



SDN Controller in WAN for content distribution

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IP SHOWCASE THEATRE AT IBC – SEPT. 14-18, 2018




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JUNIPER NETWORKS


At A Glance



FOUNDED
1996



HEADQUARTERED
Sunnyvale, CA



2016 REVENUE
\$4.99B

GLOBAL REACH

9,300
EMPLOYEES

+

88
Locations

+

43
COUNTRIES

+

24/7 AVAILABILITY
TO ADDRESS ALL CUSTOMER NEEDS

OUR MISSION Connect Everything. Empower Everyone. **OUR VISION** Engineering Simplicity

WHO TRUSTS US

1 out of 20
WORLD'S LARGEST BANKS

7 out of 10
TOP GLOBAL UNIVERSITIES


More than 1,400
LOCATIONS FOR NATIONAL GOVERNMENTS

10 out of 12
TOP TECHNOLOGY COMPANIES


9 out of 10
TOP GLOBAL WEB SERVICE PROVIDERS

10 out of 10
WORLD'S LARGEST WIRELESS & WIRELINE TELECOM COMPANIES


OUR STRATEGY




HELP COMPANIES BUILD CLOUDS



CONNECT PEOPLE TO CLOUDS








DISTRIBUTE CLOUDS TO ENABLE 5G AND IoT









BUILD THE CLOUD DELIVERED ENTERPRISE

REACHING HIGHEST STANDARDS

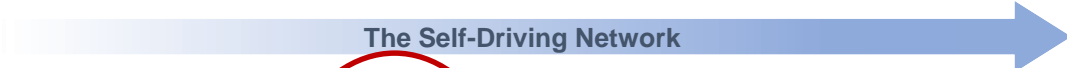
ENCOURAGING FUTURE INNOVATORS




Self Driving Networks Journey

The Self-Driving Network




Human-Driven Automation




- Standard-based network interfaces and data models
- Automate network provisioning and management
- Simplify network operations

Event-driven Automation




- Telemetry for Actionable Information
- Integration with Full IT infrastructure (Orchestration, etc)
- Rule-based Actions driven by events

Machine-Driven Automation





- Use sophisticated algorithms (statistics)
- Pre-programmed machines makes decisions and drives network change
- Humans make decisions where machines cannot

Autonomy



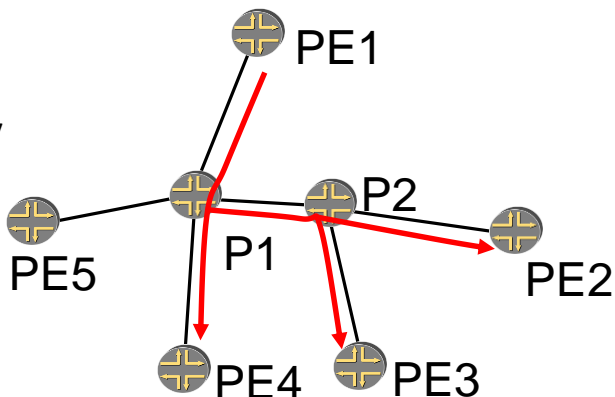
- Integrated machine-learning algorithms into the system
- Adaptive machine decisions drive network change
- Human supervision, no active intervention



A quick technological recap...

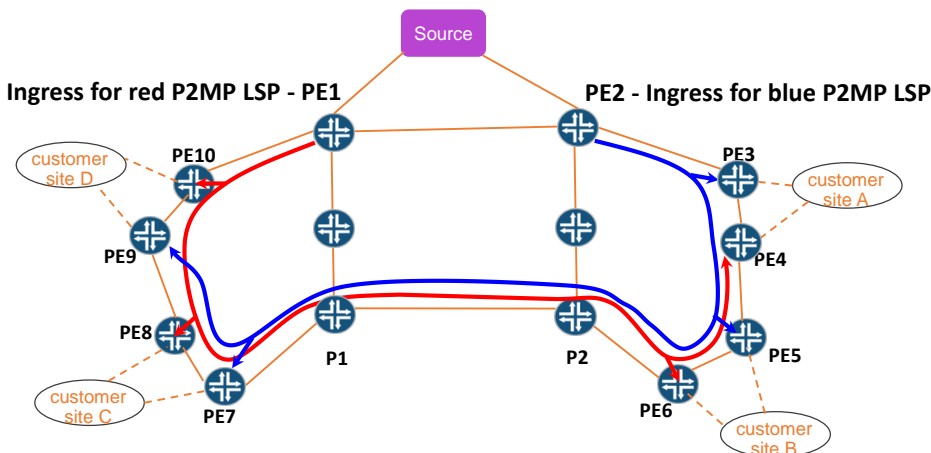
- P2MP IP/MPLS LSP is THE technology of choice to distribute multicast contents
- Replication happens where needed only
- Fast restoration to minimize traffic loss
- Constraints based path computation



Let's see a very common application in media ip based distribution infrastructure



Why P2MP matters... diverse path

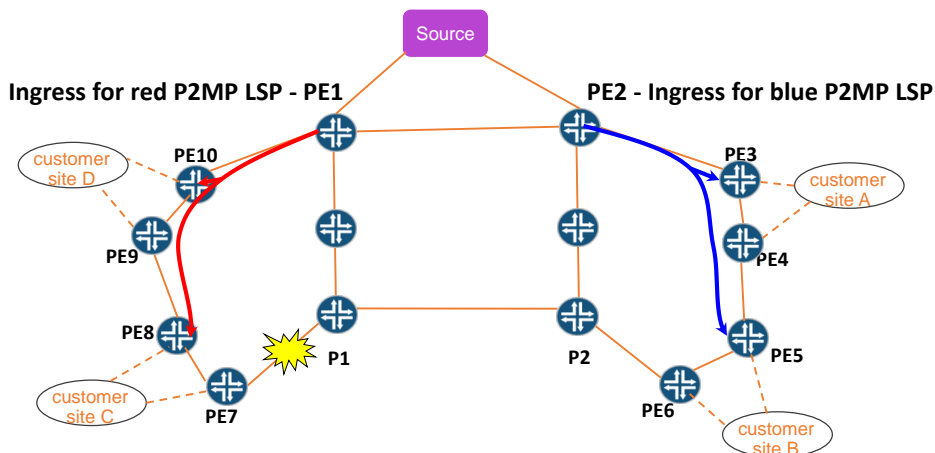


Each customer site is dual-homed to a pair of PEs
 one PE is served by the red P2MP LSP, the other is served by the blue P2MP LSP.





Why P2MP matters... diverse path



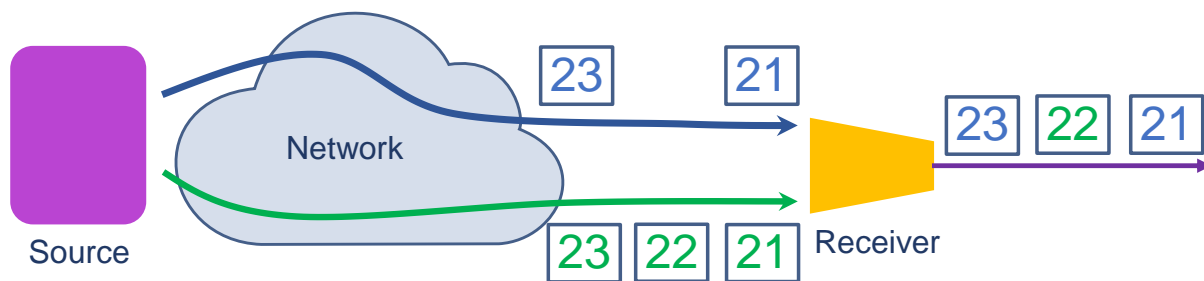
If any node or link breaks, each site is still served by at least one P2MP LSP, so no interruption to service

Live-Live seamless protection with diverse path are a perfect match!

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SMPTE 2022-7 Seamless Protection



Two duplicate streams sent simultaneously into network: "Live-live"

RTP media streams with sequence numbers

They follow diverse paths across network

Receiver buffers streams and inspects RTP seq # of packets – If packet with Seq. # N is missing from one stream, is replaced by corresponding packet from other stream



IP SHOWCASE THEATRE So, what?

So, now that we have understood what P2MP are, what path diversity is, how do these two solutions map to an SDN WAN Controller?



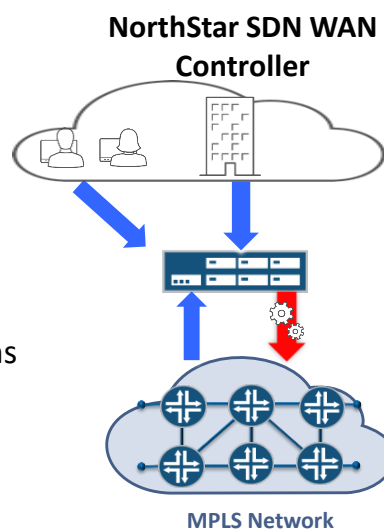
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IP SHOWCASE THEATRE SDN WAN Controller: What is it?

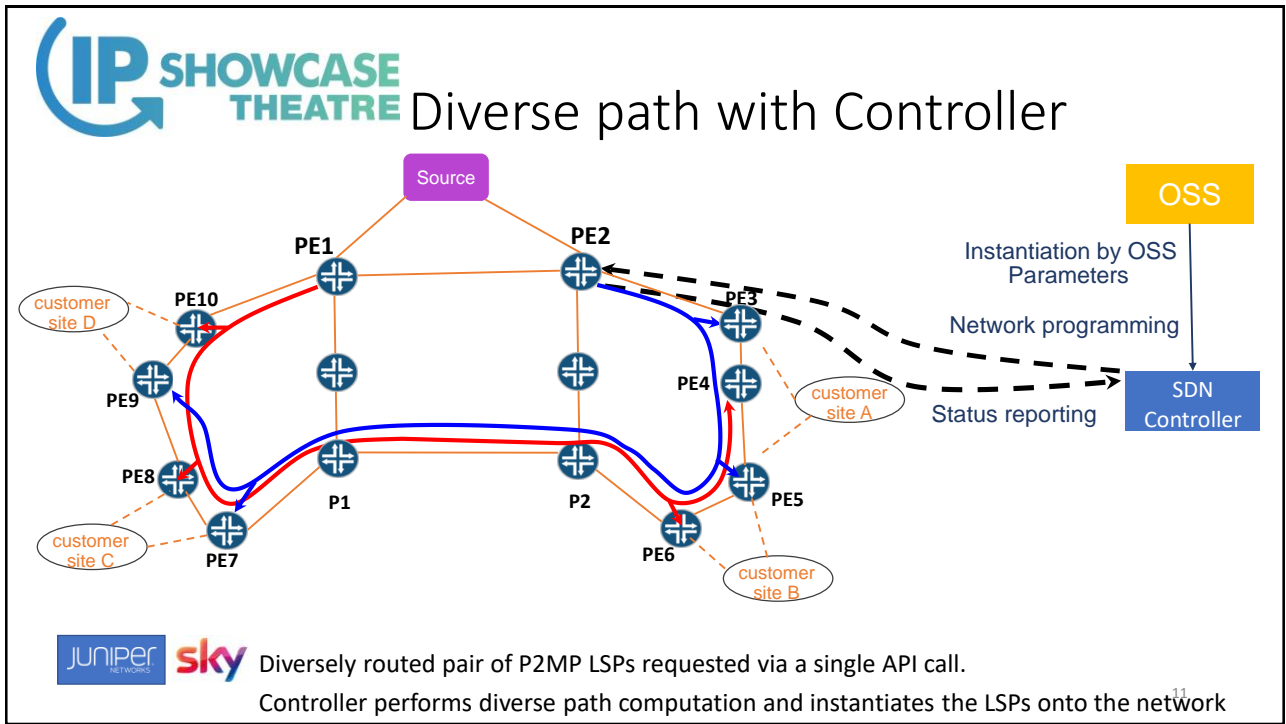
It's a single pane of glass which can:

- Acquire full network states in real-time
- Show Network topology and states in real time
- Receive requests by users
- Receive requests by external systems (OSS/BSS)
- Program the network according to requests
- Continuously monitor the network utilization
- Eventually, autonomously optimize network paths

How does it map on diverse path use case?



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IP SHOWCASE THEATRE Relevance of AMWA IS-06

The IS-06 Network API in principle could be used between the OSS and the NorthStar Controller, as it has some of the required ingredients (endpoints, network flows etc)

At present, IS-06 does not have a way of requesting a pair of diversely-routed multicast trees. Also it does not deal with multi-tenant networks (e.g. mapping of a P2MP LSP to a particular tenant's VPN)

JUNIPER NETWORKS **sky**

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Juniper and SKY – The beginning

Juniper Networks and SKY TV Italy relationship has a long history starting in 2011...

Juniper Networks was selected to deliver a fully converged IP and video distribution solution

Since 2011, things have been hugely evolving in video technology

... hence transport infrastructure, and not only, must evolve too!



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Juniper and SKY – The evolution

Juniper and SKY are on a multi-level journey to modernization involving

- Network Infrastructure
- Content delivery
- Network management, visibility and infrastructure usage optimization

Good news: this is the perfect fit for SDN WAN controller!



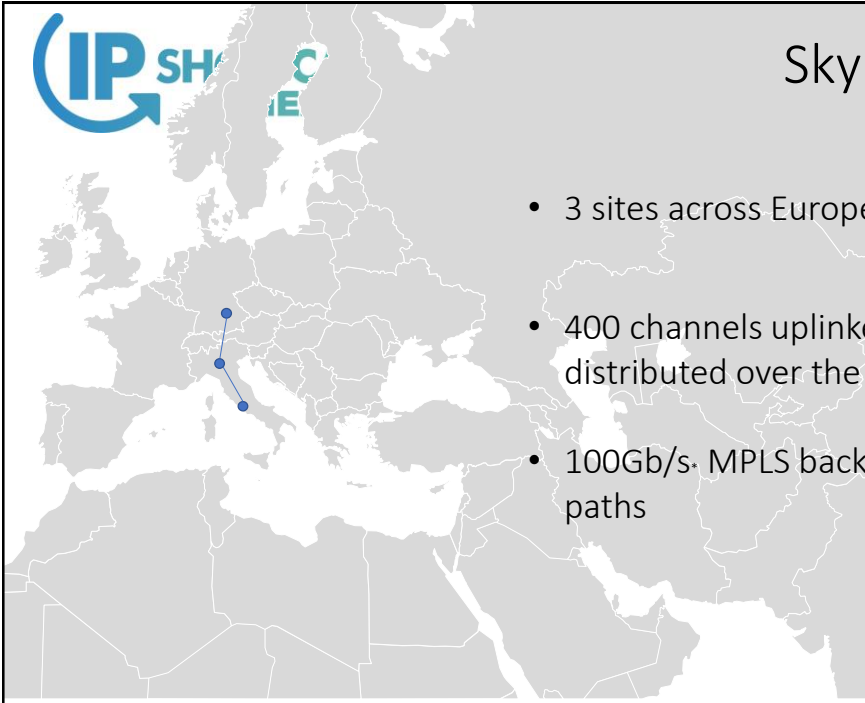
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IP SHOWCASE THEATRE

Sky Italia

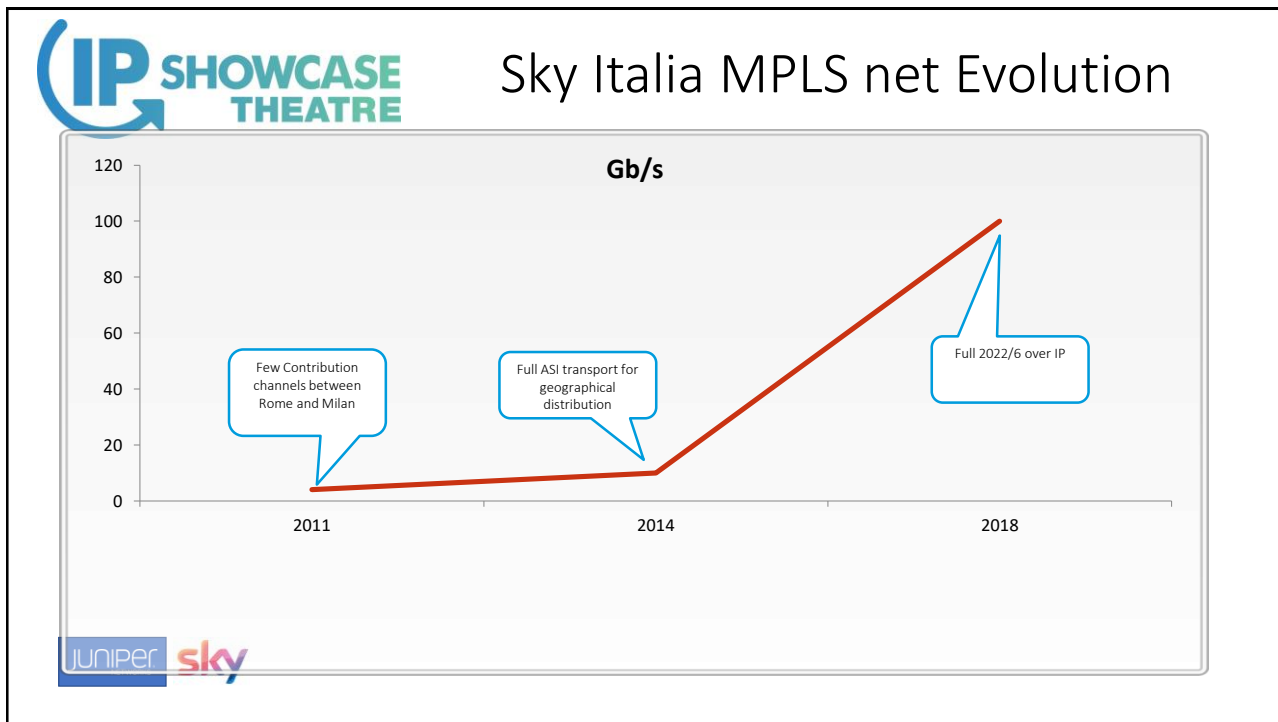


Sky Italia, established on July 31st, 2003, has a 5.5m subscriber base. It is part of Sky plc, Europe's leading entertainment company with 22 million customers across five countries: Italy, Germany, Austria, the UK and Ireland, Spain.



Sky Italia Facilities

- 3 sites across Europe
- 400 channels uplinked to satellite or distributed over the internet
- 100Gb/s MPLS backbone over 3 diverse paths



IP SHOWCASE THEATRE

Monitoring&Control

- Simple CLI
- Dataminer Dashboard for alarm collection and performance tracking
- Northstar v3: visual monitoring and alarm collection

JUNIPER NETWORKS sky



Monitor&Control Evolution

- Northstar v4: control and routing
- Future: self healing and application metrics mpls rerouting



How does NS look in SKY today?!

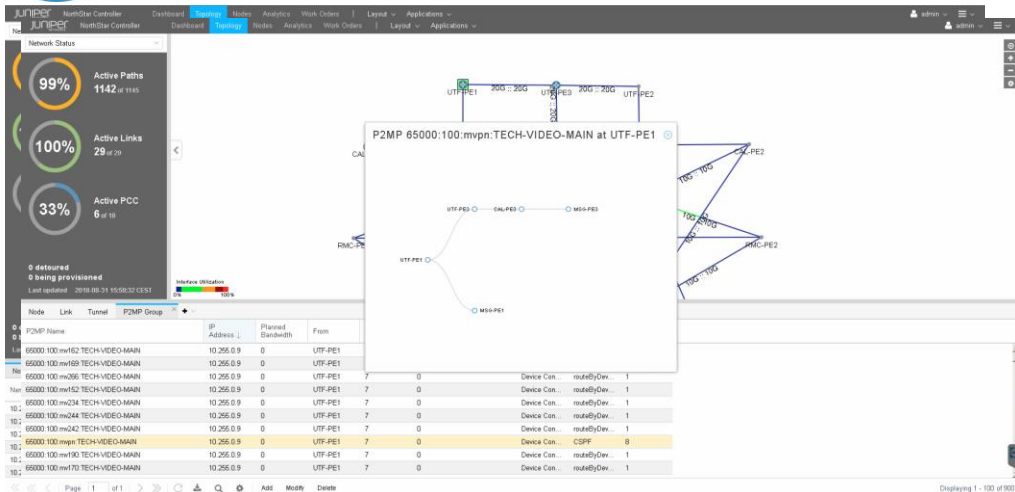
The screenshot displays the Juniper NorthStar Controller interface. On the left, a 'Network Status' panel shows: 99% Active Paths (1142 of 1155), 100% Active Links (29 of 29), and 33% Active PCC (6 of 18). Below this, it indicates 0 destinations being provisioned and a last update time of 2018-08-31 14:41:03 CEST. The main area features a network topology diagram with nodes labeled with names like SAL-PE2, MSO-PE3, JUN-PE1, etc., and their IP addresses. A table below the diagram lists node details:

Name	Hostname	IP Address	Type	NETCONF Status	PCEP Status	AS	OSD Area	Management IP	Layer	Most Recent Update
10.255.0.4	SAL-PE2	10.255.0.4	JUNIPER	Up	Up	65000			IP	
10.255.0.2	MSO-PE2	10.255.0.2	JUNIPER	Up	Up	65000		10.255.0.2	IP	
10.255.0.13	MSO-PE3	10.255.0.13	JUNIPER	Up	Up	65000		10.255.0.13	IP	
10.255.0.3	SAL-PE1	10.255.0.3	JUNIPER	Down	Down	65000		10.255.0.3	IP	
10.255.0.5	COR-PE1	10.255.0.5	JUNIPER	Up	Up	65000			IP	
10.255.0.6	COR-PE2	10.255.0.6	JUNIPER	Up	Up	65000			IP	

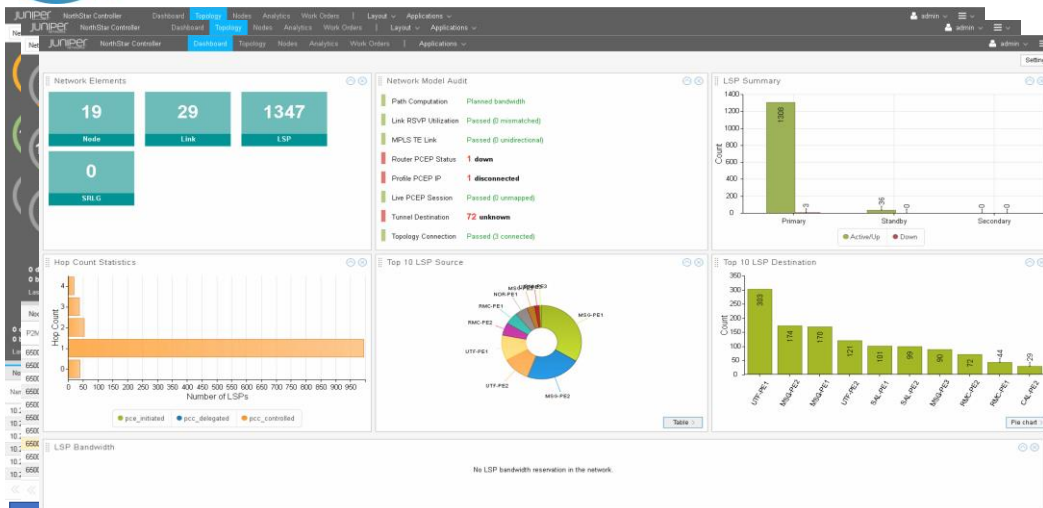




How does NS look in SKY today?!



How does NS look in SKY today?!





How does NS look in SKY today?!

The screenshot displays the Juniper NorthStar Controller interface. On the left, a sidebar shows 'Network Elements' with 19 nodes and 0 SRLG. A 'Timeline' section lists several events from 2018-08-31, including link up/down and active path statistics. The main area shows the 'Provision Diverse LSP' configuration page with tabs for 'Properties', 'Advanced', and 'Scheduling'. The 'Properties' tab is active, showing fields for Tunnel 1 and Tunnel 2, including Name, Node A, Node Z, IP Z, Planned Bandwidth, Setup, Hold, and Planned Metric. A 'General' section at the bottom includes Provisioning Method (PCEP), Provisioning Type (RSVP), Diversity Level (link), and Diversity Group.

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Thank You

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