



SRv6 uSID

Clarence Filsfils

The un-expected Innovation

Using IP protocol differently
than anyone else imagined in the past

Any service without any shim (MPLS, VxLAN...)

With Better Scale, Reliability, Cost
and Seamless Deployment in Brownfield

Grand Architecture with HW-Efficiency

- Revolutionary Network Programming Model (Turing Complete)
 - The IP Destination Address (DA) holds up to 14 instructions
 - > 2-byte block, 1-byte uSID's
 - SRH extension header holds additional instructions (rarely needed)
- Any behavior can be bound to the instruction
 - Shortest path according to cost, latency with exclusion of unsecured links
 - TDM-alike behavior (one instruction per hop/interface)
 - TE, FRR, NFV, Cryptography...
- Linerate across our entire portfolio

Novel Architecture with Brownfield

- Classic Longest-Match at Legacy IP node
- The network program is opaque to legacy node
- Alibaba, Swisscom, Bell... are all brownfield deployments

Unified Core Metro Access DC Cloud IP solution

Outperforms per-domain custom shim (MPLS, VxLAN)

Outperform MPLS - Daniel Voyer (Bell Canada)

- Native Optimum Slicing
 - SLID is encoded in Flow Label
- HW Linerate Push: 3 times better
 - J2 uSID linerate push: 30 uSIDs >> 10 MPLS Labels
- HW Counter and FIB consumption: 4 times better
 - uSID requires 4 times less counters and FIB entries than MPLS
- Routing scale: 20 times better
 - uSID supports summarization. MPLS requires host routes.
- Lookup efficiency: 2 to 3 times better
 - uSID can process 2 to 3 SIDs in a single lookup (LPM nature)
- Load-balancing: optimum and deterministic
 - uSID provides HW friendly entropy (fixed offset, shallow)



Bell SRv6 uSID Deployment
Paris 2022

Outperforms VxLAN – Gyan Mishra (Verizon)

- Seamless Host support for Network Programming
 - 6 uSID's in outer DA: RFC2460 IPinIP with opaque DA
- TE in the DC
 - elephant flows exist, asymmetric fabrics exist, TE is needed
- TE in the Metro/Core from the host
 - An SRv6 uSID DC allows for the application to control the network program in the metro/core without complex DPI and protocol conversion at the DC boundary,
- uSID DC provides lower MTU overhead (~5%)
 - Lower MTU overhead means lower DC cost
- Vendor, Merchant and SONIC/SAI maturity
 - uSID support across DC vendor (Cisco), Merchant (Cisco, Broadcom, Marvell), Sonic/Sai (Alibaba deployment)



SRv6 uSID DC Use-Case
Paris 2023

Rich SRv6 uSID Ecosystem

Network Equipment Manufacturers



Merchant Silicon



Open-Source Applications



Open-Source Networking Stacks



Smart NIC



Partners



SRv6 is Proposed Standard

Architecture

- SR Architecture – RFC 8402
- SRTE Policy Architecture – RFC 9256

Data Plane

- SRv6 Network Programming – RFC 8986
- IPv6 SR header – RFC 8754

Control Plane

- SRv6 BGP Services – RFC 9252
- SRv6 ISIS – RFC 9352
- SR Flex-Algo – RFC 9350

Operation & Management

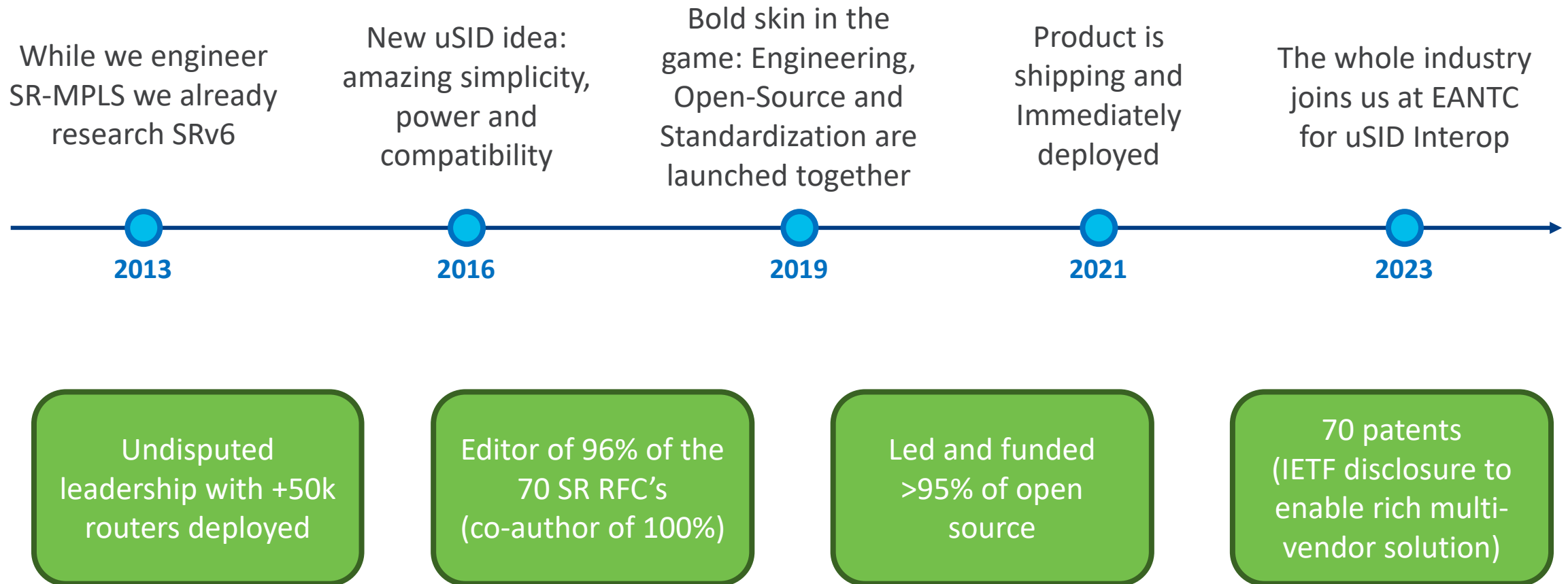
- SRv6 OAM – RFC 9259
- Performance Management – RFC 5357

Strong Commitment and Leadership

Editor of
Co-author of

96% IETF RFCs
100% IETF RFCs

The Leadership Journey



Value

Any Service over IP without any shims

- TDM
- Disjointness
- BW
- Latency
- Secured Routing

Unified Solution

- No DPI at VxLAN/MPLS boundaries
- No GW

Native Host and Cloud

- uSID is in IP
- MPLS is neither in the IP socket nor in the cloud

Better Reliability

- 0 Net Outage in 4 years of commercial service & 50k+ deployed routers



Seamless Brownfield Deployment

- Alibaba
- Bell
- Swisscom

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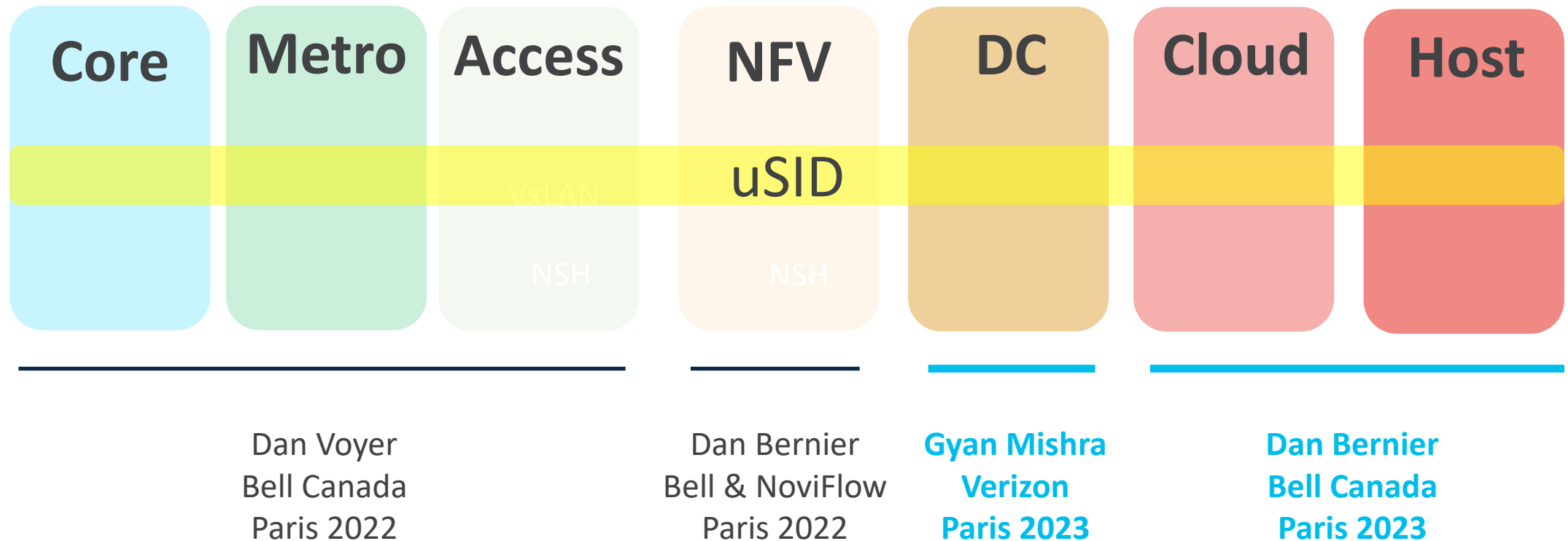
Cheaper

- Lower Overhead
- Smaller instructions (8 or 16 bits)
- Elimination of shim's
- HW Linerate

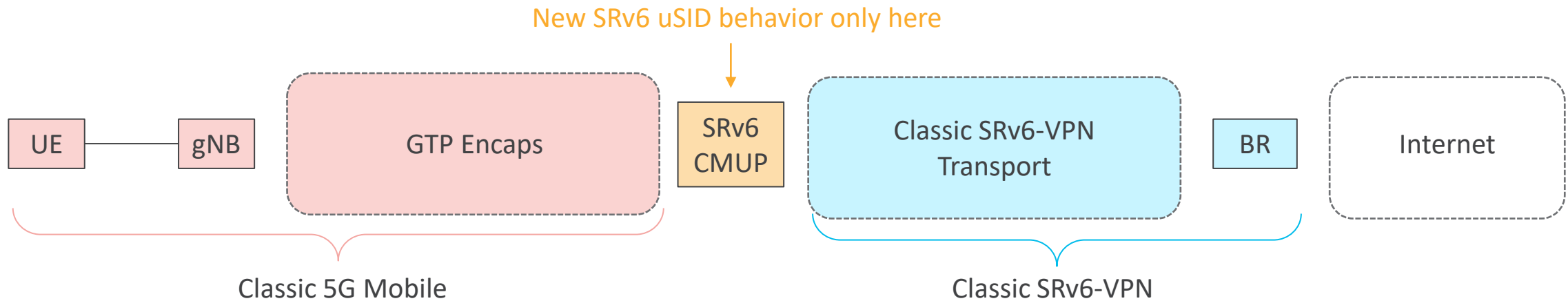
Seamless Brownfield Deployment

- Alibaba
- Bell
- Swisscom

Operator Endorsement across Unified Solution

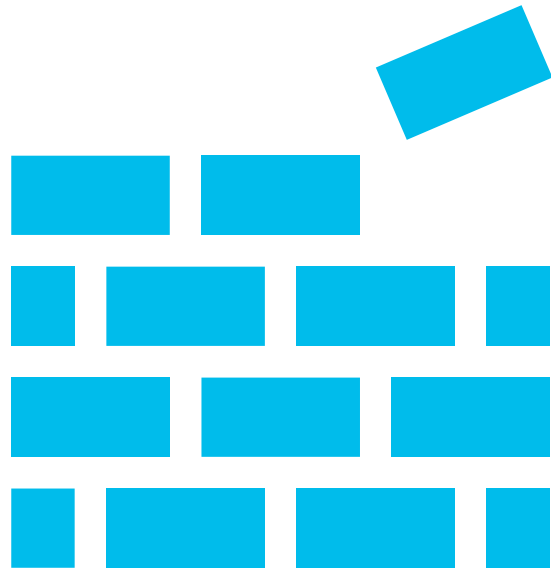


5G UPF Bypass – 50x Times Cheaper Transport

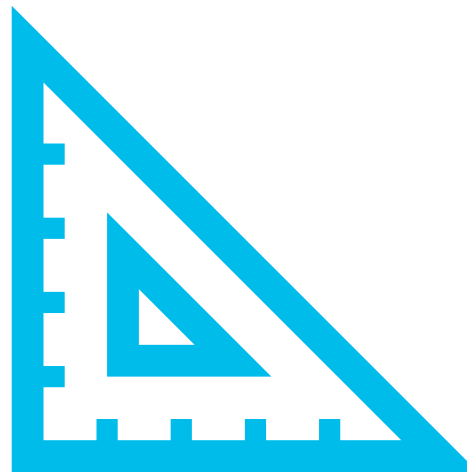


- Bypass UPF processing for selected mobile traffic (stationary devices...)
- Seamless Deployment
 - CMUP gateway does it all without any gNB or 5G Control Plane change
- 50x cheaper transport cost: Silicon1 Linerate vs x86 VNF
- 7% discount on fiber thanks to lower MTU overhead
- Lower latency (no DC detour, no x86 VNF delay)

Integrated Solution



Creation



Measure



Analyze

Measure

Performance Measurement (PM)

- Unidirectional
- Loss
- Latency histograms
- Liveness
- Silicon 1 integration
- 14M probes per sec!

Demo at booth

Path Tracing (PT)

- Per-ECMP Path Discovery
- Per-hop timestamp
- 60 usec accuracy in WAN
- HW Linerate
- Shipping
- In Deployment

Demo at booth

Deterministic Demand Matrix (DDM)

- Per-Demand
- Absolute
- HW Counters
- Telemetry Export

Demo at booth

Rakuten

Analytics

- Digging billions of Performance Measurements
- Correlating with Current and Past Routing Data
- Automatically drawing your attention to what matters

**Measurement Analytics
(MA)**

Demo at booth

Colt

**Path Tracing Analytics
(PTA)**

Demo at booth

**Automated Capacity Planning
(ACP)**

Demo at booth

Rakuten

Simplicity Always Prevails

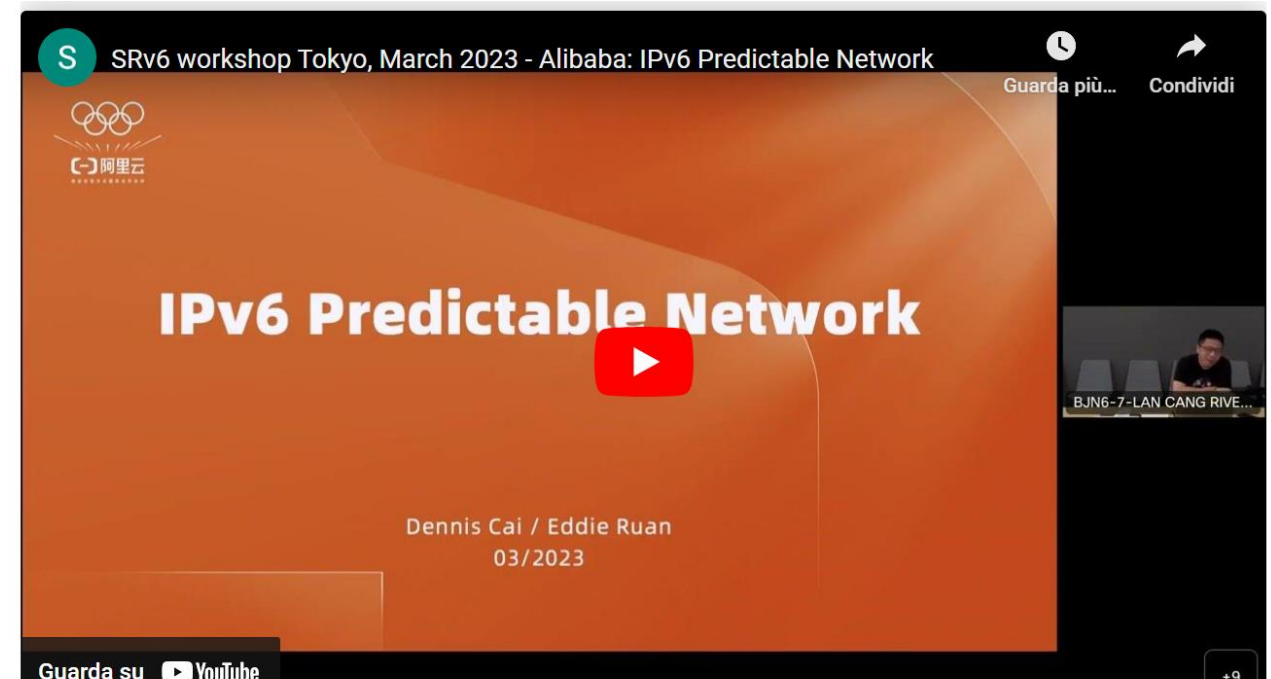


SRv6 uSID Events

- Dubai in Jan 2023
- Tokyo in April 2023
 - Tutorial
 - Hands-on Lab
 - Lead Operator Deployment reports: Bell, Softbank, Rakuten, Alibaba
- US in May 2023
- EU and LatAm in Fall 2023



segment-routing.net/conferences/2023-03-30-lead-operators-at-srv6-workshop-japan

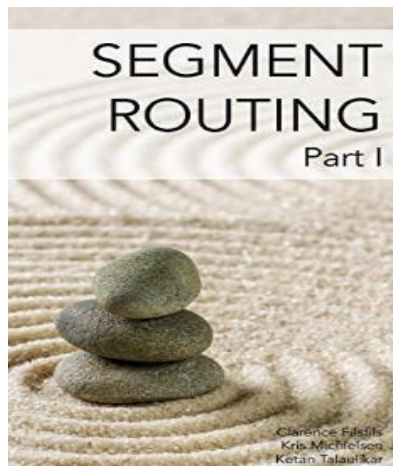


segment-routing.net

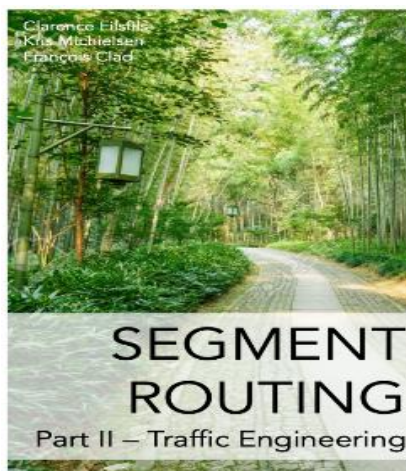
- Detailed recording of the presentations in this track
- Recordings of the demo's
- Training



segment-
routing.net/conferences/Paris23



amzn.com/B01I58LSUO



amazon.com/dp/B07N13RDM9

SRv6 Part III
Coming by
Summer 2023



twitter.com/SegmentRouting



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segment-routing.net



linkedin.com/groups/8266623

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Record-Speed Deployment

- 4 years of commercial deployment (2019-2023)
- > 100M SRv6 subscribers
- > 100 deployments, with ~14 public reports
- Across markets (Web, SP, Enterprise) and geographies (Asia, EU, US)

SoftBank

Rakuten

Indosat

MTN Uganda

Noia

Iliad

Alibaba

China Telecom

China Bank

Cernet2

Free

Bell Canada

China Unicom

Line

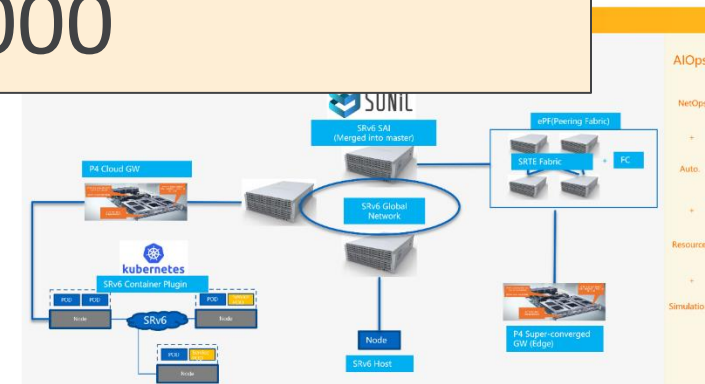
Alibaba - Full Stack SRv6 Deployment

- “Predictable network services to **every single application, based on the full stack SRv6 innovations across endpoints(container,host,P4 gateway), network devices and controller/network service center**”

YuanChao Su, Alibaba

Co-Development

- SID ↔ S
- Massive ✓ SRv6 Service Anchors on C8000
- Seamless ✓ 2. The uSID POC in C8000
 - Many u



Alibaba: Full stack SRv6 towards a 'Predictable Network'

Rakuten – SRv6 uSID in Deployment



- 5G End-to-End Network Slicing based on SRv6 u-SID Flex-Algo
 - SRv6 uSIDs are allocated from the ULA address range
 - SRv6 uSID ISIS Flex-Algo: Low-Cost vs Low-Delay
 - SRv6 uSID BGP services
 - SRv6 uSID TILFA
 - Cisco NCS5500 and NCS-540 series
- Innovation in partnership with Cisco
 - BGP PIC Core and Edge with SRv6 Summarization: ISIS UPA ([demo](#))
 - SR BW counters for deterministic and scalable capacity planning and BW guarantee



Bell Canada - SRv6 uSID Deployment

- Bell promptly switched from SR-MPLS to SRv6 uSID
- Continued Simplification (remove MPLS dataplane)
- Better Routing Scale: Summarization
- Better HW Scale: linerate 26 uSID push for end-to-end SR Policy
- Seamless Deployment (6 uSID's in DA without SRH)
- End-to-End IP Unified Dataplane from socket to Internet Peering
 - SRv6-TE Policy: topological and service uSID's
- Service Programming
- Reduce network service costs by up to 90%
footprint by 75%
power consumption by as much as 66%



Bell SRv6 uSID
Deployment



Daniel Bernier
Technical Director, Bell Canada



Jesper Eriksson,
VP Product Management, NoviFlow inc
SRv6 and P4 at the Network Edge

SRv6 uSID Interop – Report April 2023



Linux



Bell SRv6 uSID Deployment



Security

- SRv6 Security model is exactly the same as
 - GRE, L2TPv3, MPLS, VxLAN etc
- Dan Voyer from Bell explained this in 30sec at Paris 2022
- Juniper Professional Service also confirms the obvious



Alex Bakhmutov • 2nd

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Security of SRv6 networks. Guys from Huawei and China telecom made draft with overview of security considerations of operating an SRv6 network.

In couple of words, nothing new, If you secure your IP/MPLS Networks today, then you will do the same with SRv6. Principles are the same (IPSec, ACL, rate limiters, etc)

<https://lnkd.in/diNU9ZvQ>