

DATA COMMUNICATION AND NETWORKING II

PROJECT TITLE

CONFIGURING A SMALL ENTERPRISE NETWORK

GROUP MEMBERS

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SUBMITTED TO: **MA'AM ATTIA AGHA**

OBJECTIVE

DESIGN AND CONFIGURE A SMALL ENTERPRISE NETWORK USING CISCO PACKET TRACER. THE NETWORK SHOULD INCLUDE MULTIPLE VLANS, ROUTING BETWEEN VLANS, DHCP, AND BASIC SECURITY USING ACCESS CONTROL LISTS (ACLs).

REQUIREMENTS

1. Network Layout:

- 3 departments (Sales, HR, IT) connected via a switch.
- Separate VLANs for each department.
- A router for inter-VLAN routing.
- DHCP configuration for automatic IP addressing.
- Implement a wireless network for guest access.

2. Devices:

- PCs (4 per department)
- Switches (Layer 2)
- Router (Layer 3)
- Access Point (Wireless)
- DHCP Server
- DNS Server (optional)

3. VLAN Configuration:

- VLAN 10: Sales Department
- VLAN 20: HR Department
- VLAN 30: IT Department
- Ensure that each department is on a separate VLAN with proper IP addressing.

4. Inter-VLAN Routing:

- Configure routing on the Layer 3 router to allow communication between VLANs.

5. DHCP:

- Set up a DHCP server to assign IP addresses dynamically to each department.
- Ensure each department gets addresses from different subnets.

6. Access Control Lists (ACLs):

- Implement an ACL to block HR VLAN from accessing IT VLAN resources.
- Allow Sales VLAN to access only specific services (e.g., HTTP) on the IT VLAN.

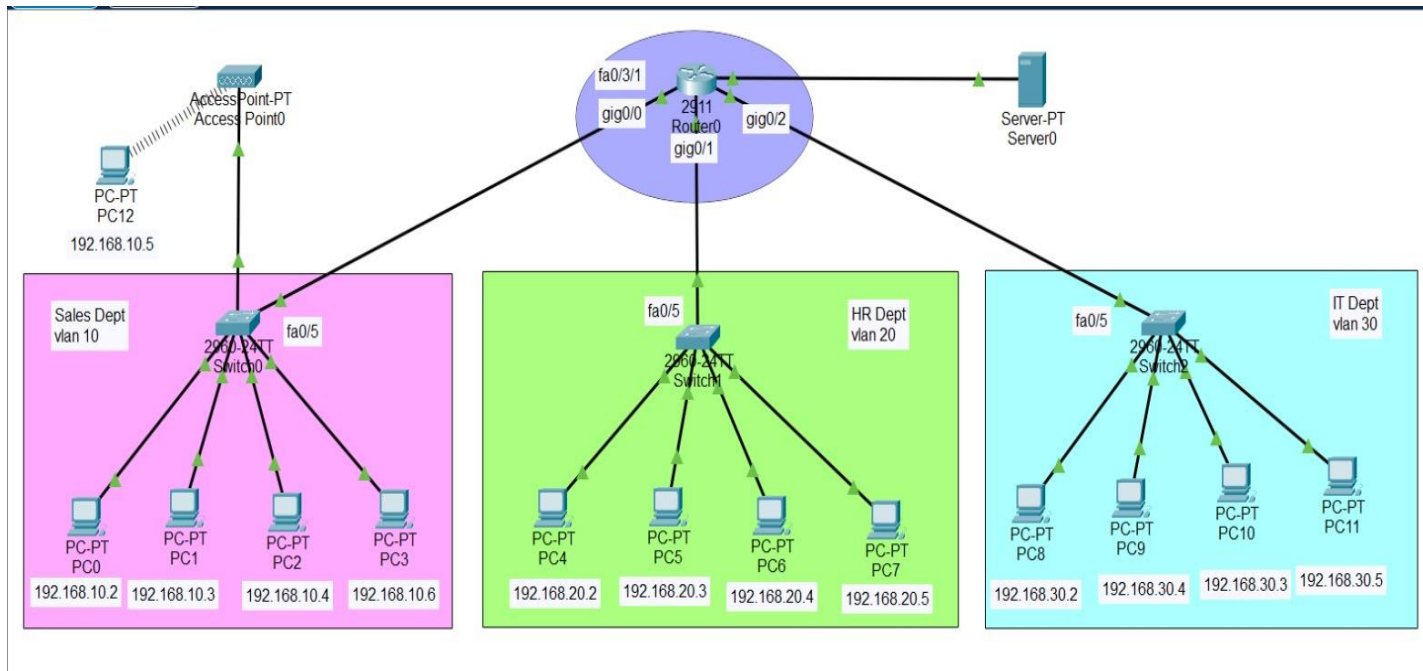
7. Wireless Setup:

- Configure an access point for guest users.
- Use WEP security for the wireless network.

STEPS

1. NETWORK DESIGN:

- Start by placing devices (PCs, switches, routers, access points) in Packet Tracer.
- Interconnect them using appropriate cabling.



2. VLAN CONFIGURATION:

- On the switches, create VLANs for each department and assign respective PCs to their VLANs.
- Configure trunk links between switches and the router for VLAN tagging.

```
Switch0
Physical Config CLI Attributes
IOS Command Line Interface
Compiled Wed 26-Jun-13 02:49 by mnguyen

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
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name Sales
Switch(config-vlan)#exit
Switch(config)#int range fa0/1-4
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 10
Switch(config-if)#exit
Switch(config)#
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
```

IOS Command Line Interface

Compiled Wed 26-Jun-13 02:49 by mnguyen

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
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
```

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name HR
Switch(config-vlan)#exit
Switch(config)#int range fa0/1-4
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 20
Switch(config-if)#exit
Switch(config)#
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
```

IOS Command Line Interface

Compiled Wed 26-Jun-13 02:49 by mnguyen

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
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
```

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#name IT
Switch(config-vlan)#exit
Switch(config)#int range fa0/1-4
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 30
Switch(config-if)#exit
Switch(config)#
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
```

3. INTER-VLAN ROUTING:

- Enable inter-VLAN routing on the router by creating sub-interfaces for each VLAN.
- Assign IP addresses to these sub-interfaces from their respective subnets.



```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig0/0
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)#int gig0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up

Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.1 255.255.255.0
Router(config-subif)#exit
Router(config)#int gig0/1
Router(config-if)#no shutdown

Router(config-if)#
%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)#int gig0/1.20
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1.20, changed state to up

Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.1 255.255.255.0
Router(config-subif)#exit
Router(config)#int gig0/2
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up

Router(config-if)#exit
Router(config)#int gig0/2.30
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2.30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2.30, changed state to up

Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.168.30.1 255.255.255.0
Router(config-subif)#exit
Router(config)#
Router(config)#ip dhcp pool Sales
Router(dhcp-config)#network 192.168.10.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.10.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#exit
Router(config)#ip dhcp pool HR
Router(dhcp-config)#network 192.168.20.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.20.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#exit
Router(config)#ip dhcp pool IT
Router(dhcp-config)#network 192.168.30.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.30.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#exit
Router(config)#
```


4. DHCP SETUP:

- Configure the DHCP server with pools of IP addresses for each VLAN.
- Ensure that each department gets IP addresses automatically from the correct pool.

Server0

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: serverPool

Default Gateway: 0.0.0.0

DNS Server: 0.0.0.0

Start IP Address: 0 0 0 0

Subnet Mask: 0 0 0 0

Maximum Number of Users: 512

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
IT	192.168.30.1	8.8.8.8	192.168.30.10	255.255.255.0	246	0.0.0.0	0.0.0.0
HR	192.168.20.1	8.8.8.8	192.168.20.10	255.255.255.0	246	0.0.0.0	0.0.0.0
Sales	192.168.10.1	8.8.8.8	192.168.10.10	255.255.255.0	246	0.0.0.0	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	512	0.0.0.0	0.0.0.0

PC0

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☒ DHCP ☐ Static

IPv4 Address: 192.168.10.3

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.10.1

DNS Server: 8.8.8.8

PC4

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☒ DHCP ☐ Static

IPv4 Address: 192.168.20.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.20.1

DNS Server: 8.8.8.8

PC8

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☒ DHCP ☐ Static

IPv4 Address: 192.168.30.4

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.30.1

DNS Server: 8.8.8.8

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::230:A3FF:FE93:C1A7

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

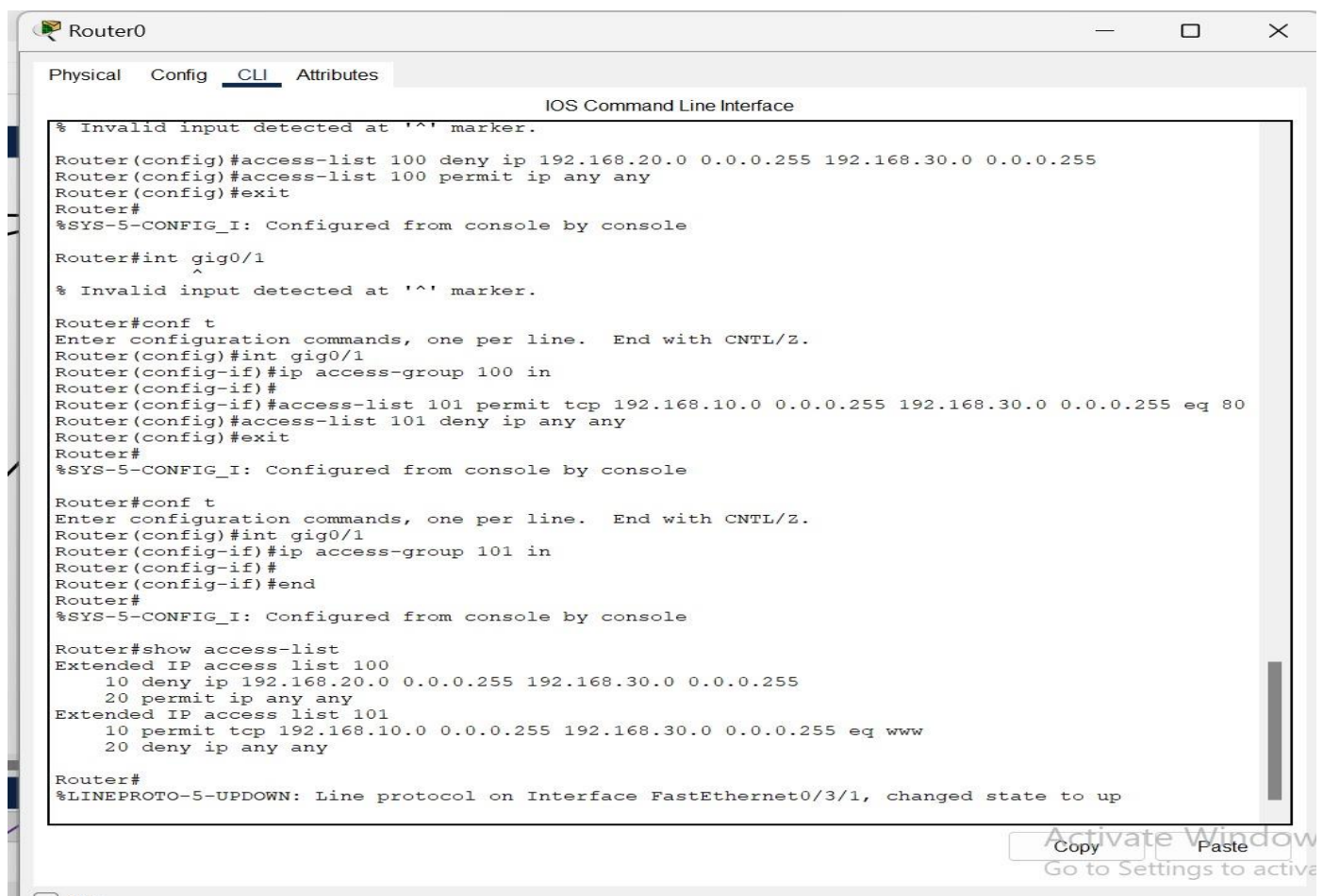
Authentication: MD5

Username:

Password:

5. ACL SETUP:

- Apply ACLs on the router to control traffic flow between VLANs.
- Block unauthorized access based on the requirements.



The screenshot shows the CLI of Router0 with the following commands and output:

```
% Invalid input detected at '^' marker.
Router(config)#access-list 100 deny ip 192.168.20.0 0.0.0.255 192.168.30.0 0.0.0.255
Router(config)#access-list 100 permit ip any any
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#int gig0/1
% Invalid input detected at '^' marker.

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig0/1
Router(config-if)#ip access-group 100 in
Router(config-if)#
Router(config-if)#access-list 101 permit tcp 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255 eq 80
Router(config)#access-list 101 deny ip any any
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

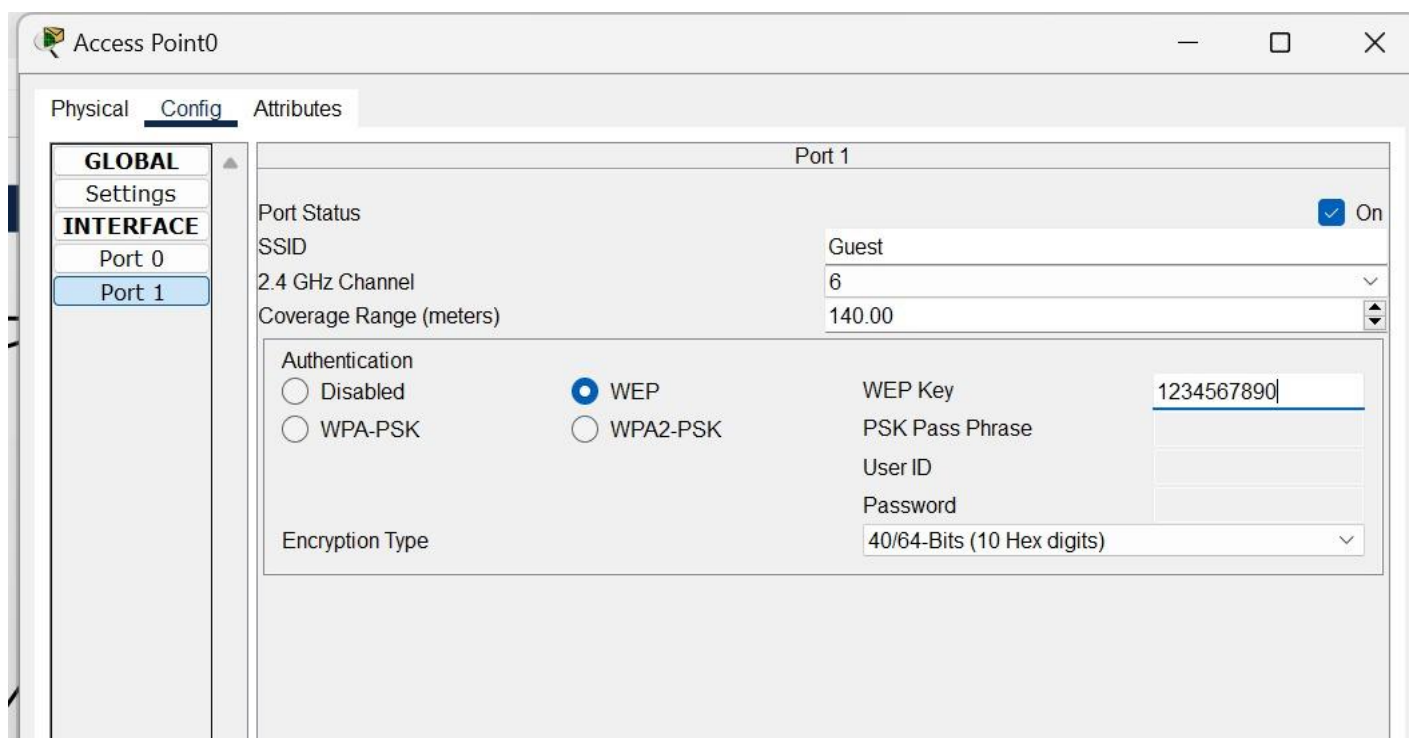
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig0/1
Router(config-if)#ip access-group 101 in
Router(config-if)#
Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show access-list
Extended IP access list 100
  10 deny ip 192.168.20.0 0.0.0.255 192.168.30.0 0.0.0.255
  20 permit ip any any
Extended IP access list 101
  10 permit tcp 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255 eq www
  20 deny ip any any

Router#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3/1, changed state to up
```

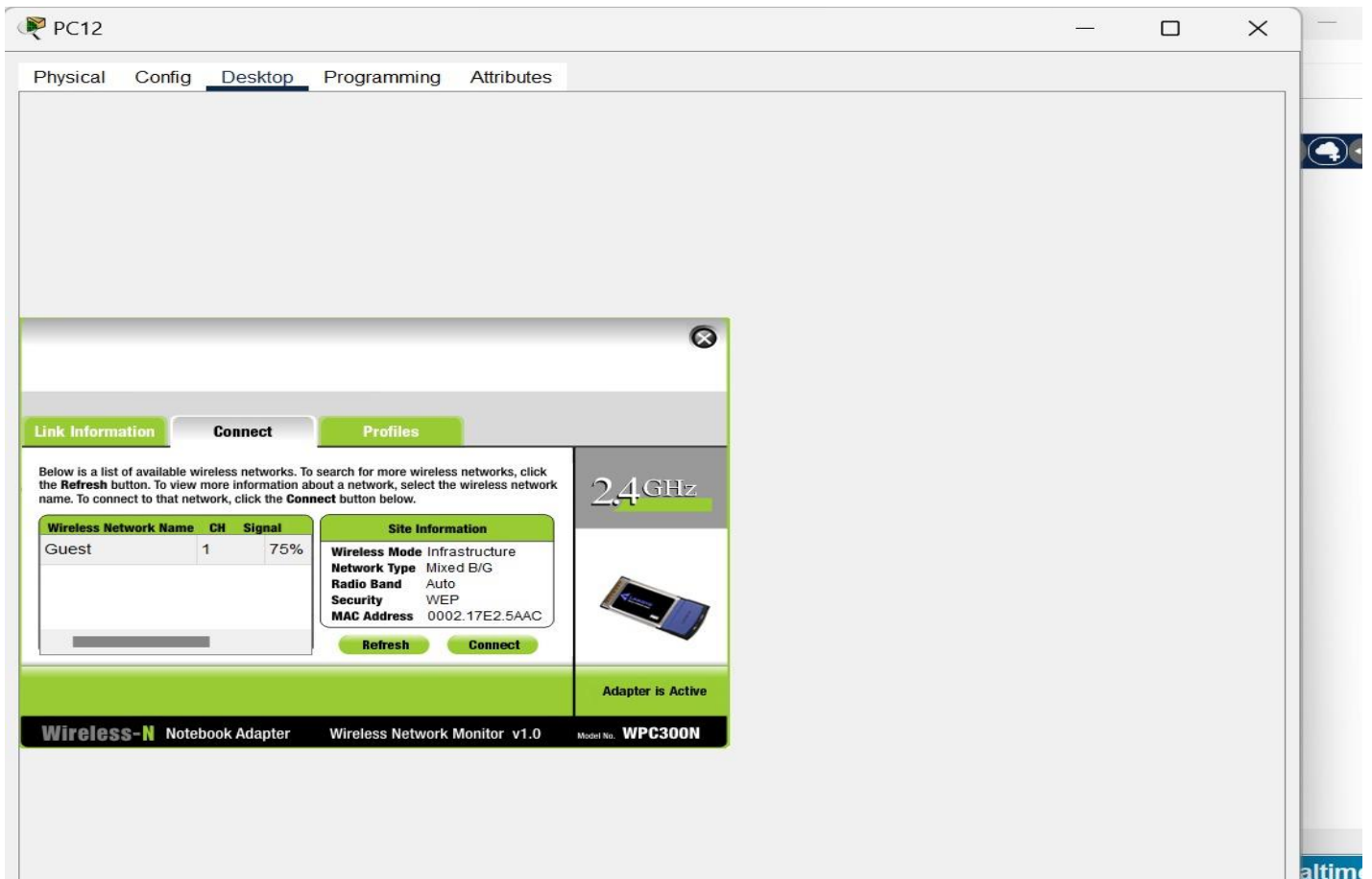
6. WIRELESS NETWORK CONFIGURATION:

- Set up a wireless access point with SSID and WEP security for guest users.
- Test wireless connectivity by adding wireless PCs to the simulation.



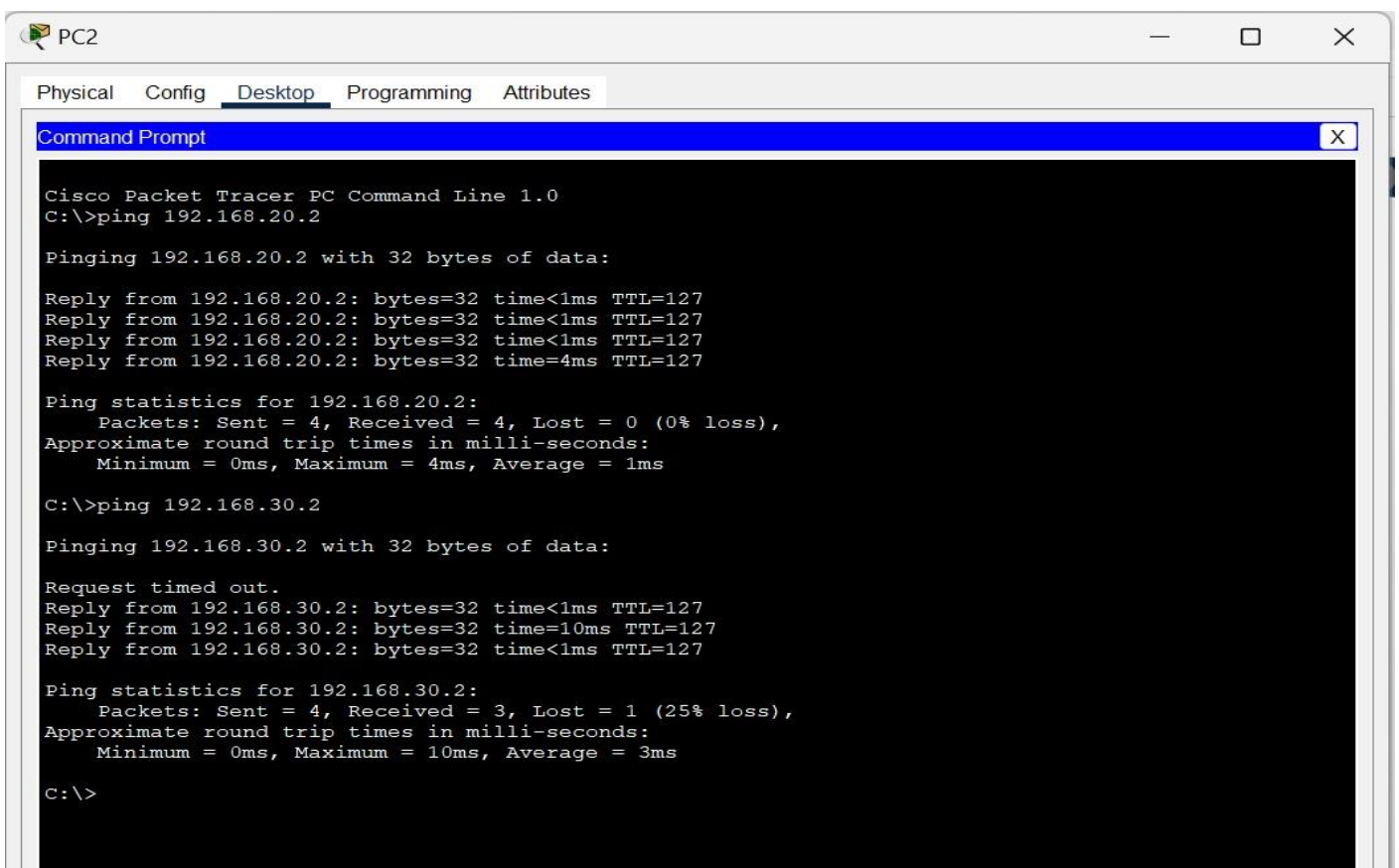
The screenshot shows the configuration window for Access Point0. The 'Config' tab is selected, and 'Port 1' is chosen under the 'INTERFACE' section. The configuration details are as follows:

Port 1	
Port Status	<input checked="" type="checkbox"/> On
SSID	Guest
2.4 GHz Channel	6
Coverage Range (meters)	140.00
Authentication	
<input type="radio"/> Disabled	<input checked="" type="radio"/> WEP
<input type="radio"/> WPA-PSK	<input type="radio"/> WPA2-PSK
WEP Key	1234567890
PSK Pass Phrase	
User ID	
Password	
Encryption Type	40/64-Bits (10 Hex digits)



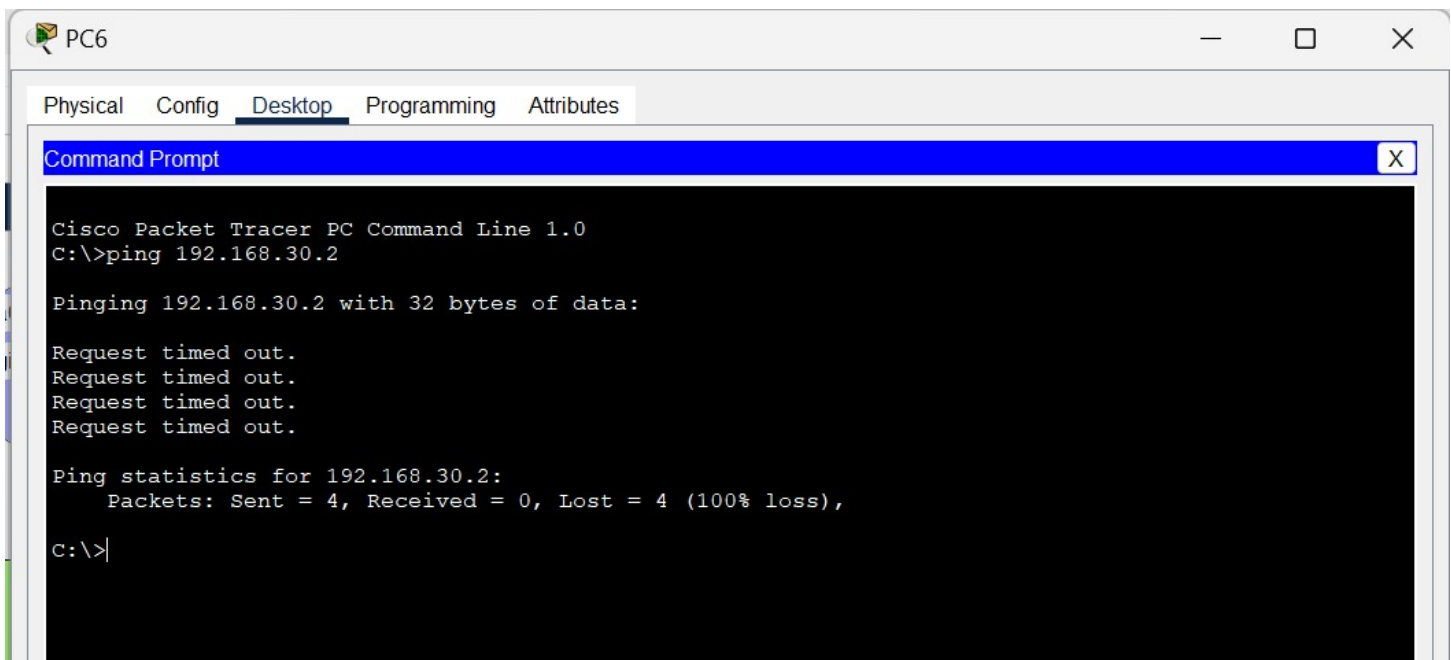
- SCREENSHOTS ROUTING VERIFICATION USING THE PING COMMAND.

SALES TO HR AND IT



- ACLS APPLIED AND FUNCTIONING AS EXPECTED.

HR CANNOT ACCESS IT



SUMMARY

We have set up a network with three departments on separate VLANs (i.e: Sales, HR and IT) with inter-VLAN routing and have applied DHCP for dynamic IP assignment after that we have implemented guest Wi-Fi with WEP security and ACLs to restrict access between departments as required.