

OSPF Packet Header

0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
Version #	Type	Packet Length	
Router ID			
Area ID			
Checksum		Instance ID	0

Type 1 Hello
 Type 2 Database Description
 Type 3 Link State Request
 Type 4 Link State Update
 Type 5 Link State Acknowledgment

OSPF Hello

0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
Version #	1	Packet Length	
Router ID			
Area ID			
Checksum		Instance ID	0
Network Mask			
Hello Interval		Options	Router Pri
Router Dead Interval			
Designated Router			
Backup Designated Router			
Neighbor (could repeat for multiple neighbors)			

Options Field

0	1	2	3	4	5	6	7
*	*	DC	R	N/P	*	E	V6

DC Bit: identifies support for demand circuits
 R-bit: specifies whether the router is Active or not.
 N/P Bit: support for LSA Type 7 (NSSA Externals)
 MC Bit: support for multicast packets (MOSPF)
 E Bit: identifies the support for LSA type 5 packets
 V6-bit: IPv6 routing calculations are to be used.

OSPF Database Description

0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
Version #	2	Packet Length	
Router ID			
Area ID			
Checksum		Instance ID	0
Interface MTU		Options	0 0 0 0 0 I M MS
An LSA Header			

I Bit: When set, this is the first in sequence of database descriptor packets
 M Bit: When set, there are more database descriptor packets to follow
 MS Bit: Master/Slave bit, when set, this router is the master

OSPF Link State Request

0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
Version #	3	Packet Length	
Router ID			
Area ID			
Checksum	Instance ID	0	
Link State type			
Link State ID			
Advertising Router			

After exchanging Database Description packets with a neighboring router, a router may find that parts of its link-state database are out-of-date. The Link State Request packet is used to request the pieces of the neighbor's database that are more up-to-date.

OSPF Link State Update

0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
Version #	4	Packet Length	
Router ID			
Area ID			
Checksum	Instance ID	0	
How many LSAs within this update			
LSAs			

OSPF LSA Header

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								LS Type*																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							

* To keep from confusing routers, the LS Type is the type value + 0x2000

LSA Type 1 – Router LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								1 (0x2001)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0	Nt x V E B							Options																							
Type	0							Metric																							
Interface ID																															
Neighbor Interface ID																															
Neighbor Router ID																															

} Could repeat for multiple links

LSA Type 1 Bits/Fields

- Nt Bit: When set, the router is an NSSA border router and will translate LSA Type -7 to LSA Type-5
- V Bit: When set, the router is an endpoint of one or more fully adjacent virtual links.
- E Bit: When set, the router is an AS boundary router
- B Bit: When set, the router is an area border router
- Type is a brief description of the link
 - 1 Point to point
 - 2 connection to transit network
 - 3 connection to a stub network
 - 4 Virtual link
- Link ID identifies the object that this links connects to
 - 1 Neighbors Router ID
 - 2 IP address of the DR
 - 3 IP Network/Subnetwork number
 - 4 Neighbor Router ID
- # TOS is the number of different Type of Service metrics given (other than the required link metric)

LSA Type 2 – Network LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								2 (0x2002)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0				Options																											
Attached Router ID																															

LSA Type 3 – Inter-Area-Prefix LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								3 (0x2003)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0				Metric																											
Prefix Length				Prefix Options				0																							
Address Prefix																															

LSA Type 4 – Inter-Area-Router LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								4 (0x2004)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0				Options																											
0				Metric																											
Destination Router ID																															

LSA Type 5 – AS External LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								5 (0x2005)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0 0 0 0 0 E F T								Metric																							
Prefix Length				Prefix Options				Reference LS Type																							
Address Prefix																															
Forwarding Address (optional)																															
External Route Tag (optional)																															
Referenced link State ID (optional)																															

} Could repeat for multiple links

LSA Type 7 – NSSA External LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								7 (0x2007)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
0 0 0 0 0 E F T								Metric																							
Prefix Length				Prefix Options				Reference LS Type																							
Address Prefix																															
Forwarding Address (optional)																															
External Route Tag (optional)																															
Referenced link State ID (optional)																															

} Could repeat for multiple links

LSA Type 8 – Link LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								8 (0x2008)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
Router Priority				Options																											
Link Local Interface Address																															
Number of Prefix																															
Prefix Length				Prefix Options				0																							
Address Prefix																															

Could repeat for multiple Prefixes

LSA Type 9 – Intra-Area-Prefix LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								9 (0x2009)																							
Link State ID																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
Number of Prefixes								Referenced LS Type																							
Referenced Link State ID																															
Referenced Advertising Router ID																															
Prefix Length				Prefix Options				Metric																							
Address Prefix																															

Could repeat for multiple Prefixes

LSA Type 12 – Opaque LSA

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Link State Age								1 S12	12																						
0 (Link State ID)																															
Advertising Router																															
Link State Sequence Number																															
Link State Checksum								Length																							
Type								Length																							
Information Capabilities																															

S12 bits are dependent on the desired flooding scope for the LSA.

Information Capability Types

The following informational capability bits are assigned:

Bit	Capabilities
0	OSPF graceful restart capable [GRACE]
1	OSPF graceful restart helper [GRACE]
2	OSPF Stub Router support [STUB]
3	OSPF Traffic Engineering support [TE]
4	OSPF point-to-point over LAN [P2PLAN]
5	OSPF Experimental TE [EXP-TE]
6-31	Unassigned (Standards Action)

OSPF Link State Acknowledgement

0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Version #				5				Packet Length																							
Router ID																															
Area ID																															
Checksum								Instance ID				0																			
An LSA Header																															

To make the flooding of LSAs reliable, flooded LSAs are explicitly acknowledged. This acknowledgment is accomplished through the sending and receiving of Link State Acknowledgment packets.