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Subject : Computer Architecture

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Q1:

Ans:(a) The glass substrate has a number of benefits, including the following:

(*) Improvement in the uniformity of the magnetic film surface to increase disk reliability.
(*) A significant reduction in overall surface defects to help reduce read-write errors.
(*) Ability to support lower fly heights.
(*) Better stiffness to reduce disk dynamics.
(*) Greater ability to withstand shock and damage.

Ans:(b) Track:

The head is relatively small device capable of reading from or writing to a portion of the platter rotating beneath it. This gives rise to the organization of data on the platter in a concentric set of rings, called tracks. Each track is the same width as the

head. There are thousands of tracks per surface.

Cylinder:-
The set of all the tracks in the same relative position on the platter is referred to as a cylinder.

OR

A cylinder is comprised of the set of tracks described by all the heads at a single seek position.

Sectors:-
Data are transferred to and from the disk in sectors. There are typically hundreds of sectors per track and these may be of either fixed or variable length.

Ans: (c) Seek time:-
On a movable-head system, the time it takes to position the head at the track is known as seek time.

Rotational 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 rotational delay.

Access Time:-

The sum of the seek time, if any, and the rotational delay equals the access time, which is the time it takes to get into position to read or write.

Transfer Time:-

Once the head is in position, the read or write operation is then performed as the sector moves under the head; this is the data transfer portion of the operation; the time Required for the transfer is the transfer time.

Ans:- (d)

Seven RAID Levels:-

RAID Level 0:-

For RAID 0, the user and system data are distributed across all of the disks in the array. This has a notable advantage over the use of a single large disk.

RAID Level 1:-

In RAID level 1, each logical strip is mapped to two separate physical disks so that every disk in the array has a mirror disk that contains the same data. RAID 1 can also be implemented without data striping, though this is less common.

RAID Level 2:-

RAID level 2 requires fewer disks than RAID 1, it is still rather costly. The number of redundant disks is proportional to the log of the number of data disks. RAID 2 would only be an effective choice in an environment in which many disk errors occur.

RAID Level 3:-

RAID 3 requires only a single redundant disk, no matter how large the disk array. RAID 3 employ parallel access, with data distributed in small strips.

RAID Level 4:-

With RAID 4, a bit-by bit parity strip is calculated across corresponding strips on each data disks, and the parity bits are

stored in the corresponding strip on the parity disk.

RAID Level 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 then repeats.

RAID Level 6:-

In RAID 6 scheme two different parity calculations are carried out and stored in separate blocks on different disks.

Ans:(e) RAID 1 is differ from RAID level 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, whereas in RAID 1, redundancy is achieved by the simple expedient of duplicating all the data.

Ans:(f) Optical Disk Products:

CD:-

Compact Disk: A nonerasable disk that stores digitized audio information.

The standard system uses 12-cm disks and can record more than 60 minutes of uninterrupted playing time.

CD-ROM:
Compact disk Read-Only Memory: A nonerable disk used for storing computer data. The standard system uses 12-cm disks and can hold more than 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 rewrite 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.

DVD-R:
DVD Recordable. Similar to a

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

DVD-RW:-

DVD. Rewritable. Similar to a DVD-ROM. The user can erase and rewrite to disk multiple times.

Blu-ray DVD:

Provides considerably greater data storage density than DVD, using a 405-nm laser. A single layer on a single side can stores 25 Gbytes.

Ans: (9) Read Operation:-

Information is retrieved from a CD or CD-ROM by a low-powered laser housed in an optical disk player, or drive unit. The laser shines through the clear polycarbonate while a motor spins the disk past it. The beginning or end of a pit represents a 1; when no change in elevation occurs between intervals, a 0 is recorded.

Write Operation:-

Recall that on a magnetic disk, information is recorded in concentric tracks. With the simplest

constant angular velocity (CAV) system the number of bits per track is constant.

Ans: (h) The DVD's greater capacity is due to three differences from CDs are;

(1) Bits are packed more closely on a DVD. The spacing between loops of a spiral on a CDs is 1.6 μm and the minimum distance between pits along the spiral is 0.834 μm.

(2) The DVD employs a second layer of pits and lands on top of the first layer. A dual-layer DVD has a semireflective layer on top of the reflective layer, and by adjusting focus, the lasers in DVD drives can read each layer separately. This technique almost doubles the capacity of the disk, to about 8.5 GB. The lower reflectivity of the second layer limits its storage capacity so that a full doubling is not achieved.

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

Q2:-

Ans:(a) Physical Characteristics of Magnetic Disk System:-

Fixed-head Disk:-

In a fixed-head disk, there is one read-write head per track.

Movable-Head Disk:-

In a movable-head disk, there is only one read-write head. The head is mounted on an arm.

Non-removable Disk:-

A non-removable disk is permanently mounted in the disk drive; the hard disk in a personal computer is a non-removable disk.

Removable Disk:-

A removable disk can be removed and replaced with another disk. Floppy disks and ZIP cartridge disks are removable disks.

Double sided Disk:-

The magnetizable coating is applied to both sides of the platter is called double sided

disk. Some less expensive disk systems use single-sided disks.

Ans: (b) Solid States Drives (SSD):-

One of the most significant developments in computer architecture in recent years is the increasing use of solid state drives (SSDs) 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 memory device made with solid state components that can be used as a replacement to a hard disk drive.

Ans: (c) Parallel Access:-

All member disks are participate in the execution of every I/O request. Typically, the spindles of the individual drives are synchronized so that each disk head 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)
Ans: The DVD's greater capacity is due to three differences from CDs.

(1) Bits are packed more closely on a DVD. The spacing between loops of a spiral on a CD is 1.6 μm and the minimum distance between pits along the spiral is 0.834 μm.

(2) The DVD employs a second layer of pits and lands on top of the first layer. A dual-layer DVD has a semireflective layer on top of the reflective layer and by adjusting focus, the lasers in DVD drives can read each layer separately.

(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)
Ans: Solid State Drive Architecture.

On the host system, the operating system invokes file system software to access data on the disk. The file system, in turn, invokes I/O driver software. The I/O driver software provides host access

to the particular SSD product. In addition to interface to the host system, the SSD contains the following components:

- Controller: Provide 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.

Ans: (f) Practical Issues peculiar to SSDs:-

There are two practical issues peculiar to SSDs that are not faced by HDDs:

(1) SSD performance has a tendency to slow down as the device is used. To understand the reason for this, you need to know that files are stored on disks as a set of pages, typically 4KB in length. These pages are not necessarily, and indeed not typically, stored as a continuous set of pages on the disk.

(2) Flash memory becomes unusable after a certain number of writes. As flash cells are stressed, they lose their ability to record and retain values. A typical limit is 100,000 writes. Techniques for prolonging the life of an SSD drive include front-ending the flash with a cache to delay and group write operations, using wear-leveling algorithms that evenly distribute writes across block of cells, and sophisticated bad-block management techniques.

Q3:-

Ans:(a) Magnetic Disk:-

Read Mechanism:-

The traditional read mechanism exploits the fact that a magnetic field moving relative to a coil produces an

electrical current in the coil. When the surface of the disk rotates under the head, it generate a current of the same polarity as the one already recorded.

Write Mechanism:-

The write mechanism exploits the fact that electricity flowing through a coil produces a magnetic field. Electric pulses are sent to the write head, and the resulting magnetic patterns are recorded on the surface below, with different patterns for positive and negative currents.

Ans: (b) CAV:-

A bit near the center of a rotating disk travels past a fixed point slower than a bit on the outside. Therefore some way must be found to compensate for the variation in speed so that the head can read all the bits at the same rate. The information can be scanned at the same rate by rotating the disk at a fixed speed, known as the constant angular velocity (CAV).

Multiple Zone Recording:-

Multiple zone recording is the process in which the surface is divided into a number of concentric zones. Each zone contains a number of contiguous tracks, typically in the thousands. Within a zone, the number of bits per track is constant. Zones further from the center contain more bits than zones closer to the center.

(c)
Ans(c) Solid State Drive (SSD):-

(1) They have copy/write speed of 200-550 Mbps.
(2) They draw less power averages about 2-3 watts resulting in an increase of 30+ minutes of battery life.
(3) They are not typically larger than 512 GB for notebook size drives; and maximum of 1TB for desktops.
(4) They cost Approx. $0.50 per GB for a 1-TB drive.

Hard-disk Drive:-

(1) They have a copy/write speed of 50-120 Mbps.
(2) They draw more power averages about 6-7 watts and therefore

uses more battery.

(3) They are typically around 500GB and 2TB for notebook size and maximum of 4TB for desktops.

(4) They cost Approx. $0.15 per GB for a 4TB drive.

(d)
Ans: CD :-

Compact Disk. A nonerasable disk that stores digitized audio information. The standard system uses 12-cm disks and can record more than 60 minutes of uninterrupted playing time. They have maximum size of 680MB.

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 upto 17 Gbytes. The basic DVD is read-only (DVD-ROM).

(e)
Ans: HD DVD :-

The HD DVD scheme can store 15 GB on a single layer on a single side.

- HD DVD players have been much cheaper than Blu-ray machines.
- It deliver sharp resolution.
- It is cheaper than Blu-ray.

Blu-ray DVD:

- Blu-ray discs have more storage space and more advanced protections against piracy.
- It also deliver sharp resolution.
- Blu-ray has 25GB capacity and is more expensive than HD DVD.