Autonomous Driving – The changes to come

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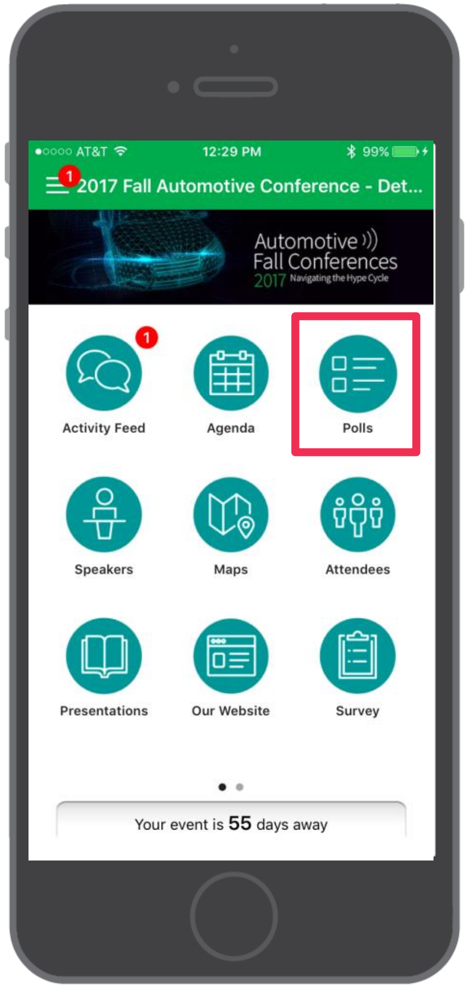
POLL QUESTION!



How to you view the impact of autonomous driving technology on your business?

- ☐ Positive (embracing new opportunities)
- ☐ Neutral
- ☐ Negative (threat to Business)

Access this poll on the event app!

Autonomous driving technology impacting the market today

Investment frequency in auto tech in 2017 increased to 170 deals, up 45% over 2016

Investment funding in auto tech in 2017 increased to $4bn, up 180% over 2016

Auto Tech investment activity related to:

Autonomous driving software	Connected vehicle & data
Automotive cybersecurity	V2V communication
Driver safety tools	Fleet telematics

Source: CB Insights, JNovember 2017

Transportation & mobility attracts big money and names

Honda part of Grab $750M funding round	TomTom acquires Autonomos	BMW i Ventures increases fund size 5X	Intel Capital to invest $250M over two years
Argo AI receives $1B from Ford	Gett follows VW's $300M with $100M	Peloton wins $5M DOE grant	Zoox hits $1.55B valuation
Volvo Cars plans IPO with $532M funding	Ola plans $600M funding round	LeEco secures $600M loan	Nauto raises $9M

Agenda

Where are we now?

Changing architecture

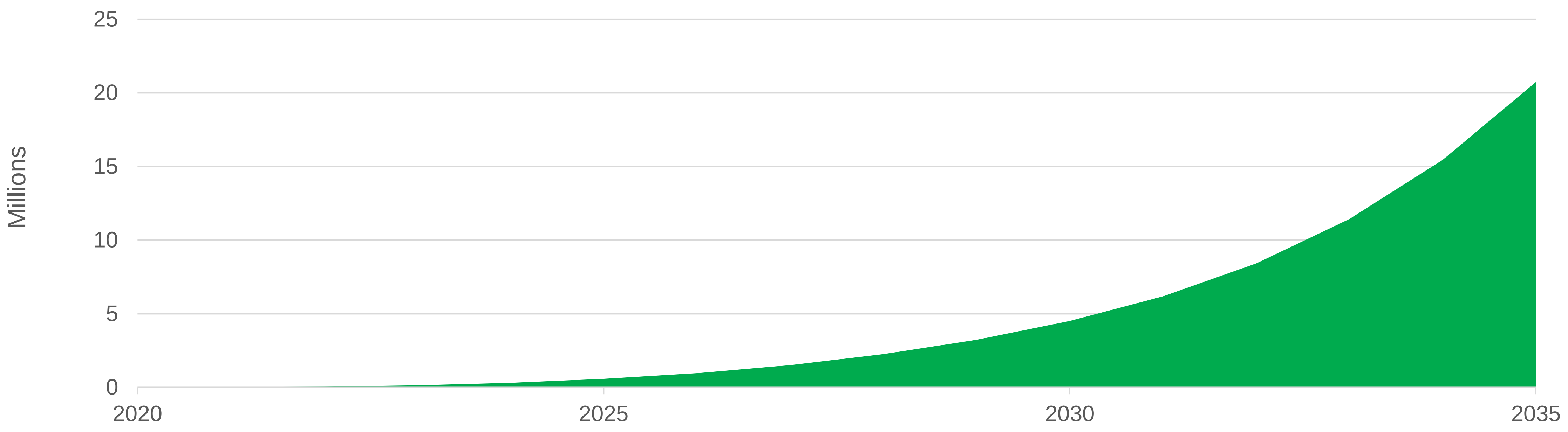
Supply base impact

Mobility impact

Autonomous vehicle sales growth accelerates post-2025

Maturity of tech, manufacturing, regulation and mobility service business models converge

Global Autonomous Vehicle Sales Forecast



Source: IHS Markit

Mega-themes

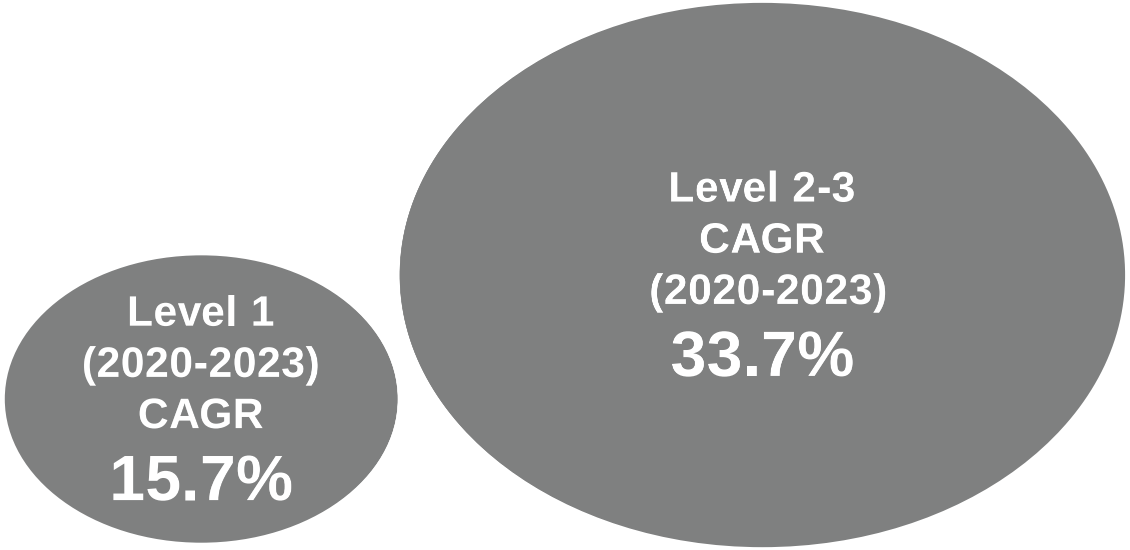
Drivers assist upgrading into L2-3 automation

Development of L4-5 Autonomy

Regulations shaping markets

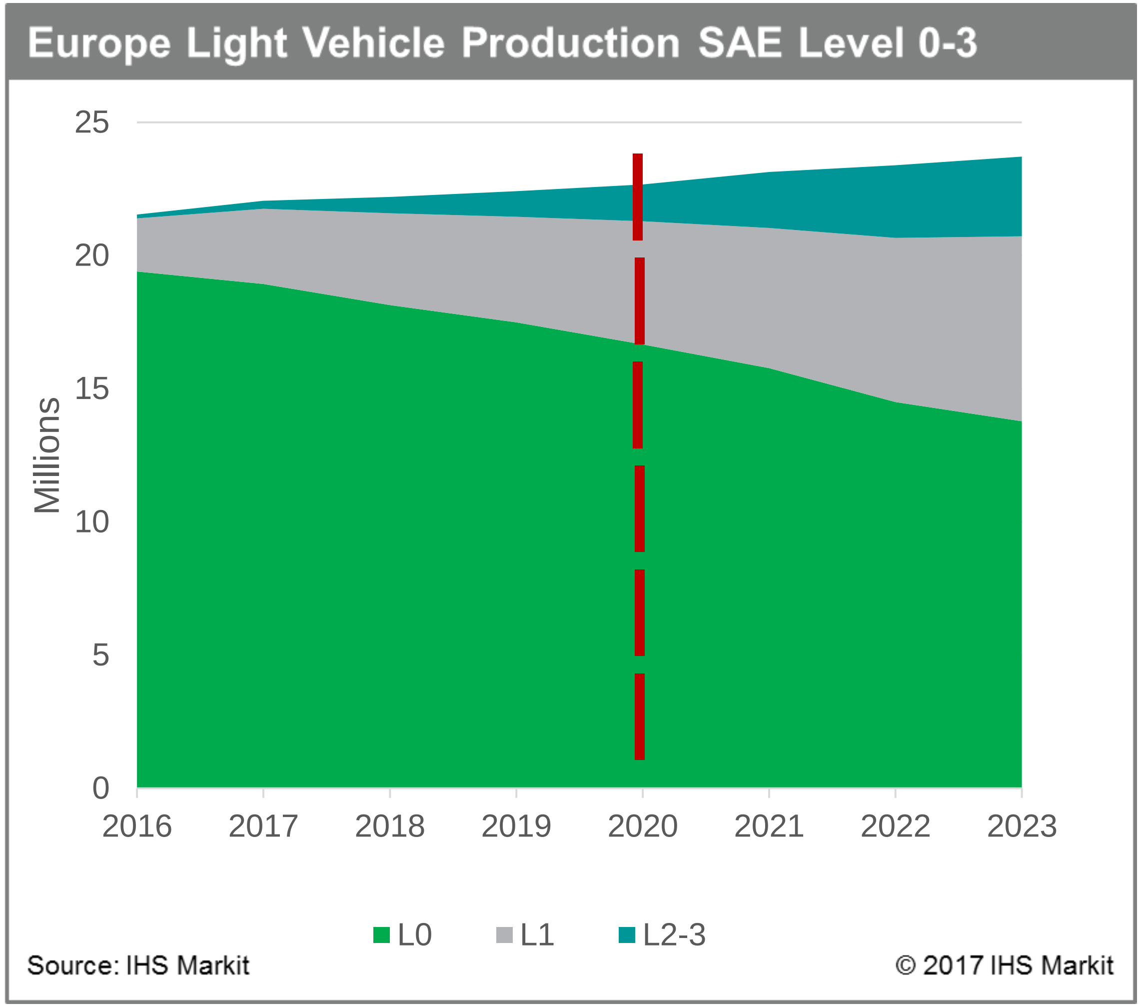
Balancing autonomous and ADAS

Level 2-3 systems to lead growth after 2020



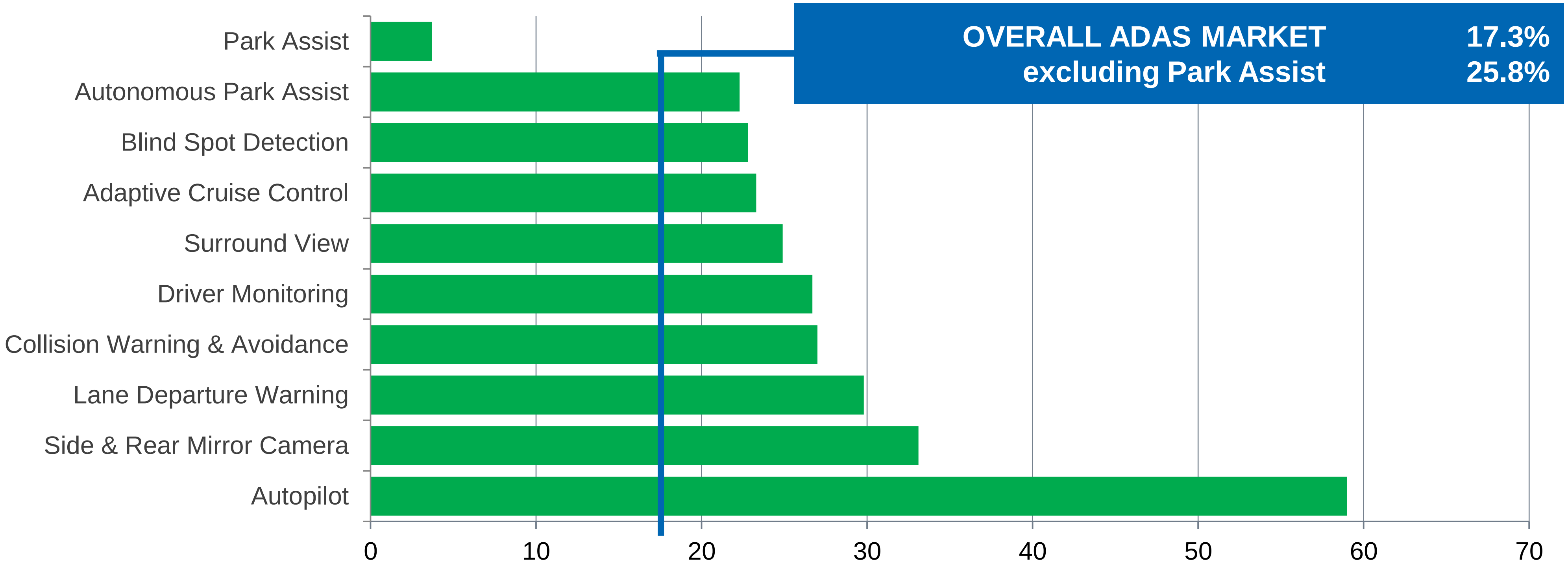
L1 Adaptive cruise control, semi-automatic parking (steering only)

L2–3: Autopilot, automated driving systems, fully-automatic parking, remote parking



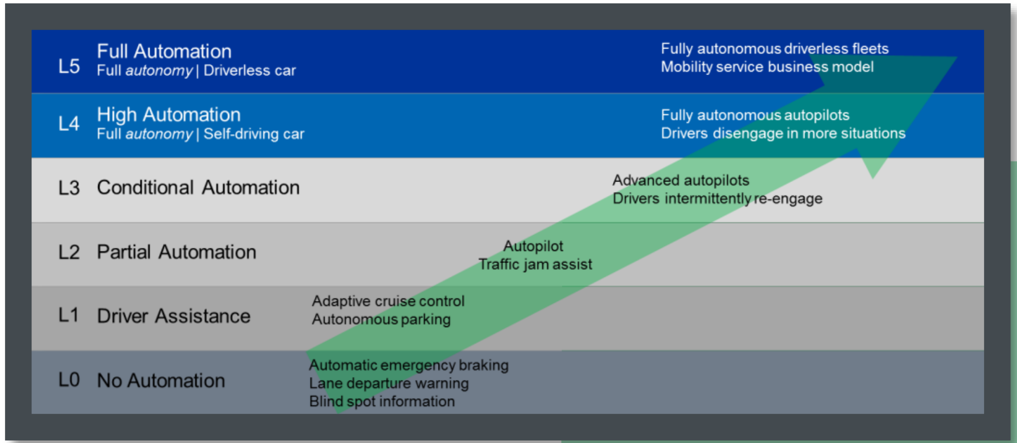
Advanced Driver Assist Systems growing rapidly

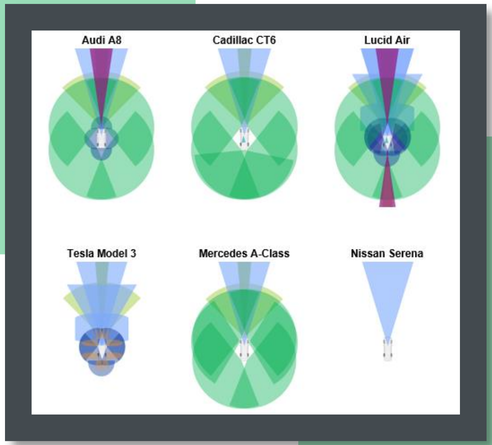
ADAS Unit Growth – CAGR 2017-2023

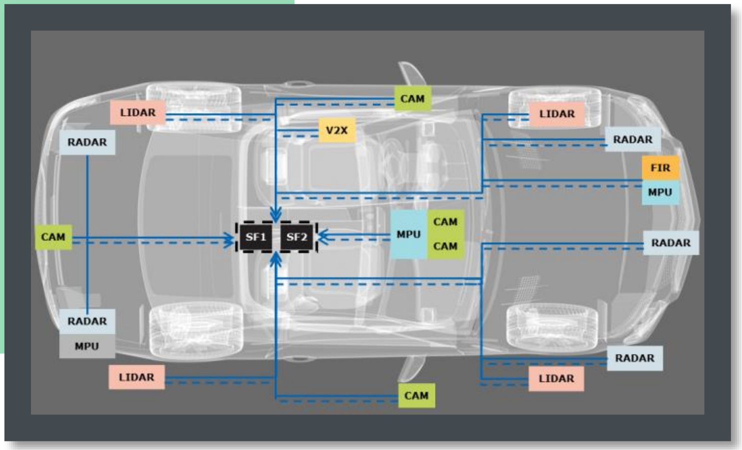


Source: IHS Markit

As automation and complexity increase, vehicle architectures must evolve







ADAS domain controllers: Distributed versus central processing

Key considerations

- Power Consumption
- Redundancy
- Cost
- Efficient Engineering

Assuming a need for centralized processing:

- Premium – L3-L5, full-featured, most upgradeable
  - Full redundancy: ADAS ECU, cabling, software, AI
  - Higher cost and power consumption
  - Key suppliers: NVIDIA

- Economy – L0-L3, cost-aware, limited upgradability
  - Single ADAS ECU fail-safes to distributed processing in sensors and downgrades automated driving functionality
  - Lower cost aimed at supporting NCAP requirements and lower levels of automated driving
  - Key suppliers: Delphi, ZF, Autoliv & other Tier 1s

Source: IHS Markit
Autonomous Driving Service

Alliances helping push beyond ADAS application silos

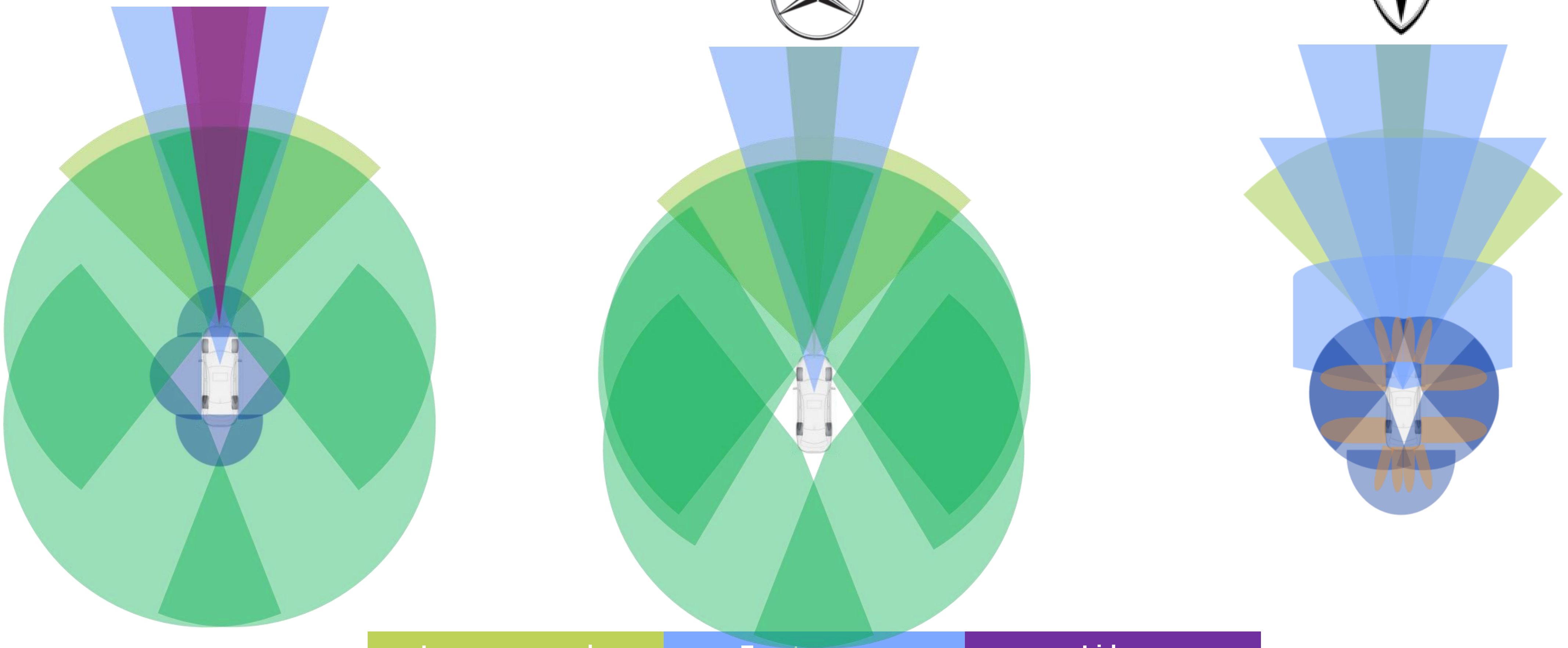
Cooperation is necessary because of complexity of autonomous driving technology

Auto/mobility partnerships	Lyft: Ford, GM, Didi, JLR	Uber: Volvo, Toyota, Mercedes-Benz	Softbank: Didi, Grab, Ola, 99, Nauto, NVIDIA
Industry Alliances	Intel-Mobileye: BMW, FCA | Delphi, Continental	NVIDIA: Mercedes-Benz, Audi, Toyota | ZF, Bosch	Waymo: FCA, Honda, Lyft, Intel

New models, New strategies

Automated driving enabled by many sensor configurations

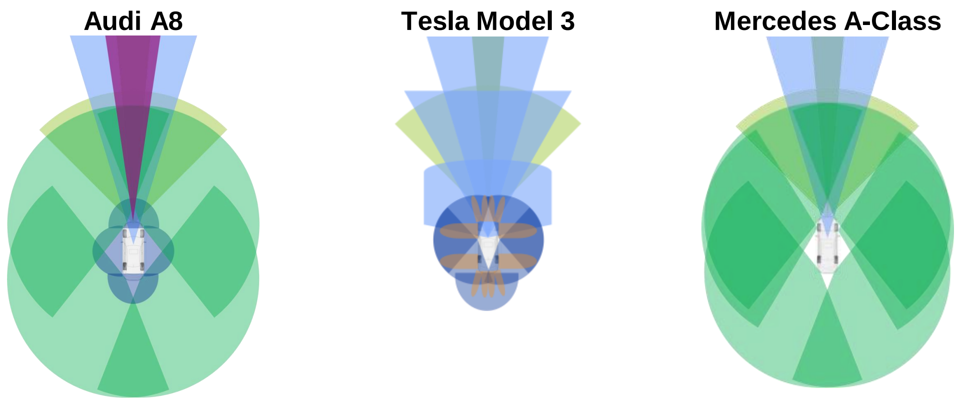
Audi A8 | **Mercedes A-Class** | **Tesla Model 3**



Long-range radar	Front camera	Lidar
Short-range radar	Driver camera	Surround camera

Source: IHS Markit
Autonomous Driving Service

Market competition will force changes to tech strategy



Many sensor configurations and architectures will co-exist within a brand for the foreseeable future:

- Complicating platform sharing efficiencies and supply chain management
- Leading to unique demands from automakers to support different use-cases and end markets

Source: IHS Markit
Autonomous Driving Service

New competition not just focused on software

Despite an overall shift in value from hardware to software the Lidar market is forecast to grow at a CAGR of 80% making sensor hardware attractive.

Self-Driving Car Sensor Startup , Quanergy Raises $90Million

Fortune

SoftBank, Samsung, Join Investment in LiDAR Startup

CTECH

GM Acquires LiDAR Startup Strobe to advance its own self-driving car plans

Silicon ANGLE

"Canada, a leader in AI, is now taking aim at Autonomous vehicles. The nations main contender is LeddarTech

The Times

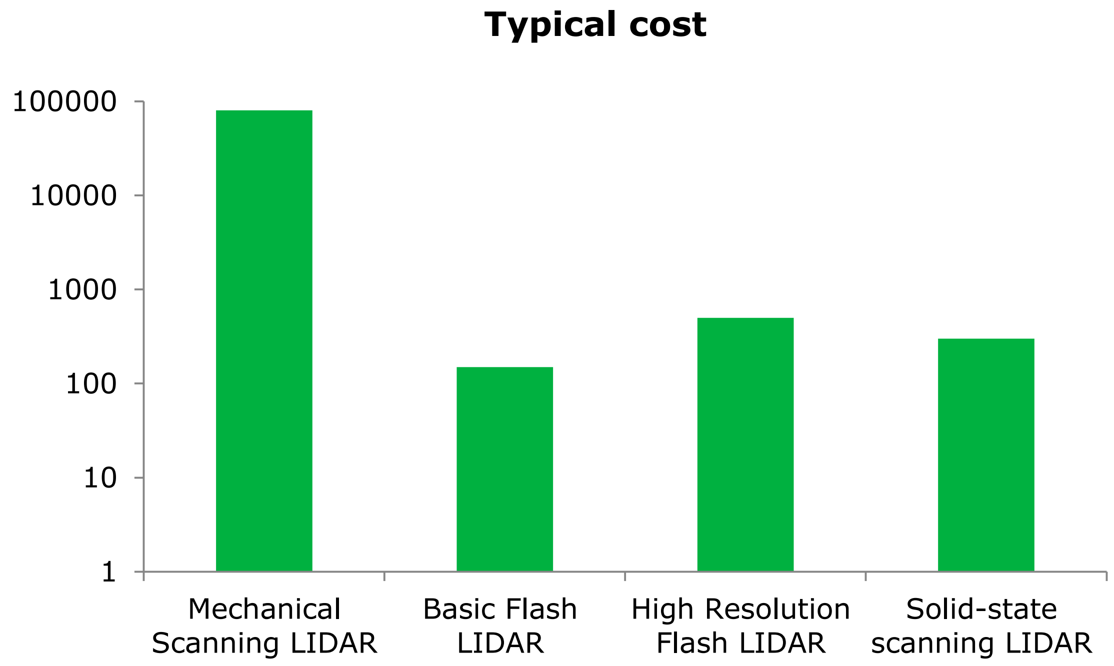
More than $336m Raised by Israeli companies in September.

Innoviz and Storedot

Israel 21c

Lidar fitment to accelerate post 2021

- Solid Sate technology driving down the cost.
- Range and resolution of sensors still improving.
- Targeted for next Gen model fitment.



New capabilities are needed to enable autonomy

Automakers & suppliers gaining expertise via acquisition, partnership and internal development

Sensing

Computing

Cloud Connectivity

User Experience

Driver Software

Maps

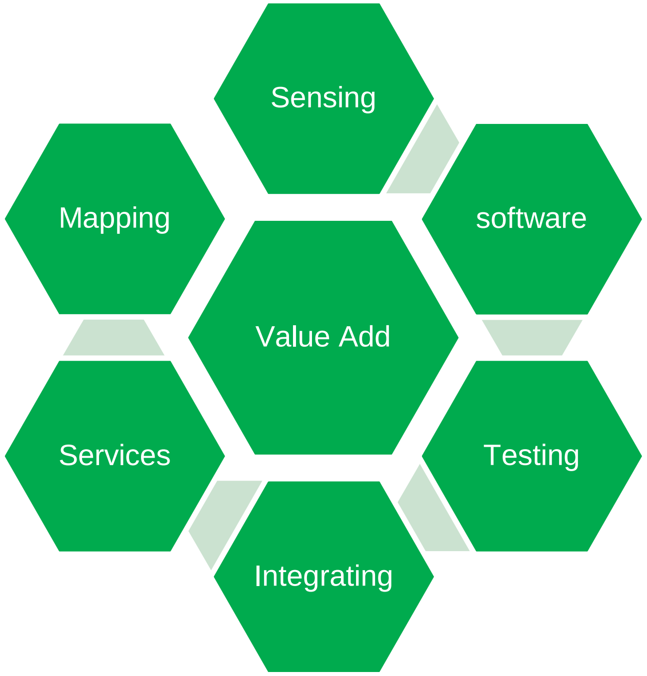
Artificial Intelligence

Service Business Model

Auto Expertise

Tech Expertise

The supplier response: anticipating the shift



Acquisition
- Delphi to acquire NuTonomy
- Continetal's acquisition of Hi-Res 3D flash LiDAR business from Advanced Scientific concepts

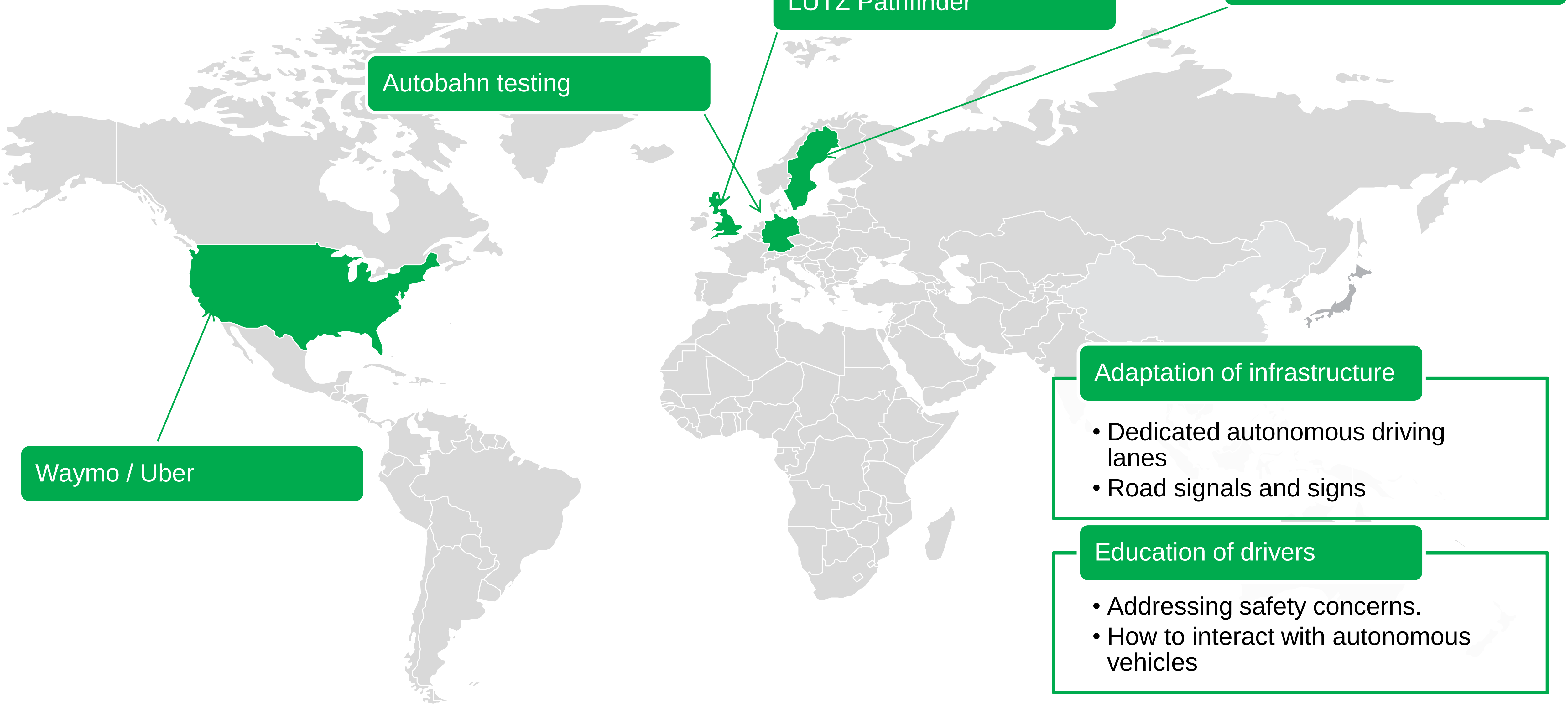
Partnership's and Testing
- Autoliv partnership with Volvo
- Software partnership Bosch- SAP, Software AG, IBM
- Bosch, ZF, Autoliv – Nvidia

Investment
- Delphi Investment in Innoviz
- Continental investment in EasyMile

Integration
- ZF system integration business
- Bosch System integration

Innovation
- Bosch $1.1 billion new facility to produce semiconductors.

Testing and pilot schemes



Adaptation of infrastructure

- Dedicated autonomous driving lanes
- Road signals and signs

Education of drivers

- Addressing safety concerns.
- How to interact with autonomous vehicles

Regulation vital and malleable

Regulatory activity is already influential, but it becomes one of the most important market forces for ADAS

NCAP	Traffic Law	Standards and guidance ISO 26262 + ASIL	Sharing economy
Euro NCAP continues to move forward on new AEB features Little-to-no activity from other countries	consultation period designed to suggest changes to motor insurance rules and the highway code. This is aimed at allowing Lv4-5 autonomous vehicles to be on the roads by 2020.	New automated vehicle guidelines expected in US and Europe Steady progress on cybersecurity and driver distraction guidance	Open question everywhere today Even China allowed ride-hailing services in legal grey zone Regulation likely to be defined by the current market

Guidance will shape the future of automotive technology, regulatory decisions will affect how the sharing economy evolves

In Summary….

Continued investment

Leading to increased competition and cooperation. Market pushing sensor advances, artificial intelligence, innovative interiors and platform development towards public deployment

Growing ecosystem

A period of transformation, cooperation vital. New frontier of integration.

Testing, Regulation and mobility

Key factors influencing the rate of introduction of autonomous driving technology. Testing a perfect partnership facilitator.