SCSX1027 - HARDWARE PERIPHERALS AND INTERFACING

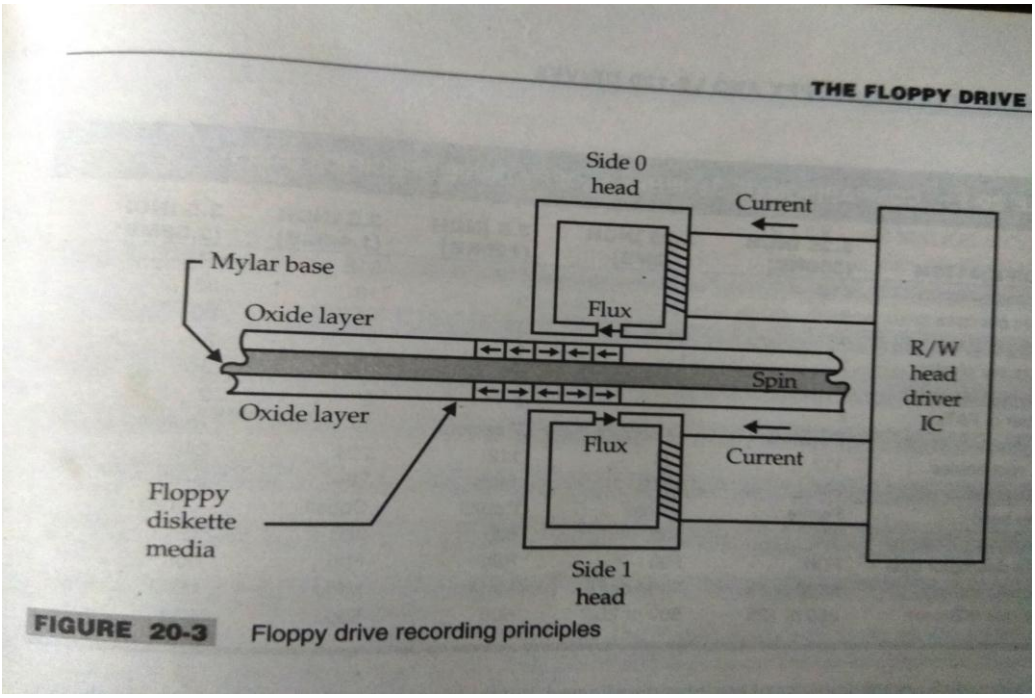
UNIT –III

STORAGE DEVICES

FLOPPY DRIVE(1969-1999)

- To interchange programs and data between various computer is the fundamental requirement at every computer system.
- Floppy drivers are inexpensive and reliable, very limited in their storage space(1.44MB)
- LS-120 ultra high density floppy system with 3.5 inch disk can support upto 120MB
- Floppy drives useful for transferring files and data between various systems.
- Floppy drivers have evolved from 8 inches to 5.25 inches to 3.5inches.

Magnetic Storage concept:



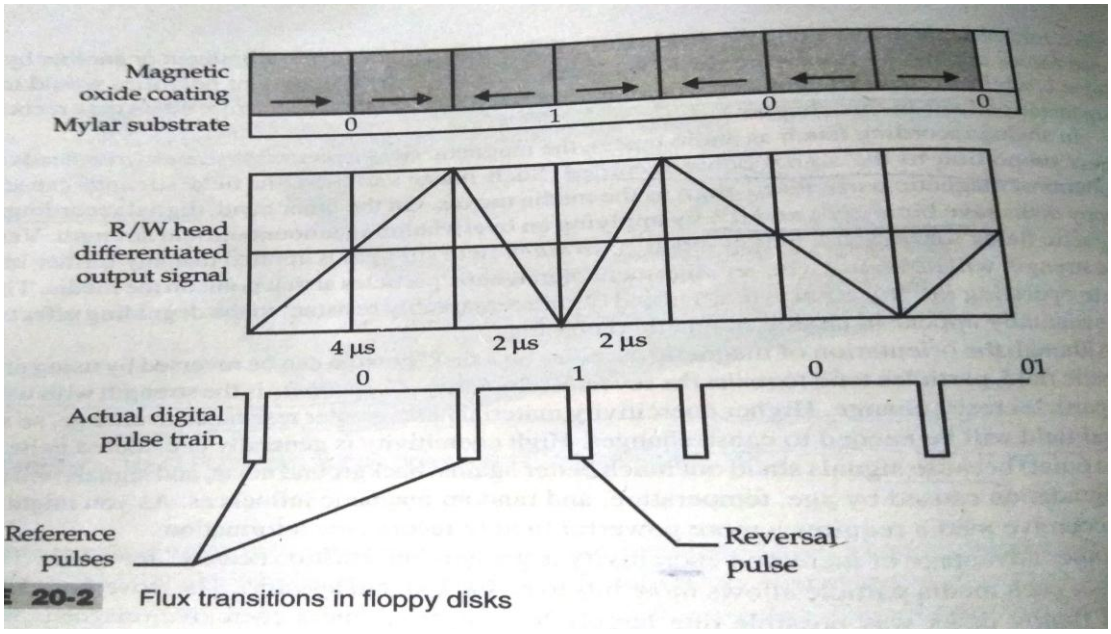
- Floppy disk is a magnetic media and non volatile memory
- In floppy Disk Electric energy is used to read and write magnetic data

- It is a process of transaction from electricity to magnetism
- Magnetic Storage media and devices store data in the form of tiny magnetized dots

Magnetic Media:

- Magnetic media physical material that actually holds recorded information
- In a floppy disk the media is small MYLAR disk coated on both sides precisely formulated magnetic Referred to as a oxide layer,MYLAR disk –Plastic covering
- In the magnetic layer each and every particle acts as a Microscopic Magnet
- Each magnet particle can be aligned in one orientation under the influence of an extreme magnetic field
- In floppy disk Microscopic points along the disk surfaces and magnetized in one alignment or another by the precise forces applied by read and write heads
- The shifting of alignment polarities would indicate –Logic 1
- No change in polarities indicate –Logic 0
- In audio recording (audio tapes) magnetic field generated by the Read Writers head varies in direct proportion to the signal being recorded.
- In digital recording the floppy disk save binary 1's and 0's by applying a over amount of field strength
- Very strong magnetic field saturate the media
- The advantage of saturation is that 1's and 0's are resistant to the degrading affect of noise
- COERCIVITY is the storage with which magnetic particles resist change Increasing coercivity is greater information during far media
- Media particles allocate more bits to be packed into less area
- The main premises of magnetic storage is least change(once recorded information is retained with out at any electric energy)
- The ability of the media to retain its magnetic information is known as retentivity
- A good magnetic field media to remember alignment of particles over a long time

Magnetic Recording Principle:-



20-2 Flux transitions in floppy disks

1) Understanding digital recording is to see how binary data is stored on a disk
2) Binary 1's and 0's are not representing by discrete polarities of magnetic field orientation
3) Binary digits are represented by the presence or of flux transitions
4) Types:
    - Logic 1 is indicated by the presence of a flux reversal with in a fixed time frame
    - Logic 0 is indicated the absence of flux reversal

Degradation :-

- By using sector ID we can access data if the sector-ID failure can't we can access the data
- The direction of reversal event that defines a 1 or 0.
- First zero '0' uses left to right orientation ,Second zero uses right to left orientation
- Fig 2 represents an amplified output signal from a typical read / write head
- Amplitude output signal from typical read/write head
- Analog signal peaks where ever there is a flux transition

- Here the long slope represents ‘0’ short slope represents ‘1’
- Such peaks are encountered , peak detection circuits in floppy drive making pluses in ultimate data signal
- The ability of floppy disk to store information depends upon being able to write new magnetic field polarities on top of old or existing orientations
- The drive must also be able to sense the existing polarities of a disc during read operation
- The mechanism responsible for translating electric signal into magnetic signal is the Read /write head
- When the head is energized to the current flow from a drives chip a path of magnetic field is established in the head core
- The direction of flux depends of the direction of energizing current
- To reverse a head magnetic orientation the direction of energizing current must be reversed
- The small head size and low current levels needed to energize a head allow very high frequency flux reversals
- As magnetic flux generated in head the resulting tightly focused magnetic field align the floppy disk particles at that point
- The current signal magnetizes an microscopic area on the media
- Pairing read operation the heads are left energized while the disk spins

Data and Disk organization:-

- It is used to Understand how data is arranged on the disk ,You can’t place data anywhere.
- Disk information to recorded in concentric circles
- The disk rotates one direction (clockwise)
- The concentric circles are tracks or cylinders
- Data are recorded as tiny spots on the tracks
- When read /write jumps from track to track

- Sector:
  - Every cylinder is divided into smaller units called sector
  - The circular tracks are divided in wedge shaped section
  - A sector store 512 bytes of data

- In 3.5” disk:
    - Totallty 160 tracks, 80 tracks on each side
    - 18 sector in each track
    - When formatting the location of each sector and data set down during formatting
    - The sector contains
        - Sector id
        - Synchronization
    - The extra tease information also hold by the sector
    - We can access 5/2 data bytes ,During read/write operation
    - The boot record is first sector on a disk (sector)
- Magnetic flux:-
    - A measure of the quality of magnetism
- Removable media:-

Types of floppy disk storage

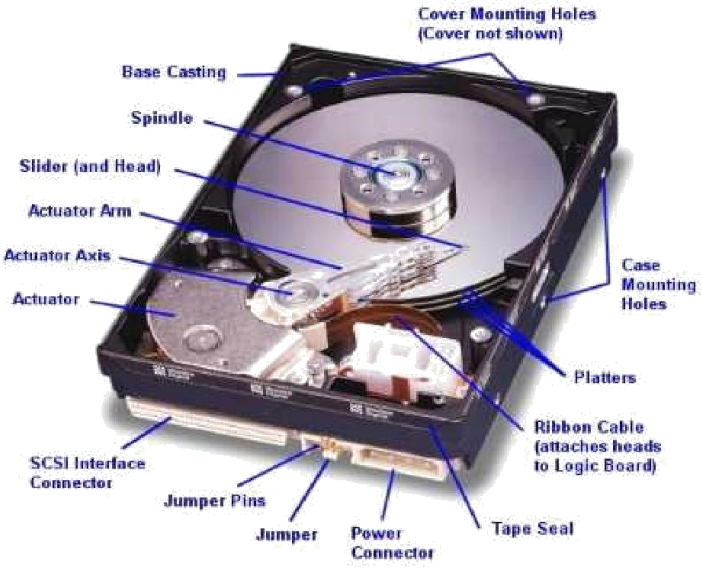
- Zip Disc (1994):
    - It is aRemovable floppy disc
    - It has 100 MB,250MB,750MB storage capacity.
    - It is also known as Super floppy
    - ZIP drive connected in parallel port.
- Jaz disc (1995):-
    - It is a Removable hard disk storage
    - It has 1GB of storage capacity
    - Used in SCSI (small computer system interface)interface (IDE version)

HARD DISK DRIVE

Hard disk drive is very similar to a floppy disk. Hard disk is high volume , high speed , file and data storage in PC

- PLATTERS &MEDIA:-
    - Hard drive used rugged solid substrate called platters.

- In traditional platters are made of aluminum. Now platters are made from ceramic composite materials
- Light strong materials have a very low thermal expansion
- The major advantage is speed about 7,200 to much as 10,000 RPM
- Traditional hard disk 3,600 to 5,400 RPM
- Hard drivers must be capable of tremendous recording density 10000 bits per inch BPI
- To achieve such recording densities platters media is far superior to the oxid media
- The media must have high coercitvity
- Hard drive read/write heads does not contact the media but ride with a microscopic flow of air over the platters surface



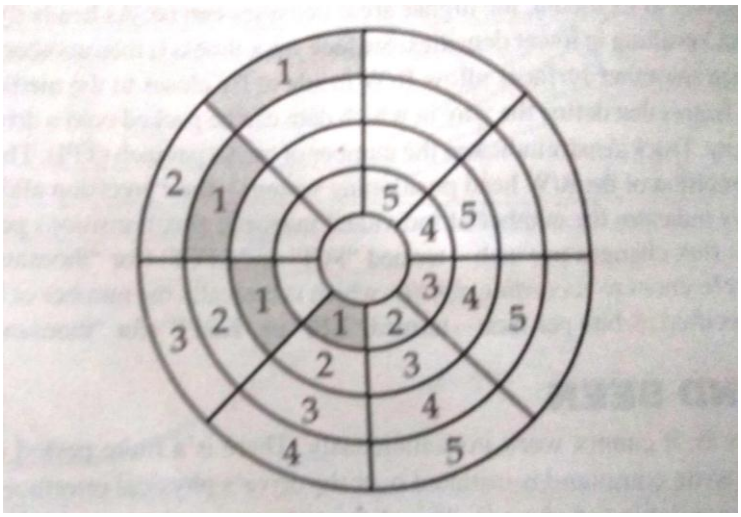
- Air flow & Head flight:-
  - Read/write heads in the hard drive must travel extremely close to the surface of each platters
  - But they can never actually contact media while drive is running
  - Read/write heads made a float above the platters surface of moving air
  - All hard drives seal with their platters assemblies in to an air tight chamber.It used to prevent contamination from dust.Contamination creates head crash.
- Data Density characteristics :-
  - The areal density of the media describes maximum amount of capacity in terms of megabytes per square(MBSI or MB in ^{2})

- Today hard support 2500 MBSI
- Larger coercitivity of the media and small read/write head with tighter magnetization field allow higher area densities
- Track density indicates the track per inch TPI
- Flux density -> the number of individual flux transition per inch of the track space and rated flux changes per inch FCI or KFI
- Bits per linear inch of trace space bits per inch KBPI or BPI
    - KFCI – thousand of FCI
    - KBPI – thousand of BPI

- Latency of seek:-
    - The finite period of delay between the moment that read& write command is initiated over the drive physical interface and moment the desired information is available .This delay is known as latency.
    - Time takes for needed bytes to pass under read/write heads . If the head reached the desired location (latencyshort)
    - If the head missed the desired location the head must wait for full rotation to reach the location (latency long)
    - If the disk spinning at 7200 RPM offer average latency of 4.2MS

- Seek time:-
    - Time taken to step the read/write heads between tracks add another delay in blood drive performance
- Track to Track seek:-
    - Time taken to step between two adjacent traces on the platter(2ms)
- Full stroke seek:-
    - The time needed to step from the inner most to the outer most track and relatively long (about 20ms)
- Seek latency :-
    - work together when loading or saving files
- cylinder skewing:-

- Technique used to improve hard drive performance by reducing the disk time lost during normal steps .A head should identify and read the desired information from a track with one disk rotation



Data organization:-

Tracks, cylinder , and sector

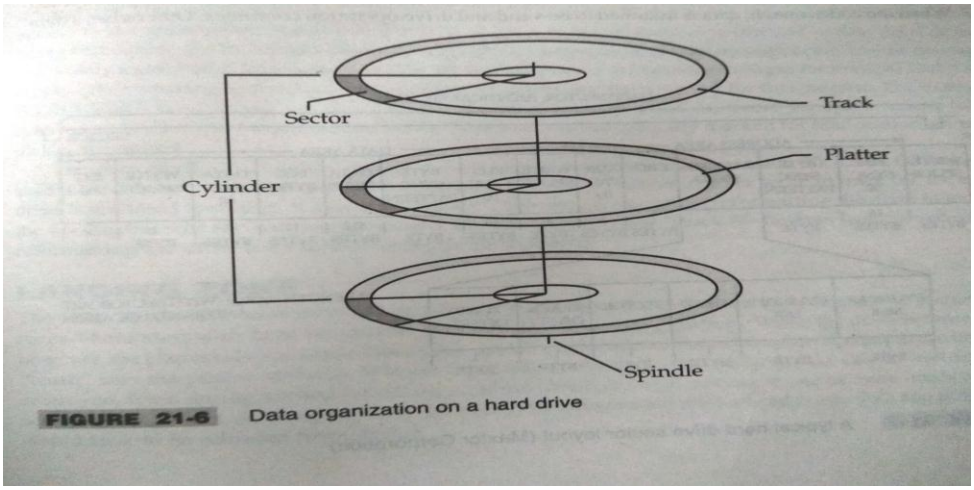


FIGURE 21-6 Data organization on a hard drive

- The information of each platter must be stored and organized into the series standard location
- Data is recorded in the set of concentric circles
- Every concentric circles on platter called track

- Platter contains many tracks
- Eg : Maxtor diamond Max 80GB drive
- 158,816 physical tracks
- Logical tracks 16383
- 63 sector per track (512 bytes per sector)
- **Tracks** are broken down into small segments called sector
- 512 bytes of data stored in every sector marked with a pulse
- The pulse signaling the first sector of the track called Index pulse
- There are two portion in every sector

➢ Identify the sector Sector area:-
- There are 2 types of sector area
  - Address area
  - Data area

➢ Address area:-
-
- To identify cylinder sector location when data read or write
- It is followed by the two byte of CRC cyclic redundancy check
- When the drive identifies location it generates CRC code that it compares the CRC code recorded in the disk
- If two bytes CRC codes matches the address assumed to be valid and disk operation continues
- Otherwise invalid
- 512 bytes can be read and write to the data field
- Data is processed to derive 11 bytes of ECC (Error checking code)
- If the data is being read the derived ECC and recorded ECC going comparison if valid continues the operation
  - ❖ CRC
    - Check data verification
    - To detect accidental changes in Raw data
    - Based polynomial divison
  - ❖ ECC
    - That detect and correct the most common internal data corruption

CD-ROM DRIVE

- CD-ROM drive origins for digital audio recording
- CD(Compact Disc) is an optical disk store digital data

➢ CD MEDIA:-

- CD is produced by stamping pattern of pits and lands on a molded polycarbonate disc called substrate
- The polycarbonate disc is given a silvered (Reflected coating) so that it will reflect the laser light
- Silver coats all parts at the disc side(pits and lands) equally
- The disc is coated with tough scratch resistance Lacquer that seals the disc from oxidize and the rain the reflecting coating
- Finally disc is caballed can be silk screened on to finished disc

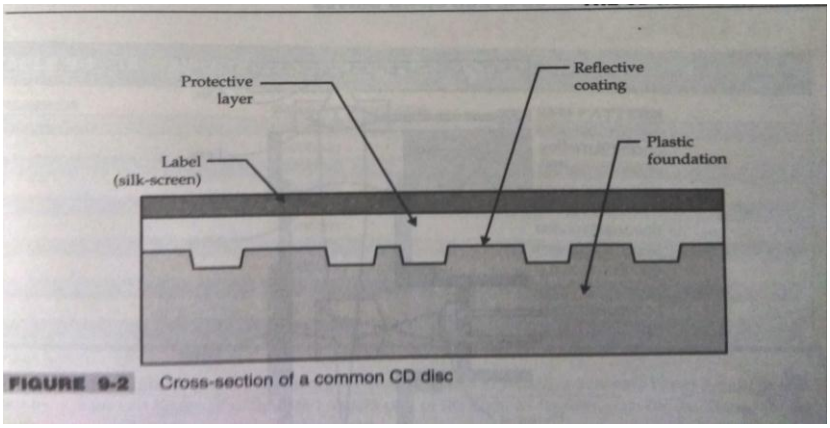


FIGURE 9-2 Cross-section of a common CD disc

➢ CD-DATA:-

- CD's are recorded as a single continuous spiral track from spindle (inner)to the lead out(outer) area
- Spiral track is the relationship pits and lands
- Each pit – 0.12 µm(micro meter)deep and 0.6 µm wide
- Lands may range 0.9µm to 3.3µm in length

  There are approximately 1.6µm between each iteration at the spiral -16000 tracks per inch TPI

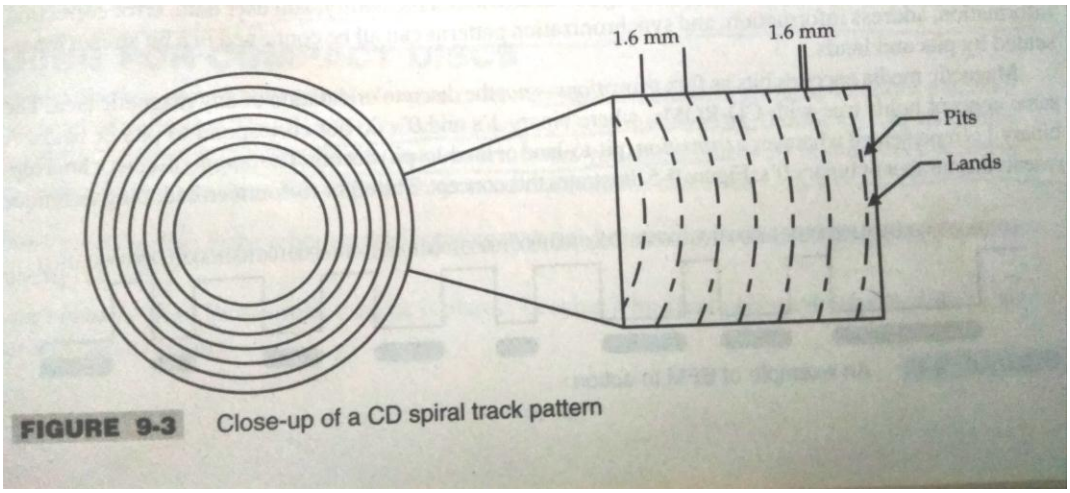


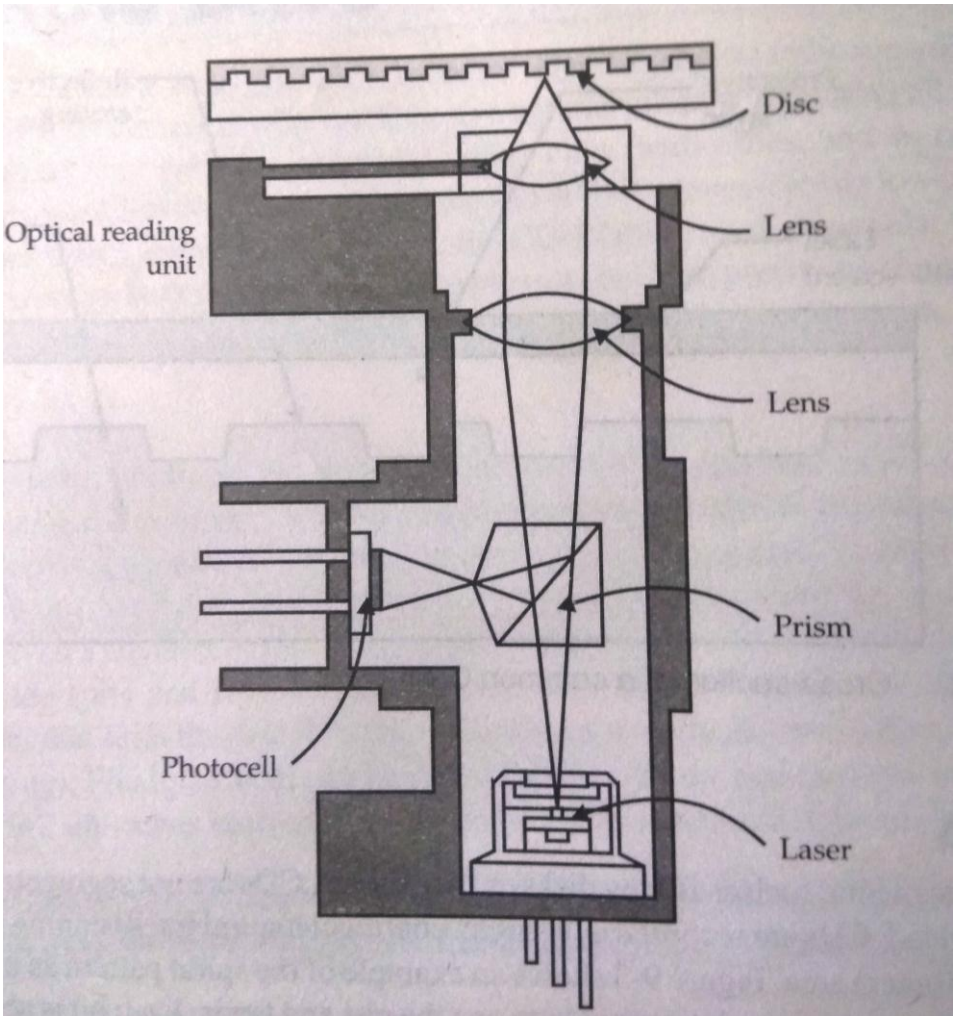
FIGURE 9-3 Close-up of a CD spiral track pattern

- During Playback:-
  - CD use a high focused laser beam & laser detector to sense the presence and absence of pits
  - The laser directed under side the CD where it penetrates more than 1mm of clear plastics before the reflective surface
  - When the laser strikes the land the light is reflected towards the detector and very strong output signal
  - When the laser strikes pits the light is slightly out of focus so most of incoming laser energy is scattering away in all direction
  - So little output signal is generated by the detector

DATA STORAGE:

- CD-ROM frame is composed of 24 synchronization bits(detecting of beginning block),14 control bits,14 bit Data Symbols,8 complete 14 bit error correction.
- CD ROM disc is recorded as one continuous spiral track running around the disc.
- So no sector ID and track ID
- The information divided in terms of 0-59 minutes and 0 to 59 seconds recorded at the begining of each blocks.
- Audio CD hold up t 79 minutes of data.
- CD ROM tends to limit this 60 minutes because last 14 minutes of data are encoded in outer circle 5mm at the disc space.
- 2,70,000 blocks of data in 60 minutes.

- 2048(1024*2) bytes 2KB per block[2,70,000*2048 byte(527MB)]



CD ROM CONSTRUCTION:

- The drive must be able to accept standard size disk from variety sources(CD-R,CD-RW,VCD)
- The drive must then spin the constant linear velocity(CLV)
- Near tracks(smaller)->run faster
- Outer tracks(larger)->run slower
- Disk spear varies inversely with tracking radius
- CLV is to ensure that CD data is read at a constant rate

EFM BASICS: (Eight To Fourteen Modulation)

- A complex decoding process is necessary to convert this, the sequence of pits and lands into meaning full binary information.
- EFM have this ability of user data, Error correction information, address information and synchronization patterns can all be contained in a bit stream represented by pits and lands.
- In CD-ROM, the binary 1's and 0's do not correspond to pits or lands.
  1 -> transition (pit to land or land to pit)
  0->the length of the pit or land
- The eight to fourteen encoding technique equates each byte(8 bit) with fourteen bit sequence(symbol) i.e where each binary 1 must be separated by atleast two binary 0's

CD-ROM MECHANISM:

COMPONENTS:

- The front bazel
- Eject button,lid attached to the frame for CD insertion and ejection
- The drive electronics package has split into
  - Main pc board(PCB)->driver ctrl
  - Head phone PCB
- The BC-7C assembly is the foundation of engine
- It acts as a sub frame,the spindle motor and connected to spindle PCB
- The most critical part of CD engine is the optimal device contains 780nm(nano meter) and 0.6 MW(mega watt)(GaAIAS) laser diode and detector (GaAIAS) -> gallium Aluminum arsenide along with optimal focus and tracking components
- The optical device slides along two guide rails and shines through an exposed hole in sub frame
- The combination of device mounting and guide rail is called sled
- The sled must be made to follow the spiral track along the disk.

CD-ROM ELECTRONICS:

- The electronic package can be divided into
  - Controller section->connection to drive controller board(drive interface)

  - Drive section : will manage

    1)physical operation(load, unload, spin the disk, move the sled)

    2)data decoding(EFM) and error correction
- CD uses spiral track 1.6
- Wave length of laser 70nm
- Cp pit 0.83
- Uses one side of the disc

DVD- DIGITAL VERSATILE DISC

- (same as CD)
- Data is recorded in a spiral pattern as a series of pits and lands pressed into a plastic substrate.

DIFFERENT FROM CD:

- Data is highly concentrate on the disc

DVD:

- DVD tracks only 0.74
- DVD pits are just 0.4
- DVD is much denser than on a regular CD
- Operator uses shorter wavelength red laser (635/650 nw)
- DVD have multiple layer of pits and layers in their own reflective layer
- Both sides at DVD can be used

SINGLE LAYER(4.7GD)

DOUBLE SIDED/SINGLE LAYER(8.5 GB)

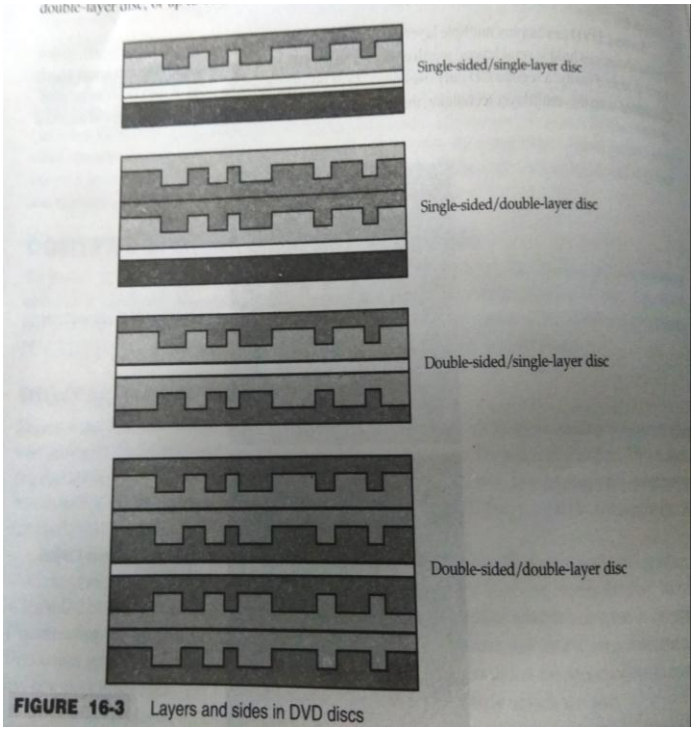


FIGURE 16-3 Layers and sides in DVD discs

IDE(INTEGRATED DRIVE ELECTRONICS STANDARDS AND FEATURES)

- IDE and ATA are basically one and same thing
- The hard disk size is measured in megabytes and gigabytes
- The hard disk capacity can be measured by multiplying the number of cylinders, sector and heads times 512
- Capacity=cy;linder *heads*sectors(bytes per sector)
- Eg:AC3400 drive with 7752 cylinder 16 heads and 63 sector =7752*16*63*512 =4,000,776,192 bytes
- The hard drive manufacturers use the notation decimal mega bytes to determine the size of hard drive
- To calculate drive size in decimal megabytes just divide the drive size by 1,000,000
- Eg:AC 2850

  1654*16*63*512

  853,622,784/1,000,000 = 853.6MB

For GIGA Byte

AC 3400: 7752*16*63*512=4,000,776,192/1,000,000,000=4.0 GB

IDE/ATA:

- IDE and ATA are basically one and same thing
- It is assigned by ANSI American National Standard Institute in 1990

  FEATURES:
- Two channels presenting the mother board
- We can use it in master and slave
- Using IDE interface using two channels we make it primary master slave and secondary master slave
- IDE uses PIO programme I/O
- It is used to transfer data between cpu and peripherals such as network adapter
- PIO MODE 0,1,2

MODE	MAXIMUM TRANSFER	TIME
0	3.3 MB/S	600 ns
1	5.2 MB/S	383 ns
2	8.3 MB/S	240 ns

- Uses DMA 0-> 2.1 to transfer 8.3MB/S
- Uses 40 pins 40 conductor cable

ATAPI:

- Advanced technology attachment packet interface
- ATAPI uses devices like CD flopy and other removable media drives
- The ATAPI protocol suggests the commands to ATAPI devices are sent in groups called packets

ATA-2,FASTATA and EIDE:

- New address method i.e logical block addressing(LBA)
- Used for specifying the location of block of data stored in secondary devices(hard disk)
- Uses faster PIO and DMA data transfer mode

- Support PIO modes 3 2 4
    - PIO 3- transfer 11.1 MB/S
    - PIO 4- transfer 16.7 MB/S
- DMA modes 1 and 2
    - 1 -> 13.3 MB/S
    - 2 -> 16.7 MB/S

ATA/ATAPI – 4:

- CRC -> cyclic redundancy checking was added to ensure the integrity of data send using faster DMA modes
- ATPI4 : uses
    - Ultra DMA to the PC
    - Ultra DMA 0,1,2
    - Ultra DMA supports burst mode (maximum transfer rate)

ATA/ATAPI-5:

- Supports ultra DMA modes 3 and 4
  3 -> 44.4 MB/S transfer rate
  4 -> 66.7 MB/S
  Ultra DMA4 is known as UDMA/66

ATA/ATAPI-6:

- Supports ultra DMA mode5
- Burst rate 100 MB/S
- DMA 5 also known as UDMA/100,ultra ATA/100
- LBA address size is extended from 28 bit to 48 bit length
- Drives upto 137GB may use 28 bit to 48 bit addressing
- Drives greater than 137GB uses 48 bit addressing

ATA/ATAPI-1:

- Ultra DMA mode 6
- Burst rate 133MB/S
- Ultra DMA 6 is also known as ultra ATA/133 UDMA/133

ATA-3:

- It is minor standard update
- To improve the reliability of the data transfer but 40-pin,40 conductor cable remain limited to a maximum of 18 inches
- SMART -> Self Monitoring Analysis and Reporting Technology
- For improving data reliability