

# Comparing ISIS and OSPF



**AfNOG 2013**

# Comparing ISIS 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?

# What Is IS-IS ?

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- ❑ 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

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- 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 ?

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- ❑ 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

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- ❑ 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

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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)

## **ISIS**

- 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)

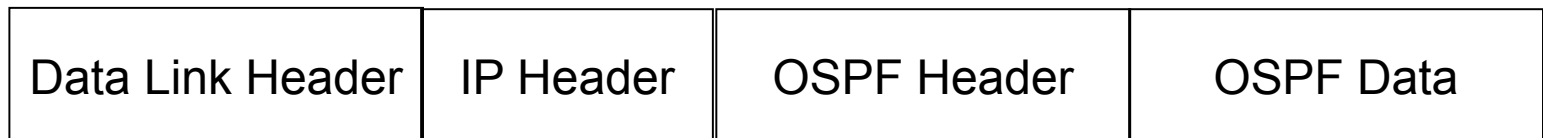
## **ISIS**

- 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 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

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- 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

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- 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?

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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
- Teaches good routing protocol design practices

# How to choose an IGP?

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## □ 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

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- 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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