Software Updates Over-the-Air and Diagnostics

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Interesting Times...

- Machine learning
- Crowdsourced data
- System of systems
- Third party access
- Personalization
- Shortened development cycles
- Evolution after SOP
- New topics
- New business models
Status Today

Setup:
- Main delivery of hardware and software respectively functions at SOP
- Updates will be done at garage

Business:
- Cash-Flow is Customer to OEM to Tier1, Tier2, …
- Software value not fully visible (cost is realized, value is not)
Driving Forces behind OTA

Setup:
- First delivery of hardware, software and functions at SOP
- New players enter the market with a focus on operations

Driving maybe not possible when data connection missing
Driving Forces behind OTA

Business:
- Value streams change
- Business cases always need to include both: production and operations
- Heterogeneous business models
Updates through the Ages

Classic software updates

- Physical access to vehicle necessary
- Needs to be done in repair shop

Software updates over-the-air

- Software updates executable anytime and anywhere
- Time- and cost-efficient updating of a fleet on the road
SW Update Process OTA “creates” New Challenges

Software updates over-the-air

- Software updates executable anytime and anywhere
- Time- and cost-efficient updating of a fleet on the road

Challenges for the SW update

- “Unprotected” environment / power consumption calculation necessary / download strategy
- Different embedded runtime environments and architecture
- Virtual diagnostic tester / embedded diagnostic client
- Security
- SW quality / Failover Strategy
SW Update OTA Major Use-Cases

Safety & security updates
- Prevent the intrusion of malicious software code with cybersecurity updates on connected cars
- React on new threats and vulnerabilities
- Mitigate the impact of software-related recalls

Functional updates
- Improve driver assistance functions on their way towards autonomous driving
- Enable Software-as-a-Service in the automotive area
- Enable an additional source of revenue after vehicles are sold

Infrastructure use-cases
- Update the vehicle’s ECU’s during manufacturing
- Enable remote diagnostics on a fleet of cars on the road
- Predict failures by conducting data analysis on the collected data
Benefit from our In-Vehicle Know-How

**Classic AUTOSAR**
- Deep understanding of underlying operation systems and basic software for update process
- Success story:
  - AUTOSAR migration for Renault-Nissan-Mitsubishi Alliance

**Adaptive AUTOSAR**
- EB is a supplier for SW for high performance controllers on the road in 2019
- Offering includes basic software, operating systems (Linux), Hypervisor, and tooling

**Functional safety**
- Basic software configuration and development to fulfill project requirements
- Functional safety concepts based on EB’s safety products
- ASIL- and SPICE-compliant development processes

**Security**
- Secure SW base for ECUs
- On the road in >36 million vehicles
- EB’s portfolio is extended by Argus’ offerings to enable a one-stop-shop

**Software integration**
- Can be integrated in any cloud environment
- Success stories:
  - ADAS integration for Daimler
  - Ford Sync integration
EB cadian Product Line at a Glance

**EB cadian Analytics**
Remote analytics tool to gain valuable insights from the fleet on the road, and as a powerful basis for updates.

**EB cadian Sync**
Secure software updates over-the-air.
On-Board OTA Component Allocations

Example 1
- TCU
  - Connectivity client
- Performance Gateway
  - VLM Master
  - Local storage
- Classic Target (Autosar)
- Performance Target
  - Update Slave

Example 2
- TCU (Performance ECU)
  - Connectivity Client
  - VLM Master
  - Local storage
- Classic Gateway
  - (Routing from TCU to update targets enabled)
- Classic Target (Autosar)
- Performance Target
  - Update Slave

Example 3
- TCU
  - Connectivity client
- Classic Gateway
  - VLM Master
  - Local storage
- Classic Target (Autosar)
- Performance Target
  - Update Slave
- IVI
  - VLM Master
  - Local storage
Modular Solutions for Maximum Flexibility

High level overview of EB cadian

On-board components
- EB cadian Sync components
- Lifespan protection components
- EB cadian Analytics components

Backend services
- EB cadian Sync services
- Lifespan protection services
- EB cadian Analytics services

Portal
- Update UI
- Security UI
- Analytics UI
- Foundation UI

Foundation service including on-board connectivity client

Argus service/component
Software Updates Over-the-Air in AdaptiveCore

EB corbos

- Update capability the Adaptive AUTOSAR is provided by services in the Adaptive platform

- On application level, the Connectivity client to enable backend communication and the Update master as central update manager are required
Benefit from Differential Updates

- Save costs by saving bandwidth
- Reduce update time through differential updates
- Creation of a differential file between initial software version and new software version on binary level
- Application of the diff to the target image
Software Updates Over-the-Air and Diagnostics

Failover Strategies in Detail

Retry

• In case of a failure during or after installation of the new software it is installed again to bring the target ECU back to an operational state
• Retry logic is in the VLM master
• Amount of retries is configurable

Rollback

• In case of a failure during or after installation of the new software the latest operational software will be installed again to bring the target ECU back to an operational state
• Rollback logic is in the VLM master or in the target ECU
• Requires additional storage to preserve the “old” software
Failover Strategies in Detail

A/B/A’ with external flash

- Download of the new application software (plus the old one – optional) to an external flash memory on the target ECU
- Update of the internal NvM with the previously downloaded software from the external flash memory
- In case of a failure the initial application software may be restored with the 2nd application image initially stored in external flash memory

A/B swap (double-bank)

- Internal NvM ist available with at least twice the size of the application software
- New software application is installed to the 2nd flash segment while parked
- When 2nd application was installed successfully, ECU will boot the new software
- Update while driving is possible with an additional SWC for installation of 2nd application while driving
Key Technologies for Connected Cars

**EB cadian Sync**

The way to manage higher SW complexity and shorter development and update cycle.

Enabler for new business – SWaaS, new features for cars on the road.

**EB cadian Analytics**

Key technology to update SW inside a car and enable new features.

Key technology to collect data for further analysis.

Change from “connected” to “embedded”

**Elektrobit offer**

End-to-end products for Connected services and Cyber Security using SW update OTA and embedded Diagnostics.
Thank you!

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