Cisco Internetworking I – Report

Switching, Routing, and Wireless Case Study

Prepared by:

Tony Braxton Tchio Ngoumeza

Deven Chandel

Table of Contents

Contents

Table of Figures

Introduction

The Switching, Routing, and Wireless Case Study is a thorough project description on how to showcase our understanding of the concept of learning in Cisco Internetworking I. The main objective of this project is to implement, design and troubleshoot a topology of a network using Cisco Packet Tracer. In this project we will configure a network that has VLANs, inter-VLAN routing, dynamic IP addressing through DHCP, EtherChannel for link aggregation, Layer 2 switch security, Wireless LAN Controllers (WLCs), Lightweight Wireless Access Points (LWAPs), and static routing with redundancy.

Originally, this project was carefully planned with specific IP addresses using VLSM Variable Length Subnet Mask scheme to make sure the efficient utilization of the IP addresses and scalability. After the using VLSM the VLANs help in creating separate broadcast domain, further enhancing network performance and security. Inter-VLAN routing allows the seamless communication between VLANs possible.

Using DHCP dynamic IP addresses are configured to streamline the assignment of the IP addresses to the devices, making the network more manageable and efficient. To bundle up multiple physical links into a single logical link, EtherChannel is used. Which imptoves the bandwidth utilization and the link reliability of the network.

Layer 2 switch security configurations, which also include port security and DHCP snooping, are implemented to deny unauthorized access and protect against a number of possible security threats. WLCs and LWAPs configure wireless networks, providing users with more connectivity options.

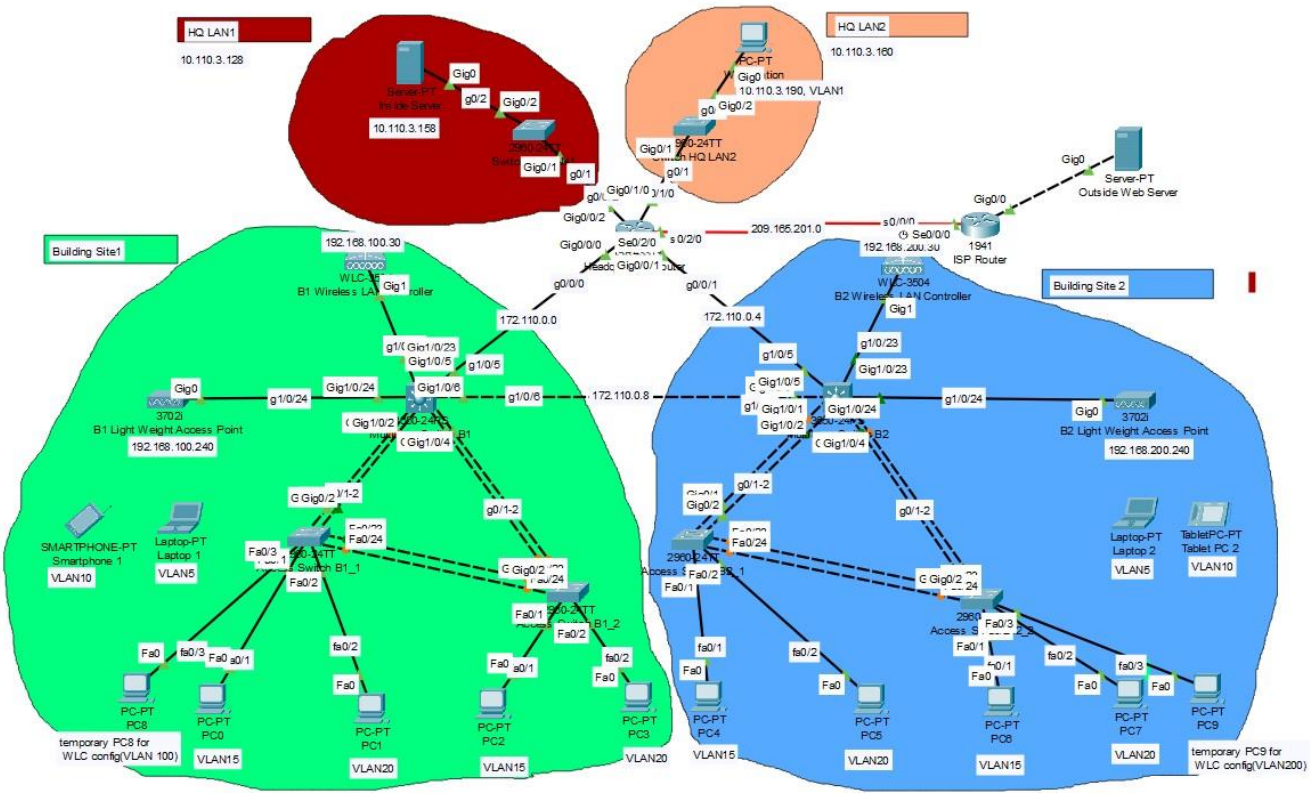
Static routing is a process whereby the explicit paths that data has to take to travel between the source and destination are indicated. This, in turn, makes it simple while offering control in data forwarding. In addition to this, there are floating static routes put in place so that in case the route fails, network connectivity will remain uninterrupted.

Finally, project testing of the network configuration is done to ensure everything is connected and working right, and troubleshoot any issues that may arise. This case study demonstrates the capability in designing, configuration, and maintenance of complex network environments that shall prepare us for real-world networking challenges.

Network Diagram

The below figure shows the whole network set up on the Cisco Packet Tracer application.

The Green part is the Building Site 1 network, Blue part is the Building Site 2, Red part is the HQ LAN 1, and the cream part is the HQ LAN 2.



Components:

ISP Router:

Interface s0/0/0: IP 209.165.201.1/30 Interface

g0/0: IP 209.165.202.129/30

Outside Web Server:

IP: 209.165.202.130/30

Default Gateway: 209.165.202.129

HQ Router:

Interface g0/0/0: IP 172.110.0.1/30 (to B1-MLS)
Interface g0/0/1: IP 172.110.0.5/30 (to B2-MLS)

Interface g0/0/2: IP 209.165.201.2/30 (to ISP)

Interface Vlan1: IP 10.110.3.161/27

B1-MLS (Multilayer Switch):

Interface g1/0/5: IP 172.110.0.2/30 (to HQ Router)

Interface g1/0/6: IP 172.110.0.9/30 (to B2-MLS)

SVI Vlan5: IP 10.110.3.193/28

SVI Vlan10: IP 10.110.3.209/28

SVI Vlan15: IP 10.110.2.1/25

SVI Vlan20: IP 10.110.2.129/25

B2-MLS (Multilayer Switch):

Interface g1/0/5: IP 172.110.0.6/30 (to HQ Router)

Interface g1/0/6: IP 172.110.0.10/30 (to B1-MLS)

SVI Vlan5: IP 10.110.3.225/28

SVI Vlan10: IP 10.110.3.241/28

SVI Vlan15: IP 10.110.3.1/26

SVI Vlan20: IP 10.110.3.65/26

Wireless LAN Controllers (WLCs):

B1-WLC: IP 192.168.100.30/24

B2-WLC: IP 192.168.200.30/24

Access Points and Wireless Devices:

B1 LWAP: DHCP (192.168.100.240-192.168.100.249) B2

LWAP: DHCP (192.168.200.240-192.168.200.249)

Access Switches:

B1-S1: Management IP 192.168.100.10/24

B1-S2: Management IP 192.

VLSM Table

Network Name	Required Hosts	Available Hosts	Network ID	Subnet	First Usable IP	Last Usable IP	Broadcast IP	Subnet Mask
B1_1	120	126	10.110.2.0	/25	10.110.2.1	10.110.2.126	10.110.2.127	255.255.255.128
B1_2	120	126	10.110.2.128	/25	10.110.2.129	10.110.2.254	10.110.2.255	255.255.255.128
B2_1	60	62	10.110.3.0	/26	10.110.3.1	10.110.3.62	10.110.3.63	255.255.255.192
B2_2	60	62	10.110.3.64	/26	10.110.3.65	10.110.3.126	10.110.3.127	255.255.255.192
HQ_1	30	30	10.110.3.128	/27	10.110.3.129	10.110.3.158	10.110.3.159	255.255.255.224
HQ_2	30	30	10.110.3.160	/27	10.110.3.161	10.110.3.190	10.110.3.191	255.255.255.224
W_1	14	14	10.110.3.192	/28	10.110.3.193	10.110.3.206	10.110.3.207	255.255.255.240
W_2	14	14	10.110.3.208	/28	10.110.3.209	10.110.3.222	10.110.3.223	255.255.255.240
W_3	14	14	10.110.3.224	/28	10.110.3.225	10.110.3.238	10.110.3.239	255.255.255.240
W_4	14	14	10.110.3.240	/28	10.110.3.241	10.110.3.254	10.110.3.255	255.255.255.240
Routed Port_1(HQ - B1-MLS)	2	2	172.110.0.0	/30	172.110.0.1	172.110.0.2	172.110.0.3	255.255.255.252
Routed Port_2(HQ - B2-MLS)	2	2	172.110.0.4	/30	172.110.0.5	172.110.0.6	172.110.0.7	255.255.255.252
Routed Port_3(B1-MLS - B2-MLS)	2	2	172.110.0.8	/30	172.110.0.9	172.110.0.10	172.110.0.11	255.255.255.252

In this VLSM scheme, the variable length subnet mask has been planned and implemented for efficiently using the IP address space while fulfilling the nos. of required hosts for any subnet. The table shows the detailed breakdown for each subnet, including network name, no. of required hosts, available hosts, network ID, subnet prefix, usable IP addresses, broadcast IP, and subnet mask.

This Subnetting ensures efficient utilization of the IP address space: •

Scalability for future growth.

- This clearly separates different network segments and improves security and performance.
- It simplifies network management.

Here are some examples of the VLSM calculations: -

Step-by-Step VLSM Calculation

Step 1: Determine Subnet Mask and Subnet Ranges

1. **B1_1 Network:**
    - Required Hosts: 120
    - Available Hosts: 126
    - Subnet Mask: 255.255.255.128 (/25)
    - Network ID: 10.110.2.0
    - First Usable IP: 10.110.2.1
    - Last Usable IP: 10.110.2.126
    - Broadcast IP: 10.110.2.127
2. **B1_2 Network:**
    - Required Hosts: 120
    - Available Hosts: 126
    - Subnet Mask: 255.255.255.128 (/25)
    - Network ID: 10.110.2.128
    - First Usable IP: 10.110.2.129
    - Last Usable IP: 10.110.2.254
    - Broadcast IP: 10.110.2.255
3. **B2_1 Network:**
    - Required Hosts: 60
    - Available Hosts: 62
    - Subnet Mask: 255.255.255.192 (/26)
    - Network ID: 10.110.3.0
    - First Usable IP: 10.110.3.1
    - Last Usable IP: 10.110.3.62

- Broadcast IP: 10.110.3.63

Calculation for Networks

B1_1 Network Calculation

For 120 hosts:

- Minimum required hosts: 120 • Subnet Mask Calculation:
  - 2^7 = 128 (which provides 126 usable IP addresses, subtracting 2 for network and broadcast addresses)
  - Subnet Mask: 255.255.255.128 (/25) Address Range:

- Network ID: 10.110.2.0
- First Usable IP: 10.110.2.1
- Last Usable IP: 10.110.2.126
- Broadcast IP: 10.110.2.127

B1_2 Network Calculation

For 120 hosts:

- Minimum required hosts: 120 • Subnet Mask Calculation:
  - 2^7 = 128 (which provides 126 usable IP addresses, subtracting 2 for network and broadcast addresses)
  - Subnet Mask: 255.255.255.128 (/25) Address Range:

- Network ID: 10.110.2.128
- First Usable IP: 10.110.2.129
- Last Usable IP: 10.110.2.254
- Broadcast IP: 10.110.2.255

B2_1 Network Calculation

For 60 hosts:

- Minimum required hosts: 60 • Subnet Mask Calculation:
  - 2^6 = 64 (which provides 62 usable IP addresses, subtracting 2 for network and broadcast addresses)
  - Subnet Mask: 255.255.255.192 (/26) Address Range:

- Network ID: 10.110.3.0
- First Usable IP: 10.110.3.1

- Last Usable IP: 10.110.3.62
- Broadcast IP: 10.110.3.63

Addressing Table

Device name	Interface/Subinterface/SVI	IP address	Subnet Mask	Default Gateway
Server-PT Outside Web Server	G0	209.165.202.130	255.255.255.252	209.165.202.129
Server-PT Inside Web Server	G0	10.110.3.158	255.255.255.224	10.110.3.129
ISP Router	G0/0	209.165.202.129	255.255.255.252	
	Se0/0/0	209.165.201.1	255.255.255.252	
Headquarter Router	G0/0/0	172.110.0.1	255.255.255.252	
	G0/0/1	172.110.0.5	255.255.255.252	
	G0/0/2	10.110.3.129	255.255.255.224	
	VLAN1	10.110.3.161	255.255.255.224	
	Se0/2/0	209.165.201.2	255.255.255.252	
Switch HQ LAN1	VLAN1	10.110.3.130	255.255.255.224	10.110.3.129
Switch HQ LAN2	VLAN1	10.110.3.162	255.255.255.224	10.110.3.161
MLS-B1	G1/0/5	172.110.0.2	255.255.255.252	
	G1/0/6	172.110.0.9	255.255.255.252	
	VLAN5	10.110.3.193	255.255.255.240	
	VLAN10	10.110.3.209	255.255.255.240	
	VLAN15	10.110.2.1	255.255.255.128	
	VLAN20	10.110.2.129	255.255.255.128	
	VLAN100	192.168.100.1	255.255.255.0	
MLS-B2	G1/0/5	172.110.0.6	255.255.255.252	
	G1/0/6	172.110.0.10	255.255.255.252	
	VLAN5	10.110.3.225	255.255.255.240	
	VLAN10	10.110.3.241	255.255.255.240	
	VLAN15	10.110.3.1	255.255.255.192	
	VLAN20	10.110.3.65	255.255.255.192	
	VLAN200	192.168.200.1	255.255.255.0	

B1 Wireless LAN Controller	G1	192.168.100.30	255.255.255.0	
B2 Wireless LAN Controller	G1	192.168.200.30	255.255.255.0	
B1 Lightweight Access Point	G0	192.168.100.240 (DHCP)	255.255.255.0	
B2 Lightweight Access Point	G0	192.168.200.240 (DHCP)	255.255.255.0	
Access Switch B1_1	VLAN100	192.168.100.10	255.255.255.0	192.168.100.1
Access Switch B1_2	VLAN100	192.168.100.20	255.255.255.0	192.168.100.1
Access Switch B2_1	VLAN200	192.168.200.10	255.255.255.0	192.168.200.1
Access Switch B2_2	VLAN200	192.168.200.20	255.255.255.0	192.168.200.1
PC-PT Workstation	G0	10.110.3.190	255.255.255.224	10.110.3.161
PC-PT PC0	Fa0/1	10.110.2.6 (DHCP)	255.255.255.128	10.110.2.1
PC-PT PC1	Fa0/2	10.110.2.134 (DHCP)	255.255.255.128	10.110.2.129
PC-PT PC2	Fa0/1	10.110.2.7 (DHCP)	255.255.255.128	10.110.2.1
PC-PT PC3	Fa0/2	10.110.2.135 (DHCP)	255.255.255.128	10.110.2.129
PC-PT PC4	Fa0/1	10.110.3.6 (DHCP)	255.255.255.192	10.110.3.1
PC-PT PC5	Fa0/2	10.110.3.70 (DHCP)	255.255.255.192	10.110.3.65
PC-PT PC6	Fa0/1	10.110.3.7 (DHCP)	255.255.255.192	10.110.3.1
PC-PT PC7	Fa0/2	10.110.3.71 (DHCP)	255.255.255.192	10.110.3.65
Temporarily added PC8	Fa0/3	192.168.100.2 (static)	255.255.255.0	192.168.100.1
Temporarily added PC9	Fa0/3	192.168.200.2 (static)	255.255.255.0	192.168.200.1
Laptop-PT Laptop 1	W0	10.110.3.198	255.255.255.240	10.110.3.193

SmartphonePT Smartphone 1	W0	10.110.3.214	255.255.255.240	10.110.3.209
Laptop-PT Laptop 2	W0	10.110.3.230	255.255.255.240	10.110.3.225
Tablet PC-PT Tablet PC 2	W0	10.110.3.246	255.255.255.240	10.110.3.241

Configurations

Switch and Router Configurations

Wireless Controller Configuration

Routing Configurations

Connectivity Testing

Conclusion

Appendices

```
B1-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 NVRAM  up                    up
GigabitEthernet1/0/2   unassigned      YES NVRAM  up                    up
GigabitEthernet1/0/3   unassigned      YES NVRAM  up                    up
GigabitEthernet1/0/4   unassigned      YES NVRAM  up                    up
GigabitEthernet1/0/5   172.110.0.2     YES manual up                    up
GigabitEthernet1/0/6   172.110.0.9     YES manual up                    up
GigabitEthernet1/0/7   unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/8   unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/9   unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/10  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/11  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/12  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/13  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/14  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/15  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/16  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/17  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/18  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/19  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/20  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/21  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/22  unassigned      YES NVRAM  down                  down
GigabitEthernet1/0/23  unassigned      YES NVRAM  up                    up
GigabitEthernet1/0/24  unassigned      YES NVRAM  up                    up
GigabitEthernet1/1/1   unassigned      YES NVRAM  down                  down
GigabitEthernet1/1/2   unassigned      YES NVRAM  down                  down
GigabitEthernet1/1/3   unassigned      YES NVRAM  down                  down
GigabitEthernet1/1/4   unassigned      YES NVRAM  down                  down
Vlan1                  unassigned      YES unset  administratively down down
Vlan5                  10.110.3.193    YES manual up                    up
Vlan10                 10.110.3.209    YES manual up                    up
Vlan15                 10.110.2.1      YES manual up                    up
Vlan20                 10.110.2.129    YES manual up                    up
Vlan100                192.168.100.1   YES manual up                    up
```

Figure 1 B1-MLS show ip interface brief

```
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 172.110.0.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 10 subnets, 4 masks
C       10.110.2.0/25 is directly connected, Vlan15
C       10.110.2.128/25 is directly connected, Vlan20
S       10.110.3.0/26 [1/0] via 172.110.0.10
S       10.110.3.64/26 [1/0] via 172.110.0.10
S       10.110.3.128/27 [1/0] via 172.110.0.1
S       10.110.3.160/27 [1/0] via 172.110.0.1
C       10.110.3.192/28 is directly connected, Vlan5
C       10.110.3.208/28 is directly connected, Vlan10
S       10.110.3.224/28 [1/0] via 172.110.0.10
S       10.110.3.240/28 [1/0] via 172.110.0.10
     172.110.0.0/30 is subnetted, 2 subnets
C       172.110.0.0 is directly connected, GigabitEthernet1/0/5
C       172.110.0.8 is directly connected, GigabitEthernet1/0/6
C    192.168.100.0/24 is directly connected, Vlan100
S    192.168.200.0/24 [1/0] via 172.110.0.10
S*   0.0.0.0/0 [1/0] via 172.110.0.1
```

Figure 2 B1-MLS show ip route

```
B1-MLS#show running-config
Building configuration...

Current configuration : 5310 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 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
!
ip dhcp excluded-address 10.110.2.1 10.110.2.5
ip dhcp excluded-address 10.110.2.129 10.110.2.133
ip dhcp excluded-address 10.110.3.193 10.110.3.197
ip dhcp excluded-address 10.110.3.209 10.110.3.213
!
ip dhcp pool B1_VLAN5
 network 10.110.3.192 255.255.255.240
 default-router 10.110.3.193
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN10
 network 10.110.3.208 255.255.255.240
 default-router 10.110.3.209
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN15
 network 10.110.2.0 255.255.255.128
 default-router 10.110.2.1
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN20
 network 10.110.2.128 255.255.255.128
 default-router 10.110.2.129
 dns-server 10.110.3.158
!
!
!
no ip cef
ip routing
!
no ipv6 cef
!
!
!
!
!
!
```

Figure 3 B1-MLS show running-config (1)

```
spanning-tree mode pvst
!
!
!
!
!
!
interface Port-channel1
 description Etherchannel MLS B1 to Access Switch B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel2
 description Etherchannel MLS B1 to Access Switch B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/0/1
 description MLS B1 to Access Switch B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet1/0/2
 description Redundant MLS B1 to Access Switch B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet1/0/3
 description MLS B1 to Access Switch B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface GigabitEthernet1/0/4
 description Redundant MLS B1 to Access Switch B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 --More--
```

Figure 4 show running-config(2)

```
interface GigabitEthernet1/0/4
 description Redundant MLS B1 to Access Switch B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface GigabitEthernet1/0/5
 no switchport
 ip address 172.110.0.2 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet1/0/6
 no switchport
 ip address 172.110.0.9 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet1/0/7
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
 switchport access vlan 100
 switchport mode access
!
```

Figure 5 show running-config(3)

```
interface GigabitEthernet1/0/23
 description MLS B1 to B1 Wireless LAN Controller
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/0/24
 description MLS B1 to B1 Light Weight Access Point
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 mac-address 0060.3e87.9201
 ip address 10.110.3.193 255.255.255.240
!
interface Vlan10
 description VLAN 10 Wireless 2
 mac-address 0060.3e87.9202
 ip address 10.110.3.209 255.255.255.240
!
interface Vlan15
 description VLAN 15 team1
 mac-address 0060.3e87.9203
 ip address 10.110.2.1 255.255.255.128
!
interface Vlan20
 description VLAN 20 team2
 mac-address 0060.3e87.9204
 ip address 10.110.2.129 255.255.255.128
!
interface Vlan100
 description VLAN 100 Management
 mac-address 0060.3e87.9205
 ip address 192.168.100.1 255.255.255.0
!
```

Figure 6 show running-config(4)

```
ip classless
ip route 10.110.3.0 255.255.255.192 172.110.0.10
ip route 10.110.3.64 255.255.255.192 172.110.0.10
ip route 10.110.3.224 255.255.255.240 172.110.0.10
ip route 10.110.3.240 255.255.255.240 172.110.0.10
ip route 10.110.3.128 255.255.255.224 172.110.0.1
ip route 192.168.200.0 255.255.255.0 172.110.0.10
ip route 10.110.3.160 255.255.255.224 172.110.0.1
ip route 0.0.0.0 0.0.0.0 172.110.0.1
ip route 10.110.3.128 255.255.255.224 172.110.0.10 10
ip route 10.110.3.160 255.255.255.224 172.110.0.10 10
ip route 10.110.3.0 255.255.255.192 172.110.0.1 10
ip route 10.110.3.64 255.255.255.192 172.110.0.1 10
ip route 10.110.3.224 255.255.255.240 172.110.0.1 10
ip route 10.110.3.240 255.255.255.240 172.110.0.1 10
ip route 0.0.0.0 0.0.0.0 172.110.0.10 10
!
ip flow-export version 9
!
!
!
banner motd ^CAuthorized Access Only^C
!
!
!
!
line con 0
 password cisco
 login
!
line aux 0
!
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
!
!
!
end
```

Figure 7 show running-config(5)

```
B1-MLS#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig1/0/7, Gig1/0/8, Gig1/0/9, 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    Gig1/0/10
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 8 show vlan brief

```
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)
```

Figure 9 B1-S1 show Etherchannel summary

```
B1-S1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel1          unassigned      YES manual up                    up
Port-channel3          unassigned      YES manual up                    up
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/2        unassigned      YES manual up                    up
FastEthernet0/3        unassigned      YES manual up                    up
FastEthernet0/4        unassigned      YES manual down                  down
FastEthernet0/5        unassigned      YES manual down                  down
FastEthernet0/6        unassigned      YES manual down                  down
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
FastEthernet0/11       unassigned      YES manual down                  down
FastEthernet0/12       unassigned      YES manual down                  down
FastEthernet0/13       unassigned      YES manual down                  down
FastEthernet0/14       unassigned      YES manual down                  down
FastEthernet0/15       unassigned      YES manual down                  down
FastEthernet0/16       unassigned      YES manual down                  down
FastEthernet0/17       unassigned      YES manual down                  down
FastEthernet0/18       unassigned      YES manual down                  down
FastEthernet0/19       unassigned      YES manual down                  down
FastEthernet0/20       unassigned      YES manual down                  down
FastEthernet0/21       unassigned      YES manual down                  down
FastEthernet0/22       unassigned      YES manual down                  down
FastEthernet0/23       unassigned      YES manual up                    up
FastEthernet0/24       unassigned      YES manual up                    up
GigabitEthernet0/1     unassigned      YES manual up                    up
GigabitEthernet0/2     unassigned      YES manual up                    up
Vlan1                  unassigned      YES manual administratively down down
Vlan5                  unassigned      YES manual up                    up
Vlan10                 unassigned      YES manual up                    up
Vlan15                 unassigned      YES manual up                    up
Vlan20                 unassigned      YES manual up                    up
Vlan100                192.168.100.10  YES manual up                    up
```

Figure 10 B1-S1 show ip interface brief

```
B1-S1#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
--------------------------------------------------------------------------
        Fa0/1        2          1                0          Protect
        Fa0/2        2          1                0          Protect
--------------------------------------------------------------------------
```

Figure 11 B1-S1 show port-security

```
B1-S1#show running-config
Building configuration...

Current configuration : 3776 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B1-S1
!
!
!
!
!
ip dhcp snooping vlan 5,10,15,20,100
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface Port-channel1
 description Etherchannel Access Switch B1_1 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel3
 description Etherchannel Access Switch B1_1 to B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface FastEthernet0/1
 description Access Switch B1_1 to PC0
 switchport access vlan 15
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0006.2A86.D523
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
```

Figure 12 B1-S1 show running-config(1)

```
interface FastEthernet0/2
 description Access Switch B1_1 to PC1
 switchport access vlan 20
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0060.477D.D1DC
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
interface FastEthernet0/3
 description temporary PC8 for WLC config
 switchport access vlan 100
 switchport mode access
!
```

Figure 13 B1-S1 show running-config(2)

```
interface FastEthernet0/23
 description Access Switch B1_1 to B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface FastEthernet0/24
 description Redundant Access Switch B1_1 to B1_2
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface GigabitEthernet0/1
 description Access Switch B1_1 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet0/2
 description Redundant Access Switch B1_1 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 no ip address
!
interface Vlan10
 description VLAN 10 Wireless 2
 no ip address
!
```

Figure 14 B1-S1 show running-config(3)

```
interface Vlan15
 description VLAN 15 team1
 no ip address
!
interface Vlan20
 description VLAN 20 team2
 no ip address
!
interface Vlan100
 description VLAN 100 Management
 ip address 192.168.100.10 255.255.255.0
!
ip default-gateway 192.168.100.1
!
!
!
!
line con 0
 login
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end
```

Figure 15 B1-S1 show running-config(4)

```
B1-S1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                Fa0/20, Fa0/21, Fa0/22
5    Wireless1                        active
10   Wireless2                        active
15   team1                            active    Fa0/1
20   team2                            active    Fa0/2
100  Management                       active    Fa0/3
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 16 B1-S1 show vlan brief

```
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
------+-------------+-----------+-----------------------------------------------

2      Po2(SU)           LACP   Gig0/1(P) Gig0/2(P)
3      Po3(SU)           LACP   Fa0/23(P) Fa0/24(P)
```

Figure 17 B1-S2 show etherchannel summary

```
B1-S2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel2          unassigned      YES manual up                    up
Port-channel3          unassigned      YES manual up                    up
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/2        unassigned      YES manual up                    up
FastEthernet0/3        unassigned      YES manual down                  down
FastEthernet0/4        unassigned      YES manual down                  down
FastEthernet0/5        unassigned      YES manual down                  down
FastEthernet0/6        unassigned      YES manual down                  down
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
FastEthernet0/11       unassigned      YES manual down                  down
FastEthernet0/12       unassigned      YES manual down                  down
FastEthernet0/13       unassigned      YES manual down                  down
FastEthernet0/14       unassigned      YES manual down                  down
FastEthernet0/15       unassigned      YES manual down                  down
FastEthernet0/16       unassigned      YES manual down                  down
FastEthernet0/17       unassigned      YES manual down                  down
FastEthernet0/18       unassigned      YES manual down                  down
FastEthernet0/19       unassigned      YES manual down                  down
FastEthernet0/20       unassigned      YES manual down                  down
FastEthernet0/21       unassigned      YES manual down                  down
FastEthernet0/22       unassigned      YES manual down                  down
FastEthernet0/23       unassigned      YES manual up                    up
FastEthernet0/24       unassigned      YES manual up                    up
GigabitEthernet0/1     unassigned      YES manual up                    up
GigabitEthernet0/2     unassigned      YES manual up                    up
Vlan1                  unassigned      YES manual administratively down down
Vlan5                  unassigned      YES manual up                    up
Vlan10                 unassigned      YES manual up                    up
Vlan15                 unassigned      YES manual up                    up
Vlan20                 unassigned      YES manual up                    up
Vlan100                192.168.100.20  YES manual up                    up
```

Figure 18 B1-S2 show ip interface brief

```
B1-S2#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
-------------------------------------------------------------------------
        Fa0/1        2          1                0          Protect
        Fa0/2        2          1                0          Protect
-------------------------------------------------------------------------
```

Figure 19 B1-S2 show port-security

```
B1-S2#show running-config
Building configuration...

Current configuration : 3682 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B1-S2
!
!
!
!
!
ip dhcp snooping vlan 5,10,15,20,100
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface Port-channel2
 description Etherchannel Access Switch B1_2 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel3
 description Etherchannel Access Switch B1_2 to B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 switchport mode trunk
 switchport nonegotiate
!
interface FastEthernet0/1
 description Access Switch B1_2 to PC2
 switchport access vlan 15
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0004.9A7C.1752
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
```

Figure 20 B1-S2 show running-config(1)

```
interface FastEthernet0/2
 description Access Switch B1_2 to PC3
 switchport access vlan 20
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 00E0.F736.5AE0
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
```

Figure 21 B1-S2 show running-config(2)

```
interface FastEthernet0/23
 description Access Switch B1_2 to B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface FastEthernet0/24
 description Redundant Access Switch B1_2 to B1_1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface GigabitEthernet0/1
 description Access Switch B1_2 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface GigabitEthernet0/2
 description Redundant Access Switch B1_2 to MLS B1
 switchport trunk native vlan 100
 switchport trunk allowed vlan 5,10,15,20,100
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 no ip address
!
interface Vlan10
 description VLAN 10 Wireless 2
 no ip address
!
```

Figure 22 B1-S2 show running-config(3)

```
interface Vlan15
 description VLAN 15 team1
 no ip address
!
interface Vlan20
 description VLAN 20 team2
 no ip address
!
interface Vlan100
 description VLAN 100 Management
 ip address 192.168.100.20 255.255.255.0
!
ip default-gateway 192.168.100.1
!
!
!
!
line con 0
 login
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end
```

Figure 23 B1-S2 show running-config(4)

```
B1-S2#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
5    Wireless1                        active
10   Wireless2                        active
15   team1                            active    Fa0/1
20   team2                            active    Fa0/2
100  Management                       active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 24 B1-S2 show vlan brief

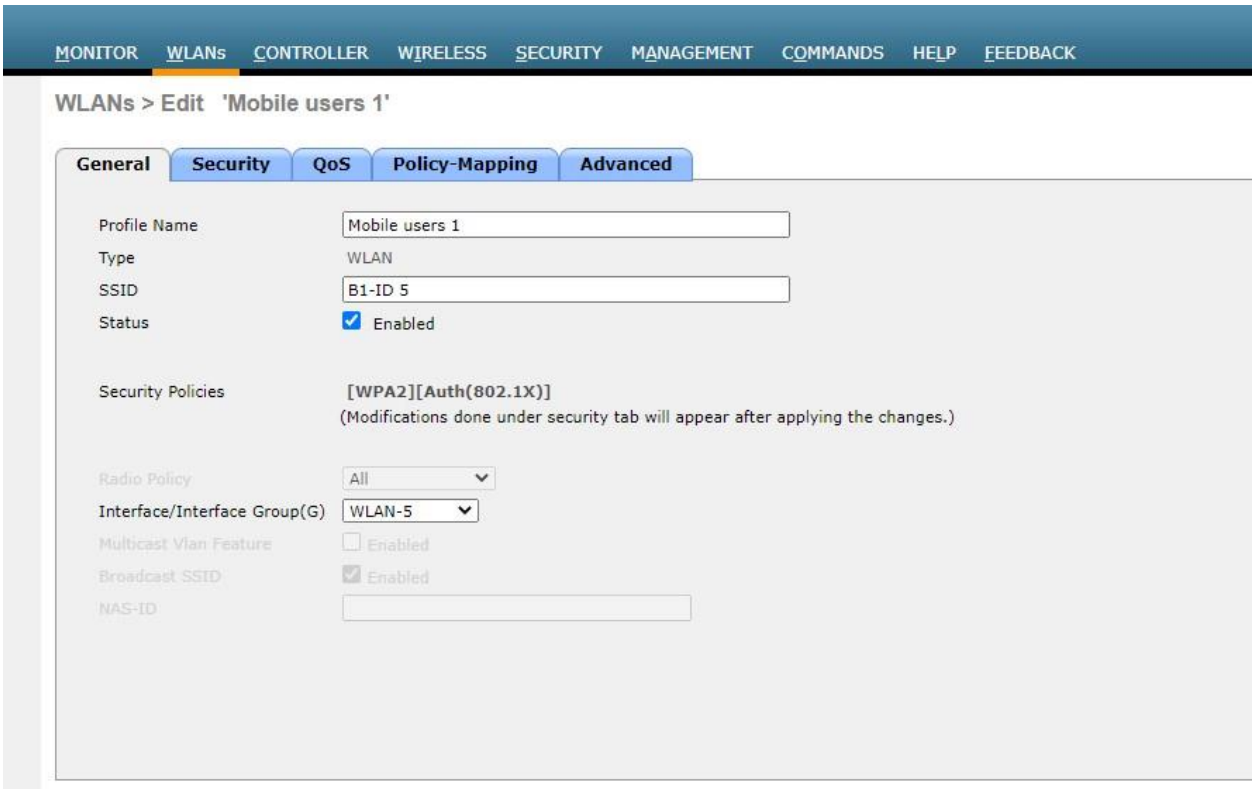


Figure 25 B1-WLC. WLAN--5 general

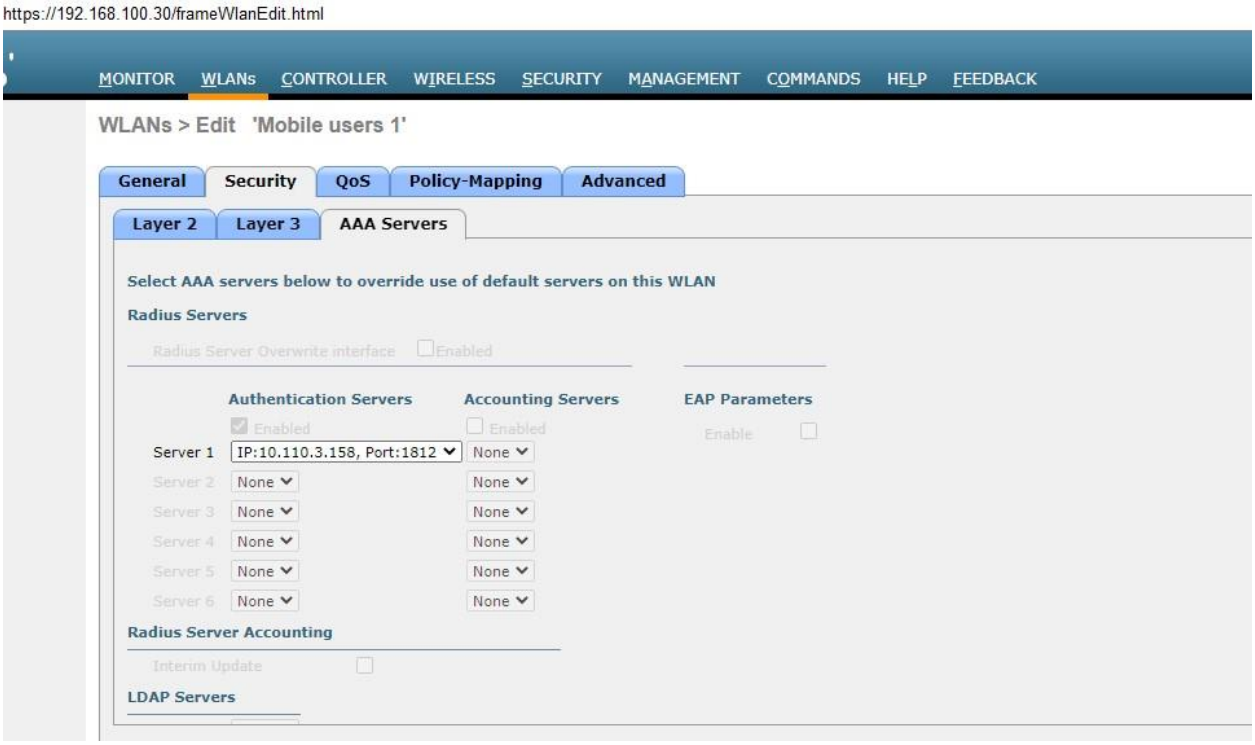


Figure 26 B1-WLC. WLAN--5 security(AAA servers)

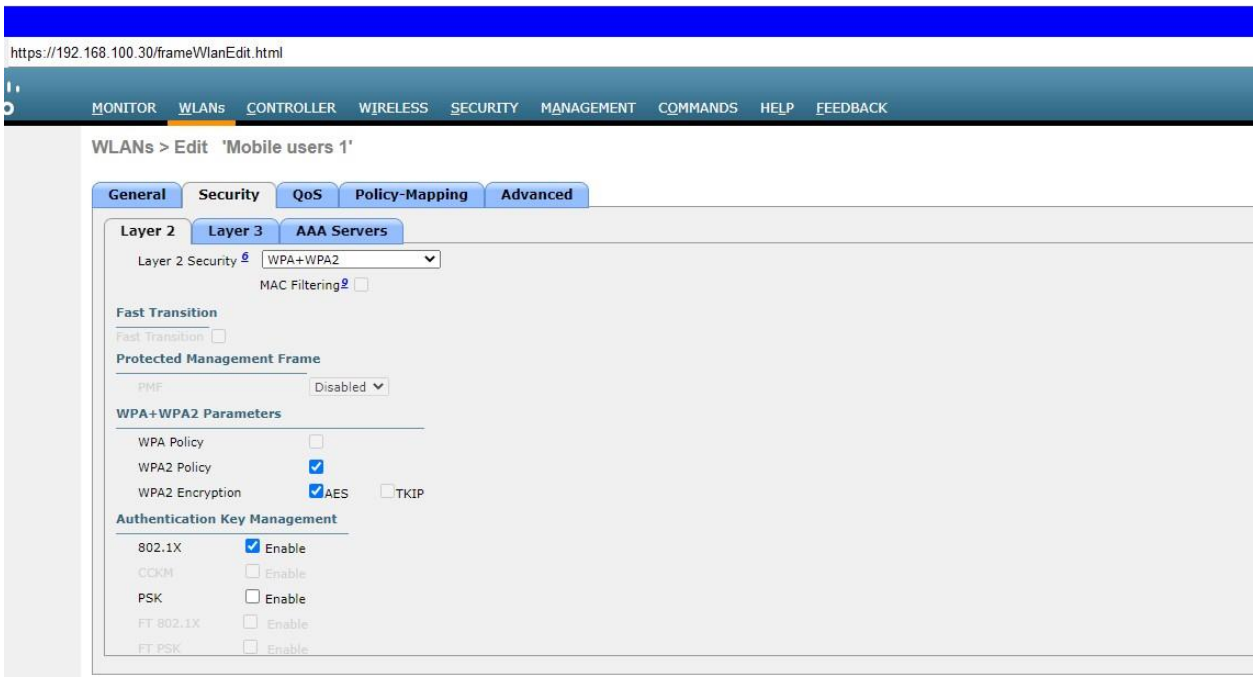


Figure 27B1-WLC. WLAN--5 security(layer2)

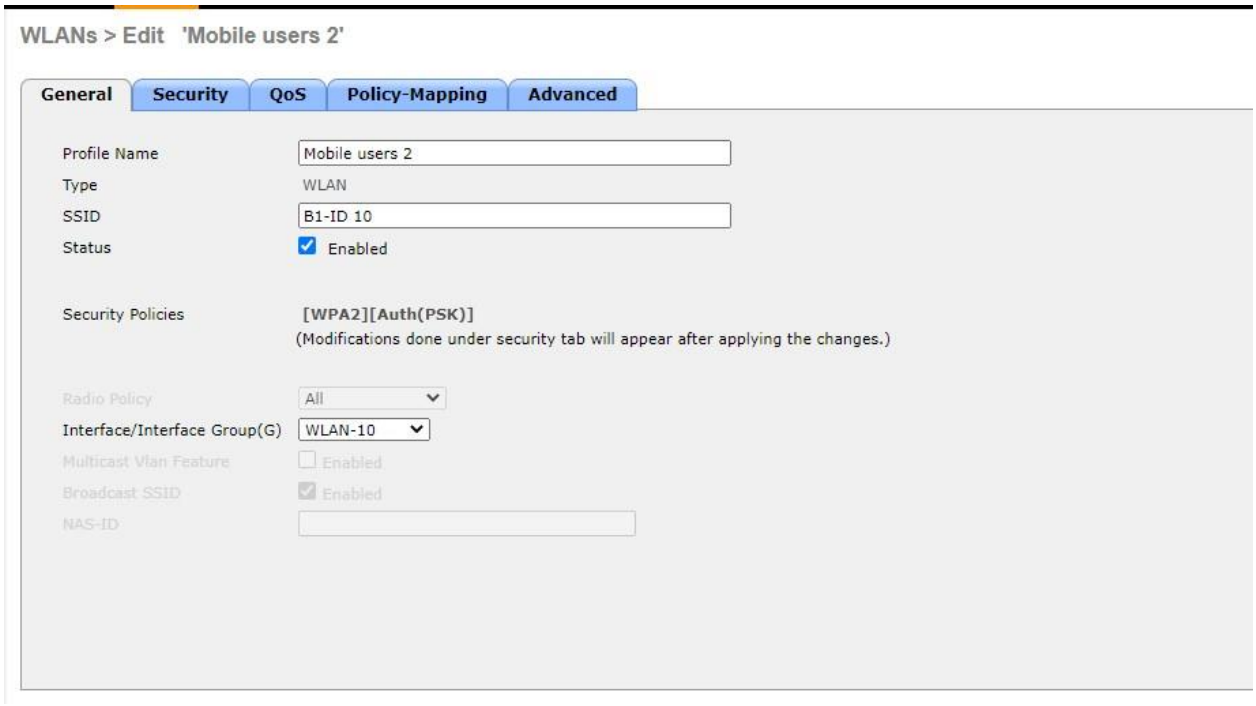


Figure 28 B1-WLC captures\WLAN-10 general

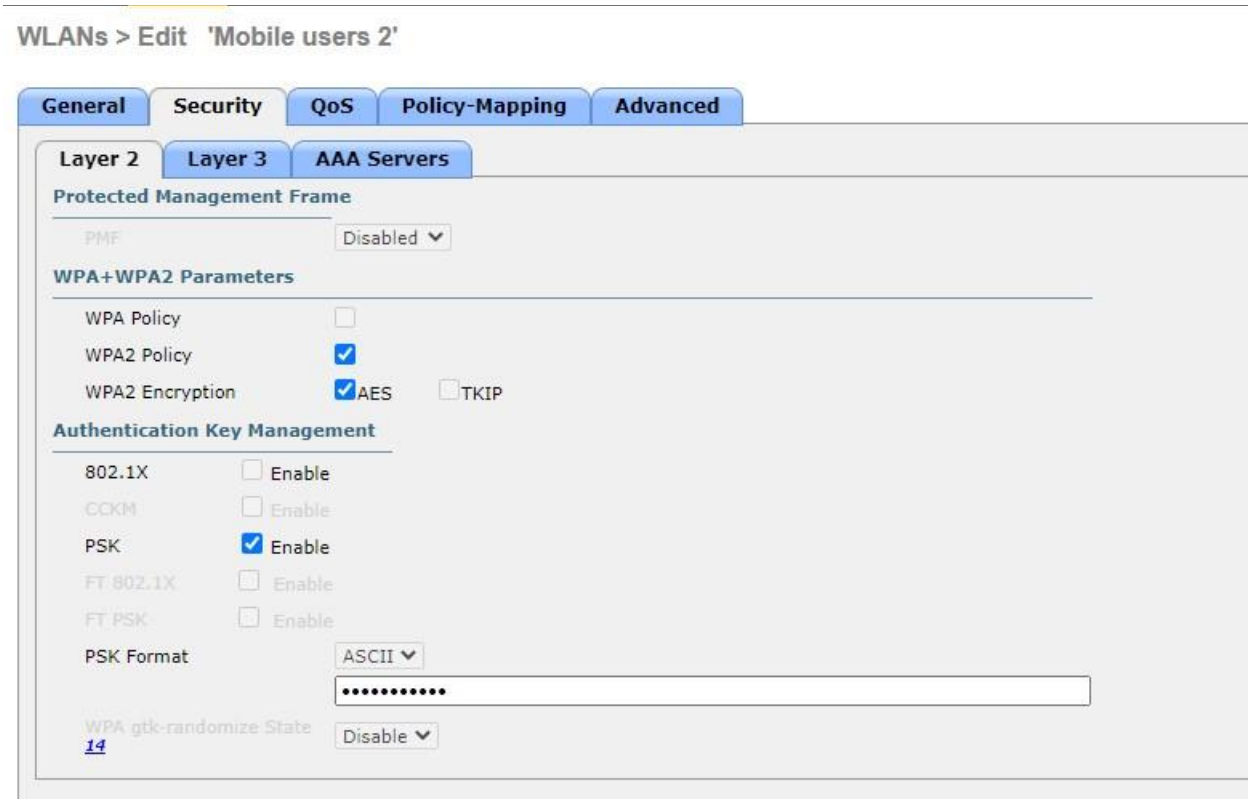


Figure 29 B1-WLC captures\WLAN-10 security (layer2) pt2

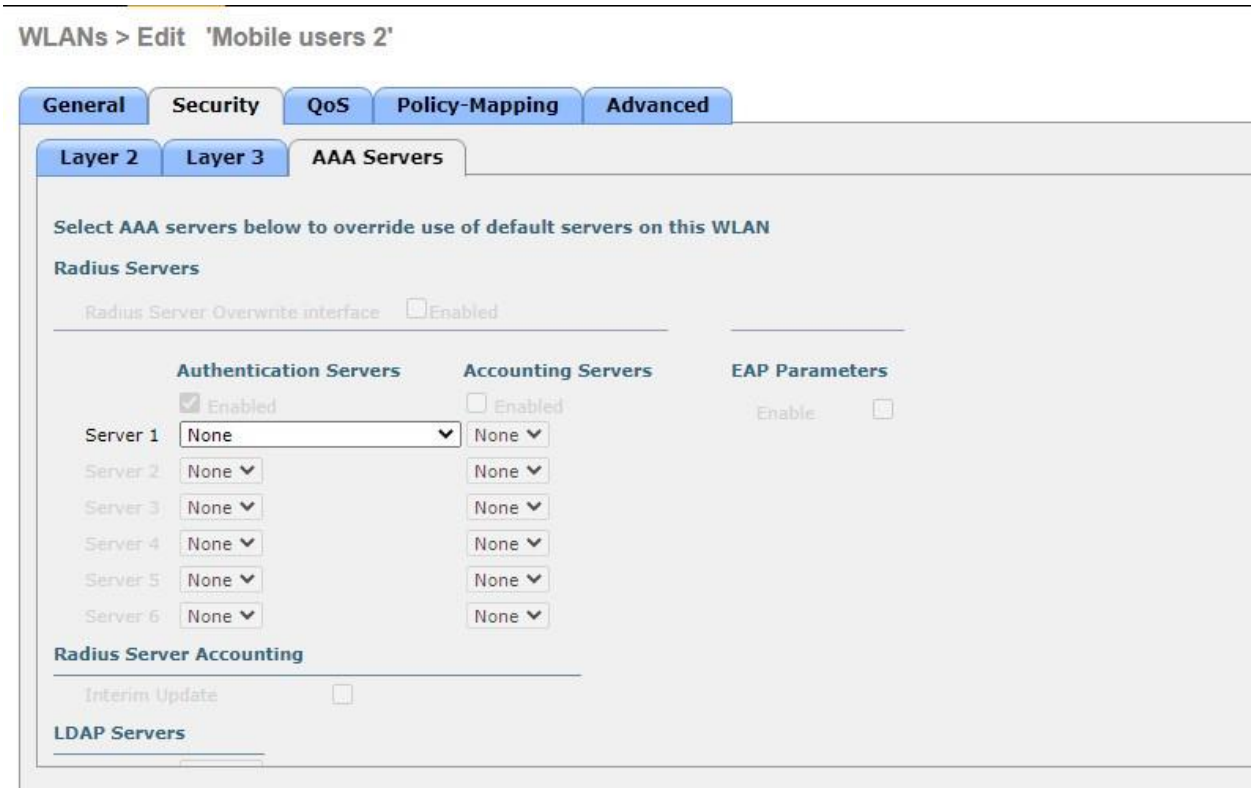


Figure 30 B1-WLC captures\WLAN-10 security (layer2) pt2 security(AAA server)

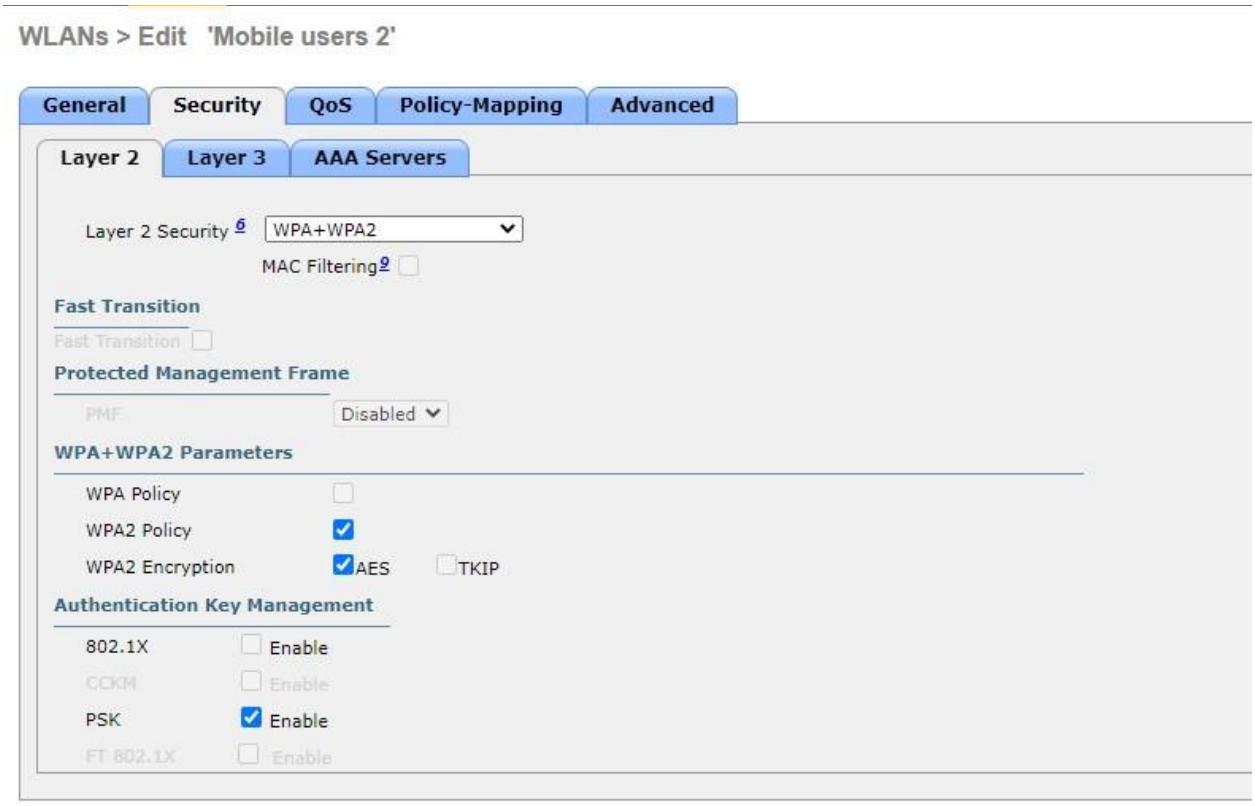


Figure 31 B1-WLC captures\WLAN-10 security(layer2)pt1

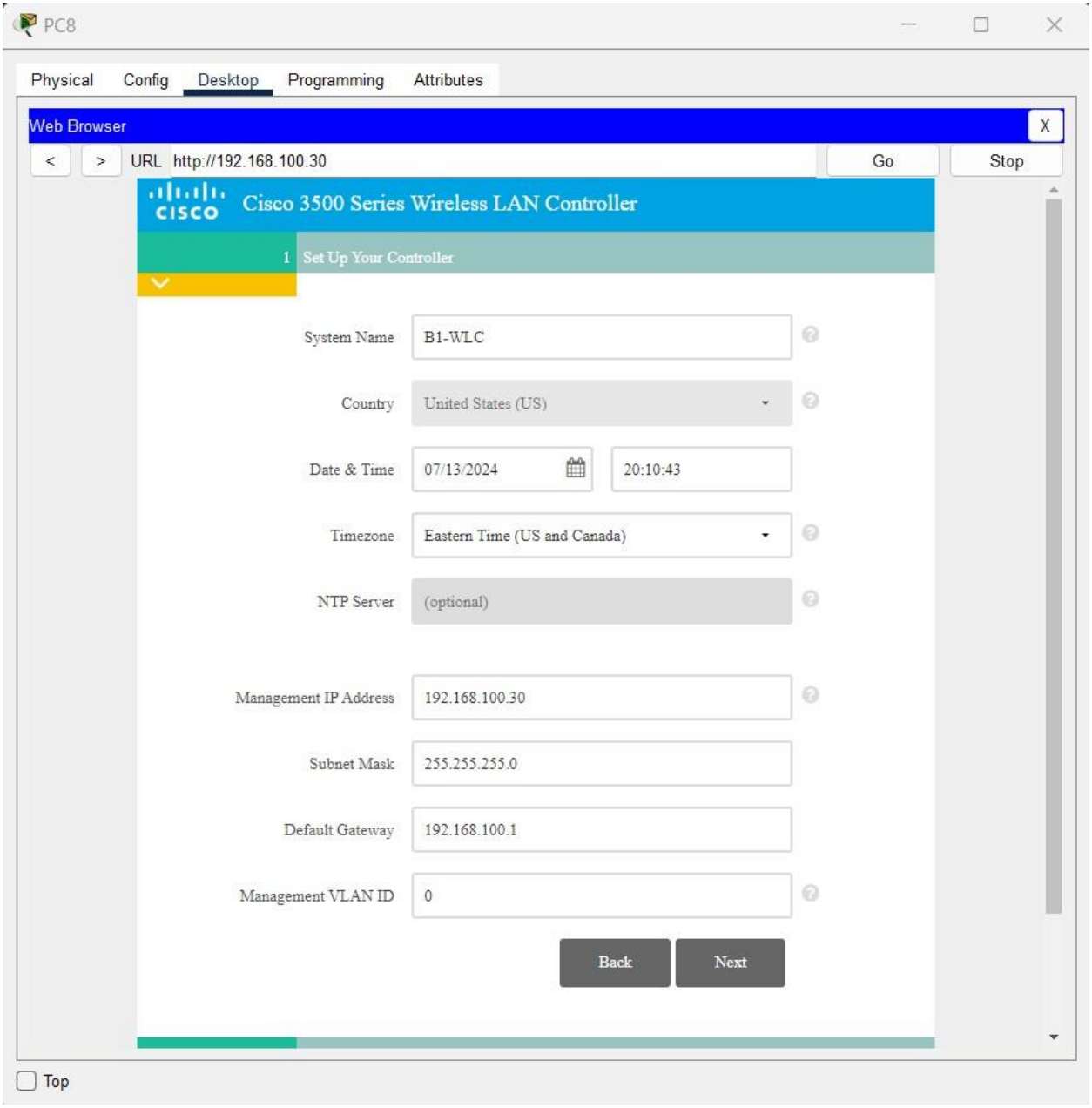

PC8
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL
http://192.168.100.30
Go
Stop
Cisco 3500 Series Wireless LAN Controller
1
Set Up Your Controller
System Name
B1-WLC
Country
United States (US)
Date & Time
07/13/2024
20:10:43
Timezone
Eastern Time (US and Canada)
NTP Server
(optional)
Management IP Address
192.168.100.30
Subnet Mask
255.255.255.0
Default Gateway
192.168.100.1
Management VLAN ID
0
Back
Next
Top

Figure B1-

32 WLC initial config pg1

Figure B1-

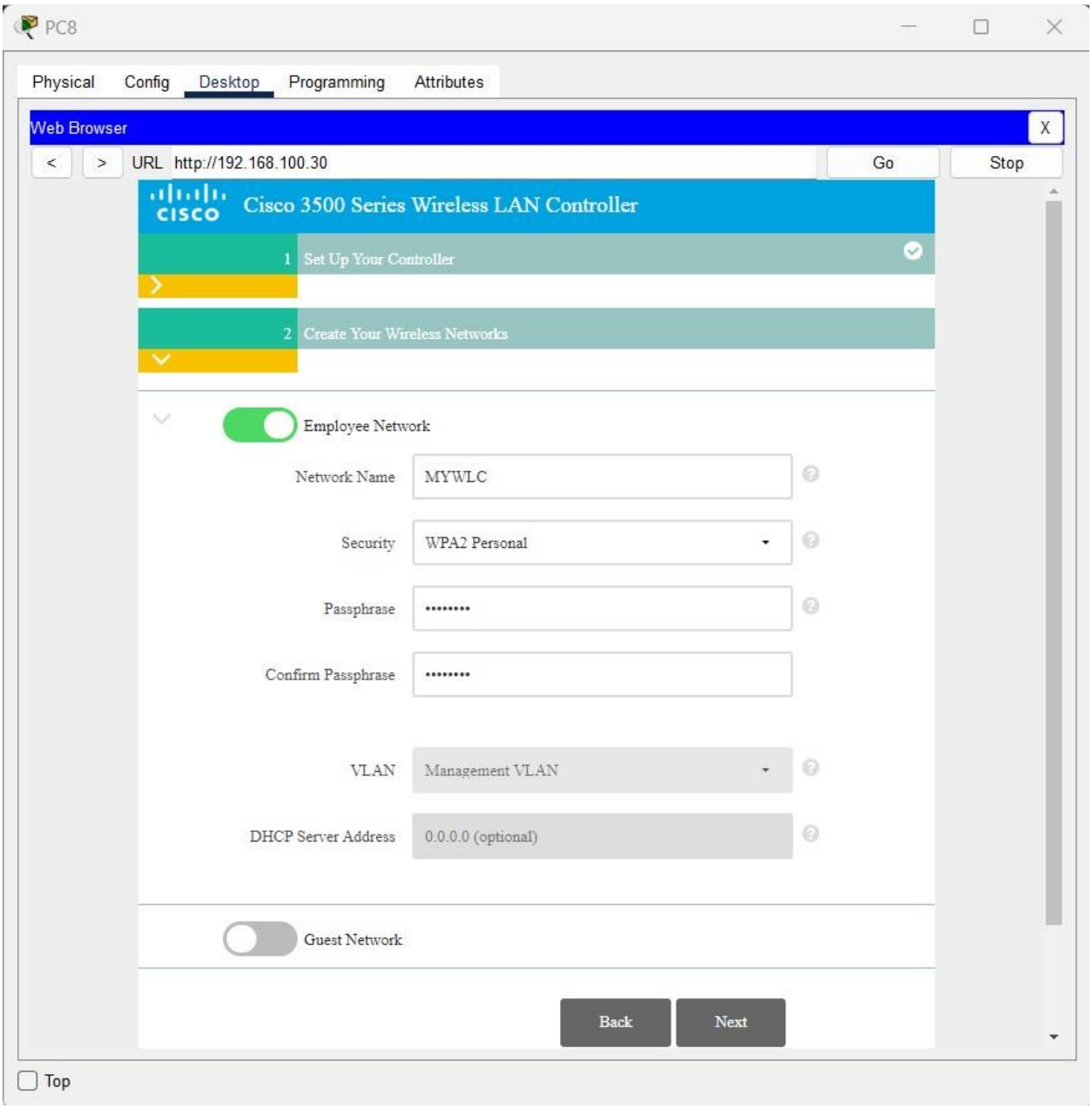

PC8
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL http://192.168.100.30
Go
Stop
cisco
Cisco 3500 Series Wireless LAN Controller
1 Set Up Your Controller
2 Create Your Wireless Networks
Employee Network
Network Name
MYWLC
Security
WPA2 Personal
Passphrase
Confirm Passphrase
VLAN
Management VLAN
DHCP Server Address
0.0.0.0 (optional)
Guest Network
Back
Next
Top

Figure B1-

33 WLC initial config pg2(passphrase is Cisco123)

Figure B1-

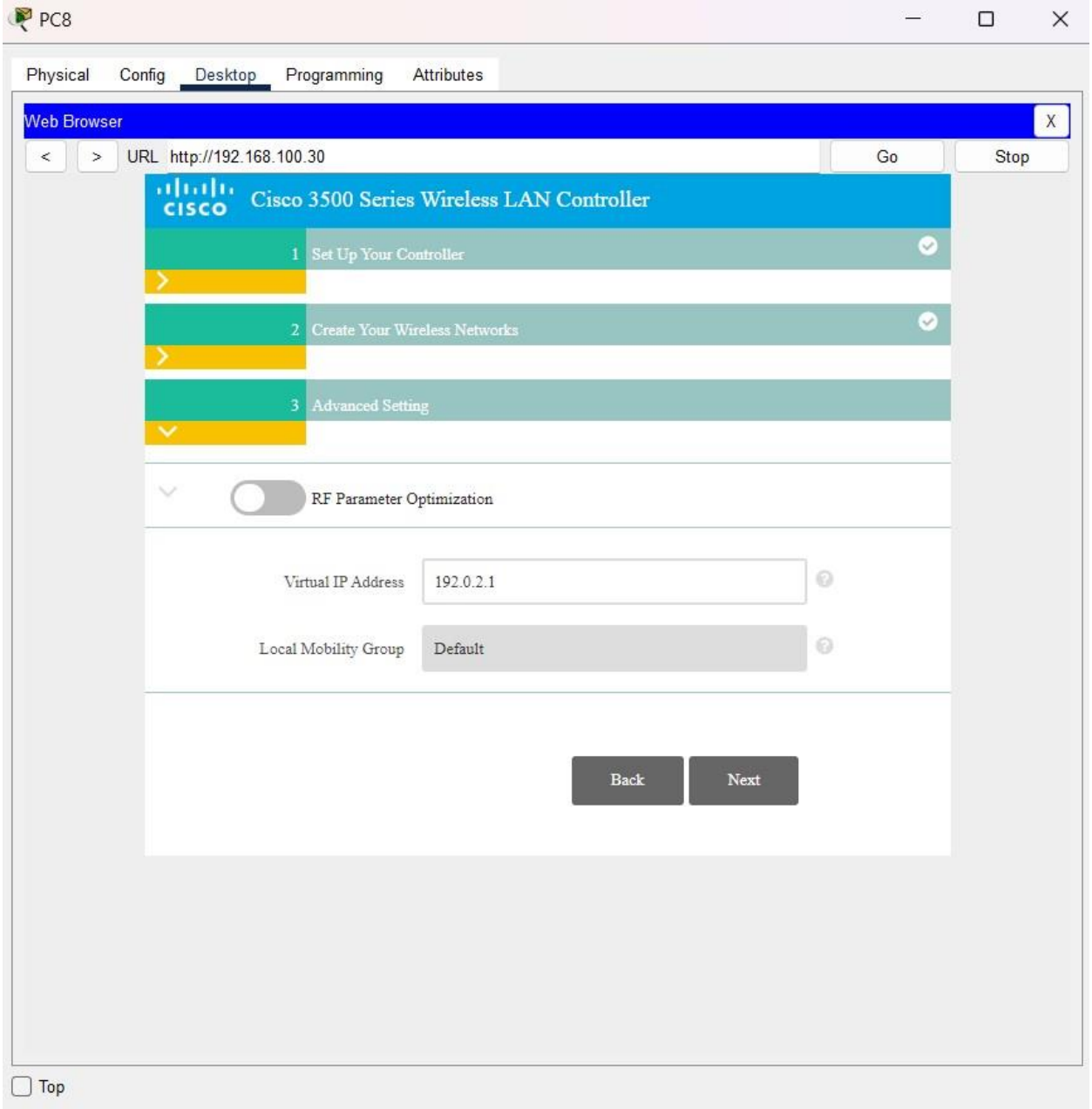
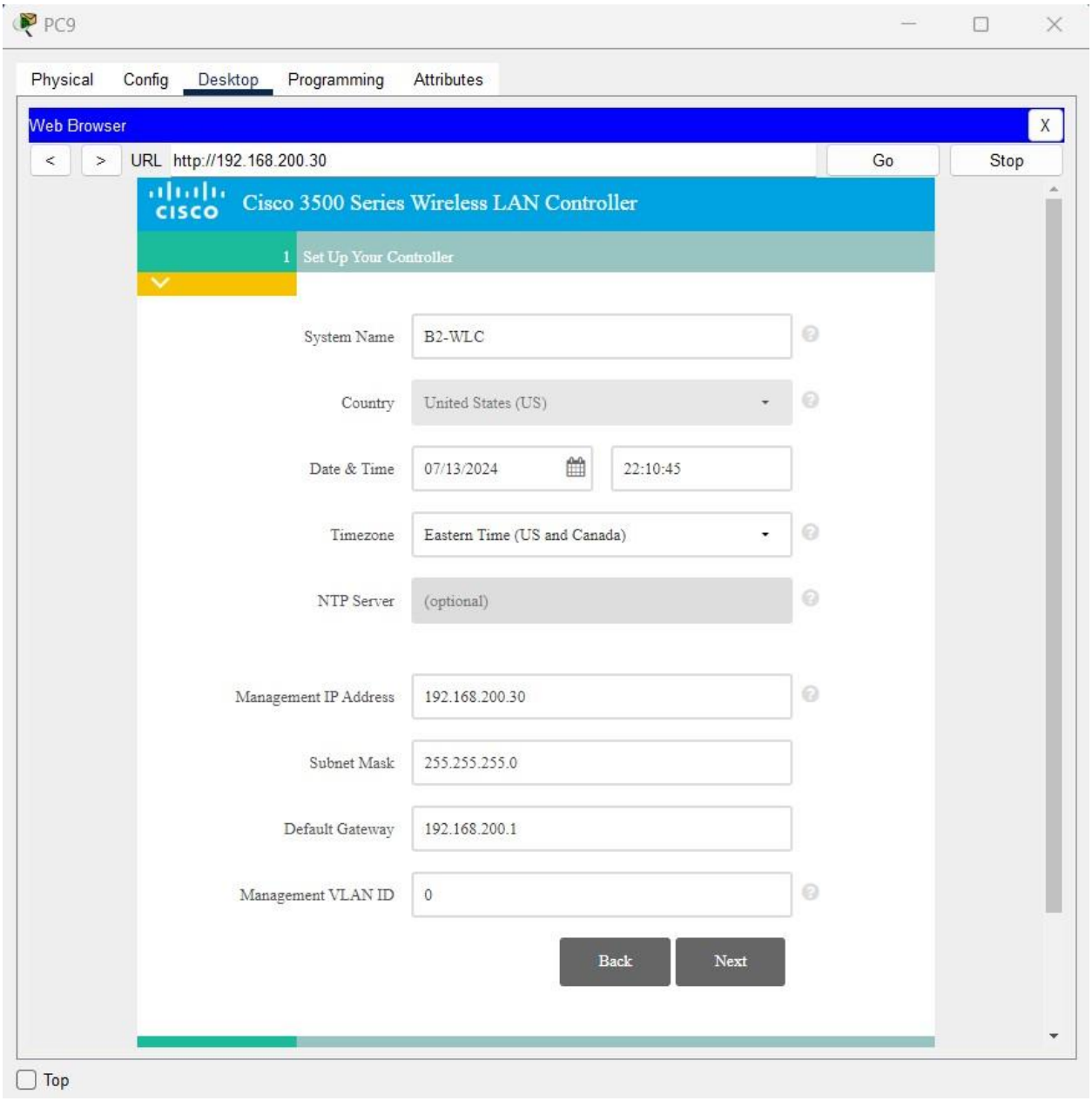

PC8
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL
http://192.168.100.30
Go
Stop
Cisco 3500 Series Wireless LAN Controller
1 Set Up Your Controller
2 Create Your Wireless Networks
3 Advanced Setting
RF Parameter Optimization
Virtual IP Address
192.0.2.1
Local Mobility Group
Default
Back
Next
Top

Figure B1-

34 WLC initial config pg3

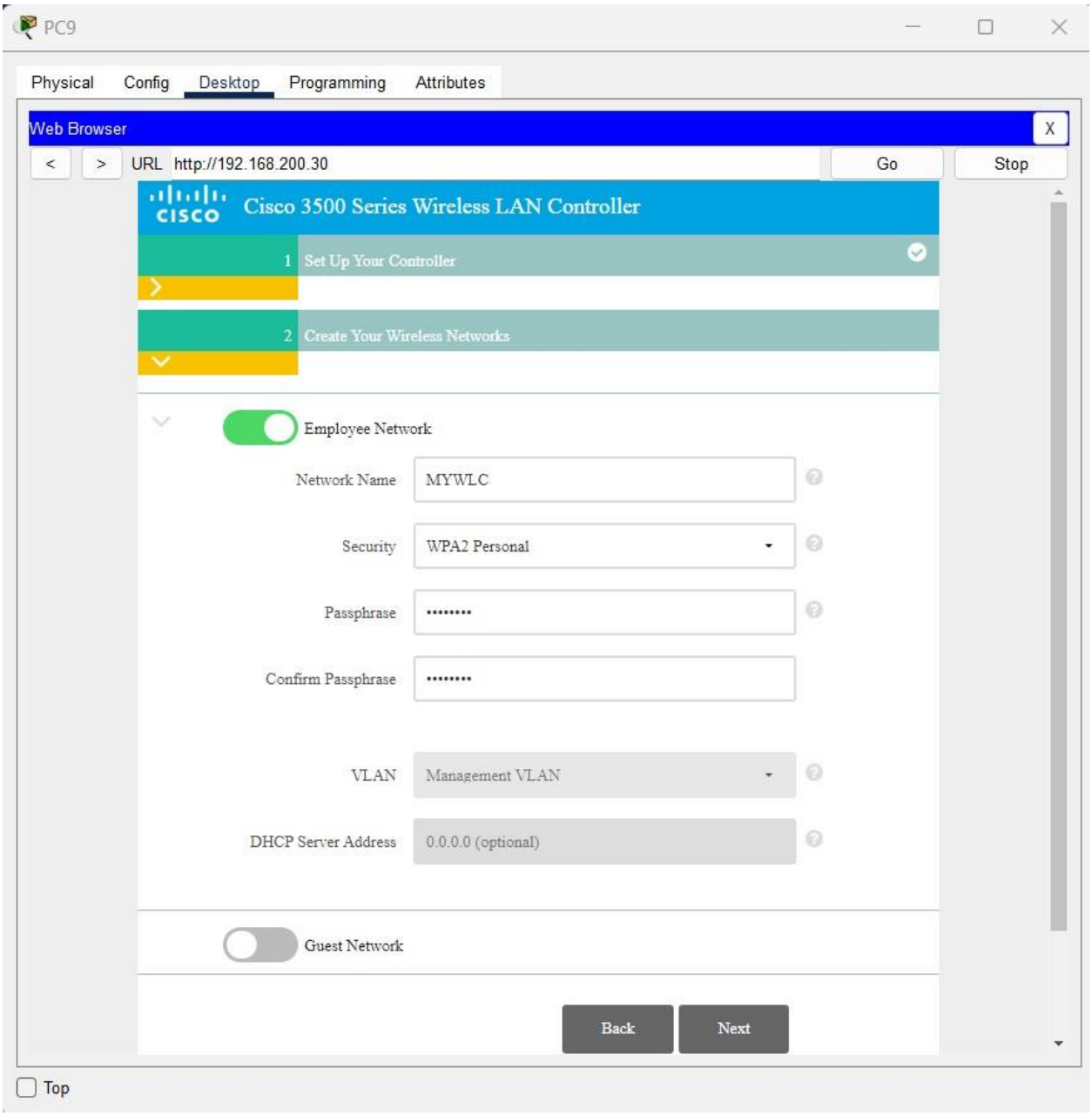
Figure B1-


PC9
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL http://192.168.200.30
Go
Stop
Cisco 3500 Series Wireless LAN Controller
1 Set Up Your Controller
System Name
B2-WLC
Country
United States (US)
Date & Time
07/13/2024
22:10:45
Timezone
Eastern Time (US and Canada)
NTP Server
(optional)
Management IP Address
192.168.200.30
Subnet Mask
255.255.255.0
Default Gateway
192.168.200.1
Management VLAN ID
0
Back
Next
Top

Figure

35 B2-WLC initial config pg1

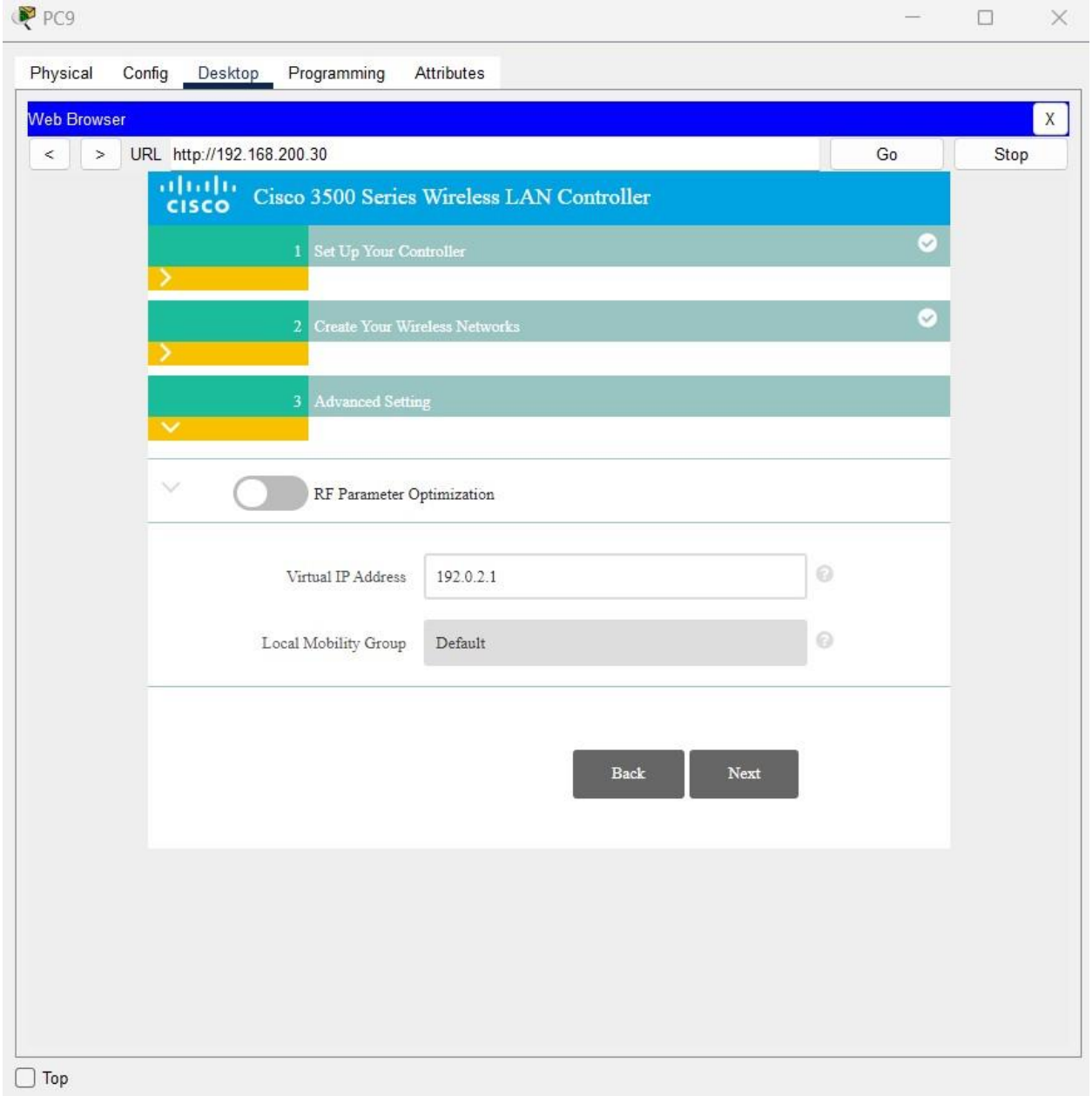
Figure


PC9
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL
http://192.168.200.30
Go
Stop
Cisco 3500 Series Wireless LAN Controller
1
Set Up Your Controller
2
Create Your Wireless Networks
Employee Network
Network Name
MYWLC
Security
WPA2 Personal
Passphrase
Confirm Passphrase
VLAN
Management VLAN
DHCP Server Address
0.0.0.0 (optional)
Guest Network
Back
Next
Top

Figure

36 B2-WLC initial config pg2(passphrase is Cisco123)

Figure


PC9
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL
http://192.168.200.30
Go
Stop
Cisco 3500 Series Wireless LAN Controller
1 Set Up Your Controller
2 Create Your Wireless Networks
3 Advanced Setting
RF Parameter Optimization
Virtual IP Address
192.0.2.1
Local Mobility Group
Default
Back
Next
Top

Figure

37 B2-WLC initial config pg3

Figure

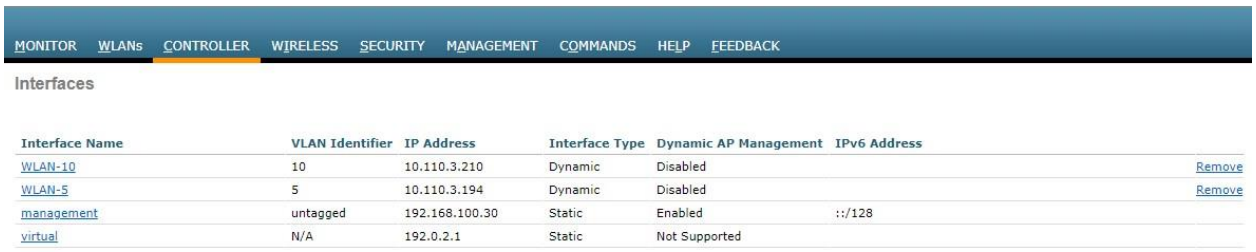


Figure 38 B1-WLC interfaces

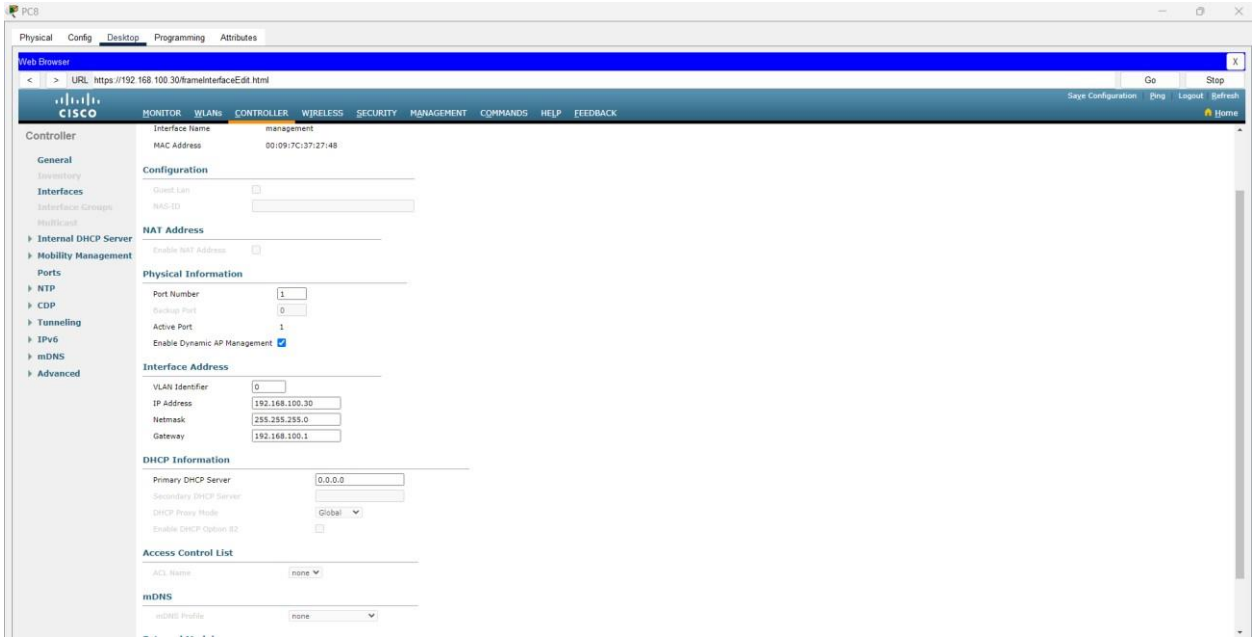


Figure 39 B1-WLC management interface settings

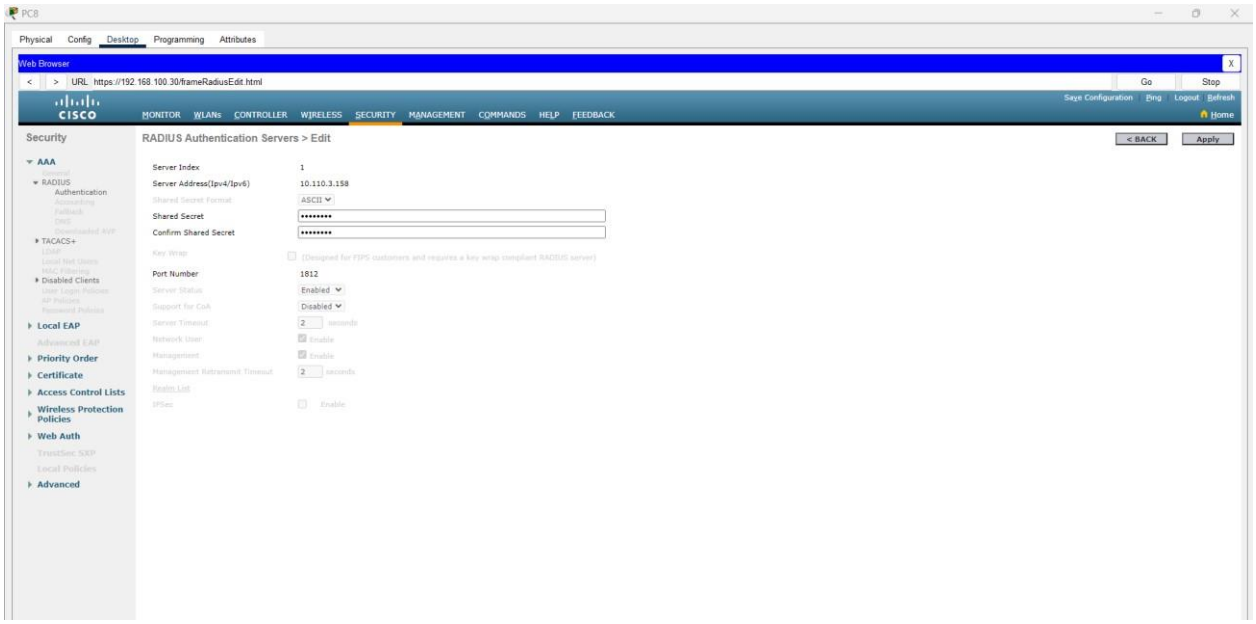


Figure 40 B1-WLC security

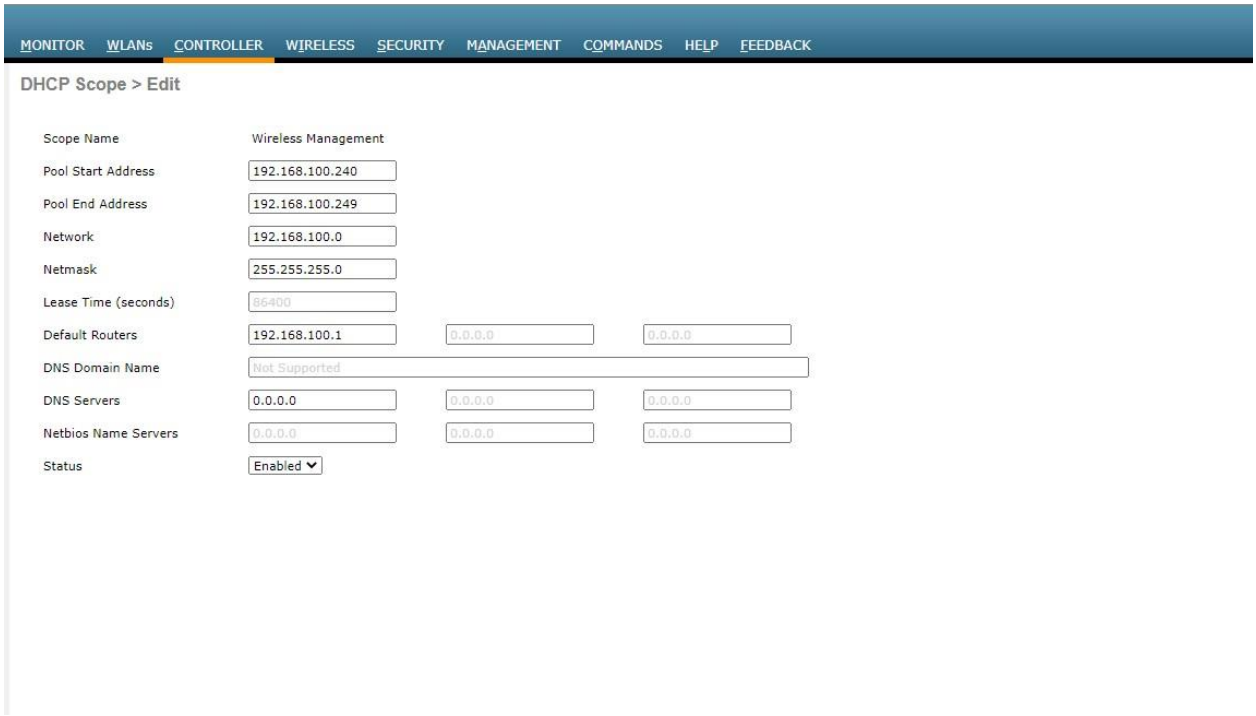


Figure 41 B1-WLC Wireless Management DHCP scope settings

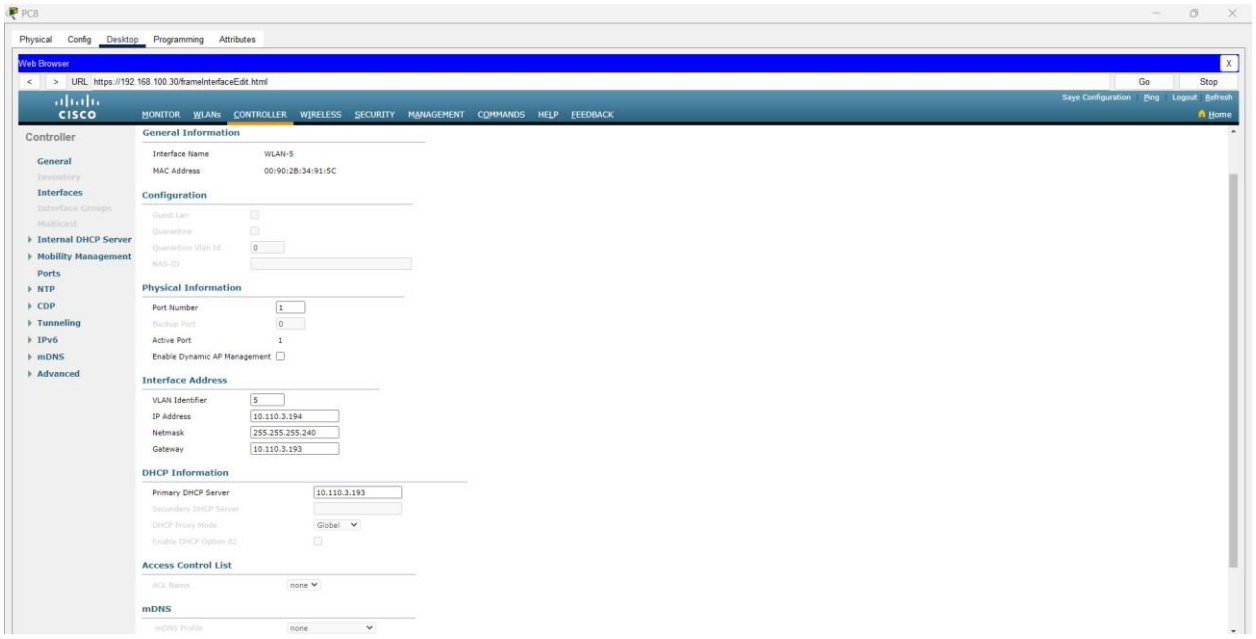


Figure 42 B1-WLC WLAN-5 interface settings

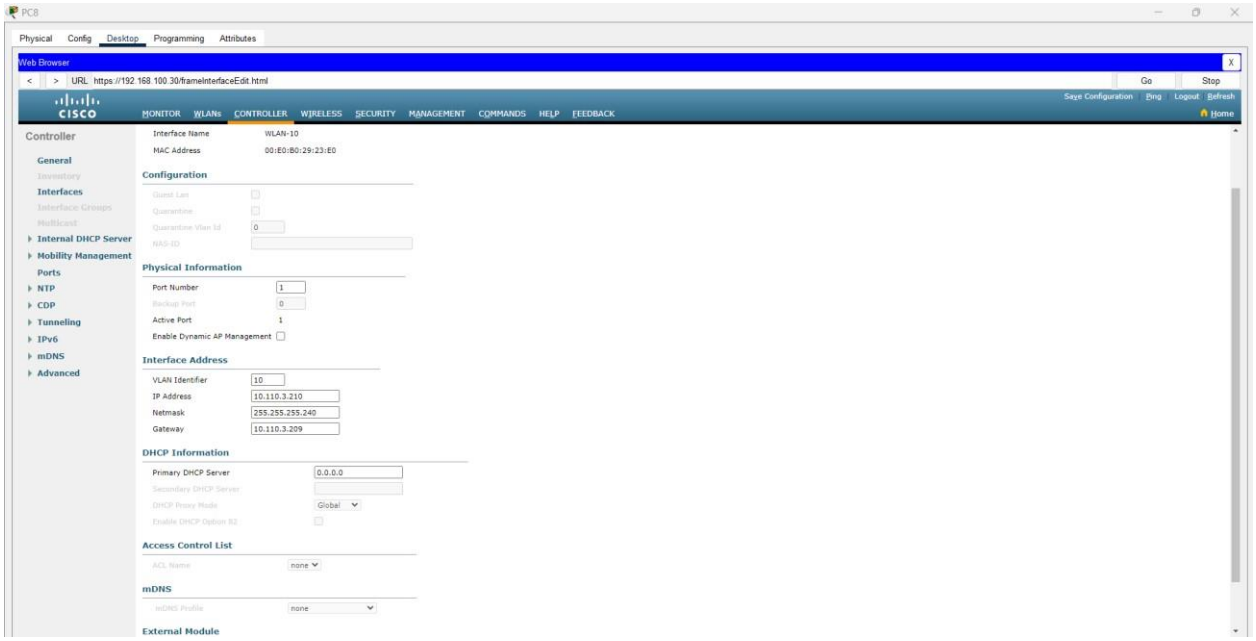


Figure 43 B1-WLC WLAN-10 interface settings

```
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   172.110.0.6     YES manual up                    up
GigabitEthernet1/0/6   172.110.0.10    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                  10.110.3.225    YES manual up                    up
Vlan10                 10.110.3.241    YES manual up                    up
Vlan15                 10.110.3.1      YES manual up                    up
Vlan20                 10.110.3.65     YES manual up                    up
Vlan200                192.168.200.1   YES manual up                    up
```

Figure 44 B2-MLS show ip interface brief

```
B2-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 172.110.0.5 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 10 subnets, 4 masks
S       10.110.2.0/25 [1/0] via 172.110.0.9
S       10.110.2.128/25 [1/0] via 172.110.0.9
C       10.110.3.0/26 is directly connected, Vlan15
C       10.110.3.64/26 is directly connected, Vlan20
S       10.110.3.128/27 [1/0] via 172.110.0.5
S       10.110.3.160/27 [1/0] via 172.110.0.5
S       10.110.3.192/28 [1/0] via 172.110.0.9
S       10.110.3.208/28 [1/0] via 172.110.0.9
C       10.110.3.224/28 is directly connected, Vlan5
C       10.110.3.240/28 is directly connected, Vlan10
     172.110.0.0/30 is subnetted, 2 subnets
C       172.110.0.4 is directly connected, GigabitEthernet1/0/5
C       172.110.0.8 is directly connected, GigabitEthernet1/0/6
S    192.168.100.0/24 [1/0] via 172.110.0.9
C    192.168.200.0/24 is directly connected, Vlan200
S*   0.0.0.0/0 [1/0] via 172.110.0.5
```

Figure 45 B2-MLS show ip route

```
B2-MLS#show running-config
Building configuration...

Current configuration : 5300 bytes
!
version 16.3.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B2-MLS
!
!
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
!
ip dhcp excluded-address 10.110.3.1 10.110.3.5
ip dhcp excluded-address 10.110.3.65 10.110.3.69
ip dhcp excluded-address 10.110.3.225 10.110.3.229
ip dhcp excluded-address 10.110.3.241 10.110.3.245
!
ip dhcp pool B1_VLAN5
 network 10.110.3.224 255.255.255.240
 default-router 10.110.3.225
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN10
 network 10.110.3.240 255.255.255.240
 default-router 10.110.3.241
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN15
 network 10.110.3.0 255.255.255.192
 default-router 10.110.3.1
 dns-server 10.110.3.158
ip dhcp pool B1_VLAN20
 network 10.110.3.64 255.255.255.192
 default-router 10.110.3.65
 dns-server 10.110.3.158
!
!
!
no ip cef
ip routing
!
no ipv6 cef
```

Figure 46 B2-MLS show running-config(1)

```
spanning-tree mode pvst
!
!
!
!
!
!
interface Port-channel1
 description Etherchannel MLS B2 to Access Switch B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel2
 description Etherchannel MLS B2 to Access Switch B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/0/1
 description MLS B2 to Access Switch B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet1/0/2
 description Redundant MLS B2 to Access Switch B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet1/0/3
 description MLS B2 to Access Switch B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
```

Figure 47 B2-MLS show running-config(2)

```
interface GigabitEthernet1/0/4
 description Redundant MLS B2 to Access Switch B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface GigabitEthernet1/0/5
 no switchport
 ip address 172.110.0.6 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet1/0/6
 no switchport
 ip address 172.110.0.10 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet1/0/7
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
 switchport access vlan 200
 switchport mode access
!
```

Figure 48 B2-MLS show running-config(3)

```
interface GigabitEthernet1/0/23
 description MLS B2 to B2 Wireless LAN Controller
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/0/24
 description MLS B2 to B2 Light Weight Access Point
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface GigabitEthernet1/1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 mac-address 0001.4277.2d01
 ip address 10.110.3.225 255.255.255.240
!
interface Vlan10
 description VLAN 10 Wireless 2
 mac-address 0001.4277.2d02
 ip address 10.110.3.241 255.255.255.240
!
interface Vlan15
 description VLAN 15 team1
 mac-address 0001.4277.2d03
 ip address 10.110.3.1 255.255.255.192
!
interface Vlan20
 description VLAN 20 team2
 mac-address 0001.4277.2d04
 ip address 10.110.3.65 255.255.255.192
!
```

Figure 49 B2-MLS show running-config(4)

```
interface Vlan200
 description VLAN 200 Management
 mac-address 0001.4277.2d05
 ip address 192.168.200.1 255.255.255.0
!
ip classless
ip route 10.110.2.0 255.255.255.128 172.110.0.9
ip route 10.110.2.128 255.255.255.128 172.110.0.9
ip route 10.110.3.192 255.255.255.240 172.110.0.9
ip route 10.110.3.208 255.255.255.240 172.110.0.9
ip route 192.168.100.0 255.255.255.0 172.110.0.9
ip route 10.110.3.128 255.255.255.224 172.110.0.5
ip route 10.110.3.160 255.255.255.224 172.110.0.5
ip route 0.0.0.0 0.0.0.0 172.110.0.5
ip route 10.110.3.128 255.255.255.224 172.110.0.9 10
ip route 10.110.3.160 255.255.255.224 172.110.0.9 10
ip route 10.110.2.0 255.255.255.128 172.110.0.5 10
ip route 10.110.2.128 255.255.255.128 172.110.0.5 10
ip route 10.110.3.192 255.255.255.240 172.110.0.5 10
ip route 10.110.3.208 255.255.255.240 172.110.0.5 10
ip route 0.0.0.0 0.0.0.0 172.110.0.9 10
!
ip flow-export version 9
!
!
!
banner motd ^CAuthorized Access Only^C
!
!
!
!
line con 0
 password cisco
 login
!
line aux 0
!
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
!
!
!
end
```

50 B2-MLS show running-config(5)

```
B2-MLS#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig1/0/7, Gig1/0/8, Gig1/0/9, 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    Gig1/0/10
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 51 B2-MLS show vlan brief

```
B2-S1#show running-config
Building configuration...

Current configuration : 3682 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B2-S1
!
!
!
!
!
ip dhcp snooping vlan 5,10,15,20,100
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface Port-channel1
 description Etherchannel Access Switch B2_1 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel3
 description Etherchannel Access Switch B2_1 to B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface FastEthernet0/1
 description Access Switch B2_1 to PC4
 switchport access vlan 15
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 00E0.F7C0.14BD
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
```

52 B2-S1 show running-config(1)

```
interface FastEthernet0/2
 description Access Switch B2_1 to PC5
 switchport access vlan 20
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0090.2BBC.3CE2
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
```

Figure 53 B2-S1 show running-config(2)

```
interface FastEthernet0/23
 description Access Switch B2_1 to B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface FastEthernet0/24
 description Redundant Access Switch B2_1 to B2_2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface GigabitEthernet0/1
 description Access Switch B2_1 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface GigabitEthernet0/2
 description Redundant Access Switch B2_1 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 1 mode active
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 no ip address
!
interface Vlan10
 description VLAN 10 Wireless 2
 no ip address
!
```

54 B2-S1 show running-config(3)

```
interface Vlan15
 description VLAN 15 team1
 no ip address
!
interface Vlan20
 description VLAN 20 team2
 no ip address
!
interface Vlan200
 description VLAN 200 Management
 ip address 192.168.200.10 255.255.255.0
!
ip default-gateway 192.168.200.1
!
!
!
!
line con 0
 login
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end
```

Figure 55 B2-S1 show running-config(4)

```
B2-S1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
5    Wireless1                        active
10   Wireless2                        active
15   team1                            active    Fa0/1
20   team2                            active    Fa0/2
200  Management                       active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 56 B2-S1 show vlan brief

```
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)
```

Figure 57 B2-S1 show etherchannel summary

```
B2-S1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel1          unassigned      YES manual up                    up
Port-channel3          unassigned      YES manual up                    up
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/2        unassigned      YES manual up                    up
FastEthernet0/3        unassigned      YES manual down                  down
FastEthernet0/4        unassigned      YES manual down                  down
FastEthernet0/5        unassigned      YES manual down                  down
FastEthernet0/6        unassigned      YES manual down                  down
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
FastEthernet0/11       unassigned      YES manual down                  down
FastEthernet0/12       unassigned      YES manual down                  down
FastEthernet0/13       unassigned      YES manual down                  down
FastEthernet0/14       unassigned      YES manual down                  down
FastEthernet0/15       unassigned      YES manual down                  down
FastEthernet0/16       unassigned      YES manual down                  down
FastEthernet0/17       unassigned      YES manual down                  down
FastEthernet0/18       unassigned      YES manual down                  down
FastEthernet0/19       unassigned      YES manual down                  down
FastEthernet0/20       unassigned      YES manual down                  down
FastEthernet0/21       unassigned      YES manual down                  down
FastEthernet0/22       unassigned      YES manual down                  down
FastEthernet0/23       unassigned      YES manual up                    up
FastEthernet0/24       unassigned      YES manual up                    up
GigabitEthernet0/1     unassigned      YES manual up                    up
GigabitEthernet0/2     unassigned      YES manual up                    up
Vlan1                  unassigned      YES manual administratively down down
Vlan5                  unassigned      YES manual up                    up
Vlan10                 unassigned      YES manual up                    up
Vlan15                 unassigned      YES manual up                    up
Vlan20                 unassigned      YES manual up                    up
Vlan200                192.168.200.10  YES manual up                    up
```

Figure 58 B2-S1 show ip interface brief

```
B2-S1#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
-------------------------------------------------------------------------
        Fa0/1        2           1                0          Protect
        Fa0/2        2           1                0          Protect
-------------------------------------------------------------------------
```

Figure 59 B2-S1 show port-security

```
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
------+-------------+-----------+-----------------------------------------------

2      Po2(SU)           LACP   Gig0/1(P) Gig0/2(P)
3      Po3(SU)           LACP   Fa0/23(P) Fa0/24(P)
```

Figure 60 B2-S2 show etherchannel summary

```
B2-S2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel2          unassigned      YES manual up                    up
Port-channel3          unassigned      YES manual up                    up
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/2        unassigned      YES manual up                    up
FastEthernet0/3        unassigned      YES manual up                    up
FastEthernet0/4        unassigned      YES manual down                  down
FastEthernet0/5        unassigned      YES manual down                  down
FastEthernet0/6        unassigned      YES manual down                  down
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
FastEthernet0/11       unassigned      YES manual down                  down
FastEthernet0/12       unassigned      YES manual down                  down
FastEthernet0/13       unassigned      YES manual down                  down
FastEthernet0/14       unassigned      YES manual down                  down
FastEthernet0/15       unassigned      YES manual down                  down
FastEthernet0/16       unassigned      YES manual down                  down
FastEthernet0/17       unassigned      YES manual down                  down
FastEthernet0/18       unassigned      YES manual down                  down
FastEthernet0/19       unassigned      YES manual down                  down
FastEthernet0/20       unassigned      YES manual down                  down
FastEthernet0/21       unassigned      YES manual down                  down
FastEthernet0/22       unassigned      YES manual down                  down
FastEthernet0/23       unassigned      YES manual up                    up
FastEthernet0/24       unassigned      YES manual up                    up
GigabitEthernet0/1     unassigned      YES manual up                    up
GigabitEthernet0/2     unassigned      YES manual up                    up
Vlan1                  unassigned      YES manual administratively down down
Vlan5                  unassigned      YES manual up                    up
Vlan10                 unassigned      YES manual up                    up
Vlan15                 unassigned      YES manual up                    up
Vlan20                 unassigned      YES manual up                    up
Vlan200                192.168.200.20  YES manual up                    up
```

Figure 61 B2-S2 show ip interface brief

```
B2-S2#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
-------------------------------------------------------------------------
        Fa0/1        2          1                0          Protect
        Fa0/2        2          1                0          Protect
-------------------------------------------------------------------------
```

Figure 62 B2-S2 show port-security

```
B2-S2#show running-config
Building configuration...

Current configuration : 3776 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname B2-S2
!
!
!
!
!
ip dhcp snooping vlan 5,10,15,20,100
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface Port-channel2
 description Etherchannel Access Switch B2_2 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface Port-channel3
 description Etherchannel Access Switch B2_2 to B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 switchport mode trunk
 switchport nonegotiate
!
interface FastEthernet0/1
 description Access Switch B2_1 to PC6
 switchport access vlan 15
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0002.4A87.72DC
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
```

Figure 63 B2-S2 show running-config(1)

```
interface FastEthernet0/2
 description Access Switch B2_1 to PC7
 switchport access vlan 20
 ip dhcp snooping limit rate 5
 switchport mode access
 switchport port-security
 switchport port-security maximum 2
 switchport port-security mac-address sticky
 switchport port-security violation protect
 switchport port-security mac-address sticky 0060.70E8.7DA8
 switchport port-security aging time 10
 spanning-tree portfast
 spanning-tree bpduguard enable
!
interface FastEthernet0/3
 description temporary PC9 for WLC config
 switchport access vlan 200
 switchport mode access
!
```

Figure 64 B2-S2 show running-config(2)

```
interface FastEthernet0/23
 description Access Switch B2_2 to B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface FastEthernet0/24
 description Redundant Access Switch B2_2 to B2_1
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 3 mode active
!
interface GigabitEthernet0/1
 description Access Switch B2_2 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface GigabitEthernet0/2
 description Redundant Access Switch B2_2 to MLS B2
 switchport trunk native vlan 200
 switchport trunk allowed vlan 5,10,15,20,200
 ip dhcp snooping trust
 switchport mode trunk
 switchport nonegotiate
 channel-group 2 mode active
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan5
 description VLAN 5 Wireless 1
 no ip address
!
interface Vlan10
 description VLAN 10 Wireless 2
 no ip address
!
```

Figure 65 B2-S2 show running-config(3)

```
interface Vlan15
 description VLAN 15 team1
 no ip address
!
interface Vlan20
 description VLAN 20 team2
 no ip address
!
interface Vlan200
 description VLAN 200 Management
 ip address 192.168.200.20 255.255.255.0
!
ip default-gateway 192.168.200.1
!
!
!
!
line con 0
 login
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end
```

Figure 66 B2-S2 show running-config(4)

```
B2-S2#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                Fa0/20, Fa0/21, Fa0/22
5    Wireless1                        active
10   Wireless2                        active
15   team1                            active    Fa0/1
20   team2                            active    Fa0/2
200  Management                       active    Fa0/3
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 67 B2-S2 show vlan brief

```
HQ-Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0/0   172.110.0.1     YES manual up                    up
GigabitEthernet0/0/1   172.110.0.5     YES manual up                    up
GigabitEthernet0/0/2   10.110.3.129    YES manual up                    up
GigabitEthernet0/1/0   unassigned      YES unset  up                    up
GigabitEthernet0/1/1   unassigned      YES unset  administratively down down
GigabitEthernet0/1/2   unassigned      YES unset  administratively down down
GigabitEthernet0/1/3   unassigned      YES unset  administratively down down
Serial0/2/0            209.165.201.2   YES manual up                    up
Serial0/2/1            unassigned      YES unset  administratively down down
Vlan1                  10.110.3.161    YES manual up                    up
```

Figure 68 HQ-Router show ip interface brief

```
HQ-Router#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 209.165.201.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 12 subnets, 5 masks
S       10.110.2.0/25 [1/0] via 172.110.0.2
S       10.110.2.128/25 [1/0] via 172.110.0.2
S       10.110.3.0/26 [1/0] via 172.110.0.6
S       10.110.3.64/26 [1/0] via 172.110.0.6
C       10.110.3.128/27 is directly connected, GigabitEthernet0/0/2
L       10.110.3.129/32 is directly connected, GigabitEthernet0/0/2
C       10.110.3.160/27 is directly connected, Vlan1
L       10.110.3.161/32 is directly connected, Vlan1
S       10.110.3.192/28 [1/0] via 172.110.0.2
S       10.110.3.208/28 [1/0] via 172.110.0.2
S       10.110.3.224/28 [1/0] via 172.110.0.6
S       10.110.3.240/28 [1/0] via 172.110.0.6
     172.110.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.110.0.0/30 is directly connected, GigabitEthernet0/0/0
L       172.110.0.1/32 is directly connected, GigabitEthernet0/0/0
C       172.110.0.4/30 is directly connected, GigabitEthernet0/0/1
L       172.110.0.5/32 is directly connected, GigabitEthernet0/0/1
S    192.168.100.0/24 [1/0] via 172.110.0.2
S    192.168.200.0/24 [1/0] via 172.110.0.6
     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
S*   0.0.0.0/0 [1/0] via 209.165.201.1
```

Figure 69 HQ-Router show ip route

```
HQ-Router#show running-config
Building configuration...

Current configuration : 2520 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname HQ-Router
!
!
!
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0/0
 description HQ-Router to MLS B1
 ip address 172.110.0.1 255.255.255.252
 duplex auto
 speed auto
!
```

Figure 70 HQ-Router show running-config(1)

```
interface GigabitEthernet0/0/1
 description HQ-Router to MLS B2
 ip address 172.110.0.5 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/2
 description HQ-Router to Switch HQ LAN 1
 ip address 10.110.3.129 255.255.255.224
 duplex auto
 speed auto
!
interface GigabitEthernet0/1/0
 description HQ-Router to Switch HQ LAN 2
 switchport mode access
!
interface GigabitEthernet0/1/1
 switchport mode access
 shutdown
!
interface GigabitEthernet0/1/2
 switchport mode access
 shutdown
!
interface GigabitEthernet0/1/3
 switchport mode access
 shutdown
!
interface Serial0/2/0
 description HQ-Router to ISP Router
 ip address 209.165.201.2 255.255.255.252
!
interface Serial0/2/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Vlan1
 ip address 10.110.3.161 255.255.255.224
!
```

Figure 71 HQ-Router show running-config(2)

```
ip classless
ip route 192.168.100.0 255.255.255.0 172.110.0.2
ip route 10.110.2.0 255.255.255.128 172.110.0.2
ip route 10.110.2.128 255.255.255.128 172.110.0.2
ip route 10.110.3.192 255.255.255.240 172.110.0.2
ip route 10.110.3.208 255.255.255.240 172.110.0.2
ip route 192.168.200.0 255.255.255.0 172.110.0.6
ip route 10.110.3.0 255.255.255.192 172.110.0.6
ip route 10.110.3.64 255.255.255.192 172.110.0.6
ip route 10.110.3.224 255.255.255.240 172.110.0.6
ip route 10.110.3.240 255.255.255.240 172.110.0.6
ip route 0.0.0.0 0.0.0.0 209.165.201.1
ip route 192.168.100.0 255.255.255.0 172.110.0.6 10
ip route 10.110.2.0 255.255.255.128 172.110.0.6 10
ip route 10.110.2.128 255.255.255.128 172.110.0.6 10
ip route 10.110.3.192 255.255.255.240 172.110.0.6 10
ip route 10.110.3.208 255.255.255.240 172.110.0.6 10
ip route 192.168.200.0 255.255.255.0 172.110.0.2 10
ip route 10.110.3.0 255.255.255.192 172.110.0.2 10
ip route 10.110.3.64 255.255.255.192 172.110.0.2 10
ip route 10.110.3.224 255.255.255.240 172.110.0.2 10
ip route 10.110.3.240 255.255.255.240 172.110.0.2 10
!
ip flow-export version 9
!
!
!
banner motd ^CAuthorized Access Only^C
!
!
!
!
line con 0
 password cisco
 login
!
line aux 0
!
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
!
!
end
```

Figure 72 HQ-Router show running-config(3)

```
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
```

Figure 73 ISP Router show ip interface brief

```
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 not set

     10.0.0.0/23 is subnetted, 1 subnets
S       10.110.2.0/23 [1/0] via 209.165.201.2
     172.110.0.0/28 is subnetted, 1 subnets
S       172.110.0.0/28 [1/0] via 209.165.201.2
S    192.168.100.0/24 [1/0] via 209.165.201.2
S    192.168.200.0/24 [1/0] via 209.165.201.2
     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
```

Figure 74 ISP Router show ip route

```
ISP#show running-config
Building configuration...

Current configuration : 1125 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname ISP
!
!
!
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
license udi pid CISCO1941/K9 sn FTX15247Z5Z-
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
```

Figure 75 ISP Router show running-config(1)

```
interface GigabitEthernet0/0
 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
 ip address 209.165.201.1 255.255.255.252
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
router rip
!
ip classless
ip route 172.110.0.0 255.255.255.240 209.165.201.2
ip route 10.110.2.0 255.255.254.0 209.165.201.2
ip route 192.168.100.0 255.255.255.0 209.165.201.2
ip route 192.168.200.0 255.255.255.0 209.165.201.2
!
ip flow-export version 9
!
!
!
!
!
!
!
```

Figure 76 ISP Router show running-config(2)

```
line con 0
 password cisco
 login
!
line aux 0
!
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
!
!
end
```

Figure 77 ISP Router show running-config(3)