



# Cisco PONC 2015

Packet-Optimized Transport: Market Analysis

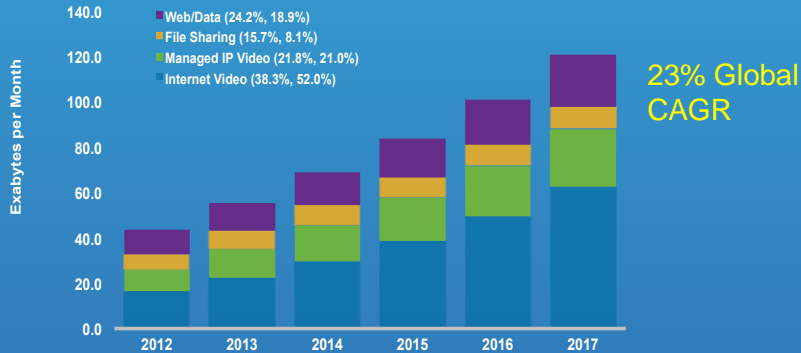
JR Due  
Systems Engineering Manager SP Sales

Mar 2015

- Market Trends
- Defining P-OTS
- Packet-Optimized Transport
- Market Outlook for P-OTS

# Industry Trends

## Significant Traffic Growth, Driven by Video



## Emergence of M2M and Internet of Everything

**50 Billion**  
Connected Things  
by 2020

Connected Things  
**Growing 5X**  
Faster than  
Mobile Devices



More than **22%** of all networked events will be  
**Machine Driven by 2017**

## Technological Inflections

Virtualized Software



4K Video



LTE



Cloud-based NFV + SDN



## Industry Consolidation



- 100 years ago, the cost of a 3-minute New York → San Francisco phone call?

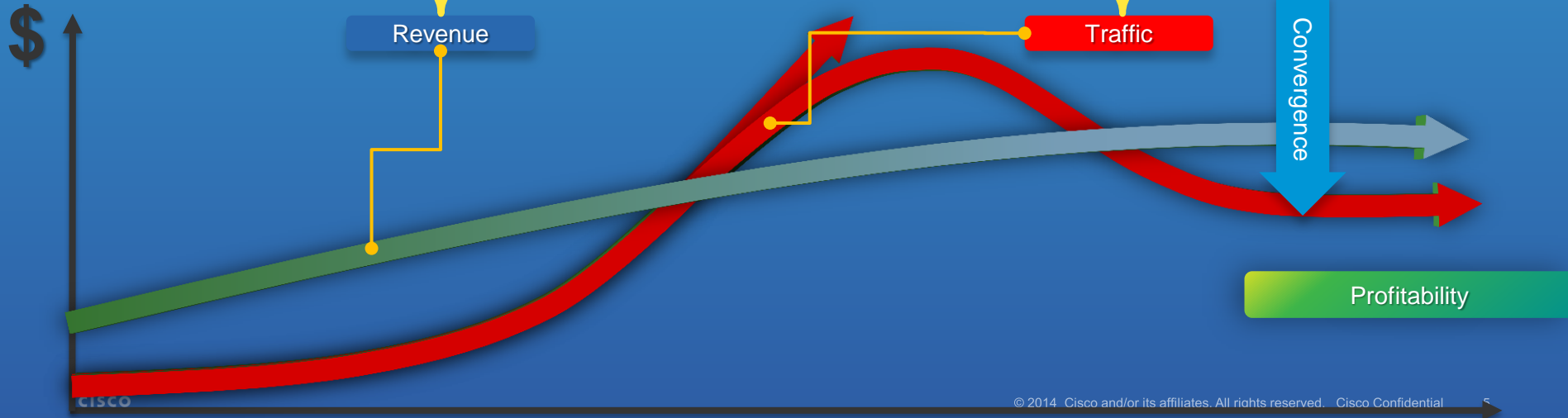
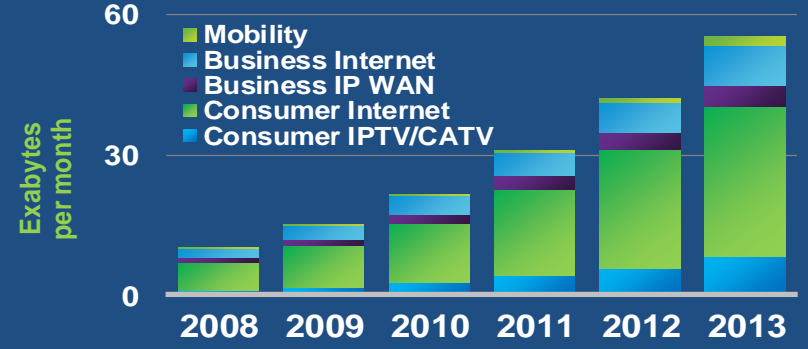
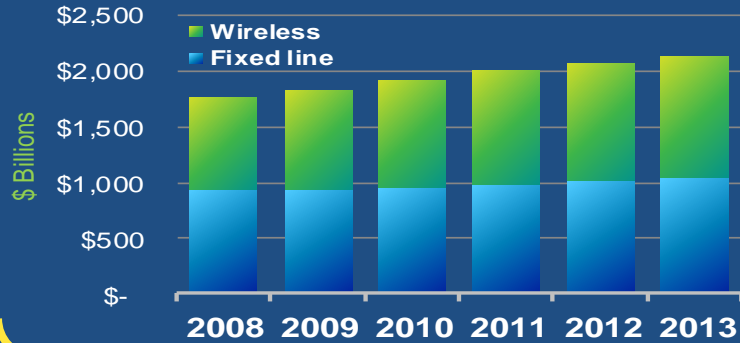
**350 euros / US\$440** (inflation adjusted)

- Innovation

- Definition: Cheaper, better, or both
- Mervin Kelly
- Bell Labs (1918–1959)



# Challenge of Shifting Environment



# Optical WAN Capacity Deployed

- Optical components are a good way to measure deployed telecom capacity

Graph shows total transmission capacity of long reach optical modules shipped in a given year

Total 10G modules shipped x 10

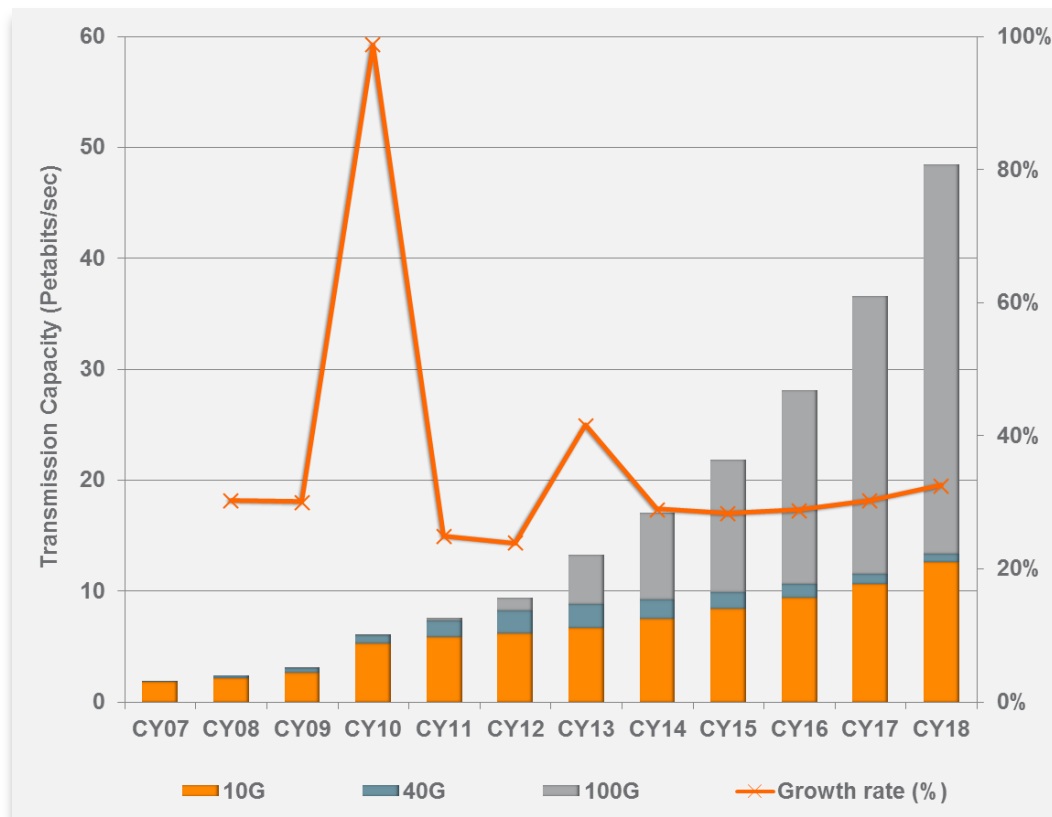
Total 40G modules shipped x 40

Total 100G modules shipped x 100

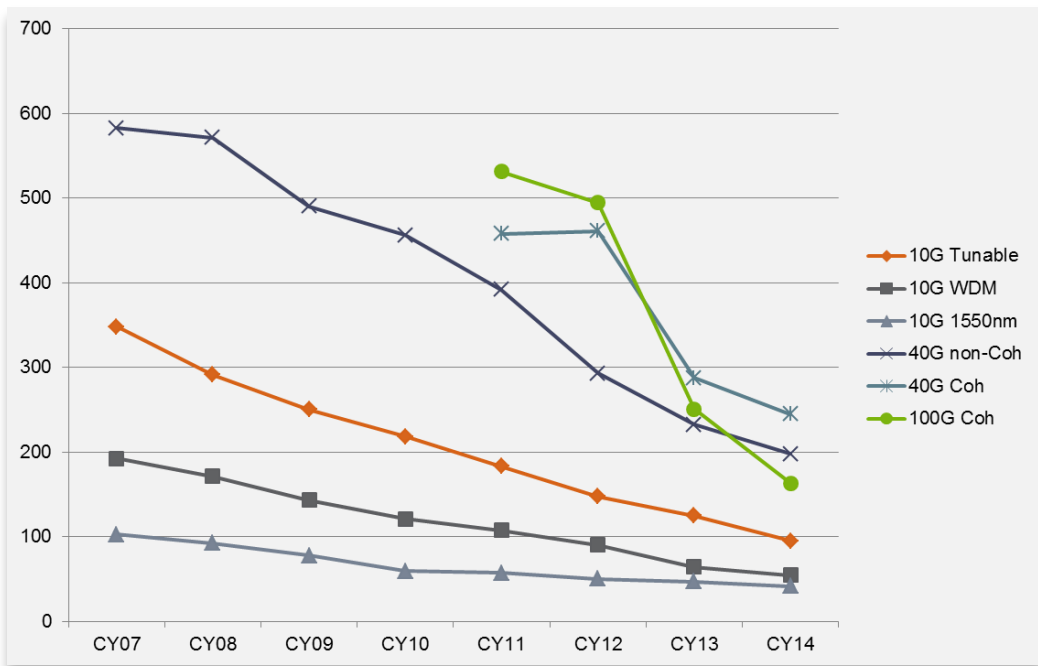
Includes in-house builds, MSAs and pluggables

- 30% year over year growth

Implies bandwidth growth is slightly less once installed base is factored in



# Historical Transceiver Cost \$/Gbs



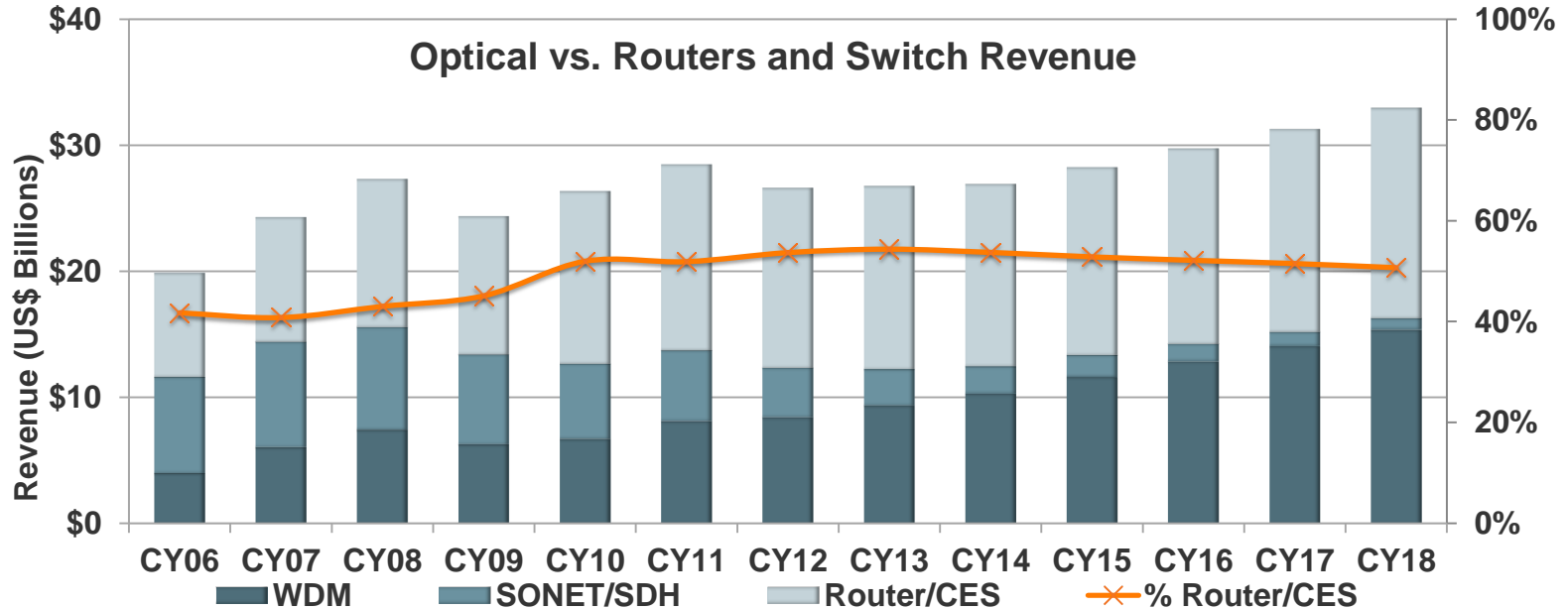
Source: Infonetics Research, May 2014  
10G/40G/100G Optical Transceivers Market Size & Forecasts

Component cost/bit follows predictable paths once a market matures.

100G Coherent data is early & limited sample size due to 85% of volume built in house by NEMs

CY07 to CY14 CAGR	
10G Tunable	-17%
10G Fixed WDM	-16%
10G Wideband	-12%
40G non-Coherent	-14%
40G Coherent	-19%
100G Coherent	-33%

# Router vs Packet-Optical



- Contrary to popular belief, routers are not taking over the world
- SONET/SDH → Routers and P-OTS at the metro/edge
- SONET/SDH → WDM/OTN switching in the regional/core



- Market Trends
- **Defining P-OTS**
- Packet-Optimized Transport
- Market Outlook for P-OTS

# P-OTS market defined

- Infonetics surveyed service providers for several years now to better understand how they define packet-optical transport systems
- *May 2014 survey of shows that 86% of respondents think this is a good definition*

Metro Edge P-OTS	Metro Regional P-OTS
Platforms with support for card level Ethernet switching and optical networking features including OTN transport and WDM	Platforms with support for non-blocking chassis level Ethernet switching and circuit switching (SONET/SDH and/or OTN);
Must support optical restoration and L2 restoration via G.8031/2	
Connection oriented Ethernet (COE) support (e.g., MPLS-TP, PBB-TE, T-MPLS, switched VLANs) with a complete suite of carrier grade layer 2 per flow classification, service differentiation, traffic management, and verification (Y.1731)	
Support for in-skin WDM, no ROADM support required	WDM and ROADM at a system level with a single control plane

# P-OTS market defined

Vendor	Metro edge P-OTS	Metro regional P-OTS
Alcatel-Lucent	1850 TSS	
BTI Systems	7000 series	7800, 8000 series
Ciena	6500 w/eMOTR	5430
Cisco	NCS2000	NCS4000 + NCS2000
Coriant		7100 OTS (Tellabs), mTera
Cyan	Z series (Z33 and Z77)	
ECI	NPT	Apollo OPT
Ericsson	SPO1410	SPO 1460
Fujitsu	FLASHWAVE 4100ES/9100	FLASHWAVE 9500
Hitachi		AMN6400
Huawei	OSN 1800 II/V	OSN 1800V, 8800, 9800
Infinera		DTN-X (future)
NEC		SpectralWave DW7000
Padtec		Packetpad
Transmode	TM-Series	
ZTE	ZXMP M721	ZXONE 9700

## • Metro edge P-OTS

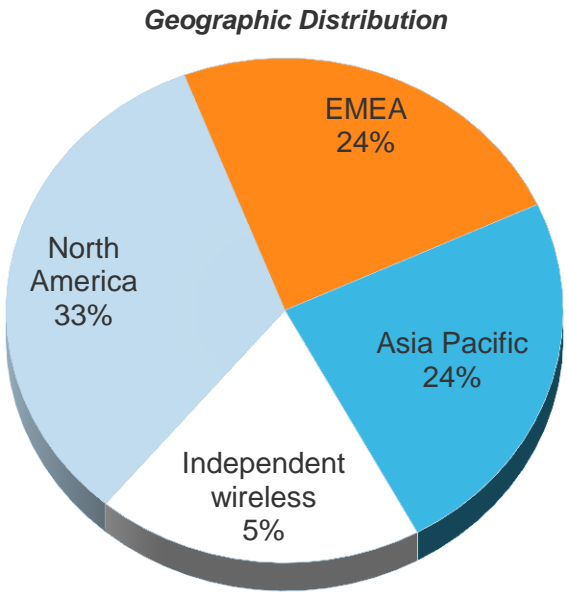
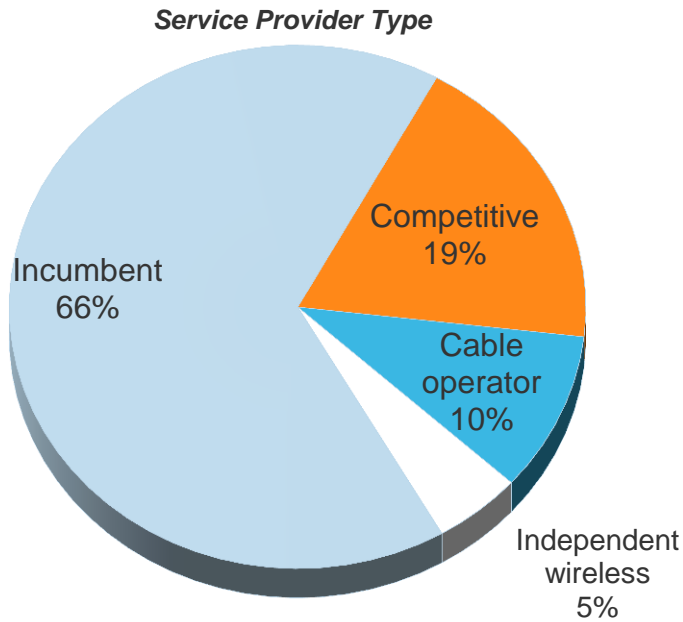
- Ethernet switching and optical networking, including OTN transport and WDM
- Must support optical and L2 restoration and connection oriented Ethernet (COE) protocols with a deep set of carrier grade per-flow features

## • Metro regional P-OTS

- Ethernet switching and circuit switching across the chassis, with COE protocols similar to metro edge P-OTS
- WDM and ROADM support at a system level with a single control plane is required

# Infonetics service provider surveys

21 Respondents to our May 2014 Questionnaire

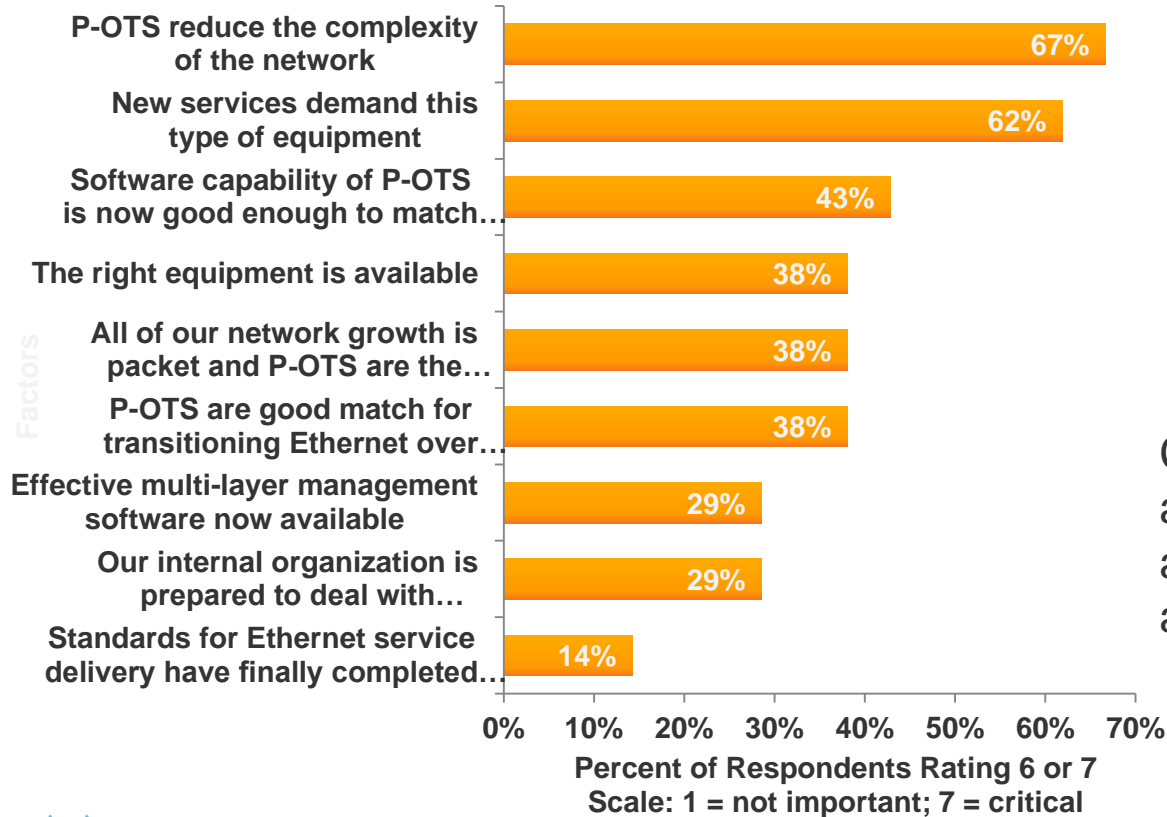


Respondents represented 24% of global capex and 20% of service provider revenue



# How service providers view the market

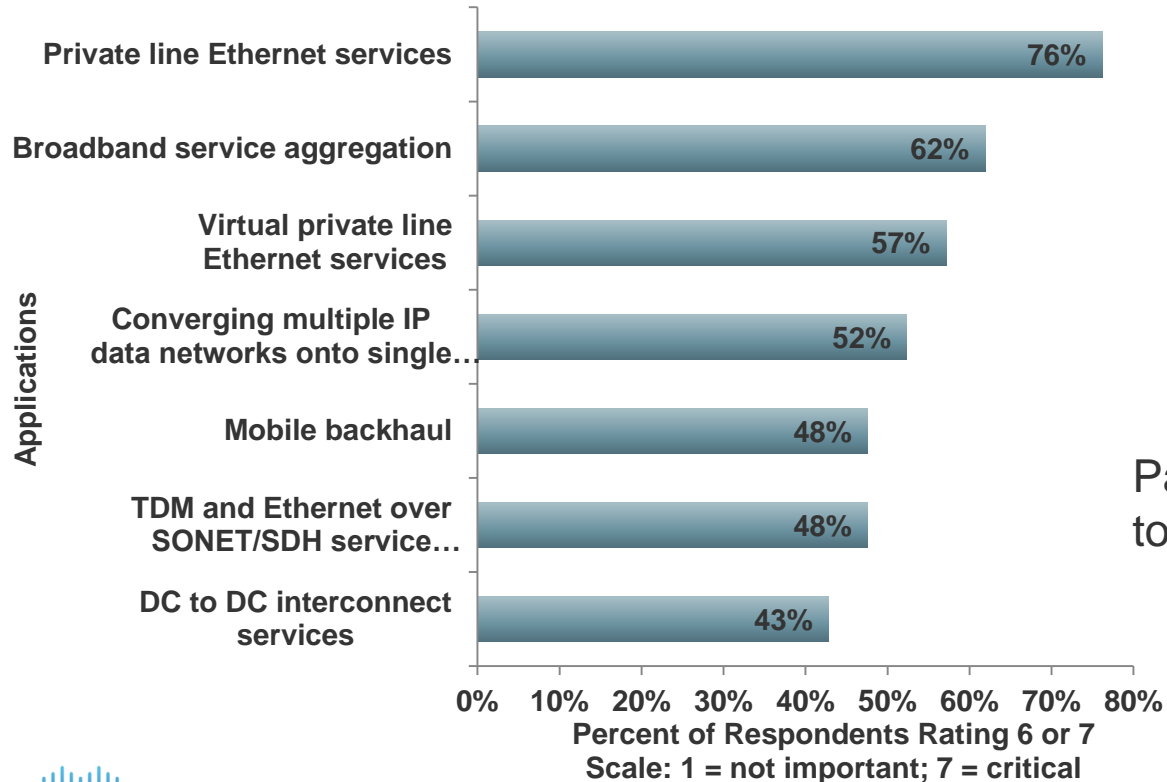
## Decision Factors for P-OTS Today



Converged equipment is seen as reducing network complexity and meeting new service and application requirements

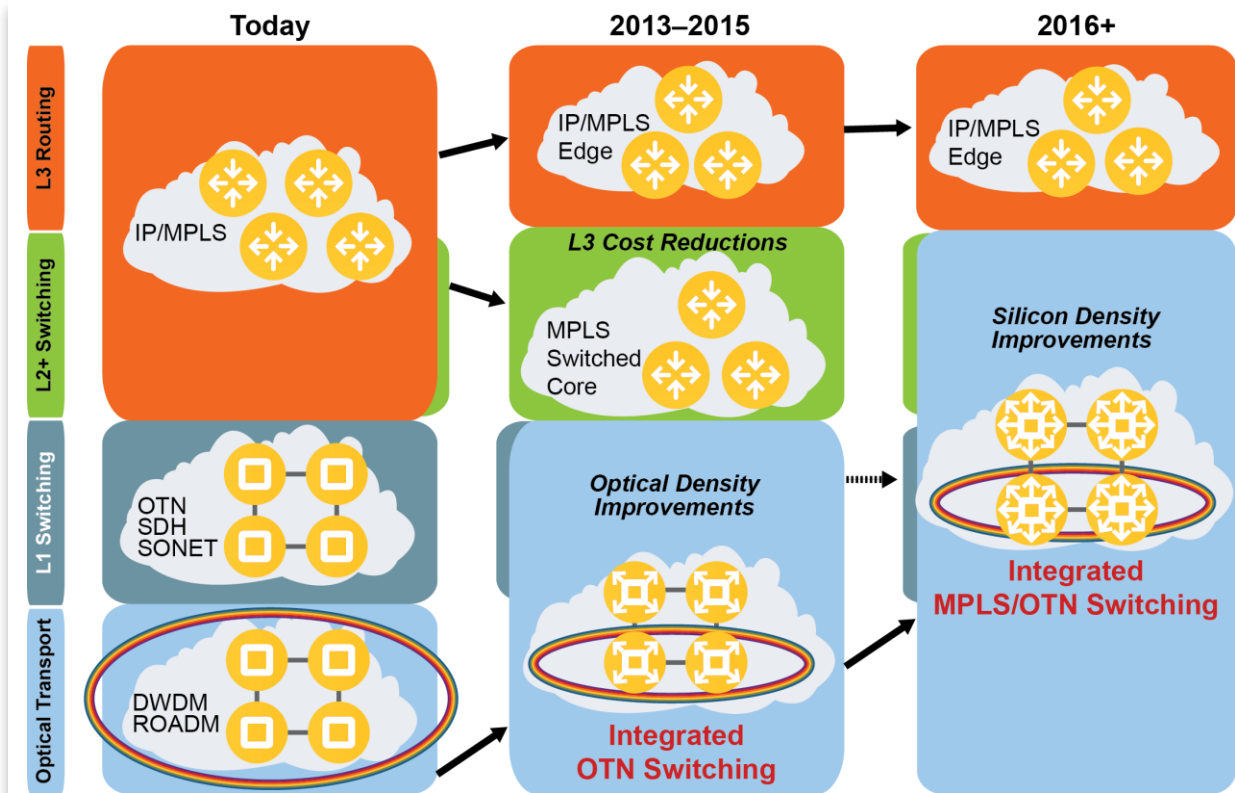
# Packet-Optical market drivers

## Important Applications for Service Provider Packet-Optical Decisions



Packet-Optical viewed as a way to extend circuits into layer-2

# Roadmap to multi-layer hardware



- ▶ Full Ethernet/MPLS switching integration on the horizon
- ▶ Carriers adoption just beginning
  - VZ Metro P-OTP RFP was a trailblazer
- ▶ Equipment should begin appearing in 2015

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# Solving the Challenge

Evolution

Revolution

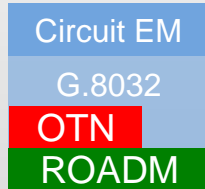


## TDM+OTN



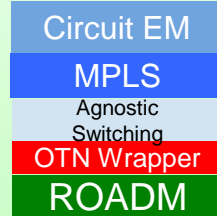
- No Packet
- TDM Poor Fit to OTN
- TDM not Merchant
- Large Footprint
- OTN Fabric cannot scale
- Network is Throw Away

## P-OTS



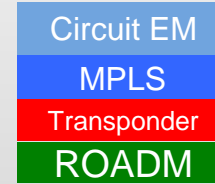
- ✓ 100% Merchant Silicon
- ✓ PDH-CEM over Packet
- ✓ Ethernet over G.8032
- VLANs cannot scale to match 10K's circuits
- OTN Fabric cannot scale

## Packet-Optimized Transport



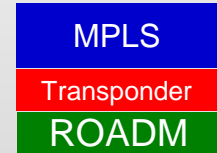
- ✓ 100% Packet & Agnostic
- ✓ 100% Merchant Silicon
- ✓ PDH-CEM over Packet
- ✓ TDM-CEM over MPLS
- ✓ Ethernet over MPLS
- ✓ Fabric Scale to 100Tb+
- ✓ Evolves to 100% Ethernet

## MetroE



- ✓ PDH-CEM over MPLS
- ✓ TDM-CEM over MPLS
- ✓ Ethernet over MPLS
- ✓ Fabric Scale to 100Tb+
- Transponder \$\$ & Space
- Not Carrier Class-Router

## Ethernet Fabric



- All Clients Ethernet
- ✓ Ethernet over MPLS
- ✓ 100% Merchant Silicon
- Transponder \$\$ & Space
- DC Fabric = More Transport
- Not Carrier Class-Router

# Packet-Optimized Transport vs Routing

## NCS 4000 Series

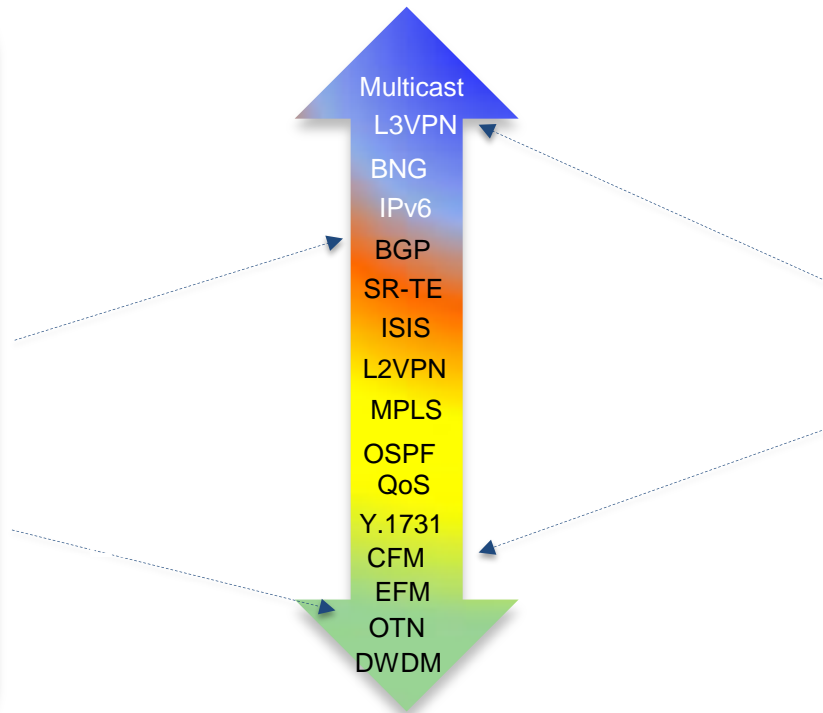


- IPv4 / IPv6 / MPLS Forwarding
- Bridging
- L2VPN (VPWS/VPLS)
- OTN/DWDM
- Legacy TDM
- Transport Opex Model
- Hard Carrier Class

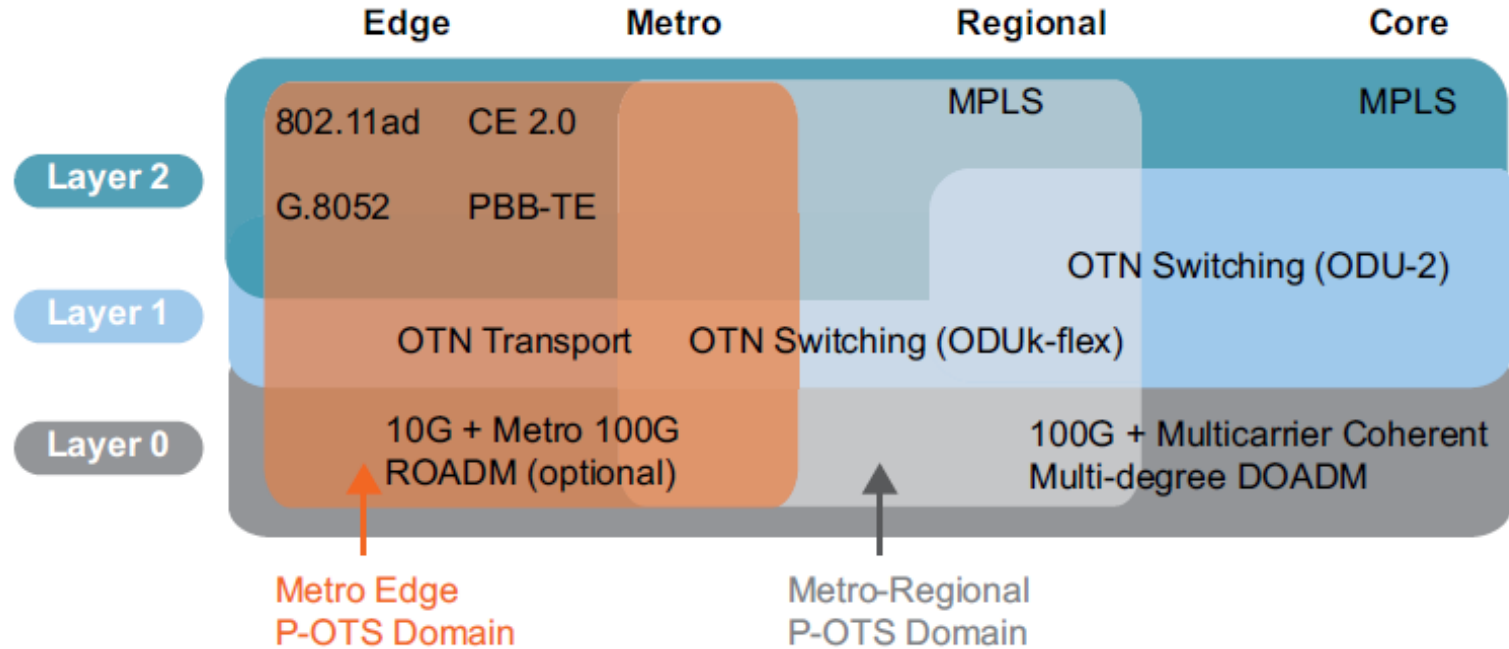
## ASR 9000 Series



- MPLS, Bridging
- Subscriber Management (BNG)
- Full L3VPN Provider Edge
- Full Internet Table Routing
- Router Opex Model
- Service Edge
- L3 Scale



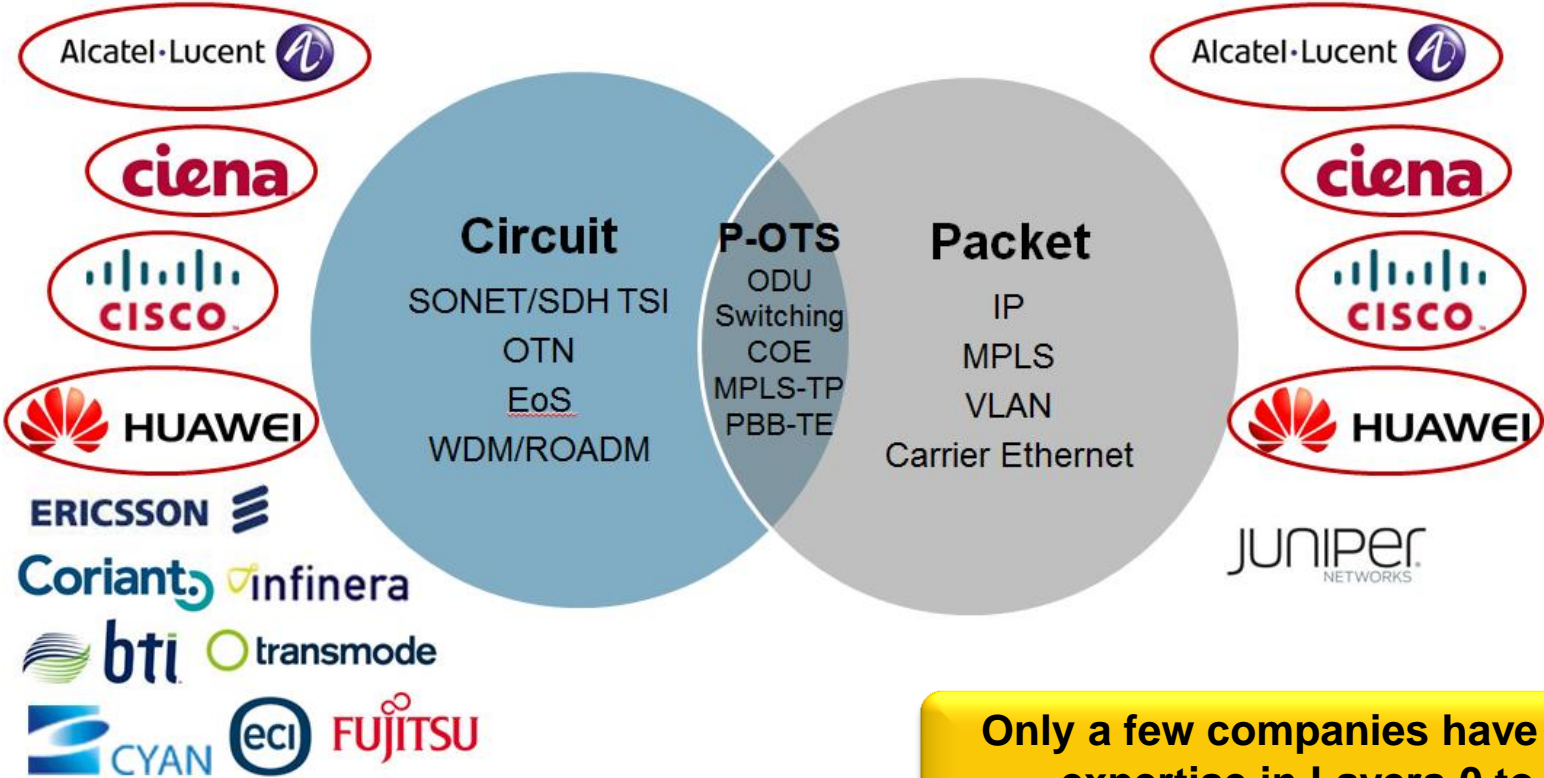
# OTN not enough in the future as L2 becomes required



**Integration of OTN + Layer 2 from edge to core without technical or business compromise is the endgame**

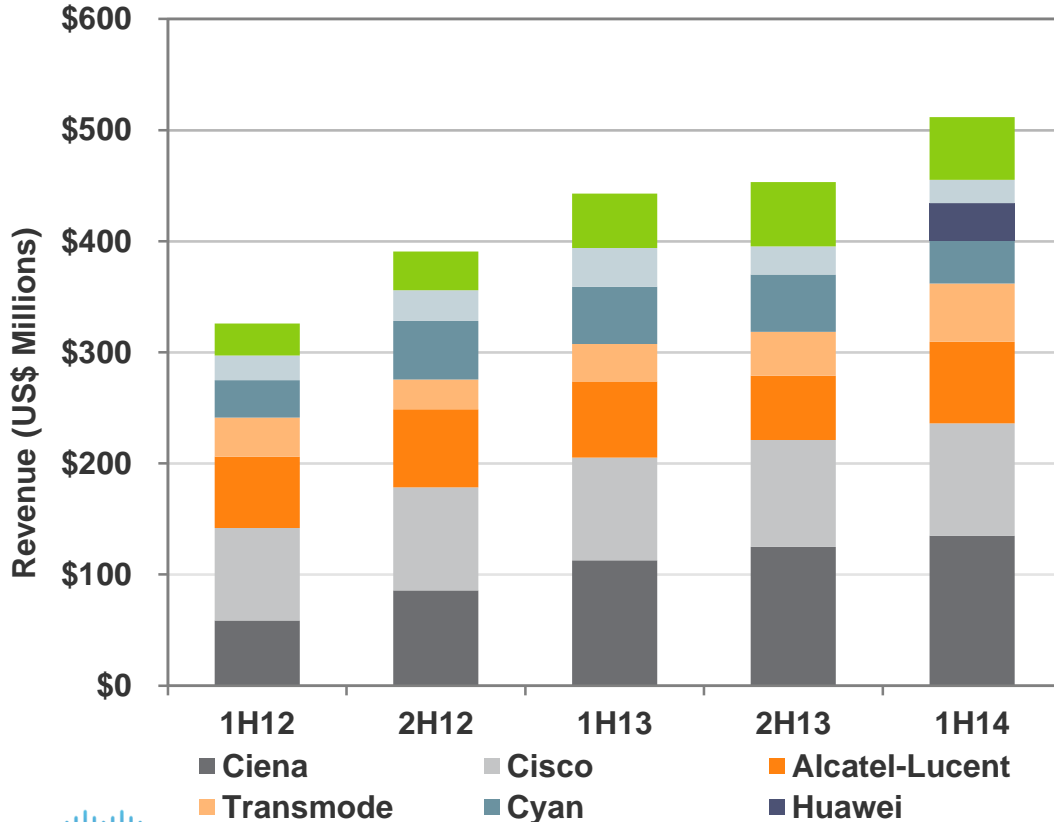
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# Bell Heads vs. the Net Heads



**Only a few companies have deep expertise in Layers 0 to 3**

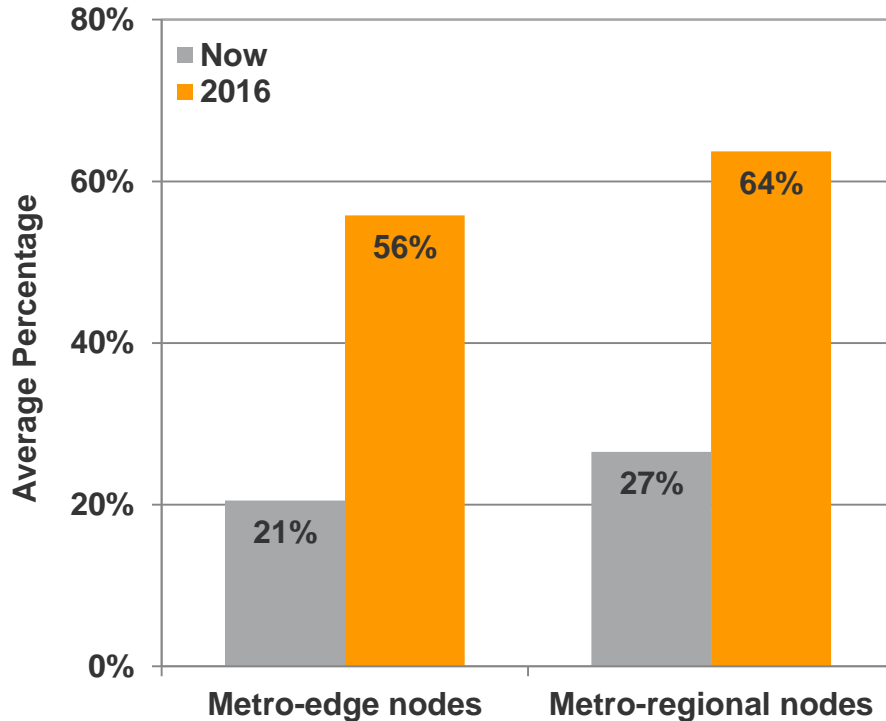
# P-OTS metro-edge market share



- Cisco NCS2000 remains a market force
- Ciena making headway with 6500 L2 blades
- Alcatel-Lucent 1850 popular for wireless backhaul
- Fujitsu 4100ES used in North America for wireless backhaul
- Transmode, BTI, Huawei all have material revenue bundled in other

# Expectations for P-OTS deployment

## *What is node penetration today and what will it be in 2016?*



- Estimate the percentage of nodes using P-OTS today and in 2016
- Service providers on average plan to more than double usage of P-OTS equipment by 2016

- ✓ Cisco is a market force in Traditional P-OTS with the NCS2000
- ✓ Now is the time for Network Transformation
- ✓ No Opex Explosion
- ✓ Programmable MPLS Transport required
- ✓ Cisco's NCS4000 with FlexLSP provides a No-Compromise Packet Optimized Architecture





**CISCO**

*TOMORROW starts here.*