

# Copper Cabling Requirements for 100 Gb/s

IEEE 802.3ck 100 Gb/s per Lane Electrical  
Task Force

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# Overview

- Current P802.3ck Cu cabling objectives
- 2m cabling limitations with current ASIC switch radix
- Required Cu Rack Cable Lengths
- Current Cu DAC cabling needs for 25G signaling
- Summary

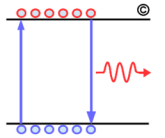
# Current P802.3ck Objectives

- 100 Gb/s
  - Define a single-lane 100 Gb/s PHY for operation over twin-axial copper cables with lengths up to at least 2 m.
- 200 Gb/s
  - Define a two-lane 200 Gb/s PHY for operation over twin-axial copper cables with lengths up to at least 2 m.
- 400 Gb/s
  - Define a four-lane 400 Gb/s PHY for operation over twin-axial copper cables with lengths up to at least 2 m.
- **Plans are to support UP TO AT LEAST 2m.**
- **Presumption is that if we only support up to 2m Cu cable we will miss the true broad market potential for 100 Gb/s Cu cabling.**

# 2m Cu cabling limitations with current ASIC switch radix

- Number of servers per rack is declining
  - Power and thermal drivers
- Switch radix at 256 will need to span multiple racks for server connect
- 2m Cu cable will limit configuration options

## Summary



- ❑ **100GEL study group is rushing to define a sub-optimal 2 m Cu cabling solution by sacrificing C2M**
  - The proposed 2 m Cu cable link budget has no margin
  - With just 11.7 dB loss host PCB limited to just 125 mm on the best PCB material Megtron 7NE
  - C2M is the most important interfaces to enable next generation system, limited host PCB reach will require adding lots of power hungry retimers
- ❑ **It is unclear if 2 m Cu DAC even has broad market potential with switch radix increasing to 256 while Cu cable reach reduced to just 2 m**
  - A switch with radix of 256 likely will be placed in the middle of row and will connect to 4-8 racks of servers and require cable reach of at least 10 m
- ❑ **The main driver for migration to 100G/lane IO is to enable next generation 12.8/25.6 Tb switches**
  - A low capacity 3.2/6.4 Tb TOR switch can stay with more generous 50GBASE-CR/100GBASE-CR2/200GBASE-CR4 cabling implementation
- ❑ **Lets not sacrifice C2M specification for niche 2 m Cu DAC application and instead lets consider the following**
  - Define a Cu port MDI based on 10 dB to provide margin and possibly extending reach to 3
  - A host with 10 dB loss may support both Cu and optical modules
  - See also Ghiasi\_100GEL\_01\_0318.pdf.

# Required Cu Rack Cable Lengths

- *Joel's Summary:*
  - **To cover all use cases, 3m length cable is needed**
  - *Dismissed cases 1, 3, and 5*
- Switches will move from Top to Middle of Rack
  - *Challenges with 'towel bar' cable management*
- Case 1 (2.89m)
  - *Front to Rear is going away*
- Case 3 (2.69m)
  - *Needed when switch stays at Top of Rack*
- Case 5 (2.44m)
  - **Becomes very important**
  - *Rack to rack: switch to server*

## Results

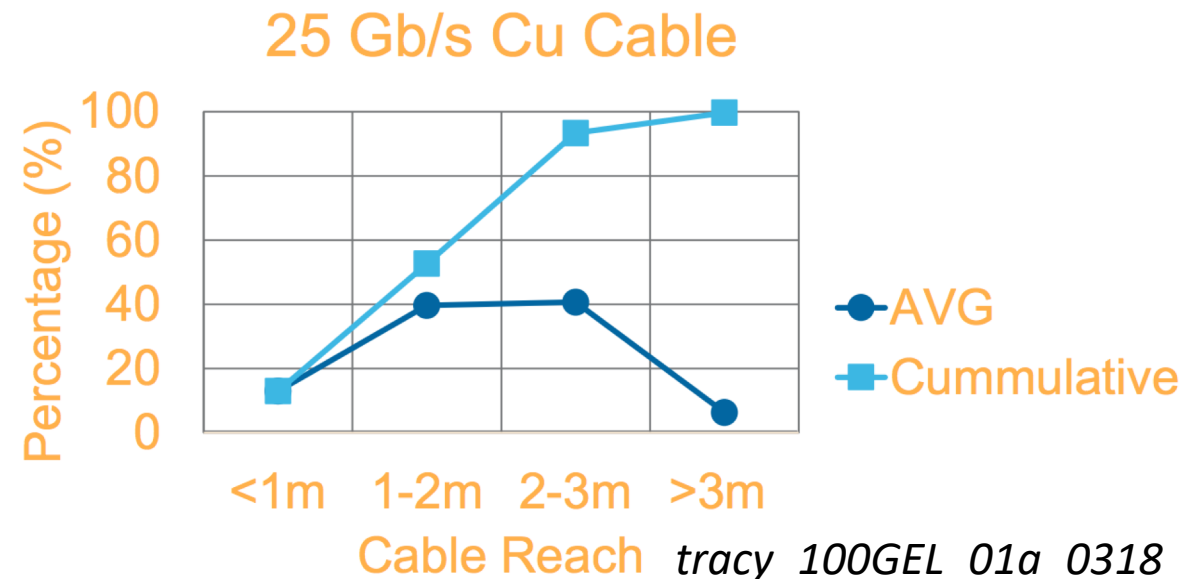
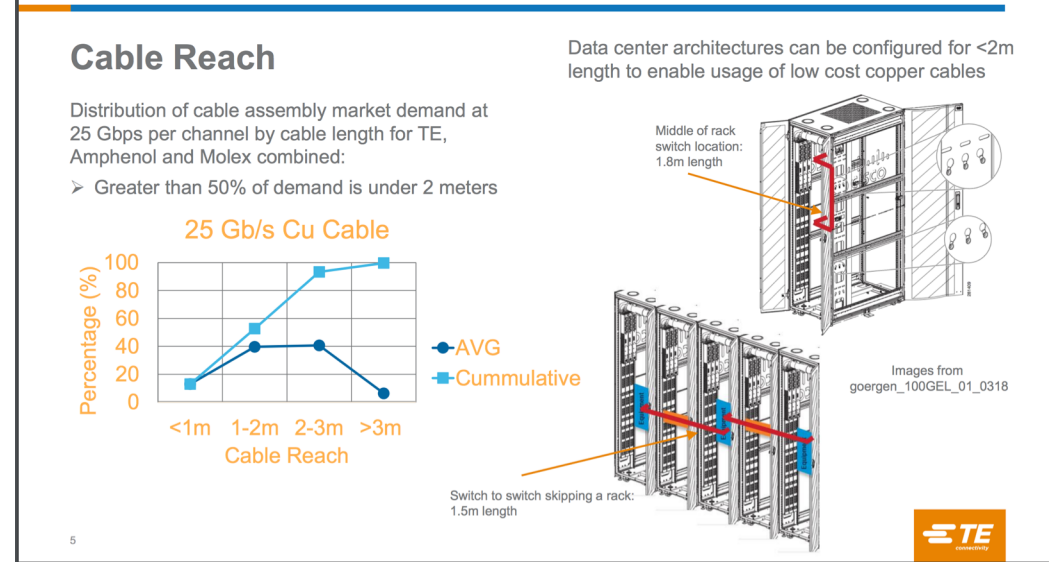
- There are clear routing solutions (case 2 and 4) that can be implemented, with some level of engineering guidance, in a length of 1500mm to 1700mm, easily targeting 2 of the 5 cases described.
- To fit all cases, the target length would have to be 3000mm.
- Case 1, 3, and 5 can be avoided with equipment planning.

Cable Routing Method	Length (mm)
1) Front Top to Rear Middle	2892
2) Front Top to Front Middle	1826
3) Front or Rear Top tot Front Bottom	2690
4) Front Middle to Front Middle + 1 Rack	1522
5) Front Middle to Front Bottom + 1 Rack	2436

*goergen\_100GEL\_01\_0318*

# Current 25 Gb/s Cu DAC cabling needs

- 55% demand is 2m or less
- **40% of current demand is for 2-3m Cu cables**
- >2m Cu Cables becomes more important for rack to rack interconnects
- Need to better understand the 2-3m Cu cable requirements
- Significant portion of current Cu DAC volumes are not addressed in 802.3ck



# Summary

- Cu DAC solutions limited to ~2m reach only covers 55% of the market, thus misses a significant portion of the potential market requirements
- Mixed use of passive Cu DAC and other (active Cu DAC / AOC / optical) solutions for the remaining 45% of the use cases in the rack will create end user configuration challenges
- Tradeoffs made to achieve the 2m Cu DAC reach with 100GEL demand significant changes in the medium, thus leading to high cost and high risk solutions for the switch to server Cu DAC connectivity

**THANK YOU!**