

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

Project SMAD



2018-2021

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

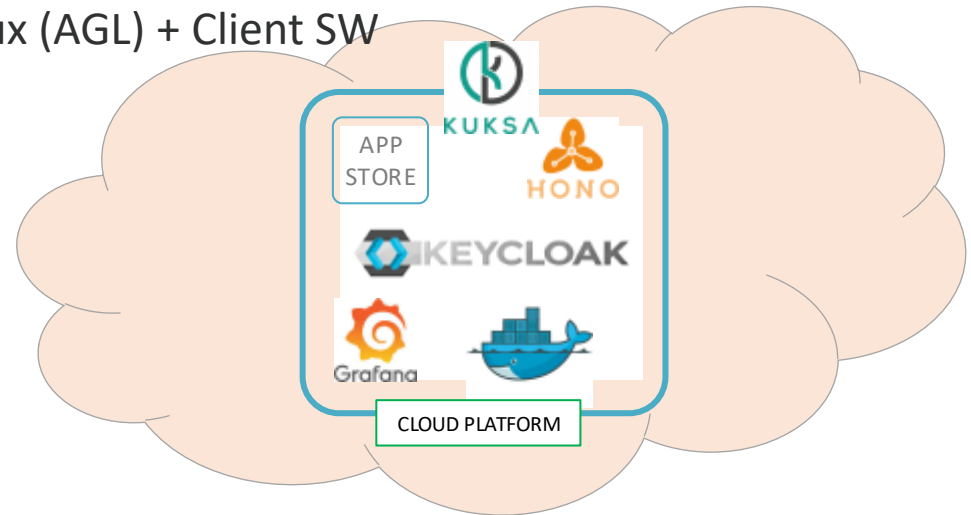
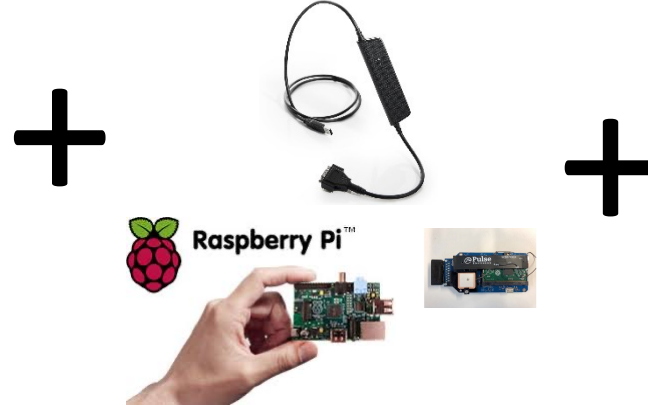
Background

- 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

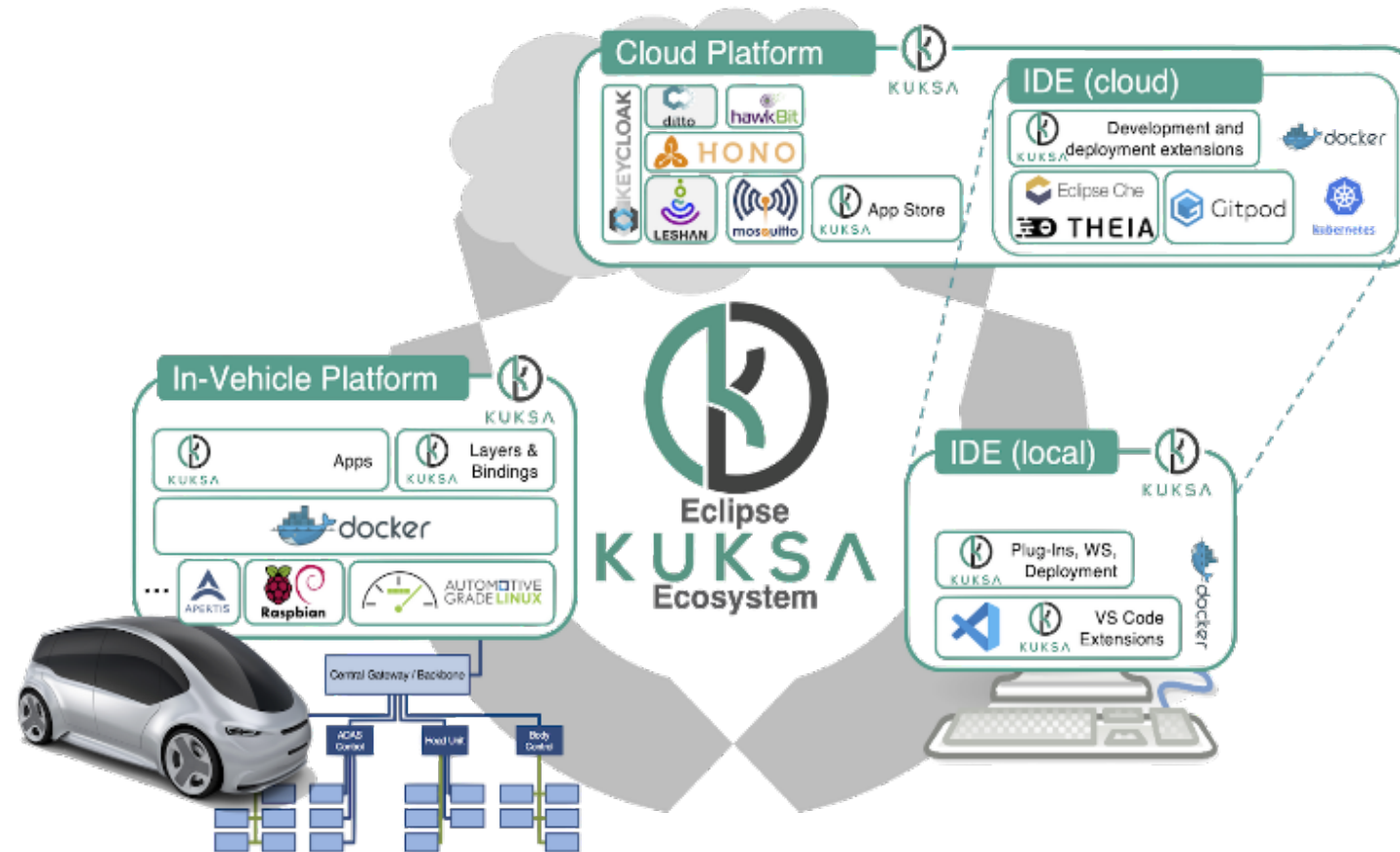
USB interface for CAN-bus messages I/O

- 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



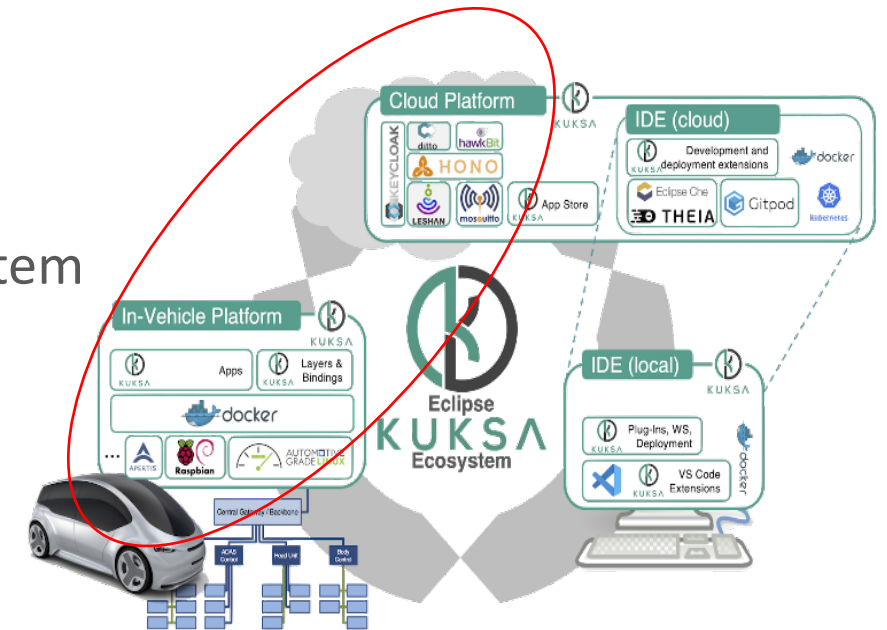
Vision, goal & plan

- 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

Design Science Research by Hevner: A Three Cycle View of Design Science Research (2007)

- 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

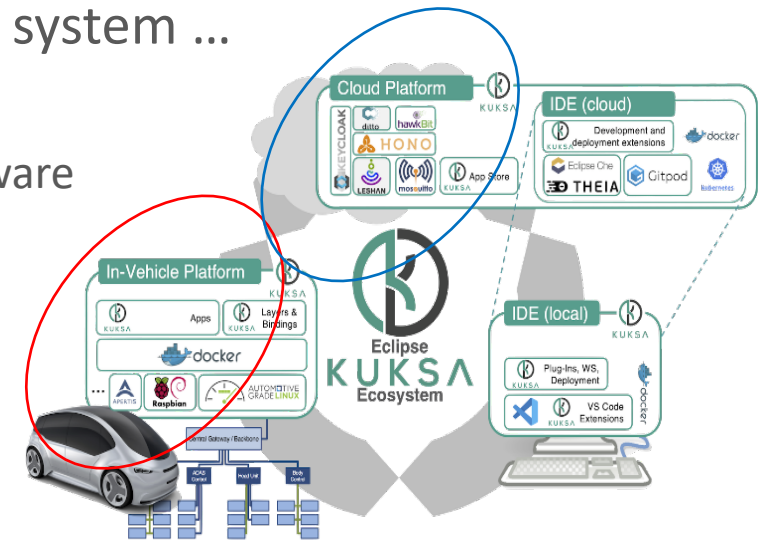
- Kuksa data communication options between the in-vehicle and cloud subsystems were more than adequate for SMAD
 - In SMAD-specific Kuksa we utilized only mutual transport layer security i.e. mTLS, protected MQTT protocol
 - Support for unnecessary protocols were disabled in Hono

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!