

Cisco Network Administration

**Project Report**

**Small Office Network Topology**

***Semester One Recap - CCNA Introduction to Networks***

**Team members**

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**Project Overview**

**This project serves as a comprehensive recap of the concepts and practical skills learned in the first semester of the CCNA Introduction to Networks curriculum. The network topology includes:**

* **Three routers**
* **Multiple switches**
* **Multiple VLANs, including a Voice VLAN**
* **Router-on-a-stick configuration**
* **Subnetting**
* **DHCP implementation**
* **Default and dynamic routing (OSPF)**
* **Relay agent configuration**
* **EtherChannel**
* **PortFast**
* **Port Security**

**Network Topology Description**

**The network is divided into three main segments:**

* **Router 1 Segment: Connected to a switch with four VLANs, including a Voice VLAN, using a router-on-a-stick configuration.**
* **Router 2 Segment: Connected to three switches, each representing a subnet derived from the 172.16.1.X network.**
* **Router 3 Segment: Added to enhance network scalability and improve routing efficiency.**
* **Inter-Router Communication: The three routers are interconnected using subnets with only 4 available IPs for efficient IP address utilization.**
* **EtherChannel: Implemented between switches to improve bandwidth and redundancy.**

**Network Design and Implementation**

**Router 2 Configuration**

**VLAN Implementation:**

* **VLAN 10: Room 22**
* **VLAN 20: Room 23**
* **VLAN 30: Room 24**
* **VLAN 40: Voice**

**Router-on-a-Stick Configuration:**

* **Sub-interfaces were configured on Router 2 to enable inter-VLAN communication.**
* **Each sub-interface was assigned an IP address within its respective VLAN.**

**Switch Configuration:**

* **VLANs were created and assigned to specific switch ports.**
* **VLAN Trunking Protocol (VTP) was configured where applicable.**
* **PortFast was enabled to speed up port transitions to forwarding mode.**
* **Port Security was configured to restrict unauthorized devices.**

**IP Assignment:**

* **Static IP addresses were assigned to each VLAN interface on Router 2.**

**Voice VLAN:**

* **A dedicated VLAN for VoIP communication was created to prioritize voice traffic.**

**Router 1 Configuration**

**Subnetting:**

* **The 172.16.1.X network was subnetted into 4 subnets.**
* **Each subnet has a specific range and is assigned to:** 
  + **Switch 1-1: Subnet 1**
  + **Switch 2-1: Subnet 2**
  + **Switch 3-1: Subnet 3**

**DHCP Server:**

* **A DHCP server is connected to Subnet 1.**
* **It is configured to distribute IP addresses to devices in Subnet 1, Subnet 2, and Subnet 3.**

**Relay Agent Configuration:**

* **Router 1 acts as a DHCP relay agent for Subnet 2 and Subnet 3, forwarding DHCP requests to the DHCP server.**

**Inter-Router Communication**

**Subnetting:**

* **Small subnets with 4 available IP addresses were created for the connections between the three routers.**
* **This ensures efficient utilization of IP addresses.**

**Routing:**

* **OSPF dynamic routing was implemented among the three routers to ensure seamless communication between all subnets.**
* **Default routing was also used where necessary.**

**IP Addressing Scheme**

| **Subnet** | **Network ID** | **First IP (Gateway)** | | **Last IP** | **Broadcast** | **Subnet Mask** |
| --- | --- | --- | --- | --- | --- | --- |
| **Subnet 1** | **172.16.1.0** | **172.16.1.1** | | **172.16.1.62** | **172.16.1.63** | **255.255.255.192** |
| **Subnet 2** | **172.16.1.64** | **172.16.1.65** | | **172.16.1.126** | **172.16.1.127** | **255.255.255.192** |
| **Subnet 3** | **172.16.1.128** | **172.16.1.129** | | **172.16.1.190** | **172.16.1.191** | **255.255.255.192** |
| **Subnet 4** | **172.16.1.192** | | **172.16.1.193** | **172.16.1.254** | **172.16.1.255** | **255.255.255.192** |

**VLAN Information**

| **VLAN ID** | **VLAN Name** | **Purpose** | **Network ID** | **Prefix** |
| --- | --- | --- | --- | --- |
| **10** | **Room 22** | **Data traffic** | **192.168.10.0** | **/24** |
| **20** | **Room 23** | **Data traffic** | **192.168.20.0** | **/24** |
| **30** | **Room 24** | **Data traffic** | **192.168.30.0** | **/24** |
| **40** | **Voice** | **Voice communication** | **192.168.40.0** | **/24** |

**DHCP Configuration**

**DHCP Server:**

* **DHCP pools were created to distribute IP addresses for Subnet 1, Subnet 2, and Subnet 3.**

**DHCP Relay Agent:**

* **Router 2 was configured to forward DHCP requests for Subnet 2 and Subnet 3 to the DHCP server on Subnet 1.**

**Routing Configuration**

**Dynamic Routing:**

* **OSPF was implemented among the three routers for better scalability and dynamic route updates.**

**Default Routing:**

* **Default routes were configured on all routers to enable communication between all subnets.**

**Summary**

**This project demonstrates the implementation of VLANs, router-on-a-stick, DHCP, subnetting, inter-router communication using OSPF, and security features. Key highlights include:**

* **Efficient IP address utilization through subnetting.**
* **Configuration of VLANs, including a dedicated Voice VLAN.**
* **Router-on-a-stick implementation to enable inter-VLAN communication.**
* **DHCP server setup with relay agent configuration to serve multiple subnets.**
* **OSPF dynamic routing for improved network performance across three routers.**
* **EtherChannel for increased bandwidth and redundancy.**
* **PortFast and Port Security for enhanced switch security and performance.**

**This project reinforces foundational networking concepts and provides hands-on experience in designing and configuring a functional network topology.**

**Conclusion**

**This project served as an excellent recap of the first semester of the CCNA curriculum, applying theoretical knowledge to practical networking scenarios. It highlights the importance of proper network design, VLAN management, router-on-a-stick, IP addressing, OSPF dynamic routing, and network security in building scalable and efficient networks.**