

SERVICES IN AUTOMOTIVE BUSINESS BASED ON CAR CONNECTIVITY POSSIBILITIES

Andrea Lešková

INTRODUCTION

One of the most important trends in our society today is the mobile Internet. Connectivity and lifestyle trends are changing the way cars are used. Young customers enthusiastic about technology want a car to function as an extension of their virtual environment. Drivers and their passengers are increasingly seeking in-vehicle mobile connectivity to make travelling by car a safer, faster and richer experience.

The connected vehicle represents a real opportunity for automakers in terms of innovation, differentiation and monetization. Automotive manufacturers all over the world are currently developing, presenting, producing, and marketing new vehicle features that enable the exchange of information with the Internet via specific interfaces, bringing the Internet into the automotive world. The “marriage” of cars and the Internet opens up a host of new possibilities for the entire automotive industry, providers of Internet services, and their customers. This article focuses on the trends involved in the use of these features, and on the challenges this development entails.

The coming era of connected vehicles offers great opportunities: automotive manufacturers will gain a direct channel to customers that will help strengthen brand relations, drive aftermarket sales and services and co-operate with new partners in the networked society.

1 APPLICATIONS OF CARS CONNECTIVITY NETWORK

The definitions of the phrase “connected car” can be explained as in [6]: The connected car enables the exchange of information between the car and its surroundings via the Internet. The vehicle’s connection to the Internet is provided either by a transmitter/receiver unit built into the vehicle itself, or via third-party systems such as smart phones. This transforms

the vehicle into a hub of communications enabling in-car use of data and services via appropriate operating and display concepts. Drivers and passengers will be able to access applications for information, navigation, and entertainment in a secure way from a screen in the vehicle. [8]

Bringing the mobile Internet into cars combines the two forms of mobility [10]:

- physical transportation: cars are an expression of individuality and a means of physical relocation;
- virtual: media and Internet connectivity based on mobile devices (such as smart phones and tablets) reflects the growing demand for access to information anywhere around the globe at any time.

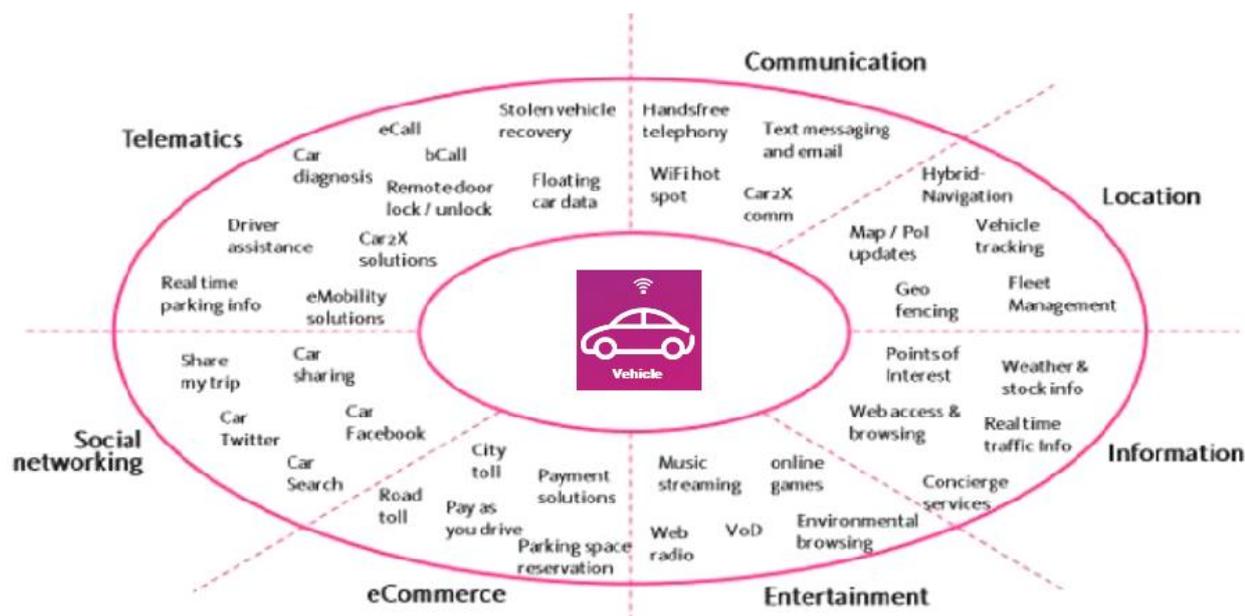
The automotive industry is an increasingly global business and connecting the vehicles demands a global solution with standards-based infrastructure to lower the cost of ownership and fully leverage the potential in the automotive ecosystem. [4]

1.1 CONNECTIVITY POSSIBILITIES TO VEHICLE INTERFACES

Best in class car producers (OEM – original equipment manufacturer) and ICT companies (information and communication technologies) are realizing the development in cooperation to use car potential as a gateway to the Internet, as access point to a connected world not only in regard to entertainment. The new technology intelligent plug-in solutions and interfaces enhance safety by helping vehicles communicate with external environment and with any Internet-capable device in car-to-x-connectivity, e.g. satellite navigation: car-to-car, traffic systems: car-to-infrastructure, service stations: car-to-OEM, virtual business: car-to-enterprise. [12] The range of car applications will increase, as presented in Fig. 1. In the

future, it will be possible to integrate all mobile devices seamlessly into car. [11]

Fig. 1: Examples of car connectivity applications



Source: [9]

The connected vehicle will enhance the driving experience in three specific areas [1]:

- **Safety:** Connectivity will give the driver access to extensive information about congestion, accidents, road conditions, and dangerous situations such as wet roads, work zones, weather changes and any hazards. It will enable vehicles to communicate with others in proximity, warning of such things as unsafe lane encroachment or impending collision. Intelligent Transportation Systems covers a wide range of applications that include communication system, positioning, sensing, and other information-related technologies to improve the safety (motorist information, dynamic route guidance and navigation, eCall system etc.). Sensors, software and wireless communications will enable the vehicle to detect road conditions and the car will send corresponding warnings directly to other road users.
- **Driver assistance:** The connected vehicle will be able to optimize routes based on fuel economy, real-time changes in traffic conditions and minimal tolling. The traffic jams and red lights could be identified before they

are reached. All parking spaces will notify the control centre of whether they are occupied or free. The vehicle will become an extension of lifestyles with entertainment solutions (streaming audio, video and communications) that allow seamless transition between mobility, office and home.

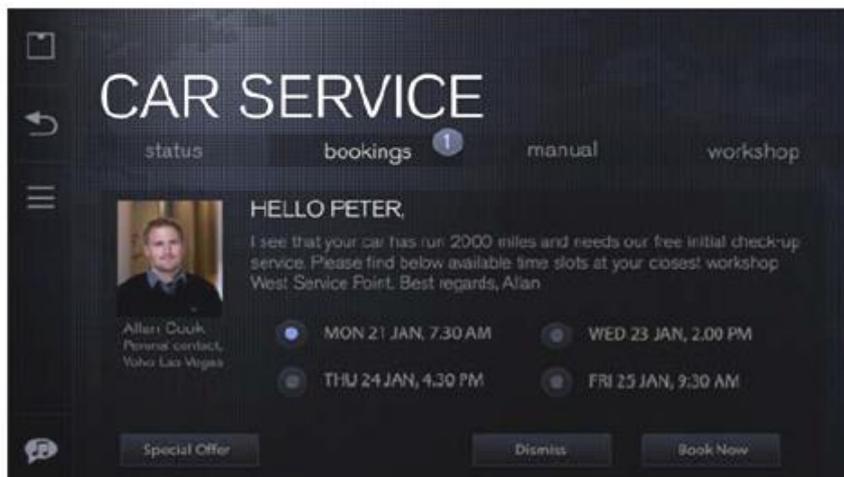
- **Service:** The connected vehicle will be able to use real-time remote diagnostics and prognostics to assess operating conditions and affect some degree of self-repair. Software and other service patches to electronic systems will be automatically delivered to the vehicle, keeping it updated with little consumer involvement.

Vehicle connectivity has already become available in certain markets, especially for cars in the premium segment. The connected vehicle could be the precursor to the fully autonomous vehicle, and later the fully automated roadway. [5] Complex solution will provide domain-independent services that can be customized to the needs of a particular application domain addressed to the automotive. By having the vehicle constantly connected, the automotive manufacturer will be able to monitor the status of the vehicle and to

feed information back to the production line resulting in faster turnaround modifications to lower warranty costs. Drivers and passengers will be able to access applications from a screen in the vehicle to enjoy the same level of digital services that consumers today are used to have in their homes, work or on the go. Owners will also be able to connect to the

vehicle remotely from other devices. The owner will have an easier service procedure where the vehicle will be able to detect issues that need to be serviced and automatically handle the service booking procedure connecting the dealership and the repair shop, as shows example of application in Fig. 2. [4]

Fig. 2: Example of connected service booking



Source: [4]

Connectivity in the vehicle is becoming more important in vehicles with alternative drive forms and city cars. For example, electric vehicles require connectivity. Connectivity systems allow to find the nearest charging station, estimate if it is reachable given the battery load and reserve a charging point online. Also new mobility and user concepts such as multimodal systems and car-sharing concepts will gain relevance in the future. These mobility solutions rely on people and vehicles being fully interconnected. [5]

The unique trend in the saturated markets is the growing importance of car connectivity as a purchase criterion. Vehicle individualization is an important factor for younger drivers in particular. Young customers enthusiastic about technology want a car to function as an extension of their virtual environment, taking features such as an individual user profile, personalized services, and social media with them. [6]

Significant increases are expected in the volume of mobility-related information exchanged, the use of commercial B2B services and in-car infotainment. Creating a link between the car, its own original data, and its surroundings via the Internet will give rise to new applications and business models. [6]

1.2 CHALLENGES OF CAR CONNECTING AND FUNCTIONALITY SERVICES

In the past, the business of automotive companies focused largely on vehicle sales. Post-sales opportunities, mostly associated with vehicle service, were limited. This now changes. The goal of car connectivity initiatives is [3]:

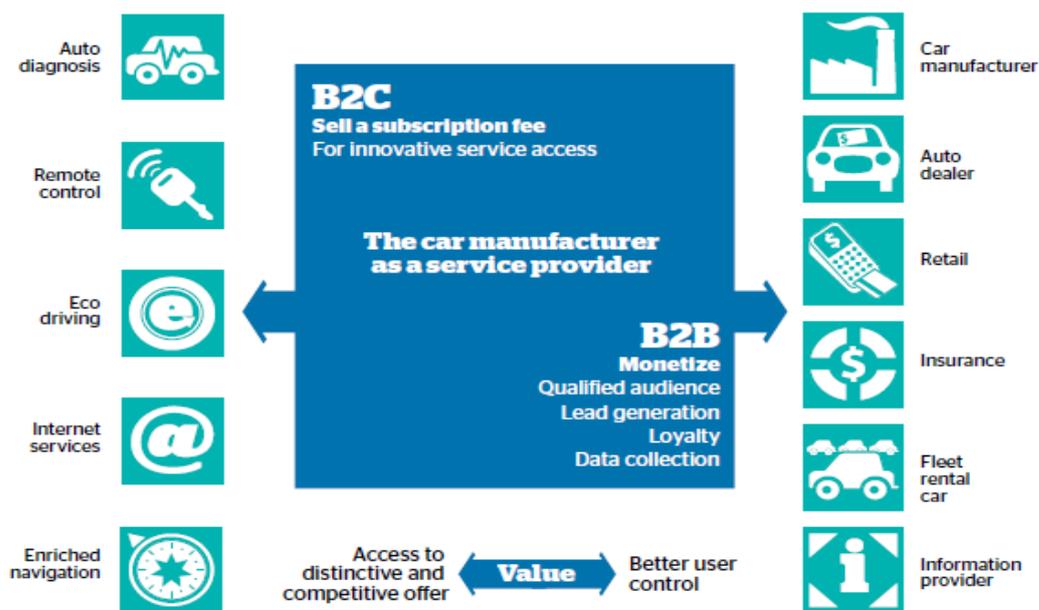
- For drivers and passengers: the vehicle must be a safely connected extension of their environment.
- For automotive manufacturers and their partners: connectivity drives a shift from product to service relationships.

In this new world everyone, everything and everywhere will be connected in real time. And the automotive industry will benefit from this evolution. In the immediate future, the connected vehicle will become the key to extending customer relationships. It will create a more rewarding experience for the driver and at the same time establish sustained revenue streams both for the manufacturers and their ecosystem partners. [3]

Within the next years, every new car will, to a greater or lesser extent, be a connected car. When most drivers already have a smart-phone in a cradle on the dashboard, this deeper connectivity is inevitable. Connectivity also

becomes the catalyst for an entirely new range of collaborative business opportunities with partners. OEMs need to collaborate closely with both developers and customers in order to create successful applications. These include insurance providers, fuel companies, retailers and civic authorities etc. Through strategic partnerships, the connected vehicle will create a number of additional revenue streams for automotive manufacturers from new players, as expressed in Fig. 3. Profitability will be achieved through directly paid services (B2C), and indirectly by leveraging benefits further along the value chain, together with other value creation partners (B2B). [6]

Fig. 3: Schematic formulation, how can the manufacturer exploit connectivity with other businesses to create and sustain new streams of revenue



Source: [3]

New actors in automotive business are able to share revenues, for example [5]:

- Governments and legislators: want to enhance road safety and collect road tolls and congestion charges.
- Insurance companies: want to be able to offer insurance based on how safely the driver drives.

- Media and content companies (telecom carriers, operators, entertainment groups): want to be present in the vehicle.
- Developers (industry associations and research institutions, software and service providers): see drivers and passengers as an attractive market for their services. Connecting the developers with the vehicle and the driver in a secure and open way is essential to build the applications of tomorrow.

The connected vehicle system allows automotive manufacturers in their role as service provider to focus on building up the customer relationship and not to worry about building isolated solutions for connectivity, service enablement, content management, charging, billing and customer care. [4] Companies such as Google, Microsoft, Cisco and Oracle are providing the hardware and software needed for connected vehicle technology and the related business models. From the underlying system architecture to the user interface, from end user applications to payment transaction models, these players are integrating themselves into the product development lifecycle, forging partnerships with OEMs and suppliers to develop new solutions. Providers of connected mobility solutions must find business models that are sustainable according to the dynamics of the new value chain. [5]

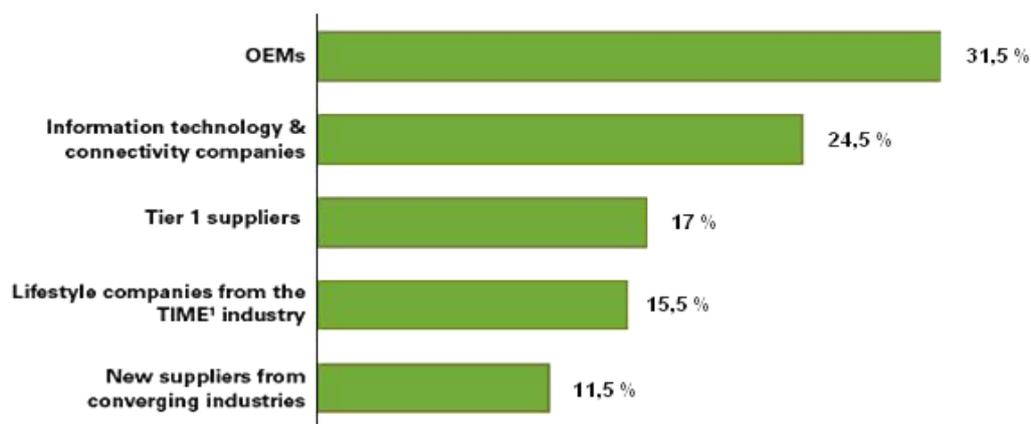
Participating partners would pay for access to this new vehicle user customer base, and connected car manufacturers or fleet operators could emulate successful business models from the technology industry. [10] Understanding and unlocking the full potential value of data will be critical for defining successful business models. Companies such as Google or Facebook have proven how customer data centric business models can be a great success. For these companies, the user is a key provider of information that can be later processed and sold (at least indirectly) to third parties. The combination with additional vehicle data will open up a variety of additional business opportunities. Companies that exploit the value of data will be able to offer their customers the connectivity services at no (or limited) costs. [5]

The technologies involved in realizing the connected car currently exist primarily in the automotive, software, and telecommunications sectors. According to analysts [10] manufacturer-independent providers of services will undermine OEMs' position of superiority. The trend leads to more rapid and adaptive lifecycles of services compared to what companies have been used to manage and produce. Service providers have a great asset in their customer base that gives them the opportunity to diversify and expand their business. The trends based on car connectivity applications give rise to promising attractive services segment, as declare published scenarios [2] for future development in automotive (see Fig. 4).

The market potential for aftermarket in-car connectivity solutions is certainly interesting because the segment of customers who are young, tech-savvy, but less willing to pay demands low-cost, flexible solutions. The challenge for OEM in terms of this target group is to provide attractive services at the speed and quality these users are accustomed to receiving from the Internet community. [6]

Aftermarket features are generally installed directly at OEM dealerships or at locations operated by automotive accessory specialists. Automakers are seeking connectivity solutions that can adapt to a wide range of use cases, such as a change of business model, a change of mobile operator and a change in the ownership of the vehicle, countries of operation, etc. [8]

Fig. 4: Control over the revenue from in-car connectivity by 2025



¹ TIME = Telecommunications, Information Technology, Media and Entertainment

Source: [2]

The prognosis of car connectivity services development is based on two different scenarios: [6]

1) Automotive manufacturers are in control of all services based on the connected vehicles marketed under their brands. Content and applications are hosted on servers operated by the automotive OEM with access provided only via manufacturer-specific portals. All services not developed directly by the manufacturers and their partners undergo a certification and review process within the OEM's organization. The automotive manufacturers' main concern – system security – thus remains under their control. Automotive OEM however, can hardly keep up with the rapid pace of development on the Internet, short update cycles, and the many different user profiles and applications in use.

2) These applications are developed and provided either by independent programmers or by software developers. They represent an intelligent way to combine different pieces of information from the Web, thereby generating high added value for users in their cars.

The automakers have the opportunity to make driving safer and reduce the impact vehicles have on the environment by leveraging new C2C communications pathways that can also be formed as a result of these new developments. Those automakers that take a cross-functional approach in developing their connected services business model and engage functions across the enterprise, while

also creating services that address consumer experiences from other industries, may have the most significant chances of taking an advantage against their competitors. [7]

CONCLUSION

Demand for car connectivity is high. The technology will initially be used for OEMs' strategic positioning on the market. Luxury and high-end vehicles marketed by premium brands and trendy city cars will be at the forefront of technology and innovation. The limit of global and worldwide implementation in vehicles is consistent real-time connectivity.

The driving forces for the services development of networking to cars are identified as: technological (major factor in the evolution society - this will have a dominant influence in the use of "intelligent" vehicle); economical (significantly reduce the costs caused by accidents and generate revenue from the production of "intelligent" vehicles); environmental (wastes fuel and environmental pollution will be reduced); cultural (it will increase the culture of travel and provide new activities).

Braking forces can be social and political factors. As with any new technology, reluctance of its adoption can be expected. Once people are aware that it is safe and offers numerous advantages, the acceptance will rise, but it may take longer time. The political aspect of

technology can be blocked of the lobbying interests of various industry groups.

Operators and vehicle manufacturers must cooperate to overcome existing barriers to the installation of connectivity in vehicles. Mobile operators should be focused on providing extended solution support in line with the automotive industry requirements, so as to aid in the deployment of seamless user experiences. Connected car services require new business models supported by strategic partnerships.

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Autorka:

Ing. Andrea Lešková, PhD.

Technical University of Košice
Faculty of Mechanical Engineering
Department of Technologies and Materials
Division of Automobile Production
andrea.leskova@tuke.sk

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Andrea Lešková

Abstract: The articles concentrate on the vision of the networked vehicle and the impact of connected cars on the automotive business. The interpretation of subject of this article is based on the combined data set of many published reports and analytical studies. Car will become an active, mobile node in the Internet. This contribution illustrates effects of Internet networking in automobiles, connected to external interfaces, and customer acceptance of these systems which are suitable for multiple application domains – external connectivity, security, telematics, diagnosis, integrated safety management etc. Bringing services and applications from the consumer space into the car is an intensive challenge for automakers. Creating a networking between the car in traffic, its own original data, and its surrounding infrastructure via the Internet will give rise to new applications and business models in automotive. The impulses that can support the development and implementation of standardized services for car connectivity are resulting from information technologies and globalization trends, assuming that the close collaboration of OEMs, Tier-x suppliers, Government bodies and consumers is realised and synergy effect is reached.

Key words: Automotive industry, services of car2x connectivity, application domains, business challenges.

JEL Classification: L9, R4