Extending Communication Beyond Vehicles

The Road To Automated Driving

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NXP SEMICONDUCTORS

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NXP - A NEW POSITION OF STRENGTH

freescale™

- ✓ **50+** year history
- ✓ **17,000** employees
- ✓ **$4.6b** revenue 2014
- ✓ **$840m** R&D

NXP

>$10B
IN ANNUAL REVENUE

~45,000
EMPLOYEES

35+
COUNTRIES

11,000+
ENGINEERS

9,000+
PATENT FAMILIES

4th Largest
SEMICONDUCTOR COMPANY GLOBALLY[1]

NXP

- ✓ **50+** year history
- ✓ **28,000** employees
- ✓ **$5.6b** revenue 2014
- ✓ **$725m** R&D

[1] All financial figures are based on trailing twelve month reported information; R&D expense are non-GAAP

NXP

CONTENT

Towards „Fully-automated Driving“

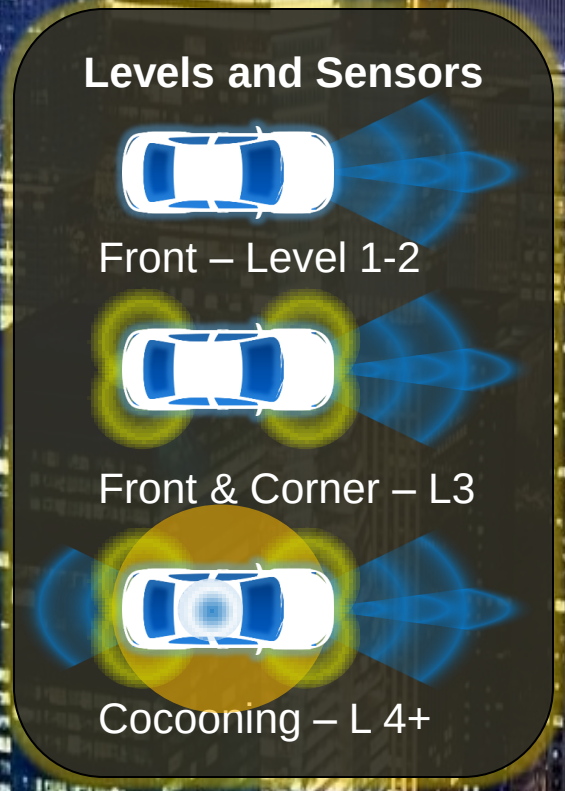
- Automated Driving and Smart System – Trends
- Communication Architectures – Evolution
- V2X Secure Communication – Essentiality
- Secured Communication – Urgency
- Requirements on Secured Car Communication – Outlook

AUTOMATED DRIVING

TRENDS:

MULTIPLE PLAYERS

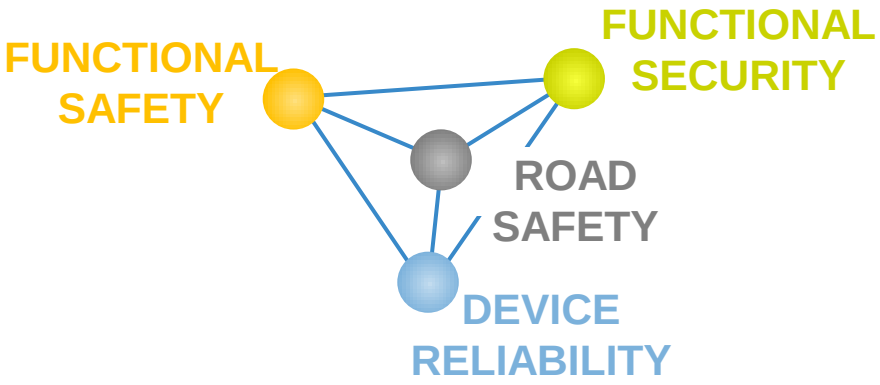
- *Car makers worldwide are presenting and testing prototypes of highly automated vehicles.*
- *IT companies are entering Auto value chains with self-driving concept cars.*
- *Politics is debating about data security, robot ethics, connectivity and need for infrastructures.*

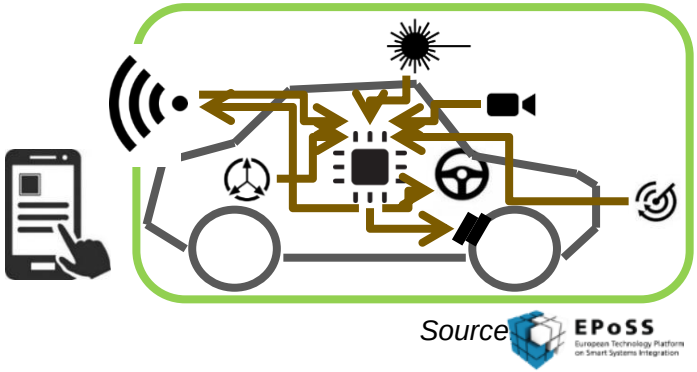


SECURE CONNECTIONS FOR A SMARTER WORLD

TOMORROW: AUTOMATED DRIVING

NEED OF SMART & ROBUST SYSTEM

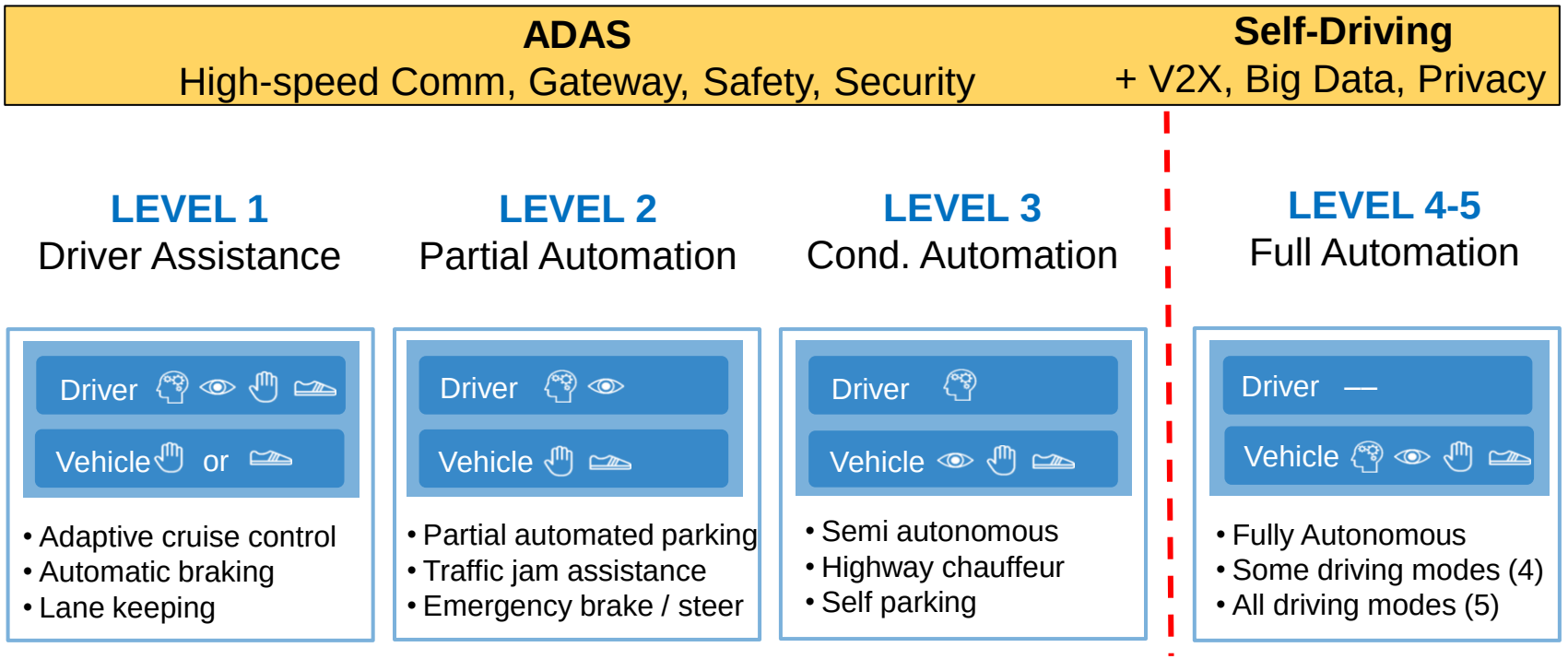




Smart System Element	Effect	Means
Sensors, Actuators, Cognitive Systems	0 accidents by human error	ADAS
Device Reliability	0 component failures	Robust Design
System Integration & Functional Safety	0 accidents by system failures	ISO26262
Comm. System & Functional Security	0 accidents by system hacks	Secure Comm.

Content of this Presentation: Secure Communication

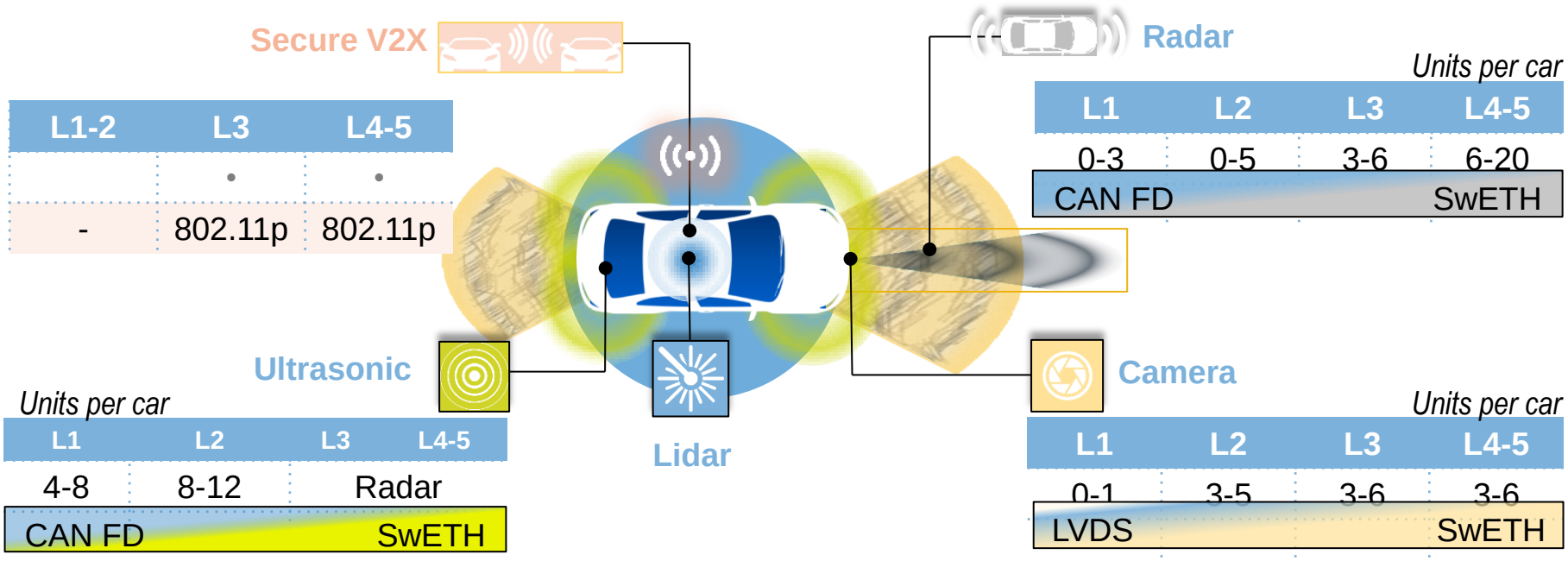
LEVELS OF “DRIVING AUTOMATION” – SAE J3016



V2X is Key Enabler for „Car System“ to get into „Driver Seat“ and Take Decisions

Responsibility for Safe Operation | Control of Complete Vehicle | Control of Steering | Control of Vehicle Speed

AUTOMATION NEEDS COMPLEMENTARY SENSORS



Expected in Future Cars
- CAN, FlexRay, LIN
- Switched Ethernet (SwETH)
- 802.11p

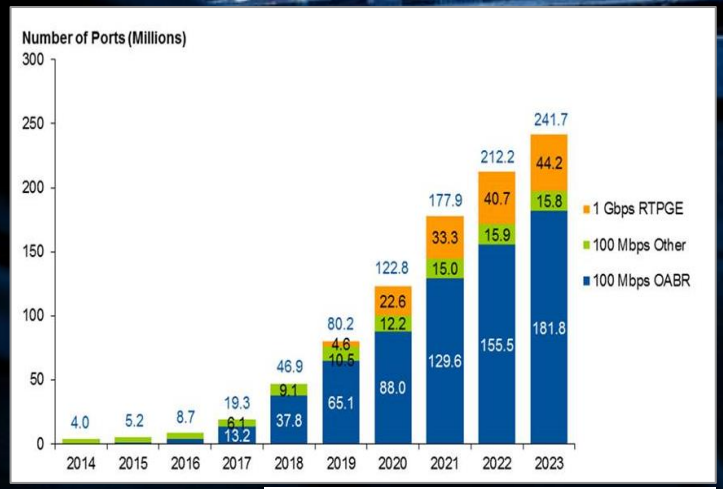
Communication Needs

- Scalability – Add Sensors over Car Lifetime
- Traffic Engineering – Latency, Bandwidth, Throughput
- Switching – Synchronization, Prioritization, Traffic Shaping, Admission Control
- Security – Authentication, Encryption
- Diagnostics

COMMUNICATION ARCHITECTURE

EVOLUTION TOWARDS HIGH-SPEED

- *Automotive Ethernet.*
- *Today, Ethernet enables applications in the car. Yesterday, Ethernet enabled datacom in telecom.*
- *Ethernet is well established and goes well with IP protocol.*



TODAY: THE CONNECTED CAR

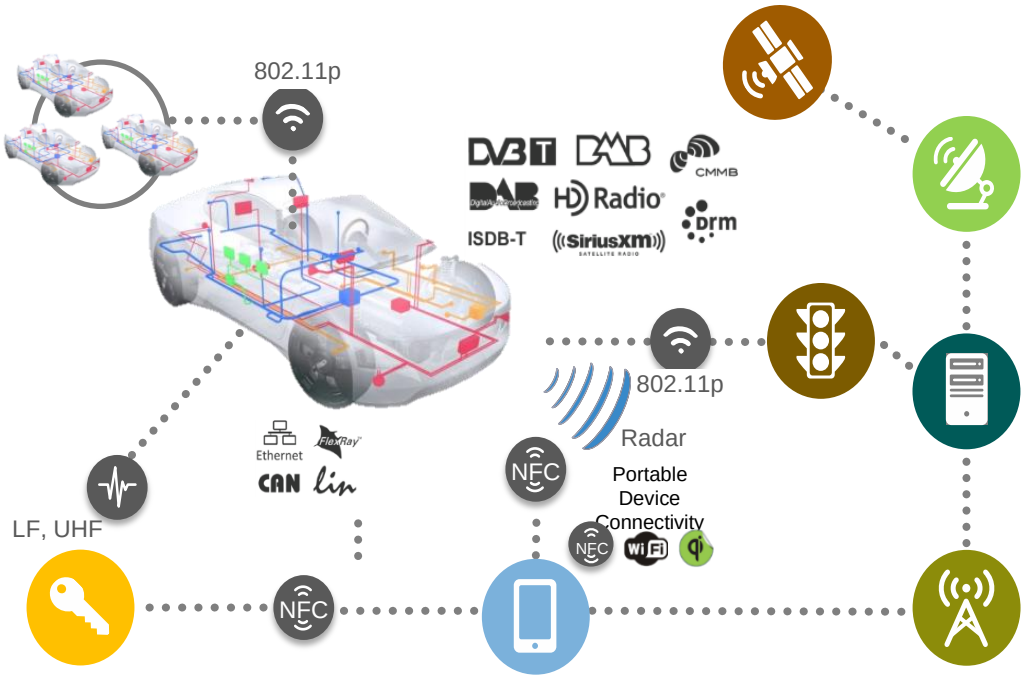
A CLOUD-CONNECTED COMPUTER NETWORK ON WHEELS

A networked computer

- Up to 100 ECUs per car
- Many sensors
- Inter-connected by wires
- More and more software

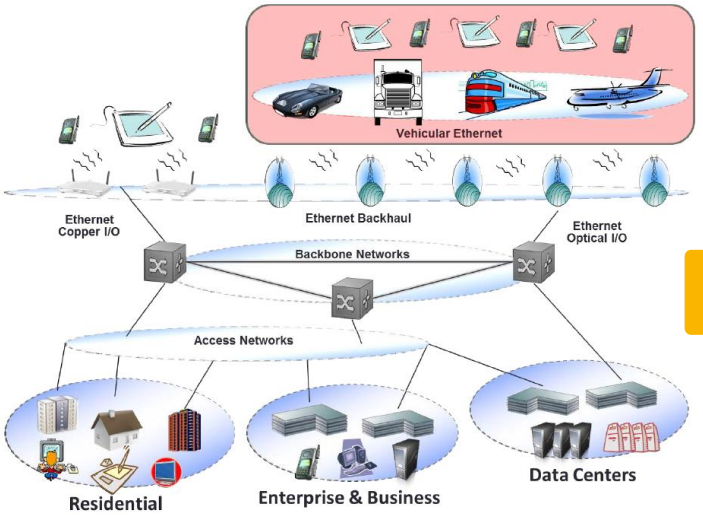
Increasingly connected to

- Vehicles & infrastructure
- User devices
- Cloud services



EVOLVING TRENDS FOR SECURE COMMUNICATION

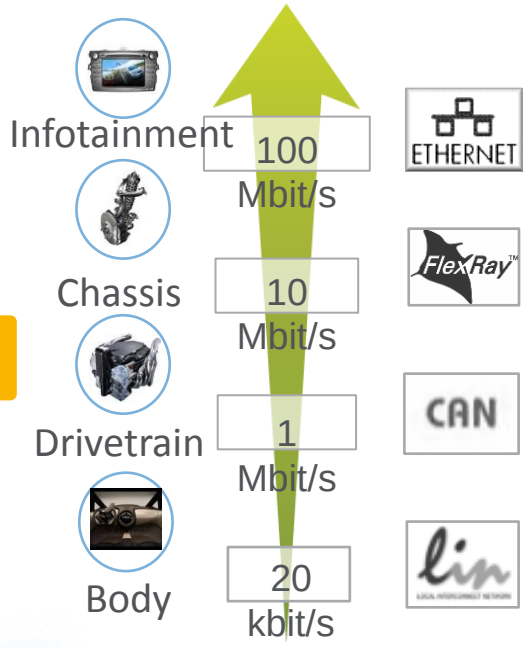
JUST „MORE“ MBIT/S? THE CONTROLLING OR CONTROLLED CAR?



Source: Steve Carlson, Bandwidth Growth, Vehicular Ethernet IEEE 802 Nov 2013 Plenary, Dallas, TX, USA

Application ↔ Bandwidth

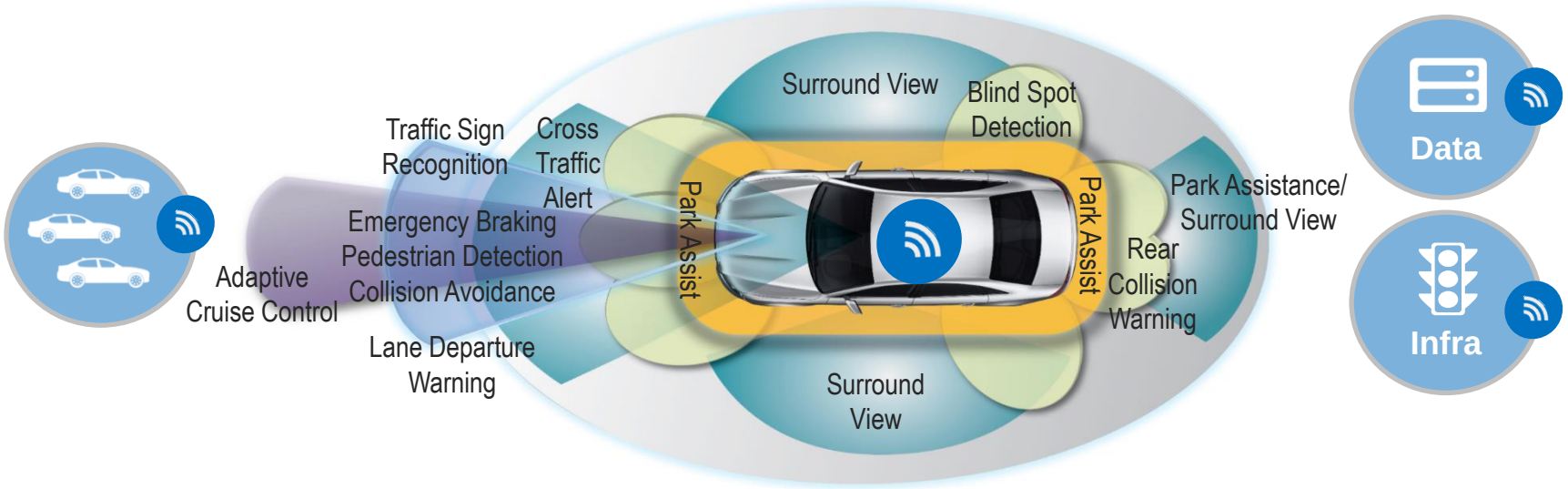
EcoSystem

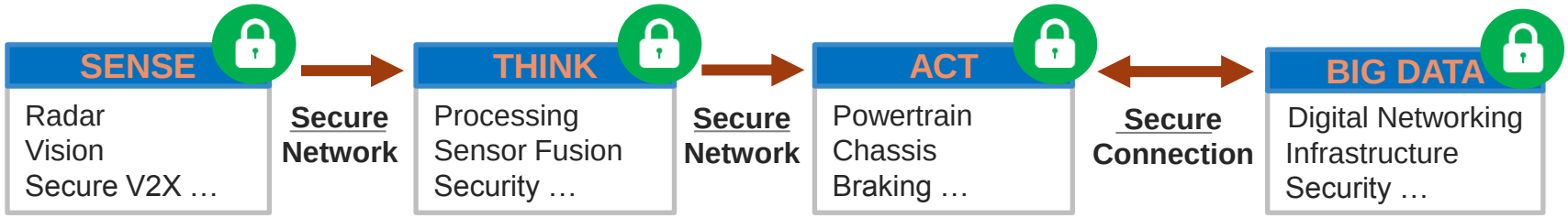


Automotive Ethernet Switch

Automotive Ethernet Transceiver

TOMORROW: ENABLING THE SECURE CONNECTED CAR





Secure V2X

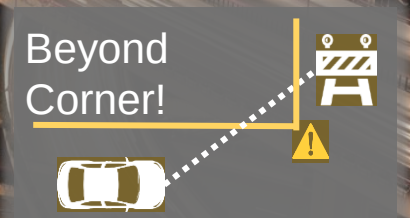
ESSENTIALITY

Connecting Cars

- *Beyond-line-of-sight*
- *From sensing to communicating*
- *Fully secure*

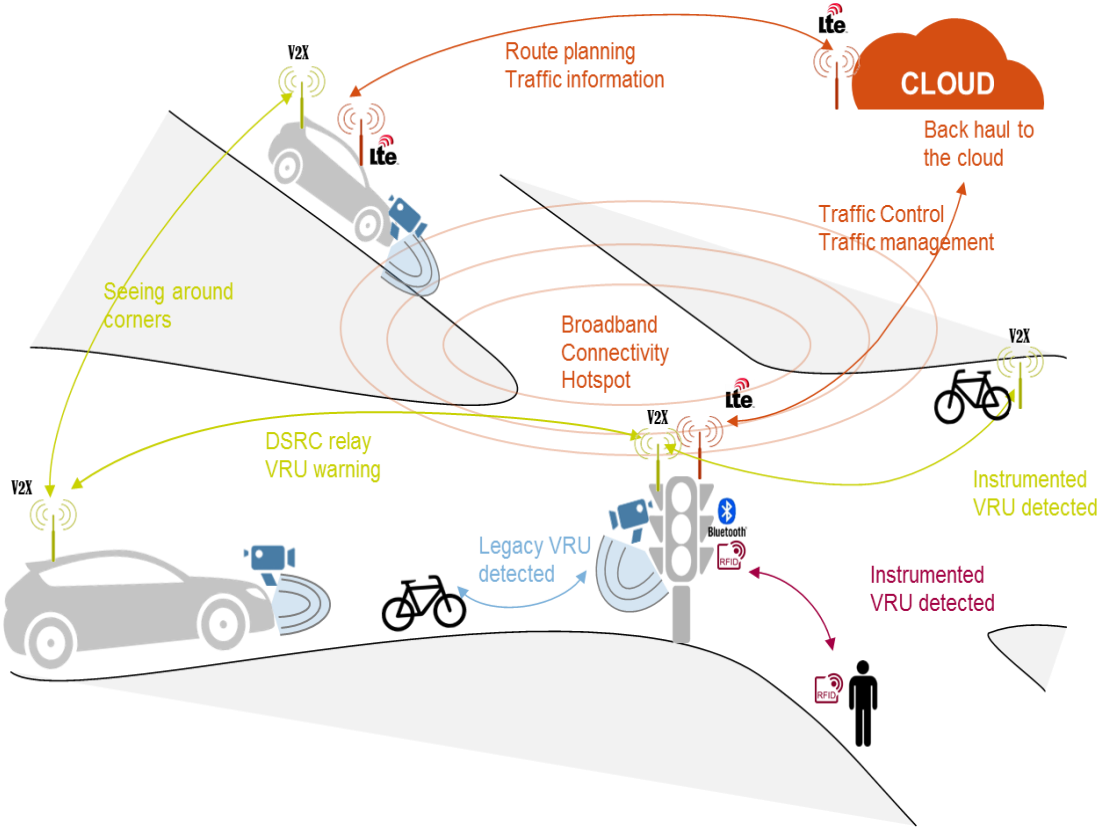
Societal Benefits (US DOT)

- *Save >1,000 lives / a*
- *Reduce 2.3M non-fatal injuries*



NXP | SECURE CONNECTIONS FOR A SMARTER WORLD

SECURE AND SAFE TRAFFIC INTERSECTIONS



Security – message “really” sent and originated by A?

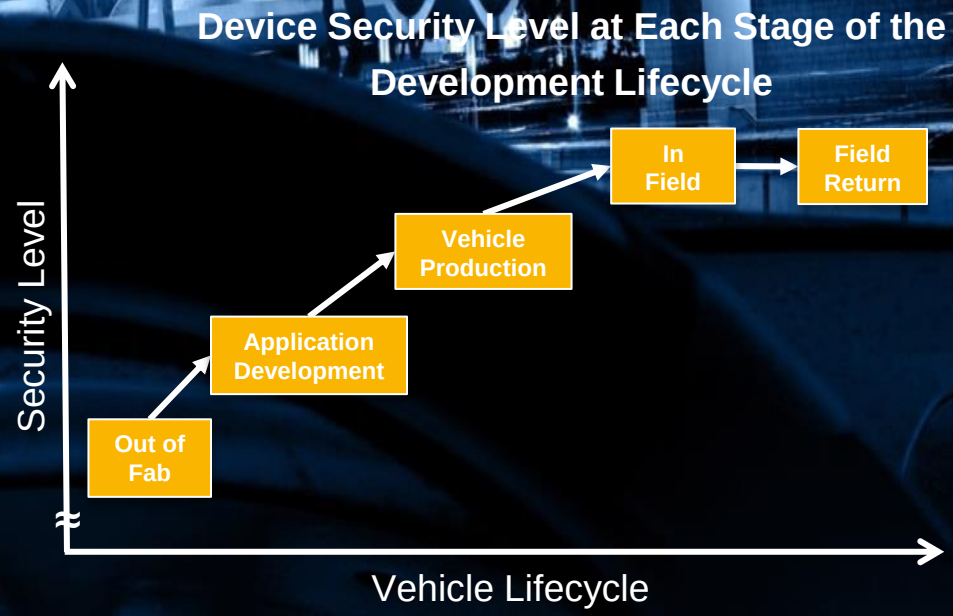
Authentication – Can I trust A?"

Privacy – others are able to track me while driving?"

SECURED COMMUNICATION

URGENCY – THE CONNECTED CAR IS AN ATTRACTIVE TARGET

- Protect Privacy
- Prevent Unauthorized Access
- Increase Safety



NXP SECURE CONNECTIONS FOR A SMARTER WORLD

THE CONNECTED CAR IS AN ATTRACTIVE TARGET FOR HACKERS

Valuable Data
- Collection of data / info
- Storage of data
- Diagnostic functions

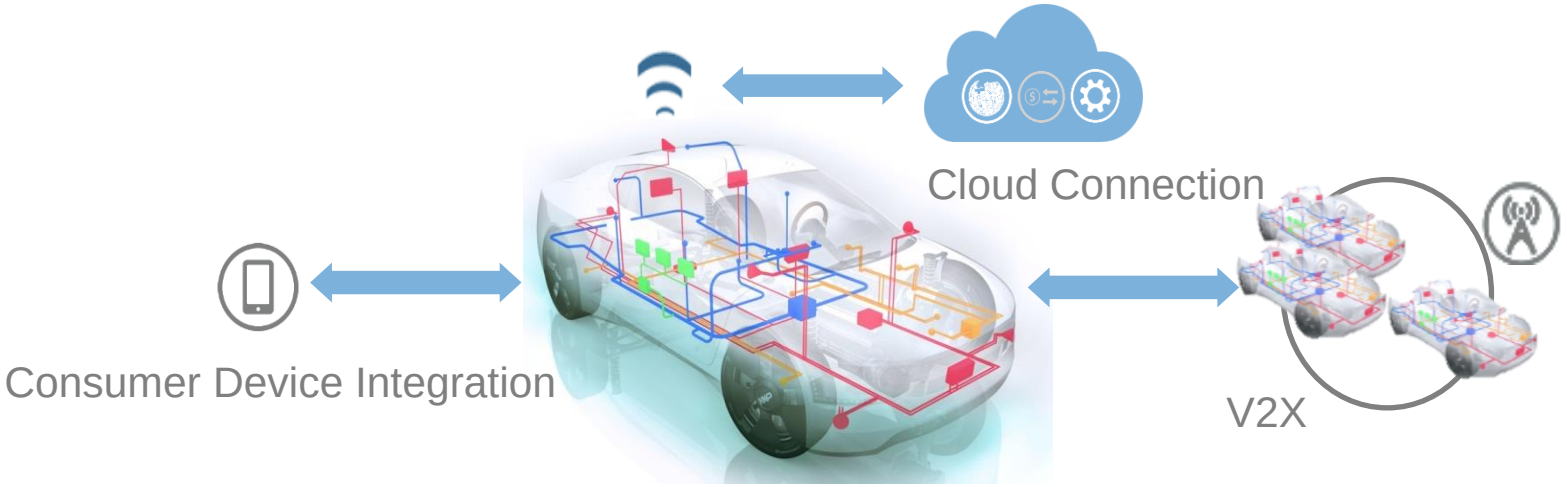
Protect Privacy

High Vulnerability
- Increasing # of nodes
- More advanced features
- X-by-Wire

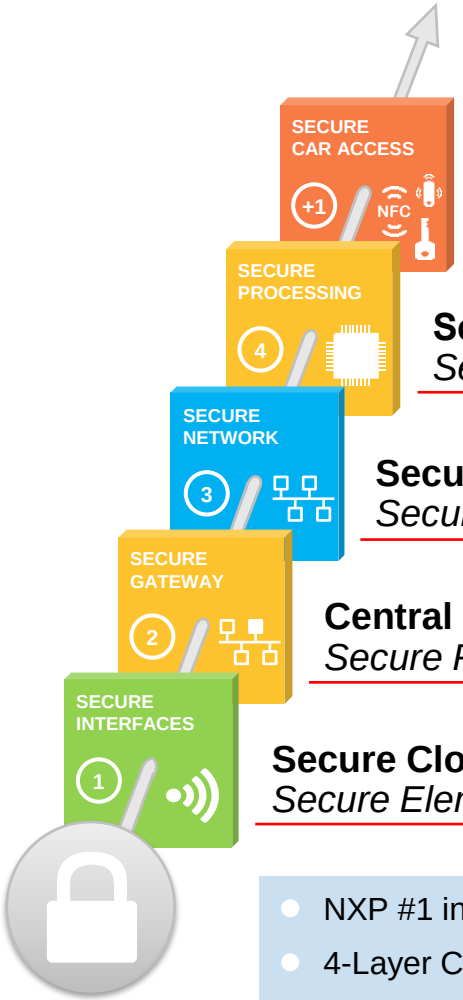
Increase Safety

Easy, Remote Access
- Fully Connected Car
- Ext & Int Interfaces
- Wired & wireless interfaces

Prevent Unauthorized. Access



NXP AUTOMOTIVE SECURITY (4+1 SOLUTION)



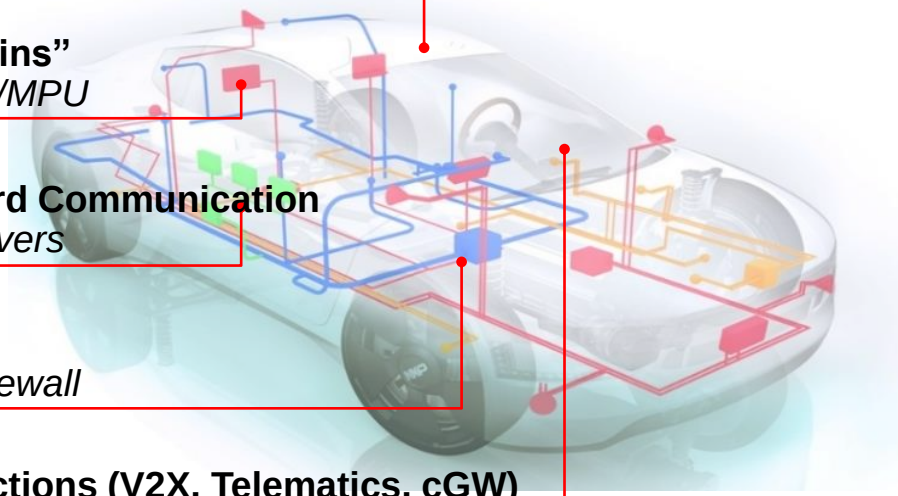
Secure Car Access
Immobilizer, RKE/PKE & Smart Car Access

Secure "Brains"
Secure MCU/MPU

Secure On-board Communication
Secure Transceivers

Central Gateway
Secure Routing, Firewall

Secure Cloud Connections (V2X, Telematics, cGW)
Secure Element



- NXP #1 in Auto HW Security
- 4-Layer Cyber Security Solution
- Plus 'Best In Class' Car Access Systems
- > 900 security patent families, ~ 200 specific to Automotive

REQUIREMENTS FOR SECURED CAR COMMUNICATION

- **MULTIPLE-PROTOCOL DATA PLATFORM** – connecting via e.g. V2X, Radar, DAB, 5G, NFC, Bluetooth, 802.11p, Automotive Ethernet, CAN, LIN, FlexRay, …
- **INTEGRATION OF DATA** – from car, user, environment, and service providers
- **SECURING DATA** – personal mobility, routing, infrastructure, traffic, car control
- **BUILT-IN PRIVACY** – from component to overall system level
- **AD-HOC SCALABILITY** – capable to add sensor, function, actor over car lifetime
- **LOCATION INDEPENDENCY** – multiple environments e.g. cities, countries


THE ROAD AHEAD FOR
SECURE CONNECTED CARS
THANK YOU
NXP
SECURE CONNECTIONS
FOR A SMARTER WORLD