



# ON-BOARD VS. OFF-BOARD – THE CONNECTED, AUTOMATED EXPERIENCE

Roger C. Lanctot

Associate Director - Global Automotive Practice

[rlanctot@strategyanalytics.com](mailto:rlanctot@strategyanalytics.com)



# HOW THE AUTO INDUSTRY SEES ITSELF



Mechanical  
Engineers

Electrical Engineers

Software Engineers

# THE AUTO INDUSTRY AS IT IS



Software Engineers

Electrical Engineers

Mechanical Engineers



**We're wired to build and sell cars**

**NOT**

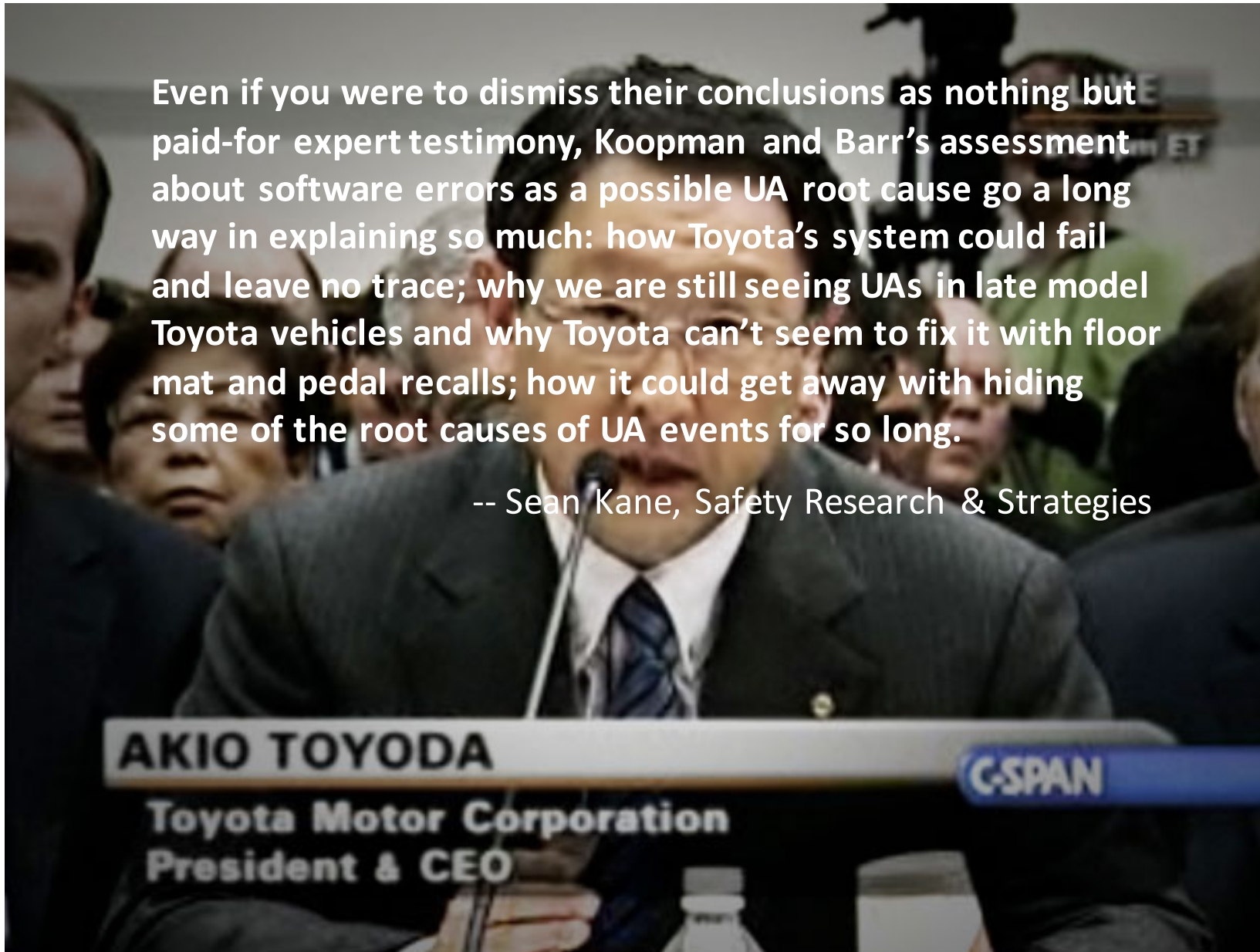
**To deliver secure software and services**

# TOYOTA – UNINTENDED ACCELERATION



Even if you were to dismiss their conclusions as nothing but paid-for expert testimony, Koopman and Barr's assessment about software errors as a possible UA root cause go a long way in explaining so much: how Toyota's system could fail and leave no trace; why we are still seeing UAs in late model Toyota vehicles and why Toyota can't seem to fix it with floor mat and pedal recalls; how it could get away with hiding some of the root causes of UA events for so long.

-- Sean Kane, Safety Research & Strategies



# GM - IGNITION SWITCHES



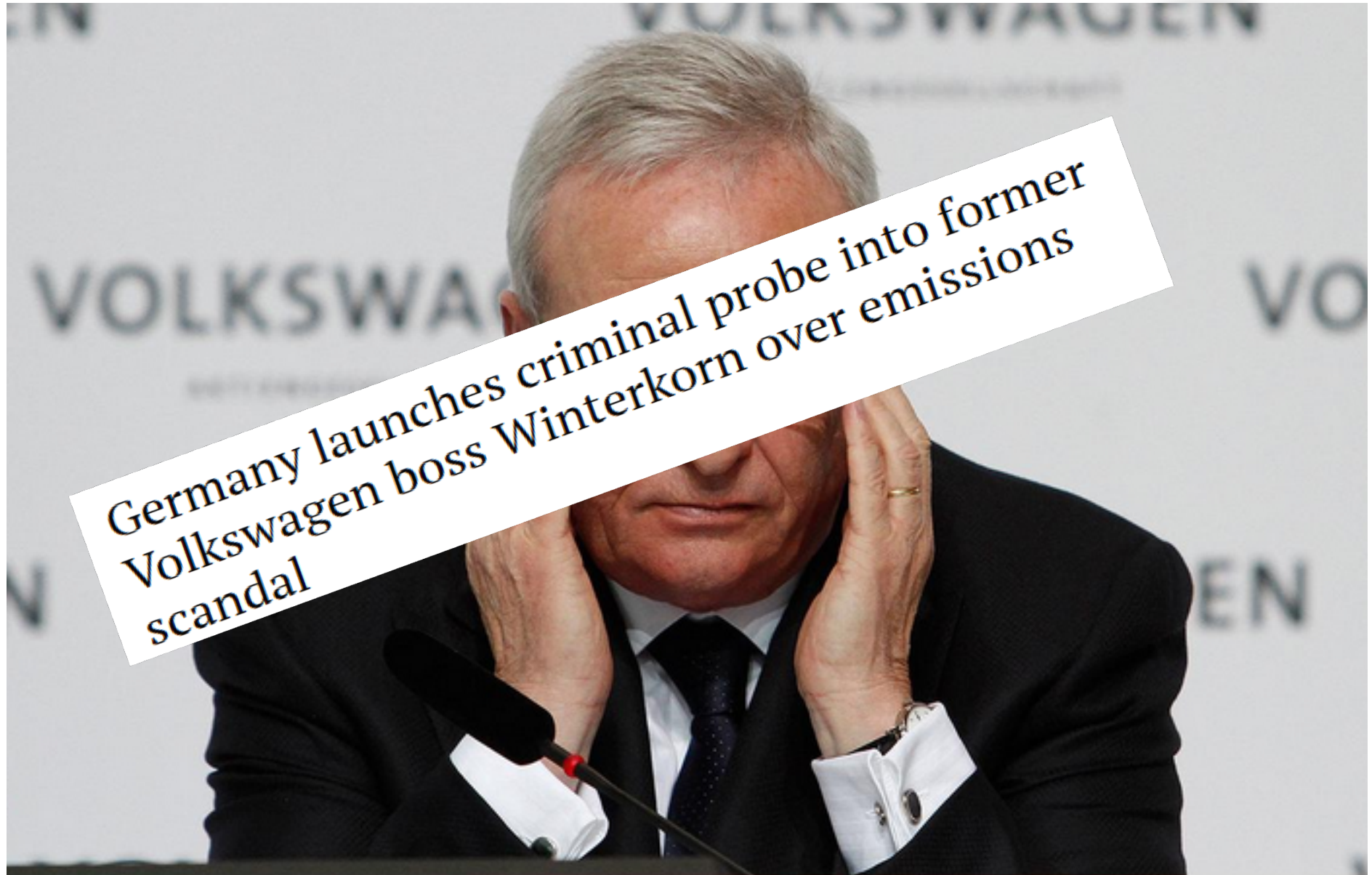
**GM faces \$900M fine in ignition switch probe**



# TAKATA - AIRBAGS



# VOLKSWAGEN EMISSIONS TESTS



**Germany launches criminal probe into former Volkswagen boss Winterkorn over emissions scandal**





# WHERE DO WE STAND?

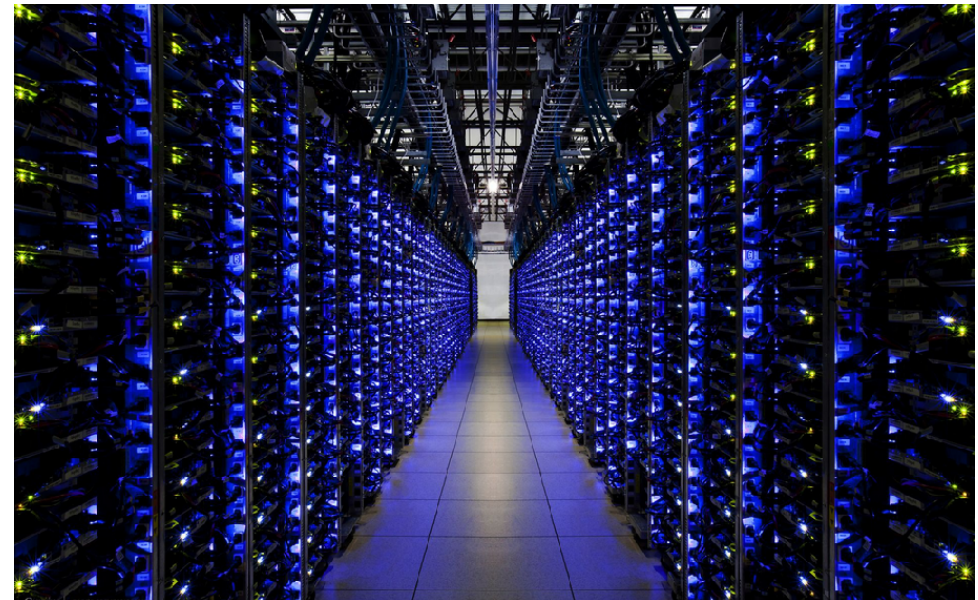
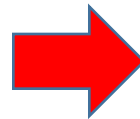
- Toyota – Untraceable software failure - \$1.2B
- GM – Willful concealment of flaw - \$900M
- Takata – Failure for which there may have been foreknowledge, slow response - \$\$\$?
- Volkswagen – Deliberate evading of law - \$18B?

**SOLUTION: \$10/year/car**



# 20-YEAR ANNIVERSARY OF ONSTAR

- Automatic Crash Notification (ACN) – Contextual Awareness
- Good Samaritan - Waze
- Turn-by-Turn Navigation – HERE, TomTom, Garmin, Googlemaps
- Hands-Free Phone – Bluetooth
- Live Assistance – Nuance





# WHY ARE SERVERS IMPORTANT?

- On-board and off-board systems will be gathering and interpreting data to determine:
  - Hardware and software integrity of the car
  - Mood, physical health, attention of the driver
  - Identification of driver and passengers
  - State of the roadway (around and ahead of the car)
  - State of surrounding vehicles
  - Weather and traffic
  - User interfaces – driver needs – voice, eye/facial tracking, gestures

**Shift from reaction to anticipation/prediction**



# ALPHABET, TESLA DISRUPTION



**Automated driving**

**No steering wheel, pedals, driver, ownership**

**Scanned road + sensors**

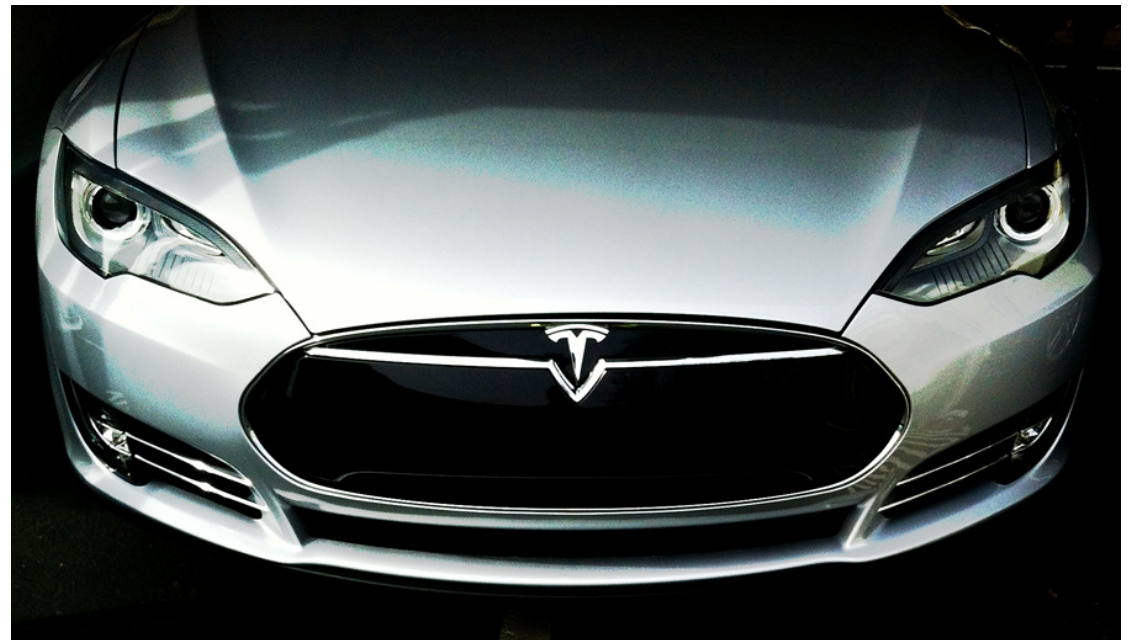
**No dealers**

**No fuel**

**No service**

**Software updates (add features, functions post-sale)**

**“Free” lifetime connectivity**





# ELECTRIFICATION, DIGITALIZATION

- **Lowered barriers to market entry – Tesla, NextEV, LeEco, Atieva, Faraday, Zoox, SAIC/Alibaba, Baidu, Apple, etc.**
- **Cloud-based value proposition**



# INDUSTRY REACTION

- GM launches Maven mobility brand
- Ford launches Smart Mobility LLC + FordPass
- BMW announces iNext strategy
- Toyota announces Toyota Connected
- Hyundai: “High performing computer on wheels”
- PSA: “Push to Pass”

## **OBJECTIVE:**

- GM: New ownership models
- Ford: Extending customer engagement beyond the car
- BMW: Digitalisierung – enhancing the driving experience
- Toyota: Humanize the driving experience
- Hyundai: Pre-emptive repairs, traffic, vehicle-to-infrastructure
- PSA: Anticipating changing car usage patterns



# EXISTENTIAL CRISIS

## What's my motivation for making a connected and/or automated vehicle?

- 1) Sell more cars
- 2) Make money selling connected services
- 3) Develop tighter customer connection - retention
- 4) Make cars safer
- 5) Enhance the driving experience – Toyota? BMW? – (Not robocars!)
- 6) Make cars easier, more pleasant to own operate
- 7) Make cars unnecessary?
- 8) Increase vehicle utilization and thereby reduce the number of cars overall?



# VALUE IN THE DATA

## \$1B

Technology | Fri Mar 11, 2016 4:00pm EST

Related: TECH, DEALS

## GM buys Cruise Automation to speed self-driving car strategy

BY JOSEPH WHITE



## \$500M

Press Release | Thu Feb 18, 2016 12:17pm EST

## GTCR Announces Acquisition of Lytx

\* Reuters is not responsible for the content in this press release.







# CONNECTIVITY = DATA

- Safety
- Security, authentication
- Automated driving
- Customer retention
- Contextual experiences
- Personalized interfaces, content

# THE CAR IS A LIVING THING



- To improve customer engagement
- To improve customer retention
- To better understand vehicle performance, wear and tear, day-to-day use of cars
- To track hardware, software, applications, services
- To better understand failures and fault codes
- To respond in real time to critical customer needs
- To anticipate, mitigate and diagnose failures





# UNIVERSAL CONNECTIVITY

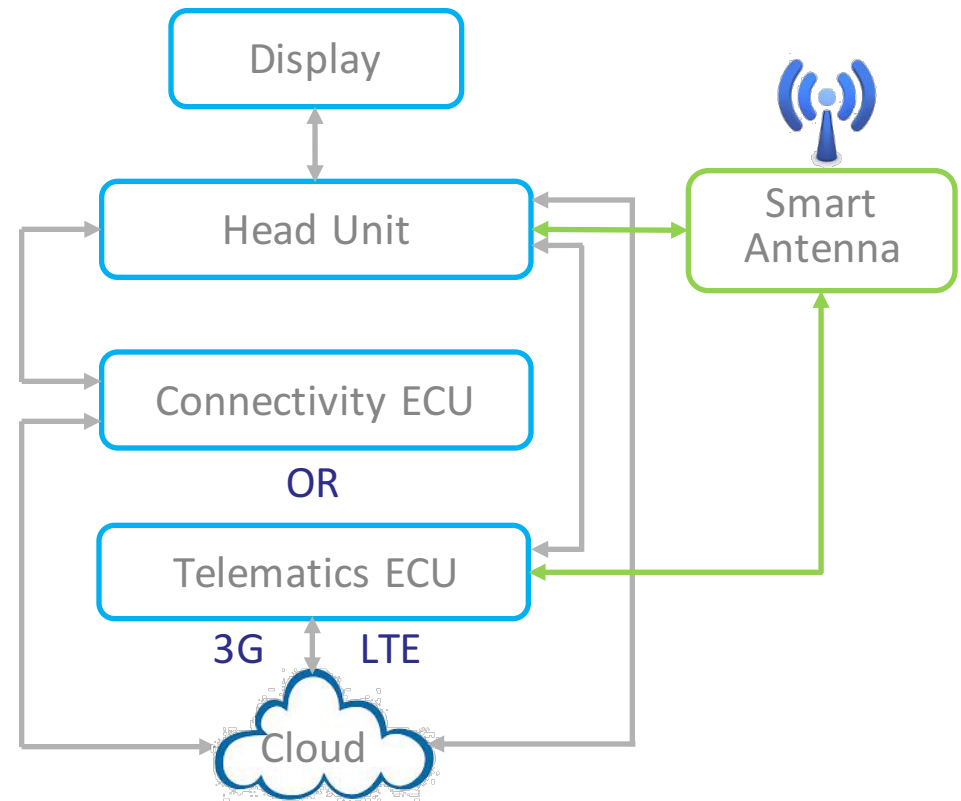
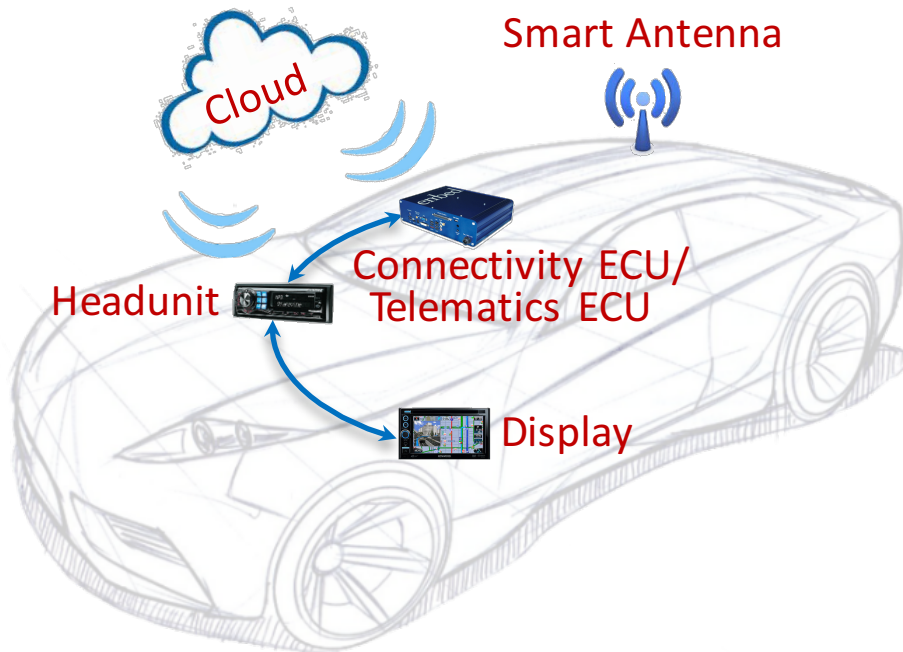


	Step 1: Std. connection	Step 2: LTE	Step 3: Free or included
Audi	Y	Y	N
BMW	Y	Y	Y
BYD	Y	N	N
GM	Y	Y	Y*
Jaguar	Y	N	Y*
Mercedes	Y	Y	N
Qoros	Y	N	Y
Tesla	Y	Y	Y
Volvo	Y	N	N

# IVI INFOTAINMENT DESIGN → THE NEXT GENERATION



5th Generation 2018? →





## OnStar: The NEXT 20 Years

Brand should be repositioned for new connectivity environment

Collision avoidance, automated driving

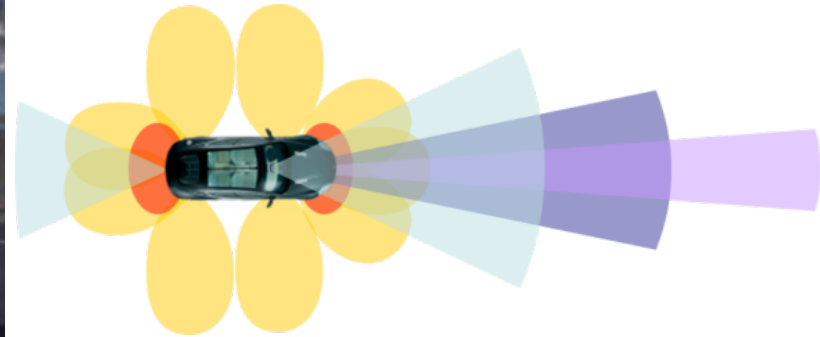
Driver detection and authentication

Biometrics, mood detection (voice, facial rec) for personalization

Enhanced crash response – severity algorithm, internal cameras for determining condition of driver, passengers

Data collection, data sharing (traffic, weather, road condition), inter-vehicle communication

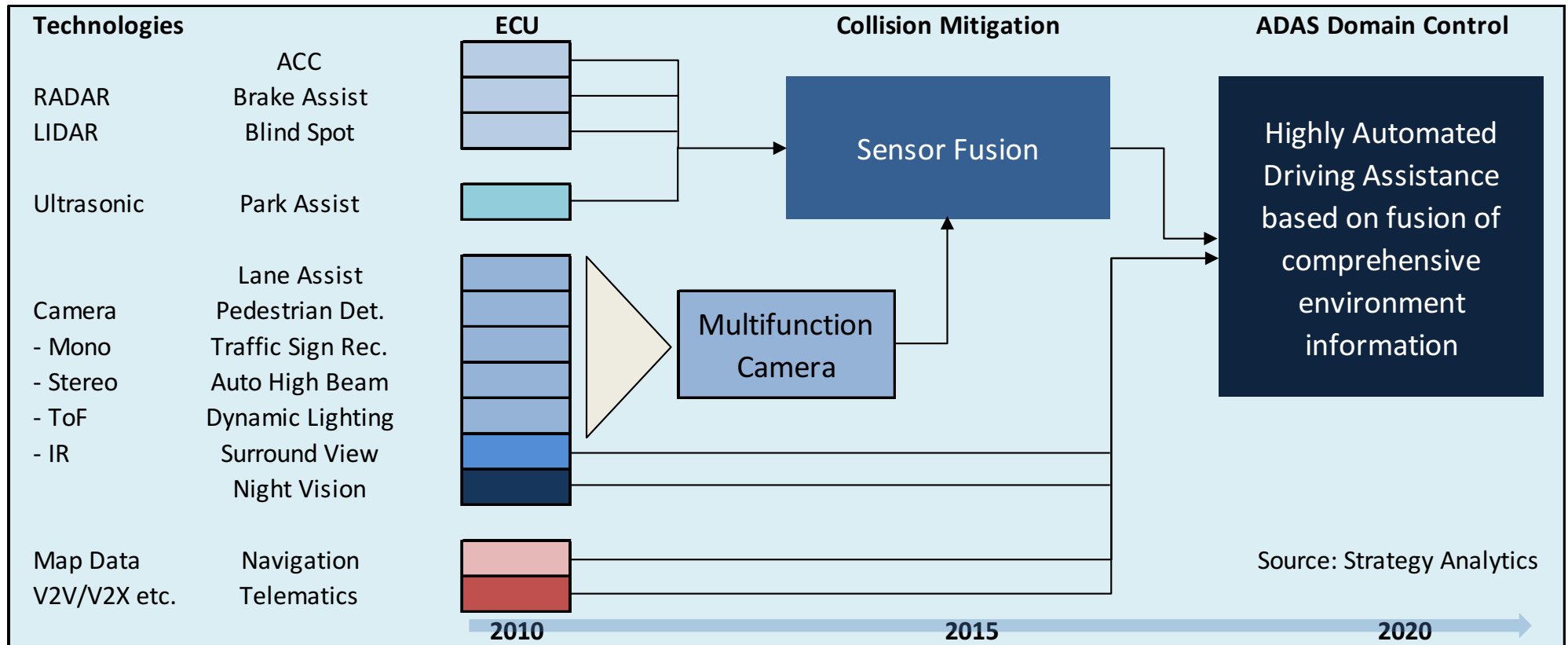
# SENSOR FUSION – E.G. 2013 CADILLAC XTS –



- **Billed as the first General Motors system to have sensor fusion technology, the car uses radar, cameras and ultrasonic sensors to detect its position and the location of potential hazards. Among the features included are:**
  - Lane Departure Warning
  - Side Blind Zone Alert
  - Rear Cross Traffic Alert
  - Adaptive Forward Lighting
  - Head Up Display
  - Safety Alert Seat
  - Rear Automatic Braking
  - Full-Speed Range Adaptive Cruise Control
  - Intelligent Brake Assist
  - Forward Collision Alert
  - Rear Vision Camera With Dynamic Guidelines
  - Automatic Collision Preparation



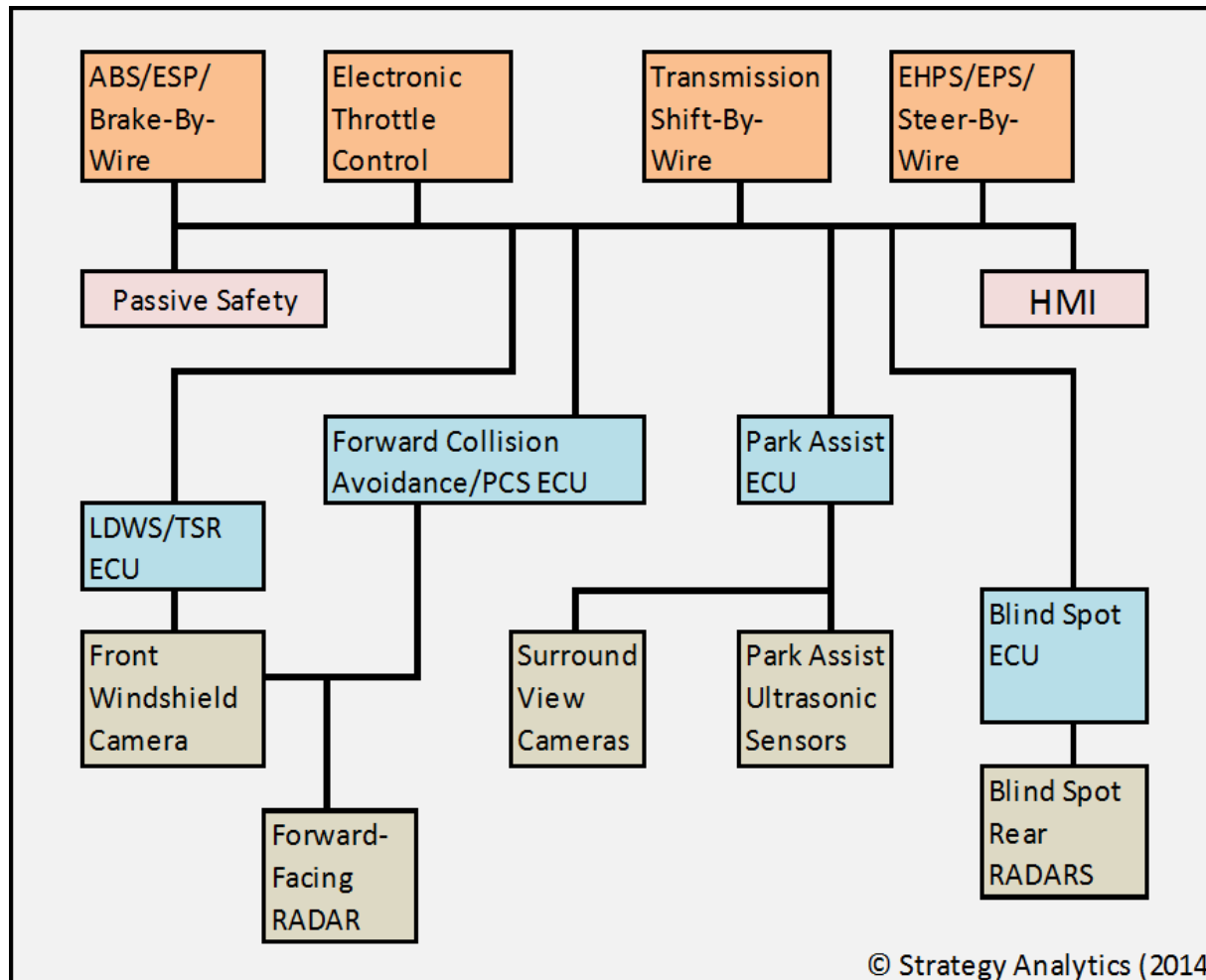
# ADAS EVOLUTION TIMELINE



- Progression will be in incremental steps of automated assistance towards **fully automated vehicles** - e.g. emergency braking, automated parking.....



# ARCHITECTURE TRENDS - NOW

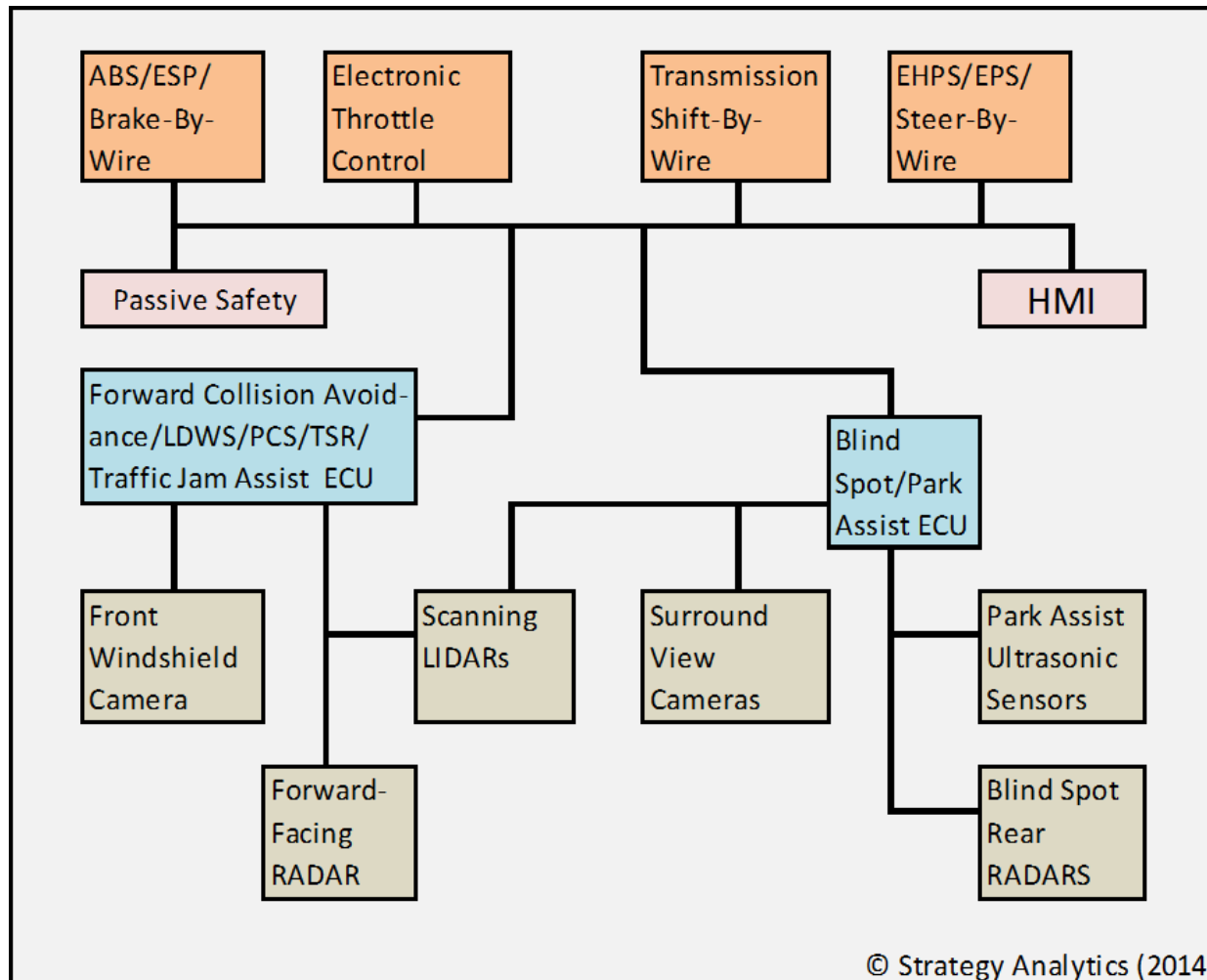


- Current architectures highly decentralized
- General paradigm is 1 function = 1 box
- Makes sense when features are optional and fitment rate is low
- Only high-level data communicated from box-to-box





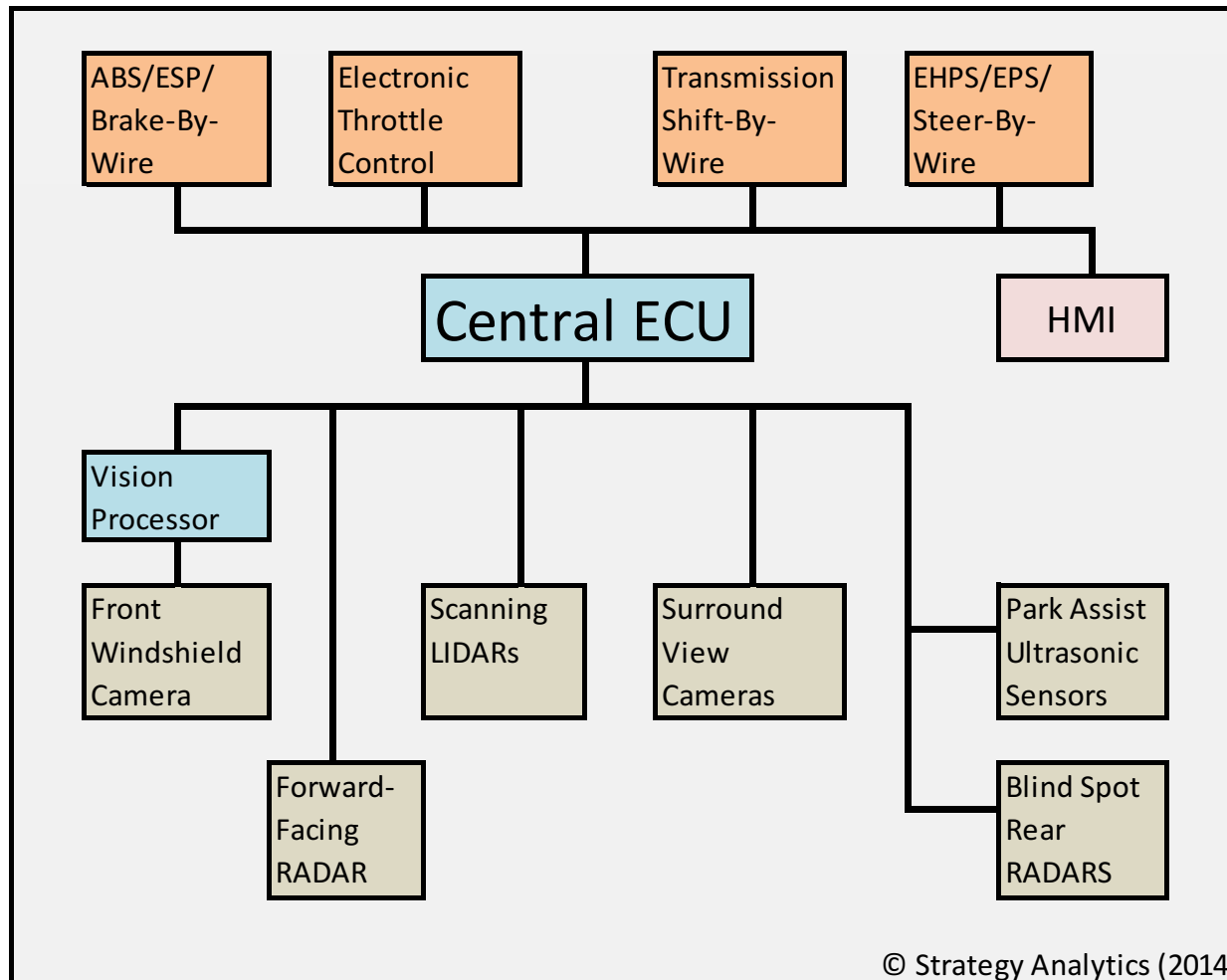
# ARCHITECTURE TRENDS - EMERGING



- Emerging architectures see emergence of “ADAS domain controllers”
- More sensor fusion and integration
- Still typically only high-level data communicated from box-to-box



# ARCHITECTURE TRENDS – FUTURE ?



- Many functions combined in powerful central ECU
- Separate vision processor may remain?
- Only makes sense when features are standard and fitment rate is high
- High-speed communications typically required



# CORE DATA SOURCES

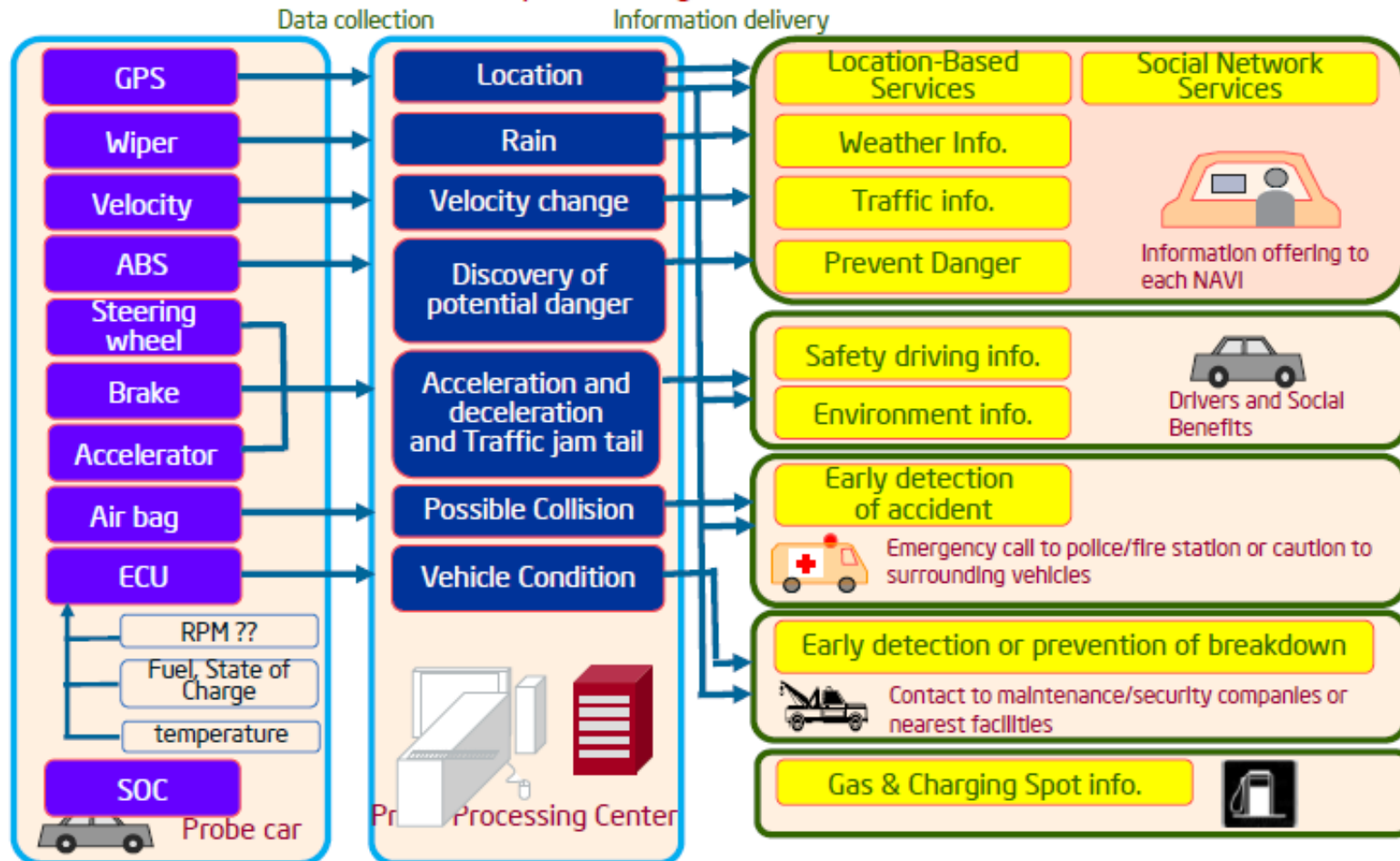
- **Customer** – demographics, preferences, social graph (calendar, contacts), driving behavior/history, app ownership/usage, mobile device ownership/usage, subscriptions
- **Vehicle** – design history, production history, supply chain, repair history, repair requirements, software codes during normal functioning, known anomalies from testing/prototyping, anticipated wear and tear, service schedule, service requirements, related replacement parts, related replacement part/service procedures/costs, performance variability related to driving conditions
- **External** – Traffic, weather, road conditions, vehicle condition, driver condition, historical/real-time/predictive, laws/speed limits etc., crowd-sourced information
- **Location** – Special case – mapping, autonomous vehicles, context



# EMERGENCE OF BIG DATA

## Possibilities to apply Big Data Analysis

Probe data example   Statistical processing   Effective use of information

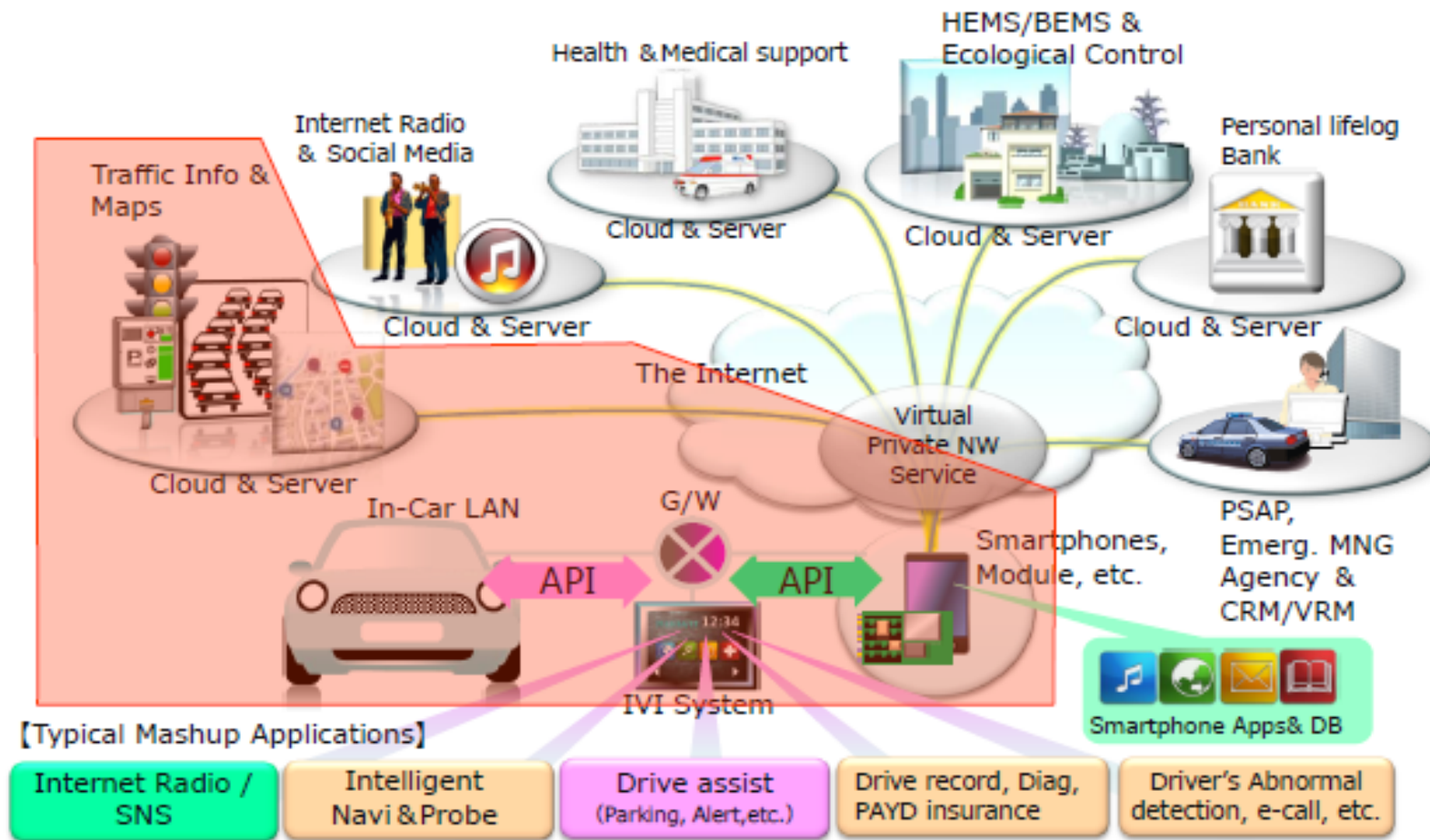


Source : National Museum of Emerging Science and Innovation

# EMERGENCE OF BIG DATA



## Conceptual Image of Connected Vehicle Services



# CARPLAY AND ANDROID AUTO: LIMITED OEM DIFFERENTIATION



Apple CarPlay

android auto



Mercedes-Benz

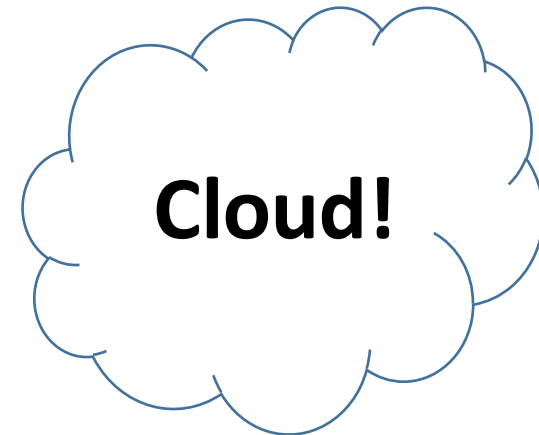
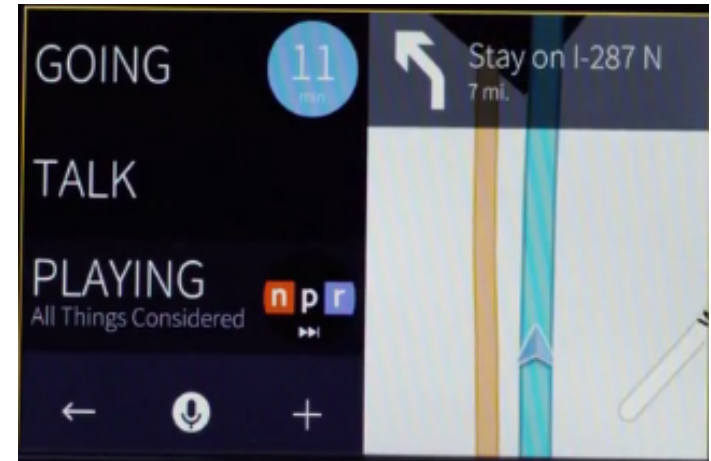


HYUNDAI





# APPLE, GOOGLE GRETZKY'D




**Next phase: Cloud fusion**



# APPLE, GOOGLE GRETZKY'D

## Context Awareness For Cars

**Driver identity & profile management**



Visual driver identification

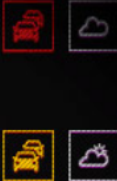
**Morning, Max!**

**Next destinations based on driver's behavior**

**Work**      1011 Broadway  
ETA: 7:48 AM

**Starbucks**      80 Delancey Str  
ETA 7:13 AM

**Context aware events on route**



**Accurate ETA with latest traffic**





# MICROSOFT AZURE CLOUD



**SOURCE: Harman International**



# WILL EVERY CAR BUILD MAPS?

- Today's luxury vehicles have capabilities similar to specialized mapping vehicles



## Beyond GPS

A HERE mapping car, sometimes mistaken for a Google Maps car, has \$80,000 worth of electronics mounted to the roof



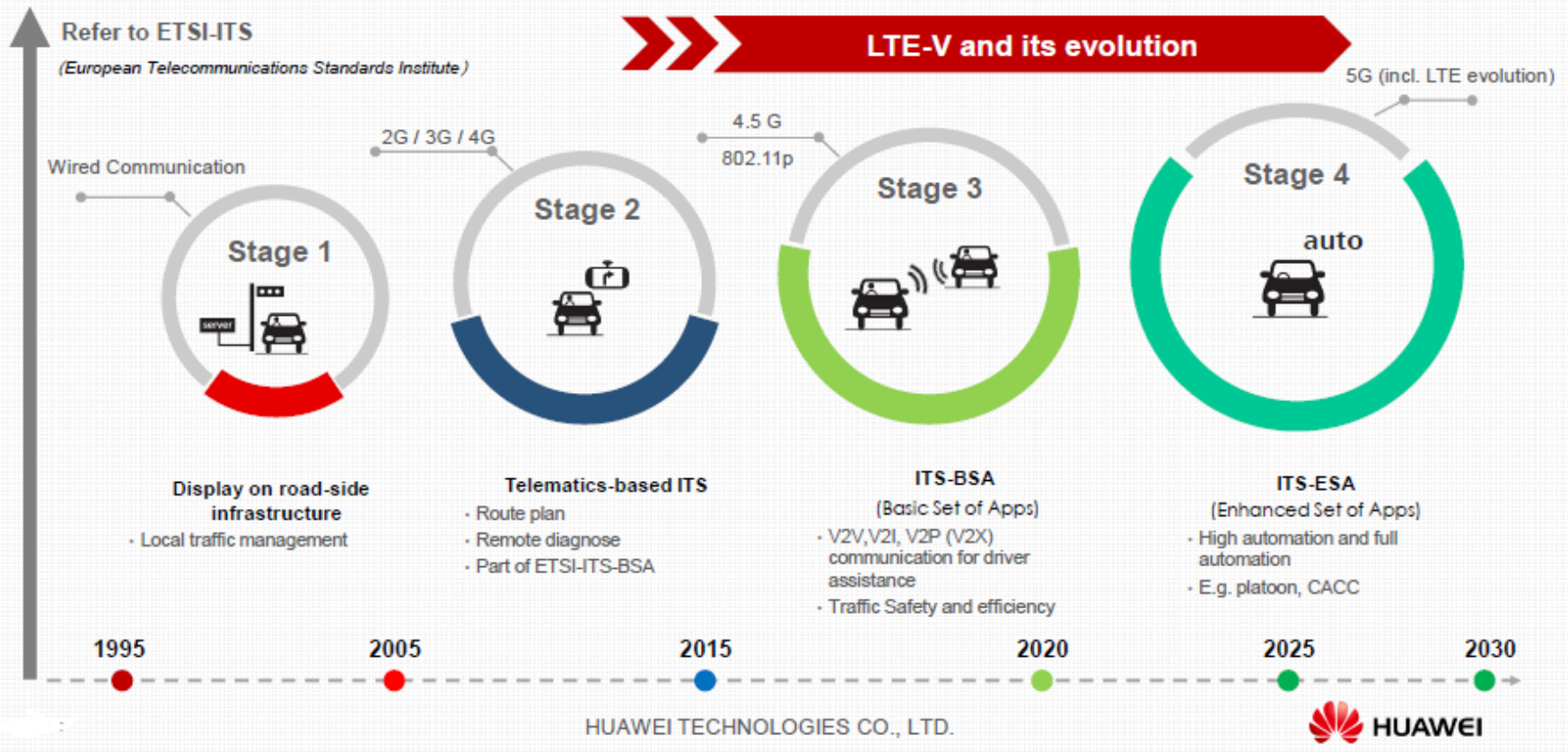
Display screen and one-terabyte hard drive



# DON'T UNDERESTIMATE THE NETWORK

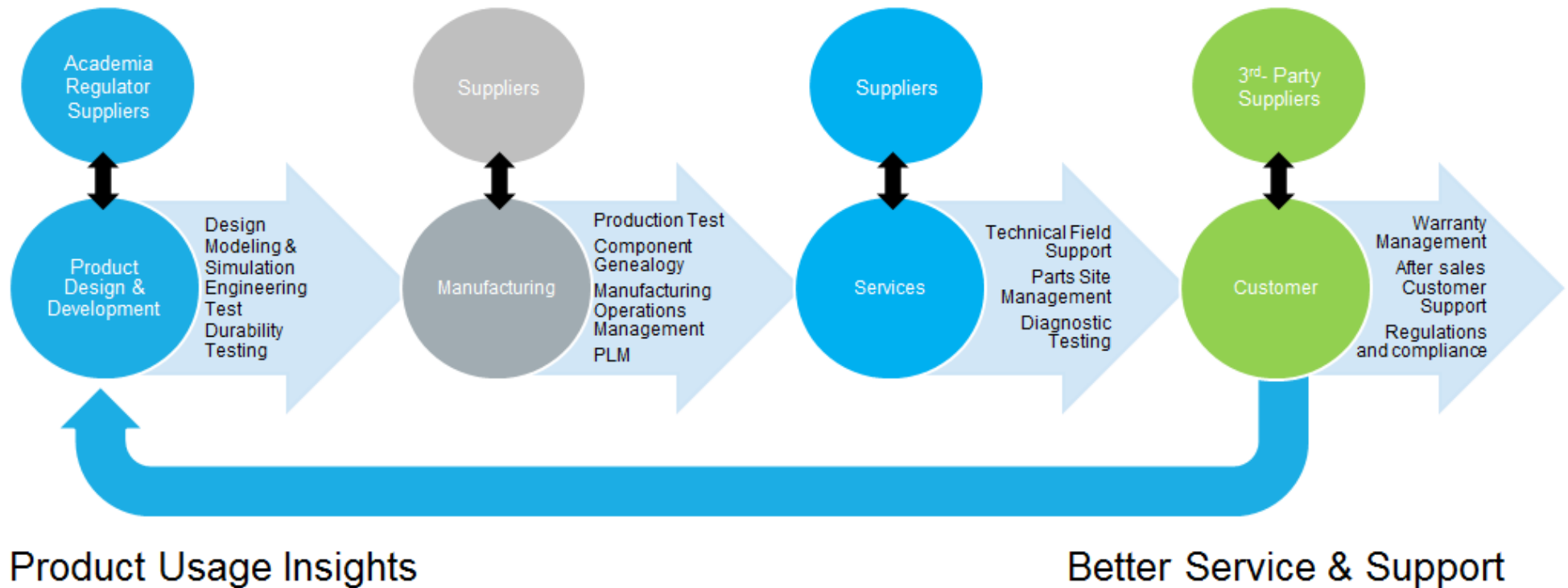


## ITS communication Technologies





## Intelligent Lifecycle Asset Management 'Cradle to Grave' Data Utilization



Source: OSIsoft



# WHY ARE WE DOING THIS?

## What's my motivation for making a connected and/or automated vehicle?

- 1) Save lives
- 2) Reduce traffic
- 3) Save time
- 4) Reduce emissions
  
- 5) **Make cars more pleasing and easier to own, use – sell more of them**