Comparing IS-IS and OSPF

ISP Workshops
Comparing IS-IS and OSPF

- Both are Link State Routing Protocols using the Dijkstra SPF Algorithm

- So what’s the difference then?

- And why do ISP engineers end up arguing so much about which is superior?
OSPF

- Open Shortest Path First
- Open:
  - Meaning an Open Standard
  - Developed by IETF (OSPF Working Group) for IP – RFC1247
  - Current standard is OSPFv2 (RFC2328)
- Shortest Path First:
  - Edsger Dijkstra’s algorithm for producing shortest path tree through a graph
**IS-IS**

- Intermediate System to Intermediate System
- ISO 10589 specifies OSI IS-IS routing protocol for CLNS traffic
  - A Link State protocol with a 2 level hierarchical architecture
  - Type/Length/Value (TLV) options to enhance the protocol
- RFC 1195 added IP support
  - Integrated IS-IS
  - I/IS-IS runs on top of the Data Link Layer
Both are Interior Gateway Protocols (IGP)
- They distribute routing information between routers belonging to a single Autonomous System (AS)

With support for:
- Classless Inter-Domain Routing (CIDR)
- Variable Subnet Length Masking (VLSM)
- Authentication
- Multi-path
- IP unnumbered links
### IS-IS and OSPF Terminology

<table>
<thead>
<tr>
<th><strong>OSPF</strong></th>
<th><strong>IS-IS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Host</td>
<td>End System (ES)</td>
</tr>
<tr>
<td>Router</td>
<td>Intermediate System (IS)</td>
</tr>
<tr>
<td>Link</td>
<td>Circuit</td>
</tr>
<tr>
<td>Packet</td>
<td>Protocol Data Unit (PDU)</td>
</tr>
<tr>
<td>Designated router (DR)</td>
<td>Designated IS (DIS)</td>
</tr>
<tr>
<td>Backup DR (BDR)</td>
<td>N/A (no BDIS is used)</td>
</tr>
<tr>
<td>Link-State Advertisement (LSA)</td>
<td>Link-State PDU (LSP)</td>
</tr>
<tr>
<td>Hello packet</td>
<td>IIH PDU</td>
</tr>
<tr>
<td>Database Description (DBD)</td>
<td>Complete sequence number PDU (CSNP)</td>
</tr>
</tbody>
</table>
IS-IS and OSPF Terminology (Cont.)

**OSPF**
- Area
- Non-backbone area
- Backbone area
- Area Border Router (ABR)
- Autonomous System Boundary Router (ASBR)

**IS-IS**
- Sub domain (area)
- Level-1 area
- Level-2 Sub domain (backbone)
- L1L2 router
- Any IS
Transport

- OSPF uses IP Protocol 89 as transport

- IS-IS is directly encapsulated in Layer 2
For Service Providers

- Which IGP should an ISP choose?
  - Both OSPF and IS-IS use Dijkstra SPF algorithm
  - Exhibit same convergence properties
  - IS-IS less widely implemented on router platforms
  - IS-IS runs on data link layer, OSPF runs on IP layer

- Why do we keep discussing the merits of each IGP?
For Service Providers

- Biggest ISPs tend to use IS-IS – why?
  - In early 1990s, Cisco implementation of IS-IS was much more stable and reliable than OSPF implementation – ISPs naturally preferred IS-IS
  - Main IS-IS implementations more tuneable than equivalent OSPF implementations – because biggest ISPs using IS-IS put more pressure on Cisco to implement “knobs”
For Service Providers

- Moving forward a decade
  - Early Cisco OSPF implementation substantially rewritten
    - Now competitive with IS-IS in features and performance
  - Router vendors wishing a slice of the core market need an IS-IS implementation as solid and as flexible as that from Cisco
    - Those with IS-IS & OSPF support tend to ensure they exhibit performance and feature parity
How to choose an IGP?

- OSPF
  - Rigid area design – all networks must have area 0 core, with sub-areas distributed around
  - Suits ISPs with central high speed core network linking regional PoPs
How to choose an IGP?

- IS-IS
  - Relaxed two level design – L2 routers must be linked through the backbone
  - Suits ISPs with “stringy” networks, diverse infrastructure, etc, not fitting central core model of OSPF
  - More flexible than OSPF, but easier to make mistakes too
Considerations

- **“Security”**
  - IS-IS runs on link layer
  - Not possible to “attack” the IGP using IP as with OSPF

- **Not dependent on IP addressing**
  - IS-IS’s NSAP addressing scheme avoids dependencies on IP as with OSPF

- **“Reliability”**
  - IS-IS has long been used by the majority of the world’s biggest ISPs
  - Belief that equipment vendors pay more attention to IS-IS reliability, scalability, and features
More considerations

- Migration to IPv6
  - Adding IPv6 means OSPFv2 and OSPFv3 in network
    - Two protocols, two sets of identical configuration
  - IS-IS simply requires the addition of the IPv6 address-family
    - Most networks operate single topology for IPv4 and IPv6
  - Is this why there is now RFC5838 describing support of multiple address families in OSPFv3?
    - Vendor support?
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