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SR-aware SD-WAN

Enabling end-to-end application-responsive networking

Mark Ferreira, Technical Fellow, Bell Business Markets
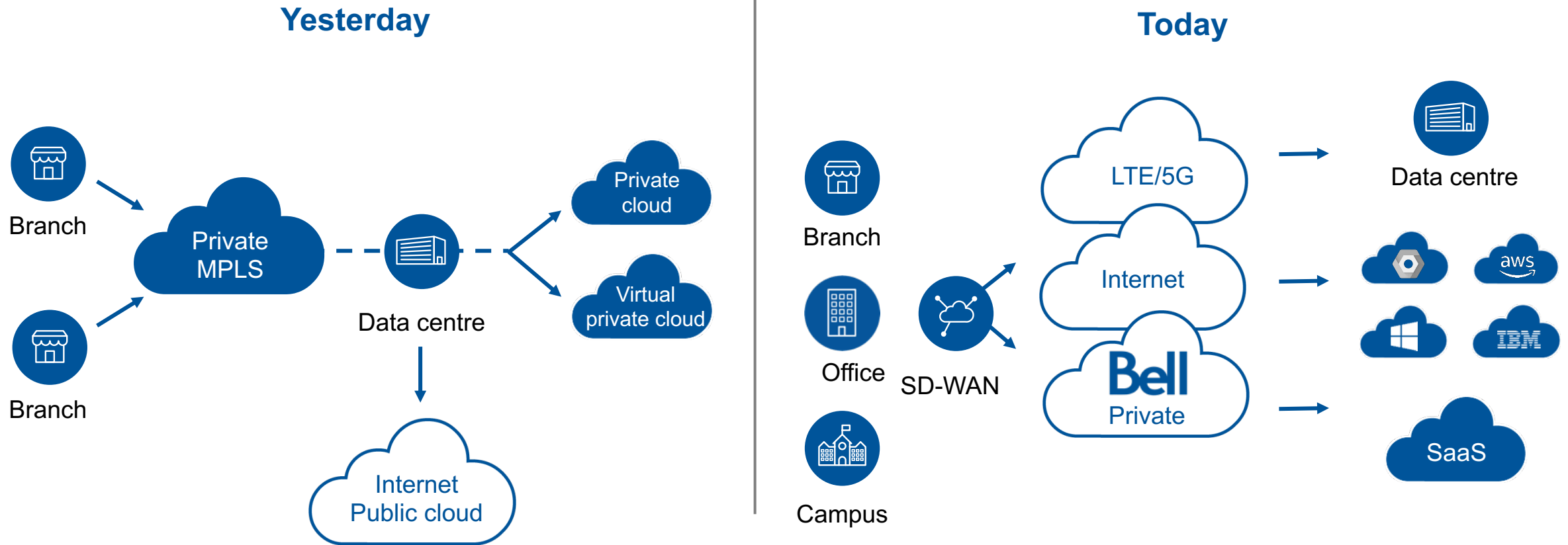**Daniel Voyer**, Technical Fellow, Bell Technology

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Agenda

- Service evolution with SD-WAN

- SR benefits for business services

- SD-WAN-SR overview

- Business SR deployment scenarios

- Bell lab test

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Service evolution with SD-WAN

Network adapting to new cloud service delivery model

Yesterday

Branch

Branch

Private MPLS

Data centre

Private cloud

Virtual private cloud

Internet Public cloud

Today

Branch

Office

Campus

SD-WAN

LTE/5G

Internet

Bell Private

Data centre

aws

IBM

SaaS

SD-WAN Edge Intelligence, common architecture for best-in-class app performance and Internet connectivity becomes business critical

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Bell Virtual Network Services
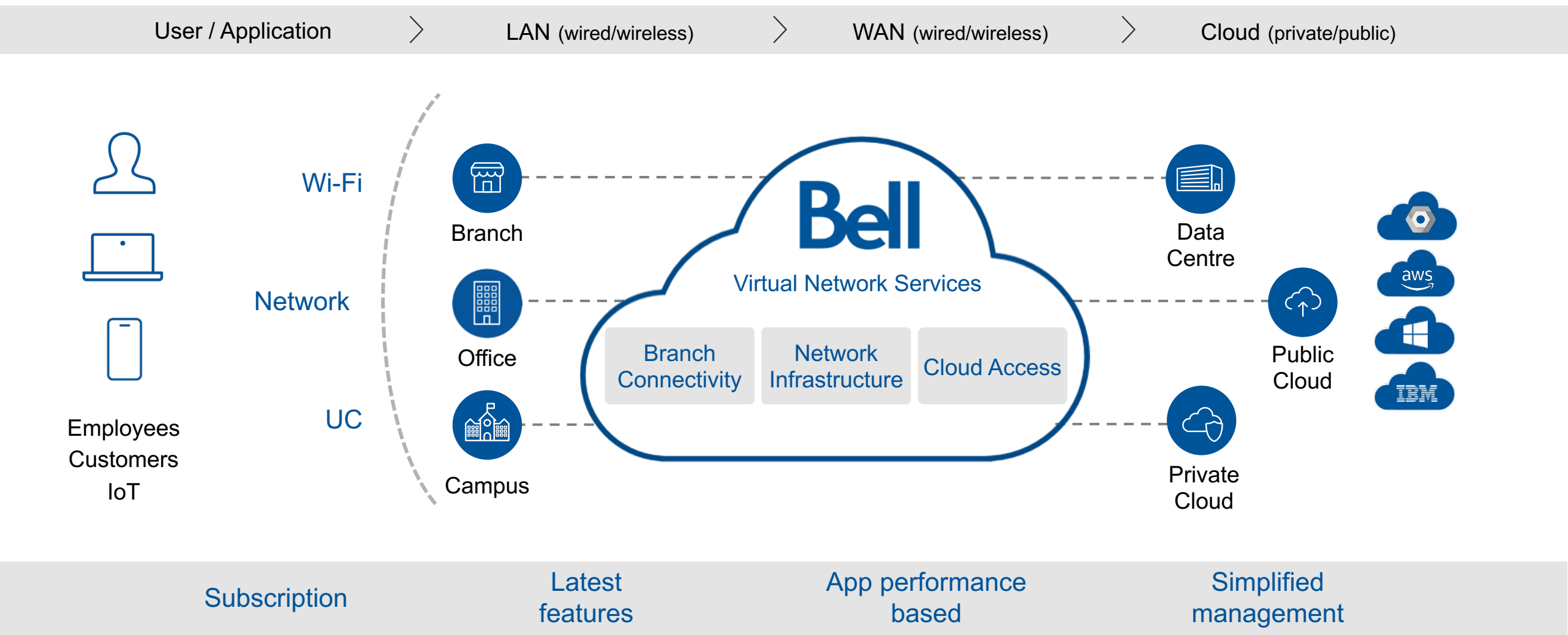
SD-WAN business challenges

Well-known facts

- SD-WAN app performance view (E2E SLA) differs from MPLS VPN (PHB)

- Services overlay and infrastructure underlay are not tied together

- Optimizing use of high performance underlay requires tuning at SD-WAN edge

- Difficult to capture additional revenue with customized solutions and services

The opportunity

- Product: innovative services by integrating services and infrastructure

- Network: capture savings provided by technological advances

- **Accelerate the pace of transformation**

SR makes the Network more flexible and agile

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SR benefits for business services

Product priorities – SR alignment

Product directions	SR benefits
Access agnostic Every service over any access	**Consistent treatment of traffic** Across access types
On-demand / dynamic services Fast service activation / fast service changes	**Centralized control** Less elements to touch in order to provision service (edge only)
Value added / differentiated services Granular offerings customized to customer	**Easy traffic engineering** Customized SLA's
Service virtualization Service composition	**Service Programming** Bring traffic to service

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Segment Routing value in delivering Business Services

| Bell	Customer
Simplification	Product / feature velocity
Automation / orchestration	On-demand / self-service / granularity
Traffic engineering	SLA / path control
Streaming telemetry	Service assurance
Optical / packet / physical / virtual	Multi-layer
Opaque service identifier	Secured
Automated sub-50msec (TILFA)	E2E network reliability
Monetize entire SP infrastructure	Choice of performance / price options

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SD-WAN-SR overview

Per-Flow Policy (PFP) – Per-Flow SR Policy mechanisms

Per-Flow SR Policy

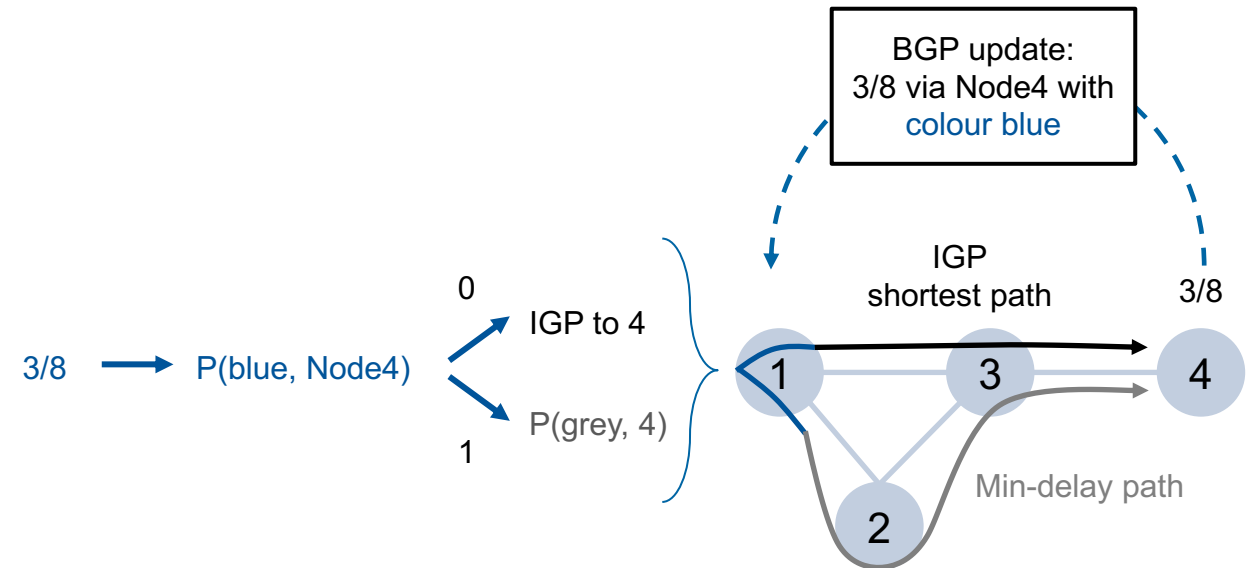Per-Flow Policy (blue, Node4) @ Node1
- FC=0 → IGP shortest path == 16004
- FC=1 → Per-Destination SR Policy (grey, Node4)
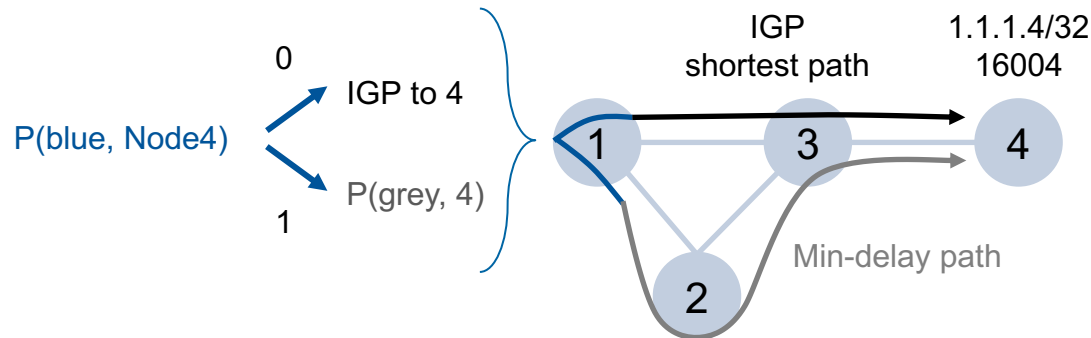
Per-flow Automated Steering (AS)

AS automatically steers a service route on the policy (C, E):
- C == colour of the service route
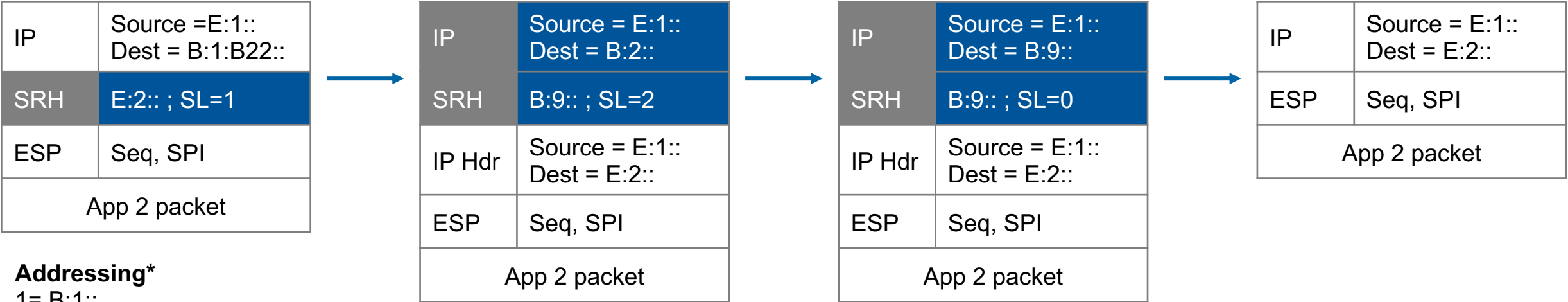- E == next-hop

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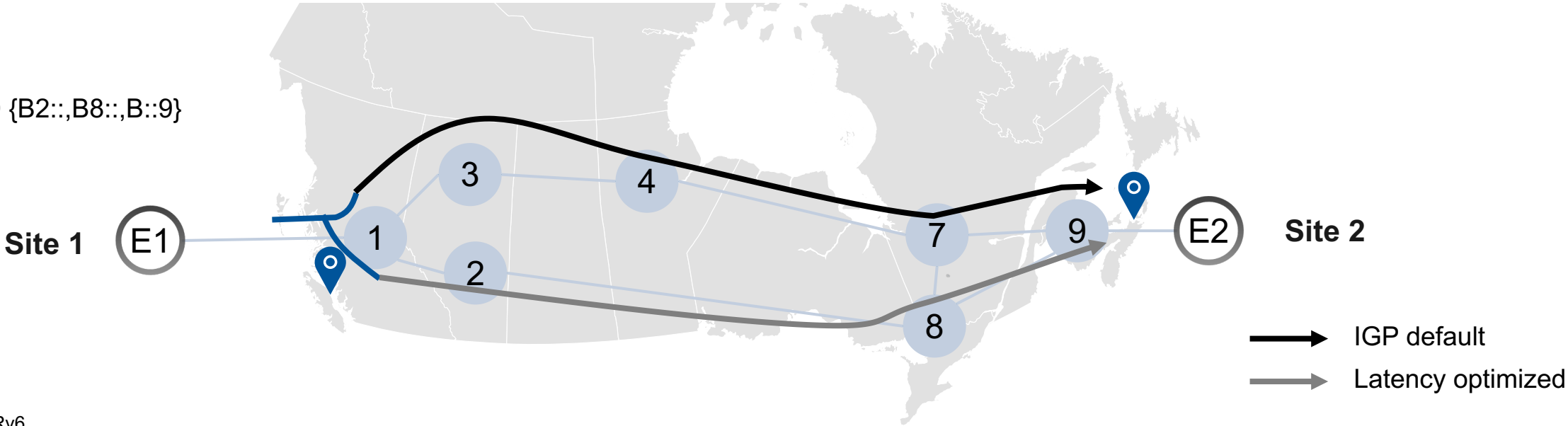# Application A uses best-effort

- E1 and E2 are SD-WAN edge nodes with address E:1:: and E:2::

- Application A at Site 1 sends a packet to a destination at Site 2

- E1 encrypts packet to site 2 and encapsulate in IPSec packet to E:2::

- E1 uses default PCP marking, packet follows IGP path

→ IGP default

→ Latency optimized

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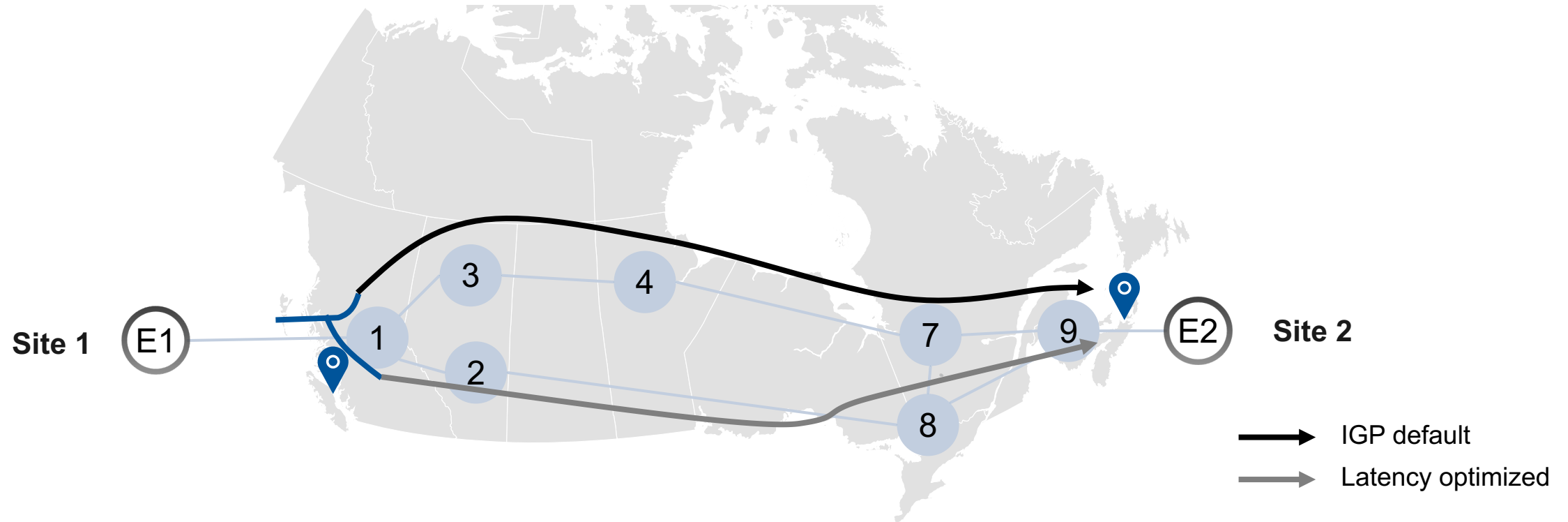
Application B requires low latency

IP	Source =E:1:: Dest = B:1:B22::
SRH	**E:2:: ; SL=1**
ESP	Seq, SPI
App 2 packet	

→

IP	**Source = E:1::** **Dest = B:2::**
SRH	**B:9:: ; SL=2**
IP Hdr	Source = E:1:: Dest = E:2::
ESP	Seq, SPI
App 2 packet	

→

IP	**Source = E:1::** **Dest = B:9::**
SRH	**B:9:: ; SL=0**
IP Hdr	Source = E:1:: Dest = E:2::
ESP	Seq, SPI
App 2 packet	

→

IP	Source = E:1:: Dest = E:2::
ESP	Seq, SPI
App 2 packet	

Addressing*
1= B:1::
2= B:2::
…
9= B:9::
B22:: B-SID {B2::,B8::,B::9}

Site 1 E1   E2 **Site 2**

IGP default
Latency optimized

*SR-MPLS or SRv6

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Performance monitoring

Enterprise-based

- Send probes with the related Binding SID

- Enhances SD-WAN default mechanisms

SP-based

- The SP can enable per-SR-policy perf monitoring

  - latency

  - loss

- These metrics can be leveraged by SD-WAN controller and provided to the enterprise

- Simple reporting

- Additional data to select which application to steer on which Binding SID

- Embedded OAM

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Business SR deployment scenarios

SD-WAN and SR Controllers

SD-WAN Controller

- Manages SD-WAN VPNs, SD-WAN policies, Enterprise Edge

- Policies are enterprise managed
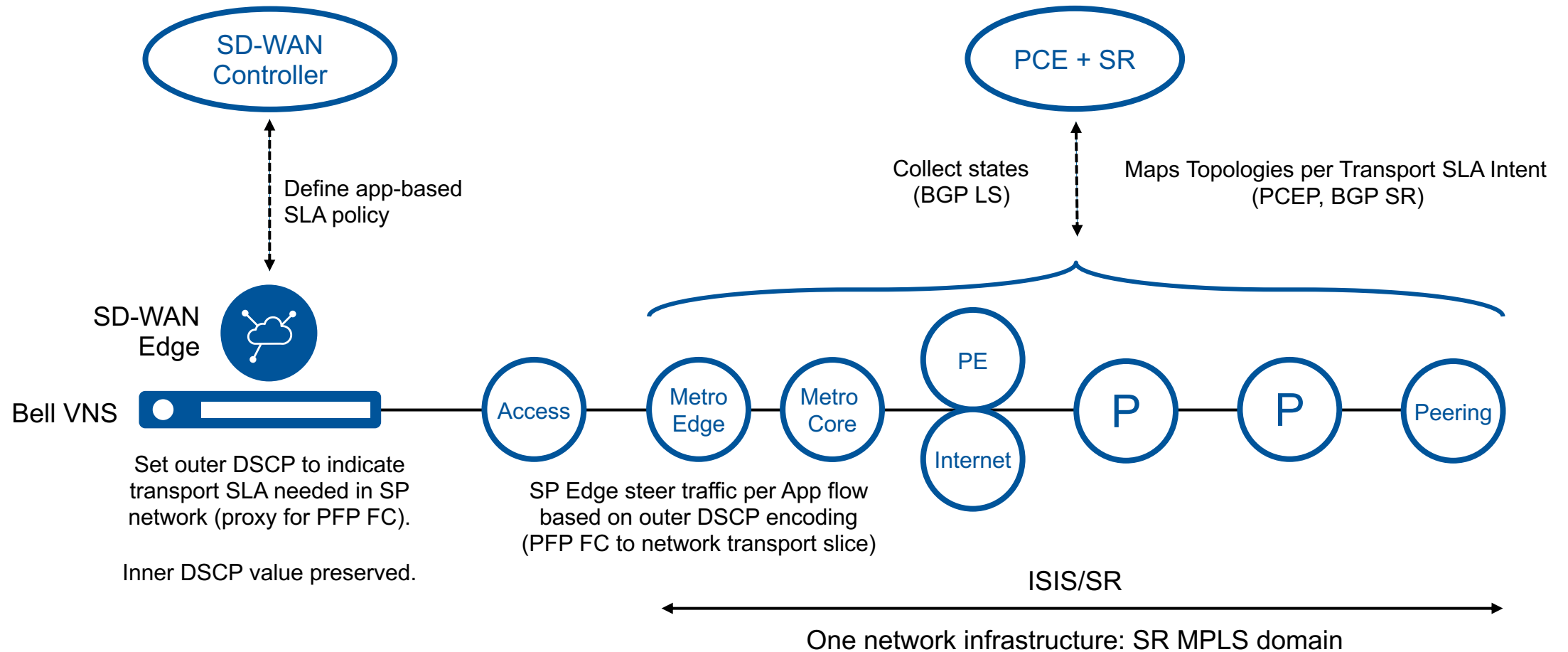
SR Controller (PCE)

- Provides service provisioning for SR policies, Service Provider Edge

- Provider owned and managed

SD-WAN
Controller

Application Overlay
Enterprise

PCE + SR

Transport Underlay
Service Provider

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Bell Architecture (future 1) – SD-WAN-SR

Enterprise leverages pre-defined transport slices

SD-WAN Controller

PCE + SR

Define app-based SLA policy

Collect states (BGP LS)

Maps Topologies per Transport SLA Intent (PCEP, BGP SR)

SD-WAN Edge

Bell VNS

Set outer DSCP to indicate transport SLA needed in SP network (proxy for PFP FC).

Inner DSCP value preserved.

Access

Metro Edge

Metro Core

PE

Internet

P

P

Peering

SP Edge steer traffic per App flow based on outer DSCP encoding (PFP FC to network transport slice)

ISIS/SR

One network infrastructure: SR MPLS domain

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Bell Architecture (future 2) – SD-WAN-SR

Enterprise request on-demand specific transport SLA (e.g. low latency)

SD-WAN request service "low latency"

SD-WAN Controller ←--------------------------------------→ PCE + SR

SR provides Binding SID (B-SID)

Define app-based SLA policy

Collect states (BGP LS)

Maps Topologies per Transport SLA Intent (PCEP, BGP SR)

SD-WAN Edge

Bell VNS

Set outer header with B-SID

Access — Metro Edge — Metro Core — PE / Internet — P — P — Peering

Maps B-SID to transport policy

ISIS/SR

One network infrastructure: SRv6 domain

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Bell lab test

Bell SD-WAN-SR Lab

Goals to validate

- SD-WAN controller components

- PCE / SR controller components

- Multiple topologies

- Edge SD-WAN (enterprise)

- Edge SR (service provider)

- Path default and latency-optimized

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Summary – SD-WAN-SR

- What does this mean for the industry?

  - Underlay differentiation for SDWAN

  - Secured, Automated, Service Assured SLA

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