The Intelligent Automated Vehicle: the Last IoT Node

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Agenda

- Autonomous vehicle introduction
- Freescale’s contribution to intelligent vehicles
And the Word
“SMART”
Is Everywhere!

Miniaturization & advances in packaging technologies
Advances in flash
New class of powerful but low-cost & low-power MCUs
Cloud-based services
Advanced Driver Assistance Systems – Vision Market

Market: 20% **CAGR**, driven by safety deployment  

*Source: IHS 2014*

8.2 million autonomous cars by 2030

*Source: IHS 2015*
The “Language” of Autonomous Vehicle

- Sensor
  - Driver Active
  - Fail Safe

**Assist**
- Automatic Cruise Control
- Lane Departure
- Blind Spot Det.
- Road Sign Recognition

- Sensor Fusion & Maps
  - Co-Pilot
  - Dependable & Reliable

**Automated**
- Park Assist
- EBA
- Highway Platoons
- ACC with Steer

- Sensors & Maps & V2X
  - Driverless
  - Fail Operational

**Fully Automated**
- Commercial Autonomous Vehicles
  - (Drones–Big Vehicle)
  - Driverless Public Transport
  - ACC with Steer

Freescale has a long history in delivering functional safety and security for the automotive industry and is designed into virtually every safe application present in automobiles today. This puts us in an optimal position to enable deployment of safety and security functions for future car technologies.
Advanced Driver Assistance System Applications

- Front View Camera System
- Interior Camera/Driver Monitoring
- Smart Camera Rear—Remote Park Assist/Park Assist/Self-Parking
- Side Impact Assist
- Night Vision/Surround View Camera
- Emergency Brake System and Adaptive Cruise Control
- Cross Traffic Assist
- Blind Spot Detection/Surround View
- Radar Fusion Center
- High Beam Control
Intelligent vehicles are a set of agents which integrate multi-sensor fusion-based environment perception, modeling, localization and map building, path planning, decision making and motion control.

Prof. Cheng - 2011
Progress Toward Autonomous Vehicle

Automotive competence combined with reliable, safe and secure, SW enabled, massive performance
Processing resources need to be dynamically managed to execute probabilistic AND deterministic functions ... Within the same vehicle context
Computing Challenges – FSL Solution

Super Computing

Safe Computing

Automated Drive | Co-Pilot | Collision Avoidance | Self Parking | Lane Keeping | Collision Warning | Sign View

Number Cruncher
- Layerscape
- 72,000 DMIPS

Safety Processor
- S32 V200
- 10,000 DMIPS

Probabilistic
1. Analyze Scenario
2. Make Contextual Decision

Deterministic
1. Initiate Safe Measure
2. Fail Safe / Operational

Protocols:
- Collision Avoidance
- Lane Keeping
- Self Parking
- Co-Pilot
- Sign View
Freescale High Performance Processors
Freescale High Performance Processors

Leadership in Wired/Wireless Communications & Embedded Control

2013 Revenue $915M
2nd Largest Business in total Freescale

- **Service Provider**
  - Wireless & Wired Equipment
- **Enterprise / Data Center**
  - Network Infrastructure
- **General Embedded**
  - Mil/Aero, Industrial, Printing & Imaging

<table>
<thead>
<tr>
<th>Segment</th>
<th>Revenue Share</th>
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<tbody>
<tr>
<td>Service Provider</td>
<td>58%</td>
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<tr>
<td>Enterprise / Data Center</td>
<td>20%</td>
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<tr>
<td>General Embedded</td>
<td>22%</td>
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Freescale Networking processors offer **server class performance** for data centers, and high touch data services in wireless & wireline infrastructure.

**Fog Computing**: latency sensitive intelligent infrastructure including smart highways.
Safety Processing for Autonomous Vehicles
S32V234 – Robust, Efficient, Flexible

Trends:

- **2010**
  - Driving Assistant
  - e.g. Traffic Sign Recog
  - Radar / Image processing

- **2015**
  - Highly Automated
  - e.g. Collision Avoidance
  - 10 × Radar/Image processing + Fail Safe Reliability/Security

- **2020+**
  - Autonomous
  - e.g. Auto Pilot
  - 100 × Radar / Image processing + Fail Operational / Reliability/Security

Needs:

- Robust
  - Fully targeted at ISO26262
  - Reliable, dependable automotive design and integration
  - Embedded security

- Efficient
  - Intelligent partitioning to reduce cost
  - Dedicated Acceleration to improve performance
  - Best in class power

- Flexible
  - Simplify the experience!
  - Flexible, Open programming models
  - Supported by off-the-shelf RTOS & tools
  - Enabled by 360º EcoSystem

Freescale Future Ready: Robust, Efficient, Flexible solutions
Conclusion

Cleaner: ADAS/AV enables greener, lighter Autos and best utilization of transporation infrastructure

Safer: ADAS/AV saves lives! Reduce accident’s impact and cost of emergency actions while ensuring communication security. Moving toward zero fatalities

IoT: ADAS contributes to enable the vehicle as the most advanced IoT node in everyday life (V2X, V2V)

Legacy: Freescale has a legacy of automotive leadership that spans more than four decades: HSM and SHE automotive security standards and first to implement into Silicon
Designed into all critical security systems in cars today
Leveraging networking (QorIQ) expertise for Connected car emergence