

INSTITUTE OF COMPUTER TECHNOLOGY
B. TECH COMPUTER SCIENCE AND ENGINEERING
Subject: Computer Networks[CN]

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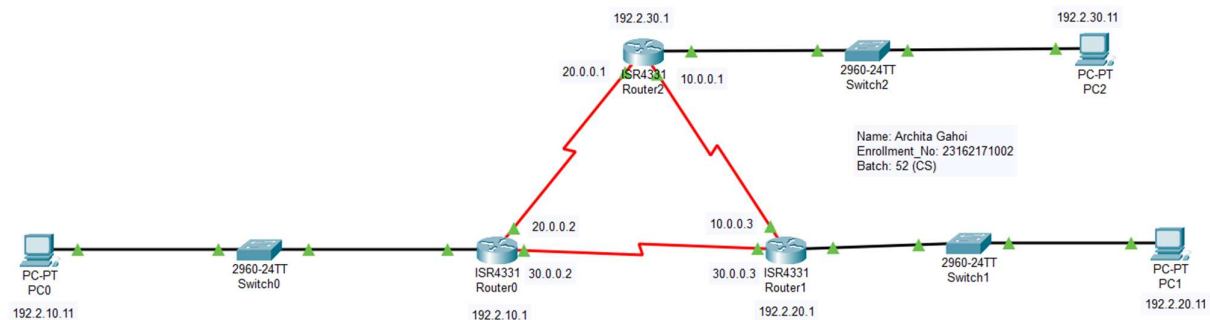
Practical 8

Aim: To design a network using Open Shortest Path First (OSPF) Protocol.

Scenario:

Consider that organization has three departments and as routing protocol Open Shortest Path First (OSPF) protocol is implemented. Configure network as shown in figure below and implement Open Shortest Path First (OSPF) routing protocol.

⇒ Main Circuit



Configuration:

IP Address:

⇒ Routers

Router 0

The screenshot shows the configuration window for Router0, specifically the GigabitEthernet0/0/0 interface. The left sidebar contains a tree view with categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, the following interfaces are listed: GigabitEthernet0/0/0 (selected), GigabitEthernet0/0/1, GigabitEthernet0/0/2, Serial0/1/0, and Serial0/1/1. The main configuration area for GigabitEthernet0/0/0 includes: Port Status (On), Bandwidth (100 Mbps), Duplex (Full Duplex), MAC Address (0090.0C63.4001), IP Configuration (IPv4 Address: 192.2.10.1, Subnet Mask: 255.255.255.0), and Tx Ring Limit (10). Below the configuration area, there is a section for Equivalent IOS Commands showing the following commands:

```
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
```

The screenshot shows the configuration window for Router0, specifically the Serial0/1/0 interface. The left sidebar is identical to the previous screenshot, with the Serial0/1/0 interface selected under the INTERFACE category. The main configuration area for Serial0/1/0 includes: Port Status (On), Duplex (Full Duplex), Clock Rate (2000000), IP Configuration (IPv4 Address: 20.0.0.2, Subnet Mask: 255.0.0.0), and Tx Ring Limit (10). Below the configuration area, there is a section for Equivalent IOS Commands showing the following commands:

```
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
```

Router0

Physical Config CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/1

Port Status

Duplex ☒ Full Duplex ☐ On

Clock Rate 2000000

IP Configuration

IPv4 Address 30.0.0.2

Subnet Mask 255.0.0.0

Tx Ring Limit 10

Equivalent IOS Commands

```

Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#

```

Top

Router0

Physical Config CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

20.0.0.0

30.0.0.0

192.2.10.0

Remove

Equivalent IOS Commands

```

Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#

```

Top

Router 1

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

GigabitEthernet0/0/0

Port Status

Bandwidth

Duplex

MAC Address

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Attributes

GigabitEthernet0/0/0

Port Status

Bandwidth

Duplex

MAC Address

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

1000 Mbps

100 Mbps

10 Mbps

Half Duplex

Full Duplex

On

Auto

Auto

0002 4AC5 1D01

192.2.20.1

255.255.255.0

10

Equivalent IOS Commands

Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#

Top

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Attributes

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Full Duplex

2000000

10.0.0.3

255.0.0.0

10

Equivalent IOS Commands

Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#

Top

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/1

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

On

Full Duplex

2000000

30.0.0.3

255.0.0.0

10

Equivalent IOS Commands

Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#

☐ Top

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

10.0.0.0

30.0.0.0

192.2.20.0

Remove

Equivalent IOS Commands

Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config)#router rip
Router(config-router)#

☐ Top

Router 2

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

GigabitEthernet0/0/0

Port Status

Bandwidth

Duplex

MAC Address

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

On

1000 Mbps

100 Mbps

10 Mbps

Auto

Half Duplex

Full Duplex

Auto

0009.7C65.B301

192.2.30.1

255.255.255.0

10

Equivalent IOS Commands

Press RETURN to get started!

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#

Top

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

On

Full Duplex

2000000

20.0.0.1

255.0.0.0

10

Equivalent IOS Commands

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#

Top

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/1

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Serial0/1/1

Full Duplex

2000000

10.0.0.1

255.0.0.0

10

Equivalent IOS Commands

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#

Top

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

10.0.0.0

20.0.0.0

192.2.30.0

Remove

Equivalent IOS Commands

Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#

Top

⇒ PCS

PC0, PC1, PC2

PC0

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.2.10.11

Subnet Mask 255.255.255.0

Default Gateway 192.2.10.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::260:2FFF:FE68:1709

Default Gateway

DNS Server

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.2.20.11

Subnet Mask 255.255.255.0

Default Gateway 192.2.20.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::260:47FF:FE16:7DAE

Default Gateway

DNS Server

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.2.30.11

Subnet Mask 255.255.255.0

Default Gateway 192.2.30.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

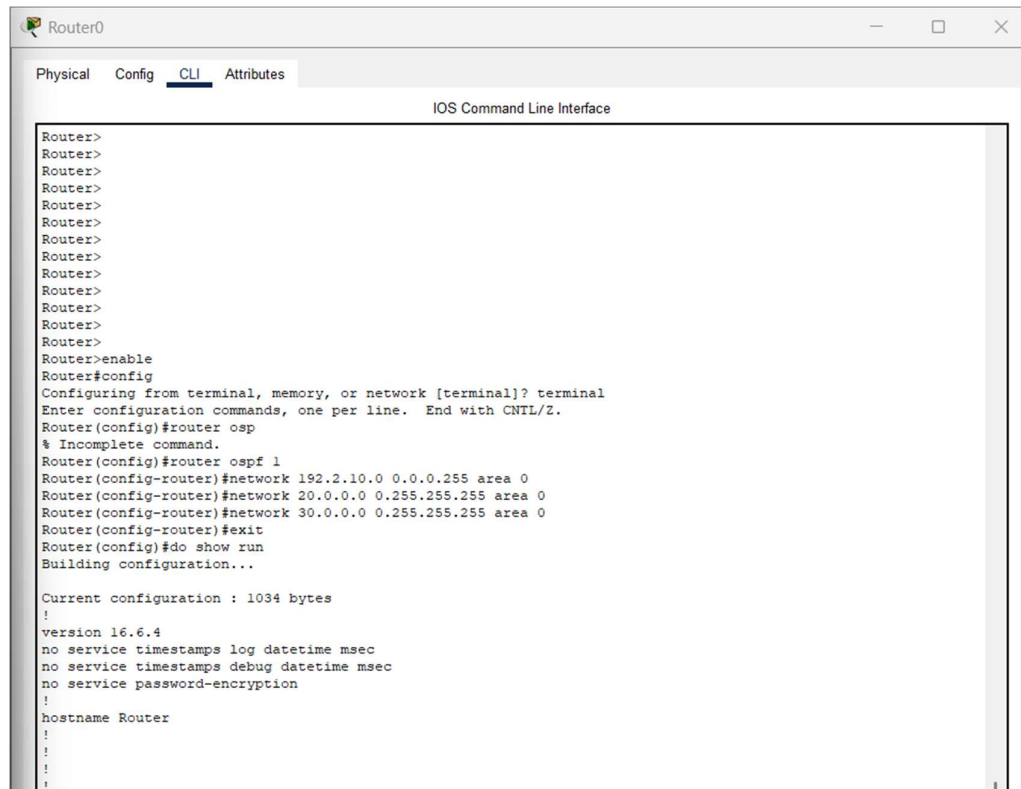
IPv6 Address /

Link Local Address FE80::290:21FF:FE36:3689

Default Gateway

DNS Server

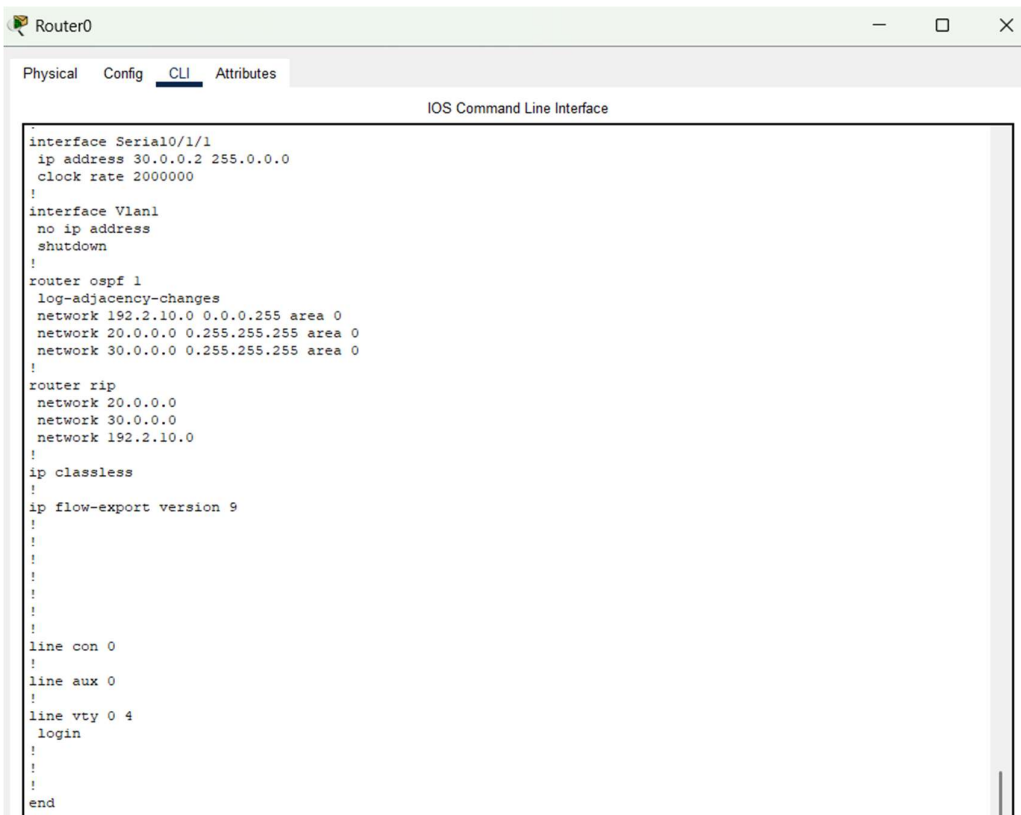
⇒ Configuring open short path first (OSPF) routing table in Router0.



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>enable
Router#config
Configuring from terminal, memory, or network [terminal]? terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router osp
% Incomplete command.
Router(config)#router ospf 1
Router(config-router)#network 192.2.10.0 0.0.0.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#do show run
Building configuration...

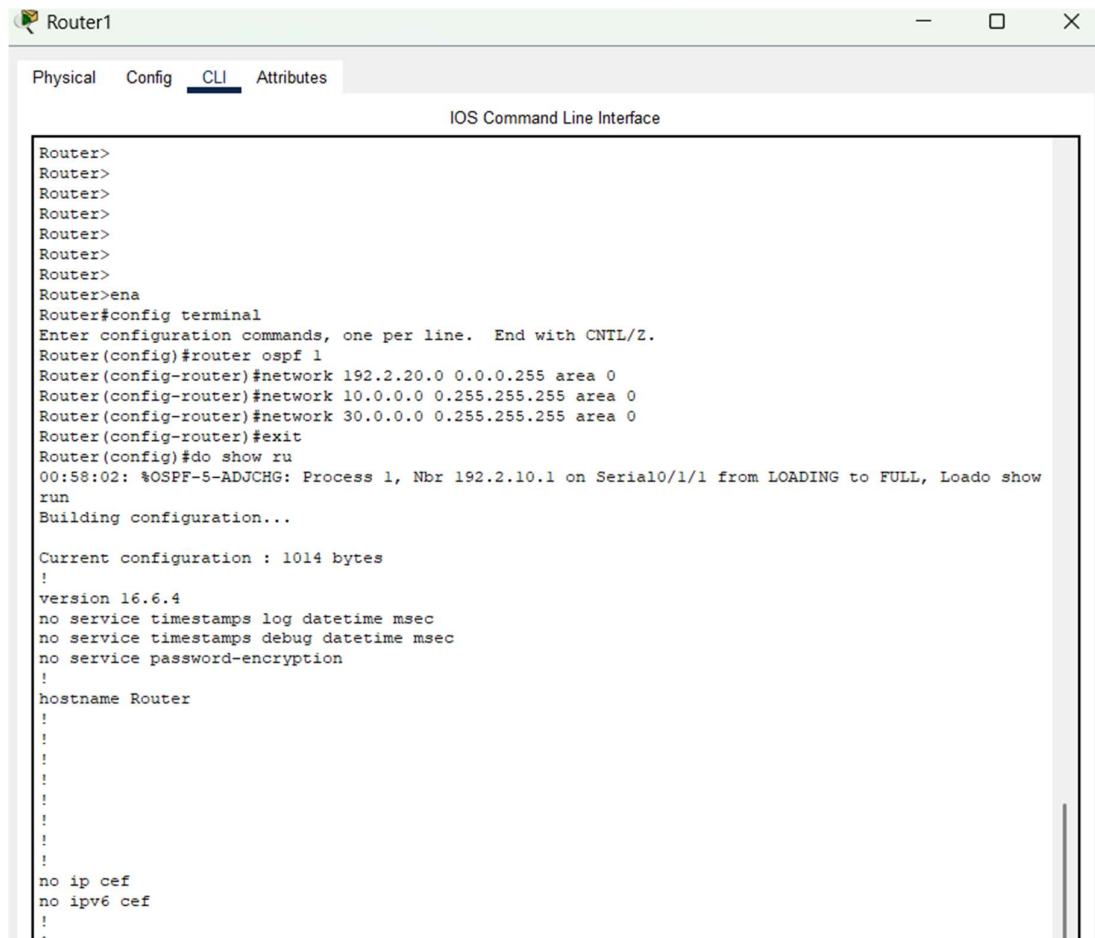
Current configuration : 1034 bytes
!
version 16.6.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
```



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

interface Serial0/1/1
ip address 30.0.0.2 255.0.0.0
clock rate 2000000
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 192.2.10.0 0.0.0.255 area 0
network 20.0.0.0 0.255.255.255 area 0
network 30.0.0.0 0.255.255.255 area 0
!
router rip
network 20.0.0.0
network 30.0.0.0
network 192.2.10.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

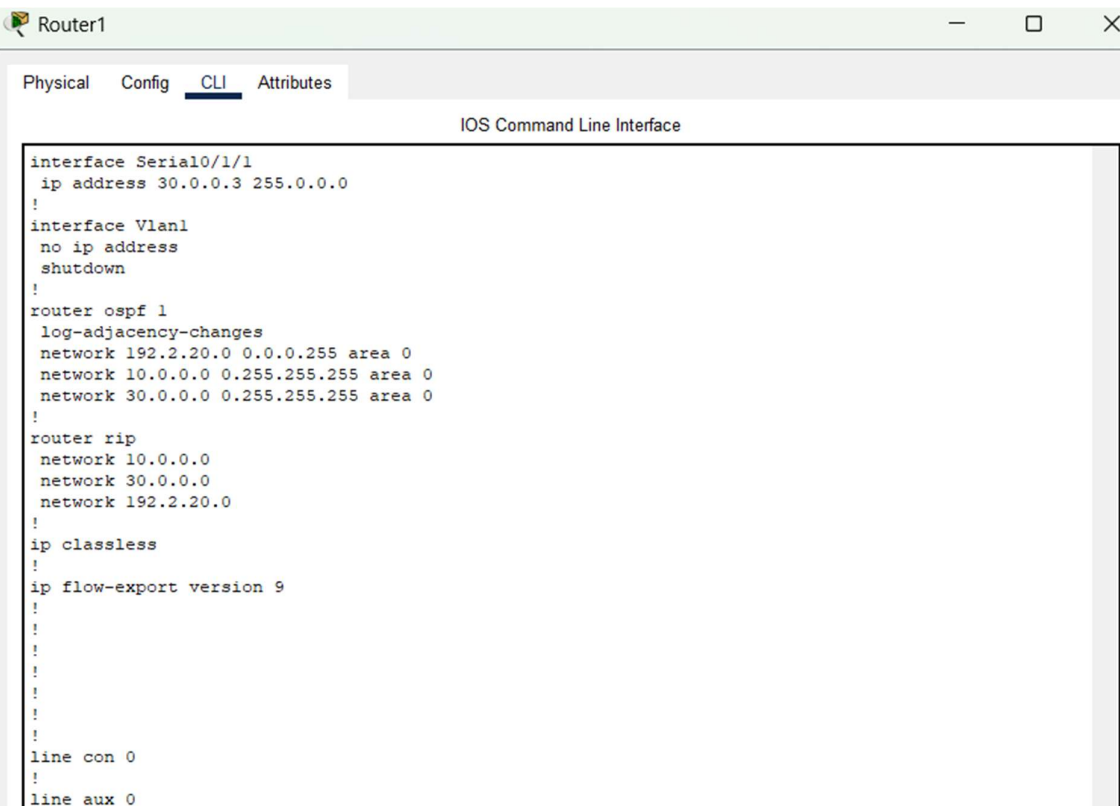
⇒ Configuring open short path first (OSPF) routing table in Router1.



The screenshot shows the Router1 CLI window with the 'CLI' tab selected. The command history shows the user entering 'ena' to enter enable mode, then 'config terminal' to enter configuration mode. They then configure OSPF by entering 'router ospf 1', followed by three 'network' commands for the 192.2.20.0, 10.0.0.0, and 30.0.0.0 networks in area 0. After exiting configuration mode with 'exit', they run 'do show run' to display the current configuration. The output shows the version (16.6.4), various service settings (timestamps, debug, password-encryption), the hostname 'Router', and the OSPF configuration.

```
Router>
Router>
Router>
Router>
Router>
Router>
Router>
Router>ena
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.2.20.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#do show run
00:58:02: %OSPF-5-ADJCHG: Process 1, Nbr 192.2.10.1 on Serial0/1/1 from LOADING to FULL, Loado show run
Building configuration...

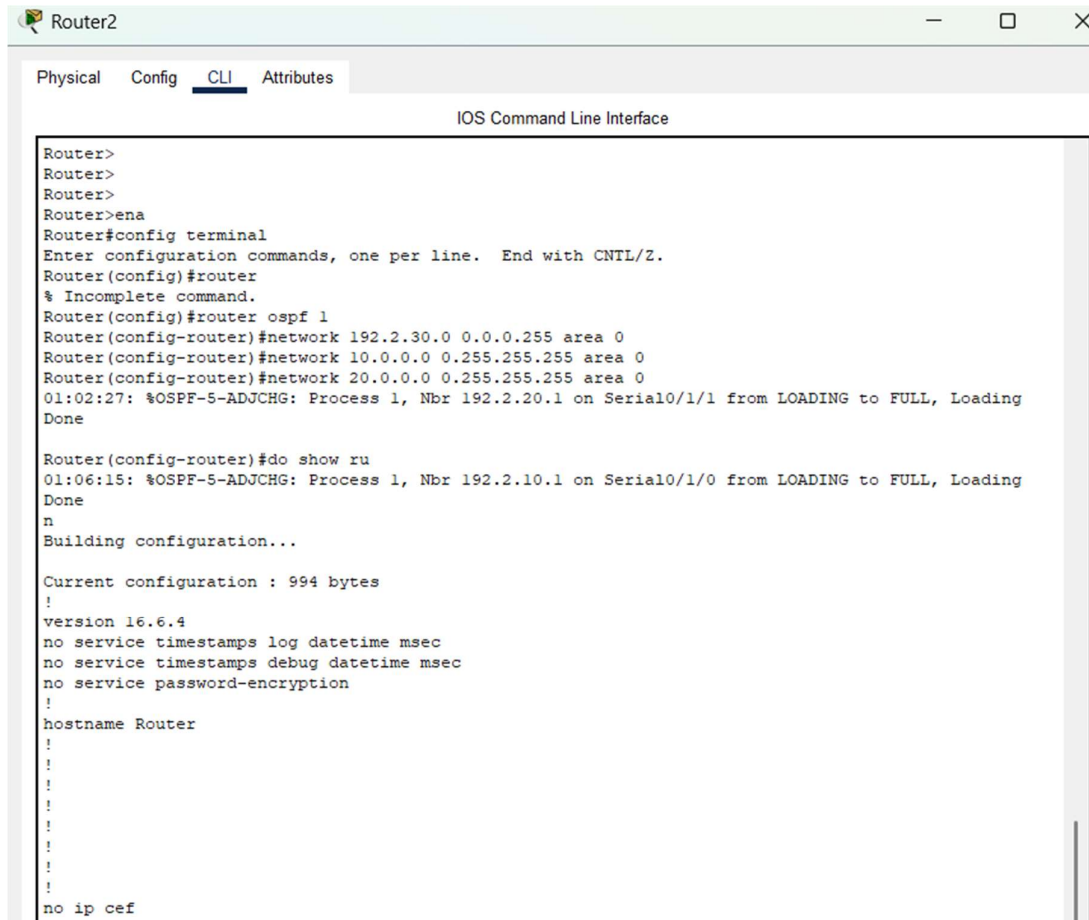
Current configuration : 1014 bytes
!
version 16.6.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
```



The screenshot shows the Router1 CLI window with the 'CLI' tab selected. The command history shows the user configuring the interfaces and routing protocols. They configure 'Serial0/1/1' with IP address 30.0.0.3/255.0.0.0, and 'Vlan1' with 'no ip address' and 'shutdown'. They then configure OSPF with 'router ospf 1', 'log-adjacency-changes', and the same three network statements as before. They also configure RIP with 'router rip' and the same three network statements. Finally, they configure 'ip classless', 'ip flow-export version 9', and set console and aux lines to 0.

```
interface Serial0/1/1
 ip address 30.0.0.3 255.0.0.0
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.2.20.0 0.0.0.255 area 0
 network 10.0.0.0 0.255.255.255 area 0
 network 30.0.0.0 0.255.255.255 area 0
!
router rip
 network 10.0.0.0
 network 30.0.0.0
 network 192.2.20.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
line con 0
!
line aux 0
```

⇒ Configuring open short path first (OSPF) routing table in Router2.

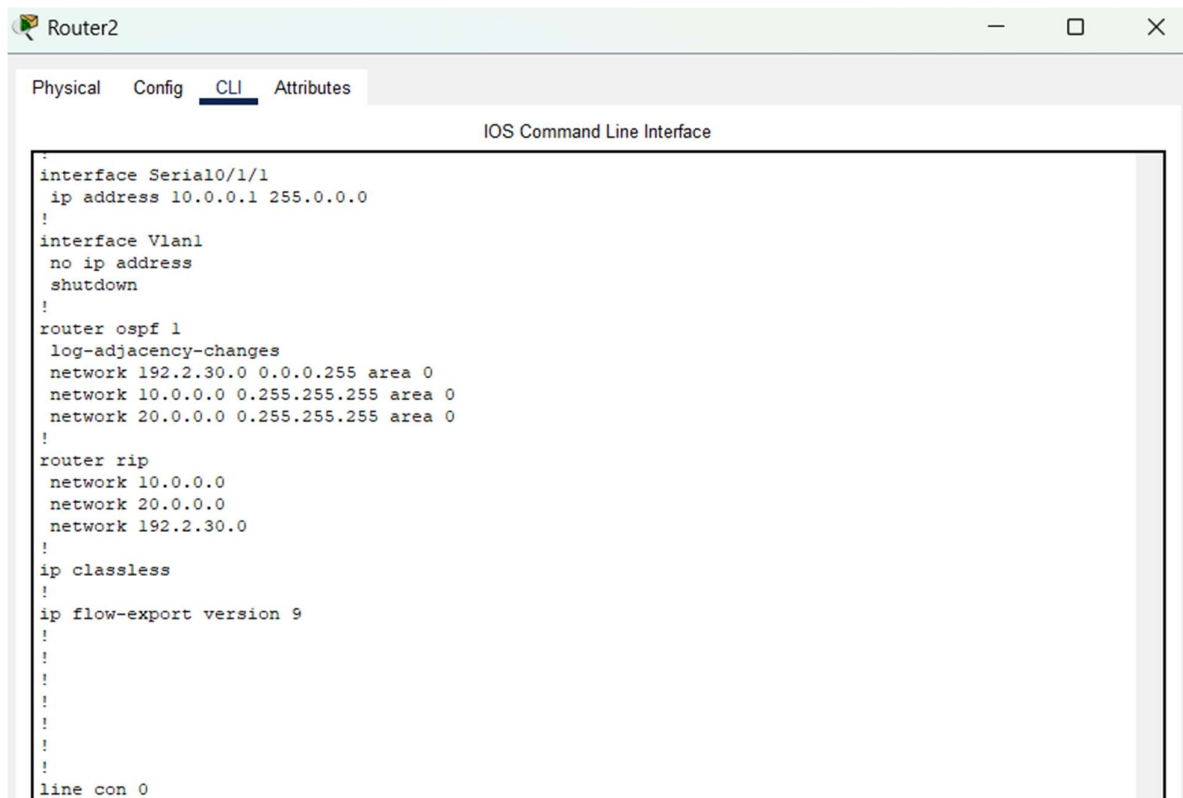


The screenshot shows the Router2 CLI window with the 'CLI' tab selected. The command history shows the user entering 'Router>ena' to enter enable mode, then 'Router#config terminal' to enter configuration mode. They then enter 'router ospf 1' to start OSPF. The next three commands are 'network 192.2.30.0 0.0.0.255 area 0', 'network 10.0.0.0 0.255.255.255 area 0', and 'network 20.0.0.0 0.255.255.255 area 0'. After the third command, a message appears: '01:02:27: %OSPF-5-ADJCHG: Process 1, Nbr 192.2.20.1 on Serial0/1/1 from LOADING to FULL, Loading Done'. The user then enters 'do show ru' to see the current configuration. The output shows the current configuration is 994 bytes, version 16.6.4, and lists the configured OSPF networks. The configuration ends with 'no ip cef'.

```
Router>
Router>
Router>
Router>ena
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router
% Incomplete command.
Router(config)#router ospf 1
Router(config-router)#network 192.2.30.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
01:02:27: %OSPF-5-ADJCHG: Process 1, Nbr 192.2.20.1 on Serial0/1/1 from LOADING to FULL, Loading Done

Router(config-router)#do show ru
01:06:15: %OSPF-5-ADJCHG: Process 1, Nbr 192.2.10.1 on Serial0/1/0 from LOADING to FULL, Loading Done
n
Building configuration...

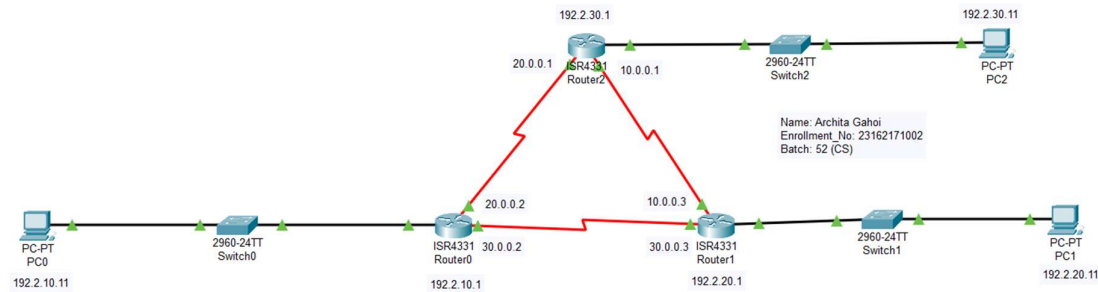
Current configuration : 994 bytes
!
version 16.6.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
no ip cef
```



The screenshot shows the Router2 CLI window with the 'CLI' tab selected. The command history shows the user entering 'interface Serial0/1/1' and 'ip address 10.0.0.1 255.0.0.0'. They then enter 'interface Vlan1' and 'no ip address' followed by 'shutdown'. Next, they enter 'router ospf 1' and 'log-adjacency-changes'. The next three commands are 'network 192.2.30.0 0.0.0.255 area 0', 'network 10.0.0.0 0.255.255.255 area 0', and 'network 20.0.0.0 0.255.255.255 area 0'. They then enter 'router rip' and 'network 10.0.0.0', 'network 20.0.0.0', and 'network 192.2.30.0'. Finally, they enter 'ip classless' and 'ip flow-export version 9'. The configuration ends with 'line con 0'.

```
!
interface Serial0/1/1
 ip address 10.0.0.1 255.0.0.0
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.2.30.0 0.0.0.255 area 0
 network 10.0.0.0 0.255.255.255 area 0
 network 20.0.0.0 0.255.255.255 area 0
!
router rip
 network 10.0.0.0
 network 20.0.0.0
 network 192.2.30.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
```

Output:



The screenshot shows the Realtek network simulator interface. The top bar includes the Realtek logo and a 'Scenario 0' dropdown. Below the bar is a toolbar with various icons. The 'PDU List Window' is open, displaying a table of network events.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC1	ICMP	Green	0.000	N	0	(edit)	(delete)
	Successful	PC1	PC2	ICMP	Purple	0.000	N	1	(edit)	(delete)
	Successful	PC2	PC0	ICMP	Blue	0.000	N	2	(edit)	(delete)
	Successful	PC0	PC2	ICMP	Blue	0.000	N	3	(edit)	(delete)

Conclusion:

In this practical, OSPF was successfully configured to enable dynamic and efficient routing in the network. The protocol provided fast convergence and optimal path selection, ensuring stable and reliable communication. This demonstrated the effectiveness of OSPF in designing scalable modern networks.