

# Intelligent Remote Services for Connected Cars



Elektrobit



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# Mobility industry needs insights

Regarding vehicle attributes & the consumer

Regarding services



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

Which functionalities are valued?

Which parts cause quality issues?

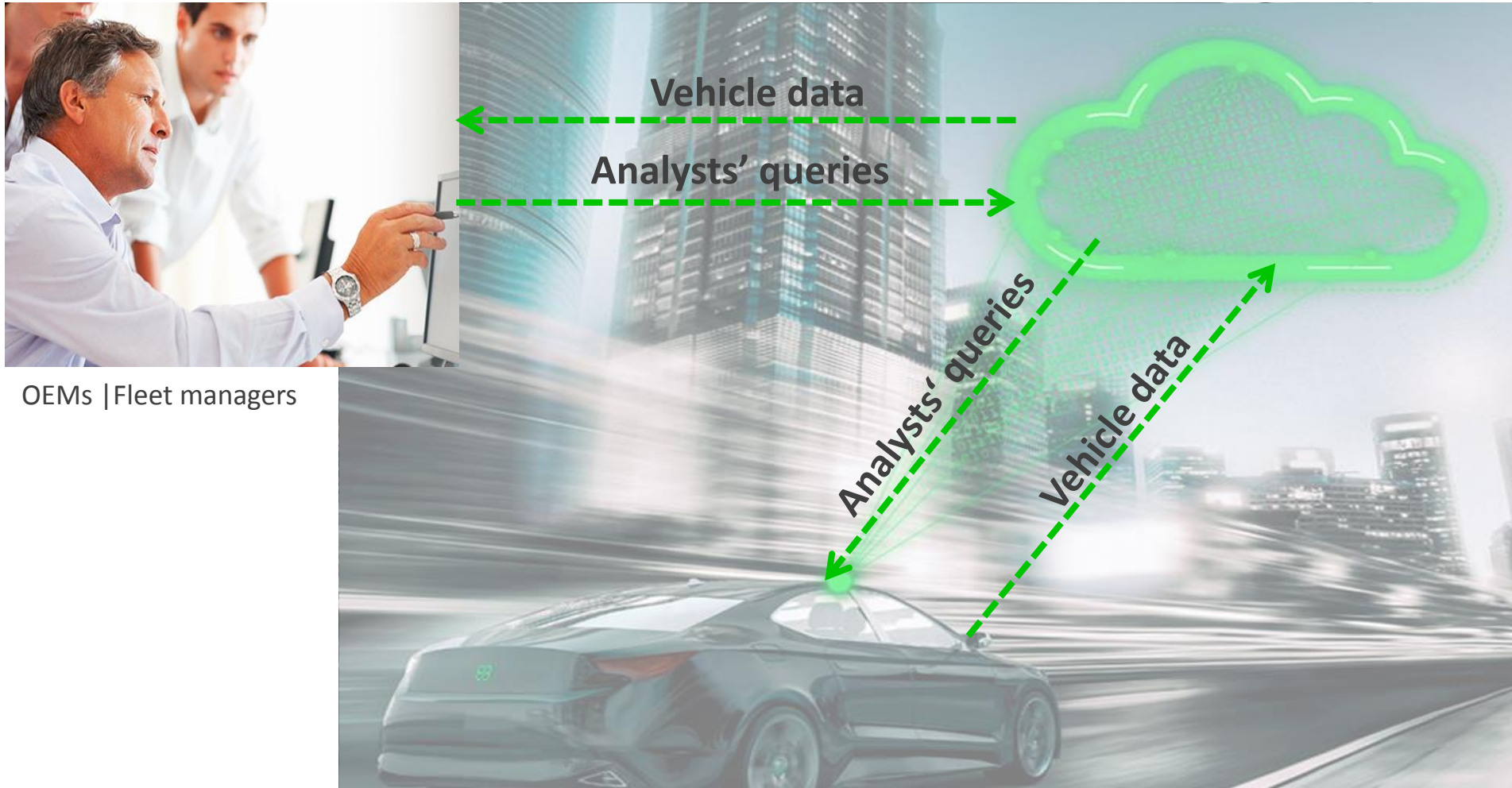
Which component are performing poorly?

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

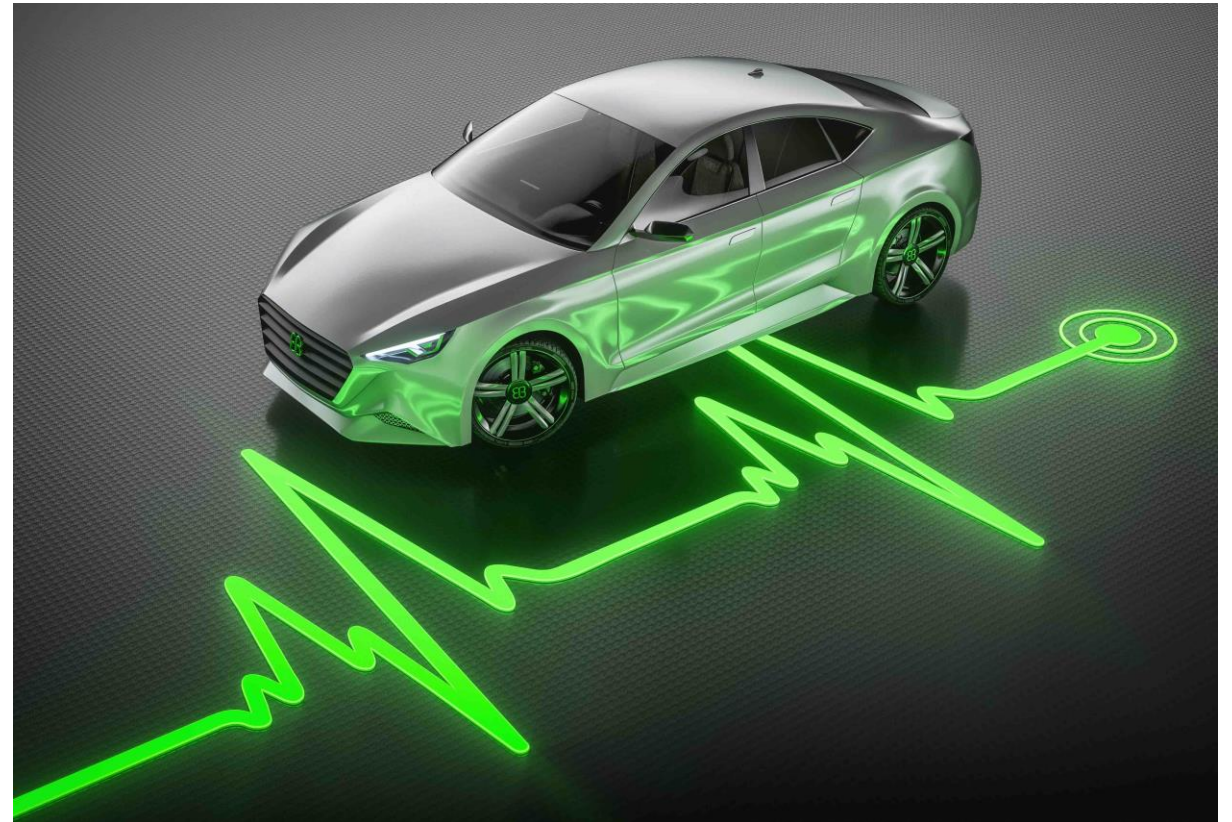
A reliable, scalable, and secure software solution for remote analytics

## 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





# Turning a question into a task

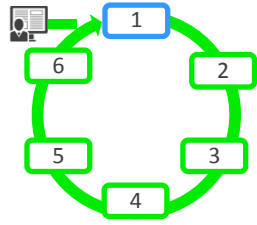
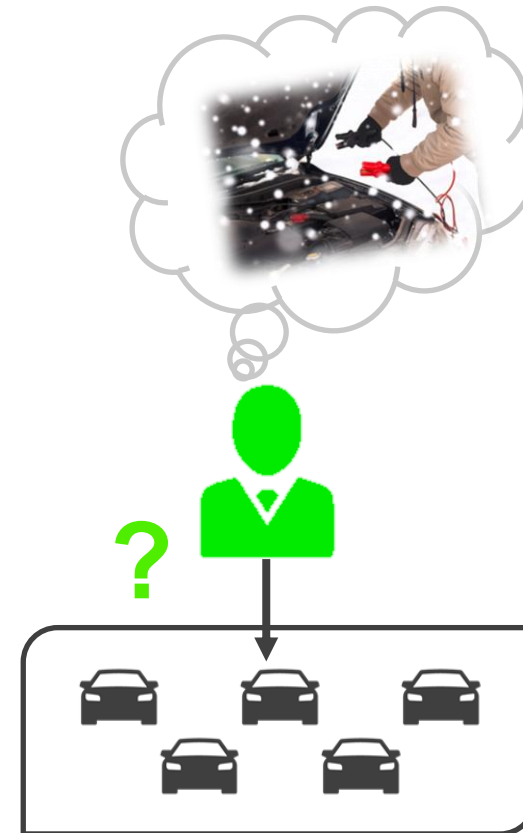
## Design fleet survey on demand

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”



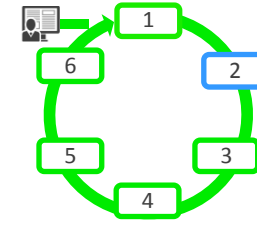
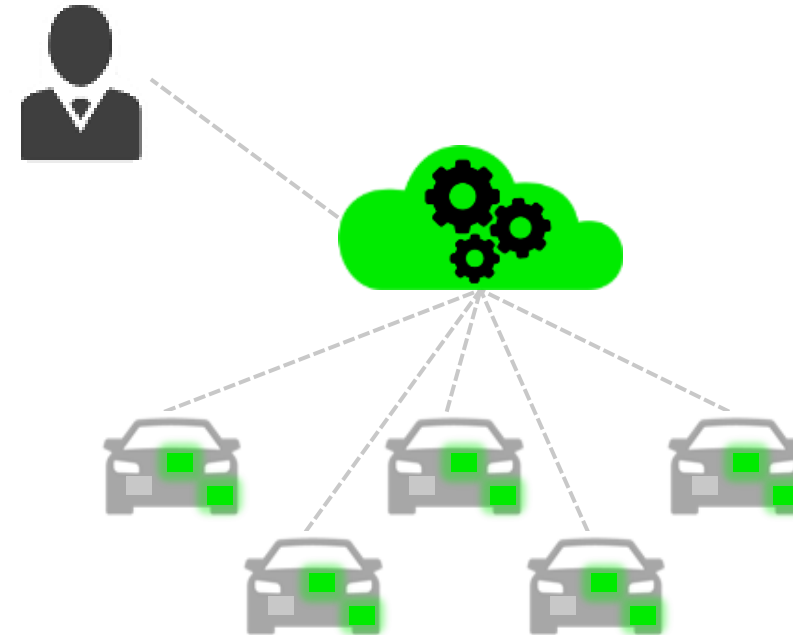
# How to specify which data?

Specification must be:

- vehicle agnostic
- flexible
- still easy to use

Possibilities:

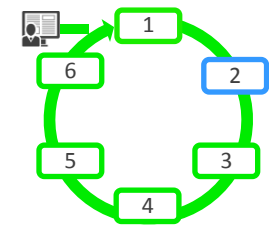
- Graphical / form-based
- Standard programming language
- **Domain specific language (DSL)**  
→ EB cadian choice



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, ...

**Vehicles / Fleets**

ALL FAVORITES INACTIVE

- ★ All Diesel vehicles
- ☆ All Petrol vehicles
- ☆ All vehicles with SOTA
- ☆ All vehicles with navigation
- ☆ All virtual vehicles
- ☆ Diesel
- ★ Diesel, navigation
- ★ Diesel, no navigation
- ☆ Petrol, navigation
- ☆ Diesel, no navigation
- ☆ Golf 7 vehicles
- ☆ Passat 5 vehicles

**Name:** Flying cars Version 2

Approx vehicle count: 12 000

**AND OR** + Add rule + Add group

- Model equal Pegasus ✖ Delete
- Model equal Icarus ✖ Delete
- Navigation equal Yes ✖ Delete
- Mileage (in km) greater or equal 10000 ✖ Delete

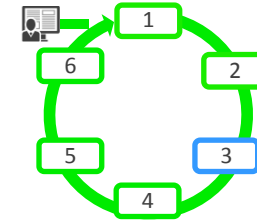
**FLEET COST SAVINGS:**

350  
175  
150

● Current 40%  
● Average 20%

Cancel Save

# Survey automation and data normalization



## Vehicle-specific data collection jobs distributed to fleet

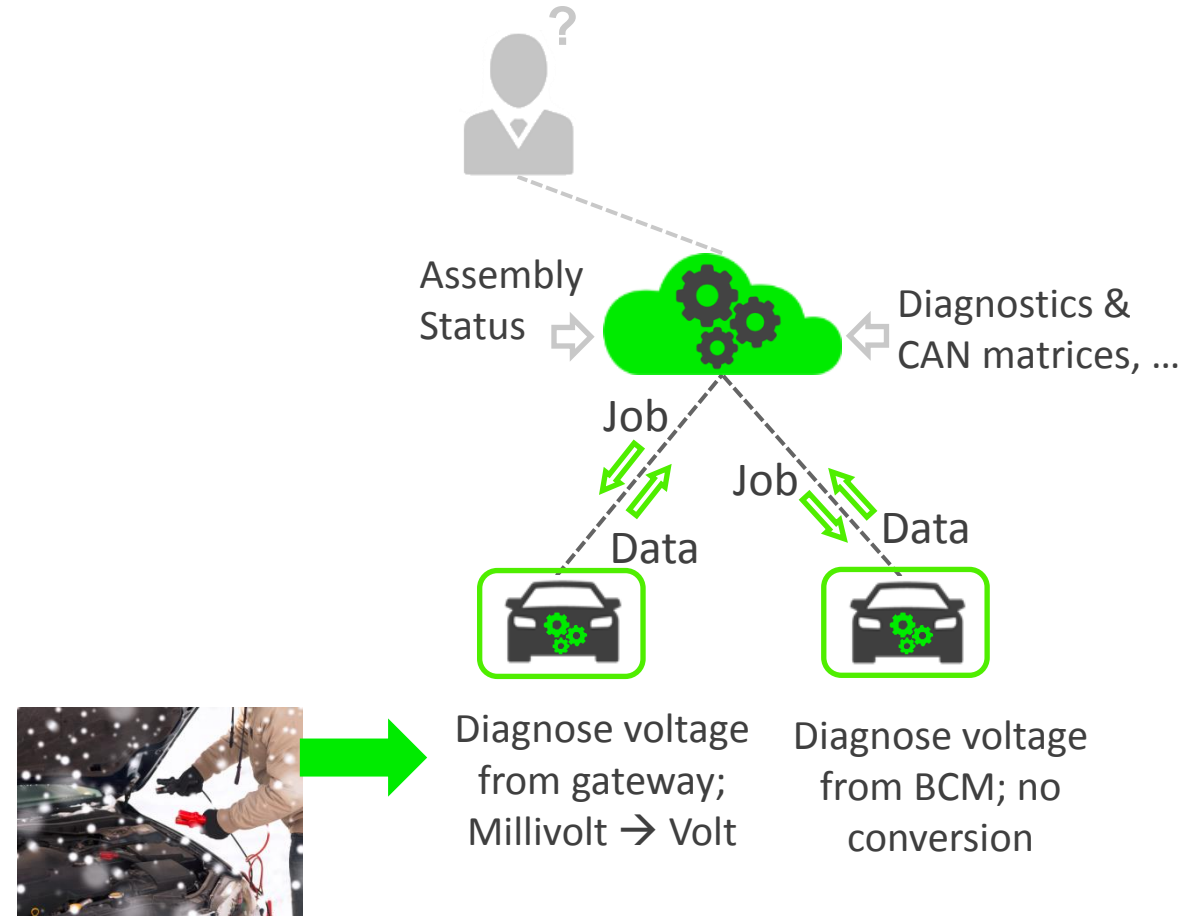
- Each vehicle gets specific job depending on assembly status
- Onboard data collection & processing

## Returned data is normalized

Usage of SI units (or derived ones)

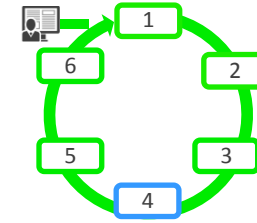
## How?

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



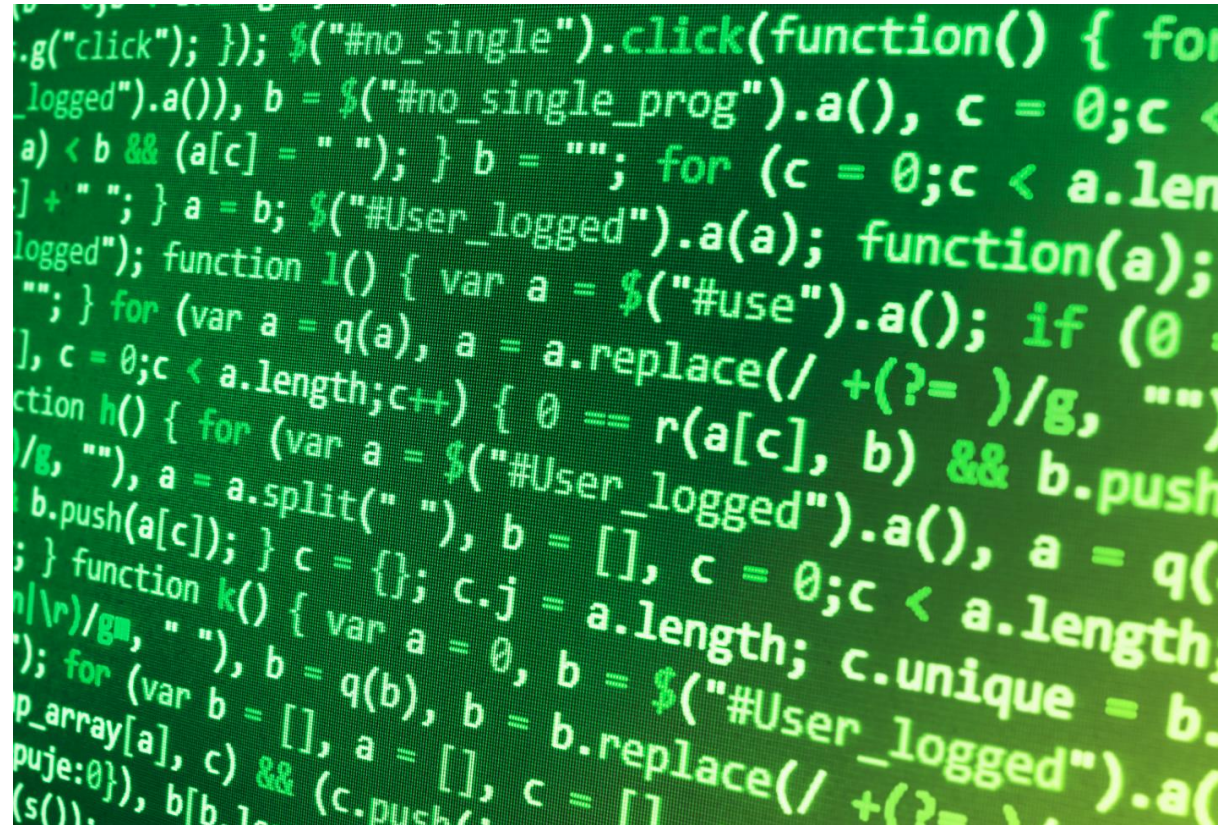


# Data quality assurance



## 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  $x > 17 V$

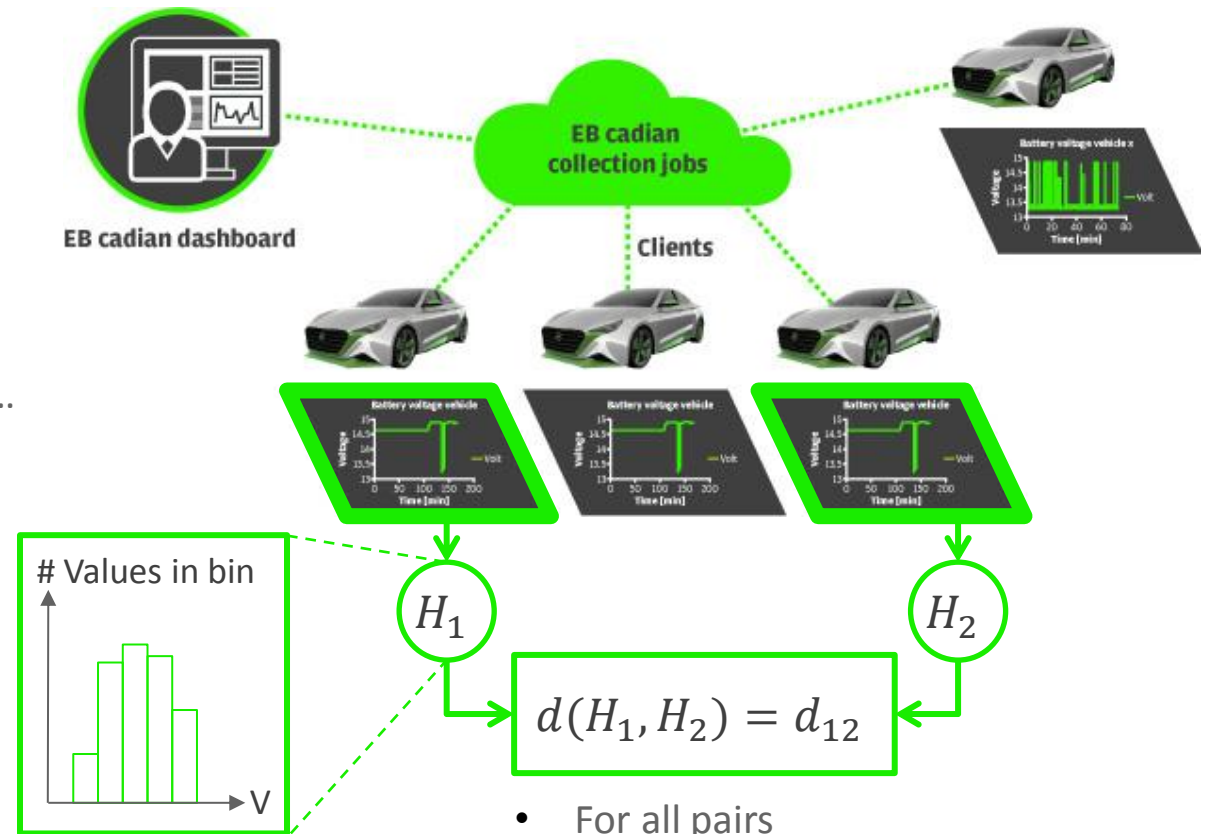
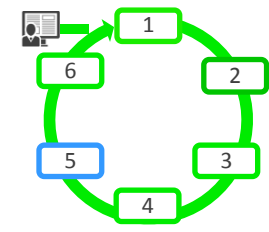
# Analytics: Anomaly detection

## 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, ...

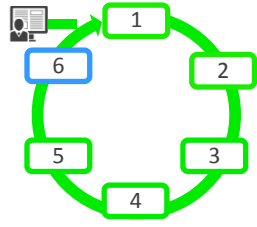
Subsequent possibilities: e.g. correlation analysis, such as detected anomalies → battery repairs → battery types



- For all pairs
- Then: e.g. distance to *k*th nearest neighbor “large”? → anomaly!



# Reporting



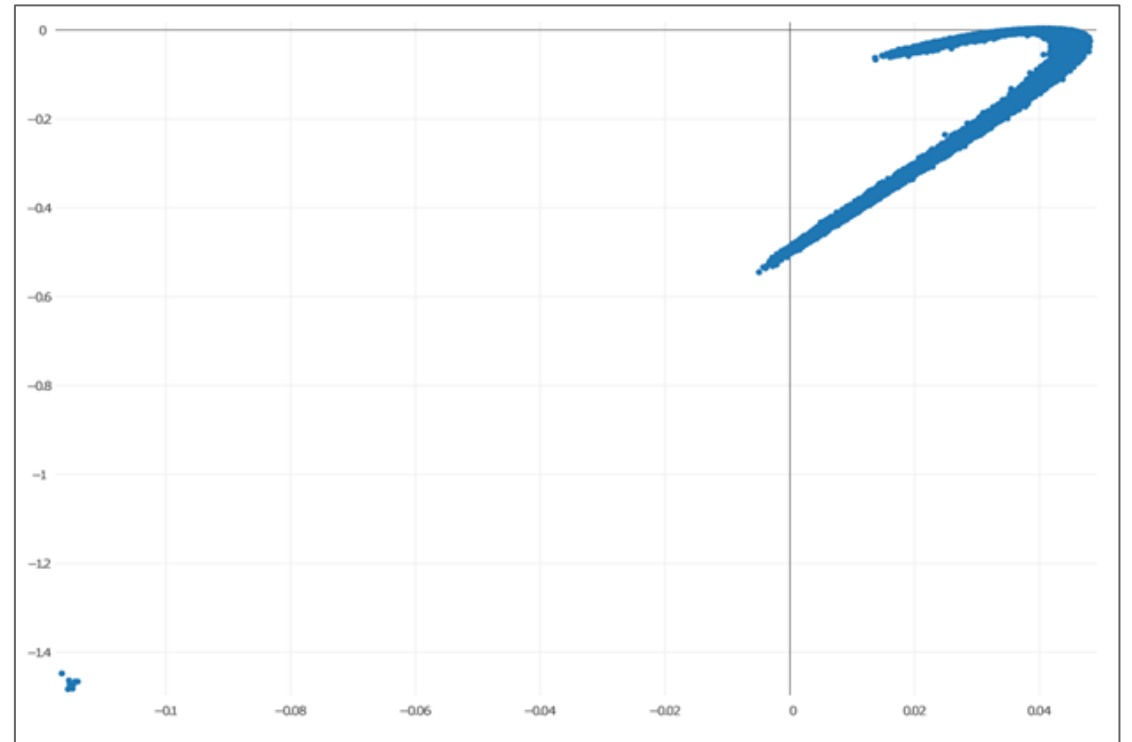
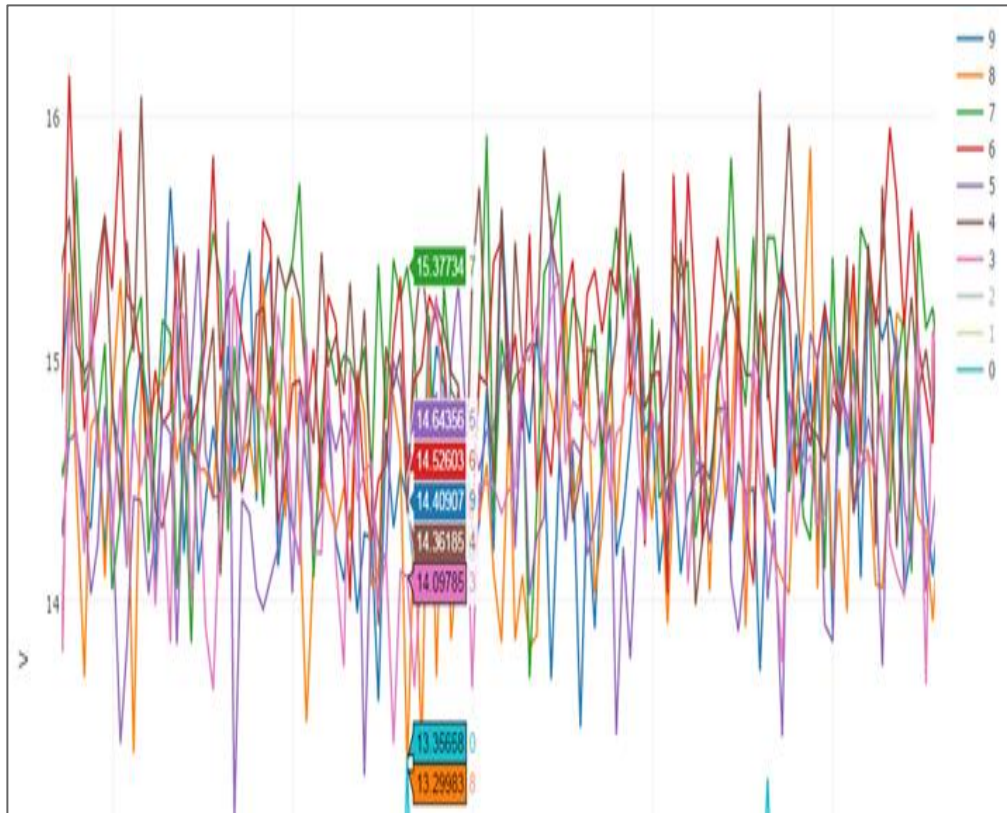
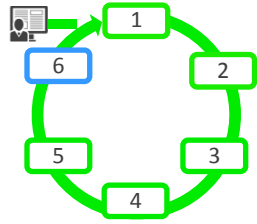
- Textual & graphical – for presentations and reports
- Numerical – for subsequent processing steps, standard formats: CSV, HDFS, ...
- Remote analytics graph – for describing the process which created certain data

## 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

Roughly  
since 2002

2010

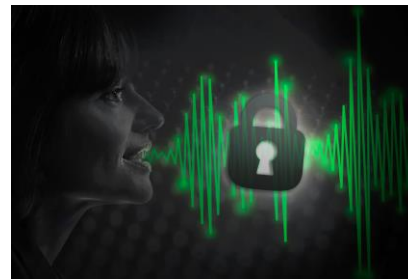
2015



Speech recognition for **call steering**



Speech output in cars for **navigation**



Speech recognition for biometric **identification**



Siri **mobile** assistant, Microsoft Cortana or Google Assistant



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.

Source: <http://creativestrategies.com/voice-assistant-anyone-yes-please-but-not-in-public/>





# 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 data 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.





# 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

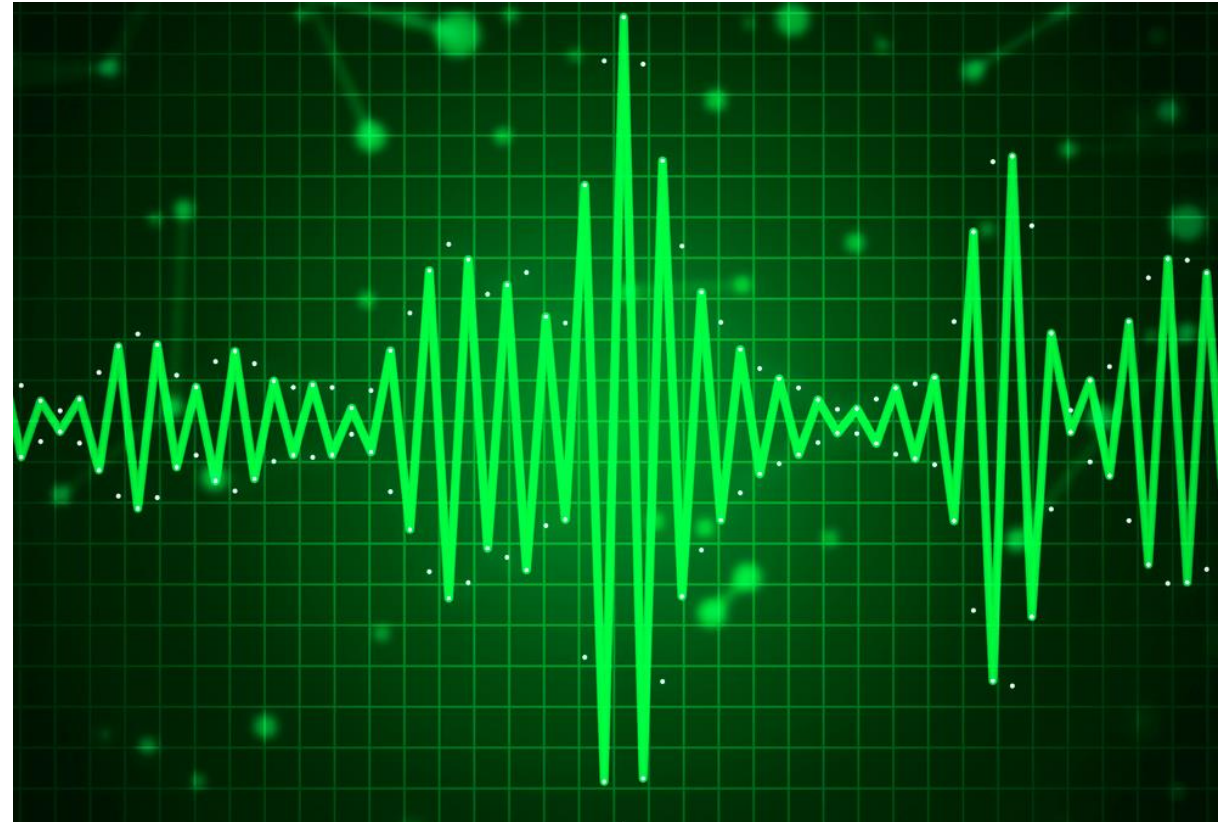
## For drivers and passengers

- 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



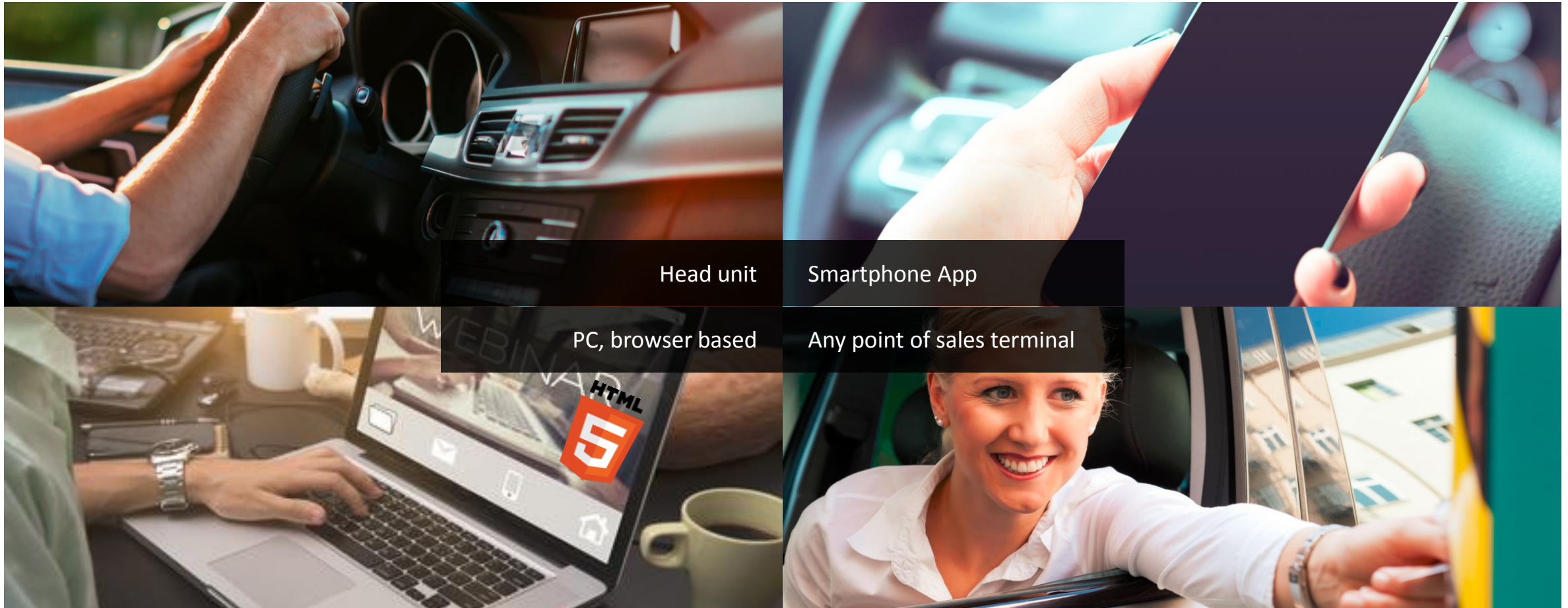
# Features

- 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

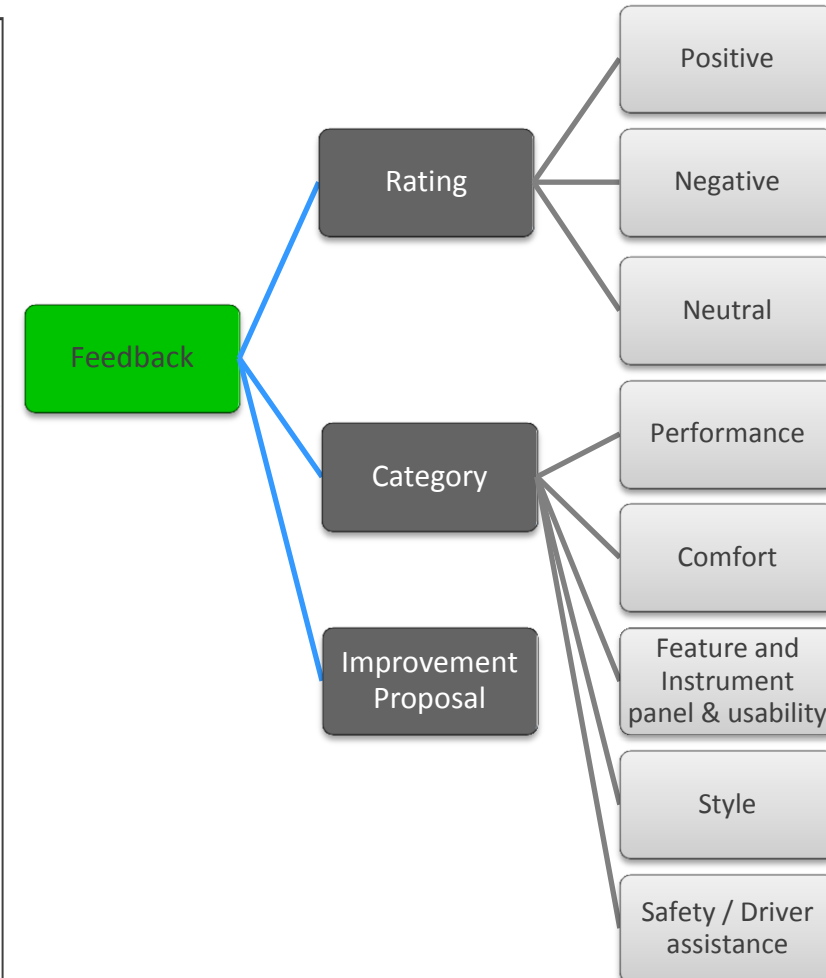
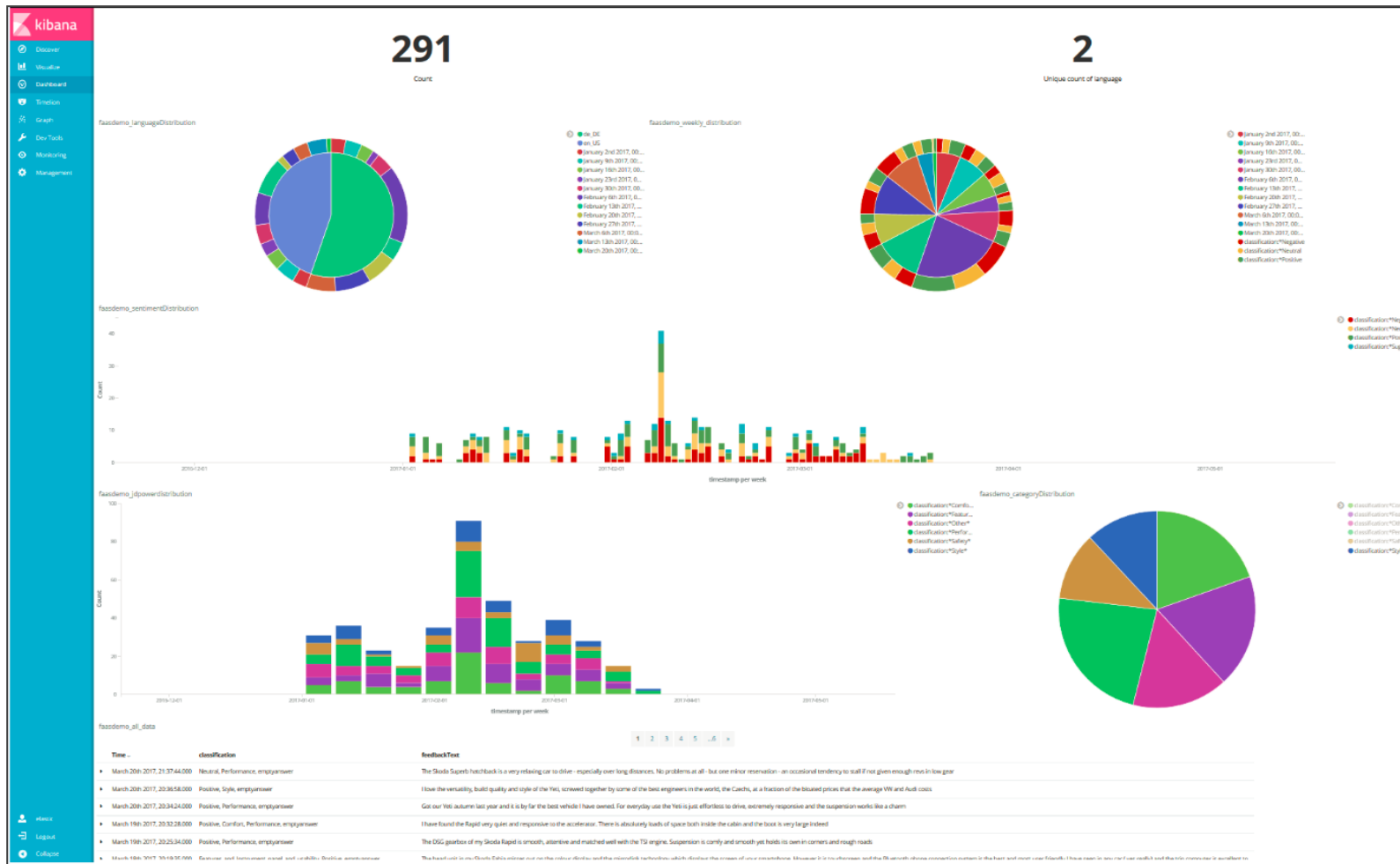




# REST API can be used from...



# Dashboard and categories



# 3 – SW-Update OTA



OEMs | Fleet managers

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





Max Muster

# DASHBOARD | Project Aleph ▾



ACTIVITY STREAM   CAMPAIGN ALERTS   FLEET MONITORING

STATUS ⚙️

- 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

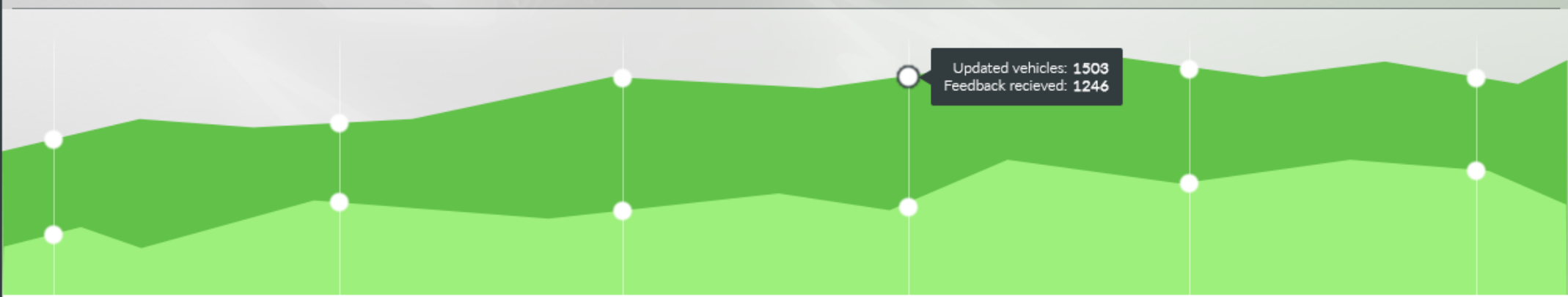
**28**  
PENDING APPROVALS

**14**  
HIGH PRIO CAMPAIGNS

**38**  
ACTIVE CAMPAIGNS

FULL ACTIVITY LOG...   Sort by: Info Warning

PROJECT PROGRESS ⚙️   ● Project Aleph   ● Project Omega

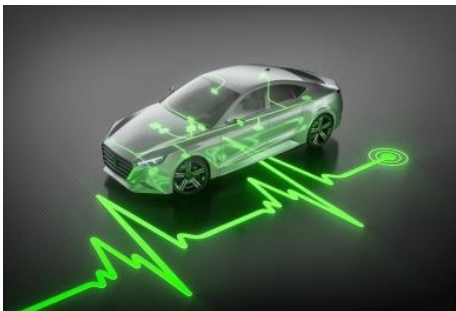


- DASHBOARD
- PROJECTS
- VEHICLES
- CAMPAIGNS
- SW PACKAGES

# EB's formula for adding value



End-to-end security through software craftsmanship



Remote analytics from car diagnostics data



Analytics from driver's direct opinion



Ability to update software over-the-air



Solutions for Vehicles Lifecycle Management



# Connected Car Metro Map





# Get in touch!



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