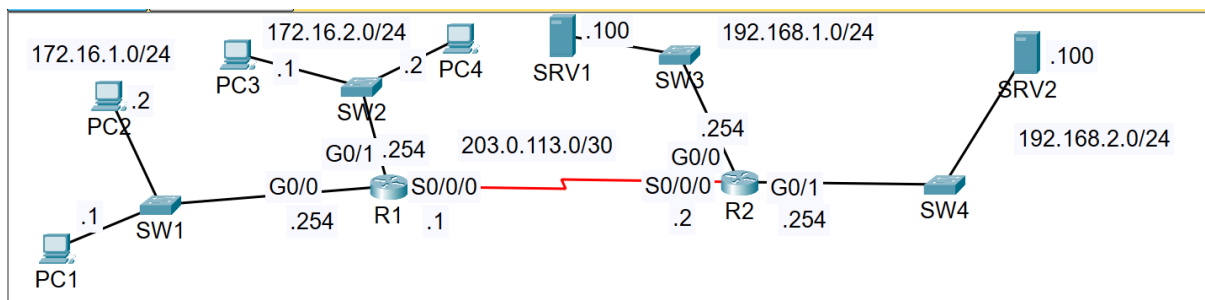


Network Topology:



Instructions and actions:

1. Configure OSPF on R1 and R2 to allow full connectivity between the PCs and servers.

Configured

R1 CLI:

```
R1
Physical Config CLI Attributes
IOS Command Line Interface

R1(config-router)#exit
R1(config)#do sh ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 203.0.113.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    203.0.113.0 0.0.0.0 area 0
    172.16.2.0 0.0.0.0 area 0
    172.16.1.0 0.0.0.0 area 0
  Passive Interface(s):
    GigabitEthernet0/0
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    203.0.113.1         110          00:09:28
    203.0.113.2         110          00:08:23
  Distance: (default is 110)

R1(config)#do sh ip route ospf
O 192.168.1.0 [110/65] via 203.0.113.2, 00:08:56, Serial0/0/0
O 192.168.2.0 [110/65] via 203.0.113.2, 00:08:30, Serial0/0/0

R1(config)#do sh ip ospf database
  OSPF Router with ID (203.0.113.1) (Process ID 1)

  Router Link States (Area 0)

  Link ID      ADV Router   Age         Seq#         Checksum Link count
  203.0.113.1  203.0.113.1  587         0x80000004  0x00d21e  4
  203.0.113.2  203.0.113.2  522         0x80000004  0x00eda7  4

R1(config)#do sh ip ospf neighbor

Neighbor ID    Pri   State   Dead Time   Address        Interface
203.0.113.2    0     FULL/  -           00:00:31      203.0.113.2   Serial0/0/0
R1(config)#
```

R2 CLI:

```
R2
Physical Config CLI Attributes
IOS Command Line Interface

R2(config)#do sh ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 203.0.113.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    203.0.113.0 0.0.0.0 area 0
    192.168.1.0 0.0.0.0 area 0
    192.168.2.0 0.0.0.0 area 0
  Passive Interface(s):
    GigabitEthernet0/0
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    203.0.113.1         110          00:11:15
    203.0.113.2         110          00:10:10
  Distance: (default is 110)

R2(config)#do sh ip route ospf
O 172.16.0.0/24 is subnetted, 2 subnets
O 172.16.1.0 [110/65] via 203.0.113.1, 00:11:23, Serial0/0/0
O 172.16.2.0 [110/65] via 203.0.113.1, 00:11:46, Serial0/0/0

R2(config)#do sh ip ospf database
  OSPF Router with ID (203.0.113.2) (Process ID 1)

  Router Link States (Area 0)

  Link ID      ADV Router   Age         Seq#         Checksum Link count
  203.0.113.1  203.0.113.1  690         0x80000004  0x00d21e  4
  203.0.113.2  203.0.113.2  625         0x80000004  0x00eda7  4

R2(config)#do sh ip ospf neighbor

Neighbor ID    Pri   State   Dead Time   Address        Interface
203.0.113.1    0     FULL/  -           00:00:31      203.0.113.1   Serial0/0/0
R2(config)#
```

All the end hosts are able to ping each other.

2. Configure standard numbered ACLs on R1 and standard named ACLs on R2 such that –
 - (a) Only PC1 and PC3 can access 192.168.1.0/24
 - (b) Hosts in 172.16.2.0/24 can't access 192.168.2.0/24
 - (c) 172.16.1.0/24 can't access 172.16.2.0/24
 - (d) 172.16.2.0/24 can't access 172.16.1.0/24

Condition (a) on R2 CLI:

```
R2(config)#ip access-list standard R2_access
R2(config-std-nacl)#10 permit 172.16.1.1
R2(config-std-nacl)#20 permit 172.16.2.1
R2(config-std-nacl)#int g0/0
R2(config-if)#exit
R2(config)#ip access-list standard R2_access
R2(config-std-nacl)#no 10 permit 172.16.1.1
R2(config-std-nacl)#no 20 permit 172.16.2.1
R2(config-std-nacl)#10 permit ?
  A.B.C.D  Address to match
  any      Any source host
  host     A single host address
R2(config-std-nacl)#10 permit 172.16.1.1 ?
  A.B.C.D  Wildcard bits
  <cr>
R2(config-std-nacl)#10 permit 172.16.1.1 0.0.0.0
R2(config-std-nacl)#20 permit 172.16.2.1 0.0.0.0
R2(config-std-nacl)#int g0/0
R2(config-if)#ip access-group R2_access out
R2(config-if)#do sh run | section access_list
R2(config-if)#exit
```

Only PC1 and PC3 can access the given network.

PC1:

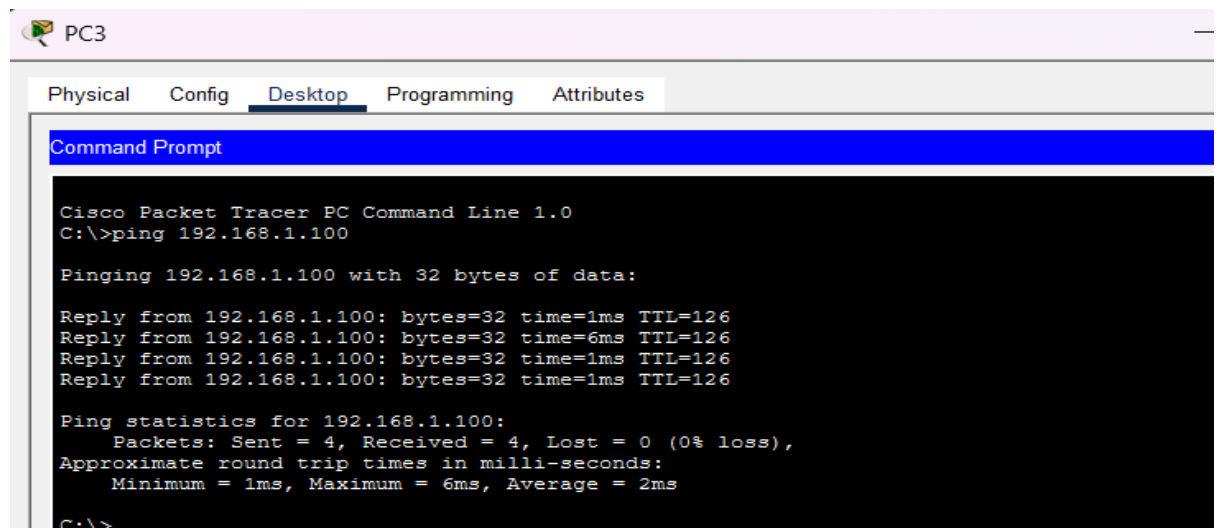
```
C:\>ping 192.168.1.100

Pinging 192.168.1.100 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.100: bytes=32 time=1ms TTL=126
Reply from 192.168.1.100: bytes=32 time=1ms TTL=126
Reply from 192.168.1.100: bytes=32 time=6ms TTL=126

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 6ms, Average = 2ms
```

PC3:



The screenshot shows the PC3 configuration window in Cisco Packet Tracer. The 'Desktop' tab is selected, displaying a Command Prompt window. The Command Prompt shows the execution of the command 'ping 192.168.1.100'. The output indicates that all four packets were received successfully, with a 0% loss rate. The round trip times are consistent with the previous ping from PC1.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.100

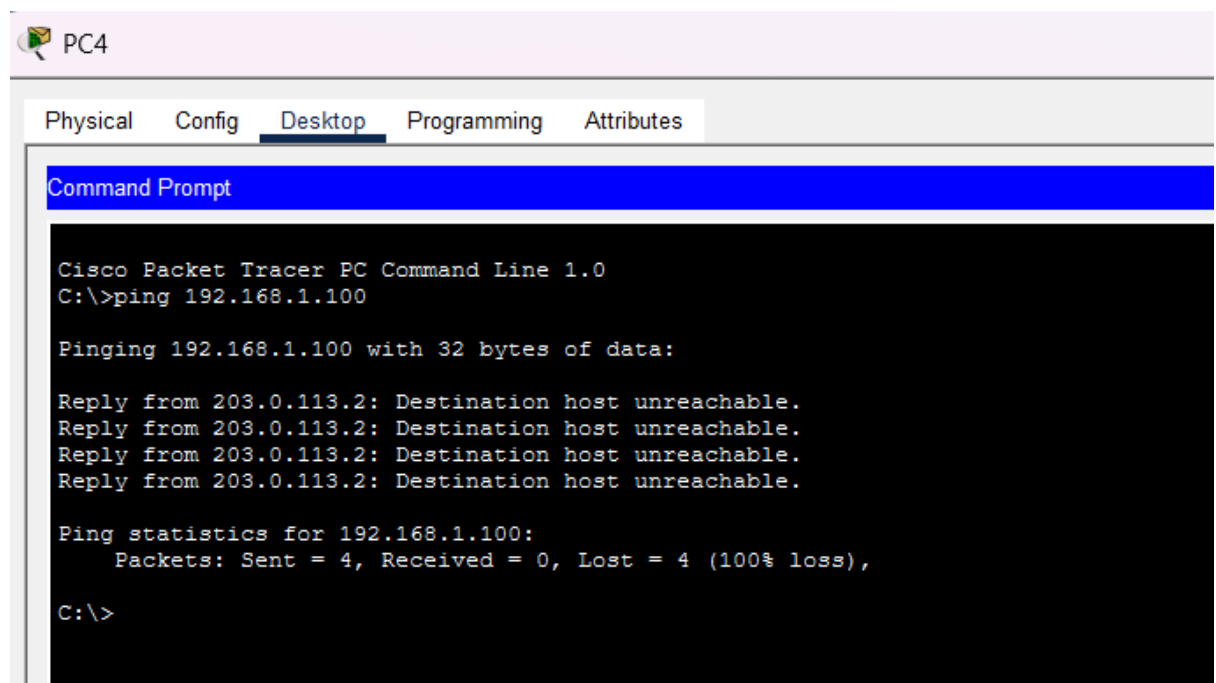
Pinging 192.168.1.100 with 32 bytes of data:

Reply from 192.168.1.100: bytes=32 time=1ms TTL=126
Reply from 192.168.1.100: bytes=32 time=6ms TTL=126
Reply from 192.168.1.100: bytes=32 time=1ms TTL=126
Reply from 192.168.1.100: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 6ms, Average = 2ms

C:\>
```

Others:



The screenshot shows the PC4 interface in Cisco Packet Tracer. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of a ping command to 192.168.1.100, which fails with 100% loss.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.100

Pinging 192.168.1.100 with 32 bytes of data:

Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

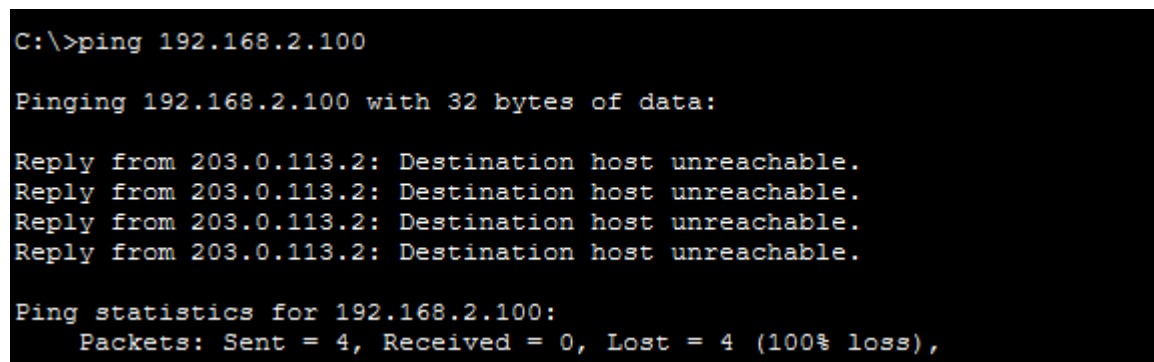
C:\>
```

Condition (b) on R2 CLI:

```
R2(config)#ip access-list standard R2_access_2
R2(config-std-nacl)#10 deny 172.16.2.0 0.0.0.255
R2(config-std-nacl)#20 permit any
R2(config-std-nacl)#int g0/1
R2(config-if)#ip access-group R2_access_2 out
R2(config-if)#do sh run
```

End hosts in 172.16.2.0/24 can't access 192.168.2.0 but others can.

PC3:



The screenshot shows the PC3 interface in Cisco Packet Tracer. The command prompt shows the execution of a ping command to 192.168.2.100, which fails with 100% loss.

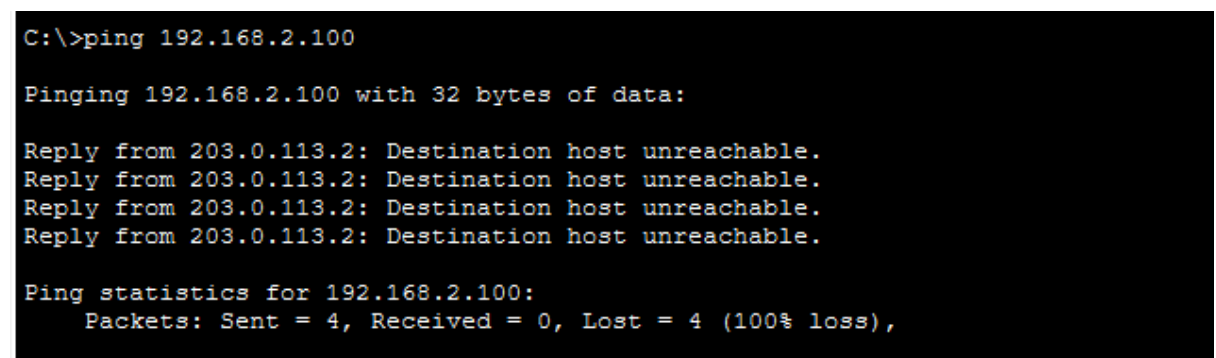
```
C:\>ping 192.168.2.100

Pinging 192.168.2.100 with 32 bytes of data:

Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.

Ping statistics for 192.168.2.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC4:



The screenshot shows the PC4 interface in Cisco Packet Tracer. The command prompt shows the execution of a ping command to 192.168.2.100, which fails with 100% loss.

```
C:\>ping 192.168.2.100

Pinging 192.168.2.100 with 32 bytes of data:

Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.
Reply from 203.0.113.2: Destination host unreachable.

Ping statistics for 192.168.2.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Others:

```

C:\>ping 192.168.2.100

Pinging 192.168.2.100 with 32 bytes of data:

Reply from 192.168.2.100: bytes=32 time=1ms TTL=126
Reply from 192.168.2.100: bytes=32 time=2ms TTL=126
Reply from 192.168.2.100: bytes=32 time=7ms TTL=126
Reply from 192.168.2.100: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.2.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 7ms, Average = 2ms

```

Condition (c) on R1 CLI:

```

R1>en
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#access-list ?
    <1-99>      IP standard access list
    <100-199>   IP extended access list
R1(config)#access-list 1 deny 172.16.1.0 0.0.0.255
R1(config)#access-list 1 permit any
R1(config)#int g0/1
R1(config-if)#ip access-group 1 out

```

PC1:

```

C:\>ping 172.16.2.1

Pinging 172.16.2.1 with 32 bytes of data:

Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.

Ping statistics for 172.16.2.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

```

PC2:

```

C:\>ping 172.16.2.2

Pinging 172.16.2.2 with 32 bytes of data:

Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.
Reply from 172.16.1.254: Destination host unreachable.

Ping statistics for 172.16.2.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

```

SRV1:

```

C:\>ping 172.16.2.1

Pinging 172.16.2.1 with 32 bytes of data:

Reply from 172.16.2.1: bytes=32 time=1ms TTL=126
Reply from 172.16.2.1: bytes=32 time=7ms TTL=126
Reply from 172.16.2.1: bytes=32 time=6ms TTL=126
Reply from 172.16.2.1: bytes=32 time=1ms TTL=126

Ping statistics for 172.16.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 7ms, Average = 3ms

```

SRV2 (because of condition (b))*:

```
C:\>ping 172.16.2.2

Pinging 172.16.2.2 with 32 bytes of data:

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

Ping statistics for 172.16.2.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Condition (d) on R1 CLI:

```
R1(config)#access-list 2 deny 172.16.2.0 0.0.0.255
R1(config)#access-list 2 permit any
R1(config)#int g0/0
R1(config-if)#access-group 2 out
      ^
% Invalid input detected at '^' marker.

R1(config-if)#ip access-group 2 out
R1(config-if)#
```

Now, PC3 and PC4:

```
C:\>ping 172.16.1.1

Pinging 172.16.1.1 with 32 bytes of data:

Reply from 172.16.2.254: Destination host unreachable.
Reply from 172.16.2.254: Destination host unreachable.
Reply from 172.16.2.254: Destination host unreachable.
Reply from 172.16.2.254: Destination host unreachable.

Ping statistics for 172.16.1.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

SRV1:

```
C:\>ping 172.16.1.1

Pinging 172.16.1.1 with 32 bytes of data:

Reply from 172.16.1.1: bytes=32 time=1ms TTL=126
Reply from 172.16.1.1: bytes=32 time=1ms TTL=126
Reply from 172.16.1.1: bytes=32 time=1ms TTL=126
Reply from 172.16.1.1: bytes=32 time=1ms TTL=126

Ping statistics for 172.16.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

SRV2:

```
C:\>ping 172.16.1.2

Pinging 172.16.1.2 with 32 bytes of data:

Reply from 172.16.1.2: bytes=32 time=1ms TTL=126
Reply from 172.16.1.2: bytes=32 time=1ms TTL=126
Reply from 172.16.1.2: bytes=32 time=1ms TTL=126
Reply from 172.16.1.2: bytes=32 time=1ms TTL=126

Ping statistics for 172.16.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```