

- 1 a) Data Centre generally includes redundant to ensure highly availability and security. What are the seven requirements in the Data Storage element of a Data Centre?

[7 marks]

Solution:

- Availability – Ensure that data is accessible at all times when needed. As seen earlier, loss of access to data can have significant financial impact on businesses.
- Security – Prevent unauthorized access to data. Mechanisms to allow servers to access only their allocated resources on storage arrays.
- Capacity – Ability to add storage capacity “on-demand”, without interruption to the business. If a database runs out of space on physical storage, it comes to a halt, thus impacting the business.
- Scalability – The storage solution should be able to grow with the business. As the business grows, more servers are deployed and new applications/databases developed.
- Performance – Service all the I/O requests at high speed. With the centralized model, several servers connect to one storage array. The intelligence of the array, the processors, and architecture should enable optimal performance.
- Data Integrity – Throughout the I/O chain, checks have to be in place to ensure that data is not corrupted along the way. The storage system has to “guarantee” that the data that was sent to it was indeed the data that was written to disk and is available for retrieval when requested.
- Manageability – The operations and activities required to meet all of these requirements should be performed seamlessly and with minimal disruption to business activity.

[1 mark each total 7 marks]

- 1b) State the differences between a General Purpose Server and a NAS Device. Give the two types of NAS systems based on their connectivity.

[9 marks]

Solution:

Unlike a general-purpose server, such as a Unix or NT server, a NAS server is a device optimized for file serving functions such as storing, retrieving, and serving files. A single function NAS device provides:

- Real-time OS dedicated to file serving

- Open standard protocols
- Built-in native clustering for high availability

[2 each total 6 marks]

The configuration can be:

- Integrated (dedicated, directly attached to NAS devices)
- Gateway (shared, directly or fabric attached devices)

[1 each total 2 marks]

1c) A travel site company enabling travelers to plan and book the perfect trip and offers trusted advice from travelers and a wide variety of travel choices and planning features with seamless links to booking tools that check hundreds of websites to find the best hotel prices. The company employs about 5000 employees worldwide. This company is Newton, US based and has 7 regional offices across the country. Although the company is doing well financially, they continue to feel competitive pressure. As a result, the company needs to ensure that the IT infrastructure takes advantage of fault tolerant features.

The company uses a number of different applications for communication, accounting, and management. All the applications were hosted on individual servers with disks configured as RAID 0. The company changed the RAID level of their accounting application based on your recommendations 6 months ago. It is now the beginning of a new financial year and the IT department has an increased budget. You are called in to recommend changes to their database environment.

You investigate their database environment closely, and observe that the data is stored on an 8-disk RAID 0 set. Each disk has an advertised formatted capacity of 3TB and the total size of their files is 20TB. The amount of data is likely to change by 20 % over the next 6 months and your solution must accommodate this growth. The application performs around 40% write operations, and the remaining 60 % are reads. The average size of a read or write is small, at around 2 KB. [N.B. Each 3 TB drive can hold 2.863 TB data]

- Suggest how to restructure their environment if a new 3 TB disk drive costs US\$1000 assuming the controller can handle all commonly used RAID levels, so it will not need to be replaced. [3 marks]
- Propose a RAID solution to enhance on its existing RAID 0 setup ensuring redundancy at minimal cost and calculate the cost of this new solution. [3 marks]
- Justify your choice based on cost, performance, and data availability of this proposed new solution. [3 marks]

Solution:

- i) Each 3T GB drive can hold 2.863 TB of data. There is currently 20 TB of data, which will increase to 24 TB (20x1.2) in the next 6 months.

That amount of data will fit on 9 disks ($24\text{TB} < 9 \times 2.863 = 25.76$ thus 9 disks), with space left over.

[3 marks]

- ii) In order to provide redundancy at minimal cost, RAID 5 is proposed. RAID 5 will need an additional drive for parity thus 10 disks are required with max. space of $25.5\text{TB} > 24\text{TB}$

[2 marks]

They already have 8 disks, so need to purchase an additional 2, for a total cost of \$2000.

[1 mark]

- iii) Cost: RAID 1+0 is the most expensive amongst and RAID 5 cost is minimal
Performance: high read data transaction rate, medium write data transaction rate. Low ratio of parity disks to data disks. Good aggregate transfer rate

Data Availability: single disk failure puts volume in degraded mode. Difficult to rebuild

[1 each total 3 marks]