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AUTOMOTIVE

Autonomous driving: The short-term impact

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Aaron Dale, Senior Analyst
+441933408038

Aaron.Dale@ihsmarkit.com

Agenda

Where are we now?

Enabling technologies

Component pricing

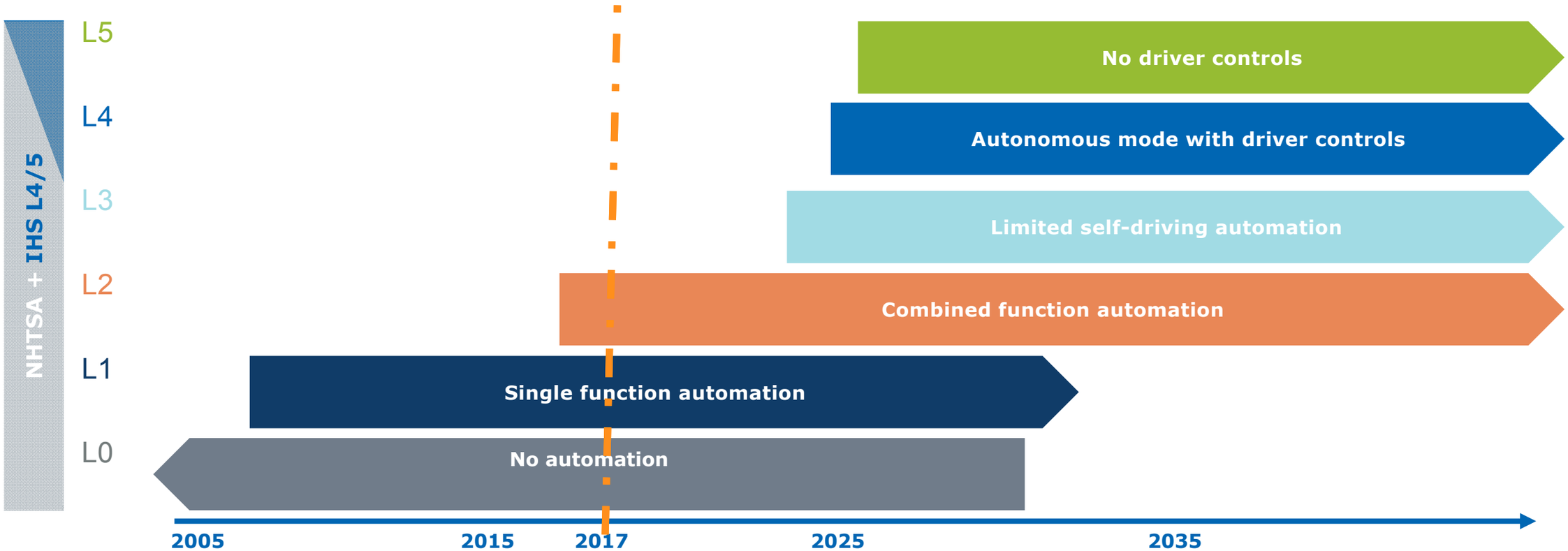
Market dynamics

2017?

Q&A

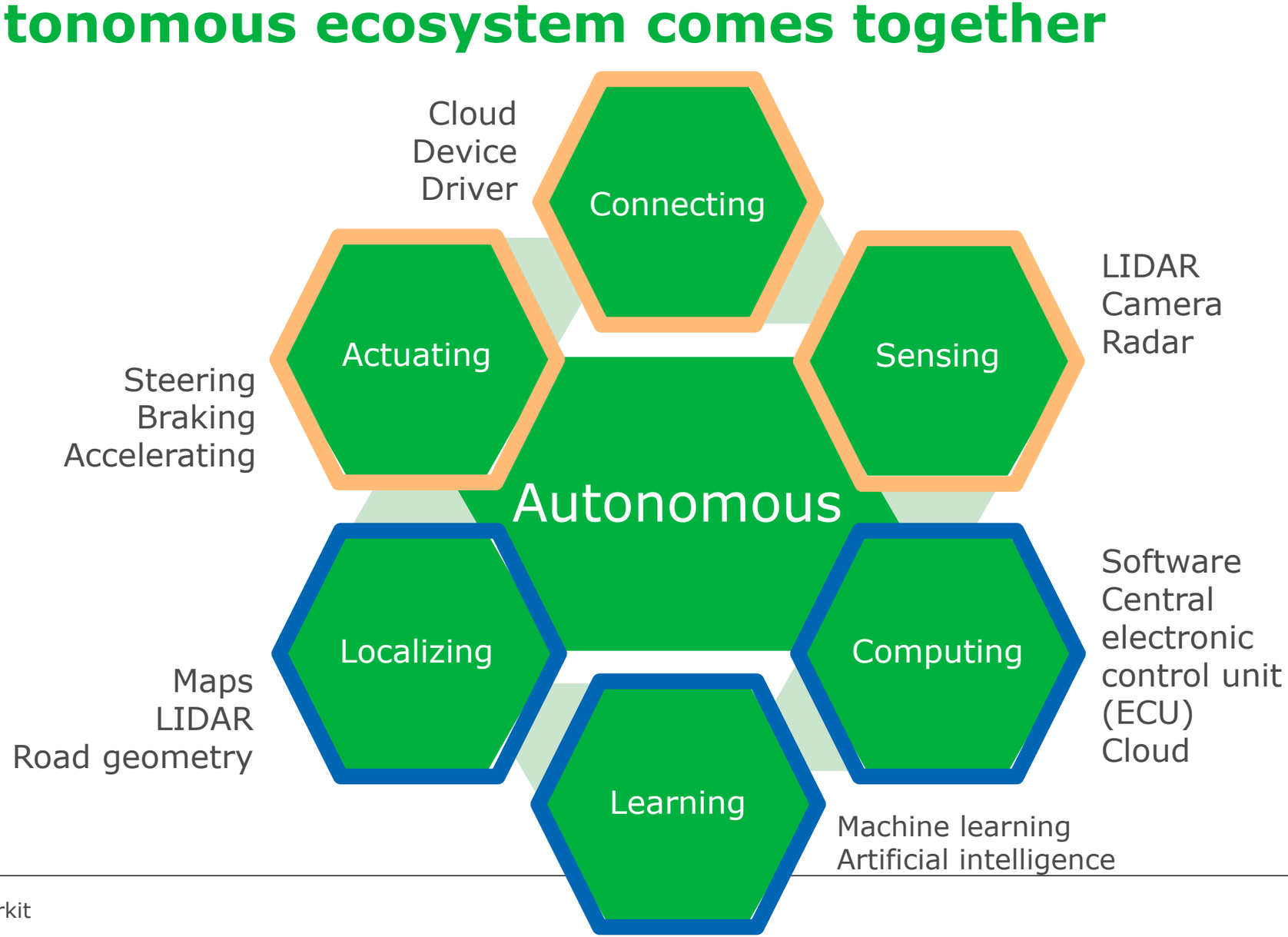
The big picture

So where are we now?

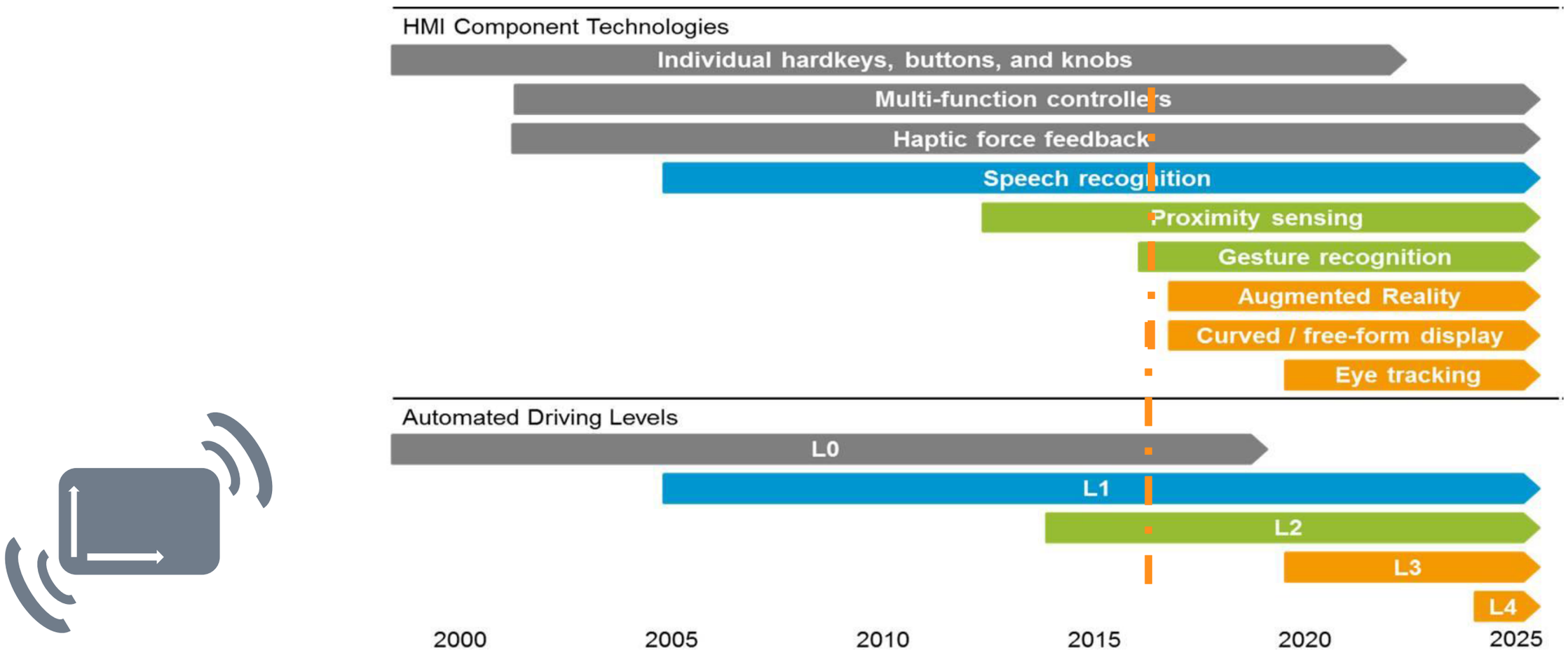


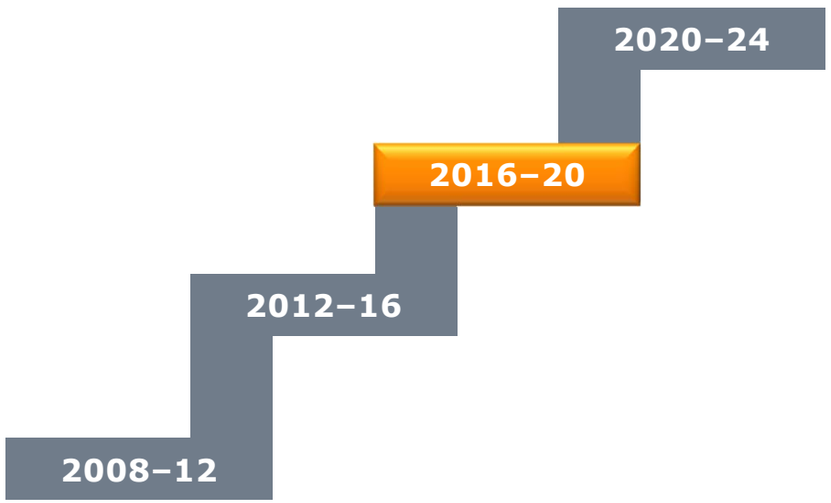
Enabling technologies

The autonomous ecosystem comes together



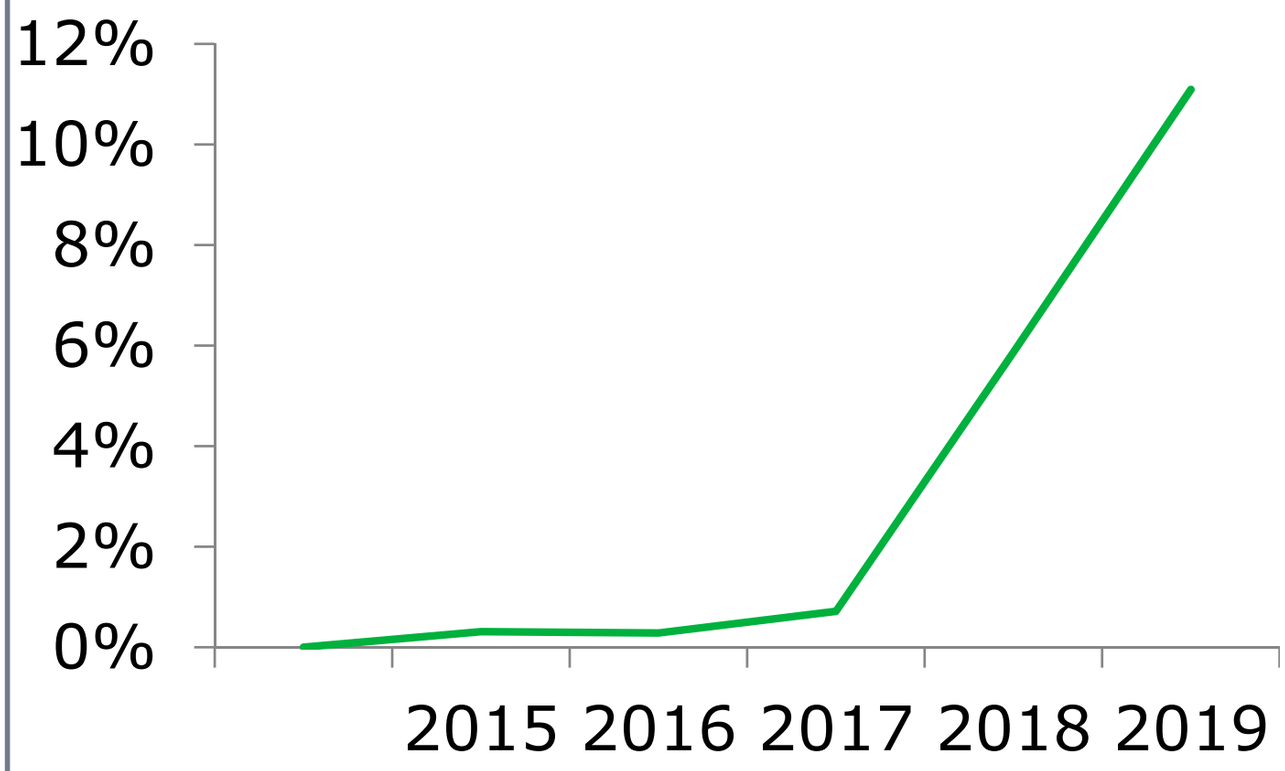
Developments in autonomy to shape user interface





Human-centric inputs	Display applications	Display technologies
➢ Speech recognition	➢ Rearview e-Mirrors	➢ Curved displays
➢ Gesture recognition	➢ Side-view e-Mirrors	➢ AMOLED displays
➢ Driver monitoring	➢ HVAC, passenger, door, etc.	➢ Augmented reality head-up display

Facial monitoring world fitment rate



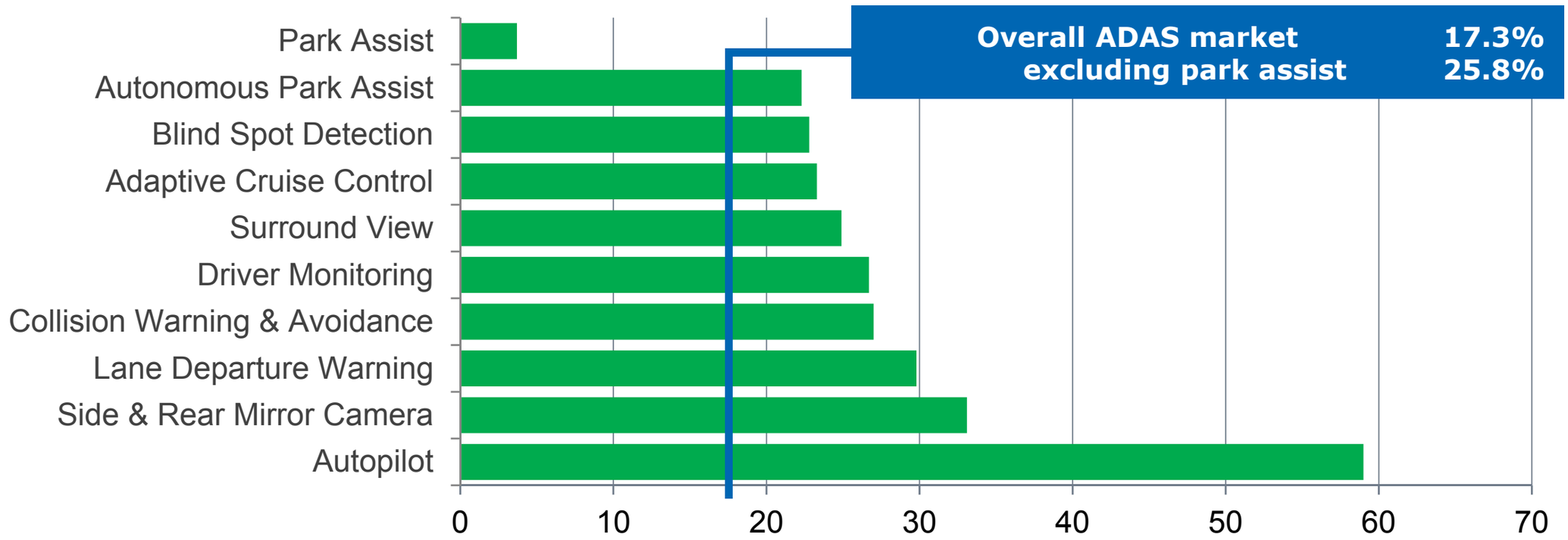
Source: IHS Markit

Assessing drivers' mental states, cognitive loads, and attention levels will become increasingly important

Regionally, Japan is forecast to see the highest fitment rates of facial monitoring, followed by North America

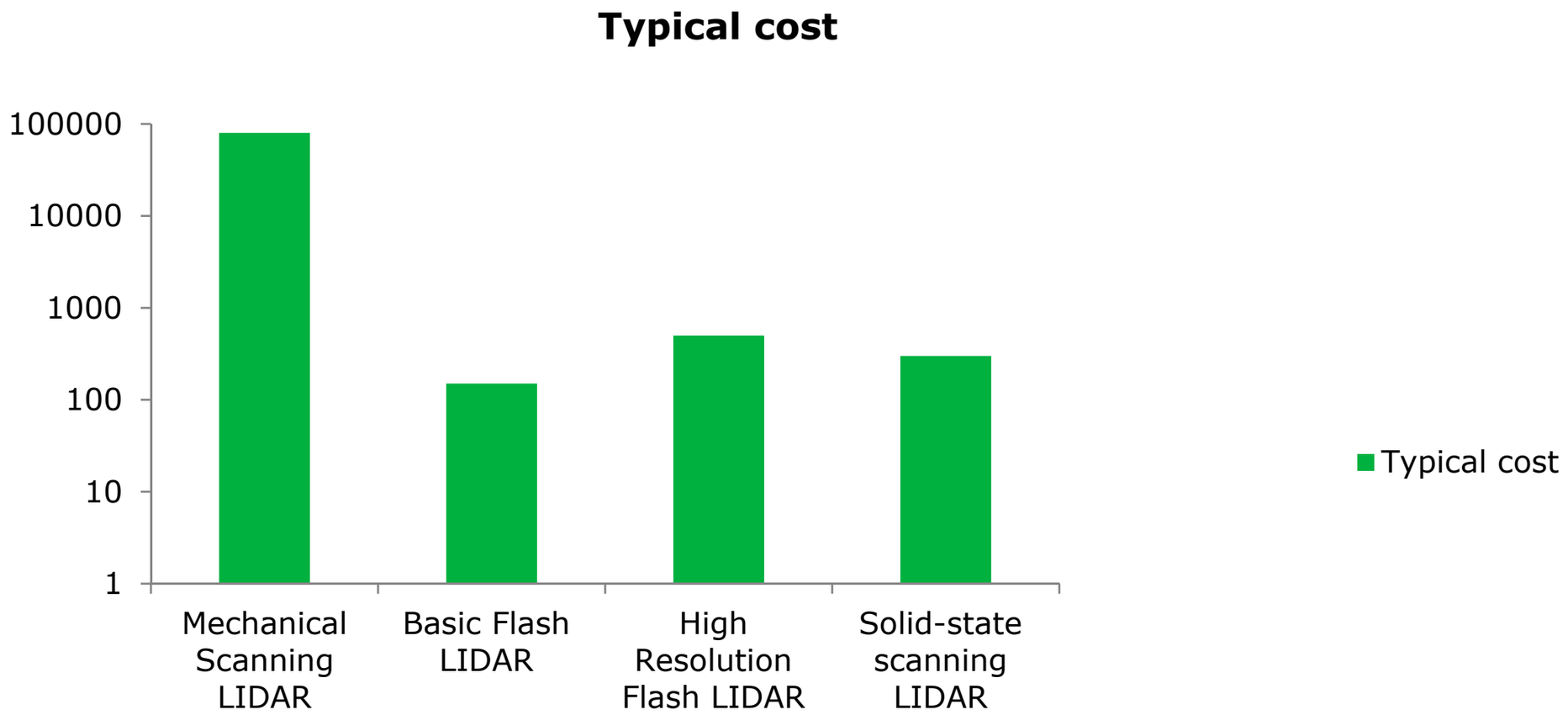
Advanced driver assistance systems (ADAS) growing rapidly

ADAS unit growth: CAGR 2017–22



Source: IHS Markit

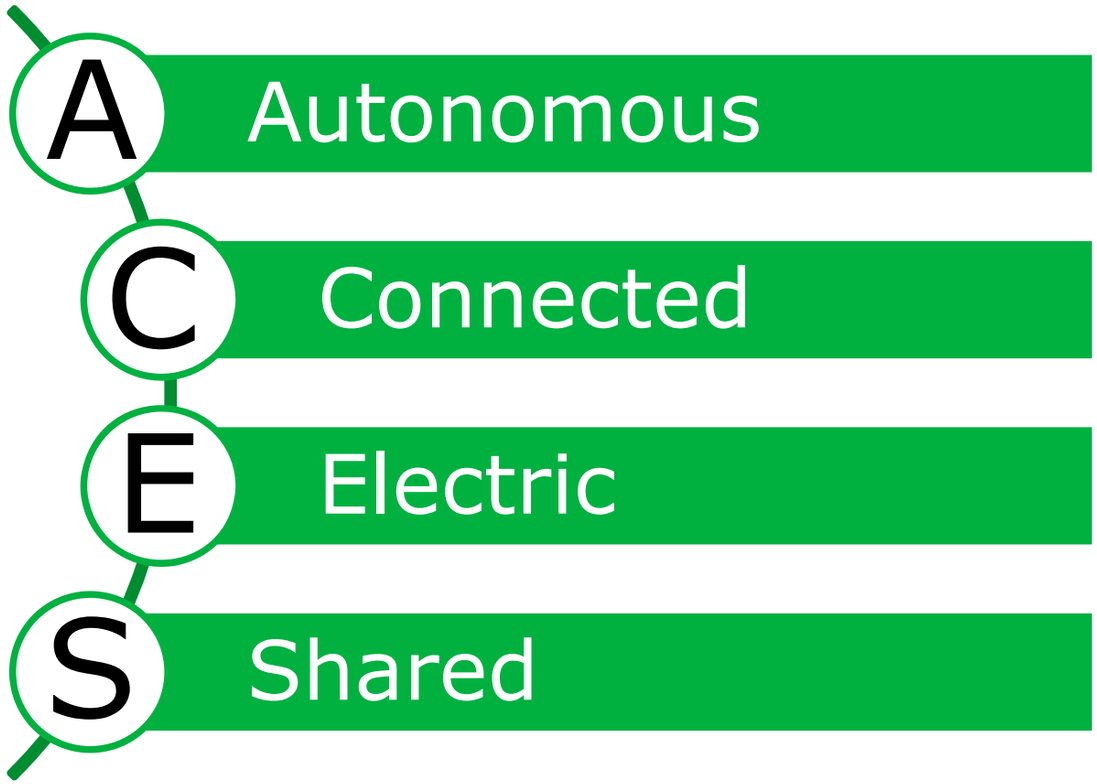
High-performance solid-state LIDARs: A key to system cost reduction



Wider change

Mobility manifesting

- Automaker subbrands become the home for new technologies
  - BMW **i**
  - Mercedes-Benz **EQ**
  - Volkswagen **ID** concept vehicles
- Companies establish stand-alone mobility units
  - Google **Waymo**
  - General Motors **Maven**
  - BMW **ReachNow**
  - Volkswagen **Moia**
  - Daimler **car2go**
  - PSA Group **Free2Move**



Testing and pilot schemes

Location	Initiated by
United Kingdom–Milton Keynes	Government
United Kingdom–London "Gateway project"	Government
United States–Pittsburgh	Uber
Sweden–Gothenburg	Volvo
Germany–Autobahn	BMW, Audi, Mercedes-Benz

Adaptation of infrastructure

- Dedicated autonomous driving lanes
- Road signals and signs

Education of drivers

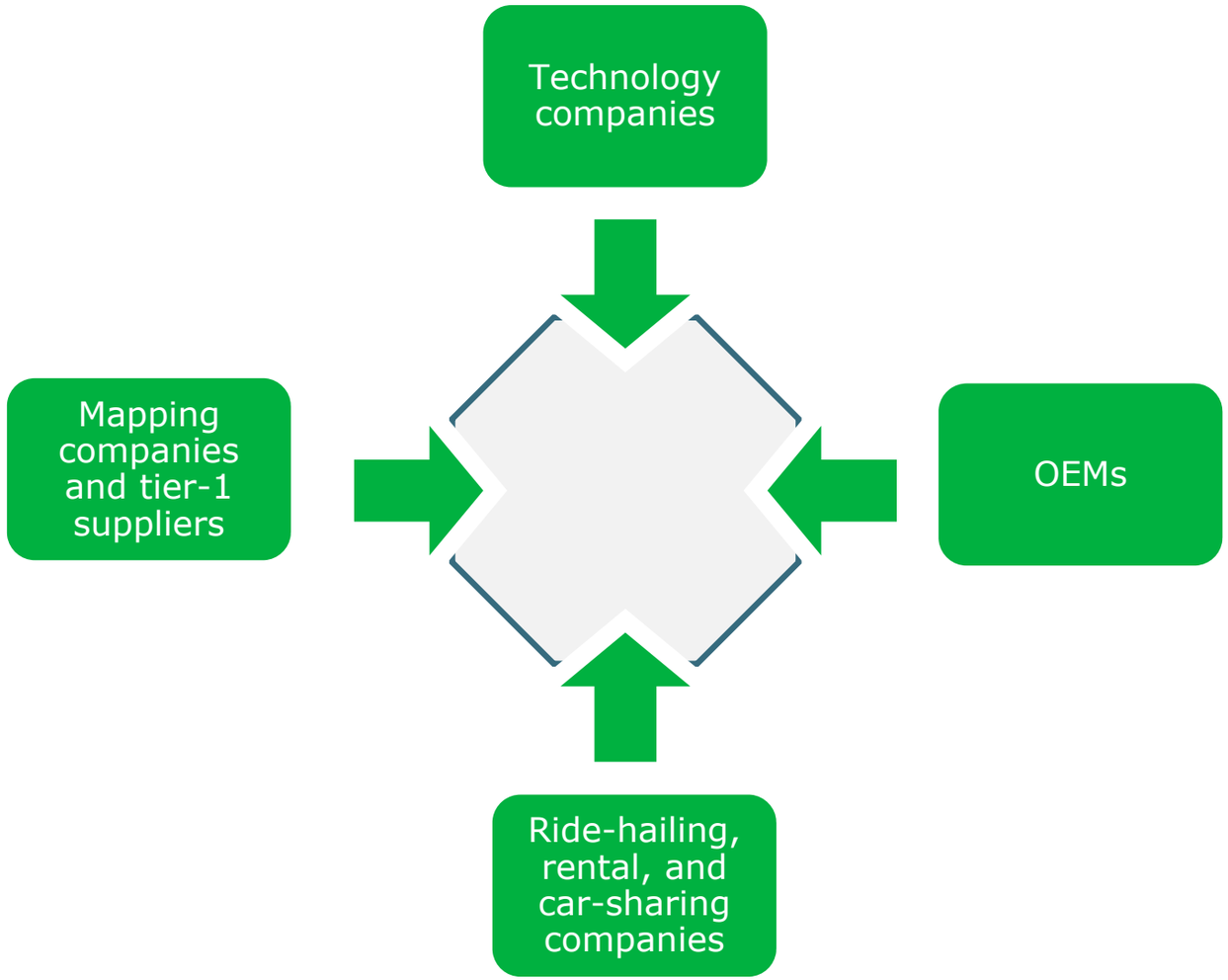
- Addressing safety concerns
- How to interact with autonomous vehicles

Forms of testing

	Key information	Comment
Ride-hailing	▸ State-sponsored pilots ▸ Private research and development and testing	▸ Singapore (Delphi, NuTonomy) ▸ Pittsburgh (Uber, Delphi)
Special routes	▸ Simple and fixed city trips ▸ Campus fixed trips ▸ Airport shuttle (two-year test) ▸ Between train stations	▸ Las Vegas–January 2017 (Navya) ▸ Santa Clara University (Auro) ▸ New Zealand (Navya) ▸ Paris (EasyMile)
Self driving–only zones	▸ Small city section at first ▸ Urban mega-centers	▸ Campus, military base, airport ▸ China, likely as low-emission zones
Low-speed driving	▸ Urban or closed communities	▸ To limit and avoid crashes
Route- or lane-specific	▸ Commuter routes ▸ High-occupancy vehicle lane for self-driving	▸ Replace current ride-sharing routes ▸ Seattle-Vancouver proposal

Market dynamics

Strategic partnerships



Recent strategic partnerships/acquisitions

- Uber and Volvo
- HERE—expanded consortium of ownership
- Autoliv/Volvo–Zenuity
- Nvidia/multiple OEMs
- Bosch/TomTom
- Intel/Mobileye

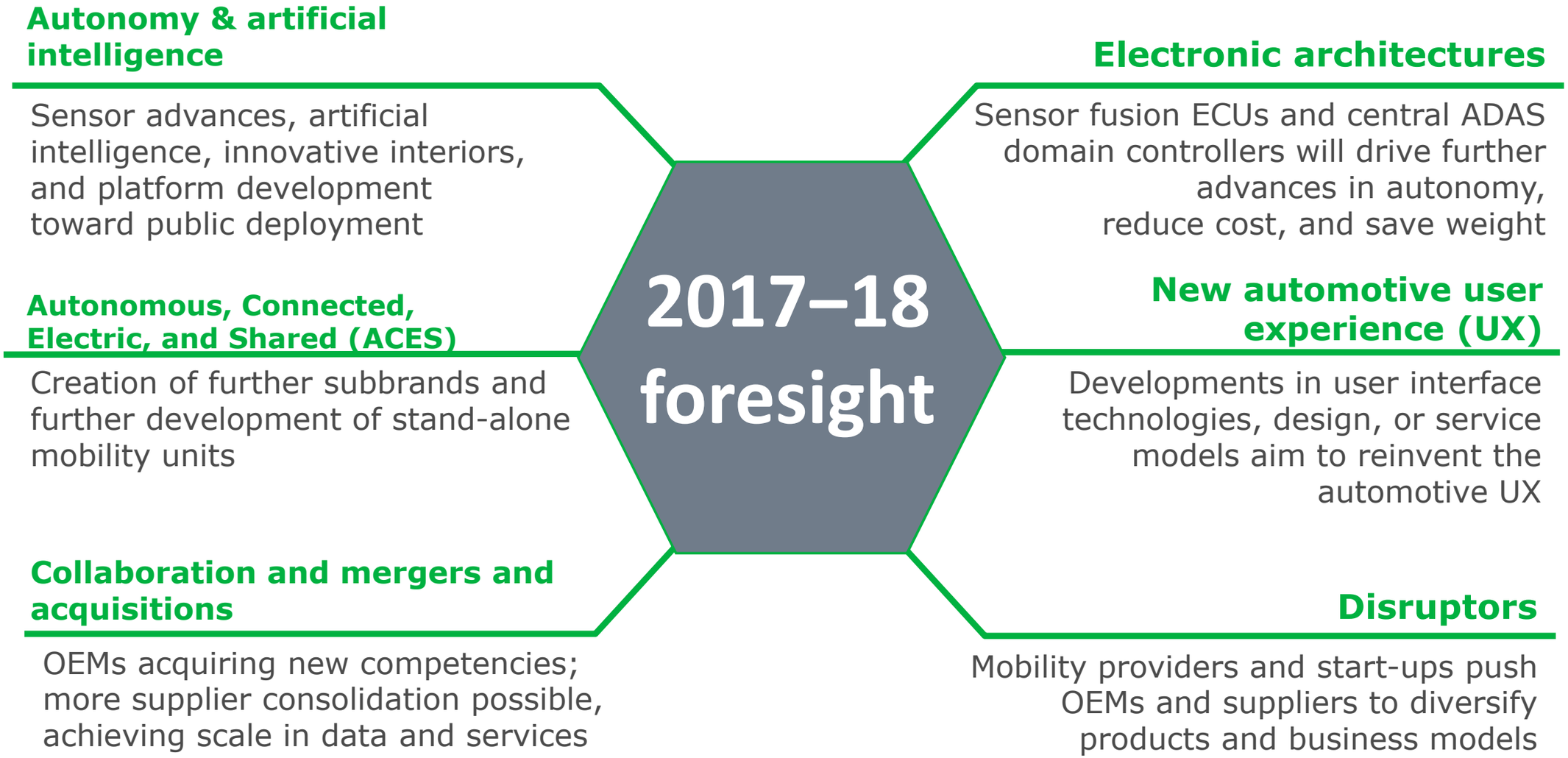
Regulations

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

New Car Assessment Program (NCAP)	Voluntary agreements	Standards and guidance	Sharing economy
US NCAP adding 7+ new ADAS in 2018 Euro NCAP continues to move forward on new automatic emergency braking (AEB) features Little-to-no activity from other countries	US commitment for standard AEB by 2022 Will effectively make AEB standard everywhere in a few years, with rare local model exceptions What is next?	ISO 26262 + Automotive Safety Integrity Level New automated vehicle guidelines expected in the United States Steady progress on cybersecurity and driver distraction guidance in the United States	Open question everywhere today Even China allowed ride-hailing services in legal gray 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

2017 automotive technology foresight



Thank you!

Aaron Dale
Senior Analyst | Automotive
3-5 Huxley Close | Wellingborough, UK | NN8 6AB
P: +44 1933 408 038
Aaron.dale@ihsmarkit.com