Comparing ISIS and OSPF

AfNOG 2011 AR-E Workshop

Comparing ISIS 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?

What Is IS-IS ?

- Intermediate System to Intermediate System
- An “IS” is ISO terminology for a router
- IS-IS was originally designed for use as a dynamic routing protocol for ISO CLNP, defined in the ISO 10589 standard
- Later adapted to carry IP prefixes in addition to CLNP (known as Integrated or Dual IS-IS) as described in RFC 1195
- Predominantly used in ISP environment

IS-IS Timeline

- 1978ish "New" Arpanet Algorithm
  - Eric Rosen et al
- 1986 to 90 Decnet Phase V
  - Radia Perlman, Mike Shand
- 1987 ISO 10589 (IS-IS)
  - Dave Oran
- 1990 RFC 1195 (Integrated IS-IS)
  - Ross Callon, Chris Gunner
- 1990 to present: All sorts of enhancements
  - Everyone contributed!
- 2008 RFC5308 adds IPv6 support
  - And RFC5120 adds Multi-Topology Routing support

What Is OSPF ?

- Open Shortest Path First
- Link State Protocol using the Shortest Path First algorithm (Dijkstra) to calculate loop-free routes
- Used purely within the TCP/IP environment
- Designed to respond quickly to topology changes but using minimal protocol traffic
- Used in both Enterprise and ISP Environment

OSPF Timeline

- Development began in 1987 by IETF
- OSPFv1 published in 1989 with RFC 1131
- OSPFv2 published in 1991 with RFC 1247
- Further enhancements to OSPFv2 in 1994 with RFC 1583 and in 1997 with RFC 2178
- Last revision was in 1998 with RFC 2328 to fix minor problems
- All above OSPF RFCs authored by John Moy
- RFC2740 introduced OSPFv3 (for IPv6) in 1999, replaced by RFC5340 in 2008

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

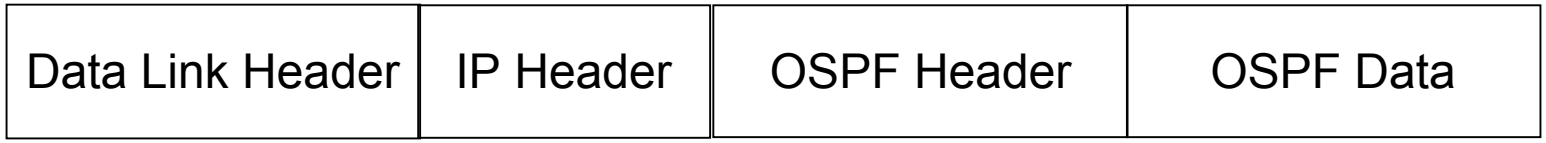
OSPF	ISIS
Host	End System (ES)
Router	Intermediate System (IS)
Link	Circuit
Packet	Protocol Data Unit (PDU)
Designated router (DR)	Designated IS (DIS)
Backup DR (BDR)	N/A (no BDIS is used)
Link-State Advertisement (LSA)	Link-State PDU (LSP)
Hello packet	IIH PDU
Database Description (DBD)	Complete sequence number PDU (CSNP)

IS-IS and OSPF Terminology (Cont.)

OSPF	ISIS
Area	Sub domain (area)
Non-backbone area	Level-1 area
Backbone area	Level-2 Sub domain (backbone)
Area Border Router (ABR)	L1L2 router
Autonomous System Boundary Router (ASBR)	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 ISIS use Dijkstra SPF algorithm
  - Exhibit same convergence properties
  - ISIS less widely implemented on router platforms
  - ISIS runs on data link layer, OSPF runs on IP layer

For Service Providers

- Biggest ISPs tend to use ISIS – why?
  - In early 90s, Cisco implementation of ISIS was much more solid than OSPF implementation – ISPs naturally preferred ISIS
  - Main ISIS implementations more tuneable than equivalent OSPF implementations – because biggest ISPs using ISIS put more pressure on Cisco to implement "knobs"

For Service Providers

- Moving forward a decade
  - Early Cisco OSPF implementation substantially rewritten
    - Now competitive with ISIS in features and performance
  - Router vendors wishing a slice of the core market need an ISIS implementation as solid and as flexible as that from Cisco
    - Those with ISIS & 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
  - Teaches good routing protocol design practices

How to choose an IGP?

- ISIS
  - 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

Other considerations

- ISIS runs on link layer
  - Not possible to “attack” the IGP using IP as with OSPF
- ISIS’s NSAP addressing scheme avoids dependencies on IP as with OSPF
- Because biggest ISPs use ISIS, major router vendors tend to apply new optimisation features before they are added to OSPF

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