Breakout Functionality

John D'Ambrosia, Dell
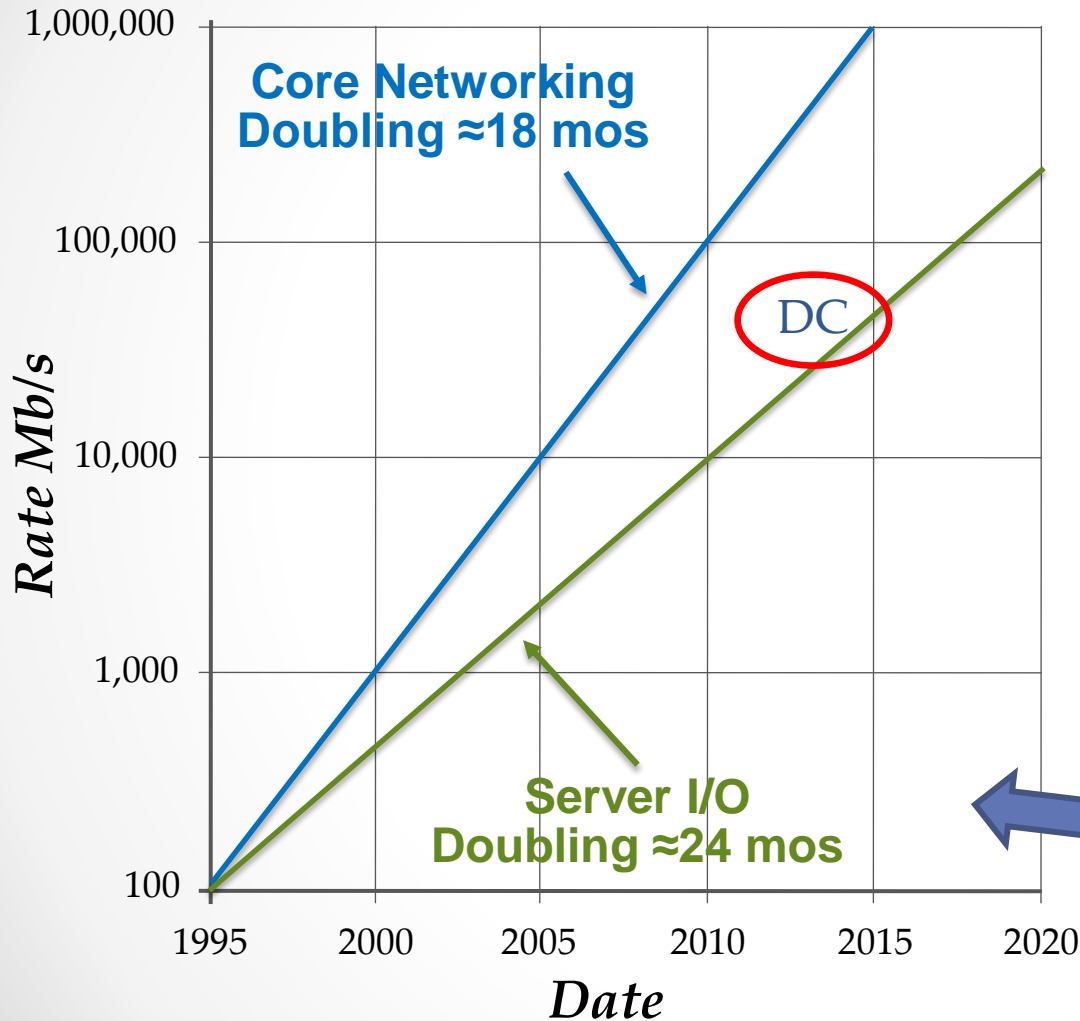
David Law, HP

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November 12, 2013

Supporters

- Derek Cassidy, BT Ireland
- Robert Lingle, Jr., OFS
- Brad Booth, Microsoft
- Matt Brown, APM
- Rick Rabinovich, Alcatel-Lucent
- Tom Issenhuth, Microsoft
- Jeff Maki, Juniper
- David Ofelt, Juniper
- Nathan Tracy, TE Connectivity
- Kent Lusted, Intel
- Kapil Shrikhande, Dell
- Charlie Chen, Titan Photonics

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40 GbE is Taking off in the Data Center…

**Core Networking
Doubling ≈18 mos**

DC

**Server I/O
Doubling ≈24 mos**

Rate Mb/s

Date

1,000,000 — 100,000 — 10,000 — 1,000 — 100

1995 — 2000 — 2005 — 2010 — 2015 — 2020

Why?
➢ **Cost**
➢ **Available
solutions to meet
target application**

From IEEE 802.3 HSSG
Tutorial, Nov11.

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40 GbE Port Usage (1 of 2)

40 GbE Port Configuration
Example #1
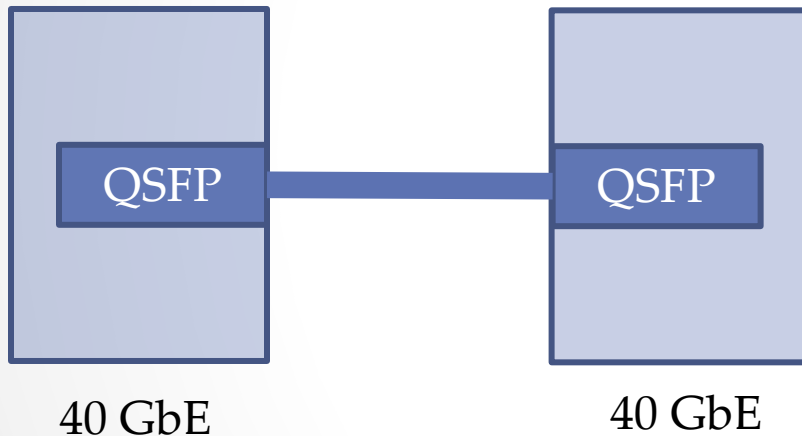
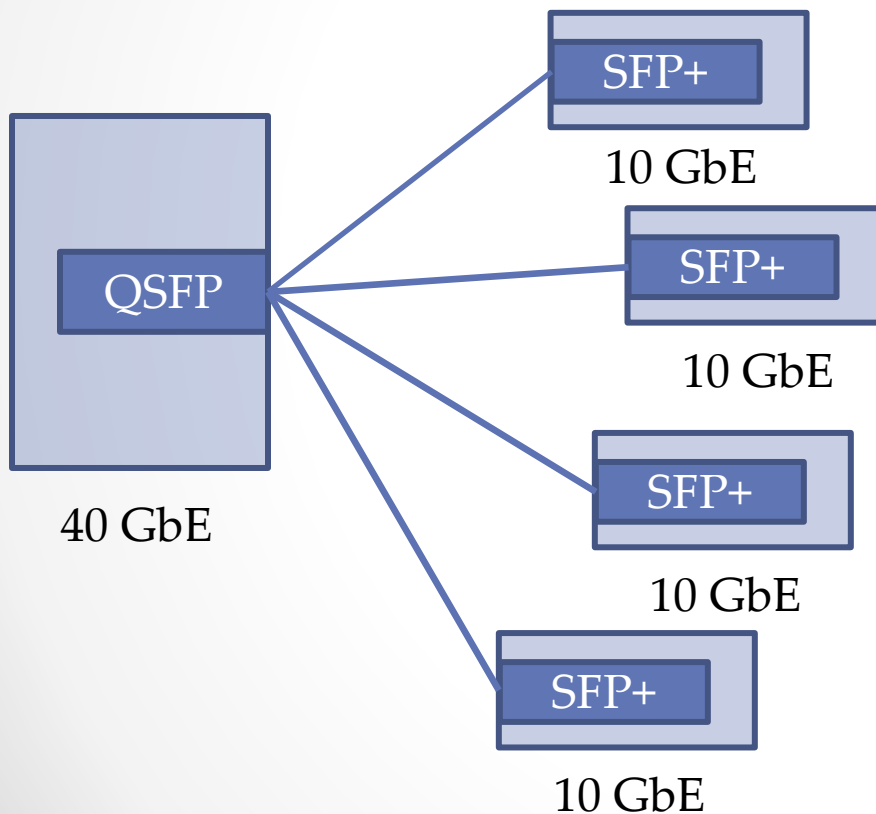| QSFP | QSFP |

40 GbE   40 GbE

<u>Today's Media*</u>

- Multi-conductor twin-ax
- Full Duplex MMF
- Multi-fibre MMF
- Full Duplex SMF
- Multi-fibre SMF

* Includes standard & non-standard technologies

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**40 GbE Port Configuration
Example #2**

QSFP

40 GbE

SFP+

10 GbE

SFP+

10 GbE

SFP+

10 GbE

SFP+

10 GbE

Today's Media*

- Multi-conductor twin-ax**
- ~~Full Duplex MMF~~
- Multi-fibre MMF**
- ~~Full Duplex SMF~~
- Multi-fibre SMF

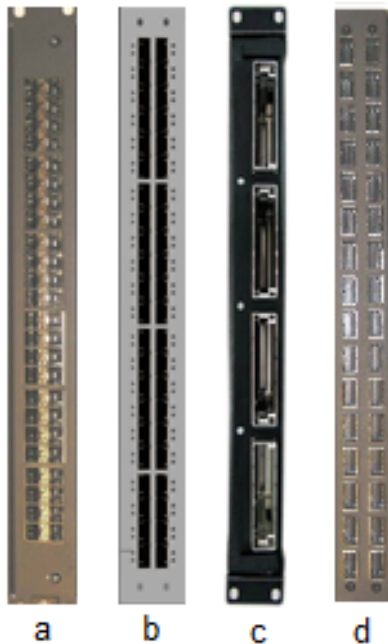** Being used in data center applications.

* Includes standard & non-standard technologies

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Port Density Implication

From 100GbE Backplane / Cu Cable CFI

Or 176 ports of 10GbE

From the figure:

Front panel I/O driving backplane capac...

Line card illustrations
a. 48 ports SFP+ @ 10GbE = 480Gb/s
b. 44 ports QSFP @ 40GbE = 1.76 Tb/s
c. 4 ports CFP @ 100GbE= 400 Gb/s
d. 32 ports CXP@ 100GbE= 3.2 Tb/s

Potential backplane bandwidth capacities
- 8 Line Cards: 3.2 Tb/s to 25.6 Tb/s
- 14 Line Cards: 5.6 Tb/s to 44.8 Tb/s

a   b   c   d

7 100GbE Electrical Backplane/Cu Cable CFI
IEEE 802 Plenary, Dallas, TX, Nov 2010

November 9, 2010

- Increased 10GbE port density based on QSFP will enable lower cost 10GbE.

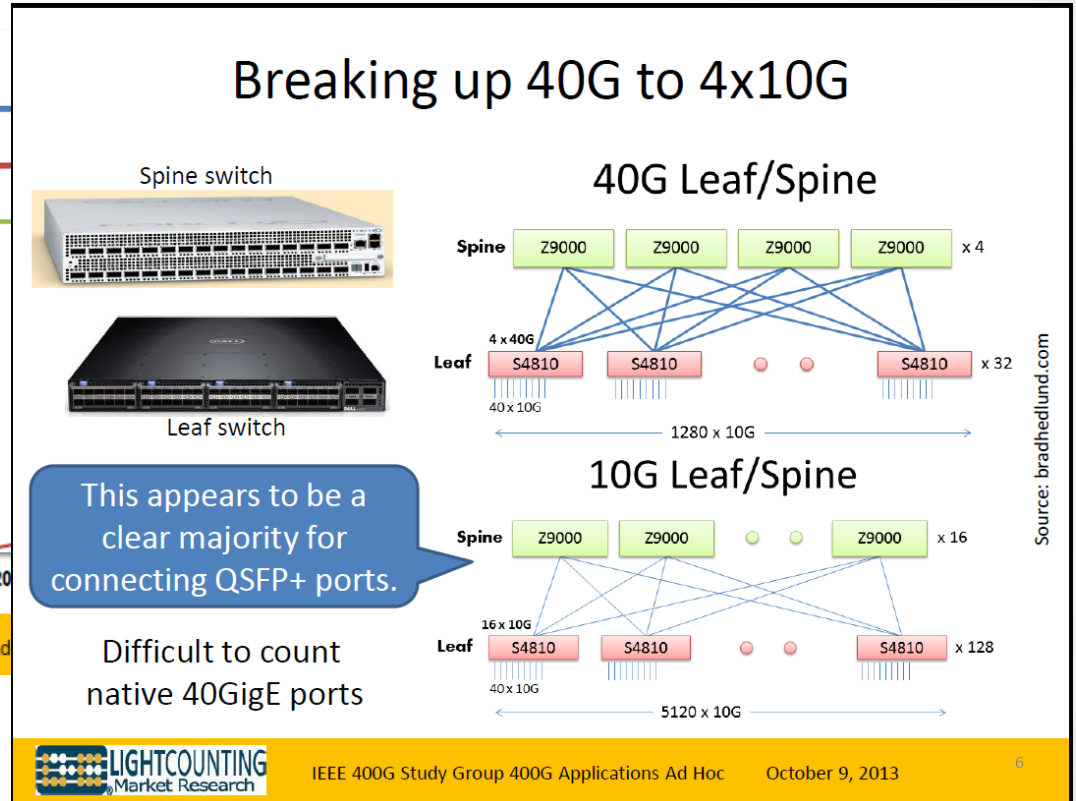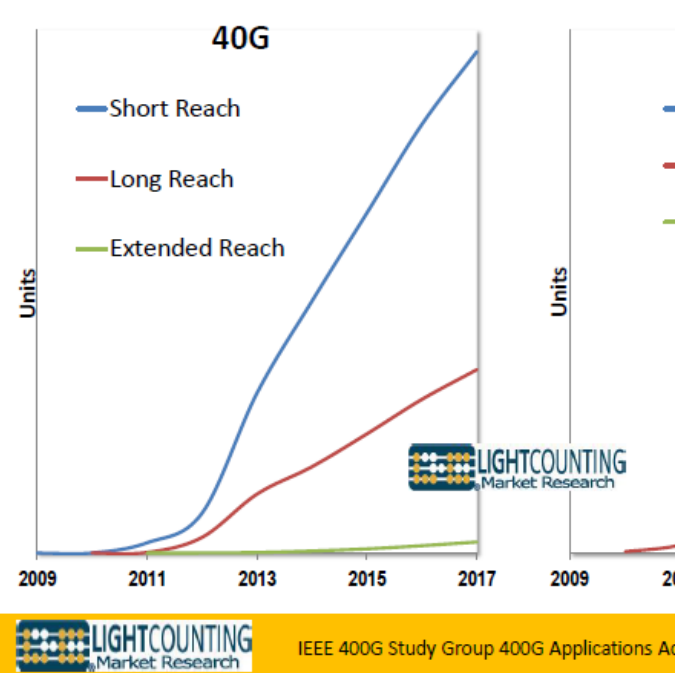- Increased usage of 40GbE ports will enable lower cost 40GbE ports.

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Market Adoption of 40GbE

Source: Dale Murray, LightCounting,
http://www.ieee802.org/3/400GSG/public/adhoc/app/murray_app_01a_1013.pdf

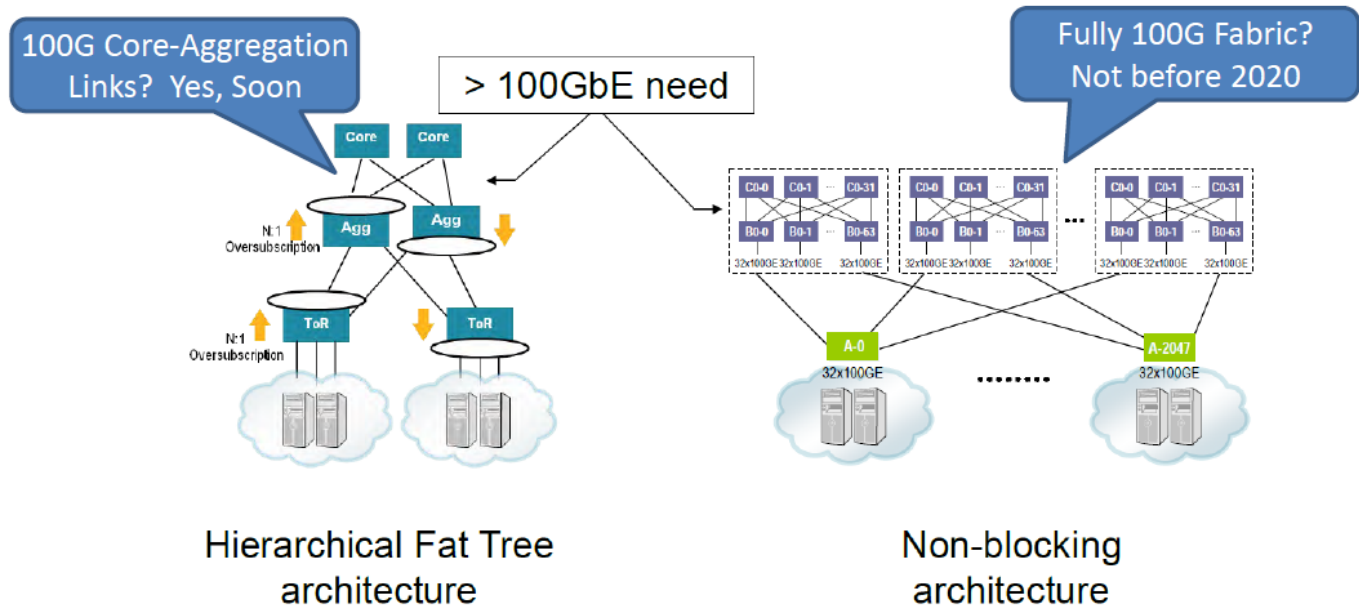- IEEE 802.3 400 Gb/s Ethernet Study Group
  IEEE 802 Nov 2013 Plenary, Dallas, TX, USA.

Looking to the Future

Future Breakout Scenarios

Source: Dale Murray, LightCounting,
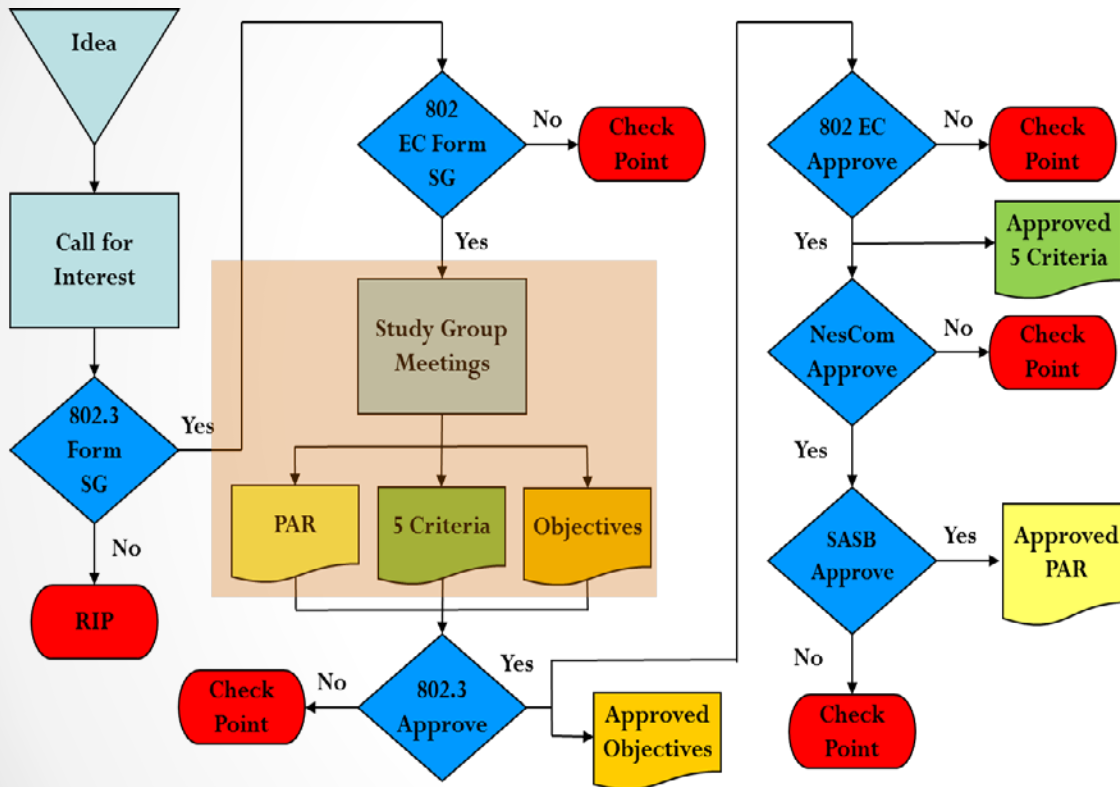http://www.ieee802.org/3/400GSG/public/adhoc/app/murray_app_01a_1013.pdf

- IEEE 802.3 400 Gb/s Ethernet Study Group
  IEEE 802 Nov 2013 Plenary, Dallas, TX, USA.

Cabling Standardization

- **ISO/IEC 24764, Information Technologies – Generic Cabling Systems for Data Centres:** Specifies the MPO interface for termination of more than two optical fibres at the Equipment Outlet (EO), including the use of single mode optical fibres.

- **ISO/IEC 14763-2, Information technology – Implementation and Operation of Customer Premises Cabling – Part 2:** Planning and Installation; provides guidance on administration and polarity maintenance. Both multimode and single mode optical fibres are supported.

- **IEC/SC 86B (in development):** Product specifications to ensure connector intermateability of 12 and 24 fibre MPO connectors.

- **IEC 60794-2:** specifies colour coding of multiple optical fibres and cables

- *ANSI/TIA 598* Optical Fiber Cable Color Coding: defines colors of cabling sheath and fibers.

- **TR-42.13 (TIA):** unanimously approved project start for MPO-16, a 2x16-fiber MT ferrule

Thanks to Alan Flatman, Paul Kolesar, and Jack Jewell for input and review.

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Project Objectives

Objectives

A project's contract with the IEEE 802.3 WG

But

Describes the goals of the project to the industry

Note: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

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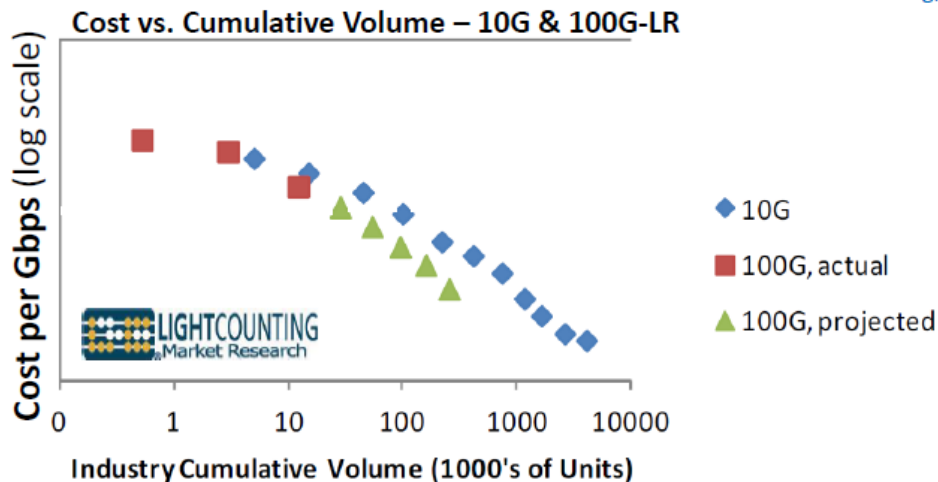IEEE 802 Nov 2013 Plenary, Dallas, TX, USA.

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Observations for 400GbE

- Reasonable assumption that 40G/100G will ship in greater volumes than 400G.
- Multiple higher density 40G/100G scenarios envisioned by 400GbE time frame.
- Multiple scenarios can be envisioned where 400GbE ports could support higher density / lower rate 40GbE and or 100 GbE PMDs. Some include:
  - 400 GbE based on 16 x 25 Gb/s
    - Could be divided into 4 ports of 100G @ 4 x25Gb/s
  - 400 GbE based on 8 x 50 Gb/s
    - Run 50Gb/s at 40 Gb/s for 8 ports of 40GbE
    - Divide into 4 ports of 100G @ 2 x 50Gb/s
  - 400 GbE based on 4x 100Gb/s (assuming modulation)
    - Divide into 4 ports of 100G @ 1 x 100Gb/s
    - Change modulation to support 40G and support 4 ports @ 1 x 40 Gb/s

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Leveraging Lower Speeds

Cost Reductions
- Integration via higher port density
- Volume

400 GbE implementations with breakout can drive lower costs via higher density lower speeds

Shared volumes can drive lower cost for 400 GbE

Source: Dale Murray, LightCounting,
http://www.ieee802.org/3/400GSG/public/adhoc/app/murray_app_01a_1013.pdf

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Conclusions

- The market is adopting this "breakout functionality" with 10GbE / 40GbE
  - Breakout functionality – the ability to use a port in a lower rate / higher density mode of operation
- Providing an upgrade path forward could further improve this scenario for lower speeds
- "Breakout functionality" will enhance broad market potential of 400GbE by enabling adoption to support higher density / lower rate lower speeds to enable lower 400GbE cost.
- Proposed objective–
  - Provide appropriate support for breakout functionality

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