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
        - 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 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

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IS-IS & OSPF: Similarities

- 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

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
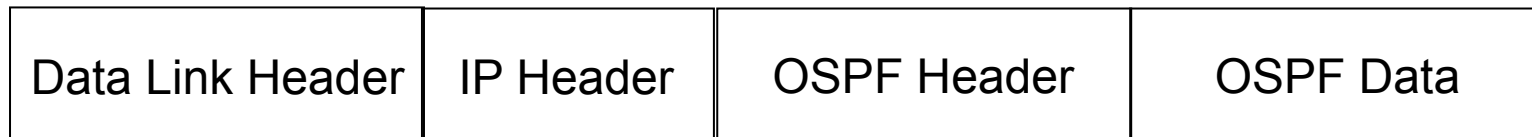
- Sub domain
- Level-1 (station)
- Level-2 (area)

- L1L2 (station & area)

- Any IS

Transport

- OSPF uses IP Protocol 89 as transport

Data Link Header	IP Header	OSPF Header	OSPF Data

- IS-IS is directly encapsulated in Layer 2

Data Link Header	IS-IS Header	IS-IS Data

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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