100G Overview and Outlook

Driving business value through collaborative intelligence

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Agenda

- Where are we?
- Lessons from 40G and 10G
- Outlook

If I had a € for every time a service provider said…

“I’d deploy 100G today if I had it.”

…I’d be richer, if no less skeptical.

What will drive deployment pace?

- **A**vailability
- Economics
  - Alternatives; e.g., light a 10G λ or do a network overbuild
  - Timeframe and scope of business case calculation vs. capex available
- **I**nvestment and **I**nnovation, for an end-to-end solution
  - Standards, e.g. for client and line optics
  - Merchant and captive chips, modules/MSAs
- **O**utlook
  - Traffic growth, revenue growth, macroeconomic indicators, …
- **U**gliness (size, power) vs. the desire for **U**biquity (operationalizing)
- (sometimes) **Y**ou just gotta do it

100G timeline: From "heroes to hype"...

2007
R&D

- **Verizon** tested **Alcatel-Lucent** 100G with **live** traffic (**504km**) network Tampa – Miami, FL

2008
Demos

- **Ciena** demo'd 100G OTN at SC08
- **AT&T** and **NEC** demo'd 61 wavelengths @ 114Gbps each
- **Verizon** tested **NSN** 100G over **1040km** distance
- **Comcast** tested **Nortel** 100G **prototype** – **300km** span of **live** network
- **VZ** tested **Nortel** 100G on **high PMD fiber**
- **OpVista** demo'd 100G using proprietary DMC technology
- **Huawei** announced 100G prototype

2009
Trials & first products

- **Ciena** and **NYSE Euronext** announced **2010 deployment** of 100G
- **Neos Networks** tested **Nortel** 100G in **live** network trial
- **Banverket ICT** completed **live** trial of **Nortel** 100G
- **DT** and **Ericsson** completed 100G **field** trial
- **Juniper** announced **100GE interface** for T1600 router
- **Alcatel-Lucent** announced **100G interfaces** for 7750 SR, 7450 ES, and 1625 LamdaXtreme
- **Qwest** announced **2010 deployment** of **ALU** 100G network
- **Adva** demo'd DPSK-3ASK 100G modulation format

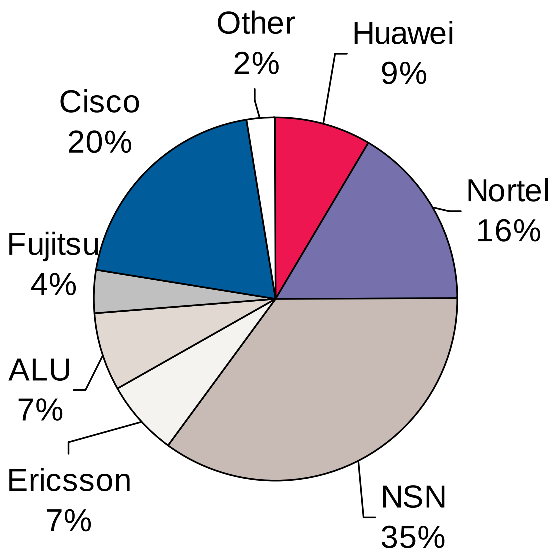
2010
Standards, Early adopters

- **IEEE 100GE standard approval** in June 2010
- **NYSE Euronext deployment**
- **Qwest** network-wide **deployment**

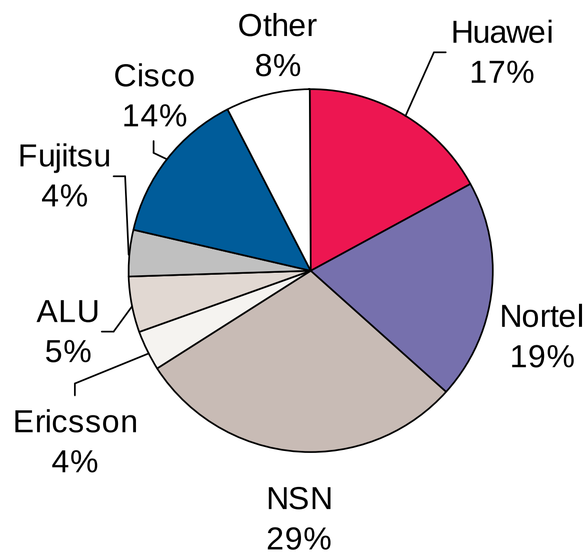
...with lots of "heavy lifting" along the way

40G: Moving to general deployment, resilient to global recession

2008 market: 5009 ports



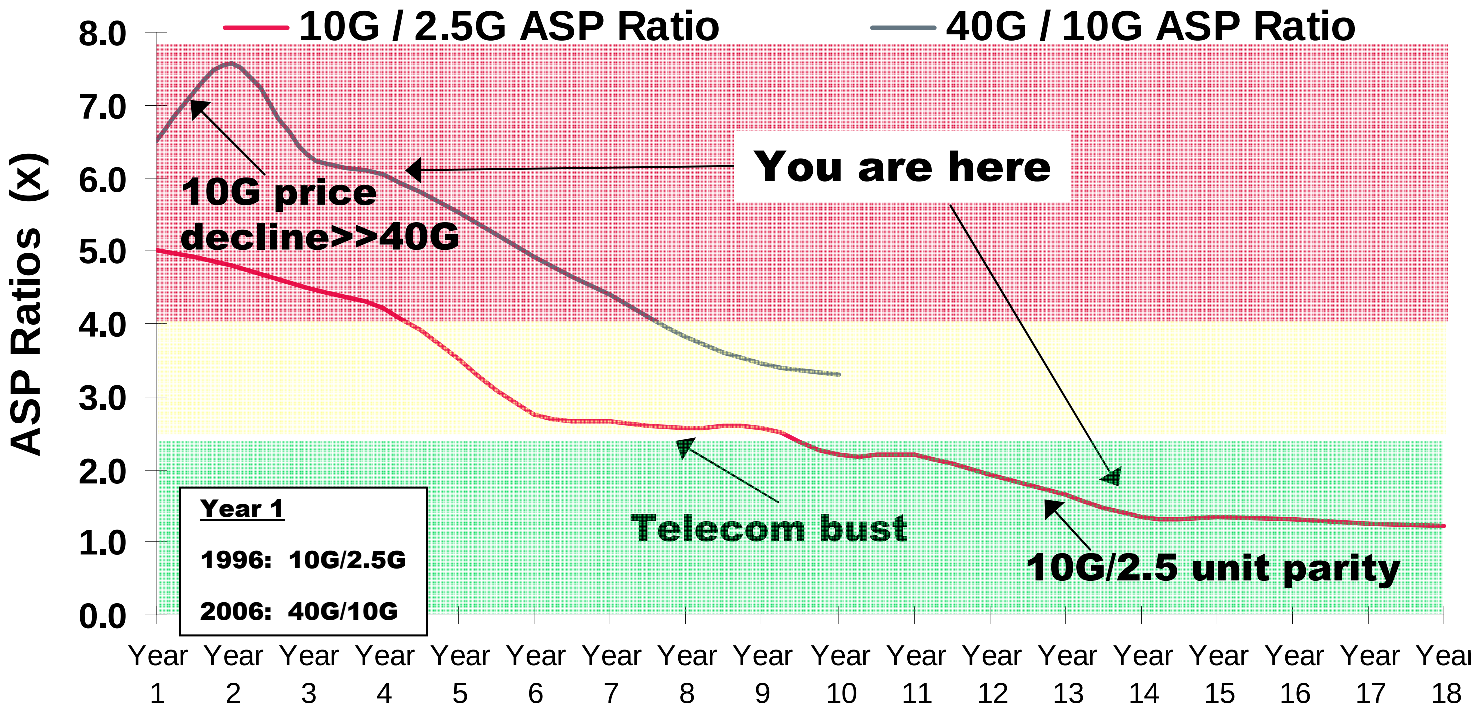
3Q08-2Q09: 7305 ports



Source: Ovum
Includes transport ports and some router ports, short and long reach.
“Other” vendors include ECI, FiberHome, NEC, Tellabs, Vello (Opvista), Xtera, and ZTE.
Juniper is not included, but has shipped 40G

NSN continues to lead in ports deployed; Huawei coming on strong

The bottom line comparison: Transponder ASP ratios



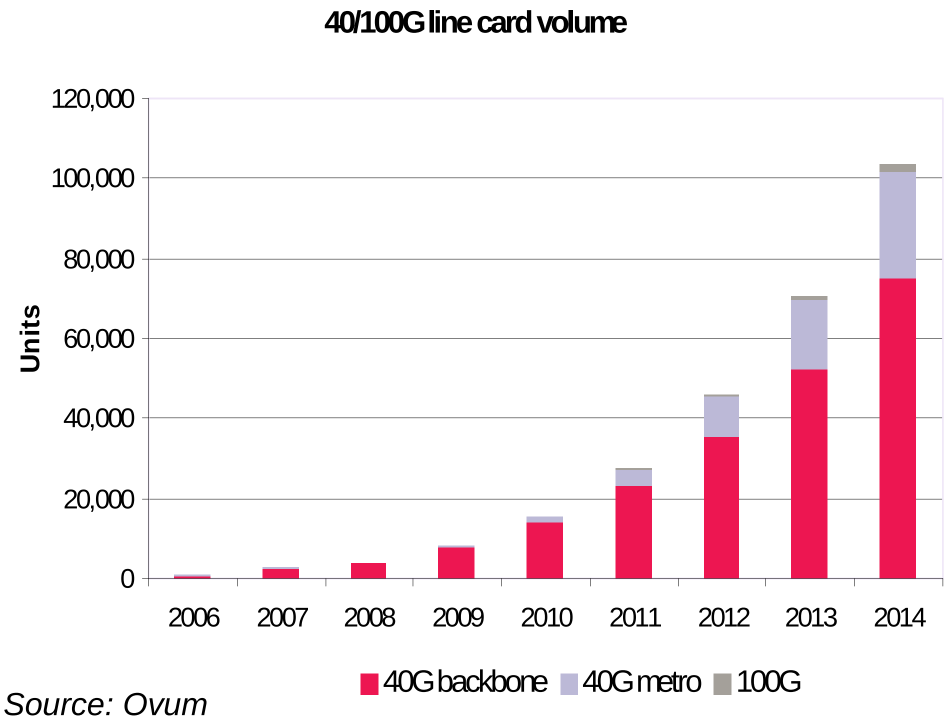
Source: Ovum
ASP = Average Sales Price

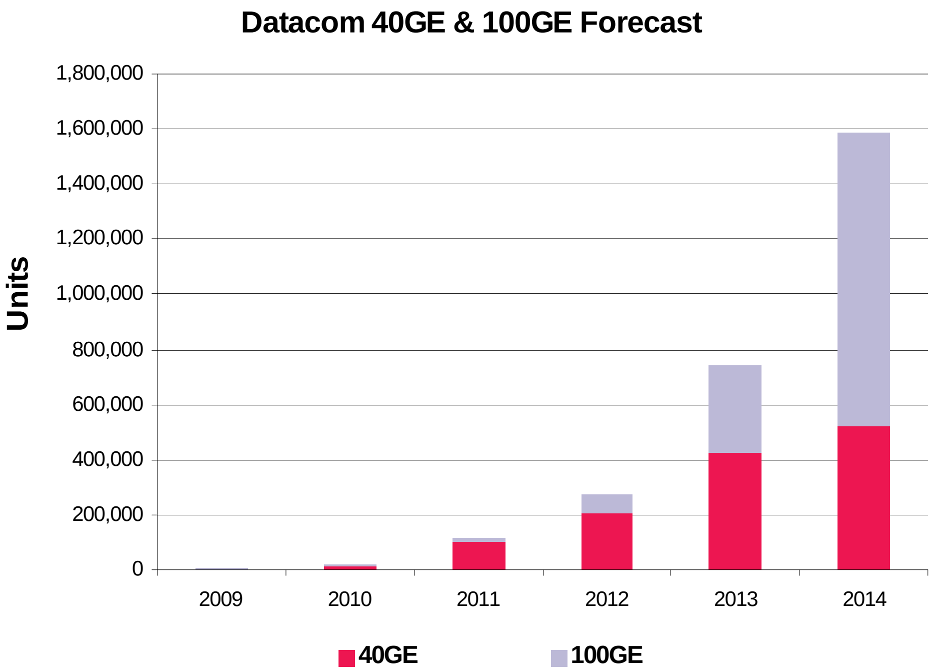
- Red zone: Heroes, hype, haggling, and headway
- Yellow zone: Economics move in favor of higher-capacity signal
- Green means go: Volume parity is likely to happen.
- Too early to graph 100G curve, but highly likely to improve on 40G's timeline
  - WDM transponders will benefit from datacom's use of 40GE/100GE

Global 40/100G volume forecast

DWDM WAN transponder cards: CAGR (2008-2014) = 72%

Ethernet transceivers: CAGR (2009-2014) = 240%





Source: Ovum

Notes: Figure on left is strictly ON systems transponders, does not included router SR or transponder sales.
Figure on right is Ethernet transceivers for datacom (aka short reach) applications.
MSA is multi-source agreement; IA is implementation agreement

Volume will be critical to lower price; standards, MSAs, IAs will all help
WAN prices/volumes should benefit from IEEE/ITU spec coordination

100G outlook and 10G/40G lessons learned

- Overall market health (or lack of health) can drastically affect the pace of innovation and deployments
  - Venture capital firms' telecoms investment trend is worrying
  - More technology options aren't necessarily better
- First to market doesn't guarantee market leadership, volume does
- Components can and will be critical path
- Operationalizing a technology can take years
- Product flexibility is critical, e.g. mixing waves in a shelf, in a span
- 100G *interest* is clear, but deployments will depend— a lot— on comparative port ASPs
- Datacom is the volume market for 100GE and 40GE through 2014

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THANK YOU

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