Back to Basics
Network as Enabler

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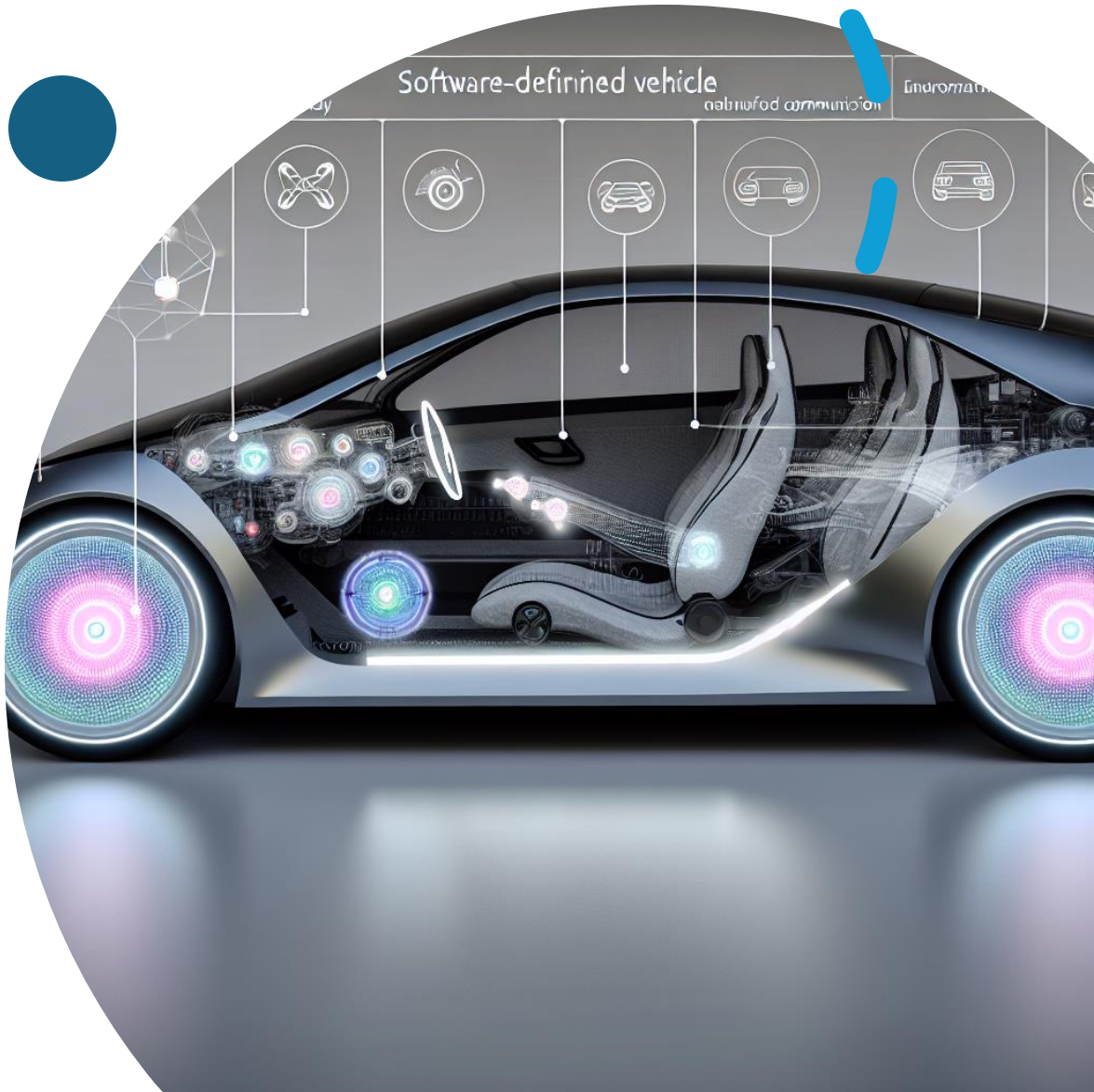
Personal Introduction

- Executive Director of Systems Life Cycle Organization, leading System Architecture and Integration at Ford Motor Company.
- Extensive career in Chip Design industry.
- Lead SW and HW architecture teams across industries.
- Most importantly : Not a network expert!

Agenda

- What is High Quality Software
- Complexities in Automotive Industry
- Other Industries
- The Future of Automotive
- Q&A



What Is Software?

- **“software**, instructions that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system. ” , *Britannica*

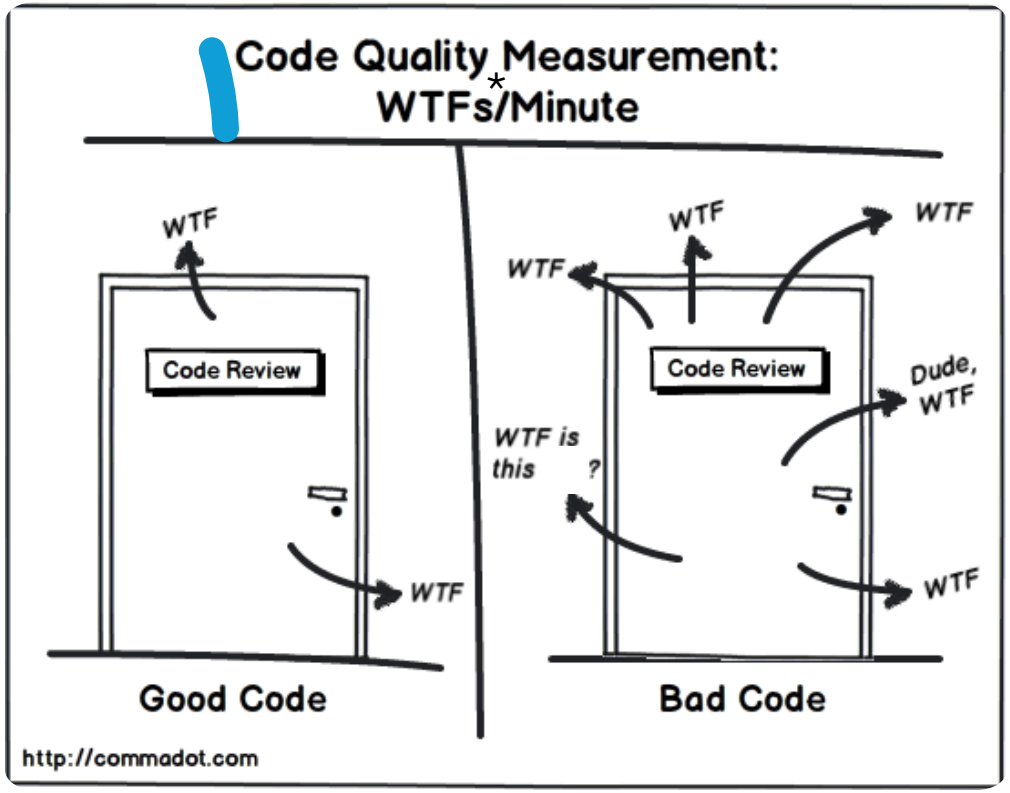
Value Of Software

- Primary value: how **easy is to change the** software
- Secondary value: What software does, solves the end-user problem

Low-Quality Software

Software complexity “smells”:

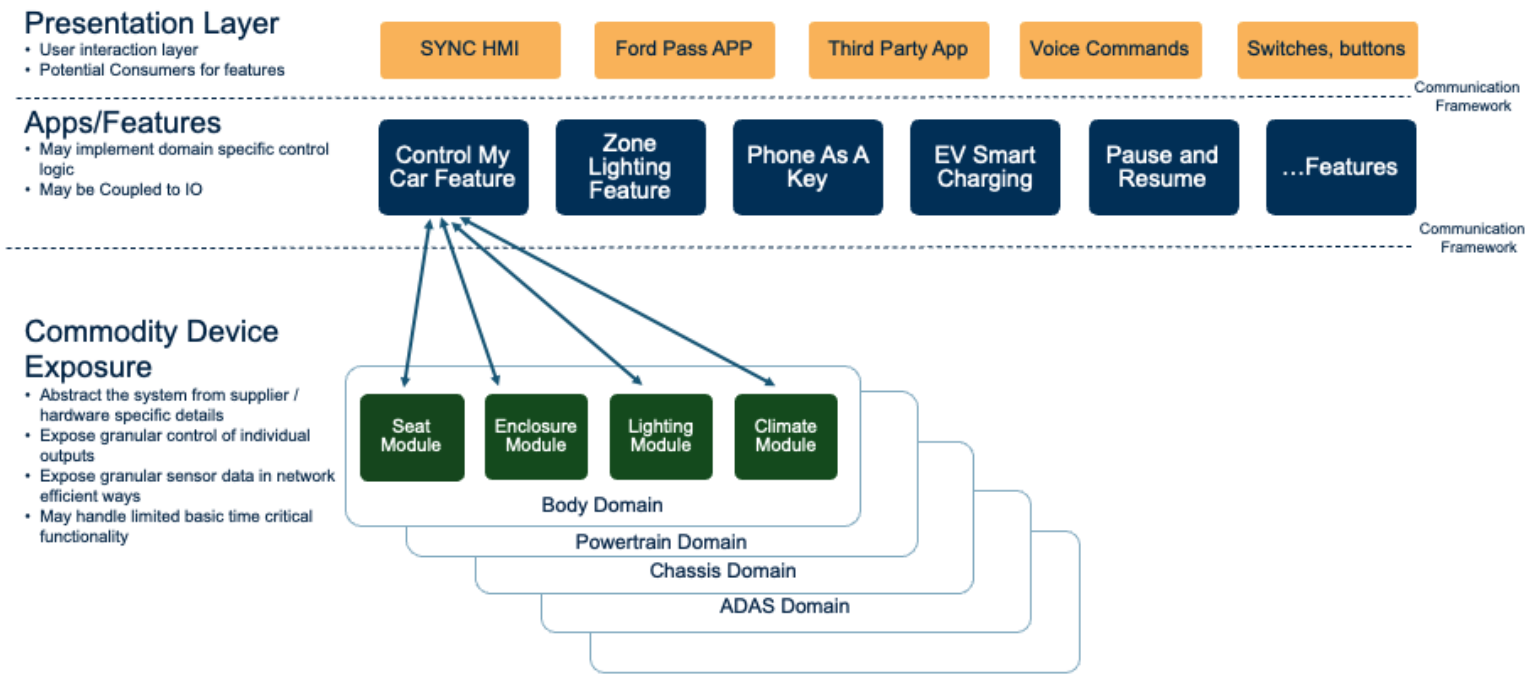
- Rigidity: A change in one module requires changes in other modules
- Fragility: A change introduces random failures
- Opacity: Hard to read and understand
- Inseparability: Impossible to reuse



*WTF: Work That Frustrates

Typical Legacy Industry Model

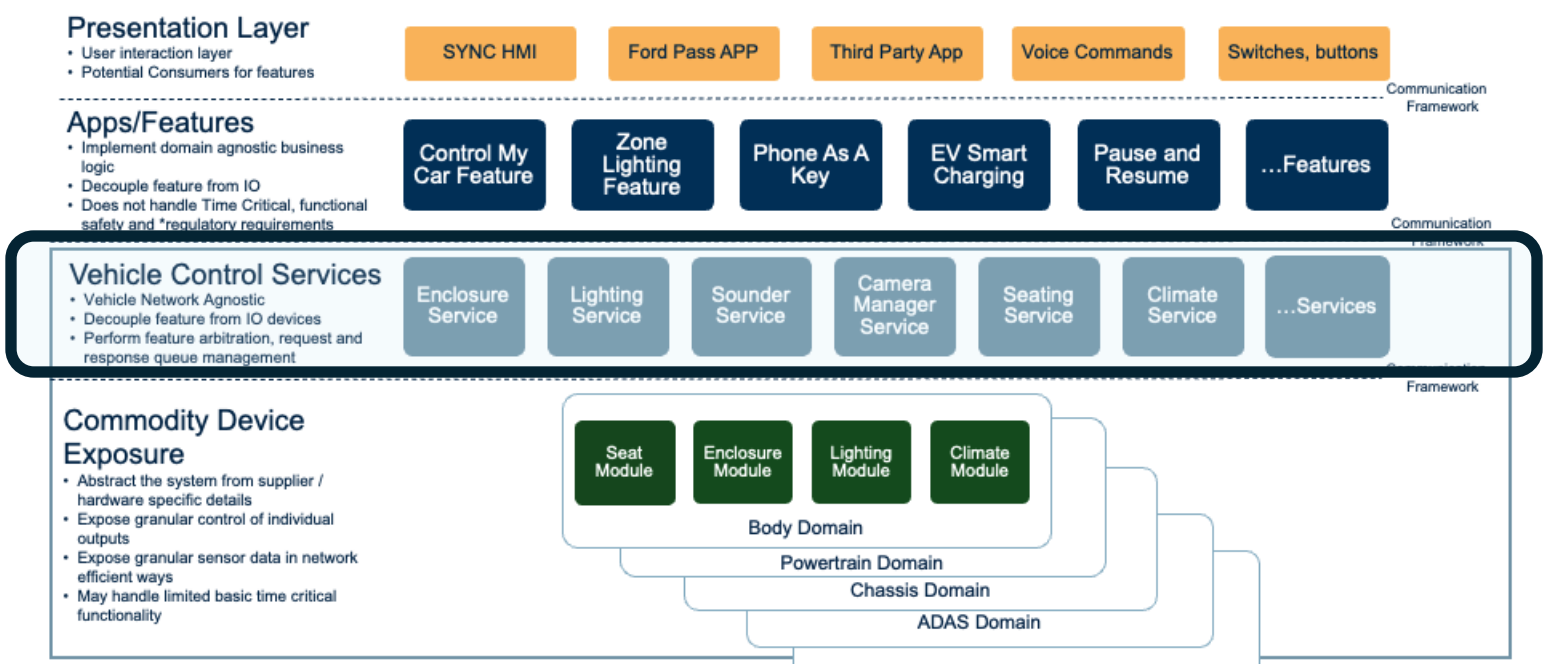
- Legacy industry model suggests vertical integration of features
- Rigid model with strong dependency on physical implementation
- Limited debuggability and inseparability of code



Limited Abstraction – Feature Driven “Verticals"

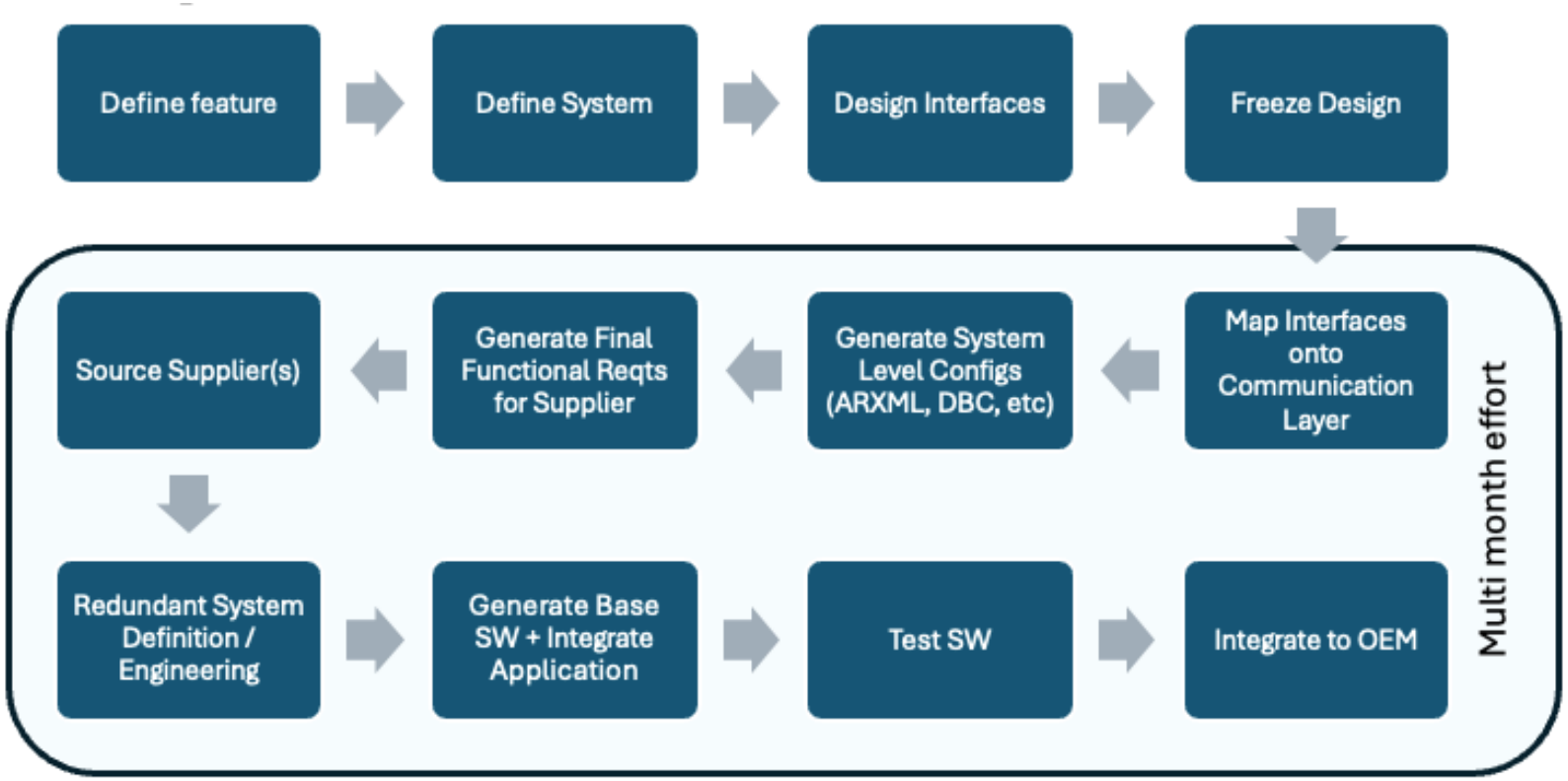
The Transition To Platforms

- Abstraction of layers reduces rigidity and dependency
- Allowing increase SW development velocity
- Abstraction layer, is part of the solution, not the full solution



Abstraction of layers – reduces the rigidity of the system

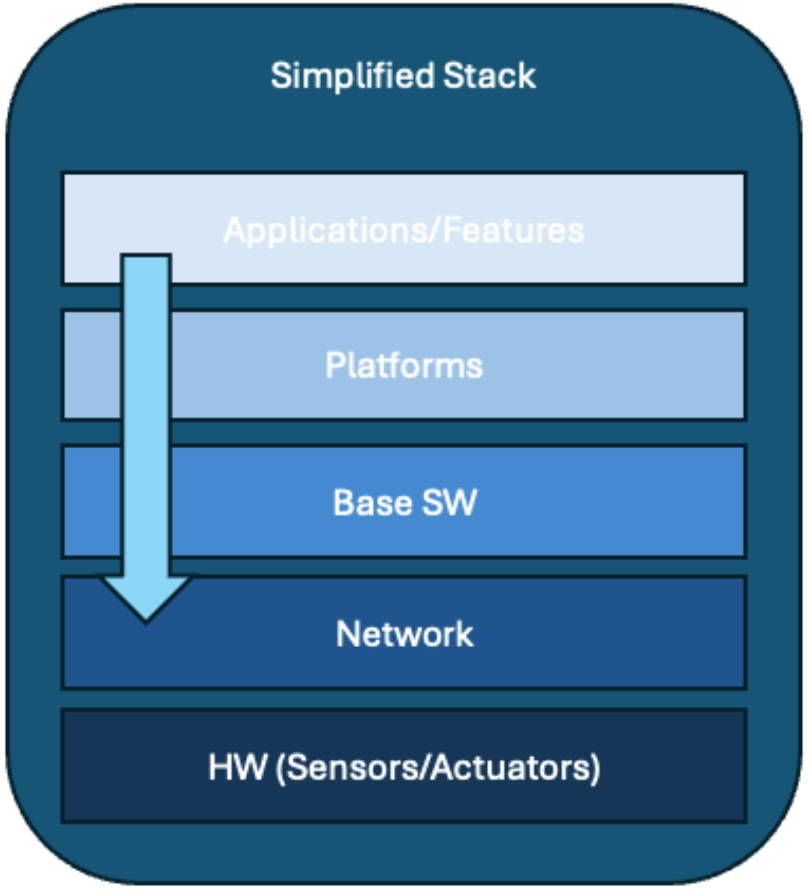
The Automotive Journey Of Feature Development



Slow process w/ limited innovation and many inefficiencies

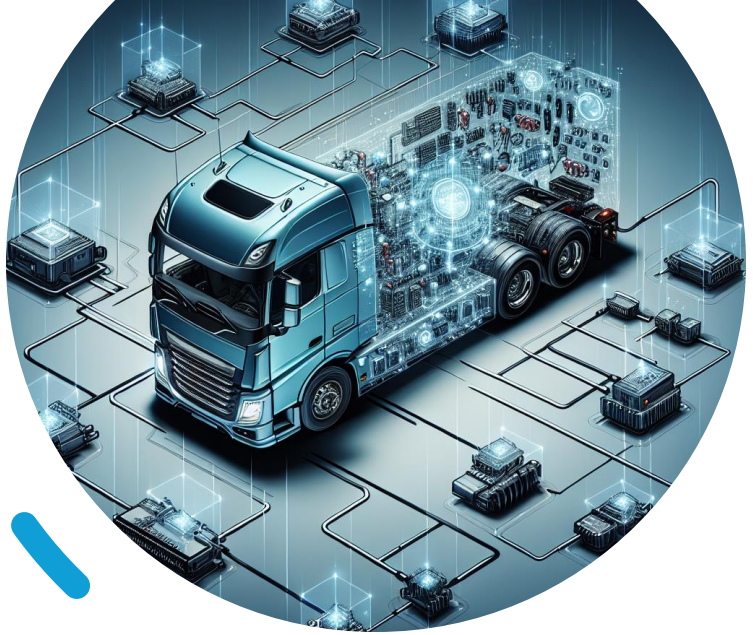
Network As Key Enabler

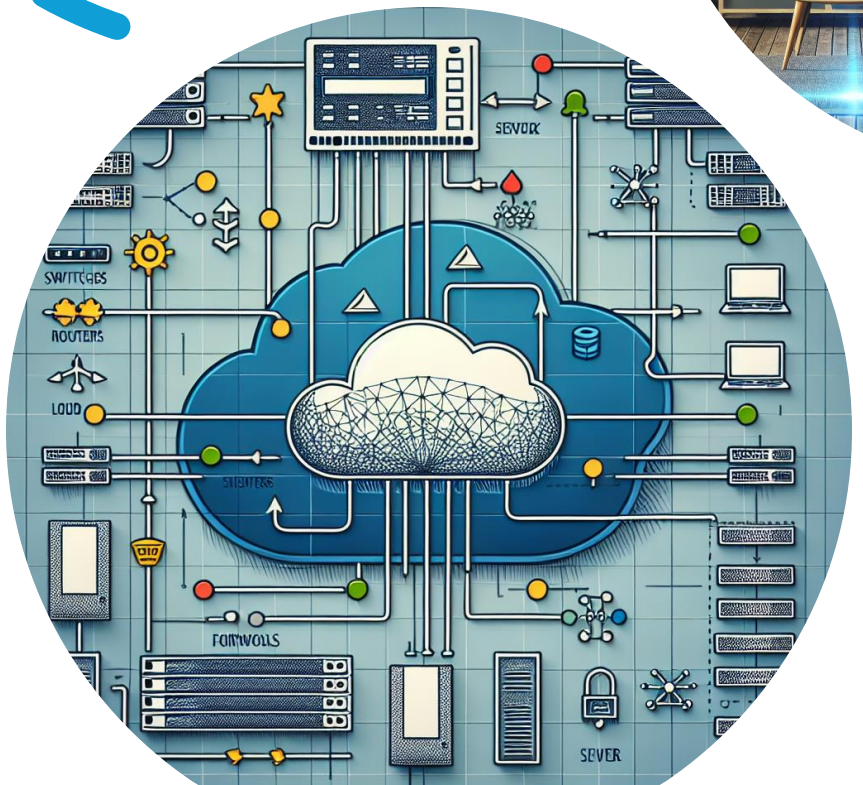
- Applications depend on access to sensors / actuators across the vehicle
- Network extensibility, backward compatibility and forward compatibility are critical
- Dependencies between modules must be simplified and abstracted



We Are Not The First In This Journey

- Software Defined Network concept provides centralized management and flexibility of network implementation
- IOT concepts provides easy plug-and-play and discoverability of devices
- J1939 provides standardization of interfaces





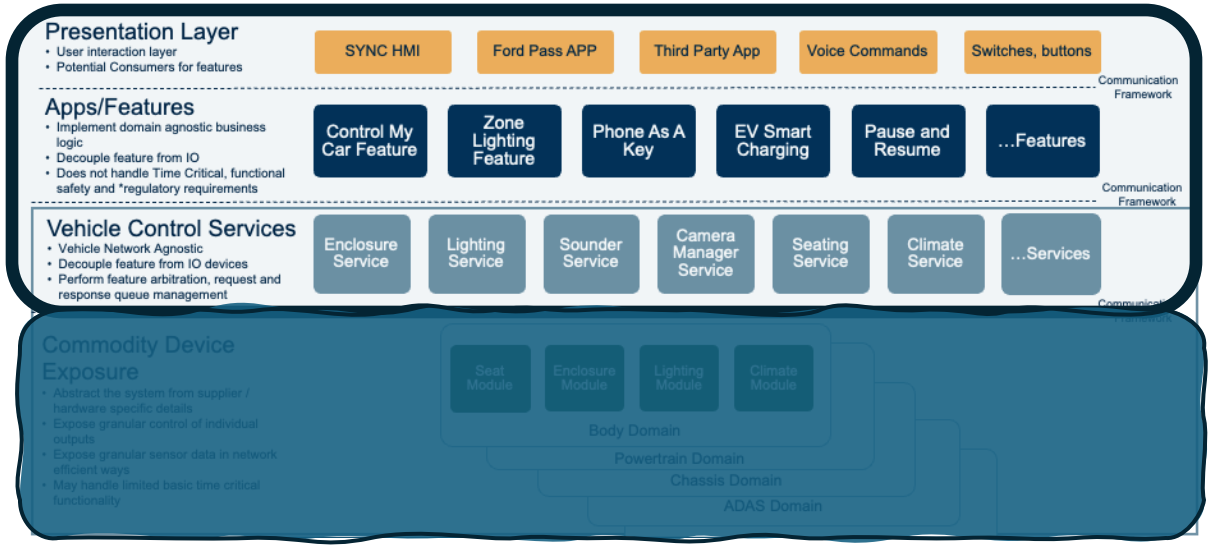
Complexities Automotive Brings

- Real-time and safety critical
- Multiple technologies (LIN, CAN, Ethernet, Autosar, QNX, Android, etc..)
- Constrained micro-controllers and limited memory
- Required Determinism
- Statically configured

The Path To Improving Development Velocity

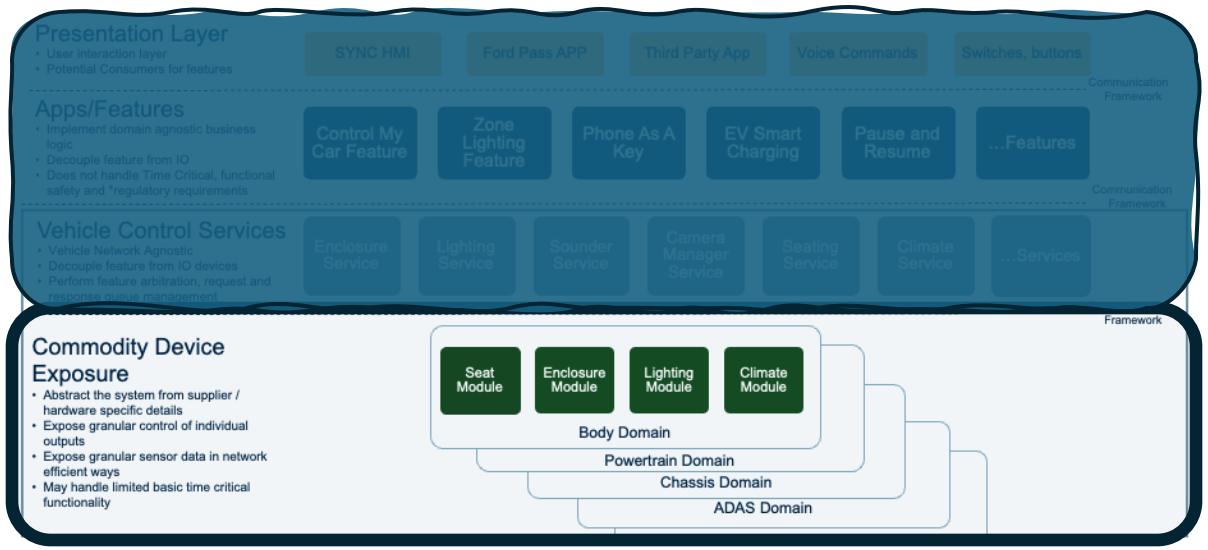
Collaboration across OEMs and Suppliers to standardize communications and enable robust development process is possible.

OEMs Responsibility



- Provide unique customer value through platforms.
- Exposing interfaces making their applications, features, and presentation appealing.
- Standardize development of interfaces and request it from suppliers

Suppliers Responsibility



- Can transform the industry
- Provide common interfaces into their modules enabling reductions in complexity and cost while improving quality and re-use of their solutions across OEMs.
- Publish the physical attributes in a conscience, standardize manner.

Thoughts To Consider

- Expand on J1939 concepts
  - **Addressing:** Unique addresses for each device simplify network management and component addition.
  - **Name-Based Services:** Components discover and interact based on functions, not fixed connections.
  - **PGNs (Parameter Group Numbers):** Standardized data types ensure interoperability.
  - **Communication:** Uses both unicast and broadcast for efficient data exchange and discovery.
  - **Dynamic Configuration:** Supports some runtime adjustments for enhanced flexibility.
- Expand on usability of IOT protocols
  - **Discovery** - Meta-data, profiles, Identification requests.
  - **Identification** – Device type, protocols, APIs, etc..
  - **Registration** - Integral part of the full platform .
  - **Configuration** – Network, authentication, FW updates and other enables to start working.
- Reduce complexity, Both in SW stack and network technologies

Call To Action

- The ability to update SW, modify and deploy it is existential to OEMs.
- Networks in automotive bring complexity compared to other industries.
- We must find a path to reduce complexity and dependency on different SW layers.

Q&A