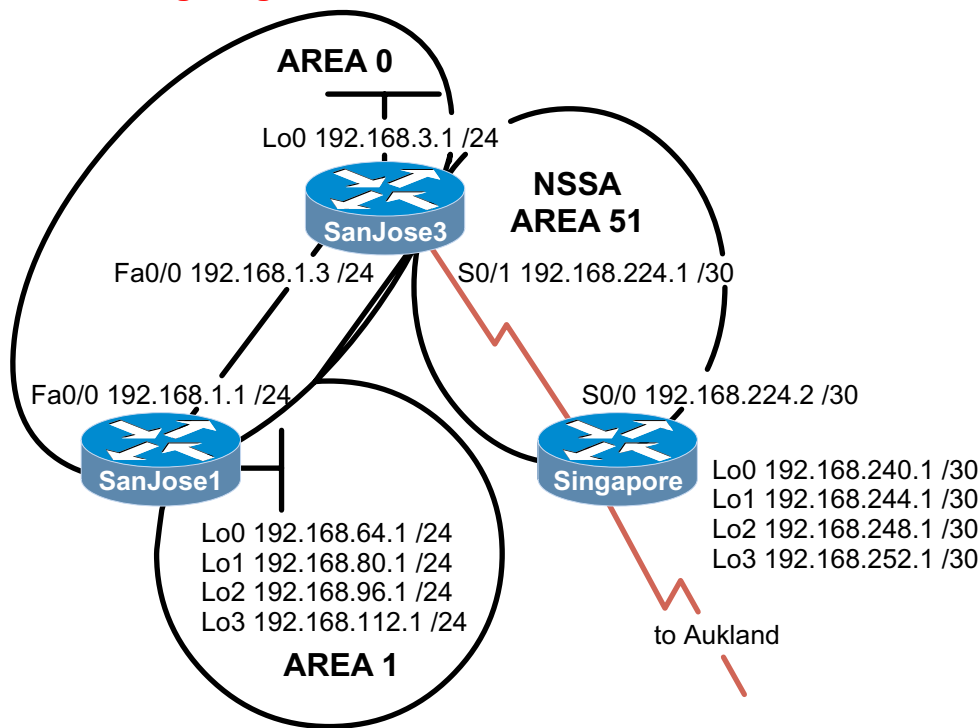


5.8.3: Configuring an NSSA



Objective

In this lab, you configure an OSPF NSSA in order to import external routing information while retaining the benefits of a stub area.

Scenario

The implementation of a totally stubby area in Area 2 was so successful that you want to implement it in Area 51 for efficient routing and greater route stability. A stub or totally stubby area won't work, because the Singapore router in Area 51 has the added responsibility of redistributing external routes from Auckland using Type 5 LSAs. To meet all your needs, you decide to configure Area 51 as an NSSA (Not So Stubby Area).

Step 1

Build and configure the network according to the diagram. Also configure multiarea OSPF according to the diagram (do not configure NSSA yet).

Note: This lab requires the use of subnet 0.

Configure each router with the loopback address indicated in the diagram. Be sure to configure SanJose1 and Singapore with additional loopbacks (Lo0, Lo1, Lo2, Lo3). On SanJose1, these loopback interfaces simulate the serial links to local San Jose sites: Westasman, Baypointe, Vista, and Eastasman. On Singapore, the loopbacks simulate Auckland networks.

Use **ping** and **show ip route** to test connectivity between all interfaces. Each router should be able to ping all network interfaces:

```
SanJose3#show ip route

      192.168.224.0/30 is subnetted, 1 subnets
C       192.168.224.0 is directly connected, Serial0/0
      192.168.64.0/32 is subnetted, 1 subnets
O IA    192.168.64.1 [110/2] via 192.168.1.1, 00:03:49,
        FastEthernet0/0
      192.168.80.0/32 is subnetted, 1 subnets
O IA    192.168.80.1 [110/2] via 192.168.1.1, 00:03:49,
        FastEthernet0/0
      192.168.96.0/32 is subnetted, 1 subnets
O IA    192.168.96.1 [110/2] via 192.168.1.1, 00:03:49,
        FastEthernet0/0
      192.168.112.0/32 is subnetted, 1 subnets
O IA    192.168.112.1 [110/2] via 192.168.1.1, 00:03:49,
        FastEthernet0/0
C       192.168.1.0/24 is directly connected, FastEthernet0/0
C       192.168.3.0/24 is directly connected, Loopback0
```

Step 2

Configure Singapore to redistribute connected routes into the OSPF domain:

```
Singapore(config)#router ospf 1
Singapore(config-router)#redistribute connected subnets
```

Check the routing tables of all three routers; they should be complete. SanJose1 and SanJose3 should also have Type 2 external routes to the Auckland networks.

```
SanJose1#show ip route

      192.168.224.0/30 is subnetted, 1 subnets
O IA    192.168.224.0 [110/782] via 192.168.1.3, 00:11:16,
        FastEthernet0/0
      192.168.240.0/30 is subnetted, 1 subnets
O E2    192.168.240.0 [110/20] via 192.168.1.3, 00:04:54,
        FastEthernet0/0
O E2    192.168.244.0/24 [110/20] via 192.168.1.3, 00:09:34,
        FastEthernet0/0
      192.168.64.0/30 is subnetted, 1 subnets
C       192.168.64.0 is directly connected, Loopback0
      192.168.80.0/30 is subnetted, 1 subnets
C       192.168.80.0 is directly connected, Loopback1
      192.168.96.0/30 is subnetted, 1 subnets
C       192.168.96.0 is directly connected, Loopback2
O E2    192.168.248.0/24 [110/20] via 192.168.1.3, 00:09:35,
        FastEthernet0/0
      192.168.112.0/30 is subnetted, 1 subnets
C       192.168.112.0 is directly connected, Loopback3
C       192.168.1.0/24 is directly connected, FastEthernet0/0
O E2    192.168.252.0/24 [110/20] via 192.168.1.3, 00:09:38,
        FastEthernet0/0
      192.168.3.0/32 is subnetted, 1 subnets
O       192.168.3.1 [110/2] via 192.168.1.3, 00:11:19,
        FastEthernet0/0
```

Step 3

Singapore has several interarea (IA) routes.

```
Singapore#show ip route

Gateway of last resort is not set

      192.168.224.0/30 is subnetted, 1 subnets
C       192.168.224.0 is directly connected, Serial0/0
      192.168.240.0/30 is subnetted, 1 subnets
C       192.168.240.0 is directly connected, Loopback0
C       192.168.244.0/24 is directly connected, Loopback1
      192.168.64.0/32 is subnetted, 1 subnets
O IA    192.168.64.1 [110/66] via 192.168.224.1, 00:00:48,
        Serial0/0
      192.168.80.0/32 is subnetted, 1 subnets
O IA    192.168.80.1 [110/66] via 192.168.224.1, 00:00:48,
        Serial0/0
      192.168.96.0/32 is subnetted, 1 subnets
O IA    192.168.96.1 [110/66] via 192.168.224.1, 00:00:49,
        Serial0/0
C       192.168.248.0/24 is directly connected, Loopback2
      192.168.112.0/32 is subnetted, 1 subnets
O IA    192.168.112.1 [110/66] via 192.168.224.1, 00:00:49,
        Serial0/0
O IA    192.168.1.0/24 [110/65] via 192.168.224.1, 00:00:49,
        Serial0/0
C       192.168.252.0/24 is directly connected, Loopback3
      192.168.3.0/32 is subnetted, 1 subnets
O IA    192.168.3.1 [110/65] via 192.168.224.1, 00:00:49,
        Serial0/0
```

In Lab 5.8.2, you minimized Capetown's table by configuring Area 2 as a stub. Attempt to repeat this configuration with the following commands on Singapore:

```
Singapore(config)#router ospf 1
Singapore(config-router)#area 51 stub
```

1. What does the router output when you enter this command?

Because Singapore imports routes that are external to OSPF, it is considered an ASBR. ASBRs cannot be members of a stub area; stub areas do not permit Type 5 LSAs. Issue the **show ip ospf database** command on Singapore.

```
Singapore#show ip ospf database

OSPF Router with ID (192.168.252.1) (Process ID 1)

Router Link States (Area 51)

Link ID          ADV Router      Age           Seq#           Checksum
Link count
192.168.3.1      192.168.3.1    817           0x80000004    0xF239    2
192.168.252.1   192.168.252.1 1307          0x80000002    0xB918    2

Summary Net Link States (Area 51)

Link ID          ADV Router      Age           Seq#           Checksum
192.168.1.0      192.168.3.1    1262          0x80000003    0xABB6
192.168.3.1      192.168.3.1    1308          0x80000001    0x8FD1
```

192.168.64.1	192.168.3.1	1258	0x80000001	0xF72B
192.168.80.1	192.168.3.1	1258	0x80000001	0x47CB
192.168.96.1	192.168.3.1	1258	0x80000001	0x966C
192.168.112.1	192.168.3.1	1258	0x80000001	0xE50D

Type-5 AS External Link States

Link ID	ADV Router	Age	Seq#	Checksum	Tag
192.168.224.0	192.168.252.1	429	0x80000001	0x7D74	0
192.168.240.0	192.168.252.1	432	0x80000001	0xCC15	0
192.168.244.0	192.168.252.1	713	0x80000001	0xB228	0
192.168.248.0	192.168.252.1	713	0x80000001	0x8650	0
192.168.252.0	192.168.252.1	713	0x80000001	0x5A78	0

2. According to the output of this command, what link IDs are included under Type 5 AS External Link States?

All Auckland network routes (loopbacks) are Type5 external links.

The workaround for this situation is to configure Area 51 as an NSSA. Enter the following commands:

```
Singapore(config)#router ospf 1
Singapore(config-router)#area 51 nssa

SanJose3(config)#router ospf 1
SanJose3(config-router)#area 51 nssa
```

Now use the **show ip ospf database** command on Singapore. Because stub areas do not support Type 5 LSAs, external routes are redistributed and are advertised as Type 7 LSAs. The output of this command should verify that Type 5 LSAs have been replaced by Type 7 LSAs.

```
Singapore#show ip ospf database
```

```
OSPF Router with ID (192.168.252.1) (Process ID 1)
```

```
Router Link States (Area 51)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
192.168.3.1	192.168.3.1	10	0x80000006	0x9A87	2
192.168.252.1	192.168.252.1	10	0x80000004	0x5B6E	2

```
Summary Net Link States (Area 51)
```

Link ID	ADV Router	Age	Seq#	Checksum
192.168.1.0	192.168.3.1	137	0x80000004	0x4F0C
192.168.3.1	192.168.3.1	137	0x80000002	0x3327
192.168.64.1	192.168.3.1	138	0x80000002	0x9B80
192.168.80.1	192.168.3.1	138	0x80000002	0xEA21
192.168.96.1	192.168.3.1	138	0x80000002	0x3AC1
192.168.112.1	192.168.3.1	138	0x80000002	0x8962

Type-7 AS External Link States (Area 51)

Link ID	ADV Router	Age	Seq#	Checksum	Tag
192.168.224.0	192.168.252.1	19	0x80000001	0xA0FA	0
192.168.240.0	192.168.252.1	20	0x80000001	0xEF9B	0
192.168.244.0	192.168.252.1	21	0x80000001	0xD5AE	0
192.168.248.0	192.168.252.1	21	0x80000001	0xA9D6	0
192.168.252.0	192.168.252.1	21	0x80000001	0x7DFE	0

NSSA routers receive updates from the ABR the same way stub area routers do. Singapore's routing table should look similar to Capetown's when it was in a stub area (see Lab 5.8.2). SanJose3 continues to flood Area 51 with summary link LSAs (Type 3 and Type 4). Because your goal is to reduce the burden on Area 51 routers, you should reconfigure SanJose3 to filter interarea summary LSAs:

```
SanJose3(config)#router ospf 1
SanJose3(config-router)#area 51 nssa no-summary
```

Again, check Singapore's table:

```
Singapore#show ip route

Gateway of last resort is 192.168.224.1 to network 0.0.0.0

    192.168.224.0/30 is subnetted, 1 subnets
C       192.168.224.0 is directly connected, Serial10/0
    192.168.240.0/30 is subnetted, 1 subnets
C       192.168.240.0 is directly connected, Loopback0
C       192.168.244.0/24 is directly connected, Loopback1
C       192.168.248.0/24 is directly connected, Loopback2
C       192.168.252.0/24 is directly connected, Loopback3
O*IA 0.0.0.0/0 [110/65] via 192.168.224.1, 00:00:04, Serial10/0
```

3. What has changed?

All interarea (IA) routes are replaced with the 0.0.0.0/0 default route. Area 51 is now acting like Area 2 when it was configured as totally stubby (see Lab 5-2). The primary difference is that an NSSA can redistribute external routes.

NSSAs allow you to minimize OSPF link state databases within an area, yet still import external routes as Type 7 LSAs. The NSSA ABR (in this case, SanJose3) must convert these Type 7s into Type 5s, which will be flooded into Area 0. On SanJose3, issue the **show ip ospf database** command:

```
Singapore#show ip ospf database

OSPF Router with ID (192.168.3.1) (Process ID 1)

Router Link States (Area 0)

Link ID        ADV Router    Age          Seq#          Checksum Link
count
192.168.3.1    192.168.3.1   170          0x80000007  0x45B2    2
192.168.112.1  192.168.112.1 1711         0x80000008  0x148A    1

Net Link States (Area 0)

Link ID        ADV Router    Age          Seq#          Checksum
192.168.1.1    192.168.112.1 1712         0x80000001  0xA10A

Summary Net Link States (Area 0)

Link ID        ADV Router    Age          Seq#          Checksum
192.168.64.1   192.168.112.1 1238         0x80000005  0xE7CA
192.168.80.1   192.168.112.1 1238         0x80000005  0x376B
192.168.96.1   192.168.112.1 1238         0x80000005  0x860C
192.168.112.1  192.168.112.1 1238         0x80000005  0xD5AC
192.168.224.0  192.168.3.1   1748         0x80000001  0x92E5
```

Router Link States (Area 51)						
Link ID	ADV Router	Age	Seq#	Checksum		
Link count						
192.168.3.1	192.168.3.1	165	0x8000000B	0x908C	2	
192.168.252.1	192.168.252.1	278	0x80000004	0x5B6E	2	
Summary Net Link States (Area 51)						
Link ID	ADV Router	Age	Seq#	Checksum		
0.0.0.0	192.168.3.1	172	0x80000001	0x12B6		
Type-7 AS External Link States (Area 51)						
Link ID	ADV Router	Age	Seq#	Checksum	Tag	
192.168.224.0	192.168.252.1	287	0x80000001	0xA0FA	0	
192.168.240.0	192.168.252.1	287	0x80000001	0xEF9B	0	
192.168.244.0	192.168.252.1	287	0x80000001	0xD5AE	0	
192.168.248.0	192.168.252.1	287	0x80000001	0xA9D6	0	
192.168.252.0	192.168.252.1	287	0x80000001	0x7DFE	0	
Type-5 AS External Link States						
Link ID	ADV Router	Age	Seq#	Checksum	Tag	
192.168.240.0	192.168.3.1	161	0x80000001	0x5A35	0	
192.168.244.0	192.168.3.1	163	0x80000001	0x4048	0	
192.168.248.0	192.168.3.1	163	0x80000001	0x1470	0	
192.168.252.0	192.168.3.1	163	0x80000001	0xE798	0	

4. Does SanJose3's database include link IDs that use Type 7 LSAs?

5. Does SanJose3's database include link IDs that use Type 5 LSAs?

SanJose3 converts the Type7 LSAs from Singapore and propagates them as Type 5 LSAs to SanJose1.

Issue the **show ip route** command on SanJose3:

```
SanJose3#show ip route

Gateway of last resort is not set

    192.168.224.0/30 is subnetted, 1 subnets
C       192.168.224.0 is directly connected, Serial0/0
    192.168.240.0/30 is subnetted, 1 subnets
O N2    192.168.240.0 [110/20] via 192.168.224.2, 00:03:23,
        Serial0/0
O N2    192.168.244.0/24 [110/20] via 192.168.224.2, 00:03:23,
        Serial0/0
    192.168.64.0/32 is subnetted, 1 subnets
O IA    192.168.64.1 [110/2] via 192.168.1.1, 00:03:23,
        FastEthernet0/0
    192.168.80.0/32 is subnetted, 1 subnets
O IA    192.168.80.1 [110/2] via 192.168.1.1, 00:03:23,
        FastEthernet0/0
    192.168.96.0/32 is subnetted, 1 subnets
O IA    192.168.96.1 [110/2] via 192.168.1.1, 00:03:24,
        FastEthernet0/0
O N2    192.168.248.0/24 [110/20] via 192.168.224.2, 00:03:24,
```

```

Serial0/0
192.168.112.0/32 is subnetted, 1 subnets
IA 192.168.112.1 [110/2] via 192.168.1.1, 00:03:30,
FastEthernet0/0
C 192.168.1.0/24 is directly connected, FastEthernet0/0
O N2 192.168.252.0/24 [110/20] via 192.168.224.2, 00:03:30,
Serial0/0
C 192.168.3.0/24 is directly connected, Loopback0

```

6. According to the output of this command, what kind of OSPF route is the external route to 192.168.248.0/24?

NSSA Type 2 (N2) routes are learned through Type 7 LSAs.

Finally, check SanJose1's routing table. The external route to 192.168.248.0/24 should still be installed. Issue the **show ip ospf database** command on SanJose1:

```

SanJose1#show ip ospf database

OSPF Router with ID (192.168.112.1) (Process ID 1)

Router Link States (Area 0)

Link ID          ADV Router      Age      Seq#           Checksum
Link count
192.168.3.1      192.168.3.1     390      0x80000007    0x45B2      2
192.168.112.1    192.168.112.1   1931     0x80000008    0x148A      1

Net Link States (Area 0)

Link ID          ADV Router      Age      Seq#           Checksum
192.168.1.1      192.168.112.1   1931     0x80000001    0xA10A

Summary Net Link States (Area 0)

Link ID          ADV Router      Age      Seq#           Checksum
192.168.64.1     192.168.112.1   1456     0x80000005    0xE7CA
192.168.80.1     192.168.112.1   1457     0x80000005    0x376B
192.168.96.1     192.168.112.1   1457     0x80000005    0x860C
192.168.112.1    192.168.112.1   1457     0x80000005    0xD5AC
192.168.224.0    192.168.3.1     1967     0x80000001    0x92E5

Router Link States (Area 1)

Link ID          ADV Router      Age      Seq#           Checksum
Link count
192.168.112.1    192.168.112.1   1457     0x80000006    0x39FE      4

Summary Net Link States (Area 1)

Link ID          ADV Router      Age      Seq#           Checksum
192.168.1.0      192.168.112.1   1924     0x80000009    0xA14D
192.168.3.1      192.168.112.1   1919     0x80000001    0x9B57
192.168.224.0    192.168.112.1   1919     0x80000001    0x9E6B

Summary ASB Link States (Area 1)

Link ID          ADV Router      Age      Seq#           Checksum
192.168.3.1      192.168.112.1   387      0x80000003    0x7F71

Type-5 AS External Link States

```

Link ID	ADV Router	Age	Seq#	Checksum	Tag
192.168.240.0	192.168.3.1	383	0x80000001	0x5A35	0
192.168.244.0	192.168.3.1	383	0x80000001	0x4048	0
192.168.248.0	192.168.3.1	383	0x80000001	0x1470	0
192.168.252.0	192.168.3.1	384	0x80000001	0xE798	0

7. Does SanJose1's database include link IDs that use Type 7 LSAs?

8. Does SanJose1's database include link IDs that use Type 5 LSAs?

Because SanJose3 converts Type 7 LSAs to Type 5, SanJose1 is unaware of the NSSA configuration of Area 51.

```
SanJose1#show ip route
```

```
Gateway of last resort is not set
```

```

    192.168.224.0/30 is subnetted, 1 subnets
O IA   192.168.224.0 [110/782] via 192.168.1.3, 00:06:38,
        FastEthernet0/0
    192.168.240.0/30 is subnetted, 1 subnets
O E2   192.168.240.0 [110/20] via 192.168.1.3, 00:06:32,
        FastEthernet0/0
O E2   192.168.244.0/24 [110/20] via 192.168.1.3, 00:06:32,
        FastEthernet0/0
    192.168.64.0/30 is subnetted, 1 subnets
C       192.168.64.0 is directly connected, Loopback0
    192.168.80.0/30 is subnetted, 1 subnets
C       192.168.80.0 is directly connected, Loopback1
    192.168.96.0/30 is subnetted, 1 subnets
C       192.168.96.0 is directly connected, Loopback2
O E2   192.168.248.0/24 [110/20] via 192.168.1.3, 00:06:33,
        FastEthernet0/0
    192.168.112.0/30 is subnetted, 1 subnets
C       192.168.112.0 is directly connected, Loopback3
C       192.168.1.0/24 is directly connected, FastEthernet0/0
O E2   192.168.252.0/24 [110/20] via 192.168.1.3, 00:06:35,
        FastEthernet0/0
    192.168.3.0/32 is subnetted, 1 subnets
O       192.168.3.1 [110/2] via 192.168.1.3, 00:06:41,
        FastEthernet0/0

```