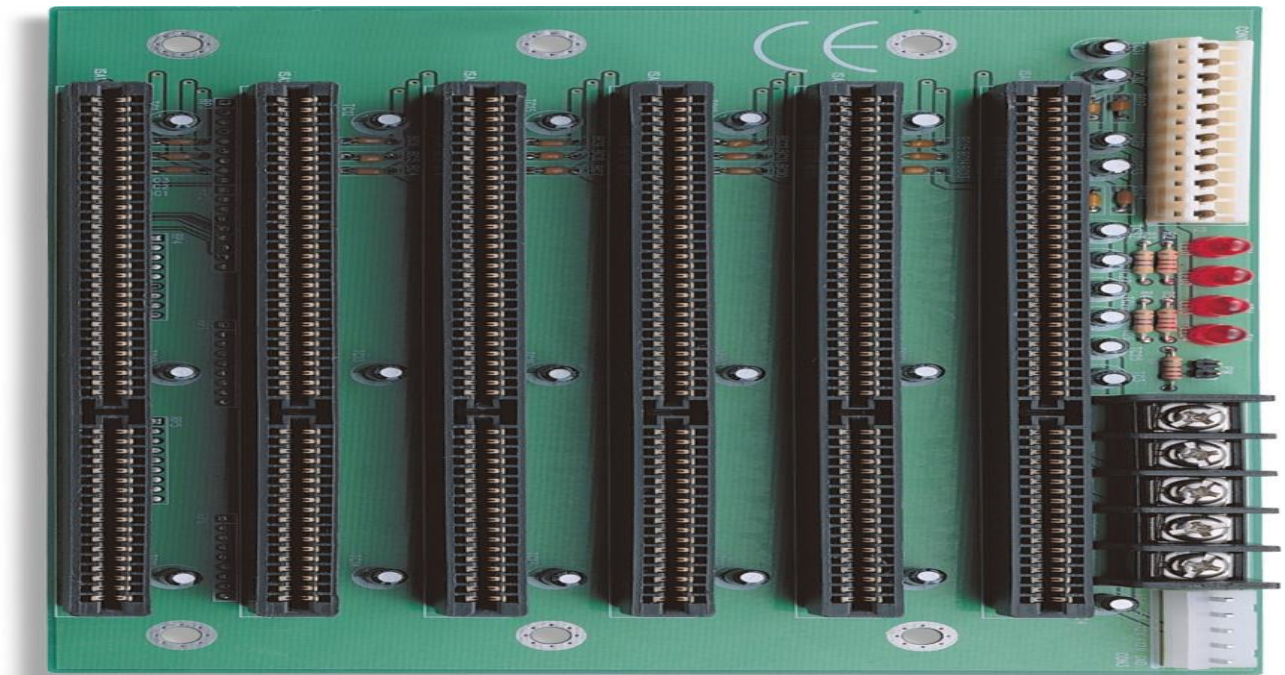
Introduced in 1981, the ISA bus was designed to support the Intel 8088 microprocessor for IBM's first-generation PC.

- 

In the late 1990s the faster peripheral component interconnect (PCI).

Soon afterwards, use of the ISA bus began to diminish, and most IBM motherboards were designed with PCI slots.

- Although there are still a few motherboards being made with ISA slots, these are generally referred to as the legacy bus motherboards

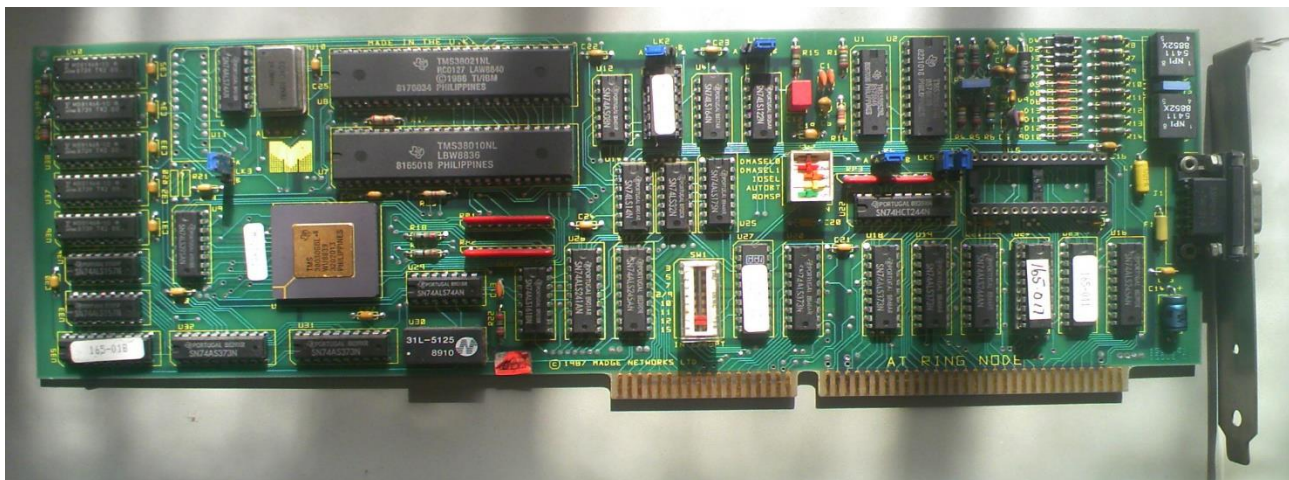


## Features

- 16-bit characteristics.
- It supported 16-bit peripheral devices.

- Five devices with 16-bit interrupt request (IRQ) could be connected at the same time.
- Also, three additional devices could be connected parallel to five devices with 16-bit IRQ.
- 16-bit direct memory access (DMA) channel.
- The CPU clock speed varied from 16 to 20 MHz.
- **Advantages**
  - Low cost
  - Compatibility
  - Used widely
- **Disadvantages**
  - Low speed
  - Jumpers and DIP switches
  - Becoming out-dated
- **Applications:**
  - The ISA bus allowed the computer to automatically detect and setup computer ISA peripherals, such as a modem or sound card.
  - Using the PnP technology, an end-user would have the capability of connecting a device and not having to configure the device using jumpers or dip switches.

- **EISA (Extended Industry Standard Architecture)**
- Extended Industry Standard Architecture (EISA) is a bus architecture that extends the Industry Standard Architecture (ISA) from 16 bits to 32 bits.
- EISA was introduced in 1988 by the Gang of Nine - a group of PC manufacturers.
- These competitors were AST Research , Compaq, Epson, Hewlett Packard , NEC, Olivetti, Tandy, WYSE, and Zenith Data Systems.
- EISA was designed to compete with IBM's Micro Channel Architecture (MCA) - a patented 16 and 32-bit parallel computer bus for IBM's PS/2 computers.
- EISA extended the advanced technology (AT) bus architecture and facilitated bus sharing between multiple central processing units (CPU).EISA is also known as Extended ISA.



# Advantages

- **ISA Compatibility:** ISA cards will work in EISA slots.
- **32 Bit Bus Width:** Like MCA, the bus was expanded to 32 bits.
- **Bus Mastering:** The EISA bus supports bus mastering adapters for greater efficiency, including proper bus arbitration.
- **Plug and Play:** EISA automatically configures adapter cards, similar to the Plug and Play standards of modern systems

## • Disadvantages

- It never became widely used .
- It is no longer found in computers today.
- **VESA (Video Electronics Standard Association)**
- Stands for "VESA Local Bus." (VESA stands for "Video Electronics Standards Association").
- The VLB, or VL-bus is a hardware interface on the computer's motherboard that is attached to an expansion slot.

- By connecting a video expansion card to the VLB, you can add extra graphics capabilities to your computer.
- The interface supports 32-bit data flow at up to 50 MHz.
- Though the VLB architecture was popular in the early 1990s, it has since been replaced by the newer and faster, but still three-lettered, ISA, PCI, and AGP slots.
- **Advantages**
  - VLB video cards provide, in general, *much* better performance than ISA cards.
  - This is primarily due to the fact that the 32-bit local bus used by VLB cards allows for several times more data throughput between the card and the processor than ISA allows.
  - VLB has however had its own share of problems. In particular, VLB video cards may cause reliability problems in motherboards running at 40 or 50 MHz .
  - Many VLB cards are very good performers, but are hampered by their general age, along with that of the motherboards they run in; most are at least four years old

and new development of better and faster chipsets is entirely in the PCI world now.

- Still, despite the fact that VLB is older than PCI, it can provide quite acceptable performance (although probably fewer features and less video memory).
- VLB is much closer to PCI than it is to ISA. Any system that will support VLB should be using it for the video card .
- The performance improvement over ISA is substantial in most cases.
- **Disadvantages**
- **80486 dependence.** The VESA Local Bus relied heavily on the Intel 80486 CPU's memory bus design.
- **Limited number of slots available.** Most PCs that used VESA Local Bus had only one or two VLB capable ISA slots from the 5 or 6 available (thus 4 ISA slots generally were just that, ISA only).
- **Reliability problems.** The strict electrical limitations on the bus also reduced any "safety margin" available - negatively influencing reliability.
- **Limited scalability.** As bus speeds of 486 systems increased, VLB stability became increasingly difficult to manage.
- **Installation woes.** The length of the slot and number of pins made VLB cards notoriously difficult to install and remove.

## **PCI (Peripheral Component Interconnect)**

- PCI (Peripheral Component Interconnect) is an interconnection system between a microprocessor and attached devices in which expansion slots are spaced closely for high speed operation.
- Using PCI, a computer can support both new PCI cards while continuing to support Industry Standard Architecture (ISA) expansion cards, an older standard
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- Using PCI, a computer can support both new PCI cards while continuing to support Industry Standard Architecture (ISA) expansion cards, an older standard
- For image processing, PCI lets applications stream live video to a display or system memory, virtually eliminating the need for costly onboard memory.
- For example, a video camera that sends 30 frames/s produces data streams of 10 to 40 MB/s, far outpacing ISA's capacity of 3 to 5 MB/s of continuous data.
- **Advantages**
  - very high speed.
  - Plug & Play.
  - Dominant board-level bus
- **Disadvantages**



- Incompatible with older systems
- Can cost more

PARAMETERS	PCI	PCI-E	PCI-X
<ul style="list-style-type: none"> <li>• Stands For</li> </ul>	<ul style="list-style-type: none"> <li>• Peripheral Component</li> <li>• Interconnect</li> </ul>	<ul style="list-style-type: none"> <li>• Peripheral Component</li> <li>• Interconnect</li> <li>• Express</li> </ul>	<ul style="list-style-type: none"> <li>• Peripheral Component</li> <li>• Interconnect</li> <li>• Extended</li> </ul>
<ul style="list-style-type: none"> <li>• Format</li> </ul>	<ul style="list-style-type: none"> <li>• 32-Bit OR</li> <li>• 64-Bit</li> </ul>	<ul style="list-style-type: none"> <li>• 32-Bit</li> </ul>	<ul style="list-style-type: none"> <li>• 64-Bit</li> </ul>
<ul style="list-style-type: none"> <li>• Style</li> </ul>	<ul style="list-style-type: none"> <li>• Parallel</li> </ul>	<ul style="list-style-type: none"> <li>• Serial</li> </ul>	<ul style="list-style-type: none"> <li>• Parallel</li> </ul>
<ul style="list-style-type: none"> <li>• Hot Plugging</li> <li>• Interface</li> </ul>	<ul style="list-style-type: none"> <li>• Optional</li> </ul>	<ul style="list-style-type: none"> <li>• Optional</li> </ul>	<ul style="list-style-type: none"> <li>• Required</li> </ul>
<ul style="list-style-type: none"> <li>• Speed</li> </ul>	<ul style="list-style-type: none"> <li>• 133MBps</li> </ul>	<ul style="list-style-type: none"> <li>• 250MBps-31.51GBps</li> </ul>	<ul style="list-style-type: none"> <li>• 1084MBps</li> </ul>
•	•	•	•

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## USB(Universal Serial Bus)

- Short for *Universal Serial Bus*, an external bus standard that supports data transfer rates of 12 Mbps.
- A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards.
- USB also supports *Plug-and-Play* installation and *hot plugging*. Starting in 1996, a few computer manufacturers started including USB support in their new machines.
- It wasn't until the release of the best-selling iMac in 1998 that USB became widespread. It is expected to completely replace serial and parallel ports.

Data	
<b>Data signal</b>	Packet data, defined by specifications
<b>Width</b>	1 bit
<b>Bitrate</b>	1.5/12/480/5,000/10,000 Mbit/s (depending on mode)
<b>Max. devices</b>	127
<b>Protocol</b>	Serial
Pin out	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Standard A</p>  </div> <div style="text-align: center;"> <p>Standard B</p>  </div> </div> <p>The standard USB A plug (left) and B plug (right)</p>	
<b>Pin 1</b>	Vcc (+5 V)
<b>Pin 2</b>	Data-
<b>Pin 3</b>	Data+
<b>Pin 4</b>	Ground

# Features

- The Personal Computer works as a Host.
- The Low-powered devices can draw their power from the host via USB. If we have to connect a high power device then we have to use external adapter.
- USB cable has two twisted pairs of wires. One for the data transfer and the other for power transfer.
- We can connect maximum 127 USB devices to a host via USB hubs.
- USB devices are hot swappable That means we do not have to turn off, On or restart our computer when connecting or disconnecting a USB device.
- When the computer enters in power saving mode, USB devices also put to sleep by the computer.


## • Advantages

- Much more **resistant** to scratches unlike CD Roms and floppies.
- Much more **convenient**, will work with almost any computer as long as there is a flash drive.
- Great **storage** space.
- It's *small size* is convenient for carrying, and takes little space.
- One can purchase a USB that more reflects them through its **colors and design**.

## Disadvantages

- It's *small size* also means it can be lost easily and/or forgotten.
- Its life span can be **short**, about several hundred thousand cycles.
- As the device ages the **speed of writing** process gradually **slows**.
- Only a few USB flash drives are equipped with a *write-protect mechanism*, meaning those that don't have the protection could be contaminated by what ever virus the computer it was connected to has.
- If inappropriately removed from the USB drive without being ejected, it become damaged or lose the data saved to it.
- **Application**
- Today, SuperSpeed USB 3.0 provides the highest standard in USB performance—up to 10 times faster than High-Speed USB 2.0, with a design data rate of five Gbps. In addition, Super Speed USB dramatically reduces the power necessary to transfer large amounts of data.
- This latest version of USB retains full backward compatibility with previous generations, so existing platforms and devices will plug-and-play equally well with newer platforms and devices that support Super Speed USB.
- Portable devices such as handhelds, cell phones, and digital cameras that connect to PCs as USB peripherals benefit from having additional capabilities to connect to other USB devices directly using USB On-The-Go (OTG) technology.

- **FIREWIRE**
- FireWire is a method of transferring information between digital devices, especially audio and video equipment.
- Also known as IEEE 1394, FireWire is fast -- the latest version achieves speeds up to 800 Mbps.
- At some time in the future, that number is expected to jump to an unbelievable 3.2 Gbps when manufacturers overhaul the current FireWire cables.
- You can connect up to **63 devices** to a FireWire bus. Windows operating systems (98 and later) and Mac OS (8.6 and later) both support it.

	
Type	Serial
Production history	
Designer	Apple Inc. (1394a/b), IEEE P1394 Working Group
Designed	1994 <sup>[citation needed]</sup>
Manufacturer	Various
Produced	1994–present

General specifications	
Length	4.5 meters maximum
Width	1
Hot pluggable	Yes
Daisy chain	Yes, up to 63 devices
External	Yes
Pins	4, 6, 9, 12
Electrical	
Max. voltage	30 V
Max. current	1.5 A
Data	
Data signal	Yes
Bitrate	400–3200 Mbit/s (50–400 MB/s)

## Features

- A simple common plug-in serial connector on the back of your computer and on many different types of peripheral devices
- A thin serial cable rather than the thicker parallel cable you now use to your printer, for example
- A very high-speed rate of data transfer that will accommodate multimedia applications (100 and 200 megabits per second today; with much higher rates later)
- Hot-plug and plug and play capability without disrupting your computer
- The ability to chain devices together in a number of different ways without terminators or complicated set-up requirements
- **Advantages**
- Simple cabling.
- Lower cost compared to parallel and Camera Link standards.
- Does not require camera files.
- Supports a variety of frame rates and image sizes.
- Supports multiple cameras on a single frame grabber.
- Available on PCMCIA cards for laptop us.
- Does not require National Instruments hardware.

- **Disadvantages**

- Slower data transfer rate - up to 400 Mbps for 1394a, up to 800Mbps for 1394b (dependent on camera, IEEE 1394 interface hardware, and operating system support).
- No onboard memory for saving images.
- Less triggering support.
- Difficult to synchronize with other devices.

## **Application**

- FireWire helped fuel a revolution for digital content creators, and was awarded a 2001 Primetime Emmy Engineering Award by the Academy of Television Arts & Sciences for its contribution.
- Due to its high bandwidth and support of both isochronous and asynchronous data delivery, FireWire has found a very successful place in both the computer and consumer electronics industries.
- Whether connecting game consoles, personal video recorders, home stereo equipment, digital TVs, hard drives, CD/DVD-RW drives, printers, scanners, tape drives or other digital hardware equipment, FireWire is well-suited to handle all these various requirements.
- With the advent of the new FireWire 800 standard, the revolution created by the original will only grow.
- For those working with digital video, the new standard will enable new bandwidth-intensive applications, such as multiple-stream, uncompressed, standard-definition video.