Considerations for a 1 Gbps downlink PHY

IEEE 802.3
ISAAC Study Group

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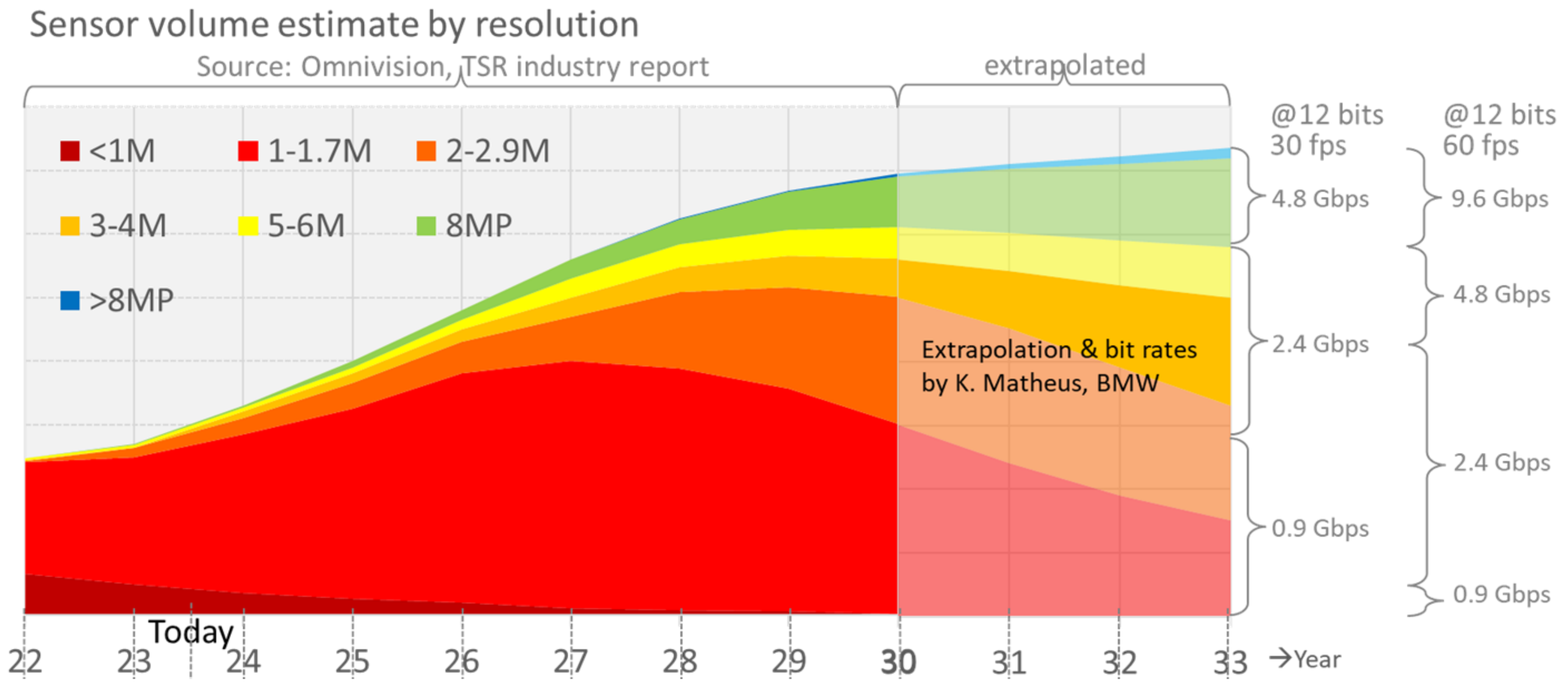
Motivation

- One of the core motivations to start the ISAAC SG was to better support automotive (camera/sensor) applications.

- This presentation discusses the possible need for an asymmetric 1Gbps/100Mbps PHY
  - Use cases
  - Possible link technologies that could serve the market today
  - Implications of a 1 Gbps asymmetric PHY on the PHY – MAC interface

Use case 1: satellite cameras



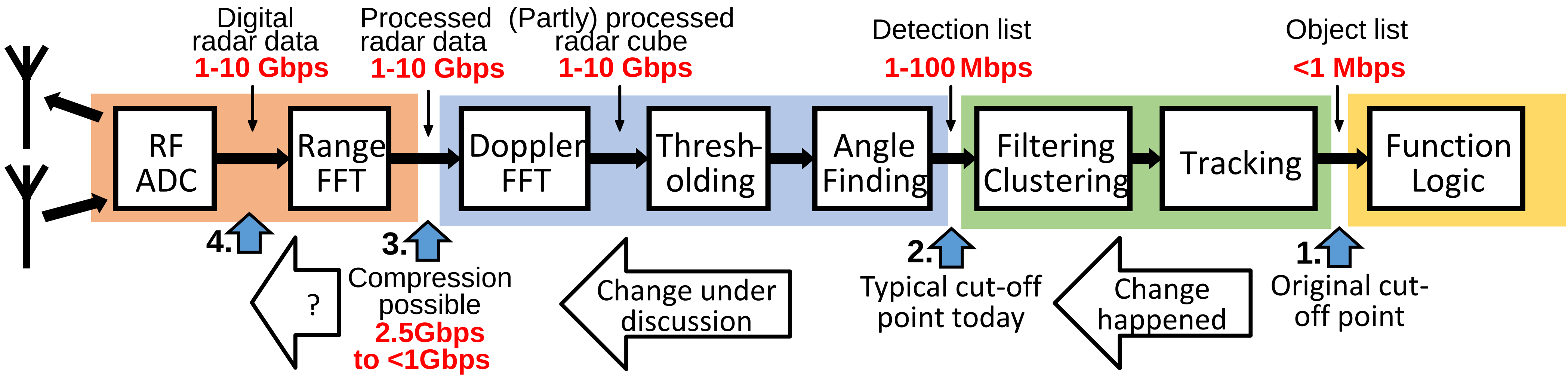
Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf
CFI slides had 81 supporters.

While resolution is increasing, cameras requiring data rates <1Gbps will keep a relevant market share.

Examples:

- VGA (640x480)*30 *12*1.1 = 122 Mbps
- 1Mpx*30fps*12*1.1= 396Mbps
- 2Mpx*30fps*12*1.1= 792Mbps

Use case 2: satellite radars (1)



- Radars today are “intelligent” sensors with software for data processing.
- For future architectures it is under discussion to centralize some of the radar processing and establish a satellite architecture.

See also: https://www.ieee802.org/3/ISAAC/public/100423/matheus_ISAAC_01c_10042023.pdf

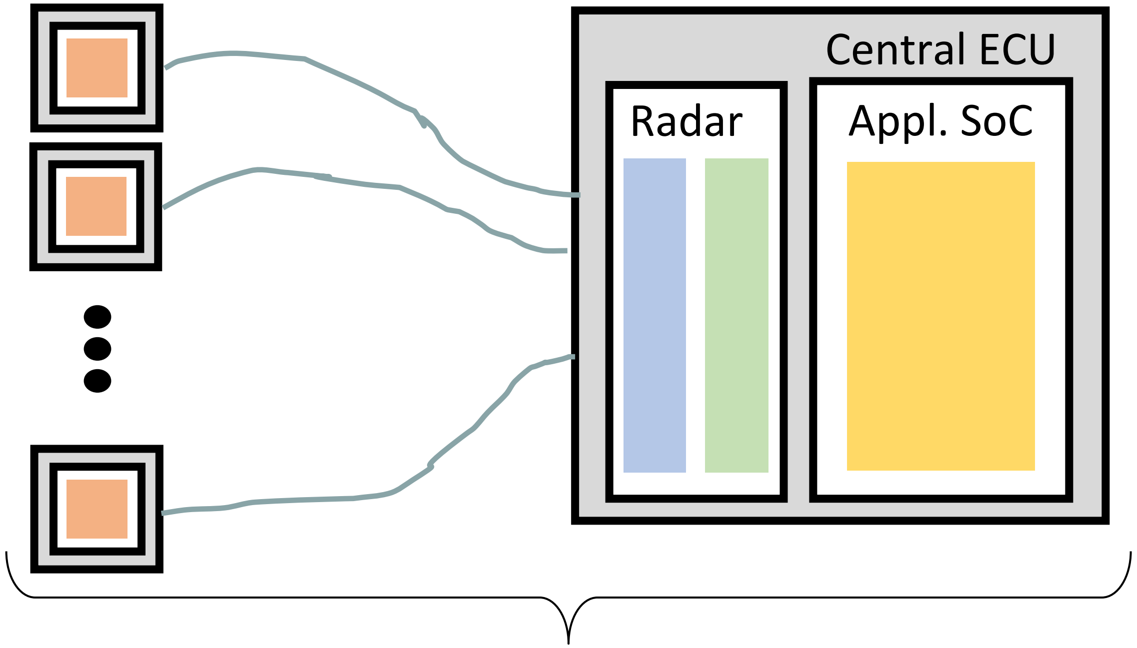
Use case 2: satellite radars (2)

Motivation for centralizing the processing

- **Reduce the overall processing,** because of potential synergies in the centralized unit the overall processing needed is smaller than the sum of the processing of the individual units, or
- **Have better data (functionality)**, because the data can be processed differently as the central unit has more processing power

  and/or
- **Have better data (functionality)**, because data of different radar sensor can be combined at a different point during processing

Requires overlap areas!

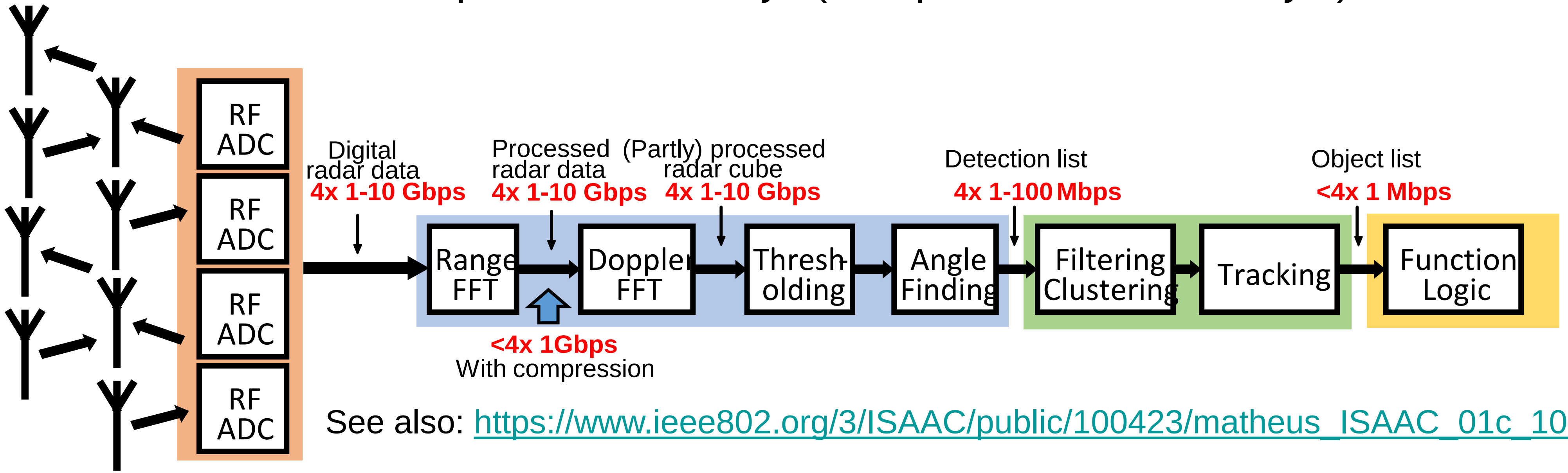


Fully centralized radar processing has yet to prove economically viable!

See also: https://www.ieee802.org/3/ISAAC/public/100423/matheus_ISAAC_01c_10042023.pdf

Use case 2: satellite radars (2)

- Radars are typically classified by reach (short range radars SRR, mid range radars MRR, long/far range radar LRR/FRR).
- The LRR can use multiple antenna arrays (multiple MMICs MIMO style).



See also: https://www.ieee802.org/3/ISAAC/public/100423/matheus_ISAAC_01c_10042023.pdf

- SRR and MRR are used for standard (often mandatory) features such as parking systems, lane departure, blind spot detection, ... LRR are used for more advanced DAS options.
- Expected market ratio is SRR+MRR >> LRR (esp. for satellite LRR).
- Assuming a satellite architecture for SRR/MRR with data < 1Gbps is reasonable.

Possible technologies that would serve the 1 Gbps sensor/camera use cases today

Automotive SerDes:

- Today‘s satellite cameras typically use one of the proprietary Automotive SerDes technologies for asymmetric connectivity < 1 Gbps.
- Respective SerDes bridge products exist.

Automotive Ethernet:

- IEEE 802.3bp/1000BASE-T1 supports 1 Gbps symmetrical communication.
- It was completed in 2016 and introduced in cars 2019.
- There is no public information on the existence bridge products that combine 1000BASE-T1 and e.g. MIPI CSI-2 in one product.
- For satellite radar use cases (which are new and have not decided on a specific protocol to use) using standard 1000BASE-T1 transceivers is in discussion.

Implications on MAC to PHY interface

- In addition to defining PHY(s), the Task Force coming out of ISAAC needs to define a client that allows the symmetric MAC to interact with the asymmetric PHY.
- Option 1 – Dual Headed RS & Asymmetrical MII
  - High speed MII uses XGMII for 10G, 5G and 2.5G
  - High speed MII uses GMII for 1G
  - Low speed MII uses MII for 100M
  - ➢ **A new RS needs to be defined**
- Option 2 – Client based interface with Symmetrical MII
  - High speed MII uses XGMII for 10G, 5G and 2.5G and GMII for 1G (or scaled down XGMII)
  - Low speed MII uses the same MII as the high speed
  - Client controls the egress rate in the low speed direction via RS
  - ➢ **Can we use LPI? Or do we need to define a new client that performs this function?**

Summary and conclusion

- For both satellite camera and satellite radar use cases, it can be expected that a significant market share will require downlink data rates >100 Mbps and <1 Gbps.
- For these use cases an asymmetric PHY supporting 1 Gbps downlink and 100 Mbps uplink would be optimum and could help to reduce power consumption and costs.
- At the same time,
  - 1000BASE-T1 PHYs exist today that might be leveraged today to serve the market (albeit efficient bridge products needed),
  - Thoughts have to go into how to address the GMII/XGMII difference at the asymmetric interface between PHY and MAC.

Straw poll

- I would support including a 1 Gbps downlink /100 Mbps uplink PHY in the project and would support a respective objective.

- Yes
- No
- Abstain

Thank You!