TLV s

1: Area Address - Generally 0 => 3 areas, else 1-254   **Hello,LSP**

2: IS Reachability - adjacent/neighbor routers   **LSP**
- Virtual/Partition Flag (unsup, 0)
- **R-bit** (0-reserved) + **I/E Bit** (always **I** in this TLV) + **Metric** (6b) - 0-63 old-style
- **S-bit**=1 => unsupported + **I/E Bit** + **Other Metrics** (unsupported) **X 3**
- **NeighborID** + 1 Bytes (00 if router, >00 if pseudonode)

22: Extended IS Reachability (wide-metrics 24 bit + TE for each neighbor)
- SubTLVs: "color", max link BW, reserv. BW, TE metric..

128: IP Internal Reach. (advertise local subnets with small metric)   **LSP**
- **U/D Bit** (0= adv. to upper, <u>1</u> = don't) and **I/E bit** (always **I** in this TLV) + M**etric**
- **S-bit**=1 => unsupported, R-bit (Reserved), **Other Metrics** (unsupported) **X 3**
- **Prefix** (IP + mask)

130: IP External Reach. (adv. external routes, like **TLV 128** with **Ext**-bit) - only in **L2**

135: <u>Extended</u> IP Reachability (wide-metrics 32 bit, **U/D**-bit, **Prefix**, **SubTLVs** (TE, etc))

When only Wide-Metrics used (TLV22 and 135) **I/E** bit lost (externals from L1 -> L2)
If **U/D** set to **Down**, the route was leaked from L2->L1, cannot be injected back to L2.
External routes in L1 (redistributed) have **U/D** set to **Up**, can be injected to L2.

6: IS neighbors (list of all neighbors sending hellos)   **Hello (not P2P)**
8: Padding (0x00 -> 1492 bytes)   **Hello**
9: LSP Entry (detailed separately)   **SNP**
10: Auth (plain, MD5)   **ALL**
12: Checksum   **Hello, SNP**
129: Protocols Supported (IPv4 or IPv6)   **Hello, LSP**
132: IP Interface Address (default only Loopback) - max 63   **Hello, LSP**
134: Traffic Engineering RID   **LSP**
137: Dynamic HostName (hostname)   **LSP**
211: Graceful Restart Flags: **RA** (Restart ACK) + **RR** (Restart Request) + Rem. Time   **Hello**
240: PtP Adjacency (for 3-way handshk; if unsupported, revert to 2-way hs)   **PTP Hello**
232: IPv6 Interfaces Address   **Hello, LSP**
236: IPv6 Reachability   **LSP**

Adjacency States: <u>NOIU</u>

1. <u>**N**</u>ew
2. <u>**O**</u>ne-Way (-> hello)
3. <u>**I**</u>nitializing (after <- hello)
(after 3rd hello bcast, P2P TLV240)
4. <u>**U**</u>p (OK!)
- a) -> CSNP
- b) -> PSNPs (if info miss)
- c) -> LSP
- d) -> PSNP (ack on P2P)
- or -> CSNP (ack on BCAST)
5. **Down** (NOK!)
6. **Reject** (Auth Failure)

Common Header

1. Protocol ID
3. Prot ID Extension
4. ID Length (0x00 = 6B)
5. PDU Type:
- 15) L1 LAN Hello
- 16) L2 LAN Hello
- 17) PtP Hello
- 18) L1 LSPDU
- 20) L2 LSPDU
- 24) L1 CSNP
- 25) L2 CSNP
- 26) L1 PSNP
- 27) L2 PSNP
6. Version
7. Reserved
8. Maximum Area Addresses
if =0 =>3 areas. Else choose 1-254

NSAP Addressing:

```
49.0002.1921.6802.4001.00
AFI| DSP  |  System ID  |NSEL
1B |1-12B|     6B       | 1B
```

ALL L1 IS: 01:80:c2:00:00:14
ALL L2 IS: 01:80:c2:00:00:15

AFI: Authority and Format Indicator
DSP: Domain Specific Part
NSEL: port no. in ISO (mostly 0) -> **NET**
(Network Entity Title)

DIS Elect (preempt, highest)
- Priority
- MAC, DLCI (SNPA)
- System ID
DIS has Holdtime 9 / Hello 3 +
DIS sends CSMP every 10s
No BDIS. If preempt resend LSP
Prio 0 can be **DIS** (unlike OSPF) Adj.
full mesh DIS-IS, IS-IS

For adjacency match: **MTU(?)**, **Hello**
& **Holdtime(?)**, **Auth**, **Level**

ISIS area similar to NSSA. L1 routes -> L2, L1 can have ext. (redistr. allowed), L1 external can be sent to L2 (if only widemetrics, is default)

Graceful Restart:
- **TLV211** sent in Hellos (**RR & RA = 0**)
- when neighbors restarts, sets **RR** =1
- neighbor(s) set **RA** = 1
- after restart router sets **RR** = 0
- neighbors set **RA**=0

LAN Hello PDU (IIH)
- Circuit Type (L1/L2/L12)
- Source ID (System ID)
- Holdtime (def 27, /3 KA)
- PDU Length (1492!)
- <u>Priority (default 64)</u>
- LAN ID (DIS SysID+CirID)

PtP Hello PDU (no neigh TLV)
- Circuit Type (L1/L2/L12)
- Source ID (System ID)
- Holdtime (def 27, /3 KA)
- PDU Length (1492!)
- <u>CircuitID</u>

CircuitID: each interface has one.
Loopbacks and PtP: "1". Rest, >2

LSP
- Len, Remaining Lifetime (1200s def)
- LSP ID (**SysID**+**CirID**+**LSP no.**(fragments))
- Seq No. (incremented on change)
- Checksum
- Attrs (supported below):
  - **bit3 - Attached** Bit (default route)
  - **bit2 - Overload** Bit (can have timer)
  - **bit0,1 - 0x01/L1**   **0x03/L2 or L12**

Old Metric: link 0-63 path 1024
New Metric: 24 bits path 32bits
Def. IF Metric: 10 (Lo = 0)
Route Leaking (to optimize)
ISIS Neighbors can have different parameters, and they can be changed on-the-fly
Network types: Brdcast & PtP