

CITY UNIVERSITY OF HONG KONG

Course code & title : EE4217 Storage Technology

Session : Semester A 2010-2011

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) What is an Intelligent Storage System (ISS)? What are the components of ISS?
[8 marks]
- 1.b) What is the difference between a read cache hit and a read cache miss? Describe a Write-through and Write-back cache process.
[8 marks]
- 1 c) Command queuing processes multiple concurrent commands based on the organization of the data on disk, regardless of the order in which the commands were received. The command queuing software reorders commands so as to make the execution more efficient, and assigns each command a tag. This tag identifies when the command will be executed. Intelligent storage systems can make use of this native disk intelligence, and provide effective queuing mechanisms through its controller. Describe three most popular types of command queuing mechanisms used in ISS.
[9 marks]

Question 2 (25 marks)

- 2.a) What is a NAS Device? State the differences between a General Purpose Server and a NAS Device.
[6 marks]
- 2.b) What are the challenges of a data centre in monitoring and managing their resources?
[9 marks]
- 2.c) By deploying specialized solutions within a system infrastructure, general purpose servers are used in a more specialized form in their deployment and utilization.

NAS deployments allow specialized servers to have easily deployed infrastructures to access their dedicated data. It also allows for certain types of I/O profiles i) to be separated file level and block level, ii) to provide businesses with better decision criteria for storage and access choice.

Illustrate with a diagram on how a NAS HTTP File server can be set up.

[5 marks]

List NAS HTTP File Server's benefits if the system also composes of SANs.

[5 marks]

/...3

Question 3 (25 marks)

- 3 a) Access Control, Confidentiality, Availability, Non-repudiation and Integrity are the Security Services built to control attacks to a storage system. Describes the four components used in Access Control to achieve this purpose. [8 marks]
- 3 b) What is a Storage Networking Industry Association (SNIA) proposed Shared Storage Model which provides access paths to storage domains for security analysis? [9 marks]
- 3 c) A company uses a traditional file management system as shown in Fig 3 c. below where the files are stored in a multi-vendor NAS systems and files in one NAS is difficult to move to the other Suggest how the company can optimize its storage resources by using File Virtualization techniques.

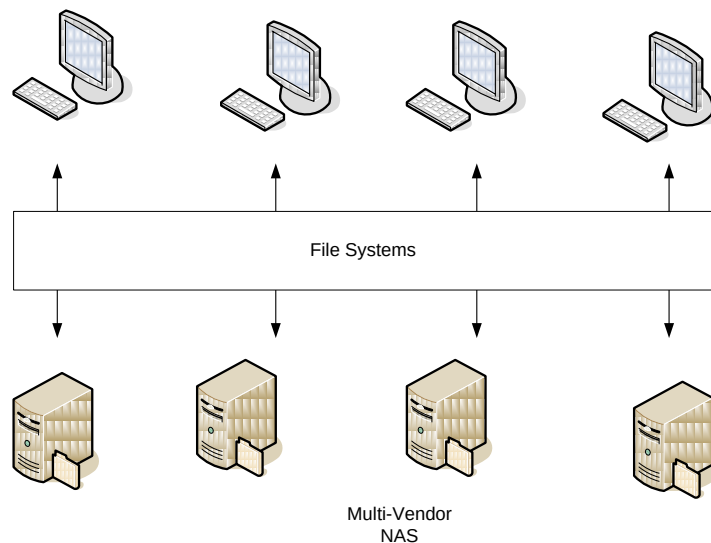


Fig 3c

[8 marks]

Question 4 (25 marks)

- 4 a) What are the system features that a data centre needs to monitor? List all major components of a data centre that these features are monitored. [7 marks]
- 4 b) State the differences between backup/recovery and archive processes. [7 marks]
- 4 c) A Manufacturing Company maintains the storage of their mission critical applications on high-end Storage Arrays on RAID 1 volumes. The company has two data centers which are 50 miles apart.

The company's mission critical Database application takes up 1 TB of storage on a high end Storage Array. In the past year, top management has become extremely concerned because they do not have Disaster Recovery (DR) plans which will allow for zero RPO recovery if there is a site failure. The primary DR Site is the 2nd Data Center 50 miles away.

The company would like explore remote replication scenarios which will allow for near zero RPO and a minimal RTO. The company is aware of the large costs associated with network bandwidth and would like explore other remote replication technologies in addition to the zero RPO solution.

Propose a remote replication solution to address the company's concern and the considerations. Justify your solution to ensure that the Company's needs are met. [11 marks]

Question 5 (25 marks)

- 5 a) What is a physical connectivity component? State the key physical connectivity components of a small systems environment. Also, state the key logical components found in all computing environment “hosts”. [8 marks]
- 5 b) What are the features of RAID5? Explain RAID5 operations. State the benefits, drawbacks, performance and data protection of RAID5. [8 marks]

- 5 c) A Telecom company provides mobile wireless services across the region and has about 5000 employees in the region. This company is Hong Kong based and has 7 regional offices across the region. 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.

After investigating their database environment closely, it is observed that the data is stored on a 6-disk RAID 0 set. Each disk has an advertised formatted capacity of 2 TB and the total size of their files is 9 TB. The amount of data is likely to change by 30 % over the next 6 months which needs to be addressed. 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 20 KB. [N.B. Each 2 TB drive can hold 1.863 TB data]

- i) Suggest how to restructure their environment if a new 2 TB disk drive costs HK\$1000, assuming the controller can handle all commonly used RAID levels, so the controller will not need to be replaced. [3 marks]
- ii) Propose a RAID solution 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]

END