Network Structure and Design

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Assignment Title and Assignment No.	Assessment 3 Network Comprehension Exercise

Contents

Task 01 - Network Design and Plan

Use **simulation** mode to send a message between PC0 and PC7. Disable the link between Router A and Router B. Again, use simulation mode to send a message between PC0 and PC7. Describe the changes in behaviour of your model.

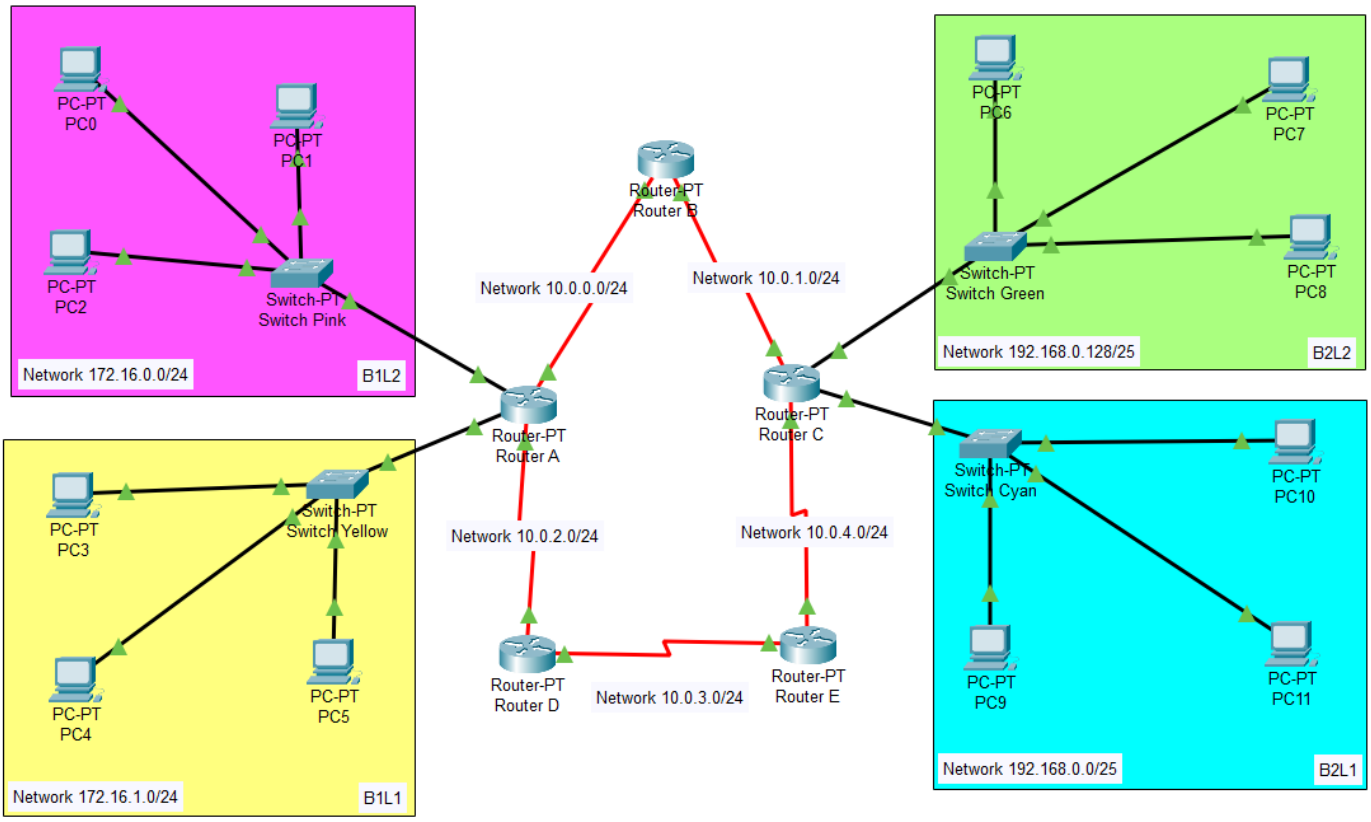
Task 02 - Layer 2 Implementation and Analysis

Check connectivity within the same and different VLANs. Use **Simulation** mode in Packet Tracer to show the connectivity with ‘pinging’ using GUI with the router interfaces being enabled and disabled. Analyze the results and explain why it was a ‘success’ or ‘failure’.

Task 03 - Layer 3 Evaluation

our report should evaluate and analyse how Layer 2 and Layer 3 addresses (source and destination) are allocated in each network’s incoming and outgoing (router) interfaces. For example, what address is changed at the router interfaces on the Pink subnet and the Green subnet.? Explain why.

Task 1 – Network Design and Plan



Explanation

Four Networks are represented in this diagram by networks, B1L1, B1L2, B2L1, B2L2. Each network has Different IP addresses and has 3 PCs for each network. I initially selected the proper IP range and Subnet mask based on the number of devices on each network. When using Networks without subnetting, it wastes the IP addresses, therefore I chose DHCP pools to establish subnets and add the required IP range for each Network.

The IP configuration for each network is as follows:

IP configuration of Network B1L2

IP address Range: 172.16.0.1 to 172.16.0.254

Subnet Mask: 255.255.255.0

Default Gateway: 172.16.0.1

Router Configuration for Network B1L2

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa1/0

Router(config-if)#ip address 172.16.0.1 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet1/0, changed state to up

Configuring DHCP pool for Network B1L2

Router(config)#ip dhcp pool B1L2

Router(dhcp-config)#network 172.16.0.0 255.255.255.0

Router(dhcp-config)#default-router 172.16.0.1

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

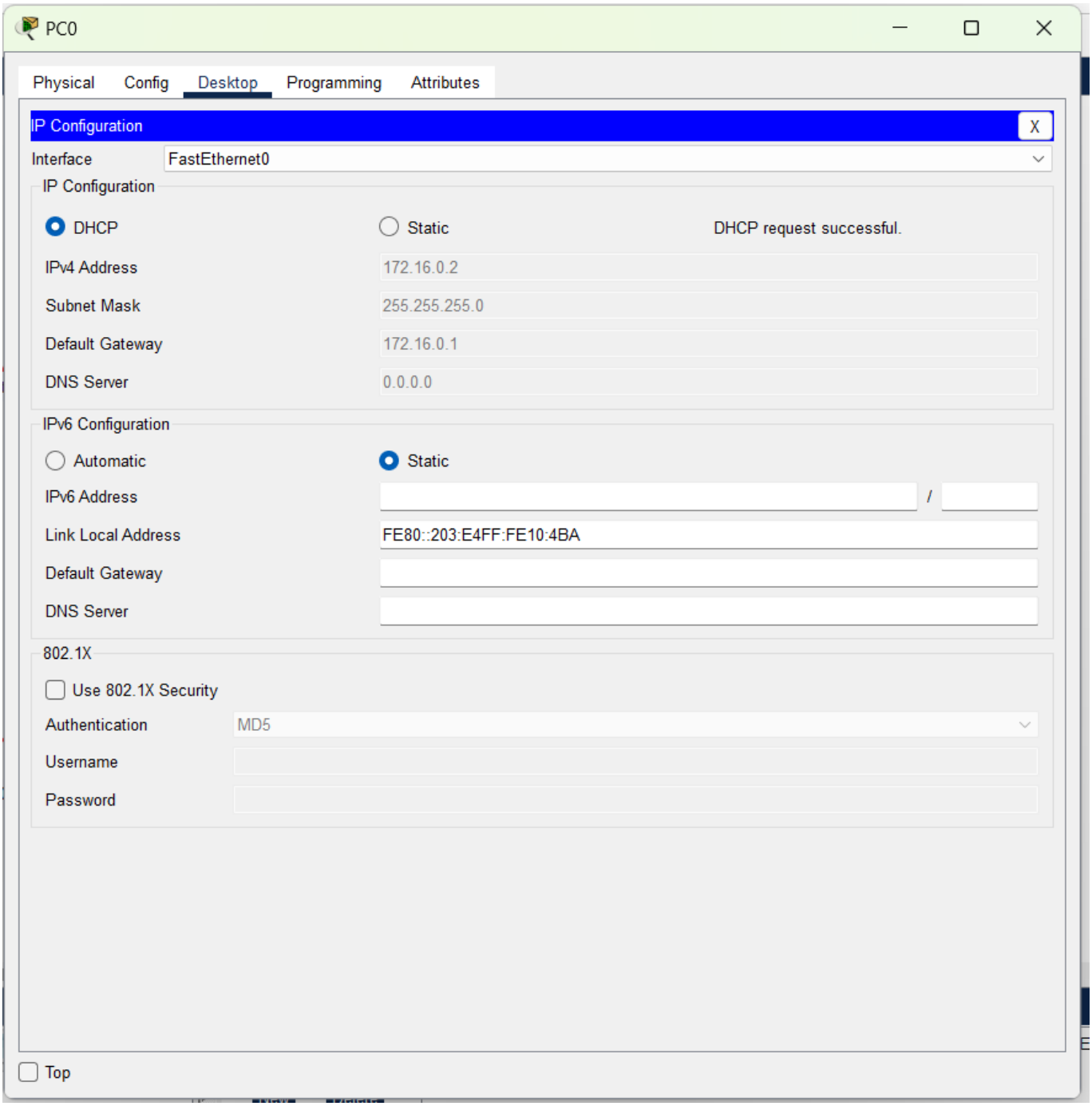
Router#write memory

Building configuration...

[OK]

Router#

PC0 in Network B1L2 has the IP address of 172.16.0.3 with a Subnet Mask of 255.255.255.0. The IP address of each PC in the Network B1L2 can be found in a similar way. You can see the IP configuration of the PC0 in Network B1L2 below.



IP configuration of Network B1L1

IP address Range: 172.16.1.1 to 172.16.1.254

Subnet Mask: 255.255.255.0

Default Gateway: 172.16.1.1

Router Configuration for Network B1L1

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa0/0

Router(config-if)#ip address 172.16.1.1 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet0/0, changed state to up

Configuring DHCP pool for Network B1L1

Router(config)#ip dhcp pool B1L1

Router(dhcp-config)#network 172.16.1.0 255.255.255.0

Router(dhcp-config)#default-router 172.16.1.1

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

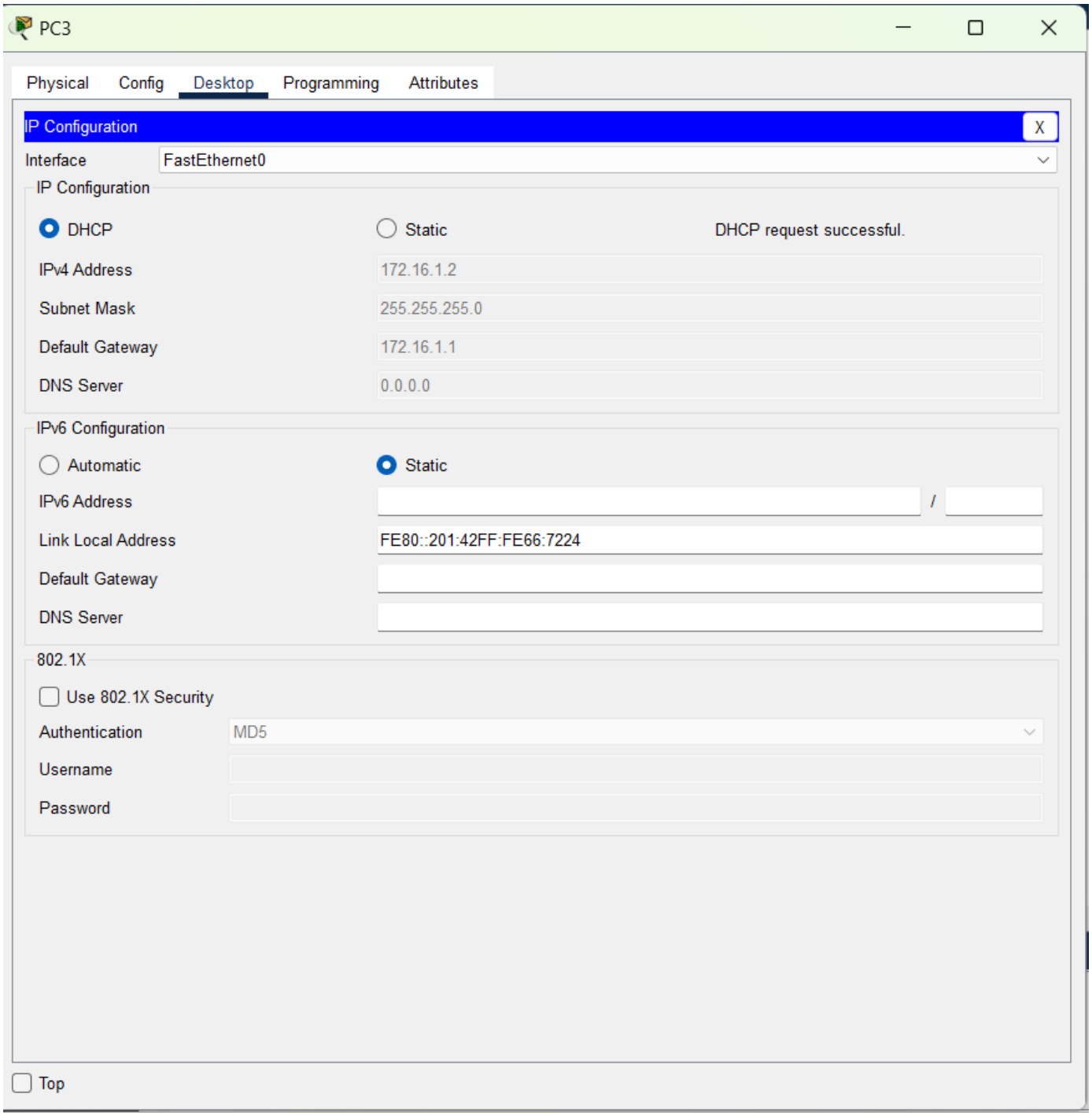
Router#write memory

Building configuration...

[OK]

Router#

PC3 in Network B1L1 has the IP address of 172.16.1.2 with a Subnet Mask of 255.255.255.0. The IP address of each PC in the Network B1L1 can be found in a similar way. You can see the IP configuration of the PC3 in Network B1L1 below.



IP configuration of Network B2L2

IP address Range: 192.168.0.129 to 192.168.0.254

Subnet Mask: 255.255.255.128

Default- Gateway: 192.168.0.129

Router Configuration for Network B2L2

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa1/0

Router(config-if)#ip address 192.168.0.129 255.255.255.128

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet1/0, changed state to up

Configuring DHCP pool for Network B2L2

Router(config)#ip dhcp pool B2L2

Router(dhcp-config)#network 192.168.0.128 255.255.255.128

Router(dhcp-config)#default-router 192.168.0.129

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

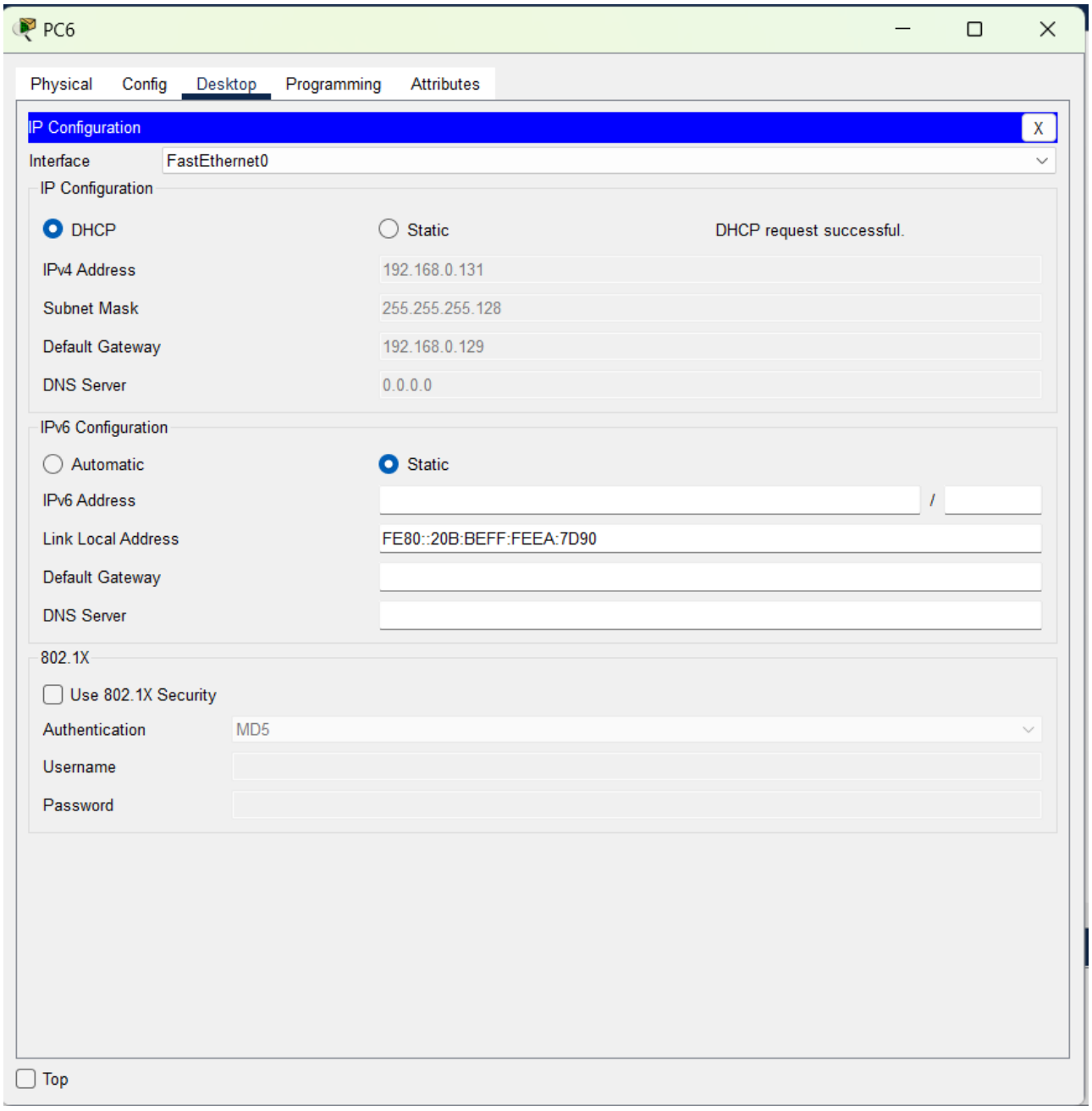
Router#write memory

Building configuration...

[OK]

Router#

PC6 in Network B2L2 has the IP address of 192.168.0.131 with a Subnet Mask of 255.255.255.128. The IP address of each PC in the Network B2L2 can be found in a similar way. You can see the IP configuration of the PC3 in Network B2L2 below.



IP configuration of Network B2L1

IP address Range: 192.168.0.1 to 192.168.0.254

Subnet Mask: 255.255.255.128

Default-Gateway: 192.168.0.1

Router Configuration for Network B2L1

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa0/0

Router(config-if)#ip address 192.168.0.1 255.255.255.128

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet0/0, changed state to up

Configuring DHCP pool for Network B2L1

Router(config)#ip dhcp pool B2L1

Router(dhcp-config)#network 192.168.0.0 255.255.255.128

Router(dhcp-config)#default-router 192.168.0.1

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

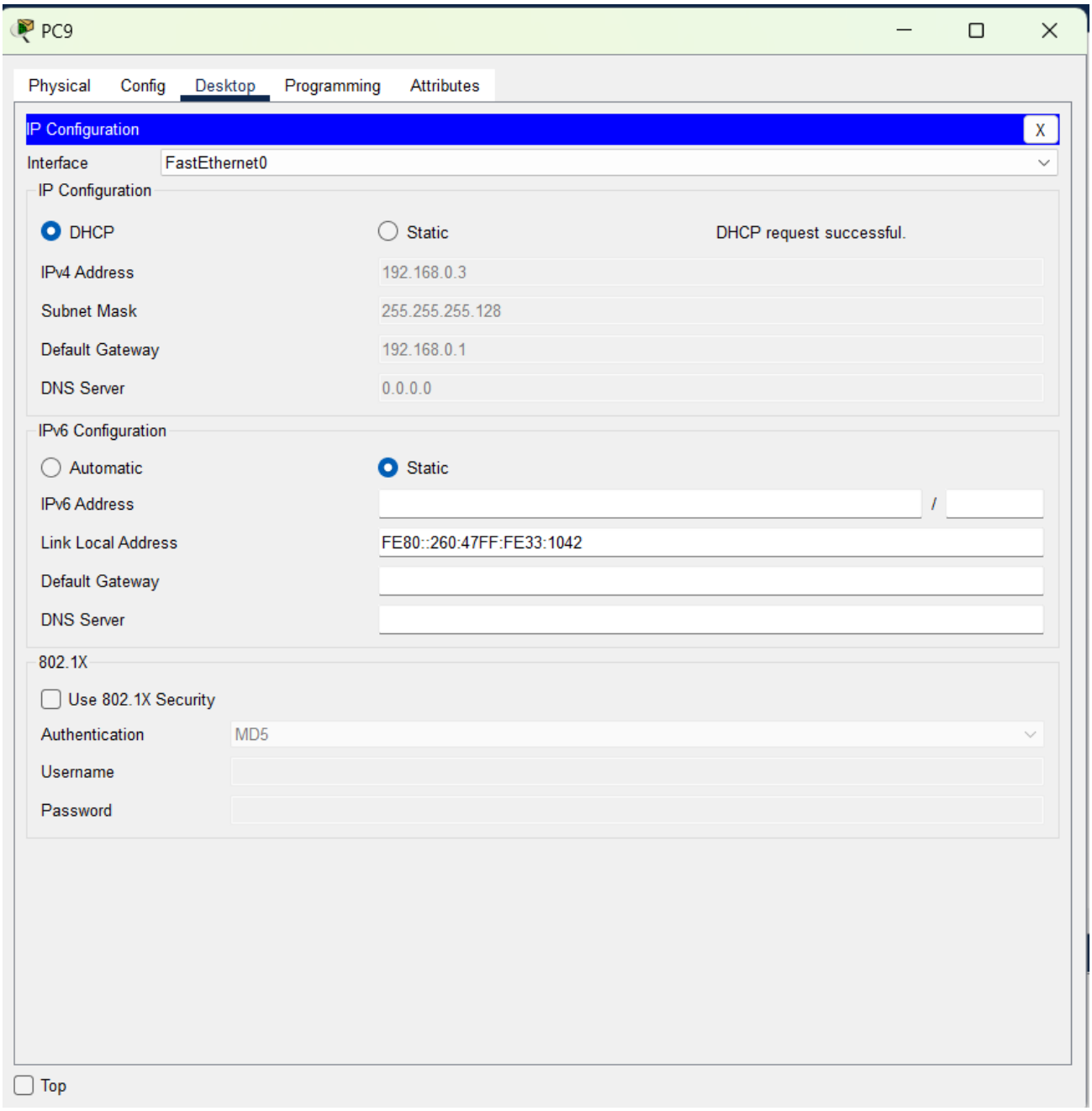
Router#write memory

Building configuration...

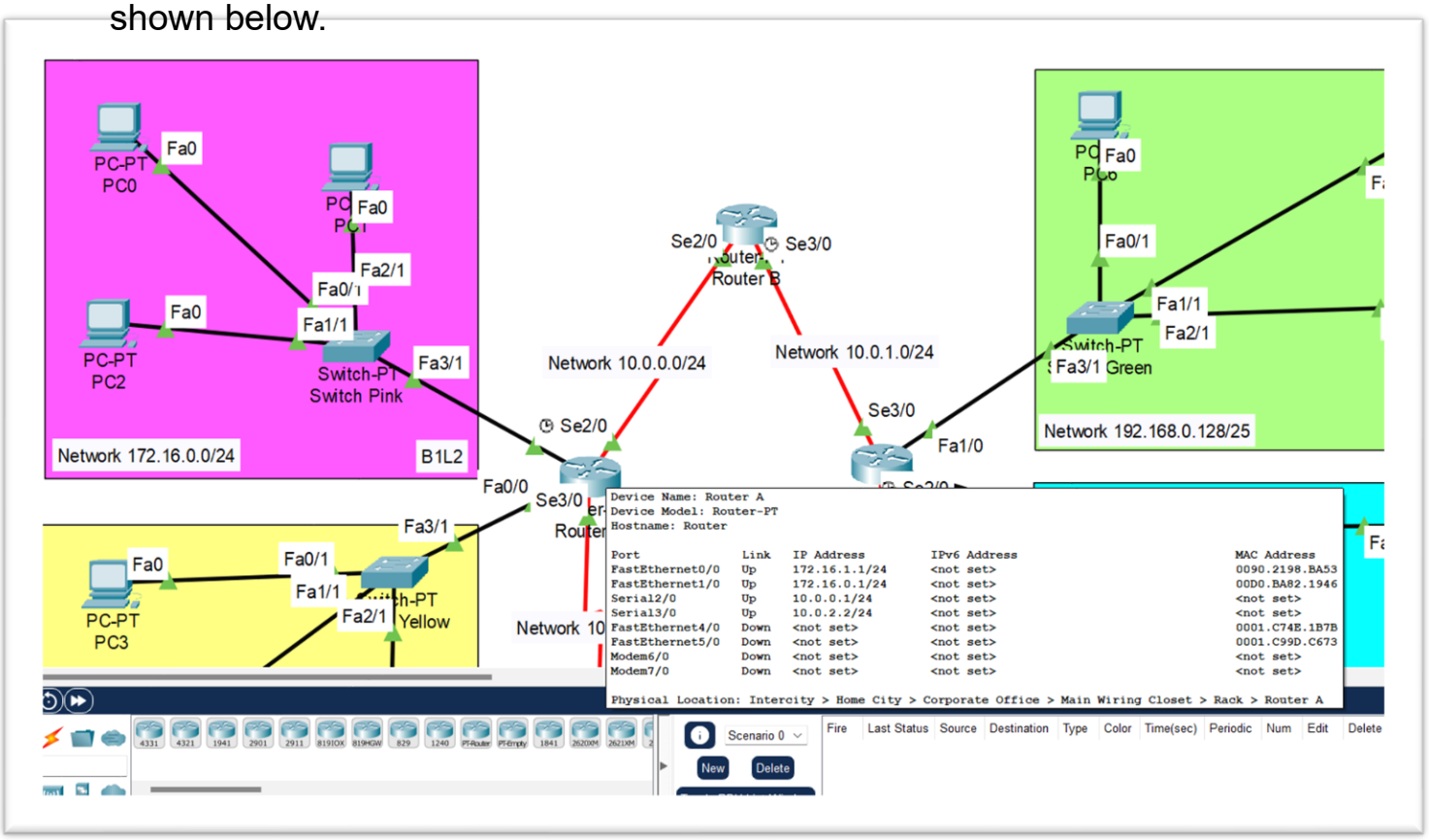
[OK]

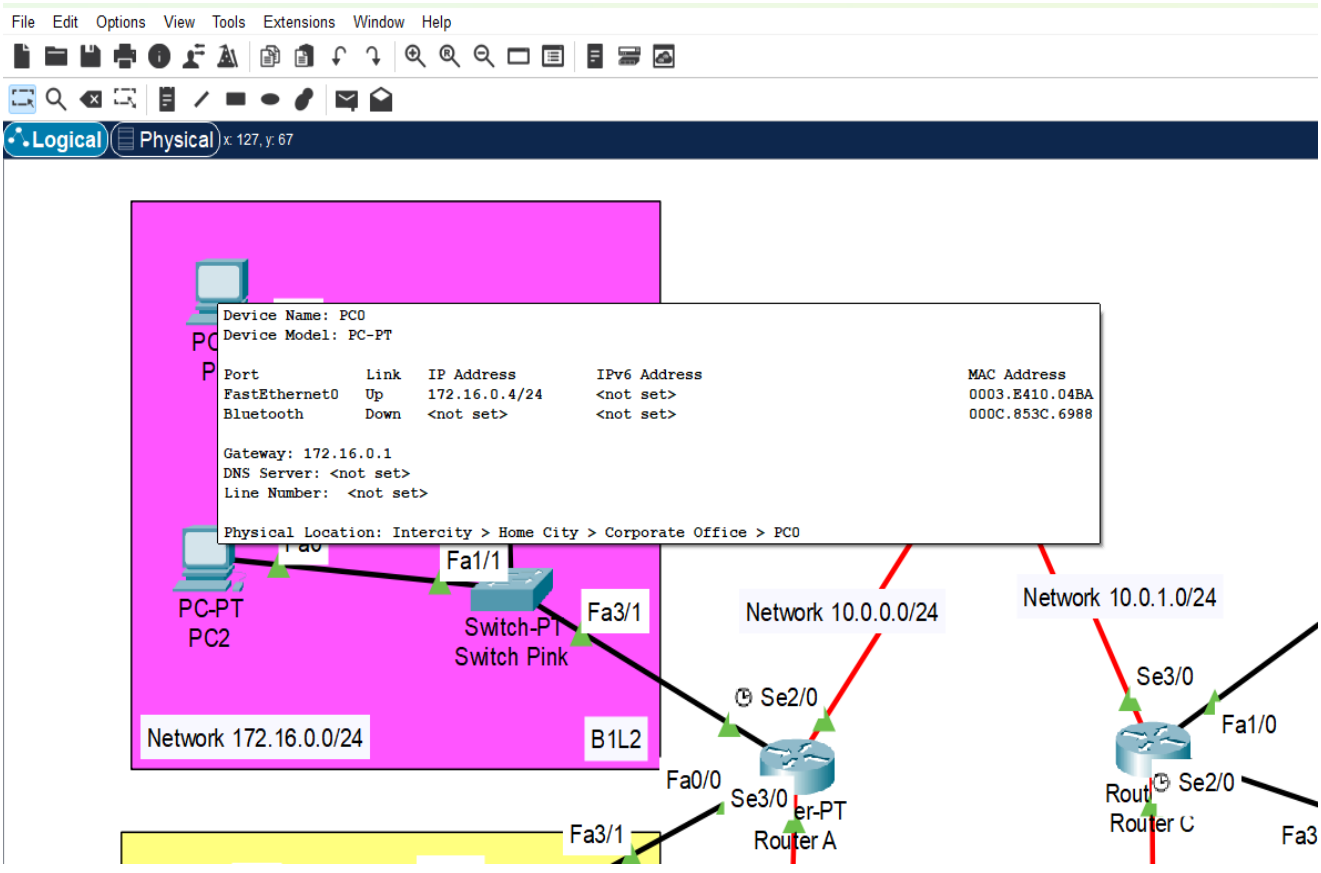
Router#

PC9 in Network B2L1 has the IP address of 192.168.0.3 with a Subnet Mask of 255.255.255.128. The IP address of each PC in the Network B2L1 can be found in a similar way. You can see the IP configuration of the PC9 in Network B2L1 below.



If you want to See the details of each PC or Router (IP address etc.), you can move the cursor near the device, and it will display all the details as shown below.

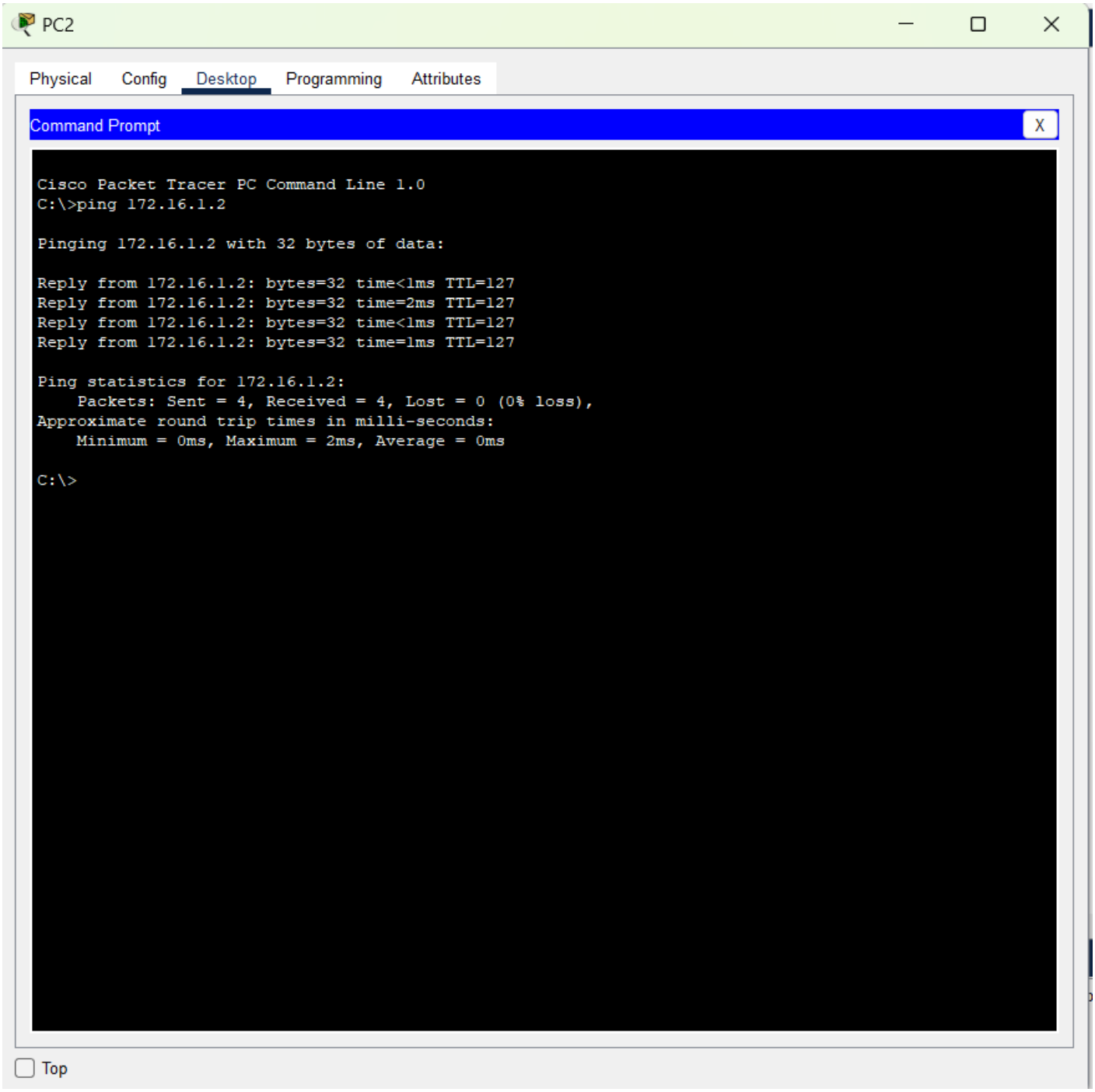




We can test the connection by sending packets from Same network and across different networks.

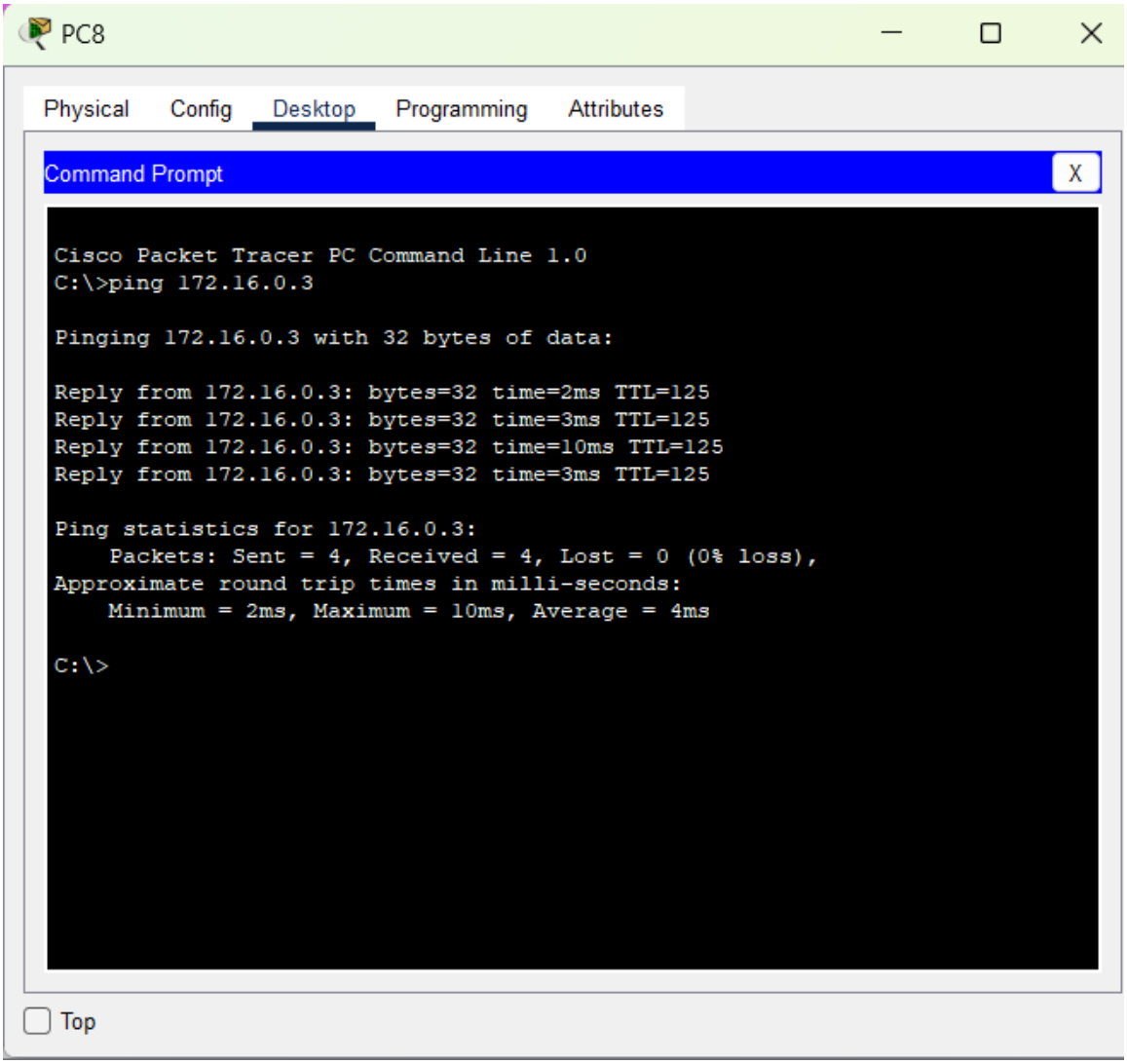
Ping Process across same network

First, I'll send packets from PC2 in Network B1L2 to PC3 in Network B1L1



Ping Process across different Networks

Now I'll Send a packet from PC8 in Network B2L2 to PC0 in Network B1L2 and these PC's are in two Different Networks.



Routing Solutions

We have decided to use OSPF (Open Shortest Path First), a dynamic routing protocol, for routing between the subnets. A link-state routing protocol called OSPF modifies routing tables dynamically in response to changes in the network topology. Here's why OSPF was selected for this network:

Scalability: Because OSPF is scalable, it may be used on networks of different sizes, including the multi-subnet network in our instance.

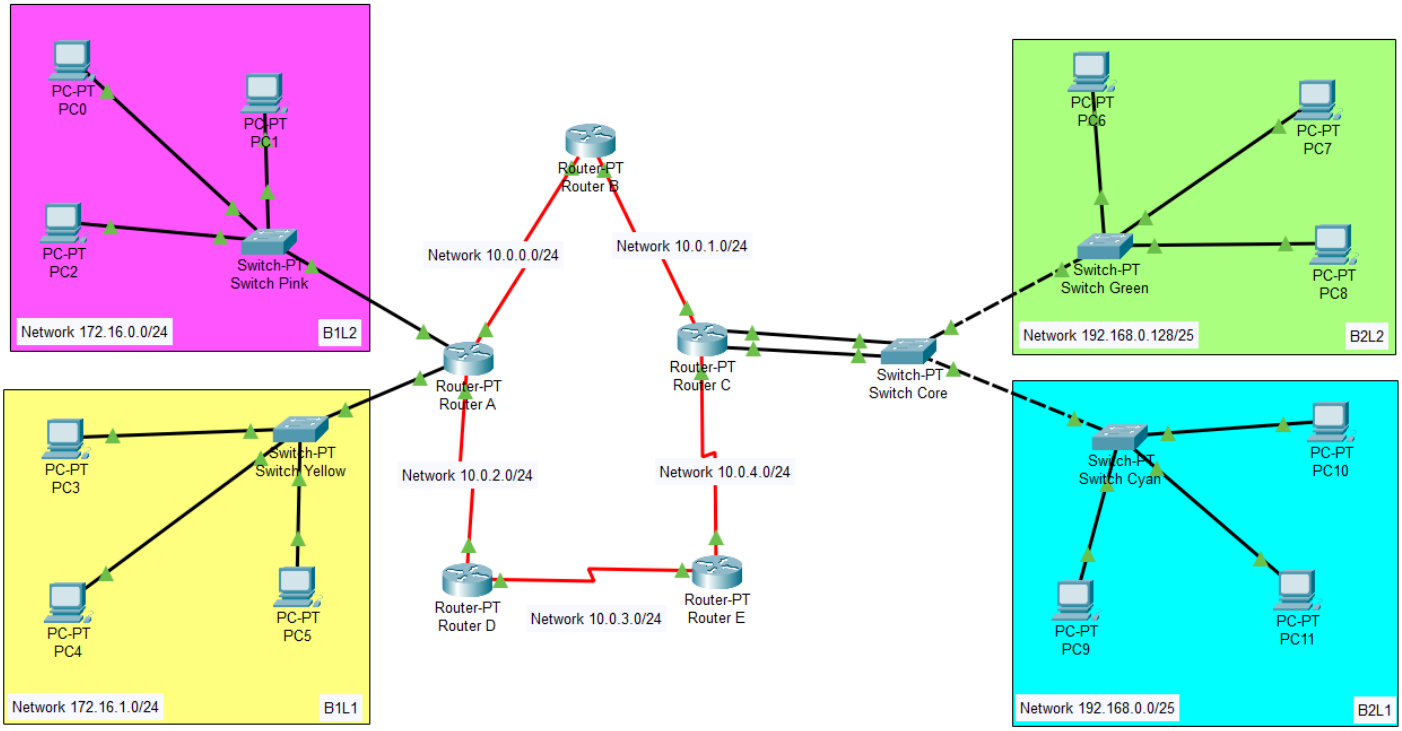
Fast Convergence: OSPF can swiftly adjust to changes in the network topology, such as new routes or failed links, because of its fast convergence times.

OSPF facilitates load balancing, which can enhance network performance by dividing traffic among several paths.

Robustness: OSPF is a robust protocol that can reliably route traffic and manage intricate network topologies.

We provide effective and dependable routing between the subnets by installing OSPF on our network's routers. This enables devices in different subnets to communicate with each other without interruption and allows the network to adapt as conditions change.

Task 2: Layer 2 Implementation and Analysis



The router must be configured with VLANs (Virtual Local Area Networks) by identifying the VLANs. In this assignment, Two VLANs are available. VLAN 100 and VLAN 200. All the even numbered PCs are members of VLAN 100, and all the Odd numbered PCs are members of VLAN 200.

VLAN 100 PCs. – PC06, PC08, PC10

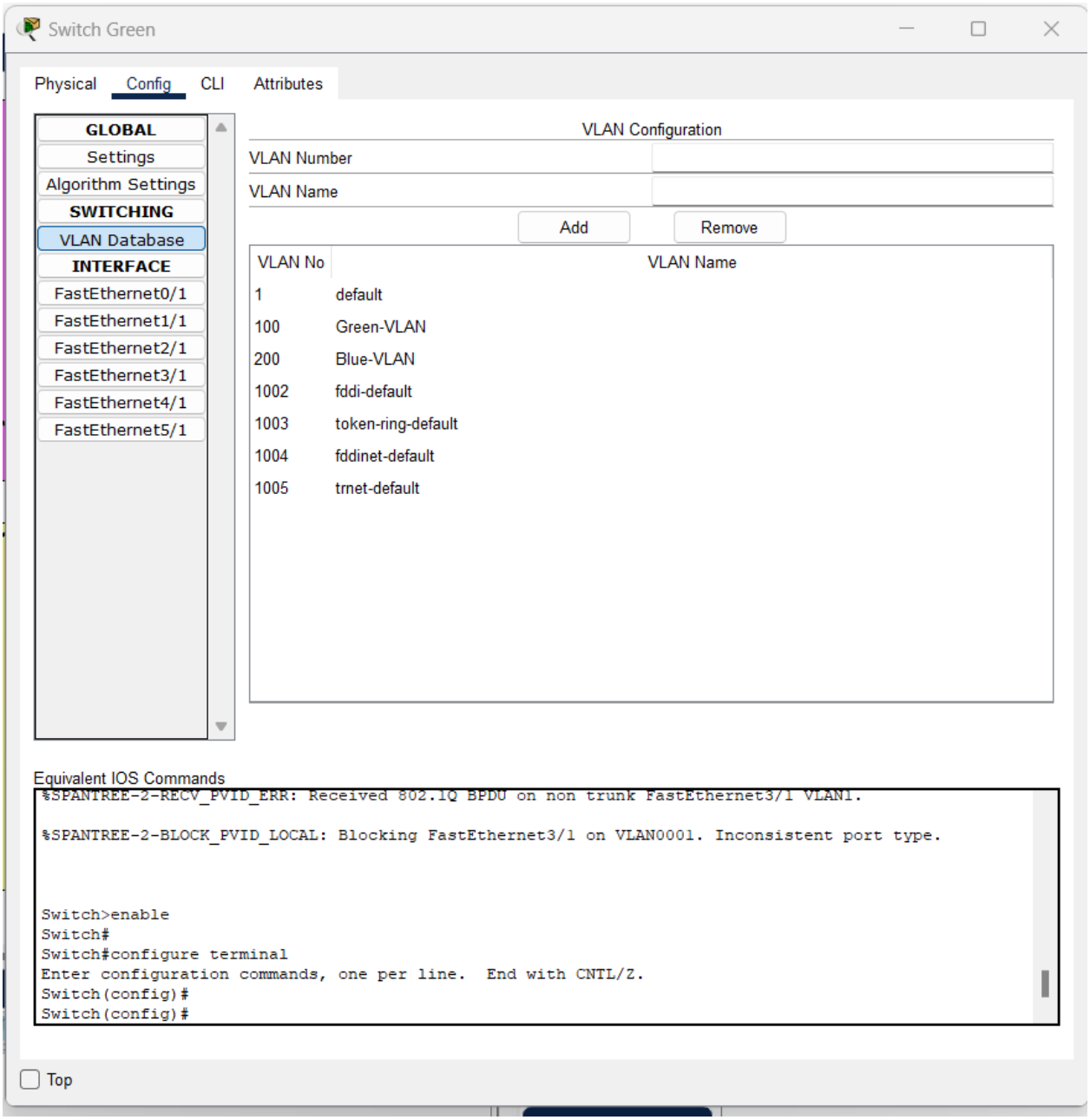
VLAN 200 PCs. – PC07, PC09, PC11

The Network ID assigned for VLAN 100 is 192.168.128.0/25 and Network id assigned for VLAN 200 is 192.168.0.0/25.

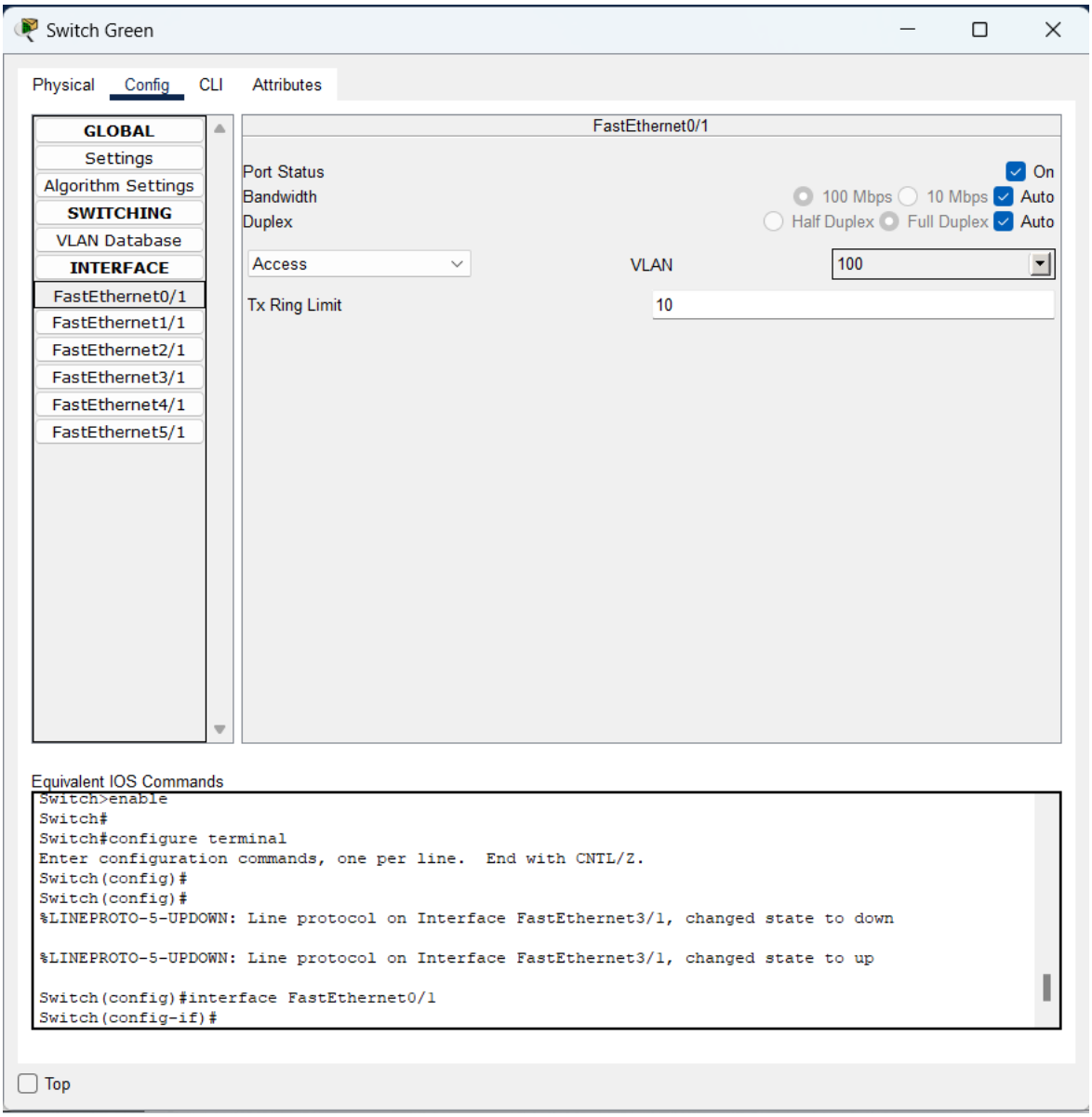
Typically, switches are configured with VLANs by assigning certain interfaces to a broadcast domain and others to a different one. An Ethernet LAN's switch ports function as a subset of every VLAN. Network managers can easily restrict access to a specific user. Grouped by dividing workstations into multiple distinct LAN segments using VLANs.

Switch Configurations for Make VLANs

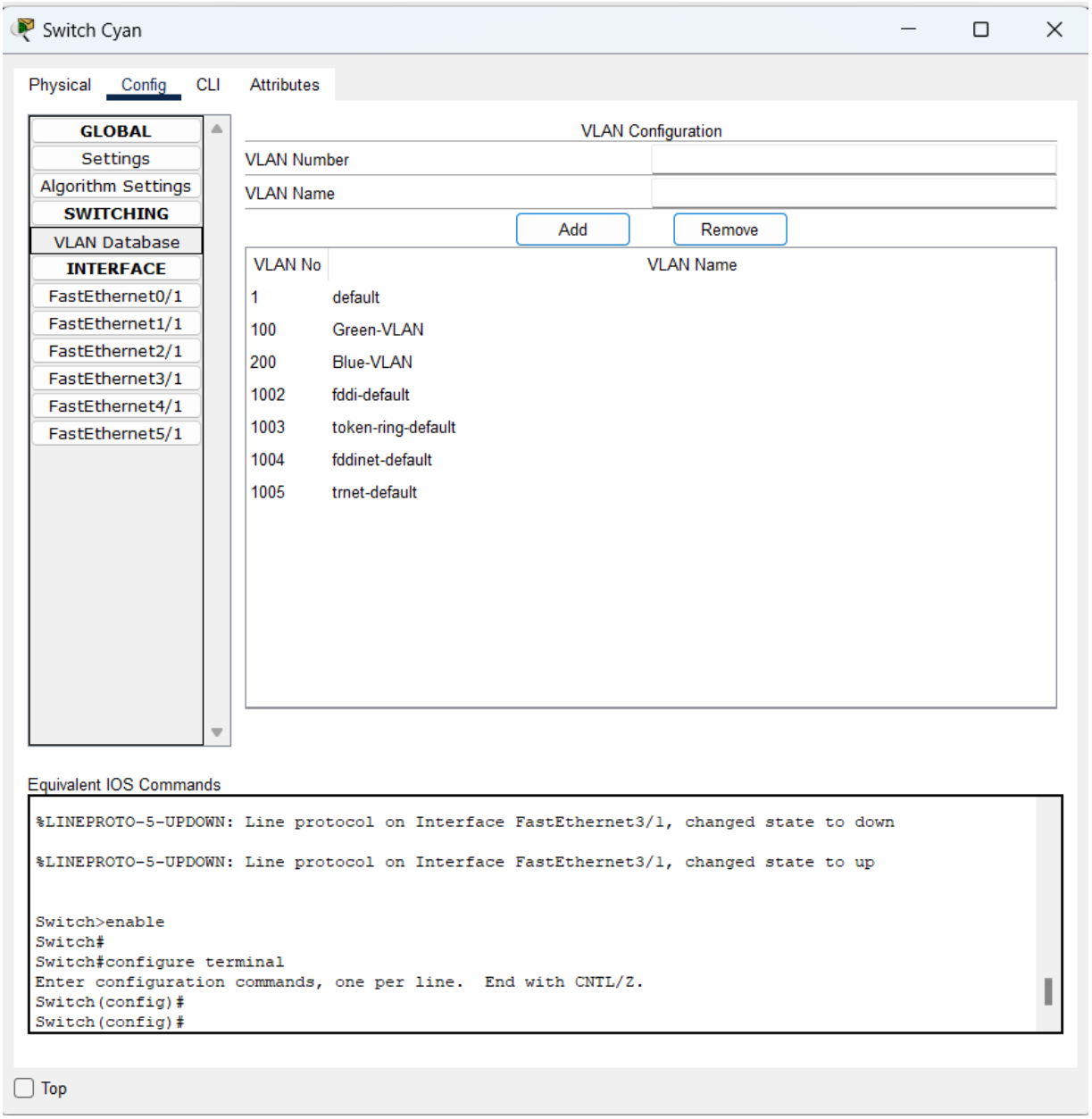
Switch Green VLAN Creation



In Switch Green Fastethernet should be always access.

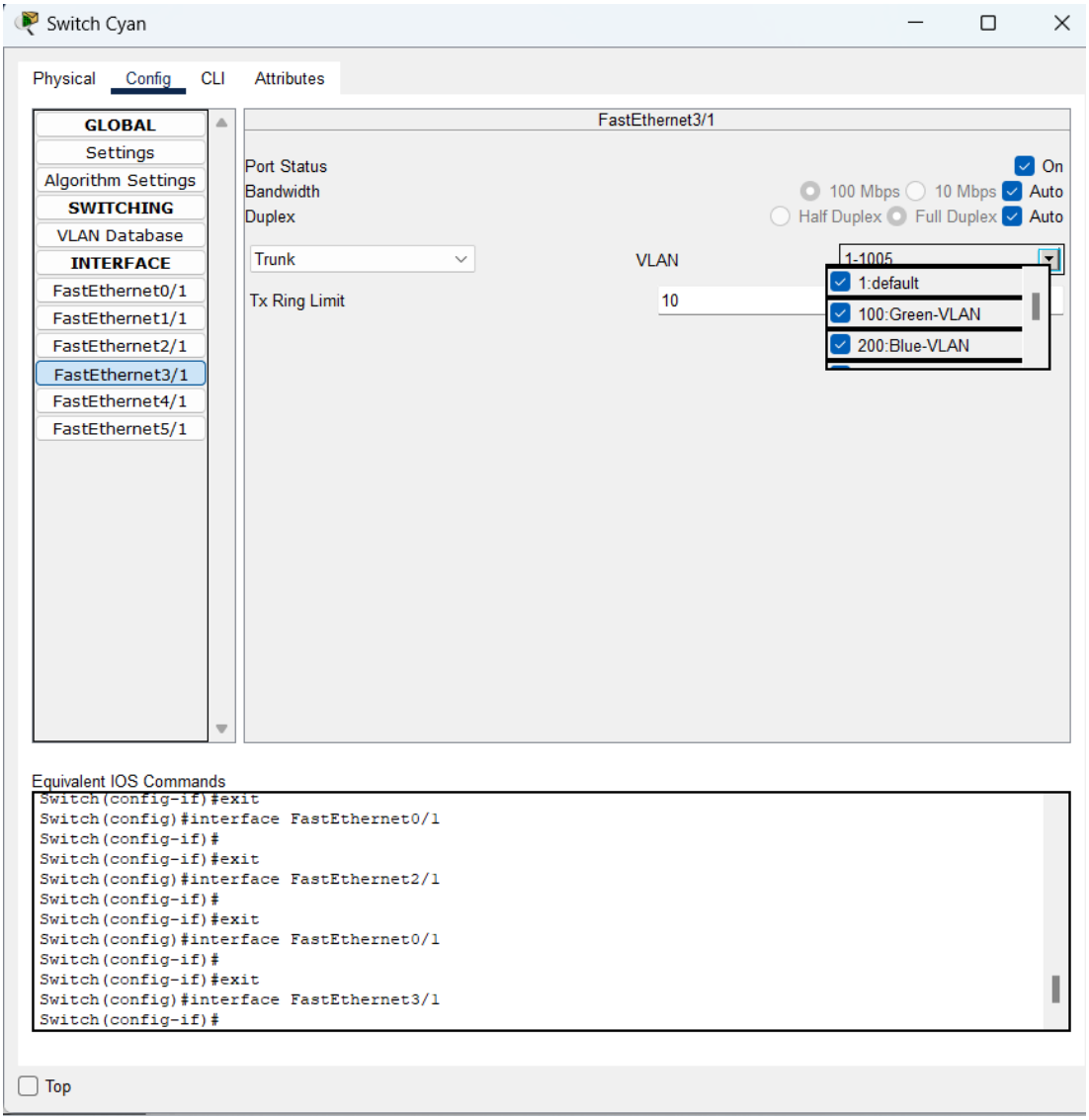


Switch Cyan VLAN Creation

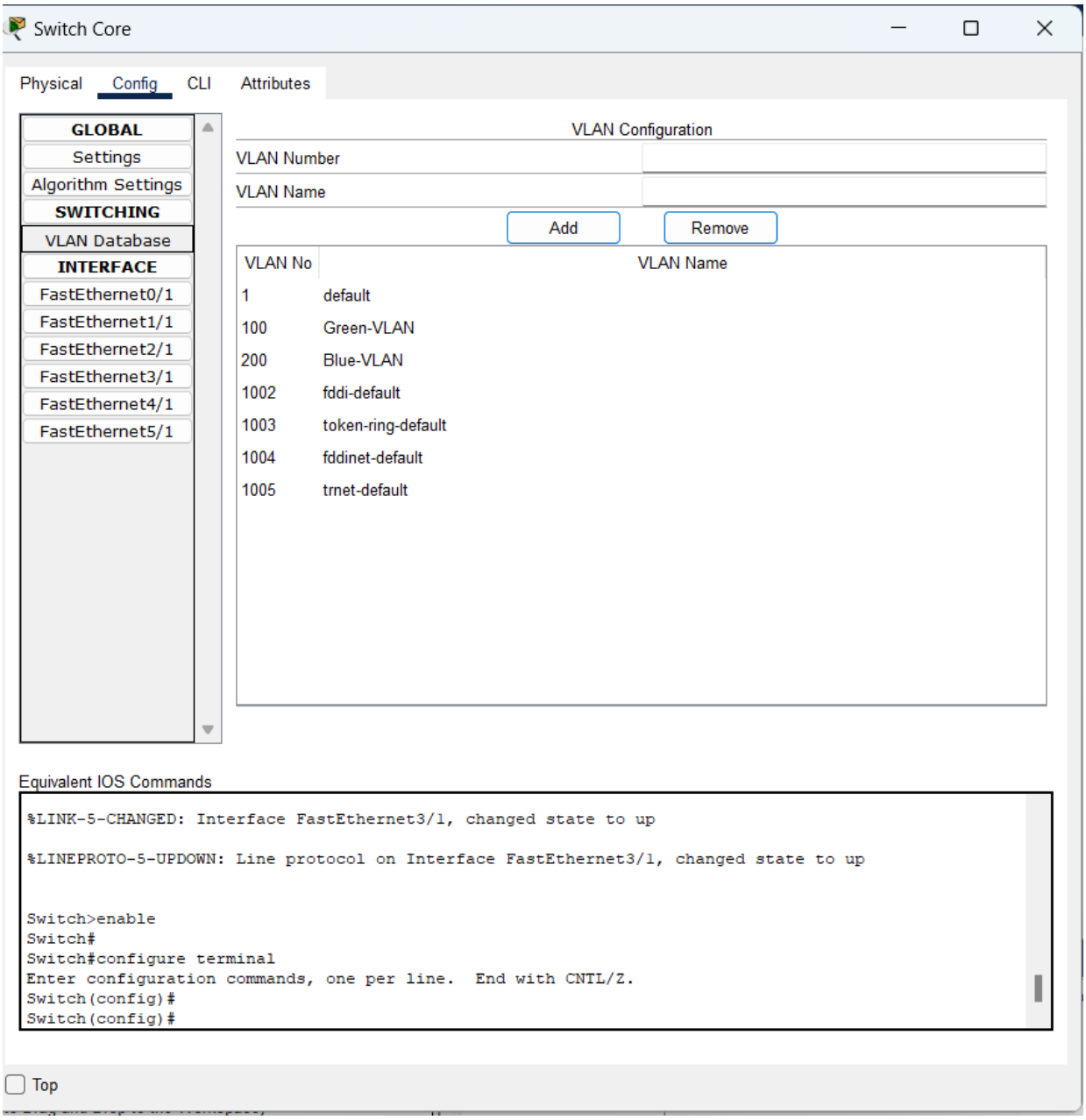


In Switch Cyan fa 0/1, fa 0/2 are access

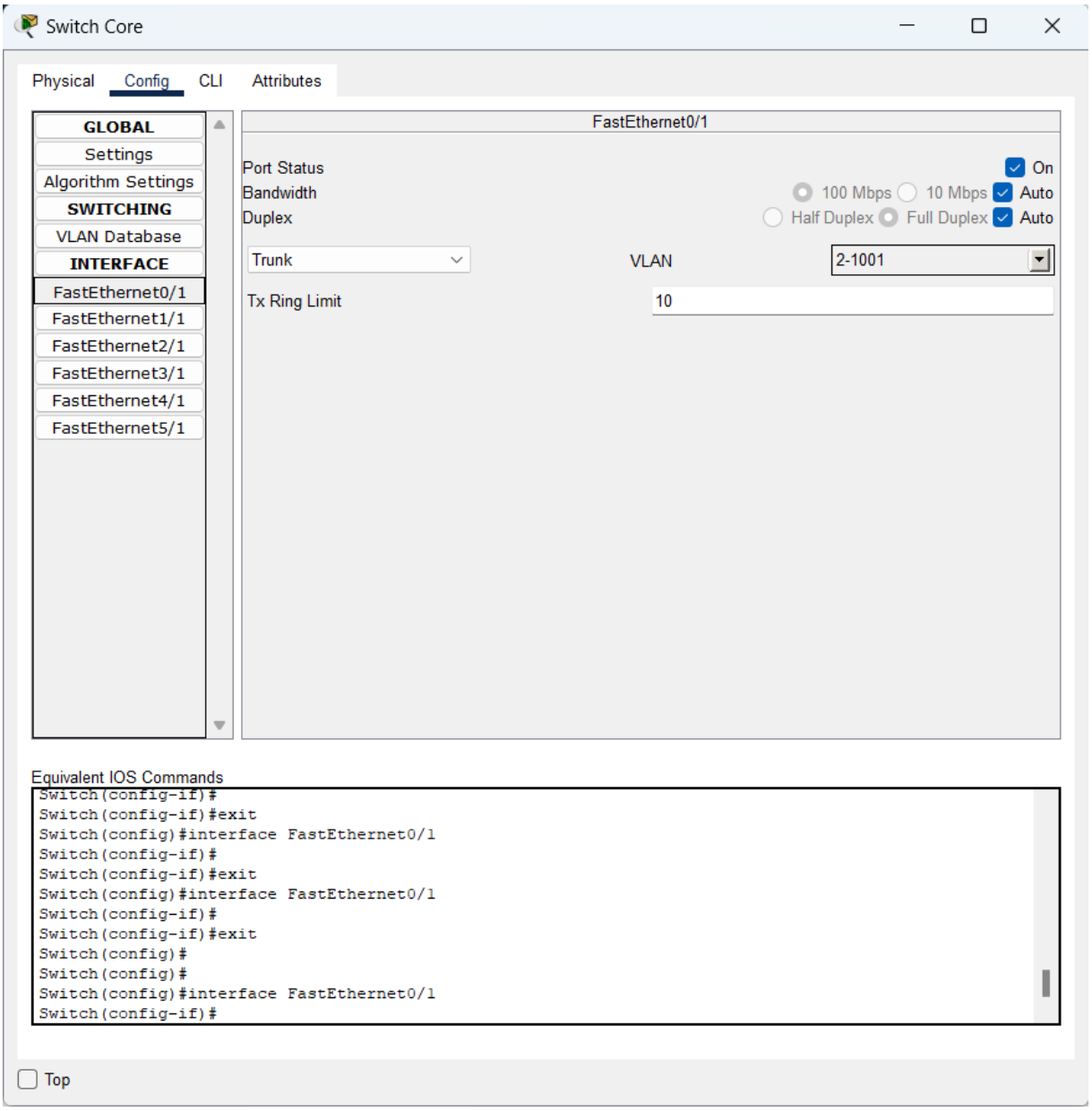
Fa0/3 is Trunk due to two types of VLANs.



Switch Core VLAN creation

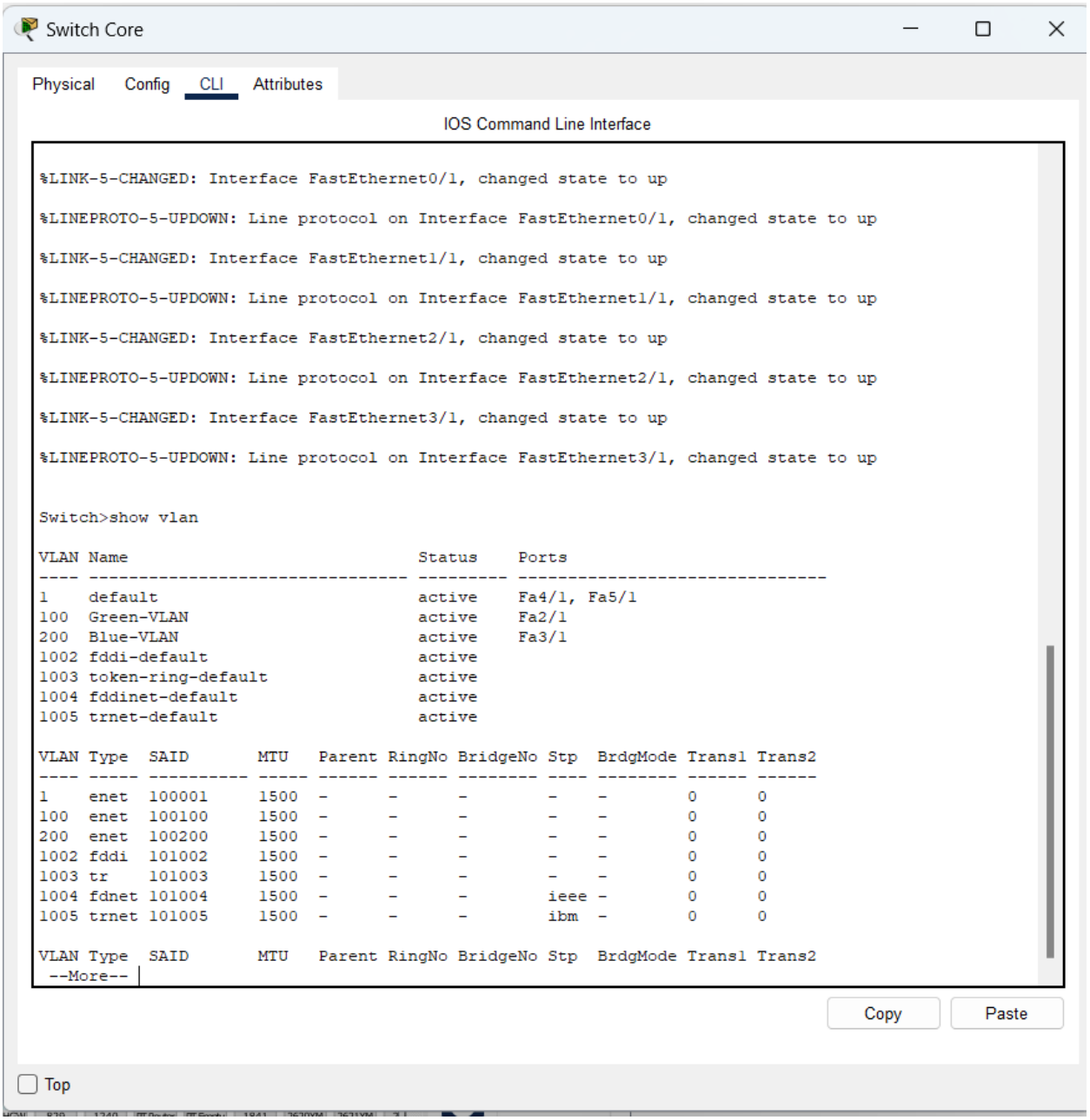


In switch Core f0/1, fa1/1 are Trunk because of two VLANs.

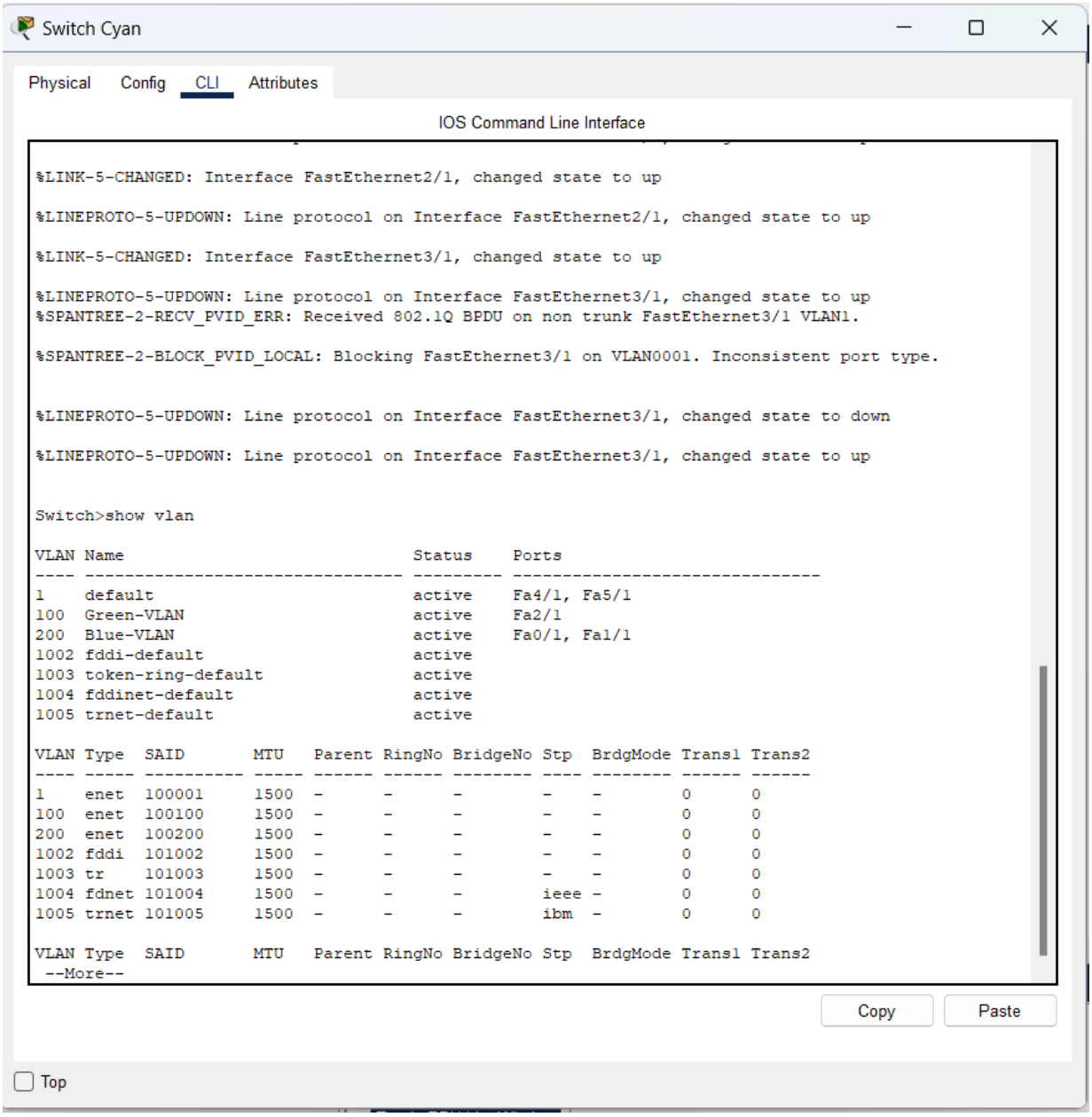


Shown below are the VLANs of the Switches. It shows the access cables but not the trunk cables.

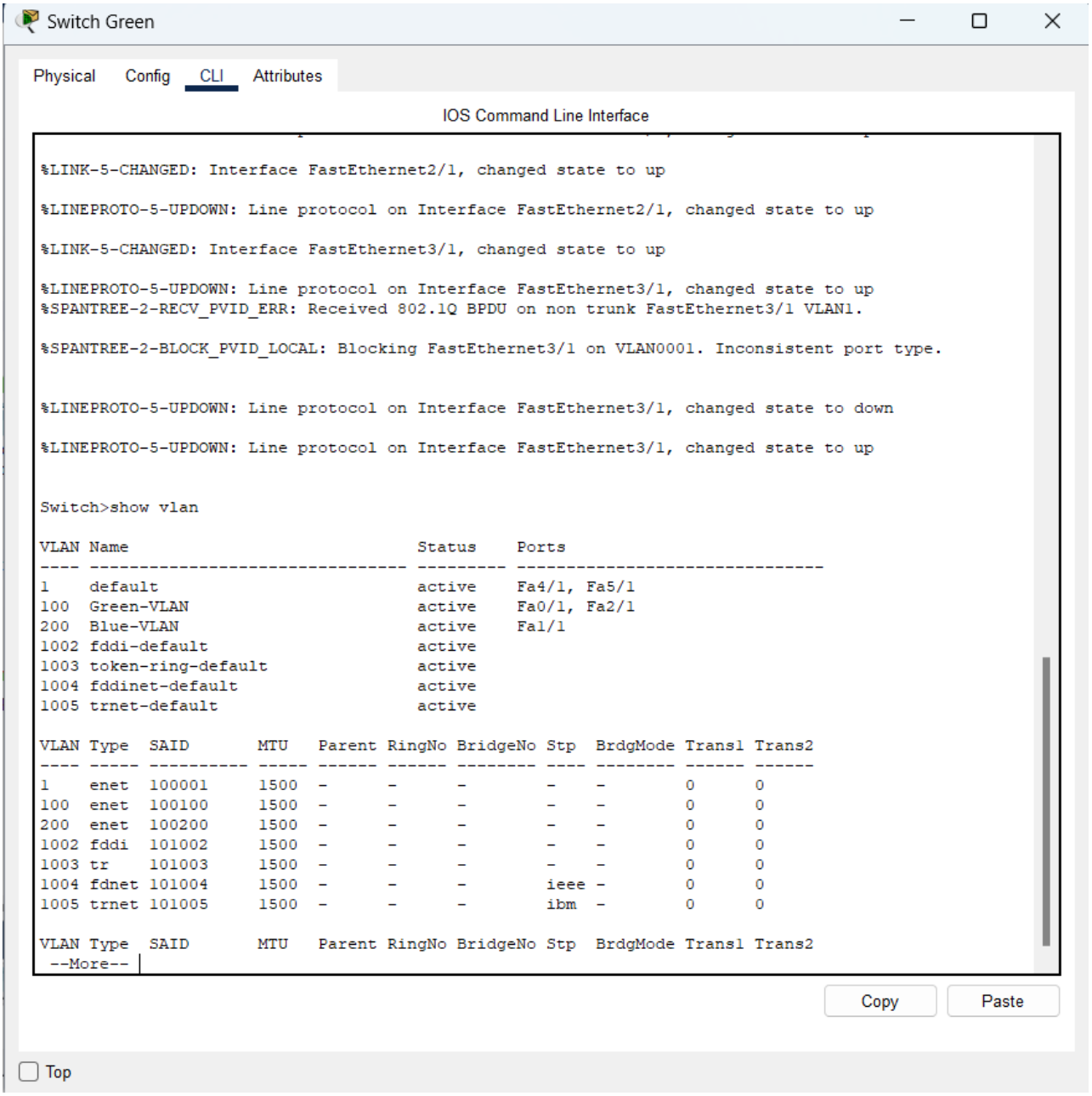
Switch Core



Switch Cyan


Switch Cyan
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINK-5-CHANGED: Interface FastEthernet2/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet3/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/1, changed state to up
%SPANTREE-2-RECV_PVID_ERR: Received 802.1Q BPDU on non trunk FastEthernet3/1 VLAN1.
%SPANTREE-2-BLOCK_PVID_LOCAL: Blocking FastEthernet3/1 on VLAN0001. Inconsistent port type.
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/1, changed state to up
Switch>show vlan
VLAN Name Status Ports
1 default active Fa4/1, Fa5/1
100 Green-VLAN active Fa2/1
200 Blue-VLAN active Fa0/1, Fa1/1
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default active
VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2
1 enet 100001 1500 - - - - - 0 0
100 enet 100100 1500 - - - - - 0 0
200 enet 100200 1500 - - - - - 0 0
1002 fddi 101002 1500 - - - - - 0 0
1003 tr 101003 1500 - - - - - 0 0
1004 fdnet 101004 1500 - - - ieee - 0 0
1005 trnet 101005 1500 - - - ibm - 0 0
VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2
--More--
Copy
Paste
Top

Switch Green



Then we can make DCHP pools for subnetworks and set default routers. In network 1 and 2

Router Configuration for Network 1

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa0/0

Router(config-if)#ip address 192.168.128.1 255.255.255.128

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet0/0, changed state to up

DHCP Pool Configuration for Network 1

Router(config)#ip dhcp pool network1

Router(dhcp-config)#network 192.168.128.0 255.255.255.128

Router(dhcp-config)#default-router 192.168.128.1

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

Router#write memory

Building configuration...

[OK]

Router#

Router Configuration for Network 2

Router>en

Router#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int fa1/0

Router(config-if)#ip address 192.168.0.1 255.255.255.128

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on interface FastEthernet1/0, changed state to up

DHCP Pool Configuration for Network 2

Router(config)#ip dhcp pool network1

Router(dhcp-config)#network 192.168.0.0 255.255.255.128

Router(dhcp-config)#default-router 192.168.0.1

Router(dhcp-config)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG_I: Configured from console by console

Router#write memory

Building configuration...

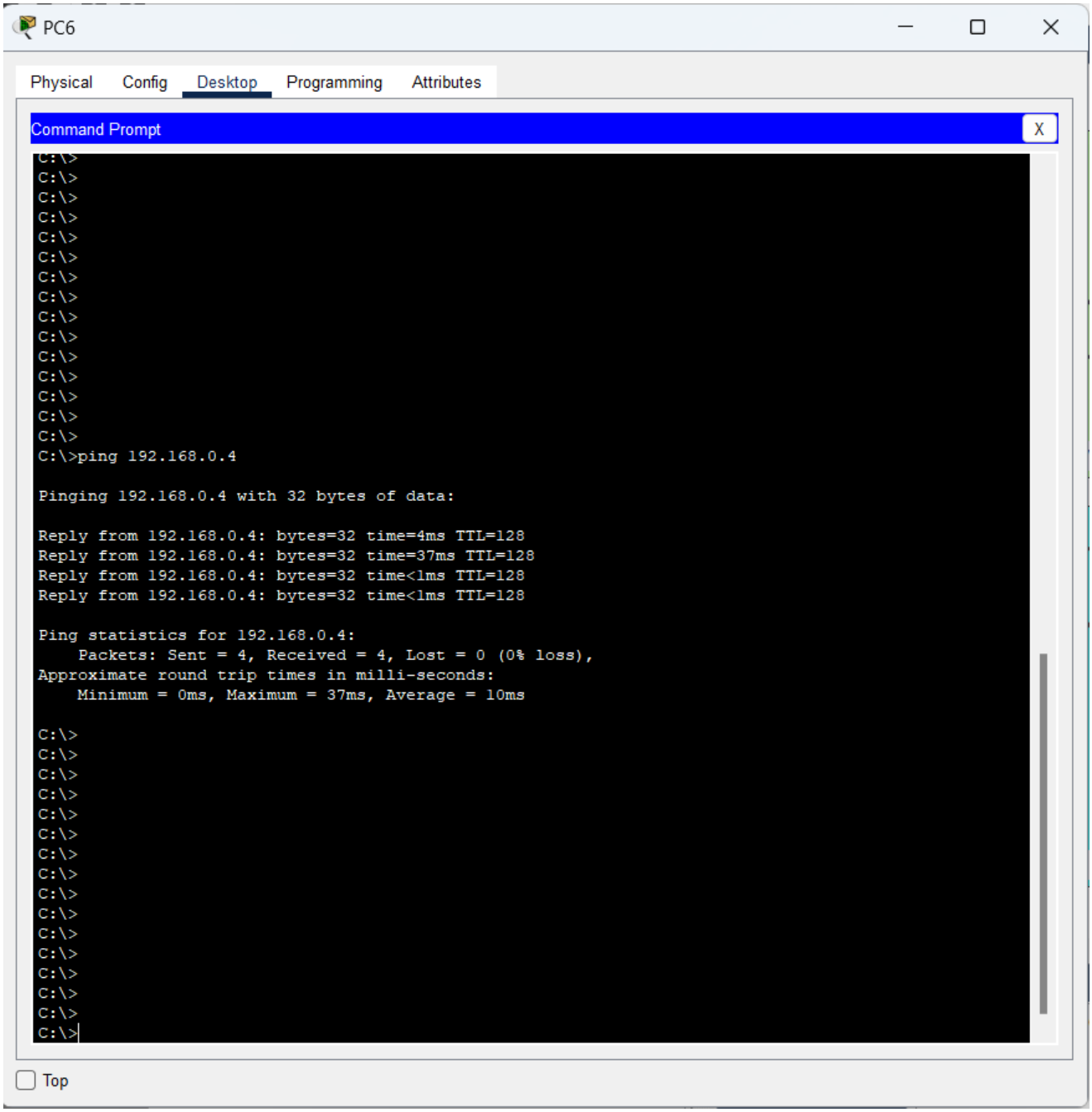
[OK]

Router#

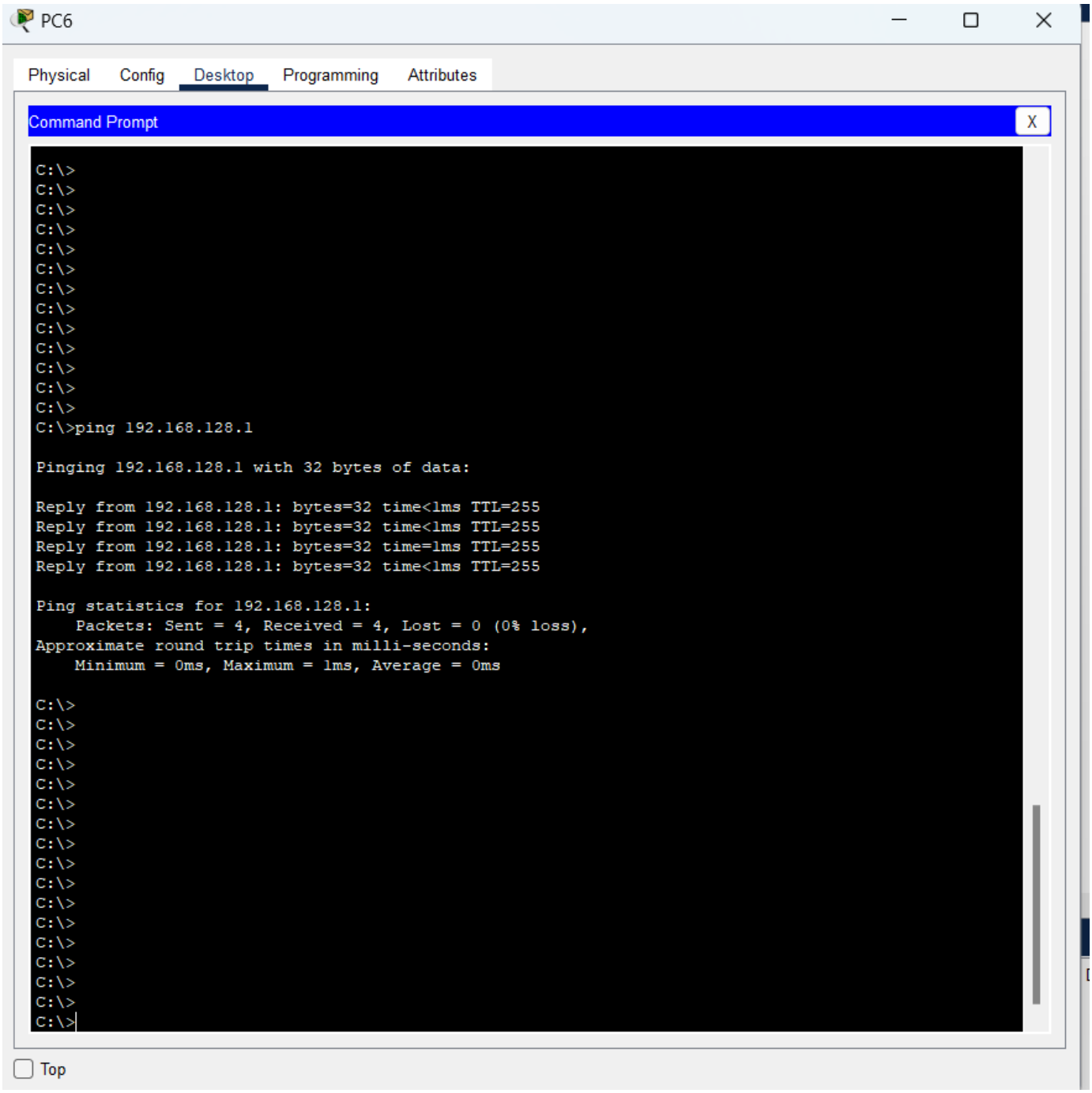
We can get IP addresses for PCs as the same way we have done in task 1.

Now, We are able to use ping command and use ping command to verify the connectivity over VLANs.

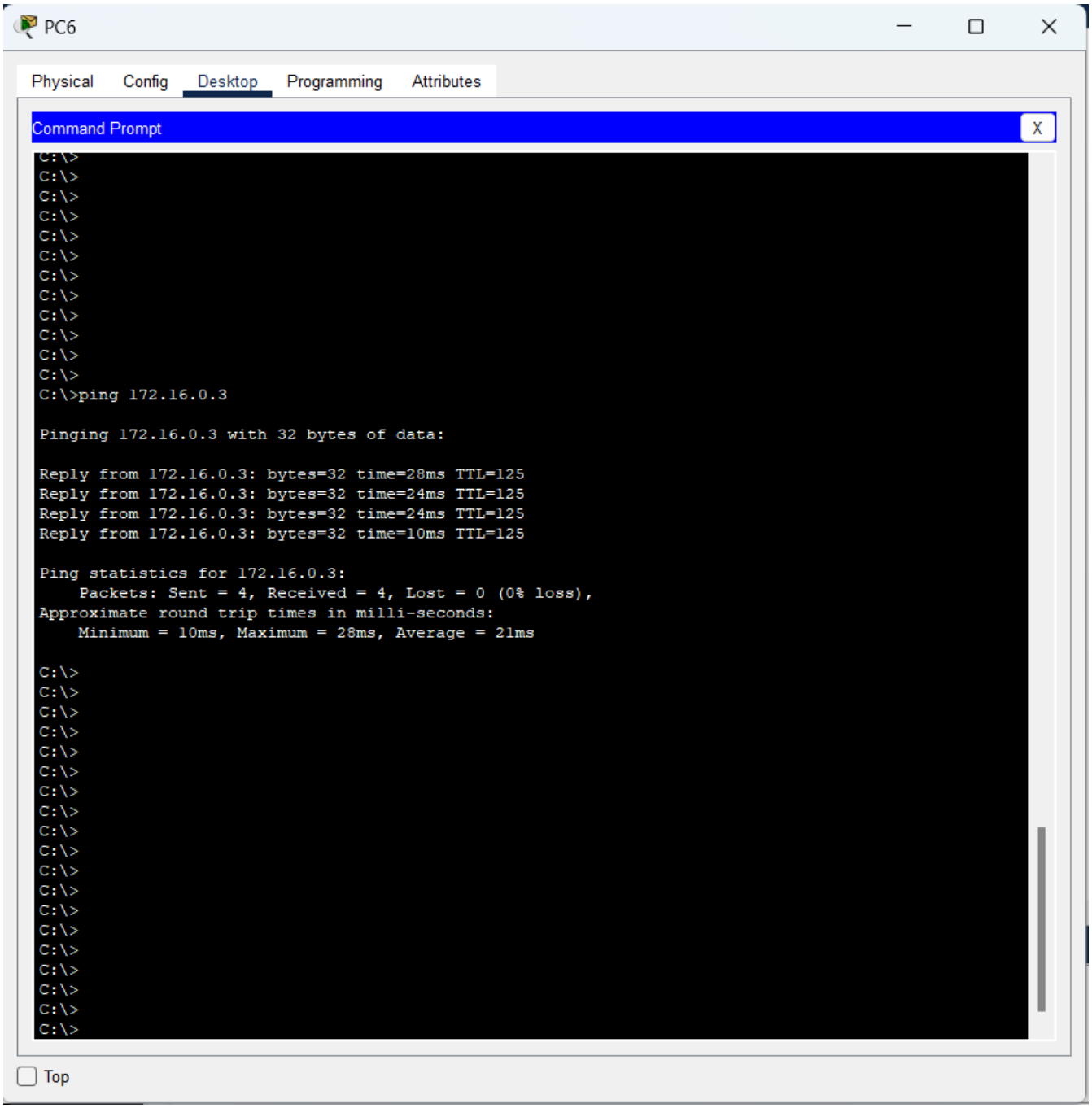
Checking Connectivity in same VLAN (PC6 to PC8)



Checking connectivity from Different Network (PC6 to PC9)



Checking Connectivity from Two Different Networks (PC6 to PC0)



Method for Setting Up VLANs and Routing Information Across Subnets:

Setting Up a VLAN:

On a Layer 2 switch, create VLAN 100 and VLAN 200.

Assign the appropriate ports to every VLAN.

Set up the switch's VLAN interfaces (SVIs) for VLANs 100 and 200.

192.168.128.1 - 192.168.128.126 should be the range for switch interfaces connected to devices in VLAN 100, and 192.168.0.1 - 192.168.0.126 should be the range for switch interfaces connected to devices in VLAN 200.

Inter-Subnet Routing:

Use a trunk port to link the router and switch it together.

Set up subinterfaces on the router using the IP addresses 192.168.128.1/25 and 192.168.0.1/25 for VLAN 100 and VLAN 200, respectively.

On the router, enable routing.

Set the switch's default gateways to point to the subinterfaces of the router.

Dissimilarities with Task 1: IP Addressing System

The IP ranges and masks for the VLANs in this scenario differ from those in Task 1. Whereas VLAN 200 uses 192.168.0.0/25, VLAN 100 utilizes the range 192.168.128.0/25.

Routing Configuration: Because VLAN 100 and VLAN 200 have different network requirements, the precise IP addresses and subnet configurations on the router's sub interfaces are different in this situation, even though the fundamental idea of routing between VLANs is still the same.

Network Segmentation: VLAN-achieved network segmentation remains the main focus, although the particular network IDs and subnetting information differ between the two tasks according to the demands of each network configuration.

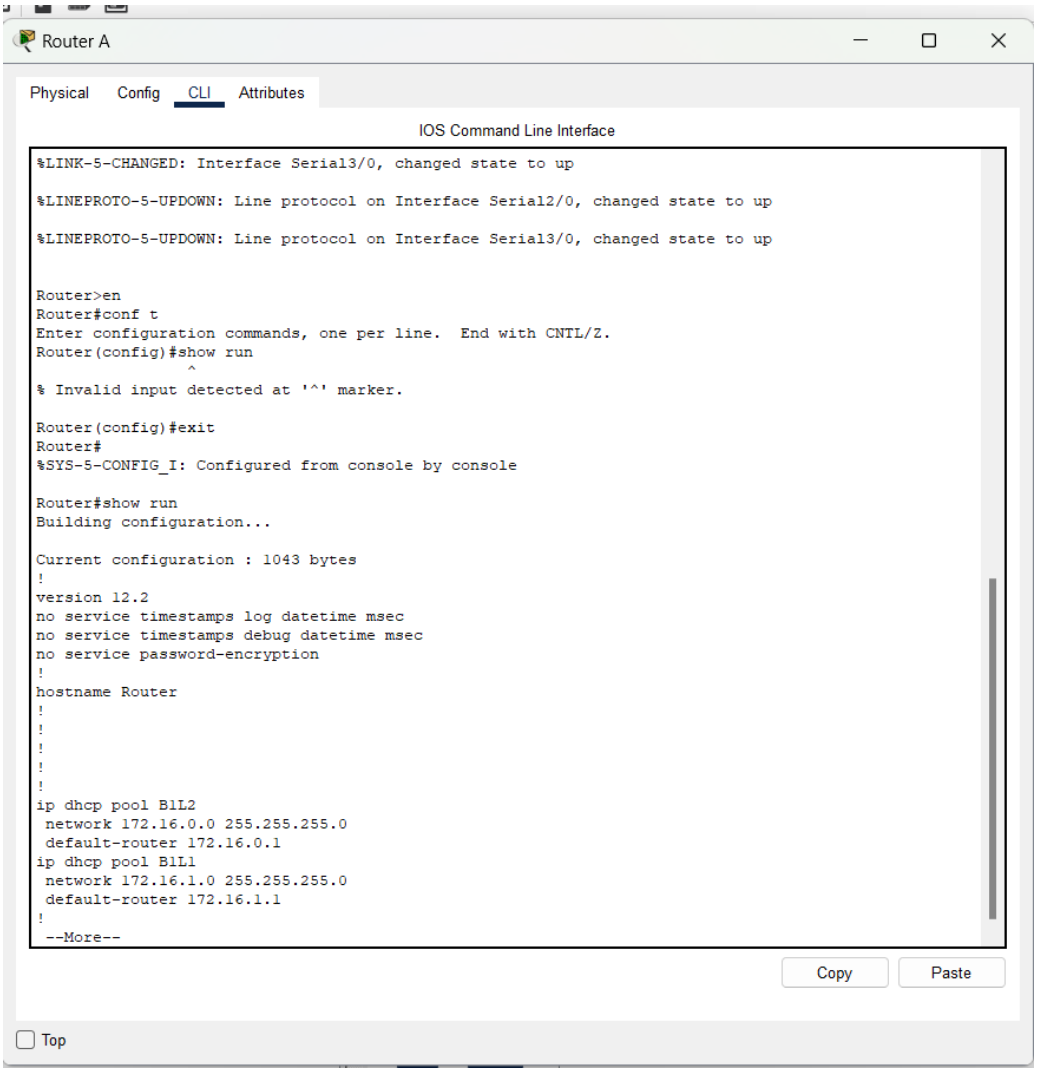
In conclusion, the basic ideas behind configuring VLANs and routing data between subnets are still the same.

Task 03 - Layer 3 Evaluation

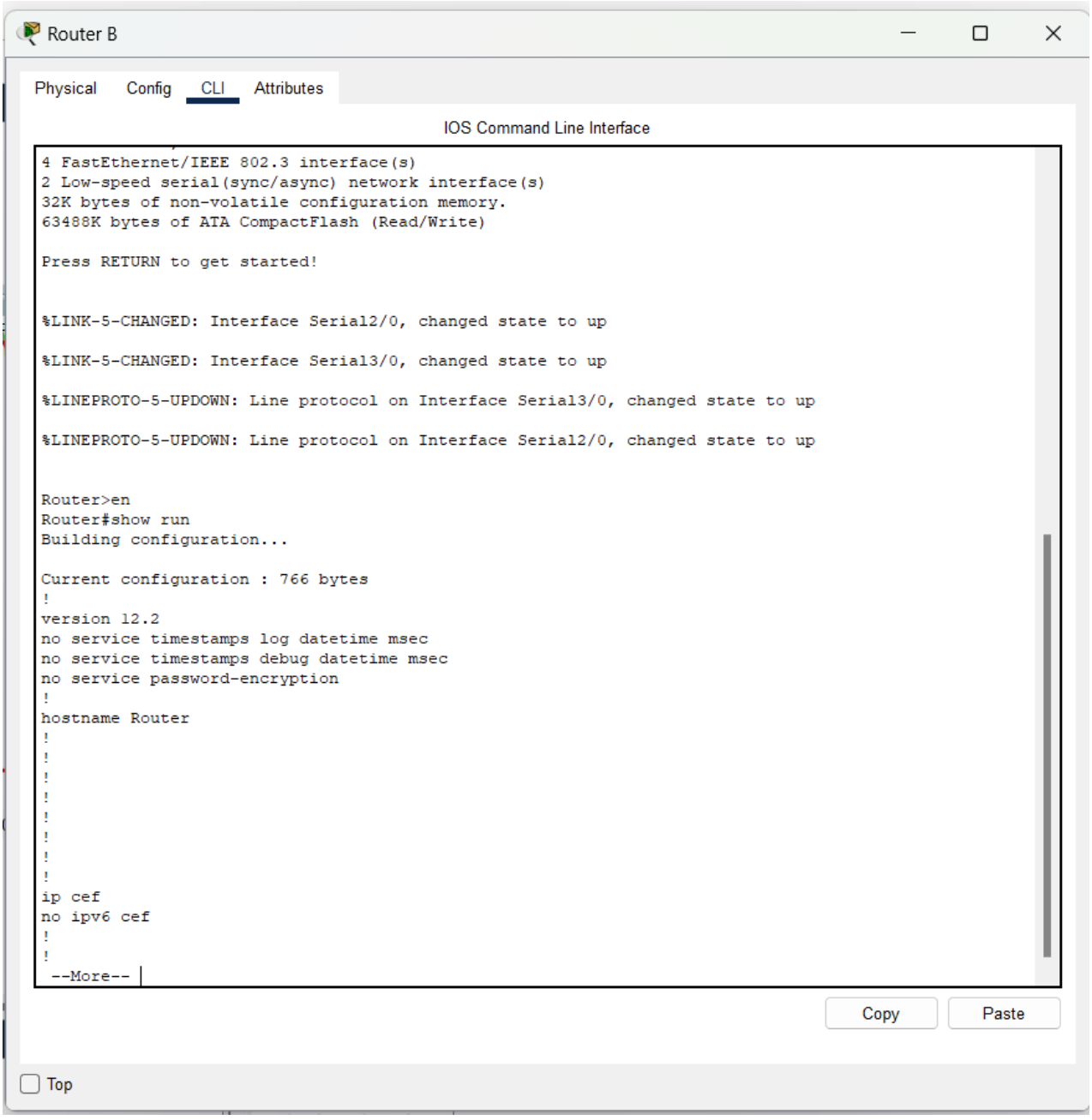
In Task 3, we focus on evaluating Layer 3 performance in the Task 1 network that has already been constructed. We start a ping operation from a host in Network B to a host in Network A with a specific focus on Network B. Our objective is to look into how Layer 2 (Data Link Layer) and Layer 3 (Network Layer) addresses are assigned and managed at the entry and exit points of each network.

First, I will use Show run command to examine the running configuration of all routers and switches.

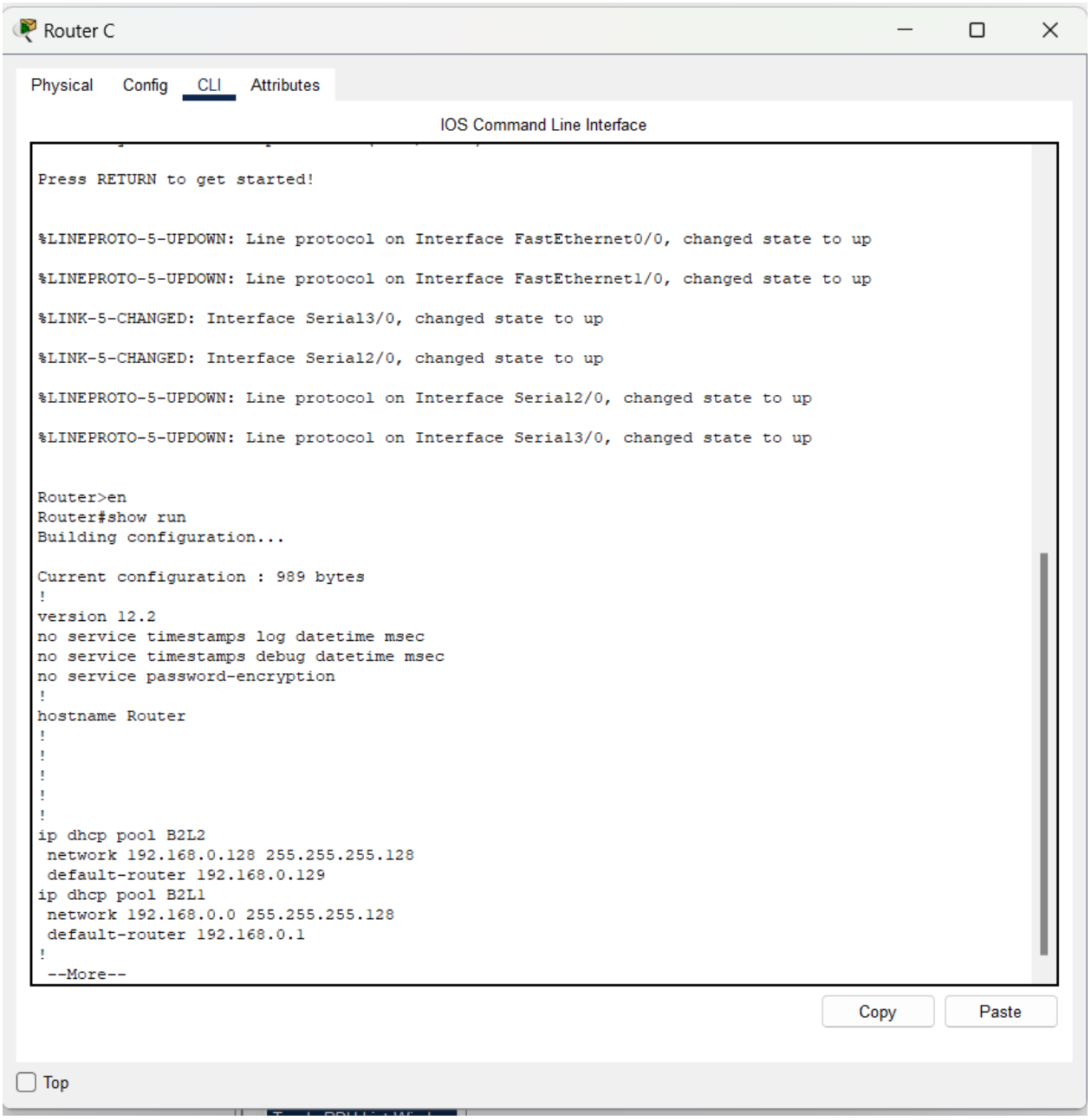
Router A



Router B


Router B
Physical
Config
CLI
Attributes
IOS Command Line Interface
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)
Press RETURN to get started!
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router>en
Router#show run
Building configuration...
Current configuration : 766 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
--More--
Copy
Paste
Top

Router C


Router C
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started!
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
Router>en
Router#show run
Building configuration...
Current configuration : 989 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
ip dhcp pool B2L2
network 192.168.0.128 255.255.255.128
default-router 192.168.0.129
ip dhcp pool B2L1
network 192.168.0.0 255.255.255.128
default-router 192.168.0.1
!
--More--
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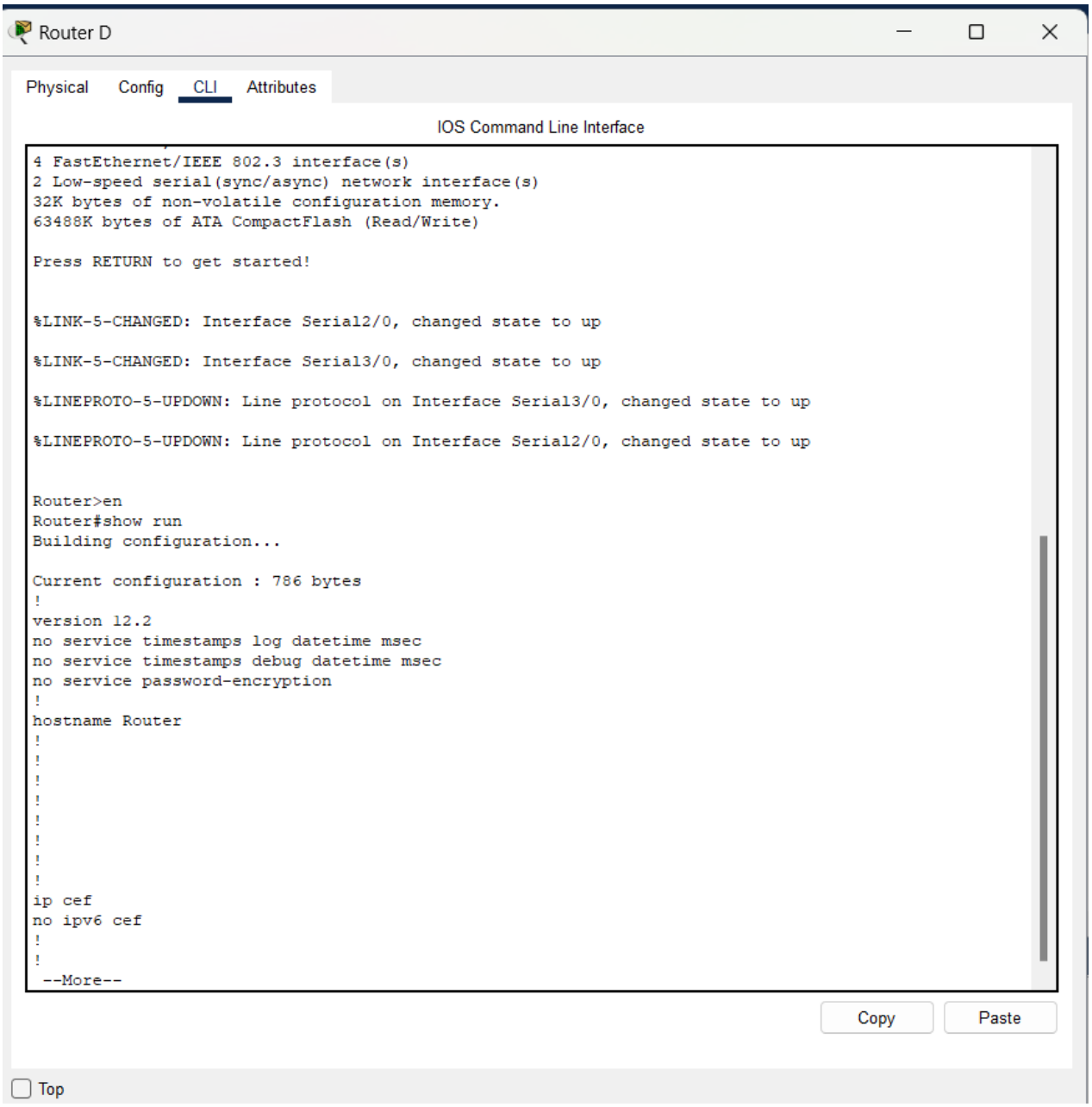
Router D


Router D
Physical
Config
CLI
Attributes
IOS Command Line Interface
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)
Press RETURN to get started!
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router>en
Router#show run
Building configuration...
Current configuration : 786 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
--More--
Copy
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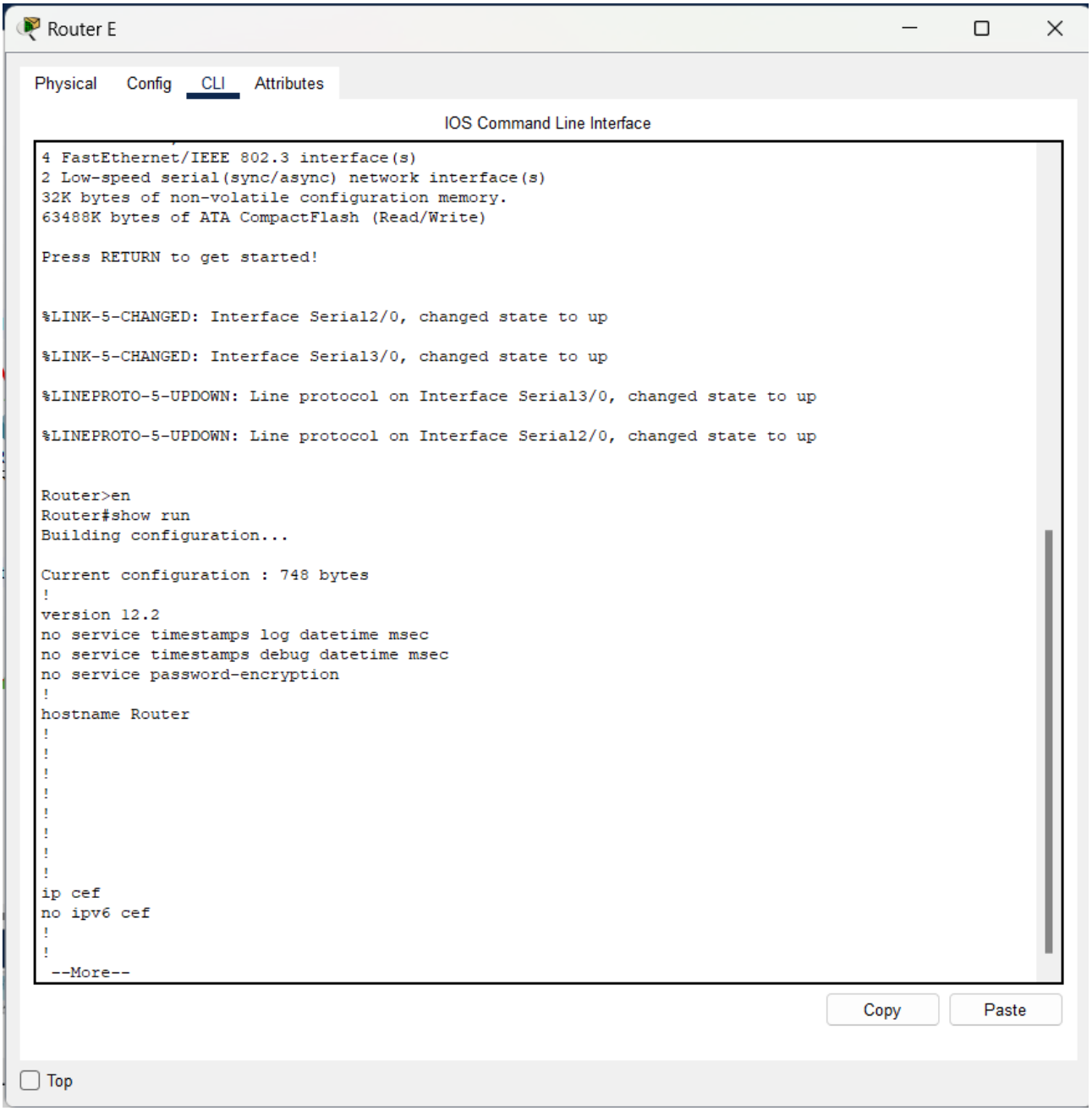
Top

Router E


Router E
Physical
Config
CLI
Attributes
IOS Command Line Interface
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)
Press RETURN to get started!
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router>en
Router#show run
Building configuration...
Current configuration : 748 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
--More--
Copy
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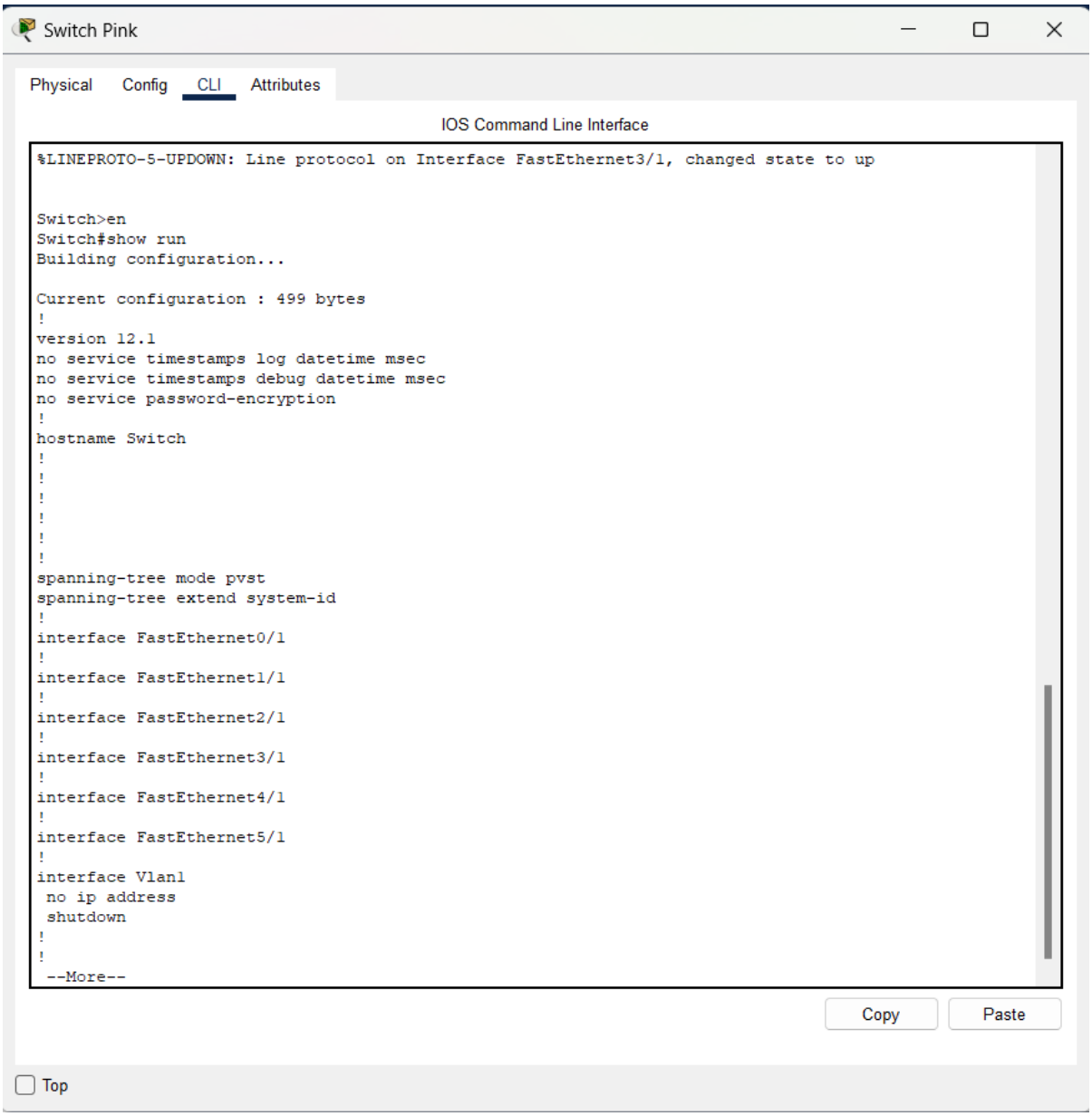
Top

Switch Pink


Switch Pink
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/1, changed state to up
Switch>en
Switch#show run
Building configuration...
Current configuration : 499 bytes
!
version 12.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
!
interface FastEthernet1/1
!
interface FastEthernet2/1
!
interface FastEthernet3/1
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface Vlan1
no ip address
shutdown
!
!
--More--
Copy
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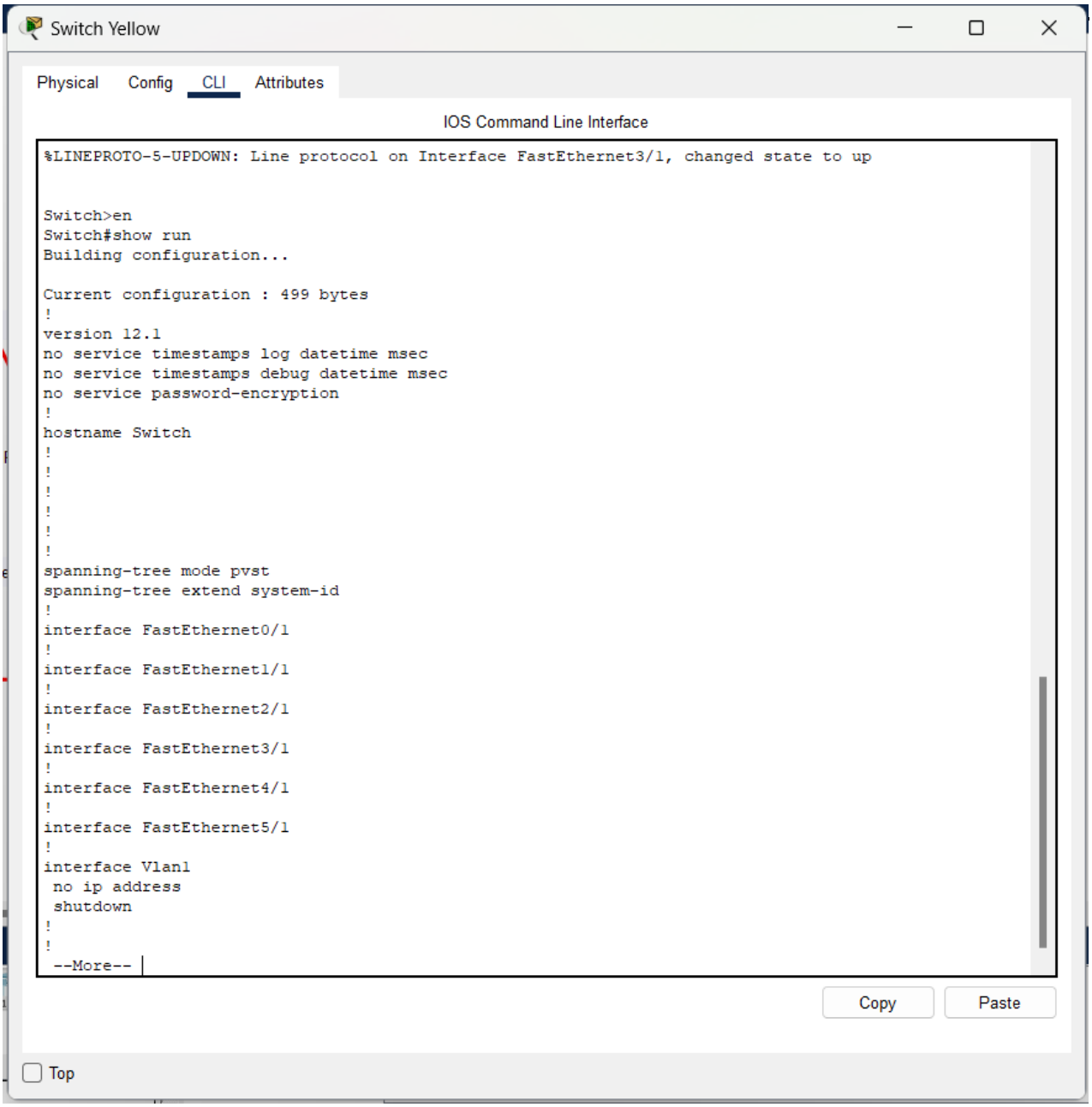
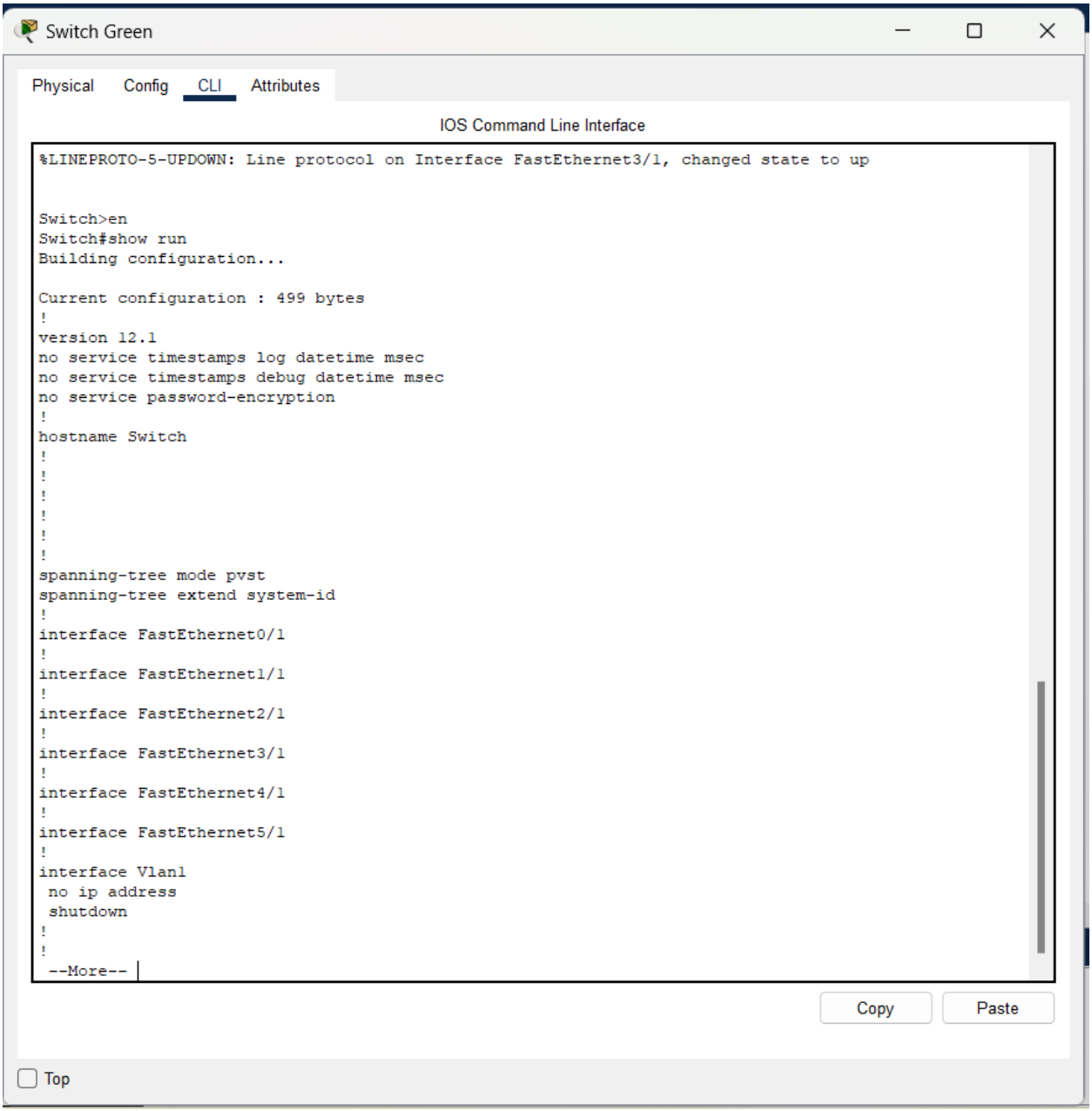
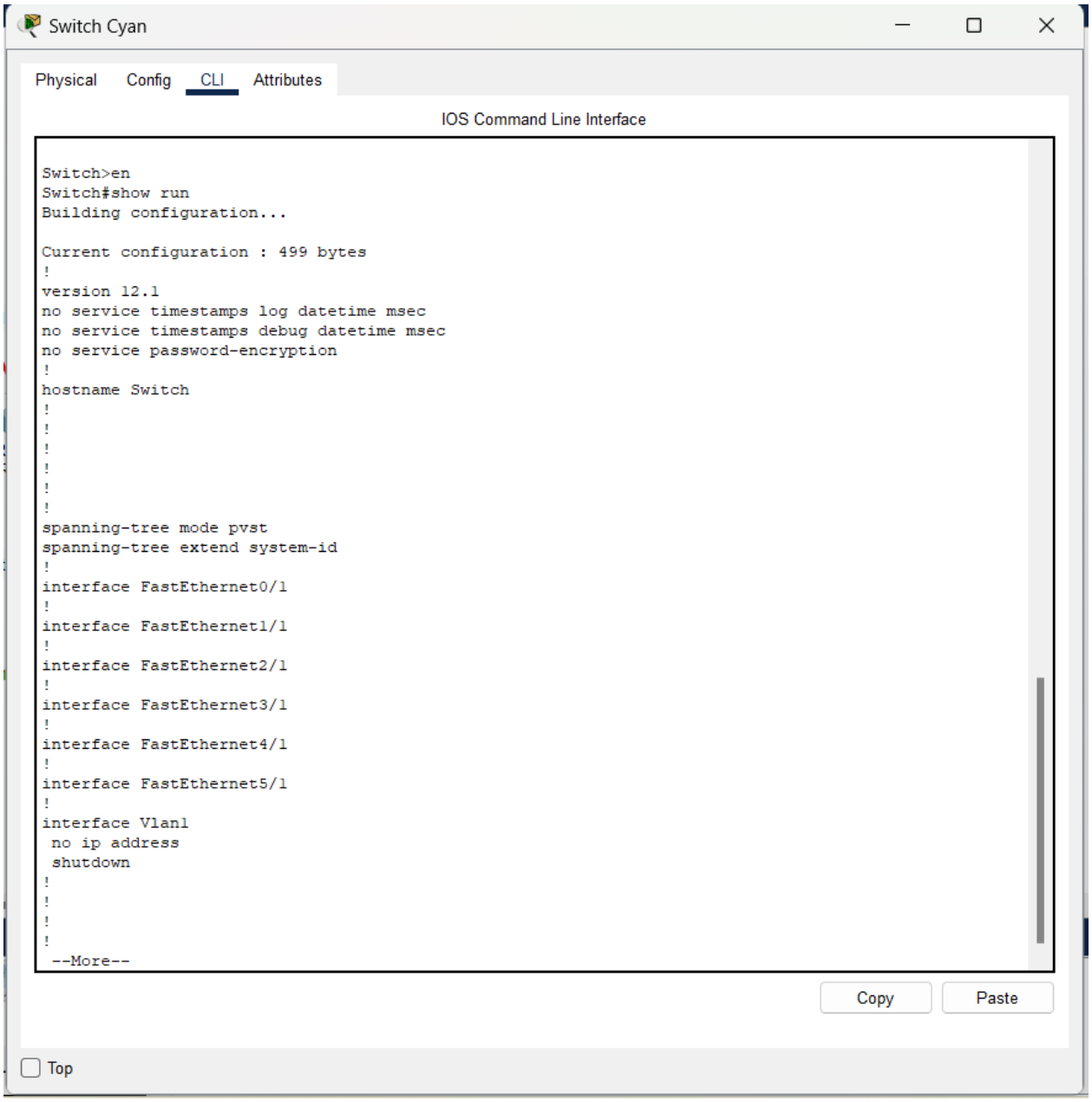
Switch Yellow



Switch Green



Switch Cyan


Switch Cyan
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch>en
Switch#show run
Building configuration...
Current configuration : 499 bytes
!
version 12.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
!
interface FastEthernet1/1
!
interface FastEthernet2/1
!
interface FastEthernet3/1
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface Vlan1
no ip address
shutdown
!
!
!
!
--More--
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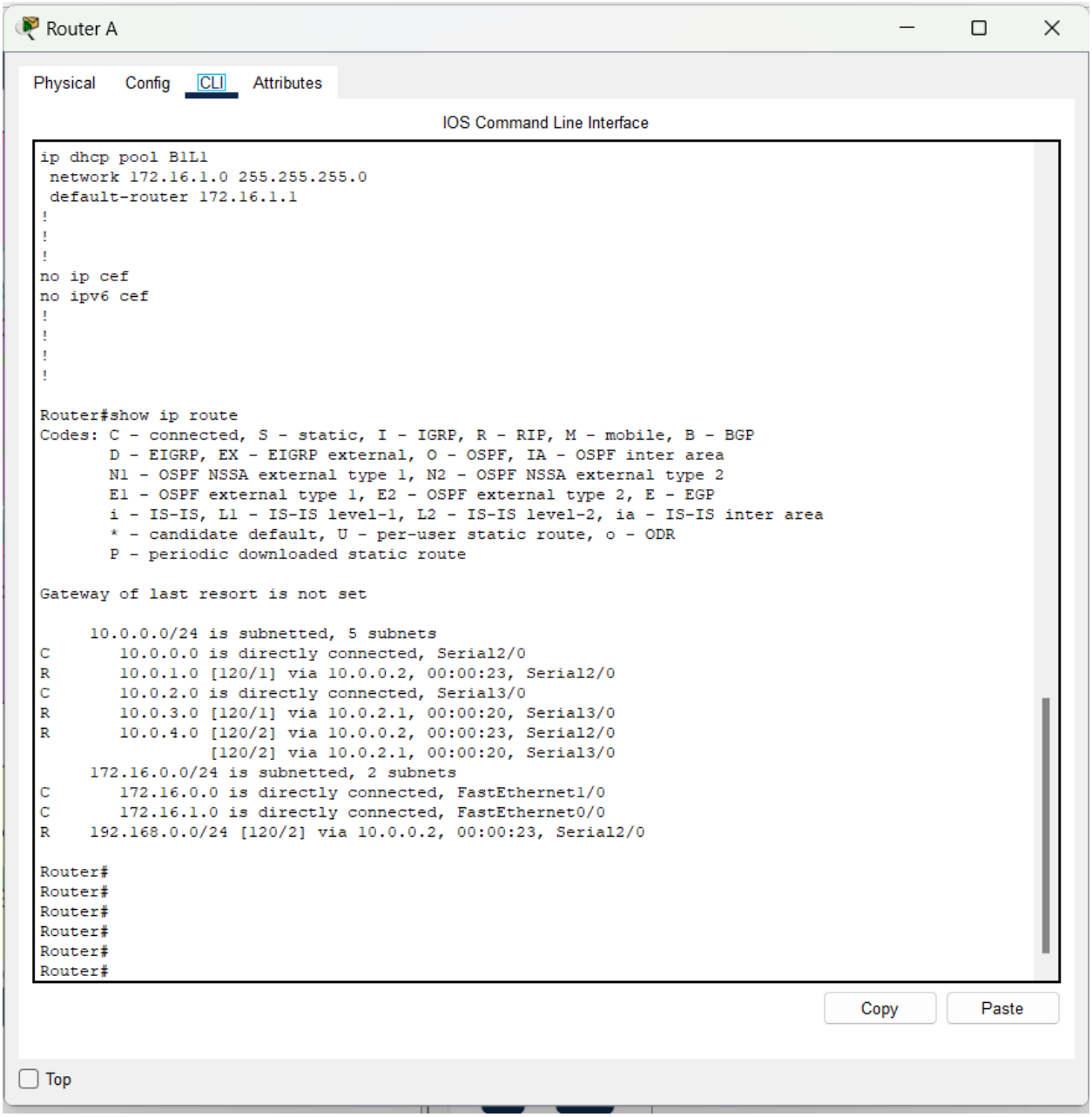
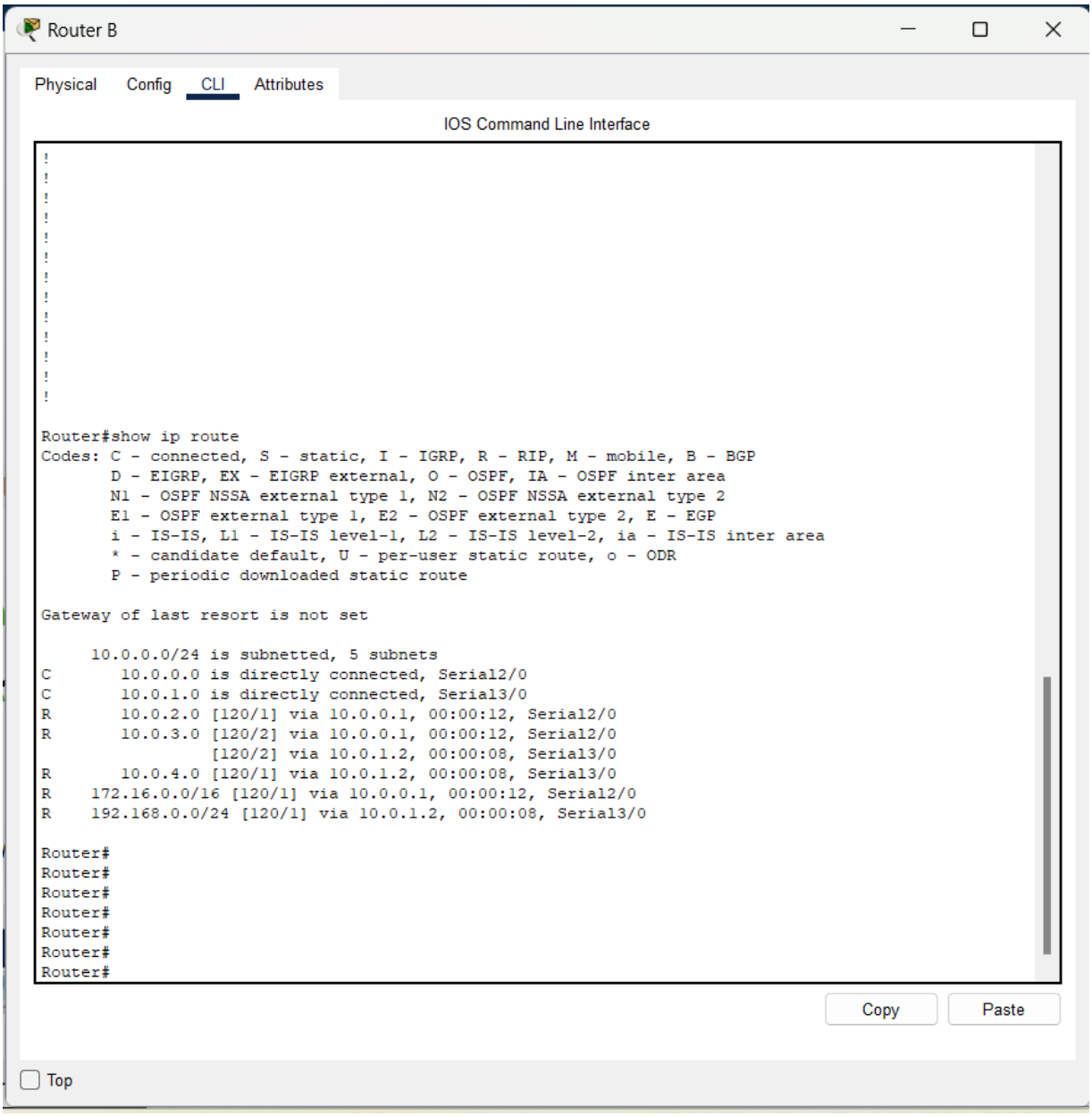
Now I will use show IP route command for all routers.

Router A



Router B


Router B
Physical
Config
CLI
Attributes
IOS Command Line Interface
!
!
!
!
!
!
!
!
!
!
!
Router#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 not set
10.0.0.0/24 is subnetted, 5 subnets
C 10.0.0.0 is directly connected, Serial2/0
C 10.0.1.0 is directly connected, Serial3/0
R 10.0.2.0 [120/1] via 10.0.0.1, 00:00:12, Serial2/0
R 10.0.3.0 [120/2] via 10.0.0.1, 00:00:12, Serial2/0
[120/2] via 10.0.1.2, 00:00:08, Serial3/0
R 10.0.4.0 [120/1] via 10.0.1.2, 00:00:08, Serial3/0
R 172.16.0.0/16 [120/1] via 10.0.0.1, 00:00:12, Serial2/0
R 192.168.0.0/24 [120/1] via 10.0.1.2, 00:00:08, Serial3/0
Router#
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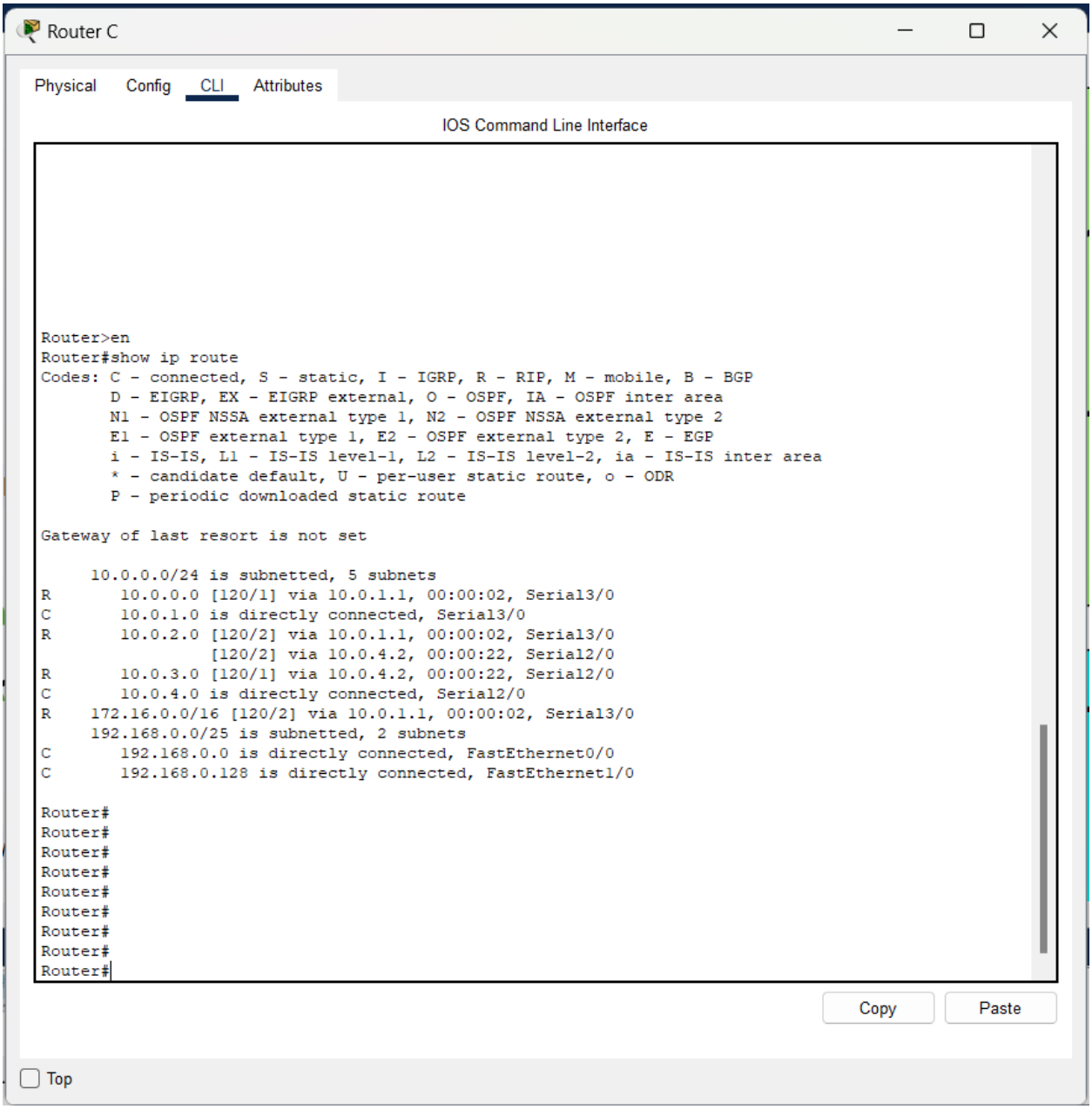
Router C


Router C
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>en
Router#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 not set
10.0.0.0/24 is subnetted, 5 subnets
R 10.0.0.0 [120/1] via 10.0.1.1, 00:00:02, Serial3/0
C 10.0.1.0 is directly connected, Serial3/0
R 10.0.2.0 [120/2] via 10.0.1.1, 00:00:02, Serial3/0
[120/2] via 10.0.4.2, 00:00:22, Serial2/0
R 10.0.3.0 [120/1] via 10.0.4.2, 00:00:22, Serial2/0
C 10.0.4.0 is directly connected, Serial2/0
R 172.16.0.0/16 [120/2] via 10.0.1.1, 00:00:02, Serial3/0
192.168.0.0/25 is subnetted, 2 subnets
C 192.168.0.0 is directly connected, FastEthernet0/0
C 192.168.0.128 is directly connected, FastEthernet1/0
Router#
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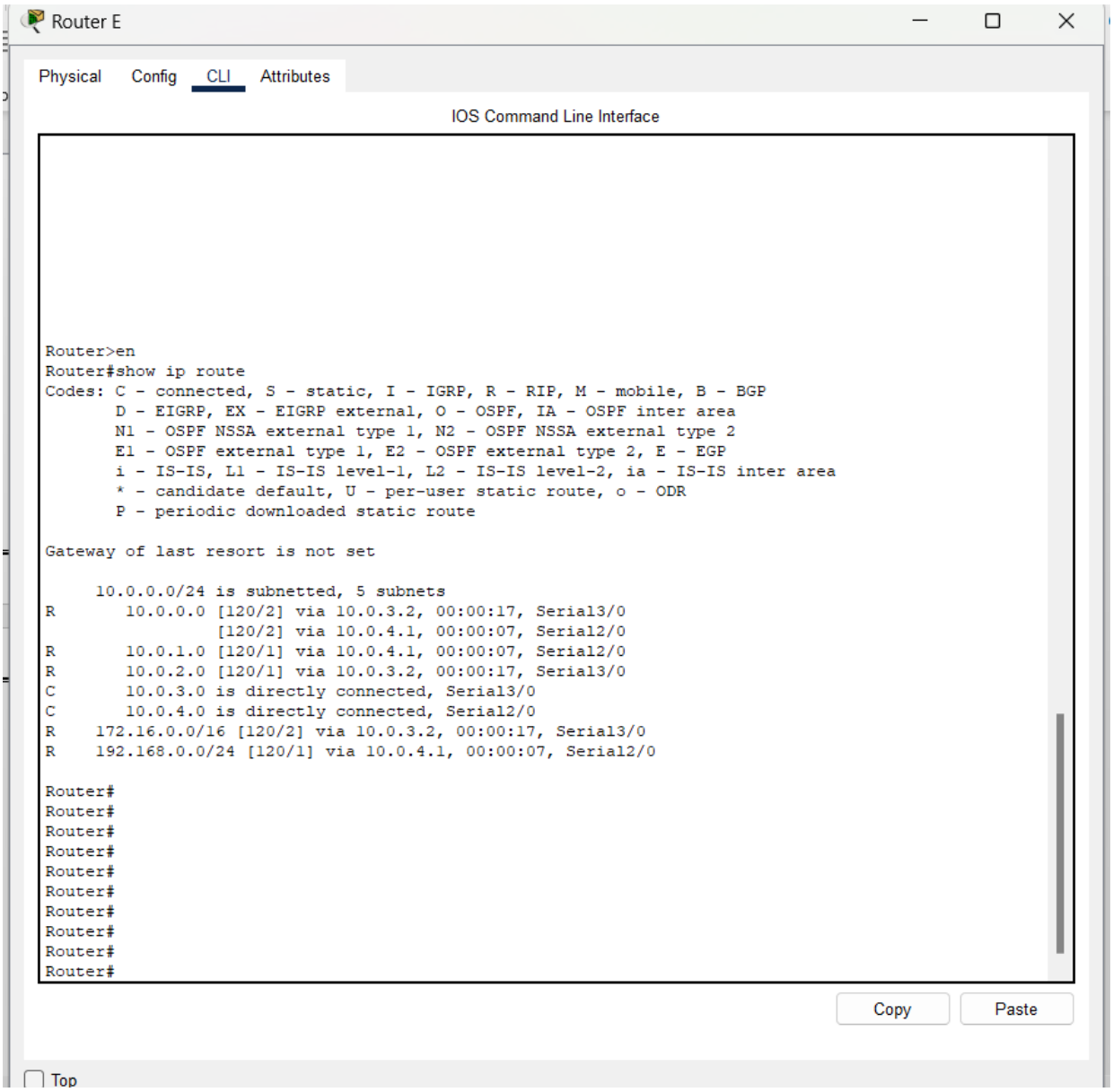
Router E


Router E
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>en
Router#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 not set
10.0.0.0/24 is subnetted, 5 subnets
R 10.0.0.0 [120/2] via 10.0.3.2, 00:00:17, Serial3/0
[120/2] via 10.0.4.1, 00:00:07, Serial2/0
R 10.0.1.0 [120/1] via 10.0.4.1, 00:00:07, Serial2/0
R 10.0.2.0 [120/1] via 10.0.3.2, 00:00:17, Serial3/0
C 10.0.3.0 is directly connected, Serial3/0
C 10.0.4.0 is directly connected, Serial2/0
R 172.16.0.0/16 [120/2] via 10.0.3.2, 00:00:17, Serial3/0
R 192.168.0.0/24 [120/1] via 10.0.4.1, 00:00:07, Serial2/0
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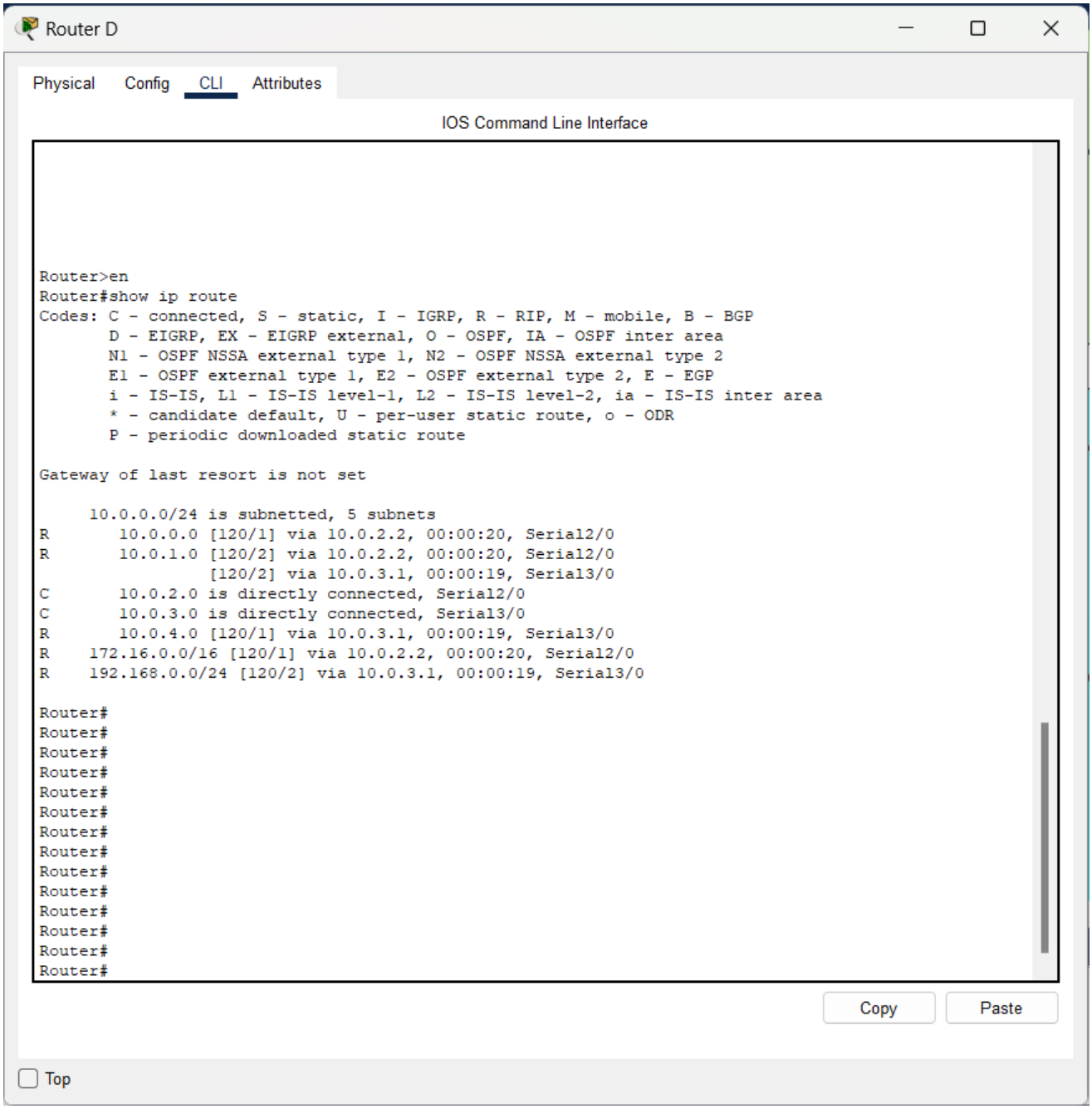
Router D


Router D
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>en
Router#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 not set
10.0.0.0/24 is subnetted, 5 subnets
R 10.0.0.0 [120/1] via 10.0.2.2, 00:00:20, Serial2/0
R 10.0.1.0 [120/2] via 10.0.2.2, 00:00:20, Serial2/0
[120/2] via 10.0.3.1, 00:00:19, Serial3/0
C 10.0.2.0 is directly connected, Serial2/0
C 10.0.3.0 is directly connected, Serial3/0
R 10.0.4.0 [120/1] via 10.0.3.1, 00:00:19, Serial3/0
R 172.16.0.0/16 [120/1] via 10.0.2.2, 00:00:20, Serial2/0
R 192.168.0.0/24 [120/2] via 10.0.3.1, 00:00:19, Serial3/0
Router#
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So now let’s examine what addresses would change in the networks.

I’ll use Green Subnet and Pink Subnet as examples.

Pink Subnet

MAC Address Change: The router must forward a data packet to the WAN after receiving it from a device in the Pink subnet. The router accomplishes this by replacing the MAC address of the device connected to the Pink subnet, which is the source MAC address of the inbound packet, with its own MAC address for the outgoing interface that links to the WAN. This is so because the WAN functions as a distinct network segment with its own set of MAC addresses, and MAC addresses are used for communication inside a local network segment.

IP Address Unchanged: Throughout this operation, the data packet's IP address doesn't change. When a packet is forwarded to the WAN, the router does not change its source IP address. The device in the Pink subnet that sent the packet initially is still listed as the source IP address.

Green Subnet

MAC Address Change: The router, like the Pink subnet, modifies the source MAC address of a data packet arriving from a device in the Green subnet to its own MAC address for the outgoing interface that is connected to the WAN. This guarantees that the packet can traverse various network segments accurately routed.

IP Address Unchanged: The data packet's IP address stays the same, just like it does with the Pink subnet. When a packet is forwarded to the WAN, the router does not change its source IP address. The device in the Green subnet that sent the packet initially is still listed as the source IP address.

In conclusion, for the outgoing interface that connects to the WAN, the router modifies the source MAC address of incoming packets from the Pink and Green subnets to its own MAC address. Given that MAC addresses are unique to each network segment, this is required to guarantee that the packets may be routed correctly across various network segments. However, because IP addresses are used for end-to-end communication and are not updated by the router during the routing process, they do not change.

Reference

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