# Automotive ADAS Update


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Automotive Microcontrollers & Processors


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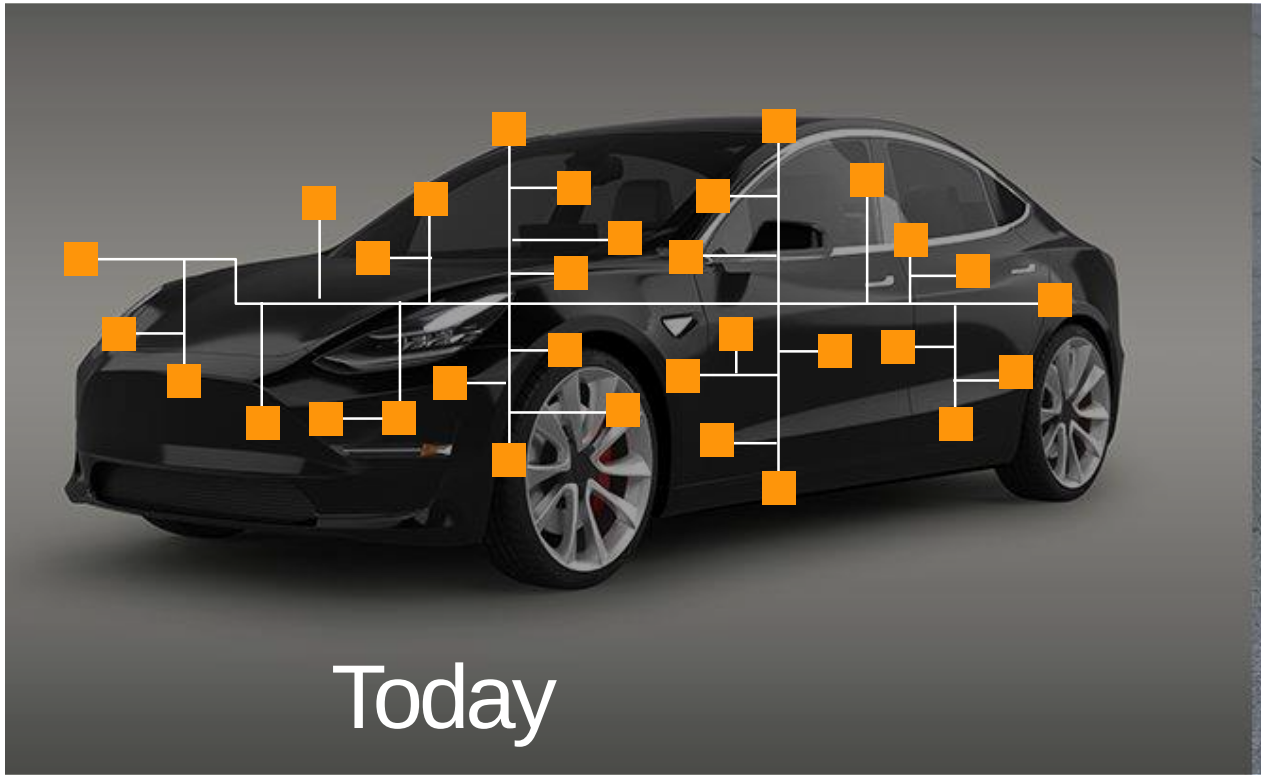
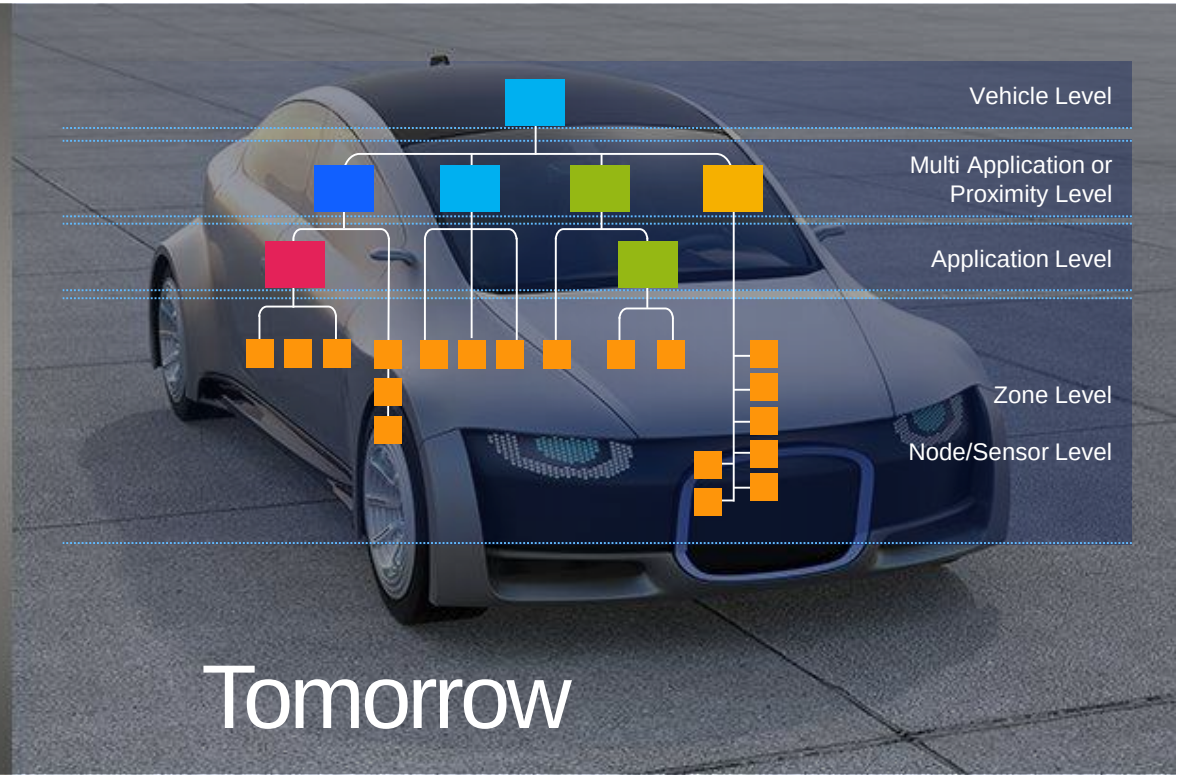
SECURE CONNECTIONS FOR A SMARTER WORLD

# NXP AMP Product Line Introduction



## Today

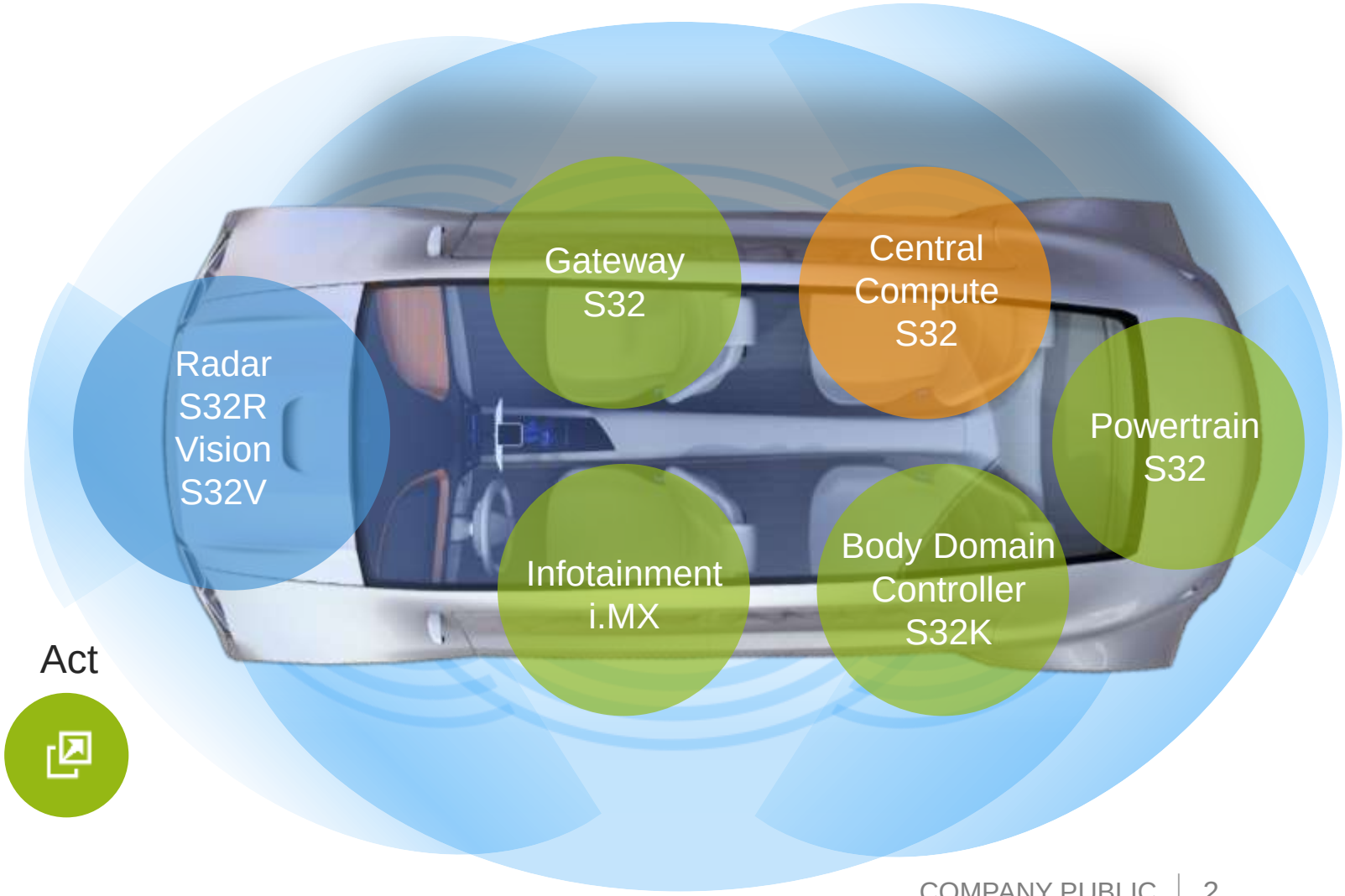
Distributed vehicle architectures
Incompatible silicon and software
Security and over-the-air update challenges
Inefficient development
Not easily upgraded or scaled



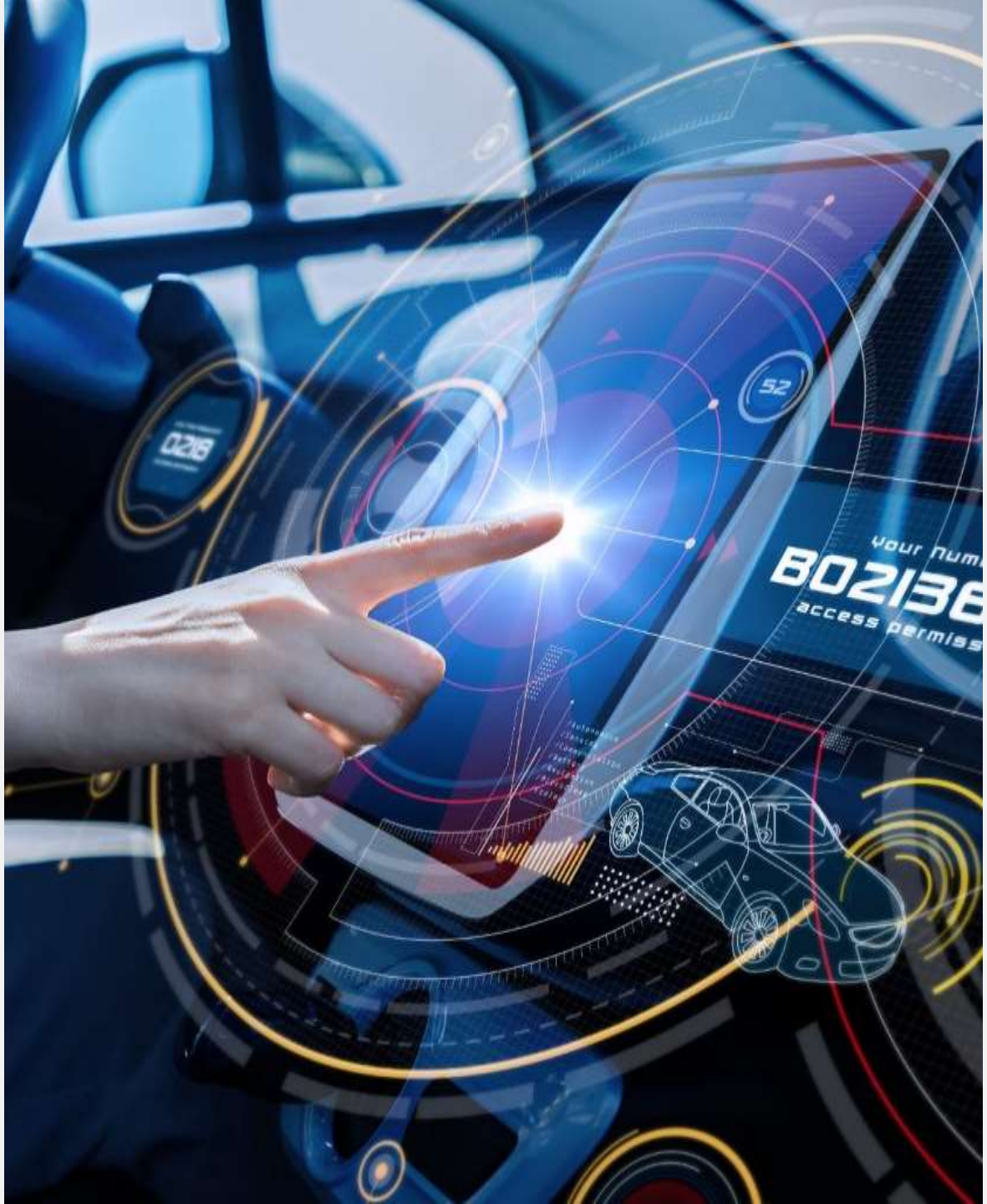

## Tomorrow

High performance domain architectures
Greater network capacity
Secure, safe over-the-air updates
Efficient to develop
Upgradable and scalable platform, future proof

# NXP Sense/Think/Act for NCAP to Autonomous




Sense Think Act



# 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

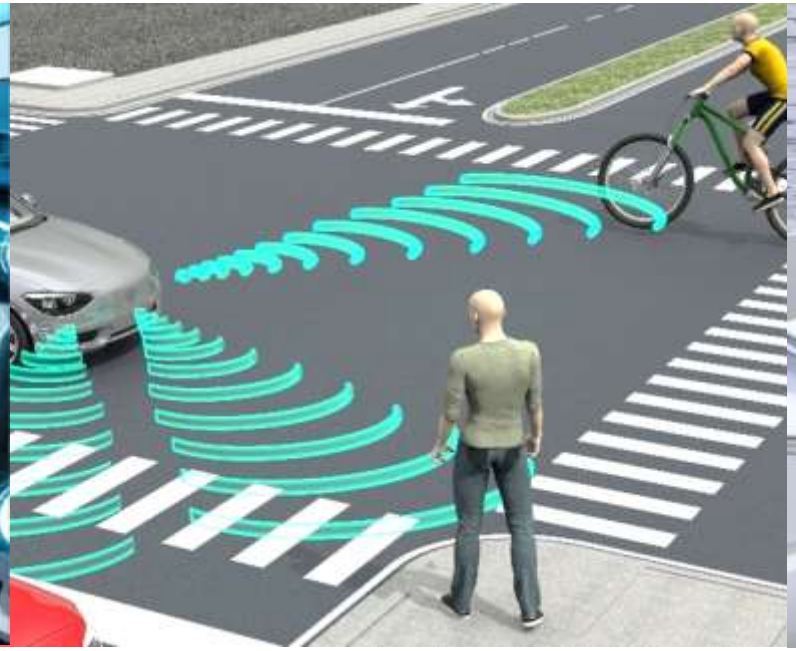
Based on OPEN standards, portable and relocatable

## Modularity Scalability

Built on ‘clear functionally separated extensible’ entities

# Safety is Non-Negotiable in a Smart, Connected and Automated World

Functional Safety



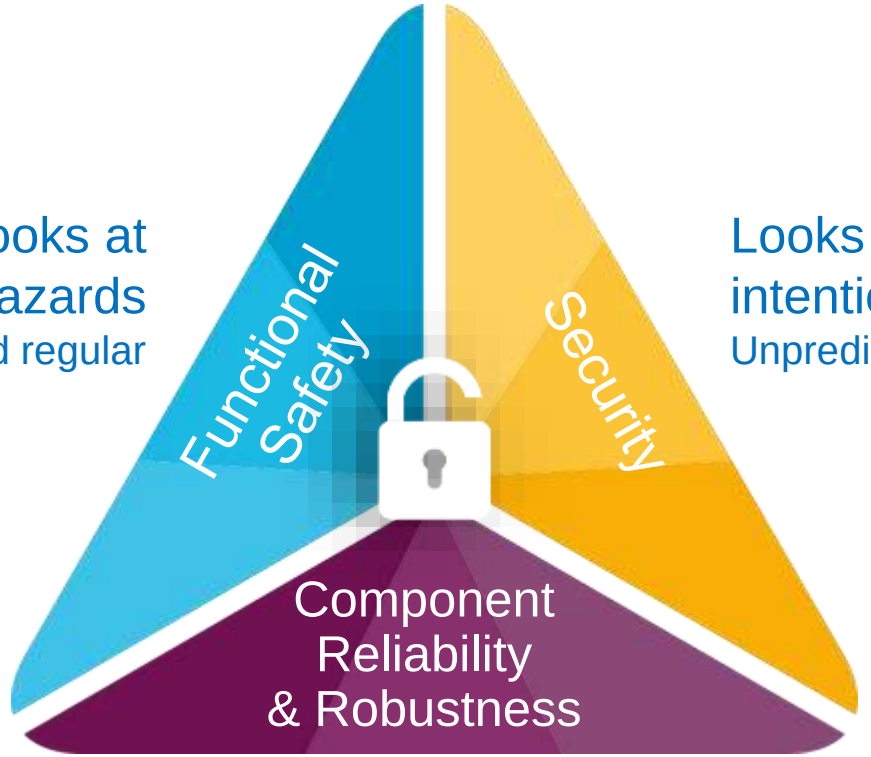
Behavioral Safety

Environmental Safety

# Delivering Automotive Grade Solutions

Zero accidents by system failures (ISO 26262)

Looks at unintentional hazards
Predictable and regular



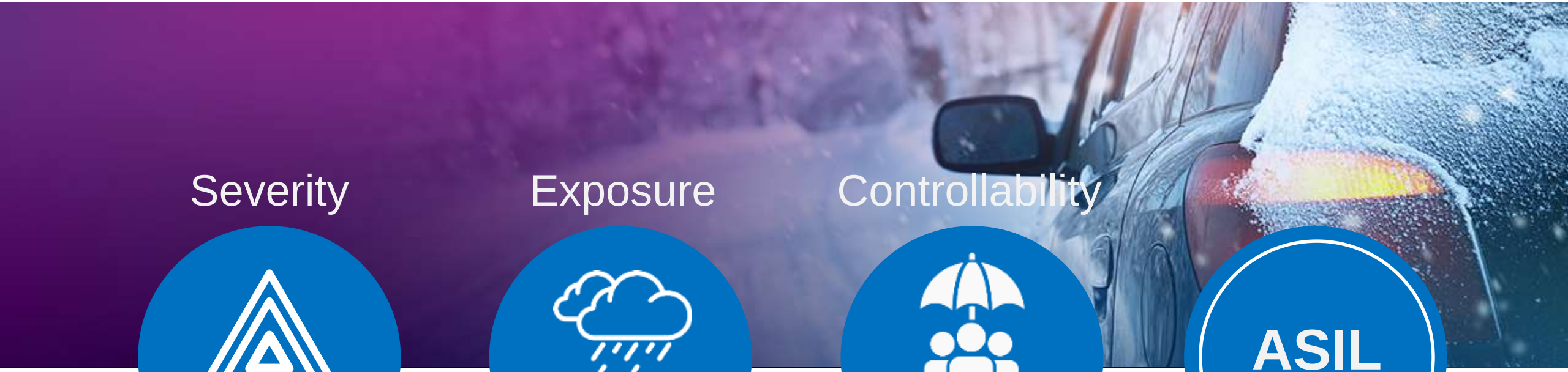

Zero accidents by system hacks

Looks at intentional hazards
Unpredictable and irregular

Maximum quality of components is mandatory for high-value system

Zero components failures (robust product)

# Quantify A Risk: Automotive Safety Integrity Level (ASIL) Definition



Severity

How much harm is done?

Exposure

How often is it likely to happen?

Controllability

Can the hazard be controlled

ASIL

# Did You Know?

**>25**

**Vehicle hacks**
published since 2015

**1.4M**

**Vehicle recalled**
in the largest incident to date


Why hacking?

Valuable Data
attracts hackers

Car-generated data may become a USD 750B market by 2030


Why is it possible?

High System Complexity
implies high vulnerability

Up to 150 ECUs per car, up to 200M lines of software code

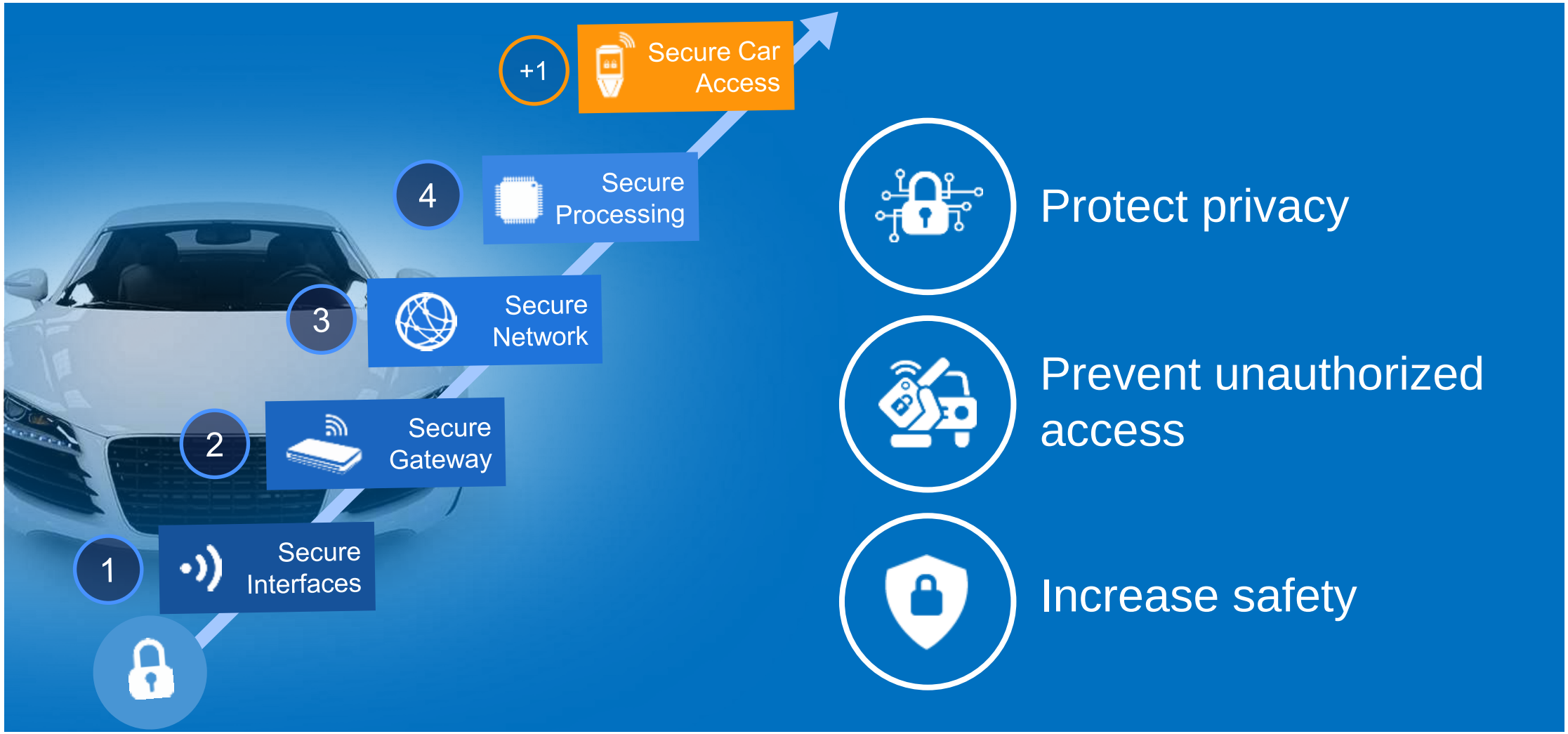
Why now?

Wireless Interfaces
enable scalable attacks

250M connected vehicles on the road in 2020

Security is a must-have for connected and autonomous vehicles

# Security Foundation for the Connected Car




# They all depend on Zero Defects

## Predict, Prevent, Protect

# Application Trends: NCAP & Autonomous

# Scalability from ADAS to Autonomous Driving


ADAS/NCAP

Comfort Features/Automated Driving

Fully Autonomous

**Domain-specific ECU**
Edge Compute
No Fusion

- Blind Spot Detection
- Traffic sign recognition
- Lane Departure Warning
- AEB
- ACC

**Enhanced ECU**
Edge Compute
Edge Fusion

- Highway Assist (Inc. Lane Change)
- Park Assist w/Automatic Steering

**Advanced ECU**
Edge Compute
Central Fusion & Compute

- Traffic Jam Chauffeur
- Park/Garage Pilot

**High-Performance ECU**
Edge Compute (Radar)
Central Fusion & Compute

- Highway Pilot
- Traffic Jam Pilot
- Fully autonomous under all conditions

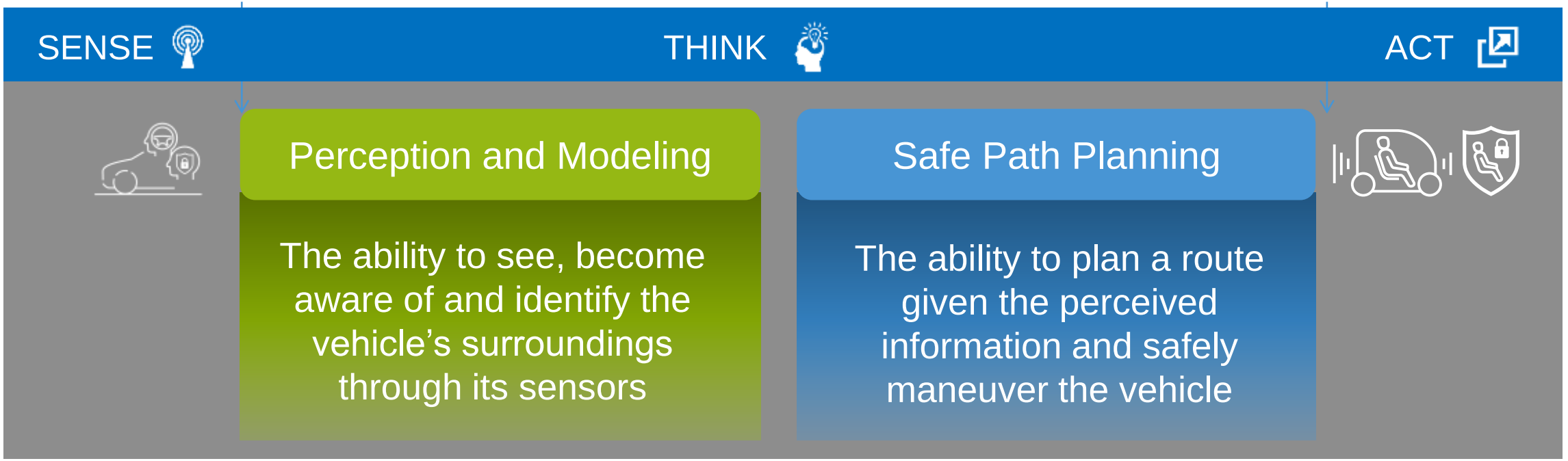
# New Car Assessment Program (NCAP): Safety Features

- AEB Pedestrians
- AEB Cyclists
- AEB Urban
- Emergency Lane Keeping
- Lane Keep Assist

- Junction / Cross Traffic Assist
- Auto Emergency Steering
- Reverse AEB
- AEB Pedestrians (low light)
- AEB Cyclists (low light)
- Driver Monitor

- Auto Emergency Steering
- AEB Head on
- Evasive Steering and AEB
- Child Presence Detection

# ADAS & Autonomous Driving Simplified




### Perception

- Sensor Feature Extraction
- Sensor Data Enhancement
- Object Detection

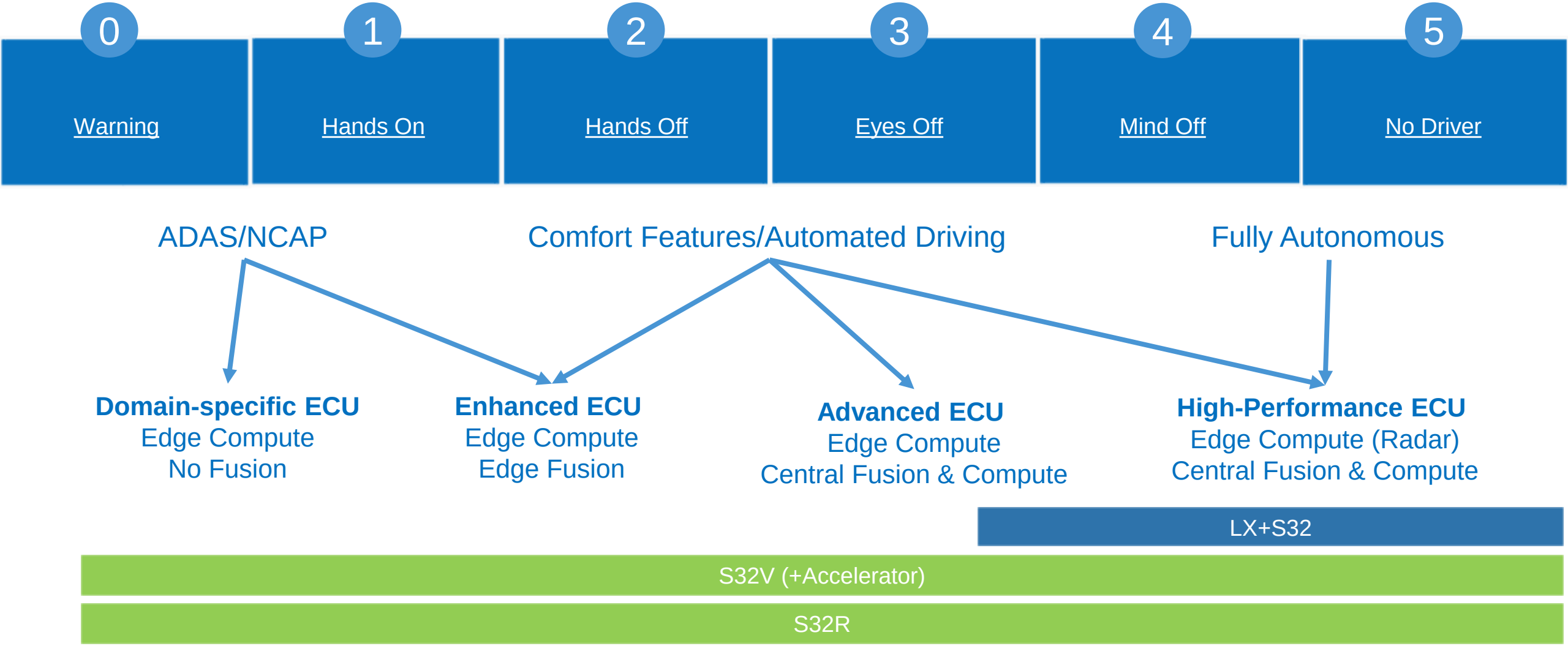
### Modeling

- Object Classification
- Objection Tracking
- Segmentation

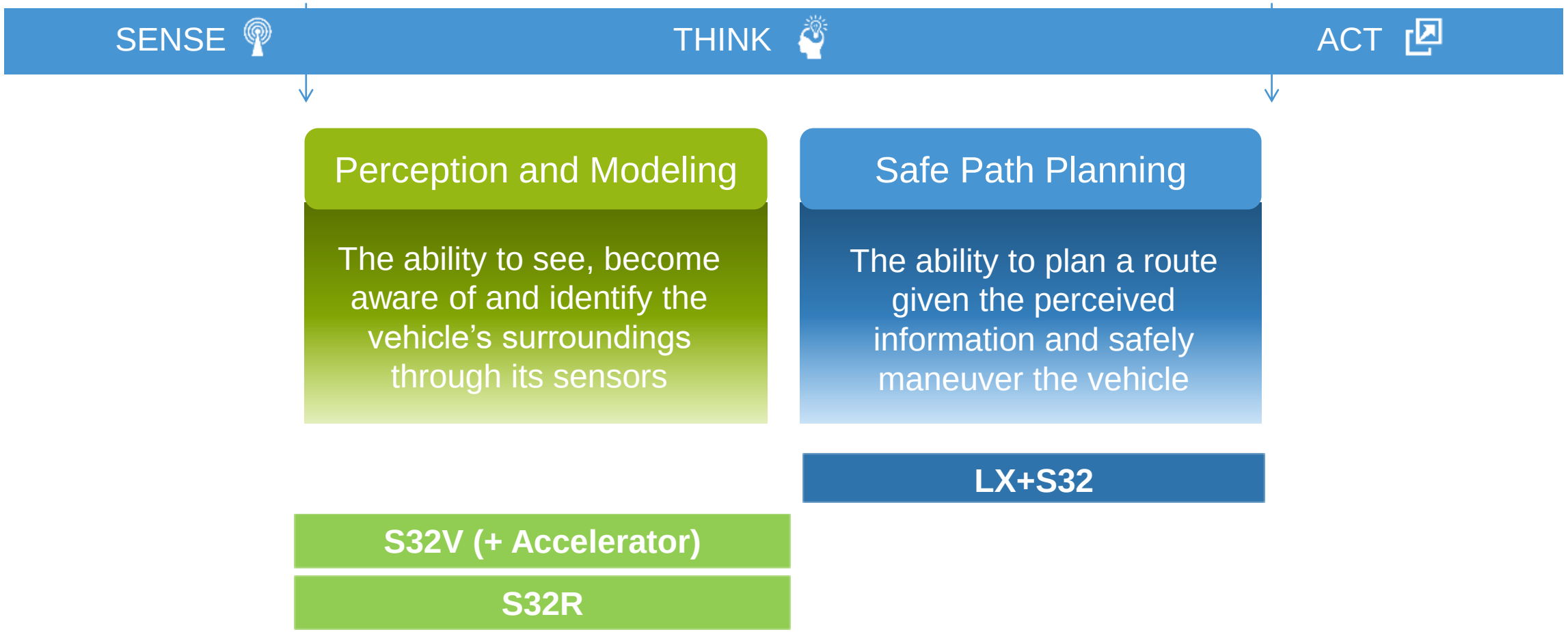
### Safe Path Planning

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

# Built to Scalability from ADAS to Autonomous Driving

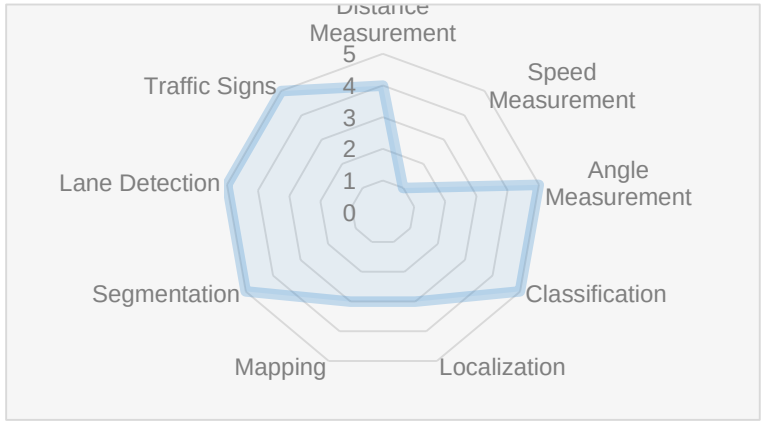


# ADAS Portfolio Built to Scalability from ADAS to Autonomous Driving

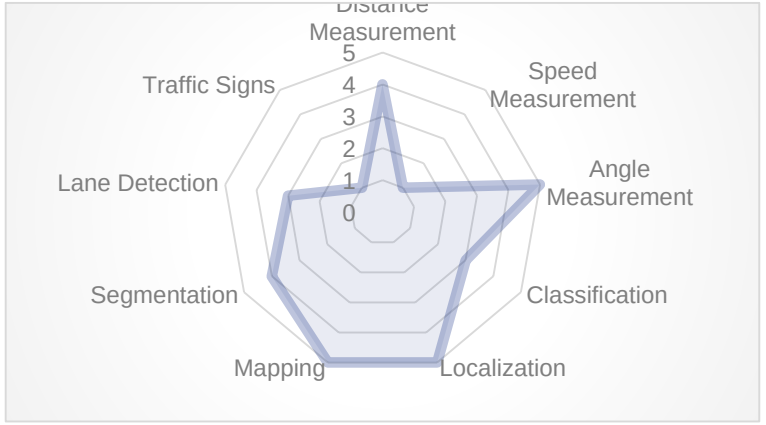


# Autonomous Driving – Today's Sensor Capabilities

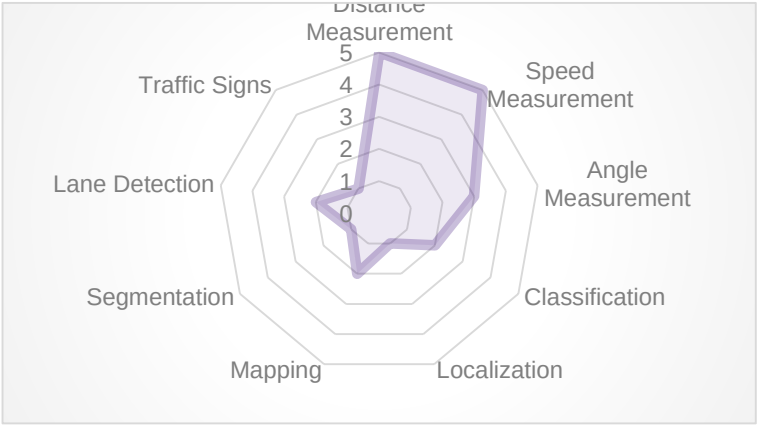
## Camera




## LiDAR

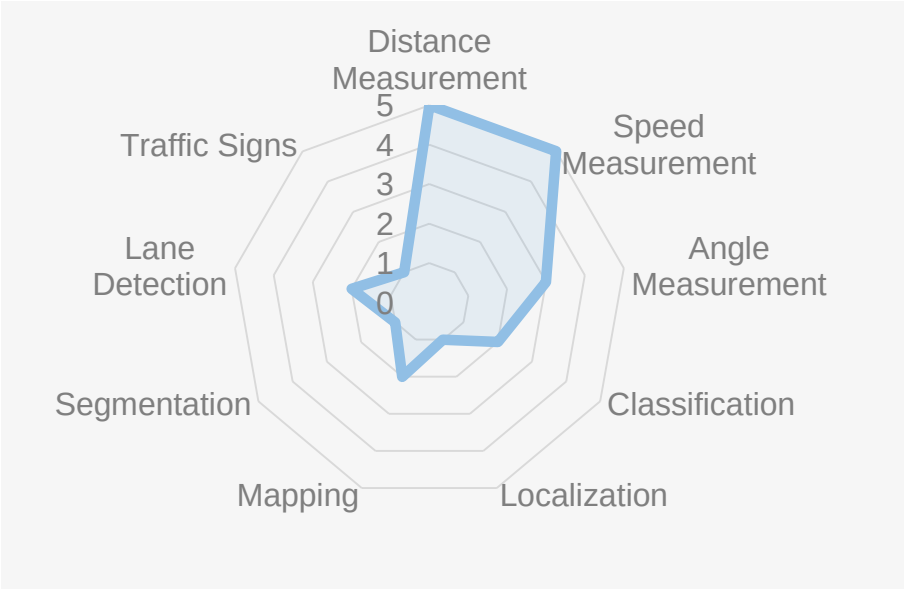


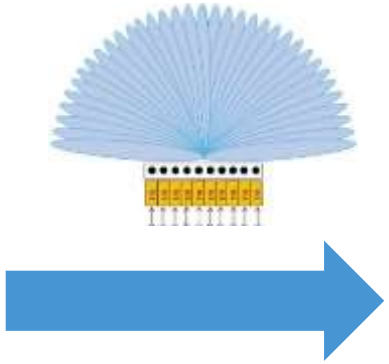

## Radar




# Imaging Radar – The Next Evolution of Radar for Autonomous

## Today's Radar

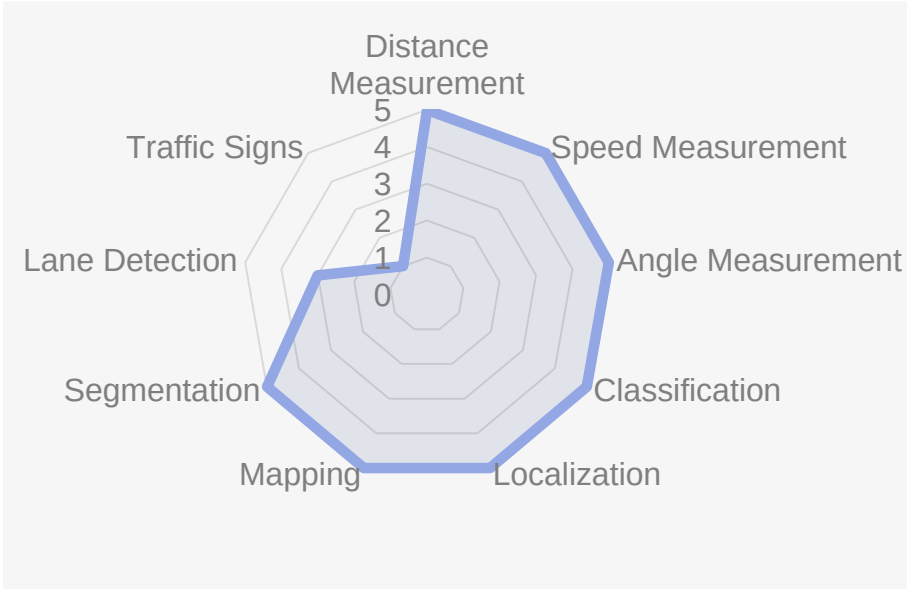


Higher Performance and Cascaded Sensors (lower phase noise is better)

Higher Performance Processing

## Future Radar



# #1 Radar Processor Provider

Scalable, highly integrated, safe & secure family driving the digitalization of radar & sensor data fusion.

**>50%**

radar modules use
NXP radar technology in 2018

**S32R**

Industry leading
Performance Per Watt

| | | |
|---|---|---|
| MPC5775K | SPT1.0 | World's 1st Automotive RADAR IP |
| S32R27x | SPT2.0 | Extended functionality |
| S32R37x | SPT2.5 | Optimized for Efficiency |
| *NG NCAP* | SPT2.8<br>• 2x performance increase<br>• Maximum reuse | 2x Performance Improvement |
| *NG High Resolution* | SPT3.0<br>• Multi-Threading<br>• DSP integration | ~10x improvement in performance |

# Superior Senses With High-performance Vision

S32V

Scalable, functionally safe, AI ready

## Advancement with Partners

NCAP Safety

NXP, Tier 1 and HELLA Aglaia Collaborate on Automotive Vision Platform,

AI

Bringing perception AI to a compact form factor through collaboration with Tier 1 & Tier 2 partners

S32V | Vision: NCAP Safety & AI Perception

Front View

Surround View

Driver Monitor

Perception

| | | |
|---|---|---|
| MPC560xE | • Enables miniaturization of camera modules<br>• Reduce system cost and time to market | First Ethernet Camera solution for automotive |
| S32V234 | • Safe: ISO26262 compliance<br>• High quality automotive grade<br>• >30x processing improvement per generation | Optimized for Higher Efficiency |

# Superior Senses With High-performance Vision

Automotive ASIL Vision Processor Family

S32V Processing Pipeline

**ISP**
- ✓ HDR
- ✓ De-mosaic
- ✓ Bayer pattern

**APEX**
- ✓ Filters
- ✓ Kernels
- ✓ Classifiers
- ✓ CNN

**A53's**
- ✓ Transformation
- ✓ Extraction
- ✓ ASILB - D Decision Making

**3D-GPU**
- ✓ 3D Rendering
- ✓ GP-GPU

- Multiple Automotive Vision Applications
- Scalable Software Ecosystem
- Partnerships (Tier 1, Tier 2)

**NCAP Camera**
VISION

**Sensor Fusion**
VISION / RADAR

**Surround View**
VISION

**Driver Monitor**
VISION

**Lidar**
LIDAR

# Enabling Safe Autonomous Driving: NXP + Kalray

## Leader in Safe Computing

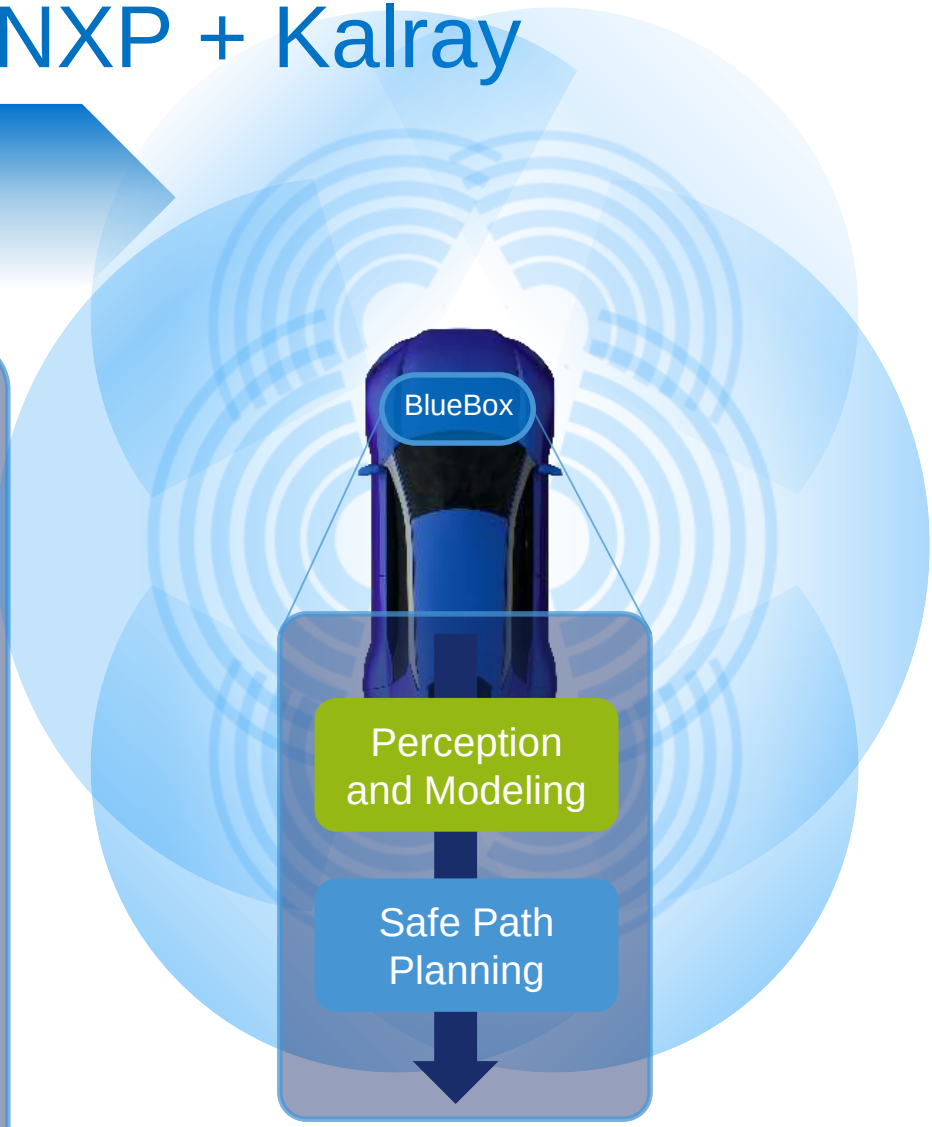
## New Safety Applications Lead by NXP

### Perception and Modeling

Extreme computing power ASIL B/C solution with industry leading performance per watt

### Safe Path Planning

Automotive-grade solution for decision making, free-space detection and safety channel



# NXP Partners With Kalray to Bring Automotive-grade Development for Autonomous Driving

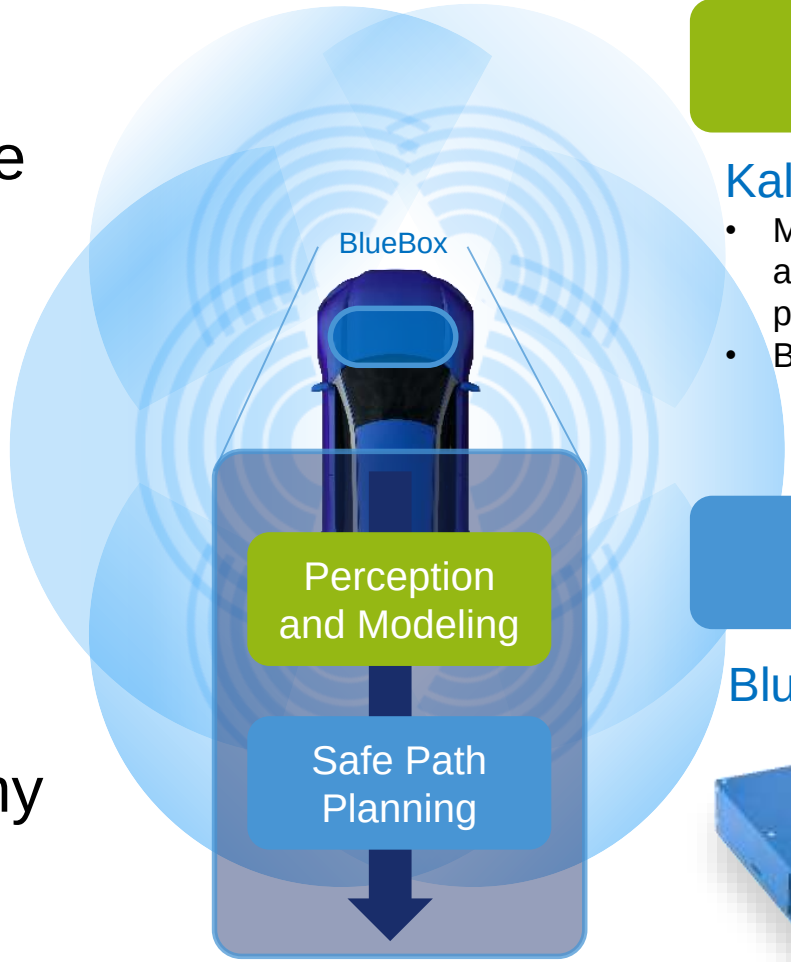
End-to-End Automotive-Grade Development Platform

## High Performance

- Embedded Arm® processor
- Embedded AI accelerator

Addresses Level 3 Autonomy

Roadmap to Level 5 Autonomy




**Perception & Modeling**

### Kalray

- MPPA high performance AI accelerator: Bostan & Coolidge portfolio up to 100 Tops
- Baidu Apollo 3.0 perception software

**Safe Path Planning**

### BlueBox 2.0

- Safe embedded AI Processor: S32V2
- High performance embedded processor: LS2084A
- Baidu Apollo 3.0 path planning software

SECURE CONNECTIONS
FOR A SMARTER WORLD