SRv6 uSID   Build Anything

IPM   Measure Everything

Clarence Filsfils

IP is back and better than ever.

Build anything

Simplified, scalable, and versatile networks that are self-sufficient

SRv6 uSID

seamless deployment in Brownfield

IPM

service optimization driven by AI

Measure everything

Embedded SLA monitoring and IPM within the network is essential

SRv6 uSID

- Within RED VPN, A sends a packet to Z

- The VPN policy asks 3 requirements
  - Underlay TE: Low Latency Routing
  - Service Chaining: Firewall Service
  - Overlay: Red VPN

```
A    1                    3    Z
              2
             FW7
```
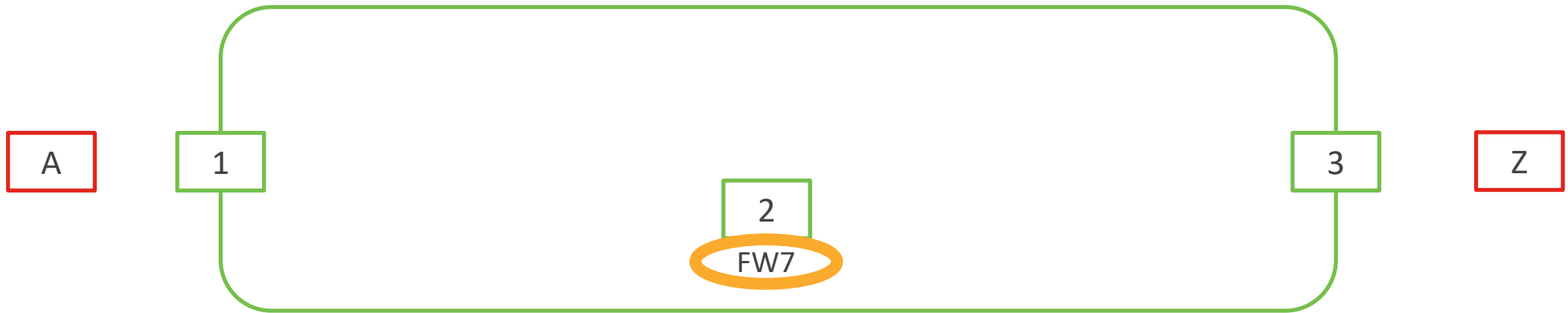
Dest: LL2, FW7, LL3, VRED, No-Op, No-Op

Dest: Z

- 1 encapsulates in a 40-byte IPv6 header

- DA encodes the end-to-end policy with up to 6 instructions

- Each instruction is 16-bit

A | 1 | 2 | FW7 | 3 | Z

Dest: **LL2**, FW7, LL3, VRED, No-Op, No-Op

Dest: Z

- The **first** 16-bit uSID routes the packet to the firewall location via a low-latency path

A | 1 | 2 | FW7 | 3 | Z

Dest: **LL2**, **FW7**, LL3, VRED, No-Op, No-Op

Dest: Z

- The **second** 16-bit uSID applies the firewall service

Dest: LL2, FW7, **LL3**, VRED, No-Op, No-Op

Dest: Z

- The **third** 16-bit uSID routes the packet to the egress PE via a low-latency path

Dest: **LL2**, FW7, LL3, **VRED**, No-Op, No-Op

Dest: Z

- The **fourth** 16-bit uSID decapsulates the inner packet and forwards it to Z

Dest: **LL2**, FW7, LL3, VRED, **No-Op, No-Op**

Dest: Z

- Instructions 5 and 6 are unused
- Most use-cases need <= 6 instructions
- Most use-cases do not use SRH

SRv6 uSID

- **Build Anything**

  - Any combination of underlay, overlay, service chaining, security…

  - VPN, Slicing, Traffic Engineering, Green Routing, FRR, NFV

- Any Domain

  - Access, Metro, Core, DC, Host, Cloud

  - End-to-End Stateless Policy

  - No protocol conversion or gateways at domain boundaries

- Seamless Deployment in Brownfield

- Standardized, Rich Eco-system, Rich Open Source (SONiC)

Outperform 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

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   96% IETF RFCs
Co-author of   100% IETF RFCs

Over 80000 uSID routers deployed

Inter-DC/Metro Traffic
Engineering across all of China
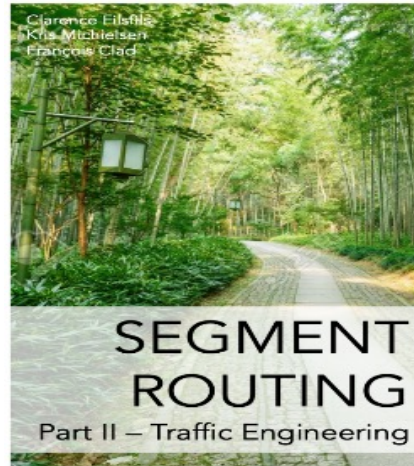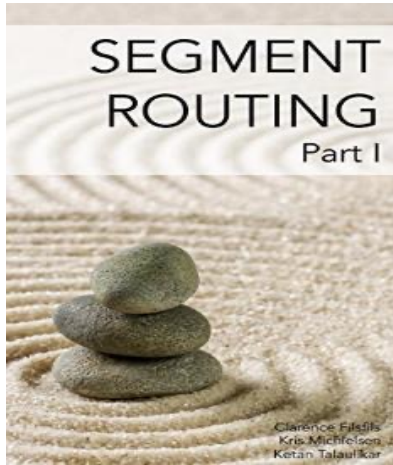Eddie Ruan

14k+ devices, 70% services on uSID
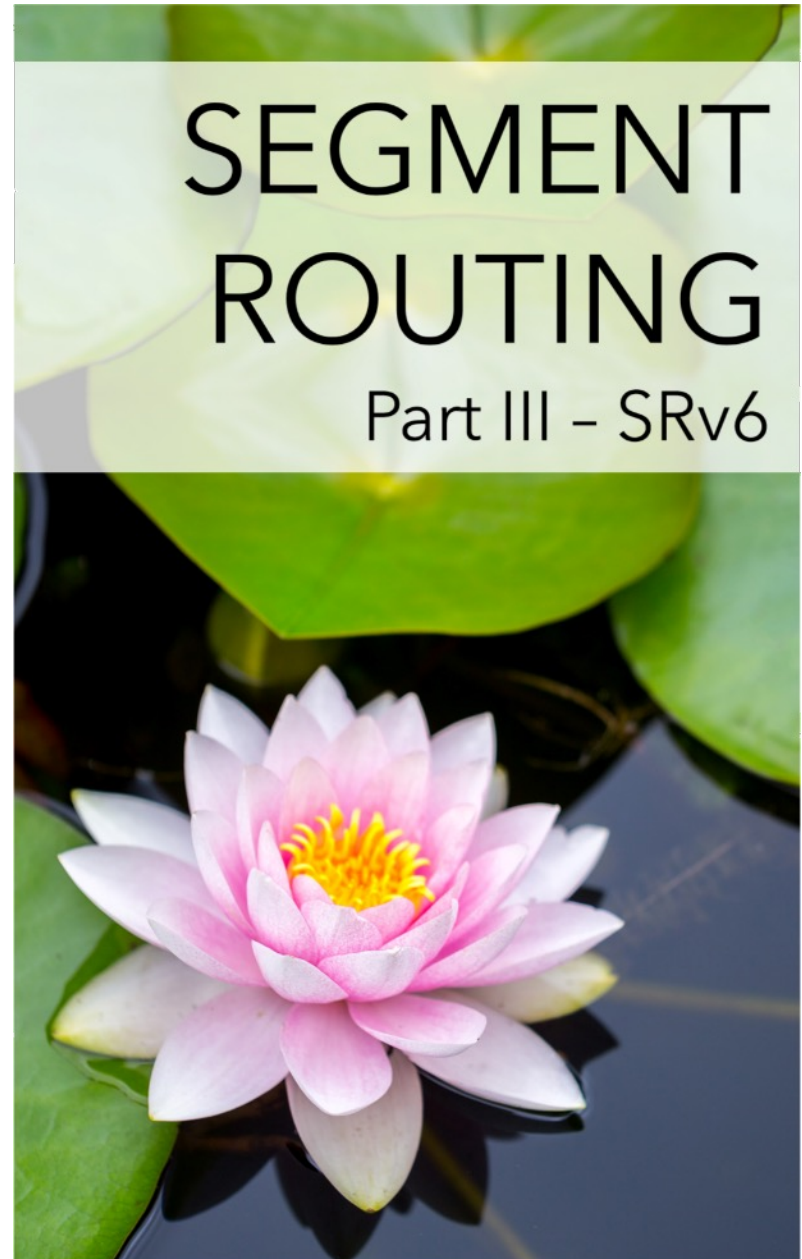Akash Agrawal

Simplicity Always Prevails

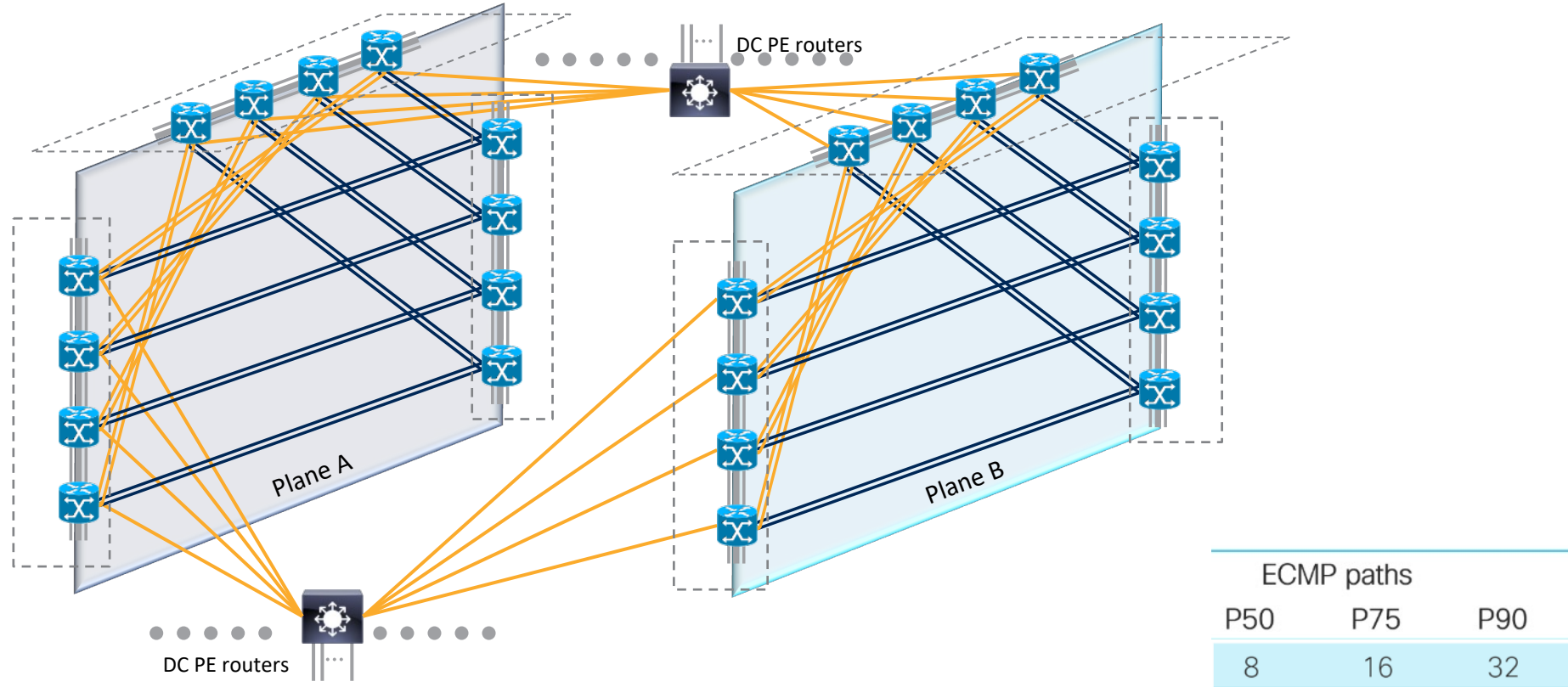# Join our next uSID/IPM event – 2 & 3 October 2024

Stay up-to-date

segment-routing.net

IPM

The nature of IP is ECMP

DC PE routers

Plane A

Plane B

DC PE routers

ECMP paths		
P50	P75	P90
8	16	32

- Legacy solutions do not have the scale to measure all ECMP paths
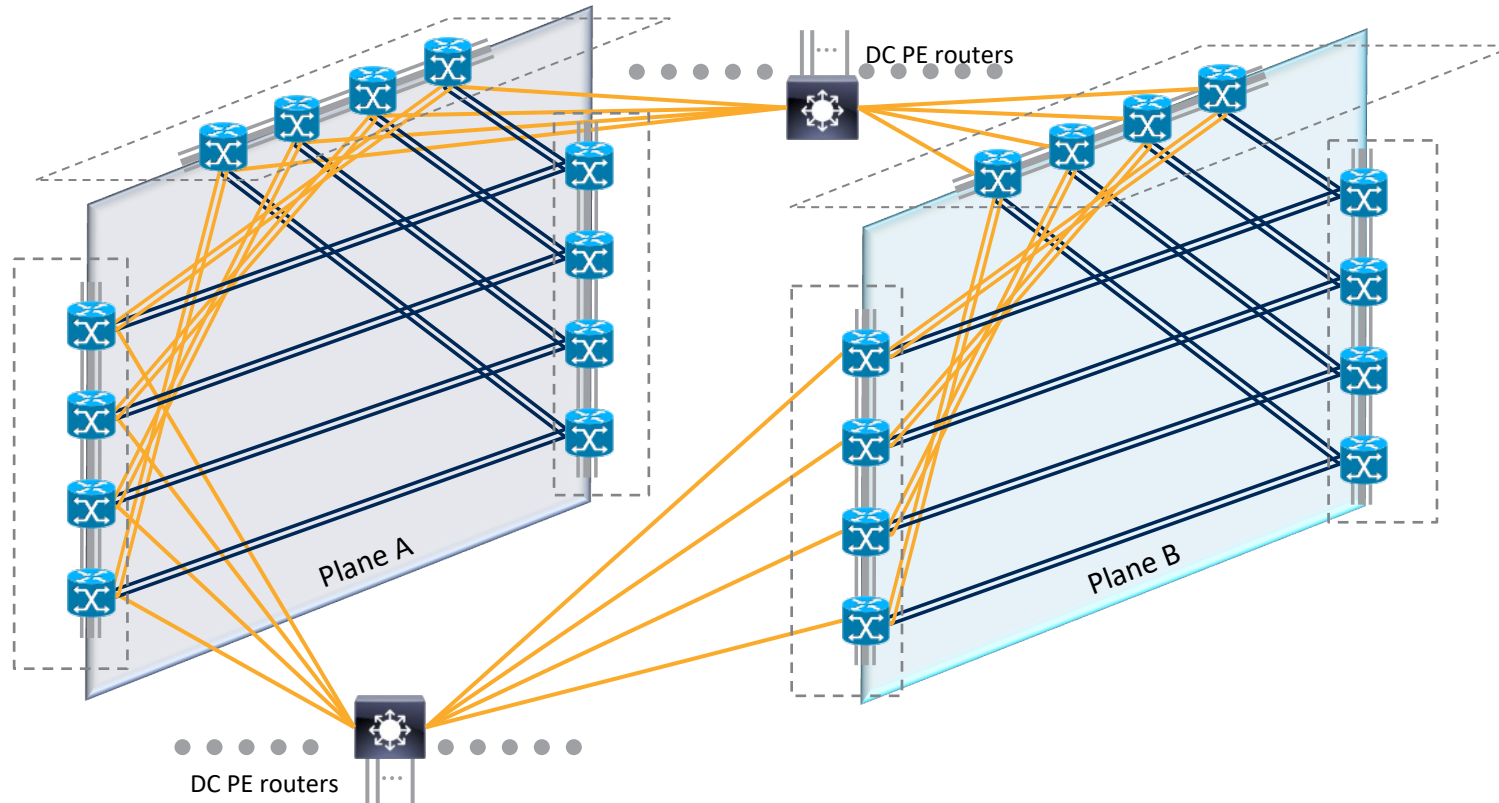
The experience of all clients must be measured

Would a bank accept to monitor < 0.1% of its access?

Legacy solutions are typically 1000 to 10000 times not scalable enough

Legacy coverage is < 0.1%

Operators learn outages from clients
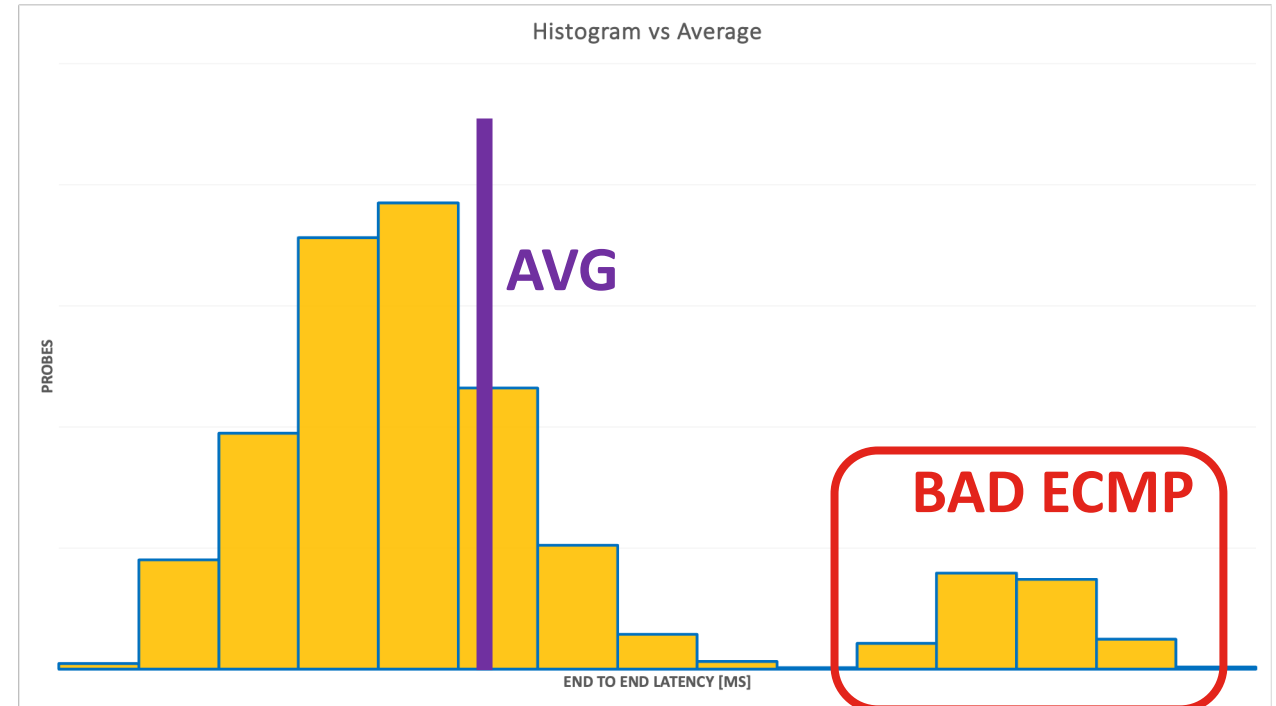
Silicon One provides 14M probes per sec

- 1 measurement every msec
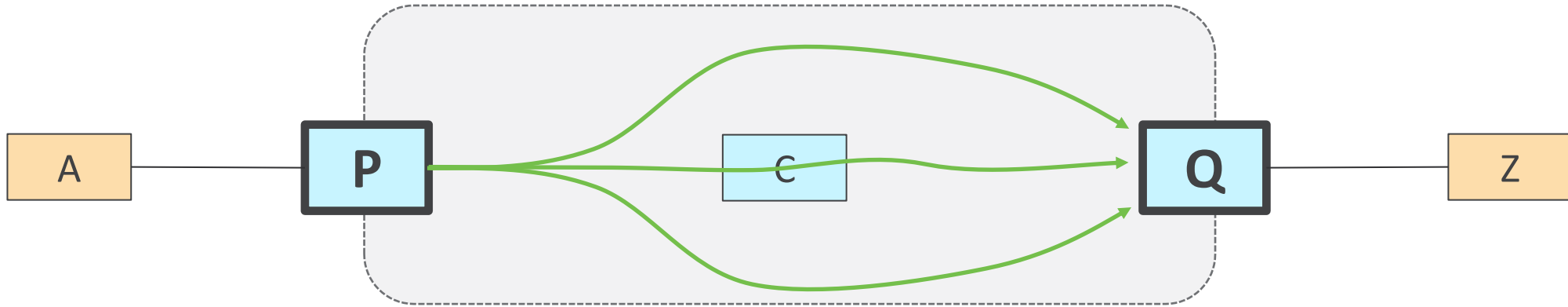
- 500 edges

- 16 ECMP paths

8M probes per sec   (57% of Silicon One capability)

Richer Metrics

- 1 bad path out of 8 ECMP

- 12.5% of the clients impacted

- Average hides the issue

- IPM Histograms reports the experience of the whole population

Histogram vs Average

AVG

BAD ECMP

PROBES

END TO END LATENCY [MS]

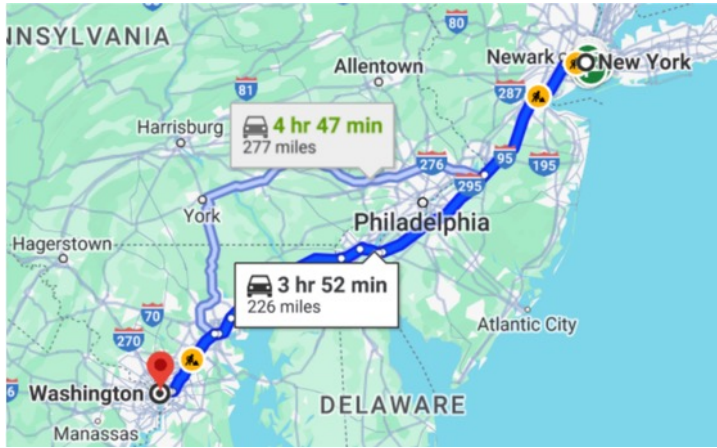# Any IP Fabric, Any Edge to any Edge, Any ECMP Path

- Absolute Loss

- One-Way Latency (20nSec)

- Liveness (sub-2msec)

- Standard: STAMP (RFC 8762 & RFC 8972)

Much Cheaper through Silicon Integration
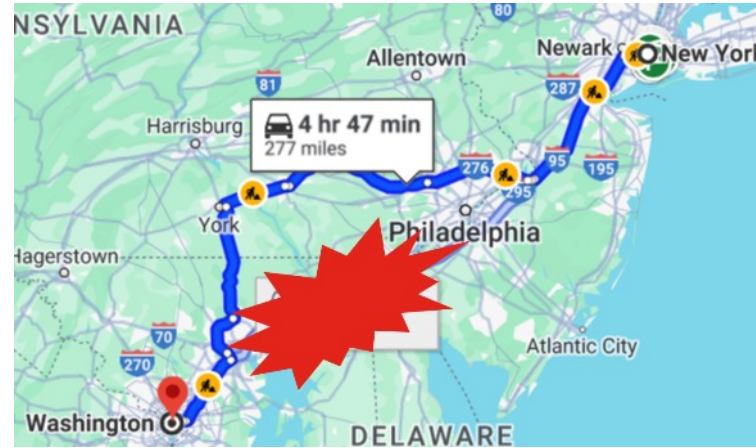
- Capex Elimination

  - SLA Appliance

  - Router port to appliance

- Opex Elimination

  - Rack Space

  - Power

Continuous Correlation to Routing

Measured Latency
compared to best topology

Measured Latency
compared to current topology
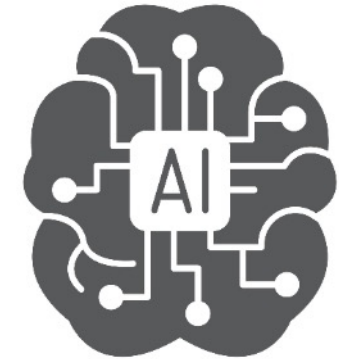
- Time-series of Measurements from any P to any Q along any ECMP path

- Time-series of ECMP routed paths from any P to any Q

Inference

- Measurement (**PAR**, **MAD**) report SLA degradation (e.g., loss)

- Without any additional measurement, Routing Correlation allows to infer other (SRC, DST) pairs that are also impacted
  - BRU to MAD/LIS/SEV is impacted
  - LON to MAD/LIS/SEV is impacted

Michael Valentine, Technology Fellow, Network Architecture, Goldman Sachs

- uSID and IPM Use-case

- IPM Silicon Integration and Metrics

Bart Janssens, Senior Specialist Packet Architecture

Colt Technology Services

- Routing Analytics

- Accedian Skylight

- Deployment and Use-Cases

Silicon One

Routed Optical Networking

- **5/9** of service availability with automation
- **Sub-50ms** restoration times
- Up to **97%** power savings
- **Accedian Skylight probe** agents to monitor third party physical and cloud-based networks

+ Integrated Performance Measurement

Helping Colt and its customers **lead in performance and sustainability**

Next phase

Accedian Skylight

End to end service visibility

Insights with micro-second granularity

Faster to launch and monetize SLA-backed services

New On-demand services based on power and SLA based metrics

Gyan Mishra, Associate Fellow, Verizon

- DC use-case

- uSID and IPM

- Lightweight Host Routing (LHR)

Eddie Ruan, Senior Staff Engineer, Alibaba

- uSID - Deployment Experience

- SONIC Experience

IP is better than ever

SRv6 uSID

Build Anything End-to-End

IPM

Measure Everything