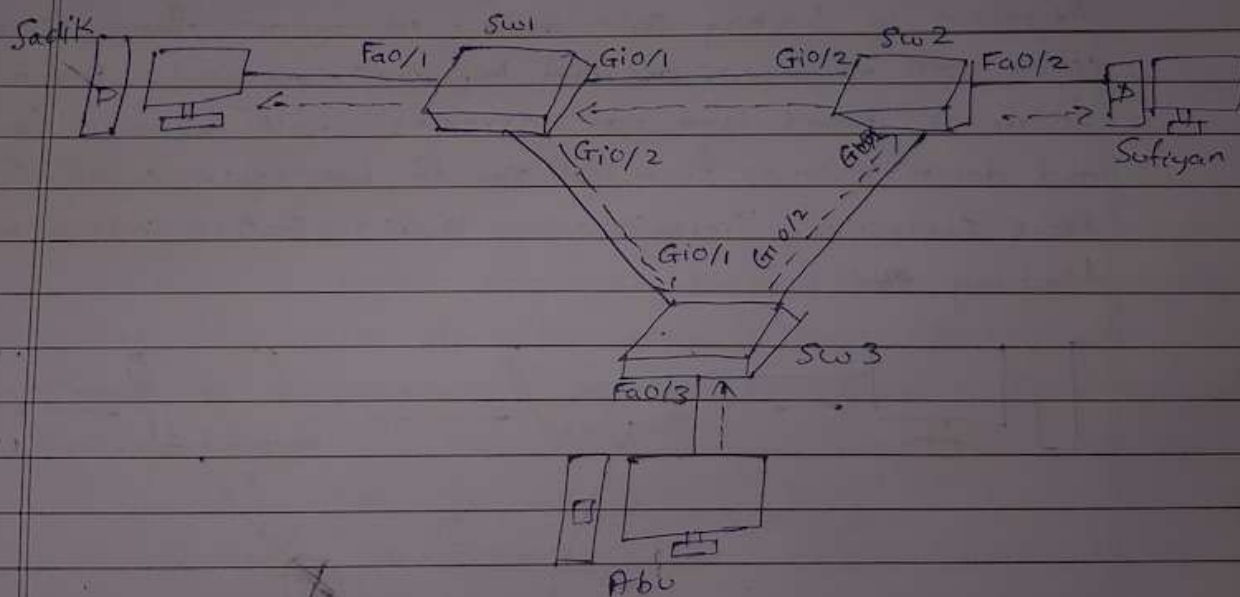


## DATA CENTRE TECHNOLOGY - UNIT 2

### Q1. Finding Spanning Tree

Ans. In LAN, spanning tree redundant links are added to improve the network availability of LAN. But these redundant links may cause the frame to loop in the network for an infinite time until some action is taken, eg, some links are taken down. To cope with the problem of frame looping, Spanning Tree Protocol (STP) came into play.

Consider the scenario below with 3 switches with one user attached to each switch.



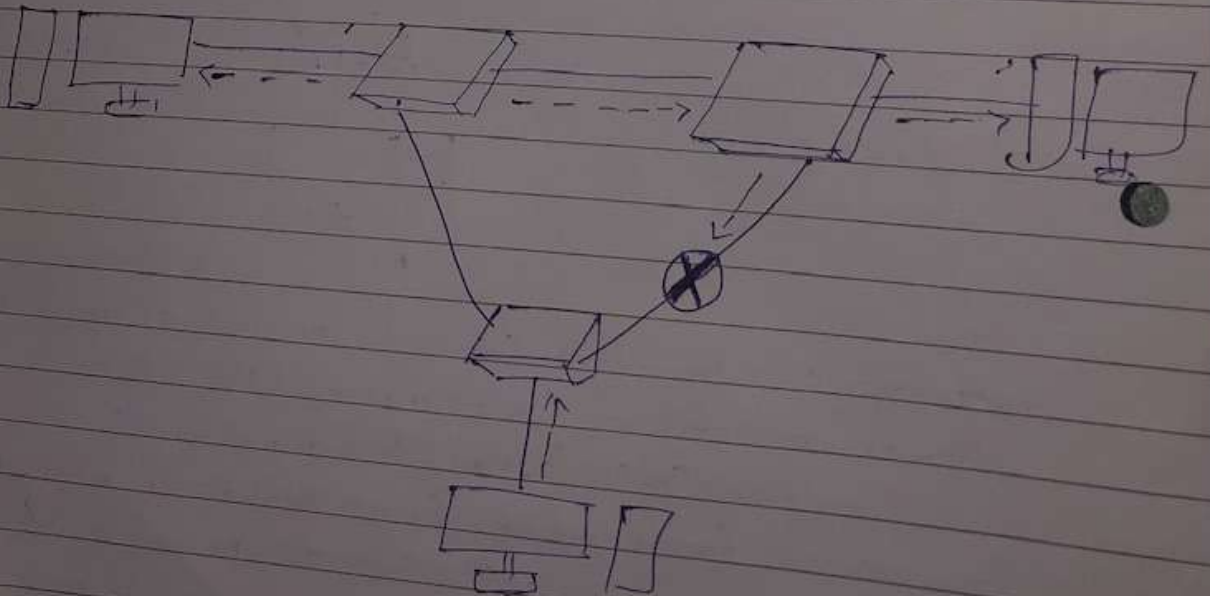
Abu sends a broadcast frame to LAN and as nature of switch frames are sent out from other ports (Gi0/1 & Gi0/2) except receiving port (Fa0/3). Now, this frame goes to Sw2, Sw2 also broadcasts frame out of Gi0/2 and Fa0/2 ports. Sw1 receives frame in its Gi0/1 ports. Sw1 also broadcasts frame in this frame goes to Sw3 and frame broadcasting goes on. Remember that this frame broadcast also occurs in other direction.

This forever looping of frames around LAN is called Broadcast Storm. This looping of frames causes three problems:

- (i) Mac Instability
- (ii) Broadcast Storm
- (iii) Multiple Frame Transmission.

How Spanning Tree will help in this:

Spanning tree protocol prevent looping of frame around LAN by placing ports of switch in their forwarding or blocking state. Interface which are in forwarding state act as a normally but interfaces in blocking state doesn't process any frame received except STP messages and other important overheads. Blocking interfaces doesn't learn mac addresses, don't forward frames and don't receives frames. Now if we again consider the above discussed scenario with sw3's Gi0/2 interface in blocking state.

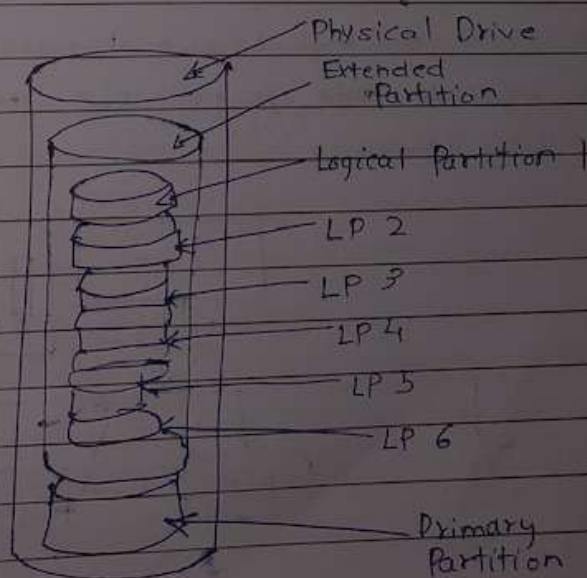




- Abu Sends the frame to sw3
  - Sw3 forwards frame only to Gi0/1 port as Gi0/2 port is in blocking state
  - Now sw1 receives frame and forward to Fa0/1 and Gi0/1 interfaces
  - Sw2 receives frame and forward to Fa0/2 and Gi0/1 interface
  - Sw3 will receive frame and Gi0/2 interface but give ignore this frame as it is in blocking state
- In this way looping of frame around LAN can be prevented by using STP

### Q. Network logical Partitioning.

Ans: Network Logical Partitioning refers to the division of a network into multiple logical segments, each acting as an independent entity. This concept is often used in data centers and enterprise networks to improve performance, security and manageability



FOR EDUCATIONAL USE

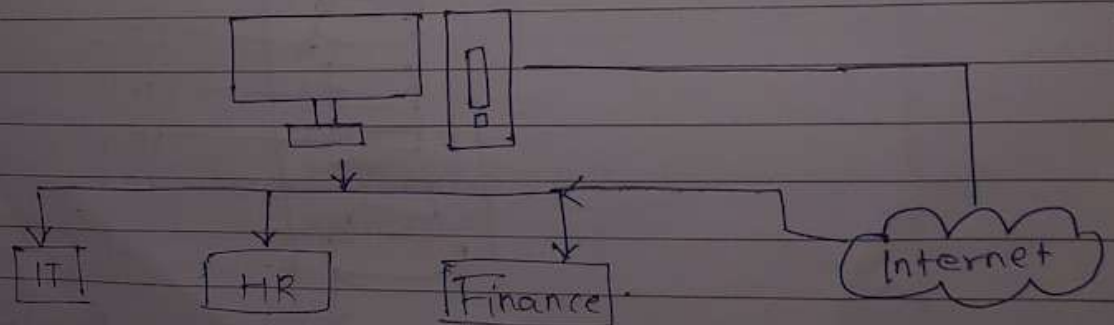
⑩ Isolation: Each logical partition operates independently, reducing the risk of interference or security breaches between segments.

⑪ Resource Allocation: Resources such as bandwidth and IP address can be allocated specifically to each partition, optimizing network performance.

⑫ Scalability: Logical partitions allow for easier scaling as network demands grow, without the need for significant physical changes.

⑬ Management: Simplifies network management by allowing administrators to control and configure each segment separately.

Ex: Imagine a company with different departments [Eg HR, IT & Finance]. By using a network logical partition, each department can have its own isolated network segment, ensuring that sensitive data is protected and network traffic is efficiently managed.





## ① History of Data Centres.

Ans: In 1946, the first data centre was created.

In 1940's, the concept of data centre as we know them today did not yet exist. However, during this period, early digital computers were being developed, and there were efforts to create centralized facilities to house these machines and support their operation.

The history of data centre began to written

- 1950's-60's: Early computing began in large mainframe environments, often dedicated rooms within co-operate or government buildings.

These systems were expensive and largely primarily used by large organizations.

- 1970's: The advent of mini-computers and early networking led to the need for more structured environments. Organizations started to design specialized space for server but they were still relatively small.

- 1980's: With the rise of personal computing and local area network (LANs) data centre grew in importance. Companies begin investing in more robust infrastructure, including dedicated cooling system.

- 1990's: The internet boom spurred the creation of larger data centers, often referred as "server farms". Companies like AOL and eBay expanded rapidly, requiring more sophisticated facilities.

- 2000's: Virtualization technology emerged, allowing for more efficient use of physical hardware. This decade also saw rise, where multiple businesses could share data centre resources.

2010's: Cloud Computing transformed the landscape, with major providers like Amazon web Service (AWS), Google Cloud and Microsoft Azure Building massive, scalable data centers.

2020's: Edge Computing and AI are shaping data centre design, pushing for lower latency and greater efficiency.

HISTORY

→ 1950's - 1960's

→ 1970's

→ 1980's

→ 1990's

→ 2000's

→ 2010's

→ 2020's

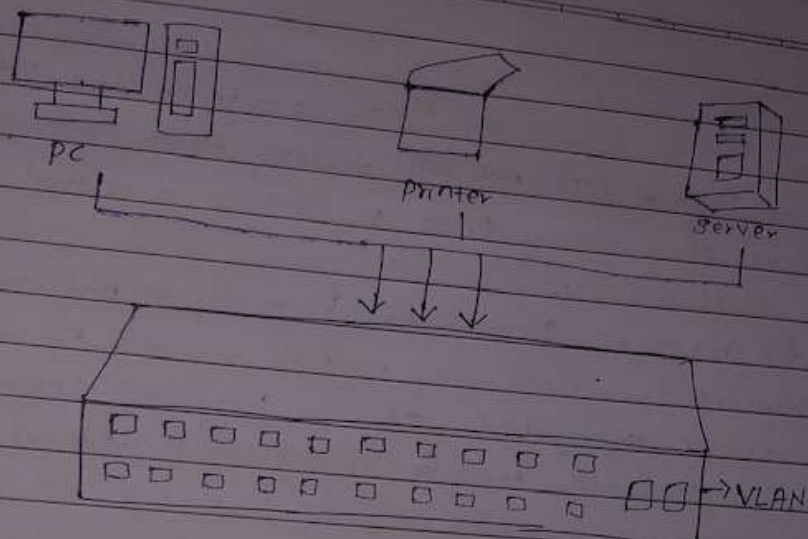
Q. VLAN'S & VRF'S.

Ans. • VLAN'S.

A VLAN is a logical grouping of networks resources connected to administratively defined ports. VLAN'S break a large broadcast domain into smaller broadcast domain. Each VLAN creates an separate broadcast domains.

A LAN is connected to a single Ethernet Network. A broadcast message is message that reaches all devices in network. Devices use broadcast message to perform many essential tasks. The more devices you add to a network, the more broadcast msg it will have. Broadcast messages reduces network performance.





Ex: Imagine an office with a single switch configured with three VLANs: Sales (VLAN 10), HR (VLAN 20) & IT (VLAN 30)

### (i) Assigning Devices

Comp & Printer in Sales Dept are connected to ports 1-10 (VLAN 10)

HR Dept devices are connected to ports 11-20 (VLAN 20)

IT Dept devices are connected to ports 21-30 (VLAN 30)

### (ii) Data Transmission

When a sales comp needs a data packet the switch tags it with VLAN 10. The switch forwards the tagged packet only to devices on ports 1-10.

(iii) If sales comp need to communicate with an HR com, the packets is routed through a router or Layer 3 switch.

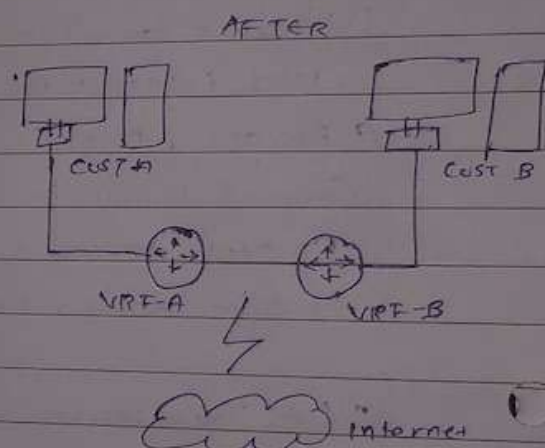
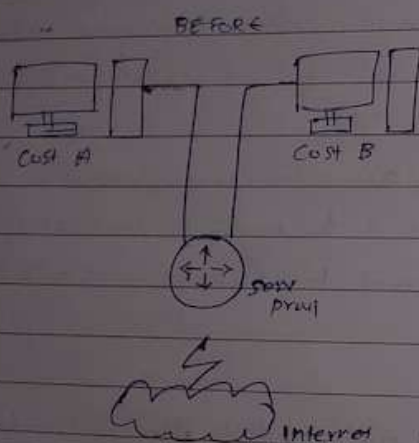
This way, VLANs enhance network efficiency, security & manageability by logically segmenting the physical network.

## • VRF'S

Virtual Router Forwarding (VRF) is a technology included in Internet Protocol (IP) network routers that enables multiple instances of a routing table to exist in a virtual router and work simultaneously.

This further increases connectivity by enabling network path to be segmented without using multiple devices. Because traffic is automatically segregated, VRF also increases network security and can eliminate need for encryption & Authentication.

### BEFORE VS AFTER OF VRF



VRF provides a path to configure multiple routing instances on either a router or Layer 3 switch. The purpose is to keep customer traffic and routing separate but through same hardware.

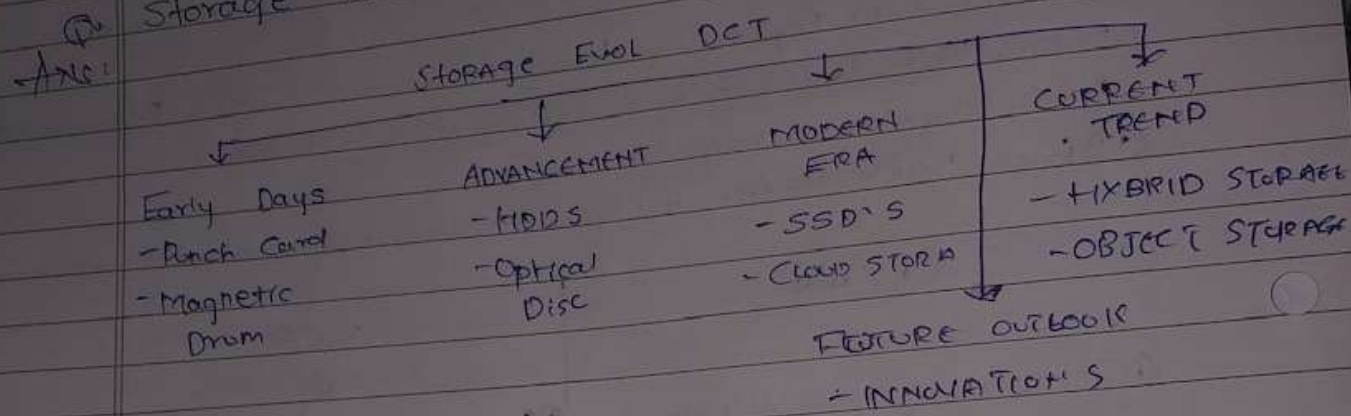
Ex: Imagine a company with 2 Depts. Engineering and marketing. The company wants to keep the network traffic of these Dept separate for security and performance reason.



- ① The network admin configures 2 VRF instance on company's router
- ② Traffic from Engineering department is routed using Engineering-VRF routing table. Traffic from marketing team is routed using marketing-vrf routing table.
- ③ Each Dept's traffic is separate, ensuring no Crossover interference

VLAN	VRF
① Separates a physical network into multiple logical network at Layer 2 (Data Link)	① Creates multiple logical routing tables on a single router at Layer 3 (Network Layer)
② Isolate network traffic within same switch	② with same router
③ Implemented on switcher, where each LAN is assigned a unique identifier (VLAN ID)	③ Implemented on Router's, where each VRF instance has its own routing table.
④ Segments broadcast Domains	④ Routing Tables
⑤ Ex: VLAN 100 for sales, 20 for HR, 30 for IT Dept's, devices can common only within their VLAN unless routed by Layer 3 device	⑤ Ex: Cust A-VRF & Cust B-VRF each Cust traffic is routed independently, ensuring complete separation

## Storage Evolution in DCT



Over the years, data centers have evolved into powerful storage hubs, driven by advancements. The evolution of storage in data centre is been growned rapidly, marked by significant technological advancements and innovation.

### ① EARLY DAYS

#### ① Punch Cards:

In early 18th century, punch cards were used to store data through punch patterns. They were widely used in computers for data input and storage.

Ex: Imagine using an punched paper cards to store data. They were used in early computers for tasks like payroll.

### ② ADVANCEMENT

#### ① HDD

Hard Disk Drive pictures a spinning disk where data is stored



magnetically. These drives are like the ones in desktop computers or older laptops.

#### ② Optical Disc

A CD or DVD where data is stored in form of tiny pits on the disc surface. You might have used CD/DVD to store music & movies.

Ex:

#### ③ Modern ERA:

##### ① SSD

Solid State Drive, which uses flash memory, became popular in 2000's due to its superior performance, lower latency and faster data access speeds.

Ex: Think of fast, silent storage in modern laptops, with no moving parts using flash memory.

##### ② Cloud Storage

Think of storing your photos and documents on internet instead of your computer. Services like Google Drive, or DropBox allow you to access your files from anywhere with an internet connect.

#### ④ CURRENT TREND:

##### ① Hybrid Storage

Imagine combining SSD & HDD, SSD for speed & HDD for capacity in a single system. Your computer might use SSD for operating system and performing tasks while HDD for storing large data & files.

### ④ Object Storage:

Picture a system that stores data as an object, which include metadata and a unique identifier. This ideal for unstructured data like media files.  
Ex: Amazon S3.

### ⑤ Current Trends Future Outlook

#### ① Hybrid Storage:

#### ② Future outlook

Innovations of Sustainability.

Envision even faster storage technologies like HVMee - (Non Volatile Memory Express), which provides high speed data access over a PCIe interface.

Think about energy-efficient storage solution that will reduce power consumption.