Security and Safety in Embedded Applications

Use Case: Instrument Cluster

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June 16th 2016
Mentor Automotive

- Part of Mentor Graphics (EDA Tool Supplier)
- Broad Portfolio of solutions: Mechanical, Thermal
- E/E Systems Design, and Embedded Software

Connectivity and Networking. In-Car Experience. Subsystems and Technology
Safety & Security in 1969..

- Simple Wire Harness – one wire for each vehicle function
- Simple to repair!
- No ECUs. No embedded software

Wiring Diagram: MG Sports 1969
Automotive MegaTrend: Embedded Security

Traditional vehicle: Closed

New “attack surfaces”

- Radio
  - DSRC
  - Antenna
- In-Car WiFi
- Keyless Entry
- DAB Radio
- Tethered Smartphone
- Bluetooth Phone/Headset
- LIDAR RADAR
- Wireless Tire Pressure Sensor
- WiFi Tethered Smartphone

In-Car WiFi

Mentor Automotive
90% of Automotive Innovation now based on Software

- Instrument Cluster / DIM
- Autonomous Connected Car
- Advanced Driver Assistance Systems
- Infotainment Head Unit
- ECU Design

RTOS & Linux
OSEK
RTOS
Linux
AUTOSAR
ISO26262
Application Example: Instrument Cluster

- **Traditional Analog**
  - Today's mass-market

- **Hybrid**
  - Mechanical dials
  - Embedded Digital Display
  - Market Segment growing

- **Fully Digital**
  - TFT / LCD Panel
  - Premium Vehicles
Complex Digital Cluster: What's Inside

HMI Design and Features

HMI Application

Tier 1 & OEM Responsibility

HMI Partner

OS and Middleware

Semiconductor Vendor

Embedded Software Platform

Graphics Interface

Middleware

Operating System

Safety Architecture

Comms / AUTOSAR

Fastboot / IBC

Hardware

Tier 1 & OEM Responsibility

HMI Partner

OS and Middleware

Semiconductor Vendor
Security challenge with Complexity

- "Lines of Code" continues to increase *
  - 2012 Gateway ECU – 50,000 LOC
  - 2015 Gateway ECU 360,000 LOC

- S/W Problems Reported per annum : up 8x

- Validation and Testing is massively labour and cost intensive
  - Average cost $10 per LOC
  - Introduces project delay / SOP risks

- OEMs are expecting ISO26262 compliance, proof of testing, requirements traceability

- Meet ASIL requirements : Typically B or higher for Cluster

* Source : Continental, June 2016
Using Embedded Architectures to manage Security

- Provide Scalable Operating Systems
- Overlays: FastBoot, Security

Multi-Domain Example:

- Infotainment
- AUTOSAR
- Linux Guest OS GENIVI
- Linux OS
- Hypervisor
- Atom E38xx
- Atom E38xx
- Intel x86 Minnow MAX

Complexity

- Multi-OS, Multi-Domain, Hypervisor
- GENIVI Linux, AGL, MultiCore
- Certifiable, Secure, Pre-Emptive, OSEK & RTOS

Capability
Complex architectures are enabling ECU Consolidation

- Multi-core SoCs Available: Consolidation is an option
- Maintenance Costs
- Wire Harness Costs
- Manufacture and Assembly Costs
- Reliability

Chart showing the following categories:
- Vehicle Safety
- Driver Convenience
- Performance
- Emissions / Environment
- Reliability


ECU Counts: 0, 50, 100, 150
Instrument Cluster Market

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Secure embedded cluster architecture

Certified Software
- Safe Instrument Logic
- Safe Graphics Rendering
- Safe Graphics Driver

Certified RTOS (Nucleus CertOS)

Advanced Graphics
- Complex Instrument Logic
- 3D Graphics Render
- Linux Graphics Drivers

Complex OS (Linux/Nucleus)

Single SOC
Summary

- The Automotive industry changed permanently
  - Innovation through embedded software will occur continuously through the life of a vehicle
  - Autonomous Vehicles evolving 2016-2025
- Secure architectures are needed to keep ahead of hackers and DOS attacks
- Problem decomposition allows safety and security requirements to be met / SEOOC approaches
Thank You

Questions?
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