Mobility industry needs insights

Regarding vehicle attributes & the consumer

Who is driving my cars? Male? Female? Age etc?

Which functionalities are valued?

Which parts cause quality issues?

Which component are performing poorly?

Regarding services

How can I personalize the driving experience for my customers?

Do they prefer the showroom concept or the dealer experience?

What is the most wanted service in which drive situation?
Remote analytics

OEMs | Fleet managers
EB cadian

A reliable, scalable, and secure software solution for remote analytics

Features
• Customizable and configurable (surveys, remote diagnostics, and analytics part)
• Permanent surveillance or ad-hoc surveys possible
• Support of standardized API’s
• Offline use possible (buffering and upload strategy)

Benefits
• Get insights from your vehicles on the road
• Automation of data collection
• Smart integration in existing OEM IT environment possible
Intelligent Remote Services for Connected Cars

Turning a question into a task
Design fleet survey on demand

Formulate the question towards your fleet
• Example: “Fleet, are there vehicles with starter batteries which behave significantly different from all other observed batteries?”

Turn question to remote analytics task
• What data am I expecting to help me answering this question?
  → e.g. “starter battery voltage”
• Which vehicles should provide this data?
  → e.g. “all petrol vehicles older than 3 years”
How to specify which data?

Specification must be:
• vehicle agnostic
• flexible
• still easy to use

Possibilities:
• Graphical / form-based
• Standard programming language
• Domain specific language (DSL) → EB cadian choice

Example survey definition:
```
read(ID.BatteryVoltage, schedule:msec(1000):times(900))
```
How to specify which vehicles?

Vehicle selection is sub-fleet design
• Define using predicates over properties
• On-demand realization of fleets including versioning

Properties
• e.g. fuel type, engine power, date of make, mileage, vehicle configuration, ...

→ OEM has (some of) them – e.g. production data, part numbers, ...
Survey automation and data normalization

Vehicle-specific data collection jobs distributed to fleet

- Each vehicle gets specific job depending on assembly status
- Onboard data collection & processing

Returned data is normalized
Usage of SI units (or derived ones)

How?
- Cloud uses diagnostics & CAN descriptions to transform data source
- Cloud holds vehicle assembly status database

Diagnose voltage from gateway; Millivolt $\rightarrow$ Volt
Diagnose voltage from BCM; no conversion
Data quality assurance

Standard methods
• Internal consistency, physically-out-of-range
• Format checks
• Duplicates
• Invalid time-stamps
• Interpolation of missing values
• ...

Optional, task-specific methods
• Reject if time series has > 3% values such that $x < 9 \, V$ and $x > 17 \, V$
Analytics: Anomaly detection
Using Elastic Map Reduce

Analytics for battery example
• Histogram-distance-based unsupervised anomaly detection
• Histograms: avoid complexity of time dimension
• Distances: precise quantification of how significant an anomaly is
• Unsupervised: no costly data labeling, additional models, ...

Subsequent possibilities: e.g. correlation analysis, such as detected anomalies → battery repairs → battery types

\[ d(H_1, H_2) = d_{12} \]

• For all pairs
• Then: e.g. distance to \( k \)th nearest neighbor “large”? → anomaly!
Reporting

- Textual & graphical – for presentations and reports
- Numerical – for subsequent processing steps, standard formats: CSV, HDFS, ...
- Remote analytics graph – for describing the process which created certain data

Reporting for battery example:
- Percentage of anomalies
- List of vehicles labeled as anomalies (e.g. more data collection) HMI: “Unfortunately, your battery looks degraded – consider a replacement. Good offers…”
From data to knowledge
The voice of your connected cars

OEMs | Fleet managers

Drivers | Passengers
The voice of your connected cars
People are getting used to speech technology

Speech technology advances quickly

80’s

Speech recognition for call steering

Speech output in cars for navigation

Roughly since 2002

2010

Speech recognition for biometric identification

Siri mobile assistant, Microsoft Cortana or Google Assistant

2015

Speech steering in smart homes e.g. Amazon echo
Facts

Where do people use voice assistants?

- 51% of users use voice assistance in the car
- 39% in the home
- 6% in public & 1.3% at work
- The high proportion of usage in the car would suggest it has to do with the hands-free law that regulate driving and texting, as well as fact that the car is a private space.

Feedback as a Service

An automated service providing customer satisfaction insights from spoken input

• Real-time, verbal feedback
• Pressure vent

• Speech to text transformation in the cloud
• Classification and machine learning
• Storage in date warehouse

• Easy to use, **interactive dashboard** with categorized feedback
• Possibility to export into CRM systems
• Start direct personal contact - if desired by the driver
• SaaS Business Model
  Pay per feedback
Activating your drivers to use FaaS

- Integrate into speech dialog with push to talk (PTT) button
- Integrate into graphical HMI
- Integrate into companion app and car configurator webpage
- Allow driver to decide if feedback shall be anonymous or if he/she agrees to be contacted
- Notify the driver with pop-ups (depending on car marker strategy)
- Combine with additional benefits such as vouchers etc.

How are you enjoying your ...?
Increased satisfaction and improved customer relationship

For OEMs
- Know the driver’s needs
- Improve products fast accordingly
- Increased service level
- Get the things gone wrong directly and fast, not publicly via Facebook or Twitter

For drivers and passengers
- A direct channel to vendors - as a pressure vent or to get help from a local dealer
- A channel to praise a good product “give me more of this” or raise new innovation ideas
Features

• English and German language available, further languages will follow
• Ready-made classification and tagging
• Customizable feedback dashboard with query capabilities
• Ability for OEM to add additional encrypted data (e.g. area, VIN, customer contact details, car model, SW version etc.)
• Easy client side integration supported by blueprint code
• Scalable REST API with device key and secure upload of audio feedback
REST API can be used from...

<table>
<thead>
<tr>
<th>Head unit</th>
<th>Smartphone App</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC, browser based</td>
<td>Any point of sales terminal</td>
</tr>
</tbody>
</table>
Dashboard and categories
3 – SW-Update OTA

OEMs | Fleet managers

Vehicle & user data

SW update OTA

Vehicle data

User feedback

Drivers | Passengers
SW Update OTA

Full software, fleet and campaign management for software update over-the-air

Features
• Scalable cloud infrastructure for any size of fleet
• Differential updates and data compression
• Secure E2E communication and data storage including Content Delivery Network based distribution and update of certificates for public key infrastructure

Benefits
• Update your vehicles on the road
• Solution to update the complete car (Multi-ECUs as well as In-Vehicle Infotainment (IVI) and other performance ECUs)
• Platform independent onboard OTA components
Intelligent Remote Services for Connected Cars

DASHBOARD | Project Aleph

**ACTIVITY STREAM**

- **James Cross**
  - Campaign approved
  - 5 minutes ago
  - Unread

- **System**
  - Campaign behind schedule
  - 20 minutes ago
  - Read

- **System**
  - Campaign finished
  - 1 hour ago
  - Unread

- **Max Muster**
  - Campaign created
  - 1 hour 12 minutes ago
  - Unread

- **System**
  - Vehicle VIN [327904328480] reported error
  - 1 hour 43 minutes ago
  - Unread

**FULL ACTIVITY LOG**

Sort by: Info Warning

**STATUS**

- **28** PENDING APPROVALS

- **14** HIGH PRIO CAMPAIGNS

- **38** ACTIVE CAMPAIGNS

**PROJECT PROGRESS**

- Project Aleph
- Project Omega

- Updated vehicles: 1503
- Feedback received: 1246

- 27 APR
- 30 MAY
- 06 JUN
- 13 JUL
- 10 SEP
- 13 AUG
EB’s formula for adding value

- Remote analytics from car diagnostics data
- Analytics from driver’s direct opinion
- Ability to update software over-the-air

End-to-end security through software craftsmanship

Solutions for Vehicles Lifecycle Management
Intelligent Remote Services for Connected Cars

Connected Car Metro Map

- Car Data Recorder
- Speech dialog design
- EB robinos
- EB sola
- IoT tokens
- Asymmetric cryptography
- Production issue management
- Remote Diagnostic Surveys
- Safety OS
- OSEK
- EB tresos
- Technology Solutions

- IoT
- Connected Navigation
- Firmware Update
- eCall
- SW block
- IoT
- Firewall
- WANBAN
- MISRA
- ISO26262
- SOME/IP
- Autosar

- Driver privacy act
- Data avoidance
- Privacy
- User trust
- Transparency

- Mobility as a Service
- Future Mobility
- IoT Impact
- Product as a Service
- Industry 4.0
- Driver Ecosystem
- Advanced CS
- Pilot aid
- Semi-automated drive
- Driverless SW
- Products
- Cloud-based
- ADAS

- Safety
- OS
- Automated
- V-Model
- ISO27K
- Software integration
- Process
- Software craftsmanship
- Embedded system
- Monitoring & Logging
- Embedded ethernet
- Threat & Key Management
- Device
- Firewall
- Cloud security

- Embedded
- Connectivity gateway
- H/W tokens
- Privacy by Design
- Car as sensor
- Safety engineering
- Event data recorders (EDR)
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- Embedded security
- Big data
- Component licensing
- OTA firmware management
- Security boot block
- AES/CCM
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- Privacy
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- Cloud basics
- Authorization
- Accountability
- Confidentiality
- Integrity
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