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MIPI ALLIANCE
DEVELOPERS
CONFERENCE
TAIPEI
18 OCTOBER 2019

Simon Teng
MediaTek Inc.

Technologies for Automated Driving

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everyday genius

MIPI.ORG/DEVCON

Outline

- ✓ Automated Driving Roadmap
- ✓ Processor Architecture, Low Power Computing and AI
- ✓ Sensors
- ✓ Wireless Communication
- ✓ High Speed Interfaces

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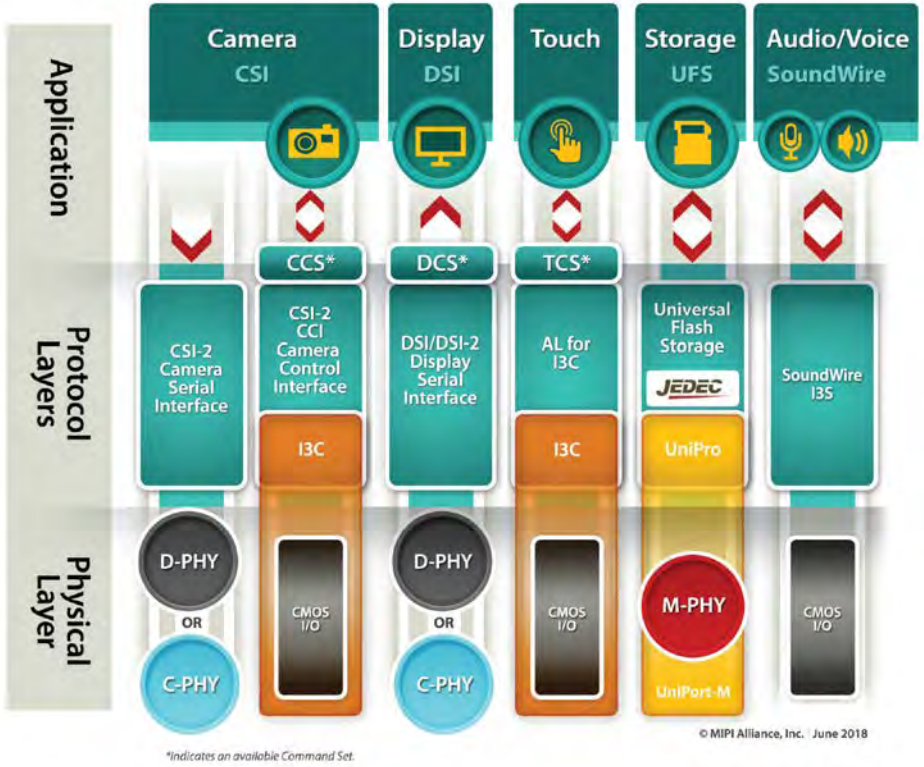
Without MIPI, there is no Mobile



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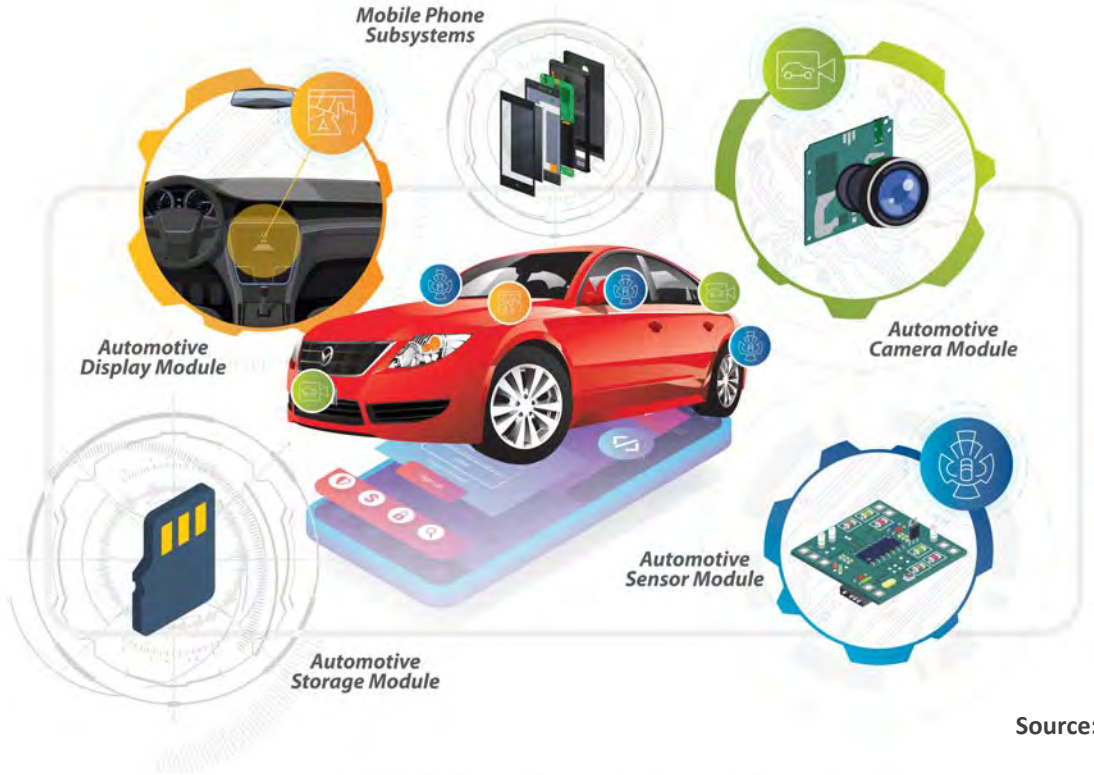
Automotive Leveraging the Mobile Smartphone



Source: MIPI Alliance

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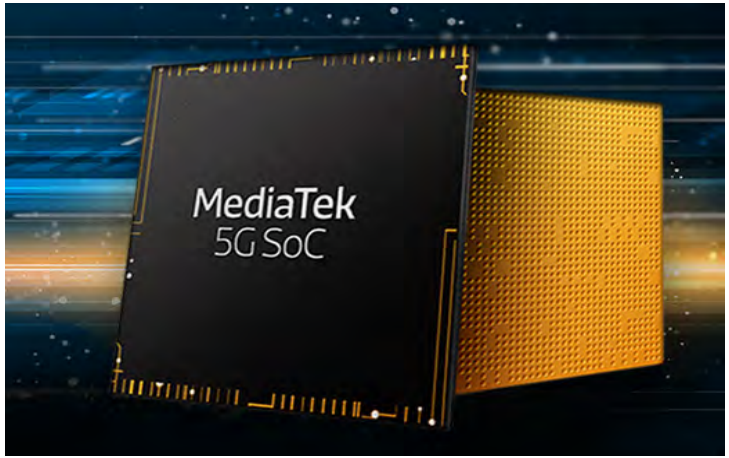
MediaTek Leveraging MIPI Standards



- MIPI CSI-2℠
- MIPI DSI-2℠
- MIPI C-PHY℠
- MIPI D-PHY℠
- MIPI A-PHY℠
- MIPI UniPro®
- MIPI M-PHY®
- MIPI I3C®
- MIPI RFFE℠

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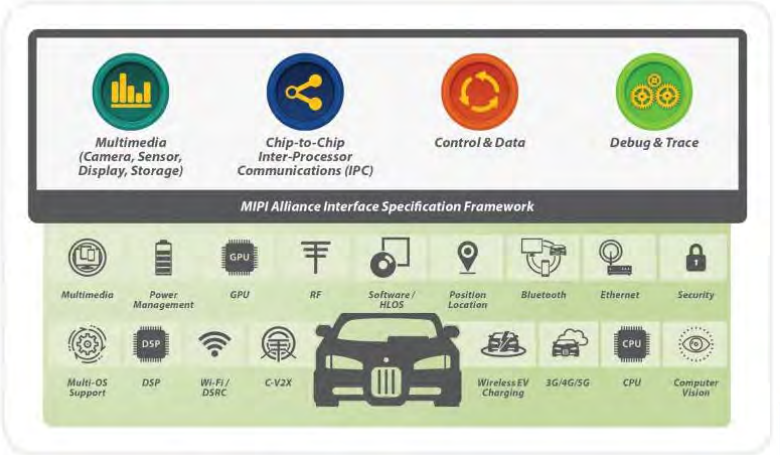

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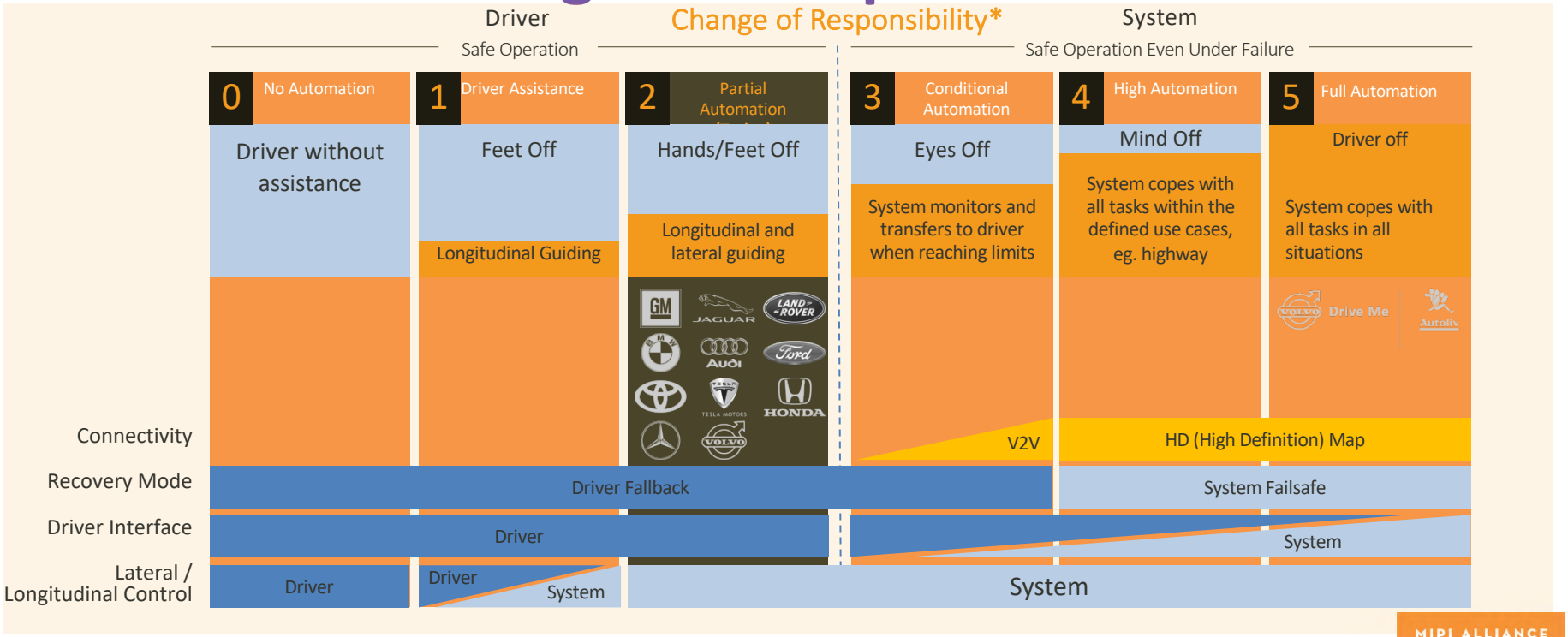
Automated Driving Roadmap



*Adaptation of the legal frame-work required - Definitions of Level 0-5 come from SAE (Society of Automotive Engineers) International.

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Path to Automated Driving

1 DATA COLLECTING AND PROCESSING

Driver Monitoring	Vehicle & Environment Sensors	Connectivity & Backend
Image sensors	Image & Ultra Sonic sensors, Radar, LiDar.	High detail digital maps, Real-time traffic info
Vision Processor (ISP, APU)	**Vision Processor, Radar (mmWave), Lidar**	**Cellular, V2X , GNSS**

2 MODELING

Driver Model	Vehicle Model	Environment Model
		
Image sensors	Image & Ultra Sonic sensors, Radar, LiDar.	High detail digital maps, Real-time traffic info

High Speed In-Vehicle Network Switcher (Multi-Giga bit Ethernet) and Sensor Fusion Processor

3 DRIVING SCENARIO DETERMINATION

Automated Driving Strategy | Traffic Jam | Automated Parking | City Driving | Highway Driving

AI Processor Units for Intelligent Algorithms with Functional Safety

4 REAL-TIME INTERACTION WITH DRIVER

Man Machine Interface			Motion Control	Steering Breaking	Engine Gear Box
					
High performance CPU, GPU, APU, WiFi, BT			**MCUs**		

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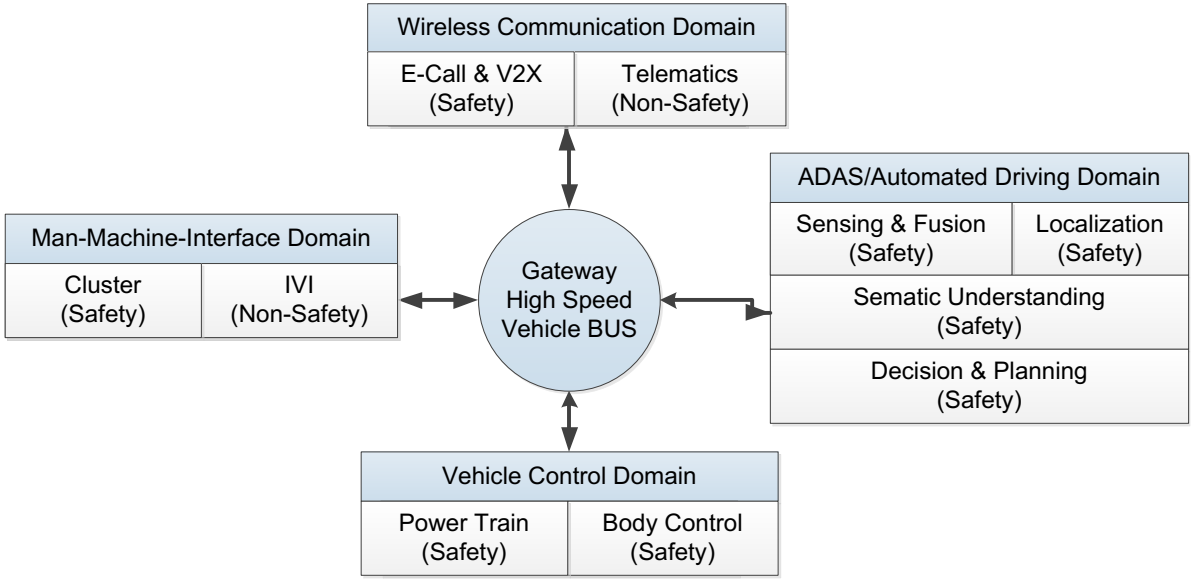
System Architecture and Technologies



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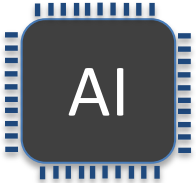

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Processor Architecture

Functionality
Flexibility

CPU
- Control
- Serial Compute
- Low latency

GPU
- Graphics
- Parallel Compute
- FP32
- High Throughput

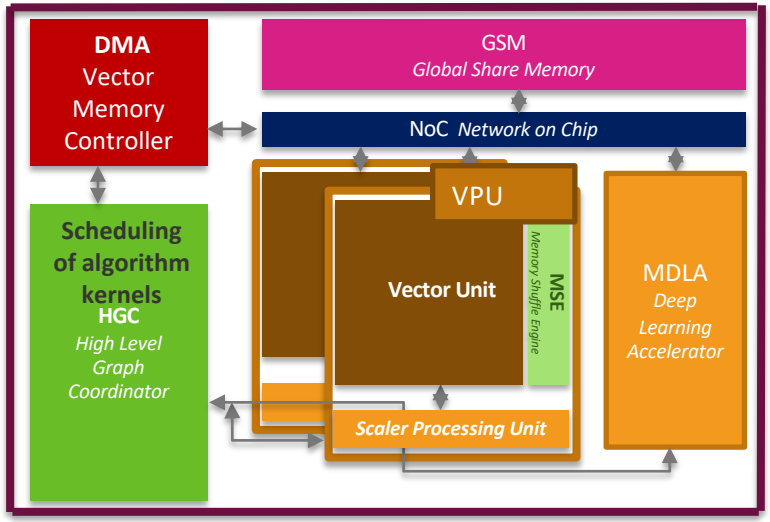
DSP
- Math. operations
- Data movement
- Real time

VPU
- NN optimization
- Low power
- Optimized for vision

DLA
- DL only

- GPU is efficient for training but not inference

Computing
Efficiency



Deep Learning Accelerator

Processor	CPU	GPU	DSP	DLA
To support AI	Vector	FP16, Fixed point	Vector	X
Industry example	ARM v8.4 SVE	NV Xavier Volta	Cadence VP6	Cadence VC5

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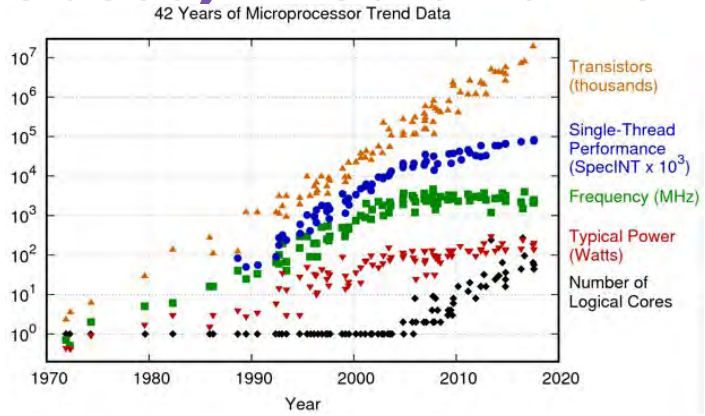
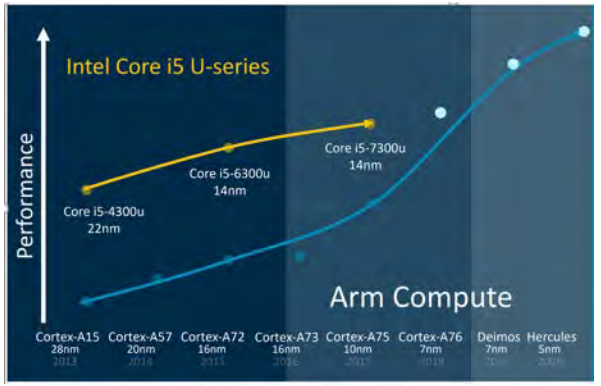
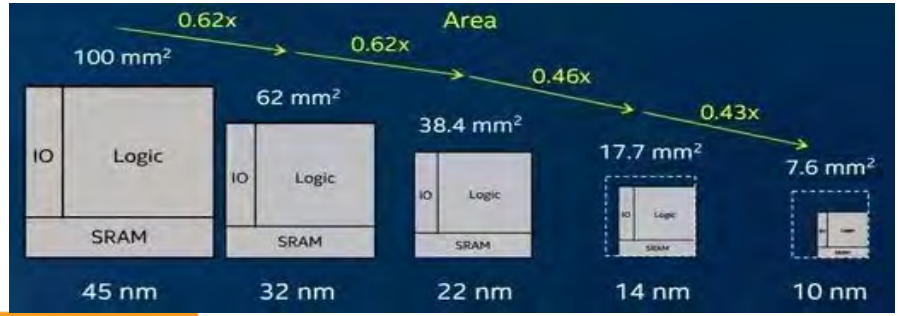
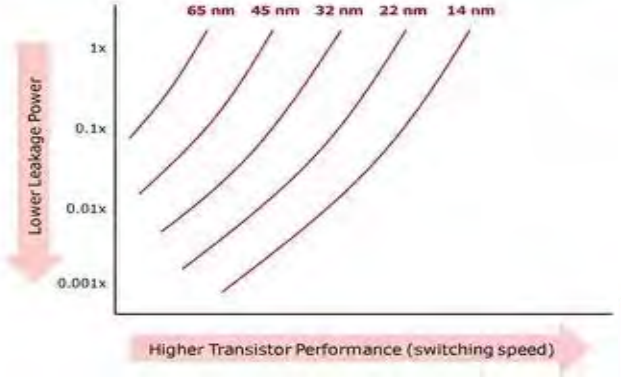
Process, Area and Performance Trend









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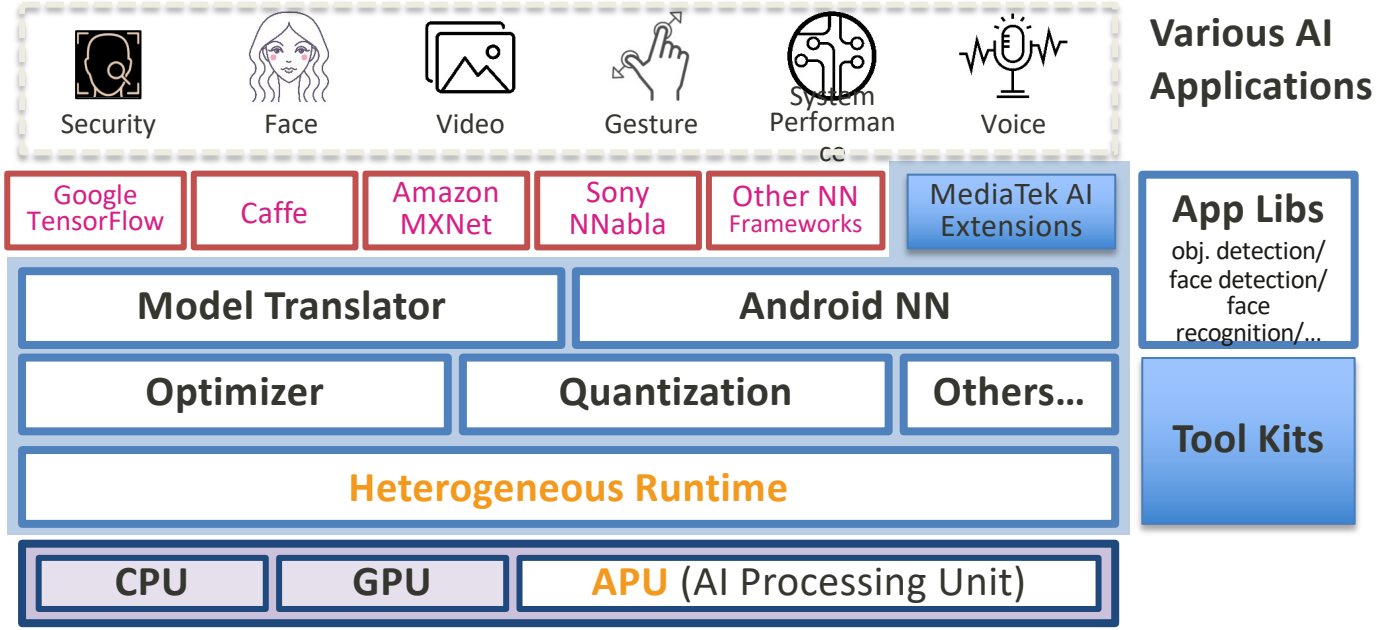
SDK and Tool Chain – Key to System Efficiency



Efficiency targeting both hardware runtime and software development

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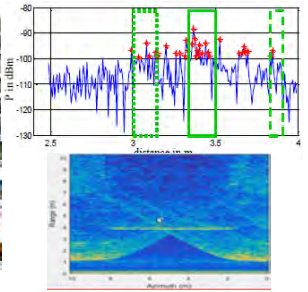
Roles of AI for Automated Driving

Perception

Recognition
- Data
- Learning
- Cloud sourcing

Reconstruction
- SLAM
- Graphics
- Environment modeling



Planning

Driving policy
Motion planning

Control

Trajectory
Vehicle

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image source:
https://www.meee-services.com/
what-are-radar-sensors-and-their-impact-on-the-automotive-industry/

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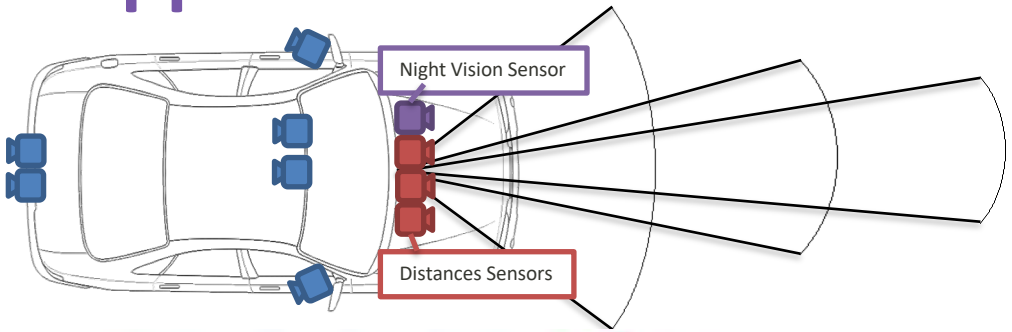
Sensors and Applications

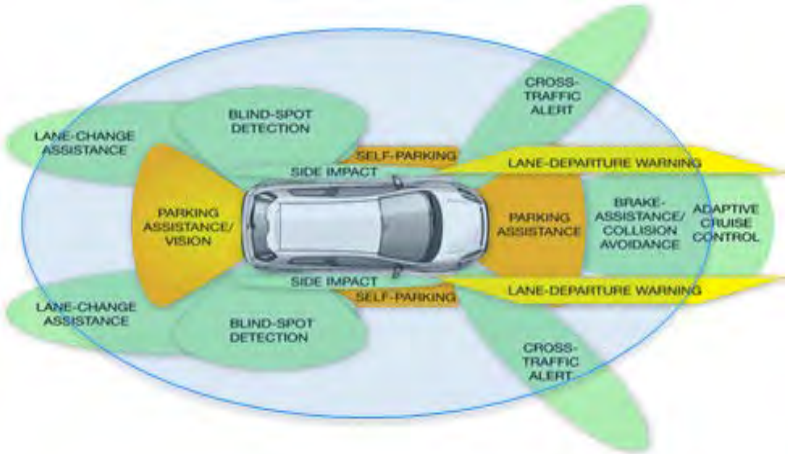
Smart Camera

- Pedestrian Detection
- Rear Cross Traffic
- Blind Spot Detection
- Driver Monitoring
- Electronic Mirror



Forward-Facing

- Lane Departure Warning
- Intelligent Headlamp Control
- Traffic Sign Recognition
- Forward Collision Warning
- Intelligent Speed Control
- Pedestrian Detection



- Ultrasonic
- Radar
- Lidar

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Sensor Fusion to Increase Accuracy and Reliability

	Ultrasonic	Radar	Lidar	Camera
Physics	Sound Wave	Electromagnetic Wave	Light Wave	Light Wave
Distance Coverage	20cm-7m*	5cm-250m	1cm-150m	1cm-100m
Distance Detection	Yes (cm)	Yes (cm)	Yes (mm)	Stereo (m)
Angle	Multi-Sensor	Multi-Antenna	Yes	Yes
Velocity	No	Yes	Yes	No
Object Recognition-Shape	No	Yes	Yes	Yes
Object Recognition-Content	No	No	No	Yes (96%)
Object Tracking	Yes	Yes	Yes	Yes

Weakness	Range is too short Sensitive to environment Sound speed is slow No recognition	High complexity in dealing false alarm No content recognition	Surface scan only Limited FoV No content recognition	Surface scan only Distance detection is complicated and inaccurate Recognition rate (96%) needs to be enhanced
Enhancement	Replace by Radar	Camera for content recognition Camera to reduce false alarm	Camera for content recognition Multiple devices needed for wider FoV Radar to cover overlay and penetration	Radar for distance measurement V2X to enhance content recognition

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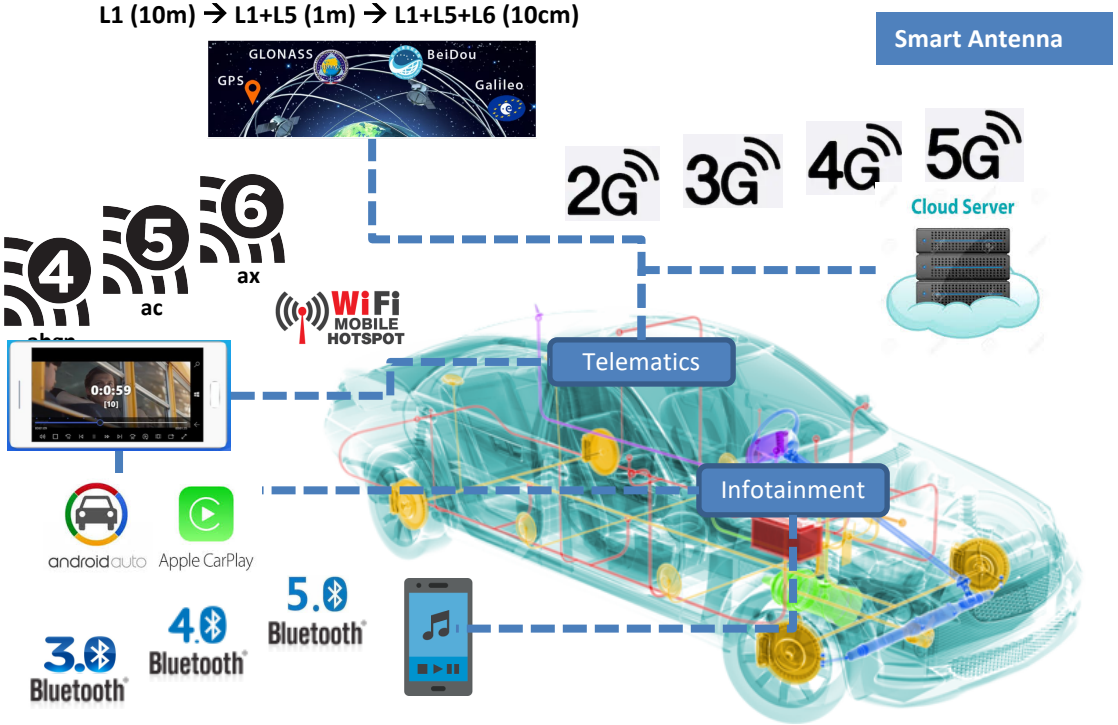
Wireless Communication: Cellular, Wi-Fi, BT, and GNSS



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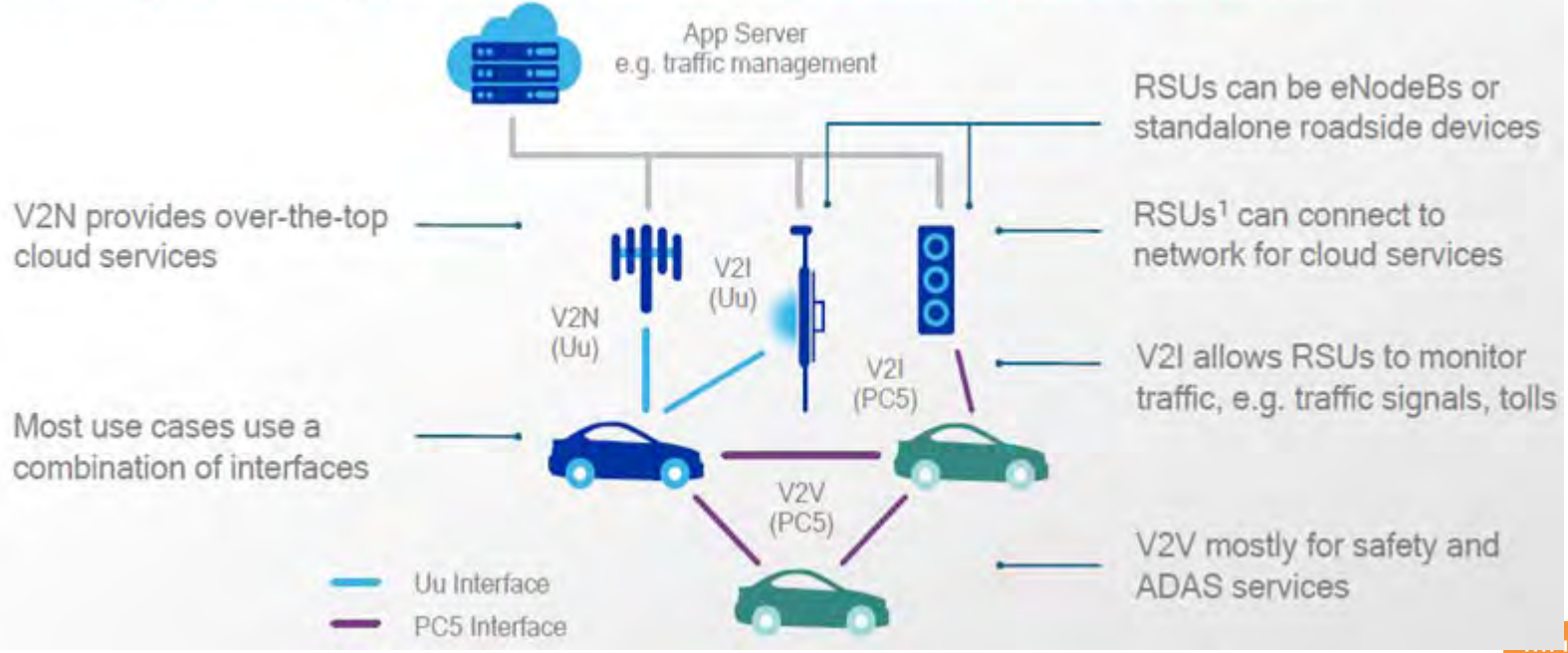
V2X

Opening up new opportunities and diverse business models for MNOs



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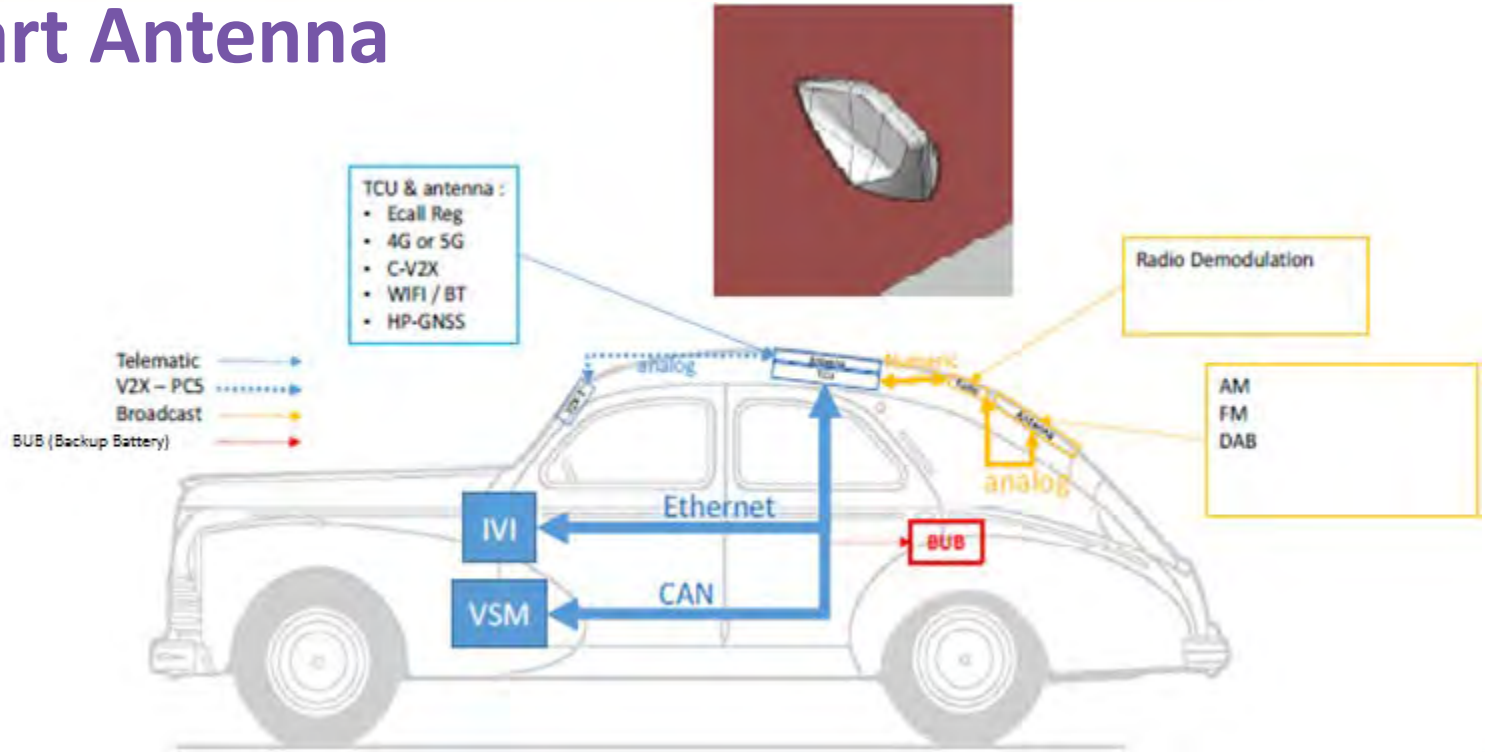
Smart Antenna



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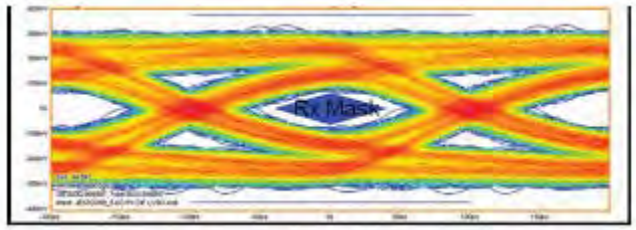

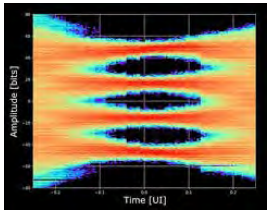

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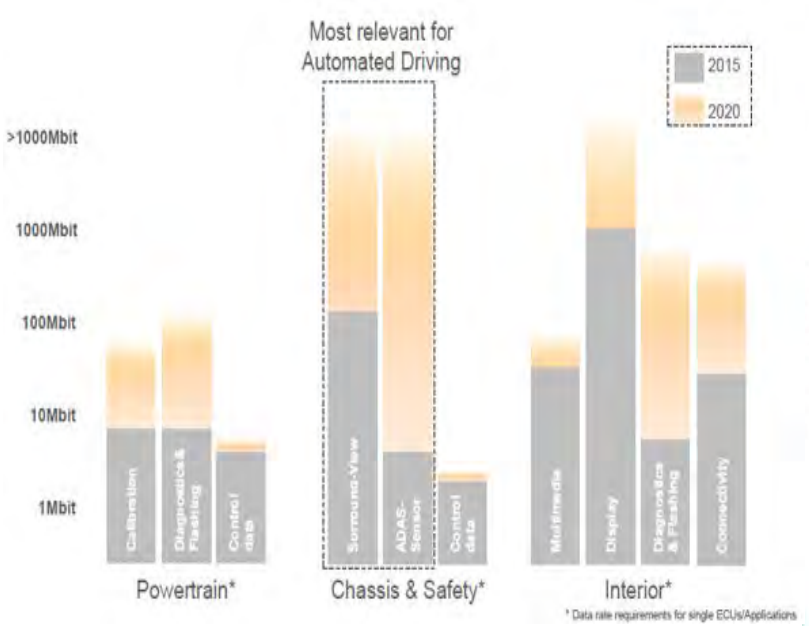
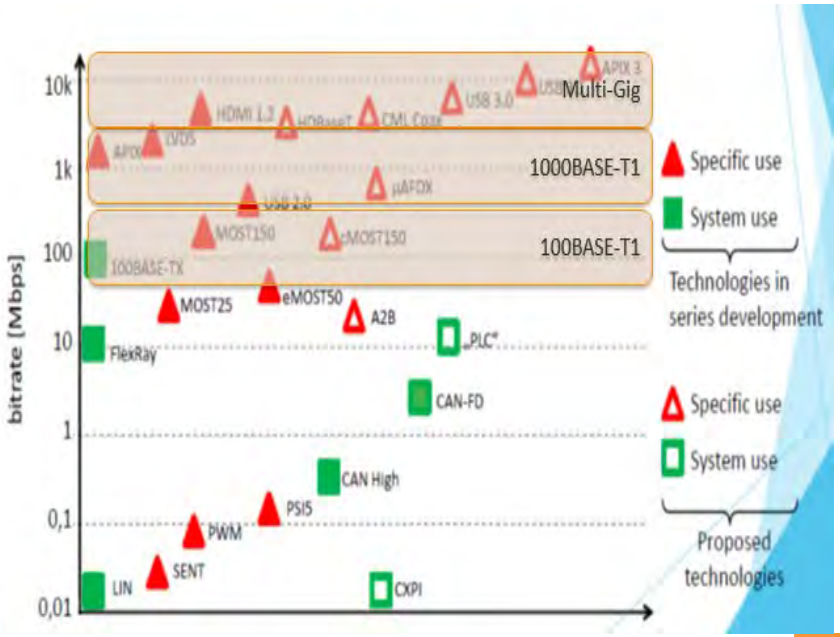
Demand High Bandwidth – Vehicle BUS





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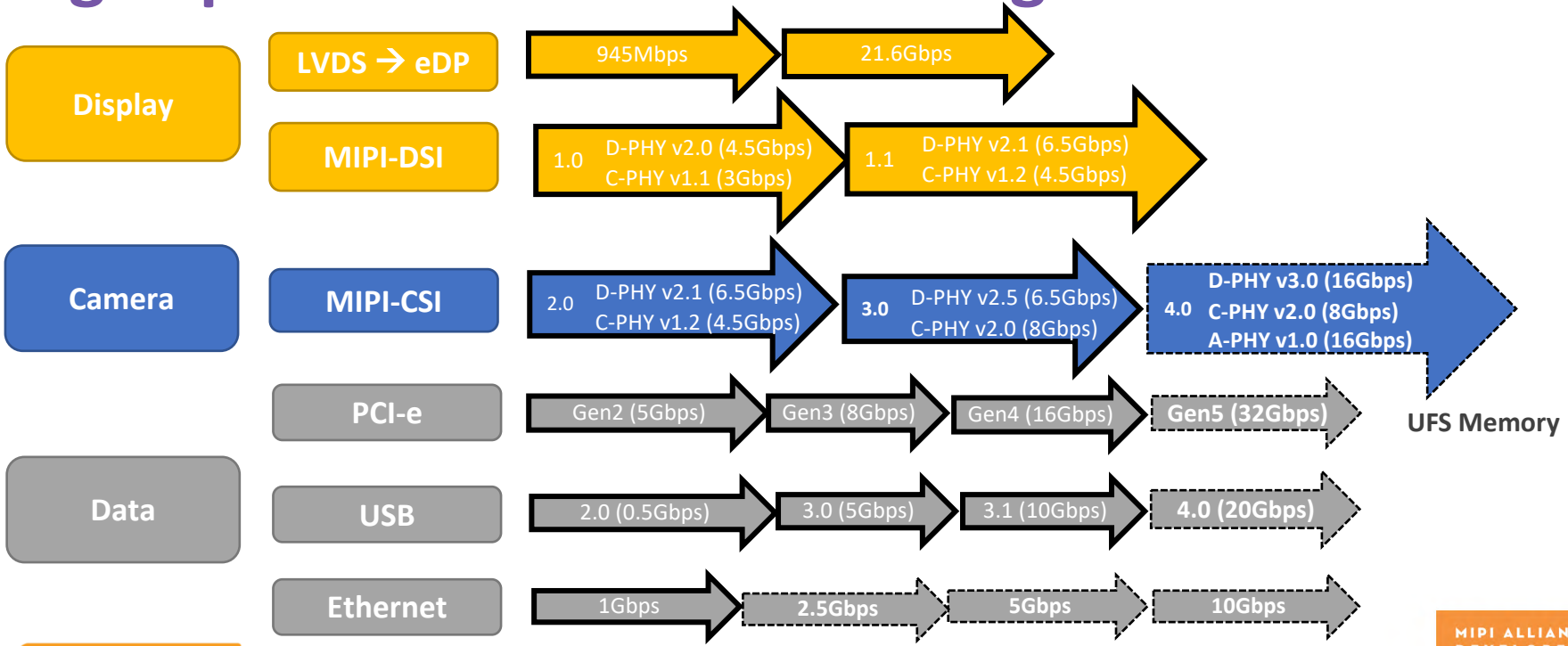
High Speed Interfaces: Streaming Video and Data



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