1. What is the job of STP in a network? Why is it important?

STP (Spanning Tree Protocol) is a network protocol used to prevent loops in Ethernet networks that have redundant paths. Its main job is to ensure a loop-free topology in a network with multiple switches by selectively blocking some redundant links while keeping others active.

Why is STP Important?

1. **Prevents Network Loops** – Without STP, redundant paths in a network could cause endless loops, leading to broadcast storms and network congestion.
2. **Ensures Redundancy** – It blocks redundant links to prevent loops but keeps them as backup paths in case the active link fails.
3. **Improves Network Stability** – STP helps maintain consistent data flow by preventing multiple copies of packets from circulating endlessly.
4. **Prevents MAC Table Corruption** – Loops can cause switches to receive the same frame multiple times, corrupting their MAC address tables.

2. What is VLAN routing? Why do we need it in a network?

What is VLAN Routing?

VLAN (Virtual Local Area Network) routing is the process of enabling communication between different VLANs in a network. Since VLANs segment a network at Layer 2 (Data Link Layer), devices in different VLANs cannot communicate directly. To allow communication between them, **inter-VLAN routing** is required, which operates at Layer 3 (Network Layer) using a router or a Layer 3 switch.

Why Do We Need VLAN Routing?

1. **Inter-VLAN Communication** – VLANs isolate network traffic for security and efficiency, but sometimes devices in different VLANs need to communicate (e.g., HR and Finance departments). VLAN routing enables this communication.
2. **Better Network Management** – It allows network admins to logically segment the network while still maintaining controlled interaction between different segments.
3. **Improved Security** – By restricting communication between VLANs, unauthorized access can be minimized, and sensitive data can be protected.
4. **Optimized Performance** – VLANs reduce broadcast traffic, and VLAN routing ensures only necessary traffic is forwarded, preventing unnecessary congestion.
5. **Scalability** – As networks grow, VLAN routing helps in efficient traffic management without overloading a single VLAN.

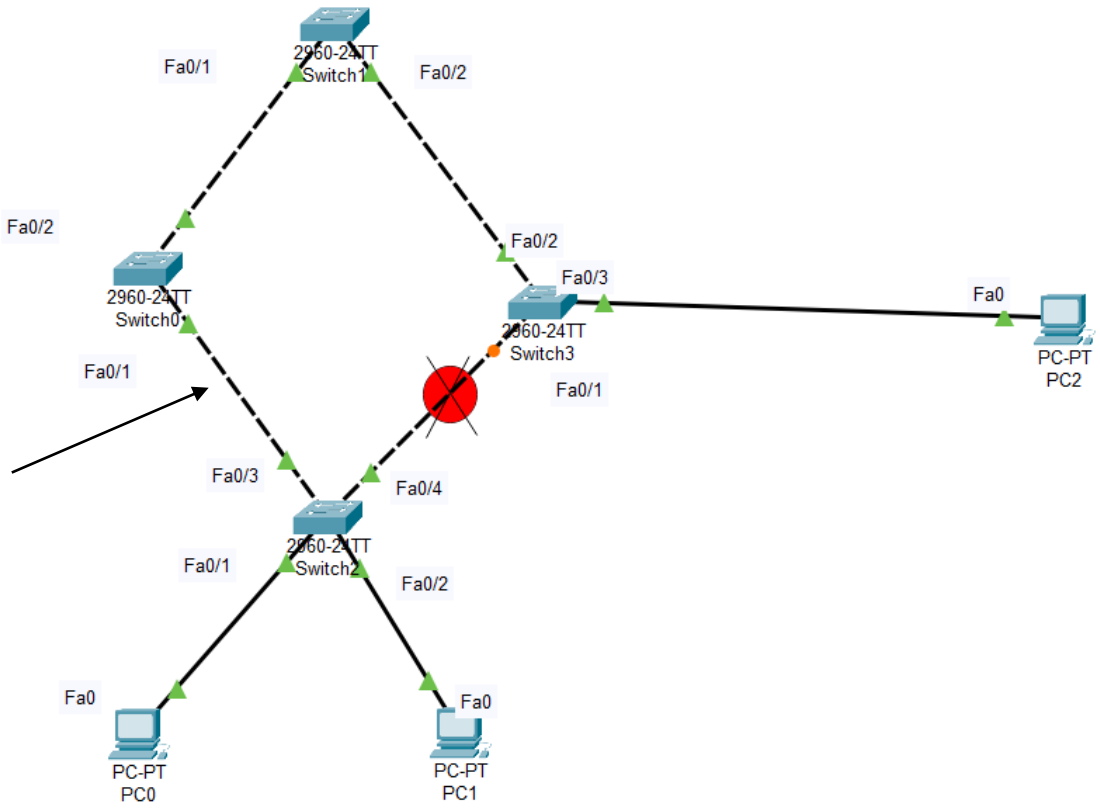
How VLAN Routing is Achieved?

- **Router-on-a-Stick** – A single router interface with subinterfaces for each VLAN, using trunking to route traffic.
- **Layer 3 Switch** – A switch with routing capabilities that allows faster inter-VLAN communication without needing a separate router.

3. In a network with four switches forming a loop, illustrate how STP prevents broadcast storms. Include a diagram and label the Root Bridge, Designated Ports, and Blocked Ports.

How STP Prevents Broadcast Storms in a Loop?

1. **Root Bridge Election** – STP selects one switch as the **Root Bridge** (the switch with the lowest Bridge ID). All paths are calculated based on this root.
2. **Path Cost Calculation** – STP assigns costs to links based on bandwidth, selecting the shortest path to the Root Bridge.
3. **Port Roles Assignment** –
    - **Root Ports (RP)**: The best path from a switch to the Root Bridge.
    - **Designated Ports (DP)**: The best forwarding port on each segment.
    - **Blocked Ports (BP)**: Redundant ports that STP disables to prevent loops.



Jya arrow che tya khali Root Bridge lakhi nakhjo and Jya red circle che tya Blocked Port

4. What is VTP? Explain its main purpose in a network with multiple switches.

What is VTP (VLAN Trunking Protocol)?

VTP (VLAN Trunking Protocol) is a Cisco proprietary protocol used to manage VLAN configurations across multiple switches in a network. It allows network administrators to **centrally configure, add, delete, or rename VLANs** and automatically propagate these changes to all connected switches, ensuring consistency.

Main Purpose of VTP in a Network with Multiple Switches

1. **Simplifies VLAN Management** – Instead of configuring VLANs individually on each switch, VTP propagates VLAN changes automatically.
2. **Ensures VLAN Consistency** – Prevents misconfigurations by ensuring all switches in the same VTP domain have the same VLAN information.
3. **Reduces Administrative Overhead** – Saves time and effort for network administrators by managing VLANs from a single switch (VTP Server).
4. **Supports Dynamic VLAN Propagation** – When a VLAN is added or modified on the **VTP Server**, all switches in the same domain update their VLAN database automatically.