University Lab Networking

COMPUTER NETWORKS
PROJECT REPORT

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Contents

Report: Networking Functions in University Lab Setup

OVERVIEW

This project report outlines the configuration and testing of a networking system for a university lab. The network was set up using various servers, routers, switches, and configurations to ensure seamless communication, efficient resource sharing, and network management.

Key Functions and Configurations

SERVER CONFIGURATION

DHCP Configuration

- Setup of Dynamic Host Configuration Protocol (DHCP) to assign IP addresses automatically to devices within the network.
- Ensures dynamic allocation of IP addresses to improve manageability.

DNS Configuration

- Implementation of the Domain Name System (DNS) to resolve domain names to IP addresses.
- Enhances user accessibility by translating human-friendly names into machine-friendly IP addresses.

HTTP Configuration

- Configuring an HTTP server to serve web pages within the network.
- Modifications were demonstrated by adding new HTTP files, showing changes before and after deployment.

ROUTER CONFIGURATION

Three routers were configured as follows:

Router 1: Primary routing functions and network segmentation.

Router 2 & 3: Interconnectivity and redundancy. Each router was tailored to meet specific network topology and traffic flow requirements.
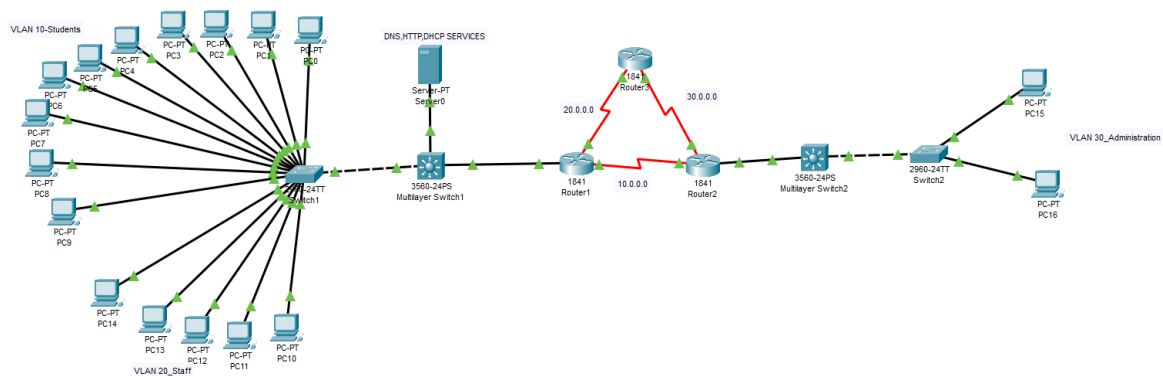
LAYER 3 SWITCH CONFIGURATION

Two Layer 3 switches were set up to handle inter-VLAN routing. These configurations helped:

- Combine routing and switching functionalities.
- Improve data transfer efficiency and reduce latency in intra-network communications.

Layer 2 switches were configured to facilitate basic switching functions like MAC address learning and forwarding.

Design

SERVER CONFIGURATION

DHCP Configuration:

Result:

DNS Configuration:

Result:

HTTP Configuration:

Result:

Before adding new http file:

After adding http file:

ROUTER CONFIGURATION

Router 1 Configuration:

Result:


```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#no ip address
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
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

Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#no clock rate
This command applies only to DCE interfaces
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
```

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
Router>router OSPF 1
              ^
% Invalid input detected at '^' marker.

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#interface 192.168.1.0 0.0.0.255 area 0
                       ^
% Invalid input detected at '^' marker.

Router(config-router)#netwotk 192.168.1.0 0.0.0.255 area 0
                         ^
% Invalid input detected at '^' marker.

Router(config-router)#exit
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#end
Translating "end"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Router#write
Building configuration...
[OK]
Router#
```
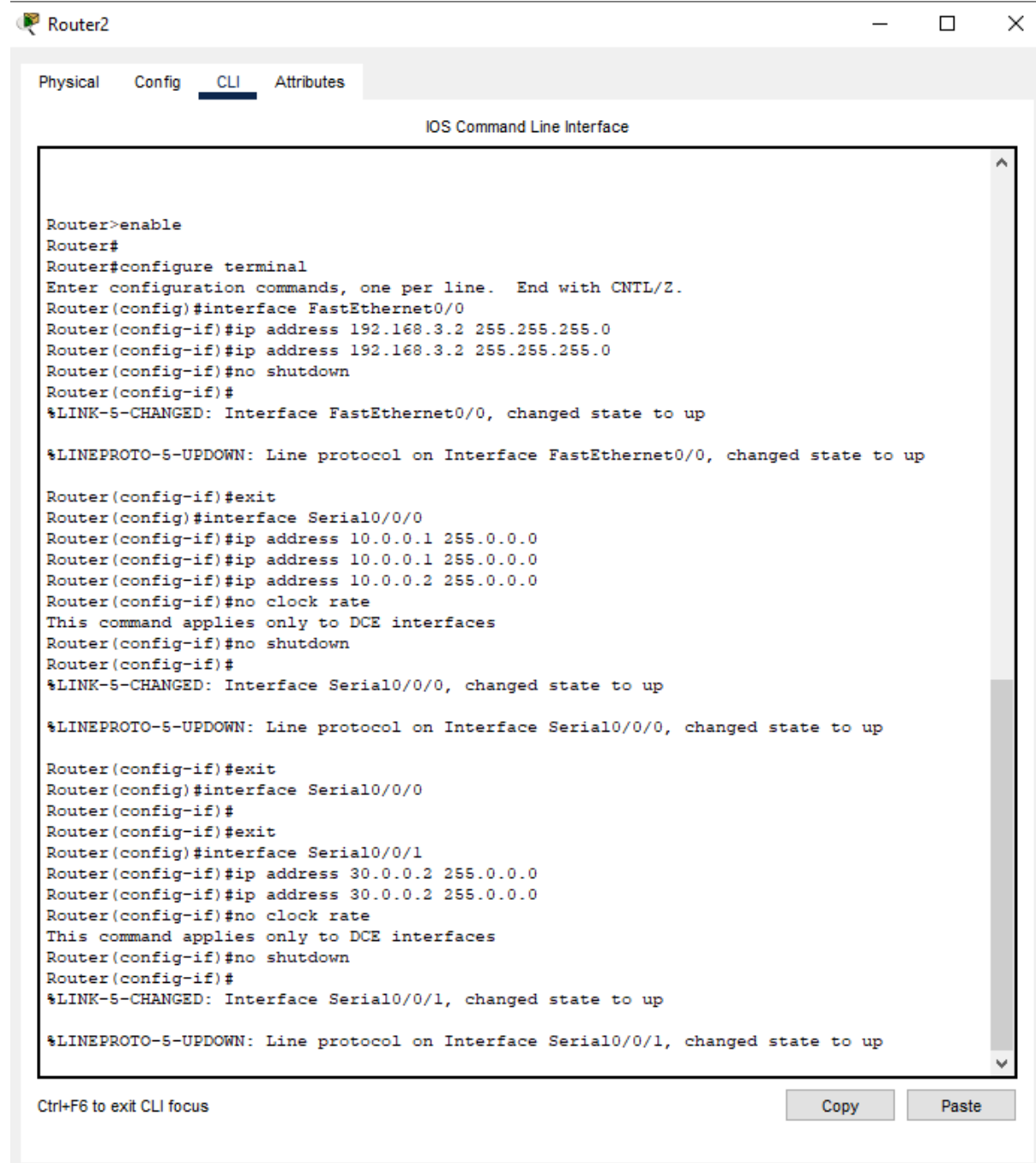
Router 2 Configuration:

Result:


```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 192.168.3.2 255.255.255.0
Router(config-if)#ip address 192.168.3.2 255.255.255.0
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

Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no clock rate
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#no clock rate
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
```

Ctrl+F6 to exit CLI focus

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#netwo
00:32:06: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.2 on Serial0/0/0 from LOADING to FULL,
Loading Done

% Incomplete command.
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#networl 192.168.3.0 0.0.0.255 area 0
                                      ^
% Invalid input detected at '^' marker.

Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#end
Translating "end"...domain server (255.255.255.255)
```
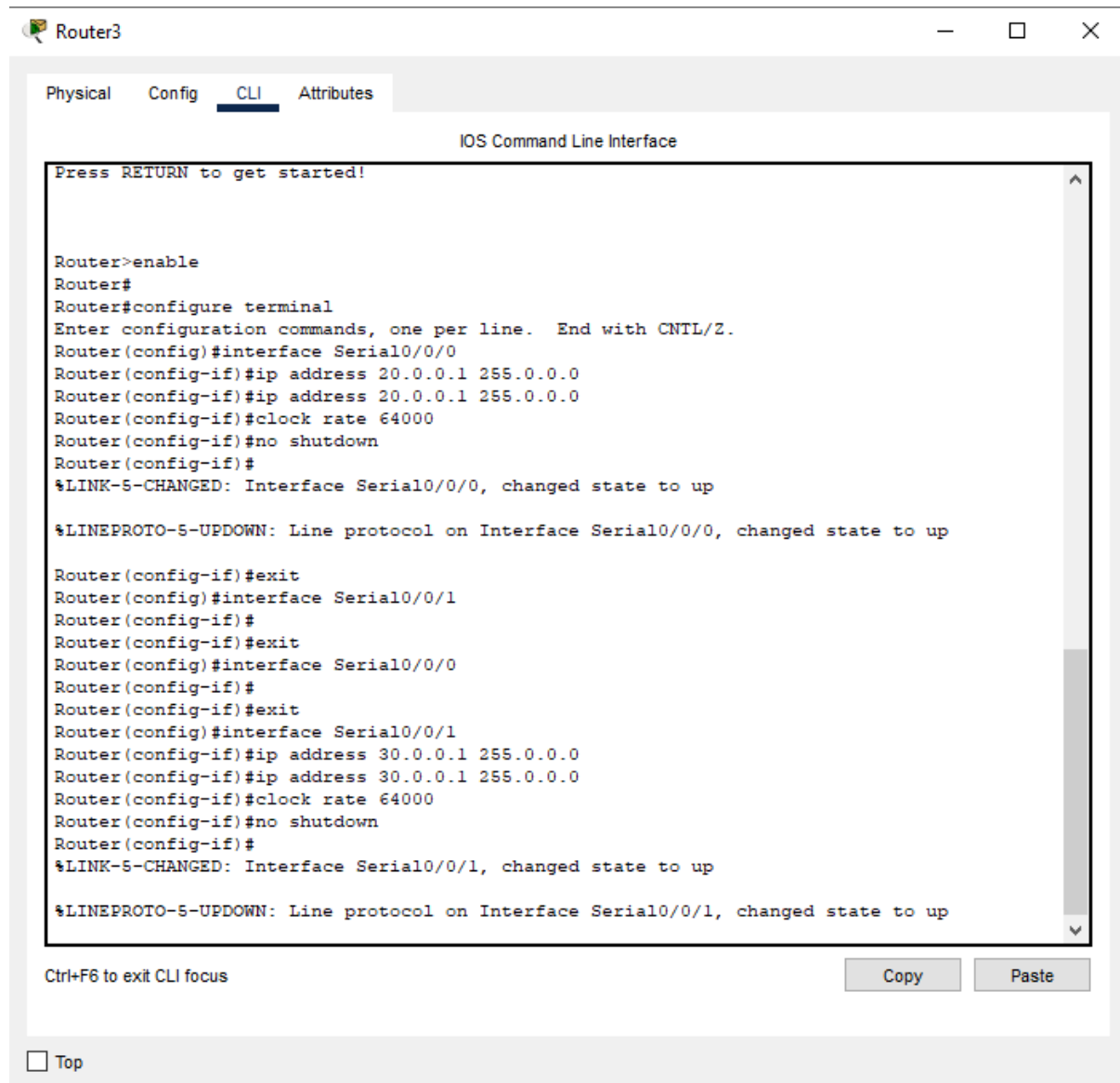
Router 3 Configuration:

Result:


```
Router3                                                    —    □    ×

Physical   Config   CLI   Attributes

                        IOS Command Line Interface

Press RETURN to get started!



Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Ctrl+F6 to exit CLI focus                          Copy        Paste

□ Top
```

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#network 3
00:36:14: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.2 on Serial0/0/0 from LOADING to FULL,
Loading Done
0
                                          ^
% Invalid input detected at '^' marker.

Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#
00:36:44: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.2 on Serial0/0/1 from LOADING to FULL,
Loading Done

Router(config)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write
Building configuration...
[OK]
Router#
```
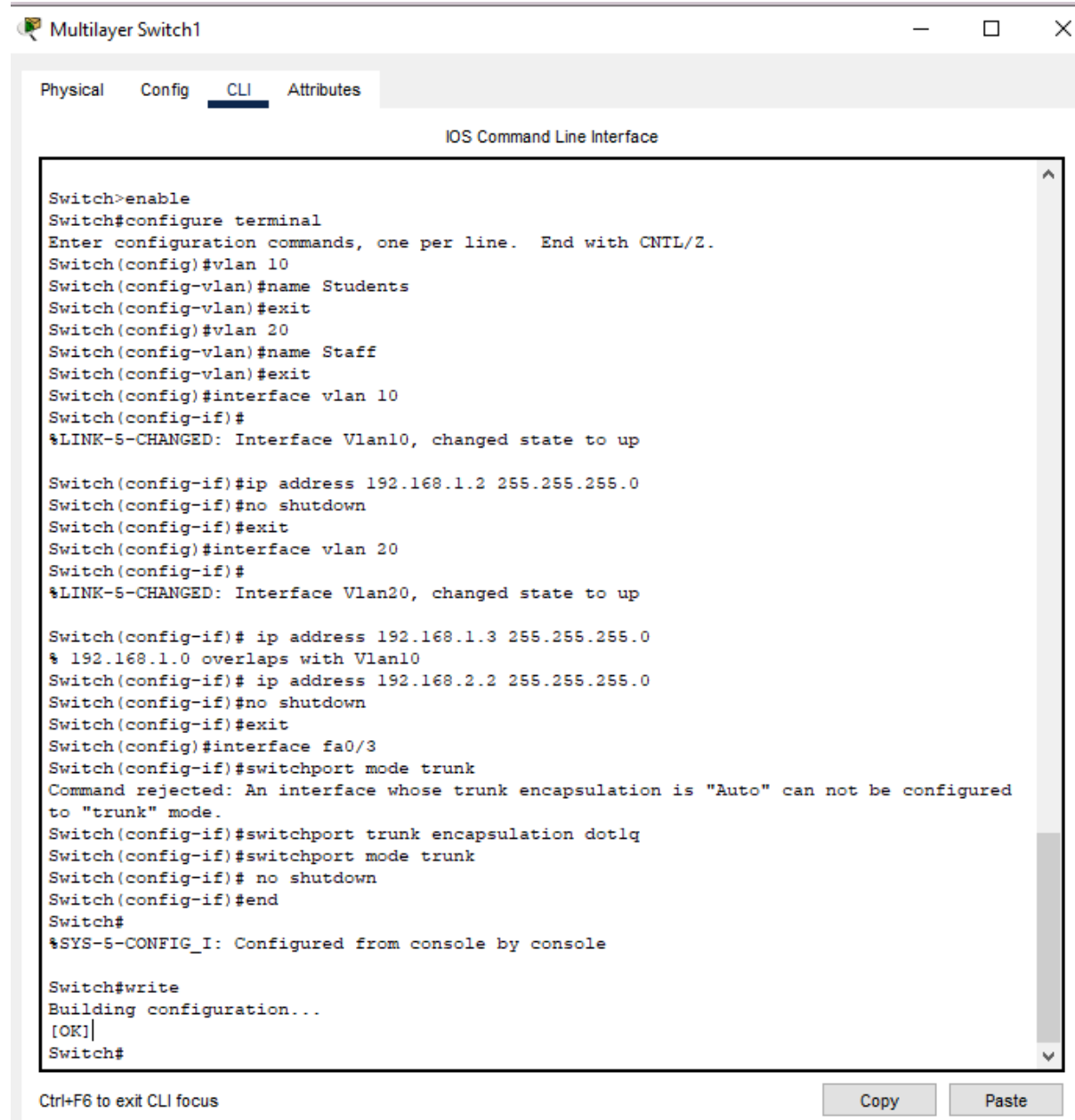
LAYER 3 SWITCH CONFIGURATION

Layer 3 Switch-1 Configuration:

Result:

```
Multilayer Switch1                                           —   □   ×

 Physical    Config    CLI    Attributes

                        IOS Command Line Interface

 Switch>enable
 Switch#configure terminal
 Enter configuration commands, one per line.  End with CNTL/Z.
 Switch(config)#vlan 10
 Switch(config-vlan)#name Students
 Switch(config-vlan)#exit
 Switch(config)#vlan 20
 Switch(config-vlan)#name Staff
 Switch(config-vlan)#exit
 Switch(config)#interface vlan 10
 Switch(config-if)#
 %LINK-5-CHANGED: Interface Vlan10, changed state to up

 Switch(config-if)#ip address 192.168.1.2 255.255.255.0
 Switch(config-if)#no shutdown
 Switch(config-if)#exit
 Switch(config)#interface vlan 20
 Switch(config-if)#
 %LINK-5-CHANGED: Interface Vlan20, changed state to up

 Switch(config-if)# ip address 192.168.1.3 255.255.255.0
 % 192.168.1.0 overlaps with Vlan10
 Switch(config-if)# ip address 192.168.2.2 255.255.255.0
 Switch(config-if)#no shutdown
 Switch(config-if)#exit
 Switch(config)#interface fa0/3
 Switch(config-if)#switchport mode trunk
 Command rejected: An interface whose trunk encapsulation is "Auto" can not be configured
 to "trunk" mode.
 Switch(config-if)#switchport trunk encapsulation dot1q
 Switch(config-if)#switchport mode trunk
 Switch(config-if)# no shutdown
 Switch(config-if)#end
 Switch#
 %SYS-5-CONFIG_I: Configured from console by console

 Switch#write
 Building configuration...
 [OK]
 Switch#

 Ctrl+F6 to exit CLI focus                          Copy        Paste
```
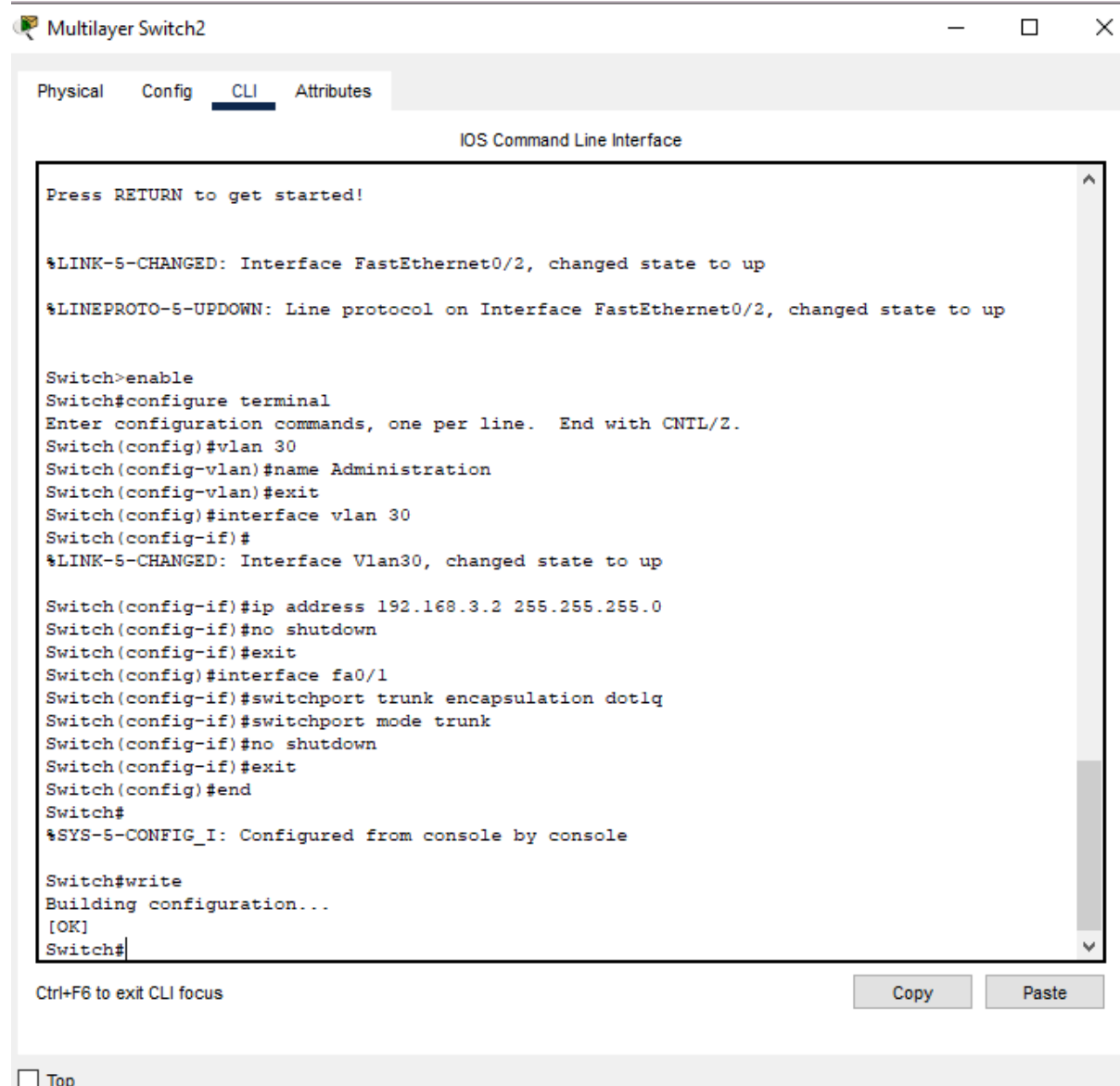
Layer 3 Switch-2 Configuration:

Result:

Multilayer Switch2

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
Press RETURN to get started!


%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#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#name Administration
Switch(config-vlan)#exit
Switch(config)#interface vlan 30
Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan30, changed state to up

Switch(config-if)#ip address 192.168.3.2 255.255.255.0
Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#interface fa0/1
Switch(config-if)#switchport trunk encapsulation dotlq
Switch(config-if)#switchport mode trunk
Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#write
Building configuration...
[OK]
Switch#
```
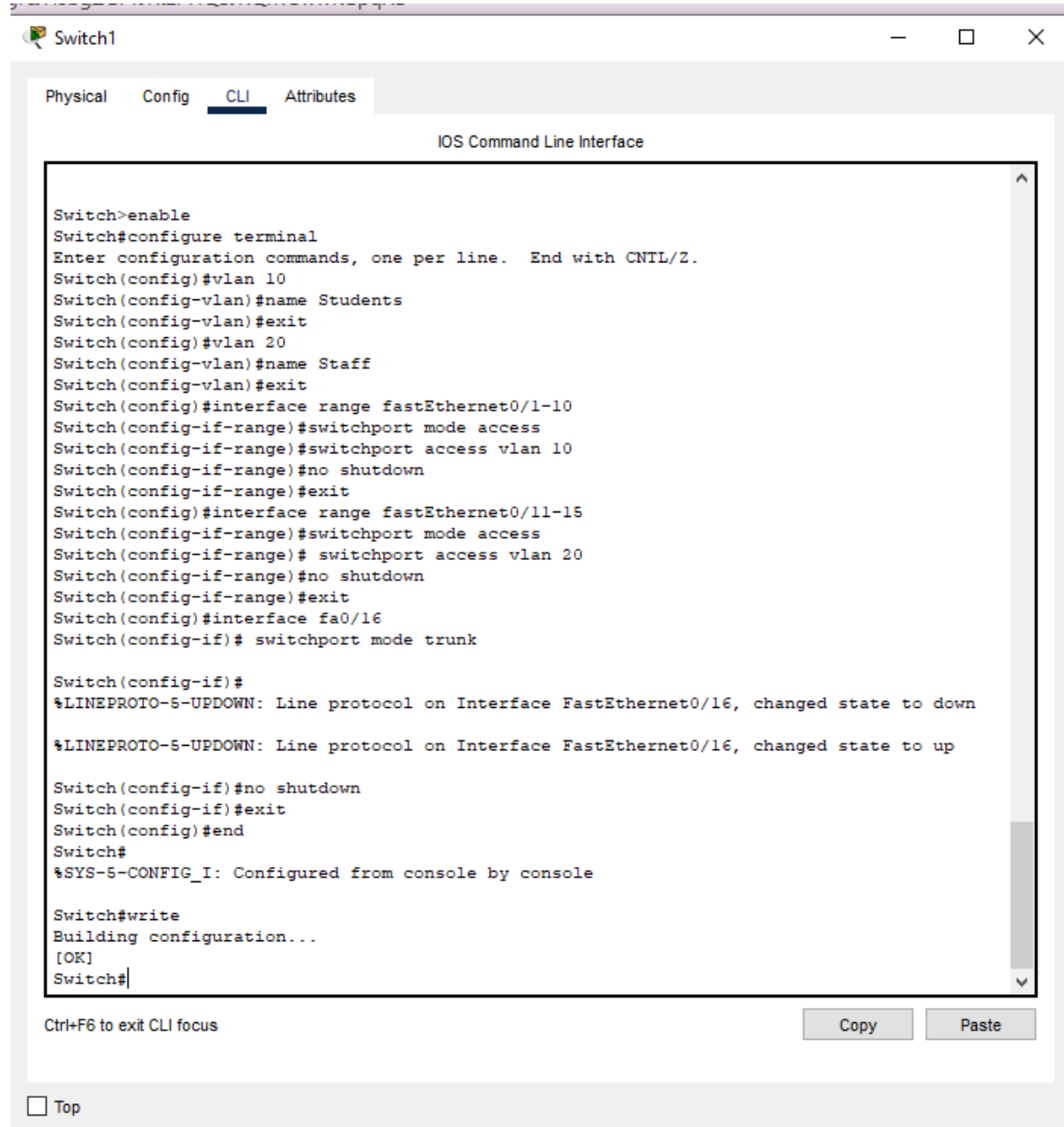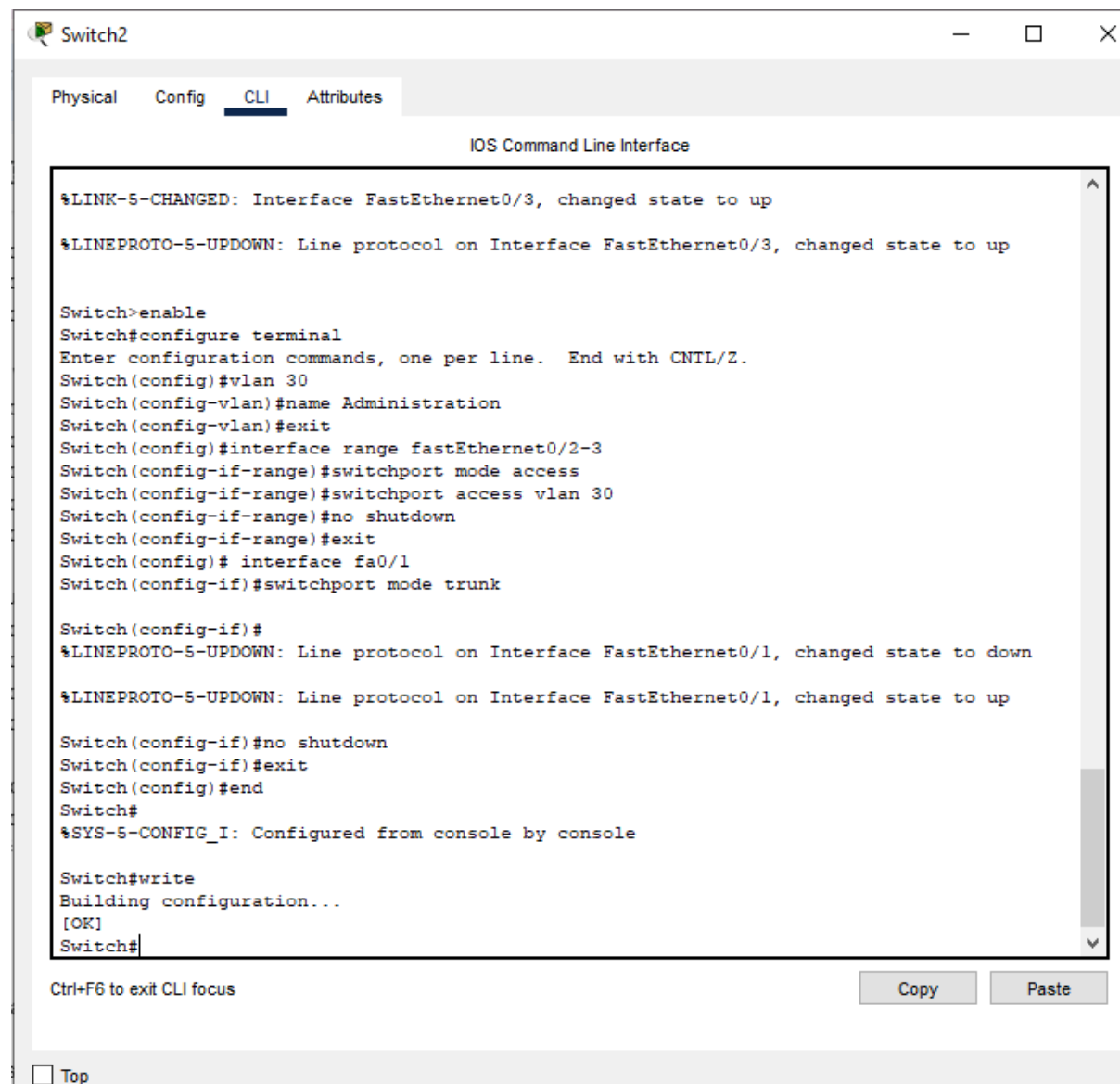
Ctrl+F6 to exit CLI focus   Copy   Paste

☐ Top

LAYER_2 SWITCH CONFIGURATION

Layer 2 Switch-1 Configuration:

Result:


```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name Students
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name Staff
Switch(config-vlan)#exit
Switch(config)#interface range fastEthernet0/1-10
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#no shutdown
Switch(config-if-range)#exit
Switch(config)#interface range fastEthernet0/11-15
Switch(config-if-range)#switchport mode access
Switch(config-if-range)# switchport access vlan 20
Switch(config-if-range)#no shutdown
Switch(config-if-range)#exit
Switch(config)#interface fa0/16
Switch(config-if)# switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/16, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/16, changed state to up

Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#write
Building configuration...
[OK]
Switch#
```

Result:

Conclusion

This project showcased a structured approach to designing and configuring a robust network for a university lab. By integrating advanced networking principles like DHCP, DNS, routing, and switching, the team successfully implemented a system capable of meeting diverse academic and administrative needs.