SRv6

Unified Solution for AI, SP Enterprise Networking

Ahmed Abdelsalam - Cisco Systems

Internet Protocol (IP)

- IP is one of the most pivotal innovations in the history of digital communication.
- IP is the Heart of our Digital Economy
  - We stream music over IP backbones
  - Sensors protect our home over IP
  - We leverage cloud workloads over IP
  - Mobile industry runs over IP

What was missing in IP?

Best Effort for 40 years

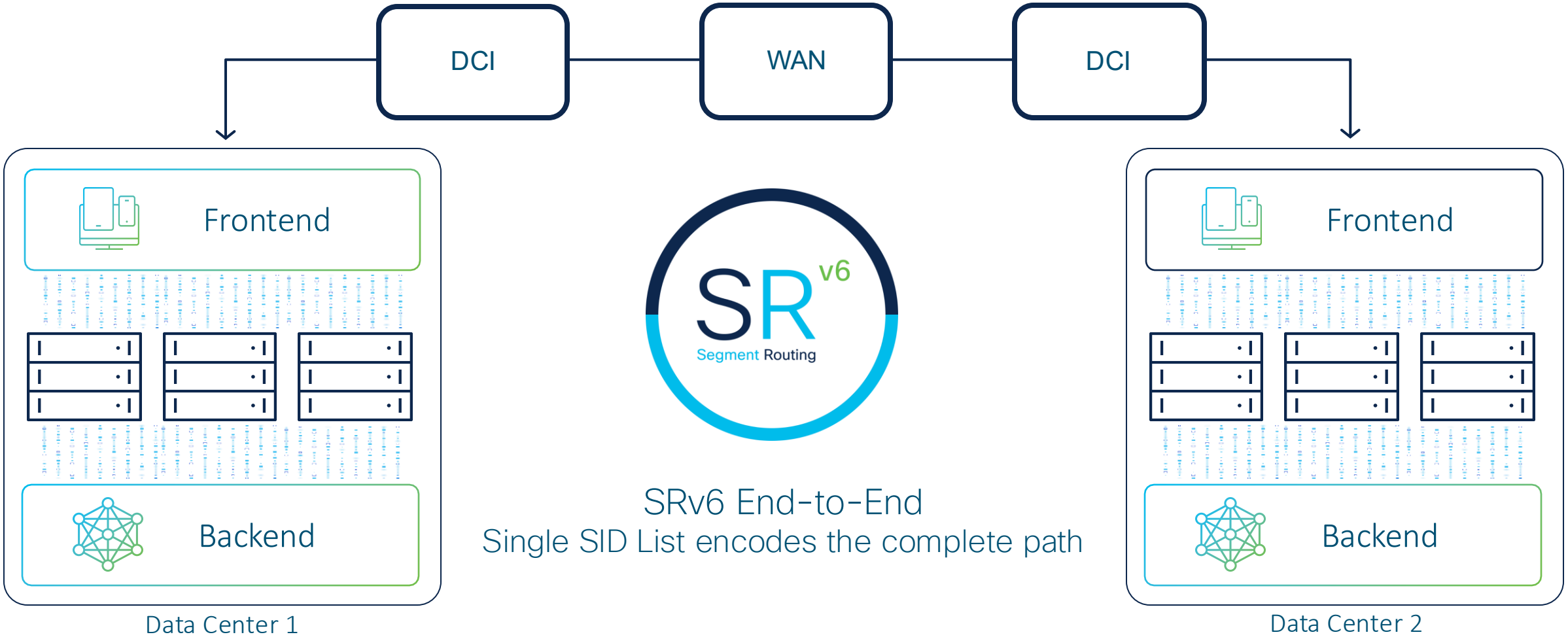
- Destination Address only localize an endpoint
- Myriad of per-domain shim layers to enrich IP
  - MPLS in the core
  - VxLAN in the DC
  - GTP for mobility
- Low scale
  - MPLS cannot summarize => BGP used as an IGP
- Poor End-to-End Services and High Operation Cost
  - Neither TE nor stateless service chaining in VxLAN
  - Translation gateways between domain (VxLAN/MPLS)

Fully Programmable with SRv6 uSID

- 128-bit DA becomes:
  - ordered list of uSID instructions (uSID)
  - uSID instruction can bound to anything .. Underlay TE, overlay, service chaining
  - 6 uSID instructions in DA
  - All current deployments requires less than 6 uSID
  - SRH is there for ultra-scale TE
- SRv6 uSID outperforms any IPv4 shim layer: MPLS, VxLAN, GTP
- Unified Solution for AI, SP and Enterprise Networking

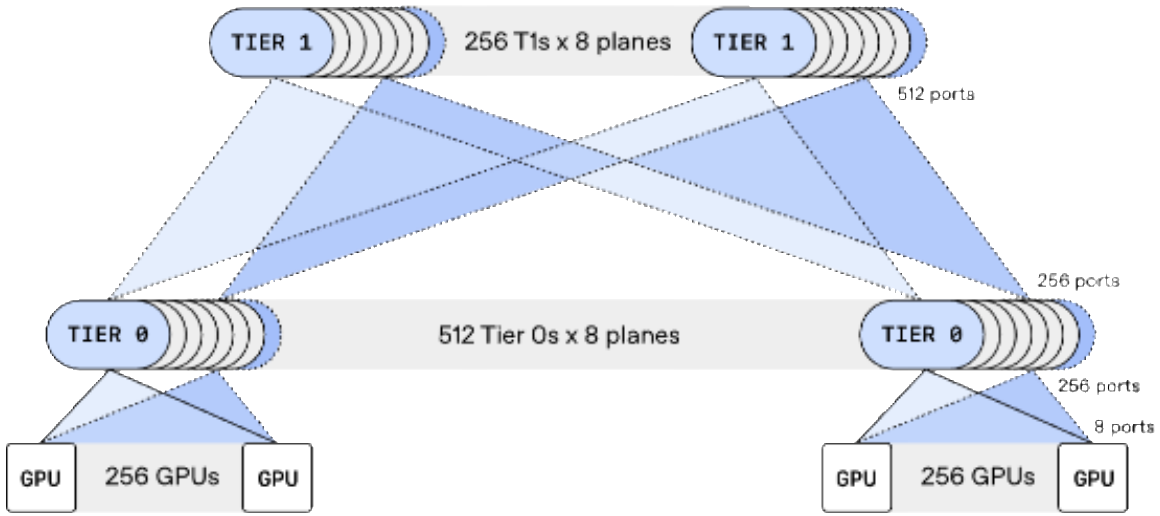
SRv6 Unified Solution for AI Networking

SRv6 Unified Solution for AI Networking

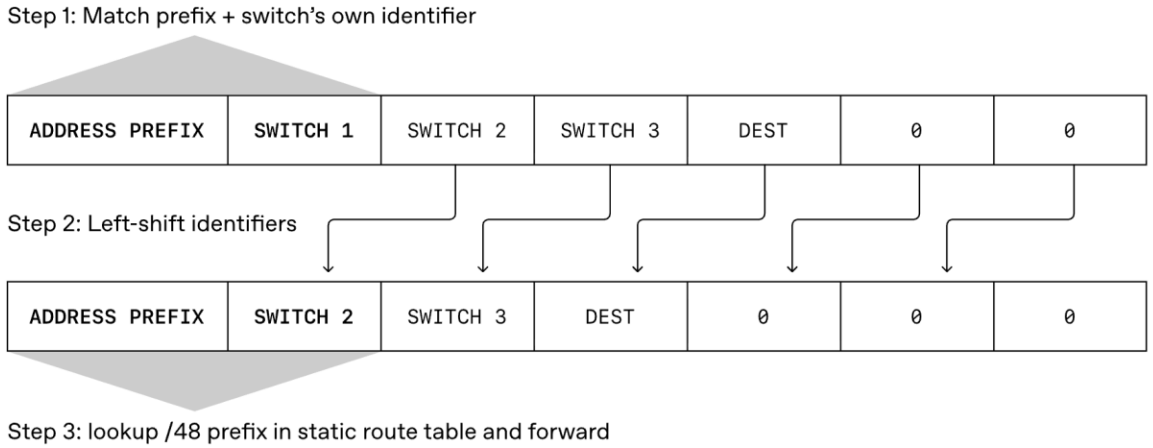


Microsoft OpenAI ORACLE Alibaba NEBIUS

SRv6 — Powers the world's largest AI backend datacenters



512 Tier 0s x 256 GPUs = 131,072 GPUs (8 planes)

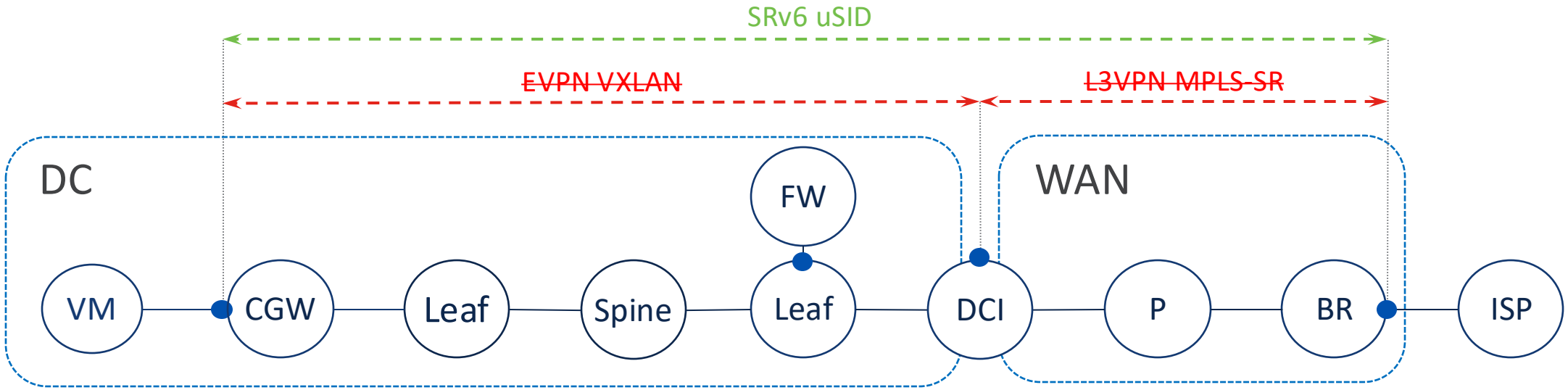


SRv6 allows the sender to encode the full path each packet should take to the network. Because this is deterministic, the sender can independently react to congestion or loss on a given path.

- Microsoft: Building resilient networks for AI supercomputers [Link]
- OpenAI: Resilient AI Supercomputer Networking using MRC and SRv6 [Link] [Link]
- Oracle: Unlocking Oracle Acceleron Multiplanar Fabric with Multipath Reliable Connection [Link]
- Cisco - MRC and SRv6: How Foundational Networking Innovations Are Enabling the Next Generation of AI Supercomputers [Link]
- IETF Draft - Cisco, Microsoft, Oracle, Nvidia, IBM [Link]

Microsoft OpenAI ORACLE

SRv6 in AI Frontend



- End-to-End unified solution from DC to WAN
  - Replaces the legacy design with VXLAN in the DC and SR-MPLS in the DCI/WAN
  - Elimination of stitching gateways
- Stateless Service Chaining
- WAN TE & Egress Peer Engineering controlled from FE

https://www.segment-routing.net/conferences/Paris26-Nebius-Alexey-Gorovoy/

NEBIUS

SRv6 DCI and AI WAN at Alibaba

- Alibaba eCore
- Ultra Scale SRv6 DCI/WAN deployment across 1000 cities in China
- 3 years of Deployment experience
- Amazing design!

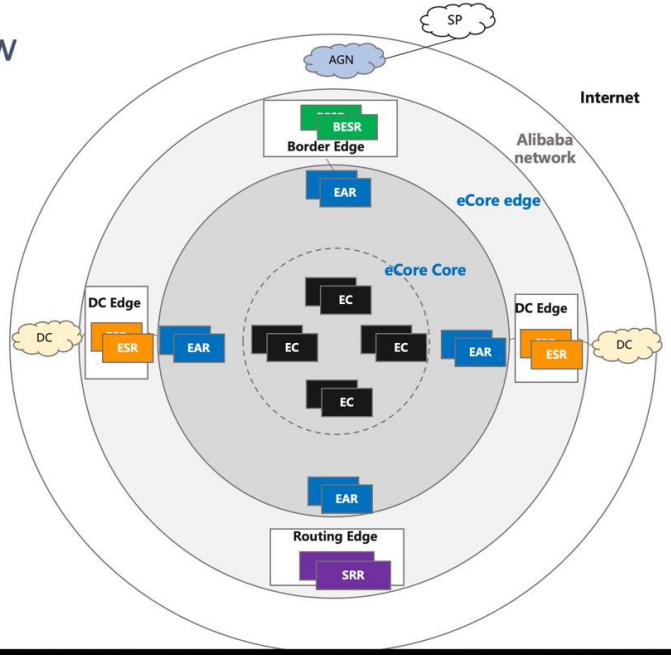
High Level Architecture Overview

Edge

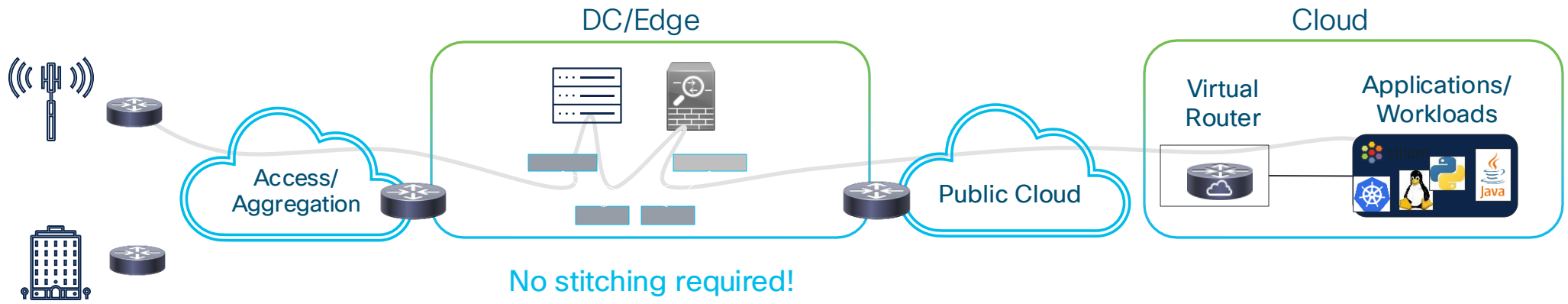
- Role
  - SRv6 VPN PE router – overlay
- Categories
  - DC edge - ESR
  - Border edge - BESR
  - Routing edge - SRR （Service Route Reflector）

Core

- Role
  - SRv6 VPN P router - underlay
  - SRv6 Traffic Engineering
- Layers
  - National Core - EC
  - Regional Core - EAR （collocated with ESR）



SRv6 Unified Solution for SP Mobility



Simplified VPN services

Service Function Chaining

Traffic Engineering and FRR

Operational Simplicity

Enhanced Scalability

Luay Jalil

verizon

Nicolai Leymann

Deutsche Telekom

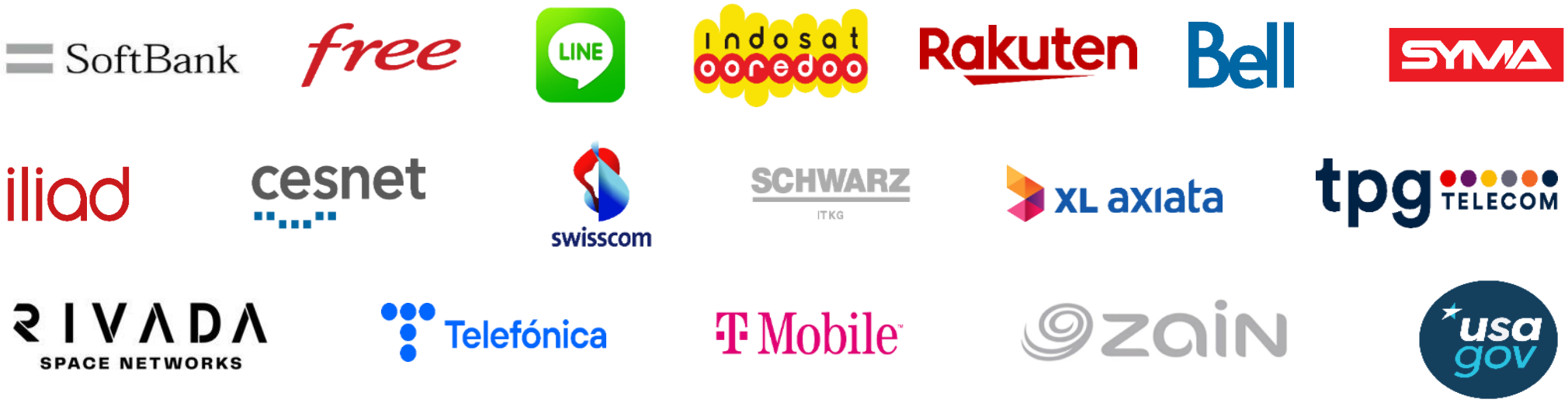
Akash Agrawal

Rakuten

Rolf Schmid

swisscom

Public SP/Enterprise Deployments



- Over 100k SRv6 routers deployed from 2019 to 2026

SRv6 Ecosystem

SRv6 Kickoff – February 2017, Rome

SRv6 Rich Ecosystem

Network Equipment Manufacturers

Cisco, Huawei, Nokia, Ciena, Juniper Networks, H3C, ZTE, Arrcus, Arista, Ericsson

Merchant Silicon

Access: A100 Edge: K100
Core: Q200, P100
ToR/Spine: G100, G200

Broadcom

DNX – Jericho
XGS – Tomahawk

Marvell, Nvidia

Open-Source Applications

Pyroute2, IPTABLES SERA, GoBGP, exa BGP, eBPF, cilium, Wireshark, FRRouting, Snort, GoBMP

SRv6 uSID

Open-Source Networking Stacks

SONiC, Linux, fd.io, P4, OCP, OPEN Compute Project, Kubernetes, OvS Open vSwitch, VyOS

Smart NIC / DPU

Intel, Nvidia

Partners

kaloom, Trend Micro, ENEA Qosmos Division, NoviFlow, ixia A Keysight Business, spirent Promise. Assured., Red Hat, f5, 6WIND, Keysight Technologies

SRv6 is fully standardized at IETF

Architecture

- SR Architecture – **RFC 8402**
- SRTE Policy Architecture – **RFC 9256**
- Compressed SRv6 Segment List – **RFC 9800**

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 Measurement – **RFC 9503**

Strong commitment and leadership

Co-author of 100% IETF RFCs

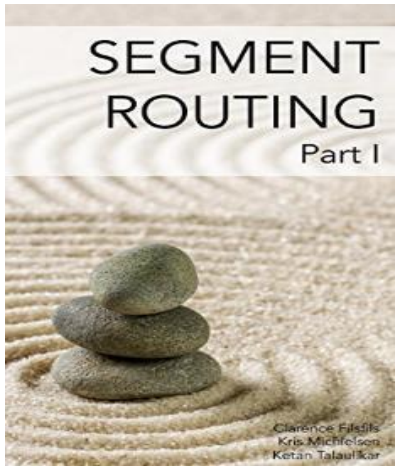
SRv6 in Academia

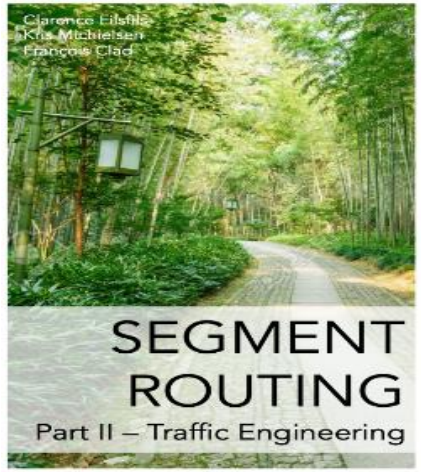
- ~50 research papers
  - https://www.segment-routing.net/scientific-papers
- ~10 PhD Students and PhD Thesis
- ~10 universities collaboration
- Supported by Cisco University Research Program

SRv6 Roadshow – Sept 22-23, Barcelona, Spain

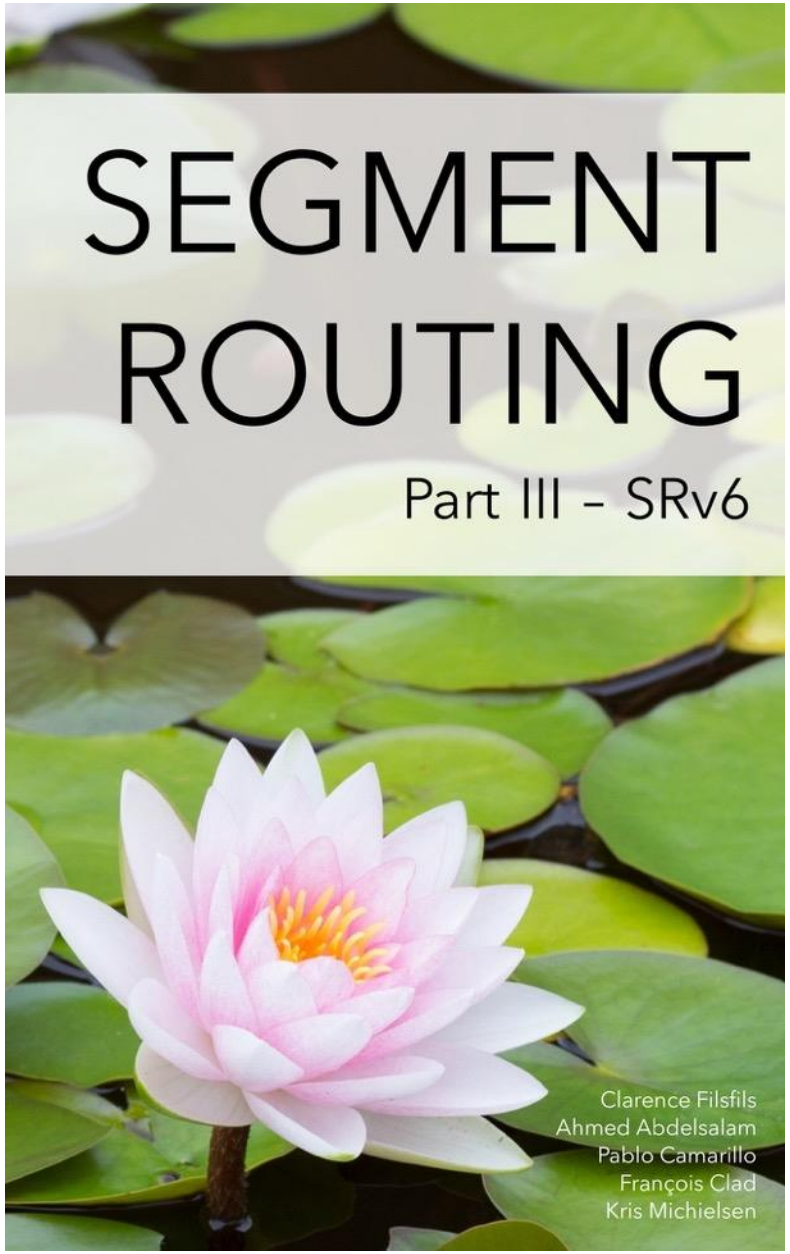
- Two days event
  - 50-75% of the agenda is SRv6 Operators presentations
  - Latest SRv6 innovations and use-cases
  - 100+ attendees and 10 testimonials over the last editions

Stay up-to-date





segment-routing.net



https://www.amazon.com/dp/B0D6GWWRWH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