

**Purpose:**

This was about different types of OSPF area networks, Stubby, Not-So-Stubby and Totally Stubby. These networks are important to learn because they are used in real topologies in order to simplify/shorten the OSPF routing tables and/or allow network administrators to have more control over how OSPF propagates external routes.

**Background Information:**

Open Shortest Path First, also known as OSPF is an open standard routing protocol used to route within networks by finding the best path from the source to the destination router. This is done by first using "Hello" packets to find neighboring routers and form adjacencies. After neighbors are found, each neighbor exchanges Link State Advertisements (LSAs) in order to send information about their network's state and status to their neighboring router. OSPF has many types of area networks. These include Stubby, Not-So-Stubby, and Totally Stubby.

Stubby area networks are networks that block all type 5 LSAs to simplify the routing table. Not-So-Stubby areas also known as NSSAs are OSPF networks that also block type 5 LSAs. The difference between Stubby areas and NSSAs is that NSSAs also allow the introduction of external routes (Type 5 LSAs) into the area. These are seen as type 7 LSAs inside the NSSA area, however, these LSAs are translated to type 5 ones when they enter the backbone area.

Totally Stubby areas block not only Type 5 LSAs but also Type 3 which are internal area summary routes. This is done to simplify the routing table to an extreme extent. The only routes that exist in a Totally Stubby area are intra-area and one default route. This results in only one Type 3 route showing in Totally Stubby networks, which is the default route out of the network.

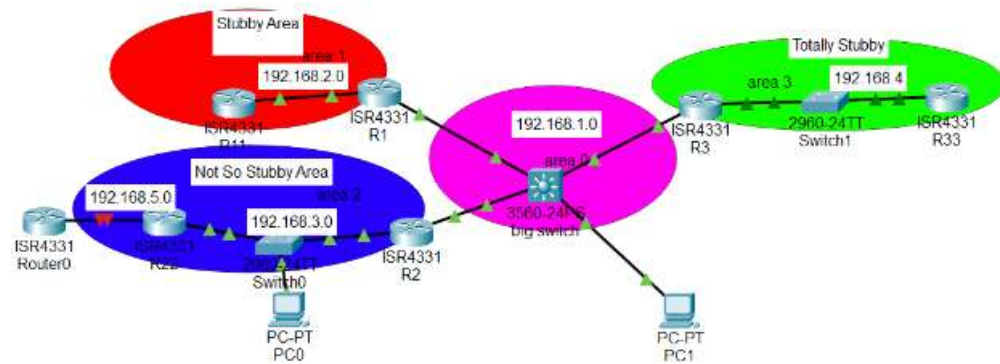
**Lab Summary:**

We create a network with 3 areas, one of each type. Stubby, NSSA, and Totally Stubby. We put switches in-between the routers in the NSSA and Totally Stubby area in order to capture Type 7 and see the difference of Totally Stubby's Type 3 LSAs. We also plugged a PC into the main switch in the backbone area in order to capture general traffic with Wireshark.

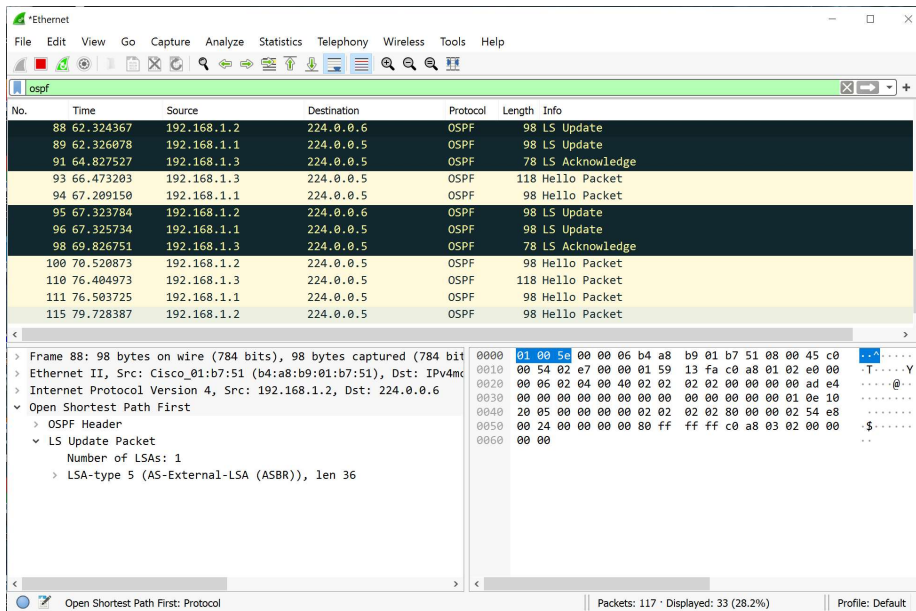
**Lab Commands:**

```
router(config) hostname R#  
router(config) interface g0/0/#  
router(config-if) ip address 192.168.## 255.255.255.0  
router(config) router ospf 1  
router(config-router) network 192.168.## 0.0.0.255 area # (N/A, stubby, stubby no-summary, NSSA)  
router# clear ip ospf processes
```

## Topology:



## Wireshark:



*Ethernet						
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
ospf						
No.	Time	Source	Destination	Protocol	Length	Info
3868	3594.395723	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3874	3601.249196	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3876	3604.136841	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3879	3606.196574	192.168.3.2	224.0.0.5	OSPF	134	LS Update
3880	3606.230662	192.168.3.2	224.0.0.5	OSPF	90	Hello Packet
3882	3606.731817	192.168.3.2	224.0.0.5	OSPF	98	LS Update
3883	3607.232051	192.168.3.2	224.0.0.5	OSPF	98	LS Update
3885	3608.697225	192.168.3.1	224.0.0.5	OSPF	98	LS Acknowledge
3886	3608.734669	192.168.3.2	224.0.0.5	OSPF	178	LS Acknowledge
3888	3612.231919	192.168.3.2	224.0.0.5	OSPF	98	LS Update
3890	3613.304748	192.168.3.1	224.0.0.5	OSPF	98	LS Acknowledge
3891	3613.852568	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3896	3614.591334	192.168.3.2	224.0.0.5	OSPF	78	LS Acknowledge
3897	3616.191341	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3904	3623.731714	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3906	3625.633189	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3912	3633.173919	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3914	3635.304133	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3921	3642.422519	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3925	3644.944101	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3930	3651.697358	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet
3933	3654.053776	192.168.3.2	224.0.0.5	OSPF	94	Hello Packet
3940	3660.841852	192.168.3.1	224.0.0.5	OSPF	94	Hello Packet

> Frame 3886: 178 bytes on wire (1424 bits), 178 bytes captured (	0000	01 00 5e 00 00 05 b4 a8 b9 a0 2e 20 08 00 45 c0	.....Y
> Ethernet II, Src: Cisco_a0:2e:20 (b4:a8:b9:a0:2e:20), Dst: IPv4	0010	00 a4 01 b6 00 00 01 59 12 dc c0 a8 03 02 e0 00	.....
> Internet Protocol Version 4, Src: 192.168.3.2, Dst: 224.0.0.5	0020	00 05 02 05 00 90 02 02 02 16 00 00 00 02 bc cc	.....
> Open Shortest Path First	0030	00 00 00 00 00 00 00 00 00 00 05 a8 28 01 02 02	.....
> OSPF Header	0040	02 02 02 02 02 80 00 00 06 0d 2d 00 24 05 a8	.....
> LSA-type 1 (Router-LSA), len 36	0050	28 02 c0 a8 03 01 02 02 02 02 80 00 00 01 ed ac	.....
> LSA-type 2 (Network-LSA), len 32	0060	00 20 06 65 28 03 c0 a8 01 00 02 02 02 02 80 00	.....e
> LSA-type 3 (Summary-LSA (IP network)), len 28	0070	00 01 40 83 00 1c 06 65 28 03 c0 a8 02 00 02 02	.....@...e
> LSA-type 3 (Summary-LSA (IP network)), len 28	0080	02 02 80 00 00 01 3f 82 00 1c 06 65 28 03 c0 a8	.....?..
> LSA-type 3 (Summary-LSA (IP network)), len 28	0090	04 00 02 02 02 02 80 00 00 01 29 96 00 1c 0e 10	.....(.....
> LSA-type 3 (Summary-LSA (IP network)), len 28	00a0	28 07 00 00 00 00 02 02 02 16 80 00 00 02 51 cc	.....-
> LSA-type 7 (NSSA AS-External-LSA), len 36	00b0	00 24	..-

## Configurations:

### R1:

Building configuration...

Current configuration : 813 bytes

```
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname R1
```

```
ip cef
no ipv6 cef
```

```
spanning-tree mode pvst
```

```
interface GigabitEthernet0/0/0
ip address 192.168.2.1 255.255.255.0
duplex auto
speed auto
```

```
interface GigabitEthernet0/0/1
```

```
ip address 192.168.1.1 255.255.255.0
duplex auto
speed auto
```

```
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown
```

```
interface Vlan1
no ip address
shutdown
```

```
router ospf 1
router-id 1.1.1.1
log-adjacency-changes
area 1 stub
network 192.168.2.0 0.0.0.255 area 1
network 192.168.1.0 0.0.0.255 area 0
```

```
ip classless
```

```
ip flow-export version 9
```

```
line con 0
```

```
line aux 0
```

```
line vty 0 4
login
```

```
End
```

Gateway of last resort is not set

```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/1
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/0
L 192.168.2.1/32 is directly connected, GigabitEthernet0/0/0
O IA 192.168.3.0/24 [110/2] via 192.168.1.2, 00:01:06,
GigabitEthernet0/0/1
O IA 192.168.4.0/24 [110/2] via 192.168.1.3, 00:01:06,
```

GigabitEthernet0/0/1

**R11:**

Building configuration...

Current configuration : 764 bytes

```
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname R11
```

```
ip cef
no ipv6 cef
```

```
spanning-tree mode pvst
```

```
interface GigabitEthernet0/0/0
ip address 192.168.2.2 255.255.255.0
duplex auto
speed auto
```

```
interface GigabitEthernet0/0/1
no ip address
duplex auto
speed auto
shutdown
```

```
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown
```

```
interface Vlan1
no ip address
shutdown
```

```
router ospf 1
router-id 1.1.1.11
log-adjacency-changes
area 1 stub
```

```
network 192.168.2.0 0.0.0.255 area 1
```

```
ip classless
```

```
ip flow-export version 9
```

```
line con 0
```

```
line aux 0
```

```
line vty 0 4
```

```
login
```

```
End
```

Gateway of last resort is 192.168.2.1 to network 0.0.0.0

```
O IA 192.168.1.0/24 [110/2] via 192.168.2.1, 00:02:05,  
GigabitEthernet0/0/0  
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks  
C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/0  
L 192.168.2.2/32 is directly connected, GigabitEthernet0/0/0  
O IA 192.168.3.0/24 [110/3] via 192.168.2.1, 00:01:55,  
GigabitEthernet0/0/0  
O IA 192.168.4.0/24 [110/3] via 192.168.2.1, 00:01:55,  
GigabitEthernet0/0/0  
O*IA 0.0.0.0/0 [110/2] via 192.168.2.1, 00:02:05,  
GigabitEthernet0/0/0
```

## **R2:**

Building configuration...

Current configuration : 813 bytes

```
version 15.4
```

```
no service timestamps log datetime msec
```

```
no service timestamps debug datetime msec
```

```
no service password-encryption
```

```
hostname R2
```

```
ip cef
```

```
no ipv6 cef
```

```
spanning-tree mode pvst

interface GigabitEthernet0/0/0
ip address 192.168.3.1 255.255.255.0
duplex auto
speed auto

interface GigabitEthernet0/0/1
ip address 192.168.1.2 255.255.255.0
duplex auto
speed auto

interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown

interface Vlan1
no ip address
shutdown

router ospf 1
router-id 2.2.2.2
log-adjacency-changes
area 2 nssa
network 192.168.3.0 0.0.0.255 area 2
network 192.168.1.0 0.0.0.255 area 0

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4
login

end
```

Gateway of last resort is not set

```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L 192.168.1.2/32 is directly connected, GigabitEthernet0/0/1
O IA 192.168.2.0/24 [110/2] via 192.168.1.1, 00:02:30,
GigabitEthernet0/0/1
192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.3.0/24 is directly connected, GigabitEthernet0/0/0
L 192.168.3.1/32 is directly connected, GigabitEthernet0/0/0
O IA 192.168.4.0/24 [110/2] via 192.168.1.3, 00:02:30,
GigabitEthernet0/0/1
```

## **R22:**

Building configuration...

Current configuration : 764 bytes

```
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname R22
```

```
ip cef
no ipv6 cef
```

```
spanning-tree mode pvst
```

```
interface GigabitEthernet0/0/0
ip address 192.168.3.2 255.255.255.0
duplex auto
speed auto
```

```
interface GigabitEthernet0/0/1
no ip address
duplex auto
speed auto
shutdown
```

```
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown
```

```
interface Vlan1
```



```

no ip address
shutdown

router ospf 1
router-id 2.2.2.22
log-adjacency-changes
area 2 nssa
network 192.168.3.0 0.0.0.255 area 2

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4
login

end

```

Gateway of last resort is not set

```

O IA 192.168.1.0/24 [110/2] via 192.168.3.1, 00:03:13,
GigabitEthernet0/0/0
O IA 192.168.2.0/24 [110/3] via 192.168.3.1, 00:02:58,
GigabitEthernet0/0/0
192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.3.0/24 is directly connected, GigabitEthernet0/0/0
L 192.168.3.2/32 is directly connected, GigabitEthernet0/0/0
O IA 192.168.4.0/24 [110/3] via 192.168.3.1, 00:02:58,
GigabitEthernet0/0/0

```

### **R3:**

Building configuration...

Current configuration : 824 bytes

```

version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec

```

```
no service password-encryption

hostname R3

ip cef
no ipv6 cef

spanning-tree mode pvst

interface GigabitEthernet0/0/0
ip address 192.168.4.1 255.255.255.0
duplex auto
speed auto

interface GigabitEthernet0/0/1
ip address 192.168.1.3 255.255.255.0
duplex auto
speed auto

interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown

interface Vlan1
no ip address
shutdown

router ospf 1
router-id 3.3.3.3
log-adjacency-changes
area 3 stub no-summary
network 192.168.4.0 0.0.0.255 area 3
network 192.168.1.0 0.0.0.255 area 0

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4
login

End
```

Gateway of last resort is not set

```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L 192.168.1.3/32 is directly connected, GigabitEthernet0/0/1
O IA 192.168.2.0/24 [110/2] via 192.168.1.1, 00:03:39,
GigabitEthernet0/0/1
O IA 192.168.3.0/24 [110/2] via 192.168.1.2, 00:03:39,
GigabitEthernet0/0/1
192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.4.0/24 is directly connected, GigabitEthernet0/0/0
L 192.168.4.1/32 is directly connected, GigabitEthernet0/0/0
```

### **R33:**

Building configuration...

Current configuration : 775 bytes

```
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname R33
```

```
ip cef
no ipv6 cef
```

```
spanning-tree mode pvst
```

```
interface GigabitEthernet0/0/0
ip address 192.168.4.2 255.255.255.0
duplex auto
speed auto
```

```
interface GigabitEthernet0/0/1
no ip address
duplex auto
speed auto
shutdown
```

```
interface GigabitEthernet0/0/2
```

```

no ip address
duplex auto
speed auto
shutdown

interface Vlan1
no ip address
shutdown

router ospf 1
router-id 3.3.3.33
log-adjacency-changes
area 3 stub no-summary
network 192.168.4.0 0.0.0.255 area 3

ip classless

ip flow-export version 9

line con 0

line aux 0

line vty 0 4
login
End

```

Gateway of last resort is 192.168.4.1 to network 0.0.0.0

```

192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.4.0/24 is directly connected, GigabitEthernet0/0/0
L 192.168.4.2/32 is directly connected, GigabitEthernet0/0/0
O*IA 0.0.0.0/0 [110/2] via 192.168.4.1, 00:04:06,
GigabitEthernet0/0/0

```

### **Problems:**

For the longest time during our lab, our issue was not getting LSA type 7 packets. This was due to us not understanding how LSA type 7 worked, and we were trying to get type 7 packets in the backbone area via PC1 (show in Topology). We went through many different variations similar to our final topology in order to try to get Type 7 packets. In the end our solution to this problem was to add a switch between the 2 routers in the NSSA and connect a PC to that switch in order to Wireshark Type 7 packets.

**Conclusions:**

This lab was a multi-area OSPF lab like the last lab we did. However, this one explores different types of OSPF areas and their functions/unique quirks as well as LSA packets and how they are used in different OSPF area types. We captured LSA packets via Wireshark and found differences in LSA packets in different area types of a network. This was mostly an exploration lab of OSPF and adds to my understanding of how OSPF works and learning about new versions of OSPF areas I didn't know before.