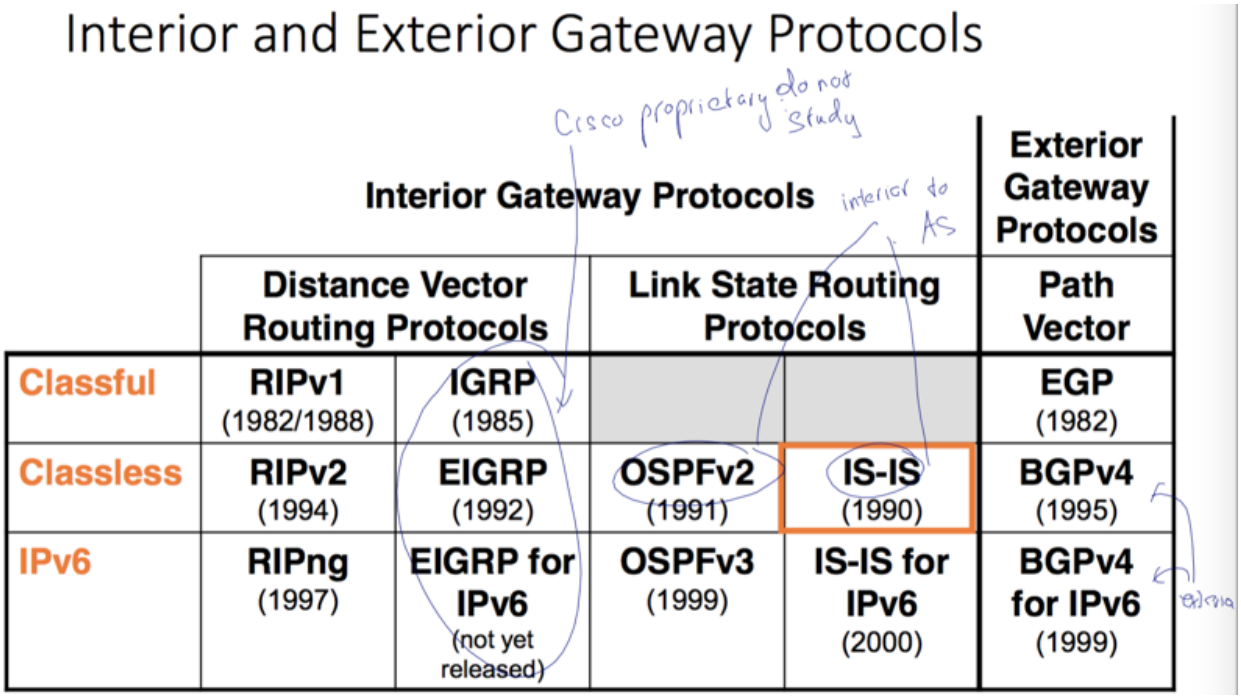
Chapter 07 - ISIS

ISIS is yet another routing protocol.



Similarities to OSPF

- Link State Routing, using Dijkstra-based SPF algorithm
- Hellos to maintain adjacencies
- Hierarchical
- address summarization
- classless
- elect and use DR for broadcast
- authentication capabilities

Differences

- IS-IS does not have the concept of backbone area 0.
- IS-IS does not use IP, it uses OSI network layer addressing (on top of MAC address): 8–20 bytes

IS-IS versus OSPF

Terminology

IS-IS	OSPF	Comments
ES (End System)	Host	
IS (Intermediate System)	Router	
Circuit	Link	
SNPA (Subnetwork Point of Attachment)	Datalink Address	
PDU (Protocol Data Unit)	Packet	
DIS (Designated Intermediate System)	DR (Designated Router)	
N/A	BDR	
IIH (IS-to-IS Hello Packet)	Hello packet	

IS-IS	OSPF	Comments
LSP (Link-State Packet)	LSA (Link -State Advertisement)	LSAs are actually comparable to TLVs used in LSPs.
CSNP (Complete Sequence Number PDU or Packet)	DBD (Data Base Description Packet)	
PSNP (Partial Sequence Number PDU or Packet)	LSAck or LSR (Link State Request)	
Routing Domain	AS	The term routing domain is also used with OSPF.
Level 1 Area	Area (non-backbone)	
Level 2 Area	Backbone area (Area 0)	IS-IS uses a backbone path connected by contiguous L2 routers. There is no backbone area in IS-IS

Routers

IS-IS	OSPF	Comments
Level 1 IS (router)	Internal Non-backbone Router	Internal, non-backbone router in a Totally Stubby Area
Level 2 IS (router)	Internal Backbone Router or ASBR	Any Level 2 router can distribute externals into the domain. No special name. (Cisco IOS allows Level 1 routers to distribute externals.)
Level 1-2 IS (router)	ABR	
System ID	Router ID	The System ID is the key for SPF calculations. Sometimes the NET address is thought of as the Router ID.
AFI = 49	RFC 1918 Addresses	AFI is part of the NSAP.

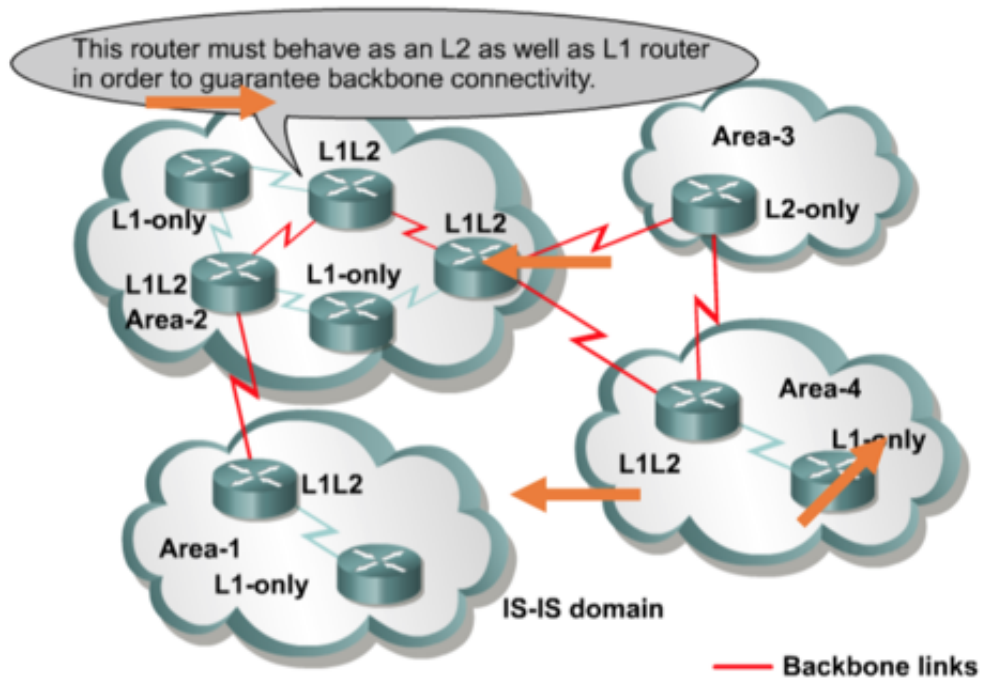
Timers

Interface	IS-IS	OSPF
Point-to-Point	Hello – 10 sec Holdtime – 30 sec	Hello – 10 sec Dead – 40 sec
Broadcast	Hello – 10 sec Holdtime – 30 sec	Hello – 10 sec Dead – 40 sec
NBMA	N/A	Hello – 30 sec Dead – 120 sec

Other	IS-IS	OSPF
LS Aging	1,200 sec or 20 min (counts down)	3,600 sec or 60 min (counts up)
LS Refresh	Every 15 min	Every 30 min
NBMA	N/A	Hello – 30 sec Dead – 120 sec
SPF Delay/Holdtime	5.5 sec / 10 sec	5 sec / 10 sec

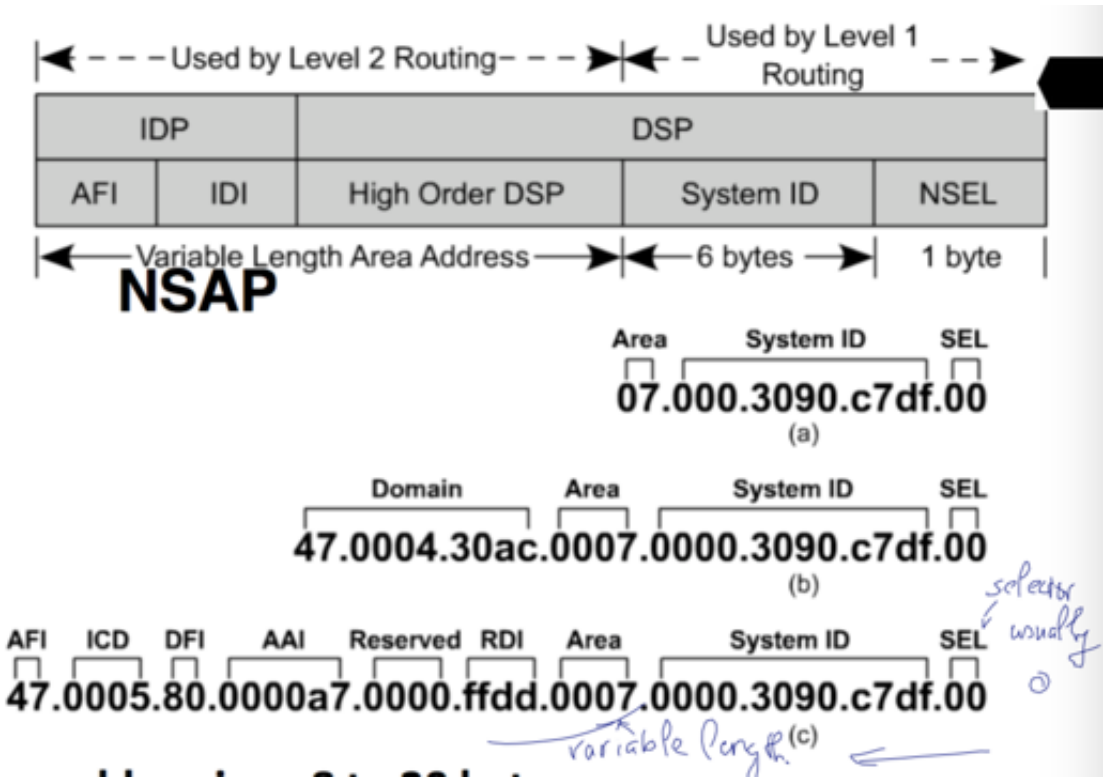
Routers

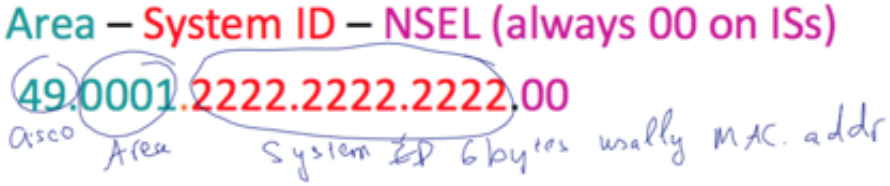
- **L1 Router**: analogous to **OSPF Internal non-backbone router** (Totally Stubby). Only for routing inside an area.
- **L2 Router**: analogous to **OSPF Internal Backbone router**, for interconnecting L1 areas.
- **L1-L2 Router**: analogous to **OSPF ABR router**, participate in both L1 intra-area routing and L2-inter-area routing.



OSI Address

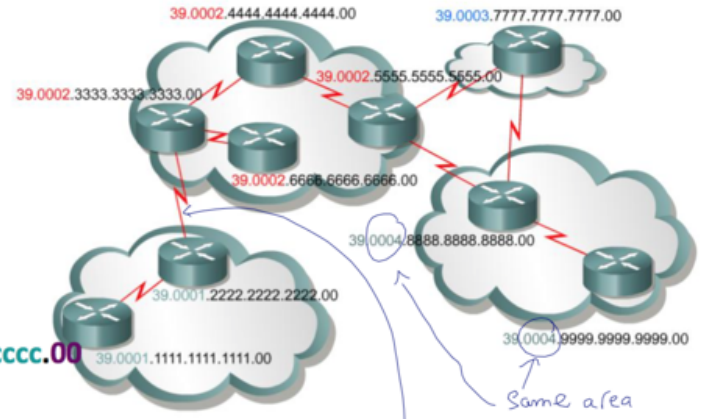
IS-IS uses OSI network layer addressing: 8 to 20 bytes.
For reference:





NSAP (NETs)

Area – System ID – NSEL
49.0001.2222.2222.2222.00



link is configured by admin to allow level 1 or level 2 or 1-2 to allow the communication

Other Examples

Example 1: NSAP **47.0001.aaaa.bbbb.cccc.00**

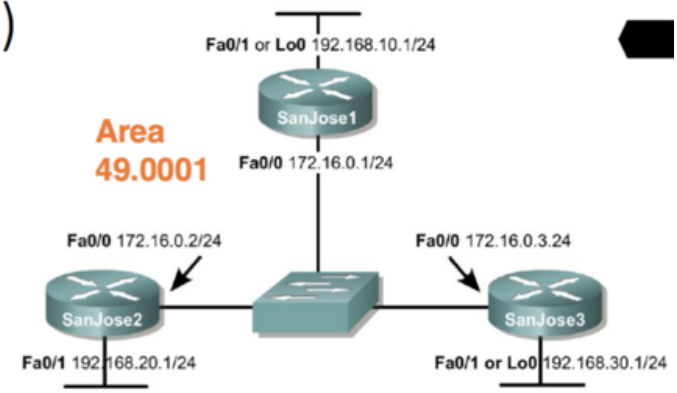
- Area ID is:
  - **47.0001**
- System ID is:
  - **aaaa.bbbb.cccc**
- NSAP selector byte is:
  - **00**

Example 2: NSAP **39.0f01.0002.0000.0c00.1111.00**

- Area ID is:
  - **39.0f01.0002**
- System ID is:
  - **0000.0c00.1111**
- NSAP selector byte is:
  - **00**

Lab 7.7.1 Configuring Basic Integrated IS-IS

Configuring IS-IS (so far)



SanJose1

```
interface FastEthernet0/0
 ip address 172.16.0.1 255.255.255.0
 ip router isis
 isis priority 100
router isis
 net 49.0001.1111.1111.1111.00
```

SanJose2

```
interface FastEthernet0/0
 ip address 172.16.0.2 255.255.255.0
 ip router isis
router isis
 net 49.0001.2222.2222.2222.00
```

Administrator

Area . System ID . NSEL

SanJose3

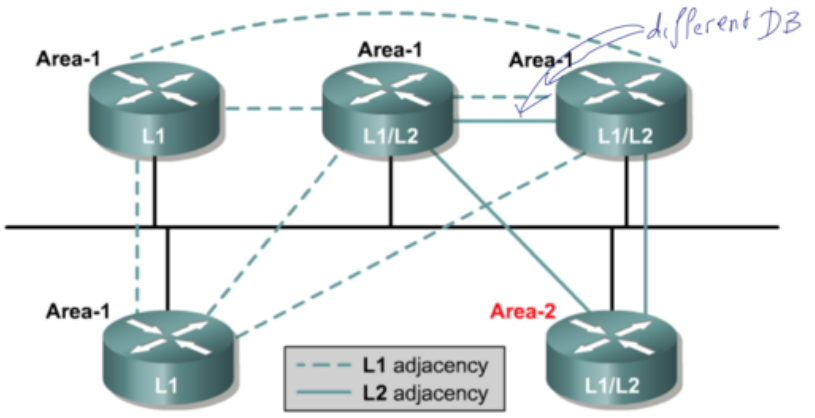
```
interface FastEthernet0/0
 ip address 172.16.0.3 255.255.255.0
 ip router isis
router isis
 net 49.0001.3333.3333.3333.00
```

if not enter level = 1&2

- **`ip router isis`**: IS-IS must be enabled on the interface
- **Note:** IS-IS routing cannot be enabled on an interface until an IP address has been configured on the interface.
- **IOS:** Cisco IOS 12.2(12) with Enterprise Plus (16 MB Flash/48 MB RAM) or Enter Plus IPSec56 (16 MB Flash/64 MB RAM)

Adjacencies

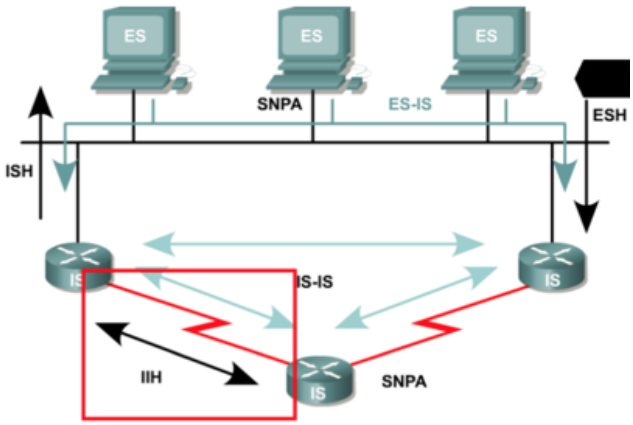
LAN Adjacencies



Adjacencies are established based on the area address announced in the incoming IIHs and the type of the router.

- L1 routers form L1 adjacencies with L1 and L1-L2 routers in their area.
- L2 routers form L2 adjacencies with L2 and L1-L2 routers in their area **or** another area.
- L1 router does not form an adjacency with an L2 router

Neighbors and Adjacencies



- IS-IS discover neighbors and forms adjacencies using **IS-IS Hello PDUs.**
  - Transmitted every **10 seconds**
  - Can be changed using the interface command, **`is hello-interval`**
  - **Hold time** defaults to **3 times** the Hello time (**30 seconds**), before declaring a neighbor dead.
    - Changed using the interface command **`is hello-multiplier`**
    - Default is 3

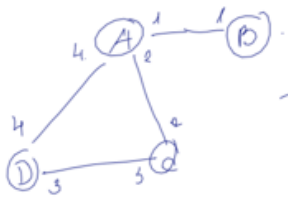
IS-IS Routing Process: Update

IS-IS Routing Process
- Update
- Decision
- Forwarding
- Receive

The Update Process

- Routers can only forward data packets if they have an understanding of the network topology.

- **LSPs are generated and flooded** throughout the network whenever:
  - An adjacency comes up or down (example: a new router comes online).
  - An interface on a router changes state or is assigned a new metric.
  - An IP route changes (example: because of redistribution)



Topology { SystemID link sequence no.

A-1. – 10 → receiver. A-1 – 11. (7 newer)

A-2 – 10

A-3 – 10

if 2 neighbors has same A-1, the sequence no. is the "version" of the link state.

not finish yet...