SAFE AND SECURE MOBILITY

Keys to Making Level-3 Autonomous Drive Safe and Secure

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AGENDA

- Automotive Market
- 5 Domains
- Functional Safety
- Security

INDUSTRY MEGA TRENDS

AN INCREDIBLE OPPORTUNITY

CONNECTIVITY

AUTONOMY

ELECTRIFICATION

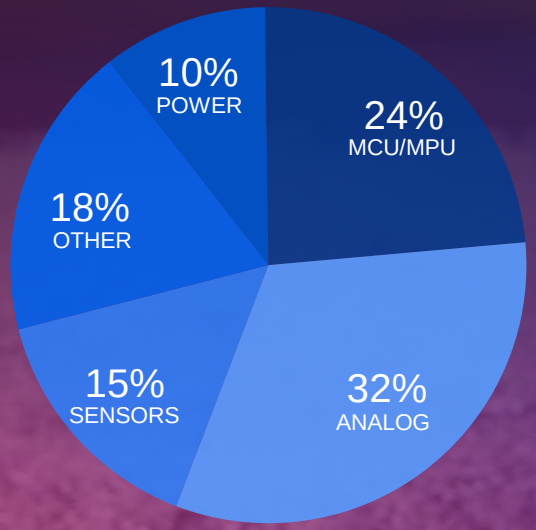
SAFE AND SECURE MOBILITY

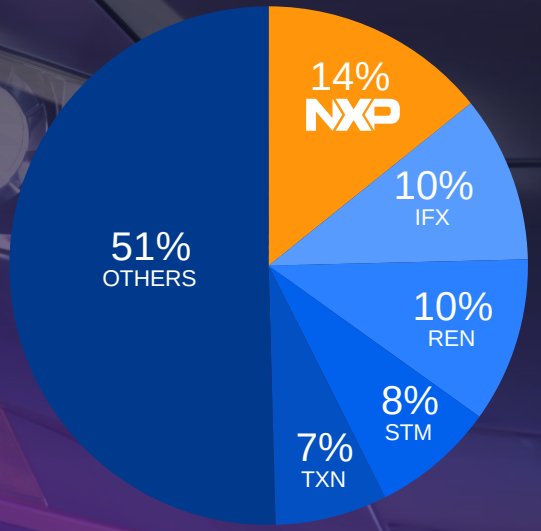
MORE THAN TRIPLING THE SEMI VALUE PER CAR

NXP IS GLOBAL #1

WITH SECURE END-TO-END HARDWARE AND SOFTWARE SOLUTIONS

TECHNOLOGY LEADERSHIP + APPLICATIONS FOCUS = **#1 IN AUTO** SEMICONDUCTORS





#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 2016 Global Auto Semi
#1 China, North America, Europe

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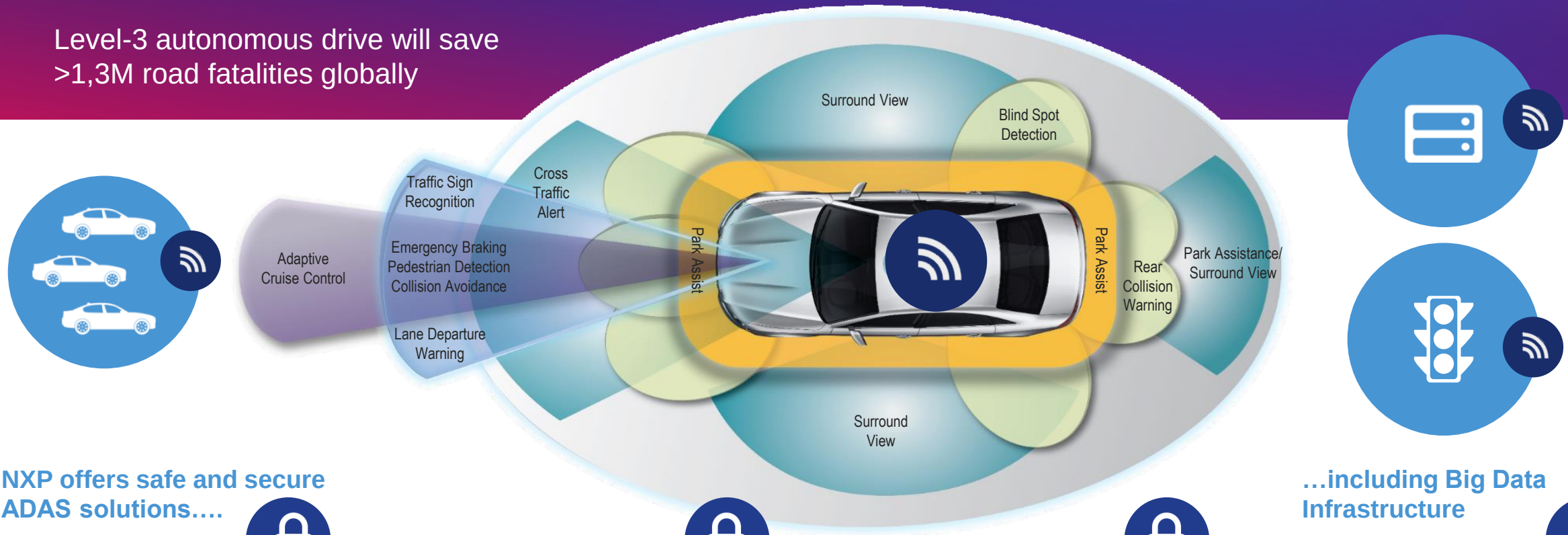
TOMORROW'S VEHICLES: SELF-DRIVING, CONNECTED ROBOTS

Level-3 autonomous drive will save
>1,3M road fatalities globally



NXP offers safe and secure ADAS solutions….

SENSE	Secure Network	THINK	Secure Network	ACT
Radar Vision Secure V2X		Processing Sensor Fusion Security		Powertrain Chassis Braking

…including Big Data Infrastructure

BIG DATA
Digital Networking Infrastructure Security

NXP LEADS DOMAIN BASED VEHICLE ARCHITECTURES

Connectivity

Driver Replacement

Powertrain & Vehicle Dynamics

Body & Comfort

Driver Experience

Networks & Gateways

COMPLETE SOLUTIONS

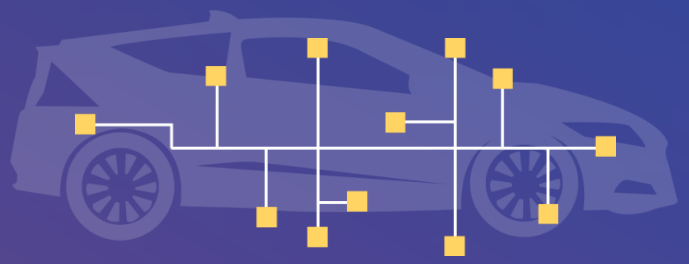
FASTER TIME TO MARKET
FULL SCALABILITY

NXP LEADS DOMAIN BASED VEHICLE ARCHITECTURES

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

FUTURE NETWORKS DRIVE FUTURE ARCHITECTURES

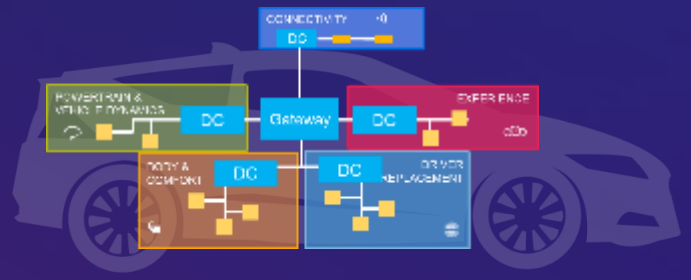
Traditional



Flat hierarchy

- Separate ECUs w/ custom MPUs
- Point to Point connections
- Limited Security
- Low bandwidth data transfer
- System cost reduction

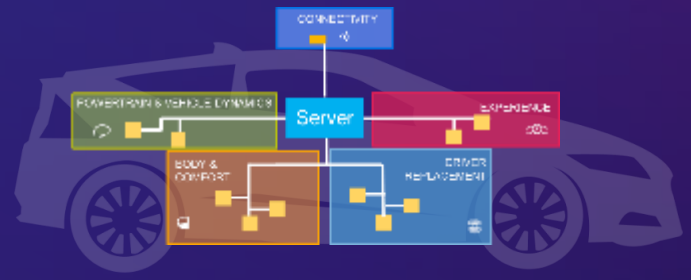
Domain Computing



Domains separated by gateway

- Ethernet backbone
- Preprocessing reduces data transfer
- Separation of concern for complex networks (HW & SW)
- Upgradeability and SW scalability

Centralized Computing



Central server hosts >1 domain

- Cost
- Fewer ECUs
- Flexible use of compute power
- Large bandwidth for data transfer
- SW virtualization and hypervisor

ADVANCED SYSTEM FUNCTIONALITY: DRIVEN BY DEMAND FOR ACCIDENT-FREE AUTOMATED VEHICLES

Assisted Driving

1

Co-Pilot Driving

3

Automated Driving

5

Fast Network

High Speed, High Bandwidth

Security

Risk of Cyber Security Attacks
Increased Connectivity

Functional Safety

Fail Safe
Fail Silent
Fail Operational
Fault Tolerant

Very High Computing Power

Blue Box

Drastic Power Increase

High Power Efficiency

Controlled Latencies

No Delay
Controlled Priorities

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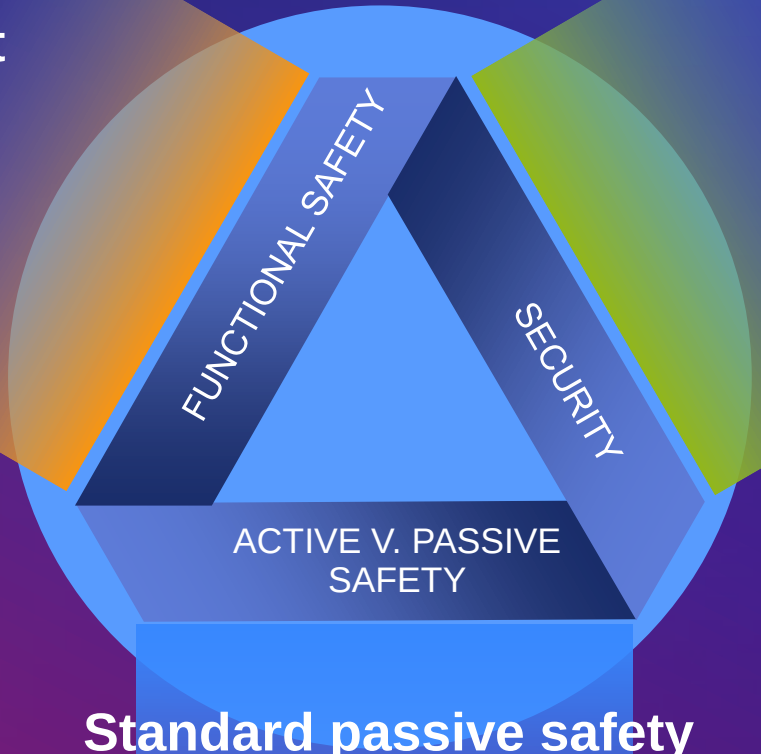
SAFETY VERSUS SECURITY

Functional Safety looks at unintentional hazards
Predictable and regular

Security looks at intentional hazards
Unpredictable and irregular



Standard passive safety systems today
Active safety becoming more pervasive tomorrow

WHY FUNCTIONAL SAFETY IS IMPORTANT FOR AUTOMOTIVE

Trust – knowing your car will do what it's meant to do

Standardization – platform consolidation and system harmonization

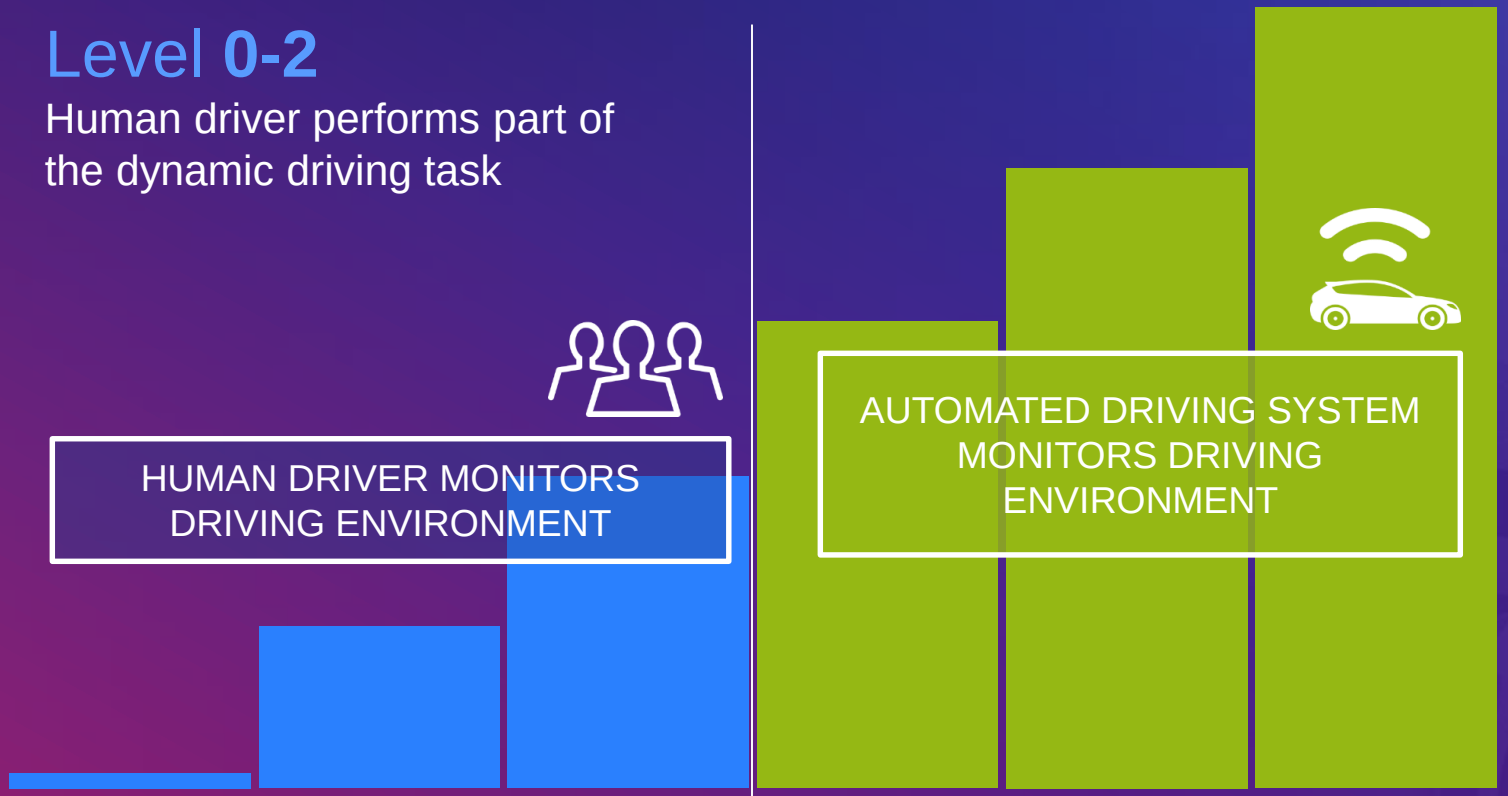
Trends – autonomous driving, electric vehicles

Legal – question of responsibility

WHAT IS DRIVING FUNCTIONAL SAFETY TODAY?

Level **0-2**

Human driver performs part of the dynamic driving task



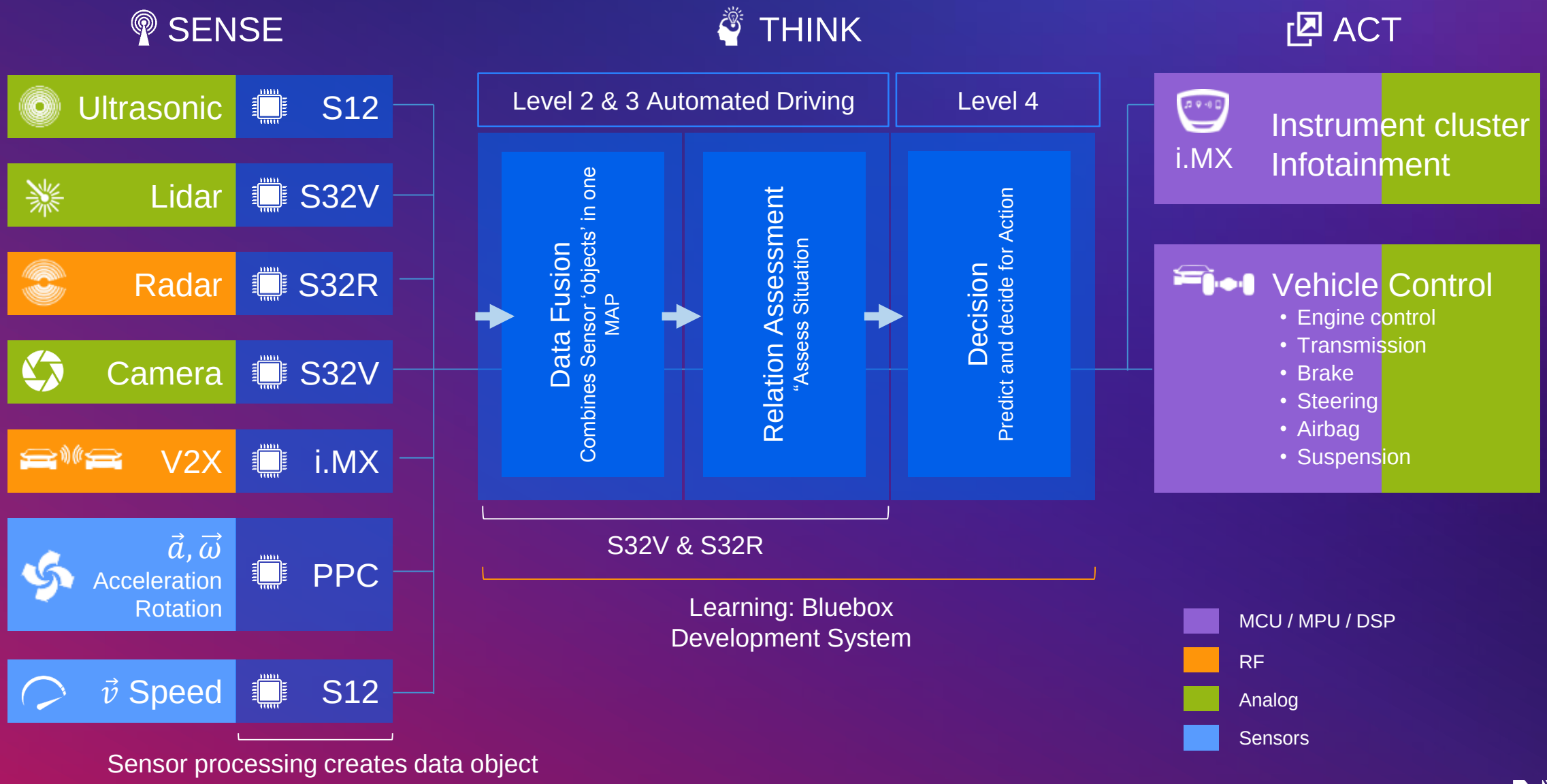
SAE standard J3016

Level **3-5**

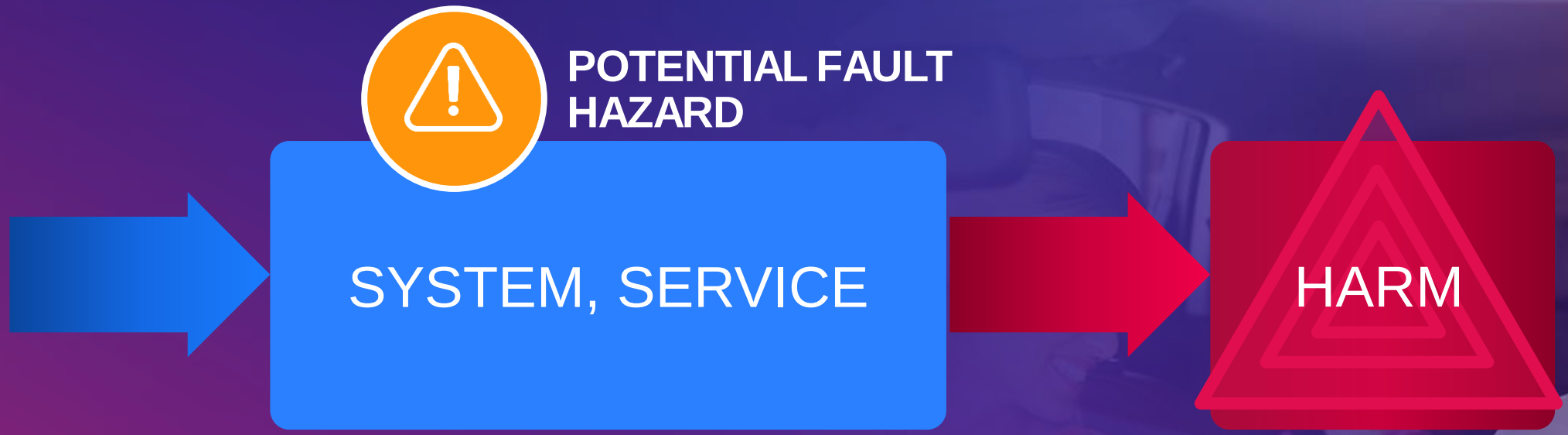
Automated driving system performs the entire dynamic driving task

Needs more performance and towards fail operational safety (Beyond ASIL D as defined by ISO 26262)

SENSOR FUSION AND HIGHLY AUTOMATED DRIVING



SO WHAT DOES FUNCTIONAL SAFETY ACTUALLY MEAN?



- Prevents risks of electronic system malfunctions
- Measures failures, mitigates impact, predict effects
- Industry-defined standard: ISO 26262 for EE systems

QUANTIFY A RISK: AUTOMOTIVE SAFETY INTEGRITY LEVEL (ASIL) DEFINITION

Severity

How much harm is done?

Exposure

How often is it likely to happen?

Controllability

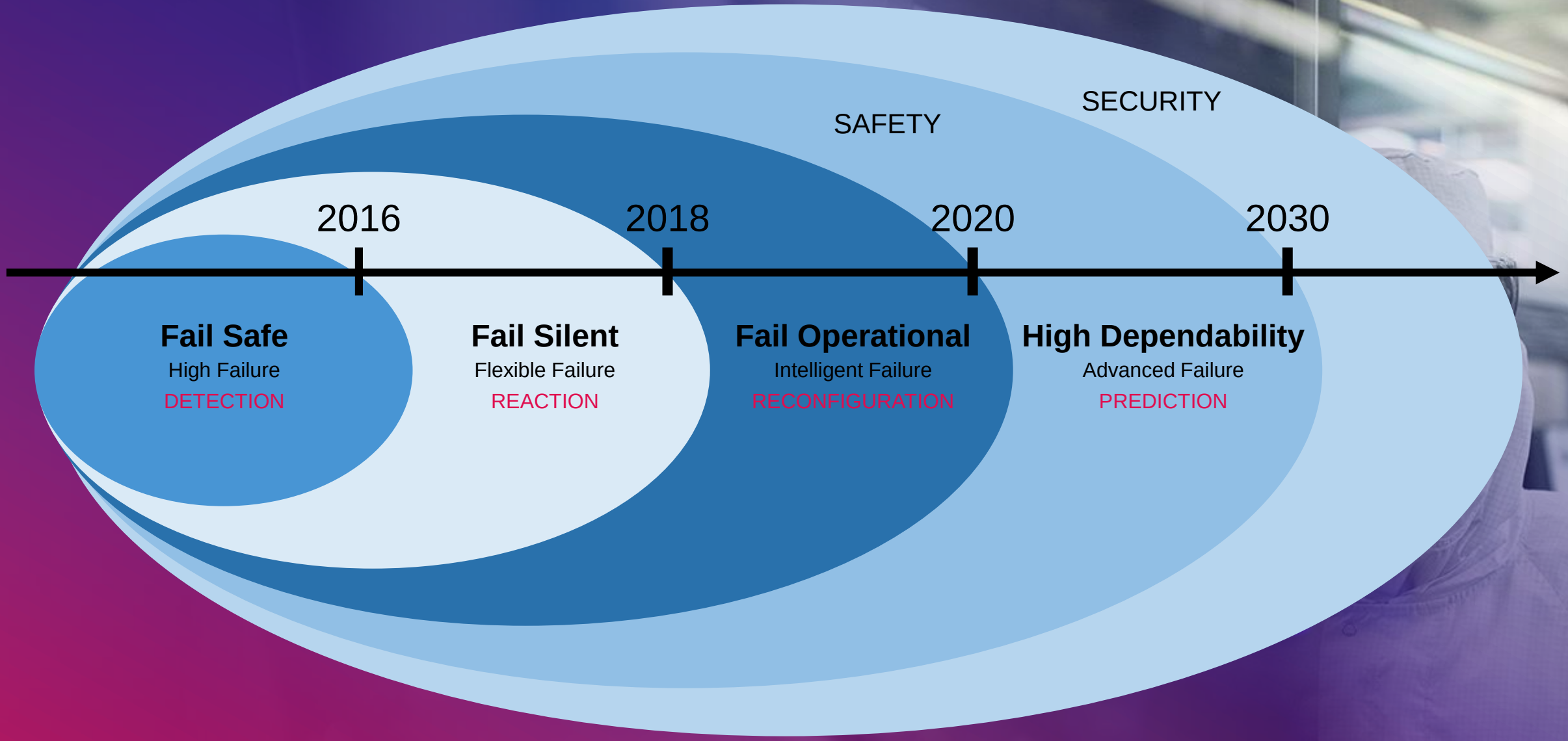
Can the hazard be controlled?

ASIL

Severity	Exposure	Controllability SIMPLE	Controllability NORMAL	Controllability DIFFICULT
LIGHT	E1→E4	QM	QM →A	QM→B
SEVERE	E1→E4	QM →A	QM→B	QM→C
FATAL	E1→E4	QM→B	QM→C	A→D

(QM: "quality managed" → no requirements from standard applied explicitly)

LEADING THE INDUSTRY TOWARDS ZERO ACCIDENTS



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

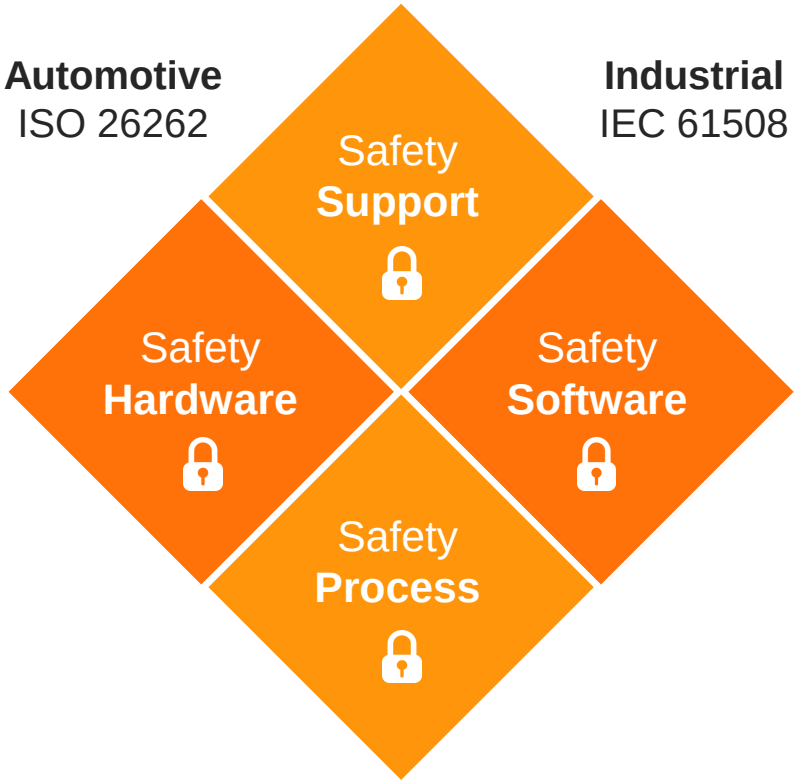
NXP'S SAFE ASSURE PROGRAM

- Simplify customer experience
- Optimize customer R&D efficiency
- Reduce risk of harm
- Safety starts with quality

Functional Safety Standards

Automotive
ISO 26262

Industrial
IEC 61508

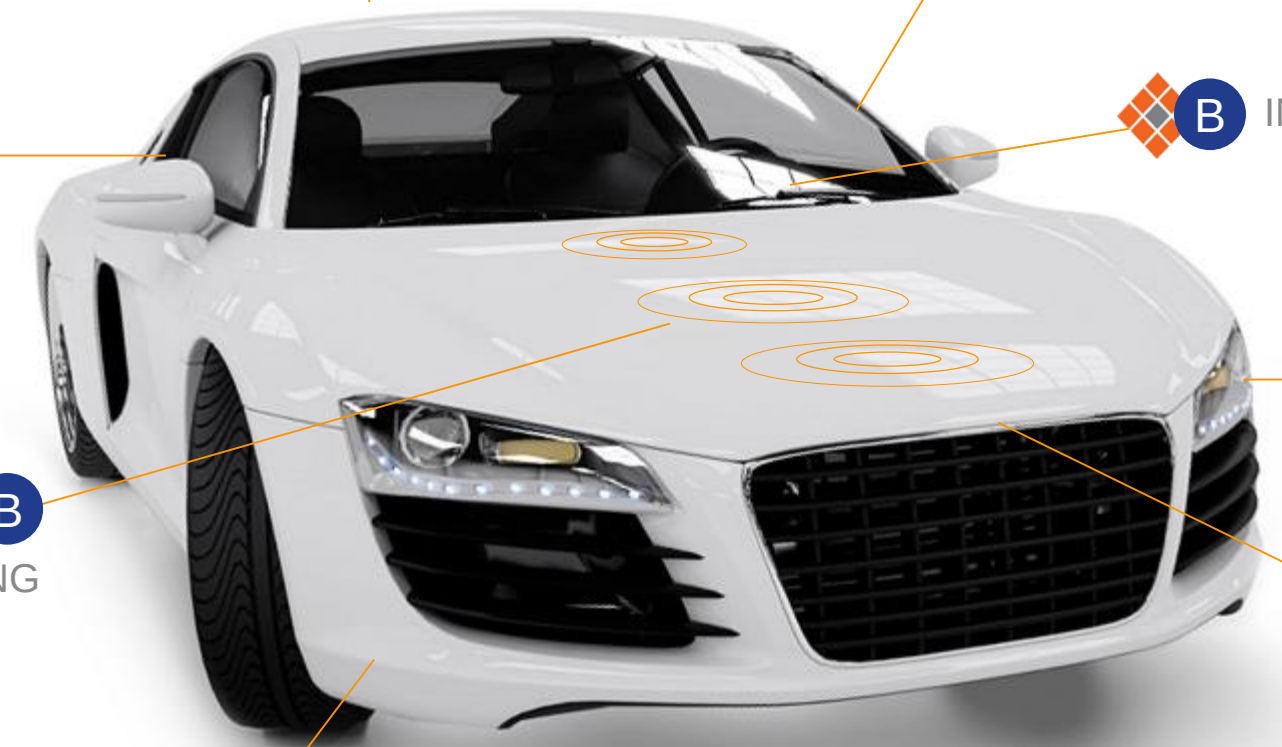


NXP Quality Foundation

SAFE ASSURE
by NXP

NXP FUNCTIONAL SAFETY SYSTEM SOLUTIONS

SAFE ASSURE™ by NXP



D ADAS/ RADAR: SENSOR FUSION

B SECURE CAR ACCESS

B INFOTAINMENT

D POWERTRAIN ELECTRIFICATION

D CHASSIS

B VEHICLE NETWORKING

D SAFETY

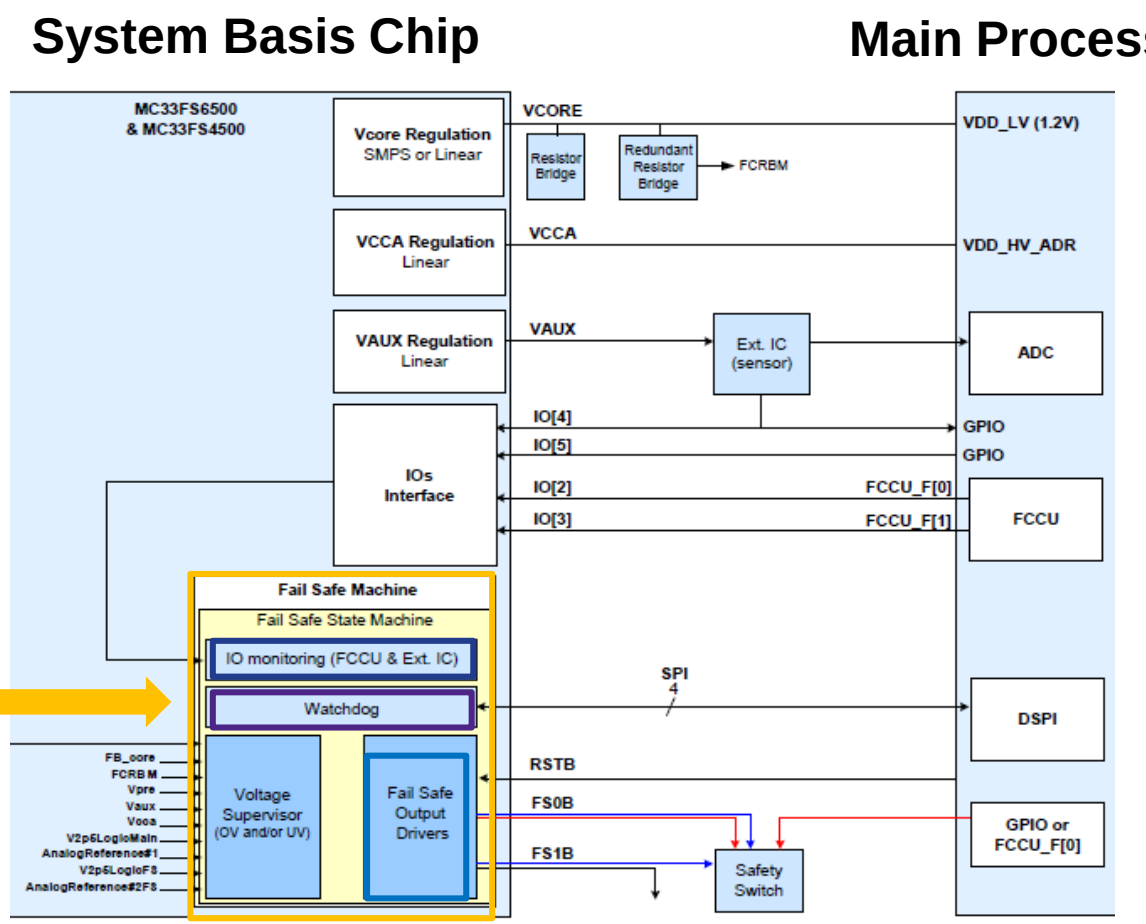
BODY B

FS6500/4500: SECOND GENERATION FUNCTIONAL SAFETY SBCS

An example of how to design with Functional Safety

The 2nd Generation Functional Safety-SBC integrates a Fail Safe State Machine:

- Physical & electrical independance (ASILD)
- Power Management Monitoring Unit (UV/OV)
- I/O Monitoring Unit
- Watchdog



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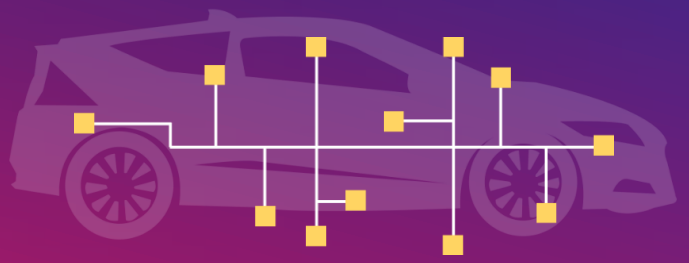
SECURITY FOUNDATION FOR THE CONNECTED CAR

- Protect privacy
- Prevent unauthorized access
- Increase safety

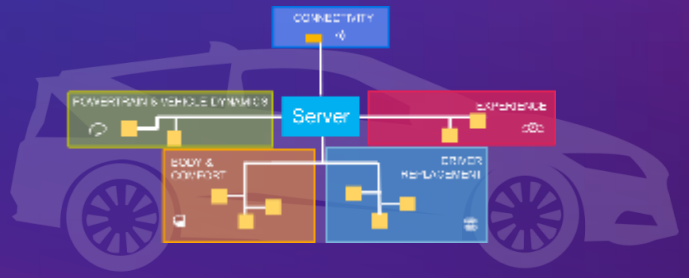
AUTOMOTIVE SECURITY – WAY FORWARD



TODAY

APPLY BEST PRACTICES:

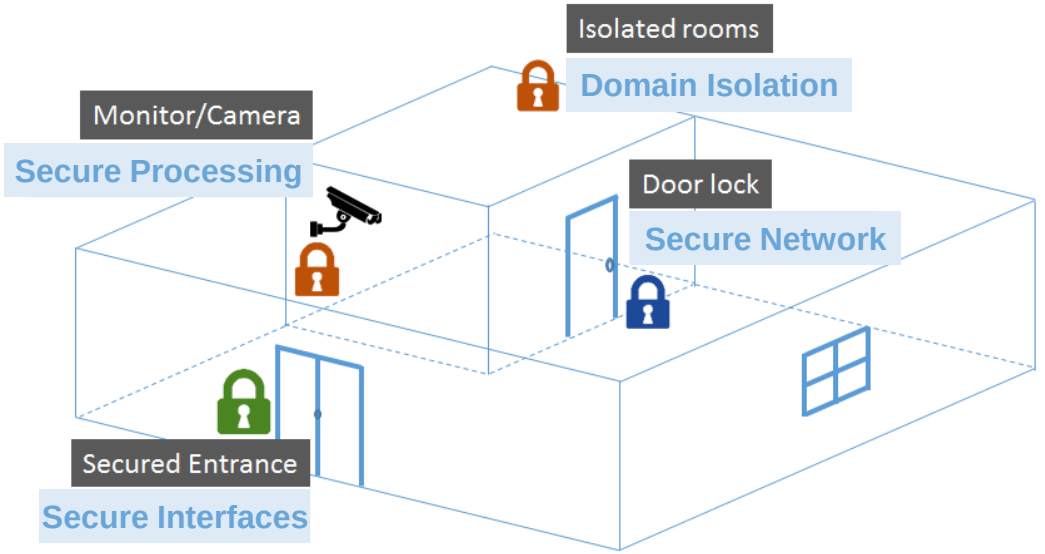
- Security-by-design & Privacy-by-Design (as opposed to being an afterthought)
- Lifecycle Management (incl. FOTA)



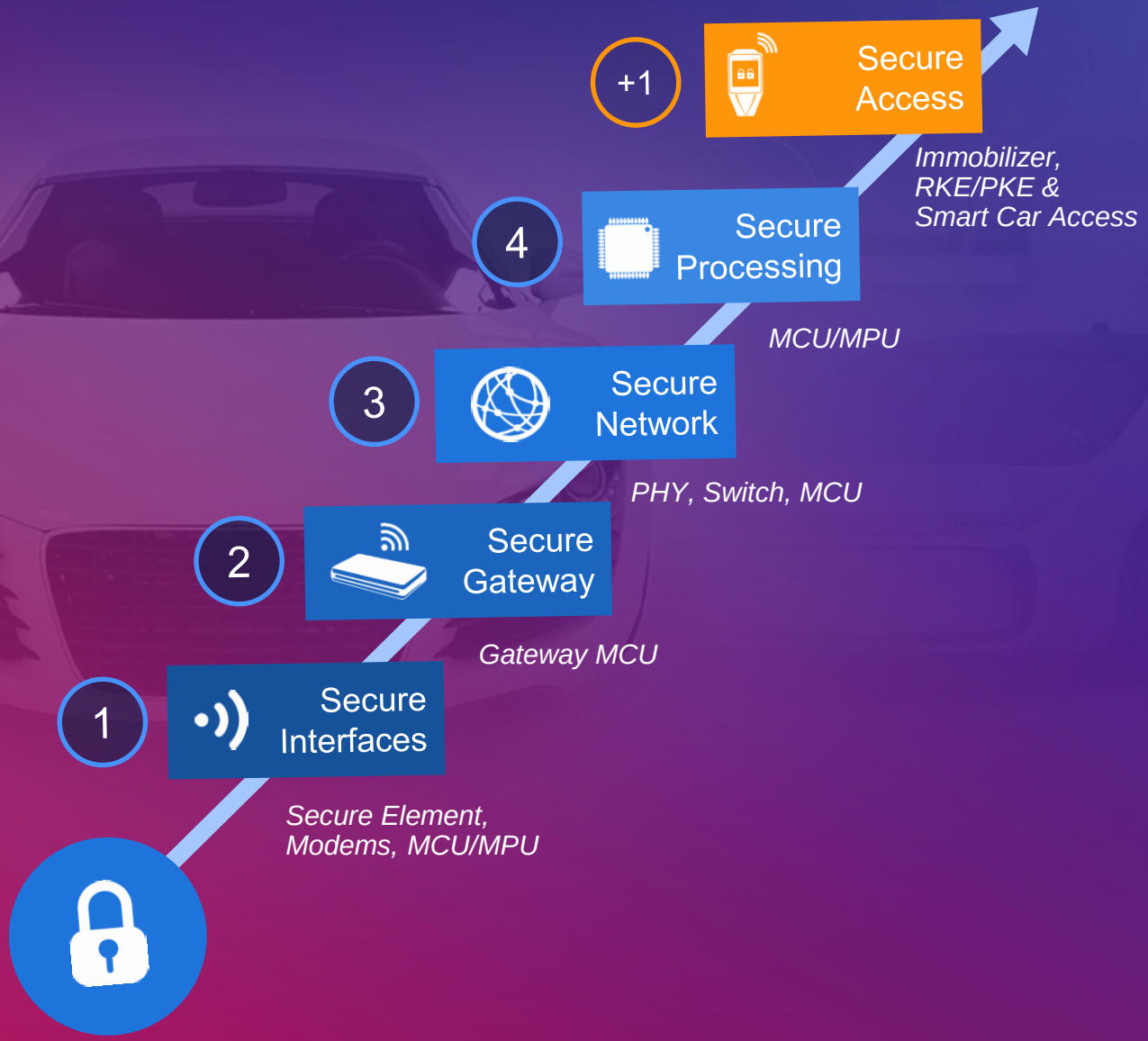
FUTURE

Essential element:
Defense-in-Depth approach

- Multiple layers of protection, at different levels in the system
- To mitigate the risk of one component of the defense being compromised or circumvented



NXP OFFERS MOST SCALABLE AUTO CYBERSECURITY SOLUTION



NXP #1 Automotive Hardware Security

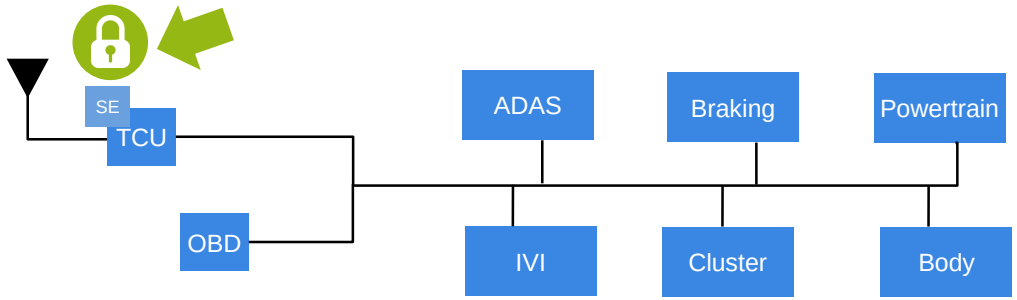
4-Layer security solution

1. Secure wireless interfaces – HW crypto
2. Secure gateway – separation of concerns
3. Secure in-vehicle network communication
4. Secure application processing

CORE SECURITY PRINCIPLES

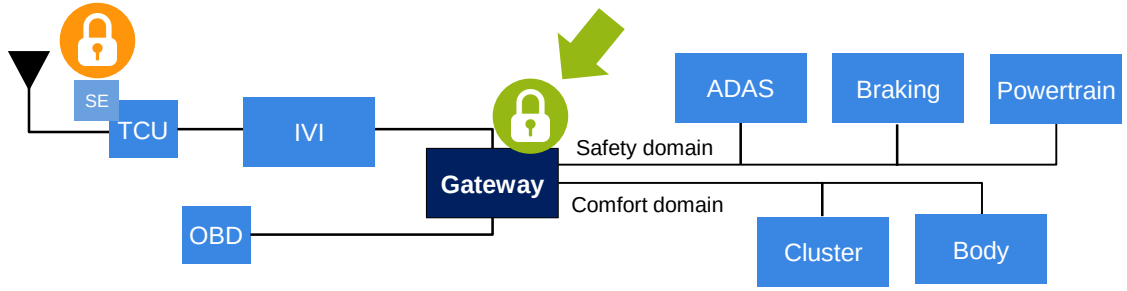
Secure External Interfaces

Secure M2M authentication, secure key storage



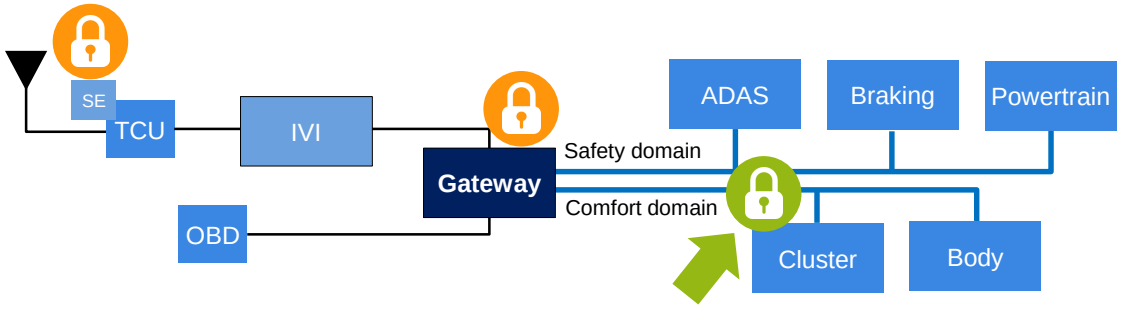
Secure Domain Isolation

Domain isolation, firewall/filter, centralized intrusion detection (IDS)



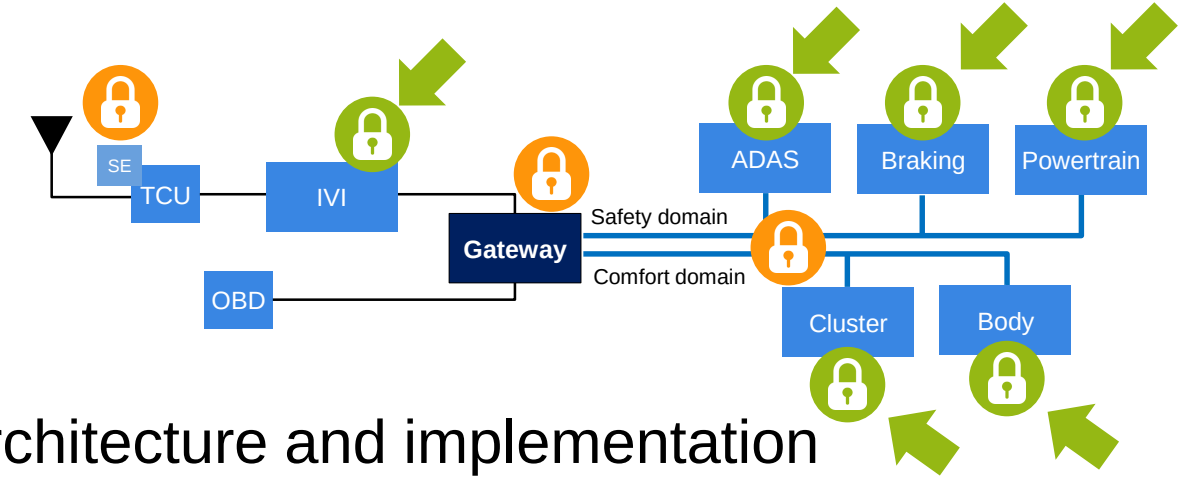
Secure Internal Communication

Message authentication, CAN ID killer, distributed intrusion detection



Secure Software Execution

Secure boot, run time integrity, Over-the-Air updates



All essential elements for any architecture and implementation

CONCLUSION

- Today’s traditional view of Automotive is converging towards Safe & Secure Mobility
- The trend towards autonomous driving is significantly increasing the compute power within the future cars
- To increase the trust of highly automated systems, Functional Safety & Security become essential elements of the self-driving car
- Functional Safety looks at unintentional hazards, while Security looks at intended hazards
- Both elements must become an integral part of the car’s electronics architecture
- NXP offers a scalable auto cybersecurity solution and high performance functional safety systems to make the autonomous car a reality


NXP
SECURE CONNECTIONS
FOR A SMARTER WORLD