OMEGA

Objectives justification

IEEE 802.3 OMEGA SG: March 2020 Atlanta

Carlos Pardo

OEM Requirements

- Feedback from several OEMs:
  - DOARTE GONCALVES - PSA
  - Magnus Eek - Volvo
  - Natalie A Wienckowski - GM
  - Michael Kaindl - BMW
  - Jaspar: Toyota, Nissan, Honda, Mazda, Suzuki MC, Isuzu, Subaru, …

Multi-Gigabit use case 1

Use case name: Smart antenna
Model year intro date: Q1/FY25
Use case description: Antenna hub which aggregates signals from GNSS, 5G, RF and GPS and sends it the head unit
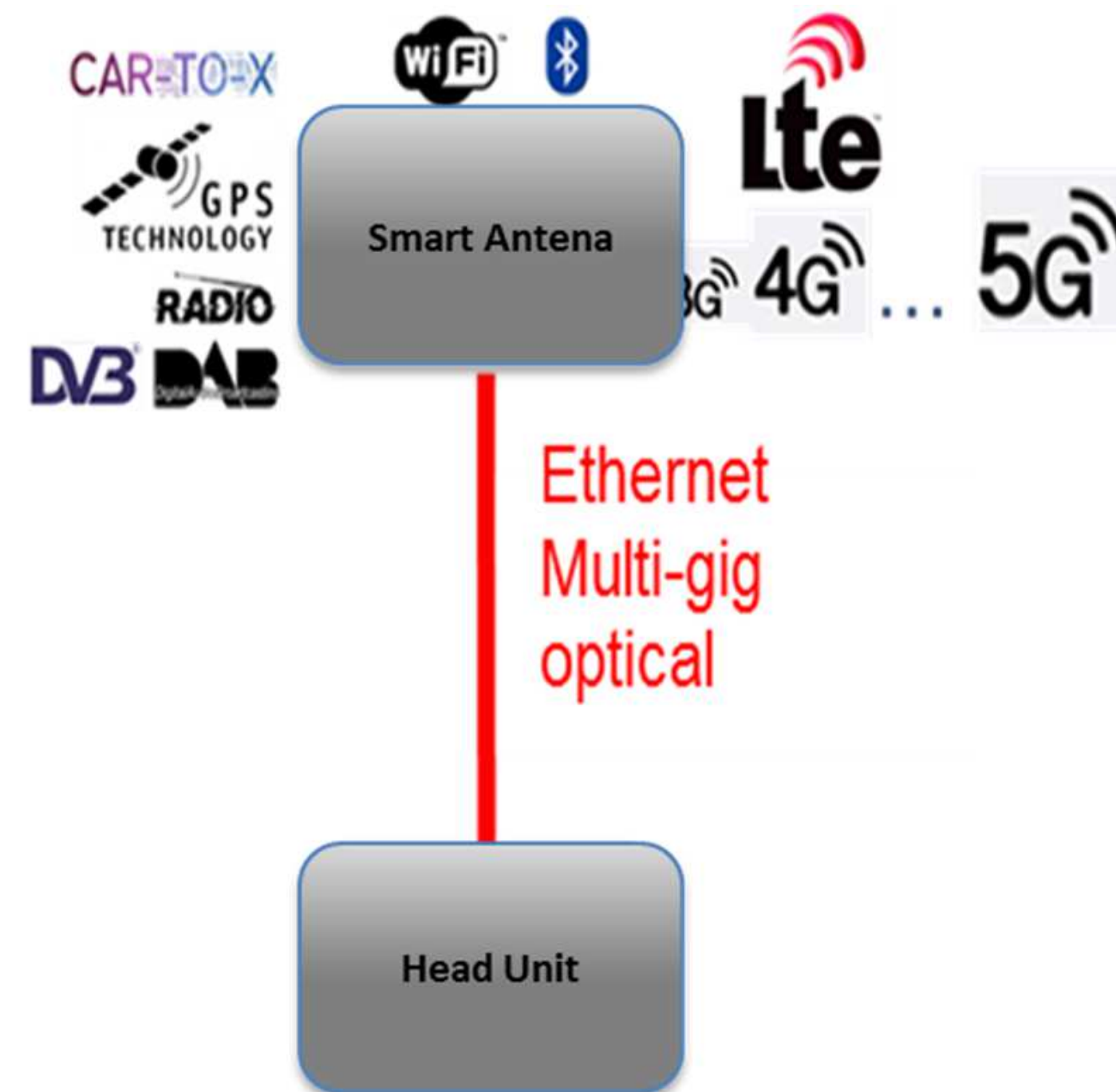**Max. Bitrate**: 2.5 Gbps
Key issues to take into account:
Radiation self coupling of transmission line into antenna
Low profile
Non conductive ceiling
High temperature profile (105ºC)
Maximum latency 5 us

Source: Doarte Concalves - PSA

Multi-Gigabit use case 2

Use case name: Multi-domain Backbone
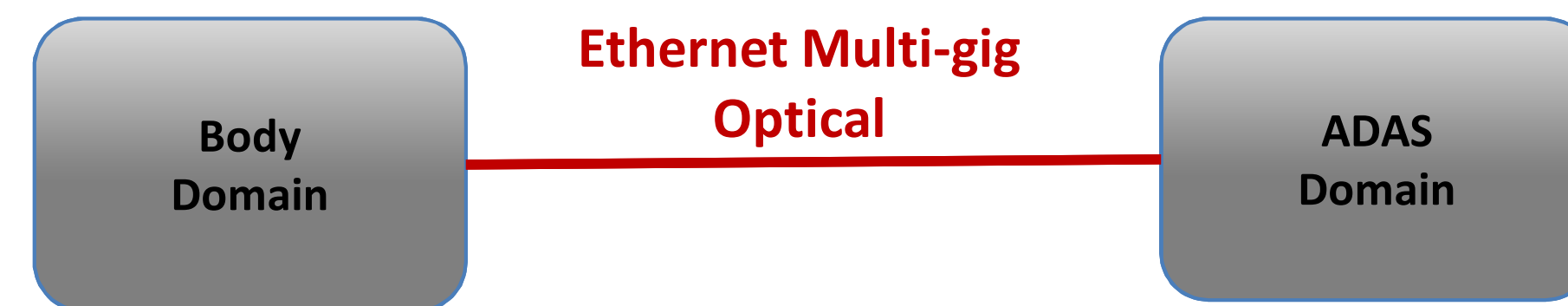**Model year intro date**: Q1/FY25
Use case description:
Aggregation of main Ethernet
communication over backbone link between main Ethernet ECU's
Max. Bitrate: 5 / 10 Gbps
Key issues to take into account:
High temperature profile (105ºC)
Latency, …

Ethernet Multi-gig Optical

Body Domain

ADAS Domain

Source: Doarte Concalves - PSA

Multi-Gigabit use case 3

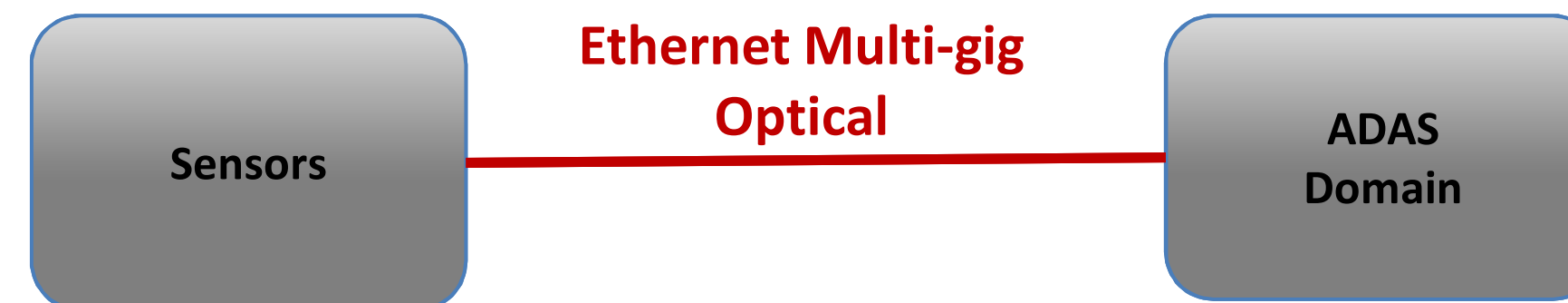**Use case name**: SENSORS (Cameras, Lidars,…)
Model year intro date: Q1/FY25
Use case description: Aggregates high definition signals from sensors (video without compression)
Max. Bitrate: 2.5 / 5 Gbps
Key issues to take into account:

    High temperature profile (105ºC)
    Low latency

Ethernet Multi-gig Optical

Sensors ———— ADAS Domain

Source: Doarte Concalves - PSA

Multi-Gigabit use case 4

Use case name: Display
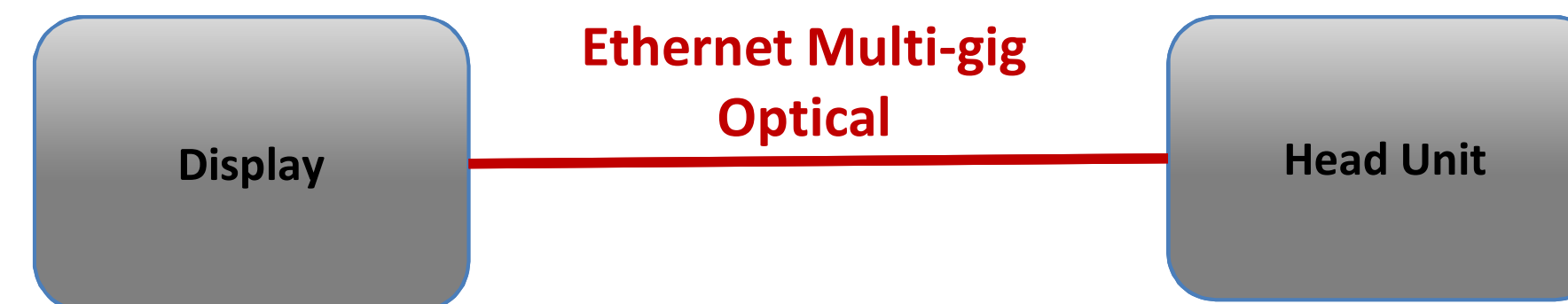**Model year intro date**: Q1/FY25
Use case description: Aggregates high definition signals
from video source to Screen
Max. Bitrate: 2.5 / 5 Gbps
Key issues to take into account:

High temperature profile (105ºC)
Latency, ...

Source: Doarte Concalves - PSA

Ethernet Multi-gig
Optical

Display

Head Unit

Multi-Gigabit use case 5G Connectivity

Use case name: 5G Connectivity / Smart antena

Model year intro date: TBD

Use case description: Antenna hub which aggregates signals from GNSS, 5G, RF and GPS and sends it to the head unit

Max. Bitrate: 2.5 Gbps

Key issues to take into account:

Radiation self coupling of transmission line into antenna

Low profile

Non conductive ceiling

High temperature profile (105ºC)

Maximum latency 5 us

Source: Magnus Eek - Volvo

Multi-Gigabit use case Magnetic Immunity communication

Use case name: Electro Magnetic Immunity communication

Model year intro date: TBD

Use case description: Communication for high Electro Magnetic Immunity for AD Fall back minimum risk condition (Intentional EMI for Safe Stop, Thunder)

Source: Magnus Eek - Volvo

Multi-Gigabit use case Back bone

Use case name: Back bone

Model year intro date: TBD

Use case description: Communication between Core System ECUs

Max. Bitrate: 10 Gbps

Key issues to take into account: Position in car both engine and passenger compartment.
High temperature profile (125ºC)

Source: Magnus Eek - Volvo

Multi-Gigabit use case Uncompressed camera

Use case name: Uncompressed camera data

Model year intro date: TBD

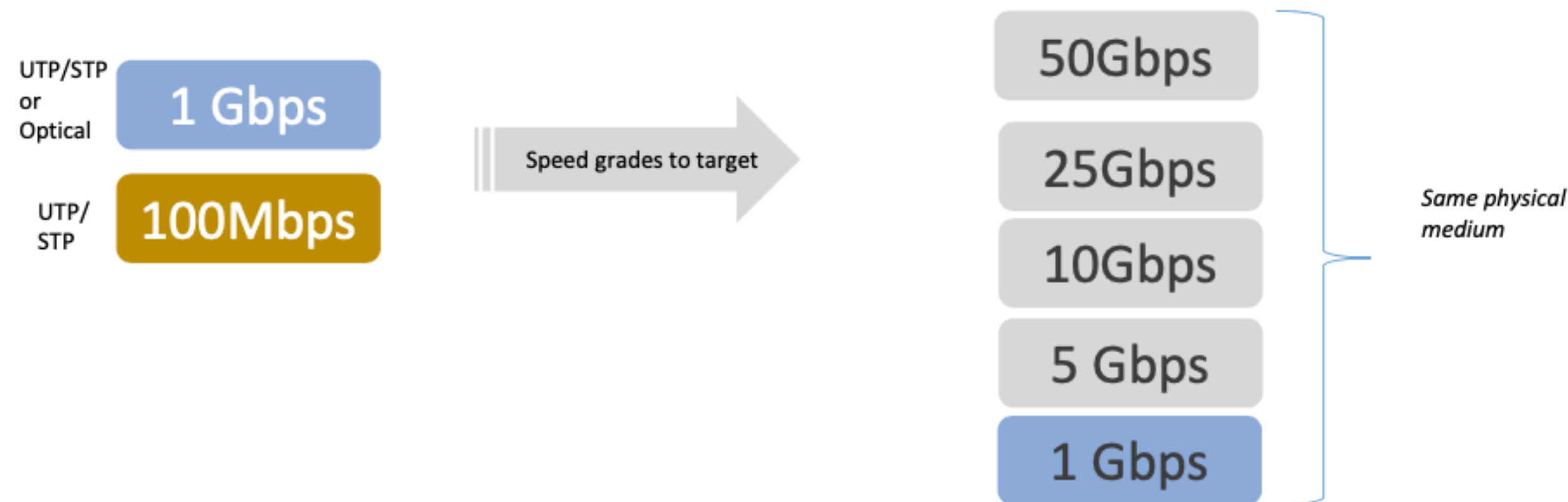**Use case description**: Raw data from camera to processing unit.

Max. Bitrate: 10 Gbps

Key issues to take into account:

Source: Magnus Eek - Volvo

Speed Requirements

Potential speed grades for future

UTP/STP or Optical **1 Gbps**

UTP/STP **100Mbps**

Speed grades to target →

50Gbps
25Gbps
10Gbps
5 Gbps
1 Gbps

Same physical medium

Important:
- It shall be possible to use the same physical medium.

- PHY (Transceiver) support of multiple speed grades is interesting. However, cost optimization important.

1/20/2020

Input - Automotive Use-cases and Requirements Multi Gigabit,
Magnus Eek - Volvo Cars

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Optical Physical Medium & Connectors

- **4 inline connectors on total length 15m** (e.g. SMD FOT with pigtail (internal inlines within ECU) to connector and 2 in lines within vehicle)
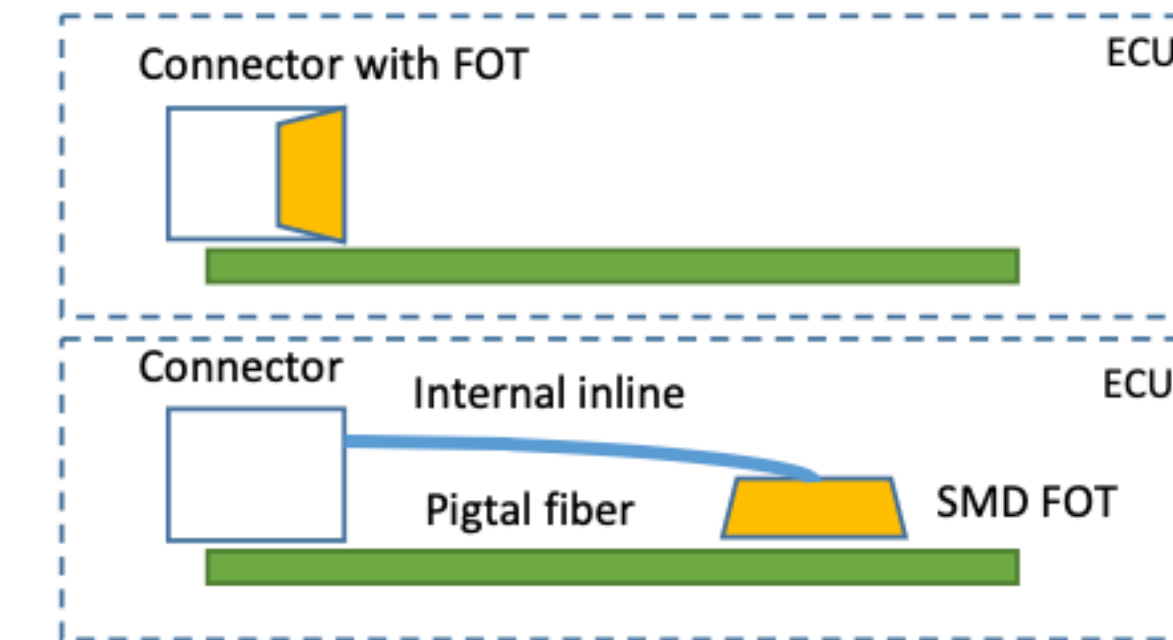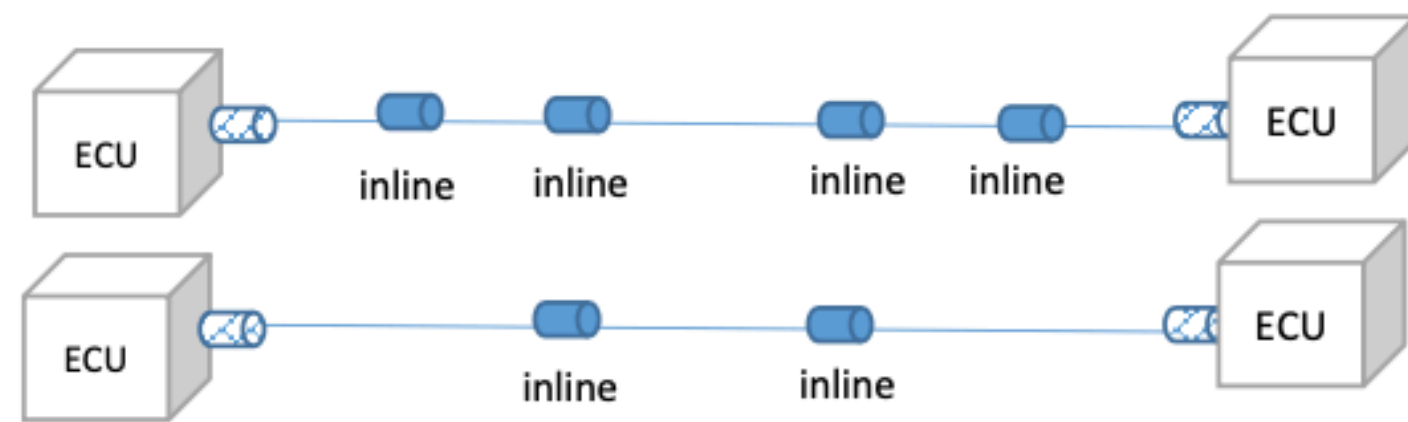
- **Connectors**

  - **Sealed** (water tight, dust protection, temperature etc.) -> e.g. cameras
  - **Unsealed** (dust protection, temperature etc.)

  - Single connector(s)
  - Multi-pin connectors (Multiple Optical connectors AND Optical + UTP harness)

Challenges: connector size

Multi Gig optical use cases

- **Camera, Display, Sensors** connection (Serializer function!)
  - TODAY
    - Download stream from1GB, up to 6GB upload stream 100MB is enough
  - Future
    - Asymmetric function (only) needed.
    - Download up to 10Gbit, uni directional; Low Speed (10…100MB) Status/ Control
- **Backbone** – point to point 2…10 ECU
  - Required for Autonomous Driving Level 3 and beyond
  - Bandwidth from 2.5 Gbps to very high speeds
- **Data cloud in the car** (as one potential solution)
  - A central data storage system, where the data available for usage when needed/requested by the processor.
  - Also, we should use higher level of SW-Design & abstraction, in order to achieve flexible structures, and reduce amount of information to be stored

**Dr Michael Kaindl
BMW**

Multi Gig optical use cases

- **Camera connection**
  - **TODAY**
    - **Download stream 1GB, up to 6 Gbps; Upload stream 100 Mbps is enough**
  - **Future**
    - **Asymmetric function (only) needed. Download up to 10 Gbps, upload 10/100 Mbps**
- **Autonomous driving**
  - **Camera/radar sensors applications**
    - **Serial (one direction) link is required. Download stream up to 10 Gbps. No upload**
  - **Display:**
    - **We need the asymmetric mode:**
      - **High speed: Image Data, uni directional**
      - **Low Speed (10...100 Mbps) Status/ Control**
  - **Backbone – point to point 2...8 ECU units**
    - **In redundancy configuration. Optical & Copper.**
    - **Bandwidth 10 Gbps and beyond**

Dr Rüdiger Roppel
Porsche

Introduction – What is JASPAR ?

- ## Vision
  - ➢ Lead the automotive industry by promulgating and encouraging the broad-based adoption of new ideas and technologies.

- ## Mission
  - ➢ Identify the common issues to be faced in the future by the automotive electronics sector.
  - ➢ Undertake standardization initiatives aimed at resolving identifed issues.

- ## Members
  - ➢ 12 OEMs
  - ➢ 43 Suppliers
  - ➢ 78 Software/Tool vendors
  - ➢ 27 Semiconductor/Component vendors
  - ➢ 25 Others (Trading companies, Universities,…)

Toyota, Nissan, Honda, Mazda, Suzuki MC, Isuzu, Subaru, …
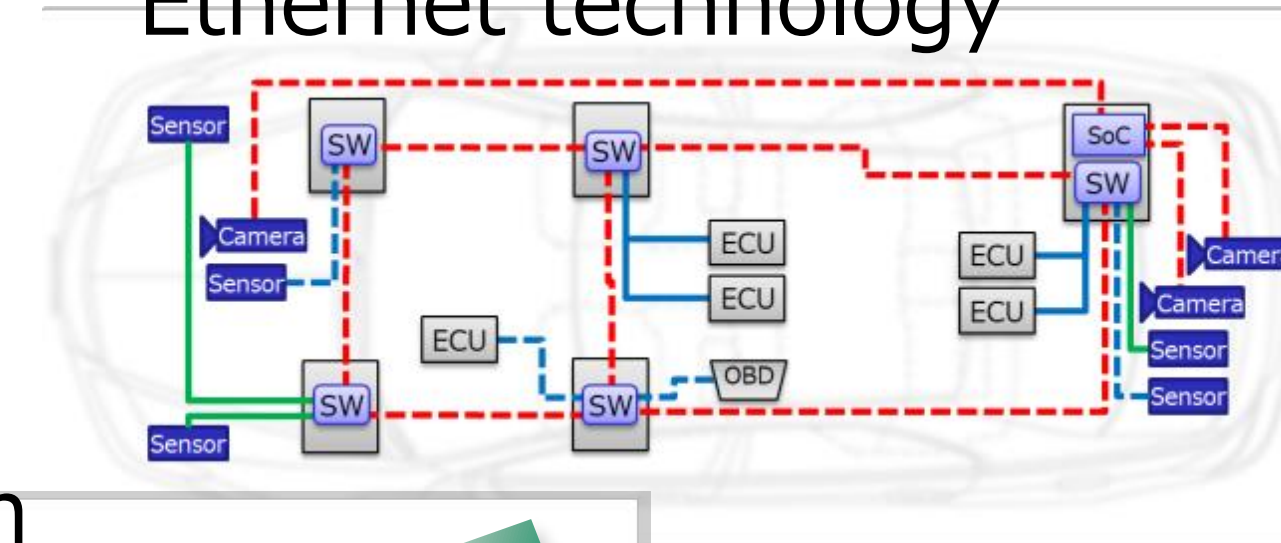
Key feature :
Connected, Cyber security, High-level aided driving, Autonomous driving

"Future"
Make full use of In-vehicle Ethernet technology

"Today"
Utilize internet protocol suite and expand bandwidth

- 10Mbps (10BASE-T1S)
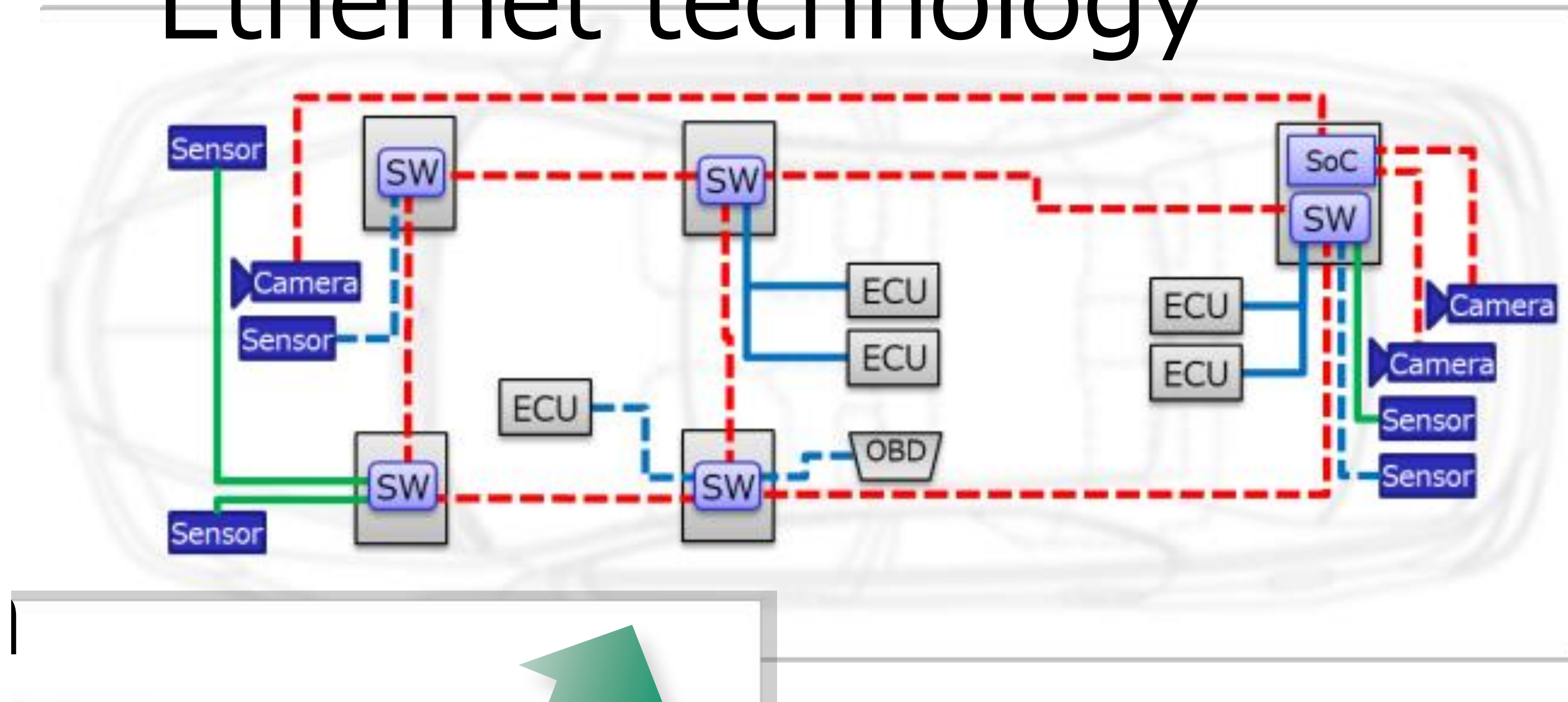- 100Mbps (100BASE-T1/TX)
- 1Gbps (1000BASE-T1/RH)
- 10Gbps
- LVDS
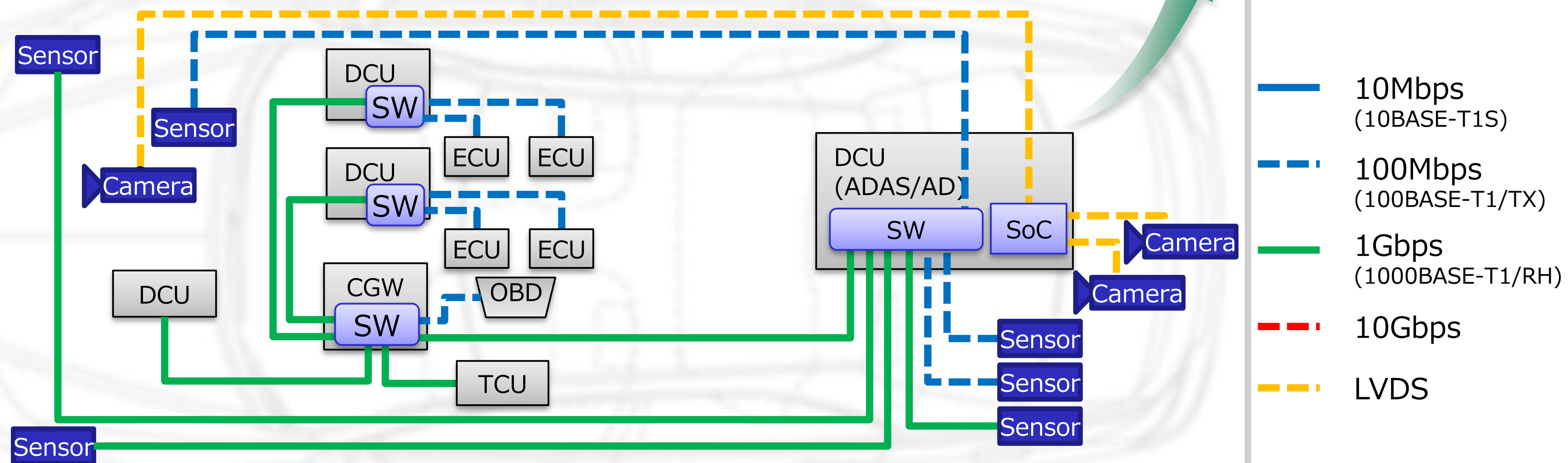
Major usecases of 1Gbps are: backbone, Sensor network...

Make full use of In-vehicle Ethernet technology

10Mbps
(10BASE-T1S)

100Mbps
(100BASE-T1/TX)

1Gbps
(1000BASE-T1/RH)

10Gbps

2.5, 5 & 10 Gbps

GENERAL MOTORS

I am interested in investigating the suitability of optical Ethernet for Automotive applications faster than 10 Gb/s, e.g. environment, manufacturability, serviceability, etc.

I expect that as speeds increase, optical may have an advantage in some or all of EMC, power, weight.

Natalie Wienckowski
General Motors

All data rates

	2.5 Gbps	5 Gbps	10 Gbps	25 Gbps	50 Gbps	Asymmetric
Backbone	✅	✅	✅	✅	✅	
Smart Antenna	✅					
Cameras, Sensors	✅	✅	✅	✅		✅
Display	✅	✅				✅
Data Loggers		✅	✅	✅	✅	

100 Gb/s

- No need has been presented
- 100 Gb/s might be needed in more than 10 years
- No technical feasibility has been demonstrated for 100 Gb/s operation in automotive environment in the SG.
- Defining a standard for 100 Gb/s today might result in a sub-optimum specification
- Desirable solution should be a single lane
- SUGESTION: Delay 100 Gb/s standardization until very high speed VCSELs become standard in the industry

Important messages from OEMs

- Same media (fibres, connectors) for all data rates
- 2.5, 5, 10, 25 and 50 Gb/s required
- Single lane solutions
- 2 - 4 inline connectors needed
- 15 m is enough for car industry
- 40 m is required for buses and trucks
  - 40 m will allow the use of the application in trains and planes

Too many speeds ?

- It is required by OEMs
- 2.5, 5 and 10 Gb/s are extrapolation of 25 Gb/s
- Real effort during task force will be 25 and 50 Gb/s
- Same media for all speeds is a strong requirement from OEMs

Inline connectors

- Between 2 and 4 is the main message
- We should have 4 as an objective if possible
- For 50 Gb/s, 4 might be too aggressive at this time
- SUGGESTION: Set 4 inline for all speeds, but 2 inline for 50 Gb/s
  - If achievable move to 4 inline at 50 Gb/s later in the task-force

Lengths

- At least 15 m is needed for automotive industry
- 40 m will broad market potential:
  - Buses, trucks, trains, planes, …
- For 50 Gb/s, 40 meters might be too aggressive at this time
- SUGGESTION: 15m & 40 m for all the data rates, but only 15 m for 50 Gb/s

ASYMMETRY

- Asymmetric operation should be guaranteed
  - EEE might be the best way to implement it

Auto-negotiation

- Not needed
- It might delay wake-up time
- Suggestion: No in the objectives
  - It might be added later if implementation is feasible and there are customer request

Supporters