R1

.1   f0/0   Switch1   PC2
VPCS
.2   e0   e1   e0
s1/0   s1/1

192.168.5.0/30   .1   13.13.13.13/24

.10

10.0.0.0/30

R2   .1   s1/0   s1/0
s1/0   .2   R3
Switch2   .1   f0/0   s1/1   s1/1   f0/0   .1   Switch3
e0   .2   e0
e1   172.16.28.0/30   .1   11.11.11.11/24
e1

12.12.12.12/24

PC1   PC3
e0   e0
VPCS   VPCS

.10   .10

```
Mar   1 02:02:15.083: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed s
R3(config-if)#ip address 11.11.11.1 255.255.255.0
R3(config-if)#DO SH IP ROUTE
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
C       172.16.28.0 is directly connected, Serial1/1
     10.0.0.0/30 is subnetted, 1 subnets
C       10.0.0.0 is directly connected, Serial1/0
     11.0.0.0/24 is subnetted, 1 subnets
C       11.11.11.0 is directly connected, FastEthernet0/0
R3(config-if)#
```

```
R2(config-if)#no ip address 172.16.28.2 255.255.255.252
R2(config-if)#ip address 172.16.28.2 255.255.255.252
R2(config-if)#do sh ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
C       172.16.28.0 is directly connected, Serial1/1
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial1/0
     12.0.0.0/24 is subnetted, 1 subnets
C       12.12.12.0 is directly connected, FastEthernet0/0
R2(config-if)#
```

```
R1#
R1#sh ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial1/0
     10.0.0.0/30 is subnetted, 1 subnets
C       10.0.0.0 is directly connected, Serial1/1
     13.0.0.0/24 is subnetted, 1 subnets
C       13.13.13.0 is directly connected, FastEthernet0/0
R1#
```

```
PC2> ip 13.13.13.10 255.255.255.0 13.13.13.1
Checking for duplicate address...
PC1 : 13.13.13.10 255.255.255.0 gateway 13.13.13.1
```

```
PC3> ip 11.11.11.10 255.255.255.0 11.11.11.1
Checking for duplicate address...
PC1 : 11.11.11.10 255.255.255.0 gateway 11.11.11.1
```

```
PC1> ip 12.12.12.10 255.255.255.0 12.12.12.1
Checking for duplicate address...
PC1 : 12.12.12.10 255.255.255.0 gateway 12.12.12.1

PC1>
```

```
PC1> save
Saving startup configuration to startup.vpc
.  done

PC1>
```

```
R1(config-router)#no network 13.13.13.13 0.0.0.255 area 0
R1(config-router)#
*Mar  1 02:40:52.663: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial1/1 from LOADING to FULL, Loading Done
R1(config-router)#EXIT
R1(config)#DO SH IP OSPF
 Routing Process "ospf 1" with ID 1.1.1.1
 Start time: 02:26:59.700, Time elapsed: 00:14:15.156
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 Supports area transit capability
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Incremental-SPF disabled
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Number of areas transit capable is 0
 External flood list length 0
 IETF NSF helper support enabled
 Cisco NSF helper support enabled
    Area BACKBONE(0)
        Number of interfaces in this area is 2
        Area has no authentication
        SPF algorithm last executed 00:00:09.996 ago
        SPF algorithm executed 7 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x01BE34
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R1(config)#
```

```
R2(config-router)#EXIT
R2(config)#DO SH IP OSPF
 Routing Process "ospf 1" with ID 2.2.2.2
 Start time: 04:39:20.576, Time elapsed: 00:11:44.728
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 Supports area transit capability
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Incremental-SPF disabled
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Number of areas transit capable is 0
 External flood list length 0
 IETF NSF helper support enabled
 Cisco NSF helper support enabled
    Area BACKBONE(0)
        Number of interfaces in this area is 3
        Area has no authentication
        SPF algorithm last executed 00:00:45.376 ago
        SPF algorithm executed 6 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x01BE34
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

```
R3(config-router)#NETWORK 11.11.11.11 0.0.0.255 area 0
R3(config-router)#DO SH IP OSPF
 Routing Process "ospf 1" with ID 3.3.3.3
 Start time: 02:23:10.828, Time elapsed: 00:11:25.736
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 Supports area transit capability
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Incremental-SPF disabled
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Number of areas transit capable is 0
 External flood list length 0
 IETF NSF helper support enabled
 Cisco NSF helper support enabled
    Area BACKBONE(0)
        Number of interfaces in this area is 3
        Area has no authentication
        SPF algorithm last executed 00:01:11.788 ago
        SPF algorithm executed 3 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x01BE34
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R3(config-router)#
```

```
R3(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 3.3.3.3
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.0 0.0.0.3 area 0
    11.11.11.0 0.0.0.255 area 0
    172.16.28.0 0.0.0.3 area 0
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway          Distance        Last Update
    1.1.1.1               110        00:02:25
    2.2.2.2               110        00:02:41
  Distance: (default is 110)

R3(config)#
```

```
R2(config)#
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 2.2.2.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    12.12.12.0 0.0.0.255 area 0
    172.16.28.0 0.0.0.3 area 0
    192.168.5.0 0.0.0.3 area 0
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway         Distance      Last Update
    3.3.3.3              110      00:02:28
    1.1.1.1              110      00:05:06
  Distance: (default is 110)

R2(config)#
```

```
R1(config)#
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 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.0 0.0.0.3 area 0
    192.168.5.0 0.0.0.3 area 0
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway          Distance      Last Update
    3.3.3.3               110      00:02:48
    2.2.2.2               110      00:03:41
  Distance: (default is 110)

R1(config)#
```

```
R1(config)#DO SH IP OSPF NEIGHBOR

Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:33    10.0.0.2        Serial1/1
2.2.2.2           0   FULL/  -        00:00:37    192.168.5.1     Serial1/0
R1(config)#
```

```
 Distance: (default is 110)

R2(config)#DO SH IP OSPF NEIGHBOR

Neighbor ID     Pri   State         Dead Time   Address       Interface
1.1.1.1           0   FULL/  -      00:00:31    192.168.5.2   Serial1/0
3.3.3.3           0   FULL/  -      00:00:39    172.16.28.1   Serial1/1
R2(config)#
```

```
R3(config)#DO SH IP OSPF NEIGHBOR

Neighbor ID     Pri   State          Dead Time   Address        Interface
1.1.1.1           0   FULL/  -       00:00:37    10.0.0.1       Serial1/0
2.2.2.2           0   FULL/  -       00:00:36    172.16.28.2    Serial1/1
R3(config)#
```

```
R3(config)#
R3(config)#DO SH IP ROUTE
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
C       172.16.28.0 is directly connected, Serial1/1
     192.168.5.0/30 is subnetted, 1 subnets
O       192.168.5.0 [110/128] via 172.16.28.2, 00:05:40, Serial1/1
                    [110/128] via 10.0.0.1, 00:05:24, Serial1/0
     10.0.0.0/30 is subnetted, 1 subnets
C       10.0.0.0 is directly connected, Serial1/0
     11.0.0.0/24 is subnetted, 1 subnets
C       11.11.11.0 is directly connected, FastEthernet0/0
     12.0.0.0/24 is subnetted, 1 subnets
O       12.12.12.0 [110/74] via 172.16.28.2, 00:05:42, Serial1/1
R3(config)#
```

```
J.J.J.J              U   FULL/         UU.UU.JJ   I/Z.IU.ZU.I      JErIdII/I
R2(config)#
R2(config)#DO SH IP ROUTE
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
C       172.16.28.0 is directly connected, Serial1/1
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial1/0
     10.0.0.0/30 is subnetted, 1 subnets
O       10.0.0.0 [110/128] via 192.168.5.2, 00:08:06, Serial1/0
                 [110/128] via 172.16.28.1, 00:05:45, Serial1/1
     11.0.0.0/24 is subnetted, 1 subnets
O       11.11.11.0 [110/74] via 172.16.28.1, 00:05:28, Serial1/1
     12.0.0.0/24 is subnetted, 1 subnets
C       12.12.12.0 is directly connected, FastEthernet0/0
R2(config)#
```

```
R1(config)#
R1(config)#DO SH IP ROUTE
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
O       172.16.28.0 [110/128] via 192.168.5.1, 00:08:30, Serial1/0
                    [110/128] via 10.0.0.2, 00:06:13, Serial1/1
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial1/0
     10.0.0.0/30 is subnetted, 1 subnets
C       10.0.0.0 is directly connected, Serial1/1
     11.0.0.0/24 is subnetted, 1 subnets
O       11.11.11.0 [110/74] via 10.0.0.2, 00:05:56, Serial1/1
     12.0.0.0/24 is subnetted, 1 subnets
O       12.12.12.0 [110/74] via 192.168.5.1, 00:06:52, Serial1/0
     13.0.0.0/24 is subnetted, 1 subnets
C       13.13.13.0 is directly connected, FastEthernet0/0
R1(config)#
```

```
R2#sh ip ospf int s1/1
Serial1/1 is up, line protocol is up
  Internet Address 172.16.28.2/30, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 3.3.3.3
  Suppress hello for 0 neighbor(s)
R2#sh ip ospf int s1/0
Serial1/0 is up, line protocol is up
  Internet Address 192.168.5.1/30, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 1.1.1.1
  Suppress hello for 0 neighbor(s)
```

```
R3(config)#DO SH IP ROUTE
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.16.0.0/30 is subnetted, 1 subnets
C       172.16.28.0 is directly connected, Serial1/1
     192.168.5.0/30 is subnetted, 1 subnets
O       192.168.5.0 [110/128] via 172.16.28.2, 00:05:40, Serial1/1
                    [110/128] via 10.0.0.1, 00:05:24, Serial1/0
     10.0.0.0/30 is subnetted, 1 subnets
C       10.0.0.0 is directly connected, Serial1/0
     11.0.0.0/24 is subnetted, 1 subnets
C       11.11.11.0 is directly connected, FastEthernet0/0
     12.0.0.0/24 is subnetted, 1 subnets
O       12.12.12.0 [110/74] via 172.16.28.2, 00:05:42, Serial1/1
R3(config)#exit
R3#
*Mar  1 02:40:22.047: %SYS-5-CONFIG_I: Configured from console by console
R3#wr mem
Building configuration...
[OK]
R3#sh ip ospf int s1/0
Serial1/0 is up, line protocol is up
  Internet Address 10.0.0.2/30, Area 0
  Process ID 1, Router ID 3.3.3.3, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:06
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 1.1.1.1
  Suppress hello for 0 neighbor(s)
```

```
R1#sh ip ospf int s1/1
Serial1/1 is up, line protocol is up
  Internet Address 10.0.0.1/30, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 3.3.3.3
  Suppress hello for 0 neighbor(s)
R1#sh ip ospf int s1/0
Serial1/0 is up, line protocol is up
  Internet Address 192.168.5.2/30, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 2.2.2.2
  Suppress hello for 0 neighbor(s)
```

```
PC1>
PC1> ping 13.13.13.10
13.13.13.10 icmp_seq=1 timeout
84 bytes from 13.13.13.10 icmp_seq=2 ttl=62 time=61.015 ms
84 bytes from 13.13.13.10 icmp_seq=3 ttl=62 time=60.355 ms
84 bytes from 13.13.13.10 icmp_seq=4 ttl=62 time=60.719 ms
84 bytes from 13.13.13.10 icmp_seq=5 ttl=62 time=61.537 ms

PC1> ping 11.11.11.10
11.11.11.10 icmp_seq=1 timeout
84 bytes from 11.11.11.10 icmp_seq=2 ttl=62 time=60.124 ms
84 bytes from 11.11.11.10 icmp_seq=3 ttl=62 time=62.087 ms
84 bytes from 11.11.11.10 icmp_seq=4 ttl=62 time=58.883 ms
84 bytes from 11.11.11.10 icmp_seq=5 ttl=62 time=63.066 ms
```

```
PC2> ping 12.12.12.10
84 bytes from 12.12.12.10 icmp_seq=1 ttl=62 time=61.029 ms
84 bytes from 12.12.12.10 icmp_seq=2 ttl=62 time=61.115 ms
84 bytes from 12.12.12.10 icmp_seq=3 ttl=62 time=60.638 ms
84 bytes from 12.12.12.10 icmp_seq=4 ttl=62 time=61.270 ms
84 bytes from 12.12.12.10 icmp_seq=5 ttl=62 time=60.606 ms

PC2> ping 11.11.11.10
84 bytes from 11.11.11.10 icmp_seq=1 ttl=62 time=61.157 ms
84 bytes from 11.11.11.10 icmp_seq=2 ttl=62 time=61.221 ms
84 bytes from 11.11.11.10 icmp_seq=3 ttl=62 time=46.601 ms
84 bytes from 11.11.11.10 icmp_seq=4 ttl=62 time=60.992 ms
84 bytes from 11.11.11.10 icmp_seq=5 ttl=62 time=62.181 ms
```

```
PC3> ping 12.12.12.10
84 bytes from 12.12.12.10 icmp_seq=1 ttl=62 time=61.781 ms
84 bytes from 12.12.12.10 icmp_seq=2 ttl=62 time=61.682 ms
84 bytes from 12.12.12.10 icmp_seq=3 ttl=62 time=61.812 ms
84 bytes from 12.12.12.10 icmp_seq=4 ttl=62 time=62.158 ms
84 bytes from 12.12.12.10 icmp_seq=5 ttl=62 time=60.970 ms

PC3> ping 13.13.13.10
84 bytes from 13.13.13.10 icmp_seq=1 ttl=62 time=62.027 ms
84 bytes from 13.13.13.10 icmp_seq=2 ttl=62 time=62.363 ms
84 bytes from 13.13.13.10 icmp_seq=3 ttl=62 time=61.496 ms
84 bytes from 13.13.13.10 icmp_seq=4 ttl=62 time=60.813 ms
84 bytes from 13.13.13.10 icmp_seq=5 ttl=62 time=61.268 ms
```

```
R1(config-if)#do sh ip ospf int s1/1
Serial1/1 is up, line protocol is up
  Internet Address 10.0.0.1/30, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 2500
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:03
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 3.3.3.3
  Suppress hello for 0 neighbor(s)
R1(config-if)#ip ospf cost 1562
R1(config-if)#do sh ip ospf int s1/1
Serial1/1 is up, line protocol is up
  Internet Address 10.0.0.1/30, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 1562
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  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 3.3.3.3
  Suppress hello for 0 neighbor(s)
R1(config-if)#
```

```
R1(config-if)#ip ospf authentication-key youli
R1(config-if)#exit
R1(config)#do sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           0   FULL/   -       00:00:32    192.168.5.1     Serial1/0
3.3.3.3           0   FULL/   -       00:00:31    10.0.0.2        Serial1/1
R1(config)#
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#int s1/1
R2(config-if)#ip ospf authentication-key youli
R2(config-if)#int s1/0
R2(config-if)#ip ospf authentication-key youli
R2(config-if)#exit
R2(config)#do sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           0   FULL/  -        00:00:35    192.168.5.2     Serial1/0
3.3.3.3           0   FULL/  -        00:00:30    172.16.28.1     Serial1/1
R2(config)#
```
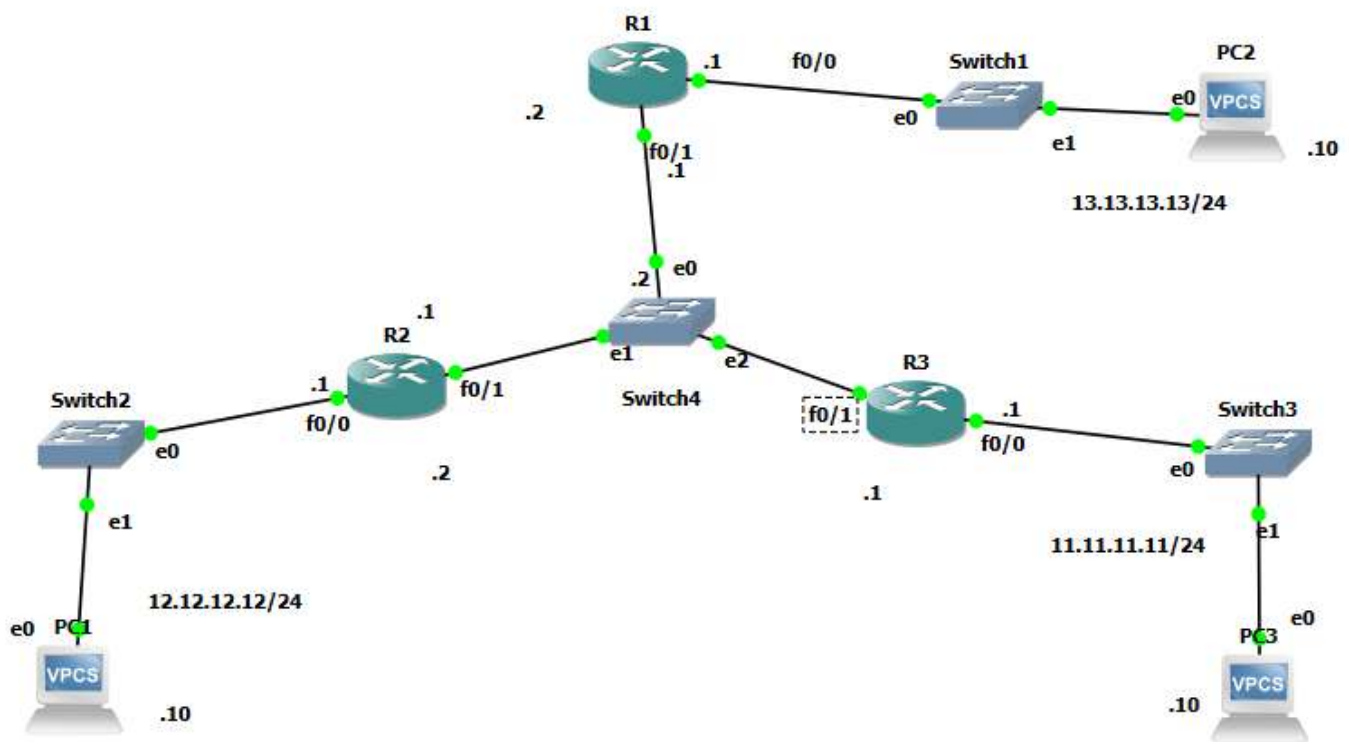
```
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#int s1/0
R3(config-if)#ip ospf authentication-key youli
R3(config-if)#int s1/1
R3(config-if)#ip ospf authentication-key youli
R3(config-if)#exit
R3(config)#do sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           0   FULL/  -        00:00:34    172.16.28.2     Serial1/1
1.1.1.1           0   FULL/  -        00:00:35    10.0.0.1        Serial1/0
R3(config)#
```

R1

.1   f0/0   **Switch1**   **PC2**

.2

f0/1
.1

.2   e0

R2   .1

.1

Switch2   f0/1   **Switch4**

f0/0   e1   e2   **R3**

e0   .2   **f0/1**   .1   **Switch3**

f0/0

.2   .1

e1

12.12.12.12/24   11.11.11.11/24

e0

e0   **PC1**   e1

VPCS

.10

e0   **PC2**

e0   **PC3**

VPCS

.10   **VPCS**

13.13.13.13/24

.10

```
R1(config)#int Fa0/1
R1(config-if)#ip ospf priority 1
R1(config-if)#exit
R1(config)#exit
R1#
*Mar  1 00:18:42.207: %SYS-5-CONFIG_I: Configured from console by console
R1#sh ip ospf int Fa0/1
FastEthernet0/1 is up, line protocol is up
  Internet Address 15.15.15.1/29, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 3.3.3.3, Interface address 15.15.15.3
  Backup Designated router (ID) 2.2.2.2, Interface address 15.15.15.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:01
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 4/4, 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 2, Adjacent neighbor count is 2
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
    Adjacent with neighbor 3.3.3.3  (Designated Router)
  Suppress hello for 0 neighbor(s)
R1#
```

```
R2#sh ip o
*Mar  1 00:20:00.107: %SYS-5-CONFIG_I: Configured from console by consoles
R2#sh ip ospf int Fa0/1
FastEthernet0/1 is up, line protocol is up
  Internet Address 15.15.15.2/29, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State BDR, Priority 2
  Designated Router (ID) 3.3.3.3, Interface address 15.15.15.3
  Backup Designated router (ID) 2.2.2.2, Interface address 15.15.15.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:00
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 4/4, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 3.3.3.3  (Designated Router)
  Suppress hello for 0 neighbor(s)
R2#
```

```
R3(config)#int Fa0/1
R3(config-if)#ip ospf priority 3
R3(config-if)#exit
R3(config)#exit
R3#sh i
*Mar  1 00:22:28.439: %SYS-5-CONFIG_I: Configured from console by console
R3#sh ip ospf int Fa0/1
FastEthernet0/1 is up, line protocol is up
  Internet Address 15.15.15.3/29, Area 0
  Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DR, Priority 3
  Designated Router (ID) 3.3.3.3, Interface address 15.15.15.3
  Backup Designated router (ID) 2.2.2.2, Interface address 15.15.15.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:07
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 4/4, 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 2, Adjacent neighbor count is 2
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
R3#
```

```
Suppress hello for 0 neighbor(s)
R1#sh ip ospf neighbor

Neighbor ID     Pri   State         Dead Time    Address        Interface
2.2.2.2           2   FULL/BDR      00:00:36     15.15.15.2     FastEthernet0/1
3.3.3.3           3   FULL/DR       00:00:37     15.15.15.3     FastEthernet0/1
R1#
```

```
 Suppress hello for 0 neighbor(s)
R3#sh ip ospf neighbor

Neighbor ID     Pri   State          Dead Time   Address          Interface
1.1.1.1           1   FULL/DROTHER   00:00:33    15.15.15.1       FastEthernet0/1
2.2.2.2           2   FULL/BDR       00:00:39    15.15.15.2       FastEthernet0/1
R3#
```

```
Suppress hello for 0 neighbor(s)
R2#sh ip ospf neighbor

Neighbor ID    Pri   State           Dead Time    Address         Interface
1.1.1.1          1   FULL/DROTHER    00:00:30     15.15.15.1      FastEthernet0/1
3.3.3.3          3   FULL/DR         00:00:37     15.15.15.3      FastEthernet0/1
R2#
```