



Relative Cost Analysis of 802.3ch for Asymmetric Sensor PHY

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Motivation

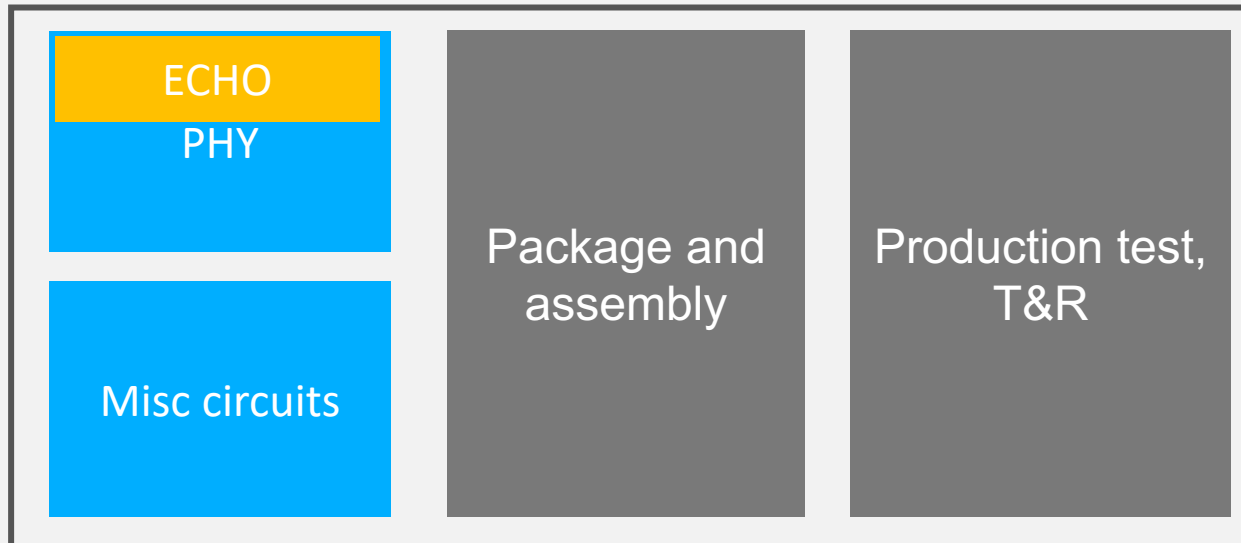
- Provide relative cost analysis between
 - A: 5Gbps payload camera serializer implementation based on 802.3ch standard
 - B: 5Gbps payload / 6Gbps line rate camera serializer implementation assuming an incumbent architecture
 - [Source: <https://www.analog.com/media/en/technical-documentation/datasheets/max96717.pdf>]
- Assume the same design team to design A and B
 - Using the same process technology

Cost-Related Considerations of Camera Links

- Focus relative cost analysis on
 - Serializer IC
 - Power Over Coax (PoC) filter
 - Power management components for serializer – Switching regulators, LDO, inductors, R&Cs
- Assume the following items are common for all competing solutions
 - Sensor, PCB, 12V/48V step down converter
 - Cables and connectors
 - Manufacturing / testing / qualification / diagnostic / safety / security / system software

Serializer IC Relative Cost Analysis

- Typical full duplex PHY port 2mm² area including ECHO
[Source: https://www.ieee802.org/3/B10GAUTO/public/nov19/zimmerman_3B10G_01_1119.pdf]
- 802.3ch PHY needs an Echo Canceller circuit compared with FDD or TDD architecture
 - Echo size at 10Gbps / 15meter is the upper bound for echo size



	Echo canceller percentage of serializer die area	Echo canceller percentage of serializer IC cost
10Gbps / 15 meter	20%	7.0%
5Gbps / 15 meter	10%	3.5%
2.5Gbps / 15 meter	5%	2.0%

PoC Filter and Power Management Relative Costs

- PoC Filter
 - 802.3ch PHY can use a single smaller inductor
 - Incumbent requires two or more inductors, one of which is much larger than what 802.3ch requires
 - [source: <https://www.analog.com/media/en/technical-documentation/user-guides/gmsl2-hardware-design-guide.pdf>]
 - Cost savings and footprint reduction
- Power management
 - 802.3ch PHY operates in full duplex mode during linkup training
 - Short transient does not add thermal stress to PMIC / inductor
 - Higher peak transient current handling can lead to minor increase in BOM cost

Summary of Relative Cost Analysis

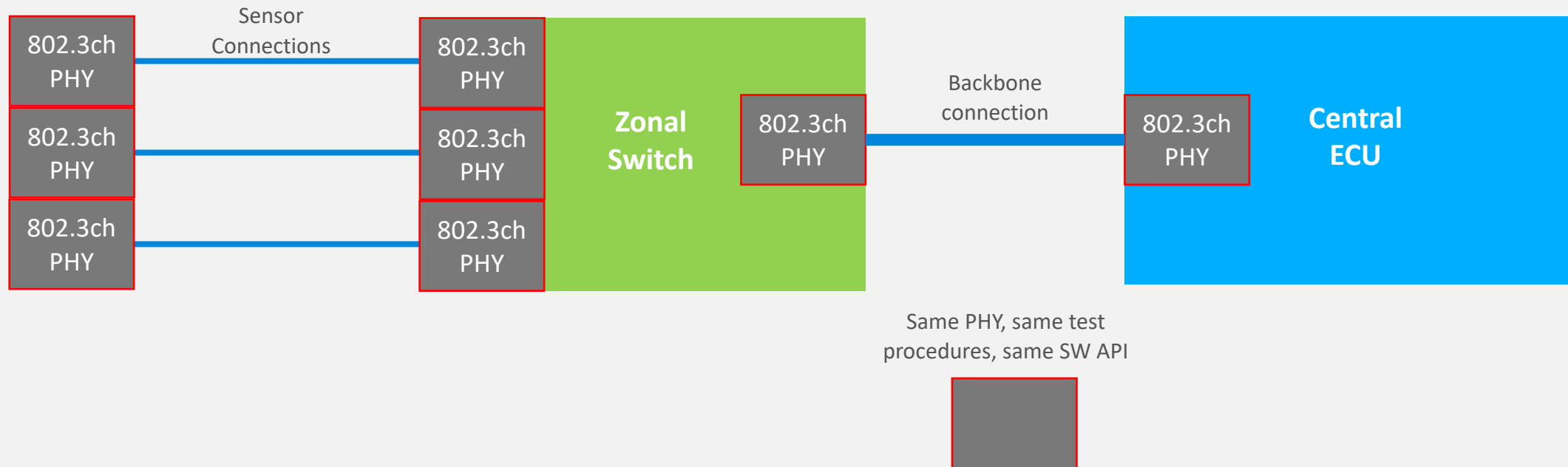
	Incumbent Serializer Reference Cost	802.3ch Serializer (5Gbps) relative cost
Serializer IC	1 A	1.035 A
PoC Filter BOM	1 B	0.5 B
Power Management BOM	1 C	1.05 C

Source: Component supplier's website, component distributors' website

Note: Estimates are based on unit price of 1ku quality

Consideration of Ecosystem Development

- “With EEE, a single 802.3ch PHY can be deployed in various system scenarios, effectively supporting all traffic scenarios and scaling the power usage accordingly”
[Source: https://www.ieee802.org/3/B10GAUTO/public/nov19/zimmerman_3B10G_01_1119.pdf]
- Leveraging existing 802.3ch ecosystem (SW stack, testing infrastructure, existing multi-vendor) accelerates time to production and reduces costs.
 - “For 2029 SOP, samples need to be provided in 2024-25” [Source: https://www.ieee802.org/3/cfi/0723_1/CFI_01_0723.pdf]



Conclusion

- Serializers based on 802.3ch can be cost neutral vs. incumbent proprietary serializers
 - Under given assumptions
- Additional savings from 802.3 ecosystem economy of scale
 - Magnitude is difficult to quantify
 - Numerous examples of standard-based products winning over proprietary ones despite implementation overhead
- Analysis shows there is very little price to pay, if any, to build sensors based on 802.3ch PHY
 - Potential improvements with amendments