OSPF | LINK-STATE (DistVector IA) | RFC 2328, 2740 | IP/89 | 224.0.0.5, 224.0.0.6

Packet Types:
1. **Hello** (kind of 3-way handshake -> 2WAY)
2. **DB D**escriptor (**Seq**, M(ore),I(nitial), MTU)
   ^^ only Master increments
3. **LSR** (Request)
4. **LSU** (Upd. - can ACK) solic. unicast, unsol. mcast
5. **LSAck** (Acknowledgement)

LSA Header (20B):
LS Age (max3600)
Options
LS Type
LS ID →
Adv. Router(Orig.)
LS Seq. no.
LS Checksum

(1*) LS ID for each type

LSA	LS ID
1	originator RID
2	IP DR
3	Dest. network IP addr.
4	ASBR RID
5,7	Dest. network IP addr.

OSPF Header:
Version, PackType (1-5),
Router ID, Area ID, Chksum
AuthType, Auth, Data

Hello Packet:
IF Mask
Hello, Dead-interval
Priority, DR, BDR
List of seen Neighbors
b7 -**DN** (loop prev.)
b6 - **O** (supp. Opaq)
b3 - **N**(SSA)/**P**(ropagat)
b1 - **E** (0=stub)

Router LSA:
- Link ID (LID)
- Link Data (LDT)
- IF Type (4 types)
- **Metric**
- **V-bit** (VirtualLink)
- **E-bit** (ASBR)
- **B-bit** (ABR)

T	Description	Link ID	Link Data
1	**Point-to-point numbered**	Neigh. RID	Interface IP
1	**Point-to-point unnumbered**	Neigh. RID	MIB IfIndex
2	**Transit** (has neighs. + DR)	DR IP	Interface IP
3	**Stub** (no neigh. on segment)	IP network	Subnet Mask
4	**Virtual Link**	Neigh. RID	Interface IP

Network LSA contains all the attached routers to the broadcast seg:
- Segment Mask + RIDs of connected routers including DR
Summary LSA contains: Network Mask, Metric
External LSA contains: Mask /(prefix is in **LSID**, header), **E**-bit (0=E2 def.), Metric, FwdAddr
NSSA External (like T5) - when multiple ABRs, highest RID performs translation

LSA Types:
1. Router
2. Network (by DR)
3. Summary
4. ASBR Summary
5. Ext. (flood domain.)
6. MOSPF
7. NSSA External
8. External Attrib.
9. Link-local Opaq.
10. Area-local Opaq.
11. AS Opaq.

Adj. states:
1. **DOWN**
2. **ATTEMPT** (in NBMA)
3. **INIT** (other Hello seen)
4. **2-WAY** - (Hel. w/ own RID DR/BDR)
5. **EXSTART** - MTU, Master/Slave
6. **EXCHANGE** (DD)
7. **LOADING** (DD done, LSA transfer)
8. **FULL**

DR Elect: first send 0.0.0.0 DR/BDR. Neighbors claim DR or BDR. Router accepts them (no preempt)

Virtual Links:
through a single area, nonbackbone, cost is ABR-ABR not through STUB, ABR sets **V** bit in LSA 1
Type 5 not send on VL; 2 purposes: **0-A1-A2**, **0-A1-0**

Network Types	DR/ BDR	Neigh. Discov	Standard?
Broadcast **MA**	DR	Yes	Cisco
Non-Broadcast **MA**	DR	-	RFC 2328
P-t-MP Non Broadcast	-	-	Cisco
P-t-MP	-	Yes	RFC 2328
P-t-P	-	Yes	Cisco

Area Types + allowed LSA Types:

Area Type	1&2	3	4	5	7
Backbone	Yes	Yes	Yes	Yes	-
Std, non-STUB	Yes	Yes	Yes	Yes	-
STUB	Yes	Yes	-	can have ASBR but extern routes local	-
TOTALLY STUB	Yes	- (only default T3)	-	-	-
NSSA	Yes	Yes	Yes	-	Yes

Overload: advertise cost 65535 (max) for all transit links (not stubs!)
Default route: T3 (in NSSA can be T7)

Graceful Restart modes:
- Possible Helper (default)
- Helper (after receving Grace-LSA)
- Restart Candidate (the restarting Router)

GraceTLV T9 (Opaq link-scope) contains
Grace Period
Restart Reason - unknown, soft upgrade
IP IF Addr

Out of Helper mode when
1) **Grace-LSA flushed** by originating router
2) **Grace-LSA expires**
3) **change** in link-state database

Interface States:
Down
Lo
Waiting (to determine (B)DR)
P2P
DROther
Backup
DR

OSPF Route Preference:
O > IA > E1 > E2
Cost to SummaryLSA:
cost(ABR)+cost(LSA)
Cost to External 1:
*[cost(ABR)+cost(ASBR)]+*cost(LSA)
Cost to External 2 (default):
cost(LSA)

ABRs ignore LSAs by other ABRs, when learned through nonBB area.

Metric on outgoing interface used
HK **5** - SJ **15** - P **25** => HK->P = **45**

SFP Algorithm: all **LSDB** -> **Candidate** Table -lowest-> **Tree**

LSA MaxAge: 3600s
LSA Refresh: 1800s/3000s