

# Comparing IS-IS and OSPF



ISP Workshops

# Comparing IS-IS and OSPF

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- 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

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- 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

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- Intermediate **S**ystem to **I**ntermediate **S**ystem
- 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

# IS-IS & OSPF:

## Similarities

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- 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

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## 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.)

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### **OSPF**

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

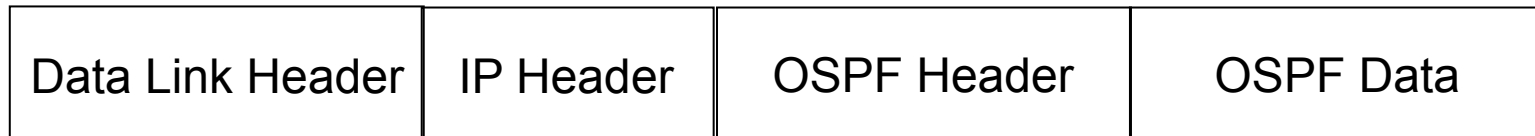
### **IS-IS**

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

# Transport

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- OSPF uses IP Protocol 89 as transport



- IS-IS is directly encapsulated in Layer 2





# For Service Providers

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- 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

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- 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

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- 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?

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## □ 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?

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## □ 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

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- “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

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- 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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