HOW THE FUTURE OF ELECTRIC AND AUTONOMOUS VEHICLES WILL RELY ON DATA CENTRICITY

Bob Leigh

SENIOR MARKET DEVELOPMENT DIRECTOR, COMMERCIAL

Pedro López Estepa

MARKET DEVELOPMENT DIRECTOR, AUTOMOTIVE

200+ RTI Autonomous Vehicle Programs!

- 50+ commercial systems
  - 10+ Passenger vehicles
  - 10+ EV startups
  - 5+ Software platforms
  - 8+ Trucks, mining vehicles, forklifts
  - 2 Flying taxi services
  - 2 Hyperloop & other
  - 2+ Autonomous ships
  - 2+ Underwater robots
- 100+ defense systems (land, sea, air)
- 75+ research programs (companies, universities, etc.)

APTIV

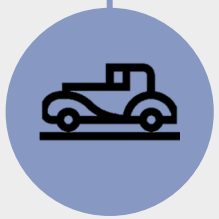
Mobility Technological Revolution

Major disruptions across the Automotive Industry

Mobility Technological Revolution

From steam power to the affordable car

1800



1920

The Vintage Era
"The first steps towards modern vehicles"

1950

The Post-war Era
"Modern engines and sophisticated bodies"

1980

The Modern Era
"Electronics take over"

2020

The Future
"Connected world, from ADAS to AVs"

Mobility Technological Revolution

“The auto industry is poised for more change in the next five to ten years than it’s seen in the past 50”

Mary Barra, CEO, General Motors

"Software will account for 90 percent of future innovations in the car”

Herbert Deiss, CEO, VW Group

“Tesla is open to licensing software and supplying powertrains and batteries. We’re just trying to accelerate sustainable energy, not crush competitors!”

Elon Musk, CEO, Tesla

The Future

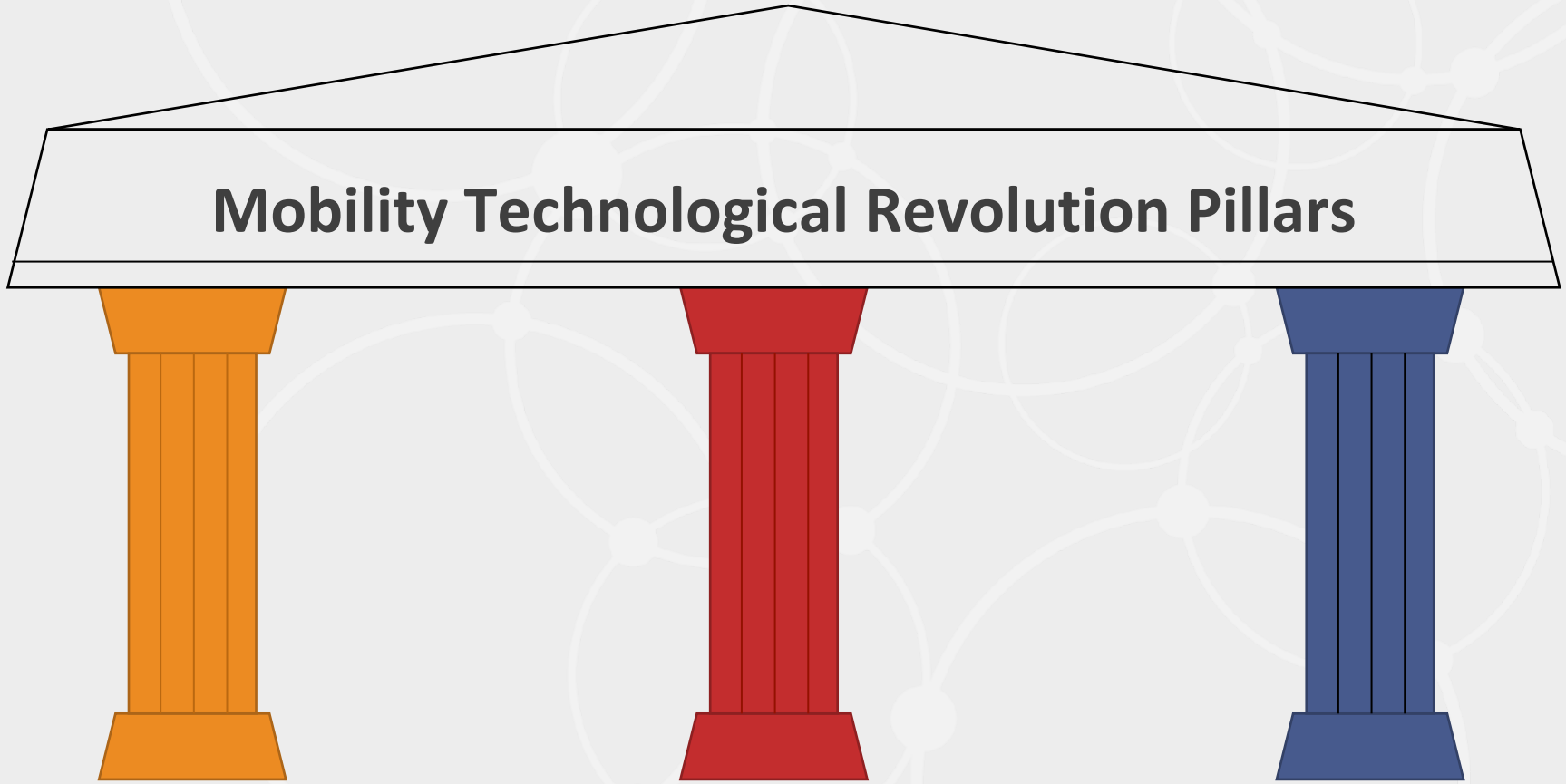
“Connected world, from ADAS to AVs”

2020

Mobility Technological Revolution

The Future
"Connected world,
from ADAS to AVs"

2020

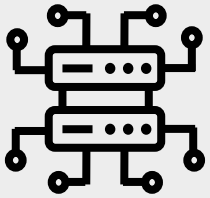


Software Architecture
"Next Gen EE and Safety"

Telecommunication Infrastructure

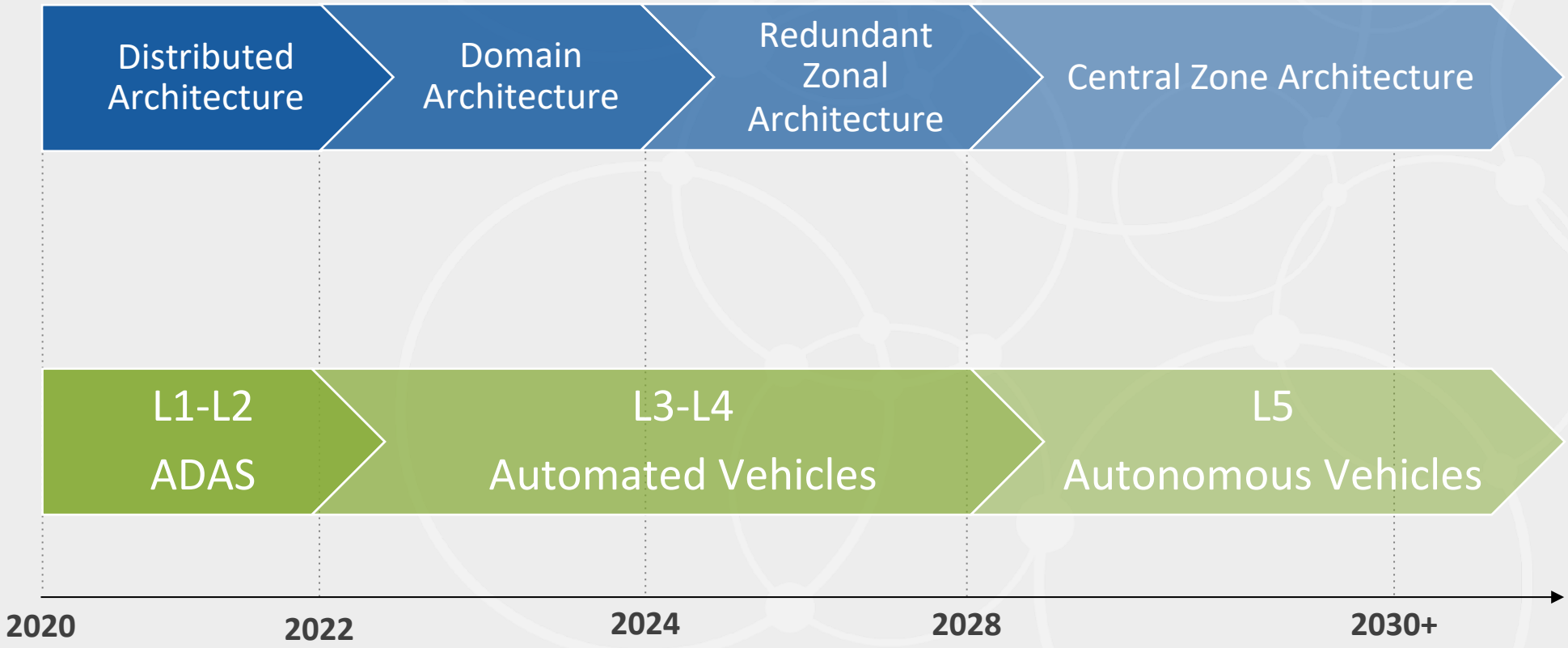
Supply Chain & Business Models

The Future of Mobility “Software Architecture”

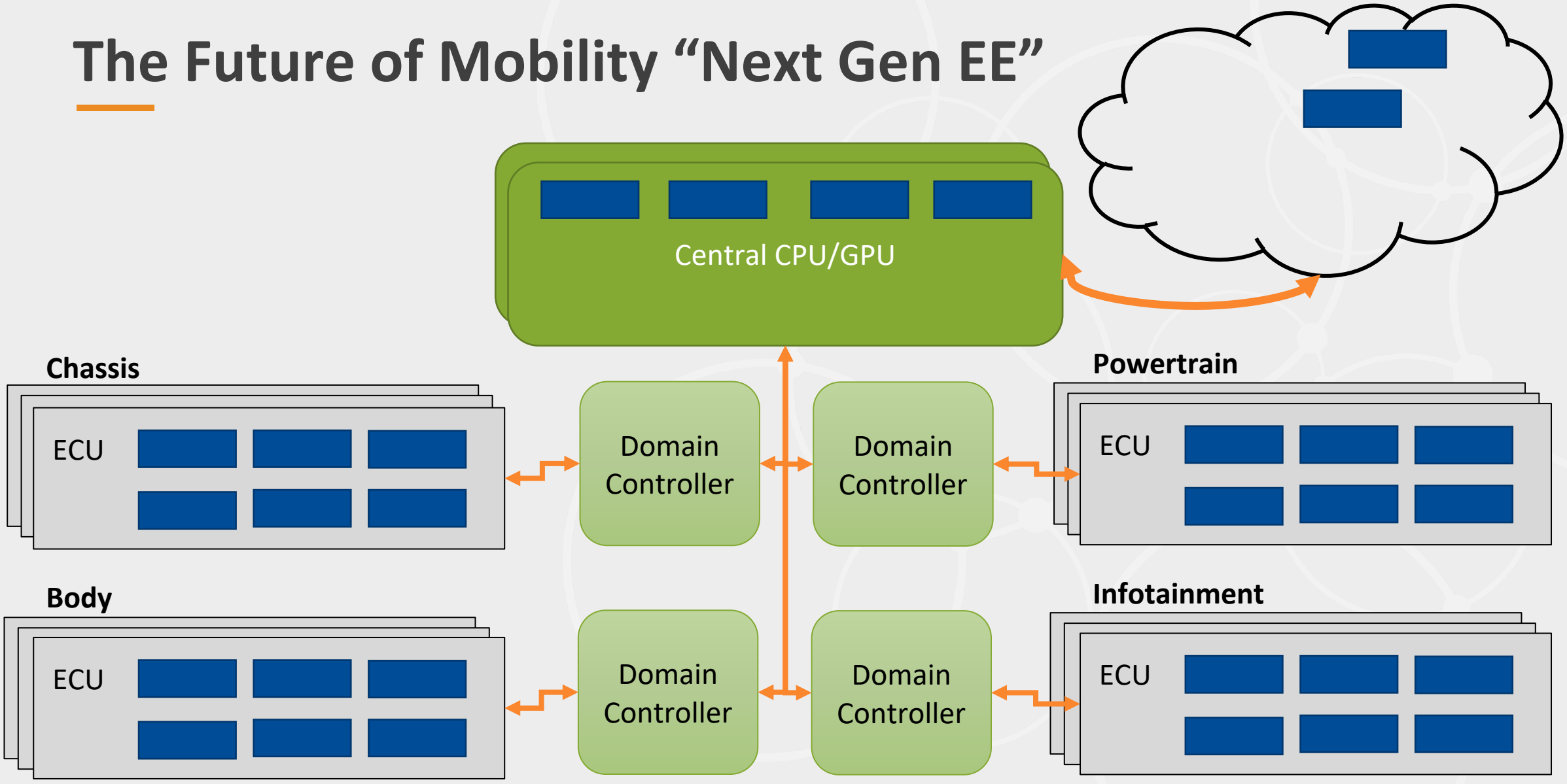


Architectur e Evolution

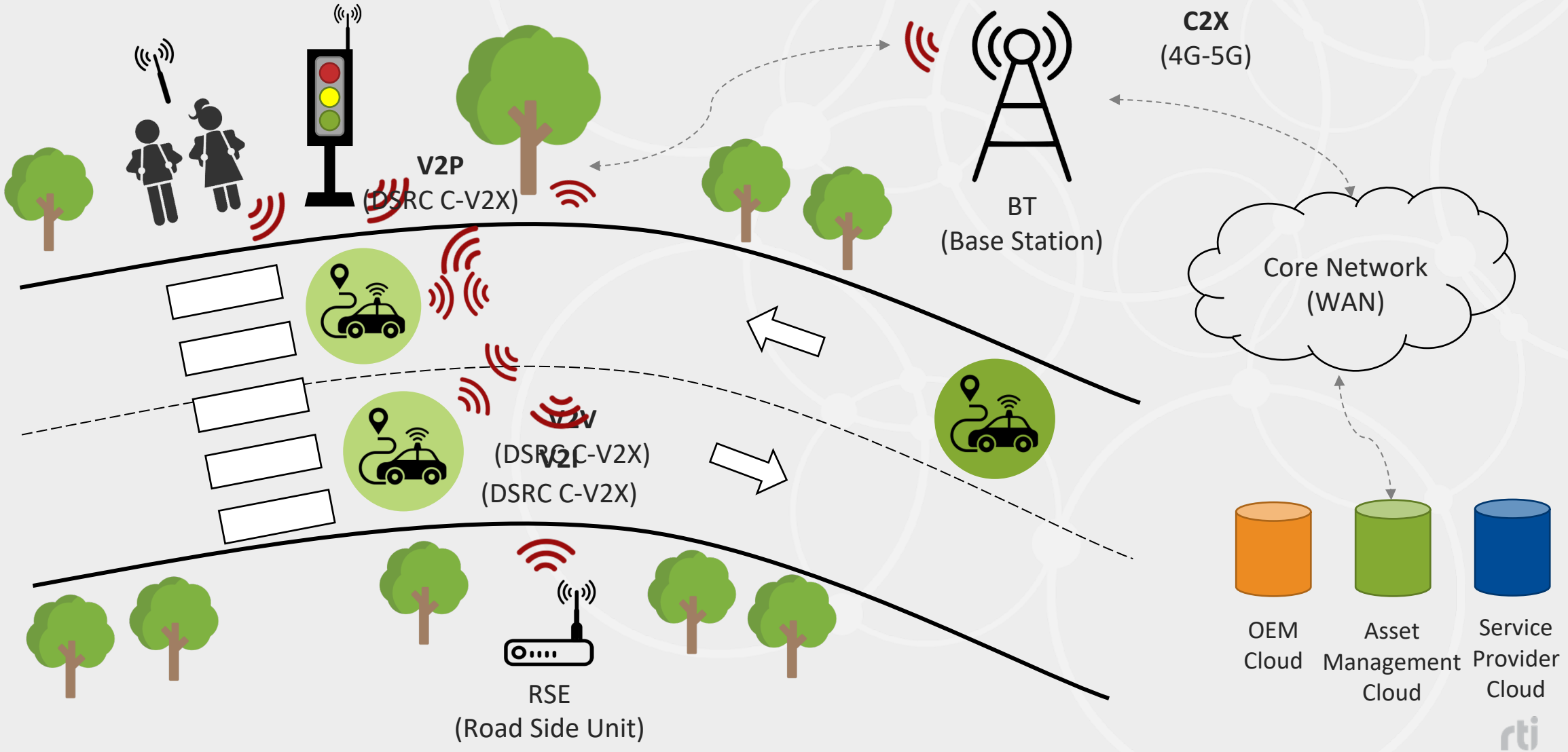
The Future “Connected world, from ADAS to AVs”



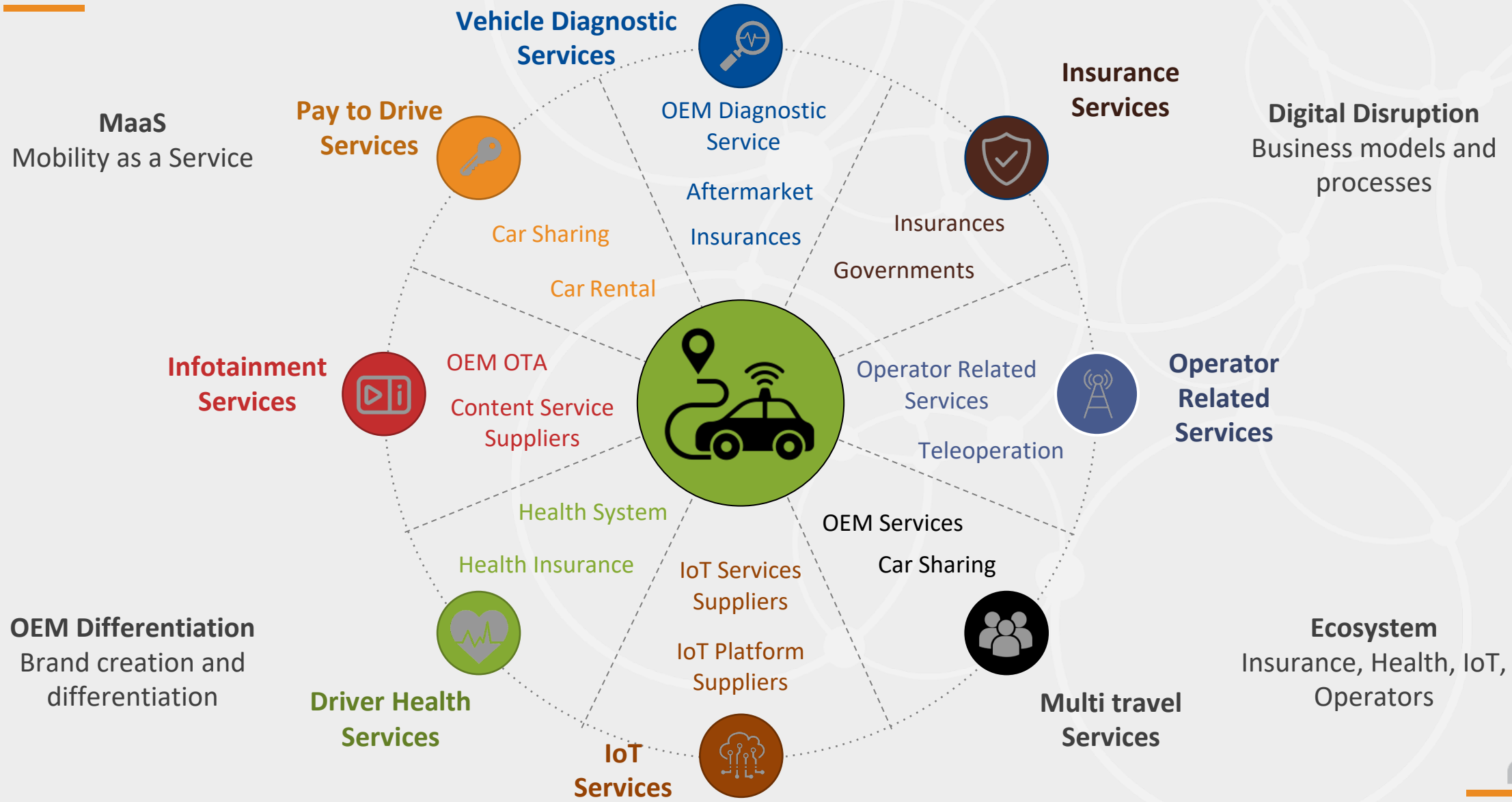
The Future of Mobility “Next Gen EE”



The Future of Mobility “Connected Infrastructure”



The Future of Mobility “New Business Models”



MaaS
Mobility as a Service

Digital Disruption
Business models and processes

OEM Differentiation
Brand creation and differentiation

Ecosystem
Insurance, Health, IoT, Operators

Future Mobility Challenges

Autonomous vehicle connectivity software is challenging and risky

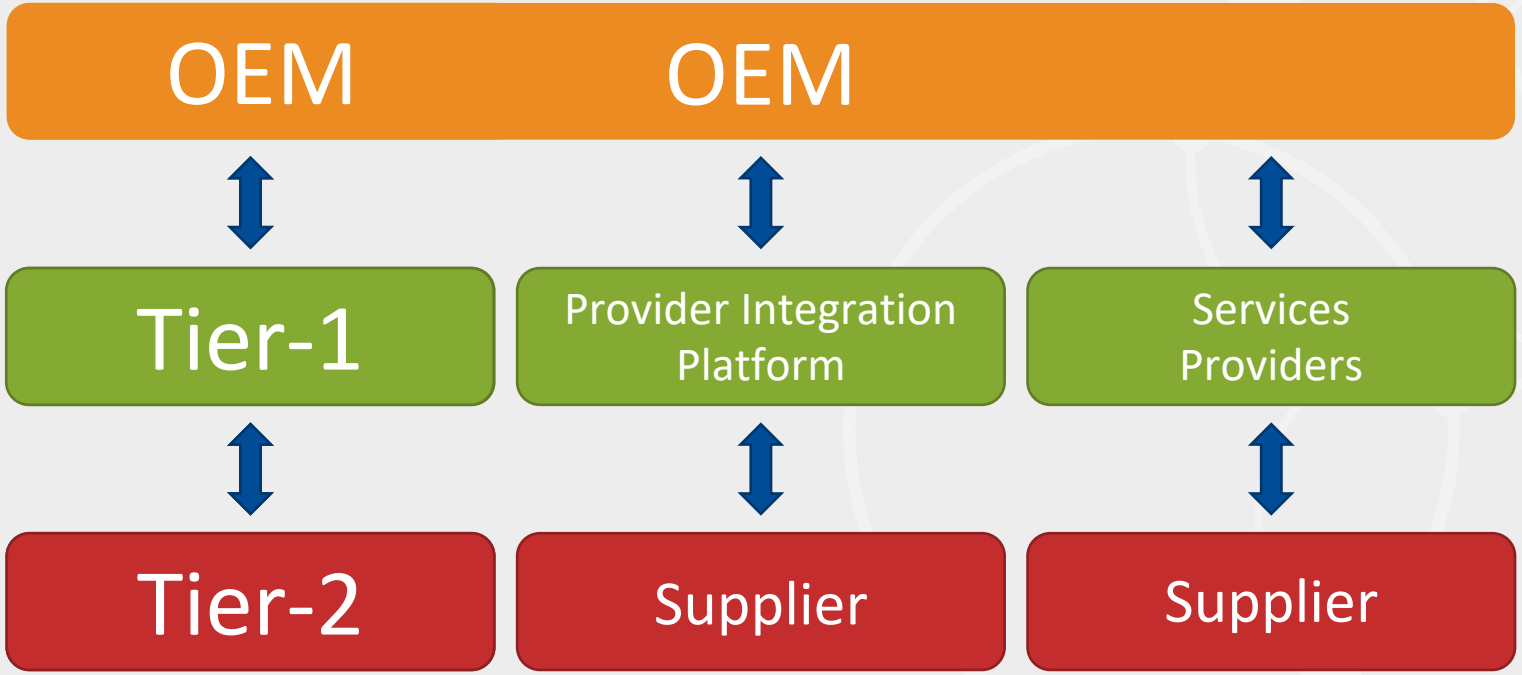
Challenges on Future Mobility

- Importance of **software** is new
  - Traditional supply chain is still adapting
- **Business models** are changing rapidly
  - Many new revenue streams
- **Competition**
  - Electric cars have drastically lowered the entry barrier
  - MaaS is changing the relationship with the customers
  - Multiple non-traditional players

Challenge #1 “Supply Chain Evolution”

Traditional Multi-tier Supply Chain

New Architecture Multi-tier Supply Chain`

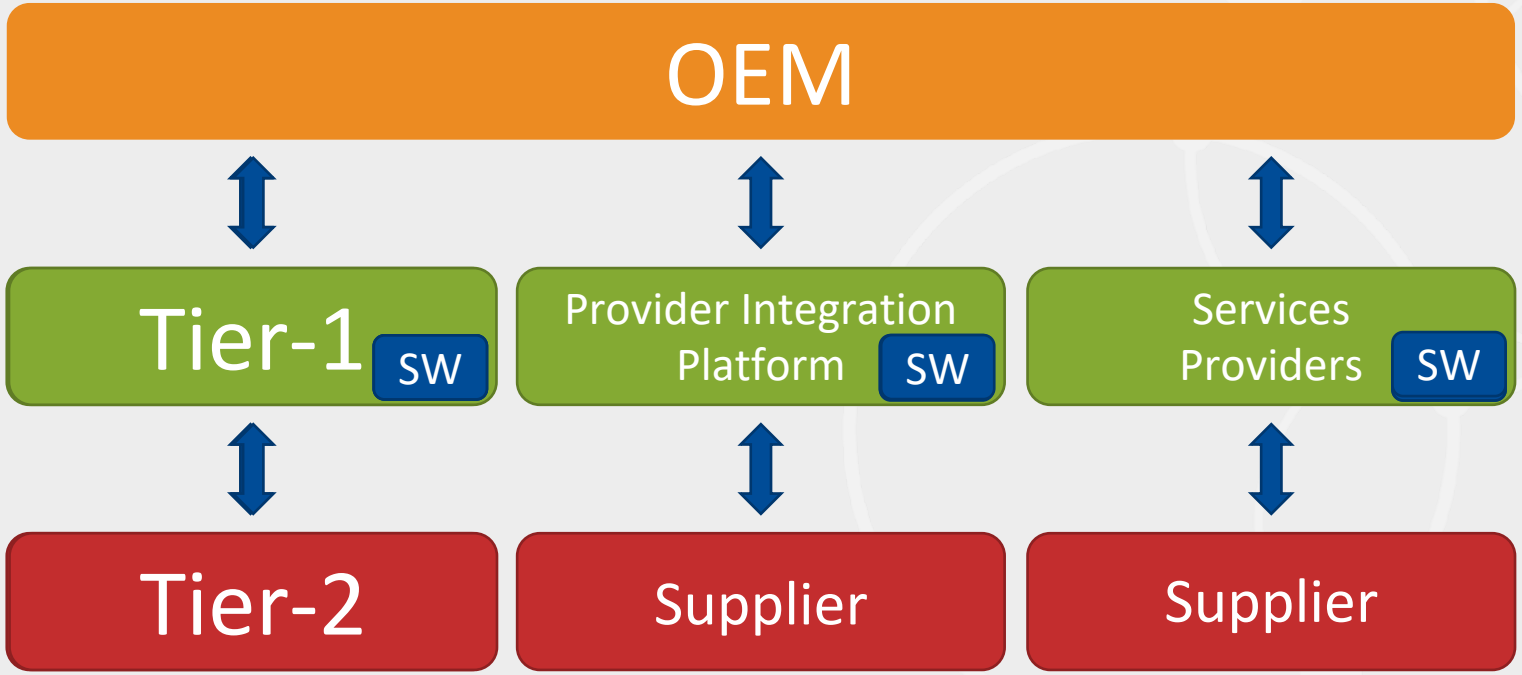


Supply Chain Challenges

- Evolving from a **traditional automotive** product to a multi-tier collaborative development.

Challenge #1 “Supply Chain Evolution”

New Architecture Multi-tier Supply Chain

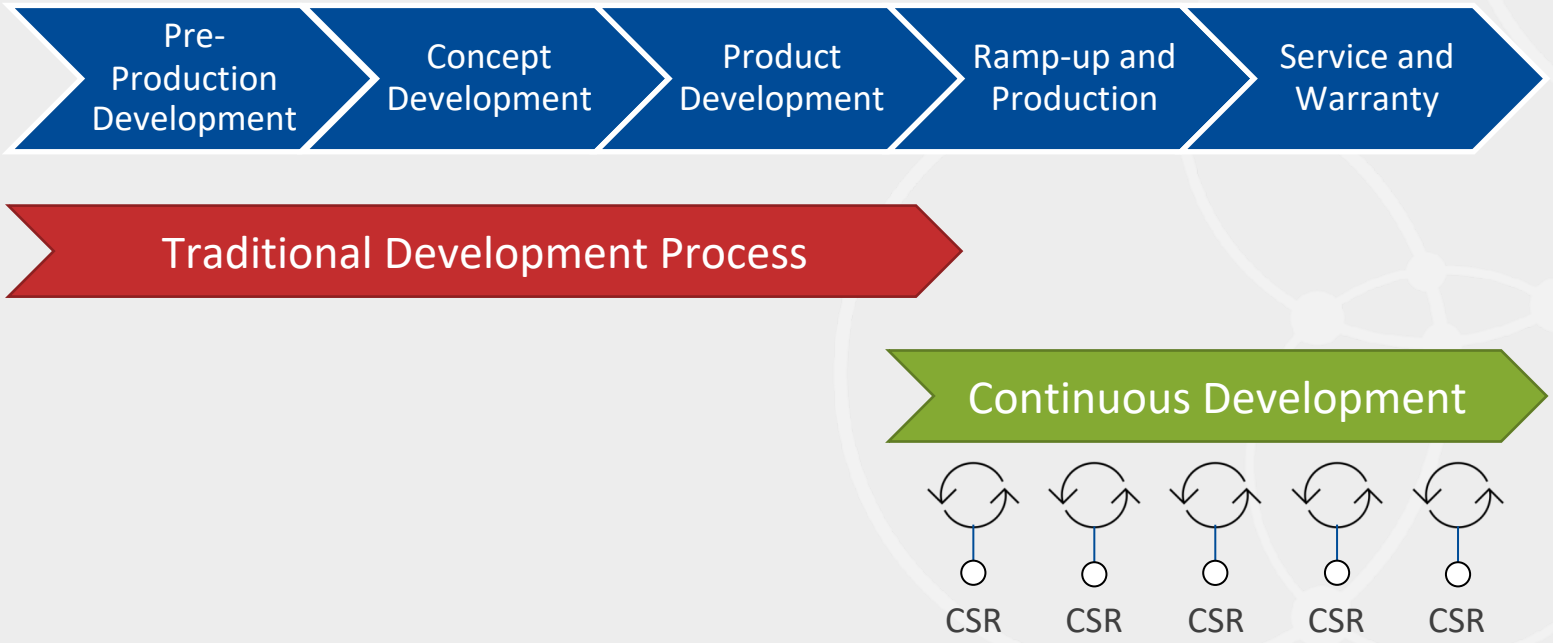


Supply Chain Challenges

- Evolving from a **traditional automotive** product to a multi-tier collaborative development.
- Navigating changes in **System and SW integration** roles.

Challenge #1 “Supply Chain Evolution”

New Architecture Multi-tier Supply Chain



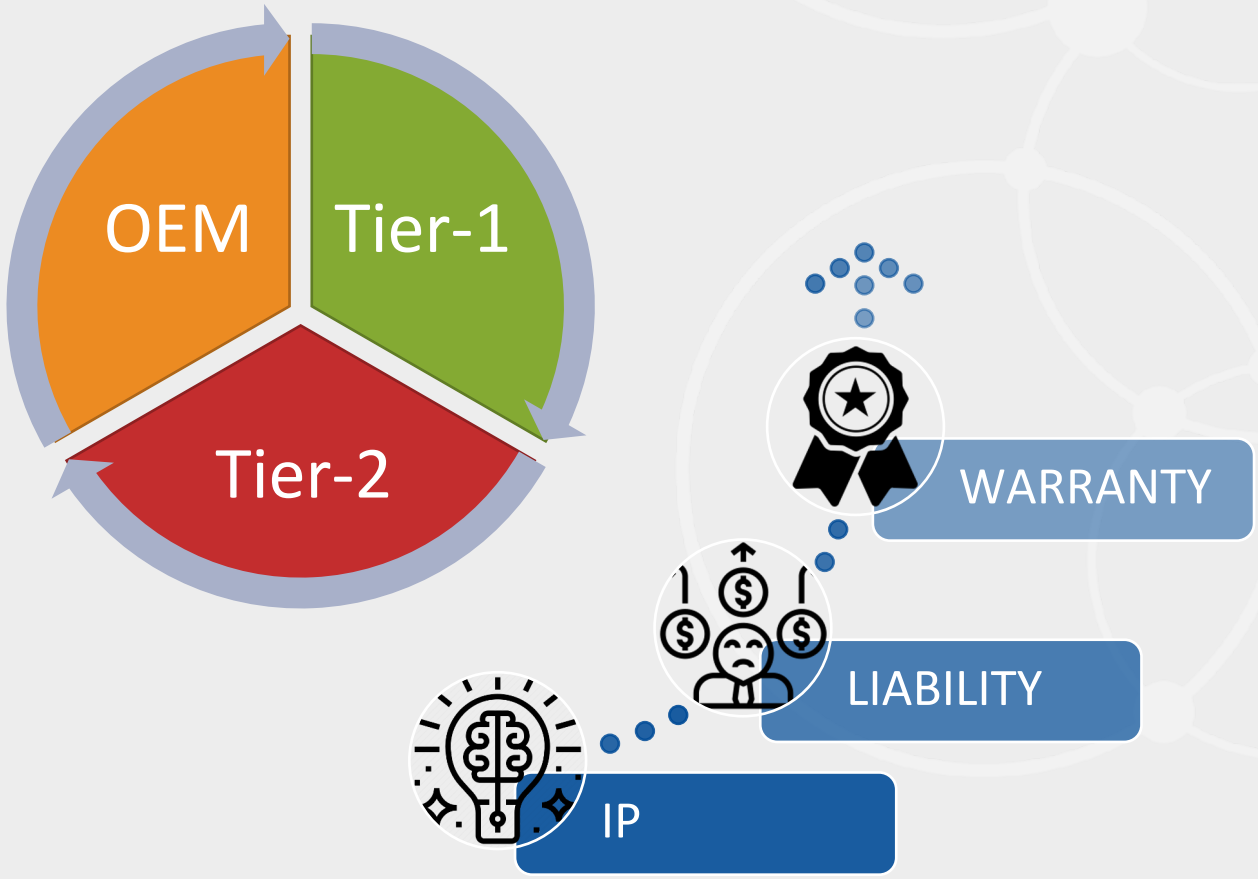
CSR: Continuous Software Release

Supply Chain Challenges

- Evolving from a **traditional automotive** product to a multi-tier collaborative development.
- Navigating changes in **System and SW integration** roles.
- Transitioning to an **agile development model** where changes might occur during development and series production.

Challenge #1 “Supply Chain Evolution”

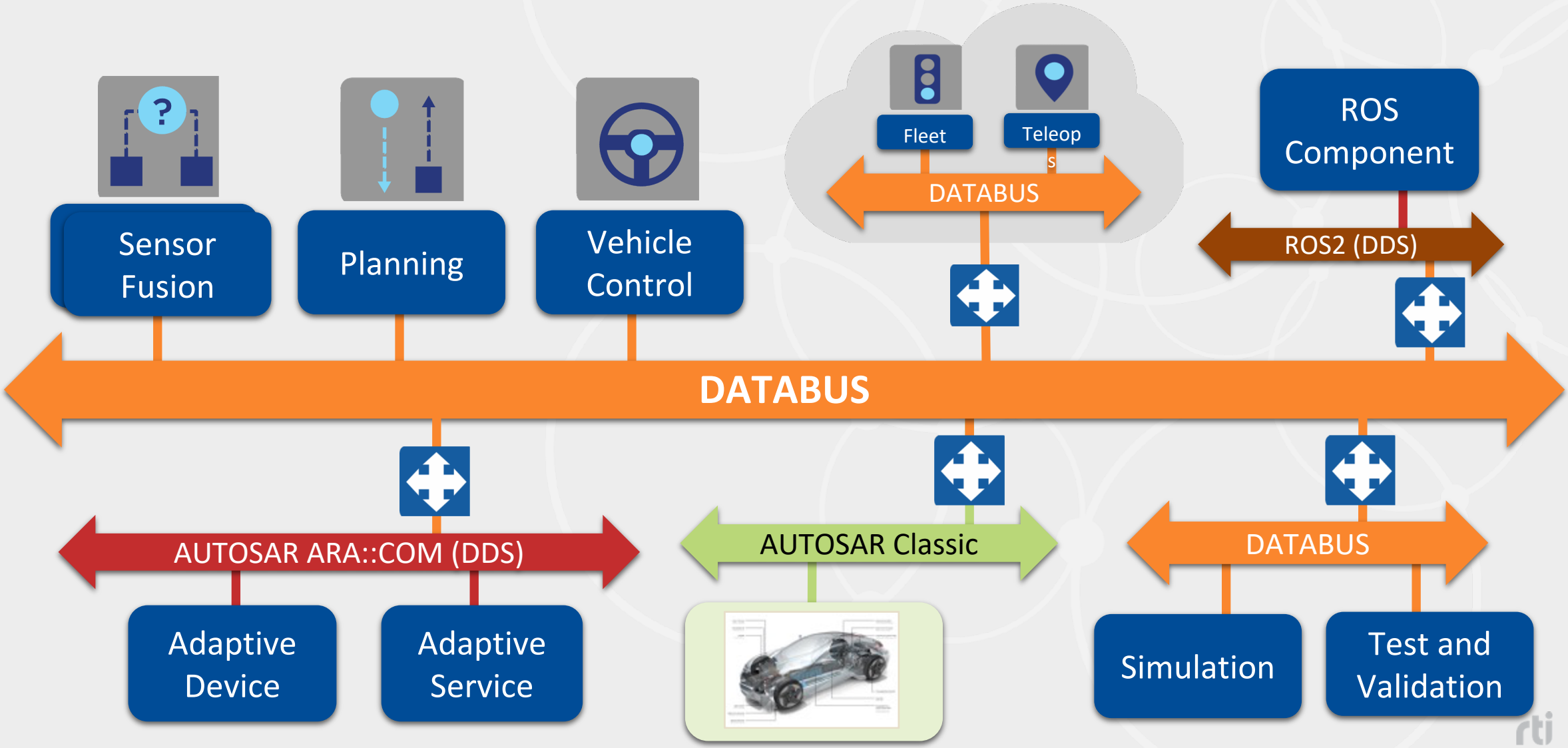
New Architecture Multi-tier Supply Chain



Supply Chain Challenges

- Evolving from a **traditional automotive** product to a multi-tier collaborative development.
- Navigating changes in **System and SW integration** roles.
- Transitioning to an **agile development model** where changes might occur during development and series production.
- Determining who will own **IP,** and be responsible for **liabilities**, **warranty** and **reliability.**

Challenge #2 “Future Proof”



Challenge #3 “Path to Safety”

- **Cost efficient** safety strategy while maintaining the highest standards.
- **Flexibility** to evolve safety platforms through the platform lifetime.
- Enable **unknown** safety requirements.
- **Easy path to integrate** in certified environments.
- **Isolate** safety data communication from non-safety, while allowing connectivity.
- Trusted software for **critical systems**.

Challenge #4 “New Business Model”

Innovation Challenges

Rapid Innovation
Even at production or during development phase

Features
Prioritization of costly and risky features

Cost Pressure
Low contributions in an unknown market

Evolution
Future updates including over the air

Customization
Mobility as a Service, Individual configuration

Brand Position
Differentiation and Positioning

Business Model Challenges

Rapid Innovation
BM to address liabilities and cost associated to them

Features
Traditional OEM BM

Cost Pressure
Software BM
Buy or build

Evolution
Vehicle upgrade BM
Data transfer BM

Customization
Mobility as a Service
Aftermarket BM

Brand Position
Premium vs. Mass
Fleet vs. Personal
Ownership vs. Sharing

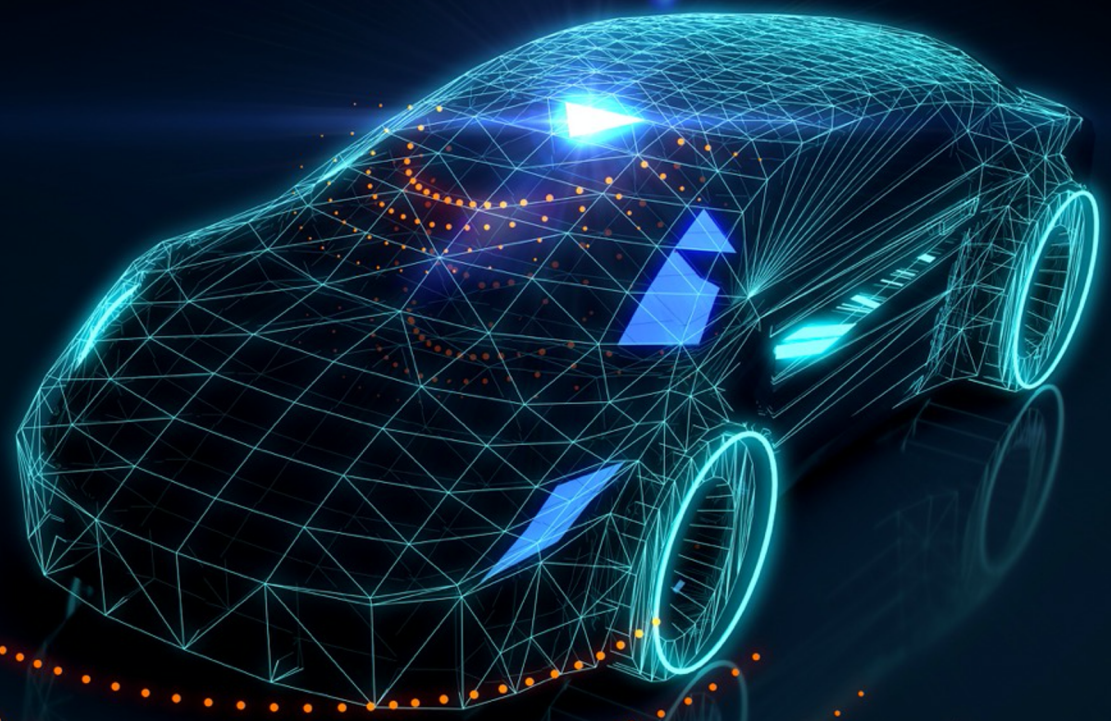
Connext Drive®

The First Complete Automotive-Grade Connectivity Solution for AV Development

CONNEXT DRIVE

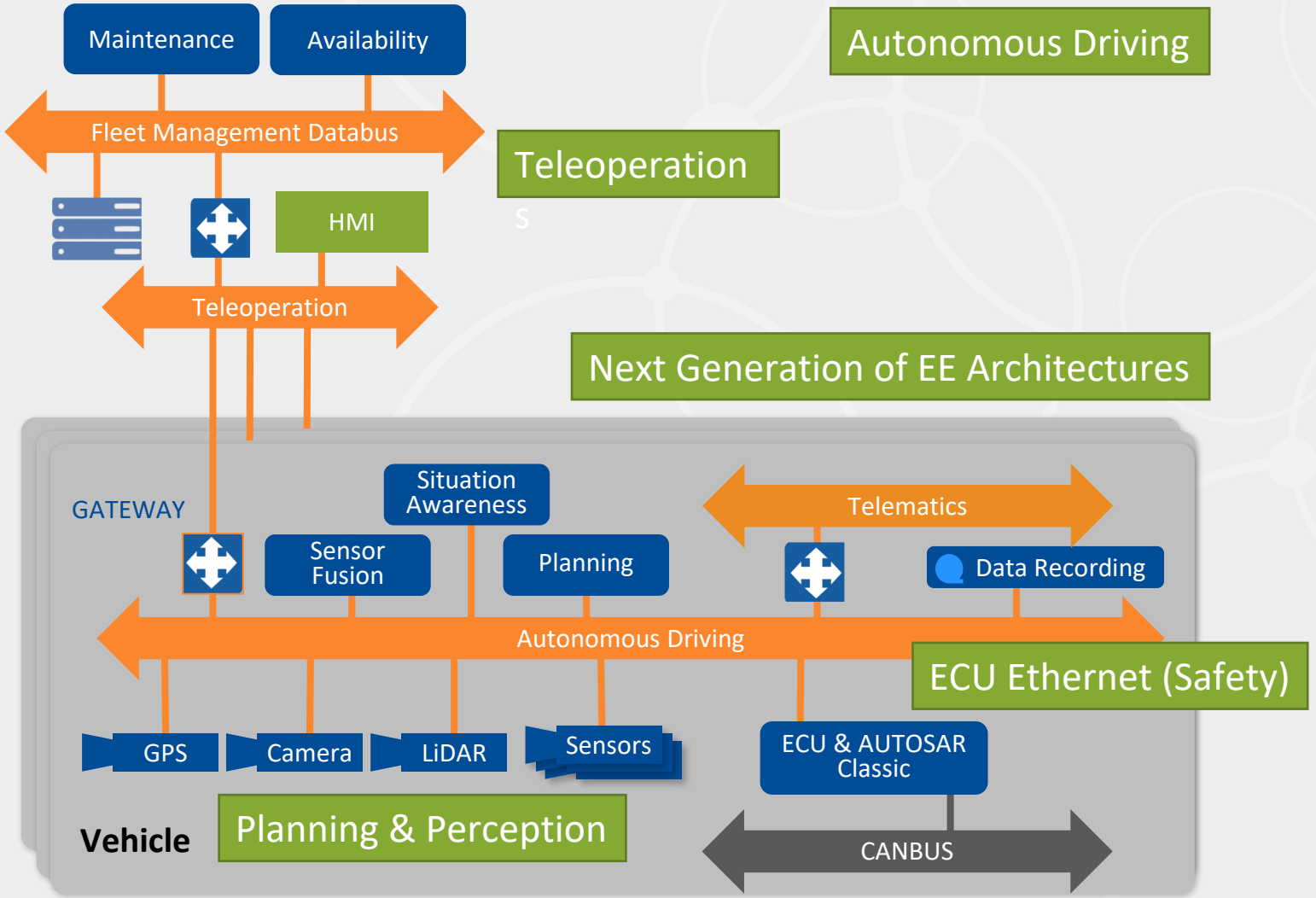
The First Complete Automotive-Grade Connectivity Solution for AV Development

- Simple solution for Automotive customers
- Designed for the Automotive Market
- Complete ECU to Cloud Framework
- Only proven-in-use framework that will meet all Autonomous use cases
- Future Proof, data-centric architecture that will support industry evolution

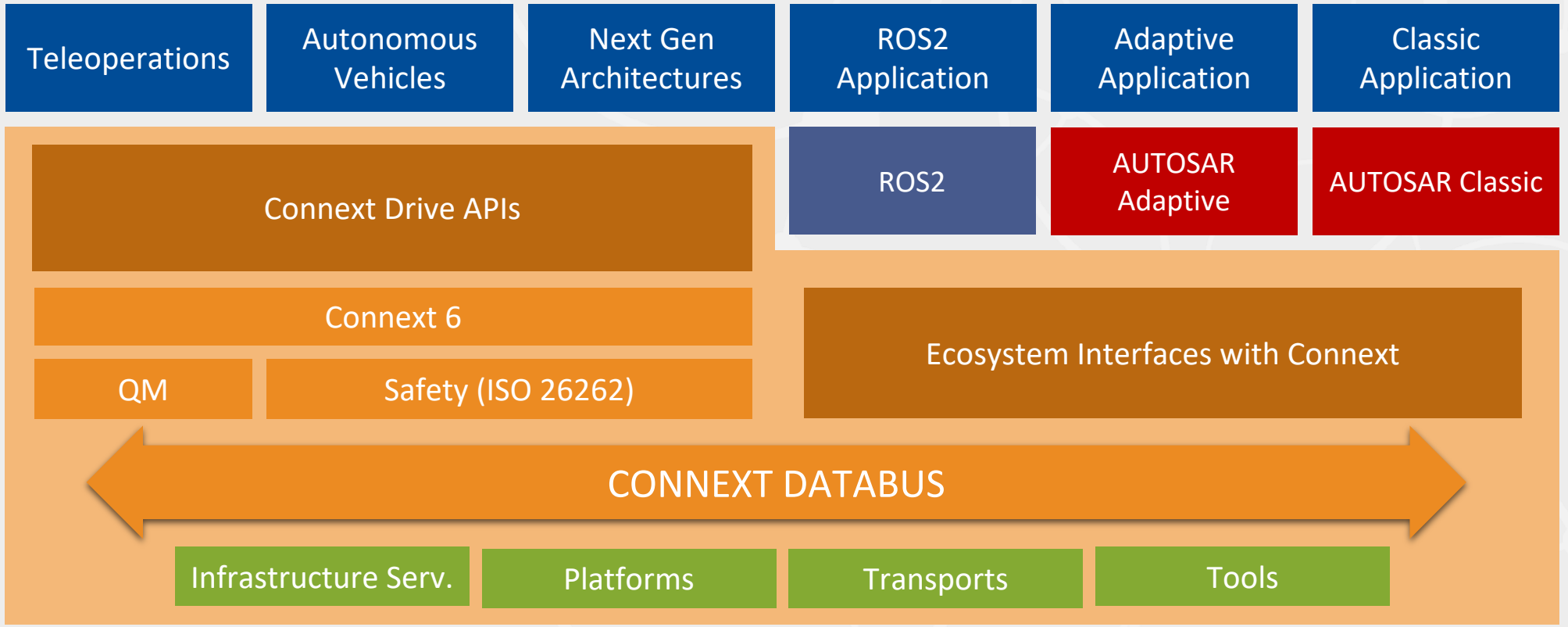


www.rti.com/drive

Connext Drive Use Cases



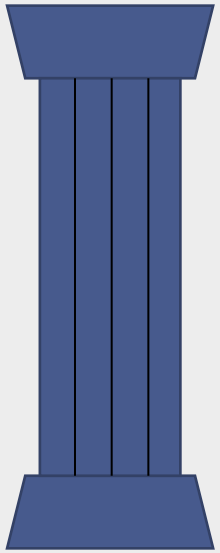
Connext Drive Framework



CONNEXT DRIVE

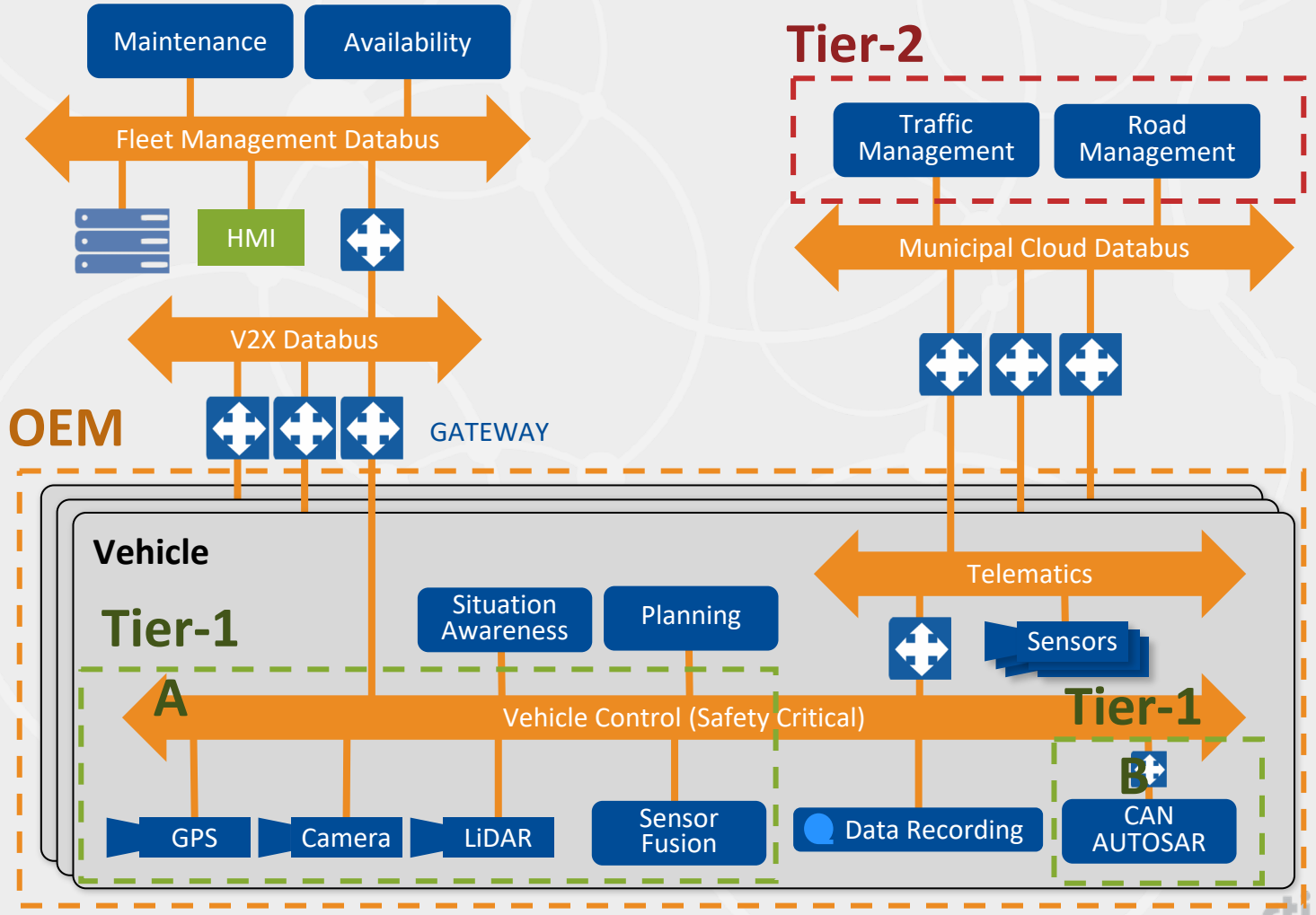
A foundation for autonomous vehicle development

Why Connext Drive?

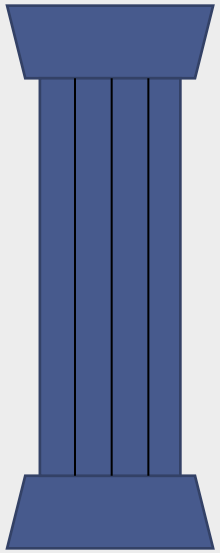


Supply Chain & Business Models

Challenge #1 “Supply Chain Evolution”



Why Connext Drive?



Supply Chain & Business Models

Challenge #4 “New Business Model”

Rapid Innovation
Reduce time to development and implementation

Features
Capabilities to deliver on Autonomy

Cost Pressure
Accurate Automotive Business Model

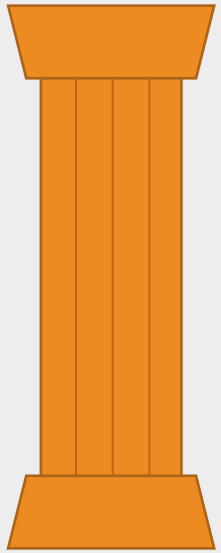
Evolution
Flexibility to adapt to both legacy and new technologies

CONNEXT DRIVE

Customization
Enable plug-in applications

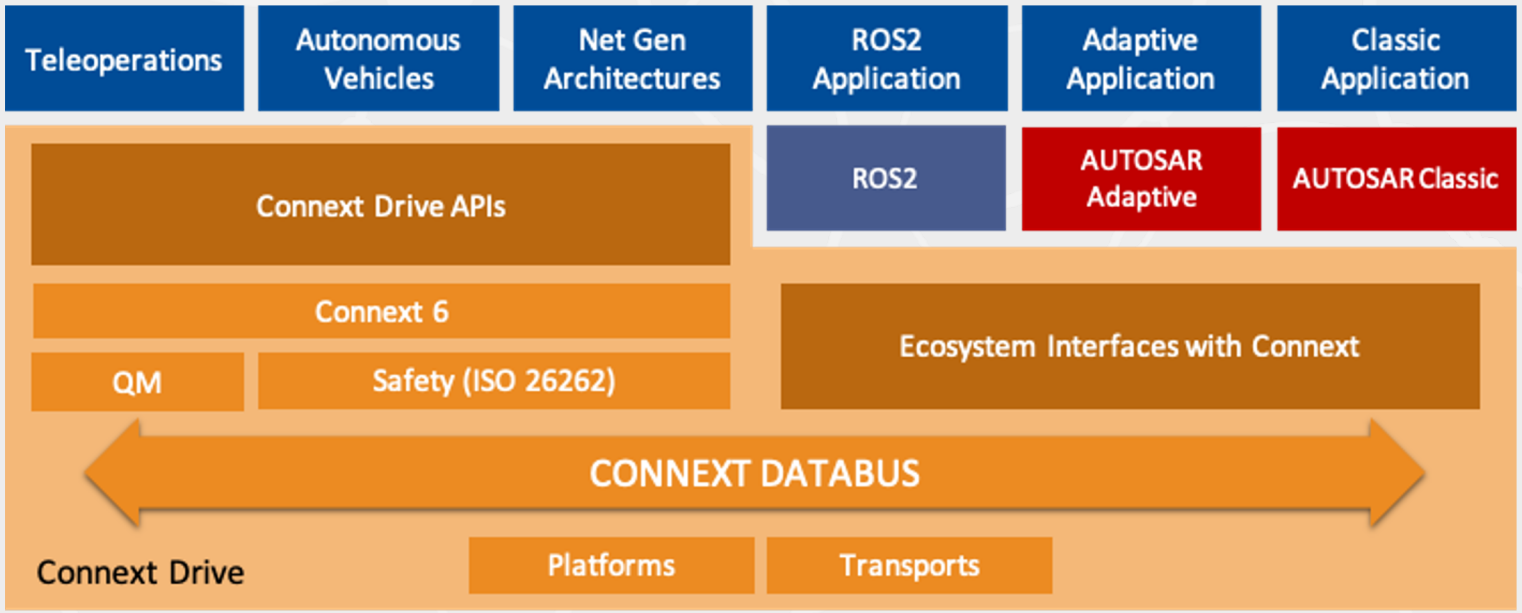
Brand Position
Easy architecture configuration to address branding challenges

Why Connext Drive?



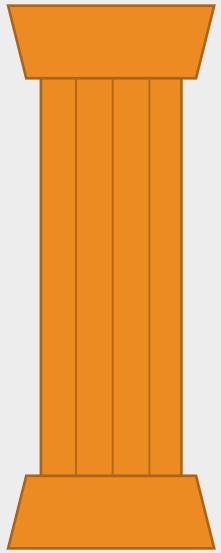
Software Architecture
”Next Gen EE and Safety”

Challenge #2 “Future Proof”



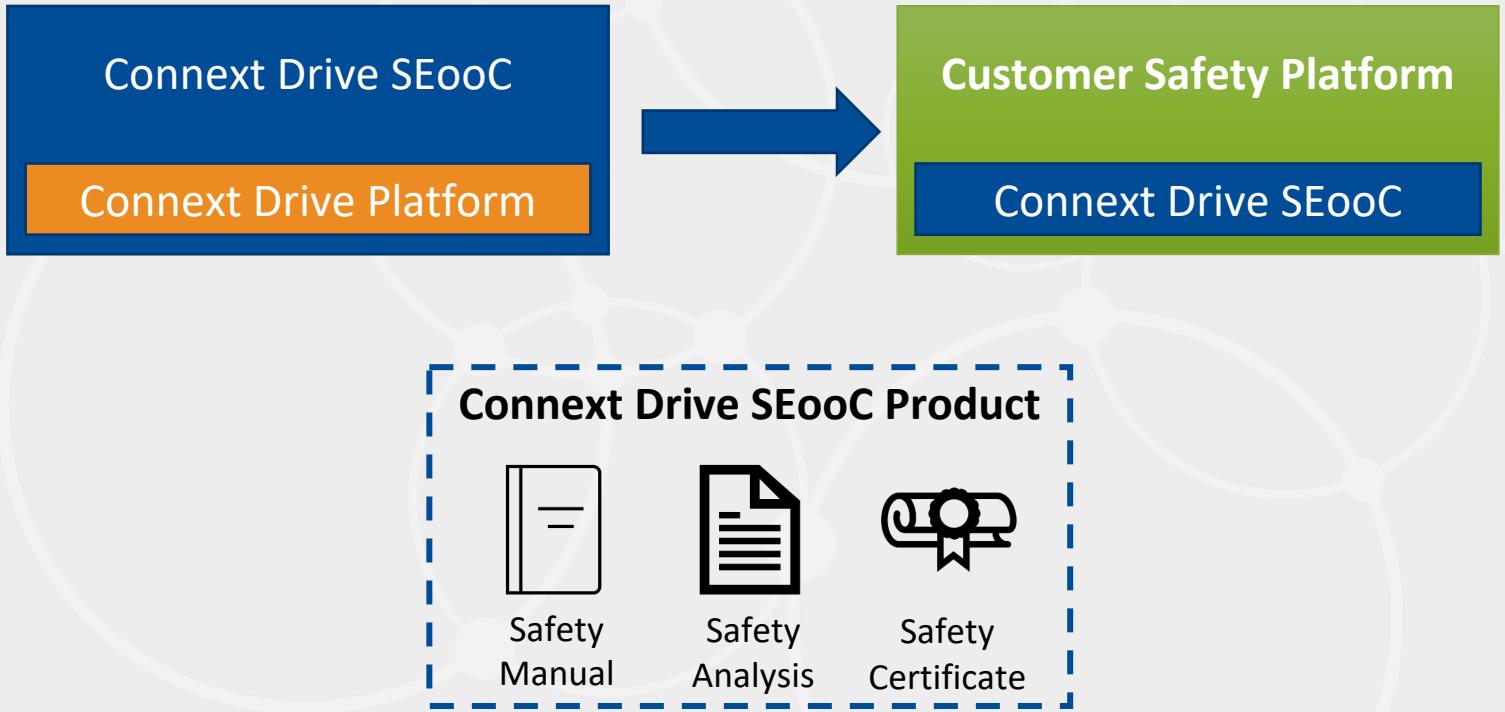
Future Proof, data-centric architecture will support industry evolution

Why Connext Drive?



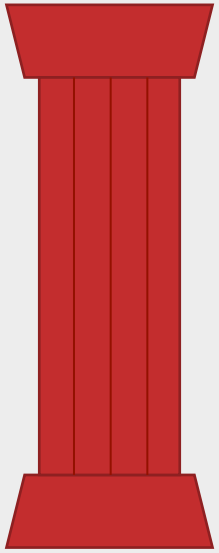
Software Architecture
”Next Gen EE and Safety”

Challenge #3 “Path to Safety”



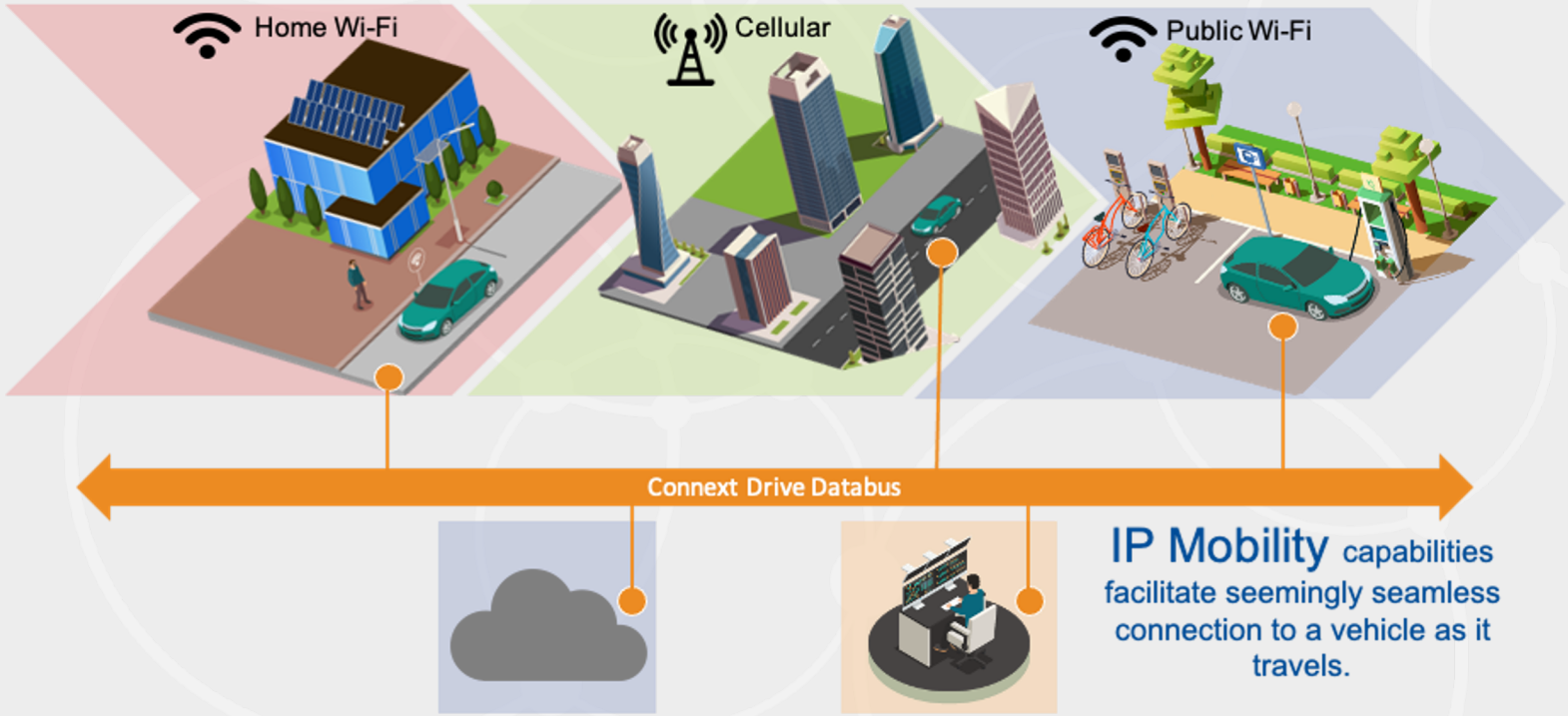
SEooC: Safety Element out of Context

Why Connext Drive?



Telecommunication Infrastructure

Challenge #2 “Future Proof”



IP Mobility capabilities facilitate seemingly seamless connection to a vehicle as it travels.

Summary

CONNEXT DRIVE

The First Complete Automotive-Grade Connectivity Solution for AV Development

- **Proven in-use**
  - Single framework for all subsystems
  - Reduced maintainability
- **Low risk and future proof**
  - Easy integration of subsystems
  - Compatible with Automotive Ecosystem
- **Easy design and customization**
  - Support for large range of data
  - Reuse design and code across teams
- **Expertise and know-how**
  - 200x years of accumulated expertise
  - Safety-critical project experience

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