Bandwidth Guarantee Services with SRv6 policy for deterministic networking

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Rakuten

Rakuten Mobile SRv6 uSID IP Transport Transformation

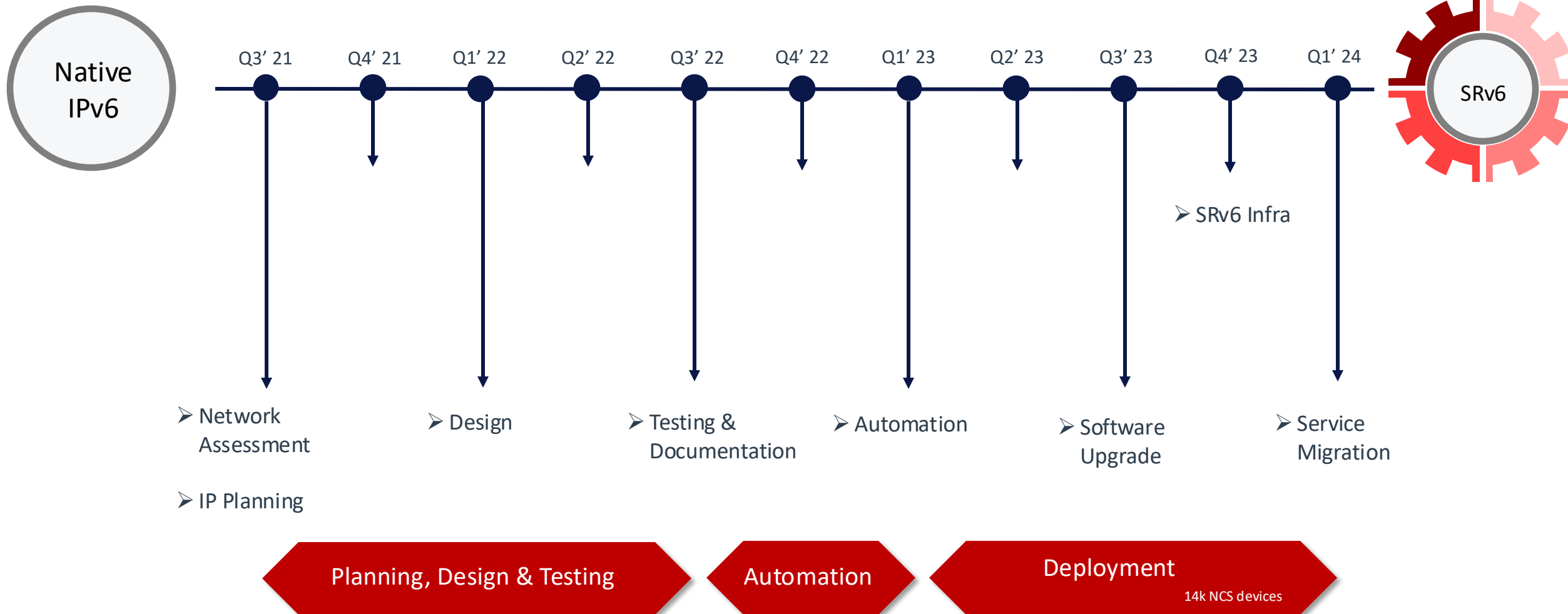| **47**	**59**	**15000**
Prefectures	IGP domains	SRv6 nodes
Largest u-SID SRv6 deployment	ISIS, BFD, BGP (vpnv4, vpnv6, rt-filter, evpn, bgp-ls)	4G,5G, L2VPN (EVPN), L3VPN

Rakuten SRv6 Journey in the last 3 years

Native IPv6 -> SRv6 deployment on 15k NCS devices

Native IPv6

| Q3' 21 | Q4' 21 | Q1' 22 | Q2' 22 | Q3' 22 | Q4' 22 | Q1' 23 | Q2' 23 | Q3' 23 | Q4' 23 | Q1' 24 |

SRv6

➤ SRv6 Infra

➤ Network Assessment

➤ Design

➤ Testing & Documentation

➤ Automation

➤ Software Upgrade

➤ Service Migration

➤ IP Planning

Planning, Design & Testing

Automation
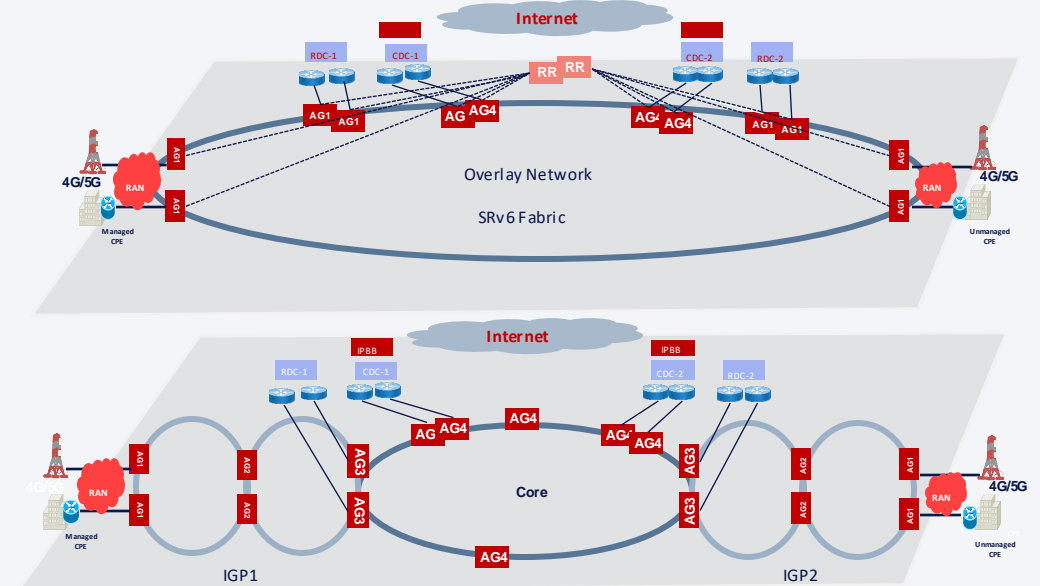
Deployment

14k NCS devices

Rakuten IP Transport Transformation

SRv6 transforms Rakuten IP Transport network to world class converged 5G SDN-ready network
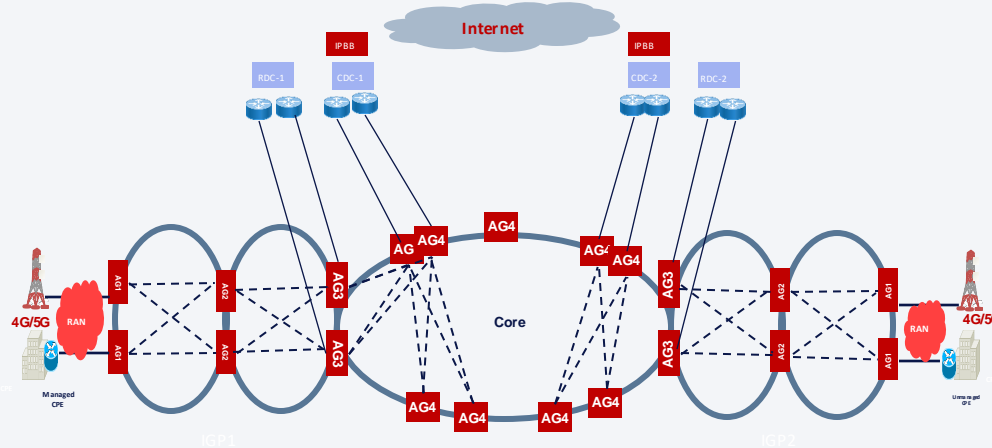
Old NW - Hop-by-hop routing architecture

Current NW - Overlay-Underlay routing architecture using SRv6

➤ More and better services offering using existing infrastructure.

➤ Single SRv6 fabric, reduced provisioning touch-points, faster provisioning time, easy to automate, less human error.

➤ Reduced number of protocols, simple to troubleshoot and operate

SRv6 Deployment Outcomes

98%
Reduction in ISIS LSP in Core

73%
Reduction in total ISIS routes in Core

96%
Reduction in number of BGP sessions on Core routers
55 to 2

SRv6 transforms Rakuten IP Transport network to world class converged 5G SDN-ready network

90%
Reduction in total routes to data centers
6500+ → 500

86%
Reduction in config touch-points
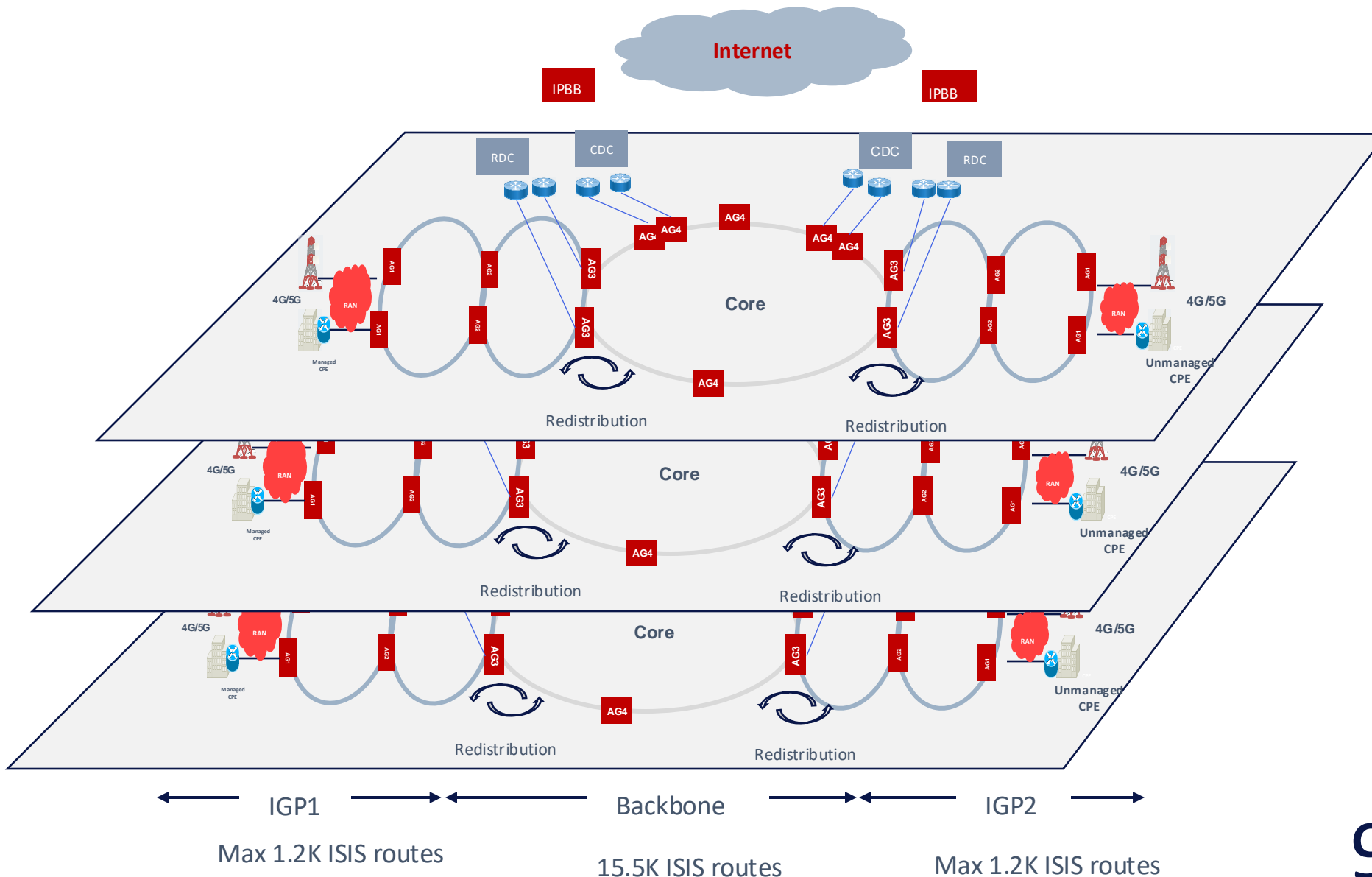13-15 -> 2

90%
Improvement in convergence time
500ms to 50ms

94% reduction in unique sites flap post SRv6 migration

Rakuten Mobile Network Slicing based Services

1 Low latency + High reliability

2 High Bandwidth

3 Default Slice

Slice-1 (Low Latency)
Flex-Algo 130

Slice-2 (High BW)
Flex-Algo 128

Default Slice

SDN Controller

On-demand Low-Latency TE

On-demand High BW TE

FlexAlgo & QoS

SRv6 Enabled Transport
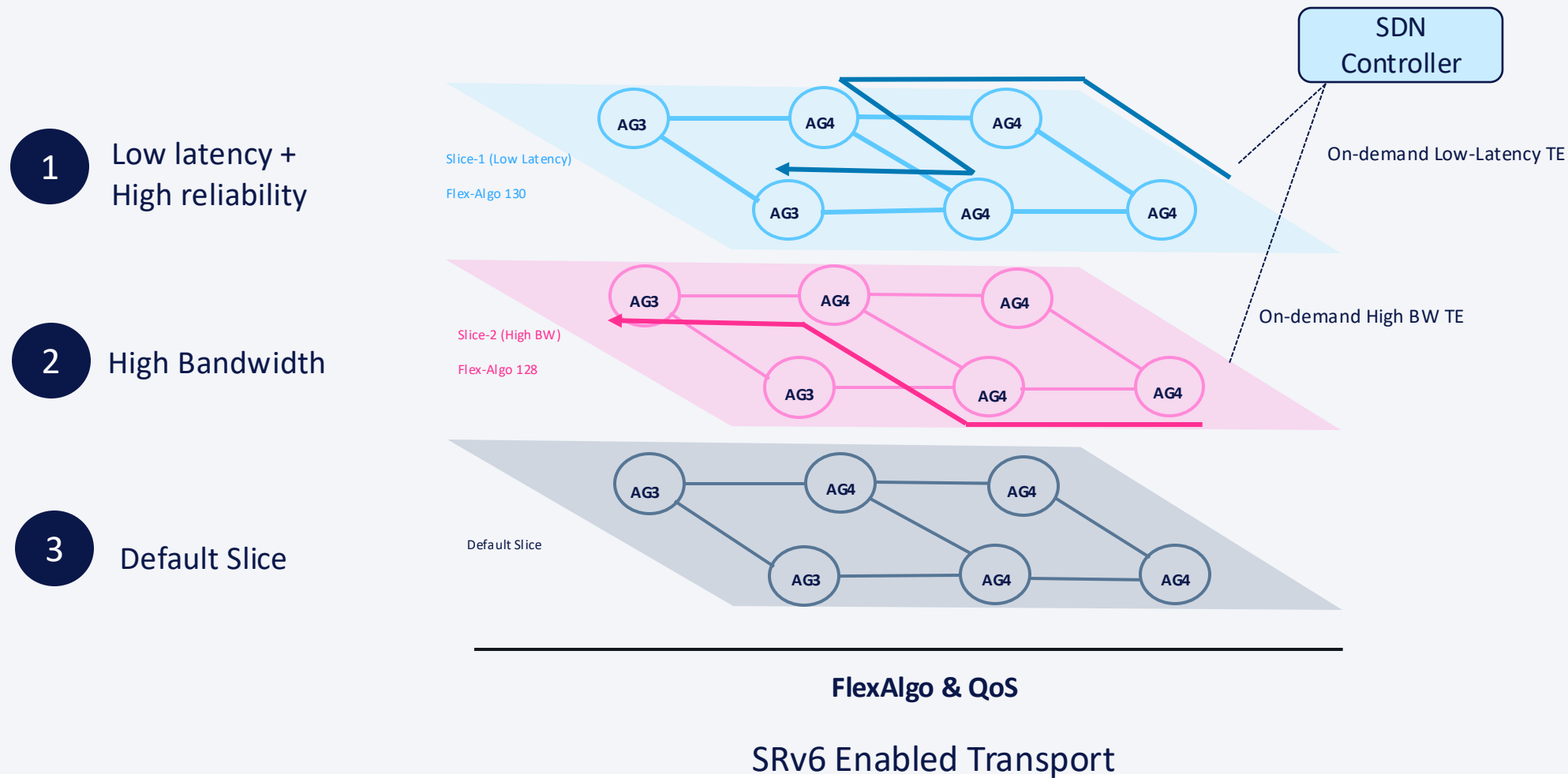
Network slicing and IGP Scale

15k locators

+

15k locators

+

15k locators

=

900 locators

SRv6 Converged Transport: Cloud-SD WAN

Tenant 1 (SLA 1)

Tenant 2 (SLA 2)

Tenant 3 (SLA 3)

Metro

Core

Central DC

Public Clouds

Internet

Regional DC

Security Chain

Mobile Wireless Access

Enterprise Branch/Campus

Edge DCs

Enterprise DC

Public Cloud (SaaS, IaaS)
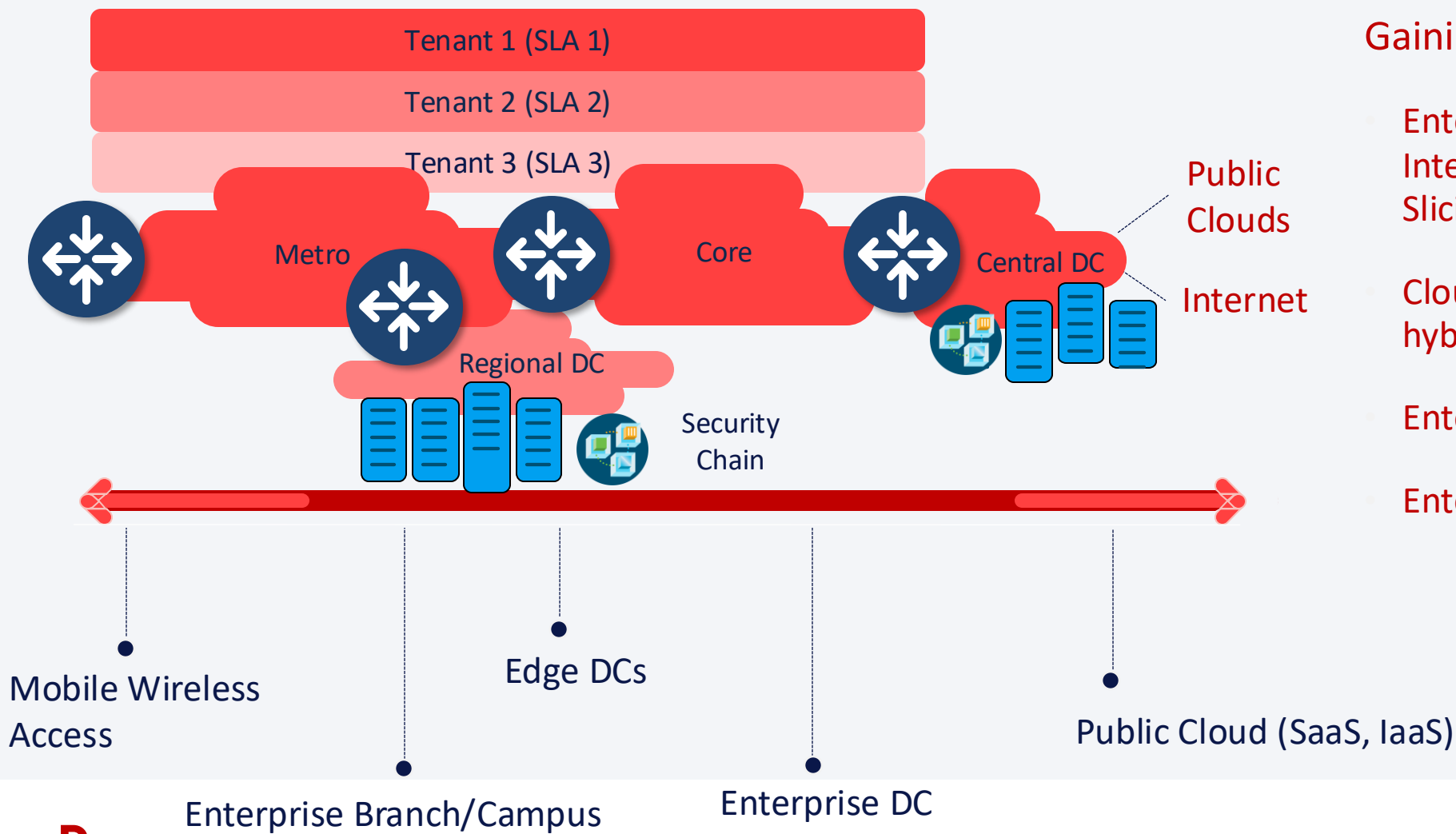
Gaining momentum

- Enterprise DCI/L2VPN/L3VPN and Internet services with Network Slicing

- Cloud on-ramps for Enterprise hybrid/multi-cloud experience

- Enterprise SD-WAN
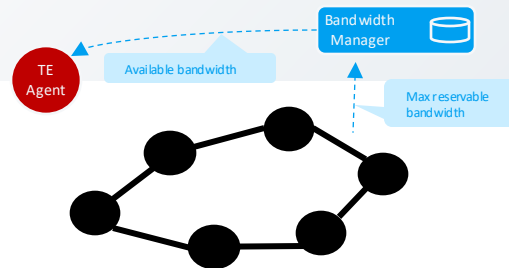
- Enterprise Private 5G

Approaching the Guaranteed BW problem

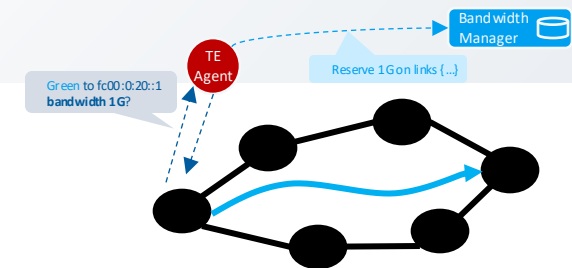Right capacity planning is fundamental to providing BW-related services

Resource Isolation
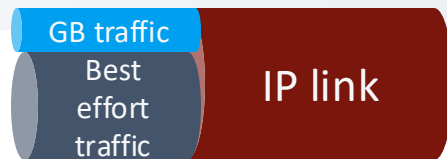
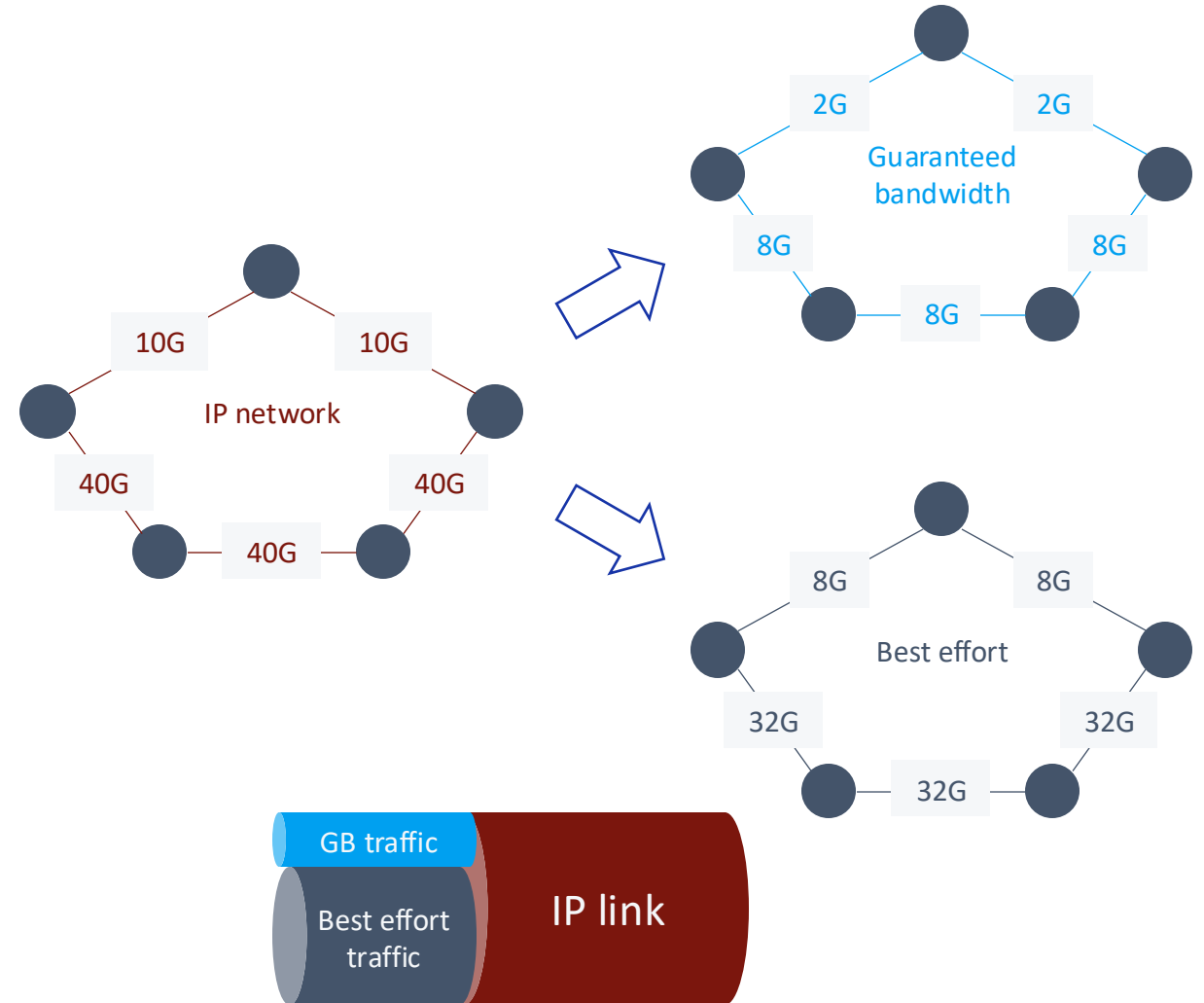## BW Resource Reservation

BW aware Path calculation

TE agent with view of available reservable BW can offer a strict path to meet Guaranteed BW SLA
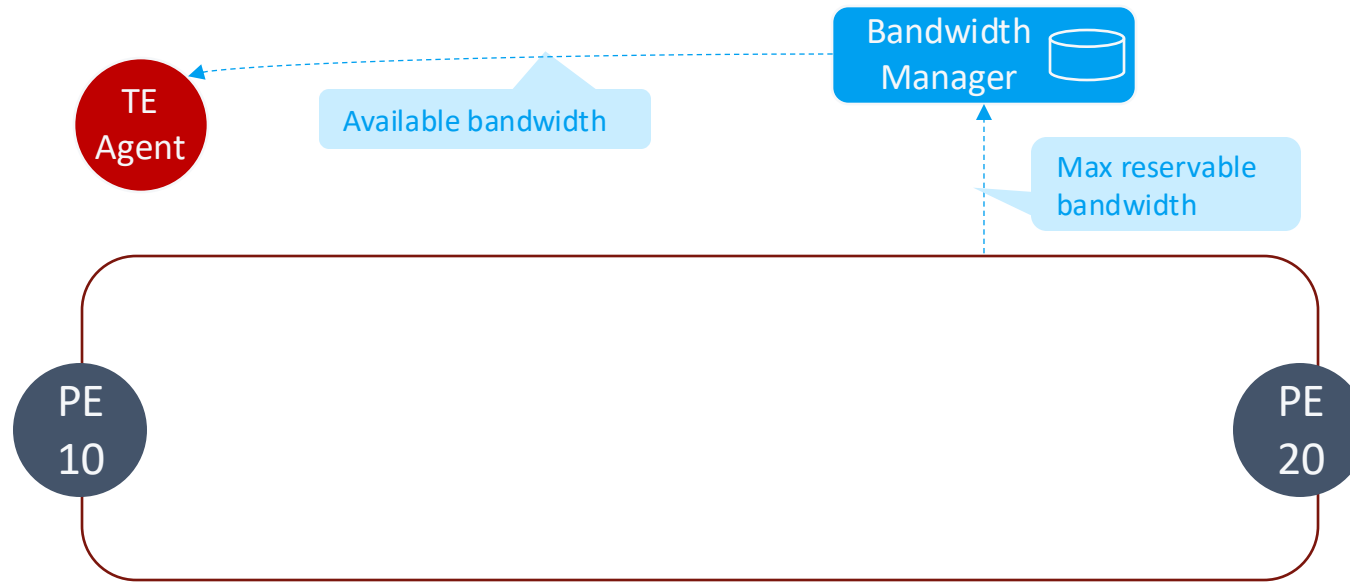
Resource Isolation

Carve out a fraction of the link capacity for guaranteed bandwidth

Dedicated QoS queue on each link

IP network

10G   10G

40G   40G

40G

2G   2G

Guaranteed
bandwidth

8G   8G

8G

8G   8G

Best effort

32G   32G

32G

GB traffic

Best effort
traffic

IP link

Dedicated queue isolates guaranteed bandwidth traffic from best effort traffic.

Bandwidth Bookkeeping

Bandwidth Manager is the bookkeeper for the guaranteed bandwidth slice

- Learns bandwidth slice "capacity" (max reservable link bandwidth) from the network

- Communicates the available link bandwidth to each TE Agent

- Maintains bandwidth reservations

BW Manager keeps track of utilized BW and prevents over subscription
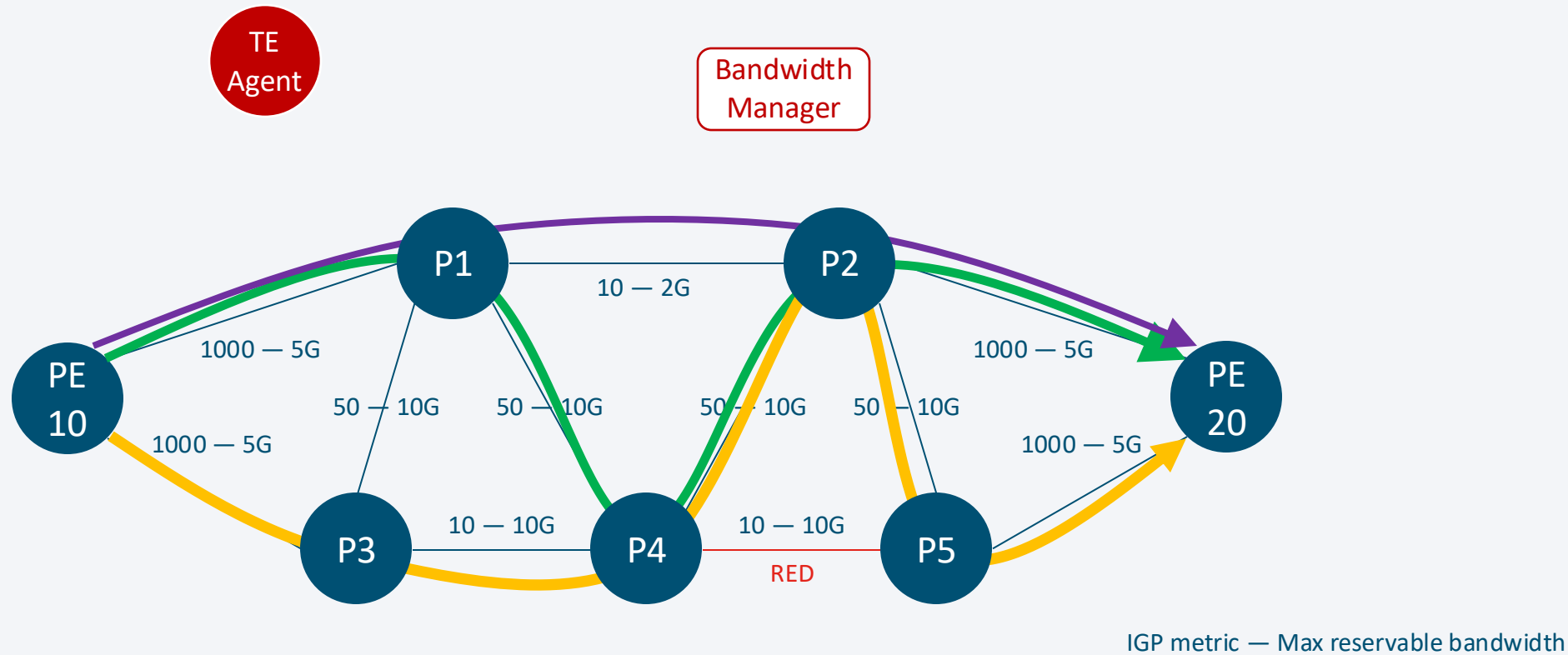
Bandwidth aware SR-TE Policies
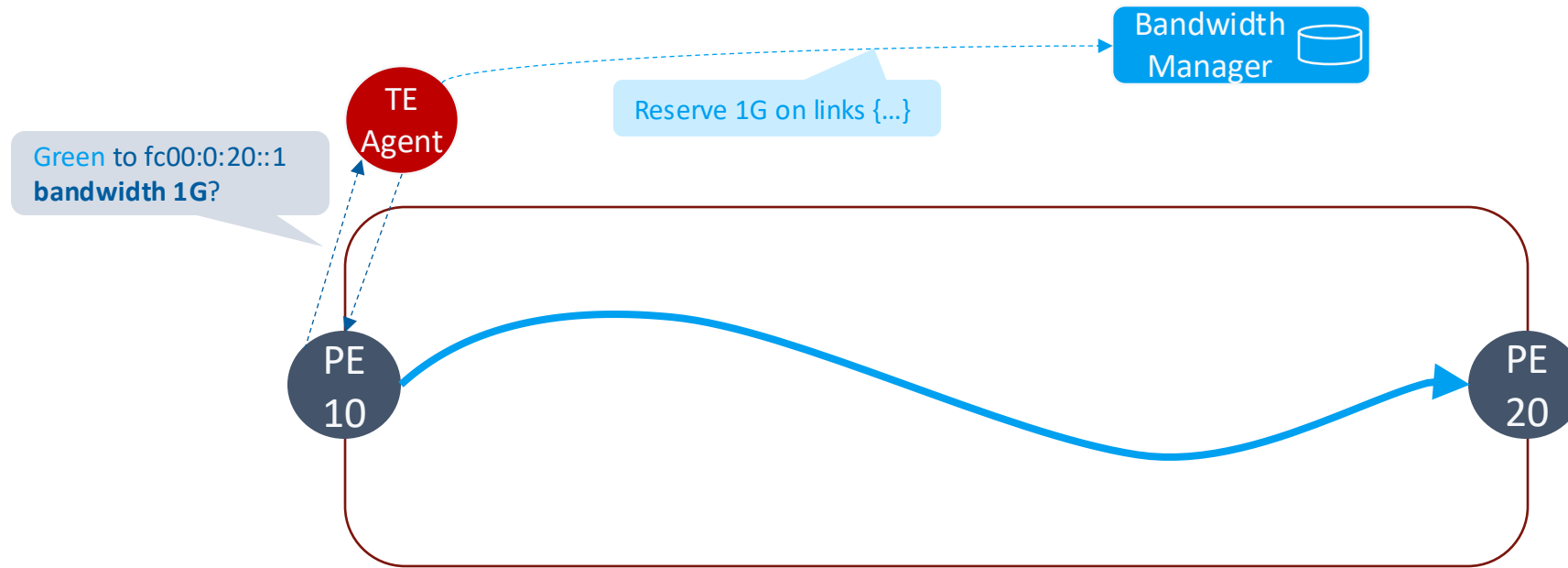
PE requests SR Policy with bandwidth constraint to TE Agent

- Strict, non-ECMP segment lists using a sequence of Adj-SIDs

- Bandwidth reservation with Bandwidth Manager for each link of the SR policy

PE polices/shapes incoming traffic according to the reserved bandwidth

TE Agent provides strict, non-ECMP SID list (Adj-SIDs) that meets BW demand

Demo