

TITLE OF PRESENTATION

MATHIEU, CLAIN

DISTRIBUTION MARKETING MANAGER

NOVEMBER 2018



SECURE CONNECTIONS
FOR A SMARTER WORLD

PUBLIC



Agenda

About NXP

Automotive Market Overview

Architecting the Car of the Future

Security Architecture

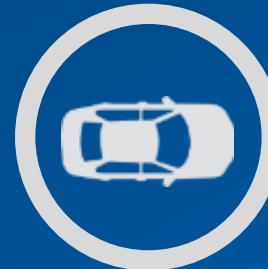
Functional Safety

Smart & Efficient Compute

- S32 Processing Platform

Domain Based Architecture

- Connectivity
- Driver Replacement
- Powertrain & Vehicle Dynamics
- Body & Comfort
- In-Vehicle Experience
- In-Vehicle Network



Secure Connections for the Smarter World

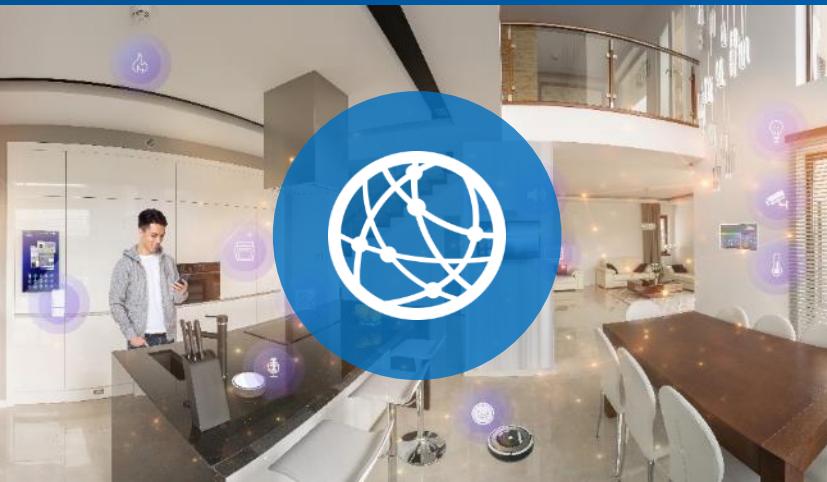
Everything **Smart**



Processing

40B+ devices with intelligence
shipped in 2020

Everything **Connected**



Connectivity

1B+ additional consumers online,
30B+ connected devices

Everything **Secure**



Security

Potential economy savings up to
half a trillion dollars

Automotive | Industrial | Connected Devices | Internet of Things



NXP

A Position of Strength to Better Serve Our Customers

7TH largest semiconductor company²

Operations in **32 countries**

Headquarters:
Eindhoven, Netherlands

30,000+ employees

11,000 engineers

9,000 patent families

60+ year history

\$9.26B annual revenue³

#1 Automotive

#1 Broad-based MCUs¹

#1 Secure Identification

#1 Communications Processors

#1 RF Power Transistors

Sources: HIS, ABI Research, Strategy Analytics, The Linley Group

1) MCU market excluding Automotive

2) Excludes memory

3) Posted revenue for 2017



Focusing NXP Solutions on High Growth Markets

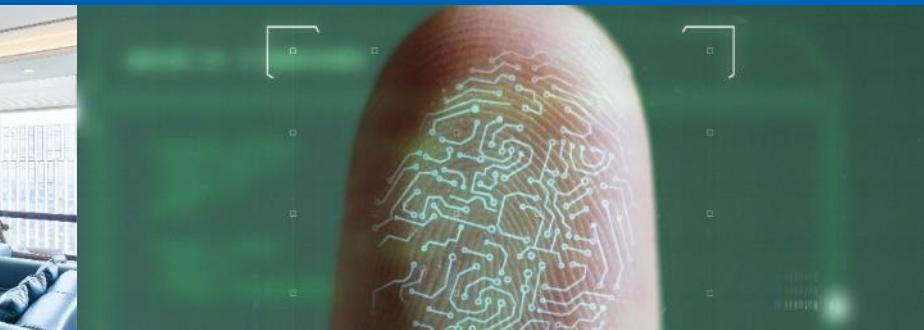
Securely connected
self-driving car



Smart, connected
solutions



End-to-end
security & privacy



#1 Car Infotainment

#1 Secure Car Access

#1 Body & In-Vehicle Networking

#1 Safety

#1 Powertrain

Innovation Leader ADAS

Innovation Leader Security

Innovation Leader in Battery Management
Systems

Consumer

- Mobile audio
- High-speed Interfaces
- Smartphone RF
- Personal health & fitness
- Healthcare

Industrial

- Smart home & buildings
- Smart cities, smart grid
- M2M, Industry 4.0
- Intelligent logistics
- 4.5G/5G Networks

• Mobile transactions

• E-Government

• Smart bank cards

• User authentication

• Embedded security

• Cloud & Infrastructure Security

Automotive



NXP Is Global #1 In Auto Semiconductors

With Secure End-to-end Hardware and Software Solutions

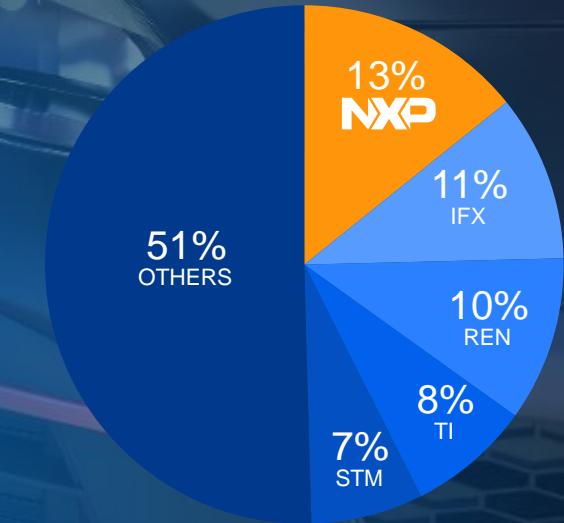
TECHNOLOGY LEADERSHIP + APPLICATIONS FOCUS =

- #1 Auto Analog / RF / DSP
- #1 Auto Microcontrollers (ex. Japan)
- #1 Merchant Auto MEMS Sensors

- #1 Car Infotainment
- #1 Secure Car Access
- #1 Body & In-Vehicle Networking
- #1 Safety
- #1 Powertrain

Innovation Leader ADAS
Innovation Leader Security

#1 IN AUTO SEMICONDUCTORS



2017 Global Auto Semi Market: \$34.5B

NXP's Top Global Automotive Customers

OEMs



DAIMLER



FCA
FIAT CHRYSLER AUTOMOBILES



HONDA



HYUNDAI



TOYOTA



Tier 1s

Autoliv

brose
Technik für Automobile

DELPHI

FUJITSU TEN

HYUNDAI
MOBIS

TRW

Visteon

BOSCH

Continental

DENSO

LEAR CORPORATION

Panasonic

Valeo

Our Value Proposition

Unrivaled Foundation for Growth

Solution Portfolio



The most complete system solutions for fastest time to market and scalability.

Innovation Power



In-house high-performance processing, security and mobile eco-system capabilities.

Safe & Secure



Zero defect quality. Leading with security and functional safety.

Global Megatrends NXP to Lead This Industry Transformation



Safe and Secure Mobility - More than **tripling** the **semi value per car**

Autonomy



Semi Content per Car increase (TAM) vs Level 0
Source: Strategy Analytics; IHS; Evercore; ABI Research; NXP



Electrification



Vehicle Electrification: Diversity of Approaches

Electrification Levels	E0	E1	E2	E3	E4	E5
Common Name	Combustion Engine (ICE)	Mild Hybrid (M-HV)	Full Hybrid (F-HV)	Plug-in Hybrid (PHEV)	Range Extended EV	Pure Electric Vehicle
Example	Ford Mustang	Honda Insight	Toyota Prius	FCA Pacifica	BMW i3	Nissan Leaf
Combustion Engine	●●●●	●●●●	●●●	●●●	●●	
Battery System	- 12V +	- 12V + - 48V +	- LV + - HV +	- LV + - HV +	- LV + - HV +	- LV + - HV +
Mains Charging	-	-	-	⚡	⚡	⚡
Electric Traction	-	10 – 20kW	15 – 60kW	40 – 80kW	40 – 80kW	> 80kW

Connectivity

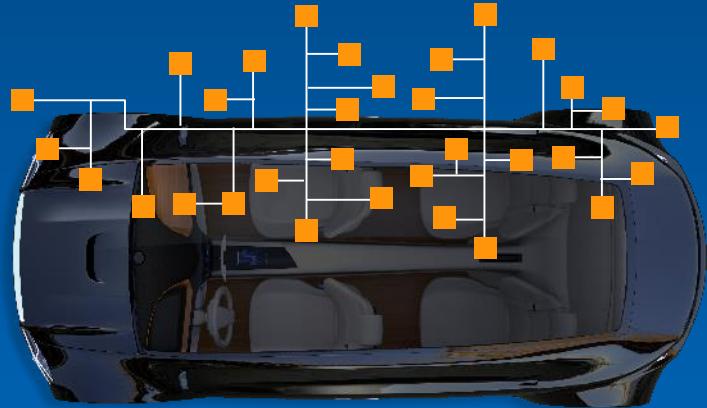


Semi Content per Car increase (TAM) vs Level 0
Source: Strategy Analytics; IHS; Evercore; ABI Research; NXP

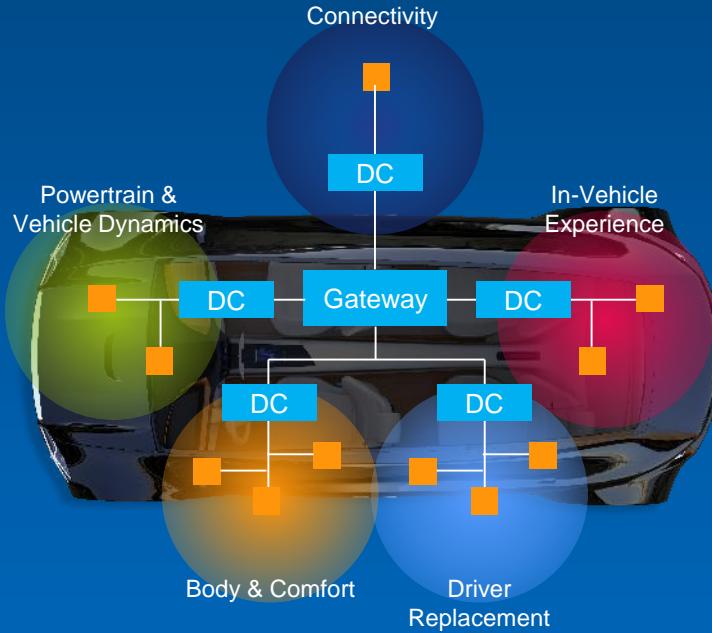
Architecting the Car of The Future



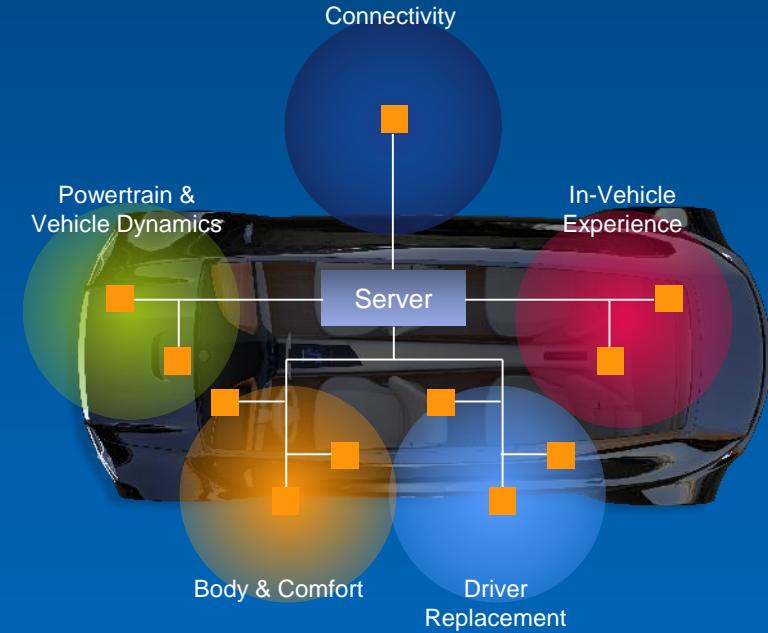
Car Architectures Changing Dramatically



Yesterday
Distributed

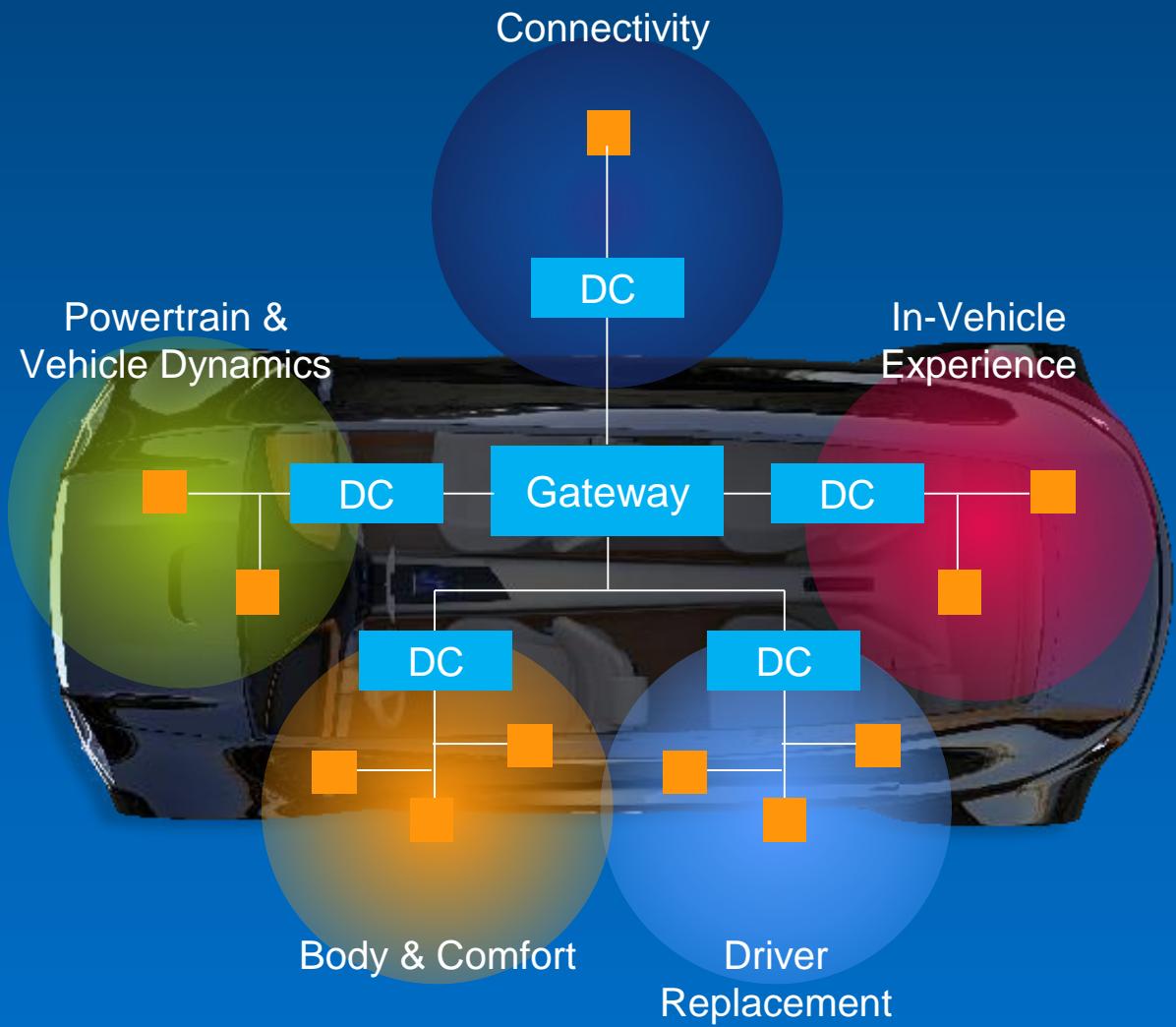


Today
Domain



Tomorrow
Centralized

Domain-based Architecture

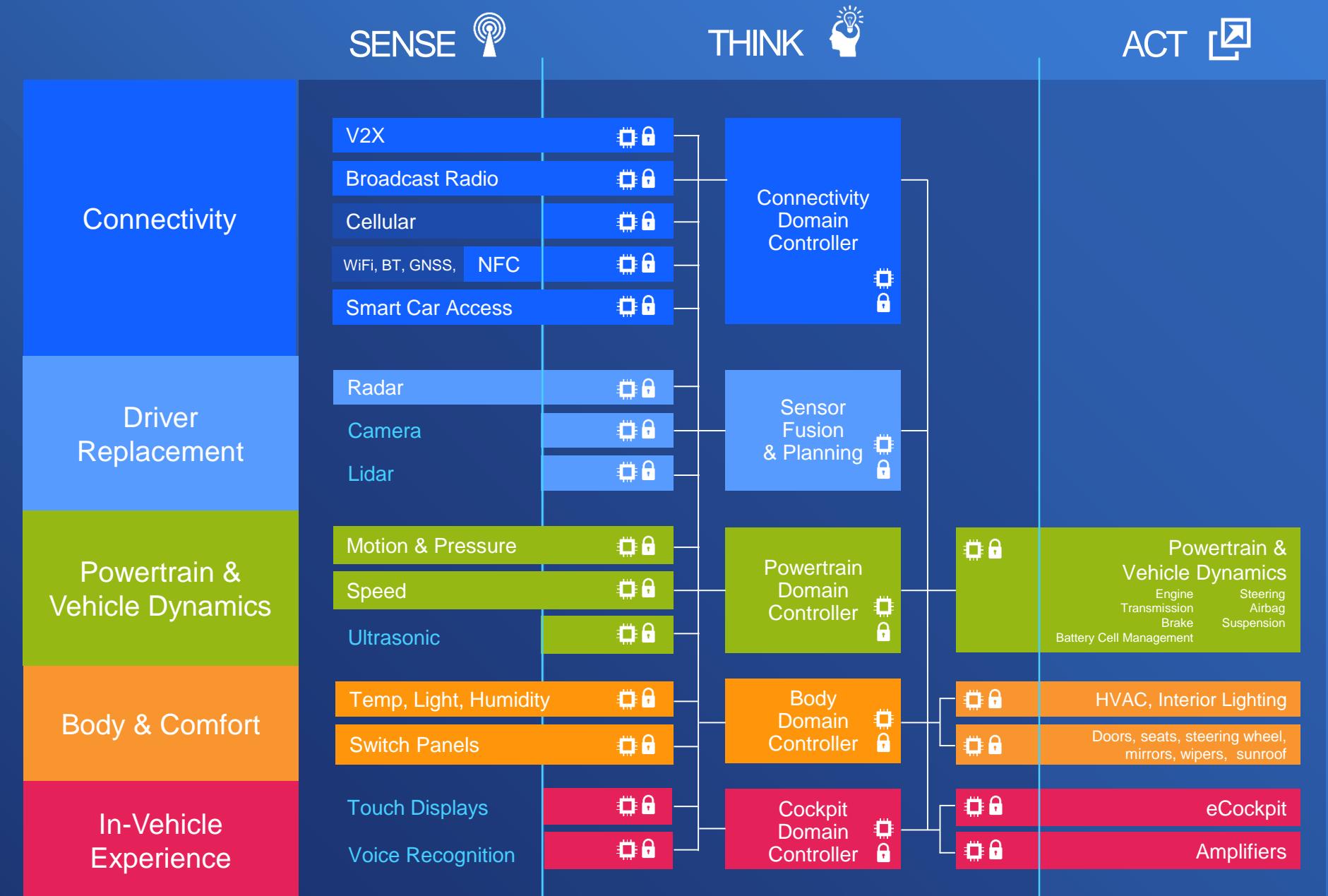


Complete Solutions

Faster time to market

Full scalability

NXP has the complete portfolio to build a self-driving vehicle



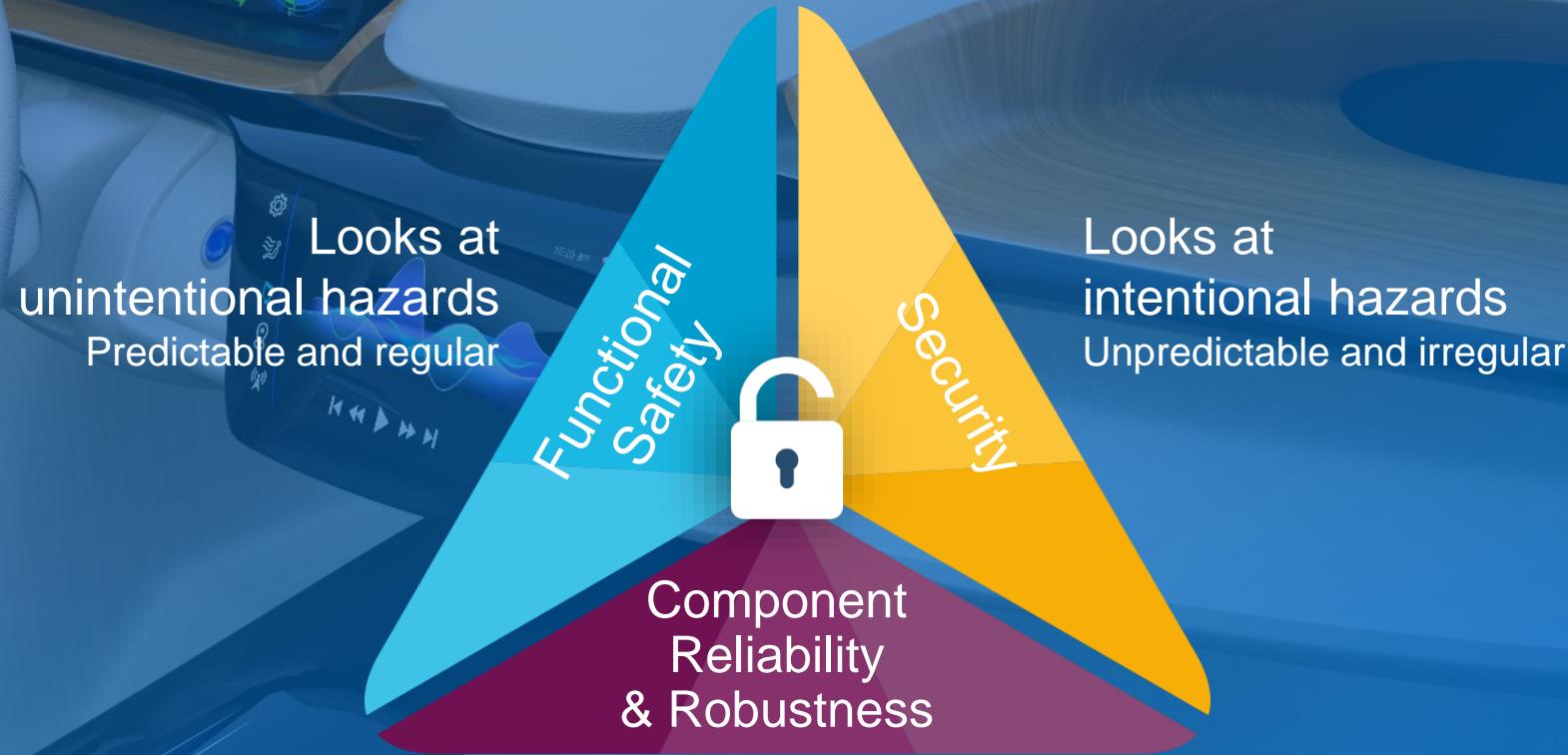
Complete Solutions

Faster time to market
Full scalability



System Development Unlocks NXP's Value Propositions

Functional Safety and Security



Maximum quality of
components is mandatory for
high-value system

Why Security?

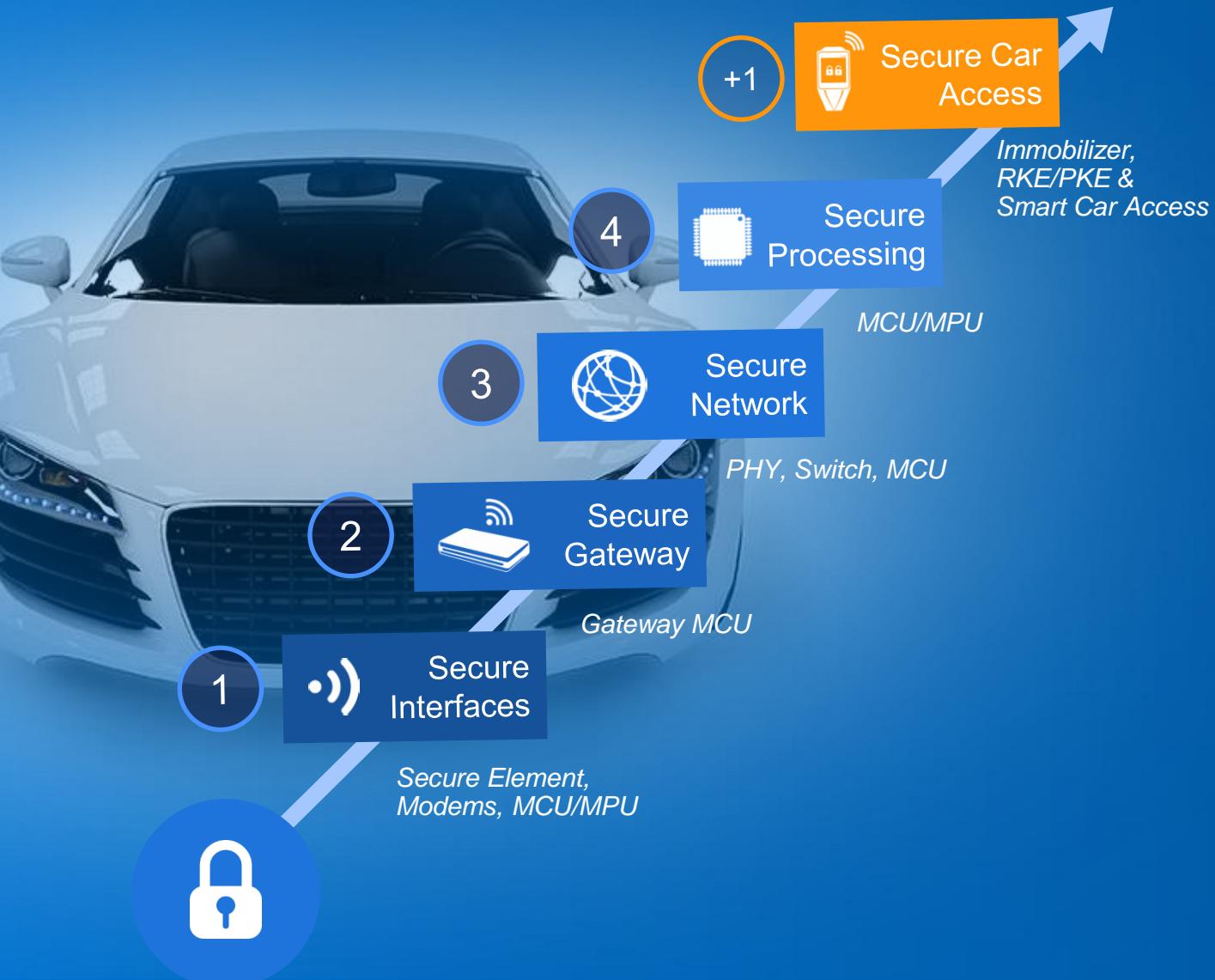


Protect privacy

Prevent unauthorized access

Increase safety

4+1 Approach: Most Scalable Auto Cybersecurity Solution



**NXP #1 Automotive
Hardware Security**

4 + 1 Layer security solution

- 1 Secure wireless interfaces – hardware crypto
- 2 Secure gateway – separation of concerns and secure over-the-air updates
- 3 Secure in-vehicle network communication
- 4 Secure application processing
- +1 Secure car access – physical security

NXP's Safe Assure Program

Simplify Customer Experience

ISO26262 system compliance process

Optimize Customer R&D Efficiency

Reduces time and complexity required to develop
ISO26262 safety systems

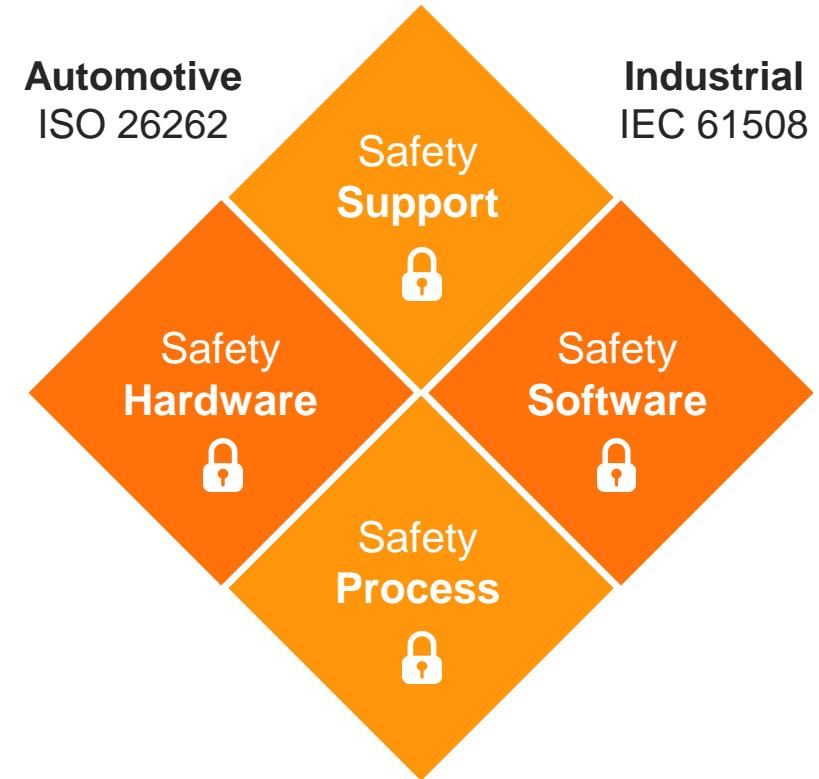
Reduce Risk of Harm

Supports the most stringent Automotive Safety
Integrity Levels (ASILs)

Safety Starts with Quality

Zero defect methodology from design to manufacturing to
help ensure our products meet the stringent demands of
safety applications

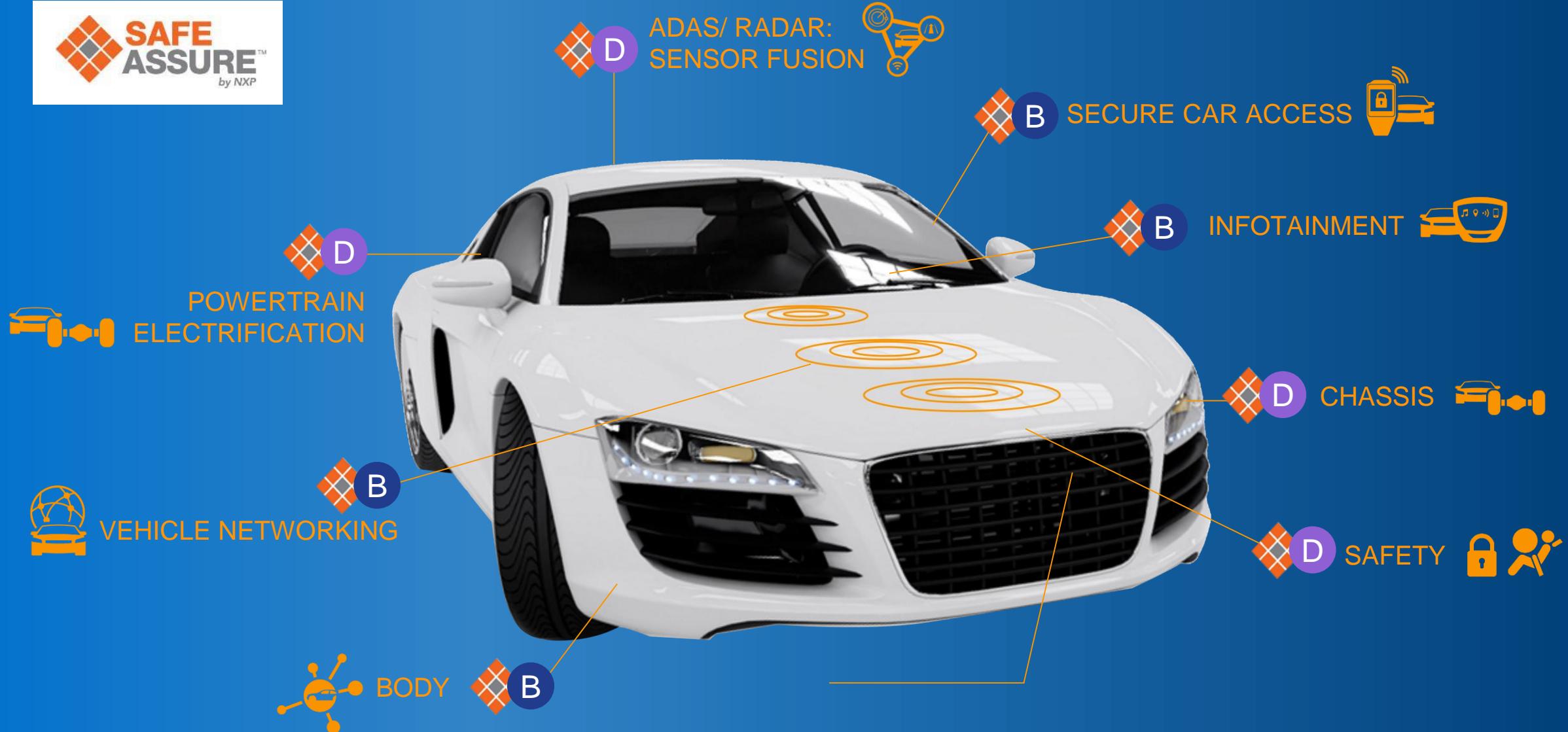
Functional Safety Standards



NXP Quality Foundation



NXP Functional Safety System Solutions



Examples Of a System Dreaded Event and ASIL Levels



ADAS Sensor

Phantom detection

ASIL B



Battery Management

Fire

ASIL C



Power Steering

Auto steering, lock, loss

ASIL D

Technologies

Superior Senses

Smart and Efficient Compute

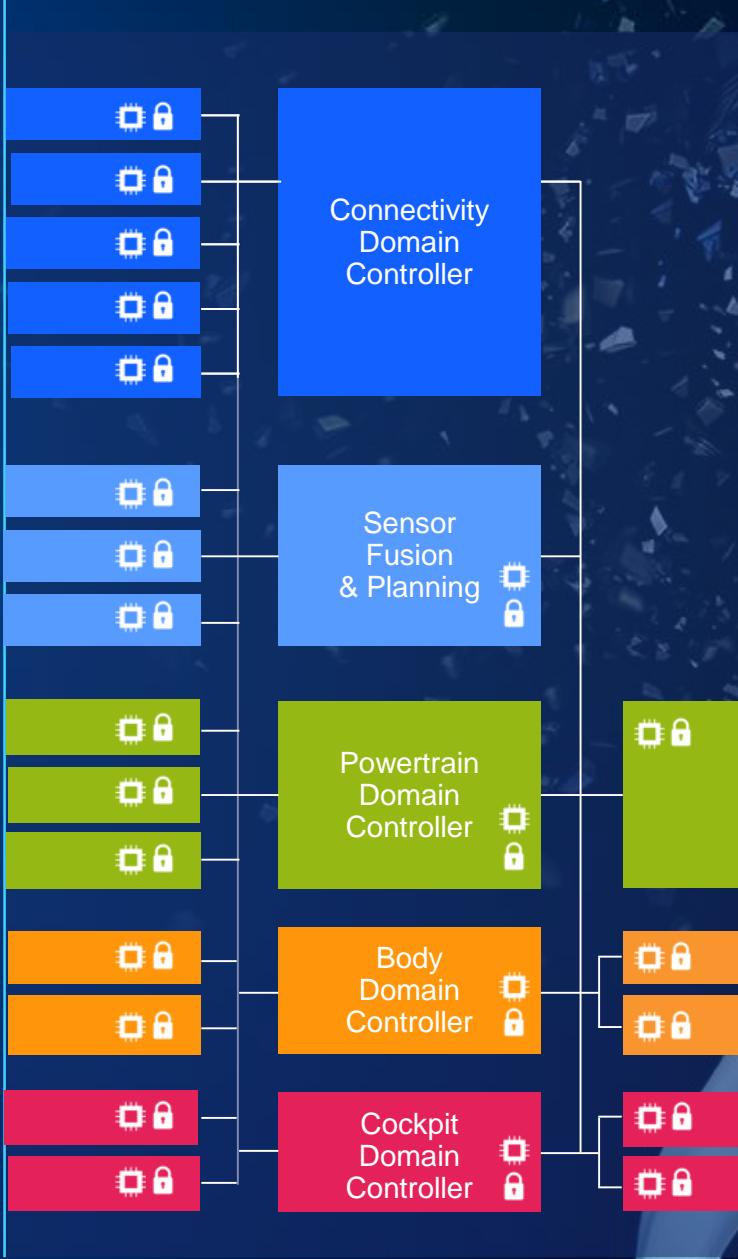
Fast and Secure Networks





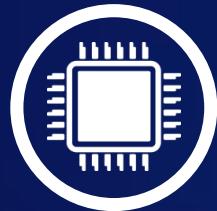
THINK

New Platform Approach Needed



Smart & Efficient Compute

S32 Automotive Processing Platform



Performance

High performance auto MCUs

Optimized for domain control

50x compute increase possible with application specific solutions



Arm

Arm based automotive platform top to bottom

Support Arm Cortex-A, -R, and -M cores



Safe

Highest performance ASIL D capability available today



Secure

Powerful Hardware Security Engine (HSE)

Firmware upgradable, Public Key Encryption, Side Channel Attack Prevention



OTA

Across most nodes

Scalable OTA capability (encrypted external NVM, wide memory range, read while write)



SW Reuse

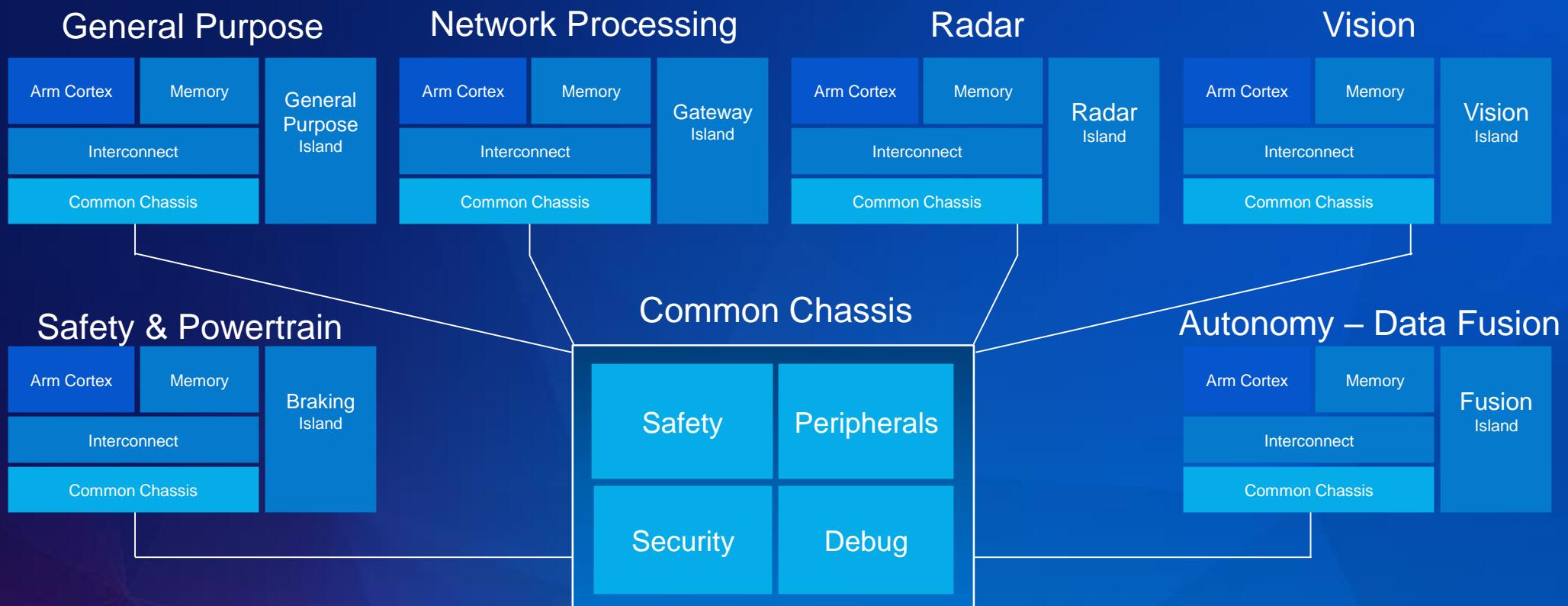
Common Hardware enables common software

As much as 90% software reuse within application domains and 40% across application domains

NXP S32 Architecture

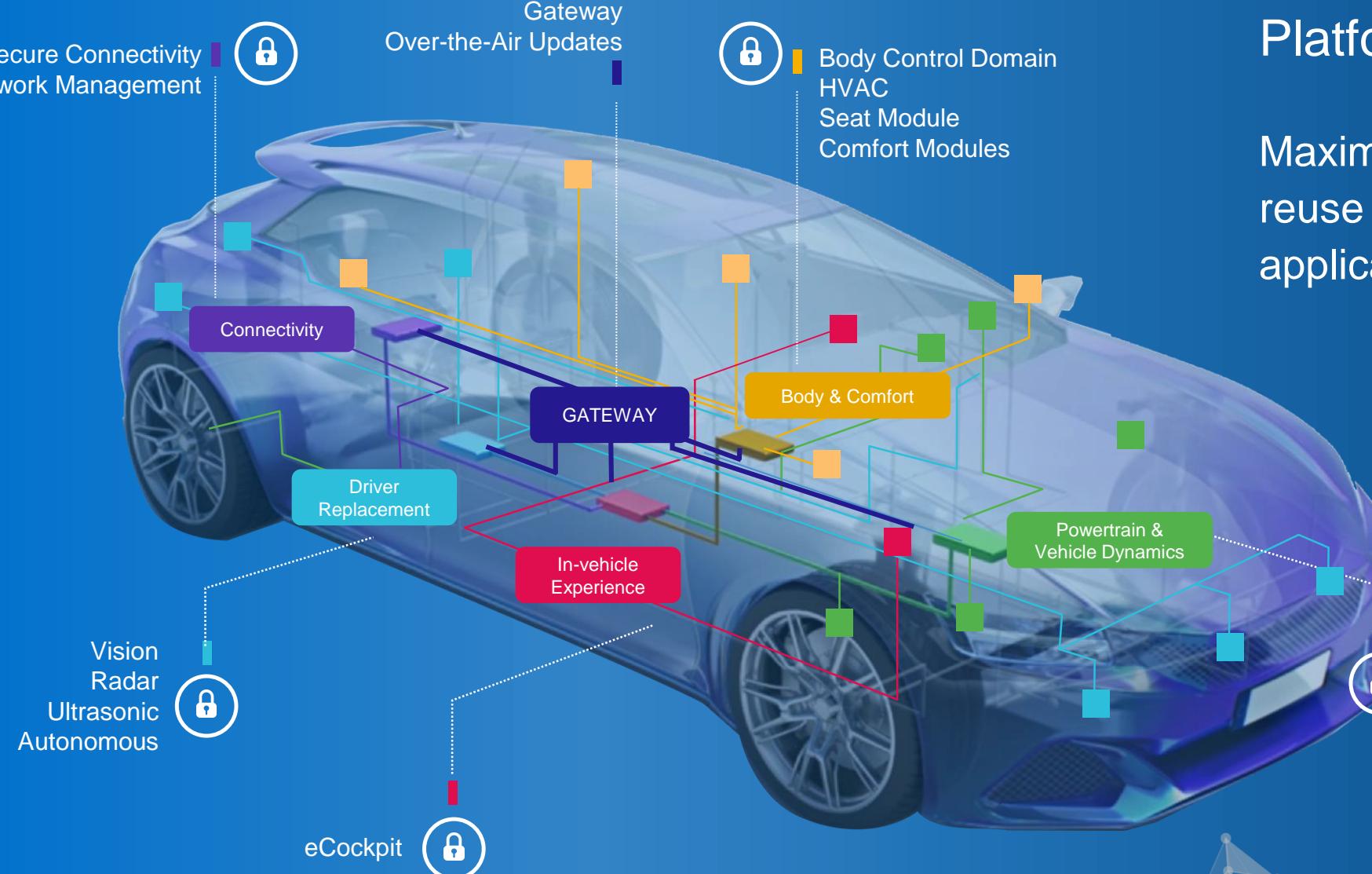


- Identical base peripheral set
- One boot / one debug concept
- Safety concept (ASIL D)
- Security concept (HSE)
- Common base SDK
- Over-the-Air ready



S32 Automotive Processing Platform

Maximizes hardware and software reuse across products and applications



S32 Automotive Processing Platform

Announced Oct 16, 2017

10X the performance

of today's best performing safe automotive platforms¹

Reduces software development effort by 90%

within application domains, and by more than 40% across application domains²

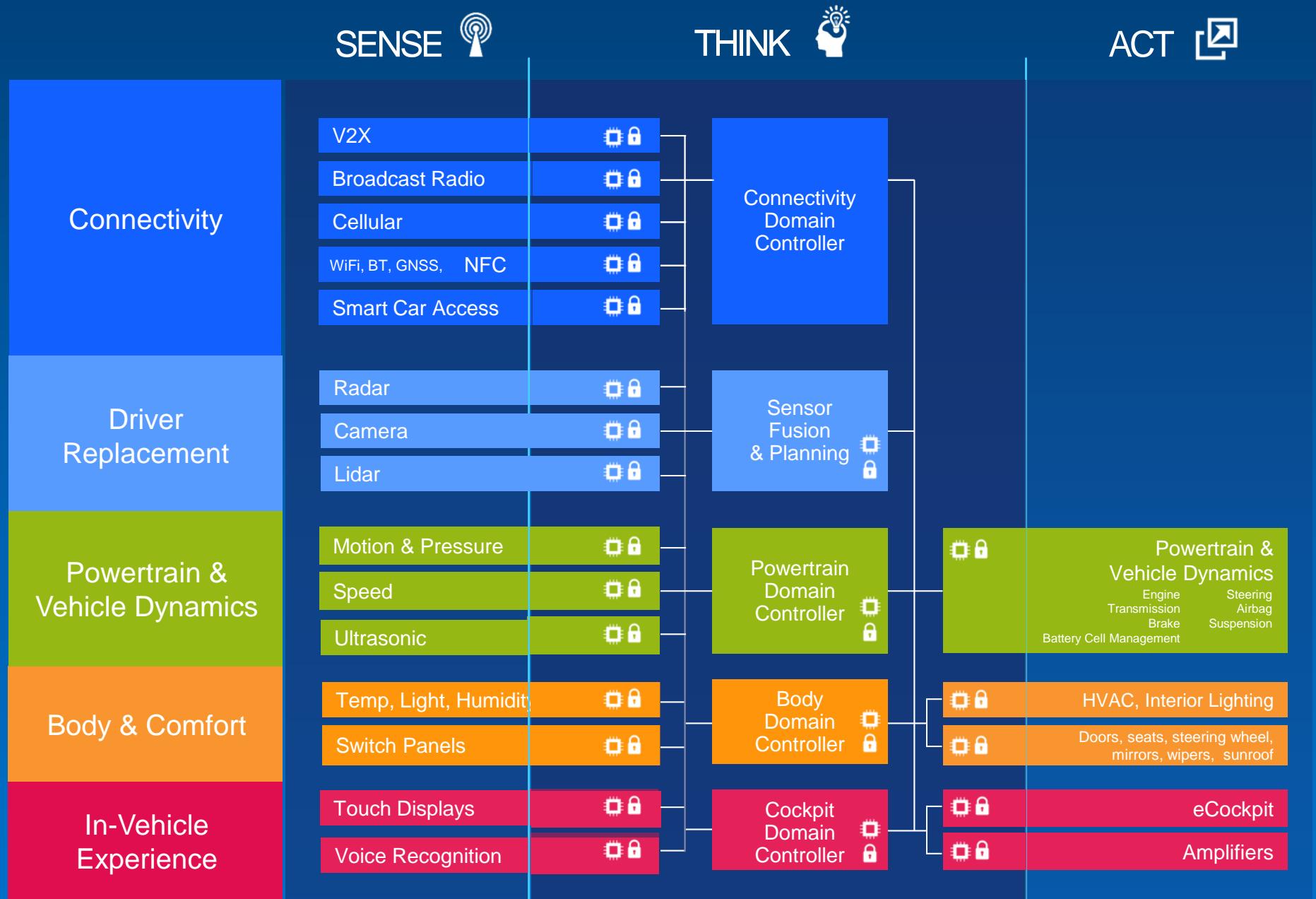
Delivers new levels of automotive safety, security and over-the-air (OTA) capabilities



1 Based on publicly available competitor roadmap performance statements.

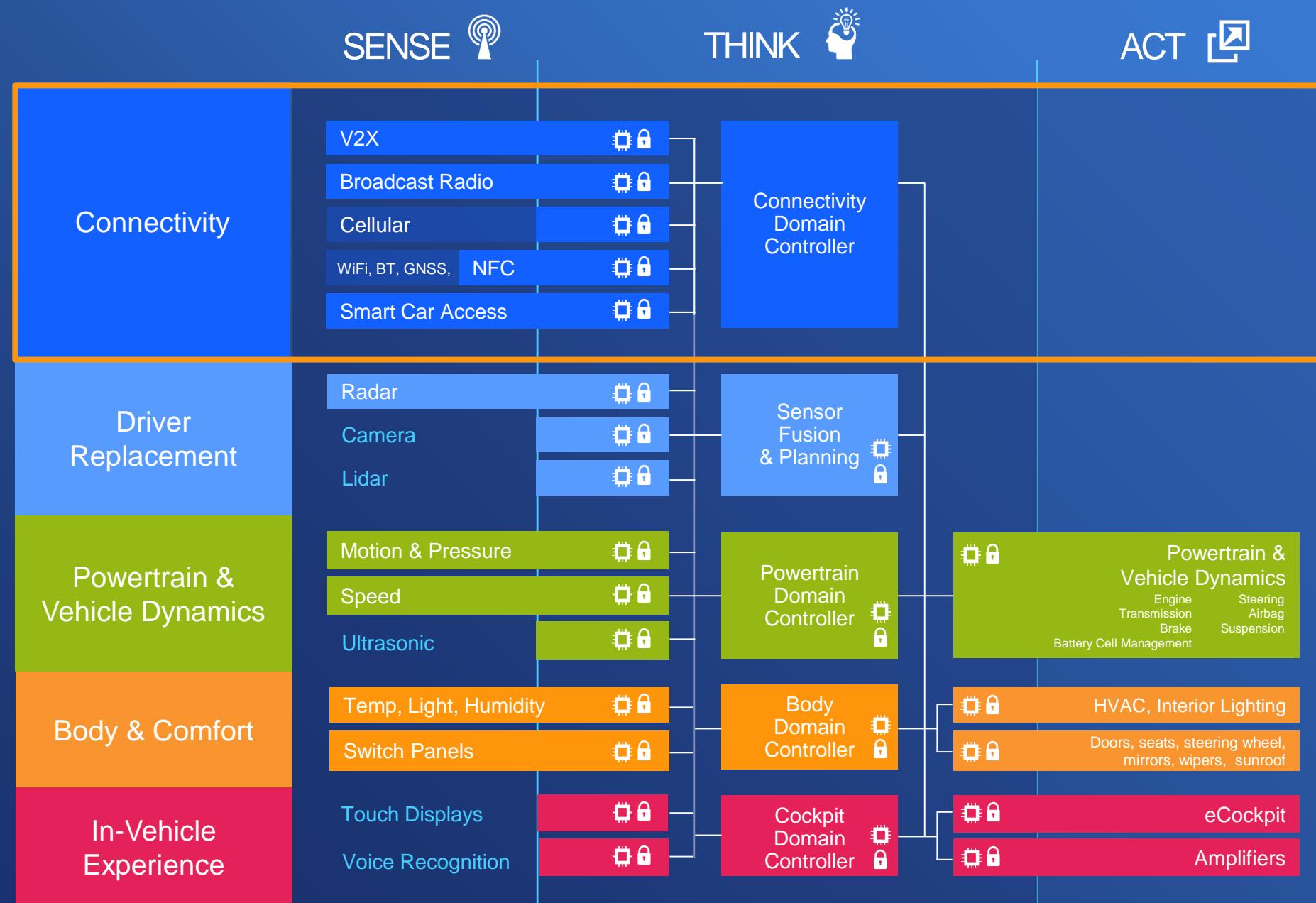
2 Based on analysis of existing NXP software code in existing customers' applications, NXP expects that software reuse will be significant both within domains and across vehicle domains at up to 90 and more than 40 percent respectively.

Domain-based Architecture



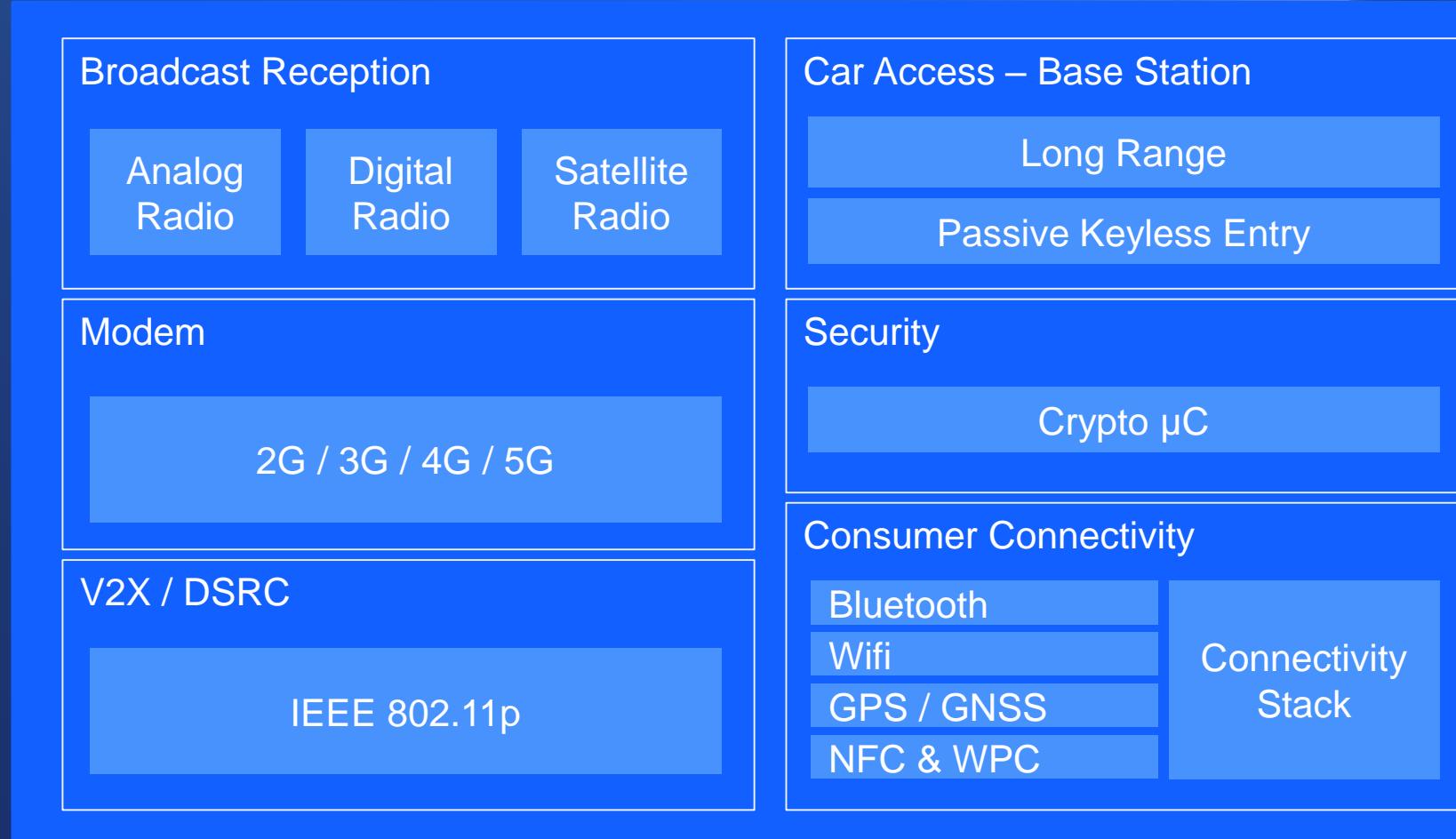
Connectivity





A Look Inside the Connectivity Domain

– All in a single ECU



Broadcast Reception: RFCMOS & SDR paving the way for leadership positions



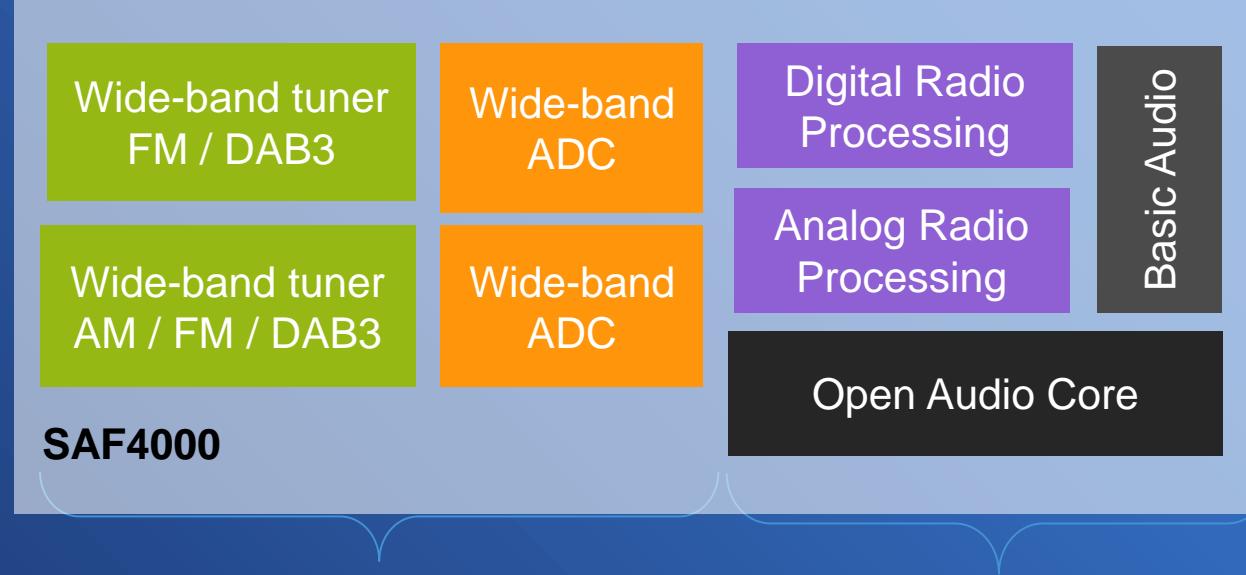
Key Features

- Global single chip radio
- Scalable product variants
- Software-defined radio
- Ultra-fast wideband tuners
- Advanced audio processing
- Significant area- and system cost-reduction

Continuous Innovation

- Seamless-blend / IP-blend
- Reception improvement
- AM for E-Vehicles

1st Global Hybrid Radio One-Chip



Benefits:

- Highest Integration
- Best Performance
- Full Flexibility
- Global Multi-Standard Platform
- Richest Feature Set
- Up to -30% Area

Wide-band RF-tuners

- ✓ Best-in-class RF & ADC

SDR digital channel selection & decoding

- ✓ Multi-channel, concurrent reception
- ✓ Demodulation/decoding
“all” terrestrial radio standards
- ✓ Powerfull Audio processing

Secure V2X Sensors

Seeing around Corners

Sees objects up to 1km, around corners

Proven IEEE 802.11p standards

Highest security
Scalable architecture

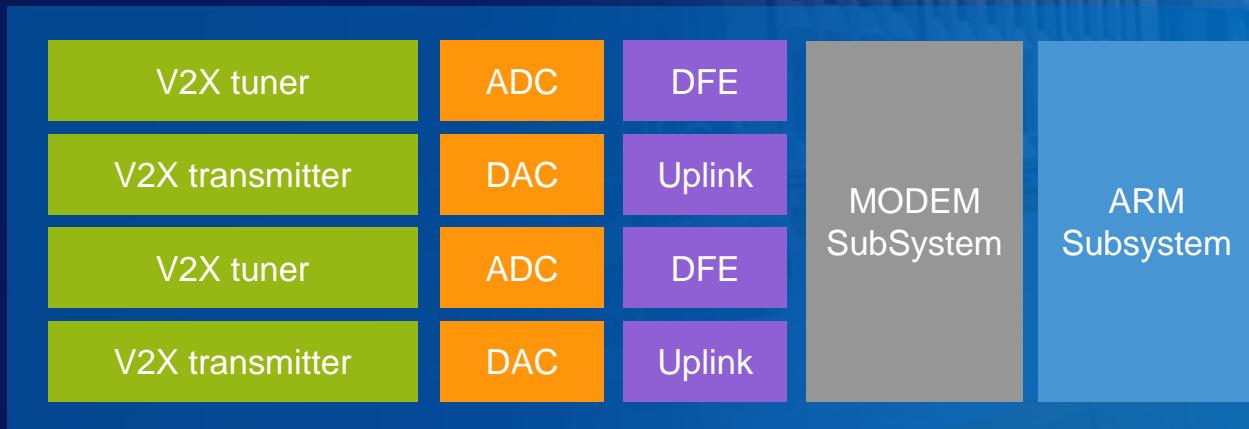


NXP RoadLINK
In volume production
1st to market with secure 1-chip modem

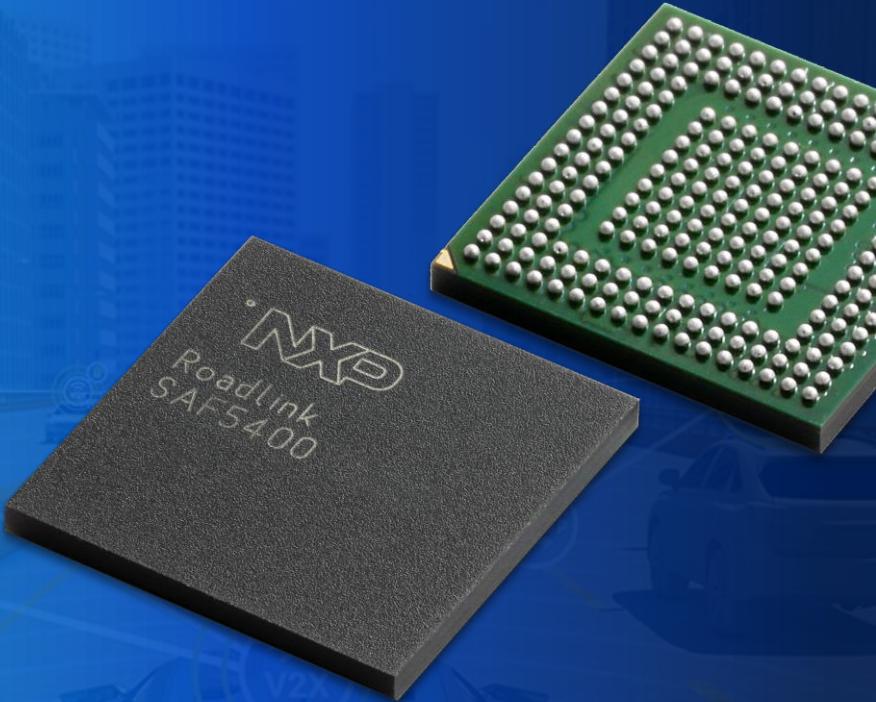


Superior Senses With Secure V2X

SAF 5400 – First Global Single-Chip V2X Modem



- Most mature solution in market
- Scalable HW/SW platform
- Best range performance – LOS¹ and NLOS¹
- Automotive grade 2
- ASIL B - Functional safety
- Global platform with regional support: US, EU, JPN, KOR



¹(N)LOS: (Non)Line of Sight

Wireless Power Charging & NFC

Market leading automotive
wireless power charging ICs

+

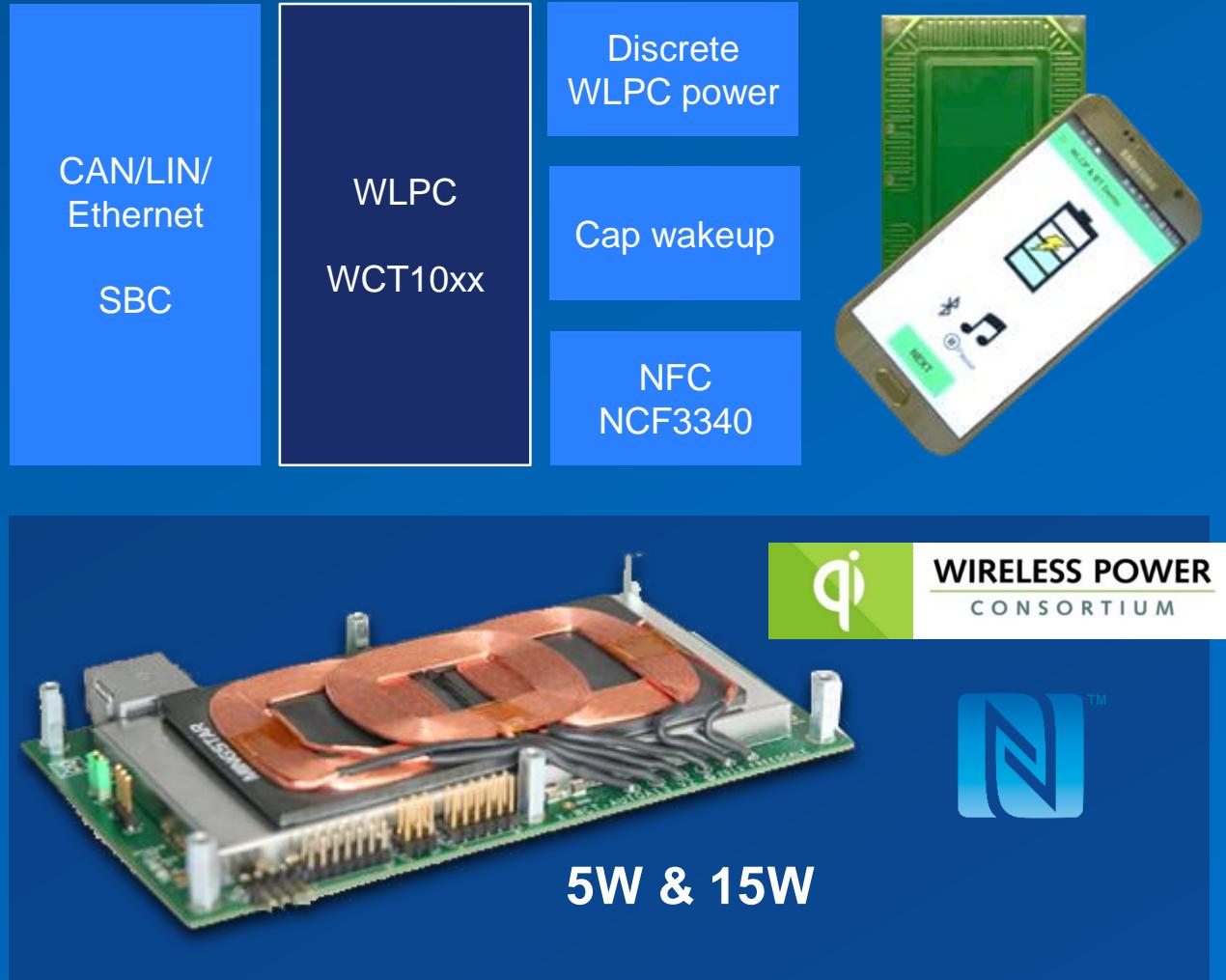
Automotive NFC ICs for engine start, pairing,
personalization and payment applications

+

Additional system content: discrete WLPC
drivers, NFC stack, AUTOSAR, IVN and sensors

=

Perfect system solution



NXP Automotive Wireless Charging Solution

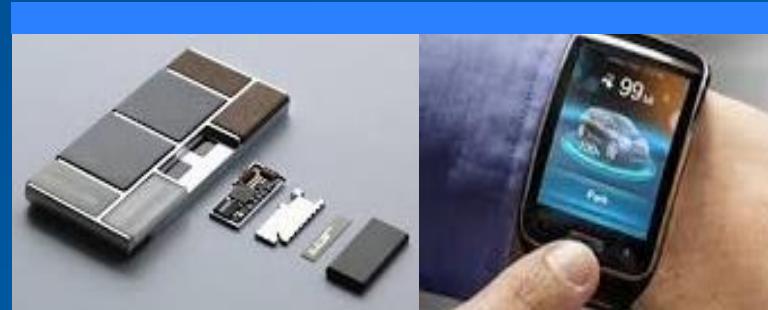
CONVENIENT Secure Car Access – System Evolution

Market trend towards flexible & smart access solutions



Smart Key

Enhanced PKE system in a high-end design (sensors, MCU, display, 2-RF)



PKE Modules

Key is integrated in small form-factor PKE hardware to fit into a portable device



Virtual Keys

Use temporary keys from cloud to provide mobile/wearables car access

Security

Flexibility

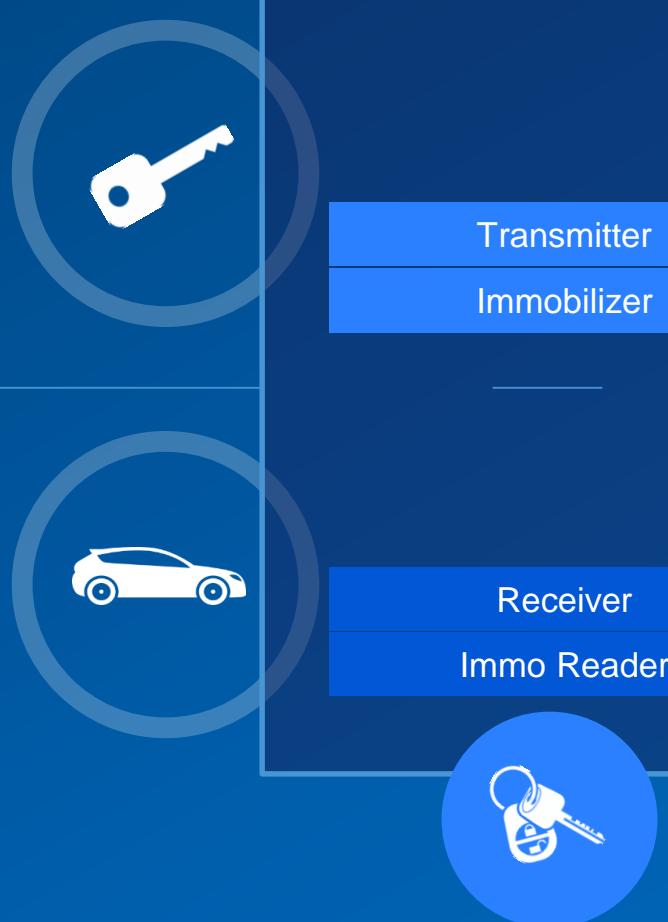
VIP Key

Flexible Key in a Smart Device

Car Sharing/Pool & Payment

NXP Secure Car Access: GLOBAL High-Performing Secure Solution

Classic Key



Smart Key

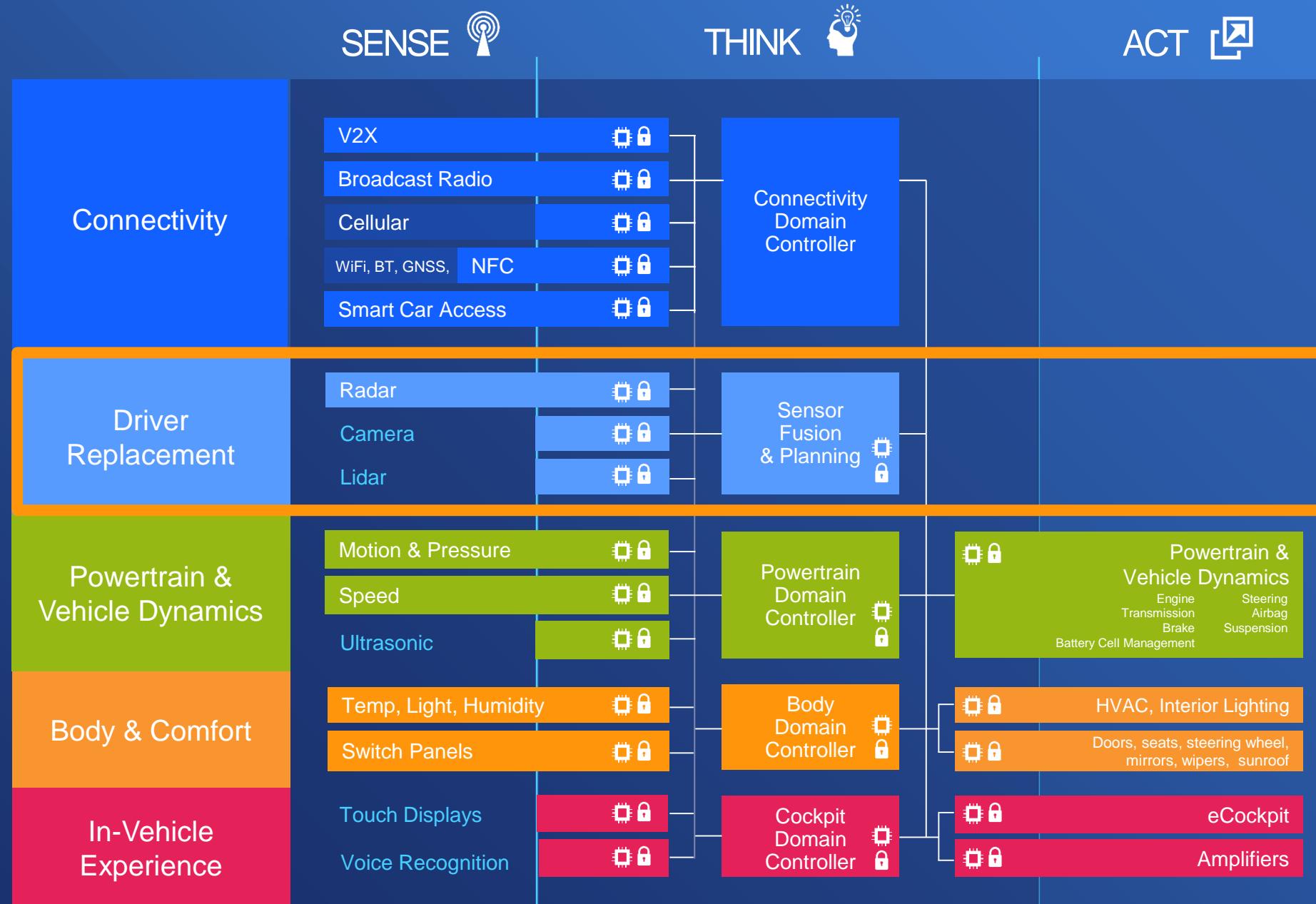


High End Smart Key



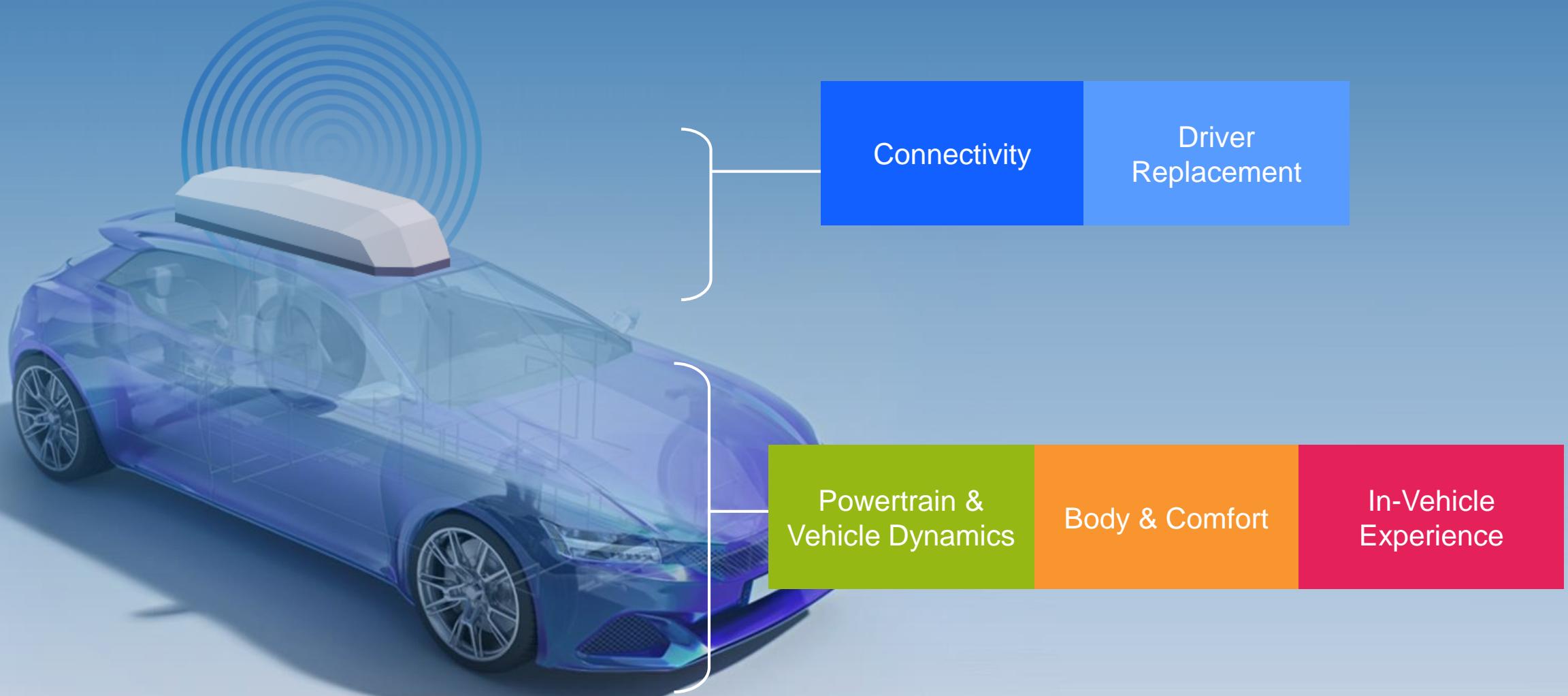
Driver Replacement





System Solution – Snap-on Module

Driver Replacement and Connectivity domains become a snap-on module



System Solution – Snap-on Module

Driver Replacement and Connectivity domains become a snap-on module



Contains two sections:
Autonomy and Connectivity

Connects to the car below via
Ethernet and power lines

Can go on any
type of car

Radar Platform for 360° Sensors

Scalable and Complete System Solutions

Short range to
high-resolution long range

360° cocooning
Mid-range multi-mode
Imaging capabilities

NXP #1 in
Radar



Superior Senses With Radar

Sensor Platform With Imaging Capabilities, 360°

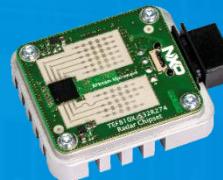
NXP #1 in Radar

Proven Performance with full System Solutions:

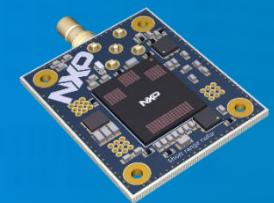
- Transceiver (SiGe, CMOS)
- Microprocessor
- Power Management
- Network IF
- SDKs for Algorithms Development

Mid-range, Ultracompact

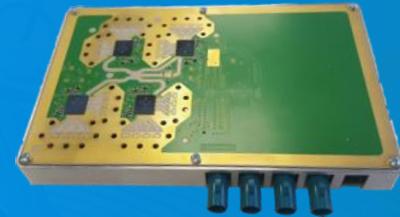
Mid-range Module
Chipset; SOP2018



Tiny Antenna-in-Package,
SOP 2021
Saving PCB cost and design-in efforts



High-performance Imaging



- Chipset SOP 2021
- Superior RF Performance
- Enhanced MIMO Concepts
- Excellent Distance Resolution; Object Separation
- Enhanced Temperature Performance & Low Power
- Supporting Multi Transceiver Radar Sensors

Radar

Evolves to 360° view with high-performance integration



Medium Range RADAR
Blind Side Detection



TODAY
TOMORROW

TODAY
TOMORROW

TOMORROW

TODAY
TOMORROW

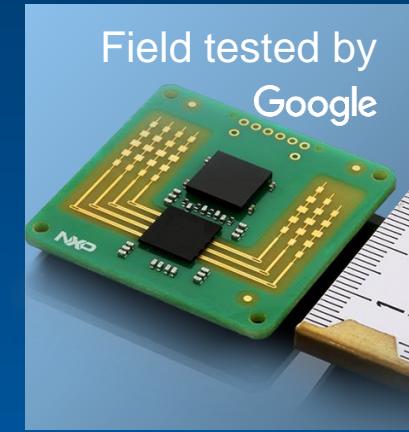
TODAY

TOMORROW

Long Range RADAR
Adaptive Cruise Control
Automatic Emergency Braking
Forward Collision Warning



**Short range/
Medium range RADAR**
Park Assist
Cross-Traffic Alert
Junction Assist



Radar Sensors



Performance

- Robust performance under all conditions
- Miniaturization / cost effectiveness
- Improved Perception: height, imaging, classification
- High 360° detection performance of static and dynamic targets



Tools & Support

- Efficient simulation tooling
- 3D construction combined with simulation
- Support for sensor validation & virtual validation



Features

- Standardized Interface (Measurement, Debugging & Vehicle Connectivity)
- High data rate interconnectivity to record and replay sensor data
- Testing capability at all processing stages – from antenna to object data

77 GHZ RFCMOS Radar – A Logical Choice



Industry
Drivers

Demand for
Silicon Innovation

RFCMOS
Radar

Enabling New
Types of Sensors

Enabling
Cocooning

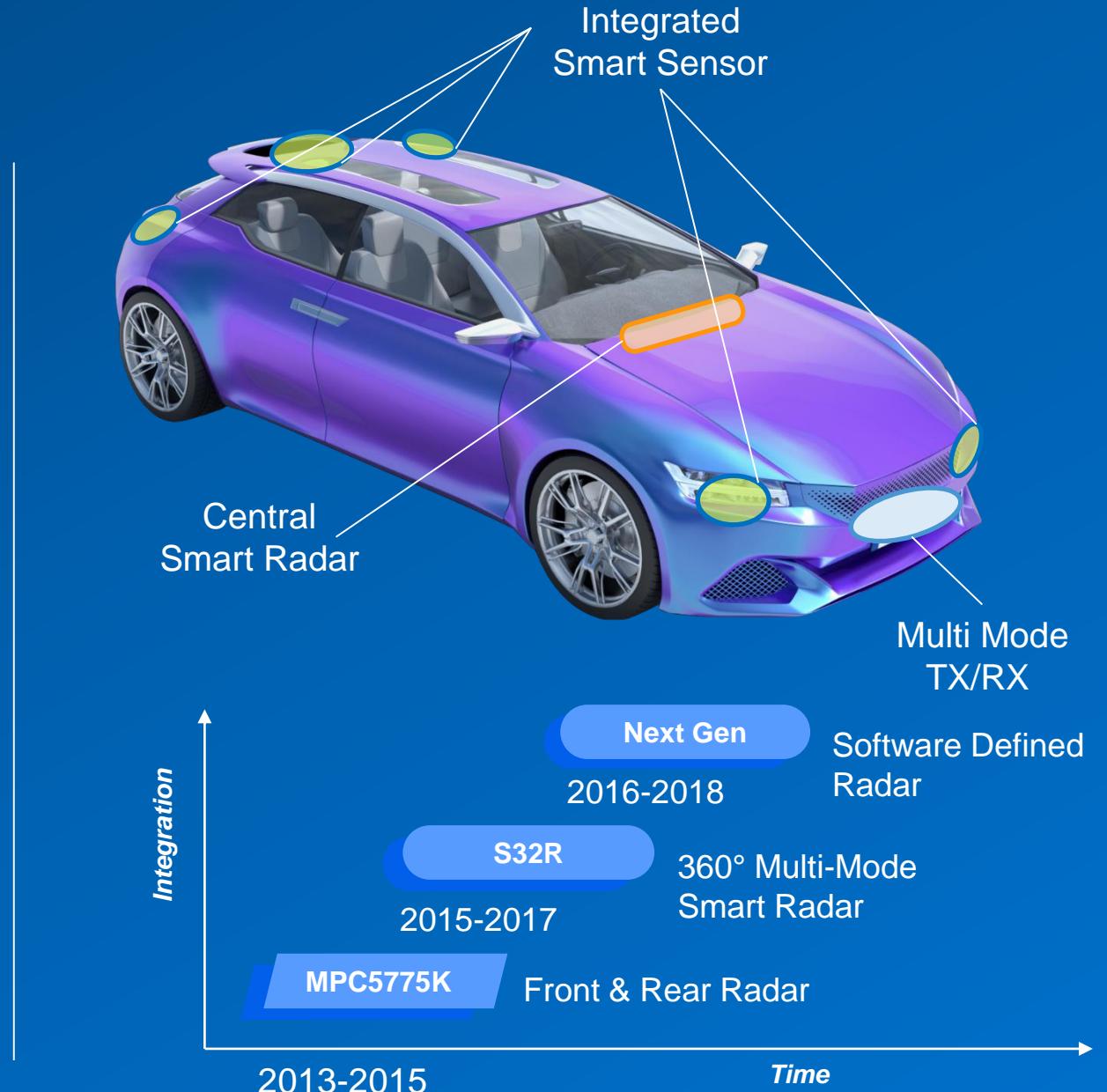
#1 Radar MCU Provider

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

50%
radar modules use
NXP radar technology in 2016

S32R

#1 in Radar Processing Integration & Performance Per Power



High-performance Vision Sensors

Improve Safety on the Road



Front View



Surround View



Driver Monitor

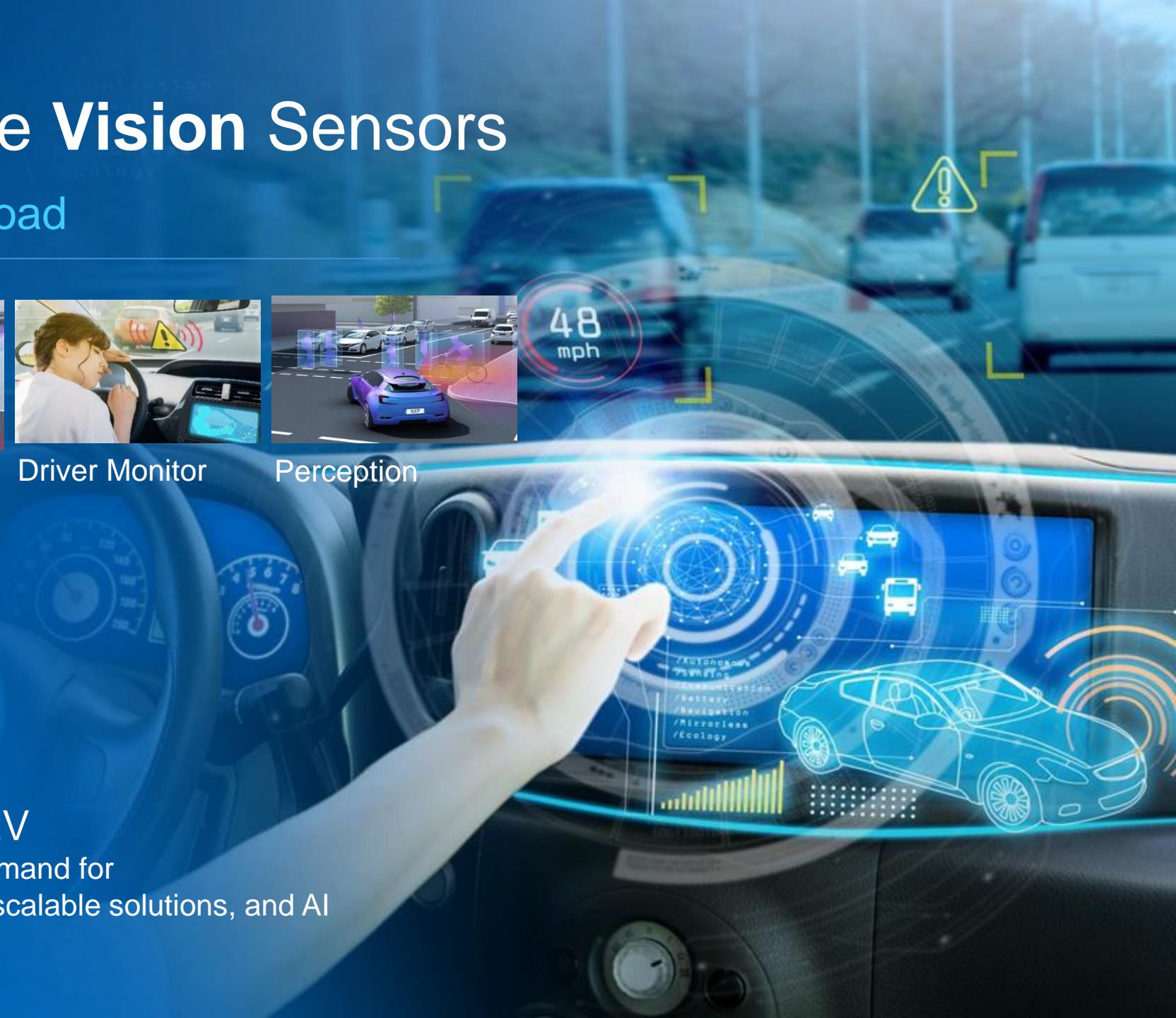


Perception



NXP S32V

Supports demand for
open, safe, scalable solutions, and AI



Superior Senses With High-performance Vision

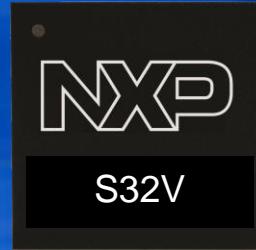
Demand For Scalable and Open System Solutions

Collaboration on Auto Vision Platform



Bringing perception AI to compact form factor, S32V

DEEPS SCALE



S32V Automotive Vision

Safe: ISO26262 compliance

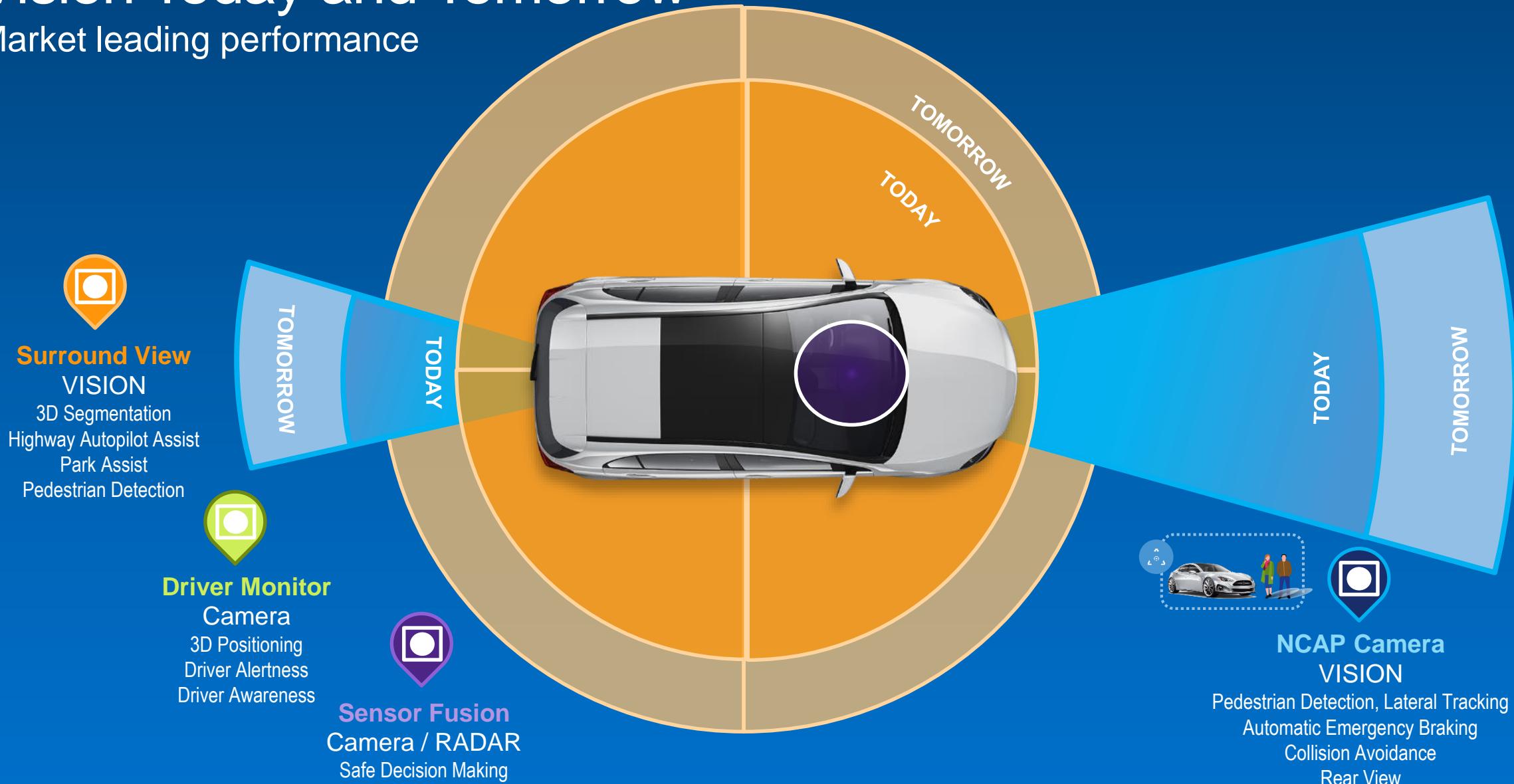
Automotive grade

>30x better processing per generation

AI algorithm deployment

Vision Today and Tomorrow

Market leading performance



S32V – ADAS Vision Processors

Safe. Secure. Reliable.

1st

Ethernet Camera MCU & Embedded
Integrated Ethernet PHY

1st

True ASIL-B Hardware Only Vision Platform

True automotive reliability



High performance/power, and true safety



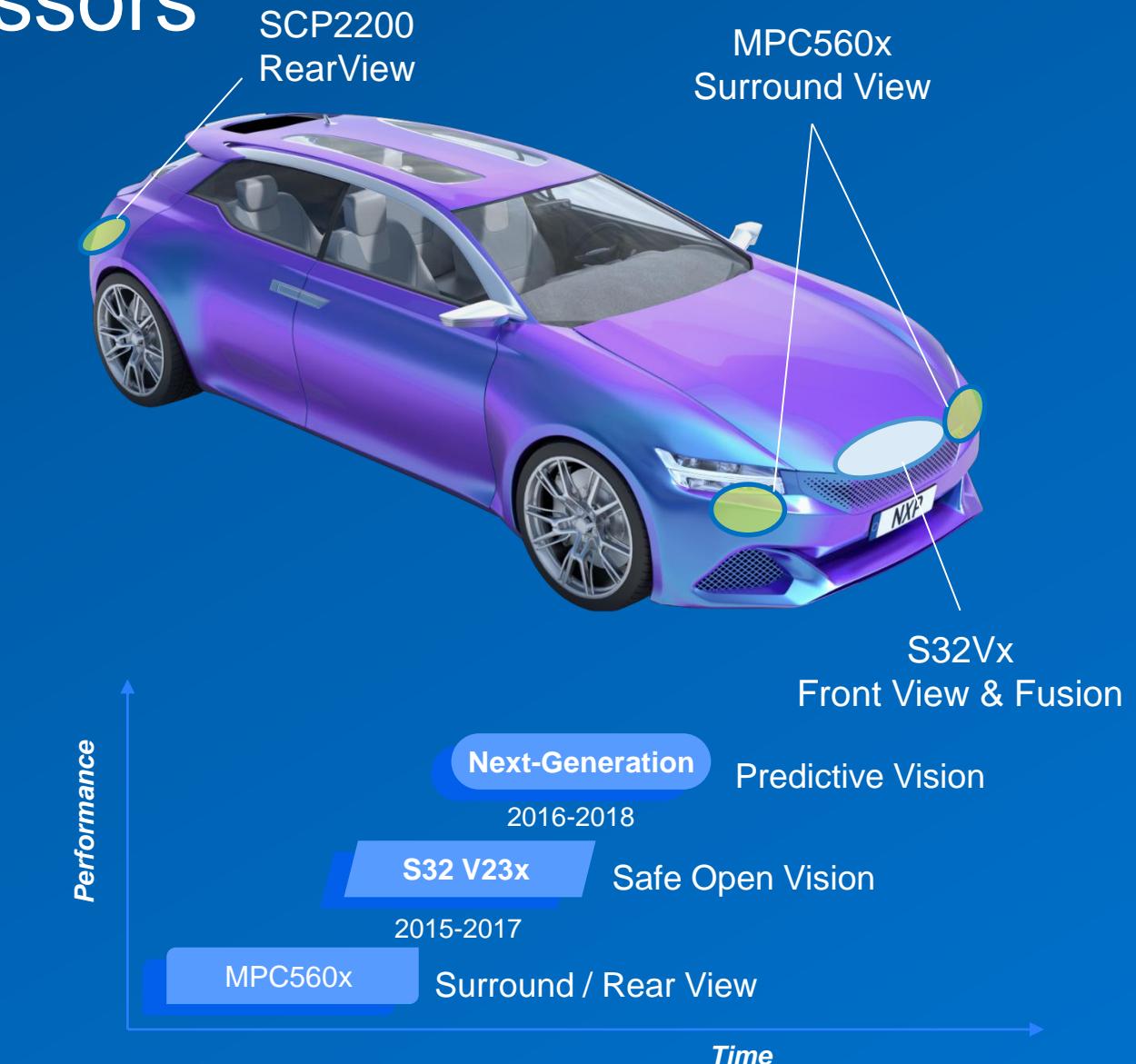
Guaranteed security and connected network



Built on highly performing fully abstracted accelerators



Ecosystem of software and tools (mCAL-Linux- Vision SDK)



Automation of Driving Decision

Industrializeable, low power, secure



Rising Computing and Safety Requirements

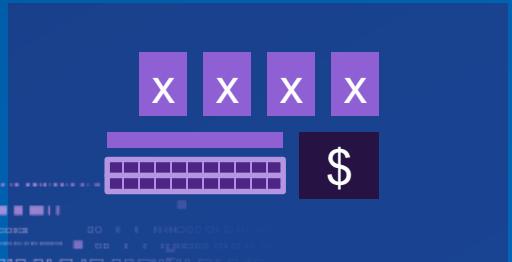
Number Cruncher
LAYERSCAPE



Probabilistic

- Analyze Scenario
- Make Contextual Decision

Safety Processor
S32V234



Deterministic

- Initiate Safe Measure
- Fail Safe / Operational



Automated Drive



Co-pilot



Collision Avoidance



Self Parking



Lane Keeping



Collision Warning



Sign View



Super Computing



Safe Computing

NXP Bluebox: Central Processing Unit For Autonomous Driving

Highly Optimized Sensor Fusion



- Various sensor data streams: Radar, Vision, LiDAR, V2X
- S32V234 automotive vision and sensor fusion processor
- LS2084A embedded compute processor
- S32R27 radar microcontroller



Ease of Development



- ROS Space
- Open ROS Space Linux®-based system
- Programmable in linear C
- Easily customizable
- Development environment for mainstream vehicles

Security



- CSE and ARM® TrustZone® technology



High Performance per Power

- Up to 90,000 DMIPS at < 40 W
- Complete situational assessment
- Supporting classification
- Object detection and localization
- Mapping

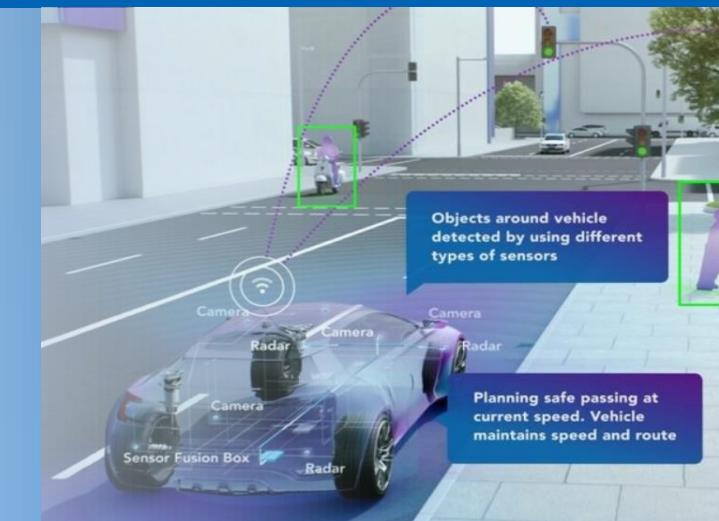


Decision Making

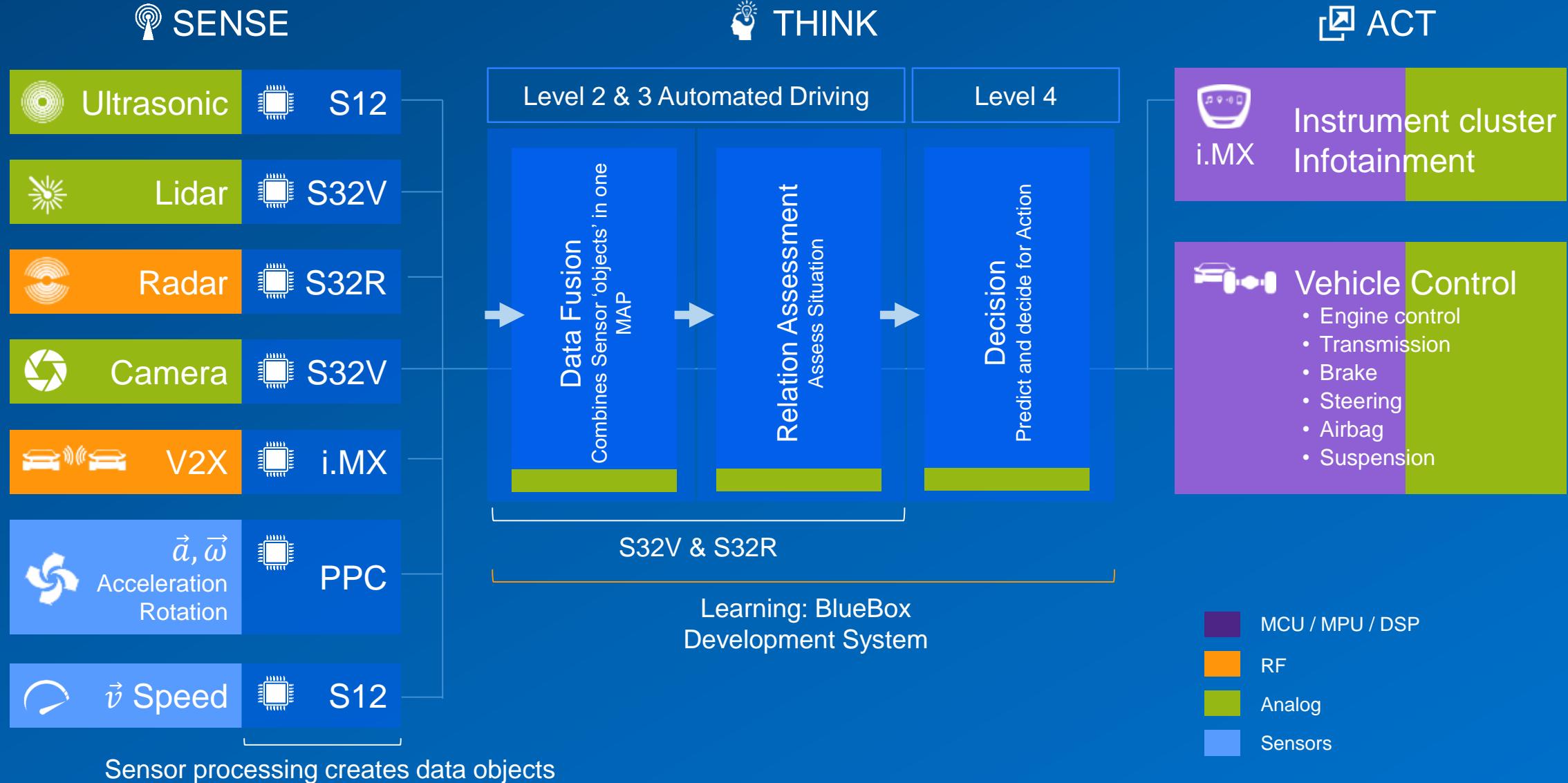
- Global Path Planning
- Behavior Planning
- Motion Planning

NXP Automated Drive Kit

- Computing: NXP BlueBox 2.0
- Vision: Front Camera Software with MIPI CSI2 Camera
- LiDAR: Selection of Lidars supported
- RADAR
- Inertial Measurement Unit & Integrated GPS
- Operating System
- Middleware: ROS (Robot Operating System)

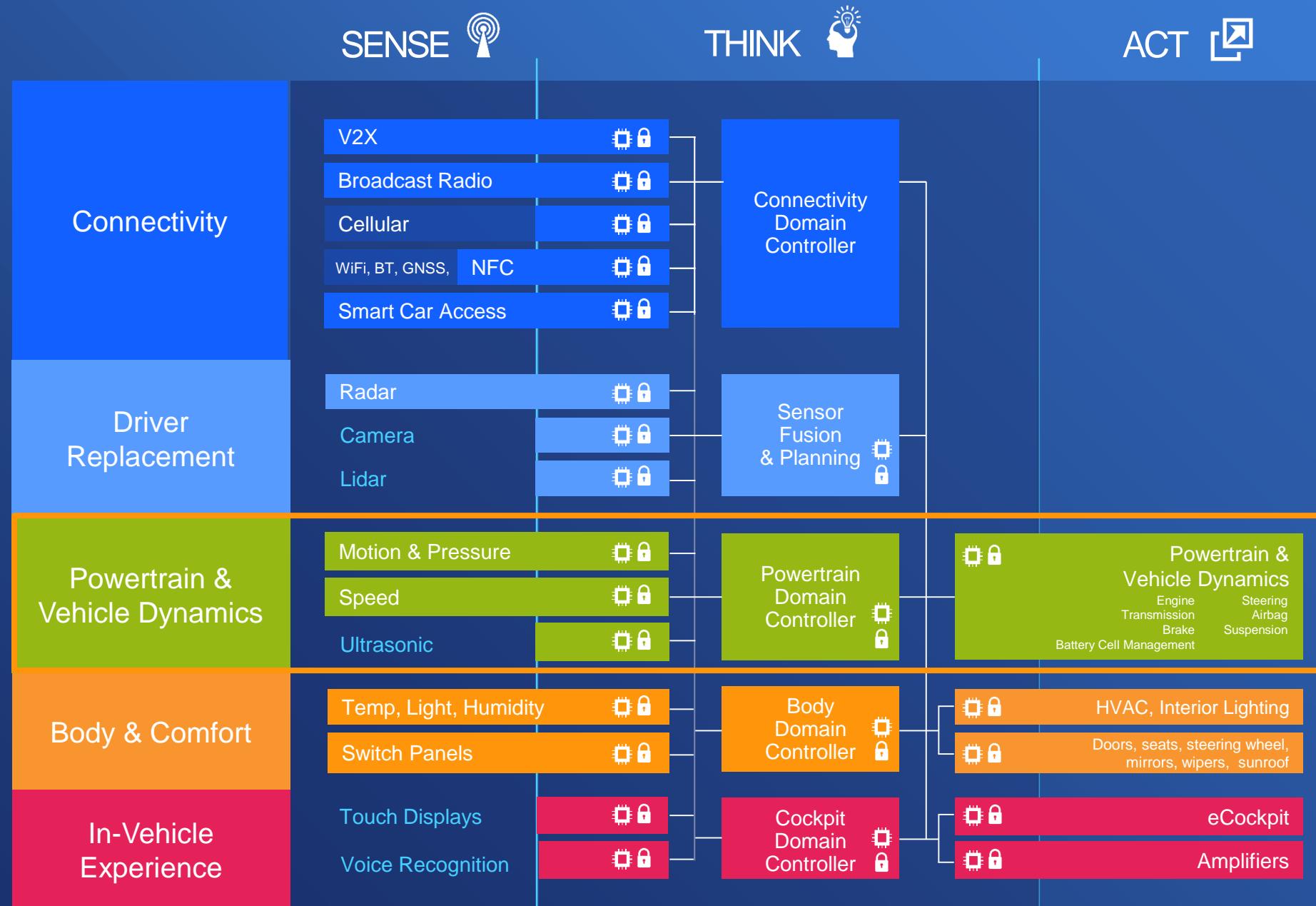


Sensor Fusion and Highly Automated Driving

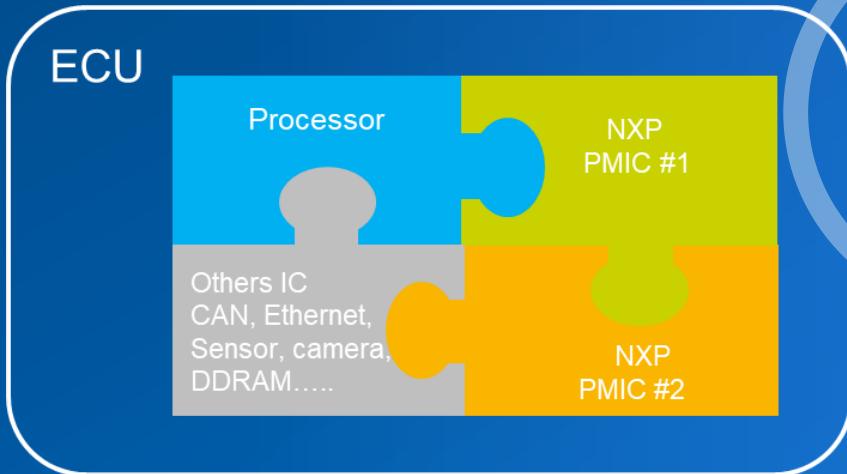


Powertrain & Vehicle Dynamics





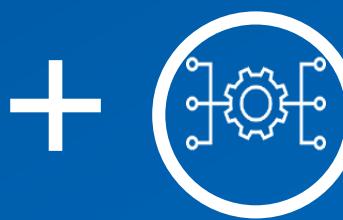
One System = Multi-PMIC Solution



NXP's next generation power management:
Simplicity of safety power management IC family



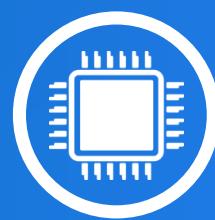
Scalable



Expandable



Safe



Unlimited
combinations

NXP Automotive – Powertrain & Vehicle Dynamics MCU

Powertrain



#1

Engine Control

Custom Braking



#1

Custom Braking Solutions

Chassis & Safety



Industry Workhorse

Vehicle Dynamics and Safety Microcontrollers



Available Today

2019

2020

2021

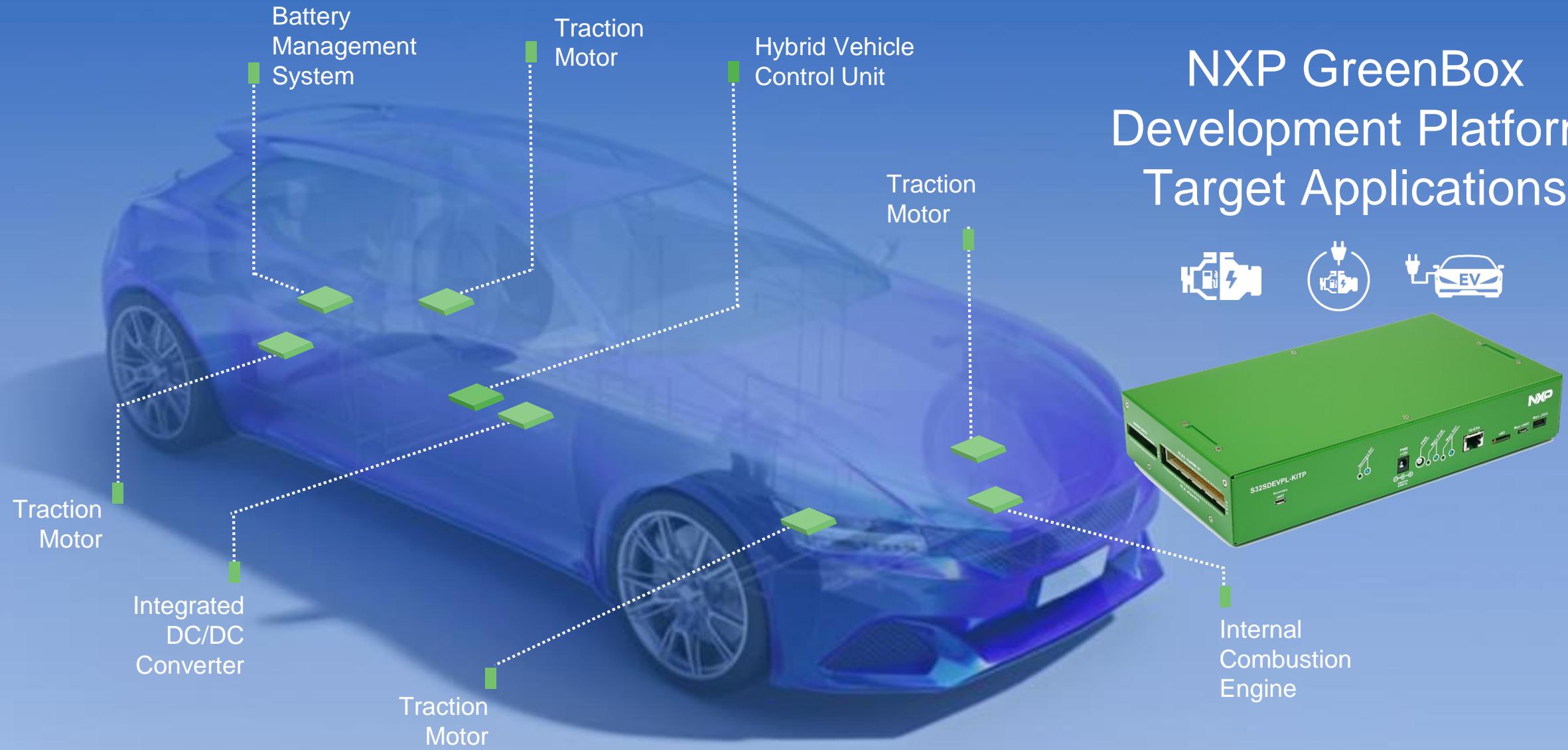


NXP GreenBox Vehicle Electrification Development Platform

- Development for S32 processing platform, an Arm® Cortex®-based safe and secure configuration
- High performance and memory requirements for tomorrow's HEV/EV applications
- Highly optimized peripherals such as advanced timers, motor control peripherals and analog subsystems to interface to customer development hardware
- Ease of development with S32 Design Studio IDE, AUTOSAR OS and MCAL drivers
- Simple out of the box experience with basic control applications including example code



NXP GreenBox Development Platform Target Applications



S32S MCUs and MPUs

Safe Dynamic Control for Electric and Autonomous Vehicles

High-performance processors to manage the systems that accelerate, brake and change vehicle direction safely across human and autonomous vehicle control



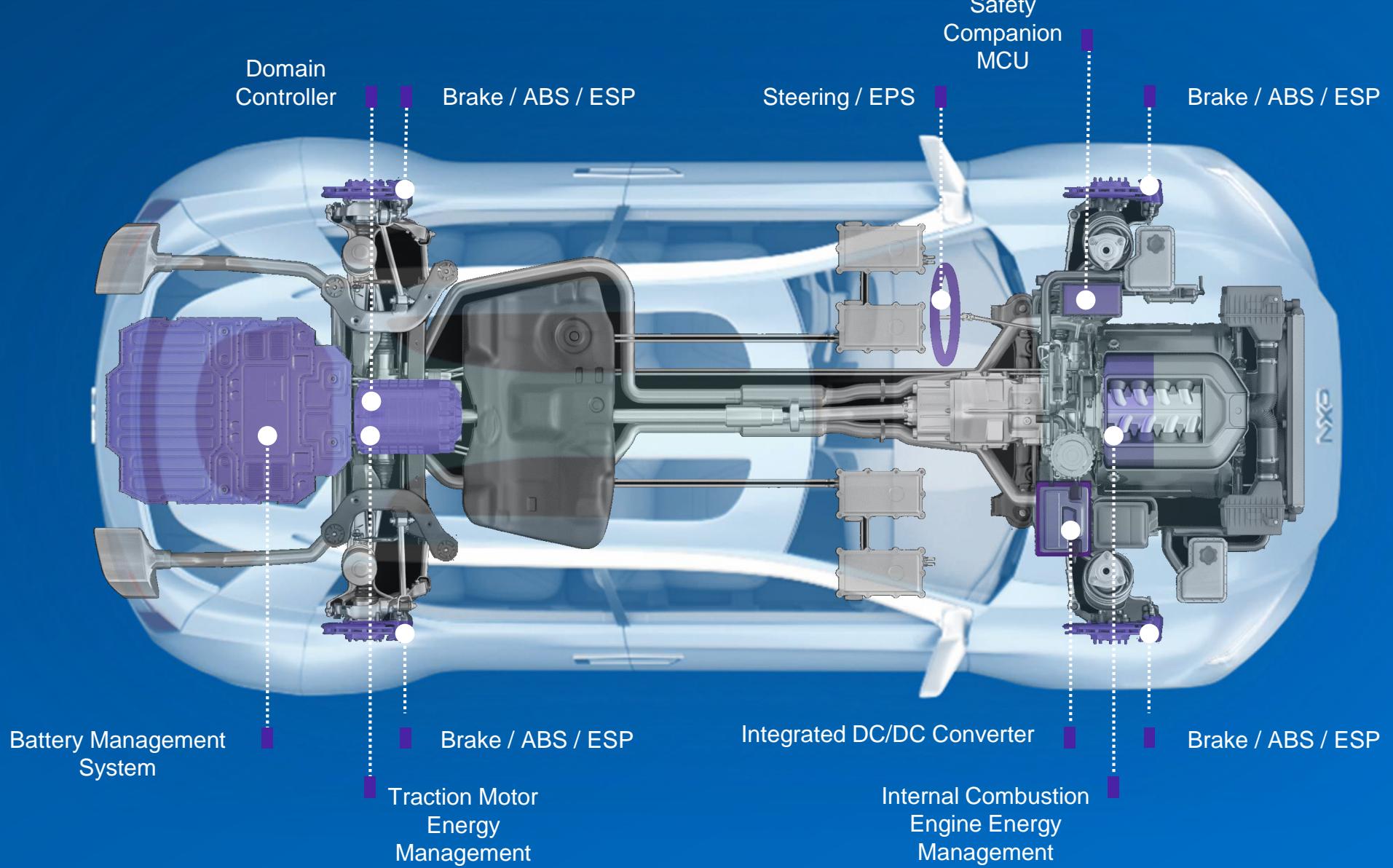
S32S MCUs and MPUs

- Arm® Cortex®-R52 cores in a quad lock stepped configuration (8 cores total), 800MHz each
- Over-the-Air updates capability with zero processor downtime
- Advanced safety functionality and fault recovery to support ASIL D applications
- User programmable Hardware Security Engine supporting public and private key encryption
- Hardware Hypervisor to support multiple sets of user applications software running safely with freedom of interference
- Available PCIe for ADAS domain supervisory applications

www.nxp.com/S32S



Safe Dynamic Control Using S32S MCUs and MPUs



Drivers and Energy Management

Enabling Green Power Train For Efficient Energy Management

DC, BLDC Motor Control

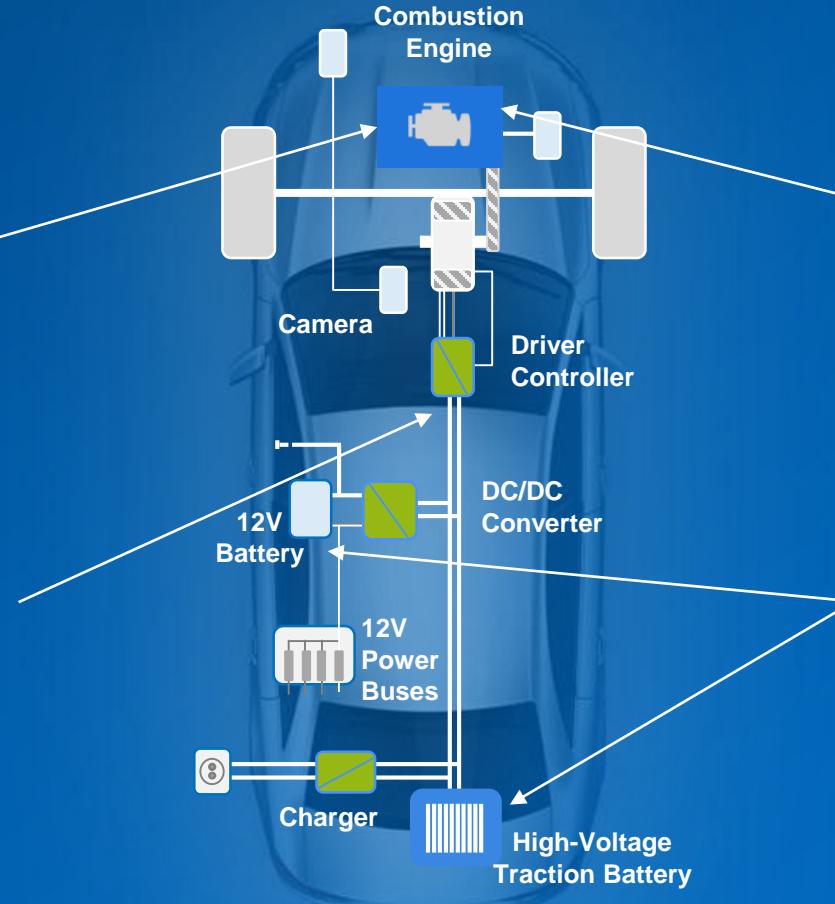
H-Bridges Drivers, 3-Phase Gate Drivers

- SPI control with configurable slew
- Real-time load current monitoring
- Functional safety ASIL-C solution

Electric Vehicle Power Converter

IGBT Gate Drivers, 48V Gate Drivers

- Low IGBT Module BOM cost
- Small footprint over-current protection
- Integrated HV Isolation
- Functional Safety ASIL-D



Power Train Solenoid Control

Direct Fuel Injection (DFI), Automatic Transmission Solenoid Controllers

- Integrated End-of-Injection measurement
- Low latency and high dynamic precision
- Lowest system BOM implementation

Electric Vehicle Li-Ion Battery Management

14V, 48V & HV Li-Ion Battery Cell Controllers

- Highest integration
- Single-chip ASIL-C
- High speed isolated daisy-chain
- Time aligned impedance measurement

Power Management Portfolio

Focus On Power Efficiency and Functional Safety

Advanced Power Management

- Accuracy & radiated emission performance
- Advanced system integration
- Safety processes, architectures, products
- Extended robust system solutions like EMC, Cranking ISO, Non ISO pulses

S32

FSBC



MC33907/8
FS6500, FS8500

i.MX

Integrated PMIC



PF0100, PF3000
PF8200

Layerscape

High Perf Regulators



VR500
VR5100

PMIC w/ I.MX

- Infotainment
- E-Cockpit, HUD
- Driver Awareness
- Cluster
- Telematics
- Cameras

SBC in Body

- Body Control
- Lighting
- HVAC



SAFETY ASSPs for Airbag and Braking

- Valves driver
- Airbag ECU
- Motor pump predriver
- Wheel Speed decoding

FSBC in ADAS

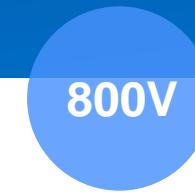
- Lane Departure Warning
- Radar
- ADAS – Vision
- ADAS – Data Fusion

FSBC in Drive Train

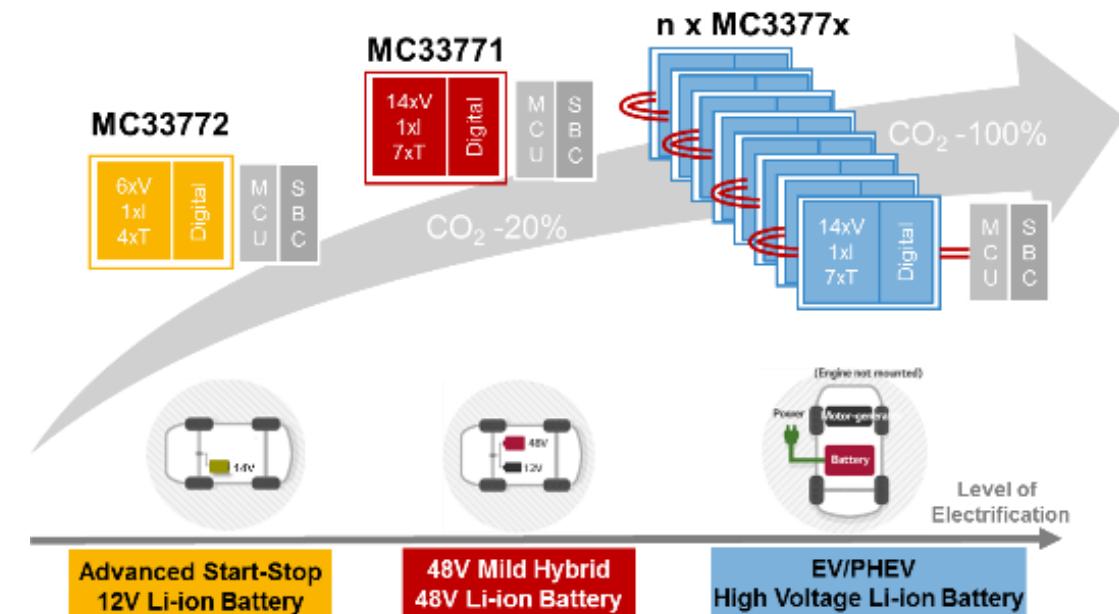
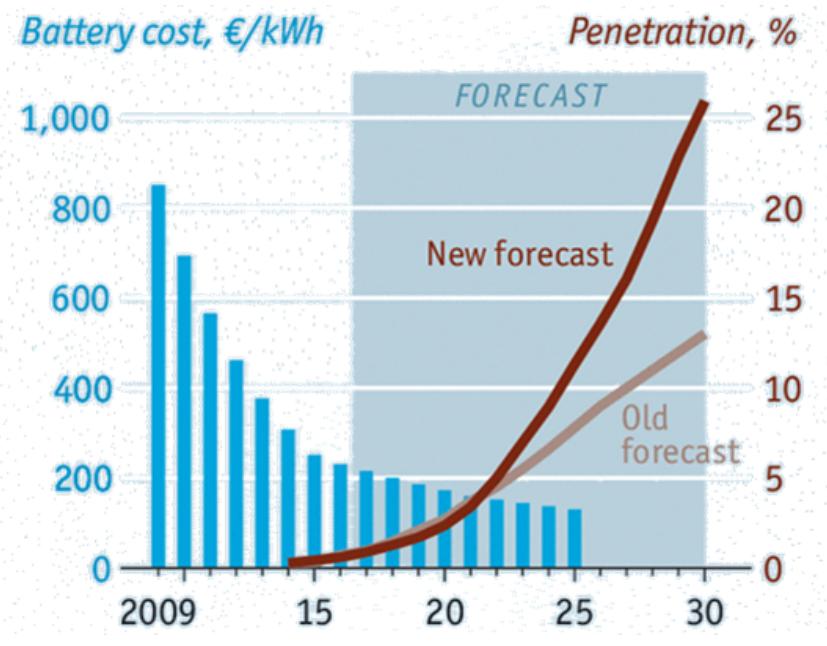
- Engine Management
- Transmission
- EV/HEV – Inverters, DC/DC
- BMS, Battery Cell Controller
- Steering, Suspension

NXP's Scalable Battery Management Portfolio

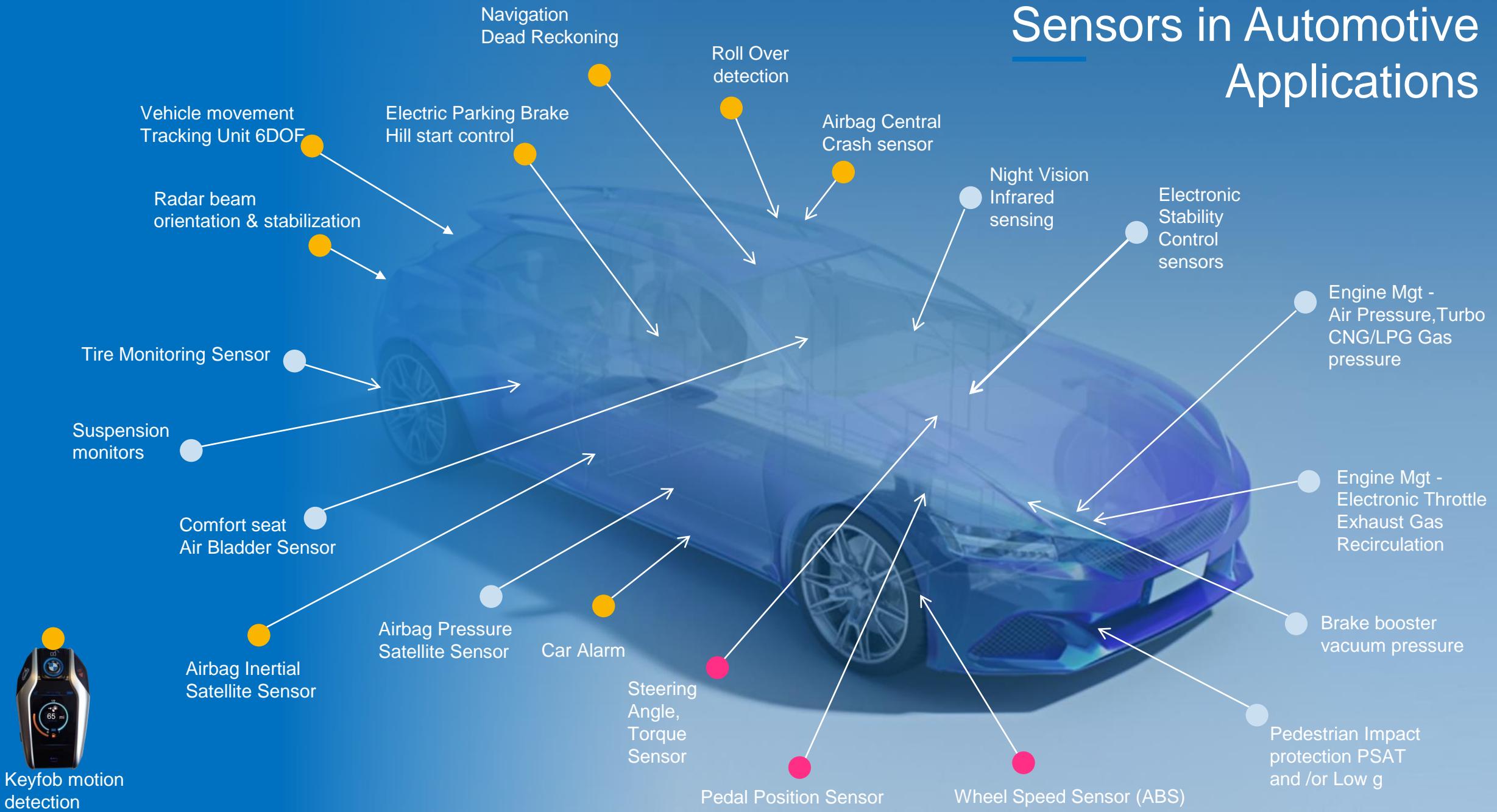
Addresses broad range of applications – maximizes hardware & software reuse



Sparks Fly — Battery electric vehicles, worldwide

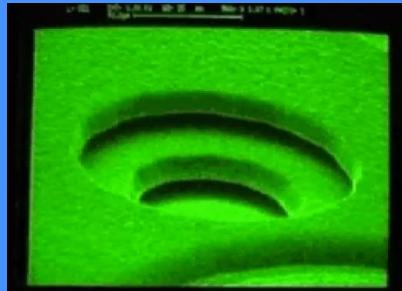


Sensors in Automotive Applications

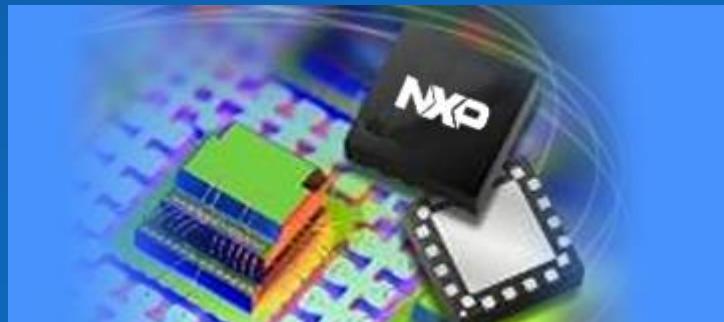


MEMS & Magnetic Sensors Uniqueness Creates Barriers for Entry

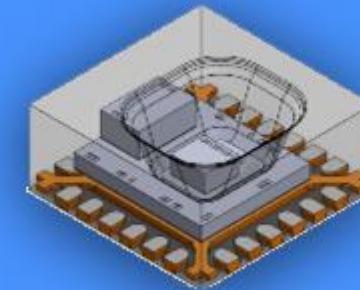
Z-axis MEMS
Sensing Device



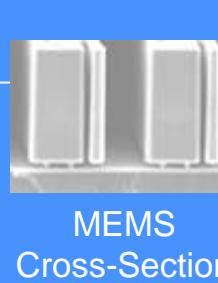
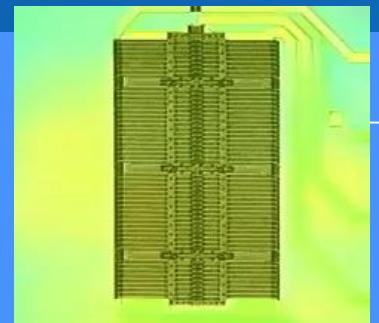
Motion Accelerometer
Stacked Die



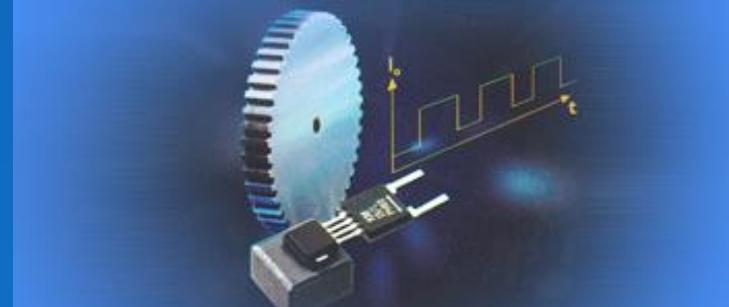
Pressure System in a Package – TPMS
MEMS on MCU/Analog Leadframe
Plastic Mold with Hole & Gel



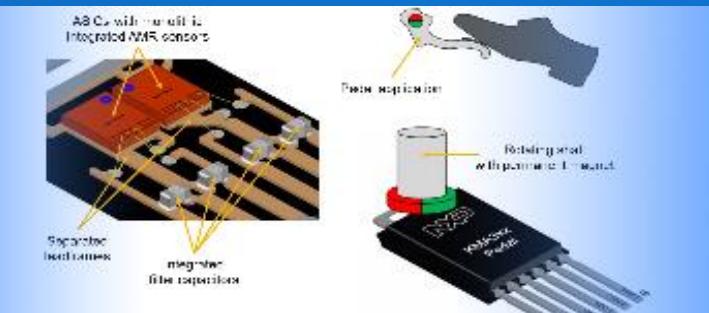
Lateral MEMS
Sensing Device



Magnetic
Speed Sensor

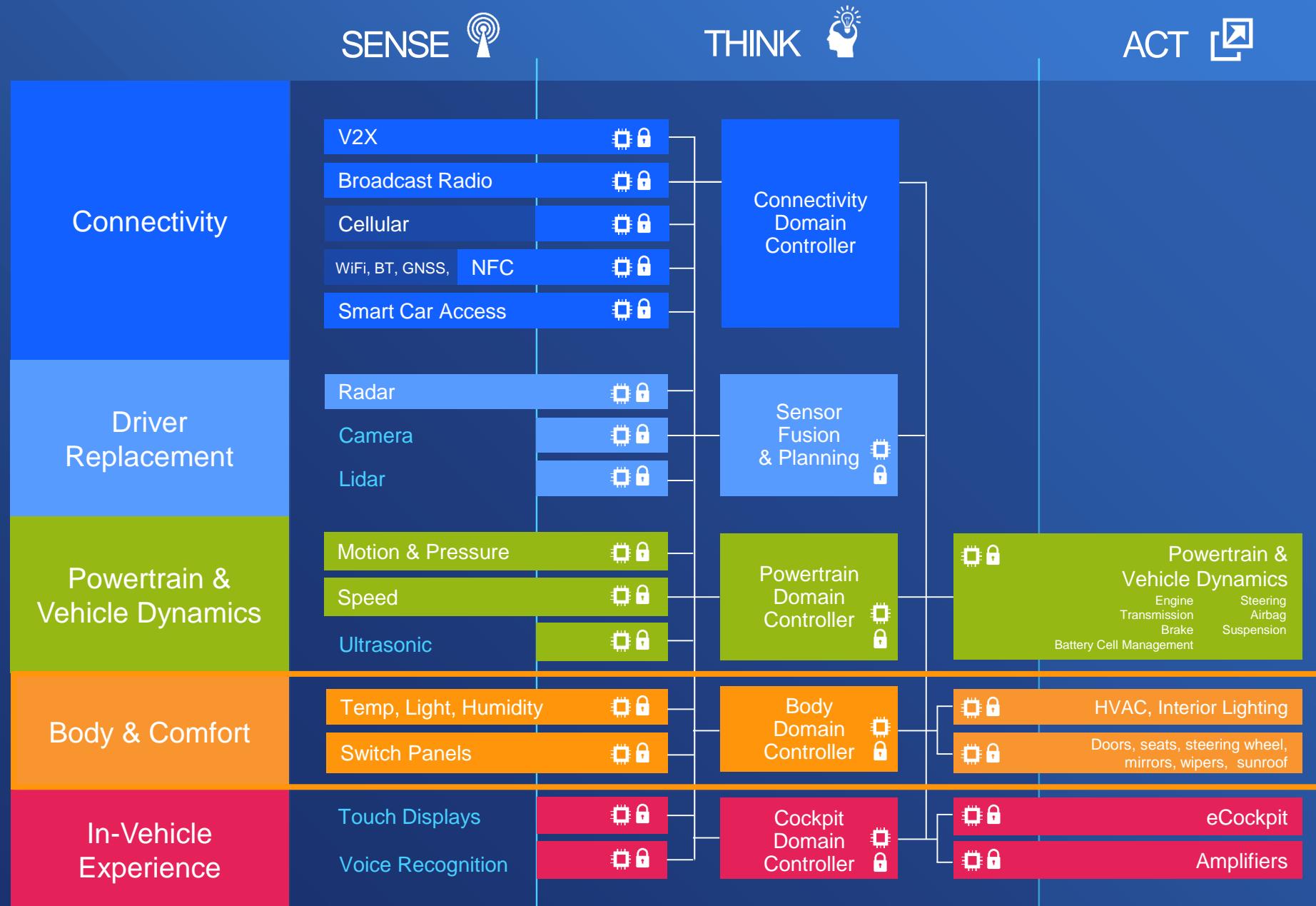


Magnetic Angular Sensor
ASIC with Magnetic Material Leadframe,
Discrete Components & Plastic Mold

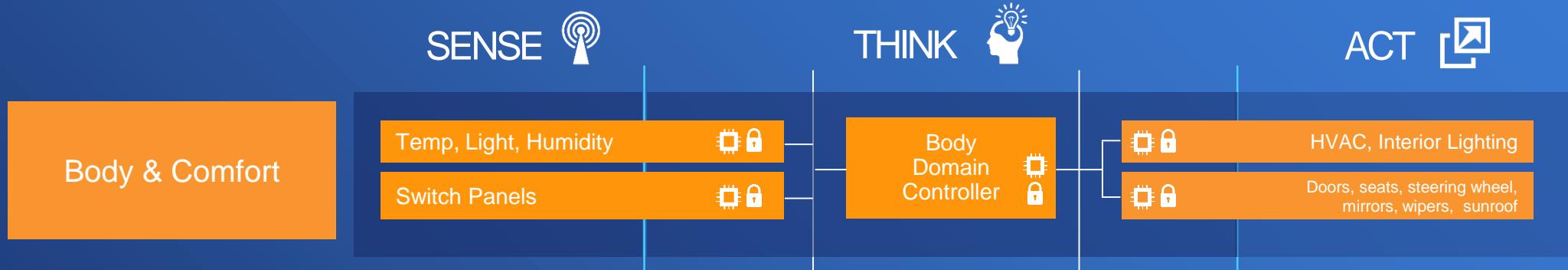


Body & Comfort





Typical Body & Comfort Systems



Interior subsystems

- Displays (instrument cluster, center stack, heads up display)
- Voice, gesture and touch commands
- Seat motion
- Car lighting and music adjusts to driver
- Climate control / HVAC adjusts to driver
- Interior lighting / mood lighting
- Driver privacy from outside onlookers and sun
- Noise-reduced environment
- Driver-takeover alert system with lights, vibrations and movement in seats and steering
- Advanced seats monitor driver biometrics

Exterior subsystems

- Mirrors
- Wipers
- Door and window control
- Trunk control
- Exterior lighting
- Exterior sounds
- Trailer hook

NXP Automotive – General Purpose & Integrated MCUs

Integrated Solutions



#1

Motor Control

General Purpose 16/32-bit



#1

Body Electronics

General Purpose 8-bit



#2

8-bit

General Purpose and Integrated Solutions

Target Markets

General Purpose

Body Electronics
Lighting



HVAC



Other



Products

ARM

KEA - S32K
The first automotive MCU
designed for software engineers

S08 - S12 - MPC56xxB/C
• Shipping ~500Mu in 2016
• 8/16/32-bit proven architectures

Integrated Solutions

Motor Control
Window Lift



Pumps, Fans



Sensor Interfaces



General Purpose

Integrated

Technology

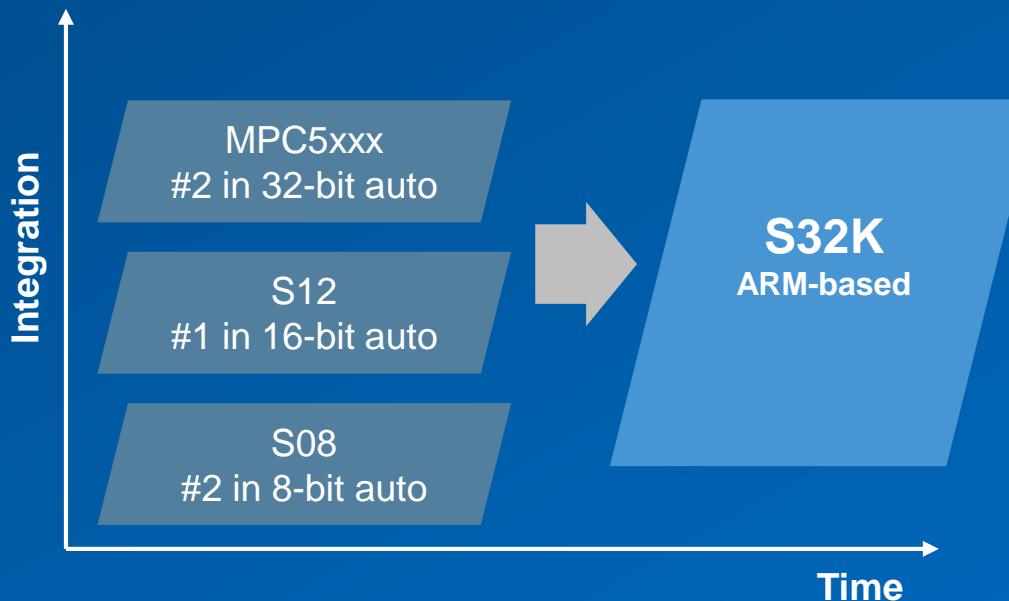
Software and
Tools

Moving to ARM
Cortex Architecture

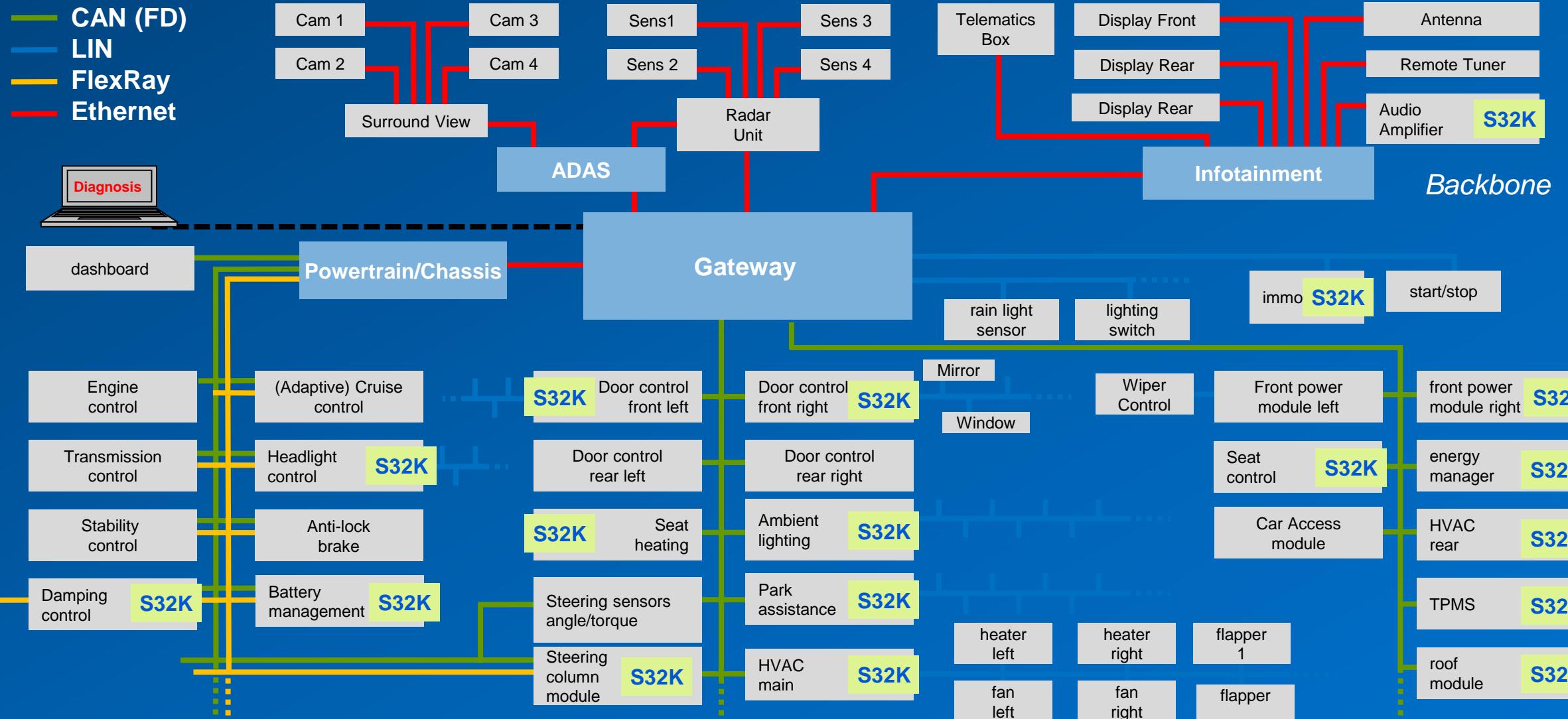
HV Analog
Integration
ASSP

General Purpose S32K Microcontrollers

- **Most scalable portfolio** Based on ARM Cortex
- **Future-proof** Superior performance and features
- **Minimize complexity and maximize re-use**
Complete software and tools ecosystem



GPIs: Solutions for Edge Nodes





S12 MagniV MCUs

MagniV solutions deliver optimal system cost and physical footprint for motor control, actuator, and sensor applications

Reduced PCB Space
Up to 30%

Improved manufacturing efficiency
Replacing typically 3 IC by 1 MagniV reduces assembly and test cost while quality improves

Reduced Bill Of Material (BOM)
Fewer components to purchase, handle, store and qualify

MagniV – Applications



Sensor Interface



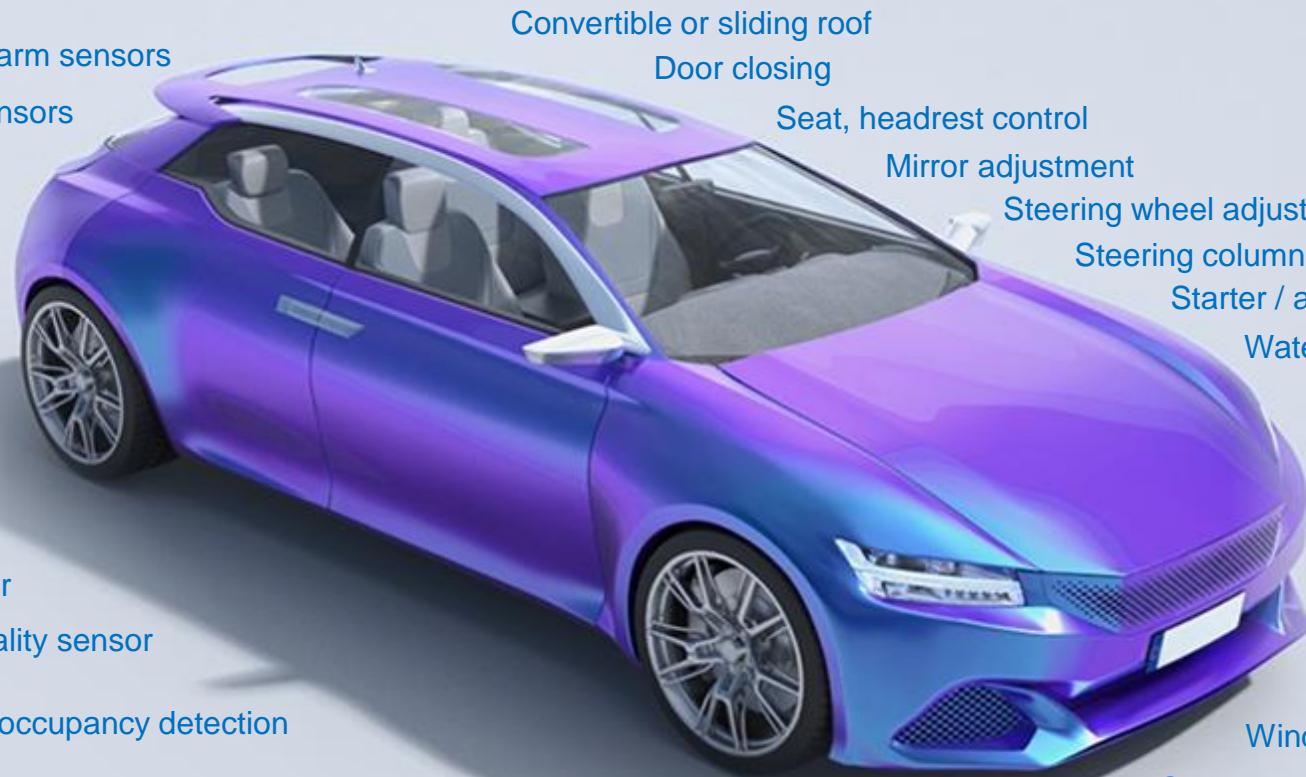
Alarm sensors
Ultrasonic sensors
Rain / light sensor
Particle sensor
NOx sensor
Urea sensor



Airmass sensor
Air quality sensor



Passenger occupancy detection
Steering wheel sensors
(touch / hands off)



Motor Control



Convertible or sliding roof
Door closing
Seat, headrest control
Mirror adjustment
Steering wheel adjustment
Steering column lock
Starter / alternator
Water pump engine cooling



Engine cooling fan
Headlight cleaning, levelling
Oil pump
ABS pump



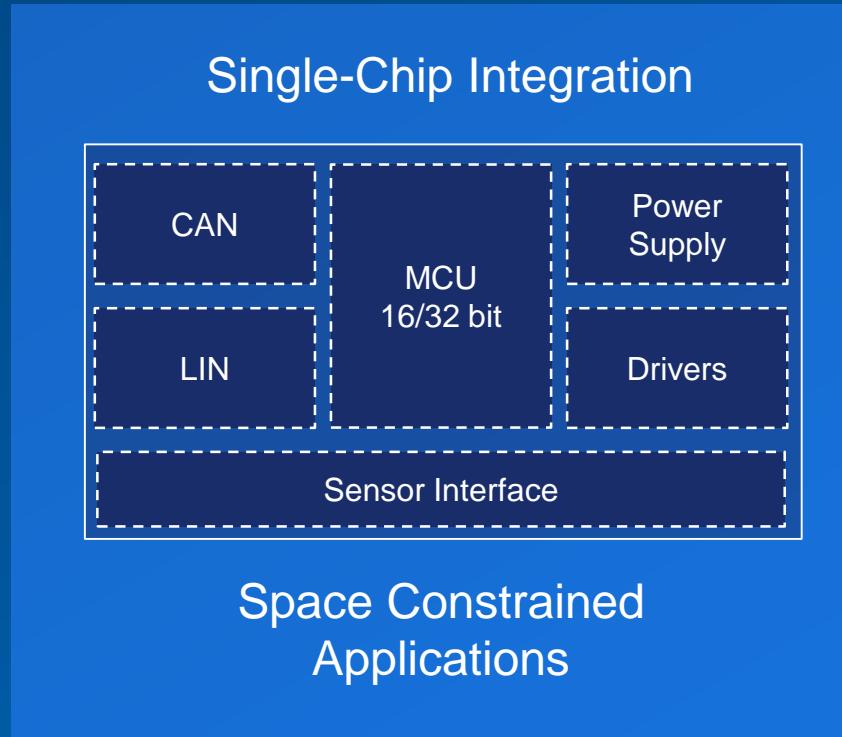
Parking break
Window lifter
Seatbelt system
Tailgate closing



Throttle valve
HVAC water pump

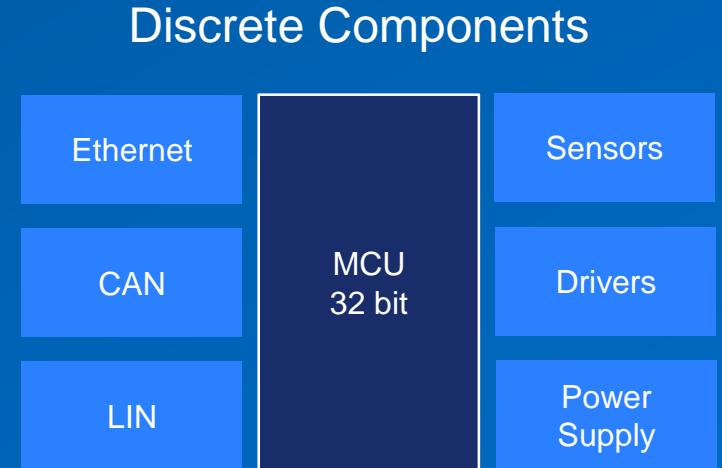
NXP S12 MagniV Microcontrollers – Integration Of Body MCU & IVN

Full Scalability for Easiest Design



Full range of solutions with 100% tool / software compatibility

A thick white double-headed arrow spans the width between the two main sections, indicating compatibility.



High Performance Applications

Automotive LED Lighting

Sleek design



Safety
(ADAS-ADB)

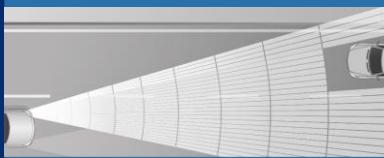
Energy efficient

50% reduction in CO₂ emissions by using LEDs



DRL-LED	DRL-Bulb
Energy Consumption	2 X 11.4 W
CO ₂ Emissions	0.58g CO ₂ /km

Differentiating Front Lighting Beam Resolution

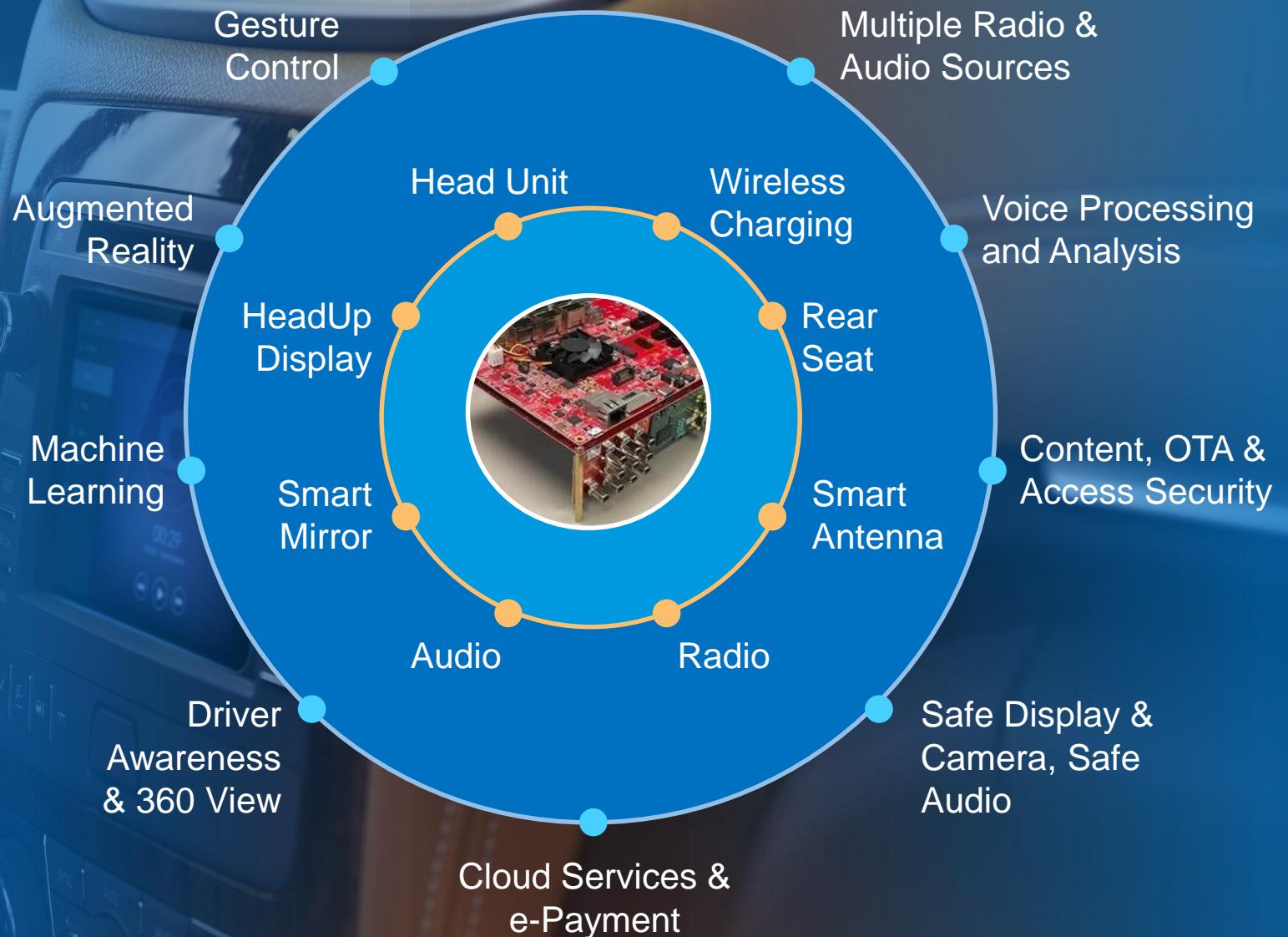
# LED SEGMENTS	8 – 24	80 – 120	120 – 30K	> 30K
MAX CURRENT	1.5 A	700 mA		3 A, 6 A
CURRENT SWITCHING FREQ.	KHz	KHz		TFT KHz Laser MHz/GHz Lidar GHz
APPLICATIONS	MATRIX	PIXEL	<i>Fuzzy Space</i>	VISIBLE LIGHT COMM.
	 	 		 
	Compact / Medium Example: Opel Astra	Premium Example: E-Class		Premium 2025+

In-Vehicle Experience

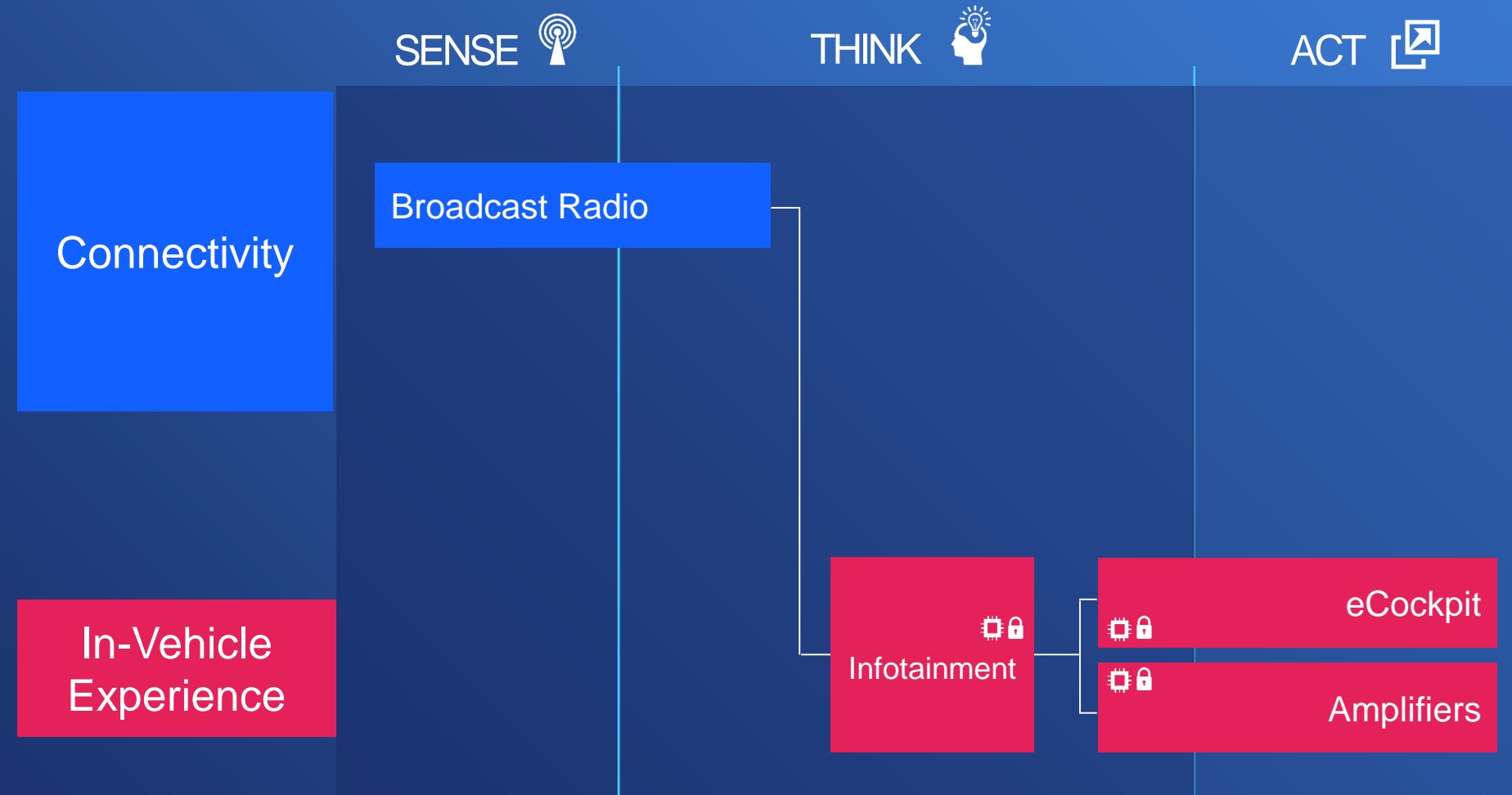
PUBLIC



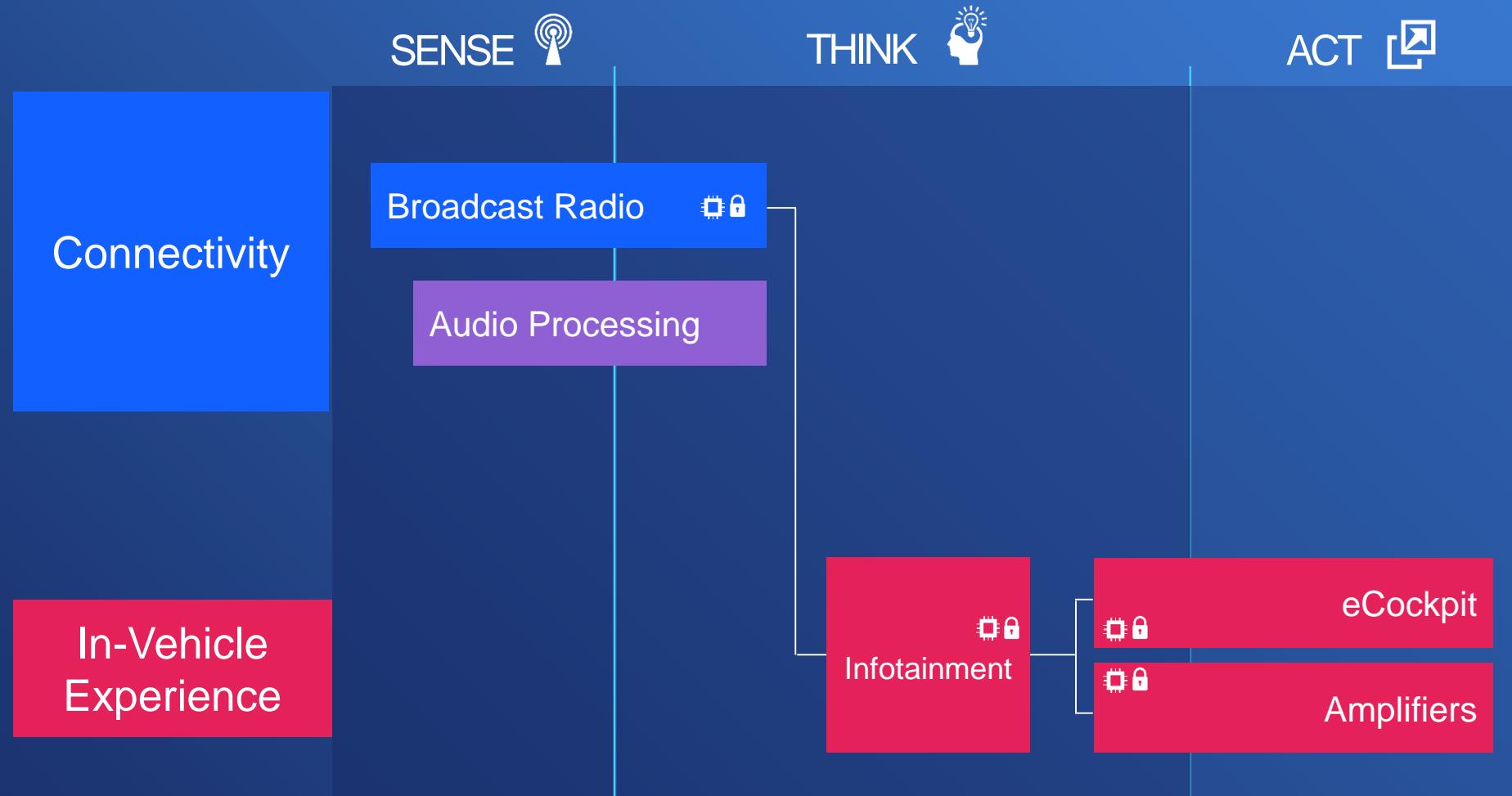
In-Vehicle Experience



System Optimization Repartitioning the Audio Function

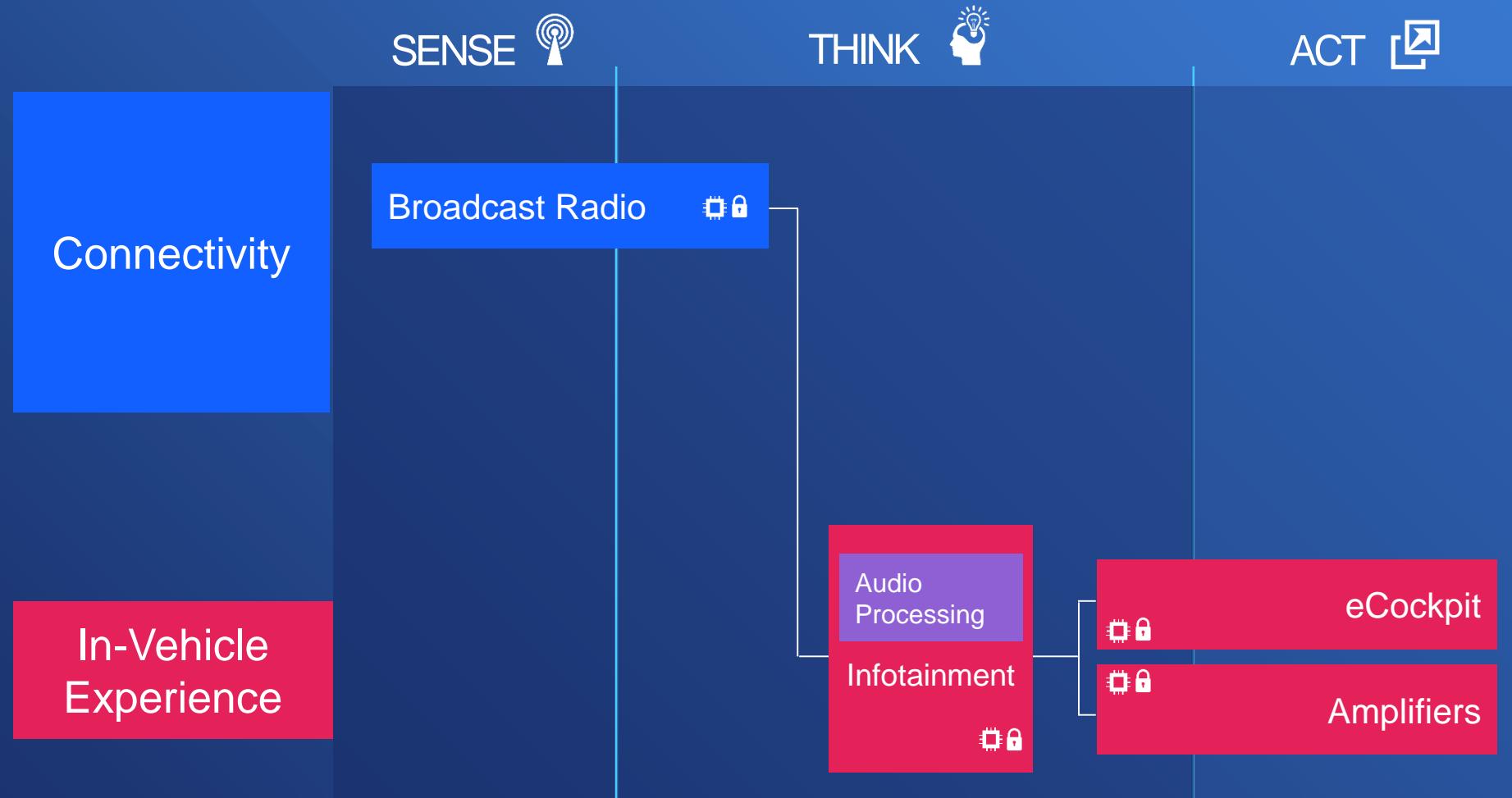


System Optimization Repartitioning the Audio Function



System Optimization

Repartitioning the Audio Function



System Optimization

Solve the Interface Nightmare

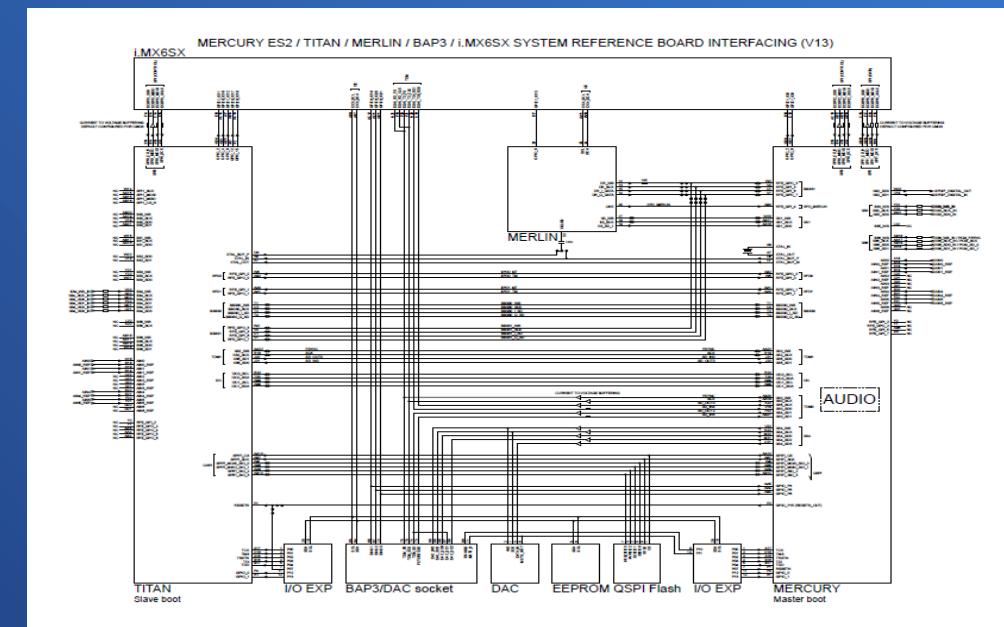


Applicable for:

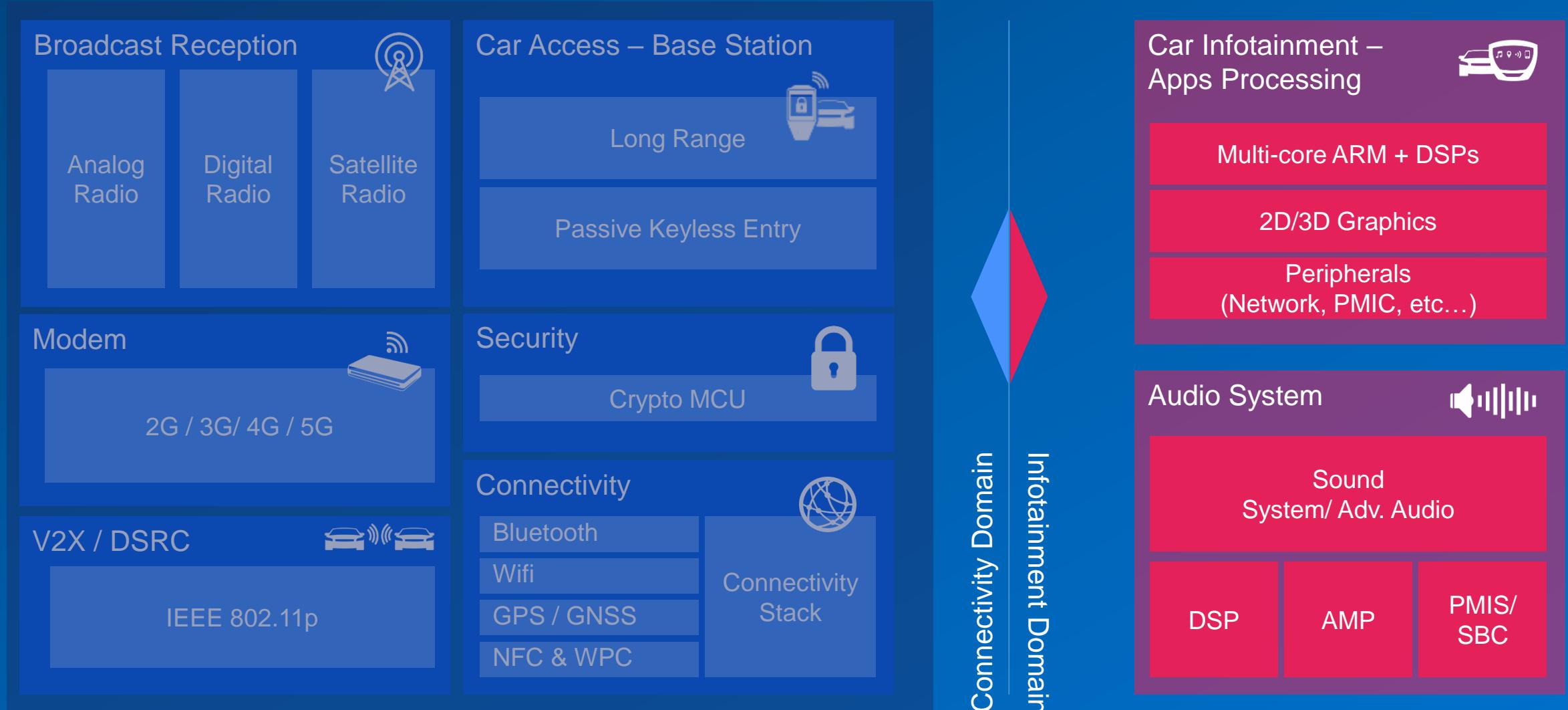
- SAF4000 \leftrightarrow TEF7700
- SAF4000 \leftrightarrow TDF853x
- SAF4000 \leftrightarrow iMX
- iMX \leftrightarrow BAP3
- SAF4000 \leftrightarrow PMIC

Interfaces:

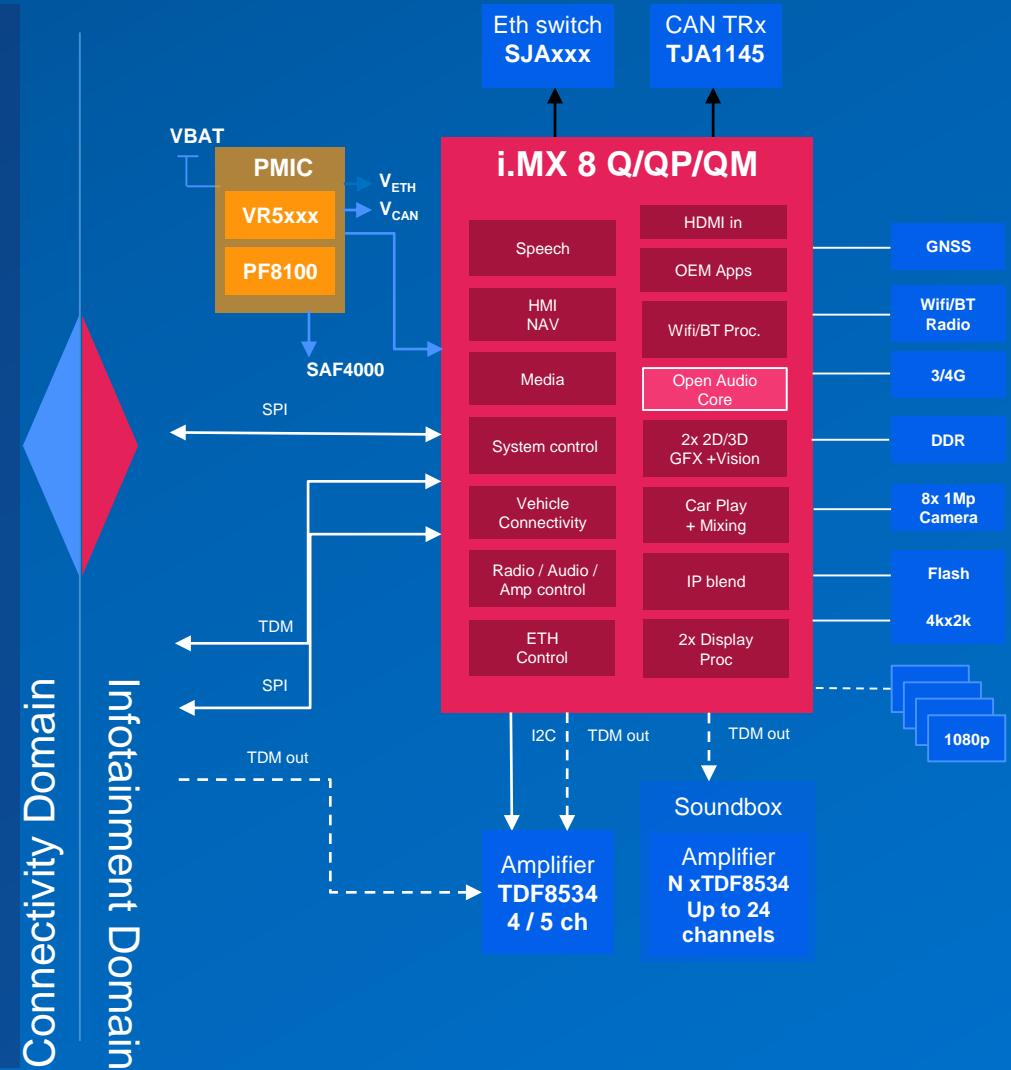
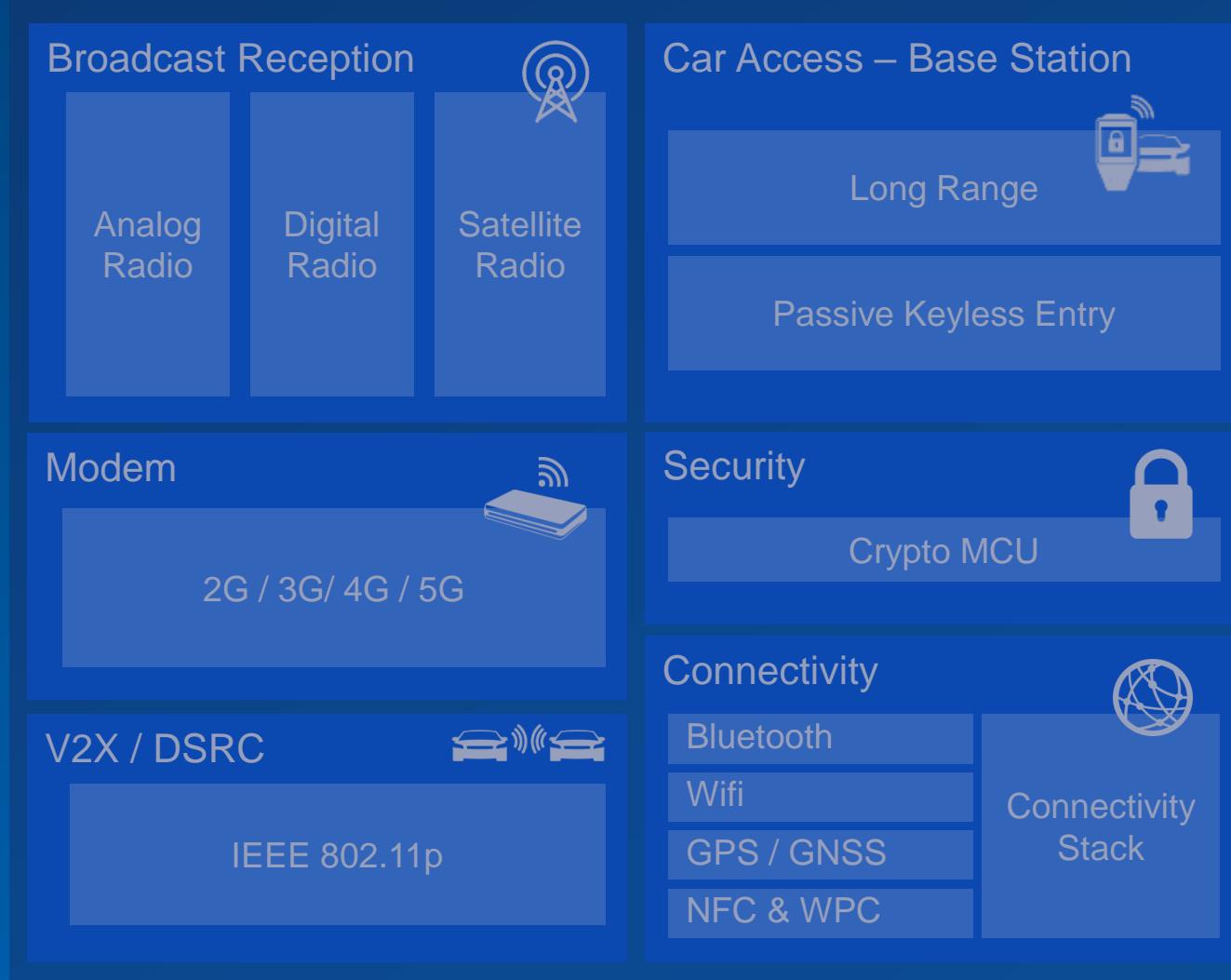
- IIS / TDM
- SPI (2-4)
- IIC (yes, still exist)
- GPIO
- Complex SW ctrl



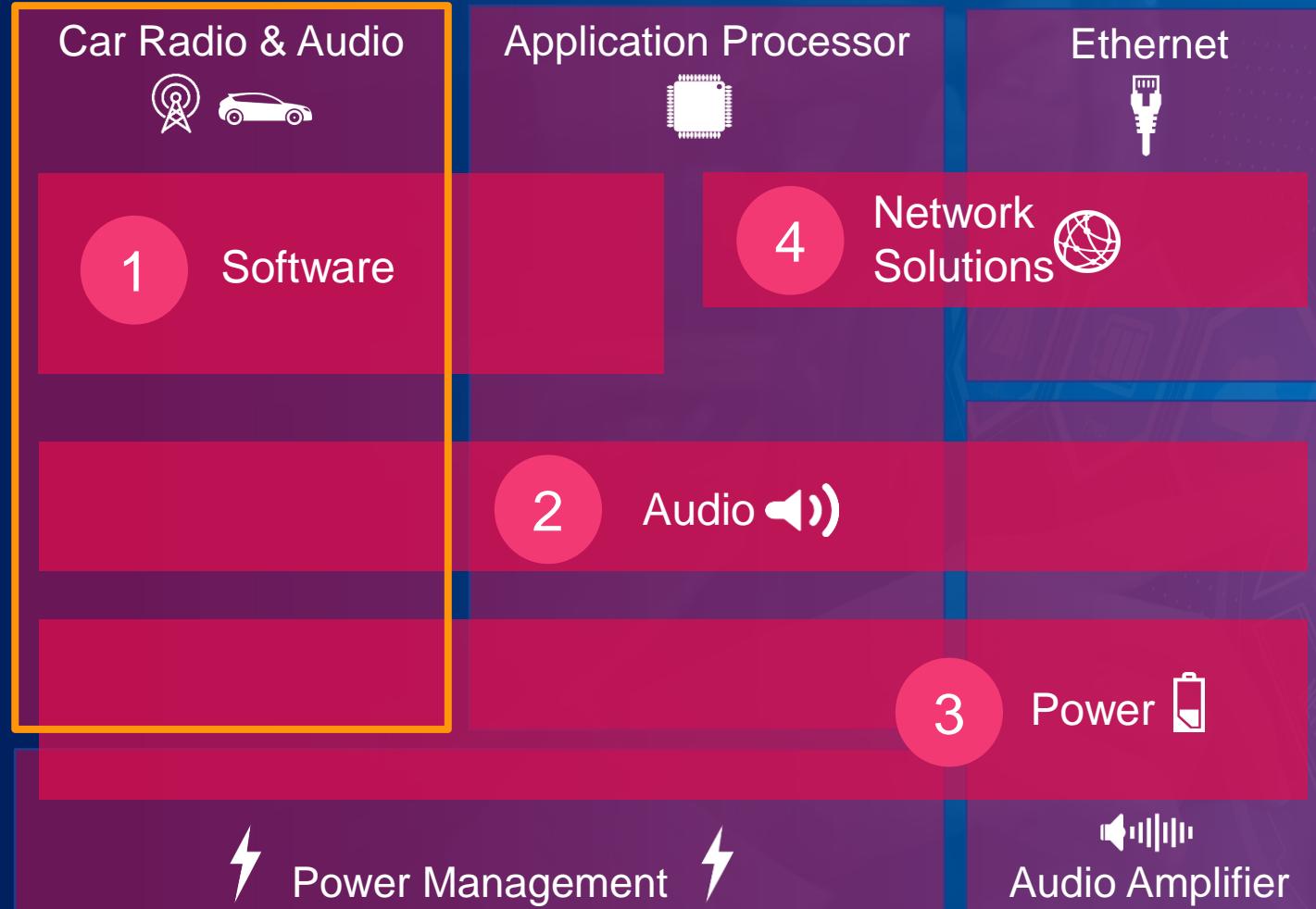
Infotainment Apps and Audio



Infotainment Apps and Audio



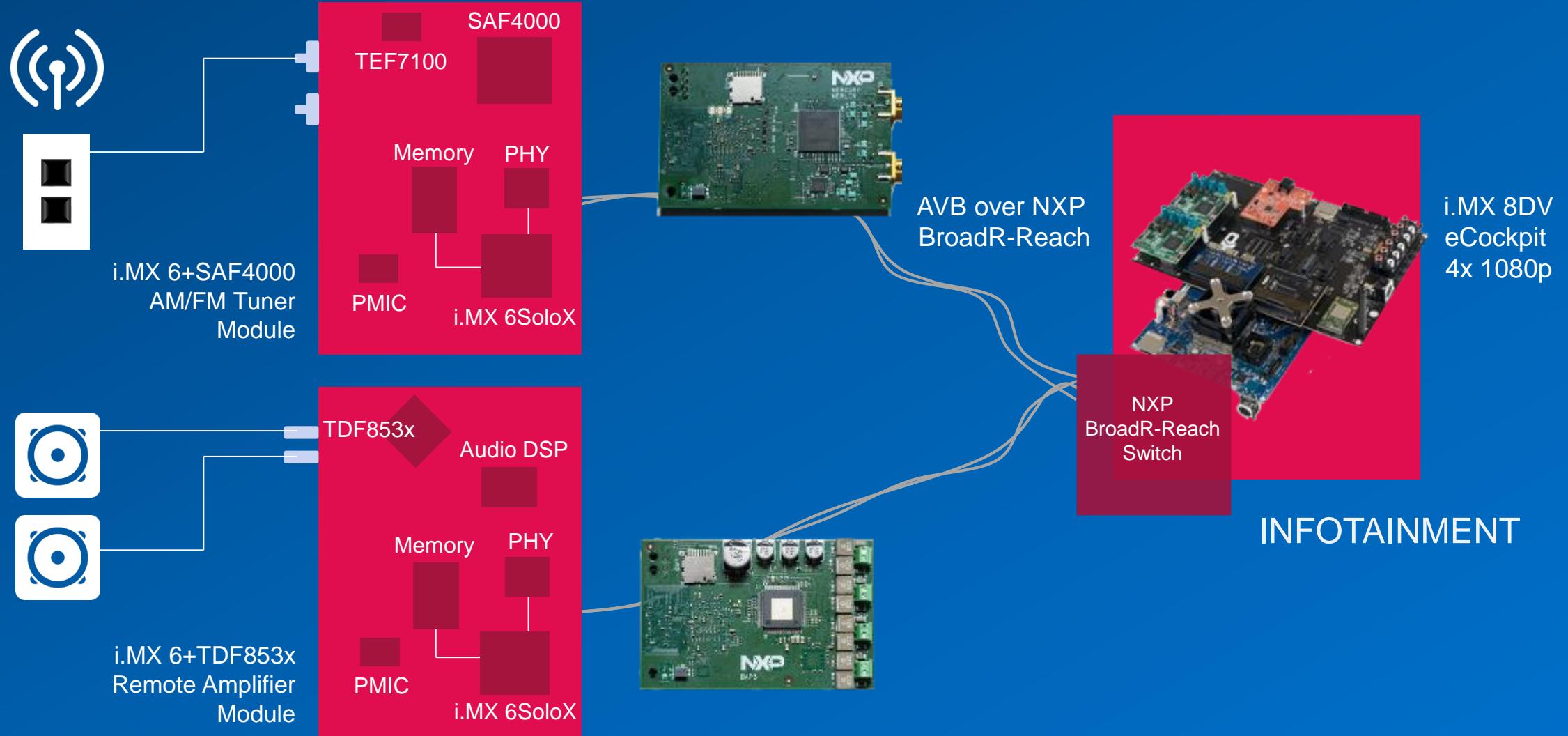
Infotainment – Unique System Opportunity



Leading System Performance

- 1 Tight system coupling
- 2 Powerful audio system play
- 3 Tailored PMIC system
- 4 Complete IVN solutions

Infotainment – Unique System Opportunity



Comprehensive Infotainment Solutions From NXP

Automotive Applications
Processors

6Quad Plus

6Quad

6Dual Plus

6Dual

6DualLite

6Solo

6SoloX

6UltraLite

32 - 64 bit OS compatibility from entry to premium

i.MX8

Advanced Graphics



ARM® v8-A Cortex-A53/A72

i.MX 8X

Efficiency
& Bill of Materials



ARM® v8-A Cortex-A35

SAF4000

Analog, Digital Radio
& Integrated Audio



Full wideband
tuner concept

TEF770

Analog Radio &
Integrated Audio



Full wideband
tuner concept

Scalable family from entry to premium segments

Broadcast Tuner Solutions

**SAF775x &
SAF360x &
TEF701x**

**SAF775x &
SAF360x**

SAF775x

SAF775D

TEF668x

Market Leadership in Infotainment & In-Vehicle Experience

PL i.MX Apps Processors



Infotainment

#1 globally in infotainment

>460Mu shipped, >140M cars
In the past 10 years with i.MX

Strong scalable portfolio
i.MX 6 & i.MX 8

20% CAGR since 2012 / 34% in 2017
MS @ 20%+

#1

PL Car Radio



Broadcast & IP Radio

#1 globally in car radio & audio

19 of top 20 tier-1s
NXP Car Radio & Audio design

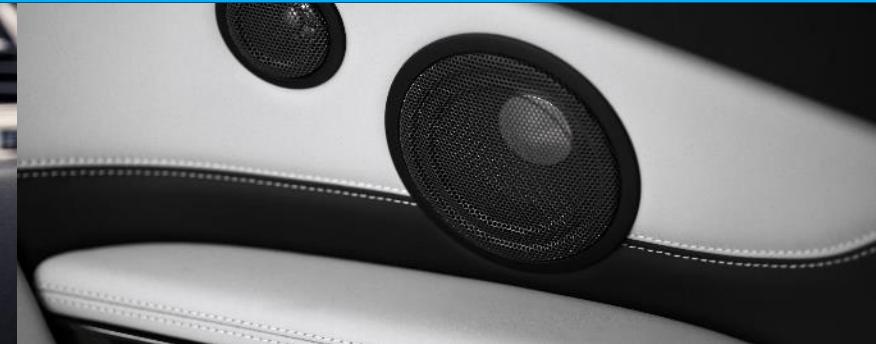
>400Mu DiRaNA's
In Q3-2018

First full hybrid broadcast system
Mercury design

RMS 4.0 / MS @ 61%

#1

PL Audio Amplifiers



Audio & Amplifiers

#1 globally in class-D

>400Mu amplifiers
Shipped in last 10 years

First full digital amplifier
TDF853x

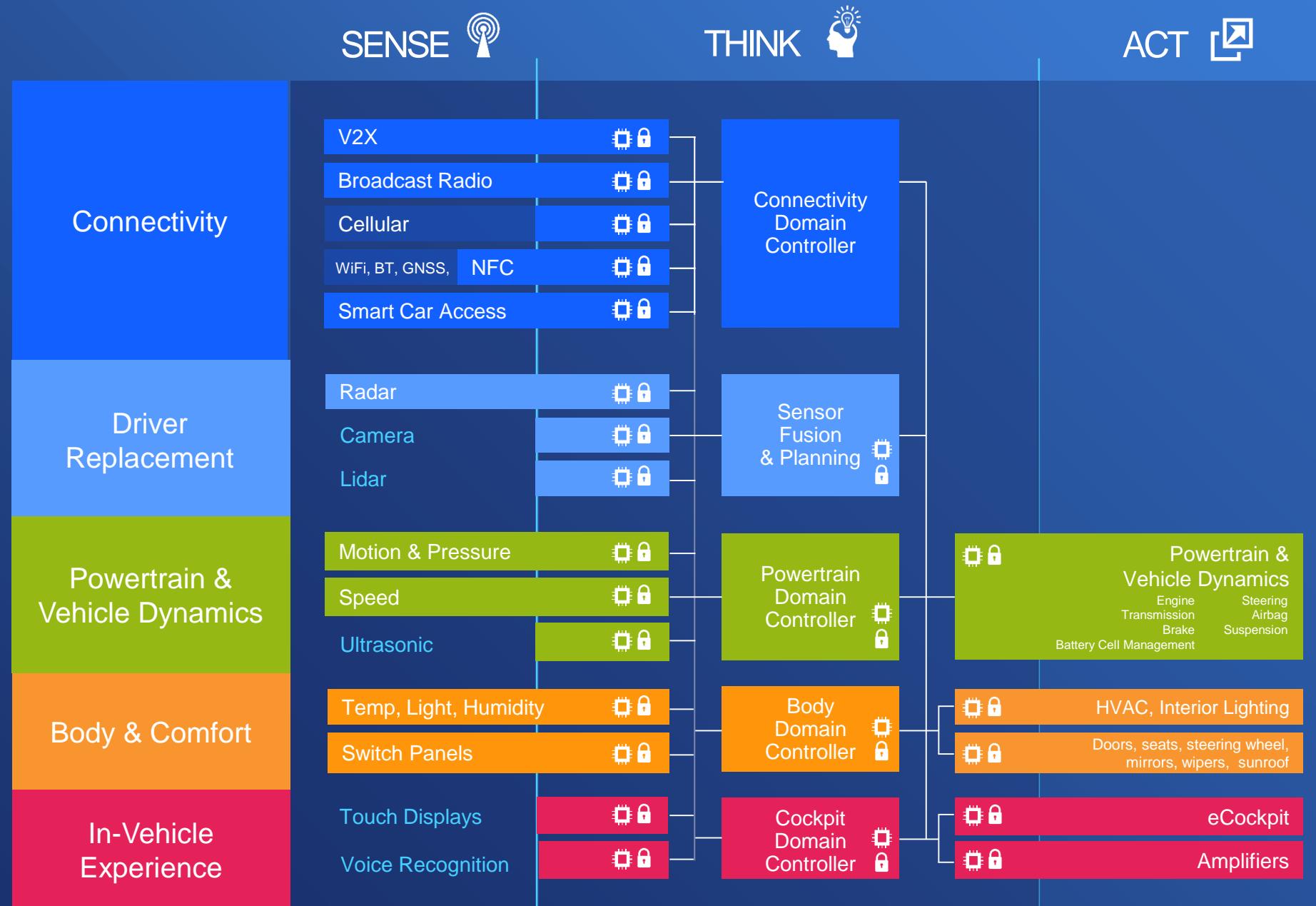
Strong portfolio
HeadUnit & Sound System support

Improved profitability
2012 - 2017

#1

In-Vehicle Network

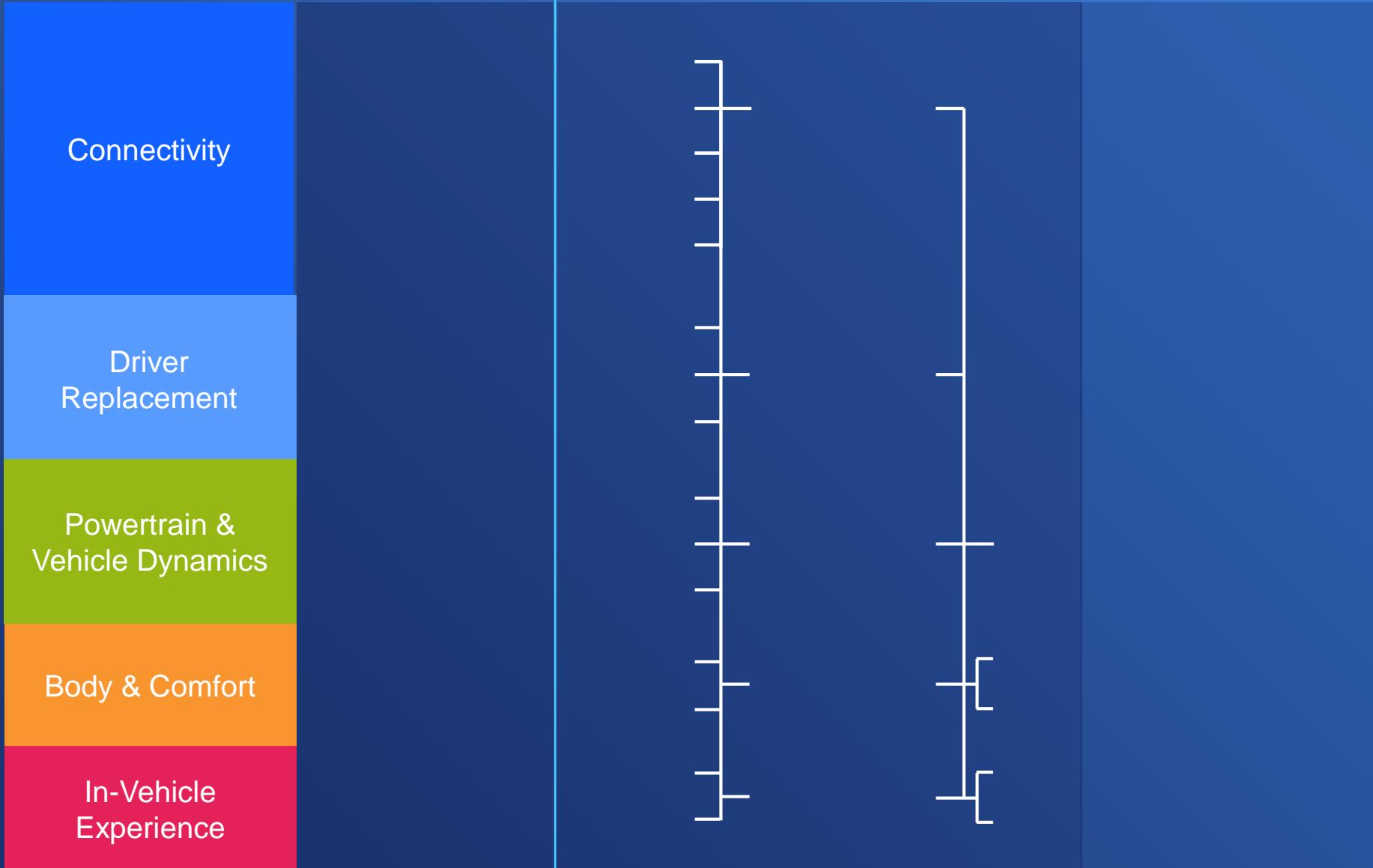




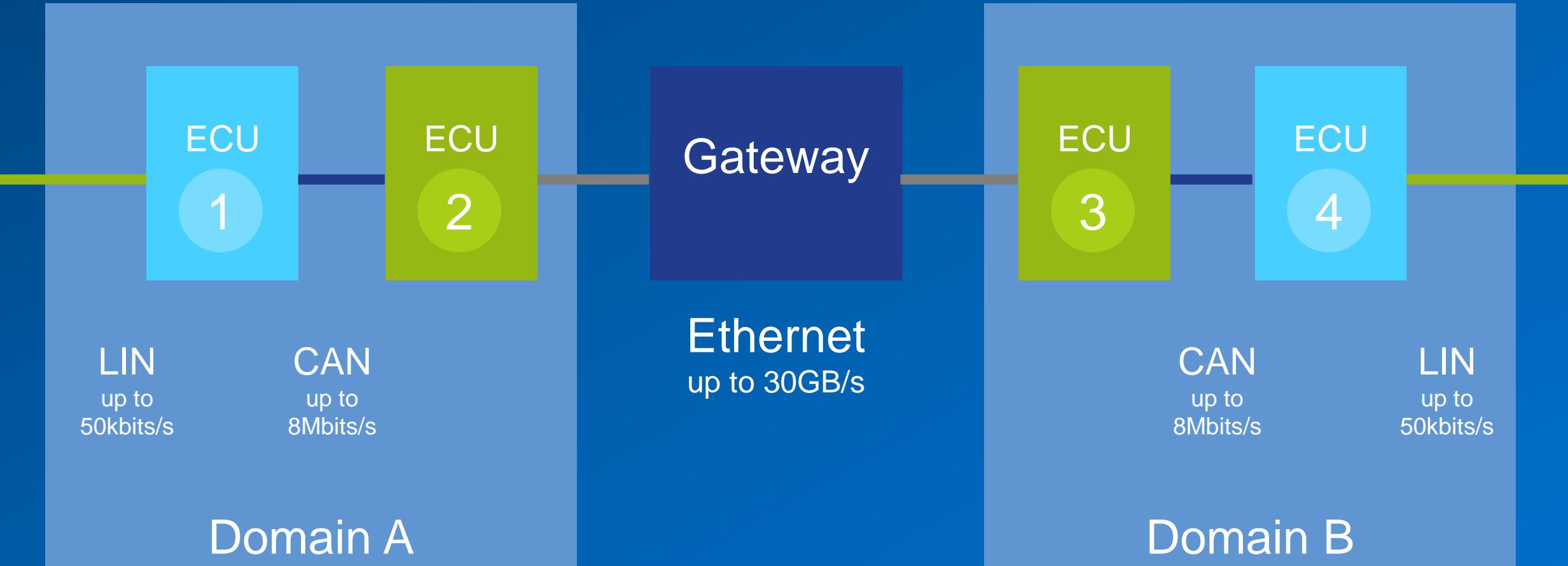
SENSE 

THINK 

ACT 



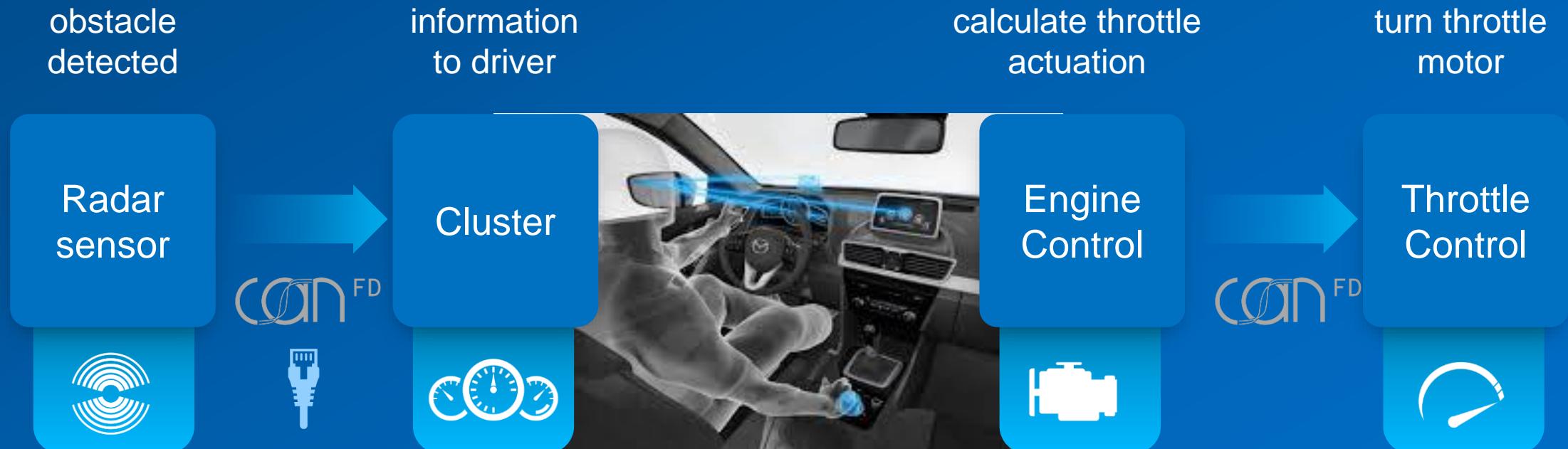
Role of In-Vehicle Networking + Gateway



Radar-to-throttle Example

Today

driver receives info and acts upon it



Radar-to-throttle Example

Driver
Replacement

Tomorrow

human is out of the loop

Powertrain &
Vehicle Dynamics

obstacle
detected

Information
processing

secure re-route
to CAN

calculate throttle
actuation

turn throttle
motor

Radar
sensor



CAN FD

NXP TJA



Fusion/
Planning



CAN FD

NXP SJA



Central
Gateway



CAN FD

NXP TJA



Engine
Control



CAN FD

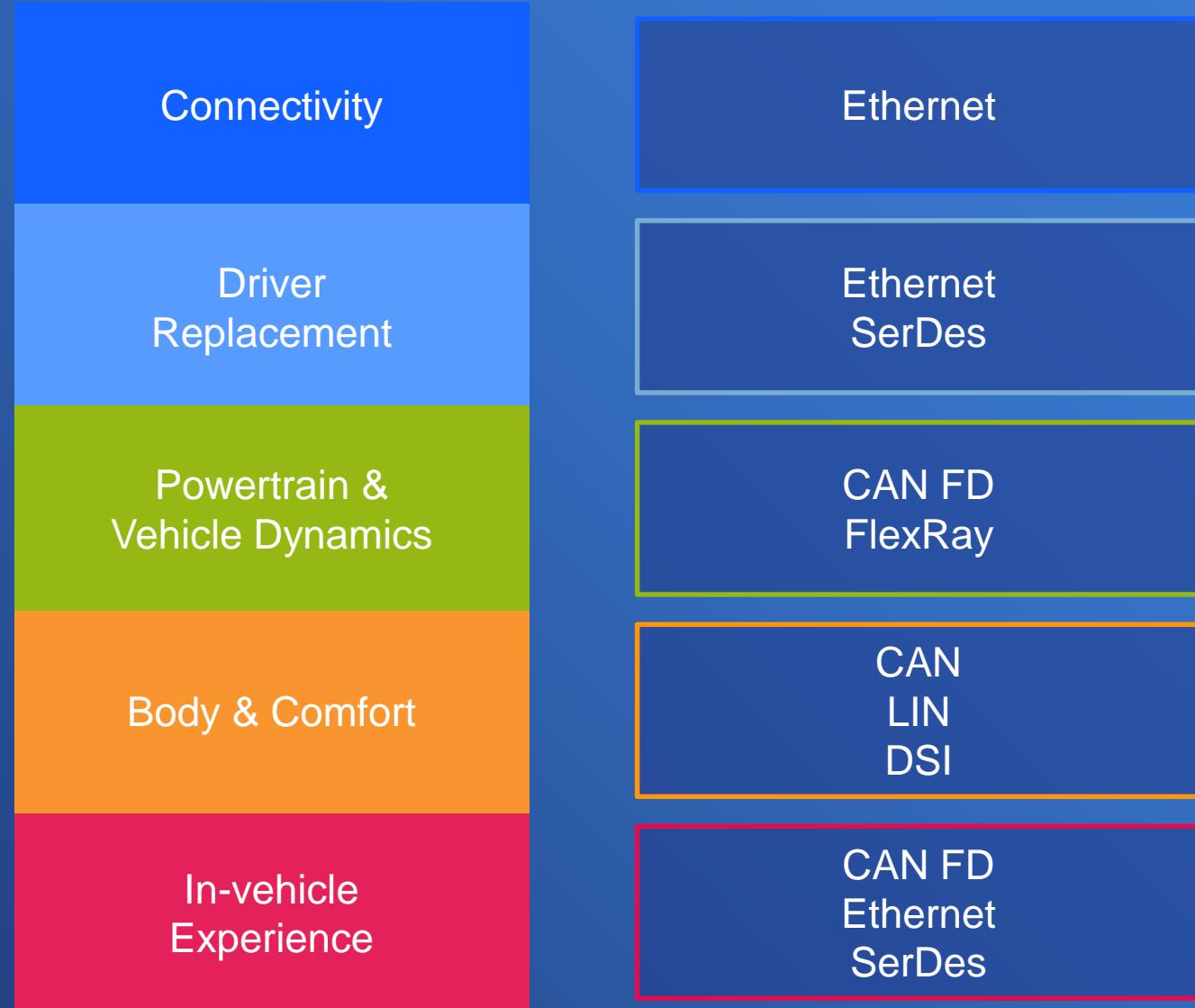
NXP UJA

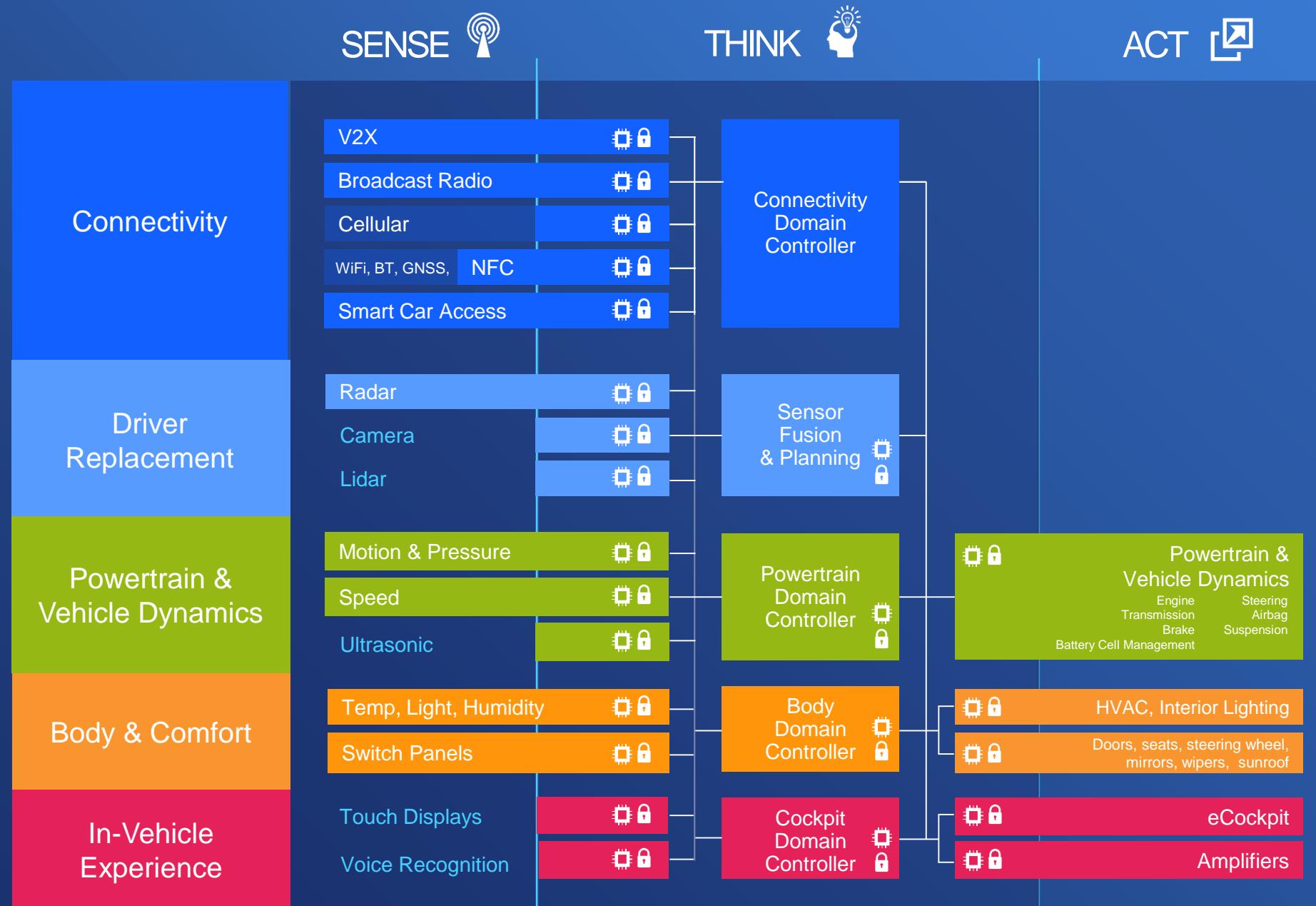
Throttle
Control



Complete Solutions

Different domains, different communication standards

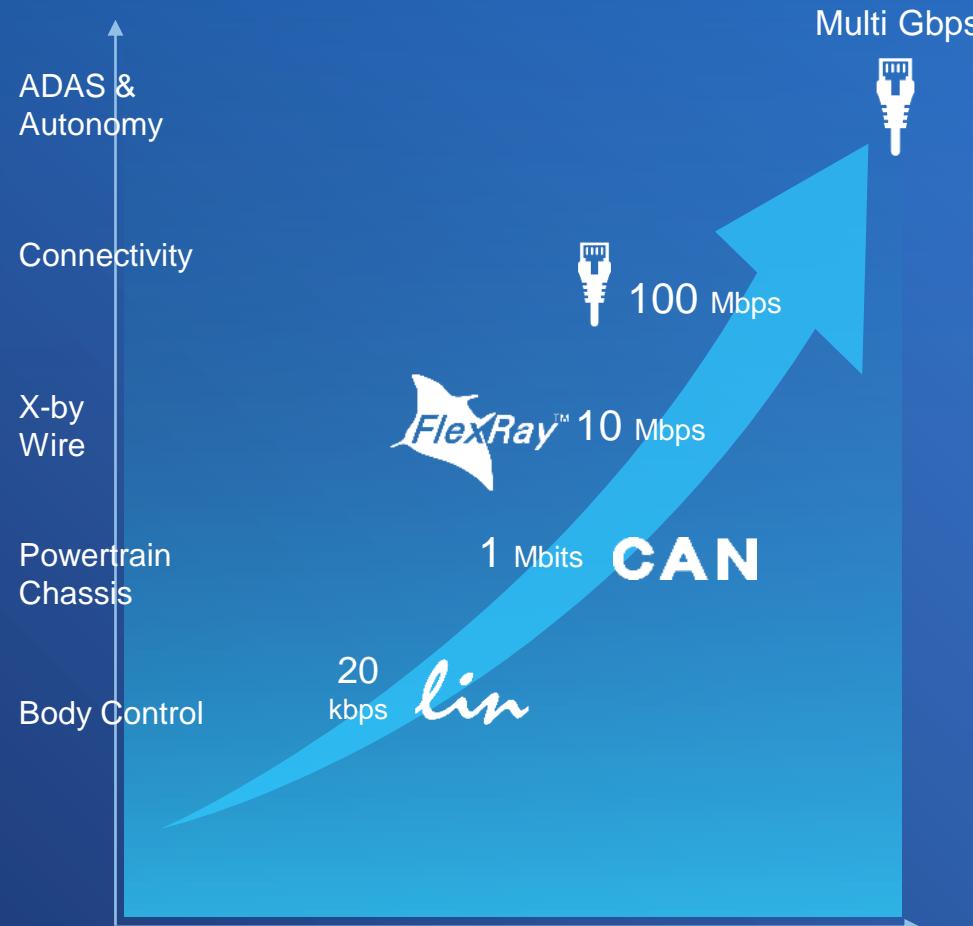




How to Solve the High-Bandwidth Challenge?

High-speed data channels

Connectivity	T-Box to Gateway <1Mbps pre-processed smart sensor >10Gbps + raw data central processing
Driver Replacement	Radar-to-Fusion Box <1Mbps pre-processed smart sensor >10Gbps raw data central processing
Driver Replacement	Camera-to-Fusion Box <1Mbps pre-processed smart sensor >10Gbps raw data central processing
In-vehicle Experience	Head-unit to Displays <1Gbps low definition displays >10Gbps high definition displays
Networks & Gateways	Cross-Domain Backbone <10Mbps Level 1-2 cars >20 Gbps AI-based self-drive cars



...driving new technologies

BASE-T and
SerDes PHYs
10Mbps ... 10Gbps ++

Ethernet Switches
& SoCs

NXP – #1 Secure Automotive Gateway Supplier

Enabling safe and secure networks within smart cars

Target Applications

- Domain Gateways
- Central Gateways
- High-end Body Controllers

NXP Key Areas

- Safety – Scalable functional safety from ASIL-B to ASIL-D
- Security – Secure Hardware Extension (SHE) and Hardware Security Module (HSM)
- Networking – Multiple CAN/LIN, FlexRay, Ethernet interfaces
- Processing – Multi-core processing with hardware acceleration

#1 in Automotive Hardware Security with Strong IP and Broad Portfolio

- 1st secured ETHERNET-based Gateway Processor, 1st to implement SHE security, 1st to production launch HSM security
- Driver of HSM & SHE automotive security standards with European OEMs

Products

Next Gen
(Under Development)

MPC574XG/S32G
Safe and secure multi-core platform HSM with network authentication, tamper detect, and secure boot

MPC564XB/C
Market leading Power Architecture security solutions supporting CSE

Software

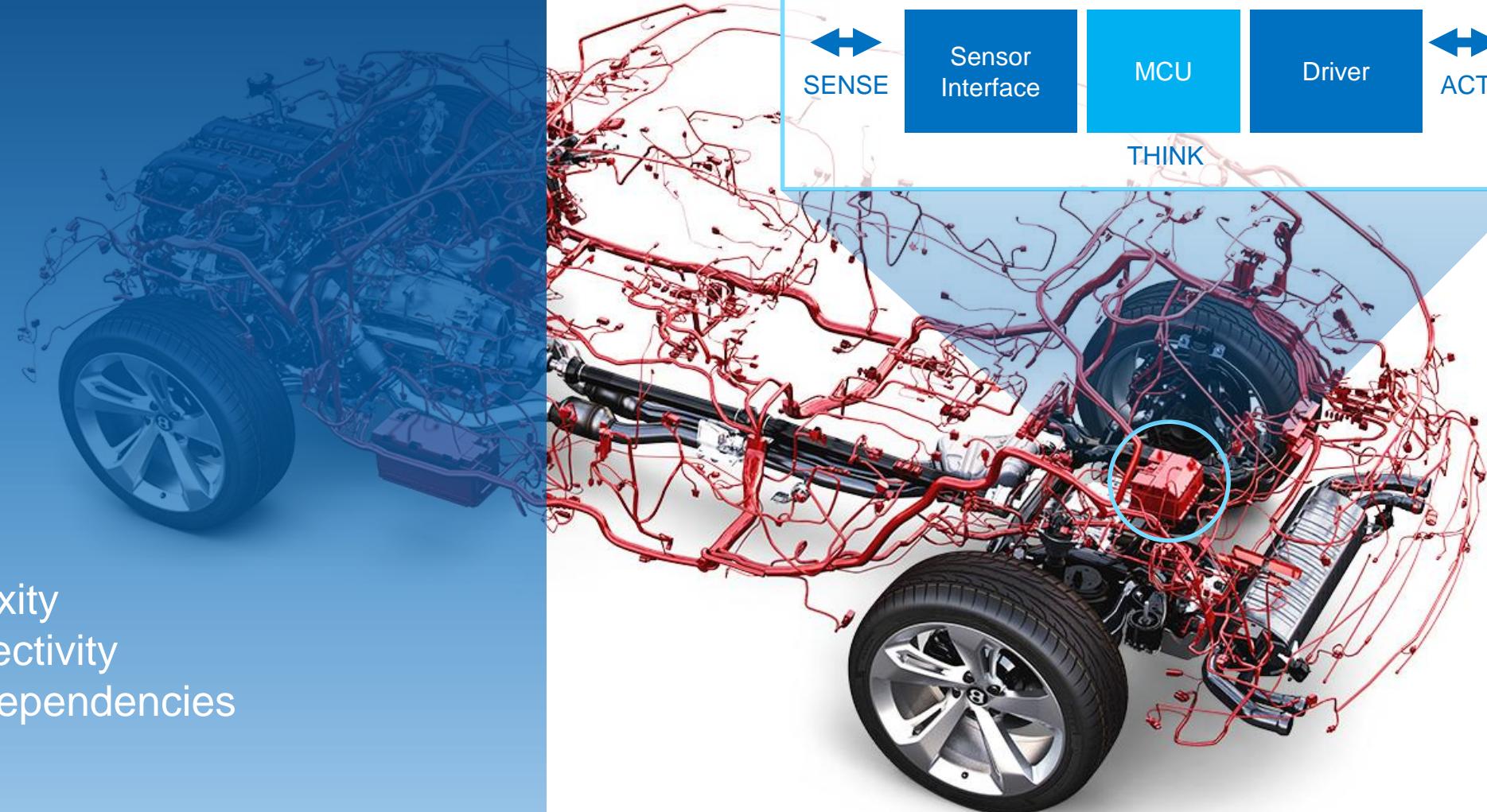
Multi-OS, Secure Platform with Linux Capability

Safe & Secure AUTOSAR Architecture

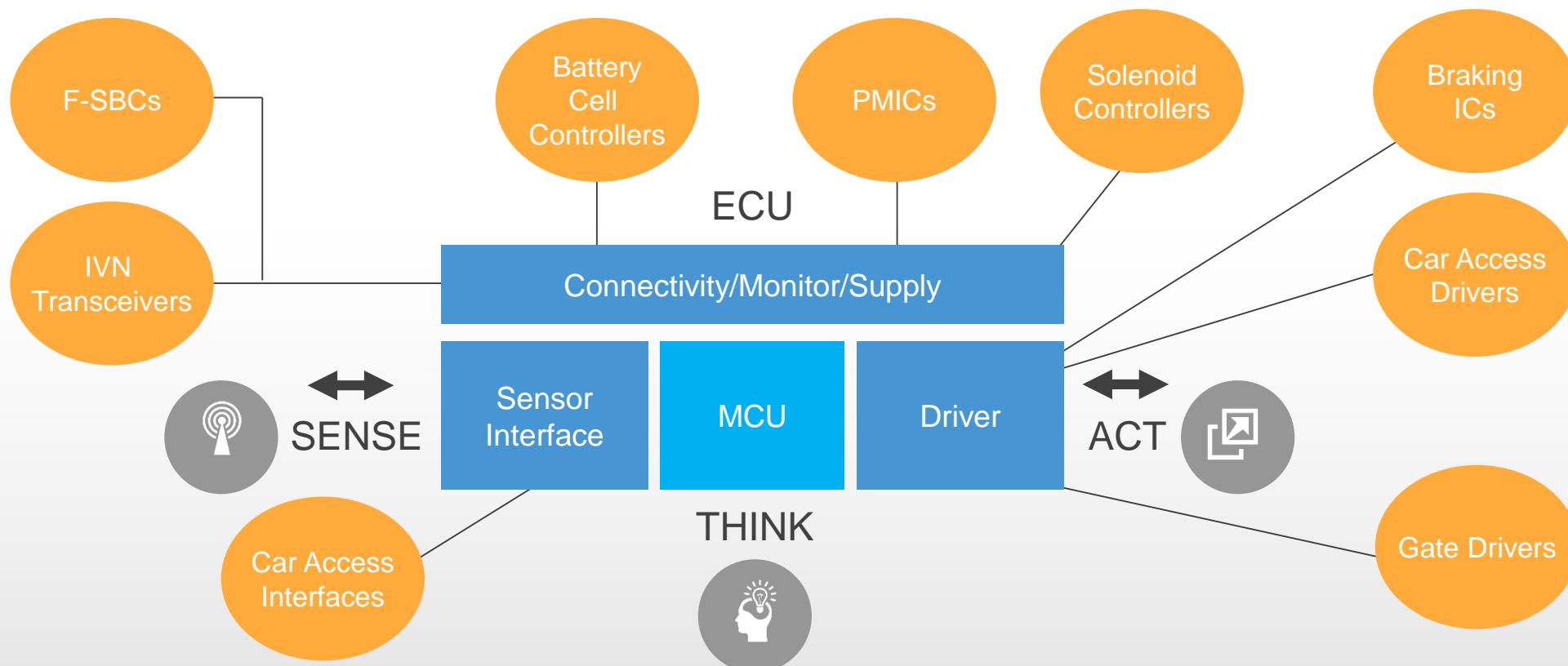
Best-in-Class, Multi-Core with Integral Security

System Domains in Reality

Growing Complexity
Increasing Connectivity
Increasing Interdependencies



NXP Broad ECU Components Portfolio



Optimized System Functionality

Enable the Energy Efficient and Self Driving Car



Assisted Driving



Co-pilot Driving



Automated Driving

Security

Risk of Cyber Security Attacks
Increased Connectivity

Power Efficiency

Manage the Power & Head

Fast Network

High Speed, High Bandwidth

Functional Safety

Fail Safe
Fail Silent
Fail Operational
Fault Tolerant

Controlled Latencies

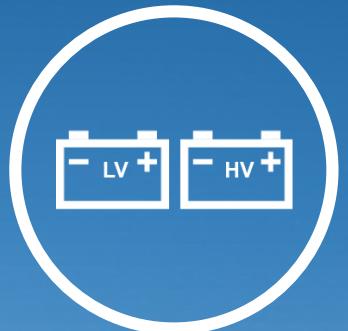
No Delay, Controlled Priorities

Very high
computing power
BlueBox



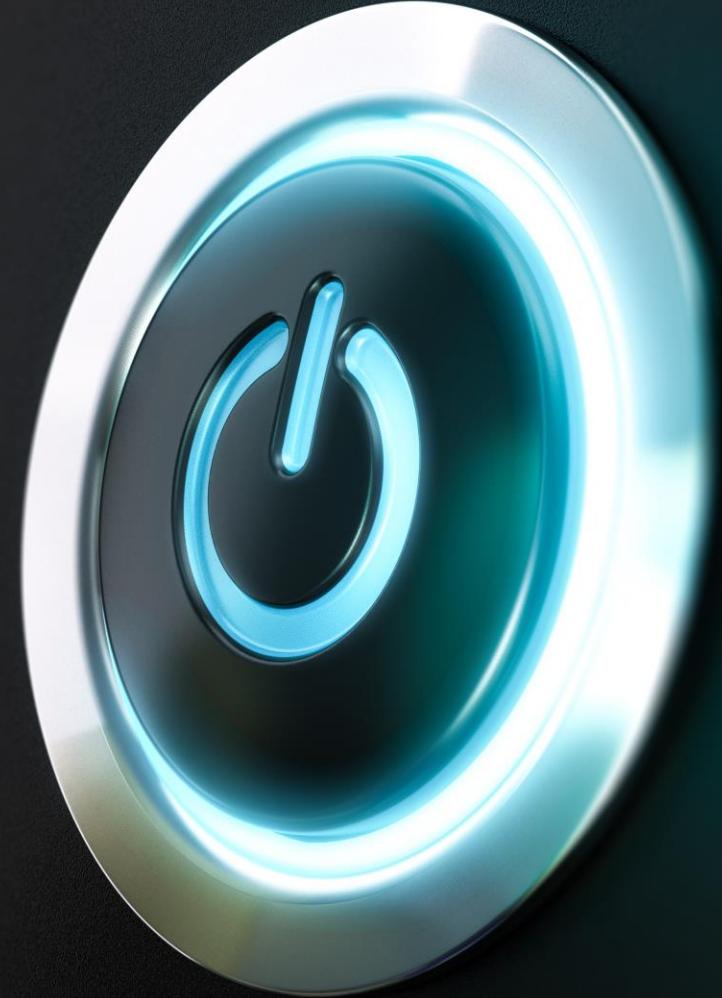
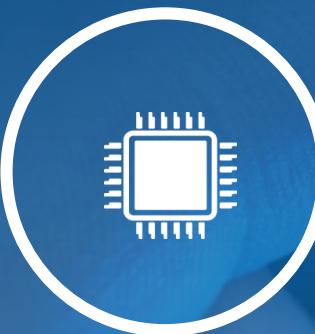
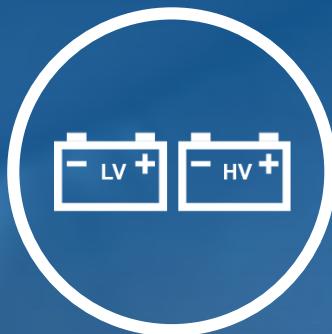
System Play Examples

Battery Management Solutions



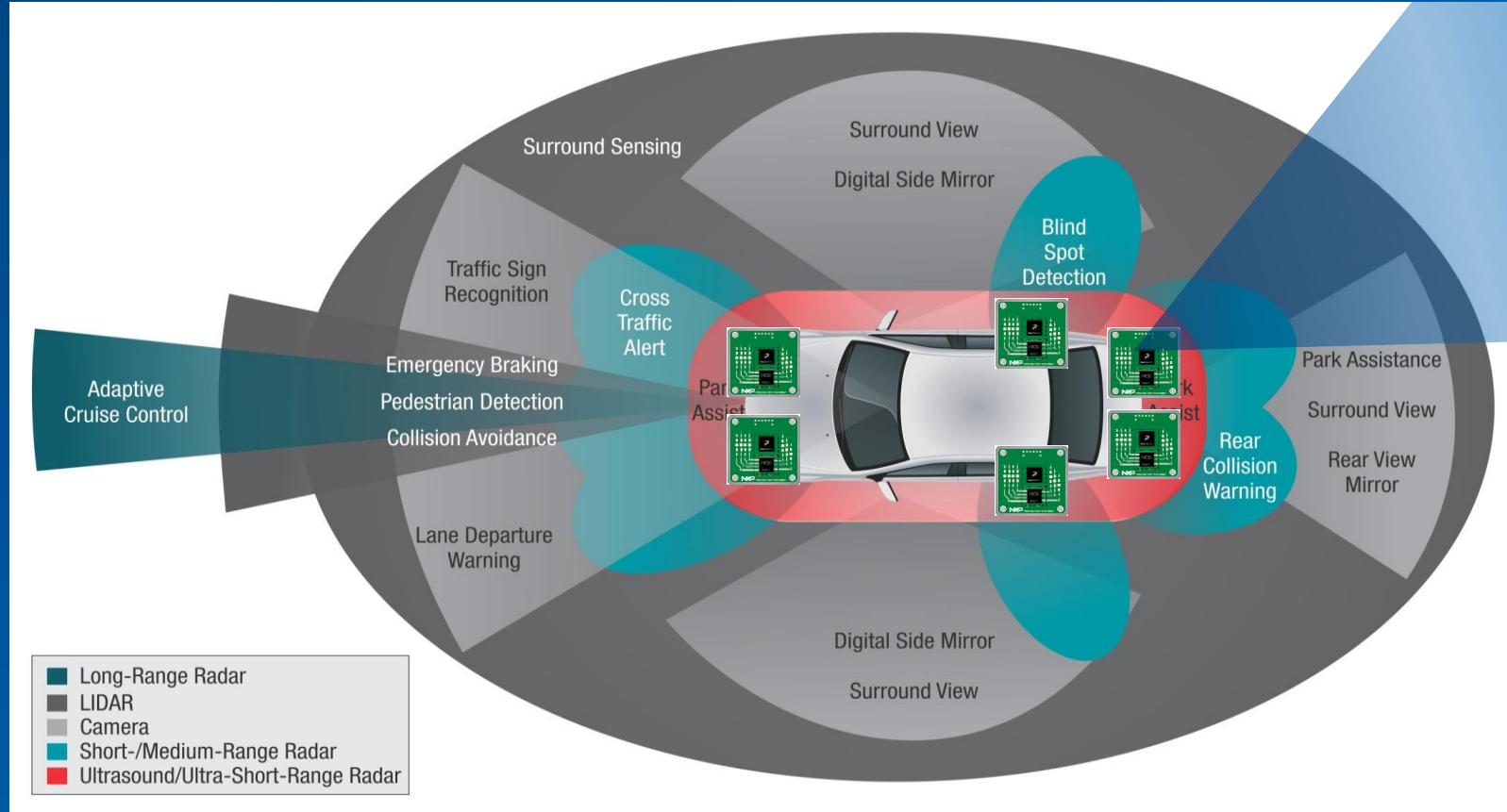
System Play Examples

System Power Solutions



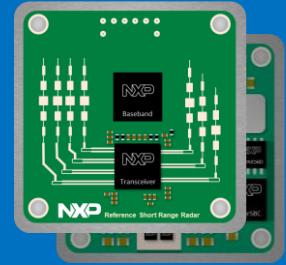
System Power Solutions

ADAS Safety Cocoon



S32R295 Processor
TEF8102 Radar Front End
FS83xx PMIC
TJA1057 High Speed CAN

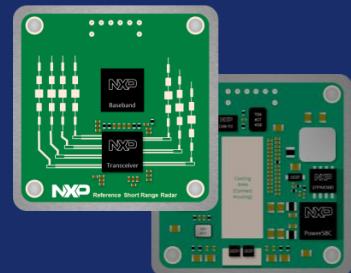
1st Generation



Size: 1600 mm²
Power: 4.2W

- 25%
Size & Power

Next Generation



Size: 1220 mm²
Power: 3.2W

NXP - Making Safe & Secure Mobility a Reality

Solution Portfolio



The most complete system solutions for fastest time to market and scalability.

Innovation Power



In-house high performance processing, security and mobile eco-system capabilities.

Safe & Secure



Zero defect quality. Leading with security and functional safety.

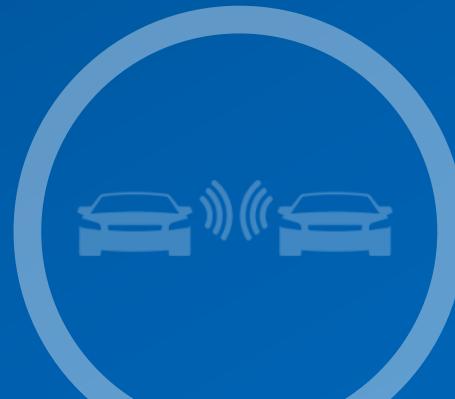


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