HYBRID STORAGE SOLUTIONS

1. Virtualization -
   It is a technique of masking and abstracting physical resources, which
   simplifies the infrastructure and accommodates the increasing pace of business
   and technological changes. It increases the utilization and capability of IT
   resources.

   → Memory Virtualization -
   Virtual memory makes an application appear as if it has its own contiguous
   logical memory independent of the existing physical memory resources.
   A memory address space is divided into contiguous blocks of fixed-size pages.

   → Network Virtualization - (include VLAN concept) - Refer Unit 3 of cloud computing.

   → Secure Virtualization - Refer Unit 3 of cloud computing.

   → Storage Virtualization - Refer Unit 3 of cloud computing.

2. Appliances (Storage Heterogeneous Configuration) -
   Storage Virtualization at the network is implemented using either in-bound
   or the out-of-bound methodology.
   An appliance is hardware-based device that provides SAN connectivity
   of one form or another.

   In in-bound appliance, handles the virtualization and function as a
   translation engine for the virtual configuration of the physical storage. While
   powering on, data packets are often cached by the appliance and then forwarded to the
   appropriate target.

   Data storing and forwarding on the done through the appliance.

   In out-of-bound appliance, store virtualized environment configuration which
   is configured external to the storage network that carries the data. The data
   is not cached at the appliance beyond what would normally occur
   in a typical SAN configuration.

   Data storing and forwarding are not done through the appliance.
1. Data center concepts and requirements - Refer Unit 1 of ISM, that is Overview of storage infrastructure components.

2. Backup and Disaster Recovery -

   A backup is a copy of production data, created and retained for the sole purpose of recovering deleted or corrupted data.

   → Backup purpose/purpose -

   Backup are performed to serve three purposes -

   (1) Disaster Recovery - The backup copies are used for restoring data at an alternate site when the primary site is incapacitated due to a disaster.

   Based on RTO and RPO requirements, organizations use different backup strategies for disaster recovery. [Refer Unit 3 of cloud computing for RTO and RPO]

   Various methods are - tape-based backup, remotereplication.

   (2) Operational Backup - It is backup of data at a point in time and is used to restore data in the event of data loss or logical corruption that may occur during routine processing.

   They are critical for the active production information by using incremental or differential backup techniques.

   (3) Archival - Used by small and medium enterprises for long-term purses of information includes e-mail messages and other business records required for regulatory compliance. Traditional backups are used.

   "Backup also serves as a protection against data loss due to physical damage of storage device, software failures, virus attacks, deletion or intentional data destruction."
1. Industry Management Standards -

(1) SNMP (Simple Network Management Protocol) -

A network management protocol used to monitor the health and performance of network-attached devices.

It was the standard used to manage multi-vendor SAN environments.

Advantages -
(1) Simple design, (2) Widely used, (3) Easy to implement

Disadvantages -
(4) Simple, connectionless protocol on the transport layer.

(1) Unavailability of automatic discovery function.

(2) Weak modelling constructs

(3) Lack of transactional support

(2) SMI-S (Storage Management Initiative - Specification) -

It is based on WBEM (Web-based Enterprise Management) technology and the DMTF's CIM (Common Information Model).

The initiative was formally created to enable broad interoperability among heterogeneous storage vendor systems and to enable better management solutions that span these environments. This initiative is known as Storage Management Initiative (SMI).

SMI-S offers a normalized, abstract model to which a storage infrastructure's physical and logical components can be mapped, and which can be used by management applications such as storage resource management, device management, and data management for standardization, end-to-end control of storage resources.
Advantages:
1. Ability to report on multi-vendor storage environment more easily
2. A common user interface instead of multiple, vendor-specific applications for each storage platform
3. Common management of storage replication in a multi-vendor storage environment
4. Reduced management costs

Features:
4. Common data model
4. Legacy system accommodation
2. Interconnect independence
5. Policy-based management
3. Multilayer management

CIM (Common Information Model)

It is a language and methodology for describing management elements.
A CIM schema includes models for systems, applications, networks, and devices.
This schema also enables applications from different vendors working on different platforms to describe the management data in a standard format so that it can be shared among a variety of management applications.

Advantages:
1. An agent can perform management functions on its own
2. Support automation
3. Resource control
4. Security levels
5. Necessity, adequacy, and accuracy

Disadvantages:
1. Needs more system resources as compared to SNMP
2. Very difficult to program
3. Full implementation

Advantages:
1. Increased integration speed
2. Reduces complexity between applications
3. Reduces data modeling and schema design effort
4. Interoperability
5. Economical Maintenance

Disadvantages:
1. Additional translation (adaptation) layer
2. Lack of standards
3. Potential maintenance issues

2. Standard framework application -
   Standard framework interface(s) is used by storage management applications.
   
   Support for multi-vendor applications using the common framework.

3. Key management metrics -
   1. Availability refers to the availability of a component to perform a desired operation.
   2. Capacity refers to the amount of storage infrastructure resources available.
   3. Performance evaluates how efficiently different storage infrastructure components are performing and helps to identify bottlenecks.
   4. Security helps to track and prevent unauthorized access and login failures, whether accidental or malicious.
   5. Threshold is a magnitude after which alerts are issued while monitoring.