Utilizing Eclipse Kuksa framework to build an intelligent moving test platform to support vehicle related research

Project SMAD

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Topics

- Background
- Vision, goal & plan
- Summary of work steps – Design Science Research
- Findings related to Kuksa
- Deployment of the results
- Conclusions
- Remarks on open source
Background

• SMAD project
  - Many stakeholders and research participants / areas
  - Several research units focused on e.g. to sensors and V2X
  - M3S research unit focused on software

• Moving test platform
  - Use vehicle as research device
  - Use vehicle as gateway for other research devices
  - Support software research
  - Long-term goal is to support local, Oulu area, automotive software development outside of research context

→ Eclipse Kuksa deployment as a continuity of Appstacle (ITEA3) project
Background, system structure

USB interface for CAN-bus messages I/O
1) Kvaser Leaf Light HS v2 + OBD adapter + Can tracing SW tools
2) Kuksa dongle + Raspberry Pi + Linux (AGL) + Client SW

1. Hardware and software for vehicle CAN bus signals tracing & On-Board Data (OBD) collection
2. Cloud server software for vehicle data storage, applications & analytics
Background, Kuksa structure
Vision, goal & plan

• Vision:
  - To build software core of moving test platform

• Goal:
  - To start with a small case - enabling data transfer from car to cloud with customized Eclipse Kuksa

• Plan:
  - To configure and integrate the cloud software
  - To configure and develop the in-vehicle system
  - To integrate the system to the test car
Summary of work steps


• Relevance cycle
  - Identifying the requirements and adjusting the focus to fit the SMAD project targets
  - Learning the Kuksa platform

• Design cycle
  - Configuration and integration of the cloud software
  - Configuration and development of the in-vehicle system
  - Integration the system to the test car
Findings related to Kuksa

• Most of the functionality provided by middleware layer of Kuksa in-vehicle subsystem was not needed in SMAD project
  - Vehicle abstraction layer (VAL) were identified to be useful
    - Provided an easy-to-use and ready-made implementation for transforming vehicle manufacturer specific CAN bus messages to GENIVI Alliance Vehicle Signal Specification (VSS)

• Also, the Kuksa cloud subsystem was simplified
  - Kuksa Appstore service was outside of context of SMAD project
  - Eclipse Ditto service was outside of context of SMAD project
  - Eclipse hawkBit usage was narrowed down compared to Kuksa
    - Will be addressed in the development SMAD-specific Kuksa after the actual SMAD project
Findings related to Kuksa

• Kuksa data communication options between the in-vehicle and cloud subsystems were more than adequate for SMAD
  - In SMAD-specific Kuksa we utilized only mutual transport layer security i.e. mTLS, protected MQTT protocol
    - Support for unnecessary protocols were disabled in Hono
Deployment of the results

• For research
  - Software research opportunities and collaboration
  - A platform to support future automotive research
    - Use of Kuksa highlights relevance and usefulness of Eclipse in automotive development

• For industry
  - Support to automotive software development
  - Fostering the adoption of open-source solutions’ usage in automotive software development
  - Supporting the Oulu area automotive hub for business opportunities
Conclusions

• Kuksa is a customizable framework, deployable in different case-specific automotive data systems

• However, also demanding:
  - Requiring lots of low-level technical knowledge on how to configure, build and use its open-source software packages
  - The easiest part to reuse turned out to be the cloud system ...
  - ... and in-vehicle subsystem the most difficult
    - In combination with Kuksa development and testing hardware
Remarks on open source

• May ease the entry of smaller players to automotive software development and business
  - 3rd party (consumer) services and applications for vehicles and transportation systems
  - Decreased entry risks & costs
    - Common tools and processes
Thank you!