TALKING POINTS

Exploring the potential of software-driven transformation in the automotive sector

RE-IMAGINING CUSTOMER VALUE IN A SOFTWARE-DRIVEN AGE

Software-driven Transformation (SDT) is a hot topic in the automotive industry today. That's understandable given the change it's motivating in areas ranging from AI and ADAS, to electric and connected vehicles – while opening up a host of new revenue opportunities in the process.

In addition, it's also causing the predominant 'hardware first' culture of manufacturers to give way to software-driven development; where the inclusion of micro controllers to perform exclusive functions is yielding to a 'central' computing platform around which the car itself is built.

But aside from this exciting re-imagining of the vehicle itself, further change is also happening. This can be seen in the shifting relationship between original equipment manufacturers (OEMs) and their customers. OEMs are now far better positioned to put customers at the center of everything they do. To devise innovative new services and experiences that help transform the way they proactively engage at an individual level. And not just from the point of sale, but across a customer's complete and on-going end-to-end journey. This desire to be truly customer-centric has long been an aspiration for OEMs, and now enabled by SDT the entire industry is able to think bigger and bolder in their efforts to stand out through eye-catching creativity.

LEADING THE CHARGE

Understanding and responding to customer demand is obviously important in any industry. For automotive OEMs, however, the reality is that core operational functions remain historically designed around the vehicle. As a result, the product-centric approach has predominated, despite the efforts of manufacturers to become more customer-focused. That this is the case can easily be demonstrated by a call to any typical dealership, where it's usually your license plate and model type they'll first enquire after – before even asking your name. All of which goes to show that it's the product rather than the customer that currently occupies center stage.

There is, however, at least one company where such traditional thinking is absent: Tesla. Having earned a reputation as a leader in developing the software-driven car with Over The Air (OTA) updates, advanced assisted driving, and a host of other ingenious features, Tesla is also envied for the depth of customer relationships it's been able to create. And in the US, Tesla leads the automotive industry for brand loyalty.[1]

The important point to note here is that behind the constant roll-out of innovative software and a stated relative independence from electronic hardware, Tesla has also managed not only to avoid the worst impact of the components shortage and maintain delivery, but also redefine the relationship between customer and OEM. Aspiring to delight a customer with the launch of a new vehicle every 3–4 years is not enough. Instead, they're maintaining far more regular interactions through OTA updates that introduce improvements, new features and capabilities every few weeks.

A key reason as to why Tesla is able to forge this new type of relationship comes down to vehicle architecture and intense usage of data. With their vehicles connected to the cloud, the company is able to capture and leverage a wide array of performance-related insight. As a result, a rich pool of raw data into vehicle usage and customer behavior is available in real-time – with Tesla able to act at the same speed to refine its offering and create new experiences. This is intelligence that goes way beyond traditional static surveys and focus groups. Analyzed to find new ways of delighting customers and improving existing services, the data opens up a world of new opportunities – with the delivery of new features then handled via OTA updates for fast resolution. Customers, able to see these changes happening on a regular basis, are therefore afforded a far more interactive and 'high touch' relationship with the Tesla brand; and if still currently firmly positioned in the premium segment, its ambition seems to be to compete with volume brands.

[1] 'Tesla No.1 in Brand Loyalty, Then Subaru': bit.ly/3tcEk7c

A PLATFORM FOR AMBITION

Alongside the opportunity of giving customers what they want when they want it, the software-driven car also provides a platform for actively shaping demand. For OEMs, the ability to deliver increased value through new connected services also provides a number of opportunities to tailor offerings to each individual customer. An example of this being a manufacturer allowing all of their models to access an additional 'sports mode' which delivers additional horsepower, for a set period of time, maybe with a discount for weekends. The potential of 'on-demand' is evident for OEMs, as they're now able to respond to customer demand in real-time. Anticipating where and when to suggest additional features is also a principal step in the journey to enabling a genuinely customer-centered approach; where OEMs have the capacity to delight customers at the point of immediate need, thereby forging a reputation for proactive and meaningful support – which in turn is likely to translate into a long-term loyalty bonus. For customers, the impact is equally transformative as it has the power to change the very way they think about their cars and what makes for a meaningful experience.

This type of thinking also opens the door to far more interactive engagement with consumers. Today, an OEM's approach to in-car concierge services can feel quite limited. But integrate access to Alexa, Siri, or Google Assistant for example, and this experience is taken to a new level where the vehicle becomes an extension of the customer's wider digital world. The task for OEMs is therefore to blend these services with location data and insight into a customer's personal preferences to revolutionize future service capabilities.

Not that progress is guaranteed to be smooth and easy, as a range of challenges will need to be overcome, including:

- For OEMs seeking partnerships, thought will need to be applied to who owns the customer data – as well as consideration of what intelligence is being given away.
- For those choosing a do-it-yourself approach, a central concern will be optimizing how their system connects with the wider world – including a customer's existing digital ecosystem.

Building services such as these, however, represents only a part of the overall challenge. Arguably, a bigger one is the task of capturing, integrating, and making sense of the huge volumes of customer and vehicle data now available to OEMs. Mastering this activity, for many, will prove a steep learning curve, given the fact that dealer networks have traditionally been the custodians of all things customer data.

Another sizeable challenge is presented by the multitude of regulatory frameworks in existence across global markets. Sharing customer data without permission is, for example, forbidden in some regions, yet the same regulatory authorities also dictate that OEMs automatically notify emergency services if they detect an incident (e.g. an airbag being released). This is not, of course, an insurmountable level of complexity – the point being that as OEMs continue putting connectivity and data to work in increasingly innovative ways, the resistance caused by regulation requires an equal level of dynamic thinking to overcome.

Connected experiences

In summary, the new truth for automotive OEMs to embrace is that the car can no longer be considered an island. More so than ever, the 'build it and they will come' mindset is proving insufficient to meet consumer expectations. That's not to say though, that future innovations in both hardware and software are now irrelevant. Far from it as SDT continues to serve up opportunities for developing value-adding technologies and services. But the bigger picture is that beyond even a software-first philosophy is the significance of a customer-first approach.

The criteria for achieving success and market growth continue to shift, and the long-term winners will be those companies able to effectively place the customer experience – rather than the car – at the heart of every future decision. It may be that the future of the automotive industry is about to get far more interesting than even Tesla imagines.

IN CONVERSATION WITH...

Software-driven transformation represents a true revolution for the automotive industry.

It's also an approach that introduces significant challenges and opportunities. Informed opinion is therefore important for shaping a development strategy that works for both your organization and your customers, while also helping define the boundaries of what's possible. That's why I've engaged with eleven experts from across the Capgemini organization, and discussed with them key aspects of SDT. Their responses, detailed below, provide useful and practical insights for advancing your own SDT strategy – while also helping bring to life the unique expertise Capgemini has to offer in this field.

I'm confident you'll find answers to many of the central questions posed by SDT, and hope these collective viewpoints prove thought provoking and inspirational.

Alexandre Audoin

Head of Global Automotive Industry Capgemini Group and Head of Automotive Industry Capgemini Engineering

Methodology:

To help create this opinion paper, Capgemini conducted interviews with twelve experts to identify and incorporate their views on recent developments in the automotive industry with regards to software-driven transformation. All opinions expressed in the following content are those of these individuals and NOT from Capgemini.

TALKING ABOUT THE VALUE OF BECOMING 'SOFTWARE FIRST'

With Jean-Marie Lapeyre

I still have an old mobile phone from the late 90s sitting in a kitchen drawer at home. Looking at it today, I see a self-contained unit where each component was designed to support the only real functionality on offer: phone calls and text messages.

No internet, GPS maps, or app store. Not yet. But place a modern smartphone next to it and I quickly lose any sense of nostalgic sentimentality. Today's phone gives me access to an almost unimaginable range of service offerings, where convenience meets choice meets expectations for 24/7 on-demand connectivity.

The parallels to SDT in the automotive sector are striking. Here, the late 90s equivalent (though still a regular design feature today) was a car dominated by micro controllers running millions of lines of code to operate very specific on-board functions. These were pre-defined (heating, sensing, navigation, etc.) and thus offered a clear yet narrow user experience: the ability to drive securely and comfortably from A to B.

Now look at today's smart car, with the most obvious example being a Tesla, and see the differences made possible by software.

The vehicle now exists within a customer's wider digital experience. On-board electronics co-exist with an ever-growing array of off-board intelligent capabilities accessed instantly via the cloud. Instead of adding multiple computers and controllers to the vehicle to deliver new features, the car itself is built around a computer that in turn offers a dynamic platform for constant software innovation.

INNOVATION THROUGH UNIFICATION

These developments have given OEMs another new battleground on which to compete, and they're quickly marshaling forces. Volkswagen for example, has created CARIAD, a software division which is already thousands of people strong. We've also seen other OEMs recently appoint (for the first time ever) Chief Software Officers to reinforce their delivery of SDT. The initial goal for many is to design, produce, and/or optimize an Extended Car Operating System – technology that unites both on-board and off-board capabilities. Such a move is rightly seen as a doorway to both accessing traditional driver services and connecting to wider support and servicing networks.

It's also a critical step toward meeting the underlying efficiency and customer experience targets inspiring the 'software first' approach. Another important step will be the creation of a supporting culture that's deemed attractive by software developers as well as automotive engineers. Both these groups represent distinct cultural reference points, different needs, and singular working practices – with development cycles alone running to very different timescales between hardware and software. Aligning these seemingly incompatible resources, and stimulating an agile and highly flexible working relationship that brings the best out of both, will be an ongoing challenge – but one that will also prove the secret to delivering stand out products and customer experiences.

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"Today's phone gives me access to an almost unimaginable range of service offerings, where convenience meets choice meets expectations for 24/7 on-demand connectivity."

TALKING ABOUT SOFTWARE AS THE NEW STRATEGIC IMPERATIVE

With Frank Drewek

Technology today clearly underpins the vast majority of strategic priorities being pursued by the automotive sector.

From increasing vehicle connectivity and smart mobility to gaining a leadership position in autonomous driving and electrification, the race is on to complete the move from traditional manufacturer to a more services business model – a journey that places SDT at the heart of every activity. Yet the reality is that rates of progress differ markedly, with most OEMs still a few years away from achieving the goal of full digitization. What the leaders are recognizing, however, is the long-term value of basing vehicle development around a dynamic software core. And not just stopping there, but also creating an array of new services centered exclusively on evolving customer needs. Strategic priorities are therefore shifting in response to address two critical questions:

- **What do customers actually want, and how far have their expectations shifted toward a greater emphasis on connected in-car services?**
- **What services and features are customers willing to pay for, and how can data be better put to work in developing new offerings in areas such as entertainment and convenience?**

Determining the answers will have big implications for a company's future prospects. For financial metrics alone their importance is striking, as the 90% of revenues typically generated by vehicle sales is, I believe, set to change over the next 10–15 years – with up to 50–60% of future revenues possibly coming from a range of software-inspired services. A change of business priorities is the inevitable response, led chiefly by a shift in focus from production to software as the organizing design principle. Or put another way, to base decisions around the need to optimize overall customer experiences rather than delivering the most appropriate engineering and hardware outcomes.

MAINTAINING THE FLEXIBILITY TO ADAPT

Delivering this change will require a huge leap in mindsets as much as design methodology as OEMs explore beyond the current areas of navigation and infotainment. The rich data available to OEMs (once they can collect and make sense of it) also holds the key to making more informed policy decisions, which in turn will impact every facet of the automotive value chain – even down to ownership models, where for example, innovative rental-style arrangements may prove a more popular option for various audience segments.

Data, and the technology needed to exploit its potential in realtime across production sites, is now the big play demanded by the forward-looking OEM. Implementing new capabilities though can be a huge challenge in itself. Hence why we've seen software development largely outsourced. A position that's rapidly changing now as OEMs increasingly look to bring these skills in-house as the pivot toward software adopts strategic importance. This is the drive to *'softwarization'* and agile development, which brings with it a host of cultural as well as technical obstacles to overcome.

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TALKING OPPORTUNITIES FOR DRIVING MARKET DIFFERENTIATION

With Stefan Fuetterling

Tesla is often justifiably viewed as a trendsetter for the automotive industry.

Certainly this is the case in the area of software-driven transformation, where the company has consistently demonstrated the value of leading with software in any development process – before building hardware around the resulting specification. Doing this, however, has meant a dramatic shift in design ethos. Software has now been elevated to the lead factor shaping the very experience of buying, driving, and maintaining a vehicle – indeed even pushing back the limits of what that experience itself should actually encompass.

When automotive software is combined with cloud connectivity, however, the rules of the game really begin to change.

No longer is a vehicles development seen to stop the moment it's sold. Instead, the user gets to experience constant updates and enhancements, including a steady introduction of cool new features that make driving easier, simpler, and more fun. Updates delivered over the air with a frequency often measured in weeks rather than months to help maintain high levels of interactive engagement.

As a result, we're seeing a fundamental reinvention of the relationship that exists between automotive OEMs and their customers. Dealerships will, of course, continue to serve as vital touchpoints, particularly in the areas of sales and servicing, but their time of exclusive interaction is fast coming to an end. Smart connectivity is instead helping to create an array of new opportunities for OEMs to build meaningful engagement direct with customers, and to deliver enhanced experiences that can lead to a host of new revenue streams.

ENDLESS POSSIBILITIES

The only limit now to an OEM's ambition is quite literally their imagination. Traditional restrictions are fast disappearing. While a vehicle's hardware frame becomes increasingly standardized, the software, services, and experience sitting atop offers many opportunities for differentiating products and building brand value. A good example here being a car that's programmed to notice when its driver appears to be tired at the wheel, and responds with directions to the nearest coffee shop or rest area.

In addition, there are the multiple revenue streams that these value-adding services are opening up, realized through the introduction of new apps and features. Hence why a growing number of OEMs are investing in new business units focused exclusively on software development. Daimler for instance, has recently announced plans to hire 1000 software developers, and for removing legacy barriers to help inspire more agile, collaborative working practices. This is true transformation and an inevitable reaction to today's market reality, where product development alone for new models has shrunk from around eight years to two or three.

Looking ahead, change is likely to remain the only constant for automotive OEMs. What's different in a software-led world, however, is the sheer amount of data made available for supporting future decisions – and for inspiring efforts to simplify and standardize for greater profitability.

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TALKING ABOUT SOFTWARE DRIVEN TRANSFORMATION AND THE CHALLENGE OF LEADERSHIP

With Benjamin Fritz

Of all the changes brought about by SDT, both real and planned, arguably the most profound and least understood is the leadership dimension. This is unsurprising given the end-to-end transformation that the shift from hardware to software-driven excellence entails, including extensive product, process, and organizational change.

In addition, SDT sits at the confluence of adjoining strategic priorities. Automotive OEMs face the constant need to become more efficient and agile in meeting customer expectations. Equally, there's the need to find long-term solutions to delivering on the four big disruptions now directly impacting the sector: autonomous vehicles, connectivity, electrification, and shared mobility. All of which demands a strong and sustained focus on software as the lead design principle over hardware. All will benefit immeasurably through an SDT strategy able to accelerate roadmaps for delivering new products and services. And all is only possible with a more fluid, adaptive, and collaborative form of command and control.

ADDRESSING THE SKILLS GAP

The traditional approach to driving change in automotive has been led by the engineering and R&D departments. Making SDT work, however, requires a rethink, and at the very least, a reappraisal of the core value an OEM delivers – and how best to optimize each and every output. That's because SDT is as much an ideology as it is a formal design process, a purpose that's bigger than any one department. Its effective deployment requires new, deeper, and more long-term partnerships with specialist providers that can help OEMs scale at pace. The end goal being to create a rich ecosystem of capabilities – gained in part by joint ventures and even acquisitions of key technology vendors – to help build out niche solutions in areas such as cloud, quantum computing, edge computing, machine learning, AI, and natural language processing. Capabilities that present a daunting level of required expertise.

Effective leadership in this multifaceted, fluid, and adaptive environment will therefore require a similar skill set. In response, leading organizations are already benefitting from having a CXO in place with a remit for transformation that incorporates every single department. An executive tasked with maximizing the available in-house capabilities, expanding them in line with strategic mandates, and attracting the right talent needed to exploit the full potential of SDT.

Defining and implementing the right strategy at an organizational level is central to the success of all these endeavors, and this is the task now set for today's leaders – as they strive to inspire more customer-centric services and experiences. Obstacles exist, particularly in terms of overcoming embedded practices and rigid planning approaches to cloud and APIs. But the ability to transform the very way a vehicle is built, sold, and developed – alongside the creation of value-optimized technology in a data-driven world – helps stimulate significant revenue opportunities that far outweigh any perceived risk.

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TALKING CHANGE DRIVERS AND VALUE-ADDING PARTNERSHIPS

With Ranu Pande, Deepti Zain, and Neha Arolkar

What is the software-driven car? Ask Tesla, leading pioneers in the field, and they'll most likely explain that it's key to building and maintaining customer engagement.

Scratch below the surface, however, and you're into the detail of what the concept actually means, and how it touches all parts of vehicle production – from engineering and embedded systems, to OTA updates, assembly, procurement, and marketing.

SDT is therefore an all-encompassing methodology, but what's driving its introduction and popularity? The answer, at the highest level at least, points to three principal forces at work:

- **Consumer demand:** which remains focused on experiencing greater convenience, productivity, safety, and security from their cars – as well as the demand for more connected and sustainable vehicles.
- **Government regulations:** and the growing drive for greater sustainability that's seeing many governments offer up tax breaks on electric vehicles.
- **Competition from 'Big Tech':** with players like Apple, Amazon, and Google already debuting advanced car concepts – and bringing with them significant industry disruption.

A common theme that's detectable in all of these drivers is, of course, SDT as a critical enabler. In fact, the importance of software continues to grow in line with the many use cases opening up to it as digitalization and vehicle connectivity increases. That's why leading automotive OEMs are continuing to announce their intentions to bring back in-house key components of the software development process, as they reassess their own unique sources of value and differentiation.

THE POWER OF PARTNERSHIP

These industry drivers are also posing some interesting questions to OEMs. In turn, senior leaders in these companies now need a much clearer idea as to what capabilities they should be maintaining, what should be outsourced, and what upcoming projects will require the fostering of new partnerships. This last point is especially relevant given the partnership activity now being seen across the industry, covering ventures from charging systems to public clouds whose scale is helping unify standardized services. Examples here being the work Amazon is doing with Toyota, and Bosch partnering with TomTom and Mercedes.

Looking ahead, it would appear evident that such partnerships will need to become wider in scope and ambition. That's certainly what we're seeing at Capgemini, as customers come to us for help in changing, adapting, and scaling faster in line with market demand. Central to this activity are the streams of customer data and insight that organizations can now capture. Information that increasingly helps them anticipate and predict with accuracy what customers want, and what they're prepared to pay for – before developing new products and services in time to capture this.



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TALKING ABOUT THE ACCELERATION OF AUTOMOTIVE INNOVATION

With Dr. Klaus Breining

I think for me, SDT went mainstream the moment consumers started asking one fundamental question: "why can't I have the same experience interacting with a vehicle as I do with a smartphone?"

This is an expectation that's now leading to a complete paradigm shift in the very architecture and design process of cars, as well as the elevation of software to the role of key enabler. In response, OEMs, face the task of radically transforming their operations as the automotive 'rulebook' goes through a major editing process:

- It's software, rather than engineering innovation or hardware, that now defines a car's stand out capabilities.
- The way automotive brands differentiate themselves in a crowded market will increasingly come down to software services and features.
- Software also presents a host of revenue opportunities throughout a car's lifecycle, with service revenues expected to slowly begin exceeding revenues achieved from the sale of the car itself.

OEMs certainly have a lot to think about. Not least the strategic imperative to accelerate speed of product development, and to maintain the introduction of new innovations beyond a vehicle's launch date. Advances in cloud connectivity bring with it the ability to consistently update a car's software during its full operational lifetime, which in turn revolutionizes an OEM's relationship with its customers. Then there's the growing complexity that's a natural by-product of these advancements. For example, most cars today include software that's isolated inside separate ECUs that serve a distinct and specific function. Fast-forward to the not too distant future, and you'll most likely find a single high-performance computer that offers multiple functions for both the manufacturer and the customer.

THE BUILDING BLOCKS FOR SUCCESS

Rapid innovation is therefore blurring the lines as to what constitutes a car, and what's possible in terms of service delivery. Traditional boundaries are quickly disappearing. Software is no longer restricted to what's embedded inside the vehicle, but rather extended by powerful new apps and services sitting securely in the cloud. Where data relating to attrition, component failures, and servicing information, etc, is immediately available to inform future design decisions.

Clearly, the way OEMs structure their businesses to reflect this new reality is going to be important, as will their ability to leverage existing technology investments. In fact, it's already interesting to see a number of OEMs creating separate organizations to work on software development, as demonstrated by Volkswagen and their Cariad spin-off operation. This decoupling of hardware and software is critical for accelerating the pace of innovation, while also inspiring new governance and agile development models that further help move OEMs away from a fixation on physical vehicles and factories.

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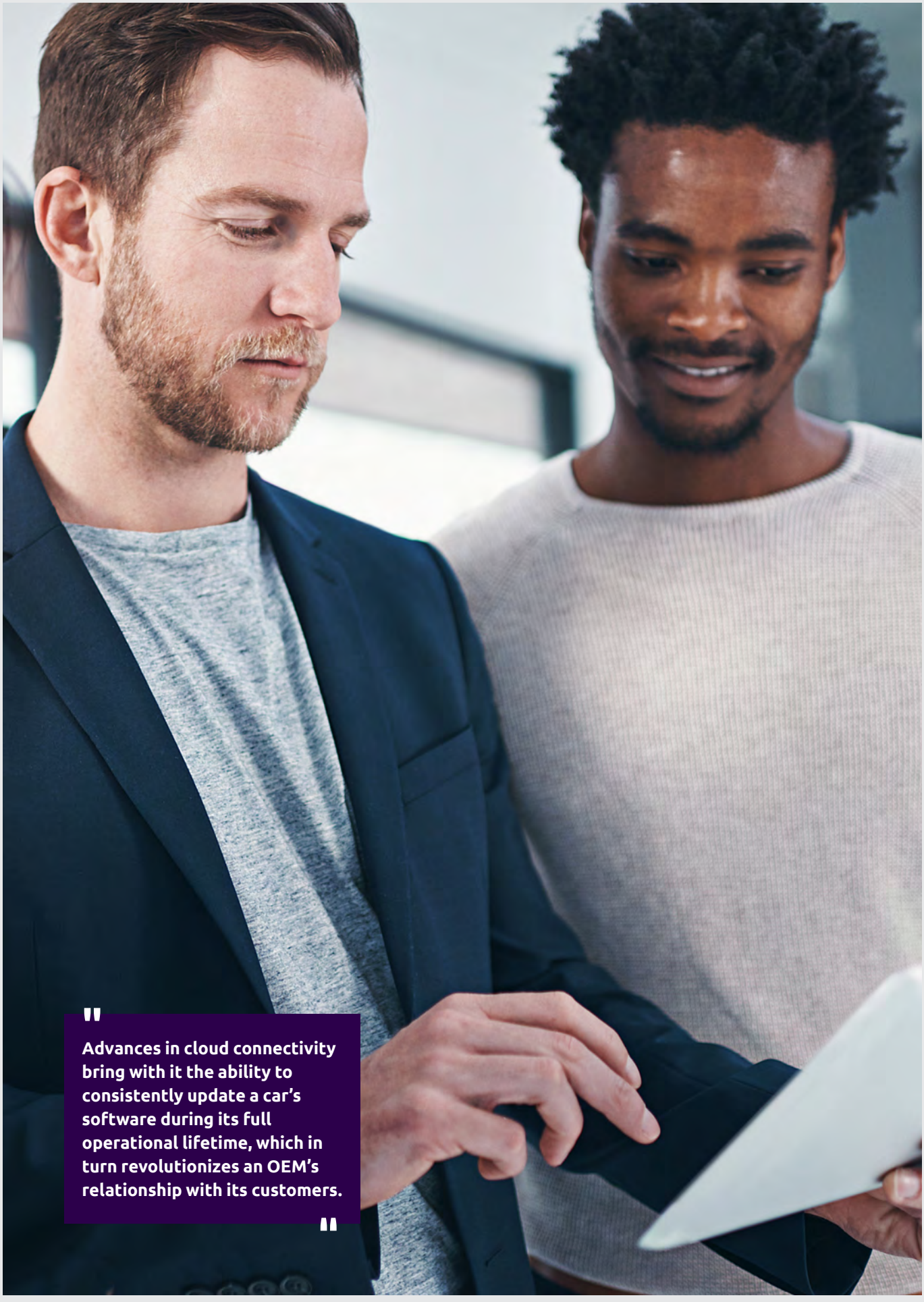
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Advances in cloud connectivity bring with it the ability to consistently update a car's software during its full operational lifetime, which in turn revolutionizes an OEM's relationship with its customers.
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TALKING CARS AND CAPABILITIES IN A DIGITAL WORLD

With Dr. Marc Cäsar

From digital natives to baby boomers loving their latest smartphones, consumers are increasingly confident and demanding when entering their digital spaces.

They want the right services made available at the right place and right time. They want a seamless experience when switching between devices. They want simplicity, where any technology is easy and intuitive to use. And now they want their vehicles to be part of this wider interactive universe.

All of which sounds perfectly reasonable except for one sticking point: most OEMs today are still a long way behind meeting these expectations. As an example, a friend of mine recently attempted to arrange a test drive of an electric car online. Three weeks after submitting the request and she's still waiting to hear back for what is obviously an important – if basic – service for OEMs to deliver. But should we collectively be giving up hope?

I would strongly suggest the answer to this question is no. In fact, far from it: Every day now we're seeing exciting new services emerging from the automotive sector. Many of these are being labeled 'functions on-demand', whereby the OEM provides certain hardware options that have been pre-built into a car – which the owner can then activate on demand. This could include a temporary boost in horsepower required for a weekend trip to the mountains, or seat heaters following the move to colder climes. And while this service model is very new for the industry, we're also seeing more basic services achieve critical mass – starting with OTA app updates that negate the need for regular trips to a garage.

FORGING STRONGER CONNECTIONS

The bigger challenge, however, is still in identifying the most suitable way to monetize such interactions. CEOs can clearly see the potential on offer, but few can confidently claim to date that they're realizing any meaningful revenue from this approach. At least not yet, but that's not slowing the momentum or fresh thinking being applied to the challenge. New solutions are being constantly tested. One approach gaining favor is to create app stores through which third party developers can publish their work. Obviously the creation of such marketplaces has worked wonders for the smartphone industry. However, for OEMs success will depend on building up an ecosystem of apps from third parties, and driving consumer demand for these.

Another concern rapidly emerging is that of cross-departmental and cross-business governance. The delivery of SDT is only going to improve as stronger connections between internal departments are forged. Likewise, new partnerships are also required with technology companies to gain access to niche capabilities and infrastructure. Agreeing on the most suitable way to handle customer data in these scenarios is going to prove a vital consideration, as will the ability to exploit the value of the data itself. Finding the right partner could, for example, help turn data on a customer's driving style into a tailored insurance offer. This is the digital world that automotive OEMs now inhabit, and keeping up with consumer expectations will prove an exhilarating adventure.

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TALKING THE 'HOW' BEHIND SDT

With Daniel Davenport

We can all appreciate the 'what' and the 'why' behind SDT in the automotive sector. The 'how' though, introduces the detail, and in so doing makes it evident just how transformational the approach is – impacting all parts of the vehicle from the operating system to sensors; ECUs to the software-driven cockpit.

This level of change is understandable given how SDT is leading the response to various megatrends now impacting the automotive market: going electric, sustainability, connectivity, and autonomous vehicles, to name a few. Each of these bring with them greater levels of sophistication, which in turn is creating more lines of code and driving up the need for increased standardization. There's a lot to factor in which is why OEMs are looking to their experiences with cloud services, where micro-services combine to deliver larger services and capabilities. Following this model promises to help simplify future product development while also significantly accelerating time to market.

ADDRESSING THE CHALLENGES AHEAD

Mastering the 'how' behind SDT, however, really places the emphasis on recognizing exactly what customers want. For example, will millennials increasingly prefer their vehicles to be made available via a subscription service? Does Generation Z largely care more about infotainment over the powertrain? Finding the answers is going to involve a radical reappraisal of how data is collected and utilized. Yet such efforts will also help open up a whole new world of in-car revenue streams.

Making the most of these is going to require OEMs to enable a more nimble and collaborative internal operating structure. No one department – be it marketing, IT, web development, or product engineering – should own the new services

coming online, but they will all play vital contributing roles. Leadership should instead be taken by those best skilled to optimize capabilities around the immersive customer experiences being crafted, while also ensuring the company's brand promise is forever front and center.

Not that the changes end there as more practical, day-to-day issues will also need to be addressed – a good example being the challenge of managing the different time horizons that exist between software and hardware projects. One common approach here is to steadily increase standardized hardware and chassis components wherever possible, which in turn will help increase the velocity of software development and innovation.

Above everything, however, exists the need to collect and analyze all relevant data in realtime, before putting the resulting insights to work in time to make a difference – data that will need to be surrounded by extensive security and safety features. But once available, it's this type of information that will alter decisively the relationship between OEMs and their customers, with more service-based engagement based on interactive, two-way communications becoming the norm – while also helping expand the very use cases a car is designed to complete.

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TALKING CXOS AS THE DRIVING FORCE OF CHANGE

With Michael Tenschert

SDT, and its ability to bridge the divide between software inside the car and out of it, is quickly proving the right approach for today's world of connected, sustainable, and electric vehicles.

That said, success is never guaranteed. Not when companies are forced to drastically reconfigure their development and build functions in the pivot from hardware- to software-led design. Not when this level of change incorporates sizeable cultural as well as structural change. And not with the level of competition that currently exists for what software development talent there is available.

It can therefore be relatively easy to understand why we're seeing the margins of automotive OEMs shrinking at present, as they struggle with the ever-growing costs of software development. Expectations are, of course, that these costs will slowly level out, as new services and revenue streams gain traction. A word of caution here though, as any new revenue stream may not be as high as first thought, due to the sheer level of competition now active in the market – from both established manufacturers and new entrants – which is only likely to drive down prices.

AN EXPANSIVE TO-DO LIST

Where growth can be counted on, however, is in the realm of off-board software, particularly as the benefits of services such as Swarm Intelligence begin to deliver on their much-publicized potential. Which is why the role of CXO inside many OEMs is also attracting a lot of attention. It's a role with a wide remit and a host of challenges to address, including:

- Combining different internal functions previously given separate responsibilities – and separate budgets – for software development.
- Overcoming the challenge of data quality and the volume of insight currently available for training AI capabilities.
- The urgency of professionalizing software development cycles, to cut time to market as software becomes more complex and more connected to back-end systems.
- Instilling greater agility into every facet of an operation to ensure an OEM can respond to customer needs and expectations in realtime – as well as to ever- evolving industry regulations.

Placing the customer at the center of everything is certainly going to be key. That's why certain CXOs are also leading large investment projects in unified customer relationship management systems to ensure this goal is implemented effectively. In fact, Capgemini is working with a growing number of automotive clients to accelerate exactly these types of developments. And by combining vehicle and customer data, we're also able to help OEMs apply AI tools to the task of making informed 'next best actions' in areas relating to servicing and assistance.

Inspiration and innovation abound within an industry seeking ever-new ways to keep up with – and indeed shape – consumer demand. CXOs are often to be found at the forefront of such change, armed with a wealth of data, development experience, and organizational motivation to support them. It's certainly an exciting time to be involved.

About the author: *Michael Tenschert is Manager of the Custom Solution Development People Unit at Capgemini Munich. Tasked with creating the IT backbone for various important automotive projects, he is also a stream-lead within the Intelligent Industry initiative – responsible for bringing together Capgemini Engineering expertise with the classical Capgemini world.*


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TALKING REVOLUTION RATHER THAN EVOLUTION IN THE AUTOMOTIVE SECTOR

With Alexandre Audoin

When I speak to customers today, the SDT conversation often comes down to one simple truth: most are looking to have new software architectures live by 2024–2025 at the latest.

Making this a reality obviously requires action to happen now, with the level of urgency fueled by a growing realization that software-driven change is the gateway to achieving two critical business outcomes:

1. With customer expectations now accustomed to seeing their technology products become better over time through the constant delivery of software updates, SDT enables OEMs to better align with these requirements – and to shape the demand for future experiences.
2. Delivering new features through software, with the correct architecture, can also prove far more cost-effective than the traditional development costs associated with vehicle innovations.

It's important to keep in mind, however, that SDT impacts more than just the car. Getting it right also means transforming an OEM's IT architecture, the aftersales experience, and indeed the entire value chain. Changes that impact the very philosophy driving an automotive brand, their methodologies and processes, decisions around *make or buy*, and their overall business model. This is the scale of change that accompanies the move to SDT, which in turn impacts the whole ecosystem supporting the OEM – including partners at every tier of involvement.

ENTERING A BRAVE NEW WORLD

What can OEMs be doing in response? Well, an important first step is shifting from a silo-based organization to a transversal one. Next, a key decision needs to be made as to whether this new architecture should be applied to existing ranges – or whether to build from new. Balancing cost and the desire to minimize business disruption will obviously be important considerations.

A strategy will also be needed for driving the necessary change in engineering and development, as well as for re-imagining the aftersales experience. With the ability to deliver updates and new services remotely, aftersales in particular will need to transform at a blistering rate – beginning with OTA updates in areas such as infotainment, before progressing to the drive train and more critical elements. It's here that I would suggest that the cockpit experience and battery usage will initially be the areas identified to receive the most attention.

Looking further afield, we can also expect SDT to transform the very concept of mobility itself. In fact, I would argue that the very purpose of an OEM will change from selling vehicles to selling kilometers of comfortable and entertaining travel. This is a brave new world built on an OEM's ability to capture, analyze, and exploit vast amounts of data relating to vehicle usage and customer behavior. A world that also modifies the role of partners, as OEMs look to control and own more closely their core software – while also offering opportunities for delivering new services and capabilities. Capgemini is in a unique position to support customers throughout this transformation, due to our industry experience and expertise in both software and the customer experience. We're ready.

About the author: *Alexandre Audoin is leading the global automotive industry for the Capgemini Group and for Capgemini Engineering (formerly Altran). Before joining Altran in 2012, Alexandre gained in-depth industry experience at Renault and PSA Group with a focus on engineering and powertrain activities. With his wide range of expertise, especially within Intelligent industry, Alexandre continues to shape Capgemini's position within the industry and help clients to master their transformation.*

> **A strategy will also be needed for driving the necessary change in Engineering & Development, as well as for re-imagining the aftersales experience.**

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