

Objective Considerations: Given Today's Data Center Environment

John D'Ambrosia, Dell

David Law, HP

"Applications" Ad Hoc
IEEE 802.3 400 Gb/s Ethernet Study Group
October 9, 2013

Supporters

- Kapil Shrikhande, Dell
- Brad Booth, Microsoft
- Tom Issenhuth, Microsoft
- Jeff Maki, Juniper
- John Petrilla, Avago
- Paul Kolesar, CommScope

May 2013 Straw Polls

| PMD | Chicago Rules (#2) | Choose 1 (#5) |
|-------------------|--------------------|---------------|
| 400 GbE Backplane | 25 | 2 |
| 400 GbE Twin-Ax | 15 | 2 |
| 400 GbE MMF | 39 | 9 |
| 400 GbE SMF | 62 | 49 |
| No PMDs | 2 | 0 |

Strawpoll #3 Made by the Chair

Are you interested in multi-rate support (backward compatibility from 400GE to 100GE and/or 40GE):

Results

Yes 50

No 10

Summary of Stated “Reach” Needs

| Presentation | 100m | 500m | 1km | 2km | 10km | 40km |
|------------------------|-------------|------|-----|------------|------|------|
| maki_400_01a_0513 | x | x | | | | |
| song_400_01_0513 | x | | | | | |
| trowbridge_400_01_0513 | x | x | | x | x | x |
| hirai_400_01_0713 | | | | | x | x |
| issenhuth_400_01_0713 | | x | x | Beyond 1km | | |
| jewell_400_01a_0713 | x (200m) | x | | | | |
| nicholl_400_01_0713 | | | | | | |
| palkert_400_01_0713 | x | x | | x | x | x |
| song_400_01a_0713 | | | | x | x | |
| takahara_400_01_0713 | | x | | | x | x |
| vijn_400_01a_0713 | | | | | | |
| wenyu_400_01_0713 | | x | | x | x | x |
| palkert_400_01_0913 | | | | | | |
| song_x_400_01_0913 | | | | x | x | x |

Sept 2013 Straw Polls

Straw Polls #4 and #5 – SMF “Inside Building” Reach Objectives

| | Chicago Rules | Choose One |
|-----------|---------------|------------|
| 500m | 30 | 18 |
| 1km | 13 | 1 |
| 2km | 34 | 27 |
| Undecided | 11 | 16 |

Straw Polls #6 and #7 – SMF “Outside Building” Reach Objectives

| | Chicago Rules | Choose One |
|-----------------|---------------|------------|
| 2km | 10 | 4 |
| 2km < x < 10km | 5 | 0 |
| 10km | 39 | 34 |
| 10km < x < 40km | 8 | 1 |
| 40km | 31 | 11 |
| Undecided | 10 | 12 |

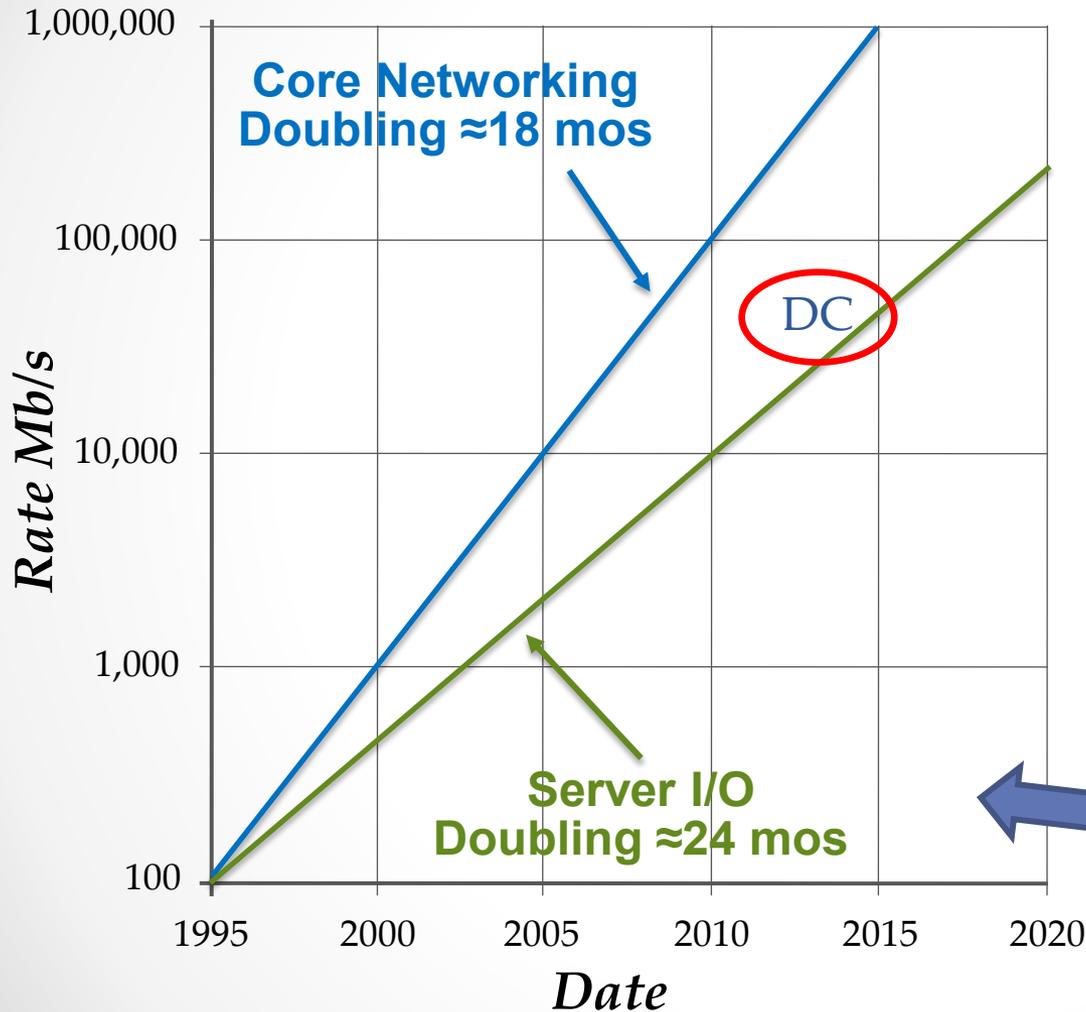
Sept-13 Interim Straw Poll #8 (Chicago Rules)

- I would support an objective that reads "Define a 400Gb/s PHY for operation up to at least X of MMF" wherein X is:
 - a) a distance less than 30m
 - b) 30m
 - c) a distance between 30m and 100m
 - d) 100m
 - e) a distance between 100m and 200m
 - f) 200m
 - g) a distance greater than 200m
 - h) undecided
- Results (All)
- a) 0 b) 3 c) 2 d) 25 e) 2 f) 1 g) 0 h) 42

Sept-13 Interim Straw Poll #9 (Chicago Rules)

- I would support an objective that provides 400Gb/s operation over:
 - a) at least 100m over OM-Y MMF and at least 100m over OM4
 - b) about 200m over OM-Y MMF and at least 100m over OM4
 - c) about 200m over OM-Y MMF and at least 30m over OM4
 - d) at least 200m over OM-Y MMF
 - e) at least 300m over OM-Y MMF
 - f) none of the above
 - g) Undecided
- Results (All)
- a) 8 b) 6 c) 1 d) 1 e) 1 f) 2 g) 53

But 40 GbE is Taking off in the Data Center...



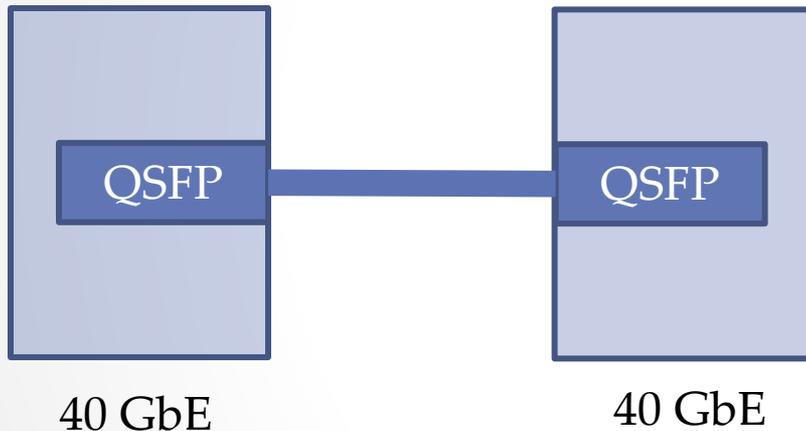
Why?

- Cost
- Available solutions to meet target application

From IEEE 802.3 HSSG Tutorial, Nov11.

40 GbE Port Usage (1 of 2)

40 GbE Port Configuration Example #1



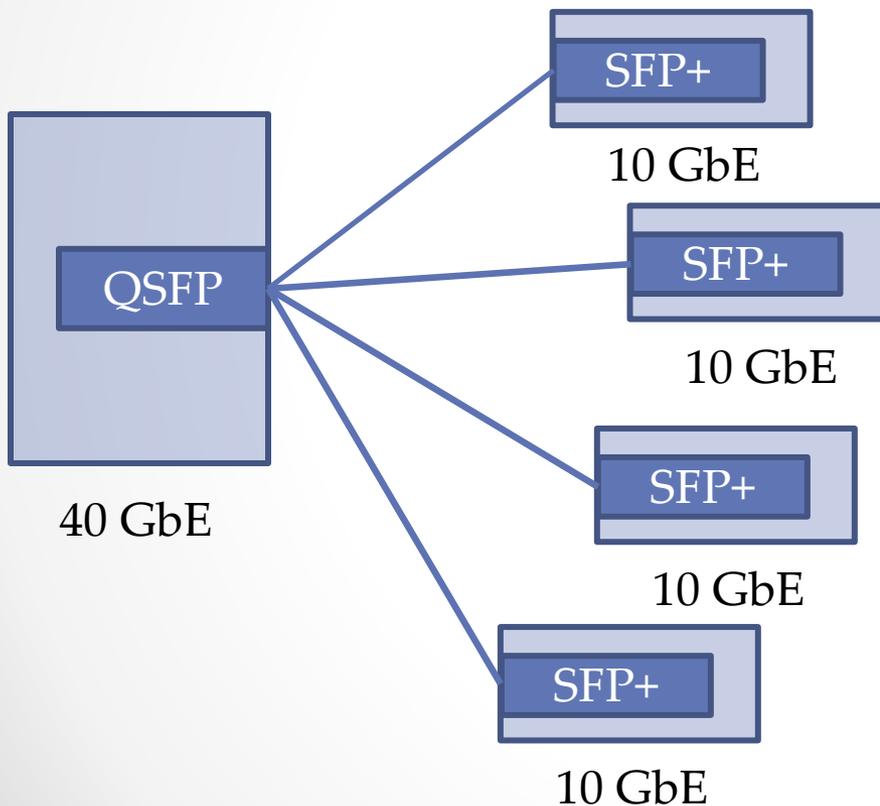
Today's Media*

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

* Includes standard & non-standard technologies

40 GbE Port Usage (2 of 2)

40 GbE Port Configuration Example #2



Today's Media*

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

** Being used in data center applications for all above.

* Includes standard & non-standard technologies

Port Density Implication

From 100GbE Backplane / Cu Cable CFI

Front panel I/O driving backplane capacity

Or 176 ports
of 10GbE



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

- Increased 10GbE port density based on QSFP will enable lower cost 10GbE.
- Increased usage of 40GbE ports will enable lower cost 40GbE ports.



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

November 9, 2010

Observations for 400GbE

- Reasonable assumption that 40G/100G will ship in greater volumes than 400G.
- 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

Conclusions

- The market is adopting this “breakout functionality” for 10GbE / 40GbE
 - Breakout functionality – the ability to use a port in a lower rate / higher density mode of operation
- “Breakout functionality” will enhance broad market potential of 400GbE by enabling adoption to support higher density / lower rate (40GbE and / or 100GbE) to enable lower 400GbE cost.
- Consider objective for breakout functionality?
- Wording of such an objective?–
 - Focus on media?
 - Focus on backwards compatibility?
 - Focus on do no harm?