Converged Access networks

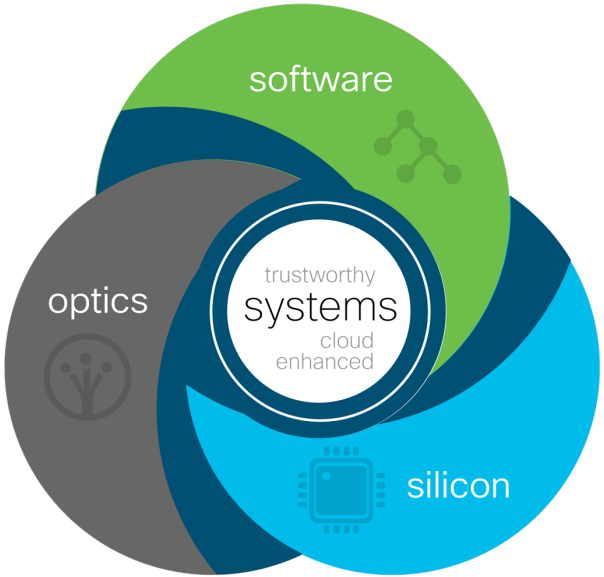
with optimal Edge Service-placement

Michiel Appelman
Technical Solutions Architect
mappelma@cisco.com
15 September 2021

Agenda

- Mass-scale Infrastructure
- Converged Access
- Edge Services & Applications
- Cisco Solutions

Mass-scale Infrastructure



Grow revenue by opening up new markets and offering new services while maintaining customer loyalty

Reduce cost by maintaining a market-leading position through an agile and open infrastructure

Mitigate risk and protect yourselves and customers from security threats

Cisco Silicon Strategy
Best of Both Worlds

IOS-XR & Segment Routing

Cisco Silicon ONE

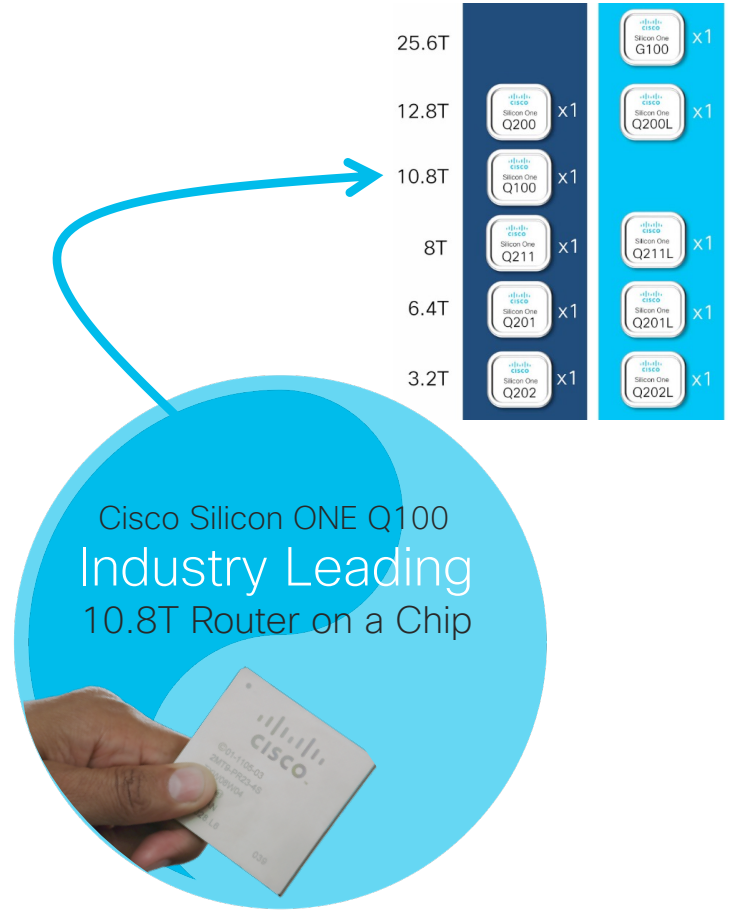
Flexible Forwarding ASIC

One Unified Silicon Architecture

- Comprehensive routing with switching efficiency
- Multiple segments: web and service provider
- Multiple functions: system-on-a-chip, line card, and fabric
- Multiple form-factors: fixed or modular

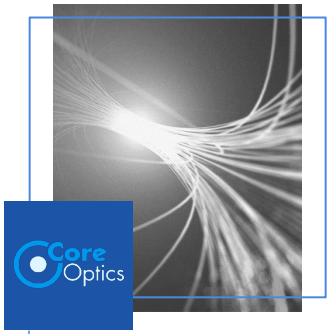
Delivers Performance Without Compromise

- First routing silicon to break 10 Tbps barrier
- 2x bandwidth, 3x packets-per-second over current industry routing silicon
- 2x more power efficient
- Global route scale, deep buffering, P4 programmable



Cisco $6 Billion Investment

Acquisitions in Optics and Silicon

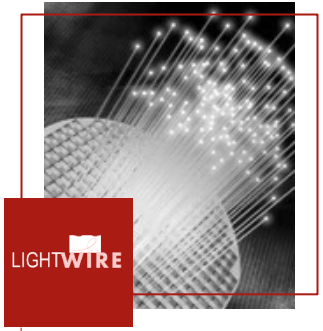


Core Optics

Innovator in coherent optical technologies

$99M

JULY 2010

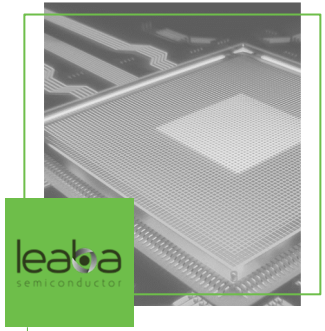


LIGHTWIRE

Innovator in silicon photonics

$271M

MARCH 2012

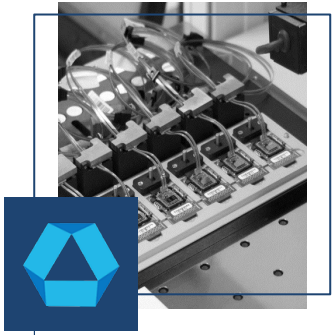


LEABA

Next gen silicon for routing/switching

$320M

MARCH 2016



LUXTERA

Leading automation of SiP manufacturing process

$660M

FEBRUARY 2019

ACACIA

Innovative high-speed coherent optics

$4.5B

FEBRUARY 2021

Cisco IOS XR

Redefining software for better operations

Simple

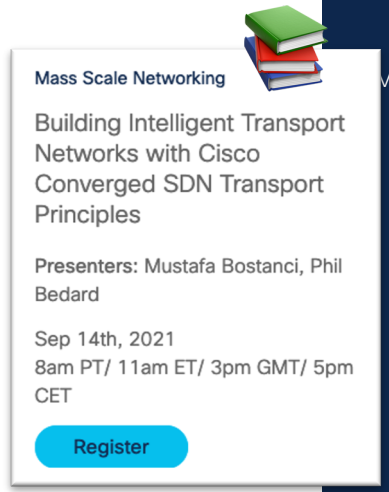
- Optimized to reduce memory, downloads, and boot times
- Streamlined protocols with SR/EVPN
- Secure zero-touch rollout

Modern

- Open APIs
- Customizable software images
- Cloud-enhanced

Trustworthy

- Assess hardware and software authenticity at boot and runtime
- Immutable record of all software and hardware changes
- Real-time visibility of trust posture



50% Less Memory Footprint

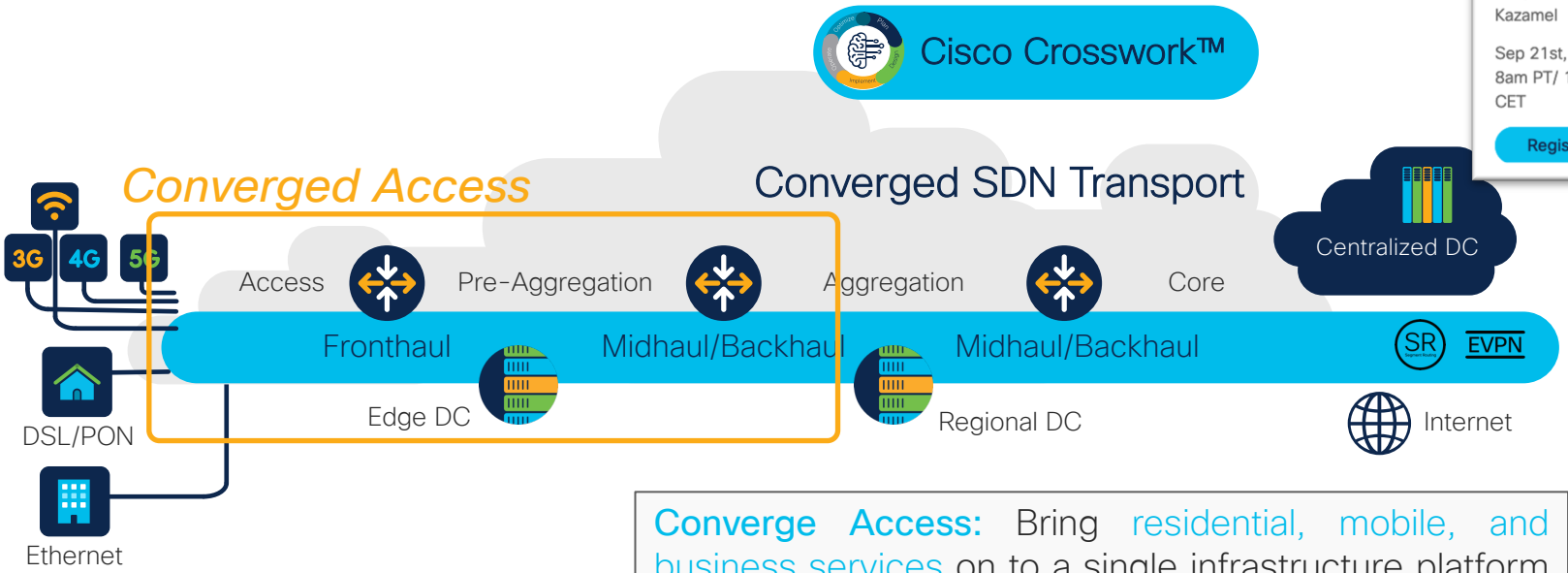
50% Faster Boot Times

40% Smaller Image Sizes

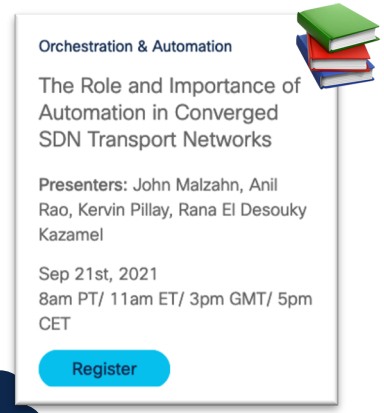
40% Faster Download

Internet for the future

Accelerated with modernized operations



Converge Access: Bring residential, mobile, and business services on to a single infrastructure platform for an access-agnostic connection to services and converge distinct subscriber management solutions under a unified, cloud native platform.



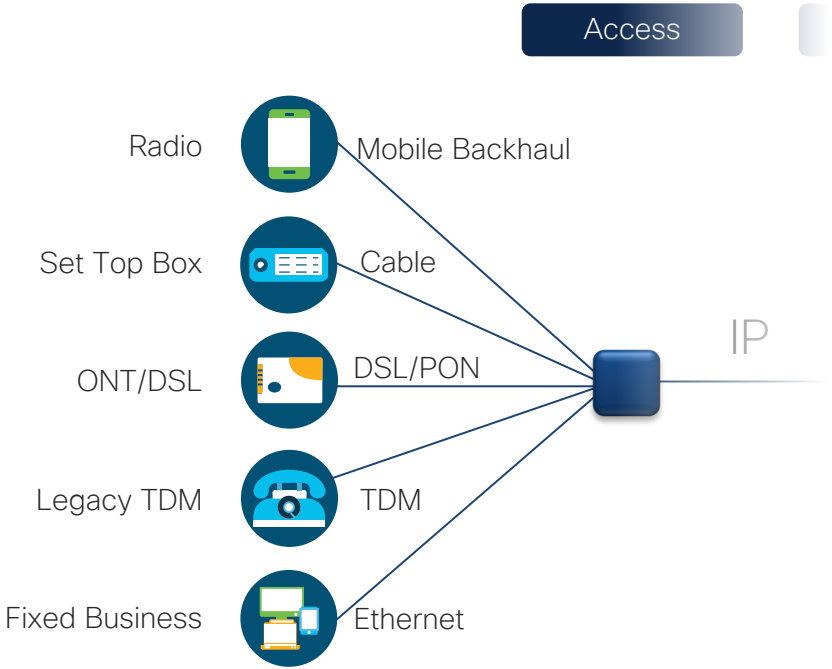
https://www.cisco.com/c/dam/en/us/solutions/collateral/service-provider/converged-sdn-transport/white-paper-sp-converged-network-design.pdf

Converged Access

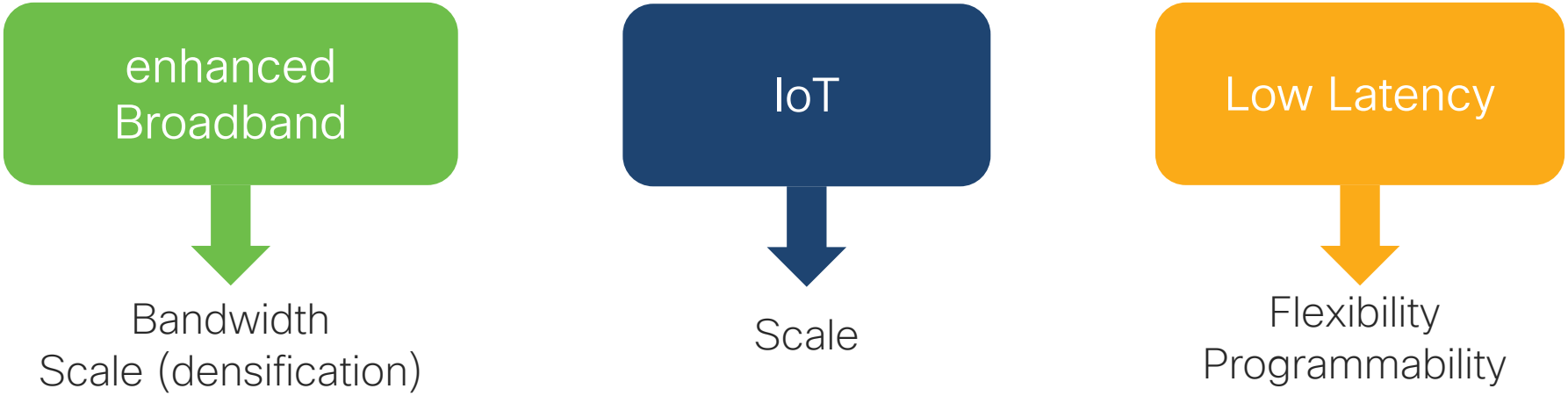
Access Convergence

Driven by:

- Packet-based Technologies
- IP-enabled Hardware
- Access-agnostic Services
- Differentiation still required



5G-defined Services

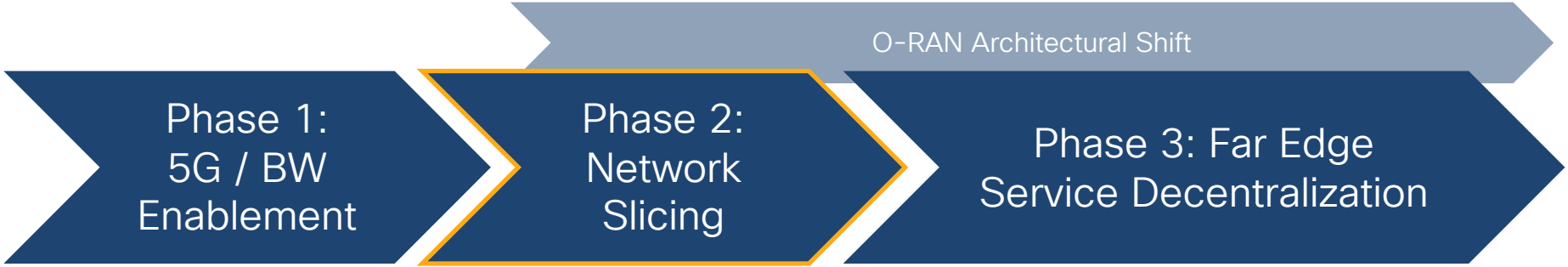


Not limited to 5G mobile access only

Transport Use-case Requirements

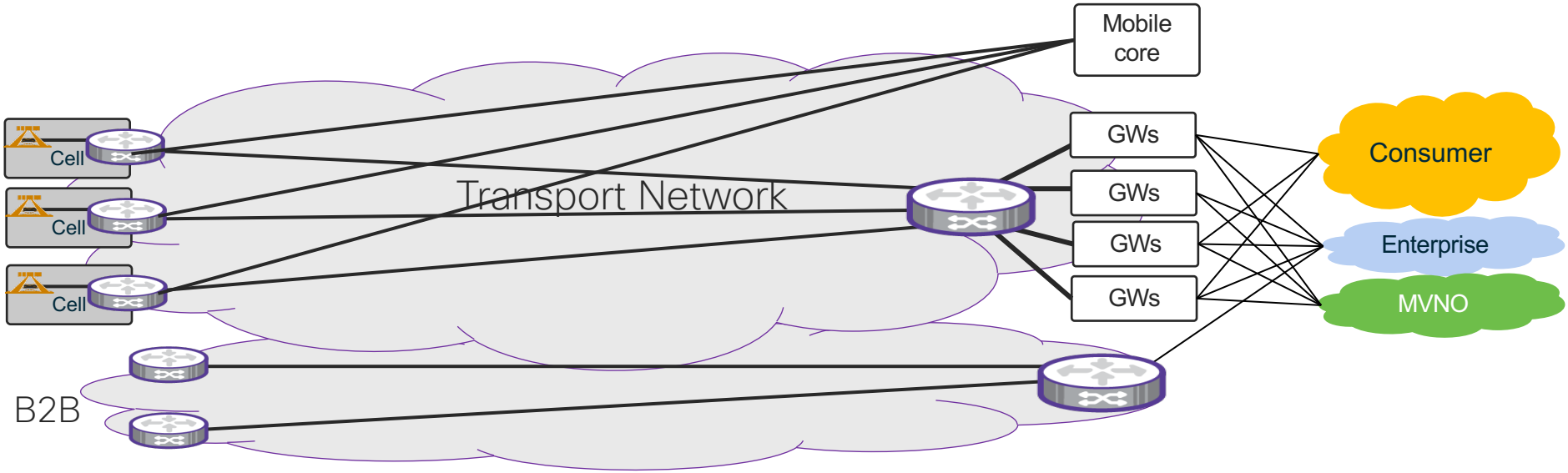
	5G xHaul	Business Services	Wholesale Transport	Wireline FttX	Cisco Solution
Bandwidth	✓	✓	✓	✓	Silicon and Optics Innovation
Scalability	✓	✓	✓	✓	Segment Routing IOS XR APIs
End to end Programmability	✓	✓	✓	+	Segment Routing
Synchronization	✓	+	✓	+	Built-in
Security	✓	✓	✓	✓	Built-in

Simplified Transport Evolution Path



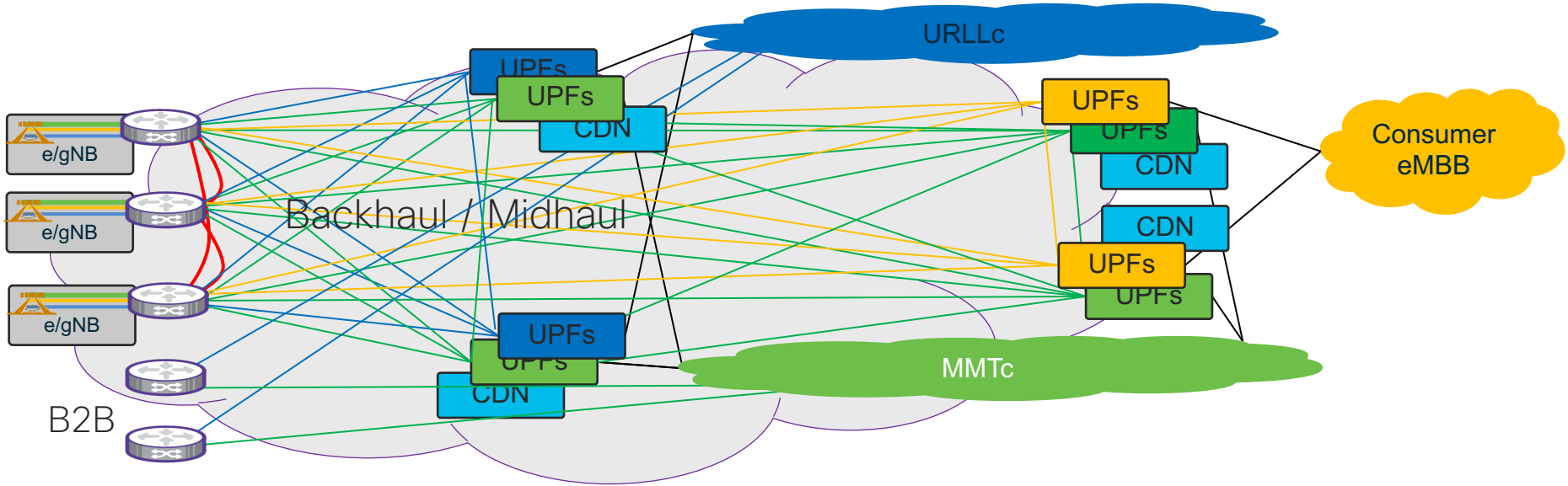
- Scalability
- Visibility
- Programmability
- Flexibility

Traditional Access Networks



Looks simple, until inter-service connectivity is required..

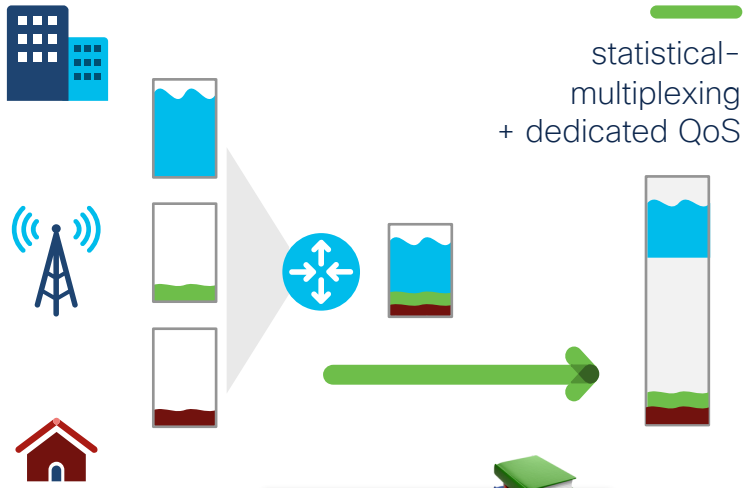
5G-like Services requiring Any-to-any

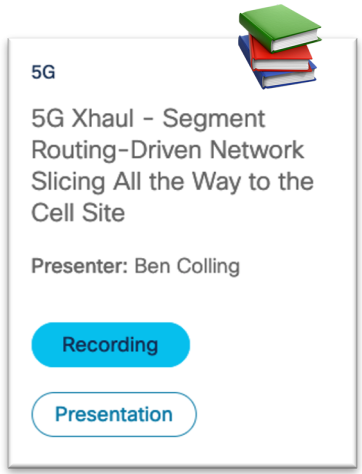


Making this work needs a radically different approach.

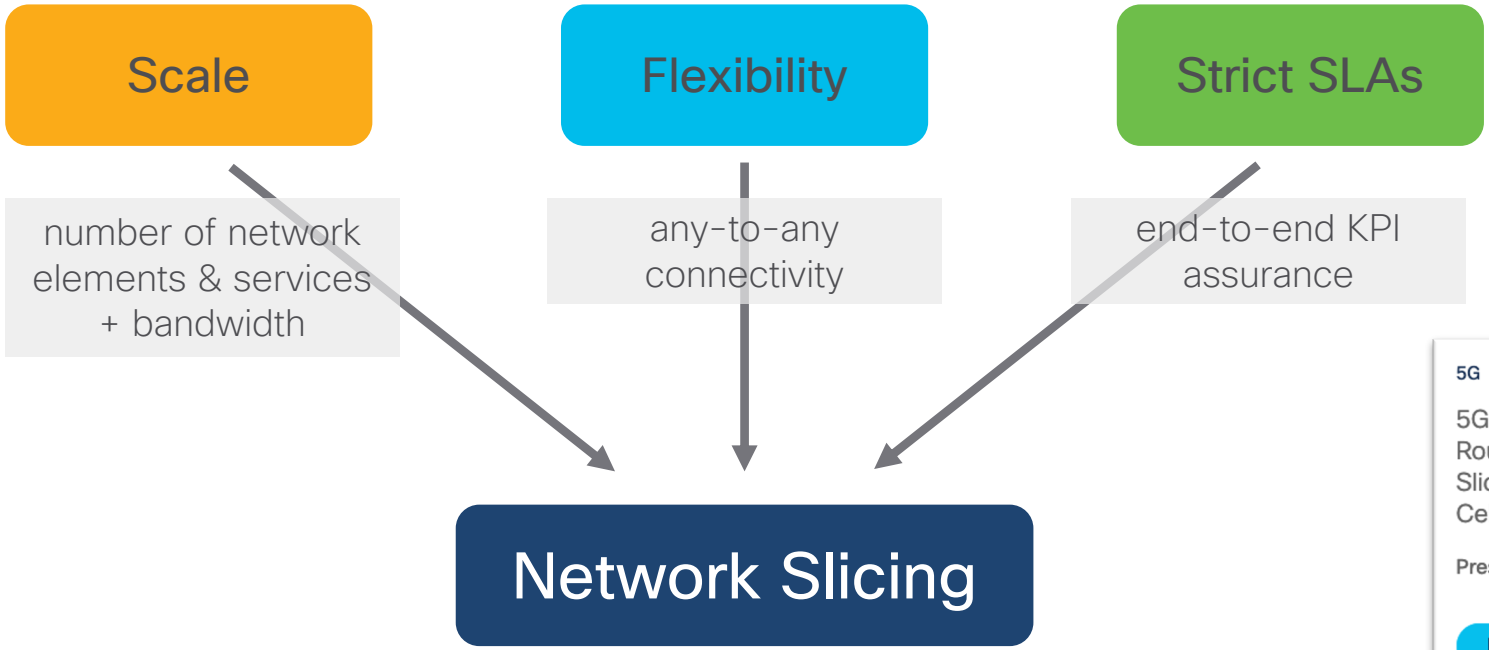
Benefits of Converging to IP

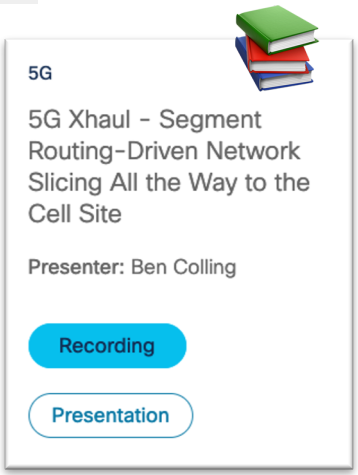
- Scalable any-to-any service connectivity
- Efficient load-sharing using statistical multiplexing
- Simplification by reducing the:
  - number of protocols and network touch-points
  - stitching points in service and transport paths
  - service-related state in the transport
- Consistent OAM and traffic flow control (Traffic Engineering)





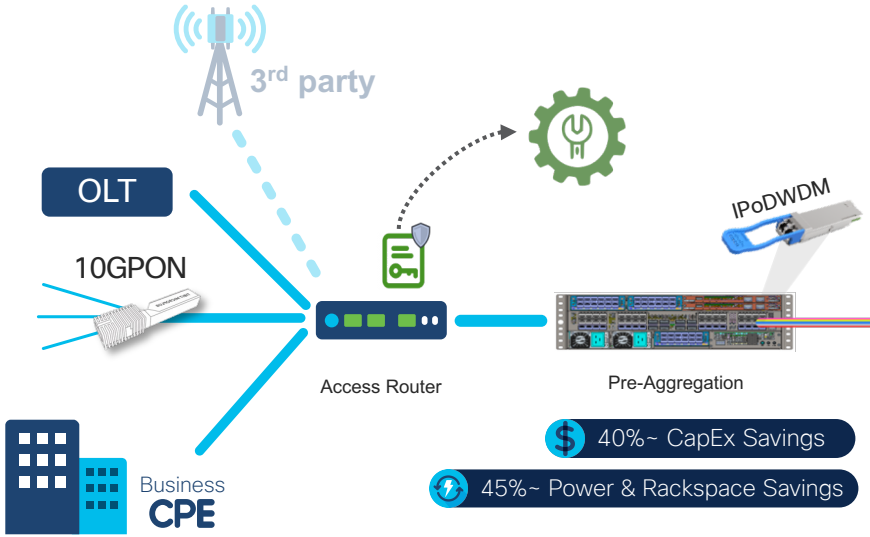
Network Slicing for Transport





Intelligence at the Edge

- Multi-service
- Programmable Paths and SLA
- Stat-mux efficiency
- Secure ZTP
- Rich streaming Telemetry
- Accurate synchronization



Case Study: Swisscom

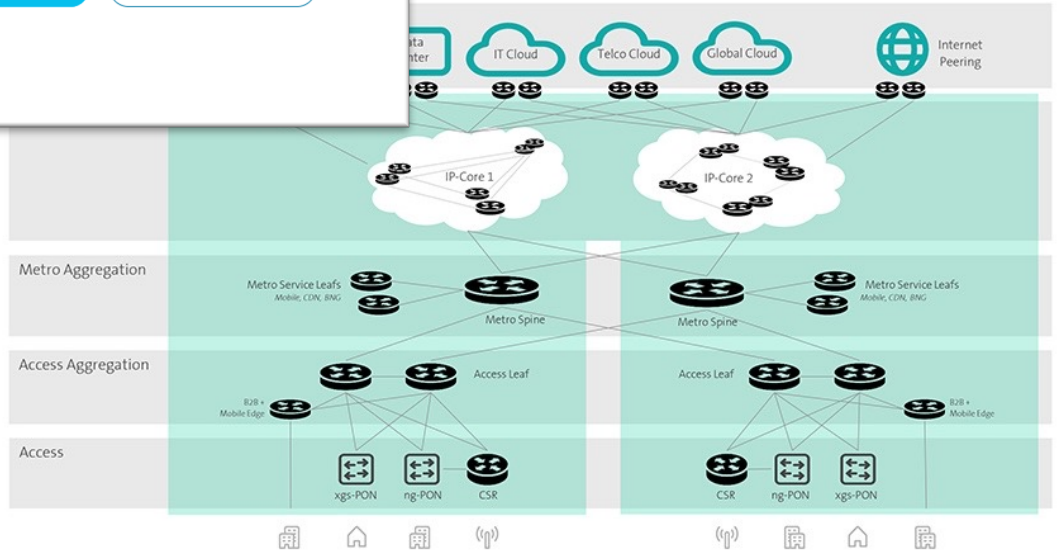
Swisscom builds future-ready network

Swisscom transformed its network to remove operational complexity, expand coverage areas, improve network scalability, and precisely manage traffic in support of new high-revenue services.

Watch the video (1:30)

Read the testimonial

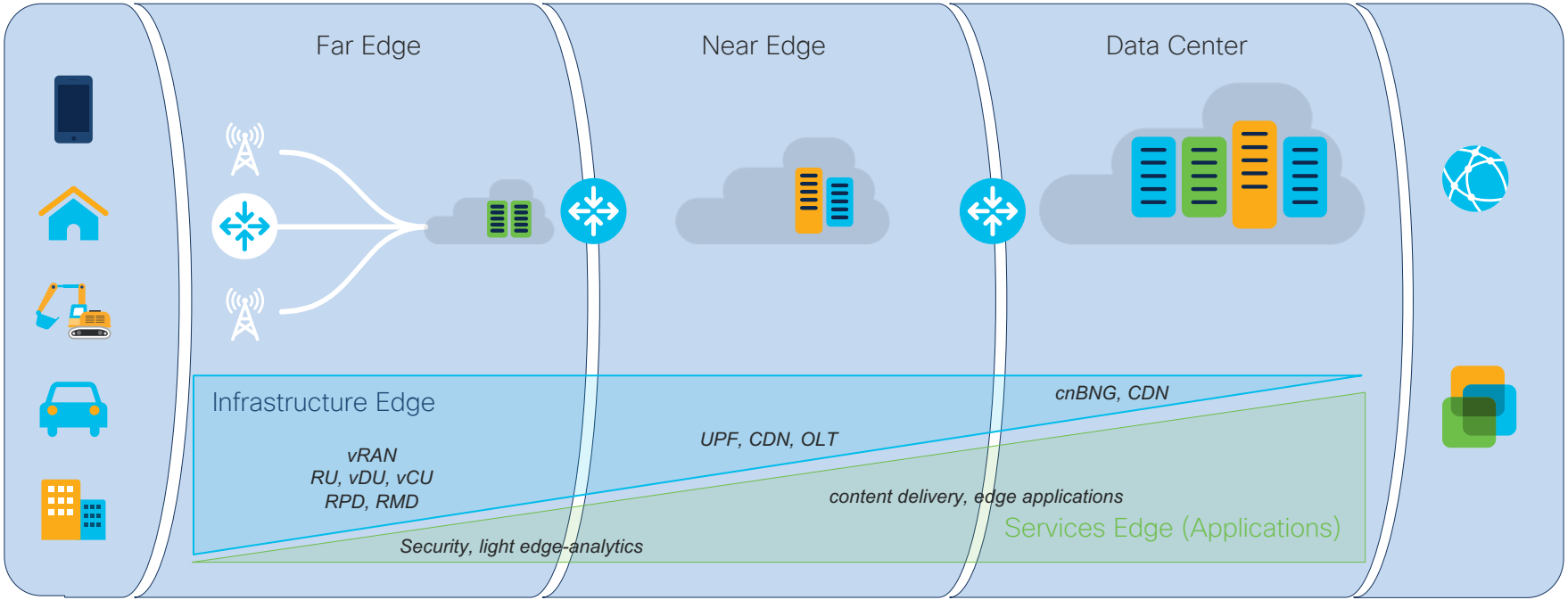
swisscom



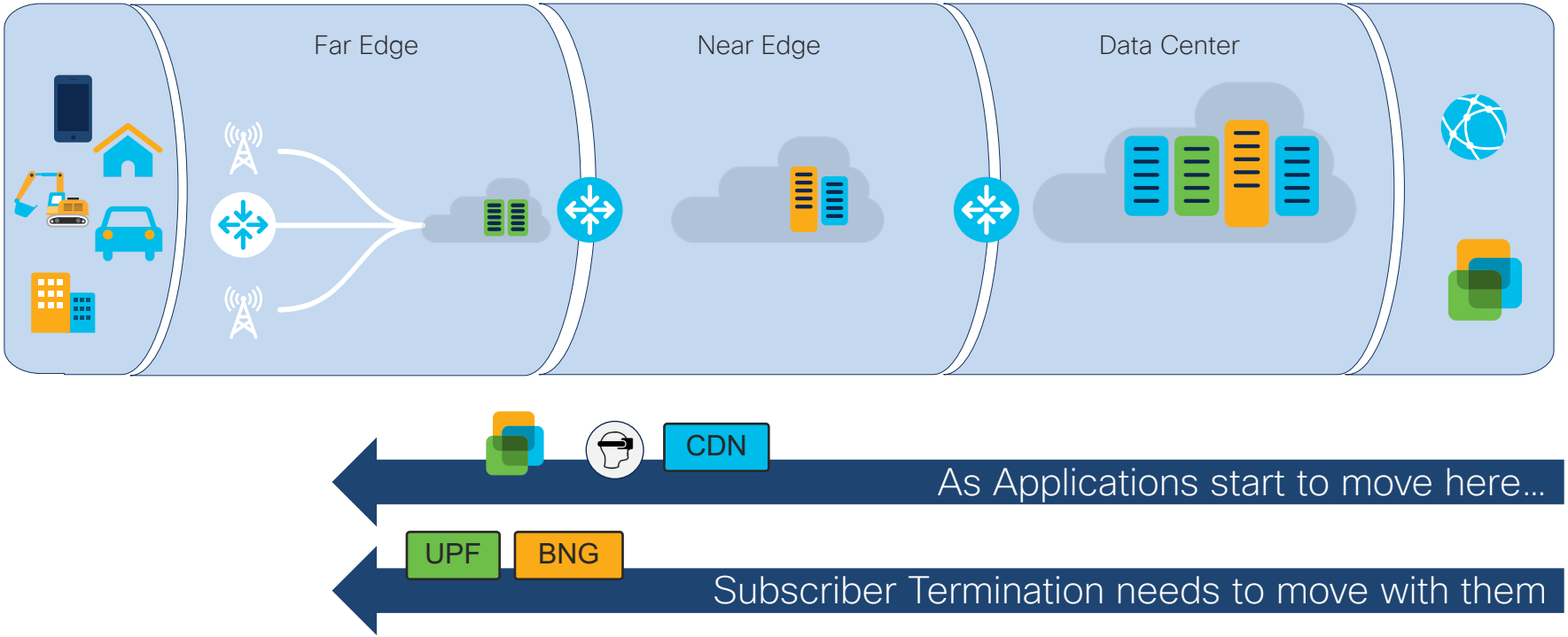
https://upshotstories.com/stories/moving-towards-100-network-availability-at-swisscom

Edge Services & Apps

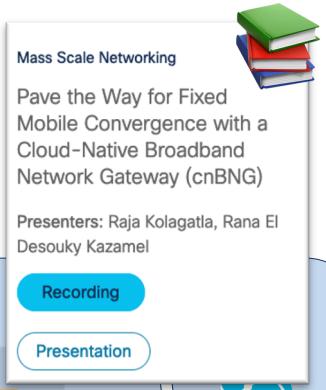
Service Distribution

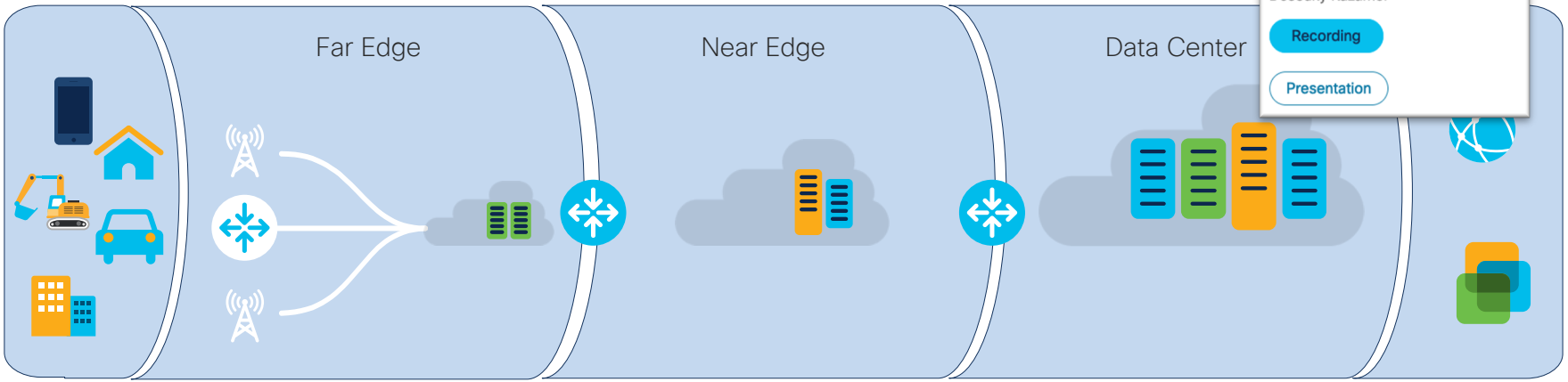


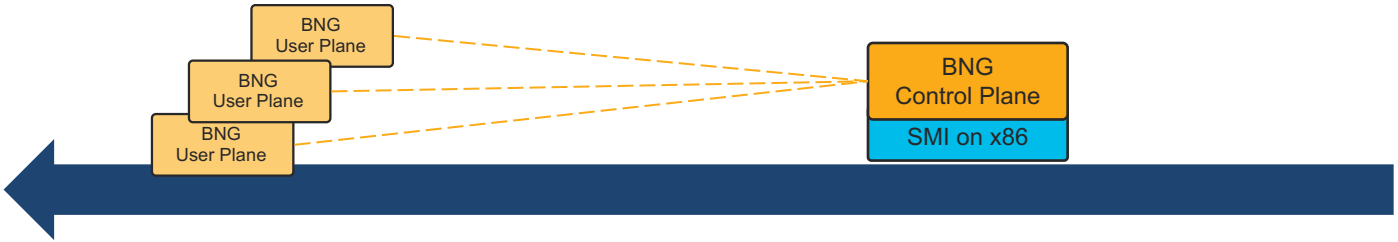
Subscriber Management Distribution



Cloud-native BNG

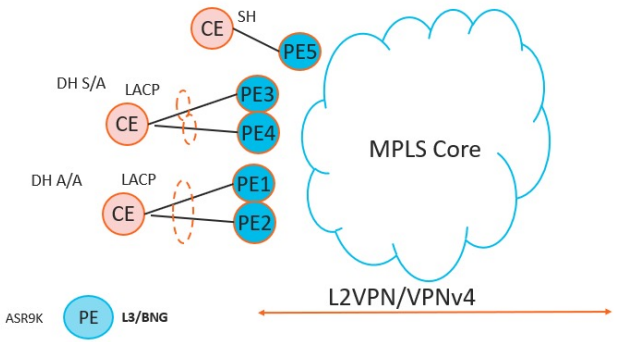




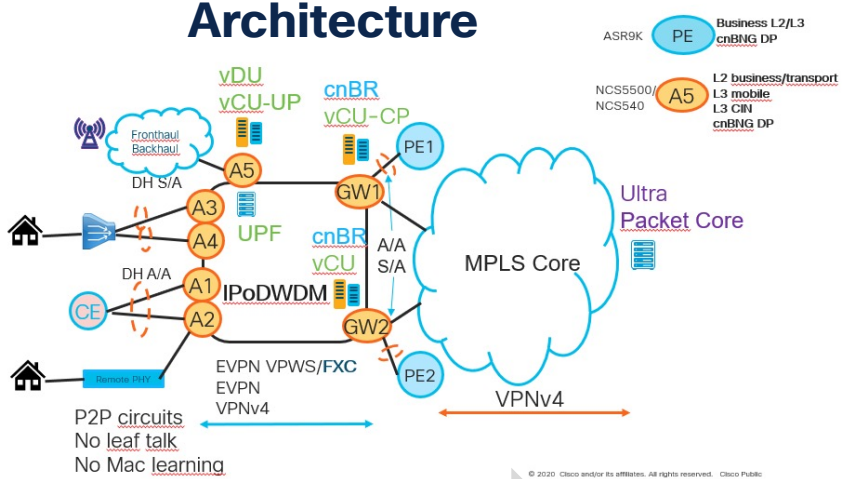


Optimizing Service Termination

Distributed PE



Optimized Service Architecture

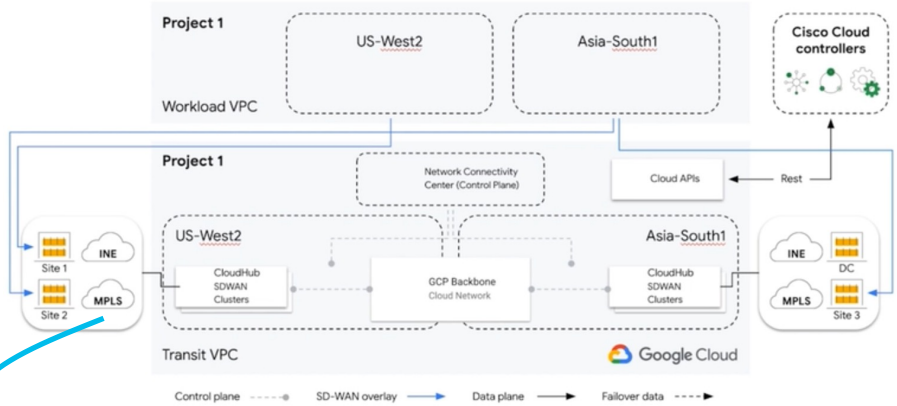


Evolving to become a hybrid

Driven by: bandwidth growth, transport simplification, application distribution, automation enablement

Overlays over Intelligent Underlays

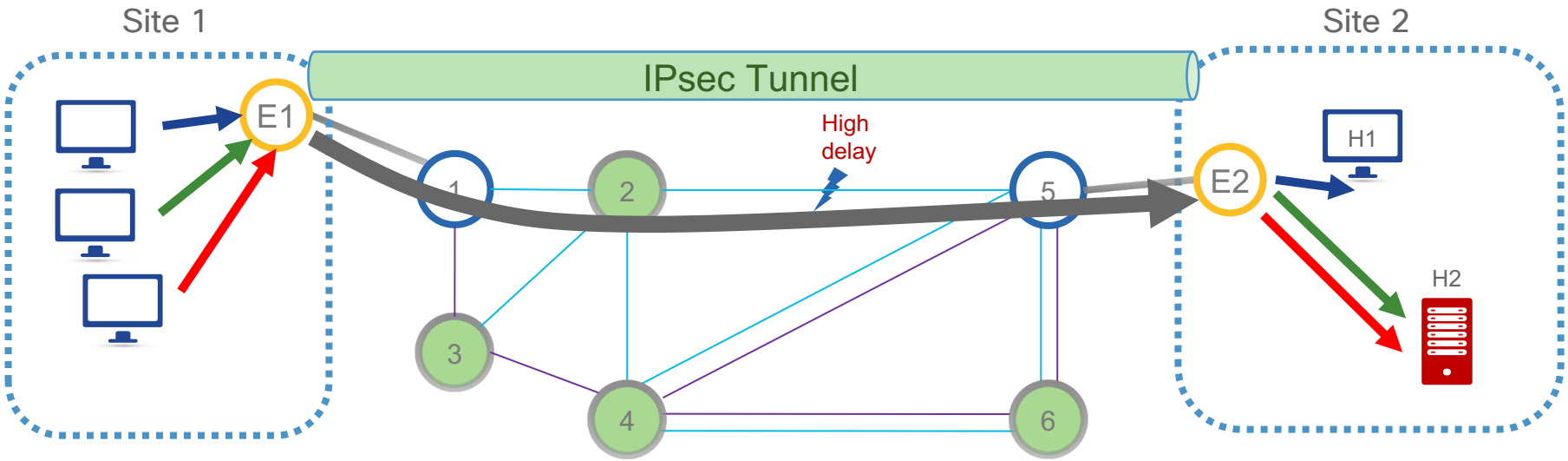
Extreme example of Service Distribution



Dependent on reliable and performant Access Networks

SD-WAN Today

All traffic between edges follows the same path

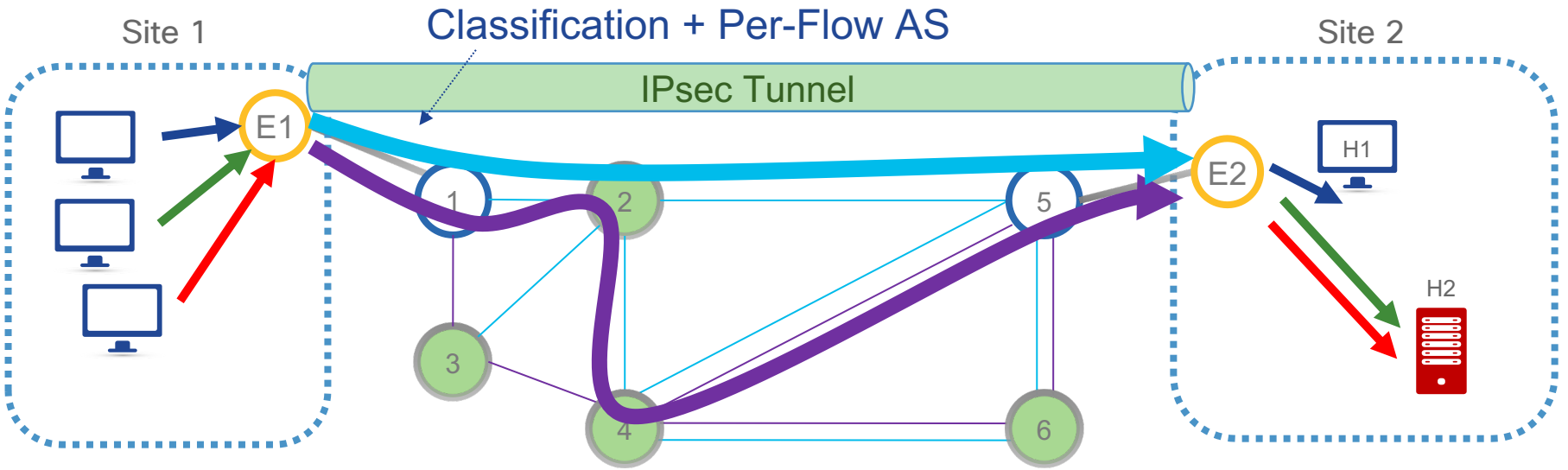


Traffic between site 1 and 2 follows the shortest path through the core

All flows (towards H1 and H2) are treated the same way

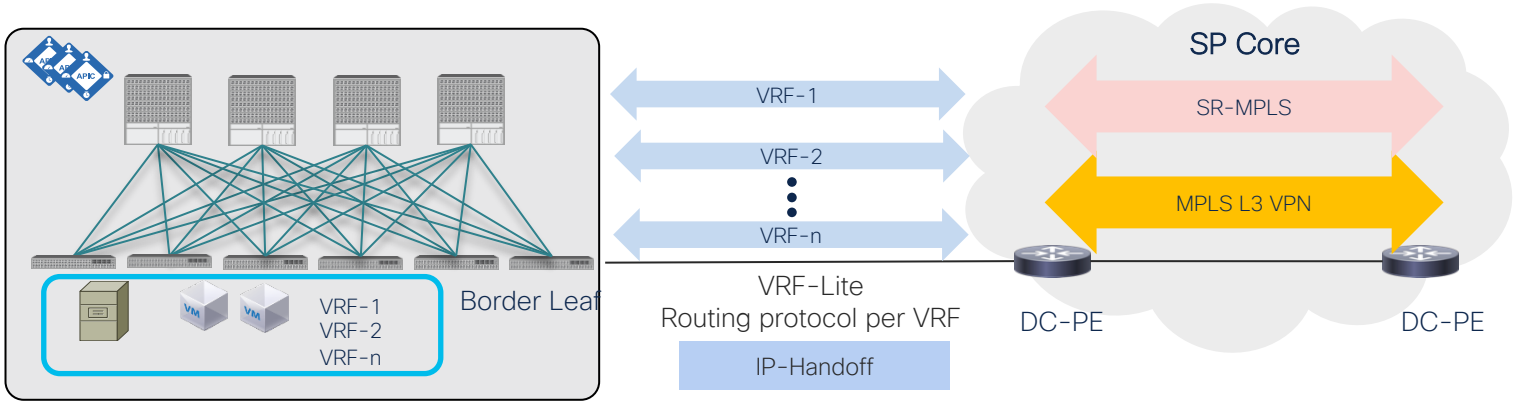
Bringing SLA Control to SD-WAN

Per-Flow Automated Steering



A provider implementing per-flow SR Policies offers multiple paths between SD-WAN endpoints.

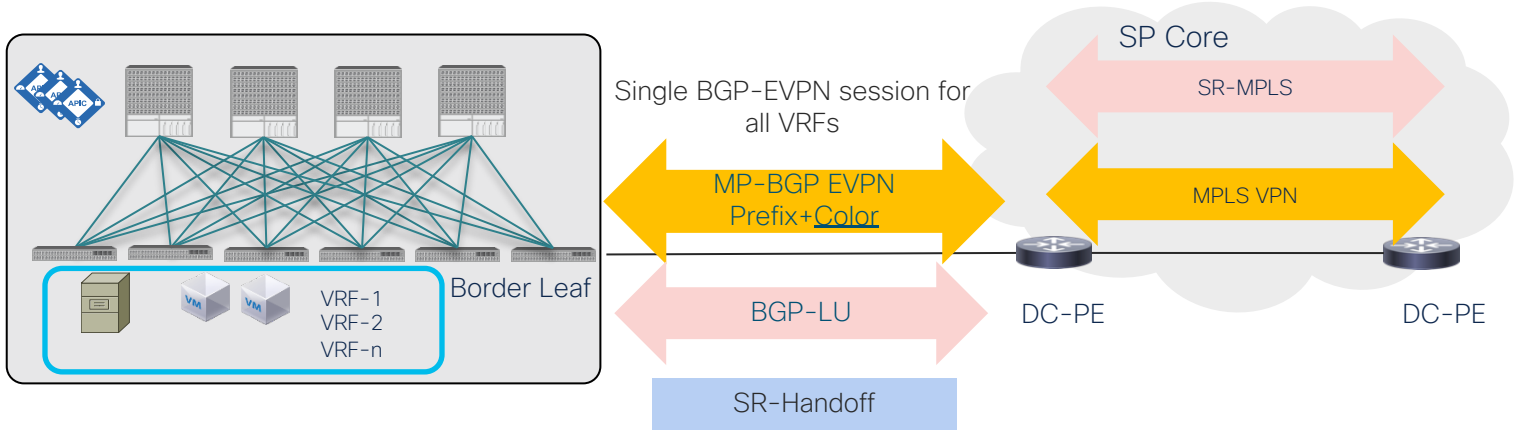
Traditional DC Stitching



Session per VRF between BL and DC-PE

Automation and scalability challenges

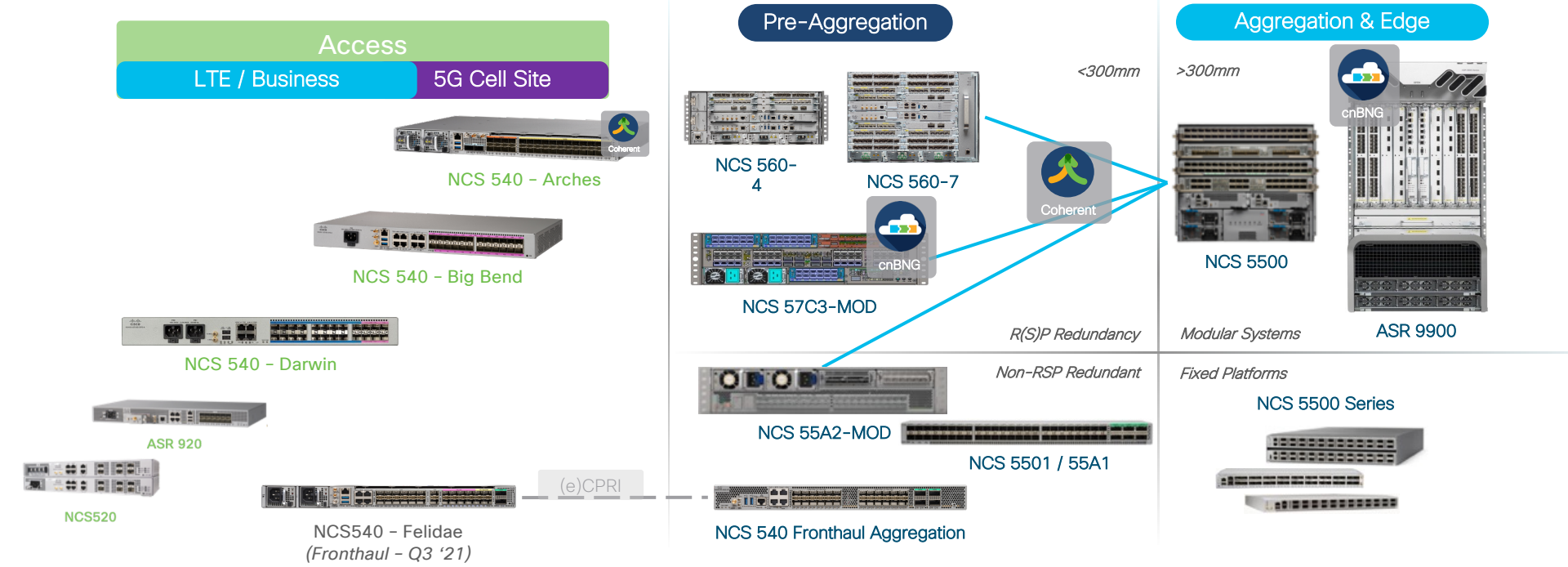
Datacenter to SR Handoff



Single control and data plane integration point

Mitigates automation and scalability challenges

Cisco Access & Aggregation Portfolio



BGP-based Services with EVPN

Segment Routing

Embedded Security & Sync

Access Router Use Cases and Examples

Phase 1: 5G Enablement → Phase 2: Network Slicing → Phase 3: Far Edge Service Decentralization

Segment Routing
for Scalability and Programmability

10G Uplink	25G Uplink	100G Uplink	400G Uplink
Darwin	Everglades		Arches
			
	100G Uplink		Felidae
			
			100G + CPRI Translation

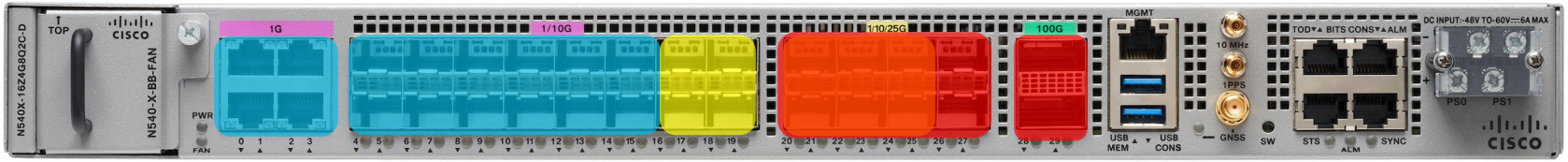
O-RAN Architectural Shift

Class C Timing Accuracy

Industrial Temperature and Environmentally Hardened

Flexible Consumption Model

Pay as you Grow towards Bandwidth Surge



Day 1

12 x 10G
n x GE

5G Ramp

+ 2 x 25G Uplinks
+ 6 x 10G

True 5G Wave

+ 2 x 100G
+ 6 x 25G

Summary & Take-aways

- ✓ Converged Access networks enable next phase of infrastructure roll-out and monetization
- ✓ Intelligence needed at the Access for scale and service differentiation
- ✓ Edge Services will push the requirements even further
- ✓ Cisco solutions are built for challenges of today and tomorrow

Questions?

mappelma@cisco.com

Resources:

- https://www.cisco.com/c/en/us/solutions/service-provider/converged-sdn-transport.html
- https://xrdocs.io/design/blogs/latest-converged-sdn-transport-hld


CISCO