

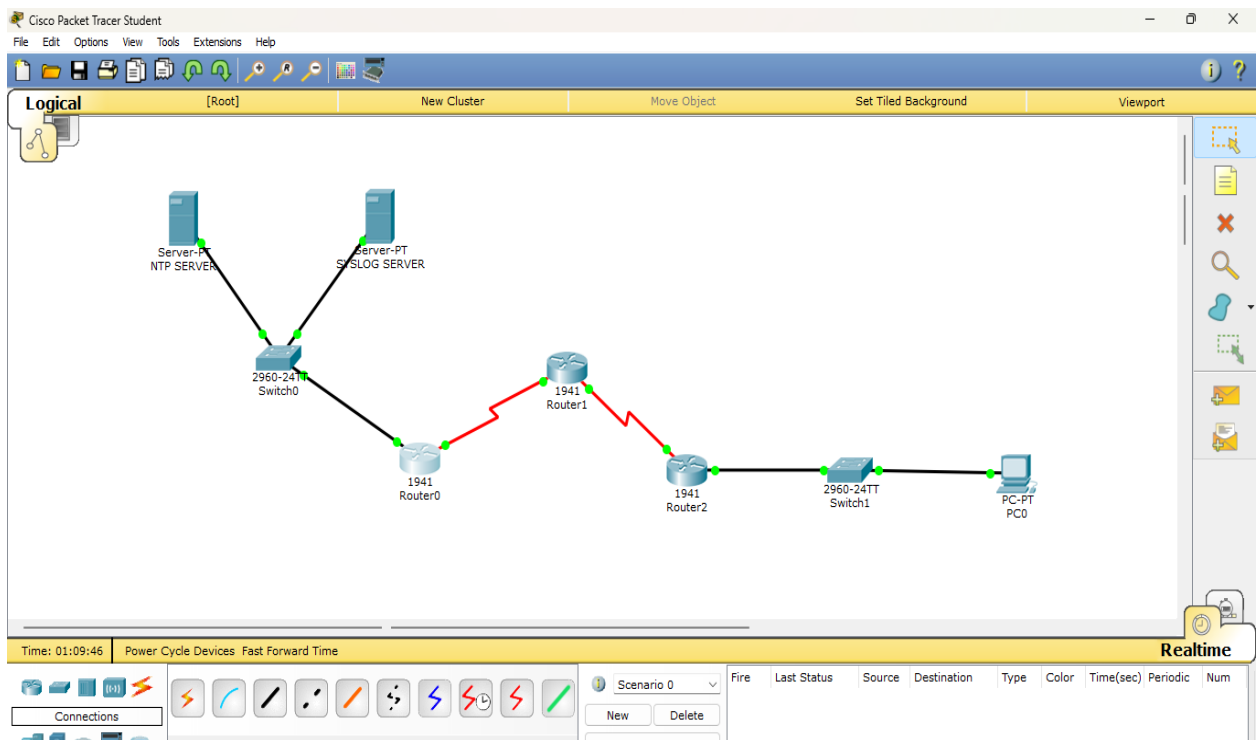
Date: 10/01/2024

## Security in Computing

### Practical 1:

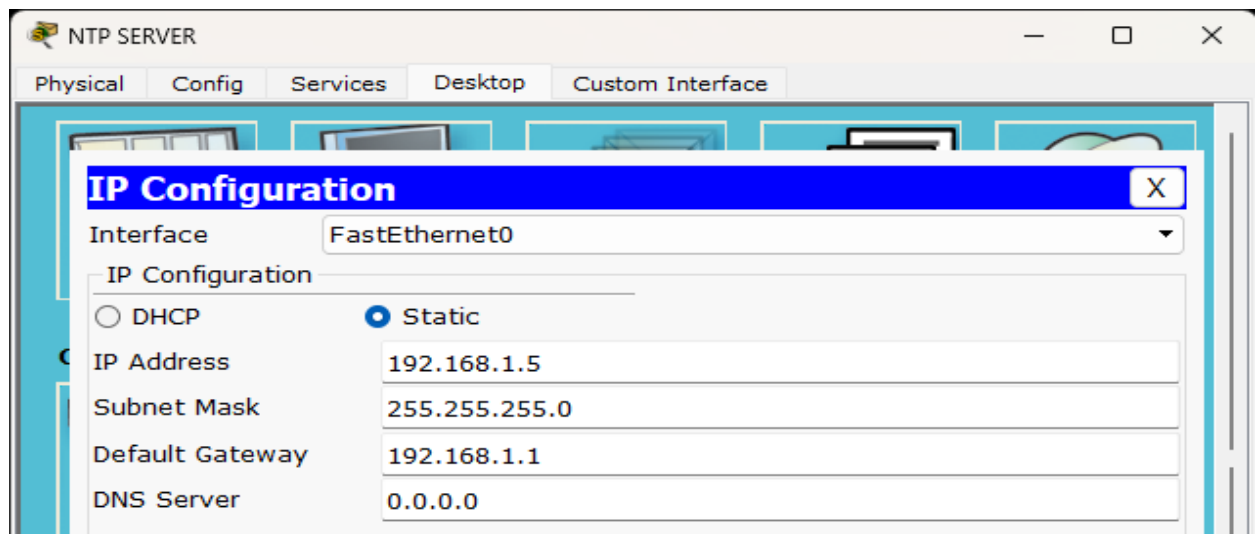
- **Aim: Configure Routers**
  - a. OSPF MD5 authentication
  - b. NTP
  - c. to log messages to the SYSLOG server
  - d. to support SSH connections.

### ➤ **Topology Diagram**

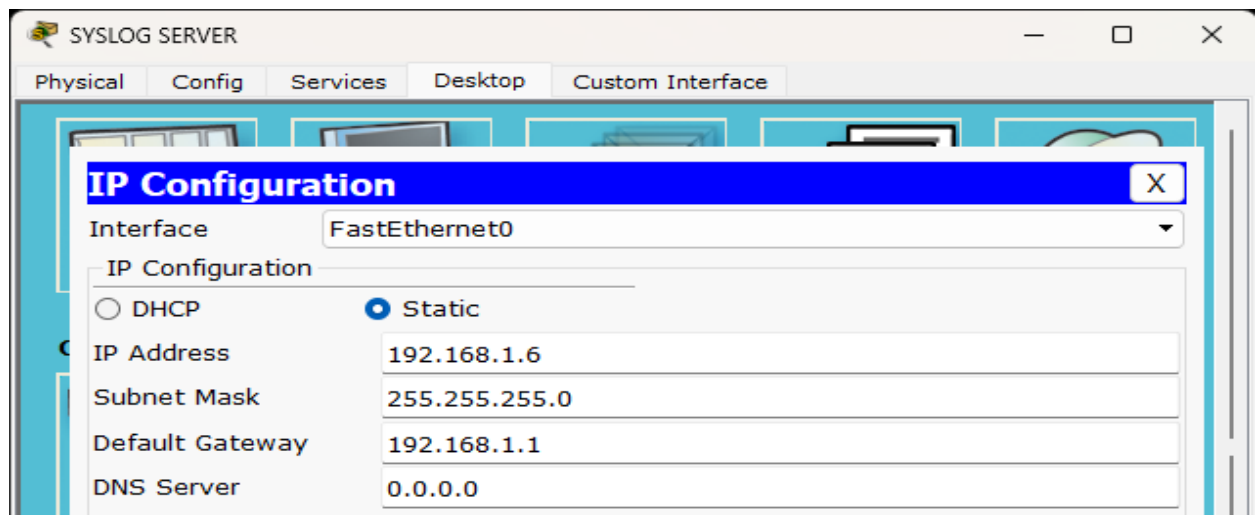


## ➤ Assigning IP Addresses

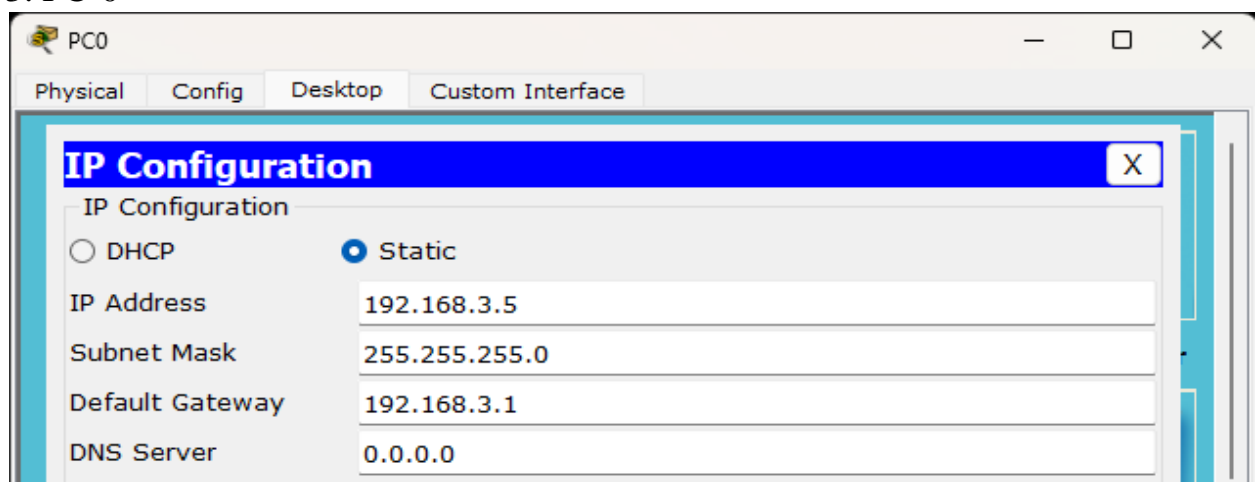
### 1.NTP Server



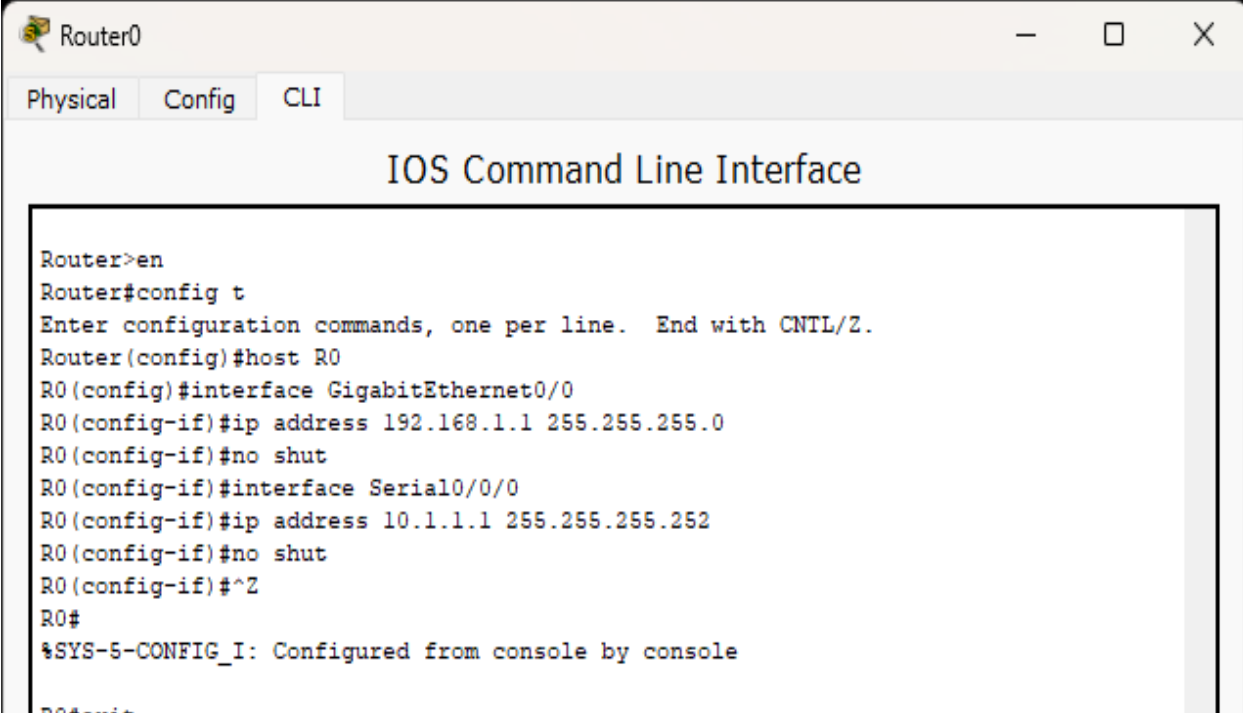
### 2. SYSLOG Server



### 3. PC-0



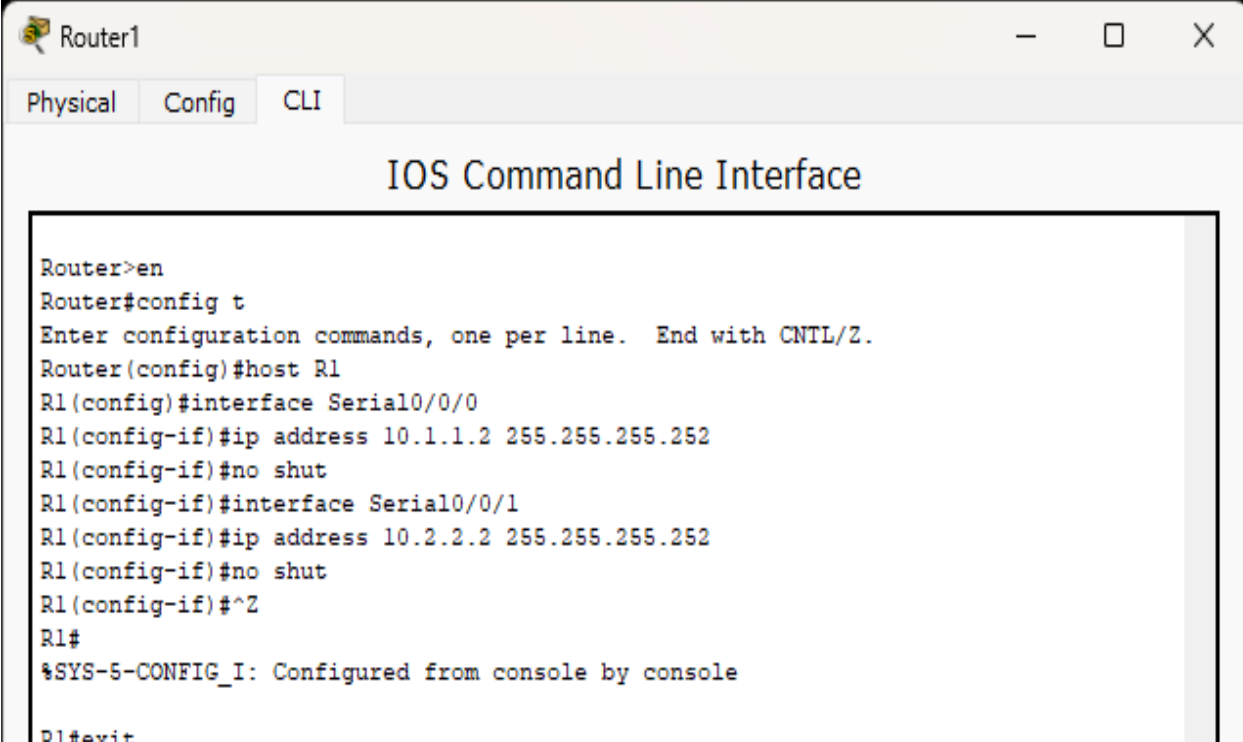
#### 4. Router 0



The screenshot shows a window titled "Router0" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal text is as follows:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#host R0
R0(config)#interface GigabitEthernet0/0
R0(config-if)#ip address 192.168.1.1 255.255.255.0
R0(config-if)#no shut
R0(config-if)#interface Serial0/0/0
R0(config-if)#ip address 10.1.1.1 255.255.255.252
R0(config-if)#no shut
R0(config-if)#^Z
R0#
%SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

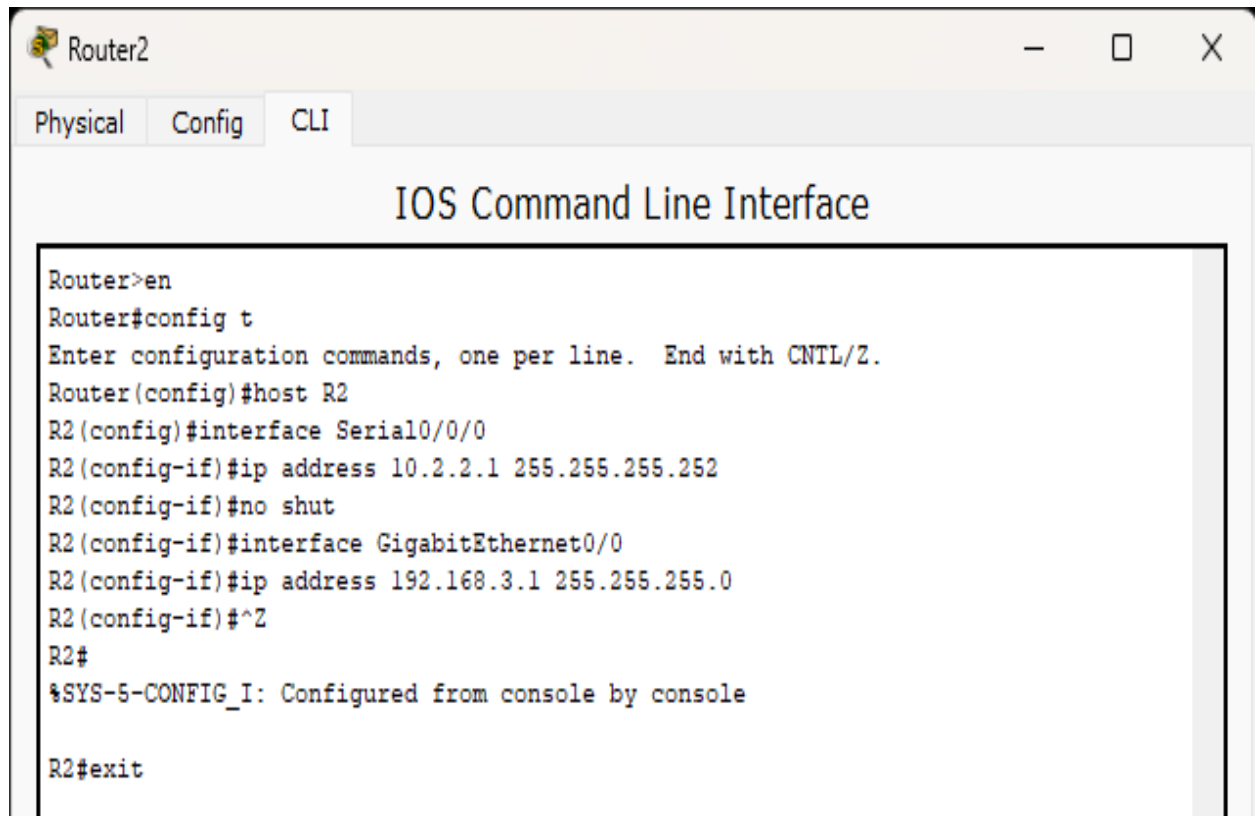
#### 5. Router 1



The screenshot shows a window titled "Router1" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal text is as follows:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#host R1
R1(config)#interface Serial0/0/0
R1(config-if)#ip address 10.1.1.2 255.255.255.252
R1(config-if)#no shut
R1(config-if)#interface Serial0/0/1
R1(config-if)#ip address 10.2.2.2 255.255.255.252
R1(config-if)#no shut
R1(config-if)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

## 6. Router 2



### ➤ Displaying IP Address Details of Routers

#### 1. Router 0

```
R0>show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	192.168.1.1	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/0/0	10.1.1.1	YES	manual	up	up
Serial0/0/1	unassigned	YES	unset	administratively down	down
Vlan1	unassigned	YES	unset	administratively down	down

## 2. Router 1

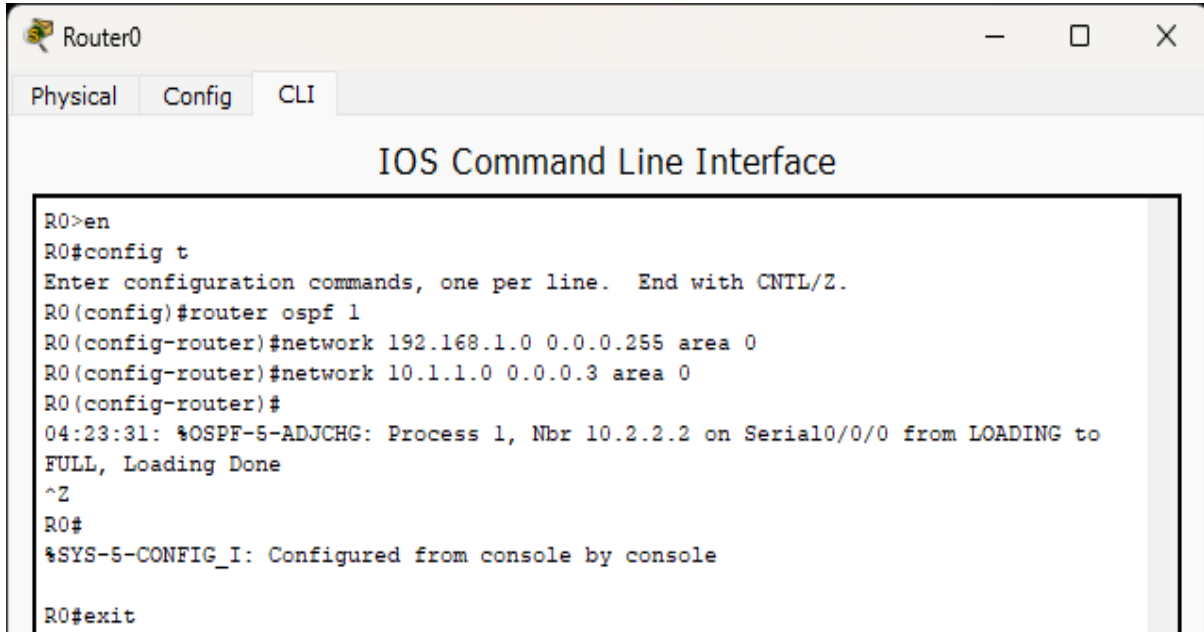
```
R1>show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0       unassigned      YES unset    administratively down down
GigabitEthernet0/1       unassigned      YES unset    administratively down down
Serial10/0/0             10.1.1.2        YES manual    up
Serial10/0/1             10.2.2.2        YES manual    up
Vlan1                    unassigned      YES unset    administratively down down
```

## 3. Router 2

```
R2>show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0       192.168.3.1     YES manual    up
GigabitEthernet0/1       unassigned      YES unset    administratively down down
Serial10/0/0             10.2.2.1        YES manual    up
Serial10/0/1             unassigned      YES unset    administratively down down
Vlan1                    unassigned      YES unset    administratively down down
```

### ➤ Configure OSPF on routes

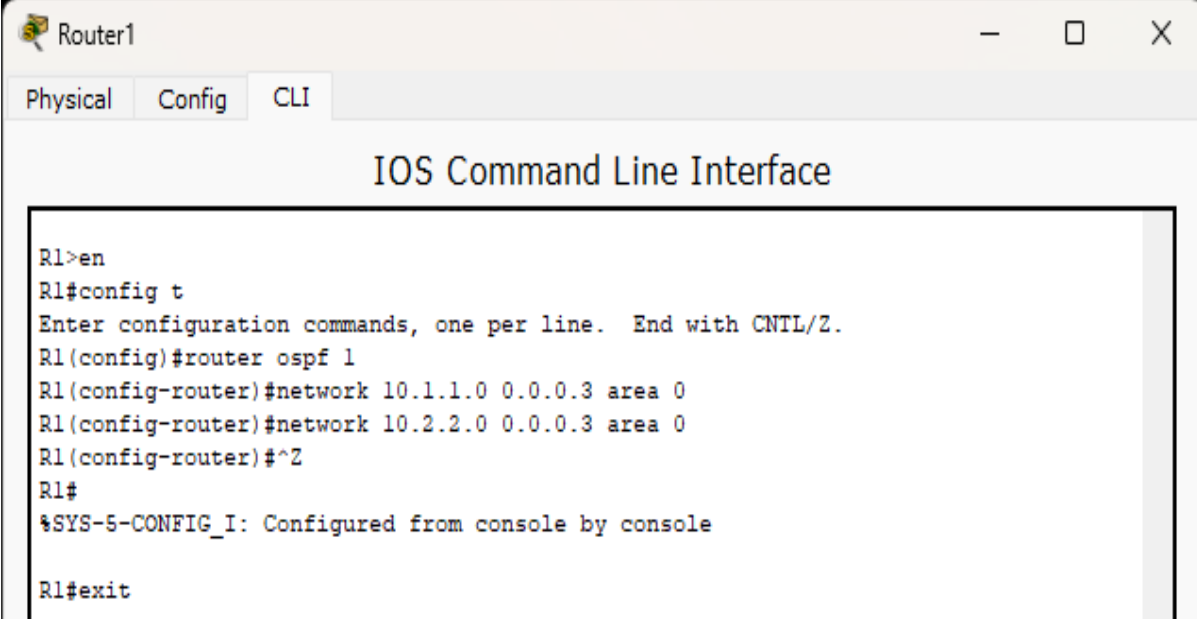
## 1. Router 0



The screenshot shows a window titled "Router0" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal output shows the following sequence of commands and responses:

```
R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#router ospf 1
R0(config-router)#network 192.168.1.0 0.0.0.255 area 0
R0(config-router)#network 10.1.1.0 0.0.0.3 area 0
R0(config-router)#
04:23:31: %OSPF-5-ADJCHG: Process 1, Nbr 10.2.2.2 on Serial10/0/0 from LOADING to FULL, Loading Done
^Z
R0#
%SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

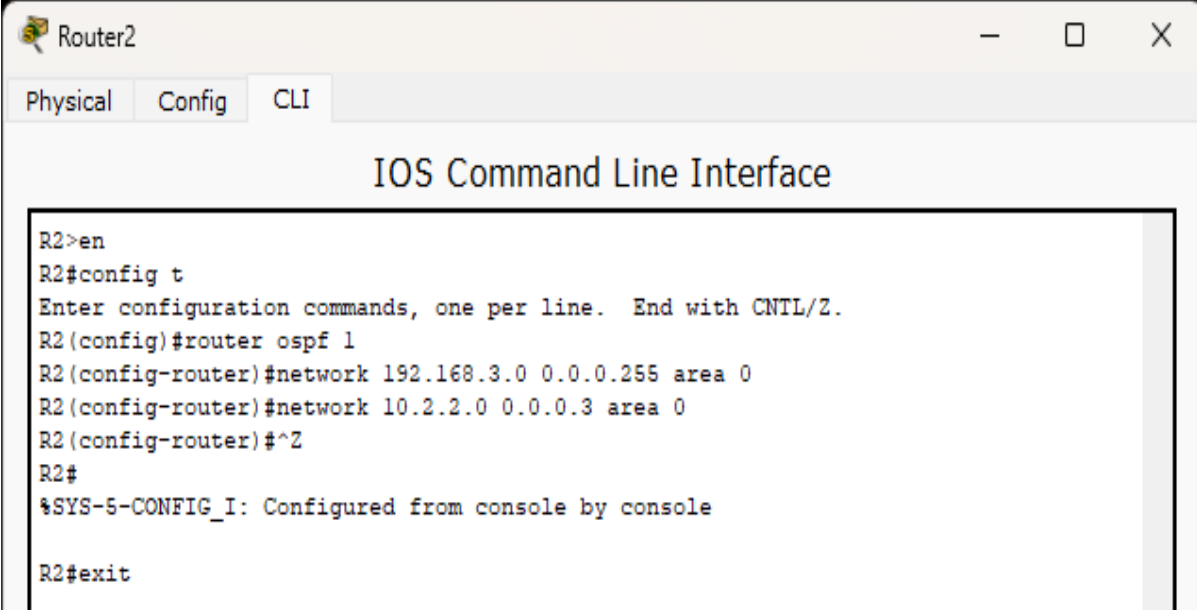
## 2. Router 1



The screenshot shows a window titled "Router1" with three tabs: "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal output shows the following commands and responses:

```
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#network 10.1.1.0 0.0.0.3 area 0
R1(config-router)#network 10.2.2.0 0.0.0.3 area 0
R1(config-router)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

## 3. Router 2

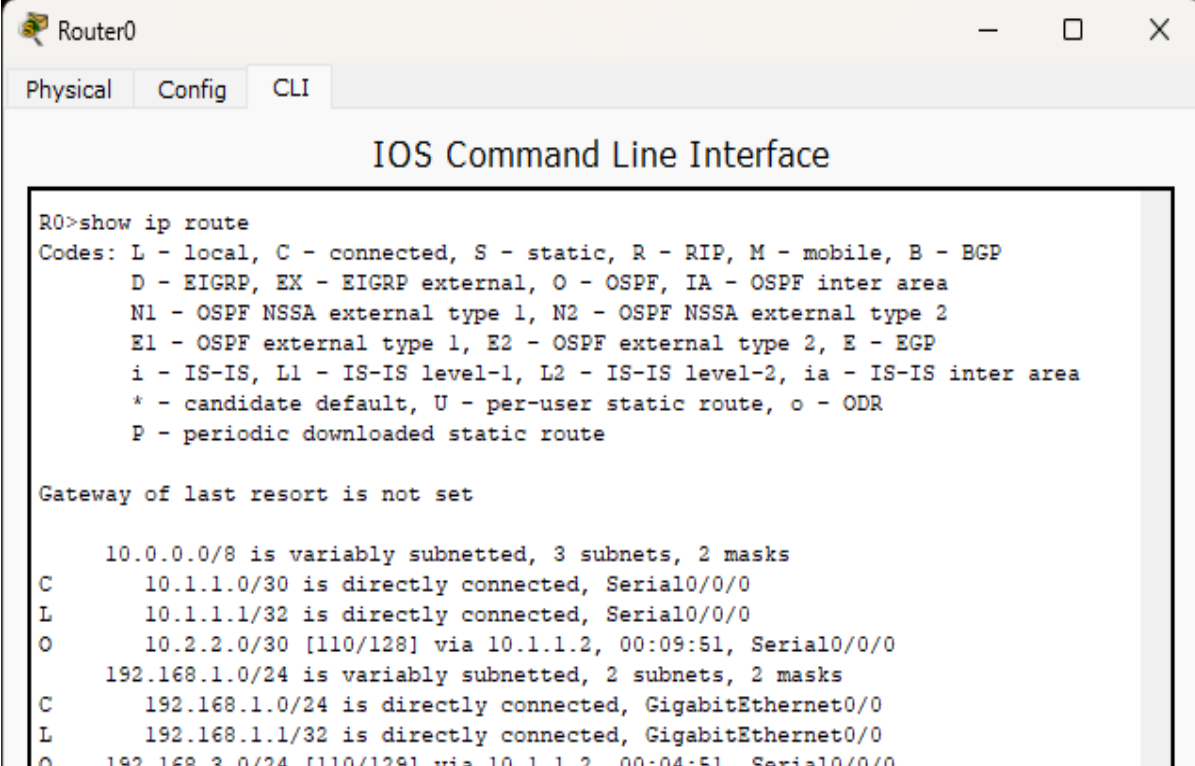


The screenshot shows a window titled "Router2" with three tabs: "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal output shows the following commands and responses:

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#network 192.168.3.0 0.0.0.255 area 0
R2(config-router)#network 10.2.2.0 0.0.0.3 area 0
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

➤ **Displaying routing table of routers**

1. Router 0



The screenshot shows the CLI of Router0. The command 'show ip route' has been entered, and the output displays the routing table. It includes codes for various route types, a message about the gateway of last resort, and a list of routes with their metrics and interfaces.

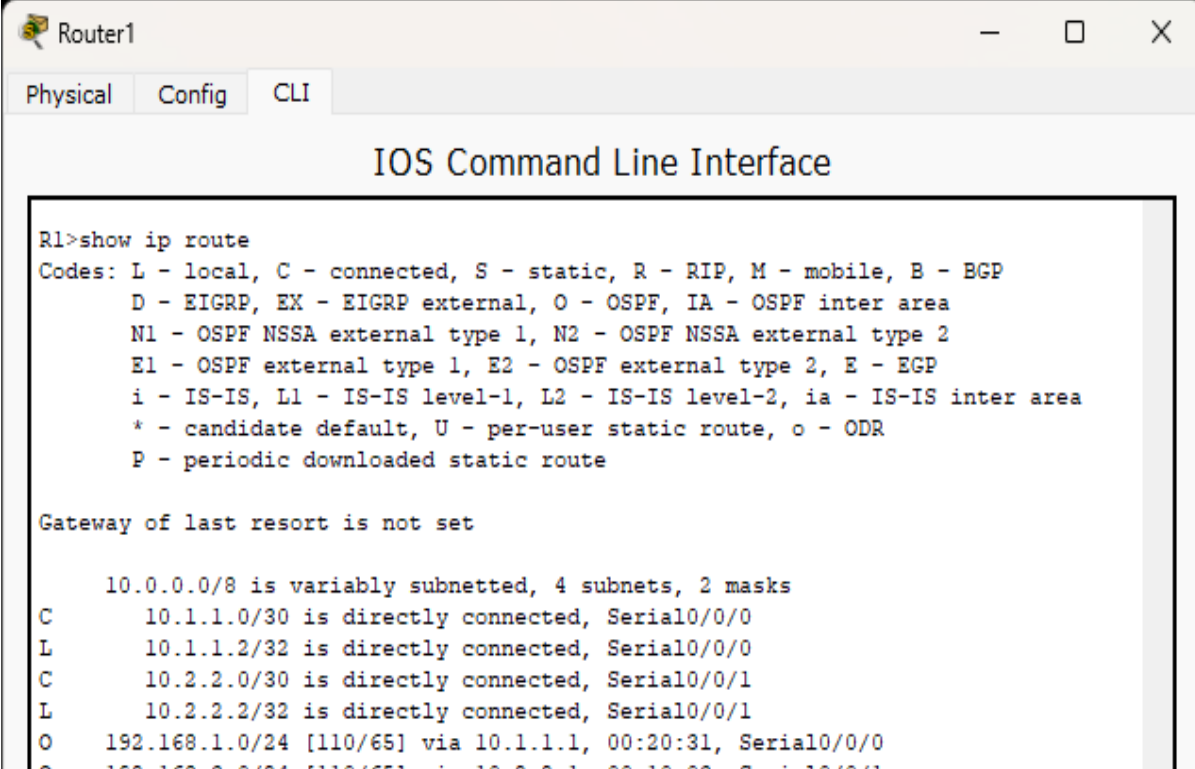
```
Router0
Physical Config CLI
IOS Command Line Interface

R0>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
L       10.1.1.1/32 is directly connected, Serial0/0/0
O       10.2.2.0/30 [110/128] via 10.1.1.2, 00:09:51, Serial0/0/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
O       192.168.3.0/24 [110/129] via 10.1.1.2, 00:04:51, Serial0/0/0
```

2. Router 1



The screenshot shows the CLI of Router1. The command 'show ip route' has been entered, and the output displays the routing table. It includes codes for various route types, a message about the gateway of last resort, and a list of routes with their metrics and interfaces.

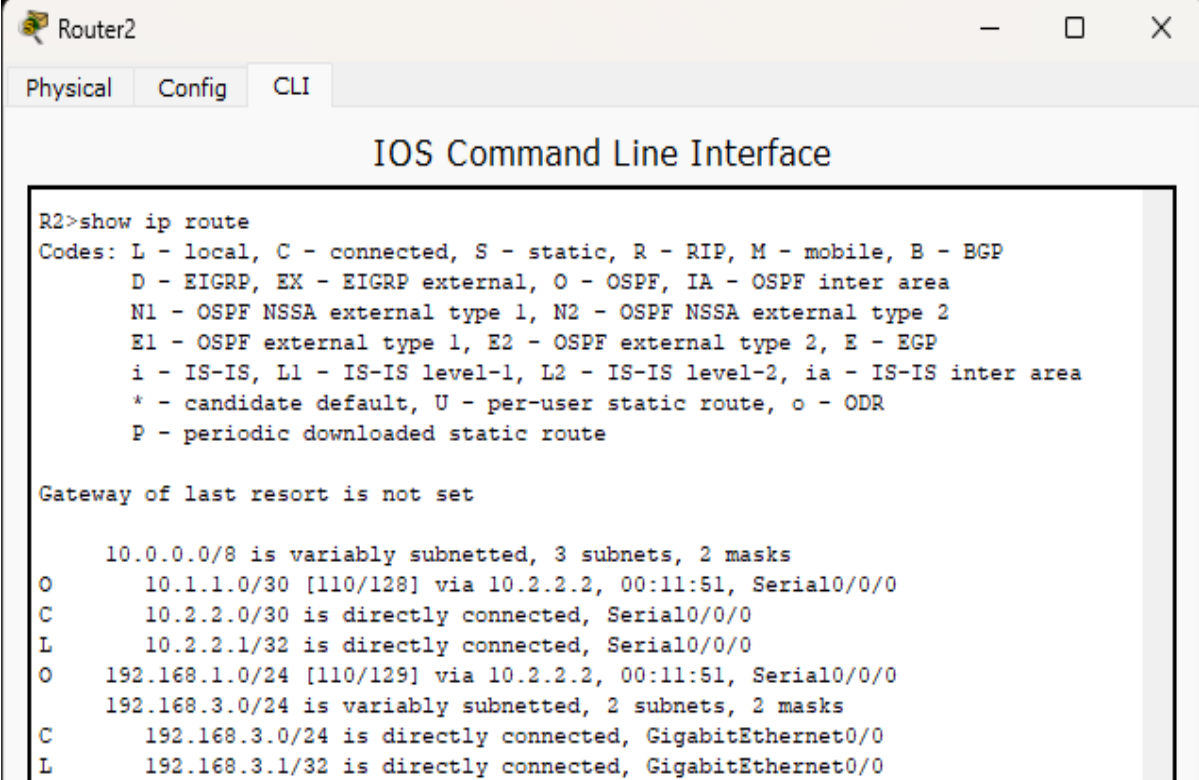
```
Router1
Physical Config CLI
IOS Command Line Interface

R1>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
L       10.1.1.2/32 is directly connected, Serial0/0/0
C       10.2.2.0/30 is directly connected, Serial0/0/1
L       10.2.2.2/32 is directly connected, Serial0/0/1
O       192.168.1.0/24 [110/65] via 10.1.1.1, 00:20:31, Serial0/0/0
O       192.168.3.0/24 [110/65] via 10.2.2.1, 00:10:03, Serial0/0/1
```

### 3. Router 2



The screenshot shows a window titled "Router2" with three tabs: "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The command "R2>show ip route" has been entered, and the output is displayed. The output includes a legend for route codes, a message about the gateway of last resort, and a list of routes with their respective metrics and interfaces.

```
R2>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

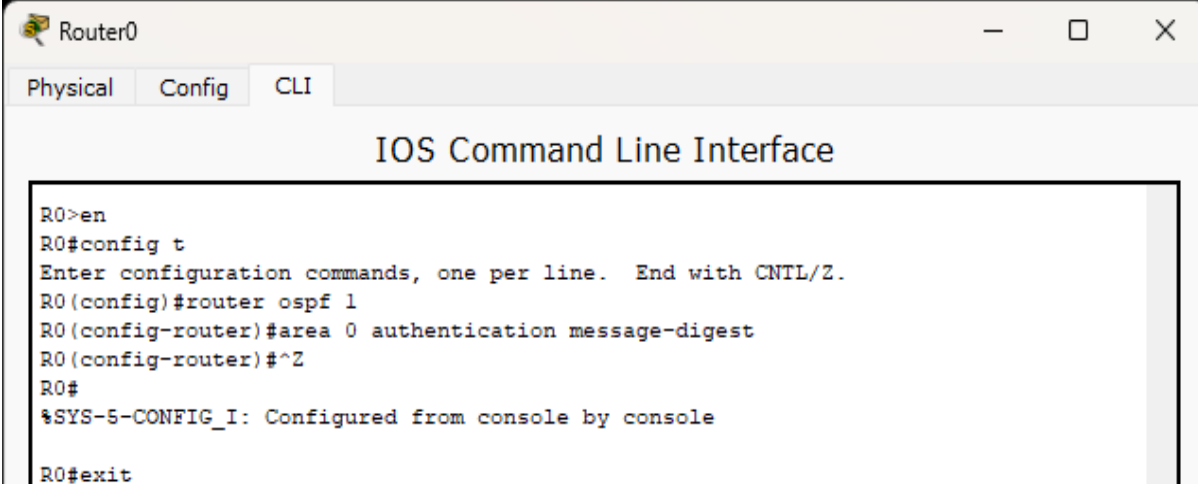
    10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O       10.1.1.0/30 [110/128] via 10.2.2.2, 00:11:51, Serial0/0/0
C       10.2.2.0/30 is directly connected, Serial0/0/0
L       10.2.2.1/32 is directly connected, Serial0/0/0
O       192.168.1.0/24 [110/129] via 10.2.2.2, 00:11:51, Serial0/0/0
       192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/0
L       192.168.3.1/32 is directly connected, GigabitEthernet0/0
```



## A. OSPF MD5 authentication

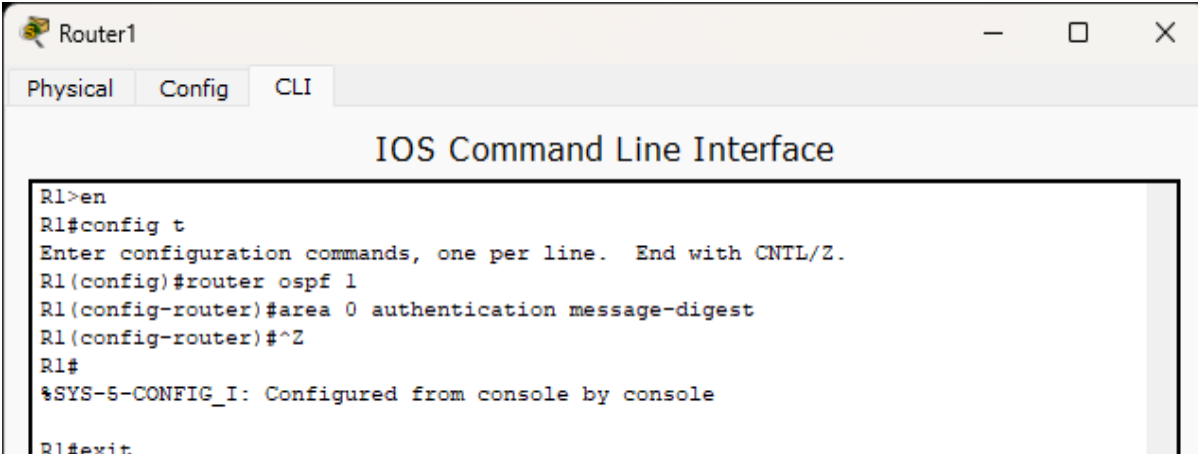
### ➤ **Configure OSPF MD5 authentication on Routers**

#### 1. Router 0



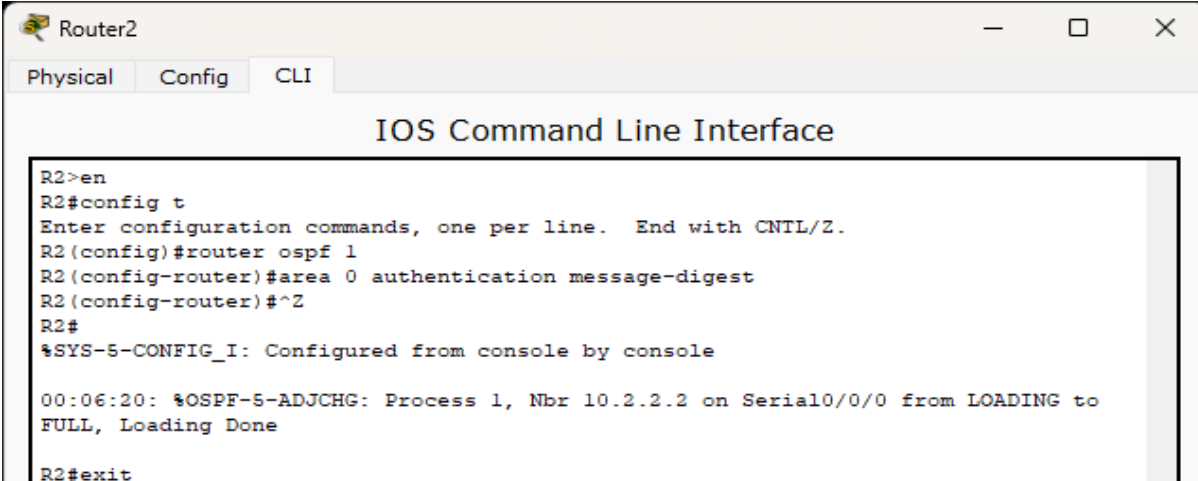
```
Router0
Physical Config CLI
IOS Command Line Interface
R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#router ospf 1
R0(config-router)#area 0 authentication message-digest
R0(config-router)#^Z
R0#
%SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

#### 2. Router 1



```
Router1
Physical Config CLI
IOS Command Line Interface
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#area 0 authentication message-digest
R1(config-router)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

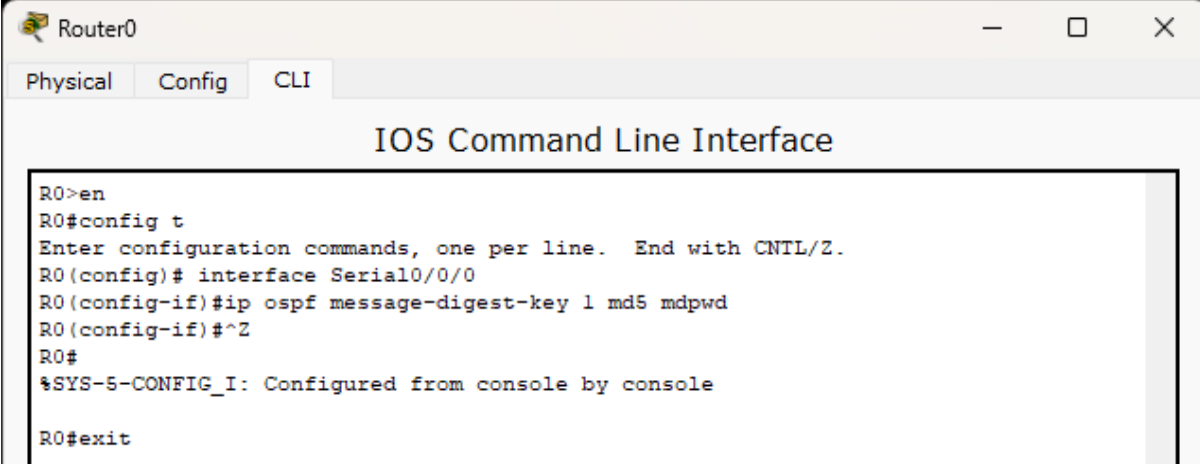
#### 3. Router 2



```
Router2
Physical Config CLI
IOS Command Line Interface
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#area 0 authentication message-digest
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
00:06:20: %OSPF-5-ADJCHG: Process 1, Nbr 10.2.2.2 on Serial0/0/0 from LOADING to FULL, Loading Done
R2#exit
```

➤ **Configure the MD5 key for all the routers**

1. Router 0



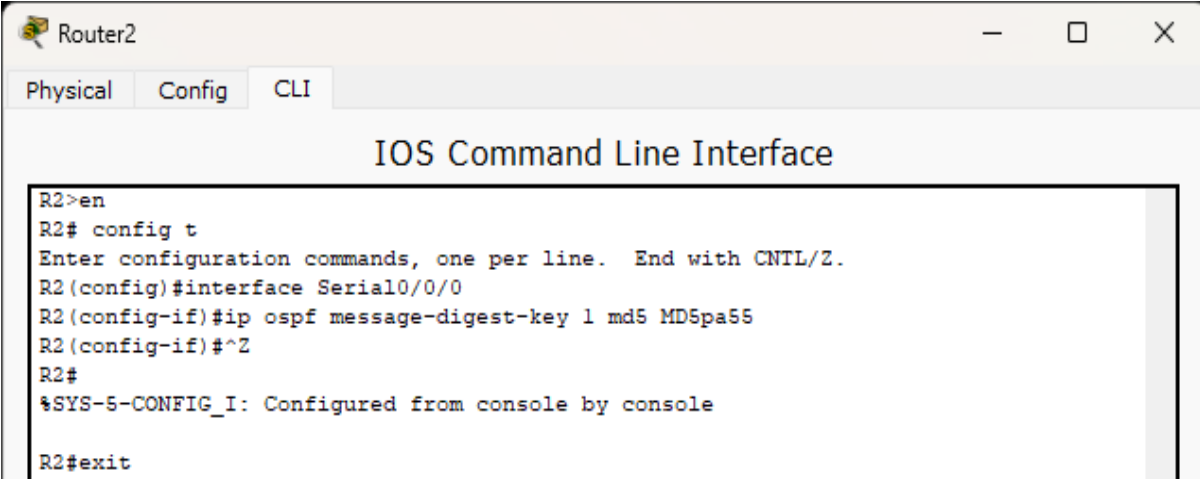
```
Router0
Physical Config CLI
IOS Command Line Interface
R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)# interface Serial0/0/0
R0(config-if)#ip ospf message-digest-key 1 md5 mdpwd
R0(config-if)#^Z
R0#
%SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

2. Router 1



```
Router1
Physical Config CLI
IOS Command Line Interface
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface Serial0/0/0
R1(config-if)#ip ospf message-digest-key 1 md5 mdpwd
OSPF: Key 1 already exists
R1(config-if)#interface Serial0/0/1
R1(config-if)#ip ospf message-digest-key 1 md5 MD5pa55
R1(config-if)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

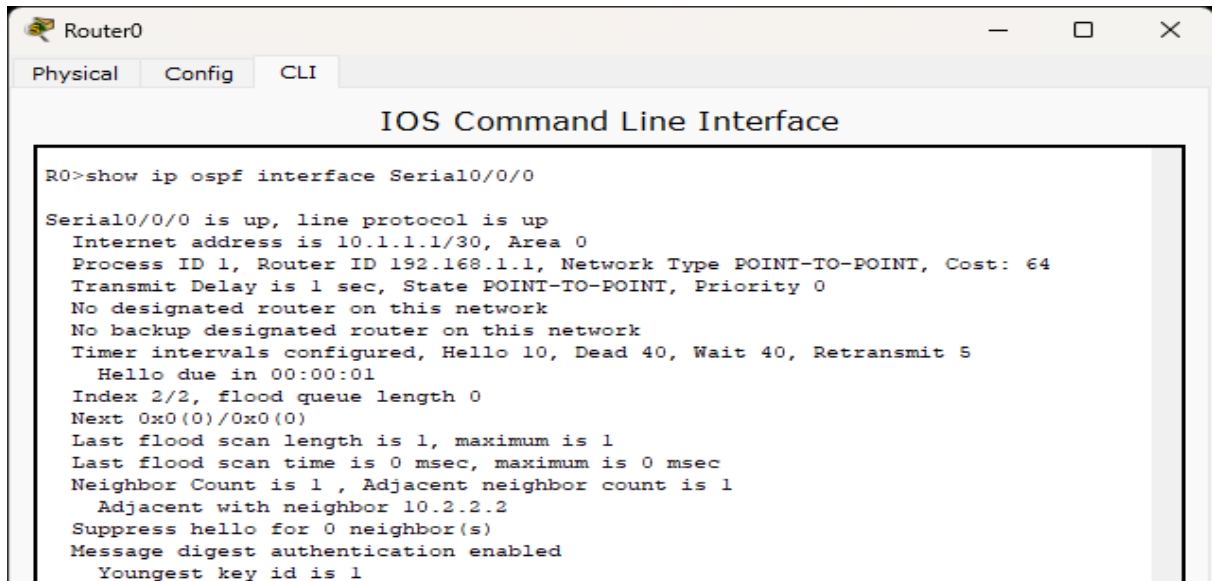
3. Router 2



```
Router2
Physical Config CLI
IOS Command Line Interface
R2>en
R2# config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#interface Serial0/0/0
R2(config-if)#ip ospf message-digest-key 1 md5 MD5pa55
R2(config-if)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

➤ **Displaying OSPF details of all the routers**

1. Router 0



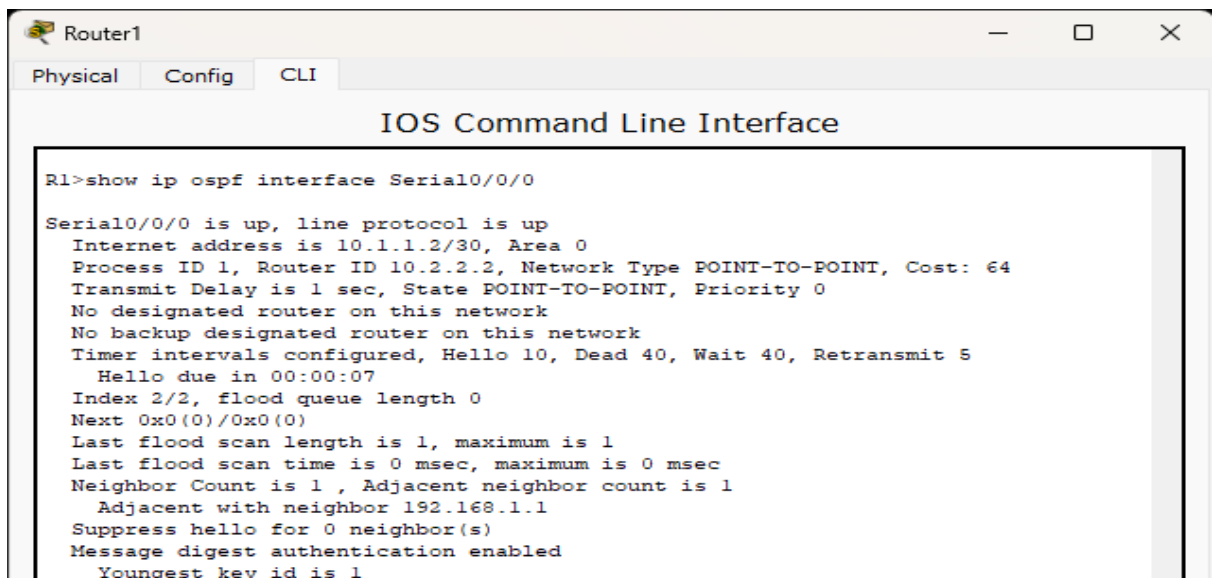
The screenshot shows the CLI of Router0. The command 'show ip ospf interface Serial0/0/0' has been executed. The output displays the following details for the Serial0/0/0 interface:

```
Router0
Physical Config CLI
IOS Command Line Interface

R0>show ip ospf interface Serial0/0/0

Serial0/0/0 is up, line protocol is up
 Internet address is 10.1.1.1/30, Area 0
 Process ID 1, Router ID 192.168.1.1, Network Type POINT-TO-POINT, Cost: 64
 Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
 No designated router on this network
 No backup designated router on this network
 Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
   Hello due in 00:00:01
 Index 2/2, flood queue length 0
 Next 0x0(0)/0x0(0)
 Last flood scan length is 1, maximum is 1
 Last flood scan time is 0 msec, maximum is 0 msec
 Neighbor Count is 1 , Adjacent neighbor count is 1
   Adjacent with neighbor 10.2.2.2
 Suppress hello for 0 neighbor(s)
 Message digest authentication enabled
   Youngest key id is 1
```

2. Router 1

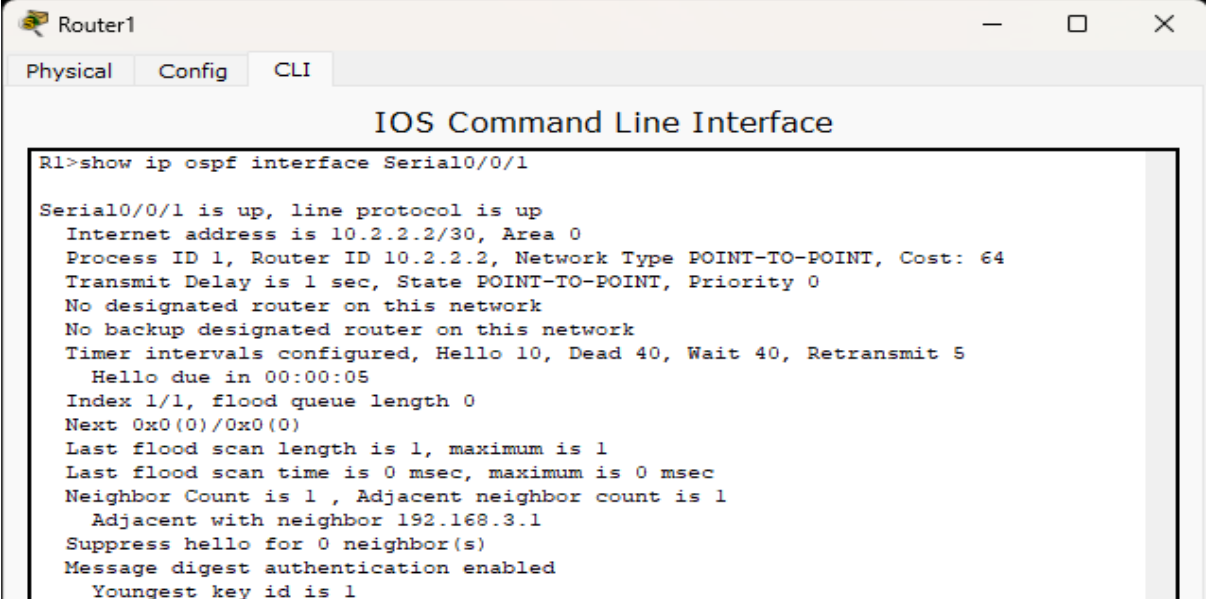


The screenshot shows the CLI of Router1. The command 'show ip ospf interface Serial0/0/0' has been executed. The output displays the following details for the Serial0/0/0 interface:

```
Router1
Physical Config CLI
IOS Command Line Interface

R1>show ip ospf interface Serial0/0/0

Serial0/0/0 is up, line protocol is up
 Internet address is 10.1.1.2/30, Area 0
 Process ID 1, Router ID 10.2.2.2, Network Type POINT-TO-POINT, Cost: 64
 Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
 No designated router on this network
 No backup designated router on this network
 Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
   Hello due in 00:00:07
 Index 2/2, flood queue length 0
 Next 0x0(0)/0x0(0)
 Last flood scan length is 1, maximum is 1
 Last flood scan time is 0 msec, maximum is 0 msec
 Neighbor Count is 1 , Adjacent neighbor count is 1
   Adjacent with neighbor 192.168.1.1
 Suppress hello for 0 neighbor(s)
 Message digest authentication enabled
   Youngest key id is 1
```

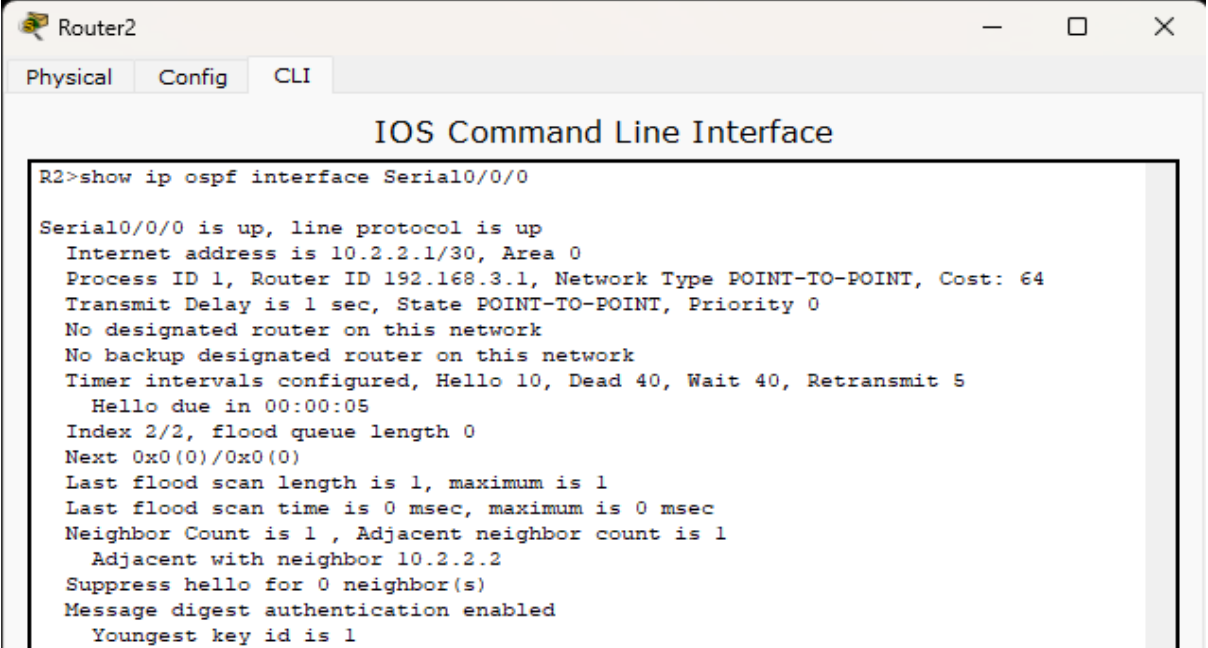


The screenshot shows a window titled "Router1" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The command entered is "R1>show ip ospf interface Serial0/0/1". The output shows that the interface is up, with IP address 10.2.2.2/30 in Area 0. It is a POINT-TO-POINT network with a cost of 64. The router ID is 10.2.2.2. The hello interval is 10 seconds, and the dead interval is 40 seconds. The neighbor count is 1, with the adjacent neighbor being 192.168.3.1.

```
R1>show ip ospf interface Serial0/0/1

Serial0/0/1 is up, line protocol is up
  Internet address is 10.2.2.2/30, Area 0
  Process ID 1, Router ID 10.2.2.2, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.3.1
  Suppress hello for 0 neighbor(s)
  Message digest authentication enabled
  Youngest key id is 1
```

### 3. Router 2



The screenshot shows a window titled "Router2" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The command entered is "R2>show ip ospf interface Serial0/0/0". The output shows that the interface is up, with IP address 10.2.2.1/30 in Area 0. It is a POINT-TO-POINT network with a cost of 64. The router ID is 192.168.3.1. The hello interval is 10 seconds, and the dead interval is 40 seconds. The neighbor count is 1, with the adjacent neighbor being 10.2.2.2.

```
R2>show ip ospf interface Serial0/0/0

Serial0/0/0 is up, line protocol is up
  Internet address is 10.2.2.1/30, Area 0
  Process ID 1, Router ID 192.168.3.1, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 10.2.2.2
  Suppress hello for 0 neighbor(s)
  Message digest authentication enabled
  Youngest key id is 1
```

## B. NTP

### ➤ Check Clock Time in the routers

#### 1. Router 0

```
R0>show clock
*0:49:14.954 UTC Mon Mar 1 1993
R0>
```

#### 2. Router 1

```
R1>show clock
*0:51:40.343 UTC Mon Mar 1 1993
R1>
```

#### 3. Router 2

```
R2>show clock
*0:53:5.140 UTC Mon Mar 1 1993
R2>
```

### ➤ Configure NTP Server

**NTP SERVER**

Physical Config **Services** Desktop Custom Interface

**SERVICES**

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

**NTP**

Service ☒ On ☐ Off

Authentication

☒ Enable ☐ Disable

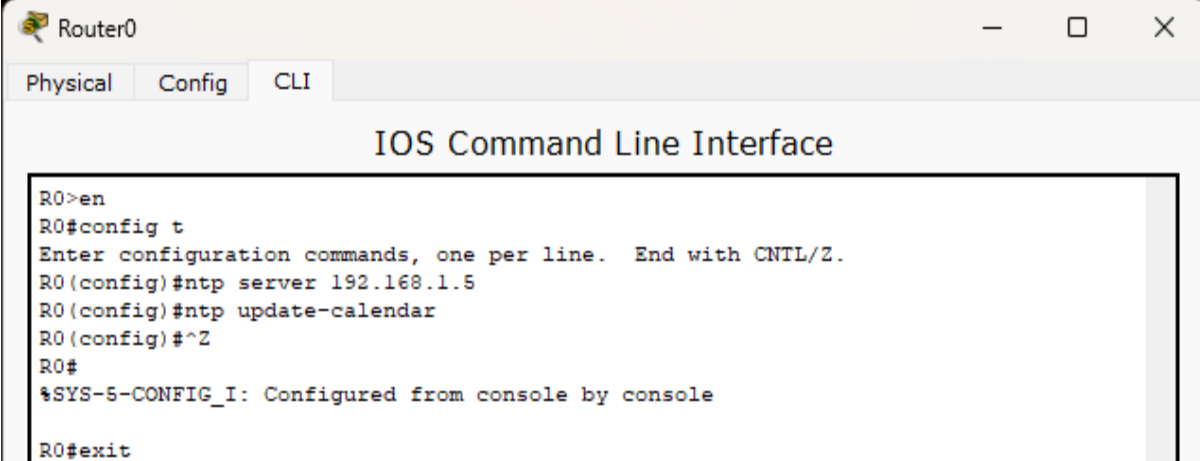
Key: 1 Password: NTPpwd

January, 2024 12.08.06 PM

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10

## ➤ Configure NTP Client

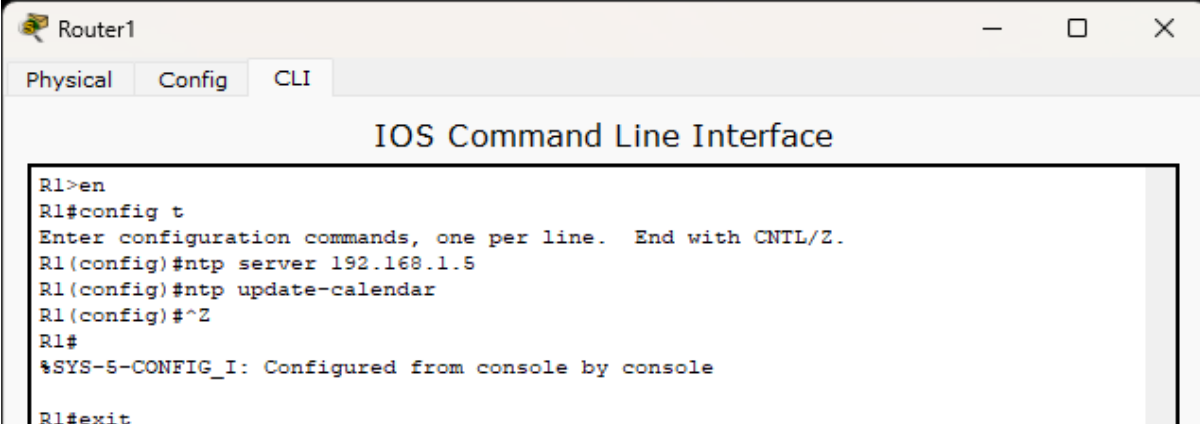
### 1. Router 0



The screenshot shows the CLI window for Router0. The window has tabs for Physical, Config, and CLI, with CLI selected. The title is "IOS Command Line Interface". The command history shows the following sequence: R0>en, R0#config t, R0(config)#ntp server 192.168.1.5, R0(config)#ntp update-calendar, R0(config)#^Z, R0#, and a system message "%SYS-5-CONFIG\_I: Configured from console by console". The session ends with R0#exit.

```
R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#ntp server 192.168.1.5
R0(config)#ntp update-calendar
R0(config)#^Z
R0#
%SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

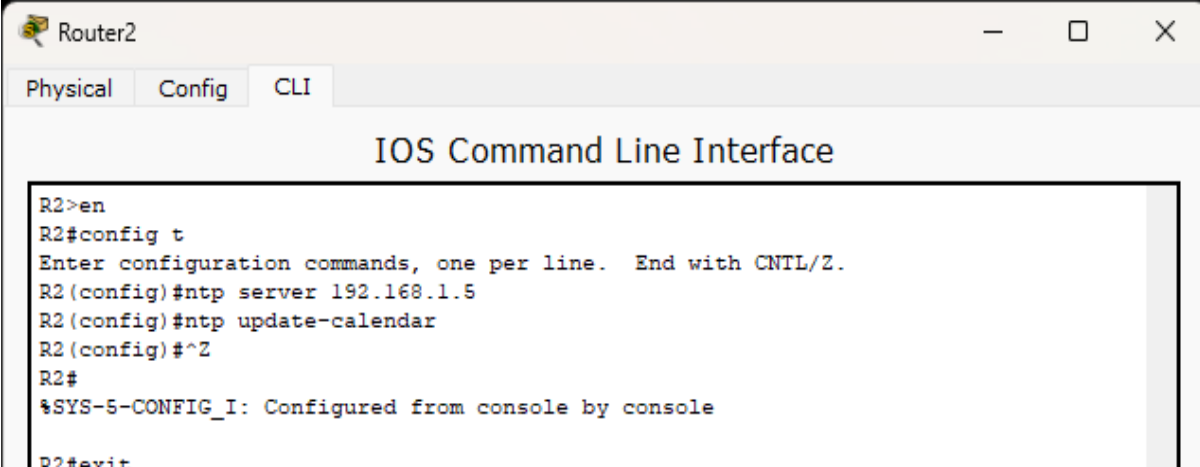
### 2. Router 1



The screenshot shows the CLI window for Router1. The window has tabs for Physical, Config, and CLI, with CLI selected. The title is "IOS Command Line Interface". The command history shows the following sequence: R1>en, R1#config t, R1(config)#ntp server 192.168.1.5, R1(config)#ntp update-calendar, R1(config)#^Z, R1#, and a system message "%SYS-5-CONFIG\_I: Configured from console by console". The session ends with R1#exit.

```
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ntp server 192.168.1.5
R1(config)#ntp update-calendar
R1(config)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

### 3. Router 2

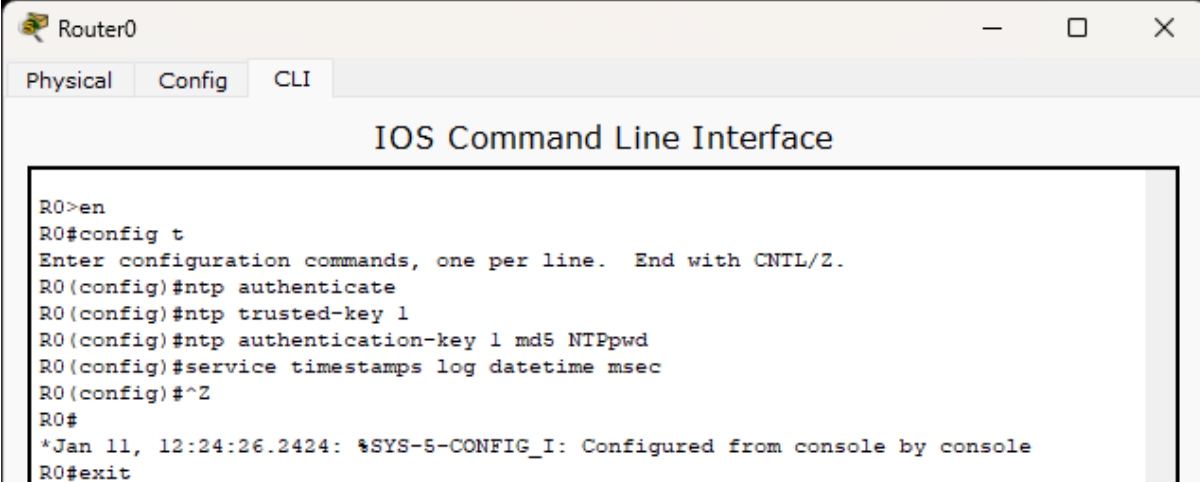


The screenshot shows the CLI window for Router2. The window has tabs for Physical, Config, and CLI, with CLI selected. The title is "IOS Command Line Interface". The command history shows the following sequence: R2>en, R2#config t, R2(config)#ntp server 192.168.1.5, R2(config)#ntp update-calendar, R2(config)#^Z, R2#, and a system message "%SYS-5-CONFIG\_I: Configured from console by console". The session ends with R2#exit.

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ntp server 192.168.1.5
R2(config)#ntp update-calendar
R2(config)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

➤ **Configure NTP authentication and to timestamp log messages on the routers**

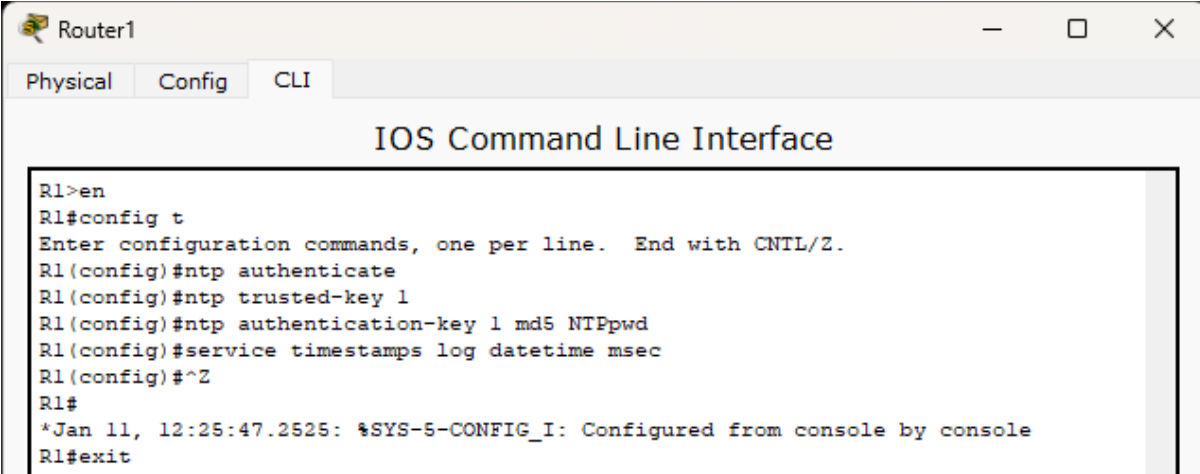
1. Router 0



The screenshot shows the CLI window for Router0. The window has tabs for Physical, Config, and CLI. The title bar says "Router0". The main area is titled "IOS Command Line Interface". The command history shows the following sequence of commands and their outputs:

```
R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#ntp authenticate
R0(config)#ntp trusted-key 1
R0(config)#ntp authentication-key 1 md5 NTPpwd
R0(config)#service timestamps log datetime msec
R0(config)#^Z
R0#
*Jan 11, 12:24:26.2424: %SYS-5-CONFIG_I: Configured from console by console
R0#exit
```

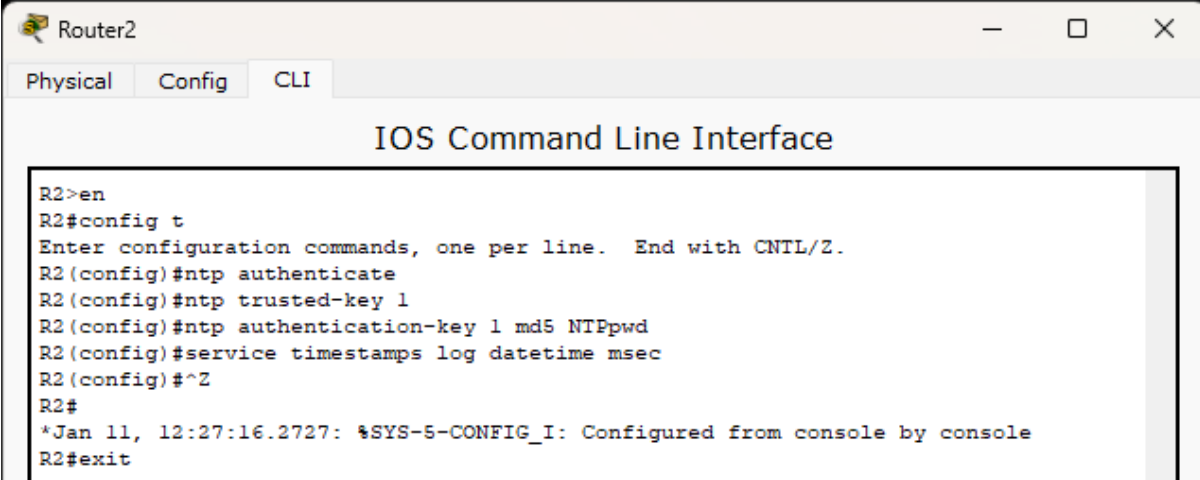
2. Router 1



The screenshot shows the CLI window for Router1. The window has tabs for Physical, Config, and CLI. The title bar says "Router1". The main area is titled "IOS Command Line Interface". The command history shows the following sequence of commands and their outputs:

```
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ntp authenticate
R1(config)#ntp trusted-key 1
R1(config)#ntp authentication-key 1 md5 NTPpwd
R1(config)#service timestamps log datetime msec
R1(config)#^Z
R1#
*Jan 11, 12:25:47.2525: %SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

3. Router 2



The screenshot shows the CLI window for Router2. The window has tabs for Physical, Config, and CLI. The title bar says "Router2". The main area is titled "IOS Command Line Interface". The command history shows the following sequence of commands and their outputs:

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ntp authenticate
R2(config)#ntp trusted-key 1
R2(config)#ntp authentication-key 1 md5 NTPpwd
R2(config)#service timestamps log datetime msec
R2(config)#^Z
R2#
*Jan 11, 12:27:16.2727: %SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

➤ **Check updated UTC Clock Time in the routers**

1. Router 0

```
R0>show clock
*12:30:36.142 UTC Thu Jan 11 2024
R0>
```

2. Router 1

```
R1>show clock
*12:30:54.211 UTC Thu Jan 11 2024
R1>
```

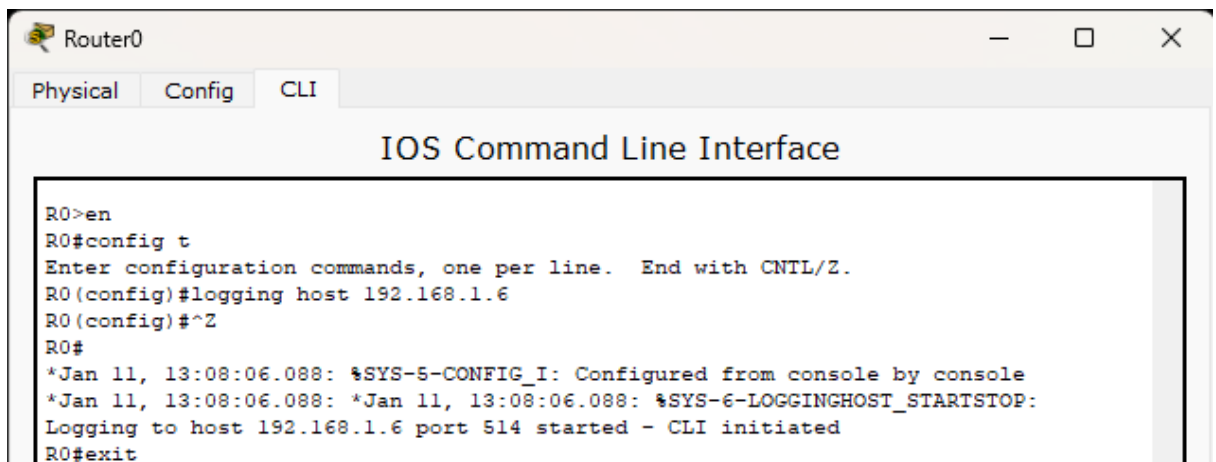
3. Router 2

```
R2>show clock
*12:31:2.851 UTC Thu Jan 11 2024
R2>
```

### C. SYSLOG

➤ **Configure Routers to Log Messages to the SYSLOG Server**

1. Router 0

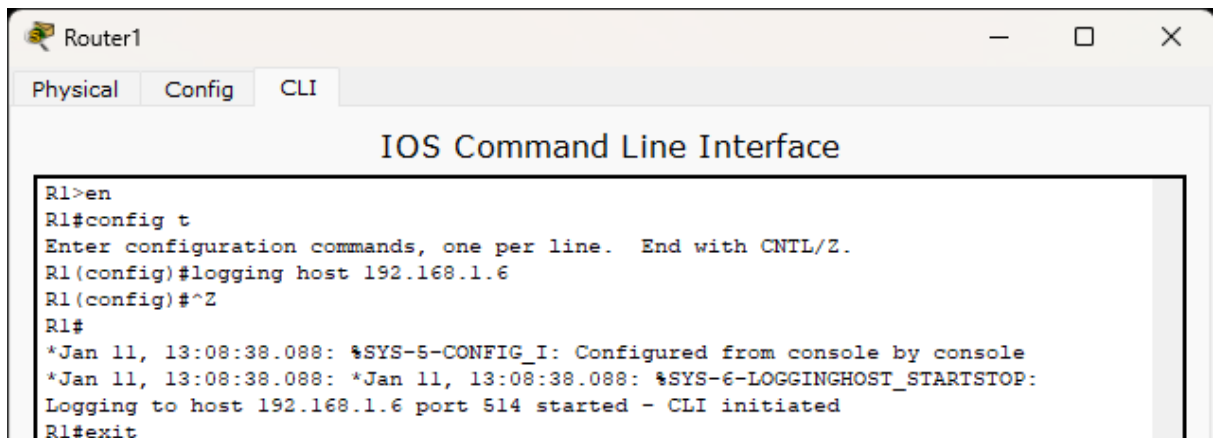


The screenshot shows the CLI interface of Router0. The user enters 'en' to enter enable mode, then 'config t' to enter configuration mode. They then enter 'logging host 192.168.1.6' and press Ctrl-Z to save the configuration. The output shows the configuration was successful and logging to the host 192.168.1.6 on port 514 has started.

```
Router0
Physical Config CLI
IOS Command Line Interface

R0>en
R0#config t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#logging host 192.168.1.6
R0(config)#^Z
R0#
*Jan 11, 13:08:06.088: %SYS-5-CONFIG_I: Configured from console by console
*Jan 11, 13:08:06.088: *Jan 11, 13:08:06.088: %SYS-6-LOGGINGHOST_STARTSTOP:
Logging to host 192.168.1.6 port 514 started - CLI initiated
R0#exit
```

2. Router 1




The screenshot shows the CLI interface of Router1. The user enters 'en' to enter enable mode, then 'config t' to enter configuration mode. They then enter 'logging host 192.168.1.6' and press Ctrl-Z to save the configuration. The output shows the configuration was successful and logging to the host 192.168.1.6 on port 514 has started.

```
Router1
Physical Config CLI
IOS Command Line Interface

R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#logging host 192.168.1.6
R1(config)#^Z
R1#
*Jan 11, 13:08:38.088: %SYS-5-CONFIG_I: Configured from console by console
*Jan 11, 13:08:38.088: *Jan 11, 13:08:38.088: %SYS-6-LOGGINGHOST_STARTSTOP:
Logging to host 192.168.1.6 port 514 started - CLI initiated
R1#exit
```



### 3. Router 2

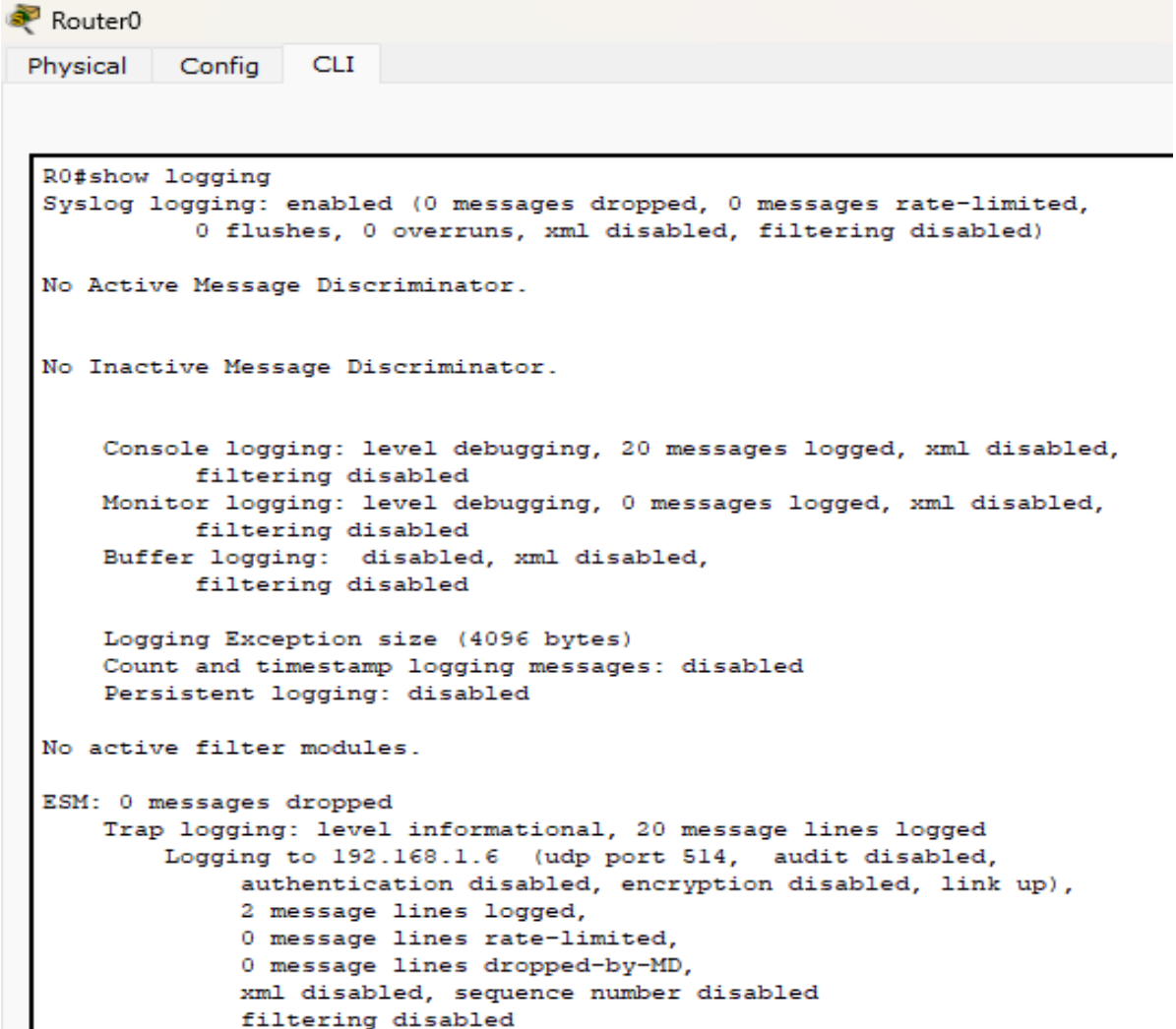


The screenshot shows the CLI window for Router2. The 'CLI' tab is selected. The command prompt is 'R2>'. The user has entered 'en' to enter configuration mode, then 'config t' to enter global configuration mode. The command 'logging host 192.168.1.6' has been entered. The user has pressed Ctrl-Z to return to the command prompt. The system has displayed two log messages: '\*Jan 11, 13:09:07.099: %SYS-5-CONFIG\_I: Configured from console by console' and '\*Jan 11, 13:09:07.099: \*Jan 11, 13:09:07.099: %SYS-6-LOGGINGHOST\_STARTSTOP: Logging to host 192.168.1.6 port 514 started - CLI initiated'. The user has entered 'exit' to leave configuration mode.

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#logging host 192.168.1.6
R2(config)#^Z
R2#
*Jan 11, 13:09:07.099: %SYS-5-CONFIG_I: Configured from console by console
*Jan 11, 13:09:07.099: *Jan 11, 13:09:07.099: %SYS-6-LOGGINGHOST_STARTSTOP:
Logging to host 192.168.1.6 port 514 started - CLI initiated
R2#exit
```

#### ➤ Verify logging configuration on Routers

##### 1. Router 0



The screenshot shows the CLI window for Router0. The 'CLI' tab is selected. The command prompt is 'R0#'. The user has entered 'show logging'. The system has displayed the following output: 'Syslog logging: enabled (0 messages dropped, 0 messages rate-limited, 0 flushes, 0 overruns, xml disabled, filtering disabled)', 'No Active Message Discriminator.', 'No Inactive Message Discriminator.', 'Console logging: level debugging, 20 messages logged, xml disabled, filtering disabled', 'Monitor logging: level debugging, 0 messages logged, xml disabled, filtering disabled', 'Buffer logging: disabled, xml disabled, filtering disabled', 'Logging Exception size (4096 bytes)', 'Count and timestamp logging messages: disabled', 'Persistent logging: disabled', 'No active filter modules.', 'ESM: 0 messages dropped', 'Trap logging: level informational, 20 message lines logged', 'Logging to 192.168.1.6 (udp port 514, audit disabled, authentication disabled, encryption disabled, link up), 2 message lines logged, 0 message lines rate-limited, 0 message lines dropped-by-MD, xml disabled, sequence number disabled, filtering disabled'.

```
R0#show logging
Syslog logging: enabled (0 messages dropped, 0 messages rate-limited,
0 flushes, 0 overruns, xml disabled, filtering disabled)

No Active Message Discriminator.

No Inactive Message Discriminator.

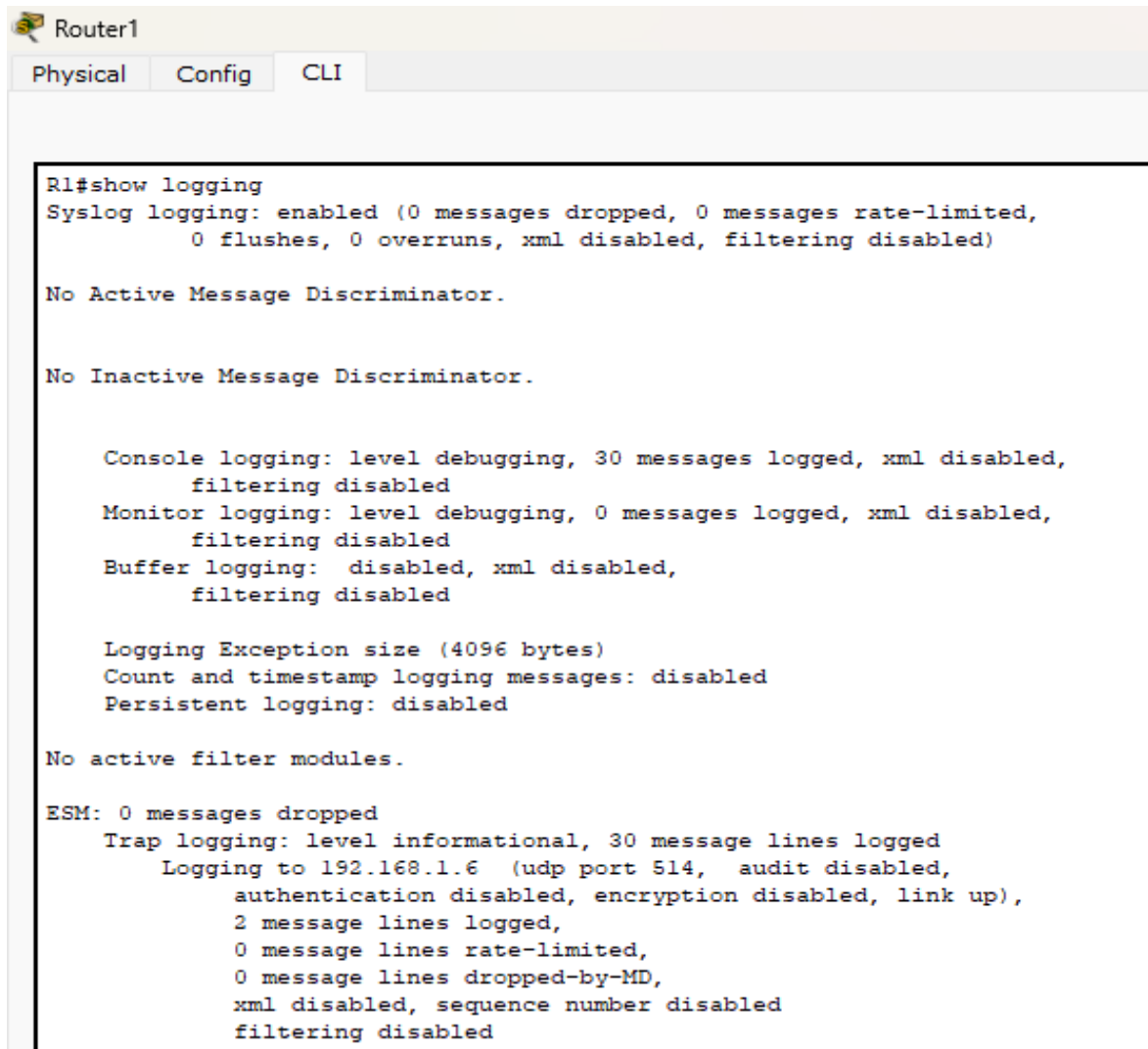
Console logging: level debugging, 20 messages logged, xml disabled,
filtering disabled
Monitor logging: level debugging, 0 messages logged, xml disabled,
filtering disabled
Buffer logging: disabled, xml disabled,
filtering disabled

Logging Exception size (4096 bytes)
Count and timestamp logging messages: disabled
Persistent logging: disabled

No active filter modules.

ESM: 0 messages dropped
Trap logging: level informational, 20 message lines logged
Logging to 192.168.1.6 (udp port 514, audit disabled,
authentication disabled, encryption disabled, link up),
2 message lines logged,
0 message lines rate-limited,
0 message lines dropped-by-MD,
xml disabled, sequence number disabled
filtering disabled
```

## 2. Router 1



```
Router1
Physical Config CLI

R1#show logging
Syslog logging: enabled (0 messages dropped, 0 messages rate-limited,
                  0 flushes, 0 overruns, xml disabled, filtering disabled)

No Active Message Discriminator.

No Inactive Message Discriminator.

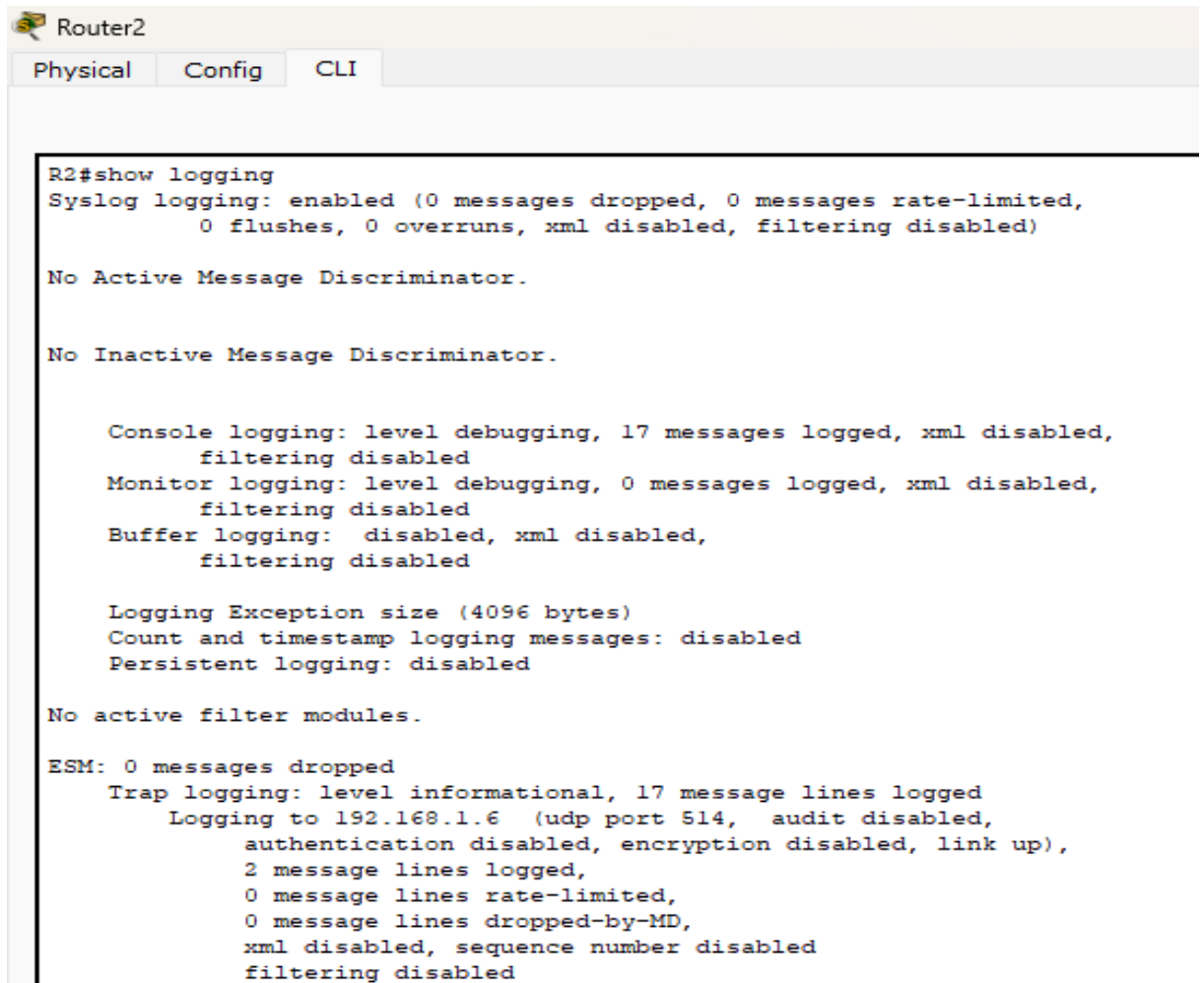
Console logging: level debugging, 30 messages logged, xml disabled,
                  filtering disabled
Monitor logging: level debugging, 0 messages logged, xml disabled,
                  filtering disabled
Buffer logging: disabled, xml disabled,
                  filtering disabled

Logging Exception size (4096 bytes)
Count and timestamp logging messages: disabled
Persistent logging: disabled

No active filter modules.

ESM: 0 messages dropped
Trap logging: level informational, 30 message lines logged
Logging to 192.168.1.6 (udp port 514, audit disabled,
authentication disabled, encryption disabled, link up),
2 message lines logged,
0 message lines rate-limited,
0 message lines dropped-by-MD,
xml disabled, sequence number disabled
filtering disabled
...
```

### 3. Router 2



```
R2#show logging
Syslog logging: enabled (0 messages dropped, 0 messages rate-limited,
                  0 flushes, 0 overruns, xml disabled, filtering disabled)

No Active Message Discriminator.

No Inactive Message Discriminator.

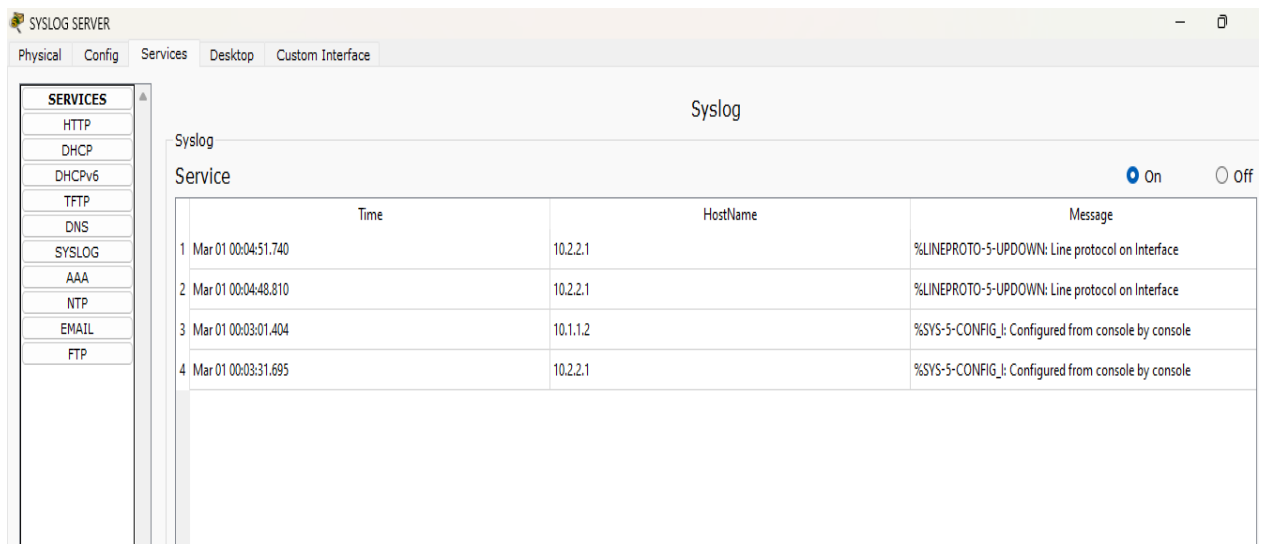
Console logging: level debugging, 17 messages logged, xml disabled,
                  filtering disabled
Monitor logging: level debugging, 0 messages logged, xml disabled,
                  filtering disabled
Buffer logging: disabled, xml disabled,
                  filtering disabled

Logging Exception size (4096 bytes)
Count and timestamp logging messages: disabled
Persistent logging: disabled

No active filter modules.

ESM: 0 messages dropped
Trap logging: level informational, 17 message lines logged
  Logging to 192.168.1.6 (udp port 514, audit disabled,
    authentication disabled, encryption disabled, link up),
    2 message lines logged,
    0 message lines rate-limited,
    0 message lines dropped-by-MD,
    xml disabled, sequence number disabled
    filtering disabled
```

### ➤ Examine logs of the SYSLOG Server



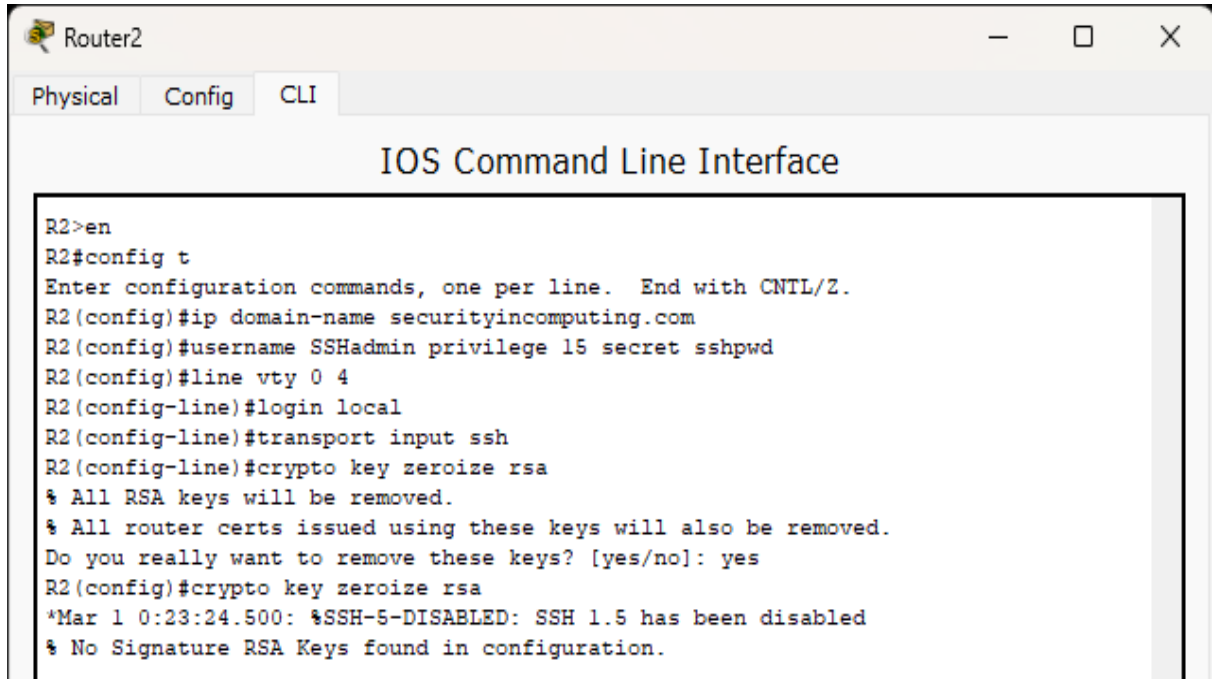
The Syslog Server interface shows a list of services on the left and a table of log entries on the right. The Syslog service is currently turned on.

Time	HostName	Message
1 Mar 01 00:04:51.740	10.2.2.1	%LINEPROTO-5-UPDOWN: Line protocol on Interface
2 Mar 01 00:04:48.810	10.2.2.1	%LINEPROTO-5-UPDOWN: Line protocol on Interface
3 Mar 01 00:03:01.404	10.1.1.2	%SYS-5-CONFIG-I: Configured from console by console
4 Mar 01 00:03:31.695	10.2.2.1	%SYS-5-CONFIG-I: Configured from console by console

## D. SSH

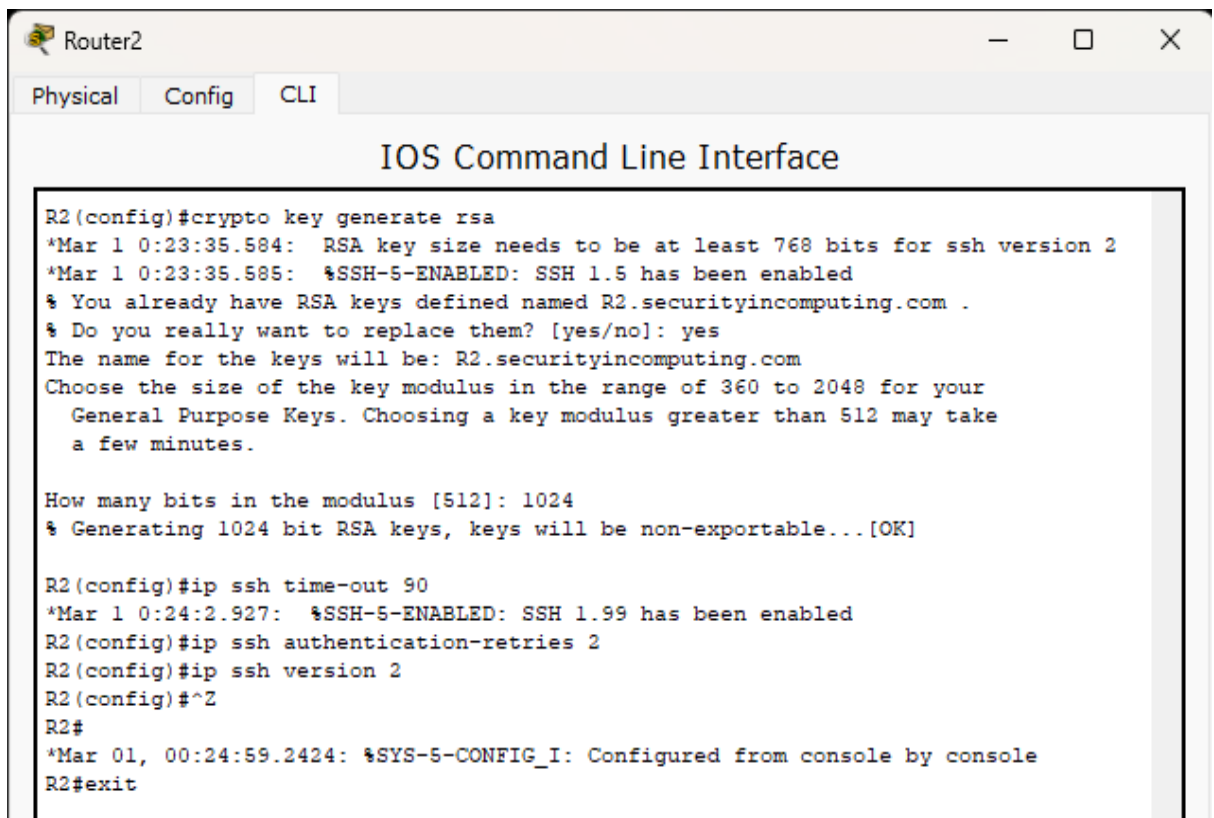
### ➤ Configure SSH on R2

Router 2



The screenshot shows the Router2 CLI interface with the 'CLI' tab selected. The title bar says 'Router2' and the window title is 'IOS Command Line Interface'. The command history shows the following steps:

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ip domain-name securityincomputing.com
R2(config)#username SSHadmin privilege 15 secret sshpwd
R2(config)#line vty 0 4
R2(config-line)#login local
R2(config-line)#transport input ssh
R2(config-line)#crypto key zeroize rsa
% All RSA keys will be removed.
% All router certs issued using these keys will also be removed.
Do you really want to remove these keys? [yes/no]: yes
R2(config)#crypto key zeroize rsa
*Mar 1 0:23:24.500: %SSH-5-DISABLED: SSH 1.5 has been disabled
% No Signature RSA Keys found in configuration.
```



The screenshot shows the Router2 CLI interface with the 'CLI' tab selected. The title bar says 'Router2' and the window title is 'IOS Command Line Interface'. The command history shows the following steps:

```
R2(config)#crypto key generate rsa
*Mar 1 0:23:35.584: RSA key size needs to be at least 768 bits for ssh version 2
*Mar 1 0:23:35.585: %SSH-5-ENABLED: SSH 1.5 has been enabled
% You already have RSA keys defined named R2.securityincomputing.com .
% Do you really want to replace them? [yes/no]: yes
The name for the keys will be: R2.securityincomputing.com
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]

R2(config)#ip ssh time-out 90
*Mar 1 0:24:2.927: %SSH-5-ENABLED: SSH 1.99 has been enabled
R2(config)#ip ssh authentication-retries 2
R2(config)#ip ssh version 2
R2(config)#^Z
R2#
*Mar 01, 00:24:59.2424: %SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

➤ **Connect to R2 using telnet and SSH on PC**

