Corporate IT’s Part in Enabling Autonomous Driving

Creating competitive advantages for OEMs in an increasingly disrupted industry

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Introduction

Autonomous driving is one of the key game changing developments in the mobility industry.

The initial high hopes triggered billions of investments and flooded start-ups with cash. A few years back, automakers were predicting Level 5 autonomous driving by 2020 – 2022 – these assumptions have given way to new scenarios. While some executives have expressed that full Level 5 might never become reality all OEMs are eager in developing their approach to autonomous driving.

One of the key challenges in this context is to establish an IT Operating Ecosystem which is supporting autonomous driving on- and off-board.

Ginkgo has developed a point of view which options an automotive OEM has and how corporate IT can / should position itself in this context.

Lars Godzik
Managing Partner
Autonomous Driving and the Role of Corporate IT

The key with autonomous is the whole ecosystem. One of the keys to having a truly fully autonomous is vehicles talking to each other.

Mary Barra
CEO, General Motors

The automotive industry is facing its largest transformation since its inception. It must electrify its fleet, to meet regulatory as well as consumer driven demands within this century, while building digital capabilities at large scale. Furthermore, it needs to reinvent itself and develop new services and business models to cater to changing customer demands. All of this happens in an increasingly competitive market environment. Ever more, OEM’s are facing competitors who put software at the core of the vehicle and design the physical product around it. These competitors have entered the market without the heavy burden of legacy IT and disrupt with their impressive time to market speed.

These developments are supported and driven by a significant push to digitalize vehicles and touchpoints around the driving experience. Software has become one of the defining factors of sold cars and trucks. OEMs adjust their overall product design approach to develop, manufacture, and maintain vehicles as well as the service offerings they provide towards integrated digital solutions. Dynamic IT capabilities are a growing advantage in an industry that continuous to digitalize itself at an ever-increasing pace.

The technological developments in vehicle sensorics such as LiDAR (Light Detection And Ranging), data management capabilities (particular processing and storing) and the improvements in artificial intelligence have already brought us semi-autonomous vehicles (up to level 3 automated driving) and a race to fully autonomous driving (AD) is unfolding before us. The challenge to bring the first and safe fully autonomous vehicles on public roads require efforts, under new ground rules, between all competence areas within an OEM.

In this white paper we will elaborate on the different market participants, classical OEMs as well as new digital disruptors, and their different approaches and starting points in the race to autonomous vehicles. Our focus will lie on the IT capabilities required and what role OEM’s corporate IT departments can and have to play. The challenges of digitalization and particular autonomous driving require corporate IT to redefine its role while competing with 3rd party vendors which provide IT capabilities directly to business units. Therefore, we will conclude this white paper with major building blocks of a required autonomous driving IT strategy for corporate IT to successfully transition in this new era.
Overview of the Autonomous Driving Market

Whether observing established players or incumbents, the automotive industry seems to be entangled in a race towards fully autonomous, self-driving vehicles. However, depending on the type of vehicle, passenger car, light and heavy-duty truck or bus deviating business models and goals are being pursued and therefore technology, software, potential partners, use cases and strategy highly differ. This makes it particularly difficult for the established players to utilize some of the synergies they hoped to realize by building a joint platform for their passenger and commercial branches instead of having to venture into coopetition projects or bring in external parties. While the development of autonomous vehicles was driven for a long-time by the arguably more prominent passenger car segment, the commercial vehicles have caught up and made some strong advancements the past couple of years. In the following segment we will take a closer look at the prominent industry leaders as well as their best practices, segment by segment.

Passenger Cars

The primary business case for passenger cars is the automated transport of people from one location to another. We are already experiencing semi-autonomous features such as lane, park and break assistance that supports the driver daily. However, approaches and technological advancements highly vary between players.

While traditional OEMs often gradually take advancements and build them into the latest car models, incumbents challenge this approach and try to skip some phases of the autonomous development. Arguably, Tesla and Alphabet’s Waymo are some of the most advanced and prominent incumbents in the development of autonomous driving, facilitated by Tesla’s auto-pilot function and Waymo’s autonomous taxis. Waymo is equipping vehicles of traditional manufacturers and solely focuses on the technology aspect of data processing and algorithms required to enable autonomous driving.

![Comparison of different in-vehicle sensor systems](source: Ginkgo Management Consulting)
Tesla on the other hand has designed its vehicle from scratch, with the vision in mind of fully autonomous driving. Tesla’s vehicle computing and sensor architecture gives it the key advantage of recording more data through their already operational vehicles in real-life scenarios.

Every Tesla on the road is a live data input source which can be utilized to further improve and train the algorithm. However, as the solution required to be feasible and marketable years ago, it also needed to be comparably cheap and therefore Tesla is heavily relying on vision focused systems (e.g. cameras and radar) instead of more advanced sensor systems such as LiDAR. Tesla is relatively alone in the market with its approach of only using vision focused systems since most manufacturers rely on LiDAR systems as part of a multi-sensory layer system. Such a system combines different sensors (e.g. cameras, LiDAR, radar, ultrasound, etc...) to get the best possible image in any situation. Each sensor has advantages and disadvantages depending on the situation and the weather conditions, but so far there is no single sensor that can work perfectly under all conditions.

**Commercial Vehicles**

Like the passenger car market, we can observe different approaches from key players in the commercial vehicles market. Use cases that are eyed by industry players primarily evolve around small and controlled areas (e.g. warehouses, ports or mining facilities), hub to hub transportation or enabling platooning, the technology where one or more trucks are autonomously following one truck which has a drive-in control of the vehicle. However, the latter has just recently been abandoned by major OEMs as they argue that the desired benefits cannot be realized. A couple of mentionable market participants have risen over the past couple of years and have shown off their capabilities such as TuSimple, embark Einride and Ike. While the overall architecture chosen for commercial vehicles is comparable to passenger cars, there are significant differences next to the use cases that make it difficult to provide a single platform for passenger cars and commercial vehicles at the same time.

**Differences between AD driving Passenger Cars and Trucks**

Trucks have many differences to PC’s that need to be evaluated and tackled when it comes to autonomous driving. Whereas PC are having a more or less fixed weight, trucks weight and length differs a lot depending on the trailer they are chaining. Furthermore there are no accessible roads for trucks and weight and height regulations.

*Figure 2: Differences between AD passenger cars and commercial vehicles (source: Ginkgo Management Consulting)*

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Looking at the differences and challenges it becomes apparent, that autonomous driving is not only about engineering the vehicle, or the self-driving technology itself. The challenges lie in combining these two aspects as well as designing the whole infrastructure surrounding the vehicle. Therefore, IT is a critical enabler not only for the algorithms that empower self-driving, but for all processes that encompass the driving process.

The key success factors are challenging for traditional OEMs, as they often lack the speed and flexibility to adapt as quickly as required. Therefore, OEMs need to proceed on their own path, encompassing as many characteristics of their new competitors without losing the factors, that have made them successful companies in the first place.

Traditional OEMs must try to keep up with the digital native companies, especially when it comes to topics like autonomous driving. As always, speed, agility, collaboration, and a clear strategy are the key success factors here. In order to define such a strategy, it is important to identify and focus on the key building blocks and proceed with a sound methodological approach.
Defining an Autonomous Driving Strategy for Corporate IT

Scope and relevance of an IT specific Autonomous Driving Strategy

Developing a holistic and successful autonomous driving strategy for corporate IT requires a close engagement between corporate IT and engineering as well as strategic partners within the industry. Without building up core AD capabilities within its own IT departments, OEMs will face the risks that the knowledge and skillset for autonomous driving will not be kept and further developed within the OEM’s own knowledge pool. Such a development would substantially increase the OEM’s dependency on 3rd Party providers for core technology as well as diminish its role to the provider of the vehicles physical hull. Thereby moving the OEM out of its current central role in vehicle production and maintenance.

Nevertheless, autonomous driving itself is such a complex topic that it would require collaboration beyond regular department alignments, particular with strategic partners involved. Therefore, most OEM’s set up separate autonomous driving units as independent organizational entities, which can operate decoupled from corporate structures but are still connected to key components. This way corporate IT can leverage it core capabilities and integrate them into the newly founded unit, focusing on developing and delivering in areas where its expertise provides the biggest impact.

It is therefore important for IT to look at autonomous driving from two different perspectives. The first perspective is the consideration of the entire value chain, from vehicle to service offering. The second perspective deals with the AD-specific topics that need to be addressed at each point in the value chain. Only by considering both perspectives and deriving topics for oneself it is possible for the corporate IT department to define corresponding building blocks and successfully enable the topic of autonomous driving.

Corporate IT must play a major role within the whole value chain of autonomous driving. Starting with the autonomous driving software within the vehicle up to the backend and the provision of various services. Some of the topics may already be managed by IT today, for example the topic of connectivity or the vehicle backend infrastructure. Other topics such as in vehicle software or a control center for autonomous fleets are completely or at least partially new territory for corporate IT.
In addition to considering the value chain aspects of autonomous driving, overarching topics must also be considered. These are mainly IT topics that either serve the entire AD value chain (e.g. security) or are only relevant in certain areas of the value chain (e.g. server maintenance or analytics).

Besides the previously mentioned factors it is also important to be fully aligned with the overall OEM’s strategy before defining your own corporate IT strategy for autonomous driving. Furthermore, corporate IT should strongly consider setting up a dedicated department that focuses solely on autonomous driving, to bundle all required skill within one department, directly connected to the autonomous driving unit. Only by considering all these points is corporate IT able to start developing its holistic autonomous driving strategy.

**Components and added value of an Autonomous Driving Strategy**

After developing an understanding of the entire autonomous driving value chain and acknowledging the overall OEM’s strategy, a corporate IT strategy development can be initiated. This development process requires a thorough analysis of several key aspects:

**Capabilities and skillsets**

Developing an autonomous driving IT strategy requires a deep understanding of the corporate IT department and its branches with focus on the available skillset and skill pool as well as the technical foundation.

Only through such a comprehensive assessment of the given corporate IT capabilities the required transparency can be achieved. This is required to assess which steps need to be taken, to jointly proceed on the path of building autonomous driving capabilities within the OEM’s IT department. In some cases, the OEM is outsourcing the development of the virtual driver to e.g. a small and highly specialized company with long term experience in that topic.

If such an approach is taken it is even more important to define the core areas of responsibility from an IT perspective, to align those topics with all involved stakeholders and to define clear delimitations.
Building Blocks

Corporate IT must determine in which areas of autonomous driving it wants to take the lead and invest. This can range from simple services and the provision of workstations up to the development of own marketable services which may even lead to develop corporate IT into an actual profit center. In general, three successive strategic layers can be differentiated:

1. **The AD Foundation layer** covers all basic IT topics which are part of the day to day business of the IT department

2. **The AD Services layer** is required to set up and operate the whole AD environment and to run AD vehicles

3. **The AD Specific layer** consist of new topics which deal with new businesses specifically for autonomies driving

Figure 4: Autonomous driving strategic layers (source: Ginkgo Management Consulting)

In order to develop a holistic and long-term IT strategy for autonomous driving, IT must have a clear vision of how it wants to position itself within the organization and how IT, engineering and a potential separate autonomous driving unit will work side by side. Without such a focused approach the risk prevails that many topics are initiated but no tangible effect realized and in the end no success materializes. Such a development would force management to outsource all critical AD components away from corporate IT.
Challenges of defining such a Strategy

As previously mentioned, close alignment between IT and the overall organization is crucial. In particular, alignment between IT and engineering is key for successful development of autonomous driving vehicles. But this is also the biggest challenge since IT and engineering are not used to such close collaboration and co-ideation. Therefore, engineering quickly tends to develop own software solutions during the development phase, which often results in scalability and security issues during operations. Clear responsibilities and elaborated specifications of required technological foundation as well as interfaces will help the whole organization to focus on their core competences while collaboratively developing new capabilities within the OEM.

Another challenge for corporate IT is the historical background many IT departments are struggling with. IT departments must manage heterogenous IT application landscapes, where they sometimes only have limited governance over, and which are characterized by monolithic application designs. Within this landscape it is difficult to turn the switch and move into agile development and release cycles that match these of their incumbents. Autonomous driving requires a very agile and strong IT, which can develop an overarching infrastructure as well as modern service layer for autonomous driving. To overcome these challenges, it is important to continuously show to the management that IT has a strategy and roadmap in place to build up the necessary skills and capabilities. Furthermore, the in-house experience of corporate IT regarding the OEM’s processes and stakeholder is a key asset to support the development of autonomous driving.

Autonomous Driving IT Strategy development

Developing an autonomous driving IT strategy is not only about understanding the technology, but also about finding an effective operating model and following a common vision. The initial development, based on Ginkgo’s industry proven approach, can be divided into three successive phases.

Figure 5: AD IT strategy development and implementation process (source: Ginkgo Management Consulting)
The first phase focuses the IT department to identify relevant stakeholder, develop a common autonomous driving IT vision and to define the target building blocks of its autonomous driving capabilities. Based on an individual decision framework these building blocks are divided into the categories Non-Core Topics, Core Topics, Internal, and External.

The second phase focuses on the development of the autonomous driving IT strategy itself. The first step is to understand the OEM’s overall IT strategy. This is especially helpful if the development of autonomous vehicles takes place at different locations or even in close alignment with strategic external partners. In the end, the autonomous driving strategy of IT must be in direct alignment with the overall IT strategy.

The second step is the development of the strategy itself. With the help of the previously defined building blocks and in coordination with the OEM IT strategy, the three strategic layers mentioned above (AD specific layer, AD service layer, AD foundation layer) are defined and conceptualized.

The last phase is the implementation and execution of the developed autonomous driving IT strategy. As one of the first steps it is important to break down the building blocks to develop appropriate use cases for them. Based on these use cases required skills and tools will be identified. Once this has been done, a gap analysis will be applied to see what skills and tools do already exist in the IT department and what is needed to add through recruitment and insourcing. The last step is the enablement of the operating model. This includes not only starting the project within the IT department, but also setting up and conducting regular meetings across different departments and involvement of relevant external partners.

Once these three phases are finalized corporate IT and the OEM at large are equipped with an initial autonomous Driving IT strategy which provides a framework for various stakeholders and partners to start working in. Based on the developed autonomous driving vision and derived building blocks a clear prioritization and planning of tasks and resources can now be initiated.

The potential autonomous driving offers are remarkable and range from fundamental new and creative service offerings to holistic, highly complex cyber security networks. Therefore, from our point of view, IT departments should support the development of cross-functional autonomous driving collaboration networks in their organization as early as possible to accelerate the journey towards a world in which autonomous driving is the norm and no longer a distant future.
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