No: 1) **FAMILIARIZATION WITH COMPUTERS**

BLOCK DIAGRAM WITH BUSES

ADDRESS BUS

It is a collection of wires connecting the CPU with main memory. That is used to identify particular locations (addresses) in main memory. The width of the address bus (that is, the number of wires) determines how many unique memory locations can be addressed. Modern PCs and Macintoshes have as many as 36 address lines, which enable them theoretically to access 64 GB (gigabytes) of main memory. However, the actually amount of memory that can be accessed is usually much less than this theoretical limit due to chipset and motherboard limitations.

CONTROL BUS

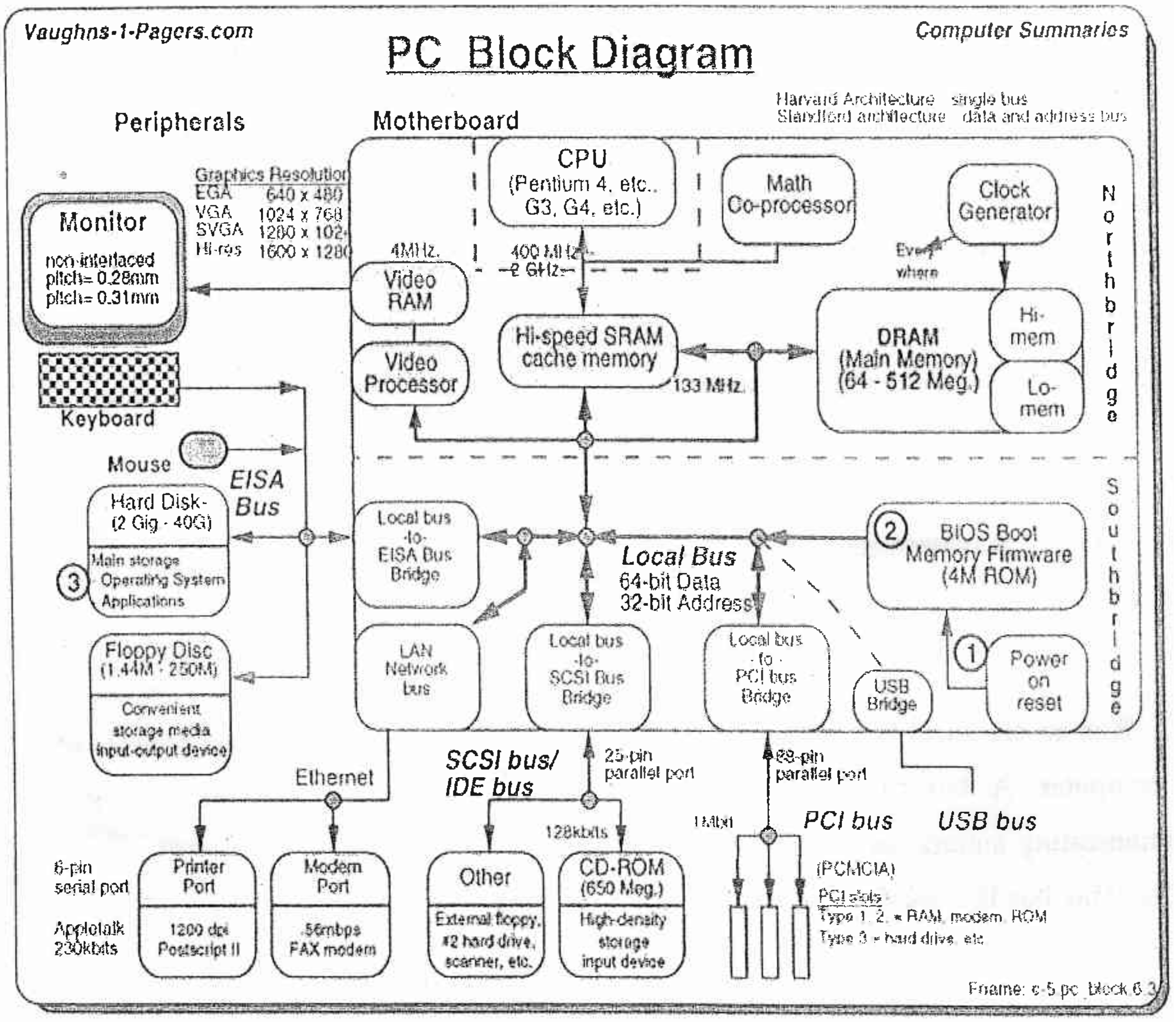
The physical connections that carry control information between the CPU and other devices within the computer. Whereas the *data bus* carries actual data that is being processed, the control bus carries signals that report the status of various devices. For example, one line of the bus is used to indicate whether the CPU is currently reading from or writing to main memory.

DATA BUS

It is an electrical pathway, or bus, used to carry data between the components of the computer. A bus that operates only within the internal circuitry of the CPU, communicating among the internal caches of memory that are part of the CPU chip's design. This bus is typically rather quick and is independent of the rest of the computer's operation.

SHORT NOTES ON COMPUTERS

Here is a brief summary computer block diagram of a typical Personal Computer. The von Neumann (CISC) architecture employs a single bus. CISC stands for Complex Instruction Set Computer. A single-bus system is illustrated. The Harvard (RISC) architecture utilizes two busses - a data bus and a separate address bus. RISC stands for Reduced Instruction Set Computer.



Relationships are shown between the CPU, DRAM, local bus, and the peripherals which connect to the motherboard. The ISA bus, SCSI Bus, PCI bus and USB Bus are shown. Some typical computer parameters are given, along with a Graphics Resolution chart. A computer as shown in Fig. performs basically five major operations or functions irrespective of their size and make. These are

1) It accepts data or instructions by way of input

2) It stores data

3) It can process data as required by the user

4) It gives results in the form of output,

5) It controls all operations inside a computer.

We discuss below each of these operations.

1. **Input**: This is the process of entering data and programs in to the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. **Storage**: The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

3. **Processing**: The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. **Output**: This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

5. **Control**: The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step-by-step processing of all operations in side the computer.

FUNCTIONAL UNITS

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are

1) Arithmetic logical unit

2) Control unit

3) Central processing unit.

Arithmetic Logical Unit (ALU)

After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output. Therefore it is the manager of all operations mentioned in the previous section.

Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations

HARDWARE COMPONENTS OF A MODERN PC

1. MICROPROCESSOR

It is a silicon chip that contains a CPU. In the world of personal computers, the terms *microprocessor* (sometimes abbreviated µP) and CPU are used interchangeably. At the heart of all personal computers and most workstations sits a microprocessor. Microprocessors also control the logic of almost all digital devices, from clock radios to fuel-injection systems for automobiles. It was born by reducing the word size of the central processing unit from 32 bit to 4 bit, so that it would fit onto a single semi conducting integrated circuit (IC). One or more microprocessors typically serve as a central processing unit (CPU) in a computer system or handheld device.

Three basic characteristics differentiate microprocessors:

- Instruction set: The set of instructions that the microprocessor can execute.

- Bandwidth : The number of bits processed in a single instruction.
- Clock speed : Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

In both cases, the higher the value, the more powerful the CPU. For example, a 32-bit microprocessor that runs at 50MHz is more powerful than a 16-bit microprocessor that runs at 25MHz.

In addition to bandwidth and clock speed, microprocessors are classified as being either RISC (reduced instruction set computer) or CISC (complex instruction set computer).

2. MOTHERBOARD

CPU Chip is the brain of any computer. This Pentium 4 2.5-gigabyte chip has a very large cooling fan, which circulates air around the chip.

RAM Memory is where information is stored for very quick access by the computer. DIMM memory was the popular memory chip until the more recent RIMM Chips came on the scene.

BIOS Chip is that chip responsible for holding the data the computer needs to start and to check all devices in the system. This data is not lost when the computer is turned off. The cmos battery keeps the data intact.

CMOS Battery provides power to the BIOS Chip so that the computer can access the data on the chip. This data allows the computer to boot up.

ISA Slots stands for Industry Standard Architecture and this is the older and slower data bus used on 486 PCs

PCI Slots replaced the slower ISA Slots. The PCI data bus gives the computer much faster data transfer from the device to the motherboard.

AGP Slot is used by the video card to provide quick and fast access by the CPU. Video data is send directly to the cpu without any delay whatsoever.AGP stands for Accelerated

Graphics Port: an Intel-designed 32-bit PC bus architecture introduced in 1997 allowing graphics cards direct access to the system bus.

USB Ports or Universal Serial Bus ports are Intel's newer standard connection for attaching such peripherals as digital cameras.

Disk Controllers are where the data cable coming from the drives are connected.These Controllers, such as the Floppy and Hard Drive controllers are mounted onto the motherboard. Some older computers had these components mounted in adapter slots

The Chipsets are simply a number of integrated circuits designed to perform one or more functions that are closely related to each other.

Expansion Slots are input/output buses made of a series of slots on the motherboard. Expansion slots are plugged into such data buses as the ISA and PCI bus.

Parallel Ports are input/output channels a such parallel devices like the printer.Data is send and received eight bits at a time over 8 separate wires.

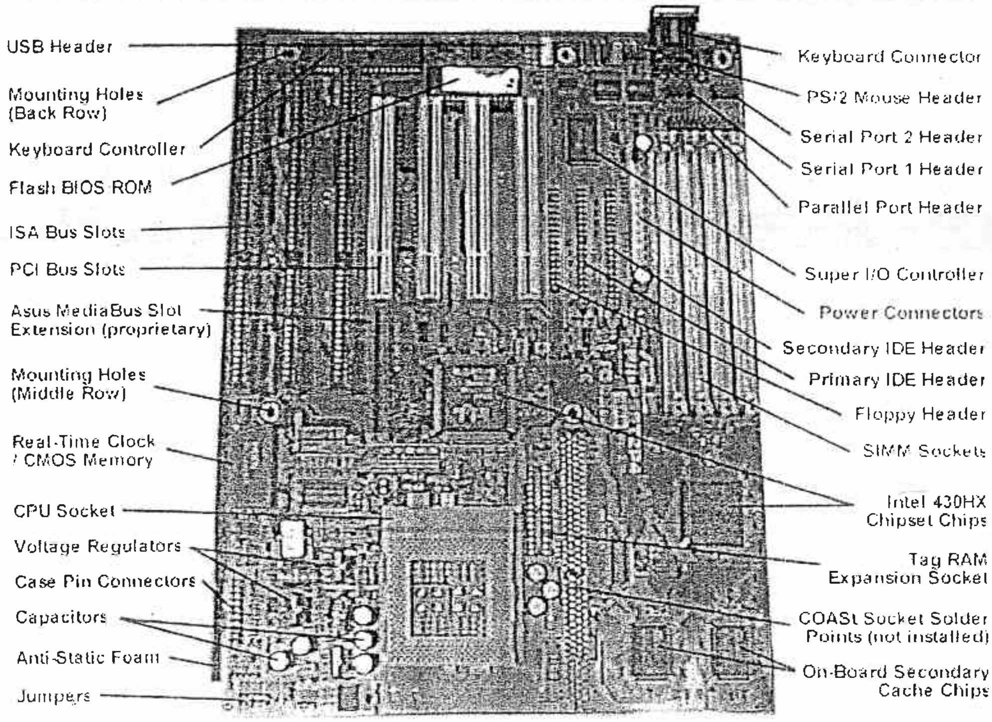
PS/2 Port is an IBM Computer port introduced in 1987.It such developed to interface keyboards and such pointing devices as the mouse, touch pads, and trackballs. This port is commonly referred to as the mouse port.

Serial Ports allow communication between the computer and such serial devices as modems, and mice. Serial Ports are also called COM or communications port.

ATX Power Connector provides power from the power supply to the motherboard. Without this connection, all other devices on the motherboard would be useless.

ZIF Socket is the designed socket where the CPU Chip is installed. This socket is best known for its quick and fast upgrade by allowing the chip to be removed and installed easily.

These are the major components of the motherboard with very few exceptions.



3. PRIMARY MEMORY

a) Random access memory(RAM)

Random-Access Memory (usually known by its acronym, RAM) is a type of data store used in computers that allows the stored data to be accessed in any order — that is, at random, not just in sequence. In contrast, other types of memory devices (such as magnetic tapes, disks, and drums) can access data on the storage medium only in a predetermined order due to constraints in their mechanical design.

Generally, RAM in a computer is considered *main memory* or primary storage: the working area used for loading, displaying and manipulating applications and data. This type of RAM is usually in the form of integrated circuits (ICs). These are commonly called *memory sticks* or *RAM sticks* because they are manufactured as small circuit boards with plastic packaging and are about the size of a few sticks of chewing gum. Most personal computers have slots for adding and replacing memory sticks.

Most RAM can be both written to and read from, so "RAM" is often used interchangeably with "read-write memory." In this sense, RAM is the "opposite" of ROM, but in a more true sense, of sequhential access memory.

Computers use RAM to hold the program code and data during computation. A defining characteristic of RAM is that all memory locations can be accessed at almost the same speed. Most other technologies have inherent delays for reading a particular bit or byte.

Many types of RAM are *volatile*, which means that unlike some other forms of computer storage such as disk storage and tape storage, they lose all data when the computer is powered down. Modern RAM generally stores a bit of data as either a charge in a capacitor, as in dynamic RAM, or the state of a flip-flop, as in static RAM.

b) **Read Only Memory (ROM)**

It is a class of storage media used in computers and other electronic devices. Because it cannot (easily) be written to, its main uses lie in the distribution of firmware (software that is very closely related to hardware, and not likely to need frequent upgrading).

Modern semiconductor ROMs typically take the shape of IC packages, i.e. "computer chips", not immediately distinguishable from other chips like RAMs but for the text printed on the chips. "ROM" in its strictest sense can only be read from, but all ROMs allow data to be written into them at least once, either during initial manufacturing or during a step called "programming". Some ROMs can be erased and re-programmed multiple times, although they are still referred to as "read only" because the reprogramming process involves relatively infrequent, complete erasure and reprogramming, not the frequent, bit- or word at a time updating that is possible with RAM (random access memory).

Types of ROMs

Semiconductor based

Classic mask-programmed ROM chips are written to during production and cannot change content afterwards. But there are other types of non-volatile solid-state memory:

- PROMs (Programmable Read-Only Memory) can be written to (*programmed*) via a special device, a PROM programmer. The writing often takes the form of permanently destroying or creating internal links (fuses or antifuses) with the result that a PROM can only be programmed once.

- EPROMs (Erasable Programmable Read-Only Memory) can be erased by exposure to ultraviolet light then rewritten via an EPROM programmer. Repeated exposure to ultraviolet light will eventually destroy the EPROM but it generally takes many (greater than 1000) exposures before the EPROM becomes unusable. EPROMs can be easily identified by the circular 'window' in the top which allows the UV light to enter. Once programmed, this window is typically covered by a label to prevent accidental erasure.
- EAROMs (Electrically Alterable Read-Only Memory) can be modified a bit at a time, but writing is a slow process and uses non-standard voltages (usually higher voltages around 12 volts). Rewriting an EAROM is intended to be an infrequent operation - most of the time the memory is used as a ROM. EAROM may be used to store critical system setup information in a non-volatile way. For many applications, EAROM has been supplanted by CMOS RAM backed-up by a lithium battery.
- EEPROM such as Flash memory (Electrically Erasable Programmable Read-Only Memory) allow the entire ROM (or selected *banks* of the ROM) to be electrically erased (*flashed back to zero*) then written to without taking them out of the computer (camera, MP3 player, etc.). Flashing is much slower (milliseconds) than writing to RAM (nanoseconds) (or reading from any ROM).
- By applying write protection, read/write memory may be turned (temporarily) into read-only memory

c) **<u>SIMM (single in-line memory module)</u>**

The *single inline* memory module or *SIMM* is still the most common memory module format in use in the PC world, largely due to the enormous installed base of PCs that use them (in new PCs, DIMMs are now overtaking SIMMs in popularity.) SIMMs are available in two flavors: 30 pin and 72 pin. 30-pin SIMMs are the older standard, and were popular on third and fourth generation motherboards. 72-pin SIMMs are used on fourth, fifth and sixth generation PCs.

SIMMs are placed into special sockets on the motherboard created to hold them. The sockets are specifically designed to ensure that once inserted, the SIMM will be held in place tightly. SIMMs are secured into their sockets (in most cases) by inserting them at an angle (usually about 60 degrees from the motherboard) into the base of the socket and then tilting them upward until they are perpendicular to the motherboard. Special metal clips on either side of the socket snap in place when the SIMM is inserted correctly. The SIMM is also keyed with a notch on one side, to make sure it isn't put in backwards.

The 30 pin SIMMs are generally available in sizes from 1 to 16 MB. Each one has 30 pins of course, and provides one byte of data (8 bits), plus 1 additional bit for parity with parity versions. 72-pin SIMMs provide four bytes of data at a time (32 bits) plus 4 bits for parity/ECC in parity/ECC versions.

SIMMs are available in two styles: *single-sided* or *double-sided*. This refers to whether or not DRAM chips are found on both sides of the SIMM or only on one side. 30-pin SIMMs is all (I am pretty sure) single-sided. 72-pin SIMMs are either single-sided or double-sided. Some double-sided SIMMs are constructed as *composite SIMMs*. Internally, they are wired as if they were actually two single-sided SIMMs back to back. This doesn't change how many bits of data they put out or how many you need to use. However, some motherboards cannot handle composite SIMMs because they are slightly different electrically.

d) **DIMM (dual in-line memory module)**

A DIMM, or dual in-line memory module comprises a series of random access memory integrated circuits. These modules are mounted on a printed circuit board and designed for use in personal computers. DIMMs began to replace SIMMs (single in-line memory modules) as the predominant type of memory module as Intel's Pentium processors began to control the market.

The main difference between SIMMs and DIMMs is that SIMMs have a 32-bit data path, while DIMMs have a 64-bit data path. Since Intel's Pentium has (as do several other processors) a 64-bit bus width, it required SIMMs installed in matched pairs in order to use them. The processor would then access the two SIMMs simultaneously. DIMMs were introduced to eliminate this inefficiency. Another difference is that DIMMs have separate electrical contacts on each side of the module, while the contacts on SIMMs on both sides are redundant.

The most common types of DIMMs are:

- 72-pin-DIMMs, used for SO-DIMM
- 144-pin-DIMMs, used for SO-DIMM
- 200-pin-DIMMs, used for SO-DIMM
- 168-pin-DIMMs, used for FPM, EDO and SDRAM
- 184-pin-DIMMs, used for DDR SDRAM
- 240-pin-DIMMs, used for DDR2 SDRAM

There are 2 notches on the bottom edge of 168-pin-DIMMs, and the location of each notch determines a particular feature of the module.

- The first notch is DRAM key position. It represents RFU (reserved future use), registered, and unbuffered.
- The second notch is voltage key position. It represents 5.0V, 3.3V, and Reserved.
- The upper DIMM in the photo is an unbuffered 3.3V 168-pin DIMM.

A DIMM's capacity and timing parameters may be identified with SPD (Serial Presence Detect), an additional chip which contains information about the module type.

ECC DIMM's are those that have extra data-bits which can be used by the system memory controller to detect and correct errors. There are numerous ECC schemes, but perhaps the most common is Single Error Correct, Double Error Detect (SECDED) which uses a 9th extra bit per byte.

4) EXPANSION SLOTS

An opening in a computer where a circuit board can be inserted to add new capabilities to the computer. Nearly all personal computers except portables contain expansion slots for adding more memory, graphics capabilities, and support for special devices. The boards inserted into the expansion slots are called *expansion boards*, *expansion cards*, *cards*, *add-ins*, and *add-ons*.

Expansion slots for PCs come in two basic sizes: *half-* and *full-size*. Half-size slots are also called 8-bit slots because they can transfer 8 bits at a time. Full-size slots are sometimes called 16-bit slots. In addition, modern PCs include PCI slots for expansion boards that connect directly to the PCI bus.

a) **ISA**

The Industry Standard Architecture (ISA) was approved in 1987 by a committee of the IEEE (Institute of Electrical and Electronic Engineers) formally approved the ISA standard.

The ISA bus is actually an 8 bit or 16 bit bus, and operates at 8.25 mhz, or approximately 4MB transfer rate with the 8 bit bus, and 8 mb/s throughput maximum with the 16-bit bus. The expansions slots on a PC's motherboard usually allow for both a 8 or 16 bit ISA card to be connected. This is not the most efficient size, and the ISA standard is being replaced gradually with EISA and PCI buses (Micronics M6Me Dual Pentium processor system for instance, which does not have an ISA expansion slot; its expansions slots are EISA and PCI; but it does have a 64-bit ISA video).

It may notice that most buses operate at a sub-multiple of the actual system clock speed. For instance, 8.25 is one fourth the speed of a 33mhz system. The sub-multiples of speed is how a bus clock and system can maintain synchronous operations.

b) **MCA**

The Micro Channel Architecture (MCA) was IBM's attempt to improve the PC/XT bus and the AT bus (also known as the ISA bus). IBM had completed its design of the AT bus prior to 1987 when the AT standard was approved as the Industry Standard Architecture (ISA). So, in 1983, IBM started the work on a total redesign of system buses even before ISA was approved. The result was the MCA bus.

The MCA was actually a great improvement in its time, but it was developed under numerous concepts not shared outside IBM with the rest of the PC world. Consequently, over time, it did not gain the popularity of ISA and EISA.

Well, this is partly due to IBM's vision that PCs should be able to handle multiple jobs simultaneously, and as a platform to connect to mainframes. The MCA was technically superior to anything available, but not for the direction that PCs took. It had a substantial impact on all subsequent motherboard design throughout the industry. While millions of the MCA motherboards were sold, it was not marketed well, and its technologies could be used under duress of heavy licensing fees.

c) **EISA**

The Enhanced Industry Standard Architecture (EISA) was developed in 1988 by a group of nine companies including AST Research, Compaq Computer Corporation, Epson, Hewlett-Packard, NEC, Olivetti, Tandy, Wyse, and Zenith.

It was developed in response to the IBM efforts with the Michrochannel Architecture (MCA). My understanding is that MCA was technologically advanced to the point of being far superior to the ISA and the older XT/PC architectures. These companies could not use the MCA technologies in their products due to the expensive licensing fees charged by IBM. Consequently, the group is supposed to have implemented the MCA technologies in their designed technologies.

It was to be a 32-bit design to increase the capabilities of ISA, and to compete with the 32-bit design of the MCA. With this increase in bus width and using an 8.33 MHz clock, the EISA can reach a theoretical 33 MB/s transfer rate. MCA at this time responded with a bus clock rate of 20Mhz and a 'potential' bus transfer of 160MB/s far outstripping the EISA. However, the EISA development group responded by beginning work on an EISA-2 specification that will move data at a potential transfer rate of 132 MB/s.

In actuality, neither MCA or EISA had a great influence on the market and the concept of a 'Local Bus' was introduced in 1991 by NEC became the most important concept in buses, and led later to the VESA Local Bus, and the PCI Local Bus. However, there are still a few motherboards available which have EISA bus in conjunction with PCI buses.

d) **VESA Local BUS**

The Video Electronics Standard Association (VESA) is a group of PC vendors who developed the VESA local bus. This group developed the standard for the VESA Local BUS (VL Bus) standard and formally announced in August 1992. It was designed to speed up video displays, but its specification was general enough for other high-speed data transfers.

VESA provided a standardized connector and protocol for local bus expansion system for PCs. VESA also announced a second generation VL Bus standard (Version 2) in 1992. This revision redefined the maximum number of VL Bus slots from 3 in the original specification to 3 slots at 40MHz and 2 slots at 50MHz in a circuit.

Its speed was originally set at up to 50MHz, and is a 32-bit card. VESA cards have two sets of connectors, one set is based on the 16 bit ISA slot, and a second set of 36 pairs of connectors that carry local bus information.

The VESA operates as follows:

1. The CPU sends signals to the I/O Controller that handles VL-Bus operations. The signals contain code and destination addresses for all the signals to follow.
2. The I/O controller decodes the addresses to determine if the signals are for any of the local-bus adapters.
3. Signals going to non-local bus adapters are sent to the ISA I/O controller. While the signals were passed at 33MHz and 32bits, the ISA controller will convert them to 16 bit, 8 MHz for the ISA BUS.
4. If a signal is for the VESA local bus, the VESA controller sends a signal control signal to the adapter in that slot, telling the adapter to execute the operation requested.
5. Once the adapter starts the operation, the VL controller lets the data for that operation pass directly from the processor to the local bus slot over a 32 bit data path, and at speeds up to 50MHz.

e) **PCI**

The Peripheral Component Interface (PCI): This bus was introduced by Intel Corporation in July 1992, a little more than a month before the VESA Local Bus specifications were announced. It was designed primarily for high-speed operation of the expansion bus. It was released again as PCI Release 2.0 in May 1993. PCI is the most popular 'bus' in the mid-1990s and is usually combined on a motherboard with an ISA or EISA expansion bus. For example, many motherboards have a number of pure ISA or EISA slots, some PCI slots, and one or more PCI/ISA combination slots.

The PCI bus was originally supposed to be a "local bus", but it is said it is a high-speed interconnection system. However, it runs at superior speed, for instance some of the SCSI interfaces can run up to 40 MB/S transfer rates, although some books indicate the original PCI bus was a 32 bit, 33MHz bus, which could move data at up to 132MBytes/sec as a theoretical maximum - this includes overhead. The May 1993 release broadened the data path to 64 bits to conform to the Pentium processors release in 1993. Please note the second release of the VESA Local Bus standards did the same.

The PCI standard provides an interface to the ISA, EISA, and MCA buses, but PCI can replace these older buses in a motherboard design. A pure PCI bus machine is possible, but most motherboards for years will still have an interface to ISA and EISA expansion slots. Remember: Most motherboards have both PCI and ISA, or PCI and EISA, or even PCI and MCA slots. The PCI I/O controller will route traffic from the CPU to the proper bus - either the PCI bus or the ISA/EISA bus.

f) AGP

In spite of its progress, PCI bus quickly became too slow for the graphic boars. INTEL developed bus AGP especially for those. The speed of this bus is of 66 MHz in all the versions. It is able by DMA (direct Memory Access) to take the control of the memory for the direct transfer of information. This characteristic is also established in bus PCI. The specifications of INTEL propose 3 operating modes:

AGP 1X, with a theoretical flow of 266 MB/s out of 32 bits (speed of 66 MHz), voltage of the signals: 3,3 V or 1,5 V

AGP 2X: this one makes it possible to charge information 1 time on the rising part of the clock, once on the downward part (doubly of the flow, 533 MB/s) on a base frequency of 66 MHz. Voltage of the signals on the bus: 1,5 V This bus are to manage by the circuits of interface INTEL 440 LX, EX, ZX and BX.

AGP 4X uses the same bus but to 133 MHz that his predecessors, as in AGP 4X, one duplicates information charged on the sides rising and downward with the clock. This type of bus implies that the read-write memory is sufficiently fast. There is a higher specification, extension of the AGP 4X, called AGP Pro which is intended for the future workstations. Specificity is related to the power supply of the board (50W for the AGP Pro 50 and 110 W for the AGP 110 against 25 W for the AGP 4X). The rate of transfer reaches 1,07 GB/s with a supply voltage of the board of 1,5 V.

Really left at the beginning of 2003,the AGP 8X remains in 32 bits but to 266 MHz. Only real advanced, the transfer reached in theory up to 2,13 GB/S. In practice, the profit of performance is lower than 5% compared to the AGP 4X. The AGP is able to detect the operating mode AGP of the graphics card. The voltage of the signals of the graphics accelerator passes to 0,8V. This weak voltage explains why a motherboard managing the AGP 8X can accept boards AGP 2X and 4X, but not a graphics card AGP 1X of the first generation.

5) ADAPTER CARD

A device that allows one system to connect to and work with another. An adapter is often a simple circuit that converts one set of signals to another; however, the term often refers to devices, which are more accurately called "controllers." For example, display adapters (video cards), network adapters (NICs) and SCSI host adapters perform extensive processing, but they are still called "adapters.

a) VIDEO CARD

A video card, (also referred to as a graphics card, graphics accelerator card, display adapter and numerous other terms), is an item of personal computer hardware whose function is to generate and output images to a display. The term is usually used to refer to a separate, dedicated expansion card that is plugged into a slot on the computer's motherboard, as opposed to a graphics controller integrated into the motherboard chipset.

A video card consists of a printed circuit board on which the components are mounted. These include:

Graphics processing unit (GPU)

The GPU is a microprocessor dedicated to manipulating and rendering graphics according to the instructions received from the computer's operating system and the software being used. At their simplest level, GPUs include functions for manipulating two-dimensional graphics, such as blitting. Modern and more advanced GPUs also include functions for generating and manipulating three-dimensional graphics elements, rendering objects with shading, lighting, texture mapping and other visual effects.

Video memory

Unlike integrated video controllers, which usually share memory with the rest of the computer, most video cards have their own separate onboard memory, referred to as video RAM (VRAM). VRAM is used to store the display image, as well as textures, buffers (the Z-buffer necessary for rendering 3D graphics, for example) and other elements.

Video BIOS

The video BIOS or firmware chip is a chip that contains the basic program that governs the video card's operations and provides the instructions that allow the computer and software to interface with the card.

b) **SOUND CARD**

A sound card is a computer expansion card that can input and output sound under control of computer programs. Typical uses of sound cards include providing the audio component for multimedia applications such as music composition, editing video or audio, presentation/education, and entertainment (games). Many computers have sound capabilities built in, while others require these expansion cards if audio capability is desired.

A typical sound card includes a sound chip, usually featuring a digital-to-analog converter that converts recorded or generated digital waveforms of sound into an analog format. This signal is led to a (typically 1/8-inch earphone-type) connector where an amplifier, headphones, or similar sound destination can be plugged in. More advanced designs usually include more than one sound chip to separate duties between digital sound production and synthesized sounds (usually for real-time generation of music and sound effects utilizing little data and CPU time).

Digital sound reproduction is usually achieved by multi-channel DACs, able to play multiple digital samples at different pitches and volumes, optionally applying real-time effects like filtering or distortion. Multi-channel digital sound playback can also be used for music synthesis if used with a digitized instrument bank of some sort, typically a small amount of ROM or Flash memory containing samples corresponding to the standard MIDI instruments. (A contrasting way to synthesize sound on a PC uses "audio codecs", which rely heavily on software for music synthesis, MIDI compliance and even multiple-channel emulation. This approach has become common as manufacturers seek to simplify the design and the cost of the sound card itself).

Most sound cards have a line in connector where the sound signal from a cassette tape recorder or similar sound source can be input. The sound card can digitize this signal and store it (controlled by the corresponding computer software) on the computer's hard disk for editing or further reproduction. Another typical external connector is the microphone connector, for connecting to a microphone or other input device that generates a relatively lower voltage than the line in connector. Input through a microphone jack is typically used by speech recognition software or Voice over IP applications.

c) **NETWORK CARD**

A network card, network adapter or NIC (network interface controller) is a piece of computer hardware designed to allow computers to communicate over a computer network. It is an OSI model layer 2 item because it has a MAC address. It allows users to connect to each other either by using cables or wirelessly.

Every network card has a unique 48-bit serial number called a MAC address, which is written to ROM carried on the card. Every computer on a network must have a card with a unique MAC address. No two cards ever manufactured should share the same address. This is because the Institute of Electrical and Electronics Engineers (The IEEE) is responsible for assigning unique MAC addresses to the vendors of network interface controllers.

Whereas network cards used to be expansion cards that plug into a computer bus, the low cost and ubiquity of the Ethernet standard means that most newer computers have a network interface built into the motherboard. These motherboards either have Ethernet capabilities integrated into the motherboard chipset, or implemented via a low cost dedicated Ethernet chip, connected through the PCI (or the newer PCI express bus). A separate network card is not required unless multiple interfaces are needed or some other type of network is used. Even newer motherboards may have built-in dual network (Ethernet) interfaces.

The card implements the electronic circuitry required to communicate using a specific physical layer and data link layer standard such as Ethernet or token ring. This provides a base for a full network protocol stack, allowing communication among small groups of computers on the same LAN and large-scale network communications through routable protocols, such as IhP.

There are four techniques used for transfer of data, the NIC may use one or more of these techniques.

- Polling is where the microprocessor examines the status of the peripheral under program control.
- Programmed I/O is where the microprocessor alerts the designated peripheral by applying its address to the system's address bus.
- Interrupt-driven I/O is where the peripheral alerts the microprocessor that it's ready to transfer data.
- DMA is where the intelligent peripheral assumes control of the system bus to access memory directly. This removes load from the CPU but requires a separate processor on the card.

A network card typically has a twisted pair, BNC, or AUI socket where the network cable is connected, and a few LEDs to inform the user of whether the network is active, and whether or not there is data being transmitted on it. The Network Cards are typically available in 10/100/1000 Mbits/s (Mbps). This means they can support a transfer rate of 10 or 100 or 1000 Megabits per second.

d) **TV TUNER CARDS**

A TV tuner card is a computer component that allows television signals to be received by a computer. Most TV tuners also function as video capture cards, allowing them to record television programs onto a hard drive.

While typically a PCI-bus expansion card, they can also be a USB device. Some video cards double as TV tuners, notably the ATI All-In-Wonder series. The card contains a receiver, tuner, demodulator, and a analog-to-digital converter for analog TV. Like TV sets, each version is designed for the radio frequencies and video formats used in each country. However, many TV tuners used in computers use DSP, so a firmware upgrade is often all that's necessary to change the supported video format. Many newer TV tuners have flash memory big enough to hold the firmwares for decoding several different video formats, making it possible to use the tuner in many countries without having to flash the firmware. In addition to the frequency tuner, many include a composite video input. Many TV tuners can function as FM radios: this is because the FM radio spectrum lies between television channels 6 and 7, and the DSP can be easily programmed to decode FM.

Some provide DVB reception for digital radio, television or data signals (either with or without hardware MPEG decoding capability); these may be used to receive satellite broadcasts but normally provide no analogue input capability.

Most internal tuners do all the low level demodulation needed to convert a radio signal into an on-screen image using a hardware DSP chip or ASIC; some also have hardware MPEG encoders and use DMA to bypass the CPU entirely. Some cheaper tuners don't have much in the way of onboard signal processing and rely on the system's CPU for that task. External tuners may convert the signal into either a video stream suitable for display on the screen, or to an intermediate format such as MPEG; in either case, the CPU is needed to direct the image onto the screen.

TV tuners supporting digital television broadcasts eventually became available: a tuner displaying an HDTV image on a computer monitor is typically much cheaper than a dedicated high-definition television system, but with a smaller physical screen.

Broadcasts can also be digitally recorded by the computer for later replay, or distribution (illegal in many countries) to other computer users.

6) PORTS

There are lots of *external devices* that you can connect to your computer. All external devices connect to the computer's system unit via cables and *ports* (where a "port" is the slot into which you plug a cable). Unless you're using a portable computer, you probably have several external devices attached to your computer already, including a mouse, keyboard, monitor, microphone, and speakers.

Whatever external devices you have, they're all connected to the system unit (where the actual "computing" takes place) via cables. Each cable plugs into a specific port on the system unit. The ports are usually on the back of the system unit. But they can be on front or side as well.

Hardware ports can almost always be divided into two groups:

- Serial ports send and receive one bit at a time via a single wire pair (Ground and +/-).
- Parallel ports send multiple bits at the same time over several sets of wires.

a) SERIAL PORT

A connection or interface on the computer used to connect a serial device to the computer. Serial ports are typically identified on IBM compatible computers as COM (communications) ports. For example, a mouse might be connected to COM1 and a modem to COM2. In computing, a serial port is a serial communication physical interface through which information transfers in or out one bit at a time (contrast parallel port). Throughout most of the history of personal computers, data transfer through serial ports connected the computer to devices such as terminals or modems. Mice, keyboards, and other peripheral devices also connected in this way.

Speed

Serial ports use two-level (binary) signaling, so the data rate in bits per second is equal to the symbol rate in baud. Common bit rates per second for asynchronous start/stop communication are 300, 1200, 2400, 9600, 19200 baud, etc. These rates are based on multiples of the rates for electromechanical teleprinters. The port speed and device speed must match, though some devices may automatically detect the speed of the serial port. Though the RS-232 standard is formally limited to 20,000 bits per second, serial ports on popular personal computers allow settings up to 115,200 bits per second; the capability to set a bit rate does not imply that a working connection will result.

Data Bits

The number of data bits can be 5 (for Baudot Code), 6 (rarely used), 7 (for true ASCII), 8 (for any kind of data, as this matches the size of a byte), or 9 (rarely used). 8 data bits are almost universally used in newer applications. 5 or 7 bits generally only make sense with older equipment such as teleprinters.

Parity

Parity is a method of detecting some errors in transmission. Where parity is used with a serial port, an extra data bit is sent with each data character, arranged so that the number of 1 bits in each character, including the parity bit, is always odd or always even. If a byte is received with the wrong number of 1 bit, then it must have been corrupted. If parity is correct there may have been no errors or an even number of errors. A single parity bit does not allow implementation of error correction on each character, and communication protocols working over serial data links may have higher-level mechanisms such as checksums to ensure data validity and request retransmission of data that has been incorrectly received.

Flow control

A serial port may use signals in the interface to pause and resume the transmission of data. For example, a slow printer might need to handshake with the serial port to indicate that data should be paused while the mechanism advances a line. Common hardware handshake signals use the RS-232 RTS/CTS, DTR/DSR signal circuits. See the separate article on transmit flow control.

b) **PARALLEL PORT**

A parallel port is an interface for connecting an external device such as a printer. Most personal computers have both a parallel port and at least one serial port.

On PCs, the parallel port uses a 25-pin connector (type DB-25) and is used to connect printers, computers and other devices that need relatively high bandwidth. It is often called a Centronics interface after the company that designed the original standard for parallel communication between a computer and printer. (The modern parallel interface is based on a design by Epson.) A newer type of parallel port, which supports the same connectors as the Centronics interface, is the EPP (Enhanced Parallel Port) or ECP (Extended Capabilities Port). Both of these parallel ports support bi-directional communication and transfer rates ten times as fast as the Centronics port.

c) **UNIVERSAL SERIAL BUS**

Universal Serial Bus (USB) is a serial bus standard to interface devices. It was designed for computers such as PCs and the Apple Macintosh, but its popularity has prompted it to also become commonplace on video game consoles, PDAs, portable dvd and media players, cell phones; and even devices such as televisions, home stereo equipment (e.g., mp3 players), car stereos and portable memory devices. USB can connect peripherals such as mouse devices, keyboards, game pads and joysticks, scanners, digital cameras, printers, external storage, networking components, etc. For many devices such as scanners and digital cameras, USB has become the standard connection method. USB is also used extensively to connect non-networked printers. replacing the parallel ports which were widely used; USB simplifies connecting several printers to one computer.

d) **PS/2 PORT**

The PS/2 connector is used for connecting a keyboard and a mouse to a PC compatible computer system. Its name comes from the IBM Personal Shystem/2 series of personal computers, with which it was introduced in 1987. The PS/2 mouse connector generally replaced the older DB-9 RhS-232 "serial mouse" connector, while the keyboard connector replaced the larger 5-pin DIN used in the IBM PC/AT design. The keyboard and mouse interfaces are electrically similar with the main difference being that open collector outputs are required on both ends of the keyboard interface to allow bi-directional communication. Most PCs have a PS/2 port so that the serial port can be used by another device, such as a modem.

Many current keyboards and mice support both USB and PS/2 with a simple wiring adaptor and active adaptors are available which plug into a USB port and provide a pair of PS/2 ports.

PS/2 ports are designed to connect the digital I/O lines of the microcontroller in the external device directly to the digital lines of the microcontroller on the motherboard. They are not designed to be hot swappable.

7) SECONDARY STORAGE DEVICES

In computer storage, secondary storage, or external memory, is computer memory that is not directly accessible to the central processing unit of a computer, requiring the use of computer's input/output channels. Secondary storage is used to store data that is not in active use. Secondary storage is usually slower than primary storage, or internal memory, but also almost always has higher storage capacity and is non-volatile, which makes it perfect for the preservation of stored information in an event of power loss.

Storage devices in this category include:

- CD, CD-R, CD-RW
- DVD
- Flash memory
- Floppy disk
- Zip Drive
- Hard disk
- Magnetic tape
- Paper tape
- Punch card
- RAM disk
- External Hard Drive
- Blue-Ray

a) **FLOPPY DISK**

It is a soft magnetic disk. It is called *floppy* because it flops if you wave it (at least, the 5¼-inch variety does). Unlike most hard disks, floppy disks (often called *floppies* or *diskettes*) are portable, because you can remove them from a disk drive. Disk drives for floppy disks are called *floppy drives*. Floppy disks are slower to access than hard disks and have less storage capacity, but they are much less expensive. And most importantly, they are portable.

Floppies come in three basic sizes:

- 8-inch: The first floppy disk design, invented by IBM in the late 1960s and used in the early 1970s as first a read-only format and then as a read-write format. The typical desktop/laptop computer does not use the 8-inch floppy disk.
- 5¼-inch: The common size for PCs made before 1987 and the predecessor to the 8-inch floppy disk. This type of floppy is generally capable of storing between 100K and 1.2MB (megabytes) of data. The most common sizes are 360K and 1.2MB.

3½-inch: *Floppy* is something of a misnomer for these disks, as they are encased in a rigid envelope. Despite their small size, microfloppies have a larger storage capacity than their cousins -- from 400K to 1.4MB of data. The most common sizes for PCs are 720K (double-density) and 1.44MB (high-density). Macintoshes support disks of 400K, 800K and 1.2MB.

b) **HARD DISK**

Magnetic disk can store computer data. The term hard is used to distinguish it from a soft, or *floppy*, disk. Hard disks hold more data and are faster than floppy disks. A hard disk, for example, can store anywhere from 10 to more than 100 gigabytes, whereas most floppies have a maximum storage capacity of 1.4 megabytes.

A single hard disk usually consists of several platters. Each platter requires two read/write heads, one for each side. All the read/write heads are attached to a single access arm so that they cannot move independently. Each platter has the same number of tracks, and a track location that cuts across all platters is called a cylinder. For example, a typical 84-megabyte hard disk for a PC might have two platters (four sides) and 1,053 cylinders.

In general, hard disks are less portable than floppies, although it is possible to buy removable hard disks.

c) **CDROM**

Compact disc (CD), a small plastic disc used for the storage of digital data. As originally developed for audio systems, the sound signal is sampled at a rate of 44,100 times a second, then each sample is measured and digitally encoded on the 4 3/4 in (12 cm) disc as a series of microscopic pits on an otherwise polished surface. The disc is covered with a transparent coating so that a laser beam can read it. Since nothing touches the encoded portion, the playing process does not wear out the CD. Introduced in 1982, the CD offered other advantages over the phonograph record and recording tape—smaller size, greater dynamic range, extremely low distortion—and met with rapid consumer acceptance; the CD became the music carrier of choice by 1991, when sales exceeded those of audiocassettes.

For its first few years of existence, the compact disc was purely an audio format. However, in 1985 the Yellow Book CD-ROM standard was established by Sony and Philips, which defined a non-volatile optical data storage medium using the same physical format as audio compact discs, readable by a computer with a CD-ROM (CDR) drive.

Replicated CDs are mass-produced initially using a hydraulic press. Small granules of raw plastic are fed into the barrel while under heat and increasing amount of pressure melt the plastic and force the liquefied material into the mold cavity. Equipped with a metal stamper the mold closes, allowing the plastic to cool and harden. Once opened, the disc substrate is removed from the mold by a robotic arm, and a 15 mm diameter center hole (called a stacking ring) is removed. This method produces the clear plastic blank part of the disc. After the foil layer is applied to the clear blank substrate the disc is ready to go to press. To press the CD first a Glass Master is cut using a high power laser on a device not dissimilar to a CD writer, the glass master being around 12 inches (30 cm) diameter and up to one inch (25 mm) thick as it needs to be strong for pressing. This glass master is a positive master. After testing it will then be used to make a die by pressing it against a metal disc. The die then becomes a negative image, a number of them can be made depending on the number of pressing mills that will be running off copies of the final CD. The die will then go into the press and press the image onto the foil layer of the blank CD leaving a final positive image on the disc. A small circle of varnish is then applied as a ring around the centre of the disc and a fast spin will evenly spread it over the surface. The disc will then be printed and packed. The method used to press an LP record is very similar except the molding of the plastic disc is a separate process with CDs.

d) **MAGNETIC TAPE**

Magnetic tape is a non-volatile storage medium consisting of a magnetic coating on a thin plastic strip. Nearly all-recording tape is of this type, whether used for video, audio storage or general-purpose digital data storage using a computer.

Magneto-optical and optical tape storage products have been developed using many of the same concepts as magnetic storage, but have achieved little commercial success.

e) **DVD**

DVD ("Digital Versatile Disc", once "Digital Video Disc", and now, officially standing for nothing according to DVD Demystified) is an optical disc storage media format that can be used for data storage, including movies with high video and sound quality. DVDs resemble compact discs as their physical dimensions are the same (120 mm (4.72 inches) or occasionally 80 mm (3.15 inches) in diameter) but they are encoded in a different format and at a much higher density. The official DVD specification is maintained by the DVD Forum.

8) PERIPHERAL DEVICE

A computer device, such as a CD-ROM drive or printer, which is not part of the essential computer, i.e., the memory and microprocessor. Peripheral devices can be external -- such as a mouse, keyboard, printer, monitor, external Zip drive or scanner -- or internal, such as a CD-ROM drive, CD-R drive or internal modem. Internal peripheral devices are often referred to as integrated peripherals.

a) **COMPUTER KEYBOARD**

A computer keyboard is a peripheral modeled after the typewriter keyboard. Keyboards are designed for the input of text and characters and also to control the operation of a computer.

Physically, computer keyboards are an arrangement of rectangular or near-rectangular buttons, or "keys". Keyboards typically have characters engraved or printed on the keys; in most cases, each press of a key corresponds to a single written symbol. However, to produce some symbols requires pressing and holding several keys simultaneously or in sequence; other keys do not produce any symbol, but instead affect the operation of the computer or the keyboard itself.

b) **MOUSE**

In the context of computing, a mouse (plural (generally): mice, also mouses) consists of a hand-held pointing device, designed to sit under one hand of the user and to detect movement relative to its two-dimensional supporting surface. In addition, it usually features buttons and/or other devices, such as "wheels", which allow the user to perform various system-dependent operations. Extra buttons or features can add more control or dimensional input.

Optical mice

An optical mouse uses a light-emitting diode and photodiodes to detect movement relative to the underlying surface, rather than moving some of its parts — as in a mechanical mouse.

c) **MONITOR**

A computer display or computer monitor is an output device that is part of a computer's display system. A cable connects the monitor to a video adapter (video card) that is installed in an expansion slot on the computer's motherboard. This system converts signals into text and pictures and displays them on a TV-like screen (the monitor).

The computer sends a signal to the video adapter, telling it what character, image, or graphic to display. The video adapter converts that signal to a set of instructions that tell the display device (monitor) how to draw the image on the screen.

d) **PRINTER**

A computer printer, or more commonly just a printer, is a device that produces a hard copy (permanent human-readable text and/or graphics) of documents stored in electronic form, usually on physical print media such as paper or transparencies. Many printers are primarily used as computer peripherals, and are permanently attached to a computer, which serves as a document source. Other printers, commonly known as network printers, have built-in network interfaces (typically wireless or Ethernet), and can serve as a hardcopy device for any user on the network. In addition, many modern printers can directly interface to electronic media such as memory sticks or memory cards, or to image capture devices such as digital cameras, scanners; some printers are combined with a scanners and/or fax machines in a single unit. A printer, which is combined with a scanner, can essentially function as a photocopier.

e) **SCANNER**

A device that can read text or illustrations printed on paper and translate the information into a form the computer can use. A scanner works by digitizing an image -- dividing it into a grid of boxes and representing each box with either a zero or a one, depending on whether the box is filled in. (For color and gray scaling, the same principle applies, but each box is then represented by up to 24 bits.) The resulting matrix of bits. called a bit map, can then be stored in a file, displayed on a screen, and manipulated by programs.

Optical scanners do not distinguish text from illustrations; they represent all images as bit maps. Therefore, you cannot directly edit text that has been scanned. To edit text read by an optical scanner, you need an optical character recognition (OCR) system to translate the image into ASCII characters. Most optical scanners sold today come with OCR packages.

f) **MODEM**

A modem (from modulate and demodulate) is a device that modulates an analogue carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. Modems can be used over any means of transmitting analog signals, from driven diodes to radio. Experiments have even been performed in the use of modems over the medium of two cans connected by a string. [citation needed]

The most familiar example is a voiceband modem that turns the digital '1s and 0s' of a personal computer into sounds that can be transmitted over the telephone lines of Plain Old Telephone Systems (POTS), and once received on the other side, converts those sounds back into 1s and 0s. Modems are generally classified by the amount of data they can send in a given time, normally measured in bits per second, or "bps".

g) **PLOTTER**

A plotter is a vector graphics-printing device that connects to a computer.Plotters print their output by moving a pen across the surface of a piece of paper. This means that plotters are restricted to line art, rather than raster graphics as with other printers. They can draw complex line art, including text, but do so very slowly because of the mechanical movement of the pens. Plotters are used primarily in technical drawing and CAD applications, where they have the advantage of working on very large paper sizes while maintaining high resolution. Another use has been found by replacing the pen with a cutter, and in this form plotters can be found in many garment and sign shops.

If a plotter is commanded to use different colors it has to replace the pen and select the wanted color.

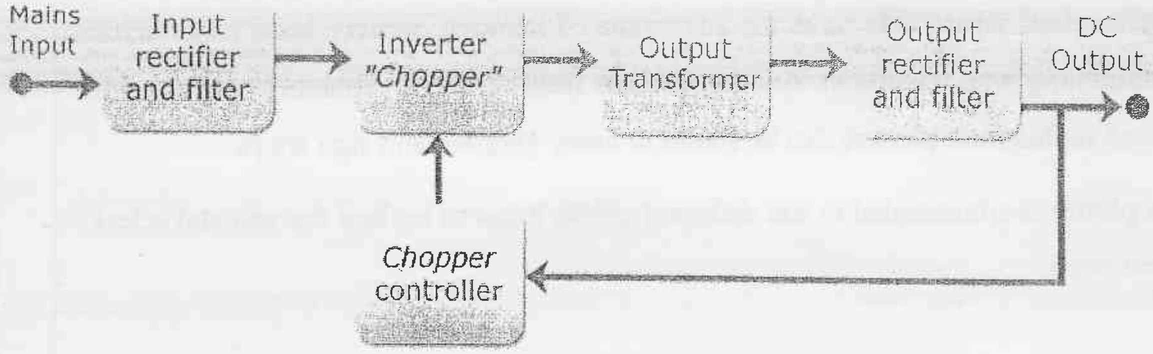
9) SWITCHED-MODE POWER SUPPLY(SMPS)

A switched-mode power supply, switch-mode power supply, or SMPS, is an electronic power supply unit (PSU) that incorporates a switching regulator — an internal control circuit that switches power transistors (such as MOSFETs) rapidly on and off in order to stabilize the output voltage or current. Switching regulators are used as replacements for the linear regulators when higher efficiency, smaller size or lighter weight is required. They are, however, more complicated and their switching currents can cause noise problems if not carefully suppressed, and simple designs may have a poor power factor. The power output to cost crossover point between SMPS and a linear regulating alternative has been falling since the early 1980s as SMPS technology was developed and integrated into dedicated silicon chips. In early 2006 even very low power linear regulators became more expensive than SMPS when the cost of copper and iron used in the transformers increased abruptly on world markets.

SMPS can also be classified into four types according to the input and output waveforms, as follows.

- AC in, DC out: rectifier, off-line converter
- DC in, DC out: voltage converter, or current converter, or DC to DC converter
- AC in, AC out: frequency changer, cycloconverter
- DC in, AC out: inverter

How an SMPS works



NO: 2)

STUDY OF MOTHERBOARDS

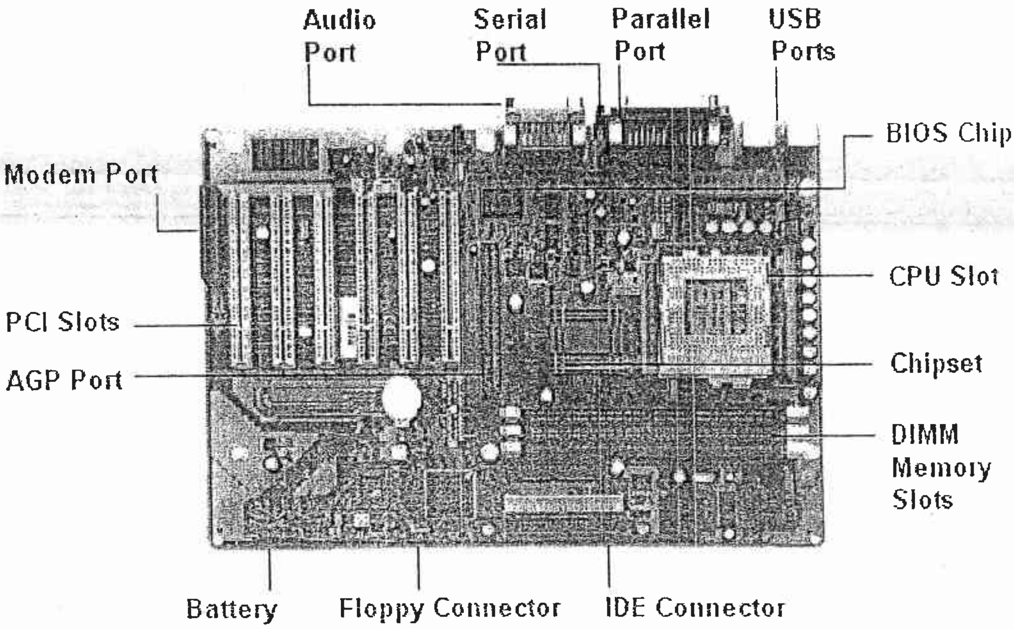
A motherboard, also known as a mainboard, system board, or logic boards on Apple Computers, and sometimes abbreviated as mobo (generally credited to the magazine Maximum PC) is the central or primary circuit board making up a complex electronic system, such as a modern computer.

A typical computer is built with the microprocessor, main memory. and other basic components on the motherboard. Other components of the computer such as external storage, control circuits for video display and sound, and peripheral devices are typically attached to the motherboard via ribbon cables, other cables, and power connectors.

Historically, a computer was built in a case or Mainframe with a series of wired together connectors called a backplane into which the cpu, memory and I/O on separate cards was plugged. With the arrival of the microprocessor, it became more cost-effective to place the backplane connectors, processor and glue logic onto a single 'mother' board, and have the video, memory and I/O on 'child' cards - hence the terms 'Motherboard' and Daughterboard.

One of the first popular microcomputers to feature this design was the Apple 2 computer, which had a motherboard and 8 expansion slots.

Motherboards are available in a variety of form factors, which usually correspond to a variety of case sizes. The following is a summary of some of the more popular PC motherboard sizes available:



1. BIOS

BIOS, in computing, stands for Basic Input/Output System also incorrectly known as Basic Integrated Operating System. BIOS refers to the software code run by a computer when first powered on. The primary function of the BIOS is to prepare the machine so other software programs stored on various media (such as hard drives, floppies, and CDs) can load, execute, and assume control of the computer. This process is known as booting up.

BIOS can also be said to be a coded program embedded on a chip that recognizes and controls various devices that make up the computer. The term BIOS is specific to personal computer vendors. Among other classes of computers, the generic terms *boot monitor*, *boot loader* or *boot ROM* are commonly used.

While the name BIOS is an acronym, it may also be a play on the Greek word βίος (bios), meaning *life*. The term first appeared in the CP/M operating system, describing the part of CP/M loaded during boot time that interfaced directly with the hardware (CP/M machines usually had a simple boot loader in ROM, and nothing else). Most versions of DOS have a file called "IBMBIO.COM" or "IO.SYS" that is analogous to the CP/M disk BIOS.A sample screen shot of BIOS is shown below:

2. CHIPSET

A chipset is a group of integrated circuits ("chips") that are designed to work together, and are usually marketed as a single product. In computing, the term *chipset* is commonly used to refer to the specialized motherboard chips on a computer or expansion card. When discussing personal computers (PCs) based on recent Intel Pentium-class systems, the term "chipset" often refers to the two main motherboard chips: *northbridge* and *southbridge*. The manufacturer of a chipset often is independent from the manufacturer of the motherboard. Examples of manufactures of PC motherboard chipsets include NVIDIA, ATI, VIA Technologies, SiS and Intel.

In home computers, game consoles and arcade game hardware of the 1980s and 1990s, the term chipset was used for the custom audio and graphics chips. Examples include the Commodore Amiga's Original Chip Set or SEGA's System 16 chipset.

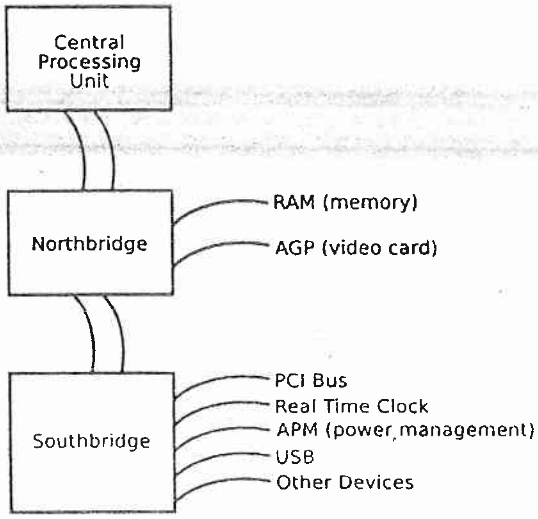
Computer systems produced since the late 1980s share commonly used chipsets, even across widely disparate computing specialties. For example, the NCR 53C9x, a low-cost chipset implementing a SCSI interface to storage devices, could be found in Unix machines (such as the MIPS Magnum), embedded devices and personal computers.

2.1 NORTH BRIDGE

The northbridge, also known as the Memory Controller Hub (MCH). is traditionally one of the two chips in the core logic chipset on a PC motherboard, the other being the Southbridge. Separating the chipset into Northbridge and Southbridge is common, although there are rare instances where these two chips have been combined onto one die when design complexity and fabrication processes permit it

2.2 SOUTH BRIDGE

The Southbridge, also known as the I/O Controller Hub (ICH), is a chip that implements the "slower" capabilities of the motherboard in a northbridge/southbridge chipset computer architecture. The southbridge can usually be distinguished from the northbridge by not being directly connected to the CPU. Rather, the northbridge ties the southbridge to the CPU.A typical north/south bridge layout is shown below:



A typical north/south bridge layout

3. I/O INTERFACES ON THE BOARD

The I/O interfaces can be used to link the I/O peripherals in the mother board. Memory-mapped I/O (MMIO) and port I/O (also called port-mapped I/O or PMIO) are two complementary methods of performing input/output between the CPU and I/O devices in a computer. Another method is using dedicated I/O processors (channels, used in IBM mainframe computers).

Memory-mapped I/O uses the same bus to address both memory and I/O devices, and the CPU instructions used to read and write to memory are also used in accessing I/O devices. In order to accommodate the I/O devices, areas of CPU addressable space must be reserved for I/O rather than memory. This does not have to be permanent, for example the Commodore 64 could bank switch between its I/O devices and regular memory. The I/O devices monitor the CPU's address bus and respond to any CPU access of their assigned address space, mapping the address to their hardware registers.

The advantage of using memory mapped I/O is that, by discarding the extra complexity that port I/O brings, a CPU requires less internal logic and is thus cheaper, Faster and easier to build; this follows the basic tenets of reduced instruction set computing. As 16-bit CPU architectures have become obsolete and replaced with 32-bit and 64-bit architectures in general use, reserving space on the memory map for I/O devices is no longer a problem. The fact that regular memory instructions are used to address devices also means that all of the CPU's addressing modes are available for the I/O as well as the memory.

Port-mapped I/O uses a special class of CPU instructions specifically for performing I/O. This is generally found on Intel microprocessors, specifically the IN and OUT instructions which can read and write a single byte to an I/O device. I/O devices have a separate address space from general memory, either accomplished by an extra "I/O" pin on the CPU's physical interface, or an entire bus dedicated to I/O.

The main advantage of using port-mapped I/O is on CPUs with a limited addressing capability. Because port-mapped I/O separates I/O access from memory access, the full address space can be used for memory. It is also obvious to a person reading an assembly language program listing when I/O is being performed, due to the special instructions that can only be used for that purpose.

4. CLOCK RATE/CLOCK SPEED

The clock rate is the fundamental rate in cycles per second (measured in hertz) at which a computer performs its most basic operations such as adding two numbers or transferring a value from one processor register to another. Different chips on the motherboard may have different clock rates. Usually when referring to a computer, the term "clock rate" is used to refer to the speed of the CPU.

The clock rate is the fundamental rate in *cycles per second* (measured in hertz) at which a computer performs its most basic operations such as adding two numbers or transferring a value from one processor register to another. Different chips on the motherboard may have different clock rates. Usually when referring to a computer, the term "clock rate" is used to refer to the speed of the CPU.

The clock rate of a computer is only useful for providing comparisons between computer chips in the same processor family. An IBM PC with an Intel 486 CPU running at 50 MHz will be about twice as fast as one with the same CPU, memory and display running at 25 MHz. However, there are many other factors to consider when comparing the speeds of entire computers, like the clock rate of the computer's front side bus, the clock rate of the RAM, the width in bits of the CPU's bus and the amount of Level 1. Level 2 and Level 3 cache.

Clock rates should not be used when comparing different computers or different processor families. Rather, some software benchmark should be used. Clock rates can be very misleading since the amount of work different computer chips can do in one cycle varies. For example, RISC CPUs tend to have simpler instructions than CISC CPUs (but higher clock rates), and superscalar processors can execute more than one instruction per cycle.

5. WORD SIZE

In computing, "word" is a term for the natural unit of data used by a particular computer design. A word is simply a fixed-sized group of bits that are handled together by the machine. The number of bits in a word (the word size or word length) is an important characteristic of a computer architecture.

The size of a word is reflected in many aspects of a computer's structure and operation. The majority of the registers in the computer are usually word-sized. The typical numeric value manipulated by the computer is probably word sized. The amount of data transferred between the processing part of the computer and the memory system is most often a word. An address used to designate a location in memory often fits in a word.

Modern computers usually have a word size of 16, 32, or 64 bits. Many other sizes have been used in the past, including 8, 12, 18, 24, 36, 39, 40, 48, and 60 bits; the slab is an example of an early word size. Some of the earliest computers were decimal rather than binary, typically having a word size of 10 or 12 decimal digits, and some early computers had no fixed word length at all.

The most common microprocessors used in personal computers have the x86 architecture (for instance, the Intel Pentiums and AMD Athlons). The x86 family includes several generations of architecture. In the Intel 8086, 80186, and 80286, the word size is 16 bits. In IA-32, the word size is 32 bits. In x86-64, the word size is 64 bits. Yet each implementation also implements the earlier instruction sets too. So Intel calls 16 bits a word in all of them; clearly this usage of *word* is different from that of this article.

6. CACHE MEMORY

In computer science, a cache is a collection of data duplicating original values stored elsewhere or computed earlier, where the original data is expensive (usually in terms of access time) to fetch or compute relative to reading the cache. Once the data is stored in the cache, future use can be made by accessing the cached copy rather than refetching or recomputing the original data, so that the average access time is lower.

Caches have proven extremely effective in many areas of computing because access patterns in typical computer applications have locality of reference. There are several kinds of locality, but this article primarily deals with data that are accessed close together in time. The data might or might not be located physically close to each other.

7. NUMERIC CO-PROCESSOR

A coprocessor is a computer processor used to supplement the functions of the primary processor (the CPU). Operations performed by the coprocessor may be floating point arithmetic, graphics, signal processing, string processing, or encryption. By offloading processor-intensive tasks from the main processor, coprocessors can accelerate system performance. Coprocessors allow a line of computers to be customized, so that customers who do not need the extra performance need not pay for it.

Coprocessors were first seen on mainframe computers, where they added additional "optional" functionality such as floating point math support. A more common use was to control input/output channels, although in this role they were more often referred to as channel controllers.

Coprocessors also became common in desktop computers throughout the 1980s and into the early 1990s due to CPU design limitations and cost considerations. The *math co-processor* was a common addition to high-end computers like the Mac II and most workstations that required the capability to do floating-point arithmetic, but until the early 1990s the demand for such capabilities was minimal. Another form of co-processor that became common during this era was the graphics co-processor, used in the Atari 8-bit family and Commodore Amiga. The graphics processor chip in the Commodore series was known as the "Copper."

A coprocessor may not be a general-purpose processor in its own right. Some coprocessors cannot fetch instructions from memory, execute program flow control instructions, do input/output operations, manage memory, and so on. These processors require the host main processor to fetch the coprocessor instructions and handle all other operations aside from the coprocessor functions. In some architectures the coprocessor is a more general-purpose computer, but carries out only a limited range of functions under the close control of a supervisory processor. Note the difference to the term multiprocessor, which refers to a computer with more than one general-purpose CPU.

No:40)

8086 PROGRAMING MODEL

8086/8088 Register Set

16 Bit "General" Registers

AX	AH (4)	AL (0)	0 Accumulator
CX	CH (5)	CL (1)	1 Counter
DX	DH (6)	DL (2)	2 Data
BX	BH (7)	BL (3)	3 Base
SP			4 Stack Pointer
BP			5 Base Pointer
SI			6 Source Index
DI			7 Destination Index

Segment Registers

ES	0 Extra Segment
CS	1 Code Segment
SS	2 Stack Segment
DS	3 Data Segment

Program Registers

IP	Instruction Pointer
F	Flags

Memory Space

2^{20}-1

0

I/O Space

2^{16}-1

GENERAL PURPOSE REGISTERS

8086 CPU has 8 general purpose registers, each register has its own name:

AX - the accumulator register (divided into **AH / AL**):

1. Generates shortest machine code
2. Arithmetic, logic and data transfer
3. One number must be in AL or AX
4. Multiplication & Division
5. Input & Output

BX - the base address register (divided into **BH / BL**).

CX - the count register (divided into **CH / CL**):

1. Iterative code segments using the LOOP instruction
2. Repetitive operations on strings with the REP command
3. Count (in CL) of bits to shift and rotate

DX - the data register (divided into **DH / DL**):

1. DX:AX concatenated into 32-bit register for some MUL and DIV operations
2. Specifying ports in some IN and OUT operations

SI - source index register:

1. Can be used for pointer addressing of data
2. Used as source in some string processing instructions
3. Offset address relative to DS

DI - destination index register:

1. Can be used for pointer addressing of data
2. Used as destination in some string processing instructions
3. Offset address relative to ES

BP - base pointer:

1. Primarily used to access parameters passed via the stack

2. Offset address relative to SS

SP - stack pointer:

Always points to top item on the stack

1. Offset address relative to SS
2. Always points to word (byte at even address)
3. An empty stack will had SP = FFFEh

SEGMENT REGISTERS

CS - points at the segment containing the current program.

DS - generally points at segment where variables are defined.

ES - extra segment register, it's up to a coder to define its usage.

SS - points at the segment containing the stack.

Although it is possible to store any data in the segment registers, this is never a good idea. The segment registers have a very special purpose - pointing at accessible blocks of memory.

Segment registers work together with general purpose register to access any memory value. For example if we would like to access memory at the physical address **12345h** (hexadecimal), we could set the **DS = 1230h** and **SI = 0045h**. This way we can access much more memory than with a single register, which is limited to 16 bit values.

The CPU makes a calculation of the physical address by multiplying the segment register by 10h and adding the general purpose register to it (1230h * 10h + 45h = 12345h):

The address formed with 2 registers is called an **effective address**. By default **BX, SI** and **DI** registers work with **DS** segment register;**BP** and **SP** work with **SS** segment register.Other general purpose registers cannot form an effective address. Also, although **BX** can form an effective address, **BH** and **BL** cannot.

SPECIAL PURPOSE REGISTERS

IP - the instruction pointer:

1. Always points to next instruction to be executed
2. Offset address relative to CS

IP register always works together with **CS** segment register and it points to currently executing instruction.

FLAG REGISTER

Flags Register - determines the current state of the processor. They are modified automatically by CPU after mathematical operations, this allows to determine the type of the result, and to determine conditions to transfer control to other parts of the program. Generally you cannot access these registers directly.

Carry Flag (CF) - this flag is set to **1** when there is an **unsigned overflow**. For example when you add bytes **255 + 1** (result is not in range 0...255). When there is no overflow this flag is set to **0**.

Parity Flag (PF) - this flag is set to **1** when there is even number of one bits in result, and to **0** when there is odd number of one bits.

Auxiliary Flag (AF) - set to **1** when there is an **unsigned overflow** for low nibble (4 bits).

Zero Flag (ZF) - set to **1** when result is **zero**. For non-zero result this flag is set to **0**.

Sign Flag (SF) - set to **1** when result is **negative**. When result is **positive** it is set to **0**. (This flag takes the value of the most significant bit.)

Trap Flag (TF) - Used for on-chip debugging.

Interrupt enable Flag (IF) - when this flag is set to **1** CPU reacts to interrupts from external devices.

Direction Flag (DF) - this flag is used by some instructions to process data chains, when this flag is set to **0** - the processing is done forward, when this flag is set to **1** the processing is done backward.

Overflow Flag (OF) - set to **1** when there is a **signed overflow**. For example, when you add bytes **100 + 50** (result is not in range -128...127).