

CITY UNIVERSITY OF HONG KONG

Course code & title : EE4217 Storage Technology

Session : Semester B 2014-2015

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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*This is a **closed-book** examination.*

Candidates are allowed to use the following materials/aids:

Approved Calculator

Materials/aids other than those stated above are not permitted. Candidates will be subject to disciplinary action if any unauthorized materials or aids are found on them.

Question 1 (25 marks)

- 1 a) Data Centre is used to house computer systems and associated components, such as telecommunications and storage systems and its redundant equipment. What are the five core technology elements of the Data Center Infrastructure? [5 marks]
- 1 b) 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]
- 1 c) An intelligent storage arrays is selected to ensure critical requirements of a Data Centre are met. In order to choose the appropriate solution, a number of factors need to be considered. What are these factors? [6 marks]
- 1 d) In Fig 1 d below, it shown a typical company using a traditional file management system where the files are stored in a multi-vendor NAS systems and in this set up files in one NAS is difficult to move to the other Illustrate how the company can optimize its storage resources by using Virtualization techniques. Give three advantages of using this technique.

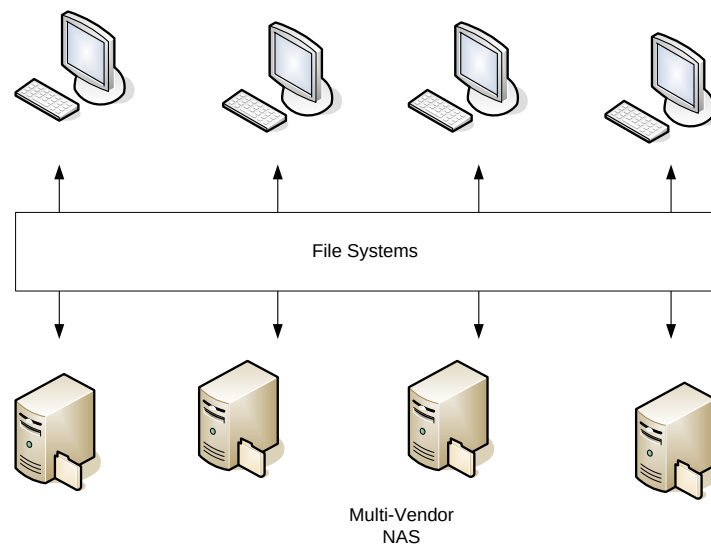


Fig 1d

[7 marks]

/...3

Question 2 (25 marks)

- 2 a) Many file systems are found on different operating systems. In order to make different file systems transparent accessed by various operating systems, Intelligent Storage System is used. What is an Intelligent Storage System (ISS)? What are the components of an ISS? [8 marks]

- 2 b) In an ISS, in order to improve the efficient of read/write operations. Cache is used to form a media to achieve this function. In Cache operations, there is a mechanism on a “read cache hit” and “a read cache miss”, what are these? Similarly in the write operations, there is a “Write-through” and “Write-back” cache process, what are these? [8 marks]

- 2 c) 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 a 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]

- i) 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]
- ii) Propose a RAID solution to enhance on its existing RAID 0 setup ensuring redundancy with minimal cost and calculate the cost of this new solution. [3 marks]
- iii) Justify your choice based on cost, performance, and data availability of this proposed new solution. [3 marks]

Question 3 (25 marks)

- 3 a) In business continuity, we have to consider both the expected loss of business due to a failure and the cost of introducing an objective to minimize loss of data or recovery time. Two objectives are called Recovery Point Objective (RPO) and Recovery Time objectives (RTO). What are they? When a system fails, two design considerations, i.e. Disaster Recovery and Disaster Restart, can also be adopted. Explain the difference of these two approaches.

[8 marks]

- 3 b) Any backup strategy starts with a concept of a data repository. Periodic backup is still a widely used method for preserving copies of data. What are the choices for setting up Backup and Recovery Strategies?

[8 marks]

- 3 c) A Power Generation Corporation maintains the storage of their mission critical applications on high end Storage Arrays on RAID 1 volumes. The Company's key database application takes up 5 TB of storage and has to be up 24x7.

The main concerns facing the corporation 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 6 hours old

Company would like to **minimize** the amount of storage used by the solution that will address their concerns. On average 480 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?

[9 marks]

Question 4 (25 marks)

- 4 a) Network-attached storage (NAS) is file-level computer data storage server connected to a computer network providing data access to a heterogeneous group of clients. What is a NAS Device? What are the physical elements of a NAS? [6 marks]
- 4 b) 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]
- 4 c) In order to achieve a high availability requirement, the system has to be designed and planned properly beforehand. The goal of complete availability can be difficult to reach due to unplanned interruptions or planned maintenance and upgrade activities. A company currently operated with 99.0% availability which is equivalent to 3.7 days downtime per year. If the company is now planning to upgrade their system and target to achieve 99.9% availability, what is the annual downtime they will expect? What will you suggest to achieve a 99.9% downtime storage system if a distributed storage environment is needed? State the advantages of this storage. [10 marks]

Question 5 (25 marks)

- 5 a) Computer system threats come in many different forms. Some of the most common threats are software attacks, theft of intellectual property, identity theft, theft of equipment or information, sabotage, and information extortion. Most people have experienced software attacks of some sort. Viruses, worms, phishing attacks, and Trojan horses are a few common examples of software attacks. What are the three security attributes normally we are addressing? Give one threat example on these attributes. [9 marks]
- 5 b) In computer security, a **threat** is a possible danger that might exploit a vulnerability to breach security and thus cause possible harm. A threat can be either "intentional" or "accidental" or otherwise a circumstance, capability, action, or event. What are the measurements to overcome the threat? [6 marks]
- 5 c) Storage securities is a specialty area of security that is concerned with securing data storage systems and ecosystems and the data that resides on these systems. The @stake researchers have published a model to analysis and mitigate the problems; this is called "Security and the Shared Storage Model". Describe this model and list all possible safeguard approaches. [10 marks]

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