Cloud & Connected Services

Capturing Vehicle Data and Communication Framework Design

13 November 2019

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Agenda

- **Brief recap of the GAP analysis discussion**
- **Considerations to have in mind**
  - Different Types of Vehicle Data
  - Services and General Needs
  - Actors
  - Off-board Access vs. On-board Access
  - Data model
  - Vehicle Data Streams
- **Joint discussion**

Recap

- GAP analysis has been presented

- Now moving from analysis to system design and a reference architecture

- Need to consider different types of data streams and service needs

- There are active open projects that address topics that have been identified in CCS

Different Types of Vehicle Data

- **Personalised vehicle data**
  - Identifiable to a specific VIN
  - Used by 3rd party services to offer tailored services to users
  - Typical delivery method point-to-point requests e.g. to a REST API when data is requested for a certain VIN
- **Pseudonymised vehicle data**
  - Most identifying fields within a database are replaced with artificial identifiers, or pseudonyms
  - Neither fully anonymous nor directly identifying
  - Typically delivered in bulk in dataset from many vehicles
- **Anonymised vehicle data**
  - All identifiers, both direct and indirect are removed
 - Big Data

Services and General Needs

- **Personalised services**
  - Retrieval of the latest cached vehicle data from the OEM server
  - Event subscriptions and notifications when new data is available
  - Retrieval of historical vehicle states, e.g. the data of the last 12 hours
  - Streaming API with real-time data updates
  - Data retrieval of a group of vehicles by a fleet owner
  - Workable request limits
  - Defining of data containers

- **Big Data services**
  - Retrieval of bulk historical data
  - Advanced data services (not only sensors but media)
  - Analytics and histograms
  - Streaming API with configurable parameters (geolocation)

Actors

- **OEM**
  - Data providers who owns the customer connectivity contract
- **Car owner**
  - Owner or controller of a vehicle
  - Grants/revokes data access to 3rd party services
- **Fleet owner**
  - Owner or controller of a fleet of vehicles
  - Grants/revokes data access on a group level
  - Typically interest to access fleet data to internal services
- **3rd party developer**
  - Provider of a service or application that consumes vehicle data
- **Neutral Server and Marketplace**
  - Intermediaries between OEMs and 3rd party developers

Off-board Access vs. On-board Access

- Distinction between accessing data from a central OEM server and directly from the vehicle

- Extended Vehicle standardisation is for off-board data access only

- Android Automotive and the connected cockpit could provide direct access

3rd Parties

Back-end apps ← OEM Back-end

3rd Parties

iOS apps

Android apps ← Vehicle OS

SGW

ECU
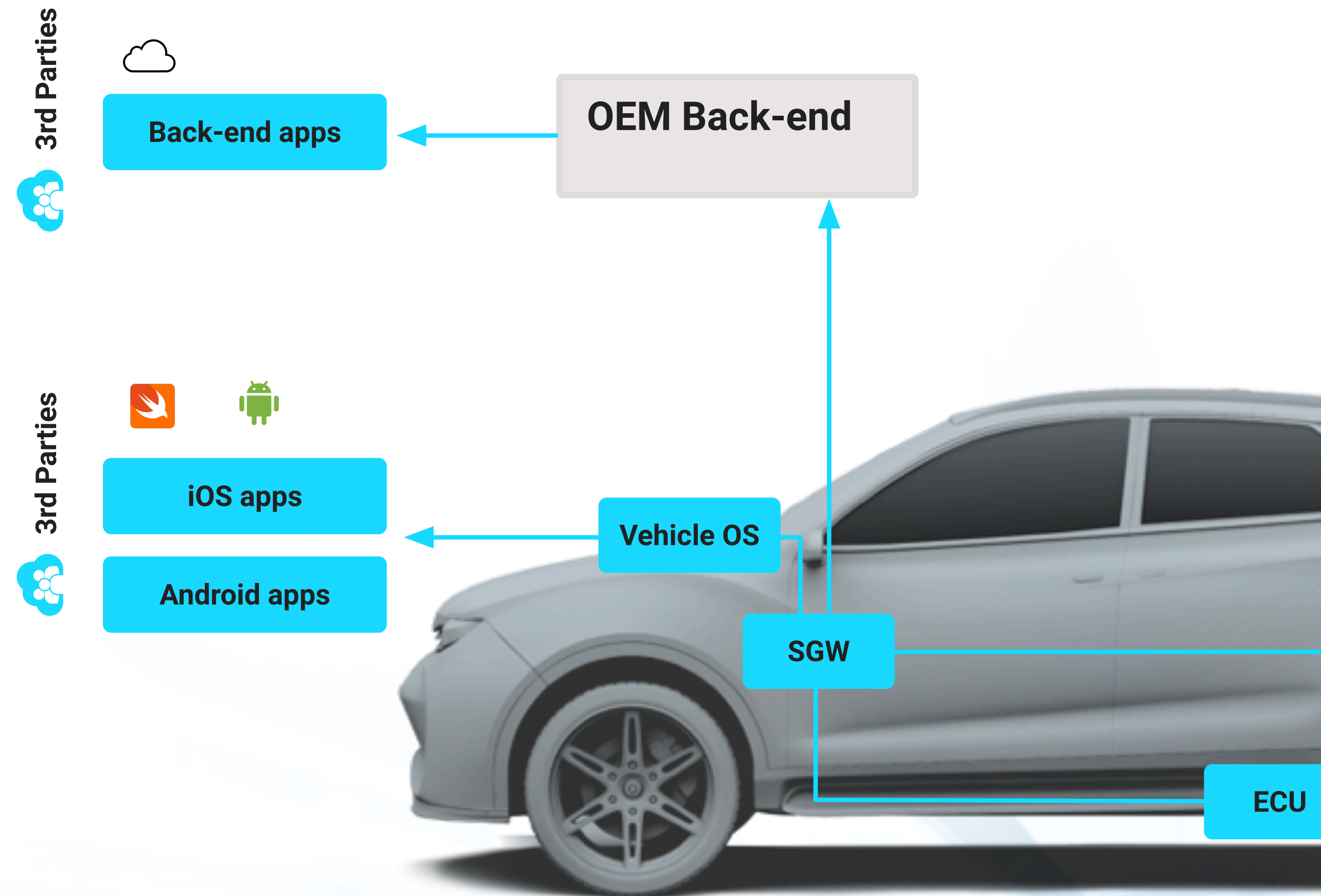
Data Model

- VSS is assumed in the first design thoughts. From comparison a most useful too to have practical discussions.
- Discussion from session 1: Common data model

GEN2 Multi Domain Vehicle Taxonomy

Gen2 defines rules for the specification of the multi domain vehicle taxonomy and how the different domain taxonomies are aggregated. The single entry point of this multi domain taxonomy is VSS 2.
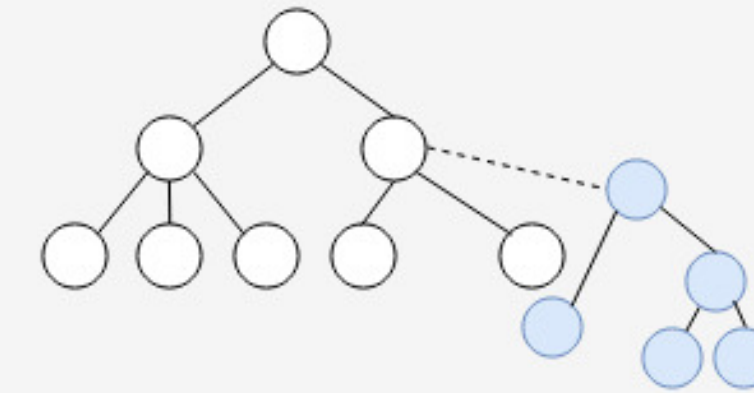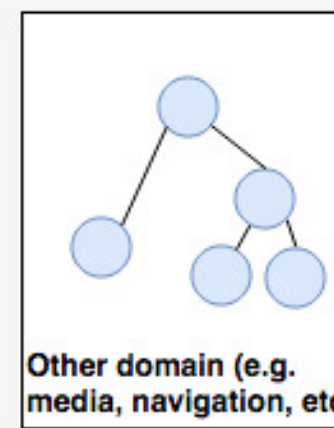
Domain Taxonomies

Domain knowledge expressed in a domain taxonomy to bridge human and machine understanding. It's about formalizing the description of a specific domain so that it is reusable by others. It's about the nouns described with semantic context and information like datatype, etc..
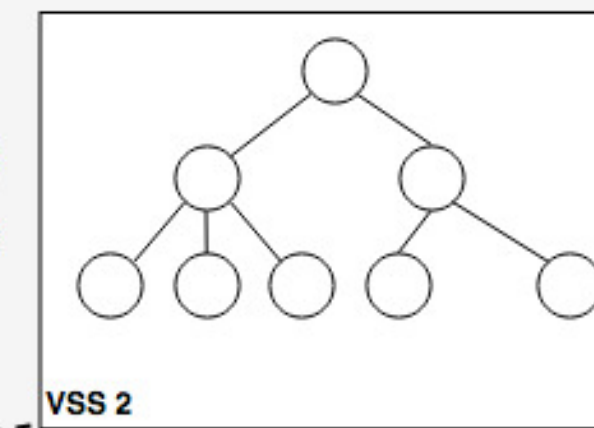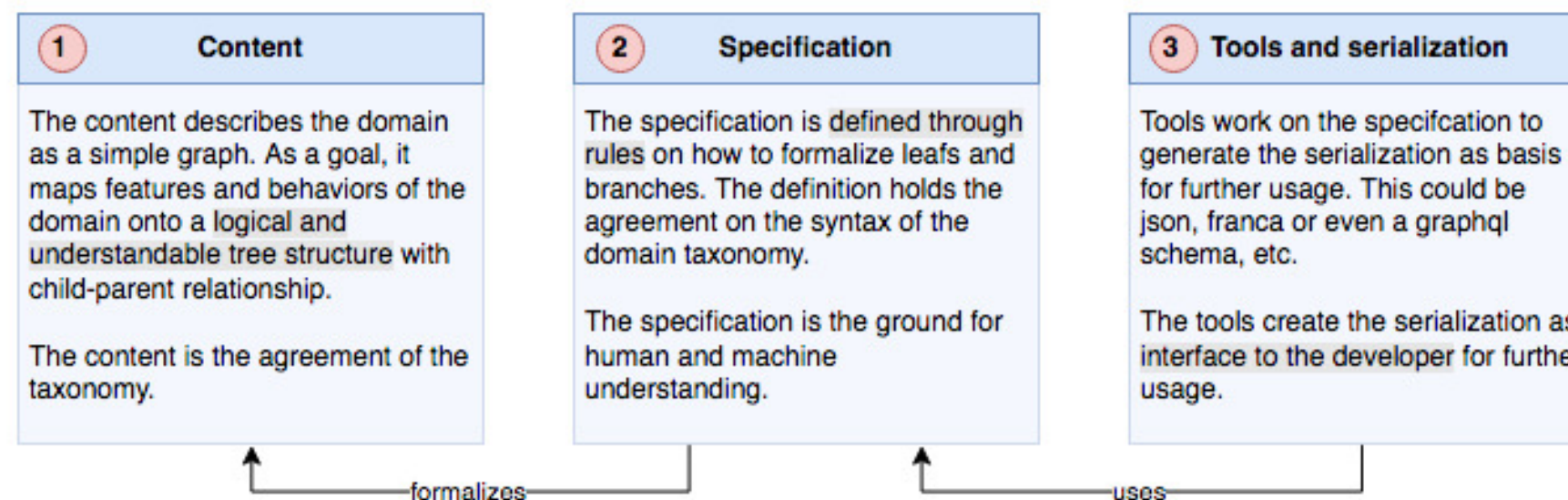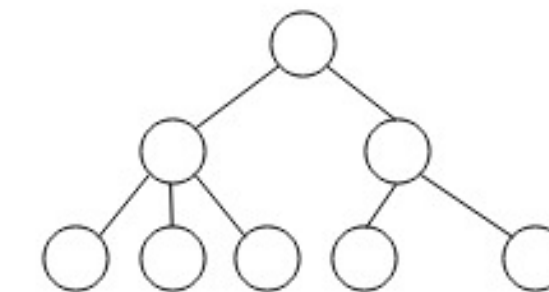
VSS 2

Other domain (e.g. media, navigation, etc.)

Domain Taxonomy

The three major components a domain taxonomy consists of in this context are shown below and described as content, specification and tools and serialization. A domain taxonomy shall be self-descriptive and only the leafs shall be attributes, signals or equivalent.

① Content	② Specification	③ Tools and serialization
The content describes the domain as a simple graph. As a goal, it maps features and behaviors of the domain onto a logical and understandable tree structure with child-parent relationship.	The specification is defined through rules on how to formalize leafs and branches. The definition holds the agreement on the syntax of the domain taxonomy.	Tools work on the specifcation to generate the serialization as basis for further usage. This could be json, franca or even a graphql schema, etc.
The content is the agreement of the taxonomy.	The specification is the ground for human and machine understanding.	The tools create the serialization as interface to the developer for further usage.

formalizes   uses

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Vehicle Data Streams

- In-vehicle data capturing
- Vehicle to OEM server
- OEM server to 3rd party services
- OEM server to Neutral Servers and Data Marketplaces

- **Alternative data streams**
  - Vehicle to 3rd party servers
  - Vehicle to consumer devices (e.g. smartphones)
  - OEM server to vehicle (downstream) for remote functions

In-vehicle data capturing

- GENIVI-Autosar joint pilot project being launched

- Access to car data in Android Automotive & cross-OS discussion ongoing

- Data gathering framework examples:
  - SensorIS
  - CVIM

- One objective is to use a single data model as much as possible, to minimise translations in different layers:
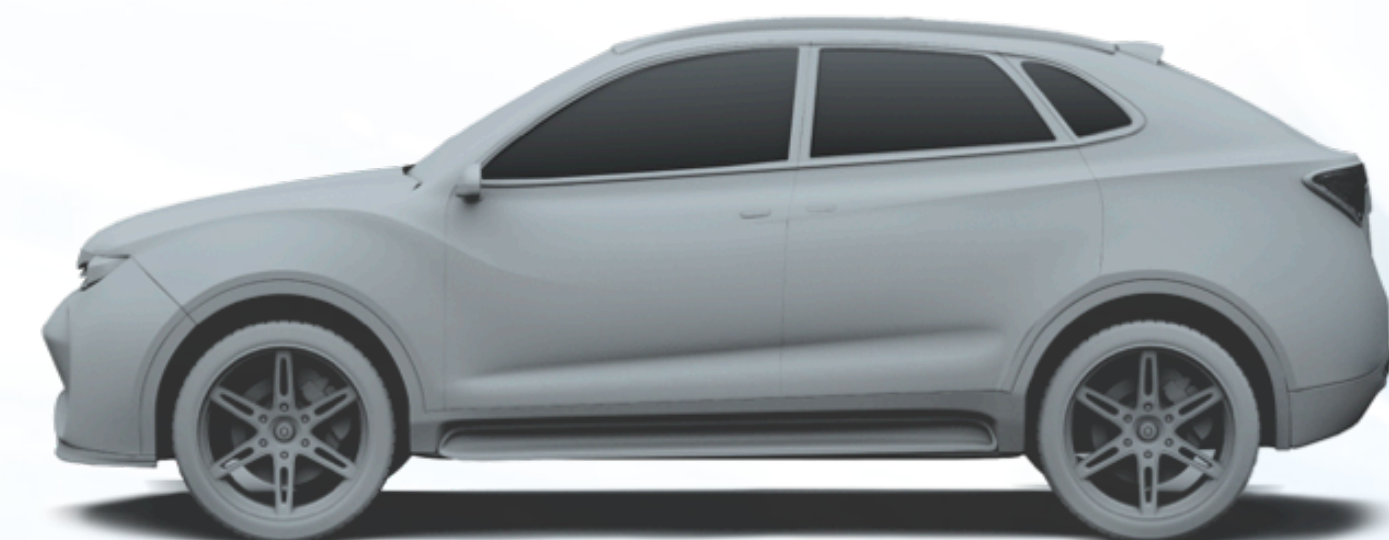 - VSS
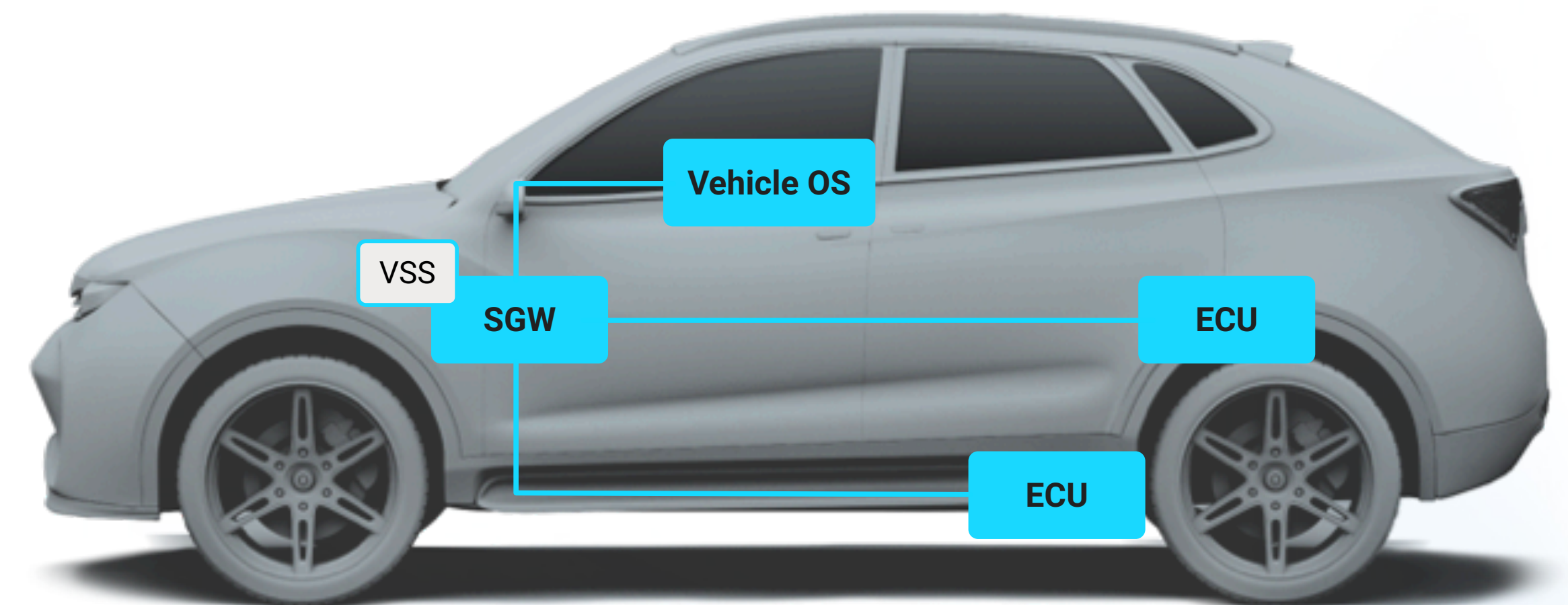
Vehicle to OEM server

- Need to consider current telematics stacks

- Benefits of using the same data model both in the vehicle and OEM back-end

- Meta information about data samples

OEM Back-end

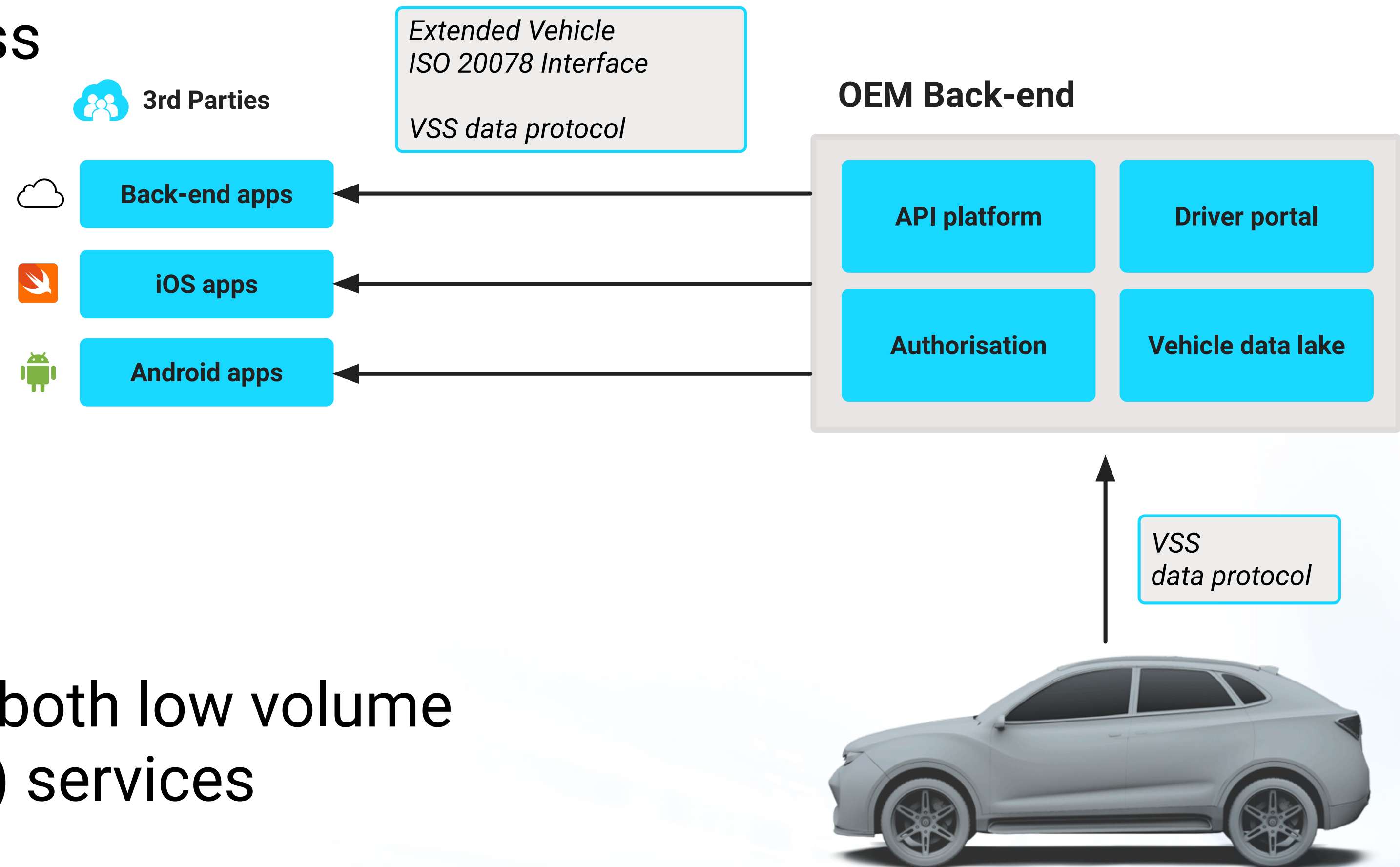| API platform	Driver portal
Authorisation	Vehicle data lake
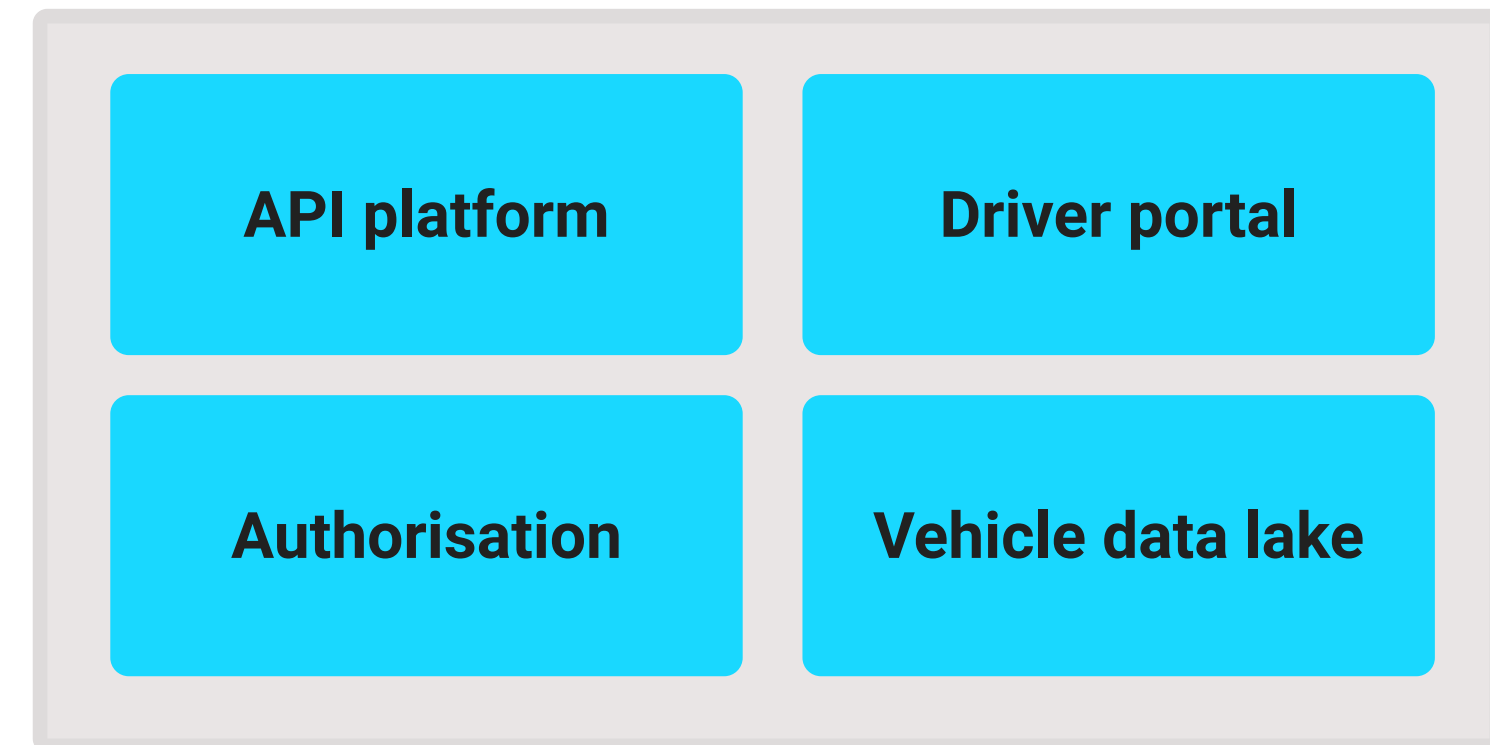
VSS data protocol

```
1    {
2        "data-package-id": "...",
3        "timestamp-start": "2017-07-06T08:00:00.00Z",
4        "timestamp-stop": "2017-07-06T08:00:09.00Z",
5        "number-of-samples": 4,
6        "data": [
7            {"timestamp": "2017-07-06T08:00:00.00Z", "value": 50.0},
8            {"timestamp": "2017-07-06T08:00:01.00Z", "value": 51.0},
9            {"timestamp": "2017-07-06T08:00:01.95Z", "value": 52.0},
10           {"timestamp": "2017-07-06T08:00:03.00Z", "value": 51.0}
11       ]
12   }
```

OEM server to 3rd parties

- Extended Vehicle standardisation
can be used for data access
through Web Services for
personalised data

- Big Data has needs
different software
components to process
a large amount of data

- VSS data model works for both low volume
and high volume (Big Data) services

3rd Parties

*Extended Vehicle
ISO 20078 Interface*

VSS data protocol

Back-end apps

iOS apps

Android apps

OEM Back-end

API platform

Driver portal

Authorisation

Vehicle data lake

*VSS
data protocol*

OEM server to Neutral Servers and Data Marketplaces

- Marketplaces act as intermediaries between OEMs and 3rd parties with potential to multiply business

- ACEA introduced a Neutral Server concept in Europe that made neutral marketplace engagement mandatory

- System design can consider marketplaces as any other 3rd party consuming data, just different commercial terms

Marketplace Back-end

OEM Back-end

| API platform |
| Added value |

Extended Vehicle
ISO 20078 Interface

VSS data protocol

| API platform | Driver portal |
| Authorisation | Vehicle data lake |

3rd Parties

| Back-end apps |
| iOS apps |
| Android apps |

VSS
data protocol
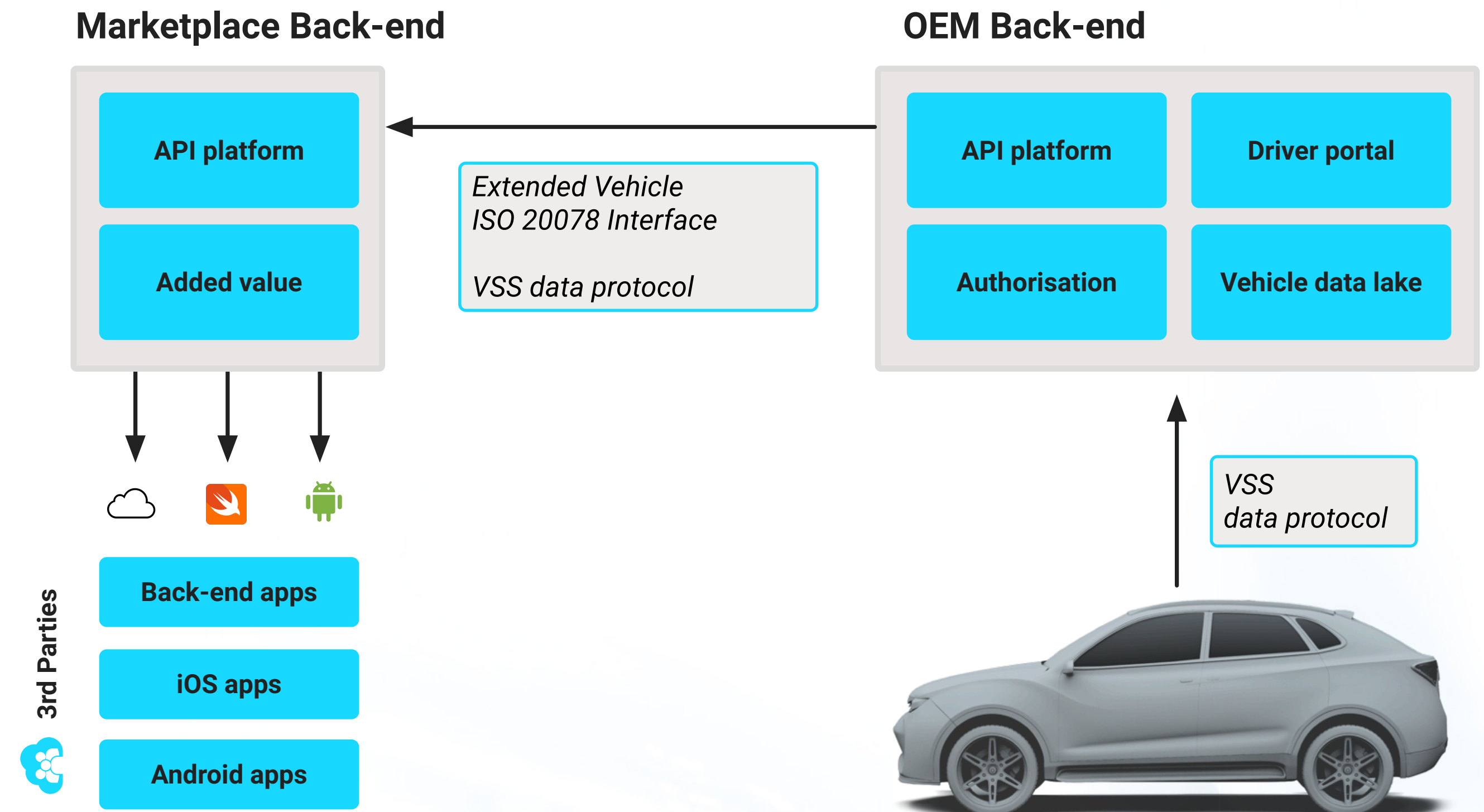
Alternative Data Streams

- **Vehicle to 3rd party servers**
  - Data upstream from the vehicle e.g. from the IVI or operating system

- **Vehicle to consumer devices (e.g. smartphones)**
  - On-board vehicle data access
  - Authorisation done centrally or locally by driver

- **OEM server to vehicle (downstream) for remote functions**
  - Write access through the OEM server
  - Only applicable to personalised services with consent
  - Opens another layer of security complexity but also business oppurtunities

Discussion Starter — Input Welcome

- What issues are the most pressing to resolve?
- What are being actively discussed vs. future topics?
- Big Data vs. personalised VIN-identifiable car data?
- 3rd party data requests vs. in-house OEM needs?
- Should we focus also on business frameworks on how to get to data sharing agreements? ›› *discussion from session 2*
- Should we add data refinement and edge processing to the design?
- Requirements and guidelines for privacy and access authorisation?

Discussion Notes

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- What else can be standardised expect the data model?
- The authorisation of access to data. Discuss how to concept this. Should be it included?
- Does the Extended Vehicle include guidelines on how authorisation is done? And is that between the OEM server and 3rd parties, while data flow between the car and OEM server is freer.
- Is the authorisation done to specific schema data points, how is then multiple schemas supported?
- Is it possible to include VSS payload in SensorIS transport layer? Or do we need to define a framework for meta information about how data was collected (e.g. timerame, sample frequency). So that in the end the general system design does not break with different data models
- Consent has to also cover purpose of data use for GDPR compliance
- Can there be components from commercial players that could solve key issues?
- To define datasets that can be provided for specific purposes/use-cases to have consistent coverage from OEMs (bundling of data per use-case)
- A need for in-vehicle data processing of data, to fully utilise the sensor data for specific use-cases. The alternative would be to upload high sample-rate data to the cloud, but this would lead to excessive costs. Needs a mechanism to download instructions to the vehicle
- Commercial fleet downstream data needs, e.g. instructing the vehicle to EV or hybrid mode only. One way of seeing bi-directional communication is beyond the data discussion: API definition; remote functionality

Thank you!

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