

Computer Networks Assignment #2

Router On A Stick

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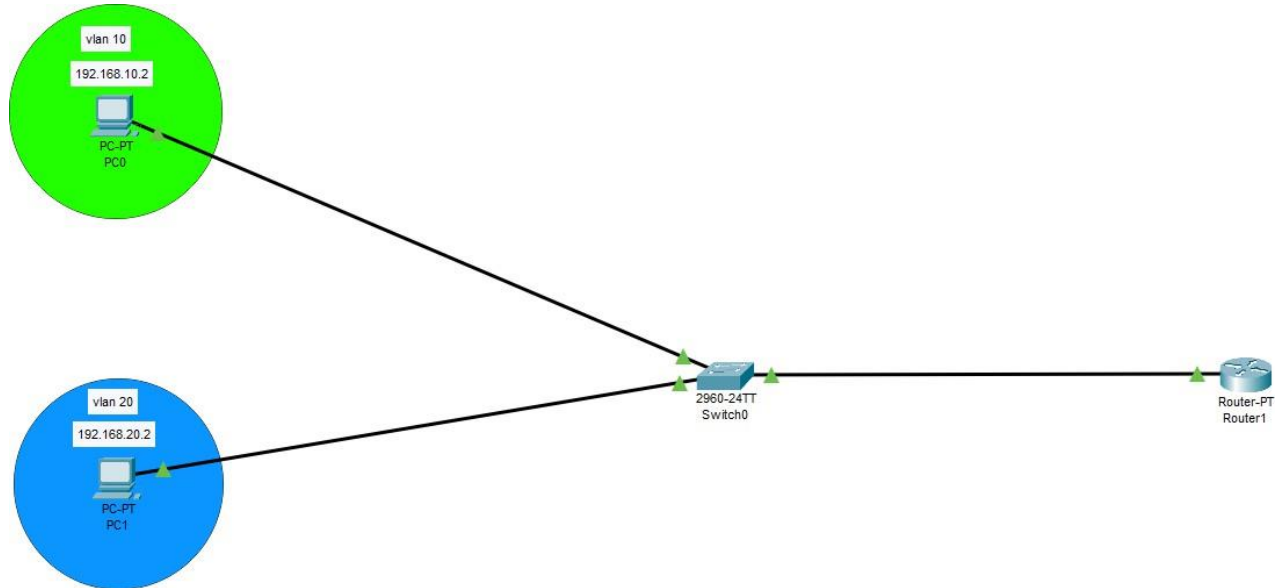
What Is A "Router On A Stick"

Purpose of the Setup

The "Router on a Stick" configuration is used to enable communication between multiple VLANs using a single router. It is a cost-effective and efficient method to manage inter-VLAN routing. In this topology:

- VLAN 10 (192.168.10.0/24): Assigned to devices on Fa0/1 of the switch.
- VLAN 20 (192.168.20.0/24): Assigned to devices on Fa0/2 of the switch.
- The router (R1) is used for inter-VLAN routing, which allows devices in VLAN 10 and VLAN 20 to communicate.

Topology:



Switch Configuration

VLAN Creation: VLAN 10 and VLAN 20 are created and named for identification.

Port Assignment: Specific switch ports are assigned to their respective VLANs. Devices connected to these ports become part of their respective VLAN.

Trunk Configuration: Fa0/3 is configured as a trunk to carry traffic for both VLANs to the router.

Physical Config CLI Attributes

IOS Command Line Interface

```
Copyright (c) 1986-2013 by Cisco Systems, Inc.  
Compiled Wed 26-Jun-13 02:49 by mnnguyen
```

```
Press RETURN to get started!
```

```
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
```

```
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
```

```
Switch>enable
```

```
Switch#config t
```

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

```
Switch(config)#vlan 10
```

```
Switch(config-vlan)#name green
```

```
Switch(config-vlan)#exit
```

```
Switch(config)#vlan 20
```

```
Switch(config-vlan)#name blue
```

```
Switch(config-vlan)#exit
```

```
Switch(config)#interface fa0/1
```

```
Switch(config-if)#switchport mode access
```

```
Switch(config-if)#switchport access vlan 10
```

```
Switch(config-if)#exit
```

```
Switch(config)#interface fa0/2
```

```
Switch(config-if)#switchport mode access
```

```
Switch(config-if)#switchport access vlan 20
```

```
Switch(config-if)#exit
```

```
Switch(config)#interface fa0/3
```

```
Switch(config-if)#switchport mode trunk
```

```
Switch(config-if)#
```

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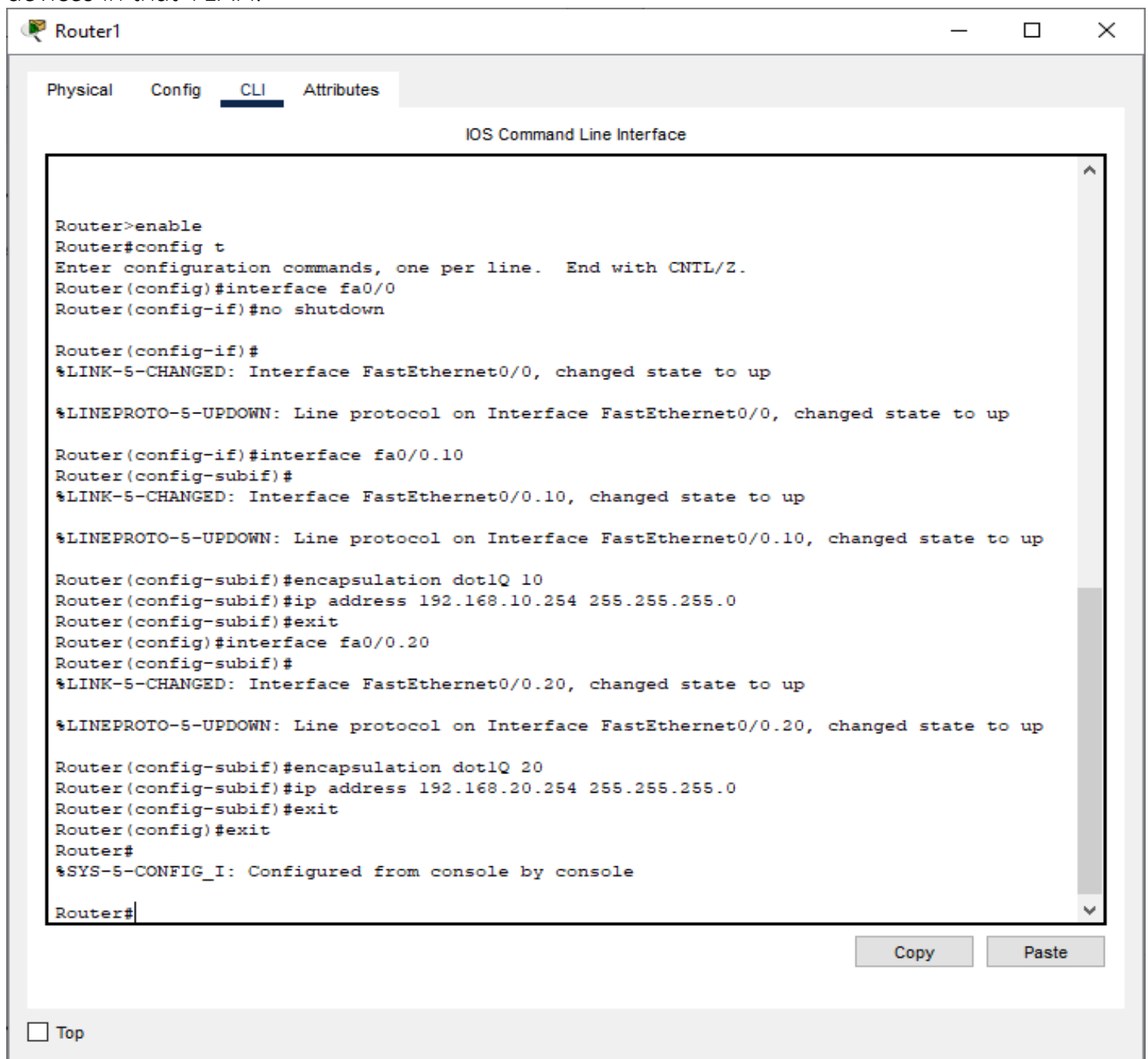
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Router Configuration

Sub-Interfaces: These virtual interfaces allow the router to handle traffic for multiple VLANs. Each sub-interface corresponds to a VLAN.

Encapsulation dot1Q: Specifies the VLAN ID for each sub-interface and enables 802.1Q encapsulation on the trunk link.

IP Address: Each VLAN is assigned a unique IP address, which acts as the default gateway for devices in that VLAN.



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fa0/0
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

Router(config-if)#interface fa0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.10, changed state to up

Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.254 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.20, changed state to up

Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.254 255.255.255.0
Router(config-subif)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

Copy Paste

☐ Top

PC Configuration

IP Address: Each PC gets a unique IP address from its VLAN subnet.

Subnet Mask: Defines the subnet range.

Default Gateway: Points to the router's sub-interface for the VLAN, allowing the PC to communicate with other VLANs.

The screenshot shows a window titled "PC0" with a standard Windows-style title bar (minimize, maximize, close buttons). The window has a tabbed interface with the following tabs: "Physical", "Config", "Desktop" (which is the active tab), "Programming", and "Attributes".

Under the "Desktop" tab, there is a sub-tabbed interface. The first sub-tab is "IP Configuration", which is highlighted in blue. It contains the following fields:

- Interface:** A dropdown menu showing "FastEthernet0".
- IP Configuration:** Two radio buttons: "DHCP" (unselected) and "Static" (selected).
- IPv4 Address:** A text box containing "192.168.10.2".
- Subnet Mask:** A text box containing "255.255.255.0".
- Default Gateway:** A text box containing "192.168.10.254".
- DNS Server:** A text box containing "0.0.0.0".

Below the IP Configuration section is the "IPv6 Configuration" section, which also has two radio buttons: "Automatic" (unselected) and "Static" (selected). It contains the following fields:

- IPv6 Address:** Two text boxes separated by a slash, both currently empty.
- Link Local Address:** A text box containing "FE80::20A:F3FF:FE35:49A0".
- Default Gateway:** An empty text box.
- DNS Server:** An empty text box.

Below the IPv6 Configuration section is the "802.1X" section, which includes:

- Use 802.1X Security:** An unchecked checkbox.
- Authentication:** A dropdown menu showing "MD5".
- Username:** An empty text box.
- Password:** An empty text box.

At the bottom left of the window, there is a "Top" button with a small square icon next to it.

PC1

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

Interface

FastEthernet0

IP Configuration

☐ DHCP

☒ Static

IPv4 Address

192.168.20.2

Subnet Mask

255.255.255.0

Default Gateway

192.168.20.254

DNS Server

0.0.0.0

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

/

Link Local Address

FE80::2D0:D3FF:FE05:ECC9

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

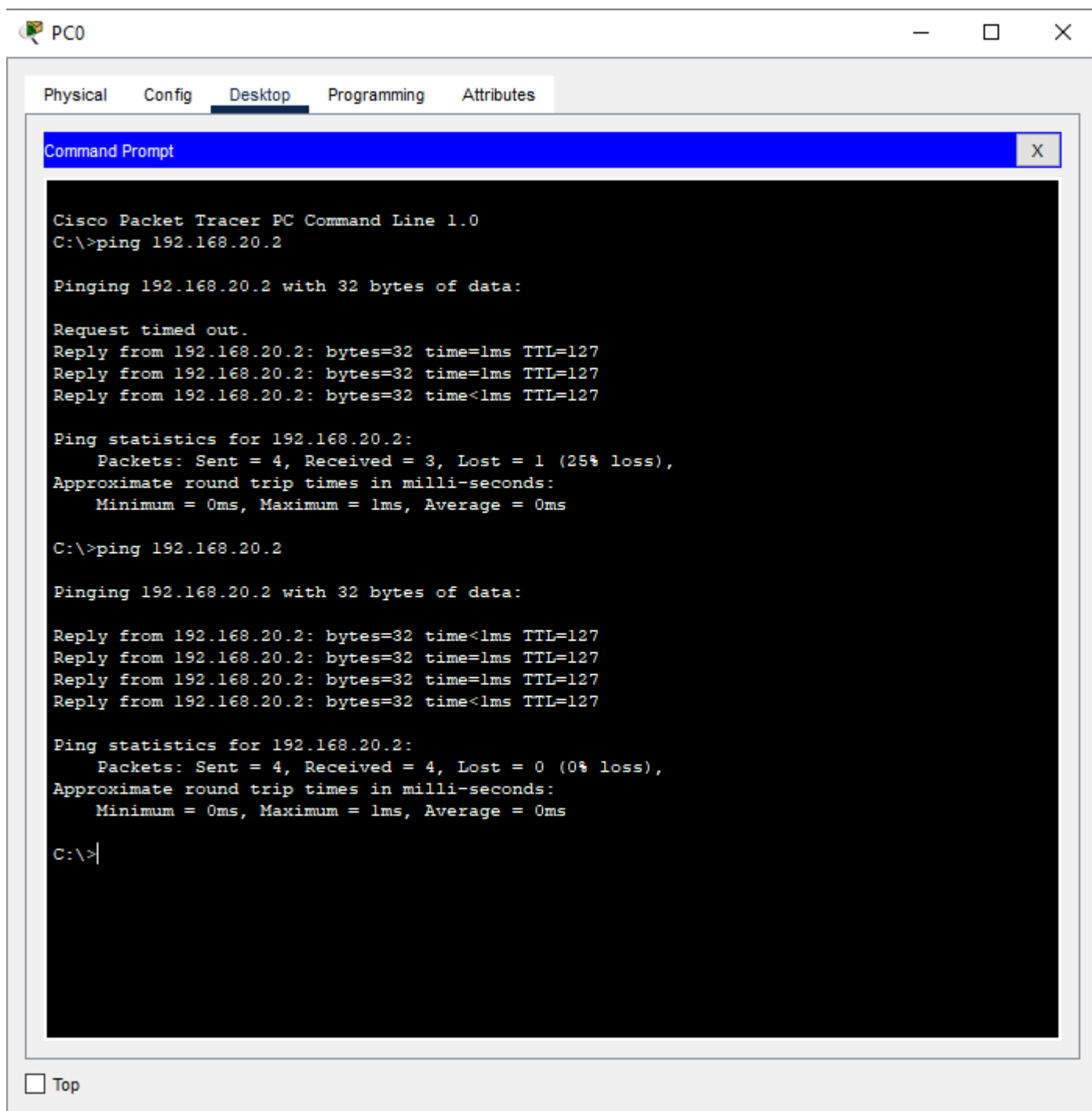
Authentication

MD5

Username

Password

☐ Top

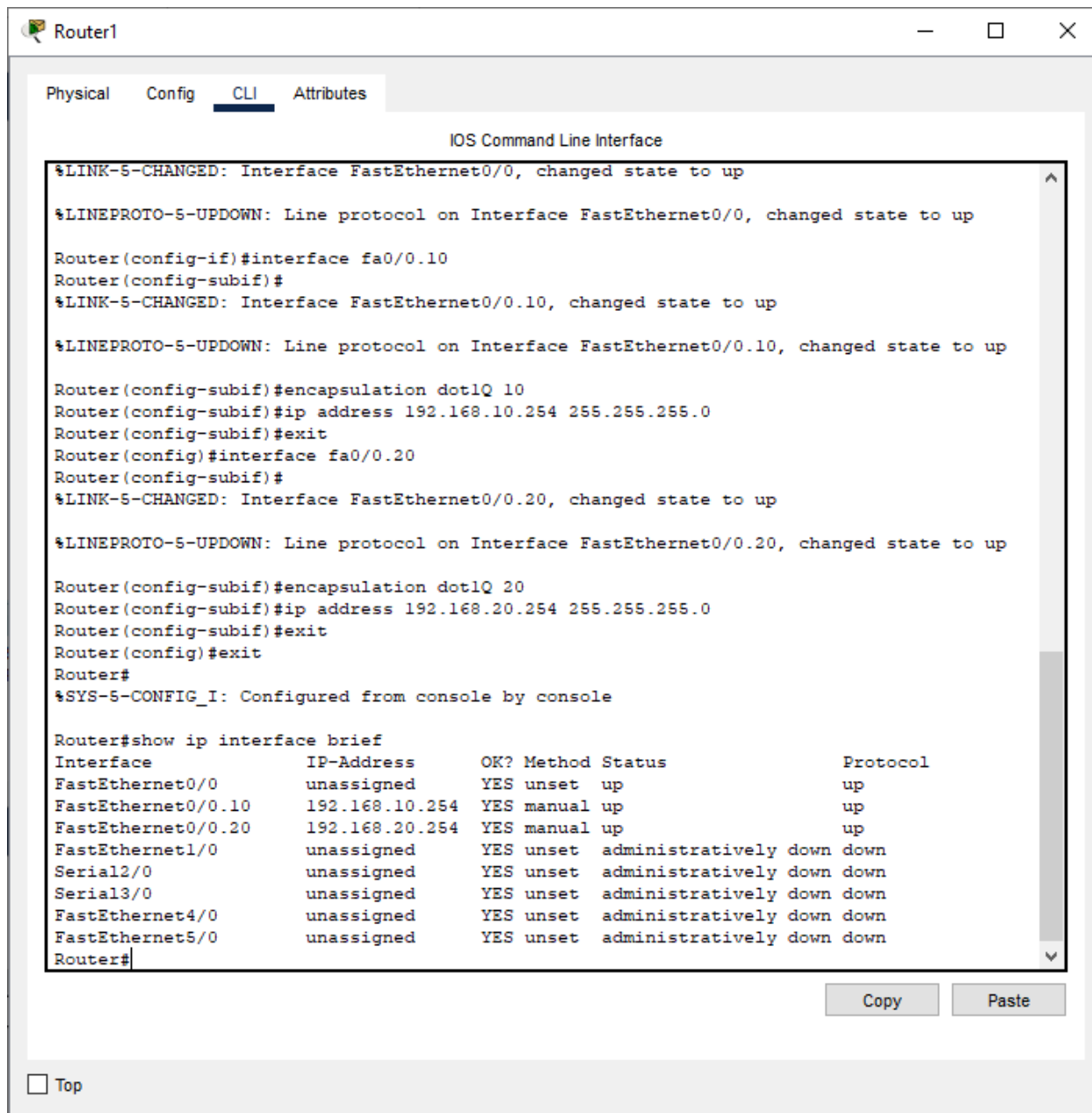


The router correctly routed the traffic between VLAN 10 and VLAN 20 using its sub-interfaces, confirming that the "Router on a Stick" configuration is working as expected.

For verifications we can use commands like:

On Router:

show ip interface brief



The screenshot shows a Cisco Router CLI window titled "Router1". The "CLI" tab is selected. The window displays the following commands and output:

```
IOS Command Line Interface

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

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

Router(config-if)#interface fa0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.10, changed state to up

Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.254 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.20, changed state to up

Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.254 255.255.255.0
Router(config-subif)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	unassigned	YES	unset	up	up
FastEthernet0/0.10	192.168.10.254	YES	manual	up	up
FastEthernet0/0.20	192.168.20.254	YES	manual	up	up
FastEthernet1/0	unassigned	YES	unset	administratively down	down
Serial2/0	unassigned	YES	unset	administratively down	down
Serial3/0	unassigned	YES	unset	administratively down	down
FastEthernet4/0	unassigned	YES	unset	administratively down	down
FastEthernet5/0	unassigned	YES	unset	administratively down	down

Router#

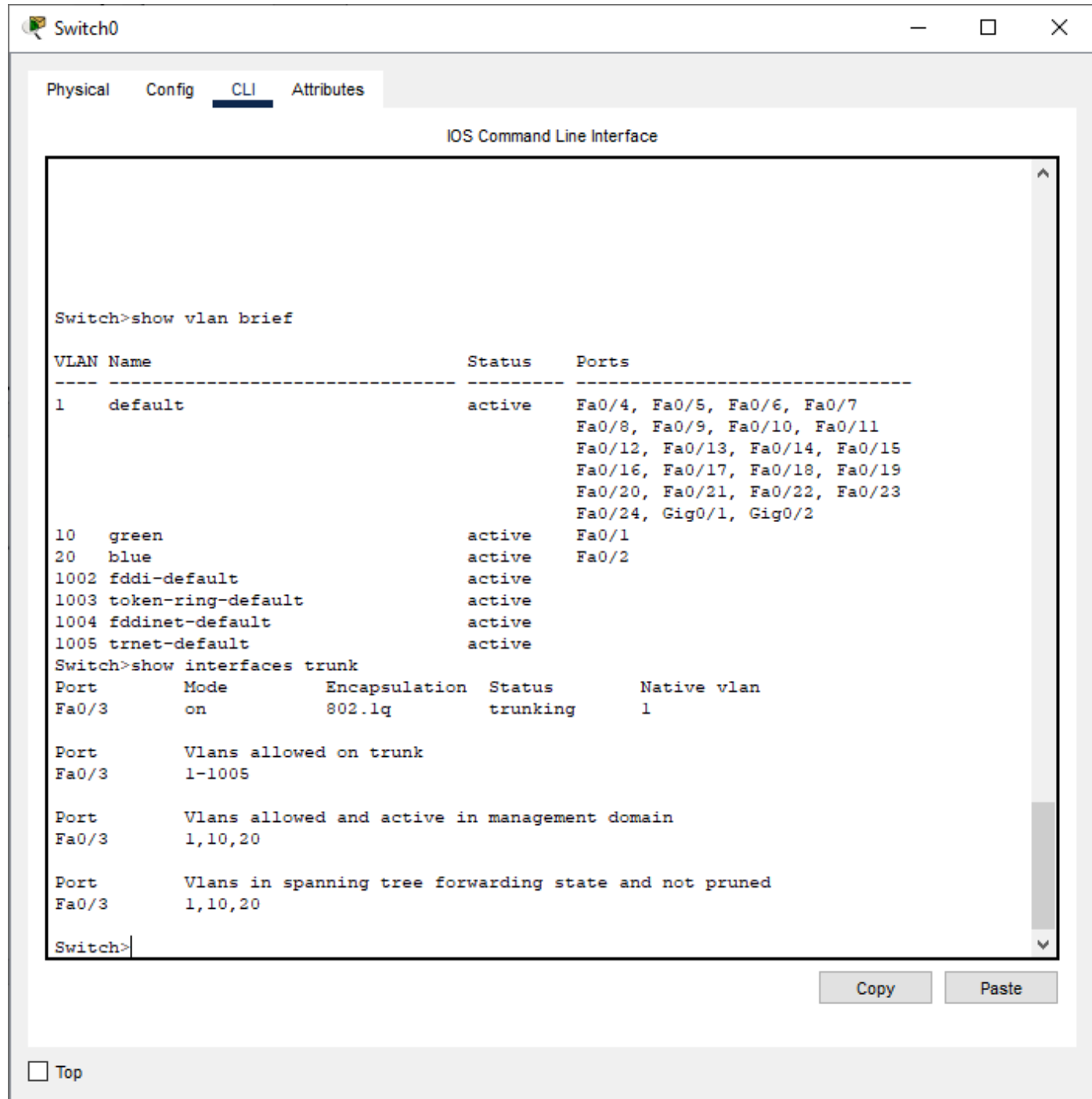
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☐ Top

On Switch:

show vlan brief

show interfaces trunk



The screenshot shows a network switch interface with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the IOS Command Line Interface. The user has entered the command 'show vlan brief', which returns a table of VLAN information. The table has three columns: VLAN Name, Status, and Ports. The first column lists VLAN IDs and names, the second column shows their status as 'active', and the third column lists the ports associated with each VLAN. The user has also entered the command 'show interfaces trunk', which returns a table of trunk interface information. The table has five columns: Port, Mode, Encapsulation, Status, and Native vlan. The first column lists the port Fa0/3, the second column shows the mode as 'on', the third column shows the encapsulation as '802.1q', the fourth column shows the status as 'trunking', and the fifth column shows the native VLAN as '1'. Below this table, there are three sections of information: 'Vlans allowed on trunk' (1-1005), 'Vlans allowed and active in management domain' (1,10,20), and 'Vlans in spanning tree forwarding state and not pruned' (1,10,20). The interface also includes a 'Copy' button, a 'Paste' button, and a 'Top' link.

```
Switch0
```

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Switch>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, Fa0/23 Fa0/24, Gig0/1, Gig0/2
10 green	active	Fa0/1
20 blue	active	Fa0/2
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

```
Switch>show interfaces trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Fa0/3	on	802.1q	trunking	1

Port Vlans allowed on trunk
Fa0/3 1-1005

Port Vlans allowed and active in management domain
Fa0/3 1,10,20

Port Vlans in spanning tree forwarding state and not pruned
Fa0/3 1,10,20

Switch>

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☐ Top

Benefits:

- Cost-Efficient: Avoids the need for a Layer 3 switch or multiple physical interfaces on the router.
- Easy Management: All inter-VLAN routing is handled by the router, making management simpler.

Limitations:

- Performance Risk: The single physical interface can become a bottleneck if there is high traffic between VLANs.
- Scalability: Not suitable for large-scale networks with extensive inter-VLAN communication requirements.