**IS-IS • Part 1**

### Protocol Header

<table>
<thead>
<tr>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRPD</td>
<td>Packet Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version/Protocol ID Extension</td>
<td>ID Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R R R</td>
<td>PDU Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>Maximum Area Addresses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Length</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NSAP Addressing**

<table>
<thead>
<tr>
<th>NSAP Condensed Example</th>
<th>Interdomain Part</th>
<th>Domain-Specific Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFI</td>
<td>IDI</td>
<td>HODSP</td>
</tr>
<tr>
<td>Condensed Example</td>
<td>Area</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>0005.80ff.f800.0000</td>
<td>0001</td>
</tr>
</tbody>
</table>

**Interdomain Part (IDP)**

Portion of the address used in routing between autonomous systems; assigned by ISO

**Domain-Specific Part (DSP)**

Portion of the address relevant only within the local AS

**Authority and Format Identifier (AFI)**

Identifies the authority which dictates the format of the address

**Initial Domain Identifier (IDI)**

An organization belonging to the AFI

**High Order DSP (HODSP)**

The area within the AS

**System ID**

Unique router identifier; 48 bits for Cisco devices (often taken from a MAC address)

**NSAP Selector (SEL)**

Identifies a network layer service; always 0x00 in a NET address

### Network Types

<table>
<thead>
<tr>
<th>DIS Elected</th>
<th>Broadcast</th>
<th>Point-to-Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

| Neighbor Discovery | Yes | Yes |
| Hello/Dead Timers  | 10/30 | 10/30 |

### Troubleshooting

- `show ip route`
- `show ip protocols`
- `show [clns|isis] neighbor`
- `show isis database`
- `show isis spf-log`
- `show isis spf-events`
- `debug isis spf-events`
- `debug isis adjacencies-packets`
- `debug isis spf-statistics`
- `debug isis update-packets`

### Attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Link-State</td>
</tr>
<tr>
<td><strong>Algorithm</strong></td>
<td>Dijkstra</td>
</tr>
<tr>
<td><strong>Metric</strong></td>
<td>Default (10)</td>
</tr>
<tr>
<td><strong>AD</strong></td>
<td>115</td>
</tr>
<tr>
<td><strong>Standard</strong></td>
<td>ISO 10589</td>
</tr>
<tr>
<td><strong>Protocols</strong></td>
<td>IP, CLNS</td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td>Layer 2</td>
</tr>
</tbody>
</table>

**Authentication**

Plaintext, MD5

### Routing Levels

- **Level 0**: Used to locate end systems
- **Level 1**: Routing within an area
- **Level 2**: Backbone between areas
- **Level 3**: Inter-AS routing

### Terminology

**Type-Length-Value (TLV)**

Variable-length modular datasets

**Link State PDU (LSP)**

Carry TLVs encompassing link state information

**Sequence Number Packet (SNP)**

Used to request and advertise LSPs; can be complete (CSNP) or partial (PSNP)

**Hello Packet**

Establishes and maintains neighbor adjacencies

**Designated Intermediate System**

A pseudonode responsible for emulating point-to-point links across a multi-access segment

### Adjacency Requirements

- Interface MTUs must match
- Levels must match
- Areas must match (if level 1)
- System IDs must be unique
- Authentication must succeed

### DIS Election

- Highest-priority interface elected
- Highest SNPA (MAC/DLCI) breaks tie
- Highest system ID breaks SNPA tie
- Default interface priority is 64
- Current DIS may be preempted
## TLV Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Use</th>
<th>Name</th>
<th>Use</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Area Addresses</td>
<td>Hello, LSP</td>
<td>6 IS Neighbors</td>
<td>Hello, L2 LSP</td>
<td>128 IP Internal Reach.</td>
<td>LSP</td>
</tr>
<tr>
<td>2 IS Neighbors</td>
<td>LSP</td>
<td>8 Padding</td>
<td>Hello</td>
<td>129 Protocols Supported.</td>
<td>Hello, LSP</td>
</tr>
<tr>
<td>3 ES Neighbors</td>
<td>L1 LSP</td>
<td>9 LSP Entries</td>
<td>SNP</td>
<td>131 IDRPI</td>
<td>SNP, L2 LSP</td>
</tr>
<tr>
<td>5 Prefix Neighbors</td>
<td>L2 LSP</td>
<td>10 Authentication</td>
<td>All</td>
<td>132 IP Interface Address.</td>
<td>Hello, LSP</td>
</tr>
</tbody>
</table>

## Configuration Example

### Router A1

```bash
interface FastEthernet0/0
description Area 1
ip address 192.168.1.1 255.255.255.0
ip router isis
isis circuit-type level-1

interface Serial1/0
no ip address
encapsulation frame-relay

interface Serial1/0.1 point-to-point
description To Area 2
ip address 10.0.0.1 255.255.255.252
ip router isis
isis circuit-type level-2-only

interface Serial1/0.2 point-to-point
description To Area 3
ip address 10.0.0.5 255.255.255.252
ip router isis
isis circuit-type level-2-only

router isis
net 49.0001.0000.0000.00a1.00
```

### Router B1

```bash
interface FastEthernet0/0
description Area 2
ip address 192.168.2.1 255.255.255.0
ip router isis
isis circuit-type level-1

interface Serial1/0
no ip address
encapsulation frame-relay

interface Serial1/0.1 point-to-point
description To Area 1
ip address 10.0.0.2 255.255.255.252
ip router isis
isis circuit-type level-2-only

interface Serial1/0.2 point-to-point
description To Area 3
ip address 10.0.0.9 255.255.255.252
ip router isis
isis circuit-type level-2-only

router isis
net 49.0002.0000.0000.00b1.00
```

### Router A2

```bash
interface FastEthernet0/0
description Area 1
ip address 192.168.1.2 255.255.255.0
ip router isis
isis circuit-type level-1

router isis
net 49.0001.0000.0000.00a2.00
```

### Router B2

```bash
interface FastEthernet0/0
description Area 2
ip address 192.168.2.2 255.255.255.0
ip router isis
isis circuit-type level-1

router isis
net 49.0002.0000.0000.00b2.00
```