

# The Roadmap to a “Beyond 400GbE CFI”

John D'Ambrosia,  
Futurewei, U.S. Subsidiary of Huawei  
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# Introduction

- The IEEE 802.3 Ethernet Bandwidth Assessment, Part 2, is anticipating approval at the Mar 2020 Plenary.
- As highlighted in Nov Presentation – “Industry Consensus Beyond 400 GbE? ([http://www.ieee802.org/3/ad\\_hoc/ngrates/public/19\\_11/dambrosia\\_nea\\_01a\\_1119.pdf](http://www.ieee802.org/3/ad_hoc/ngrates/public/19_11/dambrosia_nea_01a_1119.pdf)), industry discussions regarding next speed are already underway.
- As noted in BWA Summary Chart an 800 GbE solution in 2025 would be the lowest bandwidth growth rate for the various growth rates considered.
- This presentation looks at the roadmap to developing consensus to begin a new next speed.

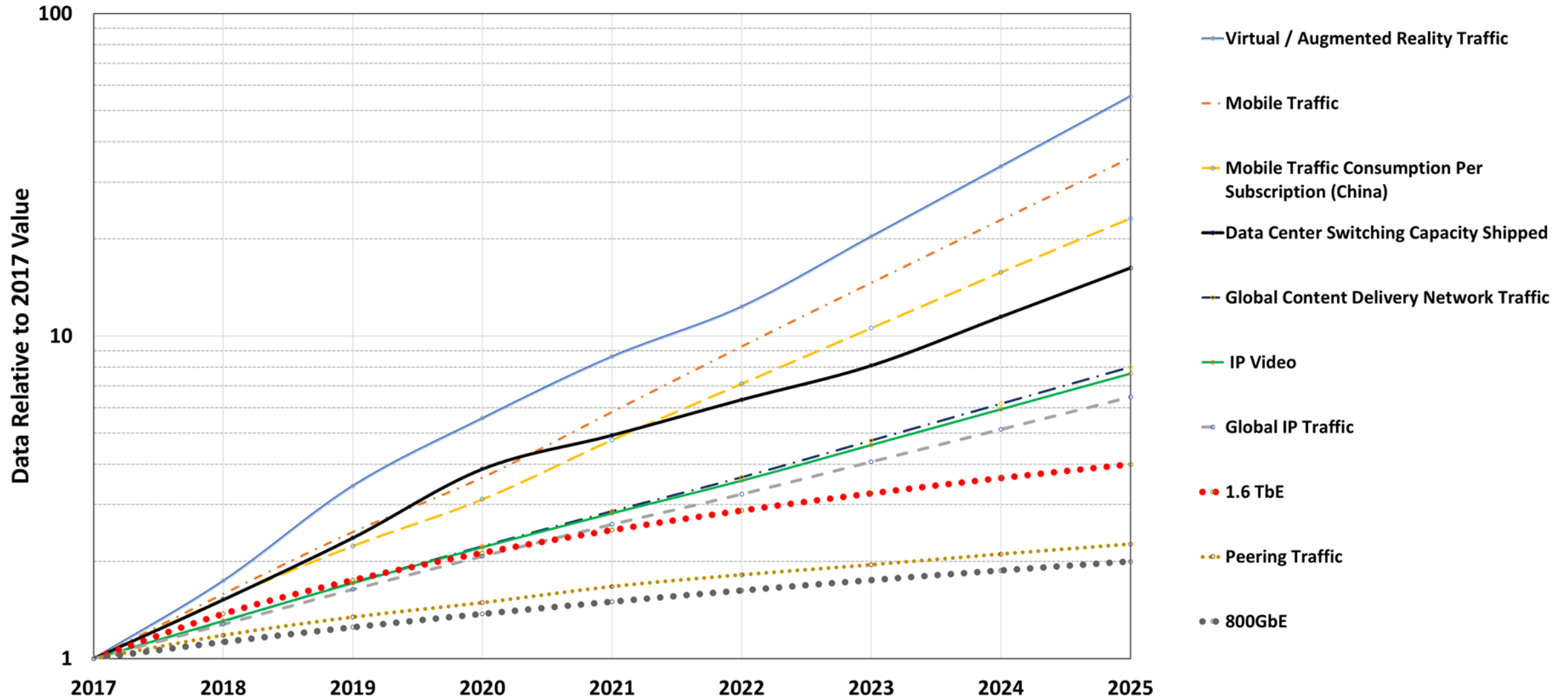
# For CFI Consensus meeting

- **For a CFI Consensus Meeting:**
  - To measure the interest in starting a study group to address:
    - Beyond 400 GbE
  - We don't need to
    - Fully explore the problem
    - Debate strengths and weaknesses of solutions
    - Choose any one solution
    - Create PAR or five criteria
    - Create a standard or specification
- **Consensus building starts before the CFI Consensus Meeting.**

# Main Agenda Items on a CFI Consensus Presentation

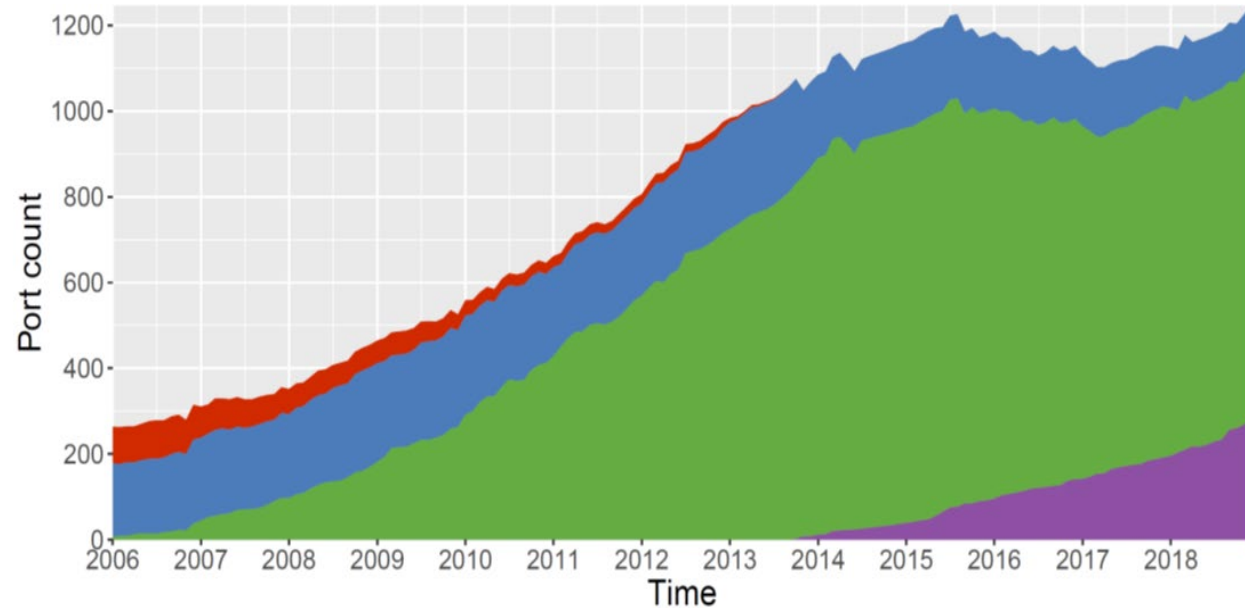
- Market Need
- Technical Section
- Why Now?

# The Ethernet BWA, Part II

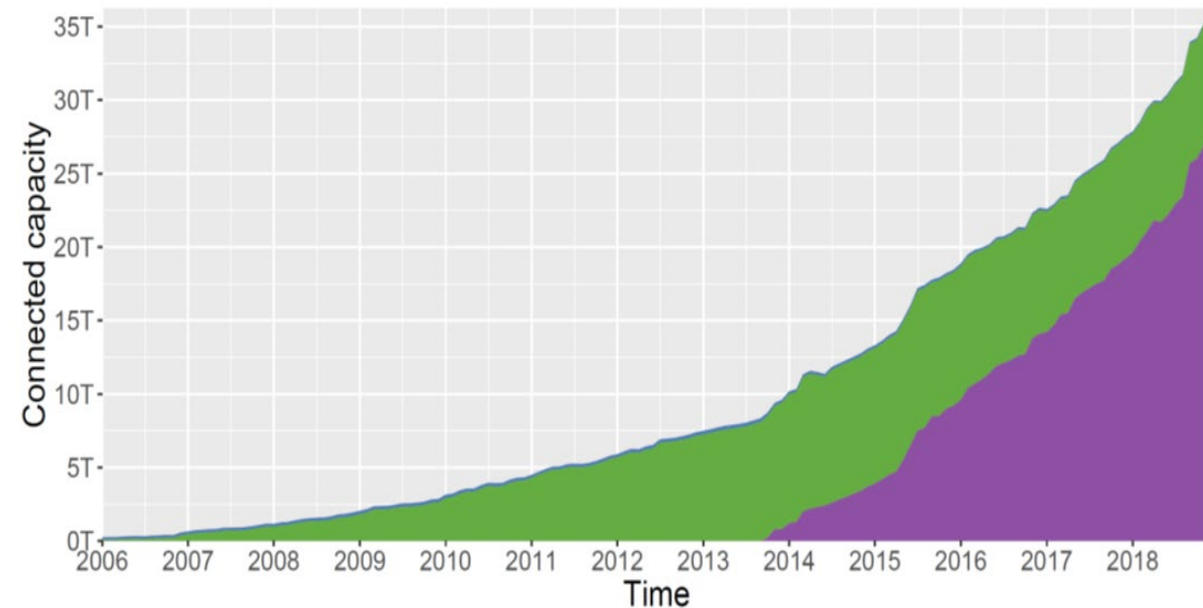


# Bandwidth Growth Caused by Higher Speeds

## DE-CIX Port Speed Mix & Bandwidth



Port speed 100MbE 1GbE 10GbE 100GbE



Port speed 100MbE 1GbE 10GbE 100GbE

Small # of 100 GbE Ports greatly grows the connected capacity to be supported

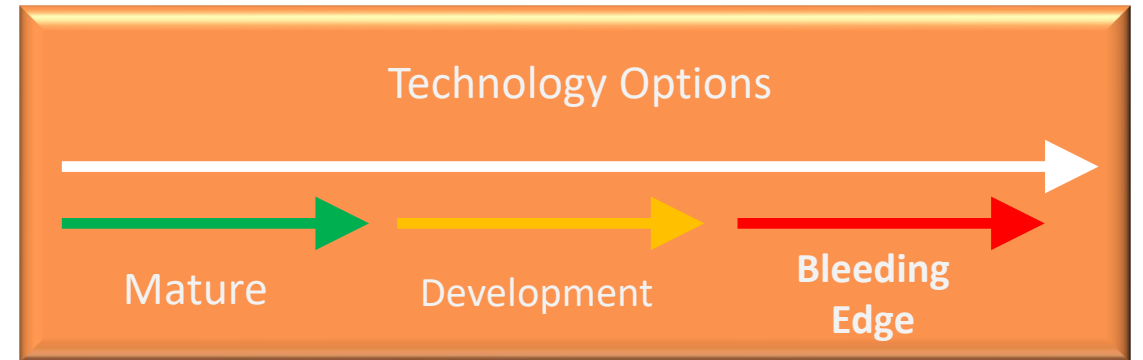
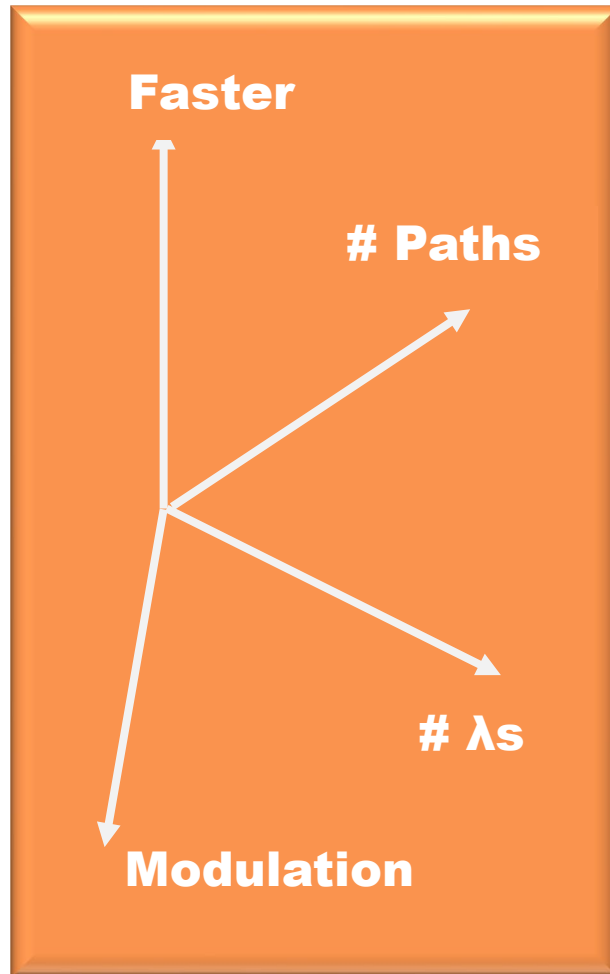
Source: Dietzel, "The European IXP Scene",

[http://www.ieee802.org/3/ad\\_hoc/bwa2/public/calls/19\\_0709/dietzel\\_bwa\\_01b\\_190709.pdf](http://www.ieee802.org/3/ad_hoc/bwa2/public/calls/19_0709/dietzel_bwa_01b_190709.pdf)

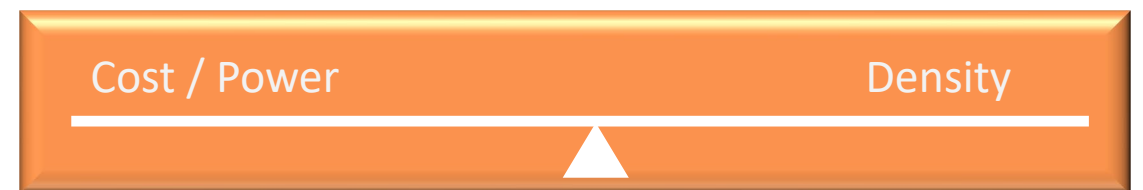
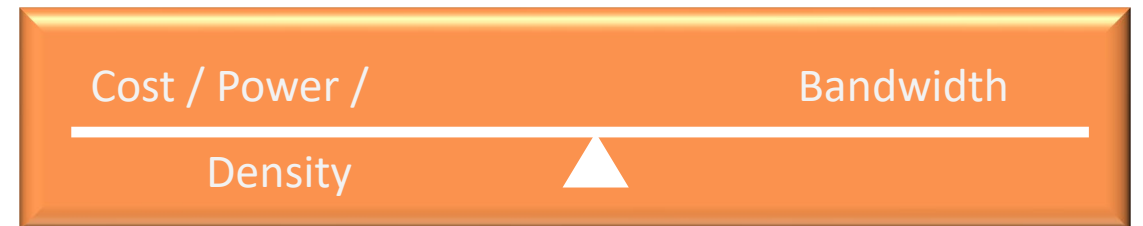
# From Ethernet BWA, Part II

- Leading Bandwidth Growth Curves
  - Mobile
  - Data Center
  - What will they look like 2027 to 2028?
- What PHYs are we talking about?

# The Path to Higher Speeds



*The never-ending balancing acts!*

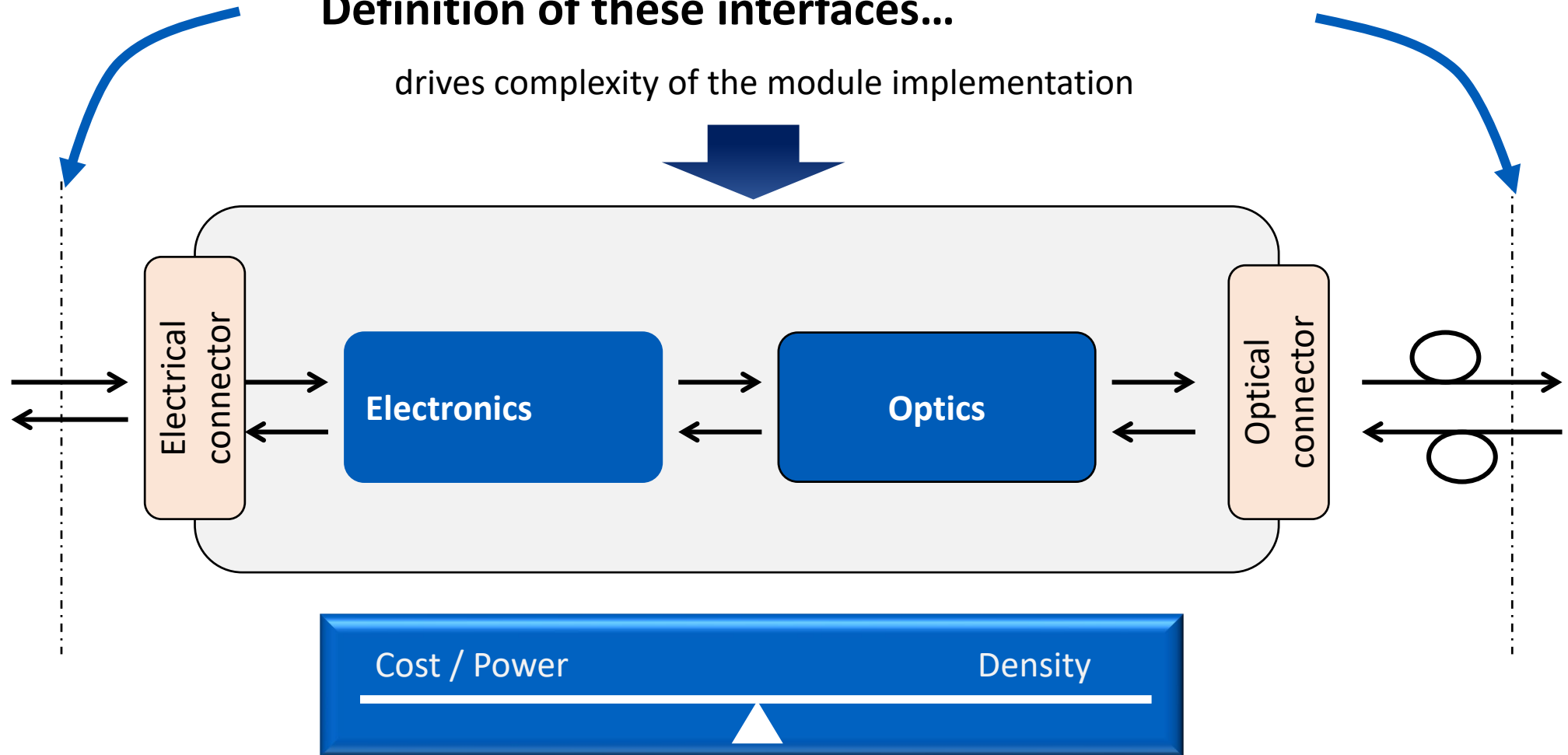




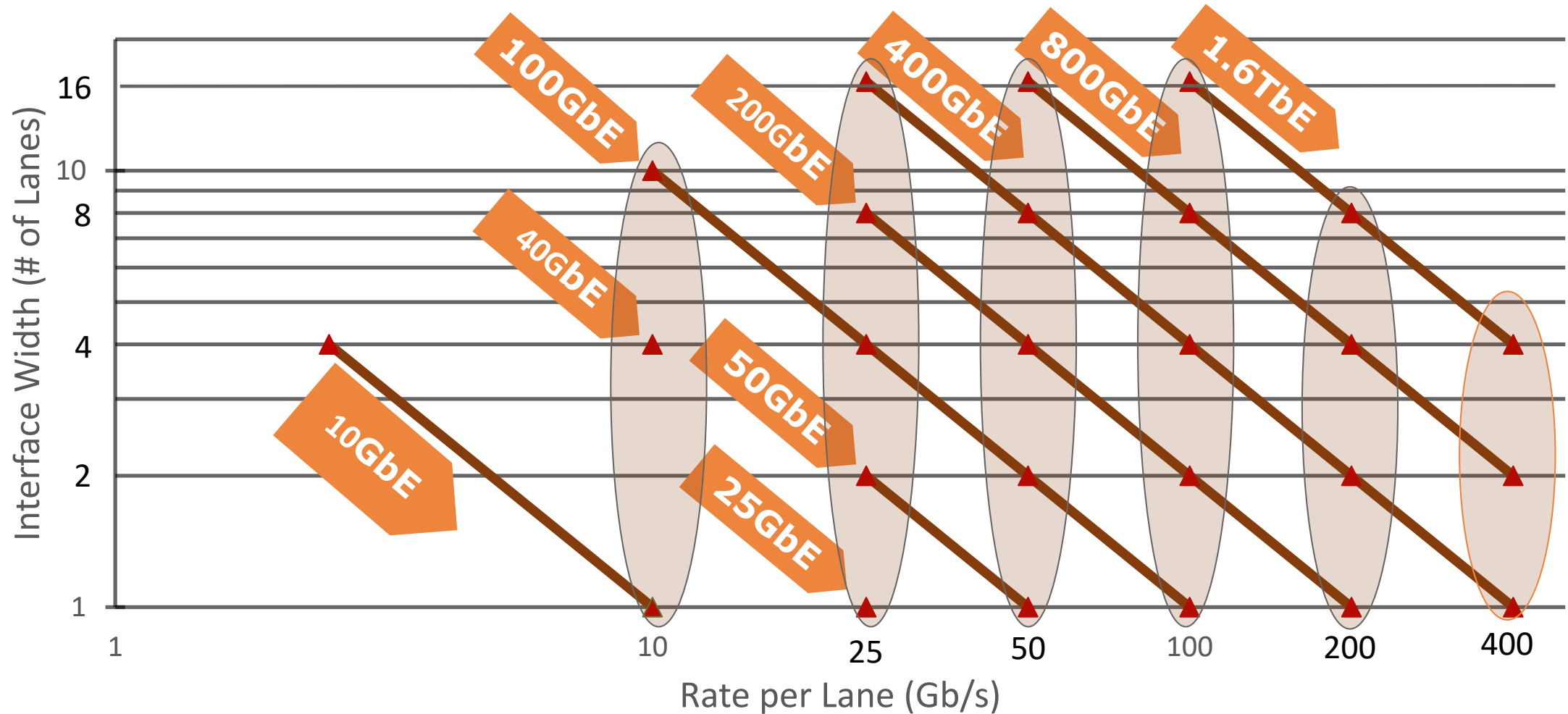
# Optical Module Implementation

## Definition of these interfaces...

drives complexity of the module implementation



# The Basic Math of Ethernet



# Why Now?

## Historical Perspective – Ethernet Ports

| Ethernet Rate (GbE) | Standard Completion | First year of Shipment | Time to cumulate 1M Port Shipments | 1 <sup>st</sup> Year 1M Ports shipped |
|---------------------|---------------------|------------------------|------------------------------------|---------------------------------------|
| 10                  | 2002                | 2001                   | 7 years                            | 2008                                  |
| 40 @                | 2010                | 2011                   | 3 years                            | 2014                                  |
| 100 @               | 2010                | 2012                   | 5 years                            | 2016                                  |
| 400 @*              | 2017                | 2018                   | 3 years                            | 2020                                  |

@ May be used to support multiple instances of a lower rate

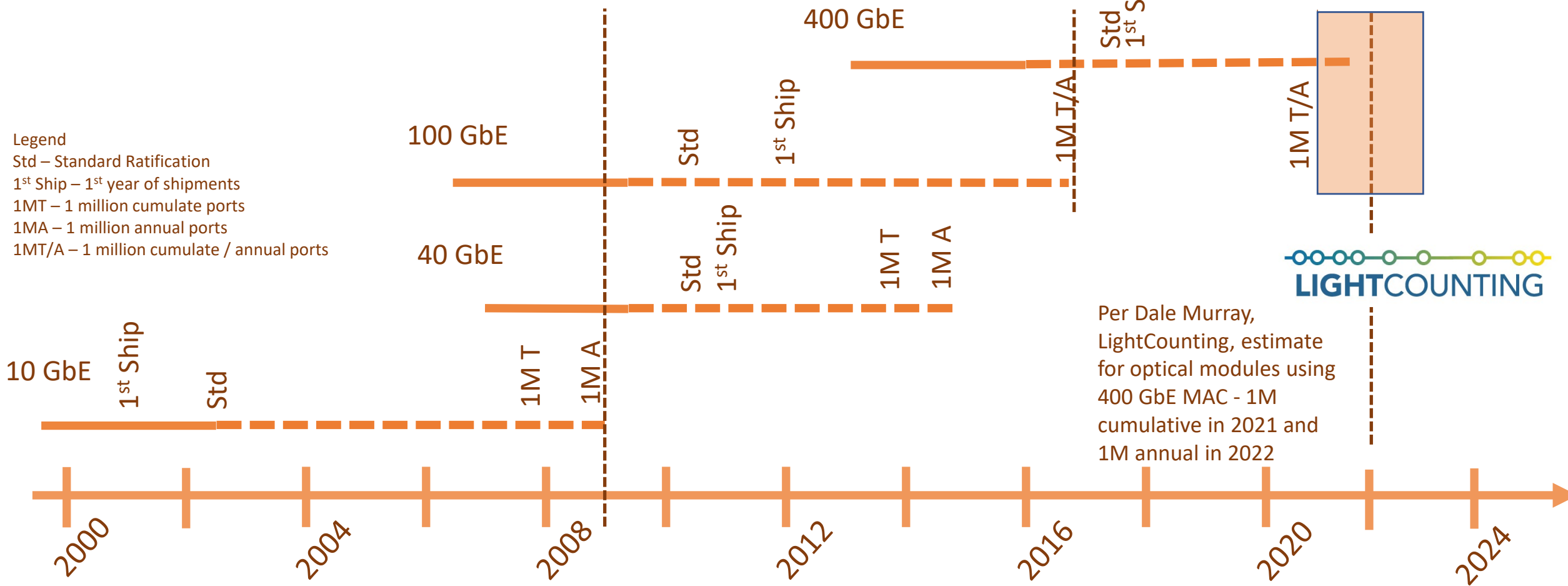
\* This data is based on actual / forecasted data.

Data Courtesy of Sameh Boujelbene of  
Dell'Oro Group



# Comparing Study Group Starts to “1 Million Ports”

A CFI in 11/20 or 3/21 would happen at ≈ same time that 1 million cumulative & 1 million annual ports & 400 GbE used optics would ship



Per Dale Murray, LightCounting, estimate for optical modules using 400 GbE MAC - 1M cumulative in 2021 and 1M annual in 2022



# Next Steps

- As noted a CFI in Nov 20 or Mar 21 would be  $\approx$  at the time of 1M 400GbE cumulate / annual ports. (Note – additional data estimate for optical modules using 400 GbE MAC - 1M cumulative in 2021 and 1M annual in 2022)
  - Bandwidth growth acceleration
  - Relatively late compared to other projects
- Leverage NEA for all of the following –
  - Explore market need for 800GbE / 1.6TbE / both
  - Explore technical / economic issues (see backup slide)
  - Other .....
  - Develop consensus presentation for CFI on target speed(s)

# BACKUP

# Potential Topics for Discussion

- Thoughts on needing new speed?
- Timing – start / completion?
- 800 GbE versus 1.6 TbE versus both? (Good question for a study group!!!!)
- Target application spaces and PHYs?
- Technology – 100 Gb/s versus 200 Gb/s signaling?
  - 100 Gb/s signaling
    - In development now
    - Impact on speed choice? 16x100G interface? Optical Mux loses impact reach?
  - 200 Gb/s signaling
    - Optics –
      - PAM4?
      - Coherent up to 400 Gb/s already being standardized / developed – building block?
    - Electrical – significant paradigm shift?
    - Technical / economic feasibility?
  - Direct detect vs coherent