

# Project report

Cisco Network Administrator

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## Project Objectives

- 1- configure VLAN 10, 20, 30, 40
- 2- configure Dist-SWs as root primary and root secondary (STP)
- 3- Configure HSRP on Dist-SWs
- 4- configure DHCP server on Rs
- 5- configure DNS server
- 6- configure OSPF between Dist-SWs and Rs
- 7- Configure PAT and public Web server
- 8- configure static NAT for the web server
- 9- configure BGP to ISP

### Optional:

- 1- Add ACL VLAN 10 in AS 100 cannot reach Web server

## Project Resources and Tools

## Packet Tracer

## Project Expected Outcomes

### Core Network Functionality

1. Inter-subnet Connectivity: Ensure seamless communication between different network segments within the same network.
2. Gateway Redundancy: Implement a backup system for the main network gateway ("core MLS") to maintain network access in case of failures.
3. Service Discovery: Enable automatic discovery of essential network services like DHCP (dynamic host configuration protocol) and DNS (domain name system).

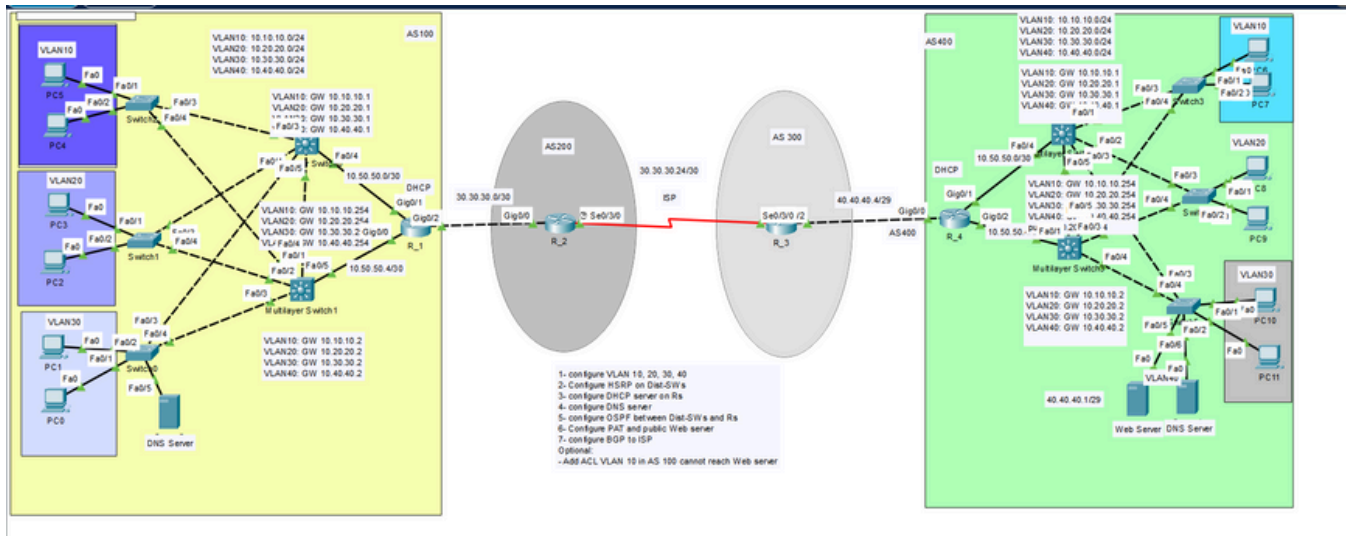
### Network Connectivity and Security

1. Internet Access: Facilitate connections to the internet by mapping private IP addresses to public ones.
2. Internal Service Access: Allow devices within the private network to access online services, such as web servers.
3. Network Security: Implement security measures like DHCP snooping and access control lists (ACLs) to protect the network from unauthorized access.

### Remote Access and Routing

1. Remote Management: Enable remote administration of network devices using control protocols over the TCP/IP network.
2. Routing Protocols: Utilize routing protocols like BGP (Border Gateway Protocol) and OSPF (Open Shortest Path First) to optimize data routing within the network.

## Topolgy:



## Introduction:

This project aims to design and implement a complex network infrastructure using Cisco Packet Tracer. The primary objective is to establish a scalable and reliable network capable of supporting various applications and services within a simulated enterprise environment.

Key components and functionalities of the network include:

- Interconnected networks: Multiple VLANs segregated into distinct subnets for enhanced security and resource management.
- Routing protocols: OSPF configured to enable efficient communication between different network segments.
- Dynamic Host Configuration Protocol (DHCP): Automatically assigning IP addresses to network devices for simplified management.
- Domain Name System (DNS): Resolving domain names to IP addresses for easy identification and access of network resources.
- Access Control Lists (ACLs): Implementing security measures to restrict unauthorized access to network resources.
- Static and Dynamic NAT: Translating private IP addresses to public IP addresses for internet connectivity.

By configuring these elements, the network will provide a robust and flexible platform for various network services, such as web servers, email, and file sharing. The project will also explore advanced networking concepts, such as High Availability (HA) and load balancing, to ensure redundancy and optimal performance.

- 1- configure VLAN 10, 20, 30, 40
- + Adding ACL VLAN 10 in AS 100 cannot reach Web server

vlan 10 AS 400 to R\_1

vlan 10 AS 400 to server

[illegible]

PC9

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Request timed out.
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time=6ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms

C:\>ping 10.50.50.5

Pinging 10.50.50.5 with 32 bytes of data:

Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

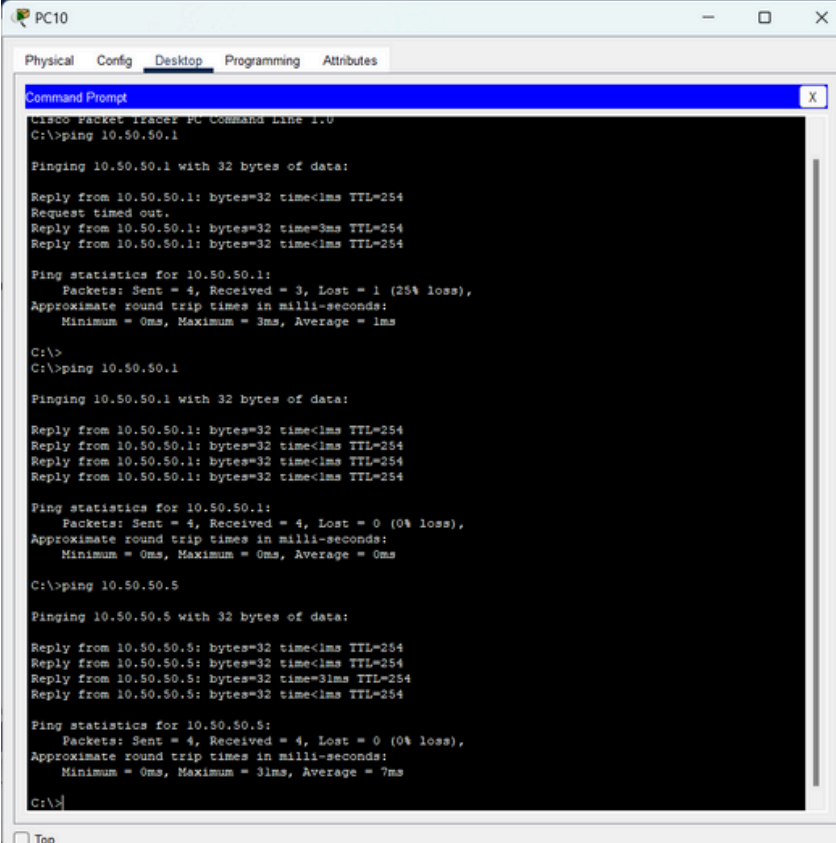
C:\>
```

☐ Top

vlan 20 AS 400 to server

[illegible]

## vlan 30 AS 400 to R\_1



PC10

Physical Config Desktop Programming Attributes

Command Prompt

```
tliso packet tracer PC Command Line 1.0
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Request timed out.
Reply from 10.50.50.1: bytes=32 time=3ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

C:\>
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 10.50.50.5

Pinging 10.50.50.5 with 32 bytes of data:

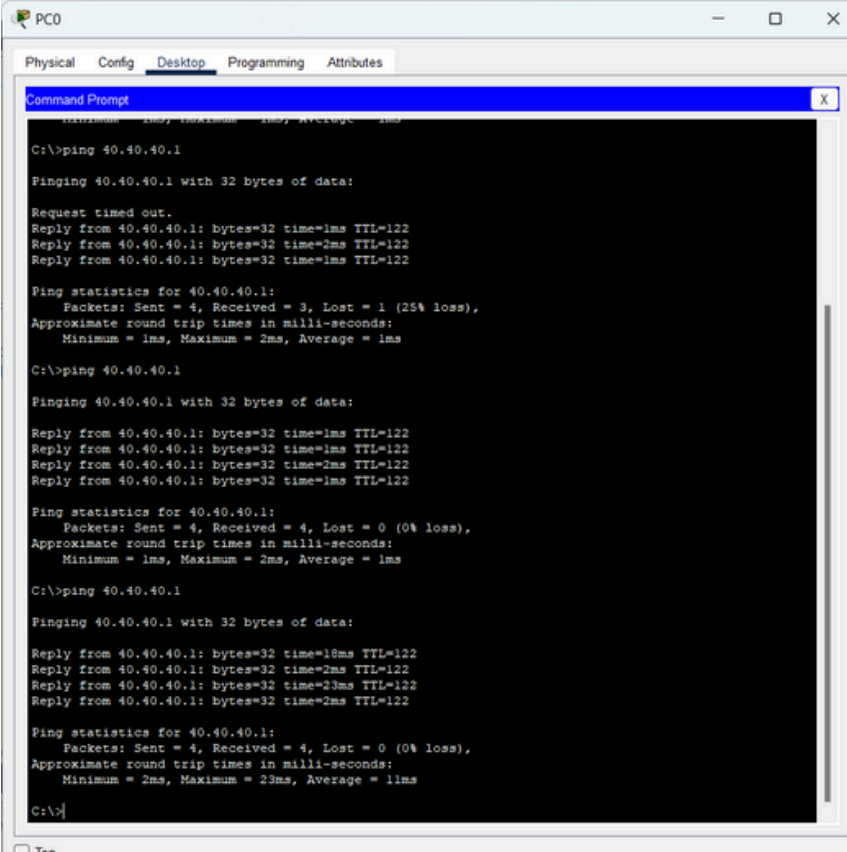
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time=31ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 31ms, Average = 7ms

C:\>
```

☐ Top

## vlan 30 AS 400 to server



PC0

Physical Config Desktop Programming Attributes

Command Prompt

```
Minimum    1ms, Maximum    2ms, Average    1ms

C:\>ping 40.40.40.1

Pinging 40.40.40.1 with 32 bytes of data:

Request timed out.
Reply from 40.40.40.1: bytes=32 time=1ms TTL=122
Reply from 40.40.40.1: bytes=32 time=2ms TTL=122
Reply from 40.40.40.1: bytes=32 time=1ms TTL=122

Ping statistics for 40.40.40.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>ping 40.40.40.1

Pinging 40.40.40.1 with 32 bytes of data:

Reply from 40.40.40.1: bytes=32 time=1ms TTL=122
Reply from 40.40.40.1: bytes=32 time=1ms TTL=122
Reply from 40.40.40.1: bytes=32 time=2ms TTL=122
Reply from 40.40.40.1: bytes=32 time=1ms TTL=122

Ping statistics for 40.40.40.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>ping 40.40.40.1

Pinging 40.40.40.1 with 32 bytes of data:

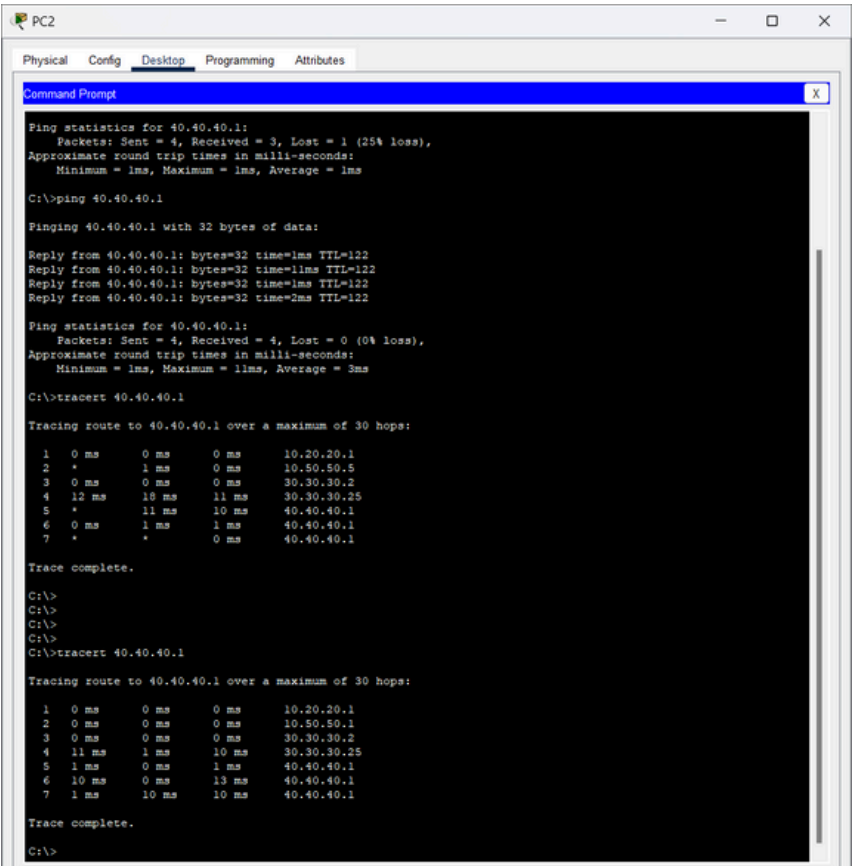
Reply from 40.40.40.1: bytes=32 time=18ms TTL=122
Reply from 40.40.40.1: bytes=32 time=2ms TTL=122
Reply from 40.40.40.1: bytes=32 time=23ms TTL=122
Reply from 40.40.40.1: bytes=32 time=2ms TTL=122

Ping statistics for 40.40.40.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 23ms, Average = 11ms

C:\>
```

☐ Top

# tracert AS 100 to server



Command	Description
vlan id	Creates a VLAN with the specified ID.
name <name>	Assigns a descriptive name to the VLAN.
interface <interface>	Specifies the physical interface.
switchport mode access	Sets the interface mode to access.
switchport access vlan <vlan-id>	Assigns the interface to the specified VLAN.
show vlan brief	Displays a summary of all configured VLANs.
show interfaces <interface> status	Displays the status of the specified interface.



# 02

## HSRP

### 2- Configure HSRP on Dist-SWs

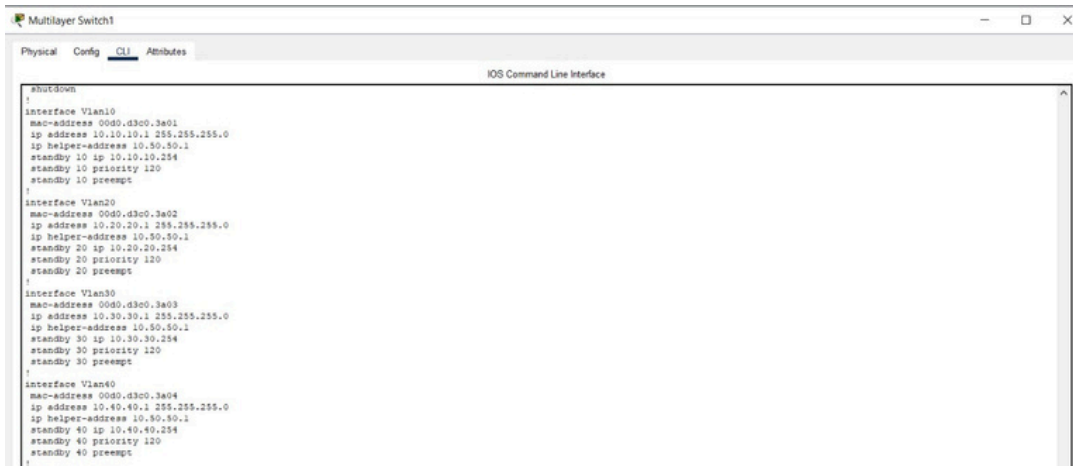
HSRP (Hot Standby Router Protocol) is a Cisco proprietary protocol used in networking to provide high availability and redundancy for IP networks. It ensures that if a primary (active) router fails, a standby router can take over the role of forwarding traffic without service interruption.

## Multilayer Switch0



```
interface GigabitEthernet0/2
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
mac-address 000b.be3e.6601
ip address 10.10.10.1 255.255.255.0
ip helper-address 10.50.50.1
standby 10 ip 10.10.10.254
!
interface Vlan20
mac-address 000b.be3e.6602
ip address 10.20.20.1 255.255.255.0
ip helper-address 10.50.50.1
standby 20 ip 10.20.20.254
!
interface Vlan30
mac-address 000b.be3e.6603
ip address 10.30.30.1 255.255.255.0
ip helper-address 10.50.50.1
standby 30 ip 10.30.30.254
!
interface Vlan40
mac-address 000b.be3e.6604
ip address 10.40.40.1 255.255.255.0
ip helper-address 10.50.50.1
standby 40 ip 10.40.40.254
!
```

## Multilayer Switch1

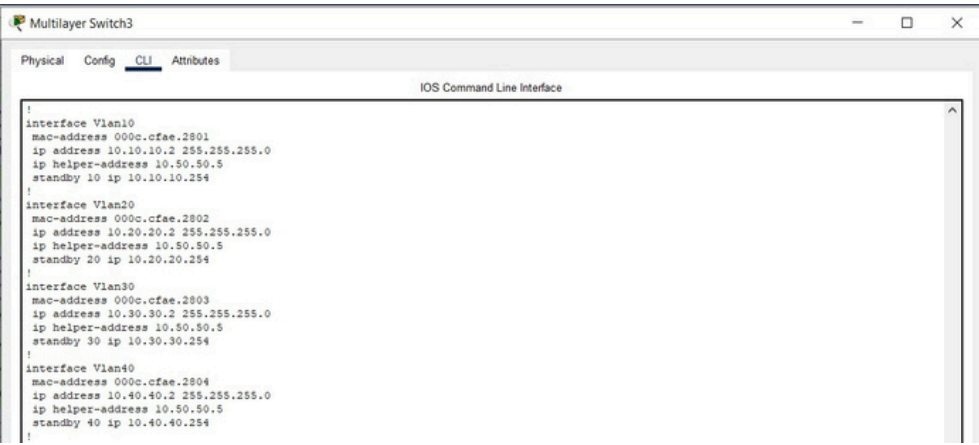


```
shutdown
!
interface Vlan10
mac-address 00d0.d3c0.3a01
ip address 10.10.10.1 255.255.255.0
ip helper-address 10.50.50.1
standby 10 ip 10.10.10.254
standby 10 priority 120
standby 10 preempt
!
interface Vlan20
mac-address 00d0.d3c0.3a02
ip address 10.20.20.1 255.255.255.0
ip helper-address 10.50.50.1
standby 20 ip 10.20.20.254
standby 20 priority 120
standby 20 preempt
!
interface Vlan30
mac-address 00d0.d3c0.3a03
ip address 10.30.30.1 255.255.255.0
ip helper-address 10.50.50.1
standby 30 ip 10.30.30.254
standby 30 priority 120
standby 30 preempt
!
interface Vlan40
mac-address 00d0.d3c0.3a04
ip address 10.40.40.1 255.255.255.0
ip helper-address 10.50.50.1
standby 40 ip 10.40.40.254
standby 40 priority 120
standby 40 preempt
!
```

# Multilayer Switch2



# Multilayer Switch3



Command	Description
interface <interface>	Specifies the physical interface.
standby <group-number>	Enables HSRP for the specified group.
standby priority <priority>	Sets the priority of the router for becoming the active router.
standby ip <IP-address>	Specifies the virtual IP address for the group.
standby preempt	Enables preemption, allowing a router with a higher priority to take over as the active router.
standby timers <hello-time> <hold-time>	Sets the hello and hold timers for HSRP.
standby track <interface> <multiplier>	Tracks the status of an interface and adjusts the router's priority based on its state.
show standby <group-number>	Displays information about the specified HSRP group.

# 03

## DHCP

### 3- configure DHCP server on Rs

DHCP (Dynamic Host Configuration Protocol) is a network protocol used to automatically assign IP addresses and other network configuration parameters to devices on a network. It simplifies network management by dynamically assigning IP addresses and reducing the need for manual configuration of devices.

## DHCP vlan 10 (AS100)

The screenshot shows the configuration window for PC5. The 'Desktop' tab is selected. The 'IP Configuration' window is open, showing the configuration for the 'FastEthernet0' interface. The 'DHCP' option is selected under 'IP Configuration'. The 'IPv4 Address' is set to 10.10.10.25, 'Subnet Mask' to 255.255.255.0, 'Default Gateway' to 10.10.10.254, and 'DNS Server' to 10.40.40.5. The 'IPv6 Configuration' section shows 'Static' selected, with 'IPv6 Address' set to FE80::201:C9FF:FE2:45DE. The '802.1X' section shows 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and 'Username' and 'Password' fields empty.

Interface	FastEthernet0
IP Configuration	
<input checked="" type="radio"/> DHCP	<input type="radio"/> Static
IPv4 Address	10.10.10.25
Subnet Mask	255.255.255.0
Default Gateway	10.10.10.254
DNS Server	10.40.40.5
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	FE80::201:C9FF:FE2:45DE
Link Local Address	
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

## DHCP vlan 10 (AS400)

The screenshot shows the configuration window for PC6. The 'Desktop' tab is selected. The 'IP Configuration' window is open, showing the configuration for the 'FastEthernet0' interface. The 'DHCP' option is selected under 'IP Configuration'. The 'IPv4 Address' is set to 10.10.10.34, 'Subnet Mask' to 255.255.255.0, 'Default Gateway' to 10.10.10.254, and 'DNS Server' to 10.40.40.5. The 'IPv6 Configuration' section shows 'Static' selected, with 'IPv6 Address' set to FE80::260:70FF:FE64:BB2C. The '802.1X' section shows 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and 'Username' and 'Password' fields empty.

Interface	FastEthernet0
IP Configuration	
<input checked="" type="radio"/> DHCP	<input type="radio"/> Static
IPv4 Address	10.10.10.34
Subnet Mask	255.255.255.0
Default Gateway	10.10.10.254
DNS Server	10.40.40.5
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	FE80::260:70FF:FE64:BB2C
Link Local Address	
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

# DHCP vlan 20 (AS100)

PC3

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

InterfaceFastEthernet0

IP Configuration

DHCP

Static

DHCP request successful.

IPv4 Address

10.20.20.19

Subnet Mask

255.255.255.0

Default Gateway

10.20.20.254

DNS Server

10.40.40.5

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::2D0:58FF:FEE0:1C66

Default Gateway

DNS Server

802.1X

Use 802.1X Security

Authentication

MD5

Username

Password

Top

# DHCP vlan 20 (AS400)

PC8

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

InterfaceFastEthernet0

IP Configuration

DHCP

Static

IPv4 Address

10.20.20.22

Subnet Mask

255.255.255.0

Default Gateway

10.20.20.254

DNS Server

10.40.40.5

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::209:7CFF:FE54:6776

Default Gateway

DNS Server

802.1X

Use 802.1X Security

Authentication

MD5

Username

Password

Top

# DHCP vlan 30(AS100)

PC1

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☒ DHCP

☐ Static

IPv4 Address

10.30.30.26

Subnet Mask

255.255.255.0

Default Gateway

10.30.30.254

DNS Server

10.40.40.5

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address

FE80::20C:CFFF:FE5B:B5BB

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication

MD5

Username

Password

Top

# DHCP vlan 30 (AS400)

PC10

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☒ DHCP

☐ Static

IPv4 Address

10.30.30.34

Subnet Mask

255.255.255.0

Default Gateway

10.30.30.254

DNS Server

10.40.40.5

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address

FE80::20A:41FF:FE39:2DAE

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication

MD5

Username

Password

Top

Command	Description
interface <interface>	Specifies the physical interface.
ip dhcp enable	Enables DHCP on the interface.
ip dhcp excluded-address <IP-address>	Excludes a specific IP address from the DHCP pool.
ip dhcp pool <pool-name>	Creates a DHCP pool with the specified name.
network <network-address> netmask <subnet-mask>	Specifies the network address and subnet mask for the DHCP pool.
default-router <router-address>	Sets the default gateway for clients in the DHCP pool.
dns-server <DNS-server-address>	Sets the DNS server address for clients in the DHCP pool.
lease <lease-time>	Sets the lease duration for clients in the DHCP pool.
exit	Exits the configuration mode for the DHCP pool.
show ip dhcp server	Displays information about the DHCP server configuration.
show ip dhcp database	Displays information about the DHCP lease database.

# 04

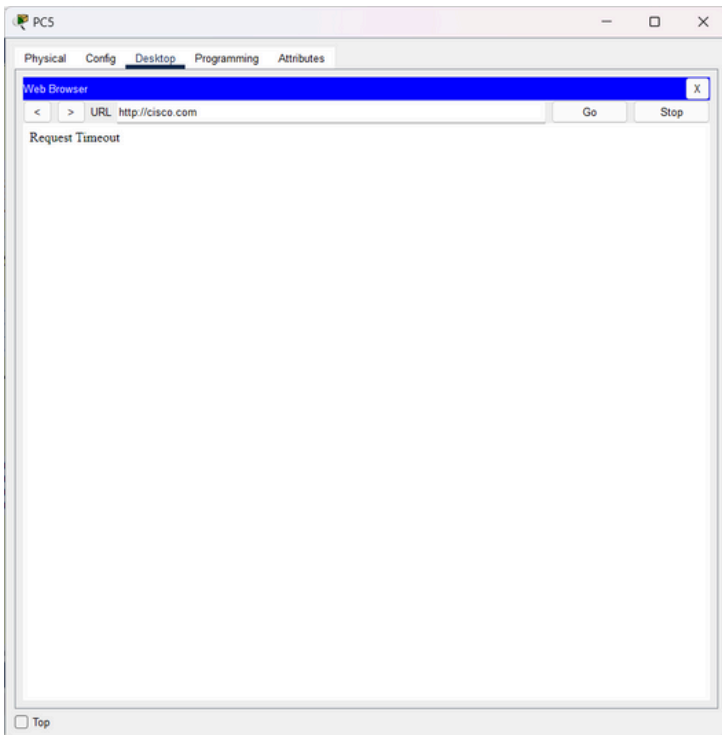
## DNS

### 4- configure DNS server

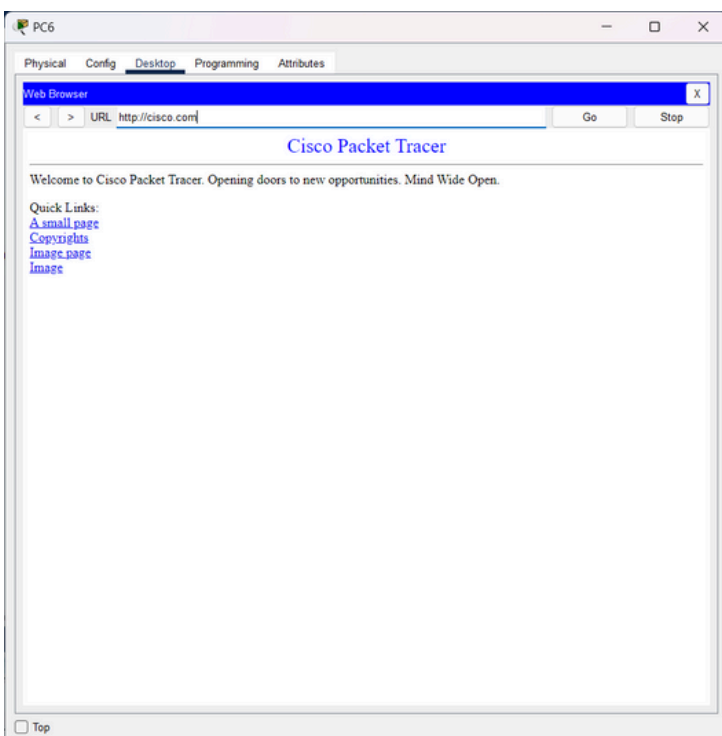
DNS (Domain Name System) is a critical protocol in networking used to translate human-readable domain names (e.g., [www.example.com](http://www.example.com)) into machine-readable IP addresses (e.g., 192.0.2.1) that computers use to communicate over the internet. DNS acts as the "phonebook" of the internet, making it easier for users to access websites and services without needing to memorize IP addresses.

vlan 10 AS100 to web server

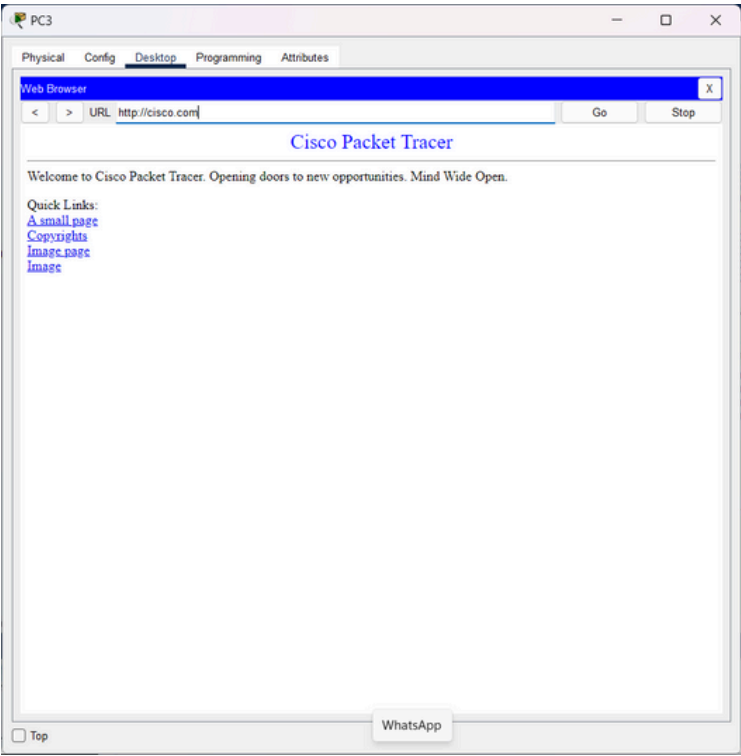
**ACL VLAN 10 in AS 100 cannot reach Web server**



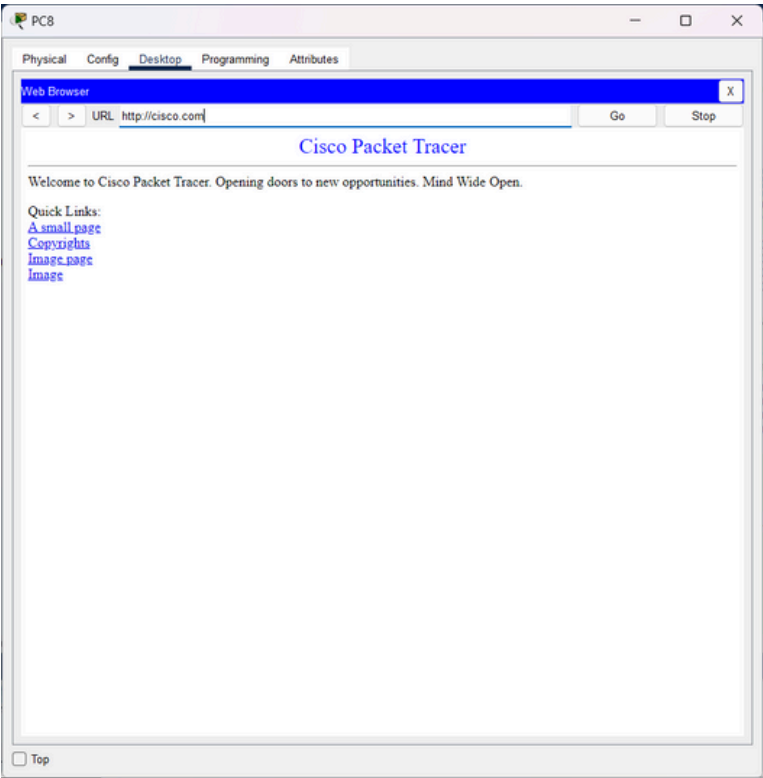
vlan 10 AS 400 to web server



vlan 20 AS 100 to web server

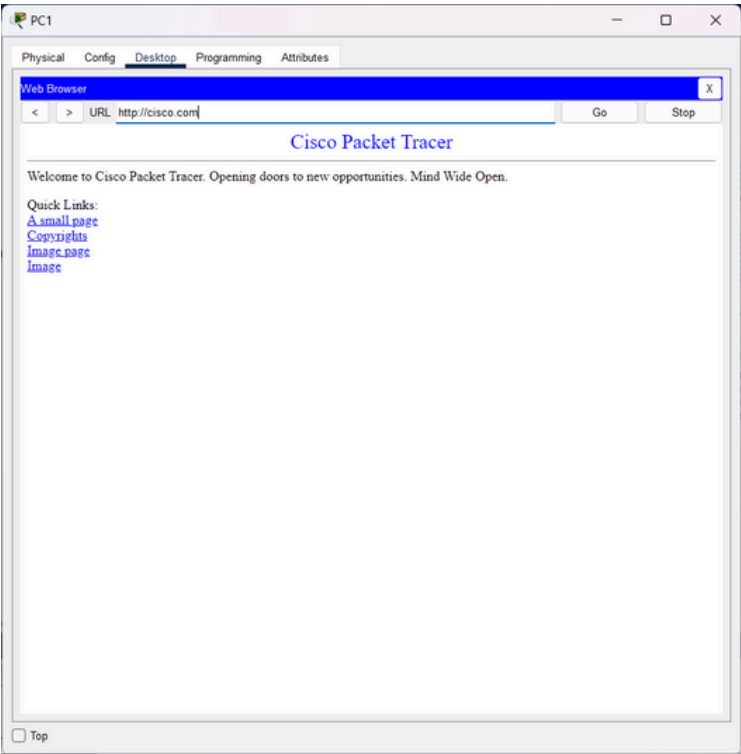


vlan 20 AS 400 to web server

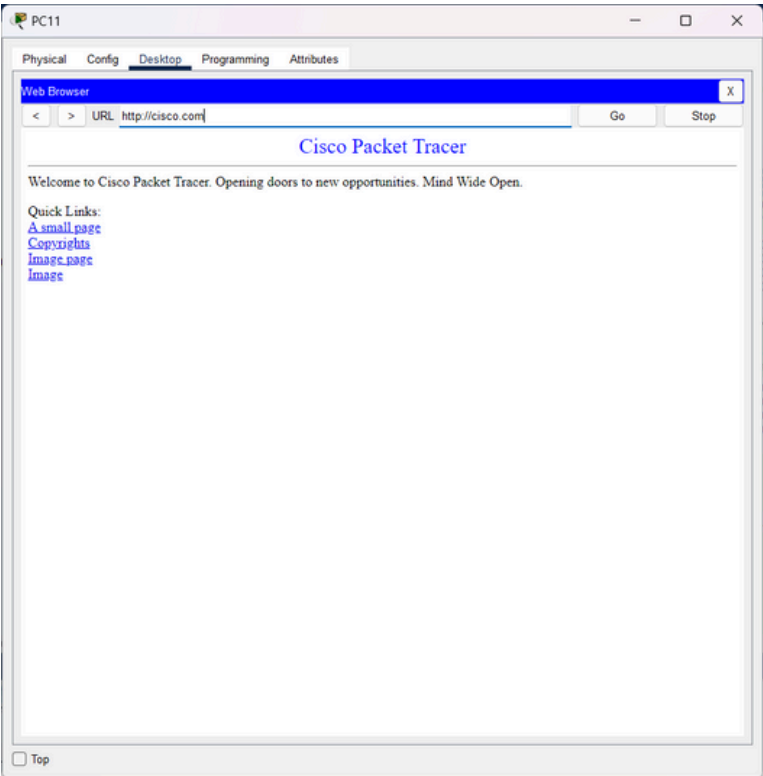




vlan 30 AS 100 to web server



vlan 30 AS 400 to web server



Command	Description
interface <interface>	Specifies the physical interface.
ip name-server <DNS-server-address>	Sets the DNS server address for the interface.
ip domain-lookup	Enables domain name lookup on the interface.
show ip name-server	Displays information about the configured DNS servers.
show ip domain-lookup	Displays the status of domain name lookup on the interface.

## 5- configure OSPF between Dist-SWs and Rs

## OSPF R\_1

## OSPF R\_4

[illegible]

# OSPF Multilayer Switch0

Multilayer Switch0

Physical

Config

CLI

Attributes

IOS Command Line Interface

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Standby -> Active

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan10 Grp 10 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan30 Grp 30 state Speak -> Standby

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan20 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan30 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan10 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan40 from LOADING to FULL, Loading Done

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Speak -> Standby

Switch>

Switch>en

Switch#sh ip ospf d

OSPF Router with ID (10.50.50.2) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
30.30.30.1	30.30.30.1	1009	0x80000073	0x003f17	2
10.50.50.2	10.50.50.2	966	0x80000105	0x004918	5
10.50.50.6	10.50.50.6	961	0x80000105	0x001a33	5

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.50.50.5	30.30.30.1	2474	0x80000099	0x00f64c
10.50.50.1	30.30.30.1	2469	0x8000009a	0x006857
10.20.20.2	10.50.50.6	966	0x80000127	0x00d372
10.30.30.2	10.50.50.6	966	0x80000128	0x00a764
10.10.10.2	10.50.50.6	966	0x80000129	0x00dc64
10.40.40.2	10.50.50.6	966	0x8000012a	0x00f229

Switch#

Copy

Paste

☐ Top

# OSPF Multilayer Switch1

Multilayer Switch1

Physical

Config

CLI

Attributes

IOS Command Line Interface

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Standby -> Active

WHSRP-6-STATECHANGE: Vlan30 Grp 30 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan30 Grp 30 state Standby -> Active

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Standby -> Active

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan20 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan30 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan10 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan40 from LOADING to FULL, Loading Done

Switch>

Switch>en

Switch#sh ip ospf d

OSPF Router with ID (10.50.50.6) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
30.30.30.1	30.30.30.1	1028	0x80000073	0x003f17	2
10.50.50.6	10.50.50.6	985	0x80000105	0x001a33	5
10.50.50.2	10.50.50.2	980	0x80000105	0x004918	5

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.50.50.5	30.30.30.1	2492	0x80000099	0x00f64c
10.50.50.1	30.30.30.1	2487	0x8000009a	0x006857
10.20.20.2	10.50.50.6	985	0x80000127	0x00d372
10.30.30.2	10.50.50.6	985	0x80000128	0x00a764
10.10.10.2	10.50.50.6	985	0x80000129	0x00dc64
10.40.40.2	10.50.50.6	985	0x8000012a	0x00f229

Switch#

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☐ Top

# OSPF Multilayer Switch2

Multilayer Switch2

Physical

Config

CLI

Attributes

IOS Command Line Interface

WHSRP-6-STATECHANGE: Vlan10 Grp 10 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan10 Grp 10 state Standby -> Active

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Standby -> Active

09:58:58: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan30 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan40 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan10 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan20 from LOADING to FULL, Loading Done

Switch>

Switch#en

Switch#sh osp

Switch#sh ip osp

Switch#sh ip ospf d

Switch#sh ip ospf database

OSPF Router with ID (10.50.50.2) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
40.40.40.5	40.40.40.5	892	0x80000073	0x00050d	2
10.50.50.2	10.50.50.2	849	0x80000106	0x004719	5
10.50.50.6	10.50.50.6	849	0x800000c5	0x009bf1	5

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.30.30.2	10.50.50.6	1742	0x80000124	0x003eef
10.10.10.2	10.50.50.6	1742	0x80000125	0x00cb8f
10.40.40.2	10.50.50.6	1742	0x80000126	0x00a05c
10.20.20.2	10.50.50.6	1741	0x80000127	0x00f7cd
10.50.50.5	40.40.40.5	560	0x8000009b	0x00ed23
10.50.50.1	40.40.40.5	560	0x8000009c	0x00225d

Switch#

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☐ Top

# OSPF Multilayer Switch3

Multilayer Switch3

Physical

Config

CLI

Attributes

IOS Command Line Interface

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Standby -> Active

WHSRP-6-STATECHANGE: Vlan30 Grp 30 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan10 Grp 10 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan40 Grp 40 state Speak -> Standby

WHSRP-6-STATECHANGE: Vlan20 Grp 20 state Speak -> Standby

09:58:58: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan30 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan40 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan10 from LOADING to FULL, Loading Done

09:59:02: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on Vlan20 from LOADING to FULL, Loading Done

Switch>

Switch#en

Switch#sh ip os

Switch#sh ip ospf d

Switch#sh ip ospf database

OSPF Router with ID (10.50.50.6) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link States
40.40.40.5	40.40.40.5	859	0x80000073	0x00050d	2
10.50.50.6	10.50.50.6	816	0x800000c5	0x009bf1	5
10.50.50.2	10.50.50.2	816	0x80000106	0x004719	5

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.30.30.2	10.50.50.6	1710	0x80000124	0x003eef
10.10.10.2	10.50.50.6	1710	0x80000125	0x00cb8f
10.20.20.2	10.50.50.6	1709	0x80000127	0x00f7cd
10.40.40.2	10.50.50.6	1710	0x80000126	0x00a05c
10.50.50.5	40.40.40.5	525	0x8000009b	0x00ed23
10.50.50.1	40.40.40.5	525	0x8000009c	0x00225d

Switch#

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☐ Top

Command	Description
router ospf <process-id>	Enables OSPF for the specified process ID.
network <network-address> wildcard mask	Specifies the network address and wildcard mask for the router's interface.
router ospf <process-id> area <area-id>	Specifies the area ID for the router's interface.
router ospf <process-id> authentication message-digest	Enables MD5 authentication for OSPF messages.
router ospf <process-id> authentication key <key>	Sets the authentication key for OSPF messages.
router ospf <process-id> network <network-address> wildcard mask area <area-id>	Specifies the network address, wildcard mask, and area ID for the router's interface.
show ip ospf	Displays information about the OSPF configuration.
show ip ospf interface	Displays information about the OSPF interfaces.
show ip ospf neighbor	Displays information about the OSPF neighbors.
show ip ospf database	Displays the OSPF database.

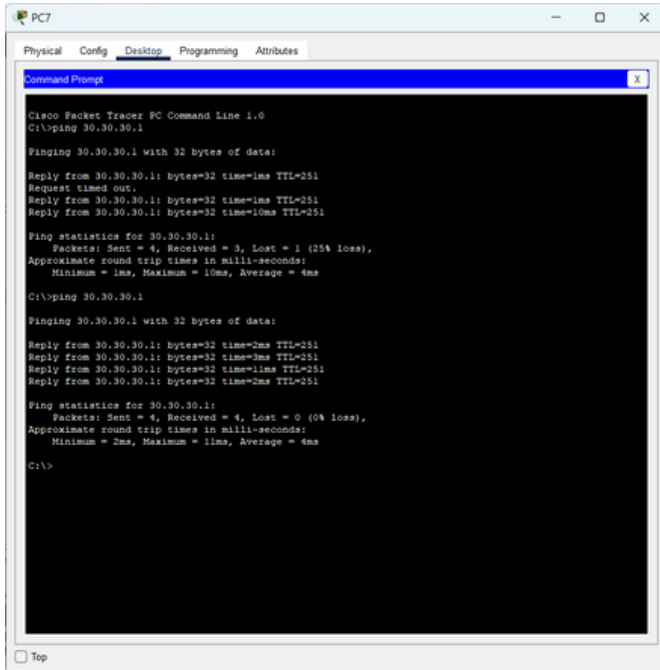
# 06

## PAT and Public web Server

### 6- Configure PAT and public Web server

PAT (Port Address Translation), also known as NAT Overload, is a form of Network Address Translation (NAT) used in networking to allow multiple devices on a local network to share a single public IP address. It extends the functionality of traditional NAT by using port numbers to distinguish different connections. PAT is commonly used in home and small office networks to enable multiple devices to access the internet using one public IP address.

#### vlan 10 AS 400 to R\_1



```
PC7
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 30.30.30.1

Pinging 30.30.30.1 with 32 bytes of data:

Reply from 30.30.30.1: bytes=32 time=1ms TTL=251
Request timed out.
Reply from 30.30.30.1: bytes=32 time=1ms TTL=251
Reply from 30.30.30.1: bytes=32 time=10ms TTL=251

Ping statistics for 30.30.30.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 10ms, Average = 4ms

C:\>ping 30.30.30.1

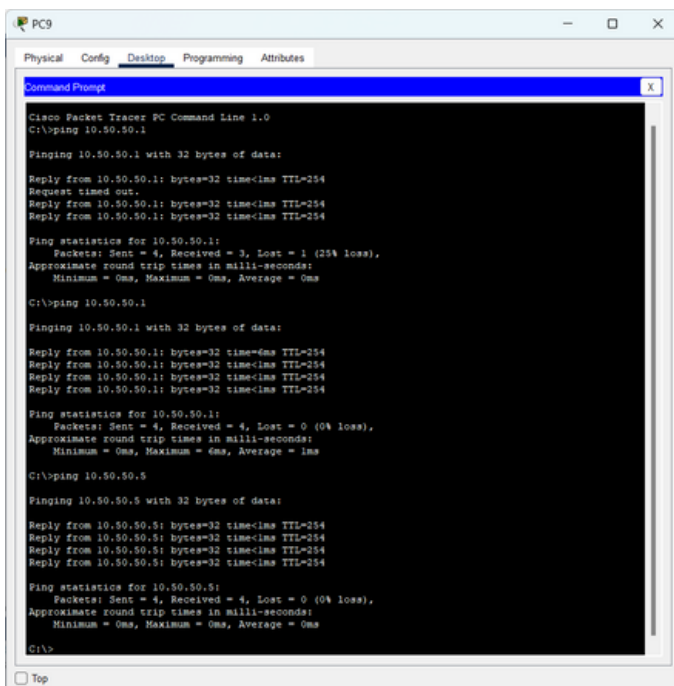
Pinging 30.30.30.1 with 32 bytes of data:

Reply from 30.30.30.1: bytes=32 time=2ms TTL=251
Reply from 30.30.30.1: bytes=32 time=3ms TTL=251
Reply from 30.30.30.1: bytes=32 time=1ms TTL=251
Reply from 30.30.30.1: bytes=32 time=2ms TTL=251

Ping statistics for 30.30.30.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 1ms, Average = 4ms

C:\>
```

#### vlan 20 AS 400 to R\_1



```
PC9
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Request timed out.
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time=6ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms

C:\>ping 10.50.50.5

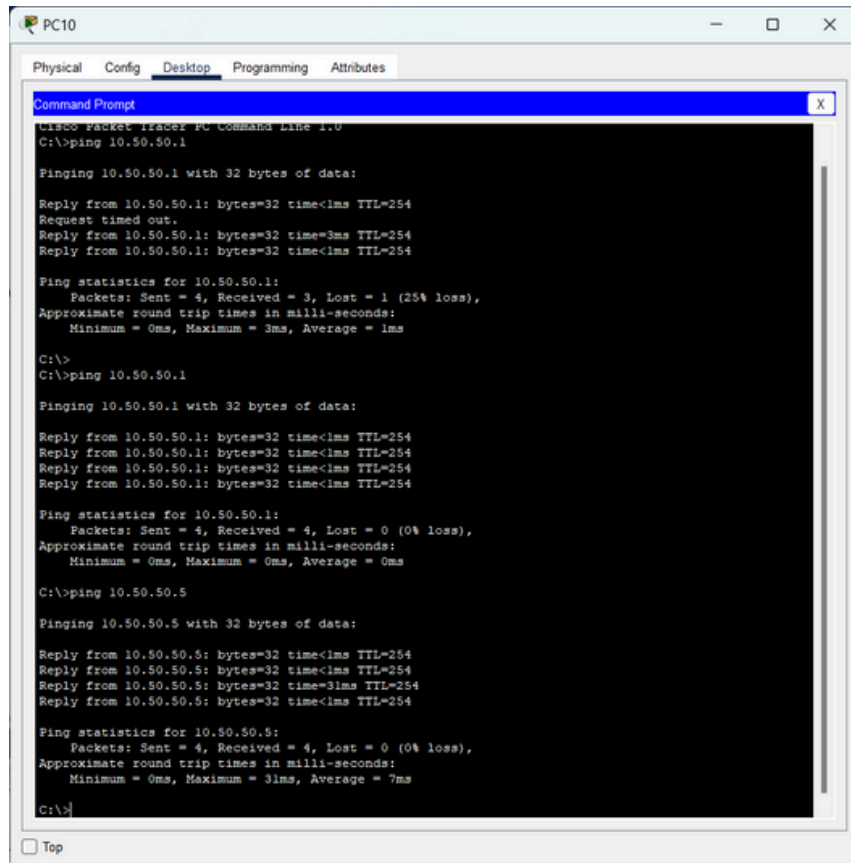
Pinging 10.50.50.5 with 32 bytes of data:

Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

## vlan 30 AS 400 to R\_1



The screenshot shows a PC10 window with a Command Prompt open. The prompt displays the results of three ping commands. The first two pings are to 10.50.50.1, and the third is to 10.50.50.5. The first ping to 10.50.50.1 shows a 25% loss (1 out of 4 packets). The second ping to 10.50.50.1 shows 0% loss (4 out of 4 packets). The third ping to 10.50.50.5 also shows 0% loss (4 out of 4 packets).

```
PC10
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Request timed out.
Reply from 10.50.50.1: bytes=32 time=3ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

C:\>
C:\>ping 10.50.50.1

Pinging 10.50.50.1 with 32 bytes of data:

Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254
Reply from 10.50.50.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 10.50.50.5

Pinging 10.50.50.5 with 32 bytes of data:

Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254
Reply from 10.50.50.5: bytes=32 time=3ms TTL=254
Reply from 10.50.50.5: bytes=32 time<1ms TTL=254

Ping statistics for 10.50.50.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 7ms

C:\>
```

Command	Description
interface <interface>	Specifies the physical interface.
ip nat inside source list <access-list> interface <interface>	Associates an access list with the inside interface for PAT.
access-list <access-list-name> <protocol> <source-address> <source-wildcard-mask> <destination-address> <destination-wildcard-mask>	Creates an access list to define the traffic to be subjected to PAT.
ip nat inside source list <access-list> interface <interface> overload	Enables overload PAT on the interface.
show ip nat translations	Displays information about the current PAT translations.



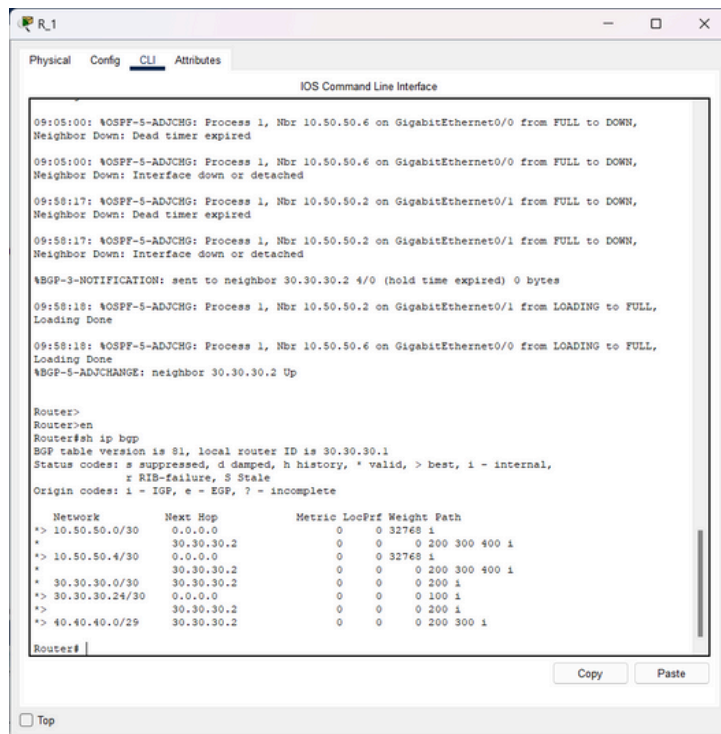
# 07

## BGP

### Configure BGP to ISP

BGP (Border Gateway Protocol) is a fundamental routing protocol used in networking, specifically for exchanging routing information between different autonomous systems (ASes) on the internet. It is the protocol that enables the interconnection of networks and ensures that data is routed efficiently and reliably across the global internet.

## BGP R\_1



The screenshot shows the CLI of Router R1. The top tabs are Physical, Config, CLI, and Attributes. The CLI window displays the following output:

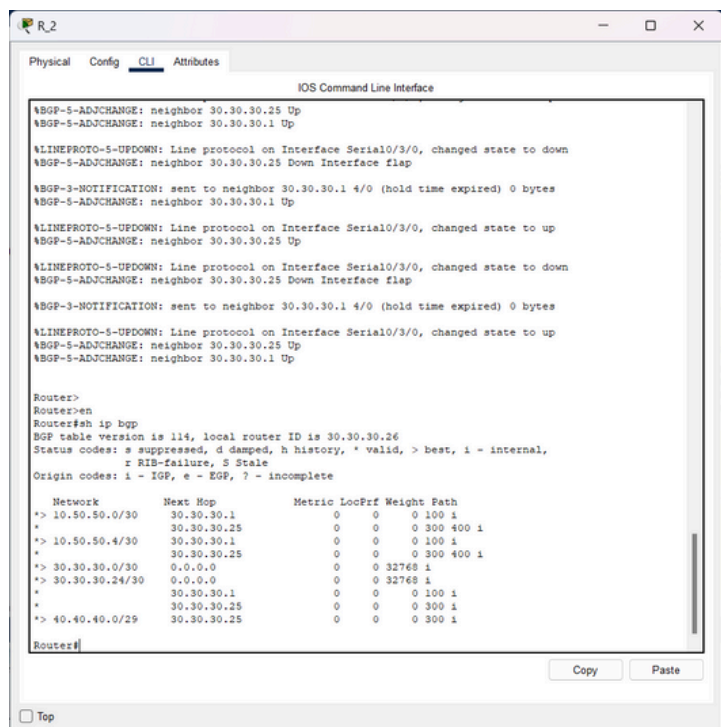
```
09:05:00: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/0 from FULL to DOWN, Neighbor Down: Dead timer expired
09:05:00: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/0 from FULL to DOWN, Neighbor Down: Interface down or detached
09:58:17: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from FULL to DOWN, Neighbor Down: Dead timer expired
09:58:17: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from FULL to DOWN, Neighbor Down: Interface down or detached
%BGP-3-NOTIFICATION: sent to neighbor 30.30.30.2 4/0 (hold time expired) 0 bytes
09:58:18: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from LOADING to FULL, Loading Done
09:58:18: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/0 from LOADING to FULL, Loading Done
%BGP-5-ADJCHANGE: neighbor 30.30.30.2 Up

Router>
Router>en
Router#sh ip bgp
BGP table version is 81, local router ID is 30.30.30.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop        Metric LocPrf Weight Path
*> 10.50.50.0/30   0.0.0.0          0         0 32768 i
*                  30.30.30.2      0         0 0 200 300 400 i
*> 10.50.50.4/30   0.0.0.0          0         0 32768 i
*                  30.30.30.2      0         0 0 200 300 400 i
* 30.30.30.0/30    30.30.30.2      0         0 0 200 i
*> 30.30.30.24/30  0.0.0.0          0         0 0 100 i
*> 30.30.30.2      0.0.0.0          0         0 0 200 i
*> 40.40.40.0/29  30.30.30.2      0         0 0 200 300 i

Router#
```

## BGP R\_2



The screenshot shows the CLI of Router R2. The top tabs are Physical, Config, CLI, and Attributes. The CLI window displays the following output:

```
%BGP-5-ADJCHANGE: neighbor 30.30.30.25 Up
%BGP-5-ADJCHANGE: neighbor 30.30.30.1 Up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down
%BGP-5-ADJCHANGE: neighbor 30.30.30.25 Down Interface flap
%BGP-3-NOTIFICATION: sent to neighbor 30.30.30.1 4/0 (hold time expired) 0 bytes
%BGP-5-ADJCHANGE: neighbor 30.30.30.1 Up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
%BGP-5-ADJCHANGE: neighbor 30.30.30.25 Up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down
%BGP-5-ADJCHANGE: neighbor 30.30.30.25 Down Interface flap
%BGP-3-NOTIFICATION: sent to neighbor 30.30.30.1 4/0 (hold time expired) 0 bytes
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
%BGP-5-ADJCHANGE: neighbor 30.30.30.25 Up
%BGP-5-ADJCHANGE: neighbor 30.30.30.1 Up

Router>
Router>en
Router#sh ip bgp
BGP table version is 114, local router ID is 30.30.30.26
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop        Metric LocPrf Weight Path
*> 10.50.50.0/30   30.30.30.1      0         0 0 100 i
*                  30.30.30.25     0         0 0 300 400 i
*> 10.50.50.4/30   30.30.30.1      0         0 0 100 i
*                  30.30.30.25     0         0 0 300 400 i
*> 30.30.30.0/30   0.0.0.0          0         0 32768 i
*> 30.30.30.24/30  0.0.0.0          0         0 32768 i
*                  30.30.30.1      0         0 0 100 i
*                  30.30.30.25     0         0 0 300 i
*> 40.40.40.0/29  30.30.30.25     0         0 0 300 i

Router#
```

# BGP R\_3

```

R_3
Physical Config CLI Attributes
IOS Command Line Interface

%BGP-5-ADJCHANGE: neighbor 30.30.30.26 Up
%BGP-5-ADJCHANGE: neighbor 40.40.40.5 Up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down
%BGP-5-ADJCHANGE: neighbor 30.30.30.26 Down Interface flap

%BGP-3-NOTIFICATION: sent to neighbor 40.40.40.5 4/0 (hold time expired) 0 bytes

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
%BGP-5-ADJCHANGE: neighbor 30.30.30.26 Up
%BGP-5-ADJCHANGE: neighbor 40.40.40.5 Up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down
%BGP-5-ADJCHANGE: neighbor 30.30.30.26 Down Interface flap

%BGP-3-NOTIFICATION: sent to neighbor 40.40.40.5 4/0 (hold time expired) 0 bytes

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
%BGP-5-ADJCHANGE: neighbor 40.40.40.5 Up
%BGP-5-ADJCHANGE: neighbor 30.30.30.26 Up

Router>
Router#EN
Router#sh ip bgp
BGP table version is 115, local router ID is 40.40.40.6
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop        Metric LocPrf Weight Path
*> 10.50.50.0/30   40.40.40.5         0      0      0 400 i
*                  30.30.30.26         0      0      0 200 100 i
*> 10.50.50.4/30   40.40.40.5         0      0      0 400 i
*                  30.30.30.26         0      0      0 200 100 i
*> 30.30.30.0/30   30.30.30.26         0      0      0 200 i
*> 30.30.30.24/30  0.0.0.0            0      0 32768 i
*                  30.30.30.26         0      0      0 200 i
*> 40.40.40.0/29  0.0.0.0            0      0 32768 i
*                  40.40.40.5         0      0      0 400 i

Router#
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Top
```

# BGP R\_4

```

R_4
Physical Config CLI Attributes
IOS Command Line Interface

09:05:00: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from FULL to DOWN,
Neighbor Down: Dead timer expired
09:05:00: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from FULL to DOWN,
Neighbor Down: Interface down or detached
09:58:17: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/2 from FULL to DOWN,
Neighbor Down: Dead timer expired
09:58:17: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/2 from FULL to DOWN,
Neighbor Down: Interface down or detached

%BGP-3-NOTIFICATION: sent to neighbor 40.40.40.6 4/0 (hold time expired) 0 bytes

09:58:18: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.2 on GigabitEthernet0/1 from LOADING to FULL,
Loading Done
09:58:18: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on GigabitEthernet0/2 from LOADING to FULL,
Loading Done
%BGP-5-ADJCHANGE: neighbor 40.40.40.6 Up

Router>
Router#en
Router#sh ip bgp
BGP table version is 91, local router ID is 40.40.40.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop        Metric LocPrf Weight Path
*> 10.50.50.0/30   0.0.0.0            0      0 32768 i
*                  40.40.40.6         0      0      0 300 200 100 i
*> 10.50.50.4/30   0.0.0.0            0      0 32768 i
*                  40.40.40.6         0      0      0 300 200 100 i
*> 30.30.30.0/30   40.40.40.6         0      0      0 300 200 i
*> 30.30.30.24/30  40.40.40.6         0      0      0 300 i
*> 40.40.40.0/29  0.0.0.0            0      0 32768 i
*                  40.40.40.6         0      0      0 300 i

Router#
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Top
```

Command	Description
router bgp <AS-number>	Enables BGP for the specified Autonomous System (AS) number.
neighbor <neighbor-address> remote-as <remote-AS-number>	Configures a neighbor for BGP.
neighbor <neighbor-address> update-source <source-address>	Specifies the source address for BGP updates.
neighbor <neighbor-address> password <password>	Sets a password for BGP authentication.
neighbor <neighbor-address> send-community	Enables sending community attributes to the neighbor.
neighbor <neighbor-address> receive-community	Enables receiving community attributes from the neighbor.
network <network-address> mask <subnet-mask>	Specifies the network address and subnet mask for the router's network.
bgp default-originate	Enables the router to originate a default route into BGP.
bgp redistribute <protocol>	Redistributes routes from other routing protocols into BGP.
show ip bgp	Displays information about the BGP configuration.
show ip bgp neighbors	Displays information about the BGP neighbors.
show ip bgp routes	Displays the BGP routing table.