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Q1 Give detail answer to each of the following.

Part a

(a) what are the advantges of using a glass Substrate for a magnetic disk?

The glass substrate has a number of benefits, include the following.

* improvement in the uniformity of the magnetic 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 stifness to reduce disk dynamics
* Greater ability to withstand shock & damage.

(b) Define the terms track cylinder & sector.

Track: A track is that portion of a disk which passes under a single di stationery head during a disk rotation a ring 1 bit wide.

Cylinder:- A cylinder is comprised of the set of tracks described by all heads at a single seek position. Each cylinder is equidistant from the center of the disk

Sector:- Data are transferred to and from the disk in sectors. or A track is divided

into segements of sectors, which is the basic unit of storage.

(C) Define seek time, rotational delay, access time & transfer for magnetic disk.

Seek time:-

Seek time is time required to move the disk arm to the required track. Its turn out that this is difficult quantity to pin down The seek time consist of two key components

Components:- the initial startup time, & the time taken to traverse the tracks that have to be crossed once the access arm is up to speed.

Rotational delay:- rotational delay disks, other than floppy disks, rotate at speed ranging from 3600 rpm (for handheld devices such as digital camera) upto as of this writing 20,000 rpm; at this letter speed, there is one revolution per 3 ms. Thus on the average the rotational delay will be 1.5 ms.

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

Transfer time:- The transfer time to or from the disk depends on the rotation

having

Speed of the disk.
T = b/rn

(d) Briefly define the seven Raid levels.

Raid level 0:- Raid level 0 is not a true number of the raid family because it doesn't include redundancy to improve performances. However there are a few applications, such as some on supercomputers in which performances & capacity are primary concerns & low cost is more important than improved reliability FOR RAID 0, the user & system data are distributed across all of the disk in the array. This has notable advantage over the use of the large disk. If two different I/O requests are pending for two different block of data then there is a good chances that the requested blocks blocks are on different disk. Thus the two request can be issued in parallel reducing the I/O queuing time.

RAID Level 1:-

RAID 1 differ from RAID level 2 through 6 in the way in which redundancy is acheived In RAID 1 redundancy is acheived by simple expedient of duplicating all the data. In case

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

RAID level 2:-

RAID level 2 & 3 make use of a parallel access technique. In a parallel access array all members participants in the execution of every I/O requests, typically the spindles of the individuals drives are synchronized so that each disk head is in the same position on each disk at any given time.

RAID level 3:- (5)

Raid 3 is organized in a similar fashion to RAID 2. the difference is that 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 of encorrecting code, a simple parity bit is computed for the set of individuals bits in the same positions on all of the data disks.

RAID level 4:-

RAID level 4 through 6 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. Because of this independent access array are more suitable for application that require high I/O requests rates & are relatively less suited for application that require high data transfer rates

RAID level 5:-

RAID 5 is in a similar fashion to RAID 4. The difference is that

RAID 5 distributes the parity Strips across all disks. A typical allocation is a round - robin Scheme, as illustrated. For an n-disk array, the parity strips is on a different disk for the first n Stripes & the pattern then repeats. The distribution of parity Strips across all drives avoids the potentials I/O bottle-neck found in RAID 4.

RAID level 6:-

RAID 6 was introduced in a subsevuent paper by the berkeley researchers [KAT289]. In the RAID 6 Scheme two different parity calculation are carried out & stored in Separate blocks on different disk. Thus a RAID 6 array whose user data revuire N disks consist of N+2 disks.

(e) How is redundancy acheived in RAID System?

RAID 1 differ from RAID level 2 through 6 in the way in which redundancy is acheived. In these other RAID Scheme, Some form of parity calculation is used to introduce redundancy whereas in RAID 1 redundancy

is acheived by the simple expedient of duplicating all the data.

(f) Discuss different optical disk products in detail.

CD:-

Compact disk: A nonvasable disk that store digitized audio information. The standard system uses 12-cm disks & can record more than 60 minutes of uninterrupted playing time.

CD-ROM:-

Compact disk read only memory. A non vasable disk used for storing computer data. The standard system uses 12- cm disks. & can hold more than 650 Mbytes.

CD-R:-

CD Recodable. Similar to CD-ROM. the user can write to the disk only once.

CD-RW:-

CD Rewritable. Similar to a CD-ROM The user can erase & rewrite to the disk multiple times.

DVD:-

Digital versatile disk. A technology for producing digitized, compressed

representation of data, as well as large volumes of the other digital data. Both 8 & 12 cm diameters are used with doubled sided capacity of upto 17 bytes.

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 Re-writable Similar to a dvd-rom The user can earse & rewrite to the disks multiple only one sided can beused

Blu-ray dvd :-
High definition video disk provide considered greater data storage density than Dvd using a 405-nm (blue-violet).

(9) Discuss the CD read & write operation.

Read :-
information is retrived from a CD or CD Rom by a low powered laser house in an optical-disk player or drive unit. The laser shine through the clear polycarbonate while a motor spins the disk past it. The intensity of the reflected light of the laser changes as it en-

Q2:

(a) counters. a pit. Specifically if the laser beam fall on a pit which has somewhat rough surface. the light scatters & low intensity is reflected back to the source. The area between pit are called lands. A land is a smooth surface, which reflects back at higher intensity. The change between pit & land is detected by a photo sensor & converted into a digital signal. The sensor tests the surface at regular intervals. The begining or end of a bit represents as 1: when no change in elevation occurs between intervals, as 0 is recorded.

write:-

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. An increase in density is acheived with multiple zo recording, in which the surface is divided into the number Although this technique increase capacity its still not optimal.

one side & a few turns U

(h) What differences between a CD & a DVD account for the larger capcity of the letter?

The DVD'S greater capcity 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 & the minimum distance between pits along the spiral is 0.834μm. The DVD uses a laser with shorter wavelength & acheives a loop spacing of 0.74μm & a minimum distance between pits of 0.4μm. The result of these two improvements is about seven fold increase in capcity to about 4.7 GB.

2) The dvd employs a second layer of pits & lands on top of the first layer. A dual layer DVD has a semi reflective & by adjusting focus, the laser DVD drives can read each layer separately. The lower reflectively of the second layer limits its storage capcity so that a full doubling is not acheived.

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

Q2: Write note on each of the following (11)

(a) Physical characteristics of magnetic disk system.

* Fixed head disk:
* One read-write head per track
* Heads are mounted on a fixed ridged arm that extend across all tracks.

Movabl-head disk:-

* One read-write head
* Head is mounted on an arm
* The arm can be extended or retracted

Non removable disk:-

* permanently mounted in the disk drive
* The hard disk in a personal computer is a non-removable disk

Removable disk:-

Can be removed & replaced with another disk.

* Advantages:-
* unlimited amounts of data are available with a limited number of disk systems
* A disk may be moved from one computer system to another.
* Floppy disks & zip cartridge disks

are examples of removable disks

Double sided disk:-
Magnitizeable coating is applied to both sides of the platter.

(b) Solid state drives(SSD):-
One of the most significant developments in computer architecture in recent years in the increasing use of solid state (SSDs) to complement or even replace hard disk drives (HDDS) both as internal & external secondary memory. The term solid state refers to electronic circuitry built with semiconductors. An SSD is is a memory device made with a solid state components that can be used as a replacement to a hard disk drive. The SSD now on the market & coming on line use Nand flash memory.

(c) parallel access & independent access RAID Schemes:-
parallel access:- All members dist participate in the execution of every I/O request. Typically the spindles of the individuals drives are syncronized so that each disk head is in the position on each disk at any given

time. (13)

independent access

Each members disk operates independtly, so that separate I/O requests can be satisfied in parallel.

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

The DVD's greater capcity 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 & the minimum distance between pits along the spiral is 0.834 μm. The Dvd uses a laser with shorter wavelength & acheive a loop spacing of 0.74 μm & a minimum distance pits of 0.4 μm. The result of these two improvements is about seven fold increase in capcity, to about 4.7 GB.

2) The Dvd employs a second layer of pits & lands on top of the first layer & by adjusting focus, the laser in dvd drives can read layers separately. This techniques almost doubles the capcity of disk to about 8.5 GB. The lower effectively of the second layer limits its storage capcity so that a full doubling is not acheived

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

(e) Solid State Drive Architecture:-
On the host system, the operating system invoked 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.
The interface component refers to the physical & electrical interface between the host processor & the SSD peripheral device. if the device is an internal hard drive a common interface is pcie, for external devices, one common interface is USB.
In addition to the interface to the host system, the SSD contains the following components:
Controller: provides SSD device level interfacing & firmware execution.
Addressing logic that perform the selection function accross the flash memory components.

* Data/buffer/cache:- (15)

High speed RAM memory components used for speed matching & to increased data throughput.

* Error correction: logic for error detection & correction

* ~~Flash memory components~~ to SSDs:-

(+) pastical issues peculiar

These are two practical issues peculiar to SSD's that are not faced by HDD's.

* SDD performance has a tendency to slow down as the device is used:-
* The entire block must be read from flash memory & 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 flash memory.
* Flash memory becomes unusable after a certain number of writes:-
* Techniques for prolonging life:
* Front ending the flash with a cache to delay & group write

operations.

* Using wear leveling algorithms that evenly distribute writes accross block of cells.
* Bad-block mangements techniques
* Most flash device estimate their own remaining lifetime so system can anticipate.

Q3: Differentiate each of the following.

(a) Magnetic & write mechanism.

Read:-

The traditional read mechanism exploits facts that a magnetic field moving relative to a coil produces an electrical current in the coil. When the surface of the disk passes under the head, it generates a current of the same polarity as the one already recorded. The structure of the head for reading in this case essentially the same as for writing therefore the same head can be used for both such single head are used in floppy disks systems & in older rigid systems. contemporary rigid disk system read mechanism. revolving separate read head positioned for convince close to the write head. The read head consists

Of a partially Sheilded magnetoresistive Sensor (MR). The MR material has an electrical resistance that depend on direction the magnetization of the medium moving under it. By passing a current through the MR Sensor, resistance changes are ~~direction~~ detected as voltage signals. The MR design allows higher frequency operation which evidates to greater storage densities & operating speeds.

Write:-

The write mechanism exploits the facts that electricity flowing through a coil produce a magnetic field. Electric pulses are sent to the write head & the resulting magnetic patterns are recoded on the surface below, with different pattern for positive & negative currents. The write head itself is madeup of easily magnetizable material & is in the shape of rectangular in doughnut with a gap along one side & a few turns of

conducting wires (R) along the opposite side. An electric current in the wire induce a magnetic field across the gap which in turn magnetize a small area of recording medium.

(b) CAV system & multipled zoned recording systems:-

CAV:-

A bit near the centre 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 variation in speed so that the head can read all the bits at the same rate. This can be done by increasing the spacing between bits of information recorded in the segements of disks.

Multiple zone recording:-

Its a technique in which the surface is divided into a number of concentric zones (16 is typical) within a zone the number of bits per track is constant. Zones farther from the centre contain more bits than zones closer to the centre. This allows generate greater

overall storage capcity at the expense of somewhat more complex circuitry. As the disk head moves from one ~~track~~ zone to another the length (along the track) of individuals bit changes.

(C) Solid-State drives & hard-disk drives:-

* SSD:-

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

* HHD:-

1) They have a copy/write speed of 50-120 Mbps.
2) They draw more power average about 6-7 watts & therefore uses more battery.
3) Typically they are around 500GB & 2TB for notebook size drives & are maximum of 4TB for desktops.

ex. be

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

(d) CD & DVD:

* CD:-

Compact disk. A nonvasable disk that stores digitized audio information The standard system uses 12-cm disks & can record more than 60 mintues of uninterupted playing time they have max size of 680 mb.

* DVD:-

Digital versatile disk. A tecmology for producing digitized, compressed repsentation of video information as well as large volumes of other digital data. Both 8 & 12 cm diameters are used with a double sided capaity upto 17Gbytes. The basic dvd ready-only (DVD-ROM).

(e) HD DVD & Blu ray DVD:-

HD DVD players have been much cheaper than Blu-ray machines. but blu-ray disc have more storage space & more advanced protections against pirvacy. Both versions deliver

(27)

Sharp resolution. Blu ray has 25GB capacity & is more expensive. HD-DVD has 15GB (30GB for dual layer) & is cheaper than Blu-ray.