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# Proposal to include optical fiber objective in Multi-gig Automotive Ethernet

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## Supporters

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# Summary

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Propose to include an optical fiber PHY objective in Multi-Gig Ethernet to support emerging high bandwidth, long length & weight reduction use cases

## Broad market potential

- Automotive networking is evolving rapidly with multiple use cases for bandwidth  $\geq 1$  Gb/s
- Related applications requiring link lengths  $\geq 15$ m
- Glass fiber media option would complement twisted pair in emerging applications

## Benefits

- Optical fiber complements copper interconnect by providing exceptional bandwidth, light weight, low power consumption, electromagnetic immunity, and harsh environment resistance

## Technical Feasibility

- Optical fiber technologies are mature and widely used in other applications and have proven reliability.  
e.g. 10GBASE-SR technology can be adapted to an automotive PHY

# Automotive use cases could benefit from an optical fiber option

- Use cases From CFI Multi-Gig Automotive Ethernet PHY CFI\_01\_1116.pdf

## CFI Multi-Gig Automotive Ethernet PHY

### Why Multi-Gig in Addition to 1000BASE-T1/-RH and 100BASE-T1?

#### ▶ Use Cases

- Sharing camera data
- 4K and 8K shared display data
- Connectivity: LTE 4G/5G, transport of 802.11ac
- Connecting 1000BASE-T1/-RH switches
- Diagnosis (port mirroring of multiple 1000BASE-T1/-RH links)



## CFI Multi-Gig Automotive Ethernet PHY

### Use Cases

- ▶ Cameras
  - 4K Cameras at 60 fps - 6 to 8 Gbps
  - Short propagation delay (< 20 ms) doesn't allow for compression
- ▶ Data Sharing
  - Aggregation of multiple 1 Gbps links requires xGbps links
- ▶ Displays
  - 4K/8K displays will start appearing in vehicles
- ▶ Data Recorder
  - Significant amount of raw data may need to be saved to reconstruct incidents

- Uncompressed camera/video data rates reach and exceed 10 Gb/s, e.g. zinner\_NGAUTO\_01a\_0217.pdf
- Commercial vehicle applications may require lengths up to 40 m: matheus\_buntz\_10SPE\_01\_0916.pdf (10 Mbps Single Pair Ethernet SG)

	Mandatory	Additional/optional
<b>Physical Medium</b>	Unshielded, unjacketed TP cabling	If possible, CAN cable (i.e. PVC insulation)
<b>Max. link length</b>	15 m for passenger vehicles	40 m for commercial vehicles

- OEM survey indicated that 50% of respondents expressed interest in 10 Gb/s and 50% said they would consider optical cable  
Wienckowski\_3NGAUTO\_01a\_0117.pdf

## Benefits of optical fiber links

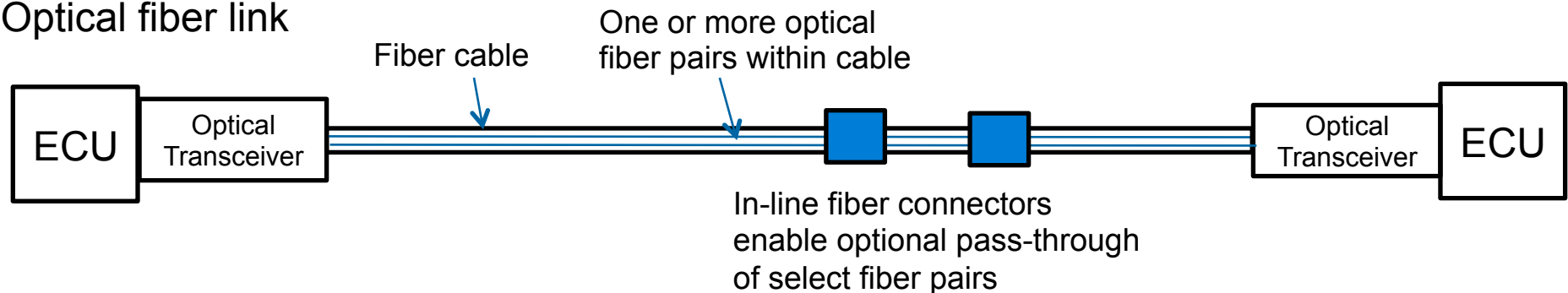
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- Optical fiber links provide compelling features that complement copper interconnects
- Reach
- Light weight
- Low power consumption
- Thin cross-section
- Low latency
- Electromagnetic immunity
- Harsh environment compatibility

Reference: whelan\_3NGAUTO\_01b\_0117.pdf

# Technical feasibility

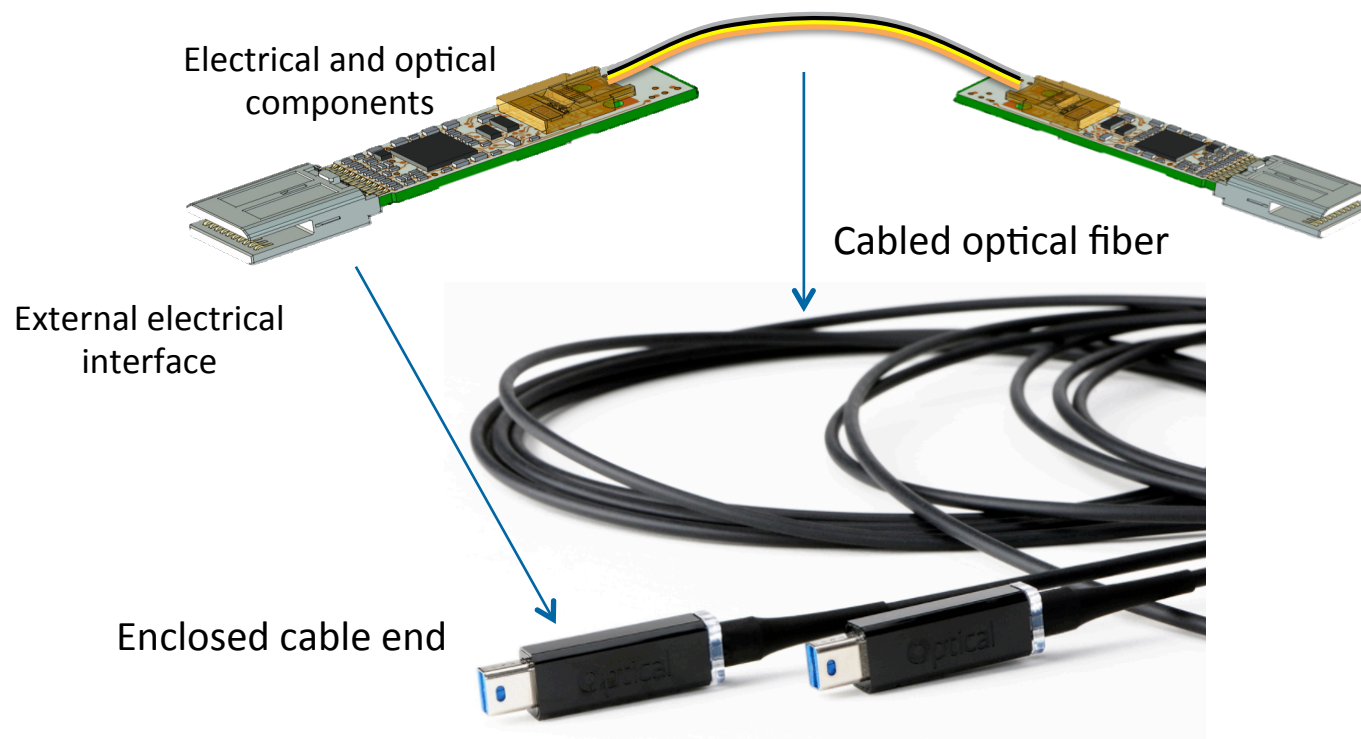
## Optical fiber link



Component	Status	Technology	Examples
Optical transceiver	Available	VCSEL	10GBASE-SR, or 10G SRL version
Fiber	Available	Multimode fiber	OM2, OM3, OM4
Cable	Available	Environmentally hardened	Fiber drop cable, Aerospace cable
Connector	Available	Environmentally hardened	Assembly suggested, see next slide as an example

# Active optical cable configuration encapsulates optical links

- Transceiver is permanently fixed to fiber cable
  - Compatible with proven transceiver technologies
- Active cable provides electrical interface to external devices
- Optical and electronic components can be environmentally isolated in sealed environment



## Objective proposal

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Add the following multi-gig objective

- Define the performance characteristics of an automotive link segment and a PHY to support 10 Gb/s point-to-point operation over this link segment supporting up to four inline connectors and up to at least 15m on at least one type of automotive cabling (e.g. STQ, STP, SPP, Coax, Twinax, optical fiber).





Thank You!

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