Addressing some "Good Questions for ISAAC Study Group"

V1.0

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Brazil

Camera Link Problem Statement (From CFI)

- Key characteristics:
    1. Efficiently support highly asymmetric data rates:
        - 1Gbps to 10Gbps or more from camera
        - Never more than 100Mbps towards camera
    2. Power constrains solution in camera module, to control temperature in the module
        - Sensor quality degrades exponentially with increased temperature.
    3. Power delivery over the data link
    4. Very cost sensitive – needs an optimized solution
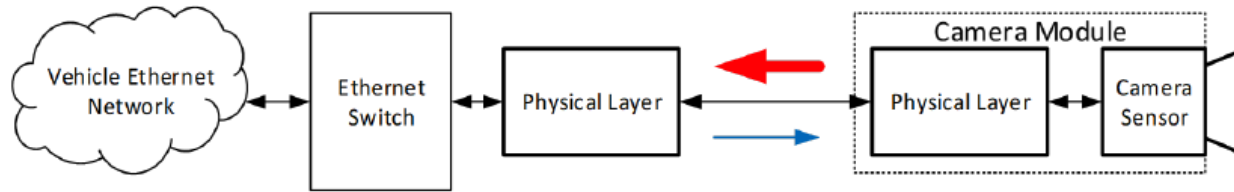   - Motivates combination of image sensor and transceiver in one package.

Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf

This presentation addresses items highlighted in blue above

Key elements of Camera Side PHY

Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf

**Key attribute listed for camera side PHY are cost and heat.
The study group should focus on these aspects.**

PHY Complexity Matters!

Good Question for Study Group – Can we enable a more efficient Ethernet solution?

A communication standard motivates combination of image sensor and transceiver in one package.

Main camera Bill of Material (BOM) items:

- PCB
- Power supply
- PoC circuitry
- Imager
- Communication chip
- Housing
- Wiring
- Connector
- Lens (barrel)
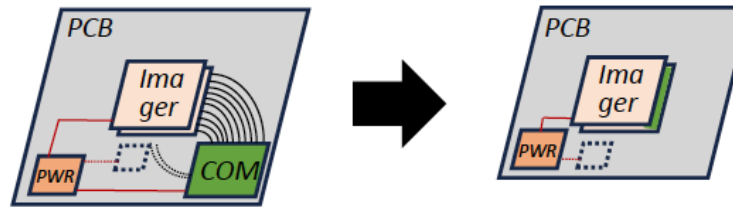
An efficient communications chip (COM) is essential for competitiveness with the incumbent technologies. A power and complexity-efficient Ethernet standard can enable:

- Fewer chip packages on the PCB
- Smaller footprints with fewer communications interfaces, lower power, and reduced cost
- Reduced PCB sizes with fewer layers

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Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf

Lower Complexity enables wider adoption and creates broader market potential
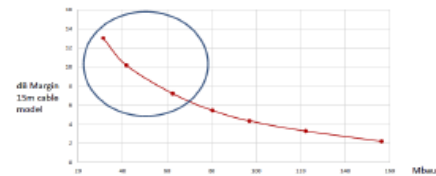
Native Asymmetry is Key

Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf

EEE uses Symmetric PHY as a basis. It is NOT "natively Asymmetric"

Echo Cancellation and Hybrid are not needed

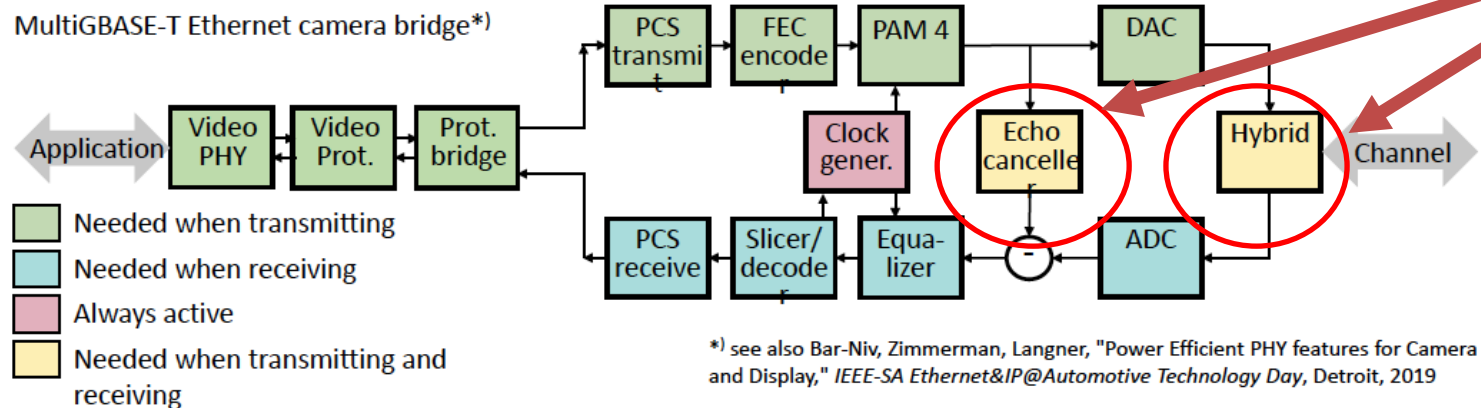Good Question for Study Group– Can we adapt 802.3ch/quiet-refresh to meet the need?

The power consumption of symmetric IEEE 802.3ch can be reduced with help of (asymmetric) EEE

MultiGBASE-T Ethernet camera bridge*)

Not needed For TDD

Legend:
- Needed when transmitting
- Needed when receiving
- Always active
- Needed when transmitting and receiving

*) see also Bar-Niv, Zimmerman, Langner, "Power Efficient PHY features for Camera and Display," IEEE-SA Ethernet&IP@Automotive Technology Day, Detroit, 2019

Power consumption of blocks not needed may be reduced with EEE.

Whether the power reduction of the existing EEE is sufficient to make symmetric IEEE 802.3 PHYs competitive or whether it must/can be improved sufficiently, needs to be confirmed.

The change in power consumption, however, does not change the complexity of the PHY as such, which impacts aspects such as size, **cost**, and integrate-ability into the imager.

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Using TDD Scheme Optimizes The PMA/PMD Complexity for Single Pair Asymmetric Communication - Example: ASA-ML

- Small Area and Low Power – Requirements Met!

  - No need for Echo Canceller or hybrid

  - No need for high resolution ADC or DAC on the camera size

  - The camera side equalizer: low complexity → upstream uses only PAM2

  - The camera side FEC Decoder is of very low complexity and low speed

  - PHY Tx complexity is low on the camera side for all speed grades.

ASA-ML PHY: The right solution for the Camera Side

Lowers the complexity of the PHY as well as reduces power consumption.
– It provides an optimized solution: lowest power, size, cost.
– Well suited for integrate-ability into the imager.

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