# Deployment & Technology Update

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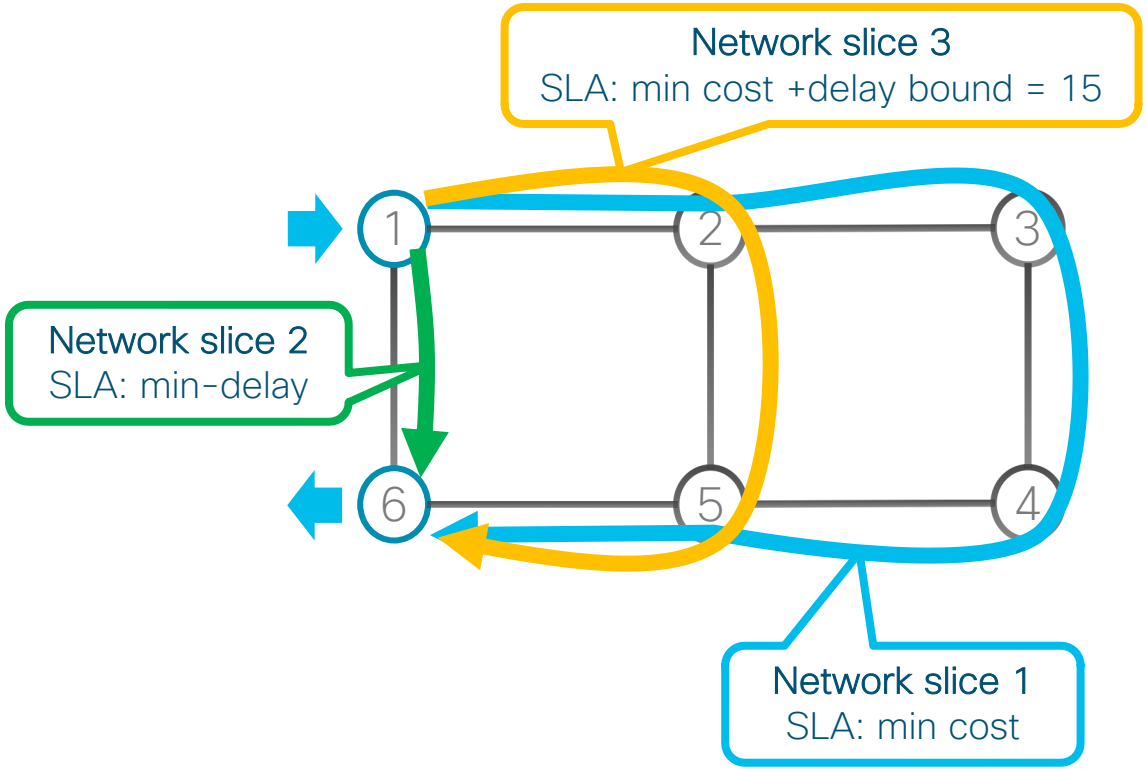
# SR-MPLS

# SR Powering Network Slicing For 5G Networks

*Three-tiered Delay Service with SR-TE and Flex-Algo*

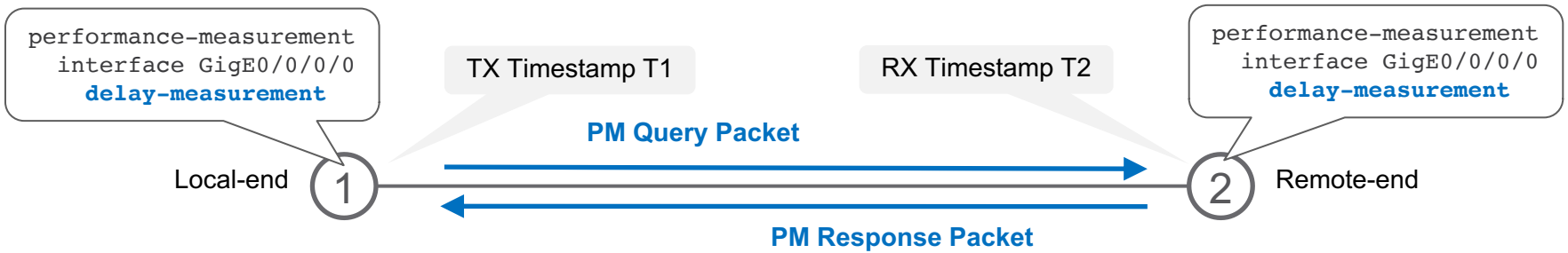



Showcased at Cisco Live Barcelona


vodafone

# How To Quantify Delay?

*Probe Measurement*

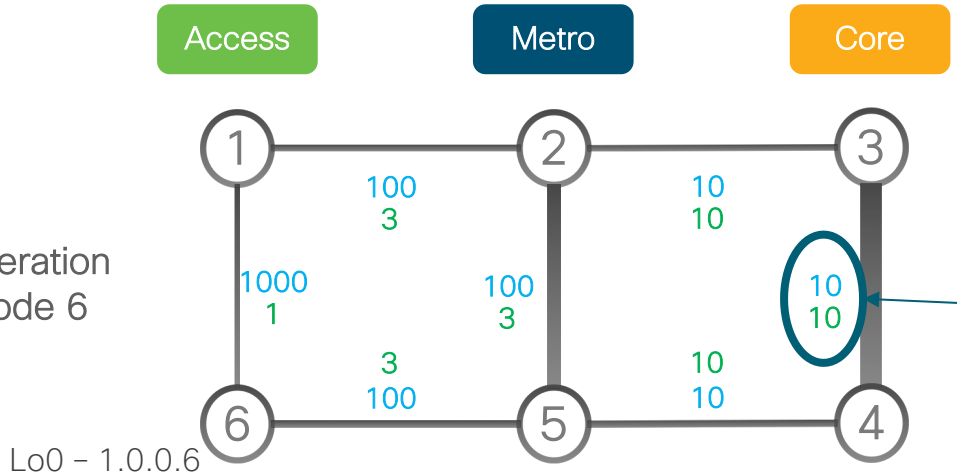



Default: every 3 sec

- One Way Delay = (T2 – T1)
- Timestamps added in hardware
- PM Query format: RFC 6374 (MPLS/GAL) or RFC 5357 (IP/UDP/TWAMP)

# Reference Network Diagram

Traffic under consideration
From Node 1 to Node 6



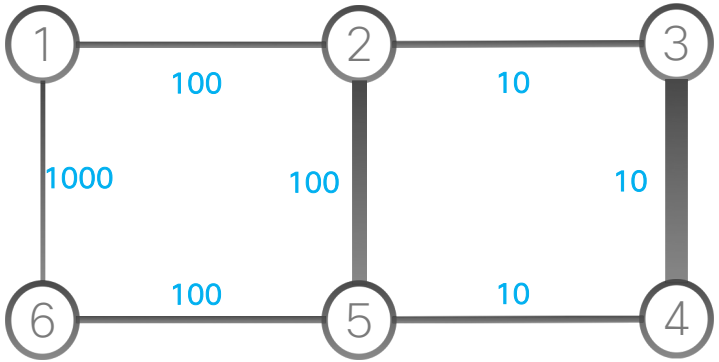

2 metrics per link:

- Cost
- Measured delay

More bandwidth at a cheaper cost

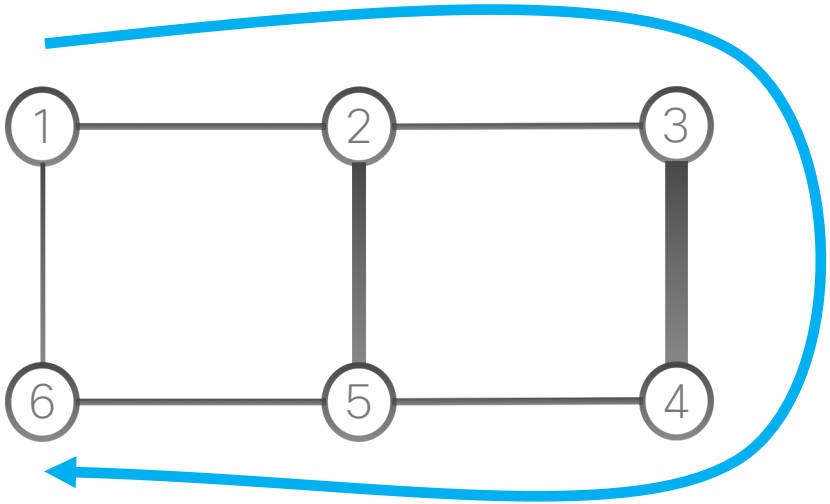
# Minimizing Routing Cost Metric

*Low Cost Network Slice*




Lo0 – 1.0.0.6

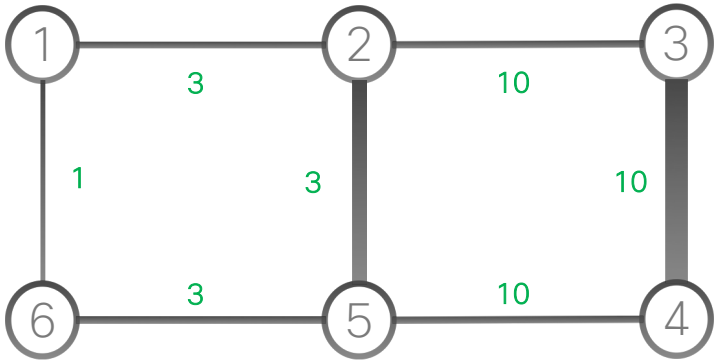
16006 (Algo 0)




16006 (Algo 0)

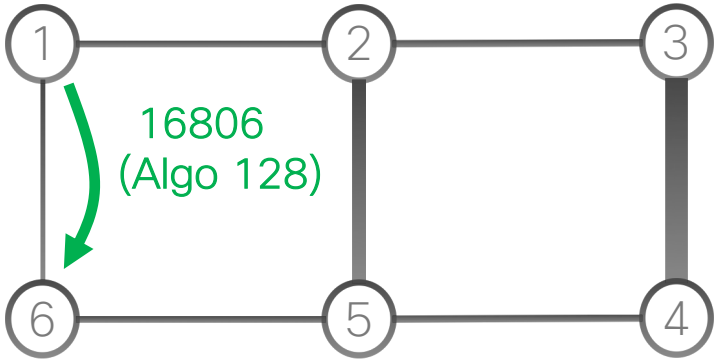
ISIS Shortest-path according to the per-link ISIS cost metric

# Minimizing Delay
## *Low Delay Network Slice*




Lo0 – 1.0.0.6

16806 (Algo 128)



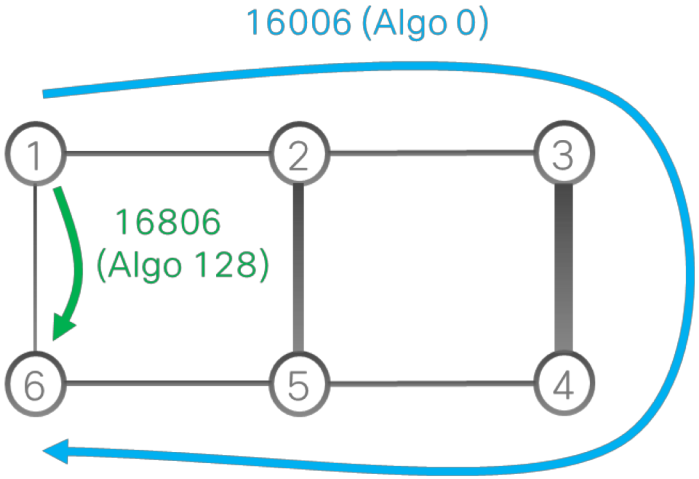

- Operator customizes its ISIS Flex-Algo 128
- Shortest-path according to the per-link delay

# Benefits

Two independent network slices

Low cost

Low delay




**Automated**
*ISIS*

**Flexible**
*Algo customization*

**Simple**
*No LDP, No RSVP-TE*

**Efficient**
*One single Label*

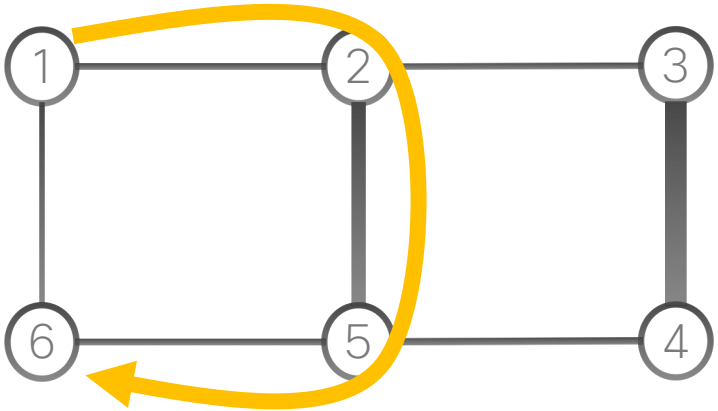
**Stateless**
*No N² RSVP-TE state*

**5G ready**
*Slicing*

# Adding A 3rd Network Slice

*Minimum Cost with Maximum Delay Bound*

Low-Cost
with <=15msec



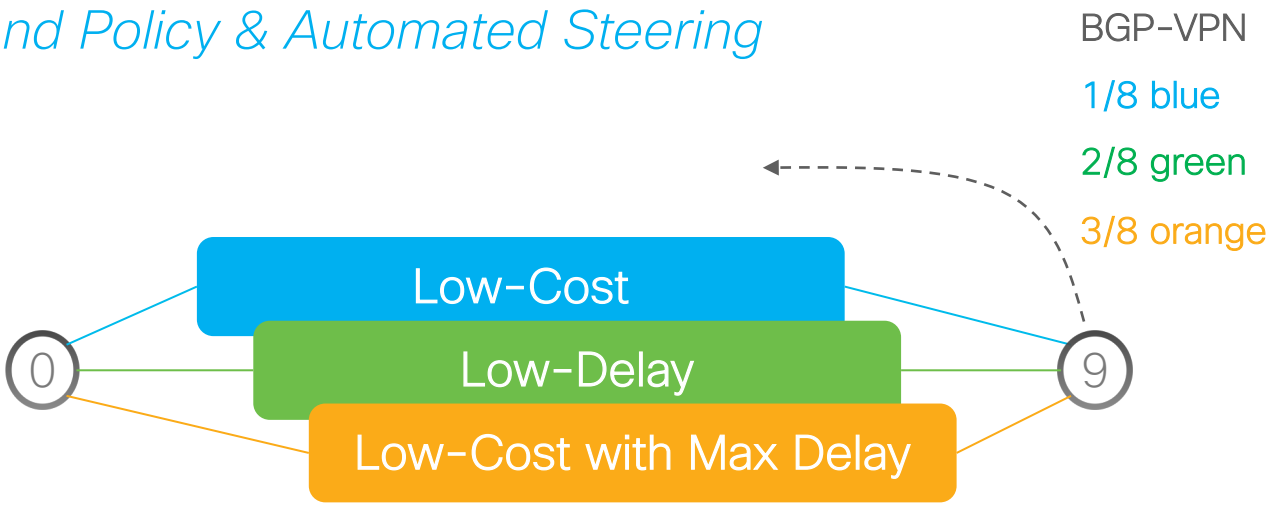

SR TE Policy

SR Native Algorithm

Business Traffic
with Delay constraint

# Automated TE

*On-Demand Policy & Automated Steering*




Operator colors VPN routes

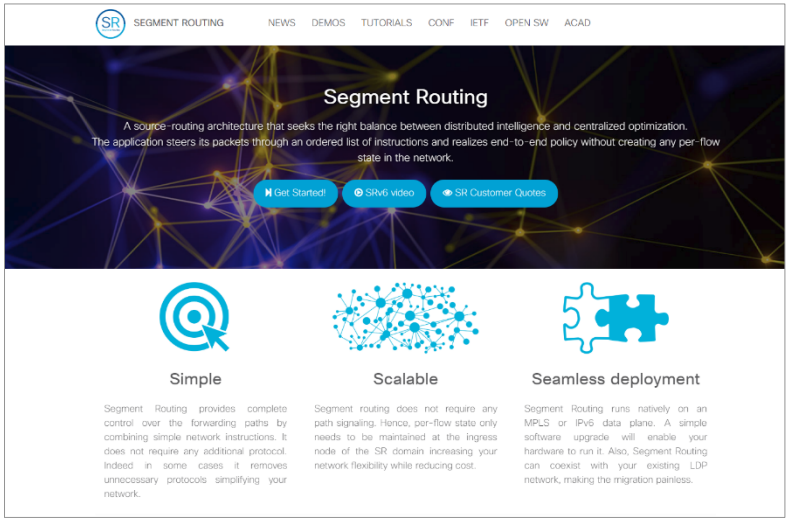
On-Demand Policy

Auto Steering into Slice

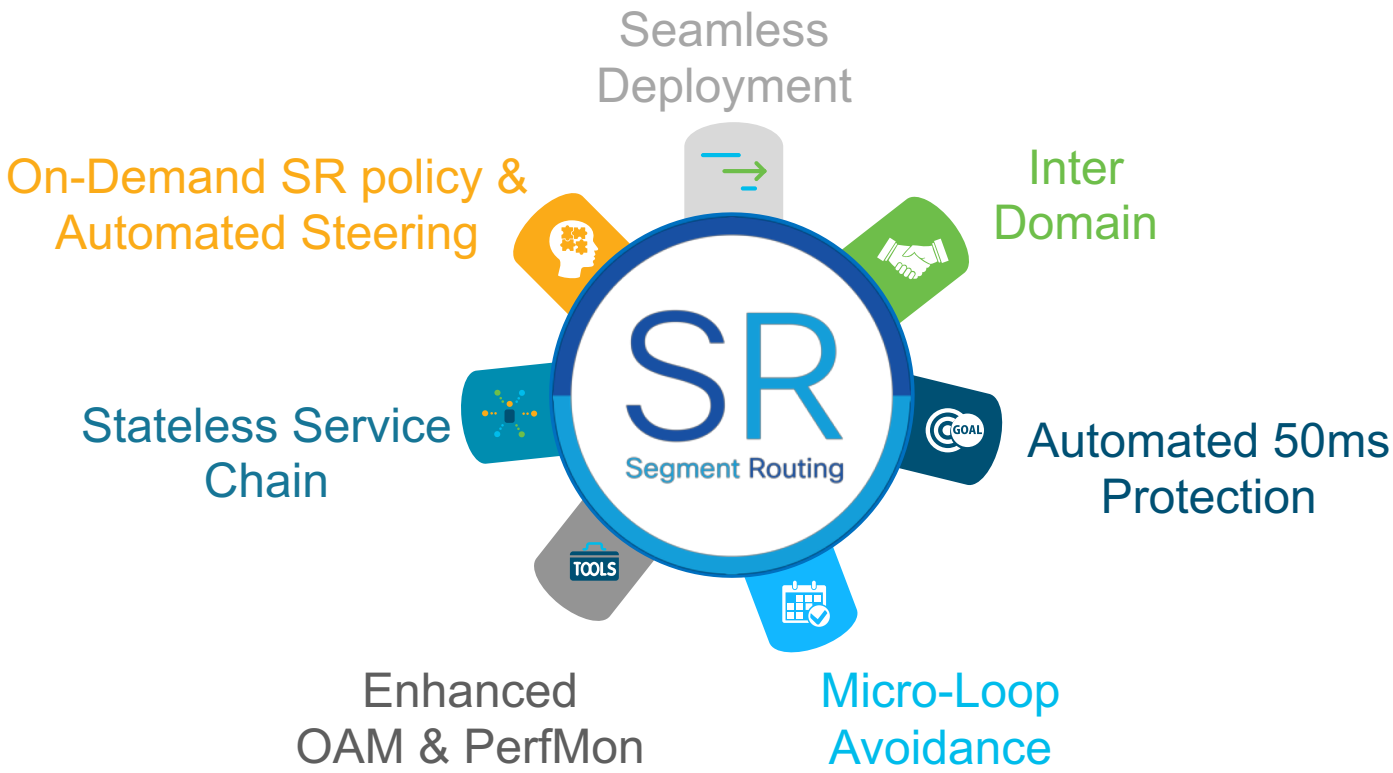
# To continue the discussion

- SD-WAN benefiting from slicing differentiation
- Delay Performance Monitoring
- Dataplane Monitoring
- Per-Flow Steering

segment-routing.net



# SR Unified Fabric Attributes



# SRv6

# Cisco Supports SoftBank on First Segment Routing IPv6 Deployment in Prep for 5G

Link to PR - https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1969030


Thanks to SRv6 network programming capabilities, Iliad is set to further disrupt the mobile market by delivering truly innovative service offerings

Iliad's NodeBox is SRv6 enabled

https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1978361

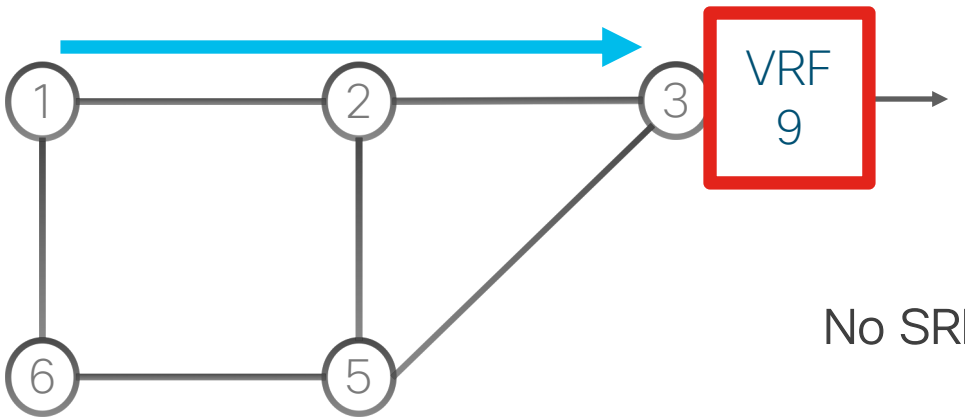
iliad

CISCO

# Best-Effort VPN

Network Program: B:3:V(9)

*B: locator block is associated with ISIS base algo (Low Cost)*

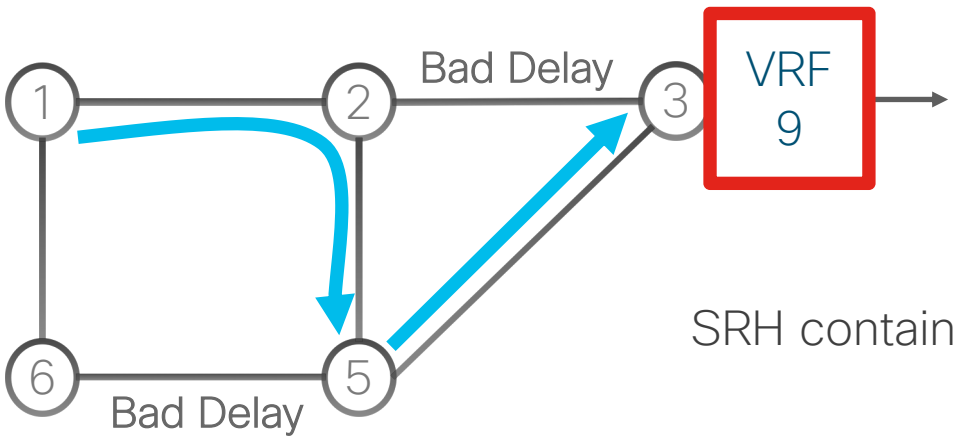



No SRH!

# Low-Delay VPN

Network Program: B:2:C5 then B:3:V(9)

*B: locator block is associated with ISIS base algo (Low Cost)*

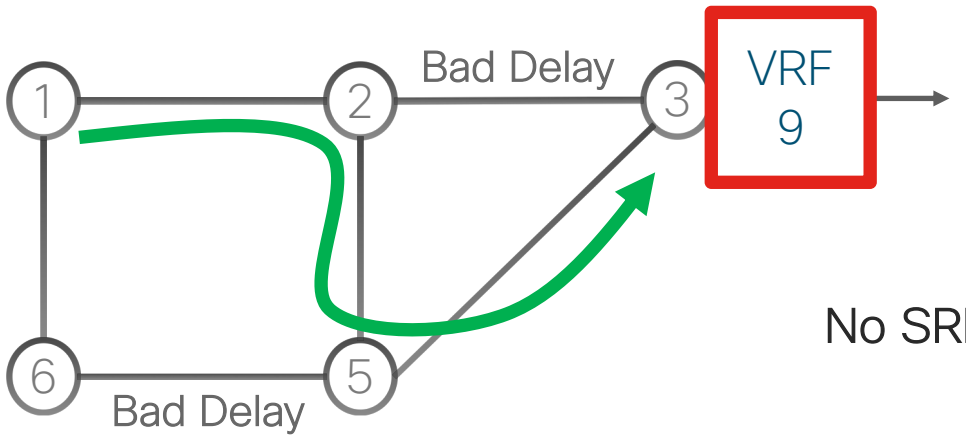



SRH contains 1 single SID

# Low-Delay VPN

Network Program: D:3:V(9)

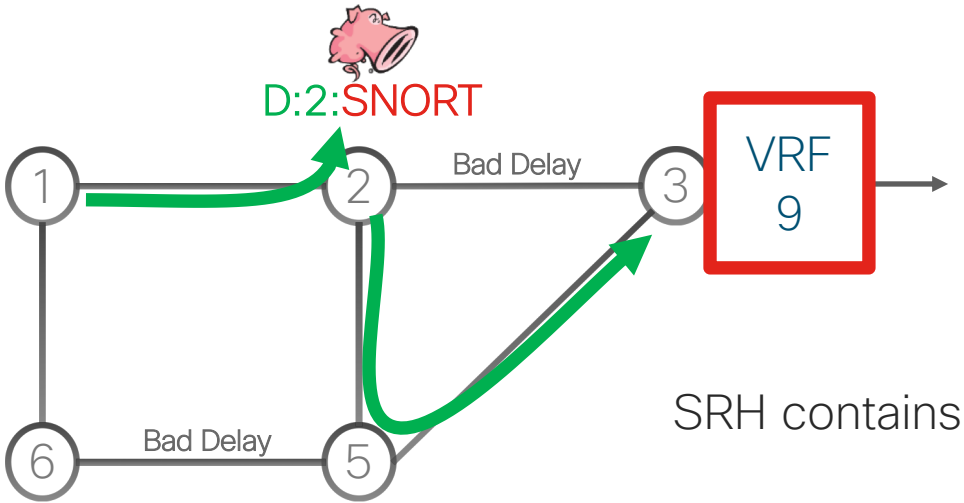
*D: locator block is associated with Low Delay Flex-Algo*



# SNORT & Low-Delay VPN

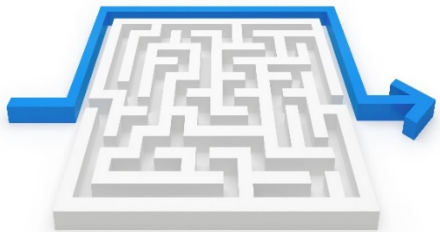
Network Program: D:2:SNORT then D:3:V(9)

*D: locator block is associated with Low Delay Flex-Algo*

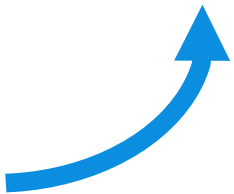



SRH contains 1! Single SID

# Simplicity Always Prevails



Furthermore with more scale and functionality



# Conclusion

# Industry At Large Backs Up SR

Strong customer adoption

WEB, SP, EN

Core, Metro, Access, DC

De-facto SDN Architecture

Standardization

IETF

Multi-vendor Consensus

Open Source

Linux, VPP

# Stay Up-To-Date

## Social media

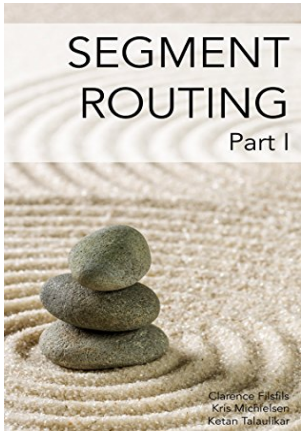
twitter.com/SegmentRouting

facebook.com/SegmentRouting/

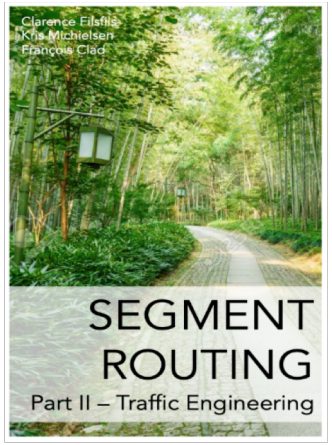
segment-routing.net

linkedin.com/groups/8266623

## Books




amzn.com/B01I58LSUO



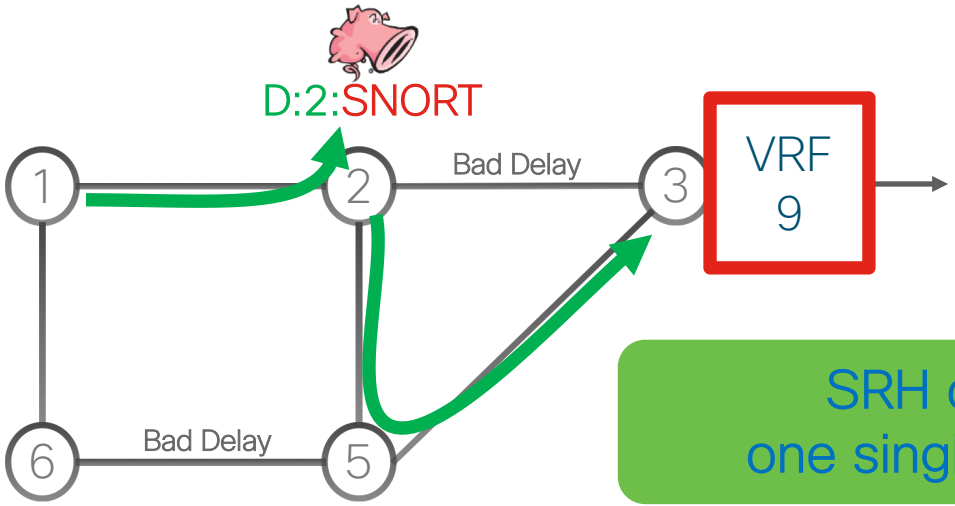

amazon.com/dp/B07N13RDM9

# SRv6 Backup

# SNORT & Low-Delay VPN

Network Program: D:2:SNORT then D:3:V(9)

*D: locator block is associated with Low Delay Flex-Algo*




SRH contains
one single Segment

# Rich consensus and Eco-system

## Implementation

*Cisco*
*Linux*
*VPP FD.IO*
*Barefoot*
*Broadcom*
*UTStarcom*
*Huawei*
*Free Node*
*SmartNIC1*
*SmartNIC2*
*NFV Apps*
*Kubernetes*

## Multiple Interop's

*Sigcomm 2017*
*EANTC 2018*
*EANTC 2019*
*Deployments*

## Deployment's

*Softbank*
*Free Telecom*
*China Telecom*
*China UniCom*

## Record Velocity

*< 2 years !*

# IETF

SPRING
Internet-Draft
Intended status: Informational
Expires: September 25, 2019

S. Matsushima
Softbank
C. Filsfils
Z. Ali
Cisco Systems
Z. Li
Huawei Technologies
March 24, 2019

SRv6 Implementation and Deployment Status
draft-matsushima-spring-srv6-deployment-status-00

## SRH

*1st: 2014-03*
*WG: 2015-12*
*Last-Called: 2019-04*
*26 revisions*

## NET PGM

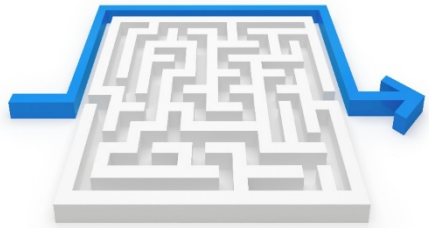
*1st: March 2017*
*WG: 2019-04*
*Rev7 (26)*

# Scale

- Network Programming model
  - Locator, Function, Argument
  - Function can be anything we want, huge oppoturnity for scale
  - Locator + function already expresses at least two MPLS labels
- IP
  - Summarizion
  - Route Leaking
- Flex-Algo
  - end-to-end Slices with one single locator
- Binding SID

# Simplicity

- Protocol elimination
  - No LDP
  - No RSVP-TE
  - No MPLS dataplane
  - No L2TPv3/GRE/UDP-VxLAN
  - No GTP
  - No NSH
- IP finally strong to handle the networking task itself



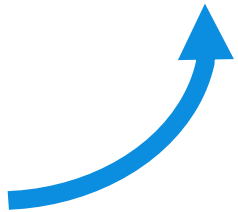
# Scale

| | # of SID's | SRH presence | Below IPv4 MPLS Label Stack | Above IPv4 |
|---|---|---|---|---|
| Best-Effort VPN | 1 | No | 1 | UDP/VxLAN |
| Low-Delay VPN (SR-TE) | 2 | Yes (1 single SID) | 3 | UDP/VxLAN |
| Low-Delay VPN (Flex-Algo) | 1 | No | 1 | UDP/VxLAN |
| Snort & Low-Delay VPN | 2 | Yes (1 single SID) | 4 | UDP/VxLAN |

- Stateless Fabric
  - The state is in the packet header, not in the fabric

# Further Scale

- IP summarization for inter-domain
- Anycast IP
- … ☺

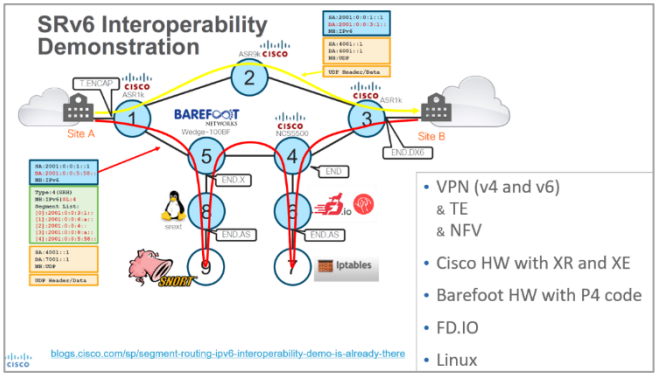


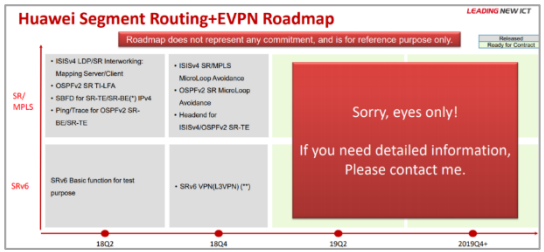
# Further Functionality

- Just program the network
- SRv6 is Turing Complete
  - Metadata is part of the solution: Tag and TLV

# Other HW

- Jericho1 and above
  - We have proven applicability by shipping it
- Barefoot
  - Interoperability shown @ Sigcomm 2017
- Huawei
  - Strong interest and declared product plan
- SmartNic



# Other SW

- Linux Kernel since 4.10
  - Extensive implementation supported by Cisco Research
- FD.io VPP
  - Extensive implementation supported by Cisco
- Container Networking


kubernetes

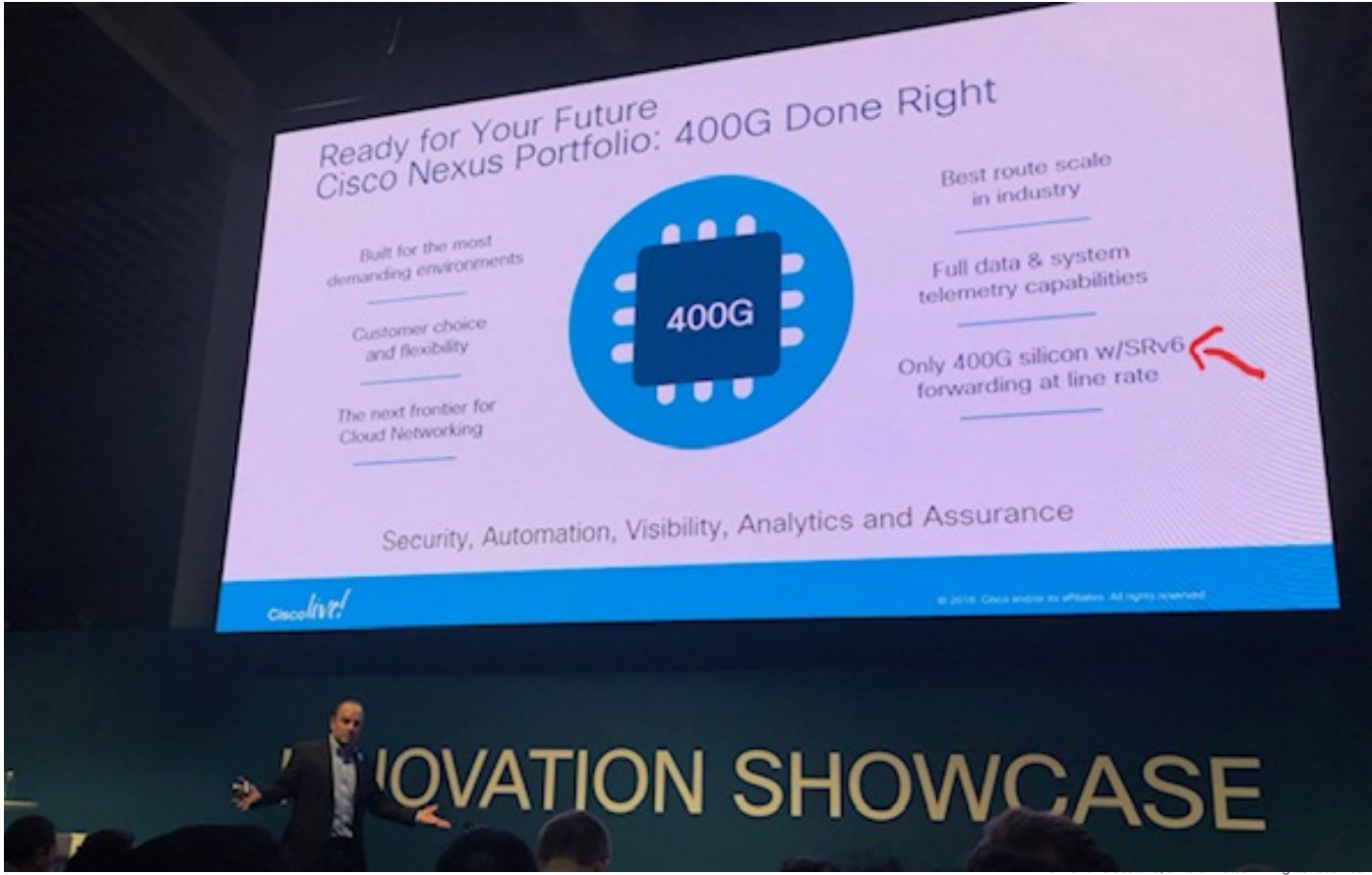
# Cisco FCS and in deployment

- SRv6 ISIS
- SRv6 TILFA
- SRv6 BGP L3-VPNv4
- SRv6 OAM

- More coming in CY19… ask us

# Also in the DC – with linerate SRv6 @ 400G

- Amazing set of SRv6 network instructions @ 400G !

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