
extreme
networks™

Challenges Facing Next Generation Networks and How To Address Them

September 2009

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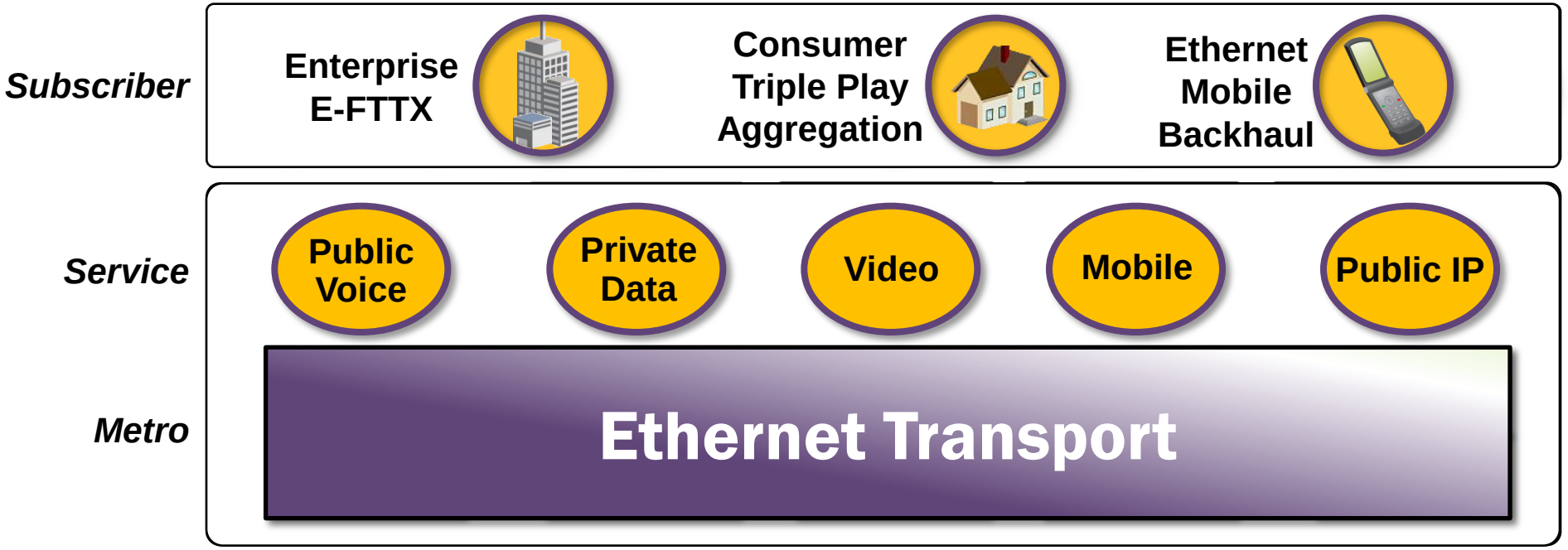
Extreme Networks

Calyx
The Managed Service Provider

Metro Ethernet Transport



Carriers Increase Profitability when Delivering More Services over a Common Transport Network

Why is the Convergence Taking Place?

Business

Ultimate Connectivity

- Data Center Consolidation
- Storage and Disaster Recovery
- Gigabit Connectivity Between Businesses
- Guaranteed Rate Multi-Megabit Internet Access
- Video Conferencing and Broadcast
- Business Telephony

Wireless

Reachability & Mobility

- 3G Mobile Backhaul
- WiMAX/LTE Backhaul
- Network in Motion
- Next-Gen Data Services
- VoIP over Wireless
- Wireless Video
- Gaming
- Digital TV

Residential

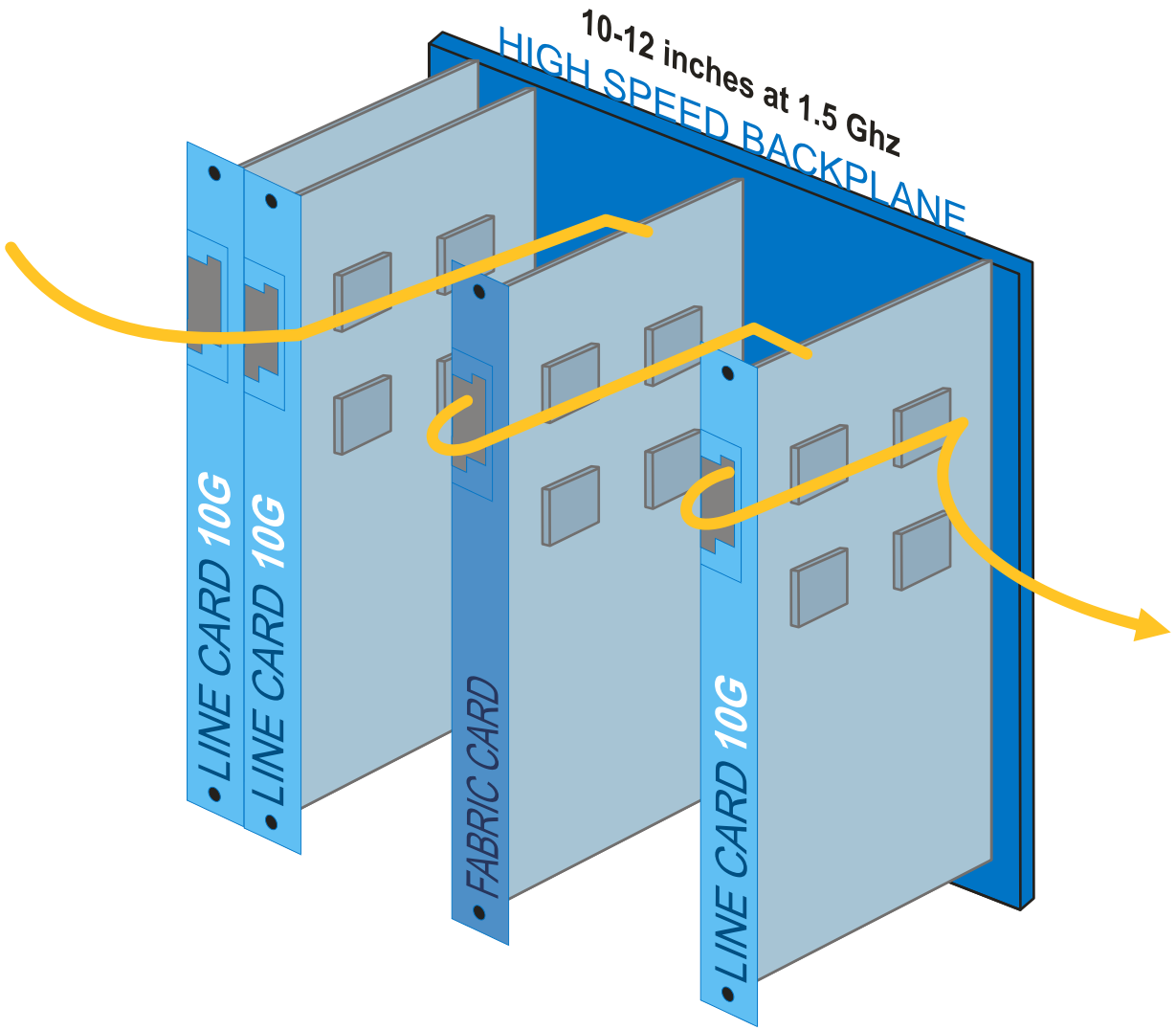
Triple Play

- Multi-megabit Internet Access
- VoIP (E911)
- 100s of TV Channels
- Video on Demand
- Video Recording
- Interactive Video Apps
- Remote Learning
- Gaming

Key Challenges

- Bandwidth
- Scale
- SLA monitoring/Application Performance
- Provisioning
- Price/Port

10G to 100G…
Equipment Vendors Need to Make a Change



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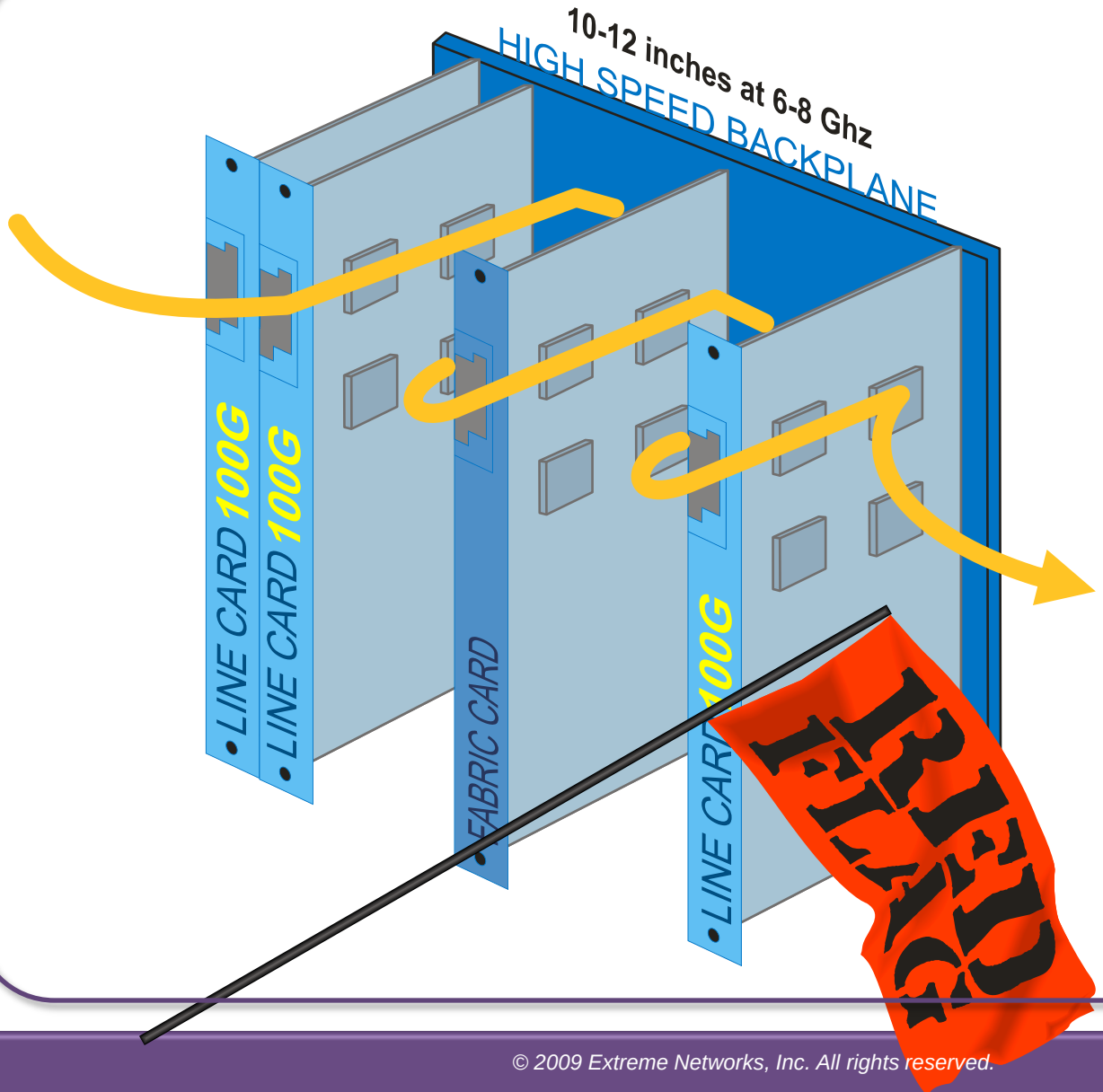
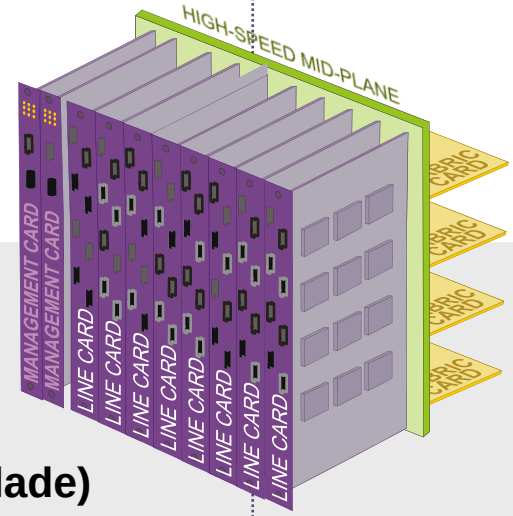


BlackDiamond 20808 Technology for 100G Migration

High-Speed Mid-Plane: Line card to fabric distance = 2 inches

100G: Scaling for future bandwidth growth

New mid-plane architecture



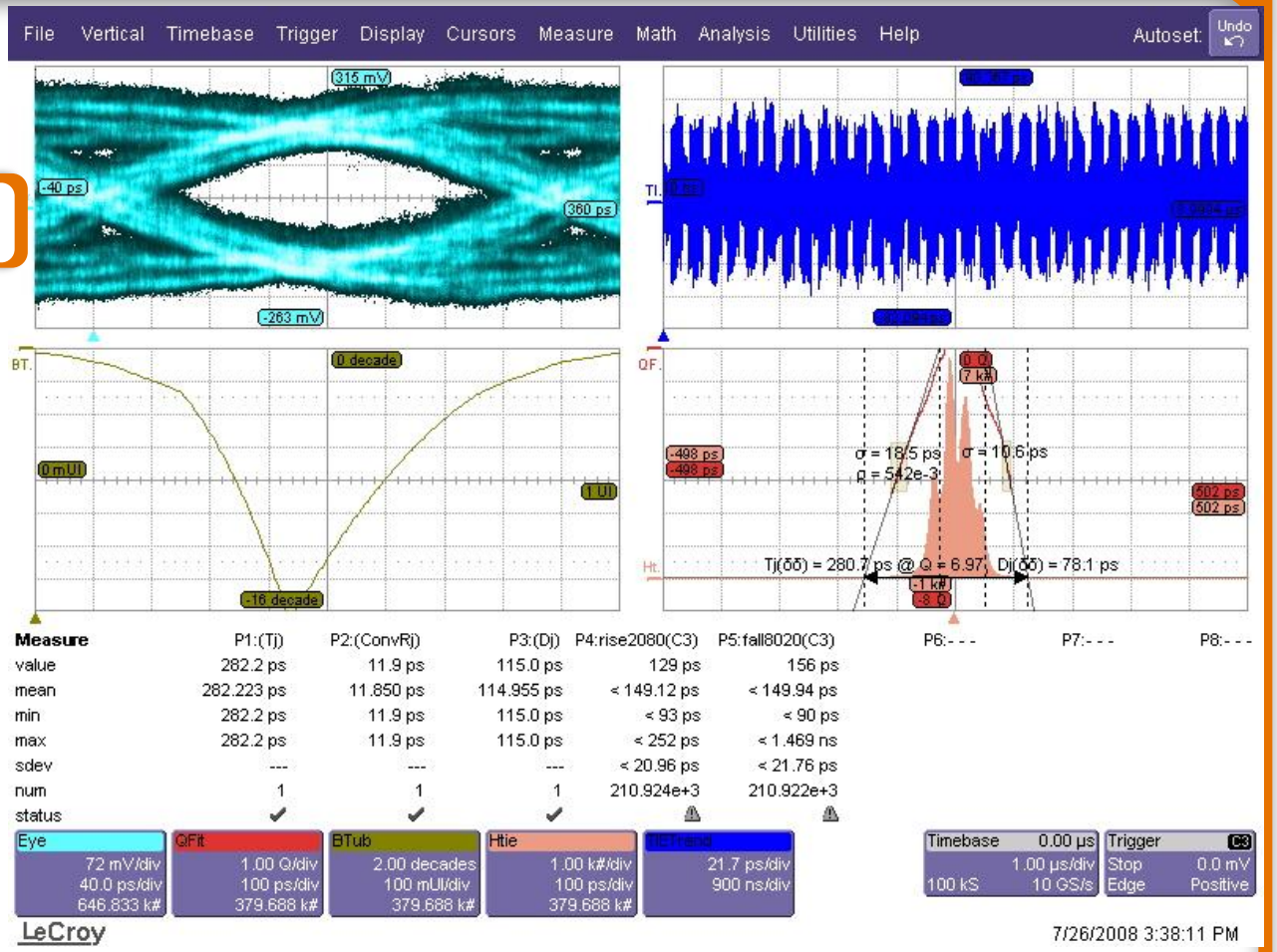
Starts at 120G per slot

Signals integrity checked to guarantee up to 500G per slot (5x100 G per blade)

120Gbps/Slot Eye Diagram Signals Verified OK

BlackDiamond® 20800: Eye with 6” of total trace at 3.125 G (120G/slot)

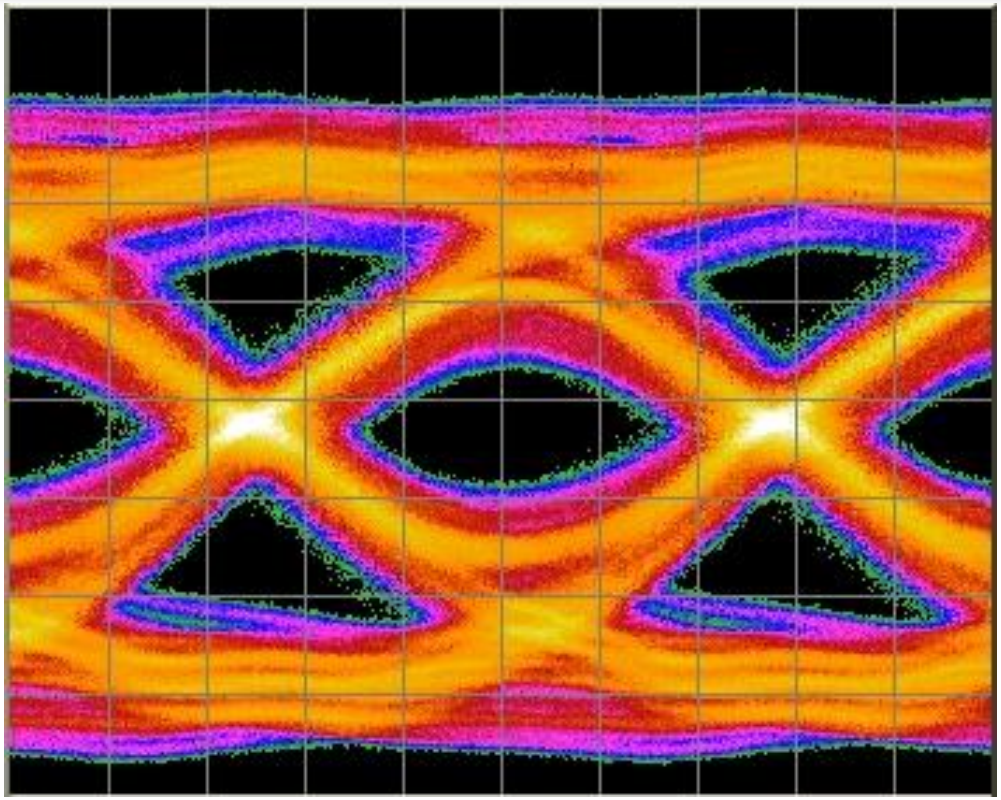
Generation 1



240Gbps/Slot Eye Diagram Signals Verified OK

BlackDiamond® 20800: Eye with 6” of total trace at 6.25 G (240G/slot)

Generation 2

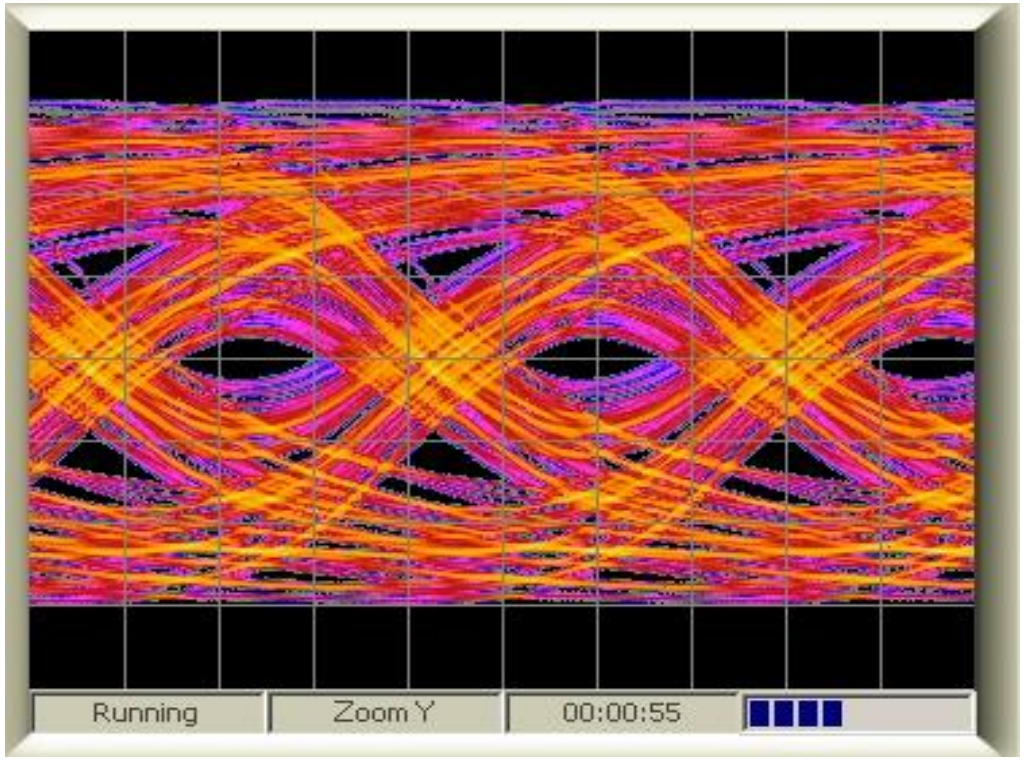


50 mV/Div, 30 ps/Div
Data Unit Interval 160 ps

480Gbps/Slot Eye Diagram Signals Verified OK

BlackDiamond® 20808: Eye with 6” of total trace at 12.5 G (480G/slot)

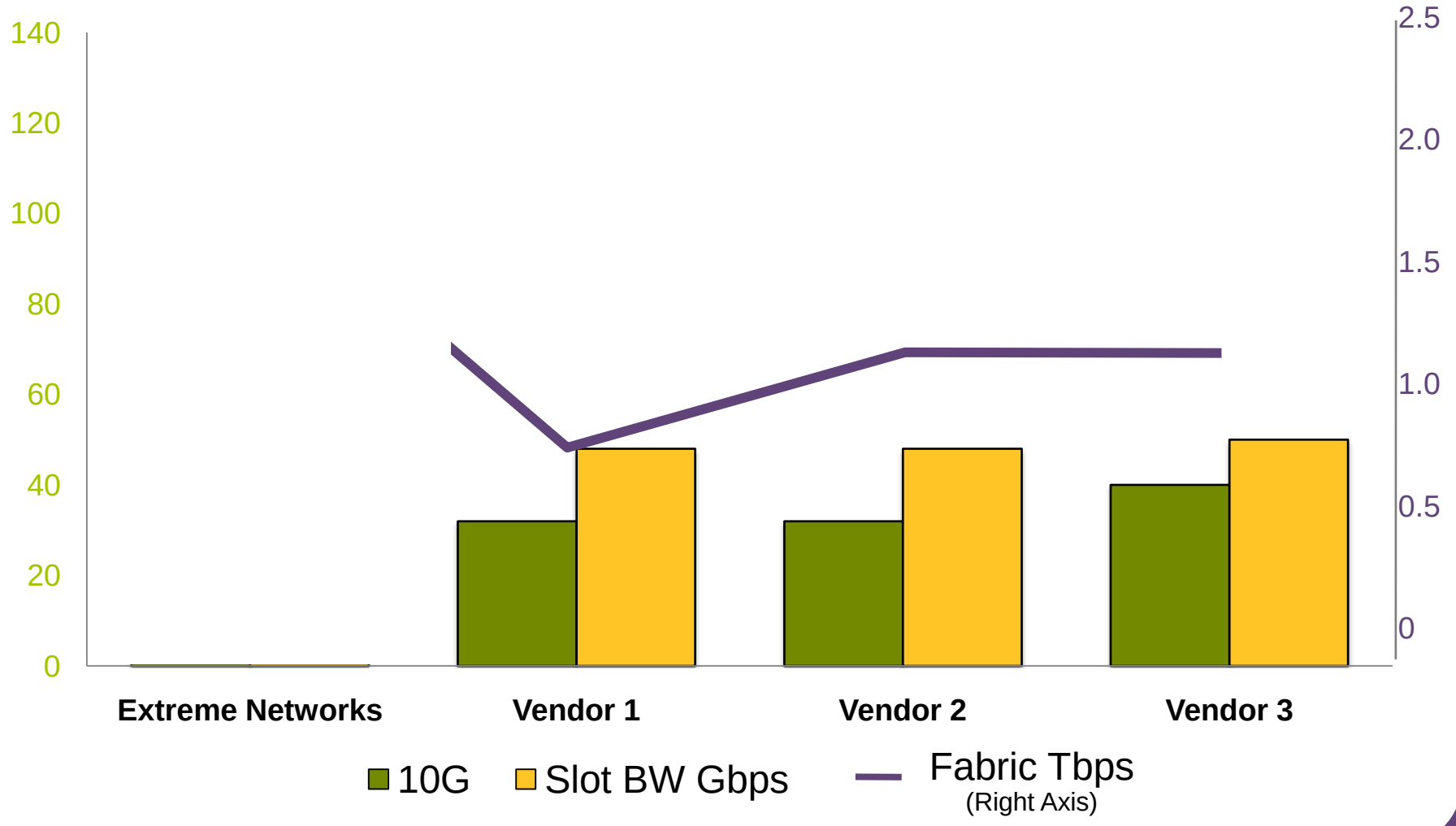
Generation 3



269 mV/Div, 22 ps/Div
Data Unit Interval 80 ps

Bandwidth or Density/Chassis

Extreme Networks® Scalability: 2 to 3 times where the industry is today



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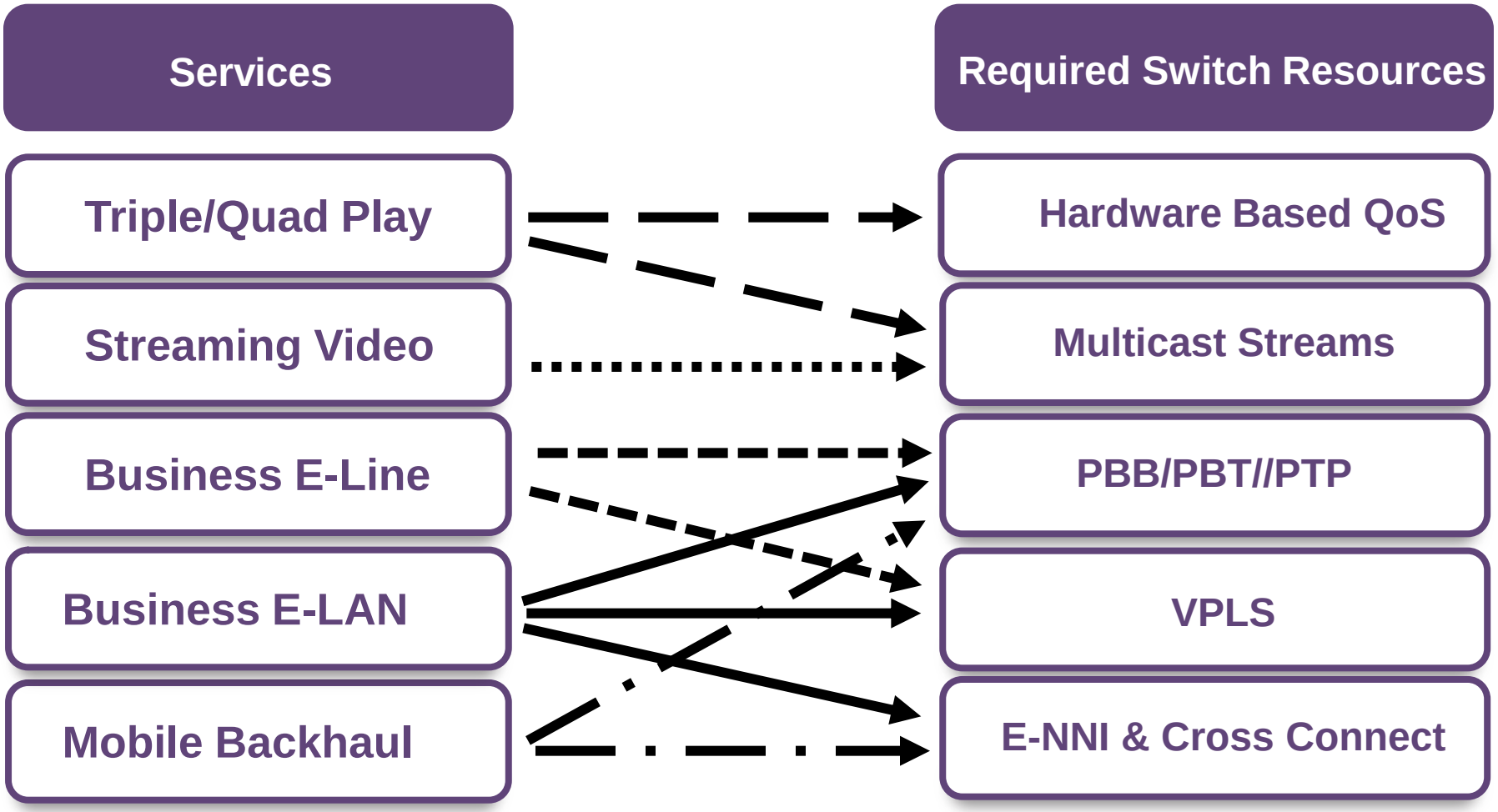
Scalability
Platforms and Protocols

Enables Providers to Offer Scalable Services



Industry Leading Scalability to Offer These Services

Key Challenges

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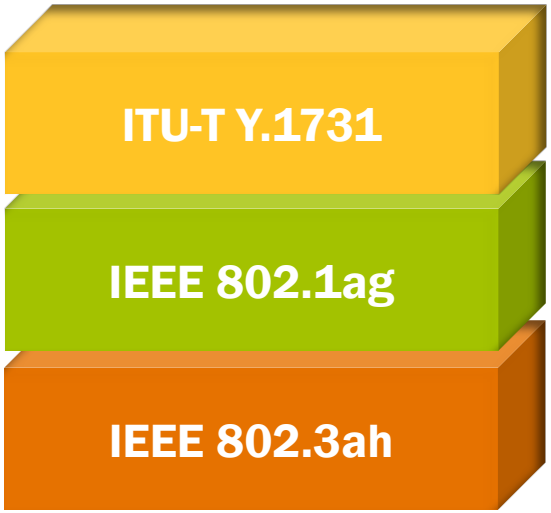
Service Assurance: SLA Requirements

	Business VPN	Mobile Backhaul	Residential Triple Play
Latency	10-55ms	5-25 ms	100 ms
Jitter	5-10ms	2-10ms	5-10 ms
Packet Loss	.05%	.05%	.05%
Class of Service	4 levels	2 CoS Levels	4 levels
Protection Switching	<50ms	<50ms	<50 ms
Availability	5 nines	5 nines	5 nines
MTTR	4 hours	4 hours	4 hours

Extreme Networks OAM Stack
Proactive SLA Monitoring



Edge-edge Performance measurement
Frame Loss, Delay, Jitter, Throughput
Use CCMs with addl TLVs

Edge-edge Connection Management
CCM, LBM, LTR

Point-to-Point Link Management
LFM, RFI, RLB

802.3ah Link Level OAM

802.3ah

- Discovery of OAM between Devices
- Link Monitoring
- Remote Fault Indication
- Remote LoopBack
- Last Dying Gasp
- Critical Event Notification

802.1ag Connectivity Fault Mgmt

802.1ag

- Continuity Check Messages
- MAC Ping
- MAC Trace Route
- Multiple Administrative Domain

Y.1731 Ethernet Service and Performance Monitoring

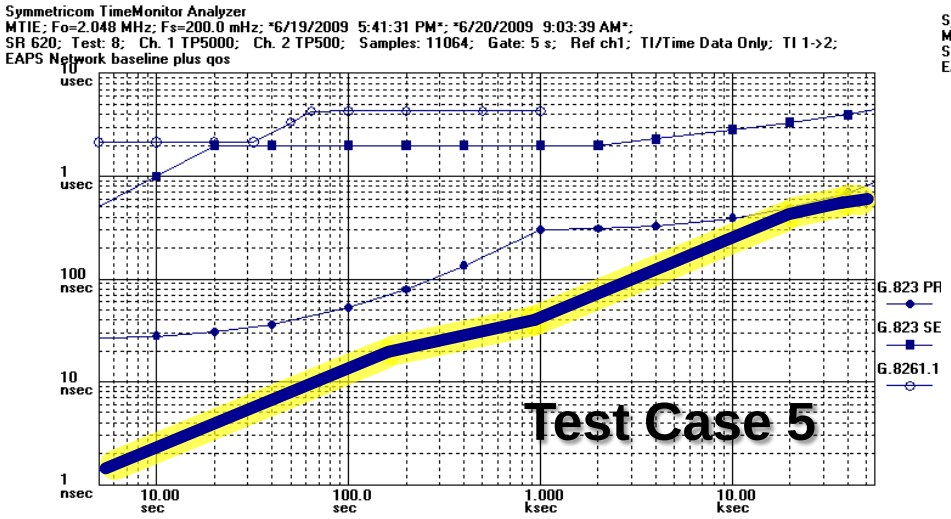
Y.1731

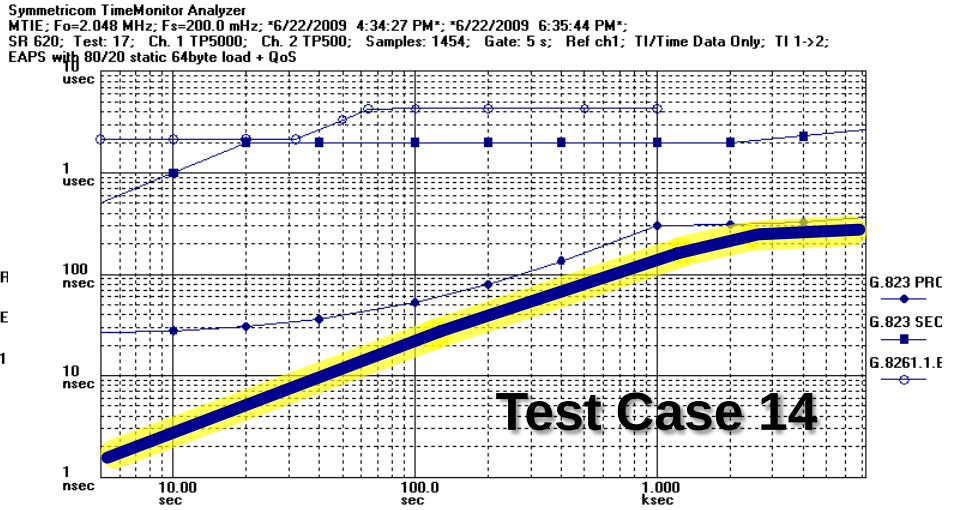
- Fault Management
- Diagnostics
- Performance Monitoring
- Loss/Jitter/Delay Measurements
- AIS/RDI notification

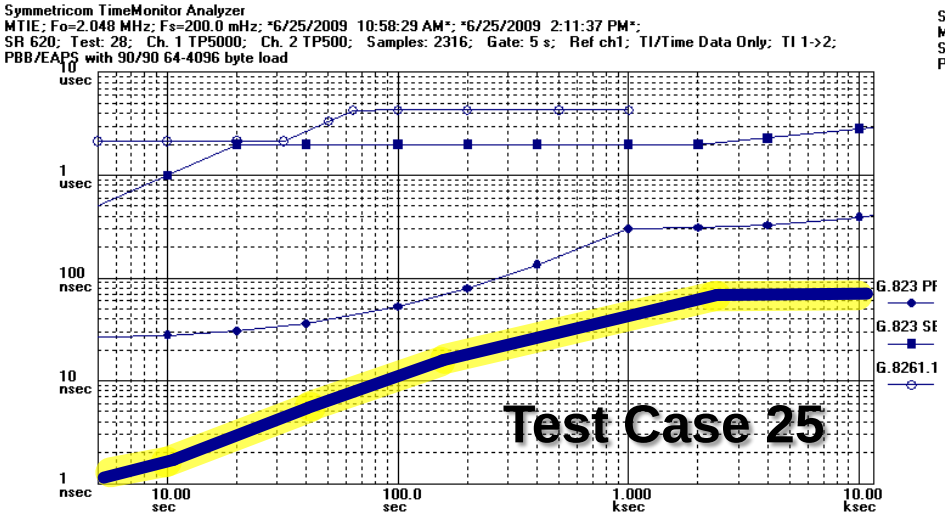
Clock Distribution to the Base Station

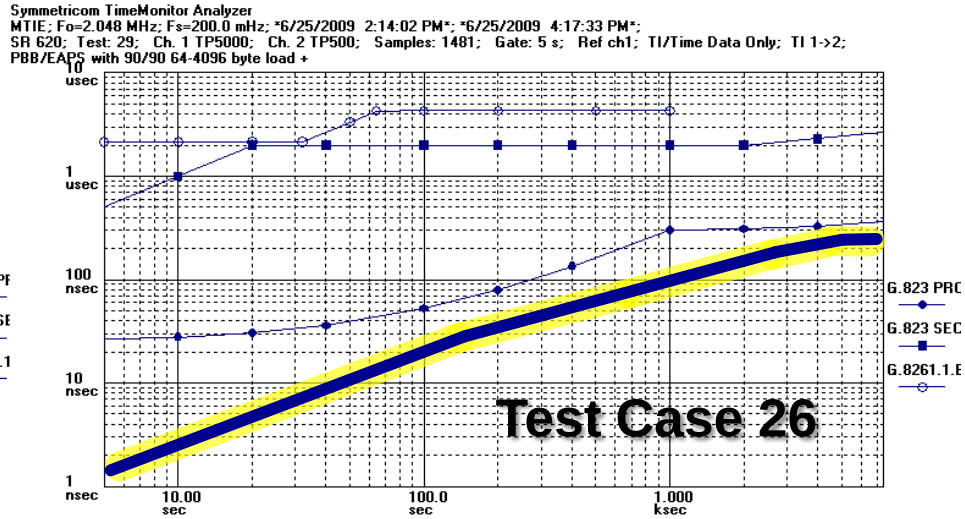
- Ethernet by design does not have any clock distribution mechanism
- IEEE 1588v2 or Precision Timing Protocol (PTP) has evolved as the standard for encoding clock information from a standard GPS source (at the Mobile Switching Center)
- The Extreme Networks® Carrier Ethernet infrastructure then carries the clock as timestamps in 1588 packets to the cell sites where it is decoded and used to synchronize the base stations

Eight HOP Ethernet Network
MTIE Consistently below G.823 PRC









Shows excellent clock stability at all times even on PTP re-route

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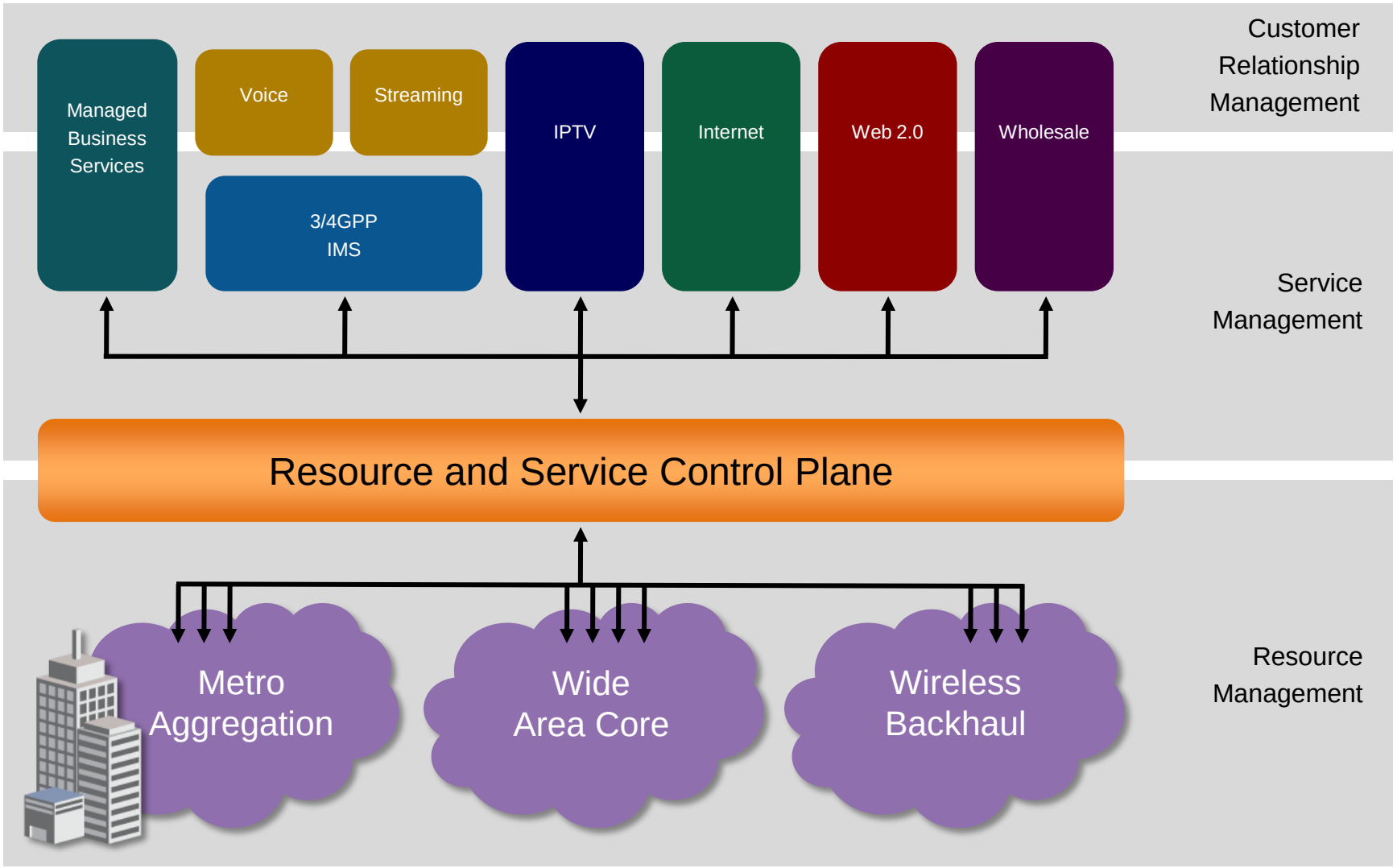
Resource and Service Management
Multi-Vendor/Multi-Technology Management



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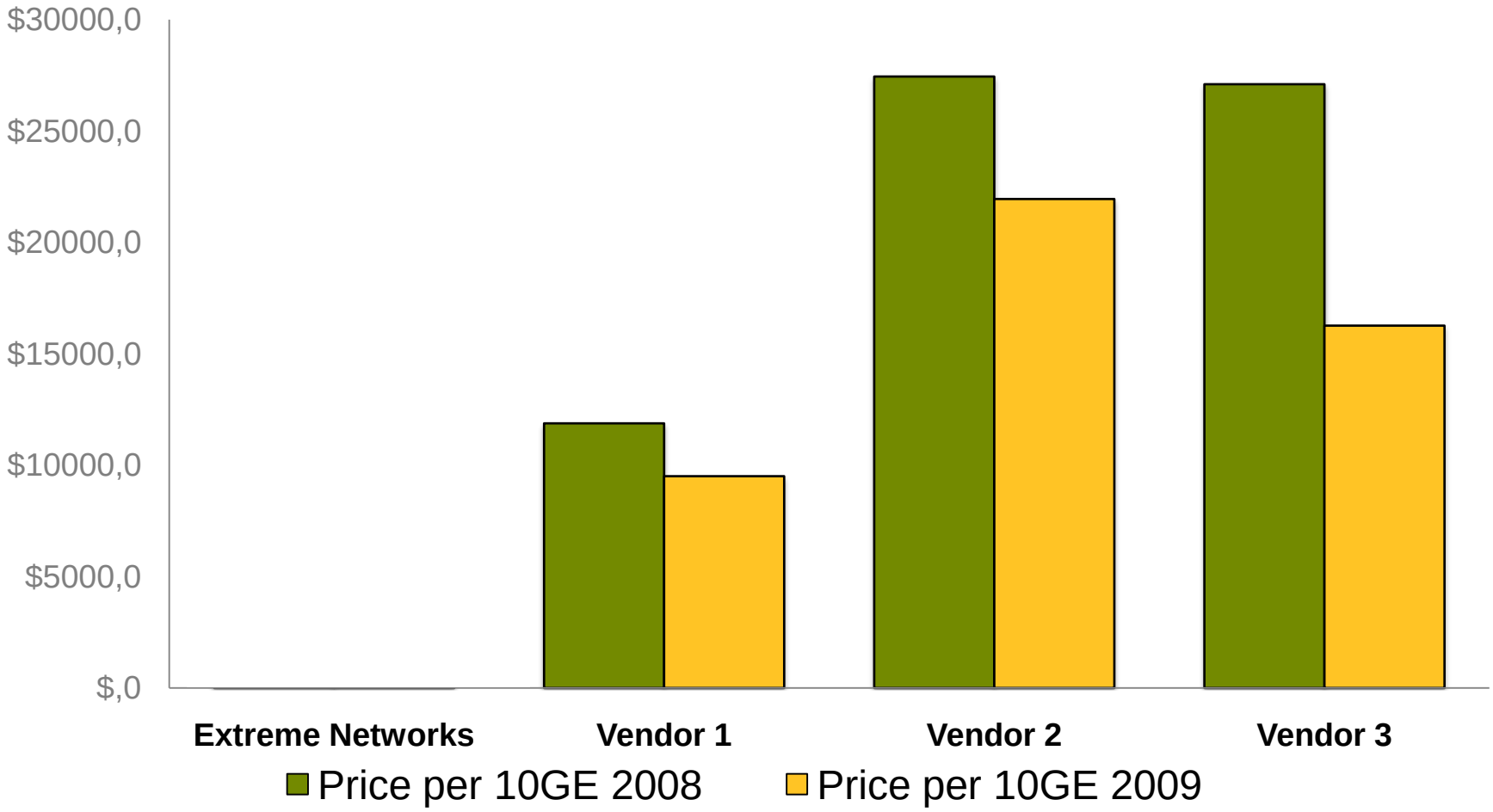
Price per Port

Extreme Networks® Price Points: ½ of where the industry is today.
Ethernet Optimized Silicon and Ultra Dense Chip Geometry



Driving Industry Leadership in 3 Dimensions…

Fewer Boxes ➡ Lower CAPEX

Density/ Chassis

Price per Port

Simpler Deployment ➡ Lower OPEX

Switch at Ethernet Layer, Multi-Vendor Multi-Technology Provisioning Tool

Reduced Service Cost

Reduced Installation Cost

Reduced Skill Set

Reduced MTTR

More Services per User per Box ➡ Higher ARPU

MACs, IP Hosts

Increase Users/Port

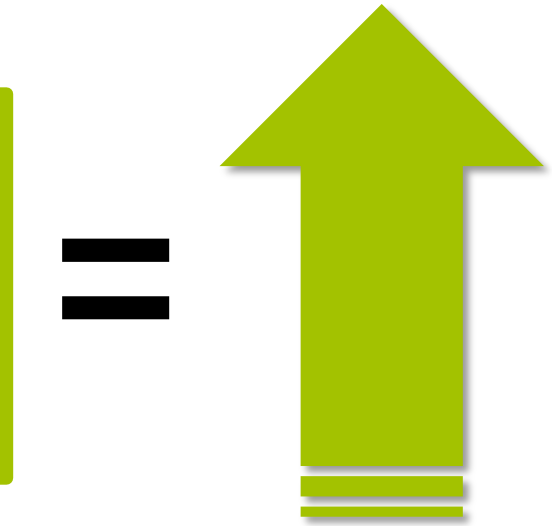
VLANs, Queues

Increase Services/User

The Formula for Success

Carrier Profit = **ARPU**

Average Revenue Per User



− **CAPEX**

OPEX

Service Providers' PROFITABILITY

Everything Else is Secondary

Forward-looking Statements

- This presentation contains forward-looking statements that involve risks and uncertainties, including statements regarding our expectations as to products, trends and our performance. There can be no assurances that any forward-looking statements will be achieved, and actual results could differ materially from forecasts and estimates. For factors that may affect our business and financial results please refer to our filings with the Securities and Exchange Commission, including, without limitation, under the captions: “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and “Risk Factors,” which is on file with the Securities and Exchange Commission (http://www.sec.gov). We undertake no obligation to update the forward-looking information in this release.

Thank You

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