

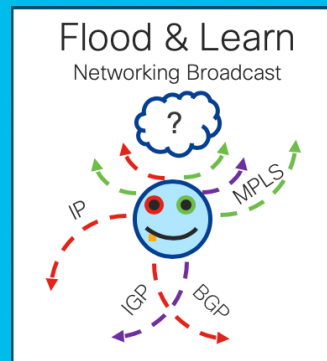


Flood & Learn

Networking Broadcast Series

Jiri Chaloupka

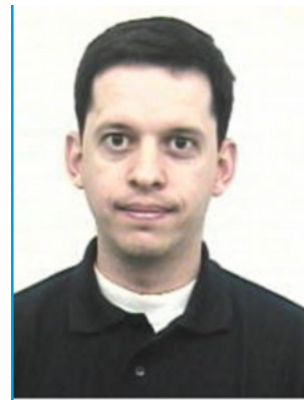
April 09, 2020



<https://e-vpn.io/fal>

Flood & Learn

- Topic of Today:
- Segment Routing Fundamentals
- Speaker:
- Jose Liste

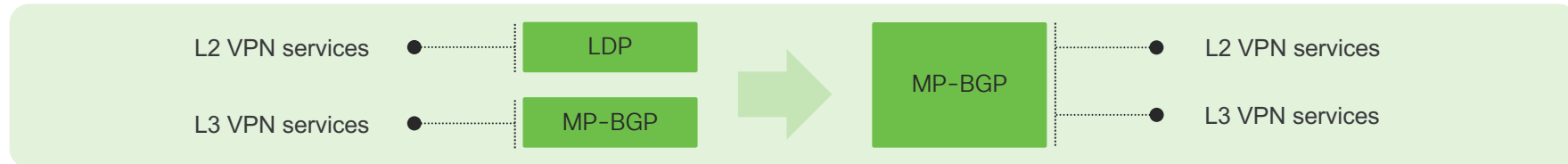


Jose Liste
Cisco, Technical Marketing
Engineer

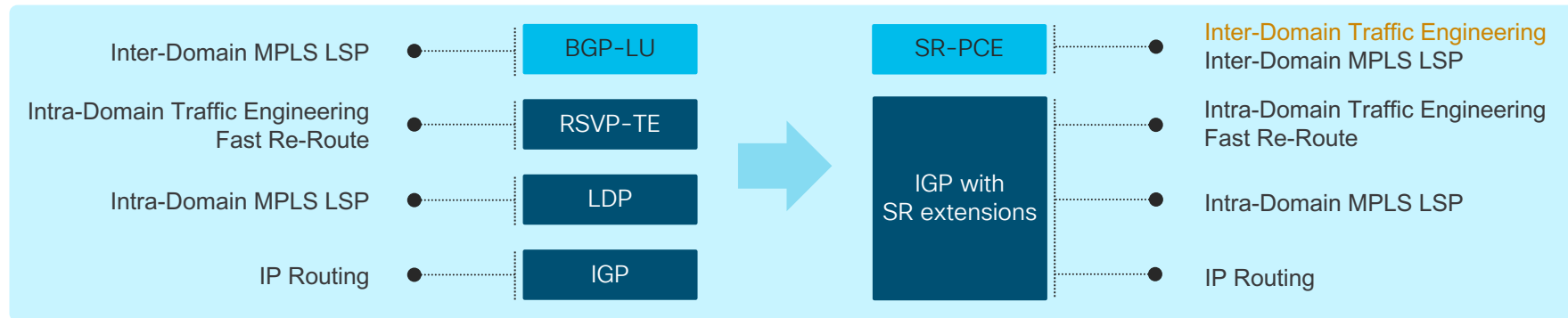
Network Evolution

Network Evolution

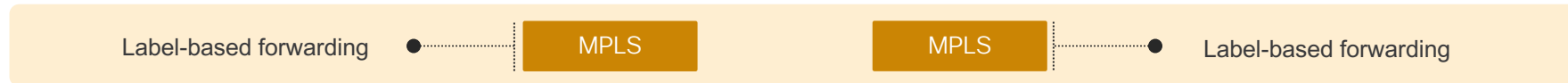
Service Protocols



Transport Protocols



Data-Plane



LDP: Label Distribution Protocol, MP-BGP: Multi-protocol BGP, BGP-LU: BGP Labeled-Unicast, PCE: Path Computation Element, RSVP-TE: Reservation Protocol Traffic Engineering

Network Evolution → Outcomes

Simplify device operation, troubleshooting

Right balance between Distributed Intelligence and Centralized Optimization

Stateless IP fabric, Policy-aware Network Infrastructure

Unburden Infrastructure, unleashing drastic power reductions & density increase

Why SR? / Use-Cases

Use Case	SR	LDP	RSVP-TE	IP/VXLAN
Operational Simplicity	✓	✓	✓	✓
ECMP	✓	✓	●	✓
Fast Reroute	✓	✓	✓	✓
Traffic Engineering	✓	●	✓	●
Multi-Domain TE	✓	●	●	●
Intent-based Network Slicing	✓	●	✓	●
Intent-based TE (On-Demand Next-Hop)	✓	●	●	●
Intent-based Traffic Steering (Automated Steering)	✓	●	●	●
LSP Blackhole Detection	✓	●	●	n/a
Microloop Avoidance	✓	●	●	●

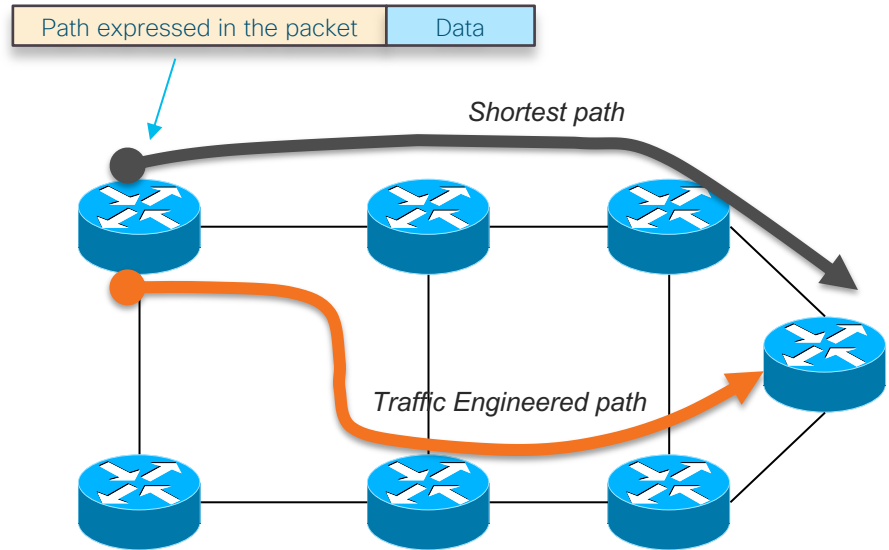


Network Evolution with Segment Routing

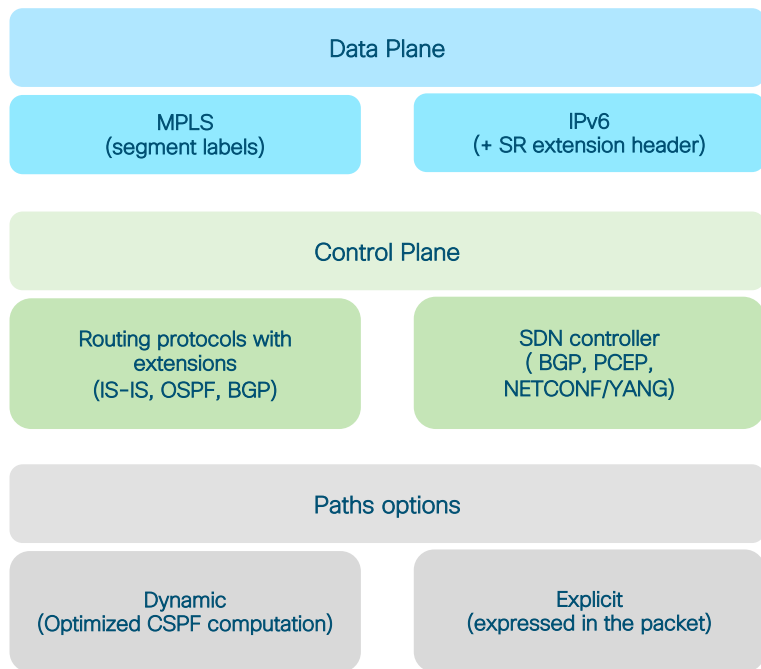
Source Routing

- Segment Routing **architecture** seeks the right balance between **distributed intelligence** and **centralized optimization**
- SR delivers an unified, **end-to-end policy-aware** network infrastructure while bringing unmatched **simplicity** and **scalability**

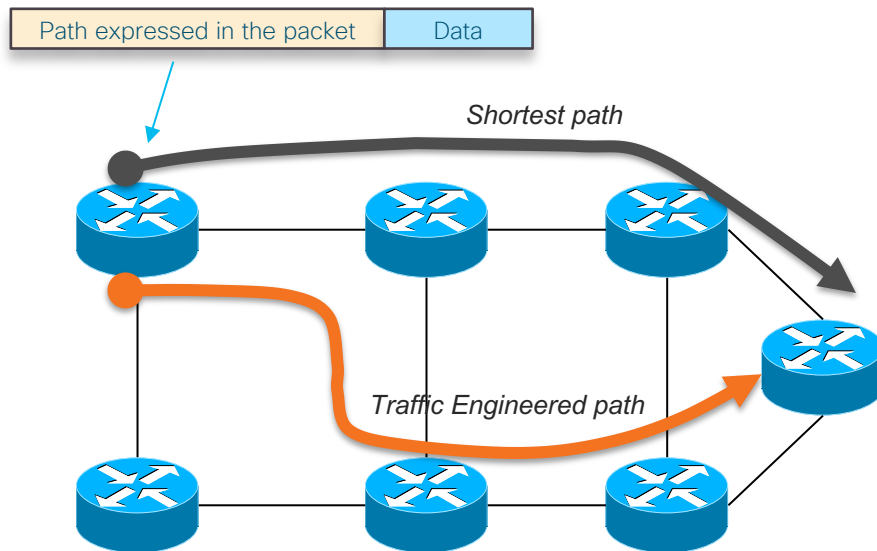
- Source Routing paradigm
 - Stateless IP fabric !!!



Segment Routing



- Source Routing paradigm
- Stateless IP fabric !!!



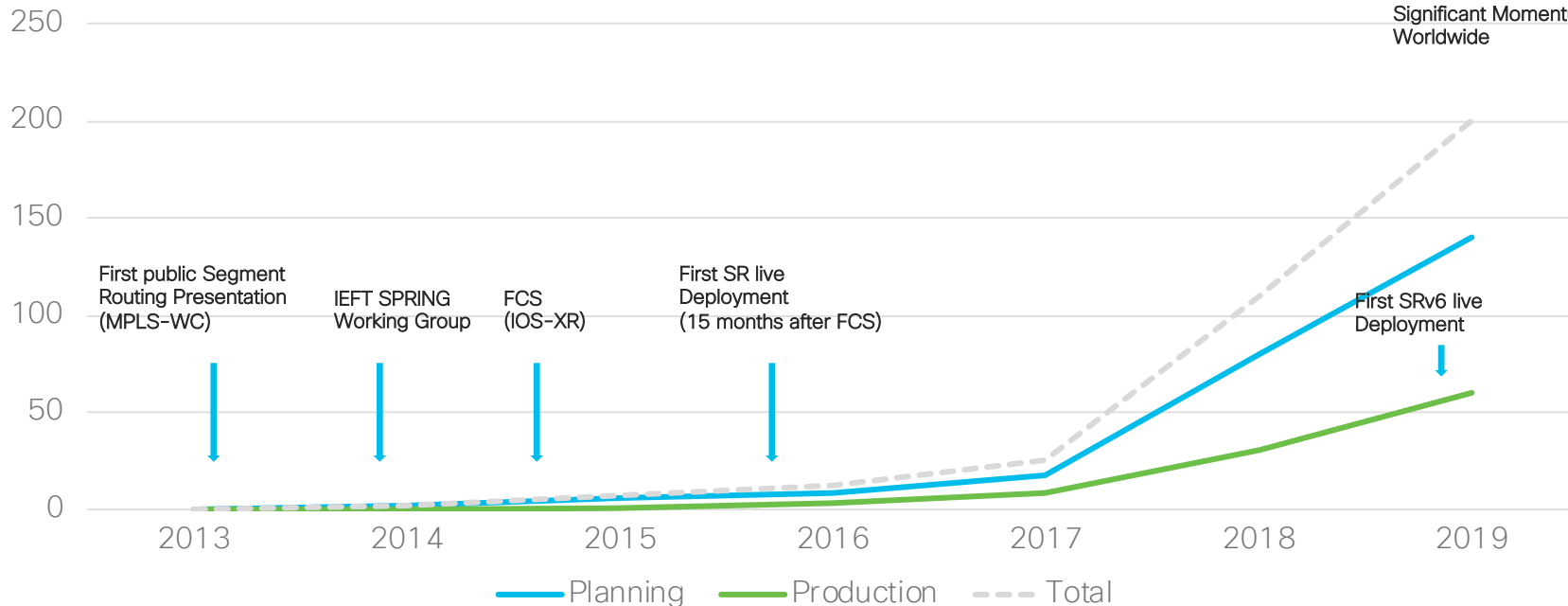


Years



Segment Routing Customer Adoption

Significant Momentum
Worldwide



Innovators

Early Adopters

Early Majority

All about Segments !!!

Control-Plane

Global and Local Segments

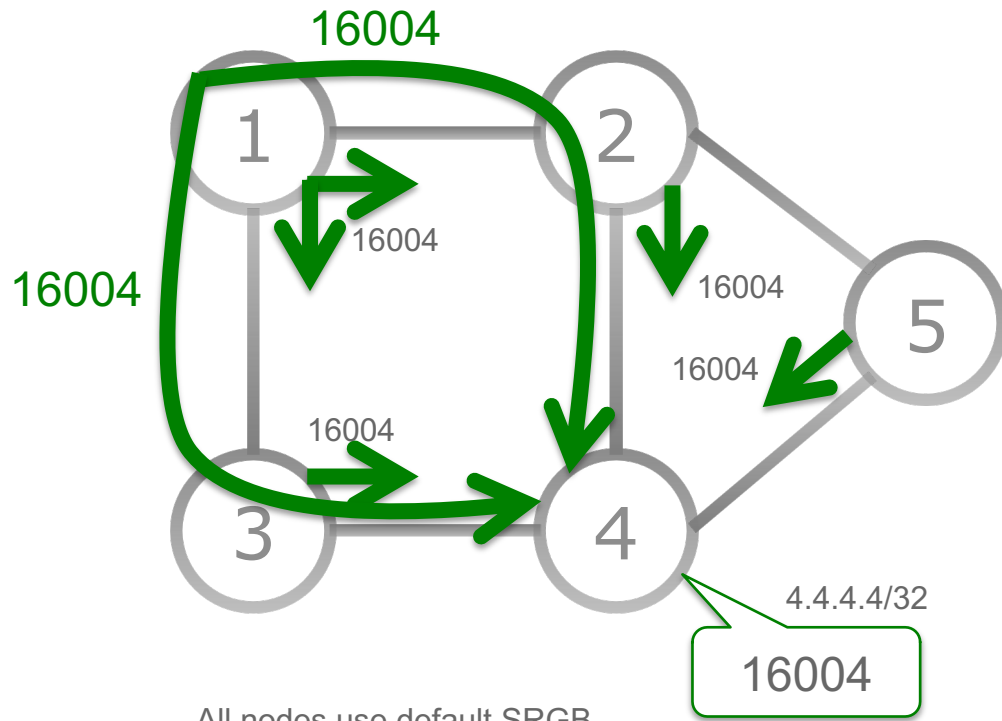
- **Global Segment**
 - Any node in SR domain understands associated instruction
 - Each node in SR domain installs the associated instruction in its forwarding table
 - MPLS: global label value in **Segment Routing Global Block (SRGB)**
- **Local Segment**
 - Only originating node understands associated instruction
 - MPLS: locally allocated label

IGP Segments

- Two basic building blocks distributed (signaled) by an IGP
 - Prefix Segments
 - Adjacency Segments

IGP Prefix Segment

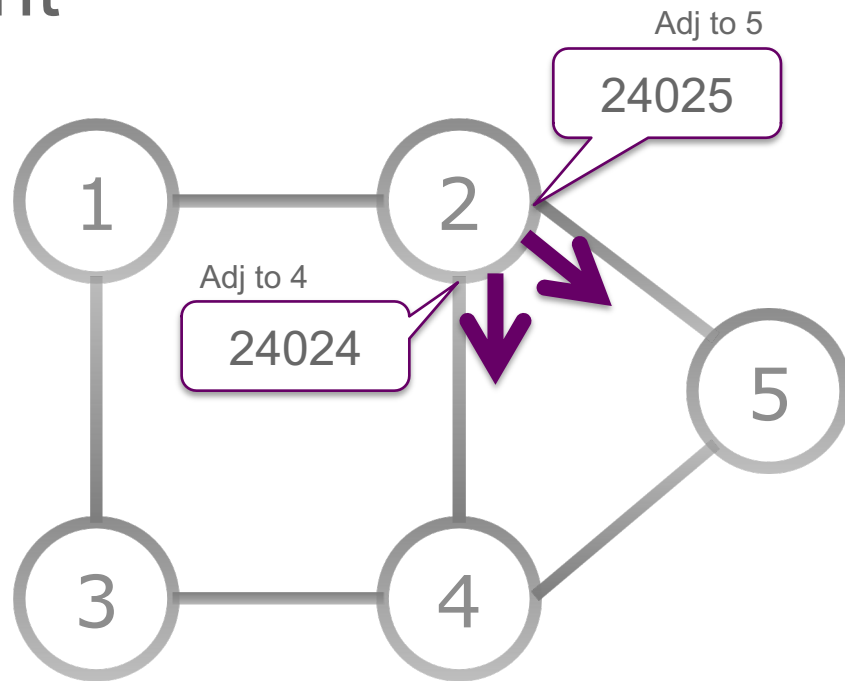
- Shortest-path to the IGP prefix
 - Equal-Cost Multi-Path (ECMP)-aware
- Global Segment
 - Programmed in every node
- IGP Prefix-SID
 - Advertised as label value
 - Operator-allocated value from SRGB
 - Advertised as index
 - e.g. label = 16004 = 16000 + 4
- Distributed by ISIS/OSPF



All nodes use default SRGB
16,000 – 23,999

IGP Adjacency Segment

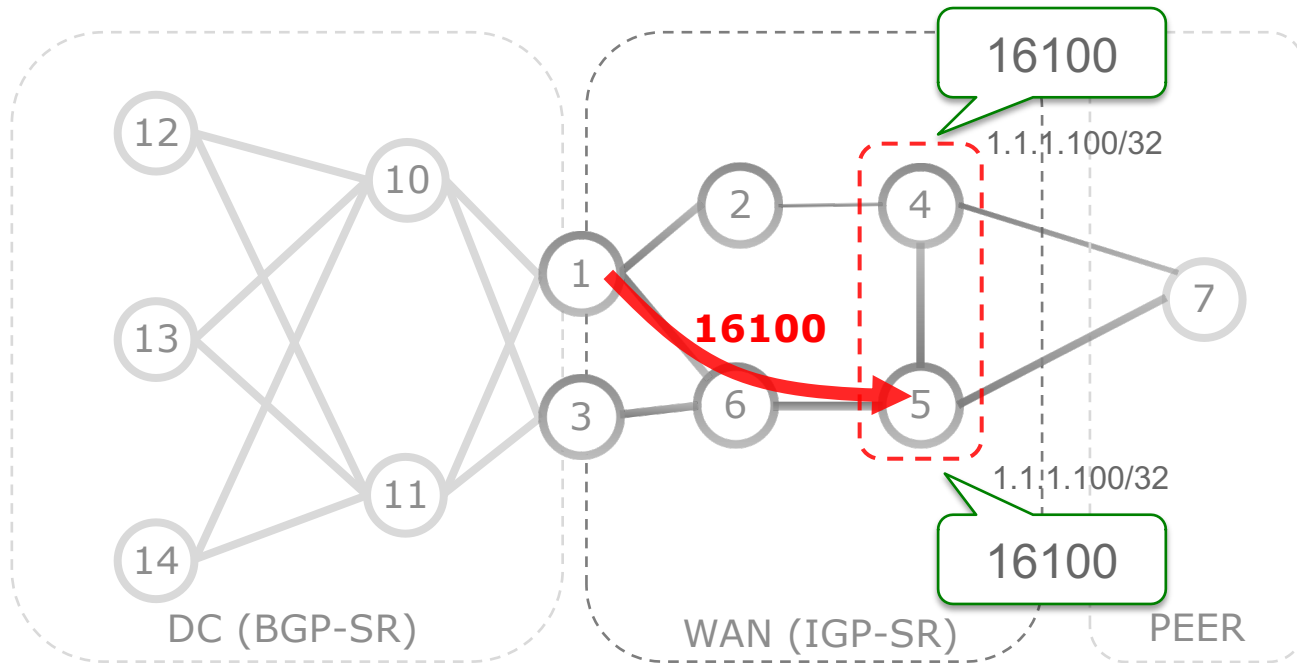
- Forward on the IGP adjacency
- Local Segment
 - Programmed only by advertising node
- IGP Adjacency-SID
 - Advertised as label value
 - Dynamically allocated by the device
- Distributed by ISIS/OSPF



All nodes use default SRGB
16,000 – 23,999

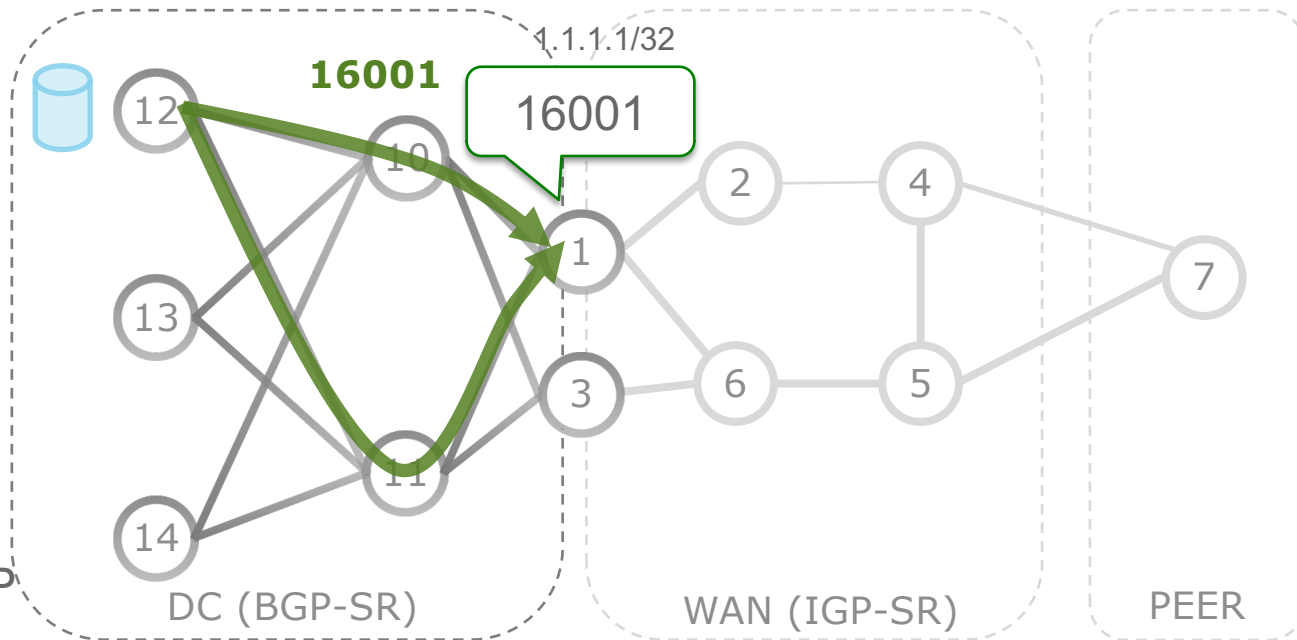
Anycast Prefix Segment

- Same prefix advertised by multiple nodes
- Traffic is forwarded to one of the **Anycast prefix-SIDs** based on best IGP path
- If primary node fails, traffic is auto re-routed to the other node



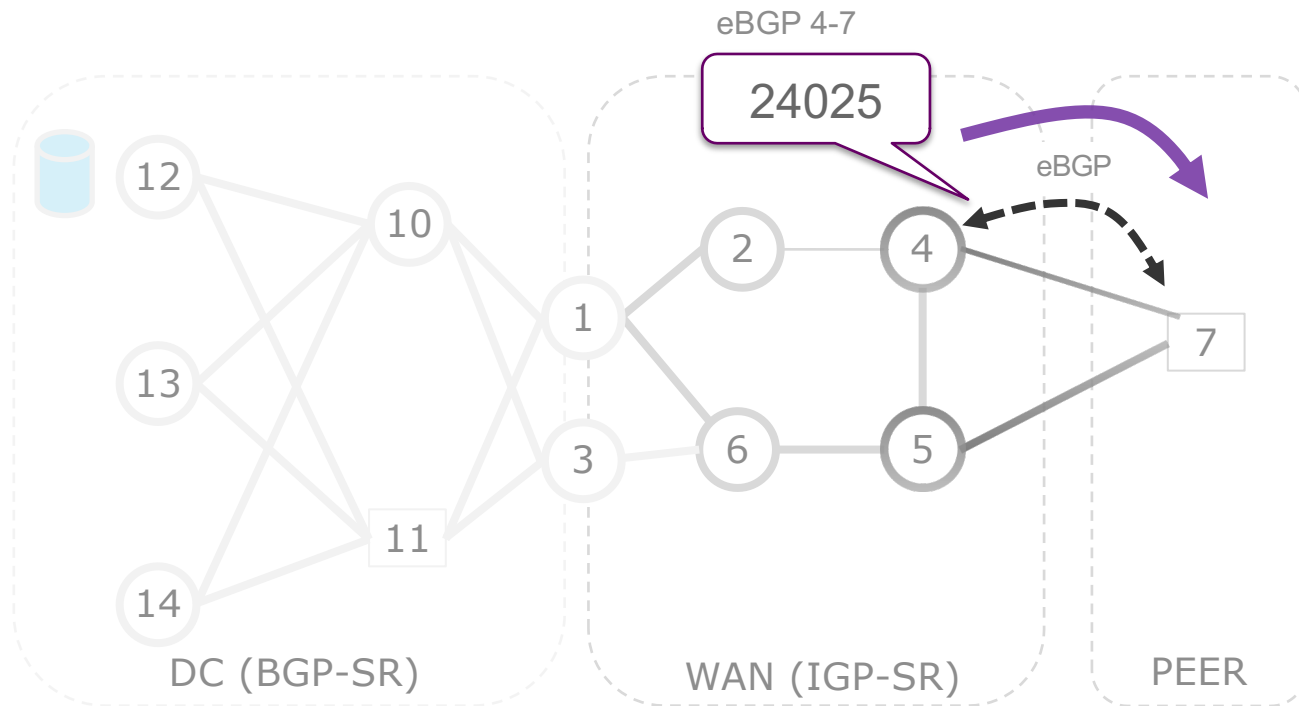
BGP Prefix Segment

- Best-path to the BGP prefix
- BGP prefix-SID
- Global Segment
- Signaled by BGP
 - Extension to RFC 3107
- Used in Data Center fabrics that use BGP as an IGP



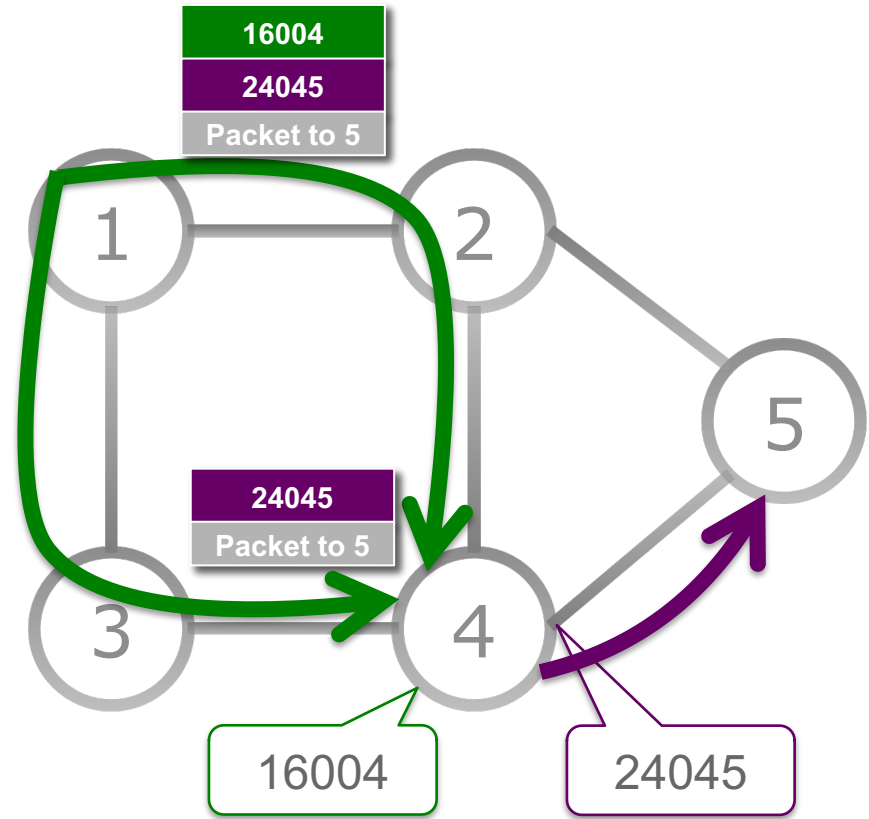
BGP Peering Segment

- Forward to the BGP peer
- BGP Peering-SID
- Local Segment
 - Dynamically allocated
- Signaled to the controller by BGP-LS (topology information)



Combining 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



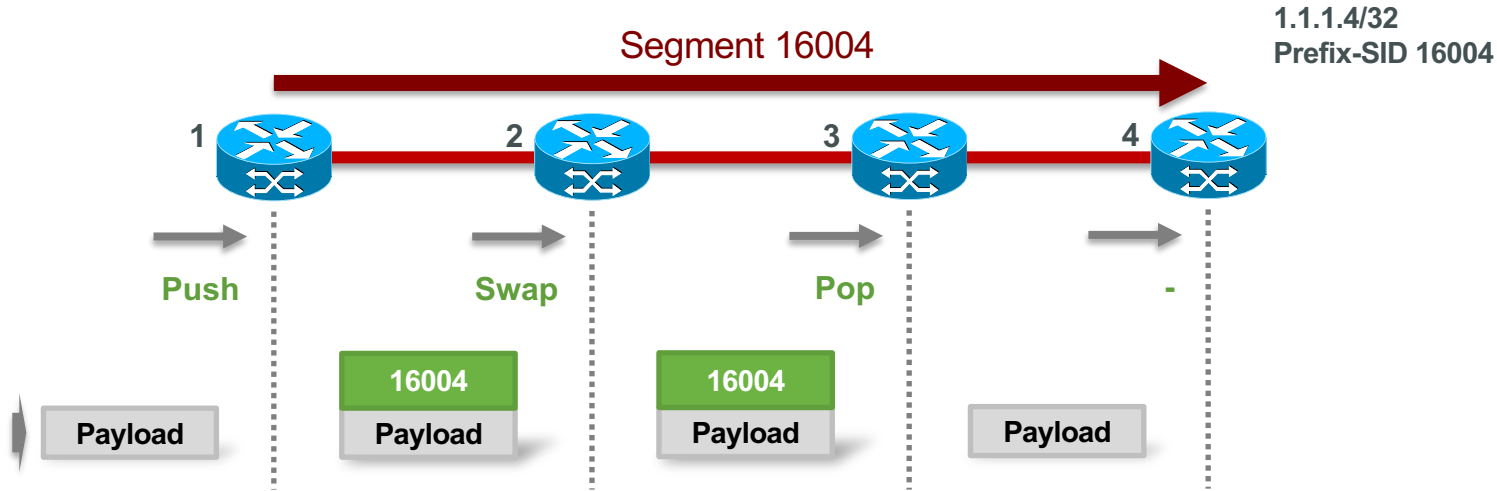
All about Segments !!!

Data-Plane

MPLS data plane operations

- Segment Routing uses the **existing MPLS data plane**
 - **Segment → label**
 - **Segment list → label stack**
- Uses Penultimate Hop Popping (PHP) and Explicit-Null functionalities
 - Default: PHP is enabled
 - Explicit-Null label can be enabled if needed
- Prefix-SID label imposition (assume SR label imposition is preferred or destination prefix has no associated LDP label)
 - Impose label if destination prefix has associated prefix-SID
 - Impose label if destination resolves on a prefix with associated prefix-SID
- E.g. impose label for BGP destination if its BGP nexthop has prefix-SID

MPLS Data Plane Operations



- Node4 advertises its loopback ipv4 prefix 1.1.1.4/32 with attached prefix-SID 16004
- Node4 requests the default PHP functionality

IF we had more time !!!

- SR Usecase deep-dive
- SR Traffic Engineering
- SRv6

Conclusion

Simplicity always prevails

Resources / Stay Up-To-Date



<http://www.segment-routing.net/>



<https://www.linkedin.com/groups/8266623>



<https://twitter.com/SegmentRouting>



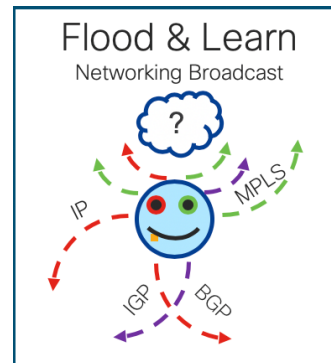
<https://www.facebook.com/SegmentRouting/>



[Segment Routing, Part I / II - Textbooks](#)

FAL – Stay Up-To-Date

- <https://e-vpn.io/>
- Upcoming “Flood & Learn” Networking Broadcast: <https://e-vpn.io/fal/>



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