



What matters?

Analysis of the self-driving software industry

Presented by Fan Wen

MBA Candidate at Yale School of Management

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There is fierce competition in the self-driving software industry. Numerous new entrants joined the competition during the past three years. Companies compete by differentiating their solutions in sensors, maps, algorithms, car integration modes, and application scenarios. To balance between risk and economic value, new companies are starting to specialize in areas such as sensing or mapping, as these technologies can be adapted to use in other industries, and can be commercialized quickly.

Self-driving system software companies have little chance to become a new unicorn.



On one hand, the self-driving software industry is highly competitive, and companies are incentivized to create a high barrier to entry. On the other hand, it is highly likely that the Android-like platform model will not work in the self-driving industry, because the self-driving platform will not be as open as Android due to security reasons. It is unlikely that a provider of self-driving car technology will be able to establish a lasting competitive advantage on the basis of technology alone. In the end, most self-driving software companies will either be acquired by automakers (or auto parts makers), or disappear.

Becoming an automaker or mobility service operator can be good options for these companies.

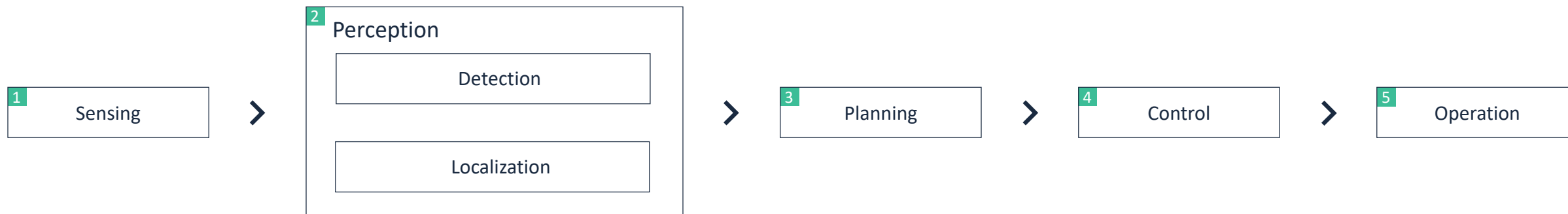


The self-driving technology will fundamentally change the auto manufacturing and mobility service industry. Start-ups such as NIO and Xpeng are challenging giant automakers by outsourcing production to small automakers, adapting to changing market conditions, and providing more creative products and services. However, these business models have not yet been proven. Other companies, such as Voyage, are looking for opportunities to operate taxi fleets themselves. New entrants to the self-driving technology industry still have the opportunity to beat Uber by differentiating their service and/or focusing on a new market.

Companies need to consider starting from a vertical market to secure a healthy cash flow.



Given the high uncertainty in the self-driving industry, self-driving software companies may need to quickly commercialize the technology. However, this is always difficult for start-ups. Focusing on a vertical market can be a good strategy before building a universal application. These markets can include providing self-driving transportation service on highways, or providing taxi services in private communities. By doing this, software companies can collect more data to refine their algorithms and secure a cash flow through the quick commercialization.



The participants

Examples



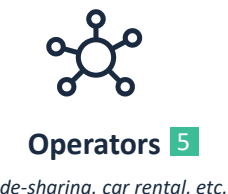
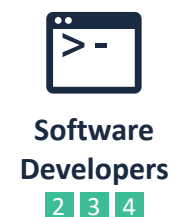
Examples

Velodyne LiDAR

INNOVIZ TECHNOLOGIES

DEEPCSCALE

DEEP VISION



Examples
System

nuTonomy drive.ai
comma.ai CRUISE

Non-system: mapping, image recognition, annotation, in-car assistance, security, V2X communication, fleet management, tracking and recovery, etc.

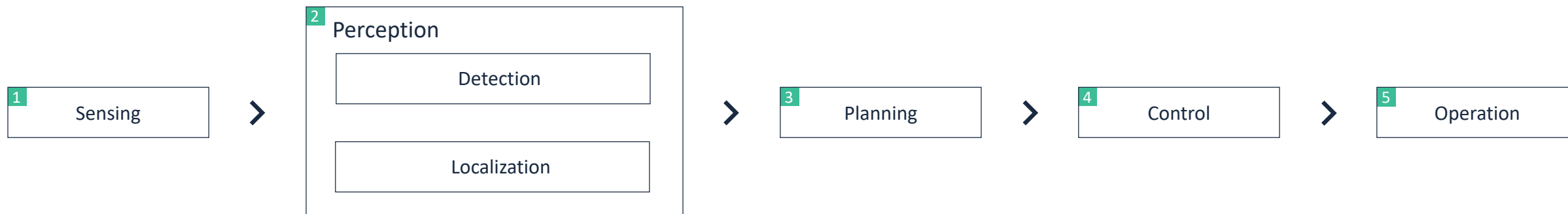
Examples

DiDi UBER Grab Lyft
enterprise Budget

AVIS Hertz 神州租车

Key Differences in Solutions

Self driving



Sensor



Map



Algorithm



Integration



Scenario



LiDAR-based

Pros: high accuracy, high resolution, long ranges

Cons: expensive, limited supply



HD Map

Pros: high accuracy, high resolution, rich information

Cons: expensive to produce and update



Rule-based

Pros: understandable

Cons: unable to deal with unexpected situations



OEM Integration

Pros: perfect integration with the auto system

Cons: time-consuming, expensive



Universal application

Pros: reach multiple markets

Cons: difficult in R&D, time-consuming



Camera-based

Pros: cost-efficient, easy to produce

Cons: relatively low accuracy, low resolution, and low ranges



Basic Map

Pros: cost-efficient, ready to use

Cons: relatively low accuracy, low resolution, and insufficient information for self-driving system



Deep-learning-based

Pros: able to handle unexpected situations, can adapt to global cities

Cons: the “black box” nature



Aftermarket Integration

Pros: easy to grow the market, first-mover advantage, cost-efficient

Cons: imperfect integration



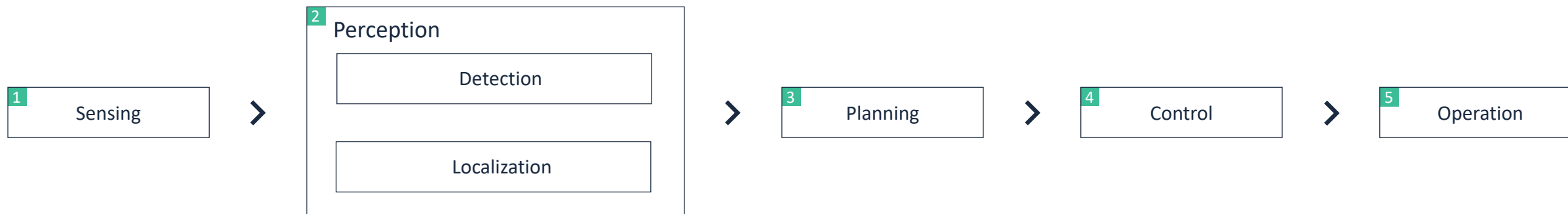
Vertical application

Pros: easy to grow the market, first-mover advantage

Cons: limited market

Key Differences in Solutions

Self driving



Sensor



Map



Algorithm



Integration



Scenario



Closed-area taxi/shuttle

AURO 清智科技

NAVYA be fluid UISEE

OPTIMUS RIDE THE HI-TECH ROBOTICS SYSTEMZ

VOYAGE



Short-distance urban shuttle

MAY may mobility

aiPod

LM local motors



Good delivery

NURO

udeliv



Highway transportation

EMBARK

STARSKYROBOTICS

tu simple



Universal application

Pros: reach multiple markets

Cons: difficult in R&D, time-consuming



Vertical application

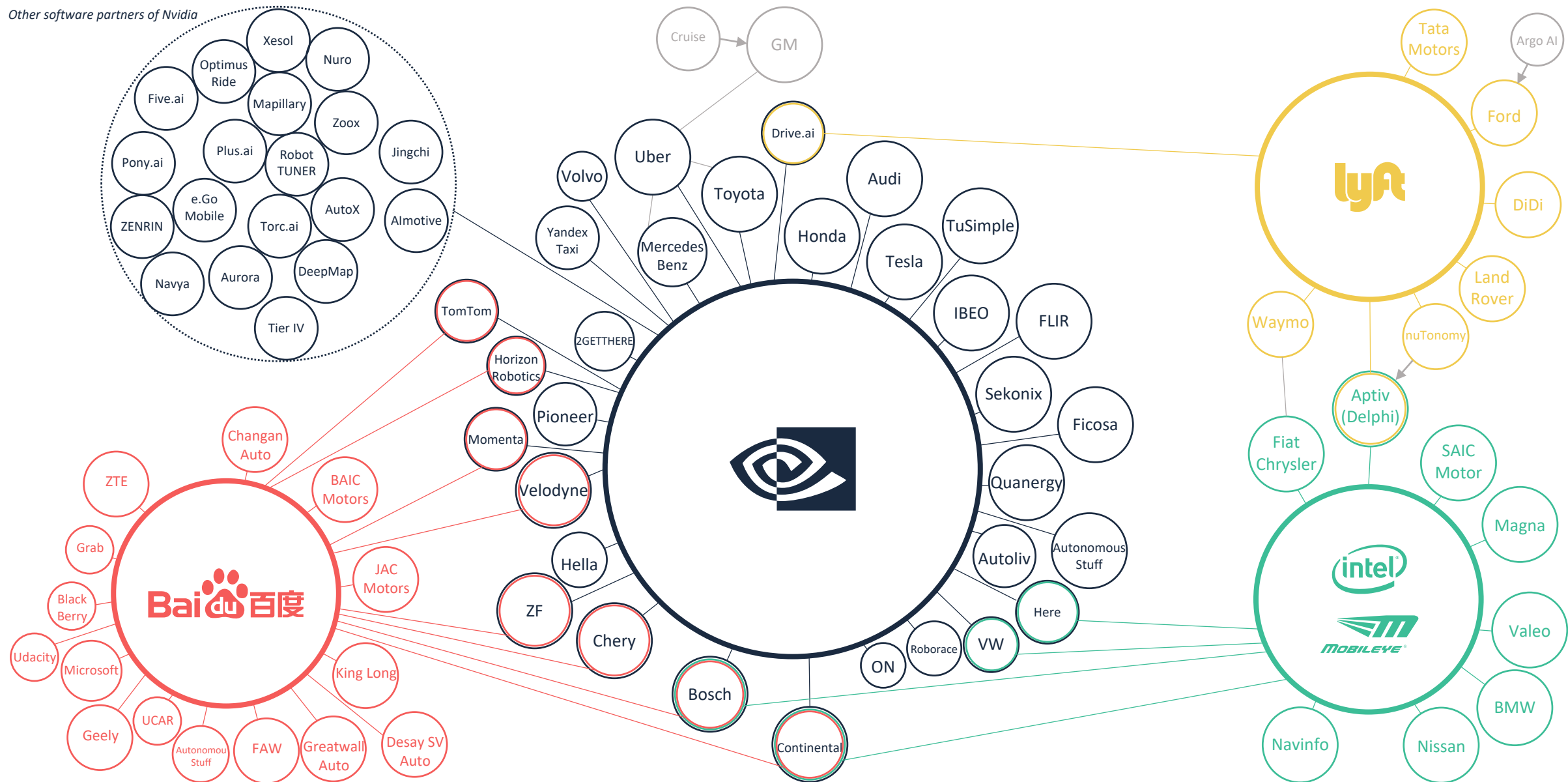
Pros: easy to grow the market, first-mover advantage

Cons: limited market

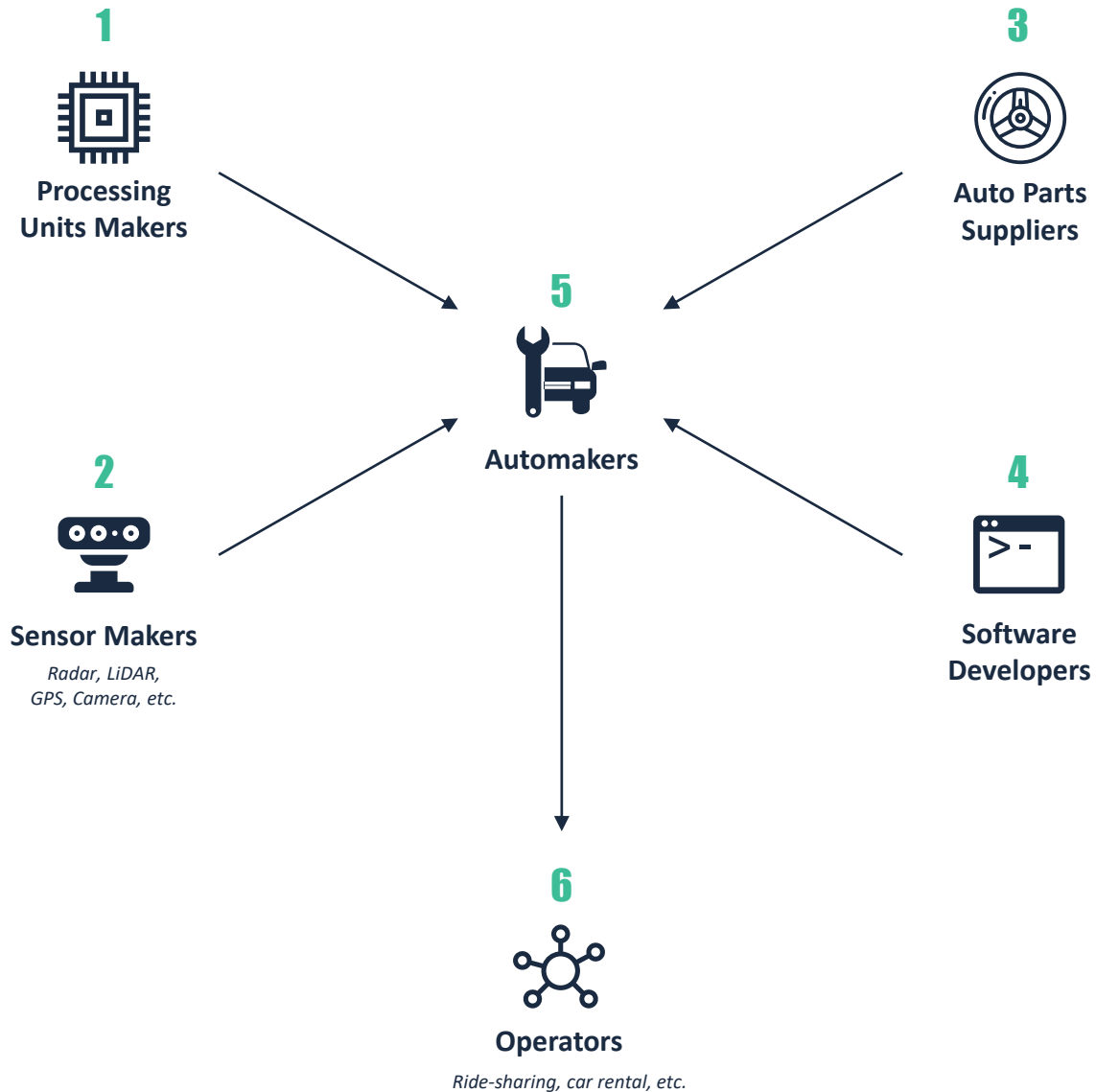
Partnership Network

Other software partners of Nvidia

Self driving



Integrations (M&A)



 Self driving

Integration cases

1 + **4**

 + 

In **March 2017**, **Intel** announced the acquisition of **Mobileye**. As of August 8, 2017, the \$15.3 billion deal is officially complete. Intel purchased 84 percent of Mobileye's outstanding ordinary shares and the company is now an Intel subsidiary.

3 + **4**

 + 

Delphi, one of the world's largest automotive suppliers, is acquiring Boston-based self-driving car startup **NuTonomy** for an upfront purchase price of \$400 million as well as \$50 million in earn-outs, the companies announced on **October 24, 2017**.

5 + **4**

 + 

General Motors announced on **March 11, 2016** that it will acquire **Cruise Automation**, a San Francisco-based developer of autonomous vehicle technology. No financial terms were disclosed.

5 + **4**

 + 

Ford Motor Company announced on **February 10, 2017** that it is investing \$1 billion over the next five years in **Argo AI**, an artificial intelligence company, to develop a virtual driver system for the automaker's autonomous vehicle coming in 2021 – and for potential license to other companies.

5 + **2**

 + 

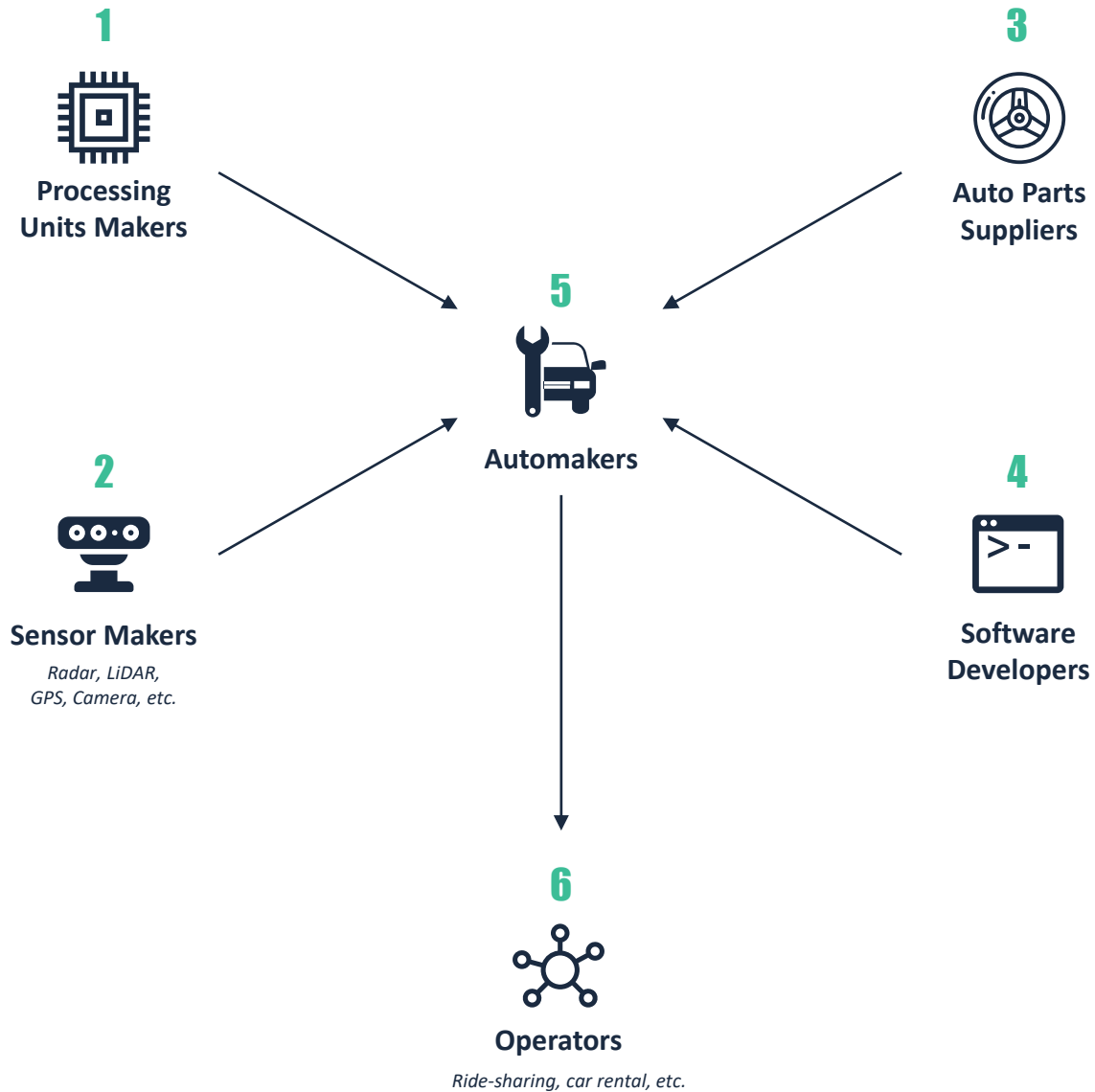
General Motors said on **October 9, 2017** that it had acquired **Strobe**, a company that specializes in laser-imaging technology geared toward enhancing the development of autonomous vehicles.

5 + **2**

 + 

On **October 27, 2017**, **Ford Motor's** Argo AI unit, which develops software for self-driving vehicles, announced that it is buying **Princeton Lightwave**, one of the oldest makers of lidar sensing devices that use laser light to help autonomous cars "see" nearby objects and obstacles.

Integrations (Strategic Partnership)



Self driving

Integration cases

4 + **6**



Ford has been ramping up its self-driving vehicle program in the past year from its \$1 billion investment in **Argo AI** to its pilot with **Domino's Pizza**. Now it's locked in **Postmates** to conduct pilot programs to learn how self-driving vehicle technology can change the delivery experience and help retailers reach new customers.

4 + **6**



On **September 27, 2017**, **Lyft** announces that it is teaming up with autonomous driving startup **Drive.ai** to deploy self-driving cars in and around San Francisco with a new pilot project.

4 + **6**



Since **2016**, **TuSimple** has been collecting video data to make the TuSimple Benchmark through collaboration with several logistics companies in China. **STO Express** is one of those partners.

4 + **6**



February 9, 2018 — Last week, **Udelv** successfully launched its autonomous, last-mile delivery vehicle today and made the world's first public road test deliveries from **Draeger's Market** in San Mateo to two nearby customers. **Udelv** CEO Daniel Laury was joined by **Delivery Guys** CEO Armen Gasanyan.

4 + **6**



June 26, 2017, **Waymo**, the self-driving car unit of Alphabet Inc., has reached an agreement for **Avis Budget Group Inc.** to manage its fleet of autonomous vehicles. It's the first such deal in a field that's still fledgling but exploding with partnerships. Avis shares surged.

5 + **6**



January 8, 2018, **Toyota** is working with **Amazon**, ride-hailing companies **Uber** and **Didi**, automaker Mazda, and **Pizza Hut** to develop an electric autonomous shuttle that can be used to deliver people—or the packages they've ordered—to their destination. And it might just make it to the Olympics in 2020.



Threats of new entrants

HIGH

The threats from new entrants in the self-driving software industry are trending upwards. Over 10 new companies were founded in the past two years, and some have become very competitive, particularly in competing for resources ranging from partnerships to sensor suppliers.



Bargaining power of suppliers

HIGH

One of the most important resources for the self-driving software industry is human capital. Since the industry is still in an early stage, there is a significant shortage of talent with self-driving expertise. The bargaining power of employees will decrease in the future when the industry matures.



Rivalry among existing competitors

HIGH

Except Waymo, no company has an overwhelming superiority over the other competitors. Every company competes fiercely with each other to provide the first commercial solution, as it is always crucial to get the first-mover advantages in the self-driving industry.



Bargaining power of buyers

LOW / MEDIUM

No company can provide a perfect solution for the automakers now, so the bargaining power of buyers (automakers) is temporarily low. However, as the automakers are also investing in inventing their own systems, the automakers' bargaining power will increase in the future when more solutions are available on the market, and self-driving car technologies are seen as a natural part of every vehicle.



Threats of substitutes

LOW

The threats of substitutes in the self-driving software industry are relatively low. Vehicles would not be able to drive automatically without the system software.

Sources of Competitive Advantage



Partnership resource

Partnership resources are crucial and scarce for self-driving software companies, especially if they want to scale up quickly. Valuable partners include automakers, ride-sharing/carpooling platforms (e.g. Lyft), car rental companies (e.g. Avis), business fleets (e.g. U.S. Foods), express delivery companies (e.g. STO Express, China), large E-commerce companies (e.g. Amazon, Taobao, JD, etc.), large chain restaurants (e.g. McDonalds), etc.



Cost-efficiency

Given that every solution will meet all the safety requirements before going to the market, software companies will compete on the cost efficiency of their solutions. Solutions with cheaper and fewer sensors, and greater adaptability, will have a competitive advantage.



For investors:

How to compare self-driving software companies?

For self-driving software companies:

How to build your competitive advantages?



Differentiation in business model

Given the fierce competition in the industry, a self-driving software company needs to differentiate itself from competitors to secure a competitive advantage. This differentiation can come from an after-market integration solution, a focus on the vertical market, and/or a combination of selling software and operating fleets.



Human capital

In the short-run, there will be a shortage of human capital supply in the self-driving software industry. Companies can build their competitive advantage by attracting the best talents in the industry. However, this strategy is unlikely to work in the long run, as the shortage will not last for too long and the techniques will mature.



Government relationship

Government relationships are important for all companies in the self-driving industry. Government support will enable a company to have more resources to test, market, and scale up. Strong relationships will also give the company an advantage in lobbying.



Funding resource

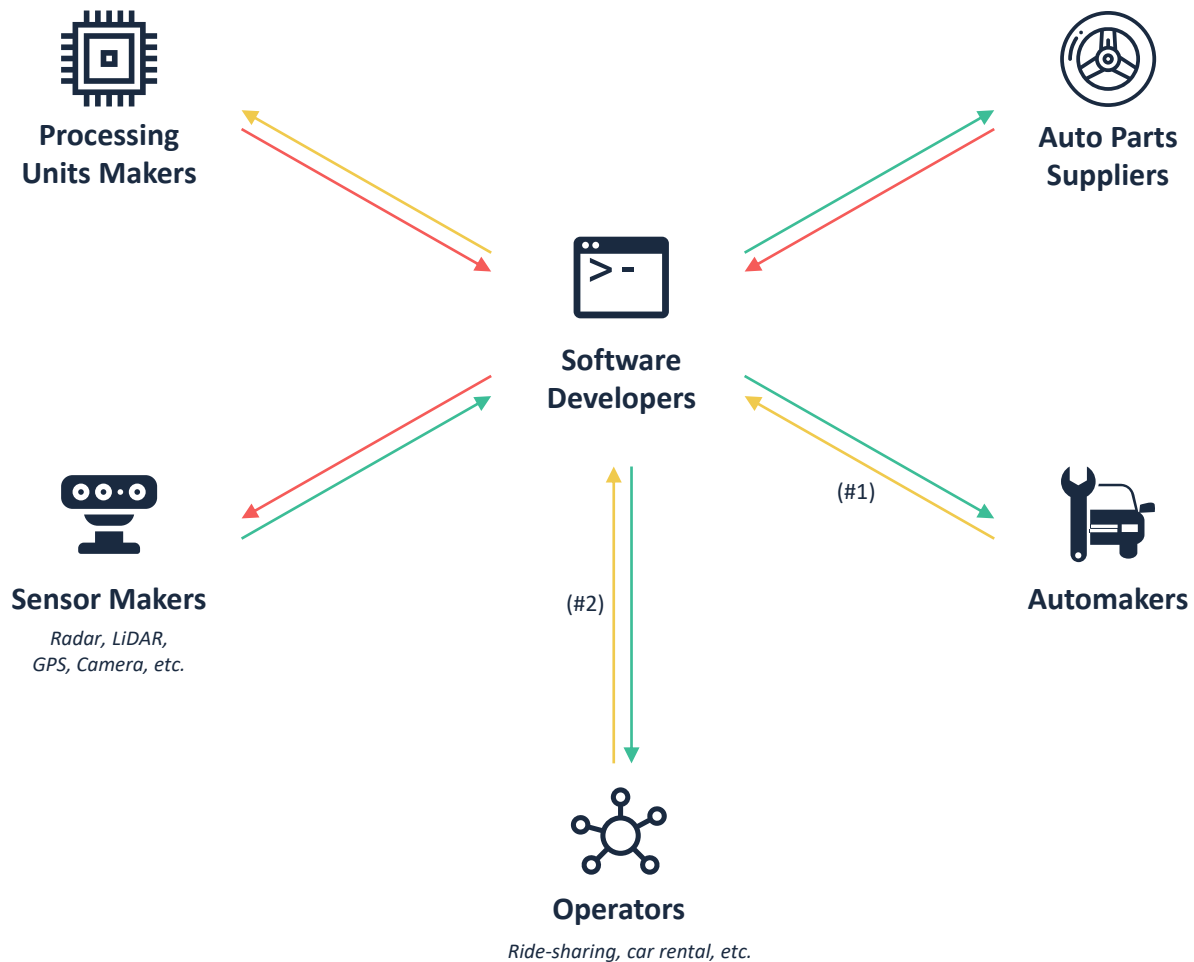
Having a steady and sufficient funding source will help a self-driving software company test, market, and scale up. Given the long time before achieving full commercialization, companies backed by large firms/VCs will have competitive advantage over their competitors.

Conclusions: *Integration Matters* - It is highly unlikely that a small tech firm could grow into a new unicorn



Possible deep integrations # Possibility evaluated from analysing past M&A deals

→ High possibility → Medium possibility → Low possibility









Key takeaways on integration

Self-driving software companies have little chance to become a new unicorn. On one hand, the self-driving software industry is highly competitive, and companies really need to create a high barrier to entry. On the other hand, it is highly likely that the Android-like platform model will not work in the self-driving industry, because the self-driving platform will not be as open as Android due to security reasons. Therefore, the best self-driving software companies will be acquired by automakers or large suppliers such as Delphi, Nvidia, or Intel in the end.

Big automakers are in acquisition mode. Few automakers have achieved a breakthrough in self-driving in past decades. Considering the high uncertainty of the self-driving industry, automakers are conservative about developing their own technologies, and prefer to acquire “mature” companies. Examples include GM-Cruise deal and Ford-Argo AI deal.

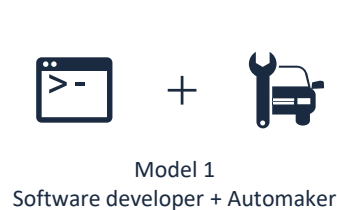
Integration options: sensor maker, automaker, or operator. Generally speaking, the sensor market is not as attractive as the other two markets: there is a low entry barrier, there are existing dominant players (e.g. Velodyne, Ibeo, Quanergy), and the market size is the smallest among the three. The “software developer + automaker” business model is being tested in the market (e.g. NIO + JAC, Xpeng Auto + Haima Auto), and the software-auto-makers have the opportunities to beat the traditional automakers in the new EV/AV time. The “software developer + operator” model is promising and is also being tested by companies such as Zoox and Voyage. Given that self-driving technology will fundamentally change the mobility market, which is the largest market, software companies still have the chance to challenge giants such as Uber and capture part of the mobility market.

			Possibility (by past deals)	Attractiveness (by market size)	Example
	+		● ● ● ● ●	● ○ ○ ○ ○	ARGO + Princeton Lightwave
	+		● ● ● ○ ○	● ● ● ● ○	NIO + JAC 江淮汽车
	+		● ● ● ● ○	● ● ● ● ●	VOYAGE

Note:

#1: There is not such kind of deal (a software company merges an automaker) yet. However, we can see that NIO partnered with JAC Motors and produced cars under the brand of NIO. In that way, software companies achieve a deep integration with automakers.

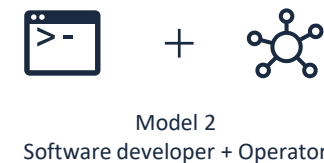
#2: There is not such kind of deal (a software company merges a mobility service operator) yet. However, companies such as Voyage are testing an integration model in which the software company will also operate fleets.



Examples

Challenges

Opportunities



Highly concentrated market. The general ride-sharing market has been dominated by the top companies. It will be difficult to beat them in the short run.

Lack of operation experience. Software companies need to gain solid experience in operating fleets, particularly in understanding customers and regulations.

Competition from traditional automakers. Automakers are also trying to enter the mobility service market. From “Ford + Chariot” to “GM + Maven”, almost every automaker is building its arm in providing mobility service.

New service models. From event- and theme-optimized vehicles, to in-car service, to automated public transit, there are new service models and markets where self-driving technology can be applied.

Vertical markets. With self-driving technology, software companies can operate fleets in vertical markets that are traditionally unattractive such as private communities.

Supply chain management. Traditional automakers have rich experience in managing their supply chains and in optimizing costs. However, for most software companies, building a steady supply chain would be extremely challenging.

Sufficient funding. Software companies require sufficient funding before they can realize mass production and have sustainable cash flows.

Competition from traditional automakers. Existing giants are also trying to produce EV/AVs. Software companies will face tough competition.

B2C business experience. Most founders of software companies have experience working in B2C business. Their experience will help the companies to compete with traditional automakers by gaining a deep understanding of customers, responding quickly to customers’ responses, and being creative in inventing new products.

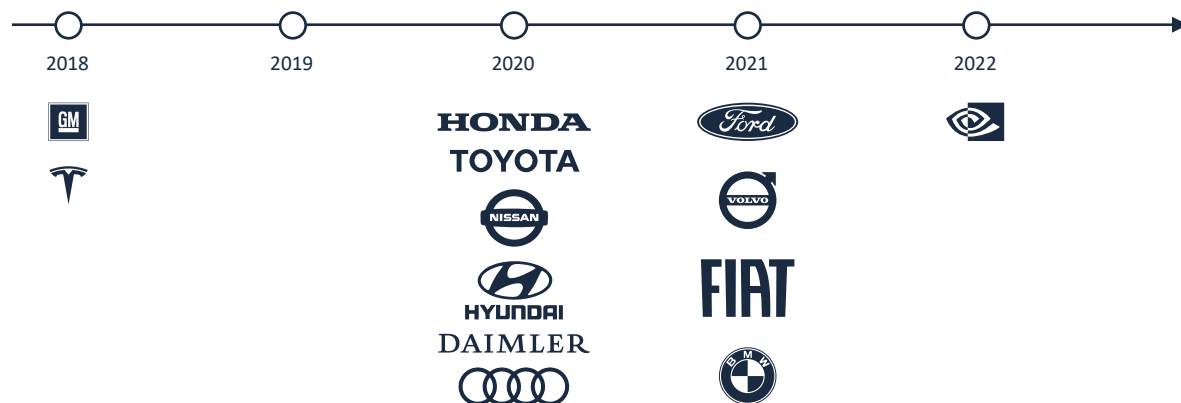
Flexibility. Software companies, which gain auto production ability externally, can have a great flexibility in making changes to organization, product, and strategy.

Conclusions: Vertical Matters – After all, it is important to secure a healthy cash flow first for a sustainable development

Self driving

First-mover advantage matters!

The Self-Driving Car Timeline – Predictions from the automakers^{#1, #2}



A vertical market can be a good starting point, given it is difficult to beat Uber/DiDi

Taxi service in large closed community

Shuttle service in airport/campus/parks/hospitals, etc.

Urban food delivery

Short fixed distance urban shuttle

Long-distance transportation for express companies

In-city document/book delivery

School bus service

Emergency ambulance service

Mining truck service

Event-based (e.g. exhibition) car service

Key benefits



Gaining operation experience

Focusing early on a vertical market can help the software company gain mobility service operation experience (from understanding customers' needs to analysing traffic pattern), which is one barrier of the mobility industry.



Securing partnership resource

Building up partnerships as early as possible will help the software company enhance its competitive advantage. Partners from ride-sharing, car rental, and public transit industries are scarce resources that all company compete for.



Exploring new business models

Diving into the market early can help the software company explore new business models such as providing in-car service. Companies have the potential to become new unicorns by satisfying customers' emerging needs.



Backing algorithms with real road data

Operating in the real world can help the software company collect data to train and polish its algorithms. The more data a company collects, the greater the competitive advantage it secures over competitors.



Getting familiar with local regulations

Providing services in a vertical market can help the software company better understand local policies. Policy knowledge can help the software company build its competitive advantage.



Differentiating from competitors

By focusing on a vertical market, a software company can differentiate itself from the competitors and achieve a high margin.

Source:

#1: Walker, Jon. "The Self-Driving Car Timeline - Predictions from the Top 11 Global Automakers." TechEmergence. August 25, 2017. Accessed February 25, 2018. <https://www.techemergence.com/self-driving-car-timeline-themselves-top-11-automakers/>

#2: Hars, Alexander. "Forecasts." Driverless car market watch. Accessed February 25, 2018. http://www.driverless-future.com/?page_id=384.



What matters?

Analysis of the self-driving software industry



□ —	Appendix
□ —	
□ —	Lists of self-driving software industry players and partnerships

Player List [1]

Self driving

Company Name	Category	OEM/Non-OEM	Map	Sensor	Technology	Application Scenario	Parent Company	Ownership Status	Last Financing Date	Last Financing Size (\$M)	Last Financing Valuation (\$M)	Year Founded
Academy Of Robotics	Full-stack Developer	Unknown	Unknown	Unknown	Rules-based *	Unknown	-	Privately Held	08/10/17	\$0.38	\$2.46	2014
Almotive	Full-stack Developer	OEM	Basic	Camera-based	Deep-learning-based	Universal	-	Privately Held	01/04/18	37.88	-	2015
aiPod	Full-stack Developer	OEM	Unknown	Unknown	Rules-based *	Vertical (Short-distance urban shuttle)	-	Privately Held	-	-	-	2017
Argo AI	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	Ford	Acquired/Merged	02/10/17	1000	\$1,000.00	2017
Auro	Full-stack Developer	OEM	Unknown	LiDAR-based	Deep-learning-based *	Vertical (Low-speed vehicle in closed-area)	RideCell	Acquired/Merged	03/10/17	\$18.00	\$18.00	2013
Aurora Innovation	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Universal	-	Privately Held	03/02/17	\$3.11	\$30.00	2016
AutoX	Full-stack Developer	OEM *	Basic *	Camera-based	Deep-learning-based	Universal	-	Privately Held	12/07/17	\$15.00	-	2016
Baidu USA LLC	Full-stack Developer	OEM	HD (from Baidu)	LiDAR-based	Deep-learning-based	Universal	-	Publicly Held	-	-	-	-
Comma.AI	Full-stack Developer	Non-OEM	Basic *	Camera-based	Deep-learning-based	Universal	-	Privately Held	03/23/16	\$3.10	\$23.10	2015
Cruise Automation	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	General Motors	Acquired/Merged	03/13/16	\$1,000.00	\$1,000.00	2013
Drive.ai	Full-stack Developer	Non-OEM	Basic	Camera-based	Deep-learning-based	Universal	-	Privately Held	09/28/17	\$15.00	-	2015
Embark	Full-stack Developer	OEM	Unknown	LiDAR-based	Deep-learning-based	Vertical (Trucks on highway)	-	Privately Held	07/18/17	\$15.50	\$75.00	2013
FiveAI	Full-stack Developer	OEM	Basic	LiDAR-based	Deep-learning-based	Universal	-	Privately Held	09/05/17	\$35.00	-	2015
HiTech Robotic Systemz	Full-stack Developer	OEM	Unknown	LiDAR-based	Deep-learning-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held (no backing)	-	-	-	2004
Imagry	Full-stack Developer	OEM	Basic	Camera-based	Deep-learning-based	Universal	-	Privately Held	07/01/17	\$7.00	-	2013
ISEE	Full-stack Developer	Unknown	Unknown	LiDAR-based	Deep-learning-based *	Unknown	-	Privately Held	09/19/17	-	-	2016
Jing Chi	Full-stack Developer	OEM	HD	LiDAR-based	Deep-learning-based *	Universal	-	Privately Held	-	\$100.00	-	2017
Local Motors	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Short-distance urban shuttle)	-	Privately Held	12/01/15	\$31.44	\$160.40	2007
May Mobility	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Vertical (Short-distance urban shuttle)	-	Privately Held	-	-	-	2017
Meridian Autonomous	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Short-distance urban shuttle)	-	Privately Held (no backing)	-	-	-	2016
Mobileye	Full-stack Developer	OEM *	HD (from Mobileye)	Camera-based	Deep-learning-based *	Universal	Intel	Acquired/Merged	09/01/17	\$15,300.00	\$15,300.00	1999
Momenta.AI	Full-stack Developer	OEM	HD	LiDAR-based	Deep-learning-based	Universal	-	Privately Held	10/17/17	-	-	2016

Data source: pitchbook.com, company official websites, the Information, Crunchbase, Techcrunch, thedrive.com, etc.

All data is updated on February 25, 2018

* Indicates the data is based on unverified source or an educated guess; - indicates the data is unavailable

Full-stack self-driving system software developer

Carpooling/ride-sharing service provider

Hardware/auto parts/automobile manufacturers

Company Name	Category	OEM/Non-OEM	Map	Sensor	Technology	Application Scenario	Parent Company	Ownership Status	Last Financing Date	Last Financing Size (\$M)	Last Financing Valuation (\$M)	Year Founded
Navya Inc.	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held	10/11/16	\$34.00	\$220.00	2014
NIO	Full-stack Developer	OEM	HD (from Momenta)	LiDAR-based	Rules-based *	Universal	-	Privately Held	11/08/17	\$1,000.00	\$5,000.00	2014
Nuro	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Vertical (Short-distance good delivery)	-	Privately Held	06/30/17	\$92.00	\$250.00	2016
nuTonomy	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	Delphi (Aptiv)	Acquired/Merged	11/21/17	\$450.00	\$450.00	2013
Optimus Ride	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held	11/06/17	\$18.02	\$57.02	2015
Ottomotto	Full-stack Developer	OEM	HD	LiDAR-based	Deep-learning-based *	Universal	Uber Technologies	Acquired/Merged	08/18/16	\$680.00	\$680.00	2016
Oxbotica	Full-stack Developer	OEM *	Unknown	LiDAR-based	Rules-based *	Universal	-	Privately Held	04/24/17	\$10.85	-	2014
Phantom AI	Full-stack Developer	OEM	Unknown	Camera-based	Rules-based *	Universal	-	Privately Held	-	-	-	-
PlusAi Inc.	Full-stack Developer	Unknown	Basic *	LiDAR-based	Deep-learning-based *	Universal	-	Privately Held	03/09/17	-	-	2016
Pony.ai	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	-	Privately Held	01/15/18	\$112.00	-	2016
Roadstar.ai	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	-	Privately Held	01/20/18	-	-	2017
Starsky Robotics	Full-stack Developer	OEM	Unknown	Camera-based	Deep-learning-based	Vertical (Trucks on highway)	-	Privately Held	03/01/17	\$3.75	-	2015
Tesla Motors	Full-stack Developer	OEM	HD	Camera-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	2003
Torc.AI	Full-stack Developer	OEM	HD	LiDAR-based	Deep-learning-based	Universal	-	Privately Held	-	\$0.69	-	2005
Tsintel Technology	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held	11/17/17	\$15.15	-	2016
TuSimple	Full-stack Developer	OEM	HD (from dynamic mapping)	Camera-based	Deep-learning-based	Vertical (Trucks on highway)	-	Privately Held	11/21/17	\$55.00	-	2015
Udelv	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Short-distance good delivery)	-	Privately Held	09/01/17	\$0.24	-	2016
UISEE	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held	-	-	-	2014
Vector.ai	Full-stack Developer	OEM	Basic	LiDAR-based	Deep-learning-based *	Unknown	-	Privately Held (no backing)	-	-	-	2016
Voyage	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Vertical (Low-speed vehicle in closed-area)	-	Privately Held	01/11/18	\$15.00	\$75.00	2017
Waymo	Full-stack Developer	OEM	HD	LiDAR-based	Rules-based *	Universal	-	Privately Held	12/13/16	-	-	2009
X-Matik	Full-stack Developer	Non-OEM	Basic *	Camera-based	Rules-based *	Universal	-	Privately Held	09/13/17	-	-	2015
Zoox	Full-stack Developer	OEM	Unknown	LiDAR-based	Rules-based *	Universal	-	Privately Held	-	-	\$3,500.00	2014

Data source: pitchbook.com, company official websites, the Information, Crunchbase, Techcrunch, thedrive.com, etc.
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Player List [3]

Self driving

Company Name	Category	OEM/Non-OEM	Map	Sensor	Technology	Application Scenario	Parent Company	Ownership Status	Last Financing Date	Last Financing Size (\$M)	Last Financing Valuation (\$M)	Year Founded
Didi Chuxing	Carpooling/ride-sharing	Unknown	Unknown	LiDAR-based *	Rules-based *	Universal	-	Privately Held	12/21/17	\$4,000.00	\$56,000.00	2012
Lyft	Carpooling/ride-sharing	OEM *	HD (from Aptiv)	LiDAR-based	Deep-learning-based *	Universal	-	Privately Held	12/05/17	\$1,500.00	\$11,500.00	2007
Uber	Carpooling/ride-sharing	OEM *	HD	LiDAR-based	Rules-based *	Universal	-	Privately Held	01/18/18	\$8,000.00	\$48,000.00	2009
Yandex Taxi	Carpooling/ride-sharing	OEM	HD (From Yandex)	LiDAR-based	Rules-based *	Universal	Yandex	Publicly Held	-	-	-	2011
Apple Inc.	Manufacturing	OEM	Basic	LiDAR-based	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Aptiv (Delphi)	Manufacturing	OEM	HD (*from Mobileye)	LiDAR-based	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Audi	Manufacturing	OEM	HD (from HERE)	LiDAR-based	Deep-learning-based *	Universal	Volkswagen	Publicly Held	-	-	-	-
BMW	Manufacturing	OEM	HD (from Mobileye & HERE)	LiDAR-based	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Bosch	Manufacturing	OEM	HD (from TomTom)	LiDAR-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Changan Automobile	Manufacturing	OEM	HD (from Baidu)	LiDAR-based *	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Continental Automotive Systems	Manufacturing	OEM	Unknown	LiDAR-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Honda	Manufacturing	OEM	HD (from DeepMap)	LiDAR-based	Deep-learning-based (Partner: Sensetime)	Universal	-	Publicly Held	-	-	-	-
Mercedes Benz	Manufacturing	OEM	HD (from HERE)	LiDAR-based	Rules-based *	Universal	Daimler AG	Privately Held (no backing)	-	-	-	-
Nissan	Manufacturing	OEM	HD (from Mobileye)	LiDAR-based	Rules-based *	Universal	-	Publicly Held	-	-	-	-
NVIDIA Corporation	Manufacturing	OEM	HD (from dynamic mapping)	LiDAR-based	Deep-learning-based	Universal	-	Publicly Held	-	-	-	-
Qualcomm	Manufacturing	OEM	HD	Unknown	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
SAIC	Manufacturing	OEM	HD (from DeepMap)	LiDAR-based *	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Samsung Electronics	Manufacturing	OEM	Unknown	Unknown	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Subaru	Manufacturing	OEM	Unknown	Unknown	Rules-based *	Universal	-	Publicly Held	-	-	-	-
Toyota	Manufacturing	OEM	HD	LiDAR-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Valeo	Manufacturing	OEM	HD (from dynamic mapping)	LiDAR-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Volkswagen	Manufacturing	OEM	HD (from Mobileye)	LiDAR-based	Deep-learning-based *	Universal	-	Publicly Held	-	-	-	-
Yutong Bus	Manufacturing	OEM	Unknown	LiDAR-based	Rules-based *	Universal	-	Publicly Held	-	-	-	-

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Full-stack self-driving system software developer

Carpooling/ride-sharing service provider

Hardware/auto parts/automobile manufacturers

Partnerships List ^[1]


 Self driving


Company Name	Partners (Manufacturer)	Partners (Software/Service Provider)
Academy Of Robotics	-	-
Almotive	PSA Group, Volvo, Nvidia, FEV, Kyocera	-
aiPod	-	-
Argo AI	-	Lyft, Postmates, Domino's Pizza
Auro	-	-
Aurora Innovation	Volkswagen, Hyundai, Byton, Nvidia	-
AutoX	Nvidia	-
Baidu USA LLC	Nvidia, King Long, JAC Motors, BAIC Motor, Chery, FAW Group Corporation, Changan Automobile, Great Wall Motors, Bosch, Continental Automotive, ZF, Desay SV Automotive, Nvidia, ZTE, Velodyne, Geely	Udacity, BlackBerry, Microsoft, TomTom, AutonomouStuff, Horizon Robotics, UCAR, Grab, Momenta
Comma.AI	-	-
Cruise Automation	Velodyne, Strobe	Uber
Drive.ai	Nvidia	Lyft, Grab
Embark	Peterbilt	Ryder
FiveAI	Nvidia	-
HiTech Robotic Systemz	-	-
Imagry	-	-
ISEE	-	-
Jing Chi	Nvidia	Guangzhou Gov (China), Anhui Anqing Gov (China)
Local Motors	IBM	Udacity, Bestmile, Meridian Autonomous
May Mobility	Cepton Technologies	-
Meridian Autonomous	Local Motors	-
Mobileye	BMW, Continental, Fiat Chrysler, SAIC Motor, Nissan, Volkswagen, Magna, Delphi (Aptiv), Valeo	Navinfo, HERE
Momenta.AI	Mercedes Benz (Daimler), GM	Baidu, NIO

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 Full-stack self-driving system software developer

 Carpooling/ride-sharing service provider

 Hardware/auto parts/automobile manufacturers

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Partnerships List [2]

Self driving

Company Name	Partners (Manufacturer)	Partners (Software/Service Provider)
Navya Inc.	Nvidia	Singapore LTA
NIO	Continental, JAC Motors, Changan Automobile, GAC Group	Tencent, Baidu, Momenta
Nuro	Nvidia	-
nuTonomy	PSA Group, Jaguar Land Rover	Lyft, Grab, LTA Singapore
Optimus Ride	Nvidia	LStar Ventures
Ottomotto	-	-
Oxbotica	-	XL Catlin
Phantom AI	-	-
PlusAi Inc.	Nvidia	-
Pony.ai	Nvidia, GAC Group, Velodyne, BD Star Navigation	AutonomousStuff
Roadstar.ai	-	-
Starsky Robotics	-	-
Tesla Motors	Nvidia, AMD	-
Torc.AI	Nvidia	NXP, AAA Northern California Nevada & Utah
Tsintel Technology	King Long, Fujian Wanrun	-
TuSimple	Nvidia, Peterbilt	STO Express
Udelv	-	Delivery Guys, Draeger's Market, Freshop
UISEE	-	Beijing Fangshan Gov (China)
Vector.ai	-	-
Voyage	-	CARMERA Autonomous Map
Waymo	Nvidia, Fiat Chrysler, Intel	Lyft, Trov, Avis, AutoNation
X-Matik	-	-
Zoox	Nvidia	LStar Ventures

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Partnerships List ^[3]

Self driving

Company Name	Partners (Manufacturer)	Partners (Software/Service Provider)
Didi Chuxing	Apple, Toyota	99 Taxis, Didi, Ola, Via
Lyft	Ford, Aptiv (Delphi), Jaguar Land Rover	Waymo, Drive.ai, Argo AI, NuTonomy, Tata, Didi
Uber	Nvidia, Cruise Automation (GM), Daimler, Toyota, Aptiv	-
Yandex Taxi	Nvidia, Kamaz	-
Apple Inc.	-	Hertz, Didi
Aptiv (Delphi)	Innoviz, BMW, Intel, Mobileye, Fiat Chrysler	Lyft, BlackBerry
Audi	Nvidia	HERE
BMW	Mobileye, Intel, Fiat Chrysler, Delphi (Aptiv), Magna	HERE, Zendrive, Scoop, Ola, Moovit
Bosch	Nvidia, Daimler	Baidu, AutoNavi, NavInfo, TomTom
Changan Automobile	-	Baidu, NIO
Continental Automotive Systems	Nvidia, Intel, Mobileye, BMW	Baidu
Honda	Nvidia	Grab, SenseTime, DeepMap
Mercedes Benz	Nvidia	Via (Daimler invests in Via), Uber (Daimler partners with Uber), HERE
Nissan	Mobileye	Transdev, DeNA
NVIDIA Corporation	Tesla, Honda, Volkswagen, Mercedes Benz, Audi, Volvo, TuSimple, Chery, Toyota, Roborace, Autoliv, Bosch, Continental, ZF, AutonomousStuff, Ficos, FLIR, IBEO Automotive, ON Semiconductor, Pioneer, Quanergy, Sekonix, Velodyne LiDAR, Hella	Aimotive, Baidu, Uber, Jingchi, Zoox, Five.ai, Optimus Ride, Aurora, Yandex Taxi, Pony.ai, Navya, Nuro, e.Go Mobile, 2GETTHERE, Automotive Artificial Intelligence, AutoX, drive.AI, Horizon Robotics, Momenta, Plus.AI, robotTUNER, Torc Robotics, Tier IV, Xesol Innovation, DEEPMAP, HERE, Mapillary, TomTom, ZENRIN
Qualcomm	-	BlackBerry
SAIC	Mobileye, Intel	KOTEL, JD, Alibaba, DeepMap
Samsung Electronics	Quanergy, TetraVue, Oculii	Renovo Auto, Aimotive, Autotalks, Valens, Graphcore
Subaru	-	-
Toyota	Nvidia, Luminar	Amazon, Uber, Pizza Hut
Valeo	Mobileye, Intel	-
Volkswagen	Nvidia, Mobileye, Intel	Gett, Didi, Aurora
Yutong Bus	Mobileye, Intel	-

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Carpooling/ride-sharing
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Hardware/auto parts/automobile
manufacturers

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