

ADAS & Driver Replacement: Vision Overview for ADAS Systems

Joseph Martinez

ADAS Product Manager

June 2019 | Session #AMF-AUT-T3658



SECURE CONNECTIONS
FOR A SMARTER WORLD

Agenda

- NXP ADAS Overview
- ADAS Vision Use Cases
- Road Map & Ecosystem





NXP Core Values to Solve the Current Challenges of the Market

Computation Performance

Lead the heterogeneous compute performance with purpose built processors, optimized for power

Safety

No compromise on safety. Progression from ASIL to enhanced dependability and fail operational modes support

Ease of Use

Based on OPEN standards, portable and relocatable

Modularity Scalability

Built on 'clear functionally separated extensible' entities

ADAS Microprocessor Solutions

NXP ADAS Value:

- Performance Per Power through Acceleration
- Enablement through Open Standards
- Safety with Automotive Pedigree

S32R | RADAR: #1 Market Leader

+50% of all car radar modules shipped in 2017 have utilized NXP technology*



Front L/M Range



Corner Radar



Imaging Radar

S32V | VISION: NCAP & Open Standards

5 star Vision NCAP, providing ISO26262 ASIL D safety case



NCAP



Multi Camera

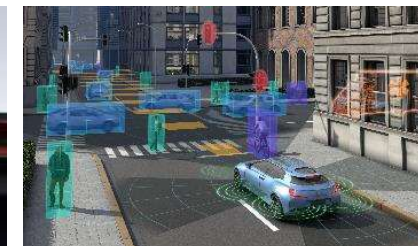


Lidar

BlueBox | SAFE Central Computing for L3-L5



Autonomous Driving AI



Perception



Planning

Superior Senses With High-performance Vision

S32V
Scalable, functionally safe, AI ready

Leading Edge Enablement
Computer Vision and Artificial Intelligence
on Compact Automotive Form Factor

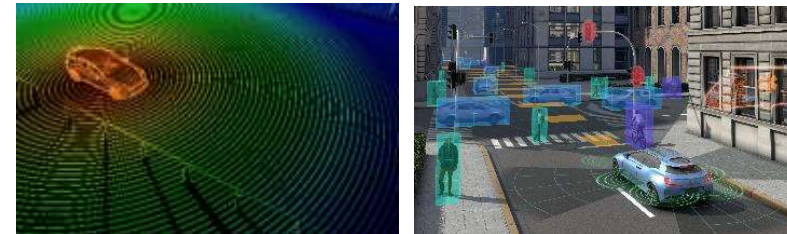


S32V | Vision: From NCAP to AI



NCAP

Multi Camera



Lidar

Vision AI Fusion

MPC560xE

- Enables miniaturization of camera modules
- Reduce system cost and time to market

First Ethernet Camera solution for automotive

S32V

- Safe: ISO26262 compliance
- High quality automotive grade
- AI Ready: Enablement to support

Optimized for Higher Efficiency

ADAS & Autonomous Driving Simplified

Sense 

Think 

Act 

Perception and Modeling

The ability to see, become aware of and identify the vehicle's surroundings through its sensors

Perception

- Sensor Feature Extraction
- Sensor Data Enhancement
- Object Detection

Modeling

- Object Classification
- Object Tracking
- Segmentation

Safe Path Planning

The ability to plan a route given the perceived information and safely maneuver the vehicle

Safe Path Planning

- Motion Planning
- Traffic Prediction
- Behavioral (Local Planning)
- Route Planning
- Feedback Control

Market Growth and Target Applications



NCAP/Mono Camera
Vision



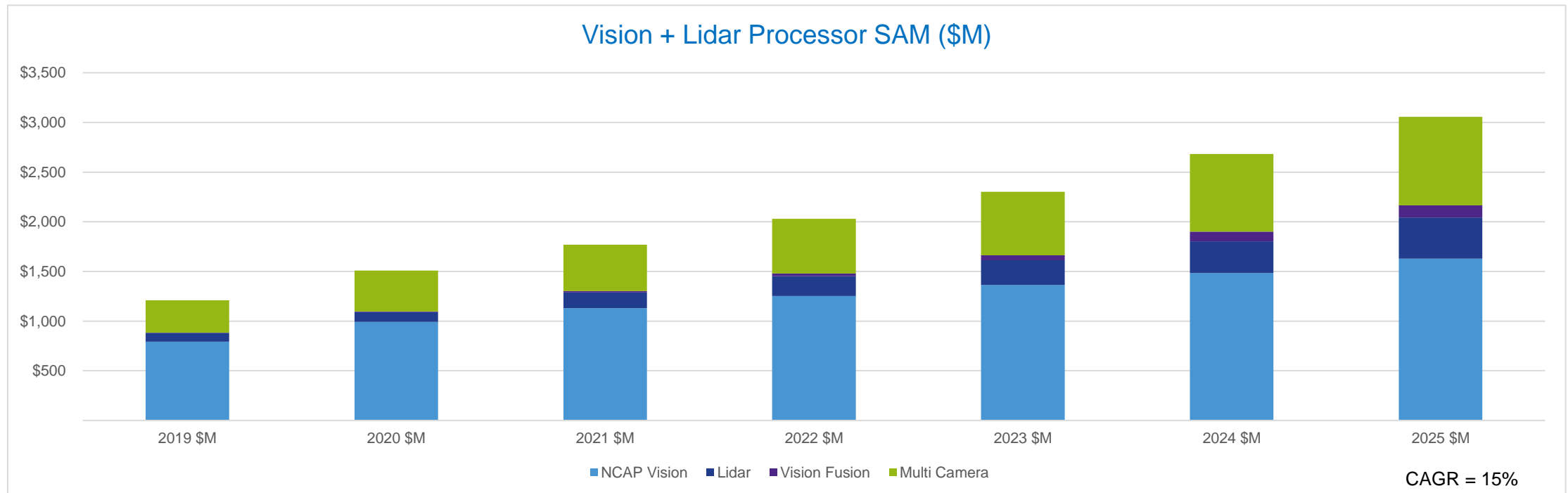
Lidar
Lidar



Vision Fusion w/ AI
Vision / Radar / Lidar
Fusion



Multi & high-end
Camera w/ AI
Vision



Note: NCAP Vision includes, Mono camera, Stereo Camera, Rear Camera and Driver monitor

S32V Vision Use Cases



NCAP/Mono Camera Vision

Pedestrian Detection. Rear View
Automatic Emergency Braking
Forward Collision Warning



Lidar Lidar

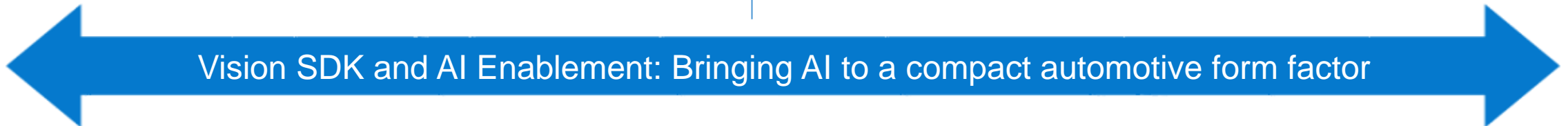
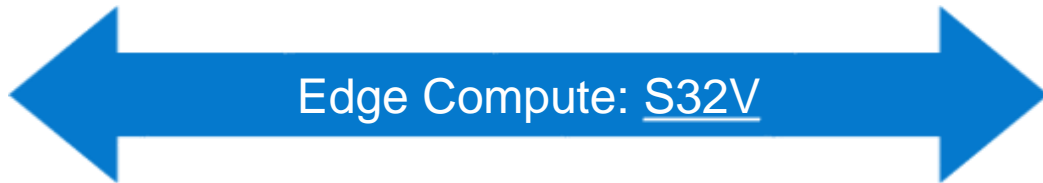
Point Cloud Post Processing
Ground Seg, Scene Seg
Free Space



Vision Fusion w/ AI
Vision / Radar / Lidar
Fusion
Perception w/ Safe Decision
Making

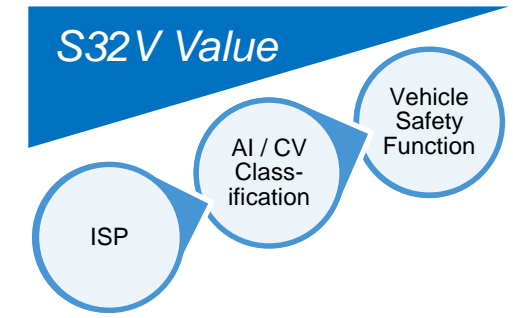


Multi & high-end
Camera w/ AI
Vision
Multi Camera perception,
Occupancy Detect, Scene Segm.
Free Space

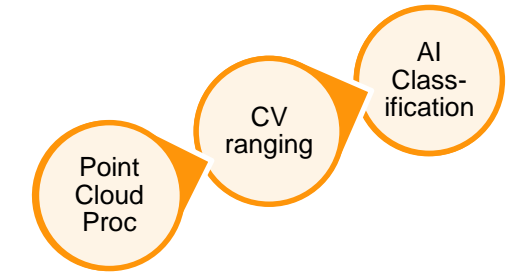
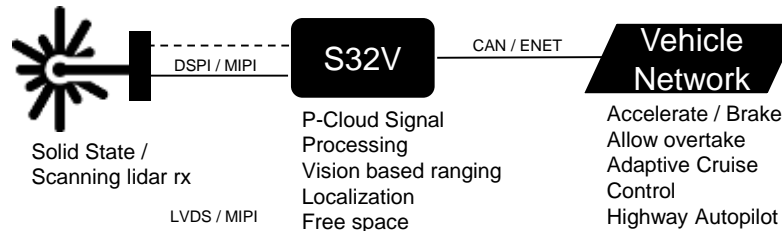


Vision Use Cases

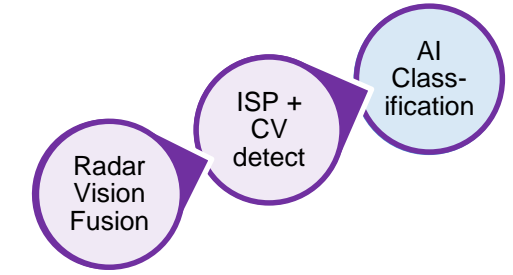
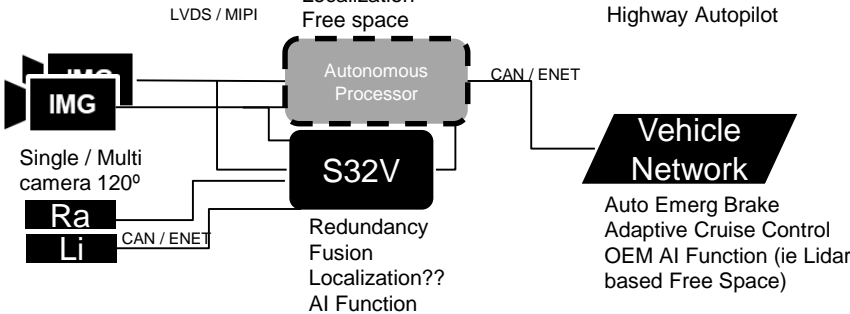
NCAP/Mono Camera



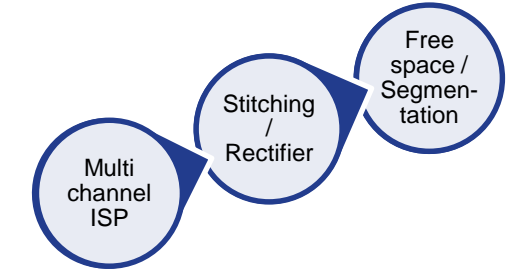
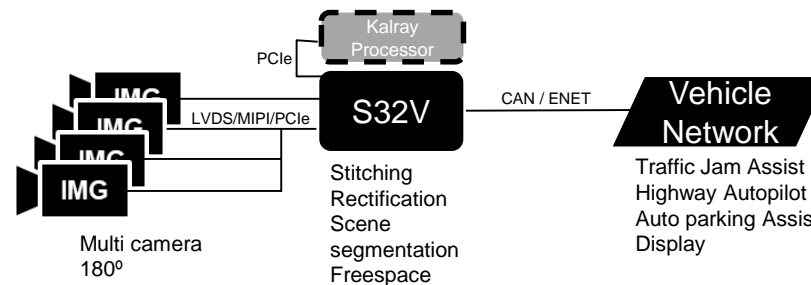
Lidar



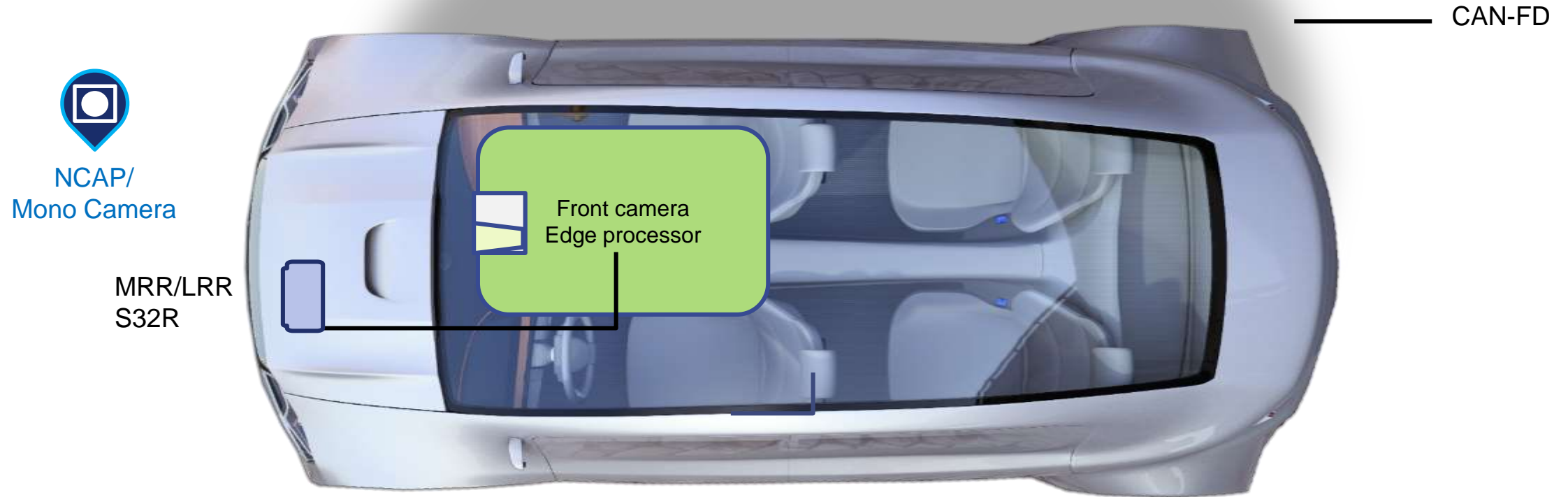
Vision Fusion AI



Multi & high-end Camera w/ AI

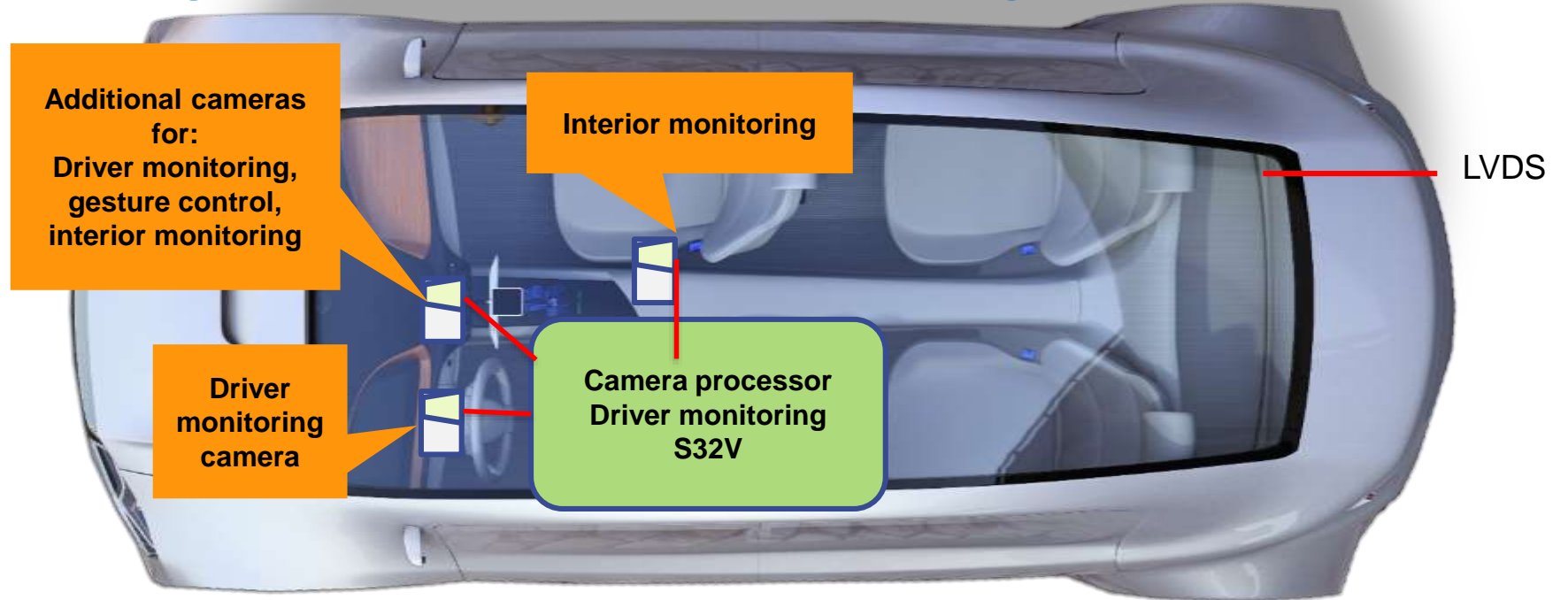


S32V: NCAP – Front Camera



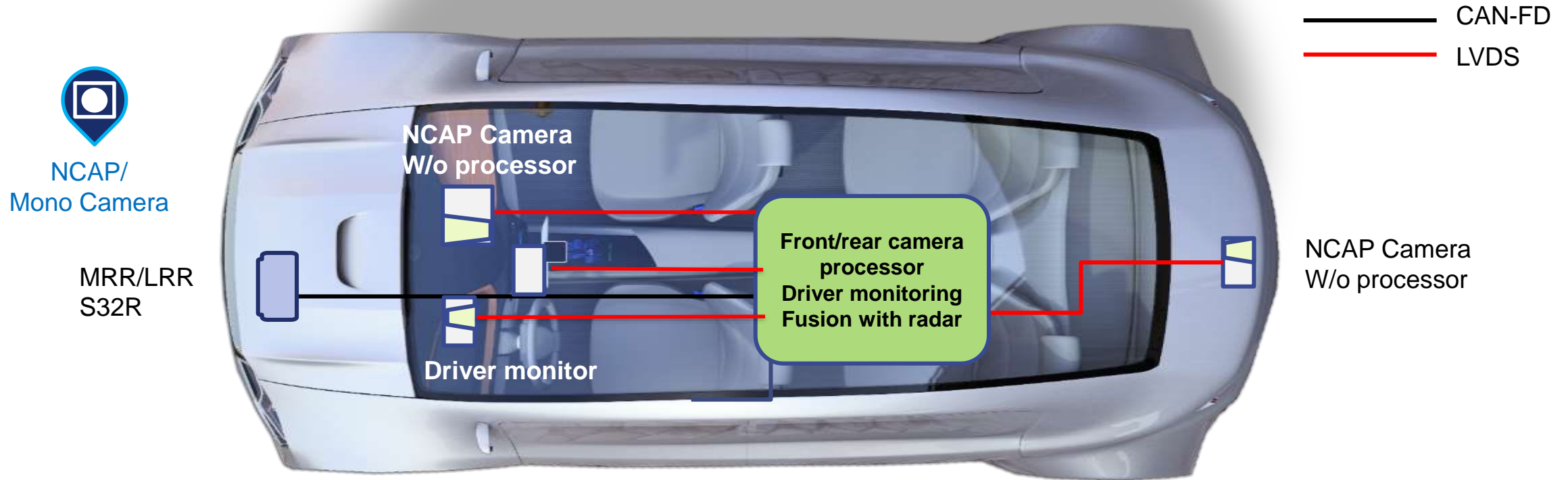
- High performance edge processing behind the windshield
- Performance/power as key technical factor
- Single front camera up to 8 Mpixel or stereo/ multi camera
- Optional: fusion with radar
- Emergency breaking

S32V: NCAP – High End Driver Monitoring and Interior Camera



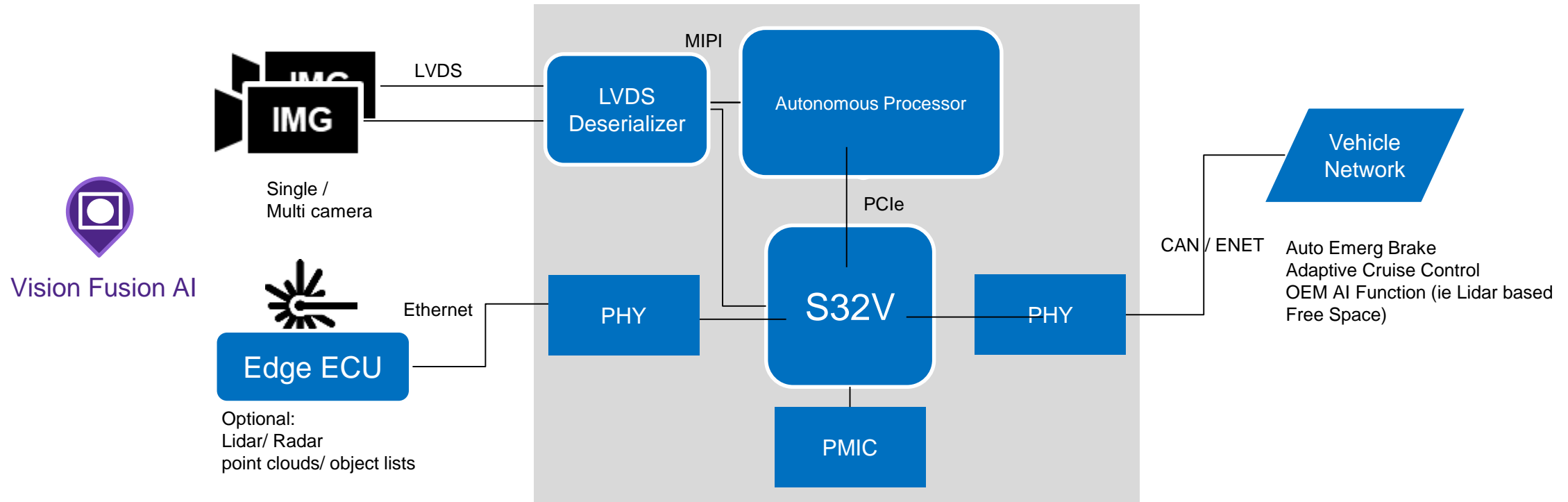
- Driver/Occupancy monitoring ECUs
- Infrared cameras and fisheye view are key requirements
- Typical resolution 2 Mpixel
- Multi camera optional, 3-5 cameras possible
- Video output via MIPI-TX possible
- Driver status (e.g. drowsiness detection), gesture recognition ...

S32V3: NCAP – Platform Use Case



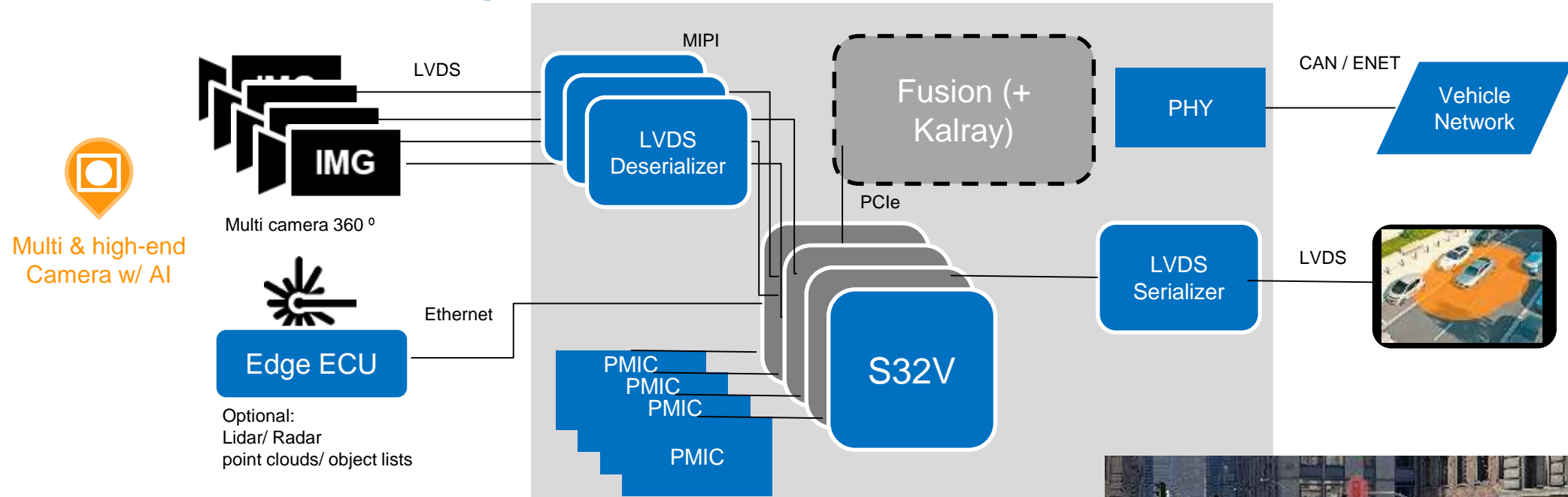
- Option to centralize NCAP functions into one platform
- Parallel execution of front camera (up to 8 Mpixel) and IR channel for driver monitoring
- Rear camera video stream output with augmented objects for display

S32V: Vision Fusion AI

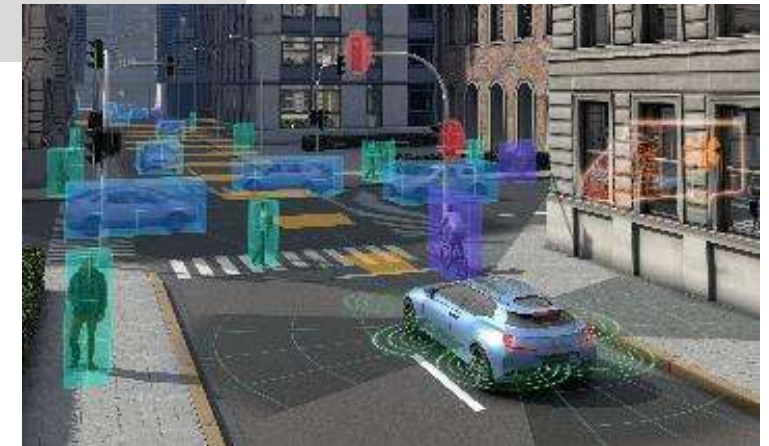


- Redundant processing to a larger, power hungry primary perception processor
- Assumes to perform a minimum level of **redundant processing to check** the primary processor
- Rule based computer vision as well as redundant NN processing
- **ASIL D CPUs** to perform sensor fusion, cross checking and commands to actuators
- Optional: Lidar (freespace) or Driver monitoring/ NCAP for a “scaled down” ECU version

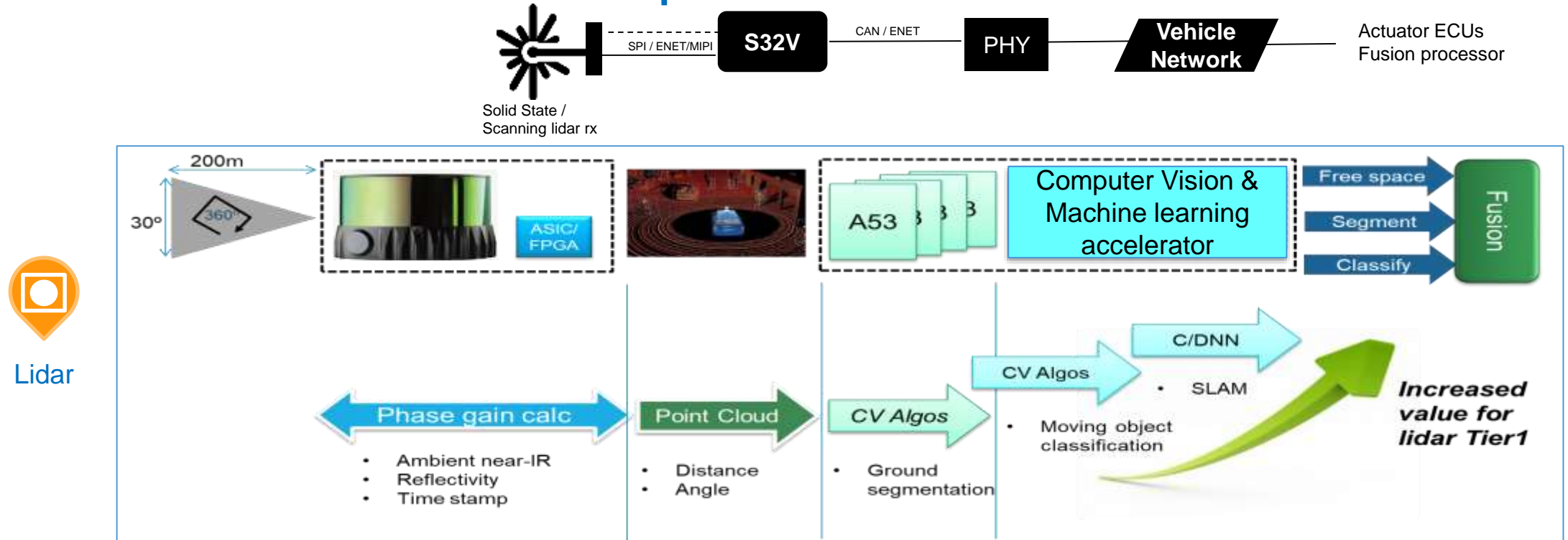
S32V: Multi & High End Camera w/ AI



- Level 2+/3: 360° AI based perception
- Highway pilot, Traffic Jam Assist, Auto Parking
- May include RGB-IR cameras and Lidar as well
- Options:
 - With external additional high performance accelerator
 - Surround viewing for parking



S32V: Lidar – Precise Depth Measurement



- Input: MIPI-CSI/SPI or Ethernet: samples or point cloud, depending on frontend (FPGA/ASIC)
- Independent from a single Lidar vendor
- As **host processor for Lidar** at the edge or as central solution with further sensors/ fusion
- ISP/Computer vision accelerator can be used to transform data to point cloud
- Point cloud as input for **3D-object detection/ freespace/ SLAM** applications
- Usage as independent **“safety channel”** or to boost performance of 3D object detection

S32V Lidar Network: SqueezeSeg



Target: S32V2 EVB

Input image is from Velodyne HDL-64E LiDAR as part of KITTI dataset

S32V Roadmap and Ecosystem



NXP ADAS Ecosystem

RTOS:

- eSol
- OpenSynergy
- QNX
- GreenHills

Middleware:

- Elektrobit
- Codeplay
- Polysync
- Baidu
- Autoware
- Renovo

Algo & Application:

- HELLA Aglaia*
- Momenta
- Jungo
- Deepscale*
- Neusoft
- Embotech
- CEA Tech
- Intempora
- Pathpartner

AI Acceleration:

- Kalray
- Cambricon

Drive By Wire:

- AutonomouStuff
- VSI Labs
- TORC Robotics

HIL/SIL/Simulation:

- dSpace
- NI Labs
- Ansys

Safety:

- Excida
- Edge Case Research
- Encore Semi

Platform:.

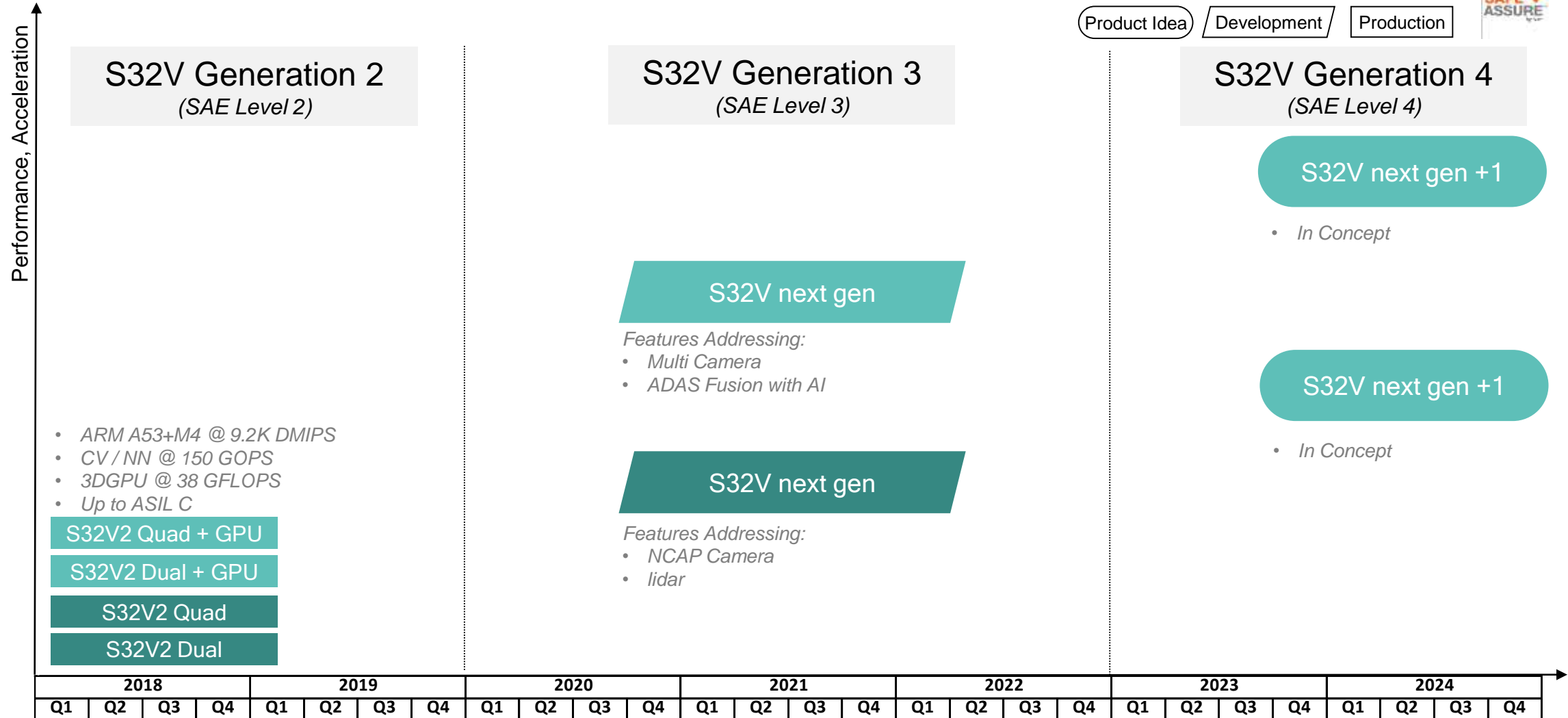
- MicroSys
- Fidus
- SolidRun

Radar:

- Colorado Engineering
- RF-Beam
- SMS
- Hawkeye

*Pending Lead Customer Confirmation

S32V ADAS Vision Processor Roadmap





**SECURE CONNECTIONS
FOR A SMARTER WORLD**