Ex_01_Simple

mercoledì 4 marzo 2020 09:27

Consider a HDD with:

- data transfer rate: 240 MB/s
- rotation speed: 10000 RPM
- mean seek time: 20 ms
- overhead controller: 0.3 ms

The mean I/O service time to transfer a sector of 8 KB will be:

$T_S^{8KB} = T_{SEEK} + T_{OH} + T_{ROT} + T_{DT}$

$= 20ms + 0.3ms + 3ms + \dots$

$T_{ROT}^{FULL} = \frac{1}{10k} * 60 = 6ms$

$T_{ROT} = \frac{1}{2} T_{ROT}^{FULL} = 3ms$

$T_{DT} = \frac{1}{DTR} * DATASIZE = \frac{8KB}{240MB/s} = \frac{8KB}{240 * 1024 KB/s} = 0.032ms$

$T_S^{8KB} = 20ms + 0.3ms + 3ms + 0.032ms \approx 23.332..$

Ex_02_Simple

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Consider a HDD with:

- data transfer rate: 280 MB/s
- rotation speed: 12000 RPM
- mean seek time: 16 ms
- overhead controller: 0.8 ms

The mean I/O service time to transfer a sector of 5 KB will be:

$$T_S^{5KB} = T_{OH} + T_{SEEK} + T_{ROT} + T_{DT}$$

$$= 0.8ms + 16ms + 2.5 + 0.017ms$$

$$T_{ROT} = \frac{1}{2} T_{FULL\ ROT} = \frac{1}{2} \frac{1}{12000} * 60 = 2.5\ ms$$

$$T_{DT} = \frac{1}{DTR} * DATASIZE = \frac{5KB}{280 * 1024 \frac{KB}{s}} = 0.0174\ ms$$

$$T_S^{5KB} = 0.8ms + 16ms + 2.5ms + 0.0174ms =$$

$$= 19.3174\ ms$$

Ex_03_AvgSeekTime

mercoledì 4 marzo 2020 17:28

Consider the following disk:

- Rotating at 8400 RPM
- an MAXIMUM seek of 9 milliseconds
- transfer time of 128 MB/second
- a controller overhead of 150 microseconds;

Calculate the average time required to read a 512B block

$T_R = \frac{1}{8400} * \frac{60}{2} = 3.57\,ms$

$\left(\frac{1}{2}\right) * \frac{0.5\,KB}{128 * 1024\,\frac{KB}{s}} = 0.004\,s$

$T_s^{512B} = T_{oh} + T_{SEEK} + T_R + T_{DT}$

$= 0.15_{ms} + \cancel{9_{ms}} + 3.57_{ms} + 0.004_{ms} =$

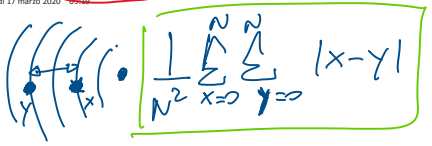
MAXIMUM

$T_{SEEK}^{AVG} = \frac{T_{MAX}}{3} = 3\,ms$

$= (0.15 + 3 + 3.57 + 0.004)\,ms = 6.724$

Tseek_avg = Tseek_max/3

martedì 17 marzo 2020 09:19



$$\frac{1}{N^2}\sum_{x=0}^{N}\sum_{y=0}^{N}|x-y| = AVGDIST$$

$$T_{MAX}^{SEEK} \qquad T_{AVG}^{SEEK} = \frac{T_{MAX}^{SEEK}}{N} * AVGDIST \Rightarrow T_{AVG}^{SEEK} = \frac{T_{MAX}^{SEEK}}{N} * \frac{N}{3} = \frac{T_{MAX}^{SEEK}}{3}$$

$$\Rightarrow \frac{1}{N^2}\int_0^N\int_0^N |x-y|\,dy\,dx =$$

$$\int_0^x x-y\,dy + \int_x^N y-x\,dy = xy\Big|_0^x - \frac{y^2}{2}\Big|_0^x + \frac{y^2}{2}\Big|_x^N - xy\Big|_x^N$$

$$= x^2 - \frac{x^2}{2} + \frac{N^2}{2} - \frac{x^2}{2} - xN + x^2 = \frac{N^2}{2} - xN + x^2$$

$$\Rightarrow \frac{1}{N^2}\int_0^N \frac{N^2}{2} - xN + x^2\,dx = \frac{1}{N^2}\left(\frac{N^2}{2}x\Big|_0^N - \frac{x^2}{2}N\Big|_0^N + \frac{x^3}{3}\Big|_0^N\right)$$

$$= \frac{1}{N^2} * \left(\frac{N^3}{2} - \frac{N^3}{2} + \frac{N^3}{3}\right) = \frac{N}{3}$$

Ex_04_Locality

mercoledì 4 marzo 2020 11:08

Consider a HDD with:

- block size: 3 KB
- mean I/O service time per block (with no locality): 9.0 ms
- transfer time of 1 block: 0.09 ms
- overhead controller: 0.8 ms

How long does it take to transfer a file of 50 MB if we assume a locality of: 70%?

$\frac{50 * 1024}{3} \simeq 17067$ BLOCKS

Sol. PREVIOUS EX

$\#B_{LOCALITY} = 17067 * 0.7$

$\#B_{NO\ LOCALITY} = 17.067 * 0.3$

$T_{TRANSF}^{50MB} = \#B_{LOCALITY} * T_{S\ LOCALITY}^{3KB} + \#B_{NO\ LOC} * T_{S\ NO\ LOCAL}^{3KB}$

$T_{OH} + T_{TT}^{3KB} = 0.89\mu s$

$= \#B_{BLOCKS} * (0.7 * 0.89 + 0.3 * 9\mu s)$

$= 17.067$

$= 56.71$ sec.