NXP - A NEW POSITION OF STRENGTH

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

$10B IN ANNUAL REVENUE

11,000+ ENGINEERS

9,000+ PATENT FAMILIES

35+ COUNTRIES

4th Largest SEMICONDUCTOR COMPANY GLOBALLY1

✓ 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
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.

Levels and Sensors

- Front – Level 1-2
- Front & Corner – L3
- Cocooning – L 4+

Secure Connections for a Smarter World

NXP
**TOMORROW: AUTOMATED DRIVING**

**NEED OF SMART & ROBUST SYSTEM**

<table>
<thead>
<tr>
<th>Smart System Element</th>
<th>Effect</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors, Actuators, Cognitive Systems</td>
<td>0 accidents by human error</td>
<td>ADAS</td>
</tr>
<tr>
<td>Device Reliability</td>
<td>0 component failures</td>
<td>Robust Design</td>
</tr>
<tr>
<td>System Integration &amp; Functional Safety</td>
<td>0 accidents by system failures</td>
<td>ISO26262</td>
</tr>
</tbody>
</table>

Content of this Presentation: Secure Communication
LEVELS OF “DRIVING AUTOMATION” – SAE J3016

<table>
<thead>
<tr>
<th>LEVEL 1</th>
<th>LEVEL 2</th>
<th>LEVEL 3</th>
<th>LEVEL 4-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver Assistance</td>
<td>Partial Automation</td>
<td>Cond. Automation</td>
<td>Full Automation</td>
</tr>
<tr>
<td>ADAS</td>
<td>Self-Driving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-speed Comm, Gateway, Safety, Security</td>
<td>+ V2X, Big Data, Privacy</td>
<td></td>
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</tbody>
</table>

- **LEVEL 1 (Driver Assistance)**
  - Adaptive cruise control
  - Automatic braking
  - Lane keeping

- **LEVEL 2 (Partial Automation)**
  - Partial automated parking
  - Traffic jam assistance
  - Emergency brake / steer

- **LEVEL 3 (Cond. Automation)**
  - Semi autonomous
  - Highway chauffeur
  - Self parking

- **LEVEL 4-5 (Full Automation)**
  - Fully Autonomous
  - Some driving modes (4)
  - All driving modes (5)

**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

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

Expected in Future Cars
- CAN, FlexRay, LIN
- Switched Ethernet (SwETH)
- 802.11p
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
TOMORROW: ENABLING THE SECURE CONNECTED CAR

**SENSE**
- Radar Vision
- Secure V2X …

**THINK**
- Secure Network
- Processing Sensor Fusion Security …

**ACT**
- Secure Network
- Powertrain Chassis Braking …

**BIG DATA**
- Secure Connection
- Digital Networking Infrastructure Security …
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

Platooning @50mph

Beyond Corner!

Do Not Pass!

Ambulance
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
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

Consumer Device Integration

Cloud Connection

In-Vehicle Network

V2X
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