Topology Description

.My topology simulates an organizational network resembling google.com

:General Overview

The network is divided into three separate networks, each further divided into three VLANs. The .organizational network is connected to an Internet Service Provider (ISP), enabling internet access

:Configurations, Protocols, and Network Settings

:VLAN Configurations

- **Subnetting:** I assigned IP addresses to each VLAN based on the number of computers in the network. Three addresses were reserved for fixed purposes: **Network ID, Default Gateway, .and Broadcast**
- Each host in the VLANs was assigned an appropriate **IP address, Subnet Mask, and .Default Gateway**
- **Access Ports:** Every port associated with a VLAN was set to **Access mode** to create a local .network segmented into smaller sub-networks

:VTP (VLAN Trunking Protocol)

- This protocol enables **centralized VLAN management.** One switch is configured as a **.server**, while others act as **clients**
- The **server** distributes VLAN configurations to all switches within the same VTP domain.
- Changes can only be made on the **server**, while **client switches** receive the configurations .but cannot modify them

:Trunking

- I configured **trunk connections** between switches and routers, allowing multiple VLANs to .pass through the same interface
- Trunk links enable traffic from multiple VLANs to flow through a single connection while **.**maintaining traffic isolation using **tagging**

:STP (Spanning Tree Protocol)

- .Prevents network loops (**Broadcast Storms**) by managing switch connections intelligently
- Instead of entirely blocking redundant ports, **STP optimizes traffic flow** by balancing loads **.**across links and placing some ports in **Standby mode**
- The selection of which port remains in **Standby** depends on two criteria: **Priority** and **MAC .Address**
- By default, all switches have the same priority, and if unchanged, the switch with the **lowest .MAC address** becomes the **Root Bridge**
- Ports on the **Root Bridge** always remain **active**, and all traffic passes through them. **.Standby** ports activate only when needed, ensuring **high availability and efficiency**

:Router On A Stick

- To enable communication between VLANs, I configured a **router with sub-interfaces**.
- The router's **main physical interface** was divided into multiple **sub-interfaces**, each assigned an IP address serving as the **Default Gateway** for its respective VLAN.
- This setup enables **Inter-VLAN Routing**, where the router directs traffic between different VLANs through a **single physical interface**.

:Routing Configurations

:WAN Network Setup

- To allow communication between different VLAN networks, **routers were interconnected and configured accordingly**.
- **IP Addresses:** I used **/30 subnetting**, which provides **4 IP addresses per router connection**:
  - One for the **Network ID**,
  - One for **Broadcast**,
  - Two for the **router interfaces**.

:OSPF (Open Shortest Path First)

- OSPF is a **dynamic routing protocol** that selects paths based on **Cost**, which is determined by **bandwidth**.
- OSPF uses three main tables:
  1. **Neighbor Table** (directly connected routers),
  2. **Topology Table** (all possible routes),
  3. **Routing Table** (most efficient route).
- All routers are in **Area 0 (Backbone Area)**, which serves as the core of the network.

:DR & BDR (Designated Router & Backup Designated Router)

- **DR (Designated Router):** Distributes updates to other routers, reducing network overhead.
- **BDR (Backup Designated Router):** Takes over if the DR fails.
- DR selection is based on **Priority**; if equal, the **Router ID** is used:
  - **Manually configured** Router ID
  - **Highest Loopback address**
  - If no Loopback, the **highest physical interface IP address** is used.

:ABR & ASBR

- **ABR (Area Border Router):** Connects different OSPF areas (**Not applicable here, as only Area 0 exists**).
- **ASBR (Autonomous System Boundary Router):** Connects the network to the **ISP**.

:Default Route

- I configured a **default route** for internet access through the ISP-connected router (**ASBR**).
- This router forwards all **non-internal** traffic to the ISP using **static routing.**

:Additional Protocols

:DHCP (Dynamic Host Configuration Protocol)

- Assigns **dynamic IP addresses** to network devices.
- Each router functions as a **DHCP server** for its connected VLANs.
- **DHCP Pools** define address ranges, and a **Default Gateway** is set so devices know where to obtain an IP address.

:SSH (Secure Shell)

- Enables **secure remote access** to network devices.
- I created **user accounts** with encrypted passwords (**secret**) and generated **1000-bit RSA keys** for encryption.
- SSH operates with **privilege levels (0-15)** for controlled access.

:Dynamic NAT (Network Address Translation)

- Translates **private IP addresses** to **public IP addresses** for internet access.
- Enhances **security** by masking internal addresses and helps **conserve IPv4 addresses.**
- The router dynamically assigns **public addresses** from a **predefined pool,** allowing multiple internal devices to share a **single public IP.**

:Summary

This topology simulates an **organizational network** with **VLAN segmentation, dynamic routing via OSPF, VLAN management using VTP, and security mechanisms such as SSH and NAT.**