Disaggregated Routing Gets Real In Deutsche Telekom

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Disaggregation in Deutsche Telekom – Access 4.0

Existing network

Deutsche Telekom have successfully deployed traditional Broadband Network Gateway (BNG) in ~1,000 locations across Germany

First disaggregated BNG now live in-service at Deutsche Telekom

- 1Gbps Internet service, triple play capable, integrated to IT
- Using RtBrick software and white box hardware

Also aligned with TIP Open BNG initiative

- Supported by TIP community
- OpenBNG white paper (DT, BT, Telefonica, Vodafone)

Disaggregation is a key principle for DT's network and service evolution.

"Disaggregation is now a reality. For the first time we're producing a BNG on Whitebox hardware and are using software-defined networking technology to control that gateway. That's a hugely important step toward our broadband network's future structure."

Abdurazak Mudesir,
Head of Services & Platforms and Access Disaggregation at Deutsche Telekom

Cloud-Native Carrier Routing Software

Black Box

- **Integrated systems**
- **Software locked to hardware**
- **Inflexible**

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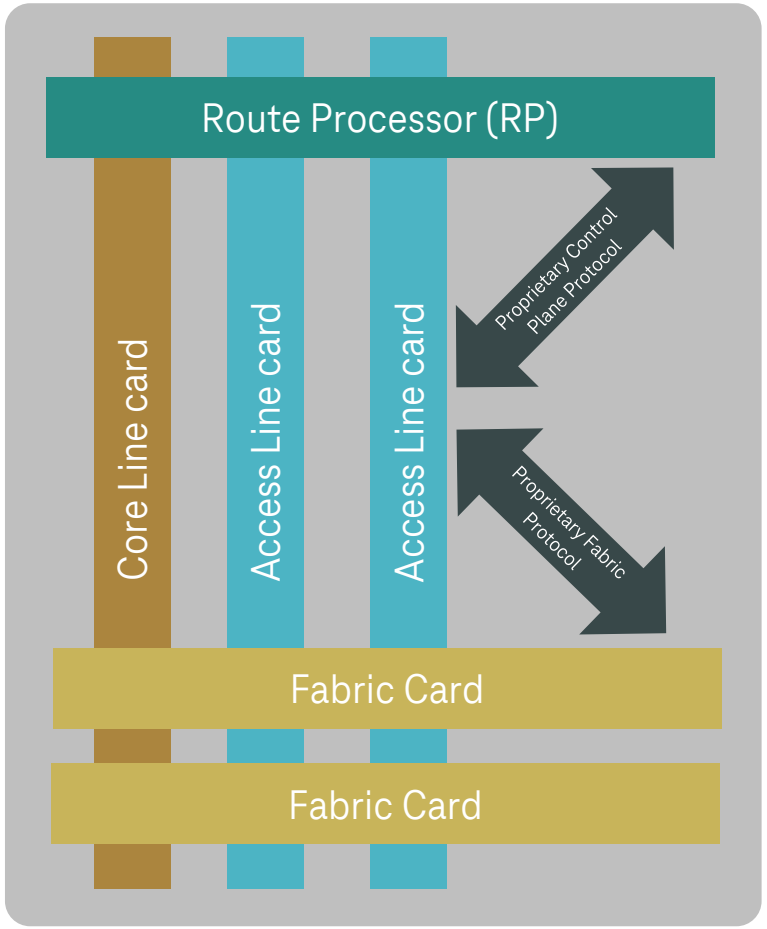
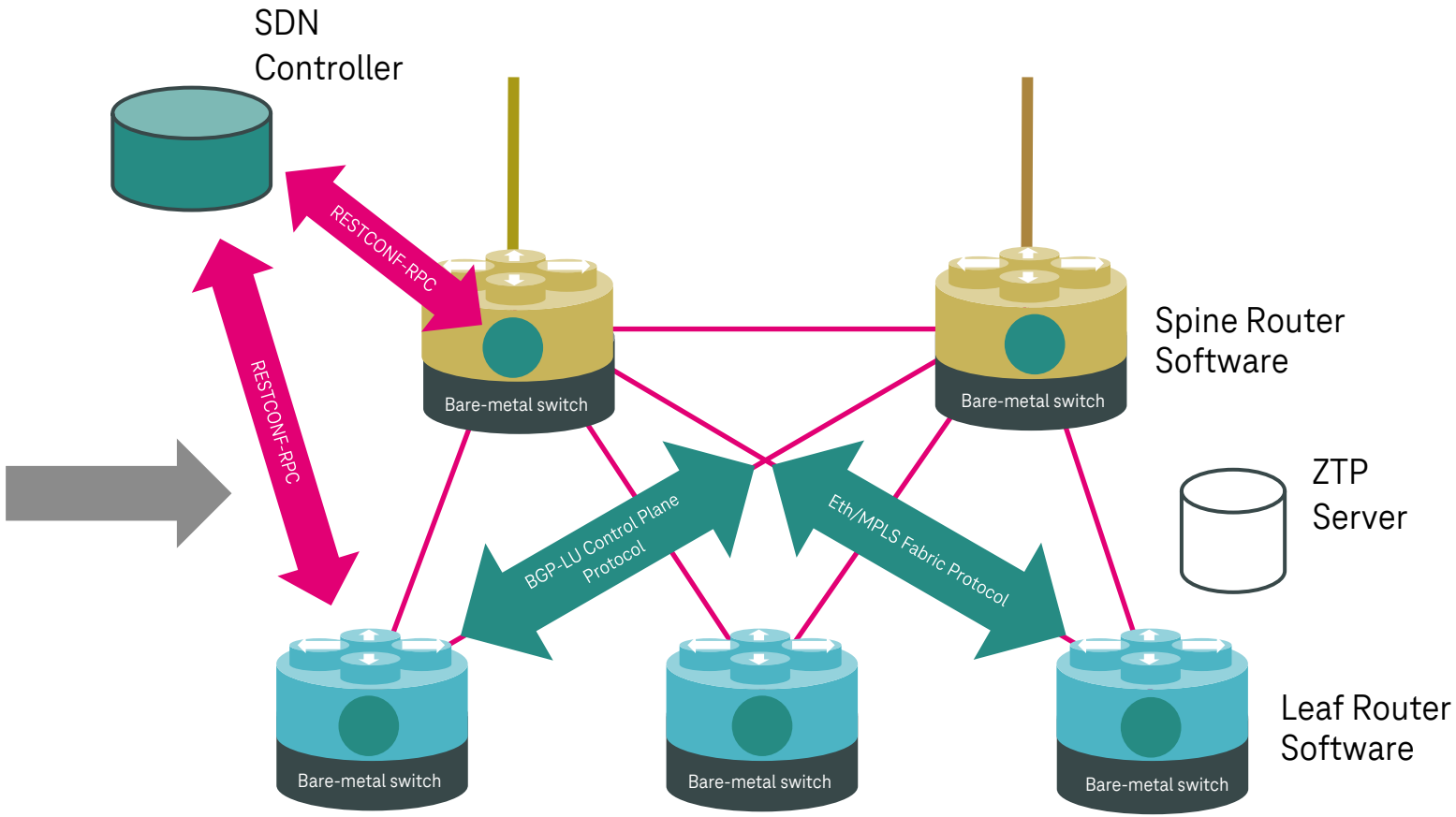
- **Disaggregated IP/MPLS networks**
- **Routing + BNG software**
- **Off-the-shelf ‘bare-metal’ switches’**
- **Economically advantageous**

The Same but Different

Monolithic Chassis Routing System



Disaggregated Routing System



Spine and Leaf Switch Evolution

New Spine / Leaf Switch with higher port density

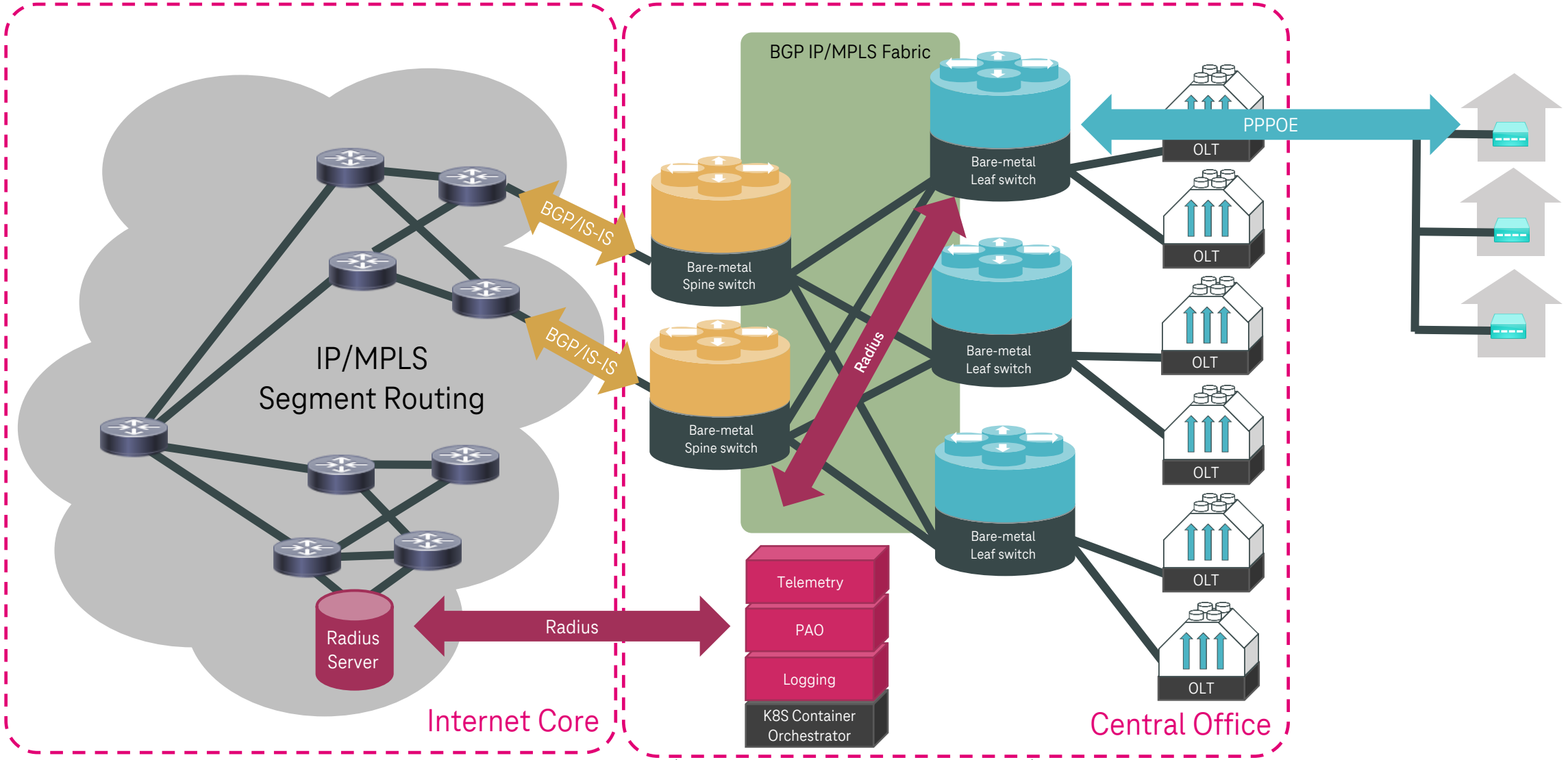
Shipping

- Jericho
  Qumran-MX
  BCM 88375
- KBP
  BCM 52311

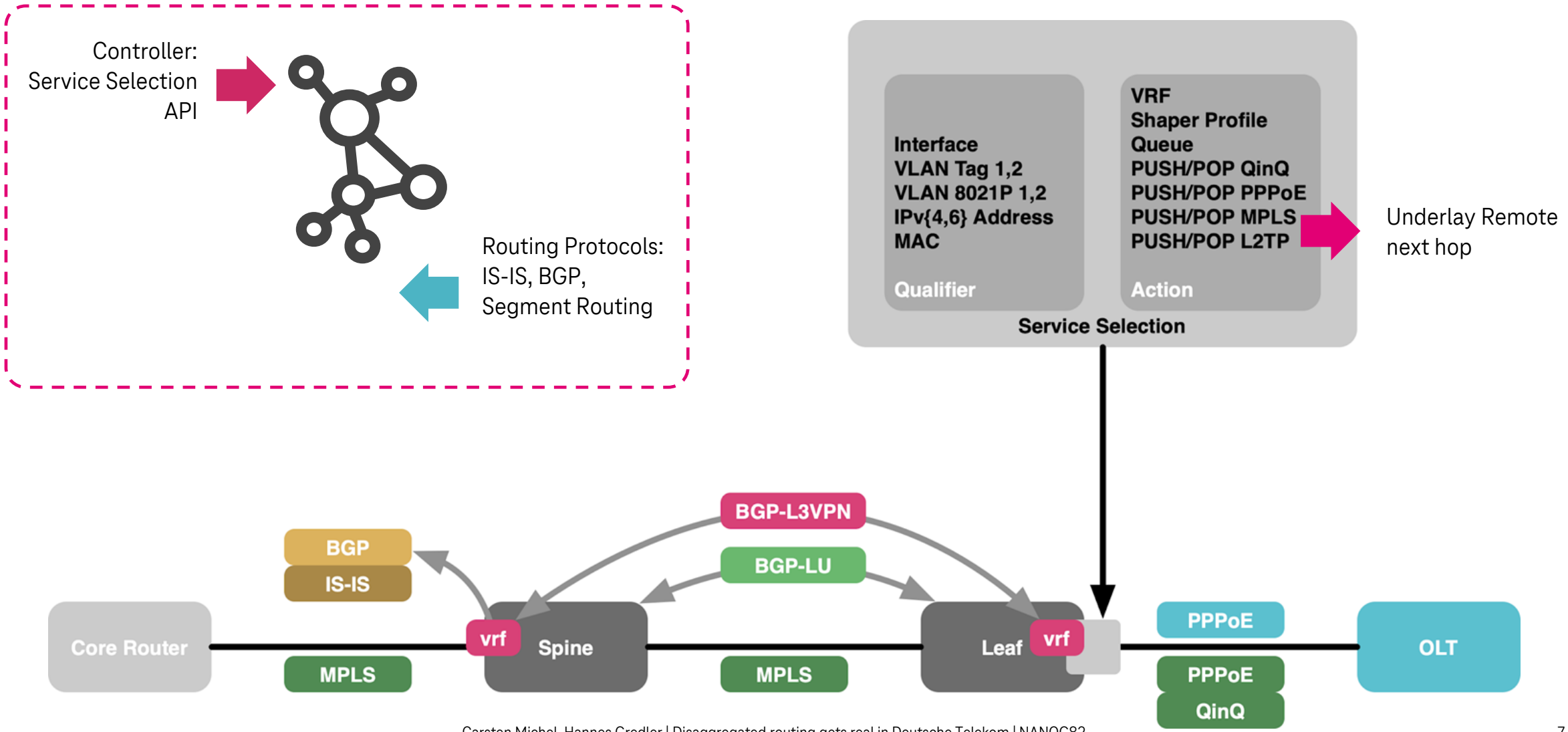
In Development

- Jericho2
  Qumran-2c
  BCM 88820
- KBP
  BCM 16000

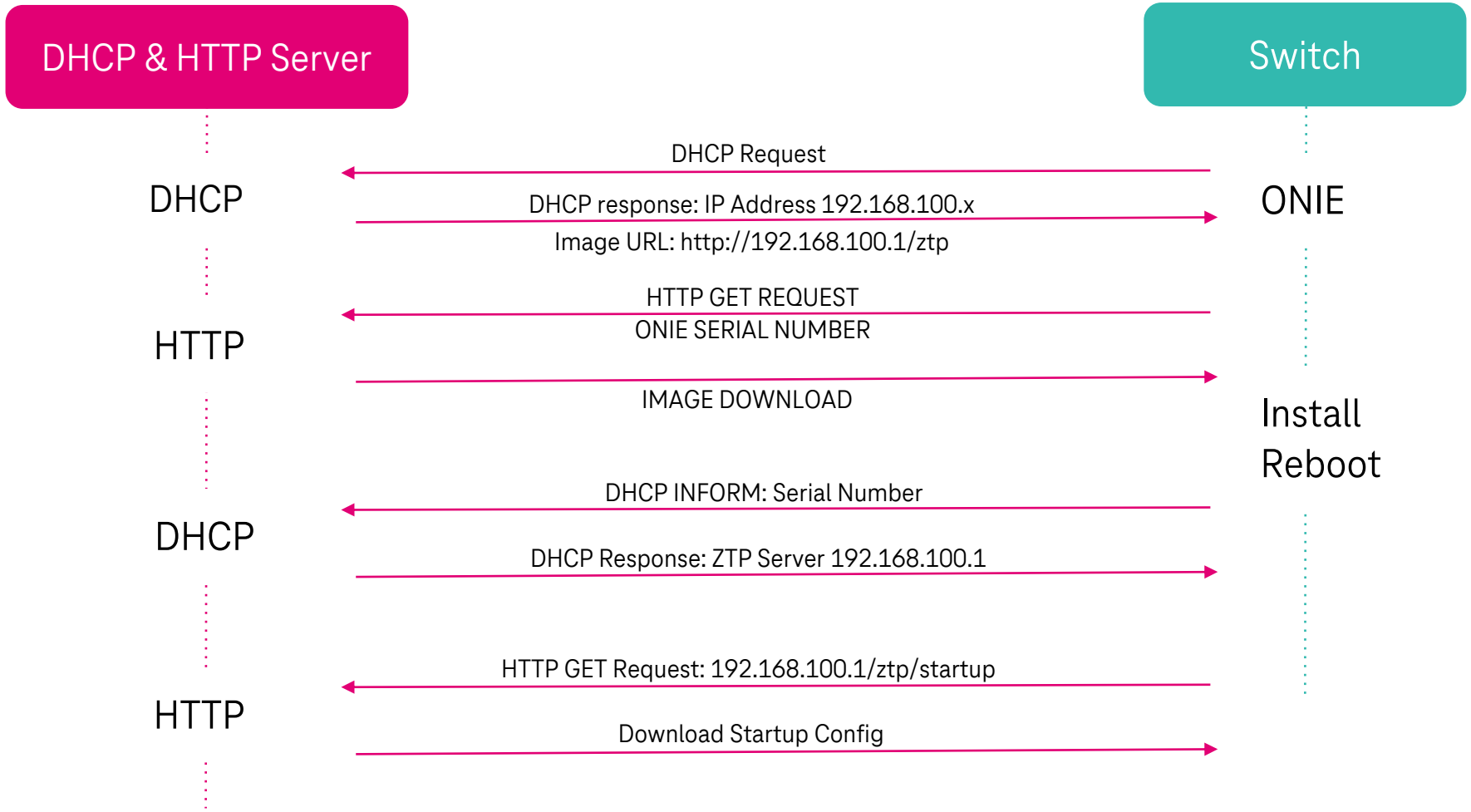
Disaggregation under the Hood



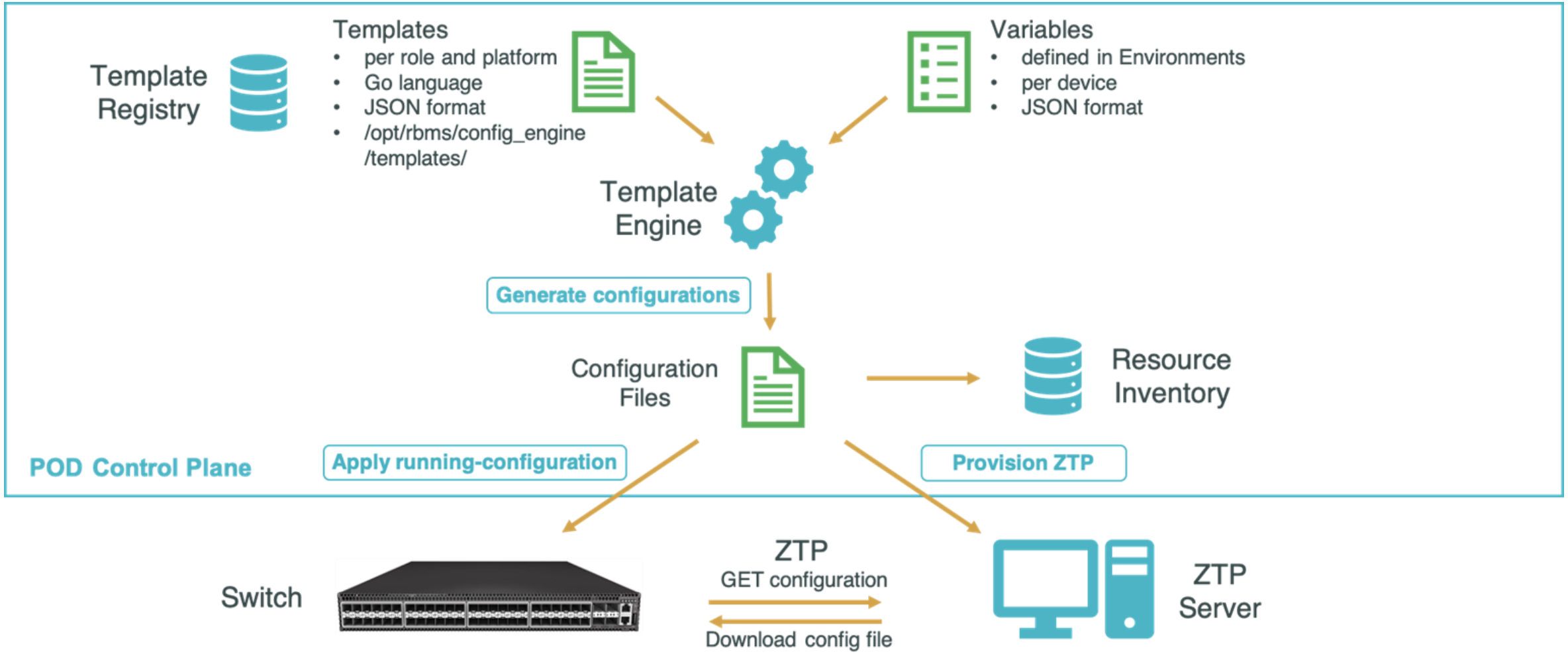
SDN Architecture Vision: Service Selection



ZTP Using ONIE Serial Number - Process Overview

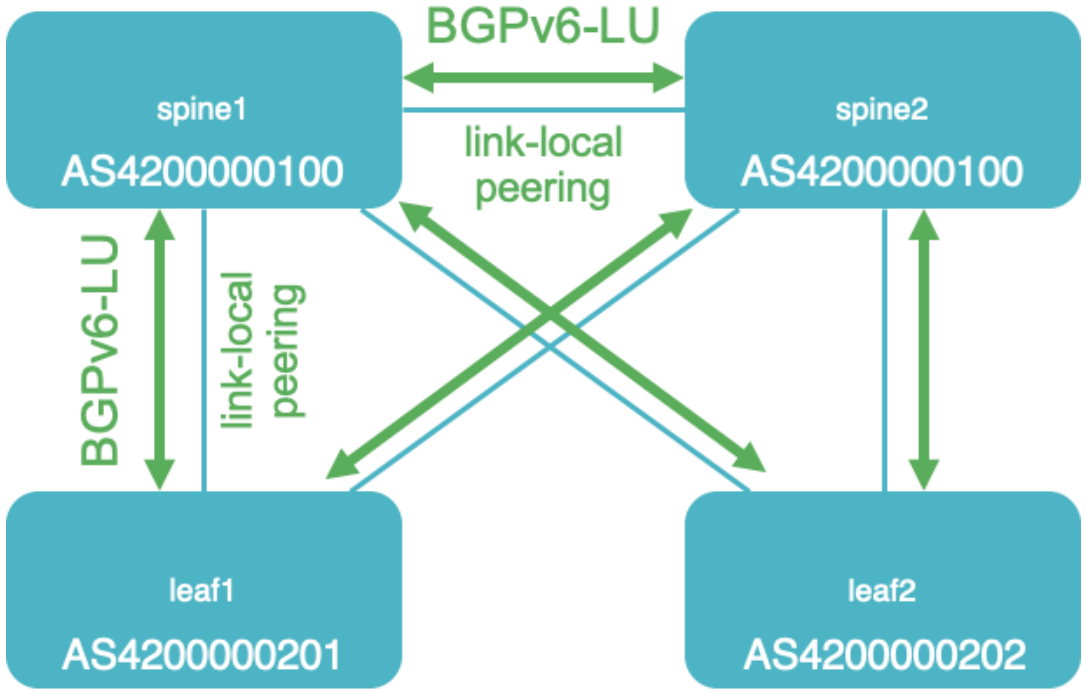


Generating Configuration Files



Central Office Fabric Underlay

2-Stage Spine/Leaf Fabric



Spines
- Simulates core LCs

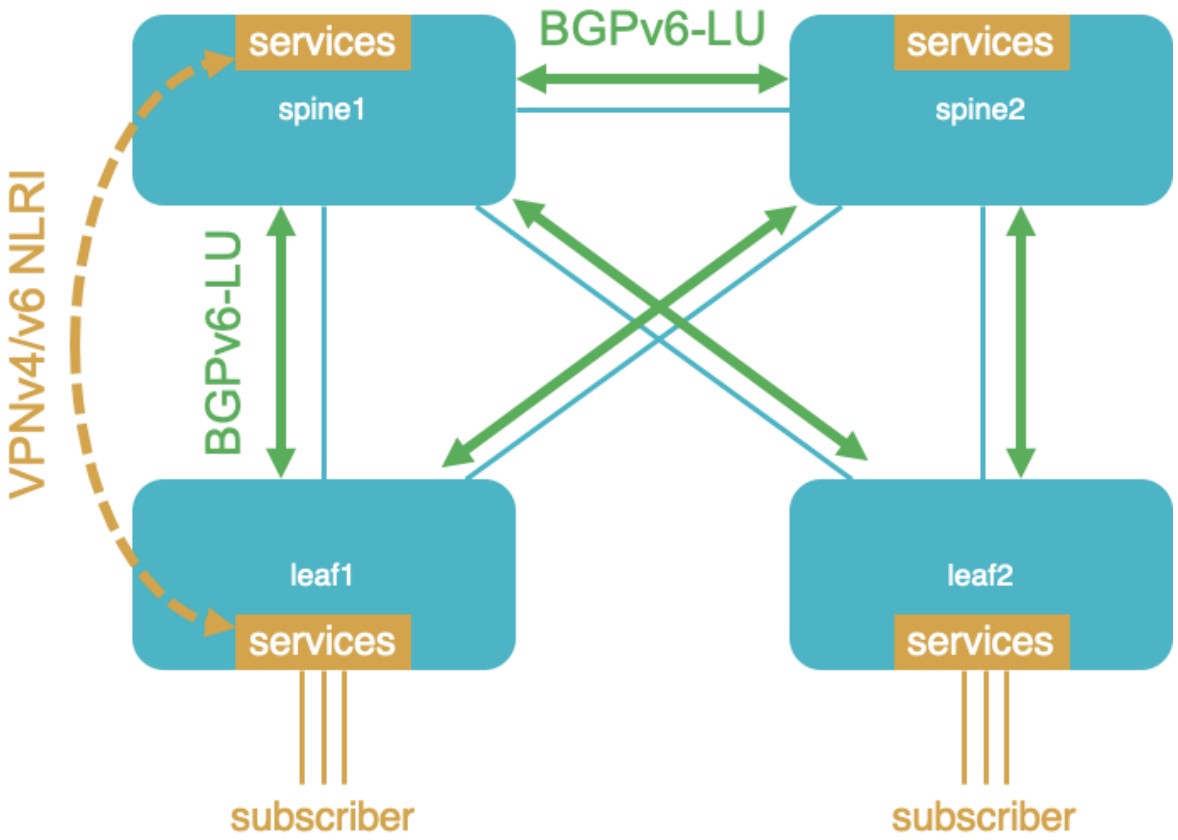
Leafs
- Simulate access LCs

Auto-Discover
- Like LCs in a chassis
- Using IPv6 Unnumbered

White Box
- Debugging possible

Everything as a Service (Overlay Service)

Spine/Leaf Fabric



Spines
- All Routing

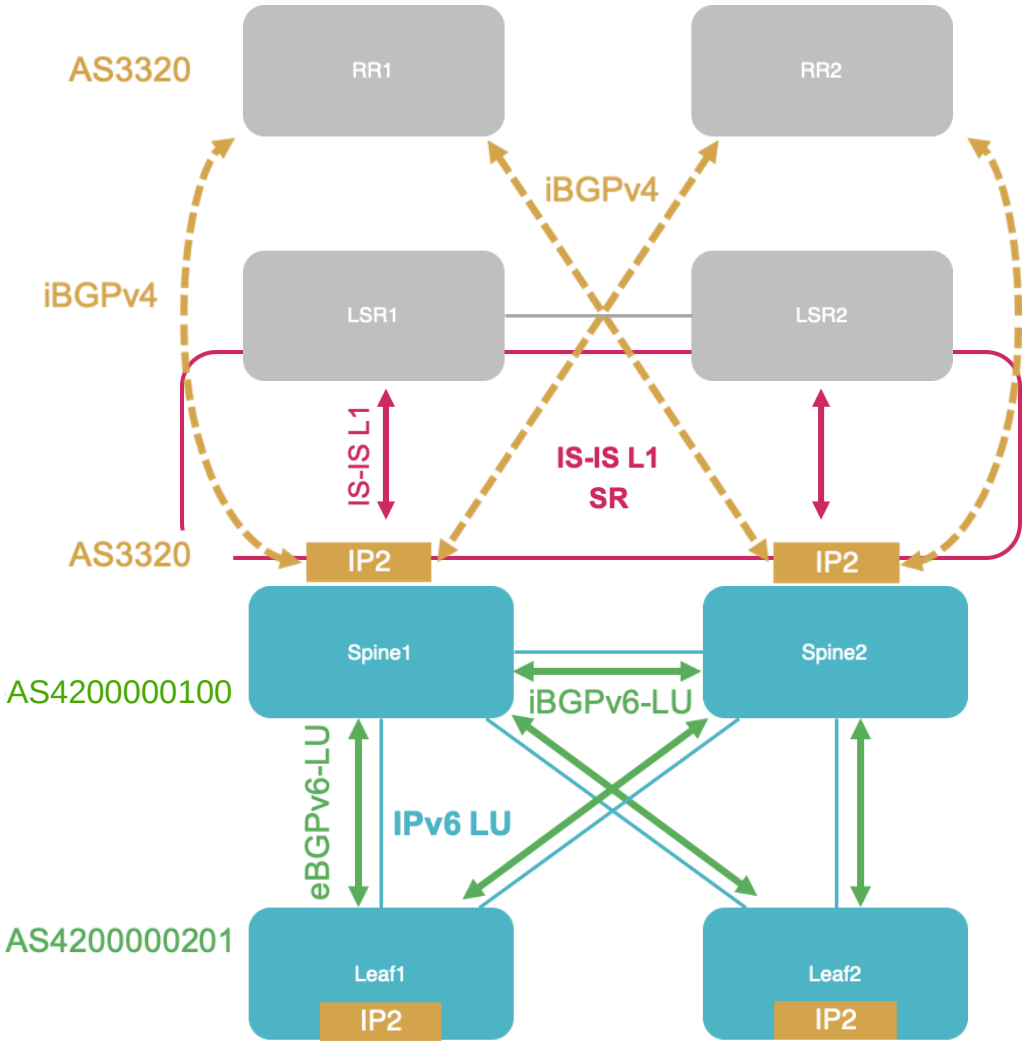
Leafs
- Specific routing
- Access Features

All Services possible
- L2, L3, UC, MC

Future IPv6 Migration
- Already done

Requirement Separation
- Per device

Anycast Backbone Attachment Dissected



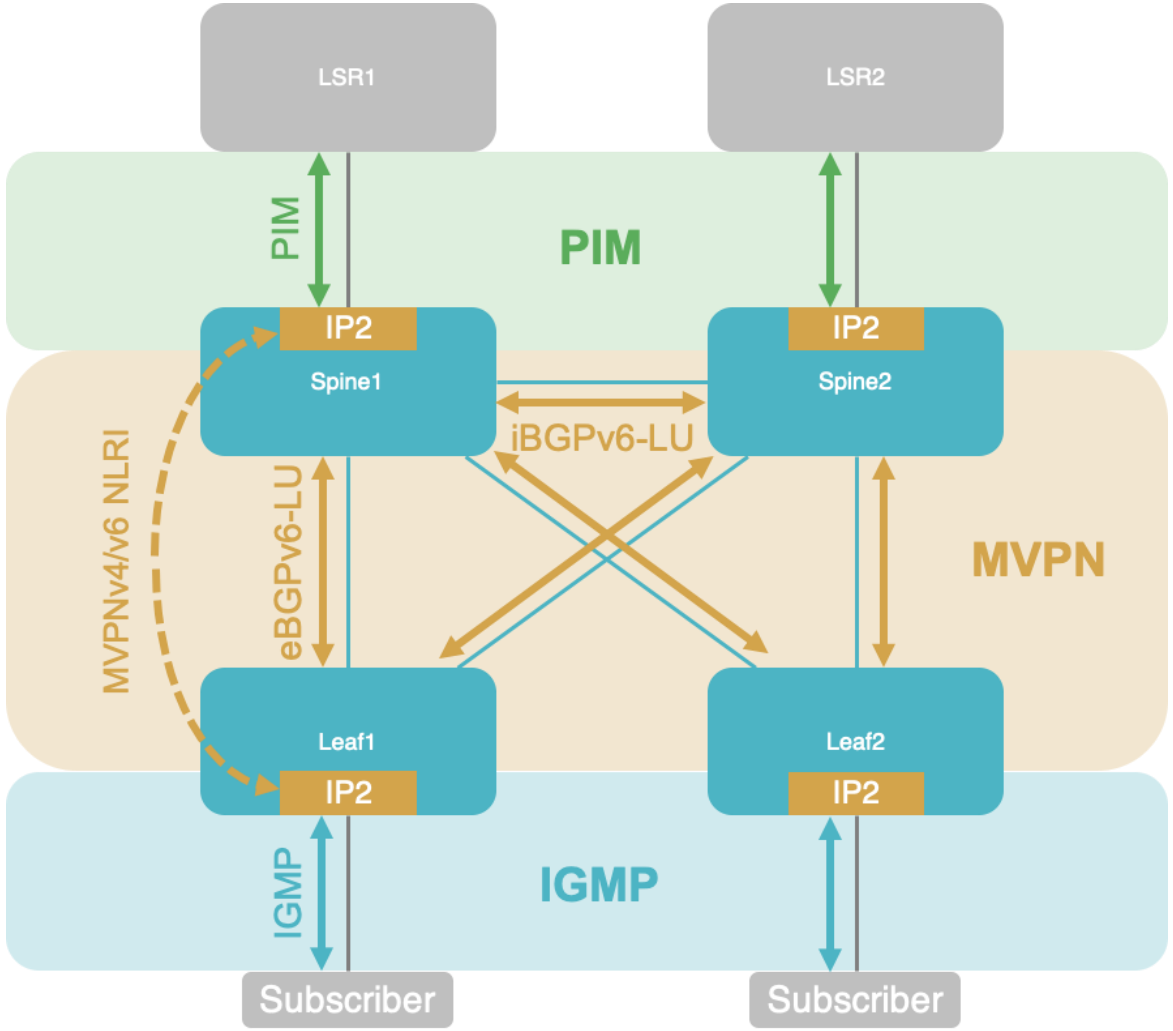
Backbone Transport:
- ISIS-LU
- 10 year SW/HW history

Backbone Services:
- BGP over IPv4
- IPv6 not native

Fabric Transport:
- BGP over IPv6 native

Fabric Services:
- BGP over IPv6

Multicast as a Service



IGMP
How the WiFi Router talks to us

MVPN
“As a Service”

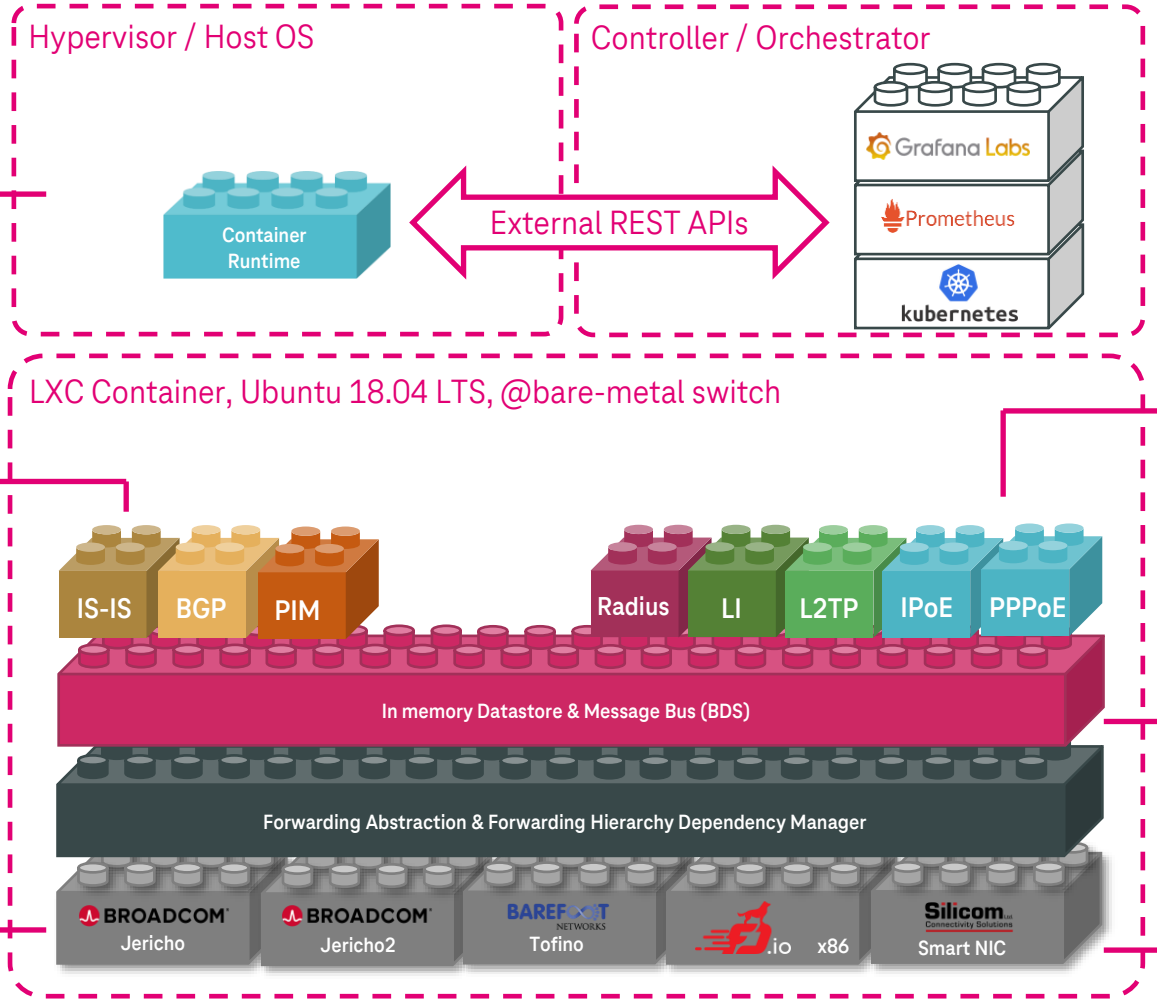
PIM
Used between spines switches and upstream core routers

Meet RtBrick Full Stack (RBFS)

Container runtime targeted at Telcos
- Graceful shutdown & insertion
- Fast Boot
- Health Checks

Carrier-grade Routing Protocols
Fully on-the-wire & bug compatible
(=Interoperable) to Cisco & Juniper

Forwarding Dependency graph Management
Platform Independent Handling
- Interfaces, Routes, Nexthops
- Slicing / VFT / VRF
- Tunneling (MPLS, PW, PPPoE, L2TP)
- Service Selection Rules (TCAM)
- Counters

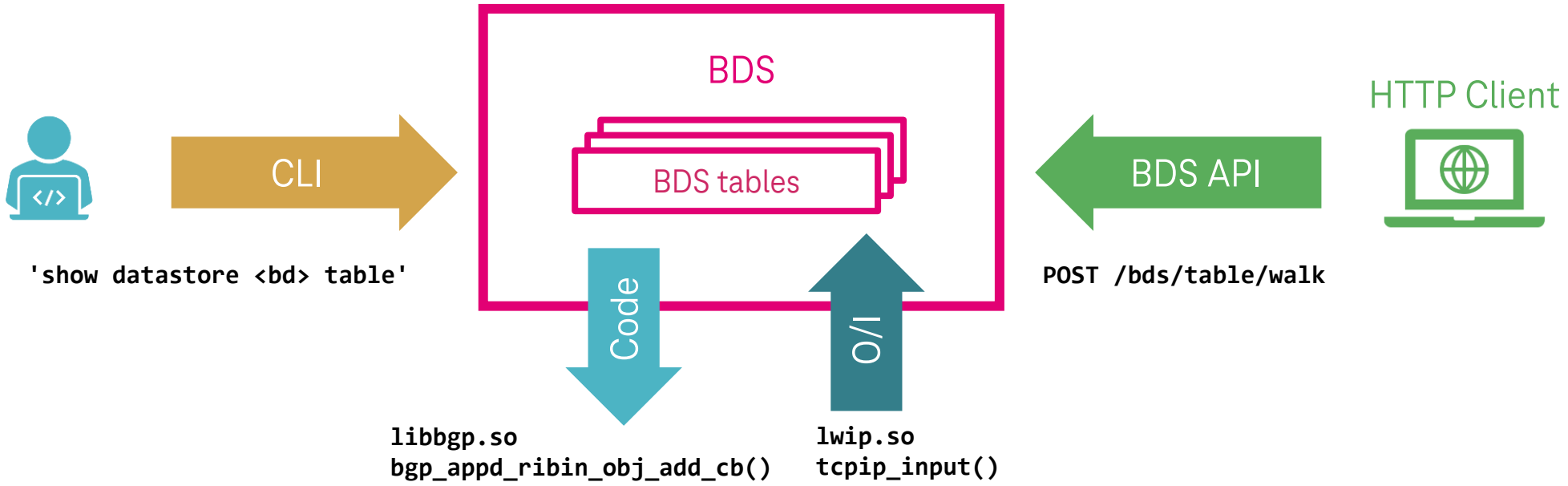


Customer / per-Service protocols

High Speed distributed Key/value Datastore
- 2M TPS per CPU Core
- 2GB/s I/O per CPU Core

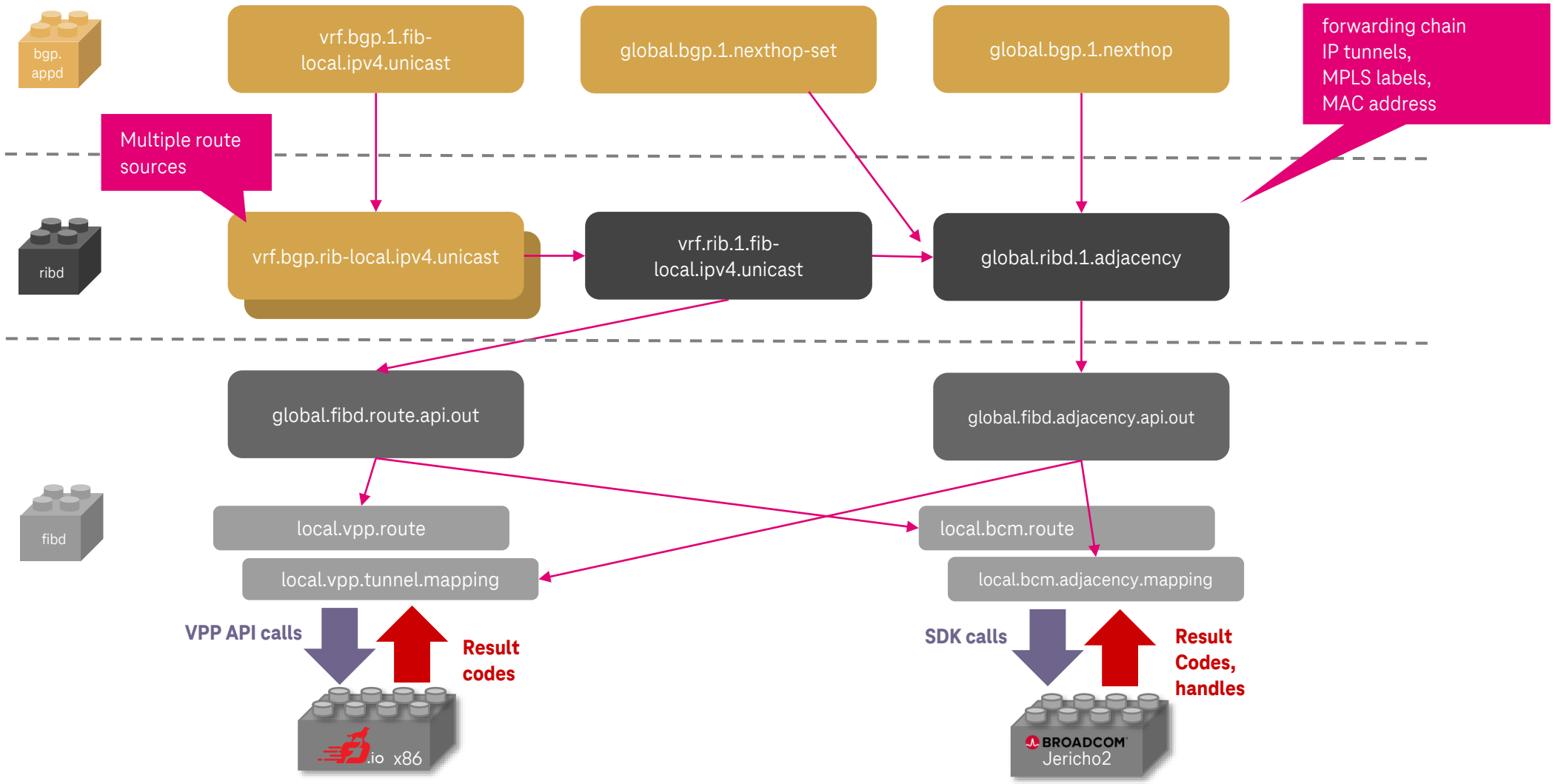
Driver / Forwarding Table API
- Chip bringup
- In-Band IO
- Register/DMA Access

BDS Datastore - Single Source of Truth

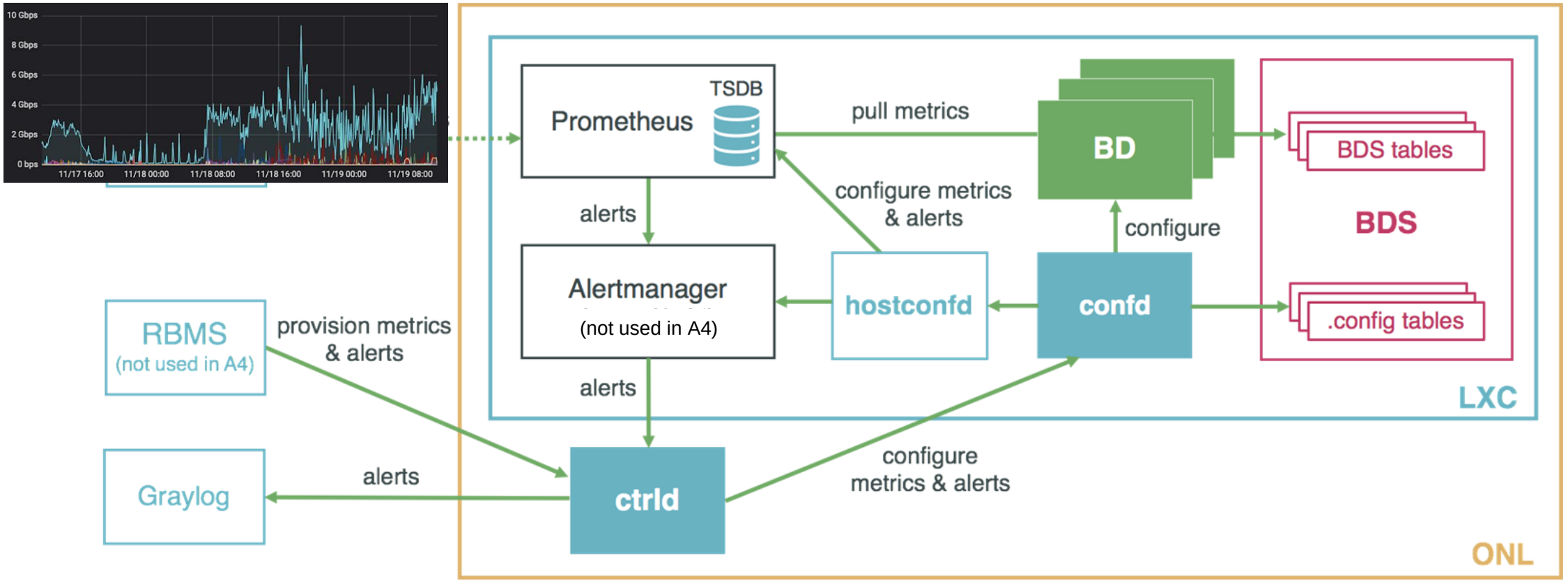


- **All states fully accessible to end users**
  - CLI – 'show datastore' commands to display table and objects
  - BDS API – Read, inject, or delete table and objects
- **Unprecedented visibility into the system state**
- **Code gets executed as “per-Table stored procedure”**

Example: Route Flow



Metrics Sampling and Monitoring



- Provides operational-state visibility
- Based on Prometheus - open-source monitoring and alerting toolkit

Wrap Up

Disaggregated Router and BNG in Production.

Thank You for Your Time!