Advanced Database Organization : CS525.

Vignesh Kumar K R (A20424508)

1: SSD VS HDD

SSD and HDD is the two main storage solution to the customers and they each have their own benefits. They can be factorised below.

(i) Storage capacity:

→ Hard drives with several Terabytes worth of storage are easy to find.

→ The cost doesn't increase much when the capacity increases.

→ SSD's are smaller but they are way too expensive when the storage capacity goes beyond 2TB.

(ii). Speed:

→ If you want to store small files sequencing them would help to read or write them faster in HDD.

→ But when the file gets larger they get fragmented and it would take more time to access these files.

→ In SSD, the fragmentation is not an issue, the files can be spreaded as much as they can, but since all the cells are accessed simultaneously, the read and write is very fast in SSD.

(iii). Longevity

→ The memory stored or the data stored in the HDD will last longer or forever.

→ They do not wear off.

→ since the SSD has the fast file access method they push the electrons to certain state which causes them to wearing out of data over time.

(iv) Physical vulnerability:

→ the HDD has the moving parts, so they tend to get dislocated or broken if they are susceptible to physical damage.

→ The SSD is one solid disk that doesn't contain any moving parts, so they are less prone to damage.

(v). Size:

→ HDD are tend to be either 3.5 inch or 2.5 inch in size

→ SSD have different or variety of shapes and size.

→ most common is 2.5 inch but smaller SSD are built.

② . Megatron 777 disk:

10 surfaces, 10,000 tracks each

1000 sectors per track, 512 bytes

20% gap, rotation 10,000 rpm.

a. Capacity of disk:

total capacity: $10 * 10,000 * 1000 * 512$

$= 512 * 10^8$

$= 51.2$ gb

b. Maximum and Minimum density of bits.

Minimum density

$1000 * 512 * 8 = 4096000$ bits

$2\pi r = 3.5 * \pi * \frac{80}{100} = 8.79$

Since 80% is only useful data

$\frac{4096000}{8.79} = 465,455$ bits/inch

Maximum density

$1000 * 512 * 8 = 4096000$ bits

$2\pi r = 1.5 * \pi * 2 * \frac{80}{100} = 3.77$

Since only 80% is useful track

$\frac{4096000}{3.77} = 1,086,472$ bit/inch

c. Maximum Seek time :

Maximum seek time occurs when head has to move from 1 to 10,000th track

that is 9999 tracks

$\therefore$ Seek time = $1 + 0.001 (9999)$

$= 1 + 9.999$

$= 10.999$

$\simeq 11.0$ milliseconds

d. Maximum rotational latency

Disk rotation = 10,000 rpm

$\therefore \quad \frac{60}{10,000} = 60 \times 10^{-4} = 6 \times 10^{-3}$

$= 6$ milliseconds

e Transfer time of a block.

Time over useful data = $6 \times 0.8 = 4.8$ milliseconds

time over gap = $6 * 0.2 = 1.2$ milliseconds

Transfer time for a block = $\frac{4.8}{312.5} = 0.01536$ millisecond

Capacity = 51.2×10^9

# of cylinders = 10,000 = bytes / cylinder = $\frac{51.2 \times 10^9}{10^4} = 51.2 \times 10^5$ / # of blocks/cylinder = $\frac{51.2 * 10^5}{512 * 2^5} = \frac{10^4}{2^5} = 312.5$

f. average seek time :

To start and stop the head = 1 millisecond

to travel over 4000 tracks = another 1 millisecond

total number of tracks = 100,000

$\therefore$ time taken for 100,000 tracks = $\frac{100,000}{4000}$ = 25 milliseconds

generally the average seek time is calculated is by 1/3rd distance of the tracks

Maximum seek time is 11.0 ms $\frac{11.0}{3} = 3.66$ ms

∴ seek time is $1 + 0.001 (1000/3)$

$= 1 + 3.333$

$= 4.33$ ms

g. average rotational latency.

Its 1/2 of the revolution time take

∴ for 1 revolution = 6 milliseconds

$\frac{6}{2} = 3$ milliseconds.

(iii) Problem 3:

Sector size - 512 bytes

2000 tracts per surface, 50 sectors per track

5 double sided platters, average seek time of 10 ms.

(a). capacity of disk:

$= 2000 * 10 * 50 * 512 = 512$ mb

Capacity of each surface.

Total = $\frac{512}{10}$ mb

# of surface = 10

$\therefore \frac{512}{10} = 51.2$ mb

1 sector has 512 bytes

$\therefore$ 50 * 512 = 25600 bytes

(b) number of cylinders

number of cylinders = number of tracks per surface

$\therefore$ # of cylinders = 2000

(c) eg of valid block size.

No 256 is not valid

block = multiple sectors

1 sectors = 512 bytes

$\therefore$ valid block size = multiples of 512

eg: 1024, 1536, 2048 ..... etc.

(d). 5400 rpm, maximum rotational delay.

Maximum rotational delay = $\frac{60}{5400} = \frac{6}{540} = \frac{1}{90}$

= 0.011 milliseconds

= 11 milliseconds

(e). Transfer rate for 1 track of data.

1 track of data = 25600 bytes/second

transfer rate = # of bits / second

= 25600 * 8

= 204800 bits / ~~second~~ 11 milliseconds

for one revolution time taken = $\frac{1}{90}$ = 0.011 second

0.11 * 90.9 → 1 second

8.
Data transfer rate is for 1 second

$\therefore$ 204800 * 90.9

= ~~188~~

= 18616320 bits / second.