



# Need for scalability beyond 10 Gbps

Contribution to the ISAAC Study Group

Janik Steyer-Ege (Bosch), Thomas Hogenmüller (Bosch), Felix Fellhauer (Bosch),  
Ragnar Jonsson (Marvell)

# Supporters

(alphabetically)

- Alireza Razavi (Marvell)
- Amir Bar-Niv (Marvell)
- Ariel Lasry (Qualcomm)
- Chad Jones (Cisco)
- Christian Neulinger (MD Elektronik)
- Erwin Koepf (Leoni)
- George Zimmerman (CME Consulting)
- Hayim Ringel (General Motors)
- Haysam Kadry (Molex)
- Hossein Sedarat (Ethernovia)
- Makato Nariya (Sony)
- Markus Gerl (MD Elektronik)
- Natalie Wienckowski (Independent)
- Peter Jones (Cisco)
- Peter Wu (Marvell)
- Steven Carlson (High Speed Design)
- William Lo (Axonne)
- tbd

# Agenda

- The need for data rates above 10Gbps
- Pros and Cons of supporting 25Gbps
- Network Integration
- How to enable „evolutionary change“, Problem
- How to enable „evolutionary change“, Solution
- Things to consider if 25Gbps is supported
- Four paths forward

# The need for data rates above 10Gbps

- There have been calls for supporting 25 Gbps in the ISAAC project, including
  - [ringle ISAAC 01 092723.pdf](#)
  - [Lo 01 1023.pdf](#)
  - [jonsson 3ISAAC 01 082823.pdf](#)
- Comparison with other solutions
  - MIPI A-PHY v1.0 supports up to 16Gbps [1]
  - MIPI A-PHY v2.0 supports up to 32Gbps [2]
  - MIPI A-PHY future plans for up to 48Gbps [1]
  - ASA v1.01 supports 16 Gbps (“a perfect fit for camera sensors”) [3]
  - Incumbent solutions support up to 12-13Gbps and probably increasing [4], [5]
- In the past, all IEEE standards became subject to rate extensions – already today development towards higher rates for asymmetric Automotive applications can be seen
  - Stereo Camera market growth [6]
  - Novel sensor types, like “Light Field Sensors” [7]
- **To summarize, there is clearly interest in the industry to support video data rates above 10Gbps**

[1] <https://www.mipi.org/resources/a-phy-frequently-asked-questions>

[2] <https://www.mipi.org/download-mipi-whitepaper-introductory-guide-to-mass>

[3] <https://auto-serdes.org/frequently-asked-questions/>

[4] <https://www.analog.com/en/applications/technology/gigabit-multimedia-serial-link.html>

[5] <https://www.ti.com/video/6314704574112>

[6] <https://www.technavio.com/report/automotive-stereo-camera-market-industry-analysis>

[7] <https://www.dlr.de/rm/en/desktopdefault.aspx/tabid-11459/>

# Pros and Cons of supporting 25Gbps

## Arguments **for** supporting 25Gbps:

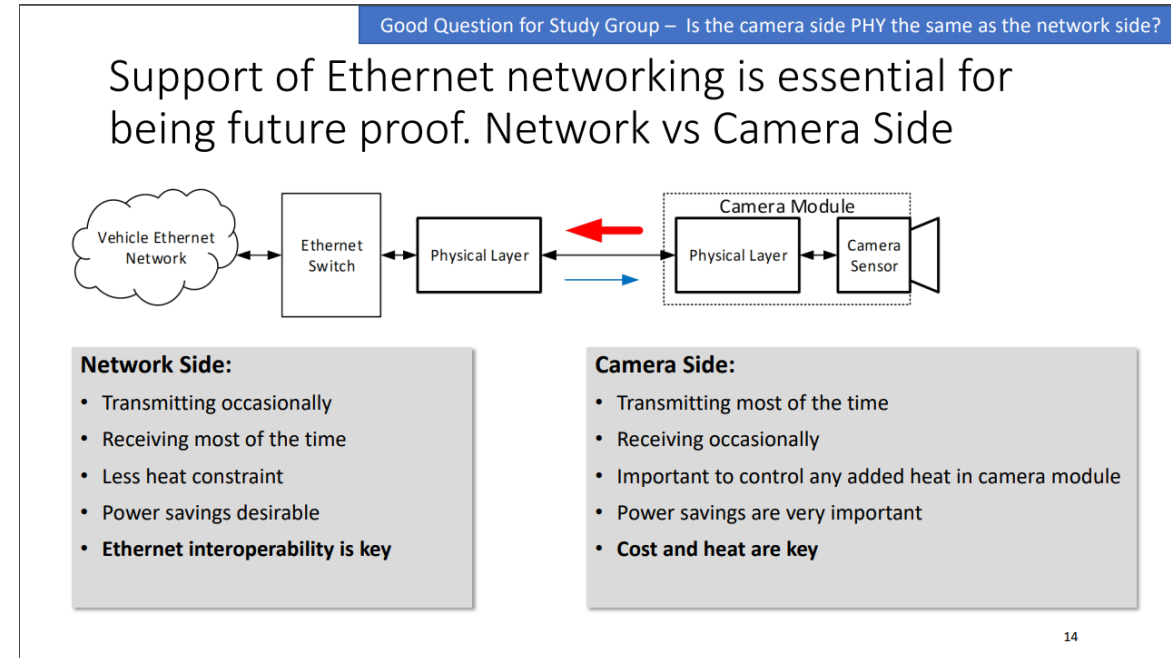
- There is a risk that without 25Gbps the ISAAC project will be “obsolete” by the time it is finished
- There is clearly interest in data rates above 10Gbps in the industry
- There have been presentations stating the need for data rates above 10Gbps
- There have been concerns that 25Gbps solution would be available too late if it is in a separate project later
- There have been concerns that supporting multi-mode device may become more difficult if 25Gbps is done in a separate project
- There are already imaging sensors requiring more than 10Gbps on the market
- Considering the entire range of existing Automotive Ethernet rates is key to ensure seamless integration into ecosystem

## Arguments **against** supporting 25Gbps:

- There have been concerns that specifying data rates above 10Gbps may slow down the ISAAC project
- There have been contributions, indicating a market majority can be addressed with 10Gbps and below

# Network Integration

- As discussed earlier, Ethernet interoperability is key [1]
- Why does the rate limit impact integration of ISAAC into existing Automotive Ethernet ecosystem?



From [https://www.ieee802.org/3/cfi/0723\\_1/CFI\\_01\\_0723.pdf](https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf) [1]

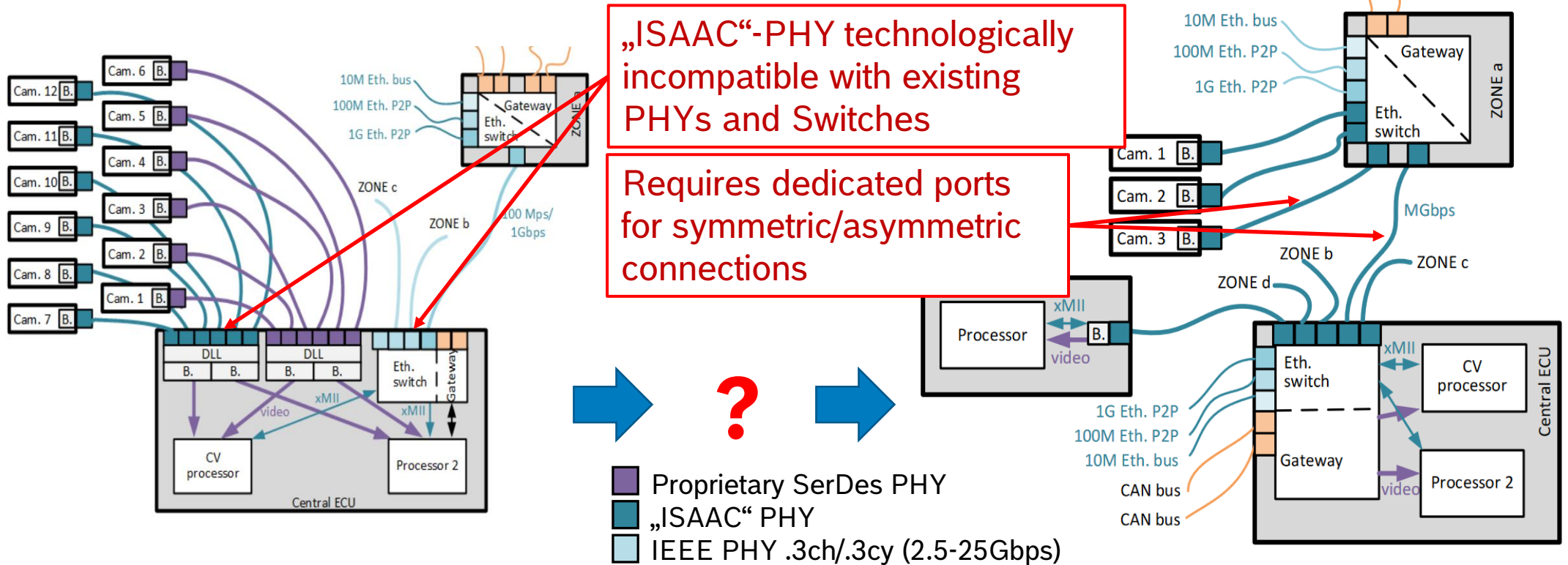
## Let's think how the output of ISAAC-TF will impact semiconductor product portfolio and how it impacts “evolutionary change”

[1] Improved Support of Asymmetric Applications for MGBps Ethernet Cameras (ISAAC) v. 1.05 – Post Meeting J. Lewis, K. Matheus, K. Dalmia, G. Zimmerman - Call For Interest (CFI) consensus meeting presentation  
[https://www.ieee802.org/3/cfi/0723\\_1/CFI\\_01\\_0723.pdf](https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf)

# How to enable „evolutionary change“, Problem

## Likely next generation [1]

## Target [1]



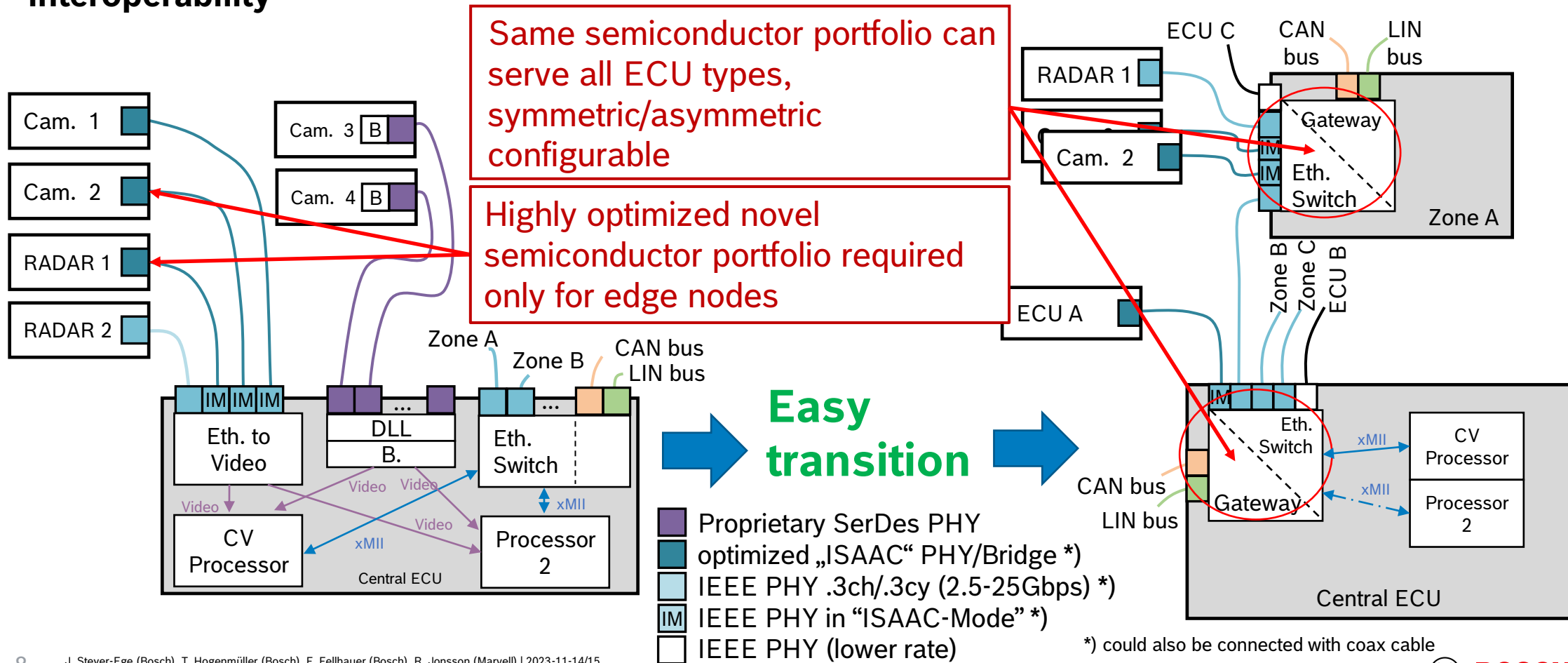
*Choosing a different technological path for ISAAC, compared to existing IEEE will require development of separated product portfolios for legacy Ethernet and ISAAC*

[1]: Call For Interest (CFI) consensus meeting presentation, 11 July 2023 by J. Lewis, K. Matheus, K. Dalmia, G. Zimmerman [https://grouper.ieee.org/groups/802/3/cfi/0723\\_1/CFI\\_01\\_0723.pdf](https://grouper.ieee.org/groups/802/3/cfi/0723_1/CFI_01_0723.pdf)

# How to enable „evolutionary change“, Solution

Likely next generation, with ISAAC and IEEE interoperability

Target, with fully interoperable ecosystem





# Things to consider if 25Gbps is supported

- Media Independent Interface and the Reconciliation Sublayer
  - The XGMII (10Gbps) and 25GMII (25Gbps) media independent interfaces are very similar, so there should not be significant effort to include 25Gbps support
- PCS, including FEC
  - Based on experience from 802.3ch and 802.3cy, there should not be significant effort to add 25Gbps PCS
- PMA, including modulation
  - It is relatively simple to extend line codes to 25Gbps, including modulation schemes such as TDD, FDD, spread-spectrum, and echo canceled systems
- Channel, including IL and RL
  - To support 25Gbps, the channel requirements would probably need to be extended to higher frequency and the supported cable length would probably be shorter (considering same link segment losses)
- In summary, there is no obvious hurdle in supporting 25Gbps in the ISAAC project and this should not cause any significant delay to the project
- But when supporting 25Gbps,
  - there will be improved level of integration into existing Automotive Ethernet ecosystem, and
  - higher versatility of semiconductor products (on network-side), and thus higher market adoption rate

# Four paths forward

- Include 25Gbps in the PAR and the Objectives (best option)
  - This would allow the task force to consider solutions for 25Gbps
  - This would allow the task force to harmonize 25Gbps solution with solutions for 10Gbps and below
  - This would provide the fastest path to having solution for data rates above 10Gbps
  - This might slow down the development in the task force, if unforeseen problems arise with the 25Gbps
- Include 25Gbps in Objectives, but PAR does not contain fixed rate limits for fast direction (second best option)
  - Would allow the TF to work towards harmonization with existing Automotive Ethernet solutions
  - Would not slow down the group, since Objectives could be adopted if necessary
- Include 25Gbps in the PAR, but not the Objectives (third best option)
  - This would allow the task force to harmonize 25Gbps solution with solutions for 10Gbps and below
  - This would not be the fastest path to having solution for data rates above 10Gbps
  - This should not slow down the development in the task force, even if unforeseen problems arise with the 25Gbps
- Exclude 25Gbps from both the PAR and the Objectives (worst option)
  - Discussion about 25Gbps should not slow down the development of solution for 10Gbps and below
  - The task force will have limited ability to discuss data rates above 10Gbps
  - There is a good chance that a separate 25Gbps study group and task force will be formed before the ISAAC work is completed
  - The development of 25Gbps solution will probably be delayed

# Summary

- There is clearly interest among study group members and in the industry to support data rates above 10Gbps
- There is some concern among study group members that including support for 25Gbps might delay the ISAAC project
- Our analysis indicates that supporting 25Gbps is not likely to significantly delay the ISAAC project, but will promote integration into ecosystem
- We believe that the best option is to include 25Gbps in both the PAR and the objectives

# Thank you!

*(...) Ethernet has generally been **simpler, faster, and cheaper** than its competitors. It has always been as **fast** as it can practically be, with little regard for current application requirements, so **if you build it, they – new applications, that is – will come**. Added to that is the decision to make Ethernet an **open standard** and the creation of **IEEE Project 802** to perfect its standardization. It was the perfect recipe for capturing that so-called “**lightning in a bottle**”. (...)*

Bob Metcalfe, [1]

[1]: “Ethernet for the Ages: A Discussion with Bob Metcalfe”, Ethernet Alliance Interview, August 22, 2013, <https://ethernetalliance.org/blog/2013/08/22/ethernet-for-the-ages-a-discussion-with-bob-metcalfe/>