WirelessCar

Agenda

- Introduction
- About the Automotive Industry and Connected Cars
- Major Game Changers
- Conclusions
- Q & A

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Introduction

Christina Rux, Lead Solution Architect, WirelessCar

We are WirelessCar

Enabling safe, smart and sustainable mobility

- A global company headquartered in Sweden, with 700+ colleagues and presence in North America and Asia
- For 20+ years we have turned vehicle data into new insights and innovative services
- A trusted tech partner offering our unique expertise through products and services
- 9+ million cars served in more than 100 countries

VOLVO LAND ROVER SUBARU

SEAT LYNK&CO JAGUAR Mercedes-Benz

ŠKODA NISSAN

About me

- Solution Architect with a degree in System Design who has worked 25 years with IT development in the automotive industry
- Solution Architect for **Connected Car** since 2011
- Experience from Volvo Cars, Volvo AB, Daimler, VW AG and other OEMs
- Last assignment: Lead Architect for Vehicle and Cloud Platform, CARIAD (VW AG)
- This presentation will be about my system perspective on major changes and the interesting problems we need to solve, especially for connected cars

Christina Rux
Lead Solution Architect

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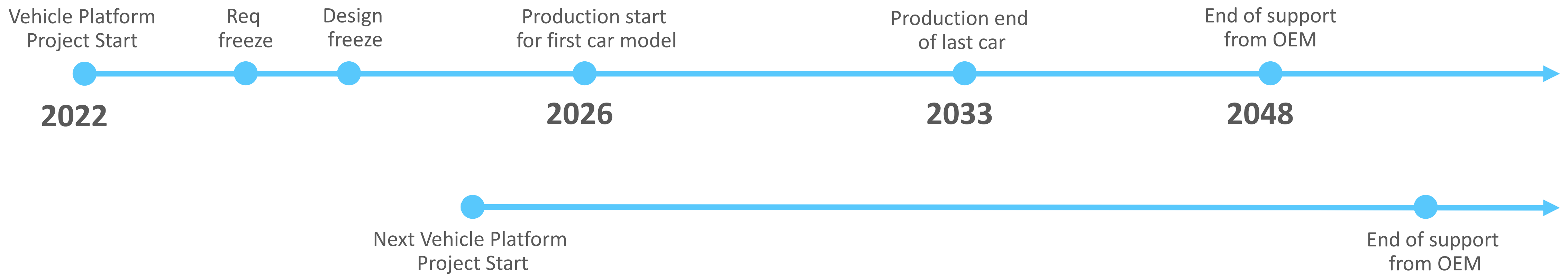
About the Automotive Industry

Why Year 2050 is Important for R&D Today

- Traditional role: sell cars to retailers. The after-market business (parts and repairs) is the cash cow
- How it's done:
  - +48 months' vehicle platform projects: a huge investment, x Billion Euros
  - Different vehicle models are designed and released on the platform for about 7 years, with major "facelifts" every 2-3 years
  - A vehicle must be supported by the OEM for approximately 15 years (liability)

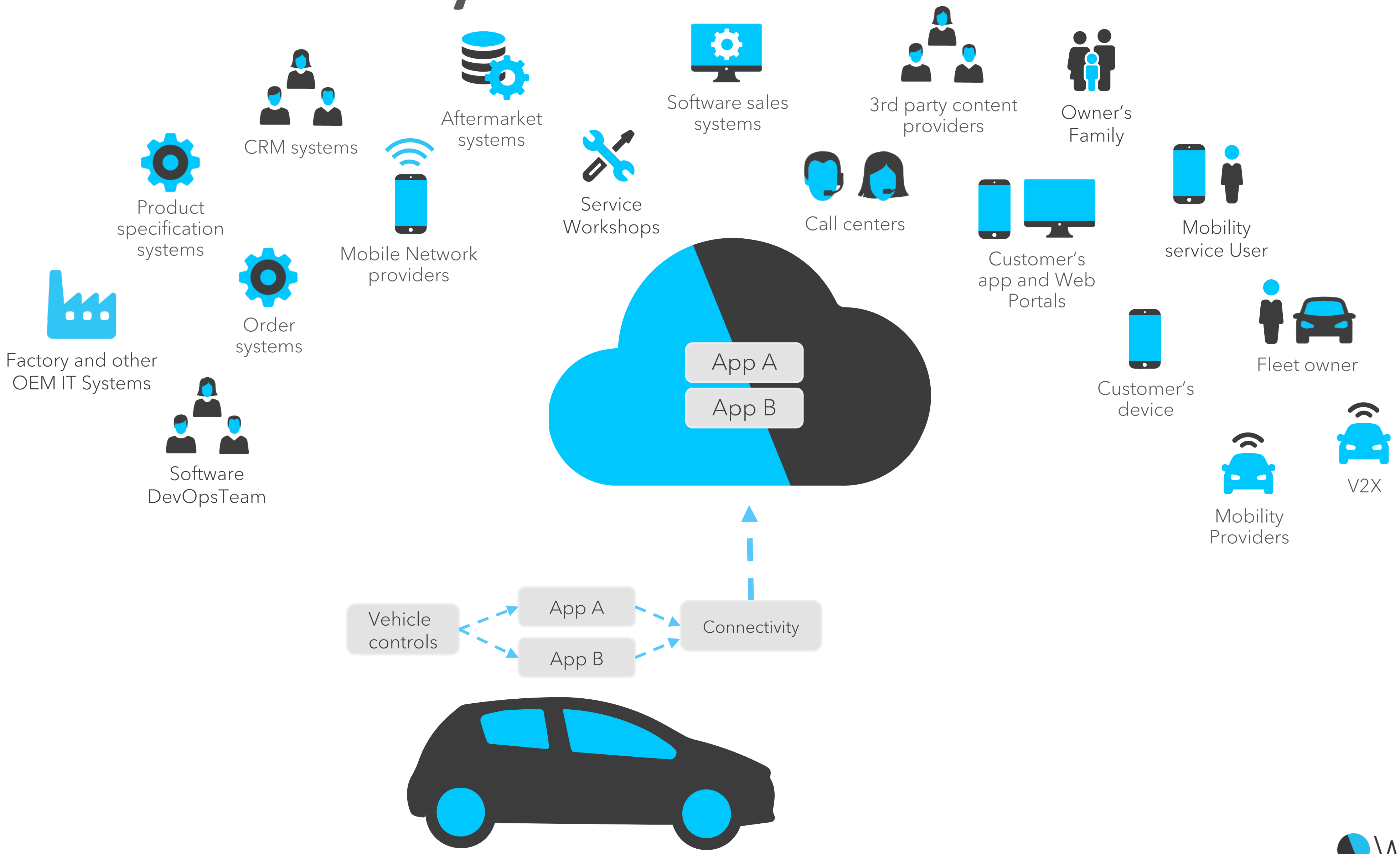


Vehicle Platform Project Start
Req freeze
Design freeze
Production start for first car model
Production end of last car
End of support from OEM
2022
2026
2033
2048
Next Vehicle Platform Project Start
End of support from OEM

Design Constraints to the System

- R&D: design a car that is buildable in the production
  - Million of variants
  - Automotive grade
  - Cost of each part, geographical fit, weight, safety, ampere budget…
- Very small margin on new vehicle sales
- Liability and Homologation: The vehicle development process is very regulated
- Parts of the design must be decided and documented in detail 2 years before start of production

A Connected Car System



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Major Game Changers

Major Game Changers for Connected Cars

1. OEM selling cars directly to the consumer (**from B2B to B2C** provider)
2. **Electrical vehicles** – the car must be connected to user and infrastructure (V2X)
3. **AD/ ADAS**: managing situations, making decisions, providing redundant systems and V2V communication require:
4. **Software-defined vehicle**: from integrating hardware and software components to being a software provider
5. **Tech Giants** move into the car and the cloud services

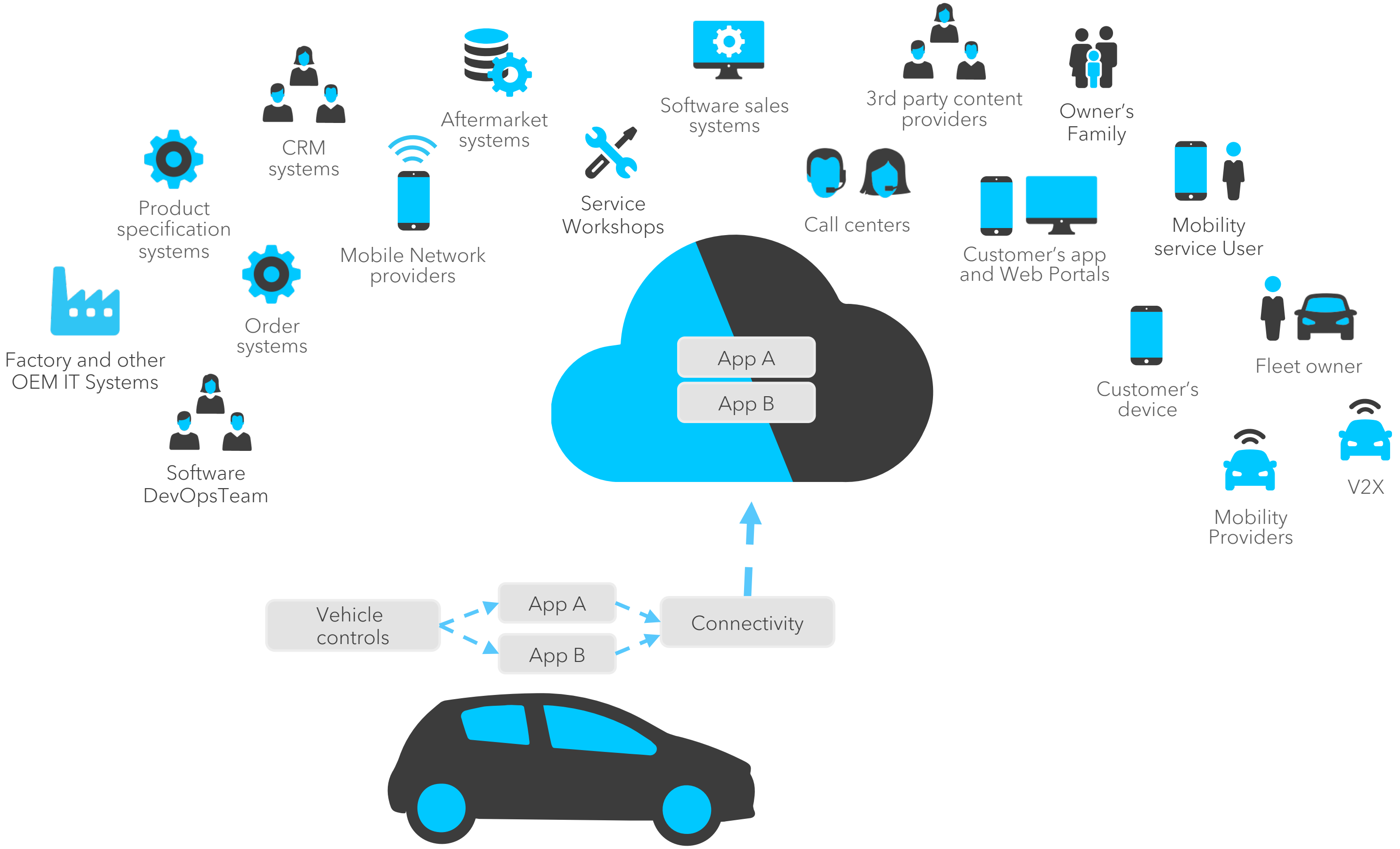
Conclusions:

- **Cybersecurity** threats change and increase daily
- Architecture Trade-offs
- New principles for software engineering

1.1 From B2B to B2C and new B2B

- From selling cars to the retailer to:
  - Direct consumer relationship
  - Fleet sales to mobility providers
  - Robotaxis

→ New, extended system to maintain



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1.2 Regulations

- Private person will have access to their own data
- OEM will need to share more data
  - Driven by European Data Act
- SAE Level 4
  - Drives more regulations (UN, etc, ect)

Regulatory pressures

NCAP / NHTSA Enhancements

UN R.144 eCall

Cybersecurity and data governance

2.1 EV Ecosystem: the Charging Challenge

Compared to the "traditional" way of going to a gas station, **"recharging" an EV can be considered a nightmare by many users.**

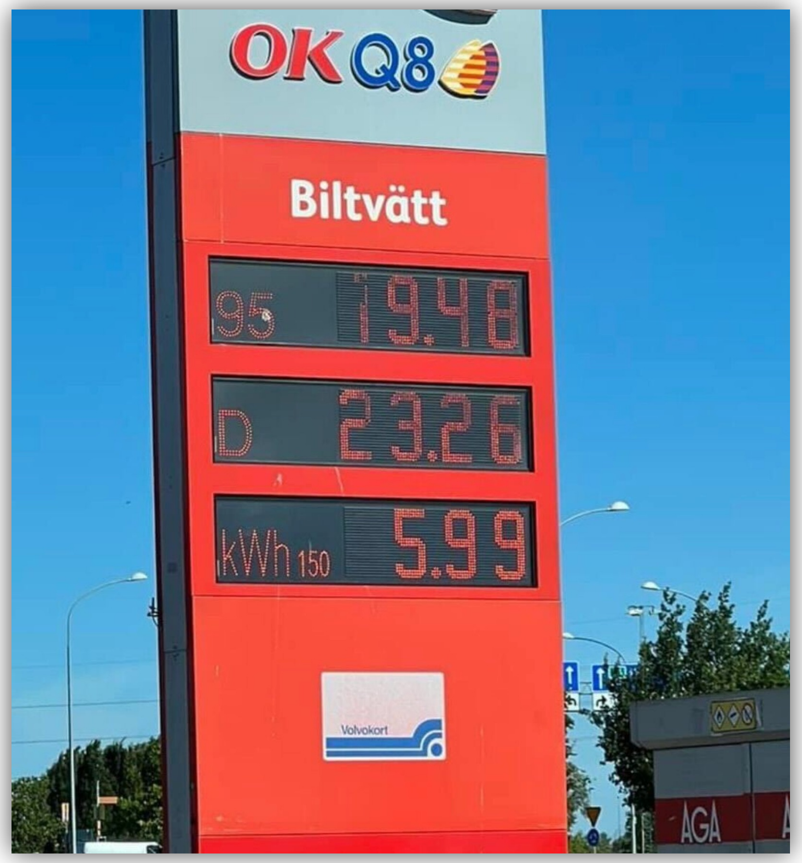
The deployment of the charging infrastructure is fragmented and controlled by different actors (private companies, oil companies, cities, states, etc.) and governed by different operators (utility providers, CPO, eMSP). **There is no unified, universal and unique way for paying a charge.**

Different possibilities:

- Smartphone registration and payment
- RFID token
- Credit card payment

Such complexity limits the deployment of EVs and creates a charging anxiety for long distance journeys

It also forces EV users to register to multiple platforms



It will take a long time until we see such deployment in each gas station.
Above: Real picture taken in Sweden

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Icons copyright: Freepik

VOLVO

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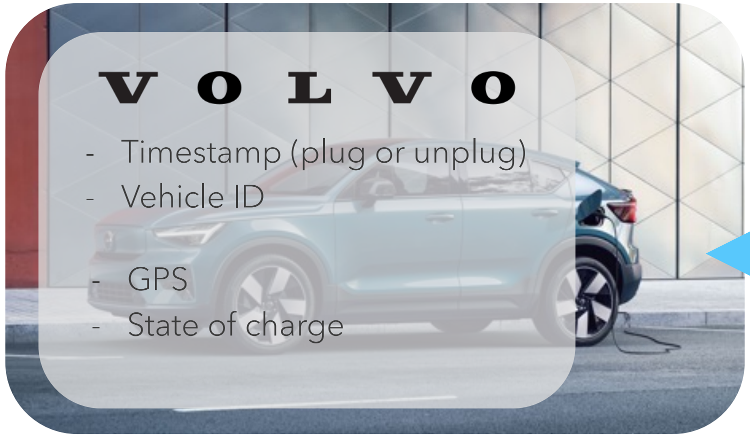
ChargeNode

Seamless Park & Charge

A proof of concept exploring how to create a seamless charging experience for urban charging (at work, or when parked in the city, support urban life with EVs)



VOLVO

- Timestamp (plug or unplug)
- Vehicle ID
- GPS
- State of charge

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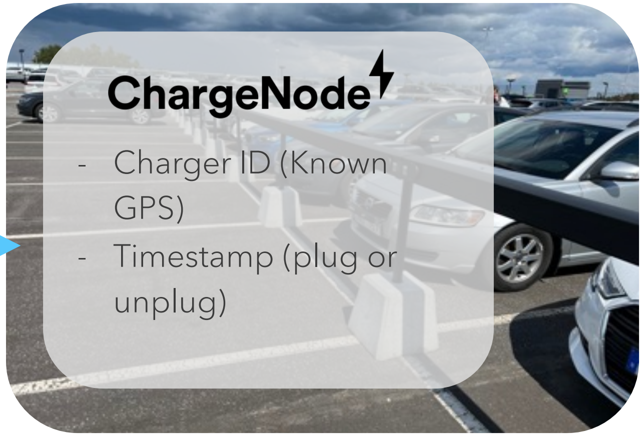
Automatically match vehicle location, ID, and position with Type 2 AC charger (OCPI)

- Control charging session
- Control parking fee
- Manage payment integration
- V2G



ChargeNode

- Charger ID (Known GPS)
- Timestamp (plug or unplug)

WirelessCar Plug & Go

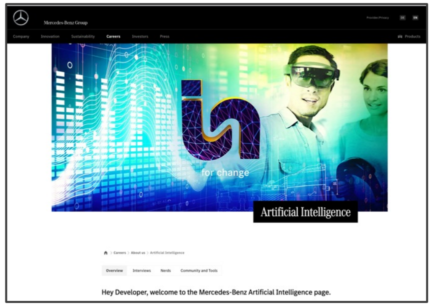
Plug & Charge – ISO15118

Short-term goal: The convenience is the main selling-point.

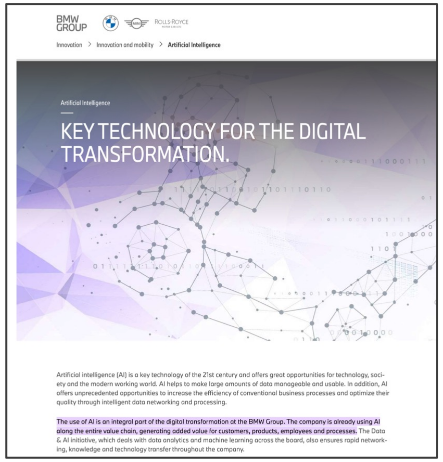
Long-term goal: V2G enables smart grid, smart city

3.1 AD/ ADAS

- AD/ ADAS: managing situations, making decisions, providing redundant systems and V2V communication require:
  - Increased computing power
  - Sensors, cameras and radars
  - Improved communication to cloud
  - AI/ ML in the vehicle and in the cloud



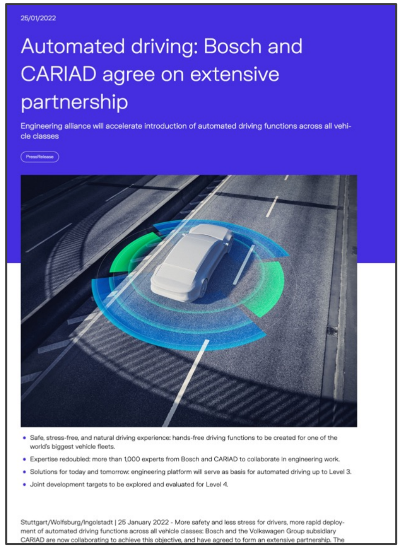
Hey Developer, welcome to the Mercedes-Benz Artificial Intelligence page.


BMW GROUP
ROLLS-ROYCE
Innovation > Innovation and mobility > Artificial Intelligence
Artificial Intelligence

KEY TECHNOLOGY FOR THE DIGITAL TRANSFORMATION.

Artificial intelligence (AI) is a key technology of the 21st century and offers great opportunities for technology, society and the modern working world. AI helps to make large amounts of data manageable and usable. In addition, AI offers unprecedented opportunities to increase the efficiency of conventional business processes and optimize their quality through intelligent data networking and processing.

The use of AI is an integral part of the digital transformation at the BMW Group. The company is already using AI along the entire value chain, generating added value for customers, products, employees and processes. The Data & AI initiative, which deals with data analytics and machine learning across the board, also ensures rapid networking, knowledge and technology transfer throughout the company.



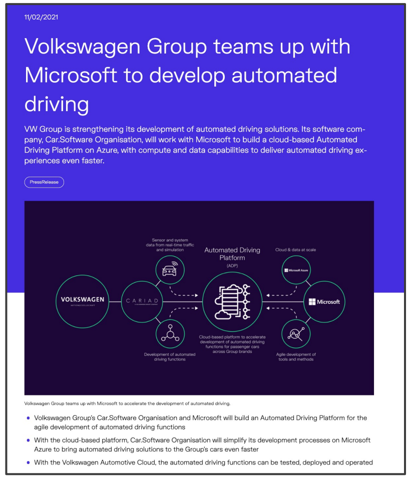
25/01/2022

Automated driving: Bosch and CARIAD agree on extensive partnership

Engineering alliance will accelerate introduction of automated driving functions across all vehicle classes

- Safe, stress-free, and natural driving experience: hands-free driving functions to be created for one of the world's biggest vehicle fleets.
- Expertise redoubled: more than 1,000 experts from Bosch and CARIAD to collaborate in engineering work.
- Solutions for today and tomorrow: engineering platform will serve as basis for automated driving up to Level 3.
- Joint development targets to be explored and evaluated for Level 4.

Stuttgart/Wolfsburg/Ingolstadt | 25 January 2022 - More safety and less stress for drivers, more rapid deployment of automated driving functions across all vehicle classes: Bosch and the Volkswagen Group subsidiary CARIAD are now collaborating to achieve this objective, and have agreed to form an extensive partnership. The



11/02/2021

Volkswagen Group teams up with Microsoft to develop automated driving

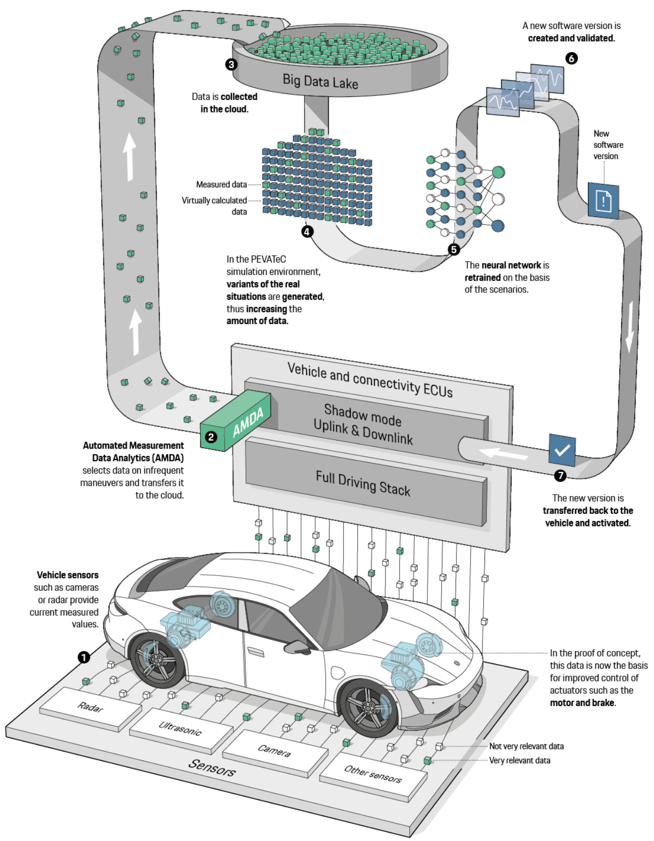
VW Group is strengthening its development of automated driving solutions. Its software company, Car.Software Organisation, will work with Microsoft to build a cloud-based Automated Driving Platform on Azure, with compute and data capabilities to deliver automated driving experiences even faster.

PressRelease
Sensor and system data from real-time traffic and simulation
Automated Driving Platform
(ADP)
Cloud & data at scale
VOLKSWAGEN
AKTIENGESELLSCHAFT
CARIAD
Microsoft Azure
Microsoft
Development of automated driving functions
Cloud-based platform to accelerate development of automated driving functions for passenger cars across Group brands
Agile development of tools and methods

Volkswagen Group teams up with Microsoft to accelerate the development of automated driving.

- Volkswagen Group's Car.Software Organisation and Microsoft will build an Automated Driving Platform for the agile development of automated driving functions
- With the cloud-based platform, Car.Software Organisation will simplify its development processes on Microsoft Azure to bring automated driving solutions to the Group's cars even faster
- With the Volkswagen Automotive Cloud, the automated driving functions can be tested, deployed and operated

Big Data Loop proof of concept



A new software version is **created and validated.**

Data is **collected in the cloud.**

In the PEVATeC simulation environment, **variants of the real situations** are **generated**, thus **increasing** the **amount of data.**

The **neural network** is **retrained** on the basis of the scenarios.

Automated Measurement Data Analytics (AMDA) selects data on infrequent maneuvers and transfers it to the cloud.

The new version is **transferred back to the vehicle and activated.**

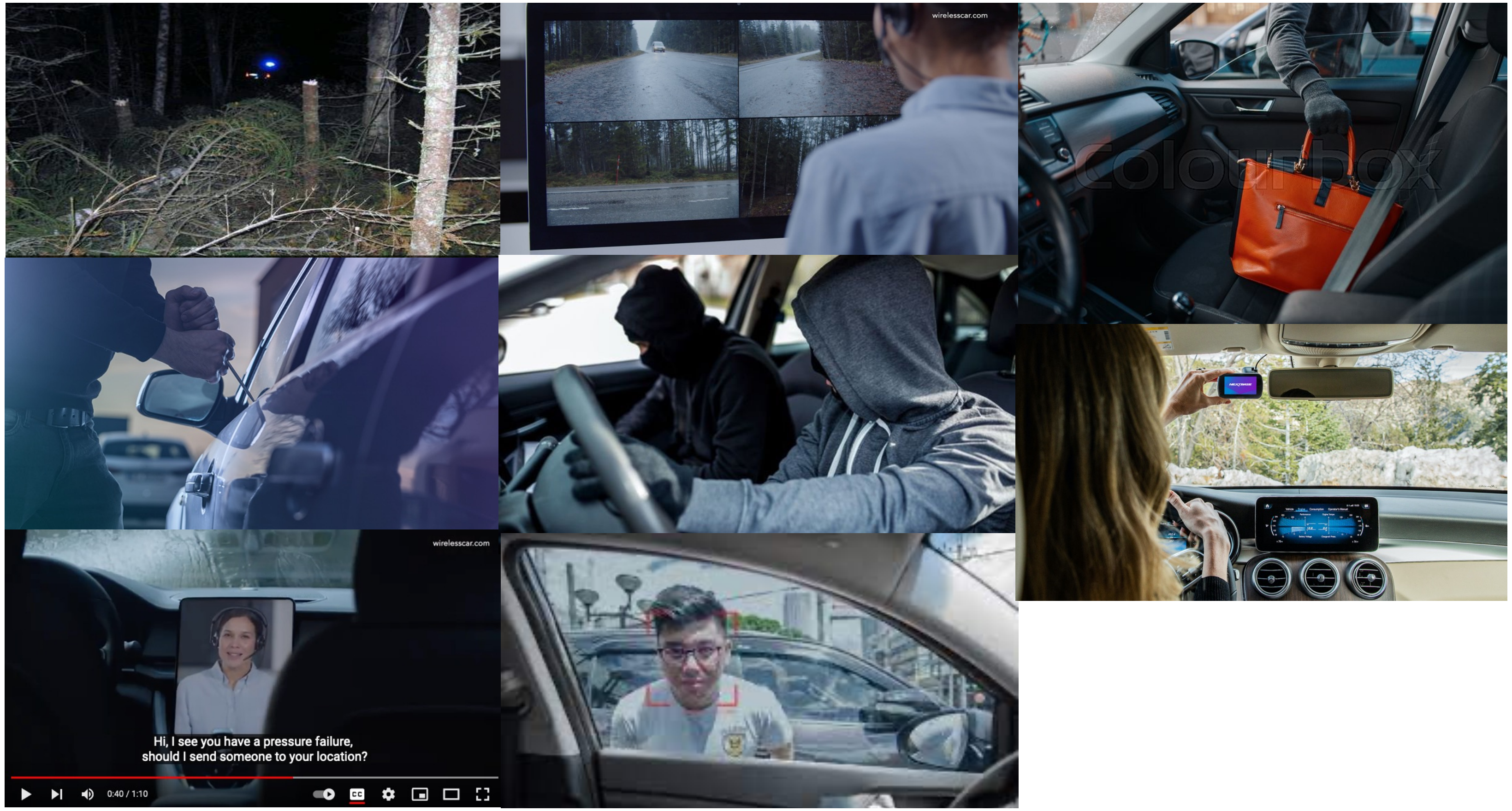
Vehicle sensors such as cameras or radar provide current measured values.

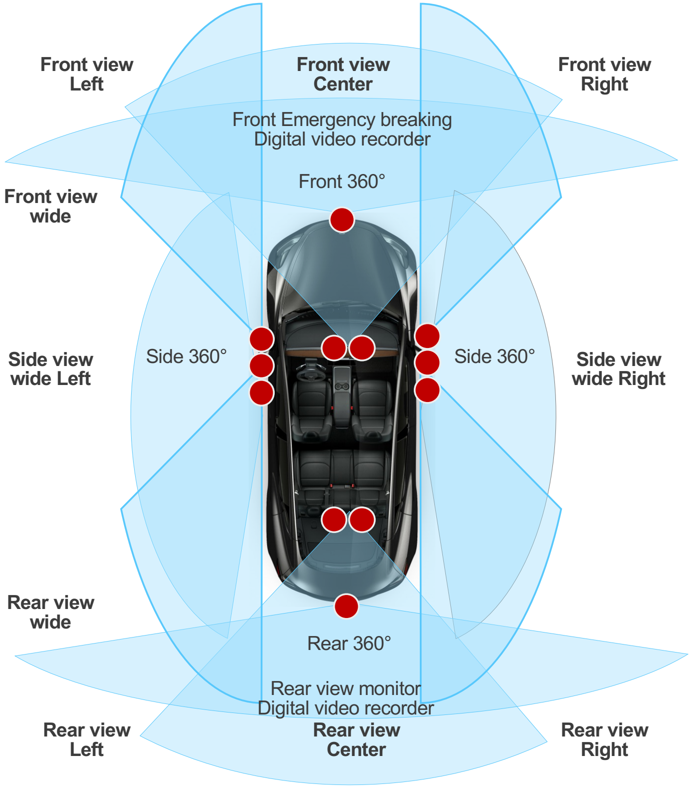
In the proof of concept, this data is now the basis for improved control of actuators such as the **motor and brake**.

https://newsroom.porsche.com/en/2021/innovation/porsche-engineering-big-data-loop-25029.html

3.2 Connected Equipment in the Vehicle

- Cameras
  - Advanced safety and security


wirelesscar.com
Colourbox
wirelesscar.com
Hi, I see you have a pressure failure,
should I send someone to your location?
0:40 / 1:10



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4.1 Software-Defined Vehicle

Objective: fully decoupled hardware from software

Software-defined vehicle: from integrator of hardware and components to being a software provider

- From relying on Tier 1, Tier 2, Tier 3 structure to in-sourcing
- New software houses
  - Examples: development of MB.OS and VW.OS

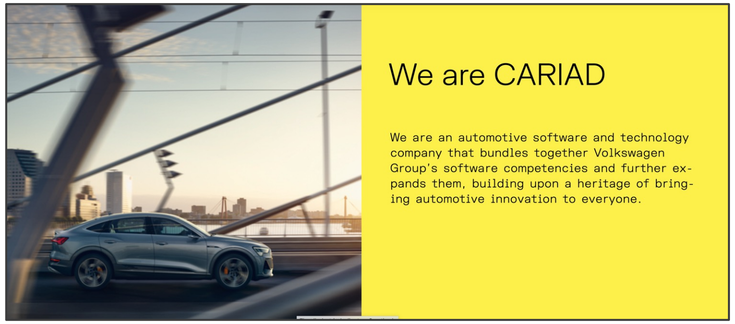
Centralized compute provides a new development environment in vehicle

- Shorten development time, allow for fast OTA updates over vehicle lifecycle
- Delivery as agile devops product teams

Cooperation on Open Source Initiatives

Mercedes-Benz opens the Electric Software Hub, a software integration factory at the Sindelfingen site

Mercedes-Benz: 3000 engineers in Electric SW Hub



We are CARIAD

We are an automotive software and technology company that bundles together Volkswagen Group's software competencies and further expands them, building upon a heritage of bringing automotive innovation to everyone.

CARIAD: 5000 engineers for VW Group

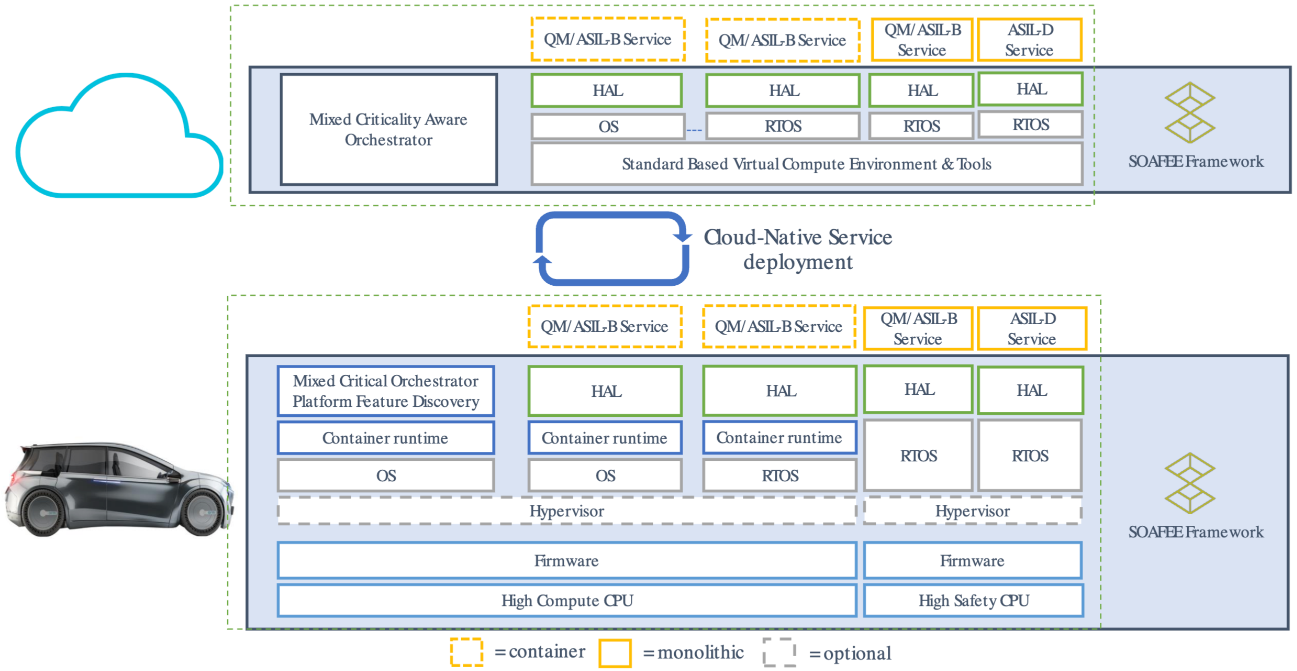
4.2 Open Source Initiatives: SOAFEE

Example of an open source initiative: **Scalable Open Architecture for Embedded Edge** (SOAFEE)

Automakers, semiconductor suppliers, open source and independent software vendors, and cloud technology leaders

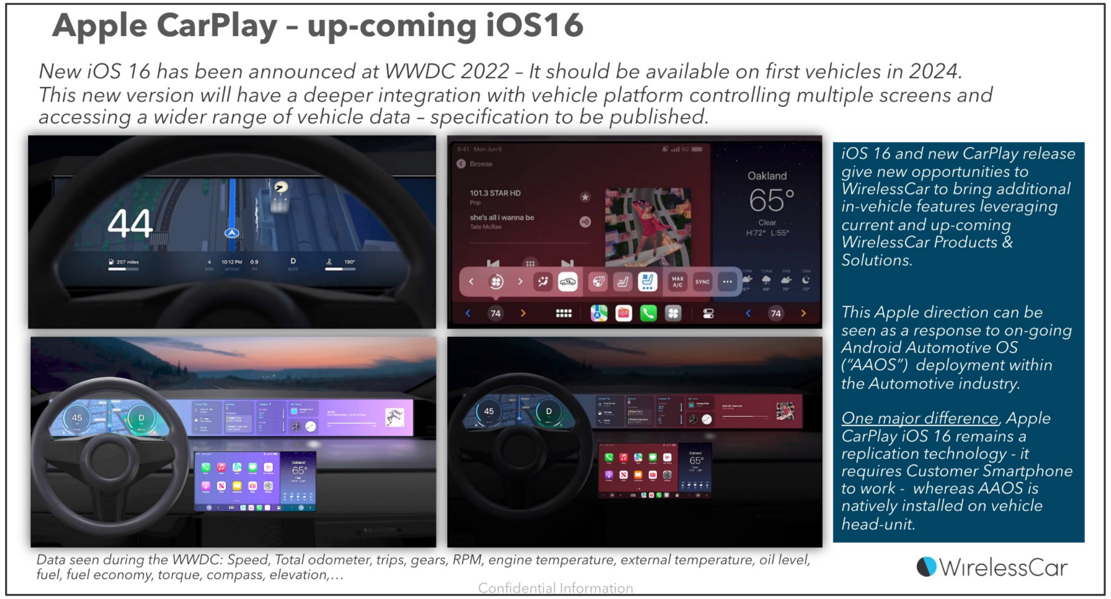
Deliver a **cloud-native architecture** enhanced for mixed-criticality automotive applications with corresponding open-source reference implementations

Standardize key non-differentiating middle-layers, such as the hypervisor, operating systems, container runtime and hardware abstraction layers



5.1 Google and Apple in the Car

- From mirroring your phone to actual OS in the car
- Android Automotive becomes the infotainment environment
  - Remote commands will be possible
  - Will replace telematics unit application layer
- Next Apple CarPlay is going to have integrations with car network



Apple CarPlay – up-coming iOS16

New iOS 16 has been announced at WWDC 2022 – It should be available on first vehicles in 2024. This new version will have a deeper integration with vehicle platform controlling multiple screens and accessing a wider range of vehicle data – specification to be published.

iOS 16 and new CarPlay release give new opportunities to WirelessCar to bring additional in-vehicle features leveraging current and up-coming WirelessCar Products & Solutions.

This Apple direction can be seen as a response to on-going Android Automotive OS ("AAOS") deployment within the Automotive industry.

<u>One major difference</u>, Apple CarPlay iOS 16 remains a replication technology - it requires Customer Smartphone to work - whereas AAOS is natively installed on vehicle head-unit.

Data seen during the WWDC: Speed, Total odometer, trips, gears, RPM, engine temperature, external temperature, oil level, fuel, fuel economy, torque, compass, elevation,…

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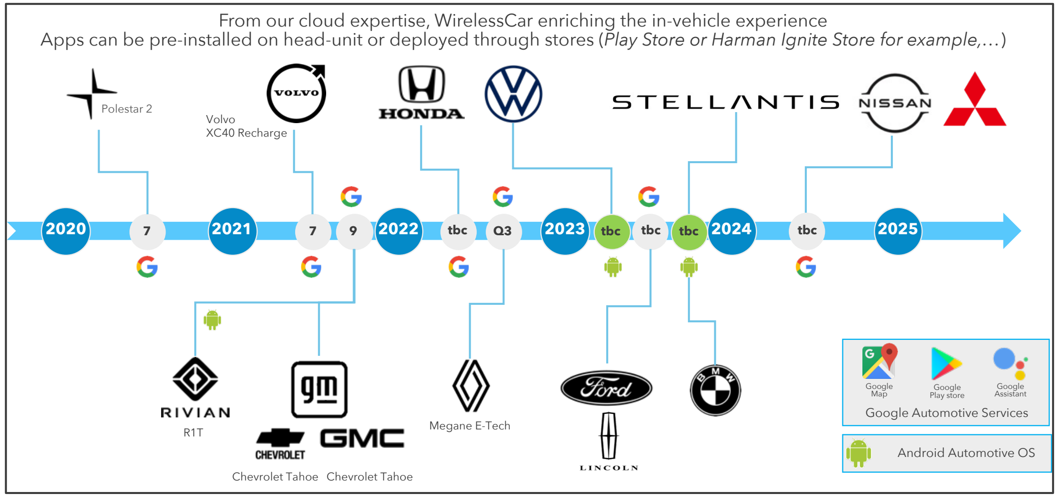
Confidential Information



From our cloud expertise, WirelessCar enriching the in-vehicle experience
Apps can be pre-installed on head-unit or deployed through stores (*Play Store or Harman Ignite Store for example,…*)

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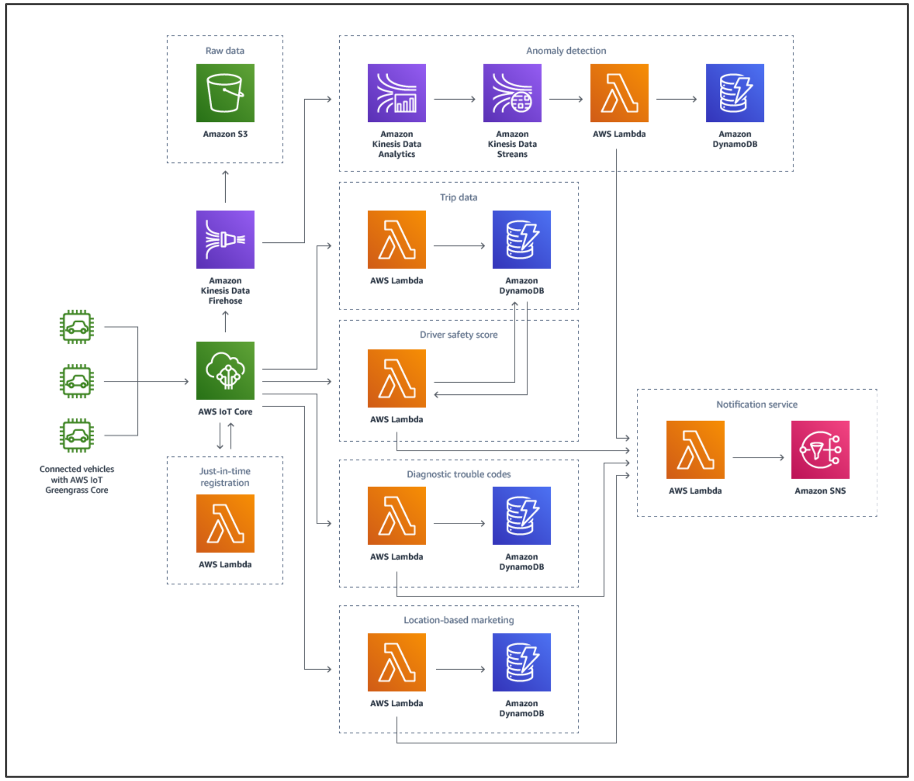
5.2 Cloud Providers’ Connected Car Services

The Cloud Providers AWS, Microsoft and Google Cloud (and Chinese Providers) are hosting most Connected Car Clouds today, but also have ambitions to provide connected car services



AWS example: Connected Vehicle Solution
https://aws.amazon.com/solutions/implementations/aws-connected-vehicle-solution/

VOLKSWAGEN
AUTOMOTIVE CLOUD
Park & Charge
On-Board Media Streaming
Personal Assistant
Personalization & Identification
Prediction
Connected Smart Home
In-Car-Office
Command & Check

Microsoft: Connected Vehicle products.
Strategic partnership with VW

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Conclusions

- Architecture Tradeoffs
- Cybersecurity
- The New Sw Engineering

Examples of Architecture Trade-offs for Connected Cars

Performance/ Response time - Security

Ease of use - Security

Global solution - Complexity

Re-use vs build vs buy - Strategic choices

Being fast - Complex systems

Attracting new talent - Process-heavy development

The New Engineering Competence

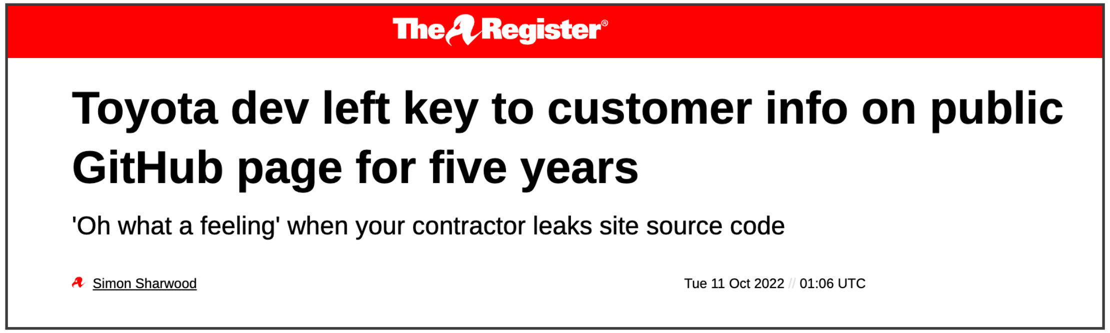
- Challenge: make changes often and fail fast. Keep the vehicle software updated!
- OEMs are trying to attract more software developers
- Time consuming development processes and extremely complex system with many dependencies
- New competence is needed on how to increase fast development and design decoupled applications, while still meeting quality demands
- "How to be productive in a complex environment"
  - Interested in the complex system and understand what is important
  - Filter out the noise
  - Understand when to re-use and when to build new

Cybersecurity for Connected Cars

- Need to secure vehicle, cloud and mobile apps, over the 15 (+7) years' lifecycle
- Examples of new attack vectors:
  - From CAN to Ethernet: encrypting the network to prevent access to vehicles' security certificate
  - Ransomware against vehicles
  - Malicious mobile app infect the car
  - Vehicle OS is hacked to trust malicious software
  - Objective in the agile development: deploy often, fail fast. The development environments are a new target area and need to be protected
- Authentication by certificates for V2V and V2X services by PKI standard by C-ITS (Cooperative Intelligent Transport Systems)
- Need to monitoring cars, apps and cloud applications for anomalies. Be able to provide software updates fast and over-the-air.

Example 1: Toyota (October 2022)

- Toyota published warning that 300 000 customers’ email addresses were accessible between 2017 and 2022
- The error was that parts of the source code were mistakenly published on GitHub, including access key to customer data server
- This is an example of risk of:
  - Negligence by developers in order to simplify dev & testing (storing credentials in the code)
  - Using public code libraries

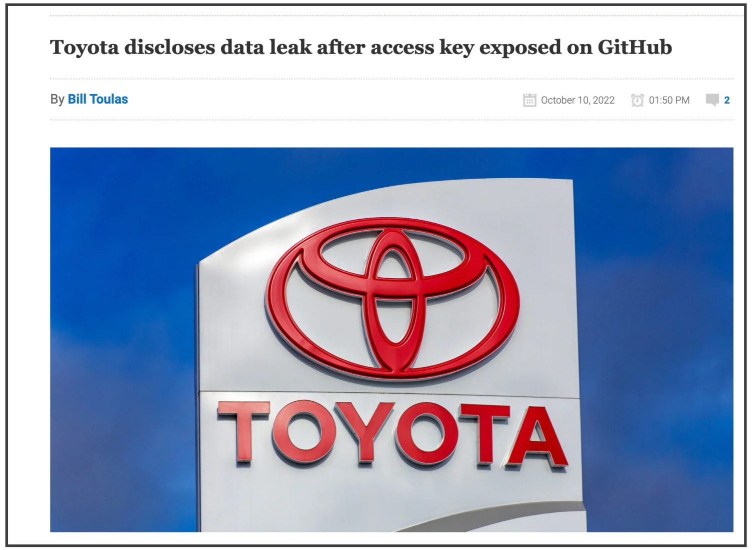


The Register®

Toyota dev left key to customer info on public GitHub page for five years

'Oh what a feeling' when your contractor leaks site source code

Simon Sharwood Tue 11 Oct 2022 / 01:06 UTC



Toyota discloses data leak after access key exposed on GitHub

By Bill Toulas October 10, 2022 01:50 PM 2

Example 2: Uber (September 2022)

- A hacker claimed to have access to Uber internal IT systems and development systems (source code), and possibly even the Vulnerabilities list (confidential results of bug bounty program)
- Uber immediately shut down a number of systems
- The attack:

  1. Malicious code on UBER contractor’s personal device
  2. Extracting credentials
  3. Repeated log in attempts triggering MFA requests
  4. …eventually the user accepted one, login successful!
  5. The user id granted access to a lot of development systems

- Lesson learned: Restrict access. Watch out for multiple MFA requests.

Home › Cyber Attack

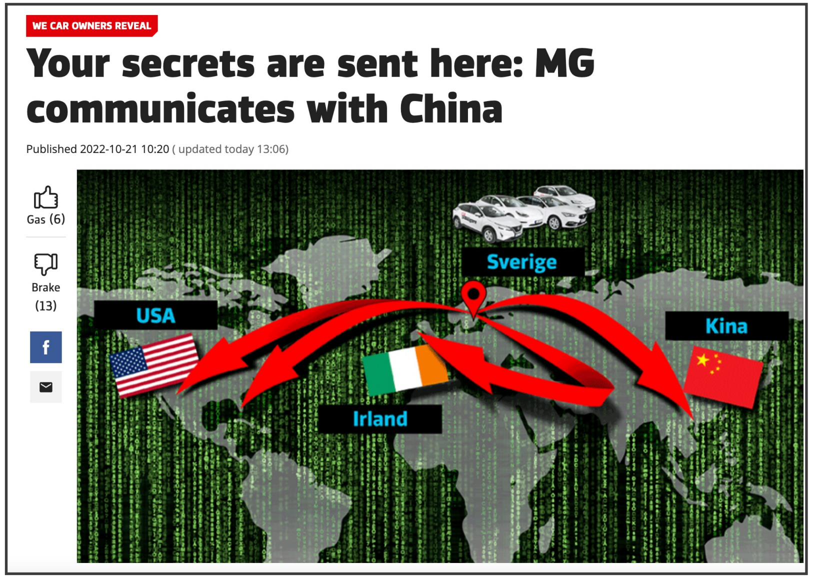
Cyber Attack | Cyber Security | Cyber Security News | Hacks

Uber Hacked – Attackers Gained Full Access to Company’s Critical IT Systems

By Balaji N - September 16, 2022 0

Example 3: MG and User Data Privacy (October 2022)

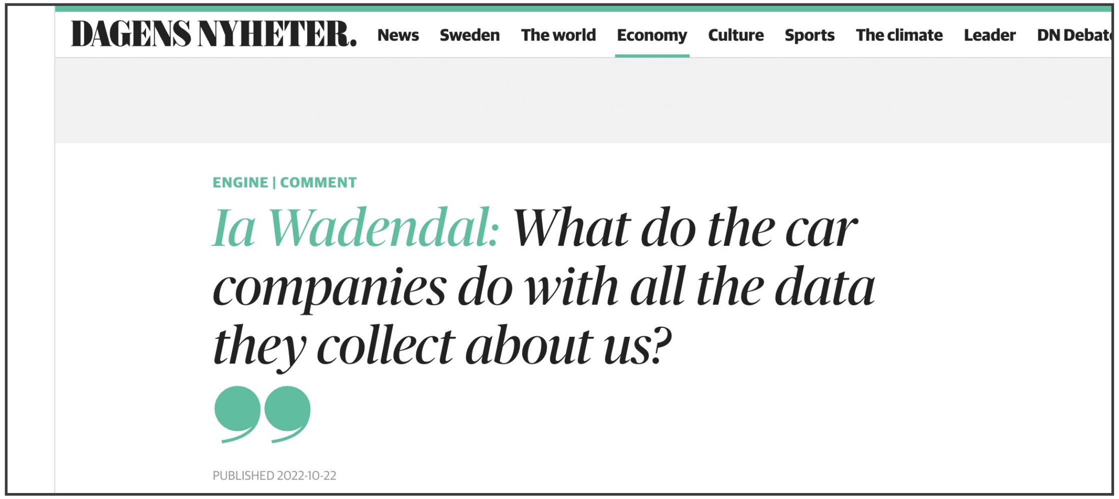
- The Swedish magazine "Vi Bilägare" reports that MG vehicles in Europe send user data from a music app to a Tencent server in China.
- 1st response: only reports if the app has crashed
- 2nd response: data is sent from the app continuously
- Privacy risk by GDPR expert Joakim Söderberg: every car has its own pattern. Identifying the car means possibility to identify the owner.



WE CAR OWNERS REVEAL

Your secrets are sent here: MG communicates with China

Published 2022-10-21 10:20 (updated today 13:06)



DAGENS NYHETER.

ENGINE | COMMENT

Ia Wadendal: What do the car companies do with all the data they collect about us?

PUBLISHED 2022-10-22

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Thank you

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