

BRKRST-3310

Agenda

- LSA Overview
- Troubleshooting Commands
- Common Issues
- Troubleshooting Enhancements

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LSA Overview



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LSA Type Review

Type	LSA
1	Router
2	Network
3	Summary Network
4	Summary ASBR
5	External
6	Group Membership
7	NSSA
8	External Attributes
9-11	Opaque

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Router LSA of R3 for Area 1

R3#show ip ospf database router 3.3.3.3

Router Link States (Area 1)

```

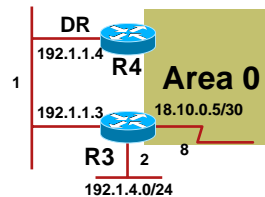
LS age: 0                Always 0 at origination
Options: (No TOS-capability)
LS type: Router Links    This is a router LSA
Link State ID: 3.3.3.3   Router ID of R3
Advertising Router: 3.3.3.3 Router ID of R3
LS Seq Number: 80000001  Initial Seq Number
Checksum: 0x146B
Length: 48
  
```

Area Border Router bit B = 1

Number of links: 2

Link Connected to: a Transit Network
 (Link ID) Designated Router address): 192.1.1.4
 (Link Data) Router Interface address): 192.1.1.3
 Number of TOS metrics: 0
 TOS 0 Metric: 1

Link Connected to: a Stub Network
 (Link ID) Network/subnet number: 192.1.4.0
 (Link Data) Network Mask: 255.255.255.0
 Number of TOS metrics = 0
 TOS 0 Metric: 2



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Router LSA of R3 for Area 0 (Cont.)

Router Link States (Area 0)

LS age: 0 Always 0 at origination
Options: (No TOS-capability)
LS type: Router Links This is a router LSA
Link State ID: 3.3.3.3 Router ID of R3
Advertising Router: 3.3.3.3 Router ID of R3
LS Seq Number: 80000001 Initial Seq Number
Checksum: 0x146B
Length: 48

Area Border Router bit B = 1

Number of links: 2

Link Connected to: another Router (point-to-point)

(Link ID) Neighboring Router ID: 6.6.6.6

(Link Data) Router Interface address: 18.10.0.5

Number of TOS metrics: 0

TOS 0 Metric: 8

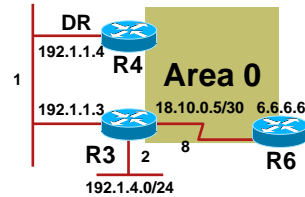
Link Connected to: a Stub Network

(Link ID) Network/subnet number: 18.10.0.4

(Link Data) Network Mask: 255.255.255.252

Number of TOS metrics = 0

TOS 0 Metric: 8



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Router Link Types Summary

Type	Description	Link ID	Link Data
1	Point-to-Point Numbered	Neighbors' RID	Interface IP Address
1	Point-to-Point Unnumbered	Neighbors' RID	MIB-II Ifindex Value
2	Transit	IP Address of the DR	Interface IP Address
3	Stub	IP Network Number	Subnet Mask
4	Virtual Link	Neighbors' RID	Interface IP Address

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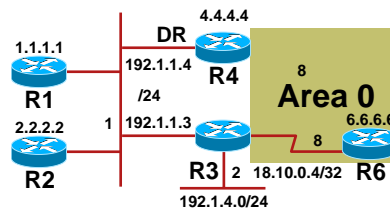
Network LSA for 192.1.1.0

R3#show ip ospf database network 192.1.1.4

Network Link States (Area 1)

LS age: 948
 Options: (No TOS Capability)
 LS type: Network Links
 Link State ID: 192.1.1.4 (address of Designated Router)
 Advertising Router: 4.4.4.4 RID of DR
 LS Seq Number: 80000001 Initial Seq Number
 Checksum: 0x9A84
 Length: 40

Network Mask: /24
 Attached Router: 4.4.4.4
 Attached Router: 3.3.3.3
 Attached Router: 2.2.2.2
 Attached Router: 1.1.1.1



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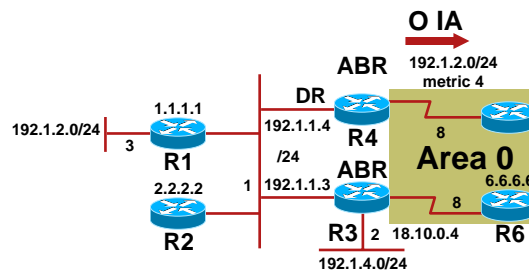
Type 3 Details

R4#show ip ospf database summary 192.1.2.0

Summary Net Link States (Area 0)

LS age: 1514
 Options: (No TOS Capability)
 LS type: Summary Links (Networks)
 Link State ID: 192.1.2.0 (Summary Network Number)
 Advertising Router: 4.4.4.4 RID of ABR
 LS Seq Number: 80000001 Initial Seq Number
 Checksum: 0xFC68
 Length: 28

Network Mask: /24
 TOS 0 Metric: 4



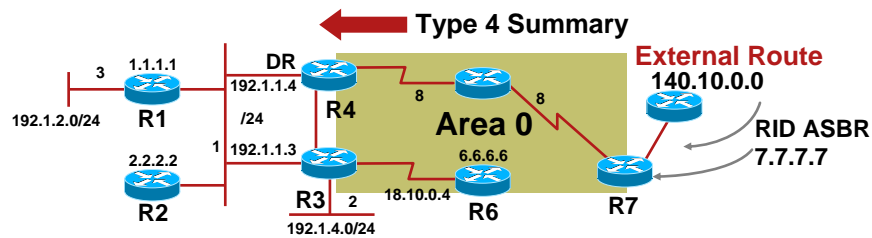
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Type 4 Details

```
R4#show ip ospf database asbr-summary 7.7.7.7
Summary ASB Link States (Area 0)
```

```
LS age: 1548
Options: (No TOS Capability)
LS type: Summary Links (AS Boundary Router)
Link State ID: 7.7.7.7 (As Boundary Router address)
Advertising Router: 4.4.4.4 RID of ABR
LS Seq Number: 80000001 Initial Seq Number
Checksum: 0x93E2
Length: 28
Network Mask: /0
TOS: 0 Metric: 16
```



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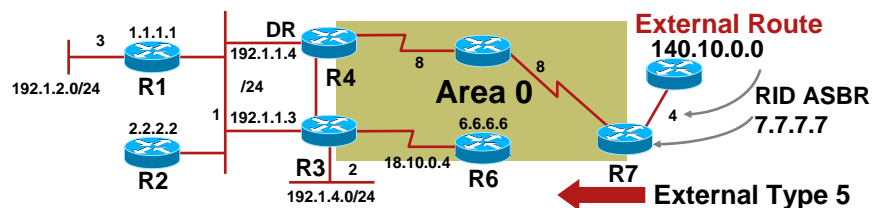
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Type 5 Details

```
R4#show ip ospf database external 140.10.0.0
```

```
LS age: 156
Options: (No TOS Capability)
LS type: AS External Link
Link State ID: 140.10.0.0 (External Network Number)
Advertising Router: 7.7.7.7 Router ID of R7
LS Seq Number: 80000001 Initial Seq Number
Checksum: 0x93E2
Length: 36
```

```
Network Mask: /16
Metric Type: 2 bit E = 1 -> O E2 (Default)
Metric: 20
Forwarding address: 0.0.0.0
```



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Forwarding Address (Type 5)

When Will It Set to Non-Zero?

- OSPF is enabled on the ASBR's next hop interface &&
- The ASBR's next hop interface is non-passive to OSPF &&
- The ASBR's next hop interface network-type is **not** p2p or p2mp &&
- The ASBR's next hop interface address falls into OSPF network range

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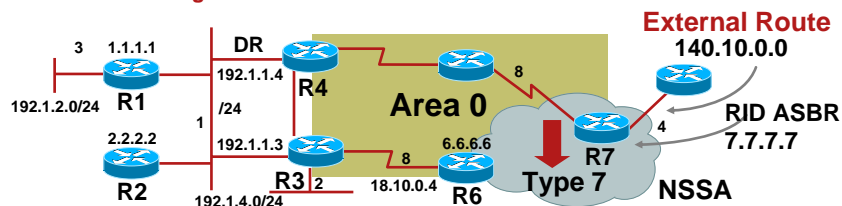
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Type 7 Details

R7#show ip ospf database nssa-external 140.10.0.0

```
LS age: 156
Options: (No TOS Capability, Type 7/5 translation)
LS type: AS External Link
Link State ID: 140.10.0.0 (External Network Number)
Advertising Router: 7.7.7.7          Router ID of R7(ASBR)
LS Seq Number: 80000001             Initial Seq Number
Checksum: 0x01A6
Length: 36
```

```
Network Mask: /16
Metric Type: 2
Metric: 20
Forwarding address: 0.0.0.0
```



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Forwarding Address (Type 7)

When Will It Set to Non-Zero?

- OSPF is enabled on the ASBR's next hop interface &&
- The ASBR's next hop interface is non-passive to OSPF &&
- The ASBR's next hop interface network-type is not p2p or p2mp &&
- The ASBR's next hop interface address falls into OSPF network range
- If the above are true then we set the fwd_addr to the next_hop addr, otherwise

If the next hop interface is passive or non multi-access, use our own IP address on the next hop interface else

Use one of the loopbacks (if it's up and OSPF is enabled) in the area we're announcing to

If no loopbacks in that area, use the address of the first interface in that area

Troubleshooting Commands



Show IP OSPF

```
R3#show ip ospf
Routing Process "ospf 1" with ID 3.3.3.3 and Domain ID 0.0.0.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
It is an area border router
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 1. Checksum Sum 0x3B57
Number of opaque AS LSA 0. Checksum Sum 0x0
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 2 2 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 2
Area has no authentication
SPF algorithm executed 2773 times
Area ranges are
Number of LSA 17 Checksum Sum 0x686B5
Number of opaque link LSA 0. Checksum Sum 0x0
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 9
Flood list length 0
```

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Show IP OSPF Database

```
R3#show ip ospf database

OSPF Router with ID (3.3.3.3) (Process ID 1)

Router Link States (Area 0)

Link ID ADV Router Age Seq# Checksum Link count
3.3.3.3 3.3.3.3 106 0x80000009 0xC3F1 3
...
Summary Net Link States (Area 0)

Link ID ADV Router Age Seq# Checksum
18.10.0.0 7.7.7.7 3 (DNA) 0x80000008 0x3DC2
18.10.0.0 8.8.8.8 1396 0x80000004 0x27D8
...
Router Link States (Area 1)

Link ID ADV Router Age Seq# Checksum Link count
1.1.1.1 1.1.1.1 671 0x80000016 0xE6CD 2
...
```

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Show IP OSPF Database Database-Summary

```
R3#show ip ospf database database-summary

OSPF Router with ID (3.3.3.3) (Process ID 1)

Area 0 database summary
LSA Type      Count  Delete  Maxage
Router        6      0       0
Network       4      0       0
Summary Net   10     0       0
Summary ASBR  0      0       0
Type-7 Ext    0      0       0
Opaque Link   0      0       0
Opaque Area   0      0       0
Subtotal      20     0       0

Area 1 database summary
LSA Type      Count  Delete  Maxage
Router        4      0       0
Network       1      0       0
Summary Net   10     0       0
Summary ASBR  4      0       0
...

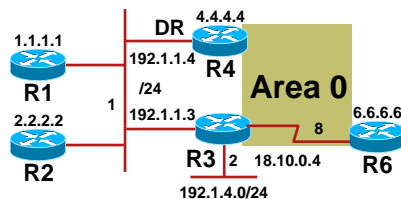
```

Show IP OSPF Neighbor

```
R3#show ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface
1.1.1.1 1 FULL/DROTHER 00:00:33 192.1.1.1 FastEthernet0/0
2.2.2.2 1 FULL/DROTHER 00:00:32 192.1.1.2 FastEthernet0/0
4.4.4.4 1 FULL/DR 00:00:39 192.1.1.4 FastEthernet0/0
6.6.6.6 1 FULL/- 00:00:38 18.10.0.6 Serial0/0
R3#

```



Show IP OSPF Neighbor Detail

```
R3#show ip ospf neighbor detail
Neighbor 1.1.1.1, interface address 192.1.1.1
In the area 1 via interface FastEthernet0/0
Neighbor priority is 1, State is 2WAY, 2 state changes
DR is 192.1.1.4 BDR is 192.1.1.2
Options is 0x2
Dead timer due in 00:00:39
Neighbor is up for 00:06:30
Index 0/0, retransmission queue length 0, number of retransmission 0
First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
Last retransmission scan length is 0, maximum is 0
Last retransmission scan time is 0 msec, maximum is 0 msec
Neighbor 2.2.2.2, interface address 192.1.1.2
In the area 1 via interface FastEthernet0/0
Neighbor priority is 1, State is FULL, 6 state changes
DR is 192.1.1.4 BDR is 192.1.1.2
Options is 0x42
Dead timer due in 00:00:38
Neighbor is up for 00:06:31
Index 2/2, retransmission queue length 0, number of retransmission 0
First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
Last retransmission scan length is 0, maximum is 0
Last retransmission scan time is 0 msec, maximum is 0 msec
```

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Show IP OSPF Interface

```
R3#show ip ospf interface
FastEthernet0/0 is up, line protocol is up
Internet Address 192.1.1.3/24, Area 1
Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State DROTHER, Priority 1
Designated Router (ID) 4.4.4.4, Interface address 192.1.1.4
Backup Designated router (ID) 2.2.2.2, Interface address 192.1.1.2
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 00:00:03
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 0, maximum is 5
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 3, Adjacent neighbor count is 2
Adjacent with neighbor 2.2.2.2 (Backup Designated Router)
Adjacent with neighbor 4.4.4.4 (Designated Router)
Suppress hello for 0 neighbor(s)
```

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Show IP OSPF Virtual-Links

```
R3#show ip ospf virtual-links
Virtual Link OSPF_VL0 to router 4.4.4.4 is up
Run as demand circuit
DoNotAge LSA allowed.
Transit area 1, via interface FastEthernet0/0, Cost of using 1
Transmit Delay is 1 sec, State POINT_TO_POINT,
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 00:00:09
Adjacency State FULL (Hello suppressed)
Index 1/3, retransmission queue length 0, number of retransmission 1
First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
Last retransmission scan length is 1, maximum is 1
Last retransmission scan time is 0 msec, maximum is 0 msec
R3#
```

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Show IP OSPF Stat

Requires Enable Mode

```
R3#sh ip ospf stat
Area 0: SPF algorithm executed 42 times
Area 1: SPF algorithm executed 38 times

SPF calculation time
Delta T   Intra D-Intra Summ  D-Summ Ext  D-Ext Total Reason
00:22:00 0 0 0 0 0 0 0 R, N, SN,
00:21:44 0 0 4 0 0 0 4 R, SN, X
00:21:34 0 0 4 0 0 0 4 R, SN, X
00:21:24 0 0 0 4 0 0 4 R, SN, X
00:21:14 0 0 0 0 0 0 0 R
00:21:04 0 0 0 0 0 0 0 R, N, SN,
00:20:54 0 0 0 0 0 0 0 X
00:20:44 0 0 4 0 0 0 4 R, SN, X
00:20:34 0 0 0 0 0 0 0 X
00:00:17 4 0 0 0 0 0 4 R, N, SN, SA, X
...
R=Router LSA; N=NetworkLSA; SN=Summary Network LSA; SA=Summary
ASBR LSA; X=External LSA
```

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Show IP OSPF Stat

Requires Enable Mode

```
R1#show ip ospf stat detail
```

```
OSPF process ID 100
```

```
Area 0: SPF algorithm executed 1 times
```

```
SPF 1 executed 1w0d ago, SPF type Full
```

```
SPF calculation time (in msec):
```

SPT	Intra	D-Intra	Summ	D-Summ	Ext7	D-Ext7	Total
0	0	0	0	0	0	0	0

```
LSIDs processed R:1 N:0 Stub:1 SN:0 SA:0 X7:0
```

```
Change record R,
```

```
LSIDs changed 1
```

```
Last 10 LSIDs:
```

```
4.4.4.4(R)
```

```
Summary OSPF SPF statistic
```

```
SPF calculation time
```

Delta T	Intra	D-Intra	Summ	D-Summ	Ext	D-Ext	Total	Reason
1w0d	0	0	0	0	0	0	0	R,

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Show IP OSPF Borders

```
R3#show ip ospf borders-routers
```

```
OSPF Process 1 internal Routing Table
```

```
Codes: i - Intra-area route, I - Inter-area route
```

```
i 4.4.4.4 [1] via 192.1.1.4, FastEthernet0/0, ABR, Area 0, SPF 42
```

```
i 4.4.4.4 [1] via 192.1.1.4, FastEthernet0/0, ABR, Area 1, SPF 38
```

```
i 8.8.8.8 [10] via 18.10.0.6, Serial0/0, ABR/ASBR, Area 0, SPF 42
```

```
i 7.7.7.7 [17] via 192.1.1.4, FastEthernet0/0, ABR/ASBR, Area 0, SPF 42
```

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Other Show Commands

```
R3#show ip ospf database self-originate
  OSPF Router with ID (3.3.3.3) (Process ID 1)

  Router Link States (Area 0)
Link ID  ADV Router  Age  Seq#    Checksum Link count
3.3.3.3  3.3.3.3  1520  0x80000015  0xABFD  2

  Summary Net Link States (Area 0)
Link ID  ADV Router  Age  Seq#    Checksum
192.1.1.0  3.3.3.3  1520  0x80000006  0x4E1A
192.1.2.0  3.3.3.3  1521  0x80000006  0x6103
...

  Router Link States (Area 1)
Link ID  ADV Router  Age  Seq#    Checksum Link count
3.3.3.3  3.3.3.3  1536  0x80000028  0x612D  2
```

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Other Show Commands (Cont.)

```
R3#show ip ospf database adv-router 7.7.7.7
  OSPF Router with ID (3.3.3.3) (Process ID 1)

  Router Link States (Area 0)
Link ID  ADV Router  Age  Seq#    Checksum Link count
7.7.7.7  7.7.7.7  871(DNA)  0x8000000D  0x8FE2  2

  Summary Net Link States (Area 0)
Link ID  ADV Router  Age  Seq#    Checksum
20.10.0.0  7.7.7.7  871 (DNA)  0x8000000A  0x39C4

  Type-5 AS External Link States
Link ID  ADV Router  Age  Seq#    Checksum Tag
140.100.0.0  7.7.7.7  1944  0x80000004  0x3759  0
```

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Common Issues



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Common Issues

- Adjacency is not coming up
- OSPF neighbor stuck in? State
- Information is in the DB but not in the RT
- SPF running constantly
- NSSA ABR not translating Type 7 LSA

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Adjacency Is Not Coming Up

Useful Commands for This Problem

- Show IP OSPF neighbor
- Show IP OSPF interface
- Debug IP OSPF adjacency

Adjacency Is Not Coming Up

- Layer 2 is down

```
R3#show ip ospf neighbor
R3#
```

```
R3#show ip ospf interface serial 2
Serial2 is down, line protocol is down
Internet Address 18.10.0.3/30, Area 0
Process ID 1, Router ID 3.3.3.3, Network Type POINT_TO_POINT, Cost: 64
Transmit Delay is 1 sec, State DOWN,
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
```

Adjacency Is Not Coming Up

- OSPF not enabled on the interface

```
R3#show ip ospf neighbor
R3#

R3#show ip ospf interface serial 2
Serial2 is up, line protocol is up
OSPF not enabled on this interface
```

In 12.0:

```
R3#show ip ospf interface serial 2
R3#
```

- Tip: Check for the wrong network statement; re-enter the network statement

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Adjacency Is Not Coming Up

- Interface is defined as passive

```
R3#show ip ospf neighbor
R3#

R3#show ip ospf interface e0
Ethernet0 is up, line protocol is up
Internet Address 192.1.1.3/24, Area 1
Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 192.1.1.4, Interface address 192.1.1.3
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
```

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Adjacency Is Not Coming Up

- Mismatched subnet mask

```
R3#show ip ospf neighbor
R3#

R3#debug ip ospf adj
OSPF adjacency events debugging is on
R3#
OSPF: Mismatched hello parameters from 192.1.1.4
Dead R 40 C 40, Hello R 10 C 10 Mask R 255.255.255.192 C 255.255.255.0
```

Adjacency Is Not Coming Up

- Mismatched hello/dead interval

```
R3#show ip ospf neighbor
R3#

R3#debug ip ospf adj
OSPF adjacency events debugging is on
R3#
OSPF: Mismatched hello parameters from 192.1.1.4
Dead R 40 C 40, Hello R 15 C 10 Mask R 255.255.255.0 C 255.255.255.0

R4(config-if)#interface ethernet 0
R4(config-if)#no ip ospf hello-interval 15
```

- Tip: Default is 10 second on LAN

Adjacency Is Not Coming Up

- Mismatched authentication key

```
R3#show ip ospf neighbor
R3#

R3#debug ip ospf adj
OSPF adjacency events debugging is on
R3#
OSPF: Rcv pkt from 192.1.1.4, Ethernet0: Mismatch Authentication Key -
Clear Text
```

- Tip: Watch for the “space” at the end of the authentication key

Adjacency Is Not Coming Up

- Mismatched area ID

```
R4#show ip ospf neighbor
R4#

R4#debug ip ospf adj
OSPF adjacency events debugging is on

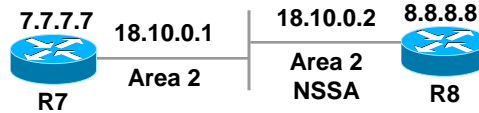
OSPF: Rcv pkt from 192.1.1.4, Ethernet0, area 0.0.0.1
mismatch area 0.0.0.2 in the header

neighbor is in area 2 but we are not:

%OSPF-4-ERRRCV: Received invalid packet mismatch area ID, from backbone
area must be virtual-link but not found from 192.1.1.4, Ethernet0
```

Adjacency Is Not Coming Up

- Mismatched transit/stub/NSSA option



```
R7#show ip ospf neighbor
R7#
```

```
R7#debug ip ospf adj
OSPF adjacency events debugging is on
OSPF: Hello from 18.10.0.2 with mismatched Stub/Transit area option bit
```

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Options

Normal area: OSPF: Send DBD to 141.108.97.1 on Serial0 seq 0xBC4 opt 0x2 flag 0x3 len 492
E bit is 1, Allow externals, option: 0x2(HEX) = 00000010(Bin)

Stub area: OSPF: Send DBD to 141.108.97.1 on Serial0 seq 0x1866 opt 0x0 flag 0x3 len 372
E bit is 0, no external allowed, options: 0x0 = 00000000

NSSA: OSPF: Send DBD to 141.108.97.1 on Serial0 seq 0x116 opt 0x8 flag 0x3 len 372
N/P bit is on, options: 0x8 = 00001000

DC: OSPF: Send DBD to 141.108.97.1 on Serial0 seq 0x1A1E opt 0x20 flag 0x3 len 392
DC bit is negotiated, options: 0x20 = 00100000



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OSPF Neighbor Stuck in? State

Useful Commands for This Problem

- Show IP OSPF neighbor
- Debug IP OSPF adjacency

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OSPF Adjacency States

ATTEMPT

INIT

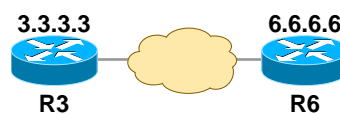
2-WAY

EXSTART

EXCHANGE

LOADING

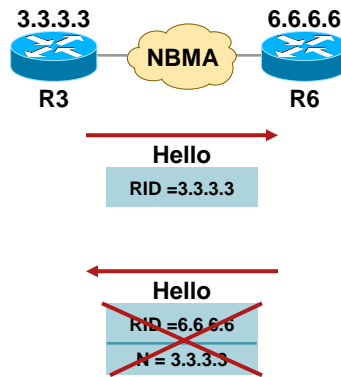
FULL



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Stuck in ATTEMPT



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Stuck in ATTEMPT

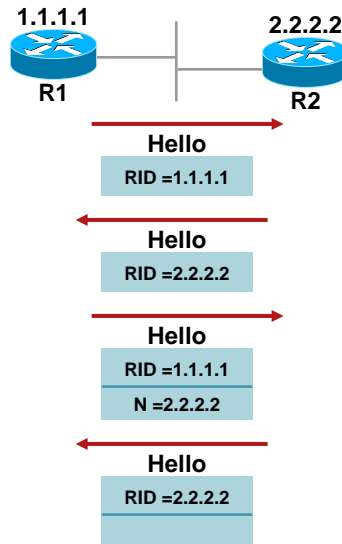
Reasons

- Our hellos are getting lost in NBMA cloud
- Neighbor hellos are getting lost in NBMA cloud
- We received neighbor's hello but rejects it for some reason
- Misconfigured neighbor statement
- Broken Unicast

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Stuck in INIT



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Stuck in INIT

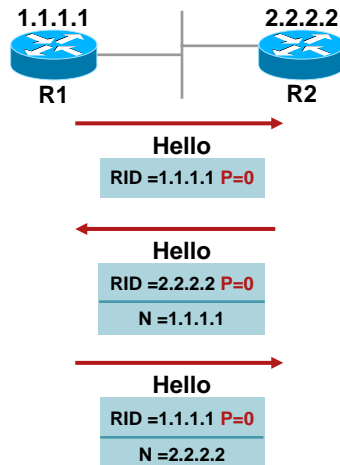
Reasons

- One side is blocking the hello packet with access-list
- One side is translating (NAT) OSPF hello
- One side multicast capabilities is broken (Layer 2)
- Dialer map or Frame Relay map is missing keyword 'broadcast'
- LLS capability issue when Cisco IOS® is upgraded

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Stuck in 2-WAY



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Stuck in 2-WAY

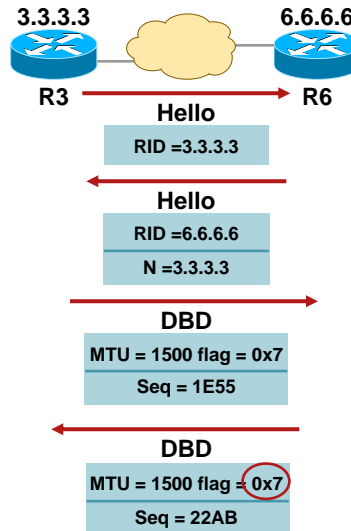
Reasons

- This is normal in broadcast network types
- This is to reduce the amount of flooding on the wire
- Problem can happen if all the router are configured with priority equal to '0'
- Only low-end routers should be configured with priority 0 so they don't participate in DR election

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Stuck in EXSTART/EXCHANGE



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Stuck in EXSTART/EXCHANGE

- Useful in debugging, defines I, M and MS bits

OSPF: Send DBD to 141.108.97.1 on Serial0 seq 0xBC4 opt 0x2 **flag 0x3** len 492

Flag 0x7 --> 111 means I(Initial) = 1, M = 1(More), MS = 1(Master)

Flag 0x6 --> 110 not possible

Flag 0x5 --> 101 not possible

Flag 0x4 --> 100 not possible

Flag 0x3 --> 011 means master has more data to send

Flag 0x2 --> 010 means slave has more data to send

Flag 0x1 --> 001 means master has no more data left to send

Flag 0x0 --> 000 means slave has no more data left to send



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Stuck in EXSTART/EXCHANGE

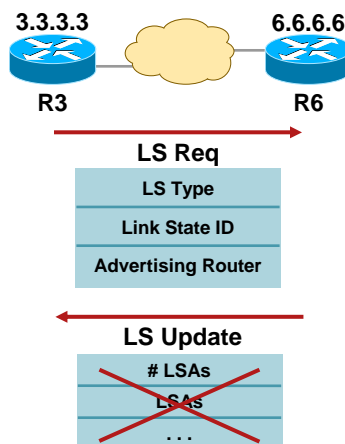
Reasons

- MTU mismatch—EXCHANGE
Note: If Cisco IOS is < 12.0.3 neighbor will show stuck in EXCHANGE
- Neighbor RID is same as ours—EXSTART
Note: If Cisco IOS is > 12.0.7, it displays msg: %OSPF-3-DUP_RTRID and OSPF neighbor list will be empty
- Unicast is broken—EXCHANGE
 1. Wrong VC/DLCi mapping in frame/ATM environment in highly redundant network
 2. MTU problem, can't ping across with more than certain length packet
 3. Access-list blocking unicast; after two-way OSPF send unicast packet except p2p links
 4. NAT is translating unicast packet
- Between PRI and BRI/dialer and network type is p2p—EXCHANGE

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Stuck in LOADING



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Stuck in LOADING

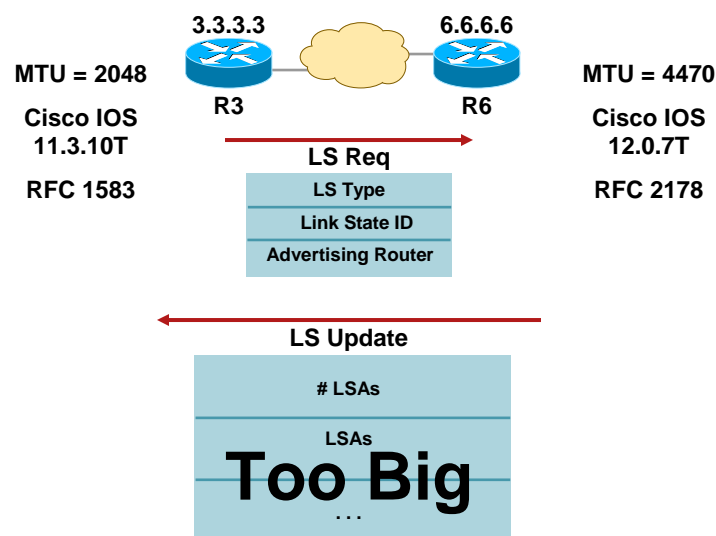
Reasons

- LS request is being made and neighbor is sending bad packet or mem corrupt
 - a. Do **show IP OSPF bad** to see bad LSA
 - b. Show log will show OSPF-4-BADLSATYPE msg
- LS request is being made and neighbor is ignoring the request
- MTU mismatch problem (RFC 1583 and 2178 compatibility issue) CSCee23634 (R). **OSPF should detect if the neighbor MTU is smaller than ours.** Currently available in latest 12.3 and 12.0S

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Stuck in LOADING



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Information Is in the DB But Not in the RT

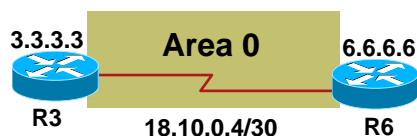
Useful Commands for This Problem

- Show IP OSPF interface <interface>
- Show IP OSPF database <x>
- Where 'x' can be router, network, summary, summary-asbr, external, NSSA

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Mismatched Network Types



R3#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
6.6.6.6	1	FULL/	00:00:30	18.0.0.6	Serial0

R3#show ip ospf interface serial 0

Serial0 is up, line protocol is up
Internet Address 18.0.0.5/30, Area 0
Process ID 1, Router ID 3.3.3.3, Network Type **POINT_TO_POINT**, Cost: 64

R6#show ip ospf interface serial 0

Serial0 is up, line protocol is up
Internet Address 18.0.0.6/30, Area 0
Process ID 1, Router ID 6.6.6.6, Network Type **BROADCAST**, Cost: 64

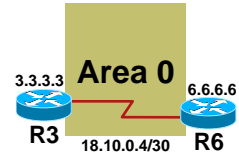
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Mismatched Network Types (Cont.)

```
R3#show ip ospf database router 3.3.3.3
```

```
...
  Link ID = 6.6.6.6           Router id of the neighbor
  Link Data = 18.10.0.5      IP interface address
  Type = 1                   This is a point-to-point link
  # TOS metrics = 0
  metric = 8
```



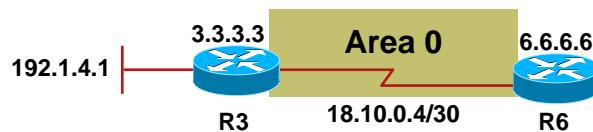
```
R3#show ip ospf database router 6.6.6.6
```

```
...
  Link ID = 18.10.0.6        IP address of the DR
  Link Data = 18.10.0.6      Interface address
  Type = 2                   This is a transit link
  # TOS metrics = 0
  metric = 8
```

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Point-to-Point Numbered and Unnumbered Links



```
R3#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
6.6.6.6	1	FULL	00:00:30	18.0.0.6	Serial0

```
R3#show interface serial0
```

```
Serial0 is up, line protocol is up
Hardware is HD64570
Interface is unnumbered. Using address of Ethernet1 (192.1.4.1)
```

```
R6#show interface serial0
```

```
Serial0 is up, line protocol is up
Hardware is HD64570
Internet address is 18.10.0.6/30
```

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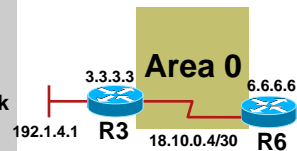
Point-to-Point Numbered and Unnumbered Links (Cont.)

R3#show ip ospf database router 3.3.3.3

```

...
Link-ID = 6.6.6.6
Link Data = 0.0.0.5
Type = 1
# TOS metrics = 0
metric = 8
Router id of the neighbor
MIBII IfIndex Value
This is a point-to-point link

```



R3#show ip ospf database router 6.6.6.6

```

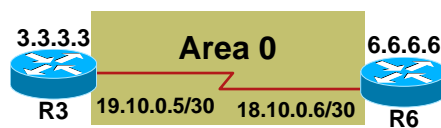
...
Link-ID = 3.3.3.3
Link Data = 18.10.0.6
Type = 1
# TOS metrics = 0
metric = 8
Router id of the neighbor
IP interface address
This is a transit link

```

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Different Mask or IP Subnet on P2P Links



R3#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
6.6.6.6	1	FULL	00:00:30	18.0.0.6	Serial0

R3#show interface serial 0

Serial0 is up, line protocol is up
Hardware is HD64570
Internet address is 19.10.0.5/24

R6#show interface serial 0

Serial0 is up, line protocol is up
Hardware is HD64570
Internet address is 18.10.0.6/30

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Different Mask or IP Subnet on P2P Links (Cont.)

R3#show ip ospf database router 3.3.3.3

```

...
Link ID = 6.6.6.6           Router id of the neighbor
Link Data = 19.10.0.5       Interface address
Type = 1                    This is a point-to-point link
# TOS metrics = 0
metric = 8

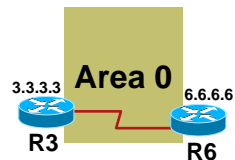
```

R3#show ip ospf database router 6.6.6.6

```

...
Link ID = 3.3.3.3           Router id of the neighbor
Link Data = 18.10.0.6       Interface address
Type = 1                    This is a point-to-point link
# TOS metrics = 0
metric = 8

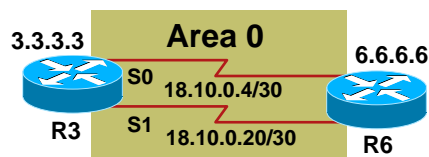
```



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Address Flipped on Dual Links



R3#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
6.6.6.6	1	FULL/ -	00:00:30	18.10.0.6	Serial0
6.6.6.6	1	FULL/ -	00:00:33	18.10.0.22	Serial1

R3#show interface serial 0

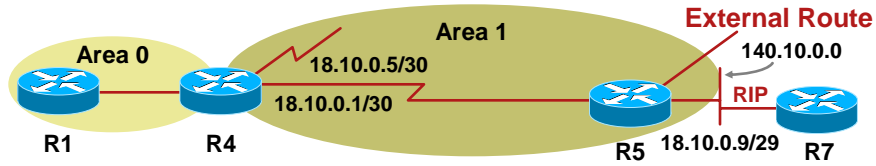
Serial0 is up, line protocol is up
Hardware is HD64570

Internet address is 18.10.0.21/30

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Forwarding Address Problem



```
R1#show ip ospf database external 140.10.0.0
```

```
...
Link State ID = 140.10.0.0
Advertising Router = 5.5.5.5
Network Mask = 255.255.0.0
...
```

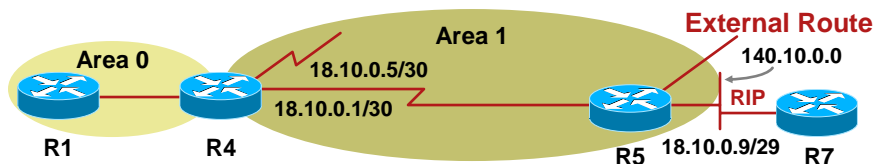
```
Forwarding address = 18.10.0.10
```

```
R1#show ip route 18.10.0.10
Routing entry for 18.10.0.8/29
Known via "ospf 1", distance 110, metric 20, type extern 2,
forward metric 10
...
```

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Forwarding Address Problem



R5:

```
router ospf 1
network 18.10.0.0 0.0.0.255 area 1
redistribute rip subnets
redistribute connected subnets
```

```
!
router rip
network 10.0.0.0
```

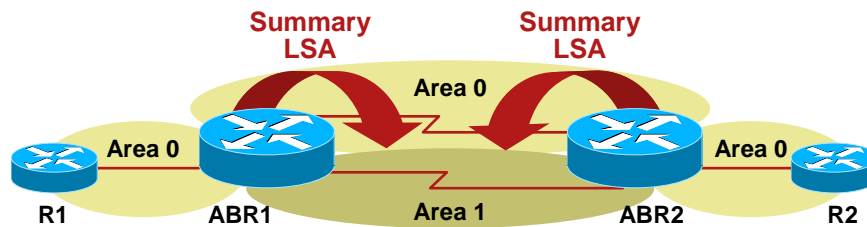
R4:

```
router ospf 1
area 1 range 18.10.0.0 255.255.255.240
```

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Discontiguous Backbone



- R1 and R2 are not be able to see each other
- Summary LSA for inter-area routes must not be generated into the backbone
- The solution is to create virtual link between ABR1 and ABR2

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SPF Running Constantly

Useful Commands for This Problem

- Show IP OSPF stat
- Show IP OSPF database
- Show IP OSPF database database-sum

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SPF Running Constantly

Reasons

- LSA Flaps Due To:
 - Duplicate RID/IP address
 - Constant link flapping in an area

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SPF Running Constantly

Requires Enable Mode

```
R3#sh ip ospf stat
Area 0: SPF algorithm executed 42 times
Area 1: SPF algorithm executed 38 times

SPF calculation time
Delta T   Intra D-Intra Summ   D-Summ Ext   D-Ext Total Reason
00:22:00 0 0 0 0 0 0 0 R, N, SN,
00:21:44 0 0 4 0 0 0 4 R, SN, X
00:21:34 0 0 4 0 0 0 4 R, SN, X
00:21:24 0 0 0 4 0 0 4 R, SN, X
00:21:14 0 0 0 0 0 0 0 R,
00:21:04 0 0 0 0 0 0 0 R, N, SN,
00:20:54 0 0 0 0 0 0 0 X
00:20:44 0 0 4 0 0 0 4 R, SN, X
00:20:34 0 0 0 0 0 0 0 X
00:00:17 4 0 0 0 0 0 4 R, N, SN, SA, X
...
R=Router LSA; N=NetworkLSA; SN=Summary Network LSA; SA=Summary
ASBR LSA; X=External LSA
```

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Show IP OSPF Stat

Requires Enable Mode

```
R1#show ip ospf stat detail

OSPF process ID 100
-----
Area 0: SPF algorithm executed 1 times

SPF 1 executed 1w0d ago, SPF type Full
SPF calculation time (in msec):
SPT  Intra D-Intr Summ  D-Summ Ext7  D-Ext7 Total
0    0    0    0    0    0    0    0    0
LSIDs processed R:1 N:0 Stub:1 SN:0 SA:0 X7:0
Change record R,
LSIDs changed 1
Last 10 LSIDs:
4.4.4.4(R)

Summary OSPF SPF statistic

SPF calculation time
Delta T  Intra D-Intra Summ  D-Summ Ext  D-Ext Total Reason
1w0d    0    0    0    0    0    0    0    R,
```

SPF Running Constantly

```
R3#deb ip ospf mon
OSPF: Schedule SPF in area 1
Change in LS ID 1.1.1.1, LSA type R,
OSPF: schedule SPF: spf_time 0ms wait_interval 861421816s
OSPF: Begin SPF at 0x33585480ms, process time 752ms
spf_time 0ms, wait_interval 861421816s
OSPF: End SPF at 0x33585488ms, Total elapsed time 8ms
Intra: 4ms, Inter: 0ms, External: 0ms
```

SPF Running Constantly

```

R3#show ip ospf database

OSPF Router with ID (3.3.3.3) (Process ID 1)

Router Link States (Area 0)

Link ID  ADV Router  Age  Seq#      Checksum  Link count
3.3.3.3  3.3.3.3    106  0x80000009  0xC3F1    3
...

Summary Net Link States (Area 0)

Link ID  ADV Router  Age  Seq#      Checksum
18.10.0.0  7.7.7.7    3 (DNA)  0x80000008  0x3DC2
18.10.0.0  8.8.8.8    1396    0x80000004  0x27D8
...

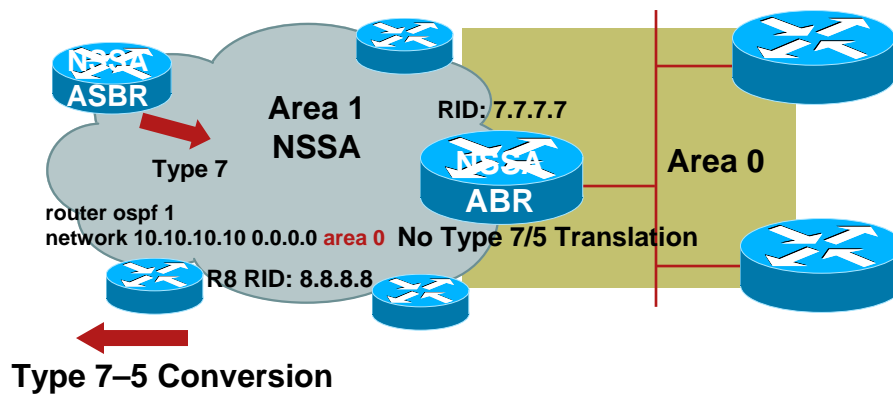
Router Link States (Area 1)

Link ID  ADV Router  Age  Seq#      Checksum  Link count
1.1.1.1  1.1.1.1    2    0x80000016  0xE6CD    2
...

```

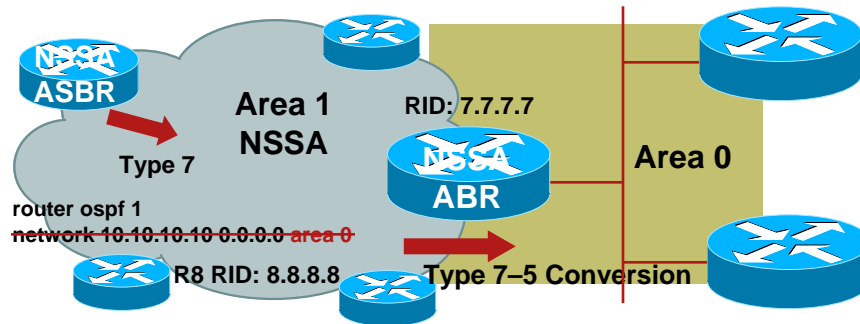
NSSA ABR Not Translating Type 7 LSA

- Only NSSA ABR with the highest RID does the conversion



NSSA ABR Not Translating Type 7 LSA

- Only NSSA ABR with the highest RID does the conversion



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Common Issues



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Interface Scoped Debugging

- Enhancement in limiting the OSPF debug output to just a selection of interfaces
- Example below will generate debug output for only two interfaces specified below

```
debug condition interface Ethernet 0/0
```

```
debug condition interface Ethernet 1/0
```

```
debug ip ospf hello
```

```
debug ip ospf adjacency 
```

Available in: 12.4(4)T 12.2(30)S 12.0(32)S

```
debug ip ospf flood 
```

Further enhancement to allow an access-list filter, and a "detail" option (for verbose output)

Available in: 12.4(4)T 12.2(30)S 12.0(32)S

```
debug ip ospf packets
```

Available in: 12.4(10) 12.2(33)SXH 12.2(33)SRB

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OSPF Traffic Statistics

show/clear ip ospf [process-id] traffic [interface]

- Output consists of:
 - Global summary section
 - Per-process sections
 - OSPF queues
 - Interface details
 - Per-process summary

```
router2#show ip ospf traffic
```

```
OSPF statistics:
```

```
Rcvd: 29 total, 0 checksu errors  
7 Hello, 8 database desc, 2 link state req  
8 link state updates, 4 link state acks
```

```
Sent: 29 total
```

```
8 Hello, 6 database desc, 2 link state req  
8 link state updates, 5 link state acks
```

- Available in: 12.4(6)T 12.0(28)S 12.2(30)S
- OSPFv3 support in 12.2(31)SB

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OSPF Traffic Statistics— Per Process Summary

```

Summary traffic statistics for process ID 1:

OSPF packets received/sent

Type  Packets  Bytes
RX Invalid 0      0
RX Hello  8      384
RX DB des  8      496
RX LS req  2      72
RX LS upd  8      740
RX LS ack  4      236
RX Total  30     1928

TX Failed  0      0
TX Hello  10     792
TX DB des  6      624
TX LS req  2     112
TX LS upd  8     708
TX LS ack  5     460
TX Total  31     2696

OSPF header errors
Length 0, Checksum 0, Version 0, Bad Source 0,
No Virtual Link 0, Area Mismatch 0, No Sham Link 0,
Self Originated 0, Duplicate ID 0, Hello 0,
MTU Mismatch 0, Nbr Ignored 0, LLS 0,
Authentication 0, TTL Check Fail 0,

OSPF LSA errors
Type 0, Length 0, Data 0, Checksum 0,
    
```

Per process filter:
`sh ip ospf <process_id> traffic`

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OSPF Traffic Statistics—Queues

```

          InputQ      UpdateQ      OutputQ
Limit          0          200          0
Drops          0          8881         0
Max delay [msec] 1076        21188        28
Max size       3961          200          6
  Invalid      0            0            0
  Hello       3961          0            0
  DB des      0            0            0
  LS req      0            0            0
  LS upd      0           200            0
  LS ack      0            0            6
Current size   0            0            0
  Invalid     0            0            0
  Hello       0            0            0
  DB des      0            0            0
  LS req      0            0            0
  LS upd      0            0            0
  LS ack      0            0            0
    
```

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OSPF Traffic Statistics—Interface Details

Interface Serial2/0

OSPF packets received/sent

Type	Packets	Bytes
RX Invalid	0	0
RX Hello	8	384
RX DB des	8	496
RX LS req	2	72
RX LS upd	8	740
RX LS ack	4	236
RX Total	30	1928
TX Failed	0	0
TX Hello	10	792
TX DB des	6	624
TX LS req	2	112
TX LS upd	8	708
TX LS ack	5	460
TX Total	31	2696

Per interface filter:
`Show/clear ip ospf traffic <if_name>`

Available in: 12.4(6)T 12.0(28)S

OSPF header errors
Length 0, Checksum 0, Version 0, Bad Source 0,
No Virtual Link 0, Area Mismatch 0, No Sham Link 0,
Self Originated 0, Duplicate ID 0, Hello 0,
MTU Mismatch 0, Nbr Ignored 0, LLS 0,
Authentication 0, TTL Check Fail 0,

OSPF LSA errors
Type 0, Length 0, Data 0, Checksum 0,

Interface Related Enhancements



OSPF Packet Size Honors IP MTU

- Default OSPF packet size 1500B
- IP MTU small, for example 1400 in IPSec environment
 - OSPF builds 1500B packet, IP code does packet fragmentation
 - Increase in CPU load and pps rate
- IP MTU large, for example 4470 on POS interface
 - Available resources are not used
- CSCse01519
 - Available in 12.4(13), 12.2(33)SXH, 12.2(33)SRB

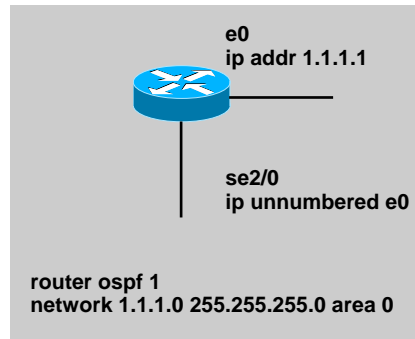
Interface Brief Keyword

- Show ip ospf interface brief
- Show ipv6 ospf interface brief

```
r100#sh ipv6 ospf interface brief
Interface      PID      Area          Intf ID    Cost  State Nbrs F/C
Lo2147483644  65535   4294967294    21         65535 LOOP  0/0
Lo2147483647  65535   255.255.255.255 22         1     LOOP  0/0
VL1           6       0              25         65535 DOWN  0/0
VL0           6       0              24         62    P2P   1/1
Se3/0         6       0              14         64    DOWN  0/0
Lo1           6       0              20         1     LOOP  0/0
Se2/0         6       6              10         62    P2P   1/1
Tu0           1000    0              19         11111 DOWN  0/0
```

Interface-Based OSPF Enable

- OSPF has traditionally supported enabling the protocol on interfaces by a “network” command
- On unnumbered interfaces, OSPF automatically assumes the same area as the corresponding numbered interface
- What if the unnumbered interface is desired to be in a different area?

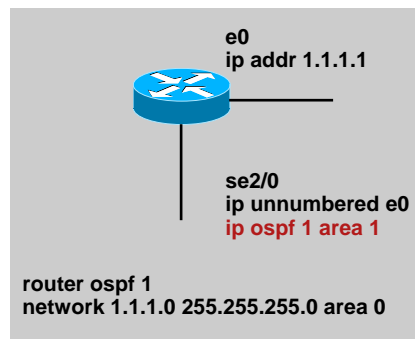


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Interface-Based OSPF Enable

- Allow an interface specific command to enable OSPF in a different area
- Interface scoped command has higher precedence
- This allows to preserve address space
- A new tool which can be used instead of network command
- By default secondary addresses are announced; can be turned off with an option
`ip ospf 1 area 1 secondaries none`
- Available in:
`12.3(11)T 12.2(28)SB 12.0(29)S`



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OSPF Graceful Shutdown



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OSPF Graceful Shutdown

- Technique of removing an OSPF router from a network with minimal disruption to the network
- OSPF configuration is retained
- When router enters the shutdown mode it informs all other routers in the network about this event
 - Floods it's own maxed router-lsa in each area
 - Sends Hello packet with no neighbors listed on all it's interfaces
- OSPF process does not perform any activity when shutdown
 - OSPF packets received on any interface are dropped
 - No OSPF packets are sent
 - Only configuration changes are processed

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OSPF Graceful Shutdown (Cont.)

- Router Mode command
 [no] shutdown
- Per interface shutdown is also available
 - Hello packet with no neighbors is sent on interface
 - Link(s) associated with the interface are removed from Router LSA
 - Network LSA is flushed for broadcast segment
 - OSPF operation is disabled on the interface
 - OSPF configuration is retained
- Interface Mode command
 [no] ip ospf shutdown
- Available in 12.2(33)SRC

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Summary

What We Learned?

- Overview of OSPF LSAs
- Different troubleshooting commands and what to look for in those commands
- Common issues in OSPF networks; e.g., adjacency problems, information in the database but not in RT, SPF problems and NSSA problems and how to correct those problems
- OSPF Troubleshooting Enhancements including debugs and interface based enhancements

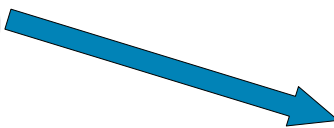
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More Information

- White Papers
- Web and Mailers
- Cisco Press

RTFB

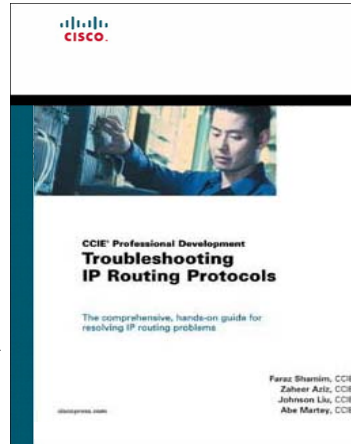


CCO OSPF Page:

http://www.cisco.com/en/US/tech/tk365/tk480/tsd_technology_support_sub_protocol_home.html

Customer Support Mailing List:

tac@cisco.com

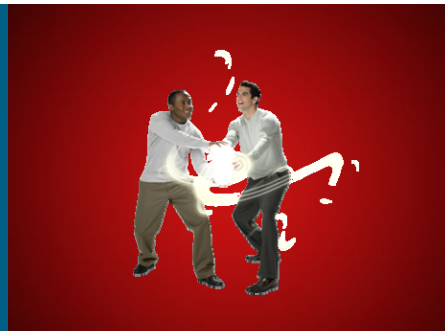


RTFB = "Read the Fine Book"

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Q and A



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