Disk Arrays — Single Disk-Array Disk — Single disk

Single Disk-Array Disk (central node)

Disk Arrays — **Single disk**

Nomenclature (Disk Arrays)

- n_r: number of stripe units reads by a read request
- n_w: number of stripe units modified by a write request
- λ^r_{array}: arrival rate of read requests to the disk array
- λ^w_{array}: arrival rate of write requests to the disk array
- λ^r_{disk}: arrival rate of read requests to any of the disk in the array
- λ^w_{disk}: arrival rate of write requests to any of the disk in the array
- N: number of physical disks in the array
- S^r_{array}: average service time at a disk array for read
- S^w_{array}: average service time at a disk array for write

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➢ Fraction of read requests to the array that goes to any of the disks (uniform distribution to all disks):

➢ Arrival rate of disk requests at a disk:

where $n(n_w)$ is the number of read request to a disk as a result of n_w write requests

➢ Arrival rate of write requests to any disk in the array:

⇒ Average service time of read request at disk array:

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where $R^r_{disk\,i}$ is the average response time of read requests at disk i:

⇒ Average service time of write request at disk array:

where $R^w_{disk\,i}$ is the average response time of write requests at disk i.

Nomenclature (Single disk)

Sd: service time
SeekTime
Seek$_{rand}$
DiskSpeed
DiskRevolutionTime
RotationalLatency
BlockSize
TransferRate
TransferTime
ControllerTime
P$_{miss}$

Computing Disk Service Time

$$S_d = ContrTime + P_{miss}(Seek + Latency + TransferT)$$

$$TransferT = \frac{BlockSize}{TransferRate}$$

Types of workloads

Random Workload:
10, 201, 15, 1023, 45, 39, 782

Sequential Workload:
4, 102, 103, 104, 105, 106, 25, 88, 32, 33, 34, 35, 36, 37, 38, 29, 15

run length= 5   run length= 7

Random Workload:

$$P_{miss} = 1$$
$$RunLength = 1$$
$$SeekTime = S_{rand}$$
$$Latency = 1/2 \times RevolutionTime$$

Sequential Workload:

$$P_{miss} = 1/RunLength$$

$$SeekTime = Seek_{rand}/RunLength$$

$$Latency = \frac{1/2 + (RunLength-1)[(1+U_d)/2]}{RunLength} \times RevolutionTime$$

$$RunLength = NumberRequests/NumRuns$$

$$SeekTime = \frac{NumRuns \times Seek_{rand}}{NumberRequests}$$
$$= \frac{Seek_{rand}}{NumberRequests/NumRuns}$$
$$= Seek_{rand}/RunLength.$$

$$TransferTime = \frac{BlockSize}{10^6 \times TransferRate} \qquad (3.3.19)$$

Random workloads:

$$\overline{S}_d = ControllerTime + Seek_{rand} + \frac{DiskRevolutionTime}{2} + TransferTime \qquad (3.3.20)$$

Sequential workloads:

$$\overline{S}_d = ControllerTime + \frac{Seek_{rand}}{RunLength} + \frac{[1/2 + (RunLength-1)(1+U_d)/2] \times DiskRevolutionTime}{RunLength} + TransferTime/RunLength \qquad (3.3.21)$$