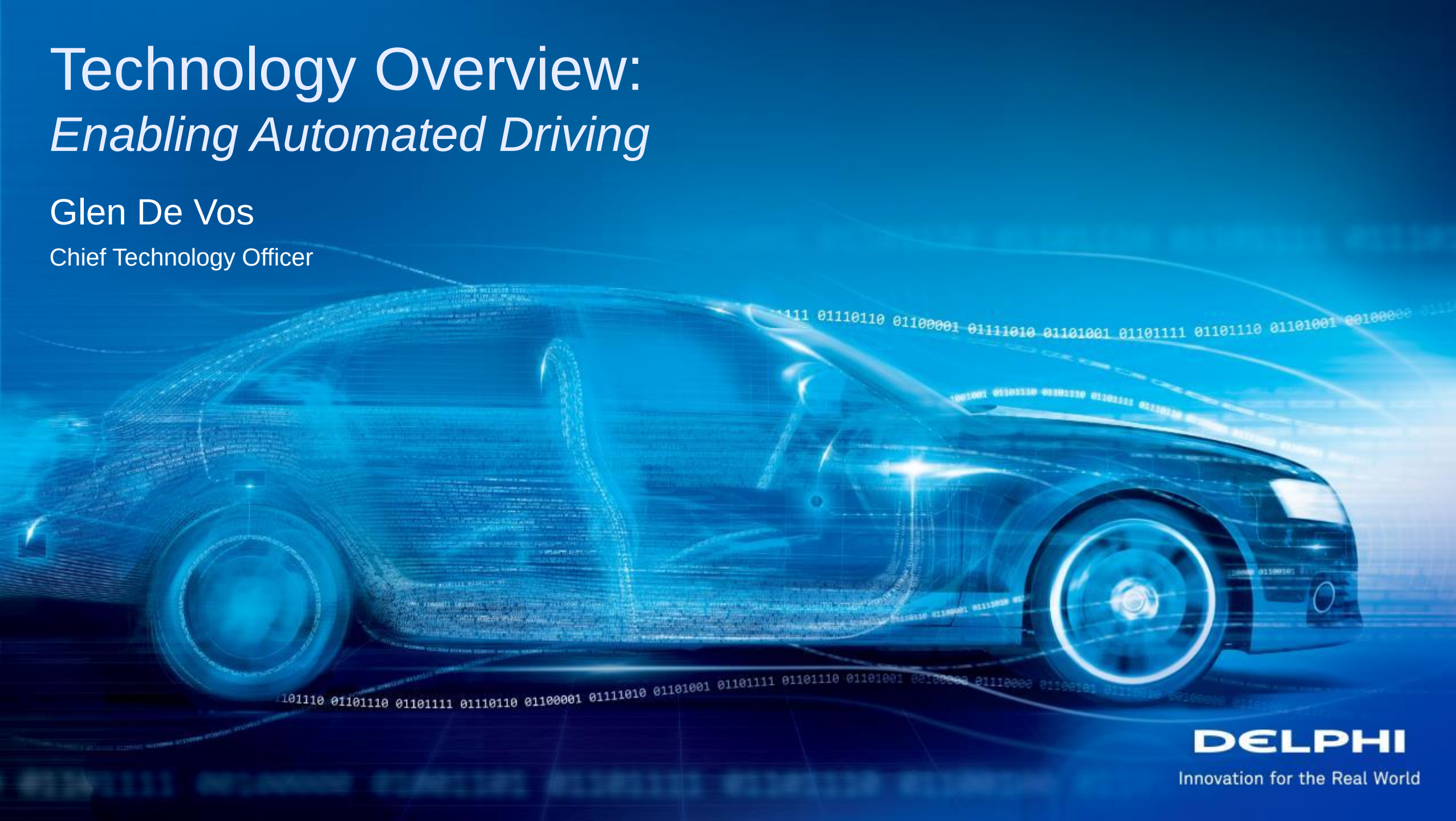
Technology Overview:
Enabling Automated Driving

Glen De Vos

Chief Technology Officer



DELPHI

Innovation for the Real World

Forward-looking statements

This presentation, as well as other statements made by Delphi Automotive PLC (the “Company”), contain forward-looking statements that reflect, when made, the Company’s current views with respect to current events, certain investments and acquisitions and financial performance. Such forward-looking statements are subject to many risks, uncertainties and factors relating to the Company’s operations and business environment, which may cause the actual results of the Company to be materially different from any future results. All statements that address future operating, financial or business performance or the Company’s strategies or expectations are forward-looking statements. Factors that could cause actual results to differ materially from these forward-looking statements are discussed under the captions “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in the Company’s filings with the Securities and Exchange Commission. New risks and uncertainties arise from time to time, and it is impossible for us to predict these events or how they may affect the Company. It should be remembered that the price of the ordinary shares and any income from them can go down as well as up. The Company disclaims any intention or obligation to update or revise any forward-looking statements, whether as a result of new information, future events and/or otherwise, except as may be required by law.

DELPHI

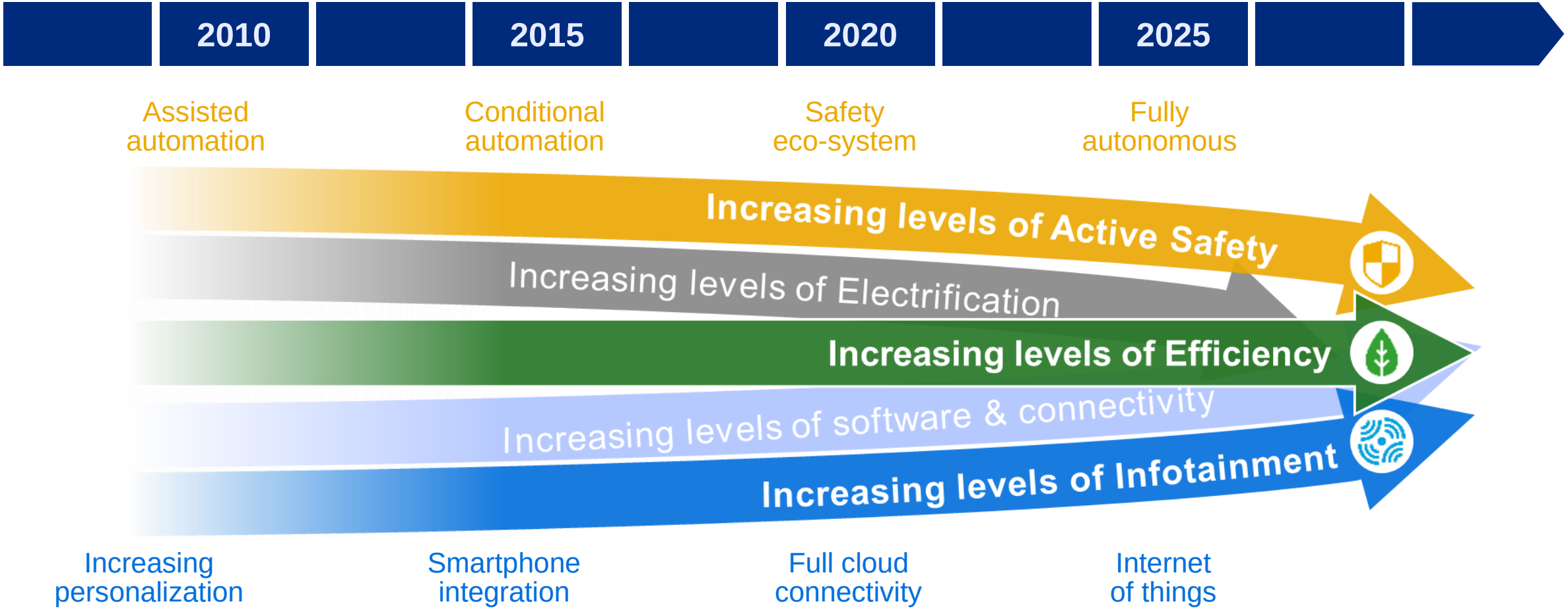
Today's discussion

- Safe, green and connected megatrends driving increased computing, signal and power demands
  - Continued proliferation of wiring and ECUs to support incremental content becoming unsustainable
  - ADAS and Infotainment features requiring more automation, software and signal distribution
- Uniquely positioned to support the brain and nervous system of the vehicle
  - Optimized vehicle architectures and more powerful compute platforms enabling software defined vehicle
  - Systems integration capabilities, technology partnerships critical to delivering automotive grade solutions
- Smart mobility moving beyond the vehicle
  - Unlocking turnkey data monetization solutions for OEMs through acquisitions and strategic partnerships
  - Integration into infrastructure / smart cities creating new use cases, opportunities to create value

Convergence of safe, green and connected megatrends creating unique opportunities

DELPHI

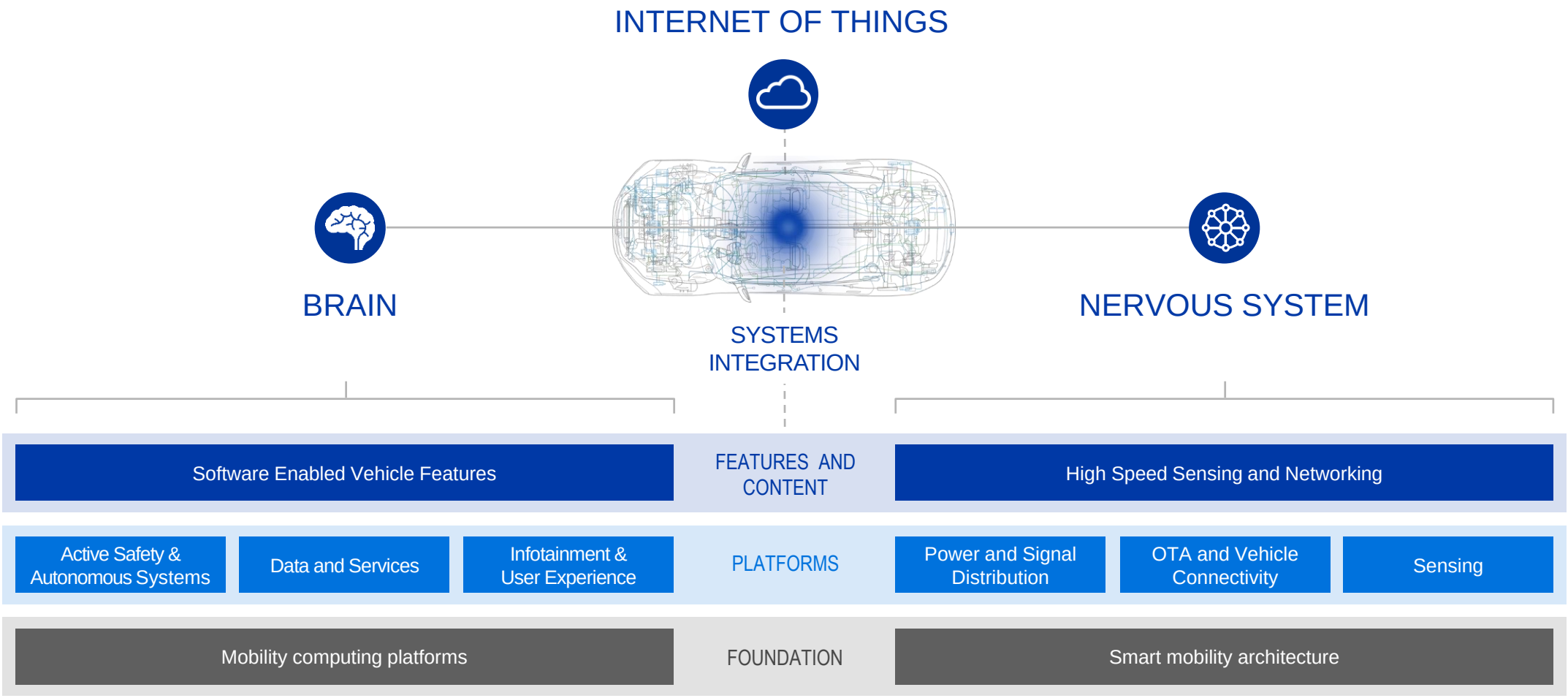
Megatrends driving computing power requirements



Convergence of megatrends driving demand for increased computing power

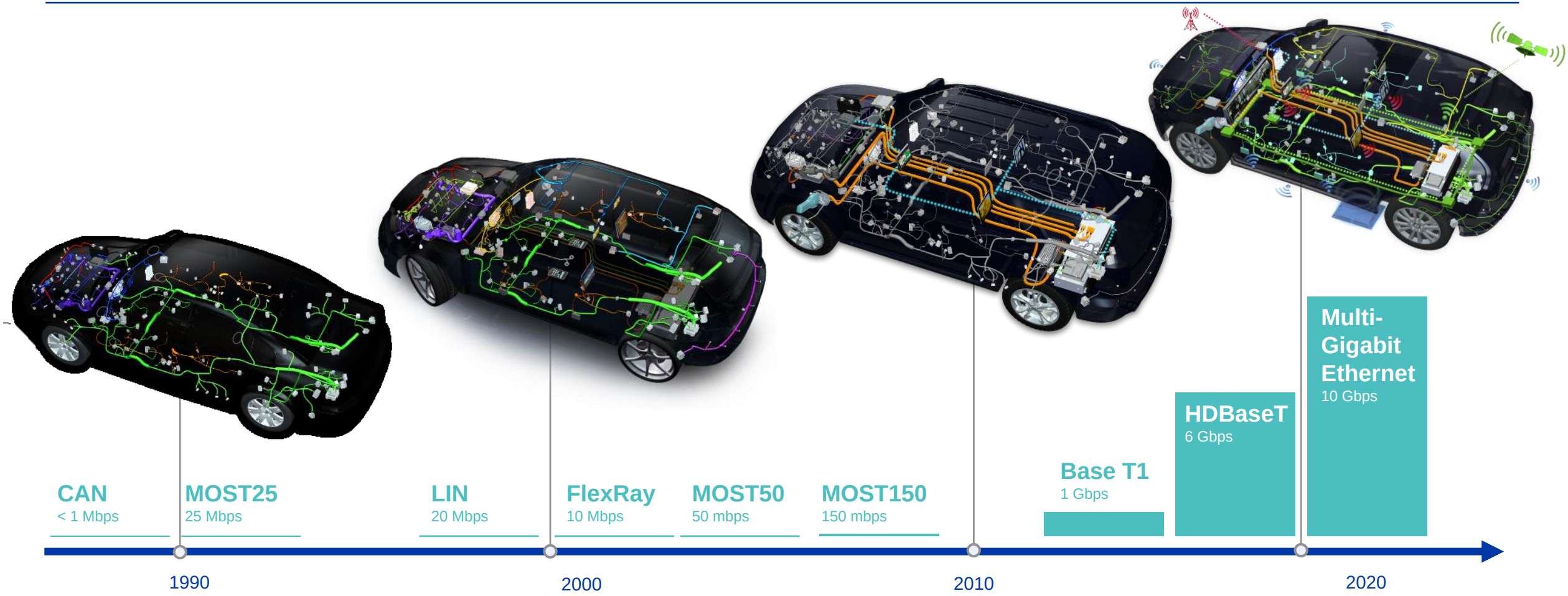
DELPHI

E/EA and E&S vision: Enabling smart vehicle architectures



Uniquely positioned to support smart mobility solutions

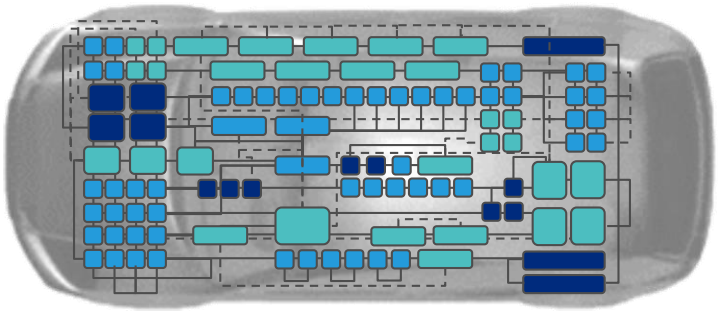
Vehicle architecture evolution

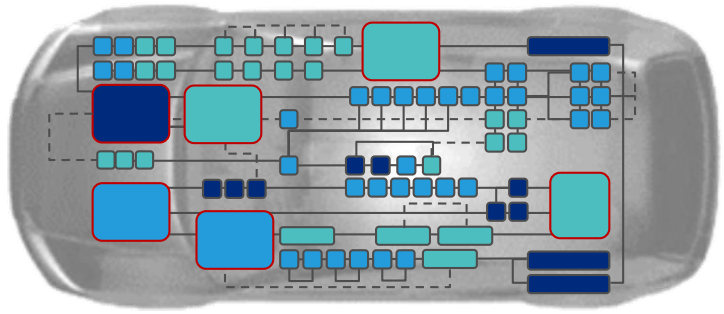


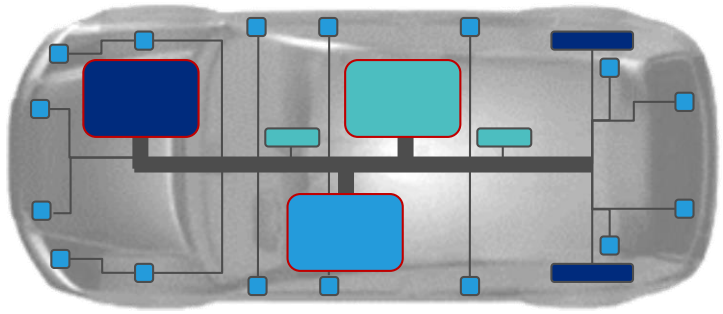
Exponential increases in data content and speeds

Vehicle computing evolution

Distributed ECUs | **Domain Centralization** | **Software Defined Vehicle**







Yesterday

- Separate ECUs with individual custom microprocessors
- Primarily low and mid speed data busses
- Conventional power distribution network
- Autosar and one OS per ECU
- Scalable by removing or adding processors
- Cybersecurity risks

Tomorrow

- Centralized compute platforms
- High speed busses (ETH, LVDS, HDBaseT)
- Fault tolerant power distribution supporting redundancy
- Adaptive Autosar and multi-OS (Hypervisor)
- Scalable computing platform processing power
- Cybersecurity “built-in” with intrusion detection & OTA

Computing centralization a “must do” to increase functionality

DELPHI

Computing platform: Multi Domain Controller (MDC)

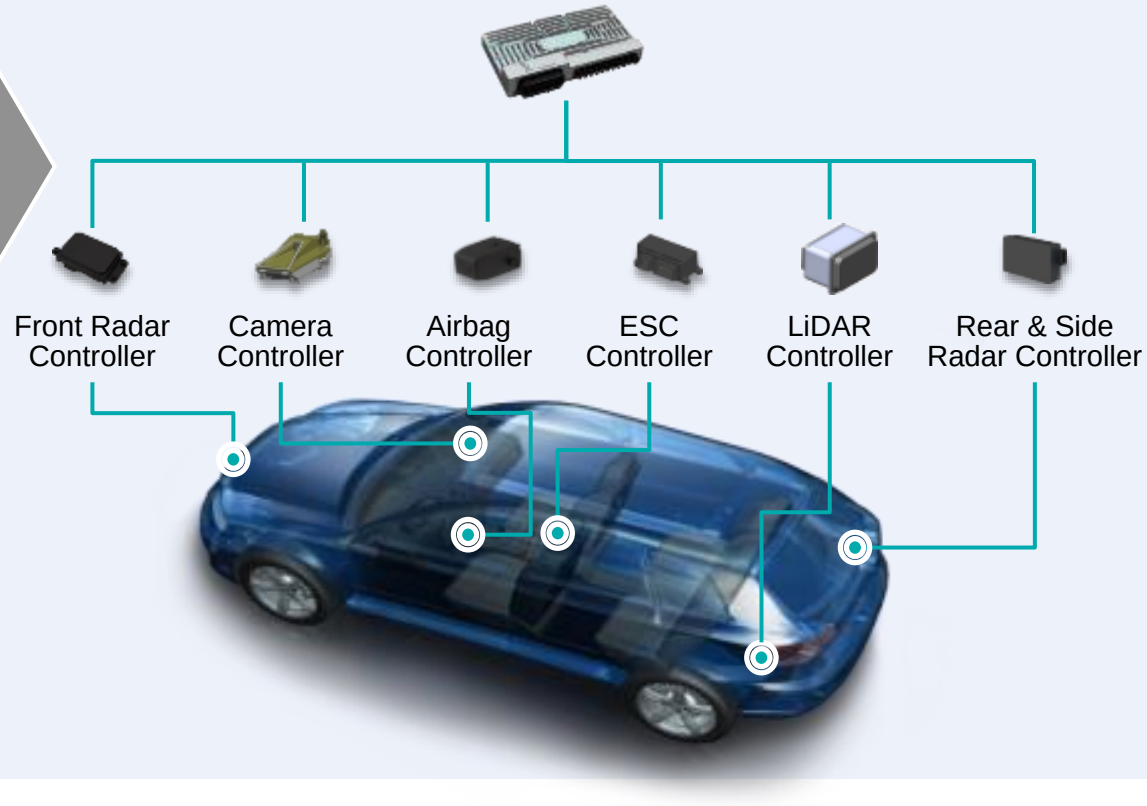
Active Safety Multi-Domain Controller (MDC)

Production
2017
Launch



- Scalable software platform
- Reduced architecture complexity
- Faster communication/interconnection
- Multi-processor configurations

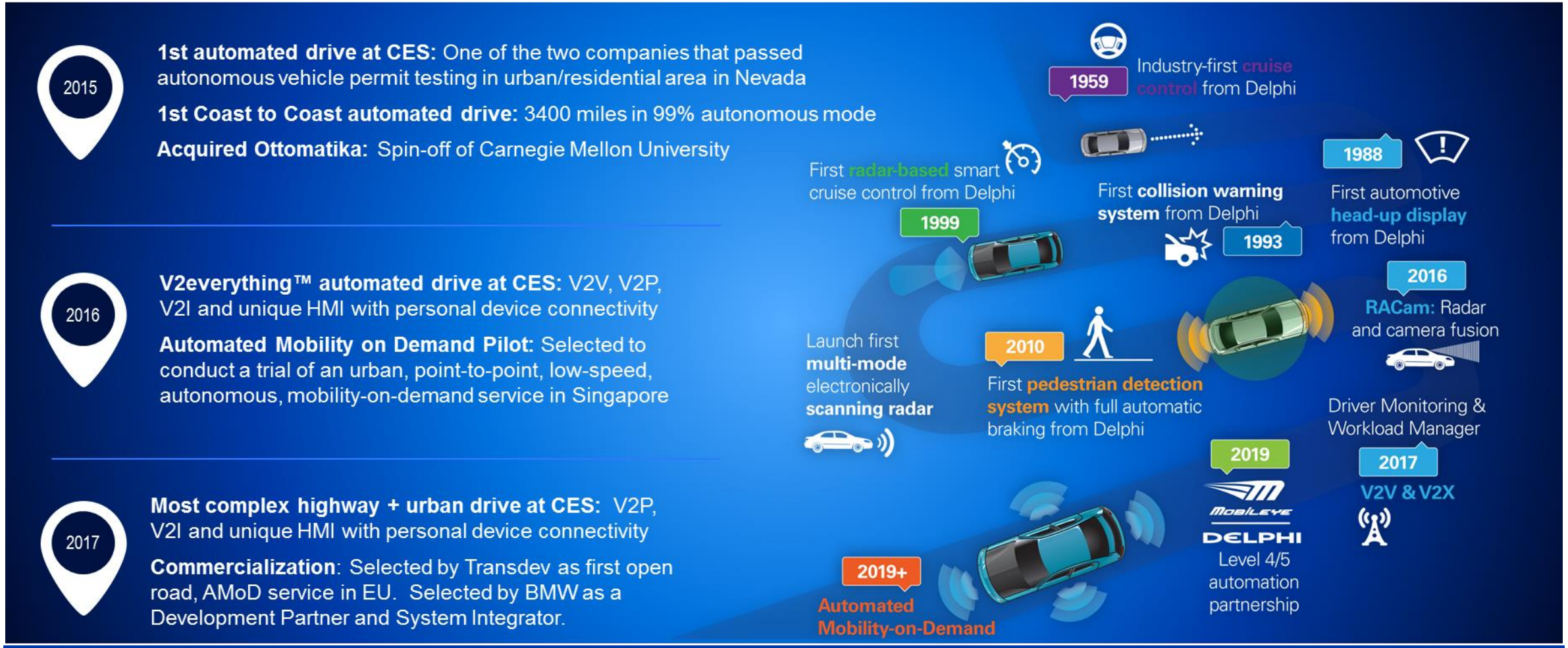
ADAS Centralized Sensor Fusion/Control



MDC reduces complexity and enables future expandability

DELPHI

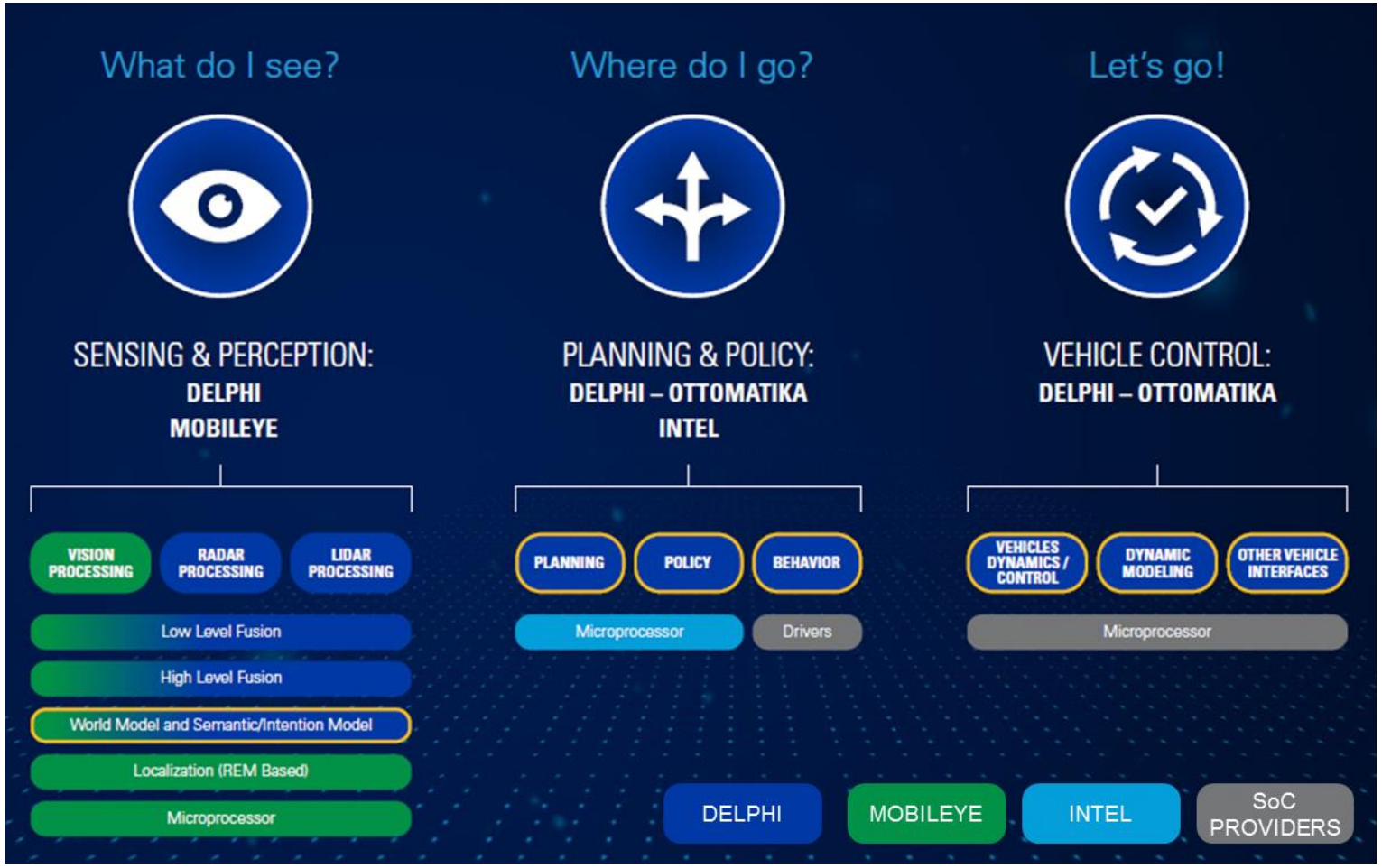
Demonstrated automated leadership

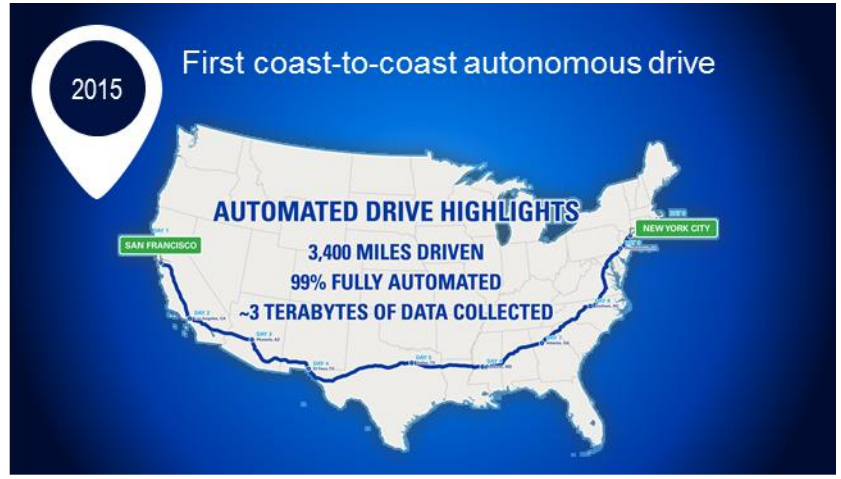


A rich history of firsts and milestones in active safety and automated driving

DELPHI

CSLP platform and milestones







Key strategic partnerships enabling the CSLP platform execution

Automated Driving Platform Architecture

Deterministic Policy

Absolute rules that govern vehicle behavior, which are used to set boundaries of operation





+ Predictable, repeatable behavior

+ Difficult to create rules for every scenario

APPLICATIONS



SPEED LIMITS



STOP LIGHTS



RIGHT OF WAY



ROAD MARKINGS



ACCELERATION & BRAKING



TURNING RADIUS

Artificial Intelligence (AI)



AI teaches the car "how" to drive, through path planning, object classification and prioritization

Flexible, adaptable behavior +

Can't be debugged, unpredictable in new scenarios +

APPLICATIONS



WHEN TO PASS



ROUTE OPTIMIZATION



DETOURS & REROUTING



OBSTACLE AVOIDANCE



EXERCISE CAUTION

Strengths and weaknesses to both approaches

DELPHI

CLSP taking a hybrid approach

HYBRID APPROACH

Take the strengths of both approaches to obtain the benefits of AI within a configurable deterministic framework

START WITH POLICY FIRST

Absolute rules that govern how the vehicle performs, and can be changed or updated as required

AI COMPLETES THE SOLUTION

Teach the car how to drive, recognize the world around it and enable creative solutions to new scenarios



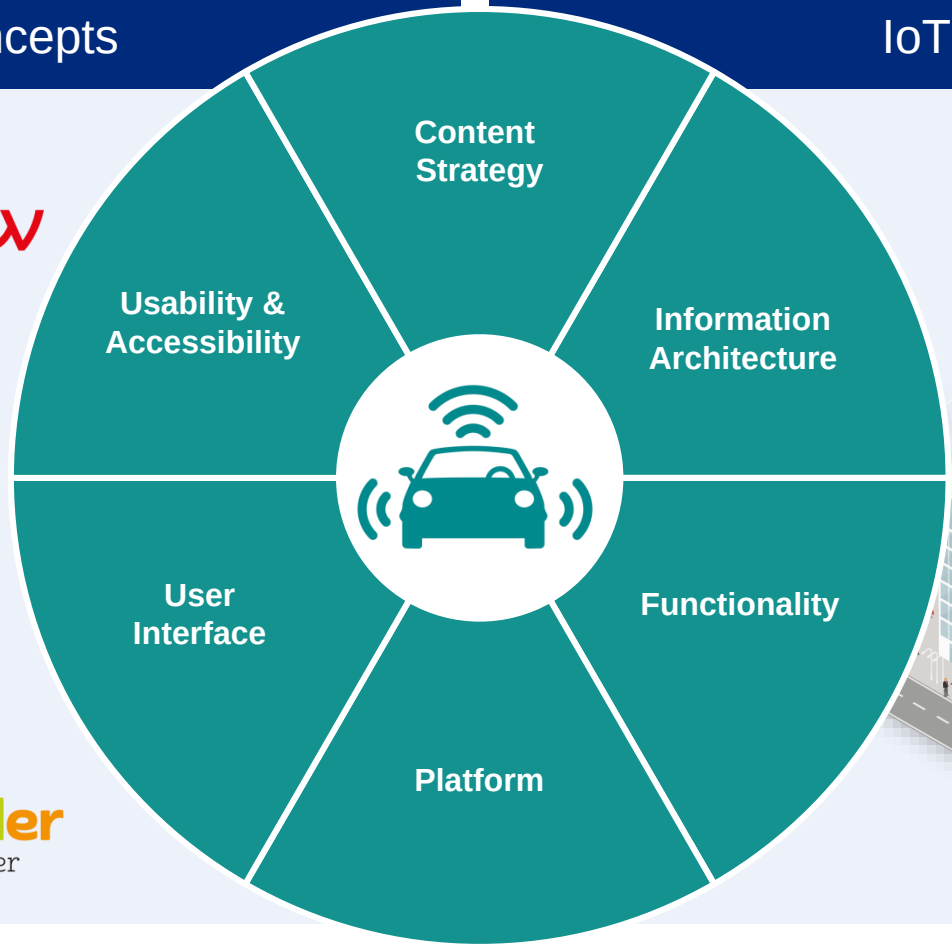

Data Analytics & Smart Cities

We are only at the beginning …

New Mobility Concepts

IoT → Big Data







The vehicle is becoming a software and data driven platform

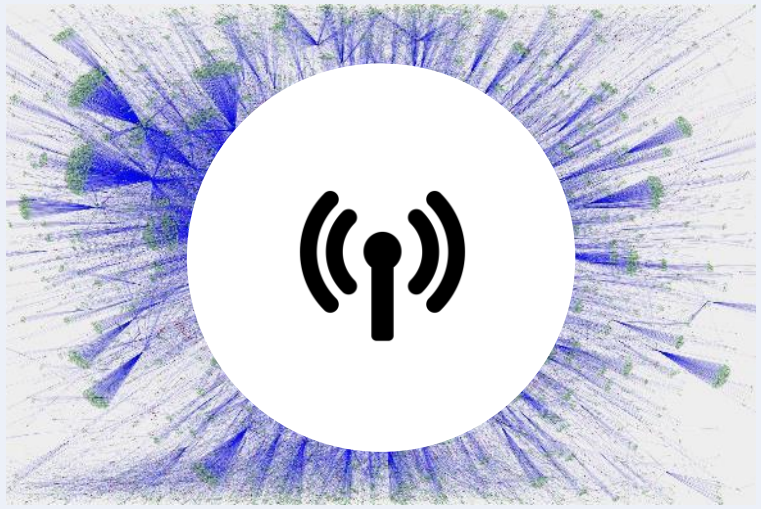
Delphi: Smart mobility architecture

Smart Vehicles



- Connected Server Platform
- High Speed Data Network
- Software Abstraction
- Smart Power Distribution

Smart Connectivity



- Secure Gateway
- Edge Processing
- Firmware / Software Over the Air
- Connectivity Manager

Smart Cloud

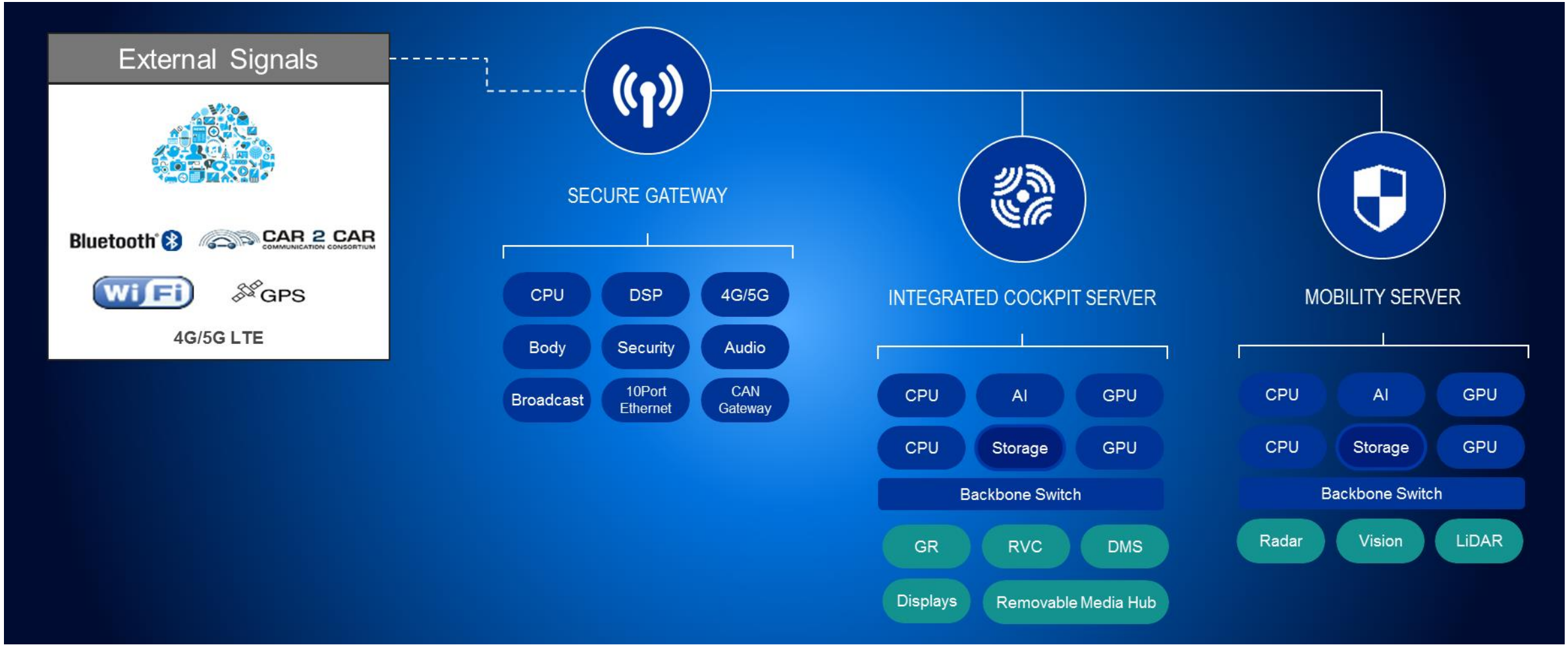


- Data Market Place & Analytics
- IoT Server
- Configuration Manager
- Virtual Twins

Data services and smart mobility moving beyond the vehicle to create value

DELPHI

Connectivity smart vehicle architecture



Smart mobility architecture enabling the software defined vehicle

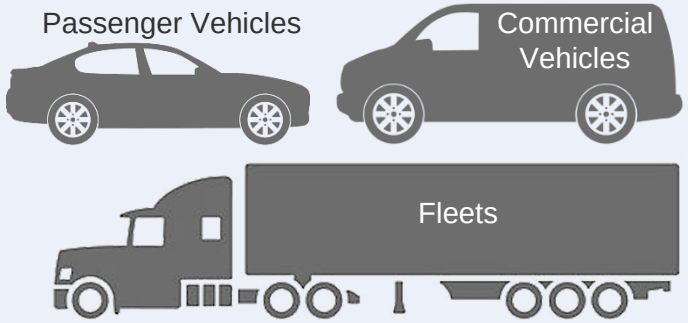
DELPHI

Delphi end to end data management solution

Acquisition

CONTROLTEC

Real time vehicle data monitoring and edge processing



Configuration

MOVIMENTO®

Vehicle telematics, analytics and Over The Air (OTA) updates

Consumer Apps | ADAS & HD Maps | Software & Firmware | Config & Regulatory | Personal Profile



Monetization

otonomo

Online marketplace managing monetization and data privacy

Fleet Mgmt | Transport Services | Insurance | Vehicle Maint

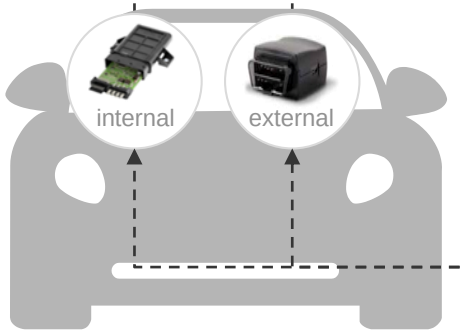
Retail | Emergency Services | Smart Cities | Expense Control

Strategic partnership with otonomo highly complementary to Delphi capabilities

DELPHI

Delphi offering fully connected vehicle platform

CUSTOMER VEHICLE



DELPHI

CONTROLTEC

- CT-EDGE Data Acquisition
- Config Management
- Business Intelligence
- Fleet Management

MOVIMENTO®

- Vehicle information database
- Multi-module OTA Re-flash

OEM / RETAIL / FLEET PLATFORM



otonomo

- Third party data exchange



DATA USERS

- Fleet Management
- Transport Services
- Insurance
- Vehicle Maintenance
- Retail
- Emergency Services
- Smart Cities
- Expense Control

Flow of Data ---------->

Flow of Money ———>

Unlocking turnkey data monetization solution for OEM partners

DELPHI

Illustrative Data Services use cases

Roadside Assistance



1 A car breaks down and the driver does not know why



2 Vehicle diagnostic data is shared with tow company to determine if it's a lack of fuel or dead battery, or something more serious.



3 The average cost of a tow truck trip is $175. If a low or dead battery is detected, a different, less costly vehicle could be sent to help -- saving time and money.

Retail



1 As cars move past a certain point, location and gas gauge information is sent to the cloud.



2 Gas station companies purchase access to the location/gas gauge data.

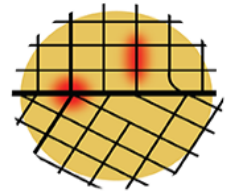


3 A new filling station opens where people's fuel tanks tend to be low and customers are most likely to buy.

Smart Cities



1 As traffic moves through a city, cars send their location data to the cloud.



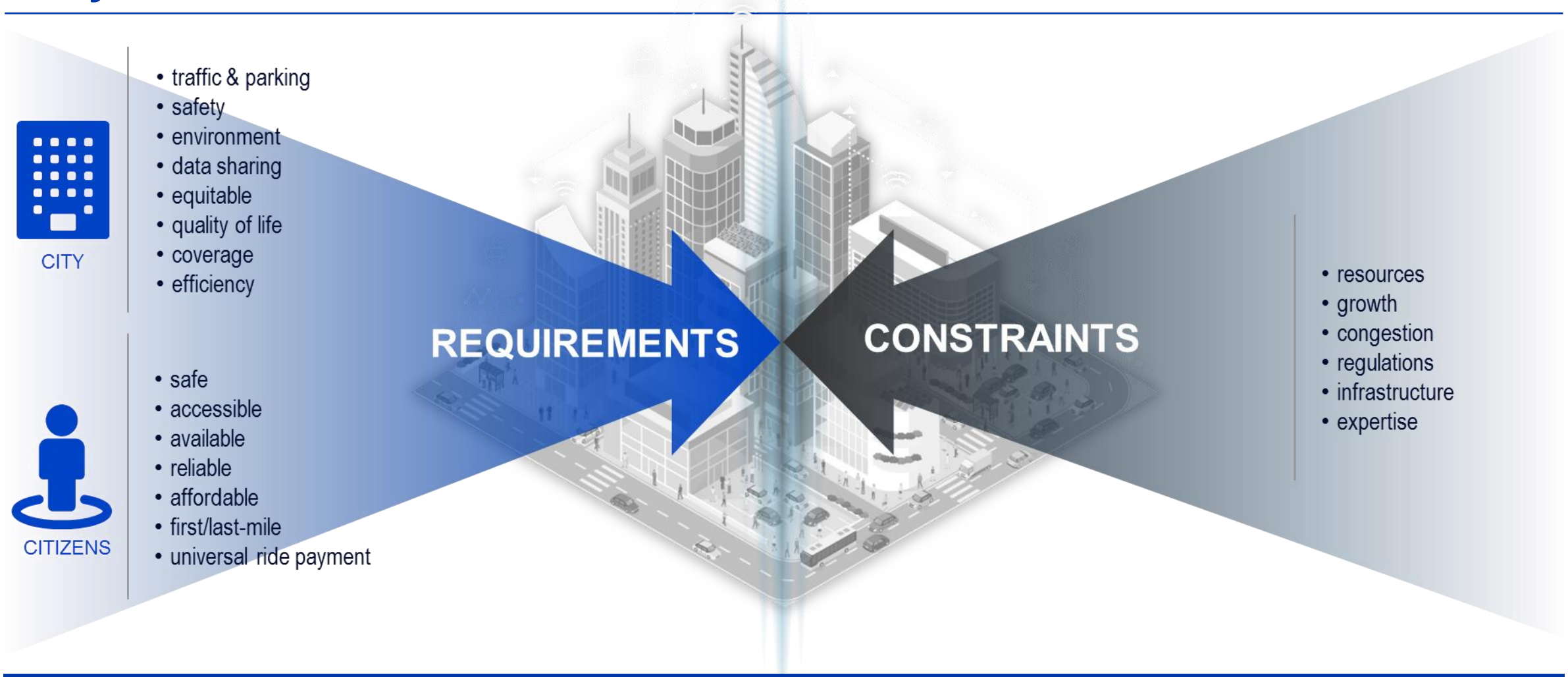
2 Smart cities look at this data to determine when and where traffic is worst.



3 Traffic signals are better coordinated to reduce grid lock, and times are set to optimize service vehicles, like garbage trucks and street cleaners, cutting CO_2 levels.

DELPHI

Why smart cities?



Station zero for mobility

DELPHI

Urban mobility challenges by 2050



+70%
#people



5x
emissions



4x
cost



3x
travel time



+40%
freight

*Research by Arthur D Little

DELPHI

Benefits of mobility automation to cities

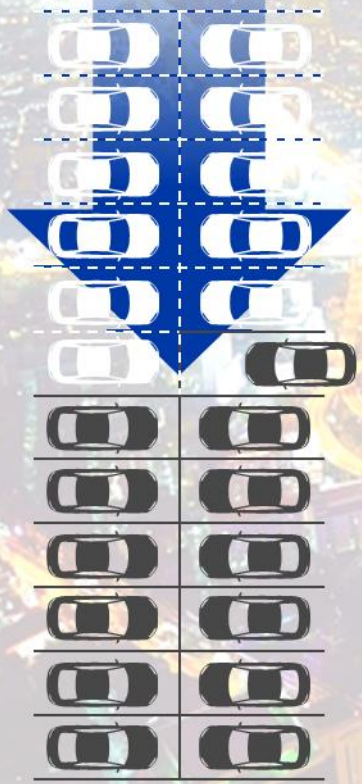
28%

Less vehicles



44%

Fewer parking spaces



30%

Shorter travel time



66%

Lower emissions



87%

Fewer accidents



*Research by Arthur D Little

DELPHI

Smart city examples

Singapore AMoD

Land Transport Authority

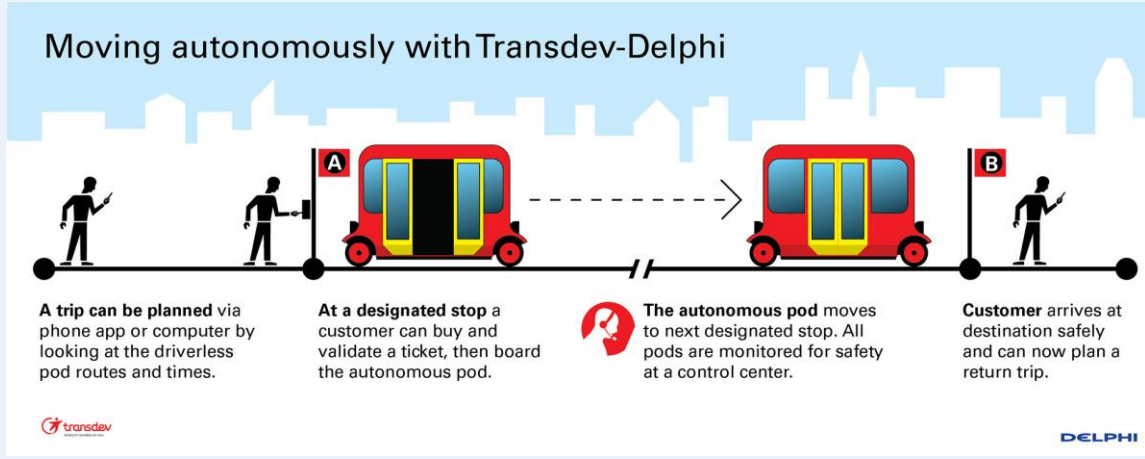
Trial of an urban, point-to-point, low-speed, autonomous, mobility-on-demand service in Singapore's one-north business park



Transdev

transdev
MOBILITY INSPIRED BY YOU

Pilot for first open road, autonomous on-demand mobility service in the EU.



Continued progress in real world applications

DELPHI

Summary



Delphi uniquely positioned to enable smart mobility architectures

DELPHI

DELPHI

Innovation for the Real World