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Digital Transformation of the Fleet, Lease & Rental Sector

How Software-Defined Vehicles Will Unlock Innovation

13 June 2023

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Preface

Digital Transformation:

What's holding the fleet sector back?

Retrofit application of Fleet Management Services (FMS) in the aftermarket is currently generating SAAS revenues of over $30Bn annually and has been growing at 15% CAGR for several years.

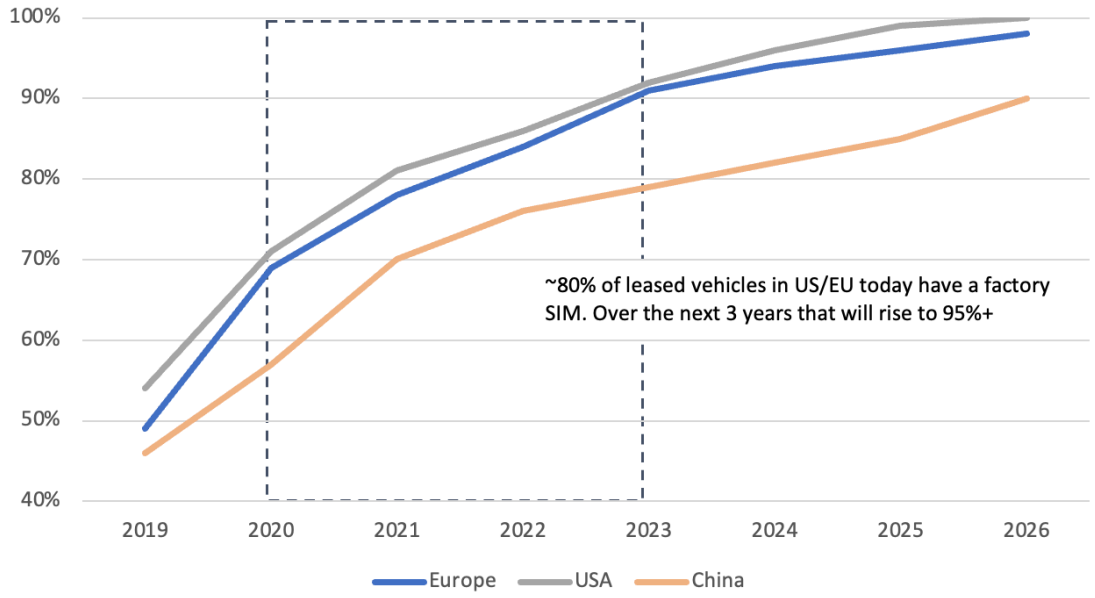
Despite these impressive figures, the market is still heavily centred around commercial vehicles rather than passenger cars even though the fleet volume of passenger cars (e.g. those which are lease-operated) is significantly larger than the LCV fleet.

In the LCV sector, OEM fleet management solutions have been largely ignored by fleet managers because the OEMs have been offering OEM-brand only solutions which aren't fully compatible with competing brands. Fleet managers don't take kindly to brand lock-in.

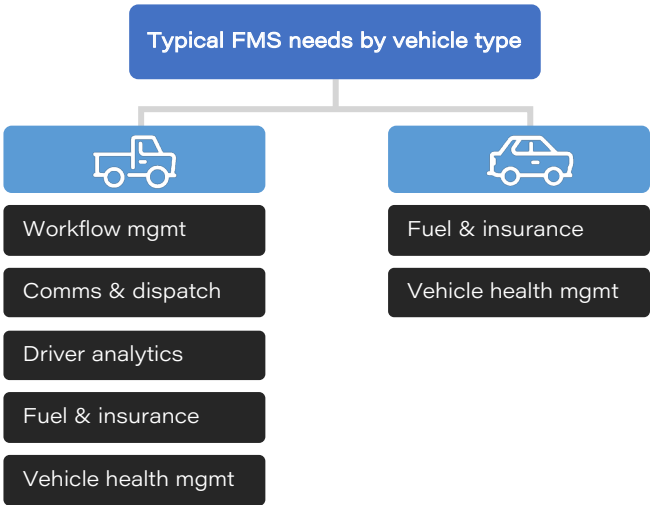
With fleet managers willing to pay per-VIN annual revenues of up to $400 for these services, it comes as no surprise that there are over 200 SAAS companies competing for this business. Managers operating LCVs as part of their business typically cite a return on investment from these services in fuel savings, driver safety improvement and operational efficiency gains. The competitive landscape could be ready for change though, especially when we consider that there are less than 20 significant LCV manufacturers, and that most of them offer embedded connectivity straight from the factory, rather than having to retrofit the communications device to pull data from the vehicle. This 'cost saving' of built-in comms immediately puts the OEM at a competitive advantage, but there's more to offering FMS than simply connecting the vehicles.

If the return on investment for aftermarket FMS in the LCV sector is proved, the case is not proved in the passenger car sector of fleet operators. While lease operators could gain operational efficiencies from having remote access to vehicle health and status data, the ROI is far less compelling than it is for LCVs. Therefore, despite its huge fleet size, the lease and rental sector is barely penetrated with FMS services. The financial viability of retrofitting comms devices and paying for SAAS services simply does not translate into compelling ROI for those fleet managers.

New vehicle sales with factory embedded SIM



The reasons behind the contrast in ROI of fleet management services between LCVs and passenger cars amounts to the use cases that the fleet managers of these sectors require. Both vehicle fleets are operated as 'assets' within their businesses; meaning that the management of vehicle health, repairs and maintenance, plus insurance and fuel/EV charge cards are the common needs of both sectors. However, in the case of LCVs, the management of actual business activities similarly plays a role in the FMS products – for example, managing a driver's jobs, sending location details on where their next delivery will be picked up from, handling company-specific workflows, and even timesheet management.



So, the complexity of FMS use cases is typically smaller, and worth less than an annual SAAS subscription to the fleet manager of passenger cars than the LCV manager - $40 would be the annual charge that starts to attract lease/rental operators for basic fleet management services. While this is not a viable price point for the aftermarket to retrofit comms devices, a change takes place when comms come equipped as standard from the factory.

Factory-fitted embedded connectivity is becoming standardised across LCVs and passenger cars thanks, in part, to the eCall mandate. That doesn't mean it's game over for the aftermarket FMS companies, though. There's more to the tech-stack than comms alone. Cloud services for vehicle monitoring, reporting, alerting, and custom reporting are complex in the fleet industry – they need to be in order to meet the varying needs of so many different types of fleet managers trying to drive digital transformation into their businesses. However, OEMs are used to managing data securely in own their managed cloud systems while providing portal-based access to users inside and outside their brands.

The more significant challenge for OEMs is to keep pace with the aftermarket SAAS companies who mastered the quick, agile, development of in-vehicle software, configuration-based services, FAAS and OTA over a decade ago.

Transformation #1:
Automotive software ecosystem

So, almost all vehicles sold in 2023 will leave the factory with embedded comms built-in. OEMs are developing B2B portals, securely handling sensitive data, and are setting ambitious targets for service-based B2B revenue streams. This means it is game-over for the aftermarket FMS players, surely?

Well, for sure, there are some important building blocks in place, but what about the in-vehicle hardware and software? The OEMs have the same enabling components that are retrofitted by the FMS companies - onboard vehicle signal processing for cloud-based analytics, in-vehicle displays for driver-to-dispatcher comms, integrated cameras for insurance applications, and driver monitoring are all big sellers for the FMS companies. But there's a problem. Are these devices all suitably connected within the OEM's in-vehicle architecture? Can parameters, firmware and apps be changed at the pace that the market demands? The typical time to market for an FMS feature needing a firmware change can be measured in weeks or even days – but making these changes in traditional OEM architectures is not so straightforward and can take many months.

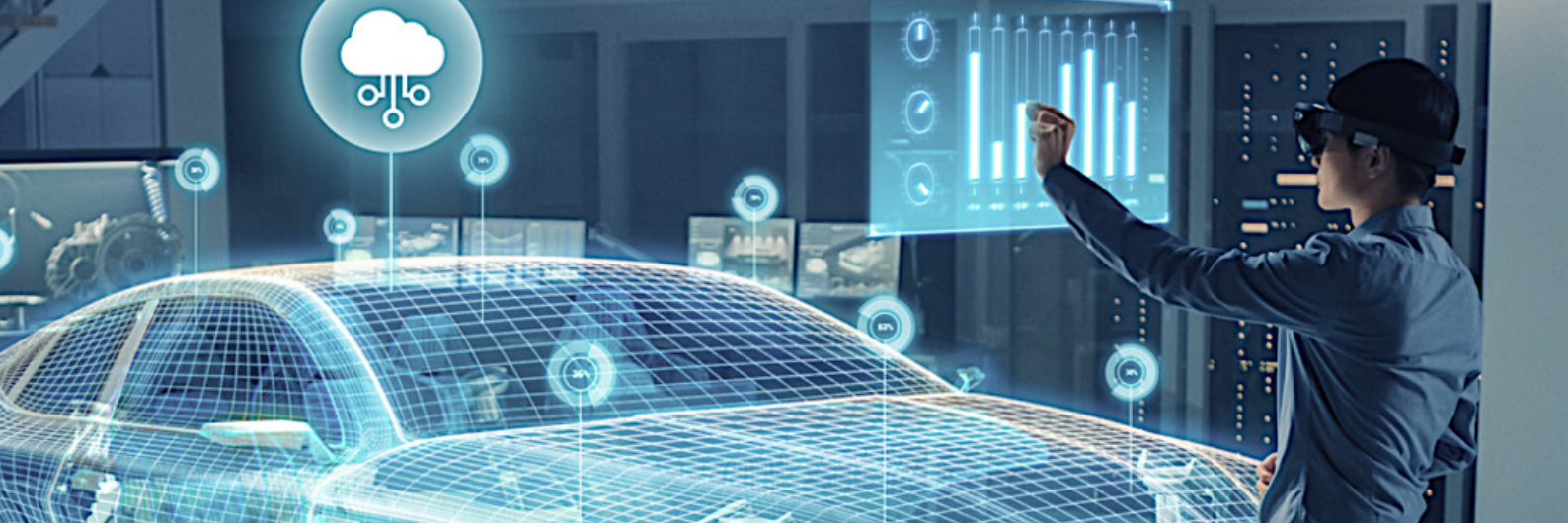
While FMS product planners in the aftermarket can respond this quickly to market needs, or even to individual clients, most OEMs will find it impossible to keep pace, due to the tight binding of hardware and software in their distributed ECUs of their vehicles. But of course, this limitation is changing, and vehicle manufacturers are adopting more flexible E/E architectures as they move away from feature-based ECUs in favour of service-oriented architectures. The objective of course is the software-defined car. Hardware-based services are expensive, and time consuming to develop and validate. Decoupling software from hardware reduces the cost and lead-time of change requests and provides a flexibility that was previously impossible.

Alongside hardware decoupling, other layers of the in-vehicle stack can be decoupled, again adding to the agility and cost control benefits of the new software ecosystem. Open-source code supports the non-differentiating enablers, leaving more resources and better still, budget, for the application layer.



Software-defined vehicles create opportunities for service differentiation & segmentation

Private Owner Features	Fleet Owner Features	Market-Specific Features	Brand-Specific Features
Family & Friends	Fleet Management Services	Local Digital Content	Luxury "Concierge" Experiences
Private Car Sharing	Integrated Fleet Branding	Local Maps & Navigation Content	Rugged/Off-road Digital Services
Driver Personalization	Custom 3rd Party Services	Data Sharing & Privacy	Performance/Track Experiences



Software ecosystems for agility and cost control

The transformation is in progress for most OEMs. Driven by the need to reduce the cost of feature development and, at the same time, deliver to market faster to remain competitive, existing software is being re-factored to make it portable and reusable, and more responsive development and verification processes are being introduced.

As the list of services that need to be enabled by software rather than discrete ECUs grows, and is not held back by the standard operating procedure of the vehicle but the whole lifetime, OEMs are also having to reconsider the way their series production models are budgeted and resourced. In the same way that drivetrain, ADAS, and infotainment software have been considered 'platform' investments to be shared among models, a similar approach must be applied to budgeting and developing connectivity, security, centralised compute, domain controllers, and more.

This shift in resourcing and budgeting is leading OEMs to reorganise themselves into platform development teams, rather than teams focused on specific model introductions or running changes. The traditional V-cycle and waterfall development methods are also being dropped in favour of service-focused scrums and continuous integration.

There are certainly more software positions open than hardware developer positions at OEMs, and the same is true for suppliers.

More recently, value creation has overtaken cost reduction as a key area of focus. For a given platform budget, more value has to be created for it to remain competitive. Whether that means being able to offer software-defined services that give the vehicle more consumer appeal at the point of selection, quickly understanding and addressing field issues which could damage customer loyalty, or creating revenue streams by offering new software-enabled services during the life of the vehicle.

While the general trend is for car makers to want to take more control over the specification, design, and maintenance of their software, the stack is arranged into enabler and differentiator layers. It is generally more cost-effective to share code or use open-source platforms for services that don't have to be brand-specific or inventive, and this is redefining the relationships that OEMs have with their software suppliers. Every car maker has to take care of functional safety, secure comms, enabling protocols, and more - regulations increasingly specify the 'what', but leave the industry to come up with the 'how' . This scenario is leading to more industry collaboration on frameworks like AUTOSAR, Uptane, AOSP, etc that help OEMs and their partners to focus their creativity on new software-enabled experiences for consumers and B2B customers.

Transformation #2

Competing with aftermarket fleet services

The aftermarket sector of fleet management SaaS products is a very crowded space. It's easy to count 200 companies competing for market share. There are two key reasons for this: (1) There's a well-established value for fleet management services and penetration into fleets is growing quickly. (2) There's a relatively low barrier to entry into the sector – the retrofit hardware is not interesting, cloud services can be hosted on PaaS from AWS, Azure or Google, and for the revenues available there's relatively low CAPEX required.

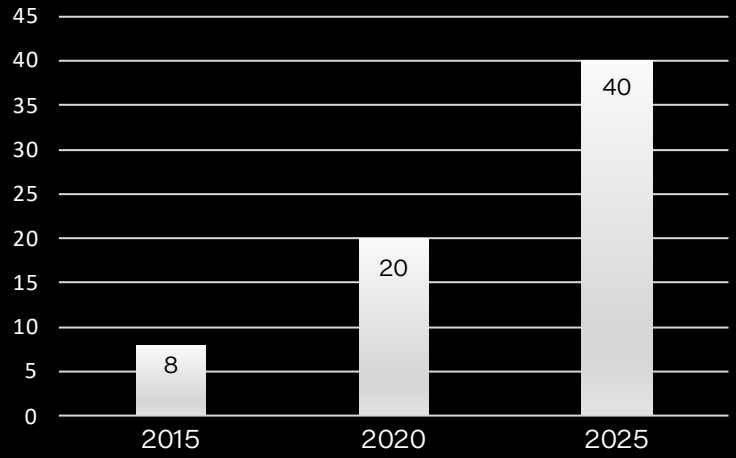
Against this competitive backdrop, if you're a Product Manager working in the fleet management sector, there are three realities which will drive your product roadmap and dominate your decision making:

1. How can I make my platform flexible enough to be able to say "yes" to all client requests for custom features – my numerous competitors will also be eager to say "yes".
2. How can I make sure I'm either first to market with new features, or at least be a very fast following second?
3. How can I achieve greater scale to realise self-propagating growth? Larger client base means higher revenues, meaning higher marketing spend to stand out from the crowd.

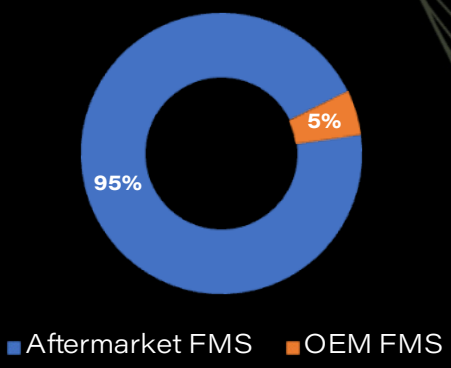
For OEM Product Managers, the market realities are just the same, so the same three challenges apply. However, the playing field is not equal. For two decades, the 'not equal' statement meant that opportunities were sloped in favour of the aftermarket due to their agility, flexibility and singular focus on building the industry. However, the playing field is finally level now, perhaps starting to move in favour of the OEM.

As explained earlier in this article, factory connectivity is a key advantage for the OEM - but the step change in feature development agility being enabled by electrical and software architectures in the vehicle is just as significant. Pairing that with R156-compliant OTA programmes that can reach deep into the vehicle's ECUs to change parameters, firmware, and applications; and teams of data scientists pulling insights from data onto portals, shows that the creative working environment for OEM Product Managers focused on the fleet sector is becoming a much more flexible and agile place than it ever has been. As this enabling tech gets rolled out to vehicle platforms, how should Product Planners be preparing to finally take advantage of the shift in the playing field?

Global FMS Market Value $Bn



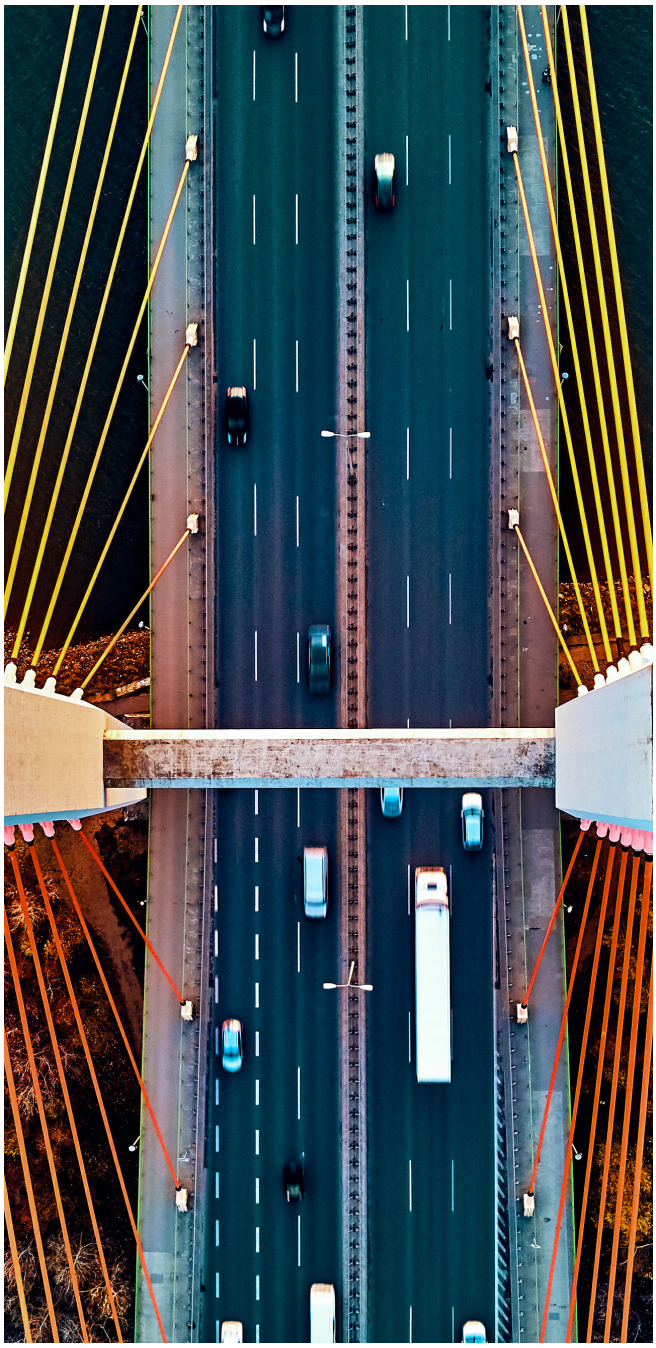
SBD estimates that OEMs are capturing <5% of today's FMS market



So, the conditions to compete in the SaaS fleet sector are improving for OEMs. Greater opportunities to develop services for fleet managers will be enabled by the connectivity that is already being fitted to vehicles, while the transformation of in-vehicle electrical and software architectures, deep-reaching OTA, and data analytics in portals are coming. But for most OEMs, that transformation is being planned or implemented – it's not quite ready yet.

For the OEM Product Manager responsible for fleet services and revenues, the entry into fleet penetration will typically come in phases:

Phase 1 is to create a secure API to enable vehicle data to be shared with fleet management clients. In most cases for small and medium fleets (which is where the volume is) these APIs enable vehicle data to be ingested by aftermarket fleet SaaS companies who already have significant penetration in LCV fleets. These partnerships between OEMs and their potential competitors are not always ideal for either party, but they do offer a mutual benefit to both: The OEM is able to (discreetly) commercialise their API, and the aftermarket SaaS partner slightly lowers their cost base and friction of onboarding clients by removing the retrofit hardware from their offer. The limits of these partnerships, of course, revolve around the SaaS partner giving up their total control of the data/hardware/software stack – meaning that they can find themselves feature-constrained. The OEM acknowledges that they are only seeing a small percentage of the SaaS revenues that their partner is seeing while they continue to scale.



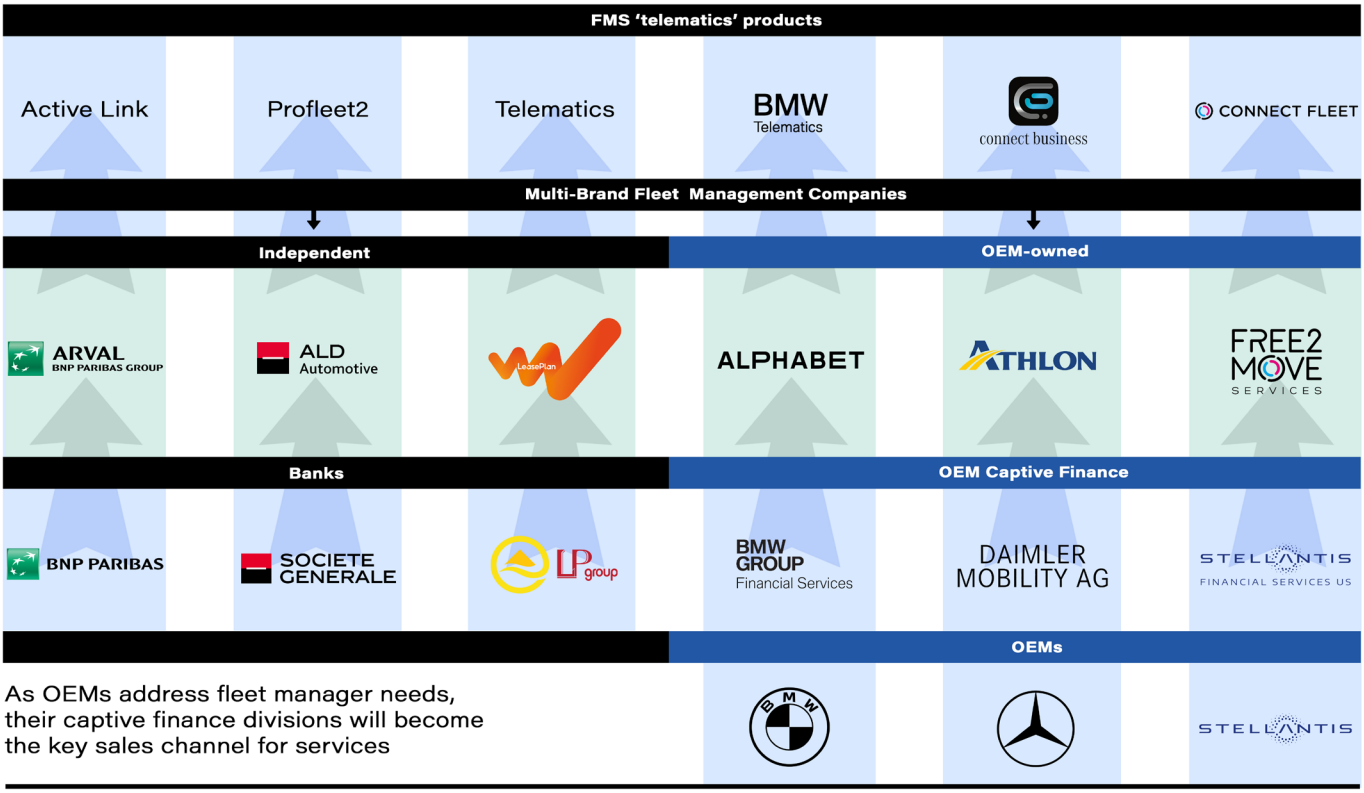
Phase 2 is to extend the capability and value of the OEM API, often at the recommendation of the SaaS partner. This begins by enabling more detailed, advanced, data collection configurations, such as remotely setting data collection parameters for optional FMS services - including driver behaviour monitoring, EV battery management, insurance, and security-related features. Secure 'send command to vehicle' features may also be enabled by the OEM, adding value to both the SaaS partner's products and the OEM's API. Most of this is achievable with the OEM's existing in-vehicle electrical and software architectures.

Phase 3 is where things get more interesting for the OEM. Possibly at the request of the SaaS partner (based on their observation of market need) or based on more creative ideas from the OEM Product Manager, services which are not feasible with retrofit aftermarket hardware are considered.

What if the hardware and software architecture of the vehicle was flexible enough to innovate on services using digital key, video streams from ADAS cameras, integration to the IVI stack for driver interaction, and full access to vehicle sensor data with edge processing capability on HPCs? Rather than extend the vehicle's integration depth with the aftermarket SaaS partners, could the OEM begin to offer differentiated services directly to their own fleet clients?

Alongside the competitive advantage in vehicle HW/SW that is emerging for the OEMs, the other potential advantage is the relationships and sales channel that the OEMs already have with fleet buyers: their captive finance divisions.

For some brands, as much as 50% of production is sold or leased through the OEM's own captive finance companies or owned multi-brand lease companies. The fleet managers on the other side of the table are the same buyers who are served by the aftermarket SaaS companies. Here, OEMs are increasingly well placed to offer not just APIs as a supplement to the vehicle lease, but fully-featured, highly customisable fleet services direct to the fleet managers - collecting 100% of the SaaS revenues.



As OEMs address fleet manager needs, their captive finance divisions will become the key sales channel for services

Transformation #3:
OEM vehicle & cloud services

Now the scene is set for OEMs to respond to the fleet management sector's needs in competitive, creative, and agile ways. The possibility for OEM Product Managers to develop and launch new fleet services could, and will likely, be made possible with drastically reduced timescales when compared to developing services on old architectures.

For OEMs to fully realise their potential in the fleet sector, the most important enablers are in the vehicle hardware and software architectures.

As explained in the previous sections of this article, the competition is very active in the fleet space - meaning that OEMs need to specify their vehicle architectures to enable fleet services which aren't even imagined today. This requires deep architectural planning to provide maximum flexibility for the future.

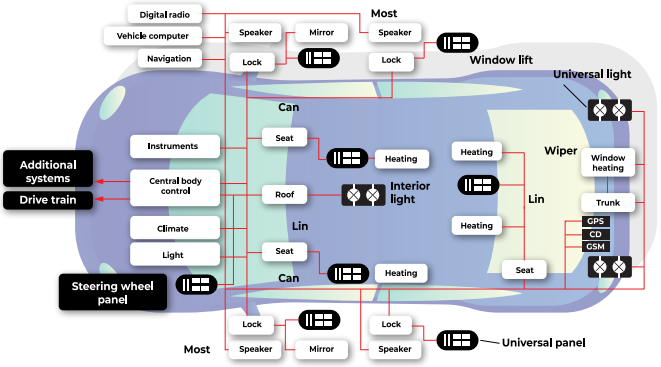
Firstly, the vehicle's electrical architecture must provide full-reach connectivity within the vehicle – while the cellular communications device must have secure access to all vehicle domains and their sensors. Bandwidth between those domains must be considered. For example, at a later point, the Product Manager does not want to find that killer services based on the capture, processing and upload of video or even Lidar are constrained by the vehicle architecture.

Other hardware considerations include the processing and memory capability for future edge use cases. Today, it's already common for vehicle status and diagnostics data to be processed onboard, at the edge, to keep the cellular payload within practical limits. In the near-future, the use cases requiring edge processing will inevitably increase for fleet services.

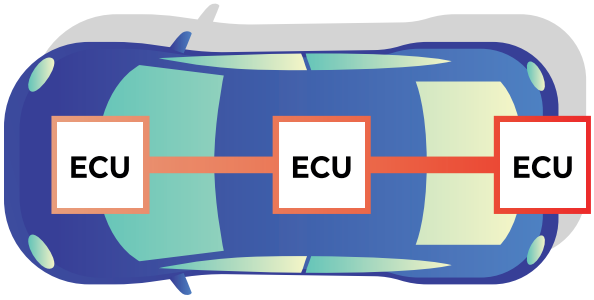
The reach of OTA configuration, firmware and application capability must extend to all in-vehicle software. It is possible that fleet operators will demand direct access to make configuration changes, offer FaaS services, and upload branded services to the IVI. The software architecture itself needs to support these challenges in a secure and flexible way without compromising the functional safety of the vehicle. Integration into the OEM's Software Update Management System (SUMS) must also retain its integrity and traceability.



Conventional Architecture



Software Centric Approach



Perhaps one of the biggest challenges for OEMs facing this likely but uncertain revenue opportunity is how to ensure that cost-based decisions about vehicle hardware and software architectures are not held back by today's SaaS and FaaS revenues, but by confidence in the possibility of tomorrow's service revenues.

Some OEM groups are forecasting annual software-enabled service revenues in tens of billion dollars by 2030 (e.g. Ford, $20Bn) and are investing now for future enablement.

Creating the 'ideal' in-vehicle environment for creative, software-enabled, services begins with the consideration of the vehicle's electrical architecture. As discussed, Product Planners can't be constrained by low-bandwidth (or missing) connectivity between domains within the vehicle, and the hosting hardware needs to have sufficient processing & memory capability for future use cases. Assuming those hardware fundamentals are strong, then, how should the ideal software stack be built on top?

One leading activity that is becoming common among OEMs is to focus the R&D spend on software that stands out and adds value, rather than building everything (including operating systems) from scratch. Deep, historic tie-ins with component suppliers who packaged hardware and software have led OEMS to be wary of the software that they're not in full control of. Expensive change requests, long development cycles and interoperability problems have led some (CARIAD are a good case study) to overwork themselves on the path to software control and IP ownership.

Open-source software like Android Open Source Project, AGL, SOAFEE and open frameworks such as AUTOSAR and UPTANE are enabling OEMs to focus their innovation spending on the application layer rather than developing proprietary middle layers like OS/RTOS, hypervisors, hardware abstraction etc. Although essential, these components are not seen by the end user, so are non-differentiating. Ideally then, the low and middle layers of software will be open source or at least built around standardised frameworks. A well-focused selection and implementation of these components can create a secure, maintained, platform upon which to build services aimed at creating value for the vehicle user and fleet manager.

With the lower levels of software architected in a cyber-secure and functionally safe platform, innovation at the application layer can become the focus of suitable innovation. In-house developers from the OEM can use the same development frameworks and tools as suppliers/partners to realise continuous integration and delivery cycles. In this development environment, the OEM product manager for fleet services can finally compete with their aftermarket FMS competitor, but with the further advantage of being able to reach across the whole vehicle – leveraging data from sensors and onboard compute power which would be inaccessible to the aftermarket.

A foundation for most fleet-focused services is to pull data from the vehicle to help the fleet manager run their business more efficiently using the insights gained from that data. Not all fleet managers need the same data, so the ability to remotely configure the data upload profile of the vehicle to the needs of the individual manager are a must. As new use cases come to mind, it's largely expected that the edge processing of that data sourced from inside the vehicle will become more valuable, and can reduce operational costs by keeping the cellular traffic between the vehicle and cloud optimised.

The other essentials for fleet management applications are super-flexible APIs that sit between the fleet manager and the OEM cloud, and, of course, between the OEM's cloud and the vehicle. Full flexibility on vehicle-side applications and configuration enables the functions of these APIs and cloud services to advance with modest investment.

With the flexible software approach described, OEMs can innovate not just as fast as their aftermarket competitors in the fleet sector, but also more deeply. Domains such as ADAS, EV, in-vehicle infotainment, and vehicle security are controlled and managed by the OEM, giving them an unrestricted reach within the vehicle for fleet use cases.



Transformation #4:
B2B agility

The enabling platform of a vehicle which can support software-defined services unleashes potential for the OEM to offer a broad range of new features and experiences that their fleet buyers and managers need.

Remote configurability during the life of the vehicle offers the chance for businesses with differing needs to gather data from vehicles that specifically meet their needs, rather than working to the constraints of 'generic' and unsuitable data sets.

Imagine the operational improvement for a vehicle rental company of being able to pull odometer and fuel level data from a vehicle when a customer returns it to the company's rental depot. Enabling the customer to lock the car, end the rental agreement, and automatically receive their closing balance without having to employ staff to collect those data points makes a huge positive difference to the customer experience and operational cost. The enabling building blocks to this use case are:

— Configurable data harvest parameters, updateable over the air.
— Business-specific geofences (e.g., at the rental depot) with logic to trigger detection of the geofence entry.
— Secure 3rd party access to remote lock/unlock.

How about more ambitious services? What if the rental company wants to offer menu-based pricing for vehicle functions to pitch new opportunities or enable customers to redeem loyalty rewards points. If the services in the vehicle are software defined or enabled, it becomes possible to make vehicle-by-vehicle changes per rental – encouraging the additional purchase of features such as music streaming, navigation, and EV charge point pre-payment. Here, even features like ADAS, vehicle preconditioning, and performance boost become possible.

This concept becomes especially attractive as an upselling or reward option if the vehicle IVI can support a branded interface for the rental company. A new touch point for the customer, that has previously been OEM-branded, now extends the rental company's reach to the customer. The interface now acts as a shop window to upsell features or redeem reward points, handling the start or end of a rental agreement, managing the account, and even keeping track of the customer's preferred vehicle settings allows for the rental experience to be consistently personalised - even if the customer uses different vehicle brands.



Software for bespoke fleet solutions with OEM quality

Integrating agility into use cases that are based on IVI content, and factors specific to the business, can be a relatively simple process – especially when those use cases were a part of the solution's early designs. Likewise, a key advantage of true SDV and service-oriented architectures is their ability to enable product planners and their fleet clients to continue innovating together for years after the platform has been developed.

Many OEMs are already moving towards architectures that support software abstraction and provide OTA update capabilities across core domains such as digital cockpit, ADAS and vehicle body. As these new architectures launch, the ability to flexibly update software and services is more clearly shown through service updates that go beyond infotainment, reaching to ADAS services and the EV powertrain. Some of these will be corrective (for faulty features which may have otherwise required recall campaigns), but the OEM will increasingly provide service upgrades and improvements across these domains either for free, to improve the customer experience (and loyalty), or as a way to promote premium features as significant as rear wheel steer and improvements to the vehicle's power or range.

Unlocking the full potential of the software -defined vehicle requires a new approach to software development and validation. First of all, compatibility management and software traceability must be handled within an R156-compliant SUMS.

As well as being a certification requirement, the SUMS also integrates with the model of continuous integration and delivery. This concept significantly accelerates the traditional automotive V-cycle of design and validation by automating the build and testing of code every time a change is made, and committing that code to a central repository. The OEM's functional safety and cybersecurity processes will determine which software releases will go through software-in-the-loop (SIL), hardware-in-the-loop (HIL) or vehicle-in-the-loop (VIL) to ensure that the integrity of the deployment achieves OEM grade performance and reliability.

The SDV, paired with today's CI/CD methods and tools, makes collaboration on software quicker and more agile between the OEM and their software partners. Third parties, such as the software development teams of large fleet companies, or their nominated software partners, can collaborate more readily in these CI/CD environments - meaning that innovation levels can be maximised based on the fleet customer's own knowledge of their business needs, and the OEM's enabling of a flexible and secure vehicle platform.

As the capabilities of vehicle platforms and software variants expand, the tools and protocols used to ensure the integrity, security and safety of the software must also expand. Safeguards such as AI-enabled anomaly detection and R155-compliant Cybersecurity Management Systems (CSMS) work to maintain OEM-level quality in the new era of agile software deployment for automotive and fleet use cases.

Summary

Until now, OEMs have struggled to make an impact on the strongly competitive sector of aftermarket Fleet Management Services. Now, however, OEMs are beginning to take advantage of new opportunities to deliver this impact as they move quickly towards the adoption of 100% line-fit cellular connectivity, in-vehicle software defined services, OTA capability, and continuous integration and deployment of software reaching deep into all domains of the vehicle.

The first mass deployments of OEM fleet services will likely be aimed at the LCV sector, which has well-developed use cases and ROI within the aftermarket. Following this, OEMs will shift their focus to serving the currently underused sectors of lease and rental fleets, which are, at this time, largely ignored by the aftermarket FMS companies due to cost viability, despite the huge fleet sizes.

Digital Transformation:

Outlook for the Fleet, Lease & Rental sector

grape up®

About Grape Up

Grape Up provides automotive software development services and consulting for vehicle manufacturers, mobility providers, and Tier1 suppliers. By delivering end-to-end services for building SDVs, Grape Up enables the most innovative companies to create the software-centric future of the automotive industry.







Do you need support from experts who specialize in automotive software development services?

If you want to discuss your challenges, ask about some details mentioned in the ebook, or get more insights into automotive projects developed by Grape Up, drop us a line.



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