

CITY UNIVERSITY OF HONG KONG

Course code & title : EE4217 Storage Technology

Session : Semester A 2009-2010

Time allowed : Two hours

This paper has FIVE pages (including this cover sheet)

1. This paper consists of 5 questions.
 2. Answer Any FOUR questions.
 3. Use a separate sheet for each question.
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Question 1 (25 marks)

- 1 a) Virtualization is not a new technology however it can provide logical views of physical resources while preserving the usage interfaces. What makes Virtualization interesting to IT industries?
[6 marks]
- 1 b) What is a Virtual Local Area Network? What are the benefits of Virtual networks?
[7 marks]
- 1 c) Describe and illustrate the SNIA Storage Virtualization taxonomy including what is created, what has been done and how it is implemented.
[12 marks]

Question 2 (25 marks)

- 2.a) Data that do not change are referred to as fixed content. They are any informational objects retained for future reference and/or business value including electronic documents and many types of newly digitized information. Unlike transactions or files, it is typically unchanged once created. Storage of these data is called content addressed storage (CAS). What are their features?
[6 marks]
- 2.b) Currently, fixed content data are the fastest growing sector of the data storage market. Assets include X-Rays photos, MRIs images, broadcast content, CAD/CAM designs, surveillance video, MP3s and financial documents. What are the challenges of storing these fixed content data?
[9 marks]
- 2.c) Healthcare represents the fastest growing CAS market segment. A typical installation includes a PACS (Picture Archive Communication System) front end that captures and acquires the images. Suggest a method to store and retrieve data object from the PACS.
[10 marks]
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Question 3 (25 marks)

- 3 a) What are the five core technology elements of the Data Center Infrastructure?
[5 marks]
- 3 b) What are the seven requirements in the Data Storage elements of a Data Centre?
[7 marks]
- 3 c) While the requirements of Data Storage are applicable to all the elements of the data center infrastructure, an intelligent storage arrays meet these critical requirements and various techniques and technology solutions can be deployed, however the existing constraints affect the selection of methods. What are they?
[6 marks]
- 3 d) The goal of complete availability can be difficult to reach due to unplanned interruptions or planned maintenance and upgrade activities. For example, the amount of time needed for planned and unplanned interruptions can be limited as seen in the following, 99.0% = 3.7 days downtime per year and 99.9% = 9 hours downtime per year. Calculate the downtime required for 99.99%. What will you suggest to achieve a 99.99% downtime storage system?
[7 marks]

Question 4 (25 marks)

- 4 a) What is meant by Business Continuity and why Business Continuity is needed?
[6 marks]
- 4 b) Business continuity technology solutions include local replication, remote replication, and backup/restore. Describe these solutions.
[9 marks]
- 4 c) A Manufacturing Corporation maintains the storage of their mission critical applications on high end Storage Arrays using RAID 1 volumes. The Company's key database application takes up 1 TB of storage and has to be up 24x7 (24 hours and 7 days per week).

The main concerns the corporation facing are:

- Logical Corruption of the database (e.g. accidental deletion of table or table space)
- Guaranteed restore operations with a minimum RPO of 1 hour and with an RTO of less than ½ hour
- On occasion may have to restore to a point in time that is up to 8 hours old

Company would like to **minimize** the amount of storage used by the solution that will address their concerns. On average 240 GB of data changes in a 24 hour period. Customer is not concerned about physical failure of the database devices – other solutions in place already address this issue. The company's IT group is very interested in leveraging some of the Local Replication technologies that are available on their high end array.

Propose a local replication solution to address the company's concern. Justify how your solution will ensure that the Company's needs are met. How much physical storage will this replication actually need?

[10 marks]

Question 5 (25 marks)

5 a) An individual drive has a certain life expectancy before it fails, as measured by MTBF. Given a typical MTBF of a disk is 750,000 hours and for a disk array composing 100 units, the MTBF drops to 7500 hours. A way to mitigate the problem is to use a RAID. What is a RAID? What are the 6 levels of RAID?
[8 marks]

5 b) What are the features of RAID1? Explain RAID1 operations. State the benefits and drawbacks of RAID1.
[8 marks]

5 c) A Telecom Company is involved in mobile wireless services across China and has about 5000 employees worldwide. This company is Beijing based and has 7 regional offices across the country. Although A Telecom 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 are hosted on individual servers with disks configured as RAID 0. All financial activity is managed and tracked by a single accounting application. It is very important for the accounting data to be highly available.

The application performs around 15% write operations, and the remaining 85 % are reads. The accounting data is currently stored on a 5-disk RAID 0 set. Each disk has an advertised formatted capacity of 200 GB, and the total size of their files is 730 GB.

The company performs nightly backups and removes old information—so the amount of data is unlikely to change much over the next 6 months.

The company is approaching the end of the financial year and the IT budget is depleted. Buying even one new disk drive will not be possible. How would you suggest that the company restructure their environment? You will need to justify your choice based on cost, performance, and availability of the new solution.

[9 marks]

END