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AUT

Autonomous Car

#811

L4 Autonomous Vehicles

Are we there yet?

Automation is one of the biggest drivers of change within the mobility sector, promising to deliver safer, more efficient and more affordable movement of goods and people, but this major transformation also comes with significant risks and uncertainties. The purpose of this report is to give strategic and product planning teams within the mobility sector a grounded valuation of the 'What', 'When', 'Where' and 'How' of autonomous mobility:

- What are the most promising Level 4 segments?
- Where will autonomous vehicles be most widely deployed?
- When will sales of L4 autonomous vehicles reach inflection?
- How should companies position themselves within the eco-system?

This report explores the progress so far in deploying highly autonomous vehicles (L4) for commercial applications and the hurdles that still need to be overcome. The report outlines four major segments (Trucking, Last-mile delivery, public transport and Robotaxis), analysing the technical, regulatory, user acceptance and commercial factors that will determine how fast the transition to autonomous vehicles will be.

COVERAGE: GLOBAL | NA | CHINA | EUROPE

FREQUENCY: ANNUALLY | QUARTERLY | 1 ONE-OFF

PUBLICATION FORMAT: PDF | POWERPOINT | EXCEL | ONLINE

PAGES: 78

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Key questions answered

- What are the most promising Level 4 segments?
- When will sales of L4 autonomous vehicles reach inflection?
- Where will autonomous vehicles be most widely deployed?
- How should companies position themselves within the eco-system?

This research supports

- PRODUCT PLANNERS
- C-SUITE
- MARKETING
- ENGINEERS

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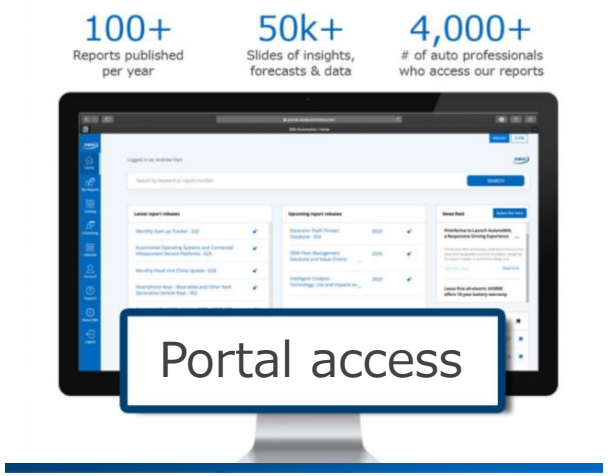

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December 2021

AUT811

L4 Autonomous Vehicles: Are we there yet?

Contents page

Introduction

Purpose of this report

Ever since humans began domesticating and riding horses around 3,500 BCE, we've grown accustomed to being in control of our own modes of transportation. Fast forward to more recent years, and as the aviation and rail sectors began automating parts of their journeys, the continued presence of airline pilots and train drivers served as a visible and comforting reminder that humans were still in control.

Humans are now being challenged to give up control. Automation is one of the biggest drivers of change within the mobility sector, promising to deliver safer, more efficient and more affordable movement of goods and people. This major transformation also comes with significant risks and uncertainties.

The purpose of this report is to give strategic and product planning teams within the mobility sector a grounded evaluation of the '**What**', '**When**', '**Where**' and '**How**' of autonomous mobility:

- **What** are the most promising Level 4 segments?
- **Where** will autonomous vehicles be most widely deployed?
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If you have any questions or feedback on the report, please contact us at info@sbdautomotive.com.

Example slides from the report

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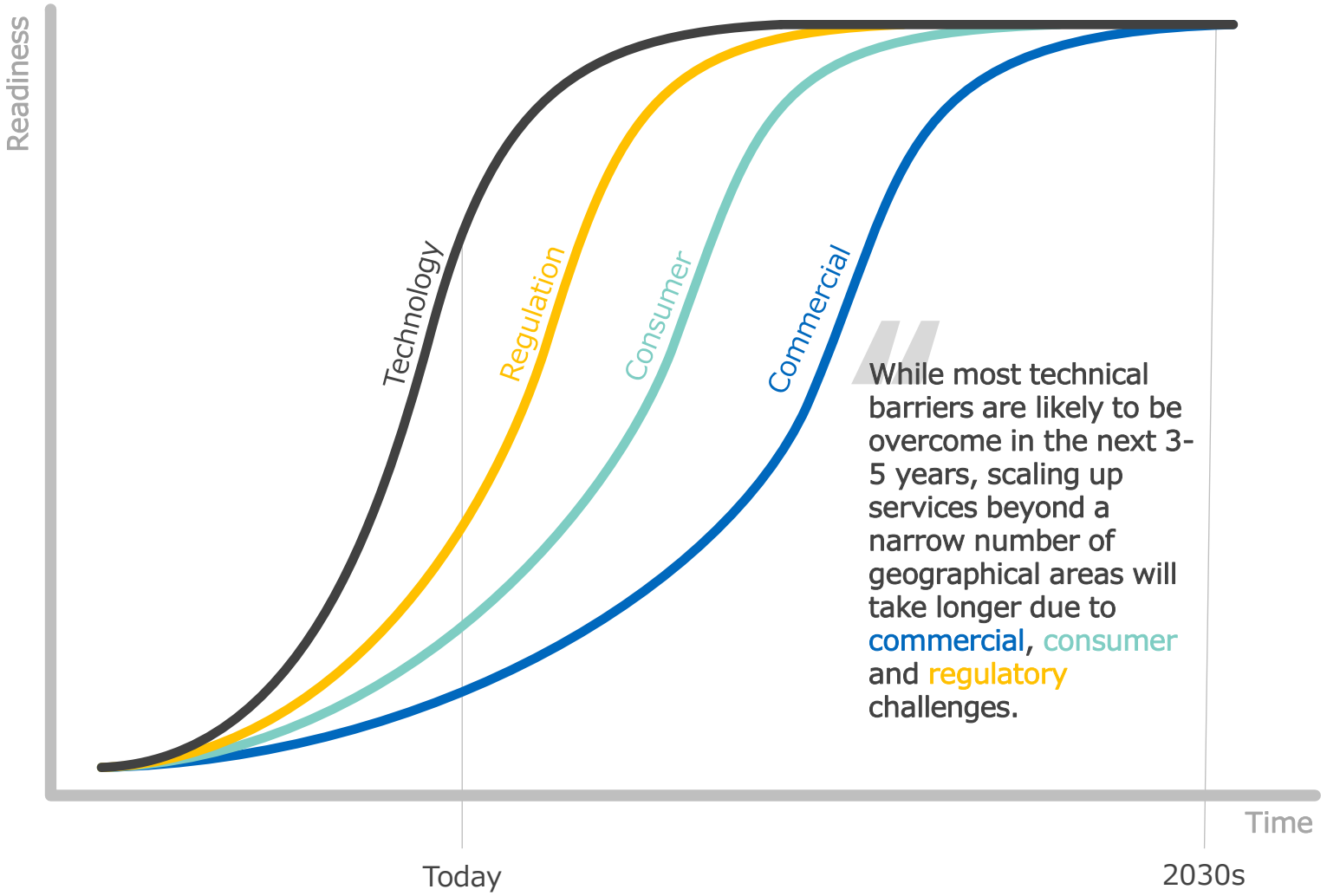
Technology is just one part of the race towards L4 autonomy



While most technical barriers are likely to be overcome in the next 3-5 years, scaling up services beyond a narrow number of geographical areas will take longer due to commercial, consumer and regulatory challenges.

Mass adoption requires Autonomous Vehicles to be...

Safe

Many technical barriers have been overcome but still difficult to scale

Legal

Governments racing to update road and homologation rules

Desirable

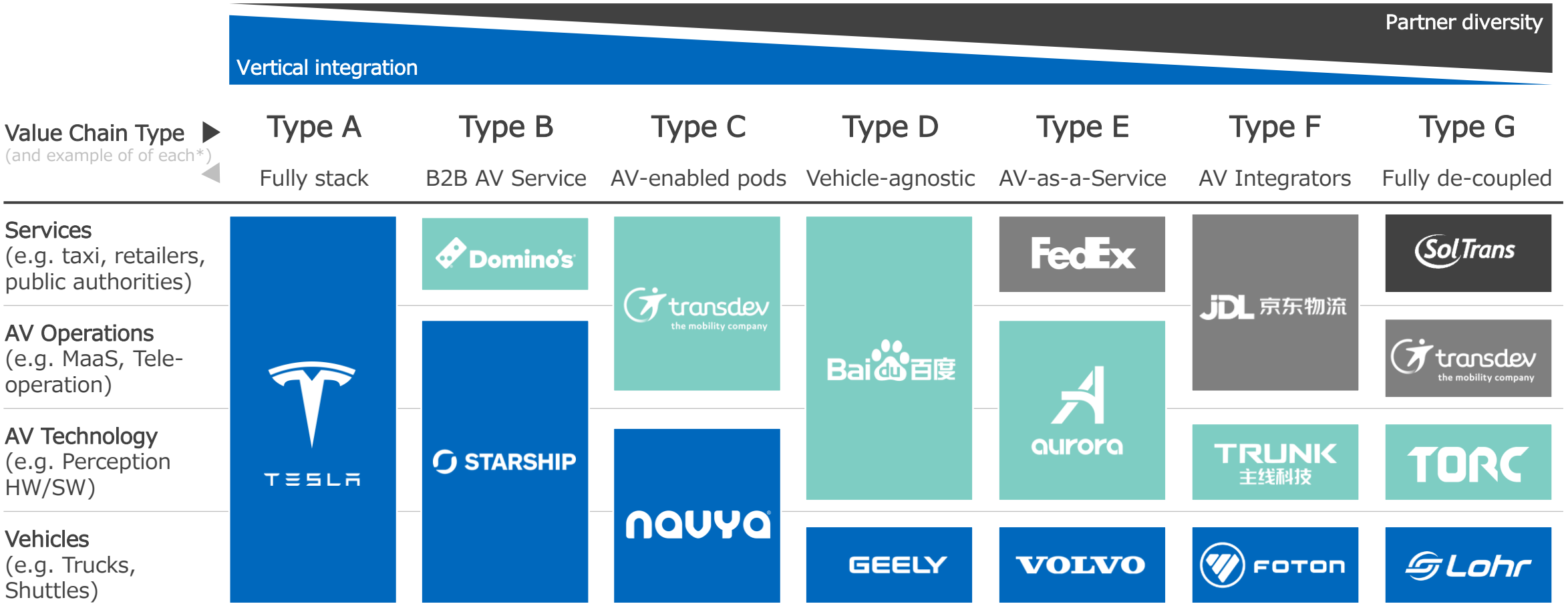
AVs are a double-edged sword, with both UX upsides and downsides

Profitable

Various unforeseen costs may lead to long period of unprofitability

The eco-system for L4 autonomy is still in its infancy

Over 300 partnerships have been announced as part of the AV pilots that have launched in USA, Europe and China. Although there is a widespread acceptance that partnerships are required in order to succeed within this space, vertical integration is likely in the coming years as major players look to deliver a greater level of certainty and assurance to operators.



* Examples shown for each Value Chain Type, although some companies may be targeting multiple Types

Introduction to Last Mile Delivery

Parcel volumes in USA, China and Europe will reach 120 Billion in 2020. This represents a significant increase since the pre-pandemic era. China alone accounts for approximately 60% of all packages delivered globally each year.

There is a parallel and steep growth in the use of online food delivery services. Globally the market for online food delivery services grew 21% between 2020 and 2021, with China again accounting for over 60% of the total revenue.

Both of these trends have accelerated partly due to COVID lockdowns, but also due to a broader shift in consumer habits towards online platforms and away from traditional retailors. This is fundamentally changing the economics and eco-system of last mile delivery services.

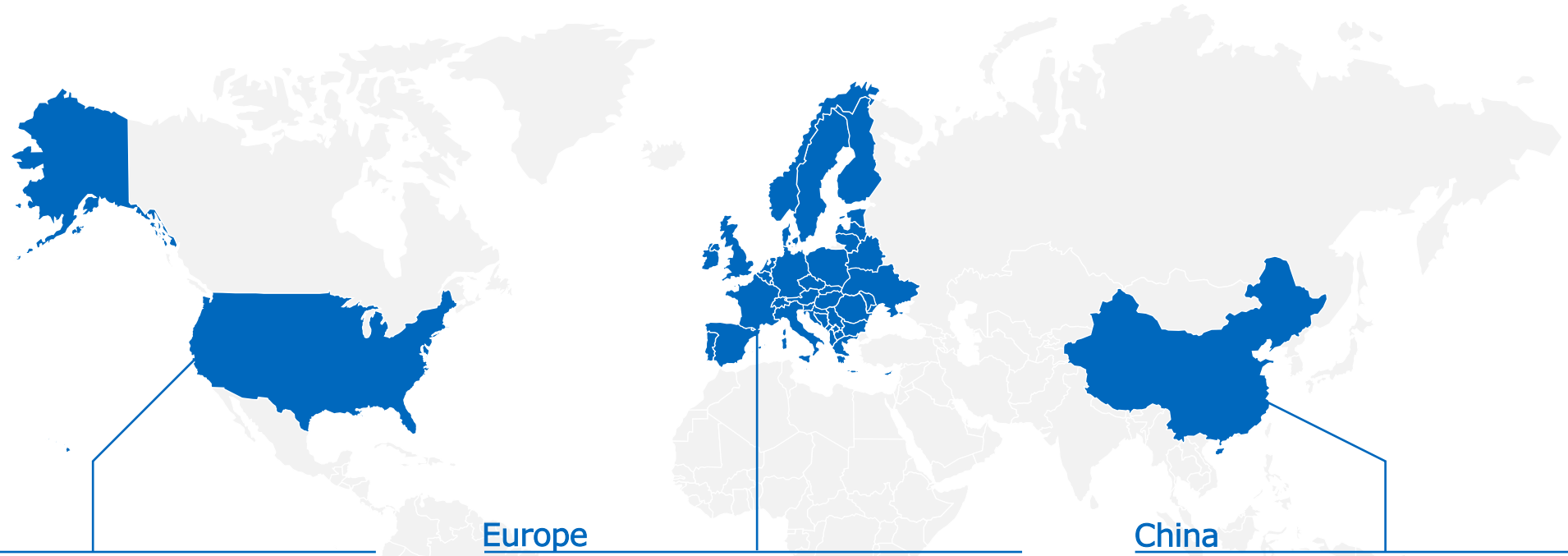
Sector in numbers...

120Bln Number of packages delivered in USA, China & Europe in 2021

$306Bln Global global revenue generated from online food delivery services

25.7% Global growth in eCommerce sales during the COVID Pandemic (2020)

Regional factors affecting Autonomous Public Transport



USA

- USA has a significant number of large Corporate/Education campuses
- Large eco-system of tech players and OEMs focused on AV public transport
- Significantly smaller market for public transport compared to EU/China
- Public transit in USA has traditionally suffered from under-investment

Europe

- Many cities in Europe are already advanced in terms of last-mile mobility
- Europe already heavily subsidizes public transport (free in some cities)
- Greater focus on pedestrianization and reliance on bikes than on microtransit
- Building Europe-wide services is tough due to country-level fragmentation

China

- Rapid urbanization is putting pressure on authorities to re-think mobility
- The Chinese government is placing a high priority on AI and mobility
- China has a large number of residential campuses
- Much greater mix of traffic types for AV vehicles to react to

Autonomous Public Transport partnerships

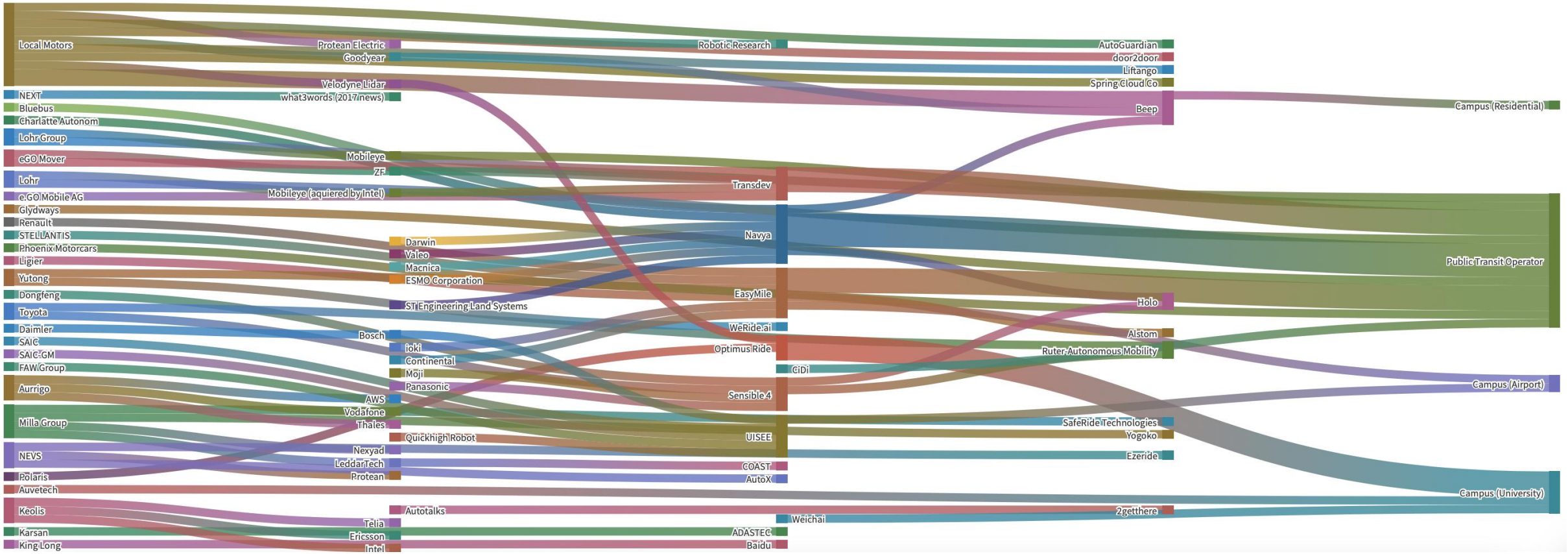
Vehicle Manufacturers
Companies that are either supplying shuttles as part of pilots or managing their own pilots

Tech Suppliers
Companies that are supplying HW/SW or services to support AV public transport

L4 AV Service Operators
Companies that are primarily focused on developing AV SW for public transport

MaaS Providers
Companies that are primarily focused on supporting logistics for public transport

public transport Operators
Companies or organisations that are responsible for public transport services



Technologies required to enable Robotaxis

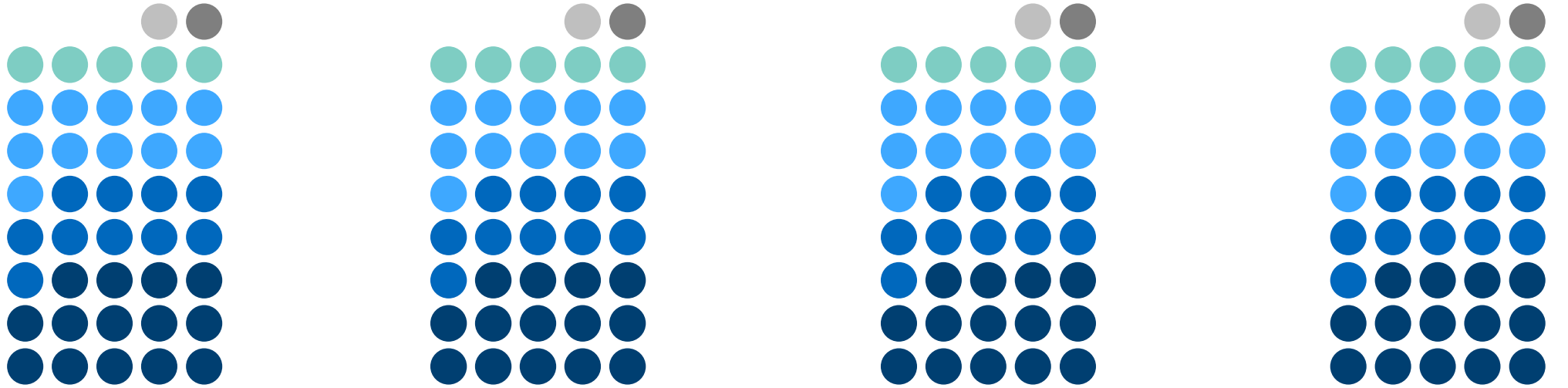
1-2 people / First & Last Mile
Micro Robotaxi

1-4 people / <5 Mile
City Robotaxi

3-6 people / All Mile
Large Robotaxi

Business / All Mile
Premium Robotaxi

Robotaxi applications are one of the most demanding and complex use cases to deliver robustly. The urban environment is very dense, cluttered and with many corner cases. The vehicle needs to detect and predict the trajectories of many different vulnerable road users (pedestrian, cyclist, e-scooter, etc.) in different lighting and weather conditions. Although maximum vehicle speed is not very high, being able to safely operate at up to 60 Km/h makes the safety case very challenging to deliver. Being able to embark & disembark safely riders can also be complex depending on traffic conditions (e.g. double parked vehicles). The consequence is that a very rich set of sensing modalities and a very large number of sensors is required in order to remove blind spots and ensure a high level of redundancy. Cabin sensing is also required so that riders can feel safe as well as ensuring that the interior is kept clean. Finally, teleoperation is a must as there will be cases when the robotaxi will not be able to decide the safest trajectory to follow (e.g. broken down vehicle ahead, having to cross the solid line, etc.)



Sensors required for high robustness levels: Cameras | Ultrasonics | Radars | Lidars | V2X | HD Maps | Enhanced GNSS

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Further Information

Our Autonomous Vehicle Expertise

Consultancy projects we've delivered

<260

Most common projects

1. AV forecasting
2. Sensor capabilities
3. Vehicle benchmarking
4. Consumer surveys
5. Due diligence

Companies we've worked with

<100

Client breakdown

- OEM
- Supplier
- Investment/Banking
- Other

Reports we've published

<50

3,000+ slides delivered each year

Our Top Experts

SBD has a team of 11 AV experts based in UK, USA, China, Japan, Germany and India. We also have a further 60 experts from other related automotive domains.

Alain Dunoyer
Head of AV research

Deepa Rangarajan
Senior Specialist

Howard Abbey
Senior Specialist

+ Experts from other domains who support AV projects

Simon Halford
EE Expert

Jithesh Joshy
Cyber Expert

Mo Al-Badour
Mobility Expert

Contact SBD Automotive

Do you have any questions?

If you have any questions or feedback about this research report or SBD Automotive's consulting services, you can email us at info@sbdautomotive.com or discuss with your local account manager below.

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