

System Comparison

IEEE 802.3dm

Ad-Hoc Call October 10th 2024

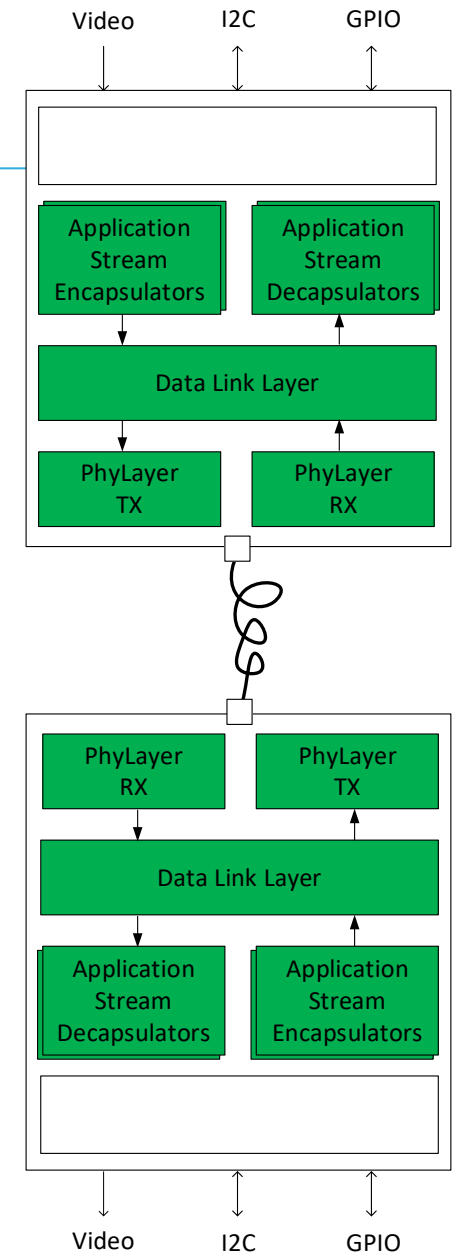
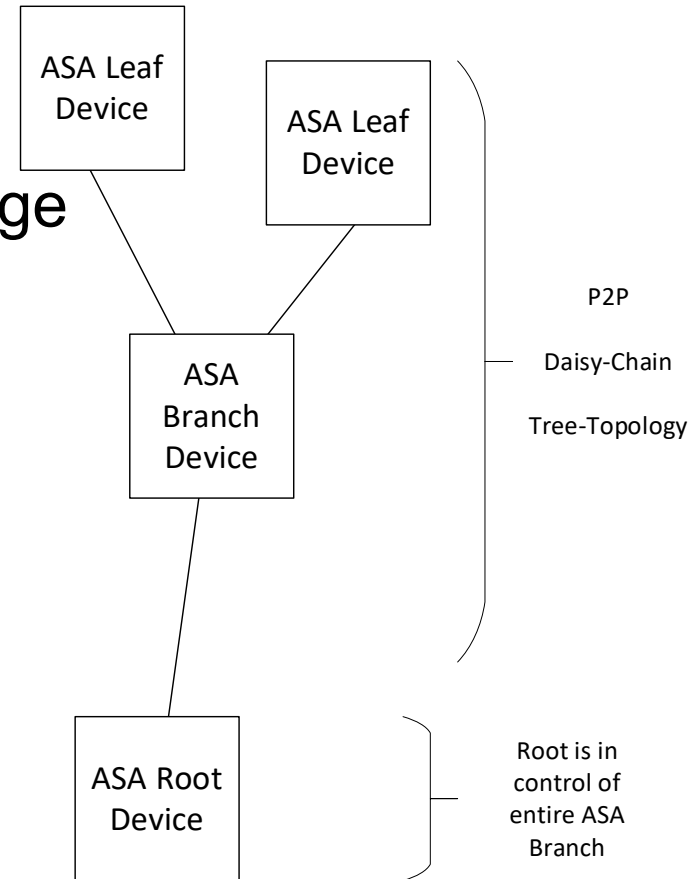
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Agenda Overview

- Introduction to ASA Motion Link
... a system built for Automotive
- MLE is leveraging the physical layer of ASA Motion Link
- Direct comparison for volume use cases

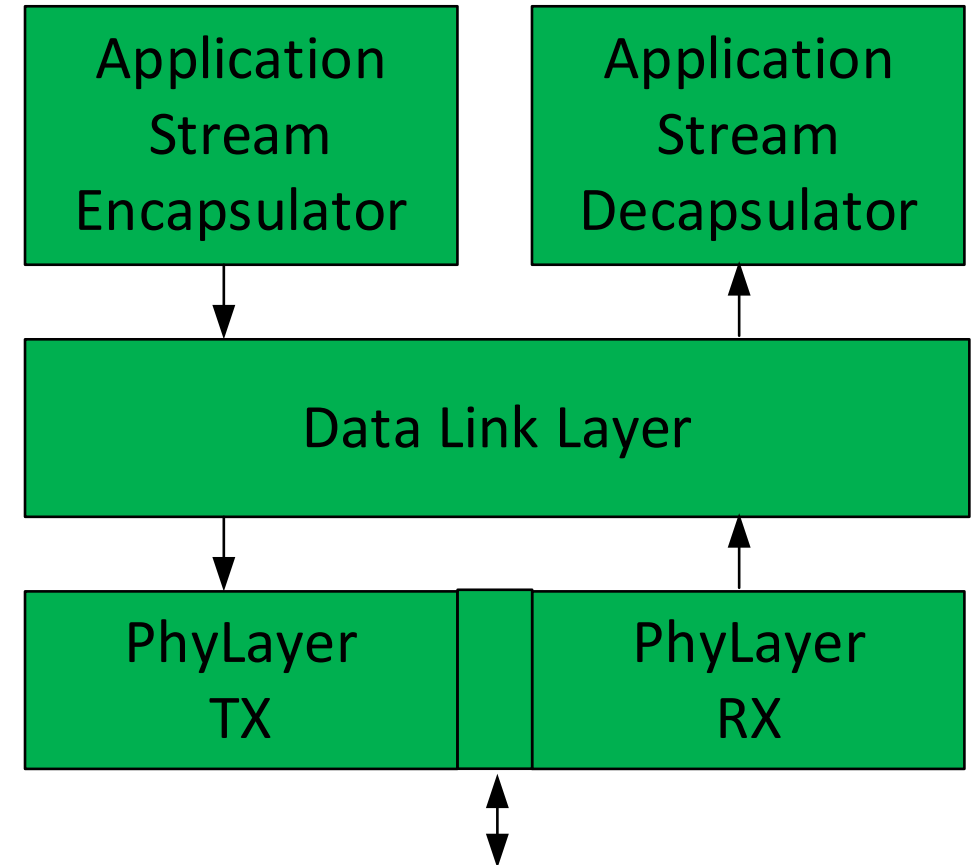
ASA Motion Link SerDes

- ASA ML is built grounds up for Automotive environment and asymmetric Sensor & Display use cases
- Replacement for current SerDes usage
 - Point-to-point connection
 - Deterministic link layer
 - Application interface tunnels
- Scalability and evolution for future ADAS & IVN architectures
 - Security
 - Precision Time Base
 - Daisy-chain topology, ASA branch



ASA Motion Link SerDes

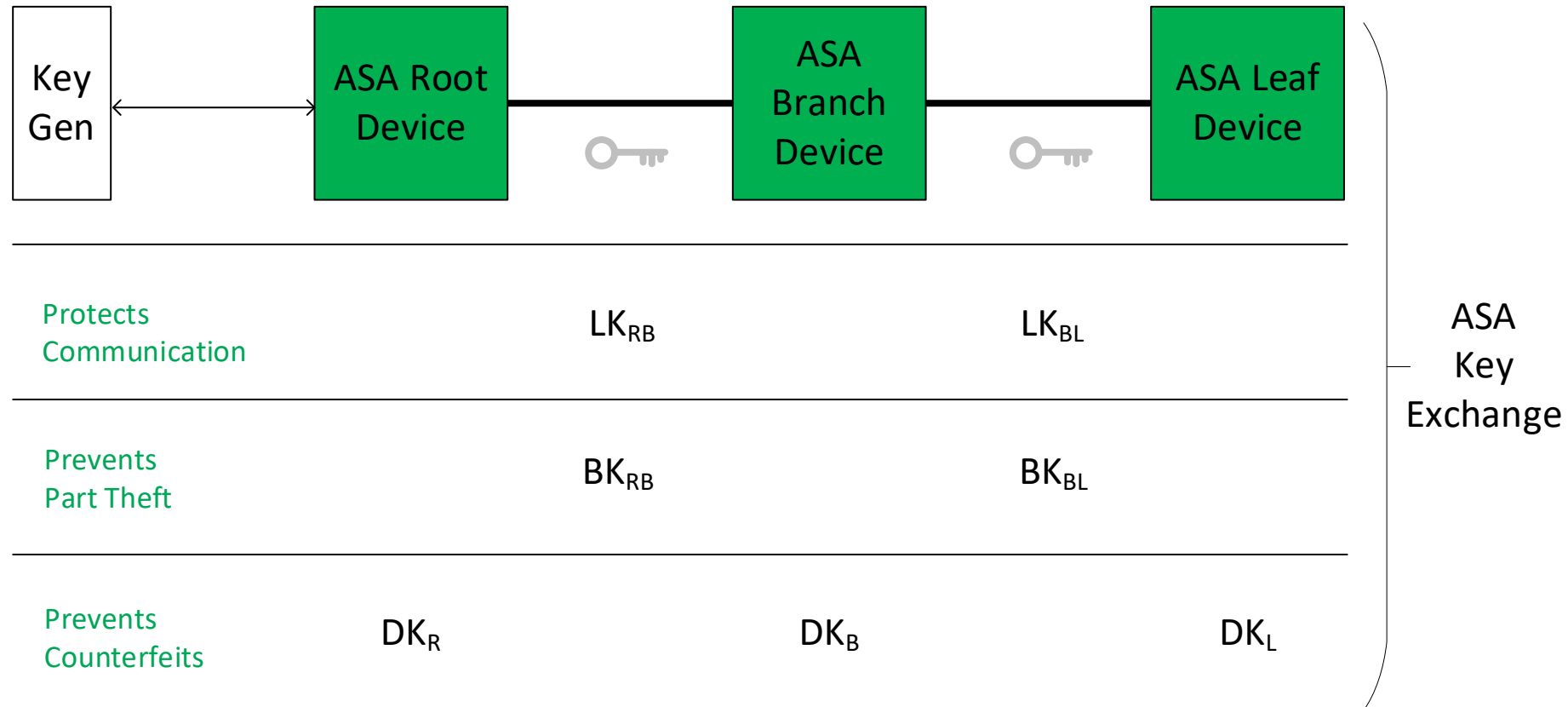
- ASA ML is a complete communication stack, slim and optimized for Automotive
 - Physical layer, Security layer, Link layer, Adaptation layers (encapsulation)
- ASEPs
 - Video Data
 - I²C ... Byte Mode ... Bulk Mode
 - GPIO
 - VESA eDP[®] *
 - SPI
 - Ethernet Layer 2 frames
 - I2S
 - MIPI CSI-2[®] **



* specification developed under liaison with and approved by VESA

** specification developed under liaison with and approved by MIPI

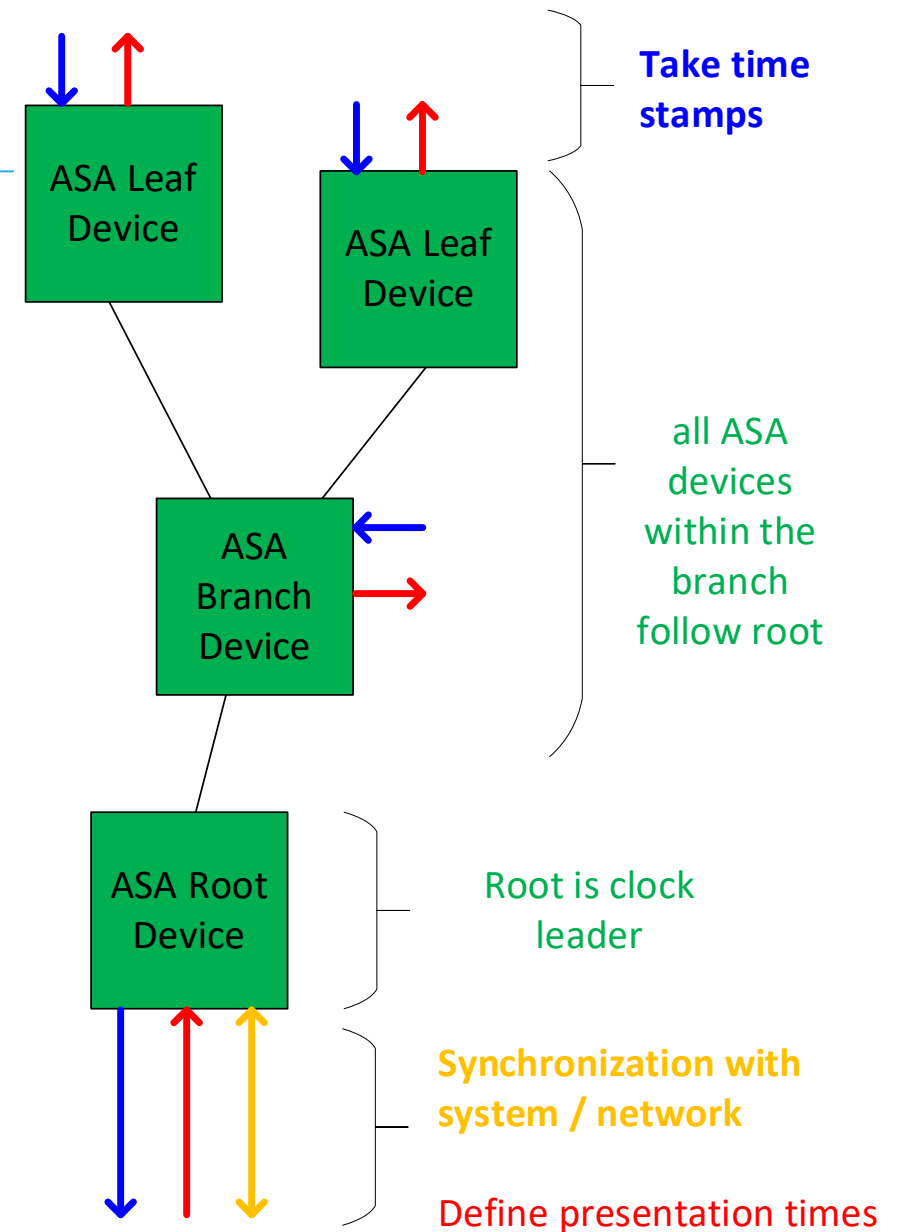
ASA Motion Link SerDes



- ASAsec specified Automotive tailored key hierarchy and interoperable Key Exchange messages / primitives
- and leveraged proven industry standard symmetric AES algorithms

ASA Motion Link SerDes

- ASA Precision Time Base (PTB)
 - Root node is clock leader
 - All Branch and Leaf devices synchronize their logical clocks (with $t_{ic}=4ns$) to the clock leader
- PTB only takes payload bandwidth for initialization; synchronization is tied to physical layer and thus is highly accurate
- Precision Time Base enables
 - Data time stamping (for sensor fusion)
 - Event synchronization through presentation time stamp (for sensor cycle trigger)



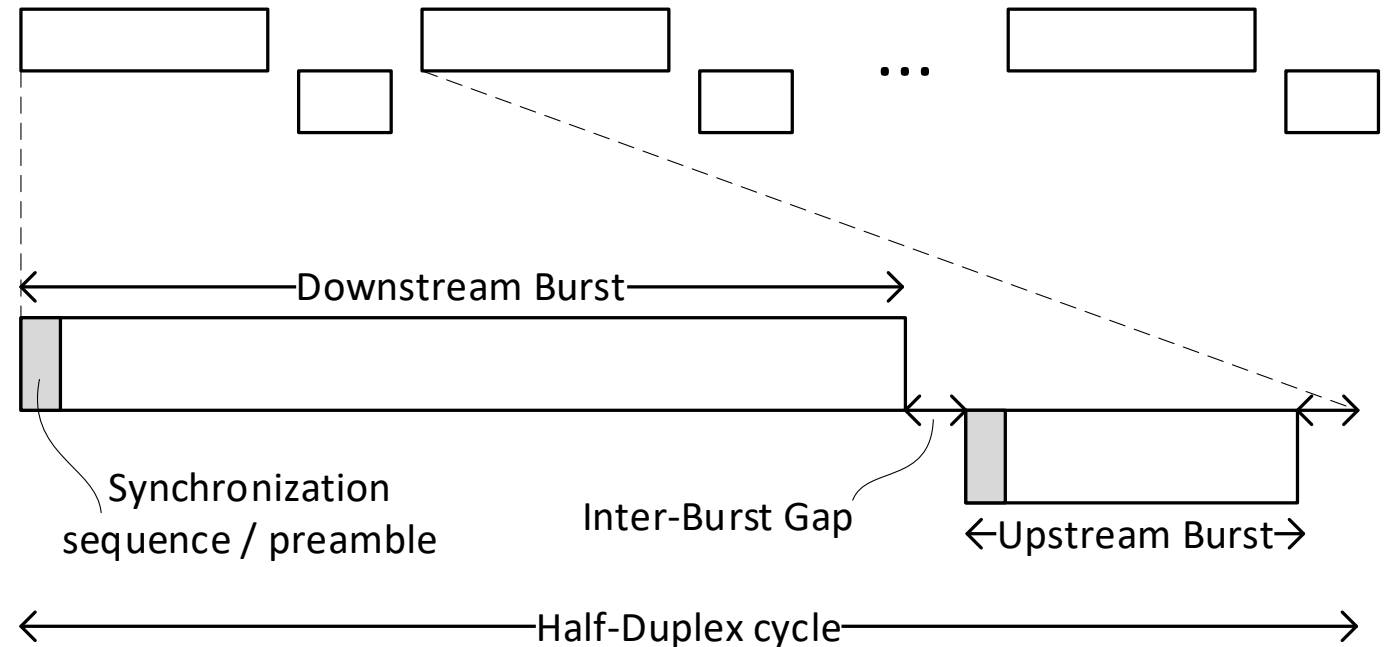
ASA Motion Link SerDes

DOWNSTREAM TRAFFIC (Forward Channel)					UPSTREAM TRAFFIC (Reverse Channel)			
Speed Grade	Downstream Line Rate	Modulation	Baud Rate	Payload Data rate (after ASAsec)	Upstream Line Rate	Modulation	Baud Rate	Payload Data rate (after ASAsec)
SG1	2 Gbps	PAM2	2G	> 1.8 Gbps	2 Gbps	PAM2	2G	50 Mbps
SG2	4 Gbps	PAM2	4G	> 3.6 Gbps	2 or 4 Gbps	PAM2	2G or 4G	50 or 100 Mbps
SG3	8 Gbps	PAM2	8G	> 6.4 Gbps	2 or 4 Gbps	PAM2	2G or 4G	50 or 100 Mbps
SG4	12 Gbps	PAM4	6G	> 9.7 Gbps	2 or 4 Gbps	PAM2	2G or 4G	50 or 100 Mbps
SG5	16 Gbps	PAM4	8G	> 13 Gbps	2 or 4 Gbps	PAM2	2G or 4G	50 or 100 Mbps

- ASA ML physical layer combines
 - Low cost on PHY
 - Low cost on system level (PoC)
 - Better EMC performance
 - Low power scalability into deep submicron and low supply voltages

ASA Motion Link SerDes

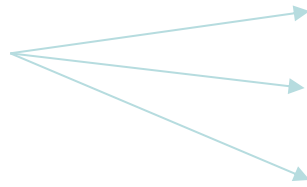
- Half-duplex physical layer adds parameters, which can be changed very cheaply
 - Downstream burst time
 - Upstream burst time
 - Interburst Gap
- For instance, adjust payload data rate to fit Ethernet MAC
- Many parameter combinations are possible to prioritize different properties
- ASA Light Sleep skips over TDD cycles to save power beyond absolute minimum data rate requirement



ASA Motion Link SerDes

- These are MLE asymmetric modes, which were settled on for different priorities / reasons

- These prioritize short cycle time



Downstream Payload Rate	Upstream Payload Rate
2.5G	100M
5G	100M
10G	1G
10G	100M

- This one is for smallest line rate overhead over 10G MAC rate



Downstream Burst time	Upstream Burst time
2.88 us	0.48 us
2.16 us	0.24 us
2.16 us	0.24 us
25.92 us	0.32 us

- For any system consideration, the most suitable parameter set should be picked
- Many more parameter combinations are possible to address other priorities

Volume Use Cases

- By volume, the top tier resolutions for cameras in Automotive are 1Mpxl, 3Mpxl, 5Mpxl and 8Mpxl
- Together, these make up the VAST majority of volume
- Within this vast majority
 - Higher volume of 3Mpxl cameras than 5Mpxl cameras
 - Higher volume of 5Mpxl cameras than 8Mpxl cameras
- Even though these resolutions were introduced one after the other from lower to higher resolution, with years between the upgrades
... **3Mpxl still outsells the later upgrades**

Comparison for Volume Use Cases

Imager				Payload rate [Gbps]	MAC Rate	MLE						ch + FDD			
Mpxls	fps	bpp	emb data			Dn Levels	Dn Line Rate	Up Levels	Up Line Rate	Dn burst	Up burst	Dn Levels	Dn Line Rate	Up Levels	Up Line Rate
3	15	12	1.05	0.57	2.5G	2	4	2	4	2.88	0.48	4	2.8125	2	0.117
	30	12	1.05	1.13											
	60	12	1.05	2.27											
5	30	12	1.05	1.89	5G	2	8	2	8	2.16	0.24	4	5.625	2	0.117
	60	12	1.05	3.78											
8	30	12	1.05	3.02	5G	2	8	2	8	2.16	0.24	4	5.625	2	0.117
	45	12	1.05	4.54											

- ALL volume use cases require only 2.5G and 5G MAC rate
→ These are the important configurations to pay attention to!
- MLE is still PAM2 for Downstream and Upstream
- ch-based proposal is PAM4 for even 2.5G

Summary

- Introduction to ASA Motion Link
... a system built for Automotive application end-to-end
- MLE is leveraging the physical layer of ASA Motion Link, with all its advantages
- Direct comparison for volume use cases: 2.5G and 5G MAC rate have to be in focus!

Thank You!