Motherboards

Prepared & Presented by

Professor Gupta

Motherboard

Audio chip

Input-output connectors

PCI extension slots

AGP

Motherboard power supply connector

Chipset (1)

Processor support

Chipset (2)

Processor power supply connector

RAM connectors

CMOS battery

BIOS

Jumpers   Disk drive and floppy drive connectors

Case fan power supply connector
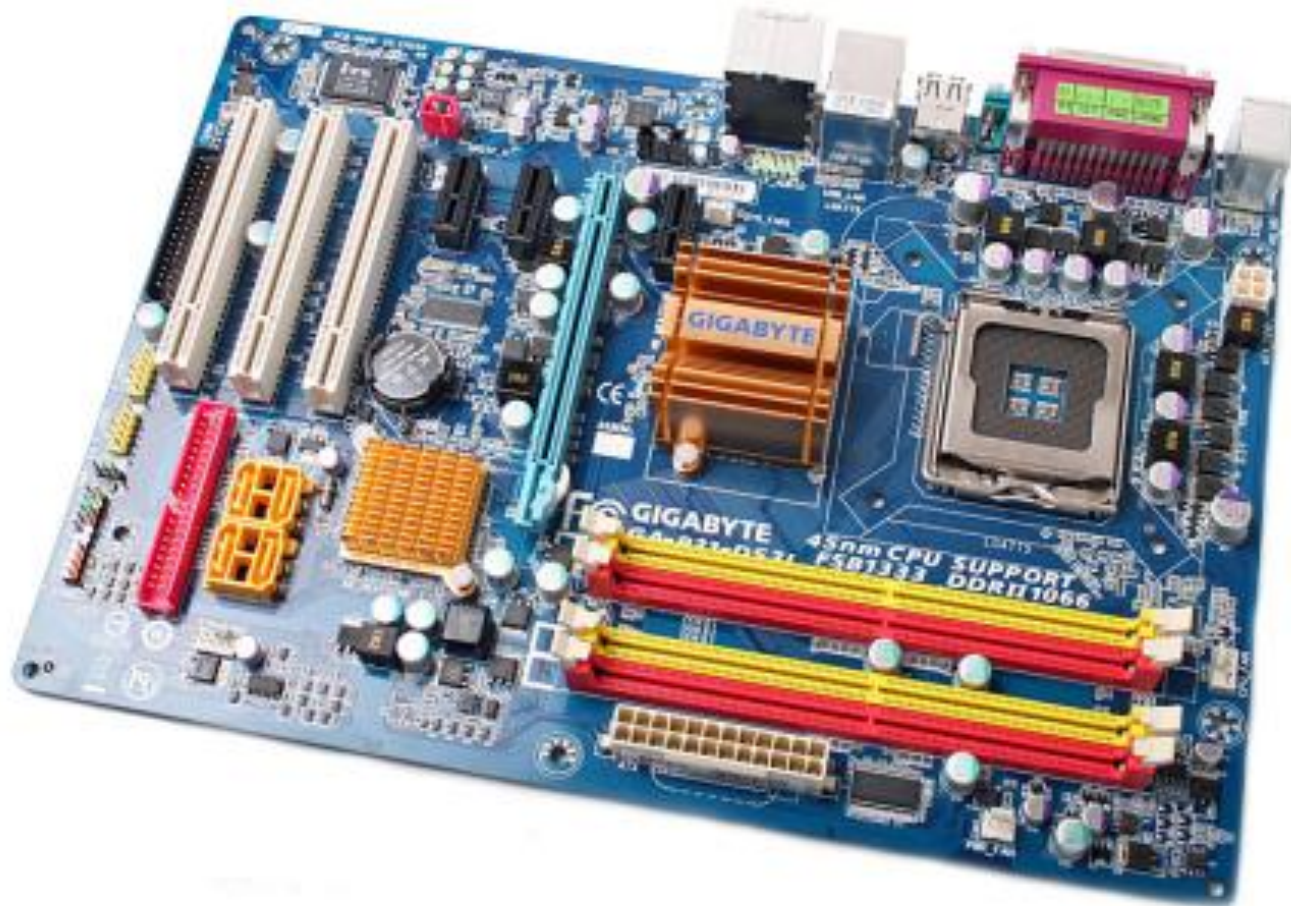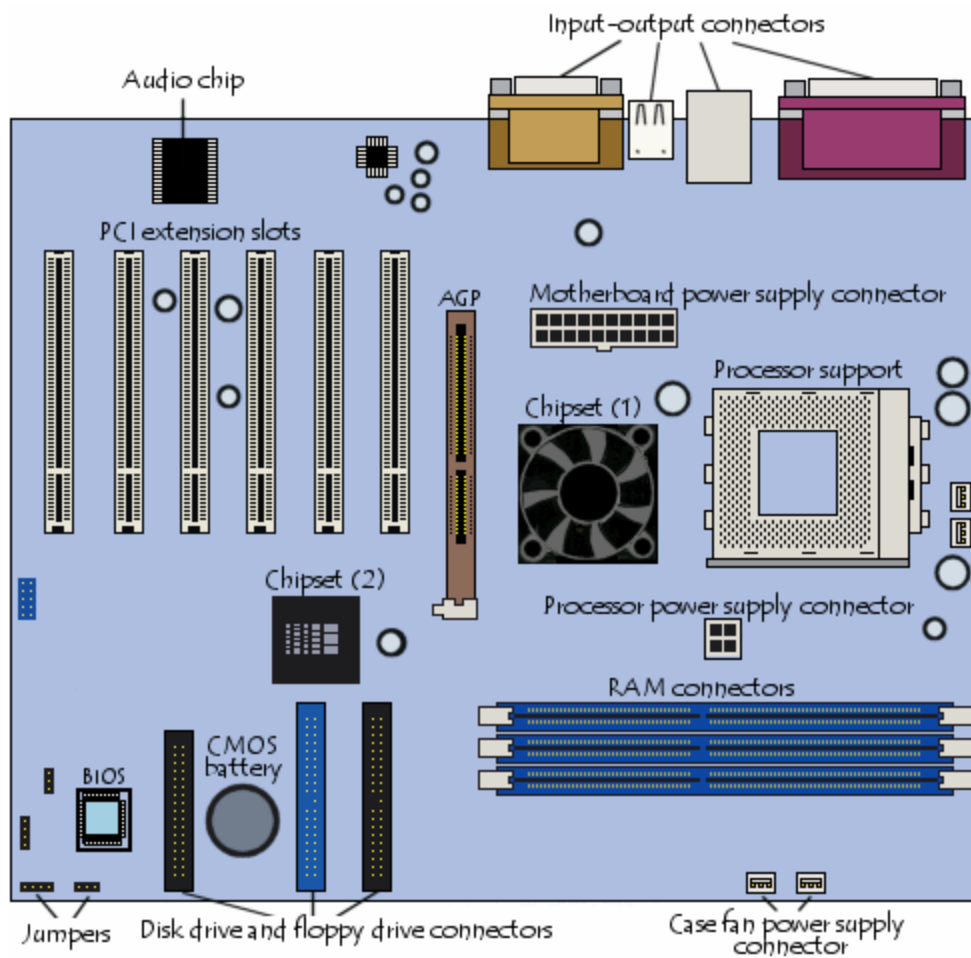
The primary component of a computer is the motherboard (sometimes called the "*mainboard*"). The motherboard is the hub which is used to connect all of the computer's essential components.

Motherboards

■ Everything that makes a computer a computer must be attached to the motherboard. From the CPU to storage devices, from RAM to printer ports, the motherboard provides the connections that help them work together.

■ The motherboard is essential to computer operation in large part because of the two major buses it contains: the system bus and the I/O bus. Together, these buses carry all the information between the different parts of the computer.

■ **Components:** Socket 775 processor; Dual-channel DDR2 memory slots; Heat sink over North Bridge; 24-pin ATX v2.0 power connector; South Bridge chip; PCI slots; PCI Express x16 slot; PCI Express x1 slot; CMOS battery; Port cluster; SATA host adapter; Floppy drive controller; PATA host adapter; 4-pix ATX12 power connector; Mounting holes.

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AT & ATX Motherboard form factor

The term "form factor" is normally used to refer to the motherboard's geometry, dimensions, arrangement, and electrical requirements. In order to build motherboards which can be used in different brands of cases, a few standards have been developed:

- AT baby/AT full format is a format used in the earliest 386 and 486 PCs. This format was replaced by the ATX format, which shape allowed for better air circulation and made it easier to access the components;

- ATX: The ATX format is an upgrade to Baby-AT. It was intended to improve ease of use. The connection device on an ATX motherboard is designed to make plugging in peripherals as easy as possible (for example, the IDE connectors are located beside the disks.) What's more, motherboard components are arranged in parallel, so as to improve heat removal.

Continued…

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ATX form factor Formats

o ATX standard: The ATX standard format is traditionally 305x244 mm. It includes an AGP connector and 6 PCI connectors.

o Micro-ATX: The microATX format is an upgrade to ATX, which has the same primary advantages in a smaller format (244x244 mm), with a lower cost. Micro-ATX includes an AGP connector and 3 PCI connectors.

o Flex-ATX: FlexATX is an expansion of microATX which offers manufacturers greater flexibility when designing their computers. It includes an AGP connector and 2 PCI connectors.

o Mini-ATX: miniATX is a compact alternative to the format microATX (284x208 mm), and includes an AGP connector and 4 PCI connectors instead of 3 that come with microATX. It is mainly intended for mini-PCs (barebone computers).

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BTX and ITX form factors

BTX: The BTX format (*Balanced Technology eXtended*), supported by Intel, is a format designed to improve upon the arrangement of components, so as to optimize air circulation, acoustics, and heat dissipation. The various connectors (memory slots, expansion slots) are aligned in parallel, in the direction in which air circulates. Additionally, the microprocessor is located in the front end of the case, by the air intake, where the air is freshest. The BTX power cord is the same as with ATX power supplies. The BTX standard defines three formats:

o BTX standard, with standard dimensions of 325x267 mm;

o Micro-BTX, with small dimensions (264x267 mm);

o Pico-BTX, with much smaller dimensions (203x267 mm).

ITX: The ITX format (*Information Technology eXtended*), supported by Via, is an compact format designed for miniature configurations such as mini-PC.

o Mini-ITX, with small dimensions (170x170 mm) and a PCI slot;

o Nano-ITX, with small dimensions (120x120 mm) and a miniPCI slot.

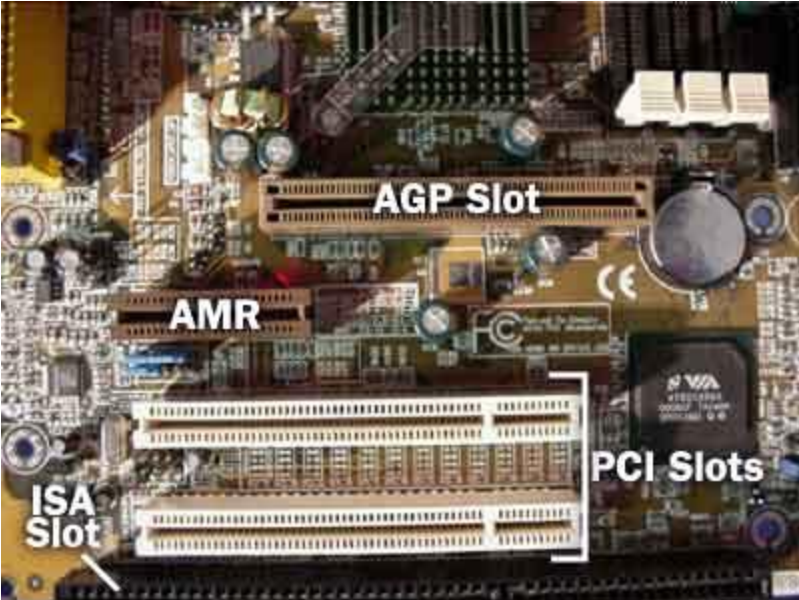Prepared & Presented by *Professor Gupta 301-802- 9066*

Form Factors, Dimensions & Slots

The choice of the motherboard (and its form factor) depends on which case is chosen. The table below summarizes the characteristics of the various form factors.
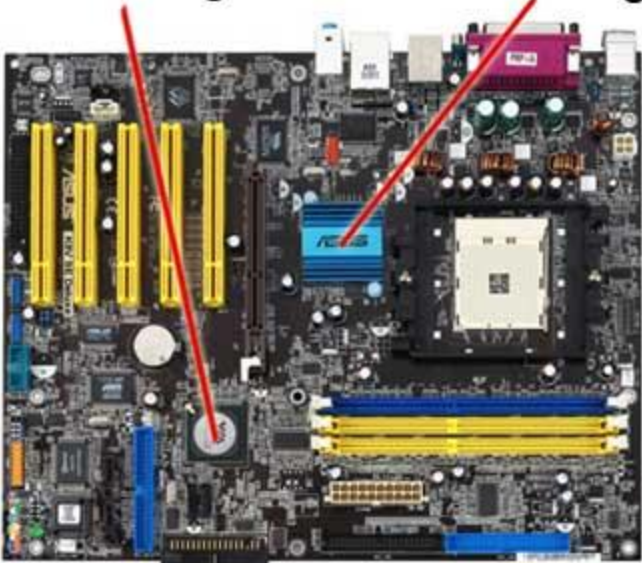
Form factor	Dimensions	Slots
ATX	305 mm x 244 mm	AGP / 6 PCI
microATX	244 mm x 244 mm	AGP / 3 PCI
FlexATX	229 mm x 191 mm	AGP / 2 PCI
Mini ATX	284 mm x 208 mm	AGP / 4 PCI
Mini ITX	170 mm x 170 mm	1 PCI
Nano ITX	120 mm x 120 mm	1 MiniPCI
BTX	325 mm x 267 mm	7
microBTX	264 mm x 267 mm	4
picoBTX	203 mm x 267 mm	1

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Motherboards

Motherboards and Their Components

AGP Slot

Socket 7 CPU

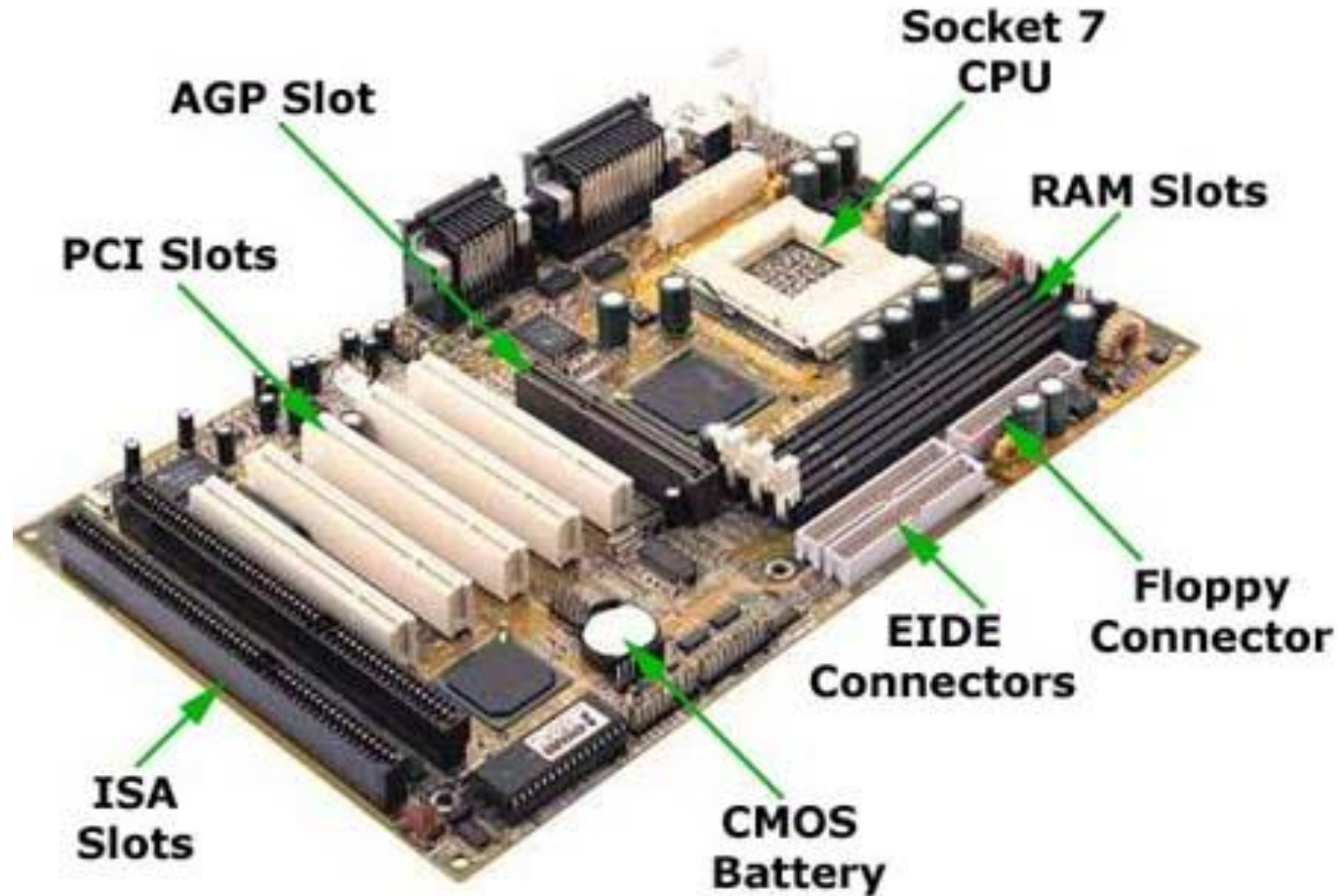RAM Slots
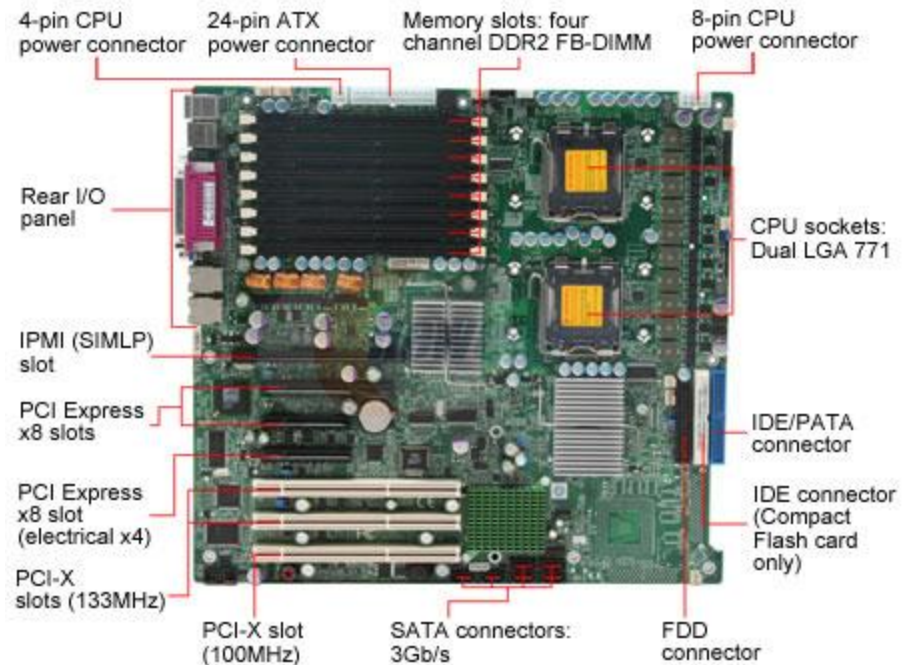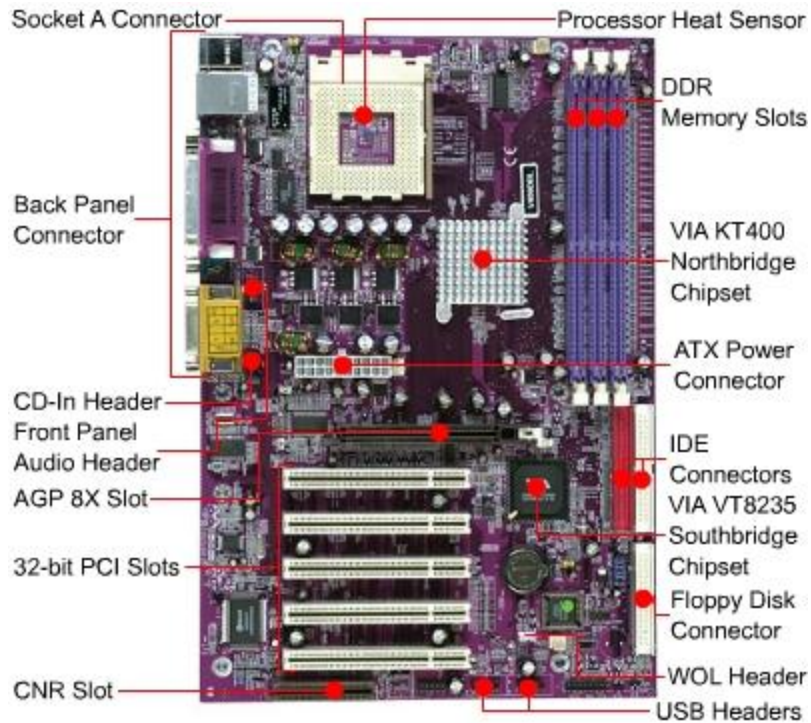
PCI Slots

Floppy Connector

EIDE Connectors

ISA Slots

CMOS Battery

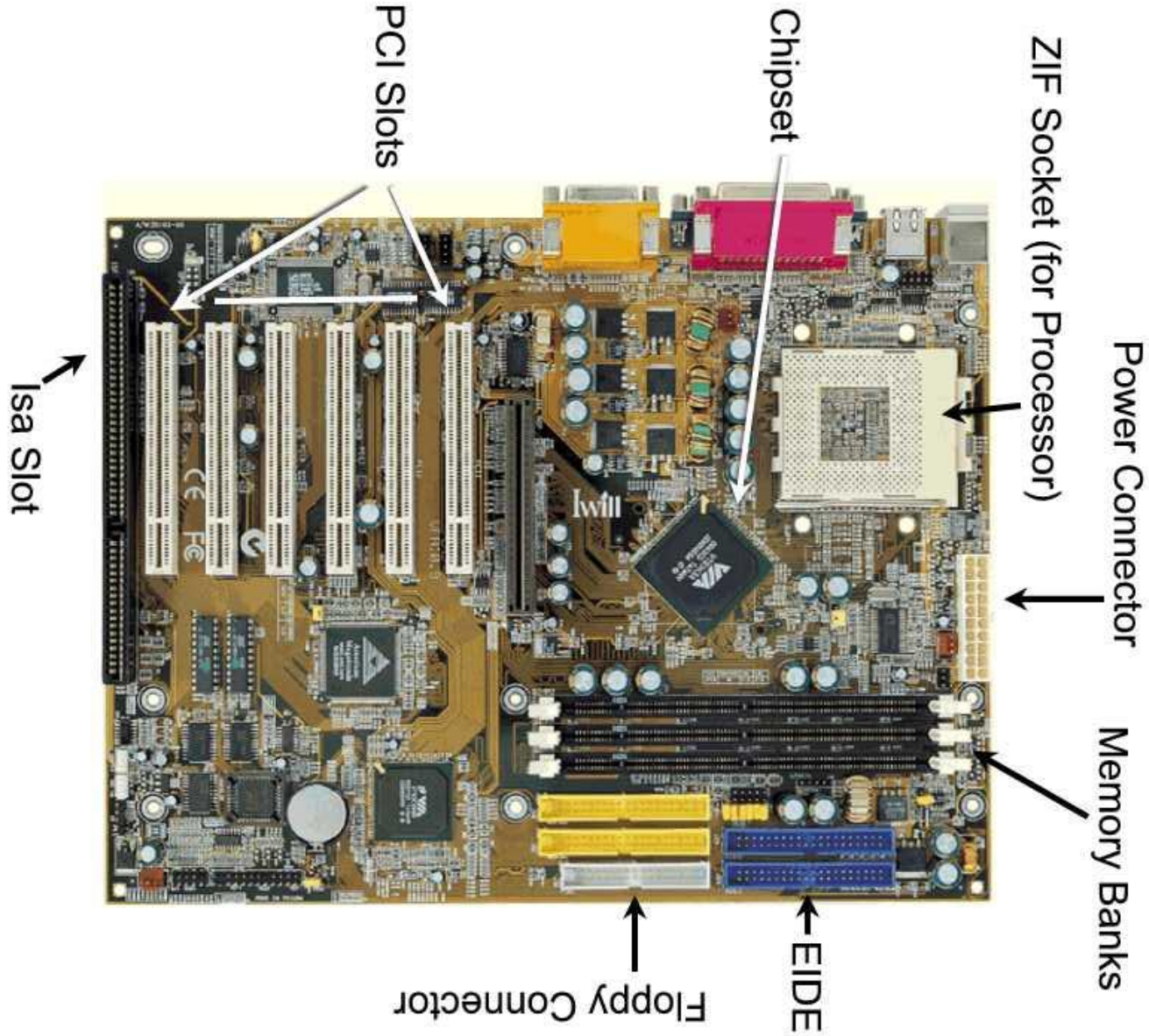# Motherboards and Their Components

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Motherboards and Their Components

LGA 775 Motherboard & Specs

- ➢ **MSI G41TM-E43**
- ➢ **LGA775 Micro ATX**
- ➢ **Intel G41 Chipset**
- ➢ **Supports 45nm Intel Core 2 Multi-Core Processors**
- ➢ **Dual DDR2 800**
- ➢ **PCI Express x 16**
- ➢ **SATA 3 Gb/s with HDMI**
- ➢ **Gigabit LAN and**
- ➢ **8 Ch Audio**
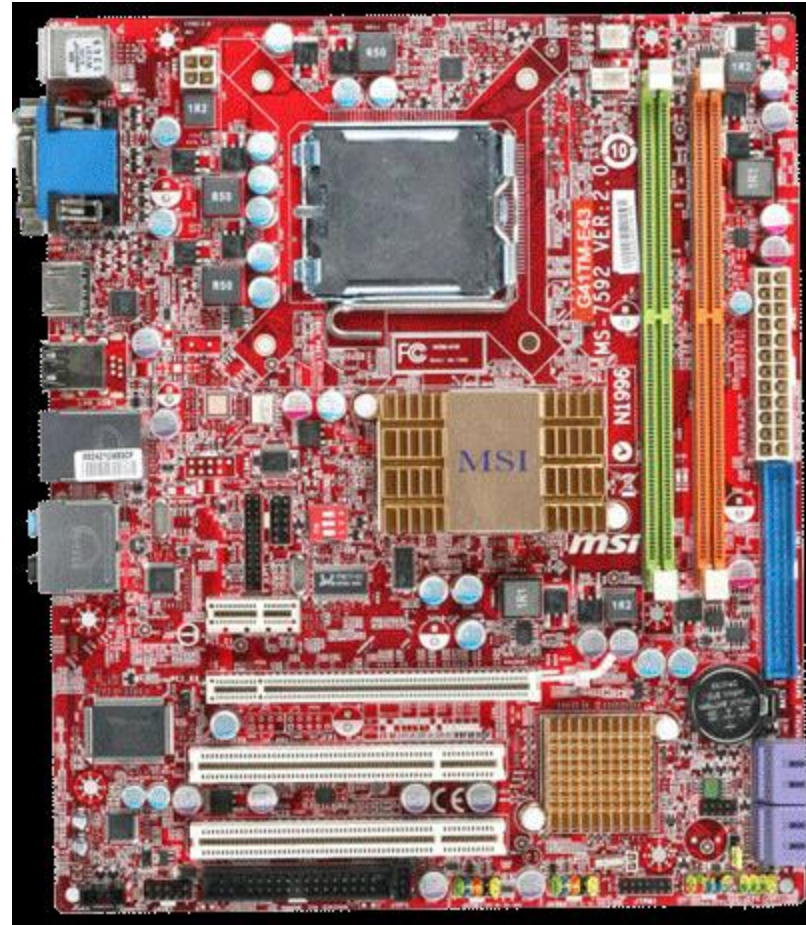
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Socket 775 LGA Motherboard

- **Gigabyte GA-G41M-ES2L**
- **Socket 775 Micro ATX**
- **Intel G41 Chipset**
- **Supports 45nm Intel Core 2 Multi-Core Processors**
- **1333 FSB**
- **Dual channel DDR2 800**
- **SATA HDD**
- **Gigabit Ethernet LAN**

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Socket 775 LGA Motherboard
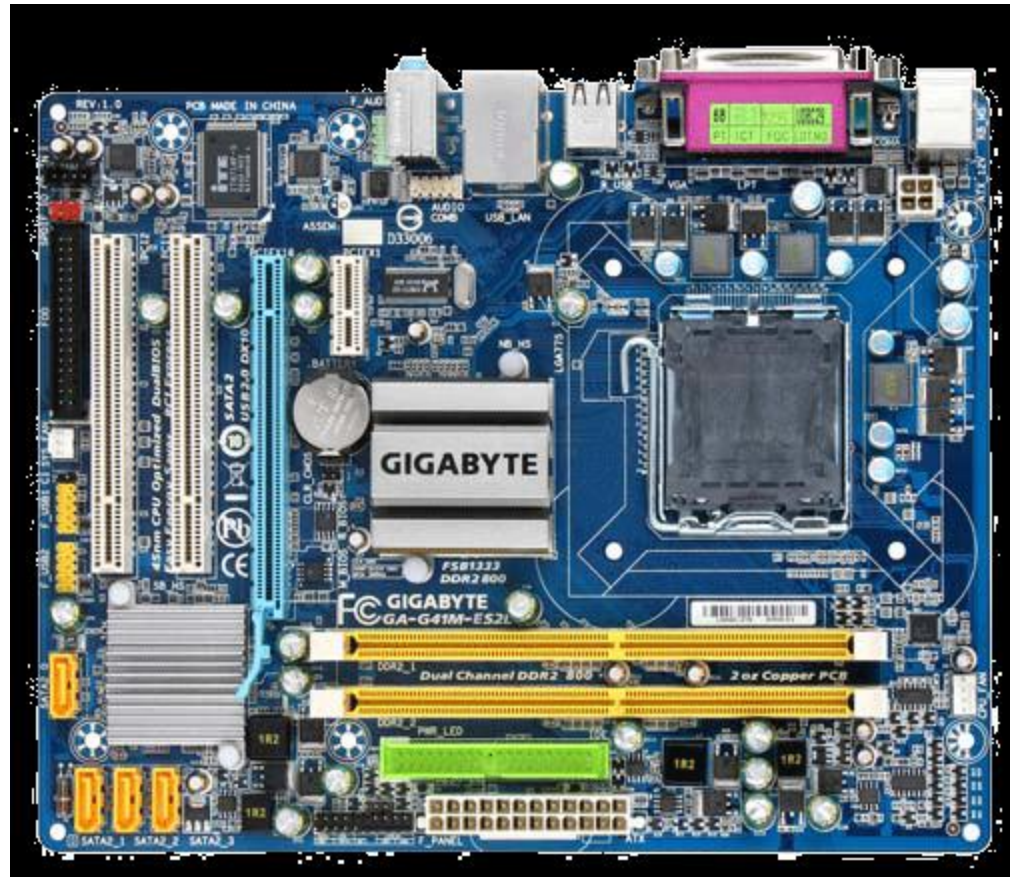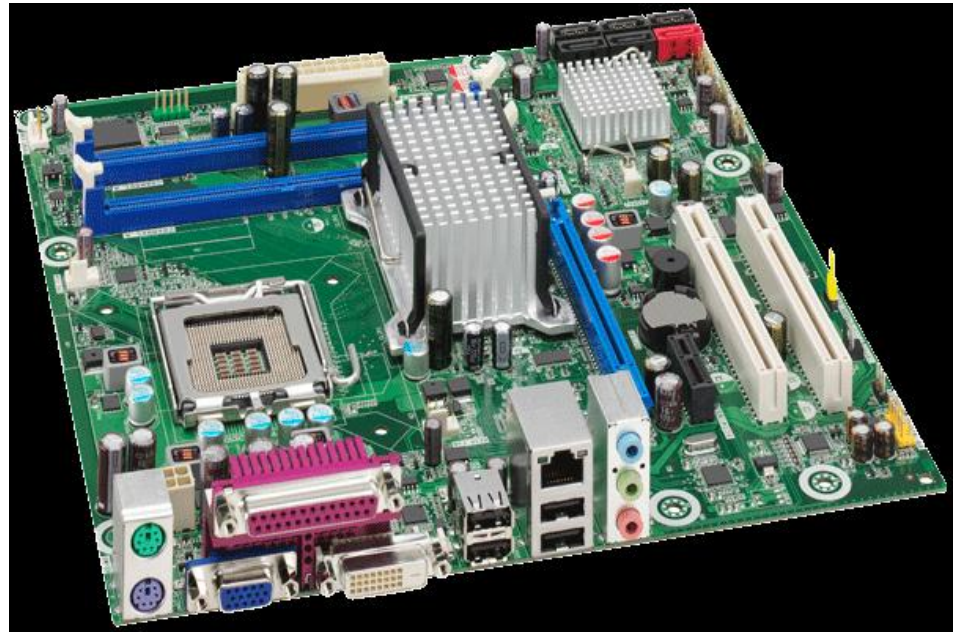
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Intel Desktop Board DB43LD MicroATX Motherboard, Intel B43 Express Chipset, Supports Intel Core2 Quad Shocket 775 Processor, DDR2 800, with X4500 Video Card and Gigabit LAN
Intel Desktop Board DB43LD is an energy-efficient entry-level product designed for businesses interested in legacy-to-premium features with additional options to upgrade and expand manageability and security.

Enjoy dual-independent displays with DVI and VGA ports and internal eSATA connector, as well as legacy features such as parallel and PS/2 ports and serial header.

This board is ready for Intel Upgrade Service, is Microsoft Windows Vista* Premium WHQL certified, and comes bundled with full versions of several value-add software packages designed to enhance productivity and security for any business.

Socket 775 LGA Motherboard

- **Gigabyte GA-EP45T-UD3LR**
- **Socket 775 ATX Motherboard**
- **Intel P45 Express Chipset**
- **Supports Intel Core 2 Quad Processor**
- **1600MHz FSB**
- **Dual channel DDR3 2200+**
- **PCI Express 2.0**
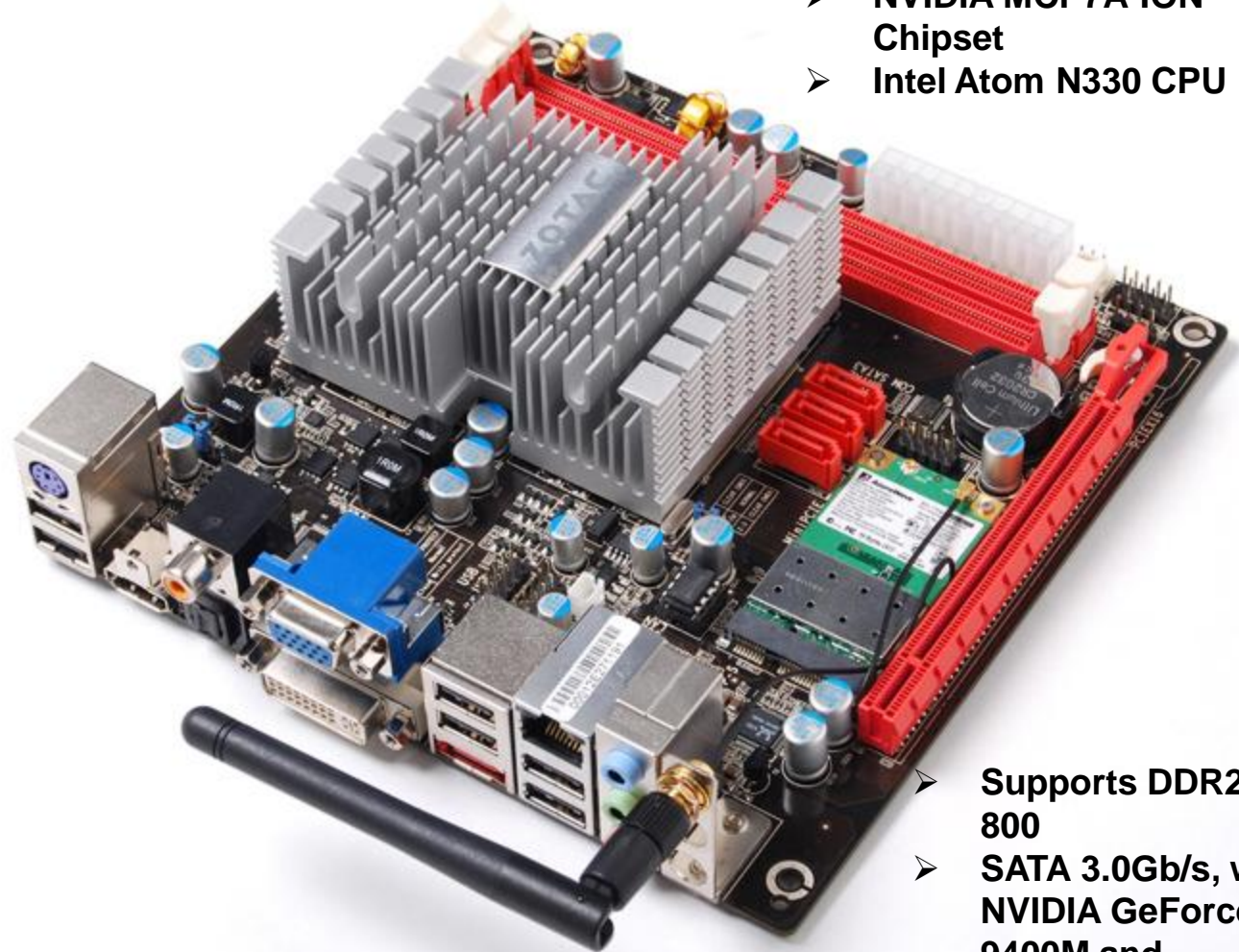- **SATA RAID**
- **Gigabit Ethernet LAN**

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ITX Motherboard Specifications

- **CPU**: Intel Atom 330 (1.6GHz, dual-core)
- **CPU Socket**: BGA 437
- **FSB**: 533 MHz
- **Chipset**: MCP7A-ION
- **Memory Type**: DDR2 667/800
- **Memory Slots**: 2x240pin
- **Maximum Memory Supported**: 4GB
- **PCI Express x16**: 1
- **Other Slots**: 1 x mini-PCIE (WiFi occupied)
- **SATA**: 3 + 1 eSATA
- **SATA RAID**: 0/1/0+1
- **Onboard Video Chipset**: NVIDIA GeForce 9400M
- **Onboard Audio**: 5.1
- **Onboard LAN**: 10/100/1000Mbps
- **Wireless LAN**: WiFi IEEE 802.11 n
- **Rear Panel Ports**:
- 1 x PS/2
- 1 x COM
- D-Sub + DVI
- 1 x HDMI
- 6 x USB 2.0
- 1 x eSATA II
- 1 x Optical, 1 x Coaxial
- 3 Audio Ports
- **Onboard USB**: 4 x USB 2.0
- **Form Factor**: Mini ITX
- **Dimensions**: 38.40mm (H) x 177.55mm (L) x 169.93mm (W)
- **Power Connector**: 20 Pin

➢ **Mini ITX Motherboard**
➢ **NVIDIA MCP7A-ION Chipset**
➢ **Intel Atom N330 CPU**

➢ **Supports DDR2 800**
➢ **SATA 3.0Gb/s, with NVIDIA GeForce 9400M and**
➢ **WiFi**

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Motherboards and Their Components

- ➢ **DFI HYBRID**
- ➢ **P45 ION-T2A2**
- ➢ **LGA 775 ATX Motherboard,**
- ➢ **Intel P45 Express Chipset,**
- ➢ **Supports Intel Core2 Quad CPUs,**
- ➢ **Dual DDR2 1200(O.C.), SATA RAID,**
- ➢ **PCI Express x16**
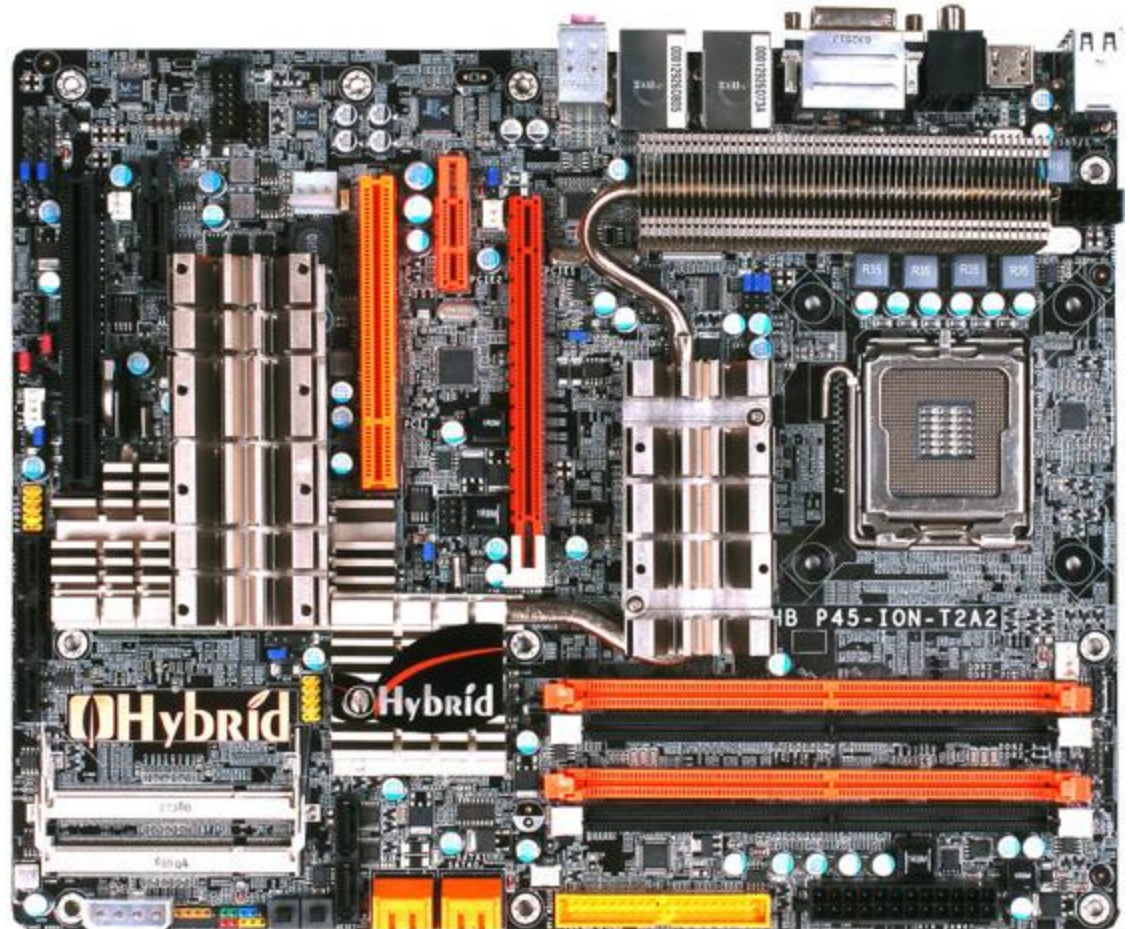
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Socket 478 Motherboard

CHIPSET: Intel 945GC / ICH7
•**CPU SUPPORT**: Intel Pentium 4, Celeron D
•**FSB**: Support FSB 533/800MHz
•**MEMORY**:
- Support Dual Channel DDR2 400/533/667 MHz
- 2 x DDR2 DIMM Memory Slot
- Max. Supports up to 2GB Memory
•**EXPANSION SLOT**:
- 2 x PCI Slots, 1 x PCI-E x16 2.0 Slot
•**STORAGE**:
- 4 x SATA2 3Gb/s Connector , 1 x IDE Connector
•**USB**:
- 4 x USB 2.0 Port
- 2 x USB 2.0 Header
•**LAN**: Realtek RTL8102EL - 10/100 Controller
•**INTEGRATED VIDEO**: Intel Graphics Media Accelerator
950, On Board Graphic Max. Share Mem Up To 224MB
•**CODEC**: Realtek ALC662 6-Channel HD Audio
•**REAR I/O**:
- 1 x PS/2 Mouse
- 1 x PS/2 Keyboard
- 4 x USB 2.0 Port
- 1 x VGA Port
- 1 x RJ-45 Port
- 3 x Audio Connector
•**INTERNAL I/O**:
- 1 x Printer Header
- 2 x USB 2.0 Header
- 4 x SATA2 3Gb/s Connector
- 1 x IDE Connector
- 1 x Floppy Connector
- 1 x Front Audio Header
- 1 x Front Panel Header
- 1 x S/PDIF-OUT Header
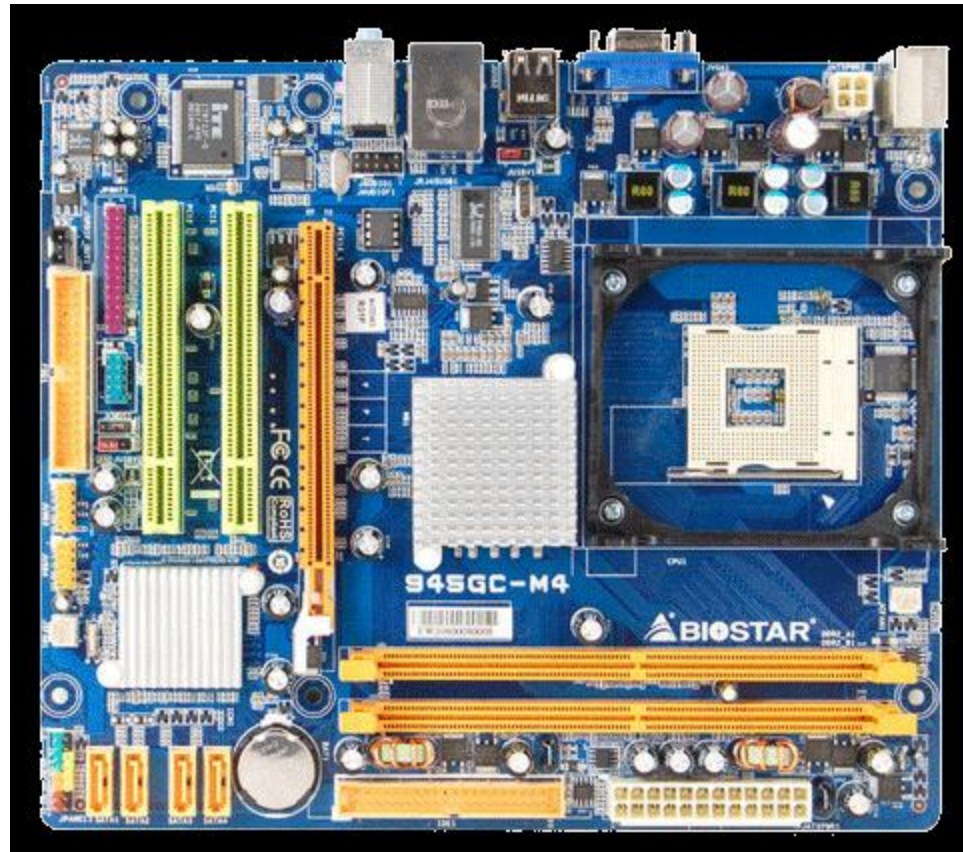- 1 x CPU FAN Header
- 1 x System FAN Header
- 1 x Serial Header
•**DIMENSION**: Micro ATX Form Factor Dimension:
22.5cm X 17cm (W x L)
•**OS SUPPORT**: Support Windows 2000 / XP / Vista

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**Biostar 945GC-M4 Socket 478 Micro ATX
Motherboard, Intel 945GC Chipset, Supports
Intel Pentium 4 / Celeron D / Celeron CPUs,
Dual DDR2 667, SATA2 3Gb/s**

Socket 370 Motherboard

CPU:
- Intel Pentium III FCPGA 1.13GHz-1.26GHz/133MHz
- Intel Pentium III FCPGA 533EB-1GHz/133MHz
- Intel Pentium III FCPGA 500E-1.1GHz/100MHz
- Celeron FCPGA 1.2GHz+/100MHz
- Celeron FCPGA 800MHz-1.1GHz/100MHz **CPU**
Socket: - Socket 370
Chipset:
- Northbridge: VIA 8601T
- Southbridge: VIA 686B **Memory**:
Memory: 2 DIMM sockets
- Supports up to 1GB unbuffered DIMMs
- Supports PC100 and PC133 SDRAMs **Expansion**
Slots:
- 3 PCI slots , - 1 CNR slot **BIOS**:
Award BIOS
Graphics:
- Integrated Trident 2D/3D/Video accelerator **Audio**:
- AC 97 audio codec **IDE**:
- Dual PIO modes 3 and 4 EIDE channels supporting up to 4 IDE devices
- UltraDMA/100 transfer rate up to 100MB/sec **Rear**
Panel I/O Ports:
- 2 USB ports
- 1 RJ45 LAN port
- 1 DB-9 serial port
- 1 DB-15 VGA port
- 1 DB-25 parallel port
- 1 PS/2 keyboard port
- 1 PS/2 mouse port
- 1 game/MIDI port
- 3 audio jacks **I/O Connectors**:
- 2 connectors for 4 external USB connections
- 1 connector for an external serial port
- 1 IrDA connector
- 2 IDE connector
- 1 floppy connector
- 1 ATX power connector
- 2 fan connectors
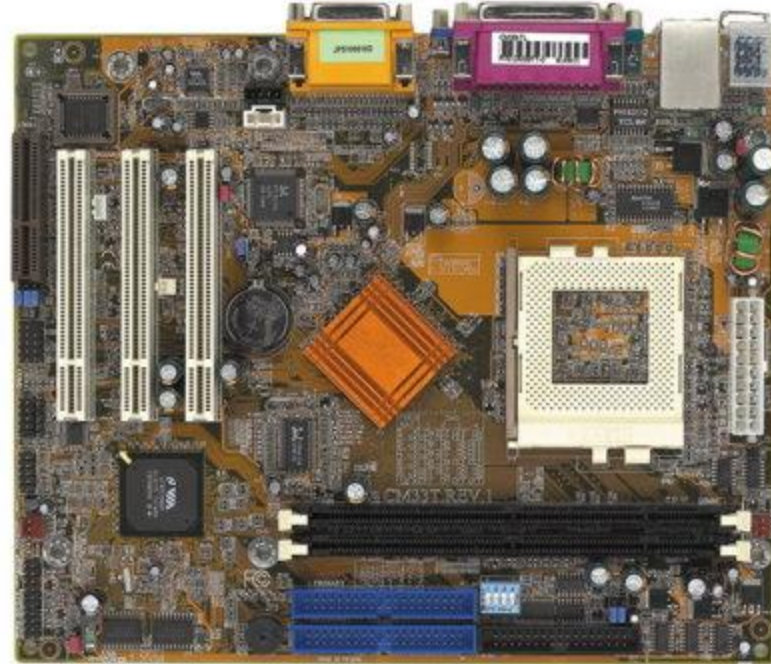
DFI Socket 370 Micro ATX 4 Layers Motherboard CM33-TL/G, Intel Pentium III / Celeron FCPGA CPU, VIA 8601T Chipset, PC 100/PC 133 SDRAMs, Trident 2D/3D VGA, 3 PCI Slots.

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Micro ATX Motherboard

CPU:
- AMD AM3/AM2+/AM2; PhenomII /AthlonII /Phenom / Athlon /Sempron Processors

Chipset: AMD 760G/SB710 (AMD 780L/SB710)

Memory:
- 2 x DIMM, Max. 8 GB
- DDR2 1200(O.C.)/1066*/800/667 ECC, Non-ECC, Un-buffered Memory

Expansion Slots:
- 1 x PCIe 2.0 x16
- 1 x PCIe x1
- 2 x PCI

VGA:
- Integrated ATI Radeon HD3000
- Support Maximum shared memory up to 1G
- Supports HDMI Technology with max. resolution up to 1920 x 1200 (1080P) (@60Hz)
- Supports DVI-D with HDCP compliant with max. resolution 2560 X 1600 (@ 60Hz) dual-link
- Supports RGB with max. resolution 2048 x 1536 (@85Hz)
- Hybrid CrossFireX Support (For Windows Vista only)
- Dual VGA output support: RGB & DVI, RGB & HDMI

Storage:
- 1 xUltraDMA 133/100
- 6 xSATA 3 Gb/s ports
- Support RAID 0,1,0+1,JBOD

LAN: RTL8112L Gb LAN

Audio:
- VT1708S High Definition Audio 8-Channel CODEC
- Supports Jack-detect and Multi-Streaming technologies
- Supports S/PDIF out interface

USB:
- 12 USB 2.0/1.1 ports (6 ports at mid-board, 6 ports at back panel)

Overclocking Features:
- SFS (Stepless Frequency Selection) - FSB tuning from 200MHz to 550MHz at 1MHz increment

ASUS M4A78L-M AMD 760G uATX Motherboard, Supports AMD AM3/AM2+/AM2 CPU, Dual Channel DDR2, Hybrid CrossFireX, SATA RAID, w/ HDMI and Gb LAN
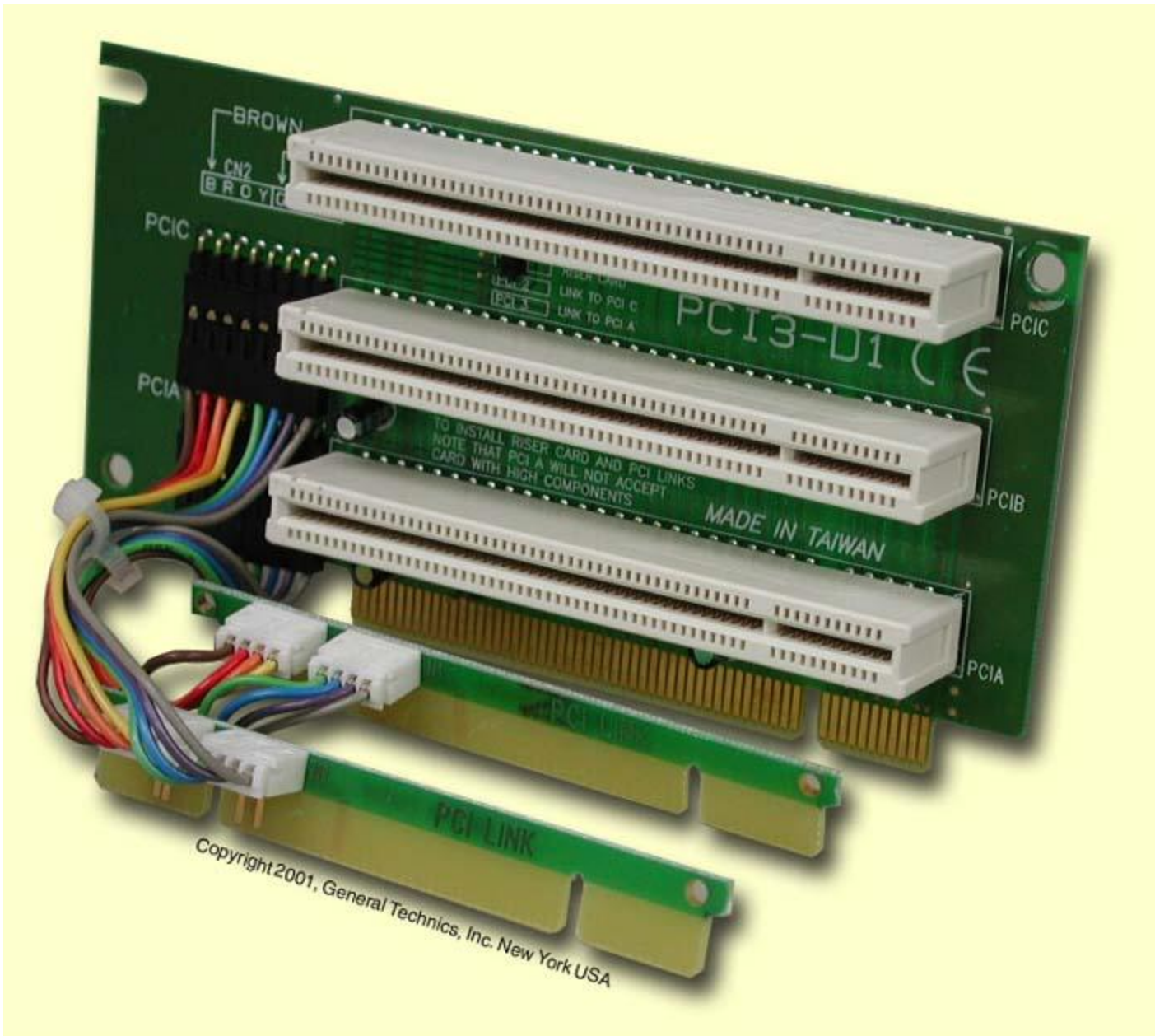
What do you like or dislike about this motherboard?

Riser Cards

Riser Cards
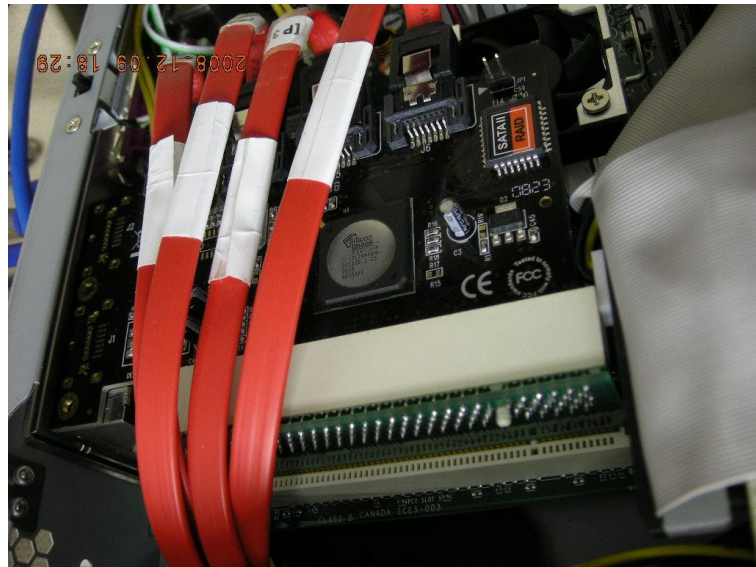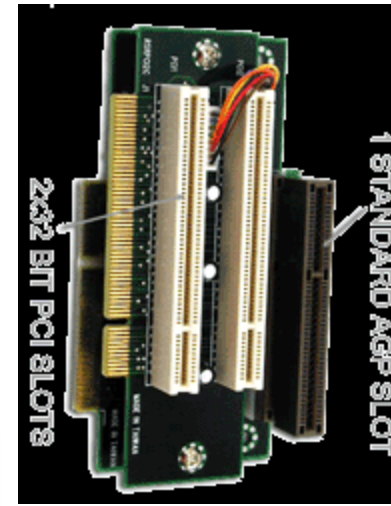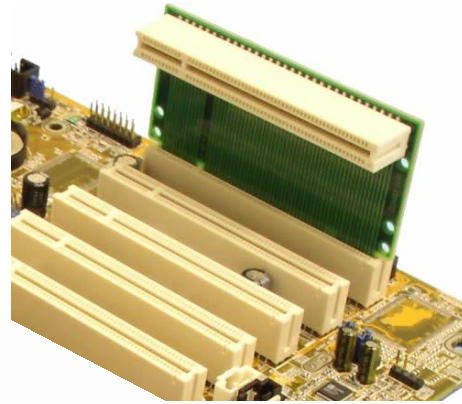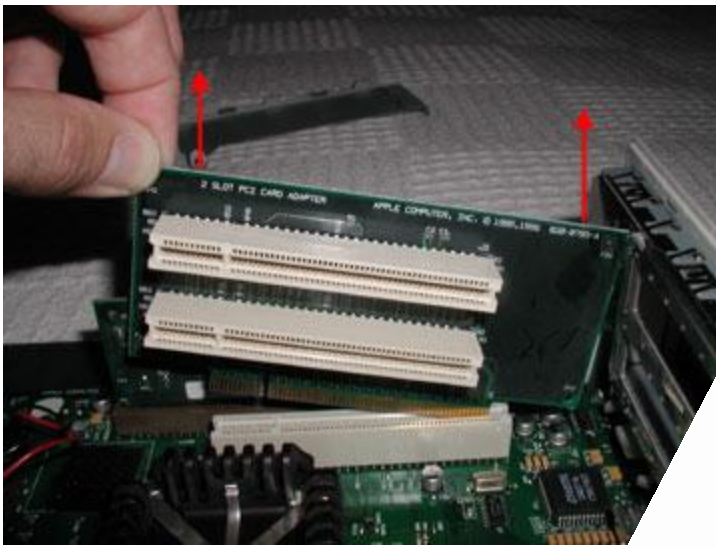
Riser Cards

Riser cards and daughterboards provide two different methods for providing access to motherboard–based resources. In current slimline or rackmounted systems based on ATX or BTX technologies, riser cards are used to make expansion slots usable that would otherwise not be available because of clearances inside the case. Riser card designs can include one or more expansion slots, and are available in PCI, PCI-X (used primarily in workstation and server designs), and PCI-Express designs.

PC Buses

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Diagram labels: CPU, System bus, L2 Cache RAM (256 Kb), RAM (32 MB), Bridge, I/O busses, I/O units: drives, keyboard, mouse, ports, adapters a.o.
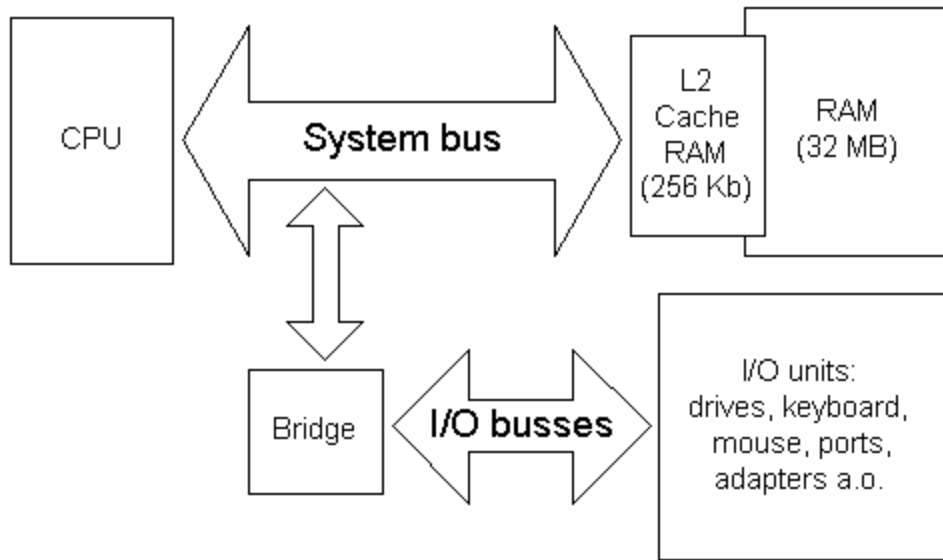
The PC receives and sends its data from and to *buses*. They can be divided into:

- The system bus, which connects the CPU with RAM
- I/O buses, which connect the CPU with other components

You see the central system bus, which connects the CPU with RAM. A **bridge** connects the I/O buses with the system bus and on to RAM. The bridge is part of the **PC chip set.**
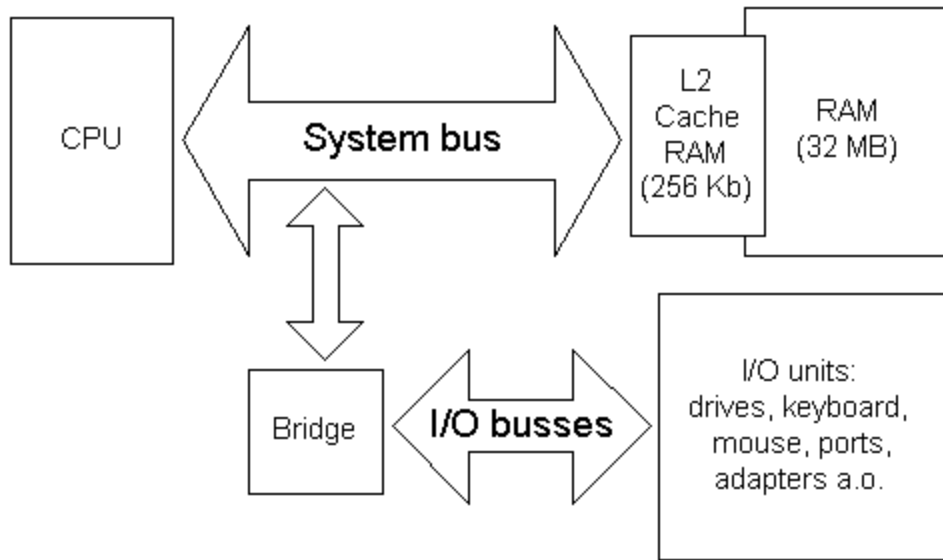
The System Bus

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The system bus carries four different types of signals throughout the computer:

- **Data:** Data bus portion of the system bus, which carries information between RAM and the CPU. (Think of a highway looking down from Washington Monument.)

- **Power:** Power lines in the system bus, which transfer power from the motherboard's connection to the power supply to the integrated circuits (ICs or chips) and expansion boards connected to the motherboard. (Think of elaborate network of electric and gas lines beneath the street carrying the energy needed to power the city.)

- **Control:** Control lines in the system bus, which control the transmission and movement of information between devices connected to the motherboard. (Think of Traffic Light Signals, which control the movement of road and Amtrak traffic . Traffic stops and starts in response to the signals.)

- **Address:** Address bus, which is used to "pick up" information from the correct memory location among the gigabytes of RAM in computer systems and "deliver" new programs and changes back to the correct memory locations. (Think of looking around Washington DC, take a close look at the men and women toting blue bags around their shoulders or driving electric vans and Jeeps around the city. As these mail carriers deliver parcels and letters, they must verify the correct street and suite addresses for the mail they deliver.)
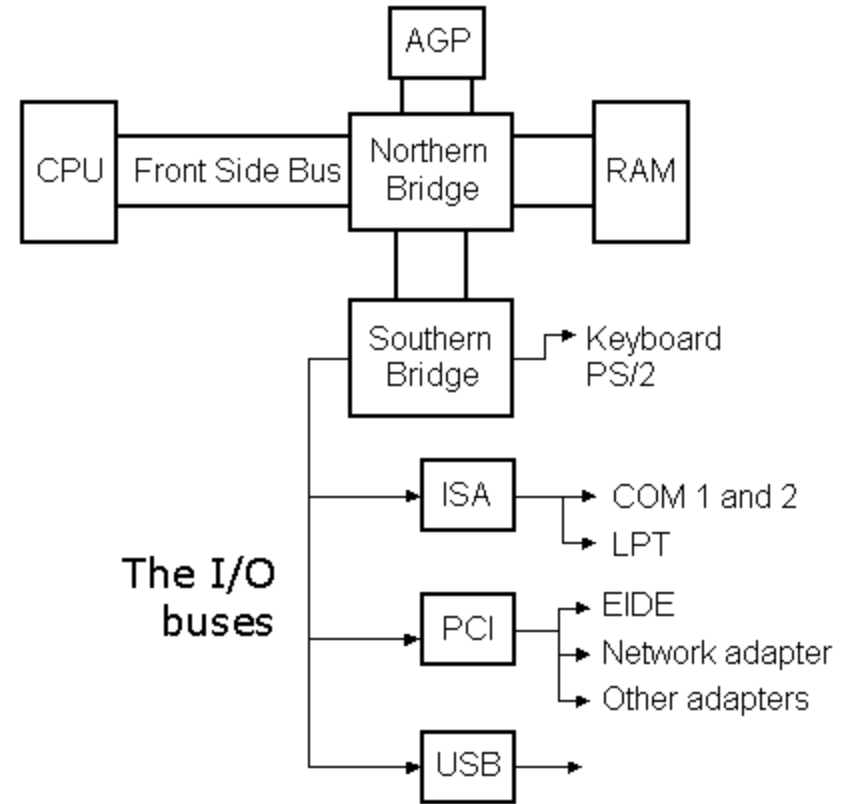
The I/O bus

➤The I/O bus connects storage devices to the system bus and can be compared to the daily flow of commuters and travelers into the city in the morning, and out again in the evening. Between them, the system and I/O buses carry every signal throughout the motherboard and to every component connected to the motherboard.

➤I/O buses connect the CPU to all other components, except RAM. Data are moved on the buses from one component to another, and data from other components to the CPU and RAM. The I/O buses differ from the system bus in speed. Their speed will always be lower than the system bus speed. Over the years, different I/O buses have been developed. On modern PCs, you will usually find four buses:

> ➤*The ISA bus, which is an old low speed bus, soon to be excluded from the PC design.*
>
> ➤*The PCI bus, which is a new high speed bus.*
>
> ➤*The USB bus (Universal Serial Bus), which is a new low speed bus.*
>
> ➤*The AGP bus which solely is used for the graphics card.*

➤The I/O buses move data. They connect all I/O devices with the CPU and RAM. I/O devices are those components, which can receive or send data (disk drives, monitor, keyboard, etc).

➤All in all, the buses have had a very central placement in the PC's data exchange. Actually, all components except the CPU communicate with each other and with RAM via the different I/O buses. Here you see a demonstration of this logic:

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The I/O bus
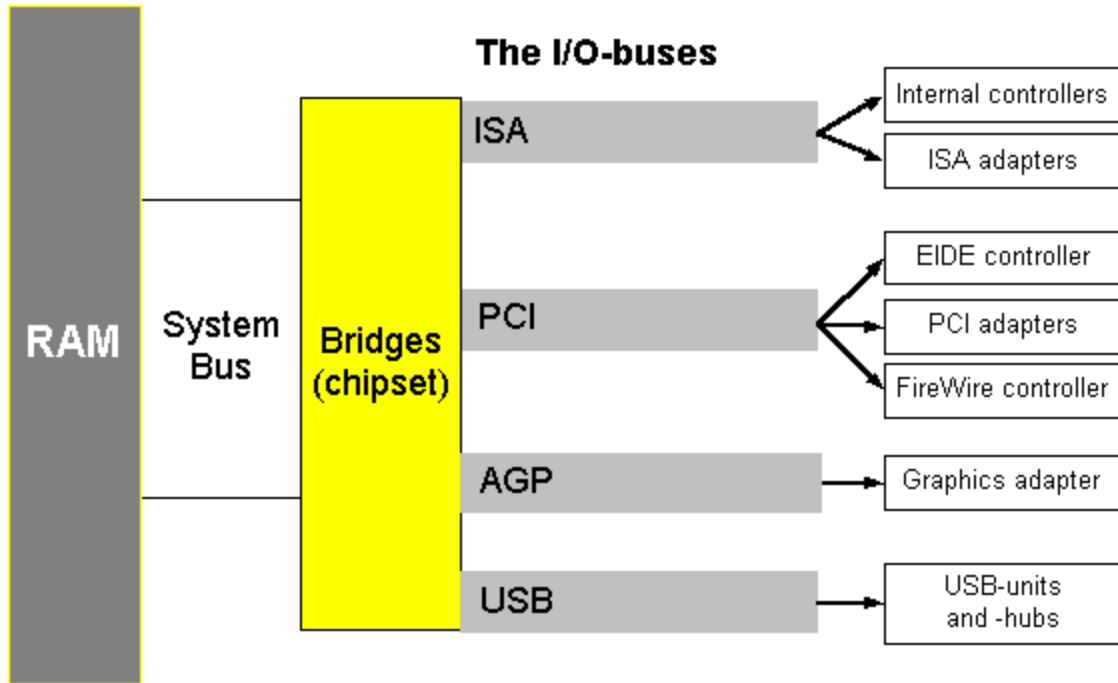
As I discussed earlier, there are four I/O buses in the modern PC architecture and each of them has several functions. They may lead to internal and external ports or they lead to other controlling buses. The four buses are:

- **ISA**, which is old, slow, and limited, compared to the alternatives listed below. We hope that it is replaced by the following interfaces:

- **PCI**, which is the newer high speed multifunction I/O bus.

- **AGP**, which only is used for graphics adapter.

- **USB**, which is the new low speed I/O bus to replace ISA.

The I/O bus
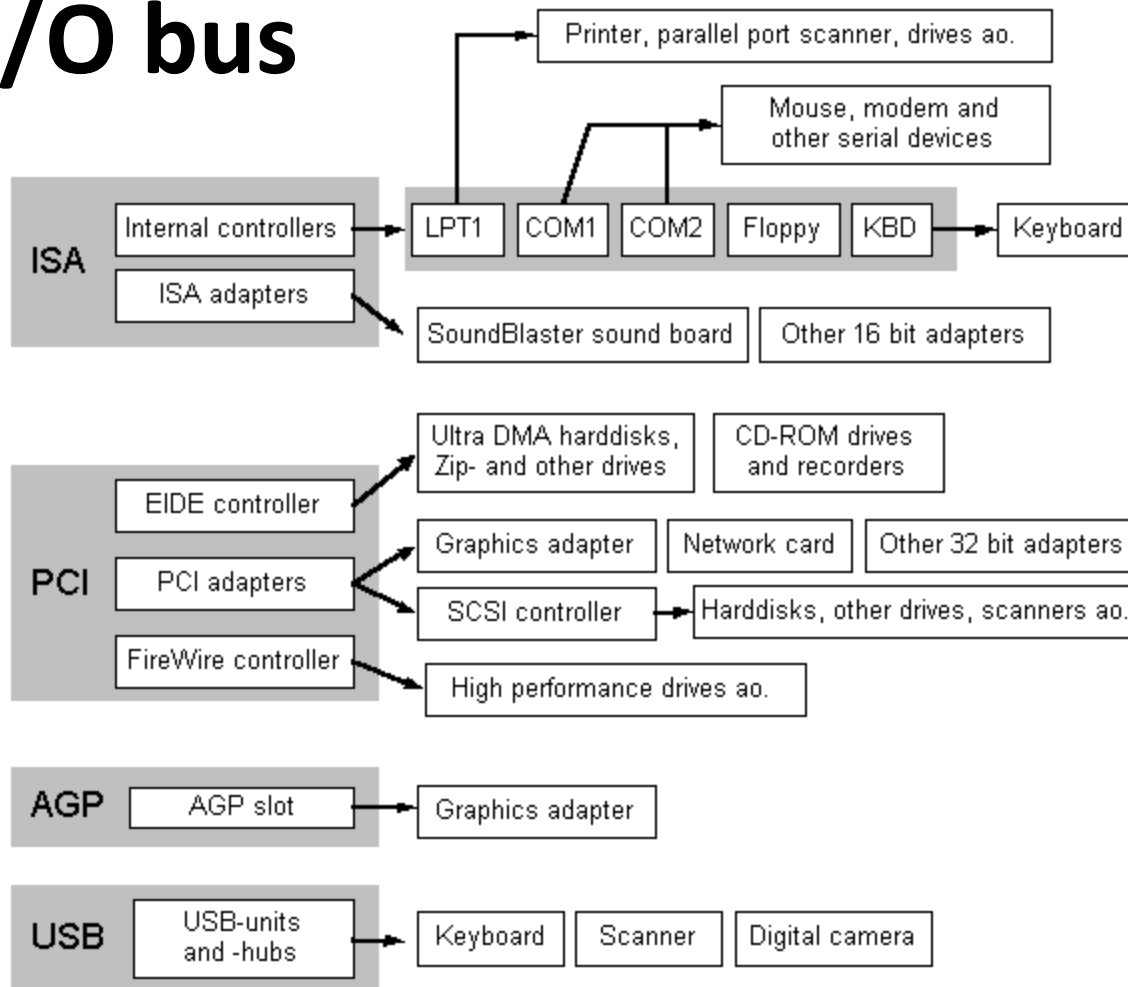
As you see, there is room for a lot of units to be connected to the PC.

The PCI bus is the most loaded of all the buses. It is used for so many purposes that the output for the graphics adapter has been isolated on its own AGP-bus.

But still the PCI bus is heavily loaded, connecting the system bus to the network controller and the various EIDE- and SCSI drives. Because of the high bandwidth of the FireWire bus, overall throughput of both interfaces would be improved by separating these. I hope to see a separate FireWire interface in future motherboard architectures.

The Chipset

➤The chip set is very important to the modern PC and its performance. Many technologies meet on the motherboard and are "glued" together via these controllers, which we call the "chip set".

➤The chip sets are a bunch of intelligent controller chips, which are on any motherboard.

➤The controllers are closely tied to the CPU, in that they control the buses around the CPU. Without the chip sets, neither RAM nor I/O buses could function together with the CPU:
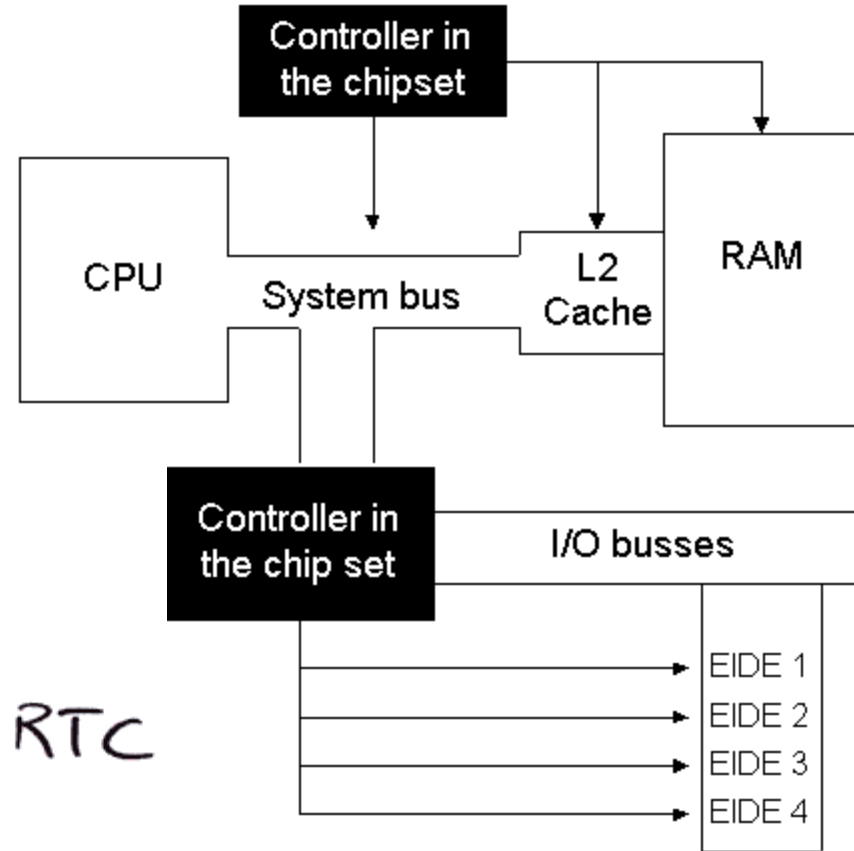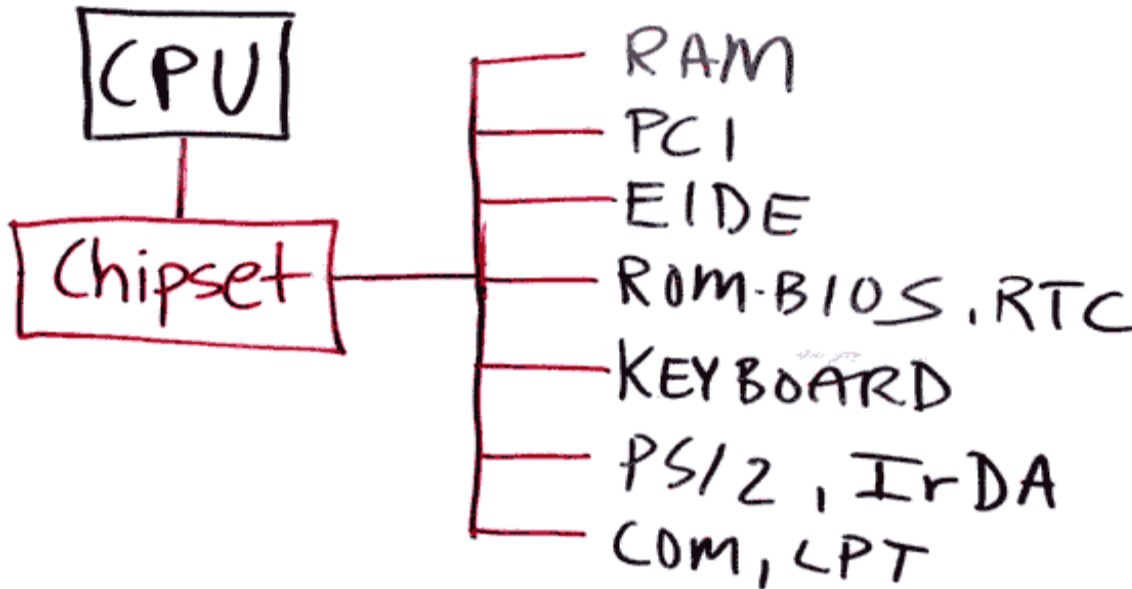
Suppliers of Chipset

➢ The chip sets are quite central components on the motherboards. When new technological features are introduced (and this happens continuously) they are often accompanied by new chip sets. The new chip sets often enable:

  ➢ Higher speed on one or more buses
  ➢ Utilization of new facilities (new RAM types, new buses, improved EIDE, etc.)

➢ There are several suppliers of chip sets for the motherboard:

  ➢ Intel
  ➢ SIS
  ➢ Opti
  ➢ Via
  ➢ ALi

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Two Bridges, but new look

Memory Controller Hub (MCH) Chipset
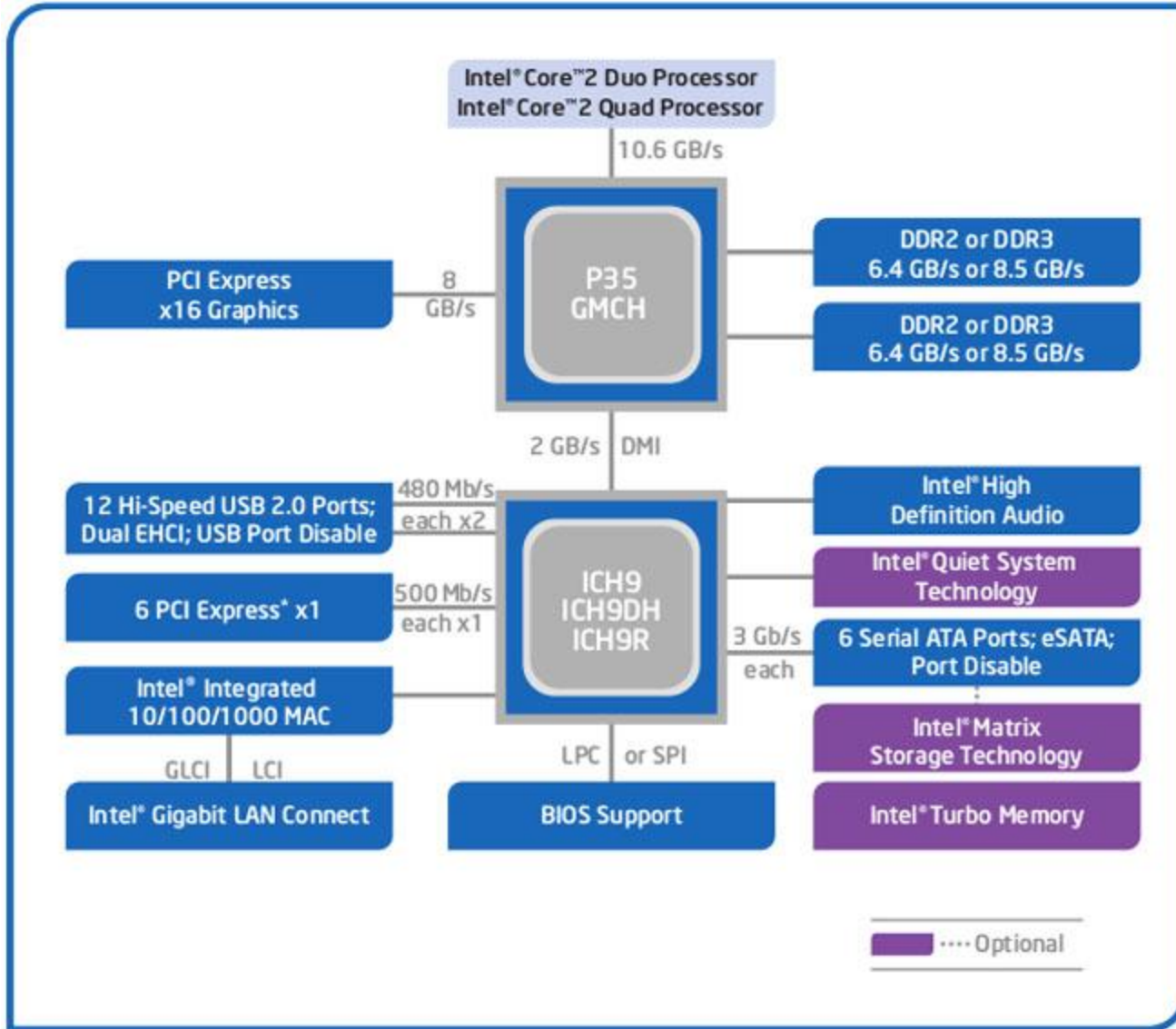
I/O Controller Hub (ICH) Chipset

Intel® Core™2 Duo Processor
Intel® Core™2 Quad Processor

10.6 GB/s

P35 GMCH

PCI Express x16 Graphics — 8 GB/s

DDR2 or DDR3 6.4 GB/s or 8.5 GB/s

DDR2 or DDR3 6.4 GB/s or 8.5 GB/s

2 GB/s | DMI

ICH9 ICH9DH ICH9R

12 Hi-Speed USB 2.0 Ports; Dual EHCI; USB Port Disable — 480 Mb/s each x2

6 PCI Express* x1 — 500 Mb/s each x1

Intel® Integrated 10/100/1000 MAC

GLCI | LCI

Intel® Gigabit LAN Connect

LPC or SPI

BIOS Support

Intel® High Definition Audio

Intel® Quiet System Technology

3 Gb/s each — 6 Serial ATA Ports; eSATA; Port Disable

Intel® Matrix Storage Technology

Intel® Turbo Memory

···· Optional

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Two Bridges

➢ Here you see the architecture of a modern chip set consisting of two chips:
  ➢ a north and
  ➢ a south bridge.

➢ Both bridges are essentially *routers.* This means that they route data traffic from one bus (network) to another.

➢ The north bridge takes all the heavy traffic, and the south bridge routes in to a lot of different narrow routes:

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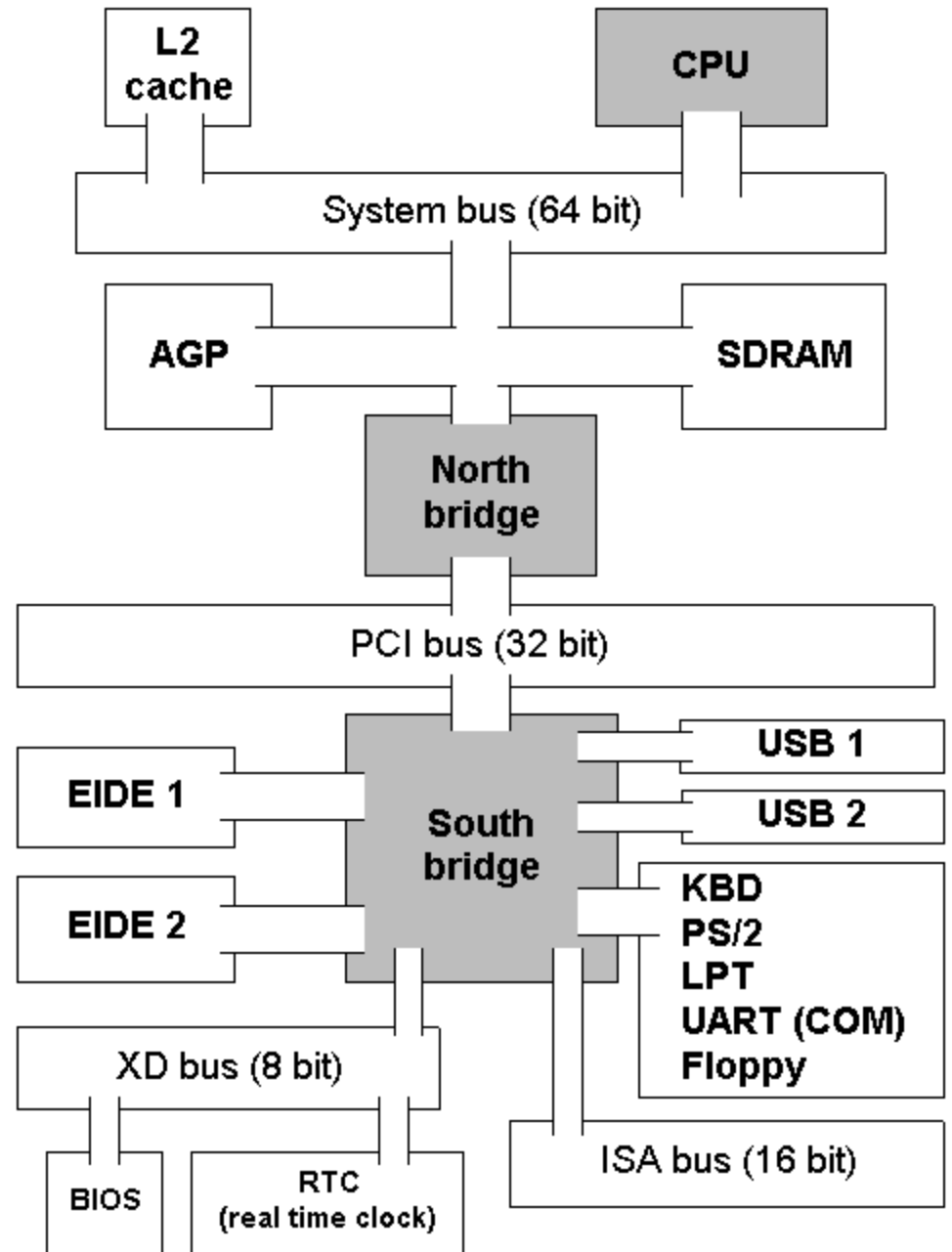
The CMOS clock and battery

- The real time clock (or RTC for short) is a circuit which synchronizes system signals. It is made from a crystal which, as it vibrates, gives off pulses (called *timer ticks*) in order to keep the system elements running on the same time. The *timer frequency* (expressed in *MHz*) the number of times the crystal vibrates each second, i.e. the number of *timer ticks* per second. The higher the frequency, the more information the system can process.

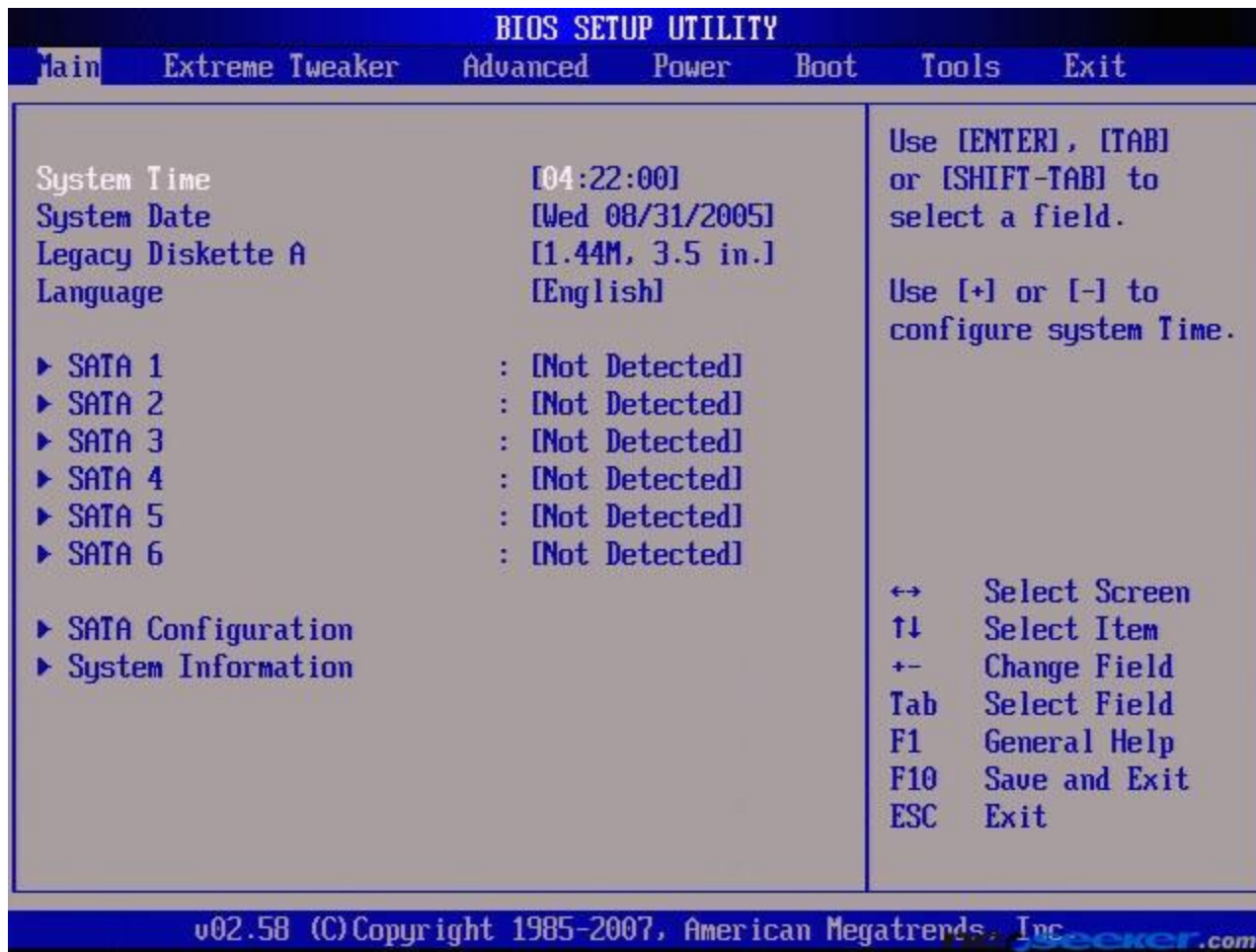- When the computer is turned off, the power supply stops providing electricity to the motherboard. When the computer is turned on again, the system is still on the right time. An electronic circuit, called the *CMOS* (*Complementary Metal-Oxide Semiconductor*, sometimes called the *BIOS CMOS*), saves some system information, such as the time, the system date, and a few essential system settings.

- The CMOS is kept powered by a battery (a *button battery*), or a battery located on the motherboard. Information on the hardware installed in the computer (such as the number of tracks or sectors on each hard drive) are stored in the CMOS. As the CMOS is a form of slow storage, certain systems sometimes recopy the CMOS's content into the RAM (fast storage); the term "*memory shadow*" is used to describe this process of copying the data into RAM.

- When the system time keeps getting reset, or the clock runs late, all that is usually necessary is to change the battery.

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The BIOS


```
                         BIOS SETUP UTILITY
  Main    Extreme Tweaker    Advanced    Power    Boot    Tools    Exit

  System Time              [04:22:00]            Use [ENTER], [TAB]
  System Date              [Wed 08/31/2005]      or [SHIFT-TAB] to
  Legacy Diskette A        [1.44M, 3.5 in.]      select a field.
  Language                 [English]
                                                 Use [+] or [-] to
  ▶ SATA 1              :  [Not Detected]         configure system Time.
  ▶ SATA 2              :  [Not Detected]
  ▶ SATA 3              :  [Not Detected]
  ▶ SATA 4              :  [Not Detected]
  ▶ SATA 5              :  [Not Detected]
  ▶ SATA 6              :  [Not Detected]
                                                 ↔      Select Screen
  ▶ SATA Configuration                           ↑↓     Select Item
  ▶ System Information                            +-     Change Field
                                                 Tab    Select Field
                                                 F1     General Help
                                                 F10    Save and Exit
                                                 ESC    Exit

      v02.58 (C)Copyright 1985-2007, American Megatrends, Inc.
```
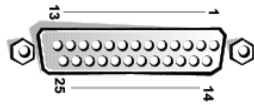
- The BIOS (Ba*sic Input/Output System*) is the basic program used as an interface between the operating system and the motherboard. The BIOS is stored in *ROM* (read-only memory, which can not be rewritten), so it uses data contained within the *CMOS* to find out what the system's hardware configuration is.

- The BIOS can be configured using an interface (named the *BIOS setup*), which can be accessed when the computer is booting just be pressing a key (usually the *DEL* key. In reality, the BIOS setup is only used as an interface for configuration; the data is stored in the *CMOS*. For more information, check your motherboard's manual.)
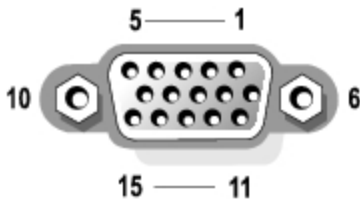
I/O Ports
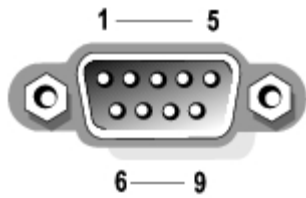
Serial Connector Pin Numbers

Keyboard and Mouse Connector

Parallel Connector Pin Numbers

Video Connector

NIC Connector

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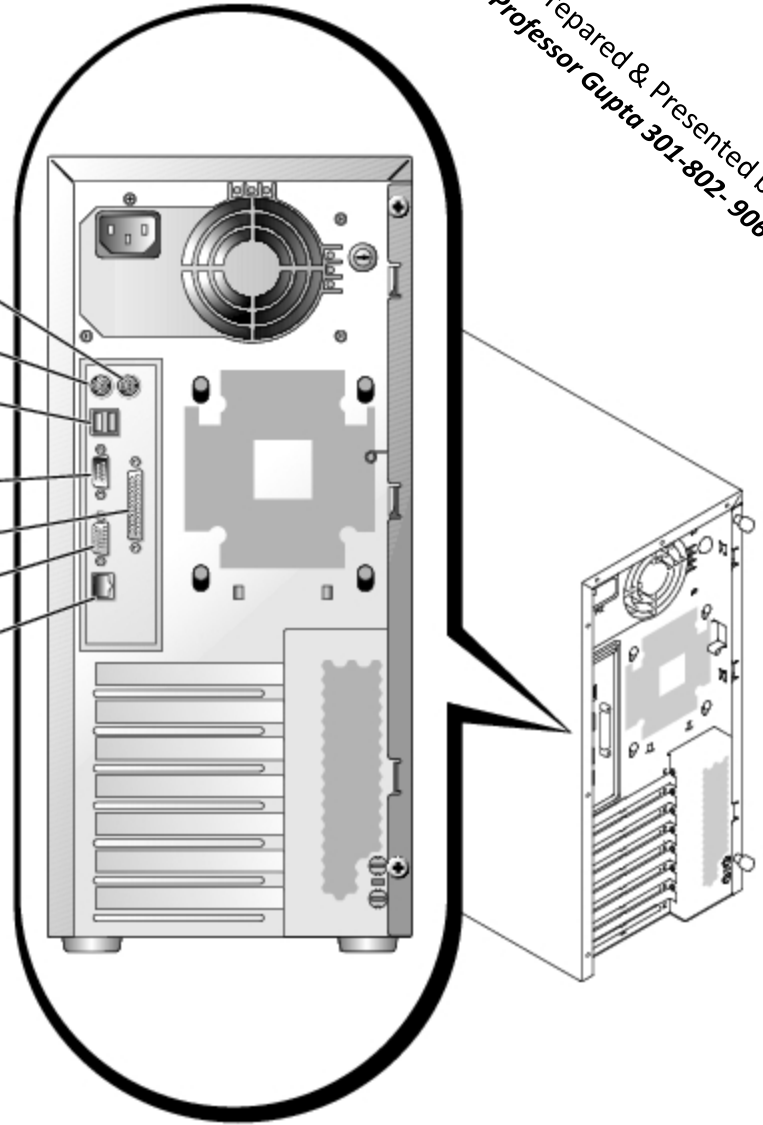

mouse connector
keyboard connector
USB connectors (2)
serial connector
parallel connector
video connector
NIC connector

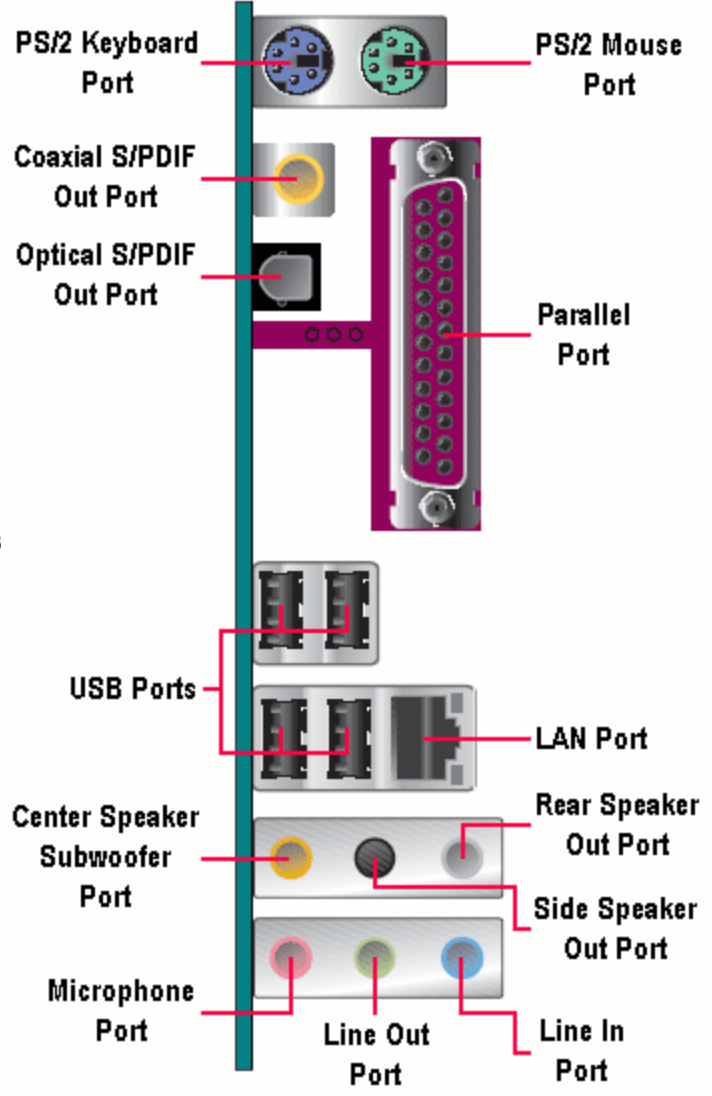Motherboards in both the ATX and BTX families feature a variety of integrated I/O ports. These are found in as many as three locations: all motherboards feature a rear port cluster, and many motherboards also have additional ports on the top of the motherboard that are routed to header cables accessible from the front and rear of the system.

I/O Ports

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serial port 2 connector
10/100/1000 NIC
connectors (2)

serial port 1 connector
keyboard connector
mouse connector
video connector
USB connectors (2)
embedded
remote access
Ethernet
connector

PS/2 Keyboard
Port

PS/2 Mouse
Port

Coaxial S/PDIF
Out Port

Optical S/PDIF
Out Port

Parallel
Port

USB Ports

LAN Port

Center Speaker
Subwoofer
Port

Rear Speaker
Out Port

Side Speaker
Out Port

Microphone
Port

Line Out
Port

Line In
Port

For technicians, the greatest benefits of integrated components come during initial setup. Fewer components need to be installed to make a system meet standard requirements and components can be enabled or disabled through the BIOS setup program. Very handy!
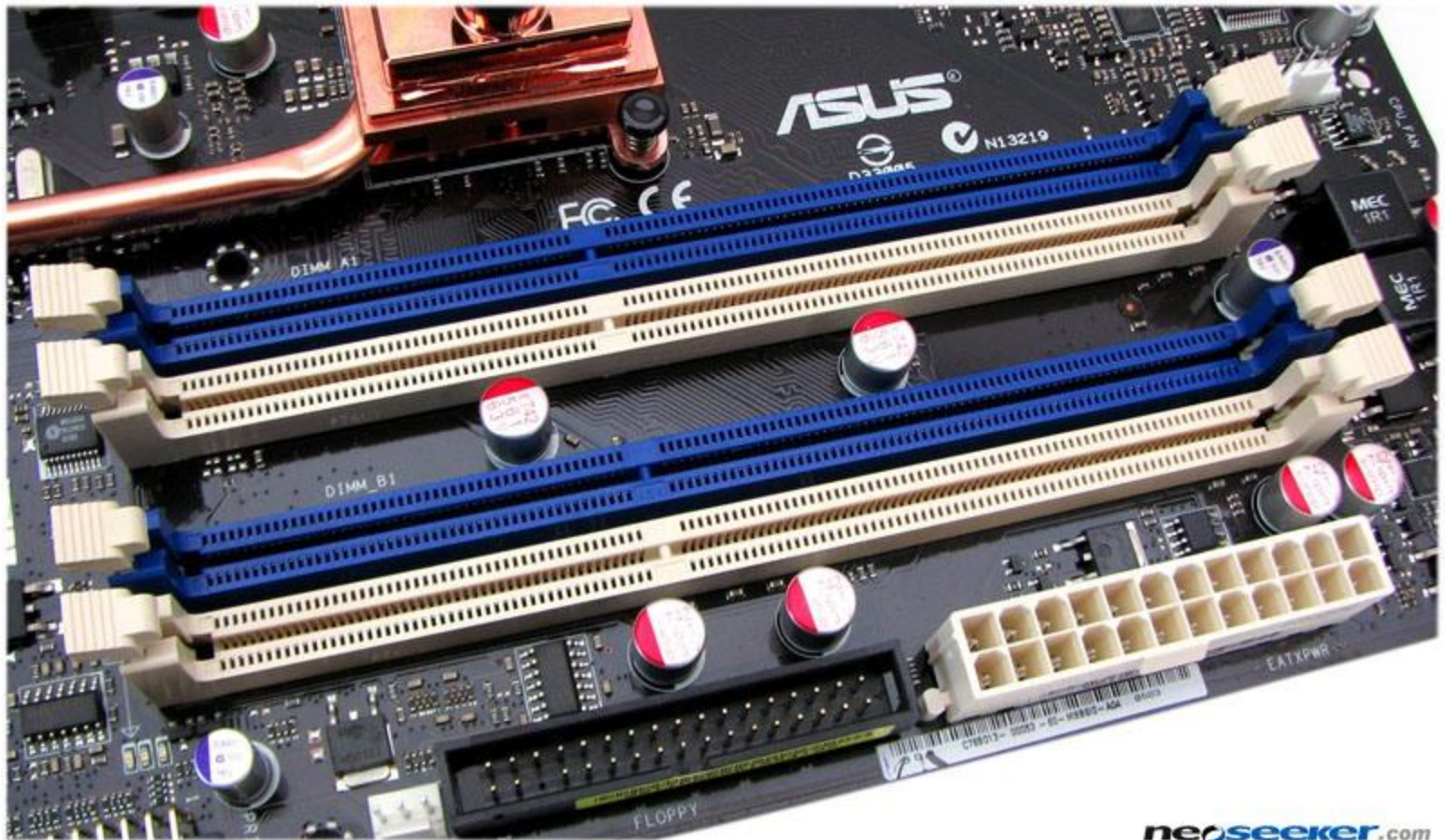
Memory slots vary in design according to the type of memory the system supports. Older systems that use SDRAM use three-section memory slots designed for 168-pin memory modules. Systems that use DDR SDRAM use two-section memory slots designed for 184-pin modules. Systems that use DDR2 SDRAM use two section memory slots designed for 240-pin modules.
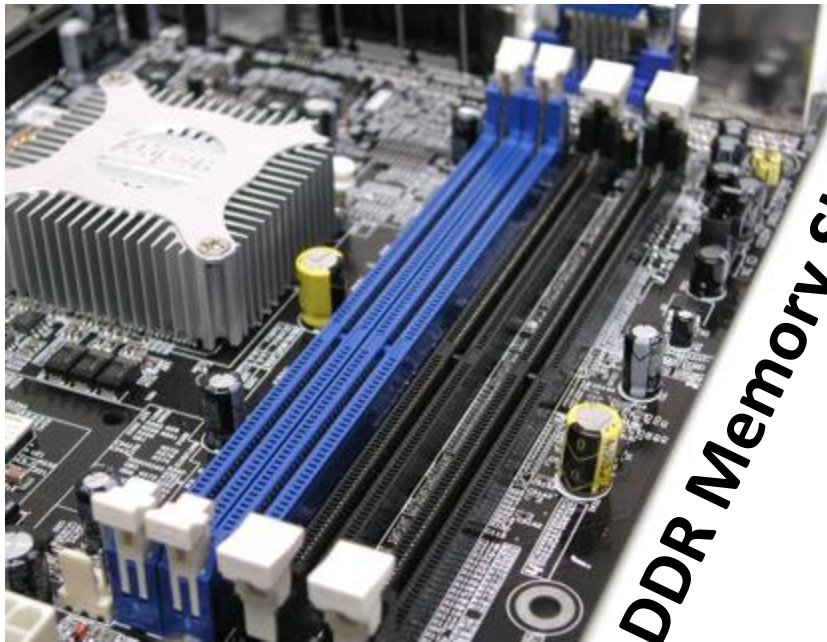
DDR Memory Slots

DDR3 Memory Slots

DDR2 Memory Slots

Each memory slot includes locking levers that secure memory in place. When memory is properly installed, the levers automatically swivel into place.

PC2100 266Mhz 184PIN DDR Memory DIMM				
DDR PC2100 266Mhz	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC2100 266Mhz ECC	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC2100 266Mhz ECC Registered	256MB DIMM	512MB DIMM	1GB DIMM	2GB DIMM
PC2700 333Mhz 184PIN DDR Memory DIMM				
DDR PC2700 333Mhz	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC2700 333Mhz ECC	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC2700 333Mhz ECC Registered	256MB DIMM	512MB DIMM	1GB DIMM	2GB DIMM
PC3200 400Mhz 184PIN DDR Memory DIMM				
DDR PC3200 400Mhz	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC3200 400Mhz ECC	256MB DIMM	512MB DIMM	1GB DIMM	
DDR PC3200 400Mhz ECC Registered	256MB DIMM	512MB DIMM	2GB Kit	2GB DIMM

Each memory slot includes locking levers that secure memory in place. When memory is properly installed, the levers automatically swivel into place.

PC2 3200 400Mhz 240 Pin DDR2 Memory DIMM				
DDR2 PC2-3200 400Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-3200 ECC 400Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-3200 ECC Registered 400Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
PC2 4200 533Mhz 240 Pin DDR2 Memory DIMM				
DDR2 PC2-4200 533Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-4200 ECC 533Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-4200 ECC Registered 533Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-4200 ECC Fully Buffered 533Mhz	512M DIMM	[1GB DIMM](#)	[2GB Kit](#)	[4GB Kit](#)	[8GB Kit](#)
PC2 5300 667Mhz 240 Pin DDR2 Memory DIMM				
DDR2 PC2-5300 667Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-5300 ECC 667Mhz	512MB DIMM	[1GB DIMM](#)	[2GB DIMM](#)	
DDR2 PC2-5300 ECC Registered 667Mhz	512MB DIMM	[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-5300 ECC Fully Buffered 667Mhz	512MB DIMM	[1GB DIMM](#)	[2GB Kit](#)	[4GB Kit](#)	[8GB Kit](#)
PC2 6400 800Mhz 240 Pin DDR2 Memory DIMM				
DDR2 PC2-6400 800Mhz	[512MB DIMM](#)	[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-6400 ECC 800Mhz		[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-6400 ECC Registered 800Mhz		[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-6400 ECC Registered Low-Profile 800Mhz		[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)
DDR2 PC2-6400 ECC Fully Buffered 800Mhz		[1GB DIMM](#)	[2GB DIMM](#)	[4GB DIMM](#)

PC3-8500 DDR3-1066 DIMM Memory	1GB	2GB	4GB	
PC3-8500 DDR3-1066 ECC DIMM Memory	1GB	2GB	4GB	4GB CL7 18c 256x8
PC3-8500 DDR3-1066 ECC Registered DIMM Memory		2GB	2GB	4GB
PC3-10666 DDR3-1333 DIMM Memory	512MB	1GB	2GB	4GB	8GB
PC3-10666 DDR3-1333 ECC DIMM Memory		2GB	4GB	
PC3-10666 DDR3-1333 240pin Registered ECC DIMM Memory		2GB	4GB	
PC3-11000 DDR3-1375 DIMM Memory	1GB			
PC3-12800 DDR3-1600 DIMM Memory	1GB	2GB	4GB	8GB
PC3-14400 DDR3-1800 DIMM Memory	1GB			
PC3-16000 DDR3-2000 DIMM Memory		2GB		

SCSI (pronounced "scuzzy") is an abbreviation for "Small Computer Interface System." With a SCSI expansion card, you can connect up to fifteen devices to one SCSI connection. SCSI is one of the fastest data transfer interfaces there is. SCSI cards are available with transfer rates up to 320 MB per second! The Ultra320 SCSI-3 interface is the fastest SCSI interface, with a 320MB/sec data transfer rate

ISA Slots: ISA slots are an older type of expansion slot, twice as big as PCI slots and slower than PCI slots as well. ISA slots are usually black, while PCI slots are usually white. ISA slots are not used much anymore, but most computers still have at least one of them.

PCI Express is a new technology that is slowly replacing AGP. PCI Express x16 slots can transfer data at 4GBs per second, which is about twice as fast as an AGP 8x slot. PCIe stands for PCI Express, or PCIexpress. PCI Express slots come in five different sizes and speeds: PCIe x1, PCIe x2, PCIe x4, PCIe x8, and PCIe x16. PCIe x16 slots are used for graphics cards

PCI slots can handle 64 bits of data at a time, twice as fast as ISA slots, which can only handle 32 bits of data at a time. PCI is an abbreviation for "Peripheral Component Interconnect." A 64-bit PCI slot has 64 connections to the motherboard, and each connection is capable of handling 1 bit of data at a time.

The AGP expansion slot connects AGP video cards to the motherboard. Video cards are also known as graphics cards. They process video and image data that will be displayed on your screen. The monitor plugs into the video card. AGP is an abbreviation for Accelerated Graphics Port. Most AGP video cards are capable of a higher data transfer rate than PCI video cards. AGP slots and cards come in four different modes, and you must be careful to match the card and slot with the correct mode. Some AGP cards and AGP slots are capable of running in more than one mode. AGP 1x mode is the oldest; it transfers data at 266MBs per second. AGP 2x mode transfers data at 533megabytes per second. AGP 4x mode transfers data at 1.07 gigabytes (1007 megabytes) per second. The latest AGP mode is AGP 8x. It transfers data at 2.14gigabytes (2140 megabytes) per second.

➢ Expansion slots are located on the motherboard, and openings on the back of the computer allow the ports on the cards that go in the slots to be accessed. There are several types of expansion slots, including AGP, PCIe (also known as PCIexpress), PCI, and ISA.
➢ An expansion slot is a computer system interface slot which accepts peripheral devices as circuit cards which are physically inserted into the slot, thus expanding the capability of the system. Additional ram memory and disk drives are examples of peripherals which can be added through expansion slots.
➢ Expansion slots in a computer are a connection on the motherboard that additional cards such as video or graphic adapters can be plugged into. Most cases will also have punchout sections lined up with the slots to enable connections to the cards installed.

The motherboard shown includes most of the slots that you'll run into these days. It's a little unusual in that you don't often see motherboards which have both PCI-Express slots and an AGP slot. The best slot to use for video cards is the PCI-Express x16 slot. The next best is the AGP slot. The next best is a PCI-Express x1 slot but video cards which fit that slot are very hard to find as of late 2006. The worst choice for a video card is a PCI slot. If you're building or buying a new computer then be sure to get one with a PCI-Express x16 slot. You shouldn't buy anything else. Some low-budget computers are sold with **integrated video** and have neither a PCI-Express x16 slot or an AGP slot. With that kind of computer you're stuck using a very slow PCI slot when upgrading your video system. You definitely want to avoid that situation. Many low-budget computers with integrated video include either a PCI-Express x16 slot or an AGP slot so be sure to get one of those. That way you'll have good choices available if you decide to upgrade your video system. If you only have a PCI slot then your upgrade choices are extremely limited, underpowered, and overpriced.

Case Back

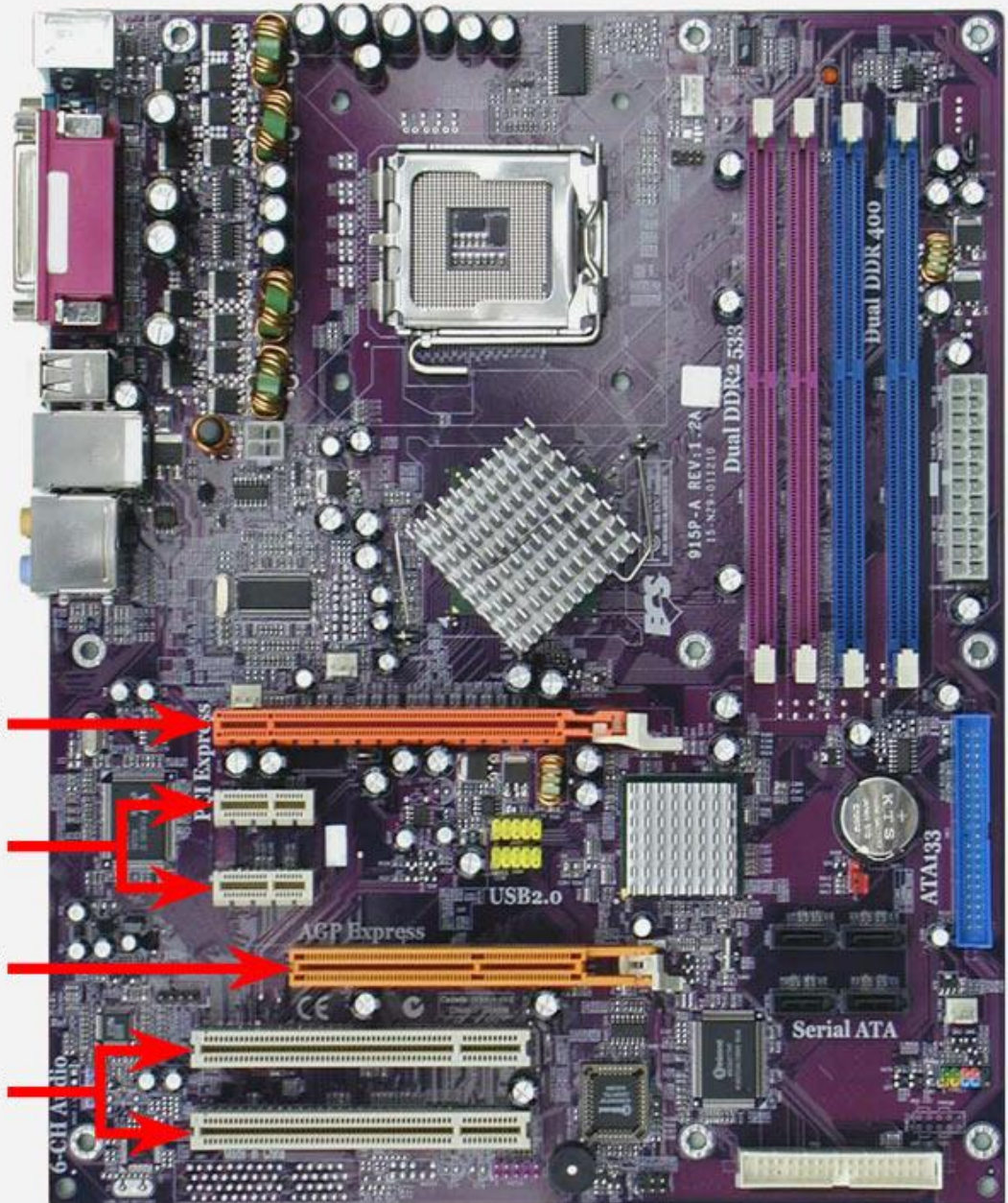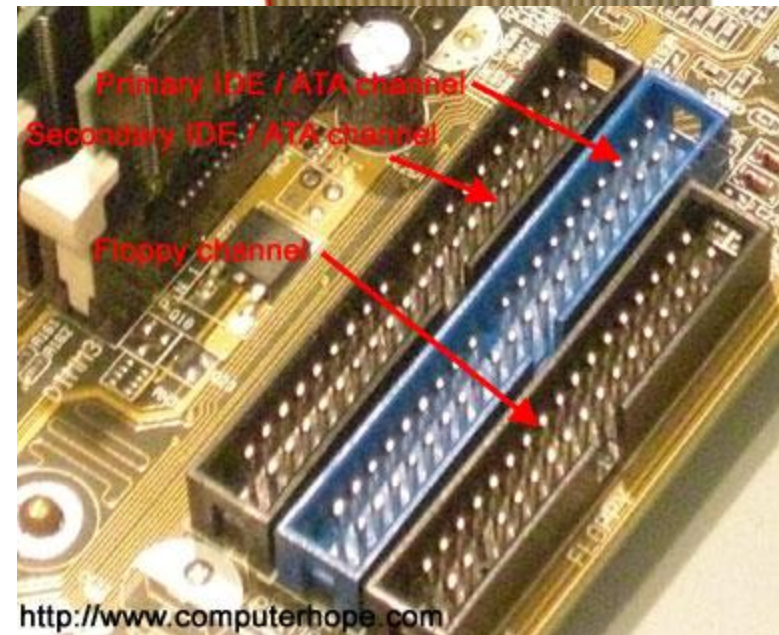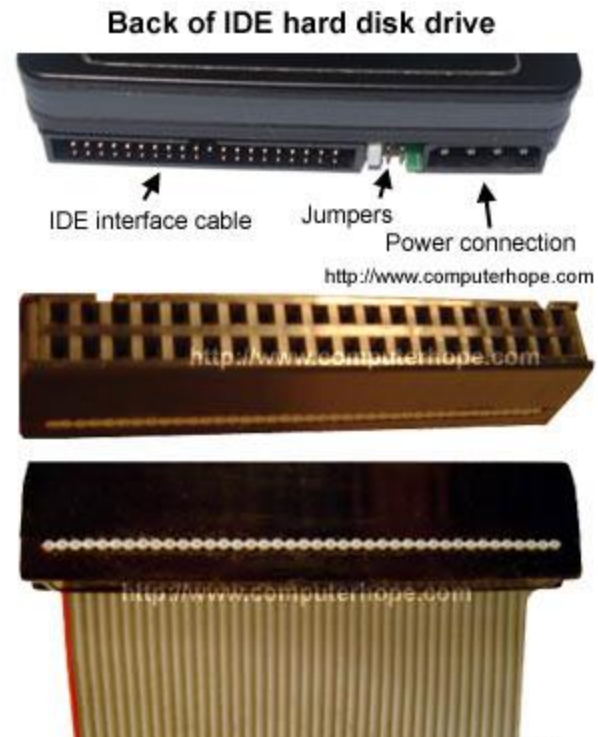Case Front

PCI-Express x16

PCI-Express x1

AGP

PCI

Expansion Slots
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Short for **Integrated Drive Electronics** or **IBM Disc Electronics**, **IDE** is more commonly known as ATA and is a standard interface for IBM compatible hard drives. IDE is different from the Small Computer Systems Interface (SCSI) and Enhanced Small Device Interface (ESDI) because its controllers are on each drive, meaning the drive can connect directly to the motherboard or controller. IDE and its updated successor, Enhanced IDE (EIDE), are the most common drive interfaces found in IBM compatible computers today. Below is a picture of the actual IDE connector on the back of a hard disk drive, a picture of what an IDE cable looks like, and the IDE channels it connects to on the motherboard.

Back of IDE hard disk drive

IDE interface cable   Jumpers   Power connection

http://www.computerhope.com

Primary IDE / ATA channel
Secondary IDE / ATA channel
Floppy channel

http://www.computerhope.com

SerialATA, SATA 1.0 was first released in August 2001 and is a replacement for the Parallel ATA interface used in IBM compatible computers. SerialATA is capable of delivering 1.5Gbps (150MBps) of performance to each drive within a disk array, offers backwards compatibility for existing ATA and ATAPI devices, and offers a thin, small cable solution as seen in the picture to the left. This cable helps make a much easier cable routing and offers better airflow in the computer when compared to the earlier ribbon cables used with ATA drives.In addition to being an internal solution SATA also supports external drives through **External SATA** more commonly known as **eSATA**. eSATA offers many more advantages when compared to to other solutions. For example, it is hot-swappable, supports faster transfer speeds and no bottleneck issues when compared with other popular external solutions such as USB and Firewire, and supports disk drive technologies such as S.M.A.R.T..
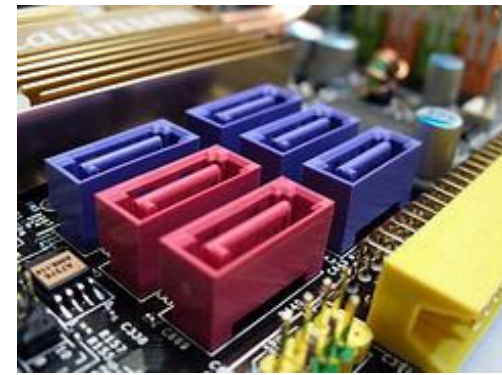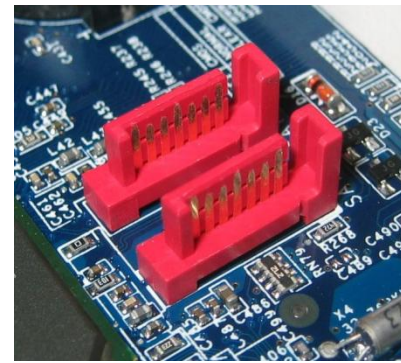
SATA 1 And SATA 2 Standards
•The SATA 1 named SATA 150, offers a bandwidth of 1.5 Gbit/s. In comparison with the ATA/133, it was a slight advantage. The first SATA generation was more used for its features than its bandwidth.
•The SATA 2 called SATA 300 is the new generation working at the rate of 3 Gbit/s. It is more than twice than the ATA rate. With a frequency like this you can finally feel the difference between the 2 technologies.
•The SATA 3 is on the way and will offer a bandwidth of 6 Gbit/s. The ability of using more than 1 drives by cables should appear on the 3rd generation.

Small Computer System Interface, SCSI, pronounced as *"Scuzzy"*, is the second most commonly used interface for disk drives that was first completed in 1982. Unlike competing standards, SCSI is capable of supporting eight devices, or sixteen devices with Wide SCSI. However, with the SCSI host adapter located on ID number 07 and boots from the ID 00. This leaves the availability of six device connections.

➤ **SCSI-1** is the original SCSI standard developed back in 1986 as ANSI X3.131-1986. SCSI-1 is capable of transferring up to eight bits a second.
➤ **SCSI-2**, approved in 1990, added new features such as Fast and Wide SCSI, and support for additional devices.
➤ **SCSI-3** was approved in 1996 as ANSI X3.270-1996.
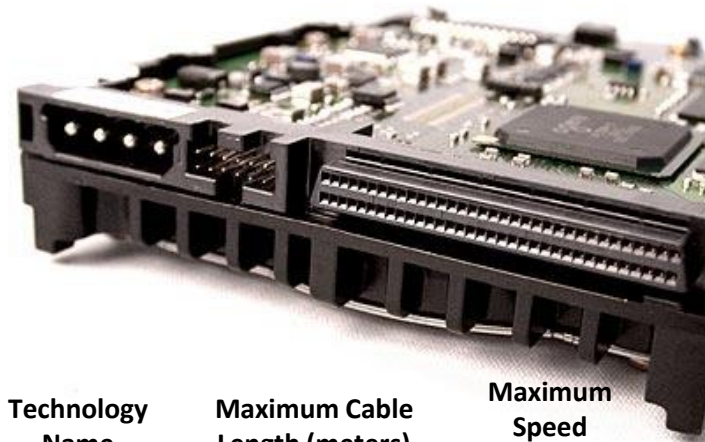
Technology Name	Maximum Cable Length (meters)	Maximum Speed (MBps)	Maximum Number of Devices
SCSI-1	6	5	8
SCSI-2	6	5-10	8 or 16
Fast SCSI-2	3	10-20	8
Wide SCSI-2	3	20	16
Fast Wide SCSI-2	3	20	16
Ultra SCSI-3, 8-bit	1.5	20	8
Ultra SCSI-3, 16-bit	1.5	40	16
Ultra-2 SCSI	12	40	8
Wide Ultra-2 SCSI	12	80	16
Ultra-3 (Ultra160/m) SCSI	12	160	16