# NetCraft: Building a Secure and Scalable Network


| Name of Student |
| --- |
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## NetCraft: Building a Secure and Scalable Network

This project focuses on the design and implementation of a secure, scalable, and well-structured enterprise network. The network is organized into four departments, each operating within its own subnet and connected through dedicated switches. All departmental networks are linked through a central router, enabling controlled inter-department communication and access to core network services.

**Project Scope:**

- **Four departmental LANs:**
    - Administration (4 PCs)
    - Accounting (4 PCs)
    - IT Department (5 PCs)
    - HR Department (3 PCs)
- **Four switches** (one for each department)
- **One central router** for inter-network communication

**Objectives:**

- Build a secure and scalable network topology that follows enterprise-level design standards
- Apply subnetting and VLAN segmentation to support future network growth
- Configure inter-VLAN routing to ensure full communication between departments
- Deploy essential network services, including DHCP, DNS, and a centralized file server

# 1. IP Addresses for All PCs Across Four Departments

This section documents the complete IP addressing scheme used in the network. Each department (HR, IT, Administration, and Accounting) has its own subnet, and each PC is assigned a unique static IP address, subnet mask, and default gateway. The purpose of this section is to ensure correct network segmentation and to verify that all devices in the enterprise network follow a consistent addressing plan.

## 1.1 HR Department (3 PCs)

| PC no | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|
| PC0 | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| PC1 | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC2 | 192.168.1.4 | 255.255.255.0 | 192.168.1.1 |

## 1.2 IT Department (5 PCs)

| PC no | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|
| PC3 | 192.168.2.2 | 255.255.255.0 | 192.168.2.1 |
| PC4 | 192.168.2.3 | 255.255.255.0 | 192.168.2.1 |
| PC5 | 192.168.2.4 | 255.255.255.0 | 192.168.2.1 |
| PC6 | 192.168.2.5 | 255.255.255.0 | 192.168.2.1 |
| PC7 | 192.168.2.6 | 255.255.255.0 | 192.168.2.1 |

## 1.3 Administration Department (4 PCs)

| PC no | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|
| PC8 | 192.168.3.2 | 255.255.255.0 | 192.168.3.1 |
| PC9 | 192.168.3.3 | 255.255.255.0 | 192.168.3.1 |
| PC10 | 192.168.3.4 | 255.255.255.0 | 192.168.3.1 |
| PC11 | 192.168.3.5 | 255.255.255.0 | 192.168.3.1 |

## 1.4 Accounting Department (4 PCs)

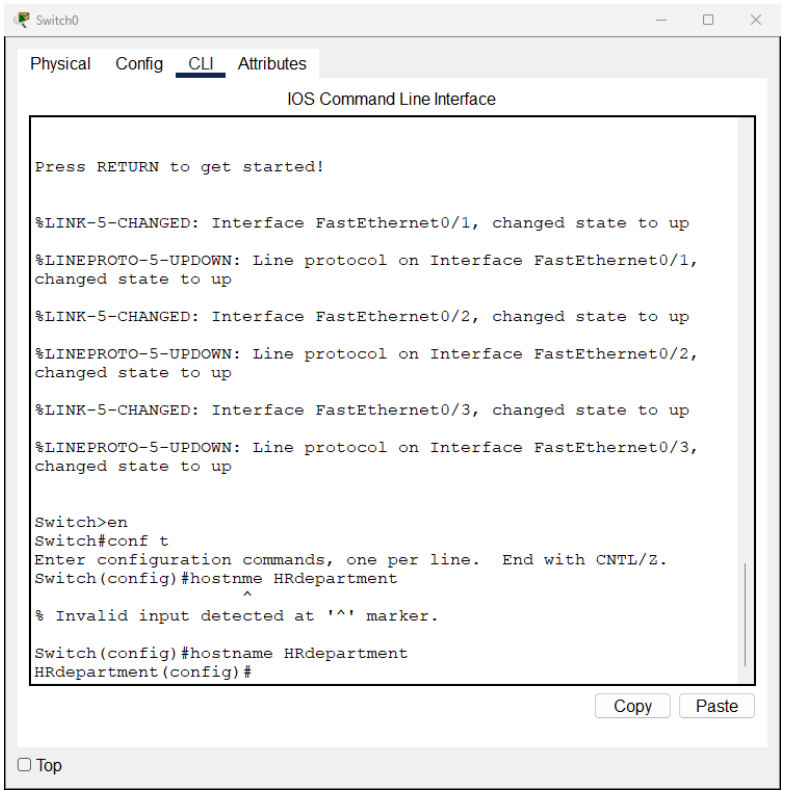
| PC no | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|
| PC12 | 192.168.4.2 | 255.255.255.0 | 192.168.4.1 |

| PC no | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|
| PC13 | 192.168.4.3 | 255.255.255.0 | 192.168.4.1 |
| PC14 | 192.168.4.4 | 255.255.255.0 | 192.168.4.1 |
| PC15 | 192.168.4.5 | 255.255.255.0 | 192.168.4.1 |

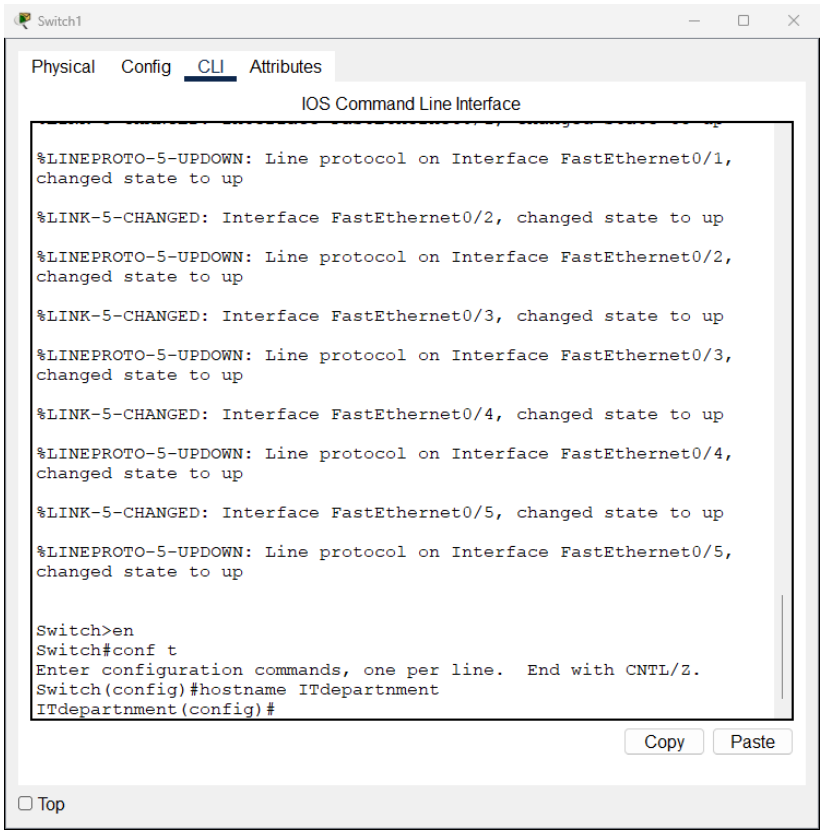
## 2. Change the Default Names of all Switches

This section explains how the default switch name was changed to a meaningful device name. Renaming the switch improves network organization, simplifies device identification, and aligns the switch with the HR department it serves. The new hostname helps administrators recognize the switch when managing configurations or troubleshooting.

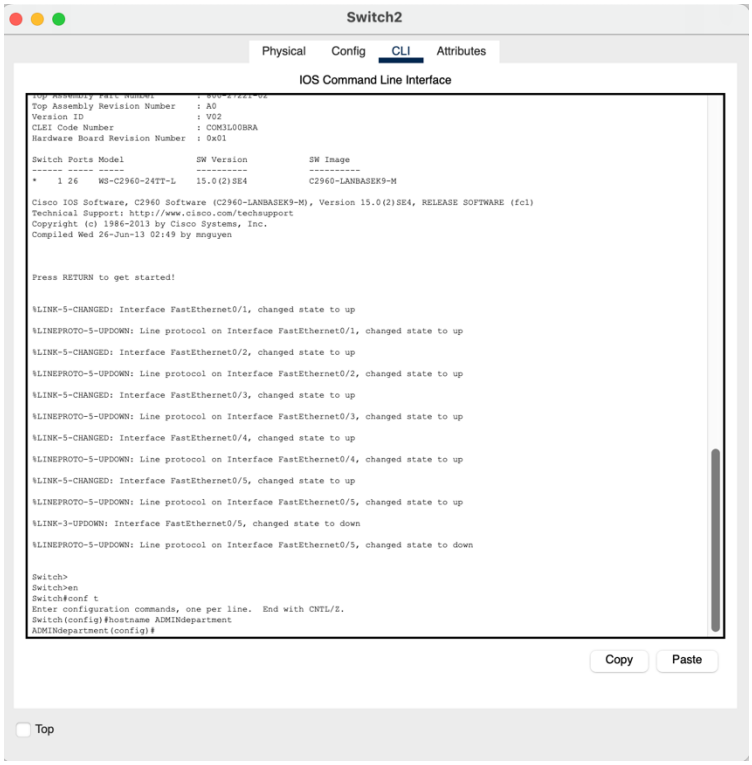
### 2.1 Change the name from switch 0 to HRdepartment



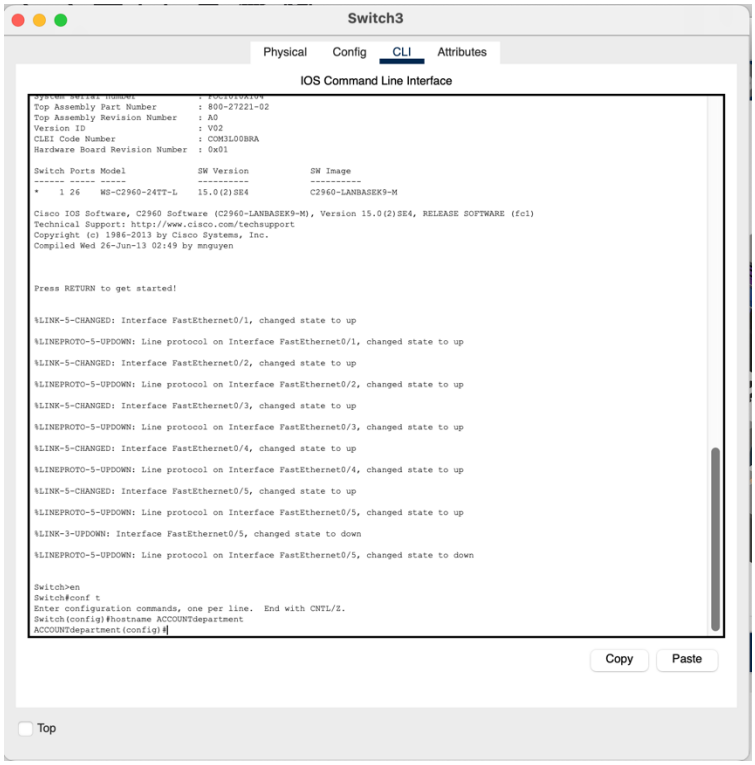

### 2.2 Change the name from switch 1 to ITdepartment




## 2.3 Change the name from switch 2 to ADMINdepartment



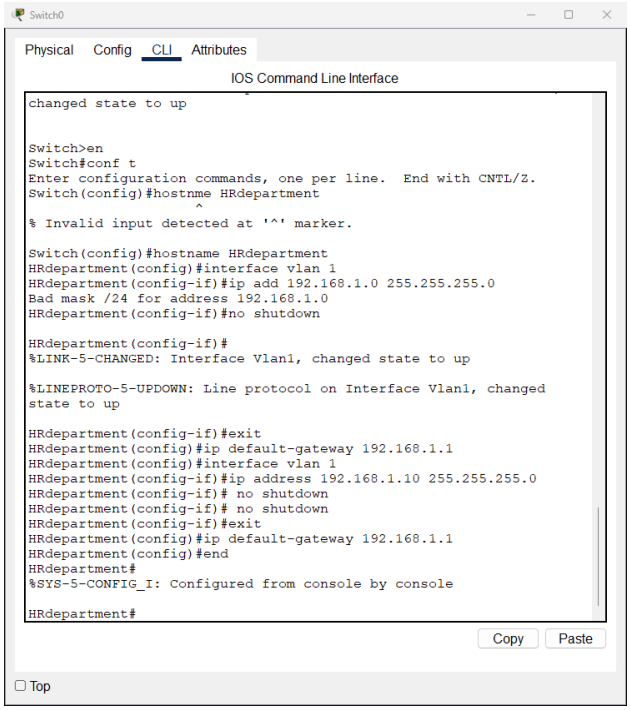

## 2.4 Change the name from switch 3 to ACCOUNTdepartment



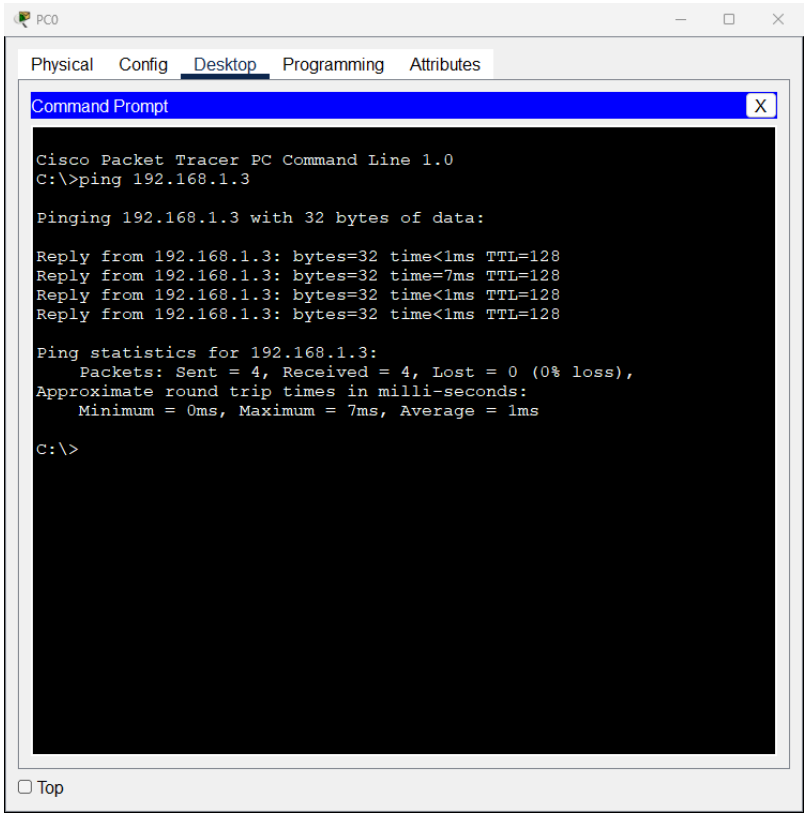

## 3. Assign IP Address for Switches (IP Management)

This part describes how a management IP address was assigned to each switch through the VLAN 1 interface. The management IP allows administrators to remotely access the switch for configuration, monitoring, and troubleshooting. It also ensures that the switch can communicate with its gateway for remote access across the company network.

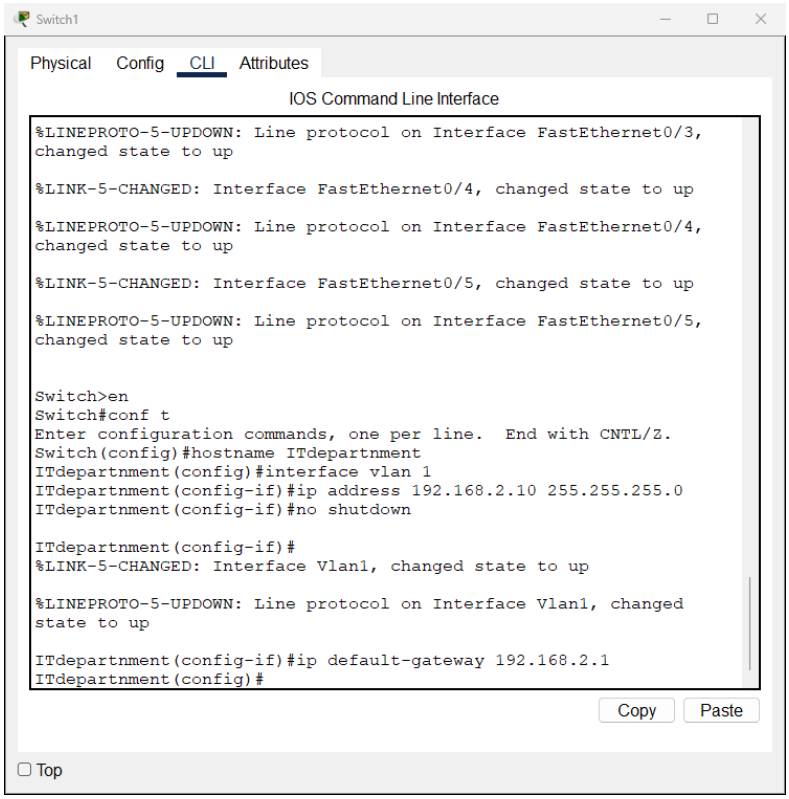
### 3.1 HRdepartment Switch:



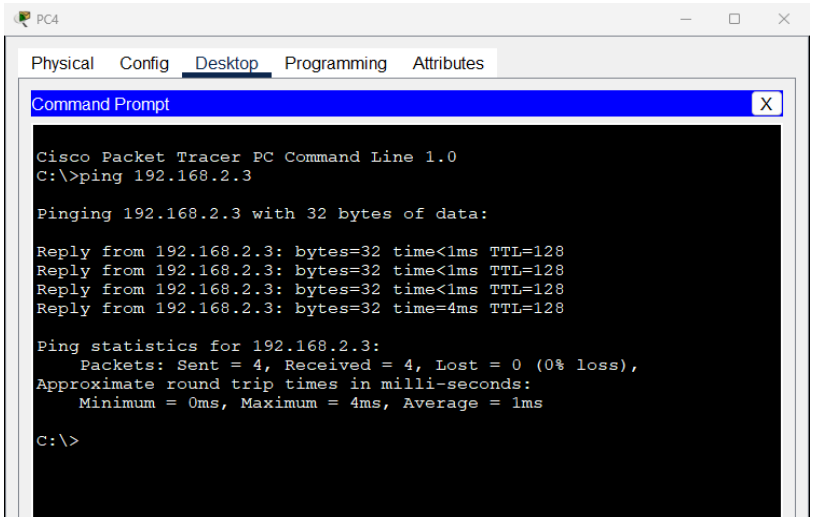
### 3.1.1 **Ping Command:** Confirmation of Connection



## 3.2 ITdepartment Switch:

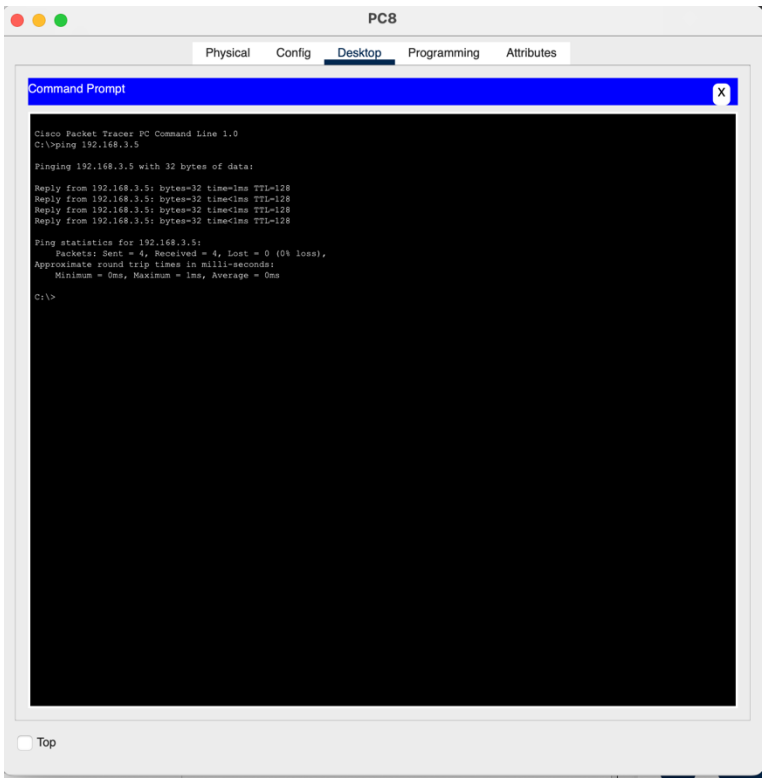



## 3.2.1 Ping Command: Confirmation of Connection



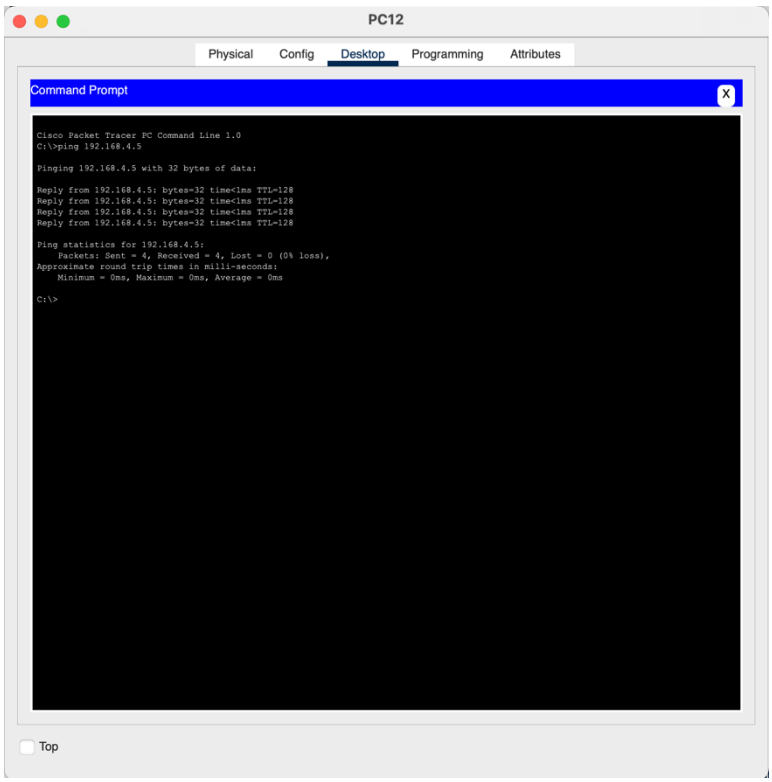
## 3.3 ADMINdepartment Switch:


## 3.3.1 Ping Command: Confirmation of Connection

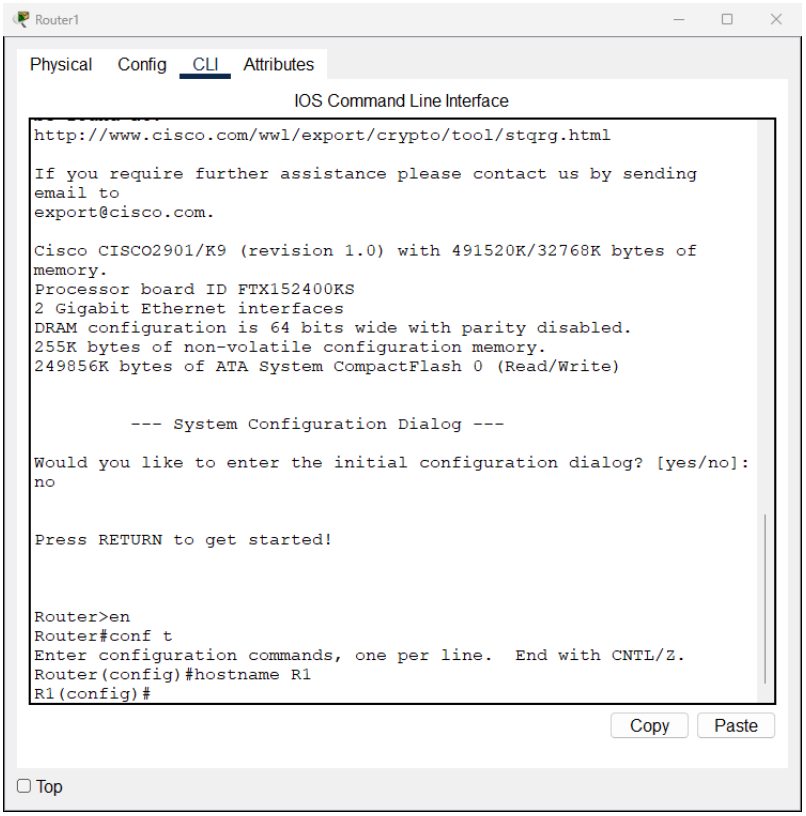


## 3.4 ACCOUNTdepartment Switch:

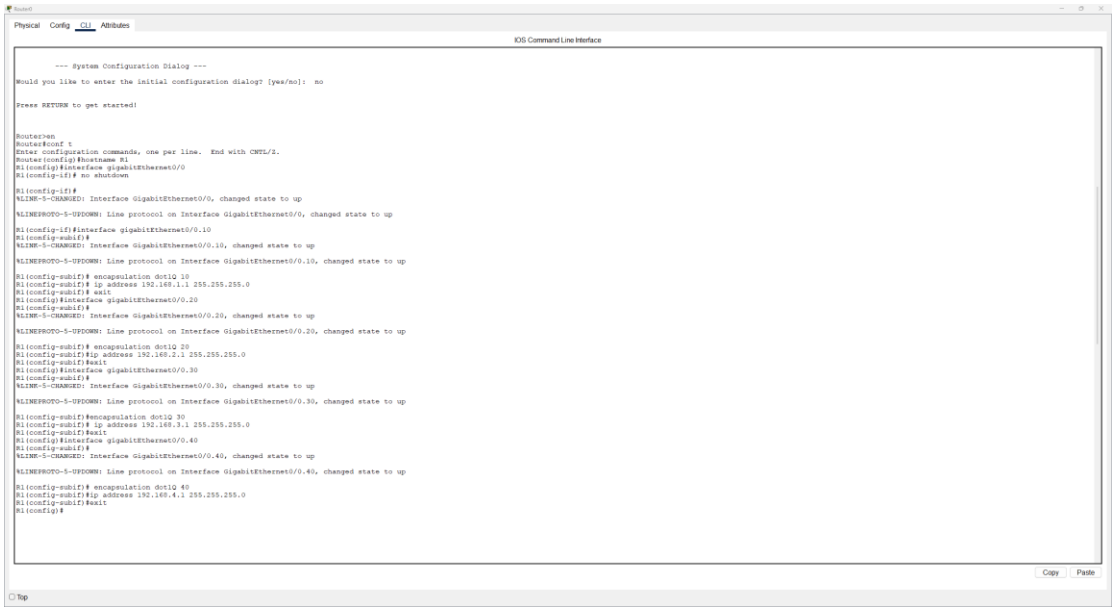

### 3.4.1 Ping Command: Confirmation of Connection



## Changing  the router name

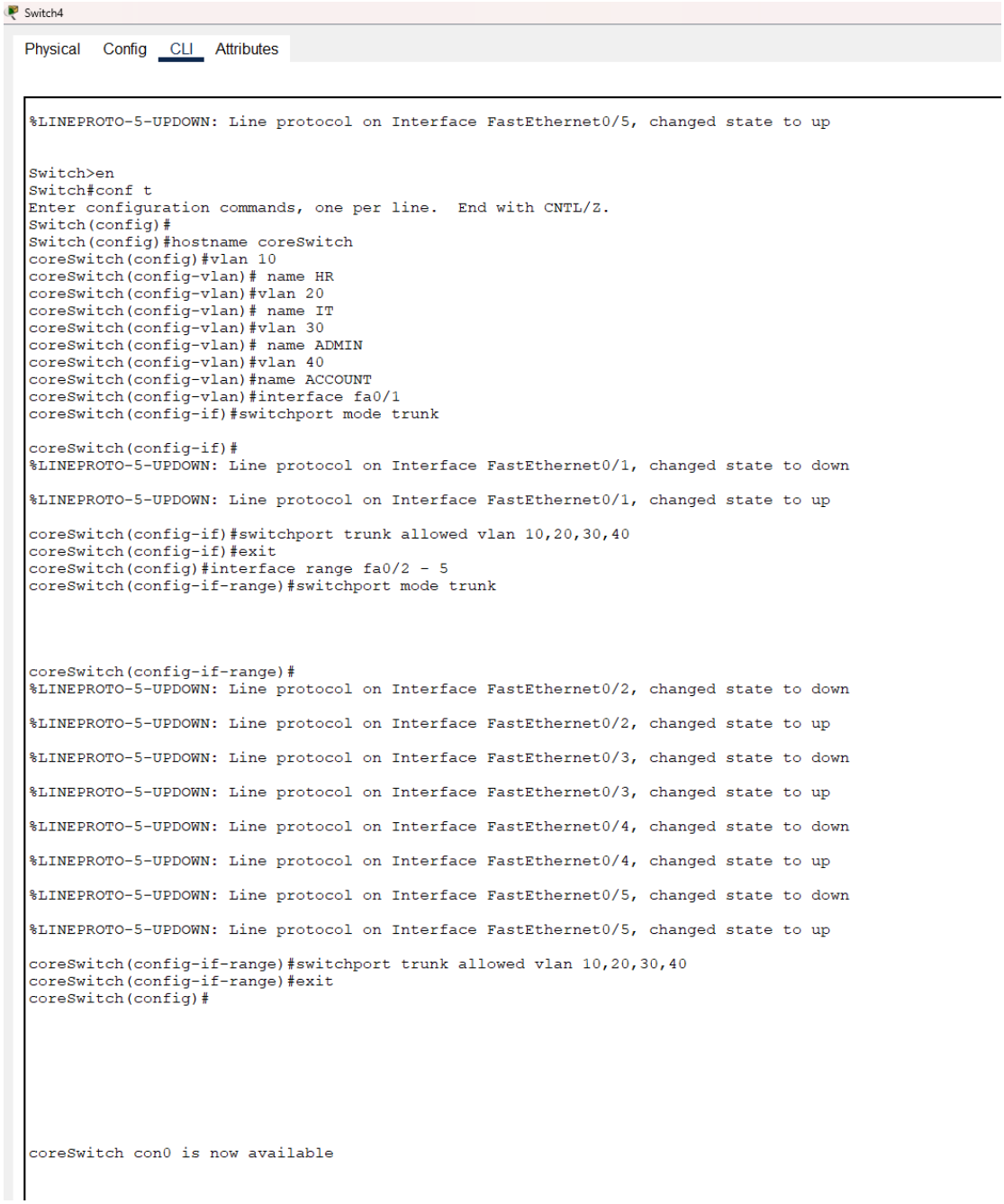



## Router-on-a-Stick Configuration for Inter-VLAN Communication



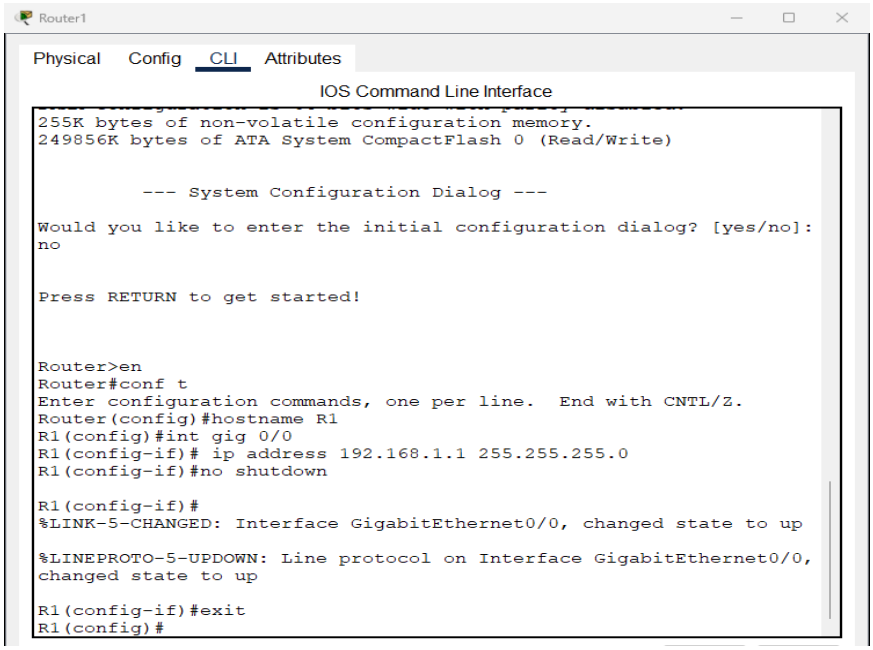
## Core Switch VLAN Configuration

*The core switch is configured with multiple VLANs and trunk ports to support communication between different departments.*



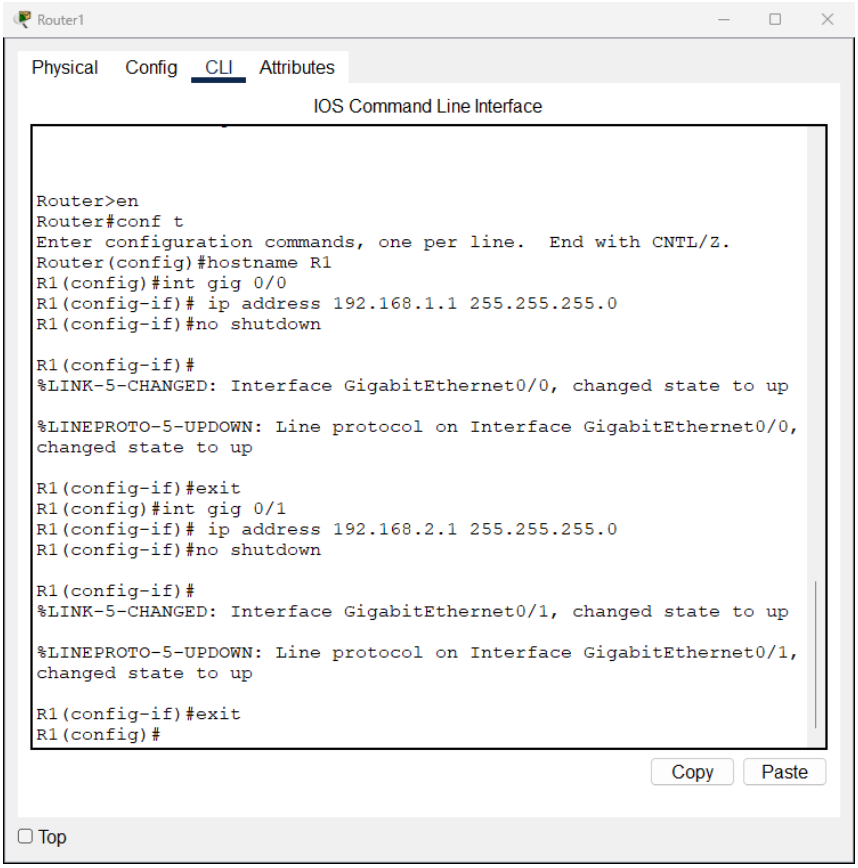
Configuring the first port (HR network)

HR Network: 192.168.1.0 /24



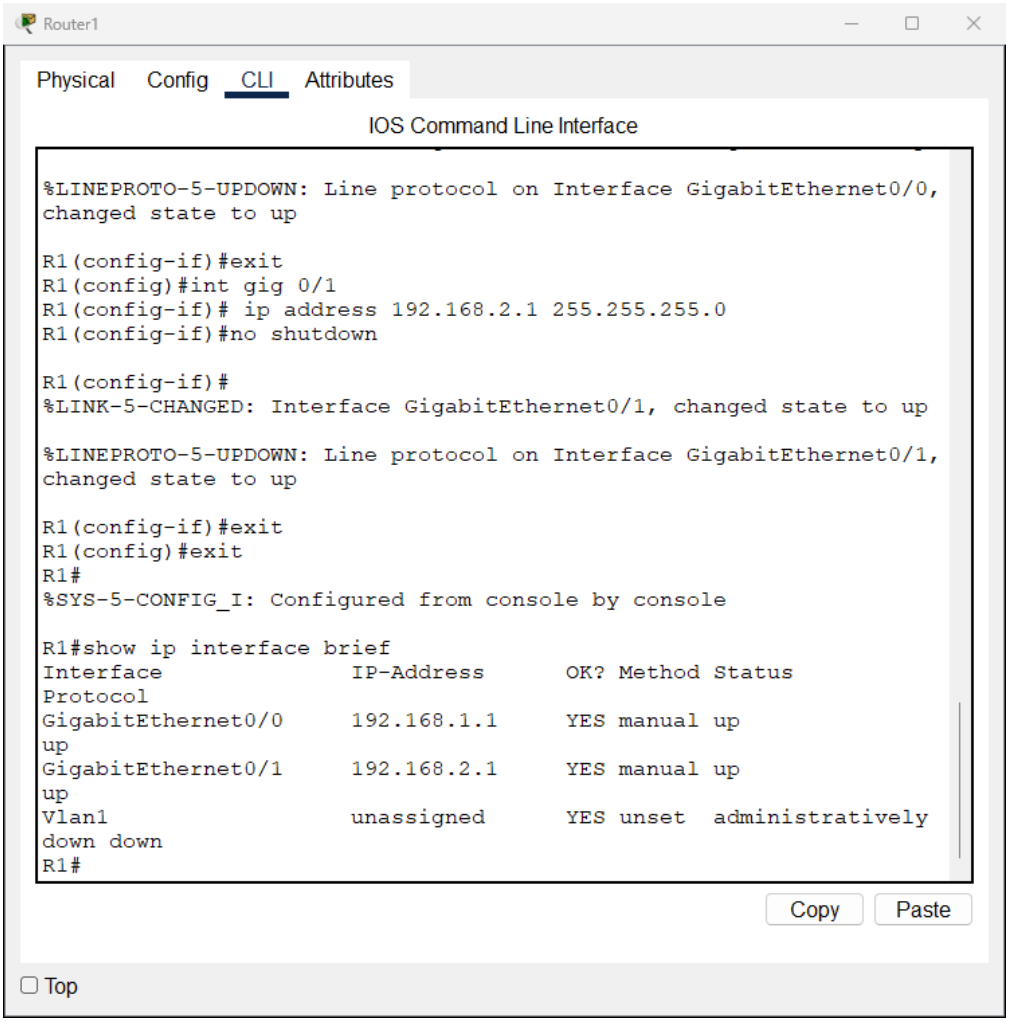

Configuring Port 2 (IT Network)

IT Network: 192.168.2.0/24



Confirm that the ports are working.

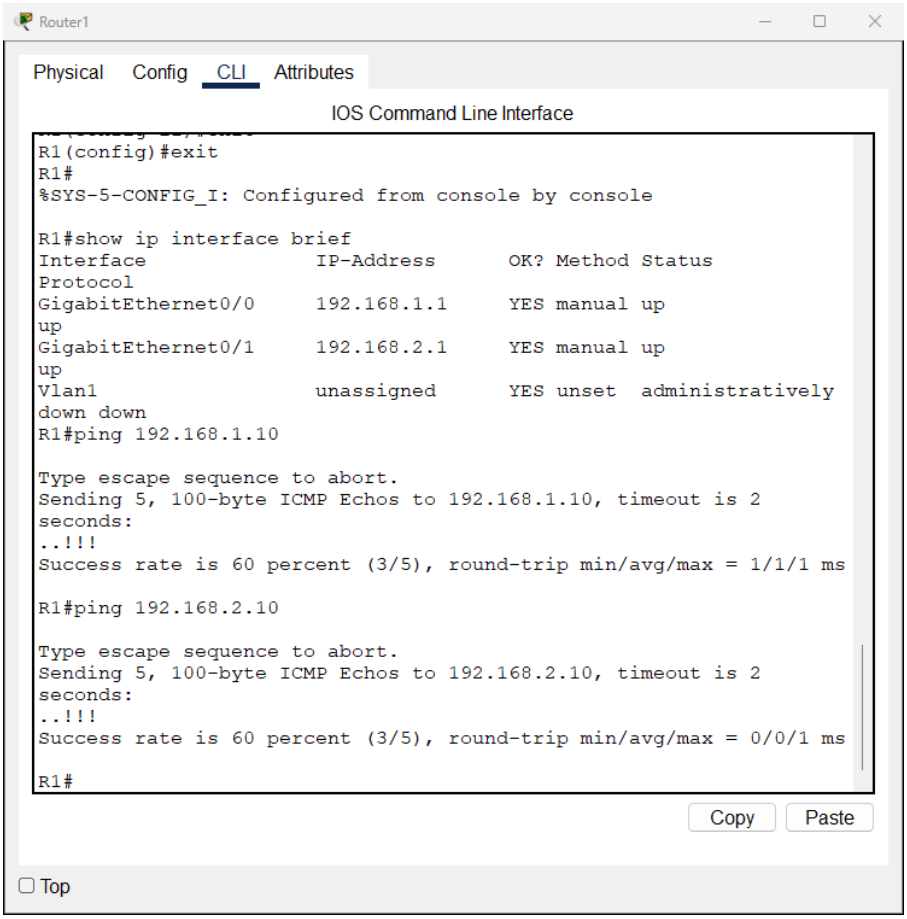
R1# show ip interface brief



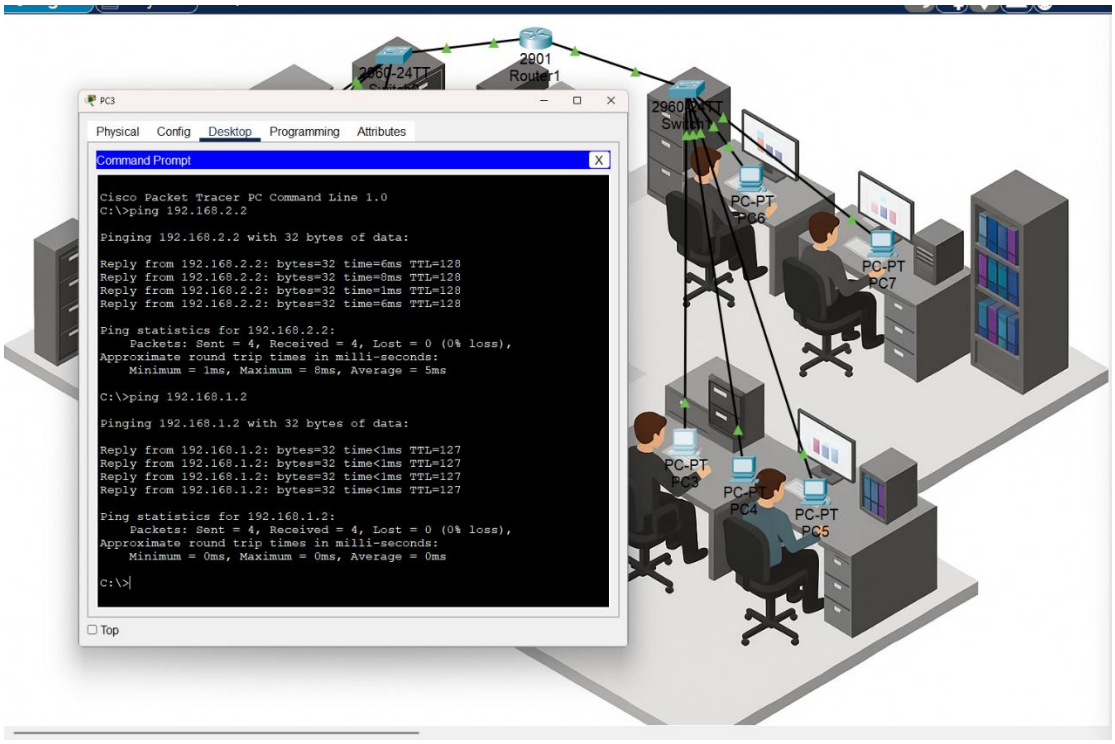
Ping the router from the router itself:

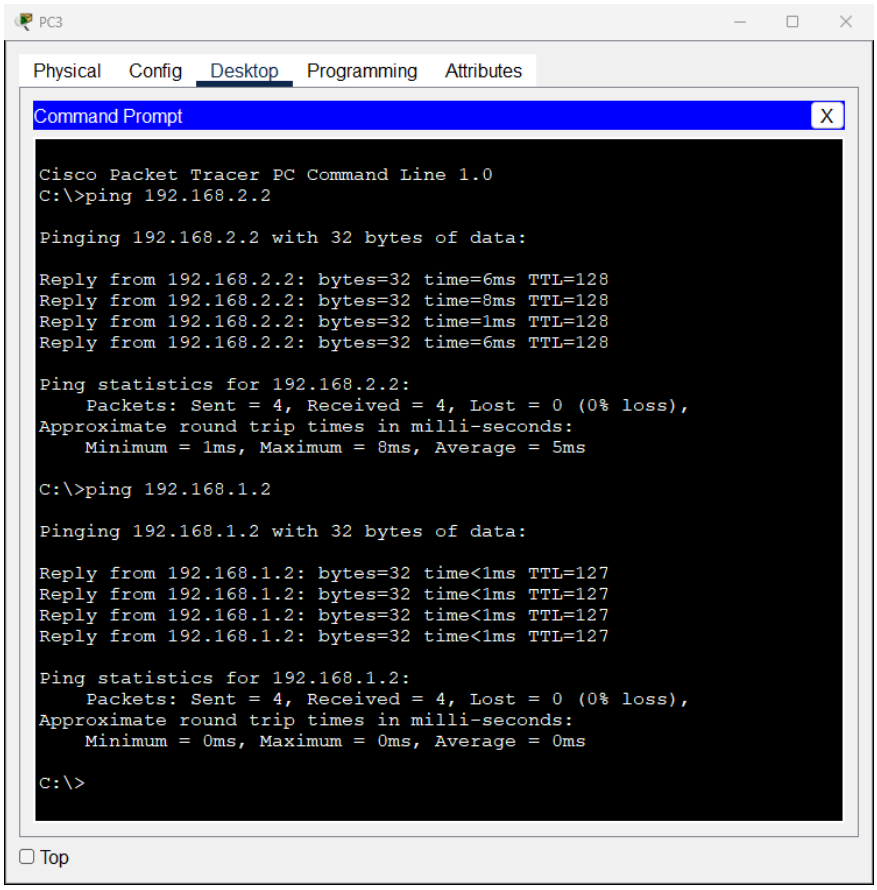
R1# ping 192.168.1.10 (This is the HR switch's IP address)

And  R1# ping 192.168.2.10 (This is the IT switch)



Ping Test Between IT and HR Departments ping 192.168.1.2

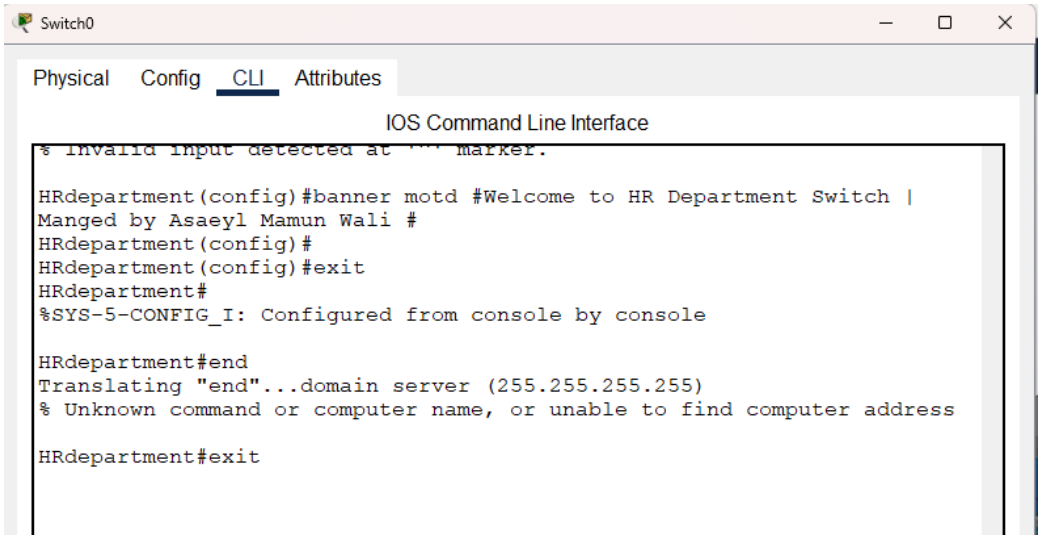


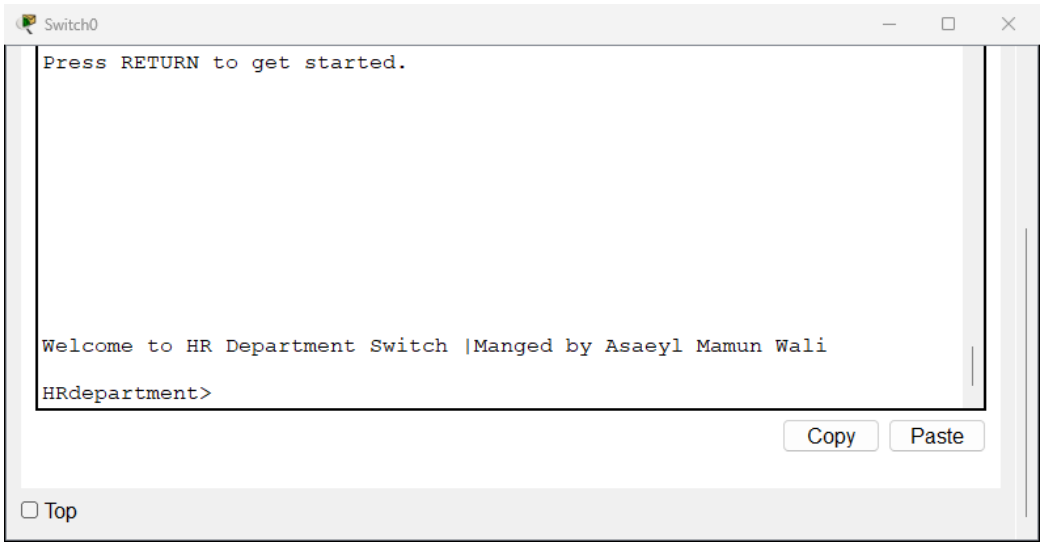



## 4. Message of the Day (MOTD)

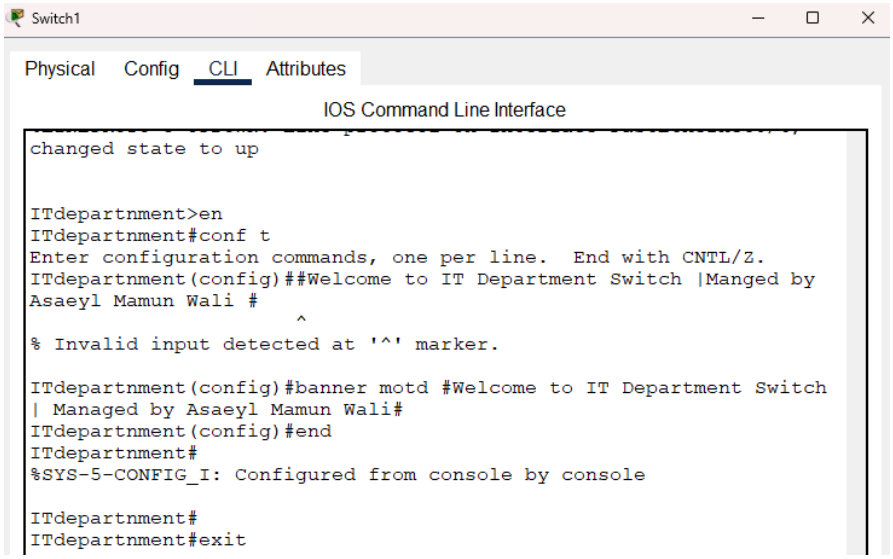
The Message of the Day banner is a security feature displayed to anyone accessing the switch. This section includes the configuration of a MOTD banner that warns unauthorized users and reinforces network security policies. It ensures that anyone attempting to access the device is aware that only authorized personnel are allowed.

### 4.1 Message for HRdepartment Switch:



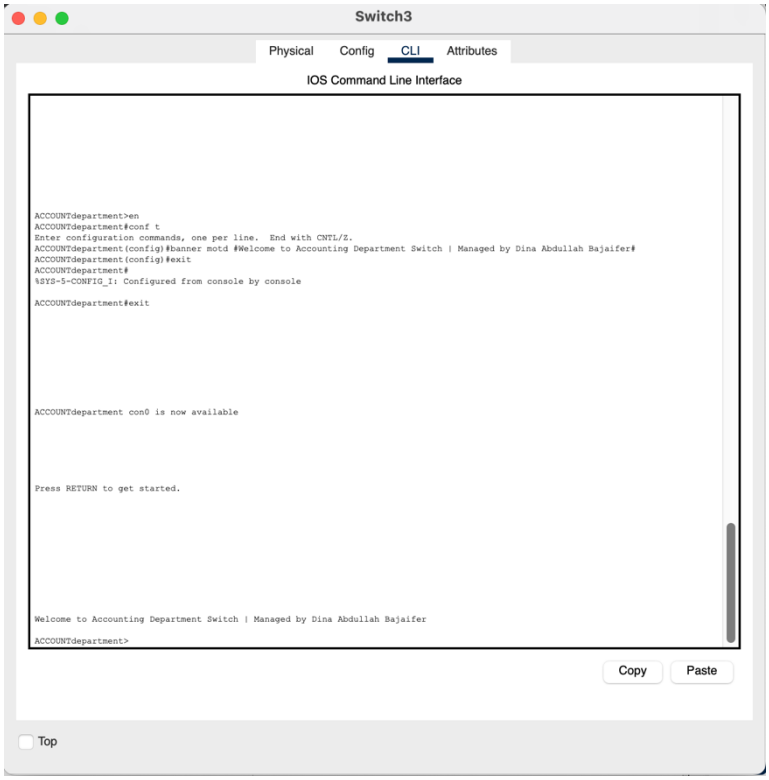



## 4.2 Message for ITdepartment Switch:




## 4.3 Message for ADMINdepartment Switch:

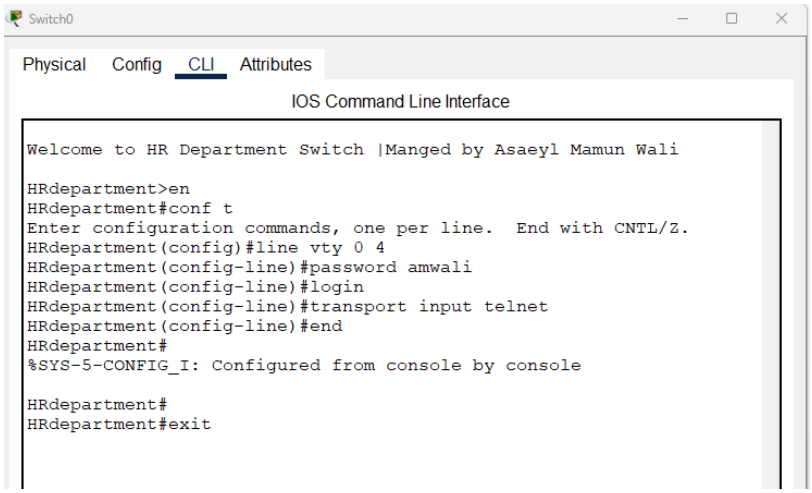

## 4.4 Message for ACCOUNTepartment Switch:

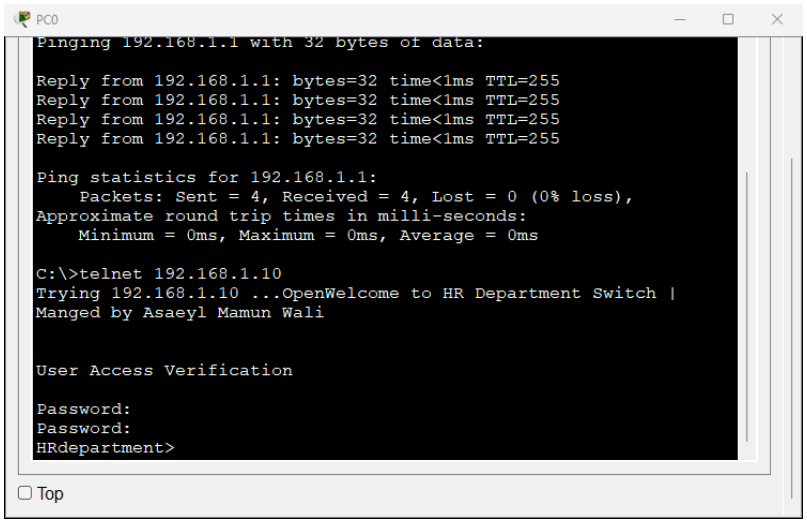


# 5 .Remote Access to the Switch from a PC (Telnet)

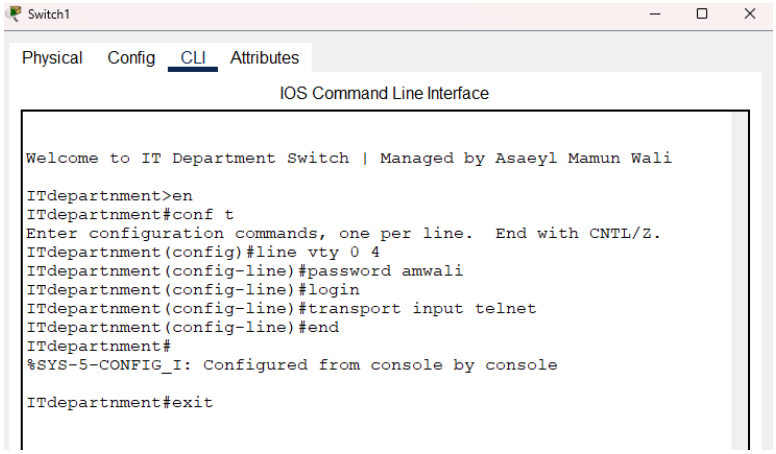
This section documents how remote access was configured so administrators can manage the switch using Telnet. It explains the steps required to enable vty lines, set login credentials, and verify connectivity from a PC. Remote access allows management without needing physical console cables.

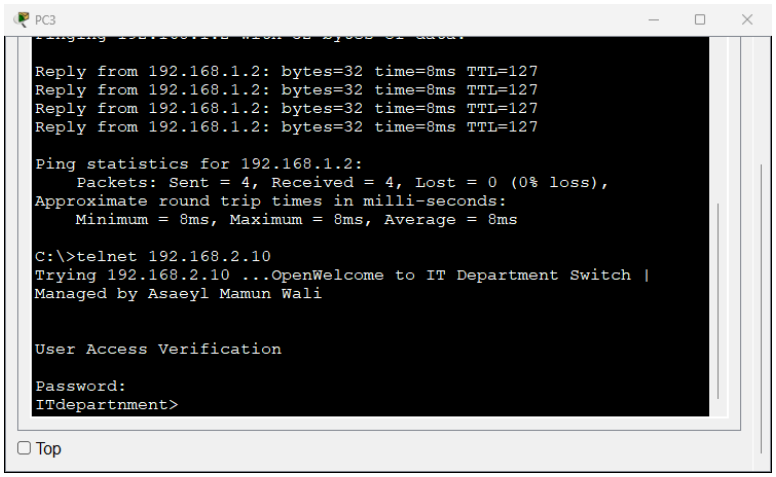
## 5.1 HRdepartment Switch:



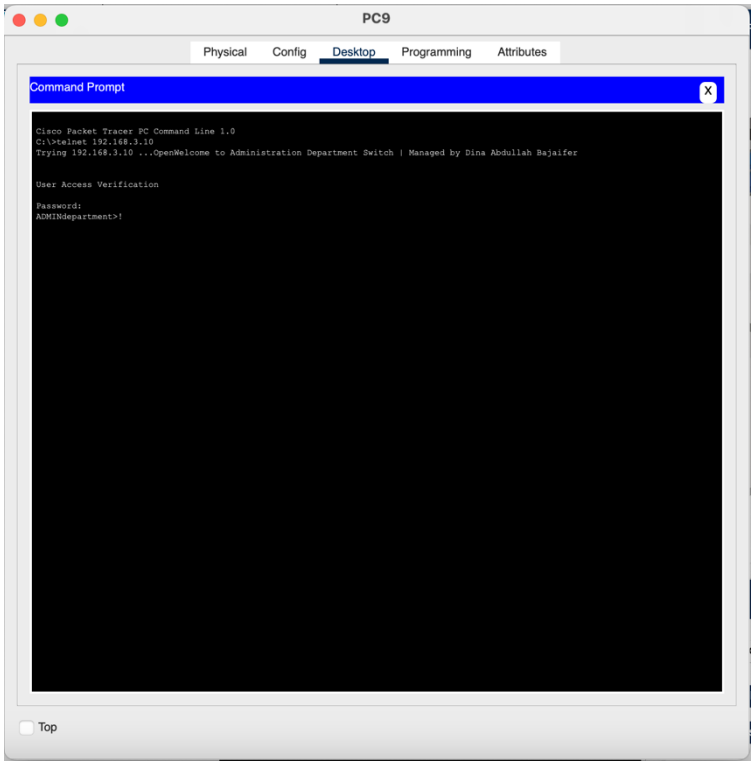



## 5.2 ITdepartment Switch

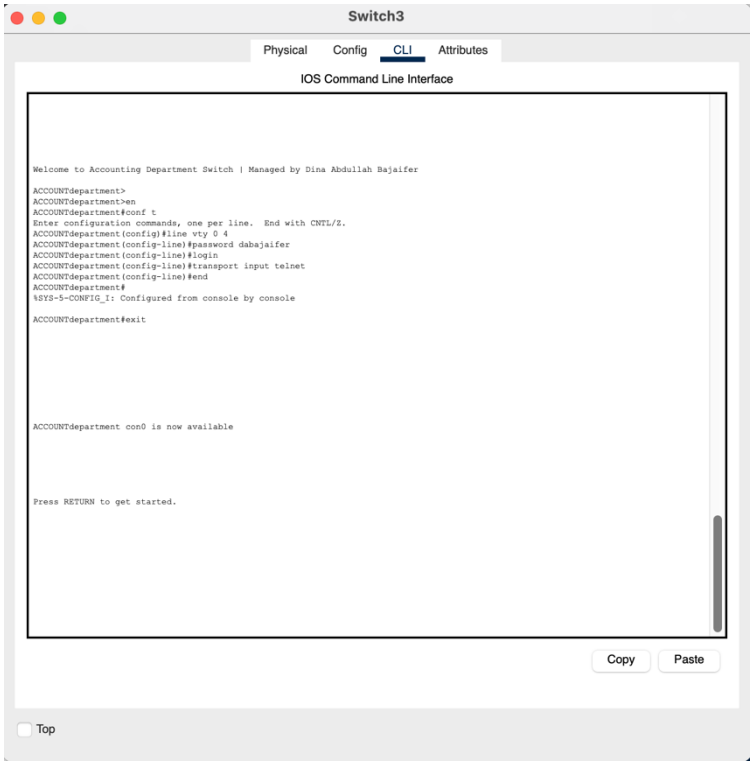


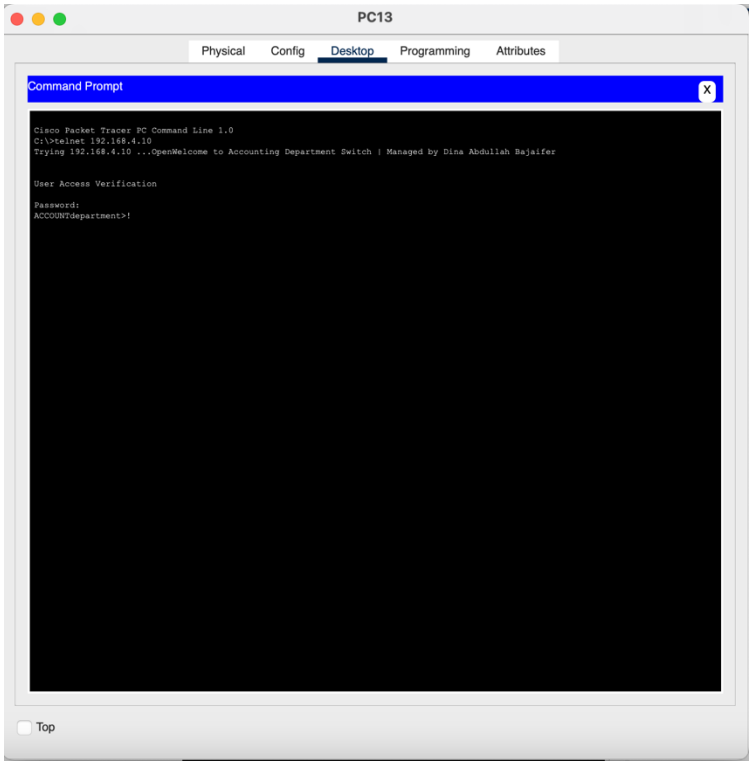




## 5.3 ADMINdepartment Switch:




## 5.4 ACCOUNTdepartment switch:

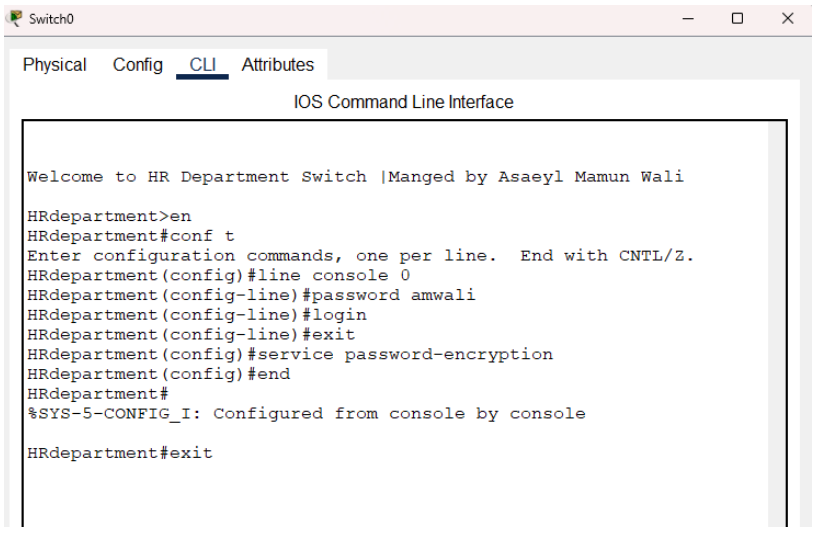


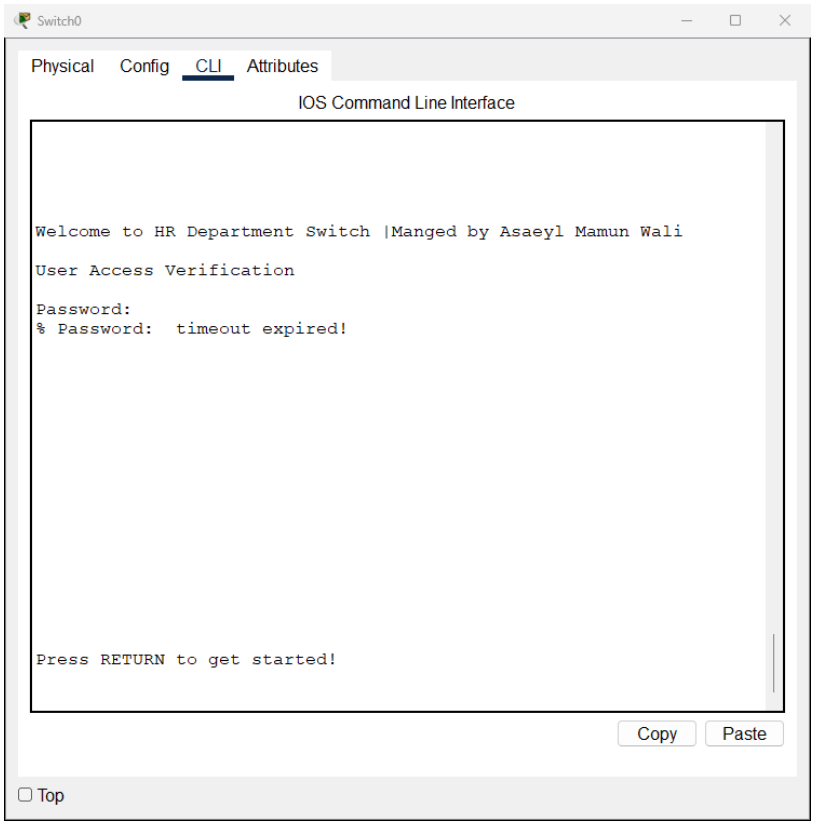



## 6. Set a Password for the Console

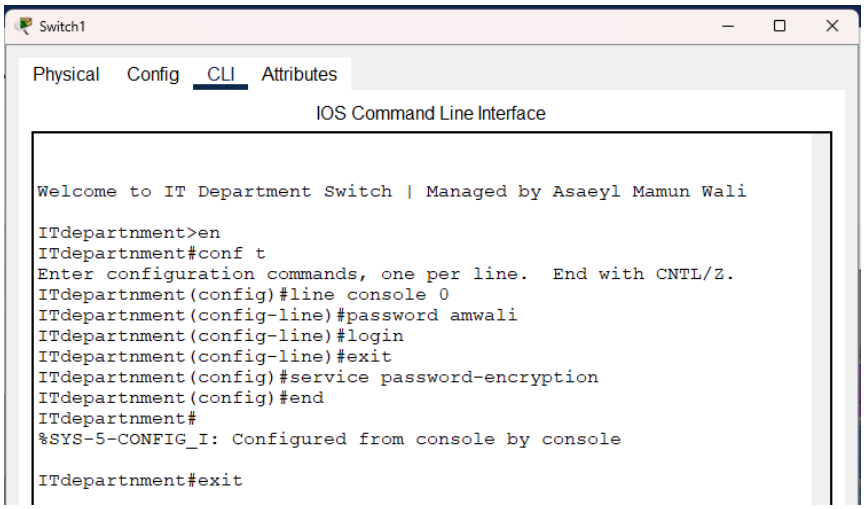
This part describes how a console password was added to secure physical access to the switch. Setting a console password prevents unauthorized users from configuring the device if they connect directly to it. This step is a fundamental part of applying basic device security.

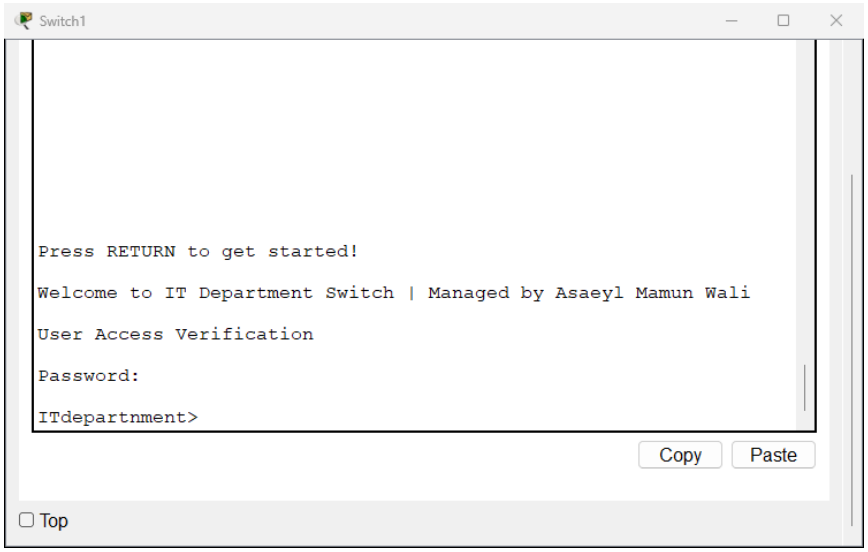
### 6.1 HRdepartment Switch:



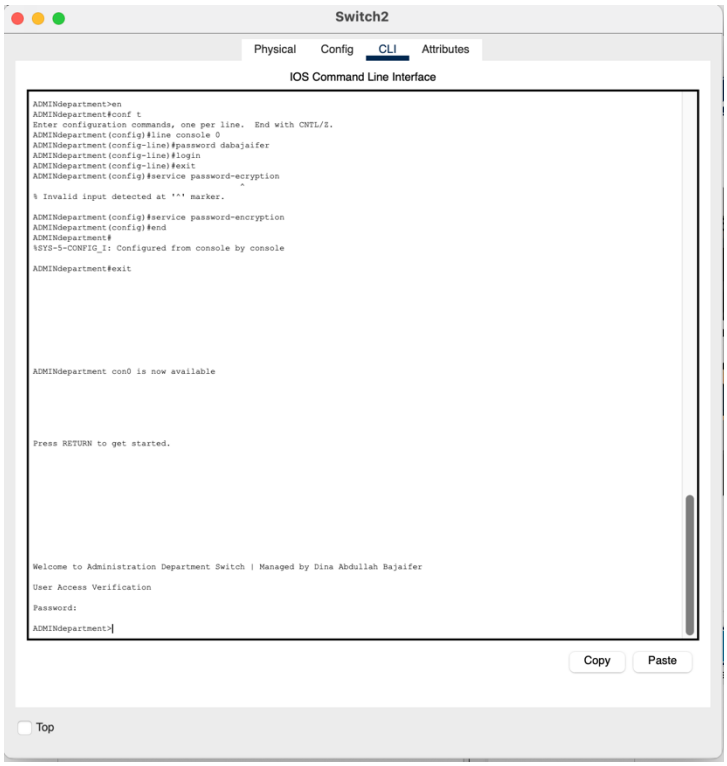

Switch0
Physical
Config
CLI
Attributes
IOS Command Line Interface
Welcome to HR Department Switch |Manged by Asaeyl Mamun Wali
User Access Verification
Password:
% Password: timeout expired!
Press RETURN to get started!
Copy
Paste
Top

## 6.2 ITdepartment Switch



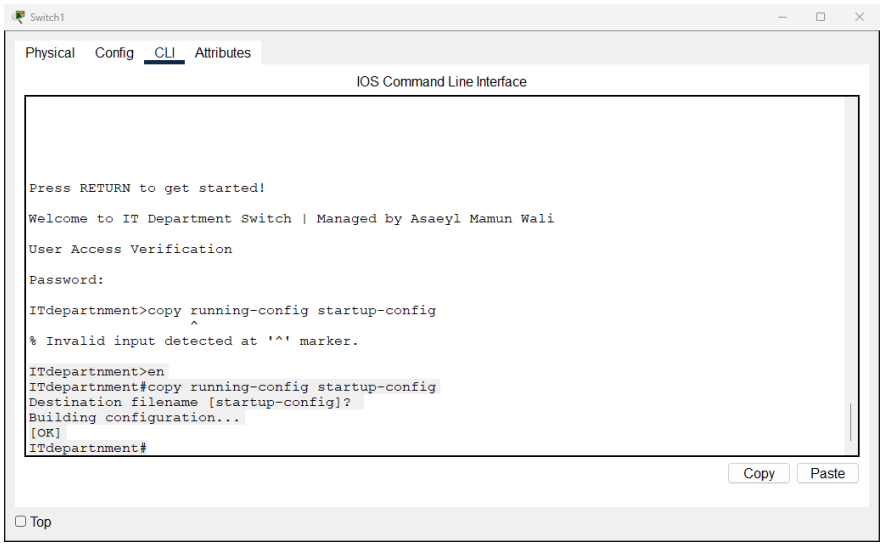
## 6.3 ADMINdepartment Switch:

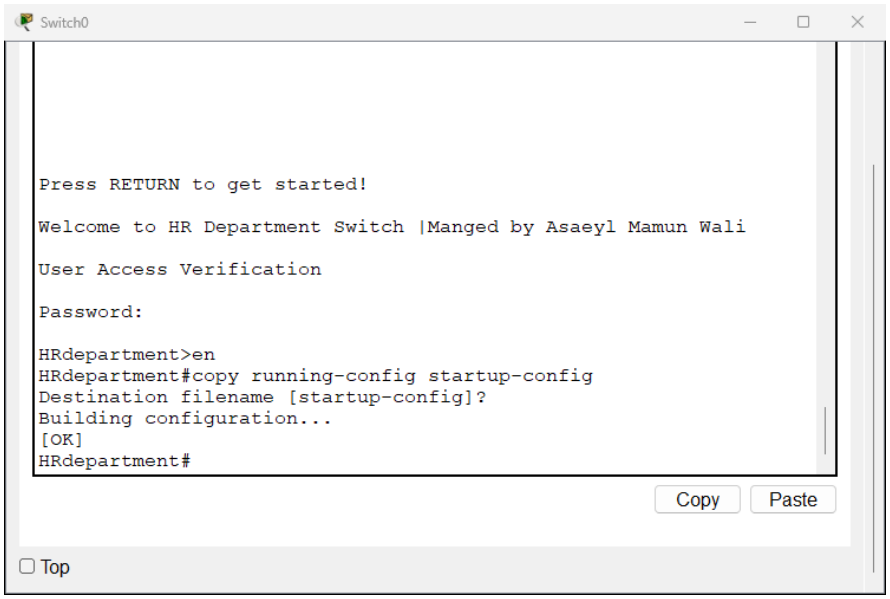



## 6.4 ACCOUNTdepartment switch:

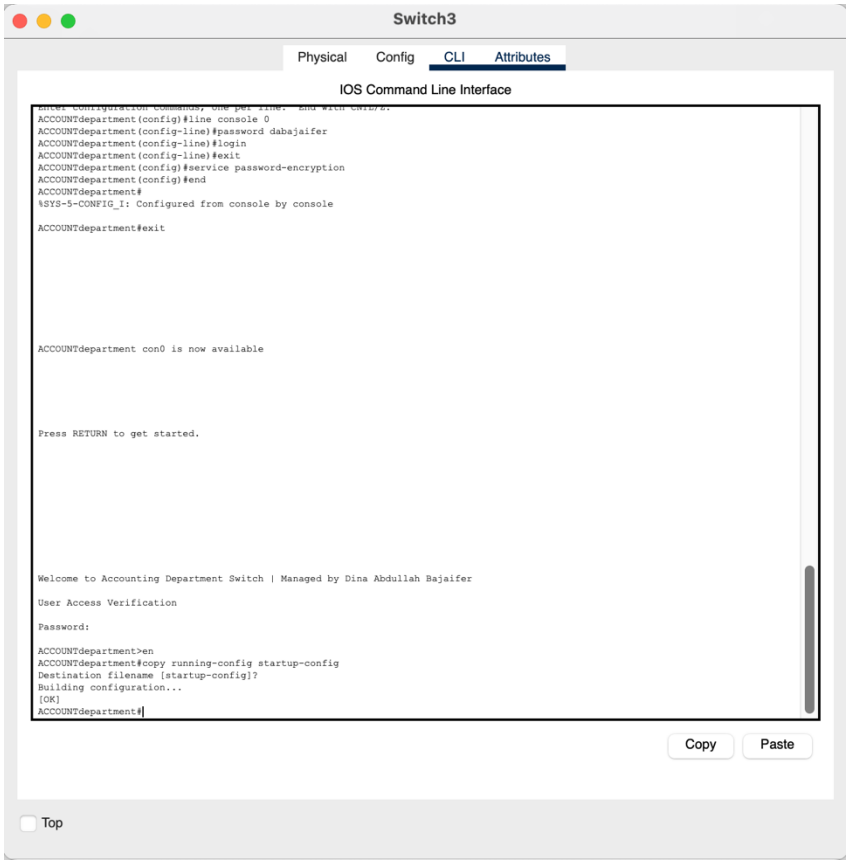
## 7. Save Settings

This section explains how all device configurations were saved to the startup configuration file. Saving ensures that all settings (hostname, IP management, passwords, MOTD, and Telnet configurations) remain active even after the switch or router restarts.



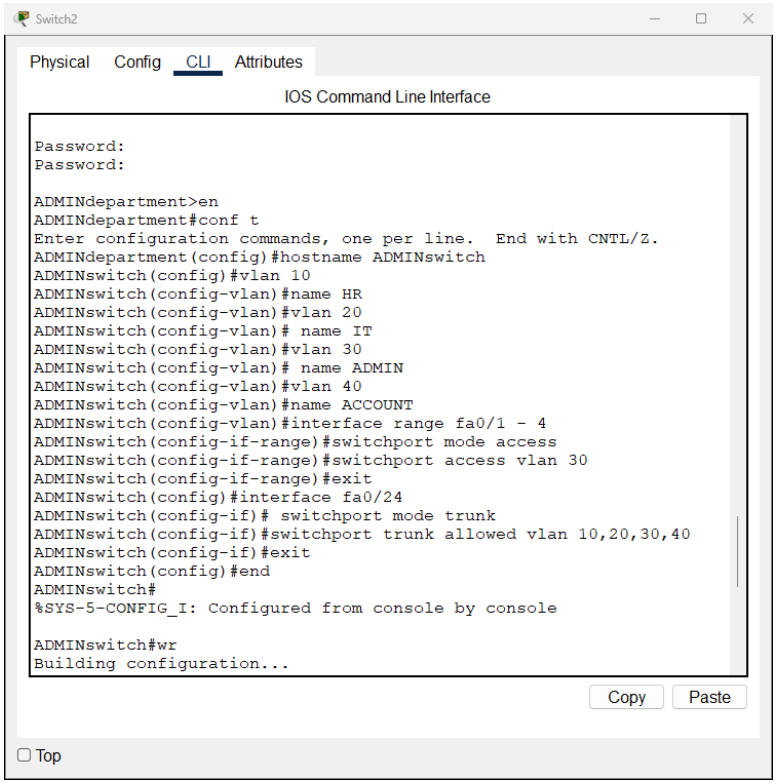

Switch2
Physical
Config
CLI
Attributes
IOS Command Line Interface
ADMINdepartment(config-line)#password dabajaifer
ADMINdepartment(config-line)#login
ADMINdepartment(config-line)#exit
ADMINdepartment(config)#service password-ecryption
% Invalid input detected at '^' marker.
ADMINdepartment(config)#service password-encryption
ADMINdepartment(config)#end
ADMINdepartment#
%SYS-5-CONFIG_I: Configured from console by console
ADMINdepartment#exit
ADMINdepartment con0 is now available
Press RETURN to get started.
Welcome to Administration Department Switch | Managed by Dina Abdullah Bajaifer
User Access Verification
Password:
ADMINdepartment>en
ADMINdepartment#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
ADMINdepartment#
Copy
Paste
Top

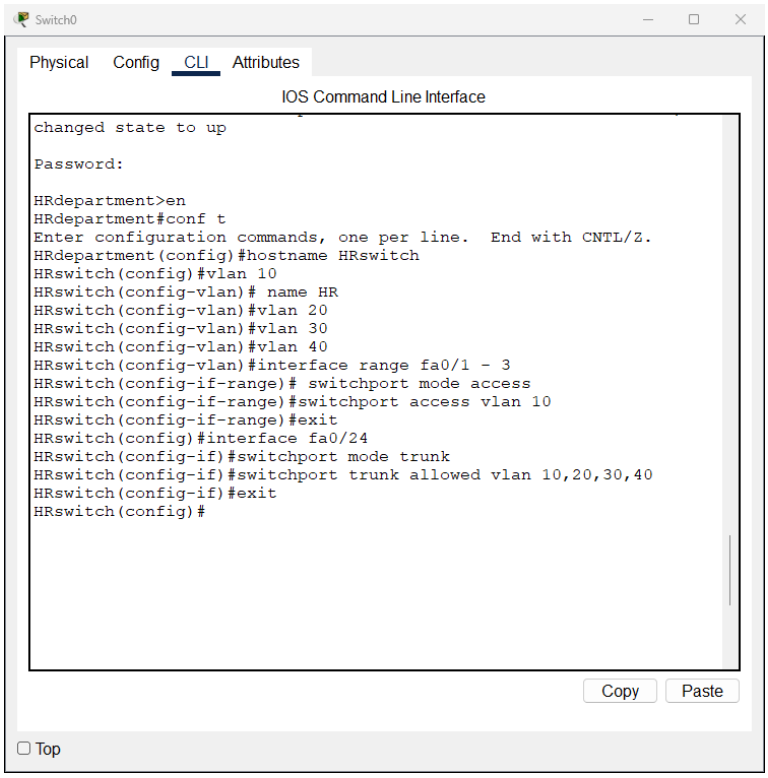

Switch3
Physical
Config
CLI
Attributes
IOS Command Line Interface
ACCOUNTdepartment(config)#line console 0
ACCOUNTdepartment(config-line)#password dabajaifer
ACCOUNTdepartment(config-line)#login
ACCOUNTdepartment(config-line)#exit
ACCOUNTdepartment(config)#service password-encryption
ACCOUNTdepartment(config)#end
ACCOUNTdepartment#
%SYS-5-CONFIG_I: Configured from console by console
ACCOUNTdepartment#exit
ACCOUNTdepartment con0 is now available
Press RETURN to get started.
Welcome to Accounting Department Switch | Managed by Dina Abdullah Bajaifer
User Access Verification
Password:
ACCOUNTdepartment>en
ACCOUNTdepartment#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
ACCOUNTdepartment#
Copy
Paste
Top

## VLAN Configuration on the Core Switch

: This screenshot shows the configuration of multiple VLANs (HR, IT, ADMIN, ACCOUNT) on the core switch, including assigning VLAN names and configuring trunk ports to allow inter-VLAN communication across the network.

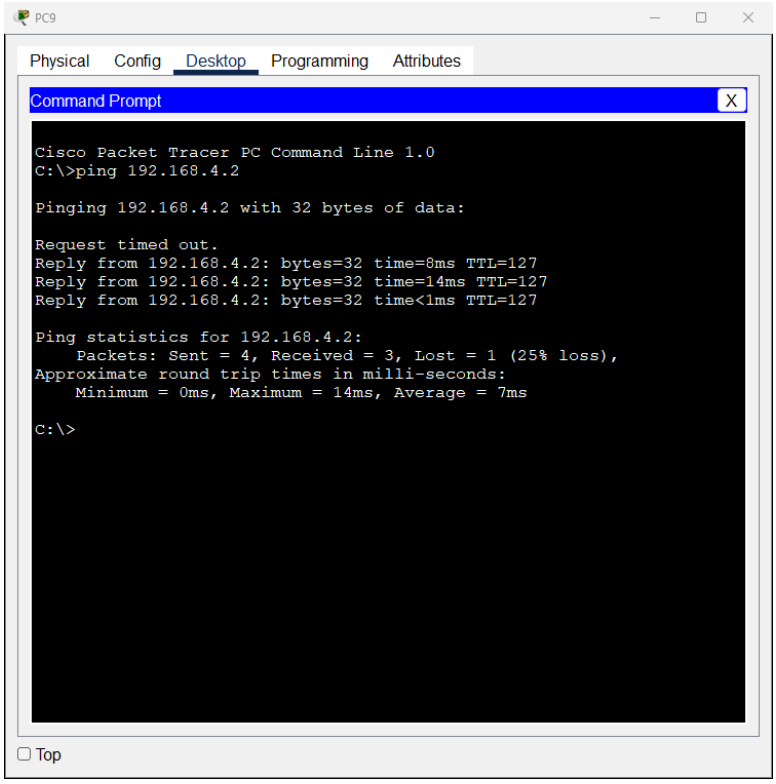
```
Password:

ACCOUNTdepartment>en
ACCOUNTdepartment#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
ACCOUNTdepartment(config)#hostname ACCOUNTswitch
ACCOUNTswitch(config)#vlan 10
ACCOUNTswitch(config-vlan)# name HR
ACCOUNTswitch(config-vlan)#vlan 20
ACCOUNTswitch(config-vlan)# name IT
ACCOUNTswitch(config-vlan)#vlan 30
ACCOUNTswitch(config-vlan)# name ADMIN
ACCOUNTswitch(config-vlan)#vlan 40
ACCOUNTswitch(config-vlan)#name ACCOUNT
ACCOUNTswitch(config-vlan)#interface range fa0/1 - 4
ACCOUNTswitch(config-if-range)#switchport mode access
ACCOUNTswitch(config-if-range)#switchport access vlan 40
ACCOUNTswitch(config-if-range)#exit
ACCOUNTswitch(config)#interface fa0/24
ACCOUNTswitch(config-if)# switchport mode trunk
ACCOUNTswitch(config-if)#switchport trunk allowed vlan 10,20,30,40
ACCOUNTswitch(config-if)#exit
ACCOUNTswitch(config)#end
ACCOUNTswitch#
%SYS-5-CONFIG_I: Configured from console by console

ACCOUNTswitch#wr
Building configuration...
[OK]
ACCOUNTswitch#
```

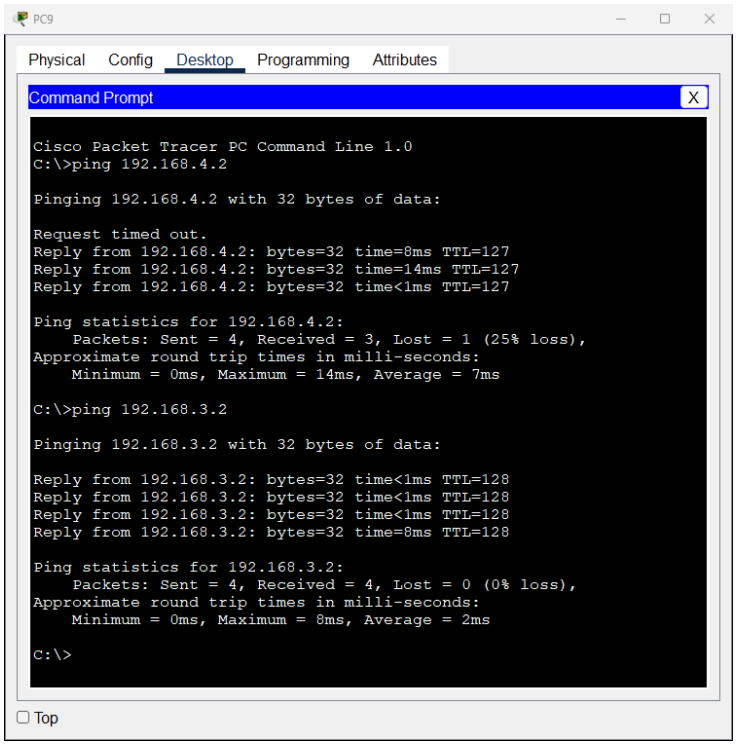


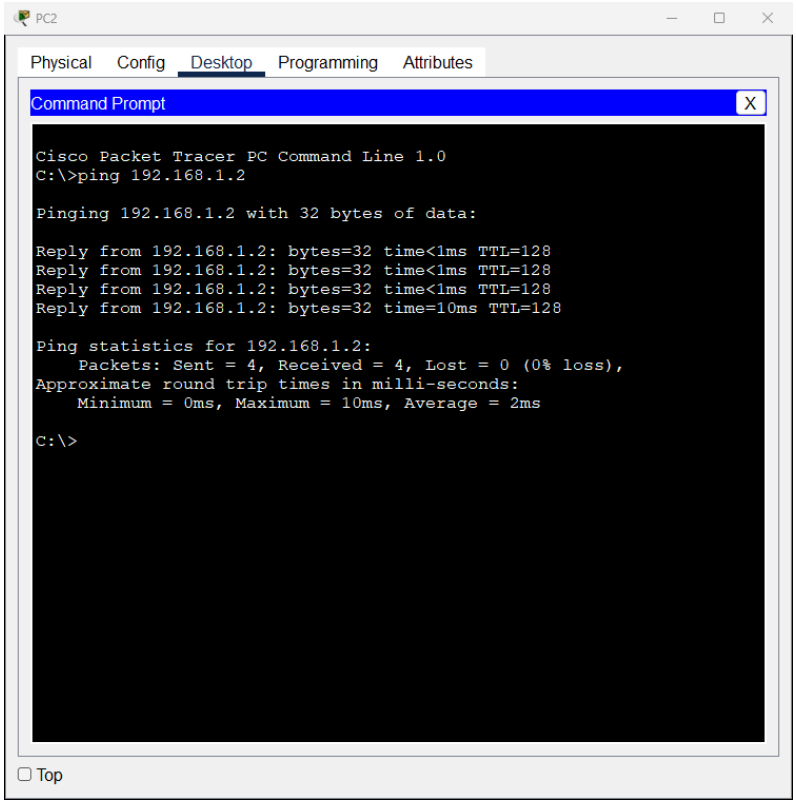

Switch0
Physical
Config
CLI
Attributes
IOS Command Line Interface
changed state to up
Password:
HRdepartment>en
HRdepartment#conf t
Enter configuration commands, one per line. End with CNTL/Z.
HRdepartment(config)#hostname HRswitch
HRswitch(config)#vlan 10
HRswitch(config-vlan)# name HR
HRswitch(config-vlan)#vlan 20
HRswitch(config-vlan)#vlan 30
HRswitch(config-vlan)#vlan 40
HRswitch(config-vlan)#interface range fa0/1 - 3
HRswitch(config-if-range)# switchport mode access
HRswitch(config-if-range)#switchport access vlan 10
HRswitch(config-if-range)#exit
HRswitch(config)#interface fa0/24
HRswitch(config-if)#switchport mode trunk
HRswitch(config-if)#switchport trunk allowed vlan 10,20,30,40
HRswitch(config-if)#exit
HRswitch(config)#
Copy
Paste
Top

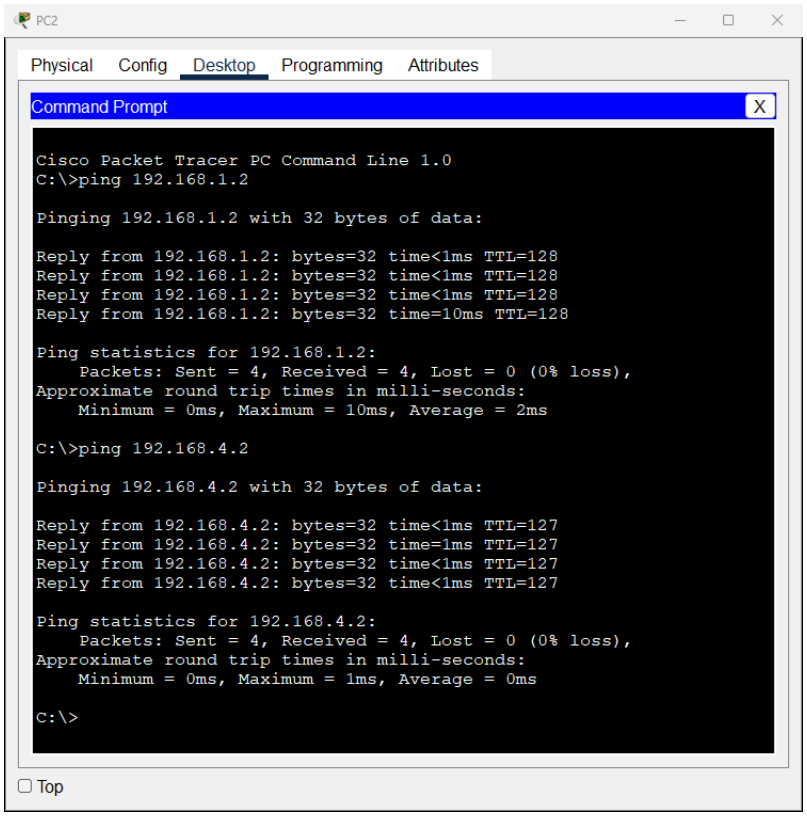
# Full Network Connectivity Verification

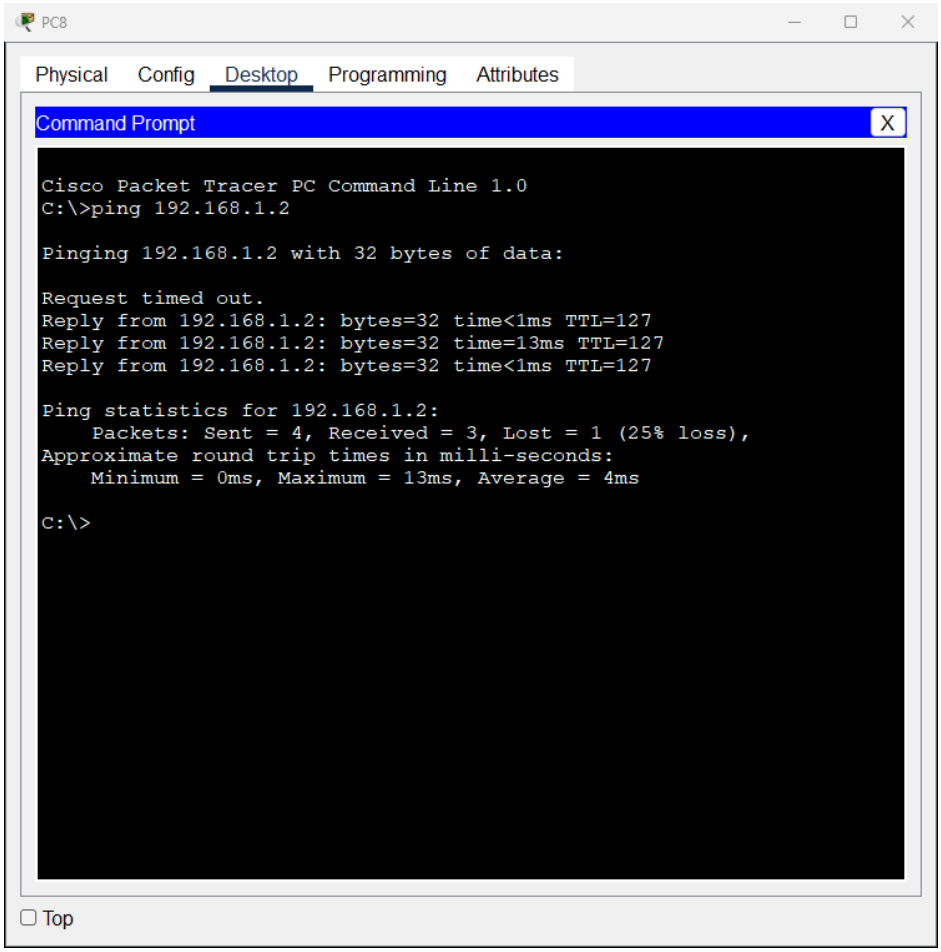
This series of ping tests demonstrates full communication between all departments (HR, IT, Admin, Accounting). Each PC successfully reaches devices in different VLANs, proving that trunking, VLAN assignments, and router sub-interfaces are correctly configured.



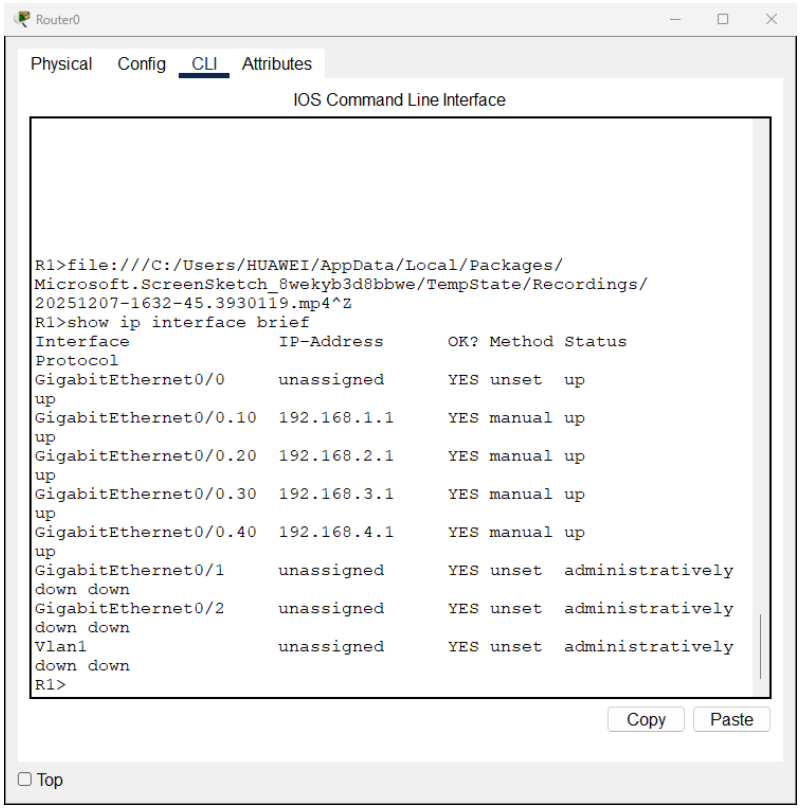

PC2
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.2
Pinging 192.168.1.2 with 32 bytes of data:
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=10ms TTL=128
Ping statistics for 192.168.1.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 10ms, Average = 2ms
C:\>
Top


PC2
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.2
Pinging 192.168.1.2 with 32 bytes of data:
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=10ms TTL=128
Ping statistics for 192.168.1.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 10ms, Average = 2ms
C:\>ping 192.168.4.2
Pinging 192.168.4.2 with 32 bytes of data:
Reply from 192.168.4.2: bytes=32 time<1ms TTL=127
Reply from 192.168.4.2: bytes=32 time=1ms TTL=127
Reply from 192.168.4.2: bytes=32 time<1ms TTL=127
Reply from 192.168.4.2: bytes=32 time<1ms TTL=127
Ping statistics for 192.168.4.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>
Top


PC8
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.2
Pinging 192.168.1.2 with 32 bytes of data:
Request timed out.
Reply from 192.168.1.2: bytes=32 time<1ms TTL=127
Reply from 192.168.1.2: bytes=32 time=13ms TTL=127
Reply from 192.168.1.2: bytes=32 time<1ms TTL=127
Ping statistics for 192.168.1.2:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 13ms, Average = 4ms
C:\>
Top

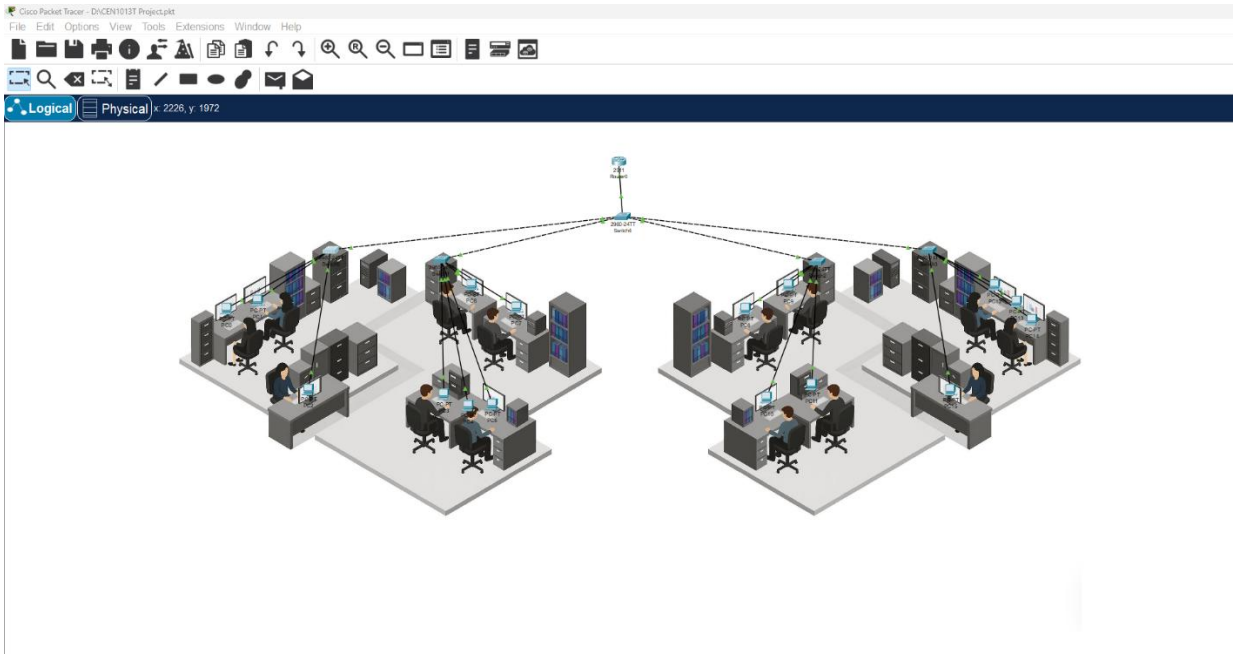
# Router Subinterfaces Configuration (Router-on-a-Stick)

This screenshot displays the router interface summary after configuring multiple subinterfaces on GigabitEthernet0/0. Each subinterface is assigned a unique IP address to serve as the default gateway for its corresponding VLAN (HR, IT, Admin, and Accounting). This confirms that inter-VLAN routing is successfully enabled using the router-on-a-stick approach.



# Enterprise Network Topology with VLAN Segmentation

This diagram illustrates an enterprise network design implemented in Cisco Packet Tracer. The network consists of multiple departments connected through access switches to a central core switch and a router. VLANs are used to logically separate departments (such as HR, IT, Admin, and Accounting), while inter-VLAN communication is enabled via router-on-a-stick configuration. The topology demonstrates structured cabling, centralized routing, and effective network segmentation.



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   https://www.netacad.com

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   *CCNA Routing and Switching Complete Study Guide*
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   *Data Communications and Networking* (5th Edition)
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