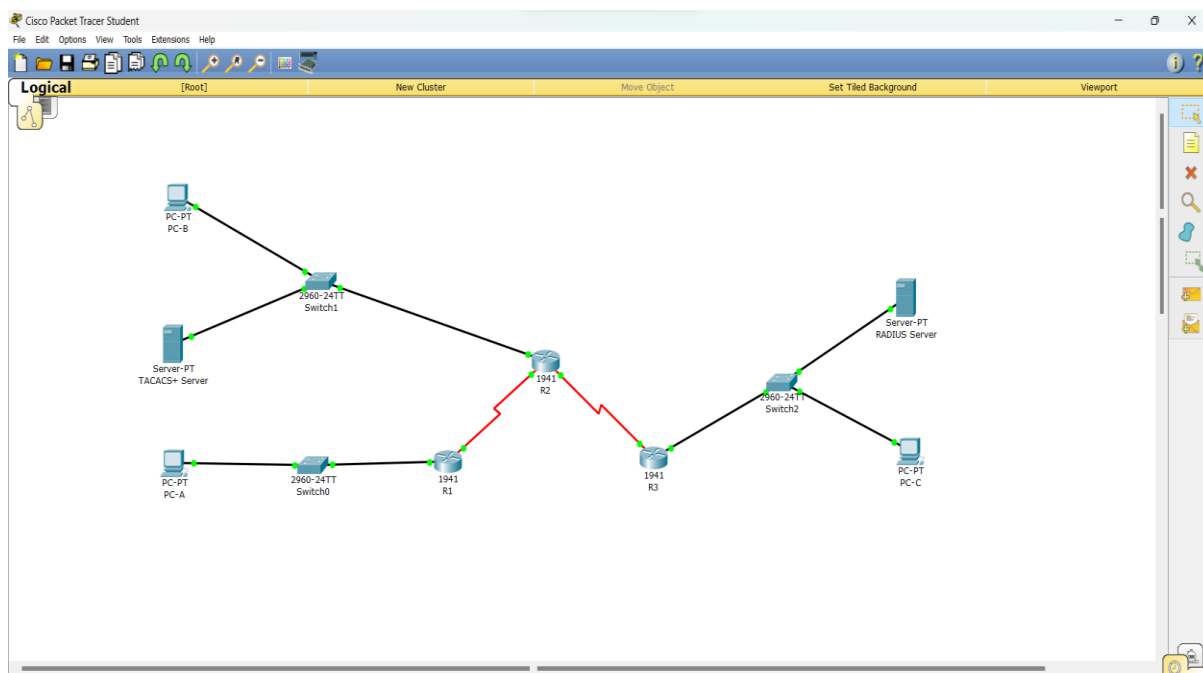


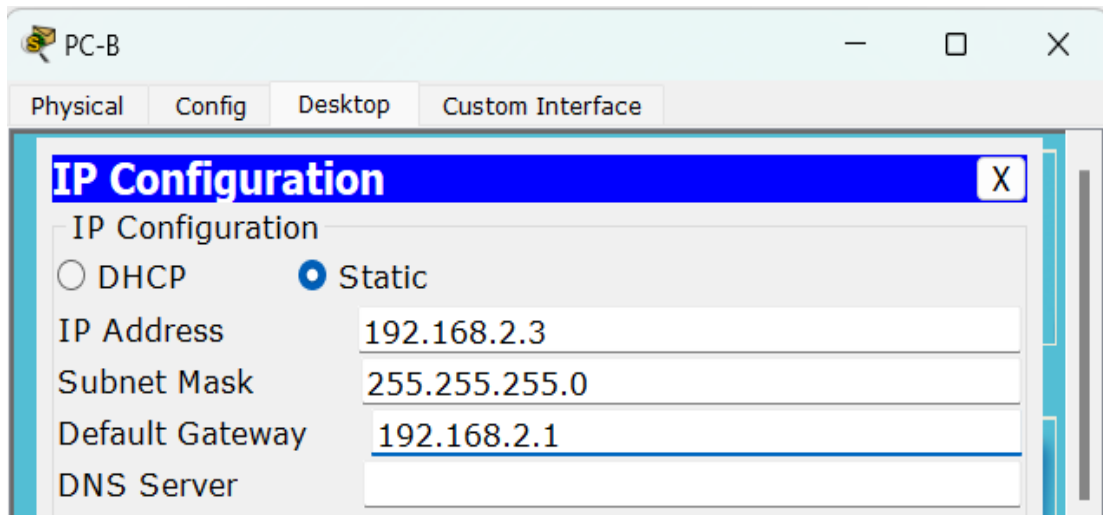
Date: 17/01/2024**Security in Computing****Practical 2:****➤ Aim: Configure AAA Authentication.**

- Configure a local user account on Router and configure authentication on the console and vty lines using local AAA.
- Verify local AAA authentication from the Router console and the PC-A client.

➤ Topology Diagram:**➤ Assigning IP Address:****1. PC-A**

IP Configuration	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IP Address	192.168.1.3
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	

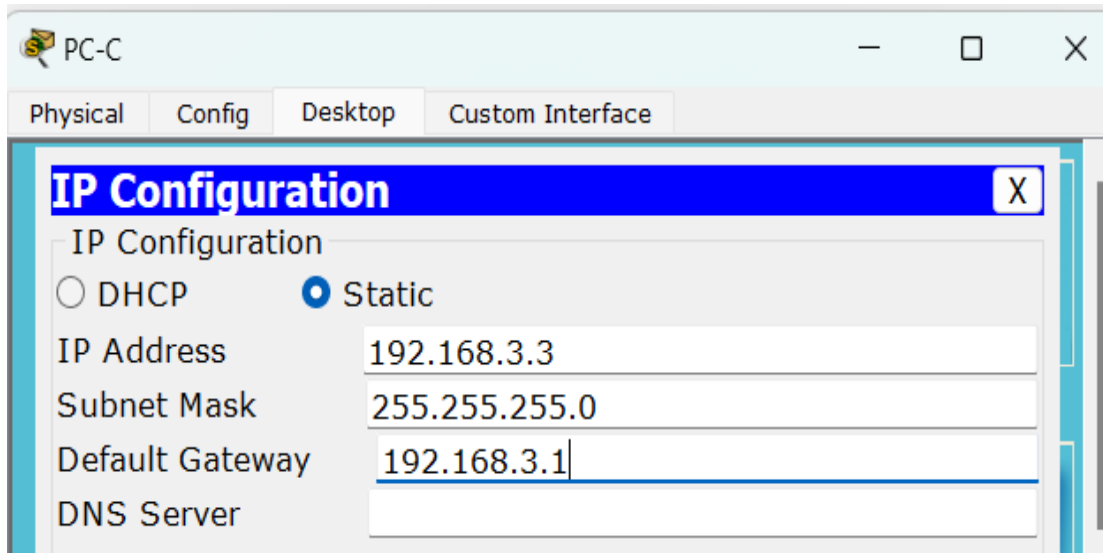
2. PC-B



The screenshot shows the 'IP Configuration' window for PC-B. The window has tabs for 'Physical', 'Config', 'Desktop', and 'Custom Interface'. The 'Config' tab is selected. The 'IP Configuration' section is expanded, showing 'DHCP' and 'Static' options. 'Static' is selected. The fields are filled with: IP Address: 192.168.2.3, Subnet Mask: 255.255.255.0, Default Gateway: 192.168.2.1, and DNS Server: (empty).

IP Configuration	
<input type="radio"/> DHCP <input checked="" type="radio"/> Static	
IP Address	192.168.2.3
Subnet Mask	255.255.255.0
Default Gateway	192.168.2.1
DNS Server	

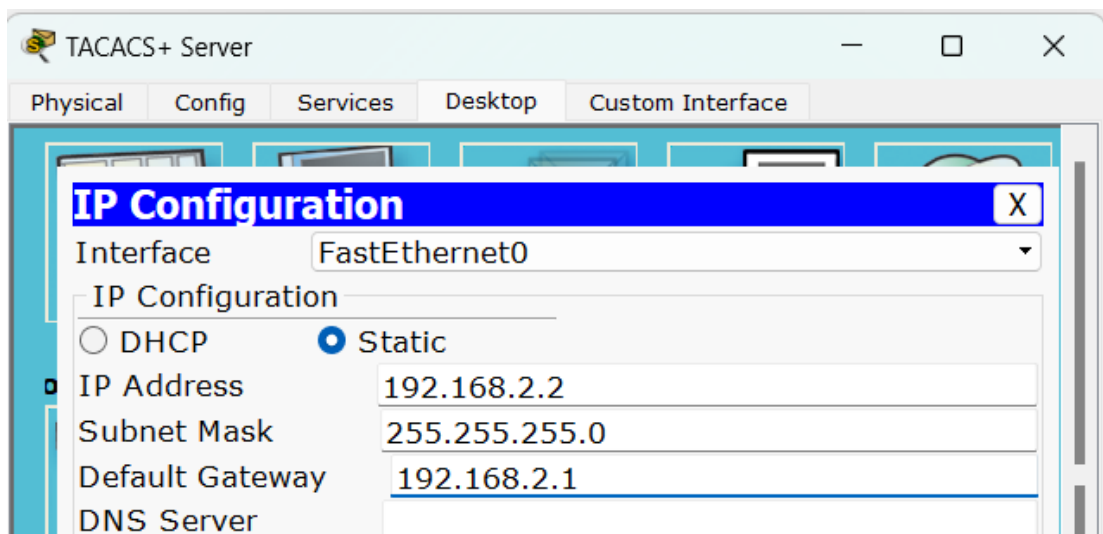
3. PC-C



The screenshot shows the 'IP Configuration' window for PC-C. The window has tabs for 'Physical', 'Config', 'Desktop', and 'Custom Interface'. The 'Config' tab is selected. The 'IP Configuration' section is expanded, showing 'DHCP' and 'Static' options. 'Static' is selected. The fields are filled with: IP Address: 192.168.3.3, Subnet Mask: 255.255.255.0, Default Gateway: 192.168.3.1, and DNS Server: (empty).

IP Configuration	
<input type="radio"/> DHCP <input checked="" type="radio"/> Static	
IP Address	192.168.3.3
Subnet Mask	255.255.255.0
Default Gateway	192.168.3.1
DNS Server	

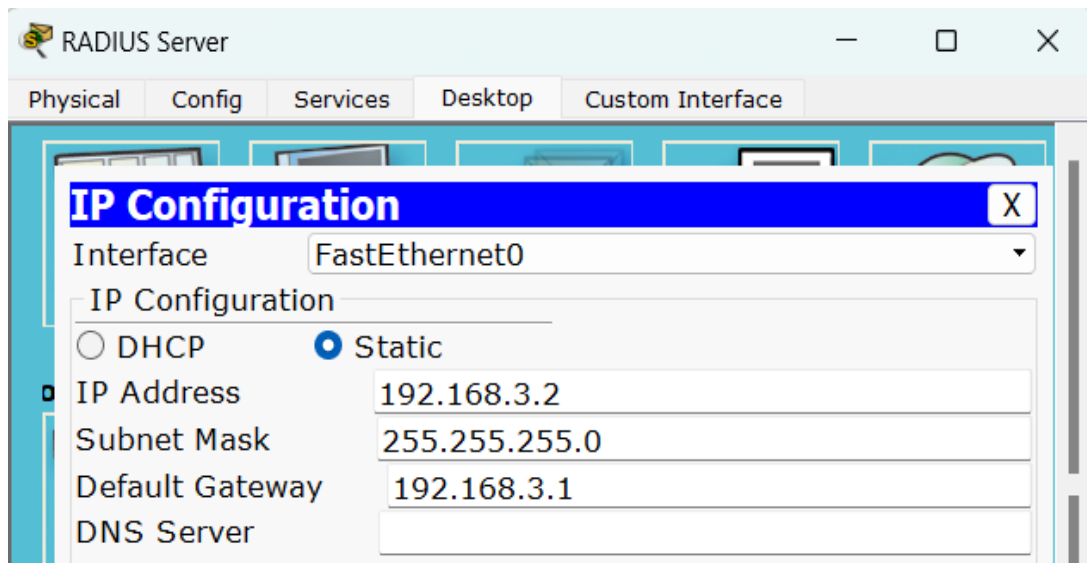
4. TACACS+ Server



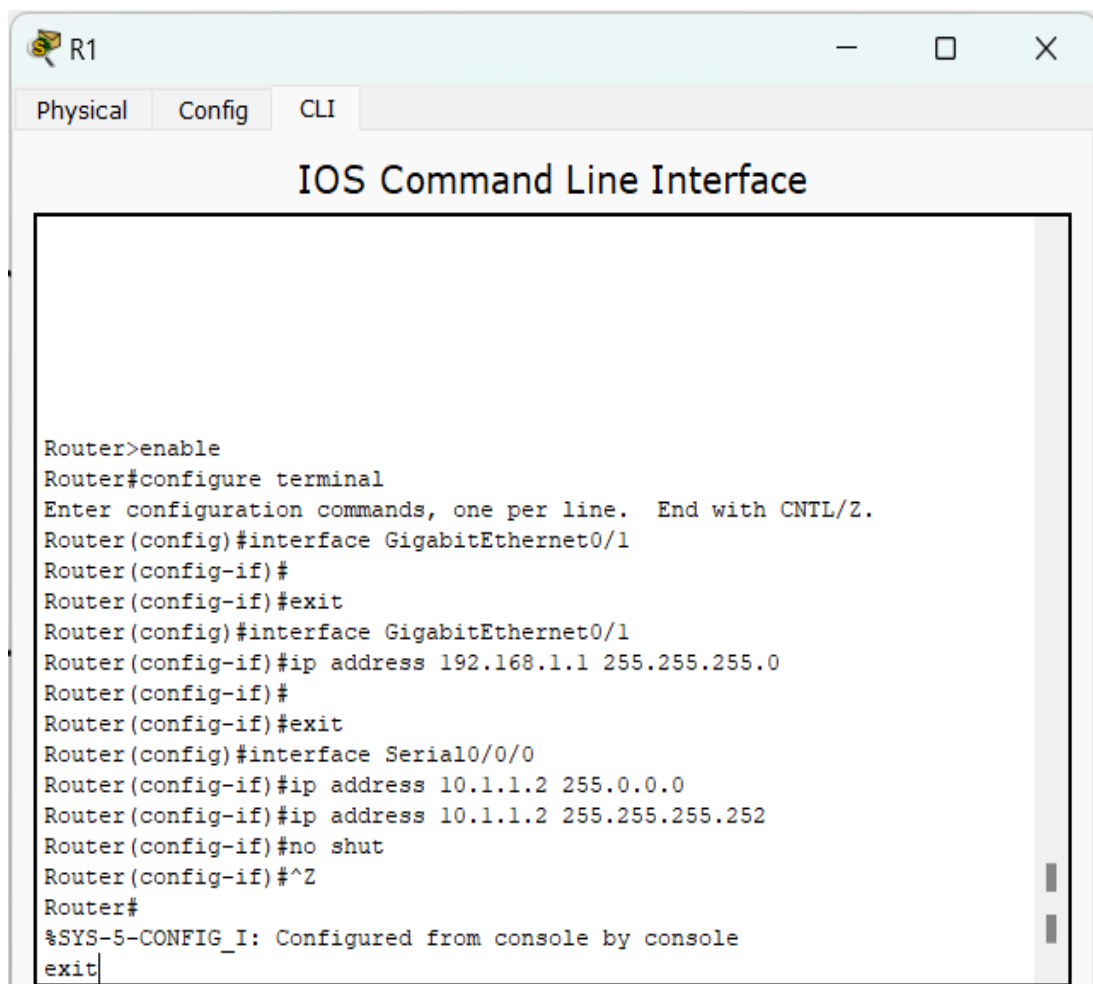
The screenshot shows the 'IP Configuration' window for the TACACS+ Server. The window has tabs for 'Physical', 'Config', 'Services', 'Desktop', and 'Custom Interface'. The 'Config' tab is selected. The 'IP Configuration' section is expanded, showing 'DHCP' and 'Static' options. 'Static' is selected. The 'Interface' dropdown is set to 'FastEthernet0'. The fields are filled with: IP Address: 192.168.2.2, Subnet Mask: 255.255.255.0, Default Gateway: 192.168.2.1, and DNS Server: (empty).

IP Configuration	
Interface	FastEthernet0
<input type="radio"/> DHCP <input checked="" type="radio"/> Static	
IP Address	192.168.2.2
Subnet Mask	255.255.255.0
Default Gateway	192.168.2.1
DNS Server	

5. RADIUS Server



6. R1



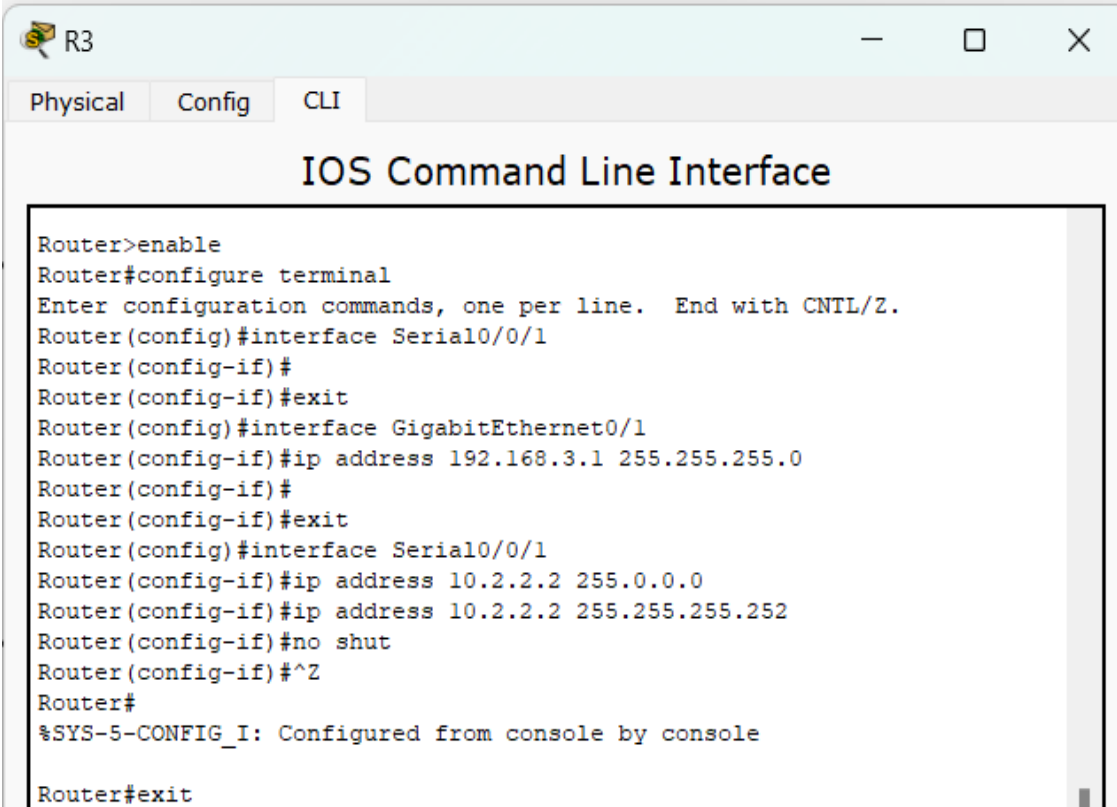
7. R2



The screenshot shows a window titled 'R2' with tabs for 'Physical', 'Config', and 'CLI'. The 'CLI' tab is active, displaying the 'IOS Command Line Interface'. The terminal output shows the following commands and responses:

```
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 10.1.1.1 255.0.0.0
Router(config-if)#ip address 10.1.1.1 255.255.255.252
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 10.2.2.1 255.255.255.252
Router(config-if)#no shut
Router(config-if)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

8. R3



The screenshot shows a window titled 'R3' with tabs for 'Physical', 'Config', and 'CLI'. The 'CLI' tab is active, displaying the 'IOS Command Line Interface'. The terminal output shows the following commands and responses:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial0/0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 10.2.2.2 255.0.0.0
Router(config-if)#ip address 10.2.2.2 255.255.255.252
Router(config-if)#no shut
Router(config-if)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#exit
```

➤ Displaying IP Address Details of Routers

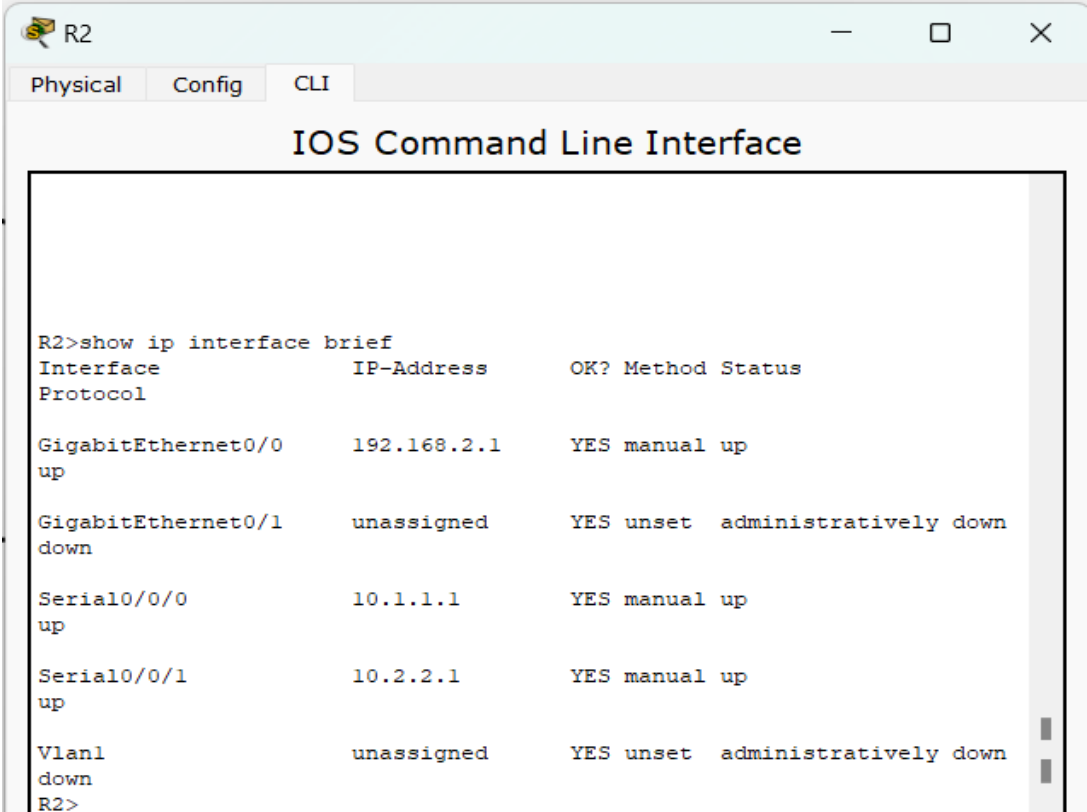
1. R1



The screenshot shows the CLI of router R1. The command `show ip interface brief` has been executed, displaying a table of interface details. The table has four columns: Interface, IP-Address, OK?, and Method Status. The interfaces listed are GigabitEthernet0/0, GigabitEthernet0/1, Serial10/0/0, Serial10/0/1, and Vlan1. GigabitEthernet0/1 and Serial10/0/0 are up with IP addresses 192.168.1.1 and 10.1.1.2 respectively. The other interfaces are administratively down.

Interface	IP-Address	OK?	Method	Status
GigabitEthernet0/0	unassigned	YES	unset	administratively down
GigabitEthernet0/1	192.168.1.1	YES	manual	up
Serial10/0/0	10.1.1.2	YES	manual	up
Serial10/0/1	unassigned	YES	unset	administratively down
Vlan1	unassigned	YES	unset	administratively down

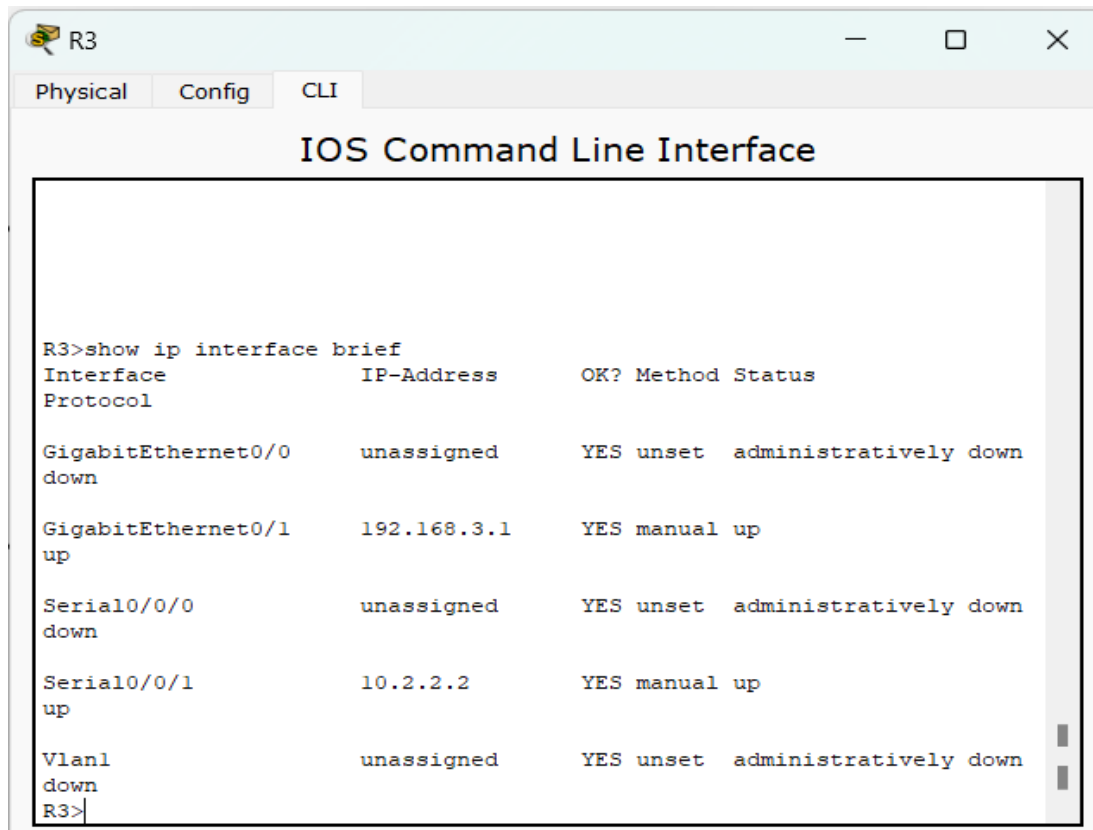
2. R2



The screenshot shows the CLI of router R2. The command `show ip interface brief` has been executed, displaying a table of interface details. The table has four columns: Interface, IP-Address, OK?, and Method Status. The interfaces listed are GigabitEthernet0/0, GigabitEthernet0/1, Serial10/0/0, Serial10/0/1, and Vlan1. GigabitEthernet0/0 and Serial10/0/1 are up with IP addresses 192.168.2.1 and 10.2.2.1 respectively. The other interfaces are administratively down.

Interface	IP-Address	OK?	Method	Status
GigabitEthernet0/0	192.168.2.1	YES	manual	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down
Serial10/0/0	10.1.1.1	YES	manual	up
Serial10/0/1	10.2.2.1	YES	manual	up
Vlan1	unassigned	YES	unset	administratively down

3. R3

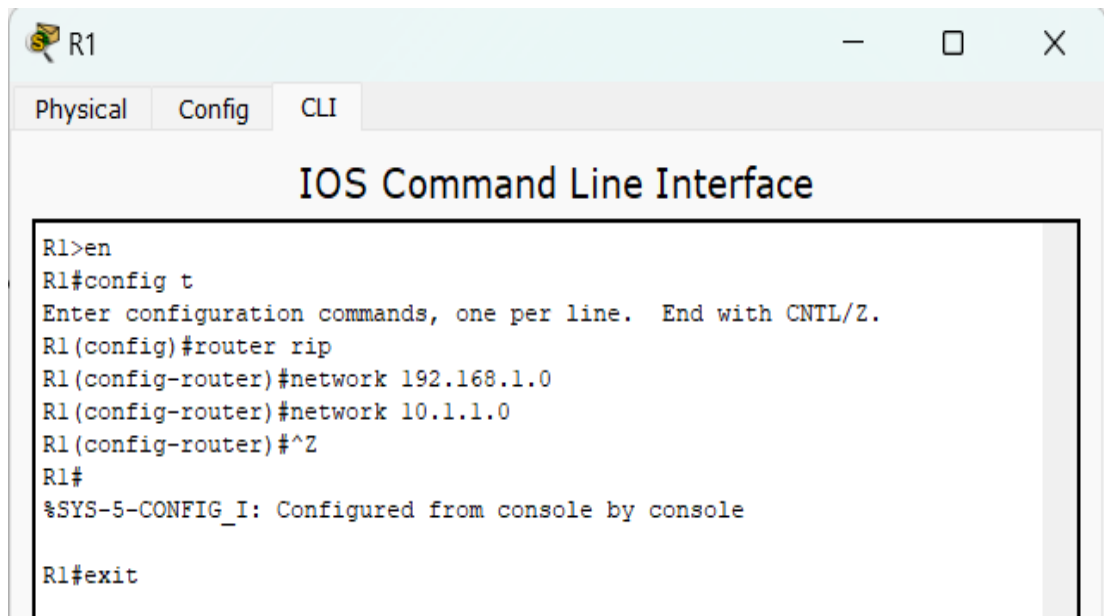


The screenshot shows the CLI window for router R3. The 'CLI' tab is selected. The command 'show ip interface brief' has been entered, and the output is displayed in a table format. The table has five columns: Interface, IP-Address, OK?, Method, and Status. The output shows the status of various interfaces: GigabitEthernet0/0 is administratively down, GigabitEthernet0/1 is up with IP 192.168.3.1, Serial0/0/0 is administratively down, Serial0/0/1 is up with IP 10.2.2.2, and Vlan1 is administratively down.

Interface	IP-Address	OK?	Method	Status
GigabitEthernet0/0	unassigned	YES	unset	administratively down
GigabitEthernet0/1	192.168.3.1	YES	manual	up
Serial0/0/0	unassigned	YES	unset	administratively down
Serial0/0/1	10.2.2.2	YES	manual	up
Vlan1	unassigned	YES	unset	administratively down

➤ Configure RIP on routers

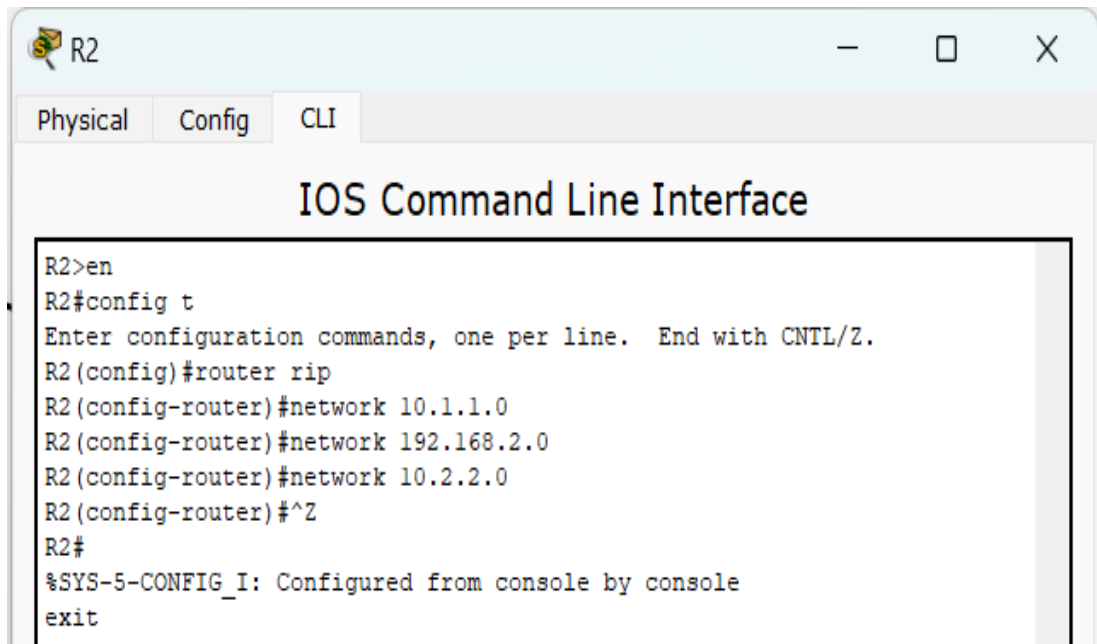
1. R1



The screenshot shows the CLI window for router R1. The 'CLI' tab is selected. The user has entered the command 'en' to enter enable mode, followed by 'config t' to enter global configuration mode. Then, 'router rip' is entered to start the RIP configuration. Two networks are configured: 'network 192.168.1.0' and 'network 10.1.1.0'. The configuration is saved with '^Z'. The prompt returns to 'R1#', and the user enters 'exit' to return to user EXEC mode.

```
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router rip
R1(config-router)#network 192.168.1.0
R1(config-router)#network 10.1.1.0
R1(config-router)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#exit
```

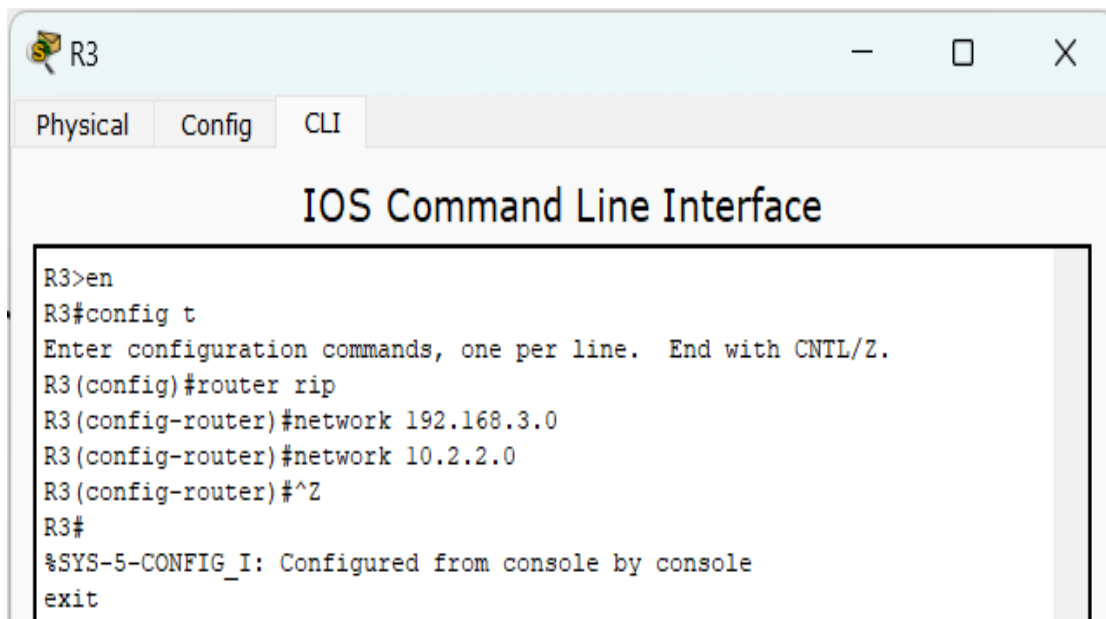
2. R2



The screenshot shows a window titled 'R2' with tabs for 'Physical', 'Config', and 'CLI'. The 'CLI' tab is active, displaying the 'IOS Command Line Interface'. The command history shows the user entering 'en' to enter enable mode, 'config t' to enter configuration mode, 'router rip' to start RIP, and three 'network' commands for 10.1.1.0, 192.168.2.0, and 10.2.2.0. The session ends with '^Z' to return to privileged mode, followed by a system message and 'exit'.

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router rip
R2(config-router)#network 10.1.1.0
R2(config-router)#network 192.168.2.0
R2(config-router)#network 10.2.2.0
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

3. R3

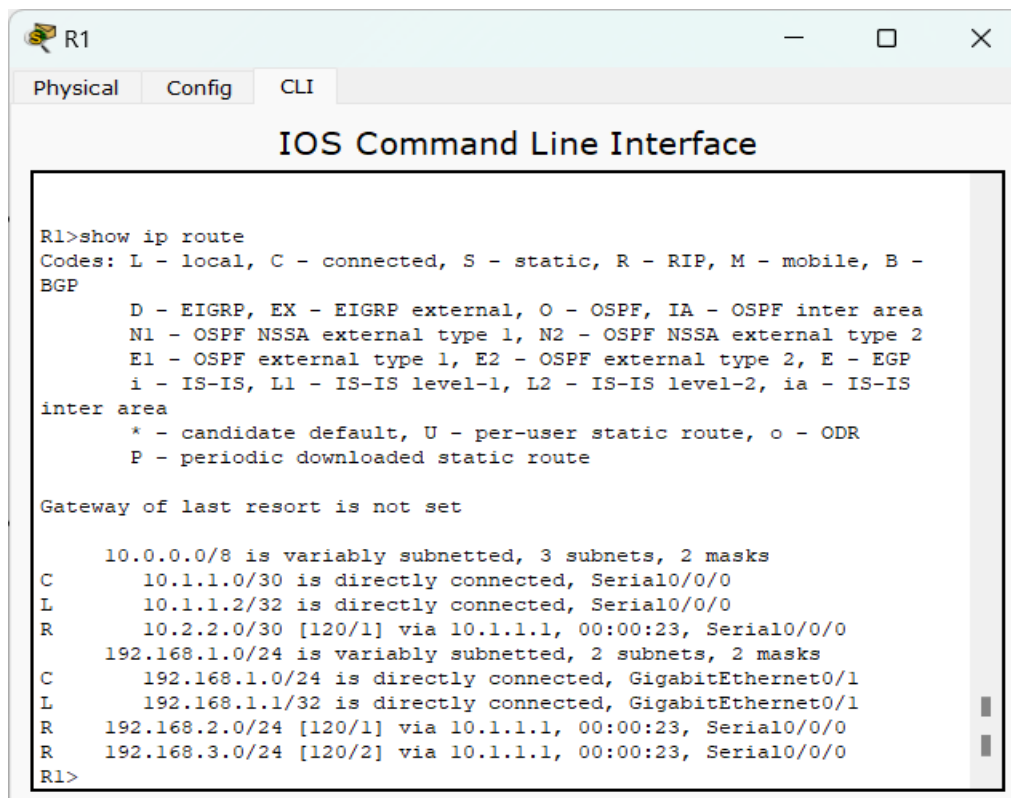


The screenshot shows a window titled 'R3' with tabs for 'Physical', 'Config', and 'CLI'. The 'CLI' tab is active, displaying the 'IOS Command Line Interface'. The command history shows the user entering 'en' to enter enable mode, 'config t' to enter configuration mode, 'router rip' to start RIP, and two 'network' commands for 192.168.3.0 and 10.2.2.0. The session ends with '^Z' to return to privileged mode, followed by a system message and 'exit'.

```
R3>en
R3#config t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#router rip
R3(config-router)#network 192.168.3.0
R3(config-router)#network 10.2.2.0
R3(config-router)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

➤ Displaying routing tables of routers

1. R1



```

R1
Physical Config CLI
IOS Command Line Interface

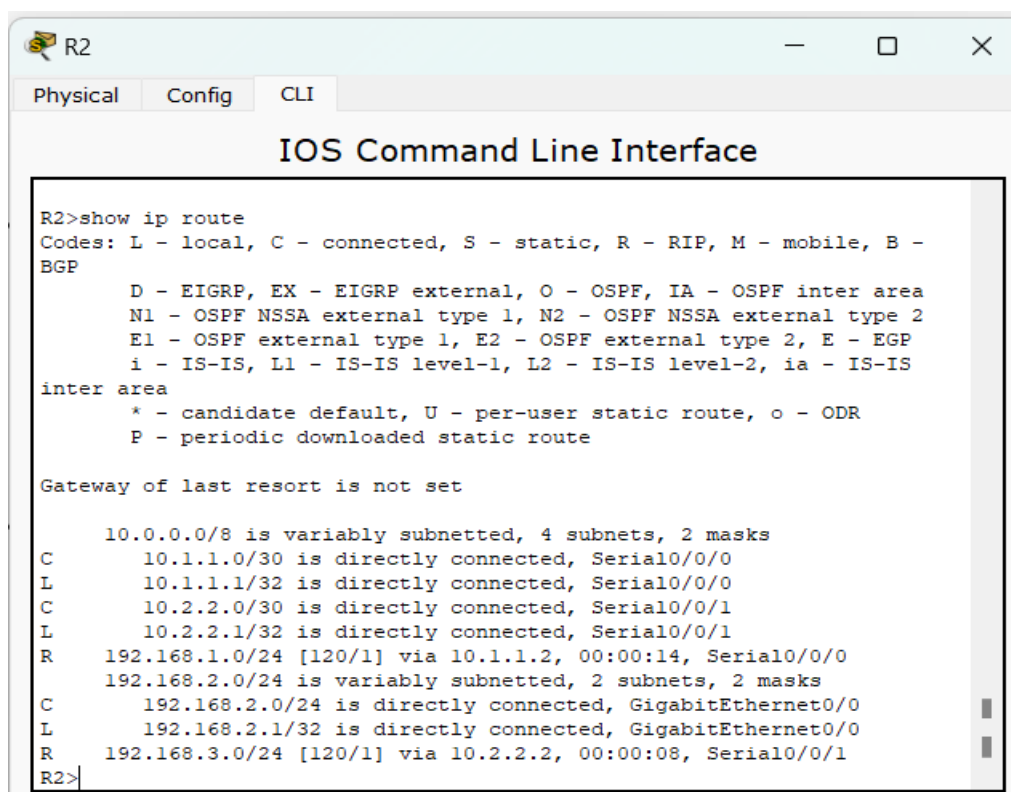
R1>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B -
BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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, 3 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
R       10.2.2.0/30 [120/1] via 10.1.1.1, 00:00:23, Serial0/0/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/1
L       192.168.1.1/32 is directly connected, GigabitEthernet0/1
R       192.168.2.0/24 [120/1] via 10.1.1.1, 00:00:23, Serial0/0/0
R       192.168.3.0/24 [120/2] via 10.1.1.1, 00:00:23, Serial0/0/0
R1>

```

2. R2



```

R2
Physical Config CLI
IOS Command Line Interface

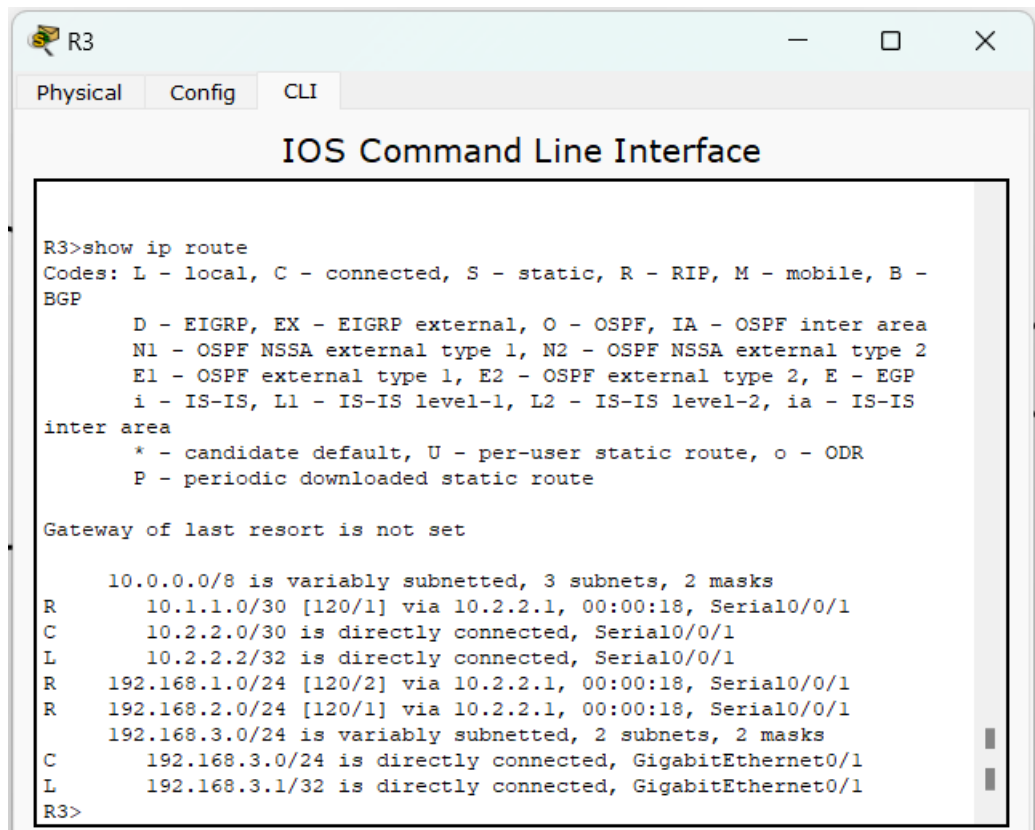
R2>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B -
BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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, 4 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
C       10.2.2.0/30 is directly connected, Serial0/0/1
L       10.2.2.1/32 is directly connected, Serial0/0/1
R       192.168.1.0/24 [120/1] via 10.1.1.2, 00:00:14, Serial0/0/0
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.1/32 is directly connected, GigabitEthernet0/0
R       192.168.3.0/24 [120/1] via 10.2.2.2, 00:00:08, Serial0/0/1
R2>

```


3. R3



```

R3>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

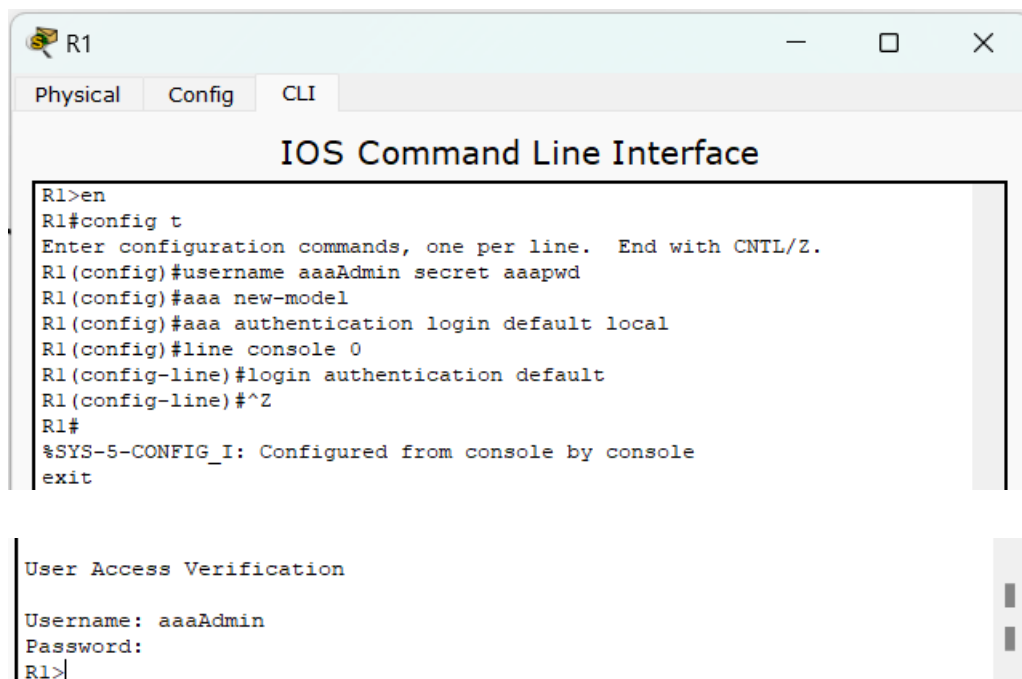
Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
R       10.1.1.0/30 [120/1] via 10.2.2.1, 00:00:18, Serial0/0/1
C       10.2.2.0/30 is directly connected, Serial0/0/1
L       10.2.2.2/32 is directly connected, Serial0/0/1
R       192.168.1.0/24 [120/2] via 10.2.2.1, 00:00:18, Serial0/0/1
R       192.168.2.0/24 [120/1] via 10.2.2.1, 00:00:18, Serial0/0/1
       192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.1/32 is directly connected, GigabitEthernet0/1
R3>

```

➤ Configure Local AAA Authentication for Console Line on R1

1. R1



```

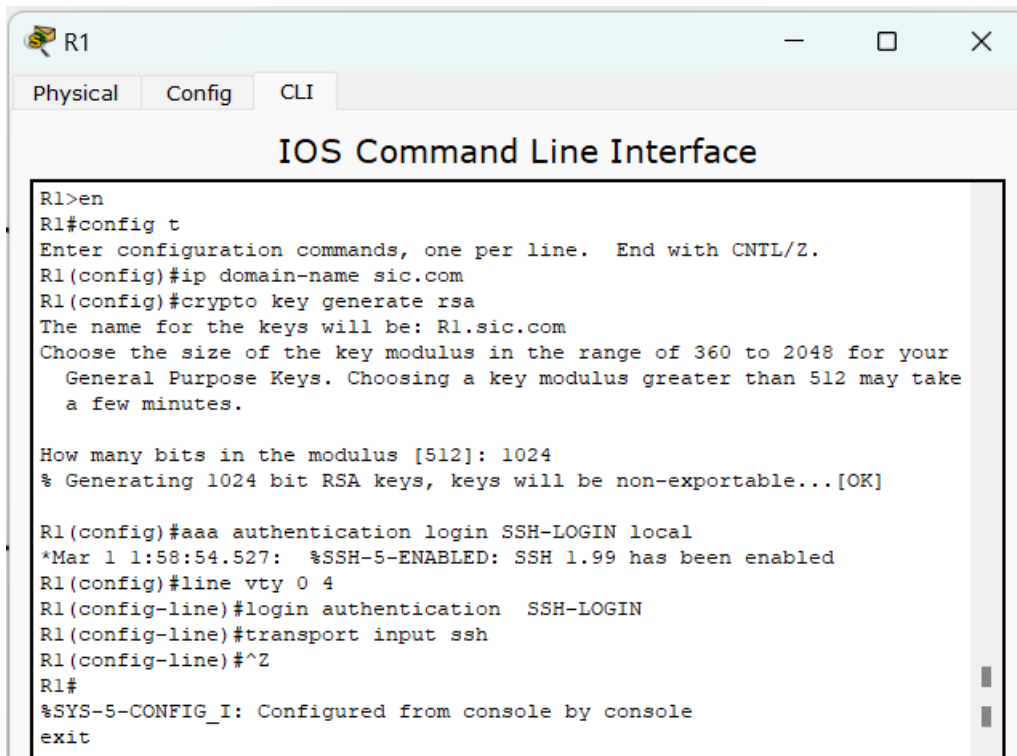
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#username aaaAdmin secret aaapwd
R1(config)#aaa new-model
R1(config)#aaa authentication login default local
R1(config)#line console 0
R1(config-line)#login authentication default
R1(config-line)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
exit

User Access Verification

Username: aaaAdmin
Password:
R1>

```

➤ Configure Local AAA Authentication for vty Lines on R1

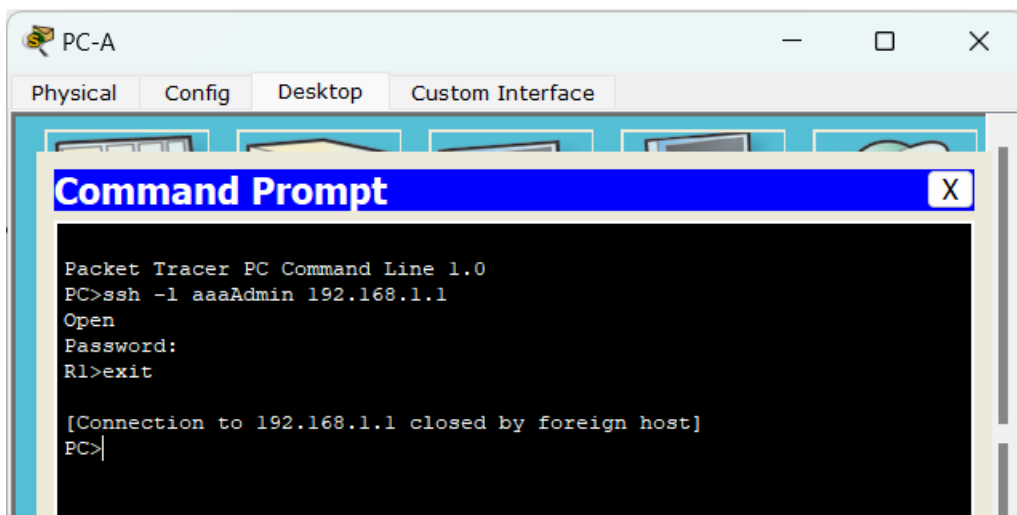
A screenshot of a Packet Tracer window titled 'R1'. The window has tabs for 'Physical', 'Config', and 'CLI'. The 'CLI' tab is active, showing the 'IOS Command Line Interface'. The command history is as follows:

```
R1>en
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ip domain-name sic.com
R1(config)#crypto key generate rsa
The name for the keys will be: R1.sic.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]

R1(config)#aaa authentication login SSH-LOGIN local
*Mar 1 1:58:54.527: %SSH-5-ENABLED: SSH 1.99 has been enabled
R1(config)#line vty 0 4
R1(config-line)#login authentication SSH-LOGIN
R1(config-line)#transport input ssh
R1(config-line)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

PC-A

A screenshot of a Packet Tracer window titled 'PC-A'. The window has tabs for 'Physical', 'Config', 'Desktop', and 'Custom Interface'. The 'Desktop' tab is active, showing a 'Command Prompt' window. The command history is as follows:

```
Packet Tracer PC Command Line 1.0
PC>ssh -l aaaAdmin 192.168.1.1
Open
Password:
R1>exit

[Connection to 192.168.1.1 closed by foreign host]
PC>|
```

➤ Configure Server-Based AAA Authentication Using TACACS+ on R2

TACACS+ Server

Physical Config Services Desktop Custom Interface

SERVICES

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

AAA

Service ☒ On ☐ Off Radius Port **1645**

Network Configuration

Client Name Client IP

Secret ServerType **Radius**

	Client Name	Client IP	Server Type	
1	R2	192.168.2.1	Tacacs	tac

Add Save Remove

User Setup

Username Password

	Username	Password	
1	admin2	pwd2	

Add Save Remove

R2

Physical Config CLI

IOS Command Line Interface

```
R2>en
R2#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#username admin2 secret pwd2
R2(config)#tacacs-server host 192.168.2.2
R2(config)#tacacs-server key tacacspwd
R2(config)#aaa new-model
R2(config)#aaa authentication login default group tacacs+ local
R2(config)#line console 0
R2(config-line)#login authentication default
R2(config-line)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console
R2#exit
```

User Access Verification

Username: admin2

Password:

R2>

➤ Configure Server-Based AAA Authentication Using RADIUS on R3

RADIUS Server

Physical Config Services Desktop Custom Interface

SERVICES

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

AAA

Service ☒ On ☐ Off Radius Port **1645**

Network Configuration

Client Name Client IP

Secret ServerType Radius

	Client Name	Client IP	Server Type	
1	R3	192.168.3.1	Radius	rad

Add Save Remove

User Setup

Username Password

	Username	Password
1	admin3	pwd3

Add Save Remove

R3

Physical Config CLI

IOS Command Line Interface

```

R3>en
R3#config t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#username admin3 secret pwd3
R3(config)#radius-server host 192.168.3.2
R3(config)#radius-server key radiuspwd
R3(config)#aaa new-model
R3(config)#aaa authentication login default group radius local
R3(config)#line console 0
R3(config-line)#login authentication default
R3(config-line)#^Z
R3#
  
```

User Access Verification

Username: admin3
Password:

R3>