* A **computer** is an electronic device that allows **input** and processes it into meaningful data to produce information as **output** for **display** or **storage**.

MOTHERBOARD FORM FACTOR /DESIGN

* The form factor of a motherboard describes its shape, physical layout, type of case of the power supply that can be used.
* A company can make motherboard with the same functionality but different form factors.
* The most common differ with layout of the components of the mother board.
* The most common design found on modern pc.
  1. AT & Baby AT
* They were the most common form factors of the 1990s and only 1900s
* The difference btwn AT & Baby AT is primary the width.
* The full AT board is 12 inches wide & they don’t fit into the mini desk.
* The Baby AT is 8.5 inches wide, it’s recognized by the shape in the presence of a single full side keyboard.
* The connectors should be on the board & the AT baby boards have their processors sockets & the memory sockets at the part of the mother board.
* The Baby AT motherboard is only 8.5 inches & the INC in width means much less overlap with other drios although there is still some overlap at the front of the desk case.
* The Baby AT design the processor is located at the front of the motherboard & the full length expansion have intended to extend over it.
* This means that removing the processor requires the removal of sense or all the expansion cards.

PS

Peripheral connector

M

Memory

**ADVANTAGE OF BABY AT DESIGN**

1. Size of 8.5 inches wide makes it easy to design a small PC although the board can be used in sever & also in some transaction processing.

2. Most of the boards are easily accessible for upgrade & expansion.

**DISADVANTAGES**

**1.** CPU location with the processor & the heat sink in place.

**2.**Difficult to get along the expansion cords of expansion slots coz the CPU get in 2 way of the expansion cords.

**3.** Motherboard maintain some system cases aren’t purchased to support all mounting holes.

**4**. From Baby AT motherboard the front edge of the system board tends to hand left & supported over a time this edge can hand leading to lose components or other problems. This forces the user to mount

The motherboard with some adhesives.

* 1. **ATX & mini ATX Motherboard**
* In 1997 Intel produced a new motherboard called ATX combining the built in technology and the component quality from the Baby AT wit new board design features. This motherboard are base for the current most popular ATX motherboard. ATX specification allows PC manufacturer to build products more cheaply with improved case of serviceability & incorporate new input/output features.
* The key features of ATX Motherboard

1. The processor are located from the expansion slot to allow full length board to be stored.
2. On board pc mouse connector.
3. Hard disk & drives connector moved to the front of the board to reduce the cable length.
4. A new power supply design with improved cooling & less noise a soft switch i.e. at the power supply.
5. A power supply fan to be located to the side of the to provide a cooling air.
6. Integrated output/input connectors.
7. 3.3 volts power supply.

**MOTHERBOARD COMPONENTS**

* The most important component that are found in a typical motherboard includes:

1. Expansion Slot
2. Memory Slot
3. On Board Disk Driver
4. Mouse Connector
5. Peripheral Port Connector
6. Cmos Battery
7. USB port
8. Parallel port
9. Processor slots & sockets
10. Power connectoors
11. Floppy connectors
12. Keyboard connectors
13. Bios chip
14. Jumper & Dip slots
15. Power supply plugin

**1. Expansion Slot**

* It is the most visible port of any motherboard.
* They look like small plastic slots
* They are between 3-11 inches long \* approximately 112 inch wide.
* They are used to install various devices in a computer to expand its capability.
* Some expansion devices that are installed in this slot include:

1. Video, Network, Sound & Disk interface card.

**TYPES OF EXPANSION SLOTS;**

1. Industrial Standard Adapters/architecture.(ISA)
2. Peripheral Component Interconnection(PCI)
3. Accelerated Graphic Port(AGP)

**Industrial Standard Adapters/architecture. (ISA)**

* Usually mostly on computers that are of 1997 made.
* Easily recognized as they are usually brown and have two parts i.e. short &long part.
* Most of computers are made after 1997 include a few ISA slots for backward compatibility with old Expansion card.
* They have very large bus (VL-BUS) are designed to provide a 32 bit processor direct capabilities to ISA.

**Peripheral Component Interconnection (PCI)**

* They are contained in computers that are made today & primarily peripheral components interconnect (PCI ports)
* They are usually recognized as they are short (along 3 inches) they are usually wide.
* PCI slot are found in any computers that have a Pentium class processor or higher.

**Accelerated Graphic Port (AGP)**

* They are designed to be direct connection btw the video circuiting and PC memory.
* Initially if one wanted to use a high speed accelerated 3D graphics Video card; one had to install the card into an existing PCI/ISA.
* They are usually brown and located right to the PCI slot on the motherboard, usually shorter than PCI slots.

**2. MEMORY SLOTS –** Are the most next slot of motherboard that contain the actual memory chips. The chips are arranged on a small circuit board and these circuit boards are called single inline memory module or Dual inline memory module. (SIMM & DIMM)

* This depends on whether there are chips on both sides respectively.
* Apart from a chip placement memory modules also differ on the number of conductor or pin a particular memory module use e.g. 30 pins, 72 pins & 168 pins.
* The 72 & 168 pins are common with Dual inline memory module.
* Memory slots are easy to identify on motherboard.
* They are usually white and around 3 inches long.
* The number of memory slots vary from motherboard to motherboard.

**3. CPU SLOTS**

* CPU is the brain of any computer & does all the calculation and performs 90% of the function of a computer.
* Usually placed either under a fan or heat zinc or sometimes both.
* They are usually used to draw away heat that a processor generates.
* The heat is an energy of any micro-electronics.
* They are several sockets & slots of motherboard, and vary with motherboard.
* There are 3 most popular sockets namely;

-Socket 5

-Socket 7

-Single edge contact card

* Socket 5 & 7 CPU sockets are usually flat & they have several roles of holes arranged in a square.
* The second (ring edge contact card) connector is a slot where Pentium 2/3 can be inserted.

**4. POWER CONNECTOR**

* There are several, which are connected to the motherboard to supply it with power.
* Usually labeled P8 & P9 connector.

**5. ONBOARD FLOPPY & HARDDISK CONNECTOR**

* They are also known as drive interface.
* They are 2 types;

-Floppy Disk interface.

-Hard disk interface.

* Floppy disk interfaces allows floppy disk to be connected to the motherboard & allows hard disk to be connected to the interface.

**6. CABLE CONNECTOR**

* Allows keyboard to be connected directly to the motherboard through the case.

Types of keyboard connectors

-AT connector

-Ps/2 connector.

* AT is around an inch in diameter and it has 5 sockets.
* Ps/2 connector is smaller & it’s the most modern with current computers.

**7. PERIPHERAL PORTS**

* They are connected ports for getting data in and out of the computer.
* Common types of ports are:

1. Serial port
2. Game port
3. Parallel port
4. USB port

**8. Processor**

* The role of the processor is to control and direct all the activities of the computer using both internal & external buses.
* Processor is also regarded as the brain of the computer because it performs the role of the computer.
* It does all the calculations &the functions of the computer.
* The most CPU used are either VGA or single edge contact card (SECC from factor).

**Processor Manufactures**

* The market reader in the manufacture of processor chip is Intel Corporation.
* Its competitor include: Motorola, Advanced Micro Device (AMD) cynx &I.B.M.

INTEL PROCESSOR

* Together into processors & their compatible make up the back of compatible PC processors market. The INTEL family of PC processors started within 8080 was rectangular using dip of array of 40 pins it originally run at a speed of 4.77 MHz with 29000 transistors. It was used primarily in IBM pc’s.

8086

* It was next to be realized.
* It had 16 bits external data bus & used 9 bits bus for compatibility with older systems.
* After 8080x series the 80x86 series also known as Intel.
* X86 series the 80286 was 1st to implement PGA (pin grid array)
* It has a speed of between 6 MHz to 20 MHz.
* It physically could address up to 16 MB of RAM.

80386

* It was introduced by Intel in 1995 with 275000 transistors.
* It used both 32 bits data bus & 32 bits address.
* It had a range speed of 16MHz – 32MHz.
* It used up to 4GB of memory.
* It supported multitasking & was significantly faster than 80286.

80486

* It was introduced by Intel.
* It had 32 bits address bus & integrated math processor.
* It was simple to install & operated a minimum of 33MHz & to overcome limitation of speed intel came up with a technology known as **CLOCK DOUBLING.**
* This worked by allowing the chip to run at the rated speed external but run the interior clock twice the speed of the bus.

Pentium & Pentium Pro

* It had 3.1 transistors using a 64 bits data bus & 32 bits address bus.
* It had a speed of 60.200MHz.It was a combination of 80486chips in a larger chip.
* The benefit of two in one architecture was that each chip could execute instructors independently.
* This is a form of parallel processors. Pentium required a special motherboard because it significantly becomes hotter than previous processors.
* This requires the use of a heat sink on top of processor to absorb & penetrate the heat.

MMX & OVERDRIVE

* It was a result of need for speed.
* It was designed for 8086 users who wanted to give their machines a Pentium performance without having to pay the price for a full Pentium chip.
* It involves replacing the CPU with the overdrive.
* Once installed the older over drive run approximately 2 times the speed of motherboard of with bus speed of 33MHz the overdrive processor will run approximately 83MHz.
* Another technology added by Intel was MMX which added new features to Pentium processor i.e. - It added 27 new instruction for a better video, audio & graphic capability.

- Its features were single instruction multiple data (S.I.M.D) technology which enable instructions to several pieces of data rather than a single instruction per piece of data.

- Its cache has double up to 32 kb SECC single edge contact card.

PENTIUM II

* Its speed ranged from 233MHz to 400MHz.
* It was a single edge connector (SECC) to attach to the motherboard instead of PGA package with carrier processors type ie the processor is on a card that can be easily replaced. Later Intel released Pentium II soon & it was based on same operation and the same Pentium 3 Circuiting which could only be used by multiprocessors Pentium II servers.

CELERON

* It was a solution to Pentium II processors which were very expensive.
* They were released by intel to meet the market needs.
* It had the computing power ranging equivalent to Pentium II but costed less.

PENTIUM III

* It was released in 1999 & used the same SECC connectors as Pentium II included 70 new instructors & was optimized for voice recognition & multimedia.
* One of significant features of Pentium III is the processors serial number.
* It has a unique number electronically encoded into processor & this number can be used uniquely to identify a system during internet transaction therefore unfailing internet privacy.

PENTIUM IV

* This feature of Intel processor but are developing processor & they at least have two processors in development.
* The processor are given code name until official market names are released.
* Pentium IV processor were released after Pentium III with a speed of more than 1.6GHz.

CPU package

* One number of different package are used to house the CPU.
* The package design takes to account the following:

-The number of electricity connections that must be made to CPU.

-The physical size of the CPU & its surrounding circuit.

-The amount of heat generated by devices.

* There are 5 major package types for processors found inside a standard desktop PC

1) Dual inline package (DIP) – This type of package is suitable for devices with few pins such as Intel 8088, 8086 & 80286.

2) Pin grid Array (PGA) – The last structure of processor is provided with a grid array of pin at right angle to the chip structure.

-This chip is inserted into that socket called zero insertion force (ZIF).It can install or remove the processor chip from the socket requires very small amount of force.

-The PGA also fits into least insertion force socket which is used for Intel 80386, 80486, Pentium pro

3) The tape carrier package (TCP)

-It is for portable computers where space is initial for locating processors on the motherboard.

-The T.C.P helps the package to reduce heating while providing a very low profile for processor resolution on the motherboard.

4)Quaid flat package – It is where all contacts are arranged around the edge of chip carrier & unit is pushed into the socket mounting heat sink or a fan in this package is not on easy task.

5) It is a single card with processor usually inserted into the slot.

Ways of dealing with heating in a CPU.

* The increase in CPU clock speed provides increase in system performance. This introduces a major component i.e. heat during the operation of the processor.
* The faster the clock speed the more heat that is generated.
* If the temperature rises above its designed specifications, then it will start to behave critically (funny ways causing software to fail).
* If the processor gets too hot it will fail completely & may need to be replaced.
* The maximum working temperature of most processors is 185 ◦ C fare nights but the temps to be maintained much lower than this during the normal ratio.
* The ways of dealing with the problem of overheating includes:

I) Using a heat sink /fun

* This involves mounting a heat sink or a fun on a processor to throw away heat generated by the processor.

II) By reducing the CPU heat production.

* This is done by reducing the operating voltage of the chip.
* Example. The 1st operation of IBM processor (Prog 8088 to Pentium) they run at 5 volte power supply.
* But nowadays the processor run at a lower voltage of 3.3 volte & below.

III) Setting the voltage operation in the CPU.

* This is found in modern CPU where the CPU has split power requirement i.e. a part of the chip that rest of the system was a particular voltage (btw 2.3 volte & 3v)while the CPU core (the one that get hot uses a lower voltage of btw 1.6v & 1.9 v)

PROCESSOR UPGRADES

* The earlier fashion of processor have been upgraded to result to the current day processors.

Factors to consider before upgrading a processor.

1. Bio support – Some faster processor are not supported by BIOS. If your BIOS doesn’t support the new processor you need to check whether you can upgrade the BIOS first which might take time & is probably cheaper to buy a new motherboard.
2. Voltage support – The new processors run as lower voltage & some motherboard doesn’t have any way to adjust motherboard to be supplied to CPU through most drives have a voltage regulator.
3. Cooling- Faster processor generate more heat & usually require a bigger hot sink or a fun check that a bigger heat sink will actually fit and wont distract anything else with a heat sink.
4. Compatibility- Some upgrade parts are not possible for technological reasons.eg. You cannot upgrade an 80286 with a Pentium II processor due to a socket time therefore resulting to downgrading issues.

**TYPES OF UPGRADES**

I) **Chip to chip**

* It is a kind of upgrade where the existing processor is fully removed & replaced with a new processor. It is most common type of upgrade.

II) **Piggy back**

* It is done using those processors with an upgrade socket on their backside.
* The new processor is slotted on top of old processor.

III) **Daughter card**

* It is also called card replacement while a small board with a CPU is attached & installed to the existing motherboard.
* The small board card are slotted to the expansion slot.

NB. The piggy back & daughter card are rarely used nowadays.

**PROCEDURE OF UPGRADING A PROCESSOR**

* This is possible with a new processor which is compatible with the system.

1. Prepare a static save area
2. Power down the system & disconnect all the power code & external power connectors.
3. Remove the system case.
4. Wear antistatic wrist strap & locate the old processor & ensure its package.
5. Access whether only the heat sink can be removed or whether is glued to the processor.
6. If the heat sink includes a fun disconnect the power code.
7. Remove the heat sink if possible taking care not to damage any component nearby or in the motherboard.

NB. Before replacing the new processor the cheap side of the hot sink may be smiled with a layer of heat sink compound (thermal grease/thermal paste) this increases thermal board btw the heat sink & CPU.

* It retains the thermal just in case the new heat sink is not supplied with it.

h. Don’t use a screw driver to level out the old CPU as it can damage the nearby component & pins on the chip.

If the processor is on a ZIF socket (Zero insertion force socket) carefully pull the socket level away from the body of socket just a few centimetres then upward until it won’t move further away.

Lift out the processor taking note in one position that maybe printed on the socket or alternatively look at the CPU corner for a processor that are clipped (not at 90 degrees)then place the old processor at a save antistatic position.

**TROUBLESHOOTING PROCESSOR**

* The processor failures are rare on most systems & faults are likely to be caused by overheating, incorrect configuration, failed components or even power supply problems.

NB. Always rule out one potential problem before suspecting the processor.

* In case of a new processor upgrade then follow the following steps to check the problem;

i) Compatibility – Check whether the processor is actually supported by the motherboard.

ii) Orientation – Make sure the processor is inserted into its position & it has been inserted the right way.

iii) Voltage – Double check the voltage.

* Some chips such as Pentium use different voltage measurement, each differ from a standard 3.3/3.5 volte used by the original Pentium processors.
* If the voltage has been set incorrectly try connecting it.

iv) Test by substitution (SWAP) – If the old processor works then the new one may be faulty then when this diagnostic fails then take into consideration that the processor itself may be defective i.e. it has a multifunctioning defect & only solution is to buy a new one.

**Causes of unstable operations in a processor**

They are characterized by:

1. **The system hugging on clashing.** This faults are difficult to drug & other component may have stopped which may make additional checks of the components eg.The hard disk and memory chip difficult. Therefore you need to check or perform diagnostic check before suspecting the processor.

* This check that may be carried out includes checking the bio setup motherboard clock & timing settings. This is by incorrect settings will cause the cash memory to become unstable.

1. **Heat/Insufficient cooling.** This is the main cause in some cases therefore powering down for a while will allow the processor cooling. If heat is suspected the following checks should be performed :

**I) Heat sink/Fun –** Ensure that they are fitted correctly i.e. make sure that the fun is not gummed.

**ii) Ensure that the power supply fun is not jammed or too slow –** if the case implement another fun anymore in the system.

**iii) Speed-**Running the processor at the wrong speed may cause overheating.

**IV) Voltage –** Wrong voltage may also cause overheating.

**SPEED PROBLEMS**

They are characterized by:

i)Slow processing

ii) System reporting wrong CPU speed at the volte time.

* The diagnostic checks are a set up where you are supposed to verify BIO components & motherboard java settings.

iii) Check that all funs are well fitted & the contacts. Some upgrade processors e.g Intel have electronic components between the CPU & the fun.

* They are able to detect if the fun is jammed missing or fitted incorrectly.In this case if the processor detects a problem they will simply switch to a slow slot so as to produce less heat.

**PROCESSOR MODES**

* It is also referred to as the CPU state; The CPU preverange level etc. They are operating mode for CPU of some computer architecture that plays restriction on the type & type of operation that can be performed by certain processes being run in the CPU.
* This design allows the O.S to function with more preverange than the application software.
* The most common processor mode are;

a) **Real or Native mode –** It was meant for 8086 mode that had a restriction to I.M.B memory and only one program at a time.(except for special resident programs)which runs in the background called T.S.R programs.(Terminate & stay resident).

**b) Protected mode (process of protecting race condition) –** It was introduced with 80286 processor supporting multitasking (running multiple programs).Each program is assigned a memory i.e. protected from other programs hence the name protected mode.

- It supports extended memory. The 80386 & rater processors can operate 7 switch between protected mode & real time mode.

**C) Virtual real mode.** – It was introduced with 80386 processors & runs with real mode and protected mode to allow close programs to run under Microsoft windows.

**COMPUTER MEMORY (MAIN MEMORY)**

* It consist of RAM & ROM.
* They are both internal to the computer and facilitates the input processing output cycle that wouldn’t be possible without a holding place for the instructions & data that the processor can easily reach.

**RAM** – It’s an internal memory that holds data & instruction while the computer is in use.

* Its random access of two processors of the computer can access any location in memory in any order as opposed to sequential access drivers which must be accessed in certain order.
* RAM can be read from and written to.
* They are viotile i.e. they lose the stored information in case of power loss.
* They are quite expensive.
* They are two types of RAM ;

i) Static – It doesn’t need to be refreshed this makes it faster but is more expensive than dynamic RAM.

ii) Dynamic – It needs to be refreshed 1000 times per second.

NB. Both static & dynamic RAM are violatile.They lose their content when power is turned off.

**ROM –** It’s a non- volatile memory, it retains its content even when the computer is turned off.

* It can only be produced by manufacturers & it’s designed to perform a specific function & cannot be changed.
* Generally used for program that are static (not changing often) & that are mass produced.
* They are also random access but only for reads once data has been written onto the ROM chip it cannot be removed & can only be read.
* It’s a special memory that’s used to store a program that boots a computer & performs diagnostics.
* Computers contain as more amount of ROM (a few thousand bytes) as compared to amount of RAM.

**Types of ROMS**

1. **PROM** – It’s a type of ROM that can be programmed using special equipment.

It can be written to but only once.

-It’s similar to a CD-ROM recorder that allows to ‘burn’ the program into blanks once & let you read from them many times.

-Programming a ROM is also called Burning.

2. **EPROM –** it’s a ROM which can be erased & re-programmed.

- It’s much useful than a regular PROM but require an erasing light & it’s applicable in CD-RW.

3. **EAROM** (Erasable Alterable ROM)-They can be modified one bit at a time but writing them is a slow process.

-They use non-standard voltages usually high voltages e.g. in a CMOS battery backed up by lithium battery.

4. **EEPROM –** It can be erased under a software control.

-Its commonly used for BIOS program.

-It’s not done oftenly.It can be done once a year or so compared to other read-write memories.

**Characteristics of main memory**

Main memory in a computer are characterized in the following activities:

i) They are very closely to the computer.

ii) They hold programs & data that the processor is acting on.

iii) ROM is used for long term storage while RAM is used for short term storage.

iv) The processor interact with the main memory millions of times per second.

V) The content in the memory can be easily changed in case of programmable memories.

vi) The main memory have low capacity.

NB.The memory applies to any electronic component capable of temporary storing data which can be either internal or external memory.

-They can be characterized by:

1) Capacity – This is the global volume of information in bits that the memory can store.

2) Access time – Those in the time internal between the read-write request & the availability of data.

3) Seek time – These represents the minimum time interval between two successful accesses.

4) Throw put – The volume of information that’s changed per unit of time which is expensive in bits per second.

5) Non volatility – It’s the ability of memory to store data when it’s not supplied with power/electricity.

**Characteristics of storage devices**