

NET 556 – Cisco Internetworking

Switching, Routing and Wireless Case Study

Saket Chahal

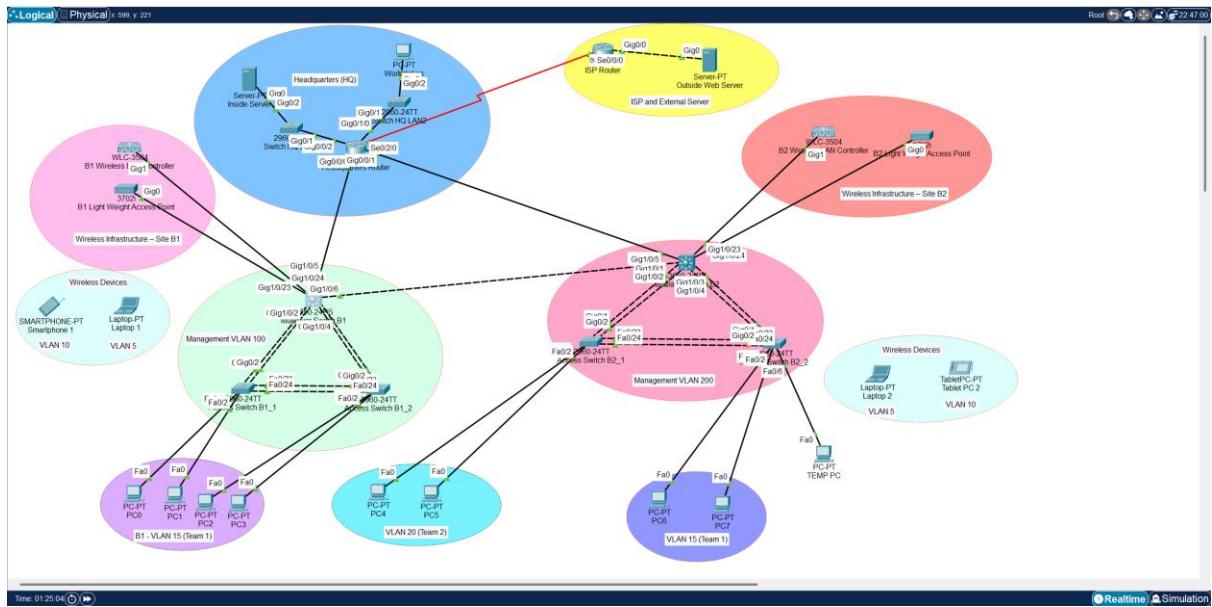
INTRODUCTION

This case study presents the comprehensive design, implementation, and configuration of a multi-site enterprise network infrastructure using Cisco equipment within Cisco Packet Tracer. It specifically addresses network segmentation using VLANs to logically separate different departments, subnets assigned through **Variable Length Subnet Masking (VLSM)** to optimize IP address utilization, and hierarchical design employing **multilayer switches (MLS)** for efficient routing and switching. Wireless technologies are integrated through Cisco **Wireless LAN Controllers (WLCs)** and **Lightweight Access Points (LWAPs)**, providing centralized management, seamless roaming capabilities, and enhanced security. Secure wireless connectivity is achieved by deploying WLANs configured with both **WPA2-Enterprise authentication**, leveraging **RADIUS servers** for robust user authentication, and WPA2-PSK protocols for simpler guest access. Additionally, internal **DHCP scopes** and **SNMP monitoring** are configured for **dynamic IP management** and proactive network administration, respectively. The effectiveness and reliability of the implemented network solutions are validated through rigorous connectivity and security tests within the simulated enterprise environment.

VLSM TABLE

| Subnet Purpose | Subnet Mask | Network ID | First Address | Last Address | Broadcast Address | Total Hosts | Total Usable Hosts | Subnetting Group |
|------------------|-----------------|---------------|---------------|---------------|-------------------|-------------|--------------------|------------------|
| | 255.255.252.0 | 10.70.4.0 | 10.70.4.1 | 10.70.7.254 | 10.70.7.255 | 1024 | 1022 | |
| B1 Team1 (Wired) | 255.255.255.0 | 10.70.4.0 | 10.70.4.1 | 10.70.4.254 | 10.70.4.255 | 256 | 254 | B1 vlan 1 |
| B1 Team2 (Wired) | 255.255.255.0 | 10.70.5.0 | 10.70.5.1 | 10.70.5.254 | 10.70.5.255 | 256 | 254 | B1 vlan 2 |
| B2 Team1 (Wired) | 255.255.255.128 | 10.70.6.0 | 10.70.6.1 | 10.70.6.126 | 10.70.6.127 | 128 | 126 | B2 vlan 1 |
| B2 Team2 (Wired) | 255.255.255.128 | 10.70.6.128 | 10.70.6.129 | 10.70.6.254 | 10.70.6.255 | 128 | 126 | B2 vlan 2 |
| HQ LAN1 | 255.255.255.192 | 10.70.7.0 | 10.70.7.1 | 10.70.7.62 | 10.70.7.63 | 64 | 62 | HQ lan 2 |
| HQ LAN2 | 255.255.255.192 | 10.70.7.64 | 10.70.7.65 | 10.70.7.126 | 10.70.7.127 | 64 | 62 | HQ Lan 1 |
| B1 Wireless S1 | 255.255.255.224 | 10.70.7.128 | 10.70.7.129 | 10.70.7.158 | 10.70.7.159 | 32 | 30 | Wireless Vlan 1 |
| B1 Wireless S2 | 255.255.255.224 | 10.70.7.160 | 10.70.7.161 | 10.70.7.190 | 10.70.7.191 | 32 | 30 | Wireless Vlan 2 |
| B2 Wireless S1 | 255.255.255.224 | 10.70.7.192 | 10.70.7.193 | 10.70.7.222 | 10.70.7.223 | 32 | 30 | wireless Vlan 3 |
| B2 Wireless S2 | 255.255.255.224 | 10.70.7.224 | 10.70.7.225 | 10.70.7.254 | 10.70.7.255 | 32 | 30 | wireless Vlan 4 |
| | | | | | | | | |
| | | | | | | | | |
| IP Address | Subnet Mask | CIDR Notation | Network ID | First Address | Last Address | Total Hosts | Total Usable Hosts | Subnetting Group |
| 172.16.70.0 | 255.255.255.252 | /30 | 172.16.70.0 | 172.16.70.1 | 172.16.70.2 | 4 | 2 | HQ to B1-MLS |
| 172.16.70.4 | 255.255.255.252 | /30 | 172.16.70.4 | 172.16.70.5 | 172.16.70.6 | 4 | 2 | HQ to B2-MLS |
| 172.16.70.8 | 255.255.255.252 | /30 | 172.16.70.8 | 172.16.70.9 | 172.16.70.10 | 4 | 2 | B1-MLS to B2-MLS |

TOPOLOGY



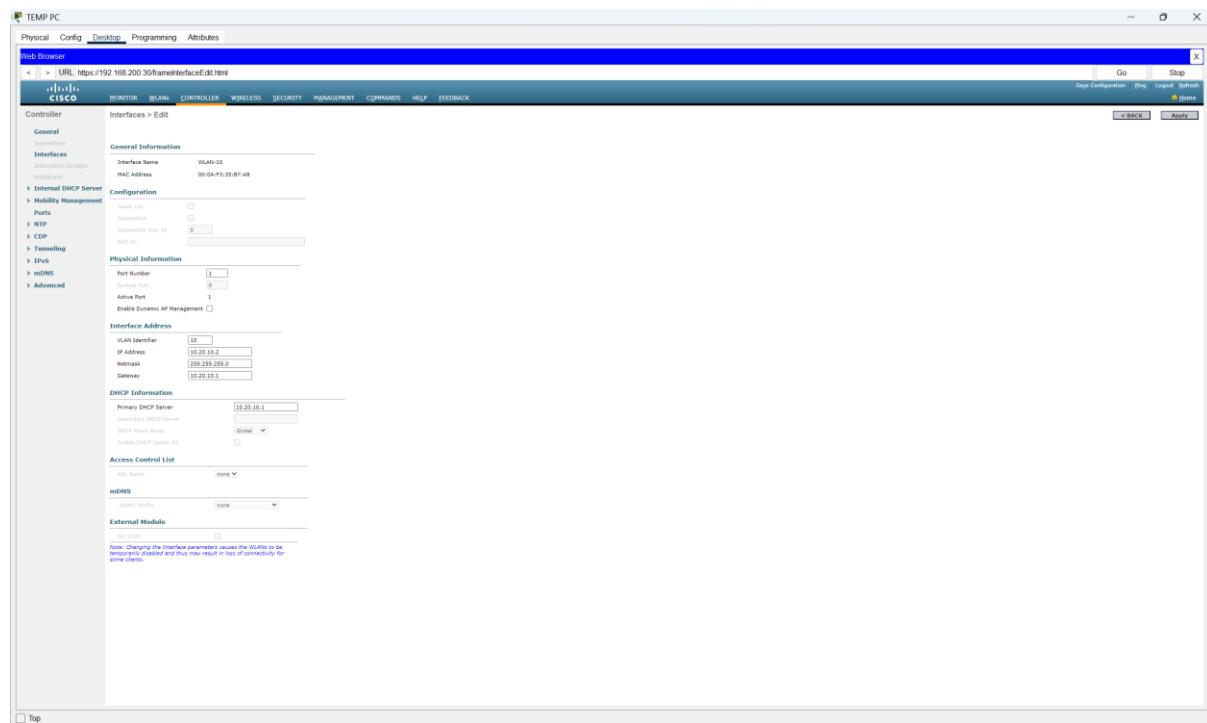
FEEDBACK

I was able to effectively apply theoretical networking concepts to a practical scenario, reinforcing my understanding of network design, VLAN segmentation, VLSM addressing, and wireless integration. Although certain challenges arose, such as configuring DHCP scopes with unique names, accurately setting up the internal RADIUS server, and correctly identifying LWAP device connections. I successfully overcame these by methodically troubleshooting and referencing provided materials. This project offered invaluable hands-on experience, highlighting areas for continued improvement, especially around detailed documentation and systematic configuration practices.

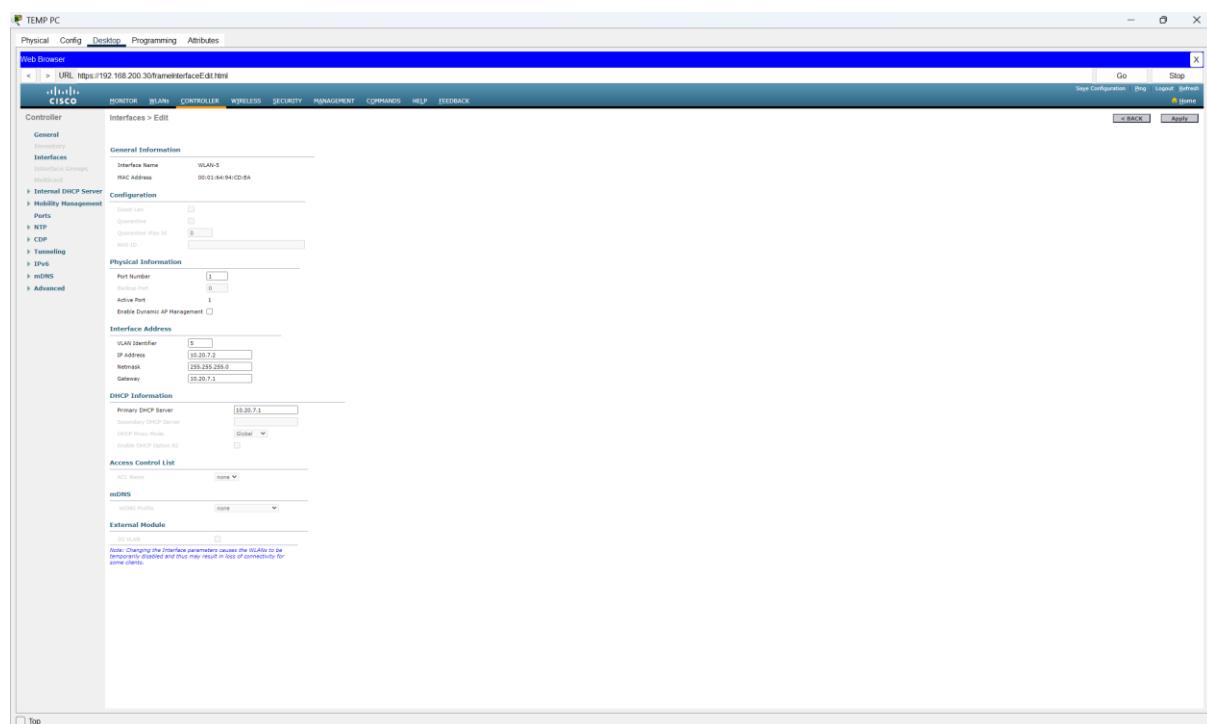
| Index | Description | Page |
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Controller WLAN 10 SS



CONTROLLER WLAN 5



RADIUS

The screenshot shows a Cisco management interface window titled "TEMP PC". The top navigation bar includes tabs for Physical, Config, Desktop, Programming, and Attributes, with "Desktop" being the active tab. Below the navigation is a "Web Browser" toolbar with back, forward, URL (https://192.168.200.30/frameRadiusEdit.html), Go, Stop, and a close button.

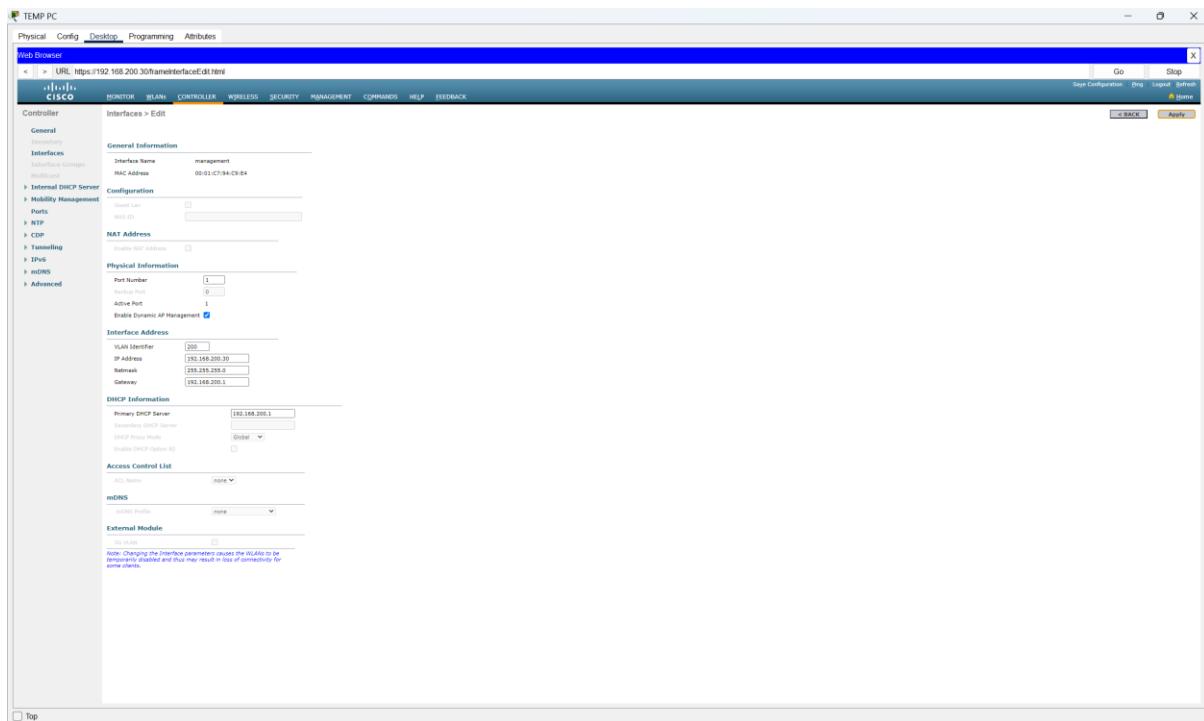
The main content area has a header "RADIUS Authentication Servers > Edit". On the left is a sidebar menu under "Security" containing sections for AAA, RADIUS, TACACS+, Local EAP, Priority Order, Certificate, Access Control Lists, Wireless Protection Policies, Web Auth, and Advanced. The "AAA" section is expanded, showing sub-options like General, RADIUS (Authentication, Accounting, Fallback, DNS, Downloaded AVP), and TACACS+ (LDAP, Local Net Users, MAC Filtering, Disabled Clients, User Login Policies, AP Policies, Password Policies).

The right side of the interface contains configuration fields:

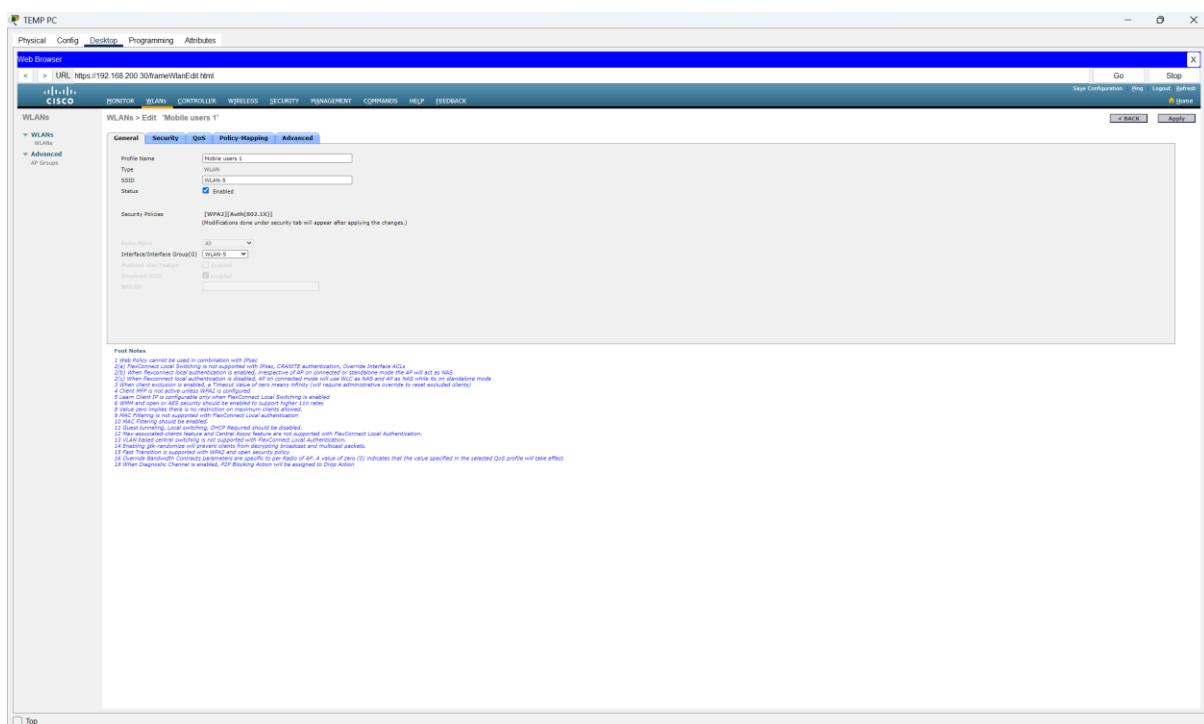
- Server Index:** 1
- Server Address(Ipv4/Ipv6):** 10.20.4.254
- Shared Secret Format:** ASCII (selected)
- Shared Secret:** (redacted)
- Confirm Shared Secret:** (redacted)
- Key Wrap:** (checkbox) (Designed for FIPS customers and requires a key wrap compliant RADIUS server)
- Port Number:** 1812
- Server Status:** Enabled
- Support for CoA:** Disabled
- Server Timeout:** 2 seconds
- Network User:** Enable (checkbox checked)
- Management:** Enable (checkbox checked)
- Management Retransmit Timeout:** 2 seconds
- Realm List:** (checkbox) (Enable)
- IPSec:** (checkbox) (Enable)

At the bottom left is a "Top" button.

MANAGEMENT



DHCP



MOBILE 1 USERS - WLAN 5

TEMP PC

Physical Config Desktop Programming Attributes

Web Browser URL https://192.168.200.30/frameDhcpScopeEdit.html X

CISCO MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK Home

Controller DHCP Scope > Edit < Back Apply

General Scope Name Wireless Management

Inventory Pool Start Address 192.168.200.240

Interfaces Pool End Address 192.168.200.249

Interface Groups Network 192.168.200.0

Multicast Netmask 255.255.255.0

Internal DHCP Server Lease Time (seconds) 86400

Mobility Management Default Routers 192.168.200.1 0.0.0.0 0.0.0.0

Ports DNS Domain Name Not Supported

NTP DNS Servers 0.0.0.0 0.0.0.0 0.0.0.0

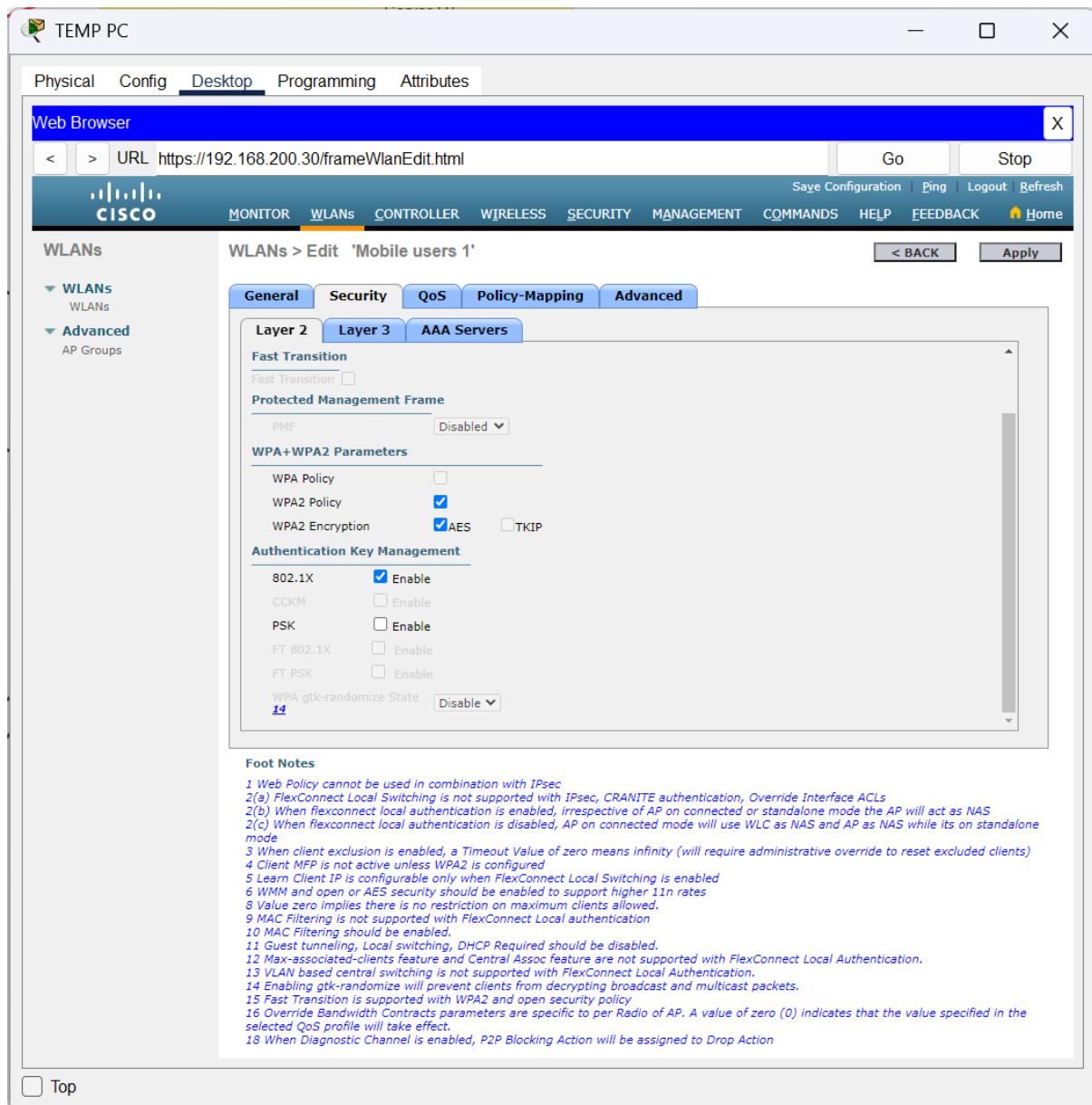
CDP Netbios Name Servers 0.0.0.0 0.0.0.0 0.0.0.0

Tunneling Status Enabled

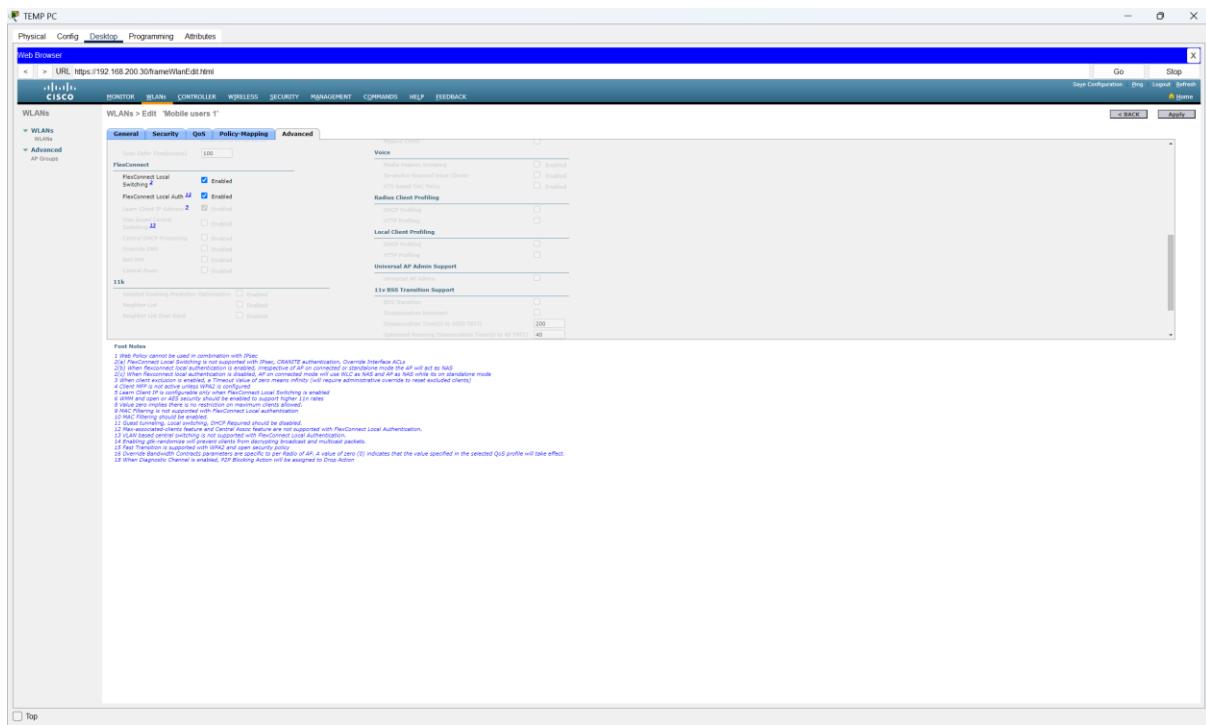
IPv6 mDNS Advanced

Top

MOBILE 1 USERS WLAN 5 SECURITY

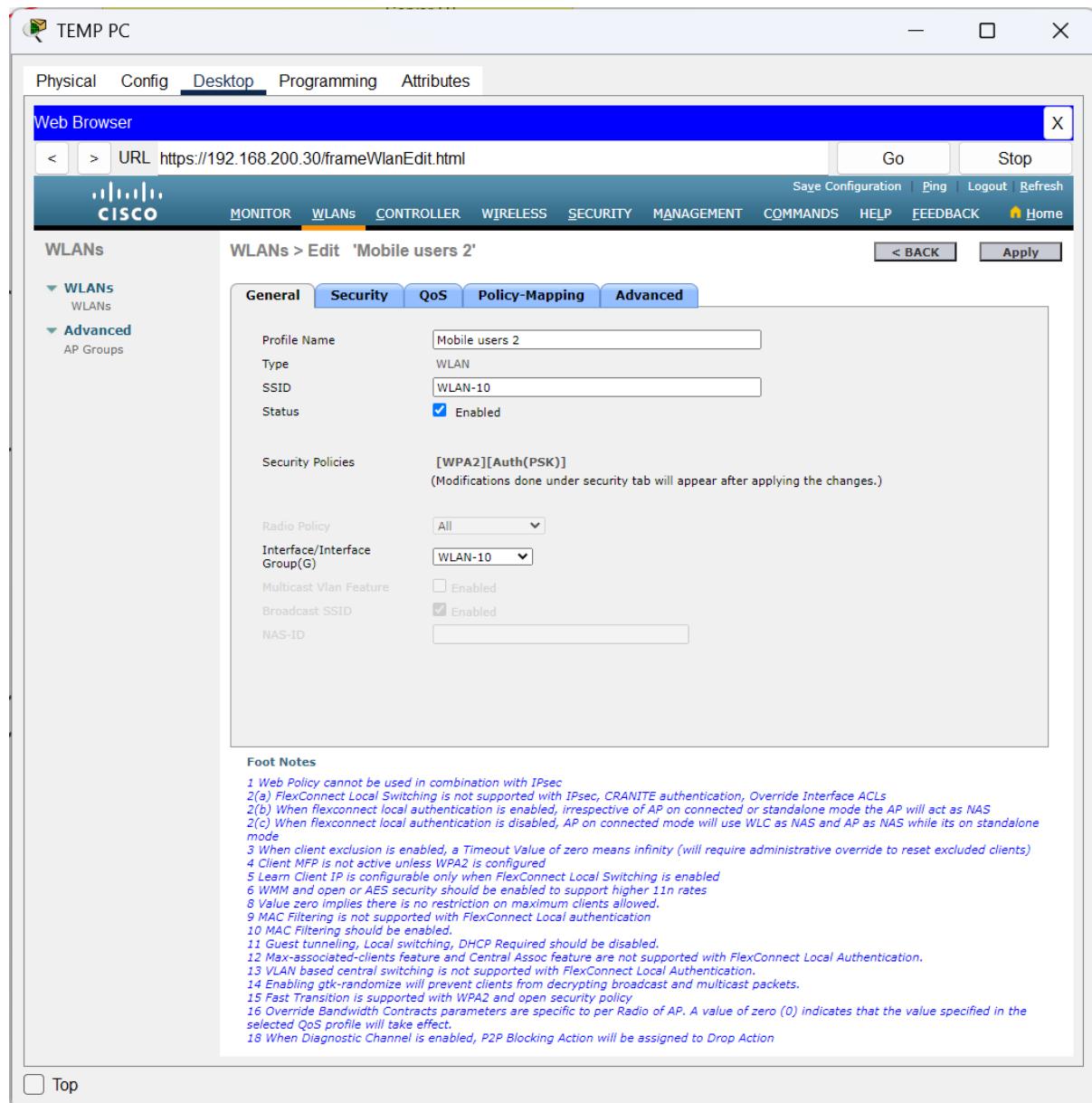


SECURITY AAA SERVER

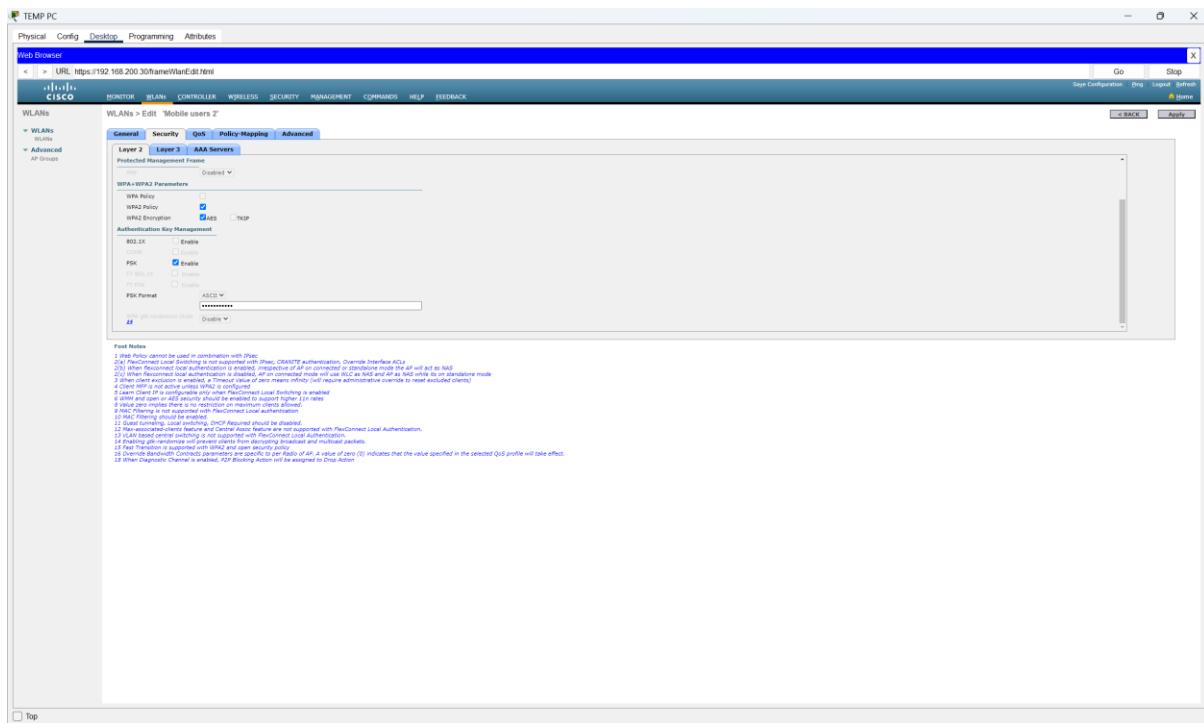


FLEX COLLECTING ENABLED

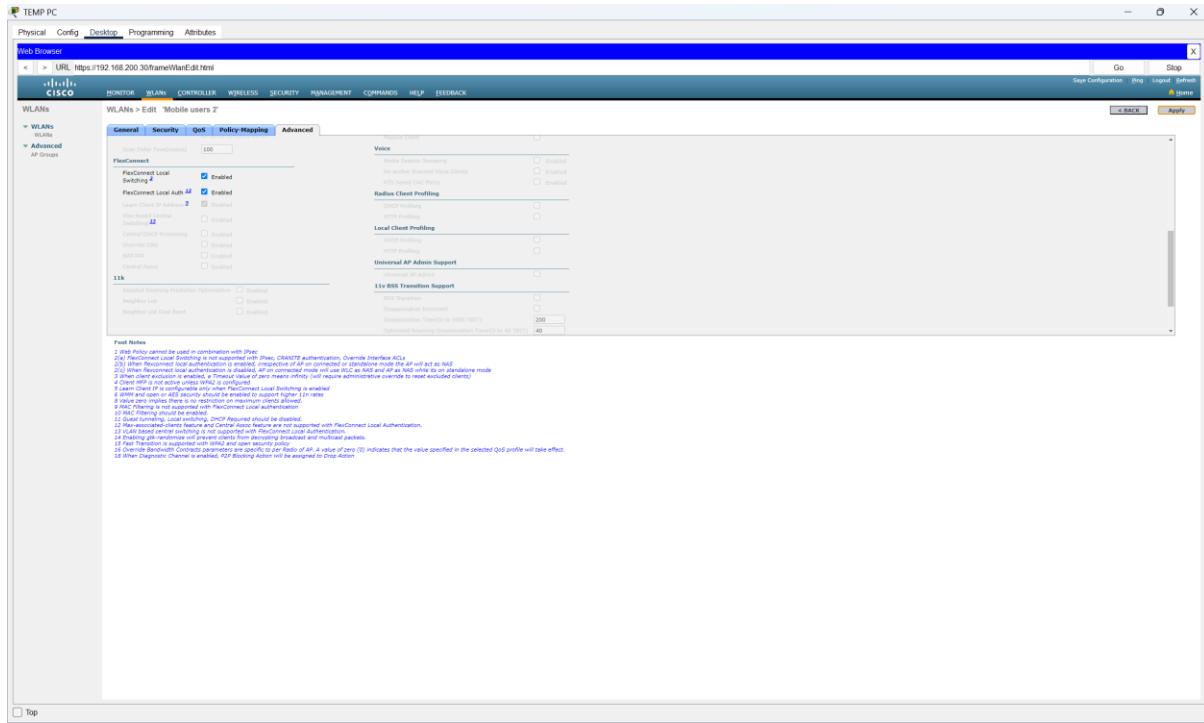
Wlan 10



WLAN 10 MOBILE USERS 2



LAYER 2 SECURITY



ADVANCED

ISP Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Cisco CISCO1941/K9 (revision 1.0) with 491520K/32768K bytes of memory.
Processor board ID FTX152400KS
2 Gigabit Ethernet interfaces
2 Low-speed serial(sync/async) network interface(s)
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
Unauthorized access prohibited

User Access Verification

Password:

ISP>show ip interface brief
Interface          IP-Address      OK? Method Status          Protocol
GigabitEthernet0/0  209.165.202.129 YES manual up           up
GigabitEthernet0/1  unassigned      YES unset   administratively down down
Serial0/0/0         209.165.201.1  YES manual up           up
Serial0/0/1         unassigned      YES unset   administratively down down
Vlan1              unassigned      YES unset   administratively down down
ISP>
```

Top

ISP ROUTER IP INTERFACE BRIEF

Multilayer Switch B1

Physical Config CLI Attributes

IOS Command Line Interface

```

GigabitEthernet0/0, GigabitEthernet0/1, GigabitEthernet0/2, GigabitEthernet0/3, GigabitEthernet0/4
GigabitEthernet1/0, GigabitEthernet1/1, GigabitEthernet1/2, GigabitEthernet1/3, GigabitEthernet1/4

5 wireless1          active
10 wireless2         active
15 team1             active
20 team2             active
100 fast-forward      active  GigabitEthernet0/23, GigabitEthernet0/24
1003 token-ring-default active
1005 token-ring-default active
1006 token-ring-default active
1008 token-ring-default active

Interface ip interface brief
Interface   IP Address    OK? Method Status   Protocol
Port-channel1  unassigned   YES unset up        up
Port-channel2  unassigned   YES unset up        up
GigabitEthernet0/0/1 unassigned   YES unset up        up
GigabitEthernet0/0/2 unassigned   YES unset up        up
GigabitEthernet0/0/3 unassigned   YES unset up        up
GigabitEthernet0/0/4 unassigned   YES unset up        up
GigabitEthernet0/0/5 172.16.20.9 YES manual up        up
GigabitEthernet0/0/6 172.16.20.9 YES manual up        up
GigabitEthernet0/0/7 unassigned   YES unset down     down
GigabitEthernet0/0/8 unassigned   YES unset down     down
GigabitEthernet0/0/9 unassigned   YES unset down     down
GigabitEthernet0/0/10 unassigned  YES unset down     down
GigabitEthernet0/0/11 unassigned  YES unset down     down
GigabitEthernet0/0/12 unassigned  YES unset down     down
GigabitEthernet0/0/13 unassigned  YES unset down     down
GigabitEthernet0/0/14 unassigned  YES unset down     down
GigabitEthernet0/0/15 unassigned  YES unset down     down
GigabitEthernet0/0/16 unassigned  YES unset down     down
GigabitEthernet0/0/17 unassigned  YES unset down     down
GigabitEthernet0/0/18 unassigned  YES unset down     down
GigabitEthernet0/0/19 unassigned  YES unset down     down
GigabitEthernet0/0/20 unassigned  YES unset down     down
GigabitEthernet0/0/21 unassigned  YES unset down     down
GigabitEthernet0/0/22 unassigned  YES unset down     down
GigabitEthernet0/0/23 unassigned  YES unset up        up
GigabitEthernet0/0/24 unassigned   YES unset up        up
GigabitEthernet1/0/1 unassigned   YES unset down     down
GigabitEthernet1/0/2 unassigned   YES unset down     down
GigabitEthernet1/0/3 unassigned   YES unset down     down
GigabitEthernet1/0/4 unassigned   YES unset down     down
Vlan1   unassigned   YES manual up        up
Vlan2   10.20.4.0/24 YES manual up        up
Vlan10  10.20.5.17 YES manual up        up
Vlan15  10.20.4.1   YES manual up        up
Vlan20  10.20.4.129 YES manual up        up
Vlan100 192.168.100.1 YES manual up        up

B1-M1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
L - link state, T1 - TOS level1, T2 - TOS level2, ia - 10-10 inter area
* - candidate default, S - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is 172.16.20.1 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 5 subnets, 4 masks
S* 10.20.4.0/24 [1/0] via 172.16.20.1
S* 10.20.5.0/24 [1/0] via 172.16.20.1, Vlan15
C 10.20.4.129/24 is directly connected, Vlan20
C 10.20.5.16/28 is directly connected, Vlan10
C 172.16.0.0/30 is subnetted, 2 subnets
C 172.16.20.0/24 is subnetted, 2 subnets, 2 routes
C 172.16.20.0/24 is directly connected, GigabitEthernet0/0/6
C 192.168.100.0/24 is directly connected, Vlan100
S* 0.0.0.0/0 [1/0] via 172.16.20.1

B1-M1#

```

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Copy Paste

IP ROUTE MLS-B1

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

User Access Verification

Password:

```
B1-MLS>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is 172.16.20.1 to network 0.0.0.0

  10.0.0.0/8 is variably subnetted, 5 subnets, 4 masks
S   10.20.4.0/22 [1/0] via 172.16.20.1
C   10.20.4.0/25 is directly connected, Vlan15
C   10.20.4.128/26 is directly connected, Vlan20
C   10.20.5.0/28 is directly connected, Vlan5
C   10.20.5.16/28 is directly connected, Vlan10
  172.16.0.0/30 is subnetted, 2 subnets
C     172.16.20.0 is directly connected, GigabitEthernet1/0/5
C     172.16.20.8 is directly connected, GigabitEthernet1/0/6
C   192.168.100.0/24 is directly connected, Vlan100
S*  0.0.0.0/0 [1/0] via 172.16.20.1

B1-MLS>show vlan brief
```

| VLAN | Name | Status | Ports |
|------|--------------------|--------|---|
| 1 | default | active | Gig1/0/7, Gig1/0/8, Gig1/0/9, Gig1/0/10 Gig1/0/11, Gig1/0/12, Gig1/0/13, Gig1/0/14 Gig1/0/15, Gig1/0/16, Gig1/0/17, Gig1/0/18 Gig1/0/19, Gig1/0/20, Gig1/0/21, Gig1/0/22 Gig1/1/1, Gig1/1/2, Gig1/1/3, Gig1/1/4 |
| 5 | wireless1 | active | |
| 10 | wireless2 | active | |
| 15 | team1 | active | |
| 20 | team2 | active | |
| 100 | management | active | Gig1/0/23, Gig1/0/24 |
| 1002 | fdci-default | active | |
| 1003 | token-ring-default | active | |
| 1004 | fdininet-default | active | |
| 1005 | trnet-default | active | |

B1-MLS>

Top

VLAN BRIEF MLS B1

Multilayer Switch B1

Physical Config **CL** Attributes

IOS Command Line Interface

```

Gateway of last resort is 172.16.20.1 to network 0.0.0.0

 10.0.0.0/8 is variably subnetted, 5 subnets, 4 masks
   10.20.4.0/24 via 1/0
   10.20.5.0/24 is directly connected, Vlan15
   10.20.4.128/24 is directly connected, Vlan20
   10.20.5.0/24 is directly connected, Vlan20
   10.20.4.128/24 is directly connected, Vlan19
 172.16.0.0/30 is subnetted, 2 subnets
   C 172.16.20.0/24 is directly connected, GigabitEthernet1/0/5
   C 172.16.20.8 is directly connected, GigabitEthernet1/0/6
   C 192.168.100.0/24 is directly connected, Vlan10
 S* 0.0.0.0/0 (1/0) via 172.16.20.1

B1-MLS#show vlan brief
VLAN Name          Status    Ports
-----+-----+-----+
 1  default         active    Gig1/0/7, Gig1/0/8, Gig1/0/9, Gig1/0/10
                                         Gig1/0/11, Gig1/0/12, Gig1/0/13, Gig1/0/14
                                         Gig1/0/15, Gig1/0/16, Gig1/0/17, Gig1/0/18
                                         Gig1/0/19, Gig1/0/20, Gig1/0/21, Gig1/0/22
                                         Gig1/0/23, Gig1/0/24
 8  wireless1      active
 10 wireless2      active
 15 team1          active
 20 team2          active
 100 management     active    Gig1/0/23, Gig1/0/24
 1002 fddi-default  active
 1004 tokenring-default  active
 1004 fddinet-default  active
 1005 trnet-default  active
B1-MLS#show ip interface brief
Interface          IP-Address          OK? Method Status      Protocol
Port-channel1      unassigned        YES unset up
Port-channel2      unassigned        YES unset up
GigabitEthernet1/0/1 unassigned        YES unset up
GigabitEthernet1/0/2 unassigned        YES unset up
GigabitEthernet1/0/3 unassigned        YES unset up
GigabitEthernet1/0/4 unassigned        YES unset up
GigabitEthernet1/0/5 172.16.20.2      YES manual up
GigabitEthernet1/0/6 172.16.20.9      YES manual up
GigabitEthernet1/0/7 unassigned        YES unset down
GigabitEthernet1/0/8 unassigned        YES unset down
GigabitEthernet1/0/9 unassigned        YES unset down
GigabitEthernet1/0/10 unassigned       YES unset down
GigabitEthernet1/0/11 unassigned       YES unset down
GigabitEthernet1/0/12 unassigned       YES unset down
GigabitEthernet1/0/13 unassigned       YES unset down
GigabitEthernet1/0/14 unassigned       YES unset down
GigabitEthernet1/0/15 unassigned       YES unset down
GigabitEthernet1/0/16 unassigned       YES unset down
GigabitEthernet1/0/17 unassigned       YES unset down
GigabitEthernet1/0/18 unassigned       YES unset down
GigabitEthernet1/0/19 unassigned       YES unset down
GigabitEthernet1/0/20 unassigned       YES unset down
GigabitEthernet1/0/21 unassigned       YES unset down
GigabitEthernet1/0/22 unassigned       YES unset down
GigabitEthernet1/0/23 unassigned       YES unset up
GigabitEthernet1/0/24 unassigned       YES unset up
GigabitEthernet1/1/1 unassigned       YES unset down
GigabitEthernet1/1/2 unassigned       YES unset down
GigabitEthernet1/1/3 unassigned       YES unset down
GigabitEthernet1/1/4 unassigned       YES unset down
Vlan1              10.20.4.1        YES manual up
Vlan10             10.20.5.17      YES manual up
Vlan15             10.20.4.11        YES manual up
Vlan20             10.20.4.129     YES manual up
Vlan100            192.168.100.1   YES manual up
B1-MLS#

```

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IP INT BRIEF MLS-B1

| IOS Command Line Interface | | | |
|----------------------------|--------------------|--------|---|
| VLAN | Name | Status | Ports |
| 1 | default | active | Gig1/0/7, Gig1/0/8, Gig1/0/9, Gig1/0/10 Gig1/0/11, Gig1/0/12, Gig1/0/13, Gig1/0/14 Gig1/0/15, Gig1/0/16, Gig1/0/17, Gig1/0/18 Gig1/0/19, Gig1/0/20, Gig1/0/21, Gig1/0/22 Gig1/1/1, Gig1/1/2, Gig1/1/3, Gig1/1/4 |
| 5 | wireless1 | active | |
| 10 | wireless2 | active | |
| 15 | team1 | active | |
| 20 | team2 | active | |
| 200 | management | active | Gig1/0/23 |
| 1002 | fddi-default | active | |
| 1003 | token-ring-default | active | |
| 1004 | fddinet-default | active | |
| 1005 | ttnet-default | active | |
| B2-MLS> | | | |

VLAN BRIEF MLS-B2

Multilayer Switch B2

Physical Config **CLI** Attributes

IOS Command Line Interface

```

20    team2                                active
200   management                            active      Gig1/0/23
1002  fddi-default                          active
1003  token-ring-default                   active
1004  fddinet-default                      active
1005  trnet-default                        active
B2-MLS>show ip interface brief
Interface          IP-Address      OK? Method Status      Protocol
Port-channel1      unassigned     YES unset up           up
Port-channel2      unassigned     YES unset up           up
GigabitEthernet1/0/1 unassigned     YES unset up           up
GigabitEthernet1/0/2 unassigned     YES unset up           up
GigabitEthernet1/0/3 unassigned     YES unset up           up
GigabitEthernet1/0/4 unassigned     YES unset up           up
GigabitEthernet1/0/5 172.16.20.6   YES manual up          up
GigabitEthernet1/0/6 172.16.20.10  YES manual up          up
GigabitEthernet1/0/7 unassigned     YES unset down        down
GigabitEthernet1/0/8 unassigned     YES unset down        down
GigabitEthernet1/0/9 unassigned     YES unset down        down
GigabitEthernet1/0/10 unassigned    YES unset down        down
GigabitEthernet1/0/11 unassigned    YES unset down        down
GigabitEthernet1/0/12 unassigned    YES unset down        down
GigabitEthernet1/0/13 unassigned    YES unset down        down
GigabitEthernet1/0/14 unassigned    YES unset down        down
GigabitEthernet1/0/15 unassigned    YES unset down        down
GigabitEthernet1/0/16 unassigned    YES unset down        down
GigabitEthernet1/0/17 unassigned    YES unset down        down
GigabitEthernet1/0/18 unassigned    YES unset down        down
GigabitEthernet1/0/19 unassigned    YES unset down        down
GigabitEthernet1/0/20 unassigned    YES unset down        down
GigabitEthernet1/0/21 unassigned    YES unset down        down
GigabitEthernet1/0/22 unassigned    YES unset down        down
GigabitEthernet1/0/23 unassigned    YES unset up           up
GigabitEthernet1/0/24 unassigned    YES unset up           up
GigabitEthernet1/1/1 unassigned    YES unset down        down
GigabitEthernet1/1/2 unassigned    YES unset down        down
GigabitEthernet1/1/3 unassigned    YES unset down        down
GigabitEthernet1/1/4 unassigned    YES unset down        down
Vlan1              unassigned     YES unset administratively down down
Vlan5              10.20.7.1    YES manual up           up
Vlan10             10.20.10.1   YES manual up          up
Vlan15             10.20.6.5    YES manual up          up
Vlan20             10.20.6.129  YES manual up          up
Vlan100            unassigned    YES unset down        down
Vlan200            192.168.200.1 YES manual up          up
B2-MLS>

```

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IP INT BRIEF MLS B2

Multilayer Switch B2

Physical Config **CLI** Attributes

IOS Command Line Interface

```

GigabitEthernet1/0/17 unassigned YES unset down down
GigabitEthernet1/0/18 unassigned YES unset down down
GigabitEthernet1/0/19 unassigned YES unset down down
GigabitEthernet1/0/20 unassigned YES unset down down
GigabitEthernet1/0/21 unassigned YES unset down down
GigabitEthernet1/0/22 unassigned YES unset down down
GigabitEthernet1/0/23 unassigned YES unset up up
GigabitEthernet1/0/24 unassigned YES unset up up
GigabitEthernet1/1/1 unassigned YES unset down down
GigabitEthernet1/1/2 unassigned YES unset down down
GigabitEthernet1/1/3 unassigned YES unset down down
GigabitEthernet1/1/4 unassigned YES unset down down
Vlan1 unassigned YES unset administratively down down
Vlan5 10.20.7.1 YES manual up up
Vlan10 10.20.10.1 YES manual up up
Vlan15 10.20.6.5 YES manual up up
Vlan20 10.20.6.129 YES manual up up
Vlan100 unassigned YES unset down down
Vlan200 192.168.200.1 YES manual up up

B2-MLS>
B2-MLS>
B2-MLS>
B2-MLS>
B2-MLS>
B2-MLS>show ip route
B2-MLS>
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/8 is variably subnetted, 4 subnets, 4 masks
C    10.20.6.4/30 is directly connected, Vlan15
C    10.20.6.128/25 is directly connected, Vlan20
C    10.20.7.0/28 is directly connected, Vlan5
C    10.20.10.0/24 is directly connected, Vlan10
  172.16.0.0/30 is subnetted, 2 subnets
C    172.16.20.4 is directly connected, GigabitEthernet1/0/5
C    172.16.20.8 is directly connected, GigabitEthernet1/0/6
C    192.168.200.0/24 is directly connected, Vlan200

B2-MLS>
```

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SHOW IP ROUTE MLS-B2

Headquarters Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
User Access Verification

Password:
Password:
Password:
% Bad passwords

Press RETURN to get started!

Unauthorized access prohibited

User Access Verification

Password:
Password:

HQ>show ip interface brief
Interface          IP-Address      OK? Method Status        Protocol
GigabitEthernet0/0/0 172.16.20.1    YES manual up           up
GigabitEthernet0/0/1 172.16.20.5    YES manual up           up
GigabitEthernet0/0/2  unassigned     YES unset  up           up
GigabitEthernet0/1/0  unassigned     YES unset  up           up
GigabitEthernet0/1/1  unassigned     YES unset  up           down
GigabitEthernet0/1/2  unassigned     YES unset  up           down
GigabitEthernet0/1/3  unassigned     YES unset  up           down
Serial0/2/0          209.165.201.2  YES manual up           up
Serial0/2/1          unassigned     YES unset administratively down down
Vlan1               10.20.4.1      YES manual up           up
Vlan10              unassigned     YES unset  down          down
HQ>
```

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SHOW IP INT BRIEF HQ ROUTER

Headquarters Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
User Access Verification

Password:
Password:

HQ>show ip interface brief
Interface          IP-Address      OK? Method Status        Protocol
GigabitEthernet0/0/0 172.16.20.1    YES manual up           up
GigabitEthernet0/0/1 172.16.20.5    YES manual up           up
GigabitEthernet0/0/2  unassigned     YES unset up          up
GigabitEthernet0/1/0  unassigned     YES unset up          up
GigabitEthernet0/1/1  unassigned     YES unset up          down
GigabitEthernet0/1/2  unassigned     YES unset up          down
GigabitEthernet0/1/3  unassigned     YES unset up          down
Serial0/2/0          209.165.201.2  YES manual up           up
Serial0/2/1          unassigned     YES unset administratively down down
Vlan1               10.20.4.1       YES manual up           up
Vlan10              unassigned     YES unset down         down

HQ>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/8 is variably subnetted, 3 subnets, 3 masks
C    10.20.4.0/22 is directly connected, Vlan1
L    10.20.4.1/32 is directly connected, Vlan1
S    10.20.6.0/23 [1/0] via 172.16.20.6

  172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C    172.16.20.0/30 is directly connected, GigabitEthernet0/0/0
L    172.16.20.1/32 is directly connected, GigabitEthernet0/0/0
C    172.16.20.4/30 is directly connected, GigabitEthernet0/0/1
L    172.16.20.5/32 is directly connected, GigabitEthernet0/0/1
S    192.168.100.0/24 [1/0] via 172.16.20.2
S    192.168.200.0/24 [1/0] via 172.16.20.6
  209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C    209.165.201.0/30 is directly connected, Serial0/2/0
L    209.165.201.2/32 is directly connected, Serial0/2/0

HQ>
```

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SHOW IP ROUTE HQ ROUTER

ISP Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```

PROCESSOR board ID F1A1Z400NS
2 Gigabit Ethernet interfaces
2 Low-speed serial(sync/async) network interface(s)
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
Unauthorized access prohibited

User Access Verification

Password:

ISP>show ip interface brief
Interface          IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  209.165.202.129 YES manual up           up
GigabitEthernet0/1  unassigned      YES unset administratively down down
Serial0/0/0         209.165.201.1  YES manual up           up
Serial0/0/1         unassigned      YES unset administratively down down
Vlan1              unassigned      YES unset administratively down down

ISP>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 209.165.201.2 to network 0.0.0.0

  209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C    209.165.201.0/30 is directly connected, Serial0/0/0
L    209.165.201.1/32 is directly connected, Serial0/0/0
  209.165.202.0/24 is variably subnetted, 2 subnets, 2 masks
C    209.165.202.128/30 is directly connected, GigabitEthernet0/0
L    209.165.202.129/32 is directly connected, GigabitEthernet0/0
S*   0.0.0.0/0 [1/0] via 209.165.201.2

```

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IP INT BRIEF AND IP ROUTE ISP ROUTER

IP RUNNING CONFIS MLS-B1

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
% Invalid input detected at '^' marker.

!<-->#>en
Password:
!<-->#>en running-config
Building configuration...

Current configuration : 3996 bytes
!
version 16.3.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B1-MLS
!
enable secret 5 $1$0mHxrdPcTjU1EqgGurqfPU.DcC11
!
ip dhcp excluded-address 10.20.4.1 10.20.4.5
ip dhcp excluded-address 10.20.4.129 10.20.4.133
ip dhcp excluded-address 10.20.4.141 10.20.4.145
ip dhcp excluded-address 10.20.5.17 10.20.5.21
!
ip dhcp pool B1_VLAN15
network 10.20.4.0 255.255.255.128
dead-peer timer infinite
dns-server 10.20.4.254
domain-name net555.local
!
ip dhcp pool B1_VLAN192
network 10.20.4.128 255.255.255.192
dead-peer timer infinite
dns-server 10.20.4.254
domain-name net555.local
!
ip dhcp pool B1_VLAN240
network 10.20.5.0 255.255.255.240
dead-peer timer infinite
option 43 ip 192.168.100.30
dns-server 10.20.4.254
!
ip dhcp pool B1_VLAN240
network 10.20.5.16 255.255.255.240
dead-peer timer infinite
option 43 ip 192.168.100.30
dns-server 10.20.4.254
!
!
no ip cef
ip routing
!
no ipv6 cef
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
```

Top

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
interface Port-channel1
description LACP Trunk to B1-S1
switchport trunk native vlan 100
switchport mode trunk
switchport nonegotiate
!
interface Port-channel2
description LACP Trunk to B1-S2
switchport trunk native vlan 100
switchport mode trunk
switchport nonegotiate
!
interface GigabitEthernet1/0/1
description LACP to B1-S1
switchport trunk native vlan 100
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/2
description LACP to B1-S2
switchport trunk native vlan 100
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/3
description LACP to B1-S3
switchport trunk native vlan 100
switchport mode trunk
switchport nonegotiate
channel-group 1 mode active
!
interface GigabitEthernet1/0/4
description LACP to B1-S4
switchport trunk native vlan 100
switchport mode trunk
switchport nonegotiate
channel-group 2 mode active
!
interface GigabitEthernet1/0/5
no switchport
ip address 172.16.20.2 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet1/0/6
no switchport
ip address 172.16.20.9 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet1/0/7
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
!
interface GigabitEthernet1/0/14
!
interface GigabitEthernet1/0/15
!
interface GigabitEthernet1/0/16
!
!
```

Top

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

```

interface GigabitEthernet1/0/20
;
interface GigabitEthernet1/0/21
;
interface GigabitEthernet1/0/22
;
interface GigabitEthernet1/0/23
description Bl-WG
switchport access vlan 100
switchport mode access
;
interface GigabitEthernet1/0/24
description Bl-AP
switchport access vlan 100
switchport mode access
;
interface GigabitEthernet1/1/1
;
interface GigabitEthernet1/1/2
;
interface GigabitEthernet1/1/3
;
interface GigabitEthernet1/1/4
;
interface Vlan1
no ip address
;
interface Vlan5
description Bl-Wireless1
mac-address 0000.9e87.9201
ip address 10.20.5.1 255.255.255.240
;
interface Vlan10
description Bl-Wireless2
mac-address 0000.9e87.9202
ip address 10.20.5.17 255.255.255.240
;
interface Vlan15
mac-address 0000.9e87.9203
ip address 10.20.4.1 255.255.255.128
;
interface Vlan20
description Bl-Main Team0 Wired Network
mac-address 0000.9e87.9204
ip address 10.20.4.129 255.255.255.192
;
interface Vlan21
description Bl-MD Management Interface
mac-address 0000.9e87.9205
ip address 192.168.100.1 255.255.255.0
;
ip classless
ip route 10.20.4.0 255.255.252.0 172.16.20.1
ip route 0.0.0.0 0.0.0.0 172.16.20.1
;
ip flow-export version 9
;
;
banner motd "CDnauthorized access prohibited"
;
;
;
line con 0
password cisco
login
;
line aux 0
;
line vty 0 4
password cisco
login
;
end
B1-MLS#
```

Top

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

```

switchport mode access
;
interface GigabitEthernet1/0/24
description Bl-AP
switchport access vlan 100
switchport mode access
;
interface GigabitEthernet1/1/1
;
interface GigabitEthernet1/1/2
;
interface GigabitEthernet1/1/3
;
interface GigabitEthernet1/1/4
;
interface Vlan1
no ip address
;
interface Vlan5
description Bl-Wireless1
mac-address 0000.9e87.9201
ip address 10.20.5.1 255.255.255.240
;
interface Vlan10
description Bl-Wireless2
mac-address 0000.9e87.9202
ip address 10.20.5.17 255.255.255.240
;
interface Vlan15
mac-address 0000.9e87.9203
ip address 10.20.4.1 255.255.255.128
;
interface Vlan20
description Bl-Main Team0 Wired Network
mac-address 0000.9e87.9204
ip address 10.20.4.129 255.255.255.192
;
interface Vlan21
description Bl-MD Management Interface
mac-address 0000.9e87.9205
ip address 192.168.100.1 255.255.255.0
;
ip classless
ip route 10.20.4.0 255.255.252.0 172.16.20.1
ip route 0.0.0.0 0.0.0.0 172.16.20.1
;
ip flow-export version 9
;
;
banner motd "CDnauthorized access prohibited"
;
;
;
line con 0
password cisco
login
;
line aux 0
;
line vty 0 4
password cisco
login
;
end
B1-MLS#
```

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IP RUNNING CONFIS MLS-B2

Multilayer Switch B2

Physical Config CLI Attributes

IOS Command Line Interface

```

% Invalid input detected at '^' marker.

B2-M2Sven
Password:
Build now run
Building configuration...

Current configuration : 4302 bytes
!
version 16.3.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B2-M2S
!
enable secret 5 $1$amXrfrfctjUIRgnGurQipWJcC11
!
ip dhcp excluded-address 10.20.6.1 10.20.6.5
ip dhcp excluded-address 10.20.6.129 10.20.6.133
ip dhcp excluded-address 10.20.6.141 10.20.6.145
ip dhcp excluded-address 10.20.7.17 10.20.7.21
ip dhcp pool B2_VLAN15
network 10.20.6.0 255.255.255.128
dead-peer timer 120
dns-server 10.20.4.254
domain-name local
ip dhcp pool B2_VLAN1
network 10.20.4.128 255.255.255.192
dead-peer timer 120
dns-server 10.20.4.254
domain-name local
ip dhcp pool B2_VLAN3
network 10.20.7.0 255.255.255.240
dead-peer timer 120
option 43 ip 192.168.200.30
dns-server 10.20.7.254
ip dhcp pool B2_VLAN4
network 10.20.7.16 255.255.255.240
dead-peer timer 120
option 43 ip 192.168.200.30
dns-server 10.20.7.254
ip dhcp pool WLAN-1
network 10.20.7.0 255.255.255.240
dead-peer timer 120
dns-server 10.20.7.254
ip dhcp pool WLAN-2
network 10.20.10.0 255.255.255.0
default-router 10.20.10.1
dns-server 0.0.0.0
!
!
no ip cef
ip routing
!
no ipv6 cef
!
!
!
!
```

Top

Multilayer Switch B2

Physical Config CLI Attributes

IOS Command Line Interface

```

!
!
spanning-tree mode pvrst
!
!
!
!
interface Port-channel1
description LACP Trunk to B2-S1
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
!
interface Port-channel2
description LACP Trunk to B2-S2
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
!
interface GigabitEthernet1/0/1
description LACP to B2-S1
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
channel-group 3 mode active
!
interface GigabitEthernet1/0/2
description LACP to B2-S2
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
channel-group 1 mode active
!
interface GigabitEthernet1/0/3
description LACP to B2-S2
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
channel-group 2 mode active
!
interface GigabitEthernet1/0/4
description LACP to B2-S2
switchport trunk native vlan 200
switchport mode trunk
switchport nonegotiate
channel-group 3 mode active
!
interface GigabitEthernet1/0/5
no switchport
ip address 172.16.20.6 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet1/0/6
no switchport
ip address 172.16.20.10 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet1/0/7
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11
!
```

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Multilayer Switch B2

Physical Config CLI Attributes

IOS Command Line Interface

```

interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
!
interface GigabitEthernet1/0/14
!
interface GigabitEthernet1/0/15
!
interface GigabitEthernet1/0/16
!
interface GigabitEthernet1/0/17
!
interface GigabitEthernet1/0/18
!
interface GigabitEthernet1/0/19
!
interface GigabitEthernet1/0/20
!
interface GigabitEthernet1/0/21
!
interface GigabitEthernet1/0/22
!
interface GigabitEthernet1/0/23
description B2-WLSS
switchport mode access
switchport access vlan 200
switchport mode access
!
interface GigabitEthernet1/0/24
description Connected_to_IMAP
switchport trunk allowed vlan 5,10,15,20,200
switchport trunk native vlan 5,10,15,20,200
switchport mode trunk
!
interface GigabitEthernet1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface Vlan1
no ip address
!
interface Vlan2
description B2-Wireless1
mac-address 0001.4277.2401
ip address 10.20.7.1 255.255.255.240
!
interface Vlan3
description B2-Wireless2
mac-address 0001.4277.2402
ip address 10.20.10.1 255.255.255.0
!
interface Vlan4
description B2 Team1 Wired Network
mac-address 0001.4277.2403
ip address 10.20.4.5 255.255.255.252
!
interface Vlan5
description B2 Team2 Wired Network
mac-address 0001.4277.2404
ip address 10.20.4.129 255.255.255.128
!
end
B2-MLSS#

```

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Multilayer Switch B2

Physical Config CLI Attributes

IOS Command Line Interface

```

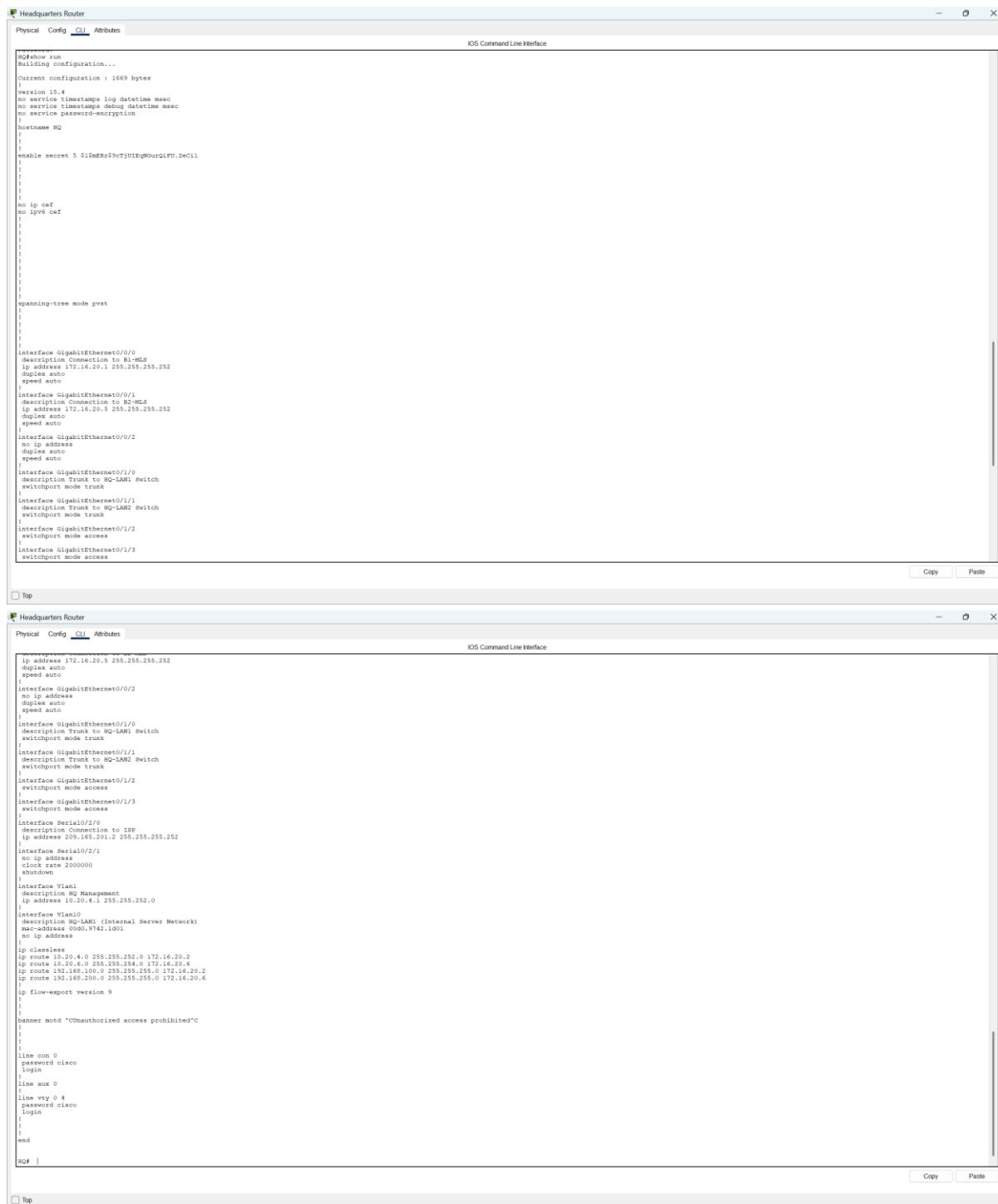
switchport trunk allowed vlan 5,10,15,20,200
switchport mode trunk
!
interface GigabitEthernet1/1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface Vlan1
no ip address
!
interface Vlan5
description B2-Wireless1
mac-address 0001.4277.2401
ip address 10.20.7.1 255.255.255.240
!
interface Vlan10
description B2-Wireless2
mac-address 0001.4277.2402
ip address 10.20.10.1 255.255.255.0
!
interface Vlan15
description B2 Team1 Wired Network
mac-address 0001.4277.2403
ip address 10.20.4.5 255.255.255.252
!
interface Vlan20
description B2 Team2 Wired Network
mac-address 0001.4277.2404
ip address 10.20.4.129 255.255.255.128
!
interface Vlan100
mac-address 0001.4277.2405
no ip address
!
interface Vlan200
description B2-ML2 Management Interface
mac-address 0001.4277.2406
ip address 192.168.200.1 255.255.255.0
!
ip classless
!
ip flow-export version 9
!
!
banner motd "Unauthorized access prohibited"
!
!
!
line con 0
password cisco
login
!
line aux 0
!
line vty 0 4
password cisco
login
!
end
B2-MLSS#

```

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IP RUNNING CONFIG HQ ROUTERS



```

Headquarters Router
Physical Config CLI Attributes
IOS Command Line Interface

no ip dns
Building configuration...
Current configuration : 1469 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname HQ
!
!
enable secret 5 $1$0mExr59ctJUIEqNurQlPU.2eC11
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
spanning-tree mode pvrst
!
!
!
!
!
interface GigabitEthernet0/0/0
description Connection to S1-MLS
ip address 172.16.20.1 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/0/1
description Connection to S2-MLS
ip address 172.16.20.5 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
!
interface GigabitEthernet0/0/3
description Connection to HQ-LAN1 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/0
description Trunk to HQ-LAN1 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/1
description Trunk to HQ-LAN2 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/2
switchport mode access
!
interface GigabitEthernet0/1/3
switchport mode access
!
switchport mode access

ip address 172.16.20.5 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
!
interface GigabitEthernet0/0/3
description Trunk to HQ-LAN2 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/0
description Trunk to HQ-LAN1 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/1
description Trunk to HQ-LAN2 Switch
switchport mode trunk
!
interface GigabitEthernet0/1/2
switchport mode access
!
interface GigabitEthernet0/1/3
switchport mode access
!
interface Serial0/0/0
description Connection to ISP
ip address 169.161.2 255.255.255.252
interface Serial0/0/1
no ip address
clock rate 2000000
!
!
!
!
line con 0
password cisco
login
!
line aux 0
line vty 0 4
password cisco
login
!
end
EOF

```

IP RUNNING CONFIG ISP ROUTER

ISP Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```

!ipwan
password:
!ipshub run
!build configuration...
Current configuration : 1021 bytes
!
version 1.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname ISP
!
!
enable secret 5 $1$amKrf9ct$UIEgNGurQlPU.LwCil
!
!
!
!
no ip cef
no ipv6 cef
!
!
license udi pid CISCO1941/K9 sn FTX15247252-
!
!
!
!
!
!
spanning-tree mode pvrst
!
!
!
!
!
interface GigabitEthernet0/0
description Connection to Web Server
ip address 209.165.202.129 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
description connection to HQ
ip address 209.165.201.1 255.255.255.252
clock rate 44000
!
interface Serial0/0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/2
description connection to HQ
ip address 209.165.201.1 255.255.255.252
clock rate 44000
!
interface Serial0/0/3
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 209.165.201.2
!
ip flow-export version 9
!
!
banner motd "Unauthorized access prohibited"
!
!
line con 0
password cisco
login
!
line aux 0
line vty 0 4
password cisco
login
!
end
ISP#

```

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ISP Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```

!
!
!
!
!
spanning-tree mode pvrst
!
!
!
!
!
interface GigabitEthernet0/0
description Connection to Web Server
ip address 209.165.202.129 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
description connection to HQ
ip address 209.165.201.1 255.255.255.252
clock rate 44000
!
interface Serial0/0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/2
description connection to HQ
ip address 209.165.201.1 255.255.255.252
clock rate 44000
!
interface Serial0/0/3
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 209.165.201.2
!
ip flow-export version 9
!
!
banner motd "Unauthorized access prohibited"
!
!
line con 0
password cisco
login
!
line aux 0
line vty 0 4
password cisco
login
!
end
ISP#

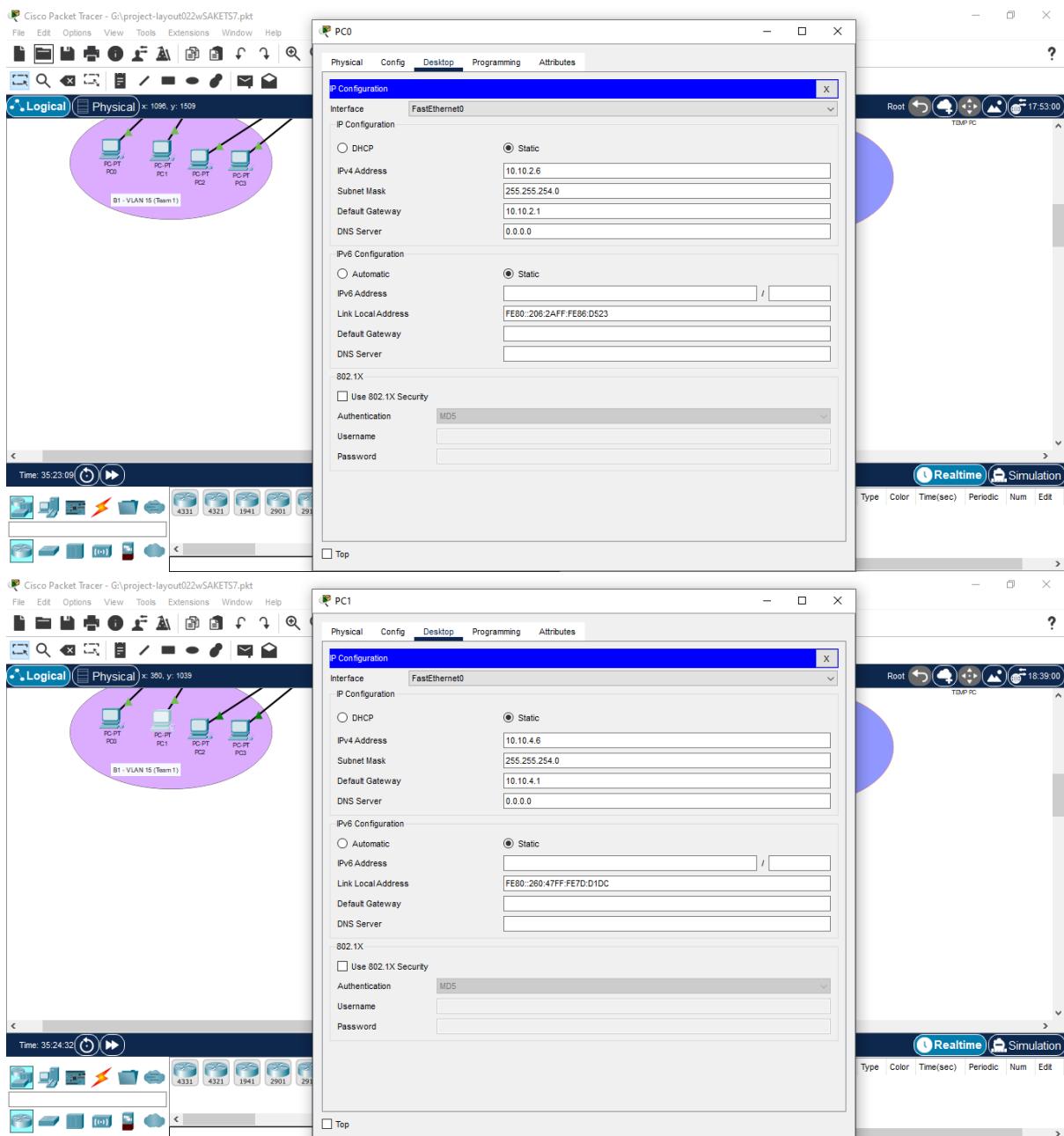
```

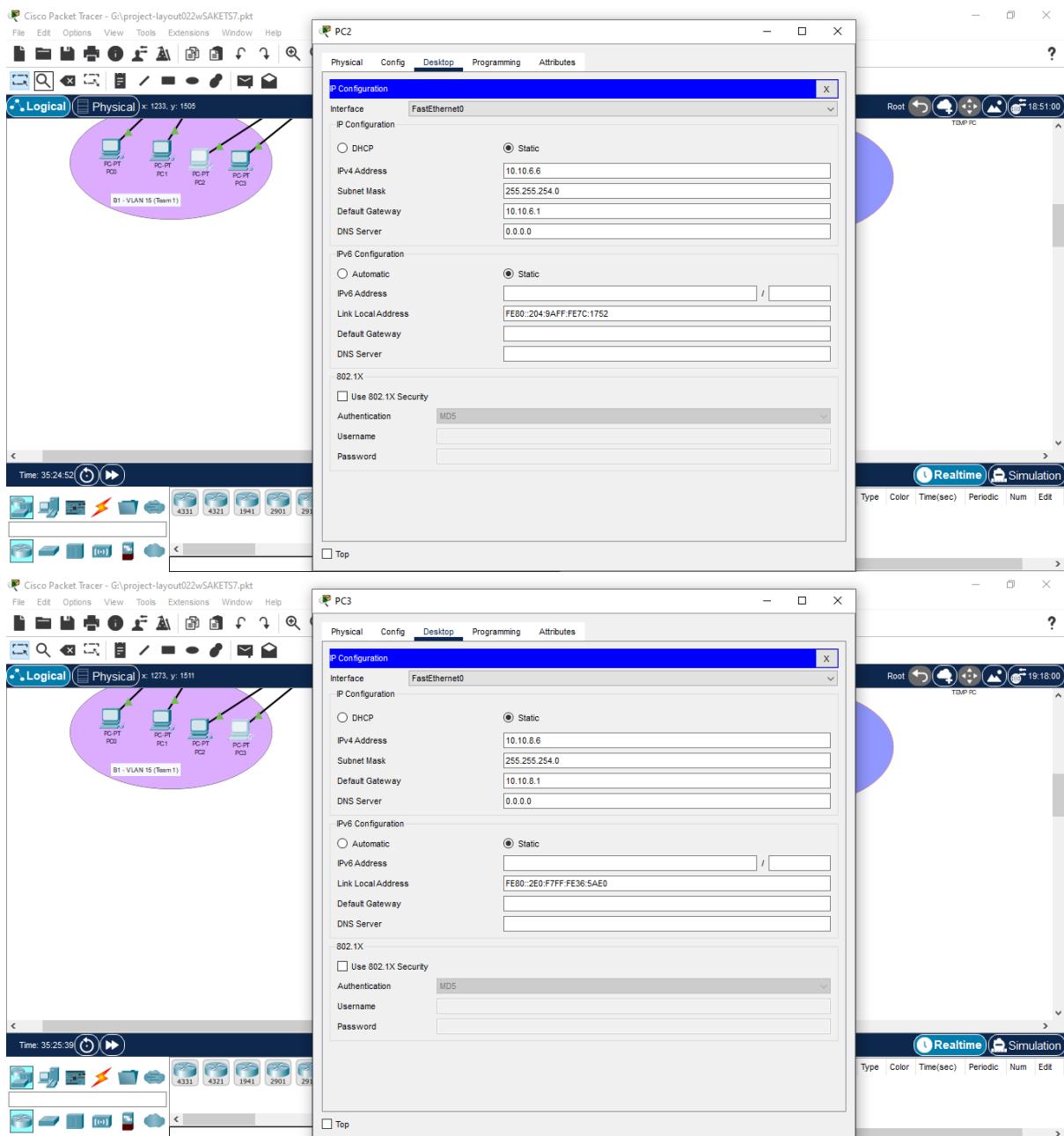
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ALL THE PING WORKING FROM HQ ROUTERS

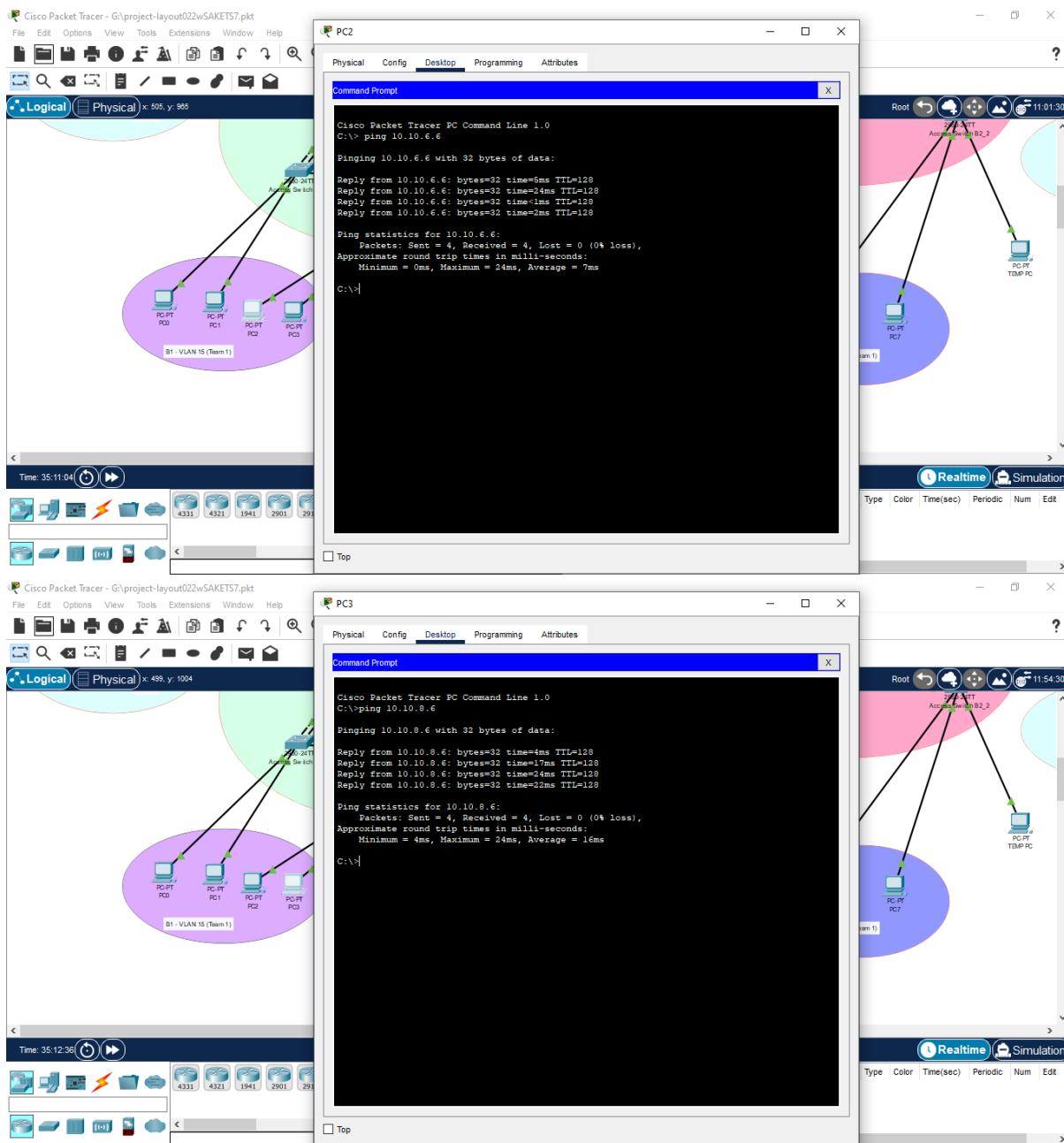
```
.....  
Success rate is 0 percent (0/5)  
  
HQ>ping 10.20.6.1  
  
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.20.6.1, timeout is 2 seconds:  
!!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms  
  
HQ>ping 10.20.5.6  
  
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.20.5.6, timeout is 2 seconds:  
!!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms  
  
HQ>ping 192.168.200.1  
  
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.200.1, timeout is 2 seconds:  
!!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms  
  
HQ>ping 10.20.4.254
```

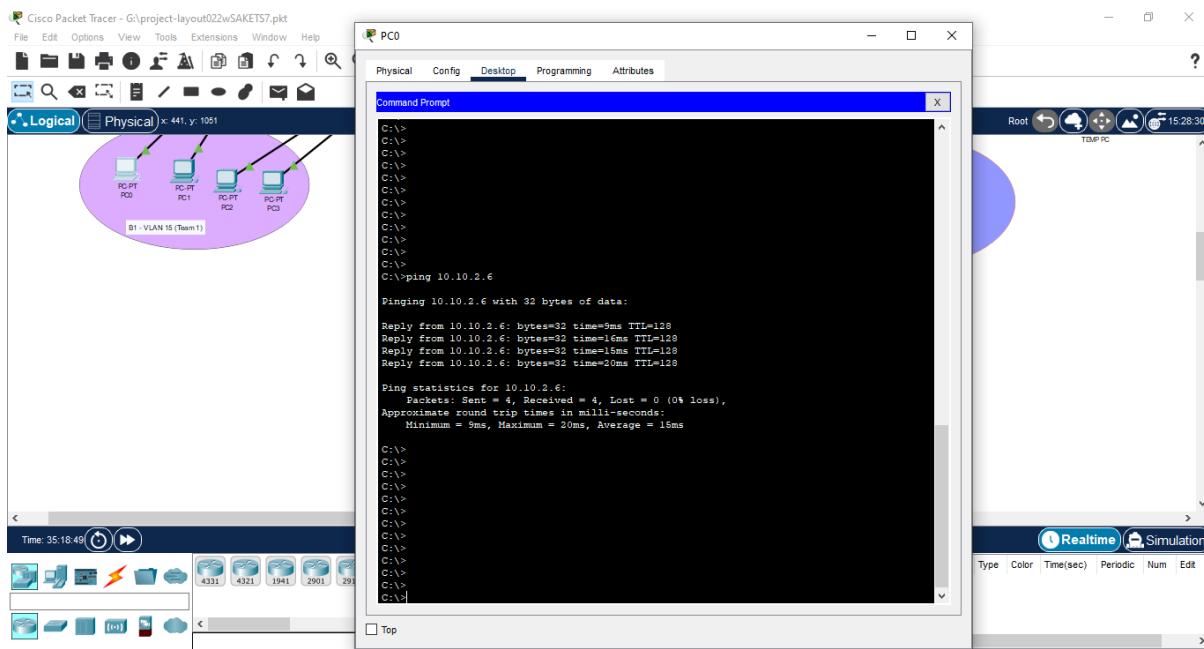
IP CONFIGURATION FOR PCS





SUCCESSFUL PINGING PCS BY THEIR IP ADDRESS





B1-S1ETHERCHANNEL

Access Switch B1_1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
B1-S1>enable
B1-S1#show etherchannel summary
Flags: D - down      P - in port-channel
       I - stand-alone s - suspended
       H - Hot-standby (LACP only)
       R - Layer3        S - Layer2
       U - in use        f - failed to allocate aggregator
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 2
Number of aggregators: 2

Group Port-channel Protocol Ports
-----+-----+-----+-----+
1     Po1(SU)          LACP   Gig0/1(P) Gig0/2(P)
3     Po3(SU)          LACP   Fa0/23(P) Fa0/24(P)

B1-S1#show interfaces trunk
Port    Mode      Encapsulation Status      Native vlan
Po1    on        802.1q        trunking    100
Po3    on        802.1q        trunking    100

Port    Vlans allowed on trunk
Po1    1-1005
Po3    1-1005

Port    Vlans allowed and active in management domain
Po1    1,15,20,100
Po3    1,15,20,100

Port    Vlans in spanning tree forwarding state and not pruned
Po1    1,15,20,100
Po3    1,15,20,100

B1-S1#
```

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B1-MLS ETHERCHANNEL

Multilayer Switch B1

Physical Config **CLI** Attributes

IOS Command Line Interface

```

%LINK-5-CHANGED: Interface Port-channel2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel2, changed state to up
Unauthorized access prohibited

User Access Verification

Password:
B1-MLS>enable
Password:
B1-MLS>show etherchannel summary
Flags: D - down P - in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator
u - unsuitable for bundling
w - waiting to be aggregated
d - default port

Number of channel-groups in use: 2
Number of aggregators: 2

Group Port-channel Protocol Ports
-----+-----+-----+-----+
1 Po1(SU) LACP Gig1/0/1(P) Gig1/0/2(P)
2 Po2(SU) LACP Gig1/0/3(P) Gig1/0/4(P)

B1-MLS#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Po1 on 802.1q trunking 100
Po2 on 802.1q trunking 100

Port Vlans allowed on trunk
Po1 1-1005
Po2 1-1005

Port Vlans allowed and active in management domain
Po1 1,5,10,15,20,100
Po2 1,5,10,15,20,100

Port Vlans in spanning tree forwarding state and not pruned
Po1 1,5,10,15,20,100
Po2 1,5,10,15,20,100

B1-MLS#

```

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B1-S2 ETHERCHANNEL

Access Switch B1_2

Physical Config **CLI** Attributes

IOS Command Line Interface

```

Group: 1
-----
Group state = L2
Ports: 2 Maxports = 16
Port-channels: 1 Max Port-channels = 16
Protocol:    LACP

Group: 3
-----
Group state = L2
Ports: 2 Maxports = 16
Port-channels: 1 Max Port-channels = 16
Protocol:    LACP
B1-S2#show etherchannel summary
Flags: D - down           P - in port-channel
      I - stand-alone s - suspended
      H - Hot-standby (LACP only)
      R - Layer3           S - Layer2
      U - in use           f - failed to allocate aggregator
      u - unsuitable for bundling
      w - waiting to be aggregated
      d - default port

Number of channel-groups in use: 2
Number of aggregators:            2

Group    Port-channel    Protocol    Ports
-----+-----+-----+-----+
1      Po1(SU)           LACP      Gig0/1(P) Gig0/2(P)
3      Po3(SU)           LACP      Fa0/23(P) Fa0/24(P)
B1-S2#show interfaces trunk
Port      Mode      Encapsulation    Status      Native vlan
Po1      on        802.1q          trunking     100
Po3      on        802.1q          trunking     100

Port      Vlans allowed on trunk
Po1      1-1005
Po3      1-1005

Port      Vlans allowed and active in management domain
Po1      1,15,20,100
Po3      1,15,20,100

Port      Vlans in spanning tree forwarding state and not pruned
Po1      1,15,20,100
Po3      none
B1-S2#

```

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B2-S1 ETHERCHANNEL

Access Switch B2_1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
B2-S1>enable
B2-S1#show etherchannel summary
Flags: D - down      P - in port-channel
       I - stand-alone s - suspended
       H - Hot-standby (LACP only)
       R - Layer3        S - Layer2
       U - in use        f - failed to allocate aggregator
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 2
Number of aggregators: 2

Group Port-channel Protocol Ports
-----+-----+-----+-----+
1     Po1(SU)          LACP   Gig0/1(P) Gig0/2(P)
3     Po3(SU)          LACP   Fa0/23(P) Fa0/24(P)
B2-S1#show interfaces trunk
Port    Mode      Encapsulation Status      Native vlan
Po1     on       802.1q        trunking    200
Po3     on       802.1q        trunking    200

Port    Vlans allowed on trunk
Po1    1-1005
Po3    1-1005

Port    Vlans allowed and active in management domain
Po1    1,15,20,200
Po3    1,15,20,200

Port    Vlans in spanning tree forwarding state and not pruned
Po1    1,15,20,200
Po3    1,15,20,200

B2-S1#
```

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B2-S2 ETHERCHANNEL

Access Switch B2_2

Physical Config **CLI** Attributes

IOS Command Line Interface

Please RETURN to get started.

```
B2-S2>show etherchannel summary
Flags: D - down      P - in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3          S - Layer2
U - in use          f - failed to allocate aggregator
u - unsuitable for bundling
w - waiting to be aggregated
d - default port

Number of channel-groups in use: 2
Number of aggregators: 2

Group Port-channel Protocol Ports
-----+-----+-----+-----+
1     Po1(SU)        LACP    Gig0/1(P) Gig0/2(P)
3     Po3(SU)        LACP    Fa0/23(P) Fa0/24(P)

B2-S2>show interfaces trunk
Port      Mode      Encapsulation Status      Native vlan
Po1       on        802.1q        trunking    200
Po3       on        802.1q        trunking    200

Port      Vlans allowed on trunk
Po1       1-1005
Po3       1-1005

Port      Vlans allowed and active in management domain
Po1       1,15,20,200
Po3       1,15,20,200

Port      Vlans in spanning tree forwarding state and not pruned
Po1       1,15,20,200
Po3       none

B2-S2>
```

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B2-MLS ETHERCHANNEL

Multilayer Switch B2

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Unauthorized access prohibited

User Access Verification

Password:

B2-MLS>enable
Password:
B2-MLS>show etherchannel summary
Flags: D - down           P - in port-channel
       I - stand-alone s - suspended
       H - Hot-standby (LACP only)
       R - Layer3           S - Layer2
       U - in use           f - failed to allocate aggregator
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 2
Number of aggregators:                2

Group    Port-channel    Protocol    Ports
-----+-----+-----+-----+
1       Po1(SU)           LACP      Gig1/0/1(P) Gig1/0/2(P)
2       Po2(SU)           LACP      Gig1/0/3(P) Gig1/0/4(P)

B2-MLS#show interfaces trunk
Port      Mode      Encapsulation    Status      Native vlan
Po1      on      802.1q      trunking      200
Po2      on      802.1q      trunking      200

Port      Vlans allowed on trunk
Po1      1-1005
Po2      1-1005

Port      Vlans allowed and active in management domain
Po1      1,5,10,15,20,200
Po2      1,5,10,15,20,200

Port      Vlans in spanning tree forwarding state and not pruned
Po1      1,5,10,15,20,200
Po2      1,5,10,15,20,200

B2-MLS#
```

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