

COMPUTER NETWORKS LAB

GROUP MEMBERS (3A)

KANWAL QAZAFI (2022-BSSE-039) A

MASHAL ZAHRA (2022-BSSE-021) A

FARWA (2022-BSSE-0) B

FAIZA (2022-BSSE-0) B

LAB PROJECT

➤ **PROJECT INTRO:**

In this project basically we create a local area network of a new builded company .this company includes 4 floors each floor having two departments. first floor having sales and HR department, second floor having finance and admin department, third floor having ICT and server room while the fourth floor having main meeting department and labour workers department. Each department consists of vlans including vlan 10, vlan 20, vlan 30, vlan 40, vlan 50, vlan 60, vlan 70, vlan 80.

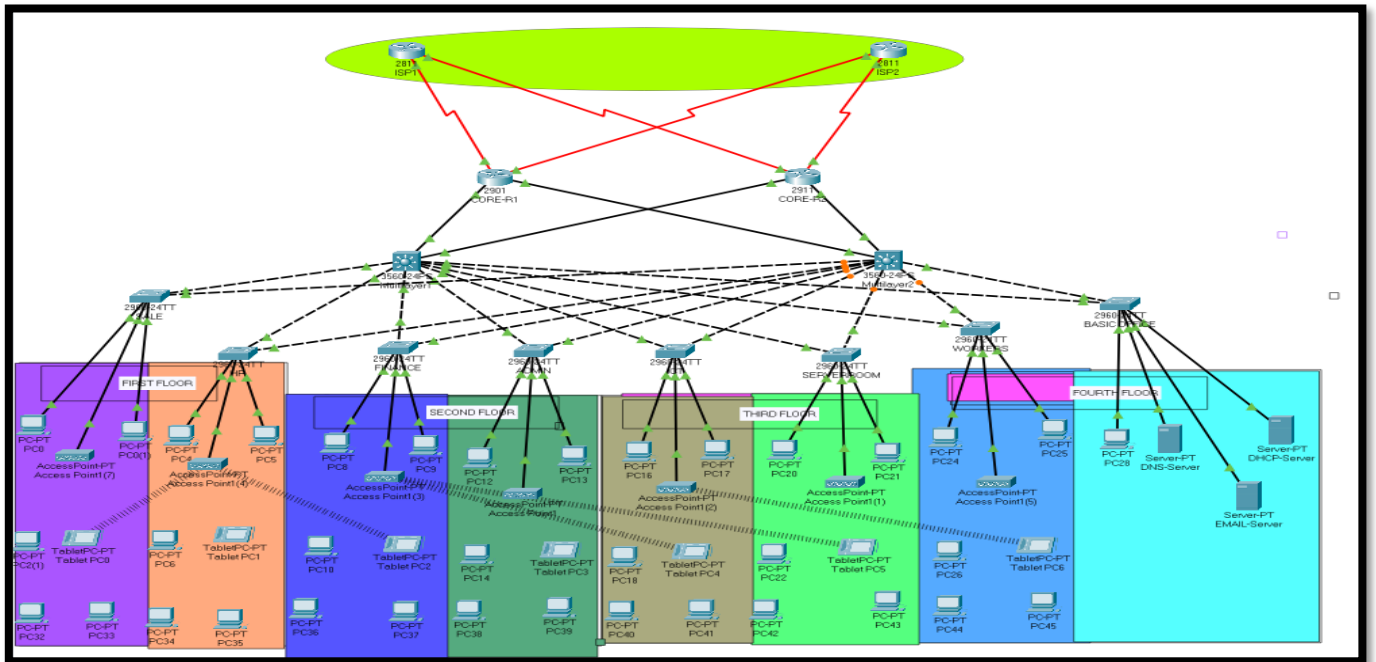
➤ **Devices:**

- In this project we use 4 router out of which two are internet service provider ,while 2 are core routers.
- Having switches two multilayer switches naming multilayer 1 and multilayer 2.while others are named with their departments.
- Including seven access points for the mechanism of wireless configuration.
- Also consists of three server DHCP,EMAIL and DNS server.
- Having seven tablets to see their connection with accesspoint along with PCs for smarter work.
- And also consists of large number of PCs.

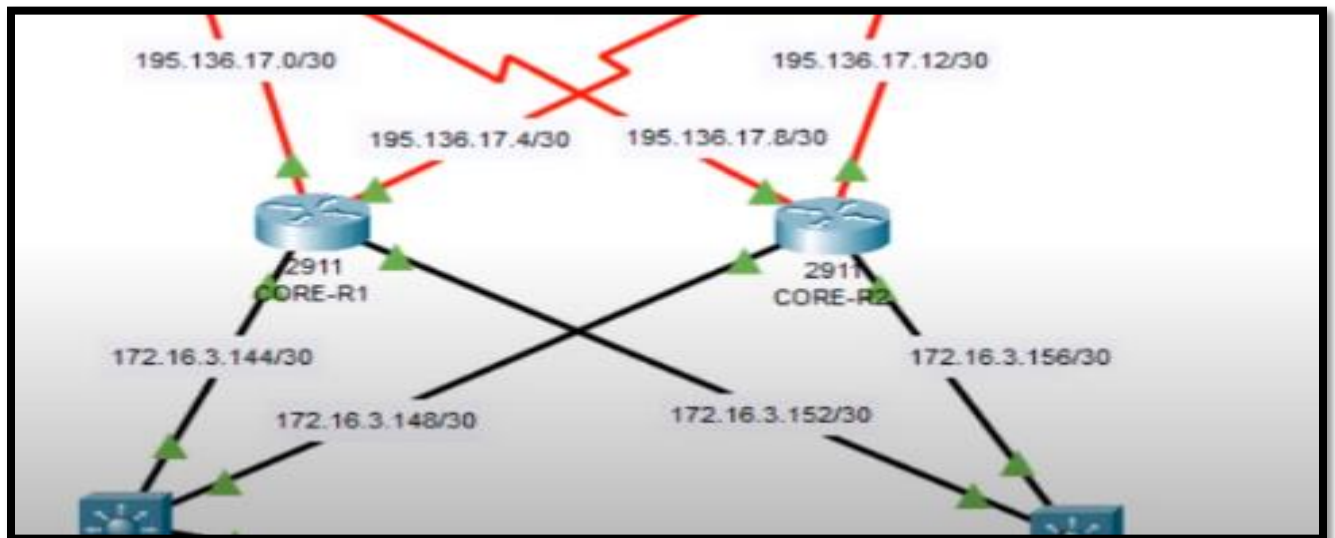
➤ **Tasks:**

- We should perform the following tasks on this networking system:
- Basic settings to all devices and ssh on the routers and no of switches.
- Vlans assessment
- Switchport security to finance department
- Subnetting and ip addressing
- OSPF on the routers and switches
- Static ip address to server room
- DHCP SERVER device configuration
- Inter-vlan routing on the switches and IP DHCP helper addresses
- Wireless network configurations

Network of company management:



Overview Of Their Ip Addresses:



The departments, their network addresses and their host addresses range:

First floor:

<u>department</u>	<u>Network address</u>	<u>Host address range</u>
Sales and marketing	172.16.1.0	172.16.1.1-172.16.1.126
HR logistics	172.16.1.128	172.16.1.129-172.16.1.254

Second floor:

<u>department</u>	<u>Network address</u>	<u>Host address range</u>
finance	172.16.2.0	172.16.2.1-172.16.2.126
admin	172.16.2.128	172.16.2.129-172.16.2.254

Third floor:

<u>department</u>	<u>Network address</u>	<u>Host address range</u>
ICT	172.16.3.0	172.16.3.1-172.16.3.126
Server room	172.16.3.128	172.16.3.129-172.16.3.254

Fourth floor:

<u>department</u>	<u>Network address</u>	<u>Host address range</u>
workers	172.16.4.0	172.16.4.1-172.16.4.126
Basic office	172.16.4.128	172.16.4.129-172.16.4.254

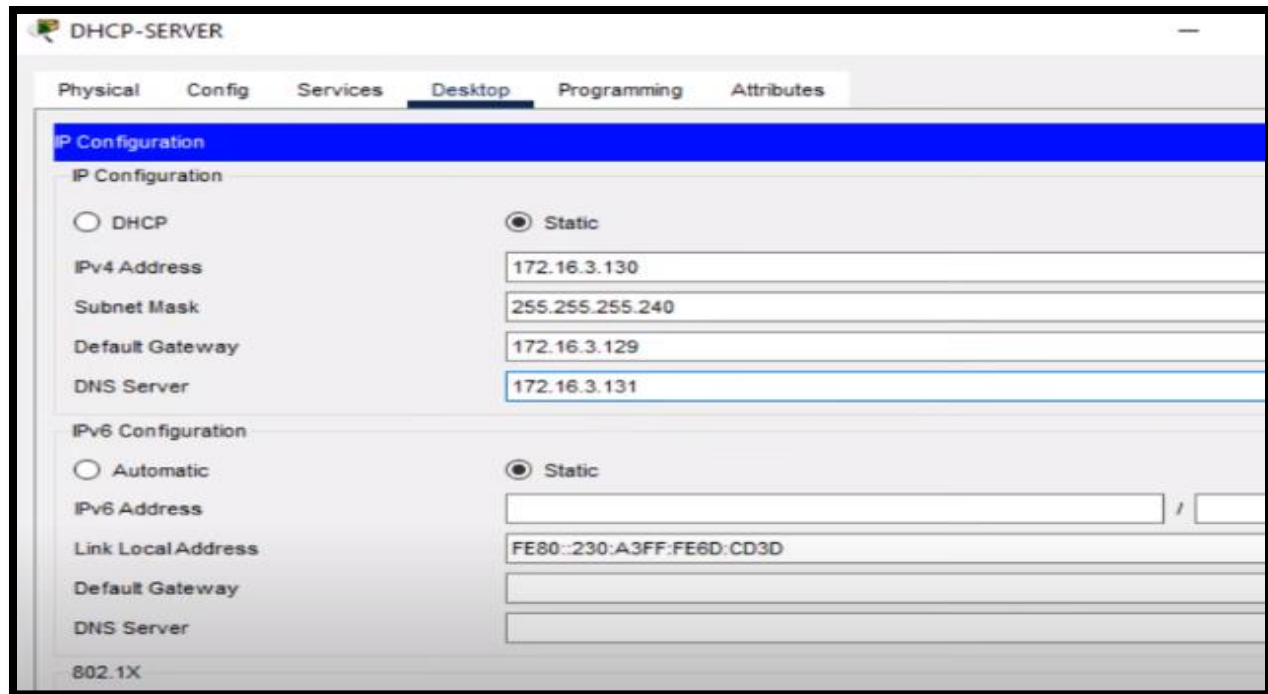
Between the router and one layer of switches:

<u>Number</u>	<u>Network address</u>	<u>Host address range</u>
R1-MLSW-01	172.16.3.144	172.16.3.145-172.16.3.146
R1-MLSW-02	172.16.3.148	172.16.3.149-172.16.3.150
R2-MLSW-01	172.16.3.152	172.16.3.151-172.16.3.154
R2-MLSW-02	172.16.3.156	172.16.3.155-172.16.3.158

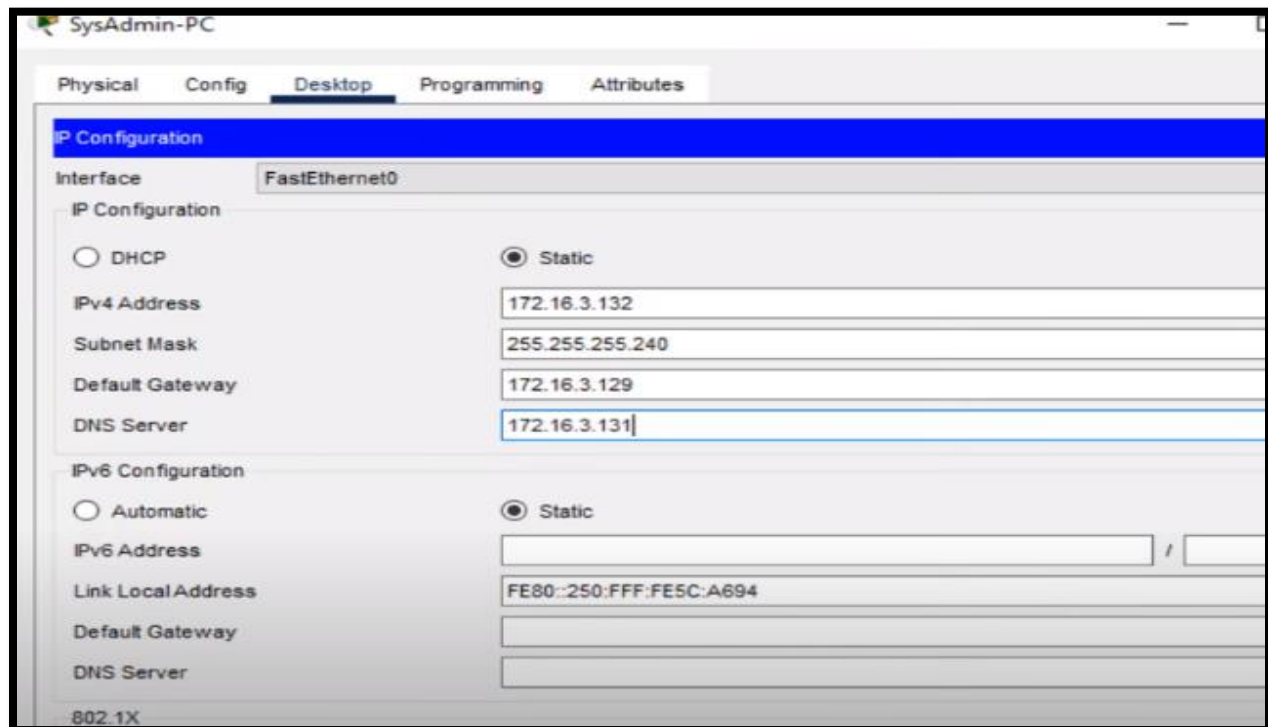
Static IP addressing to servers:

DHCP server:

Static IP addressing involves manually assigning a fixed IP address to a device on a network instead of relying on dynamic IP assignment through DHCP (Dynamic Host Configuration Protocol).



This is the system admin PC making their IP address static:



DNS server making its IP static:

DNS-SERVER

Physical Config **Services** Desktop Programming Attributes

IP Configuration

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 172.16.3.131

Subnet Mask: 255.255.255.240

Default Gateway: 172.16.3.129

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address:

Link Local Address: FE80::2D0:BCFF:FE53:B15C

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

DHCP server for sales pool:

DHCP-SERVER

Physical Config **Services** Desktop Programming Attributes

SERVICES

HTTP

DHCP

DHCPv6

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

IoT

VM Management

Radius EAP

DHCP

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: SalesPool

Default Gateway: 172.168.1.1

DNS Server: 172.16.3.131

Start IP Address: 172 16 1 6

Subnet Mask: 255 255 255 128

Maximum Number of Users: 120

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
SalesPool	172.168.1.1	172.16.3.131	172.16.1.6	255.255.255.128	120	0.0.0.0	0.0.0.0

DHCP serverfor HR pool:

DHCP-SERVER

Physical Config **Services** Desktop Programming Attributes

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: HRPool

Default Gateway: 172.168.1.129

DNS Server: 172.16.3.131

Start IP Address: 172 16 1 6

Subnet Mask: 255 255 255 128

Maximum Number of Users: 120

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
HRPool	172.168.1.129	172.16.3.131	172.16.1.6	255.255.255.128	120	0.0.0.0	0.0.0.0

DHCP server for finance pool:

DHCP-SERVER

Physical Config **Services** Desktop Programming Attributes

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: FinancePool

Default Gateway: 172.168.2.6

DNS Server: 172.16.3.131

Start IP Address: 172 16 1 6

Subnet Mask: 255 255 255 128

Maximum Number of Users: 120

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
HRPool	172.168.1.129	172.16.3.131	172.16.1.6	255.255.255.128	120	0.0.0.0	0.0.0.0
SalesPool	172.168.1.129	172.16.3.131	172.16.1.6	255.255.255.128	120	0.0.0.0	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	172.16.3.131	255.255.255.128	15	0.0.0.0	0.0.0.0

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP

Interface: **FastEthernet0** Service: ☒ On ☐ Off

Pool Name: **FinancePool**

Default Gateway: **172.168.2.0**

DNS Server: **172.16.3.131**

Start IP Address: **172** **16** **2** **5**

Subnet Mask: **255** **255** **255** **128**

Maximum Number of Users: **128**

TFTP Server: **0.0.0.0**

WLC Address: **0.0.0.0**

Add **Save** **Remove**

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
FinancePool	172.168.2.0	172.16.3.131	172.16.2.5	255.255.255.128	128	0.0.0.0	0.0.0.0
AdminPool	172.168.2.0	172.16.3.131	172.16.2.5	255.255.255.128	128	0.0.0.0	0.0.0.0
HRPool	172.168.2.0	172.16.3.131	172.16.2.5	255.255.255.128	128	0.0.0.0	0.0.0.0

DHCP server for ICT pool:

Desktop **Programming** **Attributes**

Global Settings

Display Name: **ICT-PC**

Interfaces: **FastEthernet0**

Gateway/DNS IPv4

☒ DHCP ☐ Static

Default Gateway: **172.168.3.1**

DNS Server: **172.16.3.131**

Gateway/DNS IPv6

☐ Automatic ☒ Static

Default Gateway:

DNS Server:

An overview of DNS service:

Physical Config **Services** Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS**
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT

DNS

DNS Service ☒ On ☐ Off

Resource Records

Name Type **A Record**

Address

Add **Save** **Remove**

No.	Name	Type	Detail
0	www.gtech.com	A Record	172.16.3.131

WIRELESS CONNECTION:

Building wireless connections between devices on a network involves setting up a wireless network infrastructure. Setting up a wireless network involves selecting the hardware, such as routers, access points, and network interface cards. Here we have chosen the access points. Following this, a wireless router or access point is configured. Then we connected Devices to the wireless network and so on.

Sales-Tablet

Physical **Config** Desktop Programming Attributes

GLOBAL

- Settings
- Algorithm Settings
- INTERFACE**
- Wireless0
- 3G/4G Cell1
- Bluetooth

Wireless0

Port Status ☒

Bandwidth 24 Mbps

MAC Address 00D0.D3E3.0265

SSID Sales-AP

Authentication

☐ Disabled ☐ WEP ☒ WPA2-PSK ☐ WPA ☐ 802.1X

Method: ☐ WPA2

WEP Key

PSK Pass Phrase Sales-AP123

User ID

Password

Method: MD5

User Name

Password

Encryption Type AES

IP Configuration

☒ DHCP ☐ Static

IPv4 Address 172.16.2.134

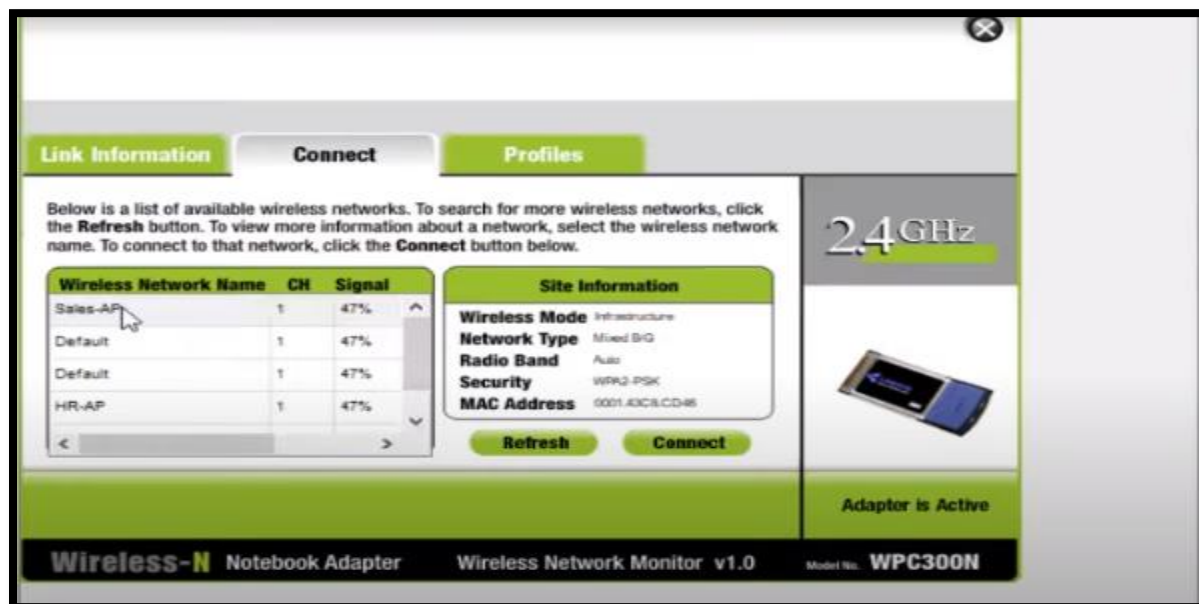
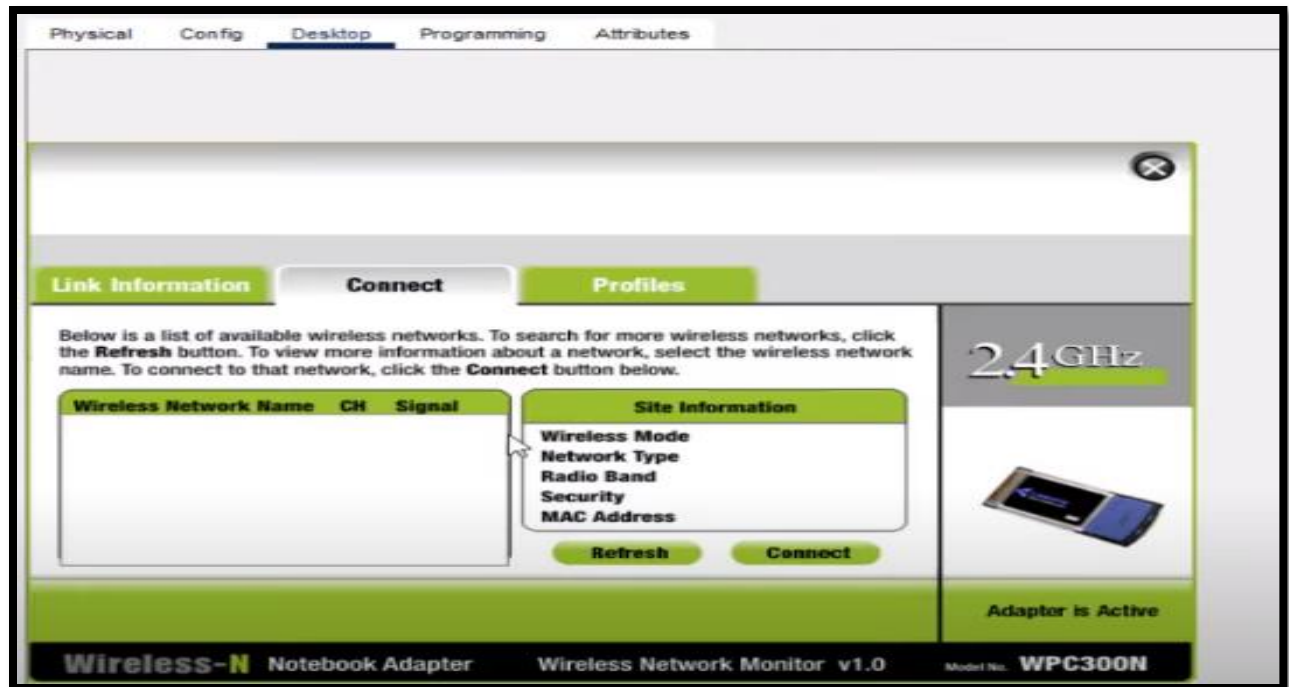
Subnet Mask 255.255.255.128

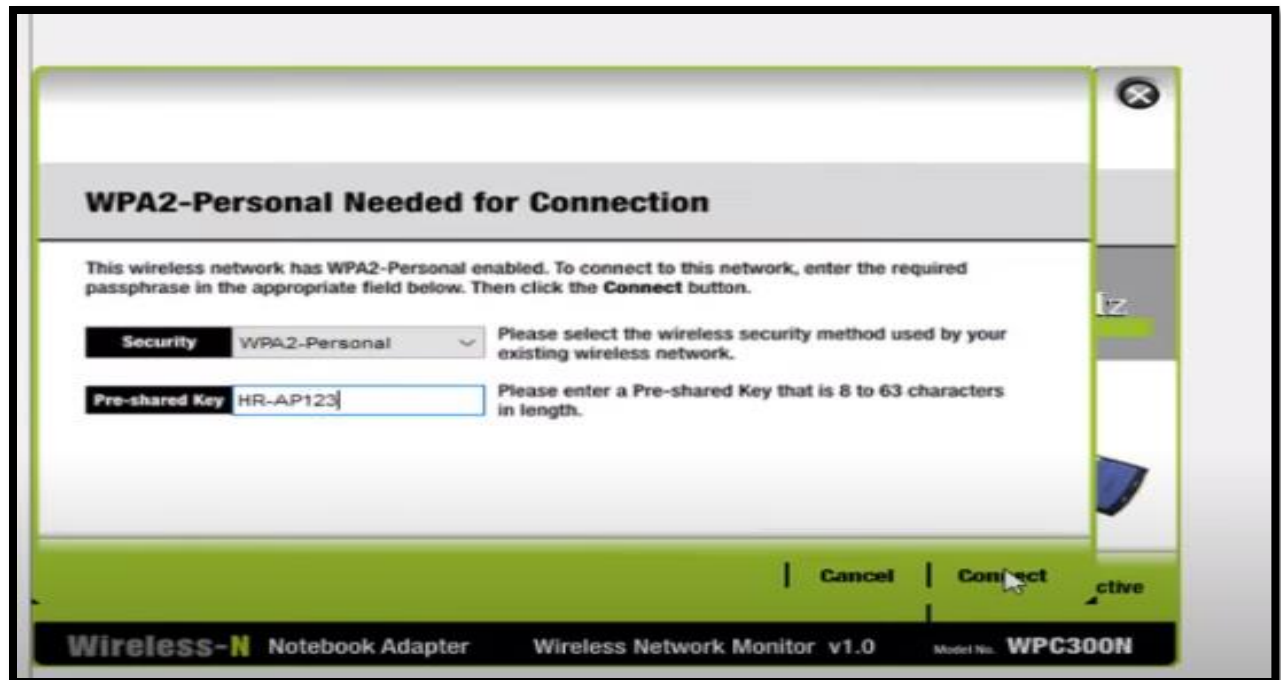
IPv6 Configuration

☐ Automatic ☒ Static

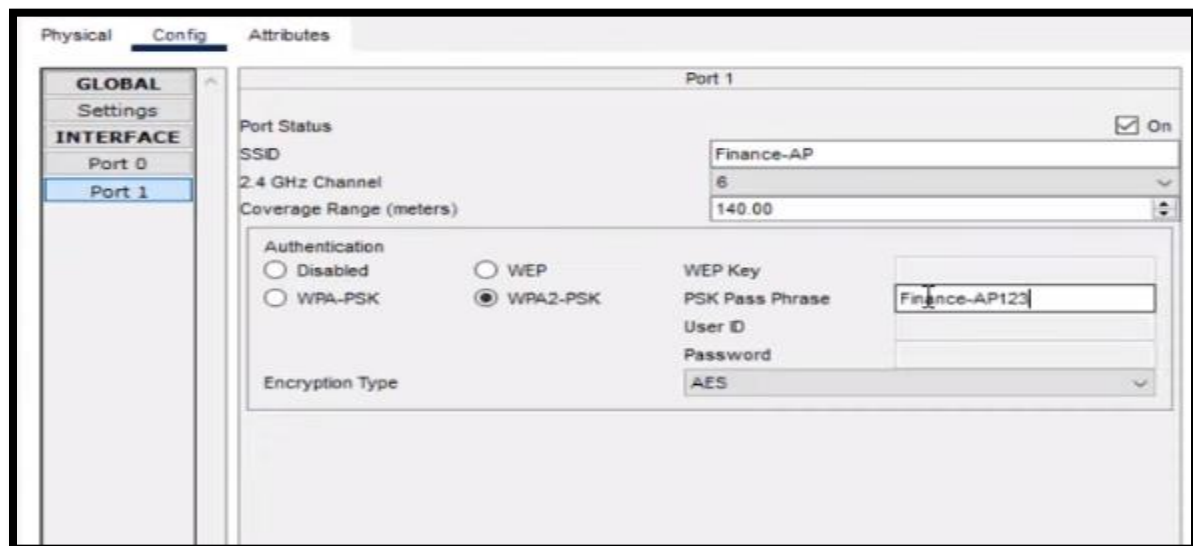
IPv6 Address

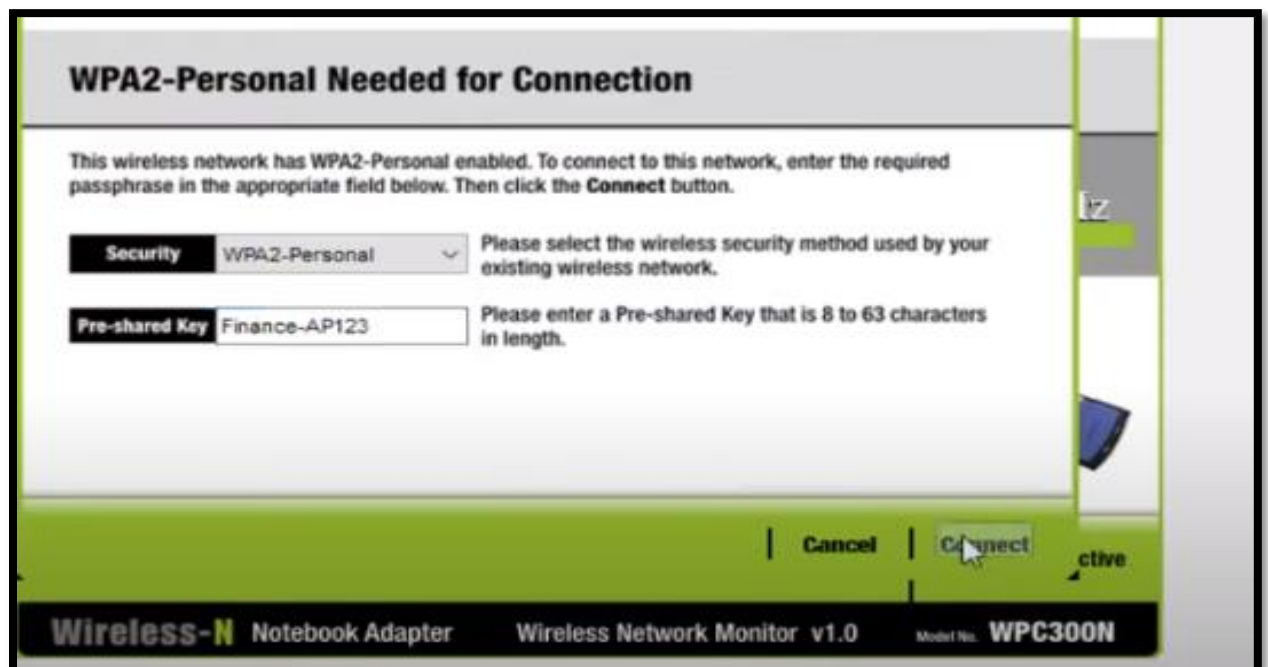
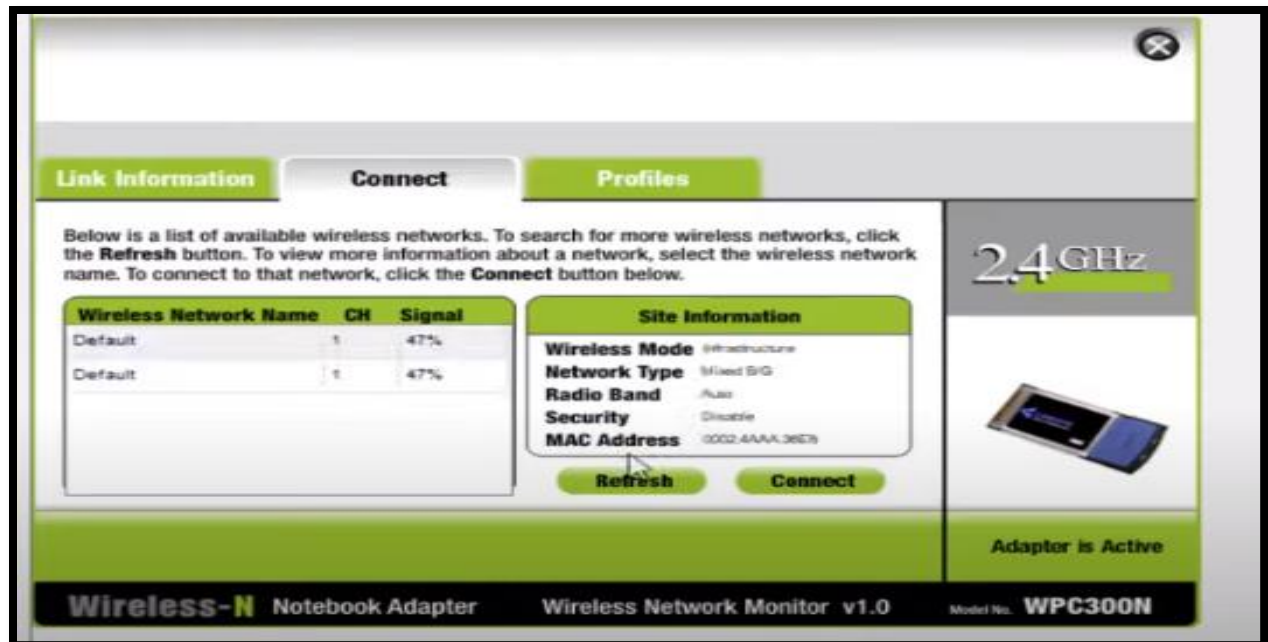
Link Local Address FE80:2D0:D3FF:FE3:265



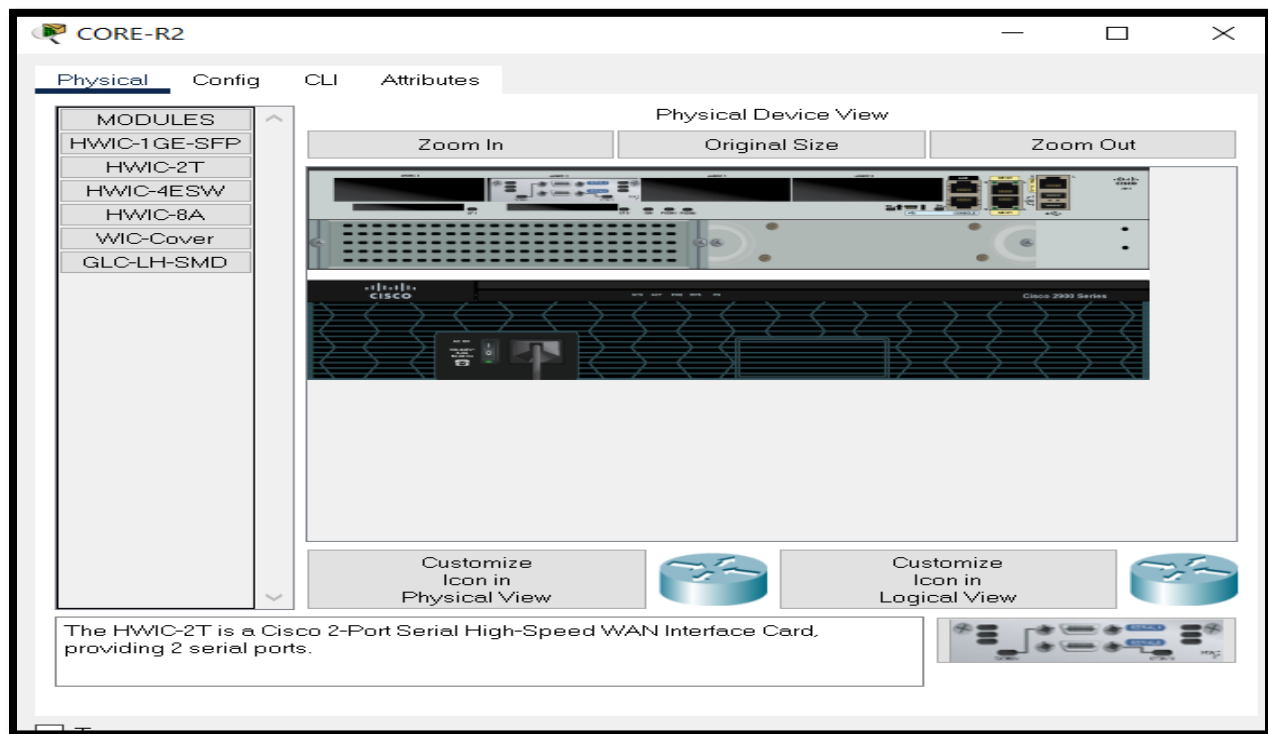
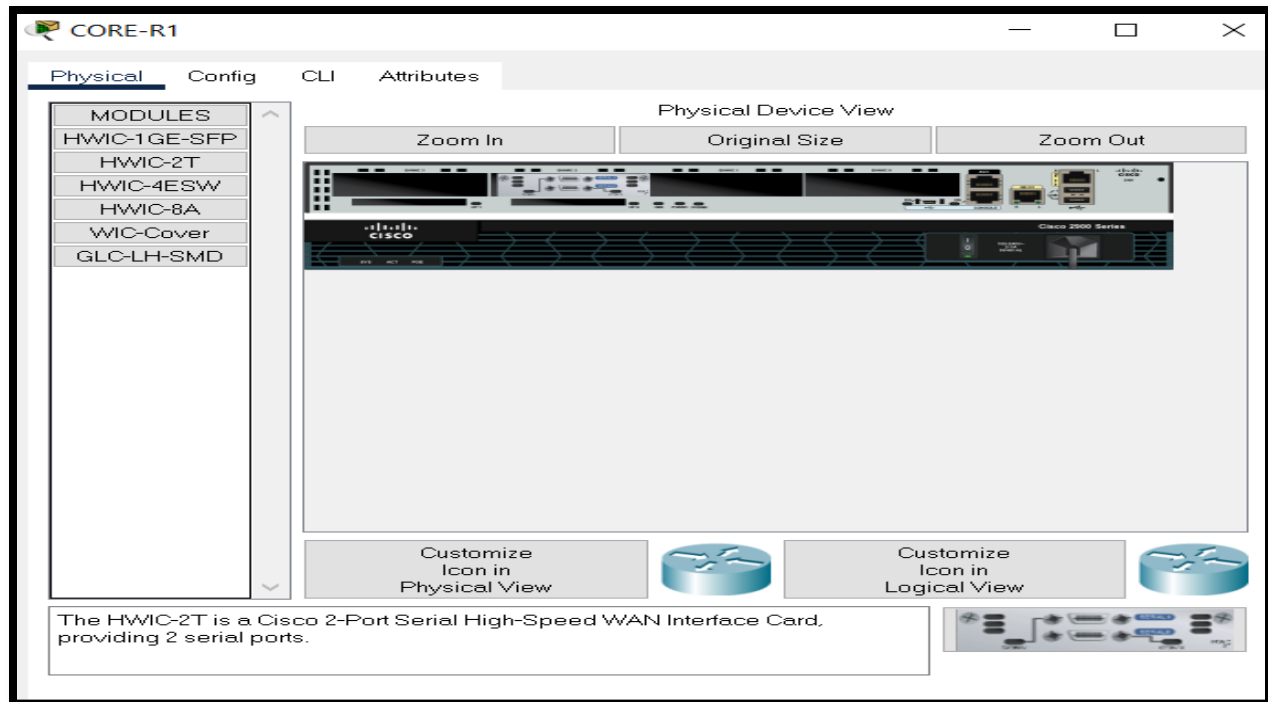


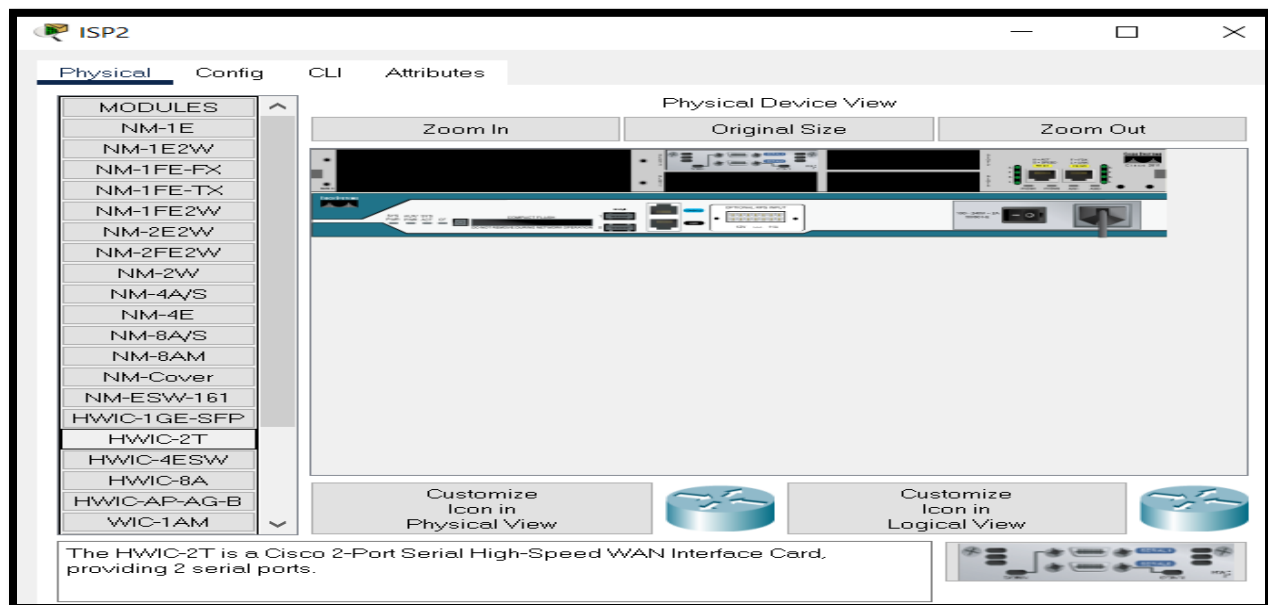
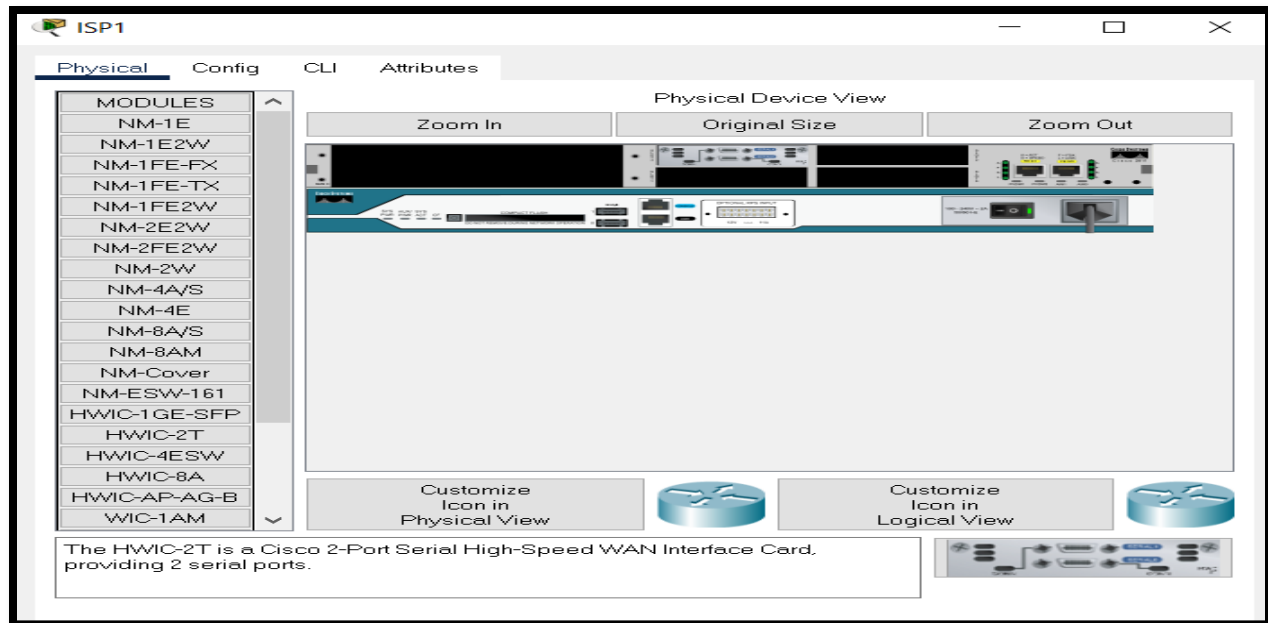
Configuration of the access point of finance department:



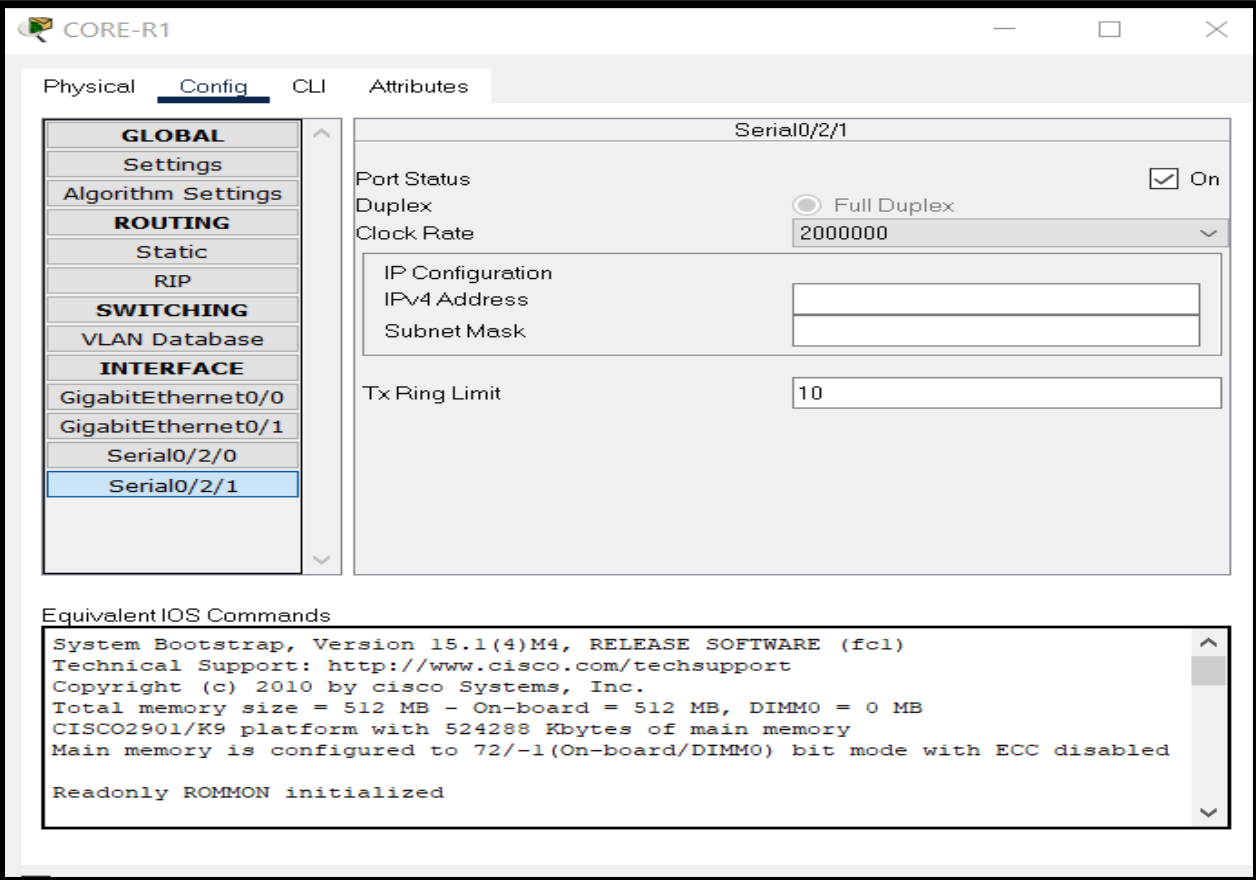


Physical settings of ISP and CORE 1,2:





SERIAL AND GIGABIT ETHERNET GET ON OF CORE ROUTER 1:



The screenshot shows the configuration window for CORE-R1. The 'Config' tab is selected. On the left, the 'INTERFACE' section is expanded, and 'Serial0/2/1' is selected. The main configuration area for 'Serial0/2/1' shows the following settings:

- Port Status: ☒ On
- Duplex: ☐ Full Duplex
- Clock Rate: 2000000
- IP Configuration: IPv4 Address and Subnet Mask fields are empty.
- Tx Ring Limit: 10

Below the configuration area, the 'Equivalent IOS Commands' section displays the following text:

```
System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2010 by cisco Systems, Inc.
Total memory size = 512 MB - On-board = 512 MB, DIMM0 = 0 MB
CISCO2901/K9 platform with 524288 Kbytes of main memory
Main memory is configured to 72/-1(On-board/DIMM0) bit mode with ECC disabled
Readonly ROMMON initialized
```

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to up
Router(config-if)#exit
Router(config)#interface Serial0/2/0
Router(config-if)#no shutdown
Router(config-if)#
```

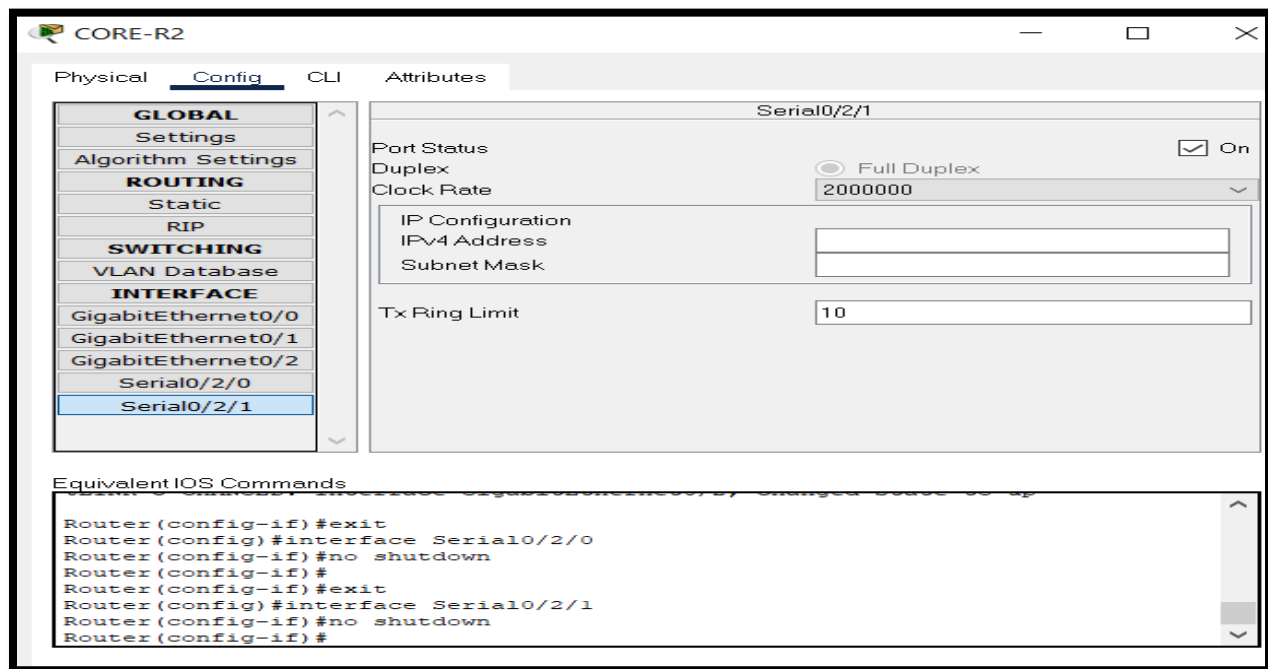


```

Router(config-if)#exit
Router(config)#interface Serial0/2/0
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/2/1
Router(config-if)#no shutdown
Router(config-if)#

```

SERIAL AND GIGABIT ETHERNET GET ON OF CORE ROUTER 2:



```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
```

```
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
```

```
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/2
Router(config-if)#no shutdown
Router(config-if)#
```

```
Router(config-if)#exit
Router(config)#interface Serial0/2/0
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/2/1
Router(config-if)#no shutdown
Router(config-if)#
```

SERIAL AND FASTETHERNET GET ON OF ISP1:

The screenshot shows a window titled "ISP1" with tabs for Physical, Config, CLI, and Attributes. The "Config" tab is active, showing a tree view on the left with categories: GLOBAL (Settings, Algorithm Settings), ROUTING (Static, RIP), SWITCHING (VLAN Database), and INTERFACE (FastEthernet0/0, FastEthernet0/1, Serial0/3/0, Serial0/3/1). The "Serial0/3/1" interface is selected. The main configuration area shows: Port Status (On), Duplex (Full Duplex), Clock Rate (2000000), IP Configuration (IPv4 Address and Subnet Mask fields), and Tx Ring Limit (10). At the bottom, the "Equivalent IOS Commands" section displays the following commands:

```
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/3/1
Router(config-if)#no shutdown
```

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
```

```
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/3/0
Router(config-if)#no shutdown
```

```
Router(config-if)#exit
Router(config)#interface Serial0/3/1
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up

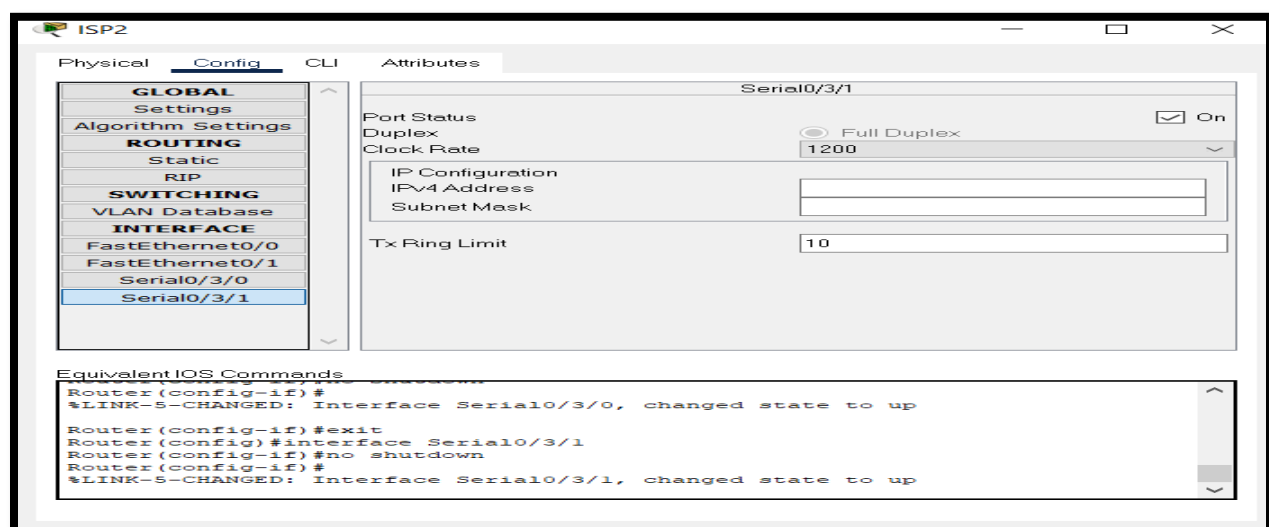
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
```

```
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/1, changed state to up
```

SERIAL AND FASTETHERNET GET ON OF ISP2:



```
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/3/0
Router(config-if)#no shutdown
```

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
```

```
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/3/1
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up
```

```
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/1, changed state to up
```

Sales department configuration:

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname SALE-SW
SALE-SW(config)#banner motd#NO Un#
^
% Invalid input detected at '^' marker.
SALE-SW(config)#banner motd#NO Unauthorized Access!!!#
^
% Invalid input detected at '^' marker.
SALE-SW(config)#banner motd #NO Unauthorized Access!!!#
SALE-SW(config)#no ip domain lookup
SALE-SW(config)#line console 0
SALE-SW(config-line)#passw cisco
SALE-SW(config-line)#login
SALE-SW(config-line)#exit
SALE-SW(config)#enable pass
% Incomplete command.
SALE-SW(config)#enable password cisco
^
% Invalid input detected at '^' marker.
SALE-SW(config)#enable password cisco
```

HR department configuration:

```
SALE-SW(config)#service password-encryption
SALE-SW(config)#exit
SALE-SW#
%SYS-5-CONFIG_I: Configured from console by console

SALE-SW#wr
Building configuration...
[OK]
SALE-SW#
```

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname HR-SW
HR-SW(config)#banner motd #NO Unauthorized Access!!!#
HR-SW(config)#no ip domain lookup
HR-SW(config)#line console 0
HR-SW(config-line)#passw cisco
HR-SW(config-line)#login
HR-SW(config-line)#exit
HR-SW(config)#enable password cisco
HR-SW(config)#service password-encryption
HR-SW(config)#exit
HR-SW#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
HR-SW#
```

Finance department configuration:

```
Switch>enable
Switch#cong t
      ^
% Invalid input detected at '^' marker.

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname FINANCE-SW
FINANCE-SW(config)#banner motd #NO Unauthorized Access!!!#
FINANCE-SW(config)#no ip domain lookup
FINANCE-SW(config)#line console 0
FINANCE-SW(config-line)#passw cisco
FINANCE-SW(config-line)#service password-encryption
FINANCE-SW(config)#exit
FINANCE-SW#
%SYS-5-CONFIG_I: Configured from console by console

FINANCE-SW#wr
Building configuration...
[OK]
FINANCE-SW#
```

```

Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname FINANCE-SW
FINANCE-SW(config)#banner motd #NO Unauthorized Access!!!#
FINANCE-SW(config)#no ip domain lookup
FINANCE-SW(config)#line console 0
FINANCE-SW(config-line)#passw cisco
FINANCE-SW(config-line)#login
FINANCE-SW(config-line)#exit
FINANCE-SW(config)#enable password cisco
FINANCE-SW(config)#service password-encryption
FINANCE-SW(config)#exit
FINANCE-SW#
%SYS-5-CONFIG_I: Configured from console by console

FINANCE-SW#wr
Building configuration...
[OK]
FINANCE-SW#

```

ICT department configuration:

```

Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname ICT-SW
ICT-SW(config)#banner motd #NO Unauthorized Access!!!#
ICT-SW(config)#no ip domain lookup
ICT-SW(config)#line console 0
ICT-SW(config-line)#passw cisco
ICT-SW(config-line)#login
ICT-SW(config-line)#exit
ICT-SW(config)#enablepassword cisco
                        ^
% Invalid input detected at '^' marker.

ICT-SW(config)#enable password cisco
ICT-SW(config)#service password-encryption
ICT-SW(config)#exit
ICT-SW#
%SYS-5-CONFIG_I: Configured from console by console

ICT-SW#wr
Building configuration...
[OK]
ICT-SW#

```

Serverroom department configuration:

```

Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname SERVERROOM-SW
SERVERROOM-SW(config)#banner motd #NO Unauthorized Access!!!#
SERVERROOM-SW(config)#no ip domain lookup
SERVERROOM-SW(config)#line console 0
SERVERROOM-SW(config-line)#passw cisco
SERVERROOM-SW(config-line)#login
SERVERROOM-SW(config-line)#exit
SERVERROOM-SW(config)#enable password cisco
SERVERROOM-SW(config)#service password-encryption
SERVERROOM-SW(config)#exit
SERVERROOM-SW#
%SYS-5-CONFIG_I: Configured from console by console

SERVERROOM-SW#wr
Building configuration...
[OK]
SERVERROOM-SW#

```

Worker department configuration:

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname WORKER-SW
WORKER-SW(config)#banner motd #NO Unauthorized Access!!!#
WORKER-SW(config)#no ip domain lookup
WORKER-SW(config)#line console 0
WORKER-SW(config-line)#passw cisco
WORKER-SW(config-line)#login
WORKER-SW(config-line)#exit
WORKER-SW(config)#enable password cisco
^
% Invalid input detected at '^' marker.

WORKER-SW(config)#enable password cisco
WORKER-SW(config)#service password-encryption
WORKER-SW(config)#exit
WORKER-SW#
%SYS-5-CONFIG_I: Configured from console by console

WORKER-SW#wr
Building configuration...
[OK]
WORKER-SW#
```

Basic office department configuration:

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname BASIC OFFICE-SW
^
% Invalid input detected at '^' marker.

Switch(config)#hostname BASICOFFICE-SW
BASICOFFICE-SW(config)#banner motd #NO Unauthorized Access!!!#
BASICOFFICE-SW(config)#no ip domain lookup
BASICOFFICE-SW(config)#line console 0
BASICOFFICE-SW(config-line)#passw cisco
BASICOFFICE-SW(config-line)#login
BASICOFFICE-SW(config-line)#exit
BASICOFFICE-SW(config)#enable password cisco
BASICOFFICE-SW(config)#servicepassword-encryption
^
% Invalid input detected at '^' marker.

BASICOFFICE-SW(config)#service password-encryption
BASICOFFICE-SW(config)#exit
BASICOFFICE-SW#
%SYS-5-CONFIG_I: Configured from console by console

BASICOFFICE-SW#wr
Building configuration...
[OK]
BASICOFFICE-SW#
```

Multilayer switch 1 configuration:

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(Config)#hostname multilayer-SW1
multilayer-SW1(config)#banner motd #NO Unauthorized Access!!!#
multilayer-SW1(config)#no ip domain lookup
multilayer-SW1(config)#line console 0
multilayer-SW1(config-line)#passw cisco
multilayer-SW1(config-line)#login
multilayer-SW1(config-line)#exit
multilayer-SW1(config)#enable password cisco
multilayer-SW1(config)#service password-encryption
multilayer-SW1(config)#exit
multilayer-SW1#
%SYS-5-CONFIG_I: Configured from console by console

multilayer-SW1#wr
Building configuration...
[OK]
multilayer-SW1#
```


Multilayer switch 2 configuration:

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname multilayer-SW2
multilayer-SW2(config)#banner motd #NO Unauthorized Access!!!#
multilayer-SW2(config)#no ip domain lookup
multilayer-SW2(config)#line console 0
multilayer-SW2(config-line)#passw cisco
multilayer-SW2(config-line)#login
multilayer-SW2(config-line)#exit
multilayer-SW2(config)#enable password cisco
multilayer-SW2(config)#service password-encryption
multilayer-SW2(config)#exit
multilayer-SW2#
%SYS-5-CONFIG_I: Configured from console by console

multilayer-SW2#wr
Building configuration...
[OK]
multilayer-SW2#
```

```
multilayer-SW1(config)#ip domain name cisco.net
multilayer-SW1(config)#user admin password cisco
multilayer-SW1(config)#crypto key generate rsa
The name for the keys will be: multilayer-SW1.cisco.net
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

multilayer-SW1(config)#line vty 0-15
*Mar 1 1:39:49.657: %SSH-5-ENABLED: SSH 1.99 has been enabled
```

```
multilayer-SW1(config)#line vty 0 15
multilayer-SW1(config-line)#login local
multilayer-SW1(config-line)#transport input ssh
multilayer-SW1(config-line)#exit
multilayer-SW1(config)#do wr
Building configuration...
[OK]
multilayer-SW1(config)#
```

```
multilayer-SW2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
multilayer-SW2(config)#ip domain name cisco.net
multilayer-SW2(config)#user admin password cisco
multilayer-SW2(config)#crypto key generate rsa
The name for the keys will be: multilayer-SW2.cisco.net
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

multilayer-SW2(config)#line vty 1 15
*Mar 1 1:42:2.410: %SSH-5-ENABLED: SSH 1.99 has been enabled
multilayer-SW2(config-line)#login local
multilayer-SW2(config-line)#transport input ssh
^
% Invalid input detected at '^' marker.

multilayer-SW2(config-line)#transport input ssh
multilayer-SW2(config-line)#exit
multilayer-SW2(config)#do wr
Building configuration...
[OK]
multilayer-SW2(config)#
```

Configuration of vlan 10 starts:


```

Sales-SW(config)#int range fa0/1-2
Sales-SW(config-if-range)#swit
Sales-SW(config-if-range)#switchport m
Sales-SW(config-if-range)#switchport mode tr
Sales-SW(config-if-range)#switchport mode trunk

Sales-SW(config-if-range)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed stat
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed stat
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed stat
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed stat

Sales-SW(config-if-range)#
Sales-SW(config-if-range)#
Sales-SW(config-if-range)#
Sales-SW(config-if-range)#exi

```

```

Sales-SW(config)#vlan 10
Sales-SW(config-vlan)#name Sales
Sales-SW(config-vlan)#
Sales-SW(config-vlan)#ex
Sales-SW(config)#
Sales-SW(config)#
Sales-SW(config)#int range fa0/3-24
Sales-SW(config-if-range)#switc
Sales-SW(config-if-range)#switchport m
Sales-SW(config-if-range)#switchport mode a
Sales-SW(config-if-range)#switchport mode access
Sales-SW(config-if-range)#switchport mode access
Sales-SW(config-if-range)#switchport mode access
Sales-SW(config-if-range)#switchport a
Sales-SW(config-if-range)#switchport access v
Sales-SW(config-if-range)#switchport access vlan 10
Sales-SW(config-if-range)#ex
Sales-SW(config)#

```

Configuration of vlan 20:

```

HR-SW(config)#
HR-SW(config)#vlan 20
HR-SW(config-vlan)#name HR
HR-SW(config-vlan)#vlan 99
HR-SW(config-vlan)#name BlackHole
HR-SW(config-vlan)#exit
HR-SW(config)#
HR-SW(config)#int range fa0/3-24
HR-SW(config-if-range)#switchport mode access
HR-SW(config-if-range)#switchport access vlan 20
HR-SW(config-if-range)#exit
HR-SW(config)#
HR-SW(config)#int range gig0/1-2
HR-SW(config-if-range)#switchport mode access
HR-SW(config-if-range)#switchport access vlan 99
HR-SW(config-if-range)#exit
HR-SW(config)#
HR-SW(config)#do wr
Building configuration...
[OK]

```

Configuration of vlan 30:

```

Finance-SW(config-if-range)#exit
Finance-SW(config)#
Finance-SW(config)#vlan 30
Finance-SW(config-vlan)#name Finance
Finance-SW(config-vlan)#vlan 99
Finance-SW(config-vlan)#name BlackHole
Finance-SW(config-vlan)#exit
Finance-SW(config)#
Finance-SW(config)#int range fa0/3-24
Finance-SW(config-if-range)#switchport mode access
Finance-SW(config-if-range)#switchport access vlan 30
Finance-SW(config-if-range)#exit
Finance-SW(config)#
Finance-SW(config)#int range gig0/1-2
Finance-SW(config-if-range)#switchport mode access
Finance-SW(config-if-range)#switchport access vlan 99
Finance-SW(config-if-range)#exit
Finance-SW(config)#
Finance-SW(config)#do wr
Building configuration...
[OK]
Finance-SW(config)#
Finance-SW(config)#

```

Configuration of vlan 40:

```

Admin-SW(config-if-range)#exit
Admin-SW(config)#
Admin-SW(config)#vlan 40
Admin-SW(config-vlan)#name Admin
Admin-SW(config-vlan)#vlan 99
Admin-SW(config-vlan)#name BlackHole
Admin-SW(config-vlan)#exit
Admin-SW(config)#
Admin-SW(config)#int range fa0/3-24
Admin-SW(config-if-range)#switchport mode access
Admin-SW(config-if-range)#switchport access vlan 40
Admin-SW(config-if-range)#exit
Admin-SW(config)#
Admin-SW(config)#int range gig0/1-2
Admin-SW(config-if-range)#switchport mode access
Admin-SW(config-if-range)#switchport access vlan 99
Admin-SW(config-if-range)#exit
Admin-SW(config)#
Admin-SW(config)#do wr
Building configuration...
[OK]
Admin-SW(config)#

```

Configuration of vlan 50:

```

ICT-SW(config)#vlan 50
ICT-SW(config-vlan)#name ICT
ICT-SW(config-vlan)#vlan 99
ICT-SW(config-vlan)#name BlackHole
ICT-SW(config-vlan)#exit
ICT-SW(config)#
ICT-SW(config)#int range fa0/3-24
ICT-SW(config-if-range)#switchport mode access
ICT-SW(config-if-range)#switchport access vlan 50
ICT-SW(config-if-range)#exit
ICT-SW(config)#
ICT-SW(config)#int range gig0/1-2
ICT-SW(config-if-range)#switchport mode access
ICT-SW(config-if-range)#switchport access vlan 99
ICT-SW(config-if-range)#exit
ICT-SW(config)#
ICT-SW(config)#do wr
Building configuration...
[OK]
ICT-SW(config)#

```

Configuration of vlan 60:

```

ServerRoom-SW(config)#
ServerRoom-SW(config)#vlan 60
ServerRoom-SW(config-vlan)#name ServerRoom
ServerRoom-SW(config-vlan)#vlan 99
ServerRoom-SW(config-vlan)#name BlackHole
ServerRoom-SW(config-vlan)#exit
ServerRoom-SW(config)#
ServerRoom-SW(config)#int range fa0/3-24
ServerRoom-SW(config-if-range)#switchport mode access
ServerRoom-SW(config-if-range)#switchport access vlan 60
ServerRoom-SW(config-if-range)#exit
ServerRoom-SW(config)#
ServerRoom-SW(config)#int range gig0/1-2
ServerRoom-SW(config-if-range)#switchport mode access
ServerRoom-SW(config-if-range)#switchport access vlan 99
ServerRoom-SW(config-if-range)#exit
ServerRoom-SW(config)#
ServerRoom-SW(config)#do wr
Building configuration...
[OK]
ServerRoom-SW(config)#

```

Switch port security:

Enhances the security of a network by controlling the access to individual switch ports. It helps prevent unauthorized devices from connecting to the network and protects against various security threats. With the ability to shut down or restrict unused ports, as well as providing monitoring and logging functionalities, switch port security ensures a robust defense against unauthorized access and helps maintain the integrity of the network infrastructure.

Switch Port security of finance department:

```

Finance-SW(config)#int range fa0/3-24
Finance-SW(config-if-range)#swit
Finance-SW(config-if-range)#switchport p
Finance-SW(config-if-range)#switchport port
Finance-SW(config-if-range)#switchport port-security
Finance-SW(config-if-range)#switchport port-security ma
Finance-SW(config-if-range)#switchport port-security maximum 1
Finance-SW(config-if-range)#switchport port-security mac
Finance-SW(config-if-range)#switchport port-security mac-address st
Finance-SW(config-if-range)#switchport port-security mac-address sticky
Finance-SW(config-if-range)#sw
Finance-SW(config-if-range)#switchport port

```

```

Finance-SW(config-if-range)#switchport port-security violation shutdown
Finance-SW(config-if-range)#ex
Finance-SW(config)#
Finance-SW(config)#
Finance-SW(config)#do wr
Building configuration...
[OK]
Finance-SW(config)#do sh port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
      (Count)              (Count)              (Count)
-----
Fa0/3      1              0              0      Shutdown
Fa0/4      1              0              0      Shutdown
Fa0/5      1              0              0      Shutdown
Fa0/6      1              0              0      Shutdown
Fa0/7      1              0              0      Shutdown
Fa0/8      1              0              0      Shutdown
Fa0/9      1              0              0      Shutdown
Fa0/10     1              0              0      Shutdown
Fa0/11     1              0              0      Shutdown
Fa0/12     1              0              0      Shutdown
Fa0/13     1              0              0      Shutdown
Fa0/14     1              0              0      Shutdown

```

```

Fa0/15     1              0              0      Shutdown
Fa0/16     1              0              0      Shutdown
Fa0/17     1              0              0      Shutdown
Fa0/18     1              0              0      Shutdown
Fa0/19     1              0              0      Shutdown
Fa0/20     1              0              0      Shutdown
Fa0/21     1              0              0      Shutdown
Fa0/22     1              0              0      Shutdown
Fa0/23     1              0              0      Shutdown
Fa0/24     1              0              0      Shutdown

```

Connection of multiplier switch 01 with vlans:

```

Mlt-SW1(config)#int range gig1/0/3-8
Mlt-SW1(config-if-range)#switchport mode trunk
Mlt-SW1(config-if-range)#
Mlt-SW1(config-if-range)#vlan 10
Mlt-SW1(config-vlan)#name Sales
Mlt-SW1(config-vlan)#Vlan 20
Mlt-SW1(config-vlan)#name HR
Mlt-SW1(config-vlan)#vlan 30
Mlt-SW1(config-vlan)#name Finance
Mlt-SW1(config-vlan)#Vlan 40
Mlt-SW1(config-vlan)#name Admin
Mlt-SW1(config-vlan)#vlan 50
Mlt-SW1(config-vlan)#name ICT
Mlt-SW1(config-vlan)#Vlan 60
Mlt-SW1(config-vlan)#name ServerRoom
Mlt-SW1(config-vlan)#
Mlt-SW1(config-vlan)#exit

```

Subsetting and IP Addressing:

```

CORE-SW1(config)#
Enter configuration commands, one per line. End with CNTL/Z.
CORE-SW1(config)#interface GigabitEthernet0/0
CORE-SW1(config-if)#
CORE-SW1(config-if)#
CORE-SW1(config-if)#ip add 172.16.3.146 255.255.255.252
CORE-SW1(config-if)#no sh
CORE-SW1(config-if)#
CORE-SW1(config-if)#
CORE-SW1(config)#
CORE-SW1(config)#
CORE-SW1(config)#interface GigabitEthernet0/1
CORE-SW1(config-if)#ip add 172.16.3.154 255.255.255.252
CORE-SW1(config-if)#no sh
CORE-SW1(config-if)#
CORE-SW1(config-if)#
CORE-SW1(config-if)#
CORE-SW1(config-if)#ex
CORE-SW1(config)#
CORE-SW1(config)#
CORE-SW1(config)#int se0/2/0
CORE-SW1(config-if)#clock
CORE-SW1(config-if)#clock s
CORE-SW1(config-if)#clock rate 64000
CORE-SW1(config-if)#ip add 195.136.17.1 255.255.255.252
CORE-SW1(config-if)#no sh
CORE-SW1(config-if)#ex
CORE-SW1(config)#
CORE-SW1(config)#
CORE-SW1(config)#int se0/2/1
CORE-SW1(config-if)#clock rate 64000
CORE-SW1(config-if)#ip add 195.136.17.2 255.255.255.252
CORE-SW1(config-if)#no

```

```

CORE-SW2(config)#
Enter configuration commands, one per line. End with CNTL/Z.
CORE-SW2(config)#interface GigabitEthernet0/0
CORE-SW2(config-if)#ip add 172.16.3.150 255.255.255.252
CORE-SW2(config-if)#no sh
CORE-SW2(config-if)#
CORE-SW2(config-if)#
CORE-SW2(config-if)#ex
CORE-SW2(config)#
CORE-SW2(config)#
CORE-SW2(config)#interface GigabitEthernet0/1
CORE-SW2(config-if)#ip add 172.16.3.156 255.255.255.252
CORE-SW2(config-if)#no sh
CORE-SW2(config-if)#ex
CORE-SW2(config)#
CORE-SW2(config)#
CORE-SW2(config)#int se0/2/0
CORE-SW2(config-if)#ip add 195.136.17.5 255.255.255.252
CORE-SW2(config-if)#no sh
CORE-SW2(config-if)#clock
CORE-SW2(config-if)#clock ra
CORE-SW2(config-if)#clock rate 64000
CORE-SW2(config-if)#ex
CORE-SW2(config)#
CORE-SW2(config)#
CORE-SW2(config)#int se0/2/1
CORE-SW2(config-if)#clock rate 64000
CORE-SW2(config-if)#no sh
CORE-SW2(config-if)#ip add 195.136.17.3 255.255.255.252

```

```

Mlt-SW2(config)#int gig1/0/1
Mlt-SW2(config-if)#ip add 172.168.3.153 255.255.255.252
Mlt-SW2(config-if)#no sh
Mlt-SW2(config-if)#ex
Mlt-SW2(config)#
Mlt-SW2(config)#
Mlt-SW2(config)#int gig1/0/2
Mlt-SW2(config-if)#ip add 172.168.3.157 255.255.255.252
Mlt-SW2(config-if)#no sh
Mlt-SW2(config-if)#
Mlt-SW2(config-if)#
Mlt-SW2(config-if)#
Mlt-SW2(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
Mlt-SW2(config-if)#

```


IP ROUTING AND ROUTER ID OF ROUTER OSPF 10:

IP routing and Router ID are fundamental aspects of the OSPF (Open Shortest Path First) routing protocol used in computer networks. Here the IP routing is determining the best path for forwarding IP packets from a source device to a destination device across an internetwork. In OSPF, each router is assigned a unique Router ID, here the Router ID serves as a way to uniquely identify OSPF routers, OSPF routers use the Router ID to exchange routing information.

Switch 02:

```
Mlt-SW2(config)#router ospf 10
Mlt-SW2(config-router)#net
Mlt-SW2(config-router)#network 172.16.1.0 0.0.0.127 area 0
Mlt-SW2(config-router)#network 172.16.1.128 0.0.0.127 area 0
Mlt-SW2(config-router)#network 172.16.2.0 0.0.0.127 area 0
Mlt-SW2(config-router)#network 172.16.3.128 0.0.0.127 area 0
Mlt-SW2(config-router)#network 172.16.3.0 0.0.0.127 area 0
Mlt-SW2(config-router)#network 172.16.2.128 0.0.0.15 area 0
Mlt-SW2(config-router)#net
Mlt-SW2(config-router)#network 172.16.3.152 0.0.0.3 area 0
Mlt-SW2(config-router)#network 172.16.3.152 0.0.0.3 area 0
Mlt-SW2(config-router)#network 172.16.3.156 0.0.0.3 area 0
Mlt-SW2(config-router)#exit
Mlt-SW2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

CORE: 01

```
CORE-R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
CORE-R1(config)#interface GigabitEthernet0/0
CORE-R1(config-if)#
CORE-R1(config-if)#
CORE-R1(config-if)#
CORE-R1(config-if)#ex
CORE-R1(config)#
CORE-R1(config)#
CORE-R1(config)#
CORE-R1(config)#
CORE-R1(config)#router ospf 10
CORE-R1(config-router)#router-id 3.3.3.3
CORE-R1(config-router)#
CORE-R1(config-router)#network 172.16.3.144 0.0.0.3 area 0
CORE-R1(config-router)#network 172.16.3.152 0.0.0.3 area 0
CORE-R1(config-router)#network 192.134.17.0 0.0.0.3 area 0
CORE-R1(config-router)#network 192.134.17.4 0.0.0.3 area 0
CORE-R1(config-router)#
CORE-R1(config-router)#do wr
Building configuration...
[OK]
```

CORE: 02

```

passw0rd:
CORE-R2>enable
Password:
Password:
CORE-R2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
CORE-R2(config)#interface GigabitEthernet0/0
CORE-R2(config-if)#
CORE-R2(config-if)#
CORE-R2(config-if)#router ospf 10
CORE-R2(config-router)#router-id 4.4.4.4
CORE-R2(config-router)#network 172.16.3.148 0.0.0.3 area 0
CORE-R2(config-router)#network 172.16.3.156 0.0.0.3 area 0
CORE-R2(config-router)#network 195.136.17.8 0.0.0.3 area 0
CORE-R2(config-router)#network 195.136.17.12 0.0.0.3 area 0
CORE-R2(config-router)#
CORE-R2(config-router)#do wr
Building configuration...
[OK]
CORE-R2(config-router)#ex
CORE-R2(config)#

```

ROUTER: 01

```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#
Router(config-if)#ex
Router(config)#
Router(config)#
Router(config)#router ospf 10
Router(config-router)#router-id 5.5.5.5
Router(config-router)#network 195.136.17.8 0.0.0.3 area 0
Router(config-router)#network 195.136.17.0 0.0.0.3 area 0
Router(config-router)#
Router(config-router)#do wr
Building configuration...
[OK]

```

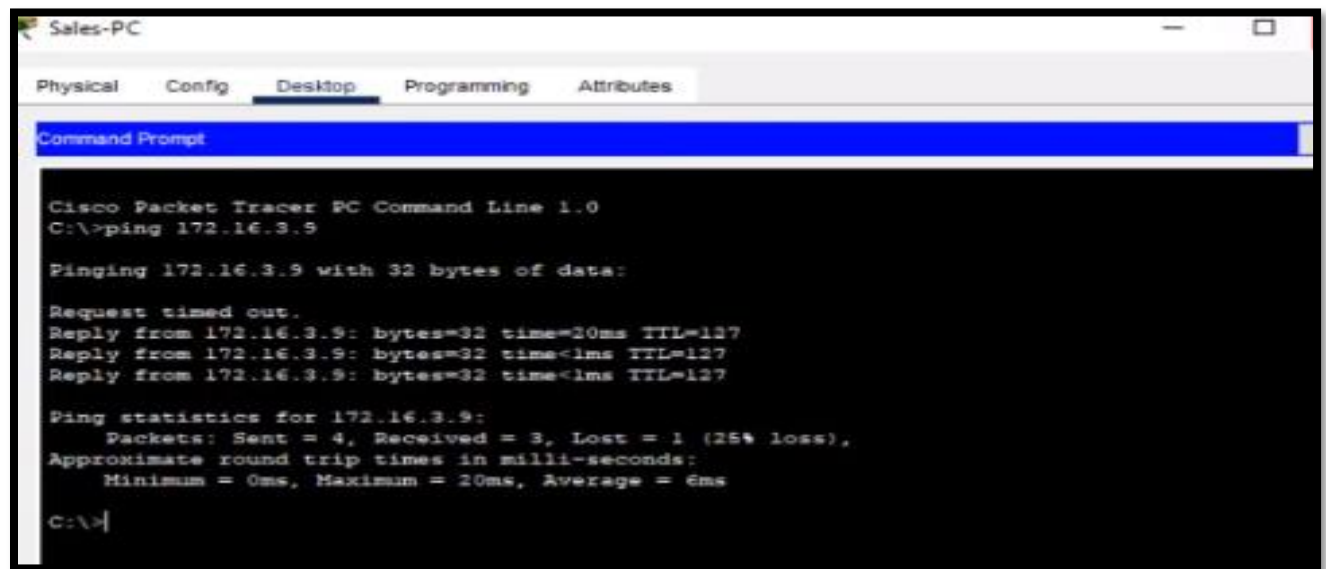
ROUTER: 02

```

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial0/3/0
Router(config-if)#ip address 195.136.17.4 255.255.255.0
Router(config-if)#ip address 195.136.17.4 255.255.255.252
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/3/1
Router(config-if)#ip address 195.136.17.14 255.255.255.252
Router(config-if)#ip address 195.136.17.14 255.255.255.252
Router(config-if)#
Router(config-if)#
Router(config-if)#
Router(config-if)#do wr
Building configuration...
[OK]
Router(config-if)#
Router(config-if)#
Router(config-if)#
Router(config-if)#router ospf 10
Router(config-router)#router-id 5.5.5.5
Router(config-router)#network 195.136.17.4 0.0.0.3 area 0
Router(config-router)#network 195.136.17.12 0.0.0.3 area 0
Router(config-router)#
Router(config-router)#do wr
Building configuration...
[OK]

```

PINGING OF SALES PC:



The screenshot shows a Cisco Packet Tracer PC Command Line window for a device named 'Sales-PC'. The 'Desktop' tab is selected. The command prompt shows the user has entered 'ping 172.16.3.9'. The output indicates that the first ping request timed out, while the subsequent three replies were successful with a time of less than 1ms and a TTL of 127. The statistics show 4 packets sent, 3 received, and 1 lost (25% loss), with an average round trip time of 6ms.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 172.16.3.9

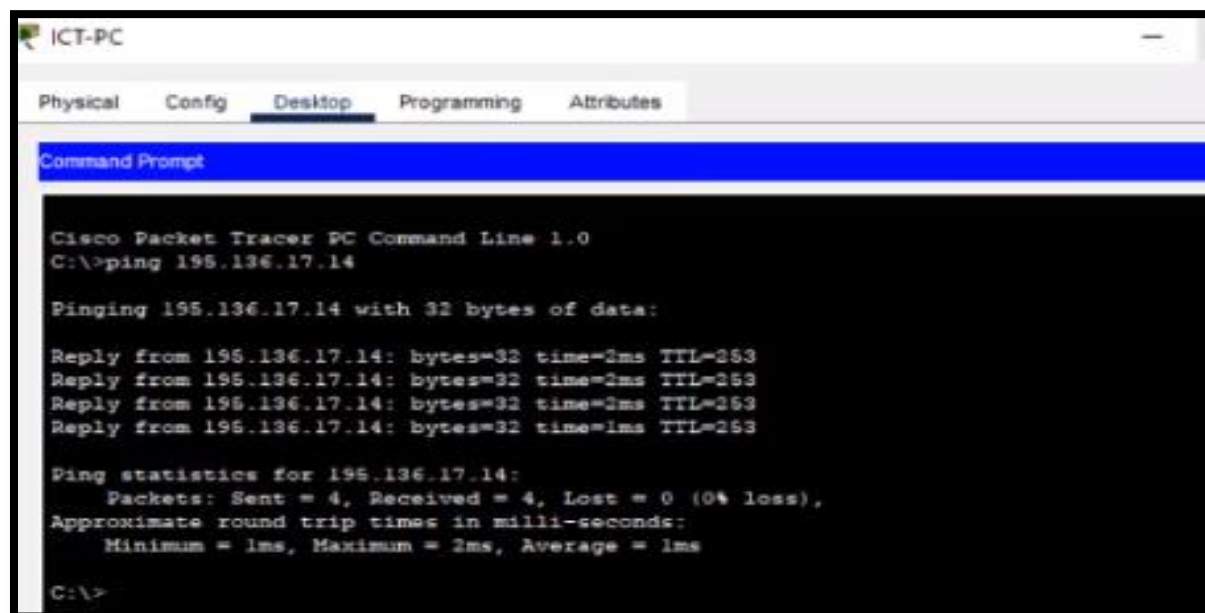
Pinging 172.16.3.9 with 32 bytes of data:

Request timed out.
Reply from 172.16.3.9: bytes=32 time<1ms TTL=127
Reply from 172.16.3.9: bytes=32 time<1ms TTL=127
Reply from 172.16.3.9: bytes=32 time<1ms TTL=127

Ping statistics for 172.16.3.9:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 20ms, Average = 6ms

C:\>
```

PINGING ICT:



The screenshot shows a Cisco Packet Tracer PC Command Line window for a device named 'ICT-PC'. The 'Desktop' tab is selected. The command prompt shows the user has entered 'ping 195.136.17.14'. The output shows four successful replies with a time of 1ms or 2ms and a TTL of 253. The statistics show 4 packets sent, 4 received, and 0 lost (0% loss), with an average round trip time of 1ms.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 195.136.17.14

Pinging 195.136.17.14 with 32 bytes of data:

Reply from 195.136.17.14: bytes=32 time=2ms TTL=253
Reply from 195.136.17.14: bytes=32 time=2ms TTL=253
Reply from 195.136.17.14: bytes=32 time=2ms TTL=253
Reply from 195.136.17.14: bytes=32 time=1ms TTL=253

Ping statistics for 195.136.17.14:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>
```