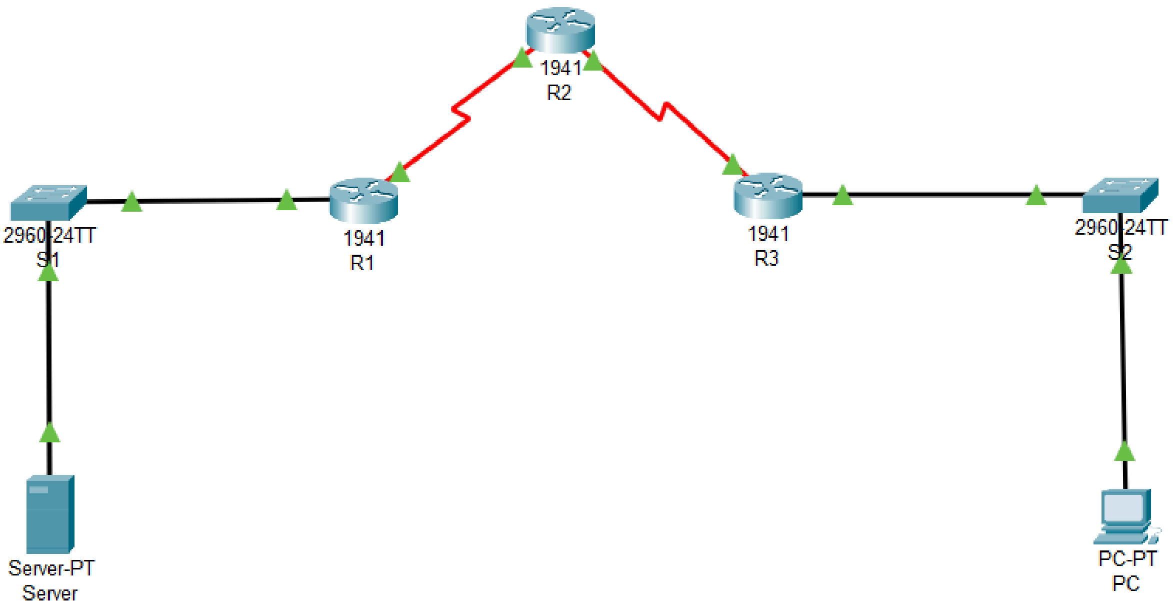
Security in Computing
Practical - 4

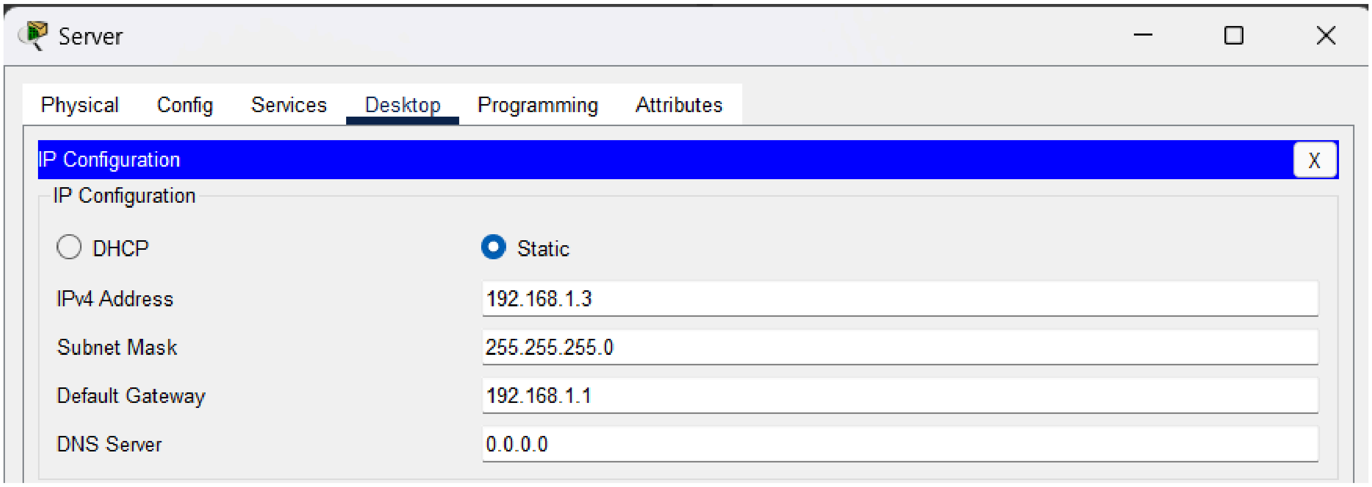
➢**Aim: Configure IP ACLs to Mitigate Attacks**

a. Verify connectivity among devices before firewall configuration.
b. Use ACLs to ensure remote access to the routers is available only from management station PC-C.
c. Configure ACLs on to mitigate attacks.

Topology Diagram:



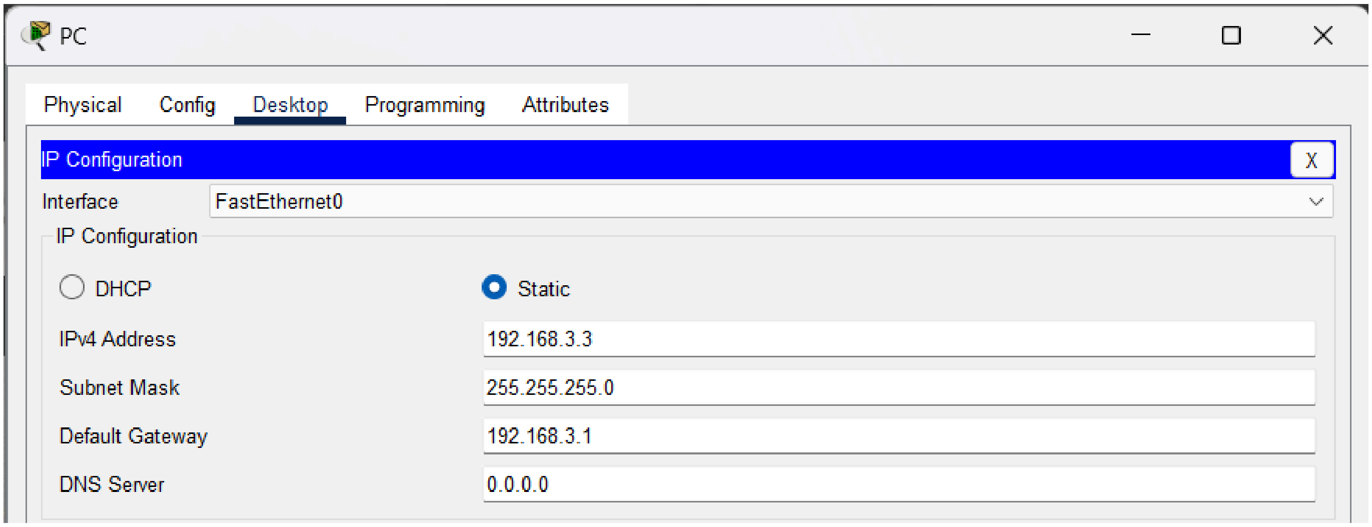
Assign IP Addresses:



IP Configuration

○ DHCP ● Static

IPv4 Address	192.168.1.3
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0



Interface: FastEthernet0

IP Configuration

○ DHCP ● Static

IPv4 Address: 192.168.3.3

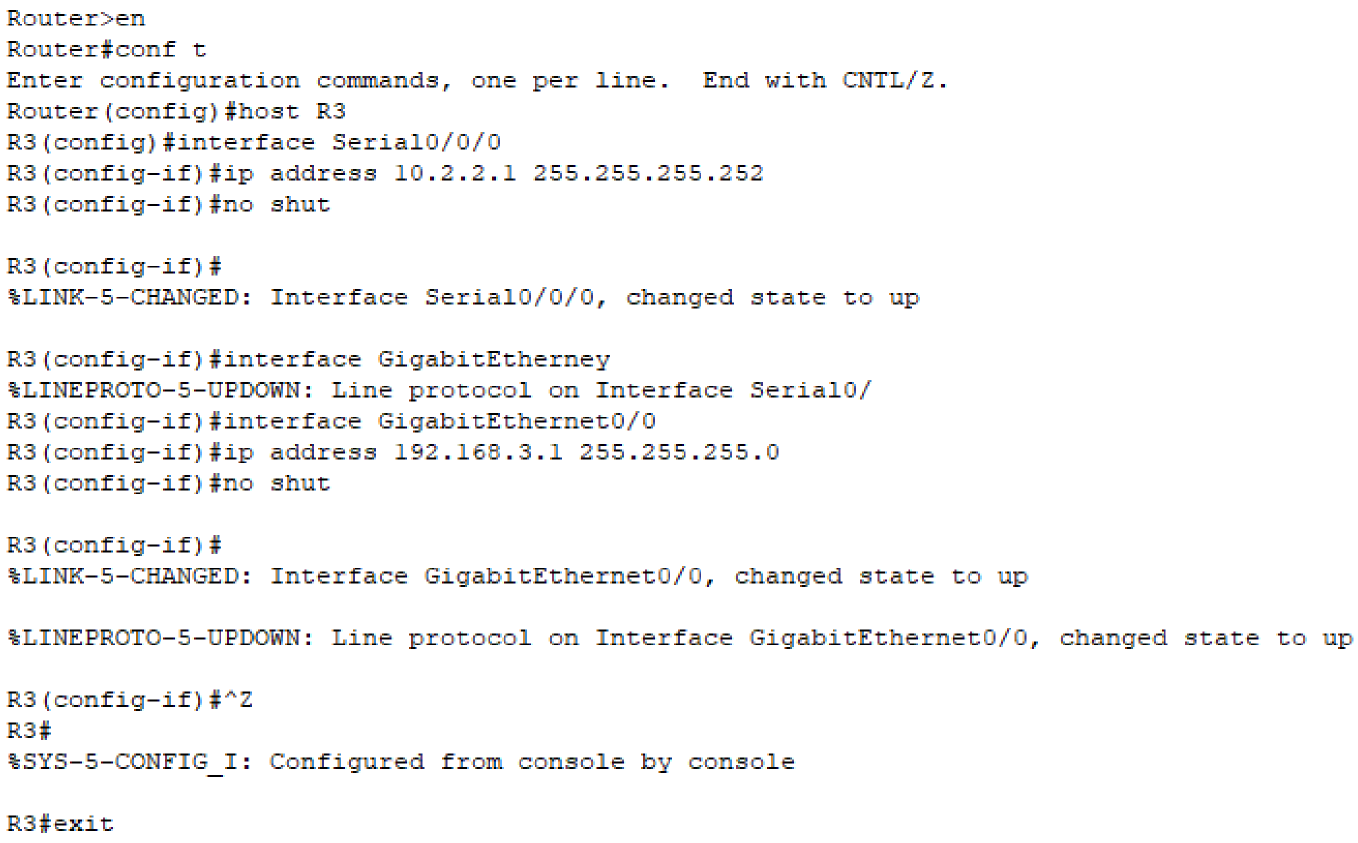
Subnet Mask: 255.255.255.0

Default Gateway: 192.168.3.1

DNS Server: 0.0.0.0

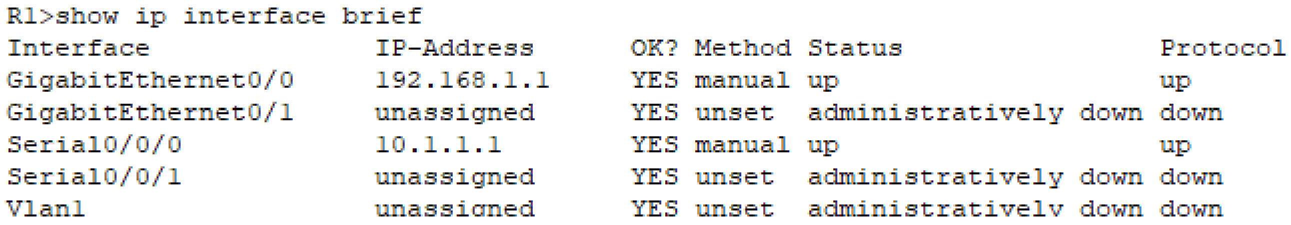
```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host R1
R1(config)#interface Serial0/0/0
R1(config-if)#ip address 10.1.1.1 255.255.255.252
R1(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
R1(config-if)#interface GigabitEthernet0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

R1(config-if)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#exit
```

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host R2
R2(config)#interface Serial0/0/0
R2(config-if)#ip address 10.1.1.2 255.255.255.252
R2(config-if)#no shut

R2(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

R2(config-if)#interface Seri
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to u
               ^
% Invalid input detected at '^' marker.

R2(config-if)#interface Serial0/0/1
R2(config-if)#ip address 10.2.2.2 255.255.255.252
R2(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/0/1, changed state to down
R2(config-if)#int loopback1

R2(config-if)#
%LINK-5-CHANGED: Interface Loopback1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1, changed state to up

R2(config-if)#ip address 192.168.2.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#exit
```

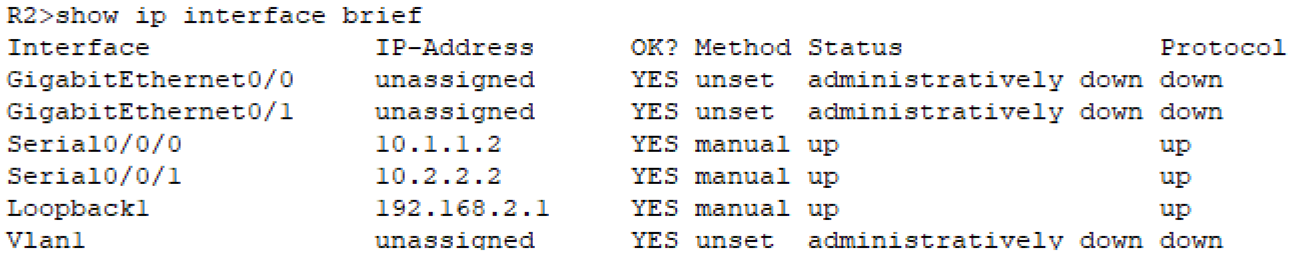


```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host R3
R3(config)#interface Serial0/0/0
R3(config-if)#ip address 10.2.2.1 255.255.255.252
R3(config-if)#no shut

R3(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

R3(config-if)#interface GigabitEtherney
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/
R3(config-if)#interface GigabitEthernet0/0
R3(config-if)#ip address 192.168.3.1 255.255.255.0
R3(config-if)#no shut

R3(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

R3(config-if)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#exit
```

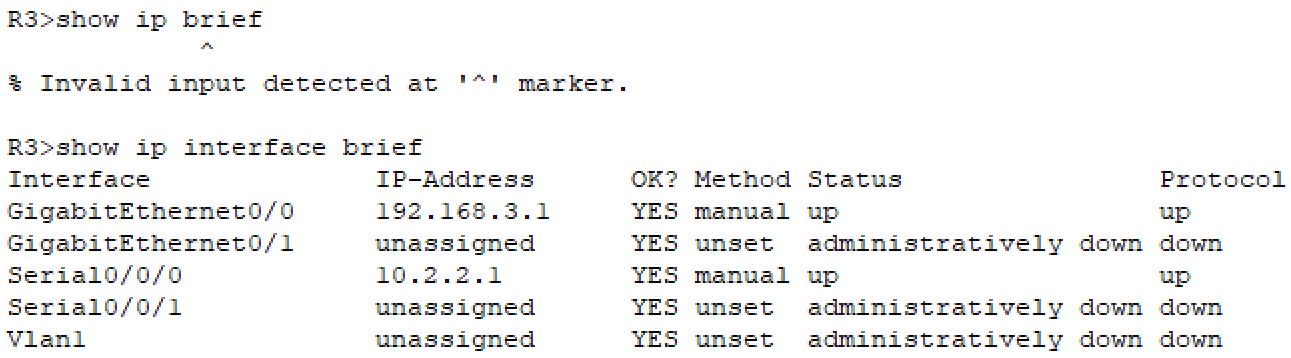
Displaying IP Address Details of Routers



```
R1>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
```

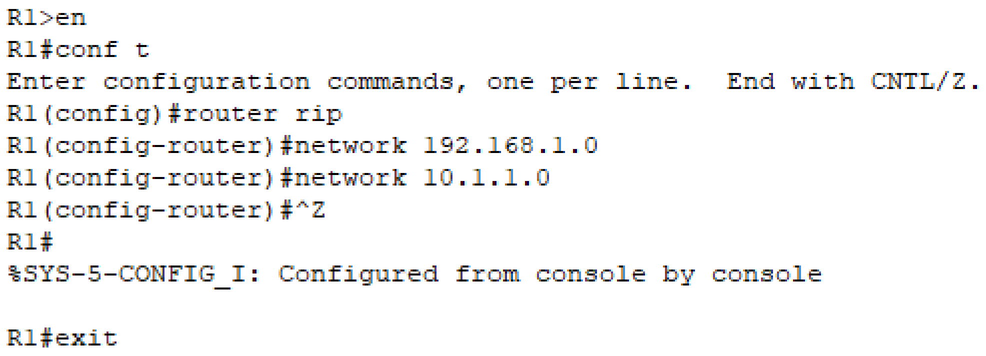


```
R2>show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/0/0            10.1.1.2        YES manual up                    up
Serial0/0/1            10.2.2.2        YES manual up                    up
Loopback1              192.168.2.1     YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

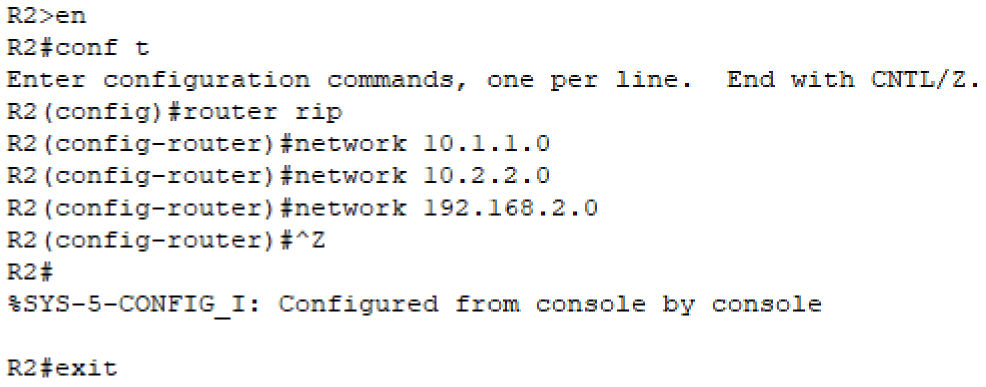


```
R3>show ip brief
            ^
% Invalid input detected at '^' marker.

R3>show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     192.168.3.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/0/0            10.2.2.1        YES manual up                    up
Serial0/0/1            unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
```

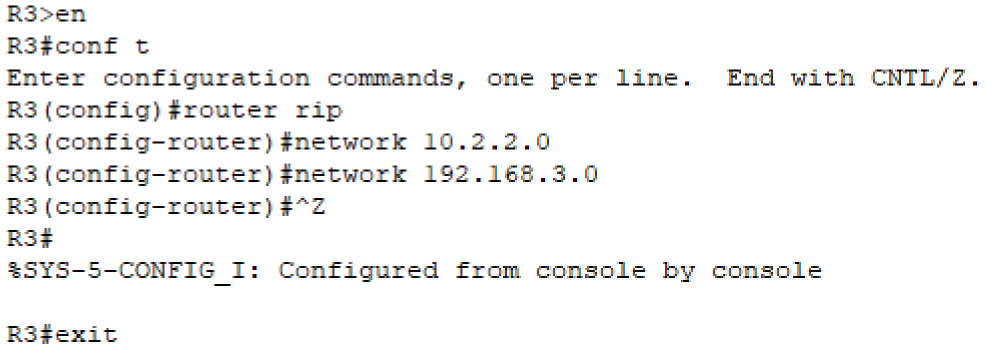
Configure RIP on Routers:



```
R1>en
R1#conf 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
```

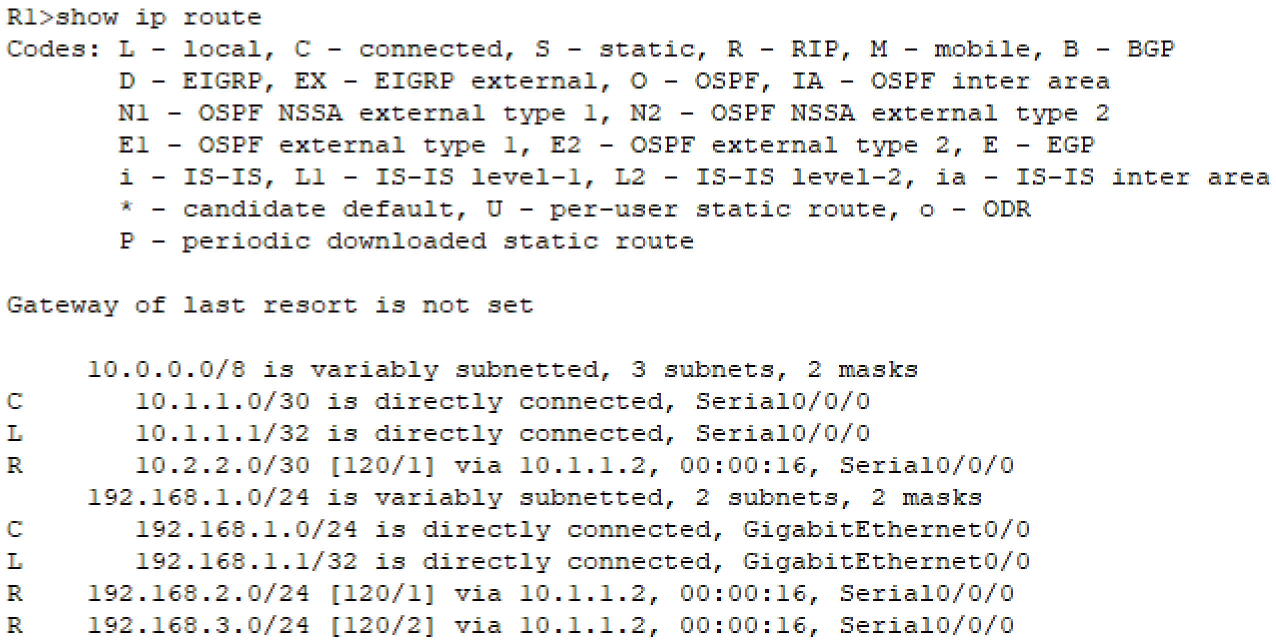


```
R2>en
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router rip
R2(config-router)#network 10.1.1.0
R2(config-router)#network 10.2.2.0
R2(config-router)#network 192.168.2.0
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#exit
```

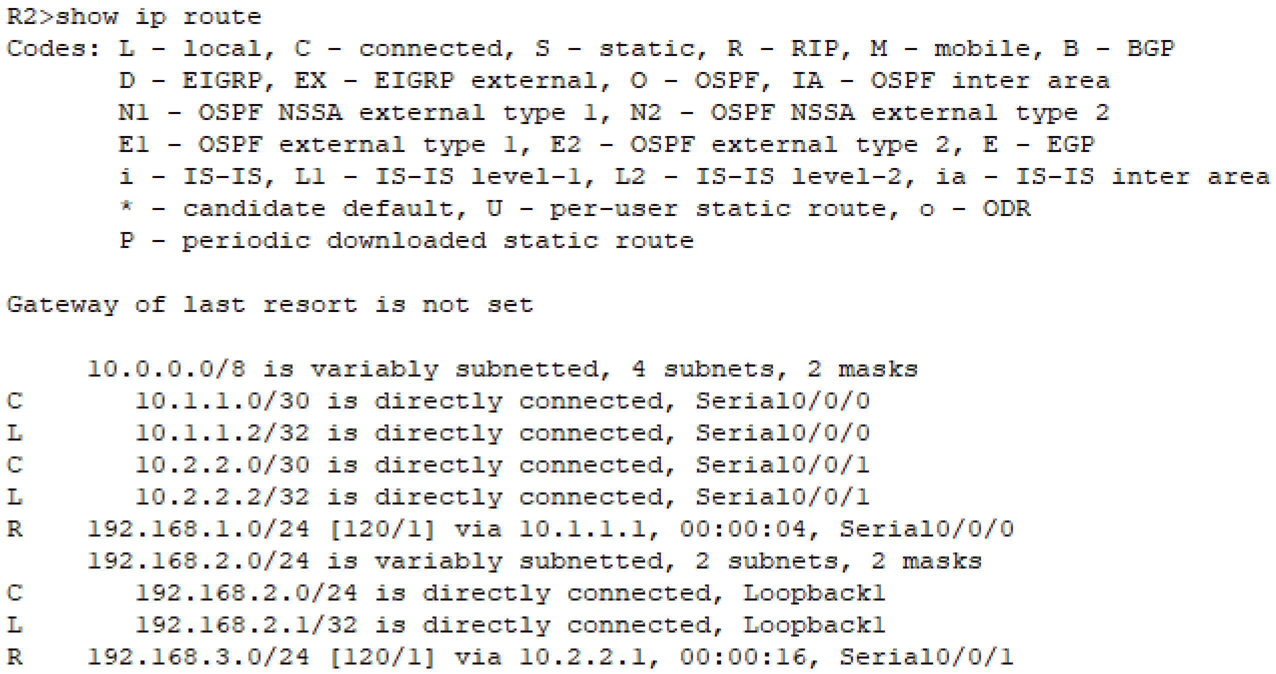


```
R3>en
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router rip
R3(config-router)#network 10.2.2.0
R3(config-router)#network 192.168.3.0
R3(config-router)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#exit
```

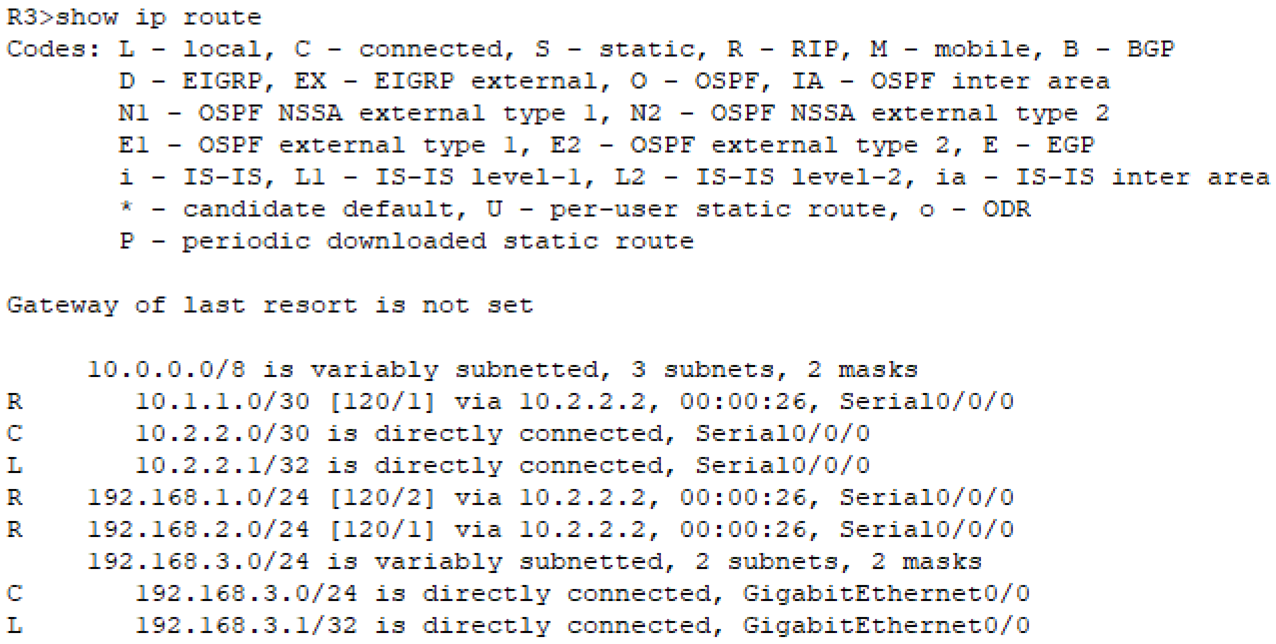
Displaying routing table of routers:



```
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       10.1.1.1/32 is directly connected, Serial0/0/0
R       10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:16, 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
R    192.168.2.0/24 [120/1] via 10.1.1.2, 00:00:16, Serial0/0/0
R    192.168.3.0/24 [120/2] via 10.1.1.2, 00:00:16, Serial0/0/0
```

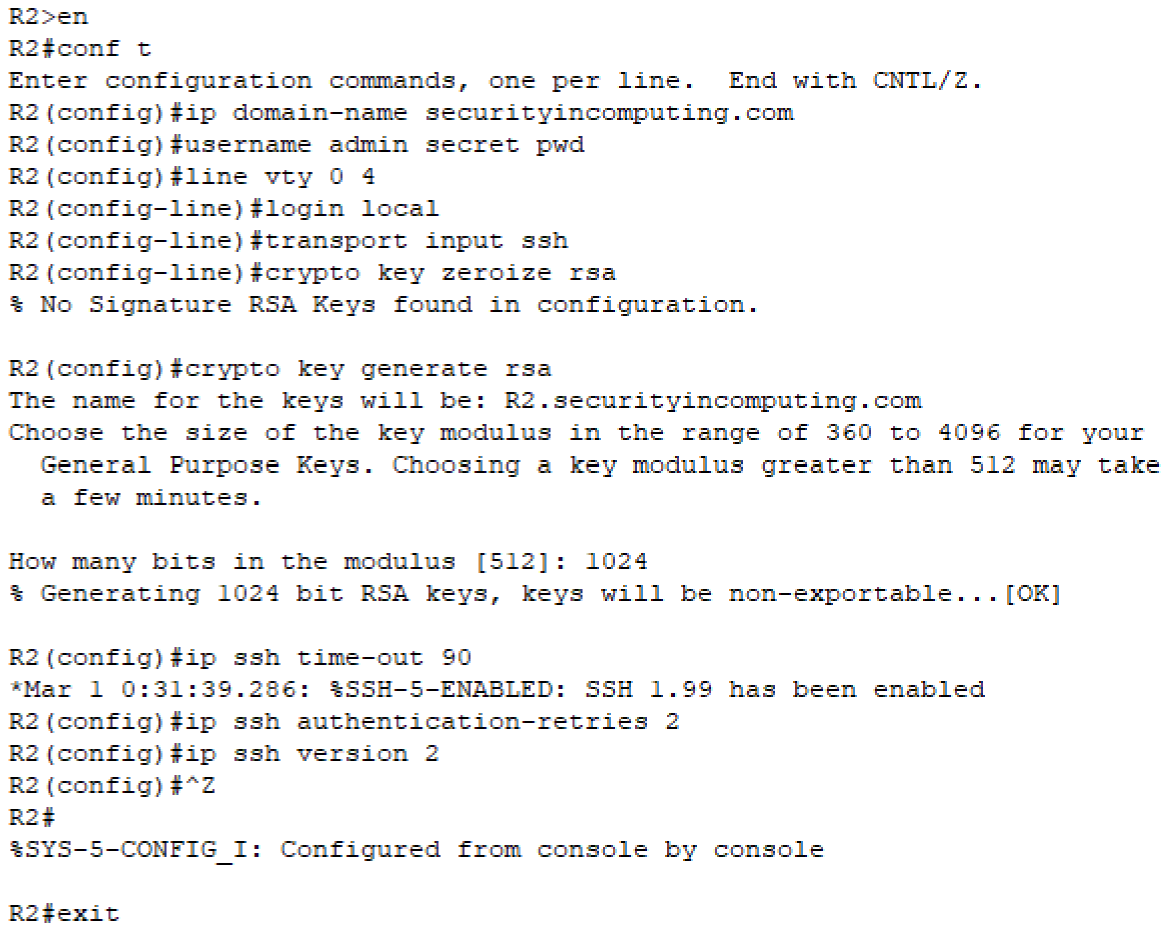


```
R2>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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       10.1.1.2/32 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
R    192.168.1.0/24 [120/1] via 10.1.1.1, 00:00:04, Serial0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, Loopback1
L       192.168.2.1/32 is directly connected, Loopback1
R    192.168.3.0/24 [120/1] via 10.2.2.1, 00:00:16, Serial0/0/1
```



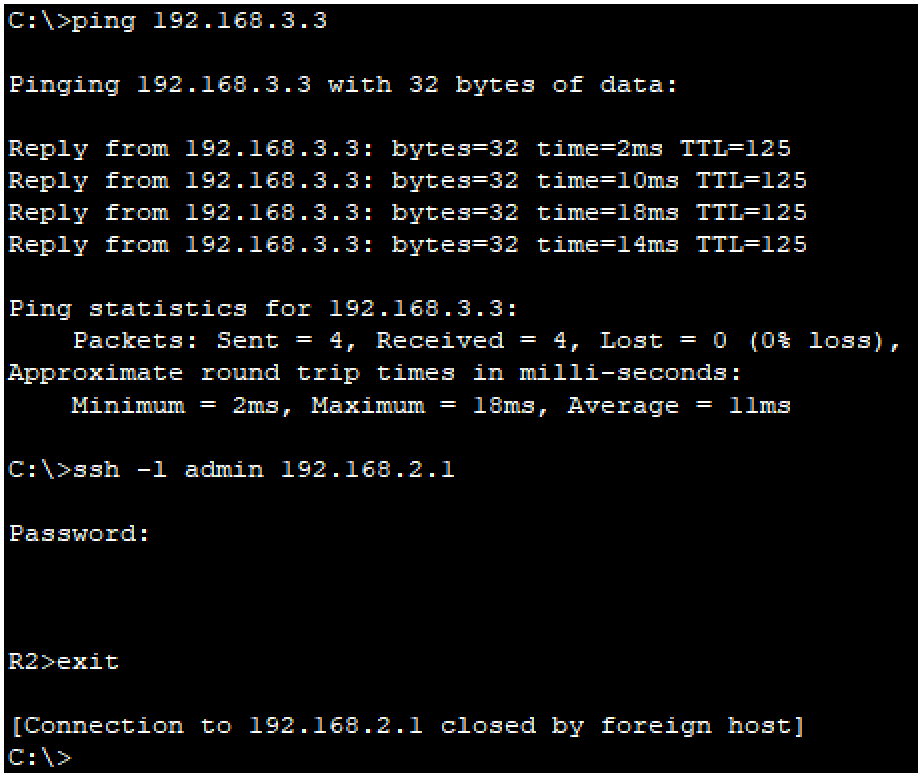
```
R3>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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 10.2.2.2, 00:00:26, 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
R    192.168.1.0/24 [120/2] via 10.2.2.2, 00:00:26, Serial0/0/0
R    192.168.2.0/24 [120/1] via 10.2.2.2, 00:00:26, 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
```

Configure SSH on R2:

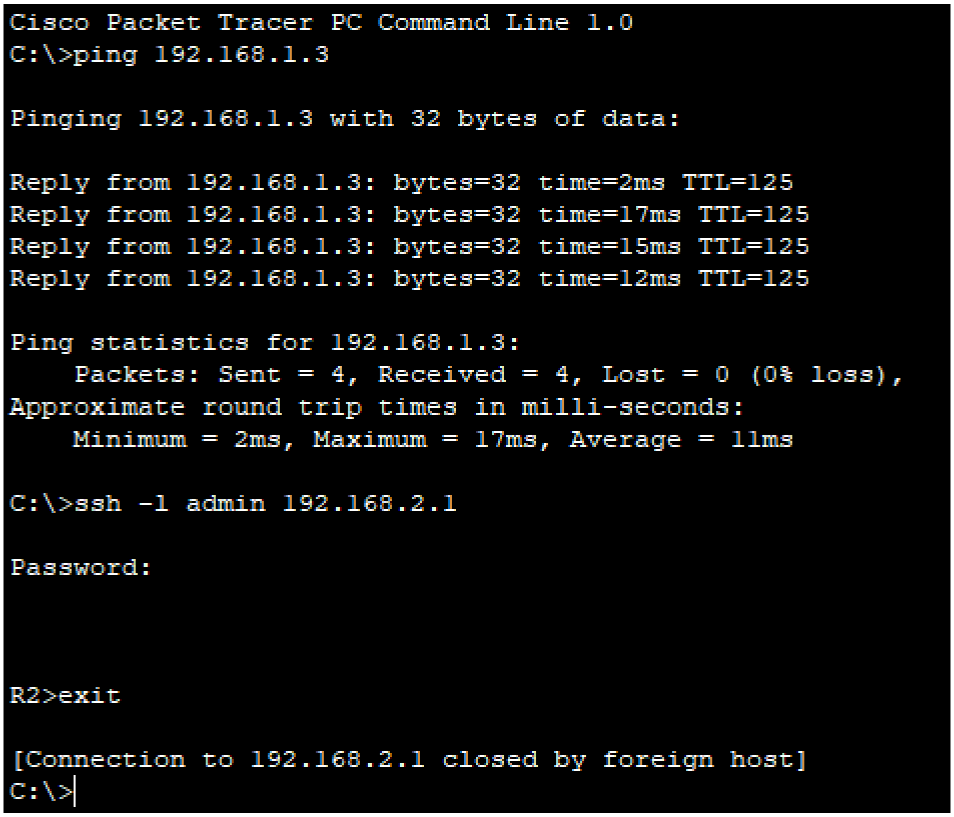


```
R2>en
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ip domain-name securityincomputing.com
R2(config)#username admin secret pwd
R2(config)#line vty 0 4
R2(config-line)#login local
R2(config-line)#transport input ssh
R2(config-line)#crypto key zeroize rsa
% No Signature RSA Keys found in configuration.

R2(config)#crypto key generate rsa
The name for the keys will be: R2.securityincomputing.com
Choose the size of the key modulus in the range of 360 to 4096 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 0:31:39.286: %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#
%SYS-5-CONFIG_I: Configured from console by console

R2#exit
```

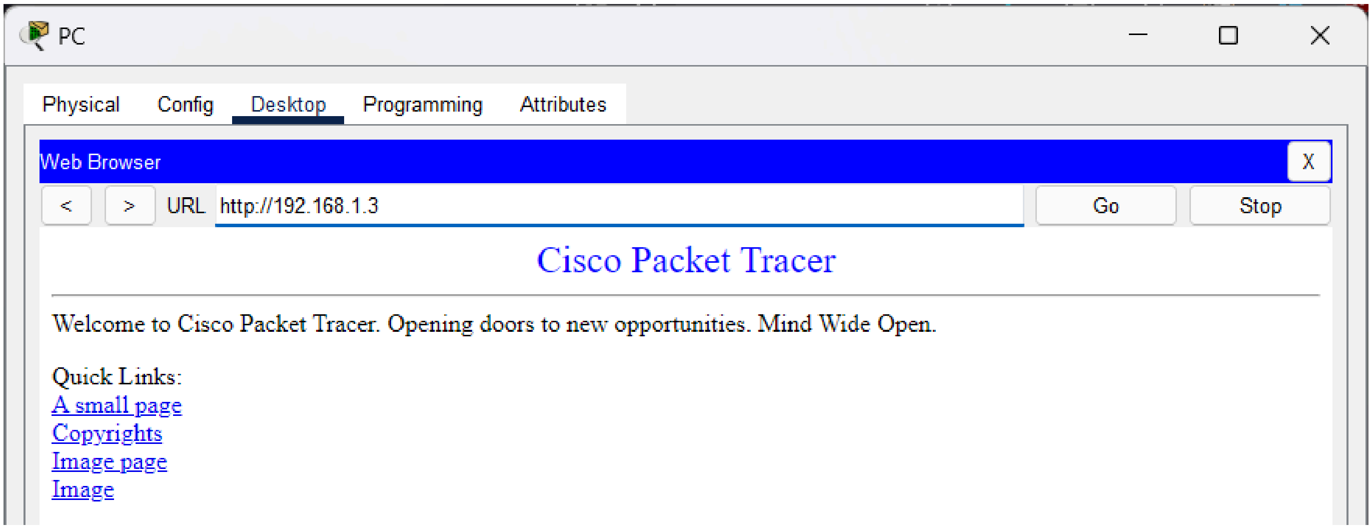
Verify Basic Network Connectivity before ACL Configuration:



```
C:\>ping 192.168.3.3

Pinging 192.168.3.3 with 32 bytes of data:

Reply from 192.168.3.3: bytes=32 time=2ms TTL=125
Reply from 192.168.3.3: bytes=32 time=10ms TTL=125
Reply from 192.168.3.3: bytes=32 time=18ms TTL=125
Reply from 192.168.3.3: bytes=32 time=14ms TTL=125

Ping statistics for 192.168.3.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 18ms, Average = 11ms

C:\>ssh -l admin 192.168.2.1

Password:



R2>exit

[Connection to 192.168.2.1 closed by foreign host]
C:\>
```



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=2ms TTL=125
Reply from 192.168.1.3: bytes=32 time=17ms TTL=125
Reply from 192.168.1.3: bytes=32 time=15ms TTL=125
Reply from 192.168.1.3: bytes=32 time=12ms TTL=125

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 17ms, Average = 11ms

C:\>ssh -l admin 192.168.2.1

Password:



R2>exit

[Connection to 192.168.2.1 closed by foreign host]
C:\>
```



URL http://192.168.1.3

Cisco Packet Tracer

Welcome to Cisco Packet Tracer. Opening doors to new opportunities. Mind Wide Open.

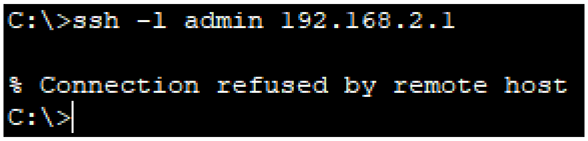
Quick Links:
A small page
Copyrights
Image page
Image

Configure ACL on routers (block all remote access to the routers except from PC):

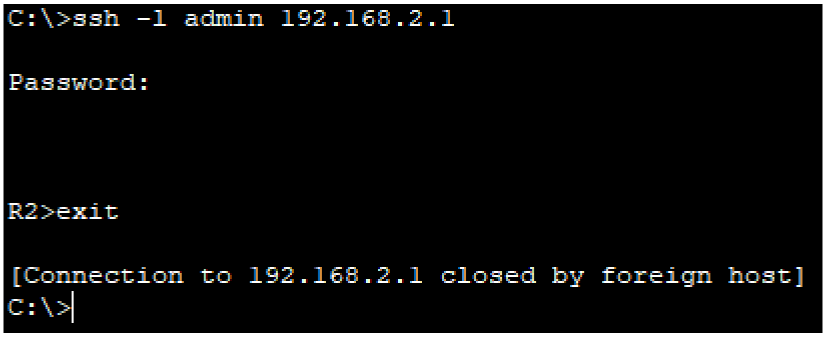
```
R1>en
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#access-list 10 permit host 192.168.3.3
R1(config)#line vty 0 4
R1(config-line)#access-class 10 in
R1(config-line)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#exit
```

```
R2>en
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#access-list 10 permit host 192.168.3.3
R2(config)#line vty 0 4
R2(config-line)#access-class 10 in
R2(config-line)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#exit
```

Verifying the working of ACL:

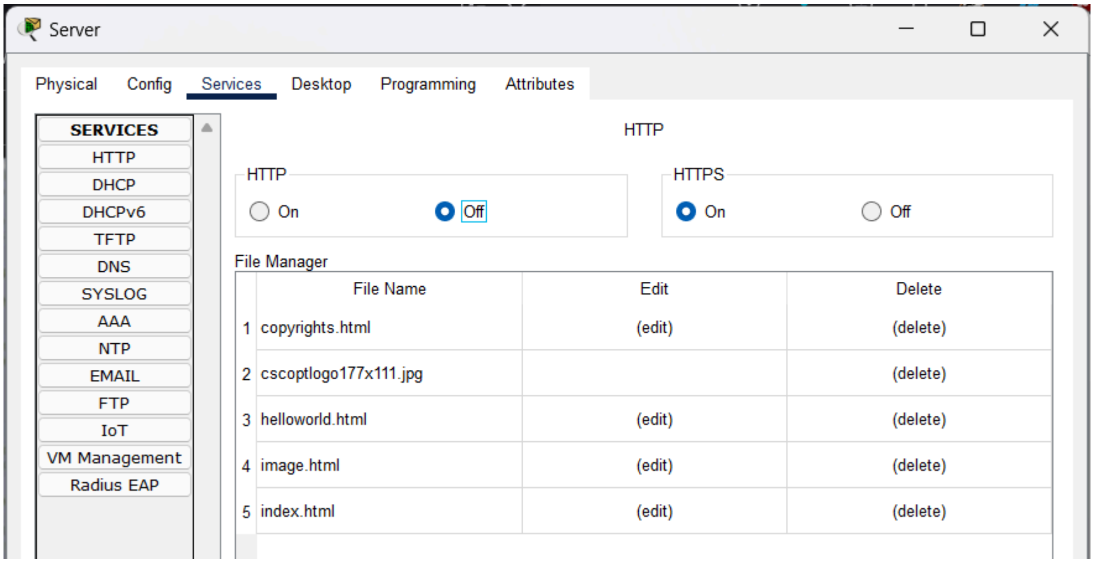


```
C:\>ssh -l admin 192.168.2.1

% Connection refused by remote host
C:\>
```



```
C:\>ssh -l admin 192.168.2.1

Password:


R2>exit

[Connection to 192.168.2.1 closed by foreign host]
C:\>
```

Disable HTTP and enable HTTPS on server:



HTTP

HTTP ○ On ● Off

HTTPS ● On ○ Off

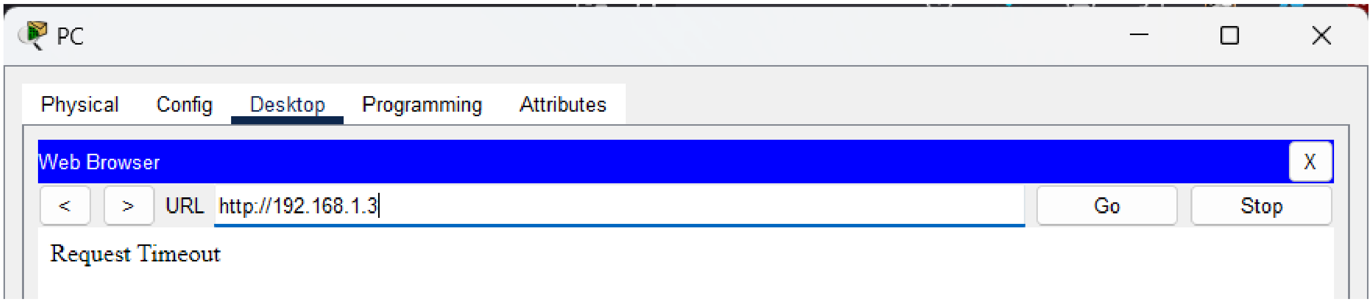
File Manager

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

Configure ACL on routers:

```
R1>en
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#access-list 120 permit udp any host 192.168.1.3 eq domain
R1(config)#access-list 120 permit tcp any host 192.168.1.3 eq smtp
R1(config)#access-list 120 permit tcp any host 192.168.1.3 eq ftp
R1(config)#access-list 120 deny tcp any host 192.168.1.3 eq 443
R1(config)#access-list 120 permit tcp host 192.168.3.3 host 10.1.1.1 ep 22
                                                                      ^
% Invalid input detected at '^' marker.

R1(config)#access-list 120 permit tcp host 192.168.3.3 host 10.1.1.1 eq 22
R1(config)#interface Serial0/0/0
R1(config-if)#ip access-group 120 in
R1(config-if)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#exit
```

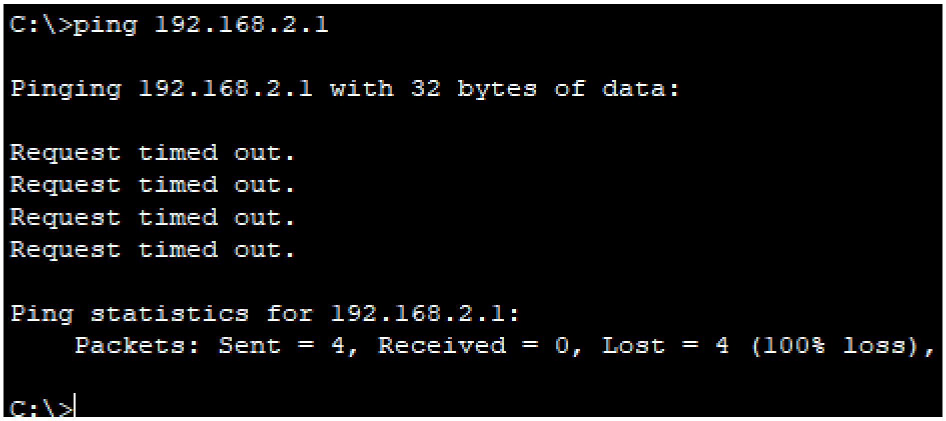
Verifying the work of ACL:



URL http://192.168.1.3

Request Timeout

Verifying the network connectivity before ACL implementation:

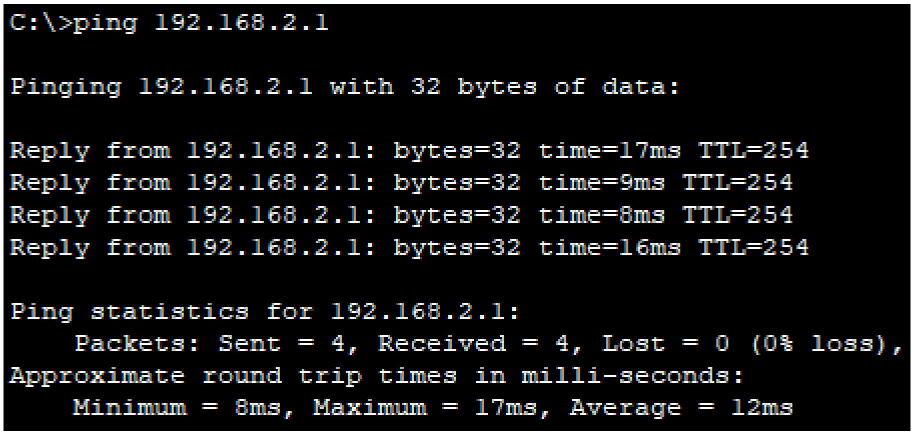


```
C:\>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

Modify an Existing ACL on R1:

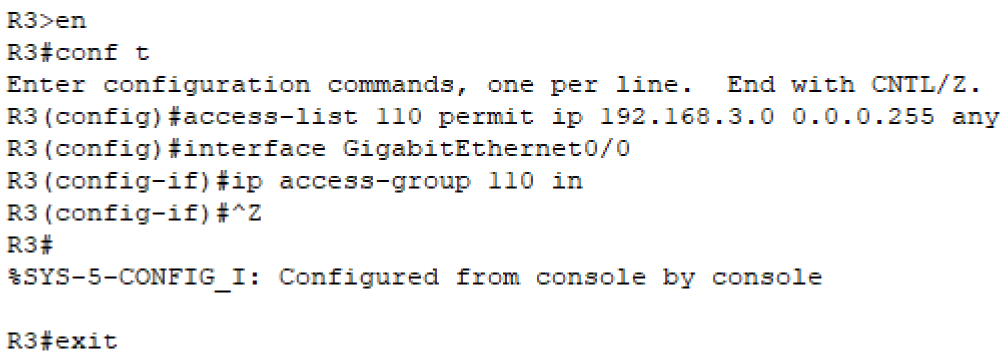
```
R1>en
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#access-list 120 permit icmp any any echo-reply
R1(config)#access-list 120 permit icmp any any unreachable
R1(config)#access-list 120 deny icmp any any
R1(config)#access-list 120 permit ip any any
R1(config)#^Z
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#exit
```

Verifying the working of ACL:



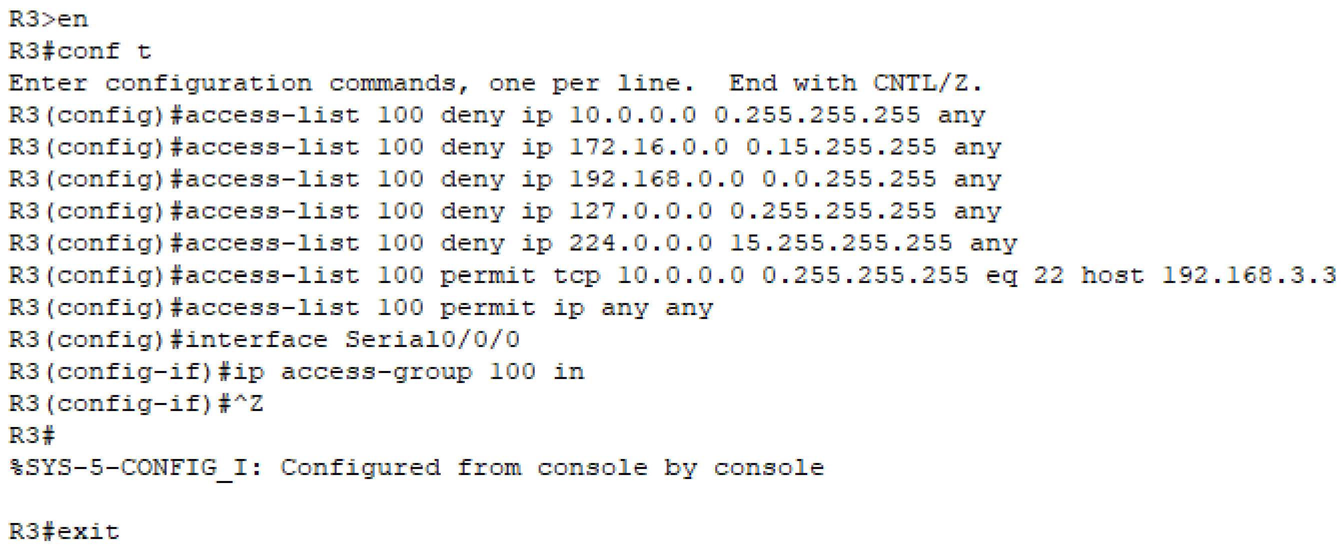
```
C:\>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:

Reply from 192.168.2.1: bytes=32 time=17ms TTL=254
Reply from 192.168.2.1: bytes=32 time=9ms TTL=254
Reply from 192.168.2.1: bytes=32 time=8ms TTL=254
Reply from 192.168.2.1: bytes=32 time=16ms TTL=254

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 8ms, Maximum = 17ms, Average = 12ms
```

Configure ACL on routers:

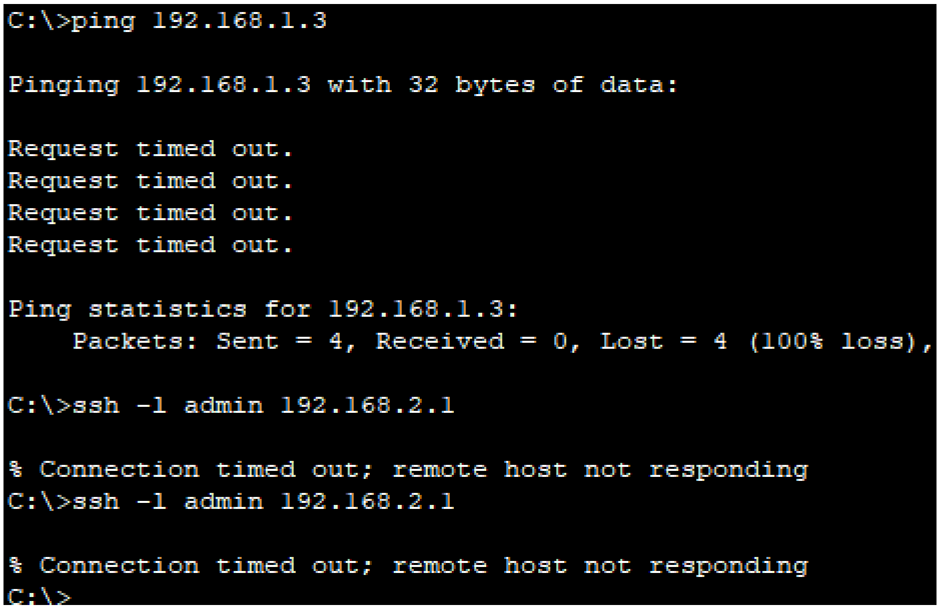


```
R3>en
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#access-list 110 permit ip 192.168.3.0 0.0.0.255 any
R3(config)#interface GigabitEthernet0/0
R3(config-if)#ip access-group 110 in
R3(config-if)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#exit
```

Configure ACL on routers:



```
R3>en
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#access-list 100 deny ip 10.0.0.0 0.255.255.255 any
R3(config)#access-list 100 deny ip 172.16.0.0 0.15.255.255 any
R3(config)#access-list 100 deny ip 192.168.0.0 0.0.255.255 any
R3(config)#access-list 100 deny ip 127.0.0.0 0.255.255.255 any
R3(config)#access-list 100 deny ip 224.0.0.0 15.255.255.255 any
R3(config)#access-list 100 permit tcp 10.0.0.0 0.255.255.255 eq 22 host 192.168.3.3
R3(config)#access-list 100 permit ip any any
R3(config)#interface Serial0/0/0
R3(config-if)#ip access-group 100 in
R3(config-if)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#exit
```



```
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ssh -l admin 192.168.2.1

% Connection timed out; remote host not responding
C:\>ssh -l admin 192.168.2.1

% Connection timed out; remote host not responding
C:\>
```