

TRENDS IN AUTOMOTIVE RADAR

MARKET DRIVERS & TECHNICAL CHALLENGES

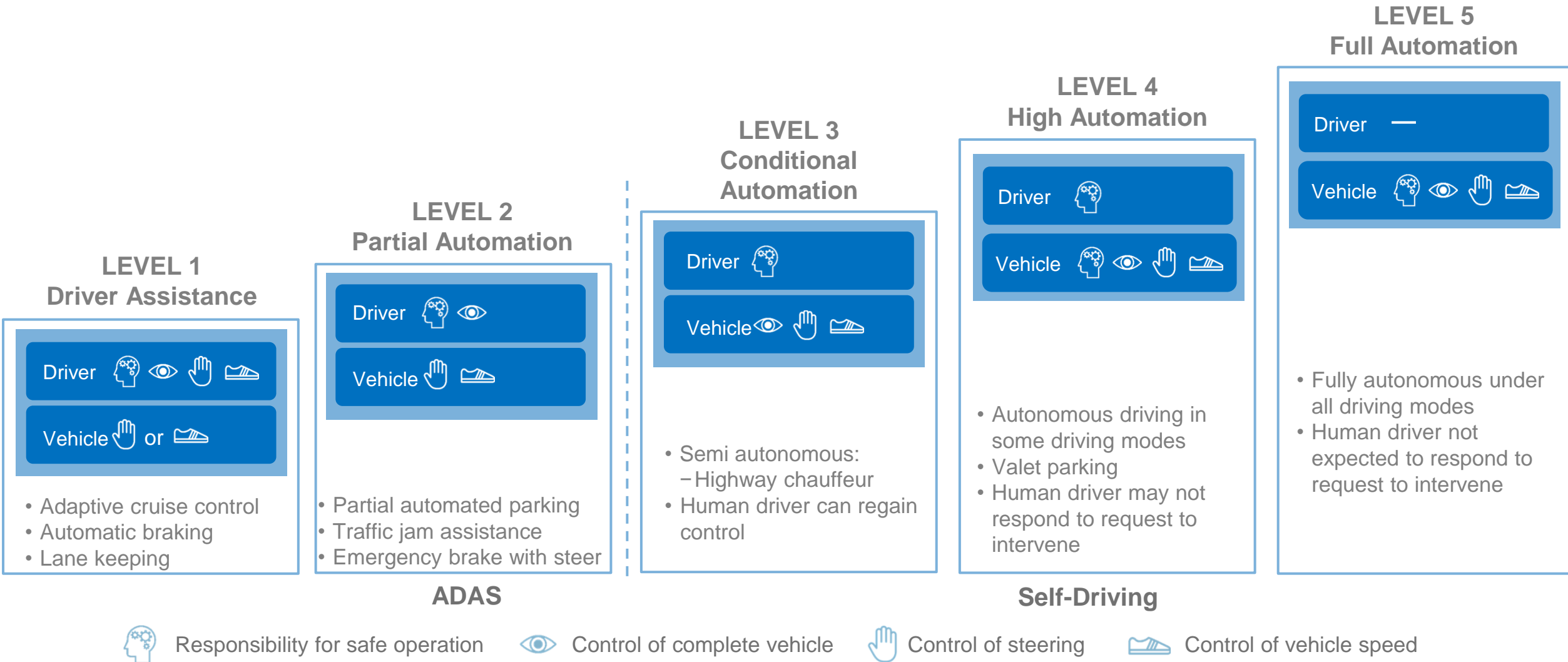
Thomas Wilson
Automotive Microcontrollers & Processors (AMP)

OCTOBER 2017



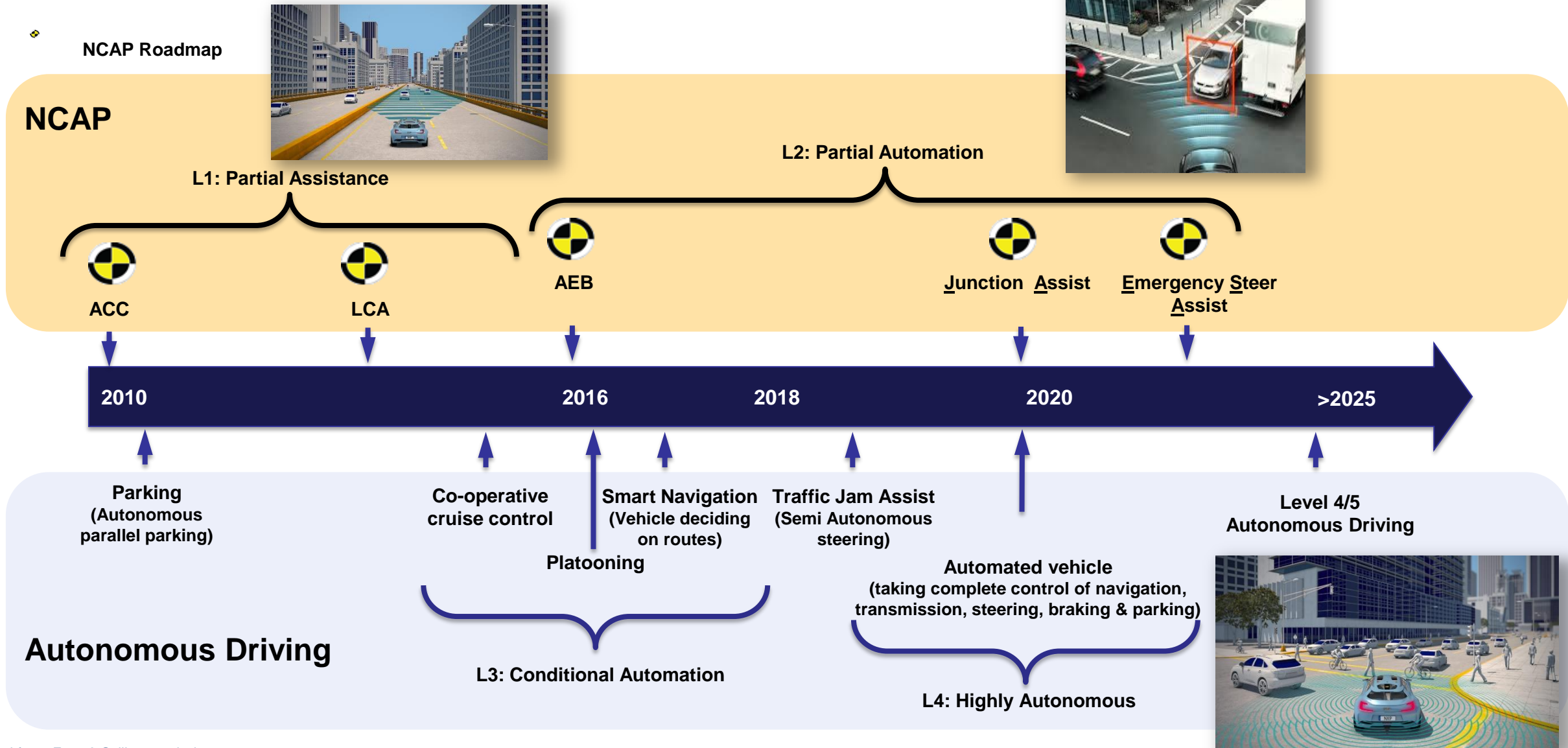
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Race to Self-Driving: Revolution and Evolution



SAE. (2014). AUTOMATED DRIVING LEVELS OF DRIVING AUTOMATION. [SAE INTERNATIONAL STANDARD J3016](https://www.sae.org/standards/content/j3016/).

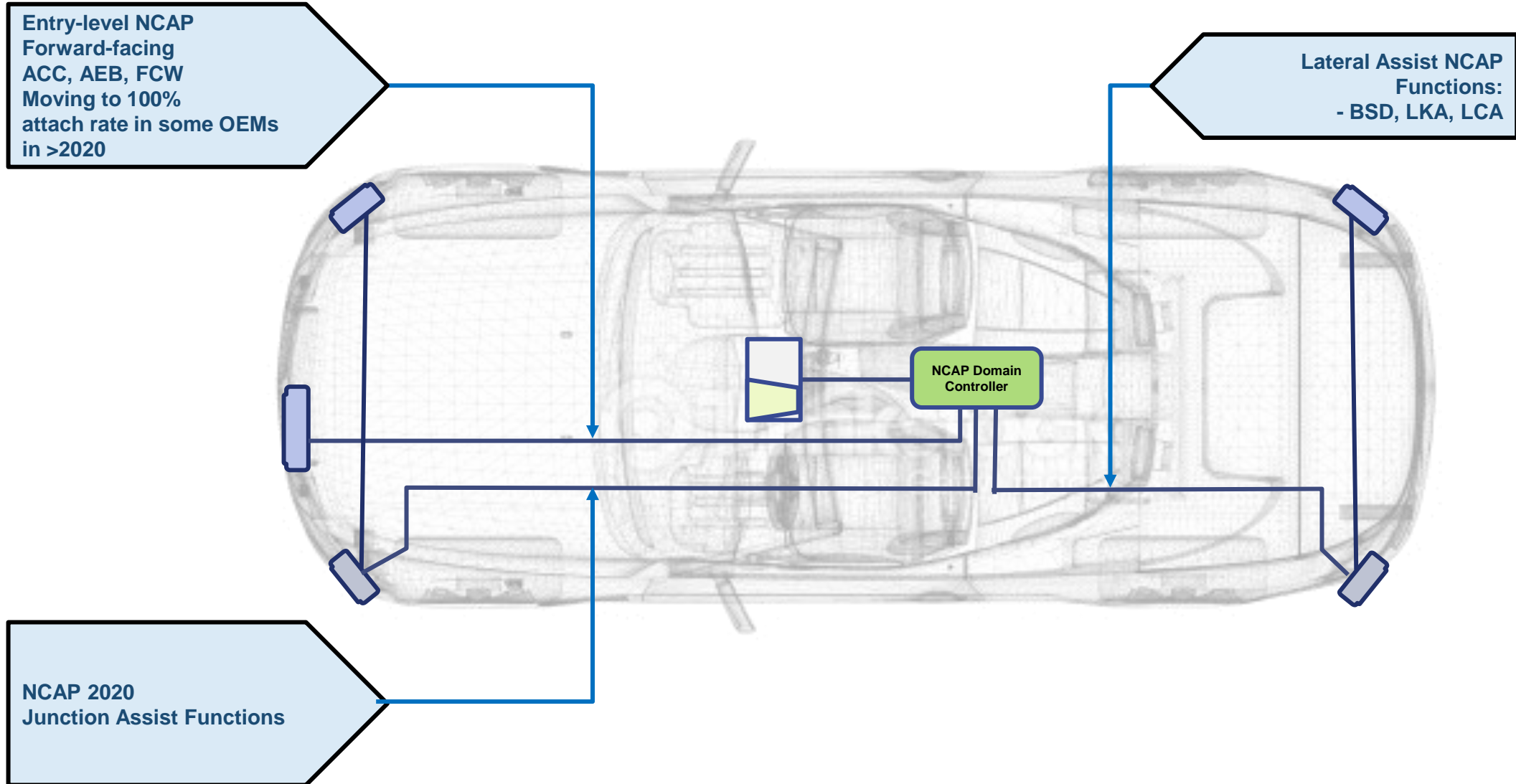
Trends: NCAP and Automation



Adapted from Frost & Sullivan analysis.

NCAP: Modular Support for 5-Star

— CAN-FD



L3/L4 Autonomous Architecture

— CAN-FD
— 100Mbps Ethernet

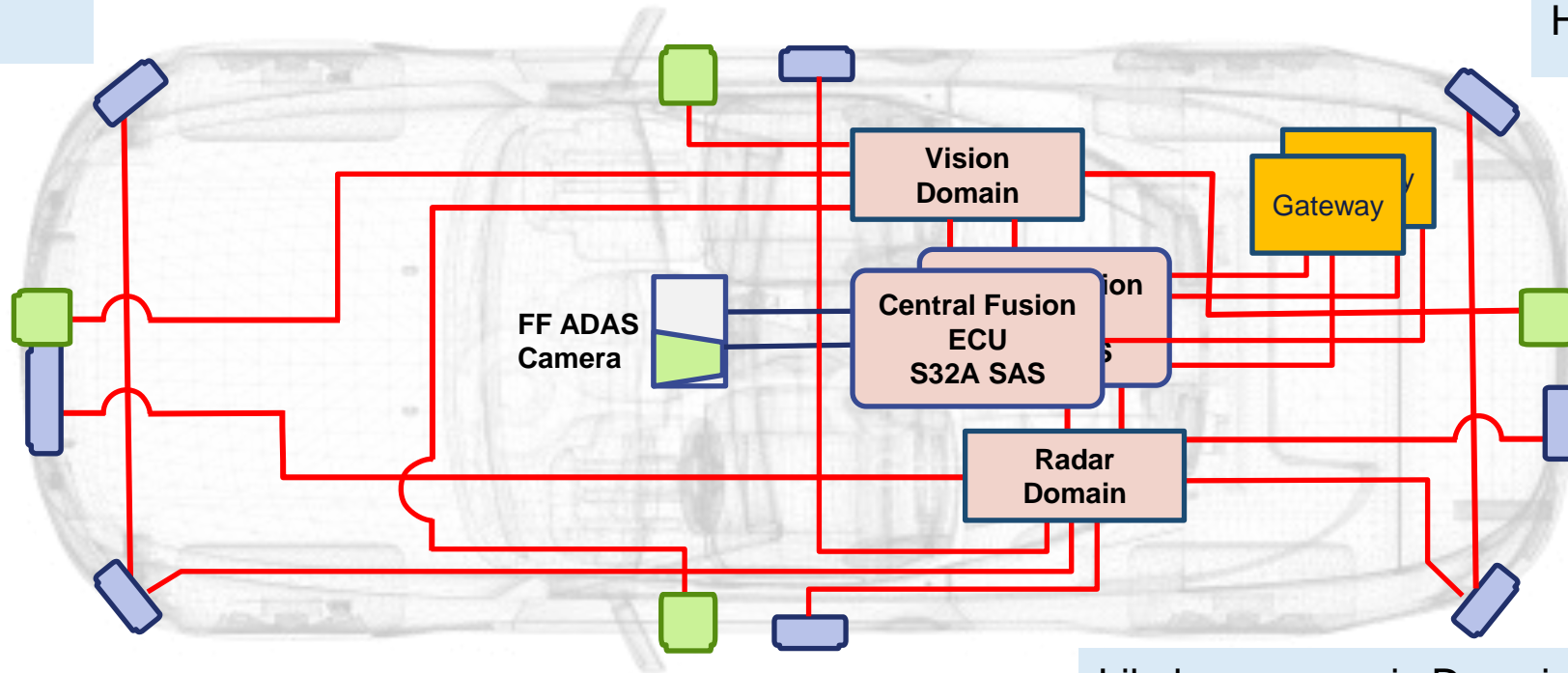
Multi-mode radar for both MRR narrow FOV and SRR broad FOV

Significant vision processing may still be FF ADAS camera

USRR modules to fill in gaps on sides, e.g. for Valet parking (L4)

MRR/LRR Hi-end corner for Highway Pilot (L3)

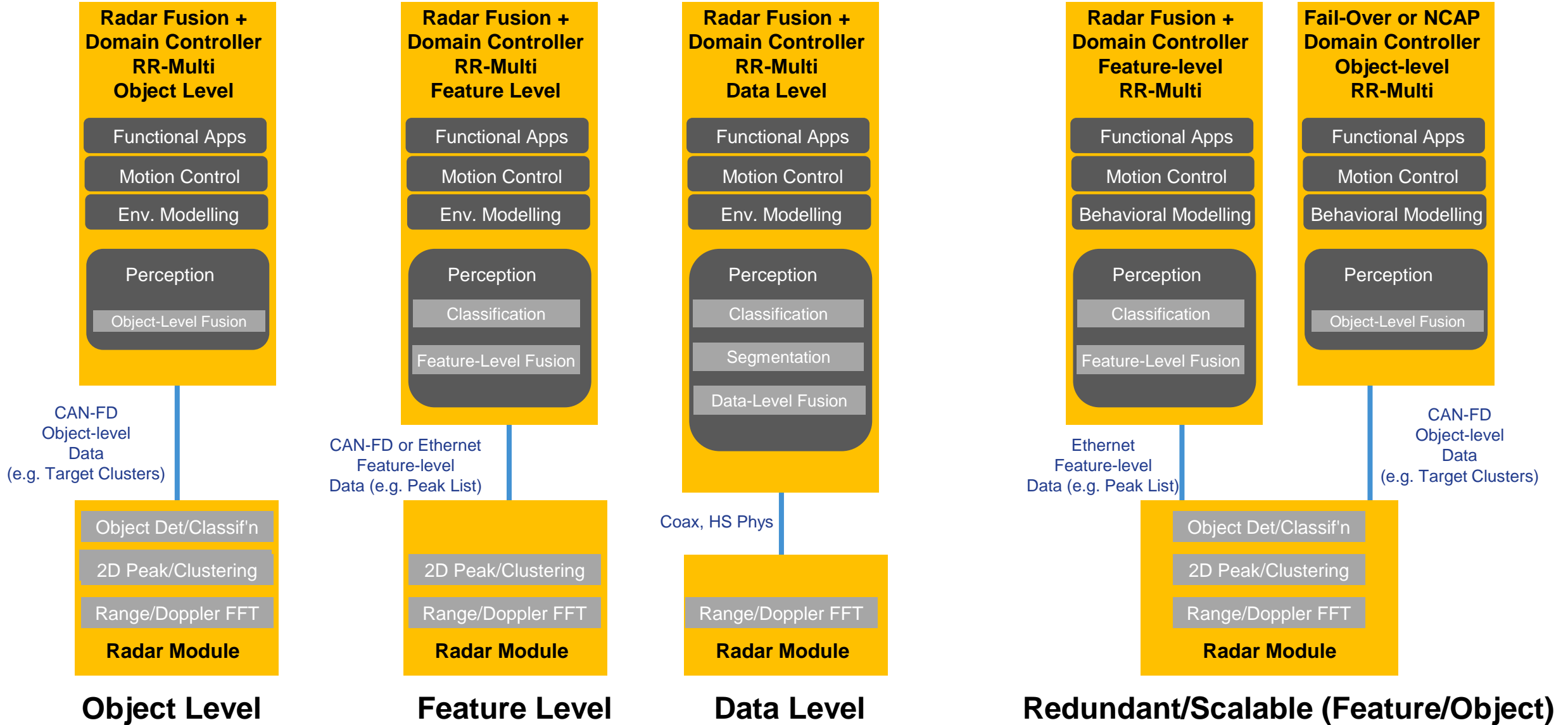
Increasingly Long Range and High Resolution Radar for 360 mapping



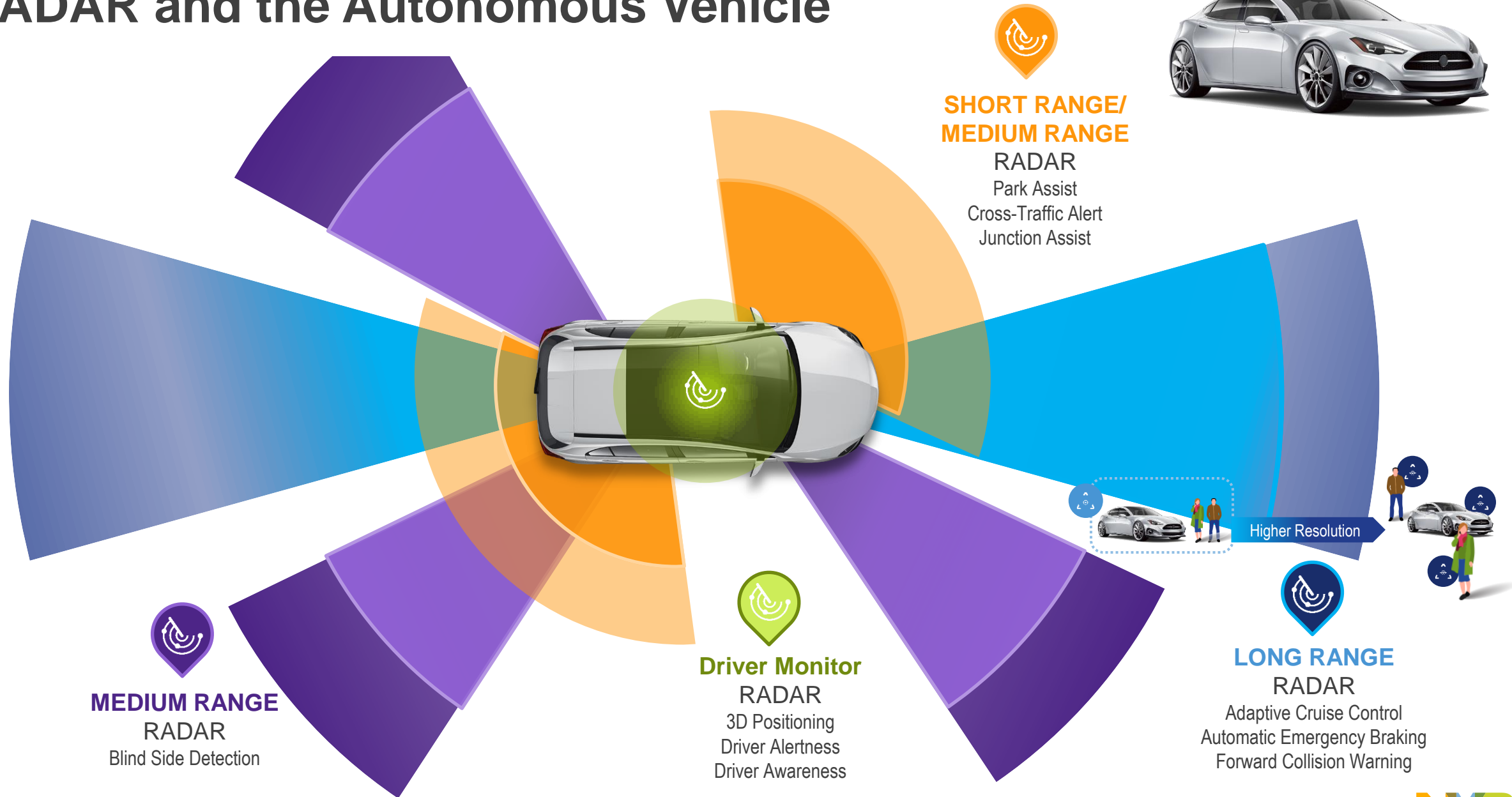
"Surround-sense" cameras vs Surround-View

Likely use case is Domain-level fusion for environmental modelling before Planning in Central Fusion

Radar Sub-System Architectures: Where to Cut Processing?

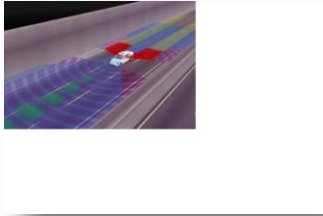


RADAR and the Autonomous Vehicle



Sensor Technologies of the Autonomous Vehicle

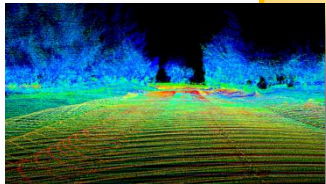
RADAR



Vision



LiDAR



Ultrasonic



A Sensor Package in a L3 Vehicle Today

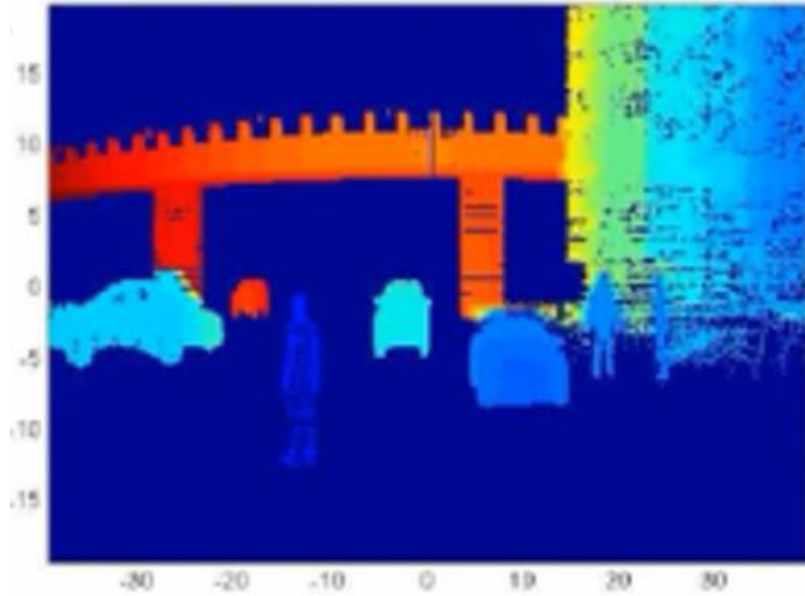
- 1-3 RADAR's
- 1-5 cameras
- 0-1 Laser/Lidar
- 4-12 Ultrasonic



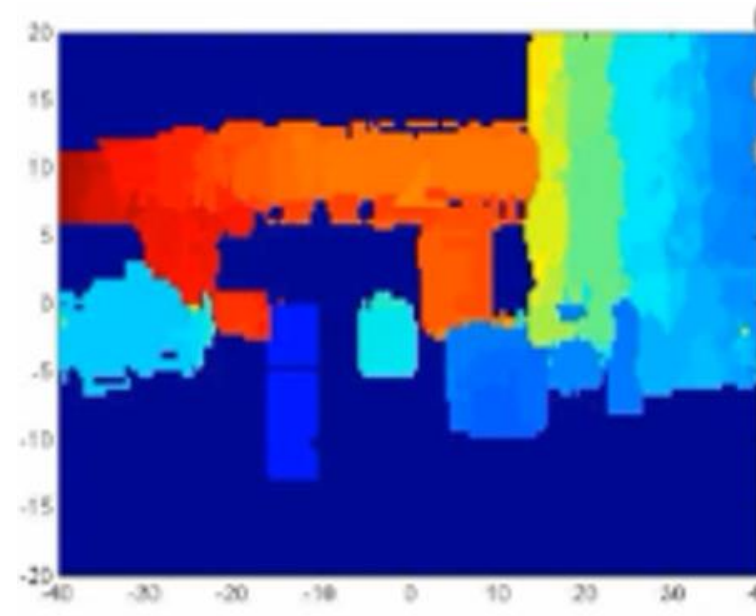
What will it be in 2020 & beyond?

All Weather	Classify Objects	Resolution	Industry Adoption
✓	✓	✗	✓
✗	✓	✓	✓
✗	✓	✓	✗
✓	✗	✗	✓

Advanced Radar vs. Lidar



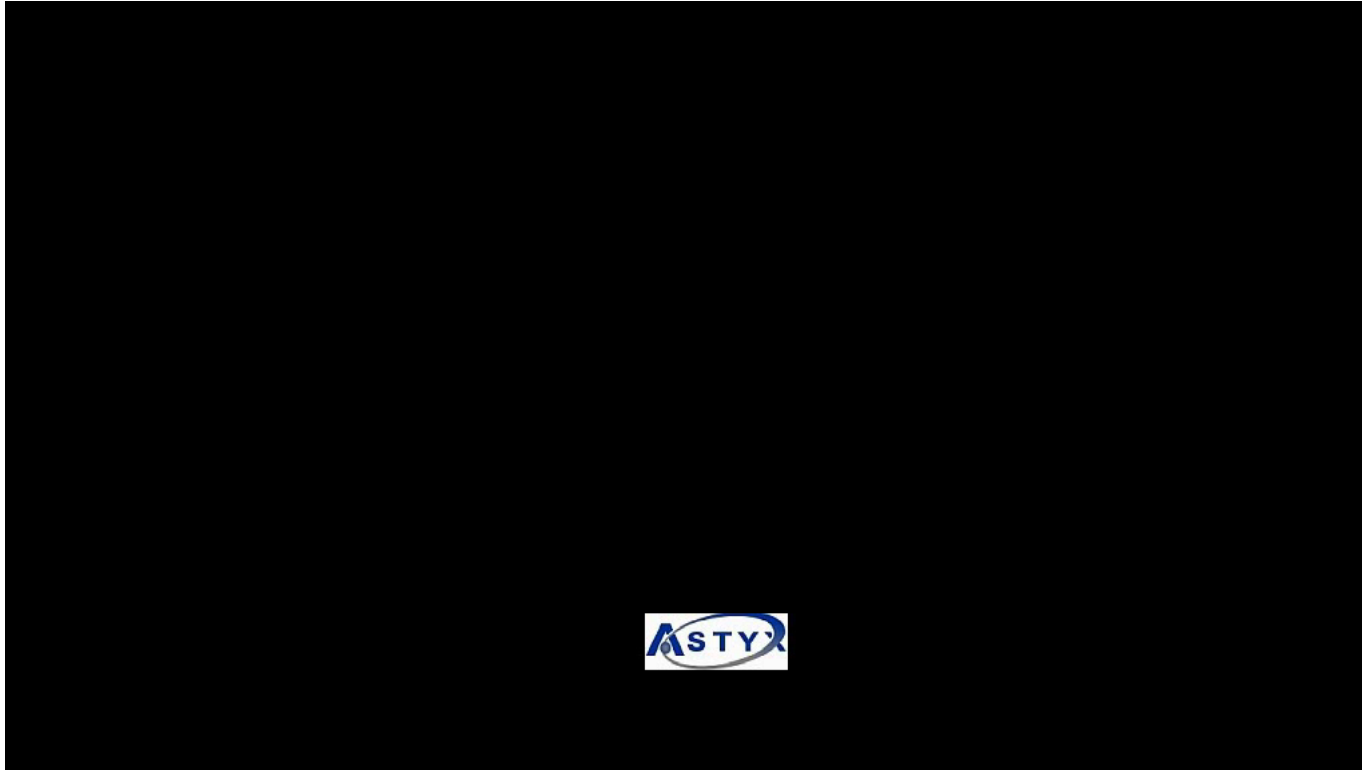
Lidar



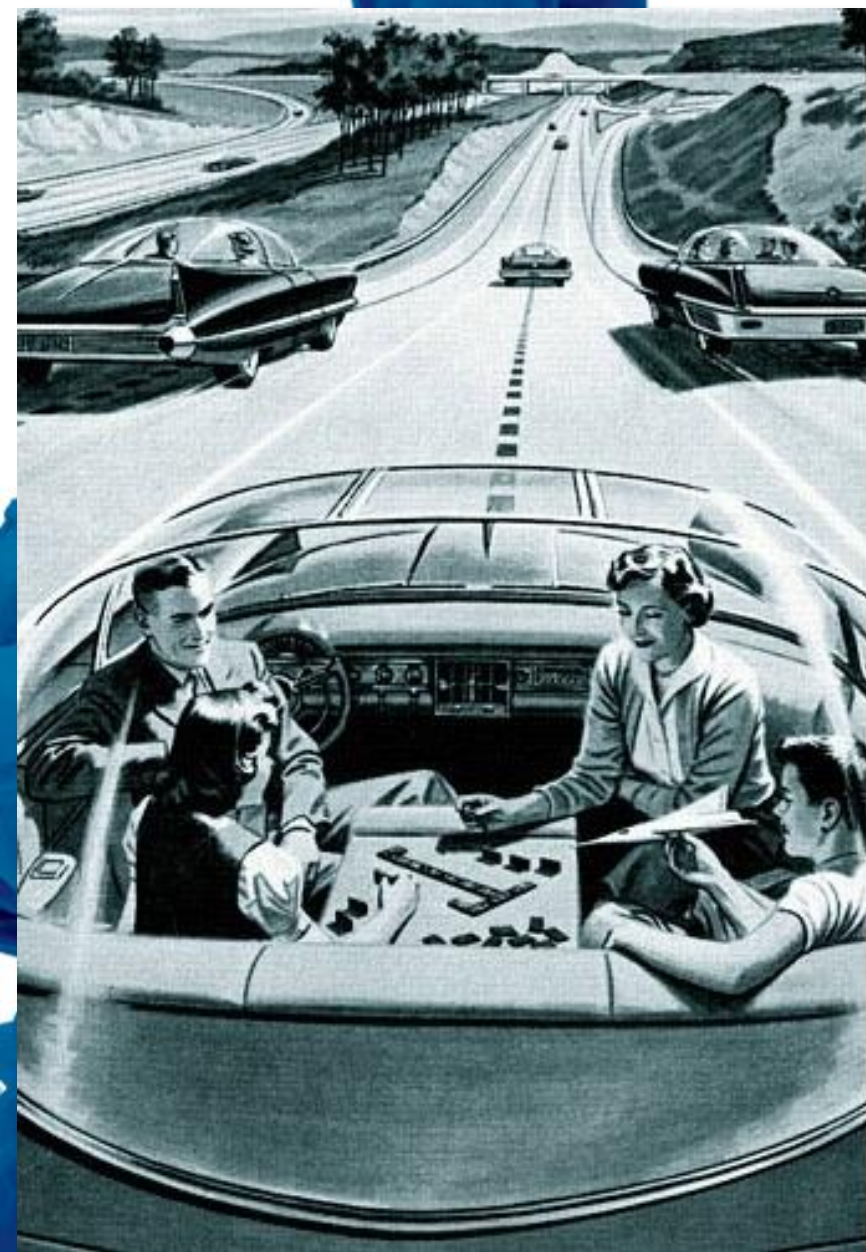
High Resolution Radar

- High Resolution Radar ('Imaging Radar')
 - Claims as low as 1.2° of angular resolution

"Imaging Radar": 360° Mapping



- High resolution radar used to map the environment to long range (~300m)
- Radar is uniquely positioned to provide robust mapping support
- New radar approaches: MIMO, SAR, beam forming, beam steering, new modulation schemes, etc.
- NXP, with its partners, is leading in enabling and prototyping high resolution radar for autonomous vehicle applications



Conclusions

- NCAP and new Autonomous driving modes require innovative, scalable system architectures
- The partitioning of processing and system interconnect decisions continue to evolve
- Autonomous vehicles are driving the requirement for higher resolution sensor modules.
- Innovation in high resolution radar ("radar imaging/mapping") is key to Autonomous vehicle sensing
- NXP is leading new approaches in radar sensing to enable the Autonomous vehicle revolution



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