In-Vehicle Commerce:

Revolutionising payments and business on the move.

WORLDLINE

Current Account
**** 8935

€ 50

Payment due

Transactions

E   EV charging   € 30,50

P   Parking   € 9,00   Make payment

C   Clock & collect   € 10,50

orange™ | WORLDLINE

Contents:

Executive summary:

In the wake of a global energy transition, the automotive industry is undergoing a massive transformation, driving the emergence of disruptive business models. For many key stakeholders in the in-vehicle ecosystem, including car makers, retailers, payment providers, banks, telcos and technology firms, new opportunities are appearing for them to offer the best customer service.

In-vehicle commerce is a growing trend that is revolutionising the way people purchase goods and services while on the go. This concept involves leveraging the advanced technologies found in modern vehicles to facilitate transactions and provide a seamless shopping experience for consumers.

With the integration of smart payment systems and intuitive interfaces directly into a car's dashboard, drivers can now make purchases with ease for things like EV charging, tolling, ordering food or booking a hotel room. Additionally, in-vehicle commerce is also being used to offer personalised recommendations and promotions, as well as to provide software upgrades and digital services such as car ambiance or extra engine power. In-vehicle commerce is a promising, emerging channel, delivering convenient and stress-free services to consumers, during their journeys. In this context, we believe that an open ecosystem providing secure and frictionless payments will help drive revenue, reduce costs and increase satisfaction.

This paper provides you with:

- Market insights and the key trends of in-vehicle commerce

- Analysis of the potential open ecosystem and the roles of individual players

- An illustrative concept using state-of-the-art communication technology and an open in-car wallet to facilitate in-vehicle commerce

To conclude, we highlight the business benefits and the actions to take from the perspectives of different stakeholders. Depending on your industry and your business interest, we hope this paper will bring to you fruitful ideas to trigger your next steps, helping you to make strategic choices for your company in this exciting emerging market.

A successful ecosystem is about building on the strengths of each other. Now is the time.

Introduction:

Digital technologies are pervading new aspects of life. In the personal transportation domain, new vehicles are now digitally enhanced and digitally managed. All recent vehicles are connected ones, thanks to mobile connectivity, allowing for remote software updates, on-board infotainment and navigation services. In the near future, enhanced safety will become commonplace, thanks to pervasive digital communication between vehicles and with the road infrastructure[1].

Yet another area which is ripe for mass development is "connected commerce around vehicles", encompassing all transactions about goods and services offered to car users. Electric vehicle charging, parking and toll fees, drive-in purchases, roadside assistance, maintenance, all can be potentially supported by transactions leading to payment. The global in-vehicle payment system market size was $1.12 billion in 2022 and is projected to grow from $1.53 billion in 2023 to $6.18 billion in 2030[2].

These services are currently quite heterogeneous and could greatly benefit from digitisation. Current developments and innovation are paving the way for delivering seamless user experiences and transactions, operated via digital interfaces already available inside cars.

In this paper, we consider all kinds of services linked to the usage of vehicles, whether they are inherent to vehicle use or are more generally pertaining to mobility needs:

- Provision of energy – gas station, EV charging station

- Use of road infrastructure – highway toll, bridge, ferry

- Parking – closed car park, indoor parking lot, or on-street parking capacity

- Food and drink sales – fast food restaurant, various "drive-in" services

- Assistance services – suggesting personalised offers

- Repair, maintenance, carwash

- On-board information and entertainment

- Purchase of additional features for the car

In addition, new services and innovative variants of the above will shortly be deployed. For example, Differentiated Road Usage Charging[3] refers to the ability to bill a precise usage scenario of road infrastructures, such as charging for using a fast lane per mile, for the time spent inside a city centre. Some services under study allow city managers to dynamically assign costs to street parking lots, on demand, giving them a very fine control over the city's resources. On highways, advance purchase of packed lunches or

Figure 1: Potential user cases of in-vehicle commerce

advance reservation of an EV charging slot, possibly combined, will be facilitated by an integrated approach to highway service offerings. Crowd-sourced last mile parcel delivery is another innovative use-case, where individuals can take part in a delivery process and earn some benefits.

And, of course, smart mobility services are envisioned to mix services around personal vehicles and public transportation, including carpooling, usage-based payment, and sustainable mobility.

1   https://builtin.com/transportation-tech/v2x-vehicle-to-everything
2   https://www.fortunebusinessinsights.com/in-vehicle-payment-system-market-103653
3   https://journals.sagepub.com/doi/full/10.1177/0361198121995510

The global energy transition brings new opportunities to the automotive industry:

Electric cars are becoming the norm, with 2023 supposed to be the year of the electric vehicle[4]. The move towards electric vehicles has been much faster than was anticipated. Clearly, people are willing to shift to more sustainable mobility. Citizens seem to be genuinely concerned with global warming, and road transport accounts for 12% of global carbon emissions in 2020[5]. Europe and the USA have implemented quite voluntary policies, including government-funded support for individuals buying new vehicles, and they are pushing for further change with their respective regulations. Meanwhile, China is leading the growth of the EV market. The Chinese government's official target is for electric cars to reach 20% of new car sales for the full year by 2025[6] and 50% by 2035.

Alongside electrification, a major trend relates to the connectivity and digital services in the cars. The integration of software is so strong in new cars that they are now referred to as "Software-Defined Vehicles". By 2030, about 95% of new vehicles will be connected cars[7] and they will represent a market of $56 billion in 2026.[8]

For customers, a digital experience brings many useful features besides the well-known guidance and infotainment services, and regulatory, safety-oriented features such as eCall (emergency call). For instance, cars come with companion mobile apps that enable drivers to monitor various conditions, such as the battery level, and to manage EV charging. On top of that, interaction through a car voice bot is expected to become a major part of the new cockpit.

Actors such as Google, Amazon or Cerence (a tech provider for car manufacturers) have already tested voice interaction to pay for gas. For example, Amazon provided this feature through Alexa in 2020 at 11,500 Exxon and Mobil gas stations in the US[9]. During battery charging, users may also have more time to enjoy services in and around their car. Moreover, in the near future, V2X technology is envisioned to provide advanced safety features by way of interoperable, real-time connectivity between vehicles, pedestrians and road infrastructure. For car manufacturers, digitisation is synonymous with innovation, providing new ways to address safety and to improve the cabin experience. It also allows for new business models where car manufacturers can expect revenues from software, for example through software updates and subscription services.

These major trends are redefining the personal mobility experience. Today, there is a strong momentum towards creating new ecosystems and offering innovative services such as in-car payment.

A third trend relates to the evolution of ownership and usage models. Of course car sharing is not new, but with the growing ecological concern, car prices increasing, and the rise of autonomous vehicles, it should grow and is already creating new business models. For example, autonomous vehicles will lead to more user interaction with infotainment and in-vehicle services. Nowadays, around 55% of new cars are owned by companies and the cars' usage is often shared[10]. Moreover, some companies are challenging the old ownership business model by providing solutions for P2P or B2C car-sharing or fleet management, rental cars, ride hailing, up to mobility as a service (MaaS) public transport. Regarding mobility, people's habits are evolving. For instance, the appetite for car ownership in younger generations is decreasing. Shared mobility is a way to smooth out expenses, as well as to lower the risks associated with investing in new automotive technologies (EV, autonomous vehicles, etc). Even manufacturers have clearly stated that they are willing to offer cars "as-a-service" rather than just selling vehicles. The rise of the autonomous car around 2030 should consolidate this change. This new form of engagement is clearly an opportunity for car manufacturers and related financial institutions to create a perennial relationship with their customers and to enrol them into payment services. These major trends are redefining the personal mobility experience. Today, there is a strong momentum towards creating new ecosystems and offering innovative services such as in-car payment.

4   https://www.iea.org/energy-system/transport/electric-vehicles
5   https://ourworldindata.org/emissions-by-sector
6   https://www.reuters.com/article/us-china-autos-electric-idUSKBN27C08C
7   https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/unlocking-the-full-life-cycle-value-from-connected-car-data
8   https://www.marketsandmarkets.com/Market-Reports/connected-car-market-102580117.html
9   https://paymentsnext.com/hey-alexa-fill-up-my-gas-tank/
10   https://www.am-online.com/data/manufacturer-insight

In-vehicle commerce, the new battle:

Historically, highway companies were among the first to investigate technological approaches towards in-car payments, developing ETS (Electronic Toll Service) systems, and they have been actively seeking to extend the concept to other purchases. With digital technologies invading all car systems, there are now many actors interested in playing a role in future in-car commerce approaches.

The in-vehicle commerce landscape:

The in-vehicle commerce landscape evolves rapidly with active participation of the stakeholders who play a key role in delivering an end-to-end value to the users. Figure 2 (overleaf) shows an overview of the key stakeholders contributing to this landscape, that together deliver the end value to the users. New entrants include telcos delivering connectivity services, bigtech companies that are increasingly gaining a foothold inside cars and paytech companies tackling the complexity of enabling seamless services.

The in-vehicle payment ecosystem is rather complex. Many initiatives have not reached substantial success so far. Actually, most recent attempts toward enabling users to pay using their vehicles' interfaces can be considered experimentations. They were mostly conducted by major, incumbent players, such as car manufacturers, oil companies, infrastructure operators and payment schemes. For instance, from 2017 to February 2022, General Motors tested its marketplace, named "in-car commerce platform"[11], which aggregated third-party partners such as the oil company Shell and food delivery firms Domino's and Dunkin' Donuts. In the same period, Jeep launched the UConnect Market service offering access to Yelp as an intermediary

to make restaurant reservations[12]. Visa is also quite active with respect to car-based purchases experiments[13]. For instance, it partnered with Honda to provide the "Honda Dream Drive experience", allowing people to pay for gas, parking, or for a movie ticket. Meanwhile, Jaguar was experimenting in combination with Shell and Paypal in the UK, with a dedicated app on the dashboard. At the time of writing, the latest announcement was made by Mercedes-Benz, unveiling its "Pay+" native in-car payment solution in partnership with Visa[14], sporting delegated authentication by way of a dash-mounted fingerprint sensor. Although the proposal is restricted to buying digital services and activating car features, soon-to-be-released use-cases were quoted in relation to "other services such as fueling".

What seems to be lacking today is a sustainable ecosystem where the actors in the value-chain accept trade-offs in order to share business value. With this mindset, the actors must step out of their comfort zone for the sake of business transition. Moreover, the success of automotive digital services depends on data sharing. Without data, the whole business model would collapse. To this extent, the EU's proposed Data Act aims to make data exchange and usage possible for the common good, which hopefully will convince car makers to be less conservative in sharing data. This will certainly help the automotive industry to achieve a breakthrough in the car data economy.

11   https://gmauthority.com/blog/2022/02/gm-to-phase-out-marketplace-app/
12   https://www.prnewswire.com/news-releases/fca-to-launch-new-in-vehicle-uconnect-market-commerce-platform-300873284.html
13   https://usa.visa.com/visa-everywhere/innovation/connected-commerce/connected-car.html
14   https://media.mercedes-benz.com/article/486af56e-4b2f-43e1-ba68-739cfe81518d

Customers

The customers expect stressless journeys during which they can order, pay and enjoy the best customer experience from their cars.

Manufacturers

Car makers see the energy transition as once-in-a-lifetime opportunity to reinvent the automotive industry with digitisation of services.

Telcos

The arrival of 5G pushes connected services to a higher level. Telcos have the advantage of being incumbent in the connected car infrastructures to continue deliver value-added services beyond connectivity.

Bigtechs

Major tech companies possess key technologies and platforms to facilitate the in-car commerce market. Balancing between what is possible and what is legitimately allowable within the legislation framework is important to build sustainable ecosystem.

Merchants

The electrification of cars forces service providers to shift business models. Providing in-car services with seamless customer experience helps increase customer stickiness and increase revenue.

Payment Schemes

In-car payments should support multiple payment schemes, including credit, debit, instant payments and even stable digital coins. The in-car payment transaction fees and efficiency must suit the characteristics of automotive use cases.

Paytechs

In the constantly digitised automotive world, paytechs play a vital role to remove friction and to increase safety and convenience for the customers. Biometric authentication methods will further help secure in-car payment transactions.

Banks

For a long time, banks have been playing key role in automotive financing, including car purchase and leasing. The adoption of pay-by-bank products and the link to in-car commerce opens many opportunities for banks to play a roll in the ecosystem.
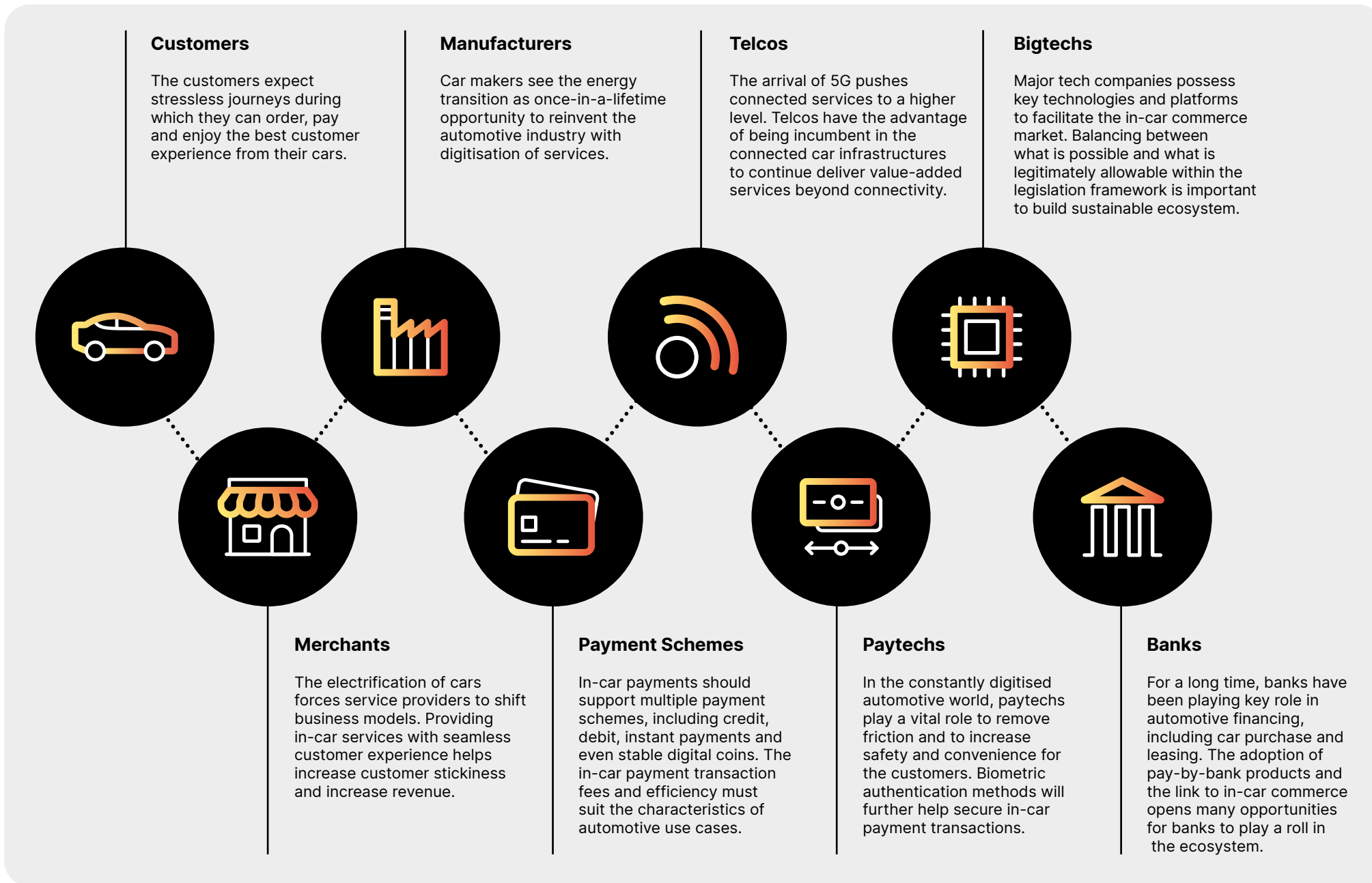
Figure 2: Overview of stakeholders in the in-car commerce ecosystem

Mobile-based vs. built-in solution?

There is indeed a very legitimate question about the relevance and benefits of built-in approaches when it is quite easy to develop smartphone-based solutions, and every car user can be assumed to also be a smartphone owner. In this section we will explore the advantages and disadvantages of each of these approaches.

Mobile-based solutions

Let us consider the use of smartphones within cars. Indeed, modern phones are in most people's hands or pockets, and replication systems are becoming commonplace, allowing in-car assistant services to be displayed on car screens. Mobile applications allows for trip planning and remote services such as car lock and status monitoring. These services are often used in extension of in-vehicle services.

Ergonomics and user experience vary depending on whether the smartphone is used by itself, or in mirror mode (CarPlay, Android Auto):

- On mobile phones, users are quite accustomed to their applications and unified ergonomic approaches. Services have full freedom to leverage large development communities, and they can reach widespread user adoption. However, users have to manage using their mobile screens while at the wheel, with only touch interactions on a somewhat small screen, and sometimes voice commands.

- Conversely, when using a mirror mode, some hardware features become available to better interact with the replicated application. However, the guidelines imposed by Apple or Google are very stringent, essentially due to restrictions guided by security considerations. The user is supposed to be busy driving, so interactions have to be reduced to the minimum. Hence, the user experience is much reduced and can sometimes be found lacking. Many popular mobile applications are not compatible with any replication mode.

Furthermore, the mobile phone is a **personal device**, not always available for pairing with the vehicle infotainment system. When several people share a car, this decision can be even more complex: which user should volunteer their device? And what about personal messages or notifications coming to the infotainment system for everyone to see?
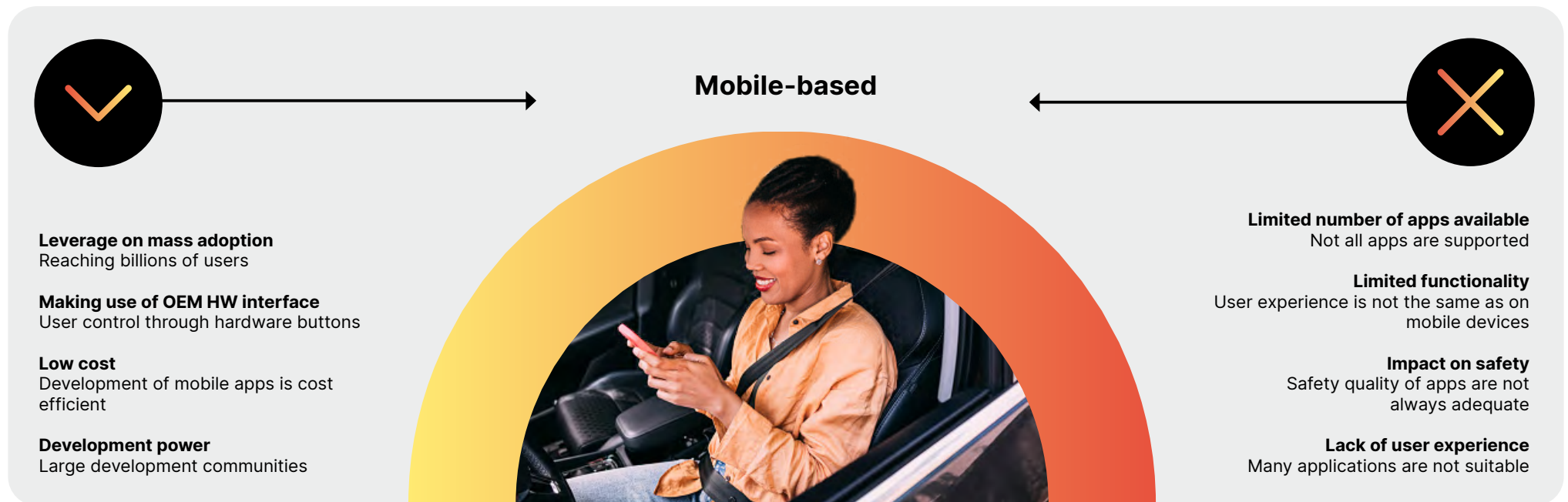

Mobile-based

Leverage on mass adoption
Reaching billions of users

Making use of OEM HW interface
User control through hardware buttons

Low cost
Development of mobile apps is cost efficient

Development power
Large development communities

Limited number of apps available
Not all apps are supported

Limited functionality
User experience is not the same as on mobile devices

Impact on safety
Safety quality of apps are not always adequate

Lack of user experience
Many applications are not suitable

Figure 3: Pros and cons of mobile-based approach

The mobile based approach is mainly driven by Apple with CarPlay and by Google with Android Automotive. Today, most car makers have integrated either or both technologies, allowing car users to port a limited set of allowable applications to the head unit, including navigating apps, communication apps (calls, SMS) and music apps[15]. It should be noted that mirror modes are usually offered with low-end vehicles as an alternative to higher quality features and better hardware typically devoted to more upmarket vehicles.

OEM built-in solutions

The OEM built-in approach refers to the software environment, including operating system and applications on the head unit, under the control of car makers. This allows car makers to better secure and certify safety aspects of in-car applications. On-board applications have different requirements to mobile applications. On-board applications need to be simple and easy to use but still maintain the attractiveness and the fun factor. On-board applications may take advantages of having access to car-data securely, via the interfaces that are well-protected with the car infrastructure. Furthermore, they can leverage edge computing to benefit from AI and real-time data.

Safety requirements may also be better addressed by an integrated experience. Application regulation and certification by the car manufacturers, through a dedicated application store, is key to ensuring a great level of control over safety requirements.

Also, from a market point of view, an obvious argument against mobile-based offerings is the risk for car manufacturers and operators to miss out on the opportunity to monetise their vehicles' connectivity and associated data flows. Nevertheless, for some use cases, providing continuity of service may benefit from using mobile phone interfaces, in addition to the interaction on vehicle interfaces. For instance, remotely adding parking time when away from the vehicle. Figure 4 describes the pros and cons of OEM built-in solutions.
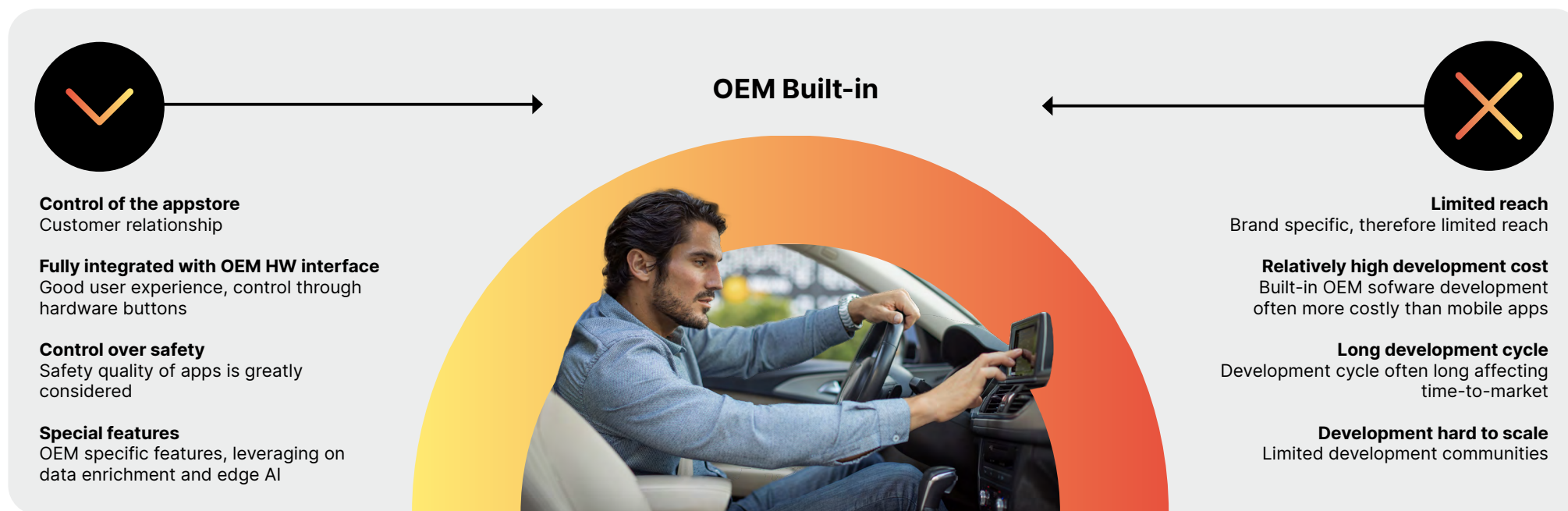

OEM Built-in

Control of the appstore
Customer relationship

Fully integrated with OEM HW interface
Good user experience, control through hardware buttons

Control over safety
Safety quality of apps is greatly considered

Special features
OEM specific features, leveraging on data enrichment and edge AI

Limited reach
Brand specific, therefore limited reach

Relatively high development cost
Built-in OEM sofware development often more costly than mobile apps

Long development cycle
Development cycle often long affecting time-to-market

Development hard to scale
Limited development communities

Figure 4: Pros and cons of built-in approach

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15   https://www.seat.co.uk/new-cars/connectivity-technology/mirror-link

Open ecosystem vs walled-garden?

Today, many car makers are supporting mobile-based technologies due to high levels of consumer interest. This development comes with the risk of losing control over the emerging in-vehicle commerce. Conversely, having a built-in application platform by default offers unique selling points and competitive advantages. Car makers are constantly managing this balancing act, making the right choice between mobile-based and built-in applications. The risk for car makers of losing control of services due to mobile-based application integration is already present. For example, the Spotify app is capable of taking air time and the attention of drivers with advertisements displayed on the head unit. Here, car makers are providing an in-car channel freely to content providers. The big question is: will car makers continue to allow this to happen? Moreover, current approaches are designed as "silos", with proprietary architectures and platforms, proprietary user experiences, and usually, payment based on prior enrolment of a payment means. All this leads to a heterogeneous service landscape.

Figure 5: A simplified open ecosystem of in-vehicle commerce

Back in 1999, NTT DoCoMo introduced i-mode[16], the first mobile internet services, that quickly gained popularity in Asia, Europe and Australia. The commercial success of i-mode was fast but short, mainly due to a combination of limited handsets supporting i-mode and limited content. I-mode was a closed-loop content service, also called "walled-garden", meaning only service providers had the right to decide which content providers could enter. With the arrival of many handsets supporting WAP (Wireless Application Protocol) and, later on, HTML (Hyper Text

Markup Language), i-mode started to lose its relevance because of the open nature of the internet. Taking lessons from this example, it is important to keep in mind that an open ecosystem is necessary to drive in-vehicle commerce, allowing for evolution and adoption of services, giving space for relevant stakeholders to deliver their value and to create business benefits.

Indeed, it is the usual way of innovation to start with proofs-of-concept and experimentations that have a modest, well-mastered footprint, with a few privileged

partners. These stakeholders naturally strive to optimise their benefits, and the result is a captive market, catering only to users having the right car brand, meeting the right service brand, and paying with the right payment means. But letting the ecosystem develop on the basis of heterogeneous, closed approaches incentivises big actors to enforce their own solutions to create a natural monopoly.

Figure 5 illustrates a simplified ecosystem with the involved key stakeholders: car manufacturers, merchants,

service orchestrators, technology and communication providers, and payment providers. There are many other imaginable actors not shown in this example, such as banks and card scheme owners. One of the key elements enabling the success of in-vehicle commerce is the "car-wallet". An open car-wallet would allow the consumers to assign different payment means. At the same time, it can be evoked by any in-car apps to render payment services[17].

16   https://en.wikipedia.org/wiki/I-mode
17   https://worldline.com/en/home/main-navigation/resources/resources-hub/blogs/2022/in-vehicle-commerce-is-growing-rapidly-but-who-owns-the-car-wallet.html

Enhancing seamless user experiences:

Today's mobility related services often provide a moderate user experience: long waiting lines in front of service stations and tolling gates, parking payment machines out of order, charging stations that do not accept your payments, to mention just a few. One of the first services to get a technological boost was highway tolls. Although electronic toll service (ETS) provides obvious benefits (time saving, reduced congestion), the user experience is still limited: prior enrolment is mandatory, almost no feedback is provided when crossing a station, the badge is always on and must be physically shielded in some situations, the amount charged remains unknown until an email receipt is sent, etc.

More recently, the ubiquity of smartphones has made it appealing to provide application services dedicated to, for instance, on-street parking or EV charging. The current situation with such digitally mediated services is rather complex: from a user's point of view, the task is to identify the proper service, install a dedicated application, usually create an account with personal data thrown in, select some payment means, or sometimes credit an account by way of a pre-payment, and finally understand how to interact with the application logic to get the service they were seeking. This may be acceptable for recurring users, as they become accustomed to their local offerings. It is however far from ideal for one-time or infrequent users, such as visitors to an area or people travelling for business.

Generally, when speaking of digital services, the user experience encompasses hardware and software components, providing the user an interface to the service, including ergonomic and interaction modalities. Recent vehicles are equipped for visual interactions (in-dash tactile screens, jogs and buttons, menus, applications, etc.) as well as audio interactions (hands free audio system, voice synthesis and recognition). The current trend in modern vehicles is to provide multiple screens and larger screen sizes, allowing enriched interactions with the driver and passengers. A companion app on a smartphone is also more and more useful for innovative, remote interactions.

Third party service development needs to tackle a couple of challenges to ensure a great customer experience. Customers may require ease of access: interacting with a given service may require installing an app and creating an account. Invoking the service interfaces may be automatic and timely, or it may require looking up inside a menu, a directory or a map. Ease of use is the ability to entertain a real-time, fluid, seamless interaction, taking into account security requirements inside a vehicle which is possibly moving. Trust is about interacting with the proper service, and paying with confidence the right amount with no fear of fraud.

Service providers will also have requirements such as freedom of design, the ability to master dialogs and design choices for their service interfaces, versus the extent of constraints and limitations posed by underlying components or intermediaries mastering the ergonomics of the interaction. Replication effort can be a challenge. Given the heterogeneity of operating systems aboard modern vehicles, how can the service interfaces be provided everywhere at reasonable cost? Reachability is about addressing all customers, irrespective of their car's brand, its operating system, or even the version of it? And how can operating costs be controlled, as there may be intermediaries asking for commission?

Most modern vehicles provide multiple screens and larger screen sizes, allowing enriched interactions with the driver and passengers. A companion mobile app is also useful for remote interactions.

"Being able to pay without a physical card and with no subscription or electronic box would be very practical" (Olivier, 47)

"The main benefit I look after is to save time: not having to look for a ticket, for a bank card, or to stop at a toll is a must" (Violette, 42)

Verbatims from an online user survey conducted by Orange in June 2022, with 30 participants

Car manufacturers and/or operators (e.g. leasers, fleet owners) may have their own objectives:

- **Consistent experience** - provide and enforce a digital experience which is aligned with the overall onboard experience of the brand.

- **Value-added benefits** - reap benefits from allowing a third-party service to address the car user using its interfaces.

- **Operating costs** – optimise connectivity costs and the ability to bill them to someone, and costs associated with maintaining an application store and validating third-party software.

Towards an open in-car commerce ecosystem:

The current, global bank card payment infrastructure is interoperable, in the sense that a customer can pay a merchant with no prior enrolment and no lingering binding afterwards. In the same way, it seems important for connected vehicle services to be freely available to car users, with no dependency on a dominating actor controlling the whole process. Fortunately, there are ways to design such an open ecosystem.

A possible approach involves two embedded technical components:

- One to provide interaction between the motorist and the service, by way of a multipurpose communication channel.

- The other to complete payment, via a flexible wallet service.

Application Programming Interfaces (APIs) between these components and the rest of the world can ensure openness and allow interoperability. Both functionalities will benefit from optimal reutilisation of existing standards.

Open interaction

Rich interaction is already a reality in a number of digital messaging services, notably on smartphones, such as Wechat in Asia or Facebook Messenger. Interactions can be based on chatbots, which are remote automata built to converse with users, sometimes using natural language, or leveraging rich content and simple requests with predefined answers. Such a way to conduct transactions is commonly named "conversational commerce".

We believe that this approach can be perfectly suited to the needs of "vehicle commerce". The connected car ecosystem is quite heterogeneous with respect to operating systems, with no dominant application store, no single communication channel, no actor dominance. Hence, a rich messaging solution, dedicated to the automotive domain, would provide an open communication channel between motorists and services, to conduct transactions.
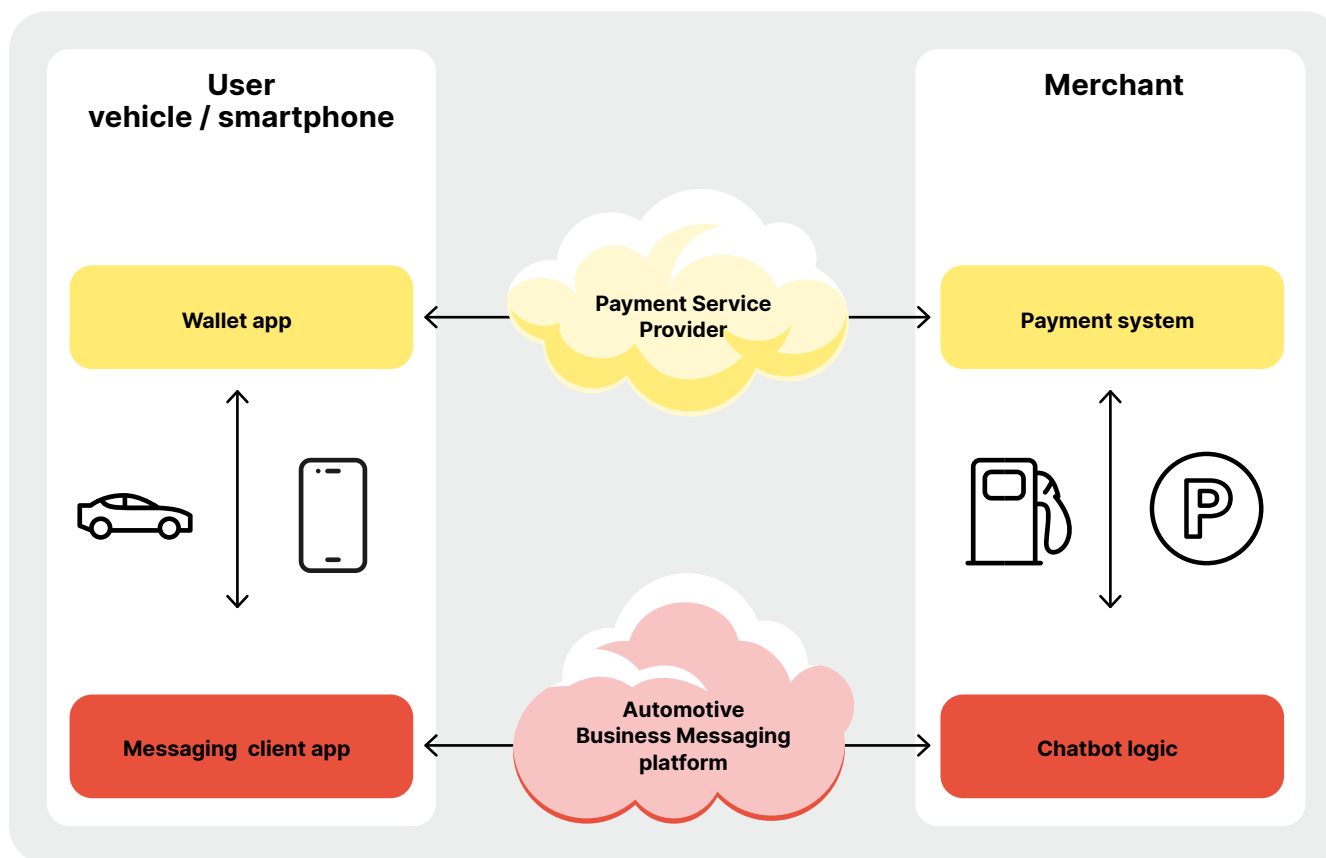

Figure 6: High level architecture of an open vehicle commerce ecosystem

An open standard allowing conversational commerce on smartphones is the Rich Communication Suite (RCS) designed by the **GSMA** (Global System for Mobile Association, responsible for worldwide mobile phone standards). Among the standardised concepts, the **Rich Business Messaging** defines a number of message formats, with rich text, image and video content, selection carrousels, quick answer buttons, etc. Re-using these formats in an "Automotive Business Messaging" solution would facilitate the setup of such a communication channel, while ensuring interoperability between different implementations.

We argue that a great number of commercial services targeting motorists can be rendered using chatbots, with the help of this kind of rich message formatting. Indeed, the vocabulary of interaction steps allowed by the GSMA standards is compatible with sharing a location, selecting a charging point or a fast-food menu, visualising price options or a transaction receipt, and many other use cases.

This would avoid the need for dedicated applications with their inherent downsides (multiple versions for multiple operating systems, maintenance, installation, enrolment with account creation, updates, etc.), while leaving service providers free to tailor their chatbots to display their brand image.

Of course installing a dedicated service app could still be an option, alongside the conversational approach. In some cases, such as a complex offer, or a daily-used service with subscription, a full-blown app could be the way to go. But not every service requires a dedicated app, and some situations may even preclude their use (e.g. short-term rental of the vehicle).

Setting up an open "Automotive Business Messaging" approach involves several actors and roles:

- The communication channel is a dedicated business messaging infrastructure and platform, built on top of mobile connectivity, managed by telcos and/or a consortium, to ensure interoperability.

- Car manufacturers interface their vehicles with an API on this platform, delivering messages. They master the implementation of the messaging client software. They can deploy it aboard their vehicles, taking benefits from the user interface components and particularities of the car equipment. They can also implement it inside their companion mobile apps, for an easy access to third-party providers, even if the vehicle information system is not compatible.

- Service providers make use of a "bot API" on the platform, to connect their compatible chatbots, with no prior link between the service and the users. The service provider is in control of the service logic and its interaction with the provider's information system.

- A directory service is also required, allowing service providers to register and qualify their offers, and allowing car manufacturers to request, select, and display services they wish to provide to their users.

- Starting a transaction may be performed in a number of ways: by making a voice request to an on-board assistant, by tapping a nearby point of interest on the tactile navigation screen, by requesting a point-of-interest directory, or even without any explicit action, through automatic methods involving geolocation and/or proximity to services (e.g. via 5G network location services). Figure 7 illustrates an in-car service application with the extension to a mobile application.

The service provider chatbot welcomes the customer and offers parking duration and charging alternatives via a carrousel of multiple choices.

In this example the motorist chooses to park for 2 hours. The selection is confirmed and an invite to pay is displayed. Quick actions allow the user to cancel or to launch the payment phase.

The car wallet is invoked, allowing the customer to quickly validate their payment, thanks to biometric authentication.

The user can also check the details of the transaction, and specify an alternative means of payment if so desired.

After payment is completed, the service chatbot provides a digital payment receipt, augmented with useful information, such as the reserved parking space number, the limit hour, and the level of battery expected at the end of the parking time.

The same conservation can also be accessed using the driver's mobile phone, for instance within the companion application provided by the car manufacturer.

This can be useful to provide remote access to the service. In this example, the parking chatbot sends a reminder and offers to add more parking time.

Figure 7: Illustration of in-car payment for parking + EV charging service

Open in-car wallet

Existing in-car payments initiatives are mainly based on international card schemes, making use of card tokenisation frameworks.[18,19] This approach enables a tokenised credit card to be linked to a car (i.e. a device) so that online transactions can be made after the enrolment process for a specific merchant.

There are many other payment means such as local debit cards, instant payments or even central bank digital currency in the future, which are valuable alternatives next to international card schemes as illustrated in Figure 8. In particular, account to account payments, made more practical with PSD2, can really make sense for certain use cases such as EV charging or company owned cars. Therefore, it is important to consider an open in-car wallet that allows the consumers to choose the desired payment means according to their needs. Identification of users and strong authentication are also a must-have for in-car payments, in order to create a secured and trusted ecosystem. Thus, providing a seamless experience with fast and zero-effort authentication based on a 3DS-compliant biometric solution (e.g. face or voice) is of great importance. We can think, for example, of Strong Customer Authentication Delegation with FIDO[20], which proposes an approach using existing security standards, whilst at the same time taking advantage of biometric technologies.

Nevertheless, in-car payments are often limited to relatively low-value payments, where we could use exemption (e.g. tolling) or a daily limit (e.g. €50 similar to NFC contactless payment) to limit financial risks. In the future, it would also be interesting to consider a digital identity wallet, in particular the eIDAS wallet in Europe, that could provide more identity credentials, such as the driving license, to offer "instant" insurance for cross border trips.

To ensure the proper security level, the in-car wallet needs to run in a secure environment. Different security measures must protect the information stored in the wallet. First, data encryption is a must, both at-rest and in-transit so that it cannot be read without decryption keys. Second, secure elements can be used to store sensitive payment information. Third, tokenisation of cards is a good way to protect card information. This means that, instead of
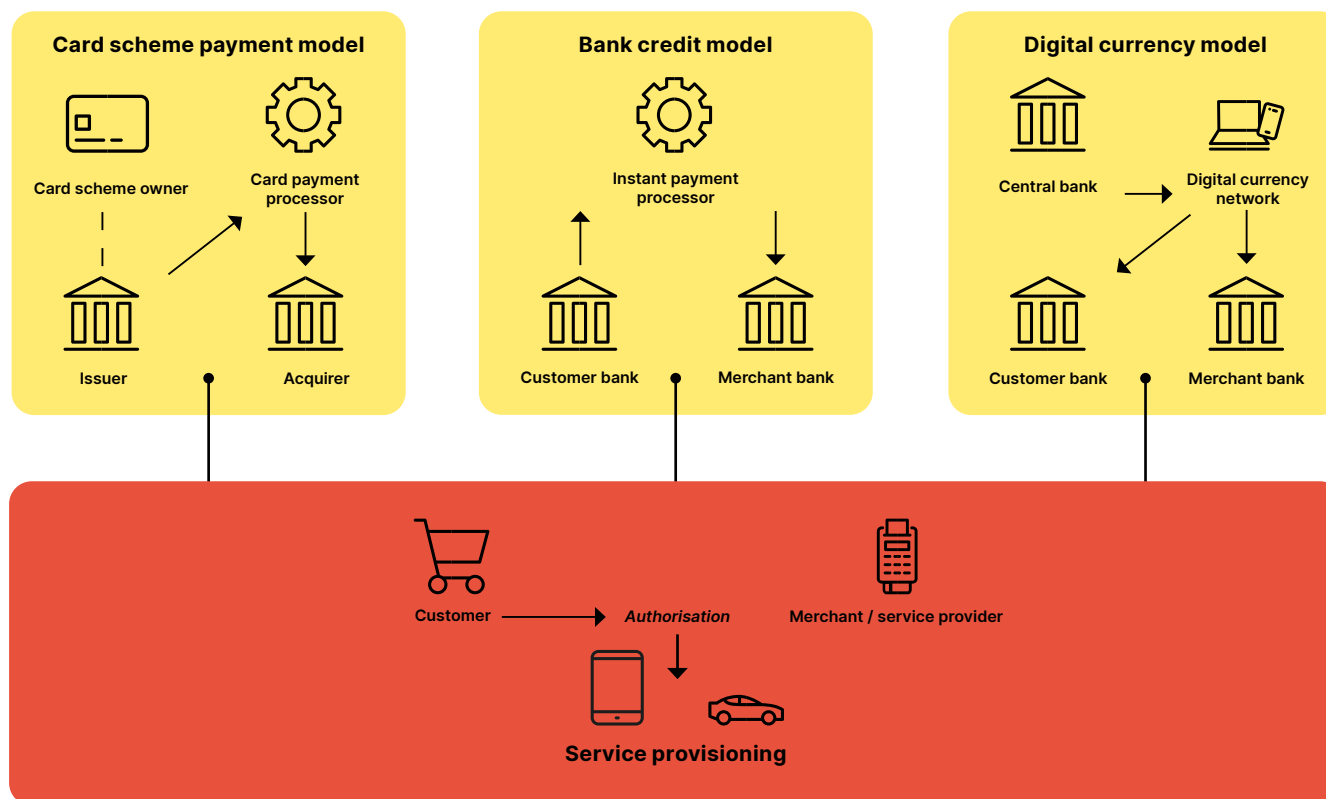

Figure 8: Payments alternatives

storing the actual card number, a unique token is used to process payment transactions without revealing the card number itself.

With the advance of cloud wallet technology, in-car wallets would take the form of a cloud wallet. When making the purchase, the payment information would be accessed from the cloud and used to complete the transaction. Examples of well-known cloud wallets include Apple Pay, Google Pay, Samsung Pay and PayPal. With this approach, it would be easy to develop omnichannel use cases with a seamless experience for the customers using both their cars and smartphones. Wallets also offer much needed cross-border payments and can take advantage of Open Banking for additional features such as credit scoring based on bank account data.

Finally, every new payment solution requires trust for mass adoption. It is in the collective interest of stakeholders, namely banks, card scheme owners, car manufactures and merchants, to establish a trusted ecosystem for the consumers.

18   https://developer.mastercard.com/mdes-token-connect/documentation/
19   https://usa.visa.com/content/dam/VCOM/global/products/documents/visa-vts-cloud-token-framework-fact-sheet.pdf
20   https://media.fidoalliance.org/wp-content/uploads/2021/03/FIDO-White-Paper-SCA-Delegation-to-Merchants-or-Wallet-Providers.pdf

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How do you perceive the in-car payment and v-commerce (vehicle oriented commerce) market?

Car manufacturers are continuously innovating, and embedded services is the next innovation. By 2030, the addressable market is an estimated $600 per car, providing a wide range of v-commerce options and new revenue streams to car manufacturers and merchants. This is supported by several trends: all cars are now connected (5G, OTA updates, ADAS...), this is a new distribution channel. Customers are more and more willing to pay for value-added services, currently around 55%. New entrants such as big tech companies are actively challenging incumbent actors, and also local policies are encouraging the development of connected car offers and services.

Which actors can facilitate the emergence of these solutions?

My conviction is that four major actors will have a role to play: car manufacturers, v-merchants which are merchants selling vehicle-oriented services, platform and technology providers, and of course payment service providers. Manufacturers will have to implement new in-car payment methods to enable v-commerce. There are different options and strategies depending on the service provider, which can be the car manufacturer itself, or a third party. V-merchants will need to maximise the number of customer touch-points by interconnecting with car manufacturer ecosystems. For this, platform and technology providers will play a crucial role, by facilitating the interaction between the car manufacturers and the v-merchants. Lastly, Payment Service Providers will be challenged to adapt the existing payment solutions to the in-car payment requirements.

What are the success factors?

I see an issue with interoperability, how to tackle the potential multiplicity of interfaces and formats proposed by car manufacturers to reach their ecosystems. Another success factor would be to delegate the strong authentication to car manufacturers. Indeed, lowering authentication friction is well known to be key to a seamless payment experience. Another very important question is how responsibility is shared. To protect the final consumer, each actor of the value chain

takes its part of responsibility in the security of a payment transaction. Payment ecosystems have developed specific solutions, such as tokenisation, which can go a long way to securing the overall market and supporting the car manufacturer. And last, V2I (vehicle to infrastructure) payments may require dedicated investments from municipalities, gas stations or parking tolls that would slow down the development of v-commerce. Meanwhile, existing e-commerce payment solutions may be an enabler to accelerate this development of v-commerce, ensuring sufficient funds to unlock the budget.

Mark Gerban
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What are the key factors to consider when selecting a partner for in-vehicle commerce ecosystem?

Unlike big tech companies, original equipment manufacturers (OEMs) are grappling with ecosystem development and market positioning to reach the mass market. To that extent, it may make sense for OEMs to form a consortium, and there are a couple of factors to consider. The first aspect pertains to what the ecosystem can offer in terms of benefits and whether those benefits align with the actual target user groups of the OEMs. Many companies propose seemingly "amazing" value propositions, but ultimately fall short in delivering value to OEMs. The other aspect revolves around content and the ability to scale that content. The reason why Google and Apple wield such significant leverage is due to their app ecosystems, which

encompass millions of apps that hold the potential to scale up over time. Consequently, when selecting partners, OEMs seek products that seamlessly fit into the ecosystem. This isn't just about simple parking apps, but rather apps that are native and can be seamlessly integrated into specific user experiences. Additionally, OEMs aim to establish robust relationships with developer teams to ensure the quality and speed of product development.

What are the implications and opportunities of in-car payment systems for car manufacturers?

Driver safety is a significant concern. Currently, most vehicle-commerce activities are facilitated through mobile phones, but using phones while driving is a safety risk. When implementing an in-car wallet, ensuring safety compliance and driver protection becomes crucial. With an in-car wallet, OEMs must rely on partners to handle the integration work, which can lead to a chicken-and-egg problem due to the impact on both sides of the systems. From the OEMs' perspective, developers may be hesitant to proceed due to security concerns within their systems. On the other hand, third-party product managers are cautious about deviating from established payment standards. In-car payment solutions should provide a comprehensive approach rather than introducing isolated solutions. For instance, current tolling solutions are tailored only for tolling services, while parking requires a different

solution, and so forth. An excess of disparate payment solutions can confuse and unsettle customers, ultimately leading to reduced product utilisation.

Are current in-car payment solutions mature enough for the mass market? Which aspects still require more attention?

Current solutions in the market lack sufficient scalability. A basic example is network tokens – how many issuers are still unprepared? What is the global interoperability of network tokens? Passing a token over to a third party may seem straightforward, but establishing an ecosystem based on network tokens with various schemes is complex and intricate. There are indeed alternative solutions to simplify the current situation. The economic feasibility of a particular scheme may be hindered by transaction fees. Thus, depending on the market's geography, one scheme may be more suitable than another. The crux of the matter is the need to generate volumes to make the payments business viable. In the long run, OEMs will accrue substantial transaction volume. For example, revenue from upgrading software options and features is expected to be significant for OEMs. However, venturing into the payment business poses risks due to low transaction volume coupled with high values. Thus, the right components must be in place to manage risk effectively.

Lastly, user adoption hinges on having the right team with a solid understanding of payments to deliver an optimal user experience. This is a pivotal aspect, as payments surprisingly serve as a potent enabler. Many OEMs lack dedicated efforts focused on payment solutions and grapple with comprehending how partnerships truly function. Often, partnerships materialise with phrases like "let's collaborate", which may sound promising on paper. Yet, delving into the interconnectedness and functionality often reveals a missing common infrastructure that requires addressing.

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What does the future of fleet management look like within the context of sustainable mobility?

The future of fleet management in the context of sustainable mobility will drive new technology developments and the leveraging of advanced AI powered analytics to make the fleet safer, more efficient, and more productive whilst minimising their environmental impact.

The transition to zero emission vehicles is top of mind for a fast-increasing number of fleet managers today, and the realisation that it is more than just replacing a traditional internal combustion engine (ICE) car with an electric vehicle. The transition is impacting the entire business operating model, requires partnering with completely new players, involves new technologies, and fleet vehicle data needs to be at the centre of the decision-making process.

At the base level, fleet management supports sustainable mobility by helping fleets to optimise routing, improve driving behaviour, eliminate idling, reduce dead-miles, and more, to reduce ICE vehicle fuel consumption and therefore emissions, but also tracking key indicators, sharing best practices and advising of ways to improve.

Moreover, as the industry slowly moves towards autonomous vehicles, advanced fleet management functionality will be central to the vehicle fleet operation to further increase productivity, efficiency and sustainability.

How do you see the role of your company in the emerging in-vehicle commerce ecosystem?

The role of mobility solution companies such as ours in the emerging in-vehicle commerce and software-defined vehicle ecosystem will be instrumental in shaping solutions for fleets and fleet managers.

In that sense, fleet management solutions companies will need to integrate more closely into the vehicle manufacturers' platforms, collaborate with fintech companies, build a modular solution and partnership ecosystem that reflect the need of the fleets, allow operation across vehicle brands, and provide the necessary actionable insights to fleet managers.

The role of the mobility solution companies operating in the fleet space will be to bridge the gap between the solution developed by the OEMs and tailored to their own vehicles, to the strategic and operational needs of the fleet managers.

Next to the user convenience, what trade-off do you see when B2B mobility services and payment services are digitised in a car-wallet?

The digital car-wallet is a powerful tool for fleet management. It will simplify transactions like toll payments, parking, and EV charging, akin to having an express pass to essential services. For fleet managers, it offers a comprehensive overview of expenses and delivers insightful data for operational optimisation.

However, it's not without its challenges. Securely handling sensitive data will be a top priority, and ensuring the system works seamlessly across diverse technology platforms, vehicle brands, etc. can be complex, and the quality of connectivity will become paramount.

The learning curve for users may also present a challenge. However, these hurdles also pave the way for innovations in safety features and data protection mechanisms. While there could be regulatory nuances to address, car-wallet systems overall hold promising potential for streamlining and enhancing fleet management.

Key take-aways:

The emerging in-vehicle commerce is attractive and beneficial for all stakeholders in the ecosystem. Its success depends strongly on the focus of individual stakeholders, while considering collective interests. Given the strong momentum in the market, it is now time for you to identify your business benefits.
Table 1 provides a summary of business benefits and choices to be made as you consider your strategic positioning in the in-vehicle commerce market.
Through this publication, we hope to have brought you new ideas, pushing further your ambition and future planning in this exciting field.

Actor	Key benefits	Choices to make
Car Manufacturers	• Car makers can accelerate the sales of software upgrades with in-car payments • At the same time extending the scope of in-car commerce with external services such parking, EV charging, restaurants, hotels, etc. will help generate new revenue • In-car commerce will create the needs for more real-time data, making data monetisation a relevant business case	• As new ecosystems are emerging, how will the new role of your business and the data value you offer need to adapt? • Both mobile-based and built-in approaches have their advantages and disadvantages, how will your business balance these?
Merchants	• In-car commerce provides merchants with a dynamic channel, merchants could extend their reach with real-time information to bring customised offers to the customers • The energy transition forces fuel merchants to shift current forecourt business models. As customers will stay longer at service stations waiting for cars to be charged merchants will have new opportunities to offer more services • The rich set of real-time information helps merchants reinvent loyalty programs and increase stickiness, by considering convenience, safety and sustainability	• The opportunity to reach the customers during their journeys allows your business to offer attractive services. How will this impact your sales and marketing approach? • User experience is one of the key success factors, how will your company work with car makers and payment providers to create seamless customer journeys?
Payment Providers	• Obviously, in-car payment brings additional transactions to payment service providers • In the complex ecosystem, payment providers have a unique position as trusted partners connecting car makers, banks, merchants and telcos • In-car payments combines different technologies, including IoT, biometric authentication, payment schemes, security. It pushes payment providers to reach the edge of innovation	• As in-car payment solutions are in the experimental phase, creating the right use cases and making the right design decision is crucial. What use cases are priorities for you? With which partners? • Many payment means are available, including debit and credit cards, instant payment or event digital currency. What schemes are the most promising for your target region?
Banks	• The ongoing electrification of cars and the necessary rolling out of EV charging infrastructure will have a major business impact, triggering banks to invent new payment products for the eMobility market • Banks can benefit from the in-car payment channel to create better customer engagement in terms of sustainability • Financing the acquisition of a vehicle can open up opportunities to be the payment vector of choice for the user afterwards	• What could be a new means of payment at the hands of your institution, dedicated to vehicle commerce? • Is your financing strategy with respect to vehicles (credit, loans) ready to incorporate vehicle commerce opportunities?
Telcos	• The new generation of messaging technology ensures openness and interoperability. Telcos can bring these benefits and be responsible for hosting and maintaining the required platforms on behalf of the other actors • With the combination of AI-enabled chatbots and Rich Communication Messaging, telcos can offer merchants know-how and technological support with building the services • The new capabilities of next generation, 5G mobile services makes it possible to enrich the ecosystem with advanced geolocation and proximity detection technologies, providing automatic triggering of services at will	• Interoperability is in the DNA of telecoms companies. What about having a cooperating approach between several telcos already involved in the vehicular connectivity markets? • How to enrich the current V2X framework with vehicle commerce use-cases in addition to the safety use-cases already described?

Table 1: Business benefits and choices to make

Authors and acknowledgements.

About Worldline

Worldline [Euronext: WLN] helps businesses of all shapes and sizes to accelerate their growth journey – quickly, simply, and securely. With advanced payments technology, local expertise and solutions customised for hundreds of markets and industries, Worldline powers the growth of over one million businesses around the world. Worldline generated a 4.4 billion euros revenue in 2022.

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