



CCIE Practice Lab: OSPF

WRITTEN BY:

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CCIE # 8877

CCIE Practice Lab: OSPF

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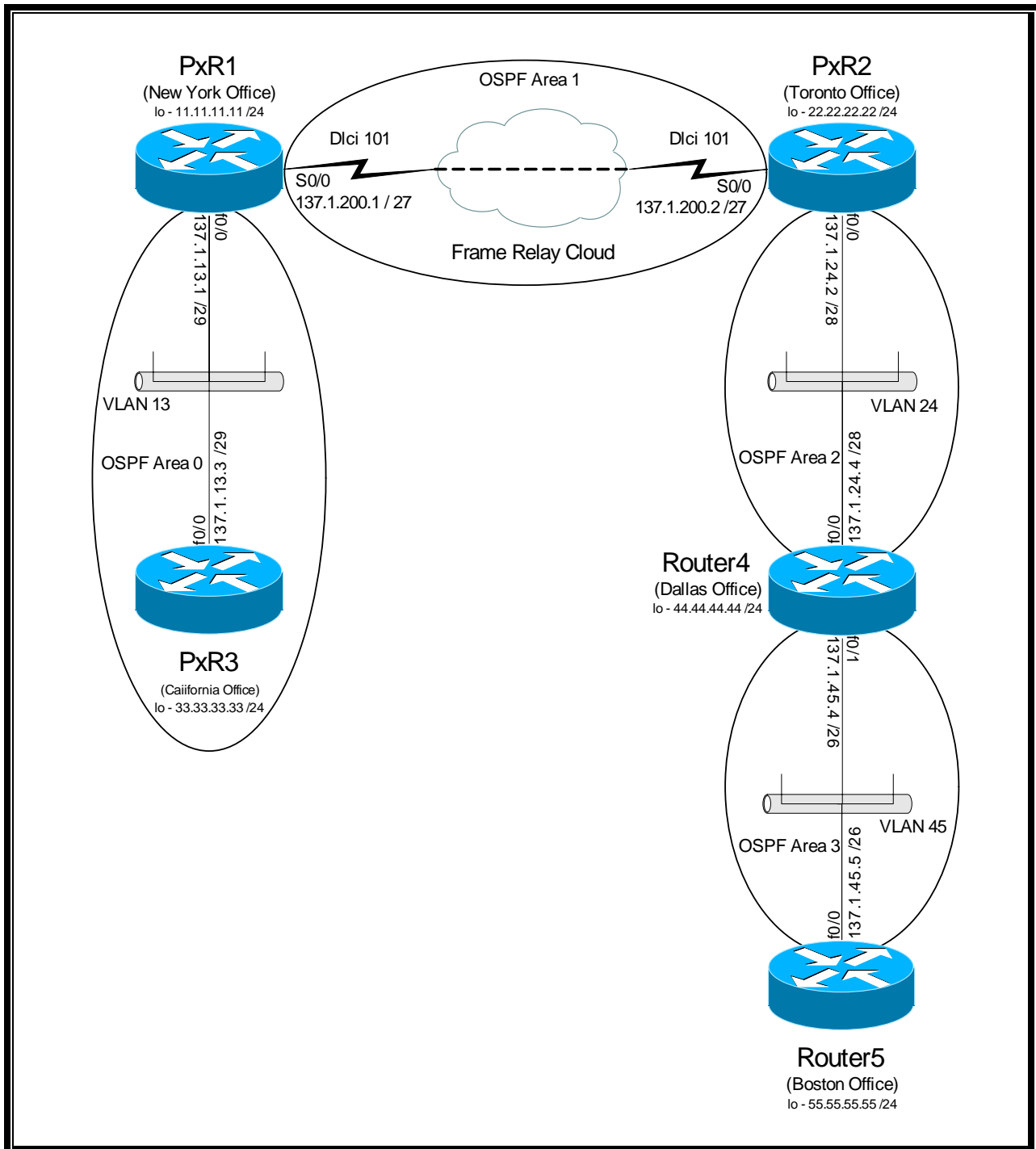
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18.0 OSPF - VIRTUAL-LINK WITH MD5 AUTHENTICATION



1. Configure the OSPF areas for your network as per the above diagram.
2. For MD5 authentication use **cisco** key.
3. Test your configuration that the correct neighbor relationships have been established. Ensure that you can ping each other's LAN network.

ANSWER

NOTE: This is a trick to putting in the inverse-mask for the OSPF. If you do not know how to calculate the inverse-mask then just put in the normal mask and the router automatically puts the inverse mask in. For example:

```
Router ospf 100
  Network 137.1.45.0 255.255.255.192 area 0
```

The router would automatically convert this to:

```
Network 137.1.45.0 0.0.0.63 area 0
```

ROUTER1

```
Interface loopback 0
  Ip address 11.11.11.11 255.255.255.0
  Ip ospf network point-to-point
```

```
Interface f0/0
  Ip address 137.1.13.1 255.255.255.248
  Ip ospf message-digest 1 md5 cisco
```

```
Interface s0/0
  Ip address 137.1.200.1 255.255.255.224
  Encapsulation frame-relay
  No frame-relay inverse-arp
  Frame-relay map ip 137.1.200.2 101 broadcast
  Ip ospf network point-to-point
  Ip ospf message-digest 1 md5 cisco
```

```
Router ospf 100
  Router-id 11.11.11.11
  Network 11.11.11.0 0.0.0.255 area 0
  Network 137.1.13.0 0.0.0.7 area 0
  Network 137.1.200.0 0.0.0.31 area 1
  Area 0 authentication message-digest
  Area 1 authentication message-digest
  Area 1 virtual-link 22.22.22.22 authentication message-digest
  Area 1 virtual-link 22.22.22.22 message-digest-key 1 md5 cisco
```

ROUTER2

```
Interface loopback 0
  Ip address 22.22.22.22 255.255.255.0
  Ip ospf network point-to-point
```

```
Interface e0/0
  Ip address 137.1.24.2 255.255.255.240
  Ip ospf message-digest 1 md5 cisco
```

```
Interface s0/0
  Ip address 137.1.200.2 255.255.255.224
```

```
Encapsulation frame-relay
No frame-relay inverse-arp
Frame-relay map ip 137.1.200.1 110 broadcast
Ip ospf network point-to-point
Ip ospf message-digest 1 md5 cisco
```

```
Router ospf 100
Router-id 22.22.22.22
Network 22.22.22.0 0.0.0.255 area 0
Network 137.1.24.0 0.0.0.15 area 2
Network 137.1.200.0 0.0.0.31 area 1
Area 1 authentication message-digest
Area 1 virtual-link 11.11.11.11 authentication message-digest
Area 1 virtual-link 11.11.11.11 message-digest-key 1 md5 cisco
Area 2 authentication message-digest
Area 2 virtual-link 44.44.44.44 authentication message-digest
Area 2 virtual-link 44.44.44.44 message-digest-key 1 md5 cisco
```

ROUTER3

```
Interface loopback 0
Ip address 33.33.33.33 255.255.255.0
Ip ospf network point-to-point
```

```
Interface f0/0
Ip address 137.1.13.3 255.255.255.248
Ip ospf message-digest 1 md5 cisco
```

```
Router ospf 100
Router-id 33.33.33.33
Network 33.33.33.0 0.0.0.255 area 0
Network 137.1.13.0 0.0.0.7 area 0
Area 0 authentication message-digest
```

ROUTER4

```
Interface loopback 0
Ip address 44.44.44.44 255.255.255.0
Ip ospf network point-to-point
```

```
Interface f0/0
Ip address 137.1.24.4 255.255.255.240
Ip ospf message-digest 1 md5 cisco
```

```
Interface f0/1
Ip address 137.1.45.4 255.255.255.192
Ip ospf message-digest 1 md5 cisco
```

```
Router ospf 100
Router-id 44.44.44.44
Network 44.44.44.0 0.0.0.255 area 2
Network 137.1.24.0 0.0.0.15 area 2
Network 137.1.45.0 0.0.0.63 area 3
Area 2 authentication message-digest
Area 2 virtual-link 22.22.22.22 authentication message-digest
Area 2 virtual-link 22.22.22.22 message-digest-key 1 md5 cisco
Area 3 authentication message-digest
```

ROUTERS

Interface loopback 0

Ip address 55.55.55.55 255.255.255.0
Ip ospf network point-to-point

Int f0/0

Ip address 137.1.45.5 255.255.255.192
Ip ospf message-digest 1 md5 cisco

Router ospf 100

Router-id 55.55.55.55
Network 55.55.55.0 0.0.0.255 area 3
Network 137.1.45.0 0.0.0.63 area 3
Area 3 authentication message-digest

router1# sh ip ospf nei

Neighbor ID	Pri	State	Dead Time	Address	Interface
22.22.22.22	0	FULL/ -	-	137.1.200.2	OSPF_VL0
33.33.33.33	1	FULL/DR	00:00:35	137.1.13.3	FastEthernet0/0
22.22.22.22	0	FULL/ -	00:00:34	137.1.200.2	Serial0/0

router2# sh ip ospf nei

Neighbor ID	Pri	State	Dead Time	Address	Interface
44.44.44.44	0	FULL/ -	-	137.1.24.4	OSPF_VL1
11.11.11.11	0	FULL/ -	-	137.1.200.1	OSPF_VL0
11.11.11.11	0	FULL/ -	00:00:38	137.1.200.1	Serial0/0
44.44.44.44	1	FULL/DR	00:00:37	137.1.24.4	Ethernet0/0

router3# sh ip ospf nei

Neighbor ID	Pri	State	Dead Time	Address	Interface
11.11.11.11	1	FULL/BDR	00:00:33	137.1.13.1	FastEthernet0/0

router4# sh ip ospf nei

Neighbor ID	Pri	State	Dead Time	Address	Interface
22.22.22.22	0	FULL/ -	-	137.1.24.2	OSPF_VL0
22.22.22.22	1	FULL/BDR	00:00:37	137.1.24.2	FastEthernet0/0
55.55.55.55	1	FULL/DR	00:00:36	137.1.45.5	FastEthernet0/1

router5# sh ip ospf nei

Neighbor ID	Pri	State	Dead Time	Address	Interface
44.44.44.44	1	FULL/BDR	00:00:38	137.1.45.4	FastEthernet0/0

router2# sh ip ospf int

```
OSPF_VL1 is up, line protocol is up
Internet Address 0.0.0.0/0, Area 0
Process ID 100, Router ID 22.22.22.22, Network Type VIRTUAL_LINK, Cost: 10
Configured as demand circuit.
Run as demand circuit.
DoNotAge LSA allowed.
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
Index 3/5, 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 44.44.44.44 (Hello suppressed)
```

```

Suppress hello for 1 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1
OSPF_VL0 is up, line protocol is up
  Internet Address 0.0.0.0/0, Area 0
  Process ID 100, Router ID 22.22.22.22, Network Type VIRTUAL_LINK, Cost: 64
  Configured as demand circuit.
  Run as demand circuit.
  DoNotAge LSA allowed.
  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 00:00:09
  Index 2/4, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 4
  Last flood scan time is 0 msec, maximum is 4 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 11.11.11.11 (Hello suppressed)
Suppress hello for 1 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1
Loopback0 is up, line protocol is up
  Internet Address 22.22.22.22/24, Area 0
  Process ID 100, Router ID 22.22.22.22, Network Type POINT_TO_POINT, Cost: 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/0 is up, line protocol is up
  Internet Address 137.1.200.2/27, Area 1
  Process ID 100, Router ID 22.22.22.22, 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 00:00:02
  Index 1/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 4 msec, maximum is 4 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 11.11.11.11
  Suppress hello for 0 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1
Ethernet0/0 is up, line protocol is up
  Internet Address 137.1.24.2/28, Area 2
  Process ID 100, Router ID 22.22.22.22, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 44.44.44.44, Interface address 137.1.24.4
  Backup Designated router (ID) 22.22.22.22, Interface address 137.1.24.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:03
  Index 1/2, 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 4 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 44.44.44.44 (Designated Router)
  Suppress hello for 0 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1

router4# sh ip ospf int
OSPF_VL0 is up, line protocol is up

```

```
Internet Address 0.0.0.0/0, Area 0
Process ID 100, Router ID 44.44.44.44, Network Type VIRTUAL_LINK, Cost: 1
Configured as demand circuit.
Run as demand circuit.
DoNotAge LSA allowed.
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 00:00:02
Index 1/3, 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 22.22.22.22 (Hello suppressed)
Suppress hello for 1 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1
FastEthernet0/0 is up, line protocol is up
  Internet Address 137.1.24.4/28, Area 2
  Process ID 100, Router ID 44.44.44.44, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 44.44.44.44, Interface address 137.1.24.4
  Backup Designated router (ID) 22.22.22.22, Interface address 137.1.24.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:06
Index 2/2, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 3
Last flood scan time is 0 msec, maximum is 4 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 22.22.22.22 (Backup Designated Router)
Suppress hello for 0 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1
Loopback0 is up, line protocol is up
  Internet Address 44.44.44.44/24, Area 2
  Process ID 100, Router ID 44.44.44.44, Network Type POINT_TO_POINT, Cost: 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 0, maximum is 0
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
Message digest authentication enabled
  No key configured, using default key id 0
FastEthernet0/1 is up, line protocol is up
  Internet Address 137.1.45.4/26, Area 3
  Process ID 100, Router ID 44.44.44.44, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 55.55.55.55, Interface address 137.1.45.5
  Backup Designated router (ID) 44.44.44.44, Interface address 137.1.45.4
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
Index 1/4, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 3
Last flood scan time is 4 msec, maximum is 4 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 55.55.55.55 (Designated Router)
Suppress hello for 0 neighbor(s)
Message digest authentication enabled
  Youngest key id is 1

router5# 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, 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

```

137.1.0.0/16 is variably subnetted, 4 subnets, 4 masks
O IA 137.1.200.0/27 [110/66] via 137.1.45.4, 00:06:17, FastEthernet0/0
O IA 137.1.13.0/29 [110/67] via 137.1.45.4, 00:04:47, FastEthernet0/0
O IA 137.1.24.0/28 [110/2] via 137.1.45.4, 00:06:17, FastEthernet0/0
C 137.1.45.0/26 is directly connected, FastEthernet0/0
33.0.0.0/24 is subnetted, 1 subnets
O IA 33.33.33.0 [110/68] via 137.1.45.4, 00:04:43, FastEthernet0/0
55.0.0.0/24 is subnetted, 1 subnets
C 55.55.55.0 is directly connected, Loopback0
22.0.0.0/24 is subnetted, 1 subnets
O IA 22.22.22.0 [110/3] via 137.1.45.4, 00:06:18, FastEthernet0/0
11.0.0.0/24 is subnetted, 1 subnets
O IA 11.11.11.0 [110/67] via 137.1.45.4, 00:06:18, FastEthernet0/0
44.0.0.0/24 is subnetted, 1 subnets
O IA 44.44.44.0 [110/2] via 137.1.45.4, 00:06:19, FastEthernet0/0

```

```
router5# sh ip ospf database
```

OSPF Router with ID (55.55.55.55) (Process ID 100)

Router Link States (Area 3)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
44.44.44.44	44.44.44.44	418	0x80000006	0x00D37F	1
55.55.55.55	55.55.55.55	416	0x80000005	0x00F94B	2

Net Link States (Area 3)

Link ID	ADV Router	Age	Seq#	Checksum
137.1.45.5	55.55.55.55	418	0x80000001	0x0076DB

Summary Net Link States (Area 3)

Link ID	ADV Router	Age	Seq#	Checksum
11.11.11.0	44.44.44.44	470	0x80000001	0x0065C3
22.22.22.0	44.44.44.44	470	0x80000001	0x0055F2
33.33.33.0	44.44.44.44	313	0x80000001	0x005491
44.44.44.0	44.44.44.44	495	0x80000001	0x0030D6
137.1.13.0	44.44.44.44	317	0x80000003	0x002D8A
137.1.24.0	44.44.44.44	495	0x80000001	0x00FAFC
137.1.200.0	44.44.44.44	470	0x80000001	0x008591

```
router5# trace 33.33.33.33
```

Type escape sequence to abort.

Tracing the route to 33.33.33.33

```

 1 137.1.45.4 4 msec 0 msec 0 msec
 2 137.1.24.2 4 msec 4 msec 0 msec
 3 137.1.200.1 28 msec 28 msec 28 msec
 4 137.1.13.3 28 msec * 28 msec

```

```
router3# ping 55.55.55.55
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 55.55.55.55, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/57/64 ms

```
PlSwitch# show vlan
```

VLAN Name	Status	Ports
-----------	--------	-------

<output truncated...>

2	VLAN0002	active	Fa0/7, Fa0/10
3	VLAN0003	active	Fa0/2, Fa0/6
4	VLAN0004	active	Fa0/8, Fa0/21

