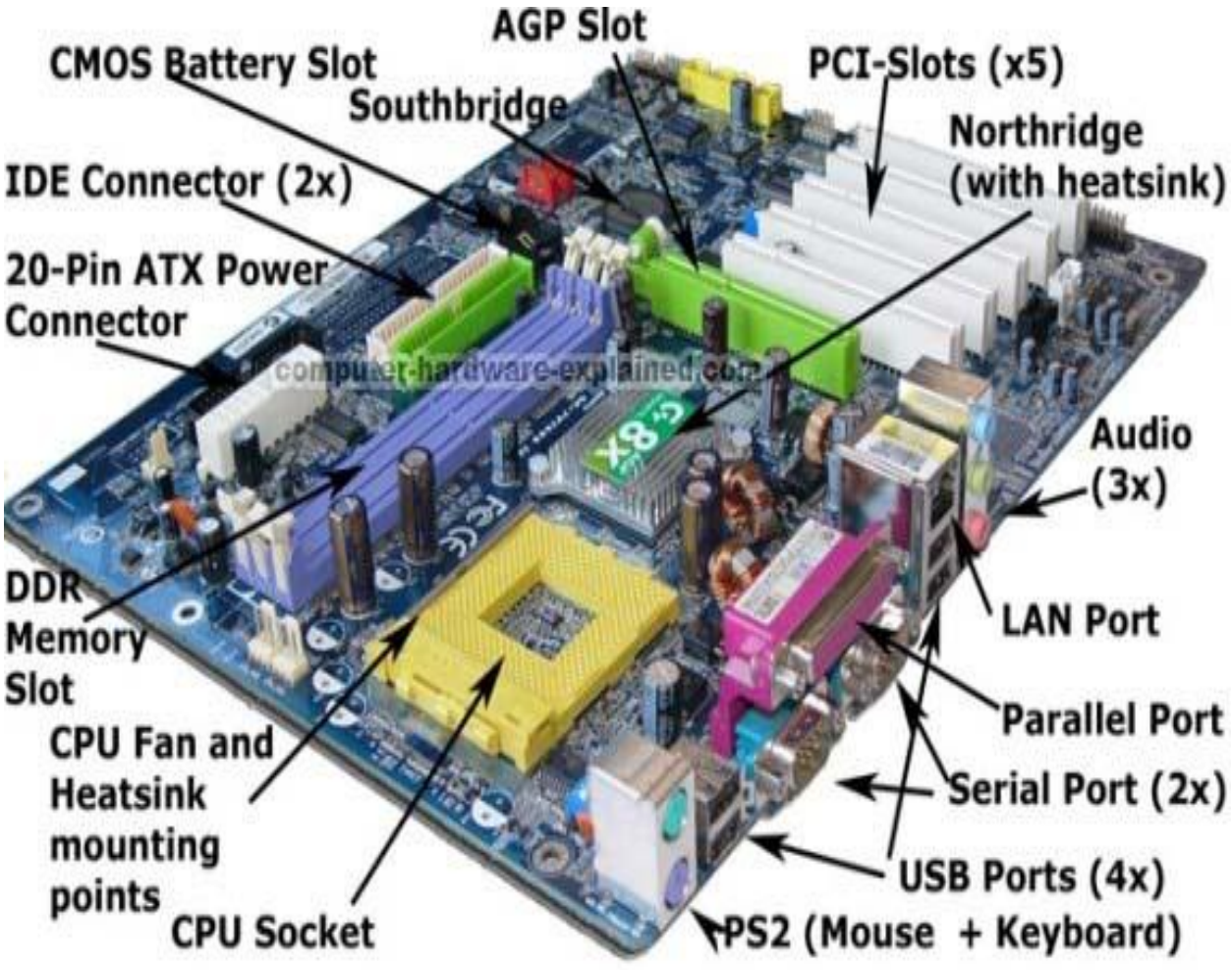
UNIT-II

MOTHERBOARDS

- Motherboard is the heart of any personal computer.
- It provides system resources interrupt request (IRQ lines), DMA channels, and Input Output locations).
- Support the core components such as CPU, chipsets &Real Time Clock (RTC).
- It handles all system memory includes SD-RAM, BIOS RAM, CMOS RAM.



MOTHER BOARD TYPES

- Motherboard is a printed circuit board.

❖ Active:

- It is comprehensive and the RAM, ROM, CPU is attached in the motherboard.
- So we can't able to upgrade by adding RAM or processor in the motherboard.
- One way to upgrade is replace with newer.
- Example: Only PCI bus slots we can add.

❖ Passive:

- More than interconnecting slots.
- No major chips on the black plane.
- The CPU, RAM, BIOS ROM and other central process component are fabricated on the board that simply plug in to one of the back plane slots

❖ Black Plane:

- It is a group of electrical connector in parallel with each other.
- So the pin and connectors is linked to the same relative pin of other connector forming a computer bus.
- The back plane is a printed circuit board containing connections (slots) for expansion boards and allows for communication between all connected boards.

SOCKETS & SLOTS

Sockets- eg,Processor socket(PIN GRID ARRAY)

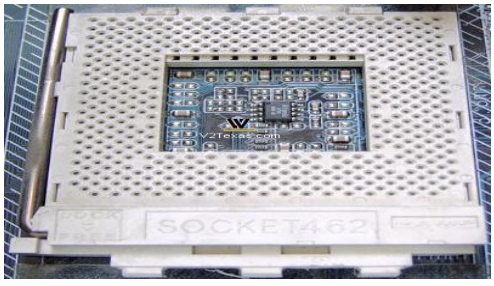


FIG: SOCKET

Slots - eg,PCI, DIMM(RAM slot)

FIG:SLOT

- ❖ Socket 7:
  - Designed for Pentium MMX,AMDK6-2, Cyrix MIII processors
  - 321 pins, super socket 7 is support processor up to 500MHZ.
- ❖ Socket 8:
  - It is used in Pentium pro, Pentium II
  - It is Rectangular shape-387 pins.
  - It supports bus speed 60-66MHZ.
- ❖ Socket 360:
  - It is used in Pentium III, Celeron Pentium processor.
- ❖ Socket A (or) Socket 462:
  - Later model AMD Athlon, AMD Duran processor.
  - It used in fsp(133MHZ & 166MHZ) 200MHZ.
- ❖ Socket 432:
  - It is used in Pentium 4 processor.
  - Intel D850 GB motherboards used for Pentium 4 processor.
- ❖ Slot 1:
  - These motherboards SEC single edge catridge.
  - Processor box is used rather than a pin grid array chip.
  - It has 242 contacts.
  - It is used in Pentium II, pentium III.

❖ Slot 2:

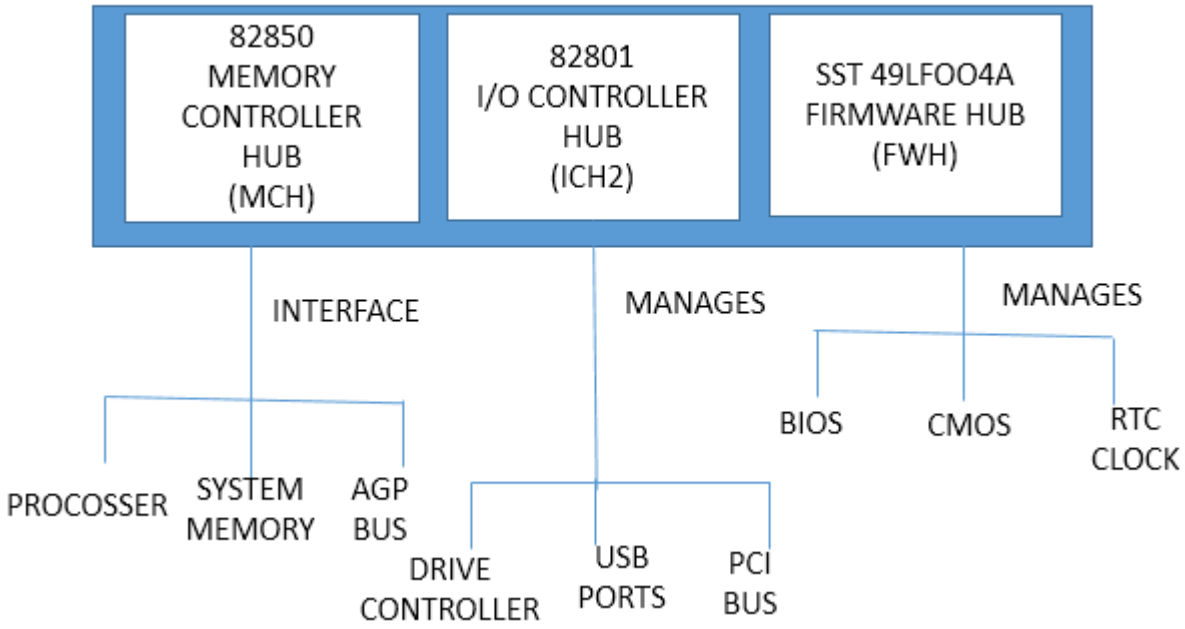
- It has330 contacts.
- It is used in Pentium II, pentium III xenon processor.
- Slot motherboards are used high end network server & work station systems.

❖ Slot A:

- It has 242 contacts.
- It is Used in AMD Athlon, Duran processor.

INTEL D850 GB MOTHERBOARD

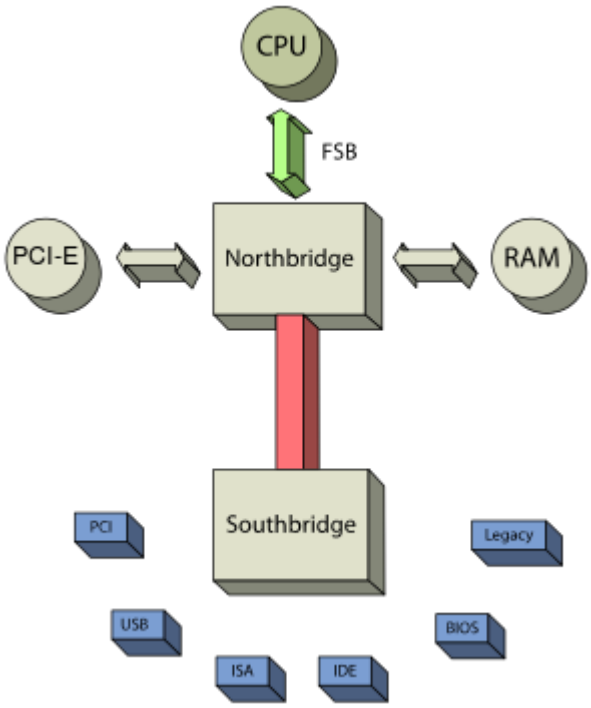
- Used in Pentium IV motherboard.



-
- Modern motherboards there are two or three longer chips on a whole motherboard ie, power full inter related chips (chip set).

❖ Chip set:

- Used to Connect processor & memory with drive controller (FDD, HDD) & expansion buses (ISA, PCI, AGP) I/O ports (serial, parallel PS 12, USB).



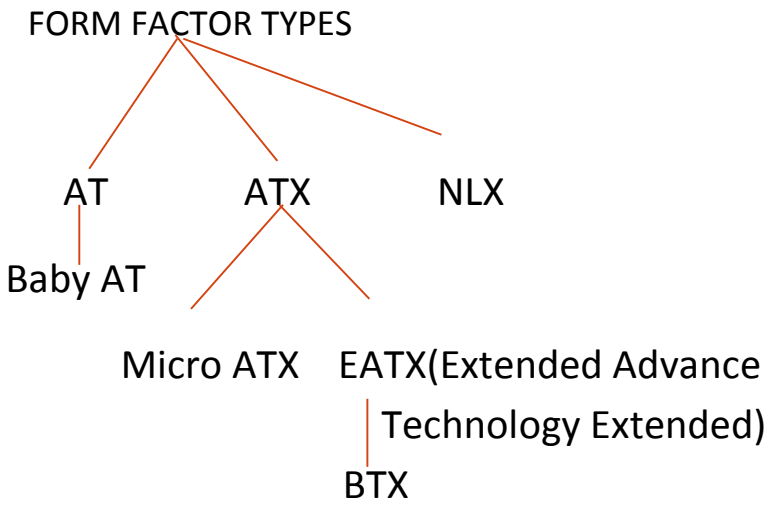
❖ Expansion slots:

- ISA(1981)- Industry standard architecture- Accommodate low band width device such as modem, sound cards
- PCI(1993)- Peripherals component interconnect -Video cards and Network interface card.
- AGP: Accelerated Graphics Card
    - Used for 3D graphics
    - It provides a high speed data path directly between the graphic card & system memory.

FORM FACTOR

- It is the Specification of the motherboard
- Depend on Dimension , power supply types
- Depend of Location of mounting holes & Number of ports on back panel.

- Placement of key component such as CPU, memory module, expansion slots, I/O parts.



❖ AT(Advanced Technology):
- AT is introduced by IBM 1984.
- Two sets of 6 pin inline connector:
- CPU is positioned in line with one or more ISA between slots.
- I/O ports (LPT, PS2, USB) are spread out in the board.

❖ Baby AT:
- 1987,size 12”to 8.5”
- The smaller version of original AT motherboard.
- The I/O ports which were cabled to connectors on the back of the case.
- Socket 7 was used.

❖ ATX (Advanced Technology Extended):
- It is Introduced in the year 1995, size 12”wideX13.8” deep.
- Ex: Intel 850GB ATX
- All I/O are connected in to single I/O panel located rear of the motherboard.
- It has 20,24 pin power connector.
- CPU is connected away from all expansion bus slots.

- ATX uses (socket 7, 360, 432, slot 1, slot 2, slot A) CPU.

❖ Micro ATX:
- It is Slim & small in structure.
- Dimension is 9.6 by 9.6 inches or 7 by 7 inches.
- It used in digital cable boxes&HD recorders.

❖ Extended ATX:
- It is Used in Work station level motherboard specification.
- It has 12 by 13 inches.

❖ NLX(New Low profile Extended):
- It is introduced 1997, 9" wide X 13.6 deep.
- All expansion slots, power cable & PCI are located on edge mounted riser card.
- This allows easy removal of motherboard.
- AT & ATX is time consuming to upgrade & replace.
- To overcome the replaceable motherboard.

❖ BTX(Balanced Technology Extended):
- North Bridge & south bridge are located near each other and hardware they control line CPU, RAM, expansion ports.

CHIPSET TYPES

❖ North bridge:
- One chip responsible to interface CPU, main memory, AGP.
- The path between CPU & RAM is referred as FSB.
- North Bridge play important role in over clocking.
- It supports:
- P II, p III, Athlon, Duran, Celeron.
- Multiprocessing.
- Processor speed 250 MHZ, 800 MHZ, and 1.5 GHZ.

❖ Southbridge:

It handles peripherals controller & I/O controller & Integrate controller.

1. It supports:
2. ISA bus, serial ports (Rs232).
3. Parallel (IEEE 1284 port).
4. Hard drive controller.
5. Power management features.
6. Key board controller.

UPGRADING THE MOTHERBOARD

Considering the motherboard:

- ❖ Compare features:
  - Check the specification closely before making choice.
  - BIOS play a vital role in such advanced features as plug & play.
  - Power conservation features ACPI.
  - The number & type of I/O slots provide on board features, video adapter, and sound devices.
- ❖ Dimension & Mounting:
  - Physical dimension of the motherboard must fit available in pc.
  - Mounting holes (new motherboard will not match the original mounting holes).
- ❖ Check CPU slot location:
  - Check the CPU location & expansion slots.
  - Pentium III and pentium 4 heat sink and fans will be mandatory.
  - CPU fan easily interface with expansion slots.
- ❖ Consider collator upgrades:
  - Changing new motherboard.
  - It requires any other upgrades.
  - It evaluates other sub assemblies.
  - Check the cost.

Example: RAM slots.

Performing the upgrade:

- ❖ Static precaution:
    - Computers are fabricated with technology ESD(Electro Static Discharge).
    - ESD is a sudden flow of electricity.
    - It use antistatic mat to eliminate static electricity.
    - It handles PCB boards by edges.
- ❖ Save your CMOS:
    - Print screen of CMOS setup.
- ❖ Prepare the system:
    - Turn off, unplug a current.
    - use screw driver blades carefull if it slip , it damage motherboard.
- ❖ Remove the motherboard:
    - Dismantle expansion cards.
    - Heat sinks , processor.
- ❖ Install the new motherboard.
- ❖ Reassemble the system.
- ❖ Testing the system.

CMOS

- CMOS complementary metal oxide semiconductor.
- IBM choose to store the system setup in small low power RAM chip called CMOS RAM.
- CMOS RAM is often combined on the same chip with RTC.
- Modern PC starts the system attributes stored in the CMOS RAM read by BIOS.

❖ Role of CMOS:

- CMOS RAM is nothing very low power than static RAM.
- Older CMOS RAM had only 64 bytes.
- Later it had extra 64 bytes totally 128 bytes.

- Latest 512bytes to store CMOS setup along with ESCD(Extended System Configuration Data) I-e, information needed for PC plug & play(pnp) system.
- Ram is naturally lost data when system power remove.
- So battery is added to PC that continuous to provide power to CMOS RAM & RTC.
- It is CMOS battery backup that keeps the data, time & system parameter.

BASIC CMOS OPTIMIZATION TACTICS

- The PC continue evolve to increasing the variety of memory types, buses.
- PC initiatives and system architecture has forced BIOS makers to provide more and more entries in CMOS setup.

❖ Check the basics:
- All standard CMOS setting correspond to the installed components at your system (Hard disc, CD drivers).
- Date & time available in memory.

❖ Enable all system cache:
- All cache memory (both internal L1 & external L2) cache memory present in the system.

❖ Minimize RAM wait status:
- Wait state values used for your main system RAM are set at minimum possible.
- Wait value too low, will make your system freeze.

❖ Enable RAM shadowing:
- Shadow the video & system ROM contents to RAM it is initiated when booting.
- Newer system uses fast flash ROM devices.

❖ Enable power management:
- Check the power devices.
- Proper power management conserve electricity.

- Extend the working life at may system components.

❖ Optimize device access:

- Hard disk data transfer speeds are major bottle neck of system performance.
- Use fast data transfer protocol that the hard disk support.

Example: ultra DMA 100

❖ Go with BIOS default:

- In modern systems it's unnecessary to re-enter every CMOS setup parameter from scratch.
- Suitable default setting are now typically in corporate in to BIOS itself.
- BIOS not optimize your system performance.

What is interrupt request?

In a computer IRQ is a hardware signal sent to the processor that temporarily stops a running program and allow a special program.

Example: key process, mouse movement.

CONFIGURING THE STANDARD CMOS SETUP

- The standard CMOS setup usually shows the basic data about your system.

(i)Date,

(ii) Time ,

(iii) Attached devices(HD)

- It is important for you to get the data correct because the system will refuse to boot unless it is aware of all the drives installed.

❖ Assign IRQ for VGA:

- When enable this option the system assign IRQ for video card in order to speed the data transfer between CPU & video card.

❖ Date & time:

- It use to change date & time of the system clock.

❖ Day light saving:
- It enables the RTC allows automatically adapt to the day light saving scheme.
- It maintains date & time.

❖ Error Halt:

This entry determines whether the PC will stop it if an error detected during initialization.

1. No error
2. All error
3. All but disk

- HDD delay:

Some hard drive require several seconds to be identified correctly by BIOS.
This setting allows you to artificially delay boot up so that the drive may be initialized.

- Key board:

Whether key board is attached.
Proper entry is initialized in BIOS.
If not, it allow the PC to boot without key board.

- Memory:

Details about memory elements:
Which memory element should be displayed in start time

- Base memory
- Extended
- Other memory is used by AGP.
- Total memory sum of all.

➢ Quick power on self-test:

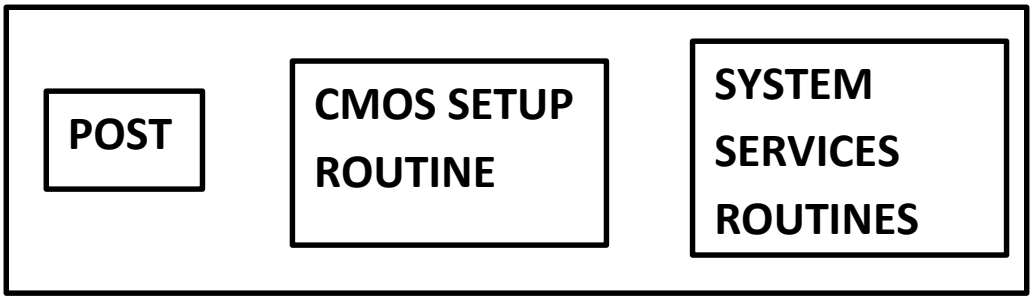
If hard disk that initialize quickly.
Able to speed your boot time by using quick post.
ie, post disable when you disable.

BIOS

- Basic I/O system:
  - Basic I/O system is added on ROM chips.
  - To provide interface between the raw PC hard ware and the standard operating system.
  - BIOS ROM chip used for major sub systems such as video & drive control.
  - BIOS ROM in UMA upper (640 KB to 1MB) memory area.
  - In general PC filled with
    - System(motherboard) BIOS.
    - Video adapter firm ware BIOS.
    - Modem card firm ware BIOS.
    - SCSI(Small computer system interface) adapter BIOS.
    -

TYPICAL MOTHERBOARD BIOS

BIOS occupies 128 KB in upper memory.It is arsenal individual routines.



- Post – power on self test
  - Manages entire system start up.
  - It handles all initialization activities of PC.
  - It performs low level diagnostic & reliability test of main processing components

1. ROM programs.
2. System ROM.
3. Test CPU.
4. Chip sets.

5. CMOS-system configuration data.

❖ CMOS setup routine:

- CMOS setup integrate in the BIOS.
- Hardware configuration for any given computer is maintained in a small amount of very low power CMOS RAM.
- Post gathers information about the system hardware and compares the setting in CMOS RAM.

❖ System service routine:

- BIOS services.
- Set of functions that form the layer between hardware and operating system.
- Contains hard ware interrupt .
- Software interrupts –hardware device must be checked or manipulated by the PC.
- CMOS & BIOS work together to make the system function propane.

➢ BIOS

- Chip contains a special program that helps the computer processor interact & control the other components in the computer(disk drives, sound cards, video card, network card, USB ports hard disk).
- Without BIOS the processor would not know how to interact with computers components.

❖ CMOS Ram:

- The RAM chip is a memory chip which stores information about the computer components.
- BIOS chip reads information from the CMOS chip during BOOT up process by post.

➢ BIOS Features:

- PC technology advancing in CPU chip sets &memory.
- As hardware continuous in advance it makes advance in BIOS.
- Core features of modern BIOS.

❖ CPU support:

- BIOS supports a rich range of CPU, Intel, AMD, Cyrix.

❖ Chip sets support:

- BIOS supports latest chip sets.

  Example: Intel 850, i7-4960x.

- Chip set is critical because chip set allows motherboard to implements power management, USB, DDR-SD RAM(memory).

❖ Memory support:

- The BIOS should be able to auto size and support most modern form of memory.
- Memory error checking should also be support.

❖ Power management:

- The BIOS should fully comply with the advance configuration & power interface(ACPI).
- Used to reduce energy waste.
- BIOS uses DPMS(display power management system) for monitors & other display devices.

❖ Drive support:

- BIOS must support 32 bit disk transfer and large ultra ATA hard drivers with very fast data transfer modern ultra DMA /33, ultra DMA /66, ultra DMA /100 (ultra ATA 100=100 MB/s).

❖ IO support:

- IO which allows dynamic assignment of ports & resources for I/O devices in PC.
- It is used in servers platform.

❖ BIOS versatility support:

- The BIOS should be able to boot from different drivers and include BIOS boot specification for Intial Program Load(IPL)devices.
- It support boots from CD ROM, SCSI drives, removable media drives.

❖ Plug & play support:
- The BIOS must detect & configure PNP devices during post.
- It also communicate with operating system to determine resources & support IR2 for PCI bus devices.

❖ Parallel port support:
- BIOS support a full range of parallel port mode.

1. SPP (standard parallel port)
2. bidirectional mode(transmit receive)
3. Enhance parallel port (EPP).
4. Enhanced capability port (ECP).

❖ PCI & AGP support:
- It support PCI (2.1) specification.
- It includes PCI to PCI & PCI to ISA bridging.
- It supports AGP20.

❖ USB(universal serial bus) support:
- BIOS support both universal and open HLL standard
- To provide legacy support for USB hardware and multilayered USB hubs.
  - 2.0 USB high speed USB.
  - 3.0 USB super speed.

❖ Anti virus protection:
- Offer of virus protection.
- Protect change to master boot record.

BIOS BOOT SEQUENCES

- BIOS are to recognize how it boots.
- The series of steps that it takes place in PC from power on state to operating system loading state.
- AMI BIOS has 24 steps in order to check and initialize the PC.

Disable NMI:

- It disables non mask able interrupt line to the CPU.
- It is the highest priority interrupt capable of interrupting are software and non virtual hardware memory.
- It is not commonly used.
- It used only to verity serious error or stop all operation.
  Example: ctrl + Alt + Del->NMI send to CPU.
- Mask able is ignored by the CPU.

Power on delay:

- The fault here indicates a problem with keyboard controller chip or system clock generator chip.
- The system resets soft and hard reset bits.

Initialize chip sets:

- It initialize motherboard chip sets.
- A problem here may be caused by BIOS, the generator chip or chip set itself.

Reset determination:

- The system reads the reset bits in the keyboard controller to determine a hard or soft reset.
- A failure here may be caused by the BIOS or KB controller chip.

BIOS ROM check sum:

- The system perform a check sum best of ROM contents and adds a factory preset value should make total equal to 00h.
- It this total does not 00hthe BIOS ROM is defective.

Key board test:

- The command is sent to the 8042 (keyboard controller) which perform test and sets a buffer space for commands.
- After buffer is defined the BIOS sends command byte, writes a data on buffer.
- It check the high order of internal KB controller.

CMOS shutdown check:

- BIOS test the shutdown byte in CMOS RAM and calculate the CMOS check sum and update a diagnostic byte.
- System the initialize a small CMOS area in conventional memory and update the date and time.
- Problem here is like RTC or CMOS back up battery.

Controller disable:

- BIOS new disable the DMA & IRQ controller chip before proceeding.
- Problem suggests trouble respective controller.

Disable video:

- BIOS disable the video controller chip.
- It this procedure fails trouble in video adapter board.

Detect memory:

- The system proceeds to check the amount of memory available.
- BIOS measures system memory in 64KB blocks.
- Problem may be in memory chips.

PIT test:

- Programmable interrupt time for memory refresh.

The problem with PIT test may reflect the fault in PIT IC or RTC chip.

Check low address line:

- The system checks the first 16 address lines controlling the first 64 KB of RAM.
- Problem with this test typically fault in address line.

Check low 64KB RAM:

- The system checks first 64KB of system RAM.
- This area must hold information that is critical for system initialization.
- Problem in RAM chip.

Initialize support chips:

- BIOS proceeds to initialize the programmable interrupt timer(PIT), the programmable interrupt controller(PIC) and the DMA chips.
- The problem would be located in one of those locations.

Load INT vector table:

- BIOS load system interrupt in to the first 2KB of system RAM.

Check memory refresh:

- BIOS now uses the PIT to try refreshing memory
- A failure indicates a problem with PIT chip.

Check KB controller:

- BIOS reads the keyboard controller buffer at I/O port 60h.
- Fault in KB controller chip.

video test:

- System checks type of video adapter then tests and initialize the video memory and adapter.
- Problem in video adapter.

load the BDA(BIOS Data Area):

- The system now loads the BDA in the conventional memory.

Test memory:

- BIOS checks all memory below 1MB.
- Fault in one or more RAM modules.

Check DMA register:

- BIOS perform a register level of check of DMA controller using binary test pattern.
- Failure in DMA chips.

Check the keyboard:

- Final check in KB interface.
- Fault in KB.

Perform high level test:

- Test to check high level devices as hard disk drive serial adapter, parallel adapter, mouse adapter.
- When error occurs the corresponding text message will displayed.
- If the hardware does not match the setup show in CMOS.

Load the operating system:

- The routing loads on operating system.
- Error generally results in error message non system disk.

Keyboard controller:

- It is a device that interfaces a keyboard to a computer.
- It inform the computer when a key is pressed or released.
- When data from the keyboard arrives the controller raises an interrupt to allow the CPU to handle the input.

Clock generator:

- It is a circuit that produces a timing single used for synchronizing a circuit operation.

BIOS SHORT COMINGS AND COMPATIBILITY ISSUES

BIOS can come up short comings before you start trouble shooting you should understanding the places where BIOS is weakest.

❖ Device drivers:
- Computer program that operates or controls a particular type of device that is attached to a computer.
- A driver communicates with the device through computer bus to the hardware connects.
- Drivers are hardware dependent and operating system specific .
- The low level device drivers loaded in the conventional memory.

❖ Flash laziness:
- Flash memory allows BIOS to be reprogrammed so no need to exchange BIOS chip.
- BIOS updates can be directly updated by interrupt.

❖ BIOS shadowing:

- The problem with BIOS chips is slow speed.
- BIOS recorded on to flash ROM chips.
- To overcome this they use shadowing .

- Copies ROM contents from the BIOS chip into available RAM in the upper memory area(UMA).
- BIOS routing to forked advantage of faster Ram.

❖ Direct control:

- New technology hardware works with drivers.
- Not involve in BIOS.

  Example: 3D accelerator

- Direct hardware may not work on all system configuration.

❖ BIOS bugs:

- BIOS code is to accidental errors.
- If a bug is present in the BIOS the system will typically lock up or crash unexpectedly.
- We can update the BIOS, and cash the BIOS.

❖ Power supply and power management:

- Power supplies play a vital role in the operation of PC and their peripherals.
- Power supply converts commercial AC into one or more level of DC that can be used by the electronic devices used in the computers.
- The disadvantage in linear power supply is tremendous waste.

CONCEPT OF SWITCHING REGULATION

- Instead of throwing extra I/O energy switching power supply creates a feedback loop.
- Feedback circuit sensor the output voltage provides then switches the AC primary voltage on or off as need to maintain steady level in output.

- Switching power supply is constantly turning on and off to keep the output steady.

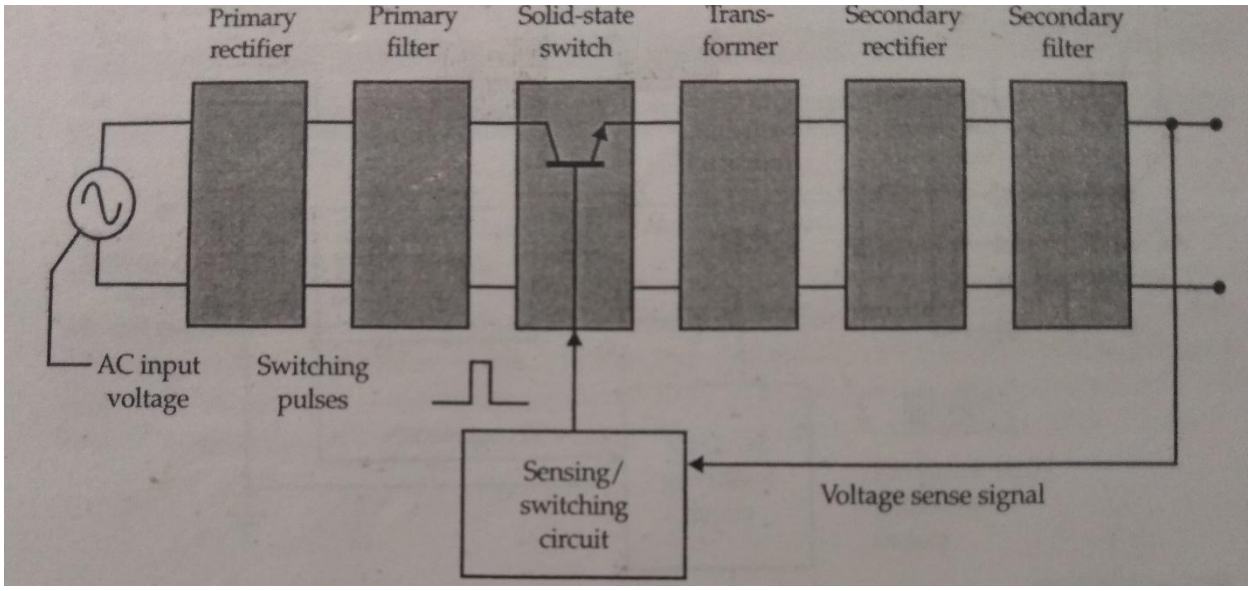


Fig: switching power supply

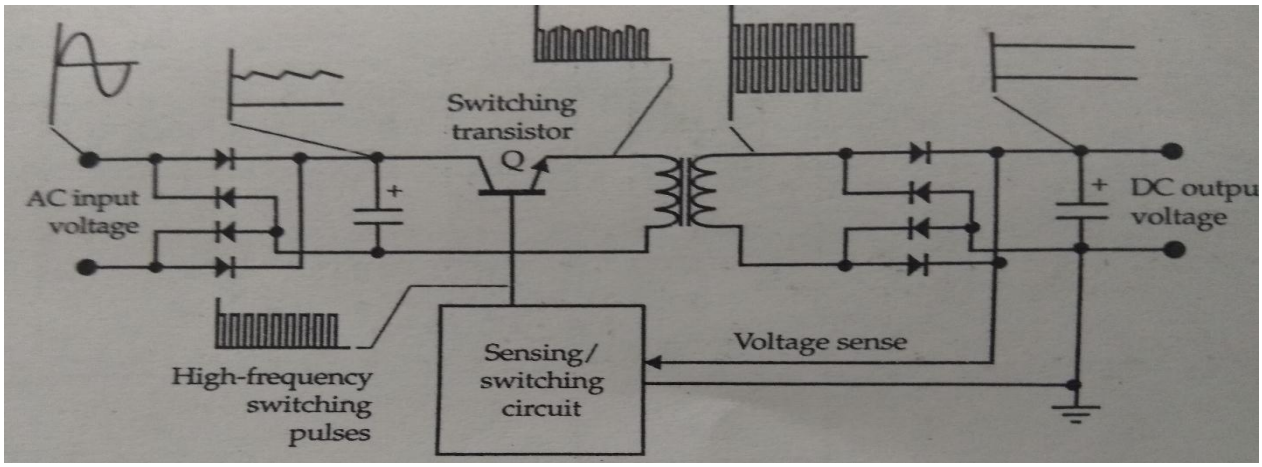


Fig:Simplified digram of switching power supply

- Raw AC line entering the supply converted to pulsating DC and filtered by rectifier.
- AC current not transformed before rectification, Capacitor charge the peak voltage.
- Switch transistor is turned on & off at high frequency.
- The switching transistor acts as chopper which breaks up primary DC to form a chopped DC ie, used as primary signal i-e input of step down transformer.

Duty cycle:

- It refers the amount of time that a signal is on.

A long duty cycle:

- Large output voltage (heavy loads).

Short duty cycle:

- Lower output voltage(light loads).

Advantages:

- Little power is wasted in primary circuit.
- Secondary circuit will supply just enough power to keep load voltage constant.
- 85% efficient.
- Less heat is generated by the supply, so components can be smaller and package.

POTENTIAL POWER PROBLEMS

- Malfunction in power supply prevent PC from booting.
- It is not able to supply enough power to keep the system running properly.
- The chronic problems can help you navigate the gray area.

The computer freezes intermittently:

- Most computers freeze due to the software applications and configuration error.
- The time you suspect power problem is when your system suddenly starts freezing for no reasons at all.
- Freezes several times a day or several times at a hour.
- Check it, may be power problems.

- If the system ends to freeze when it is running on a different power circuit.

There are random memory error:

- If you added a new application or device driver or upgrading the system.
- Suddenly see a rash of memory errors.
- Occasional memory error message does not necessarily indicate a power problem.
- Memory error occurs when the PC running in different power.

Data is lost or corrupted on the hardware:

- Hard drive problem can be result of several problem(lose data cable or operator error).
- If the drive seems to be having difficulty reading or writing the disk.
- Check the power first before attempting to back up the disk or run any disk based diagnostics.
- If you attempt to defragment with present power problem it will damage HDD more.

There is trouble communicating with modems or peripherals:

- You may see rash of communication error when trying to use a modem or mouse if the peripherals connected and installed properly.
- The system suffers from chronic hardware failures:
- Fault may reoccur after a few day or a week

Example: memory error, replace the memory and the fault.

- It goes away but the same fault occurs after few days.
- This type of problem suggest there is power spikes are entering the system AC line.

POWER MANAGEMENT

- It used to conserve power.
- Power conservation is important for mobile PC.
- Operating system provides the controls needed for selecting power management.

❖ Basic conservation:

- You can turn off your monitor and hard drive automatically after the period of inactivity.
- This conserving the great deal of power while the system is in rest.

❖ Stand by:

- When it is idle.
- In stand by your monitor and HDD turn off and some computer devices are powered down.
- When you want to use again it comes out quickly from stand by and restore exactly as you left it.

❖ Hibernation:

- After longer periods of inactivity power manage hibernate feature.
- Turn off your monitor hard drive first.
- It idle time continuous the system will save everything in memory on disk then turn off the computer.
- When you restart your computer last state is restored to memory for the disk.
- Desktop restored exactly as you left.

❖ Selecting the power scheme

- To enable stand by mode we use power management features and select power schema
    - Stand by after -after20 min
    - Turnoff –after 15 mins
- Manually invoke stand by &hibernate modes.