“What Does the Evolution to Zonal Architecture Need?”

IEEE 802.3 ISAAC Study Group Meeting, August 28, 2023

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Introduction

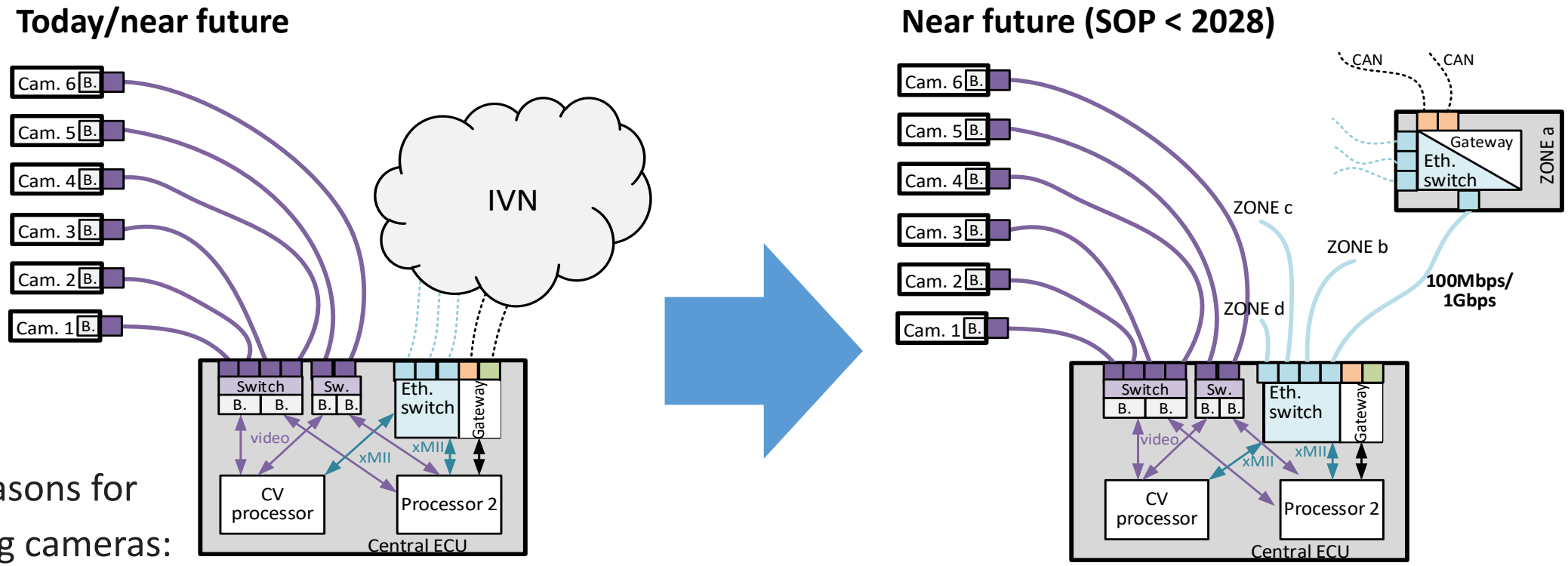
The CFI presentation lists a number of “good questions for the Study Group” of which “What Does the Evolution to Zonal Architecture Need?” is one (see https://www.ieee802.org/3/ISAAC/public/081623/PAR_CSD_OBJ_081623_01.pdf).

This presentation thus explores the requirements the move towards zonal architectures induces on the solution to be discussed within this new project.

It motivates the following items:

- Requirement for 10 m – 15 m link length
- Requirement for STP and coaxial cabling (with the principle capability of power over)
- Closeness/technical compatibility on PHY level to SerDes
- ….

Car industry trends towards Ethernet-based, zonal architectures, however, excluding camera/video connectivity for now.



Main reasons for excluding cameras:

a) Zones are a new concept. They are introduced use case by use case starting at lower data rates.

b) High-speed Automotive Ethernet technologies were not mature enough/available at the decision time.

c) The camera/video connectivity uses cost efficient (proprietary) Automotive SerDes solutions optimized for the use case, with which no other technology was able to compete.

Initiative for ISAAC is to realistically enable handling camera data flexibly as Ethernet traffic, esp. in/with zones.

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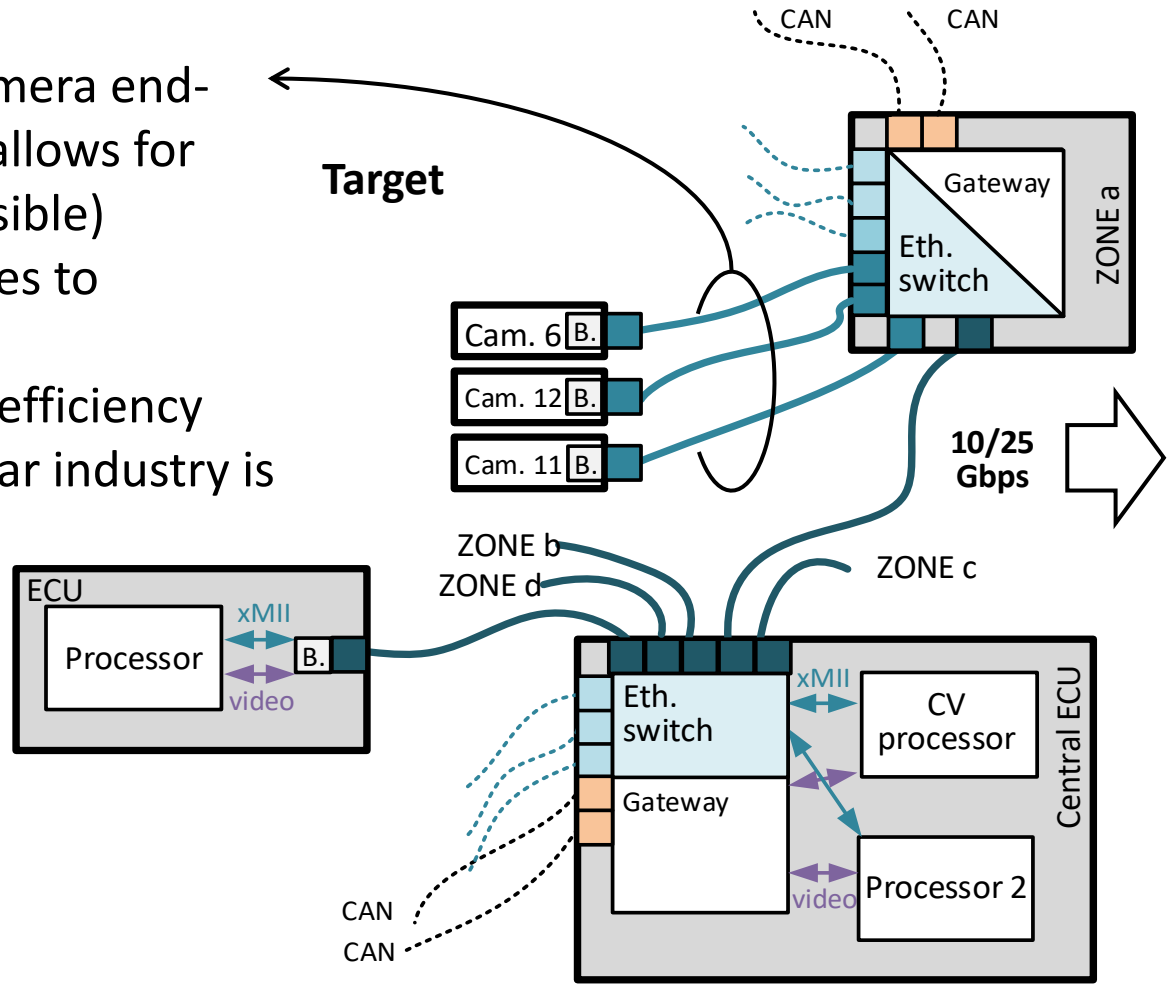
Requires an efficient camera end-point connectivity that allows for

- (As) painless (as possible) migration from SerDes to Ethernet.
- Cost and processing efficiency similar to what the car industry is used to today.



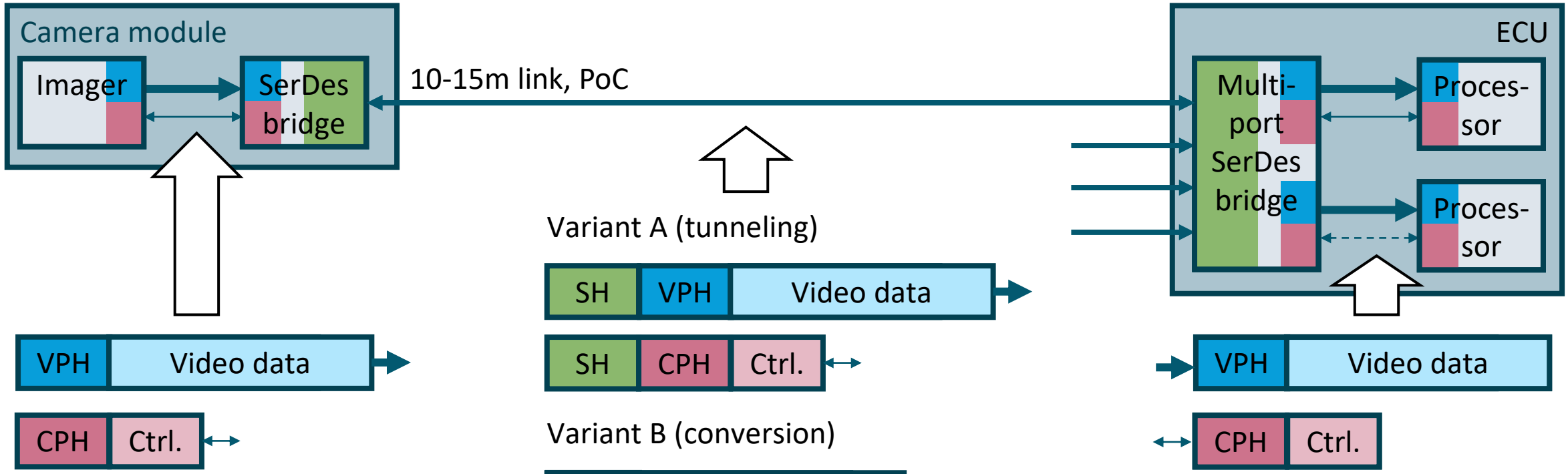
Requires a high speed Ethernet back-bone between zones.

- IEEE 802.3ch, cy, and cz offer automotive suitable solutions using STP or optical cables for SOPs 2026+. ✓

What does the “(as) painless (as possible) migration” mean in detail?

VPH = Video Protocol Header
CPH = Control Protocol Header
SH = SerDes Header

Today‘s Camera Implementations use SerDes Bridge Products, which Optimize the Protocol Processing Chain.



1. Camera side:

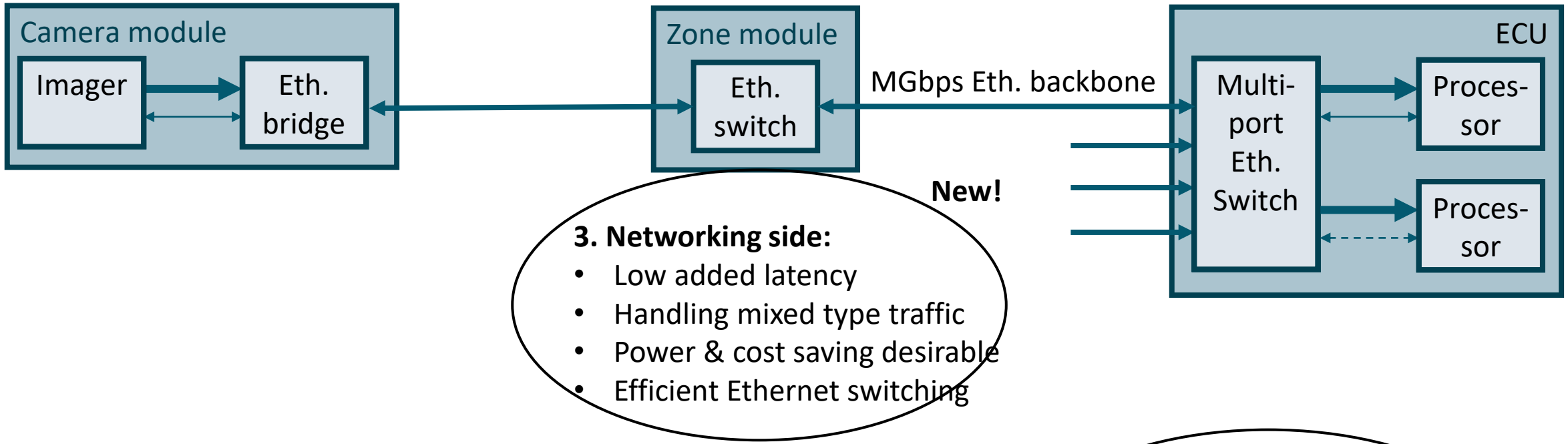
- Low complexity essential
- Low power essential
- Low cost essential

2. Processing side:

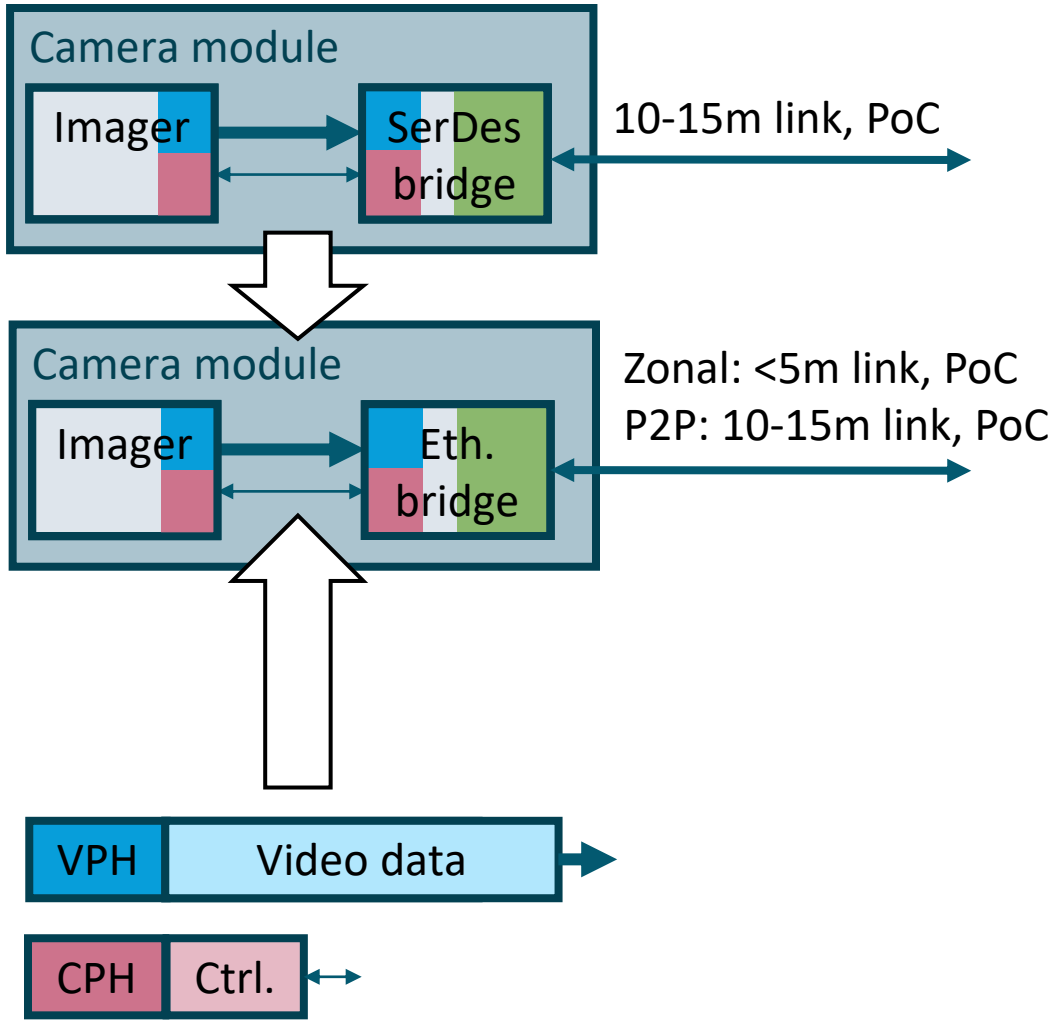
- Multiplexing of video streams
- Multiplexing of control streams
- Power & cost savings desirable
- Efficient video processing

EH = Ethernet Header

The Ethernet-based Zonalization of Video Adds the Network to the Use Case Architecture with yet Different Requirements.



1. Camera Side: For a “Painless” Migration, an Ethernet Bridge Replaces the SerDes Bridge inside the Camera.



Inside the camera:

- No added processing!
- Hardware optimized Ethernet bridges

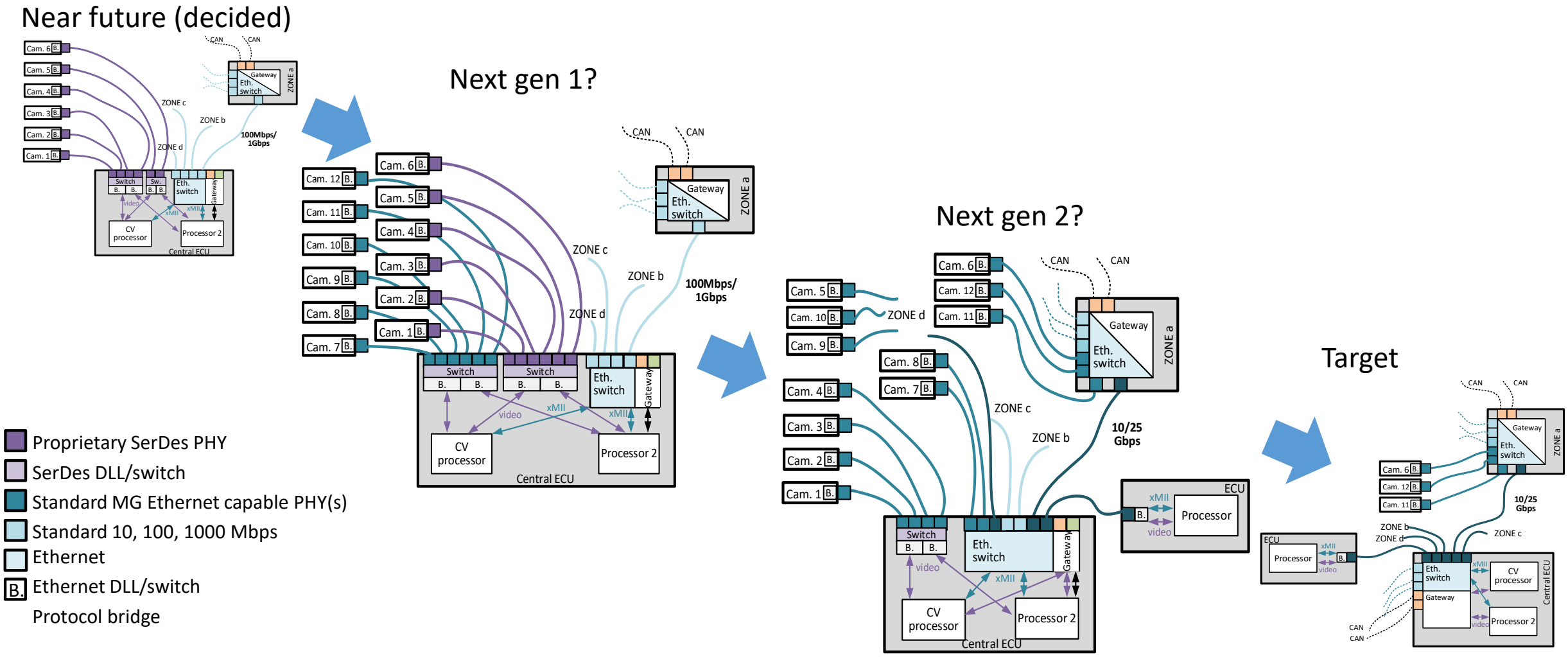
On the camera link:

- Ethernet packets instead of SerDes packets
- Link shorter in case of zones
- Same length in case of P2P (needs to be supported, see next slide)
- PoC for cost reasons, however, STP also needs to be supported

While changing the interfaces/processing inside the camera should not be precluded, requiring changed interfaces/processing in cameras would jeopardize the effort.

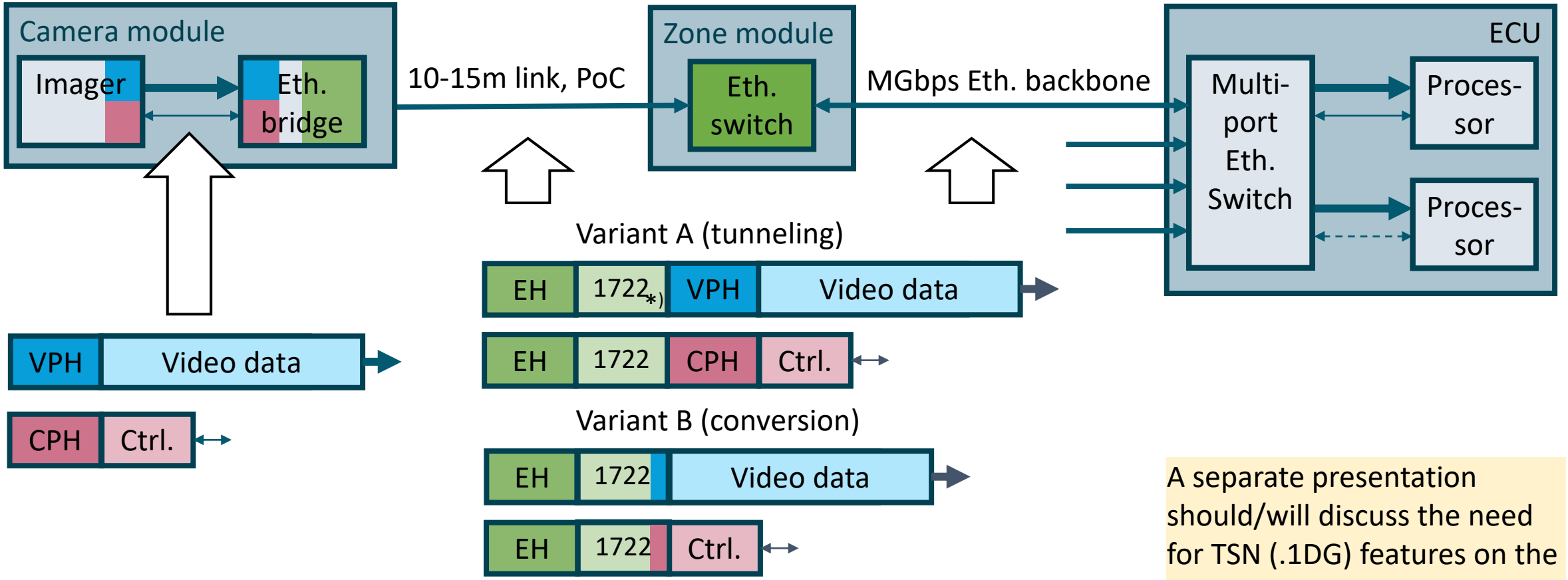
*) Other solutions possible

1. Likely, Some (Ethernet) Cameras are Always Connected P2P. Stepwise introduction needs to be possible.



EH = Ethernet Header

3. Networking Side: The Ethernet Network should be as Transparent to the Communication as Possible.



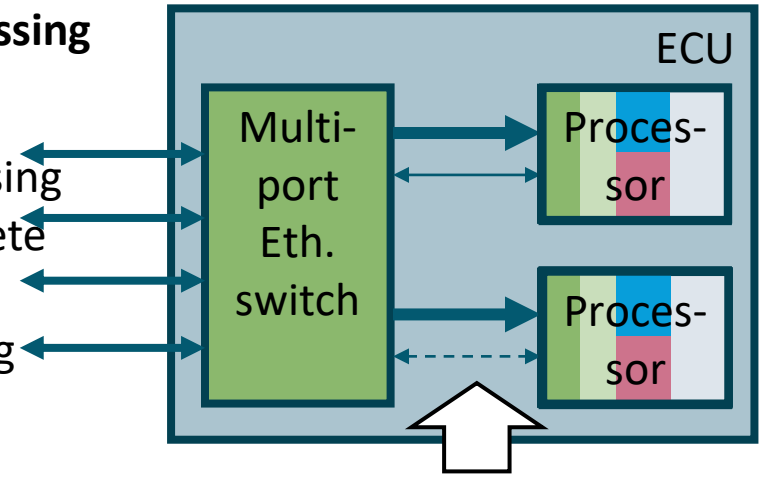
A separate presentation should/will discuss the need for TSN (.1DG) features on the camera link side.

2. Processing Side: Requires either Changed Processors or Switch/Bridge Products.

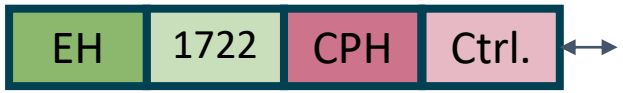
a) Changed processing

+ Standard switch

- Changed processing affects the complete data handling, potentially starting in the imager.



Variant A (tunneling)

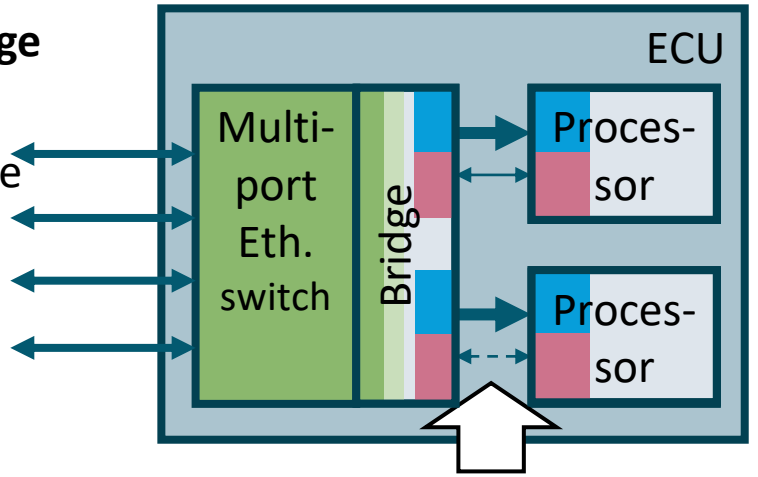


Variant B (conversion)

b) Additional bridge

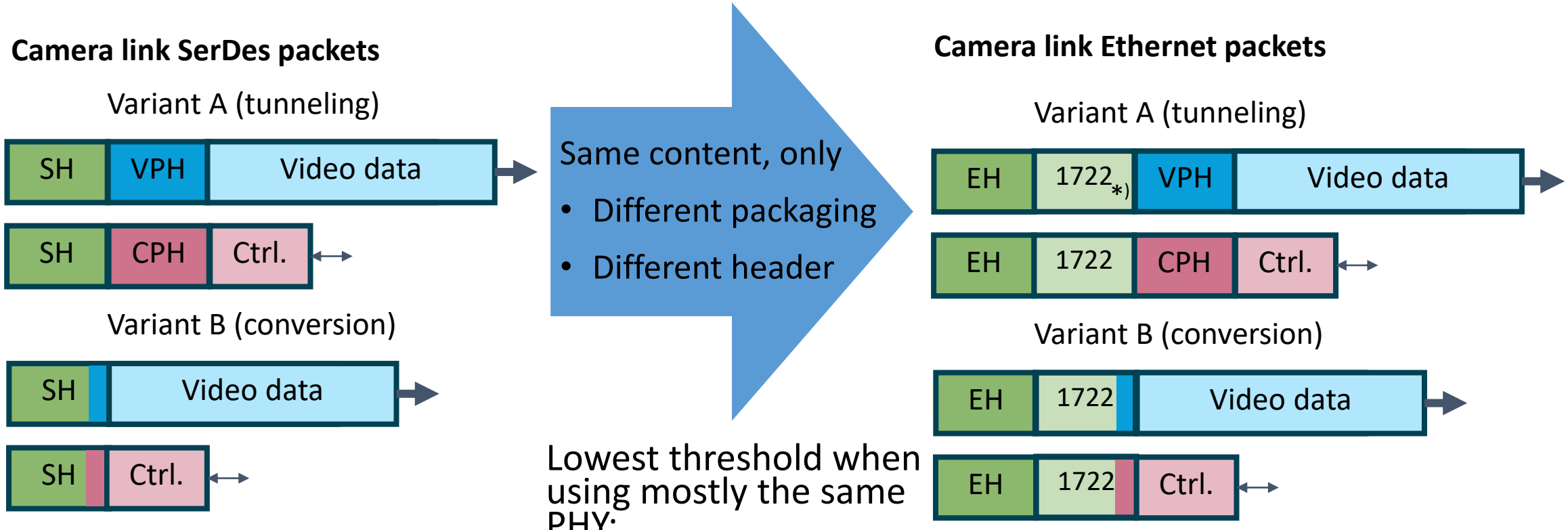
+ Changes in the communication are independent from the processing.

- Additional/new hardware needed for bridging.



While changing the interfaces/processing should not be precluded, requiring changed interfaces/processing in ECU makes introducing a new communication technology more difficult.

The least Painful Transition is if the Same Standardized PHY can be Parametrized as SerDes or Ethernet Inside the Same Camera.



Lowest threshold when using mostly the same PHY:

- Same PMA
- Same PCS mechanisms

And yes, this is just what is available with the ASA-ML and ASA-MLE.

Summary and Conclusion

- Changing the camera link technology from the proprietary SerDes to a standardized Ethernet interface (in order to best support zonal architectures) should be as low-threshold as possible.
- The core requirement for cameras remains (cost and power) efficiency.
- The core requirement for the ECU remains efficient video processing.
- The Ethernet networking should be as transparent as possible.
- The change in link technology cannot mandate (but also not preclude) any EE-architecture evolution or changed (video) processing.
- The lowest threshold is offered by an efficient link standard that can be used as SerDes and as Ethernet without increasing the complexity.