GENIVI Technical Summit 2019

Vehicle Hardware Abstraction Layer (HAL) Design

12 November 2019

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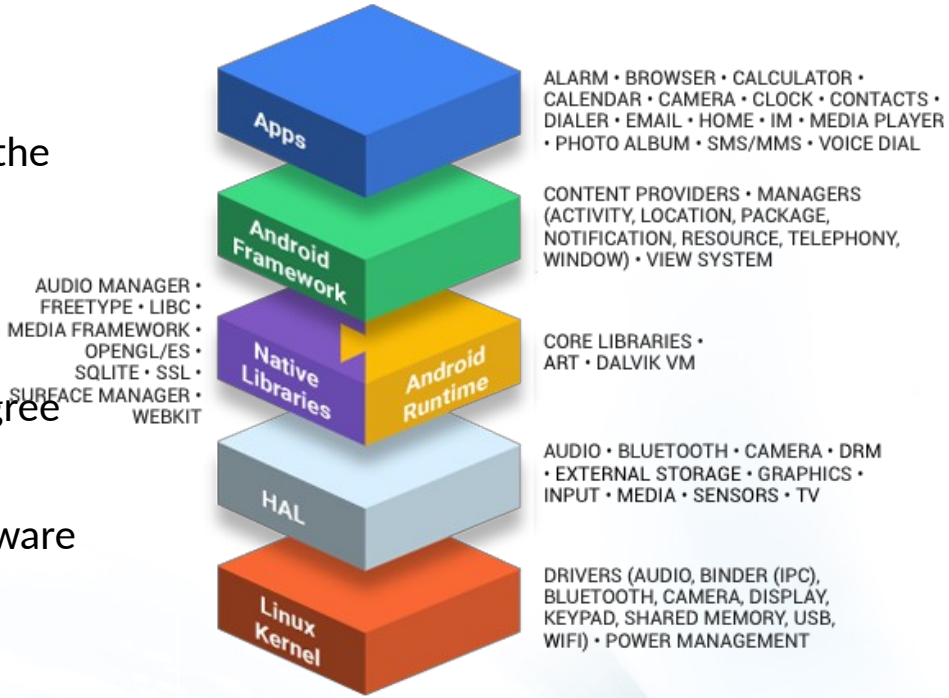
Vehicle Hardware Abstraction Layer (VHAL) Design

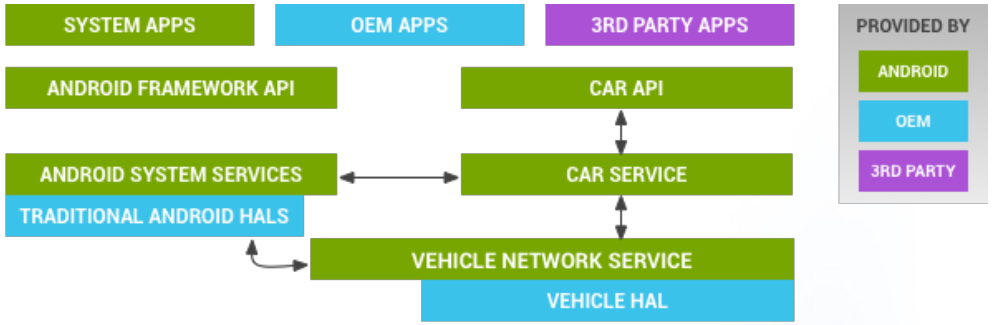
AOSP Overview

- Android is an open source, Linux-based software stack created for a wide array of devices and form factors.
- Android's primary purpose is to create an open software platform.
- The objective is a shared product that each contributor can tailor and customize.
- Uncontrolled customization can lead to incompatible implementations. To prevent this, the Android Open Source Project (AOSP)maintains the Android Compatibility Program
- Besides infotainment tasks, AOSP aims to handle vehicle-specific functions.
- **Key Architecture Aspect:**
- AIDL: allows you to define the programming interface that both the client and service agree upon in order to communicate with each other using inter-process communication (IPC)
- **H**ardware **A**bstraction **L**ayer (HAL) provides standard interfaces that expose device hardware capabilities to the higher-level.
- Binder IPC – is the backbone of Android communication system.
- TREBLE: OS Framework update without affecting lower layers and applications



Vehicle HAL & Vehicle Properties

- Vehicle Hardware Abstraction Layer (VHAL) interface defines the properties OEMs can implement.
- Each property is uniquely identified by an int32 key and has a predefined type
- Each Property is defined with following attributes:
  - Area Type
  - Zone: Each zoned property must use pre-defined area type. Each area type has a set of bit flags defined in an enum for the area type.
  - Area ID: Each zoned property may support one or more Area IDs
- Android provisions to define vendor specific properties with VENDOR as group.



Vehicle HAL & Vehicle Properties

- Every property value comes with a VehiclePropertyStatus value. This indicates the current status for the property:
  - AVAILABLE
  - UNAVAILABLE and
  - ERROR
- The VHAL uses the following interfaces
  - Getter API
  - Setter API
  - Subscribe
  - Callbacks

Problem statement

- Currently, Android defines minimal set of vehicle properties, interfaces and data types to access vehicle data. For OEMs, in order to access the vehicle data from other ECUs, custom vehicle properties and custom HALs needs to be implemented; which leads to inconsistent implementation vehicle data access.
- For accessing the vehicle property metadata, AOSP enforces the architecture to fulfill the interface requirements for the vehicle HAL.
- OEMs need a simpler, scalable and reusable approach to access aggregated vehicle data. This creates and enables App development infrastructure for better user experience.
- So, in order to address these concerns, is there a solution to define scalable, reusable vehicle data model and interface to access it?
- Does it makes sense to standardize data model and interface to access?

Data centric API as a reusable Assert

Do you see VSS as a data centric abstraction standard?

Android Automotive	CE Device (Android / iOS)	Other ECUs (Linux / QNX / Autosar)	W3C Vehicle API (VSS)	OEM Specific

Data centric model (understandable by 3rd party)

Service driven API

Vehicle

- If the answer is “No”:

  Alternatives? Missing features? Requirements to be considered?

- If the answer is “Yes”:

  Status of current VSS standard? GENIVI VSS standardization working model? APIs to consider?

Data centric API as a reusable Assert

How to expose car network the right way?

Android Automotive	CE Device (Android / iOS)	Other ECUs (Linux / QNX / Autosar)	W3C Vehicle API (VSS)	OEM Specific

Simple car data access (3rd party developers)

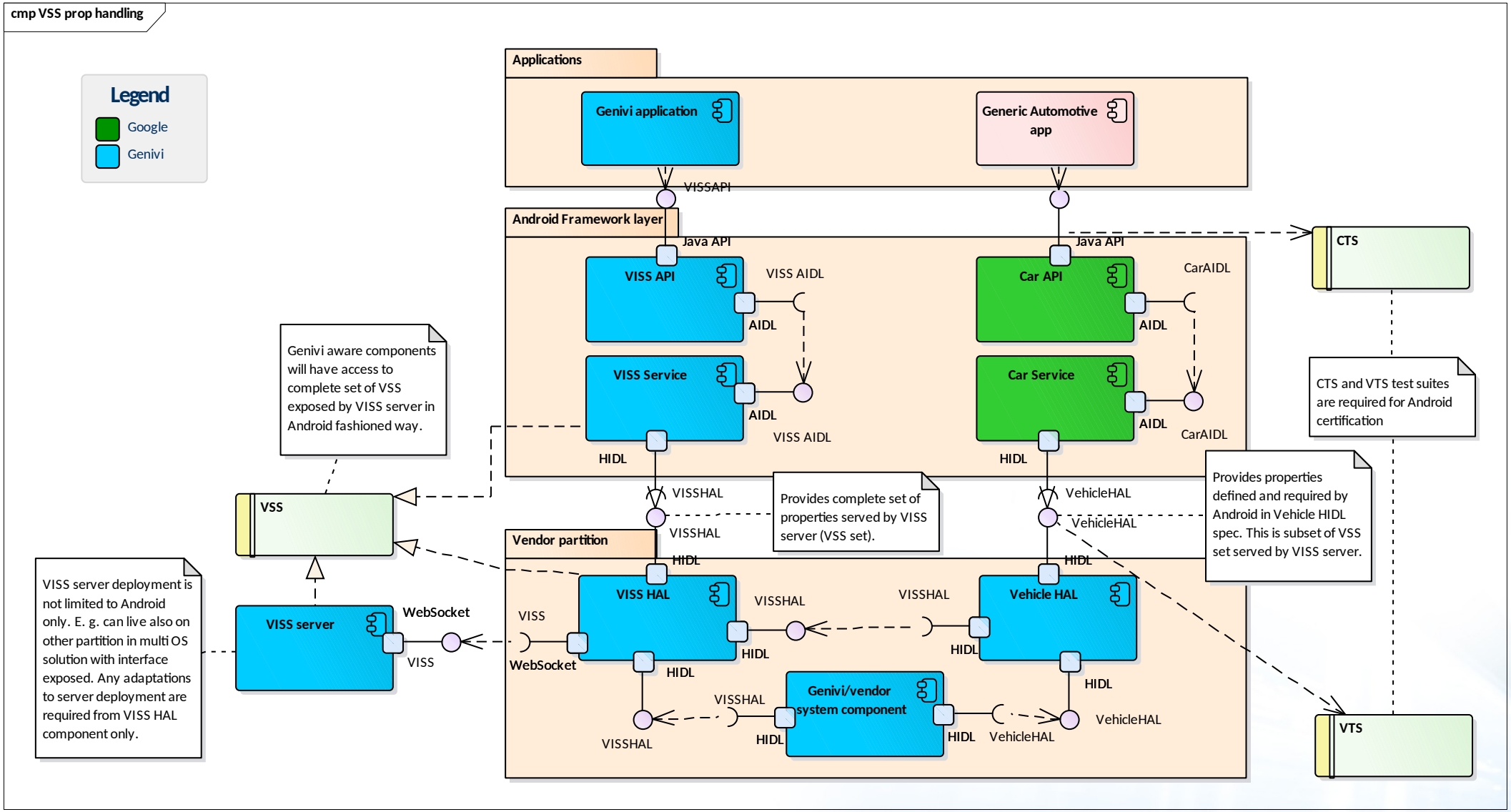
Data centric model (understandable by 3rd party)

Service driven API

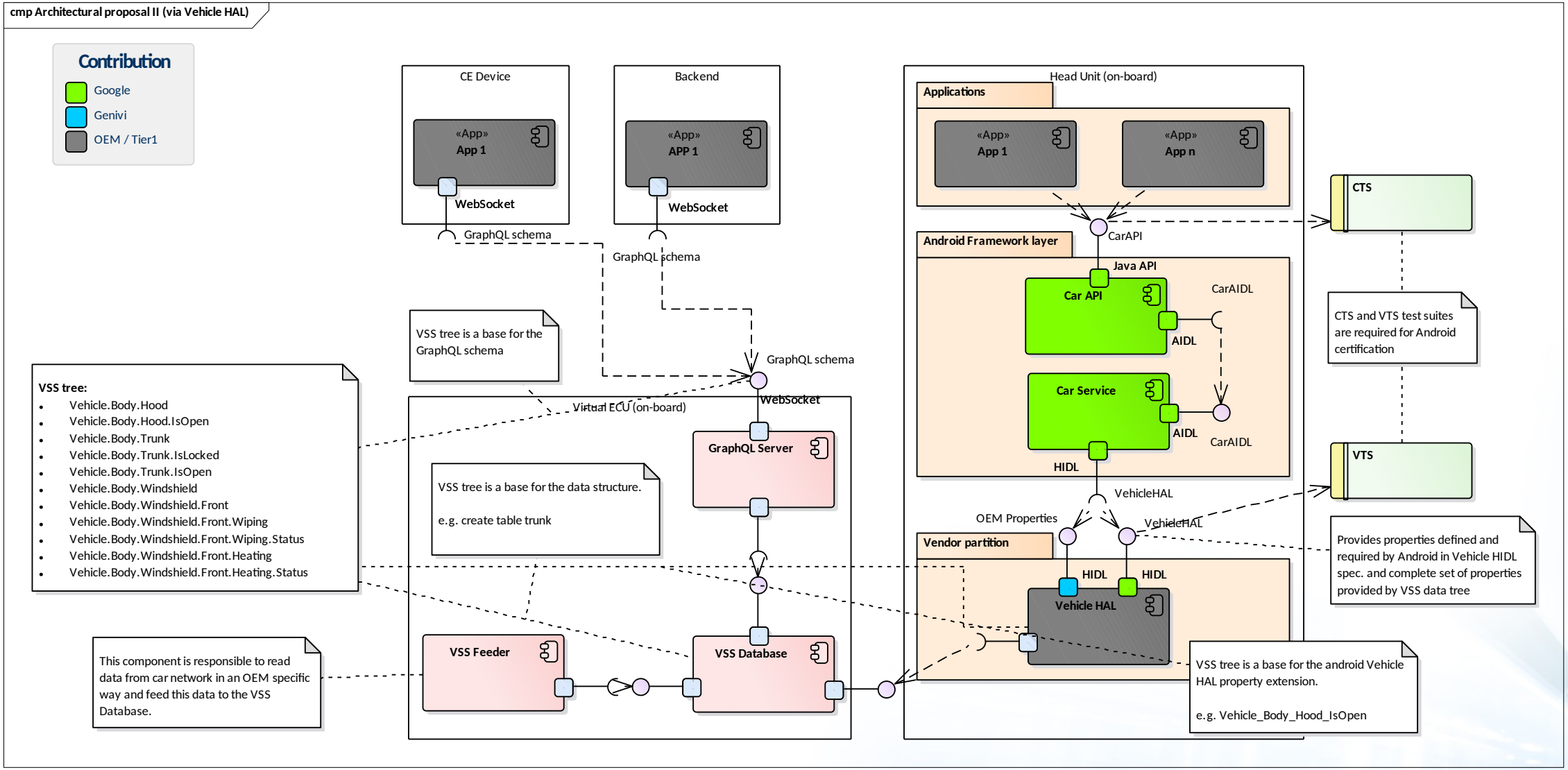
Vehicle

- Which requirements have to be fulfilled by the solution?
- What is our target architecture? (document advantages and disadvantages for each arch. proposal)
- Contribution by GENIVI?

Architectural proposal I (via custom HAL)

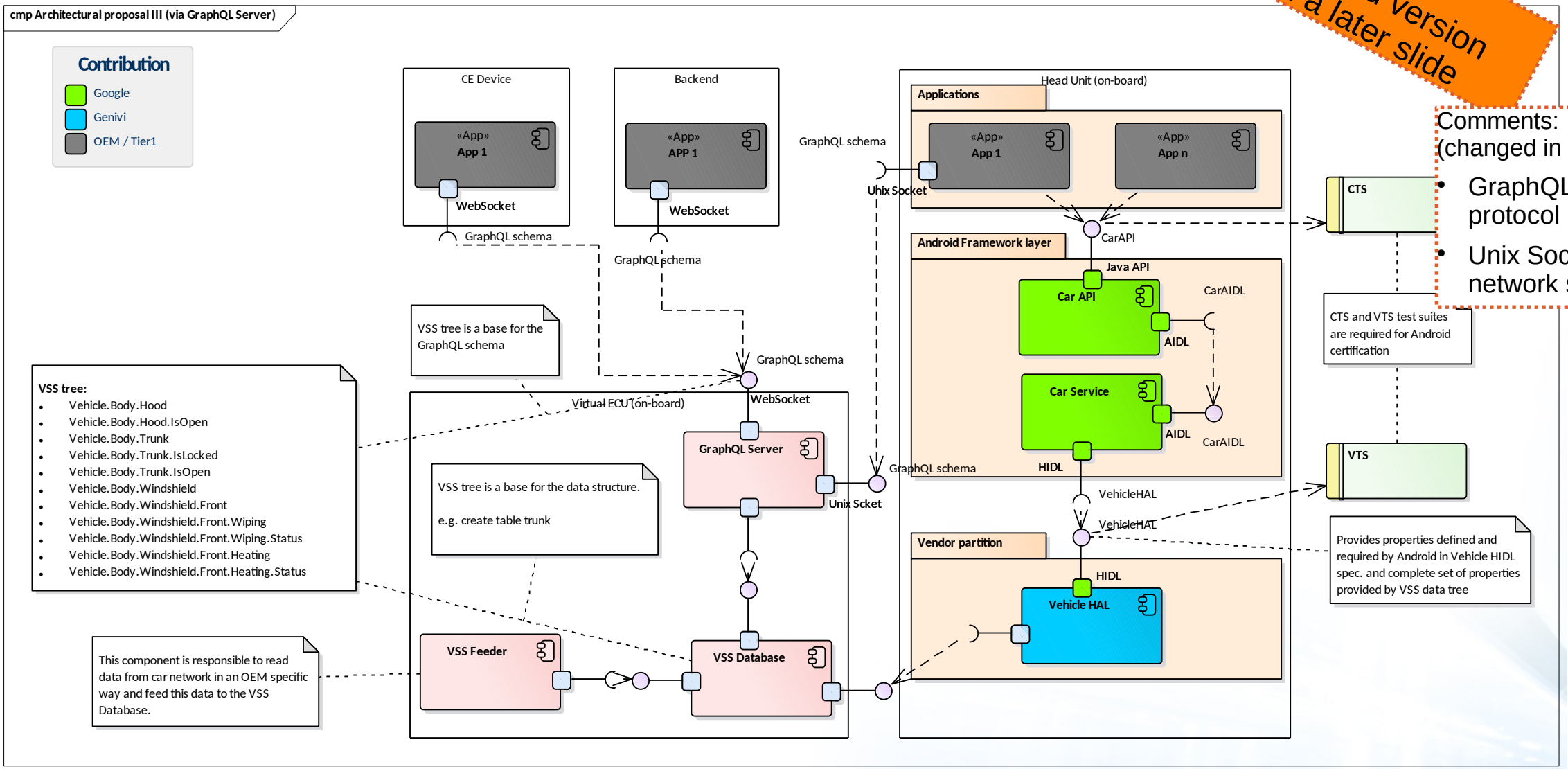


Architectural proposal II (via Vehicle HAL)



Architectural proposal III (via GraphQL Server)

NOTE:
Updated version
in a later slide

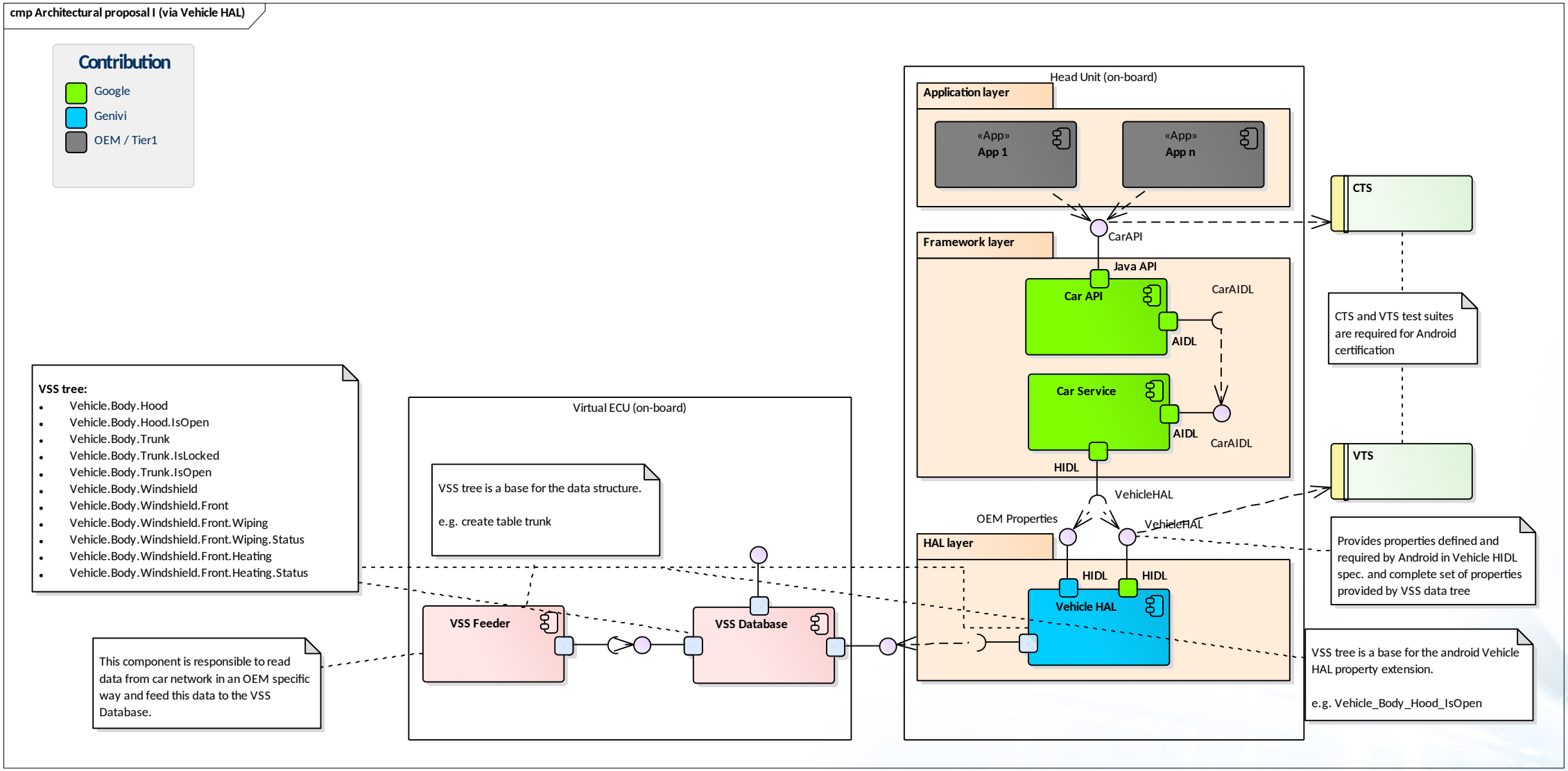


Comments:
(changed in later version)

- GraphQL could be any protocol
- Unix Socket = can be network socket

Following architectural designees have bean made based on the discussions during the Android Technical Summit in US.

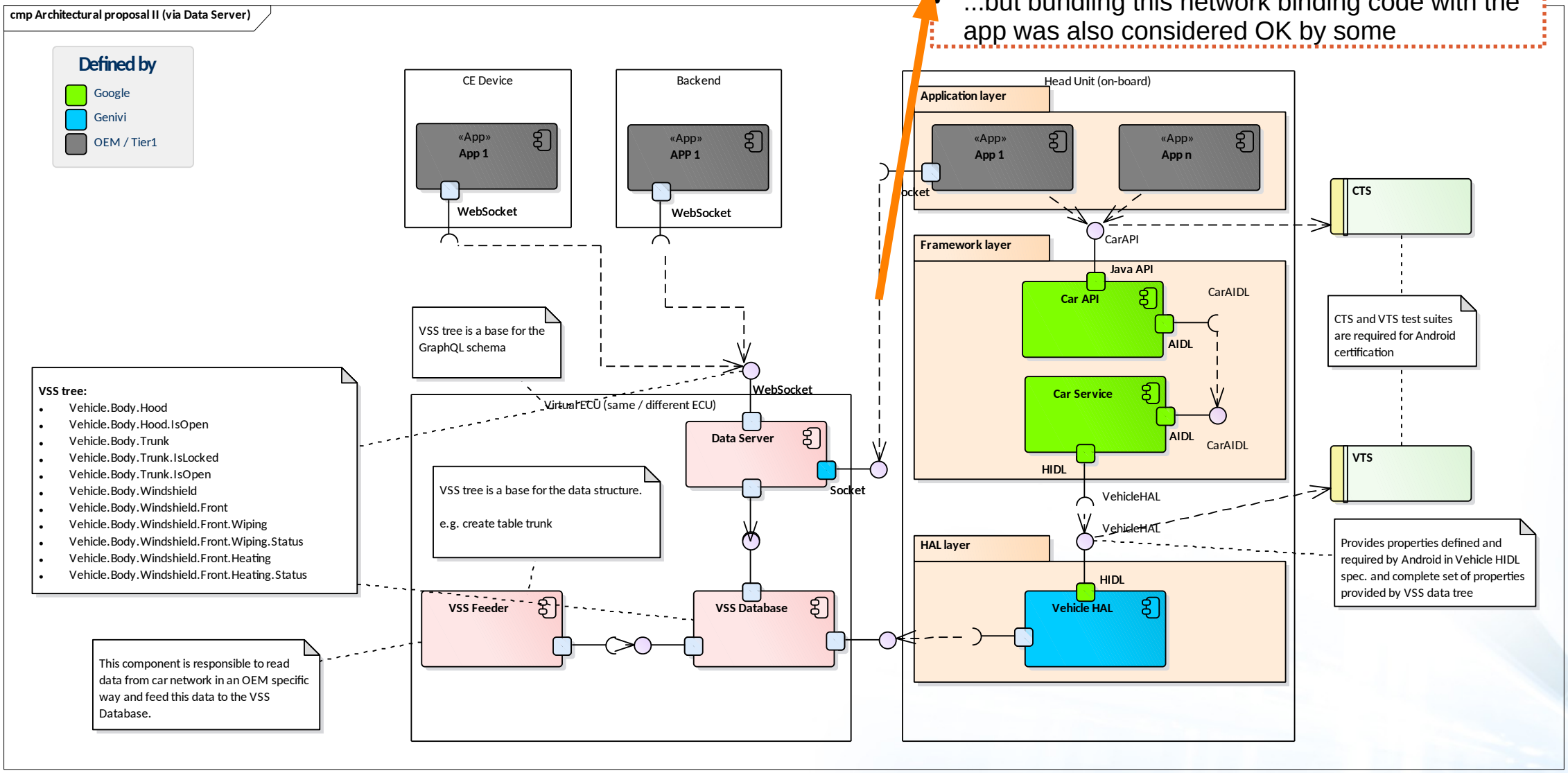
Architectural proposal I (via Vehicle HAL)



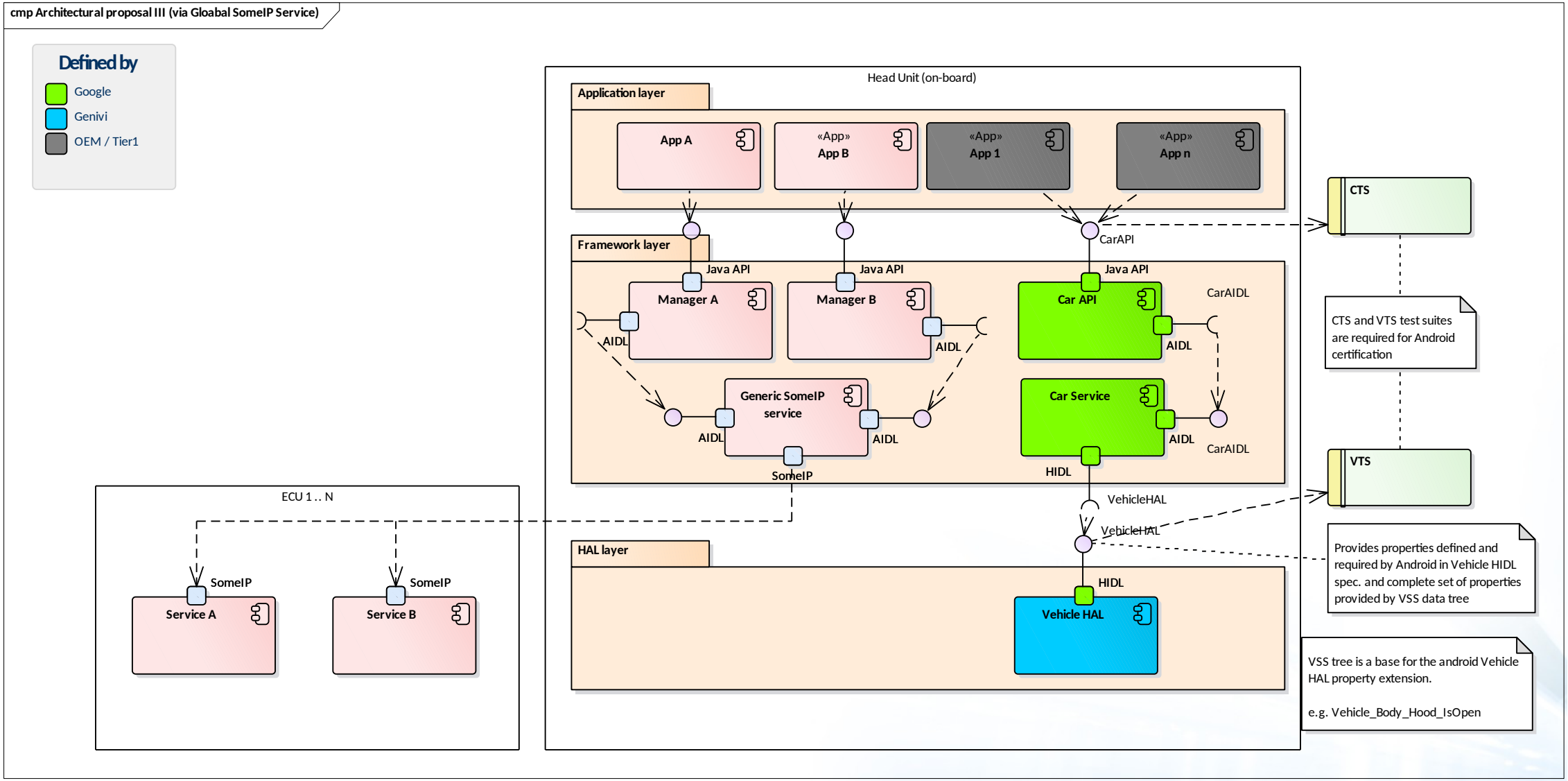
Architectural proposal II (via Data Server)

Comments:

- One idea was proposed that a helper class in Android Framework layer implements the network protocol instead (App is calling a Framework API)
- ...but bundling this network binding code with the app was also considered OK by some



Architectural proposal III (via Global SomeIP Service)



Questions

- For accessing vehicle data, what are the implications of bypassing Android architecture ?
  - Impact on CTS, VTS?
  - TREBLE?
  - What if Google keeps adapting the properties.
  - What are the alternatives to VSS Data model and interfaces to access it ?
    - How do we address the reuse from existing systems.
  - What is the process to define complex data types to be used in data model?
  - What are the concerns on Data access

