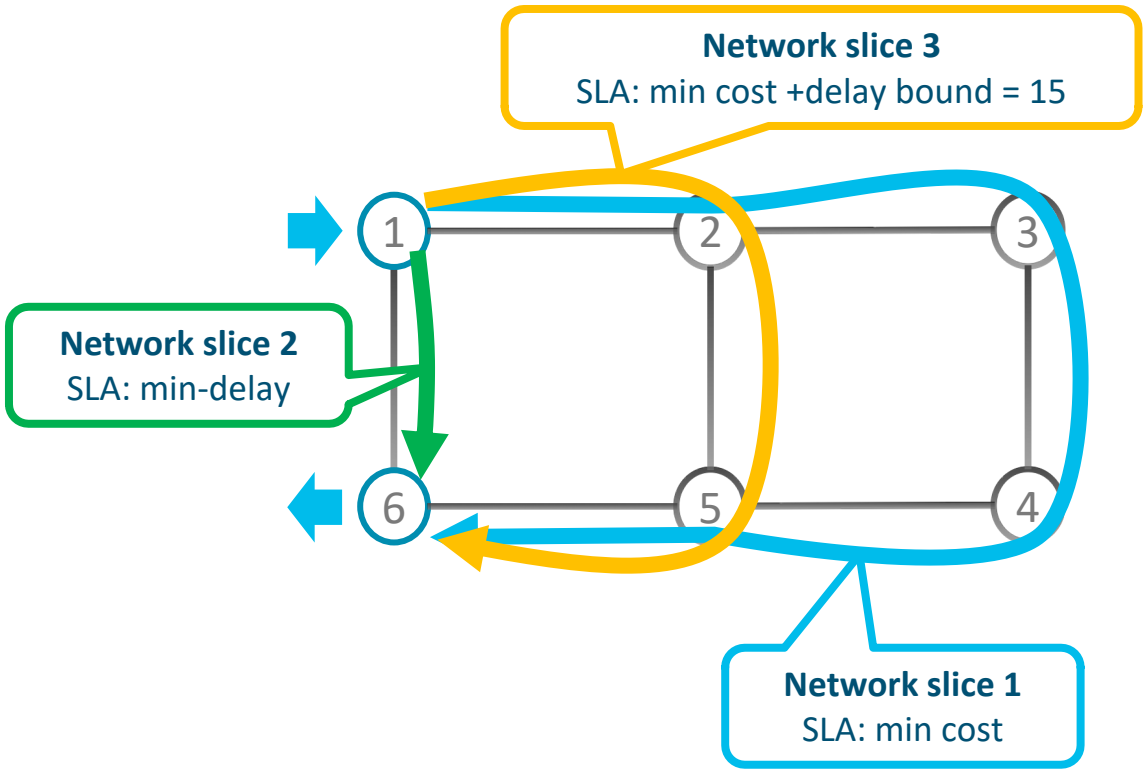
Deployment & Technology Update

Clarence Filsfils
Cisco Fellow – cf@cisco.com

SR-MPLS

SR Powering Network Slicing For 5G Networks

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

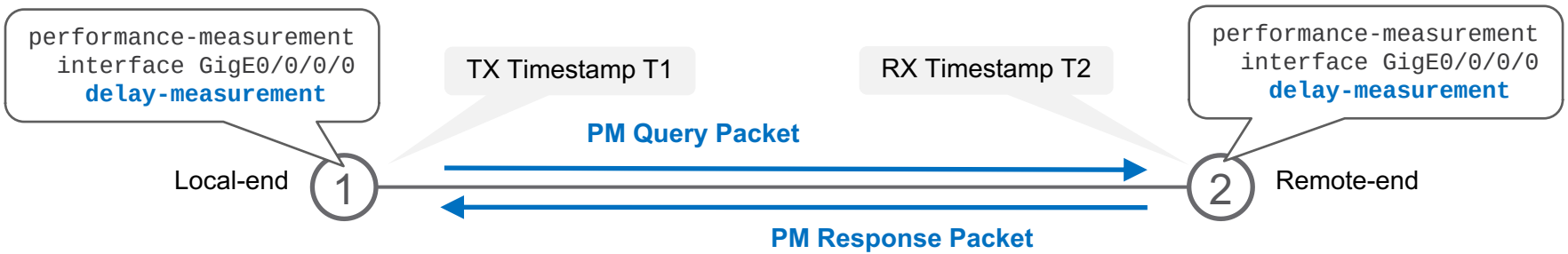


Showcased at Cisco Live Barcelona

vodafone

How To Quantify Delay?

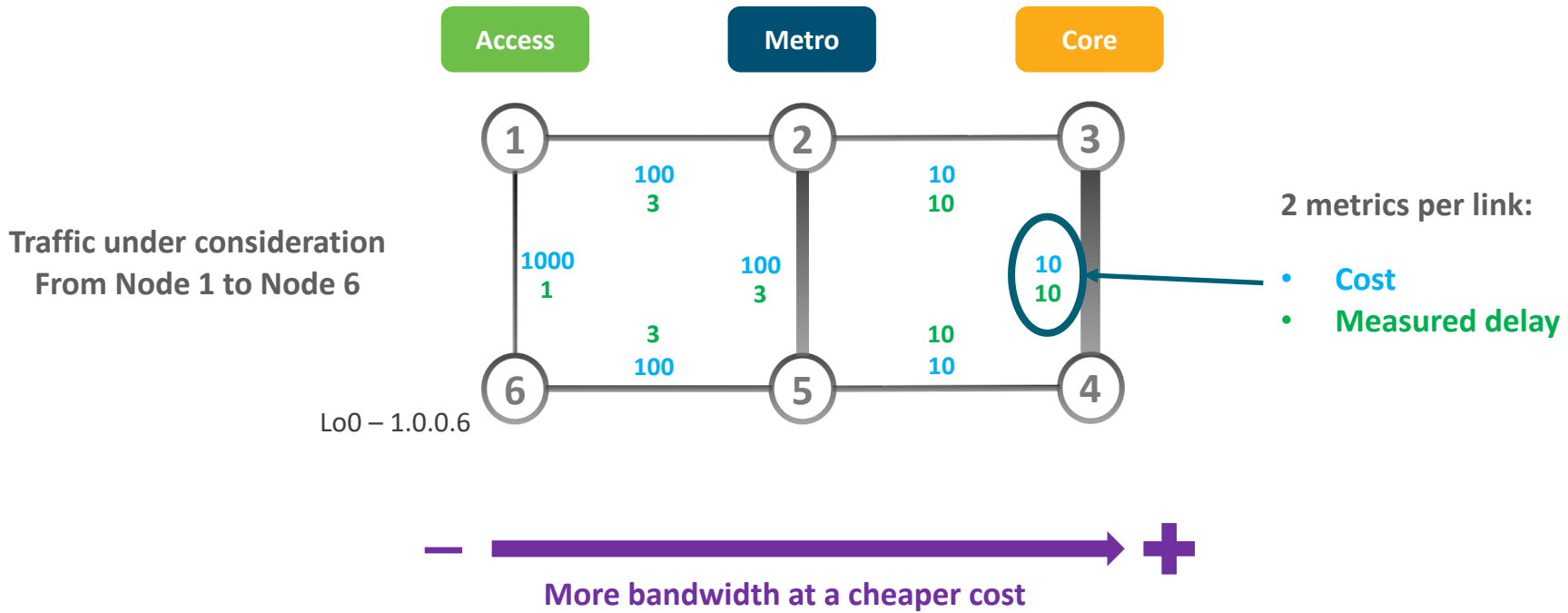
Probe Measurement



Default: every 3 sec

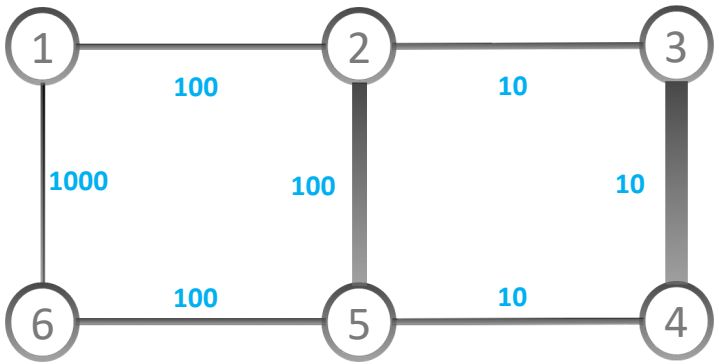
- One Way Delay = (T2 – T1)
- Timestamps added in hardware
- PM Query format: RFC 6374 (MPLS/GAL) or RFC 5357 (IP/UDP/TWAMP)

Reference Network Diagram



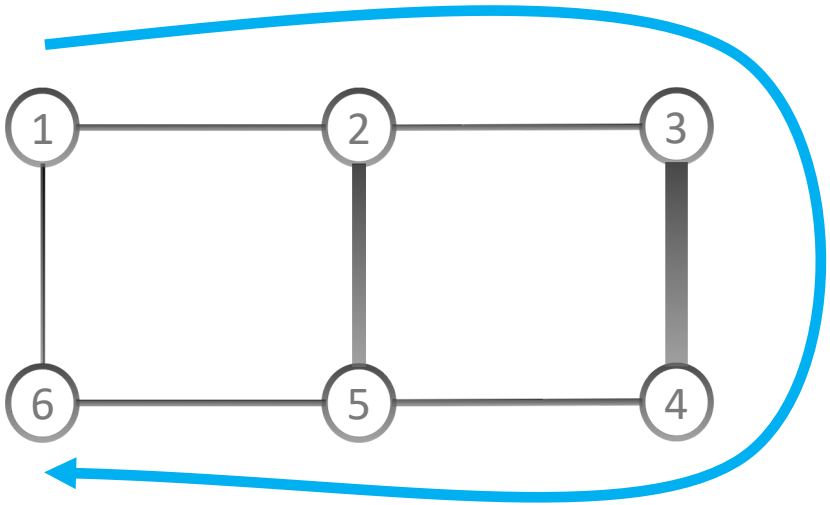
Minimizing Routing Cost Metric

Low Cost Network Slice



Lo0 – 1.0.0.6

16006 (Algo 0)



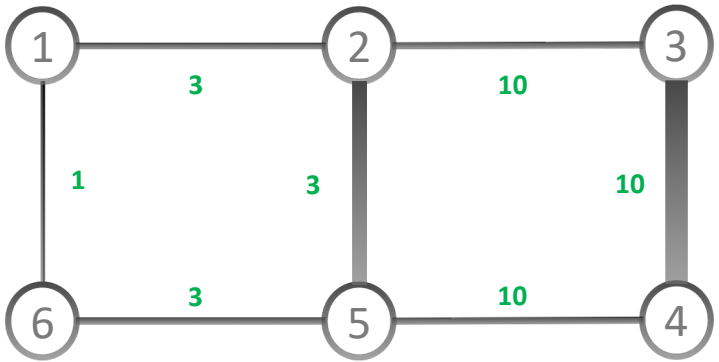
16006 (Algo 0)

ISIS Shortest-path according to

the per-link ISIS cost metric

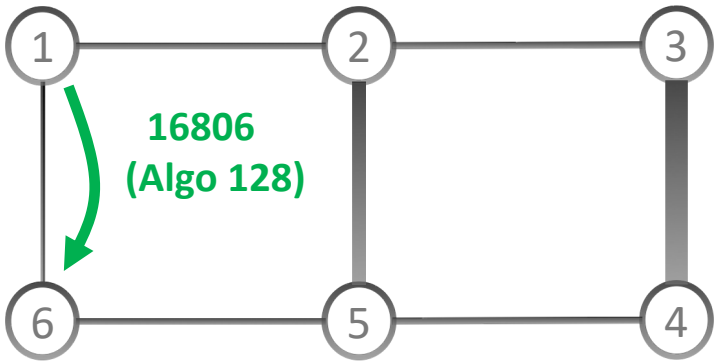
Minimizing Delay

Low Delay Network Slice



Lo0 – 1.0.0.6

16806 (Algo 128)

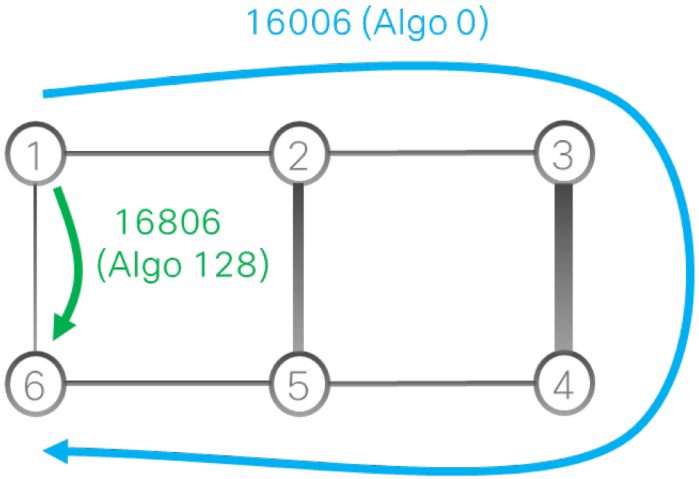


- Operator customizes its ISIS Flex-Algo 128
- Shortest-path according to the per-link delay

Benefits

Two independent network slices

- **Low cost**
- **Low delay**



Automated
ISIS

Flexible
Algo customization

Simple
No LDP, No RSVP-TE

Efficient
One single Label

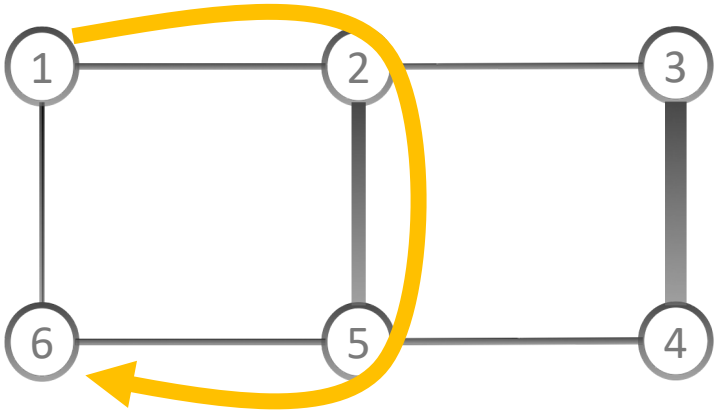
Stateless
No N^2 RSVP-TE state

5G ready
Slicing

Adding A 3rd Network Slice

Minimum Cost with Maximum Delay Bound

Low-Cost with <=15msec



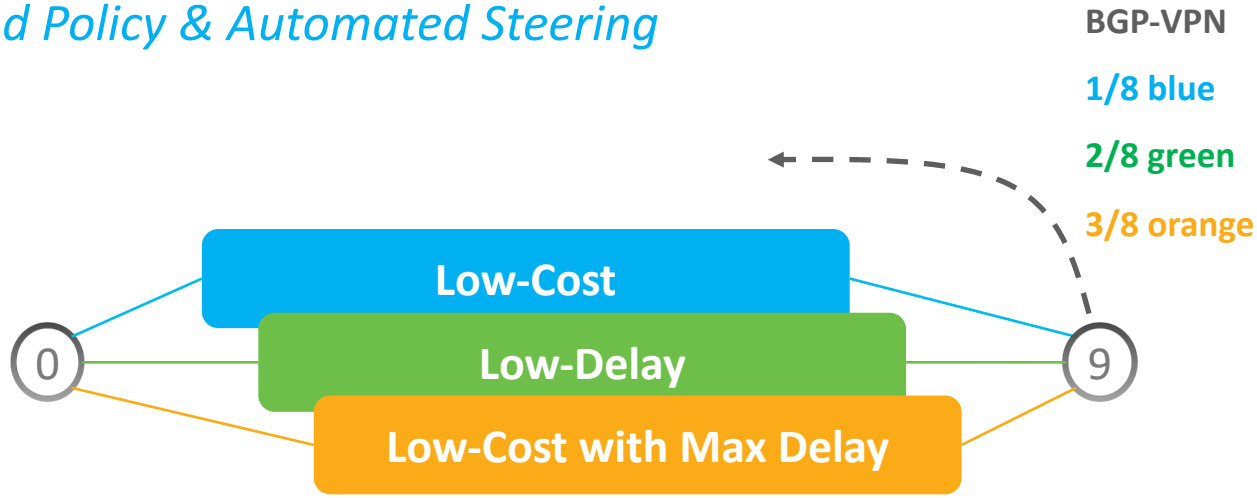
SR TE Policy

SR Native Algorithm

Business Traffic with Delay constraint

Automated TE

On-Demand Policy & Automated Steering



Operator colors VPN routes

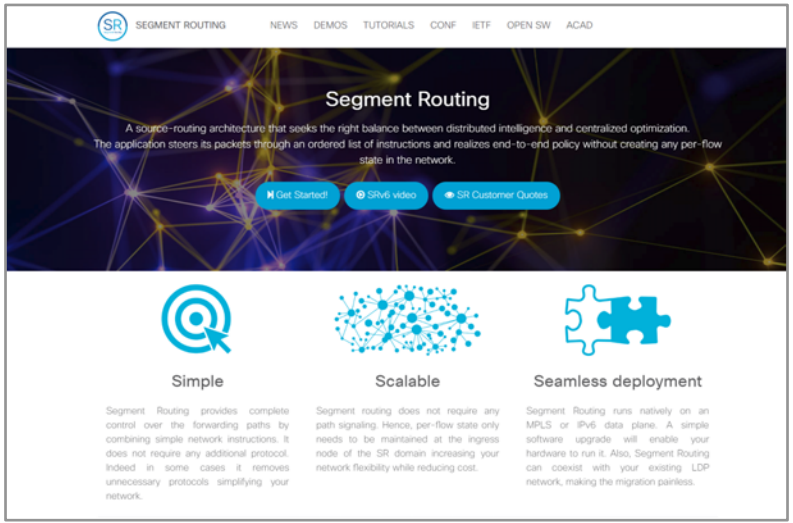
On-Demand Policy

Auto Steering into Slice

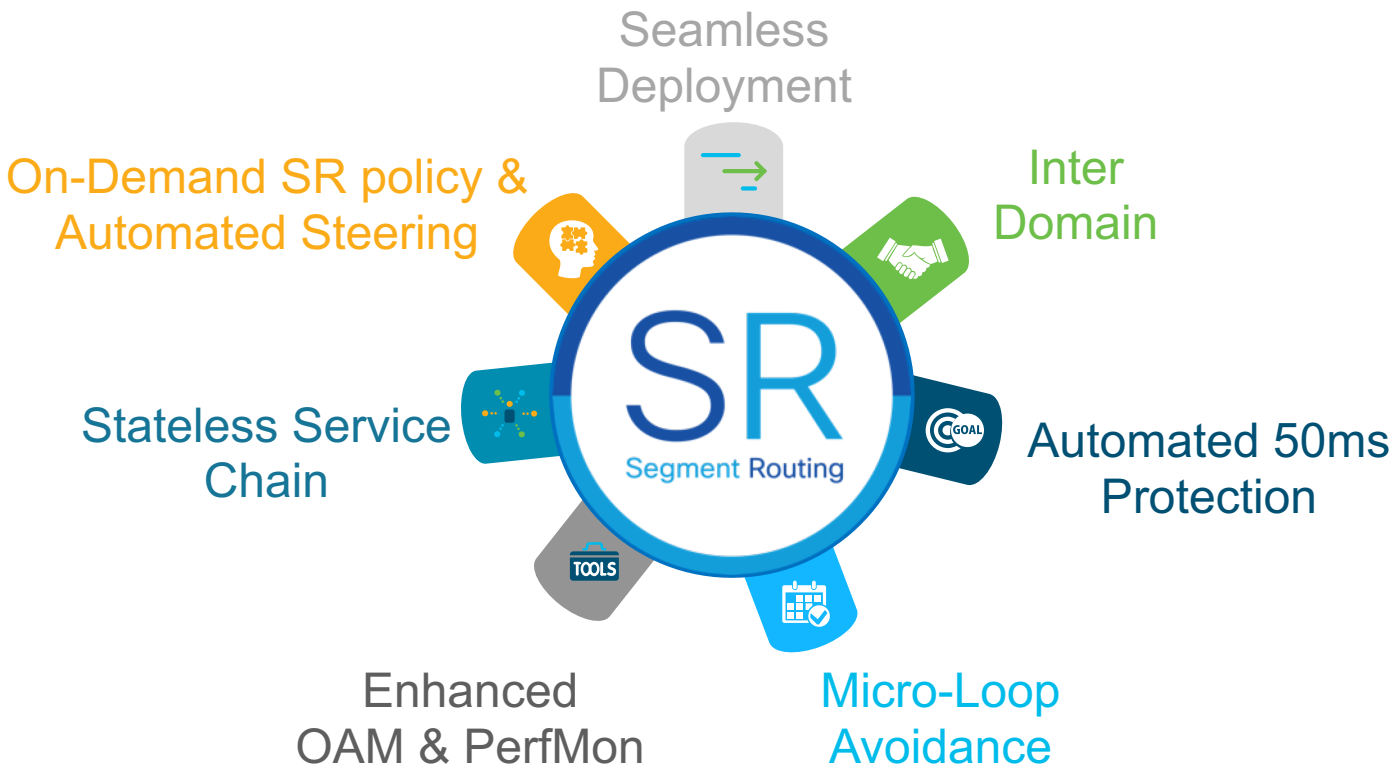
To continue the discussion

- 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

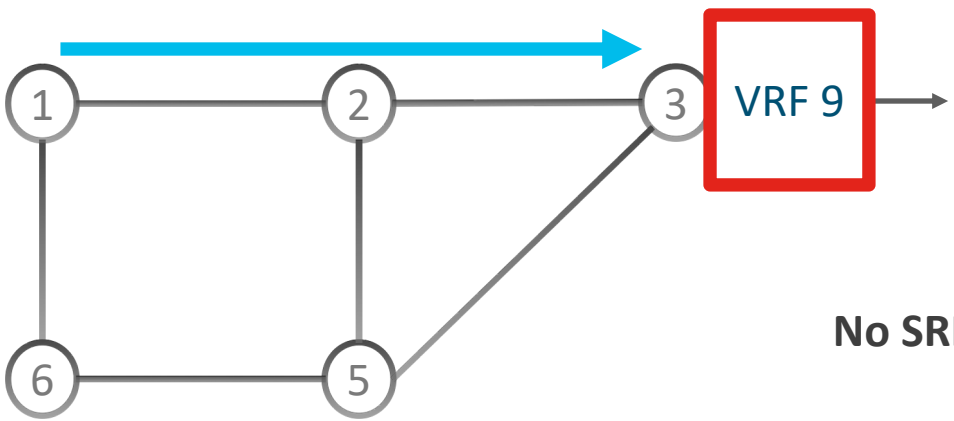
iliad

CISCO

Best-Effort VPN

Network Program: B:3:V(9)

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

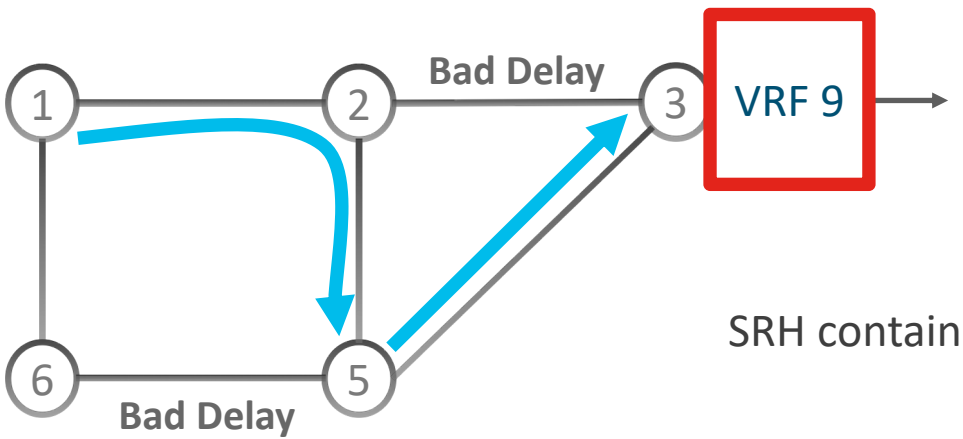


No SRH!

Low-Delay VPN

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

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

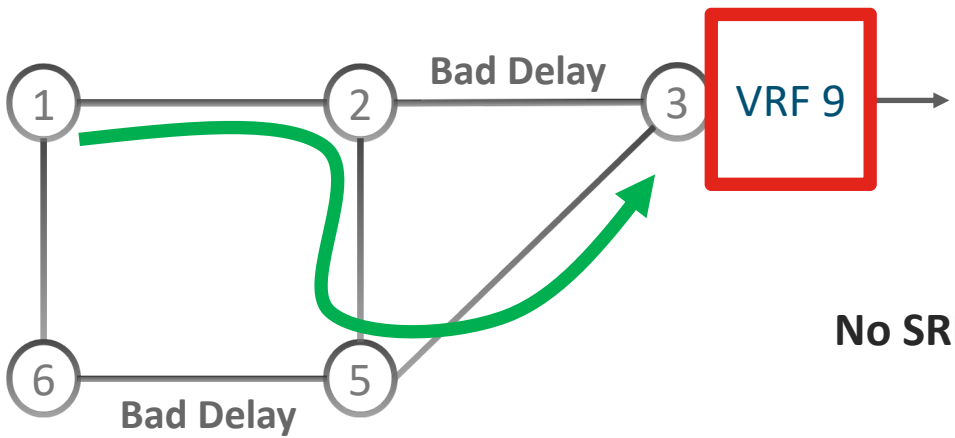


SRH contains 1 single SID

Low-Delay VPN

Network Program: D:3:V(9)

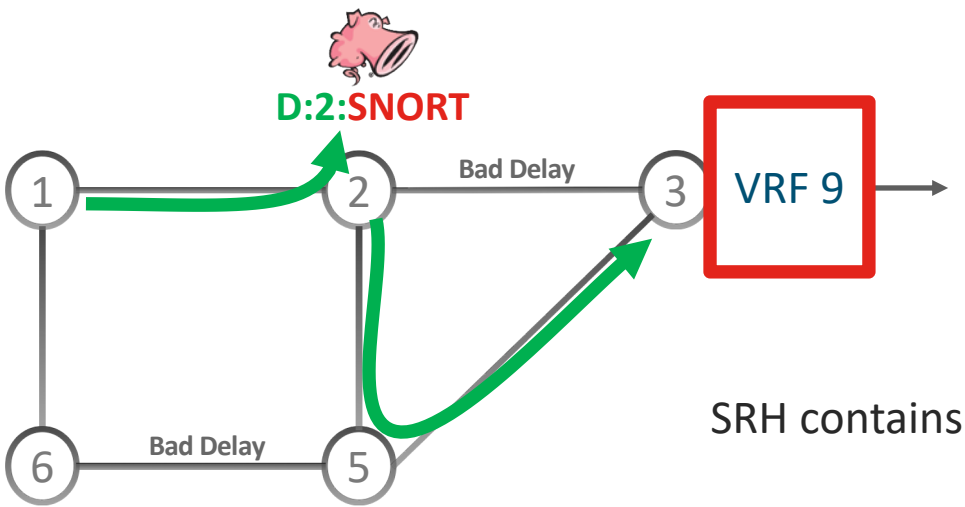
***D*: locator block is associated with *Low Delay* Flex-Algo**



SNORT & Low-Delay VPN

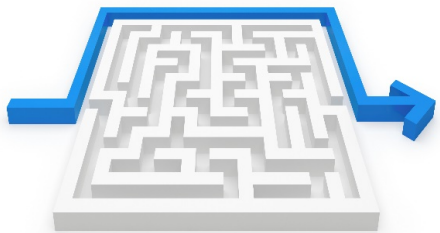
Network Program: D:2:SNORT then D:3:V(9)

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

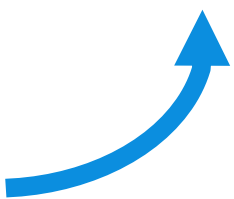


SRH contains 1! Single SID

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

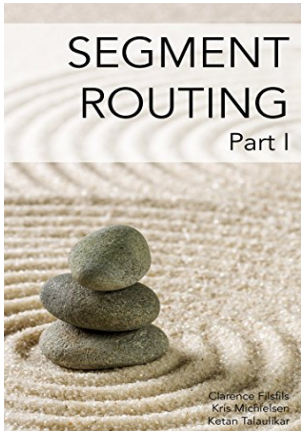
twitter.com/SegmentRouting

facebook.com/SegmentRouting/

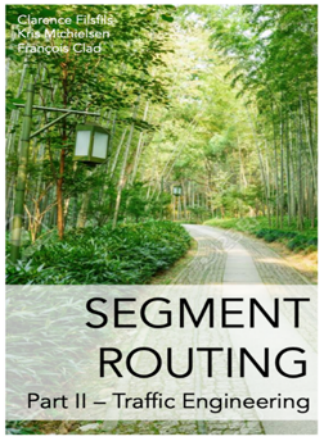
segment-routing.net

linkedin.com/groups/8266623

Books



amzn.com/B01I58LSUO



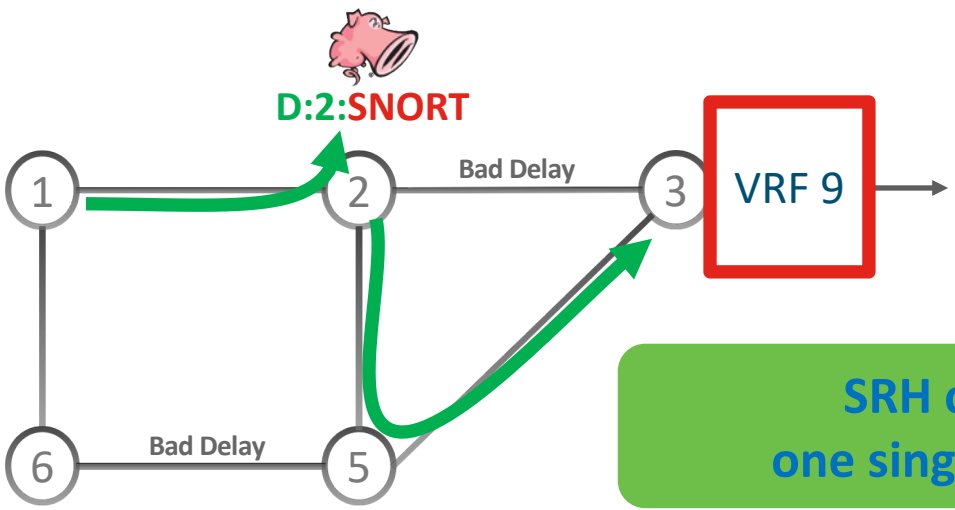
amazon.com/dp/B07N13RDM9

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
UniStarcom
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
#4 on its way

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

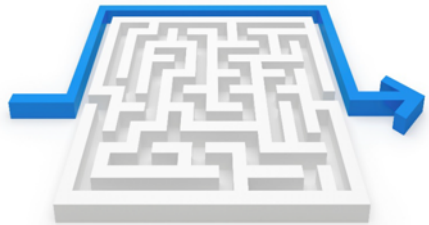
1st: March 2017
WG: 2019-04
Rev7 (26)

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**



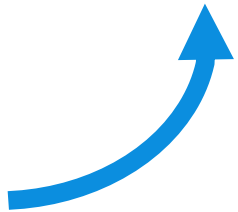
Scale

	# 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
- … ☺

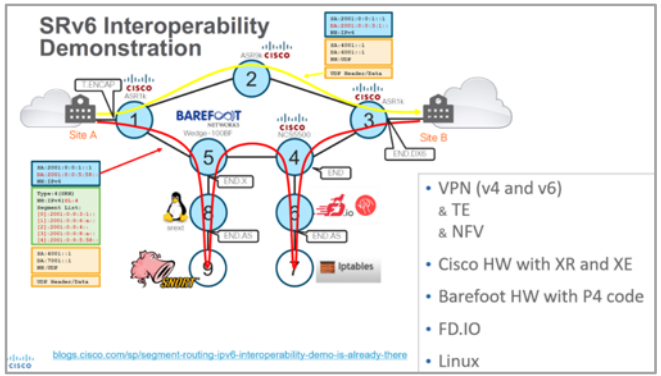


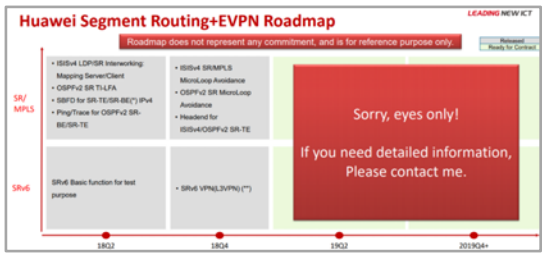
Further Functionality

- 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





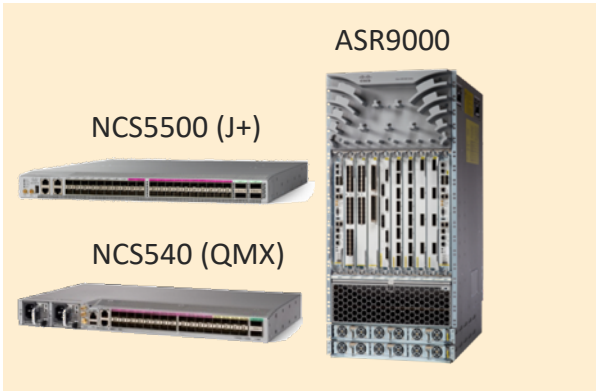
Other SW

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

Cisco FCS and in deployment

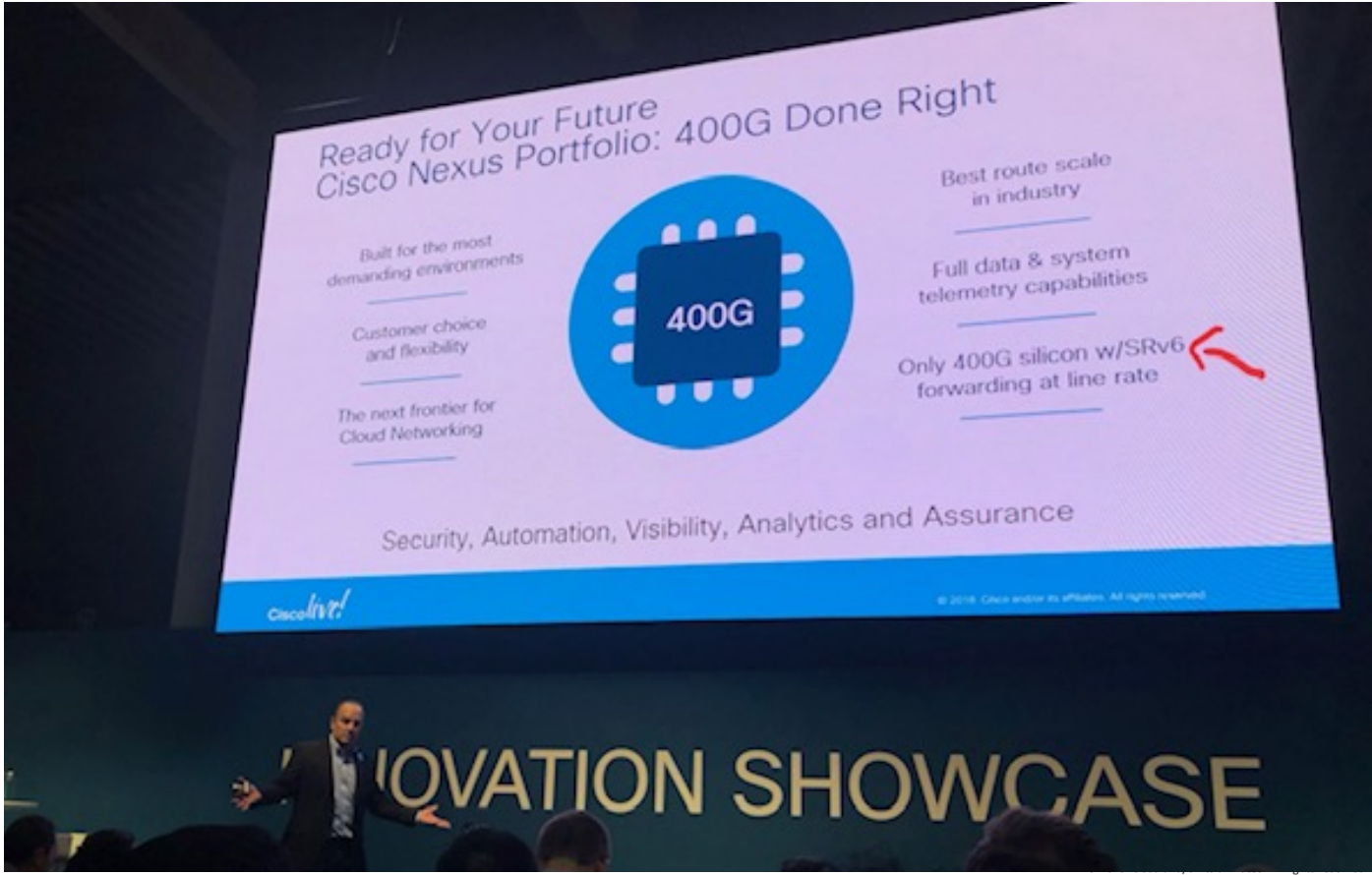
- SRv6 ISIS
- SRv6 TILFA
- SRv6 BGP L3-VPNv4
- SRv6 OAM

- More coming in CY19… ask us



Also in the DC - with linerate SRv6 @ 400G

- Amazing set of SRv6 network instructions @ 400G !




CISCO