

IS-IS — General	
Link State Routing Protocol (like OSPF)	
OSI-based — operates at Layer 2 (Data Link)	
ISO 10589 standard / Integrated IS-IS: RFC 1195	
Supports IPv4 and IPv6 (Multi-Topology)	
No IP protocol number — runs directly over L2	
Metric: Default cost 10 per interface	
Supports wide metrics (32-bit, up to 16,777,215)	
Preferred in large SP / carrier networks	
Faster convergence than OSPF in large topologies	
Does not use areas for backbone like OSPF Area 0	

Administrative Distance	
Cisco (IOS)	115
Cisco (XR)	115
Juniper	15
Nokia	15
Huawei	10

Key Timers	
Hello (IIH)	10s (point-to-point & broadcast)
Hold Time	3 x Hello = 30s (default)
LSP Lifetime	1200 seconds (20 minutes)
LSP Refresh	900 seconds (15 minutes)
CSNP Interval	10s (broadcast only)
Retransmit	5 seconds (P2P only)

IS-IS PDU Types	
IIH	IS-IS Hello — neighbour discovery
LSP	Link State PDU — topology information
CSNP	Complete Sequence Number PDU
PSNP	Partial Sequence Number PDU

IS-IS Router / Level Types	
Level 1 (L1)	Intra-area routing only
Level 2 (L2)	Inter-area / backbone routing
L1/L2	Both — similar to OSPF ABR
L1 router	Knows only intra-area topology
L2 router	Knows inter-area topology
L1/L2 router	Leaks routes between levels
DIS	Designated IS (broadcast networks)
Pseudonode	Virtual node on broadcast LAN

NET Address Format	
AFI	Authority & Format Identifier (49 = private)
Area ID	Variable length (e.g. 0001)
System ID	6 bytes — unique per router (like MAC)
NSEL	N-selector (00 = router itself)
Example	49.0001.1921.6800.1001.00
Loopback	Use lo0 IP encoded into System ID

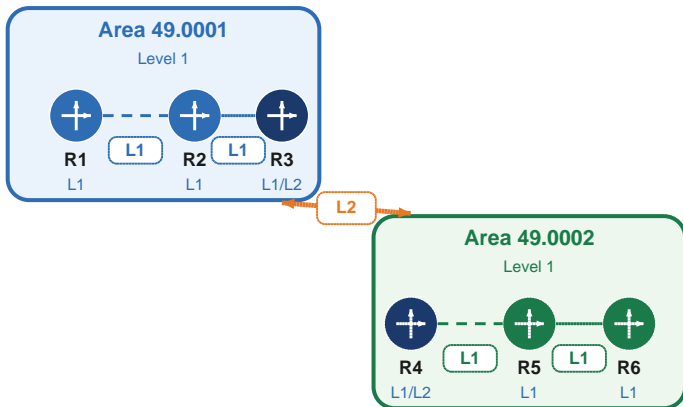
Network & Metric	
Broadcast	DIS elected — Hello every 10s
Point-to-Point	No DIS — adjacency directly
P2P on LAN	isis network point-to-point
Metric type	Narrow (6-bit) or Wide (32-bit)
Wide metric	metric-style wide (recommended)
Auth	MD5 or clear-text per interface/area

IS-IS vs OSPF Comparison		
Feature	IS-IS	OSPF
Standard	ISO 10589/RFC1195	RFC 2328
Transport	Direct L2 (no IP)	IP Protocol 89
Area design	L1 / L2 levels	Area 0 backbone
Default metric	10 all interfaces	Cost = ref/bw
Backbone	L2 adjacencies	Area 0 required
SPF scope	Per level	Per area
Convergence	Faster (SP pref.)	Slightly slower

IS-IS TLV Types	
TLV 1	Area Addresses
TLV 2	IS Neighbours (L1)
TLV 4	Partition Designated Level 2 IS
TLV 6	IS Neighbours (L2)
TLV 10	Authentication Information
TLV 22	Extended IS Reachability (wide metric)
TLV 128	IP Internal Reachability (narrow)
TLV 130	IP External Reachability (narrow)
TLV 132	IP Interface Addresses
TLV 135	Extended IP Reachability (wide metric)
TLV 222	Multi-Topology IS Reachability
TLV 232	IPv6 Interface Addresses
TLV 236	IPv6 IP Reachability

Key Cisco IOS Commands	
router isis	
net 49.0001.1921.6800.1001.00	
is-type level-1   level-2   level-1-2	
metric-style wide	
log-adjacency-changes	
interface <intf>	
ip router isis	
isis circuit-type level-1   level-2	
isis metric <value>	
isis hello-interval <sec>	
isis hello-multiplier <n>	
isis network point-to-point	
isis priority <0-127>	
isis authentication mode md5	
show isis neighbors	
show isis database	
show isis database detail	
show ip route isis	
show isis topology	
debug isis adj-packets	

IS-IS Level Hierarchy & Area Topology

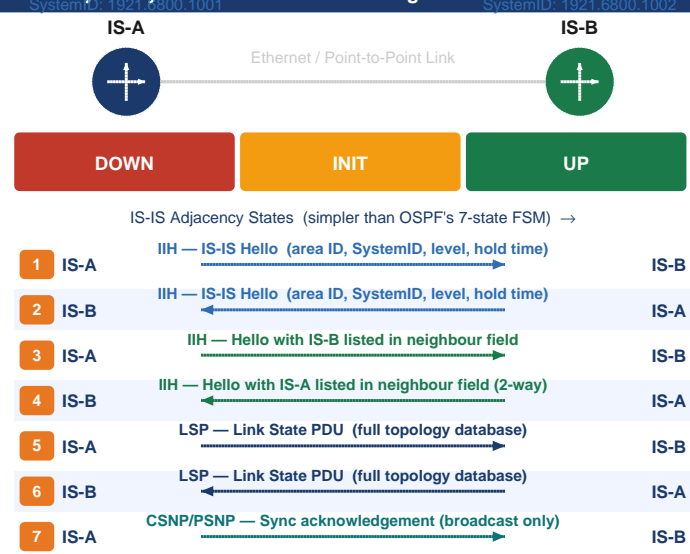


--- L1 adjacency (intra-area)    L2 adjacency (inter-area)    L1/L2 border router

IS-IS Level Design Rules

L1 routers know only their area topology — default route to L1/L2.  
 L2 routers form the backbone — can span multiple areas.  
 L1/L2 routers participate in both — leak routes between levels.  
 Route leaking: L2 -> L1 needed for specific prefix visibility.  
 No Area 0 requirement — L2 adjacencies form the backbone.

IS-IS Adjacency Formation & PDU Exchange



IS-IS Adjacency UP — SPF runs

**IS-IS Adjacency Requirements**

- Area addresses must overlap (at least one common area ID)
- Level must match (L1 with L1, L2 with L2, L1/L2 both)
- Metric style must match (narrow or wide on same link)
- Authentication must match if configured
- MTU must match on both sides of adjacency
- System IDs must be unique within the routing domain

**DIS — Designated IS (Broadcast networks only)**

- DIS elected based on highest interface priority (0-127).
- Tie-break: highest SNPA (MAC address).
- DIS generates pseudonode LSP for the LAN segment.
- No backup DIS — pre-emption enabled by default.
- All routers form adjacency with all others on LAN.

IS-IS PDU & NET Address Structure

NET Address Format (Network Entity Title)

AFI	Area ID	System ID	NSEL	Example
1B 49=private	1-13B variable	6B unique router ID	1B 00 = router	49.0001.1921.6800.00

IIH PDU — IS-IS Hello (neighbour discovery)

main	Router ID	Length	PDU Type	Circuit	Source ID	Holding	Trip	PDU Length
1B	1B	1B	1B IIH	1B L1/L2	6B	2B	2B	2B

LSP PDU — Link State PDU (topology distribution)

DU	Remaining Lifet	LSP ID	Sequence Num	Checksum	Type	Block	TLVs
2B	2B	8B SysID+PN+Frag	4B	2B	1B	Variable	Variable

CSNP & PSNP (database synchronisation)

PDU	Length	Source ID	Start LSP ID	End LSP ID	LSP Entries	Other	TLVs
2B	2B	7B	8B	8B	TLV 9	Variable	Variable

IS-IS PDU Type Codes

L1 LAN IIH	PDU type 15 — Hello on L1 broadcast
L2 LAN IIH	PDU type 16 — Hello on L2 broadcast
P2P IIH	PDU type 17 — Hello point-to-point
L1 LSP	PDU type 18 — L1 Link State PDU
L2 LSP	PDU type 20 — L2 Link State PDU
L1 CSNP	PDU type 24 — L1 Complete SNP
L2 CSNP	PDU type 25 — L2 Complete SNP
L1 PSNP	PDU type 26 — L1 Partial SNP
L2 PSNP	PDU type 27 — L2 Partial SNP

IS-IS Metric Types

Narrow metric: 6-bit per link (max 63), 10-bit total (max 1023).  
 Wide metric: 32-bit per link (max 16,777,215) — recommended.  
 Default metric: 10 on all interfaces — must tune manually.  
 Use metric-style wide globally to enable wide metrics.