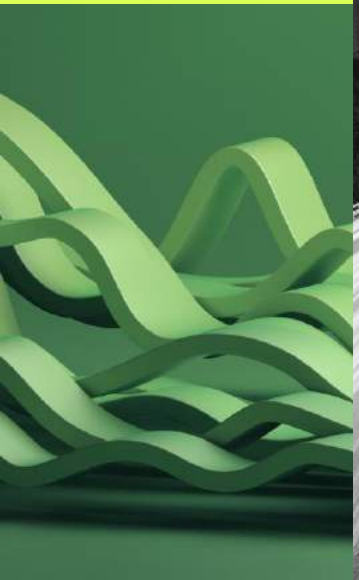
WE DEFINE
FUTURE IMPACT

TECHNOLOGY
SOFTWARE
CONSULTING

Autonomous Driving
Market Intelligence
MaaS / TaaS / POV



BUSINESS
AS UNUSUAL

P3 Autonomous Driving Market Insights

We analyze global autonomous driving ecosystems in Mobility-as-a-Service, Privately Owned Vehicles and Goods Transport.

Created by:

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Last update: **2024/07/30**

Edition #3/2024

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P3 autonomous mobility

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P3 & P3 autonomous mobility.

General Introduction

At home in the outside world.

Europe

Germany	Stuttgart	Serbia	Belgrad
	München		Subotica
	Wolfsburg	Romania	Cluj-Napoca
	Düsseldorf	Greece	Athen
	Berlin	Czech Republic	Prag
	Hamburg	Bulgaria	Sofia
	Osnabrück		Gabrovo
France	Paris		
	Toulouse		
Denmark	Kopenhagen		
Polen	Breslau		

Asia

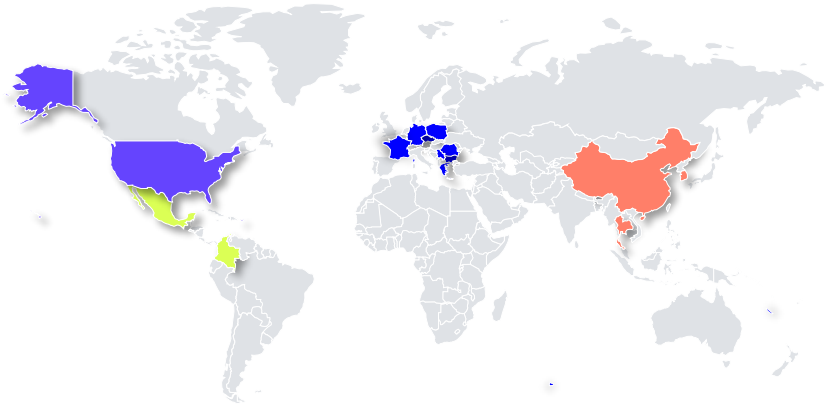
China	Peking	Korea	Seoul
	Shanghai	Thailand	Bangok
	Shenzhen		

South America

Mexico	Mexico City
	Puebla
	Querétaro
	San Luis Potosi
Colombia	Cali

North America

USA	Charleston
	Detroit
	Greenville
	Dallas



Porftolio as unusual.

SOFTWARE

- Android Automotive
- Business Intelligence
- Cloud Migration
- Cyber Security
- Data Analytics
- Enterprise Solutions
- Financial Systems
- IT-Architecture
- Certifications

TECHNOLOGY

- Autonomous Driving
- Battery Technology
- Electric Powertrain
- Energy Solutions
- Industrialization
- Charging Infrastructure
- Operations Excellence
- Task Force Management
- Testing & Engineering

CONSULTING

- Agile Transformation
- Artificial Intelligence
- M&A Strategy
- Marketing & Design
- Sustainability
- Project Management
- "Organizational Strategy"
- Quality & Compliance
- Systems Engineering
- UX/UI Design
- Transformation

P3 advises leading international OEMs, suppliers, technology and insurance companies in the field of autonomous driving and autonomous mobility.

P3 AUTONOMOUS MOBILITY /AS UNUSUAL

>9 years of international experience in autonomous driving consulting

>100 customers worldwide and more than 300 successful AD projects

>50 employees around the globe in the autonomous driving space

75% of the employees are engineers and software developers

We approach autonomous driving from many different perspectives. We understand the markets, know the players, but also have the technological know-how and the necessary software expertise.

Market & Strategy

- Go-to-market strategy
- Global market and competitive analysis for AD MaaS, TaaS & ownership
- MaaS & TaaS business model development incl. business case & TCO
- Competence analysis, assessment of “best-fit” partners
- (SDS) partnerships models and joint venture agreements
- AD shuttle / robotaxi and ADAS in-field testing & benchmarking

Technology & Regulation

- End-to-end architecture assessment and customization
- Cybersecurity, Functional Safety & SOTIF
- Regulation Implementation (AD SMS, SUMS & CSMS for SAE L3 & L4)
- Test Strategies & Management & Tool Confidence
- Sensor set evaluation and platform fortification strategies
- Support for Homologation (Type approval ODD and operation area)

Operations & Scaling

- AD Program Management incl. strategic setup, operations strategy, organizational build-up, project conduction & benchmarking
- Scaled Pilots: setup and management of runup schemes for AD pilot projects
- AD Product Lifecycle Management AD Logistics Concepts - Conceptualization of market-ready TaaS products

P3 autonomous mobility.
Market & Strategy.

Introduction

Overview | Our market, strategy, and technology intelligence portfolio.


SDS-Performance/ UX Benchmark

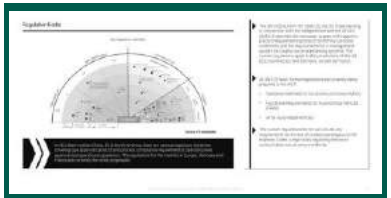

AD Market Models EU/US/Asia

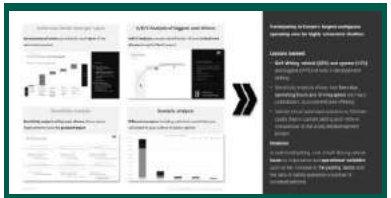

Tech Stack & AD Readiness Analysis

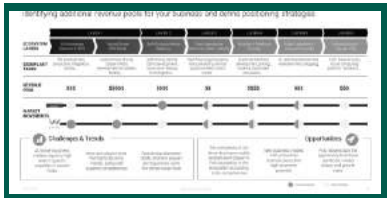

Go-to-Market Strategy


ADAS Benchmark


AV Fleet Simulation (MaaS & Trucking)


AD Regulation Radar EU/CN/US


TCO Calculations for MaaS Services


Value Chain and Positioning Strategy

P3 AD market, strategy, and technology intelligence portfolio

Working closely with our Technology & Regulation and Operations & Scaling teams, we provide holistic market, competitor, and technology intelligence for your specific needs

We help our customers to master challenges and complexity and enter new or expand existing markets - with a clear guideline for a successful Go-to-market.

Countries, Cities & Customers

Suggesting initial target countries and cities through a P3 city selection process, considering factors such as openness to innovation, consumer behavior, competitors, regulatory landscape, and market size.

Entry Strategy & Partnerships

Guidance on general market entry, including partnering with local companies, acquisitions, or establishing a local presence, with assessment and recommendations for potential partners.

Vehicle & Operations

Analysis of both city/government (e.g., inclusion) and fleet operator requirements (e.g., hub/service infrastructure, vehicle type), and passenger preferences (e.g., convenience vs. accessibility).

Economic Perspective

Elaboration of unit economics to ensure financial sustainability and profitability of L4 service, including reasonable revenue per ride, expected costs for fleet operations, fixed and variable costs

Data Protection & Safety

Guideline how to align data practices (e.g., with GDPR) and establish a clear framework for data sharing emphasizing privacy and compliance with local regulations

Local Authority Collaboration

Outlining of collaboration strategies with local authorities and communities, e.g., proactive engagement with relevant government bodies, PTA, and city officials

Regulatory Landscape

Analysis of EU regulations, including type or operating area approval requirements and draft for a governance and process landscape model

Go-to-Market Timeline

Definition of a go-to-market timeline, considering lead times, for example for lobbying with local authorities, city tendering and city development process

Our AV Fleet Simulation Tool enables companies to select the most promising G2M cities and understand business related KPIs by simulating future AV fleets.

INPUT PARAMETERS

City & Mobility Demand
- General mobility demand
- Personal demand (trip number & length)
- Modal split
- Demographics & Population density
- ...

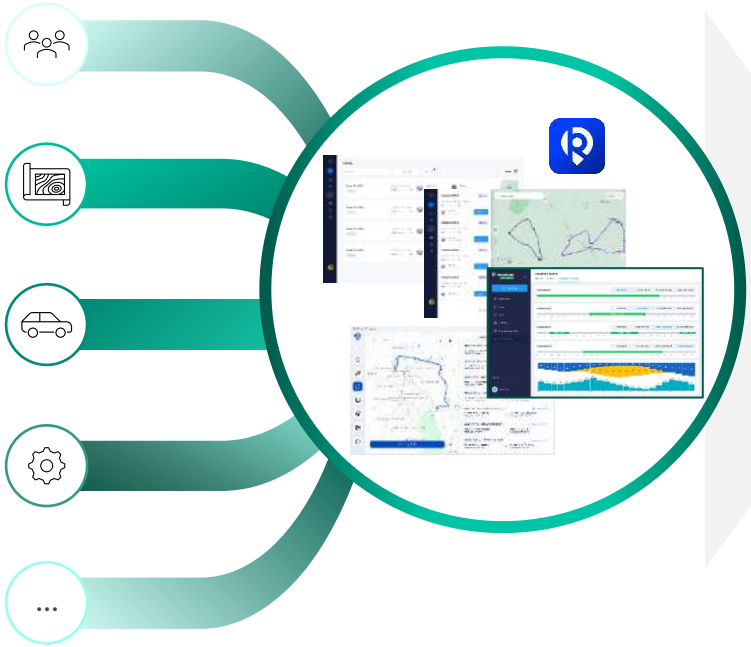
ODD & boundary conditions
- Local climate conditions & extremes (heat, cold)
- Topography
- Weather phenomenon
- Infrastructure & traffic
- ...

Vehicle parameter
- Technology availability (% of city area)
- Energy consumption & Battery size
- Passenger capacity
- Component durability
- ...

Operation strategy
- Charging strategy & deployment planning
- Hub / service network
- Fleet size & uptime
- Forecast bookings
- Service network/ route length
- ...

...

AV FLEET SIMULATION



OUTPUT implications

Vehicle manufacturers / OEMs
- Understand necessary fleet size and attractiveness of the city
- Consulting tool to emphasize the performance of the product
- ...

Cities
- Understand necessary fleet size and mobility gaps within city
- Evaluation of offers and vehicle requirements
- ...

Fleet Provider
- Evaluation of competitor products (vehicle types & fleet management)
- Identification of locations for hubs or maintenance facilities
- ...

Tech Provider
- Understand product usage to negotiate revenue sharing
- Understanding necessary service life of SDS or related components
- ...

From a holistic demand analysis to your individual tailor-made strategy: we are the right partner for your market entry and expansion.

360° **Demand Analysis**

In a first step, we jointly analyze and define your status quo, pain points and needs and sketch your future positioning and target picture in the AV ecosystem or specific market.

+

P3 AD **Market & Strategy Portfolio**

You have the needs; we have the solutions. We draw on our unique Market, Competitor, Customer, and Tech Intelligence portfolio as well as innovative software-solutions.

=

Tailor-made **Strategy**

We jointly develop your tailor-made go-to-market or market development strategy based on your capabilities and competencies and our long-term AV expertise.

P3 AD Market Insights.

Let's start: P3 AD Market Insights Introduction.

+1 since last report

41

Companies focusing on autonomous **MaaS**

+1 since last report

37

Companies focusing on **privately owned vehicles**

35

Companies focusing on **goods transport and TaaS**

We **analyze** global Autonomous Driving **value creation networks and ecosystems** using **Layer Models** and **provide overviews** of **MaaS, ownership & goods transport use cases**

Based on their respective **core business**, we identify **(strategic) partnerships**, **investments** or **acquisitions** of **specific market players** and place them in the layer model. We focus on **North America**, **Asia** (China, Japan and Korea) and **Europe**

All **insights are based on publicly available sources**. Project knowledge or other **non-publicly available information is not considered**.
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Autonomous Driving Use Cases.

- **Autonomous Driving**
  - **Passenger Transport**
    - **Ownership**
      - Parking
      - Driving
    - **Mobility-as-a-Service**
      - Ride Hailing
      - Ride Pooling
  - **Goods Transport**
    - **Transportation-as-a-Service[1]**
      - Urban Transport Mid & Last Mile
      - Hub-to-Hub
    - **Carrier-owned Transport[2]**
      - Urban Transport Mid & Last Mile
      - Hub-to-Hub







1 Self-driving truck provider owns and operates the truck and offers transport / capacity on demand
2 Customer / carrier owns and operates trucks and pays a per-mile fee to the SDS / truck provider

What you'll find in this report.

1 Mobility-as-a-Service (MaaS)

MaaS | **Intro**

MaaS | **NAR**

MaaS | **Asia**

MaaS | **Europe**

2 Privately Owned Vehicles (POV)

POV | **Intro**

POV | **NAR**

POV | **Asia**

POV | **Europe**

3 Goods Transport & Transport-as-a-Service (TaaS)

Goods Transport & TaaS | **Intro**

Goods Transport & TaaS | **NAR**

Goods Transport & TaaS | **Asia**

Goods Transport & TaaS | **Europe**

Mobility-as-a-Service.

Intro | Use Cases & Layer Description

MaaS | Use Cases

			Gated Area	Highway	Urban	Suburban	Rural
			Airport, factories, yards, harbors, ...	Highways, freeways, ...	City center, designated streets, ...	Federal highway, residential areas, ...	Rural roads, gravel road, ...
Ride Hailing	**M**		-	-	Robotaxi	Robotaxi	Robotaxi
Ride Pooling	**ML**		low speed autonomous shuttle (<25km/h)	-	low speed autonomous shuttle (<25km/h)		
	M		(private) robo shuttle	robo shuttle			
	L		(private) robo shuttle	robo shuttle			
	XL		(private) robo bus	robo bus			

MaaS | Layer Model Description

LAYER 1	LAYER 2	LAYER 3	LAYER 4	LAYER 5	LAYER 6
Sensor Set / SoC / Computing HW SW-Stack / Virtual Driver	Self-Driving Ready Vehicle	Fleet Operations	Mobility & Platform Provider	Rider Experience / Content Provider	Infrastructure
Self-Driving System (SDS) is the sum of all necessary systems to realize self driving level 4 (SAE). Key functionalities are sensor data fusion, object detection, localization, prediction, environment interpretation, trajectory planning and actuator control. The HW stack includes sensors, SoC and computing platforms, for example, while the SW stack covers the virtual driver, among others.	**Self-Driving Vehicles** are considered L4 ready vehicles with an integrated and homologated SDS (sensors, computing hardware and software), which operate in a specific ODD (Operational Design Domain).	**Fleet Operators** potentially own, operate and maintain a fleet of self-driving vehicles. It may be necessary that a fleet operator is responsible for fleet intelligence functions and technical supervision. Therefore, Layer 3 covers both physical and digital fleet operations.	The **Mobility Provider** owns the user frontend. It is point of sale and provider of the primary communication and interaction channel with the user. Thus, it is responsible for pricing, ride planning, ride execution and important for the overall brand experience.	The **Content Provider** for **Rider Experience** owns a software platform that acts as middleware to service partners. Digital content (e.g., media), digital products (e.g., productivity tools) and digital services are part of this platform.	The service area and its **infrastructure** are core elements to enable an AD service. Infrastructure includes the vehicles' IT infrastructure (especially cloud services and backend), V2X technology and takes into account human behavior prediction in that specific scenery.

MaaS | Layer Model Description

Exemplary tasks

LAYER 1		LAYER 2	LAYER 3	LAYER 4	LAYER 5	LAYER 6
Sensor Set / SoC / Computing HW	SW-Stack / Virtual Driver	Self-Driving Ready Vehicle	Fleet Operations	Mobility & Platform Provider	Rider Experience / Content Provider	Infrastructure
HW development	SW development	Design & development	Fleet financing	Customer app	In-vehicle advertisement	Localization
HW production	Simulation	Redundant chassis	Insurance	API (Layer 1-4)	Shopping	3rd party HD maps
Sensor integration	Prediction	SDS integration	Concessions	Rider authentication	Education	V2X
Automotive approval	SDS licensing	SDV testing	Charging	Pricing	Working	Data communication
Sensor testing & approval	SW testing & approval	After sales	Maintenance & cleaning	Booking	Multimodal connectivity	Cloud infrastructure
Sensor fusion	HD mapping	Production	Backend (Layer 1-4)	Dynamic routing	Gaming	Service area
...	Verification & validation	Logistics	Hub operations	Payment	...	...
	...	Sales channel	Fleet Control Center (fleet steering and monitoring)	Ticketing		
		Homologation	Driver sideline activities	Marketing & Sales		
		Pricing	Remote assistance	Customer support		
		...	Fleet intelligence (e.g., fleet & ride optimization)	Multimodal connectivity		
			...	...		

Mobility-as-a-Service. NAR.

Partnering & Value Chain, Level 4 Target & Latest News

MaaS NAR

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.		Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement		3rd party HD Maps	Cloud	V2X & Others
WAYMO	SAMSUNG, intel	WAYMO	LATENT LOGIC	STELLANTIS, JAGUAR, VOLVO, ZEEKR		AVIS, AutoNation, Swiss Re, transdev	WAYMO	WAYMO, lyft, Google Maps, Uber	TUNE IN, YouTube Music, Audacy, deezer, pandora	Spotify, npr, iHeart RADIO, sxm	Not announced		
STROBE, ASTYX, OUSTER	Qualcomm, NVIDIA	voyage, cruise		gm, HONDA		cruise		cruise, lyft	Not announced			Microsoft	
LUMINAR, mobileye, ZF	mobileye	mobileye		NIO, HOLON, SCHAEFFLER, Lohr, MAN		holo, Marubeni, moovit, beep, WILLER, transdev, SIXT, HMA		moovit, Ruter#, WILLER, transdev, SIXT, HMA	moovit		Not announced		

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

MaaS NAR

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
Aurora blackmore OURS DENSO HESAI	NVIDIA	Uber ATG Aurora		TOYOTA HYUNDAI MOTOR GROUP		TOYOTA		Uber	Not announced		aws	
APTIV OUSTER	Ambarella APTIV	Motional	Applied Intuition	HYUNDAI MOTOR GROUP KIA	APTIV	PIVET	ottopia	lyft VIA Uber	Not announced			APTIV EVERSOURCE DENSO BlackBerry
HESAI OUSTER	NVIDIA	Strio.AI ZOOX		ZOOX		Not announced		ZOOX amazon	Not announced			

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

MaaS NAR

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
AEVA, OUSTER		MAY Mobility	Applied Intuition	MAY Mobility, TOYOTA, LEXUS, BMW	GENTEX, BraunAbility	BRIDGESTONE, Stantec, MOTER TECHNOLOGIES	ottopia, Lift&ango, deepen	via, moovit, spare, Lift&ango, SW, !	Not announced	Not announced		
SICK, OUSTER, DENSO	intel	PERRONE ROBOTICS	WIND, aicas	PERRONE ROBOTICS, GreenPower, rampart, LIGHTNING E-MOTORS, tropos		SP SUSTAINABILITY, Global Finance Group	First Transit, guident	Not announced	Not announced			verizon
OUSTER, FLIR	NVIDIA	ADASTEC		KARSAN, VMC		VW	ottopia, APPLIED AUTONOMY	Kolumbus	Not announced		aws	AECOM

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS NAR

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations	Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure	
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
OUSTER, LeddarTech	Horizon Robotics	COAST		COAST		COAST	Not announced	Not announced				cs:Cities

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

MaaS NAR

At a glance	Latest news	L4 target
 Working **15+ years** towards **autonomous driving**, Waymo's virtual driver is the world's **most experienced one.** The fully driverless I-PACE fleet in Phoenix, SF and LA impresses with a **terrific system performance**. In our view and bases on our benchmark rides, Waymo is **currently ahead of competition** in the AV space.	Alphabet to invest another $5B into Waymo. (23.07.2024) Update Read	L4 achieved in Phoenix by **2020**.
 Cruise operated a **commercial robotaxi service** in **San Francisco**, which is currently not **available due to several incidents involving its robotaxis and both trust & acceptance issues and lost permits**. Recently, Cruise re-started supervised autonomous driving with safety drivers in Phoenix.	GM's Cruise abandons Origin robotaxi, takes $583 million charge. (23.07.2024) Update Read	L4 achieved in SF by **2022**.
 Mobileye is **testing its AV fleet in various locations around the globe**, including complex European traffic. First promising **pilot projects in Norway (Oslo)** and **Germany are to come** - these **will show what the system is capable of** and how well it performs compared to competitors.	Mobileye Drive™ hits the road with Deutsche Bahn. (25.06.2024) Update Read	Not announced
 While Aurora shifted its **focus primarily** to **self-driving trucks** some time ago, it has been **quiet about its robotaxis**. We believe: the **company needs a working business case**, otherwise it will become a victim of market consolidation. MaaS is therefore probably not part of the business for now.	Self-driving vehicle company Aurora cuts 3% of its workforce. (24.01.2024) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS NAR

At a glance	Latest news	L4 target
 JV of Hyundai and Aptiv, while the latter reduced its common equity interest from 50% to about 15% by end of March 2024. In this course, **Hyundai has agreed to invest nearly $1 billion in Motional by 2024**. The demise of Motional has thus been averted for the time being.	Hyundai is spending close to $1B to keep self-driving startup Motional alive. (02.05..2024) Read	**2026**
 Zoox is **meanwhile testing its SPV on public roads in the bay area**. Currently, only employees are eligible to take rides. Many people are waiting for the service to be opened up to the public - and so are we.	Zoox to test self-driving cars in Austin and Miami. (05.06.2024) Update Read	Not announced
 May's fleet is already **available to the general public** in many cities. The **SDS is designed for multiple vehicle platforms** and used in the Toyota Sienna Autono-MaaS vehicles, among others. The approach to enhance public transport instead of offering robotaxi services is pretty unique in the US	May Mobility and SouthWest Transit announce first autonomous microtransit service in the Twin Cities area. (08.07.2024) Update Read	L4 achieved in Sun City by late **2023**.
 Perrone been **developing autonomous vehicle solutions since 2003**. Apart from its low-speed shuttles, Perrone claims to have **outfitted over 30 vehicles types with its retrofit kit**. Despite its experience, we don't believe Perrone will become a leading market player.	Perrone Robotics to deploy fleet of Autonomous Ford E-Transit vans for Detroit's 'Connect' program, a two-way 10-mile autonomous vehicle shuttle route. (02.04.2024) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS NAR

At a glance	Latest news	L4 target
 Unlike most MaaS providers, ADASTEC is not focusing on robotaxis but developing an **AV stack for transit buses**, which marks a USP in the market. ADASTEC has deployed buses in several locations including the US and Europe.	Karsan e-ATAK became Finland's first driverless bus. (02.04.2024) Read	Not announced
 The company provides MaaS solutions for cities, theme parks, campuses, airports, rail yards, and other private sites. In the meantime, **COAST seems to be focusing primarily on use cases other than passenger transport** (e.g., harvesting, ports). However, transport currently seems to be the primary use case.	COAST Autonomous announces collaboration with the city of Winter Haven, Florida to explore deployment of autonomous transportation solutions. (30.03.2022) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

Mobility-as-a-Service. Asia.

Partnering & Value Chain, Level 4 Target & P3 Assessment

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
OUSTER, HESAI, robosense, ZVISION, DN	intel, NVIDIA, NXP	Baidu apollo, [illegible]		ARCFOX, GAC, [illegible], LINCOLN, BAIC, CHERY, [illegible]	HFCG	Swiss Re, Baidu		Baidu, [illegible], Grab	Not announced	CARNERA, tomtom	Microsoft	NXP, InnoFusion, SAMSUNG, [illegible]
HESAI, robosense	NVIDIA, Horizon Robotics, Lenovo	WeRide, BOSCH		YUTONG, Renault Group, XPENG, LINCOLN, [illegible], DFM		WeRide		WeRide, [illegible], [illegible], ON TIME	Not announced	Tencent 腾讯	Tencent 腾讯	
LUMINAR, HESAI, robosense, pony.ai (Sensor fusion)	NVIDIA, Horizon Robotics, pony.ai	pony.ai		TOYOTA, [illegible], [illegible], ISAIC, LEXUS		BOSCH, TOYOTA, [illegible]		pony.ai, ON TIME, [illegible], [illegible]	Not announced	NAVINFO		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
autox, HESAI, arbe, robosense, dji, SiLC	NVIDIA	autox		FCA, HiPhi, HONDA, BYD, SAIC, GWM		Not announced		autox, 高德	Not announced			Alibaba.com
OUSTER, HESAI, Valeo, Baraja	NVIDIA	Valeo, DiDi		BAIC, TOYOTA, GAC AION, XPENG	GOODYEAR	DiDi		DiDi	DEEPMIRROR		NVIDIA	INCHTEK
OUSTER, HESAI, ZVISION, robosense	NVIDIA	DEEPROUTE.AI		DFM, SAIC		曹操专车 CAOCAO		曹操专车 CAOCAO	Not announced	Tencent 腾讯 SD maps – probably consumer vehicles only	Microsoft	Alibaba.com

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
robosense HESAI	Horizon Robotics Continental NVIDIA NXP UAES intel	MAXIEYE MINIEYE UNTOUCH Zong Yi Mu QCRAFT nullmax	ThunderSoft WNDRVR STRADVISION	VOLKSWAGEN GROUP 理想 GWM BYD AION HONGQI CHERY BAIC		Not announced		Not announced	UNTOUCH 未动科技	APTIV NAVINFO		
BOSCH robosense	NVIDIA Qualcomm	momenta		LINCOLN NIO TOYOTA BYD		MSIG AD Aioi Nissay Dowa Insurance		Momenta GO	Not announced		Tencent aws	

Company's focus is meanwhile on L2+ ADAS solutions

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
mobileye, QUANERGY	mobileye	mobileye, WAYMO, pony.ai, Baidu, zenseact	foretellix	GEELY, volvo	Autoliv, SMART EYE	Not announced		CARIZON, StaRides	Not announced	AutoNavi	Tencent	
LUMINAR, HESAI, ZVISION, ZF, robosense	Horizon Robotics, TTTech	pony.ai, autox, momenta,		SAIC		Not announced			Not announced	DEEPMAP, mobileye		
robosense	NVIDIA, Horizon Robotics	pony.ai, Baidu		FAW GROUP, HONGQI		Not announced		Not announced	Not announced	Not announced		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
TierIV		Yukuang Tech		elaphe, TierIV, TechNAU, pix moving		Yukuang Tech			Not announced	Not announced		
HESAI, robosense, OUSTER	NVIDIA, Horizon Robotics	轻舟智航 QCRAFT		轻舟智航 QCRAFT, DFM, FOTON				T3出行	Not announced	NAVINFO		
WeRide	WeRide			YUTONG		WiTricity		Not announced	Not announced	Not announced		

Company's focus is meanwhile on L2+ ADAS solutions

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
	SAMSUNG 42dot	42dot		HYUNDAI MOTOR GROUP 42dot			42dot		Not announced	Not announced		
LUMINAR AISIN DENSO ZF robosense	NVIDIA QUALCOMM	Aurora pony.ai May Mobility lyft Level 5 motional	Applied Intuition parallel domain Apex.AI	TOYOTA			Aurora RIDECELL	Grab Uber DiDi	Not announced	CARMERA tomtom NTTDATA MAXAR here	aws	PERCEPTIVE AUTOMATA
APTIV Motional OUSTER ZENDAR Opsys	APTIV Motional NVIDIA	APTIV Motional Aurora pony.ai 42dot Baidu IONQ		HYUNDAI MOTOR GROUP		BOTRIDE Not in service anymore		BOTRIDE Grab AIRS i.M	Not announced	here		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS ASIA

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations	Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure	
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
NEW												
LUMINAR		NISSAN	Applied Intuition	NISSAN		Not announced		Easy Ride	Not announced	Not announced		

IONQ

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

MaaS ASIA

At a glance	Latest news	L4 target
 **Baidu Apollo** has accumulated **more than 100m km,** holds **permits for first fully driverless taxi service** in CN and **processed 3.3m autonomous ride orders** by September 2023. Baidu is an absolute heavyweight in the Chinese AD market and, in our view, the current leading company in China.	Hesai Technology serves as supplier of Baidu Apollo sixth-generation Robotaxi's primary LiDAR. (17.07.2024) Update Read	L4 reached in Guangzhou by **2021**
 WeRide was the **first AD company in China** to operate a fleet with **>100 vehicles** for AD testing and was permitted to fest **fully driverless cars** both in **China** and the **USA**. Considering >20mn autonomous kilometers, WeRide is among the strongest AD players. WeRide also offers L2+ solutions.	WeRide files for IPO on NASDAQ. (29.07.2024) Update Read	L4 reached in Guangzhou by **2022**
 Pony.ai has driven **>30mn testing and operations kilometers on urban roads & highways**, holding **permits to offer driverless rides in China and test its AVs in the US**. Pony also offers L2+ solutions to OEMs. As the BC for AD MaaS will remain negative in the medium term, that's a reasonable move.	Pony.ai permitted for unmanned Robotaxi service in Shanghai. (05.07.2024) Update Read	L4 reached in Beijing and Guangzhou by **2023**
 AutoX's **focus is on China and the Asia Pacific markets**. However, it also holds a permit to **transport passengers** on **public roads** in California. With a fleet of **more than 1000 vehicles in China**, AutoX is a **leading player** in this market.	AutoX's RoboTaxis allowed for unmanned passenger transport service in Shanghai. (08.07.2024) Read	L4 reached in Shenzhen by **2021**

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS ASIA

At a glance	Latest news	L4 target
 Following an 18-month suspension by the Chinese authorities, Didi was permitted to sign up new users by 2023. Its **active user base was 500mn** in 2020, receiving >**40 bn trip requests daily**. This means great market power - however, it has become **quiet around DiDi's AV division**.	DiDi Autonomous Driving, GAC AION's joint venture to launch first L4 commercial Robotaxi in 2025. (07.04.2024) Read	**2025**
 **DeepRoute claims to offer the most affordable SDS on the market**. In the meantime, DeepRoute has covered **10 million autonomous kilometers** on public roads by 09/23 and holds permission to carry passengers in China. The current focus seems to be rather on L2+ ADAS than robotaxis.	Vehicles powered by DeepRoute's end-to-end intelligent driving model to hit market in 2024. (18.03.2024) Read	**2025**
 Horizon Robotics now has **partnerships with many well-known OEMs and Tier1s** with whom they are **jointly developing autonomous driving functions based on their Journey chip**. It is therefore a very strong AI-chip market player, without focusing on deploying own robotaxi fleets.	Horizon Robotics announces mass production plan for SuperDrive™ AD solution. (13.06.2024) Update Read	Not announced
 Momenta **attracted attention** primarily due to **investments** (e.g., from Toyota, Mercedes-Benz, and Bosch). Although Momenta operates a robotaxi fleet in China, the **focus currently seems to be clearly on L2+ solutions for OEMs**, rather than on the MaaS use case.	GAC Toyota, Momenta to debut end-to-end smart driving solution on bZ3X model. (01.07.2024) Update Read	Focus currently clearly on L2+ ADAS

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS ASIA

At a glance	Latest news	L4 target
 In 2021, **Geely and Waymo** teamed up to **integrate the Waymo Driver** into an autonomous ride-hailing Zeekr vehicle. This beauty was presented to the public by end of 2022. Geely **itself rather focuses on the POV business instead of MaaS.**	Geely, Foretellix Enhance AV Safety. (07.05.2024) Read	Not announced
 By August 2022, SAIC accumulated **400,000km of automated driving testing** in China. SAIC has **partnered will well-known SDS providers**, such as Momenta and Pony.ai, to develop self-driving vehicles.	SAIC-backed Xiangdao Chuxing kicks off Robotaxi pilot operation in Shenzhen. (28.12.2022) Read	**2025**
 FAW's focus is primarily on privately owned vehicles. However, **its EV brand Hongqi** and its **3rd-generation robotaxi** rides on the same platform as its mass-produced vehicle to achieve economies of scale. FAW **co-developed the Hongqi robotaxi with Baidu** and also **invested in tech company Pony.ai.**	Hongqi's 3rd-gen L4 Robotaxi allowed for unmanned road tests in Beijing. (10.07.2024) Update Read	Not announced
 PIX Moving shares the vision of rebuilding the city with a special form of vehicles called **Moving Spaces**. These **multi-functional pods** can serve as moving working spaces or vending machines, among others. Great concept for technology-driven Asian markets and beyond.	Robobus is gearing up for mobility services in Europe: PIX Moving & Tecnocad form into partnership. (06.05.2024) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS ASIA

At a glance	Latest news	L4 target
 QCraft holds a **permit to test robobuses** in Beijing. The company is meanwhile rather focusing on L2+ than L4 robotaxis to increase ROI. Therefore, we'll soon be moving the company to the POV chapter.	QCraft nabs hundreds of millions of yuan in Series C funding round. (14.06.2024) Update Read	Not announced
 Yutong is China's top bus manufacturer and the world's largest one. For the AD MaaS Case, Yutong provides its **purpose-built electric robobus**, which is already operating driverless on public roads in cooperation with SDS provider WeRide. Yutong **will thus remain true to its core business.**	WiTricity and YuTong Bus revolutionize public Transportation with Wireless Charging for Autonomous E-Buses. (10.02.2023) Read	L4 reached by **2022** jointly with WeRide.
 Acquired by Hyundai Motor Group in 2022, 42dot is the **groups' global software center**. 42dot and Hyundai showcased 'software-defined vehicle' (SDV) technologies under development to lead to a '**Software-defined Everything' (SDx) ecosystem beyond mobility** at CES 2024.	Samsung partners with self-driving tech company to develop AI-based smart vehicle platform. (04.08.2023) Read	Not announced
 In the AD space, Toyota is **focusing primarily on partnerships, investments and acquisitions**. The extensive portfolio includes, for example, Lyft Level 5, Momenta, Pony.ai or May Mobility. Toyota and Pony.ai are developing a robotaxi fleet of about 1,000 vehicles.	Pony.ai teams up with Toyota China, GAC Toyota on Robotaxi development. (04.08.2023) Read	**2024**

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS ASIA

At a glance	Latest news	L4 target
 Hyundai and Aptiv jointly established **Motional** to develop robotaxis. Moreover, the **acquisition of 42dot** is **intended to strengthen capabilities**. We are curious to what extent Hyundai, apart from Motional, will therefore position itself in the AD business in the future.	Hyundai Motor, Baidu join forces to co-advance in automotive intelligence development. (28.04.2024) Read	**2026** (Motional)
 Nissan plans to offer **autonomous mobility services starting in Japan by 2027**, working closely with third parties such as local authorities and PTAs and relying on its **inhouse-developed, autonomous-drive system**. Initial trials started in 2024 with the goal so have 20 supervised demonstration vehicles on the roads between 2025 and 2026.	Nissan demos autonomous driving on streets of Yokohama. (14.06.2024) Read	**2027**

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

Mobility-as-a-Service. Europe.

Partnering & Value Chain, Level 4 Target & P3 Assessment

MaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
mobileye		mobileye		Commercial Vehicles		MOIA		MOIA	Not announced	Not announced		
WAYMO Luminar	NVIDIA	WAYMO Baidu 百度 No further announcements DiDi zenseact	Apex.AI	VOLVO GEELY		Not announced		Uber	Not announced	tomtom NAVINFO		
mobileye		mobileye		HOLON pininfarina	cognizant Continental Engineering Services	beep HOCHBAHN EMT MOIA		beep HOCHBAHN MOIA EMT	Not announced		valtech. mobility	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
Continental, Ouster, Cepton	NVIDIA, Continental, Kalray, MicroSys	easy mile	Ansys, TRUSTINSOFT	Stellantis, Renault Group, IVECO			ottopia, DriveU.auto, Applied Autonomy	easy mile, ioki, via	Not announced	Not announced		
Ouster, Valeo, Hesai	NVIDIA	Gaussin Macnica Mobility		Gamo, bluebus, tron-e	R3E	Keolis, holo, Padam	Keolis, Padam	Keolis, Padam	Not announced	Not announced		
Navtech Radar, Hesai, ZF	NVIDIA	oxa	Google Cloud	Ford, Applied EV, NEVS, eVersum		Ibatt, bp, beep, Bayanat		ocado, beep	Not announced		Tencent, Google Cloud	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations		Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
NVIDIA		IMAGRY MAPLESS AUTONOMOUS DRIVING		Otokar				Not announced	Not announced	Not announced		
mobileye		mobileye		MAN		MVG		MVV	Not announced	Not announced		
OUSTER		auvetech		auvetech		APPLIED AUTONOMY, guidenk		Robo	Not announced			NET MODULE

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS EUROPE

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations	Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure	
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
mobileye		mobileye		RIMAC, KIA, verne		verne	verne		Not announced	Microsoft	Not announced	
AVRIDE, NVIDIA		AVRIDE		HYUNDAI MOTOR GROUP		Not announced	Not announced		Not announced		Not announced	
Not announced		WeRide, WAYMO		Renault Group		Not announced	Not announced		Not announced		Not announced	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

MaaS EUROPE

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5	LAYER 6		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet Operations	Mobility & Platform Provider	Rider Experience/ Content Prov.	Infrastructure	
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Passenger App	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
mobileye		mobileye		VDL	SCHAEFFLER	Not announced		Not announced	Not announced	Not announced		

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

MaaS EUROPE

At a glance	Latest news	L4 target
 Of all the European OEMs in the AD MaaS space, VWCV is the most ambitious one and advanced. VW **collaborated** and **tested with SDS providers early on**. After **Argo's shutdown** , VW announced **Mobileye** technology to be integrated into the ID.Buzz AD. Promising collaboration!	Volkswagen ADMT announces agreement with Mobileye for autonomous driving. (20.03.2024) Read	**2026**
 There is **no clear strategy in the AD MaaS case**. Volvo has committed to **develop robotaxis with Waymo** - nothing has happened since. Volvo seems to be focusing instead on the development of self-driving trucks with its partners.	Volvo Cars to debut autonomous driving Ride Pilot feature in California. (06.01.2022) Read	Not announced
 Benteler established **HOLON as its new AD business unit**, working closely with SDS supplier Mobileye, fleet operator Beep to develop autonomous shuttles services based on HOLON's mover. As a non-OEM, bringing the vehicle to series production will be challenging – but SPVs will be a USP in the AD space.	HOLON and Rhein-Main-Verkehrsverbund cooperate on autonomous mobility. (08.04.2024) Read	**2026**
 EasyMile has been deployed vehicles >30 countries and >300 locations. the **EZ10 is the most widely used autonomous shuttle**. **ODD** and **SDS capabilities must be enhanced** to remain competitive in autonomous MaaS. However, EasyMile also provides driverless goods transportation solutions.	MicroSys and EasyMile collaborate on the development of safety-critical technology for autonomous driving. (02.04.2024) Read	L4 permission on one public road in France.

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS EUROPE

At a glance	Latest news	L4 target
 **GAMA acquired NAVYA** in 2023. As the technology is limited to **fixed routes** and **low speed applications**, it will be quite challenging to compete with more mature AV players. Gated areas seem to be the only promising use case in the future.	Gaussin and Macnica have taken over Navya. New entity GAMA to showcase a driverless shuttle at Busworld. (03.10.2023) Read	Not announced
 Oxa is **one of the few remaining autonomous technology provider in Europe**. First roboshuttle deployments in the US have been accomplished. We believe, Oxa fleets will soon at least hit the roads in the UK after the government's Automated Vehicles Act became law by May 2024.	Bayanat and Oxa announce strategic partnership to drive innovation in autonomous vehicle technology. (13.06.2024) Update Read	Not announced
 Imagery's technology relies on **multiple 360° cameras** and is based on a **deep neural network** that learns to drive by imitating human behavior. Imagery is quite present on European conferences. Therefore, we are eagerly awaiting first bus deployments in Europe.	Imagry unveils safe Driver Overwatch™, an autonomous safety feature for young and elderly drivers, at CES 2024. (09.01.2024) Read	Not announced
 MAN has not yet made an appearance in the bus segment in the context of autonomous driving. The **MINGA** project, in which MAN has a **strong partner at its side in SDS provider Mobileye**, is the first step. We see great added value in automated city buses and are excited about the project.	MAN Truck & Bus to make city buses autonomous with Mobileye. (17.05.2023) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS EUROPE

At a glance	Latest news	L4 target
 The Estonian startup offers autonomous and sustainable last-mile solution and claims to develop the **first autonomous hydrogen vehicle** in the world. Although there are already pilot projects, it will be tough to prevail against the well-known shuttle providers.	Auve Tech extends reach to U.S. market & enhances strategic partnership with Guident Ltd. (05.04.2024) Read	Not announced
 Verne creates an AV ecosystem consisting of three pillars: an **autonomous electric vehicle** for ride hailing, specialized **infrastructure**, and a mobility **service platform**. The goal is to reshape future mobility and create a unique user experience. Let's see if they will make it to industrialize their solution.	Verne: Journey to the future of mobility. (26.06.2024) Update Read	**2026**
 Avride is the **rebranded, international division** of the robotaxi and delivery robot company **Yandex Self-Driving Group**. While international assets have been separated from Russian-owned Yandex assets, Avride said it's testing AVs in diverse ODDs across the globe, focusing on safety.	Yandex self-driving group rebrands its international division as Avride. (04.08.2023) Read	Not announced
 Renault teamed up with Waymo on autonomous driving back in 2019 – no further announcements yet. Also, **Renault is partnering with WeRide on self-driving public transit** in France. A first pilot is about to be implemented by 2024.	Renault Joins Forces with WeRide for Low-Carbon Public Transit Practice in Europe. (15.05.2024) Read	Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

MaaS EUROPE

At a glance

Schaeffler joined forces with VDL to build shuttles based on its rolling chassis and VDL's expertise in vehicle bodies. The shuttle will be **powered by Mobileye's SDS** while first road tests are to be expected earliest 2025. Now it's essential to bag first partnerships with fleet operators and PTAs.

Latest news

Schaeffler and VDL Groep to team up on self-driving shuttles.

(31.08.2023)

Read

L4 target

Not announced

Definition L4 target: a robotaxi service that is publicly available in a specific ODD and operated without a safety driver.

Privately Owned Vehicles.

Intro | Use Cases & Layer Description

Privately Owned Vehicles | Use Cases

			Private Ground	Highway	Urban	Suburban	Rural
			Airport, factories, yards, harbors, ...	Highways, freeways, ...	City center, designated streets, ...	Federal highway, residential areas, ...	Rural roads, gravel road, ...
POV	Parking		home yard parking (L4)	-	self parking pilot car park (L4), urban self parking (L5)	self parking pilot parking place (L4) [e.g., supermarket], self parking (L4)	
	Driving		-	pilot (L2+), pilot (L3), chauffeur (L4)	urban highway / ring roads pilot (L2+ - L3) , city chauffeur (L4)	commuter pilot (L3/L4) , chauffeur (L4)	

POV | Layer Model Description

LAYER 1		LAYER 2	LAYER 3	LAYER 4
Sensor Set / SoC / Computing HW	SW-Stack / Virtual Driver	Self-Driving ready Vehicle	Rider Experience / Content Provider	Infrastructure

Self-Driving System (SDS) is the sum of all necessary systems to realize self driving level 4 (SAE).
Key functionalities are sensor data fusion, object detection, localization, prediction, environment interpretation, trajectory planning and actuator control.

The HW stack includes sensors, SoC and computing platforms, for example, while the SW stack covers the virtual driver, among others.

Self-Driving Vehicles (SDV) are considered L4 ready vehicles with an integrated and homologated SDS (sensors, computing hardware and software), which operate in a specific ODD (Operational Design Domain).

The **Content Provider** for **Rider Experience** owns a software platform that acts as middleware to service partners. Digital content (e.g., media), digital products (e.g., productivity tools) and digital services are part of this platform.

The service area and its **infrastructure** are core elements to enable an AD service. Infrastructure includes the vehicles' IT infrastructure (especially cloud services and backend), V2X technology and takes into account human behavior prediction in that specific scenery.

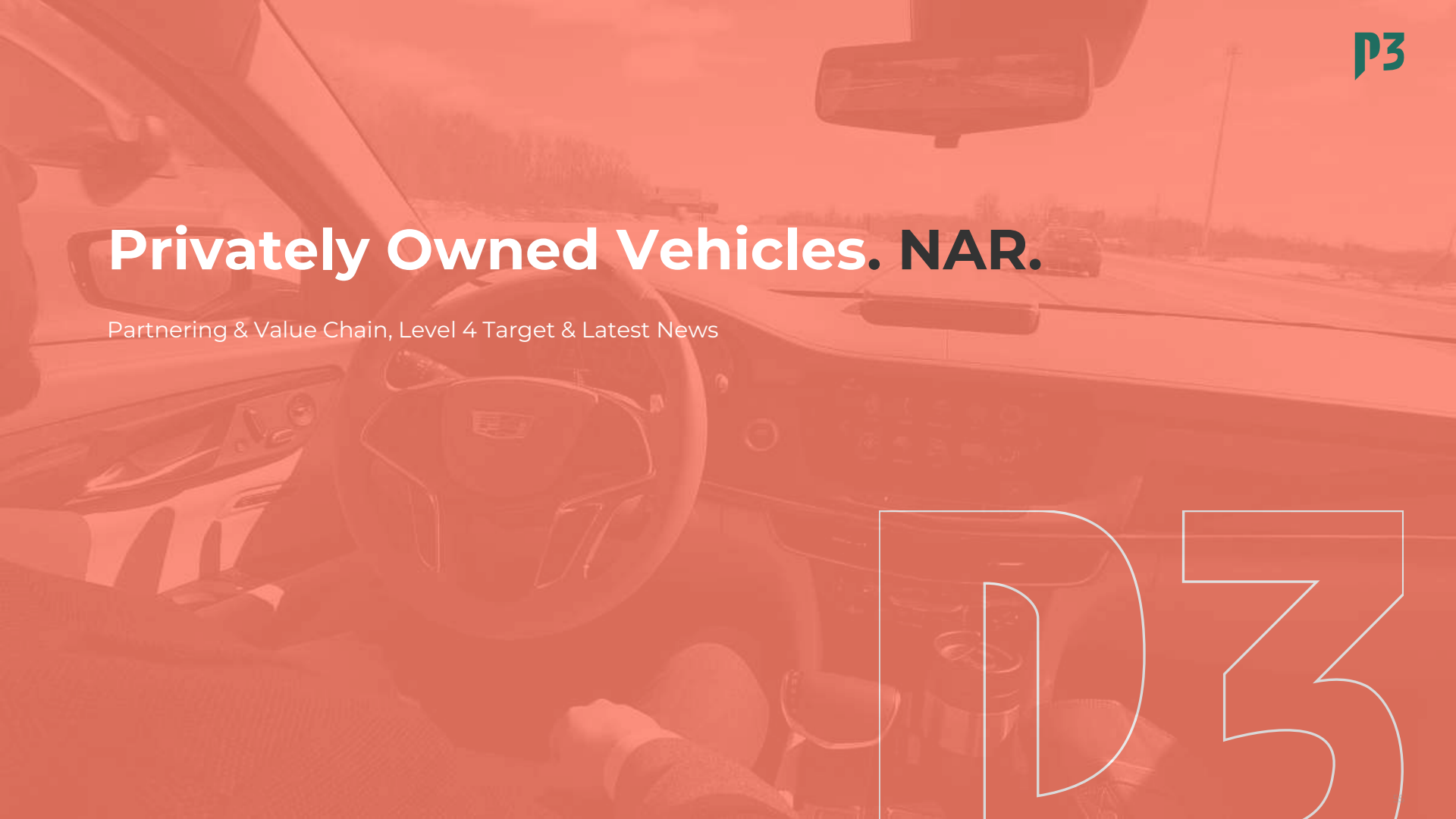
POV | Layer Model Description

Exemplary tasks

LAYER 1		LAYER 2	LAYER 3	LAYER 4
Sensor Set / SoC / Computing HW	SW-Stack / Virtual Driver	Self-Driving ready Vehicle	Rider Experience / Content Provider	Infrastructure
HW development	SW development	Design & development	TV & streaming	Localization
HW production	Simulation	Redundant chassis	Shopping	3rd party HD maps
After sales	Prediction	SDS integration	Education	V2X (e.g., cellular, satellite, WIFI)
Automotive approval	SDS licensing	SDV testing	Working	Cloud infrastructure
Sensor testing & approval	SW testing & approval	After sales	Gaming	Teleoperations
...	HD mapping	Production	...	Human behavior prediction
	Verification & validation	Logistics		Service area
	...	Sales channel		...
		Homologation		
		Pricing		
		...		

Privately Owned Vehicles. NAR.

Partnering & Value Chain, Level 4 Target & Latest News



POV NAR

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
TESLA	SAMSUNG intel AMD	TESLA		TESLA		TESLA	Baidu China !		
OUSTER CEPTON	Qualcomm UNTETHER AI mobileye	OCULii gm Momenta OAK RIDGE	Applied Intuition	gm		gm	mobileye DYNAMIC MAP PLATFORM	Microsoft	
OUSTER	mobileye	mobileye Baidu SAIPS LATITUDE nullmax		Ford		Not announced	mobileye EMG DEEPMAP Civil Maps	Au	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ! Update

POV NAR

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
mobileye, Valeo	mobileye, NVIDIA	mobileye	ecarx	Ford, GWM, Honda, BMW, Porsche, Polestar, Zeekr, Stellantis, gm, Mahindra, Volkswagen Group		Not announced	Volkswagen Group		
NEW: Ouster	NEW: NVIDIA	NEW: helm.ai		NEW: Honda		Not announced	Not announced		

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

POV NAR

At a glance	Latest news	L4 target
 Tesla **collects a huge amount of data** and build a unique ecosystem around the fleet. While there are still legitimate discussions about the robustness of vision-only approaches, the **performance of FSD in the US is already impressive**. Nevertheless, it is still an L2+ system.	Elon Musk confirms Tesla 'robotaxi' event delayed due to design change. (15.07.2024) Update Read	No binding roadmap for FSD
 GM has **combined its former Ultra Cruise system** (former goal to achieve hands-free driving for 95 percent of scenarios) **with its Super Cruise program.** May there also be a chance for struggling GM-backed Cruise to power GM vehicles? Also, in **China, GM has invested in Momenta**.	GM's hands-free Super Cruise expands to 750,000 miles. (14.02.2024) Read	**2025**
 After getting off the robotaxi business with Argo.AI, Ford said **to focus on developing differentiated L2+ and L3 applications** for privately used cars. By 2023, Ford established Latitude to develop future automated driving technology.	Ford brings BlueCruise technology to Germany. [German] (28.08.2023) Read	Not announced
 Mobileye is the **leading supplier for camera-based driver assistance systems**. In addition to L4 technology for robotaxis, **SuperVision is its state-of-the-art L2+ (eyes on) system**. Also, first **OEMs teamed up with Mobileye to integrate its Chauffeur** (eyes off) solution. We are very much looking forward to testing it on European roads.	Mobileye EyeQ6 Lite launches to speed ADAS upgrades globally. (17.04.2024) Read	Not announced

Definition L4 target: an automated driving system that does not require the driver to take over at any time in a specific ODD. Hands-off, eyes-off, brain-off.

POV NAR

At a glance

Helm.ai employs an AI-first approach to building AD software using an **unsupervised learning technology** which leverages insights from applied mathematics and compressive sensing. This technology allows to **train on vast volumes of data** without the need for large scale fleets or human annotation.

Latest news

Helm.ai announces VidGen-1: State of the Art generative AI video for autonomous driving.

(20.06.2024)

Read

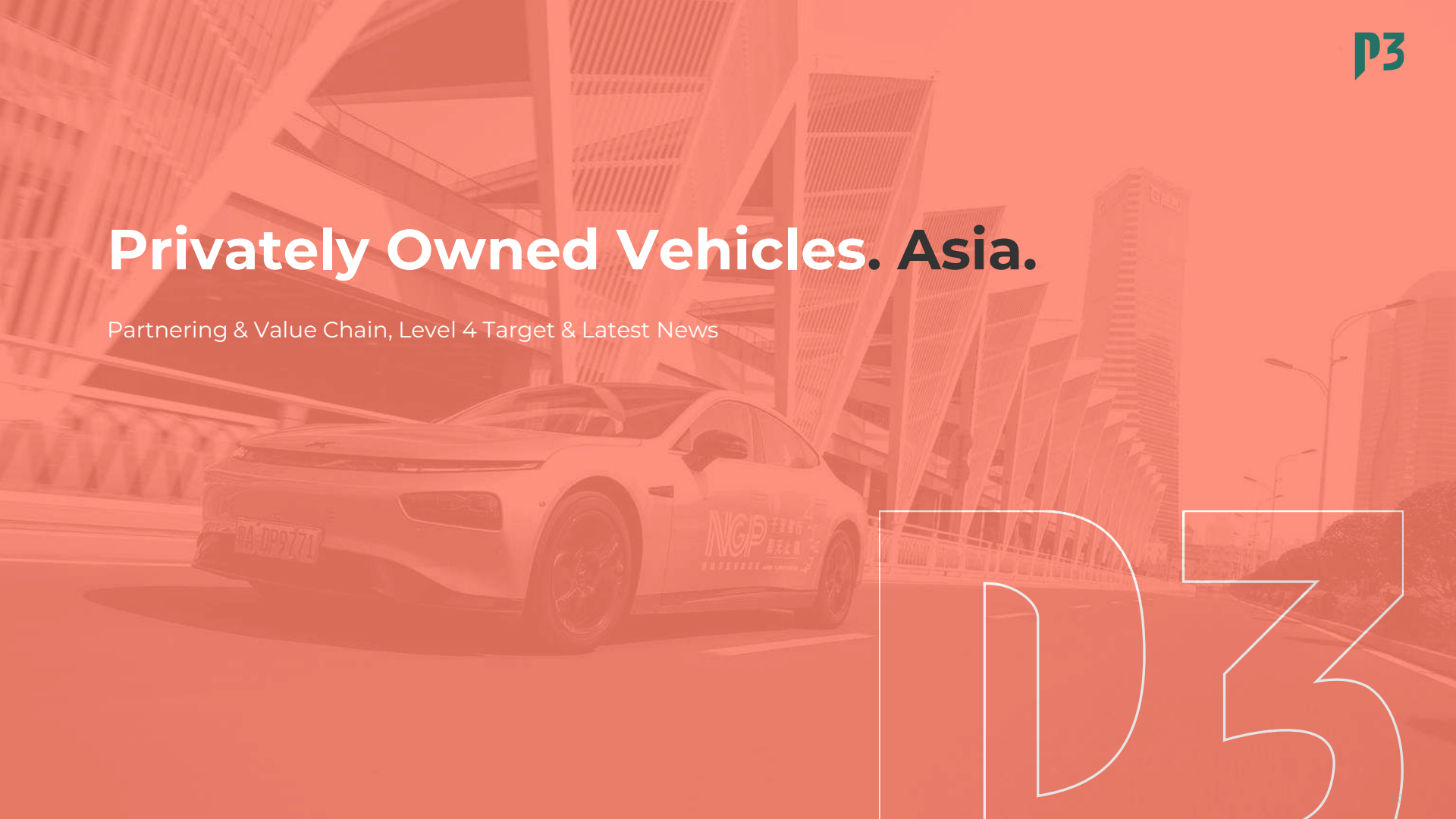
L4 target

Not announced

Definition L4 target: an automated driving system that does not require the driver to take over at any time in a specific ODD. Hands-off, eyes-off, brain-off.

Privately Owned Vehicles. Asia.

Partnering & Value Chain, Level 4 Target & Latest News



POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
HESAI	NVIDIA	NIO		NIO		nreal	Tencent 腾讯		Qualcomm
BOSCH	RHINO Tech					Qualcomm			
Si									
NXP				JAC	Continental				
ZVISION	NVIDIA	XPENG		XPENG		Qualcomm	高德	Alibaba Cloud	
LIVOX						Not announced			
robosense									
mobileye		mobileye		ZEEKR		Not announced	mobileye		
robosense	NVIDIA	NIRA		GEELY					

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
robosense Baidu apollo [illegible]	NVIDIA [illegible] Horizon Robotics	Momenta Baidu apollo nullmax AI		BYD		Not announced			HUAWEI
	mobileye Qualcomm SemiDrive Horizon Robotics NVIDIA	mobileye HAOMO.AI OCULII LiangDao nullmax AI		GWM		Not announced	NAVINFO		HUAWEI China Mobile
robosense HUAWEI Baidu apollo arbe	BOSCH	DiDi HUAWEI Baidu apollo		BAIC		Not announced	EMG HUAWEI		China Mobile

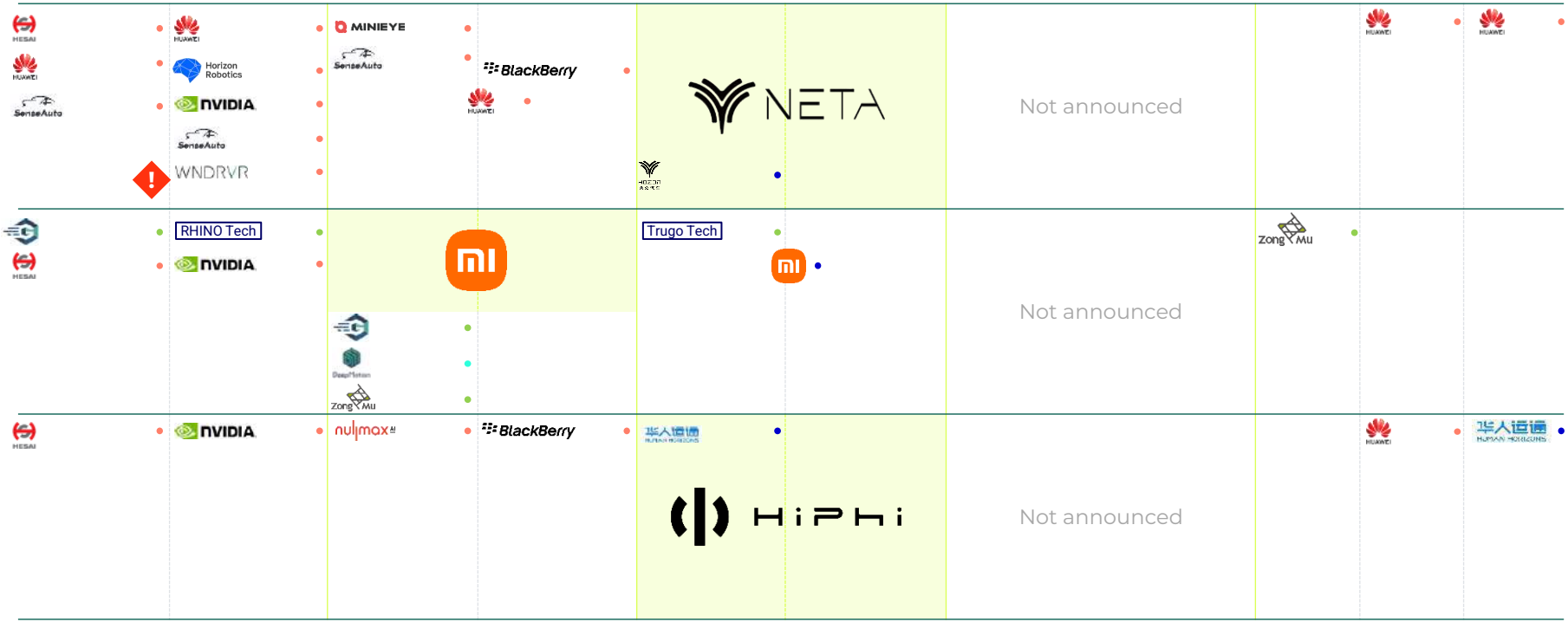
Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
Luminar	SemiDrive	momenta					mobileye		ZTE
mobileye	Qualcomm	Baidu apollo					here		
robosense	TTTech	nullmax		SAIC		Not announced			
ZF	Horizon Robotics								
Hesai	NVIDIA								
Continental	NVIDIA	LUCID							
BOSCH				LUCID		Not announced	Not announced		
Hesai	NVIDIA	Li Auto							
	Horizon Robotics	QCRAFT		Li Auto		Not announced	Not announced		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA


LAYER 1
LAYER 2
LAYER 3
LAYER 4
Sensors / SoC / Computing HW
SW-Stack
Self-Driving Ready Vehicle
Rider Experience/ Content Provider
Infrastructure
Sensors
Chips, SoC, ...
Virtual Driver
Simulation, V&V, OS, ...
Vehicles
Components
Entertainment & advertisement
3rd party HD Maps
Cloud
V2X & Others
HESAI
HUAWEI
Horizon Robotics
NVIDIA
SenseAuto
WNDRVR
MINIEYE
BlackBerry
NETA
Not announced
RHINO Tech
Trugo Tech
Zong Mu
nullmax
HiPhi
Core Business
Partnership or supplier deal
Investment
Acquisition
Parent / Subsidiary
Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
robosense, HESAI	Cambricon, Horizon Robotics, Black Sesame, mobileye, NVIDIA	Baidu, nullmax, mobileye, dji		FAW, HONGQI		Not announced		QUECTEL	
QUANERGY, dji, mobileye	NVIDIA, mobileye, Horizon Robotics, Motion	Baidu, MINIEYE, dji, nullmax, Motion		BTL, CHERY, EXEED		IFLYTEK	mobileye	QUANERGY, BOE	
robosense, HESAI	Horizon Robotics, NVIDIA	HOLOMATIC, momenta		GAC, AION		Not announced		Tencent, HUAWEI	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
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Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
HESAI	Horizon Robotics	Baidu 百度		长安汽车 CHANGAN		HUAWEI		Baidu 百度	
BOSCH		HUAWEI							
!									
	BLACK SESAME	Baidu 百度		DONGFENG DONGFENG MOTOR CORPORATION		Not announced		HUAWEI	
	NVIDIA	Baidu 百度		GEELY		Not announced	Baidu 百度		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
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Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
HUAWEI		HUAWEI; 智行者	HUAWEI	ARCFOX; Audi; BAIC Group; JAC; Changan; GAC		Not announced	Baidu 百度		PATEO; HUAWEI
KANKAN	BLACK SESAME; Texas Instruments; NVIDIA; Horizon Robotics; HUAWEI; Ambarella	nullmax AI	nullmax AI	Ford; BYD; SAIC; FAW; CHERY; GWM		Not announced	NAVINFO		
robosense	NVIDIA; Qualcomm	momenta		SAIC		Not announced			Alibaba.com

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ! Update

POV ASIA

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
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Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
OUSTER Valeo mobileye	RENESAS mobileye Qualcomm	autox cruise helm.ai		HONDA		SONY	DYNAMIC MAP PLATFORM Baidu 百度 | apollo		
robosense	Qualcomm G-PULSE 金脉	HAOMO.AI		GWM		Not announced	NAVINFO		

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV ASIA

At a glance	Latest news	L4 target
 While NIO premium EVs are **hitting several markets outside China**, ADAS capabilities and functions of other competitors in China seem to be slightly more advanced and widely available.	NIO said to revamp intelligent driving R&D division, focusing on end-to-end large models. (20.06.2024) Update Read	Not announced
 XPENG announced that its XNGP urban intelligent driving system has achieved **100% HD map-free operation** with the goal to achieve full coverage of XNGP functions in major urban road networks across China by the end of 2024.	XPENG expands XNGP urban intelligent driving coverage to 336 cities in China. (20.06.2024) Update Read	Not announced
 Geely's EV brand **develops the SPV robotaxi for Waymo** while **incorporating Mobileye's SuperVision system for private owned cars**. Considering prices, technological specifications and functions, Zeekr vehicles can also be a real alternative to conventional manufacturers in Europe.	ZEEKR receives road test permit for unmanned vehicles in Ningbo. (27.06.2024) Update Read	Not announced
 In December 2021, **BYD and Momenta**, one of China's major SDS developers, formed a **joint venture for autonomous driving**. To date, ADAS functionalities and availability lag behind other competitors in China.	BYD receives conditional L3 autonomous driving vehicle testing license in July 2023. (27.12.2023) Read	Not announced

Definition L4 target: an automated driving system that does not require the driver to take over at any time in a specific ODD. Hands-off, eyes-off, brain-off.

POV ASIA

At a glance	Latest **news**	**L4** target
 GWM aims to provide complete mobility ecosystems with dedicated brands for the European markets. **Regarding AD**, GWM has been working with companies such as **Mobileye, Qualcomm** or Nullmax. GWM is pursuing a strong partnership approach.	Hesai Technology, Great Wall Motor to step up cooperation in intelligent driving field. (29.02.2024) Read	Not announced
 While BAIC teamed up with Baidu to develop robotaxis, its EV brand **Arcfox models are equipped with Huawei software and sensor suite**. Our regular ADAS benchmark drives in China showed: **Huawei system's performance is stunning**.	ARCFOX granted L3 highway autonomous driving vehicle testing license in Beijing. (22.12.2023) Read	Not announced
 China's largest carmaker intends to equip premium electric vehicle models with **Momenta-developed intelligent driving technology**. SAIC may not seem as 'fancy' in its outward appearance as some startups from China – that's why they co-founded IM Motors in a JV with Alibaba.	SAIC-GM launches RoboTest autonomous vehicle testing platform. (06.06.2024) Update Read	Not announced
 Lucid's advanced luxury EVs are about to be equipped with its **DreamDrive ADAS systems**, consisting of **up to 32 sensors** and offering **more than 30 driver-assistance features**. Since hardly anything is known about partnerships, the **SW is apparently primarily developed in-house**.	Driving on Air: Lucid Group builds intelligent EVs on NVIDIA DRIVE. (22.03.2022) Read	Not announced

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POV ASIA

At a glance	Latest news	L4 target
 Li Auto is another EV company aiming for autonomous driving. While Li **claims** their **technology will soon be competitive with Tesla's Autopilot**, they have **yet to prove those capabilities**. Competition in China is strong.	Li Auto sets up dedicated unit for end-to-end smart driving large model R&D. (17.07.2024) Update Read	Not announced
 NETA Auto, a Hozon Auto brand, is one of several Chinese OEMs that has entered into **in-depth cooperation with Huawei**. Furthermore, teaming of with Hesai for future vehicle models shall further enhance automated driving capabilities.	Wind River powers NETA Auto's intelligent controller. (19.07.2024) Update Read	Not announced
 Xiaomi sets sight on several autonomous electric vehicle brands by **substantially investing in smart car technology**.. The unveiled **Xiaomi SU7 offers great user experience at lower cost** than Western OEMs – the ADAS has still some weaknesses but is about to catch up with competition.	Xiaomi SU7 to roll out urban NOA feature in ten cities. (31.05.2024) Update Read	Not announced
 HiPhi, a **brand of Human Horizons** is developing the '**HiPhi Pilot**', providing redundant and safe intelligent driving features aiming at both L3 and L4. At this point, too little is known about the AD capabilities to seriously assess the company. **Meanwhile, the company seems to face bankruptcy.**	Human Horizons, Huawei Cloud partner on dedicated intelligent driving cloud. (25.07.2023) Read	Not announced

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POV ASIA

At a glance	Latest **news**	**L4** target
 FAW planned to offer an L4-capable system as early as 2020 – which was not achieved. Now FAW aims to offer a **fully functional autonomous driving system by 2030** - this new timeline seems more realistic.	FAW Group partners with DJI Automotive for intelligent driving tech development. (19.04.2024) Read	Beyond **2025**
 Through **various partnerships**, the company is driving the development of intelligent vehicles. **Chery plans to offer L4-capable vehicles in 2025**. Not much time left. Partnerships with iMotion, Nullmax or dji could boost the development.	iMotion to supply iDC series autonomous driving solutions to Chery's OMODA brand. (07.05.2024) Read	**2025**
 GAC is the fifth largest car manufacturer in China and sells its vehicles under various brands. The company has always **worked closely with Huawei** and plans to produce L4 vehicles under its own AION brand from 2024 as a manufacturing partner of Huawei.	GAC Toyota, Momenta to debut end-to-end smart driving solution on bZ3X model. (01.07.2024) Update Read	Not announced
 CHANGAN is **working closely with Huawei on Level 4 Autopilot**, 5G, and C-V2X, and plans to offer **L4 capabilities in 2025**. Recently, the company announced a strategic cooperation with Geely, among others, to combine strengths and share resources in the development of autonomous cars.	Bosch delivers 3rd-gen multipurpose camera to Changan DEEPAL G318. (28.05.2024) Update Read	**2025**

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POV ASIA

At a glance	Latest news	L4 target
 Dongfeng's **VOYAH brand vehicles** are about to be equipped with **Baidu's intelligent driving system**, offering features like Navigation on Autopilot, intelligent cruise control, automatic lane changes as well as various parking modes.	Black Sesame Technologies' chip facilitates Dongfeng eπ007's smart driving system upgrade. (19.07.2024) Update Read	Not announced
 JI YUE is a joint venture between Geely and Baidu. The first production model relies on solely visual perception algorithms and thus a **pure vision approach**. The company intends to cover 200 cities nationwide with its advanced urban intelligent driving functions by end of 2024.	Ji Yue rolls out V1.4.0 OTA upgrade with enhanced intelligent capabilities. (26.03.2024) Read	Not announced
 During our benchmark drives in China, **Huawei's ADS 2.0 performance was stunning**. ADS 3.0 is about to be unveiled by the end of 2024 and promises another leap in performance. Also, the solution has been integrated in different EV models. Huawei had the goal to become China's Bosch – towards **SW capabilities, it's already much more advanced in China**.	AITO rolls out HD map-free NCA smart driving function nationwide. (20.03.2024) Read	**2025**
 Nullmax pursues a '**Machine Learning First**' approach and has **teamed up with several OEMs, chip suppliers and other companies**. While the depth of cooperation is often unclear, you should keep an eye on Nullmax and its **vision-based, multi-sensor fusion and perception technology** route.	Nullmax launches pure-vision multimodal autonomous driving tech 'Nullmax Intelligence'. (17.06.2024) Update Read	Not announced

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POV ASIA

At a glance	Latest news	L4 target
 IM Motors, **co-founded by SAIC Motor, Zhangjiang Hi-Tech, and Alibaba** pushes its AD capabilities through **joint development with Momenta**. While urban NOA was implemented swiftly, IM also obtained the official AV testing license for highway/expressway in Shanghai for L3 testing.	IM Motors kicks off presale of IM L6 model with price range of 230,000 to 330,000 yuan. (09.04.2024) Read	Not announced
 Wile providing its own "SENSING“ ADAS, Honda has attracted attention primarily through **investing in GM's Cruise for MaaS initiatives.** An **investment in Helm.ai** , however, is intended to benefit the company's own software and AI competencies.	Honda unveils SENSING 360+ system. (28.11.2023) Read	**2025**
 Haomo.ai is **backed by GWM** and develops its urban navigation-assisted Hpilot for mass-production. By Feb 2024, it has been **integrated in over 20 vehicle models**, achieving >120 mn km of assisted driving. Gathering a huge amount of data may be beneficial towards L4 development.	Haomo.ai nabs 300 million yuan in Series B2 financing round. (23.04.2024) Read	Not announced

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Privately Owned Vehicles. Europe.

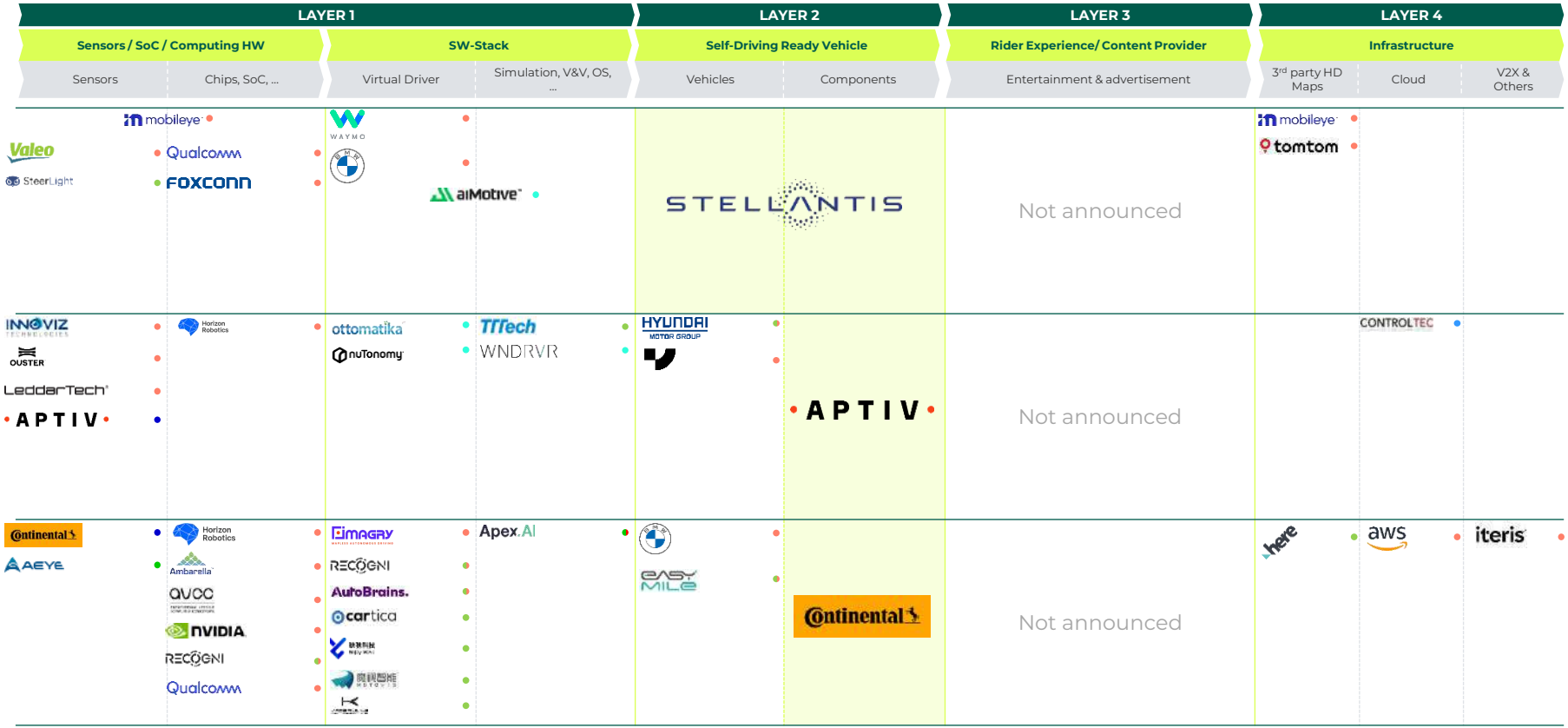
Partnering & Value Chain, Level 4 Target & Latest News

POV EUROPE

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Entertainment & advertisement	3rd party HD Maps	Cloud	V2X & Others
luminar	NVIDIA	NVIDIA		Mercedes-Benz		Mercedes me	DEEPMAP	Tencent 腾讯	
BOSCH	brainchip	Baidu 百度				ZYNC	here		
Valeo	Qualcomm	momenta							
veoneer									
mobileye		Arriver	TTTech	BMW	Continental	BMW CONNECTED DRIVE	here	aws	ottopia
INNOVIZ	Qualcomm	Valeo	BlackBerry			AirConsole			
APTIV		AutoBrains.							
MAGNA		Tencent 腾讯							
veoneer		STELLANTIS							
Valeo		TATA TECHNOLOGIES							
mobileye	NVIDIA	VAIVA Safe Mobility	CARIAD	VOLKSWAGEN GROUP		Not announced	tomtom	Microsoft	verizon
INNOVIZ	Qualcomm	Hesai Auteca	BlackBerry				mobileye		HUAWEI
	CARIAD	UAI	Luxoft				here		
	mobileye	INTENTA	TTTech				高德		
		Horizon Robotics	Applied Intuition				NIRA		
		BOSCH							

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV EUROPE



Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

POV EUROPE

LAYER 1				LAYER 2		LAYER 3	LAYER 4		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Rider Experience/ Content Provider	Infrastructure		
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BOSCH HESAI Webasto	RECOGNI NVIDIA ambarella Ambarella BOSCH	momenta WeRide FIVE AI RECOGNI CARIAD Microsoft			BOSCH NEXTEV	Not announced	tomtom DEEPMAP here atlatec	Microsoft	
luminar	mobileye NVIDIA	mobileye		polestar		polestar Google	Google		
	NVIDIA	WAYVE		JAGUAR		Not announced		Microsoft	

Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

POV EUROPE

At a glance	Latest **news**	**L4** target
 **Drive Pilot is the world's first** ADAS to gain **type approval for a L3 system** and available in Europe and the US. However, as the system's ODD is quite limited, there is currently only small added value for customers.	Automated driving revolution: Mercedes-Benz announces U.S. availability of DRIVE PILOT – the world's first certified SAE Level 3 system for the U.S. market. (27.09.2023) Read	Not announced
 BMW seems to have greatly **reduced its own activities with regard to L3 and L4** and **instead focuses on partnerships** - most recently with Stellantis and Tata. In our regular ADAS benchmark drives, BMW's driver assistance systems show the strongest performance among all European OEMs.	BMW Group and Tata Technologies aim to collaborate for the development of Automotive Software and Business IT solutions. (02.04.2024) Read	Not announced
 **CARIAD is primarily responsible for software development** in the **private ownership** segment. There is also a development partnership (Automated Driving Alliance) with Bosch. We are watching the development of CARIAD and are curious to see whether they can live up to their great task.	Volkswagen Group intensifies collaboration with Mobileye. (20.03.2024) Read	Not announced
 Stellantis is working on **L3 and L4 solutions with technology partners** - especially **BMW and Waymo**. In 2023, Stellantis launched its L2 hands-free driver assistance system, which will be integrated into the 2024 Jeep Grand Cherokee.	Stellantis boosts LiDAR technology. (20.03.2024) Read	Not announced

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POV EUROPE

At a glance	Latest **news**	**L4** target
 Aptiv is a leading company in the development of ADAS for and invested a huge amount of money in Motional, a JV with Hyundai, before reducing its common equity interest from 50% to about 15% by end of March 2024. **Aptiv has acquired or at least invested in software companies to strengthen in-house capabilities** towards ADAS and AD.	Horizon Robotics, Aptiv join forces to develop localized intelligent driving solutions. (03.07.2023) Read	Not announced
 Continental **spun off its own AD unit**. Traditional Tier 1 such as Conti compete with strong SW players as OEMs/ customers increasingly purchase HW and SW separately. However, partnerships and investments in AI companies show that Conti **is willing to keep up the race.**	Continental technical collaboration with Qualcomm. (13.05.2024) Read	Not announced
 Bosch **teamed up with CARIAD** to jointly develop automated driving functions and acquired AV company Five AI a couple of years ago to strengthen its AD capabilities. Traditional Tier 1 such as Bosch **compete with strong SW players** as OEMs/ customers increasingly purchase HW and SW separately	For safer roads: Bosch teams up with Microsoft to explore new frontiers with generative AI. (28.02.2024) Read	Not announced
 Polestar is a renowned EV player in the EU market. While ADAS of both Polestar 1 and 2 can't compete with many competitors, there is supposed to be a **significant leap with Polestar 3 and 4**. With **NVIDIA, Luminar and especially Mobileye**, they have strong technology partners at their side.	Polestar 4 to integrate Luminar LiDAR with Mobileye Chauffeur. (09.11.2023) Read	Not announced

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POV EUROPE

At a glance

Wayve does **not rely on HD maps** and **hand-coded rules** but **focuses on its deep and self-learning AI technology** based on cameras. The company raised $1bn in 2024 to take its Tesla-like technology for self-driving to many carmakers. This approach is different compared to Tesla.

Latest **news**

Wayve raises $1B to take its Tesla-like technology for self-driving to many carmakers.

(07.05.2024)

Read

L4 target

Not announced

Definition L4 target: an automated driving system that does not require the driver to take over at any time in a specific ODD. Hands-off, eyes-off, brain-off.

Goods Transport & TaaS.

Intro | Use Cases, Market Insights & Layer Description

Goods Transport & TaaS | Use Cases

			Gated Area	Highway	Urban	Suburban	Rural
			Airport, factories, yards, harbors, ...	Highways, freeways, ...	City center, designated streets, ...	Federal highway, residential areas, ...	Rural roads, gravel road, ...
Transport	S		last mile delivery	-	last mile delivery	last mile delivery	last mile delivery
	ML		automated yards, e.g., intralogistics trucks (L4)	-	hub-and-spoke robo transporter	hub-and-spoke robo transporter	robo transporter
	XL		automated yards, e.g., intralogistics trucks (L4)	hub-to-hub self-driving truck	-	-	-
Platooning			automated yards, e.g., intralogistics trucks (L4)	hub-to-hub self-driving truck	-	-	-
Offroad			e. g. snow clearing (L4), rob harvesters	-	e. g., street sweeping machines (L4)	e. g., street sweeping machines (L4)	e.g., robo tractor

Automated Yards

Transportation within gated areas, yards, hub or similar confined areas

Hub-to-Hub

Hub-to-hub transportation between logistic hubs incl. drayage run

Hub-and-Spoke

Hub-and-spoke transportation from a hub to different spokes incl. drayage runs

Robo Transporter

Robotransporter Free float autonomous transport vehicles & other use cases such as shuttles

Goods Transport & TaaS | Longlist

		WAYMO	tusimple	Aurora	DAIMLER TRUCK	nuro	Plus	KARGOBOT	TRATON	einride	VOLVO
Transport	S										
	ML	P 				P 				G/P 	
	XL	P 	P 	P 	P 	P 	P 	P 	P 		P 
Platooning					P 			P 	P 		P 
Offroad					P 				G/P 		G 

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		udelv	kodiak	Gatik	amazon	pony.ai	IVECO	Ford	TESLA	TRUNK 主线科技	INCEPTIO TECHNOLOGY
Transport	S				P 			P 			
	ML	P 		P 		P 		P 			
	XL		P 		P 	P 	P 	P 	P 	P 	P 
Platooning						P 	P 	P 			
Offroad											

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		STARSHIP	AVRIDE	TORC	MARS	SAIC	NEOLIX	HYUNDAI MOTOR GROUP	DAF	cruise	Alibaba.com
Transport	S	G/P 	P 					P 			
	ML						P 			P 	G/P 
	XL			P 	P 	G/P 					P Da Man Lv - No picture available yet
Platooning								P 	P 		
Offroad											

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		SHACMAN	UNITY DRIVE	FACTION	nuport	waabi			serve	Motional	DELIVERS.AI
Transport	S								P 		P 
	ML		P 	P 			P 	P 		P 	
	XL	G 			G 	P 					
Platooning											
Offroad			G/P 				P 				

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		westwell	Kiwibot	cartken	STREETDRONE	DEEPROUTE.AI	TERAKI	whale dynamic		AUTRA TECH	ZF
Transport	S		P 	P 			P 				
	ML				P 	P 		P 			
	XL								P 	P 	P 
Platooning											
Offroad		P 									

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		MAGNA	CLEVON	driveblocks	DEEPWAY	LOXO	Goggo network	宏景智驾 HONG JING Drive	tinymile	OTTONOMY.IO	NEUBILITY
Transport	S	P 	P 						P 	P 	P 
	ML					P 	P 				
	XL			P 	P 			P 			
Platooning											
Offroad				G 							

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Longlist

		STACK	robione	ZELOS	robomart
Transport	S				
	ML		P 	P 	P 
	XL	P 			
Platooning					
Offroad					

Activities | No activities | Stopped activities | G=Gated Area | P=Public Area

Goods Transport & TaaS | Layer Model Description

LAYER 1		LAYER 2	LAYER 3	LAYER 4	LAYER 5
Sensor Set / SoC / Computing HW	SW-Stack / Virtual Driver	Self-Driving ready Vehicle	Fleet, Hub & Tele Operations	Transport & Platform Provider	Infrastructure
Self-Driving System (SDS) is the sum of all necessary systems to realize self driving level 4 (SAE). Key functionalities are sensor data fusion, object detection, localization, prediction, environment interpretation, trajectory planning and actuator control. The HW stack includes sensors, SoC and computing platforms, for example, while the SW stack covers the virtual driver, among others.		**Self-Driving Vehicles (SDV)** are considered L4 ready vehicles with an integrated and homologated SDS (sensors, computing hardware and software), which operate in a specific ODD (Operational Design Domain).	**Fleet Operators** potentially own, operate and maintain a fleet of self-driving vehicles. It may be necessary that a fleet operator is responsible for fleet intelligence functions and technical supervision or **remote assistance**. In case of TaaS the fleet operator may also be responsible for **hub operations.**Therefore, Layer 3 covers both physical and digital fleet operations.	**Transport providers** (i.e., carriers) carry goods from shippers (e.g., grocery stores) to B2B or B2C customers using autonomous vehicles. Freight matching may be executed by **Platform providers** that connect shippers and carriers or transport demand and supply. They are responsible for order management or disposition planning based on data analysis and simulation.	The service area and its **infrastructure** are core elements to enable an AD service. Infrastructure includes the vehicles' IT infrastructure (especially cloud services and backend), V2X technology and considers human behavior prediction in that specific scenery.

Goods Transport & TaaS | Layer Model Description

Exemplary tasks

LAYER 1		LAYER 2	LAYER 3	LAYER 4	LAYER 5
Sensor Set / SoC / Computing HW	SW-Stack / Virtual Driver	Self-Driving ready Vehicle	Fleet, Hub & Tele Operations	Transport & Platform Provider	Infrastructure
HW development	SW development	Design & development	Fleet financing	Logistics platform	Localization
HW production	Simulation	Redundant chassis	Insurance	Interface connection	3rd party HD maps
After sales	Prediction	SDS integration	Fleet depot	Disposition planning	V2X (e.g., cellular, satellite, WIFI)
Automotive approval	SDS licensing	SDV testing	Cleaning	Fleet Intelligence (e.g., fleet & ride optimization)	Cloud infrastructure
Sensor testing & approval	SW testing & approval	After sales	Maintenance	Order management	Service area
...	HD Mapping	Production	Backend (Layer 1-4)	Booking	...
	Verification & validation	Logistics	Concessions	Routing	
	...	Sales channel	Fleet Control Center	Pricing	
		Homologation	Teleoperations	Payment	
		Pricing	Hub Operations	Customer service	
		...	Driver sideline activities	Authentication (delivery services)	
				...	

Goods Transport & TaaS. NAR.

Partnering & Value Chain, Level 4 Target & Latest News

Goods Transport & TaaS NAR

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
Waymo	Samsung, Intel	Waymo	Latent Logic	Jaguar		AutoNation, Swiss Re, transdev	Waymo	Uber Freight	Not announced		
Luminar, AEVA		TORC, algolux	TNO innovation for life, Applied Intuition, foretellix, DeepScenario	Freightliner		Penske		Schneider, C.R. England, Uber Freight		aws	
Plus, Ouster, Teledyne FLIR, AEVA, Luminar	NVIDIA	Plus	BlackBerry	PACCAR, TRATON, IVECO, SAIC, FAW Group, JAC, Hyundai	Cummins, Velociti, Schaeffler, Bosch	Goodyear		amazon, ZTO, SF Express, DSV, dm, CJ, Worldex		aws	Transurban

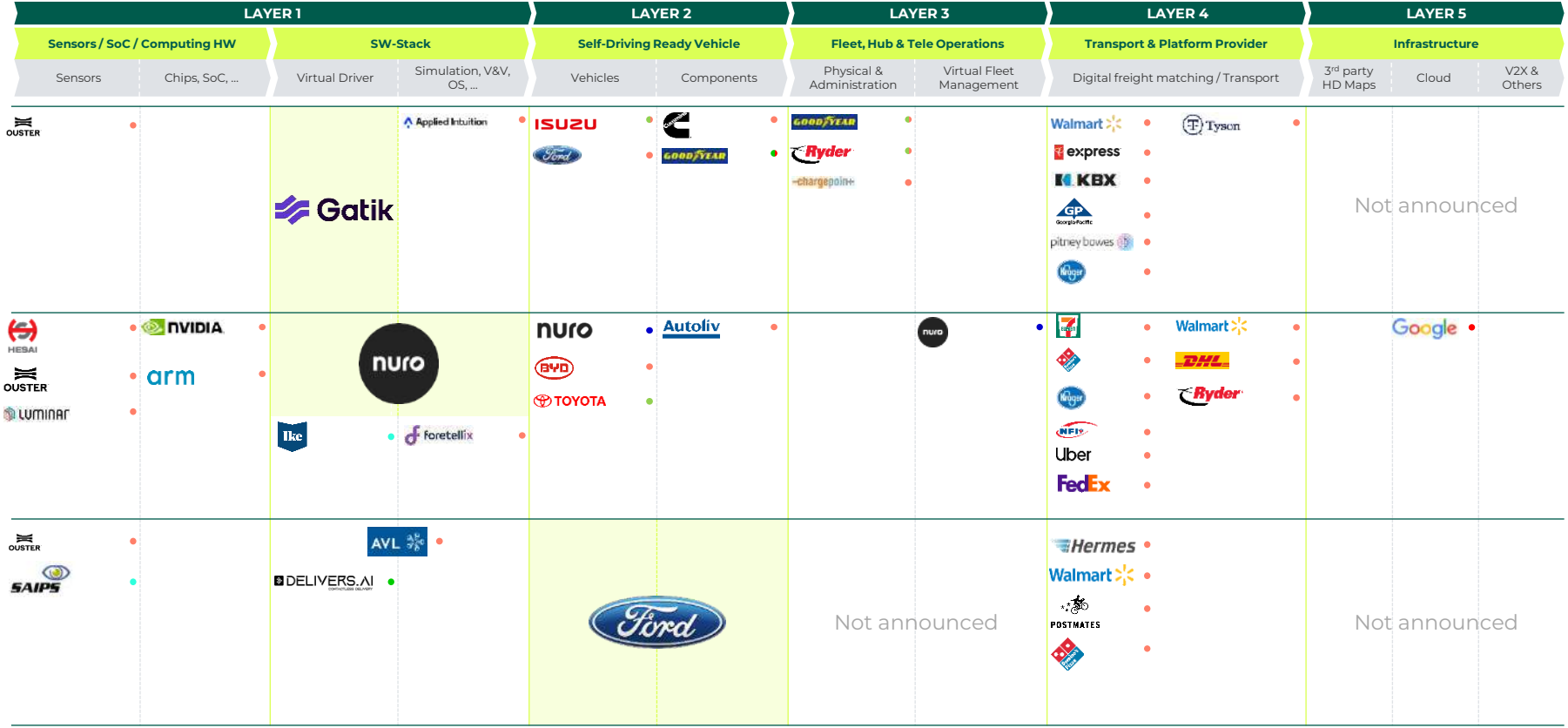
Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS NAR

LAYER 1				LAYER 2		LAYER 3		LAYER 4		LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider		Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport		3rd party HD Maps	Cloud	V2X & Others
Luminar Hesai ZF	NVIDIA Ambarella	kodiak	Applied Intuition	PACCAR BMW	Vicor	SK Bridgestone Pilot Ryder		CEVA U.S. Xpress Penske IKEA Werner Forward	MB Martin Brower C.R. England Loadsmith Maersk Atlas Note: off-highway	Not announced		Drivewyze
	NVIDIA	waabi		Peterbilt Volvo Scania Porsche SE		Not announced		Uber Freight		Not announced		
Aurora blackmore Ours Continental	NVIDIA Continental	Aurora Uber ATG		PACCAR FCA DAF Kenworth Volvo	Continental	Ryder	Aurora	FedEx Amazon U.S. Xpress Uber Freight Werner Covenant	Hirschbach		aws	Continental

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS NAR



Goods Transport & TaaS NAR

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations	Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
mobileye, OUSTER		mobileye		udelv, TOYOTA, Ford		udelv	Planzer, ZIEGLER, DONLEN, Walmart, XPO	mobileye			
Not announced		Aurora, Plus		RIVIAN, CANVAS, dispatch		Not announced	amazon		aws		
TESLA, tsmc		TESLA		TESLA		Not announced	Not announced		Not announced		

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS NAR

LAYER 1		LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations	Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
whale dynamic Whale Dynamic AV stack consists of 3rd party HW		whale dynamic		onx			zeeba	robomart AVERY DENNISON	Not announced		

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS NAR

At a glance	Latest news	L4 target
 The Waymo Driver has **over a decade of deep AD experience** including **millions of miles on public roads** and **billions of miles in simulation**. Waymo has **reduced trucking efforts to a minimum** in order to focus on the ride hailing case. Also, the existing fleet is used for food delivery via Uber Eats,	Phoenix residents can now experience Uber Eats delivery with the Waymo Driver. (03.04.2024) Read	Focus on ride hailing and urban delivery with I-PACE fleet
 Torc is an independent **subsidiary of Daimler Truck AG** and the **first AV company to enter an integrated partnership** with a **truck OEM**. Torc and DT are ramping up development and testing in the US. Go-to-market is targeted for 2027.	Daimler Truck and TORC Robotics select Aeva to supply advanced 4D LiDAR technology for series-production autonomous trucks. (09.01.2024) Read	**2027**
 PlusDrive follows an **evolutionary path from L2++ to L4**. **Global initiatives in cooperation with IVECO, TRATON Group, and Hyundai have been announced**. In contrast to competitors, Plus is already testing its self-driving and highly automated trucks on European roads.	Plus, FAW Jiefang Qingdao to co-develop autonomous gas-powered heavy-duty truck. (10.07.2024) Update Read	Not announced
 Kodiak Robotics develops autonomous technology for long-haul trucking and carried the **first commercial freight just eight months after being founded.** After long considering Kodiak as an acquisition candidate, they meanwhile became **one of the strongest players in the market**.	Kodiak Robotics is taking self-driving trucks off-road to reach profitability faster (25.07.2024) Update Read	**2025**

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS NAR

At a glance	Latest news	L4 target
 Toronto-based Waabi is renowned for both it's founder and its **closed-loop simulator**, Waabi World, which targets an **AI-first approach**. Waabi has entered promising partnerships with Volvo and Uber Freight. The company is worth observing.	Waabi raises $200M USD to launch fully driverless trucks in 2025. (18.06.2024) Update Read	**2025**
 Instead of deploying robotaxis, Aurora is **focusing primarily on TaaS** and has already entered into truck **collaborations with PACCAR, Volvo and Continental**. These **collaborations promise to scale their test fleet** to get their product ready for production.	Uber Freight and self-driving trucks startup Aurora partner for the long haul. (25.06.2024) Update Read	**2027**
 Gatik focuses on **short-haul, B2B logistics** for the **retail industry.** More specifically, hub-and-spoke supply chain operations. The vehicles are restricted to **fixed, repeatable routes.** Gatik has found a niche that no other market player is dedicated to now.	Gatik and ITOCHU form strategic alliance to transform the future of B2B short-haul logistics. (12.06.2024) Update Read	L4 target reached in Arkansas by 2021
 Nuro is a **pioneer in last-mile deliveries** with a special purpose vehicle. Contrary to media reports and its own statements, however, it is very difficult to see a vehicle 'in the wild'. **Industrialization and scaling** thus **seems to prove difficult.**	Autonomous delivery startup Nuro is gearing up for a comeback. (27.07.2024) Update Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS NAR

At a glance	Latest news	L4 target
 After Argo's shutdown, it's unclear how Ford will proceed for urban delivery and trucking. Nevertheless, **Ford Otosan is cooperating with AVL** in this area. We believe they can't keep up with the leading self-driving truck companies.	Ford, VW-backed Argo AI is shutting down. (26.10.2022) Read	Not announced
 Udelv has been doing **commercial deliveries for Walmart** for some time. With the **'Transporter**' they now have their own **versatile special purpose vehicle**, equipped with Mobileye's promising SDS. It's been quite around Udelv for a while – as other companies, Udelv seem to struggle towards industrialization of its vehicle.	Ziegler orders autonomous and electric delivery vehicles from the company Udelv. (05.01.2022) Read	Not announced
 Amazon has **invested in Aurora and conducted road tests with Embark, which later didn't survive market consolidation**. Amazon's vision could be to cover the entire logistics chain - in the future also with autonomous trucks, delivery vehicles and last mile delivery solutions.	Amazon stops field tests of its delivery robot Scout. (07.10.2022) Read	Not announced
 Little is still known about Tesla's Semi Truck and targeted automated driving capabilities. According to the company, it will be the first vehicle to drive fully autonomously. The truck is to be equipped with **'enhanced' autopilot functionalities for automated highway driving**. At least we still have doubts.	Apple chip maker TSMC to manufacture Tesla's new FSD hardware. (23.11.2022) Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS NAR

At a glance

Robomart has teamed up with a couple of companies to establish the **Autonomous Retail Collective (ARC**), an ecosystem aimed at developing and advancing self-driving shops. Collaboration is key in the autonomous mobility space – therefore, Robomart is worth to 'watch-out'.

Latest news

Robomart unveils autonomous retail collective to propel self-driving shops.
(08.04.2024)

Read

L4 target

Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS. Asia.

Partnering & Value Chain, Level 4 Target & Latest News

Goods Transport & TaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
Luminar, HESAI, RoboSense, pony.ai	Horizon Robotics	pony.ai		HYUNDAI MOTOR GROUP, SANY, SINOTRUK, NEOLIX	ZF	CYANTRON		Yamibuy, Meituan	Not announced		
HESAI	NVIDIA	WeRide 文远知行		JMC		Not announced		ZTO	Tencent 腾讯	Tencent 腾讯	
OUSTER, TRUNK 主线科技, BOSCH	Horizon Robotics	TRUNK 主线科技		SINOTRUK, NIO		TRUNK 主线科技		STO 申通快递 express, JDL 京东物流	Not announced		

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4		LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider		Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport		3rd party HD Maps	Cloud	V2X & Others
ZVISION, BOSCH	Ambarella, Horizon Robotics	INCEPTIO TECHNOLOGY		NIO, DONGFENG, SINOTRUK	ZF	Not announced		JDL 京东物流, Meituan, 壹米滴答, 跨越速运, 德邦快递, SF EXPRESS, YTO	中国邮政 CHINA POST, 中国物流, ZTO, sto 申通快递, NESTLE, Uton	NAVINFO		
HESAI		SAIC Plus		SAIC		Not announced		Not announced		Not announced		
OUSTER, HESAI	Horizon Robotics, NVIDIA	NEOLIX, pony.ai		NEOLIX		Not announced		Yum China, JDL 京东物流, FedEx, Pizza Hut, Grab Food, foodpanda, Meituan				ncs, FIXPOSITION

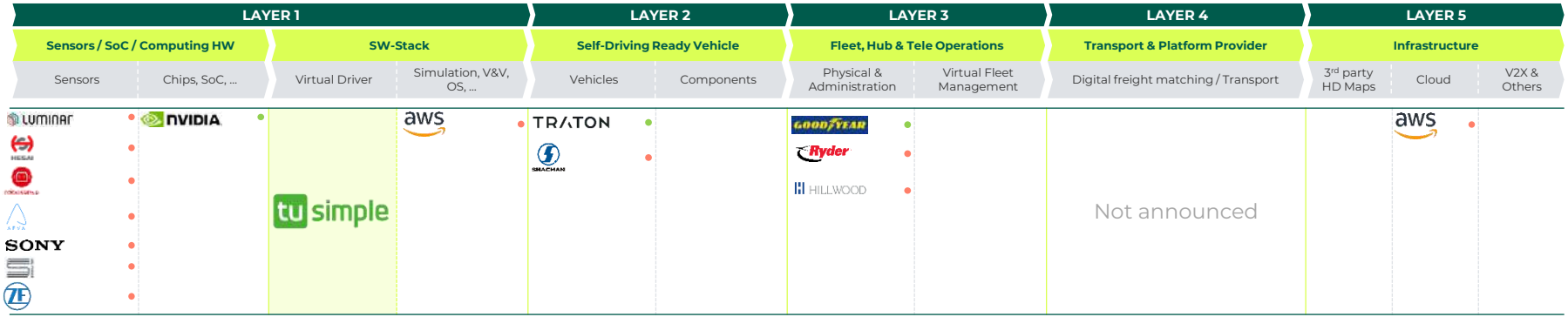
Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

Goods Transport & TaaS ASIA

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
OUSTER, HESAI, robosense, ZVISION	NVIDIA	DEEPROUTE.AI		ISUZU		Not announced		Alibaba, 德邦快递 DEPPON EXPRESS	Tencent 腾讯 SD maps – probably consumer vehicles only		
HESAI, arbe, WEIFU 威孚	Horizon Robotics	KARGOBOT		SHACMAN		Not announced		Not announced	Not announced		
Not announced		Baidu 百度 apollo		DEEP WAY		Not announced		SAP, LIONBRIDGE			Qualcomm

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS ASIA



Core Business ● Partnership or supplier deal ● Investment ● Acquisition ● Parent / Subsidiary ◆ Update

Goods Transport & TaaS ASIA

At a glance	Latest news	L4 target
 Pony.ai is a leading player in L2+ solutions for OEMs as well as L4 robotaxi deployments. However, Pony **will jointly develop premium autonomous heavy-duty truck with SANY and Sinotrans**. They are among the **pioneers in the Chinese self-driving truck market**.	Pony.ai allowed to test Robotaxi, autonomous truck on Guangzhou's expressways. (21.05.2024) Read	Not announced
 WeRide, initially focusing on robotaxi business, unveiled **China's very first L4 self-driving cargo van** in September 2021. While WeRide is a leader in China in terms of robotaxis, we are curious to see if they will take this position in the logistics space as well. The company also has a robosweeper in its portfolio.	WeRide's Robovan permitted to conduct unmanned open-road test in Guangzhou. (24.05.2024) Read	Not announced
 **Investments from Bosch, Nio and BAIC** made Trunk.Tech known outside China. It is without question **one of the most promising startups** in the Chinese self-driving truck / freight haulage space.	Autonomous truck solution developer Trunk.Tech bags hundreds of millions of yuan. (07.05.2024) Read	Not announced
 Chinese startup with the **aim to build a nation-wide freight network** using autonomous trucks. Unlike other AV truck companies, **Inceptio initially focuses on L3**. However, Inceptio could possibly be a hidden champion among autonomous trucks with regard to full autonomy - at least in China.	Inceptio Technology delivers intelligent heavy-duty trucks to Huatai Logistics. (06.05.2024) Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS ASIA

At a glance	Latest news	L4 target
 The '**intelligent driving control system**' is independently developed by SAIC. Beyond that, little is known about the trucks from one of China's largest automotive manufacturer.	Hesai Technology to deliver ADAS lidar for SAIC motor's new commercial vehicles. (07.07.2023) Read	Not announced
 Nearly **1,000 Neolix delivery vehicles have been deployed** in nine countries and **over 40 cities worldwide**, with a cumulative mileage of more than 6 million kilometers by 2024. The shuttle may be compared with Nuro, which is currently focused exclusively on the US market.	NEOLIX receives permit to launch unmanned delivery vehicle in Lishui city. (09.07.2024) Update Read	Not announced
 DeepRoute.ai **announced an autonomous medium-duty truck business line for urban logistics**. Having started a first commercialization project with Deppon Logistics, DeepRoute is **backed by Alibaba and its huge network** of ecommerce, logistics & community shopping, among others. Reads well.	DeepRoute.ai collaborates with DEPPON LOGISTICS Co., LTD to expedite commercialization. (20.06.2022) Read	Not announced
 **KargoBot** was launched during Auto Shanghai 2023 **by MaaS giant DiDi** and focuses on a pilot vehicle approach with a human driver onboard and multiple L4 trucks following its lead. We will closely trace KargoBot's development.	KargoBot launches L4 autonomous truck convoy on key Ordos freight route. (314.06.2024) Update Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS ASIA

At a glance	Latest news	L4 target
 DeepWay - a **subsidiary of Baidu** - plans to offer heavy Level-3-trucks by June 2023. The vehicles will have a range of 300 km, and in addition to a fast-charging function, it will also be possible to swap batteries in 6 minutes. The integration of fuel cells is targeted for the future.	DeepWay permitted to conduct cross-provincial autonomous heavy-duty truck pilot operations. (08.03.2024) Read	**2024-2026**
 After the **end of the Navistar partnership** and withdrawal of unprofitable routes from its autonomous freight network, TuSimple was eventually **left the US market by the end of 2023**. As a leading self-driving truck developer in the US, the focus will now be in the Asian market.	TuSimple announces intention to delist from Nasdaq. (05.12.2023) Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

Goods Transport & TaaS. Europe.

Partnering & Value Chain, Level 4 Target & Latest News

Goods Transport & TaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
Luminar AEVA		TORC WAYMO	Applied Intuition Apex.AI	DAIMLER TRUCK		Not announced		Not announced	tomtom	aws	
Plus		Plus TRATON	Applied Intuition BTC embedded systems	TRATON	KNORR-BREMSE LEONI BOSCH	FERNRIDE		HAVI RHOLA			Die Autobahn
NVIDIA		einride embotech	Applied Intuition	einride		einride		SATLY! GE APPLIANCES MICHELIN DB SCHENKER LIDL DP WORLD	DEEPMAP		

Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

Goods Transport & TaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
	NVIDIA	Aurora, Waabi		VOLVO, ISUZU		VOLVO		DFDS, DHL, Uber Freight, ascend, CONVOY	Not announced		
AVRIDE	NVIDIA	AVRIDE		AVRIDE		Not announced		Not announced	Not announced		
	Plus, NVIDIA	Plus		IVECO		Not announced		DSV, dm	here		Continental

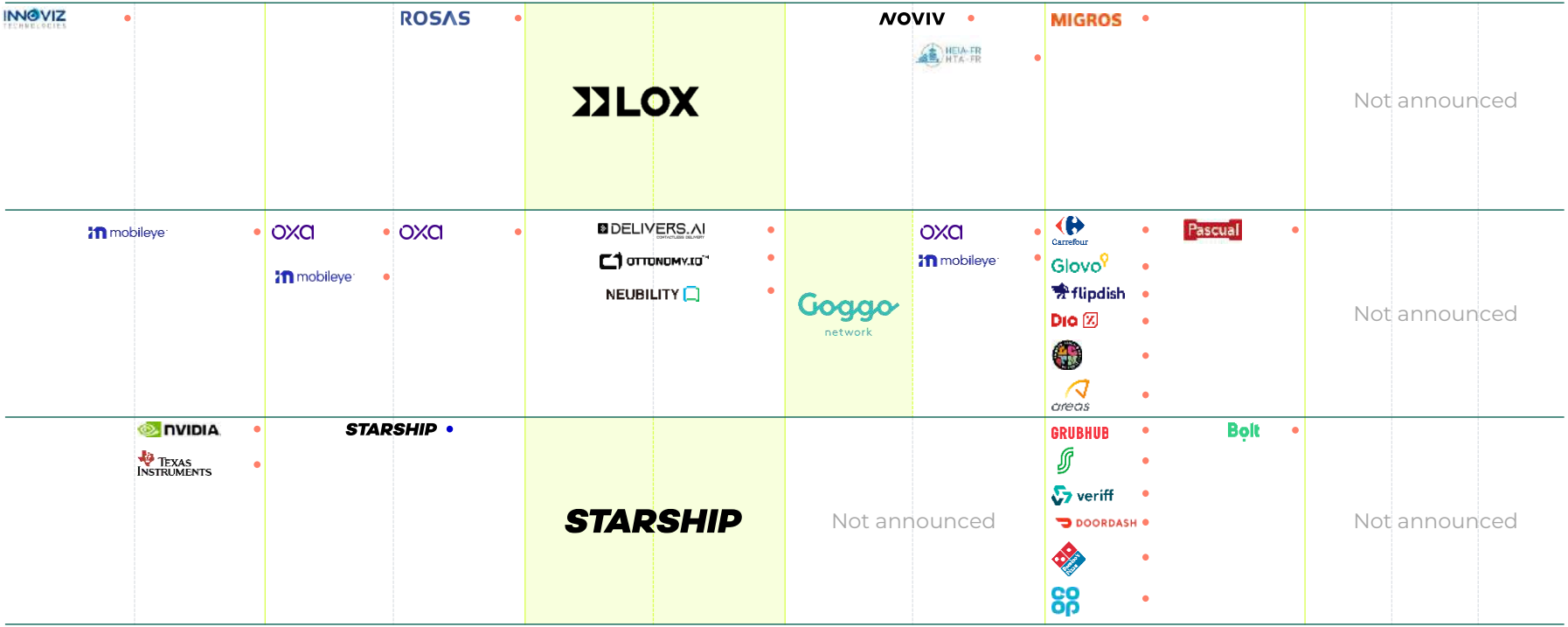
Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS EUROPE

LAYER 1				LAYER 2		LAYER 3		LAYER 4	LAYER 5		
Sensors / SoC / Computing HW		SW-Stack		Self-Driving Ready Vehicle		Fleet, Hub & Tele Operations		Transport & Platform Provider	Infrastructure		
Sensors	Chips, SoC, ...	Virtual Driver	Simulation, V&V, OS, ...	Vehicles	Components	Physical & Administration	Virtual Fleet Management	Digital freight matching / Transport	3rd party HD Maps	Cloud	V2X & Others
Not announced		WAYVE		MAXUS, JAGUAR		Admiral		ocado GROUP, dpd, ASDA		Microsoft	
kodiak	tusimple, ZF	ZF, embotech, STRADVISION		CLEVON	ZF	ZF		ZF		Microsoft	
		driveblocks, @TierIV	Applied Intuition, Apex.AI, b-plus		pepper, SHAEFFLER PARAVAN	Not announced		Not announced		Not announced	

Core Business | Partnership or supplier deal | Investment | Acquisition | Parent / Subsidiary | Update

Goods Transport & TaaS EUROPE



Core Business · Partnership or supplier deal · Investment · Acquisition · Parent / Subsidiary · Update

Goods Transport & TaaS EUROPE

At a glance	Latest news	L4 target
 DTNA's **Cascadia trucks with an integrated Torc AV stack** are already **hitting the roads in the US** with a targeted go-to-market by 2027. Currently, there is **no roadmap for the domestic market** yet.	Daimler Truck and TORC Robotics select Aeva to supply advanced 4D LiDAR technology for series-production autonomous trucks. (09.01.2024) Read	Not announced
 As TRATON's partnership with TuSimple came to an end, **Scania, MAN, and Navistar will now work together with Plus** to intensify the development of L4 self-driving trucks. The companies will focus on hub-to-hub operations – using the **same AV stack across all major TRATON brands** is a reasonable approach.	Plus and Scania, MAN, and Navistar partner to accelerate global commercial deployment of Level 4 autonomous trucks. (12.03.2024) Read	Not announced
 The **Einride Pod** is unique from other self-driving trucks as there is **no driver's cab**. The pod currently operated in gated areas on fixed routes. Towards L4 with higher speeds on public roads there need to be leaps in development. However, Einride's ecosystem is unique.	DP World and Einride announce Middle East's largest deployment of electric, autonomous freight mobility, spearheading the region's sustainable transition. (14.05.2024) Read	Target reached in gated areas only
 The **"Volvo VNL Autonomous"** fully redundant truck was unveiled in 2024 and will be **powered by Aurora**. In addition, **Volvo invested in Waabi** and thus betting on a second horse. The approach seems to make sense in order not to be dependent on an SDS provider in its self-driving roadmap.	The Volvo VNL Autonomous — Proving the Way Forward. (20.05.2024) Read	Not announced

Definition L4 target: commercial self-driving service operated within a specific ODD without a safety driver.

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At a glance	Latest news	L4 target
 Avride is the **rebranded, international division** of the robotaxi and delivery robot company **Yandex Self-Driving Group**. While international assets have been separated from Russian-owned Yandex assets, Avride said it's testing AVs (and probably the rover as well) in diverse ODDs across the globe, focusing on safety.	Yandex self-driving group rebrands its international division as Avride. (04.08.2023) Read	Not announced
 **IVECO and Plus are jointly developing self-driving trucks** and conducting **test drives on European highways**. **Pilot projects have already been announced** - so the two could be pioneers for autonomous trucks in Europe along TRATON.	IVECO, Plus, dm-drogerie markt and DSV launch automated trucking pilot in Germany. (15.11.2023) Read	Not announced
 Wayve does **not rely on HD maps** and **hand-coded rules** but **focuses on its deep and self-learning AI technology** based on cameras. The company raised $1bn in 2024 to take its Tesla-like technology for self-driving to many carmakers. Let's see if delivery vehicles are still a targeted use case for Wayve.	Asda and Wayve launch UK's largest self-driving grocery home delivery trial. (17.04.2023) Read	Not announced
 ZF offers a **comprehensive portfolio for commercial vehicle automation** such as sensors and high-performance computers. While ZF has already **supplied L4 truck companies**, we are curious if ZF wants to become a full-stack provider with an own virtual driver - that would be ambitious as competition is strong.	Clevon collaborates with ZF to orchestrate driverless last-mile delivery fleets. (22.02.2023) Read	Not announced

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At a glance	Latest news	L4 target
 driveblocks develops a **modular; scalable AD software** stack for commercial vehicles. **It allows OEMs/Tier1 to integrate it with their vehicles and solutions in an open and flexible way**. The solution targets the EU market first and is a differentiating, but also ambitious approach compared to other players.	TIER IV paves the way for highway trucking with innovative reference design. (02.05.2024) Read	Not announced
 LOXO'S last mile delivery vehicle is reminiscent of some US and Chinese market players' solutions but is the **first vehicle of its kind made in Europe**. **Commercial success** in Europe **requires both a technically mature solution and a profitable business case**.	Innoviz and LOXO enhance strategic partnership, deploying LiDAR technology in zero-emission autonomous delivery vehicles. (29.06.2023) Read	Not announced
 **Goggo builds a European network** for **middle and last mile delivery services**. Mobileye and Oxbotica have been signed up - concrete details on the delivery services (e.g., vehicle type) are not yet known. We are curious to see whew Goggo will position itself in the future ecosystem.	Pascual makes the first delivery in Spain for hospitality with an autonomous robot by Goggo Network [ES only]. (31.05.2023) Read	Not announced
 Starship delivery robots completed **>6mn autonomous deliveries**. It is **unlikely that these robots will become widely accepted for last mile delivery**. However, there could certainly be use cases in gated areas. Being a pioneer in the robot delivery space, more and more new players have entered the market.	Tallinn-based Starship Technologies raises €83.6 million to make the robot delivery take over the streets. (06.02.2024) Read	Reached at various locations

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