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GENIVI®

Why the Industry Needs a Common Vehicle Interface Initiative

CVII

Katrin Matthes – Groupe Renault | October 2020

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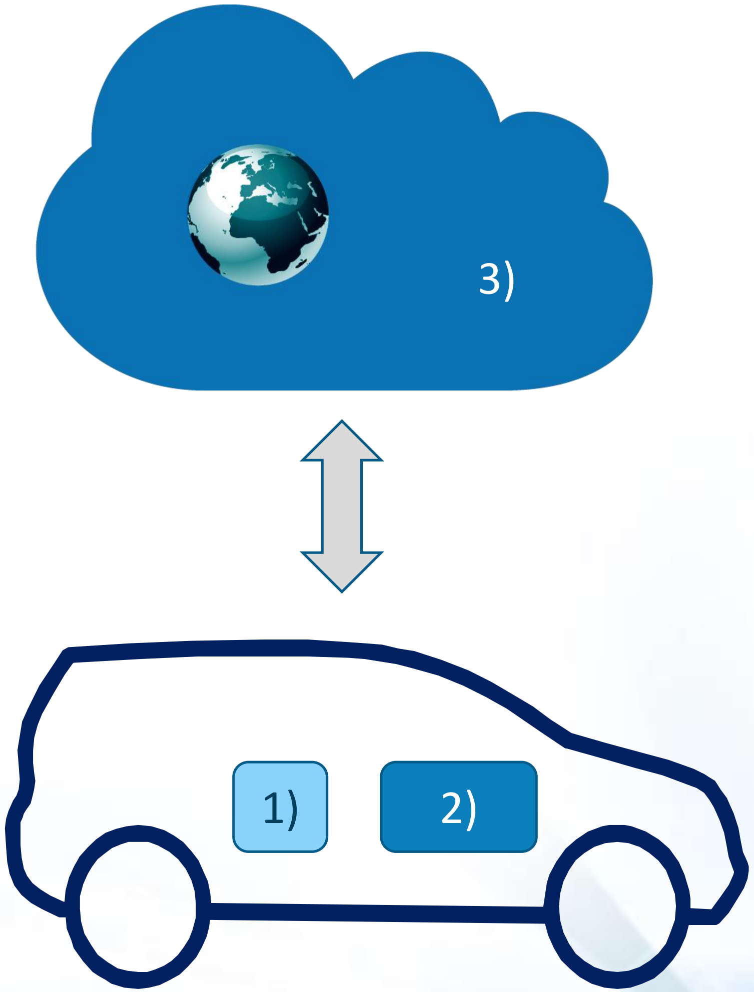
High Level Considerations for CVII

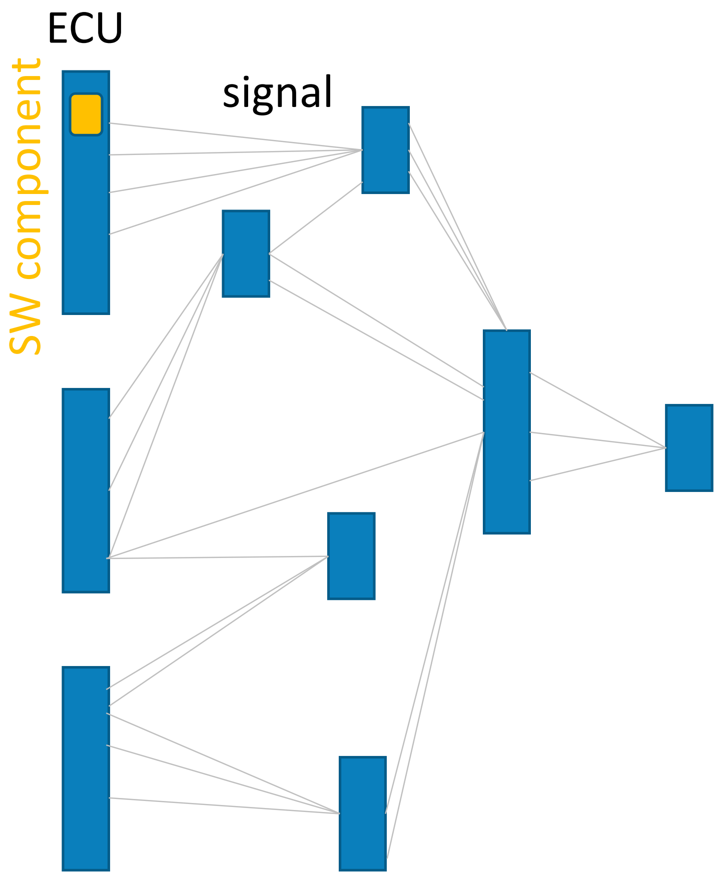
- Different application types to be considered:
  1) On-board applications (not connected)
  2) Hybrid applications (running on-board and off-board)
  3) Off-board applications
- Requirements of these applications may be very different (e.g. in terms of cyber-security, functional safety, etc.)
- Access to on-board resources (sensors, data from processing outputs, HMI, etc.) is application specific
- **CVII: Opportunity to specify Data formats for commonly used data sets** (shared among a high number of applications, e.g. vehicle speed)



Taking into account existing ecosystems

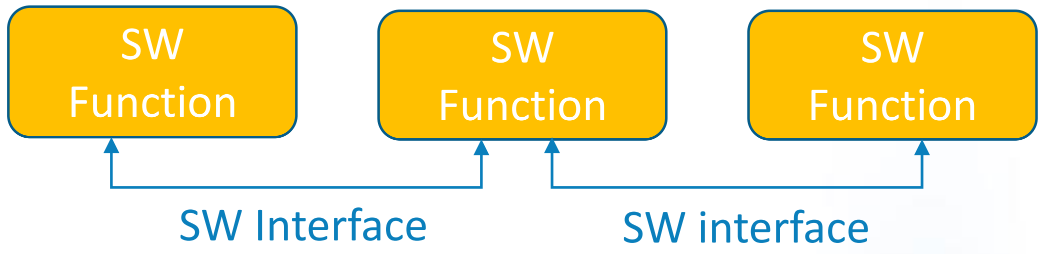
- APIs and SDKs are key ingredients to widely used application development platforms e.g.:
  - Google Automotive Services (GAS) Play Store
  - Android Auto (smart phone replication)
  - Apple CarPlay (smart phone replication)
- Standarised vehicle data formats and interfaces to be addressed in this context for relevant applications
- **CVII is an opportunity to provide a common basis for various application and services platforms**

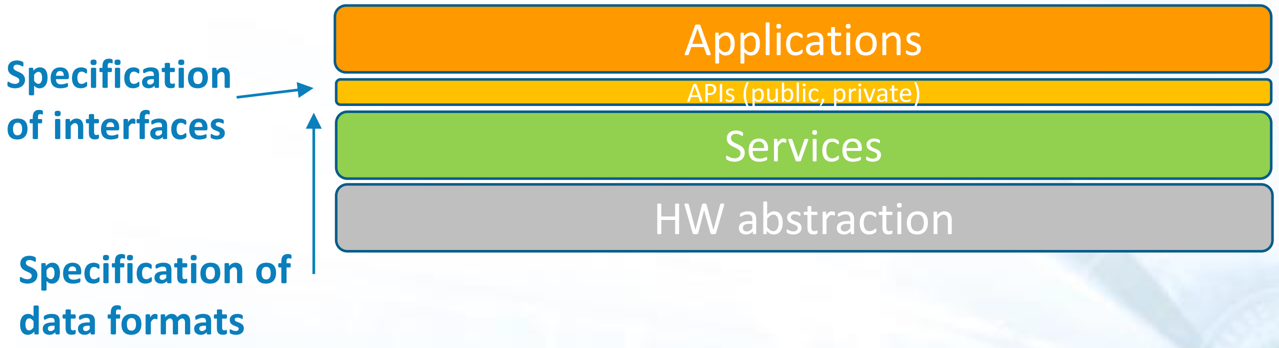
From Signal to Service Oriented Architectures



Thousands of signals exchanged between ECUs

"Service orientation means encapsulating data with the business logic that operates on the data, with the only access through a published service interface."
Werner Vogels – VP & CTO @Amazon.com





Thank you!

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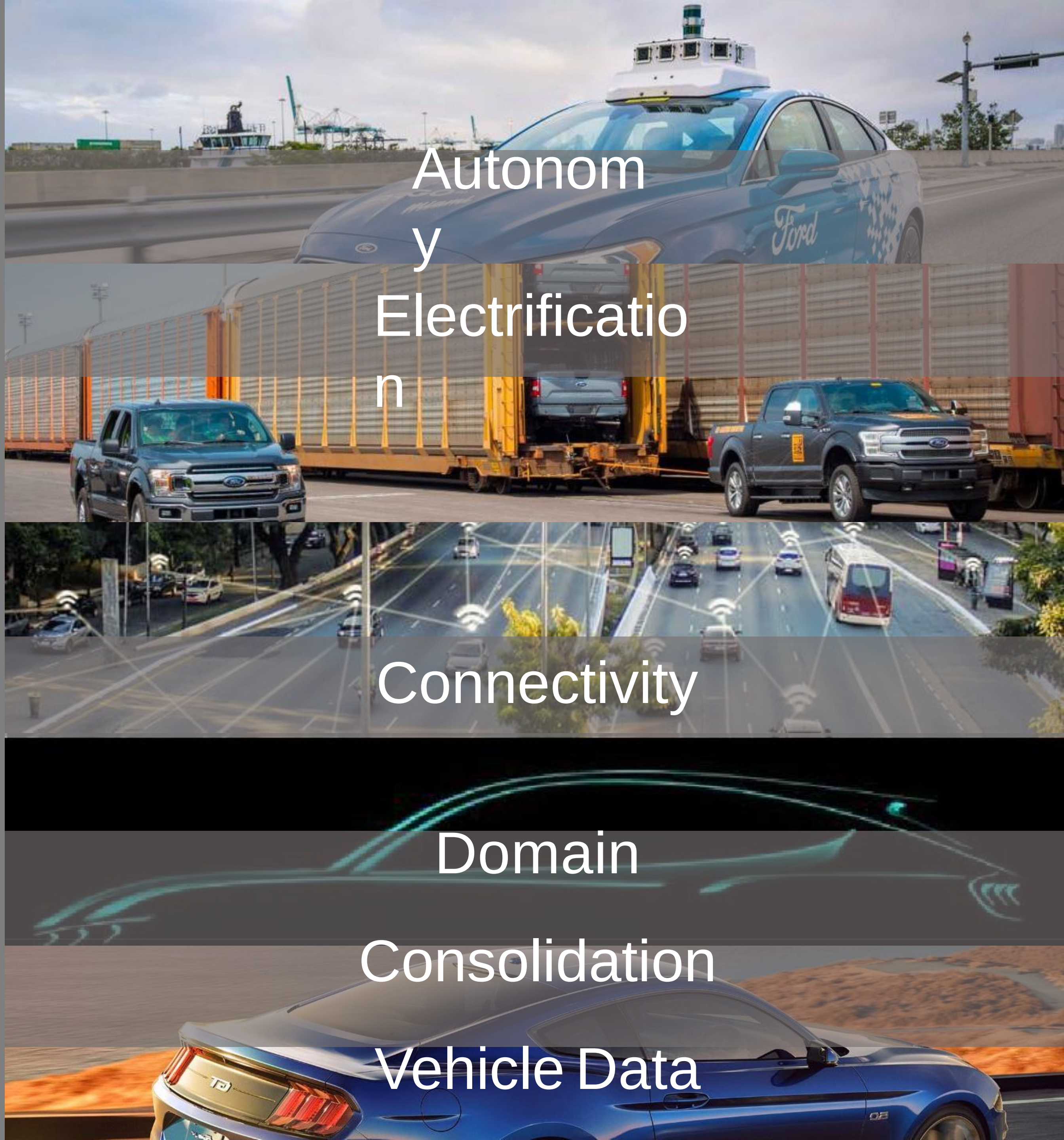
Niclas Gyllenram
Director Software Development
Volvo Cars

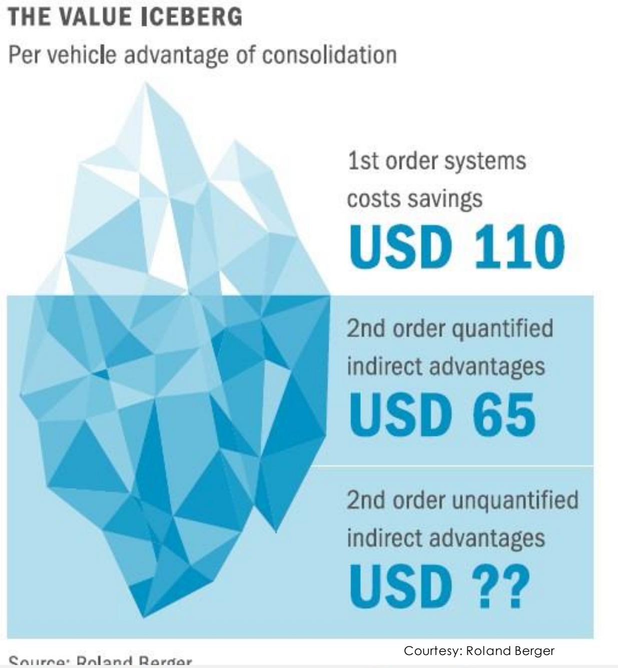
Industry standards for vehicle data

Industry Trends

It's amazing how much data is out there. The question is how do we put it in a form that's usable?
~Bill Ford



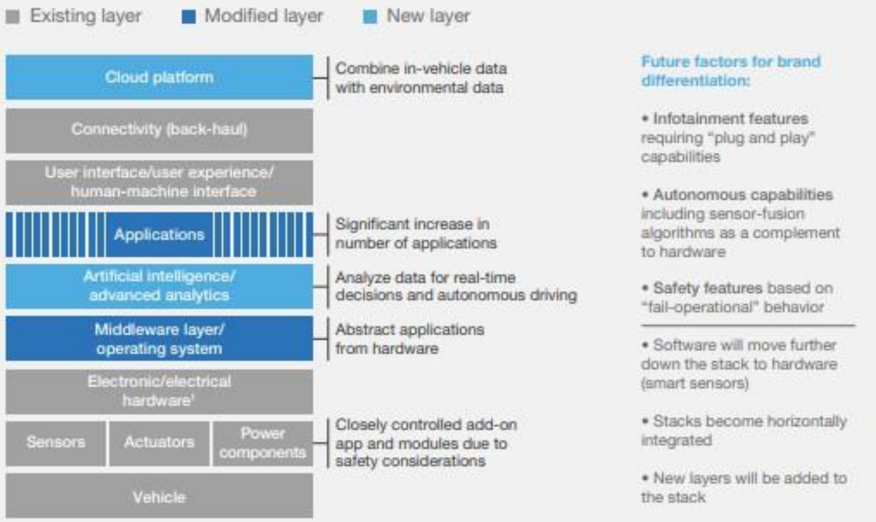
These market trends offer us the opportunity to once again rethink the relationship between a customer, their vehicle, and the connected world around them.



Courtesy: Roland Berger

Architecture will become service oriented, with new factors for differentiation.

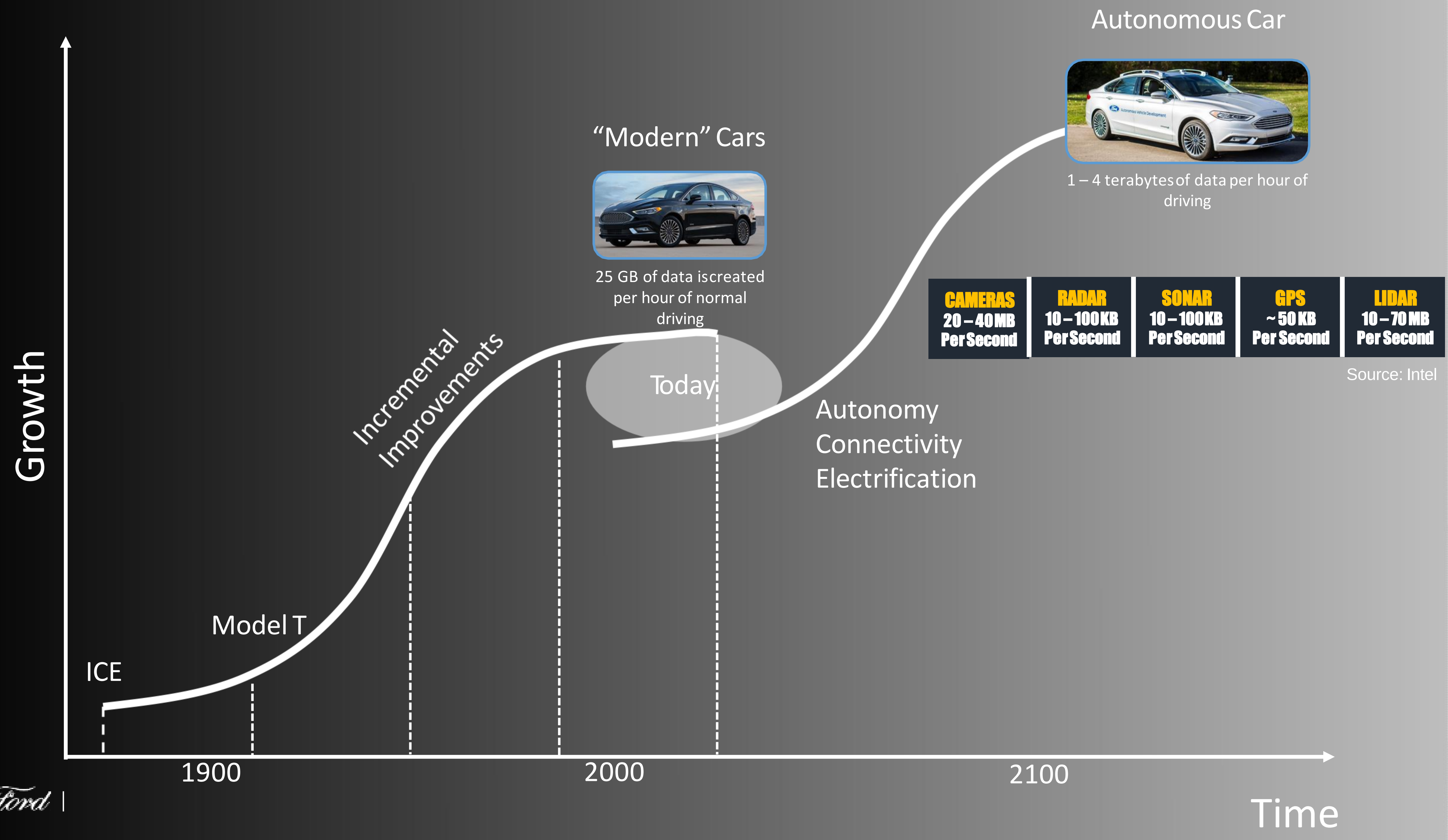
Future layered in-vehicle and back-end architecture



[1]Including operating system in status quo.

Courtesy: McKinsey & Company

McKinsey&Company

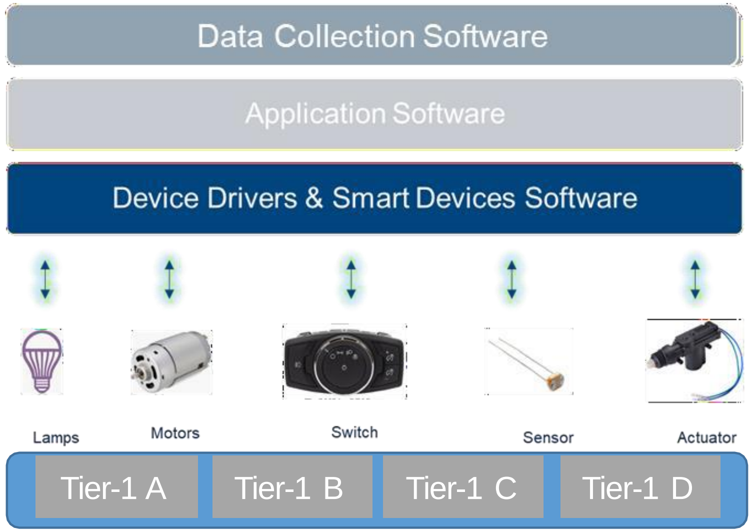

Autonomous Car
1 – 4 terabytes of data per hour of driving
"Modern" Cars
25 GB of data iscreated per hour of normal driving
CAMERAS 20 – 40 MB Per Second
RADAR 10 – 100 KB Per Second
SONAR 10 – 100 KB Per Second
GPS ~ 50 KB Per Second
LIDAR 10 – 70 MB Per Second
Source: Intel
Growth
Incremental Improvements
Today
Autonomy
Connectivity
Electrification
Model T
ICE
1900
2000
2100
Time

One Connected Vehicle Contains

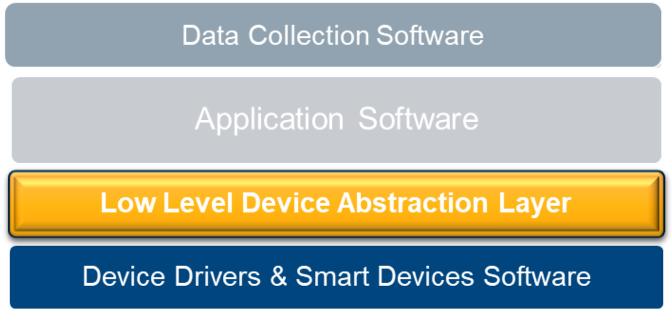
It's a Great Vision!
But what does reality look like?

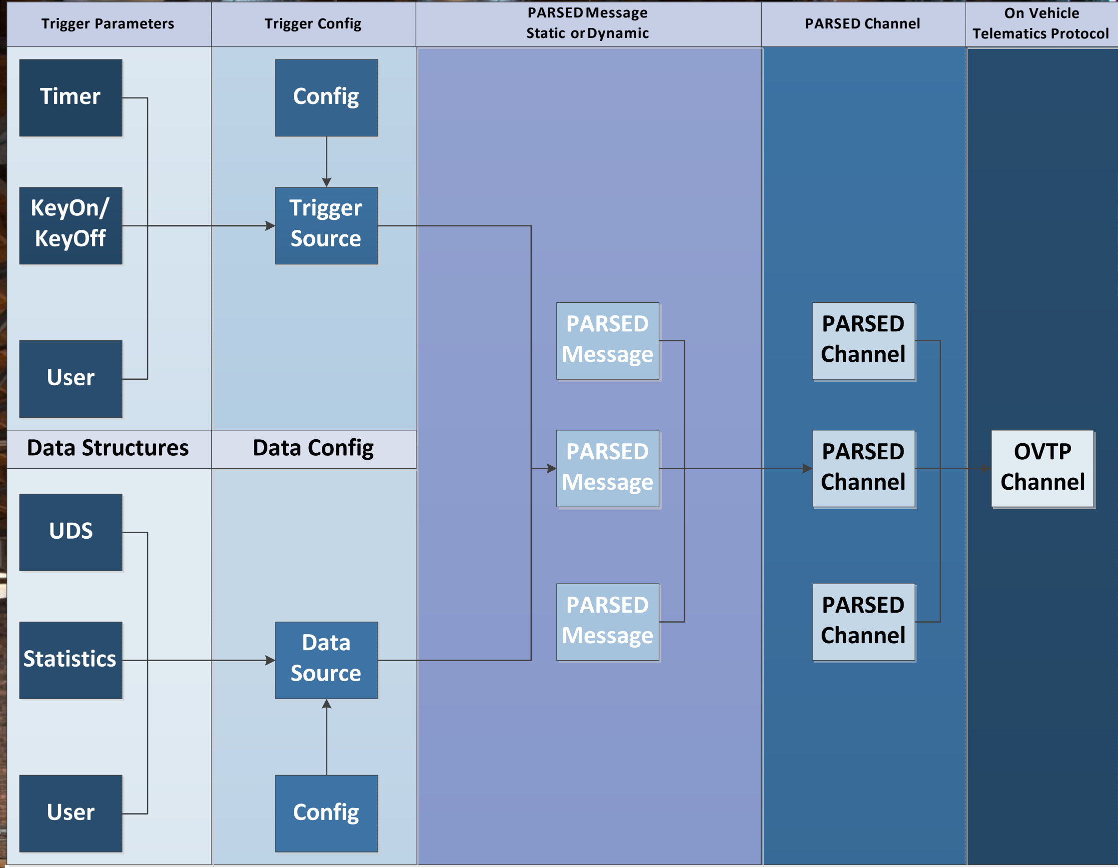
How Are Other Industries Doing It?

CAN In Automation has Established an entity to create “Device Profiles” - LINK



Mutually Agreed Abstraction





Advanced Data Schema Design

We've gone as far as defining our own embedded data sets and data schemas to accelerate the utilization of data for scalable decision making around feature utilization, warranty cost improvement, and better customer experience

We recognize this only works if the data set reaches a significant market segment and economy of scale to support Tier I and Tier II needs as well.

ECU Consolidation

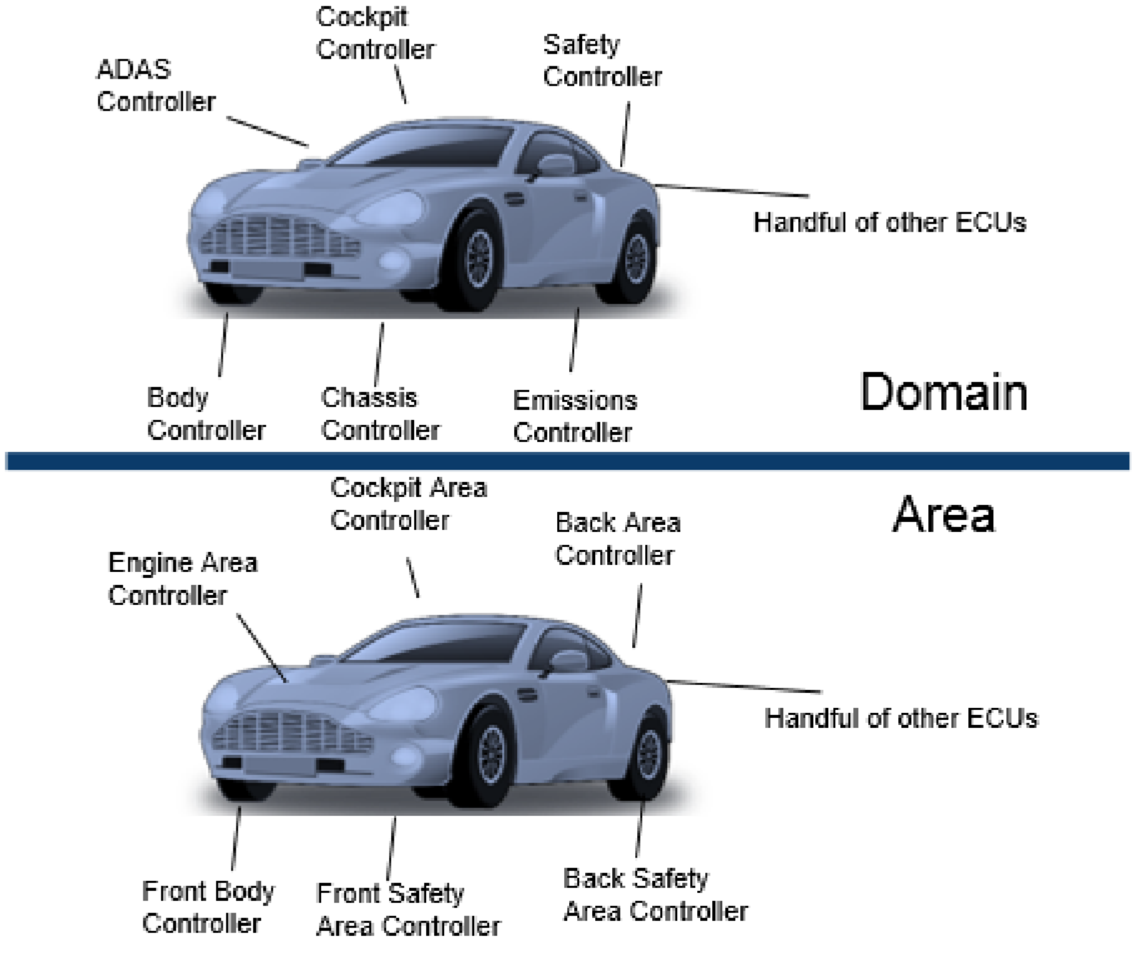
Into a distributed central compute platform

TODAY

- **60-100 ECUs**
- **6-8 operating systems**
- **Isolated operations**
- **Increasing cost & complexity**

Courtesy: QNX

Combined with improved compute performance through module consolidation



Courtesy: QNX

TOMORROW

- **6-10 Domain/Area Mega-controllers**
- **Consolidated software system**
- **Coordinated operations**
- **Reduced weight, cost, & complexity**

The compute capability of Domain Consolidation Opens New Opportunities for Advanced Data Collection

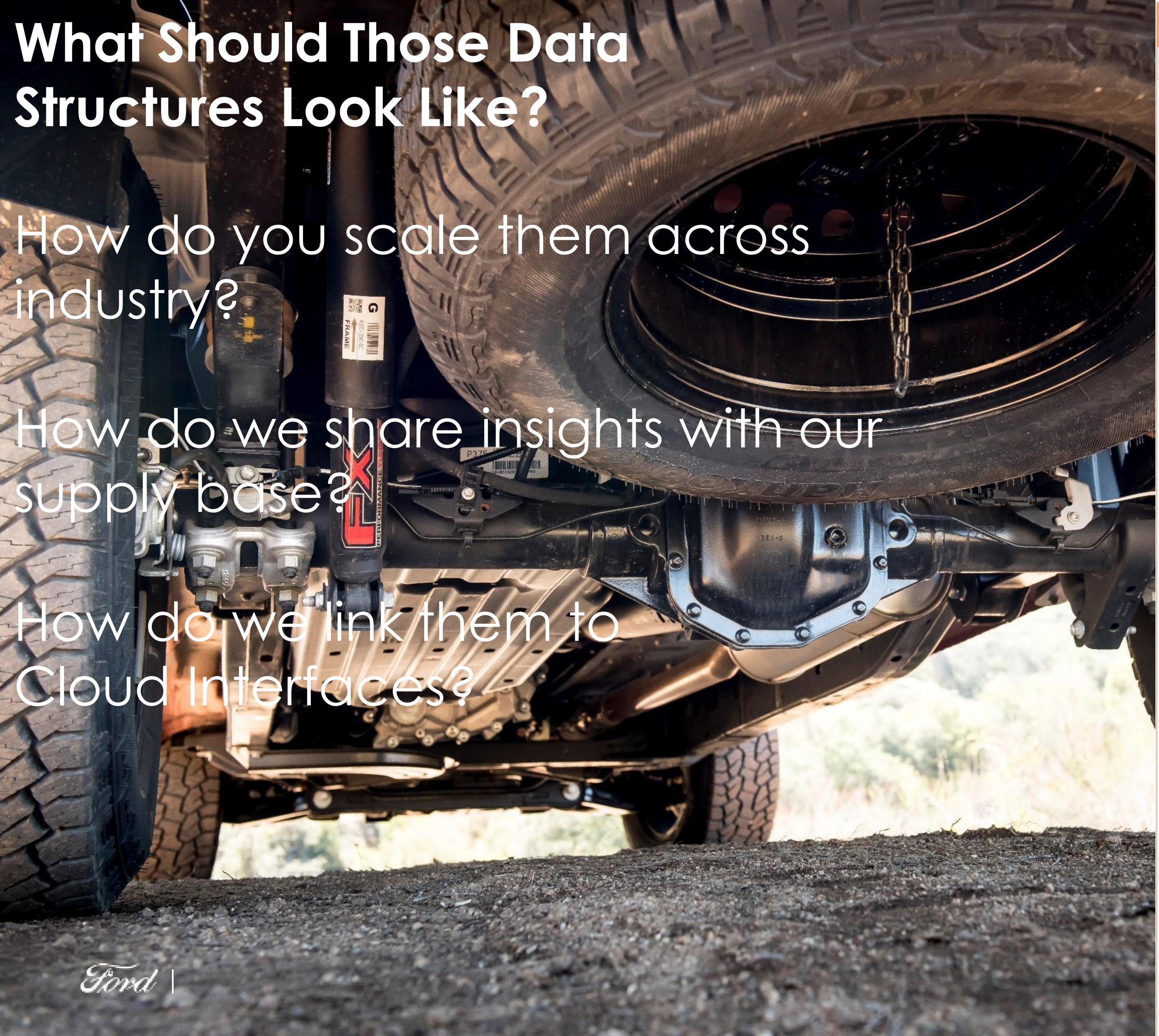
Ford |

What Should Those Data Structures Look Like?

How do you scale them across industry?

How do we share insights with our supply base?

How do we link them to Cloud Interfaces?



object ▶ Signal ▶ children ▶ ADAS ▶

```
▼ object {3}
  ▶ Attribute {3}
  ▼ Signal {3}
      description : All signals that can dynamically be updated by the vehicle
      type : branch
    ▼ children {7}
      ▶ Body {3}
      ▶ Drivetrain {3}
      ▶ OBD {3}
      ▶ ADAS {3}
      ▶ Chassis {3}
      ▶ Vehicle {3}
      ▶ Cabin {3}
  ▼ Private {3}
      description : Uncontrolled branch where non-public signals can be defined.
      type : branch
    ▼ children {0}
        (empty object)
```


Courtesy: GENIVI

With Proper Design, Legacy Vehicle Networks Can Handle Complex Data as well...

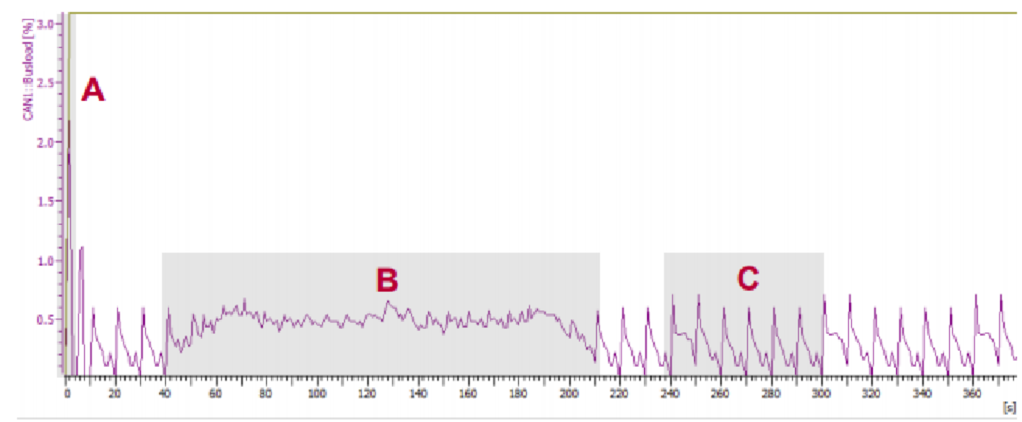
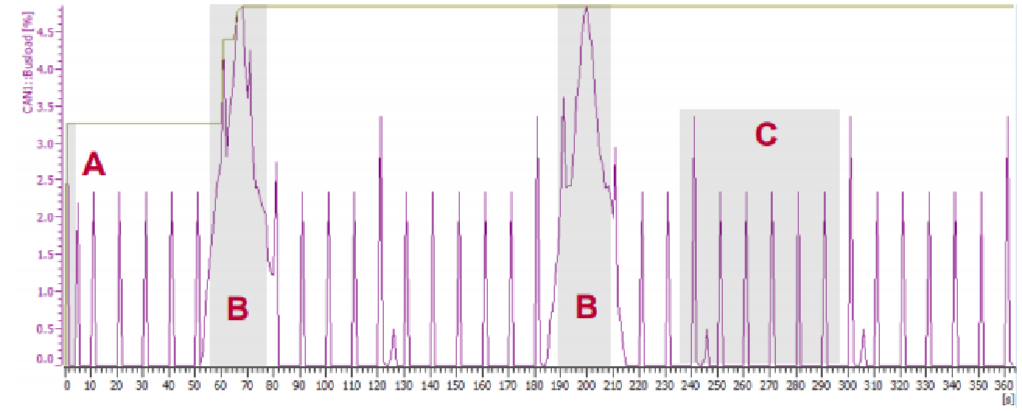
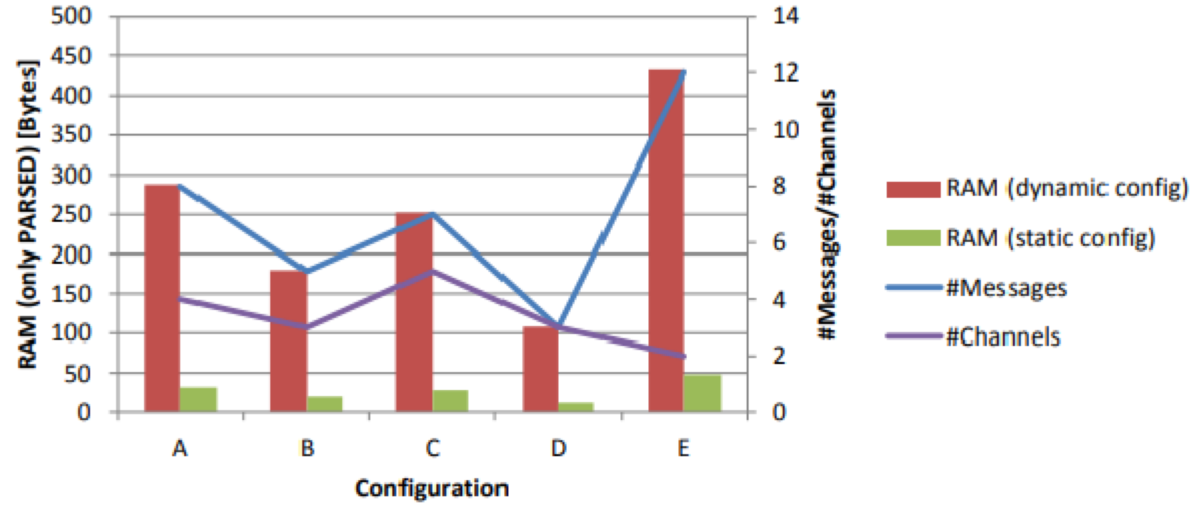


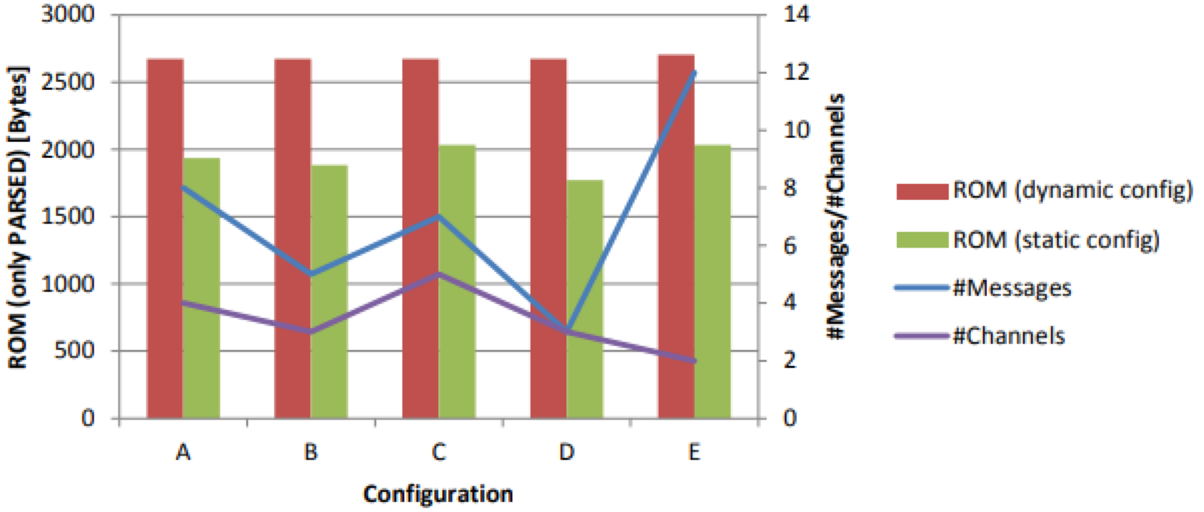
Figure 4-1 PARSED Busload for 20 ECUs with STmin=1000ms.



Courtesy: Vector Informatick GmbH

Without significantly impacting RAM and ROM Size Constraints for Limited Compute Modules.

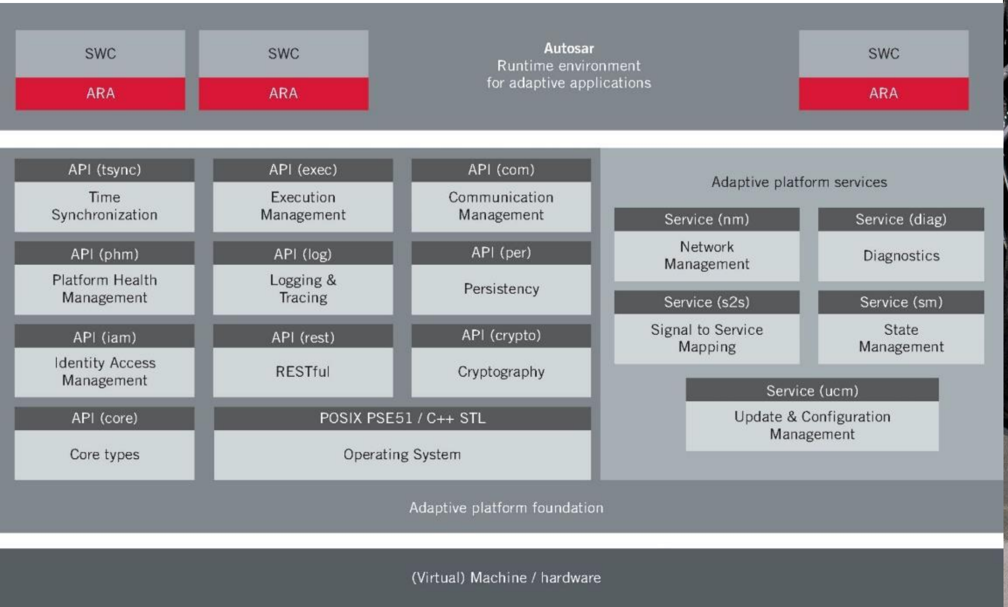




How do we scale into lower level modules?

How do we incorporate them across OEM's?

Current Standards stop at basic Integer/float definitions



What Scripting tools and capabilities should we be using as an industry in an embedded environment?

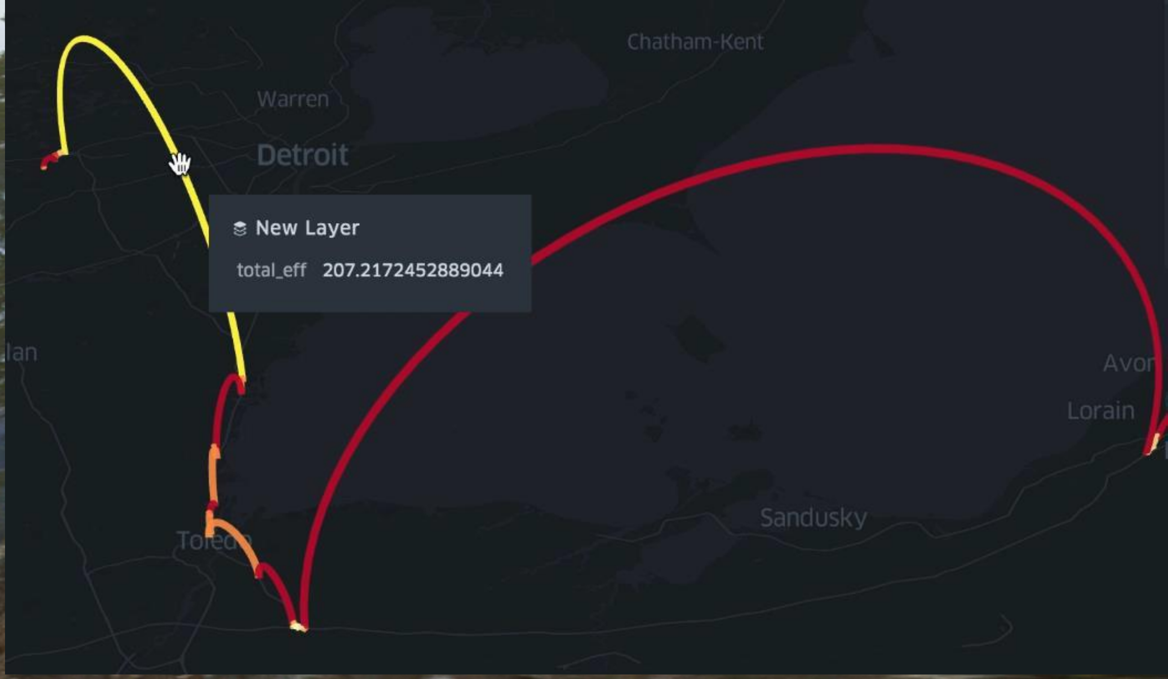
- Python?
- Lua?
- Scala?

How do we manage safety and privacy regulations with scripting?

We aren’t waiting for a full industry consensus to derive value today.

Predictive Features and Smart Vehicles

We leverage our Smart Vehicles for pre-production optimization of features and functionalities we are delivering for our customer base.



Smart Vehicles at Scale

Our mandate for 100% connectivity is unlocking new opportunities for our customers. The density of data our smart vehicles generate is staggering.

It allows us to have a new agility around insights on what products we want to provide for each region, new opportunities for efficient logistics, and a re-Imagination of the relationship between a customer and its vehicle.

Thank You

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