

Automotive Linux Summit 2022

The Evolving Software Landscape in Automotive and How Open Source Can Foster Continuous Innovation

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Agenda

1. Why automotive OEM's are racing to embrace software development
2. How customer demand for rich services has influenced the technologies in IVI over the years
3. The open source projects and standards used as building blocks to enable them today
4. Opportunities to foster continuous innovation into the future



VNC Automotive

Company	VNC Automotive Limited
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CEO	Tom Blackie
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Operation	2009~18 as a division of RealVNC
	2018~ as an independent company

Headquarters	Cambridge, UK
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Business	Automotive Industry
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Products	Device Connectivity Software
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Remote Control Software

Telematics Software and Services

	Embedded Hardware
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Locations



United Kingdom

> Cambridge (HQ)

China

> Shanghai

Korea

> Seoul

Japan

> Tokyo

Trends driving software focus



Customer-facing innovations

ADAS

- Trials
- Sensors

Electrification

- Battery range, charging speed
- Infrastructure

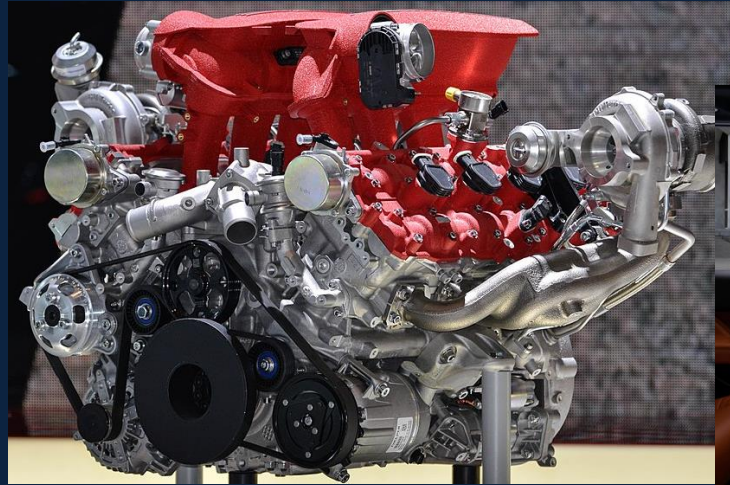
Device integration

- Digital keys
- Smartphone



Differentiation through hardware

- Engine performance
- Design and materials
- Reliability



Leads business model to repairs and maintenance

RTOS and minimise software functionality (updates are expensive)

[Sources: Flickr, CarBuzz]

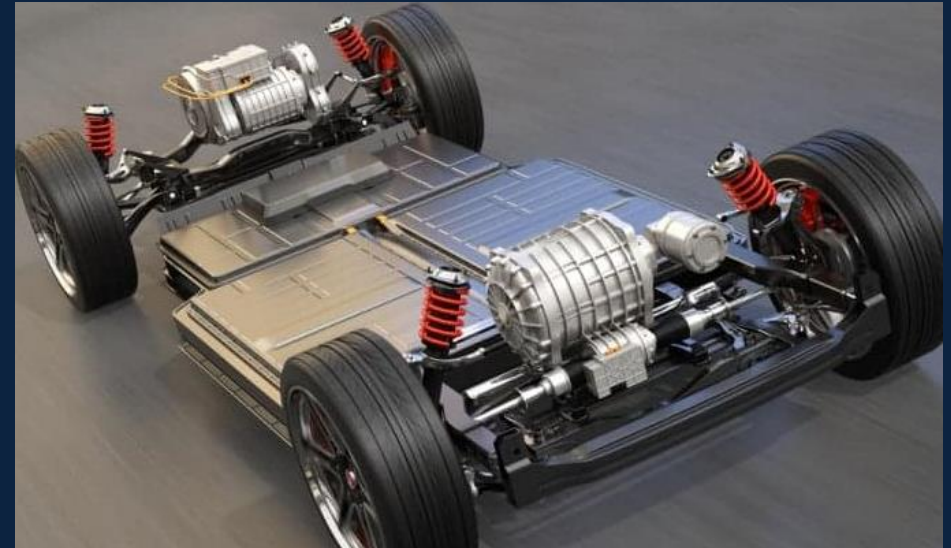
Electrification changes model

Engine is simpler, more reliable and cheaper

Powertrain and battery commoditised

Easier for new players to join industry so competition increases

Customer demand for rich services and need for differentiation shifts business model to functionality



[Source: Rxmechanic]

Differentiation through software

They used to simply define the specifications and let Tier 1's decide the details

Now bringing some development in-house for more control and faster innovation

Bottlenecks are limited talent pool and iterative mentality



[Source: Mercedes Benz]

Progression of IVI services



Deep dive into services integration

We will look at the last 15 years of progress

Multimedia and device connectivity based on customer demand and our own experience

Cover the open source projects and standards that enabled them



Early years - Audio

Customers wanted to listen to their MP3 files stored on their players/phones on the car's speakers

Apple's iPod Out standard failed to establish itself due to limited market share

Eventually Bluetooth was implemented across the industry, vendors can differentiate through codecs

Specifications available online by SIG, robust certification program



[Source: Pioneer]

Early years - Navigation

Customers were unhappy with outdated/unreliable OEM navigation so preferred smartphone apps

Proprietary solutions developed by OEM's like Ford SYNC designed to work only with specific apps

Too much work required by app vendors to support various cars so limited adoption



[Source: Ford]

Early years – Projection standards

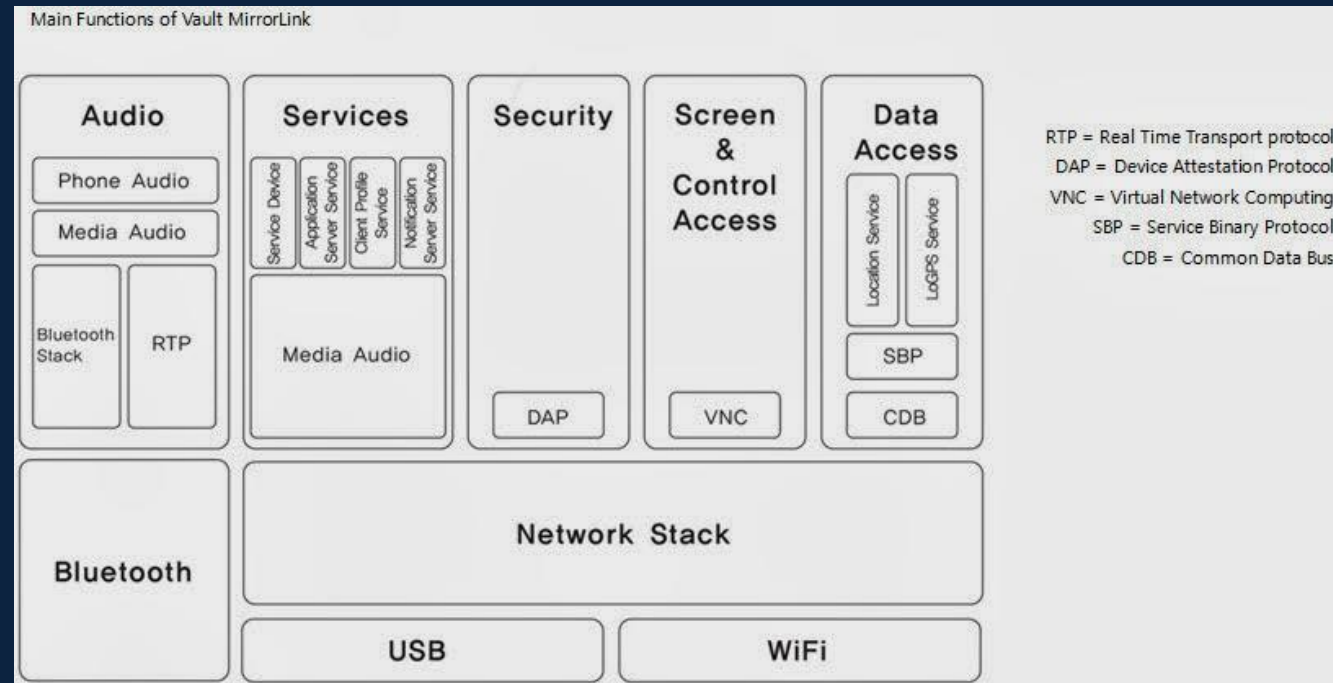
Car Connectivity Consortium formed with various car and phone OEM's to develop first open standard

MirrorLink specifications available online but missing iPhone support and complex app certification limited adoption outside of China



[Source: Skoda]

Early years – Projection standards



Later on Wi-Fi Display protocol from Wi-Fi Alliance was added for wireless connections and H.264 codec for improved mirroring performance

[Source: Vault Micro]

Early years – Projection standards

SmartDeviceLink is an alternative standard that is fully open source, managed on GitHub

Uses JSON-RPC protocol for high-level communication

User interface is handled through HTML templates and H.264 mirroring depending on the app content

Limited car OEM support as slow to support rich apps



[Source: Toyota]

Recent years – Projection standards

Apple and Google created new standards to enable their services on the IVI

Reused the open protocols chosen in previous standards with a focus on user experience and reliability

Strict requirements limit OEM's ability to differentiate



[Sources: Apple, Google]

The present – Web integration

Current generation of cars have dedicated Internet access

Services can be integrated as web apps or natively using web API's (HTTP/JSON)

Gives OEM's more flexibility but Internet access is still unreliable/unavailable in many places



[Sources: Tesla, Audi]

Key building blocks



IVI stack

Services

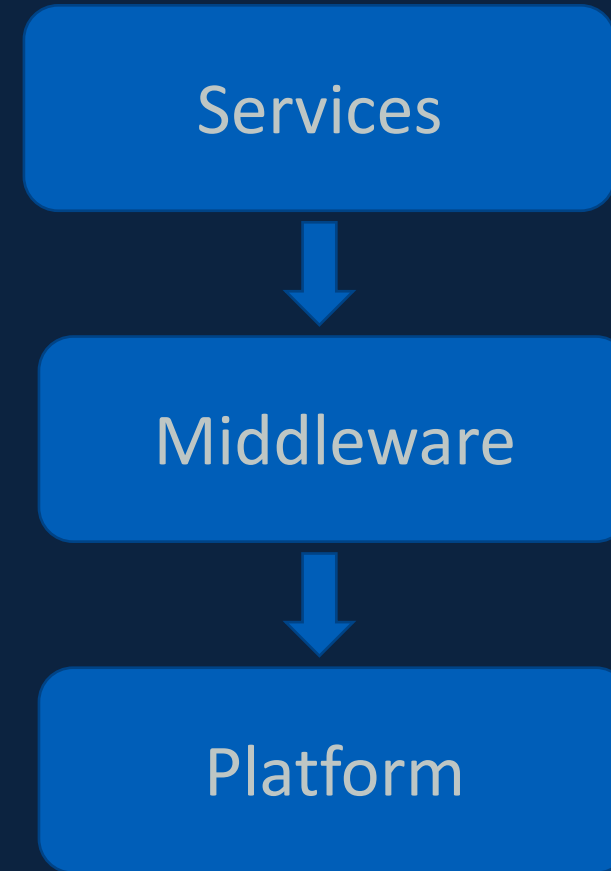
- Music/Telephony
- Navigation
- Messaging

Middleware

- Authentication
- Car data

Platform

- Operating system



Middleware - Authentication

Verification of trust is critical to any communication of sensitive data across different systems

OpenSSL is open source project widely used for cryptography, leveraging the X.509 standard for public-key certificates

A recent application in this field is the combination of various open standards (X.509 and NFC/BT) by Car Connectivity Consortium for Digital Key functionality



[Source: BMW]

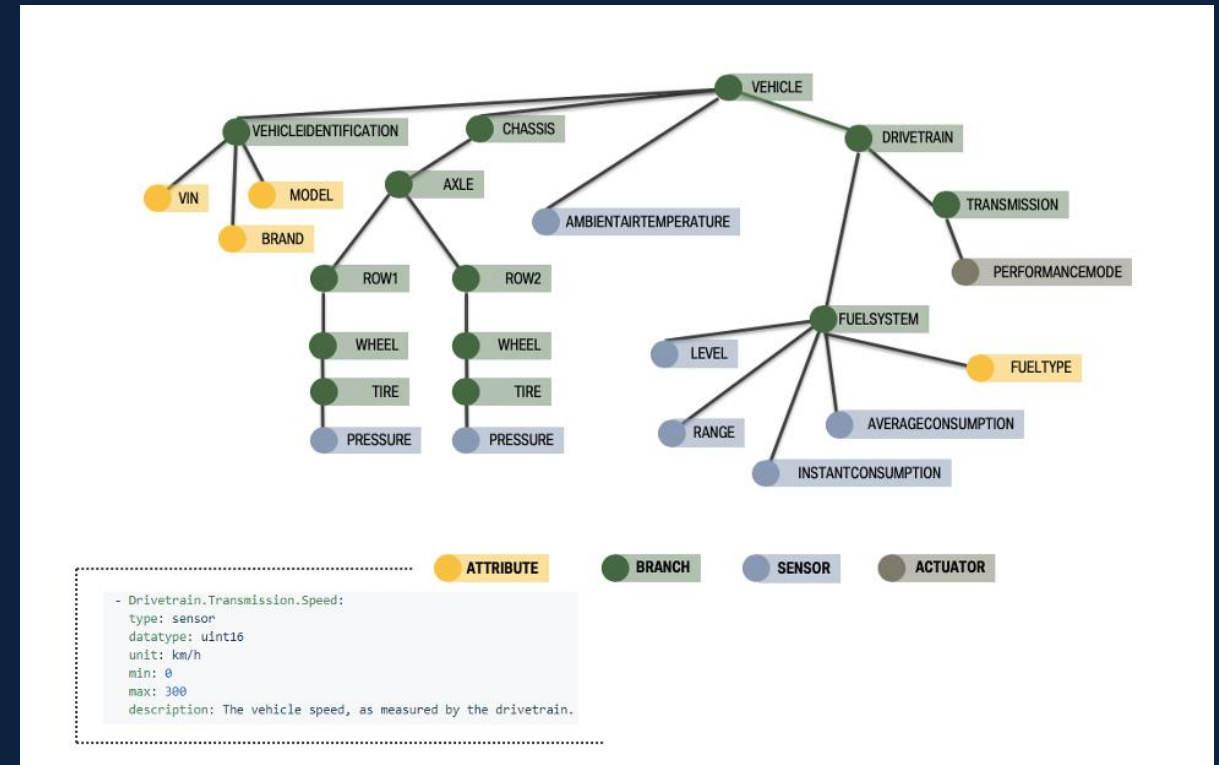
Middleware - Car Data

Useful for insurance industry, preventative maintenance, fleet management

Vehicle Signal Specification is an open standard developed by COVESA consortium for describing car data

Tooling available to generate into code

Vendor-specific extensions can be added



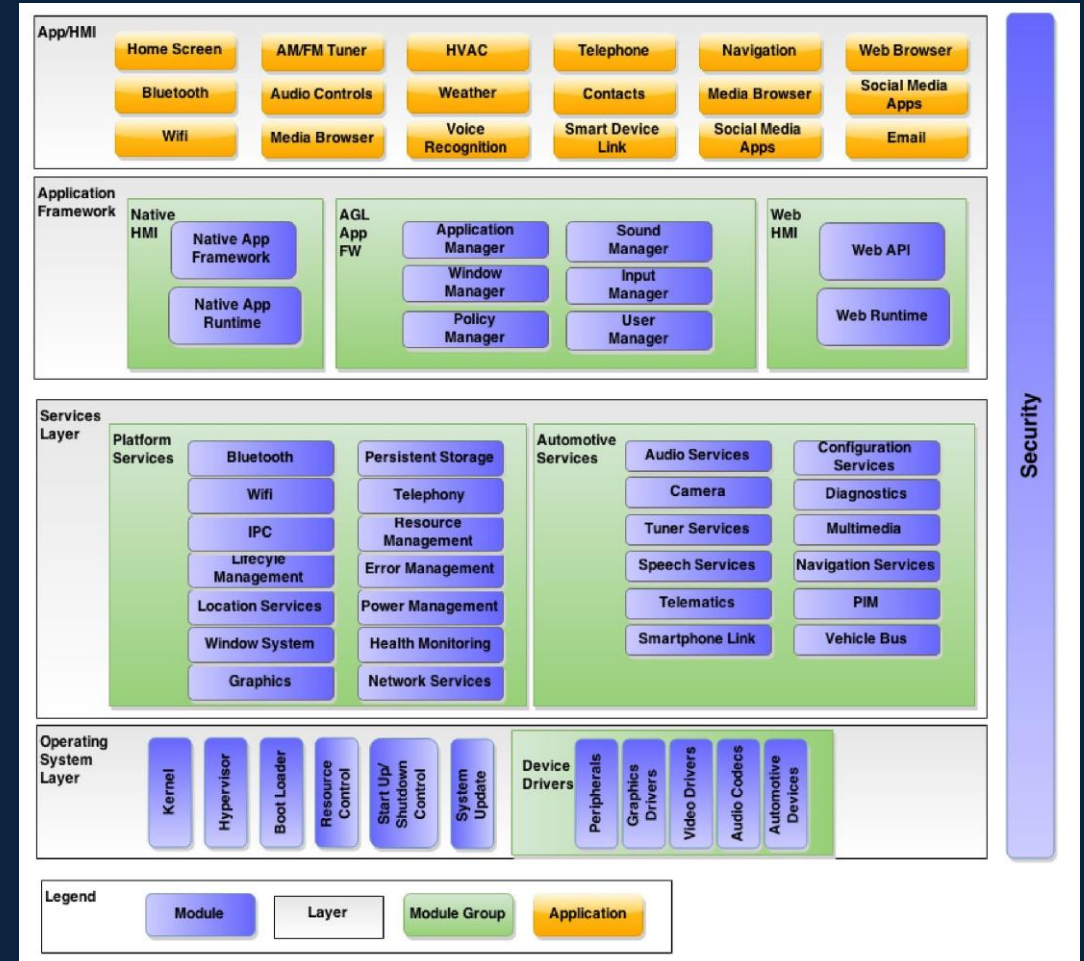
[Source: Covesa]

Platform - AGL

Open source project providing Linux distribution for IVI, Cluster, etc.

Aims to provide 80% of the work required to get to production, OEM's can focus on customising 20% to meet their requirements and UX

Analyst predicting market share will rise from its current 14% to around 25% by 2026



[Sources: AGL, S&P Mobility]

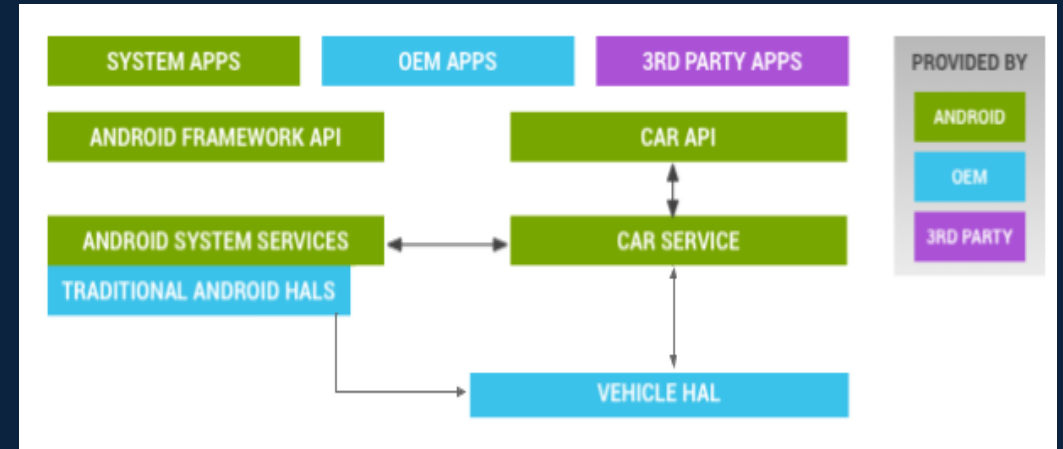
Platform – Android Automotive

Android Open Source Project created for smartphones and recently extended to automotive IVI

Main addition is Vehicle HAL layer that can interface with transport-specific module (ie. CAN)

Google Automotive Services (GAS) can be licensed separately in binary form only

Rift between GAS and non-GAS implementations



[Source: Google]

Future potential



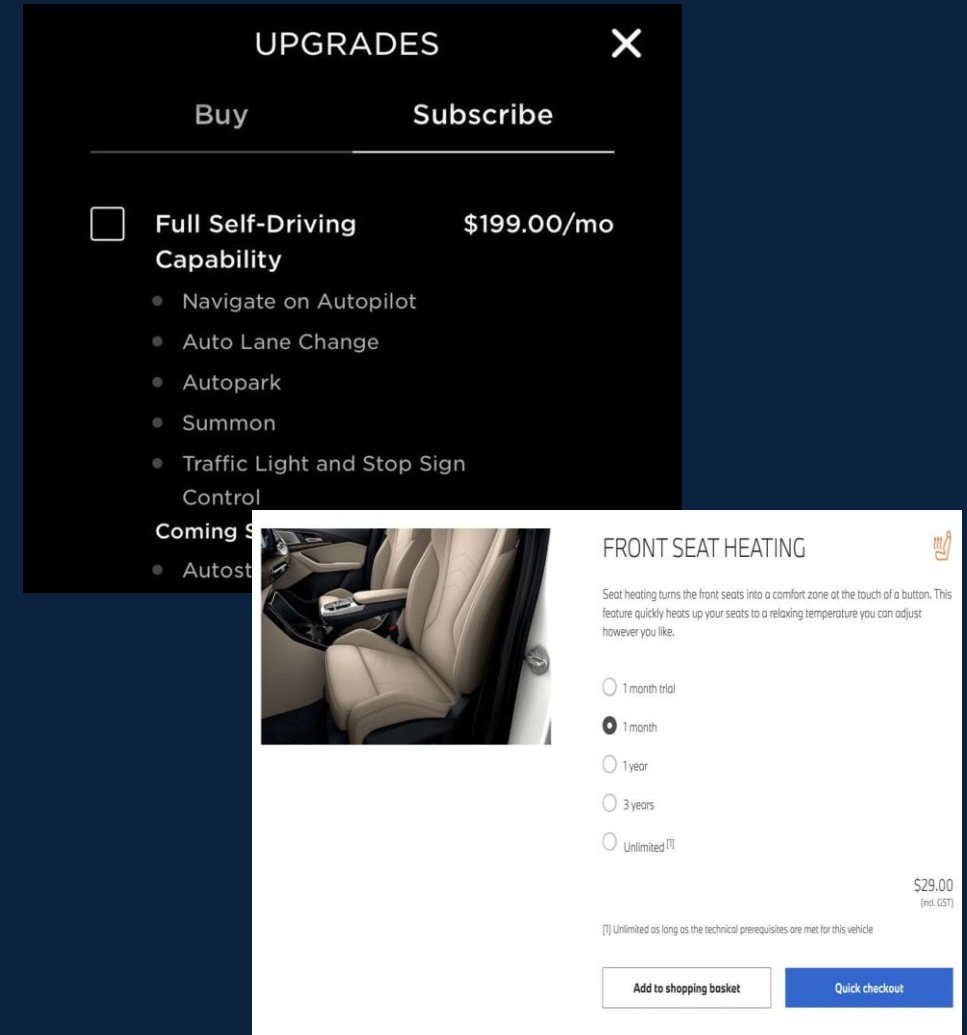
Pushing new software to cars

OTA updates

- Wi-Fi/LTE
- Security patches for OSS
- New services and features
- Risk of complacency with software development

Subscriptions

- New source of recurring revenue for OEM
- Flexibility for customer, trial
- Decouples functionality from ownership
- Encourages OEM to continue innovating

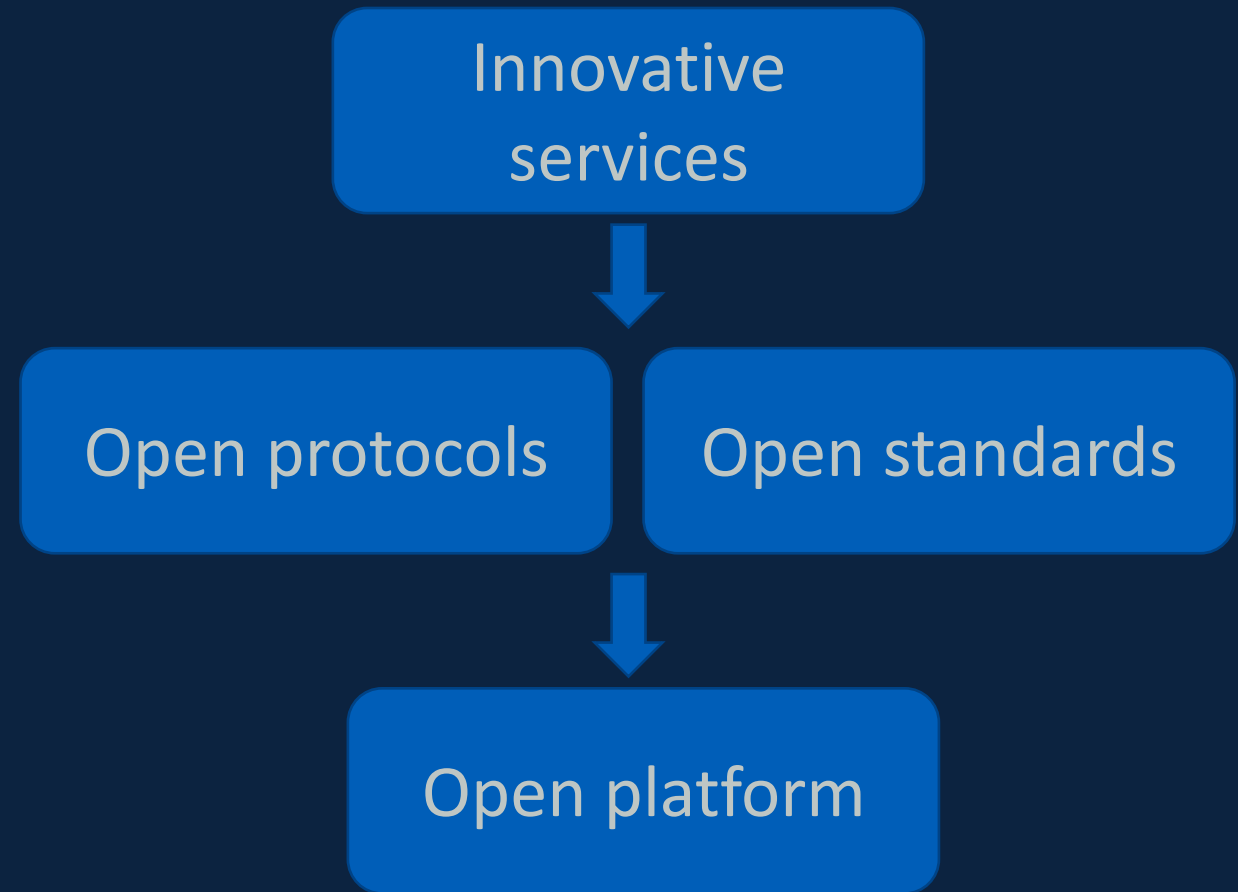


[Sources: Tesla, BMW]

Conclusion

Regularly updated software, delivering new functionality that customers are willing to pay for

How the blocks are glued together and presented to the customer is how the best OEM's will differentiate themselves



Thank you



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