Segment Routing

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Segment Routing
Introduction

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Illustration and Examples Conventions

• The examples in this presentation follow these conventions:
  – Router-id of NodeX: 1.1.1.X
  – Link address XY:
    IPv4 99.X.Y.X/24 with X<Y
    IPv6 99::X:Y:X/112 with X<Y and X, Y in decimal representation
  – Prefix-SID index of NodeX: X
  – Prefix-SIDs are labels in the range [16000 – 23999]
    > This is the default Segment Routing Global Block (SRGB)
  – Adjacency-SIDs are labels with the format 24NXY for the Nth adjacency X→Y
  – LDP/RSVP/BGP3107/… labels are in the range [90000 – 99999]
Segment Routing

• **Source Routing**
  – the source chooses a path and encodes it in the packet header as an ordered list of segments
  – the rest of the network executes the encoded instructions

• **Segment**: an identifier for any type of instruction
  – forwarding or service

• In this presentation: **IGP-based forwarding construct**
Segment Routing – Forwarding Plane

- **MPLS**: an ordered list of segments is represented as a stack of labels
  - Segment Routing re-uses MPLS data plane without any change
  - Segment represented as MPLS label
  - Applicable to IPv4 and IPv6 address families

- **IPv6**: an ordered list of segments is encoded in a routing extension header

- This presentation: **MPLS data plane**
Global and Local Segments

• **Global Segment**
  – Any node in SR domain understands associated instruction
  – Each node in SR domain installs the associated instruction in its forwarding table
  – MPLS: global label value in Segment Routing Global Block (SRGB)

• **Local Segment**
  – Only originating node understands associated instruction
  – MPLS: locally allocated label
Global Segments – Global Label Indexes

• Global Segments always distributed as a label range (SRGB) + Index
  – Index must be unique in Segment Routing Domain

• Best practice: same SRGB on all nodes
  – “Global model”, requested by all operators
  – Global Segments are global label values, simplifying network operations
  – Default SRGB: 16,000 – 23,999
    > Other vendors also use this label range
IGP segments

- Two basic building blocks distributed by IGP
  - Prefix Segments
  - Adjacency Segments
IGP Prefix Segment

• Shortest-path to the IGP prefix
  – Equal Cost MultiPath (ECMP)-aware
• Global Segment
• Label = 16000 + Index
  – Advertised as index
• Distributed by ISIS/OSPF

All nodes use default SRGB
16,000 – 23,999
IGP Prefix Segment

- Shortest-path to the IGP prefix
  - Equal Cost MultiPath (ECMP)-aware
- Global Segment
- Label = 16000 + Index
  - Advertised as index
- Distributed by ISIS/OSPF

All nodes use default SRGB 16,000 – 23,999
IGP Adjacency Segment

- Forward on the IGP adjacency
- Local Segment
- Advertised as label value
- Distributed by ISIS/OSPF

All nodes use default SRGB 16,000 – 23,999
Combining IGP Segments

- Steer traffic on any path through the network
- Path is specified by list of segments in packet header, a stack of labels
- No path is signaled
- No per-flow state is created
- Single protocol: IS-IS or OSPF

All nodes use default SRGB 16,000 – 23,999
Visit us:
cisco.com
segment-routing.net
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