

Ethernet Aggregation using PBB and PBB-TE for MPLS networks

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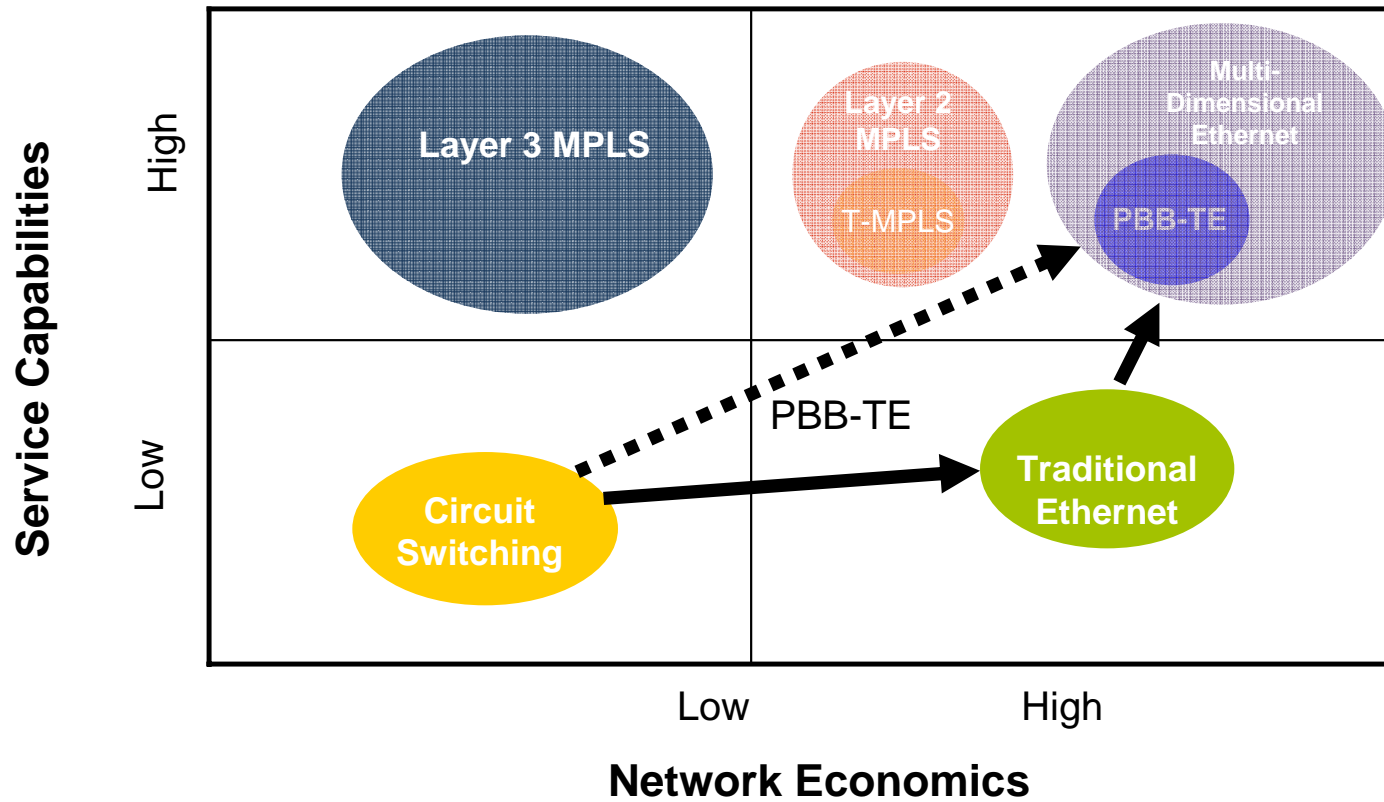
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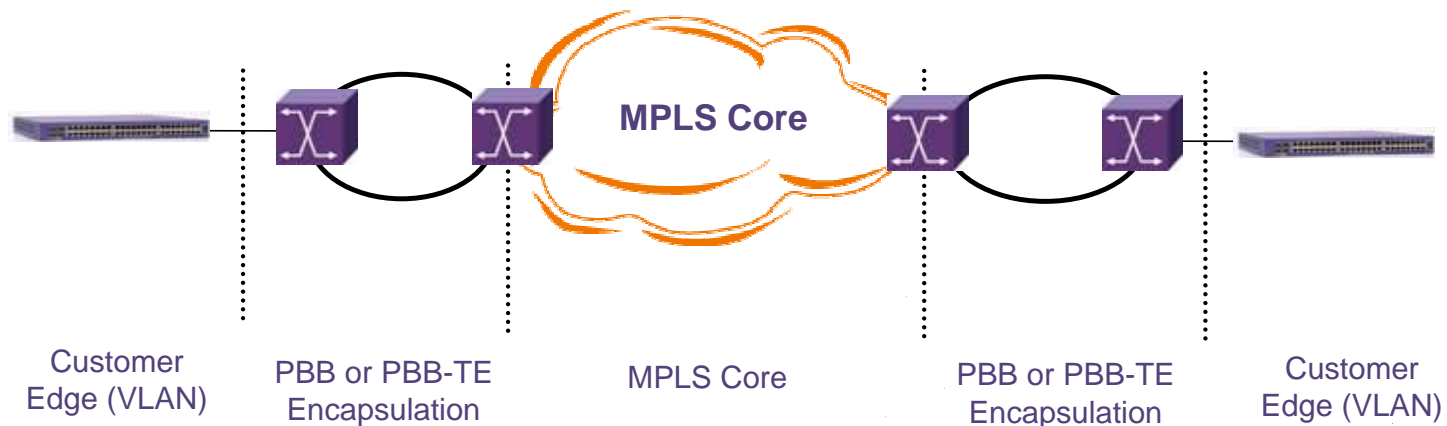


Service Delivery Evolution



Using PBB & PBB-TE in an MPLS Network

- ▶ Scales beyond 4096 VLANs
- ▶ Preservation of VLAN inner and outer tags
- ▶ QoS mapped from customer inner .1p tag to metro outer tag and MPLS EXP bits



Two Paths to Ethernet Transport

Ethernet PBB Path

Automatic

Ethernet Control Plane handles network configuration on its own

Simple

Standard Ethernet concepts are easy to manage even for large networks

Circuit Switched PBB-TE Path

Deterministic

With nailed-up circuits and complete traffic control

Familiar

Maintains current operational model and avoids complicated MPLS transport

Ethernet Transport

Best network economics

Scales to millions of services

Provides network resiliency

Recent Ethernet Technology Enhancements

Provider Backbone Bridges – Traffic Engineering

MAC-in-MAC

(802.1ah)

Provides
massive
scalability

Ethernet OAM

(802.1ag)

End-to-end
resiliency with
continuity checks

Ethernet NNI

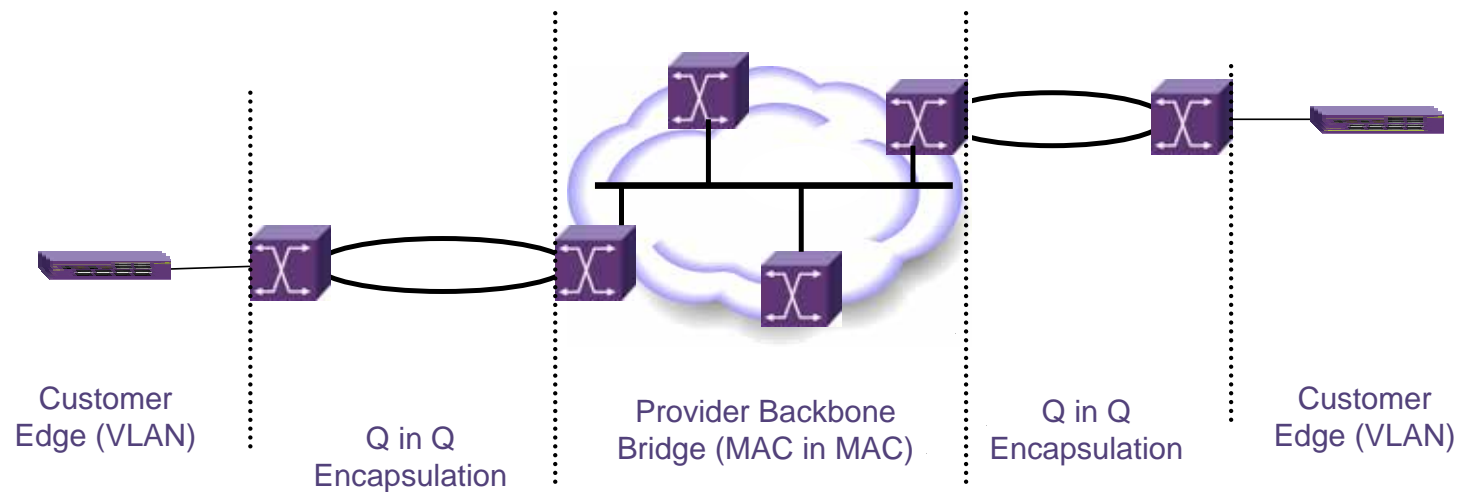
(MEF E-NNI)

Extends service
reach across
provider
boundaries

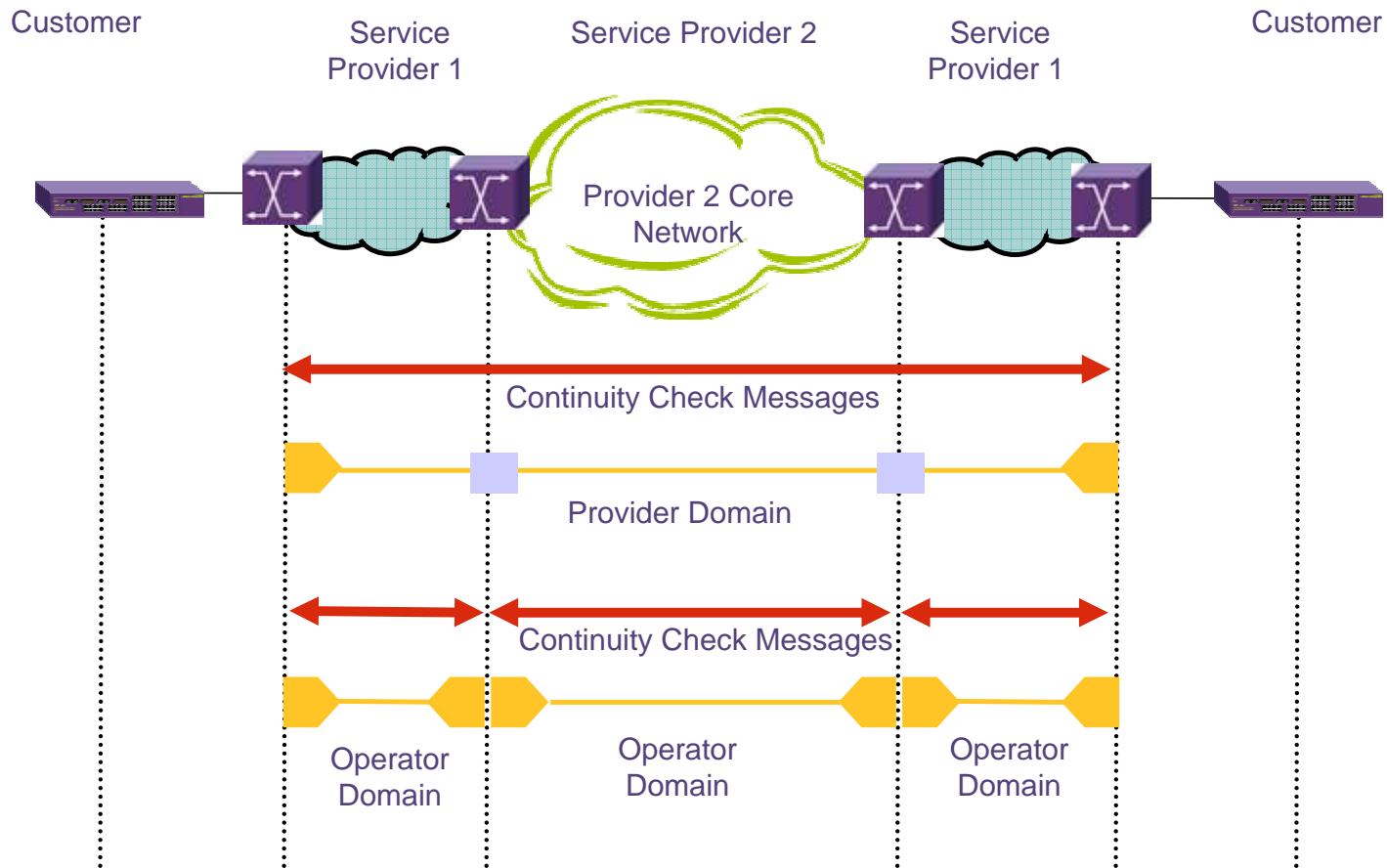
Deterministic, Resilient and Familiar

Provider Backbone Bridging

- ▶ **Eliminates address space scalability issue**
- ▶ **Solves MAC table size issue**
- ▶ **Works in conjunction with 802.1ad (Q in Q)**

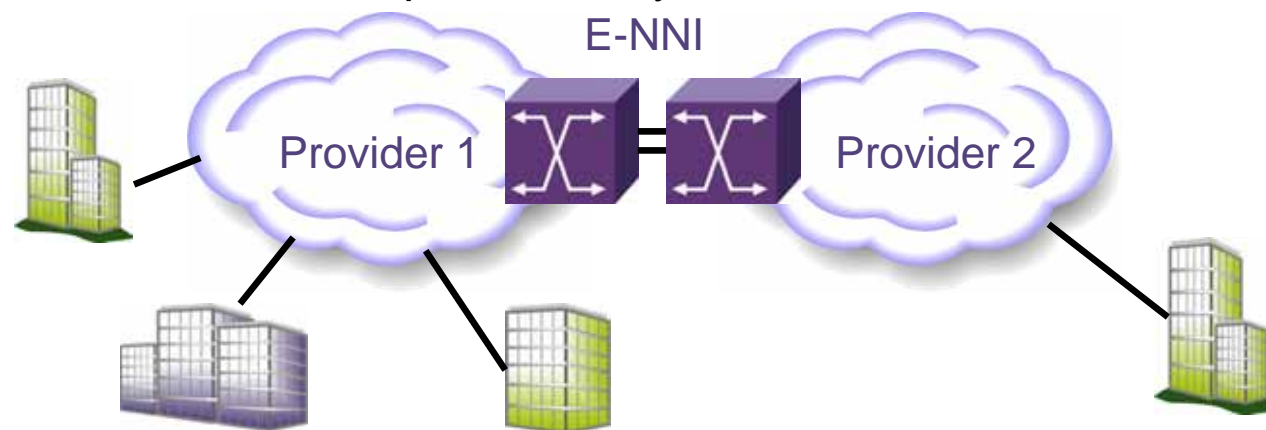


Ethernet OAM for End-to-End Resiliency



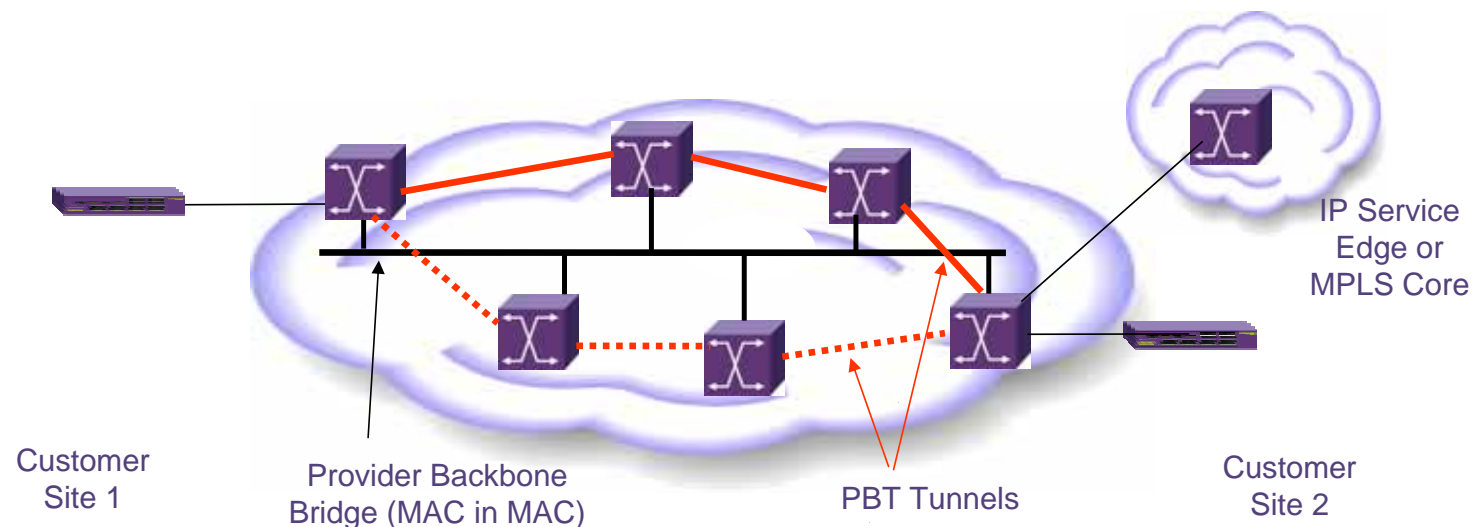
Ethernet NNI to Extend Service Reach

- ▶ Allows peering between provider Ethernet services
- ▶ Increases carrier reach with Ethernet service extension to off-net sites
- ▶ Uses a combination of technologies
 - **Link Aggregation**
 - **VLAN C-VID/S-VID translation**
- ▶ MEF Standard expected this year

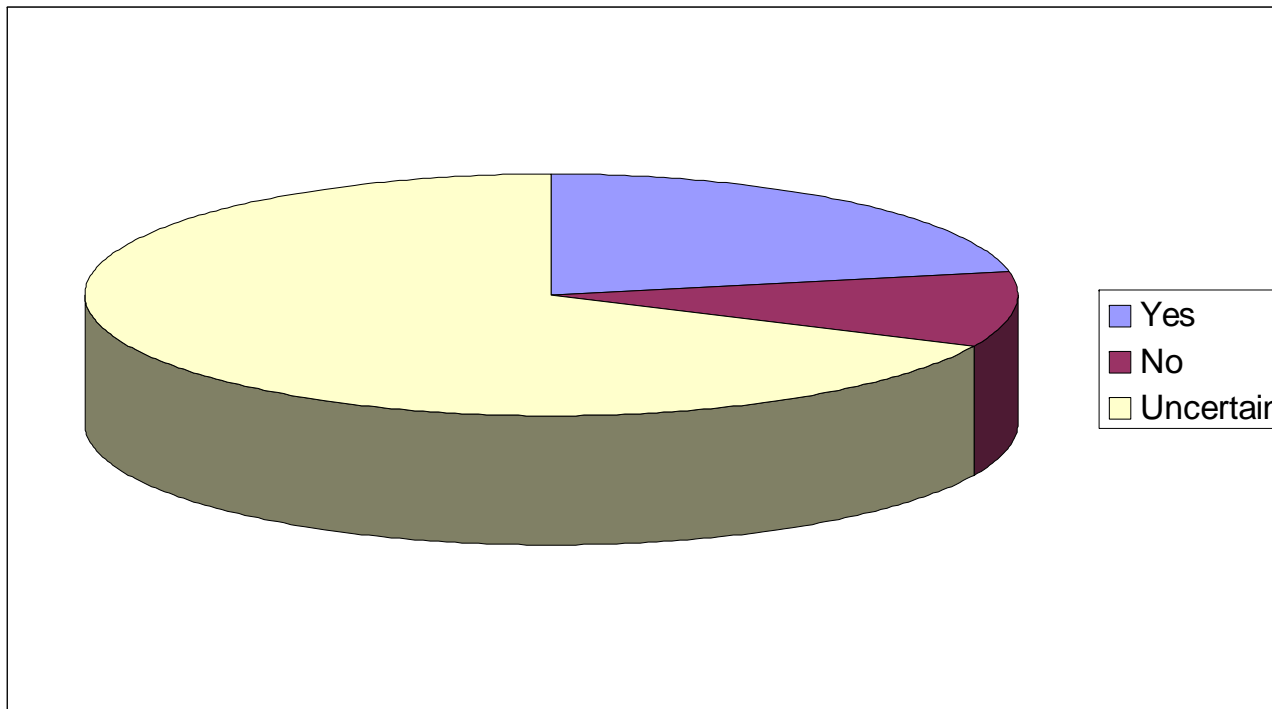


Migration to PBB-TE

- ▶ **PBB (MAC-in-MAC) networks can be deployed today**
- ▶ **PBB-TE traffic engineered trunks can be added later**
- ▶ **Both can run on the same switches at the same time**
- ▶ **PBB-TE Ready hardware**



Carrier Interest in Deploying PBB-TE



Source – Ray Mota, Synergy Research Group PBT and Metro Network Analysis

PBB-TE Applications

▶ **Business Services**

- E-Line services

▶ **Wireless Backhaul**

- High bandwidth backhaul including WiMAX

▶ **Wholesale Services**

- SLA capable Ethernet connections

Reasons for all the Carrier Interest

▶ **Deterministic network behaviour**

- Nailed-up circuits, no Ethernet learning and flooding

▶ **Resilient network designs**

- End to end circuit based resiliency with 50ms failover times

▶ **Familiar network operations offering lower CAPEX and OPEX**

- No need for new personnel with Layer 3 experience

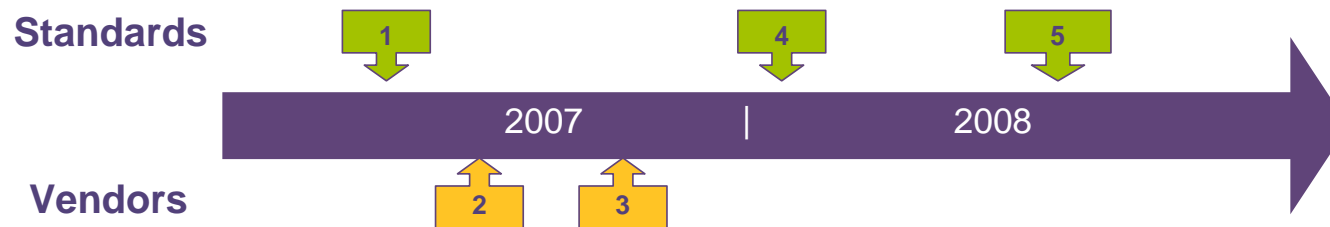
▶ **Now for the hard question:**

What's least appealing about PBB-TE?

- 85% of carriers said that it is not yet a standard and there has been no interoperability to date*

*Source – Ray Mota, Synergy Research Group PBT and Metro Network Analysis

Next Generation Networking Developments



1. IEEE PBB-TE project is approved - now officially 802.1Qay
2. Extreme & Nortel PBB-TE interoperability demonstration
3. EANTC PBB-TE interoperability showcase
4. MEF E-NNI and Standard Solidifies – important for wholesale
5. IEEE project could reach sponsor ballot in the IEEE

How to build carrier confidence

- ▶ **Single vendor approach is straight forward but a real solution will take more work**
- ▶ **No reason to wait for the standard to complete to get the interoperability established**
- ▶ **Three key results from Carrier Ethernet Geneva show:**

1. Data Plane Interoperability

2. Protocol Inter-working and Interoperability

3. Control Plane Interoperability

Data Plane Interoperability



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EANTC Demonstration Geneva

- ▶ **Live interoperability demonstration**
- ▶ **Key accomplishment #1 – connectivity and interoperability of**
 - Provider Backbone Bridging frames (IEEE 802.1ah)
 - Configuration Fault Management (IEEE 802.1ag)
- ▶ **During the event in Geneva nine vendors demonstrated trunk establishment and data forwarding**

Protocol Inter-working and interoperability



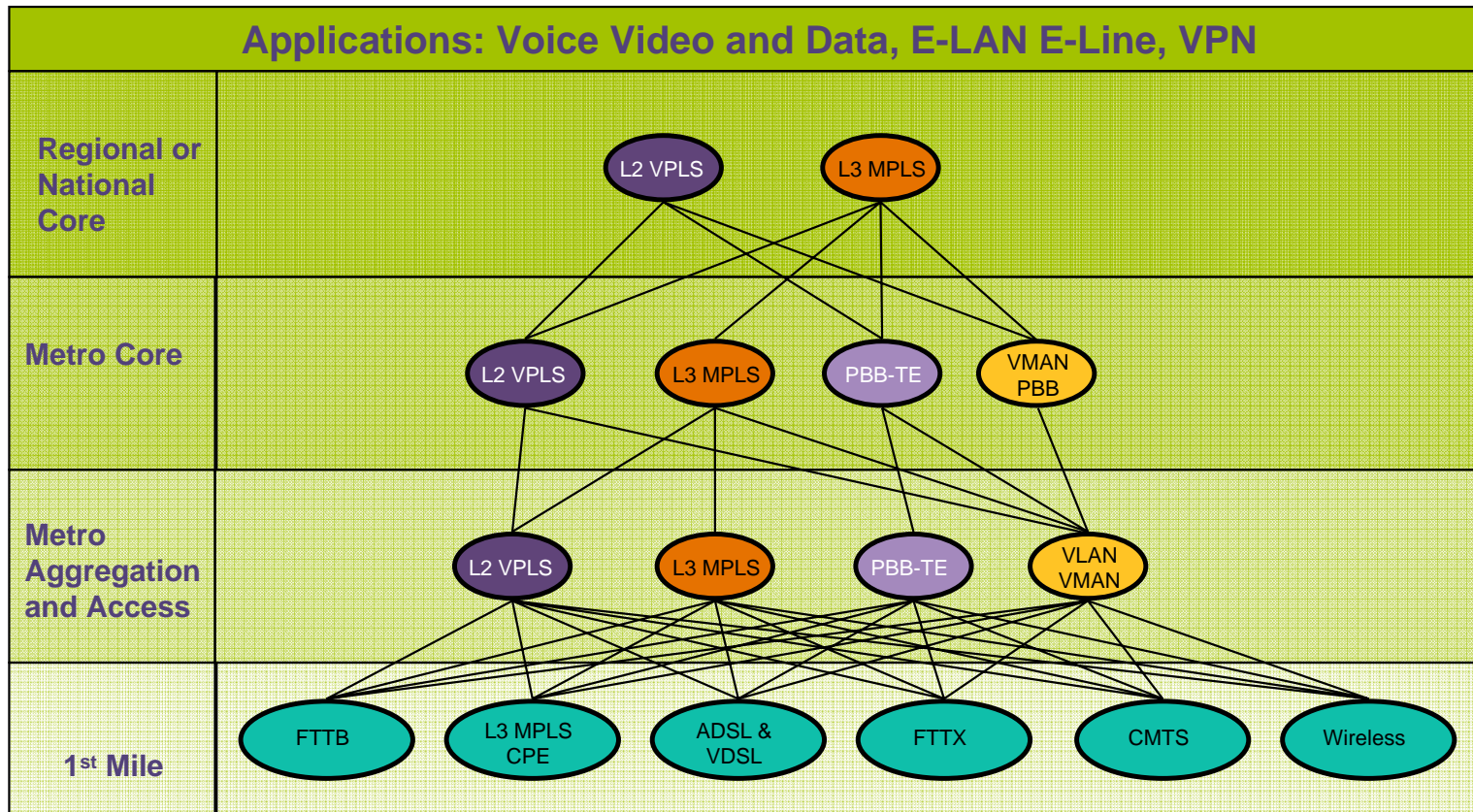
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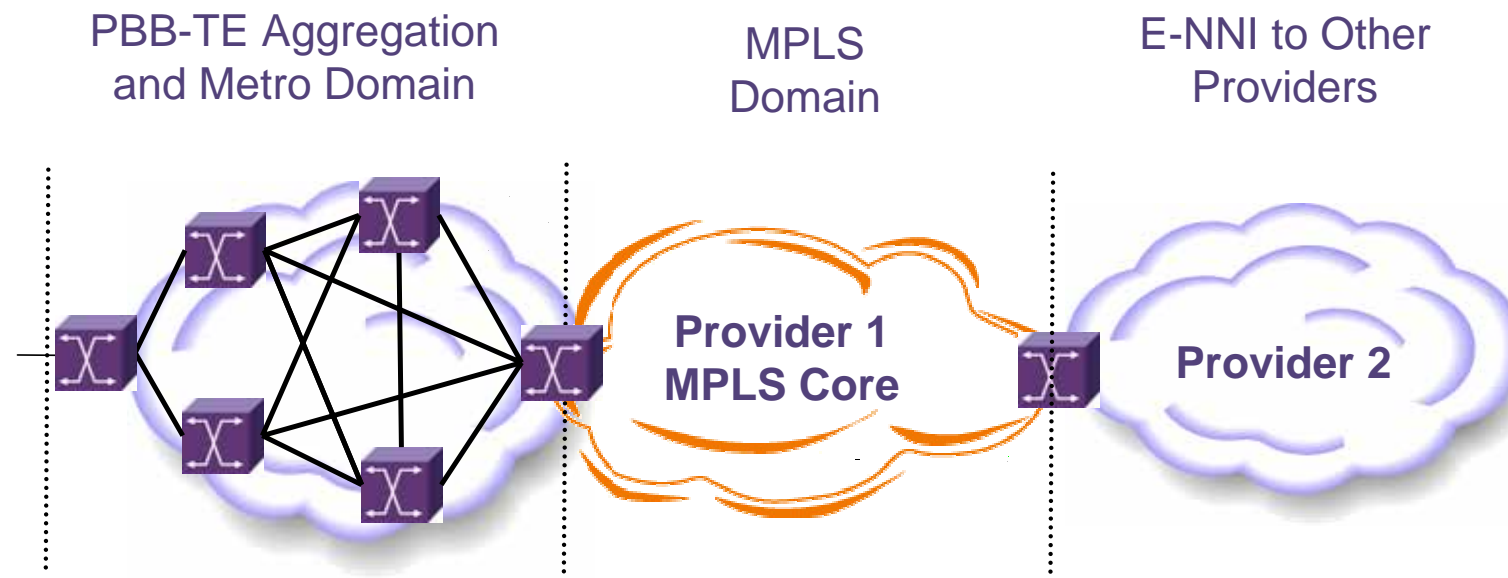
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Carrier Technology Menu



PBB-TE Ethernet Aggregation to an MPLS Core



Control Plane



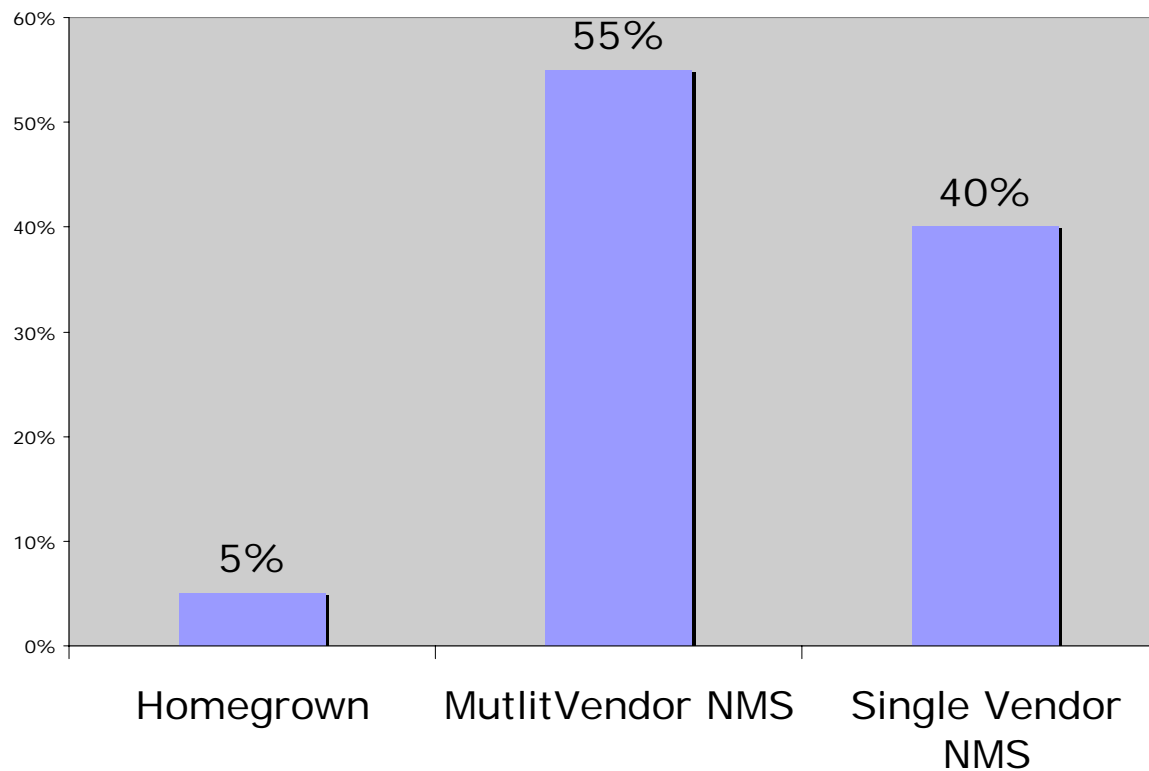
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Carrier Control Plane Preference



Source – Ray Mota, Synergy Research Group PBT and Metro Network Analysis

Multi-Vendor Control Plane Implementations

▶ **Multi-Vendor control plane is the wise choice**

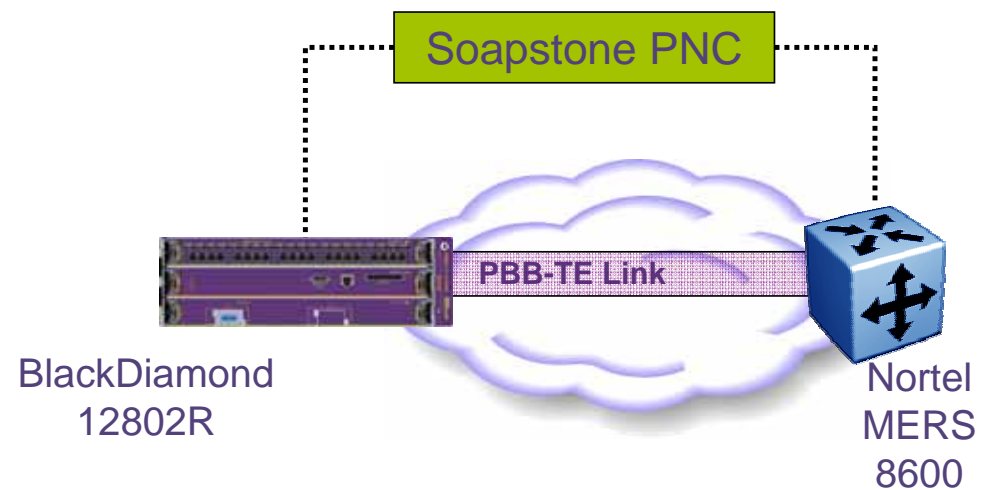
- Avoid vendor lock in on the hardware side
- Allow dual vendor supplier strategy
- Maintain flexibility in network design

▶ **The power of XML for control plane work**

- Simplicity
- Speed
- Investment protection

Control Plane Demonstration

- ▶ **Live interoperability demonstration at EANTC booth**
- ▶ **Industry first demo with dynamic configuration of services across a multi-vendor network**



Building a Carrier Ethernet Ecosystem

- ▶ **Promoting the use of PBB-TE to overcome real world challenges with Carrier Ethernet**
- ▶ **Demonstrating PBB-TE interoperability among vendors**
- ▶ **Real-world scenarios with available solutions**
 - » hardware
 - » management tools
 - » components
 - » test gear



Carrier Ethernet Ecosystem Partners



Questions?



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Thank You



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