

2020 WHMA 27TH ANNUAL WIRE HARNESS CONFERENCE



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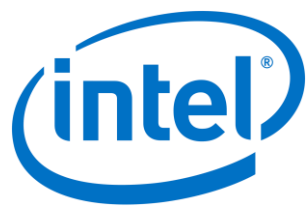
Connected, Autonomous,
Shared, Electrification
(CASE)

February 20, 2020



What do all these companies have in common?

They are shaping the future of mobility.



The Year 1920...



“If I had asked people what they wanted, they would have said faster horses.”

– Henry Ford

The Future of Mobility is CASE

- C** – Connected Vehicles
- A** – Autonomous Vehicles
- S** – Shared Mobility
- E** – Electrification



**How many of you have a
vehicle that warns you about
upcoming construction or traffic jams?**

Connected Vehicles

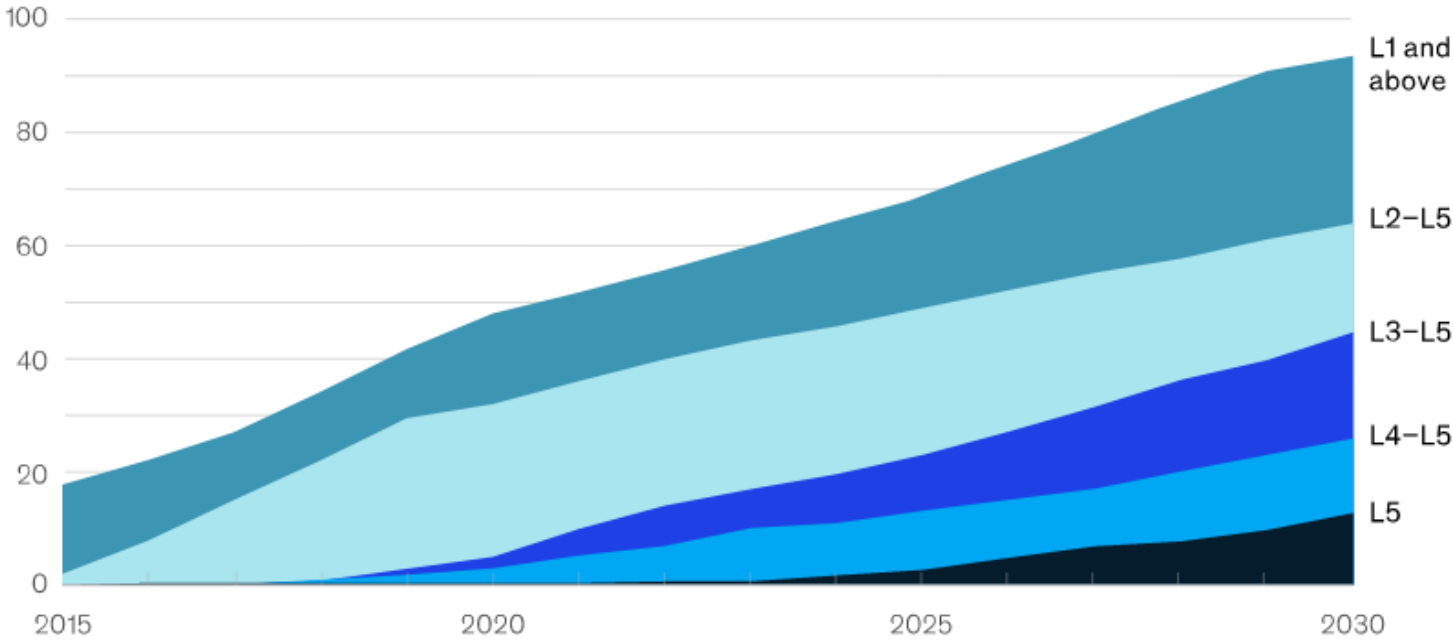
There are over 5 million crashes and 30,000 deaths on the road per year.



- Vehicle to Vehicle (V2V)
- Vehicle to Infrastructure (V2I)
- Dedicated Short Range Comms (DSRC)
- Cellular to Everything (C2VX)
- Big Data

Connected Vehicles

Global penetration of connected cars, % of new light-vehicle sales by connectivity level



Level 1

Level 2

Level 3

Level 4

Level 5

General Hardware Connectivity
Driver is able to track basic vehicle usage and monitor technical status.

Individual Connectivity
Driver uses a personal profile to access digital services via external digital ecosystems and platforms.

Preference-Based Personalization
All occupants enjoy personalized controls, infotainment content, and targeted contextual advertising.

Multisensorial Live Interaction
All occupants interact with the vehicle and receive proactive recommendations on services and functions.

Virtual Chauffeur
Cognitive AI fulfills all occupants' explicit and unstated needs, predicting and performing complex, unprogrammed tasks.

Source: McKinsey & Company



Connected Vehicles

amazon

SONY



BlackBerry™

CISCO™

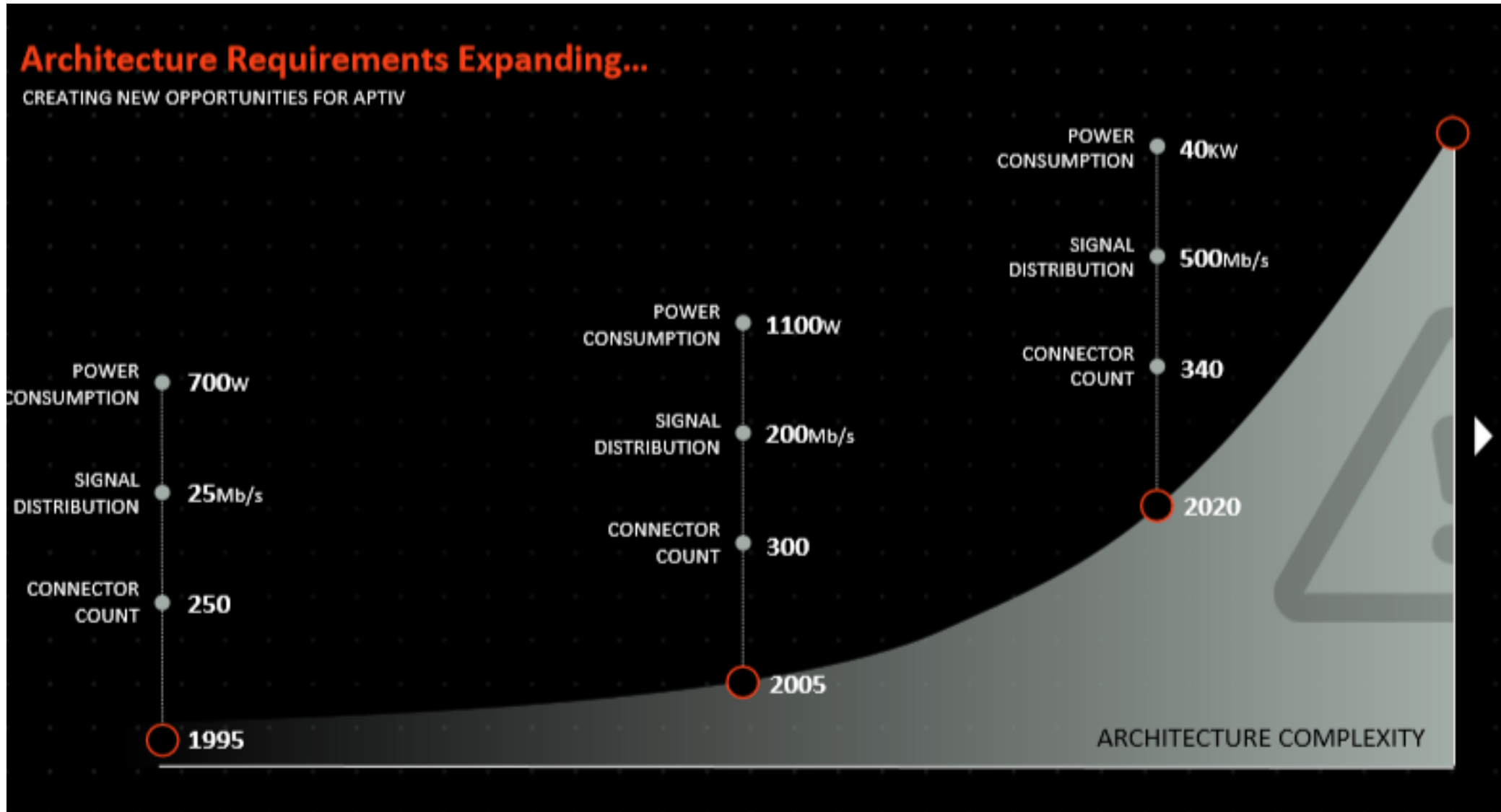
Microsoft

QUALCOMM®

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IPC®

Connected Vehicles



Connected Freight

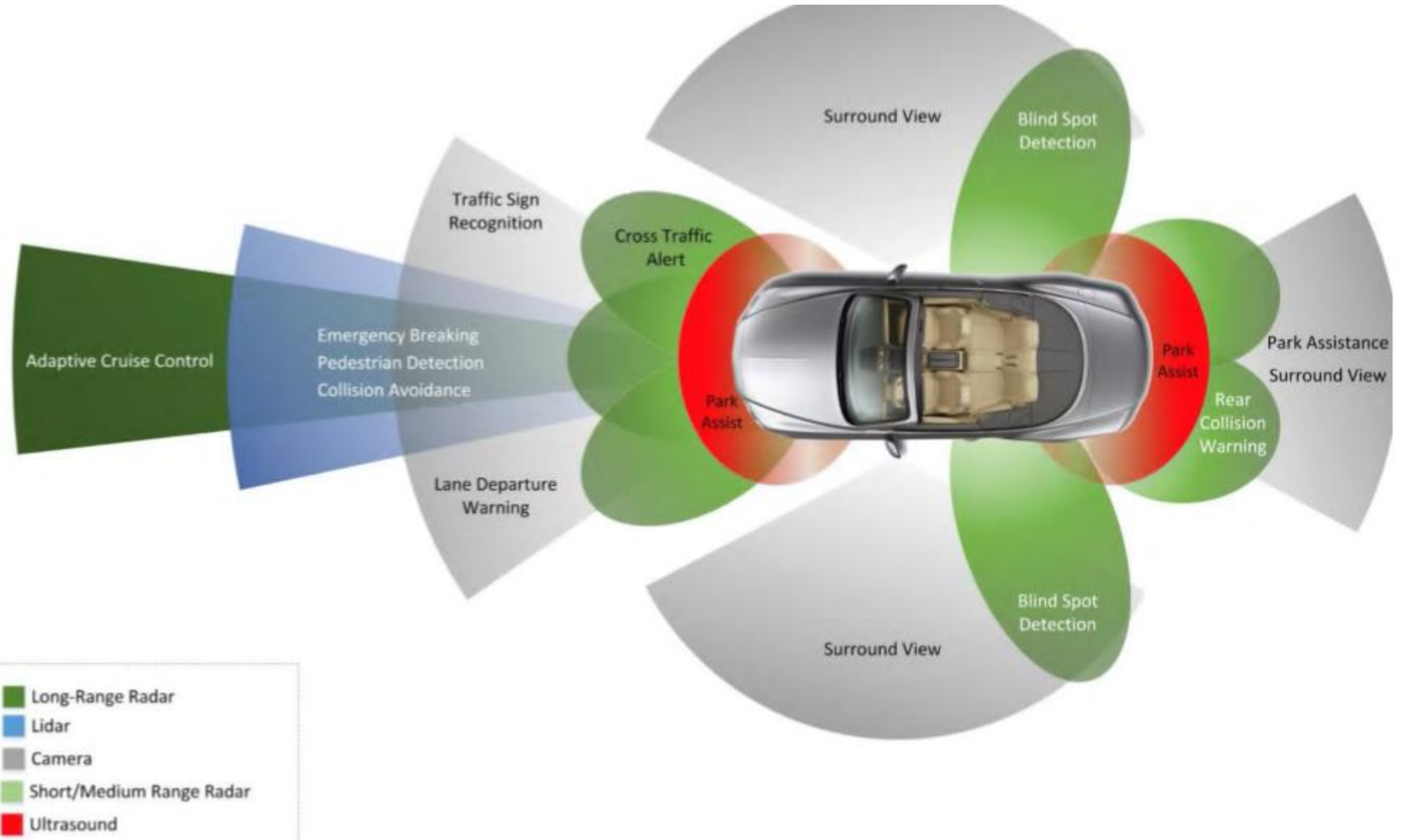


Connected Agriculture

By 2050 the World Population will be 9.7 Billion



Connected and Autonomous Vehicles



How will connected transportation impact you?

- **Vehicle architecture is changing rapidly in order to handle massive amounts of data**
- **Connections must process data more quickly**
- **Signal integrity will be a key feature**
- **Connections will handle more power**
- **Many new, potential customers and business partners will not be traditional transportation companies**

**How many of you rode from the airport
to your hotel in an autonomous vehicle?**

Autonomous Vehicles in Las Vegas

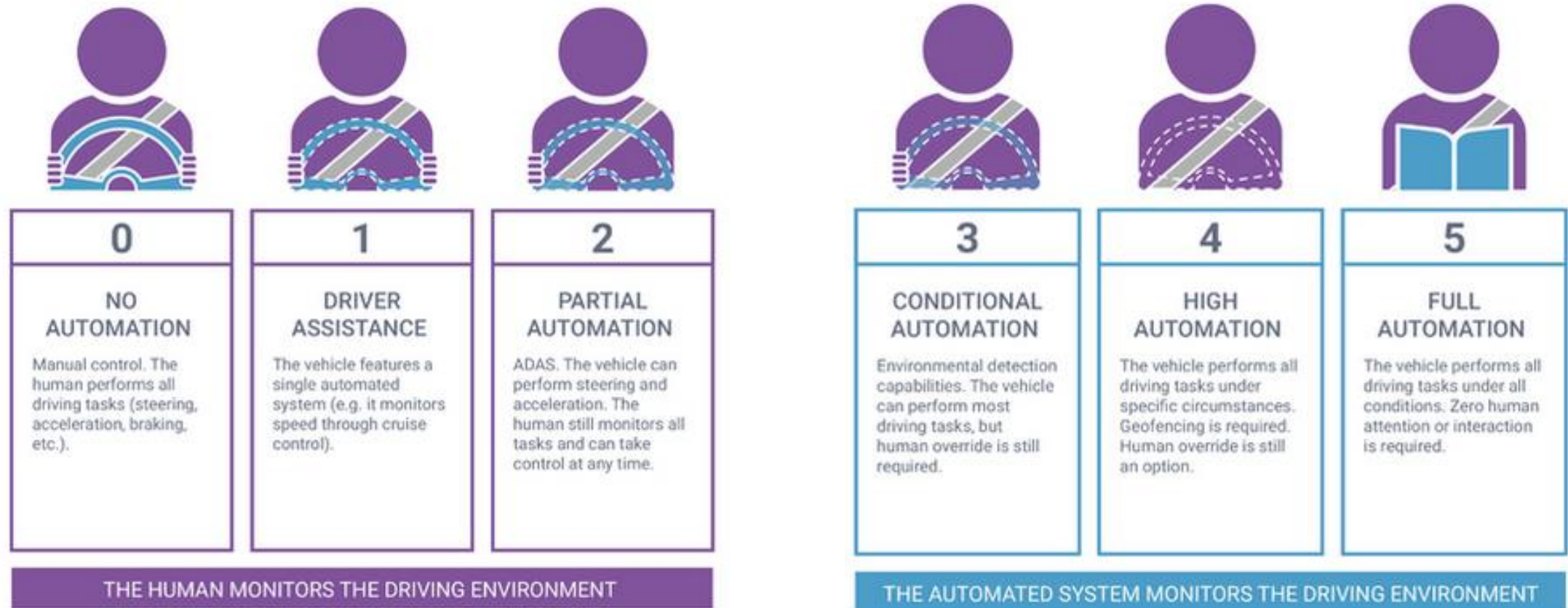


The History of Autonomous Vehicles – DARPA Challenge



Autonomous Vehicles

Levels of Driving Automation



More Autonomous = More Connections

Autonomous Requires Electrification



Autonomous Vehicles

**Autonomous
Vehicles will
Generate 3,600GB
of Data per Hour**



Autonomous Agriculture

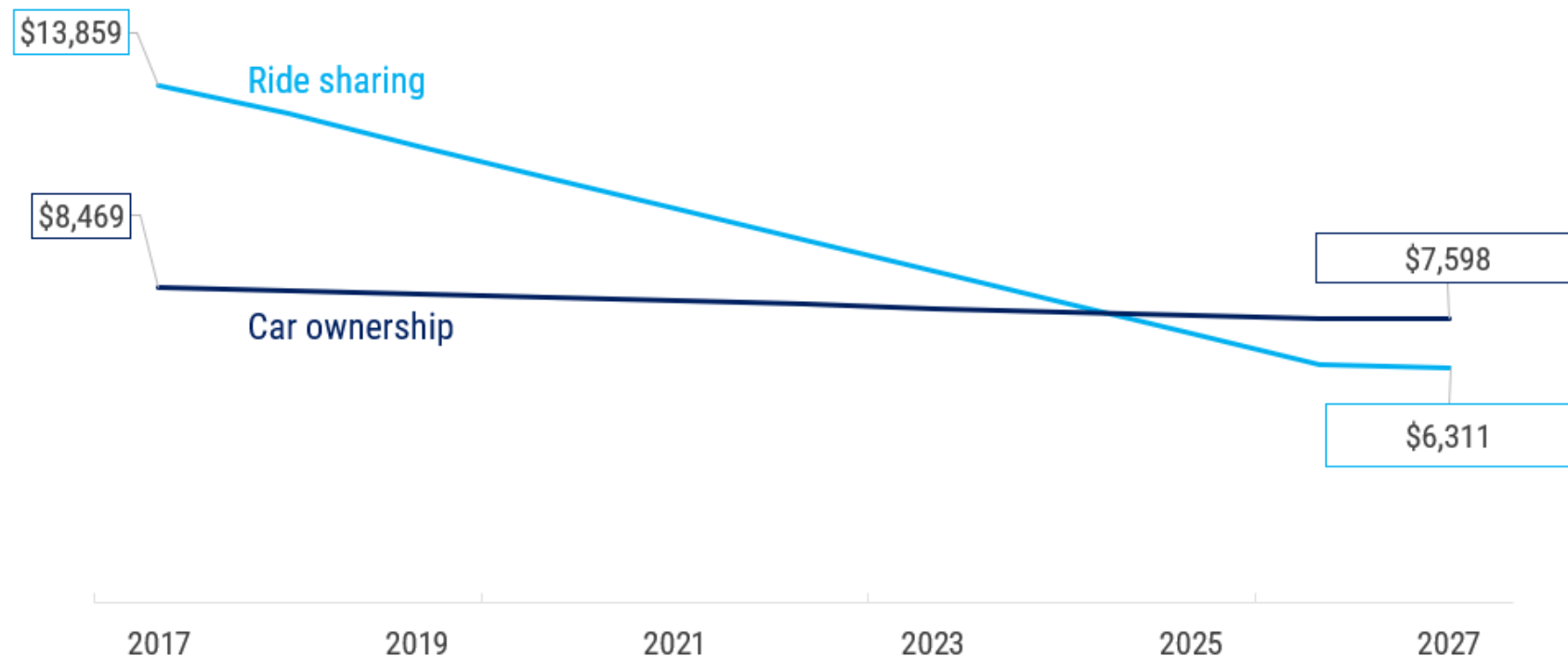


Autonomous Shared Vehicles

Sharing more affordable with driverless cars

Estimated annual cost of ride-sharing (with driverless cars) vs. ownership

**130 Million
Shared Cars
on the Road
in 2030**



Source: QuoteWizard

CBINSIGHTS

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IPC

How will autonomous transportation impact you?

- **The number of connections within a vehicle will increase exponentially**
- **Signal and data downtime will not be accepted, poor connections will not be tolerated**
- **Signal integrity will be a key feature**
- **Connections will have to handle information at unprecedented speeds**
- **Many new potential customers and business partners will not be traditional transportation companies**

Uber

How many people use a ride sharing or ride hailing app?

The Lyft logo is displayed in a vibrant pink color. It features the word "Lyft" in a bold, rounded, sans-serif font. The letters are closely spaced, with the "y" and "f" having a distinctive shape.

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Shared Mobility vs. Ride Hailing vs. Ride Sharing

Shared Mobility

Collective, organized use of a vehicle by an unspecified number of passengers and drivers. An outlined agreement stipulates how fuel, electricity, and operating costs will be shared.



Ride Hailing

Customer uses an app like Uber or Lyft to book a ride. The car has a professional driver that picks up the passenger at a specified place and drops them off at their destination.



Ride Sharing

One person drives their car a certain route, and takes along another person who wants to go to the same destination. Opportunities are generally found and settled via websites or apps.



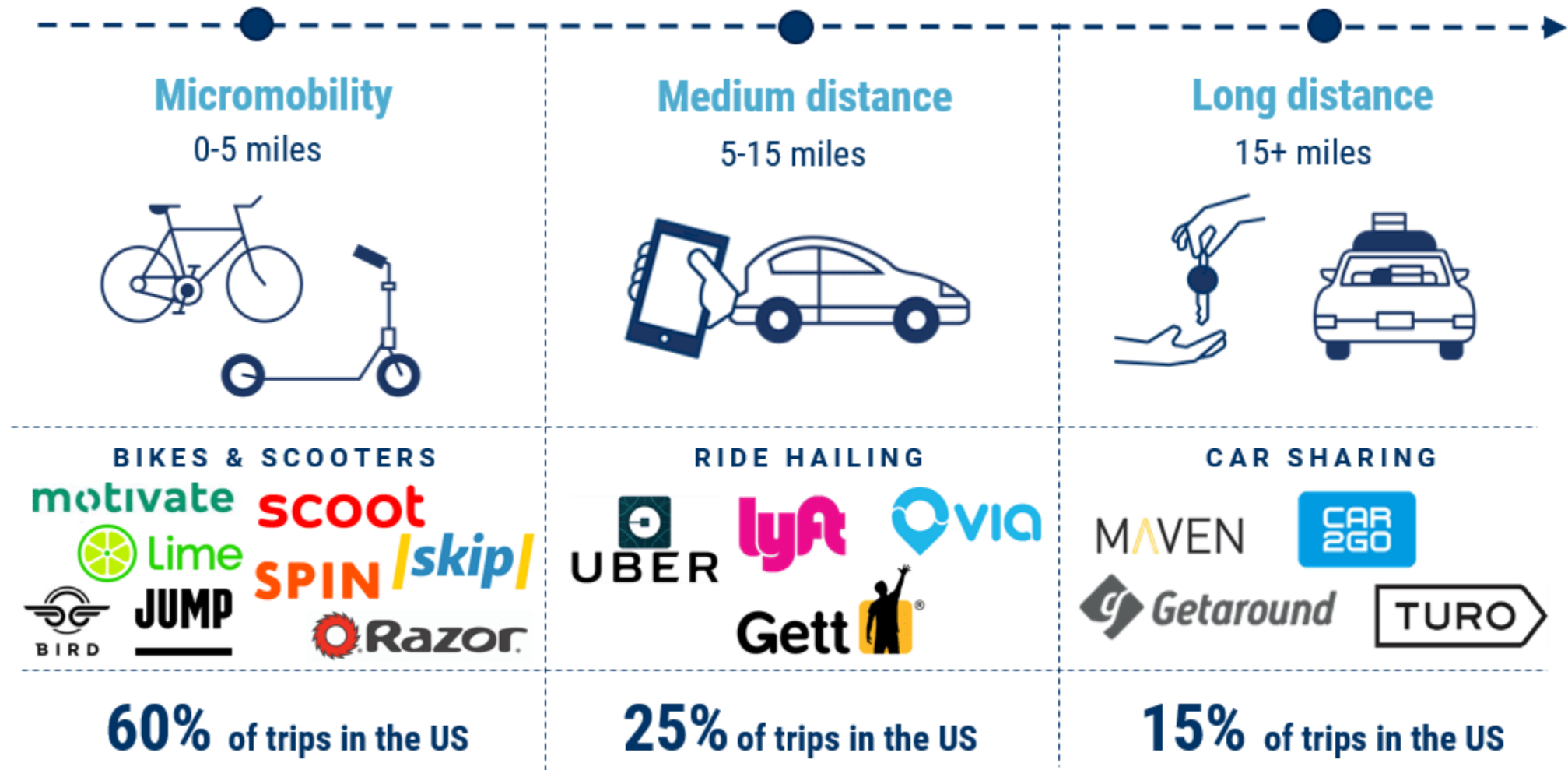
Shared Mobility Services

150,000 People use 2,000 Cars –
Vancouver



Shared Mobility Services

Disrupting the Car



So, what does this mean?

How will shared mobility impact you?

- **The rate at which vehicles are produced will decrease**
- **The use of bus and mass transit services will increase in urban cities, production of these types of vehicles will increase**
- **Bigger and more complex wire harnesses will be needed for buses and mass transit vehicles**
- **The number of vehicles in larger cities will decrease as cities strive to improve their air quality and decrease congestion**

How many people own an electric vehicle?

Formula E

ABB FORMULA-E

FIA FORMULA-E CHAMPIONSHIP



Gen. 1 Vehicle – Pre 2019

- 2 Vehicles per Race
- Top Speed 140mph
- Max Power 268hp



Gen. 2 Vehicle – Current

- 1 Vehicle per Race
- Top Speed 174mph
- Max Power 335hp

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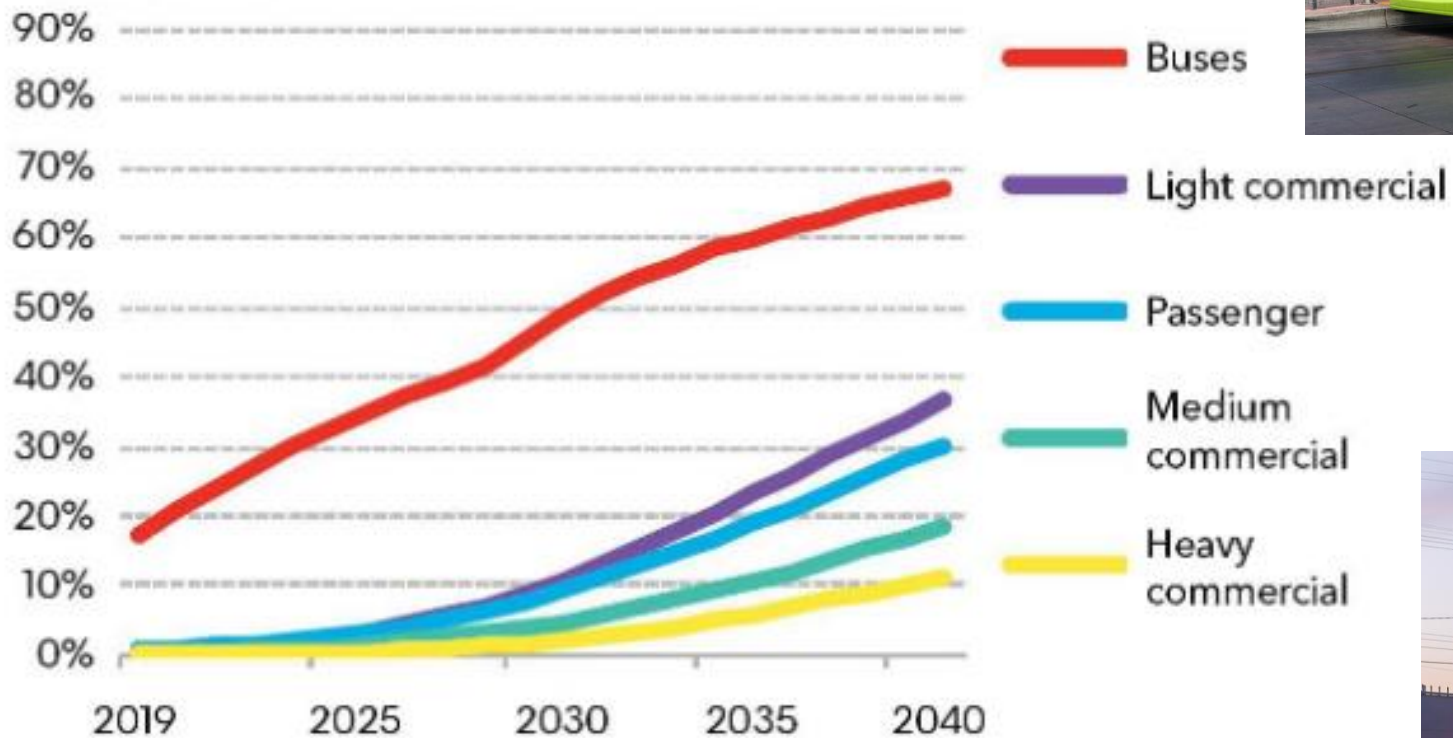
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Electrification of Transportation

EV share of global vehicle fleet by segment

Share of fleet

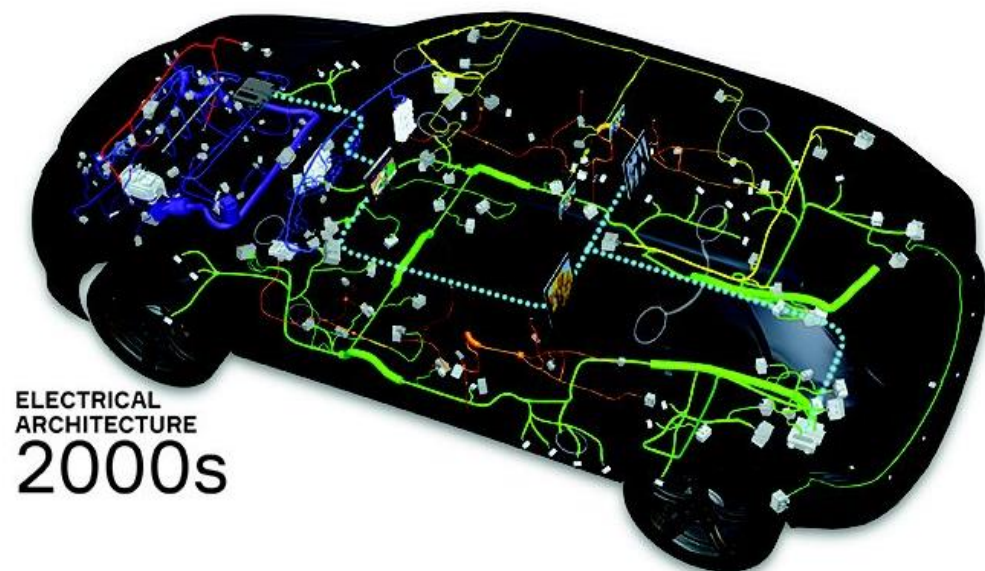


Source: BloombergNEF. Note: Commercial vehicle adoption figures include the main markets of China, Europe, and the U.S.

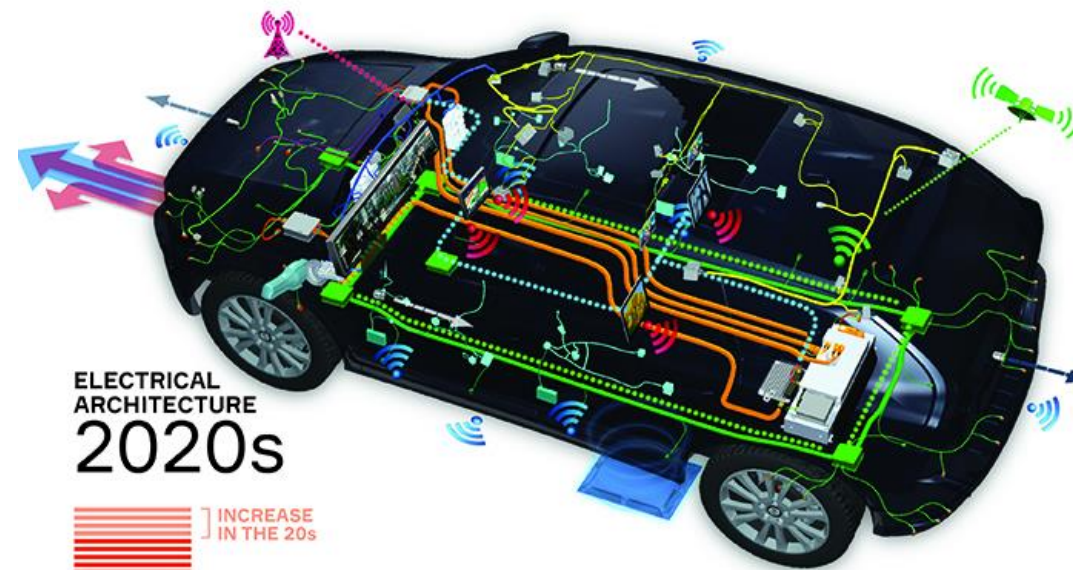
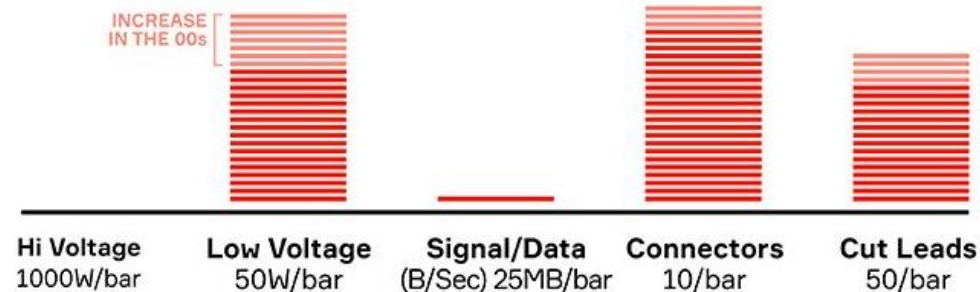


Vehicle Architecture

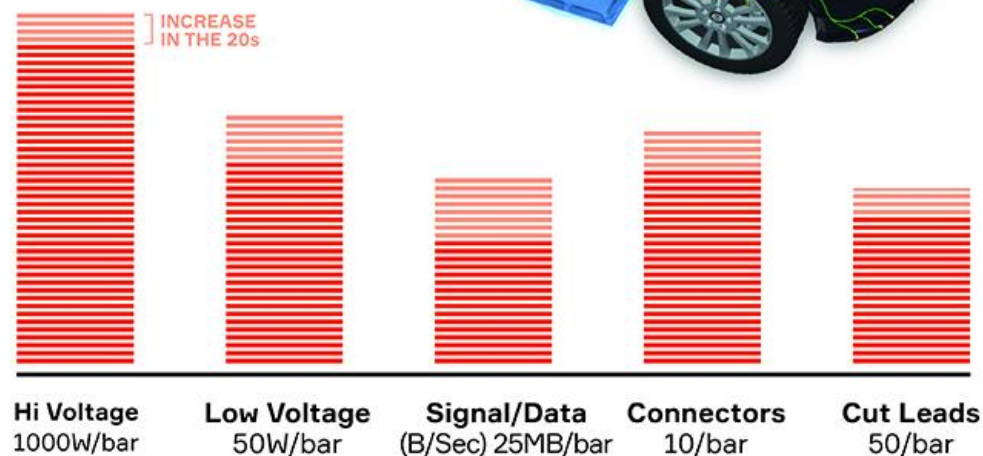
- ICE vehicle drivetrains have 200 moving parts
- The Tesla drivetrain has 17 moving parts



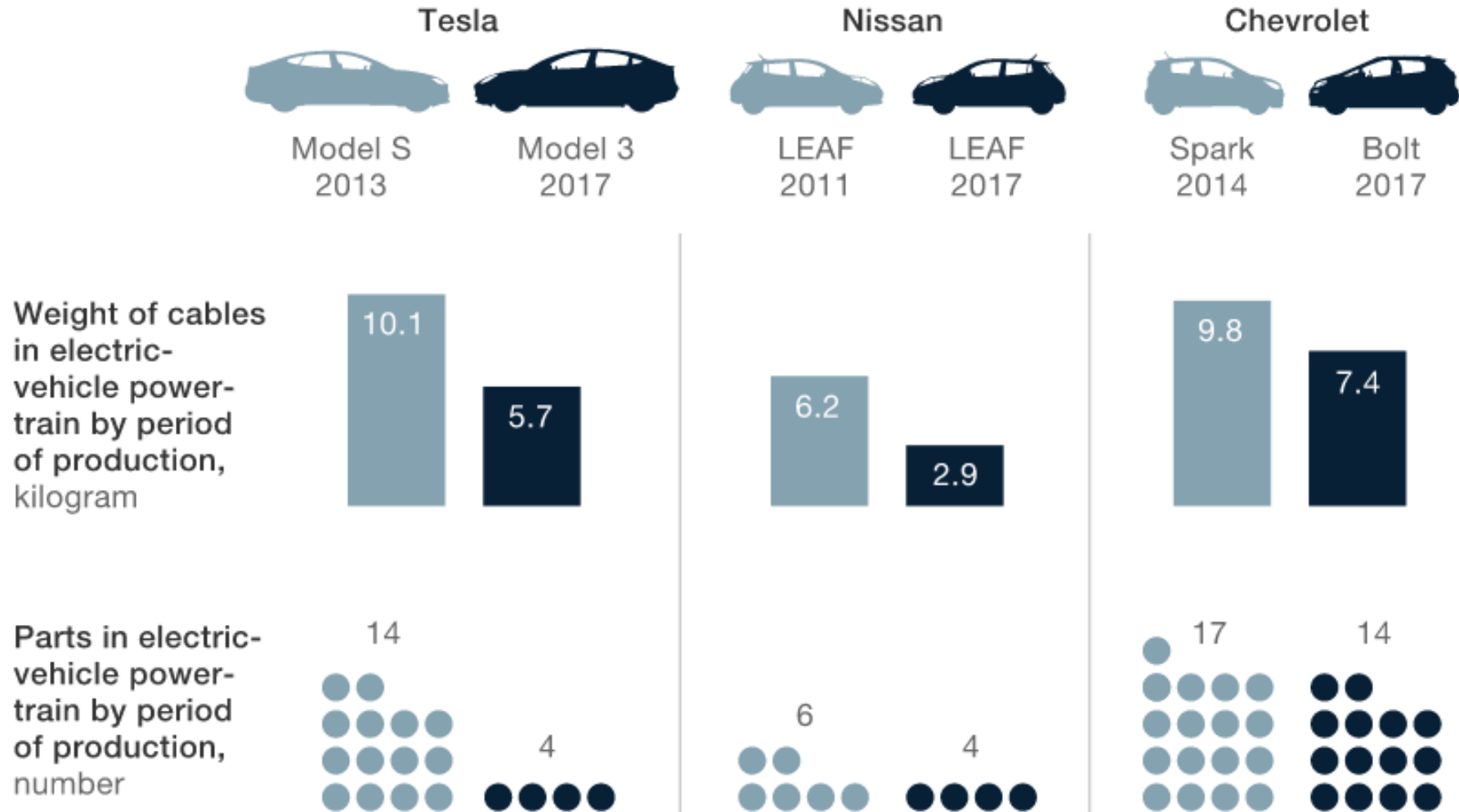
ELECTRICAL ARCHITECTURE 2000s



ELECTRICAL ARCHITECTURE 2020s



Electrification of Transportation



Source: A2Mac1; McKinsey Center for Future Mobility

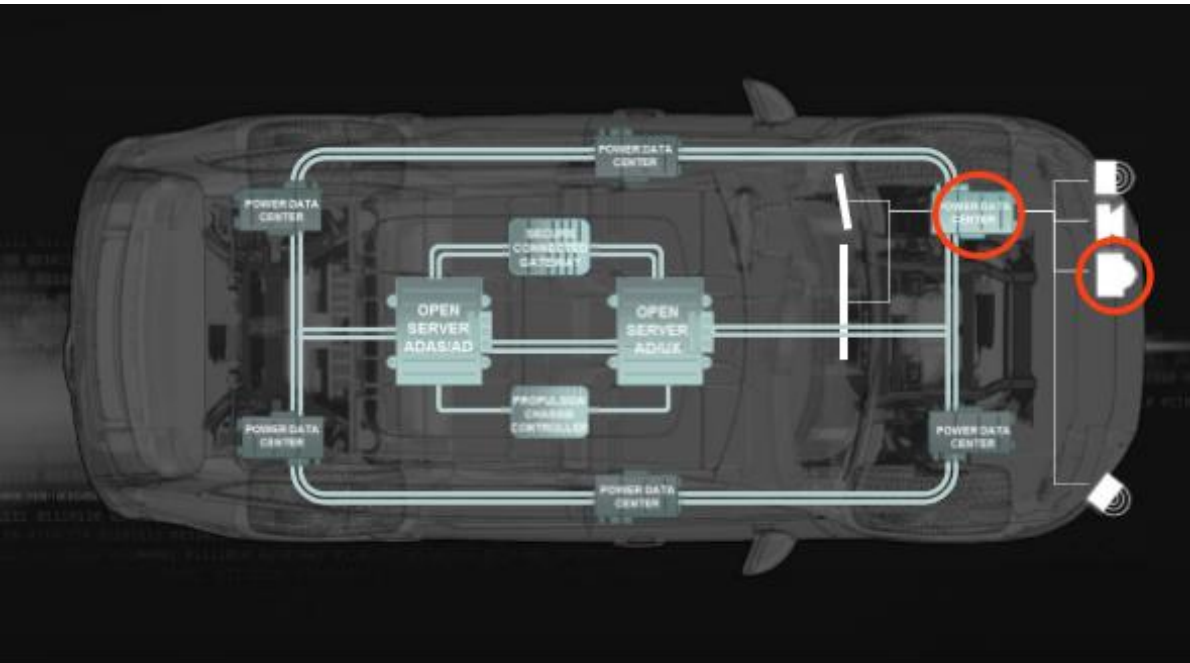
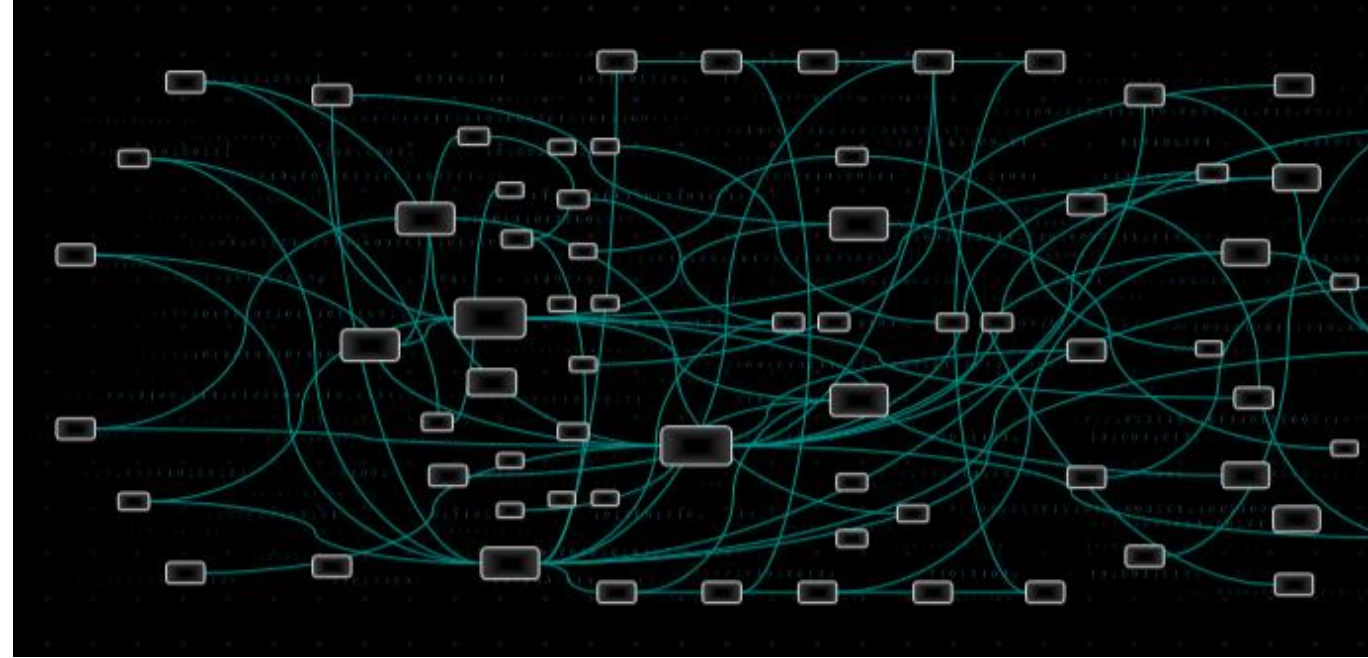
Electrification of Transportation



Electrification Architecture

Currently:

- 100+ Controllers
- 200 Millions Lines of Code
- 1,000+ Dependent Functions

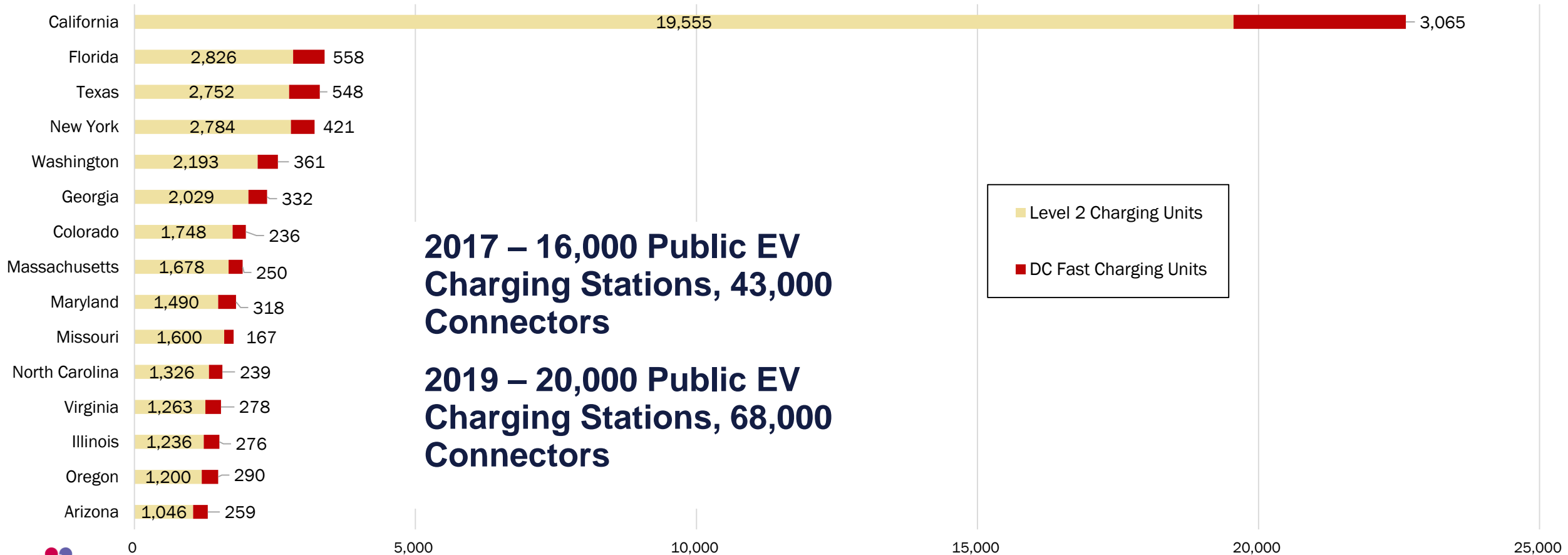


Smart Vehicle Architecture:

- Simplify vehicle system and function complexity and interdependence
- Unite diverse applications across the full vehicle lifecycle
- Empower OEMs to fully control the user experience of the vehicle

Electric Vehicle Charging...A New Opportunity for Growth

Public and Private, EV Charging Units by State, May 2019



2017 – 16,000 Public EV Charging Stations, 43,000 Connectors

2019 – 20,000 Public EV Charging Stations, 68,000 Connectors



New Electric Vehicle Companies



RIVIAN



LION



KARMA



THOR



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How will electrification impact you?

- **Significant investment will be required to properly handle high-voltage cable assemblies.**
- **Due diligence is required when partnering with customers. Start-up electric vehicle companies require quick turnaround, especially on prototype builds. These start-ups might not be around in a month.**
- **Be aware of cable trends, more options are being validated. Aluminum cable is being introduced into the high-voltage EV industry and lead times are increasing.**
- **Electrification is here and not going away. Annual growth expected to be >30% for the foreseeable future.**
- **Safety is the most important factor in high-voltage cable assembly. Safety in cable assembly, high quality production and safety for the end user.**

The Year 2030...



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