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Automotive

White Paper

GLOBAL BLACK SWANS AND AUTOMOTIVE NEXT HORIZONS

A TU AUTOMOTIVE WHITE PAPER PRODUCED FOR NETAPP

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EXECUTIVE SUMMARY

This paper examines some of the changes and challenges the automotive industry is facing as a result of Covid-19 and looks at how the current situation presents a unique opportunity to radically rethink business and operating models. Hesitancy, reluctance and indifference within corporate hierarchies and operational silos have prevented, or stymied, long overdue transformation. To ensure survival, incumbent OEMs could use this time wisely to create a compelling vision and become a catalyst for change, taking decisive action based around a 3 Horizons model. Core to this will be the development of a holistic end-to-end connectivity and compute architecture.

A BLACK SWAN EVENT

This paper is written midway through 2020, in a semi-locked-down world grappling to contain Covid-19 and develop a potential vaccine that will help restore some balance of normalcy. The global pandemic has meant that, as individuals and as a society, we have recognized our dependence on digital services. Working from home and providing online schooling for children has become a reality for many. Online shopping for groceries and the reliance on mobile applications to prevent isolation, as well as digital entertainment, have pushed many people to try new services out of necessity.

From an automotive-industry perspective, there is concern the virus has changed consumer behaviors and attitudes in ways that impact the essence of a business model that hasn't evolved much over the past 100 years. For many office-based employees, the concept of working from home was never really accepted by corporations, both large and small. However, the virus has proved that the economic and social benefits of this for businesses, as well as individuals, are far greater than anticipated. Many companies now are looking at the real possibility of eliminating or downsizing many of their offices, as employees work from home and occasionally visit hub offices. This fundamental shift in working practices, together with the fear of infection on public transportation, could have a negative impact on commuting and urbanization.

Studies of how Covid-19 has impacted transportation behaviors in many of the world's largest cities have shown improved air quality, resulting from fewer vehicles on city streets. This has created an opportunity for communities to rethink the use of streets within cities. The COVID Mobility Works database identifies over 100 cities that have either dedicated streets for pedestrians; installed so-called "corona cycle ways," or protected bike lanes; reallocated designated travel lanes for other modes of transport; eliminated curbside parking or utilized the flexible street space for outside retail and restaurant businesses to achieve physical distancing requirements. Outside dining is the most common use of this flexible space, but in some cities it is facilitating temporary curbside pickup zones to support shops and restaurants offering takeout-only services.

All this change has intensified the pressure on an already stressed automotive industry, reeling from the crisis impact on liquidity, supply chains, production and demand. Most automotive OEMs have had to temporarily close facilities and, because the industry is a key driver of GDP in many countries, this is creating serious challenges for the overall economic situation.

All this comes on top of a disappointing 2018 and 2019 for the automotive industry in terms of sales and in the face of a number of major technology and business challenges. The industry has been at the heart of the globalization of markets and supply chains, leveraging sourcing power and geographic presence to optimize its operational business model. China is the world's largest automotive market and has been driving the industry's growth for several years. Wuhan is China's "motor city," with General Motors, Honda, Nissan, PSA Group and Renault having factories there. It is also now infamous as the epicenter for the outbreak of Covid-19 and, with many global parts suppliers within the Hubei province, the global supply chains were rapidly stalled.

In Q2 2020, according to the Original Equipment Suppliers Association's (OESA's) Automotive Supplier Barometer index, Covid-19 drove North American suppliers to their most pessimistic level in the history of the series. This pessimism primarily results from concerns of Covid-19 on vehicle sales and the economy overall, as suppliers struggled to restart their businesses in response to OEMs ramping up their factories.

The barometer also focused on global supply chain issues and the ensuing implications. One of the primary concerns is sub-tier supplier distress, surging to +600% in Q2 2020. This has prompted many to heighten their vigilance of sub-tier suppliers, to mitigate risks of supply chain disruption. Another impact is the delay in R&D investments by an average of four months, particularly in connected manufacturing technologies and autonomous driving. There is an expectation among suppliers that consolidation within the industry will occur, as companies look to gain market share through M&A activity.

The global market also creates challenges for the automotive OEMs in terms of diversity of product direction. In the U.S., approximately 66% of 2019 sales were pickups or SUVs. Both these vehicle types have benefited from the low price of fuel, resulting from imports from Canada and the shale oil bonanza in the U.S. It's also true the pressure on OEMS to replace these vehicles lessened in 2016, with the White House and Congress declaring the 2025 goals of 54.5 mpg (4.3 L/100 km) unrealistic and freezing CAFE standards at 2020 levels. Both events removed any incentive for U.S. mass-market consumers to purchase battery-electric vehicles (BEVs). Meanwhile, in Europe, where emission requirements are tightening and there is a lasting hangover from the Dieselgate scandal, OEMs are increasing R&D investment in BEVs.

TRANSFORMATION WAS OVERDUE

Digital transformation has been an industry buzzword for many years and, although the automotive industry has embraced aspects related to its information-technology systems, the fundamental operations of the industry have not changed significantly. In many respects, this is a very traditional industry driven to evolve its technology to deliver safe and reliable products. The industry is not known for its innovation or speed of development.

As a start-up, the disruptive nature of Tesla certainly has intensified the focus of the major automotive OEMs on BEVs and autonomous vehicles (AVs). This has been reinforced by the incremental attention and investments from major players, such as Google/Waymo, Apple and Intel in AVs, together with billions of dollars of venture-capital money driving an AV ecosystem of more than 250 companies.

However, the most disruptive aspect of Tesla is that it started with a clean sheet of paper for the design of its onboard software, which integrates all the control elements of the vehicle and can be updated over-the-air. This integrated holistic approach to the electronic, software and communications architecture is where the real competitive advantage of Tesla has emerged.

In comparison, the automotive industry generally has outsourced its software development, resulting in spaghetti code sourced from numerous trusted vendors and incorporated into thousands of components and hundreds of controllers. With limited exceptions, none of these components or controllers link to a central point of intelligence for data gathering or communication.

Compared with Tesla, OEM incumbents have limited knowledge about their customers. Throughout their lifespan, the approximately 900,000 connected Teslas on the road have been sending back data on, not only car performance, but also driving habits. Tesla is able to feed off this data to change driving features and improve range and acceleration through simple over-the-air software updates.

Ultimately, the pace of innovation within Tesla is the prime challenge facing the rest of the automotive industry. The automotive engineering mindset of evolutionary design for long-term safety and control is in stark contrast to the Silicon Valley approach of radical experimentation and fast innovation. These

seemingly contradictory mindsets need to be reconciled if legacy automotive OEMs are to have any chance of survival.

CATALYST FOR CHANGE

An asset of the current situation, as dire as it appears, is that automotive industry leaders have an opportunity to harness their collective Covid-19 experiences that proved digital transformation is possible when the need is there. Traditional industries often show a hesitancy and unwillingness to experiment, but the pandemic has shown that everything from shopping to education, entertainment and social interaction is possible via digital channels. Those same digital technologies are the keys to ensuring survival by bringing together the silos in engineering, creating new operating and business models and embracing innovation.

To address some of the challenges faced by the industry in the shift from internal combustion-engine to electric-vehicle portfolios, leadership needs to take a holistic review of existing operational and business models. In the very near future, there will be a clear requirement for systems that can support artificial intelligence (AI), Internet of Things (IoT) and data sharing across the entire organization. For this to occur, an integrated connectivity and information technology network must be created in order to provide the necessary compute capability to support advanced engineering, smart factories and connected products that link to internal enterprise resource planning (ERP), customer relationship management (CRM) and other business systems.

For years, the automotive industry has specialized in the outsourcing of components and software for vehicles. In order to successfully achieve this integrated connectivity and information-technology network, OEMs must learn to partner with technology, cloud and network providers to architect and deliver – rapidly and at scale – the infrastructure, platforms and services required.

While each OEM is different, in terms of the specifics of their operational and business models, there are likely to be more similarities than differences. Potentially, this could mean that OEMs benefit from approaching this requirement collectively and, in so doing, create collaborative development opportunities to address future market needs. Utilization of common cloud platforms and tools could support the development of a new electric and electronic architecture, as well as supporting software for electric vehicles. It also might foster shared development between multiple OEMs seeking to reduce cost and time-to-market, and address the challenge faced by all of them to find and hire thousands of software engineers.

This scenario would require a data strategy that supports the compute, transfer, storage and management requirements of a global development environment that could be shared across multiple partner companies. It will be essential to ensure that the cloud and connectivity partners chosen can meet the key performance indicators of this strategy, especially because this compute network foundation likely will be used for the creation of AI algorithms for AVs.

This may seem a radical concept, but history has a habit of repeating itself. Prior to the arrival of Apple's iPhone, all major cellphone manufacturers faced a software situation almost identical to the one in which the automotive OEMs now find themselves. Their software code was fragmented and unable to integrate all the capabilities the iPhone brought to market, in terms of music, Internet, touchscreen and downloadable applications. Samsung and LG are the only survivors of the original players, with names like Motorola, Nokia, Ericsson, Siemens, Alcatel and BlackBerry no longer in a market now swamped with Chinese vendors. The cellphone market is dominated by the Apple and Android operating systems, and both these companies have desires to gain the same position in the automotive industry.

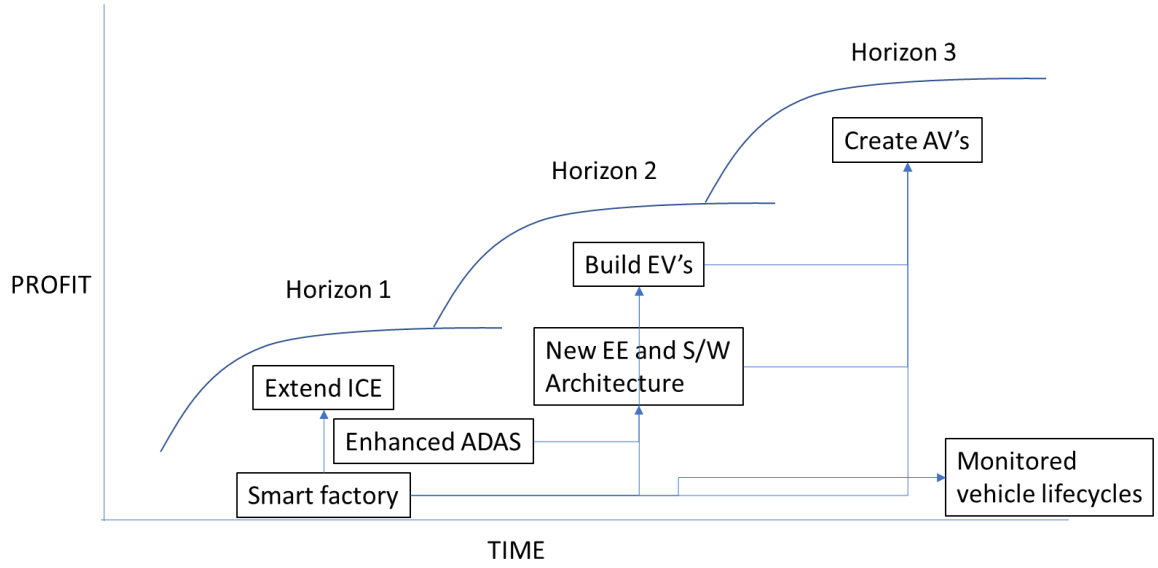
As is already the case with Volvo, some OEMs will adopt this strategy of utilizing an external operating system that can be tailored to the specific brand user-experience requirements of the OEM. Based on the

pace of software innovation within the automotive industry to date, it's doubtful that all OEMs could create a software operating system for their brand. However, collectively, they could partner with Apple or Google to create a collaborative automotive software venture that jointly develops, evolves and maintains a unique automotive operating platform.

THE NEXT HORIZON

McKinsey's 3 Horizons planning concept has been used extensively over the years. This formalizes the concurrent development of an existing business, in terms of sustaining it, to extract maximum profitability, in order to fund and build a new business and create future opportunities.

Figure 1 Automotive Industry 3 Horizons Scenario



Source: Wards Intelligence

In the case of the automotive industry, the Horizon 1 priority is to leverage the portfolio of internal combustion engines and deliver vehicles to the market as cost-effectively as possible. For this to happen, the existing supply chain needs to be optimized for the current global situation. With increasing trade rule restrictions and reduced demand, the existing global logistics may not be appropriate. It also requires looking at the opportunity to incorporate vendors in an integrated supply chain management system that's intelligent and can ensure visibility and management of risk at an optimized cost.

The fallout of Covid-19 is that existing factory operations are not ideally set up for socially distanced workers. Consequently, the changing supply chain will need to be linked to factories that are smarter, utilizing enhanced automation and AI to sustain vehicle production. However, this is no simple task. In many cases, sensors and programmable logic controllers on machines are not connected and, therefore, do not share data.

Taking the opportunity to accelerate IoT projects and connect the entire production process via a private network could enhance quality, reduce maintenance costs and improve availability of equipment, so that production efficiencies are increased. In Germany, pilot programs already have been initiated between Ericsson, Deutsche Telekom and Daimler-Benz, as well as Ericsson working with Vodafone and Audi on smart private network factories.

For Horizon 2, the development of a BEV platform and portfolio is the priority, and an essential part of that

development is the creation of the electrical/electronic and software architecture. Whether this is done collaboratively with Android Automotive OS, as outlined above, or developed in-house, the key to success is focusing efforts solely on a BEV platform. In this way, there is no requirement to link the architecture to legacy systems and components. It's a clean sheet of paper approach that should reduce development time.

Horizon 3 is focused on creating an AV platform. The concurrent developments around smart factory, new electrical and software architectures and BEV development all support this third horizon. The AV platform also can leverage advances made in ADAS capabilities to move along the AV development cycle to the point where vehicles may be produced both profitably and with a good time-to-market.

Incremental to this is the possibility to continuously monitor vehicles over their lifecycle. Since vehicles will have connectivity incorporated into them during the factory build, the opportunity exists to utilize the data from the factory and the vehicle to create a digital twin that can be monitored throughout the vehicle's lifecycle.

CREATING A VISION

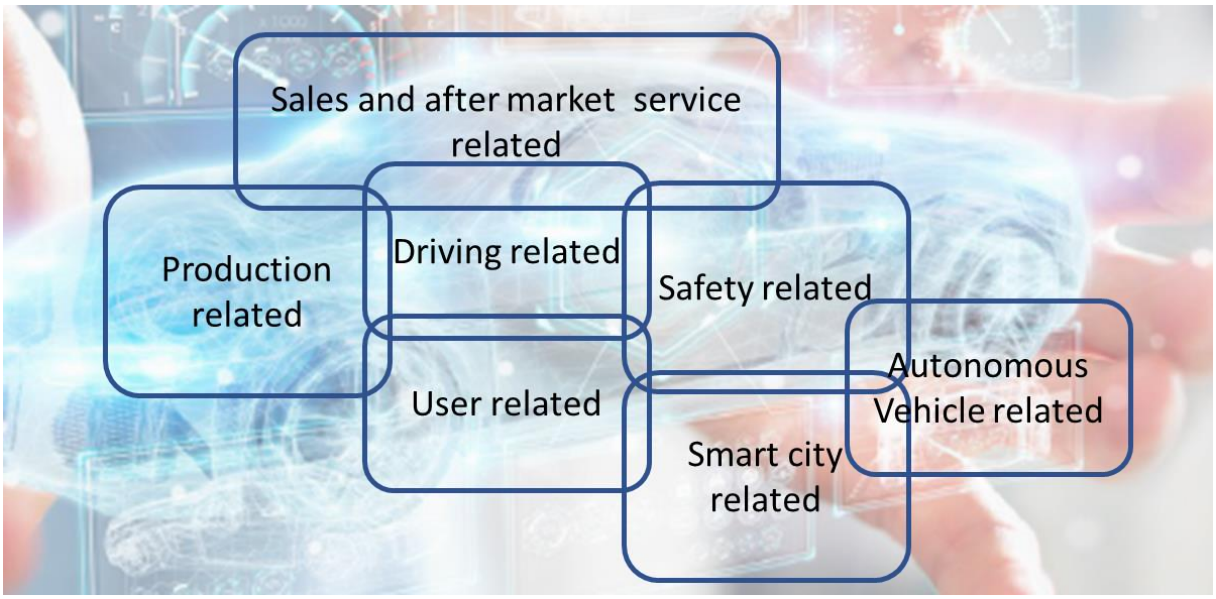
To fulfill the 3 Horizons strategy, it is necessary to engage the organization and break down the silos between departments. We already have established that the current state of pandemic has created an increasing openness to change among people and, by definition, corporations. It's the responsibility of the automotive OEM leadership to create a compelling vision that all stakeholders can embrace and execute.

In the case of Tesla's Elon Musk and Apple's Steve Jobs, they created a vision that galvanized their employees. Whatever form this vision takes, it should incorporate elements of the following narrative: From the time that a BEV is first created in an automated smart factory and the connection module is inserted, it will transmit data about everything that is being added to the vehicle. In parallel, this data will be used to create the car's digital twin. As the EV rolls off the production line and goes into the supply and dealer chain, its status and location will be tracked. When the vehicle ultimately is sold to its first and subsequent owners, it will be constantly communicating with its digital twin. In this way, the car will be updated with the latest software, and cybersecurity and personalization data will be kept current or deleted in accordance with local consumer- and data-protection directives. When the vehicle's demise becomes inevitable and the car enters the recycle center, which is now a key aspect of a vehicle's life, the center already will know which parts can be recycled, and what the life is of all other parts. If components can be reused in an aftermarket, then their lifecycle provenance can be attested.

DECISIVE ACTION

Returning to the immediate needs of Horizon 1, the automotive industry must think about IoT, connectivity and AI from a holistic solution perspective. The ongoing arguments about DSRC (dedicated short-range communications) and C-V2X (cellular vehicle 2X) are a distraction that the OEMs can't really afford. In less than four years, and in partnership with most of the major automotive OEMs, the cellular industry has developed C-V2X and provided an opportunity to not only deliver line-of-sight communication, but also to supplement it with non-line-of-sight and enhanced safety capabilities, including vehicle-to-pedestrian connectivity.

By partnering with mobile operators and encouraging private-public partnerships, the deployment of C-V2X as part of the 5G rollouts in cities and major highways could bring to fruition the greatest leap forward in automotive safety. This will move the auto industry closer to the Tesla/Silicon Valley model of innovation. Most likely, the C-V2X technology will not be perfect day one, but it will help save lives and, with connectivity and a well-architected implementation, it can be continuously improved.



At the heart of many of these changes is the fact the automotive industry must pivot to digital experiences across the entire value chain. The vehicle must be providing a series of interconnected driver-, user- and safety-related experiences.

The traditional commitment to deliver a safe, quality product must be combined with innovative digital systems that improve time-to-market and create experiences that entice the consumer to purchase and continuously enjoy the vehicle. The key to delivering this is recognizing the importance of vehicle data across its entire lifespan and ensuring access to it via connectivity.

CONCLUSION

The thread that links all these aspects together is the utilization of a holistic approach with end-to-end connectivity and compute architecture that encompasses the vehicle, the design and development of the vehicle, and the manufacturing, delivery and maintenance of the vehicle throughout its life. Global wireless connectivity, utilizing 4G and 5G in public, private and hybrid scenarios, will be closely aligned with public, private and hybrid cloud and edge data fabrics. Without this foundation, the achievement of the 3 Horizons model will be almost impossible, primarily because data will become essential to the automotive OEMs, whether that's performance data from existing vehicles and their drivers that help refine future developments, or the masses of test data from EV and AV development programs as they generate millions of miles of experiences. The key will be having the right data available at the right time, that can be analyzed in the appropriate way to identify the opportunities to enhance performance, refine production or deliver new driver experiences.