Small Network Infrastructure Configuration Project

# Project Title

Small Network Infrastructure Configuration

# Objective / Problem Statement

The objective of this project was to build a small structured and secure network using both Layer 2 and Layer 3 networking features. Working in a simulated lab environment, I created VLANs to segment traffic, set up inter-VLAN routing, configured DHCP to automatically assign IP addresses, applied QoS to prioritize voice traffic, and added wireless access with a Wireless Access Point. I tested and verified all hosts have connectivity and can ping other hosts and the internet, verified phones can make inbound and outbound calls.

# Project Scope

**Included:**

* Configuration of two switches
* Configuration of one router with Inter-VLAN routing and DHCP
* VLAN creation and assignment of access ports for data, voice, and management traffic
* QoS setup to prioritize VoIP traffic
* Wireless Access Point configuration and client connectivity
* Setup and verification of user devices and IP phones

**Not Included:**

* Configuration of the internet-facing router (ISP connection was preconfigured in the lab)
* External firewall implementation or advanced security hardening

# Tools & Technologies Used

* Cisco Packet Tracer
* Cisco Catalyst Switches and Router
* IP Phones and Wireless Access Point
* Basic PC endpoints and Tablet PC

# Step-by-Step Implementation

1. Configure Core Switch, LabCore-SW1
   1. Basic Configuration
      1. clock set hh:mm:ss DD MONTH YYYY
      2. hostname -SW1
      3. enable secret LabCorepass
      4. interface vlan 100
      5. ip address 192.168.100.251 255.255.255.0
      6. ip default-gateway 192.168.100.1
      7. username netadmin password LabC0re!Net
      8. service password-encryption
      9. line console 0
      10. login local
      11. ip access-list standard VTY
      12. permit 192.168.100.0 0.0.0.255
      13. line vty 0 15
      14. login local
      15. access-class VTY in
   2. Configure SSH and Disable Telnet
      1. ip domain-name labcore.local
      2. crypto key generate rsa
         1. *Modulus: 2048*
      3. ip ssh version 2
      4. line vty 0 15
      5. transport input ssh
      6. transport output ssh
   3. Configure Spanning-Tree Root Bridge
      1. spanning-tree vlan 1-1024 priority 0
   4. Create VLANs
      1. vlan 100
      2. name MGMT
      3. vlan 200
      4. name DATA
      5. vlan 150
      6. name VOICE
   5. Configure Access Ports
      1. interface fa0/1
      2. description NOC-PC
      3. switchport mode access
      4. switchport access vlan 100
      5. spanning-tree portfast
      6. *\*You can connect the NOC-PC to LABCORE-SW-1 port fa0/1 at this point for testing*
      7. interface range fa0/2-23
      8. description Access Port
      9. switchport mode access
      10. switchport access vlan 200
      11. switchport voice vlan 150
      12. spanning-tree portfast
      13. mls qos trust cos
      14. mls qos trust device cisco-phone
   6. Turn on mls qos
      1. mls qos
   7. Configure Trunk to Router
      1. interface fa0/24
      2. description Trunk to Router
      3. switchport mode trunk
   8. Configure Trunks to LabCore-SW2
      1. interface range g0/1 – 2
      2. description Trunks to LabCore-SW2
      3. switchport mode trunk
2. Configure Second Switch, LabCore-SW2
   1. Basic Configuration
      1. clock set hh:mm:ss DD MONTH YYYY
      2. hostname LabCore-SW2
      3. enable secret LabCorepass
      4. interface vlan 100
      5. ip address 192.168.100.252 255.255.255.0
      6. ip default-gateway 192.168.100.1
      7. username netadmin password LabC0re!Net
      8. service password-encryption
      9. line console 0
      10. login local
      11. ip access-list standard VTY
      12. permit 192.168.100.0 0.0.0.255
      13. line vty 0 15
      14. login local
      15. access-class VTY in
   2. Configure SSH and Disable Telnet
      1. ip domain-name labcore.local
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      5. transport input ssh
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   3. Create VLANs
      1. vlan 100
      2. name MGMT
      3. vlan 200
      4. name DATA
      5. vlan 150
      6. name VOICE
   4. Configure Access Ports
      1. interface range fa0/1 - 24
      2. description Access Port
      3. switchport mode access
      4. switchport access vlan 200
      5. switchport voice vlan 150
      6. spanning-tree portfast
      7. mls qos trust cos
      8. mls qos trust device cisco-phone
   5. Turn on mls qos
      1. mls qos
   6. Configure Trunks to LabCore-SW1
      1. interface range g0/1 - 2
      2. description Trunks to LabCore-SW1
      3. switchport mode trunk
   7. Save the configuration on both switches if you have not yet done so (LABCORE-SW1 & SW2)
      1. #copy running-config startup-config
      2. f. Using a crossover cable connect LABCORE-SW1 G0/1 and G0/2 to LABCORE-SW2 G0/1 and G0/2
3. Configure LabCore-RTR with Inter-VLAN routing, DHCP, & Internet Services
   1. Configure Interface G0/0 for Inter-VLAN routing for the Mgmt, Data, & Voice VLANs
      1. interface g0/0
      2. no shutdown
      3. description Trunk to LabCore-SW1
      4. interface g0/0.100
      5. description MGMT
      6. encapsulation dot1q 100
      7. ip address 192.168.100.1 255.255.255.0
      8. ip nat inside
      9. interface g0/0.200
      10. description DATA
      11. encapsulation dot1q 200
      12. ip address 192.168.200.1 255.255.255.0
      13. ip nat inside
      14. interface g0/0.150
      15. description VOICE
      16. encapsulation dot1q 150
      17. ip address 192.168.150.1 255.255.255.0
      18. ip nat inside
   2. b. Using a straight-through cable connect LABCORE-SW1 Fa0/24 to LABCORE-RTR G0/0
   3. \*All currently connected devices should now have Layer 3 connectivity to all VLANs
4. Configure DHCP Services for the Data VLAN
   1. ip dhcp pool DATA
   2. network 192.168.200.0 255.255.255.0
   3. default-router 192.168.200.1
   4. dns-server 8.8.8.8
   5. ip dhcp excluded-address 192.168.200.1 192.168.200.50
5. Add a Default Route for Internet Access
   1. ip route 0.0.0.0 0.0.0.0 205.10.49.33
6. Connect User A & User B to the Network
   1. a. Using a straight-through cable connect User A to LABCORE-SW1
   2. b. Verify the User A is configured as a DHCP client
   3. c. From the desktop of User A access the command prompt utility and perform the following
      1. ipconfig /all (to verify ip address obtained from DHCP server)
      2. ping 192.168.200.1 (to verify IP connectivity to Data gateway IP on LABCORE-RTR)
      3. ping 8.8.8.8 (to verify IP connectivity to the internet)
   4. Using a straight-through cable connect User B to LABCORE-SW2
   5. Verify the User B is configured as a DHCP client
   6. From the desktop of User B access the command prompt utility and perform the following
      1. ipconfig /all (to verify ip address obtained from DHCP server)
      2. ping 192.168.200.1 (to verify IP connectivity to Data gateway IP on LABCORE-RTR)
      3. ping 8.8.8.8 (to verify IP connectivity to the internet)
   7. \*User A and User B are now connected to the LAN and should be able to ping all network nodes and browse the internet to www.google.com using the web browser on the host desktops
7. Connect & Configure VoIP Phones
   1. Using a straight-through cable connect Phone A to LABCORE-SW1
   2. show running-config (on LABCORE-RTR, to verify ephone 1 is automatically added)
   3. Using a straight-through cable connect Phone B to LabCore-SW2
   4. show running-config (on LABCORE-RTR, to verify ephone 2 is automatically added)
8. Add Directory Numbers to the ephones on LabCore-RTR
   1. ephone-dn 1
   2. number 1001
   3. ephone-dn 2
   4. number 1002
   5. ephone 1
   6. button 1:1
   7. ephone 2
   8. button 1:2
   9. \*Phones A and B should now properly register and be able to make internal and external calls
9. Save your configuration
   1. copy running-config startup-config
10. Connect & Configure Wireless Access
    1. Using a straight-through cable connect the LabCore-WAP to port Fa0/23 on LabCore-SW1
    2. Add a description to the switchport on LabCore-SW1 to note the WAP is connected there and also clean up the interface configuration by removing the voice configurations.
11. Configure the Wireless SSID & WPA2 PSK on LabCore-WAP
    1. LabCore-WAP->Config->Port 1
    2. SSID: Core-Lab
    3. Authentication: WPA2 PSK: LabCore1
12. Configure the Tablet PC for wireless access
    1. Tablet-PC-> Config -> Wireless0
    2. SSID: Core-Lab
    3. WPA2 PSK: corelab1
    4. \*The Wireless Tablet PC should now be connected to the network, pull an address via DHCP, and have network and internet connectivity.

# Challenges and Solutions

* **IP Phones not registering:**
  + Manually configured MAC addresses for the phones
  + Verified switchport settings for voice VLAN and QoS configurations
  + Confirmed ephones were registered correctly on the router
* **VLANs not routing:**
  + Checked and corrected encapsulation settings on router sub-interfaces

# Project Outcomes / Results

Describe the results and whether the project met the initial objectives.

# Screenshots / Diagrams

Add relevant images, diagrams, or screenshots that show your setup or results.

# Conclusion / Lessons Learned

Successfully designed and configured a secure, segmented lab network with voice and wireless capabilities. Reinforced skills in trunking, VLANs, inter-VLAN routing, DHCP, SSH configuration, NAT, and switch/router CLI commands.

# GitHub or Project Link

If you have uploaded this project online, include the link here.