

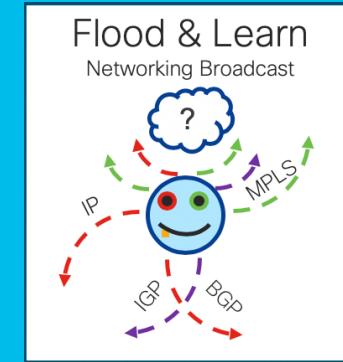


# Flood & Learn

## Networking Broadcast Series

Jiri Chaloupka

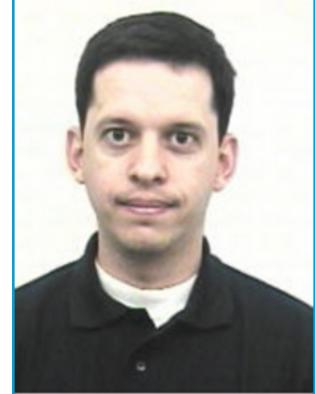
April 09, 2020



<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

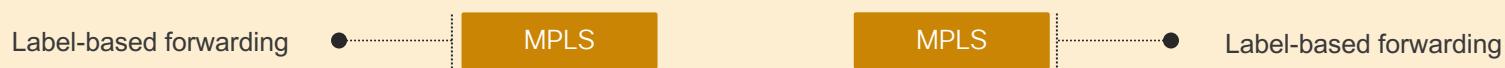
## Service Protocols



## 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	✓	✗	✗	✗

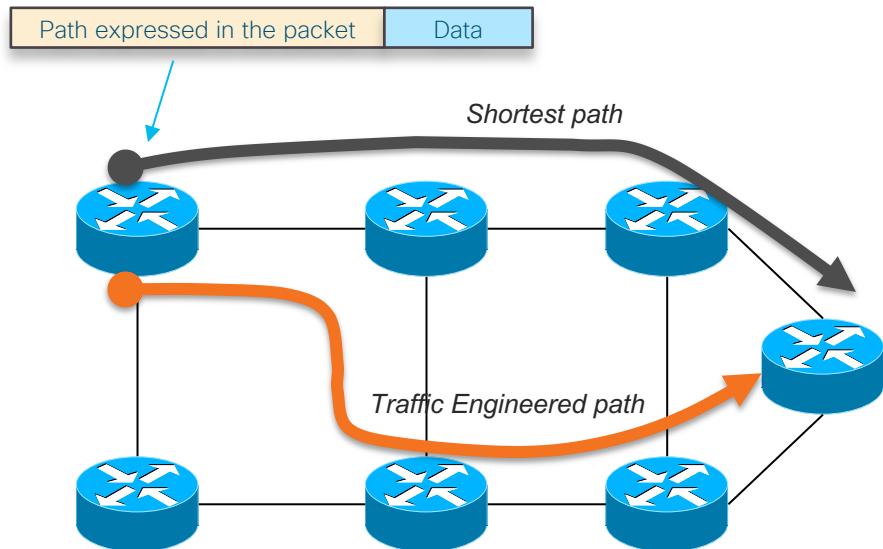


# Network Evolution with Segment Routing

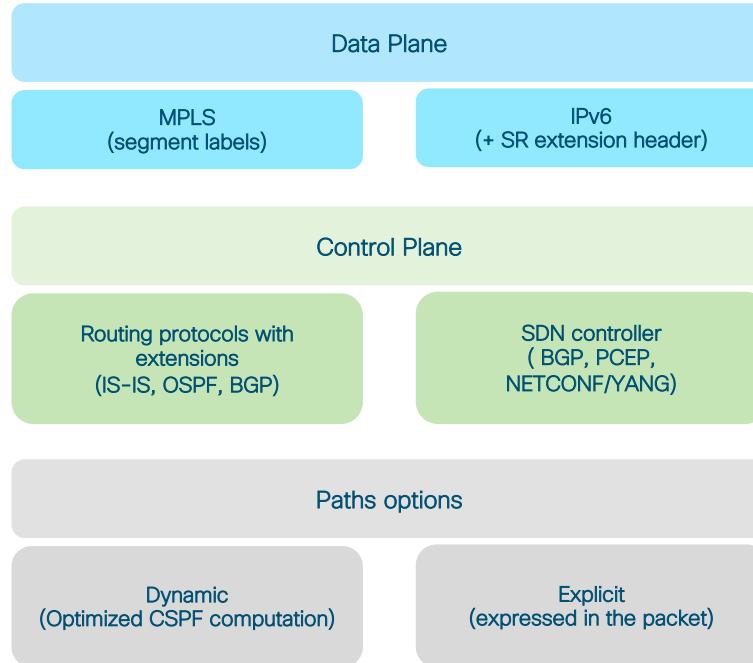
# Source Routing

- 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**

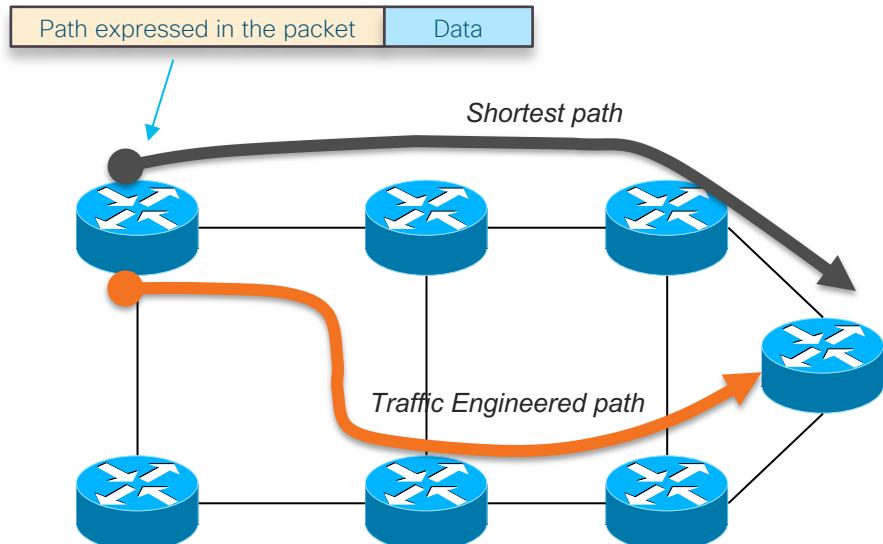
- Source Routing paradigm
  - Stateless IP fabric !!!



# Segment Routing



- Source Routing paradigm
  - Stateless IP fabric !!!



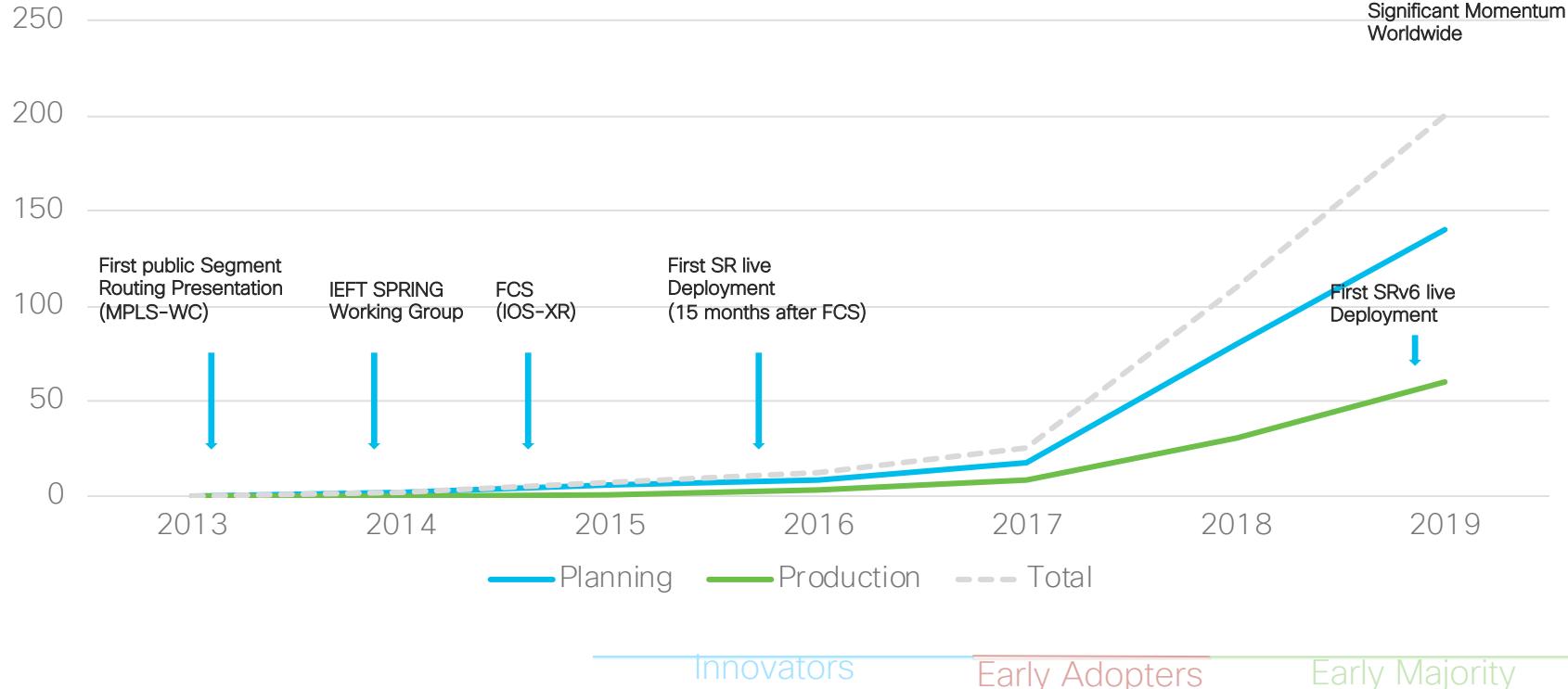


Years



Significant Momentum Worldwide

## Segment Routing Customer Adoption



# All about Segments !!!

## Control-Plane

# Global and Local Segments

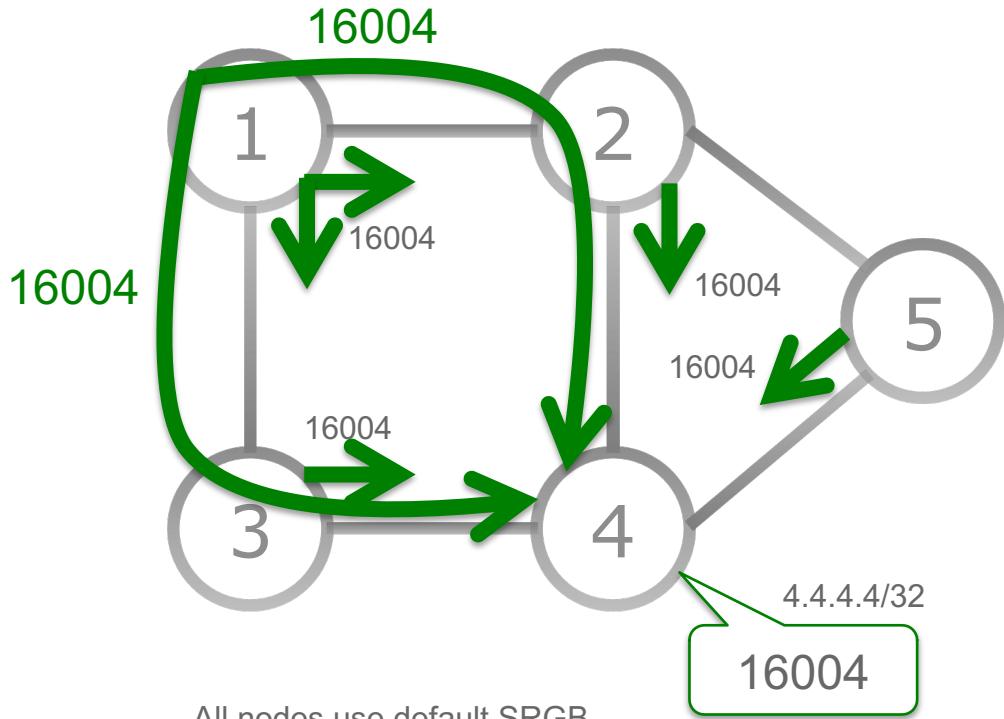
- **Global Segment**
  - Any node in SR domain understands associated instruction
  - Each node in SR domain installs the associated instruction in its forwarding table
  - MPLS: global label value in **Segment Routing Global Block (SRGB)**
- **Local Segment**
  - Only originating node understands associated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

# IGP Segments

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

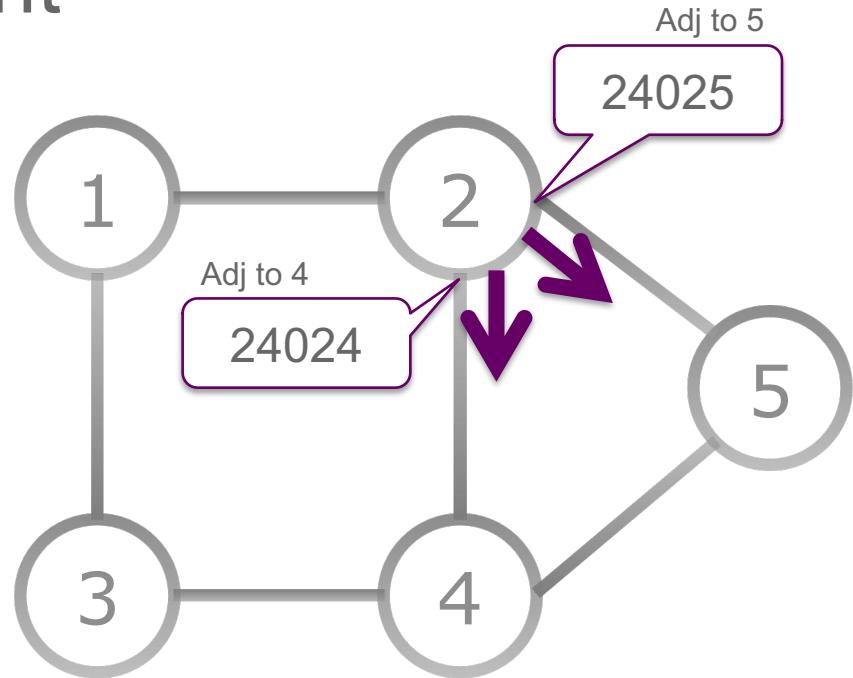
# IGP Prefix Segment

- 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



# IGP Adjacency Segment

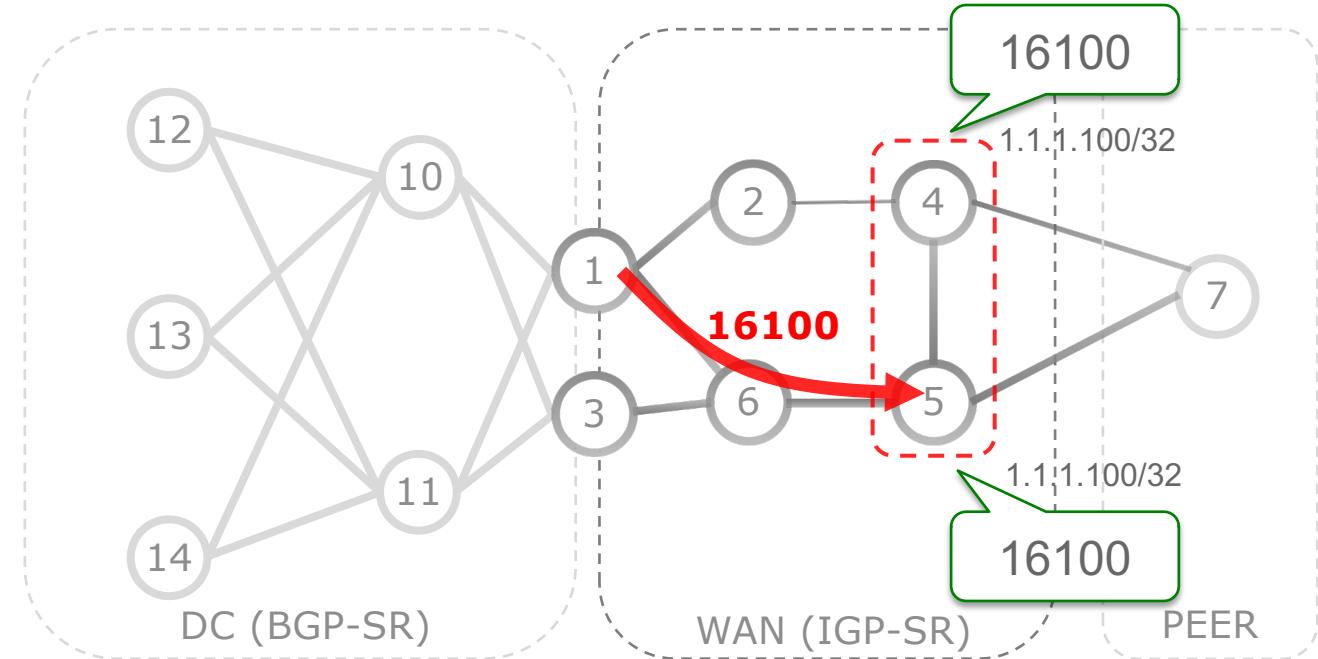
- Forward on the IGP adjacency
- Local Segment
  - Programmed only by advertising node
- IGP Adjacency-SID
  - Advertised as label value
  - Dynamically allocated by the device
- Distributed by ISIS/OSPF



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

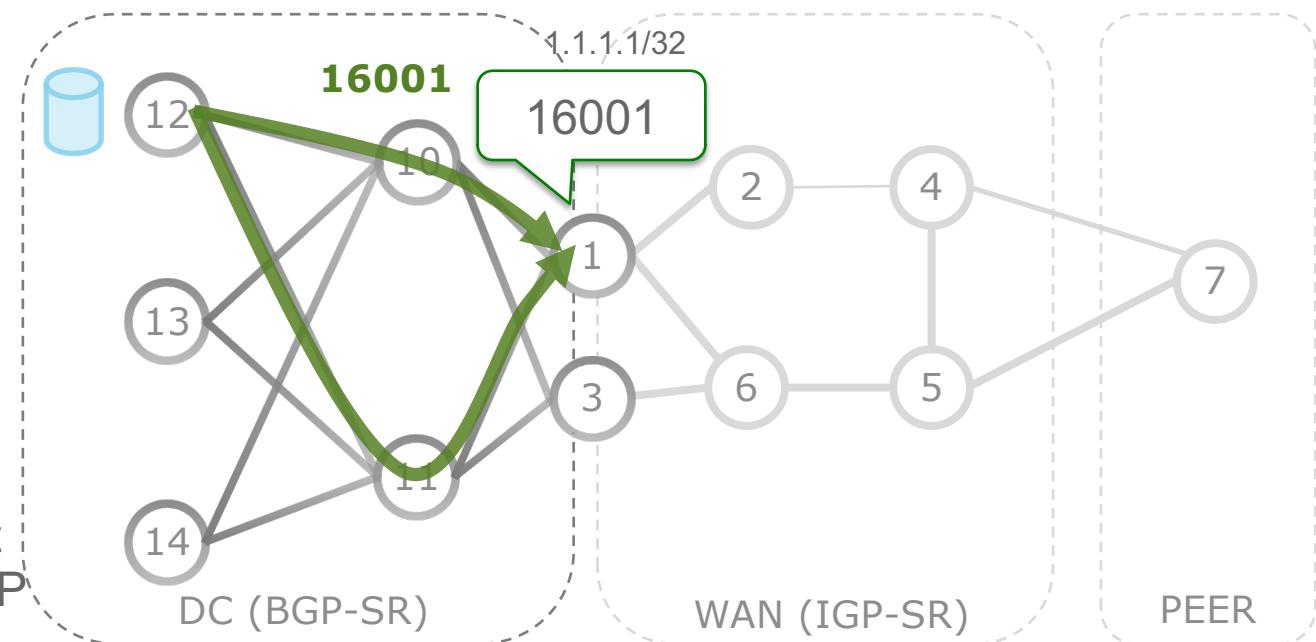
# Anycast Prefix Segment

- 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



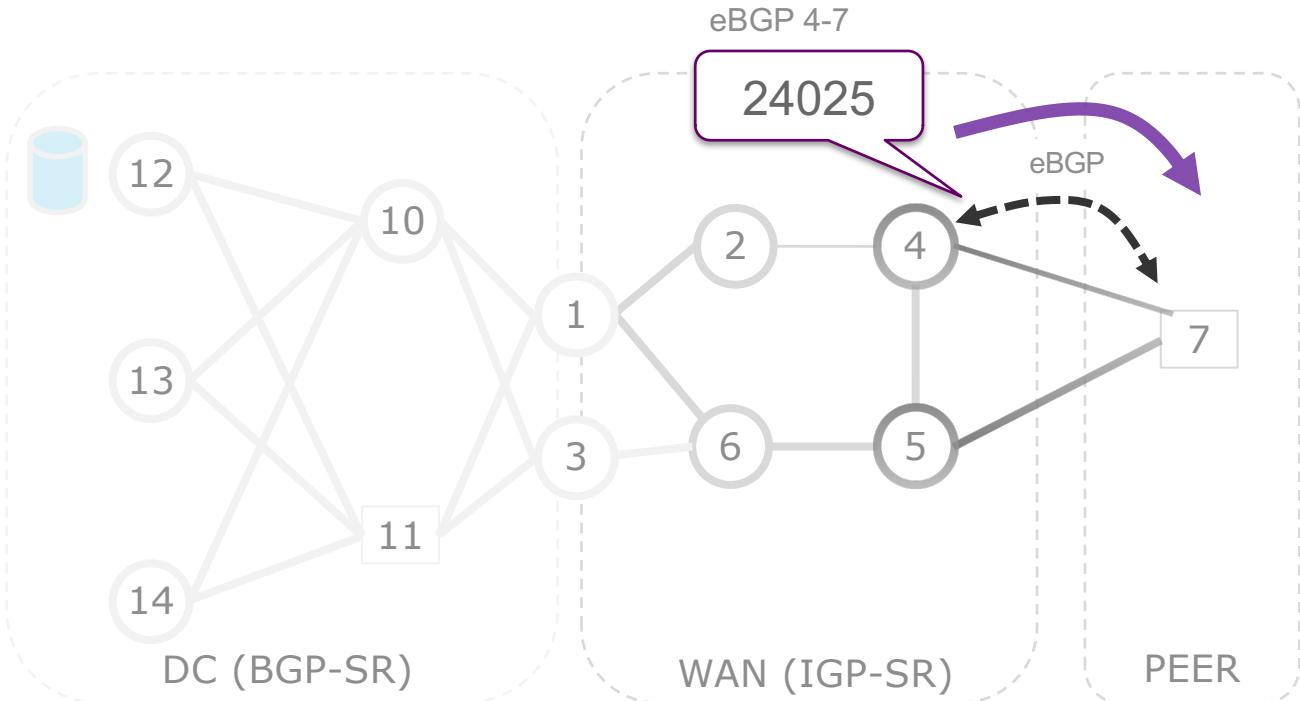
# BGP Prefix Segment

- 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



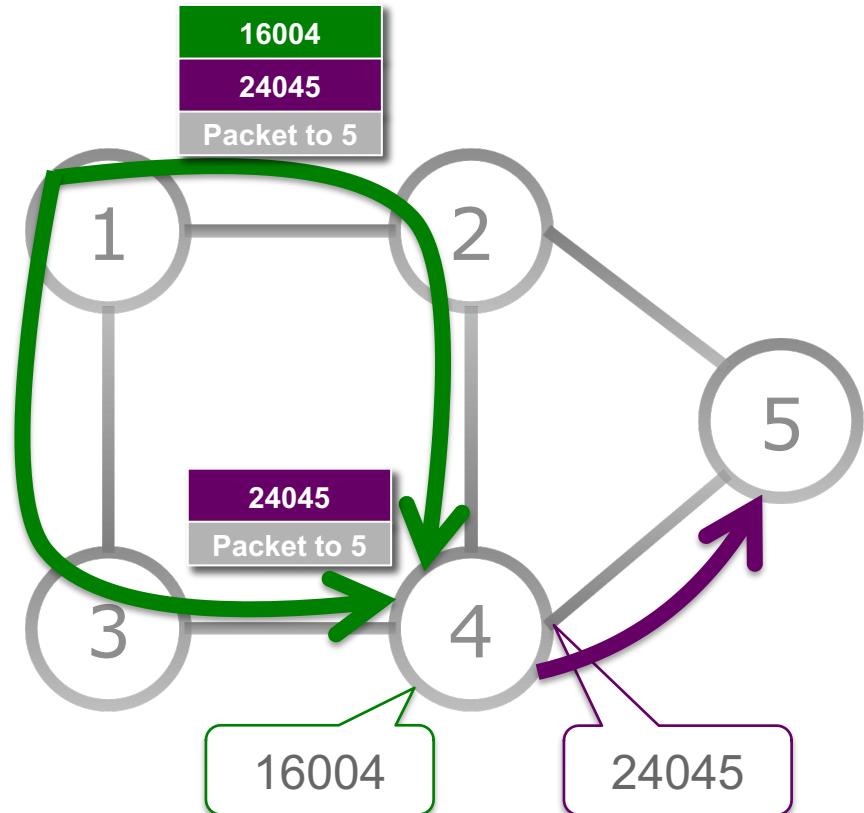
# BGP Peering Segment

- 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



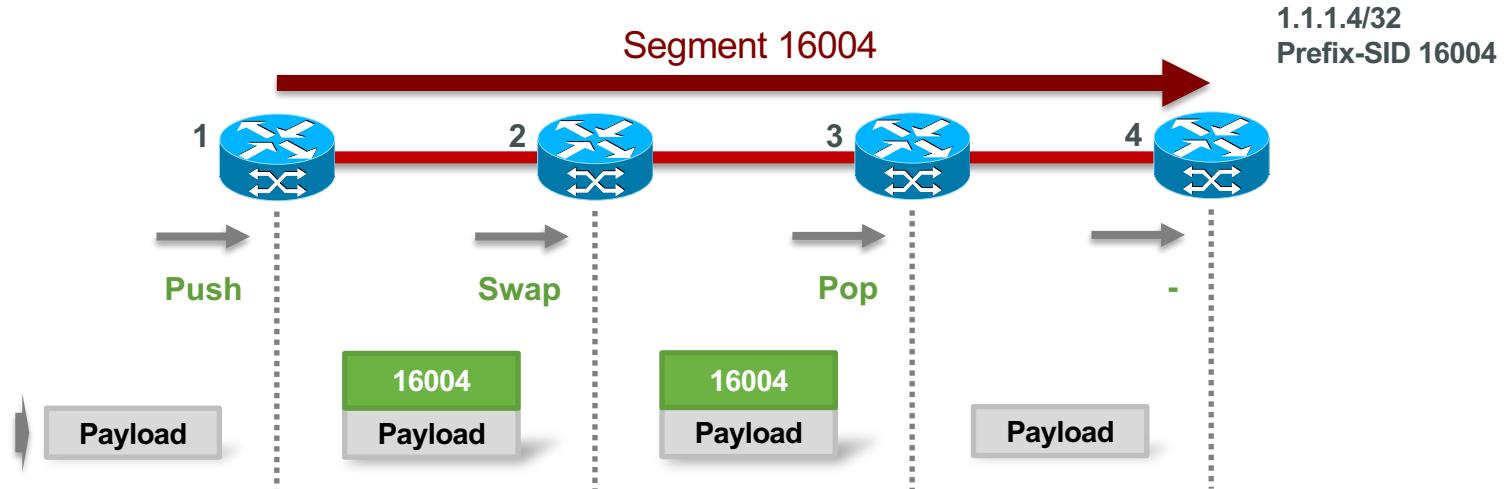
# All about Segments !!!

## 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 Use-case deep-dive
- SR Traffic Engineering
- SRv6

# Conclusion

# Simplicity always prevails

# Resources / Stay Up-To-Date



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



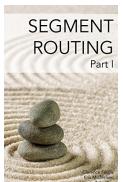
<https://www.linkedin.com/groups/8266623>



<https://twitter.com/SegmentRouting>



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[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/>

