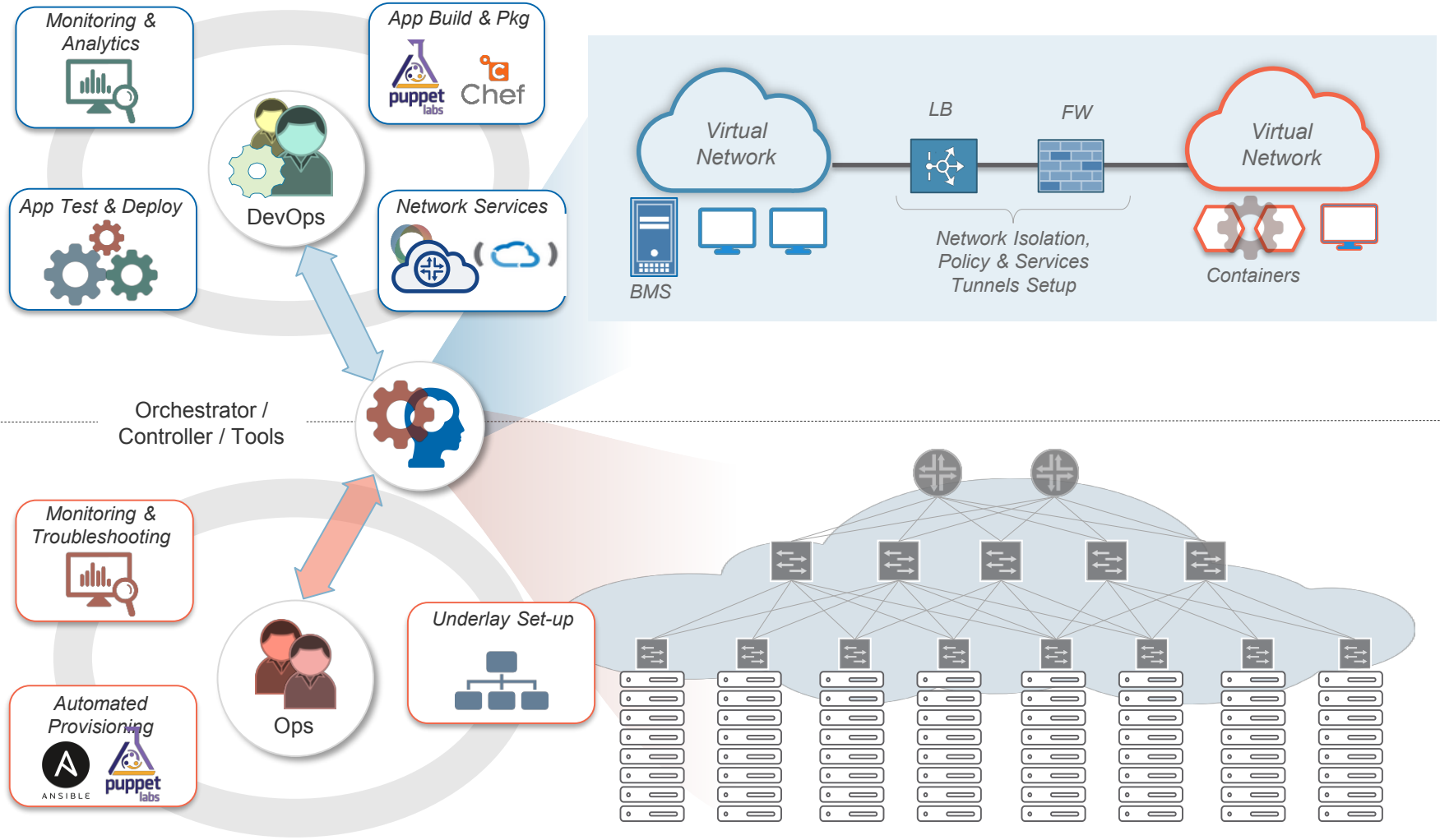
# AGENDA

1. Inter-Domain Traffic Engineer
2. EPE and SPRING End-to-End solution
3. Use Case and Benefits
4. Summary

# CLOUD – TELCO OR PRIVATE/PUBLIC
## INFRASTRUCTURE AS CODE FOR DEVOPS AND AUTOMATION FOR INFRA OPS



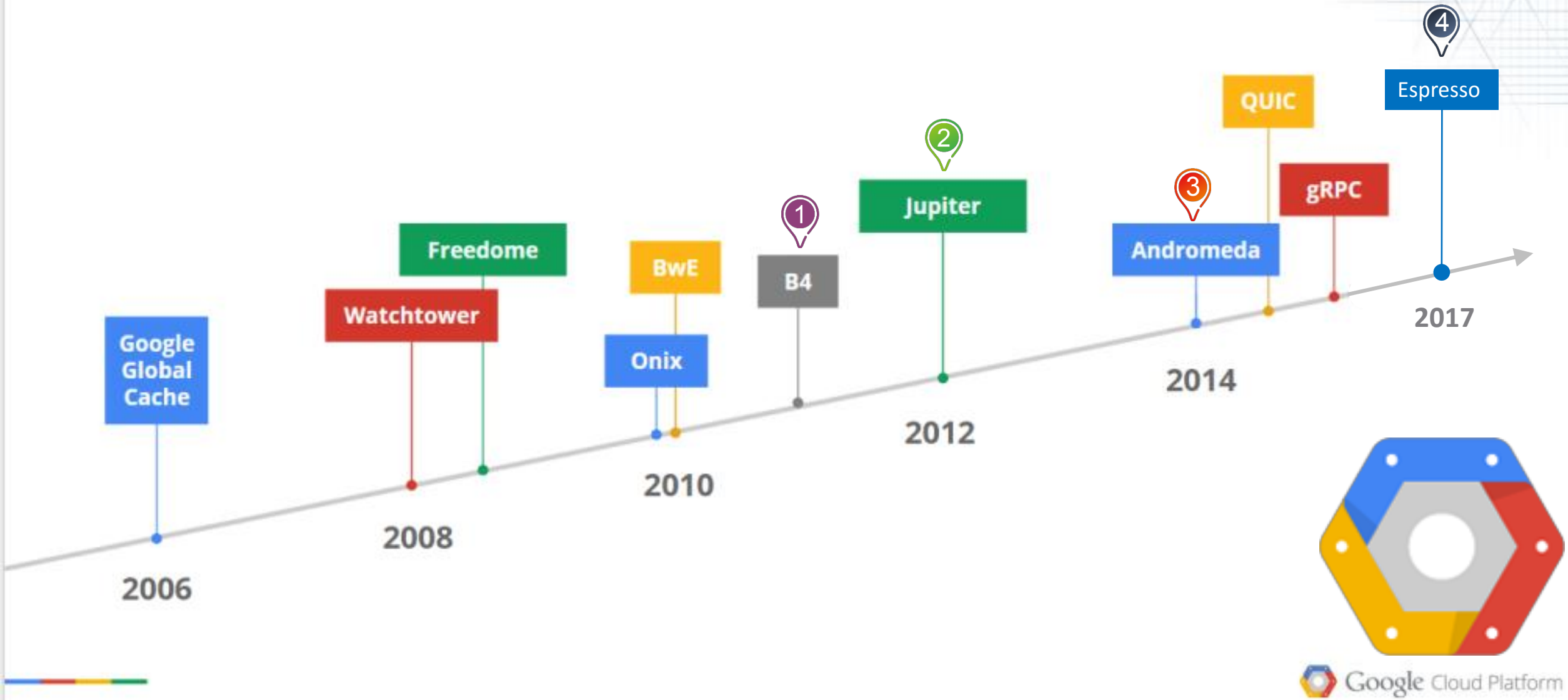

**Developer Operations (DevOps)**

- **Deploy Network & Network Services when you deploy Apps**
- Tightly Integrated Orchestration of Compute, Storage, and the Network
- All Networking Services – VLANs, Routing, Policy, Load Balancing, IPAM/DHCP, DNS – is provided in software and virtualized
- No App specific knowledge in the underlying hardware

**Infrastructure Operations**

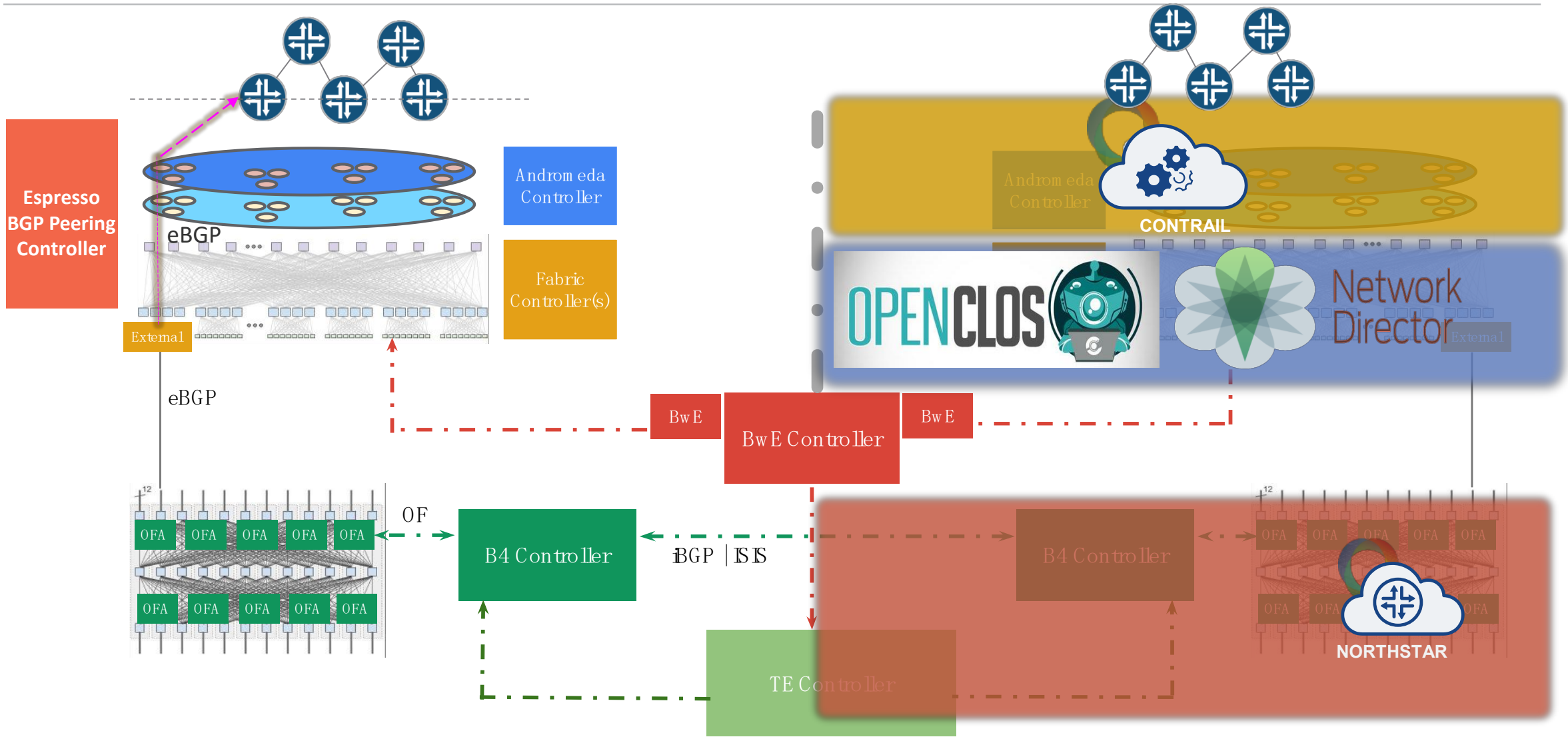
- **Cookie cutter approach to deploying Physical Hardware**
- Automated Provisioning of Hardware - Gateway Routers, Spine Switches, TORs, Servers, JBODs, DAS ..
- Secure the Infrastructure, not the Apps
- Integrated Monitoring and Alerting of all hardware components

# Google Innovations in Networking

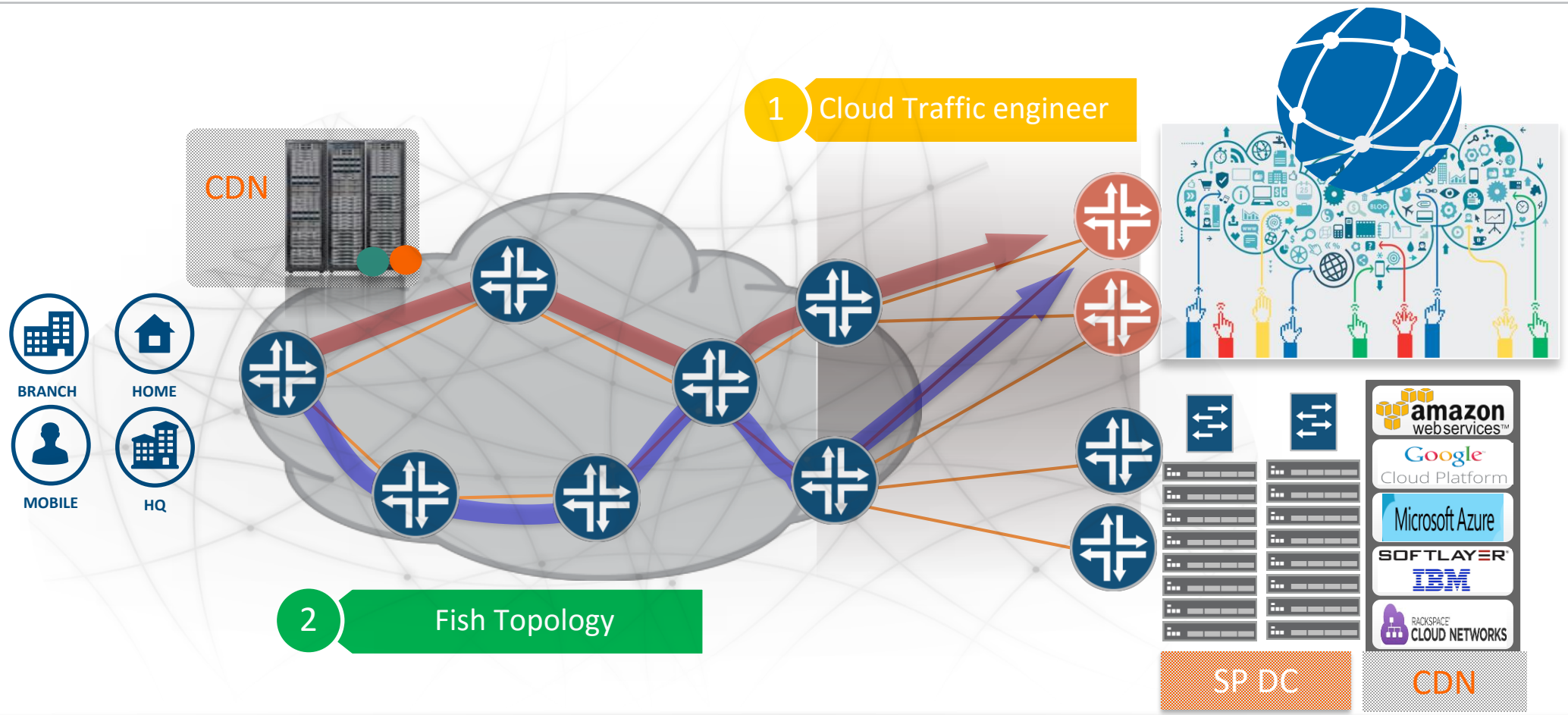



Google Cloud Platform

# 4 CONTROL SYSTEM(DC/HOST/WAN/PEERING) IN GOOGLE'S NETWORK

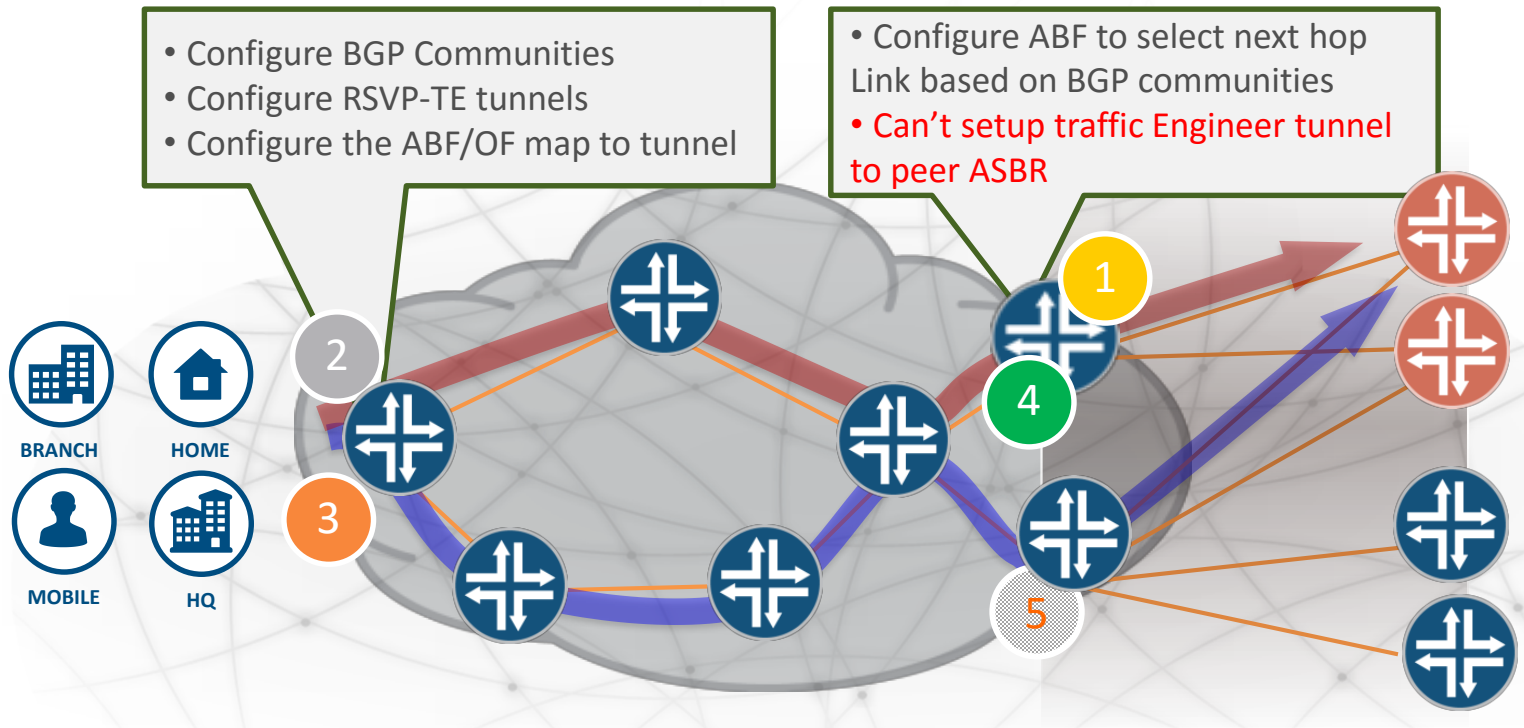


# INTER-DOMAIN CLOUD TRAFFIC ENGINEER




Easy to optimize End-To-End Traffic for SP Owned Network.
How to optimize VIP Customer for Internet/Cloud connection?

# CURRENTLY SOLUTION AND LIMITATIONS

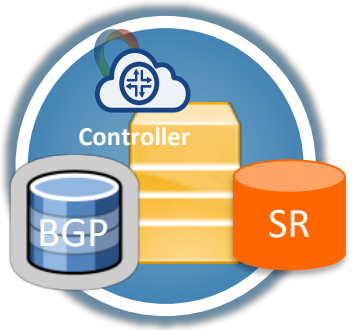



1. No Dynamic ASBR Selection
2. No BGP Link usage info
3. Static Tunnel Configured
4. Full Internet Table on ASBR
5. Lots of Policy on ASBR

Current Solution can't meet Cloud Traffic Engineer Requirement

# CLOUD TRAFFIC ENGINEER SOLUTION COMPONENTS

| | | |
|---|---|---|
| 1 | No Dynamic ASBR Selection | SDN Controller |
| 2 | No BGP Peer info | BGP Label Unicast for peer |
| 3 | Static Tunnel Configured | Dynamic Segment Routing |
| 4 | Full Internet Table on ASBR | Simplified ASBR by LSR router |
| 5 | Lots of Policy on ASBR | Policy from Ingress, LSR on ASBR |




**Egress Peering Engineer**

- draft-gredler-idr-bgplu-epe-04
- draft-ietf-idr-bgpls-segment-routing-epe-02
- draft-ietf-spring-segment-routing-central-epe-00

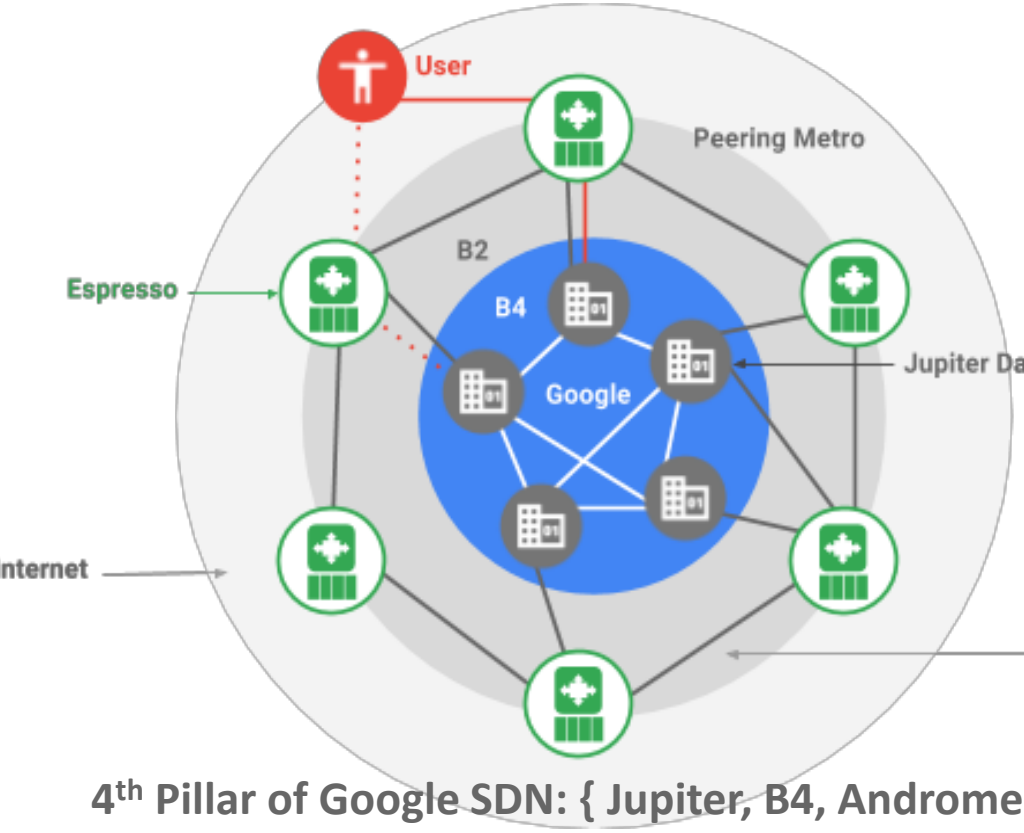
**Segment Routing**

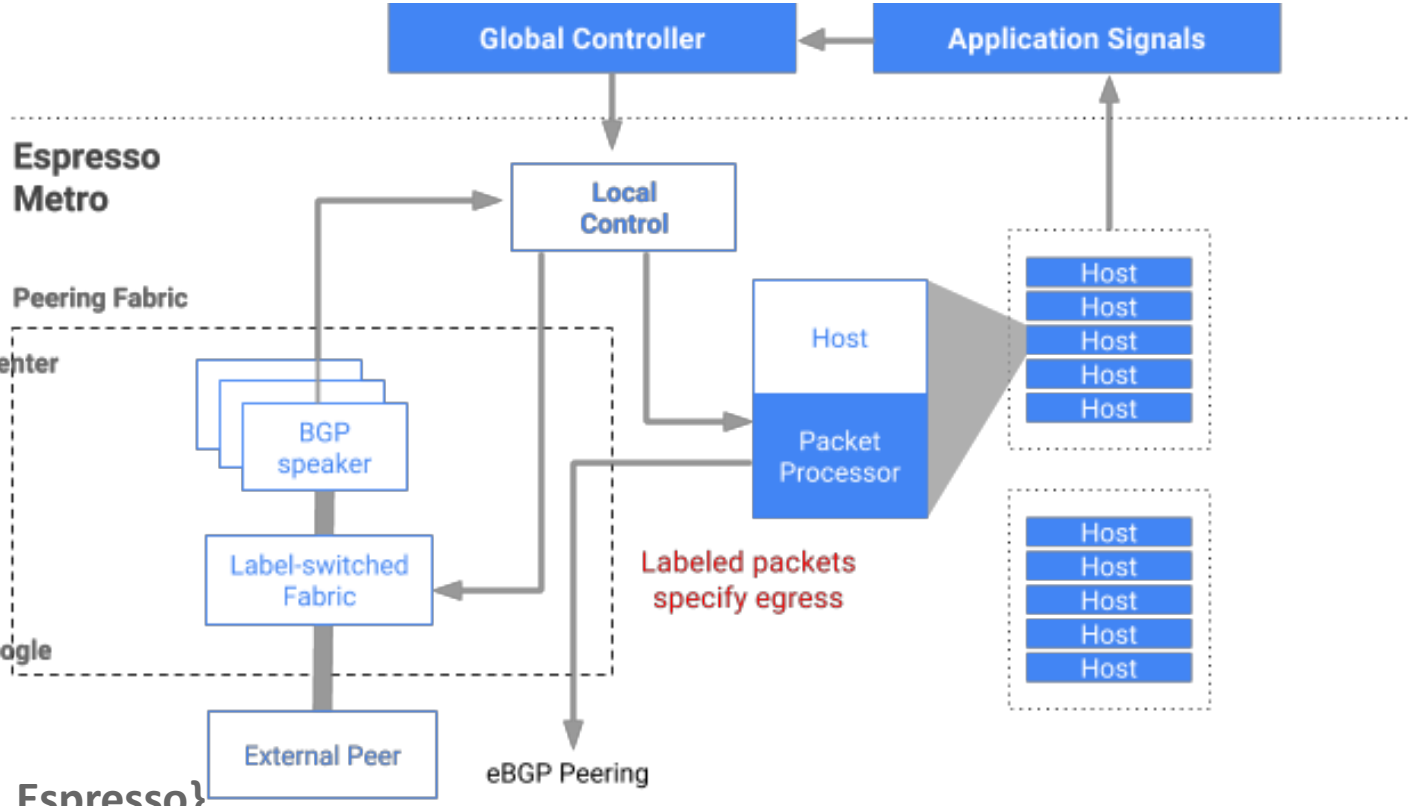
- draft-ietf-spring-segment-routing-0x

With Controller, Segment Routing and LSR Switch can build
Cheaper and Optimized Cloud traffic Engineer

# GOOGLE ESPRESSO CONTROLLER

## LEVERAGE JUNIPER BGP EPE




**4th Pillar of Google SDN: { Jupiter, B4, Andromeda, Espresso}.**

- First, it allows us to dynamically choose from where to serve individual users based on measurements of how end-to-end network connections are performing in real time.
- Second, we separate the logic and control of traffic management from the confines of individual router "boxes." Rather than relying on thousands of individual routers to manage and learn from packet streams, we push the functionality to a distributed system that extracts the aggregate information

# BGP EPE DESIGN PHILOSOPHY

## How to Select Which Peer to send

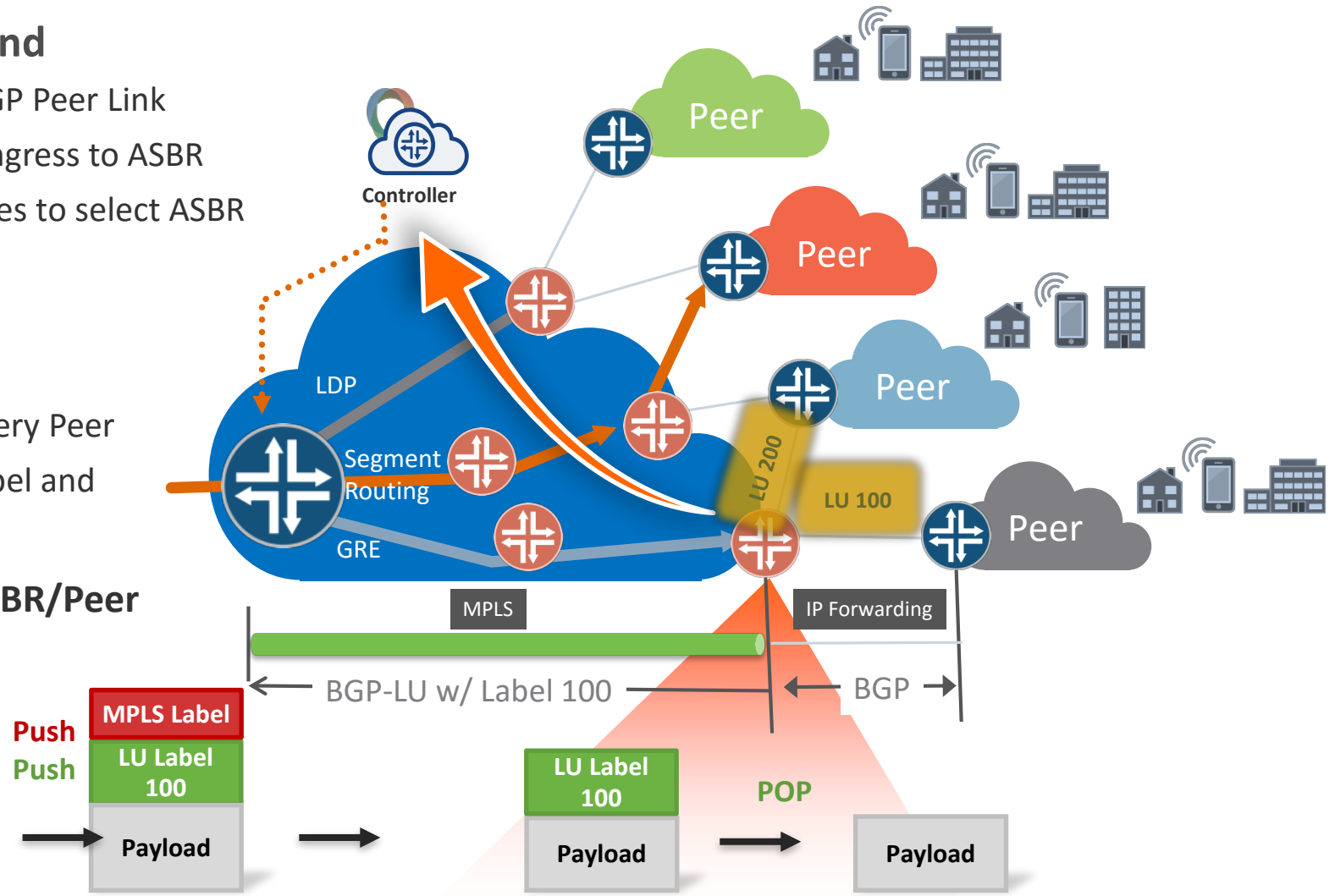
- Controller/RR may morning the BGP Peer Link
- Controller/RR find a tunnel from Ingress to ASBR
- Controller/RR based on certain rules to select ASBR

## How ASBR identify a Peer

- Per Peer /32 address per label
- Install the MPLS Label POP for every Peer
- When ASBR received different label and send traffic to specific Peer

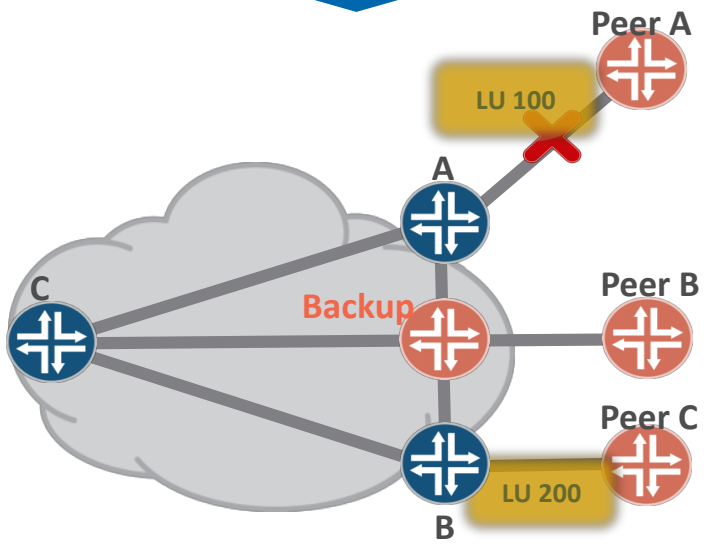
## How Ingress mapping traffic to ASBR/Peer

- Ingress push tunnel label to ASBR
- Ingress push BGP-LU label



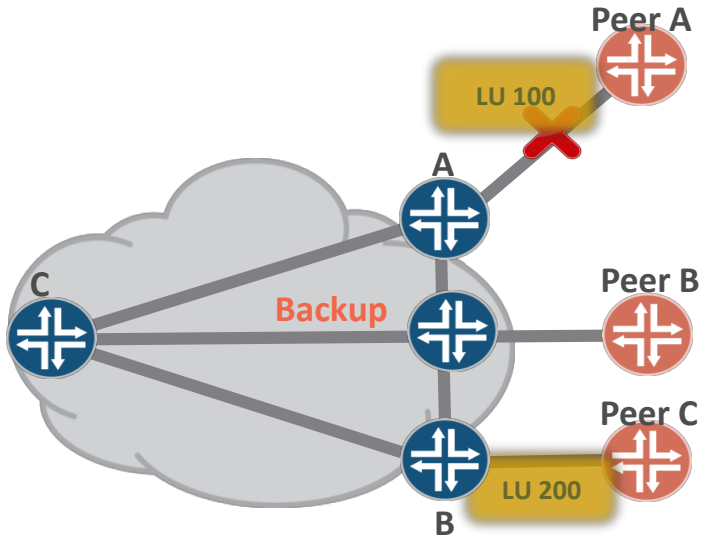
# LSR BGP PEER DEPLOYMENT AND CONSIDERATION

## One/Two LER



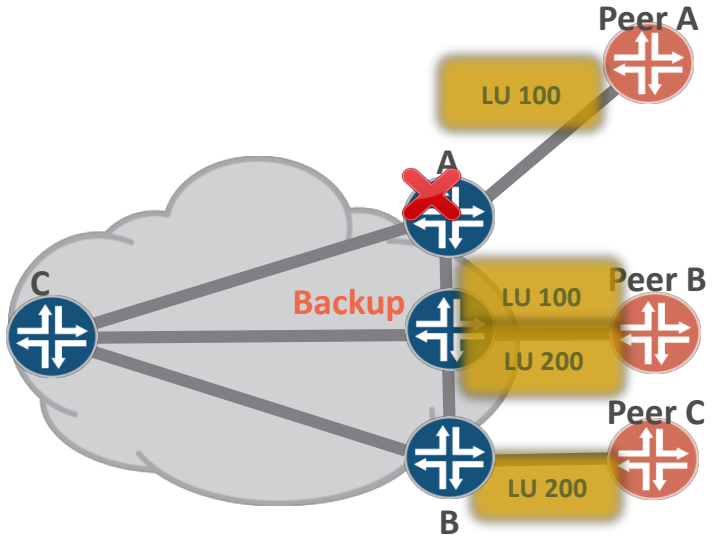

- Migrate most ASBR to LSR
- Keep 1 or 2 ASBR as legacy backup
- Redirect traffic to legacy and IP forwarding

## All LSR




- Migrate All ASBR to LSR
- Redirect traffic to backup also follow BGP-LU label forwarding

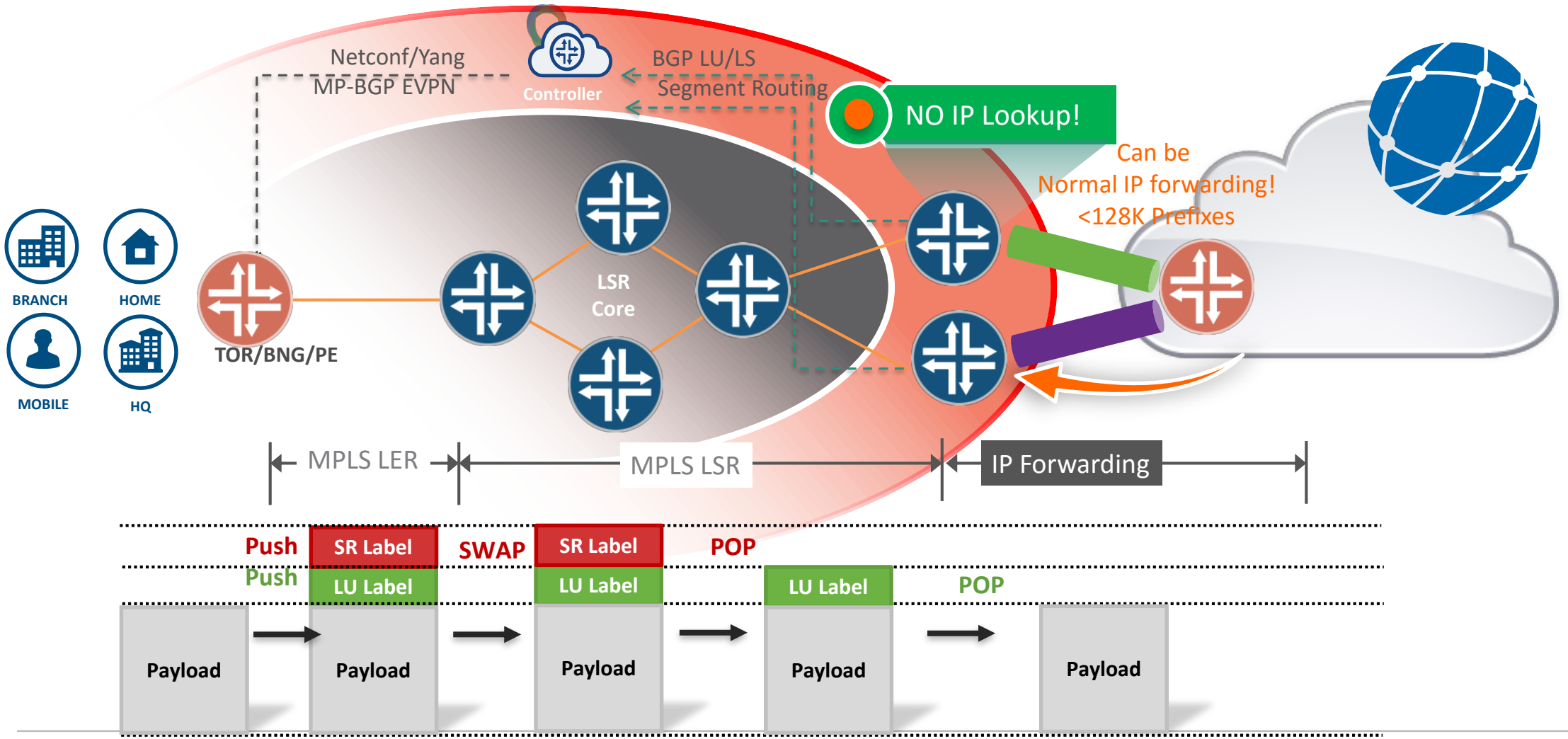
## ASBR Failure



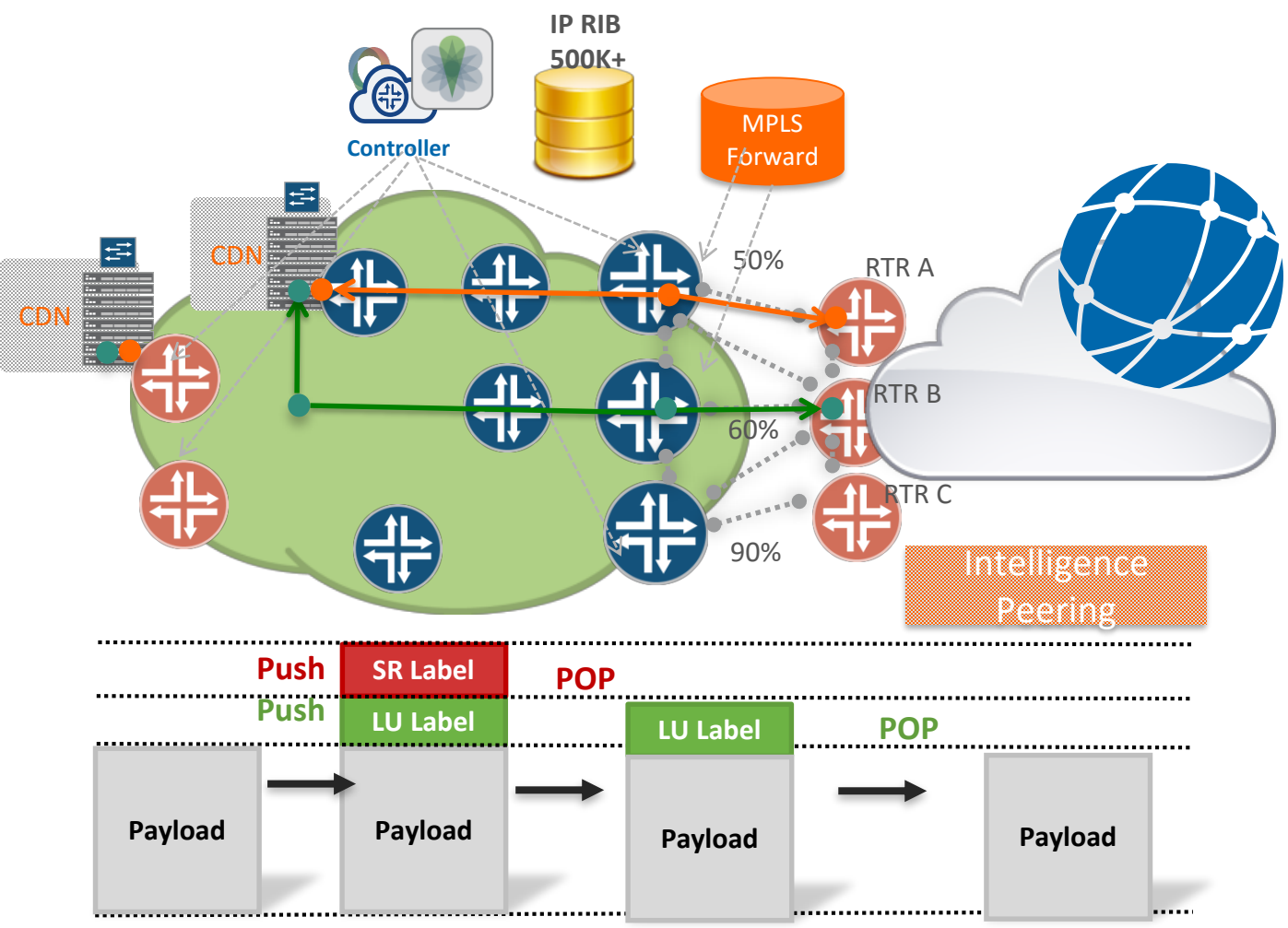

- Migrate All ASBR to LSR
- In case of ASBR failure
- Redirect traffic to backup which keep all other BGP-LU information follow BGP-LU label forwarding

# BGP-LU EPE & MPLS KEY BENEFITS

## EXTEND HOLLOW CORE/LSR TO PEERING, CHEAPER PEERING SOLUTION



# USE CASE, CDN PEERING




ASBR Setup BGP session and pass BGP-LU and BGP-LS information to Controller.

## Controller Calculate the Path

- Controller select which Peer A/B/C send traffic to with LU label.
- Controller and ASBR take part in the Segment routing domain, and know to send traffic to ASBR adding a IGP/SR label or tunnels
- Controller will send MPLS label Stack to Ingress Router or Host

## Controller keep monitor path and Egress link

- When Congestion happens, will automatically redirect traffic to another ASBR/Peer by changing the label stack

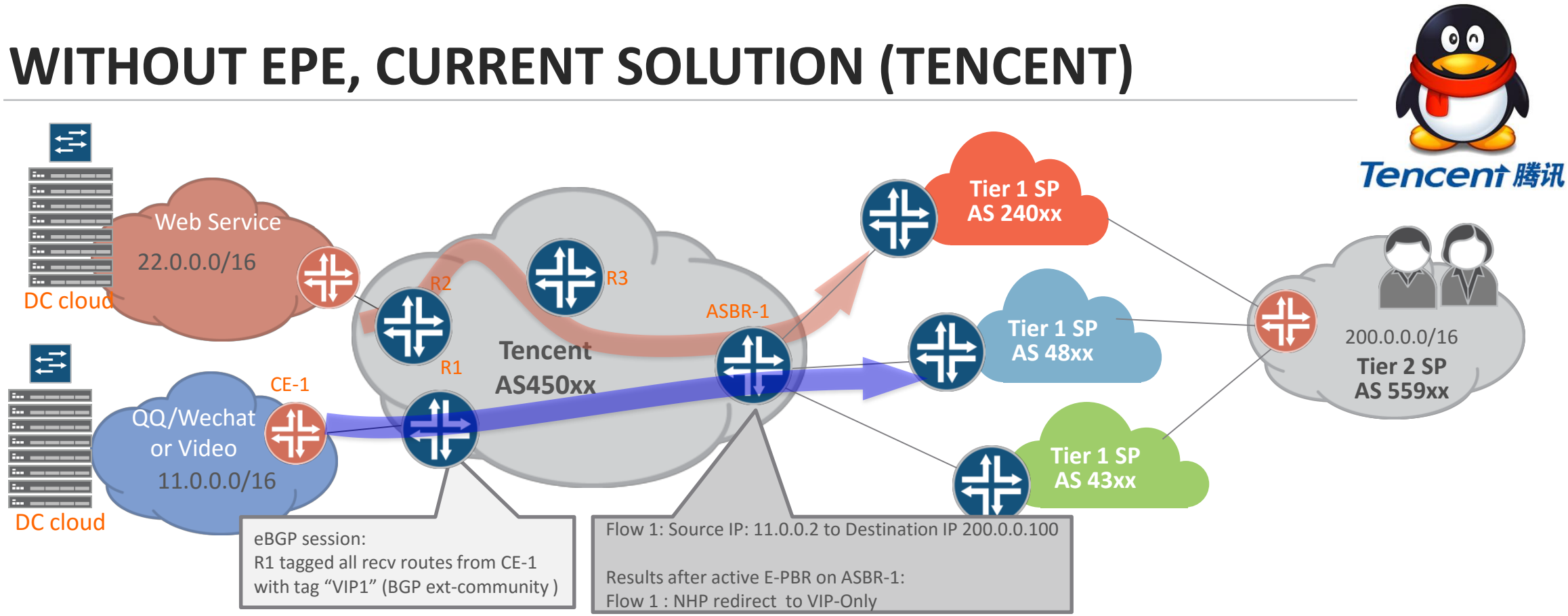
## Separate Control/Forwarding

- Controller Full Internet Table, RIB, Control Plane only.
- ASBR only Keep LSR label switching, Forwarding Plane, No IP lookup

## Policy start from Ingress

- Linux Host/Hypervisor/switch/router

# WITHOUT EPE, CURRENT SOLUTION (TENCENT)



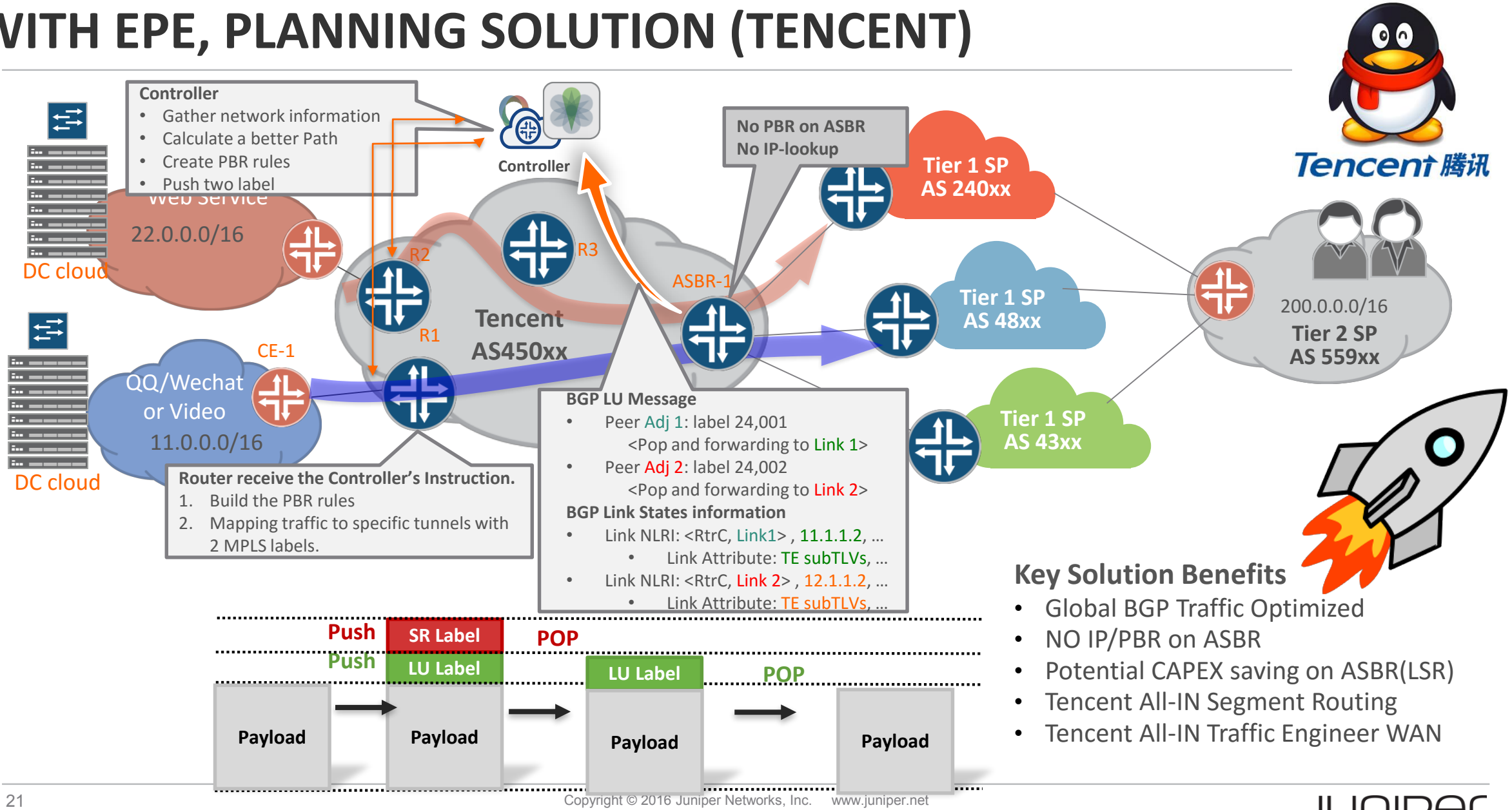

## Tencent Peering Situation

- Peering with many Tier 1 and 2 SP, around 20+ peer AS.
- Peering from 4-5 cities across China, Beijing/Shanghai/Shenzhen/Guangzhou etc.
- Peering with Hongkong for international directly

## Key Pain Points

- No Global BGP traffic Engineering optimization
- Static RSVP tunnel, A lot of Policies on ASBR.
- Peering Traffic Grow so fast, how to save CAPEX on ASBR?

# WITH EPE, PLANNING SOLUTION (TENCENT)

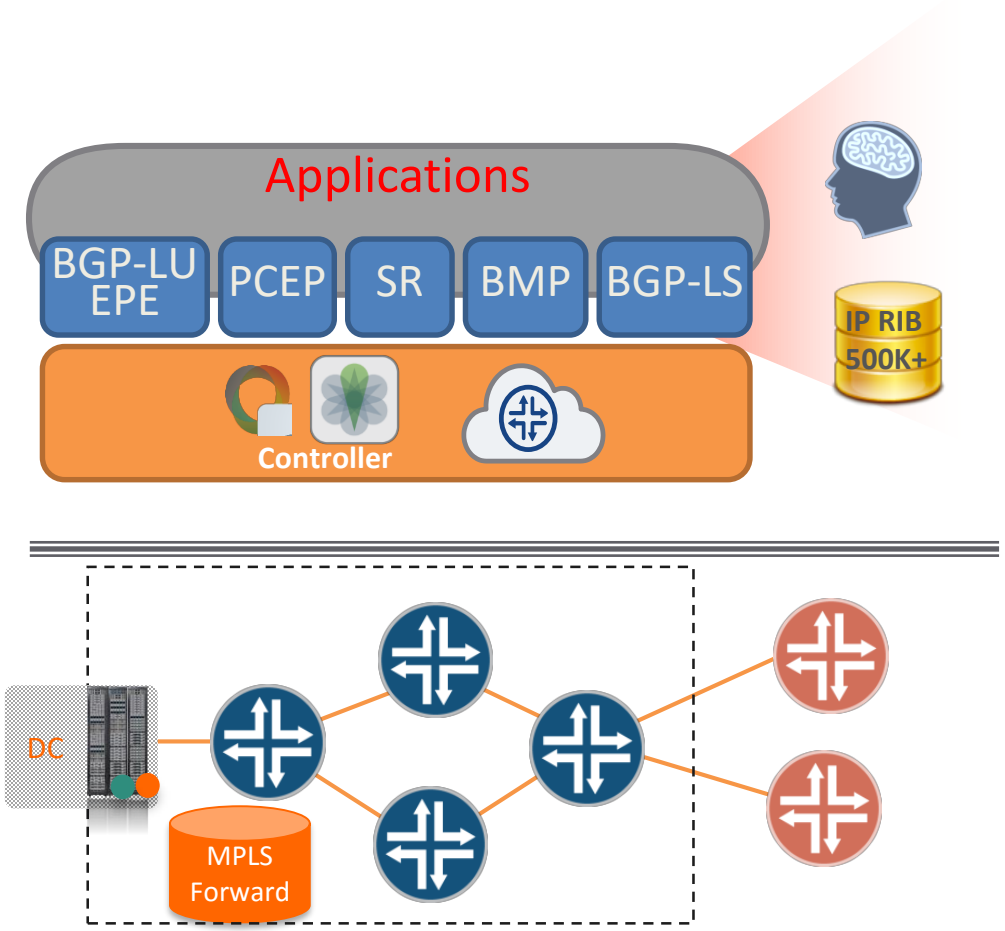



## Key Solution Benefits

- Global BGP Traffic Optimized
- NO IP/PBR on ASBR
- Potential CAPEX saving on ASBR(LSR)
- Tencent All-IN Segment Routing
- Tencent All-IN Traffic Engineer WAN

# APPLICATIONS DETAILS

## SAME TECHNOLOGY FOR DC & WAN




Application is the Network Brian:

- BGP-LU EPE information from ASBR for peer label and internet prefix table.
- BGP-LS/Netflow information for all link TE TLV, and BMP for Prefix
- PCEP, Calculate Segment routing tunnel and apply 2+ labels in network
- Traffic Steering/mapping to tunnels, and monitor tunnels
- Easier to calculate Latency based routing for network wide optimized.

Controller for Segment routing Traffic Tunnel setup/monitor

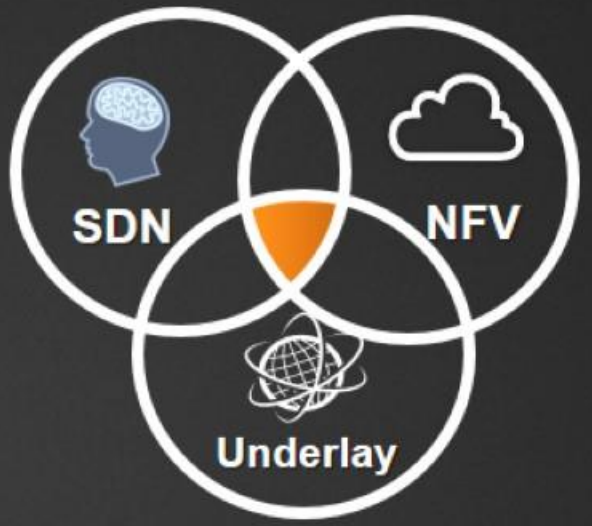
Separate Control/Forwarding

- Controller Full Internet Table, RIB, Control Plane only.
- ASBR only Keep LSR label switching, Forwarding Plane, No IP lookup

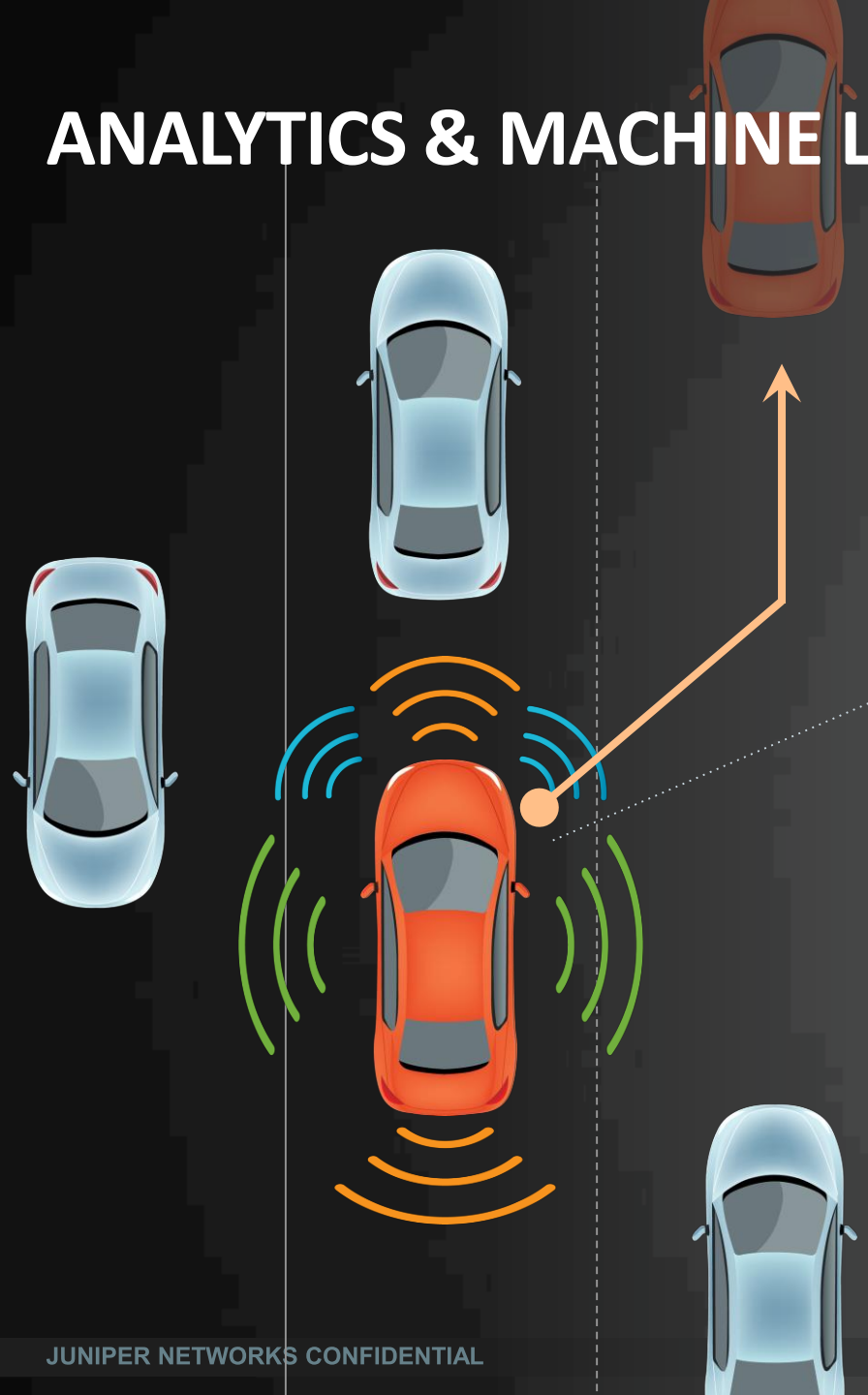
# Segment Routing Customers

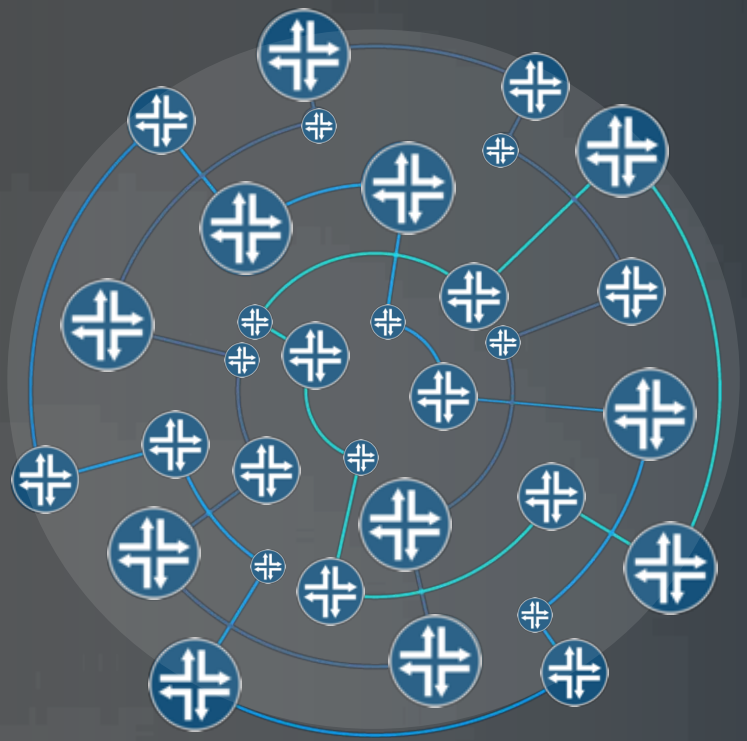
## Re-invent MPLS again! Foundation of NFV/SDN

- Major vendors claim to support, ALU/Cisco/Huawei/Juniper
- Known customer transforming to SPRING
  - AT&T CORD
  - Microsoft SWAN
  - China OTT, Tencent/Alibaba
  - Japan Softbank/NTT
  - ANZ Telstra etc




# ANALYTICS & MACHINE LEARNING





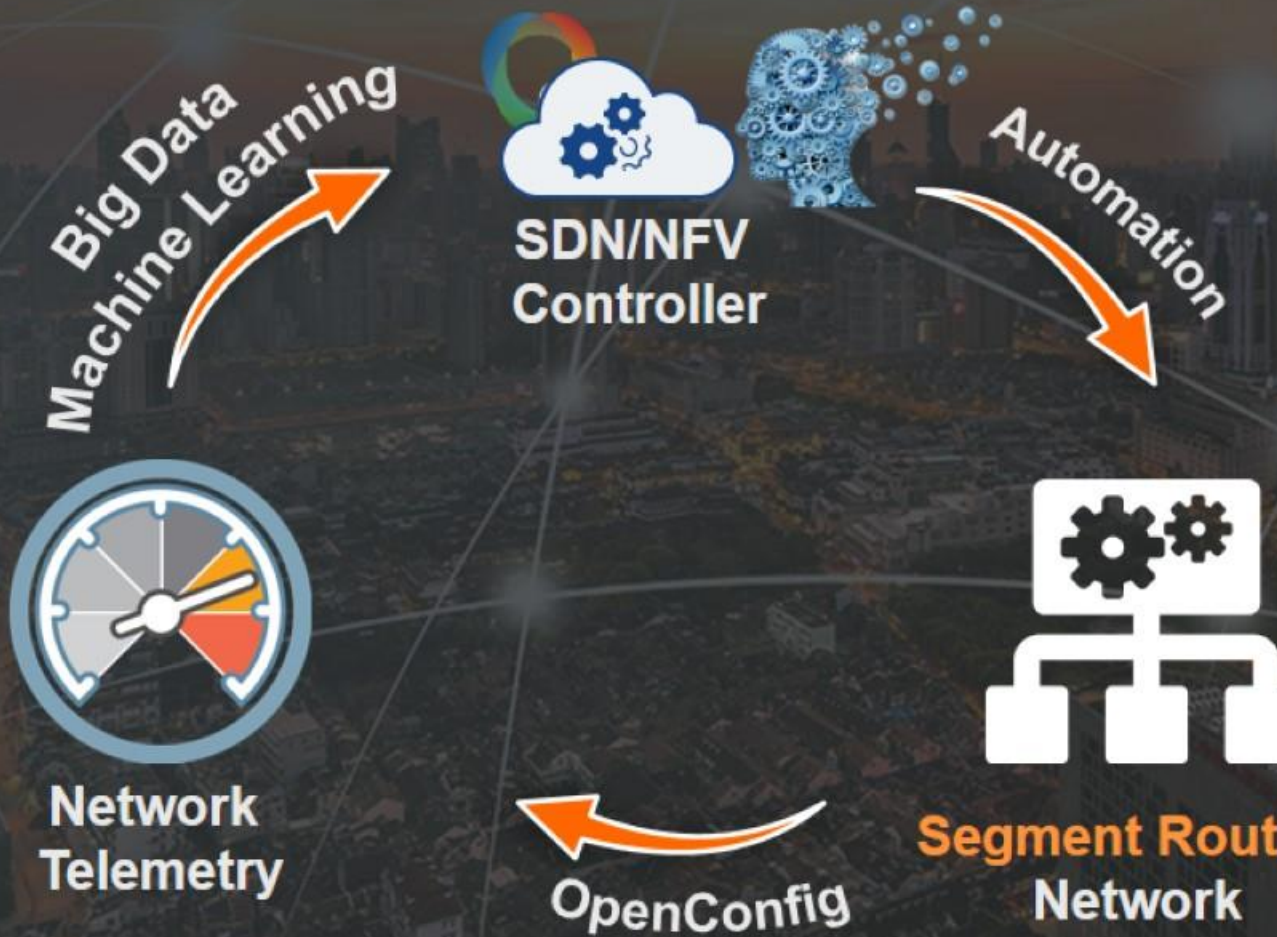
## TELEMETRY

-STREAMING ANALYTICS, OVERLAY-UNDERLAY CORRELATION

## BIG DATA ANALYTICS & MACHING LEARNING

- CONSTANT MONITORING, FEEDBACK-LOOP
- PREDICTIVE & ADAPTIVE NETWORKS

# ROAD TO SELF DRIVEN NETWORK



# SUMMARY

1. Extend Traffic Engineer to Cloud, Global Network Optimized
2. SDN Controller Solution, Automatic Congestion/Latency Optimized
3. Simplified ASBR Design, no IP, no Policy, LSR only
4. Controller/Application support full intelligence RIB/Traffic Telemtry
5. Standard Based solution, work with existing peer ASBR


JUNIPer
NETWORKS
Thank You!