

Module 2: Exercise on Design Storage Solution for New Application

Scenario:

An organization is deploying a new business application in their environment. The new application requires 1TB of storage space for business and application data. During peak workload application is expected to generate 4900 IOPS (I/O per second) with typical I/O size of 4KB.

The available disk drive option is 15,000 rpm drive with 100 GB capacity.

Other specifications of the drives are:

Av. Seek time = 5 millisecond

Data transfer rate = 40MB/sec

Task:

You are asked to calculate the required number of disk drives that can meet both capacity and performance requirements of an application.

Solutions:

1. Calculate time required to perform one I/O, which depends on disk service time.
Whereas, Disk service time = Av. seek time + rotational latency + data transfer time

Av. Seek time (given) = 5 millisecond.

Rotational latency is $\frac{1}{2}$ of the time taken for full rotation. Since rotation speed is given as 15000 revolutions per min; one revolution will take $1 / (15000/60)$ sec.

Therefore time taken for half revolution is $0.5 / (15000/60) = 2\text{ms}$.

Data transfer rate is 40MB/s, therefore transfer of 4KB I/O will take,

$$4\text{KB} / 40\text{MB/s} = 0.1\text{ms}$$

Therefore, time required to perform one I/O is $= 5\text{ ms} + 2\text{ms} + 0.1\text{ms} = 7.1\text{ msec}$

2. Now calculate maximum number of IOPS a disk can perform, which is equal to,
 $1 / 7.1\text{ ms} = 140\text{ IOPS}$

For acceptable response time disk controller utilization must be less than 70%, therefore maximum number of IOPS a disk can perform at 70% utilization is
 $140 \times 0.7 = 98\text{ IOPS}$

3. Now calculate number of disk required to meet:
 - a. Application's performance requirement $= 4900 / 98 = 50\text{ disks}$
 - b. Application's capacity requirement $= 1\text{TB} / 100\text{ GB} = 10\text{ disks}$
4. Finally, disk required = Maximum (Capacity, Performance)
 $= \text{Maximum}(10, 50) = 50\text{ disks}$