KEYSIGHT WORLD 2019

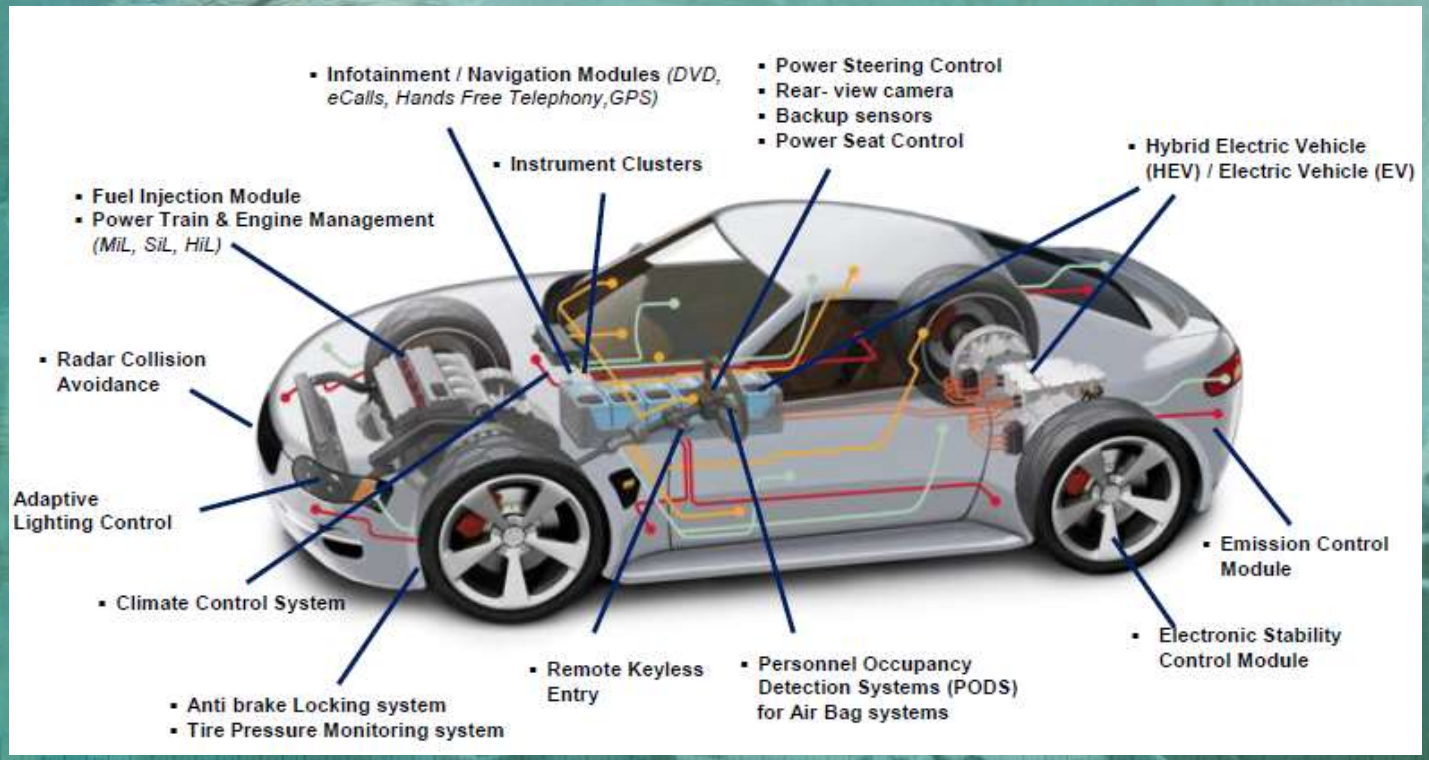
Realize your Vision of Mobility Faster

Michael Reser

Business Development Director / Keysight Technologies

Automotive & Energy Transformation

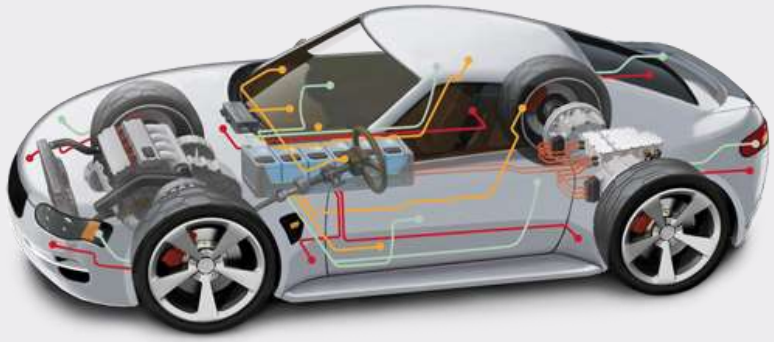
BASED ON THE ELECTRIFICATION AND DIGITAL REVOLUTION IN AUTOMOBILES



Automotive & Energy Markets Merging

E-MOBILITY ENABLES PROVIDERS FOR ALTERNATIVE ENERGY TO EXPAND THEIR BUSINESS INTO INDIVIDUAL MOBILITY

Automotive



Electrification is occurring at astonishing speed

- Electrical powertrain
- Fast Charging Concept needed
- Emission Free Miles
- Battery Reuse in Solar Installations

Energy

Distributed generation of energy is driving innovation

- Alternative energy generation
- Smart consumption
- Storage solutions
- New power semiconductor technology

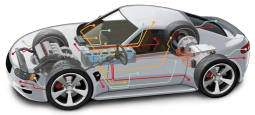
Emerging Mobility System

ADDRESSING AV,EV TEST NEEDS FOR CARS, V2X AND CHARGING INFRASTRUCTURE

The Environment

Sensors
Radar,Lidar, Camera, GPS

Autonomous Vehicle (AV)



Electrical Vehicle (EV)

Base Stations

Cellular Network
Longhaul Xmission

Data Centers

Charging Stations

New Grid

PCS

Inverters

Alternative Energy Gen.

Environment | End Node | Edge | Edge | End Node Resource

Market Drivers in Automotive

Safety
1.23M Road Deaths

Environment
+50% CO, NOx Emission

Connections
In Vehicle

ADAS
Autonomous Driving

Hybrids &
E-Mobility

Connected
Cars

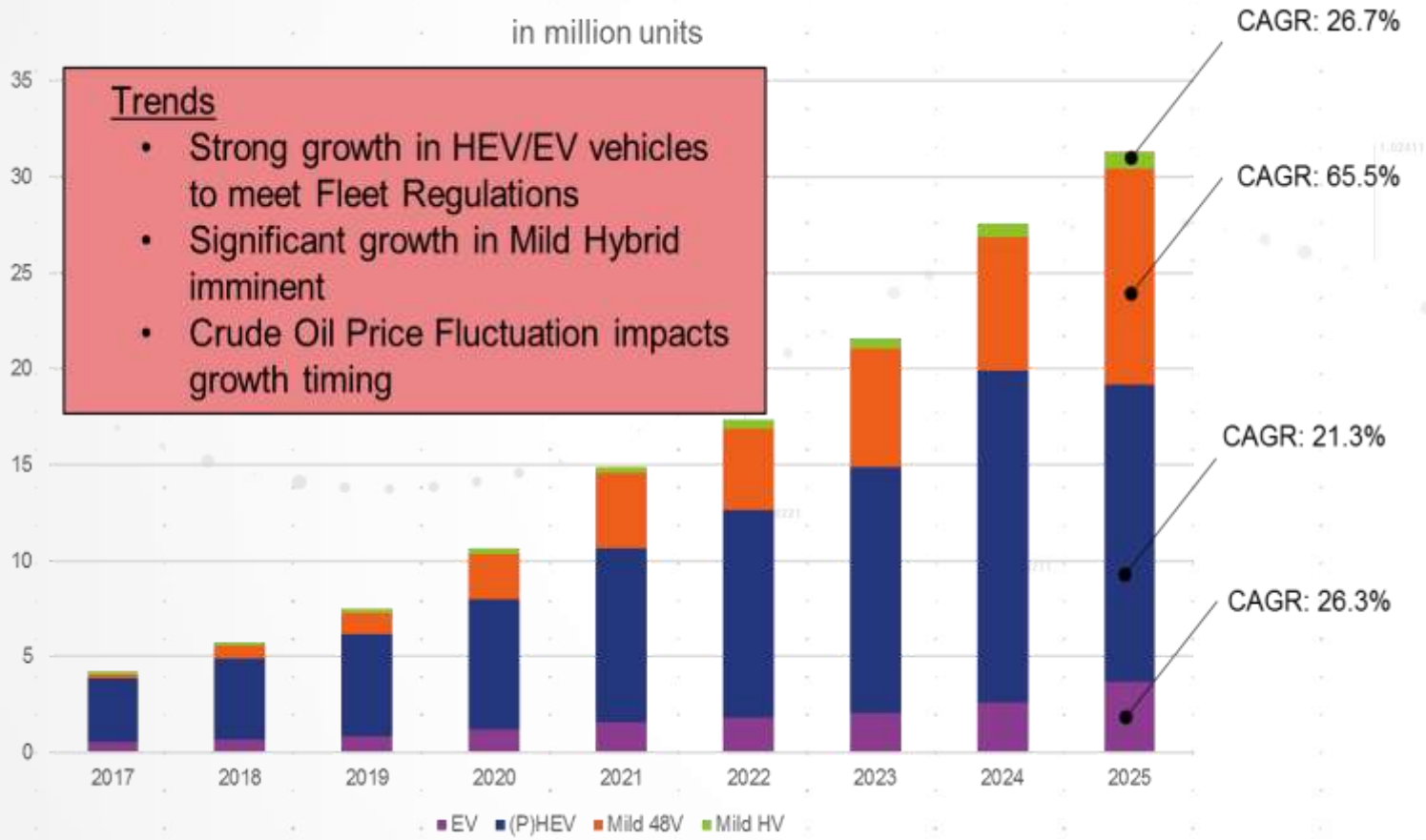
Data Source: WHO, US EPA

Vision of Mobility – Automotive Trends

Electrification investments are increasing	**Platform Readiness** HEV/EV platforms will account for 25-30% of new car sales by 2025	**Investments** $300B over the next decade for E-mobility platforms	**Ecosystems** Charging infrastructure and grid readiness needs to develop in parallel
Path to V2X is accelerating	**Acceleration** DSRC and C-V2X (R15) are poised to push V2X forward	**Maturation** 5G is propelling L3-L5 concepts forward	**Extension** New mobility concepts and much increased road safety
Connected Cars are a reality soon	**Being Connected** By 2021, 380 million vehicles will be connected	**Initial Focus** Safety & Convenience aspects were driving connectivity	**Horizon** New in-car experience and data driven business models

E-Mobility – Transformation Impacts

MOBILITY TRANSFORMATION DRIVES HUGE POWER DEMAND



- HEV/EV cars forecasted to grow to > 30M units in 2025
- 3.45TWh of new demand to the grid estimated until 2050

E-Mobility

CREATING EMISSION-FREE MOBILITY

Batteries are the critical enabling Factor

- Lower Cost/kWh
- Higher Energy Density
- Recycling System

Clean Energy is required to generate emission-free miles

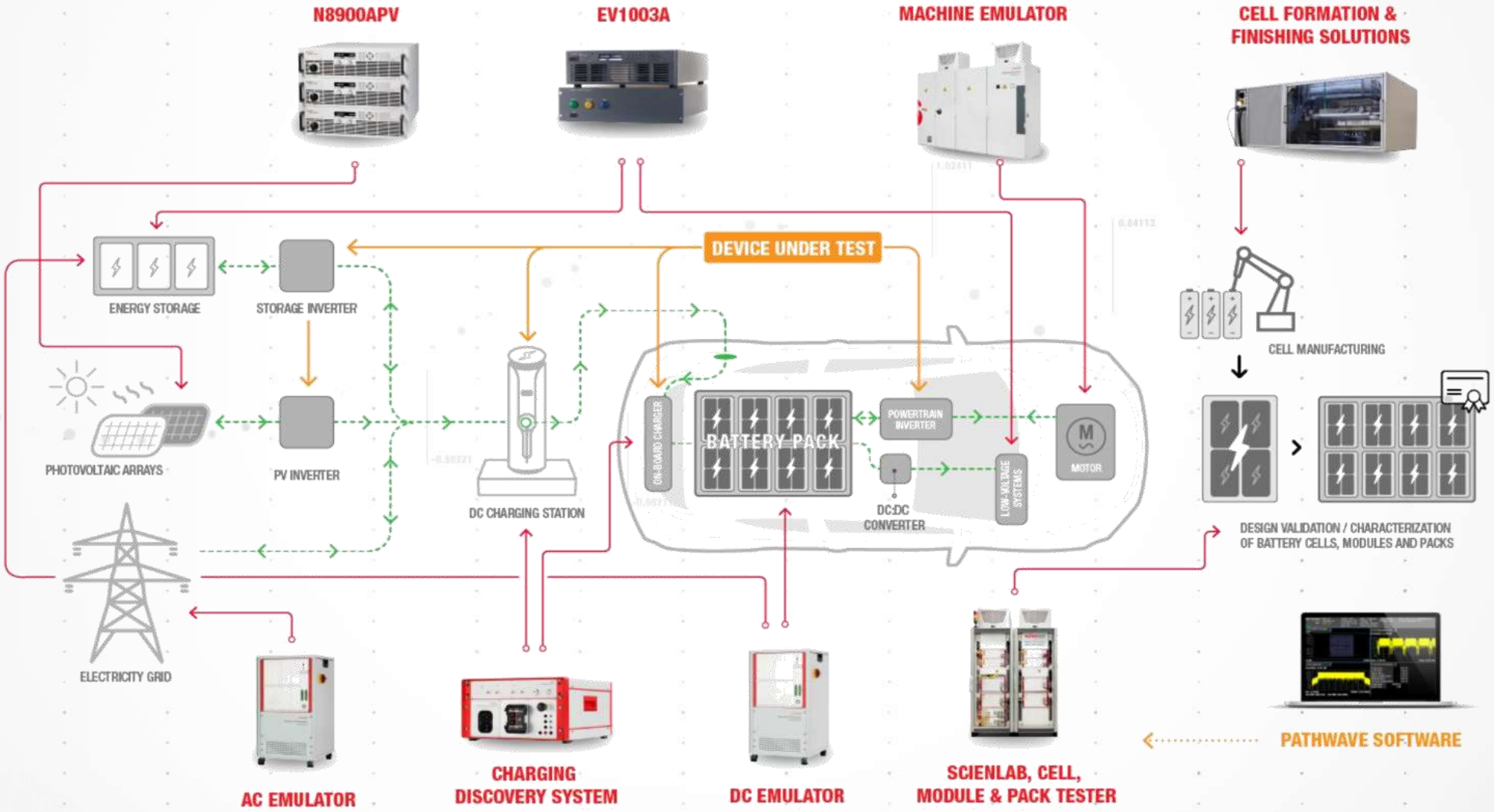
- LCOE will come down
- New Cellular Grid Structure needed
- Efficient Inverters

Charging Infrastructure needs to be build up broadly

- Standards to be established
- Interoperability needs to be ensured

Energy and Power Solutions

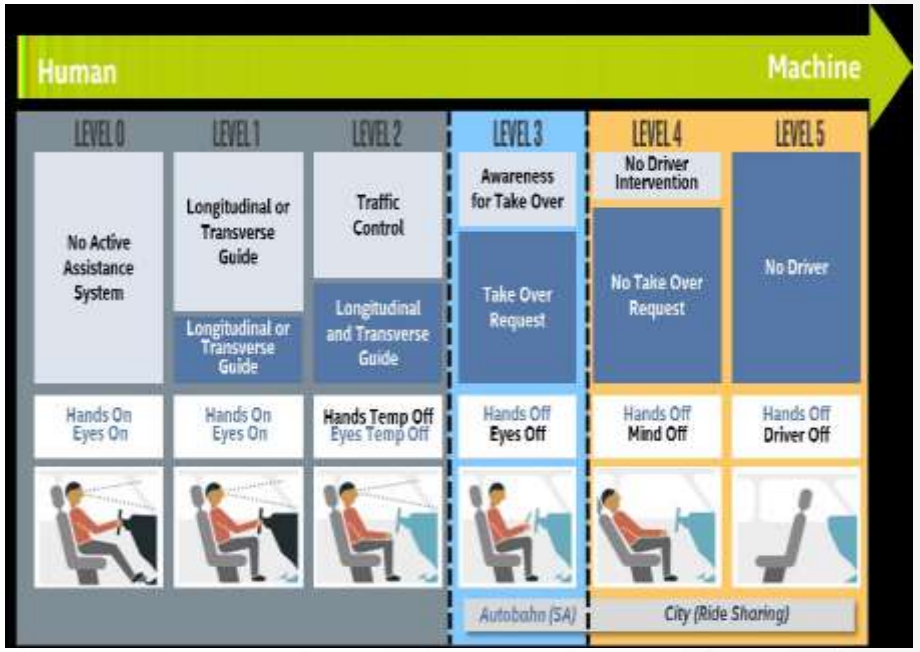
FROM THE GRID TO THE ROAD



Autonomous Driving

SELF-DRIVING CARS WILL HAPPEN SOONER THAN EXPECTED

- ADAS & Autonomous driving will need multiple sensors, much higher computing power and artificial intelligence
- Infrastructure will need to be established to support real-time information flow (e.g. maps)
- Several projects are executed all over the world, e.g. China, Korea, USA/California, Germany etc. in order to develop and test in controlled and save environment as well as on regular roads.
- Fully autonomous cars are only a few years away. Technological, regulatory and consumer adoption hurdles still remain, but progress is being made.



	L0	L1	L2	L3	L4 / L5
Radar	n/a	0-3	0-5	3-6	6-20
Cameras	n/a	0-1	3-5	3-6	3-6
Ultrasonic	n/a	4-8	8-12	radar	radar
Secure V2X	no	no	some	yes	yes

Autonomous Vehicles

INNOVATIONS FOR ALL ADVANCED DRIVER SYSTEMS

Sensors are the enabling technology

- Short and long-range Radar
- Lidar for object recognition
- Camera Systems

System Integration

- Sensor Fusion
- AI system training for decision making

V2X technologies

- Sensor reach extension with Car-to-Car and Car-to-Infrastructure Technologies
- Realtime Map Download

C-V2X Test System

C-V2X PROTOCOL, FUNCTIONAL, RF TEST AND ITS STACK

Trigger

10MHz

GNSS

Timing
Synchronisation
Position
Trajectory (dynamic)

ITS Scenario Generator & Monitoring

Custom Scenarios
Day 1 Use Cases

Multiple PC5 Schedulers
PSSS/SSSS (Synch)
PSBCH (Broadcast)
PSCCH (Control SCI)
PSSCH (Data)
DMRS

Uu

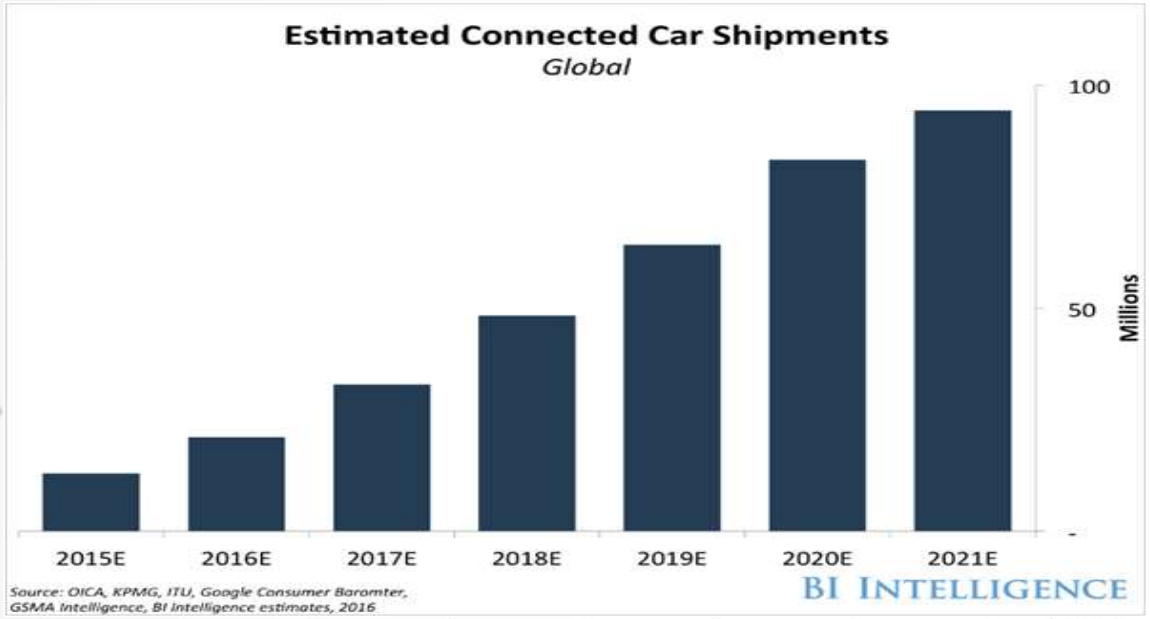
PC5

SIB 21
RRC (Dedicated Msgs)
DCI 5A
UL SPS (Multiple)

Serial conn. (AT commands)

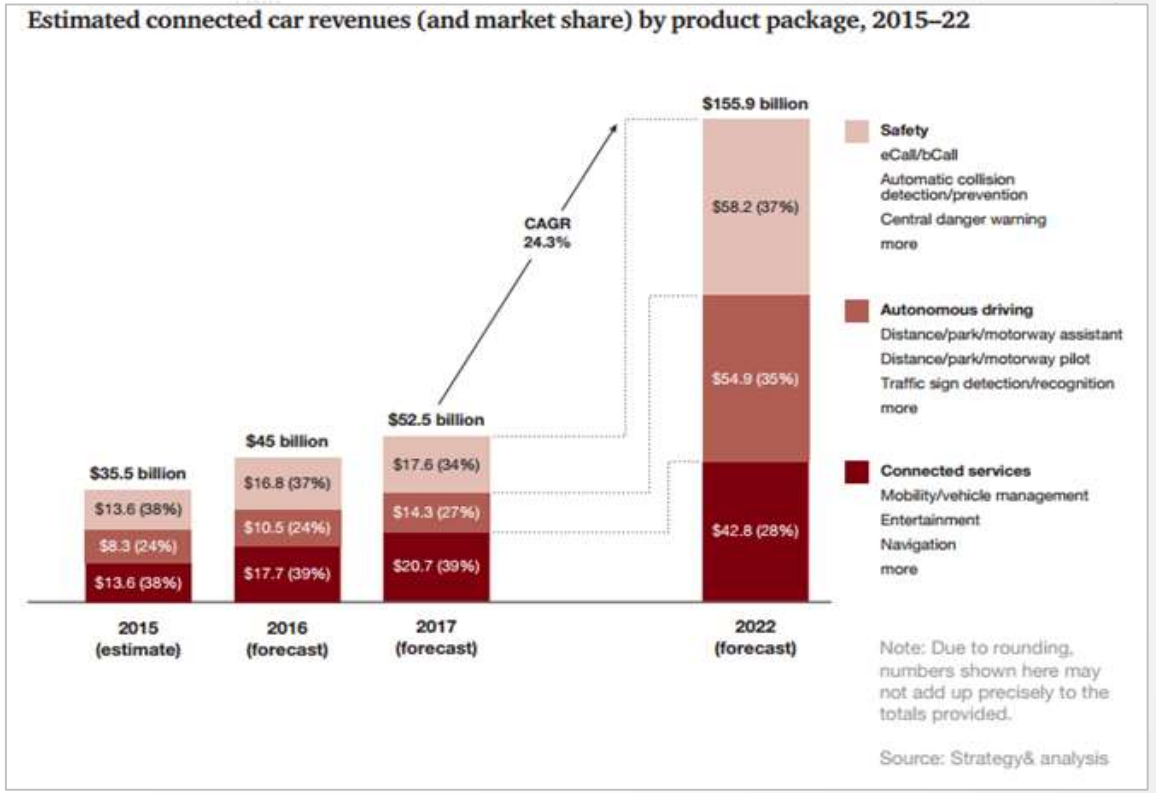
Connected Cars Will Become An End Node In IOT

MORE THAN 380M CONNECTED CARS BY 2021



- The connected car is already on the market and generating significant revenue for car makers and tech companies as consumers adapt fast
- The market position of the connected car today is similar to where the smartphone was in 2010

- Automakers are connecting the vehicles they sell, because the connectivity offers new business opportunities



Connected Cars Enable New Services

COMMERCIALIZING CONNECTED MOBILITY

Quality of Service in a dynamic environment

- Drive Test needed
- Managing wireless technology from 2G to 5G

New Functions <> New Business

- E-Call
- Telematics & Maintenance
- Enhanced e-commerce platforms

Cybersecurity becomes mission critical

- Architectural solution needed
- Penetration Testing required

Industry Solution Focus

OUR ENGAGEMENT MODEL IS PARTNERSHIP

Workflow

Maximum Contribution	Help customers optimize workflow processes with Keysight tools. Become part of automation flow

Solutions

Higher Value	Complete end-to-end answers to a customer problem Software , Fixturing, HW, Expertise

Applications

One Supplier	Multiple Keysight products based on fit to specific customer applications. One Stop Shopping Value

Products

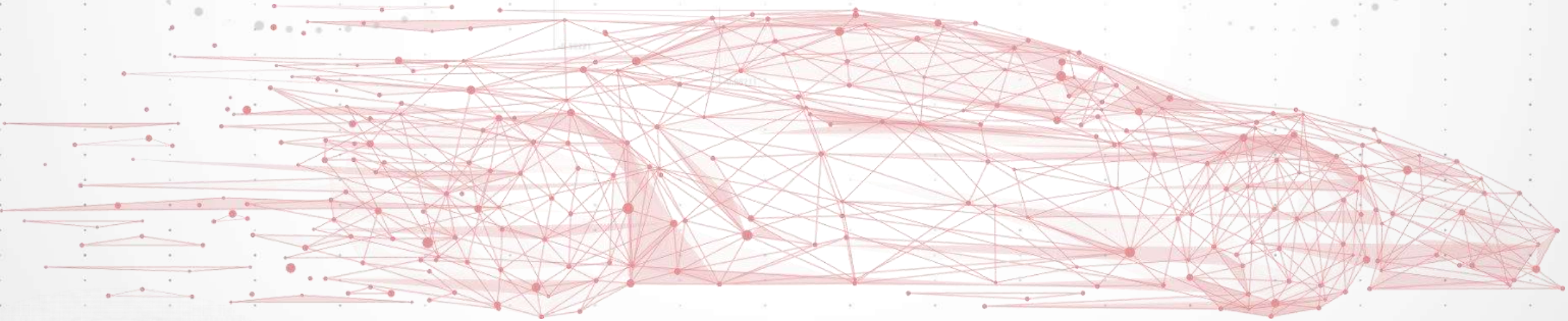
Single Product	Single products based on best-in-class attributes.

Summary

Fundamental disruptive innovations in automotive will create a new mobility ecosystem

It is our chance to create together a connected and better world

Let’s partner to master the technological challenges and bring your innovations to market first



KEYSIGHT WORLD 2019