:: ASSIGNMENT # 6 ::

ID: 11533

Name: Ashir Ali Khan

Subject: Computer Architecture

Teacher: Sir Muhammad Amin

Iqra National University

Q1 Give detail answer to each of the following:

a) What — · —

Answer:

The advantages of using glass substrate in the magnetic disk are.

- Disk Relaiability of magnetic disk increased due to the improvement in uniformity of magnetic film surface.
- Glass substrate help reduce surface defects and read-write errors
- Glass substrates support lower fly heights.
- Glass substrates in magnetic disks have better stiffness which helps in reducing disk dynamics
- Glass substrates help to withstand damages and shocks of magnetic desk.

(b) Define the terms track, cylinder and sector.

Track:

On a magnetic disk, data is organized on the platter in concentric sets of rings called tracks.

Cylinder:

On a disk with multiple platters, the sets of all tracks in the same relative position on the platters is reffered to as a cylinder

Sector:

Data are transferred to and from the disk in sectors.

C Define seek time. - - - -

Seek time:

Time taken to position the head at the track.

Rdational delay:

Once the track is selected, the disk controller waits until the appropriate sector rotates to line up with the head. The time it takes for the beginning of the sector to reach the head is known as the rotational delay.

Access time:

The sum of the seek time, if any, plus the rotational delay. The time it takes to get into a position to read or write

Transfer time:

Time taken for data transfer. Once the head is in position, the read or write operation is performed as the sector moves under the head data transfer portion of the operation.

(d) Briefly define . . .

RAID 0.

Raid level 0 is not a true member of the RAID family because it does not include redundancy to improve performance.

RAID 1:

In RAID 1, redundancy is achieved by the simple expedient of duplication all the data.

RAID 2:

Redundant via Hamming codes; an error-correcting code is calculated across corresponding bits on each disk and the bits of the code are stored in the corresponding bit positions on multiple parity disks.

RAID 3:

RAID 3 requires only a single redundant disk no matter how large the disk array. RAID 3 employs parallel access with data distributed in small strips ~~instead~~ instead of an error correcting code.

RAID 4:

RAID 4 make use of an independent access technique In an independent access array, each member disk operates independently, so that separate I/O requests can be satisfied in parallel.

RAID 5:

RAID 5 distributes the parity strips across all disks. A typical allocation is a round robin scheme. For an n-disk array, the parity strip is on a different disk for the first n stripes and the pattern ~~repeats~~ repeats

RAID 6:

RAID 6 was introduced in a subsequent paper by the Berkeley researchers [KATZ89]. In the RAID 6 scheme, two different parity calculations are carried out and stored in seperate blocks on different disks.

e) How is . . . — .

Answer: RAID 1 differs from RAID levels 2 through 6 in the way in which redundancy is achieved. In these other RAID schemes, some form of parity calculation is used to introduce redundancy, where as in RAID 1, redundancy is achieved by the simple expedient of duplicating all the data.

f) Discuss different optical . . —.

Answer:

CD:

Compact Disk. A nonerasable disk that stores digitalized audio information. The standard system uses 12-cm disks and can record more than 60 minutes of uninterrupted playing time.

CD-ROM:

CD Read Only Memory. An non-erasable disk used for storing computer data. The standard system uses 12-cm disks and can hold 650 Mbytes

CD-R

CD Recordable similar to a CD-ROM. The user can write to the disk only once

CD-RW

CD Rewritable similar to a CD-ROM. The user can erase and write to the disk multiple times.

DVD:

Digital Versatile Disk. A technology for producing digitized, compressed representation of video information as well as large volumes of other digital data both 8 and 12 cm diameters are used, with a double-sided capacity of up to 17 Gbytes. The basic DVD is read-only (DVD-ROM)

DVD-R:

DVD Recordable similar to DVD-ROM. The user can write to the disk only once. Only one sided disks can be used.

DVD-RW.

DVD-Rewritable similar to DVD ROM. The user can erase and rewrite to the disk multiple times. Only one sided disks can be used.

Blu-ray DVD

High definition video disk. Provides considerably greater data storage density than DVD using a 405 nm (blue-violet) laser. A single layer on a single side can store 25 GB.

(g) Discuss the CD. . . . . .

Write Operation:

Pulses are sent to the write head, then an electric current magnetizes a small area of the recording medium to store the pulses"

- Mechanical pressing by a Master Disk
- A laser is used to burn pits into the track (write once)

Read Operation:

The read head consists of a partially shielded magneto resistive (MR) sensor that senses the magnetization of the medium.

During reads, a low power laser illuminates the track and its pits.

In the track, pits reflect light differently than no pits thus allowing you to store 1s and 0s.

(h) Whats difference. . . . .

Answer:

- Bits are packed more closely on a DVD, which results in a 7x increase in capacity.
- DVD has a second layer of pits and lands on top of the first layer. Almost doubles capacity of DVD
- DVD-ROM can be doublesided whereas CDROM can be only one sided.

Q2 Write note on each of the following:

a) Physical Characteristics of magnetic disk system.

Answer.

Head Motion
- Fixed head (one per track)
- Movable head (one per surface)

Platters
- Single platter
- Do. Multiple platters.

Disk Portability
- No removable disk
- Removable disk

Head Mechanism
- Contact (floppy)
- Fixed gap

Sides
- Single sided
- Double sided
- Aerodynamic gap (Winchester)

b) Solid State Drives (SSD)

One of the most significant developments in a computer architecture in recent years is the increasing use of solid state drives (SSD) to complement or even replace hard disk drives (HDDs), both as internal and external secondary memory. The term solid state refers to electronic circuitry built with semiconductors. An SSD is a memory

device made with solid state components that can be used as a replacement to a hard disk drive. The SSDs now on the market and coming on lines use NAND flash memory.

(c) Parallel access and independent access RAID scheme:

Parallel access:

All member disks participate in the execution of every I/O request. Typically, the spindles of the individual drives are synchronized so that each disk head is in the same position on each disk at any given time.

Independent access

Each member disk operates independently so that separate I/O requests can be satisfied in parallel.

(d) Reasons for DVD's greater capacity over CD:

Reasons:

1. Bits are packed more closely on a DVD. The DVD uses a laser with shorter wavelength and achieves a loop spacing of 0.74 μm and a minimum distance b/w pits of 0.4 μm. These improvement gives about sevenfolds increases in capacity to about 4.7 GB.
2. The DVD employs a second layer of pits and lands on top of the first layer. This technique almosts doubles the capacity of the disk to about 8.5 GB.

3 The DVD-ROM can be two sided, whereas data are recorded on only one side of a CD. This brings total capacity up to 17 GB.

e) Solid State Drive Architecture:

On the host system, the operating system invokes file system software to access data on the disk. In addition to the interface to the host system, the SSD contains the following components.

Controller Provides SSD device level interfacing and firmware execution

Addressing:
Logic that performs the selection function across the flash memory components.

Data buffer/cache:
High speed RAM memory components used for speed matching and to increased data throughput.

Error Correction:
Logic for error detection and correction.

Flash memory components:
Individual NAND flash chips

f) Practical Issues peculiar to SSDs:

There are two practical issues peculiar to SSDs

- SSD performance has a tendency to slowdown as the device is used.

The entire block must be read from the flash memory and placed in a RAM buffer.

Before the block can be written back to flash memory the entire block of flash memory must be erased.
The entire block from the buffer is now written back to the flash memory.

- Flash memory becomes unusable after a certain numbers of writes
  - Techniques for prolonging life.
  - Badblock management techniques.
- Most flash devices estimates their own remaining lifetimes so systems can anticipates failure and takes preemptive action.

Q3 Differentiate each of the following:

(a) Magnetic disk Read and Write Mechanism.

Write:

Currents through coil produces magnetic field.
Pulses sent to head
Magnetic pattern recorded on surface below

Read:

(traditional)

Magnetic field moving relatively to coil produces current.
Coil is the same for read & write
(contemporary).
Seprate read head close to write head
Partially shielded magneto resistive (MR) sensor.
Electrical resistance depends on direction of

magnetic field.
High frequency operation.
High storage density and speed.

(b) CAV system and Multiple zoned recording system

- (CAV) Constant angular velocity system: the number of bits per track is constant.
- An increase in density is achieved with multi zoned recording, in which the surface is divided into a number of zones, with zones further from the center containing more bits than zones closer to the center.

(c) Solid-state drives and hard disk drives:

SSD:

1. They have a copy/write speed of 200-500 Mbps
2. They draw less power averages about 2-3 watts resulting in an increase of 30+ minutes of battery life
3. They cost approx $0.50 per GB for a 1 TB drive
4. Typically they are not larger than 512 GB for notebook size and are maximum of 1 TB for desktops.

HDD:

1. They have a copy/write speed of 50-120 Mbps
2. They draw more power about 6-7 watts. ~~resulting in decrease~~.
3. They are around 500 GB and 2 TB for notebook size and are maximum of 4 TB for desktops.

They cost Approx $0.15 per GiB for 4 TB drive.

(d) CD and DVD

Difference:

Storage:
A CD can store upto 700 MB of data whereas a DVD can store upto 17 GiB of data in it

Popularity:
DVD is more popular as compared to CD as it can store more data

Metal layers:
Metal layers is the centre layer in a dvd as in CD it is beneath the labeling layer.

Pit and land layer:
A CD can either have a pit or land layer whereas a DVD has both.

(e) HD DVD and Blu-ray DVD

1. HD DVD are much cheaper then Blueray DVD
2. Blu-ray discs have more storage capacity and more advanced protection against piracy then HD DVD.
3. Blu-Ray has 25 GiB capacity whereas

HD-DVD has 15 GB (30 GB for dual layer) and is cheaper than Blu-Ray.

4 Blu-Ray has a sharper resolution as compared to HD-DVD

Q⁴ Consider.- ---

Solution:

T = Transfer time = ?

b = No of bytes to be transfered = (512×500).

N = (512×500) no of byt

Avg seek time = (T_s) = 6ms

Avg rotational delay = $\frac{1}{2r} = \frac{1}{2(7500/60)}$ = 4ms

Time to read 1st Track = $\frac{b}{rN} = \frac{(512\times500)}{(7500/60)\times(512\times500)}$ = 8ms

To find Total time to read 1st track

$= T_a = T_s + \frac{1}{2r} + \frac{b}{rN} = 6+4+8 = 18$

4 Tracks are left to read (2000 sectors). These tracks are transfered without any seek time

So

$= 4\left(\frac{1}{2r} + \frac{b}{rN}\right) = 4(4+8) = 48$

Total Transfer time for whole file

$T = T_a + 48 = 18 + 48 = 66$.

b) Random Access:

$T_s = 6$ ms

$\frac{1}{2r} = 4$ ms

Time to read 500 sector = 8 ms

So to read 1 sector = $8/500 = 0.016$ ms

Time to access and read 1 sector =

$T_s + \frac{1}{2r} + 0.016$ ms

$= 6 + 4 + 0.016$

$= 10.016$

Total time to read 2500 = 2500×10.016

$= 25,040$ seconds.