

Comparing IS-IS and OSPF

ISP Workshops



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Acknowledgements

- This material originated from the Cisco ISP/IXP Workshop Programme developed by Philip Smith & Barry Greene
- Use of these materials is encouraged as long as the source is fully acknowledged and this notice remains in place
- Bug fixes and improvements are welcomed
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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
 - Dijkstra, E. W. (1959). "A note on two problems in connexion with graphs". *Numerische Mathematik* **1**: 269–271

IS-IS

- Intermediate System to Intermediate System
- ISO 10589 specifies OSI IS-IS routing protocol for ConnectionLess-mode Network Services (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

IS-IS & OSPF:

Similarities

- Both are Interior Gateway Protocols (IGP)
 - They distribute routing information between routers belonging to a single Autonomous System (AS)
 - Both use Edsger Dijkstra's algorithm
- With support for:
 - Classless Inter-Domain Routing (CIDR)
 - Variable Subnet Length Masking (VLSM)
 - Authentication
 - Multi-path
 - IP unnumbered links

IS-IS and OSPF Terminology

OSPF

- ❑ Host
- ❑ Router
- ❑ Link
- ❑ Packet
- ❑ Designated router (DR)
- ❑ Backup DR (BDR)
- ❑ Link-State Advertisement (LSA)
- ❑ Hello packet
- ❑ Database Description (DBD)

IS-IS

- ❑ End System (ES)
- ❑ Intermediate System (IS)
- ❑ Circuit
- ❑ Protocol Data Unit (PDU)
- ❑ Designated IS (DIS)
- ❑ N/A (no BDIS is used)
- ❑ Link-State PDU (LSP)
- ❑ IIH PDU
- ❑ Complete sequence number PDU (CSNP)

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
- Level-1 (station)
- Level-2 (area)
- L1L2 (station & area)
- Any IS

Transport

- OSPF uses IP as transport – Protocol 89



- 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
- There is now RFC5838 describing support of multiple address families in OSPFv3
 - Limited vendor support
 - Is not compatible with OSPFv2

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