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Chapter 3.2

Backup Technologies

Aim

To equip students with the backup technologies

Instructional Objectives

After completing this chapter, you should be able to:

- Describe the concept of backup topologies
- Explain the concept of serverless backup
- Explain the different types of backup technologies
- Discuss physical tape library and virtual tape library

Learning Outcomes

At the end of this chapter, you are expected to:

- Identify the importance of backup topologies
- Illustrate serverless backup
- Elaborate the different backup technologies
- Demonstrate backup to disk and backup to tape technologies

3.2.1 Introduction

Business, small or big, know this very well that backup today is not a luxury but a requirement. Be it the internal documents, customer-facing documents, or fast-changing transactional data, all of these needs to be protected. Losing data is a disaster in itself and it can turn out to be a nightmare if it is not recovered within a reasonable time.

The businesses need to equally focus on generating data as well keeping it secure and maintaining a backup copy. Both backup and recovery should be in the smart choice list of the enterprises so that the data is secured and safe even if the worst of the worst happens.

Backup and recovery encloses within various strategies, processes and procedures that can protect a business against any kind of data loss and help in recovering and reconstructing the business.

In the coming topics, we will discuss and understand the various backup topologies and technologies. We will also understand the concept of serverless backup and discuss the several technologies that are taken into account while performing the backup.

Let us begin with understanding the various topologies involved in backup.

3.2.2 Backup Topologies

To perform a backup and implement the backup strategy, we need to be aware of the various backup topologies associated with backup.

In a backup environment, three basic topologies are used:

- Direct-attached backup
- Local area network-based backup
- Storage area network-based backup

Let us discuss each of the three basic topologies in detail.

Direct-Attached Backup

It is the method of directly attaching a backup device to the backup client via a direct communication path between the client and the backup device. The connectivity between the client and the backup device are on a dedicated path which is separate from the network cabling. The metadata is sent to the backup server through the local area network (LAN). In

the direct-attached backup configuration, the LAN remains free from the backup traffic. Refer to Figure 3.2.1 that shows a backup device that can only be accessed through the directly attached backup client. The backup client also acts like a storage node that will write data on the backup device, when required.

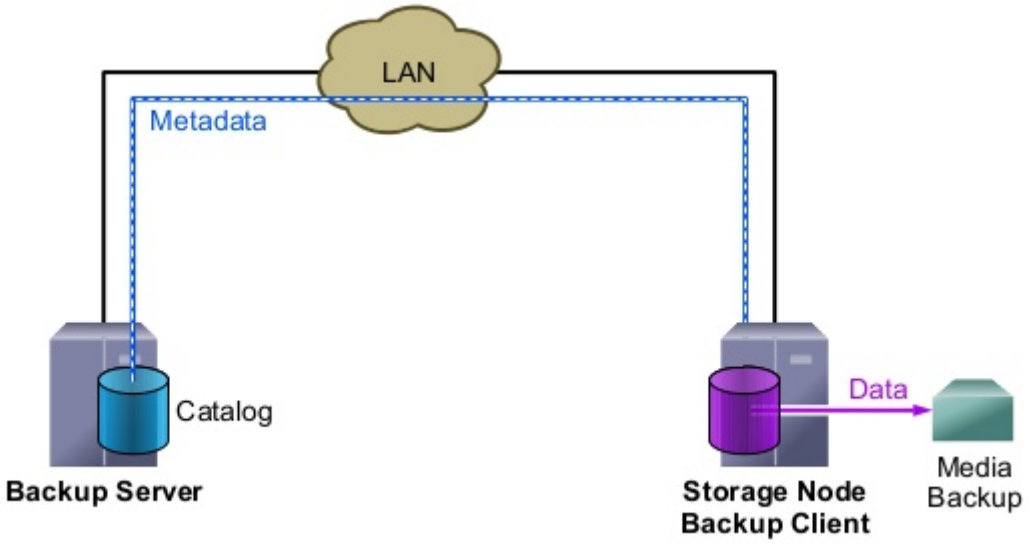

Figure 3.2.1: Direct-Attached Backup Topology

Local Area Network-Based Backup

In LAN-based backup, all the servers are connected to the LAN and all the backup devices are attached directly with the storage node. A LAN-based backup provides file access to heterogeneous computer systems and the accessing of storage data is done directly through the network. The data that needs to be backed up is transferred from the backup client, which is the source in this case, to the backup device, which is the destination in this case, over the LAN. As the transfer of data requires network connection, it may affect network performance as well. Streaming across the LAN also adversely affects the network performance of all the system that are connected to the same segment as the backup server. When multiple clients access and share the tape library unit (TLU) then the network resources get severely constrained.

In order to minimise the impact on network performance, a number of measures can be adopted, such as configuring separate networks for backup and installing dedicated storage nodes for some application servers.

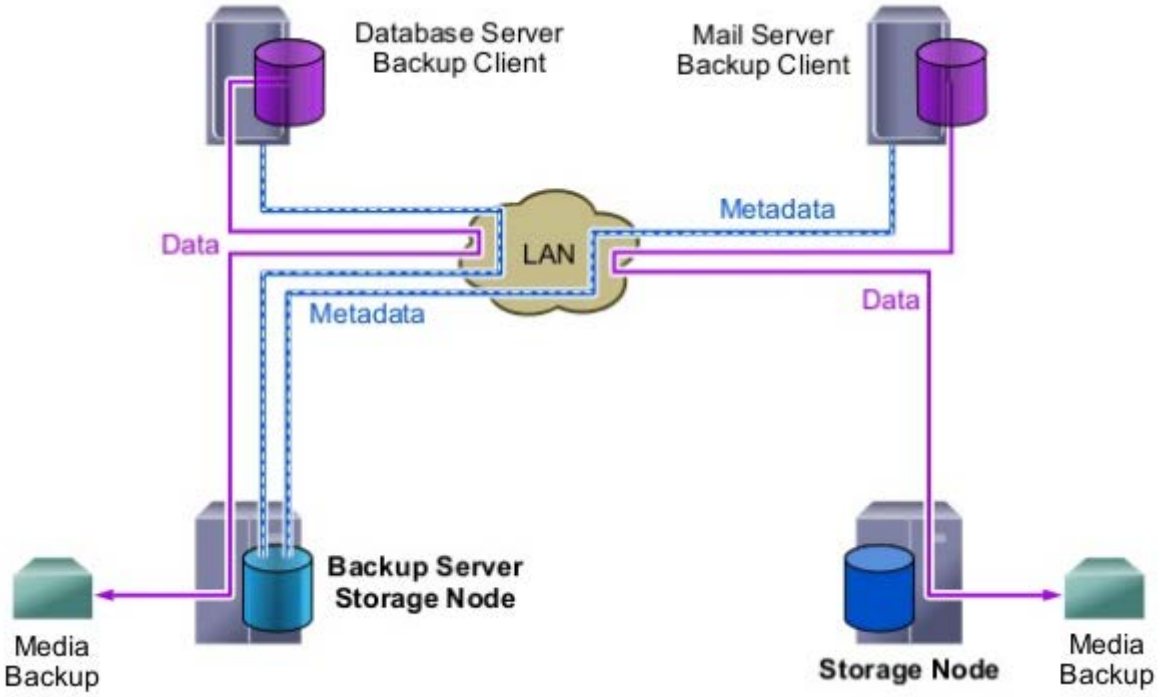

Figure 3.2.2: LAN-Based Backup Topology

Did You Know?

A TLU is a storage unit that contains multiple tape drives, various slots to hold tape cartridges, a barcode reader to identify the tape cartridges, and an automatic method for loading tapes.

Storage Area Network-Based Backup

The storage area network (SAN)-based backup is also known as **LAN-free backup**. It is the most appropriate solution when a backup device is required to be shared with a number of clients. SAN-based backups provide block-level access to the shared data storage. Block-level access refers to the specific blocks of data on a storage device as opposed to file-level access. One file can contain several blocks. Refer to Figure 3.2.3 that illustrates a SAN-based backup.

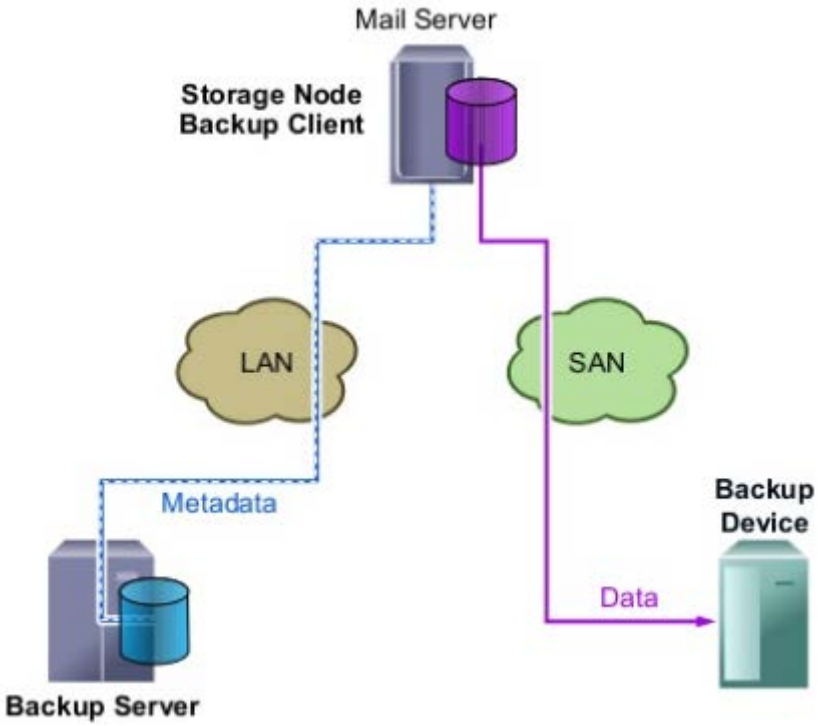

Figure 3.2.3: SAN-Based Backup

In a SAN-based backup, the backup device and the backup clients are attached to the SAN. The backup client reads the data from the mail server in the SAN and then writes to the backup device attached to the SAN. The backup data traffic remains restricted to the SAN and the backup metadata gets transported over the LAN. The volume of this metadata, however, is insignificant when it is compared to the production data.

As the backup data is transported over the SAN, the performance of LAN does not gets degraded in this configuration. This configuration removes the network bottleneck and frees the LAN from the backup traffic and results into improving the backup to tape performance.

However, at the same time, the SAN-based backups might affect the host and the application by consuming the host input/output (I/O), memory, bandwidth and CPU resources.

The emergence of low-cost backup medium has enabled disk arrays to be attached to SAN and to be used as backup devices. Data backups on these disks can be created into tape backups and can be shipped offsite for disaster recovery and long-term retention.

Did You Know?

A disk array is a hardware element containing a large group of hard disk drives (HDDs). It can contain several HDD trays, and has an architecture that improves speed and increases data protection.

Apart from these three basic topologies, there is another topology known as the **mixed topology**. The LAN-based topology and SAN-based topology can be integrated with each other to achieve a mixed topology. In this, the backup data is transported through both LAN and SAN. The mixed topology can be implemented for achieving reduced cost, reduction in administrative overhead and achieving desired performance and flexibility.

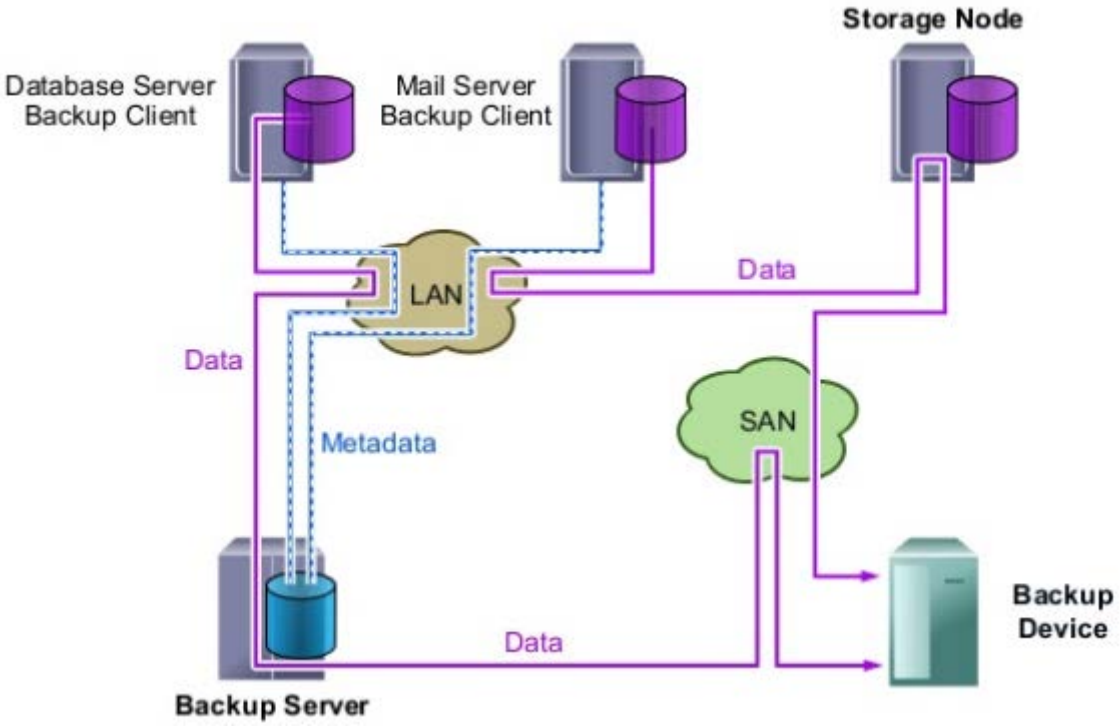

Figure 3.2.4: Mixed Topology

(i) Serverless Backup

Serverless backup, as the name suggests, has no dependency on the server to complete the backup operation. It is a LAN-free backup method and does not involve any backup server to perform the copy of data. It enables disk-to-disk or disk-to-tape backup without relying upon the server resources or the network bandwidth.

These backups are considered serverless as they utilise SAN resources instead of host resources for transporting backup data from its source to the backup device. This reduces the impact on the application server.

The backup copy gets created with the help of a network-attached controller that utilises a small computer system interface (SCSI) Extended Copy command or an application within the SAN. An SCSI extended copy is primarily applicable to the SAN environment and allows dual-mode SCSI controllers to behave as proxy initiators that can copy data on behalf of other initiators.

The controller receives an Extended Copy command from an initiator and issues Read and Write commands for a specific block of data. The controller behaves like a SCSI target and receives and interprets the Extended Copy command. It then reads data from the target source and writes it to the target destination. The number of network ports attached to the dual-mode controller can be one or more than one. However, as the SCSI function is independent of network, number of networking ports attached does not impact its function.

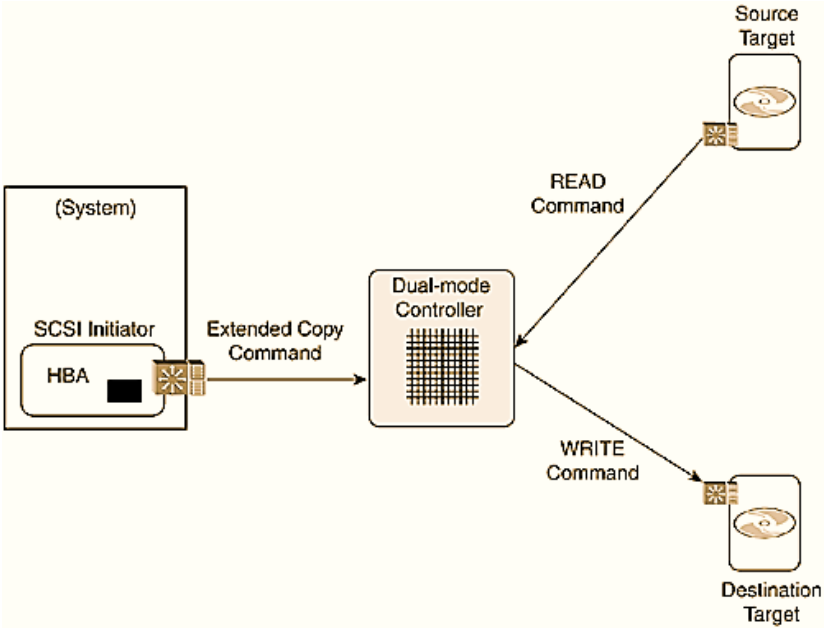

Figure 3.2.5: SCSI Extended Copy Process

Did you Know?

HBA stands for Host Bus Adapter.

We know that when the server is backed up, the backup process utilises the network bandwidth, CPU and disk I/O resources. These resources, if free, can be utilised by the production workload.

The aim of serverless backup is to offload the backup processes from the production server so that the performance of the servers does not get impacted by the backup processes. It frees the resources to be uitilised by the production workload and also frees the time devoted for backup operations to be utilised for other server tasks.

Serverless backup is a SAN solution designed to lead to lower hardware costs and improved time-effectiveness, scalability and fault tolerance.

Another widely used method for performing serverless backup is to leverage local and remote application techniques. In this technique, a consistent copy of the production data is replicated within the same array or remote array. These arrays can be moved to the backup device through the use of a storage node.

Self-assessment Question

1) Which of the following topologies are used in a backup environment? Choose all that apply.

   a) Direct-attached backup
   b) LAN-based backup
   c) Serverless backup
   d) SAN-based backup

2) Which of the following is also known as LAN-free backup?

   a) Direct-attached backup
   b) WAN-based backup
   c) SAN-based backup
   d) LAN-based backup

3) In which of the following backup topology, the flow of backup data happens via a direct communication path between the storage node and the backup device?

   a) LAN-based backup
   b) Serverless backup
   c) SAN-based backup
   d) Direct-attached backup

4) Which of the following topologies allow the transportation of the backup data via both LAN and SAN?

   a) Mixed topology
   b) Direct-attached topology
   c) LAN-based topology
   d) SAN-based topology

5) Which of the following backup topology aims at offloading the backup process from the production server to enhance its performance?

   a) LAN-based backup
   b) Serverless backup
   c) Mixed backup
   d) Direct-attached backup

3.2.3 Backup Technologies

Backup, today, has become the driving force of the organisation. To ensure business continuity it is a necessity to have a backup plan. A good backup plan constitutes of the right technology associated with it. In order to perform a backup, we must be aware of the available backup technologies and be able to choose the appropriate technology based on the requirement. A wide range of backup technology solutions are available today. Out of those tapes and disks are the two most popular and commonly used backup media.

The tape technology has scaled to make its place into the enterprise world, whereas backup to disk is emerging as a viable option with the availability of low-cost disks. As the backup medium, virtual tape libraries utilises disks emulating tapes, that provide enhanced backup and recovery capabilities.

Let us discuss more about these technologies in detail.

(i) Backup to Tape

A tape is a low-cost technology and is extensively used to cater the backup purpose. In computers, backup to tape is the ability to prepare a copy of all or a designated amount of data from its actual storage device to a tape cartridge device, in a periodic manner. It is done in order to safeguard the data in any unfortunate event of a data loss.

To read or write data from a tape cartridge, a tape drive is required. A tape drive is a device that is used for reading and writing the computer data on magnetic tapes, for backup and archiving purpose. The tape drive can be understood similar to an ordinary tape recorder that records data on a loop. A tape drive records data that can be read as well as erased. Tape drives are referred to as sequential or linear access devices as the data is read or written sequentially.

The working of tape drives is based on either using a traditional helical scan method or the linear recording method.

In a helical scan method, the recording and the playback heads touch the tape and the data is written diagonally. It uses a spinning read/write head and diagonal tracks that allows a slow-traveling tape to provide a fast transfer rate. The tape is pulled out of the cartridge and is wrapped around the read/write head.

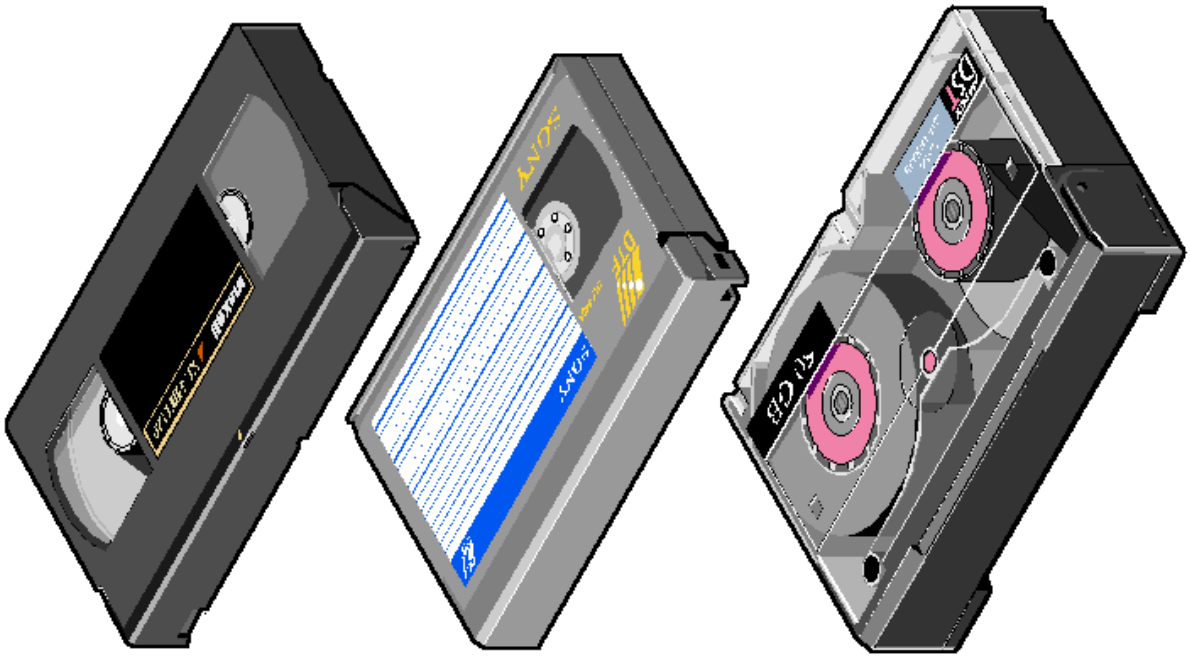

Figure 3.2.6: Helical Scan Formats

In a linear recording method, the playback head never actually touches the tape. This recording method was used in older tape drive technologies and consisted of data being written by multiple heads in parallel tracks, spanning the whole tape.

Modern tape drives, today, uses a linear serpentine method that uses more tracks and fewer tape drive heads. Data is written similar to the linear recording method, except that once the tape ends, the heads are moved and the data continues to be written backward. The linear serpentine method records several strips of data across the tape from one end to another. To write backwards, the head moves slightly up or down and performs the writing function in the reverse direction. Depending on the model of the drive, this process continues for several times before the entire recording space is utilised.

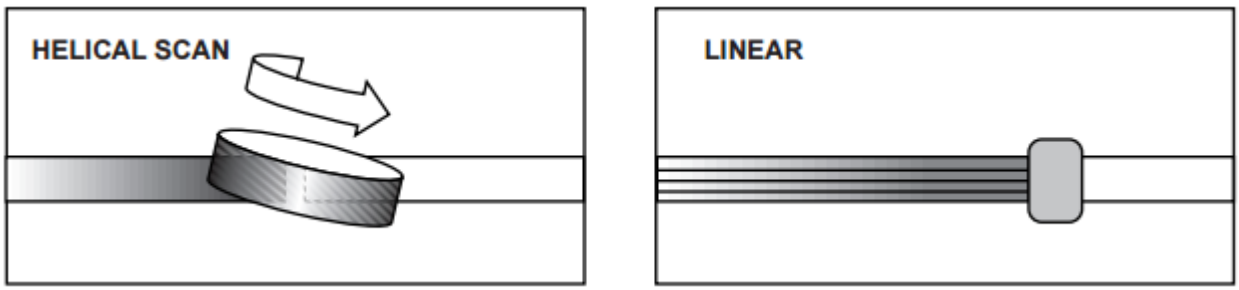

Figure 3.2.7: Helical Scan and Linear Recording Methods

Tape drives can be both rewinding and non-rewinding. Rewinding devices are most commonly used when a tape needs to be unmounted at the end of a read/write session after batch processing a large amount of data. Non-rewinding devices are useful in the case of incremental backups and in cases where new files are required to be added to the end of the previous session's file.

Tape mounting is the process of inserting a tape cartridge into a tape drive. The tape drive contains motorised controls that moves the magnetic tape around. This enables the head to perform the read/write function. Tape backup can be performed both manually or programmed to happen automatically, with the help of appropriate software.

Advantages of Backup to Tape

- Tapes have a large storage capacity for the storage of data.
- Backup to tapes happen to be very economical when compared to the cost of hard disk storage. Hence, they are primarily used for long-term offsite storage owing to their low cost.
- A tape backup includes the ability to perform the restoration of the backed up data on a hard disk storage device, when required.

Disadvantages of Backup to Tape

- The storage in a tape drive is done sequentially. The stored data can only be accessed by starting at the beginning and rolling through the tape, unless the required data is located. This slows down the backup and recovery operations.
- Tapes should be stored in locations with controlled environment. This should be done to ensure preservation of the media and avoid data corruption.
- This technique takes a long time if the backup process is unable to stream data to tape at optimum speed. Also, restoration of data from the tape can be time consuming.
- Physical transportation of the tapes to offsite locations also adds to the management overhead.

Today, various kinds of tape cartridges are available that vary in size, shape, capacity, number of reels, tape length, density, tape tracks, tape thickness and supported speed. Today, a tape cartridge is made up of a magnetic tape with either single or dual reels in a plastic enclosure.

Tape backup systems caters the backup need ranging from performing a backup of the hard disk on a personal computer to backing up large amount of storage data of an enterprise for archiving and disaster recovery purposes. A popular choice for personal computer tape backup is the OnStream universal serial bus (USB) tape drive. For enterprise tape backup, Linear Tape-Open (LTO) is an industry-open standard from Hewlett-Packard, IBM and Seagate.

Did You Know?

In a computer, batch processing means that the processing of the program is assigned to the computer to run without further user interaction. ***For example***, printing requests, analysis of a website log.

(ii) Physical Tape Library

The physical tape library is the home for a number of tape drives and tape cartridges. It provides a robotic arm or a picker mechanism. A robotic arm is a kind of a mechanical arm similar in functions to a human arm used as an automated method for loading tapes. It is usually programmable. The backup software is intelligent enough to handle and program the robotic arm and the complete backup process.

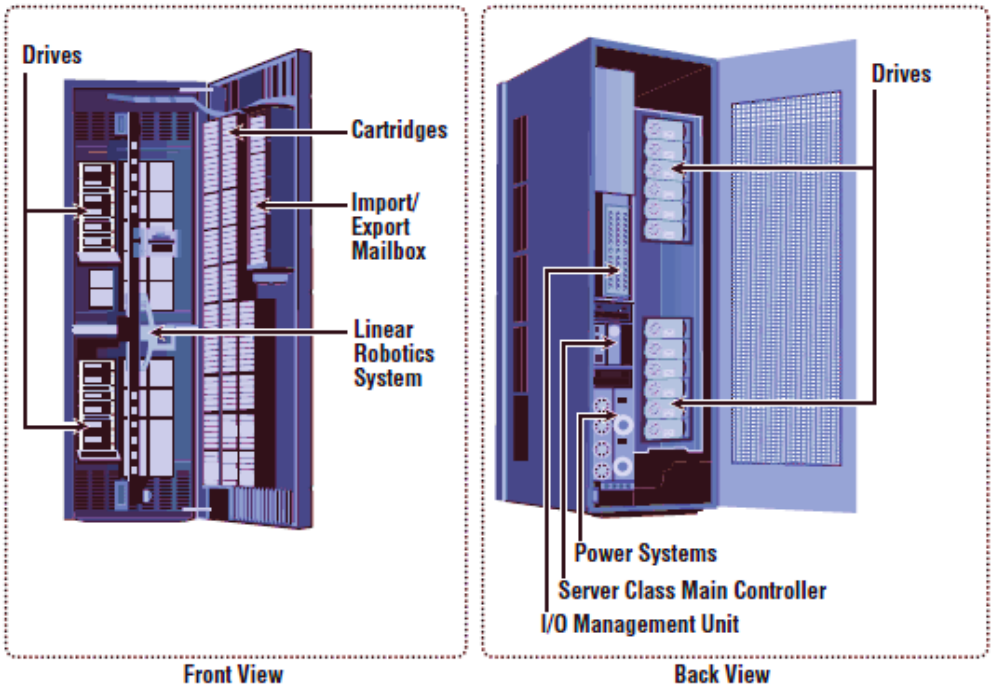

Figure 3.2.8: Physical Tape Library

We know that a tape drive is required for reading and writing the backup data from and to the tape. The tape cartridges, when not in use by a tape drive, are placed into the slots of the physical tape library. The robotic arms of the physical library are used for the movement of tapes around the library, including moving a tape drive into an available slot.

The physical tape library contains a slot known as the **mail** or **import/export slot**. This slot provides the facility to add or remove the tapes from the library without opening the access doors. Opening the access doors causes the physical tape library to go offline. Hence, the import/export slots help in adding or removing the tapes from the library without making the library go offline.

Each physical component in the tape library has its own element address. This element address is required as an addressing mechanism for moving tapes around the library.

When a backup process is initiated, the robotic arm loads the tape cartridge into the tape drive. We have just read, that this process of inserting a tape cartridge into a tape drive is known as **tape mounting**.

The time required in mounting a tape cartridge by a robotic arm depends on the kind of hardware used; generally, not more than 5 to 10 seconds are consumed in this process. After the tape cartridge has been successfully mounted, some additional time is spent to position the heads and validate the header information. The time invested in all these activities is known as **load to ready time**. This load to ready time varies from several seconds to minutes.

After the tapes are mounted, heads are positioned and the header information is validated, the backup process moves ahead. The tape drives receive the backup data and stores the data within its internal buffer. This backup data, stored in the internal buffer of the tape drives, is written to the tapes in blocks. To prevent gaps in writing between the blocks, it should be ensured that the tape drive is kept busy continuously. This is accomplished by buffering the data on tape drives. In order to match the data transfer rate, the speed of the tape drives can also be adjusted.

In order to keep the tape drive busy, tape drive streaming or multiple streaming writes the data from multiple streams on a single tape. Multiple streaming improves the performance of the media by keeping it busy, but it also has a disadvantage associated with it. As data from multiple streams is written on the tape, the backup data gets interleaved, or mixed alternatively, on the tape. This, consequently, increases the recovery time.

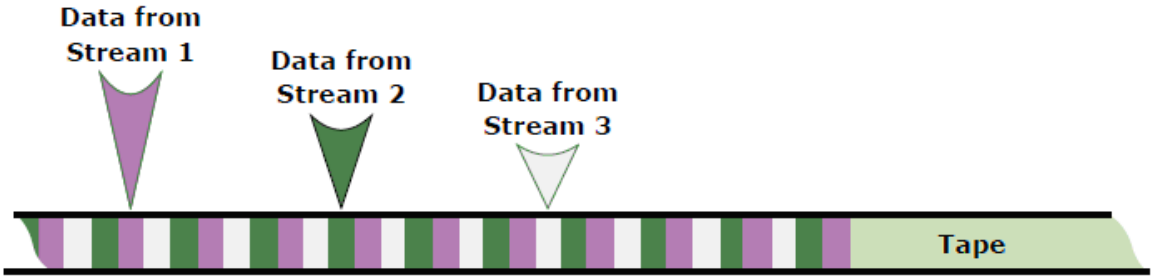

Figure: 3.2.9: Multiple Streams on Tape Media

There can be times when the buffering or speed adjustment features of a tape drive can fail to prevent the gaps in writing between the blocks. This causes the **shoe-shining effect**. The shoe-shining effect is the continuous back and forth movement made by a tape drive in case of an interruption in the data stream. This effect results in the stopping of the tape drive and rewinding to the appropriate point. The writing function is resumed by the tape drive only when its buffer is full. This adversely affects the performance of the backup process.

After the tape read/write operation is complete, the tape rewinds to the starting position for being unmounted. This rewind time can range from several seconds to minutes depending on the length of the tape cartridge. The robotic arm, as instructed by the backup software, unmounts the tape back to the slot.

When the restore process is initiated, appropriate tapes that are required for restoration are identified by the backup software. The robotic arm is instructed to move the identifies tapes from their slots to the tape drives. The backup software displays a message to the operator to manually insert the required tape in the tape library, in case a required tape is not found in the tape library.

When a file or a group of files require restoration, the tape moves sequentially to the beginning of the data before it can start reading. A significant amount of time is consumed in this process, especially if the required files are recorded at the end of the tape. The new tape devices being made today consists of an indexing mechanism. This mechanism enables the tape to fast forward to a location near the required data. The tape drive then fine-tunes the tape position to reach the required data. However, you must consider the benefits of data streaming performance against the cost of writing an index, before adopting to a backup solution.

Did You Know?

The shoe-shine effect is also known as back-hitching.

(iii) Backup to Disk

Backup to disks refer to the technology where large amount of data is backed up and stored to disk storage units. Disks are now being able to replace tapes as the primary storage device when it comes to the storage of backup data. This has been possible because of their performance advantages.

Backup to disk system offers advantage over backup to tapes because of their inherent random access and redundant array of independent disks (RAID)-protection capabilities. RAID is a way of storing the same data redundantly on multiple hard disks. This offers a benefit of performance improvement, as by placing the data on multiple disks, the I/O operations can be overlapped in a balanced way. Also, storing data randomly on multiple disks increases the mean time between failures (MTBF) and hence, increases the fault tolerance.

In most of the backup environments, backup to disks is used as a staging area or a temporary location for enhancing backup performance. The data is copied temporarily into the disks acting as staging areas, before being transferred or staged to tapes later. This process cuts down a good amount of time initially taken to backup directly on tapes.

Even after the backup data has been staged, some backup products allow the backup image to remain on the disk for a certain period of time. This enables a much faster restoration at the time of recovery. Recovery of the data with a full backup copy stored on the disk and kept onsite, or a local replica, provides the fastest recovery solutions. Backup to disk enables full backup creations more frequently. This also improves the recovery point objective (RPO). We have already read about RPO in Module 3, Chapter 1. To quickly recall, RPO defines the point in time until when the business process's recovery can tolerably proceed, keeping in mind the volume of data lost in that interval.

Advantages of Backup to Disks

- It offers ease of implementation and improved quality of service.
- It increases the fault-tolerance limit of the backup operation.

- It offers faster recovery when compared to tapes.

Disadvantages of Backup to Disk

- It is costlier when compared to backup to tapes.
- It does not offer any offsite disaster recovery protection.
- Some backup products also require additional modules and licenses for performing backup to disk. This may require additional configuration steps, including creation of RAID groups.

(iv) Virtual Tape Library

A virtual tape library (VTL) is a backup solution that intelligently combines the traditional tape backup methodology with low-cost disk technology. It creates an optimised backup and recovery solution that emulates traditional tape devices and tape formats. It is similar in structure to a physical tape library and has the same components. The different is that majority of the components are presented as virtual resources. However, a backup software does not differentiate between a physical tape library and a VTL.

The VTL acts like a tape library having the performance of modern disk drives. The data gets backed up on the disk drives similar to as it would in a tape library, but faster.

VTL uses disks as the backup media. It generally constitutes of a virtual tape appliance or server and an emulation software that emulates the traditional tape devices and formats. The emulation software consists of a database containing a list of virtual tapes. Each virtual tape is assigned a portion of a logical unit number (LUN) on the disk. If required, a virtual tape may span multiple LUNs.

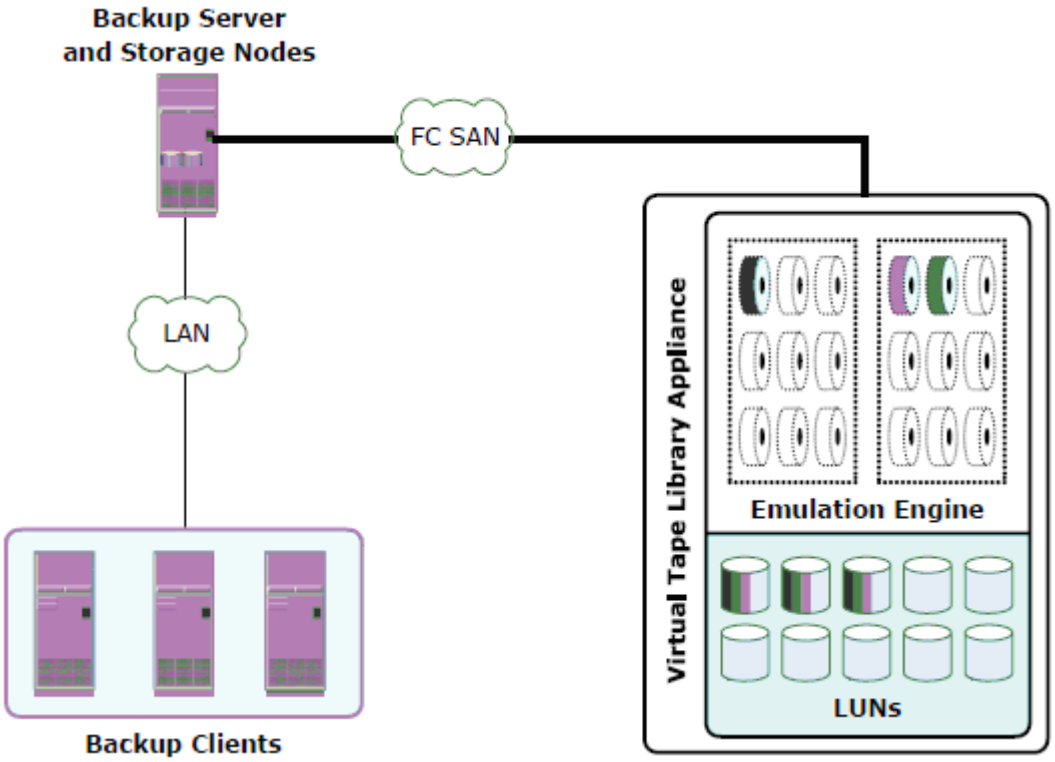

Figure 3.2.10: VTL

Similar to the physical tape library, a VTL also has a robotic arm that performs the mounting and unmounting of the tape cartridges when a backup process starts in a virtual tape library. However, in a physical tape library, this process involves some mechanical delays, such as time taken by the robotic hands in mounting and unmounting the tapes, positioning the heads, or validating the header information. In VTL, there is no such delay and it happens almost instantaneously. Even the load to ready time is very less as compared to a physical tape library and is almost instantaneous.

The backup data can be written on the virtual tape after it has been mounted and the tape drive is positioned. We have read about the shoe-shining effect in the physical tape library; however, in a VTL, there is no such constraint. In most of the cases, the write operation on virtual tape is performed immediately. When the write operation gets complete, a rewind command is issued by the backup software before the tape can be unmounted. Even the rewind command is also executed instantaneously without delay. The robotic arm unmounts the virtual tape and places it back into a virtual slot.

At the time of recovery, the steps to restore the backup data in a VTL are similar to those of a physical tape library, enhanced by being instantaneous. Even though the VTL is based on disks, the virtual disks emulate the behavior of the tapes and still provide random access.

The VTL appliances provides various features that can't be achieved with a physical tape library. Some VTL offers multiple emulation engines feature. An engine is a dedicated server that has a customised operating system (OS). It makes the physical disks in the VTL to appear as tapes to the backup application. With the help of multiple emulations engine feature, in case of any failure, one engine is able to pick up the virtual resources from another engine. This enables the users to continue using their assigned virtual resources transparently without any hindrance.

A VTL also provides the feature of replication over Internet Protocol (IP). This feature enables the virtual tapes to be able to replicate over an inexpensive IP network to a remote site. With the help of this feature, businesses can comply with the offsite storage requirement of the backup data. A VTL also provides the facility to connect the engines of a VTL to a physical tape library and copy the virtual tapes onto the physical tapes. These copied tapes can then be sent to a vault or can be shipped to an offsite storage location.

In usage, virtual tapes provide various advantages over both disks and physical tapes.

When compared to a physical tape:

- A virtual tape provides better single stream performance, random disk access characteristics and better reliability.
- The backup and recovery operations are although sequential in nature, but they get benefitted from the virtual tape's random access characteristics. This characteristic enables the virtual tapes to be always online and ready to be accessed and hence, improves on the backup and restore times.
- The effort of regular maintenance associated with physical tape drives are not at all required with the virtual tapes.

When compared to a disk:

- Virtual tape can be easily installed and administered.
- It provides offsite disaster recovery protection.

- It does not require any additional modules or changes on the backup software.

Although the virtual tapes have several advantages over both physical tapes and disks, it can only be used for backup purposes as they are generally offered as an appliance designed specifically to meet the backup purposes.

Let us refer to the Table 3.2.1 to quickly summarise the basic differences between the various backup technology options discussed just now.

Features	Tape	Disk	Virtual Tapes
Offsite disaster recovery capability	Yes	No	Yes
Reliability	Less, as compared to the disk and virtual tapes.	Yes	Yes
Use	Backup only	Backup as well as production data can be stored	Backup only
Performance	Low performance subjected to load time and mechanical delays	Faster single stream	Faster single stream

Table 3.2.1: Comparing Backup Technologies

Self-assessment Questions

6) Which of the following statements best describe a tape mounting method?
   a) It is the process of removing the tape cartridge from a tape drive.
   b) It is the process of inserting the tape cartridge in the virtual slot.
   c) It is the process of removing the tape cartridge from a virtual slot.
   d) It is the process of inserting a tape cartridge into a tape drive.

7) The working of tape drives in terms of reading and writing onto a tape is based on which of the following methods? Choose all that apply.
   a) Helical scan method
   b) Linear recording method
   c) Linear serpentine method
   d) Tape mounting method

8) In a physical tape library, which of the following provides the facility to add or remove a tape without causing the library to go offline?
   a) Robotic arm
   b) Import/export slot
   c) Backup software
   d) Slots

9) In which of the following, the load to ready time is almost instantaneous?
   a) Backup to tape
   b) Backup to disk
   c) Physical tape library
   d) Virtual tape library

10) Which of the following increases the mean time between failures (MTBF) and increases the fault tolerance of the backup operation?
   a) Backup to disk
   b) Backup to tape
   c) Physical tape library
   d) Robotic arm

11) Which of the following will you NOT choose when you are looking for an offsite disaster recovery mechanism?
   a) Backup to tape
   b) Backup to disk
   c) Virtual tape library
   d) Physical tape library

12) Which of the following utilises disks emulating tapes that provide enhanced backup and recovery capabilities?
   a) Physical tape library
   b) Backup to tape
   c) Virtual tape library
   d) Backup to disk

Summary

- In a backup environment, three basic topologies are used, direct-attached backup, LAN-based backup and SAN-based backup.
- In LAN-based backup, all the servers are connected to the LAN and all the backup devices are attached directly with the storage node.
- The SAN-based backup is also known as LAN-free backup and it provides block-level access to the shared data storage.
- In a SAN-based backup, the backup device and the backup clients are attached to the SAN.
- The LAN-based topology and SAN-based topology can be integrated with each other to achieve a mixed topology.
- Serverless backup is a SAN solution designed to lead to lower hardware costs and improved time-effectiveness, scalability and fault tolerance.
- Tape mounting is the process of inserting a tape cartridge into a tape drive.
- The working of tape drives is based on either using a traditional helical scan method or the linear recording method.
- The shoe-shining effect is the continuous back and forth movement made by a tape drive in case of an interruption in the data stream.
- Backup to disk system offers advantage over backup to tapes because of their inherent random access and RAID-protection capabilities.
- VTL combines the traditional tape backup methodology with low-cost disk technology and creates an optimised backup and recovery solution that emulates traditional tape devices and tape formats.
- Multiple emulation engine feature provided by VTL enables one engine to pick up the virtual resources from another engine.

- VTL provides the feature of replication over IP that enables the virtual tapes to be able to replicate over an inexpensive IP network to a remote site. With the help of this feature, businesses can comply with the offsite storage requirement of the backup data.

Terminal Questions

1. Describe the benefits of using VTL over physical tapes library.
2. Discuss serverless backup and the Extended Copy command.
3. List and explain the considerations in using tape as the backup technology. What are the challenges in this environment?

Answer Keys

Self-assessment Questions	
Question No.	Answer
1	a, b, d
2	c
3	d
4	a
5	a, b
6	d
7	a, b, c
8	b
9	d
10	a
11	b
12	c

Activity

Activity Type: Offline **Duration:** 30 Minutes

Description:

Do an online study on physical tape library and VTL and distinguish between them.

Case Study

Simco IT is an IT company that has been using tapes as their primary backup storage media for a long time. However, when trying to cope up with a recent data loss, the company was taken aback when the recovery operation from tapes failed. Due to poor maintenance of the tapes, most of the backup data got corrupted and the company was not able to complete the recovery operation.

The management is not happy with this loss and, considering this disadvantage of maintenance associated with the tapes, is now open to other solutions.

The management has called for an urgent meeting to discuss this and wants to have a solution that can enable them save both the production as well as backup data. The management wants a solution that allows them to have a local backup copy as well as save a backup copy offsite. However, they also want to do away with the maintenance issues, such as in case of backup to tape.

1. What as per you can be suggested to the management? Do you think you can suggest more than one approach?

2. Compare your suggested solution with the existing solution owned by the company.

Bibliography

e-References

- Farley, M. (2006). *SCSI Command Basics - Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management and File Systems* (Vol 1). Flylib.com. Retrieved 7 July 2016, from http://flylib.com/books/en/2.393.1.46/1/

- *Tape backup.* (2016). SearchStorage. Retrieved 7 July 2016, from http://searchstorage.techtarget.com/definition/tape-backup

- *Serverless backup.* (2005). SearchStorage. Retrieved 7 July 2016, from http://searchstorage.techtarget.com/definition/serverless-backup

- *Backup Data to Tape with Take Backup Software - EaseUS.* (2016). Todo-backup.com. Retrieved 7 July 2016, from http://www.todo-backup.com/backup-resource/tape-backup-software/tape-backup-software.htm

Image Credits

- Figure 3.2.1: http://image.slidesharecdn.com/03-backup-and-recovery-150629182222-lva1-app6891/95/03-backupandrecovery-24-638.jpg?cb=1435602248

- Figure 3.2.2: http://image.slidesharecdn.com/03-backup-and-recovery-150629182222-lva1-app6891/95/03-backupandrecovery-25-638.jpg?cb=1435602248

- Figure 3.2.3: http://image.slidesharecdn.com/03-backup-and-recovery-150629182222-lva1-app6891/95/03-backupandrecovery-26-638.jpg?cb=1435602248

- Figure 3.2.4: http://image.slidesharecdn.com/03-backup-and-recovery-150629182222-lva1-app6891/95/03-backupandrecovery-27-638.jpg?cb=1435602248

- Figure 3.2.5: http://flylib.com/books/2/393/1/html/2/images/1587051621/graphics/06fig07.gif

- Figure 3.2.6: http://img.tfd.com/cde/HELSCNF1.GIF

- Figure 3.2.7: http://storusint.com/pdf/helical_scan_vs_linear.pdf
- Figure 3.2.8: Information Storage and Management: Storing, Managing and Protecting Digital Information
- Figure 3.2.9: Information Storage and Management: Storing, Managing and Protecting Digital Information
- Figure 3.2.10: Information Storage and Management: Storing, Managing and Protecting Digital Information

External Resources

- Somasundaram, G. & Shrivastava, A. (2009) *Information storage and management* - Storing, managing and protecting digital information. *Indianapolis, Ind.: Wiley Pub.*
- Dufrasne, B., Eriksson, R., Martinez, L., & Kalabza, W. (2014). *IBM XIV Storage System Architecture and Implementation* (9th ed.). International Business Machines Corporation.

Video Links

Topic	Link
Virtual tape library	https://www.youtube.com/watch?v=4XmbV-mRNZ0
Tape emulation	https://www.youtube.com/watch?v=urmKIOFoAJk
SAN	https://www.youtube.com/watch?v=teEsgqI49Dk

Notes: