Broad Market Potential for 200GbE

John D'Ambrosia, Futurewei, subsidiary of Huawei

Scott Kipp, Brocade

Supporters

- David Ofelt, Juniper
- Chris Cole, Finisar
- Peter Stassar, Huawei
- Steve Trowbridge, Alcatel-Lucent
- Pete Anslow, Ciena
- Mark Gustlin, Xilinx
- Thananya Baldwin, Ixia
- Rich Mellitz, Intel
- Ali Ghiasi, Ghiasi Quantum
- Jacky Chang, HPE
- Tongtong Wang, Huawei
- Mike Dudek, Qlogic
- Jon Lewis, Dell
- Dave Chalupsky, Intel
- Vasu Parthasarathy, Broadcom
- Kent Lusted, Intel

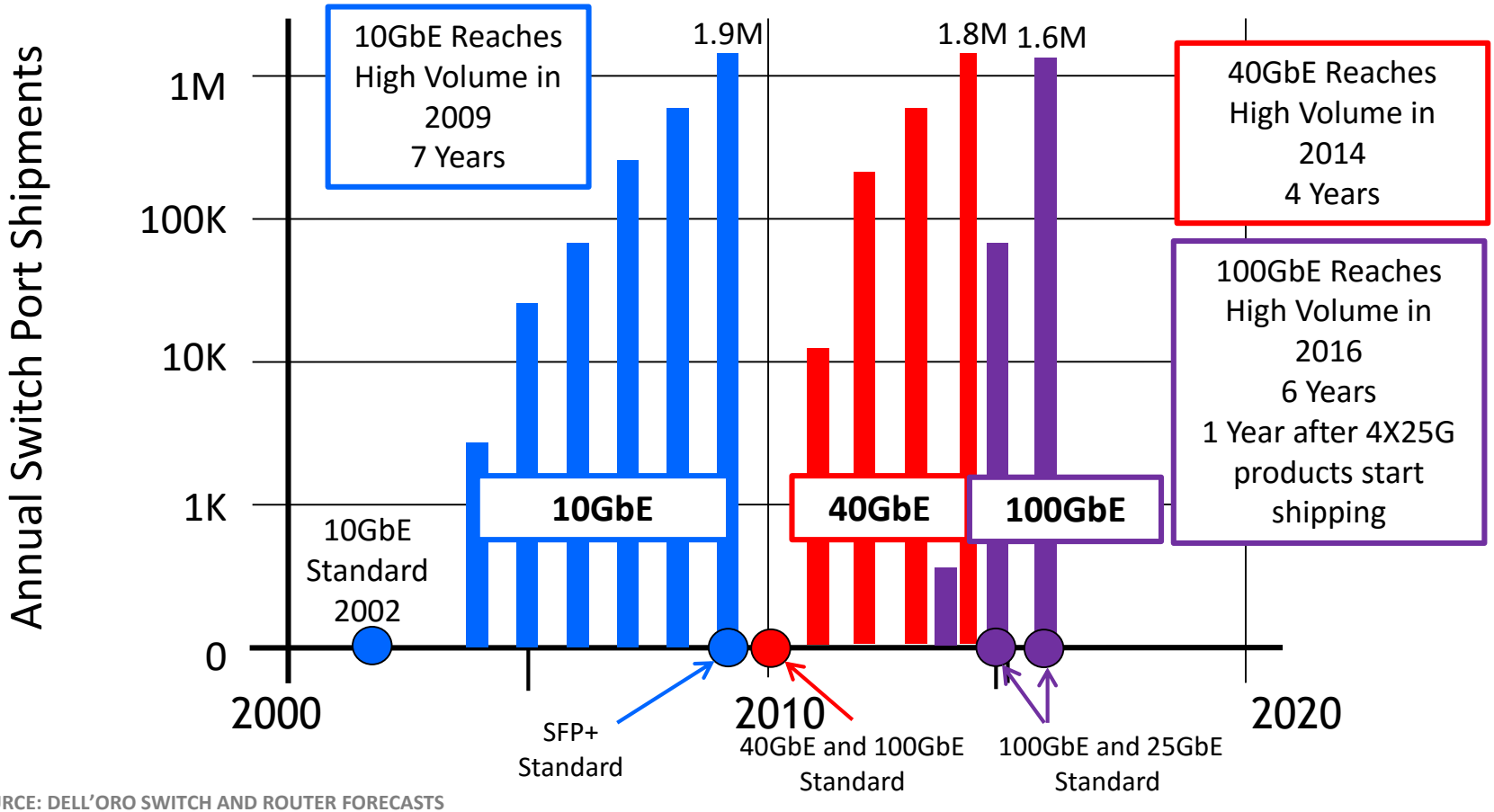
The Case for 200GbE

- Historical Perspective of Transition from 10 GbE
- Historical Success of “Quad” Technology to leverage
  - Backplanes are structured on a x4 basis
  - QSFP
  - Attractive switch radix
  - Support of Breakout for high density x1 applications
- Leveraging 50Gb/s Signaling Technology

40GbE History Lesson

- 802.3ba
  - Resistance to inclusion of 40 GbE
    - Best Summary- Gary Nicholl, Cisco (nicholl_01_0507.pdf)
    - 13 individuals from end-users supported focusing on 100 GbE only
  - The Initial Compromise -
    - 40GbE for computing
    - 100GbE for networking
  - Jan 2008 (1st Task Force Meeting)
    - Request to consider adding 40GbE for SMF applications – Alessandro Barbieri, Cisco (barbieri_01_0108.pdf)
      - "However, it is inevitable that the technology will migrate into the next layers of the network and be adopted into the inter-switch links within the data center."
      - 0 individuals from end-users supported
    - Eventually added to 802.3ba project, and the rest is history
- From 2010 – 2021, 40GbE is expected to ship >25,000,000 optical modules. (Source: Dale Murray, LightCounting)

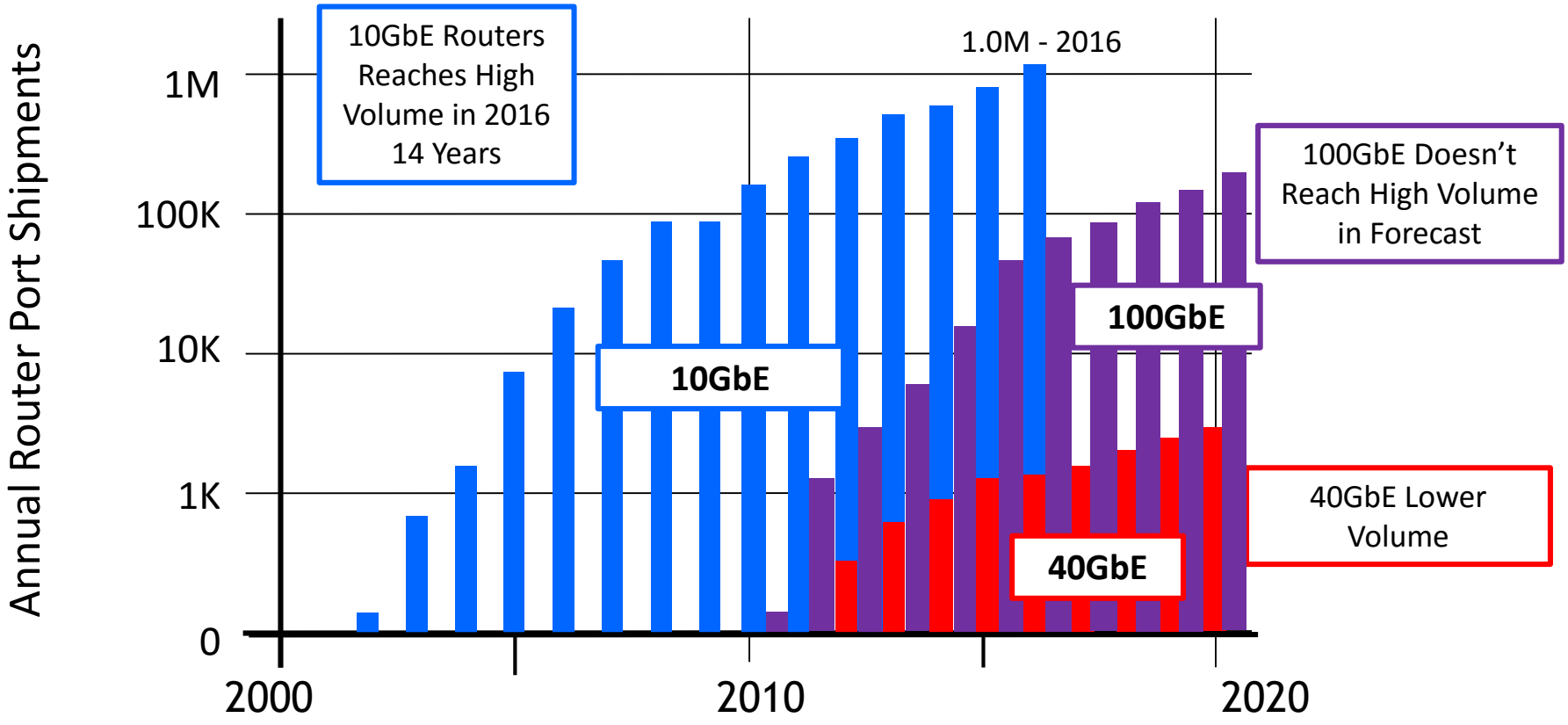
10G to 100G Transitions



SOURCE: DELL'ORO SWITCH AND ROUTER FORECASTS

Market did not wait for 100GbE

Router Port Shipments



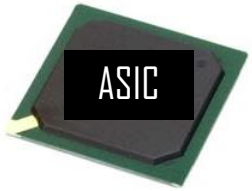
SOURCE: DELL'ORO ROUTER FORECASTS

Why is 100GbE Selling Now?

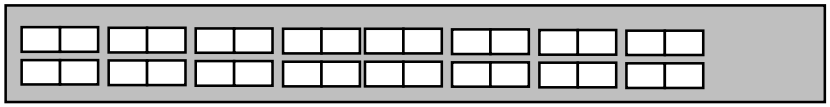
Perfect Balance of silicon and QSFP

- 100GbE is working because of 4X25G interfaces to QSFP28
- High port count ASICs lead to low cost and power
- High port count leads to low cost ports
- QSFP can breakout to servers or be used as uplinks

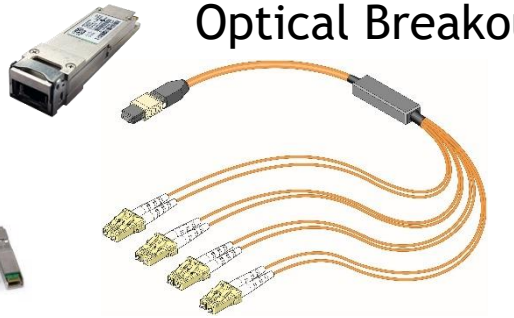
128+ Port 25G ASIC



32 QSFP Port Switch

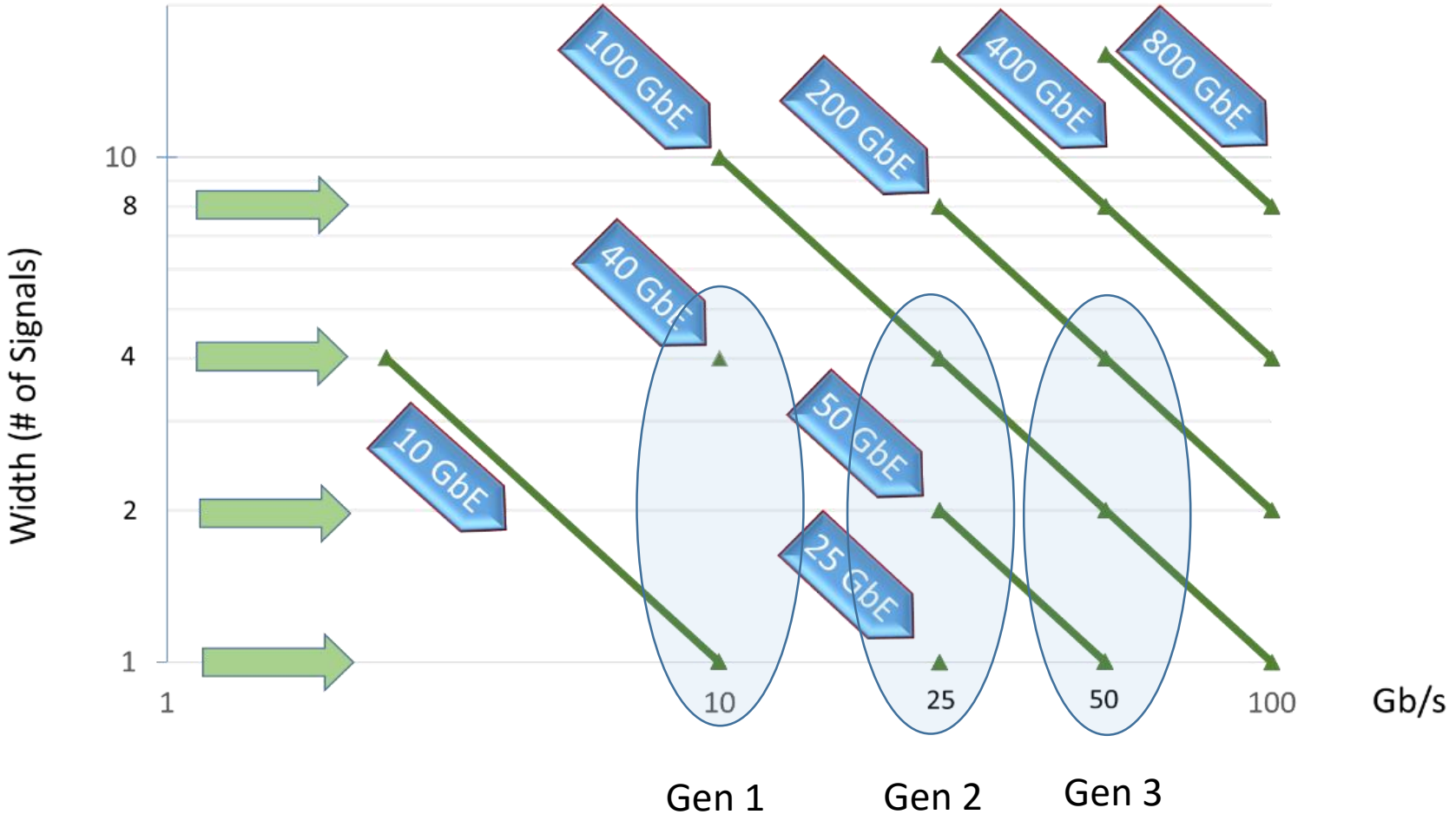


Optical Breakout



Copper Breakout

The Emergence of the 1x/4x Story



Target Volume = 1M Ports/Year
All applications (Switches, Routers, Servers)

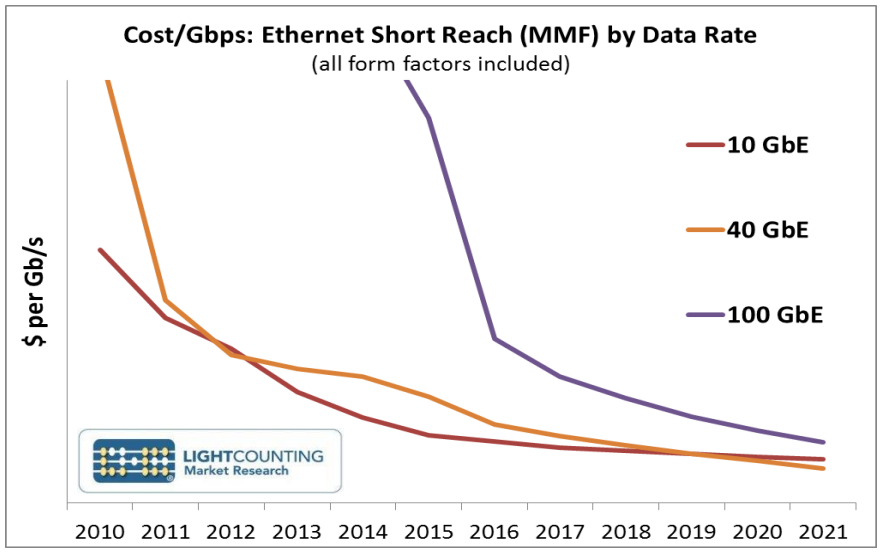
Dates below show when Ethernet speeds reach high volume

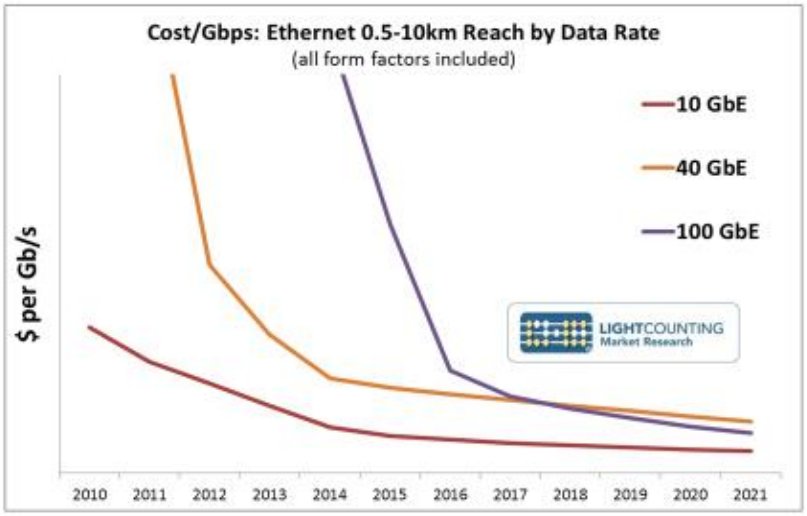
- Highly parallel solutions used for market introduction
- 1 Lane or 4 Lane links have reached 1M Ports/ Year

	10G/Lane	25G/Lane	50G/Lane	100G/Lane
Single Lane	10GbE 2009	25GbE 2016	50GbE 2019?	100GbE 2024?
Quad Lane	40GbE 2014	100GbE 2016	200GbE 2019?	400GbE 2024?
Highly Parallel	100GbE –x10 Never	200GbE x8 400GbE 16X ?	400GbE x8 ?	800GbE x8 ?

SOURCE: DELL'ORO ROUTER FORECASTS

Cost Per Gigabit





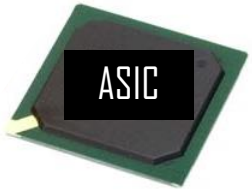
- 11 years after 802.3ba cost per gigabit for optical modules forecasted to favor 40GbE for MMF
- 7 years after 802.3ba cost per gigabit for optical modules forecasted to favor 40GbE for SMF
- Numerous factors drive cost per gigabit
  - Technology Reuse
  - New Technologies
  - Time to achieving market sweet spots to achieve volume sales to impact cost
- Forecasting is challenging in today's market

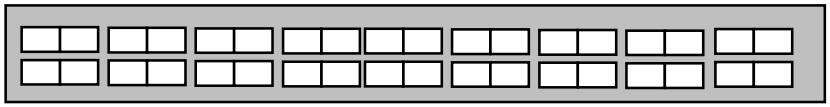
Why 200GbE Will be Adopted

Keep the Train Rolling

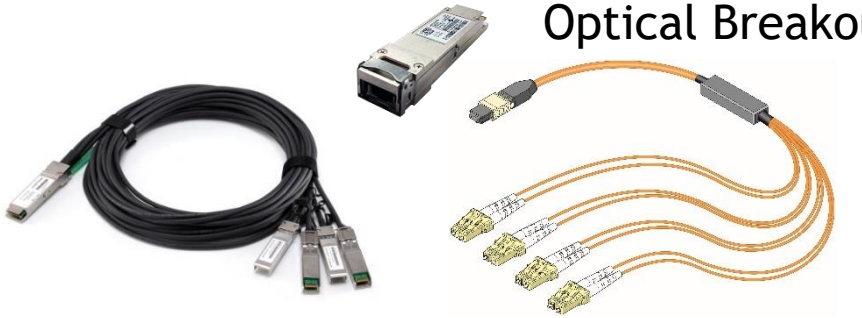
- Market history of success of x4 eco-systems
- 200 GbE achieves x4 sooner for switching applications
- 400 GbE will be needed for higher bandwidth switching applications and routing
- To date market focus has been on 100G and 400G, however history often repeats, opening the door for 200G

144+ Port 50G ASIC





Optical Breakout



Copper Breakout

Conclusions

- Market diversity is driving different timing and cost requirements
  - Shifting to 2x dangerous? Fibre Channel / Infiniband might disagree – or how about jumping from 25GbE to 50GbE for servers?
- Highly parallel electrical solutions (>=8) have been used for initial rate introductions, and then have been reduced in width to go into high volume
- x1 / x4 family successes that have achieved high volume
  - 10GbE/ 40 GbE
  - 25GbE / 100GbE
- 50GbE / 200GbE mirror market dynamics of successful deployment, and provides upgrade path for lower rate versions of existing objectives.