The Service Centric Car in 2020

Trend Report 2009

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Preface

Much has happened since Ford introduced its first model T automobile in 1922. The car was a standalone unit offering no intelligent interaction with the outside world. Today, 80% of all automotive innovations are realized in its electronic components. Those are bringing new capabilities to every part of the vehicle. The car of today is equipped with satellite navigation, HD based infotainment systems, voice-activated communication and telemetric systems for safety, security, and remote diagnostics. It can be seen as a service platform which satisfies diverse consumer needs for mobility and safety as well as communication, information, and entertainment. These changes have been made possible through the introduction of new technologies allowing for increased levels of interaction with the external world. These developments have been fuelled by advancement in embedded systems and advanced communication technologies. The latest innovations in the luxury editions trickle down to the basic models of tomorrow, and we can expect these features to become standard in the future. But this is not all - with manufacturers introducing the newest concept - that of the 'net centric' car. Here the power of the Internet is brought into the car domain with remote telemetry, streaming media, Internet enabled navigation and communication being the order of the day. The car is no longer a 'standalone' unit, but a hub, one where different services converge to serve the user. And in this sense, the car now embarks on a new epoch, one which extends the lifestyle of its user.

Against that background 20 students of the CDTM conducted a scenario analysis together with academics and practitioners to explore the future of the service centric car. The five interdisciplinary teams started with a short summary of the status quo in order to then identify trends for the topic. Each team looked at the subject from a different perspective, covering technology, market and customer trends, legal and regulatory developments, changes in the value chain, and trends in entertainment and infotainment. Building on these trends, the main drivers for the topic and their interrelations were identified to form scenarios of the future. Based on this understanding of the future framework for the service centric car, the students developed product and service ideas in the fields of navigation, communications, safety/telematics, entertainment/infotainment, and community services. The results of this seminar are wrapped up in this report providing visionary ideas for future products and services in the area of the connected car designed to meet the requirements of the future customer.

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For more information about the CDTM and its related projects,
please visit http://www.cdtm.de.

The entire trend report was written by CDTM students in 2008. The papers compiled here do not claim to be scientifically accurate in every case; they are rather meant to give a structured and broad overview of trends relevant in the context of information and communication technology in the automotive industry.

Contents

List of Figures

List of Tables

Abbreviations

API	Application Programming Interface
3GPP	3rd Generation Partnership Project
CAN	Controller Area Network
CPU	Central Processing Unit
EDGE	Enhanced Data rates for GSM Evolution
FM	Frequency Modulation
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HSPA	High Speed Packet Access
ICT	Information and Communication Technology
IETF	Internet Engineering Task Force
IMS	Internet Multimedia Subsystem
IP	Internet Protocol
IPv4	IP version 4
IPv6	IP version 6
ISM	Industrial Scientific Medical
ITS	Intelligent Transportation System
LAN	Local Area Network
LIN	Local Interconnect Network
LTE	Long Term Evolution
LVDS	Low Voltage Differential Signaling
MIMO	Multiple-Input Multiple-Output
MOTS	Media Orientated Transport System
OEM	Original Equipment Manufacturer

PAN	Personal Area Network
PC	Personal Computer
PDA	Personal Digital Assistant
QoS	Quality of Service
RFID	Radio Frequency Identification
TMC	Traffic Message Channel
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
UWB	Ultra Wide Band
VICS	Vehicle Information and Communication System
VoIP	Voice Over Internet Protocol
WCDMA	Wideband Code Division Multiple Access
WiMAX	Worldwide Interoperability for Microwave Access

Part I

Trends

Chapter 1

1 Technology Push

Anas Al-Nuaimi, Florian Gall, Christopher Scheubel,
Maximilian Schütz

The major technological trend concerning automotive information and communication technology is the integration of vehicles along with their components and the roadside infrastructure into the Internet. Existent and emerging car-to-device, car-to-car and car-to-infrastructure networks will converge and finally, together with standardized middleware and development APIs, create a common platform whose components are transparent to its users. This process and the development of more intuitive input methods will enable the implementation of many new or enhanced services that provide value to the user and hence significantly influence the market environment.

1.1 Introduction

The emergence of new software concepts promises high potential for innovative applications. Those elaborate services require reliable transmission technologies that can provide high throughput with guaranteed quality. Current car-to-infrastructure communication standards don't satisfy these requirements, but emerging mobile communication systems promise to fulfill these expectations. Once data has been delivered to the car environment, efficient in-car data transmission channels are needed. Currently, there are separate networks serving different purposes in the car, including body control and infotainment. They are providing sufficient capacity and reliability, but only the emergence of embedded All-IP networks will facilitate frictionless connectivity. To handle the new services, improved input devices are required. Intuitive human-machine-interfaces are needed to control the broad spectrum of applications and to focus the driver's concentration on the road. Consequently, it will be possible to offer sophisticated applications that take advantage of a universally connected infrastructure. As cars become standardized platforms with highly integrated components and use a variety of networks to communicate with their environment, seamless mobile services are realized, adding significant value for the customer.

In our report we first discuss trends in extra-car and intra-car communications. Afterwards we examine promising intuitive input methods and conclude by discussing the influence of our findings and recent software development trends on service provision.

1.2 Current Technologies

In this chapter we briefly introduce technologies which are already established on the market and categorize them into extra-car communications, intra-car communications, usability and enabled applications.

1.2.1 Extra-Car Communications

Following is a survey of current communications infrastructure, that can be used to deliver data within the car and allow for basic navigation within different environments.

1.2.1.1 GSM/GPRS

The Global System for Mobile communications (GSM) represents the second generation of such systems (2G). Its digital nature allowed the effective use of time sharing of resources. It also provided limited data communications which quickly reached limit (bit rates from 9.6 kbit/s up to 14.4 kbit/s). General

Packet Radio Service (GPRS) is an extension to GSM and hence 2.5G. It is the first step towards providing data communications for mobile devices. In its advanced version GPRS coupled with the so-called Enhanced Data rates for GSM Evolution (EDGE), a theoretic data access of 400 kbit/s is possible (actual raw rates are much below due to sharing and other coding overhead). [28, pp. 17f]

1.2.1.2 3G/UMTS

Universal Mobile Telecommunications System (UMTS) represents the main step towards 3G. This system uses a totally new signaling technology called Wide-band Code Division Multiple Access (WCDMA). This very technology broke "the radio technician's iron-clad rule that two or more users may never occupy the same frequency" [28, p. 30]. Furthermore, International standards bodies agreed on the joint development of this standard within the framework of the so-called 3rd Generation Partnership Project (3GPP) thus again leading to wide acceptance. One other main feature is UMTS' inherent support of Quality of Service (QoS) allowing distinctive bit stream treatment and thus higher ability to support numerous types of services beyond the traditional voice call. UMTS Release'99 was the first full standard of this kind. The later releases: 5 & 6 (2005 and 2006) comprising the High Speed Packet Access (HSPA) standard, provided real improvements in data rates. Only recently T-Mobile upgraded all of its UMTS network to full HSUPA capability (besides HSDPA) allowing upload rates of 1.4Mbit/s and download rates of up to 7.2 Mbit/s. [43]

1.2.1.3 WLAN

The concept of Wireless Local Area Network has become a means of effective connectivity even in outdoor environments. The IEEE802.11 protocol has been particularly successful and considerations to use it for vehicular ad-hoc networks has received considerable attention lately [37] as is the case for the CarTALK2000 [41] system and NOW (Network-on-Wheels). WLAN and its applications to cars is subject to intense research and already data rates in the range between 6 to 54 Mbit/s are possible. [48]

1.2.1.4 GPS

The Global Positioning System, was originally developed as a dual-use system with its prime purpose being military, and its secondary in providing civil navigation services, which quickly dominated and expanded. Applications range from mapping, surveying, air traffic management to global change research. GPS' civilian arm is limited by intentionally introduced inaccuracy due to military reasons. [53] Typical civil accuracy is in the range of 10 to 22 meters. [59]

It is seen from the analysis above, that the maturity level of nowadays communications systems is more than sufficient for the traditional voice conversation, however has large room for improvement in terms of data delivery capability, which is the essence of providing in-car services. In the next section, current in-car communications systems are analyzed.

1.2.2 Intra-Car Communications

After the discussion of current extra-car communication networks and systems in the previous chapter, the topic of intra-car communications will now be considered. First the CAN and FlexRay systems are explained, followed by the introduction of the MOST system and finally a discussion of Bluetooth, USB and Firewire closes the chapter.

1.2.2.1 CAN and FlexRay - The Chassis Control Backbone

The Controller Area Network (CAN) is a serial data bus especially designed for vehicle networks [2]. Currently it is mainly used for transmission of power train and body data which is relevant for safety [2, 39]. Its normal transmission rate is given by 1 Mbit/s for 8 bit packages when the network length does not exceed 40m [2, 44]. The disadvantages of the CAN bus are host processors needed at all devices, no simultaneous data transmission and no direct communication between single devices.

The next generation of serial bus communication in the automotive industry is the FlexRay protocol. It will succeed the CAN bus system featuring upgraded bandwidth, reliability and real time transmission. FlexRay will be the middleman until SpaceWire will be dominating in-car networks [38]. (See Figure 1.1). FlexRay supports data rates of up to 10 Mbit/s [23]. The limited bandwidth and intricate architecture are the reason for its upcoming replacement [17].

1.2.2.2 MOST - The Infotainment Backbone

The Media Orientated System Transport (MOST) is currently the state of the art in transmitting infotainment data in highly equipped cars [36]. It has a maximum transmission capacity of 25 Mbit/s. This capacity will be enhanced to a network carrying 150 Mbit/s in next generations [36]. The system is used for transmission of audio streams, video streams, VoIP and other multimedia applications. These need transmission rates of about 8 Mbit/s [39]. MOST is using a ring topology where data goes from the output of one device to the input of the next [36]. This principle is very convenient to OEMs as it simplifies installation of various device sets. There are continuous data streams (synchronous) used for the transmission of audio or video data. Packet data like GPS or Internet travel the ring of devices unsynchronized. A CPU can be installed, but is not necessarily needed. Optical fiber is used as the physical underlying architecture [2]. The payload principle, where a MOST non-compliant device's data can be encapsulated in a MOST pocket, is used for devices not compliant with the MOST-protocol. Thus devices like PDAs and Laptops can easily connect to the ring through wired or wireless gateways [36].

1.2.2.3 Technologies for Device Connection

Bluetooth is a technology creating wireless private area networks (PANs) using the principle of frequency hopping spread spectrum. It is currently used for the connection of external devices to the car's media network [2]. The license free ISM band at 2.4 GHz is utilized for transmission [46]. It can just communicate over short distances of up to 10m. The achieved data rate is similar to the CAN bus system with 1 Mbit/s.

USB Connections have a very high data transmission rate of up to 480 Mbit/s, but as they need wires and plugs for the connection to integrated devices, they are of minor importance in the automotive environment. Firewire is the Apple developed competitor to USB. It has a similar high transmission rate, but the same problems hampering its convenience for future use.

In the following section current technical solutions of usability are discussed.

1.2.3 Usability

After the description of data bus systems, the Media Oriented System Transport and diverse device connections in the previous chapter, this part will continue with an introduction of current technologies, their function and how they are or will be implemented into the car.

1.2.3.1 Touch Screen

The Touch-Screen- Technology as an established and highly developed technology, combines both input and output device . It offers fast navigation due to the direct control through physical navigation. It is universally applicable and can convert its user interface easily. Navigation could be done by one to several fingers/users; e.g. the iPhone, which supports rotation- and zoom-in and -out applications [31, 22]. Due to the area of application, there are three main systems to be differentiated into devices which function with the pick off voltage, acoustic waves or infrared rays [4]. Within a car, a touchscreen would have to be positioned next to the driver, to make it easily reachable.

1.2.3.2 Speech Recognition/Voice Control

The use of speech recognition systems is convenient in areas of application where a person cannot make use of his hands, e.g. in the car. With the car navigation- system being controlled by voice, the eyes can remain on the street which enables safer driving. A big challenge for developing accurate speech recognition systems, is the filtering of the different background noises and reverberations which add up to the input signal [24]. Although there is an electronic assistance which helps to filter out unwanted noises and distractions from the environment, the Voice- Control-System in cars is usually activated by a button on the steering wheel [10]. Currently, voice control systems in cars are used in areas like telephony, climatic control, navigation, sound system, text-to-speech and speech-to-text systems [12].

1.2.3.3 Devices

Bluetooth, as a standardized and widely available standard with most mobile phones, is the interface between the car-IT-System and the mobile device. So far, the wireless data transfer is very limited due to low network capacity via Bluetooth with approx. 1-3Mbit/s [7]. Applications are confined to standard telecommunication services.

Currently many portable devices exist, but however only few of them are provided with interfaces to the car- IT- system. A problem is the tremendous amount of different devices and their many manufacturer and standards, as well as the artificial barrier made up by the car manufacturer in order to sell their own devices and systems [20]. Only few popular devices like e.g. the iPod are granted by special interfaces.

Integrated devices within a car concentrate on the car infotainment, entertainment and navigation systems and the integration of mobile phones. A big advantage of integrated devices in comparison to portables is that they are able to communicate with the car manufacturer and provide the driver with technical analysis and assistance in case his car broke down [32]. Internet access in cars will soon be offered by certain car manufacturers [9, 56]. The following section will focus more on integrated devices respectively Intelligent Transport Systems and their current service abilities.

1.2.4 Enabled Applications

In the previous chapters we introduced current technologies and their capabilities. Now we will discuss their potential in creating services for customers and have a look at available solutions.

1.2.4.1 Mobility and Vehicle Services

Mentionable effort is made to integrate information and communication systems into cars and transportation infrastructure, e.g. in the USA, Europe and Japan. BMW developed a concept called ConnectedDrive which is offered over GPRS. It includes five components called Assist (navigation), Online (personal information services), TeleServices (maintenance services), Tracking (theft prosecution) and Internet [8]. Toyota calls its system G-BOOK mX and focuses on safety, environment and comfort [52]. The trend leads towards the creation of Intelligent Transport Systems (ITS); networks of vehicle systems and infrastructure components that aim at reducing congestion, emissions and accidents. Correspondent applications are (among others) electronic toll collection and emergency vehicle notification. The development of an ITS is most advanced in Japan where several OEMs, supported by the Japanese government, started to implement the Vehicle Information and Communication System (VICS [54]), an infrastructure designed to supply drivers with all relevant traffic information. The services are provided by official institutions (road administration offices and police headquarters) via frequency modulation (FM) broadcast, infrared and radio-wave beacons free of charge. They include dynamic navigation depending on roadworks and traffic conditions as well as information about speed regulations and parking lot locations. In addition, personalized services like providing maintenance and public transport information are available.

However, the potential of driver-assistance systems is still limited due to the lack of connectivity between the sensors on the CAN-Bus and external applications like the navigation system on a portable device. In addition, navigation systems are usually not connected to the Internet, therefore they cannot update maps dynamically; they only can use the traffic message channel (TMC) to get information about temporary events like traffic jams. Despite VICS and their ability to connect vehicles and roadside infrastructure, the connectivity between car internals and nomad devices is still poor.

1.2.4.2 Personal Services

Personal services include all applications that are centered on the customer and his needs. This is true for multimedia applications which usually include radio streaming as well as audio and video playback from discs or selected portable devices. Recently, multimedia systems with local storage are implemented, therefore allowing the customer to store a selection of media in his car and use them on demand. In addition, television broadcasts can be received inside cars. However, due to the unsatisfactory Internet connections available, real content-on-demand is still not provided. There is also a lack of integration of portable and mobile devices.

Another type of personal services are work-flow applications which are rarely to be found in cars. Usually, business related data is kept on a portable device (e.g. a laptop or PDA) or a mobile phone; to work with them it would be necessary to either synchronize data between the device and the car, or to connect the device and control it directly via the car's controls. In addition, present input methods are not fitting the user's needs. Therefore, work-flow applications are restrained to the reading of e-mails and appointments via a voice engine.

1.3 Emerging Technologies

After discussing the status quo, we now look at emerging technologies and concepts which are likely to become state-of-the-art in a few years. We examine their capabilities and then predict the developments they will inflict.

1.3.1 Extra-Car Communications

In order to understand how future in-car services can look like, a brief survey of upcoming technologies shall demonstrate the capabilities of such technologies to reliably transfer data into the car.

1.3.1.1 LTE

Long Term Evolution is one of the main 4G mobile communications standards. Although considered an advanced UMTS release, it uses a different signaling technique. LTE builds upon lessons learned from current mobile communications systems coupled with advanced communications technologies to provide unprecedented data rates. Maximal practical data rates are expected to be around 100Mbit/s for the downlink and 50Mbit/s for the uplink Holma and Toskala [25, p. 463]. Typical user rates lie in the range of 17Mbit/s. This is clearly above the 8Mbit/s rule of thumb minimum required data rate to provide typical services such as VoIP, video streaming, multimedia application, etc.. Field trials by Ericsson already exceeded 100Mbit/s [27]. T-Mobile's 2008 test resulted in data rates beyond 130Mbit/s on the downlink and more than 44 Mbit/s on the uplink [49]. The Association of German Internet Industry (eco-Verband) is expecting LTE deployment in two to three years. As reason it cites LTE's capability to support ten times as many users as currently possible, while pertaining the attractive feature of being an evolution of the currently installed HSPA and hence naturally the most cost effective alternative within all competing technologies [43]. With more than 10 million Germans already surfing mobile Internet, as the TelekomForum reports in its 2008 conference on mobile communications trends (Bonn, 25 September 2008), it seems LTE is the technology to facilitate the increasing future demand.

1.3.1.2 WiMAX

Worldwide Interoperability for Microwave Access (WiMAX) is being developed as a 4G standard to provide universal mobile services over long ranges satisfying a number of communications types, including Wireless LAN services and Broad band home-Internet access. A study conducted by the "Competence Center for Broad Band Communications" of the Munich University of Applied Sciences showed that WiMAX can meet the promised data rates, however only under "optimal" conditions [40]. Also it is to be noted that two years after the auctioning of WiMAX frequencies in Germany, coverage is still scarce. Nevertheless some German Internet service providers are deploying WiMAX to provide broadband home-Internet.

1.3.1.3 IMS

"The Internet Multimedia Subsystem (IMS) is seen as a promising solution for facilitating multimedia service creation and deployment as well as supporting interoperability and network convergence. It allows the network operators to play a central role in traffic distribution, therefore being more than "bit pipes". [6]. IMS defines an architecture for multimedia service delivery over the IP protocol, consequently laying down the foundation for the merger of wireless networks with the Internet network, the so-called Network Convergence. IMS' attractiveness lies in the non-proprietary Application Programming Interface (API) which opens up the field of communications services developments to a broad spectrum of developers. And hence the operators are not any more reliant on the vendors in terms of introducing new services, while still maintaining control over offered services.

1.3.1.4 IPv6

The Internet Engineering Task Force (IETF) is working on IP version 6 (IPv6), the new Internet Protocol standard. This comes as answer to the limitations of the current IP (IPv4) which is plagued by limited address space and inherent incapability to provide guarantees on quality. IPv6 boasts amongst others a bigger address space, capability to provide QoS, increased security (IPsec), and mobility support using MobileIP. The IETF has realized that the switching from IPv4 to IPv6 will not happen over night, and has worked on various technologies to facilitate the smooth migration [18]. The attractive features of the new IP are fundamental to car service delivery, which is inherently mobile and does not compromise security.

1.3.1.5 Galileo

Galileo, the European satellite navigation system was finally started in 2008. This system is different to GPS: It is totally civilian and hence does not include intentionally introduced inaccuracy. It also promises an accuracy of location of 2cm [3]. In one operation mode it can co-act with GPS to provide even more precise positioning. Galileo's attractiveness to cars is its specific design to provide Safety-of-Life applications as well as commercial services amongst others [15].

In 1.3.2 an insight into emerging in-car data handling technologies will be provided that complement the extra-car infrastructure in terms of successful provision of services inside the car.

1.3.2 Intra-Car Communications

In the previous section the emerging technologies of extra-car communications were discussed. In the remainder technological trends of intra-car networks are examined. The SpaceWire system, car applications of RFID technology as well as Wi-Fi and Bluetooth are discussed, and finally an assumption of future developments of in-car networks is made.

1.3.2.1 SpaceWire - Future Chassis Control and Data Stream Backbone

SpaceWire is to replace the current CAN and FlexRay systems [45]. It is also a serial data bus transmission system, but offers higher data streaming capacity and reliability. New applications like video sensors and vision assistance need a stable connection to the car's CPU with a bandwidth of several tens of Mbit/s. Unfortunately the emerging MOST systems lack the reliability needed for these safety relevant applications, though offering enough bandwidth [45]. The standard is based on LVDS (low voltage differential signaling) and thus achieves high data rates of up to 200 Mbit/s at relatively low voltage. There are four pairs of twisted copper cables necessary to guarantee fully duplex and bi-directional data flow[16].

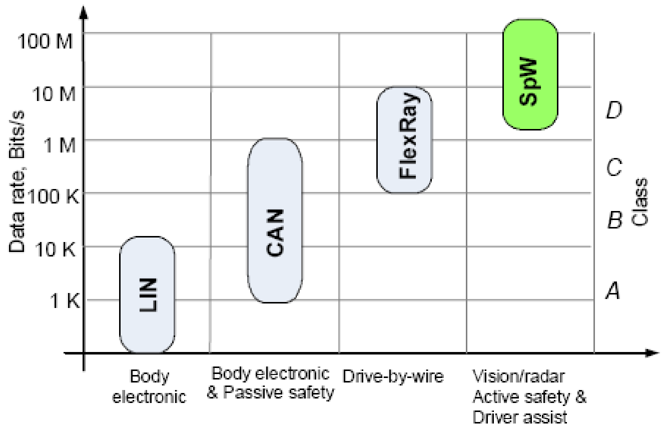

Figure 1.1: Comparison of Bus Systems
Source: Saponara et al. [45]

1.3.2.2 RFID - Future Chassis Control Possibility

The intensive wiring of the currently used CAN network implies much costs and weight for a new car [51]. This could be significantly reduced by using RFID technology for the communication of sensors and microprocessors (See figure 1.2). Transponders (Tags) are attached to the sensors. These can transmit data to the Reader via radio frequencies when the Reader sends energizing pulses to the Transponders. The Reader itself can communicate with the microprocessors via the bus system or wireless connections [51]. Consequently this technology could reduce car wiring and enable much more sensors to be placed inside a car. The largest problem identified by [51] is the power loss in transmission. This problem will have to be overcome to make the technology feasible for in-car use.

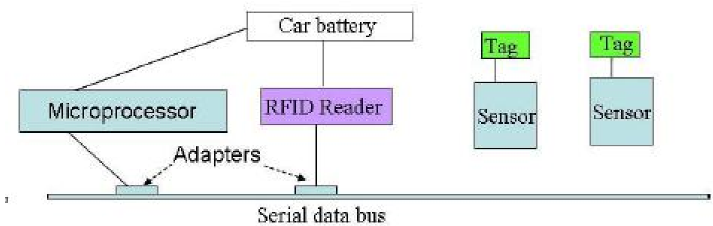

Figure 1.2: RFID Sensor Communication
Source: Tonguz et al. [51]

1.3.2.3 Wi-Fi, Bluetooth and Wireless USB for External Device Connection

Wi-Fi is a communication technology used for longer-distance wireless communication. It has a very high data transmission rate of 54 Mbit/s but also a very high power consumption. Thus it would only serve for in-car devices connected to the car battery. Bluetooth has lower transmission rates and shorter transmission distances. However, there is an advanced version of Bluetooth capable of transmitting 3 Mbit/s and a proposed device, WiMedia Alliance, reaching 52-480 Mbit/s [29]. The technology is also called wireless USB. These data rates enable video and high quality audio streaming making wireless UWB an option for connecting in-car infotainment devices to the car's CPU. As networks up to 10m are envisaged, the power consumption would be far less than Wi-Fi connections [29]. Applications could be key-less car entry, using Bluetooth headsets for system control and remote diagnostics. But there are concerns about hackers intruding this WPAN network [34].

1.3.2.4 Future In-Car Networks and Storage

Currently there are already powerful CPUs inside a car managing body control and networks. These include the CAN bus, MOST, RFID Sensors, Bluetooth and outside connections like WLAN [33]. A upcoming trend is the integration of large storage capacities to the CPUs. They will enable buffering for videos and upstreaming of collected and processed sensor data. Software companies are currently working on programs managing all the needed interactions for consumer applications and driver assistance systems [33]. This process also enables the standardized IP based communication. It offers the great advantage of well developed authorization, security and addressing [30]. The physical infrastructure will be the Ethernet. IT will ensure a fast and reliable connection of all devices using the Internet Protocol, which integrates the car into the world wide web [21].

In the following chapter future technologies which enhance the usability of future devices and applications are discussed.

1.3.3 Usability

After the overview of potential successors for data bus transmission systems and the forecast for wireless communication technologies, the next part will discuss future trends for mobile devices, seamless transmission as well as a potential optical input technology.

1.3.3.1 Smart Phones

With the share of smart phones growing very fast on total mobile phones, it is a matter of time until they replace most of other portable devices. With PDAs as biggest competitors, the smart phone already clearly positioned itself in the market [1, 11]. Through GPS capabilities, smart phones can also be used as a navigation system and can be seen as a threat for devices like TomTom and others [60]. Nothing is more convenient than to have all applications in one device. A merger of infotainment, entertainment and telecommunication is already existing. With the Smart phones running on complex- standard operating systems like e.g. Windows CE or Mac OS X and with increasing memory capacity, the devices are getting to a level where most all- day computer applications can be run on smart phones. The consequence is that a lot of information is stored on smart phones and could be used wherever the Smart phone user is going. By entering the car for example, the car-IT-system could start with the wireless transmission of the data from the smart phone so that all required data is available on the more comfortable car-IT-system for the user. Information could include on the one hand personal information e.g. the body dimension (to fit the seat positioning), temperature preferences or driving behavior (to trim the carriage) and on the other hand hard facts like e.g. address book, music- files, emails etc. At the end of the driving session, the smart phone should be updated with all new or changed data [32]. This exchange of data could enable a digital driver's logbook (which is saved on the smart phone and transmitted to the administration department) and could facilitate the use of permanent changing cars within a company fleet in order to provide the driver with the same settings in each different car. Requirements for advanced communication between car-IT and mobile phones are faster network possibilities and standard interfaces.

1.3.3.2 Session Mobility

The aim of Session mobility is to enable seamless transmission of active sessions between portable devices, car-IT-system and e.g. home entertainment systems. The starting position is that these different devices have different capabilities and usually different protocols. Following it is essential that all the devices must be based on common protocols, to enable communication between them and to remove barriers. The first step to enable a session transfer for a user is always the search for devices in the vicinity of the user where the current session could be transferred to. The second step would be the check for rights to use the device where the session should be transferred to, since most devices cannot be configured for multiple users. Therefore a mobile device could inherit a role as an information transmitter between the integrated/ stable devices, the mobile phone as a buffer for active sessions until a device is found and the rights have been checked up [47]. A radio program which was listened to in the car for example, should be automatically transmitted to the home entertainment system with leaving the car and entering the door. Hereby the mobile phone can act as a transmitter, since it is with the user anyway. This should also work for unfinished tasks such as unfinished emails etc. [32]. Disruptions of active sessions could be caused by waiting time to build up a secure network or time the device needs to adapt to new conditions, as e.g. the download of a new user profile. Radio- and TV- programs could be buffered through the mobile device whereas phone calls could be badly affected by delays [19].

1.3.3.3 Holo-Keyboard

The holographic keyboard is a virtual input device. It consists of a projector, an invisible-light transmitter and a light receiver. The device is able to project a keyboard pattern, which the user then can use for typing. When the user touches a projected pattern, invisible-light is emitted and received whereby the position of the user's finger can be measured and be translated by software into a letter [26, 50]. The keyboard can be adapted to any application. Furthermore, this technology is very space saving; given the conditions in a car, there would be hardly space for an extra keyboard in the console. Although there is the possibility of a touch screen as navigating screen, a holographic keyboard could enable a bigger depiction of patterns and could simultaneously save operating space on the screen. With the patterns being bigger and projected to a more horizontal background in comparison to the vertical navigation screen, the user is able to type faster and with less typing failures [26]. Accordingly, this technology could be a completion to a full- fledged navigation/ computer-system in future cars [32]. To enable all the technological developments above, it is necessary to have common software and transmission standards that build the technical basis for future applications. This and other topics regarding software development are discussed in the following part.

1.4 Implications

After discussing emerging trends in the fields extra-car communications, intra-car networks and human-machine-interaction, we now will introduce services made possible by these technologies as well as trends in software development that also influence future applications.

1.4.1 General Trends

As we learned in the previous chapters, the major trends influencing application development are the convergence of networks along with the standardization of platforms and, to a smaller extent, the implementation of intuitive input methods. The convergence of external and internal networks to provide the user ubiquitous connectivity will have a similar effect on automotive information and communication technology (ICT) as the emergence of the Internet had on the PC. As availability, bandwidth and stability increase and costs greatly decrease, users will take advantage of online content and services, therefore driving development and innovation. To make this possible, however, it's not enough to connect the networks. There is also a need for standardized software platforms that ensure the compatibility of developed applications with a large number of car computers. The emergence of common software platforms (e.g. Microsoft Auto or Autosar), flexible middle-ware (e.g. KESO [57]) as well as uniform development tools (e.g. MACS [42]) will greatly simplify the development of applications and make them available to a broad audience. Finally, the development of more intuitive input methods, like reliable voice and gesture recognition, multi-touch screens and holographic keyboards will further increase the ease of use. In addition, the more intuitive and easy the user can control his applications, not only is he less frustrated by various buttons and complex procedures but also less distracted from driving the car. As a result, more applications become controllable and therefore demanded. To sum it all up, these three developments will create a common framework for software developers as well as for users that will allow the emergence of a broad spectrum of application and services.

1.4.2 Software Development

Besides general trends, there are also topics in software development which will have a significant impact on further applications. First, there is the emerging of semantic webs [5]. The vision is a network where autonomous agents are given tasks and complete them without further user interaction by interpreting an ontology that defines objects, their attributes and their relations.

Another interesting trend is the development of advanced context-aware applications [13]. Emerging from location-based services like dynamic navigation, they do not only take spatial data into account but also use information about the user, the car and/or the environment. The vision is to create sentient cars [55]. This is especially interesting regarding the possibility of ad-hoc car-to-car networks [14]. Cars may connect to each other when in close range to exchange information about environmental data (like traffic or emission information) that are only of limited relevance in terms of location and time, therefore not important enough to upload them to the Internet.

Since networks and platforms converge, security becomes a even bigger issue than before. In this context trusted platforms may be worth mentioning. It is clear that without appropriate security technology the discussed trends will get stuck.

1.4.2.1 Mobility and Vehicle Services

Regarding the emergence of car-to-car and car-to-infrastructure networks, context-aware applications and semantic networks, a lot of possibilities for driver assistance systems are created. This will be especially attractive for fleet managers or individuals who user their car for business purposes since it will be possible to automatically create a detailed driver's log, including all relevant parameters. Car-to-car communications allow a safer and more economically style of driving since the behavior of other cars can be taken into account. They also can help to avoid congestion by providing local alternatives to crowded routes. An important role is played by ITS; besides the already implemented navigation and personal information services it is the intention to implement value-added services and revolutionary applications like autonomous driving. In Japan it is planned to provide these services country-wide after 2010-2015 [35]. However, with new services also the danger of overstraining the driver with too much information comes along. Systems need to avoid information overflow and distract drivers as little as possible. One way to achieve that may be appropriate prioritization [58].

1.4.2.2 Personal Services

Since networks and platforms get standardized, the seamless integration of devices into the car infrastructure will become much easier. As a result, the usage of decentrally distributed multimedia content will be virtually frictionless; portable and mobile devices connect to the car infrastructure intuitively via bluetooth, wireless USB or wireless LAN and their data can be used via the car's multimedia system. In addition, Internet streams will be available. Due to semantic networks and context-awareness it will also be possible to provide content depending on customer's preferences and environmental factors more precisely and more automatized than ever.

Due to the development of proper input methods and the inter-connectivity of devices work-flow applications will be of greater importance than before. The implementation of holo-keyboards gives drivers access to their accustomed input device when the car is standing still, and reliable voice recognition will allow editing text even while driving. Since the files are not transferred to the car's storage but edited directly on nomad devices, there is no need for synchronization. This is also important when dealing with sensible data since no copies remain in the vehicle.

1.5 Conclusion

In our report we discussed several trends in the fields of extra-car and intra-car communications as well as intuitive input methods and software development.

As a result, we introduced ideas of applications and services enabled by those trends. We conclude that we will see a convergence of the various extra- and intra-car networks and vehicle software systems in the next few years. This will result in the seamless integration of vehicles and roadside infrastructure into wide area networks and finally the Internet. Consequently, various applications and services will become available that take advantage of this interconnectivity. The availability of intuitive input methods will allow drivers to handle this variety and increase the acceptance of these new systems, therefore laying the foundation of the success of the interconnected car.

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Chapter 2
Market Pull

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The in-car-ICT market consists of five players (service providers, telecommunication operators, OEMs, device manufacturers, consumers) and shows problems like “telematics systems are too expensive”, “missing standardization”, “long innovation cycles”, “data protection”. One important problem is a gap between the solutions offered by the industry and the actual needs. To solve this problem this paper lists the needs of today’s customers (“information”, service optimization”, “entertainment”, “always on”). Based on the current needs the future customers needs are identified. It turns out that the customers of the future will have needs like “fast and ubiquitous Internet access”, “self-actualization”, “safety”, “smarter information”, “personalization” and “simplicity”.

2.1 Introduction

In the last two decades, connectivity and communications between individuals both at home and at work have increased dramatically. Since 1990, the number of mobile phone subscribers has leaped from a few million to over 1.1 billion at the end of 2002. The number of Internet users worldwide was only two million in 1990 and surpassed 660 million in 2002. Personal computers in use have risen from less than 100 million in 1990 to over 660 million in 2002. The result is that a large portion of the population is dependent on communications and content and wants to extend this capability to their vehicles. This creates a long-term market pull for telematics technologies and the resulting telematics content and services [85].

A lot has happened since the first cars and their wooden dashboards were introduced. Nowadays, the dashboards have almost turned into information centers embracing new technologies. The rapid development of traffic telematics applications and in-car communication applications provides drivers with radically enhanced information and functionality [75].

In the following section, the status quo of In-car-ICT is described. It explains the current market situation and the current customer needs. Based on the status quo the future market situation is derived and future customer needs are identified.

2.2 Current Market and Customers

In the following the status quo of the In-car-ICT is described. This section is needed to provide the foundation for deriving the future market situation and what the future customers look like.

2.2.1 Market in Brief

Within this section the relevant market segments, the market players and the problems of the market are described. It is shown that in-car ICT is a market of size.

2.2.1.1 Market Segments

Basically four market segments of today's in-car information and communication (in-car ICT) systems can be identified:

- *Communication* (e.g. hands free communication)

  The main approach to fulfill two-way communication capabilities right now is an embedded mobile phone with a hands-free car kit [85]. This is the telecommunication operators' main business concerning in-car ICT right now.

- *Navigation* (e.g. GPS-routing)

  The common device concerning location technology is a geographic positioning satellite (GPS) receiver as it is used in most navigation systems [85]. Telecom operators have lately introduced their own GPRS or GPS/GPRS based solutions which offer customers seemingly improved benefit, due to mobility (navigation outside the car). These services have not yet proved to be widely accepted because their business model is monthly subscription. Customers have been used to get these services for free, after they have obtained the necessary hardware and the software [107].

- *Infotainment* (e.g. in-car DVD-player)

  Entertainment services are still a niche in the in-car ICT portfolio. Generally, acceptance of these services is an issue, since they are basically intended for the co-passengers and do not provide a visible value added compared to usage of these service via Internet at home [107]. It is also still much easier and cheaper to download music and video at home, store it on an I-Pod or on a portable hard disk and bring it into the car.

- *Telematics* (e.g. E-Call)

  Emergency and safety services like E-call and B-call (emergency and breakdown call), roadside assistance, thief protection, stolen vehicle recovery do provide clear benefits for the customers. However, usage of these services and profit generation for the service providers is very limited right now. For example, E-Call and B-Call services generate one voice call or SMS message per user every couple of years [107]. Business models which use high yearly subscription did not prove applicable. Customers expect to get these services for free or at least with minimum fees (for details please see the next section on current customer needs). A limiting factor for growth of these services are currently also high costs of systems installation. Furthermore, there is not yet an international standard for the infrastructure needed to provide support for emergency calls. However, there is work done within the EU to develop such a standard [76].

2.2.1.2 Market Players and their Benefits

There are five main types of "players" in the telematics market and they have different benefits. For their functions in detail and their positions in the value chain, please see the Basic Report on "Value Chain":

- *Service providers*

  The first generation of added services were run by joint ventures of car makers, device manufacturers and related companies like digital map suppliers [107]. The Japanese car makers were pioneers on that field. Today's service providers are car manufacturers offering telematics services like Volvo OnCall or Audi Telematics (developed with T-Mobile Traffic), telecommunication operators like T-Traffic and independent service providers like ATX in the USA (providing location based telematics services, which includes locating stolen vehicles). Their benefits are mainly earning profit and product differentiation (car makers). But also service providers like insurance companies have to be mentioned. They benefit from usage data to lower their claims and fraud exposure and can lower rates to customers that are willing to share usage data [85].

- *Telecommunication operators*

  Infrastructure providers like Deutsche Telekom operate networks and provide infrastructure for telematics data transport. Secure position due to ownership of infrastructure enables infrastructure providers to spread along the value chain to other positions, like application developing, service provisioning (for further detail please go to the Basic Report "Value Chain"). They are also very well positioned to make commercial partnership with other players [107]. Benefits arise from an increasing usage of their networks and a higher number of SIM-cards on the market.

- *OEMs (Original Equipment Manufacturers)*

  The major OEM players in Germany regarding in-car ICT are AUDI, Daimler, MAN and BMW. The automotive manufacturers have the most to gain from telematics operational and usage data. The supply of integrated infotainment functions works as an opportunity for differentiation for the OEMs, because ambitious customers pay more for higher quality and better information services [97]. Customer relationship management and vehicle relationship management via telematics systems have significant potential for the automotive manufacturers and their dealers. Telematics operational and usage data is also valuable to numerous segments of the automotive support industries.

- *Device Manufacturers*

  Aftermarket device manufacturers like TomTom or Navigon are right now highly successful with selling their devices directly to the customer. Manufacturers of integrated devices like Motorola and Bosch Blaupunkt are selling their devices to the OEMs. These two business models are the ones which have been "mass accepted" [107]. The device manufacturers earn all the profit, while car companies benefit from the mean of differentiation.

- *Consumers*

There are approximately 300 million car drivers in the European Union and there is a need of a safer, more comfortable and more time efficient driving. The number of vehicles per thousand inhabitants increased from 232 in 1975 to 460 in 2002 [76]. The traffic congestion makes services like dynamic routing valuable for the customer. Basically the customer benefits from in-car ICT technologies due to higher comfort, more information and increased safety.

2.2.1.3 Problems of the Market

Nevertheless the market seems to be interesting, there are also problems with in-car ICT. The following five points are mentioned by various skeptics:

- *Telematics systems are too expensive and few customers pay for telematics services*

  Right now the fully networked car is in total too expensive and high costs for devices lower the success of infotainment systems [85]. Pricing models are not transparent for the customers, who want to know for which exact service they are charged [107]. On the other side, price models accepted by the market are hard to develop and sustain. The challenge with telematics services is to get customers to pay for premium services such as customized news or location-based services. Currently, only a fraction of telematics customers are willing to pay for premium services [107]. The telematics service prospects were grossly inflated as part of the Internet 'bubble' in 2000 [85].

- *Standardization is not yet at the necessary level*

  Competing technologies and end devices limit the choice of customers, as certain telematics appliances might only work in a special car or with a certain end device. The benefits of compatibility and standardization for the different players generate a pressure for a single technology standard to be adopted [102].

- *Long innovation cycles in the car industry*

  Whereas the mobile industry has short innovation cycles of three to twelve months, the automotive industry has much longer cycles of six to seven years for new models and currently introduces new telematics equipment every three to four years with face-lifts or in new models [107]. The missing standards make an upgrade in between very difficult (see "standardization is not yet at the necessary level").

- *Protection and ownership of data*

  This is a problem to be solved before many forms of ICT and telematics solutions can be applied [73]. Many potential customers might be skeptical about telematics technologies for that reason.

- *Gap between the solutions offered by the industry and the actual needs*

  The outcome is a launch of products that result mainly from a technology push rather than from a market pull. This often leads to failure, because it has been shown that it is critical in any industry to develop products the customer really needs [111].

2.2.1.4 A Market of Size

As described before, in Germany a broad range of services are technically possible, but the lack of demand is present for many offered applications [107]. Right now, in-car ICT has been applied specifically to the use of Global Positioning System technology integrated with computers and mobile communications technology in automotive navigation systems. This has been a success story - the number of private households with navigation systems has tripled between 2005 and 2007 in Germany [78]. In the beginning of 2007 four million German households owned such a device - that is 12% of all households. That shows that there exists a huge market for in-car information and communication technology. Furthermore the European market for in-car infotainment was estimated to generate a revenue of about 4 billion Euro in 2008 [97]. Although these numbers seem to be very positive there are a lot of problems with in-car ICT right now that have to be solved before other services can be successful (see “Problems of the Market”). The industry should especially focus on the customer needs and on the critical target groups. In the following sections, this paper examines the current and future needs of the customers and the target groups the industry has to build their services for.

2.2.2 Current Customer Needs and Behavior

One of the most fundamental rules of any business is to identify, to analyze and to understand the interests of the customers [76]. As far as the interests of the customers and their needs are concerned, 300 million car drivers in the EU wish their driving to be more comfortable without any troubles and safe. In order to identify current customer needs, it is important to classify these needs in five application fields:

2.2.2.1 Information and Routing

The vast majority of online Americans hold a high opinion of the Internet as a place to seek information [77]. Getting the weather report, getting news, looking up phone numbers, addresses or zip codes, checking sports scores and getting a map or driving instructions were the most popular answers in a survey done about American behavior towards the Internet. 87% of the Internet users who look at maps or get directions in their everyday lives, do it online [77]. A recent survey of vehicle owners in the USA identified many different services such as parking location, public transport schedules, real time traffic reports and mainly navigation, which the respondents rated as being of high interest to them. Similar surveys have been undertaken for European consumers and while the service priorities are different for European consumers similar needs are observed [96]. Hence, getting the most recent and the most actual information about the traffic situation and the weather condition has been highly demanded for every driver.

2.2.2.2 Service Optimization

We can also go beyond private drivers since privately owned cars are the least used. In average they are driven less than 10.000 kilometers a year [93]. Delivery services are also interested in optimizing the number of kilometers driven and the number of deliveries, as well as gaining transparency on the delivery status. One of the most important economic factors in the heavy goods traffic is the petrol consumption and the energy economization. The car rental companies are not concerned with the driving itself. For them the optimization of the check-in and check-out processes are issues of interest. For taxi services it is interesting to increase the number of customers and to decrease the costs. So timely arrivals and the quality of the services fulfill the customer satisfaction [93].

2.2.2.3 The Need for Entertainment

Entertainment is an activity designed to give people pleasure or relaxation. A survey done by Pew-Internet on 2006 showed that 8-18 year-olds spend about 4h per day watching TV, 1h 44min listening to music and 50min playing video games [99]. Entertainment facilities represent a very important need in the In-car-ICT portfolio. These services are basically intended for the co-passengers. As far TV is concerned, the total number of homes receiving multi-channel television at the end of Q3 2007 has risen to 86.1% [98]. TV, MP3 and games are the highlights of the entertainment in the car. However it is still much easier and cheaper to download media files (music, films, pictures,...) at home from the Internet, store it on an iPod or an iPhone and bring it into the car [107]. In a nutshell, especially young customers need more entertainment in the car.

2.2.2.4 Communication and the Need to be "Always On"

We are living in a very small world nowadays where it has become obvious that the necessity to be "always-on" is nearly vital. The mobile telephone use has proliferated and been one of the most omnipresent communication devices within the past decade. The revolution of the mobile phones brought so many dramatic and fundamental changes to the world, that everybody has been not only obliged to have such a device but also dependent on it or even addicted to it. In Japan, with a population of 128 million, the number of mobile phone users had exceeded 100 million (78.1%) by the end of December 2007 [114]. In addition to that, customers especially telecommuters face substantial changes in time use due to the Internet. Three in five (58%) telecommuters spend more time working at home because of the Internet, 31% spend less time in traffic [84]. In addition to the mobile telephone and the Internet there are many more different ways to keep in touch with the others. The Consumer Electronics Association of America says that the average American home in 2006 has 26 different electronic devices for communication and media [99]. The reduction of this number of devices is highly needed, so that everyone could profit from higher usability and reach a higher multi-functionnality.

2.2.2.5 e-Safety

When it comes to safety, accident handling, roadside assistance, medical and pharmacy services, stolen vehicle remote recovery and tracking, theft protection as well as E-call and B-call are the most demanded ICT-solutions in the car [107]. The existence and the improvement of the safety measures on the roads have been highly demanded in the last five years. The big number of fatal road accidents increases constantly the costs for the health system and decreases the productivity of human resources. No one can doubt that action to reduce deaths and injuries on Europe's roads is urgently needed. At present, more than 40,000 people are killed and 1.7 million injured annually in about 1.4 million traffic accidents in the European Union [104]. There are about 1.7 million road accidents every year in Europe, which need an immediate medical intervention. In case of an accident, the victims are generally shocked, injured or unconscious. So they would be unable to tell about their position or to give any consistent information about their situation [61].

2.3 Future Market and Customers

Having described the status quo, it is now possible to deduce the future market situation and future customer needs. Important target groups are also disclosed and analyzed.

2.3.1 Market Trends

Like most high tech markets the in-car ICT market is very dynamic and the products change rapidly. This chapter describes the most important trends and gives an outlook what the future market might look like.

2.3.1.1 Convergence of Different Devices

Numerous different mobile and portable devices emerged in the last decades. Today's average customers often carry notebooks, cell phones, PDAs, media players and portable navigation devices (PNDs) with them. And the market is still growing. Experts predict that there will be a steady shipment growth of portable devices through 2011 and that the markets for digital radio receivers, edutainment toys, portable media players and portable navigation devices will thrive over the next 5 years [101]. Simultaneously all of those devices will gain more and more features like cell phones which serve as PNDs. Facts like 74% of teenagers use their phones for more than just voice proof that trend.

By 2011 there will be 16.7 million handsets capable of navigation which makes this an extremely fast developing trend [81]. The combination of these two services leads to advantages for the customer: Not only that navigation devices connected to the Internet can receive real-time traffic and the most current map information but there are experiments which use the data generated by mobile phones to provide real-time traffic data in an unprecedented quality [80].

On the other hand PNDs will be equipped with GSM technology for the very same reason. This convergence leads to a direct competition between these device categories.

2.3.1.2 Market Consolidation

The convergence of cell phones and PNDs has a vast effect on the market. If every phone serves as a PND there is simply no need to buy a dedicated navigation device and therefore less market for companies which sell those devices. Already in 2009 phones capable of navigation will begin outselling PNDs [63]. Of course mobile phone producers currently don't have as much know-how as PND producers but they are already taking action to get rid of this handicap [62]. Nokia for example bought Navteq which used to be the biggest provider of digital maps.

2.3.1.3 Market Outlook

Concerning in-car ICT it is important to say, that while our society rapidly advances towards an information age, more and more people and their vehicles depend on wireless technologies to keep them connected with others and to facilitate safe, efficient travel [116]. Numerous analysts see a strong growth potential when it comes to the in-car ICT market [97]. The estimated turnover for Europe in 2010 is 9.24 billion US-$. The largest ICT market segment right now is the telematics systems that are installed by automotive manufacturers [85]. Mobile phone integration systems are becoming popular and are expected to remain the most important in-car ICT application [85]. Also promising is the fact that individuals at younger age or with higher household income are found to be more likely ICT users [113]. The long-term outlook for telematics services and content providers looks promising because the installed base of telematics-enabled vehicles will continue to grow [107]. The important factor for service providers is consumer preference. Certainly there are telematics features specific to the vehicle such as remote vehicle diagnostics and airbag deployment notification that service providers would not be able to provide without collaborating with automotive OEMs. However wireless service providers are much more to the point when it comes to recognizing the customer needs and being flexible with the service offerings. Therefore we think that, ultimately, wireless service providers are likely to have the upper position over automotive OEMs in the future telematics environment [107].

2.3.2 Target Groups

To know the preferences and behavior-patterns of relevant target groups is key to the creation of developing successful products that are demanded in the future [107]. Basically there are four groups of people to focus on: younger people, business persons, working parents and elderly people.

2.3.2.1 Younger People Display Experimental Lifestyle Behavior

Consuming technological products is perceived by the young generation as self-expression, individuality and creativity. Therefore logos and brands in this area have become ever more important for younger consumers as they identify themselves with the object [115]. This is why emotional attachment increases and the younger customers tend to consider 'how can I incorporate this technology into my life?' rather than 'how can this technology help me to complete this task?' [71].

In cars the sales of the lifestyle brand Mini increased from 2003 to 2007 about 27%. This is the highest growth rate in the BMW Group and still a very high rate, when compared to international competitors [68]. As these figures keep growing, there is a great demand for lifestyle environment on the road.

The point is that the life-cycle of cars is about twelve years - on the contrary consumer electronics are usually outdated after twelve months. So users of compact cars will likely not buy the whole integrated technology-offer [90]. In 2007 a study by IFD Allensbach among over 8000 persons found out that already more than 60% of the people aged of 14 to 19 years are at least interested in the iPhone by Apple [106]. Soon, most of them will be able to buy cars. As music consumption in the car is estimated to increase in the future, they want to be able to use these "must-have"-portable devices like their iPod very conveniently during driving [95]. At the moment there are still problems to use mp3 players in the car. That is why e.g. Audi already started to not only offering integration services, but also to inform the customer via an online database which mobile devices are compatible in which Audi car [66].

2.3.2.2 Business People Use Car as Mobile Office

The workplace is not limited to a physical office any longer. At the beginning of 2007 e.g. already 42% of the IBM´s 330,000 employees worked not in the office [86]. They worked on the road, from home or at the client´s company. This saved a significant amount of about $100 million in real estate-related expenses. Google now offers most of the business-tools, like spreadsheet-, document- and presentation processing, online and the use increased from October 2007 to October 2008 about 400% [91, 103]. So it is likely that this trend of the mobile office will also increase in the future .

The mobile office will also make its way into the car, because business-people want to use their time efficiently. Especially well paid business persons need to drive a lot. A study by Ifak Institute among 4136 persons in Germany found out that the driving distance is highly on the income [105]. Those who earn a maximum of 1500€ per month drive less than persons with an income of 4.000€ or more per month. For example do 37% of these highly paid workers usually drive over 15.000km per year, while only 11% of the other group drives the same distances.

Due to the fact that the driver needs his main attention for driving, he can not extensively use physical interaction for working purpose like writing emails. This is the reason why hands-free technologies like voice-controlled devices become very important [107]. The in-car speech recognition system of e.g. BMW can already be used for phone, phone book, navigation and for taking notes [69]. Their "connected drive" additionally offers the possibility to simply call trained staff of BMW to ask for e.g. hotels nearby instead of searching in complicated road maps. In the future the use of natural speech for handling any tasks in the car "will be so mature and efficient that it will be standard" says Helmut Matschi, Head of Division Interior of Continental AG [90].

2.3.2.3 Working Parents

Working parents are an interesting segment for in-car telematics because they have heavy demands in both home and work spheres. Working parents are heavily dependent on the car as a kind of "mobile habitat" in which work and home demands are dealt with. More particularly, it was found that the car is the context within which the transition both geographically and mentally between work and home life is managed [74]. Because of this, working parents spoke of a number of particular stresses associated with car travel. Eardley et al. conducted a follow-up questionnaire involving 715 people in both the US and the UK. They found that some of the most severe everyday problems for working parents were related either specifically to being in the car:

- The stresses of having to drop off or pick up children on time due to the uncertainties of traffic and unexpected demands from home or work: *dynamic navigation, information about daily routes on mobile phone*
- Stresses surrounding remembering objects and items for school and work that must be taken in the car or transferred between cars: *online synchronization of to-do list*
- The difficulty of taking care of work activities (e.g., time management and communications) while in the car: *in-car computer synchronization with Outlook, speech to text application*
- The difficulty of communicating with family and managing and coordinating family life while driving: *family communication (my faves)*
- The difficulty of entertaining children, especially younger ones, on longer journeys: *in-car entertainment (movie download, IPTV)*

2.3.2.4 Elderly People

Due to the demographic shift at least 25 percent of automobile buyers will be over the age of 50 in the next ten years [72]. According to a study by Coughlin et al., published at the MIT, elderly people are the ones who purchase premium cars for private use. They state that therefore it seems quite paradox that especially these cars contain a lot of new digital systems, which elderly people are often likely not using. The reason is that the system expects the knowledge of a juvenile PC user from the driver. Elderly people simply do not have too much knowledge in digital systems [90]. Especially in driving assistant services they rely more on their own often over 30 years of driving-experience than on a digital system [72].

Research has shown, that older drivers take 1.5 to 2 times longer to read information from an in-car display compared to younger drivers [83]. To improve the perception of digital information in the car it should be easily possible to let them adapt size, luminance and contrast fitting to their needs.

The study of Coughlin et al. further declares that older adults practice self-regulation in driving to avoid insecurity. This means that they avoid driving in unsuitable weather conditions, driving in the night, periods of peak traffic or major highways. According to Coughlin et al. this is why older drivers are most often safe drivers. But on the other hand by these avoidances they steadily limit their mobility. Navigation- and location systems which fit their needs could enhance the confidence of older people to travel to unfamiliar locations. It is supposed that due to electronic control and security assists more people will be able to use their car up to a relatively high age. This results in a rising traffic volume of individual motor car traffic till the year 2020 [112].

2.3.3 Future Customer Needs

Based on the identified target groups many important trends of customer needs have been identified. The following section gives an overview what the future customer might want to buy.

2.3.3.1 Fast and Ubiquitous Internet

The Internet already conquered our offices and our homes. Now it is about to spread into our mobile life. In 2010 a quarter of the mobile users will be UMTS subscribers and in 2012 61% of the users will have a 3G capable device [82, 94]. At the same time data service revenues will reach 5.7 billion €. The mobile search market will grow to 1.3 billion users through 2013 and the mobile advertising market will rise from $4.2 billion in 2008 to $14.4 billion in 2011.

Even airplanes will be equipped with a fast Internet access. American Airlines for example plans to expand their just launched Internet service which is currently only available on a few routes [117].

This new era of being “always on” gives the user a feeling of being in demand and needed which is more and more accepted by the society. Mobile devices are used in every possible situation: 41% of Japanese even use them in the bathtub, especially for emails [82].

Not only the availability but also the connection speed increases dramatically. British Telecom for example plans to provide 100MBit/s connections to 10 million households through 2012 [67]. A similar trend is noticed in Germany where several regional providers start to offer fiber connections which at least double the speed currently available.

2.3.3.2 User Generated Content

Sharing content and presenting yourself online has become very popular in the last couple of years [64]. This includes video, audio, photos, blogs, wikis, podcasts and online bulletins. In 2008 over 75 million people created online content and the number is supposed to raise to 95 million through 2011. Simultaneously the amount spent for advertising at user generated content is supposed to rise from $278 million in 2008 to $824 million in 2012. A first approach to integrate this currently Web only functionality in the car is demonstrated by TomTom PNDs where you can add information about blocked roads or update street names and share it with other users online [89].

A quite similar trend is the online representation of oneself and the establishment of friend and business networks. More than 9.6 million Britons use social networking sites in 2008 and the participation is expected to raise to 27 million through 2012 which would be almost half of the population [108]. This makes Great Britain the fastest growing social networking market of Europe. Surprisingly many older people start to participate in these platforms, too. France and Germany are a little behind with almost 9 million users each. Both markets are expected to grow to over 21 million through 2012.

2.3.3.3 Traffic Safety

In the year 2006 over 5.000 people were killed and over 400.000 injured in road traffic in Germany. The good news is that these numbers are decreasing since more than five years [79]. This was made possible due to the development of active car safety systems, which still have enormous potential [87]. According to recent studies over 50% of all collisions could be avoided if all cars would be equipped with these systems. A recent survey shows that vehicle safety is a very important demand of the customers [65]. They listed safety technologies as more than half of their top twenty wants. The only thing more important to customers is fuel efficiency. Collision warning and prevention are two of the most wished features. A few years ago drivers weren't in favor of giving up some of their control to a machine. But now the trend is towards more and more acceptance because the more a safety system can control a car the more collisions can be prevented.

In a recent survey it was discovered that the broad majority wants to have the latest safety technology [109]. More than 80% of the people in Europe want things like the e-Call, real time traffic information, pre-crash systems or electronic stability control. But it was also shown that 60% want the freedom to switch all of those systems off.

On the one hand it seems that the customers want safety but on the other hand they are often not about to pay extra money for it but see it as a matter of course to get the latest in safety technology when buying a new car [93]. This leads to more and more manufacturers shipping their cars equipped with it in series because having the reputation of building safe cars helps them to sell more [100].

A technology currently under heavy development is Car2Car communication [93]. This system allows to warn other cars if e.g. one car just had to brake hard or if an accident happened. The problem is to work properly at least 10% of the cars have to be equipped with it. In Germany assuming that half of all new cars have this technology installed means that it takes three years until the 10% barrier is reached. This leads to the problem that no one is ready to pay for equipments which cannot be used for such a long time. One possibility to bypass this dilemma is to establish a fixed infrastructure which provides the functionality of the missing cars to allow an instant usage of the new technology. Other options would be to provide additional services like fleet management to make it more interesting to the customer.

2.3.3.4 Smarter Information

To show the usefulness of smarter information the scenario of a journey-planner would be very significant. While planning a journey a Web-Service would work out and compute the route e.g. map engine. The route planner would be able to consider more relevant information like current environmental conditions. This Web-Service could tell information about the nearest petrol-station which accepts a certain type of loyalty card (petrol station location finder). If the preferred station is too far away from the current position, the Web-Service will ask for a different set of parameters to find another alternative. After or during the journey information about the car's performance e.g. consumption, pollution, top-speed... can be uploaded to a centralized data center and stored for a future use. Thus the state of the vehicle can be monitored throughout the journey, but a description of the environment and the infrastructure surrounding the vehicle during the journey can also be monitored and later reused by other applications [96]. Moreover, Car-to-Personal Equipment e.g. address book, personal calendaring, synchronization, music download into the vehicle form mobile devices etc.), Car-to-Home e.g. comfortable download of route planning information, music program etc from the home PC into the car and the use of information points, with the latest local information e.g. on parking space or tourist sites can be made available in the vehicle. It is decisive for the acceptance of these applications that they are very cheap to have, easy to use, that they do not cause an information overflow [93].

2.3.3.5 Personalization of the Interface

People who earn less than 1500€ per month tend to drive not over 10.000km per year [105]. Due to this fact and the increasing energy costs more and more people use car sharing, because it can safe them a lot of money. The problem is: The driver is asked to leave the lend car in the state he got it, which is: clean and anonymous [88]. No favorite radio stations, no favorite seat settings and no previous destinations for navigation are available.

Also without car sharing it becomes quite difficult to offer a "one-for-all" solution, because drivers are quite different. When cars get more and more complex, it is crucial to adapt the ways cars have to be operated to the individual demands and expectations of the users [70]. Especially in digital technology this mass individualization is more easy to handle, because no physical objects have to be changed. Ideally this is done automatically with a context aware system. This means that it semantically adapts to the user by showing exactly the functions the user needs in a specific situation. This kind of system can increase efficiency e.g. by overcoming the problem of small screen sizes and limited input functionalities.[92] In the future end-users will pay for these context-aware systems because of the added value via personalized applications. These are tailored to their needs and circumstances, and do always choosing the optimal communication means and serving the user with appropriate assistance. As a next step, context aware systems should support the user's intentions, his plausible needs and meant goals [110]. The vision of the programmable car gets already within reach, because one can create new functions purely by programming and introducing new software [70].

It does not matter if the customization happens automatized or manually. The car "knows" the preferences of the user in any case and car manufacturers can use this information to supply people with better fitting interfaces or even customized in-car advertising.

2.3.3.6 Simplicity in the Car-Cockpit

Cars get more complex also due to software – but due to that software they get safer and more convenient. But to get an easy access to this convenience we have to offer those functions to drivers and passengers in a way where they do not have to operate all this complexity explicitly [70]. To avoid complexity, customers often behave technological agnostic when it comes to use digital products. This means that they only want a "black box" which is easy to use, will cover their needs and solve their problems [107]. Relating to the car, this is not easy to pursue. As technological innovations are being put into the cockpit in inflatable amount, the peril of "Info-Trash" caused by this "Innovation Fireworks" gets very dominant [90]. The advantages of these technologies are gone, when they themselves are the cause of mental pressure, distraction or even errors which cause critical safety issues. "When the customer drives in the car (...) he wants to handle everything immediately, intuitively and logically from the very first time" says a representative of Mercedes Benz [90]. Only if digital technology in the cockpit can provide additional value and convenience, people will be willing to pay for it [107].

2.4 Conclusion

To sum it up, the ICT market in the car will expand while customers like business people, younger people, working parents or elderly people will ask for specific services. Customer needs will develop hand in hand with the emerging new technologies and certain needs like fast and ubiquitous Internet, self actualization, more reliable safety systems, smart information and personalization of car-telematics will emerge in the next five years. As the complexity of most of the recent technologies is manageable, it should be possible to satisfy these needs with innovative customer-oriented product ideas.

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Chapter 3

Legal Issues and Regulation

Henry Brodski, Julia Butter, Dominikus Huber, Liwei Zhou

By providing the services in automobile, telecommunication providers could benefit a lot, but there are still some legal and regulatory issues to be considered. In this report, we talked about all the legal legislation or standardizations existing or upcoming for the C2X telecommunication, including the data transfer, privacy, safety, market regulations etc. Also, we study some emerging applications like E-call, which is controversial because of human privacy. But one thing is for sure, legal legislation is slower than the technology!

3.1 Introduction

Two thirds of the Germans decide against eSecurity and other car-related systems and applications when it comes to intrusion into privacy. This fact reveals a recent study of the ADAC and other automobile clubs. The results of the survey are furthermore connected with the crucial question, what legal trends and upcoming regulations could be relevant for a telecommunications provider who wants to offer services for the automobile industry. The following section will analyze potential legal problems: First of all there will be an analysis of data transfer safety regulations regarding already existing frequency and transmission standards, the necessity of encryption and the issue, which human safety have to be granted. Second, the focus of the investigation will move to the issue of data policy: That is to say which data have or have not to be collected or stored, for which propose the collected data is allowed to be used and if the driver has the right to authorize the collection of data or not. The third section will treat the topic of a cooperative, electronic tracking system, it deals with existing laws for safety during driving, upcoming regulations for new applications, etc. Another burning issue within this chapter is the eCall which is supposed to be mandatory for all new cars being delivered from 2012 on. Finally there will be given an insight in the current market regulation discussions in the field of telecommunication. The possible destabilization of the deregulation means carried out within the last some years shall be highlighted.

3.2 Legal Issues about the Service Centric Car

3.2.1 Data Transfer

Data transfer within the 'Car to X' communication system is an interesting topic, when it comes to the legislation, a lot of issues must be taken into consideration. For the telecommunication providers, it is important to realize that upcoming regulations and law enforcement will influence on the trend of the development of the 'Car 2 X' communication. 'Car 2 X'(C2X) [120] means interactions among cars, between cars and infrastructure, and vice versa using wireless communications. C2X communication enables a great number of use cases in order to provide drive safety or trac efficiency, also provide information or entertainment to the driver. Thus the content of data transferred between cars or between cars and infrastructure is a big issue. It exists some regulations for the available bandwidth for the WLAN usage especially for the C2X communication, and also some standards for the data transmission. Moreover, people care about their safety more and more each day, so whether the C2X is totally safe for the driver as well as the pedestrians become an important issue. Finally, we have to consider also the coding schemes as well as the encryption scenario for the telecommunication providers, in order to protect the safety of the data.

3.2.1.1 Frequency Bandwidth

Since the C2X communication insures the safety as well as the communications in the car, thus it requires a certain level of guarantee for the data transfer. For example, it should keep some kind of minimum latency while sending, forwarding or receiving messages from other infrastructures. This is hard to be guaranteed when sharing the same bandwidth with other communication systems. Especially for the safety critical message, it must arrive to all the receivers in time, no matter who is using this network, no matter how much data flow is currently being transferred. Thus it is a must to reserve a certain bandwidth for C2X communication. Fortunately, there has already some regulations on this part. The Car to Car Communication Consortium (C2C-CC) has already reserved 2*10 MHz effectively protected channels on a pan-European basis preferred in the range 5.885-5.905 GHz for C2C communications, especially for the critical road safety communications. And there is another regulation under discussion, which enlarges the frequency band from 5.850-5.925GHz, for 4*10MHz, in order to provide bandwidth for more information, including the road safety and trac efficiency, and non-safety related data transmission.

3.2.1.2 Safety Standards

In this section, we are going to talk about all the related technical standards for the C2X communication existed, and also talk about some trends in this field in the future. And these includes the discussion about the transmission standards, power, antenna and stuff alike.

Transmit Standard
Because we use WLAN in this communication system, actually it follows the standards of IEEE 802.11p, which is especially designed for Intelligent transportation systems. In the near future we are going to cope with this standards, and maybe some patches will come out in the following years.

Transmit Power
Nowadays, people care about their safety much more than before. And it is necessary to be aware of all the damages can be from radio frequency and large transmission power. The maximum allowed transmit power is 33 dBm. This is the same kind of transmission power we used currently in GSM and UMTS, so it won't hard people more than now. The communication range to be achieved by C2X communication is 500m to 1000m, which is enough for the urban areas.

Data Rates

A maximum data rate could reach 54Mbps, since there is no such huge demand yet, a solution of 3/4.5/6/9/12/18/24/27 Mb/s should also be supported. Although the supported data rate should be more in the future due to the high demand of entertainment and communication in the cars.

Antenna

The antenna beam design is not yet fixed. Since the way of installation affects the performance of communication for the antenna, currently there exists discussions for this topic. Based on the experimental results from ETSI, the circular characteristic of the antenna beams achieves best performance. And the best installation way is to be on the top of roof. This is not going to change in the near future.

Modulation Standards

Half-duplex, which means either send or receive could be the status, but not both, and broadcast communication modes will be used based on the current technology, and modulation scheme should be OFDM (Orthogonal Frequency Division Multiplexer), since using this scheme, it is possible to cope with several channel conditions, for example, attenuation, interference and fading or multipath, oversingle-carrier scheme. Also, this mechanism can be used for several adjacent transmitters to send signals simultaneously at the same frequency, without interfering each other.

3.2.1.3 Security

Wherever there is a network, it exists all the regulations for the transmission. This rule is also true for our C2X communication systems. Although there does not exist a 100% trustful system, there should be some agreement on the trustworthiness of the data. To establish trust, basically the message should be delivered from a trusted source, some extra encryption for confidential data, and certain identification and authentication should be guaranteed. An anonymous authentication of message should be ideally possible.

Encryption

Regards to the encryption part, since using the Wired Equivalent Protocol (WEP), which is based on a certain encryption key, it is not difficult to intercept your data, and it has already crippled with numerous security flaws. So network security is really a big issue. Better security is now available such as DES, VPN, and WPA, but none of them is totally safety. So for the encryption standards, is certainly under discussion.

Certification and Authentication

For the operators, messages from the broadcast can not be trusted until they have been authenticated. If the operator has been certificated by a large group of users, then it has the group signature. In all, for the cars and telecommunication operators, the trust is built between the bidirectional authentication process.

3.2.2 Cooperative, Electronic Trac Systems

In June 2005 the European Union adopted the i2010 strategy that provides a framework for future efforts to support the development of an information society in Europe. One of the three policy priorities of i2010 is to improve the quality of life through different initiatives. A major initiative in this area is the Intelligent Car Initiative. Launched in February 2006, this program is based on three pillars: Coordination of efforts of member states and industry, support of R&D in this particular field and building people's awareness for electronic-safety technologies. The aim of the initiative is to make cars safer, more intelligent and more environmentally sound. Therefore, gaps in legislature may emerge but will be closed by new laws quickly since the overall trend is already cemented by current EU and national law and policy.

3.2.2.1 Electronic Safety Systems

The European Union is aiming for a reduction of fatalities by 50% from 2001 to 2010. With 41.600 deaths in 2005 safety has been improved, yet this is still 4000 above the target [129]. The eCall, the Commission's latest and most pushed effort to reduce trac deaths, originates in the enhanced emergency call recommendation of the Commission, suggesting that all members should adapt the 112 as a European emergency number and think of ways to automatically acquire the GPS coordinates of the caller. This recommendation paved the path for the electronic car safety or e-safety program of the Commission [122]. The case of a drunken driver that failed to cover up his accident because his BMW's connected drive had already called the rescue team and couldn't win a law-suit against the car's manufacturer demanding reparations for his costs [118] illustrates both the existing regulation's state of the art - or the lack of it and the privacy problems that arise with the new technology. The Commission promotes the use of 112 as a pan-European emergency number [121] and after adopting a directive that suggests the implementation of such a number in all member states in 2002 [126] it further specified the requirements to emergency calls in a recommendation of 2003. According to these papers, the member states are hold to provide 112 as an emergency call free of charge that is handled equally to national numbers and eventually adopted as the single national emergency number and provides information on the caller location. On German national level emergency calls are regulated by the TKG in paragraph 108 that binds the supplier of both the telecommunication networks and services. It fully implements and specifies the Commission's recommendations and enables the institution in charge to publicize regulations on technical issues outside the legislative process to accommodate for rapid technical progress. First, there is the question who and if anybody is liable if the electronic system fails and does not send, as expected, an emergency call and he location to a call center. Other than the product liability code providing a general regulatory framework for consumer protection, the German law knows no explicit legislation or cases in this area since the technology is very new [131]. Still, this issue should be considered to be relevant and any legislative or judicative development should be followed closely. Also, since paragraph 108 TKG is not exhaustive, the question of market regulations in the ecall business is still unanswered, and will be explained in the market regulations section. Eventually the ecall could proof to be a leak in the private data security if it sends sensitive data along with the location. However, this part will be discussed more intensively in the data privacy section. Although there are many promising safety technologies currently in development it is one of the main concerns of the European Commission to introduce these technologies into the market as quick as possible . A good example for a safety system that was successfully pursued by the EU is the Electronic Stability Control system (ESC). Although the University of Cologne recently published an analysis, stating that 4000 trac deaths could be avoided annually if every car in Europe had this system, still only 40% of the cars in Europe used ESC in 2005. When faced with the fact that only few drivers were willing to pay for an optional safety system, the benefit of which they did not fully comprehend, the European Commission decided to take action. They relied on a two-sided strategy according to the guidelines of the i2010 initiative which is exemplary for the Commission's strategy on the introduction of new safety technologies: On the one hand they started a legislation process to make ESC mandatory in new cars from 2012 on and have already presented a draft for this regulation in March 2008. On the other hand they initiated a campaign to increase public awareness for this technology, to explain the benefits to the citizens and, finally, convince people to buy ESC. Prior to the intelligent car initiative the Commission has already signed a cooperation between the association of European car manufacturers ACEA and non profit organizations to build a system and provide the necessary legislature[1]. So far, the Commission has no further directives proposed, although EU parliamentarians expect them to come. In Germany, the TMG is the latest effort of the BMJ to adapt EU recommendations and pave the way for future developments in the telecommunication sector. Precedently, the TKG was updated and a short-lived TDDSG replaced by the exhaustive and modern TMG. This developments show two things: first and most obvious the existence of laws that deal with the latest technology (and a bit further) as well as the awareness of the legislator of the necessity to act. Secondly, derived from the recent history in legislature, there is a willingness as well as the possibility to speed up the law-giving

[1] http://www.ertico.com/

process and to provide laws when they are needed and fill gaps when they emerge. Especially in the case of Commission-pushed technologies such as the eCall, and this is probably the most interesting trend, the legislation is even ahead of technological developments. This is possible because the European government is the source of both the new technological trend and the laws accompanying it. With immense monetary resources and, over the council, political power at hand, the Commission was able to plan ahead and control the processes at each step to a certain extent. Therefore, the conclusion is twofold: on the one hand, a concerted action of Commission, Council and industry and non-profit organizations may produce relatively fast adaption and change of legislation to new technological developments. On the other hand, German regulation is always very close to the directives and recommendations on European level that are already quite clear and steady.

3.2.2.2 Environmental Regulations

In 2007 the European Commission presented a framework for its participation in the Kyoto Protocol. The overall amount of greenhouse gases that are emitted annually should be lowered by 30% versus the amount of 1990. [128] Although greenhouse gas emission in the EU decreased by 5% from 1999-2004, the amount of CO2 emitted increased by 26%. [128] Since a significant amount of carbon dioxide emission in the EU comes from passenger cars, the European Commission set the aim to reduce average carbon dioxide emission of cars down to 120g CO2/km in 2012. To reach this goal the Commission wants to bind the automotive industry by law to not exceed these limits with their cars, by improving the vehicle's motor and by using new technologies. [129] Meanwhile the Intelligent Car Initiative presented a completely different approach to reduce emissions. In their endeavor to make cars more intelligent they picked up the idea of an infrastructure-related system that directs the trac efficiently and safely. This Intelligent Transport System (ITS) will use latest Information and Communication Technologies (ICT) that allow the cooperation of cars and infrastructure. Several research projects have already proven that cooperative systems might not only increase safety on the roads but also contribute considerably to the success of European environment policies. A study has found that the Adaptive Cruise Control System (ACC) for example, a system that automatically regulates the speed of cars according to the front car, could reduce pollution by 8-18% if only 10% of the cars had this system. [119] For its contribute to the success of the policy European Commission's policy strongly relies on the development and the introduction of these new technologies, into the market. On the one hand they introduced the Ertrac Strategic Agenda in April 2006, which regulates European research and development expenses on these technology developments. [129] On the other hand the Commission enforces regulatory frameworks that are necessary to implement a transportation system that can be accessed by all Europeans. An example for these regulations is the current attempt to unit national solutions for transportation charges under one summarized framework. [127] Especially for a cooperative EU-wide transportation system, the national market entry barriers are still a problem. To accelerate the legislative process in the national parliaments the European Commission wanted to publish guidelines on tax incentives for the ITS by mid2008 but hasn't done so yet. [129] A final legislative roadmap can be expected as soon as studies have evaluated the overall amount of CO2 reduction that ICT can contribute. [129]

3.2.2.3 Regulations on the Use of In-vehicle Systems

On February in 2001, paragraph 23 1a of the German Highway was applied for the first time. The so called hand-held-prohibition limits the use of mobile phone devices for the driver of a vehicle. It forbids the use of a mobile phone or an integrated car phone if the driver holds the receiver in his hand while using the device. This regulation does not apply for vehicles that do not move and for those whose motors do not run [130, § 23, 1a]. The implication of this new law was interpreted by German courts. According to a recent judgment, the term use does not only imply the use of mobile phones for making phone calls, it even forbids to use any function of mobile phones, including the use of Internet services [133], the checking of notes [132] and the writing of messages [134]. The court argued that the regulation does not differentiate between distinct types of utilization of mobile phones, but it doesn't allow any usage as long as the driver is holding the device or the receiver. The judges explained that it is the intention of the legislator to prevent the driver from driving single-handed [134]. Moreover, the regional appeal court of Karlsruhe decided in a leading case that every device that can generally be used for phone calls is considered a mobile phone and may therefore not be used by the driver. This judgment concerns particularly multifunctional devices like integrated organizer-phones, whose main function are not telecommunication but having equipping to allow phone calls [134]. Nevertheless, a judgment of the regional court of Bamberg denies hands-free equipment as not being part of the mobile phone and therefore allows the driver to use it. The European Commission's future actions, however, might in part be dependent on the results that emerge from recent studies like the HASTE-Initiative. In January 2002, this project was originated with the aim to provide a testing framework that can be used to effectively and efficiently evaluate safety aspects of in-vehicle information systems. The Project is called Human Machine Interface. And the Safety of Trac in Europe examined the distraction caused by these systems and their influence on the driving performance. In March 2005, the HASTE-Committee published a final report revealing a major connection between visual distraction and problems in lateral control of the car. The main findings of the report, however, were new methods that can be used now to test upcoming systems. The committee recommended that the results should either lead to some kind of legislation or should be used as consumer information. HASTE has the plan to add another subgroup to the current safety assessment of cars. According to the plan, the cars should also be judged from the driver assistance. It remains to be seen whether the published results of the HASTE project will influence future regulations or whether they will encourage further studies that may lead to a new sort of quality standards for in-vehicle information systems.

3.2.3 Market

Market Regulation in telecommunication markets, though complex in its economic implications, is far more settled in terms of legislation. 2007's regulation on voice roaming charges [125] is the latest legal document in a history of efforts to liberalize and harmonize the European telecommunication market. Indeed, the roaming prices plunged demonstrating the possible scope to which EU legislation can be elective. This document was preceded and is legally complemented by several directives that, as a whole, build a regulatory framework for the telecommunication markets across Europe. The directive on electronic commerce of 2000 [123], the directive on a common regulatory framework on electronic communication networks and services [125] and the directive on the authorization of electronic communication networks and services [124], both issued in 2002, are deeply reaching into the market and have at their core consumer benefits and protection on the one hand and a more efficient, standardized and competitive European market for electronic communication on the other hand. In particular, Member States are hold to let their procedures and requirements to authorize new competitors and deal with network and service issues of existing ones. Furthermore, Art. 5,7 and 8 of the 2002/20/EC directive govern technical issues such as frequencies and bandwidth in general [125]. Commissioner Reding, in charge of the communication sector and responsible for the directives stated above, explicitly named the dissolution of monopolies and market power in general that she suspected to be existent in telecommunication markets as a main goal of her efforts and provided in articles 14 seq. 2002/21/EC directive the necessary tools to the Members to enforce market liberalization. Further more the regulatory framework is supposed to increase consumer protection regarding both legal contraction and data privacy, as explained in the previous section. Although intense in reach and scope compared to only a few years ago the EU regulations are only as strong as the Member State's implementation. In fact Germany has fully adopted the EU recommendations since the mid nineties in the TKG that strive to demonopolize telecommunication markets introducing a licensing system and imposing a market surveillance duty on German regulatory institutions. Moreover, paragraph 116 to 141 TKG create a federal agency to administer and monitor so-called network markets. This Bundesnetzagentur is authorized to regulate markets such as the telecommunication sector without further legislative backup and immediately and represents the one crucial governmental player regarding national market regulation. Paragraph 48 to 65 TKG regulate pricing and paragraph 66 TKG takes care of the frequencies used in Germany. While the last ten years saw a fierce and quite busy Commission and national government regulating the telecommunication sector and imposing laws, price-caps and even expropriation on telcom-companies the youngest signals point towards even more regulation. Apparently, the institutions in charge are disappointed by what is accomplished by the last decade's flood of regulations see their main goals, consumer protection fostering competition, not realized, yet. This is materialized in Member State specific reports. Therefore, further regulation can and has to be expected, although it is unclear and impossible to say how and when the Commission is able and willing to act. The Commission regards enforcement of existing law as a major factor contributing to the ineffectiveness of the directives stated above. This would rather point to a fining or any other kind of punishment of Member States hesitating or refusing to implement the laws that should actually exist in all member countries. Germany is one of the hesitating countries and both able and willing to pay the fines for a policy it defends against the community and powerful enough to suspend a political process that would lead to such fines. On the other side the Commission has built up a reputation of decisiveness regarding the fight against market power in the markets in question.

3.2.4 Data Safety

In the following we will touch on the subject of data privacy. It shall be presented which laws and regulations exist and which effects these and upcoming legislation could have on the in-car-communication sector.

3.2.4.1 Data Privacy in General

Especially the "Telekom-Skandal" in may 2008 attracted a great deal of attention. Personal data had been heavily misused. Thereupon a lot of debates in public and politics started. Many called for stricter laws and a better protection of personal data. Others defended the German law saying that the legislation was already very strict. These discussion and privacy regulations in Germany and the EU are also related with upcoming trends in the in car communications area and technological developments as the eCall. Civil rights activists rise the question, if we will live in a world where no step we take won't be recorded. Their worries are legitimate, but as it will be evident from this chapter, exaggerated. What will thus quite the mind of civil rights activists, will on the other hand trouble communications providers who are eager to implement new technologies and services. To first existing regulations and laws on data privacy will be demonstrated being described in detail in the following part.

3.2.4.2 Existing Regulations

Data privacy is the relationship between collection and dissemination of data, technology, the public expectation of privacy and the legal issues surrounding them. The challenge in data privacy is to share data while protecting personally identifiable information. To meet theses challenges several laws have been passed: The probably most far-reaching legal regulation regarding data privacy is the Directive 2006/24/EC on the retention of data generated or processed in connection with the provision of publicly available electronic communication services or of public communication networks and amending Directive 2002/58/EC. As a consequence of those directives EU member states have to adopt the content within their national legislation happening in Germany within the "Gesetz zur Neuregelung der Telekommunikationsüberwachung und anderer verdeckter Ermittlungsmaßnahmen".

3.2.4.3 Details of the Regulations

The "Gesetz zur Neuregelung der Telekommunikationsüberwachung und anderer verdeckter Ermittlungsmaßnahmen" obliges communication providers to retain certain data for a period of at least six months: the source of a communication, the destination of a communication, the date, time and duration of a communication the type of communication, the communication device (e.g. computer, mobile phone, etc.) and the location of mobile communication equipment have to be recorded. The German law and the EU Directive respectively apply to fixed telephony, mobile telephony, Internet access, Internet email and Internet telephony. All the data have to be stored for at least six months. During this time they are available to competent national authorities including courts, Customs Criminology offices and the German intelligence service.

3.2.4.4 Trends and Possible Developments

A current development in the field of car and communication is the mandatory implementation of an emergency call (eCall) system in all new cars starting in 2010. eCall is a project of the European Commission intended to bring rapid assistance to motorists involved in a collision anywhere in the European Union. The projects aims to employ a hardware black box installed in vehicles that will wireless send airbag deployment and impact sensor information, as well as GPS coordinates to local emergency agencies. Additional collection of location data in addition to the data to be collected and saved and as a further development of the eCall, the permanent registration of the location of the car could become mandatory for the purpose of the investigation, detection and prosecution of serious crime. Consequences of the regulations for communication providers. Therefore some services telecommunication providers are about to think of will collide with these very strict legal regulations. A possibility to evade the barriers imposed by laws could probably be an agreement of users to allow the communications providers to record certain activities and to use them for improving services.

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Chapter 4

Value Chains

Stefan Fischer, Jonas Huckestein, Veronika Riederle

Entering the market for in-car service solutions will mean considerable changes in how telecommunication providers create value for their customers. With an increasingly complex business environment, the mobile operator's value chain will shift towards an interwoven value network of network providers, providers and aggregators of content and services and car manufacturers. The consequence will be a strategic realignment of the industry's players as the focus of the value network shifts towards the provision of information and services. The business model of the operators will be to capture value by acting as the central axis between service/content providers and the customer, thus offering an open service platform for third parties. This means both an increasing necessity for co-operative behavior in value creation as well as a virtualization of business models and a shift towards a service centric world.

4.1 Introduction

As one can see in the other sections of this book, both the demand of the customers as well as the technological capabilities for the offering of multiple mobile services inside the automotive are already present and will be increasing in the future. Yet, it still has to be examined how mobile operators will (or will not) be able to capture the value created in this new field of business. As the sources of services and information diversify, it will get increasingly difficult for telecommunication operators to be more than just the pipes through which the content demanded by the customer is being distributed. To understand the shift in value creation when entering the business of offering services in the car, one has to understand the value chain logic of a mobile operator today. This will be the author's concern in the first section of the analysis. Then it will be analyzed which trends are identifiable for the upcoming five years regarding the value system for in-car services. Firstly, the strategic realignment of the telecommunications providers will be depicted. Secondly, it will be examined how the industry's value system will change as a whole. In the end, an outlook over the future challenges for telecommunication operators will be given.

4.2 Status Quo

4.2.1 Mobile Value Chain and its Players

The value chain, a concept from business management first described and popularized by Michael Porter [152], acts as helpful tool to visualize the strategic positioning of players creating value for the customer. As the telecommunication industry is very complex there are several layers with several relevant players in the mobile value chain. The present shift from voice traffic to mobile data as future significant revenue source [138] creates even more complexity and competition. The author's concern is to first describe the value chain for mobile telecommunication to give the reader an understanding of the mobile operator's core business.

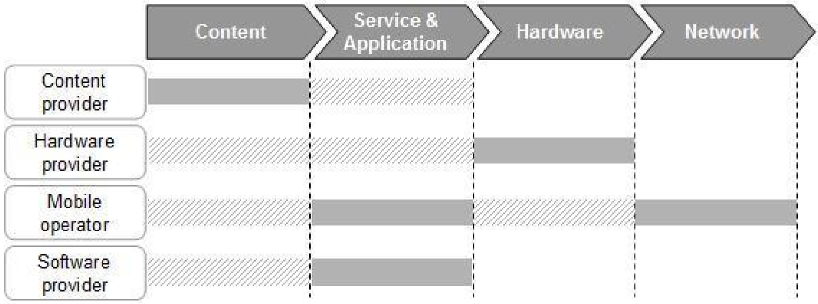

Figure 4.1: Mobile Value Chain
Source: Own Illustration

4.2.1.1 Content Provider

Today content providers suffer intense competition due to the present overload of content: ring tones, images, wallpapers, games, weather, news, maps, directions, financial services [154] or multimedia like video, music or radio. Web 2.0 platforms (e.g YouTube, MyVideo, Flickr) and any kinds of social networks (e.g. Facebook, MySpace, studivz) enable and provide user generated content. Customers can access them directly either via the browser, a search engine (e.g. Google), portals of device manufacturers (Nokia's Ovi) or of mobile operators (T-Mobile web'n'walk, Vodafone's live!). Content providers either gain revenue by advertising or by charging directly for contents.

4.2.1.2 Hardware Provider

Being more than just a functional piece of technology today, the mobile device provides access to content and services by connecting to the mobile network. As new technologies like HSDPA and UMTS have been rendering higher bandwidth rates possible PDAs and smart phones gained significant market share (Apple iPhone, Blackberry) and even laptop manufacturers entered the mobile value chain. With the introduction of the iPhone Apple is even offering its own software (OS X), content and services. In addition traditional device manufacturers are entering other parts of the value chain like Nokia with Symbian and its Ovi platform and as well offering software, content and services for its customers. With the acquisition of Navteq and introduction of GPS-enabled handsets the company also paved the way for its navigation business [150].

4.2.1.3 Mobile Operator

Mobile operators are in a key position as they are providing the network infrastructure enabling connectivity and owning relationships with customers.

Acting both as billing interface and as customer-facing brand they are able to influence other players in the value chain: They are the main distribution channel of device manufacturers and are able to veto or arrange software pre-installments on handsets. Open software and platforms as well as new 3G technologies forcing mobile data penetration led to a myriad of services, contents and third party applications that can easily be accessed without a relation to the mobile operator [144]. The disruption enabled by VoIP (Voice over Internet Protocol) induces the telecommunication providers to offer individual value-added services next to the traditional mobile services like telephony and SMS to assure future additional revenue streams [143]. To remain profitable it is important for them to avoid becoming merely data bit pipes. Telcos have already begun offering value-added services like navigation (T-Mobile with its 'Navigate'), or payment services [153].

4.2.1.4 Software/Application Provider

The increasing mobile data penetration enables software and application providers [137] to add more value to the telecommunication business. Traditional software developers like Microsoft entered the mobile value chain by launching its operating system for mobile phones (Windows Mobile). There are also several white label providers offering software for mobile phones free for download, mostly funded by advertisement (e.g. free navigation software AmAze[1]). Thus, content and service can easily be obtained via applications and software. Nevertheless white label providers are still weak players due to missing pre-installments and value-added contents.

4.2.2 The Mobile Operator Enters Value Chains and Business Models for In-car Services

Next to the traditional mobile business described previously, mobile operators were able to spread out into new businesses. The telecommunication operator is positioning himself in the value chains for in-car services. In fact, he already participates in the navigation (T-Mobile 'Navigate') and telematics (T-Mobile 'Traffic') business [136]. Infrastructure providers (satellite or network operators) are in an advantageous position to extend their influence along the value chains by offering services or agreeing on partnerships with other players, because they possess the connectivity for data transport [136].

Regarding in-car services it is required to differentiate between mobile (e.g. Apple iPhone or Garmin Nüviphone), portable (e.g. Dash express or TomTom PNDs) and integrated devices. Car OEMs dominate in the area of integrated devices. Due to increasing diffusion of integrated GPS receivers in mobile phones [138] competition between mobile devices and portable devices evolved

[1] http://www.amazegps.com

in the navigation business. The telecommunication operator partakes both in the OEM's value chain regarding integrated devices and in the mobile navigation value chain regarding mobile and portable devices.

4.2.2.1 Overlap with the OEM's Value Chain

The traditional automotive value chain was characterized by the OEMs domination. Suppliers acted as direct subcontractor for the OEM and the dealer distributed the car [146]. But as more software is integrated into the car, the value chain is beginning to change. Collaboration among OEMs, suppliers and service providers is necessary. Mobile operators and content provider enter the value chain for automotive services as in-car services are being developed. Automotive OEMs are extremely competitive in the area of in-car services. As example for an already prevalent system BMW's telematics flagship product called ConnectedDrive will be described. It is offering navigation and location-based services (BMW Assist), Internet and value-added services in the car (BMW Online), security and maintenance services (BMW TeleServices) and the technology for Car-to-Car and Car-to-Infrastructure communication. As BMW has already closed several partnerships (e.g. Google, 11880, Hotel Reservation Service) they are paving the way for further business models [333]. Telekom with T-Systems is already providing BMW cars with in-house E-Traffic solutions opening up the way to deliver further in-car services to the customer [333]. Vodafone and BMW agreed upon a cooperation as early as July 1999, [139] now enabling emergency calls, roadside assistance and mobility-related information services. Vodafone is the strategic partner when it comes to the replacement of the current BMW 7 Series as the first Internet-capable production. As automotive services hitherto have not been very successful on the market, automotive OEMs have recognized that they need to work with competitors and other players of the value chain to cut costs, develop standards and common platforms .

4.2.2.2 Value Chain for Mobile Navigation

Considering in-car services, mobile navigation is the most established and popular location-based service today. To cash in on location-based services mobile operators, handset manufacturers of mobile devices (Nokia) [150], and several software/application and content providers have entered the value chain for mobile navigation, hitherto dominated by PND manufacturers like TomTom and Navigon. Latter ones started to make inroads into the telecommunication business by offering navigation solutions for mobile phones, especially Garmin with the development of the world's first mobile navigation phone (Nüviphone)[2]. TomTom provides hybrid solutions by equipping their PNDs with integrated

[2] http://www.garminonline.de/intro/nuvifone/index.php

SIM cards and offers High Definition (HD) Traffic in Germany (Vodafone – TomTom cooperation 2008) [159]. In addition TomTom entered the business for integrated devices by having agreed upon a cooperation with Renault to provide integrated navigation solutions [158]. Nokia established a strong position with the acquisition of Gate 5 in 2006 (small German navigation software firm) and Navteq in 2007 (card data provider) [150].

4.3 Trends

4.3.1 From Value Chain to Value Network in Mobile Communications

We have analyzed the mobile value chain as it is today. In order to discuss the development of the value system and the interrelations between the industry's actors associated with in-car services in the future, we have to look on the future positioning of these players first.

4.3.1.1 Future Positioning of Content Creators and Aggregators

Besides location and navigation information, consumers will increasingly demand the same services and information in the car as they enjoy at home in the future [144], including m-commerce solutions. As customers' mobile phones get more reliable connections to the Internet while driving, more value will get added to the system. Simultaneously, the satisfaction of niche interests will be possible, further altering the value generated. This relates to the the "long tail" theory, which means that in e-commerce, the industry is shifting from mass to niche markets, because the quicker and cheaper content and services can be provided the more is becoming profitable to be offered. [157] As customers surf online, they will access any content and (location-based) service that is of interest to them. [136] Cisco's CEO John Chambers for instance reckons that by 2010, all content will be available on one network, so appropriate content will virtually find the user. [143]

4.3.1.2 Future Positioning of Service Providers

Service providers will act as an axis between content creators and users, but also coordinate user's communication sessions. Thus, they will add value to the system as they play a coordinating role that the individual consumer could hardly perform himself. In e-commerce for instance, transactions get quicker and easier for the customer if he only has to provide his banking information once to the service provider instead of doing this with every vendor individually, [144] especially in the car where his/her attention is rather focused on the traffic.

4.3.1.3 Future Positioning of Mobile Operators

As has been argued before, mobile operators are facing the threat of becoming mere bit pipes. [144] Thus, they are in the process of increasing their added value by further expanding in other fields of business. One example is to offer services in automotives. This expansion of the mobile operators' business models is facilitated due to their secure position in the value system as infrastructure providers. [136]

4.3.1.4 Future Positioning of Application and Software Providers

In the future, applications and software will be developed both by automotive telematics providers and traditional embedded-software developers such as Microsoft. High value creation will primarily be possible by the interplay of both sides, hence bringing their core competencies on the table. Furthermore, this part of the value network will increasingly be driven towards standardization and the building of open platforms.

4.3.1.5 Development of Future Interwoven Value Network

Traditionally, the production of goods and services followed a value chain logic. This value chain has been depicted in the first section of this report. However, the telecommunications industry's value chain has already been in the process of deconstruction for some time. We see a shift towards an interwoven value network. The reasons are multi-dimensional.

Firstly, Internet technologies such as VoIP have drawn players from other markets into the industry. IP-applications like Skype for instance challenge mobile operators in their established field of business. As the time-to-market gets shorter, the entry barriers get lower. Thus, from the market's point of view, the increased competition and multiplying points of entry and exit increase potential strategic alliances between industry players and hence the value chain's complexity. [144]

Secondly, the value in the telecommunications industry is not created by a distinct set of sequential activities, but co-created by different actors as the services do not have a physical dimension. [144]

Yet the most important factor that shows the shift from the traditional value chain system towards an interwoven value network is the fact that alliances, co-operation and co-opetition are getting increasingly important, i.e. that the actors inside the network co-produce value. The level of competition is altered from firms competing against each other towards wars between networks of interconnected players. There is also co-operation, for instance through standardization along the industry. Examples of such co-operations have already been given in the first chapter. What this development means in detail will be the concern of the next section.

4.3.2 Towards Co-operation and Co-opetition in Mobile Communications

4.3.2.1 Need for Co-operation and Co-opetition

The various actors within the value network act as independent entities. Still, the value is being co-created by these actors. According to the "move-to-the-middle hypothesis", transaction costs between firms are lowered through digitization. Thus, market solutions through partnerships get increasingly more efficient in comparison to hierarchical solutions within one company. Therefore the design of the network is crucial for the benefit the customer ultimately derives from the provided services. Value will incrementally be created by the firms on the basis of common principles and SLAs (service level agreements). [144] The development of common protocols and open standards to ensure interoperability between car manufacturers' and other service providers' software and applications will be one of the in-car service industry's key tasks in the future. [136] For this a team-oriented development approach will be needed, including OEMs and all service providers. [146] This means of course that formerly competing firms must agree upon co-operations across industry boundaries, based on the key assets and capabilities that they can provide.

Furthermore, the development of open standards and the need to co-operate will also drive the mobile operators away of their "walled garden" approach regarding their present service provision activities. [144] As we have seen before, consumers will demand the same choice of content in their car that they can access online with their computer as well.

Furthermore, firms which perform the same function in the value net will no longer only act as competitors either. Rather, they are already - and will increasingly - enter a dynamic interplay of co-opetition. They are competitors on their level within the network, but they will co-operate opportunity driven in the value system as a whole as complementors. The aim is to foster their position against the players of other levels within the network. [148]

4.3.2.2 Examples for Co-operation and Co-opetition

In the following two examples for the above argument will be given. In the 3GPP (3G partnership project) and ETSI TISPAN (Telecommunications and Internet converged Services and Protocols for Advanced Networking) driven development of the IMS (IP multimedia subsystem) for instance, telecommunication operators co-operate to develop a service platform which puts the mobile operators back in the cent re of the value system for service provision. The aim is to design this platform in a way that third parties are motivated to build their services on top of it. The mobile operator will then play the central co-ordinationg role. [144]

Another example for standardization is AUTOSAR (AUTomotive Open System ARchitecture) in the automotive industry. Major OEMs and several other players in the industry, both hardware and software suppliers, are in the process of developing an standardized platform for automotive hard- and software development. [151] Therefore it will be easier for software developers to synchronize with the electronic infrastructure of different automotive manufacturers. By 2012 it is expected that AUTOSAR's full capacity will be implemented on the road. [147]

To sum up, the mobile industry is shifting towards co-operation and coopetition through standardization and the development of open platforms. We will now analyze the strategic realignment of the industry's players.

4.3.3 Software Development Influencing Cost and Innovation in Mobile Communications

Due to the increasing saturation of the mobile market, operators are required to enter new segments of the market for revenue growth. It has become evident that this sector will be the mobile services. Developing software for mobile services will be a major cost driver for players looking to enter the mobile services market. The value of a mobile device will thus largely be created in the software development, which represents a major shift away from e.g. hardware and network access.

4.3.3.1 Mobile Services Shaping the Future Mobile Value Chain

A mobile service is characterized by being available anywhere in a mobile setting. The common availability of mobile devices and wireless broadband access has rendered any service possible. The first mobile services were launched by mobile operators and focused on mobile content retrieval through portals (in Germany Vodafone-live, i-mode and web'n'walk). These services suffered from one fatal flaw which prevented widespread adoption; due to security measures taken to prevent copying of the content, the services were inconvenient to use. In fact, they were less convenient to use than the process of downloading the content from the Internet for free and manually transferring it to the mobile device.

The problem here was that all digital content can be downloaded (although sometimes not legally) from the Internet for free. Therefore service providers must add value to their service by providing easy access (interactive radio), adding context (location based services), cross-referencing information (such as maps and yellow-pages data) or enabling new functions (such as social interaction), because people will spend money on convenience, even if the actual service/content is free. Consider plastic bags; most people buy new grocery bags every day, although they could bring bags from home, free of charge.

We have argued that mobile services present a considerable source of revenue and it is important to understand the relevance of such services for the mobile value chain. To create a service, the service provider has to develop a suitable software and install it on the user's mobile devices. With the dawn of open platforms (such as Android and OpenMoko) and automatic deployment systems already in place [135, 145], the development of a commonly available mobile service will be reduced to developing the software, thus dramatically lowering the entry barriers for new market players and creating a highly competitive market.

4.3.3.2 Software as Driving Factor of Cost and Innovation in Mobile Services

Developing software today is one of the most expensive activities in any digital product's development process. According to M. Broy [142], the software development and licensing costs for mobile phones already make up to 50% of the phone's market value and it is reasonable to assume that this proportion will rise. Barry Boehm et al. have persuasively argued [141], that Moore's law of exponential growth in time also holds true for software complexity, thus indicating an exponential growth in software development costs. Two years ago the average mobile phone contained 2.5 MOI (million object code instructions, measurement of software size). This compares to 1,5 MOI in Mercury (the first manned space mission) and 40 MOI in a modern B-ISDN routing node or a space shuttle. [155, 156]

We will now consider why software–as opposed to e.g. hardware–will be the driving factor of innovation. A product is defined by the activities in its value chain [152]; for many digital products in the telecommunications market that includes a piece of hardware, advertisement, an accounting model, network access, customer support, some form of content and the software. Innovation is the process by which market players intend to gain a competitive advantage by introducing or combining concepts and features of a product which no competitor can match. Thus the innovating player's product stands out and generates revenue until the other players have introduced a similar and perhaps improved product. Innovation is possible in any of a value chain's activities and obviously happens in all of them. Recently, we have witnessed the advent of context aware advertisement, ad-supported discounts on prices, premium user-generated content, multi-touch displays and new mobile operating systems. As G. Naumovich et al. have pointed out [149], the only innovation which can effectively be protected from inappropriate reproduction is innovation in software. Advertisement and accounting models can bluntly be reproduced, content and network access are usually licensed and hardware can be cloned by simply buying the corresponding or similar components. Due to the complexity of software, copying the functionality of a software does not take substantially less time than it did to originally develop it. Therefore, software is the only feasible option to introduce sustainable innovation into the market and a prime target for mobile player's capital and knowledge investment.

For a specific example, consider the iPhone. Only one year after its introduction, a myriad of touch phones and cheap knockoffs have entered the market (comp. Meizu M8, which will even ship to the US). Another recent Chinese hardware clone, the C-002 HiPhone, features a multitouch screen and accelerometer, yet it does not offer as many features or runs as smoothly as the iPhone, which retains its edge through superior software.

4.3.3.3 Implications for Mobile Operators

We have put forth the thesis that mobile market players are shifting their activities towards developing software for value-added mobile services which add value to content which otherwise would be free; thus a competitive market with low entry barriers will be created. We have then argued that the defining property in terms of cost and innovation of such a mobile service products is the underlying software. The personal computing market showed a very similar trend from its dawn in the late 1970s until the early 1990s.

In the beginning a PC was defined by its proprietary hardware and entry barriers to the market were extremely high, with a few major players (Apple, IBM, Atari, Commodore) dominating the market. In the 1980s manufacturers started using similar x86 processors in their computers, which enabled platforms (operating systems) to be installed on a wide variety of PCs. With such operating systems in place, it was easy for small companies to develop and deploy software for a vast number of user, thus creating the extremely competitive software market we know today.

For mobile operators this trend presents an array of attractive opportunities for revenue growth. Furthermore, the mobile operators own customer relations, which gives them two core advantages in the new market. Firstly, they can preinstall the mobile devices they sell with their services and software and secondly they already have the infrastructure in place to offer interesting business and accounting models (such as funding through context aware advertisements). Due to the availability of automatic software deployment and the widespread adoption of open platforms, smaller software companies pose a major threat to mobile operators.

A conclusion with general implications for mobile operators' will be the concern of the next section.

4.4 Conclusion

The purpose of this report is to outline the emerging changes on the mobile value chain. We have described the current situation and relevant market players and subsequently analyzed three key trends, specifically the shift from value chain to value network, the establishment of a co-operative and co-opetitive market and the relevance of software development as driving force of cost and innovation.

The implications for mobile operators are manifold; in order to maintain revenue growth rates in the face of saturated mobile markets, they need to expand more into the complex area of mobile services. Moreover, users will increasingly be able to access any content they want directly, no matter if they are at home or in the car. Thus, the mobile operators are in the risk of losing their central role in the mobile industry's value network. In order to maintain this role, they have to focus on software development for the provision of mobile services. They also have to accept to co-operate with and build open platforms for virtually all players of the interwoven value network.

This will not be easy. The mobile industry is increasingly getting complex with players entering out of diverse business areas and industries. However, it would be the wrong approach for the operators to build up barriers. They have to proactively drive the mobile industry towards co-operation based on the actors' core competencies in order to maximize the network's value. And they have to make heavy investments in the development of software as this will be the future source of innovation in the industry.

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Chapter 5

5 Infotainment

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In our report we deal with upcoming trends in the area of in-car infotainment, whereas we understand infotainment as all ways of providing drivers and passengers with both entertaining and informational content. As the media consumption of drivers and passengers profoundly differs, both target groups have to be addressed with different offers. One major issue for the drivers' perspective is the development of real-time and dynamic traffic assistance systems. More and more cars will be equipped with overall infotainment platforms ensuring for example the integration of future all-in-one devices and service applications in the car. Furthermore, due to the implementation of Internet connectivity, customized audio and video services are pushed forward.

5.1 Introduction

DVD-players in headrests, intelligent navigation systems, Internet hook-ups in the dashboard - the market of in-car high-tech features is growing rapidly and applications, that seemed impossible a few years ago, may belong to the standard equipment of any economy car in the near future. As the average driver spends over 1.5 hours in his car every day, the demand for connectivity, entertainment and convenience is constantly increasing [188]. Drivers expect their car electronics to keep up and connect with home equipment. Moreover, considering to become more important for the technological development, completely new applications and services become possible.

Therefore we focus in our report on the profound changes in the infotainment market, whereas we do understand infotainment as all ways of providing drivers and passengers with both entertaining and informational content. While searching for new ways of satisfying the drivers' and passengers' needs for information, it is crucial to know the current situation of media consumption in car environments as well as overall developments. Consequently, we first describe media consumption in cars and the general development of the in-car infotainment market in our Status Quo. Based on these findings, we discovered trends in the three main areas driver infotainment, passenger infotainment and convergence till 2015.

5.2 Status Quo

5.2.1 Current Media Consumption in Cars

Drivers and passengers have a wide range of possibilities to provide themselves with information and entertainment, covering for example the traditional car radio, navigation systems or portable devices like MP3-players. In the following part we would like to examine these media relying on their hitherto development in order to make out current problems and future opportunities.

5.2.1.1 Audio, Video and Gaming

In cars the major part of content like music, news or weather and traffic information is still consumed via audio, since thus it is possible for the driver to focus mainly on driving. According to the "ARD/ZDF-Langzeitstudie Massenmedien" the traditional radio still ranks among the key media [182, p. 2]. 83.5% of all cars are equipped with a car radio [193]and nearly three quarter of all drivers declare to listen to radio whilst driving [182, p. 6]. Yet, in the recent time competing offers have developed. There are digital and satellite radio formats, mobile phones offering UMTS-technology and the popularity of portable devices like MP3-players is growing rapidly. Whereas in 2003, 40 car models were available with satellite radio systems, there are now 260 [194]. It also becomes easier to connect one's iPod to the car. According to Edmunds.com, 34 car manufacturers offer seamless integration between their cars and the iPod [183]. The major advantage of individual music archives for example on music players is that they perfectly respond to the drivers preferences. However, digital radio formats such as last.fm[1] make it possible to better take into consideration the consumers' music taste and thus answer the ongoing trend to further personalization. A special audio service for the car environment, which easily allows the driver to tailor his individual program consisting of music, news and information services according to his respective profile, is still missing.

At the moment, video content plays a marginal role compared to audio. However, there are cars that already integrate a DVD-player in their entertainment system and applications like the Sirius Backseat TV make it possible for co-drivers to watch TV while traveling[2].

Mainly for passengers, gaming is also an interesting occupation. In the past, handheld PCs or game consoles covered the major part of this field, yet the impact of mobile phones is recognizable.

5.2.1.2 Communication

As mobile phones have reached a market coverage of over 80% [175], more and more drivers use them to communicate in cars as well. Due to safety issues, in Germany it is only allowed to use mobile phones in combination with hands-free speaking systems with snap-in adapters or bluetooth for example. Still, mobile phones are not designed for in-car usage and further improvement in design as well as integration is necessary. Besides telephony, all the other functions of mobile phones such as music, gaming or Internet connectivity are also available in cars.

Furthermore, Internet connectivity has become a widely discussed topic since BMW presented its system ConnectedDrive. Via a BMW-server it is possible to enter the WorldWideWeb from some of BMW's models [187]. Although there exist some other solutions like Autonet Mobile[3], having access to the Internet from one's car is exceptional at the moment at least in Europe. To further pursue technologies like car-2-car-communication or car-2-infrastructure-communication, manufacturers like Audi, VW, BMW or Daimler Chrysler have aligned to the Car-2-Car-Communication Consortium [169].

[1] cf.: http://www.last.fm
[2] cf.: http://www.sirius.com/backseattv
[3] cf.: http://www.autonetmobile.com

5.2.1.3 Navigation

Navigation systems can either be integrated in the car or designed as portable or mobile devices. According to Canalys.Com, the market for navigation systems is rapidly growing. Compared to in-car solutions, portable and mobile devices have become more widely accepted. During the recent years the development to enrich navigation systems with further information or value added services can be observed. One popular example is the Traffic Message Channel (TMC), which makes it possible to automatically avoid traffic jams or accidents. Another interesting application is the Merian Scout[4]. It combines a navigation system with a multimedia travel guide and offers for instance background information on the respective region, recommends hotels and restaurants and also has an audio guide. However, these approaches can be developed further and there is great potential in creating more integrated and enhanced services.

5.2.1.4 Key Success Factors for In-Car Infotainment-Applications

Summing up these findings, there are many opportunities to create car-specific infotainment services. Therefore it is important to clearly differentiate between the media consumption of drivers and passengers. Yet, one major problem to be solved concerning in-car-information is the missing integration of the different embedded, portable and mobile services and devices. Approaches in that direction are already made but there still is a lack of interconnection. Necessary fields of action are for example implementing interfaces, creating integrated services or pursuing the idea of an overall multimedia platform for the car. Mandatory is furthermore an ergonomic design of all functions that is intuitive, standardized and totally adapted to driving situations. Finally it is very important that infotainment services must not distract the drivers' attention from driving itself, as otherwise security is in danger.

5.2.2 Market Development

The market for infotainment devices is a growing segment. In 2008, it is supposed to increase by 8% to a total volume of 40 billion US-dollars and till 2012 growth rates of 7% per year are expected [163]. More and more car manufacturers try to differentiate their cars form competing products by pushing further the high-tech in-car equipment. The increased importance of in-vehicle technology is also proofed by the fact that the Consumer Electronics Show in Las Vegas, the biggest special fair for entertainment electronics, has an own growing section for the mentioned category[5].

[4] cf.: http://www.merianscout.de
[5] cf.: http://www.cesweb.org/inVehicle/default.asp

Different players like manufacturers or automotive suppliers, but also companies from the so-called aftermarket as well as software producers or telcos are engaged in the field of in-car infotainment. The market is not consolidated yet, and at the moment isolated applications instead of overall solutions prevail. There is a wide range of interesting applications, which have been launched in the recent time, for example the local application “Wireless Wolfsburg” supported by Volkswagen or the multimedia platform “Blue&Me” by Fiat.

So far, “Wireless Wolfsburg” is the biggest local WiFi-network in Germany providing user with touristy and cultural information all around the city. Volkswagen is working on an exploratory car called “auto@web”, which should allow drivers to access this local network based on wireless LAN technology [196].

In 2006, the Fiat Group Automobiles launched its modular constructed multimedia platform “Blue&Me”. This platform not only allows drivers to integrate portable infotainment devices such as MP3-players or a special navigation device with the onboard system of the car, but also offers additional services like voice control or insurance applications [188].

5.3 Trends in Infotainment

So far we have described the current situation and the market development of in-car infotainment. We will now deal with the upcoming trends till 2015. As already said, it is important to distinguish between services and applications for drivers and passengers. Additionally we identified the ubiquitous trend to and need for more convergence regarding all mobile and portable devices as well as the onboard system of the car.

5.3.1 Driver Infotainment Services

Providing the driver with the respective content he needs, is one of the major tasks in infotainment, as most of the cars are only used by the driver himself [181]. In this regard, traffic assistance is a field that definitely will advance in the near future - as well as entertaining services and communication.

5.3.1.1 Traffic Assistance

The car is one of the most commonly used transportation vehicles in the world and a symbol of freedom. Nevertheless, its image is changing as gas is getting more expensive and traffic jams occur more often. As a consequence, huge improvements to cope with this situation have to be made. On the one hand, every driver wants to reach his destination as fast and comfortable as possible. Yet on the other hand, higher fuel prices and the climate change increase the attractiveness to stop wasting gas by optimizing the traffic flow [198]. Another effect of the growing traffic is the increased danger of car accidents [172]. Until now, every vehicle acted as a lonely island which got almost no information about its environment and the live traffic situation. Therefore it seems obvious that just a navigation system that calculates the shortest route is not enough anymore.

An improvement could be reached in the future by using synergy effects of the communication and in-car technology to provide better information.

Taking the Best Route

A high need for flexibility regarding domestic and international traveling is nowadays common in everybody's work life. Increased traffic is just one of the consequences, which itself causes a lot of traffic jams. This is one major reason of productivity losses for an economy [176]. To overcome these problems, drivers need better and more recent information than delivered at the moment. To reach that, the system as it is today has to move on, it cannot stay static, but has to become dynamic. For example, the state-of-the-art navigation systems are based on static maps and sometimes additionally get further information via TMC regarding big traffic jams. What people (and devices) do not know is, that there might temporarily exist a faster way to go from A to B. Some routes may be blocked by a crash, the traffic lights are always red or the data concerning small congestions is not the latest. To change this, it is no longer sufficient to only have some sensors on the highway or drivers who call the radio station. To provide the latest and most realistic information, a system has to collect and analyze data which is provided by the automobile itself. In combination with accurate positioning devices like Galileo, the system would be able to detect crowded streets. Galileo is the European successor of GPS, which is able to deliver more precise information about the car position.

In addition to that, the navigation device is aware of one's destination and the route to reach it. Sharing this information with a route information server, a prediction of the future traffic flow would be possible. Using this data, the vehicle would able to recalculate its route, which is again transmitted and approved. If this large amount of data is refined properly, the navigation device knows, which route is the "best" under the given traffic conditions. Especially in big cities, which are extremely crowded and where the rush hour is a huge daily problem, this method would provide a solution. Furthermore, if more people would be using this technology, the benefit for everybody would increase. Regarding all these circumstances, the cars equipped with proper navigation devices using the "route information sharing" are able to be first at their destination [197, 162].

Enriched with additional information like fuel prices or hotel recommendations, the navigation system could increase the value for the driver. Approaches in that direction are already made by TomTom[6] for example. One possibility to provide this information are local based services like local based car-pooling [177]. Another possibility would be to promote regional bargains, car washing or restaurants.

The key success factor would be, as always, introducing a standardized system. Otherwise every car company has its own, separated data collection without synergy effects and the data is a lot less accurate.

Communication as Basis of a Safe Ride

Driving the best route is, however, not the only ingredient of a pleasant journey. The ride itself should also be comfortable and by all means, safe. In a time, where population as well as the average driver is getting older, cars have to overcome human curtailing like slower reflexes and worse sight. The automobile of the future has to support the driver as good as possible. This is only achievable, if the driver is provided with additional information about the environment, presented in an easy and comprehensible way.

One major trend to reach this aim is the car-2-car-communication. The automobile possesses not only information about its location; it has even knowledge about other circumstances from the weather up to the road itself. The sensors recognize the situation and transmit every information to the surrounding cars. The driver himself is warned by other traffic participants to drive slowly, when the roads are icy or there is strong side wind, which decreases the risk of a crash. Furthermore, a car involved in an accident could send a warning parallel to the e-call, which advises the other cars to slow down. By that way, danger of harm is reduced and no sudden breaks are needed, which often cause accidents or traffic jams. Furthermore such a system could be used to indicate that a police car wants to pass or just that a traffic jam is around the corner. It might even prevent a crash, because the vehicle can predict a collision based on accurate positioning, and warn the driver or even automatically brake [190, 161, 167].

The other trend is the car-2-infrastructure-communication. This contains intelligent traffic lights or signs, which inform the vehicle about the speed limit, or the traffic lights are able to switch more dynamic, adapting to the actual traffic situation, allowing people who have already been waiting for a long time to pass immediately [164, 195]. Highway surveillance is already used to control and reroute the traffic to ensure a smooth flow. Pushing this to the next level, it could be extended to a whole city which has a higher complexity. Knowing the exact position and route may also allow the introduction of a road charge with fees adapting to the current situation to control the traffic. A possible usage model is that crowded highways or streets during rush hour are more expensive than they are during the night or when there's low traffic. The driver gets a motivation to start working one hour later, avoiding the peak

[6] cf.: http://www.tomtom.com/plus

times, because he has the opportunity to save money due to lower charges [173].

Visualizing this huge amount of information will be one of the biggest challenges. The most appropriate device would be the windshield itself, like already introduced by Head-Up Displays [160]. This would limit the distraction of the driver and at the same time enhance the driver's experience with the delivered information [178]. Mixing it up with technologies like "Night-Vision" the Navigation System could push the usability a giant leap ahead.

5.3.1.2 Audio and Video

The average driver spends considerable time in his car and wants to be entertained and informed during his journey. As his main attention has to be focused on driving, every service or application has to be presented in a convenient way, which is adapted to the driving situation. According to the study "The Entertaining Way to M-Commerce" released by the "Electronic Markets", these entertaining services include for example news, music, videos, travel guides or language courses [165].

Audio

The audio sector consists - among others - of music, news, language courses, travel guides or audio books. In the year 2015, the majority of audio content will be consumed either via downloading, streaming (Internet radio) or using individual music players.

The bandwidth provided by wireless technologies in the near future will be enough to guarantee a smooth transmission of music streams in sufficient quality. According to a study performed by Bridge Ratings comparing traditional radio consumption with a successful deployment of WiFi in car, a constant decline of traditional radio is predicted [168]. This means, that the more people use WiFi in their car, the less people will be consuming traditional radio shows. When analyzing the impact of WiFi on satellite radio in the car, the anticipated decrease of hours listened to satellite radio is even bigger compared to the anticipated loss of traditional radio. Summarizing, this means that there could be a trend opening up a window of opportunity for telcos and radio stations to monetize the increase of WiFi usage in car by offering personalized radio streams diffused via mobile Internet [168]. This could be achieved by offering programs, that are specialized on content important for car drivers according to a personalized profile. One may for example choose of a pool containing news, different fields of information, music or language courses to improve one's skills. Another interesting business model could be exploited by selling ad space to companies, like fast food restaurants, garages and gas stations.

Another scenario in the audio sector is opened up by car-2-car-communication. Whereas mainly pushed for security reasons (see 5.3.1.1) this technology also offers interesting possibilities for multimedia applications. For example there could be a joint music listening experience where one device pushes out music and the others in a certain range can listen to it and also see a visual representation of the source [189].

Video
Summarizing the content consumed by the driver we can say, that most video services do not need a high quality picture or large screen to be watched on. Therefore a system projecting content on the windshield may fit best. Additionally, this would help to achieve the minimal distraction for the driver. Due to security reasons the e-windshield would only work as an entertaining device depending on the driving speed and the location [160]. For example, if the car is not moving or moving with a max of 5 km/h, short and rapidly accessible content like news, weather information, location based services and user generated videos could be displayed in front of the driver.

Another trend, that might come up, could be the offer of short entertaining user generated clips[7]. They are especially attractive for drivers, because they cannot focus on a whole storyline of a movie.

User generated content is not only limited to video. But there is also great potential for implementing a recommendation system for hotels, restaurants or events based on reviews of other drivers. As another study carried out by PEW Internet & American Life Project in the area of video consumption shows, people are generally open minded about sharing their knowledge. A total of 75% of Internet users receive video links and a total of 57% send video links to others, indicating the social mindedness of users [179]. This is certainly not entirely applicable to the in-car environment, but it certainly shows, that the trend in car entertainment could also go in the direction of Web 2.0 and social interaction between drivers.

Potential revenue could be generated by adding small sales promotions to the content displayed on screen or played on the radio. To better personalize these ads and make them fit into the current travel situation, location based ads could be implemented suggesting the driver nearest bargains like best gas prize, cheap meal offers, free tire or oil change, as already mentioned in the Driver Assistance part (see 5.3.1.1).

5.3.1.3 Communication

Although communication regards both drivers and passengers, this paragraph is part of the driver infotainment. The most potential trends in this area are coping with the facilitation of driver communication. As passengers are always "hands-free", they can easily access and browse the Internet via notebooks, mobile phones or in-car user interfaces, which do not make newly developed interfaces or ways of communication mandatory.

[7] cf.: http://www.youtube.com

Integration of E-Mail, SMS or MMS user interfaces into the car environment will have a huge impact on the usability of communication services. This could for example be realized by voice control, as it is implemented by Ford. Ford Sync uses an interface based on speech recognition allowing message reading and writing and also including a reading mode by a computer voice[8]. Head-up displays would be a solution to further enhance the integration, as it would become possible to check the spelling of one's voice input. By this means, the driver gets the possibility to write, read and send messages over a projected interface on his windshield. Of course, this would only work under the constraint, that the driver can only access this interface when the car is not moving or moving with a maximum speed of 5km/h (see 5.3.1.2). However, while driving the system should be entirely based on voice input and output. Furthermore, it is imaginable to integrate a webcam, which allows the driver to visualize his opponent during phone calls. Again, this has to be implemented respecting all security regulations, e.g. switching off the display when driving at higher speeds.

5.3.2 Passenger Infotainment Services

As passengers can consume entertaining content during the whole journey a big revenue potential for service providers might come from this area. These services, which need the entire attention of users, have been grouped as pure entertainment services in the already mentioned study dealing with M-Commerce in Japan [165]. Nevertheless, all services are also available for drivers and can be consumed parallel by driver and co-driver, when respecting security regulations. Although it is more unlikely that drivers will watch an entire movie while driving.

5.3.2.1 Audio and Video

There is no part of audio content specifically for passengers, as there are no major differences between drivers and passengers regarding this topic (see 5.3.1.2). Yet, we see major variations between drivers and passengers with respect to video consumption, wherefore the following paragraph will focus on this topic.

One precondition for new video services is the implementation of WiFi in the car. According to a report from Bridge Ratings, the percentage of the US population using in car WiFi technology will reach up to 56% in year nine after a successful implementation. As car manufacturers are unclear about the exact implementation date, the study is working with base years [168]. But before successfully deploying WiFi in cars, manufacturers must provide devices that are capable of playing back and displaying the latest

[8] cf.: http://www.syncmyride.com

video and audio formats, which are another precondition for entertaining services offered. The goal is to leverage the already existing and future in car entertainment technologies by offering custom made services the user is looking for. Most of these devices, respectively technologies, have already been implemented into the car environment, as seen in BMW´s “Individual Rear Seat Infotainment Online” [187]. Until now most devices being able to playback in-car-TV are reserved for luxury class models. Due to the still low acceptance of in-car TV, low production capacity and analogue technologies have been driving the costs. With increasing acceptance of in-car technology, higher production capacities and cheaper digital distribution technologies (e.g. DVB-T, WiMax, LTE), costs will decrease and support faster deployment of in-car entertainment in the future [174]. This opens up a huge window of opportunities for service providers and other companies in the value chain to leverage existing technologies and offer customer oriented services, allowing a differentiation and broadening of current product portfolios.

Focusing on video content, a differentiation between traditional TV and Video on demand has to be done. As traditional TV has already entered the car domain (BMW, etc.), the biggest trends until 2015 will be improved image quality and cheaper and faster access technologies enriching the in-car media experience. As it is unclear, if TV streaming over wireless-only networks (WiFi, WiMax, LTE) does work as smoothly as needed until the year of 2015, it is impossible to predict what technology will be used. Nevertheless possible cases, including Satellite TV and TV over WiMax / LTE, have to be considered when creating new services, to increase differentiation and diversify portfolio offerings.

A study conducted by ARD and ZDF concerning mobile TV shows revealed, that people are most likely (89%) to consume video content during longer car journeys or travels [191]. Therefore a potential trend besides DVD/Blue Ray consumption in the car could be streaming or downloading of video-on-demand over a platform. To bridge the time gap till proper streaming is possible, a hybrid solution of streaming and downloading would be recommendable. This hybrid solution could allow the user to start watching the movie after a predefined amount of data has been downloaded.

Another not-to-be-missed trend in video entertainment is user generated content, which does not seem to offer any great value to anyone in the value chain right now. But this could change rapidly as soon as profitable business models have been successfully implemented. So this obvious trend has to be mentioned and to be taken into account, because it offers a huge revenue potential but also a huge danger if it is not being addressed by telcos. To be mentioned in this context is the announcement of Google and Youtube from November 2008, stating to show video ads next to search results. If Google’s program is successful, it eventually allows Google to make money out of YouTube [170]. This approach could lead to a successful implementation of a business model into the YouTube environment and therefore be a trendsetter for future business models in many user generated video platforms. An indicator for a possible trend in in-car entertainment is a study by PEW/Internet in 2007 highlighting that video viewers in the age group of 18-29 most commonly use YouTube to watch video content online. So does the average of video viewers of all age groups [179]. This is an evidence for an unbowed interest in user generated content, especially videos, which has to be taken into account and will most likely be entering the car domain too. Although media consumption at home is a bit different it can up to a certain degree definitely be transferred to in-car media consumption.

5.3.2.2 Gaming

Another field of entertainment necessary to be covered is the future of gaming. According to a study conducted by the OECD in 2005 dealing with the development of Gaming from 1999 to 2008, online and wireless gaming had and will have the strongest growth. As the OECD anticipates a comparable growth for online and wireless gaming until the year of 2015, it will most likely be the art-of-gaming in the future [186]. When categorizing classic online games, the OECD is dealing with four different types of online games: Classic board and card games, mostly offered by web portals like Yahoo, MSN and AOL; PC or console games with network connectivity, where playing is mainly offline, but updates can be downloaded via an Internet connection; multiplayer games where players play individually or in teams; and entertainment games that provide a platform for learning, training and interactive applications [186].

As a trend-setting type of online gaming most likely to be adopted in the car environment may serve online gaming of classic board or card games. They do not need a high bandwidth to exchange data between in-car and online players. One of the biggest trends in wireless gaming might be the interaction between passengers in the car via PC or console games. As the in-car wireless connection between passengers will be stable, there will most likely be no disconnections. Hence for in-car gaming high resolution multiplayer games like the well known Counterstrike could be possible. This allows passengers an enriched multiplayer gaming experience as they know it from home. Another possible and interesting trend, which is not included in the OECD study from 2005, is pervasive multiplayer gaming [166]. In pervasive games the real world is mixed with a virtual environment. Within these games the drive with the car could become part of the game.

5.3.3 Convergence

The area of convergence plays a big part in the ongoing change of in-car infotainment and entertainment and can be split up into two main areas.

The first of it is the convergence between the devices, e.g. devices that were formerly only used for one specific purpose are now taking over more and more functionality from other devices. The other area deals with the interconnection between the several devices inside the car.

5.3.3.1 All-in-One Devices

Especially in the mobile device market we see the ongoing trend of device convergence very clearly. Almost all mobile phones are equipped with some multimedia functionality like an MP3-player or a camera. The newest models of mobile phones like the Nokia N96 [184] also include television functionality, enhanced video functions and navigation software. In the future, mobile phones will be able to replace multiple devices (e.g. cameras and MP3 players) without compromises in terms of quality and usability. The phone will be a "hybrid multi-platform medium" [180] offering and requiring new forms of media and games.

A similar development can be seen at personal navigation devices (PNDs). The latest models also contain multimedia functionality for playing photos, music and videos [192]. Some are even equipped with direct Internet access [171]. Therefore PNDs will converge with mobile phones as their size is growing and displays are improving in order to achieve a better car-suitable usability.

We can also see a certain functionality increase if looking at integrated devices like board computers. In the beginning they were only used as a hidden interface to the car. However, if you look at today's interface systems such as BMW's iDrive or Mercedes COMMAND, these systems provide a close integration between highly car-oriented functions with multimedia and communication. It is for example possible to control heating as well as music applications or bluetooth options for hands-free mobile operations. As car manufacturers have very long product cycles, efforts will be made in to building overall software-upgradable platforms like Fiats "Blue&Me" or the open source infotainment platform[9][188].

5.3.3.2 Interconnection between Devices and the In-Car Environment

Besides the functionality increase of single devices, also a trend can be observed that devices get more and more connected to each other. Especially in the car environment there have been significant developments in this area.

The first development is regarding the hands-free mobile communication. In the last years hands-free sets got universally usable through wireless Bluetooth technology, that is compatible with almost any mobile phone. As the functionality increases, modern hands-free sets also download address books and the

[9] cf.: http://www.heise.de/autos/Open-Source-im-Auto-Intel-und-Wind-River-wollen-Linux-im-Auto-etablieren–/artikel/s/5796/1

call history and make them accessible via the on-board systems such as BMW's iDrive. Besides the technical developments they're also getting more and more popular not at last driven by legal requirements [278, § 23]. This development is a chance for car manufacturers to offer multimedia functionality via this connection.

Secondly, the integration between mobile multimedia devices like MP3-players and cars gets better all the time. Today almost every car vendor offers some sort of interface to MP3-players and iPods - often realized by a USB interface. Even for cars not offering such an interface solutions are available, e.g. FM transmitters that transmit the audio signal of an iPod into the radio like a normal radio station. However the current solutions are all singular solutions with no common standard. Establishing a standard would help to increase interoperability and therefore user acceptance and usability would increase.

An even more changing area is the connectivity between the various portable devices like phones, music and video players, PNDs and PDAs. Bluetooth is the ubiquitous technology for this type of short range networks - sometimes also WiFi comes into play. With the newest products you can easily use your PND as a hands-free set that itself uses the car's stereo system via an FM transmitter as high quality audio output device. Or you could transfer the pictures you took with your mobile phone to your PND to watch them on a bigger screen. You can even control your iPod from your PND [192].

In short, future combinations and use cases are almost endless in this area. For example it might be very useful to create a connection between your mobile phone and your car that offers a suitable user interface while driving. The car could then playback music and videos stored on the phone or access the Internet for additional services and media offerings. A widely accepted standard for the interconnection between mobile devices like Bluetooth seems to be a key success factor [185].

5.4 Conclusion

Summing up we have to say that the infotainment market is a really interesting field as it is in a profound state of flux.

New technologies like car-2-car- or car-2-infrastructure-communications make completely new applications and services possible, in order to support, inform and entertain both drivers and passengers. Each journey therefore promises to become a more convenient experience as before.

Infotainment technologies also contribute to the further trend of customization of one's car and eventually, the car will be considered as a "second living room". Especially due to the competitive market situation, infotainment applications serve as a unique selling proposition for car manufacturers.

It is still hard to predict which are the sustainable business models that will be trendsetting. A promising revenue source will definitely be personalized car advertisement via local based applications. In the future we additionally see a time-conflict-situation. Whereas more dynamic and interconnected navigation systems will reduce the time drivers and passengers spend on the road, the entertainment industry will be interested in letting their potential customers use their in-car services for the longest time possible. Another huge threat may be the missing standardization which limits the usability of almost every service.

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Part II

Scenarios and Business Ideas

Chapter 6

6 Navigation

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With this report we explore the future of navigation services by applying the scenario planning methodology. We first define the most important certain and uncertain drivers and their possible characterizations. Out of the uncertain drivers we pick three key scenario drivers which are used to create three scenarios. Among them, the “Smart Society” scenario seems to be the most likely, consequently we explore it in detail and finally introduce our product idea based on this vision. Our product called “MMIQ” takes all possible means of transportation for a certain route into account and offers several alternatives based on the user’s preferences. Since traffic data is updated in real-time the user is always provided with the optimal route and means of transport. While gaining a strong position on the market by meeting the customers demands for convenience and efficiency, a versatile business model and a value network consisting of all major market players guarantee our long-term success.

6.1 Introduction

Today navigation is mostly restricted to calculation of the shortest or fastest route from A to B by taking static map data into account. The user's position is identified by artificial earth satellite systems such as the Global Positioning System (GPS). Recently several new innovations have been developed regarding navigation which are to be implemented in the future, for example dynamic navigation or pedestrian navigation. Whereas they are quite poorly conceived and thus have not much significance right now, this may change in the future. In addition there are also some other considerable shifts possible within the field of navigation itself; technological progress and changing customer demands may lead to completely new possibilities and challenges. All these developments are dependent on several factors, which we tried to identify. Our goal is to find out which factors will be the main drivers for future development until the year 2020 and to define their most likely characterizations. Based on these assumptions we present a product idea that will benefit from the expected future situation.

Starting with a short executive summary in the first section, we depict the methodology of the scenario analysis in the second section. The report contributes to an identification of drivers that are important for future navigation in the third section. Furthermore we defined three very uncertain and highly important drivers as our key drivers. As it is very difficult to foresee what the future holds, different developments of the key drivers are taken into account by forming the scenarios. This approach led us to three scenarios: 'The individual society', 'The cooperative society' and 'The smart society' which are described in the fourth chapter. 'The smart society' is the most likely scenario from our point of view. Thus we developed a service idea called 'MMIQ' based on this scenario in the fifth chapter.

6.2 Methodology of the Scenario Analysis

Scenario planning was developed by the military to be able to prepare for unexpected and dangerous situations. Within the economy it is applied to prepare companies for possible future risks and to reveal strategic options and opportunities. In the following report we are using this kind of methodology to assess how navigation will develop in the future and what services and devices are to be there.

Devices based on the Global Positioning System (GPS) are currently widely used in Germany. They serve as a reliable navigation means that have matured to support a variety of add-ons. However, we expect navigation to gain even more importance in the future. The goal of this study is to highlight possible scenarios for the development of future navigation and to identify how services can be offered based on these trends. In the course of this study we have started out by identifying relevant drivers and trends in demographics, politics, technology and traffic behavior. We have then singled out the most important and uncertain drivers to be the basis for drawing out possible scenarios with respect to navigation behavior in the year 2020.

We have come up with three main scenarios of which one is expected to occur according to how the main drivers develop and interact. The underlying assumptions for each scenario made are explained in the respective scenario section. The scenarios enlisted here are not exhaustive. Finally we develop a product idea based on the most likely scenario.

6.3 Driver Analysis

In this section we sought to identify and analyze the development of the most important driving factors of our society that are expected to have an impact on future navigation. These drivers are divided into two parts: drivers which are certain to develop in a certain way over the next decade; and drivers about which no real conclusions can be made regarding the way they will evolve over time and are hence highly relevant while developing the scenarios.

6.3.1 Certain Drivers

In the following subsections the various certain drivers that we have come up with are discussed.

6.3.1.1 Hybrid Co-operations

The emergence of the Internet and other digital media facilitated communication and transaction enormously. There was a myriad of radical and incremental innovations in the ICT industry and also globalization proceeded rapidly in the last decades. The new communication means like Internet and mobile devices have become very important and affect all parts of our life. Regarding economy this enables increasingly efficient market solutions through partnerships, especially in the ICT industry. In the future there will be a shift from value chains to interwoven value networks, enabling multiple products according to the user's individual preferences. Time-to-market will get shorter and the entry barriers get lower. Considering location-based services, a myriad of contents and services will be available for the consumer. As digitization renders a significant decrease of transaction costs possible, parties will be able to arrange themselves in hybrid co-operations - co operations emerging and ending rapidly dependent on market demands. The long-tail theory supports this thesis: It says that the quicker and cheaper content and services can be provided, the more products and services are becoming profitable to be offered. This pattern definitely applies to mobile services. Thus the electronic and mobile commerce industry will undergo a shift from mass to niche markets. Specific customer needs will be served and the number of market players will rise significantly.

Additionally, the power of the consumer will further increase. As today user-generated content already plays an important role, this pattern will be ratcheted up with an increase in convergence, ubiquitous connection and mobility. Consumers will play an increasingly important role in the value chain and the value network respectively. Some experts even assume over eighty percent of content in the Internet to be user-generated at least in 2020[201].

6.3.1.2 Changing Demographic Structures

The demographics in Germany are known to be changing. To identify the main trends, three indicators are included which forecast demographic development until the year 2050 taken from the German Federal Statistics Report issued in 2006 [203].

Fig. 6.1 shows the expected population size of Germany.

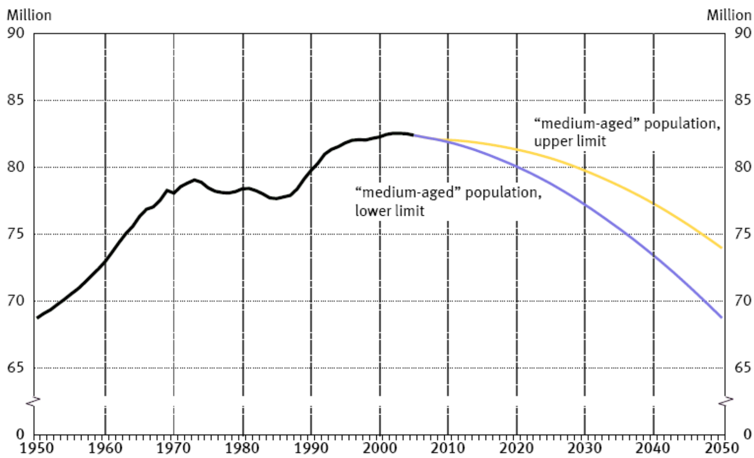

Figure 6.1: Trends in Population Size in Germany
* From 2006 onwards estimates of the 11th coordinated population projection
Source: Federal Statistical Office [203]

The curves show a decrease in population size in all possible scenarios. This can be explained by the decreasing birth rates which in turn mean there are less "potential mothers" which again decreases birth rates and hence leads to a positive feedback effect. In figure 6.2, it can be seen that in all cases the average population age will be increasing dramatically.

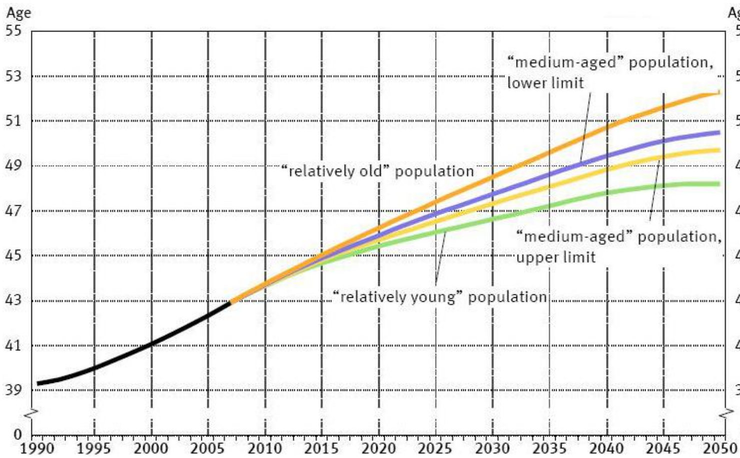

Figure 6.2: Trend in average population age
* From 2006 onwards estimates of the 11th coordinated population projection
Source: Federal Statistical Office [203]

Fig.

Finally, figure 6.3 shows the distribution of age groups and their size until the year 2050.

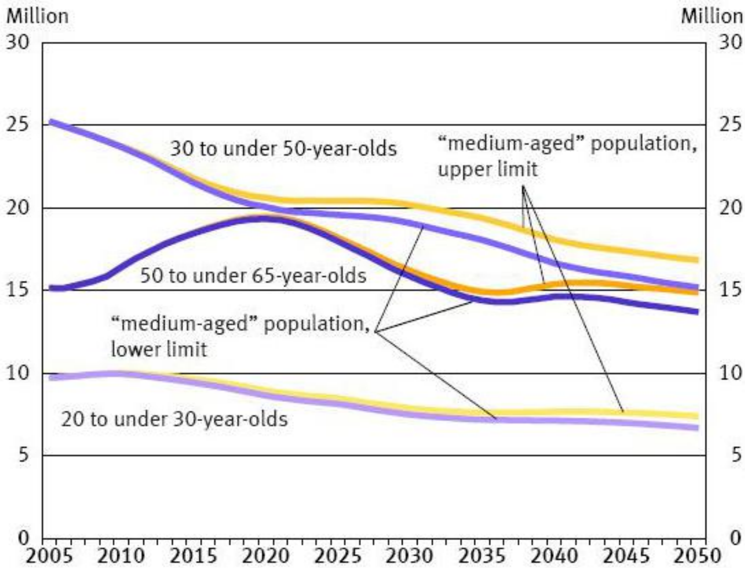

Figure 6.3: Working age population (20-65 year old) by age groups
* From 2006 onwards estimates of the 11th coordinated population projection
Source: Federal Statistical Office [203]

The figure shows that until 2020 the number of 50 to 65-year-old increases, however the other age groups shrink. The number of 30 to 50-year-old decreases most rapidly. Notice this population sector can be considered the relevant population part for providing car navigation. Hence this statistic shows that the market for such products is shrinking in the year 2050. However in the year 2020 the number of 50 to under 65-year-old will actually increase. This segment of the population generally has greater purchasing power.

Older people tend to be out of pace with technology. And hence these demographic changes will certainly have their impact on the developed services, their implementation and the optionalities included. Also, a society where the elderly make up a big percentage is expected to have less money per person as the return from the social contributions of lesser amount of younger people will have to be divided up among a larger older population.

6.3.1.3 Ubiquitous Connection and Seamless Mobility

The digital age has revolutionized the ways mankind communicates. Perhaps the most dominating were the emergence of effective wireless communications and the ingenious inter-networking of world-wide dispersed networks using the Internet and the world wide web. Soon, the need was felt to make joint use of them and hence wireless systems were required to reliably carry data besides the traditional voice traffic. However the spread of digital appliances into every day life and inside almost any environment and the continuous drive to control these devices in a centralized way and possibly remotely and to make full use of their features at any time has required separate technologies to provide common interfaces and standardized interaction methods, which laid down the basis for the second requirement: interoperability and uninterrupted communications.

The recent strive towards “all IP” promises to introduce the successful IP protocol into almost every digital device enabling its remote control and integration into the Internet. The recently deployed IP version 6 (IPv6) promises to provide the required mobility support (mobileIP) as well as security features (IPsec) and other useful add-ons to the traditional IP protocol that serve the needs of the anticipated seamless mobility and universal connection. Furthermore with technologies such as Long Term Evolution (LTE), the latest mobile communications standard, data can be carried effectively in packets as analogous to the Internet methodology of data communications and hence the access of- and communications with any IP-enabled device becomes possible and easy. Furthermore, the scientists have been working on standardizing platforms that make mobile service provisioning and development easy while enabling operators to maintain control of the service, such as the IP Multimedia Subsystem (IMS). Evidently this technology has been developed to support the IP world and enables rapid and standardized service creation media for IP capable devices.

The communications engineering society has been working on providing universal connectivity for some time now. Their most notable contribution to it was the Universal System for Mobile Communications (UMTS) where ideas of adapting signaling techniques and protocols to data communications were the main focus of development for the first time. And this is not strange as these efforts came at a time when the Internet was in its hype. However, technology has only really now become mature enough to support the ubiquitous interaction and the uninterrupted connection. And it seems, this is the general trend towards the future. Despite the obvious benefits of having such seamless uninterrupted connection, this trend also brings a number of challenges. By considering figure 6.4, it is seen that the Internet is plagued by an increasing number of malicious attacks which compromise security. And hence, global connectivity also means the need for increased and improved security as safety critical systems and personal data can not be left unprotected.

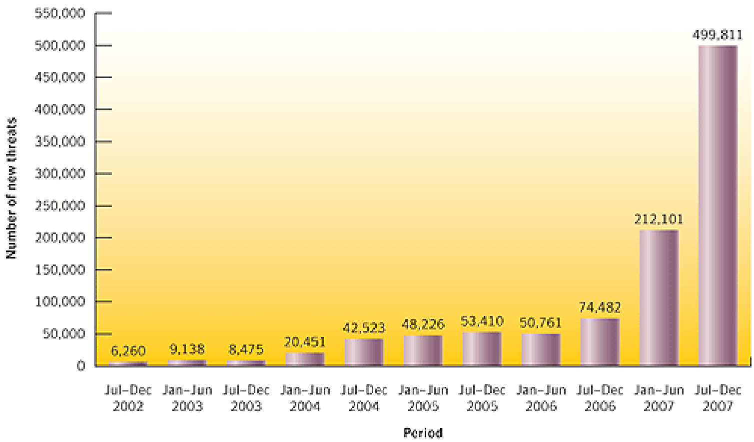

Figure 6.4: Increase in malicious attacks over the years
Source: Symantec [210]

6.3.1.4 Energy Scarcity

"In August 1859, in Oil Creek, Pennsylvania, oil industry pioneer Colonel Edwin L. Drake had to drill a grand total of 21 meters and 20 centimeters before hitting black gold" [199, p. 30]. Ever since oil has been playing an increasingly larger role in shaping the world's energy map. However, gone are those days of easily extractable oil with stable cheap prices. The years 2007 and 2008 have been a great proof to that: In its roller coaster-like ride, oil jumped up from $40/b (dollar per barrel) up to nearly $150/b and again down to around $40/b by the end of 2008. There have been a number of reasons attributed to this instability, most notably the current world financial crash. However, a deeper look into the dynamics of world oil production and trade reveal a rather uneasy future.

OPEC's forecast in its 2008 executive summary -before the world financial crisis set in- expects the world oil demand to rise up to 113mb/day (million barrels a day) in the year 2030 from the current average of around 86mb/day [208]. This represents a 50% increase in demand [204]. The question is: can the world producers cope with this amount of demand increase? A survey of six recent studies (see figure 6.5) concerning possible trends in production output expects in the most optimistic scenario a level of supply surpassing 130mb/day. Only two out of the six studies expect supply to surpass demand. The worst case scenario is predicted by SAIC (Science Applications International Corp.) to actually decrease levels down to 70mb/day. Hence average scenarios are those of the International Energy Agency (IEA) and the EIA (Energy Information

Administration) which put forecasts at around 113mb/day. Furthermore, signals from leading world producers don't seem to be encouraging: While oil fields in the Caspian sea are soon reaching their peak, those in north sea already did in 2001.

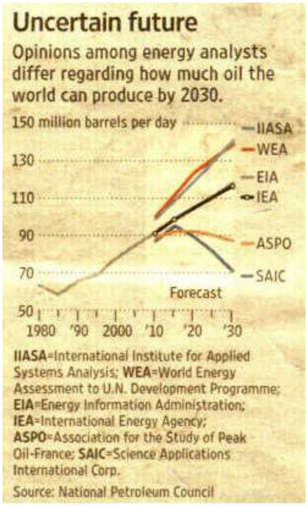

Figure 6.5: Expected increase (decrease) in oil supply until 2030
Source: Wall Street Yournal Europe [206]

Considering the current economic breakdown, perhaps growth in demand for oil will not be as large as was forecast. Yet, a number of problems still prevail: A large portion of the actual supply increase is expected to come from heavier crudes with high sulfur content and sand oils as well as oil from other derivatives. These require specialized refining installations. However, lack of money due to the current price slump and the economic status as well as environmental movements are inhibiting investments into new refineries and refining capacities. In Europe, refineries are cutting back production and some considering total business halt -let alone investment into excess capacity- due to fierce competition from Asian refineries and waning demand in the U.S. [207].

Oil alternatives such as bio fuel are plagued by similar problems. Although not as polluting as oil, the increased demand for bio fuel has been blamed as a main reason for the world food shortage in 2008. Natural gas maybe available in abundance, however a large portion of gas exports into Europe come from one source: Russia. The struggles to diversify the sources seem to last for a while yet. Renewable energy such as wind energy, solar energy and energy from tidal waves is picking up, however until 2006 it only accounted for 12% of the gross electricity consumption in Germany. The situation gets even more uncertain when considering these sources for cars, which requires the wide adoption of electrical cars, an issue that is highly speculative.

Finally, even if wide acceptance of electrical cars comes around and renewable energies cope with the increase in demand to cover up the needs of the car sector, the current energy infrastructure capabilities in Europe are considered to have come to their limits and need to be upgraded which again requires high amount on investment that is not certain to come.

6.3.1.5 Increased Ecological Awareness

In 2020 ecological awareness will be even more present in the society than it is today. One can observe a development towards environmental protection and that this topic is gaining further importance for citizens. A growing number of people name environmental protection when asked about the most important issue facing Germany today [205]. Due to the fact that the effects of global warming and environmental destruction will be observable for everyone in 2020 more clearly, we think that the trend towards increased ecological awareness will go on in the future and will be a lot more present in the common mind of the society.

Even today, every fourth person considers environmental protection one of the most important issues in Germany. In response to an open-ended question regarding today's most significant problems in Germany, 25% of respondents spontaneously name environmental protection (2004: 18%, 2002: 14%). One can see that the numbers were increasing over the last years and it is certain that this trend will go on in the future.

Environmental protection has climbed in the rankings steadily from fourth place in 2000 and 2002 to third place in 2004 to its current position in second place. The increasing importance of environmental protection can be traced back most clearly to the fact that the general public is more and more conscious of the worldwide climate change. Everyone can see and feel the problem now and in the future. We are sure that in 2020 environmental protection will be the most important issue.

When confronted with a variety of political fields of duty, 50% of the German population perceives environmental protection as "very important" (2004: 45%). Germany should be on the Cutting Edge of International Climate Protection Policies. That is what 67% of Germans are demanding for the future. In comparison to the last few years, the number of people who support Germany's role on the cutting edge has increased dramatically (2002: 47%, 2004: 56%) .

The problem of global warming is growing more and more important to the general public. 62% of Germans believe that Germany cannot overcome the problems that result from climate change. 70% of Germans are of the opinion that the government should do more to protect the environment (2004: 63%).

All this information shows that there is an increased ecological awareness in the German society and this trend will go on until 2020. So increased ecological awareness is a certain driver of future scenarios.

6.3.2 Uncertain Drivers

This subsection deals with the uncertain drivers. They are briefly discussed and their possible impact on the society in the future is highlighted. We have identified five relevant drivers: convergence of devices into "smart devices" capable of offering a wide range of features; standardization of platforms and providing the specifications openly to outside developers; data privacy standards which are highly important for possible offered services; the demand for automobiles which is a highly relevant factor when considering car navigation services; and finally, safety regulations that will regulate how any services provided within the car can be accessed or maybe even prohibited.

6.3.2.1 Convergence of devices

Devices are the means to access applications and information, and therefore highly influence the way people use them. Nowadays there are three types of navigation devices on the market: On-board units in cars that are tailored to specific vehicles and their capabilities, portable navigation devices which function independently of the means of transportation, and smart phones that are equipped with generic hard- and software and are capable of running navigation applications. Today it seems likely that portable navigation devices will slowly vanish while smart phones gain in navigation functionality and therefore replace them. However, it is not clear how the remaining devices, namely smart phones and built-in systems, will work together in the future.

One possibility is that smart phones will continue to offer increasing functionality and finally replace any built-in navigation systems. Functionality offered by car systems will be reduced to in- and output operations that are processed by a linked smart phone, and car-specific functions like car-to-car communication and sensor activities. Another likely development is the linking of smart phones and built-in devices over a standardized infrastructure and their collaboration to offer the user the best service possible. In contrast, it is also thinkable that proprietary technologies will prevail, therefore hindering the establishment of the smart phone as the key device for navigation.

Which of these alternatives will come true depends on a number of factors. First of all the convergence of devices may be hindered by the car manufacturers who might refuse to provide open interfaces to their on-board units. In this case, functionality will remain distributed over several devices. Due to the lack of integration, it is even possible that portable navigation devices prevail since they are the adequate trade-off between the mobility and independence of the smart phone, and the usability of built-in devices. Another factor is the standardization of platforms (which is also a driver and will be discussed in the next chapter). If a common communication infrastructure for navigation devices will be established, the convergence of devices will be boosted since devices can be connected and make use of each others services. In this case functionality will be concentrated on smart phones while in- and output operations will be handled by other systems like personal computers or vehicle controls, therefore making portable navigation devices dispensable.

The convergence of devices plays an important role in the future of navigation services. First, a consolidation of devices will greatly reduce the effort for developing applications since less hard- and software combinations have to be supported. As a result the saved resources can be used to create more and better services which will attract a larger user base. Second, the characteristics of future devices will determine the limitations and possibilities for services running on them. The importance and market penetration of smart phones, portable navigation devices and on-board units will influence which services are created and what kind of functionality is supported. Third, the kind of devices used for navigation will also influence service creation due to the characteristics of their core markets. Service developers will have to negotiate with car manufacturers or mobile network operators if they want to see their service implemented on on-board units or smart phones respectively.

It is clear that the balling of functionality on one device would bear a number of advantages for users. Instead of using devices and applications separately, all information and all services would be accessible with one single device. Navigation services will become user-centered instead of vehicle-centered; however, this depends not on the convergence of devices alone, but also on the standardization of platforms which will be discussed in the next chapter.

6.3.2.2 Standardization of Platforms

The impact of the convergence of devices on future navigation services has been discussed in the previous chapter, now we raise a closely related but still different issue; the convergence of platforms, meaning the software framework which application developers build their programs upon. This is especially an issue for compatibility between navigation devices since communication with the outside world will most likely be realized with existing and standardized interfaces and network technologies like the Internet.

There are several indicators for the successful implementation of a common technological basis for car manufacturers, device manufacturers and application software developers in the future. Several standardization attempts and the trend towards all-IP networks show the need for industry-wide standards on many communication layers. They will lead to a well-defined generic infrastructure comparable to the Internet and provide a common playing field for actors of all kinds, therefore reducing entry barriers and greatly boosting innovation.

However, there are also signs that this development is not embraced by all parties involved. Although common standards evolve they might not lead to a completely open architecture; while the communication infrastructure will be available to all, navigation systems and their underlying platforms may stay proprietary. Especially car manufacturers and mobile network operators are reluctant to give up their market power by allowing third parties to freely access their devices and data. Still they realize the customers demand for connected services and the development of the mobile phone as the key to digital communication and lifestyle which force them to allow for connectivity at least on the application layer and at least to a certain extent. In this case, access might be restricted to certain business partners or bound to a fee which will slow down innovation but still allows for connected user-centered navigation services.

Finally, there is also the possibility that there will be no or only a few agreed-upon standards. Just like today, consumers will have to use systems mostly independent of each other, or they will only be able to use connected services with a certain combination of devices from companies which are partners. This constellation will not be very attractive for consumers and will see little success. However, since the creation of connected services on a non-standardized infrastructure requires much effort and resources, innovation as well as market growth will be strongly limited.

It can easily be seen why the standardization of platforms is of great importance for the development of future navigation services. Without at least common interfaces, much potential to create innovative, connected and individualized services is lost.

6.3.2.3 Data Privacy Standards

The convergence of devices and the standardization of platforms which were mentioned in the previous chapters are the technological prerequisites for integrated, connected and user-centric navigation solutions. However, another important aspect has to be considered and that is legislation in terms of data privacy. The development of navigation services will greatly depend on the legal framework considering tracking data, data mining, data exchange between companies and similar issues.

Again, there are several possible alternatives. The first case would be that data privacy standards will be lowered. Considering recent developments this is quite likely; topics like terrorism and digital copyright infringement caused excessive discussions how to align the human right for privacy and the need to collect data to prosecute criminals. There have already been several legislative decisions in Germany to deal with these issues in favor of data collection rather than of the privacy of its citizens. So far these laws mostly affect government institutions, but it seems likely that in the future this might affect businesses too. If this trend continues, it will be possible for companies to handle customer data much more flexibly and freely than today, therefore offering a lot of opportunities for connected navigation services. User data like home destination, travel preferences, yearly mileage and many more could be exchanged between companies and their systems, allowing them to combine information about the user and to provide him with his favorite settings no matter which service he uses. System boundaries will not be recognizable anymore. However, the user might lose control over his data; it may be nontransparent which data is stored and exchanged, and who is able to get the data.

Alternatively, legislation concerning data privacy will not change significantly, at least not for data exchange between companies. In this case data gathering and exchange would not be handled by the back-office systems of the service provider but by the device the service runs on. The device will authenticate itself automatically against systems and services the user subscribed to. For the user, this has the advantage of staying in control while being able to use all the advantages of connected services.

Finally there is the possibility of increasing data privacy standards, either explicitly expressed by law or by consumer behavior motivated by a high consciousness for this issue. Exchange of user data will be restricted to a minimum. Like today, every connected service will require the creation of an account and a manual login. In the worst case, companies will implement strict data privacy policies which even deny the exchange of non-customer data like time schedules for public transportation means or weather forecasts. Instead of connected services, users will operate individual conglomerates of independent applications and have to combine information manually.

The development of data privacy standards is as essential for the creation of innovative, connected navigation services as the convergence of devices and the standardization of platforms. These three issues represent the technological and legal push factors of future navigation applications. In the next chapter the discussion will focus on the future demand for public and individual transportation means and its impact on the need for navigation services, therefore representing an important pull factor.

6.3.2.4 Demand for Automobiles and Public Transportation Means

The demand for automobiles and public transportation in the year 2020 is highly uncertain. First of all the demand for automobiles is highly dependent on the economy. The effects of a rapidly worsening global economic slowdown lead directly to a smaller number of car purchases. The speed and magnitude with which the actual financial crisis affected stock markets and the real economy was impossible to foresee, and it is still unclear whether the global economy is headed for a prolonged recession. The only thing that is certain is that a crisis, which may occur in 2020 as well, will have a severe impact on automotive sales worldwide. Basically it is highly uncertain how the demand for automobiles will develop until 2020.

Furthermore the automotive industry did not manage to meet customer needs in the past years. Although there is a lot going on right now concerning the reduction of CO2-emissions of cars and alternatives to the combustion engine, it is not clear whether the car industry will be able to offer cars that are more attractive for the customers in the future. As the car industry has long innovation cycles of seven years or more, they pretty much have to know in the next years what the customer of 2020 will demand. It is also questionable whether the car manufacturers succeed in developing a new kind of engine and forget about their leadership position they have in building combustion engines. If they manage to build a “green car” that also satisfies other needs of consumers (status symbol, comfort, design) car sales might increase dramatically. There are many factors influencing the position of cars in the transport of 2020 which are very hard to foresee. This makes the demand for automobile a highly uncertain driver of future scenarios.

In addition the demand for public transport in 2020 is also highly uncertain because it is primarily dependent on factors like incomes, car ownership and land-use patterns, with car ownership being the dominant factor. One can observe that the demand for public transportation is highly dependent on the demand for automobiles which was discussed above. If the demand for cars decreases because of higher operating costs there may be a growing demand for public transport. That is why these two points have to be discussed together.

If the car industry does not manage to provide cars with alternative drives and in the prospect of higher fuel prices, there may be a move to shorter travel distances and cheaper forms of going from A to B like public transportation. Higher car operating costs and the will to save the environment may attract people to public transport means.

Also the investment in infrastructure that is planned today (due to pushing the economy in the financial crisis) could have a severe impact on the demand for public transportation means. Today many people (mainly in rural areas) cannot use public transport because their town is not linked to the train network [209]. If the government would enhance the infrastructure, more people would have the option of switching from car usage to the public transport. The demand for public transport could increase theoretically. Substantial evidence was found to show that if all forms of travel including walks are counted, people living in areas as different as inner cities and country villages make roughly the same number of trips per day and spend roughly the same amount of time in traveling [202]. The people from country villages might use the public transport if it was possible. All this is highly uncertain and is directly connected to governmental investments, the position of the car in 2020 (status-object, individuality), the common attitude towards public transport and the environmental situation. Due to that we perceive the demand for public transport as highly uncertain and important for the development of the future.

6.3.2.5 Safety Regulations

The development of navigation services until 2020 will be greatly influenced by present and future safety regulations concerning issues like the use of handheld devices in cars and the limitation of radiation caused by wireless communication. In principle, regulations of any kind could occur once safety is at stake, and it is highly uncertain to what extent they will affect the use of navigation services in the car.

One possible issue is the distraction of the driver. The use of in-car services might be severely hampered by restrictions and regulations that aim at keeping the driver's concentration on driving. Even today drivers are easily distracted by the variety of functions their cars offer, and with the increasing number of applications and services this will become worse. Consequently, the use of mobile phones without hands-free equipment has already been banned in many countries, but that alone does not solve the problem. This topic calls for innovative usability concepts as well as intuitive human-machine interfaces in order to reduce the time drivers are occupied when accessing features they demand while driving. Many ideas are already discussed today, for example the use of head-up displays, the improvement of speech recognition, the implementation of artificial intelligence and the application of haptic responses. To put it in a nutshell this is an issue that is likely to be regulated in the future, but there are also many concepts to avoid distraction and therefore a regulation would not be a big problem.

However, this is completely different with radiation issues. Until now, it remains unclear if radio transmissions emitted by wireless network devices have any harmful effects on the human body, and consequently there are already regulations concerning the maximum radiation devices like mobile phones are allowed to emit. It seems likely that the implementation of car-two-car and device-to-device ad-hoc networks and the amount of radiation they effect will draw the attention of legislative institution, especially densely populated areas like city centers. As a result the creation of these networks may be prohibited and services relying on this kind of connectivity will be useless.

Another aspect is the regulation of access of sensor data or in-car network traffic to limit the ability of hackers to intrude into safety critical components and cause harm to the passengers or other road users. These factors can be very well feared from stopping development in intelligent car services that use multiple inputs from many participants.

While safety regulations can be feared to harm development of in-car services, they might be also stimulate them. Indeed the E-Call which was imposed by the European Union is expected to create a business opportunity for companies supplying the system. Regulations that could be passed in the future to stem pollution and fuel consumption or decrease the chances of accidents might encourage societies into using cooperative services wherein exchange of traffic data about traffic jams and accidents to warn drivers against potential dangers.

It is seen that safety regulations are a critical issue that is uncertain in the way it will develop, that will however have its impact on how well services can be provided inside a car in the future and what type of services are possible.

6.3.3 Characterization of the Scenario Drivers

To base our three different scenarios for navigation systems in 2020 upon reasonable and comprehensible assumptions, we identified three key drivers that are highly important for future development but at the same time highly uncertain. With every technological development being also due to a market need or at least market acceptance at first, the scenarios are formed by technology push and market pull factors respectively. Identification of key drivers consists of Convergence of Devices and the Standardization of Platforms on the technology side, Demand for Automobiles and Public Transportation Means on the consumer side.

At first, the so-called convergence of devices may happen in different dimensions over the next ten years. There may be either a development towards a convergence of devices in a material sense causing a domination of the smart phone being the central processor regarding automotive and navigation services. Considering the antithetic approach it is possible that no establishment of the smart phone as key device for navigation takes place until 2020.

Closely related to the first key driver, the second factor regarding the navigation usage in 2020 is the standardization of platforms. Considering the present situation, there is almost no standardized infrastructure for technological platforms. This pattern may either remain the same to some extent until 2020 or there may be an approach towards a well-defined generic infrastructure providing a common playing field. Such development will also affect entry barriers, market growth and innovations in the future.

Whereas current navigation is mainly focused on cars this may change in the future. The demand for automotives and on the other side for public transportation means, which is affected by a myriad of factors like GDP, ecological awareness or technological capabilities, may have a big influence on this development. Future demand for the two forms of transportation is interdependent to some degree and will have a great impact on mobility and therefore navigation.

Accounting for all different possible evolutions leads to an identification of several scenarios. We picked out three scenarios to describe and dedicated our advertence to them as we consider them being the most probable ones and therefore the most important ones.

6.4 Scenario Development

In this section three main scenarios are discussed that can occur out of the different ways the uncertain drivers would develop in the next decade. Simultaneously, the stable drivers are taken into account as predictable inputs. The three scenarios describe the the way society develops under certain assumptions regarding the aforementioned drivers and the impact of this development on transportation behavior and demand for navigation services.

6.4.1 The Individual Society

In this scenario we assume that the key drivers remain quite stable compared to today. The development of electric engines results in independence from fossil fuels, but the increasing demand surpasses supply. As a result, massive amounts have to be invested in infrastructure and energy costs increase. Although driving a car becomes more expensive, the lack or low convenience of public transport in many regions will lead to an increasing number of cars as people tend to settle down around big cities and have to commute longer distances. In addition more and more families will contain more than one earner and therefore have to possess more than one car. As a result the number of traffic jams will slightly increase, but not enough to result in a collapse of the road infrastructure.

The technological and legal framework will also not change drastically compared to today. Although ubiquitous connectivity is achieved in terms of Internet access via mobile networks, ad-hoc networking is still not standardized and therefore remains unimportant. Instead of open platforms, proprietary systems dominate the market. A variety of value networks, each consisting of car manufacturers, mobile network operators, device manufacturers and service providers, will offer integrated products that are incompatible to those of their competitors. As a result, many people still use separate devices for different purposes and the convergence of devices will not take place.

In this situation the main concern of many people is how to satisfy their mobility needs without losing too much time on the road. Being stuck in traffic congestion does take up much time and also leads to higher power consumption which is expensive. Consequently, avoiding traffic jams is a main interest. This will be done via traffic flow prediction and similar methods. However, in addition it is also important to be able to spend time in the car as convenient as possible since waiting times cannot be completely eliminated. The car will gain importance as it not only is the dominant means of transportation but also a second home. People will demand a seamless integrated environment instead of a number of isolated services and applications; navigation, multimedia, infotainment and other services have to interact smoothly. Since car systems are mainly isolated and compatibility is only ensured with a very limited number of portable devices, customers expect the car manufacturers to provide all these services. On the one hand this gives them the possibility to create a harmonized environment by perfectly integrating the services into the car; on the other hand this means high efforts in terms of service development even when most services will not differentiate one car model from another.

Besides the demand for convenience there will also be a need for efficient navigation focused on the personal benefits for the driver. Traffic flow prediction and congestion avoidance will be hot topics, but also features like a parking assistance that gives you information about nearby parking lots will be very popular. Due to the high integration of navigation in the car it will be possible connect navigation applications to the car systems and provide new functions based on sensor and control data.

The market will be quite similar to what we see today, except that instead of singular companies more and more alliances will compete against each other. The most important players on this market are the car manufacturers who will not primarily compete with the characteristics and prices of their vehicles, but more and more with the services their electronic systems support. Since many services greatly gain in attractiveness when connected to other systems they will strive to forge partnerships with device manufacturers and mobile network operators, and to a lesser extent also to the providers of public transport. The dominant status of the car in these values networks which is based on its superior price gives car manufacturers an edge over their partners and therefore will give them much market power. However, they have to permanently improve their services and systems to differentiate themselves from their competitors.

Device manufacturers are rather small players in this scenario. On the one hand, device manufacturers will be under a high pressure in their value networks. Since the life-cycle of handheld devices like smart phones or portable devices is much shorter than that of a car model and its systems, device manufacturers will be forced to implement the technical standards defined by them. On the other hand they have the advantage of being able to implement various standards and can consequently be part of many value networks at once. Like today, they will supply their business partners with devices that are capable of communicating with a variety of systems; the partners then will decide which functionality should be usable by the customer and how they will be priced.

In contrast, mobile network operators will play a key role within the value networks for a number of reasons. First, communication will mainly take place over infrastructure technologies. Second, due to their large customer bases they yield a high bargain power. Third, they are free to decide to which extent they want to be bound in strategic alliances; in contrast to software developers they are not dependent on third parties, although cooperation with car manufacturers bear the potential of attracting customers of these manufacturers via exclusive services. And finally they are in control of the movement data derived from cellular status information that is needed for traffic flow prediction.

Finally, software companies that want to offer navigation services will be in a very difficult situation. They will be forced to be part of at least one value network to gain access to the interfaces and to have their software pre-installed on smart phones or on-board units. If they are not part of any value network they will have to struggle to sell their services since they neither can offer connected services nor profit from the market power of strong partners.

6.4.2 The Cooperative Society

In this scenario we assume that oil remains to be the dominant source of energy for cars, and the current trend in energy scarcity remains throughout the next decade. Furthermore, if the current debate over CO2 emissions leads to stringent regulations to cut back these emissions and the reduction of fuel and energy consumption becomes a main goal for politics and traffic authorities society will be challenged by a series of limitations to the development of its standard of living. This will mean that research will be intensified in the areas of energy efficiency and the best use of available resources.

The strive towards efficiency will lead to cooperation across society to achieve best exploitation of society assets. Data exchange will play a vital role to coordinate within society and benefits from the trend towards ubiquitous connection and universal communications.

The trend towards universal access and uninterrupted communications will facilitate the access of important data from different inputs to allow for the intelligent use of resources. People will be interconnected virtually everywhere. This connection is not limited to communities but also to needs. This will be extended to mobility. In this scenario we assume that seamless communication will be further supported by standardized IT car platforms to allow for the access of important car and traffic data and allow for their easy exchange. This kind of information exchange will be used to provide optimized mobility across society. This will be a shift from current transportation paradigm, wherein a person is routed along a path that is individually optimal. Using the multiple input coordinated navigation, traffic will be balanced on available roads that consequently alleviates traffic load on individual streets avoiding traffic jams and decreasing probability of accidents while at the same time decreasing over all fuel consumption and pollution levels. The benefits of cooperative navigation can be simply explained by figure 6.6. In the figure, data is collected about an accident that has occurred on street (A) through which cars were originally routed as it is the street with the shortest distance. In case of typical navigation, the cars will be re-routed through the next shortest path which in this case is (B). However if all cars are re-routed through (B), chances are high that a congestion happens. In cooperative navigation, the traffic is balanced on the two roads (B) and (C) according to their capacity and other parameters. This way the optimal use of available resources is achieved while avoiding other problems at the same time, such as congestion. The environmental relevance of this scheme becomes immediately evident: By avoiding traffic jams the over all fuel consumption is known to decrease as the motor runs on low torque in high gears.

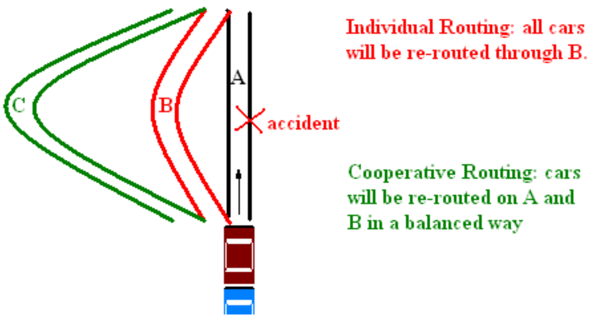

Figure 6.6: Balanced routing vs. individual routing.
Source: Own Illustration

This scenario also places big emphasis on developments in terms of car2x communications. Correspondingly, it assumes that improvements in this field yield standardized communications protocols and access technologies that allow for the exchange of data between cars and other infrastructure.

There already are a number of ambitious projects regarding the efficient mass collection of data, to support efficient navigation. One such project is “Mobile Millennium” which is a joint project of NOKIA, NAVTEQ and UC Berkley supported by the U.S. Department of Transportation [200]. Also the German Institute for Transportation Systems (Deutsches Zentrum für Luft- und Raumfahrt) conducts research specifically on data fusion and efficient data collection as well as navigation scenarios based on car-to-car communications.

It can be argued that the interest of an individual in the common good while sacrificing personal convenience as is the case in cooperative navigation is probably not very high (think of drivers routed through street C in Fig. 6.6). Furthermore, the share of personal driving data may pose another problem that such a navigation scheme has to face. Perhaps, a state regulation endorsing this kind of navigation for reasons of safety and pollution reduction, can push the market size up again yet should that happen, it is then expected that centralized navigation will be handled through a state controlled center. Which would make the network operator carrying the data only a data pipe. It would also allow competing operators into the market as it can be almost ruled out that a single operator will be granted permission to carry the service. Perhaps a really encouraging scheme * From 2006 onwards estimates of the 11th coordinated population projectionwould be a system that priorly warns other participants against a traffic jam or an accident by incoming alert from a car that has witnessed the event. This can be implemented by having only a subset of all cars driving exchange this data. This might then become very interesting even for just one operator as it has been shown that if only 1 in every tenth car provides such data, that is then enough to allow for good decisions. This would size up the market to a subset of the current number of subscribers of a mobile operator, namely those who own a car. Considering that more than 50% of the population of Germany owns cars, a rough estimate would be that 18million out of the 36million T-mobile subscribers have one. If just 5% of these accept using such a service then that is a customer base of around 900,000 people to start with.

6.4.3 The Smart Society

In this scenario the demand for automobiles decreases because of energy scarcity and increased ecological awareness in the society. Although car manufacturers did manage to offer electric cars the problem of energy scarcity could not be solved. The consumption of electricity increased dramatically due to the development of electric cars and so prices for electricity did. Electricity is produced in power plants and due to the nuclear power phase-out there is a problem with the supply of energy.

In Germany the production of electricity will still be done with gas-fired and coal-fired power plants in 2020. Wind power and solar power will only satisfy a very low portion of the demand since the demand increased dramatically. This leads to the situation that people decide to search for alternatives to driving individually with their own car. Energy is simply too costly (operating costs) and they realize that electric cars are not the solution to environmental problems nor to energy scarcity if the electricity has to be produced with fossil fuel. The society wants to save the environment for future generations and a new thought of sustainability is developing in the society of 2020.

People will find their alternative to cars in the public transport where the need for energy per person is much lower. Technological developments will help to reduce the energy consumption of trains and investments in the infrastructure made the use of public transport more attractive for the people. Even rural areas will be connected to the train network with the use of buses. Transport will not be as based on the individual use of a car anymore and people will need more and better information to link their traffic behavior to the schedules of the public transport. An optimization of the combined use of different means of transportation is strongly needed.

As a consequence people in 2020 will have one device for everything that they always carry with them. We call this "convergence of devices". This one device will ensure their mobility and replace the car-based navigation system (actually it will be interfaced to the car wireless and the information will be presented in a head-up display for safety reasons), portable navigation devices and mobile phones. The trend towards this scenario is foreseeable right now when you look at the development of the mobile phone towards the PDA and towards smart phones with GPS modules and UMTS Internet connection.

In 2020 there will be Internet connection available everywhere and the device will have a constant connection to the Internet. Everyone will have a data traffic flat-rate so it is not too expensive. The same situation was observable with Internet at home. At first you had the time-based billing and over the time it switched to flat-rate behavior. Due to that mobility is not car-based anymore, people search for solutions that make the usage of the different transportation means more comfortable. Nowadays people tend to use their car when they want to go from A to B because it is the easiest and most comfortable option. To use other means of transportation it is necessary to search for timetables or maps, parking slots and you have to buy a ticket first. For this ticket you need change and so on. You see, it is much more comfortable to step in the car (which also has a navigation system inside) and start driving.

People will not prefer a car-ride in 2020, because a car ride is too expensive and would not go in line with the new thought of sustainability that arises in the society. They will accept to search for the right train in the Internet, to loose time while searching for a parking slot or buying a ticket. People in 2020 are coping with this uncomfortable situation because it is much cheaper and can they can contribute to save the environment. Fortunately, in this situation our Multimode Navigation device will come into play.

6.4.3.1 Market

The market in this scenario will be different to what we see today. In the following we will describe the market players and list their contributions:

Device Manufacturers
The device manufacturers have to design devices that are able to process all the information that is necessary for the multi mode navigation in 2020 (train schedule, flights, traffic situation, costs, satellite data, Points of Interest). So basically there is a huge processing power necessary. But if you look at the development of the devices in the past years it will be no problem for the device manufacturers to offers such devices. They also will have to agree upon common standards, because the whole scenario only can happen when you are

allowed to install the new (multimode) navigation software on the device.
Example: Nokia

Telecommunication Infrastructure Providers

In this scenario the infrastructure that is needed the most besides the public transport infrastructure, is wireless Internet access. We think that in 2020 there will be an area-wide high-speed wireless Internet access. But providers like T-Mobile have to be aware of the fact that this area-wide Internet might not be based on mobile phone networks. The use of mobile phone networks will not be necessary if you have for example wireless LAN connection everywhere.
Example: Deutsche Telekom

Suppliers of Transportation Means

They have to satisfy the growing demand and give detailed information about train delays and so on. They do this right now, so this is not a problem. The critical point is to develop a navigation software that includes all the data from the suppliers of transportation means. Also the ticketing will be done with the single device the customer carries with him.
Examples: Deutsche Bahn, Lufthansa, MVV

Points of Interest

Information about Points of Interest will become more important, but we see this as a side-effect. They could benefit from the trend that everyone has a navigation enabled device with connection to the Internet. To profit, they have to upload their opening hours, photos etc.
Examples: Restaurants, Museums

Car Manufacturers

They have to work together with the Device Manufacturers, because there will not be a dedicated navigation device in the car of 2020. There will be just a bigger display (most likely: head-up display) and an interface to the navigation device. This means that the car manufacturers may lose a chance for differentiation and a potential source for revenue. Also they have to cope with a decreasing demand because of the energy problem.
Examples: Audi, BMW

Suppliers of Mobile Phone Tracking Data

To give the customer full information, every mobile phone user has to the tracked. This may lead to a discussion because of legal issues but finally the information need will be bigger than the fear of losing privacy.
Example: T-Mobile

Suppliers of Geographic Card Material

We believe that there will be very good open source map data available in 2020. There are open source initiatives right now that start to register all streets and walks.
Example: OpenStreetMap

Software developers
There will be new companies that develop software solutions to bundle and combine all the information from the different means of transportation. They will offer the intelligence to see mobility from a holistic point of view. This is only possible if there are open standards which we will have in the year 2020. *Example: Our MMIQ software - see Service Idea*

6.4.3.2 Customer Needs

As it was also discussed in the Basic Report on "Market Pull" the customer wants to have one device that is able to satisfy his needs for information, navigation, entertainment and communication instead of having two or three devices. In 2020 this trend towards convergence of devices will have significant effects on mobility. The navigation device will be integrated in mobile phones. Right now, few mobile phones have navigation integrated. Today's mobile phone navigation is also very limited, because of slow processors and few services. Navigation will not just be demanded in the car, but also pedestrians and bikers want to be navigated in the future. Customers do not want to be dependent on a car.

Customers also want navigation to be more realistic and that will lead to something we call "video navigation". Today's navigation systems show the situation in a very abstract way. In 2020, especially when it comes to pedestrian navigation, people want to see a more realistic scenario. This may be helpful when you want to go to a cafe in the city and you do not know if they have tables outside. Then you might consult your navigation device and zoom in your destination. It is also better for the orientation of the user, when the world on the navigation system looks more realistic. People in 2020 also want to be navigated in a more intelligent way. As said before, people do not want navigation to be limited on cars. If you plan a trip, the navigation device should also consider going there by plane or by train as well. It should also calculate intelligent combinations of different means of transportation.

Multimode Navigation is about planning a trip including all means of transportation. When you decide to go from Munich to Berlin by train the navigation device - due to it's Internet connection - could automatically buy a ticket from Deutsche Bahn. Deutsche Bahn will then send you a optical so called "Aztec Code" (2D-Code) that you can show the train guard when asked. Such a system would also be applicable for flights and public transportation. The device should propose different options for your trip:

- The fastest option by including all means of transportation (car, train, flights, taxi, bus, walks). This option should be calculated intelligently by including the time for passport control or boarding when you decide to fly or the time for finding a parking slot when you go by car.
- The cheapest option by including actual prices for gas and tickets.

- The most convenient option by including information concerning your personal preferences and the actual situation in the different means of transportation (crowded train).

- The environmentally friendliest option by calculating the carbon dioxide emissions of the different options.

The device should also give information about car-sharing and car-pooling possibilities but this will be discussed in the Trend Report on "Community Services" in detail.

Navigation should also detect unforeseen circumstances. It should include information concerning train delays, traffic jams and (interfaced with the car) also information concerning an empty tank and include the time you need at the petrol station. The daily-updated petrol price should also be included in the calculation which will be possible with the ubiquitous Internet access. Customers in 2020 will want to have Internet access everywhere. Even today there are initiatives to open up private WLAN routers for the public or an area-wide wireless high-speed Internet access over the mobile phone networks (UMTS, LTE). Ubiquitous Internet access opens up new possibilities for navigation and location based services. The latest ratings and reviews of restaurants or museums could be included in the navigation user interface. What will also be demanded by the consumer of the year 2020 in the case of navigation is a speech recognition and a voice control of the navigation device. Especially in the case of navigation in the car, safety is an issue. People do no longer want to adjust their navigation device before the trip starts, they want to do this while driving.

More information is another point that will come up until 2020. If you plan a trip in the morning, the navigation device could propose a nice restaurant where you could have breakfast. This proposal could also include reviews of other users and restaurant tests available in the Internet. Basically this point is about more information and about better information. When you got to Milan in 2020 the navigation device will not just tell you where you can have an espresso, it will tell where you can find the best espresso in town. This will be realized with the ubiquitous Internet connection and more user-generated content. Location based services will not just tell you the address of a restaurant, but due to your Internet connection you can have look at the menu when you plan your trip. You can think of various possibilities like the reservation of a table when you plan a trip via your navigation device.

6.4.3.3 Business Models

In order to multimode navigation being the established navigation form in 2020, this entails a lot of advantages for the supply side as well as for the demand side. Life may become much more convenient. People are to possess one device they always carry with them and which is capable of processing all relevant information and able to connect uninterruptedly to the Internet. As even today there is such an abundance in information this pattern will increase much more until 2020. With multimode navigation the users get the right information at the right time quickly and without endeavor.

But not only the users of multimode navigation will enjoy many advantages and possibilities. As the user is permanently connected to the Internet and carries one device with him, a lot of possible business models may emerge. The user is always and everywhere attainable. Furthermore his location is ascertainable anytime. User-specific location-based services may be offered in an enhanced way and especially the network provider may play a central role due to possessing the customer relationships and acts as billing interface.

Of course, to let the scenario become true there has to be increasing cooperation among all market players. At first, provider of public transportation means have to deliver detailed and real-time information about their time schedule. They also have to agree upon another party entering their sales and distribution channel so that the users of multimode navigation are also able to buy a ticket via the mobile device. This can not be carried out by each of the providers of different public transportation means, because the vision of the scenario is that the user is able to directly compare different transportation means and picking out one, followed by immediately booking the ticket (in case of public transportation) at the same time. Also the data privacy standards have to be designed accordingly in 2020, so that the user is able to correctly foresee the traffic and the inconvenience - and thus the location of all people - within a certain route. The government will have to take up certain positions in order to enable that. Furthermore real-time information has to be available to make dynamic navigation possible. The cooperation issue holds true for all market players having to make some compromises, including car manufacturers and card data providers.

In the multimode navigation scenario different players are acting within the value chain for mobile navigation or the value net respectively. The main players in this market are software providers, mobile operators and device manufacturers. They have different conditions and possibilities for providing multimode navigation.

Telecommunication Operator

Assuming that navigation in the future is no more based on PNDs (Portable Navigation Devices) or on in-car devices, as the navigation will no more be focused on the car but on the individual, the mobile phone will play the dominating role. As long as there can not be built ad-hoc networks throughout whole Germany or ubiquitous connection can not be achieved without mobile networks, it has to be provided by mobile operators. They are in a key position for offering multimode navigation, because the positioning of people has to be determined by data sourced from the cellular phones. Thus the telco operator may enhance its position in the value network of mobile navigation. One possible chance for the MNO to establish as navigation provider is acquiring a software company developing navigation solutions or just buying or partnering the software developers.

Software Provider

The software developer may be a white label provider or one with an established brand (e.g. Microsoft). In case of having developed a multimode navigation solution, the company will have to agree upon a partnership with a mobile network operator or a device manufacturer (e.g. Nokia) to get access to data sourced from cellular phones and to reach a critical mass. Of course he could also sell the software or license it for a certain period of time. Licensing is even possible exclusively. The software provider may have a quite good position in 2020, because the handset will be more similar to a little personal computer and people will increasingly download software from the Internet directly to their mobile phone or just buy software from a retailer just for their handsets. Thus it will be more easier than now to cash in on software or services for mobile handsets. Nevertheless software developers will not be able to offer all the services associated with multimode navigation on their own as they do not possess the data sourced from cellular phones.

Device Manufacturer

Device manufacturers may also be in a good position in 2020 to establish as navigation provider. Of course this depends also on the mobile operator's willingness to cooperate, because in order to ascertain locations of people they need to have access to data sourced from cellular phones. Handset manufacturers already now have developed platforms. For example Nokia has designed platform devices to help developers build and deliver mobile applications and content. In the future this will be way more expanded and thus the platform of the respective handset manufacturer will be able to act as sales channel for mobile applications.

Considering that a multimode navigation application requires a lot of know-how, it is most probable that a software provider is to develop this kind of application. He could either sell the software to a mobile operator or agree on a partnership with him. As he also needs access to content and the tracking data sourced from cellular phones there is definitely a need for cooperation. Multimode navigation software could either make money out of direct access fees for example on a monthly base or a one-time license fee, out of advertising or out of revenue shares. Revenue shares are to result from partnering with all kind of public transportation means as multimode navigation is to provide the tickets for public transportation means. Revenue share may as well result from additional applications that may be installed upon the multimode navigation software, e.g. an application that informs you when your friends are around. Once there is an established multimode navigation software there are a lot of ways to cash in on location-based services. If the mobile handset in 2020 also will serve as payment device, navigation providers would be able to make increasingly more money out of location-based and user-specific advertising.

6.4.3.4 Opportunities and Threats

As already explained in the last section, one significant opportunity is represented by the possibility to build a lot of business models on top of the mere multimode navigation.

There is a huge revenue potential regarding advertising, because the ubiquitous connection and the fact that people most of the time carry one multifunctional device with them enables user-specific and at the same time location-specific advertising. Customer needs can be identified and addressed much more easily. Due to knowing the user's locations, it will be possible to contact them at the right time with the right advertisements. Of course advertising on the mobile phone will not be accepted before the location-based services are established. But once the user is used to have location-based services he is to accept also location-specific advertising (See figure 6.7).

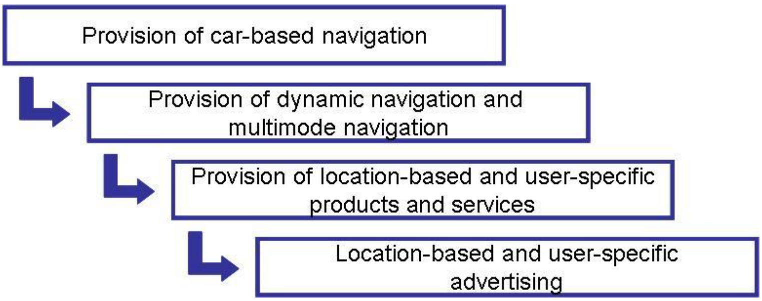

Figure 6.7: Provisioning of location specific advertising
Source: Own Illustration

The multimode navigation application could also act as kind of platform where third parties can offer their applications on top of the navigation software. Thus the navigation provider is able to participate in revenue shares, if the respective application is offered for sale. Furthermore developing such an application and offering it exclusively for customers, e.g. a mobile operator for its mobile customers, may result in a significant increase in market share and brand reputation.

With multimode navigation being an enormous facilitation for the user's lifes there are also lots of opportunities for the consumers. For example, the multimode navigation could be linked with social communities, where users are able to identify where their friends are at the moment. In addition they could get location-specific recommendations for bars, cafes etc. dependent on their specific position. Regarding ecological awareness and the assumption that in 2020 the ecological awareness will have been increased, multimode navigation could make a contribution to reducing CO2 emissions. The multimode navigation as well takes public transportation means into account and makes it much more convenient to come from A to B also via public transportation. This issue may accelerate general demand and acceptance for multimode navigation. Customers additionally profit from an increased mobility and are able to save a lot of time and inconvenient issues, as they no more have to compare and evaluate the different options for their target route themselves addressing cost, time and convenience.

As there are always two sides of a coin, not only opportunities result from bringing multimode navigation to market but also threats come along. As we imply all people carrying one multifunctional device with processing capabilities with them, this may hold not true for 2020. Due to the device being very advanced in technology, either the market demand may not be enough or the price be too high for consumers to reach a critical mass required for an establishment of the software. Also the increasing share of elderly people may cause a problem as they are usually more resistant towards innovation and technology. We assumed certain developments of the key drivers at the beginning, like a convergence of devices and a standardization of platforms to become true until 2020 in order to let the smart phone interact with cars, PCs and embedded systems. These circumstances may not be true for 2020. Furthermore the data privacy standards need to be designed accordingly and the people first have to accept whether their location can descried anytime. As the smart phone acts as processor for several other systems, the safety and the security both need to be granted. In case of a system crash the question arises which party is responsible. It may be very difficult to make out the liability of one party. Additionally there may be a further problematic issue regarding the calculation of different options for one route. For instance consider that the airline gives wrong or information about the flight schedule and the user of the multimode navigation counts on the respective information, it may also be difficult to arrange which party has to be liable.

Altogether we consider this scenario to be the most forward-looking scenario and the one where the most business models emerge from. Even if there are considerable downsides we expect them to account less than the opportunities until 2020.

6.5 Service Idea

In the last section we have developed an idea for an intelligent navigation service that is expected to deliver a notable benefit to the customer while exploiting the trends in development in technology and society as discussed above. In the following subsections, the idea is generally introduced. Furthermore the required partnerships and devices to support the service are described and are rounded up by a revenue model and an analysis of the possible risks and opportunities.

6.5.1 Business Idea

We call our Service Idea “MMIQ”. That stands for our Intelligent Multimode Navigation software. We basically offer a software that navigates you more efficiently. Today you step into your car and then type in where you want to go. So you are stuck to the car when you want to be navigated. With our software, navigation will be on a mobile device (i.e. mobile phone) and will include not just the car as a possible way of going from A to B, but all means of transportation.

With our software navigation will not be car-based anymore, but based on the individual. The information will be processed in one device and available everywhere. This seems to be obvious due to the fact that mobility does not just begin when you step in your car and does not end when you leave it. Mobility should consider **you** as an individual and not just be connected to the car. Imagine when you walk out your apartment in Munich in 2020 at 9 o’clock in the morning and you have a meeting at 14 o’clock in Berlin, your Multimode Navigation enabled device will calculate not just one route but different routes for you. In this calculation **all** means of transportation are included and not just driving with your own car: walking by foot, public transportation means, going there by train, flights and others. The device will show you different options including real-time information concerning the traffic situation, the train and public transportation schedule and available flights. The real-time information about the traffic situation, the number of people in a train or in the subway will be available because every device will have a connection to the Internet can be traced back to its actual position with an accuracy of a few meters.

Based on this data the device will show you different options of using all means of transportation. It may show you the best option concerning the price, the fastest option, the best option concerning CO2-emissions, the most convenient option based on your individual preferences and real-time information that tells you how full for example the train is. You can tell the device your individual preferences, for example if you prefer a specific means of transportation over another. The software enables the user to find her best way including:

- Trains schedules (i.e. for the German market: Deutsche Bahn)
- Public transport schedules (i.e. in the area of Munich: MVV)
- Flight plans (i.e. Lufthansa, Air Berlin)

- Footwalks and Bike-rides

As mentioned before the software tells the user what the best way of going from A to B. Today, when you are navigated, every person is navigated the same way. MMIQ is different. It allows you to include:

- personal preferences: you can tell the software what your preferences concerning the mean of transportation are. If you prefer the train over going by car. Or if you prefer walking over the metro.
- the actual situation of comfort in different means of transportation: Using mobile phone tracking we can tell you the actual situation of the means of transportation and use it in our calculation of the options
  - the real-time traffic situation on your route (maybe you feel stressed when there is too much traffic and decide to go by train)
  - how full the subway actually is (maybe you will not want to choose the subway when it is too full)
  - if there is enough space in the train to work or sleep (maybe there are empty rows and tables where you can work)

The idea changes navigation in different ways. First of all it gives you more information, because it takes all means of transportation into account. It also gives you better information due to the use of mobile phone traffic data. Furthermore it will enhance the use of the public transport, because it allows you to match your traveling behavior to the schedules of the public transport.

Our service idea enables you to combine the ecological friendliness of the public transport with the individuality of driving with a car.

6.5.2 Mock-Up

Our product idea is further explained in detail in this section using a series of screen shots of a simulated scenario. In the first figure (Fig.6.8) the user chooses his destination and sets his profile. This profile is important to determine the services he gets offered while being navigated and how preferences are set for the offered routes. A business profile for e.g. prioritizes travel time over cost.

Figure 6.8: Mock-Up: Choice of destination and profile.
Source: Own Illustration

In figure 6.9 the three best routes are returned. They offer different combinations of transportation that are optimized according to cost and time of travel. These options are prioritized according to the personal preferences and the chosen profile. The user chooses the route he prefers and the route is shown on the map.

Figure 6.9: Mock-Up: The three calculated best routes based on preference
Source: Own Illustration

Once an option is chosen, the corresponding convenience factor is shown. This indicator takes a number of vital inputs into account that can make the trip more convenient, such as the approximate fill up inside a train or the traffic status on the offered routes as shown in figure 6.10.

Figure 6.10: The convenience indicator includes a number of inputs that make the trip comfortable
Source: Own Illustration

Through this client, any required tickets necessary can be bought directly (and possibly refunded according to circumstances), see figure 6.11.

Figure 6.11: Mock-Up: Buying required tickets for trip on the spot
Source: Own Illustration

The intelligence of the system and its ability to collect information from multiple inputs allows it to warn the user while he is being routed against any possible problems such as a traffic jam or a flight delay. If such a situation is identified the client offers updated routes and indicates the changes in travel duration and cost as seen in figure 6.12. In this example another benefit of the system is seen. In this particular situation, the user who wanted to go from Munich to Augsburg, was offered to drive to Munich central station and take the train to Augsburg (see figure 6.9). Now, due to the traffic jam detected, the user is now advised to continue by car to Olching, which is a town north of Munich, as the train will be passing by that city and hence the user does not loose his ticket and also he does not loose the competitive price offered by taking a train trip instead of going to Augsburg by car. To comprehend the real benefit, it is seen that the user will not be frustrated by the traffic jam as he will avoid it. Also he will be spared the disappointment of losing the train and accordingly loosing the ticket and also the induced delay by having to wait for the next on going train.

Figure 6.12: Mock-Up: update of routing options due to traffic jam
Source: Own Illustration

This Mock-Up is a demonstration of some of the functions this service supports.

6.5.3 Revenue Model and Organization

These services of the 'MMIQ' software increase the mobility and facilitate the life of the user. With this application customers are able to save more time and cost and it increases their convenience. 'MMIQ' also addresses the ecological awareness as it points out the CO2 emissions that are induced by each of the options.

Potentially this service is relevant for all kinds of people and does not only serve needs of specific target groups. There are hardly persons that would not profit from this innovation. But as we need to address a specific market segment first, we think about younger and higher educated persons. As they are in to new technologies and therefore mostly act as early adopters, they could most easily be enthused about MMIQ. When MMIQ has been established within this target group, the spread into new market segments takes place easily. As in the future there will be an increased amount of elderly people, they also represent a large potential customer segment. By addressing them specifically for instance with an easily operated version of MMIQ, their lives could be made more easy and convenient. Furthermore we expect voice recognition to have reached a reasonable standard so that MMIQ with included voice recognition could solve a lot of day-to-day problems of elderly people without raising all of the problems about operating the technical device.

The proposed service idea requires a number of partnerships that would otherwise render the service usable only to limited extent. A number of agreements with regional transportation companies and the German rail way system (Deutsche Bank) have to be forged. As we expect this system to work also on long distances, similar agreements with airlines operating locally have to be signed. They have to deliver their detailed time schedule with real-time updates, delays or other changes in time. Finally, co-operations with car rental offices and car sharing communities can extend the service and give it increased flexibility and added optionality. But the most important success factor is a cooperation with a mobile network operator as he delivers the location data sourced from cellular phones. Considering that the penetration of mobile phones in Germany even nowadays already has exceeded one hundred percent, in 2020 nearly everyone will possess a mobile phone. Furthermore we expect the LTE standard to have established and also having been expanded in nearly all areas of Germany. Thus the mobile provider will be able to track the locations of the people, of course anonymously, in real-time. This data is essential for the MMIQ service idea.

As for devices, the increased capabilities of handhelds can already cope with the requirements of such a service and system. Programmable platforms using System On Chip (SOC) technology that provide connectivity, GPS navigation and a number of other built-in functionalities are capable of supporting complex applications and can hence be expected to support such a service in the near future on wide basis.

Due to the partnership with a mobile operator, most desirably T-Mobile as possessing the highest customer share in the German market, MMIQ would have access to the location data tracked from mobile phones. Although the T-Mobile customer base only represents a part of the German population, this would be at first enough to estimate the total amount of people or cars respectively in a certain place like in the train. T-Mobile also disposes of an already established sales channel. The mobile operator possesses the customer relationships and also acts as billing interface. As the people are used to pay money also on a monthly base to the telco provider, it would be much more easy to cash in on the multimode navigation service idea. Of course also the established brand of T-Mobile would lead to a higher customer acceptance of MMIQ.

Revenue generation results out of different sources, mostly out of revenue shares. With real-time multimode navigation being the central success factor of our service idea, provider of public transportation means have to agree upon partnerships to deliver their on-time and always up-to-date schedule. As MMIQ provides the possibility to buy the ticket for the respective transportation means directly and via one click on the mobile phone, it acts as additional sales channel for the public transportation providers. Thus they would on the one side have an incentive to cooperate with us and on the other hand to agree upon yielding a small percentage of their revenue to us. The possibility for users of MMIQ to compare different options of transportation may lead to a higher usage of public transportation means, because in direct comparison to the car the public transportation is often cheaper (e.g. train) or faster (e.g. airplane) and may be more convenience and emit less CO2. To create a competitive advantage against potential competitors one could consider not to call for revenue shares but to strive for an exclusive agreement with some public transportation providers or at least one who is big enough. This would hinder other providers offering the same service and create a competitive advantage.

In the beginning the biggest revenue shares result from the partnership with the mobile operator. In order to being able to offer MMIQ to its customers, the mobile operator has to agree upon a revenue sharing agreement with us. Hey either has to pay a monthly base or one-time costs for offering the service for its customers. Hey can furthermore decide himself if he wants to charge the service additionally at a monthly fee or give it for free to its customers. As MMIQ is to drive data traffic, is to drive sales of data packs, can generate additional revenue if customers are charged at an additional fee and is an additional and highly relevant value-adding service, he definitely would have an incentive to cooperate with us.

If once people are used to employ the multimode navigation service and are as well used to buy tickets via their mobile phone, they will also accept location-based advertising. Consider the enormous potential of advertising revenues that can be generated as it is possible to contact the user with the right advertisements in the right location in the right time. For example, if the customer drives by car on the highway he could be addressed with a hint that there is a McDonalds near the next gateway of the highway. Via MMIQ we will be able to agree upon a lot of advertising contracts with various businesses like restaurants, shops, gas stations or cafes.

6.5.4 Opportunities and Risks

Now that our product idea was presented we confront it with the assumptions we made about the situation in 2020 to identify possible opportunities and risks for “MMIQ”.

One major opportunity is derived from the fact that we address a daily need of many people; the desire to travel from A to B in the most efficient and convenient way possible. This is true for long, unique trips, daily commuting and flexible mobility in the city alike. As a result our potential customer base will be very large and interest in our product will be high. Once in use our service will be used very frequently, therefore generating much data traffic and being very attractive for advertisers. We believe that our product will soon become indispensable for many people and enjoy high popularity among users of all target groups.

The attractiveness of our product is further enhanced by the possibility to extend it very easily. There are many services imaginable that would add new functionality to our product, for example the integration of a parking space finder or a component for taking car-sharing pools into account. We strive to become a platform for free and commercial third party services which will result in high market power and will establish our product as the first choice among navigation application(figure s. People will be able to select the additional features they would like to use, download them from the Internet and customize their MMIQ according to their personal needs.

Another important aspect is the high usability. Our service is easy to use and does not require any specific knowledge or skills. Although advanced users can customize their MMIQ with profile settings, this is not necessary to use the service effectively. In addition, users do not pay directly for the service; an important aspect since this removes a fundamental barrier that might drive away potential costumers.

Finally, our product is based on a very versatile business model. Since we generate value for several stakeholders we are able to generate a variety of revenue streams and are not dependent on a single source of income. First, there are the mobile network operators that benefit from the additional data traffic our service creates. In exchange, we demand a monthly fee per user or a one-time fee per device. Second, there are the providers of public transport who will profit by the easier accessibility of their services while we get a provision for sold tickets and/or a subscription fee. Third, various businesses that we summarize as “points of interest” will be interested in advertising linked to our location-based information services. This will generate an additional source of income while they profit from an increased awareness for their branches. This versatility provides us with a very stable basis. Even if change occurs and we lose some of our partners, we will not be put out of business and we will have time to find other partners that fill the gap.

However, there are also some threats that have to be considered. First of all we are dependent on our partner’s will to cooperate. If mobile phone operators deny us the access to traffic flow data, our service will slightly lose attractiveness, but if they are not interested in pre-installing our application it will be very difficult to reach enough people to create a sufficient user base. Furthermore, if public transport providers refuse to provide the data needed to integrate their network into our calculations, the benefit of our service for users in the affected areas will be greatly reduced.

Another critical aspect is the acceptance of our service by elderly people since they will represent a large fraction of the population. This will be determined by the usability and presentation of our service, but also by the input methods available, soft factors like reputation, especially word of mouth, and the market penetration of appropriate devices.

Finally, our service will be threatened by alternative, free products offering similar functionality. What they lack in usability and functionality they might compensate for by certain innovative features, a loyal community and/or the fact that they are available for free. In that case our product might not be used by a large enough number of customers and our partners might lose interest in supporting MMIQ.

To sum it all up our product idea has great potential on the market in 2020, but we also have to be aware of the dangers and troubles that might await us. However, the opportunities outweigh the threats and we are optimistic that MMIQ will be highly successful.

6.6 Conclusion

We discussed the development of navigation applications until 2020 considering the likely trends for the most important factors. These key scenario drivers are highly uncertain and therefore we used three scenarios to picture different possible future situations. We saw that by altering the flow of events with just three key drivers we heavily influenced the likely developments and created very different scenarios to outline the major implications for each of them.

Among our three visions of an individualistic, a cooperative and a smart society, the smart society seems to be the most likely scenario. The standardization of communication platforms enables the creation of connected services that integrate a variety of information sources to offer the user the best possible navigation experience. Functionality will be concentrated on one portable device so that navigation becomes user centered instead of bound to vehicles. As a result the integration of public transport into navigation solutions becomes an important issue.

Our product idea MMIQ is based on exactly these assumptions. The service will run on smart phones or similar handheld devices and offers what we call multi-mode navigation. This means that the application takes several means of transport for the chosen route into account and offers travel suggestions based on the user's preferences. One important aspect is the processing of real-time information about traffic jams, seat availability in trains and similar factors that might lead to a re-computation of the optimal route and the appropriate transportation means. Finally, it will be possible to book the required tickets directly.

Considering the possibilities and the expected market situation we believe this product will meet the demands of many consumers. In addition our value network consists of all major players and our business model is very versatile and flexible. Regarding these factors and the many opportunities we identified we are convinced that our service will be an instant success and become the first choice among all navigation applications.

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Chapter 7

7 Communications

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The report starts by analyzing the relevant drivers for the communication scenario, which are then classified as stable and unstable drivers. As our key drivers we identified the deployment of a mobile broadband network, the legislation concerning hands-free in-car communication and the time people spend in cars. Key drivers in general are the most important, but also the most unstable ones.
Based on this driver analysis we will identify three potential future scenarios - the Public Transport Generation, where most people switch to public transport, Role Model America, where car usage will increase, but the technology development will be slow. Last but not least the most likely scenario "Technology Driven Society" will be presented, where all developments are very favorable for new technologies.
Consequently our product CallYouCallMe is based on this scenario. CallYouCallMe is a context-aware address book that allows users to perform simple call requests like "Call the next repair shop" or "Call Bob at the IT department". Three areas of application can be differentiated - private use ("Call my mother"), company use ("Call Bob at the IT department") and location-based services ("Call the next Italian restaurant"). Besides technical possibilities and business models we will describe possible add-on services and products.

7.1 Introduction to Communications in Cars

First we like to provide a short overview of the different aspects of communication in cars.

7.1.1 Internal vs. External Communication

The first differentiation that has to be made is if communication happens only inside the car or with the outside world.

Internal communication between passengers is usually done face-to-face. However there might also be local networks in the future that passengers use with their devices to connect to each other for e.g. gaming or file exchange or as a bridge to a car-wide Internet connection.

External communication is considered everything that happens with the outside world. Therefore mobile phone networks belong into this category as well as Car-to-Car or Car-to-Infrastructure communication.

7.1.2 Communication Services

The next area of interest around communication is the service area. As a communication service we consider every service that is offering communication or is based on communication. Here are some examples:

- Mobile phone network
- Broadband to the car
- Travel information services (hotel bookings, restaurants, traffic, ...)

7.1.3 Devices and Applications

The devices that are related to communication within the car can be divided into two groups. First, there are in-dash systems. These are systems that are fitted into the car. Therefore the user is not able to carry these devices with him (at least not without significant work). A modern car's head-unit for example is an in-dash system.

Second there are mobile devices. These are all devices that can be carried around with ease. Mobile phones and personal navigation devices belong into this group.

As application we consider a piece of software that is installed onto a system of any kind. If it has been preinstalled by the vendor or if the user installed it himself doesn't matter.

7.1.4 Email and Mobile Office

An area which is quite new to the in-car communication environment is email and mobile office. Email and mobile office applications have been around for quite some time on mobile (business) phones. However there are still only a few integrations with the car available. This might be the case because the usability problem could not be solved so far - using email in the car is still quite unusable, at least while driving.

However we think that working on the go will be getting more important in the future as the demand for mobility in the work setting rises and working people have to become more efficient all the time.

7.2 Drivers for the Scenarios

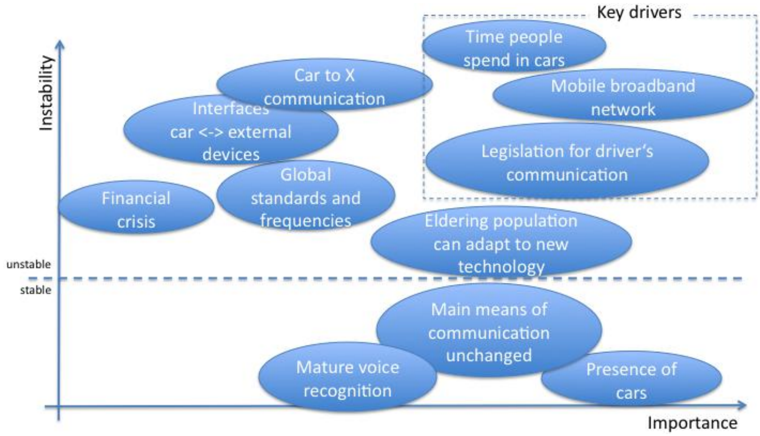

Figure 7.1: Driver overview
Source: Own Illustration

The following sections contain the drivers we identified as relevant for the communication area. We subdivided them into stable drivers, which we think remain unchanged during the relevant time frame, and unstable drivers, which are likely to change. The key drivers are the ones which are most important and most unstable, therefore they are the most relevant drivers for forming the scenarios. To avoid repetition the key drivers are not listed within the unstable drivers, although they are in fact highly unstable. Figure 7.1 shows an overview of all drivers, sorted by importance and (un)stability.

7.2.1 Stable Drivers

7.2.1.1 Presence of Cars

Presence of Cars is a natural requirement for communication in the cars. However we think that cars will be present in the relevant time frame. What might indeed change is the type of fuel we use to power our cars. Current developments show that we might move away from pure petrol to hybrid or electric cars. However this doesn't change the basic concept of a car.

The presence of cars or even the prospected presence of cars significantly influences the amount of money companies willing to invest into the in-car communication technologies. Nobody will invest large amount of money on anything if it might not be present anymore in the near future.

7.2.1.2 Email, SMS and Voice as Main Means of Communication

If you look back at the last years, you will see that - despite of new technologies like MMS, VoIP and mobile video telephony - the communication behavior of people has basically not changed at all. There has always been oral communication (personally or via a phone of any kind) and some written communication, either in short form (telegrams, SMS) or in a longer form (letters, emails).

For the development of communication technologies this is an important fact, because if we know that the basic communication behavior of human doesn't change, the development of new technologies for this kind of behavior can be fostered and we can neglect the search for fundamentally new types of communication.

7.2.1.3 Mature Voice Recognition

Voice Recognition is a technological key success factor for hands-free mobile communication. However voice recognition can be considered mature already today, although the error rate is still not desirable, also the market penetration is still quite low.

This also closely connects to the legislation. For real hands-free communication you basically need a mature voice recognition. Most other types of interfaces, e.g. buttons at the steering wheel, seem to be only interim solutions, because they still distract the driver's attention very much from driving. Think about e.g. entering a number or choosing an entry in a large address book while driving.

7.2.2 Uncertain Drivers

7.2.2.1 Globalization in Terms of Frequencies and Standards

Globalization is a very relevant driver for mobile communication. For equipment manufacturers market entry will be much more attractive if their devices can work on the same frequency bandwidth and same standards on a global level. For the consumers this means an offer for more different devices that will operate with each other better. More competitors also mean falling prices and therefore usually trigger a higher market penetration.

If we look at the relevant standardizations today, the picture looks like a mixed bag. Some areas, e.g. the Internet Protocol(IP), are standardized very well and the standards are accepted worldwide. Other areas, for example the frequencies for mobile phones, are not that well standardized which requires devices that are compatible with more than one frequency (e.g. quad-band mobile phones).

7.2.2.2 Interfaces to External Devices in the Car

External communication interfaces could offer a broad range of mobile interconnectivity scenarios if there is a standard (see also the previous driver). Current solutions are singular and only limited connectivity is available, e.g. for MP3 players and mobile phones. But even if you consider mobile phones, only voice functionality is offered via the interface, SMS, Internet and navigation functionality is usually not part of the interface but an add-on service.

The standardized interface is also very important because of the very different life cycle between cars and today's communication and entertainment devices. Whereas cars have a time on the market around 7 years before the get replaced with newer models, mobile phones for example have something around 2-4 years. This means that there will be around 3 generations of mobile phone only for one car generation. When offering a suitable interface cars could integrate new functionality of the latest devices into their high quality system, e.g. the sound system, the head-unit or a head-up display.

7.2.2.3 The Financial Crisis

The Financial Crisis will also influence especially the time when new devices and applications will be introduced (because of lower investments) and when a certain market penetration is reached (because of reduced consumer purchases). However we think that the financial crisis will go over and will only influence the time frame and not the basic directions of development.

7.2.2.4 Car to X Communication

Car to X Communication like the Car to Car communication and the Car to Infrastructure communication are mainly planned for safety - e.g. transmitting warnings about road conditions or accidents from one car to another. It might also open new possibilities for communication, e.g. you might be able to call your neighboring car in a traffic jam.

As there are very concrete developments in this area (like the Car to Car communication consortium [214]) we consider the introduction of these technologies for sure, although if the time of introduction is still uncertain.

7.2.2.5 The Ability of the Eldering Population to Adapt to New Technologies

Adaption ability is a key success factor for any new product and technology. If elder people are not able to adapt to the new products, the market penetration will always be limited, as the elder people have a lot of money and the population is getting eldering. Although it is very difficult to predict the ability of people to adapt to new technologies, current statistics show that eldering people get more and more adapted to new technology. For example Germany's federal statistics office announced in 2005 that the growth of people using the Internet over 54 years of age is actually higher than in the age group starting at 10 years [220]. However it can not be foreseen if this trend will keep up and at which speed.

No matter how this trend develops elder people should clearly be taken care of whenever designing a new product. This is especially true for developing a user-friendly interface.

7.2.3 Key Drivers

7.2.3.1 Broadband Mobile Network Deployment

The Deployment of a Broadband Mobile Network like LTE [212] is a key driver for new in-car communication scenarios. Most new communication technologies like VoIP are based on the Internet Protocol (IP) and usually require more bandwidth than current technologies, e.g. video or music streaming.

When thinking about any communication service that wants to use some central platform connected over the Internet in near real-time, the deployment of a new generation of mobile broadband network is crucial. This is simply because current networks don't offer enough bandwidth for many users at the same time and latencies are significantly higher than on fixed broadband connections.

The technology for a new mobile broadband network is available, however the deployment of it is still uncertain because a very large investment is required (which is not exactly easier because of the financial crisis). As the past has shown with UMTS the deployment of a new communication network technology takes a very long time and usually significantly longer than expected (e.g. UMTS is still only available in cities with almost no coverage on the countryside).

7.2.3.2 Legislation for Mobile Communication While Driving

Legislation for Mobile Communication While Driving is also an important driver. Currently drivers are basically not allowed to communicate while driving. However more requirements concerning a hands-free interface are coming up like the recent legislation for hands-free sets has shown. This must also be taken into account for product development. At the moment we don't see a clear trend whether the communication will be allowed in the future (maybe even more liberally) or it will be more restricted (or even totally forbidden) for traffic safety reasons.

As most cars are currently only driven by one person at a time:the driver , it is important for any new communication technology in the car that the driver is legally allowed to use them. If it is not legally allowed, basically there is no meaning to bring a product to the market for in-car communication at all.

7.2.3.3 Time People Spend in Their Cars

Time is a very uncertain and also very important driver for in-car communication. It is uncertain because on one hand there is increasing traffic and therefore increasing traffic jams leading more time people spending in their cars. On the other hand there are rising oil prices which leads to less people using their cars and instead changing to public transport.

It is very important for the communication scenarios because companies will not want to invest in any in-car communication technology if people don't spend at least some time in their car actually using the technology.

7.3 Scenario Development

After having described main factors and key drivers, which have an impact on the future development of in-car communication, possible outcoming scenarios will now be discussed. First, two scenarios will be shortly evaluated concerning their assumptions, relevance and importance in relation to the context. This will be followed by another scenario being characterized in a more detailed way in order to give a good background knowledge about the product idea, which will be described at the end.

7.3.1 Public Transport Generation

The first scenario mainly focuses on the competition between public transport systems and private cars. The main factor, which sets a framework for this scenario is the cross elasticity between the number of cars on the road and the availability of in-car services. If cars are substituted by alternative transport systems, in-car services will also lose attraction for companies providing communication related products. In the following scenario we consider a major trend towards the use of public transport systems. The key drivers are considered to behave accordingly to this trend. However, there are still assumptions to be made concerning key drivers. These will be discussed in the following section.

7.3.1.1 Development of Broadband Networks

For the first key driver we assume, that broadband networks like LTE will not be provided on a high coverage ratio in the relevant time frame. Although LTE is expected to be technically available, it is assumed, that it will not be initially deployed in the analyzed time frame. We assume this because of similar developments that UMTS went through [224]. Additionally we think that too little investors will participate who are willing to take the risk of an investment in the network infrastructure of rural areas. The investors will fear that the high licensing costs of LTE, which might even exceed the costs of UMTS licenses in 2000, will not be compensated by high returns because of the low population in these areas. On the one hand this assumption is dependent on the economical situation and the investment atmosphere in Germany. On the other hand the availability of co-operations between telecommunication providers and state authorities can be crucial, since single companies might not be able to bring up the required amount of investments. We assume that UMTS however, will be available in high populated areas, but high data rate performance will still be not available in rural areas. Additionally, further significant investments in the existing UMTS network, in order to guarantee similar coverage in rural areas, are not expected. It is assumed that these investments are held back in favor of the development of more modern and more efficient technologies. Although Volkswagen is supporting the development of "Wireless Wolfsburg", the biggest WiFi network in Germany, it is assumed that WiFi networks will only supply connectivity in few urban locations till 2020 if at all. It is also assumed that telecommunication providers do not consider WiFi as the adequate solution for mobile networks concerning technical applicability. Another reason for a slow deployment of broadband networks might be the politics of the "big players" of the mobile phone market, who haven't yet compensated their investments in the UMTS network. This has been the same case for the substitution of GPRS with UMTS [215]. We assume that these companies will not invest large sums into the development of new broadband technologies as long as they have not received satisfying returns on previous technologies. In this scenario it is expected that a maximum of 15% of the mobile phone users will have the necessary devices to access mobile broadband networks like LTE and 30% of the population will be living in areas, which are covered by broadband mobile networks. For the usage of in-car devices this means that services, requiring high bandwidth, may not be used on highways and country roads, which normally lead through low populated areas.

7.3.1.2 Time People Spend in Cars

The second major assumption on the development of the mentioned key drivers concerns the time people will spend in cars in the analyzed time frame. It is assumed that the amount of time will decrease significantly compared to the current state. Reasons for that could be the general shortage of conventional fuels, the unreliability of energy suppliers or crises in supplier countries. This would lead to a rise of oil and gas prices, offering sufficient incentives for the majority of the population to use alternative ways of transportation. Another reason for abandoning the private car as the main transport vehicle could be the growing awareness for environmental issues. In this scenario we assume that cars will be basically considered as an inefficient way of transporting, wasting too much energy. The introduction of "Umweltzonen" in many cities will not only improve the quality of air in these zones but might also lead to a diminished usage of cars by the majority of the population. The reason for this could be that on the one hand these zones restrict the usability of cars, which do not fulfill modern environmental standards and on the other hand many people are not able to simply replace their old cars by new models. Similar regulations could for example enforce "car-free" Sundays or weekends as it was done during the first oil crisis. Although electric cars might have entered the automobile market in the analyzed time frame, we assume that these cars will not have a high market penetration due to their newness and their high development costs. Currently 67% of the employees go to work by car [227]. However, 55% of the car users want to reduce the amount of travels with their cars and 8% already want to completely abandon their private cars [226]. We think that this trend is going to be enhanced and will lead to an increase of public transport usage. It is assumed that this development will be supported by the expansion of available transport systems by state investments. Moreover, elder people who cannot use their cars anymore will switch to alternative transport systems for convenience and safety reasons. Since the demographic development in Germany in the last years is leading to an eldering society [221], it can be expected that this population group will be of big importance in the future. It may also be possible that state authorities introduce a maximum age for driving vehicles, since older people might in some cases even be a safety problem for other participants as their reflexes and awareness will get worse. More efficient technologies and further investments in infrastructure will additionally reduce traveling times and provide more comfort to passengers, for instance by offering mobile networks or entertainment systems in trains. The increasing efficiency of public transport systems might also lead to a decrease of transport costs and might even give a time advantage over car travels by the usage of high speed transports. In this scenario it is assumed that public transport use of employees will increase from currently 13% in 2008 [227] to a higher percentage. An exact statement of the percentage increase is impossible due to too many influencing factors. This means a significant negative market growth of in-car communication services and devices.

7.3.1.3 Legislation Concerning In-car Communication

The third main assumption concerns legal regulations in Germany which concern in-car usage of communication devices and services. Here we assume that the legislator will set up new regulations to counter the increasing distraction of the driver by communication, entertainment and navigation devices. After the introduction of the “hand-held” prohibition in 2001 [219, § 23] the government will enforce higher safety standards as reaction to demands of the European Union to increase safety in traffic systems. While currently it is only forbidden for the driver to hold mobile phone devices during travel we assume that the German legislator will extend this regulation to all forms of devices. This would implicate for example the use of mobile navigation devices and devices that are used via control panels which are not located on the steering wheel, for instance the iDrive system BMW is using. We assume that the driver will even not be allowed to access information via screens, which are not directly located in his view. Therefore control and information functions will only be available to the driver, if they are either accessible by the steering wheel or by head-up displays. With the launch of the “Intelligent Car Initiative” in 2006 the European Union is trying to establish a standardized emergency call, which is send out by an installed device in the car in case of an accident to inform rescue teams about the location of the accident and in order to warn other traffic participants. In the next step the European Union is already planning to build up a whole intelligent traffic system. In this system cars should communicate with infrastructure and other cars in order to get information about traffic jams, accidents and other useful information. Telecommunication providers hope to then use established channels and frequencies for offering special services to the driver and the passengers of the car. Besides high investments, the establishing of such a huge system is dependent on standardization of frequencies, services and regulatory exercise of influence by state authorities. We assume that in the analyzed time frame the emergency call will be mandatory for every new car. However, as the emergency call can be send out via existing mobile networks we do not expect regulations boosting the deployment of broadband networks and devices, that are needed for accessing these networks.

7.3.1.4 Description of the Scenario

After having described the general background for this scenario, the next part will focus on the results and the influences that the development of the key drivers will have on in-car communication. It will give an overview over a possible future and possible existing technologies that will be available to car users. In consideration of the development of the key drivers we think that the mobile communication market will get into a negative cycle.

On the one hand we will face a decrease in car usage, which will result in a reduced market for all kind of car service providers. The development of new telecommunication devices and service will slow down, since important investments are held back because of the uncertain future of the market. The main reason for the decreasing usage of cars, the rising oil prices, will also have an influence on the overall economic situation in Germany. As the general investment atmosphere will become worse, Investor will fear the high investments that accompany the introduction of new communication networks. This will slow down the deployment of LTE and will slow down the enhancement of UMTS connectivity. Moreover, restrictive legislative interventions by state authorities will lead to increasing research and development costs for new communication services, since the devices have to satisfy additional safety standards. Additionally, new environmental restrictions will lead to a decrease in the amount of premium cars. As most of the new communication service will be first provided for premium cars it will make it harder for companies to justify high investments in a market that is shrinking, which will lead the hole economic sector into a negative cycle.

On the other hand, as the overall need for transportation will not diminish there will be a shift to public transport systems. This will be encouraged by increasing benefits of those transport systems which were mentioned previously. Additionally state authorities will boost this development by further investments, since they might recognize a possibility to fulfill the CO2-emission goals, which were set up by the European Union. The communication technologies in trains that are already being developed in 2009 benefit from lower costs per passenger. Also the technology may be completely different to LTE. While UMTS will be used in urban areas, small satellite receivers will provide connectivity for passengers in rural areas [222]. Although the bandwidth of those connections is not as high as with LTE it comes at a significant lower price, leading to a competition between in-car communication systems and systems that are used in trains. As a result investment in car services will be drawn back in favor of solutions for public transports.

Considering all these developments, it can be expected that only a minority of all communication technologies, which are available on the market can be used in cars. We assume, that under these circumstances applications like VoIP will not be standard in private cars, due to the lack of high bandwidth connections in most rural areas. Telephone conferences with video transmission and access to video and music content from the Internet will also not be available due to the same reason. Although it can be expected that at least VoIP will be available in urban areas, where UMTS will provide a sufficient bandwidth, still only premium cars will have the required devices to access the network. For car-to-car communication it can be expected that current technologies like the adaptive cruise control will be available to all premium cars. However, more complex technologies like car-to-infrastructure communication or Car-to-Car Communication, which deliver high amounts of data, for example about road conditions, locations of traffic jams and accidents will not be available. The first reason for that is that the critical mass of cars, having the required devices is not being reached, since only customers of premium cars are willing to pay for this additional equipment. This minimum amount of cars, however, is needed to set up an efficiently working system, delivering reliable information. The second reason is the lack of available broadband network connectivity, which will not be available in rural areas. Therefore we think that the introduction of a broadly deployed intelligent traffic system can not be expected at this point of time. The main way of communication in cars will still be the mobile phone, offering some extra Internet services via UMTS connection in urban areas. Voice recognition of devices installed in cars will be mature at this point of time, so that the driver will address functions over his steering wheel or by voice commands.

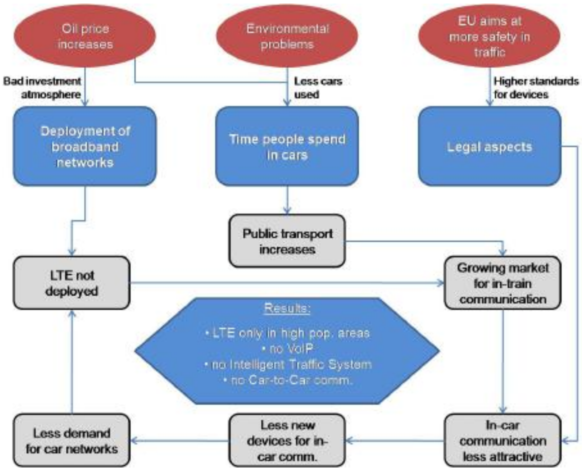

Figure 7.2: Possible Scenario
Source: Own Illustration

7.3.2 Role Model America

7.3.2.1 Deployment of Mobile Broadband Networks

For this scenario we assume that the deployment of mobile broadband networks will nearly reach today´s expectations. We consider LTE to be technically available in the analyzed time frame. Compared to UMTS which was introduced in 2000 and which granted more than 50% of the population in Germany connectivity by 2005, we expect a similar development for the deployment ratio of LTE. History has shown that overestimating expectations about the pace of introduction of new technologies have proven to be wrong in this field. We assume that investors and companies will recognize the potential of mobile broadband networks, but they will be cautious because of the uncertainties concerning acceptance and demand by customers. In 2006, 6 years after its introduction every tenth mobile phone had the ability to use UMTS, however, only 2% of the mobile phone users were actually using UMTS [223]. Only 0.6% of the users had tried out video phone calls, which is exemplary for the demand problems that communication providers are and will be facing. Investors still remember the problems they had concerning the introduction of UMTS. Customer demand is still laying far behind of the expectations concerning. In the relevant time frame it can be expected that LTE will be available in high populated areas together with UMTS. A widely deployed homogeneous LTE network can not be expected in rural areas, since investments may not be compensated by returns in these areas. It can be assumed that communication provider will try to mix two types of networks in order to assure connectivity in an area which is as big as possible. Studies show that UMTS will have a market share of 70% in 2009 [215] it can be expected that in the relevant time frame every mobile device will have the ability to use UMTS. UMTS will be available for all users in Germany and will completely replace GPRS. On the one hand this will enable a nation-wide access to services which need high bandwidth. On the other hand the success of UMTS might lead to a slower development of the new LTE network, since telecommunication providers will first want to generate a high return with UMTS before replacing it by a new network. A similar development can be seen in the rivalry between GPRS and UMTS. Investors were waiting until the GPRS system was profitable before supporting the development of UMTS. Therefore the UMTS deployment was being delayed [215]. For car-to-car communication we assume that the wireless network technology will be developed a little slower than expected and will be introduced in the analyzed time frame.

7.3.2.2 Time People Spend in Cars

We assume that oil prices will increase in this scenario. But we expect that further efforts of the automobile industry will lead to a significant increase of fuel efficiency of cars. One reason for that could be new restrictions concerning CO2 emission of cars. We assume that the European Union will follow its path in this context. The maximum CO2 emission of 120 g/km per car will be introduced in 2012 and will be followed by more restricted regulations. Environmental zones will be enlarged and will prompt the automobile industry to develop more efficient and cleaner cars. We assume that also the development of electric cars will make large steps in the next years. Although the price of the first electric car that is already being produced in series since 2008 is very high, big automobile companies like VW and General Motors have announced the introduction of their first electric car by 2010 [211]. As the increasing oil prices will give high incentives to accelerate the development of these technologies, we assume that electric cars might already have a considerable market share in the relevant time frame. The positive effects of new drive technologies will compensate or even outweigh the negative effects of rising energy prices. Therefore it can be expected that the costs for driving a private car will stagnate compared to today. Although public transport systems will become more efficient and cheaper at the same time, we assume that users of private cars will still be willing to pay a higher price for using cars in exchange for more comfortable transportation and more flexibility. All this will lead to a higher attractiveness of cars, since they will no longer be made responsible for high CO2 emission and transportation costs will be less dependent on the oil price. Moreover, we assume that the German economy will not suffer as hard as other economies under rising energy costs, because it is one of the leading countries in using renewable energy sources and is already expanding the deployment of these alternative energy supplies. For all these reasons it can be expected that the number of people that have the financial possibility to afford cars will increase and that the car will be used more often because of the advantages mentioned before.

7.3.2.3 Legislation Concerning In-car Communication

Legislation concerning the in-car usage of communication device will be very important for the development communication devices in this scenario. We assume that state authorities will not enhance the currently existing hand-held prohibition. It will still be allowed to use devices installed in cars and no significant restrictions concerning the usability of these devices will come up. On the other hand the European Union will encourage the development of new communication technologies by setting frequency standards and by enforcing the utilization of new services by law. The reason for this will be that the European Union wants to fulfill its aims concerning safety in traffic. The reduction of traffic deaths by 50% till 2010 will not be possible with in-car safety improvements only. For that they will try to boost the development of car-to-car communication and the deployment of an intelligent traffic system. This will facilitate investments in this field, since it ensures a significant market size for new products. Furthermore installed devices in cars and standardized frequencies will allow telecommunication providers to use these channels for offering new communication services. An example for this is the emergency-call. If the e-call becomes mandatory for all new cars, the required e-call devices can be equipped with additional services and functions provided by telecommunication providers. Car-to-car communication requires short-range wireless networks that operate via a big network of cars. Since for this communication every car is required to have such a device it can be expected that the European Union will first set some incentives for installing these devices. Afterward the EU will set strict deadlines for a mandatory implementation of in-car wireless routers and thereby ensure a high market penetration, which is needed in order to make the traffic system work efficiently. However, these regulations depend on the state of the technology. The European Union will not enforce the use of car-to-car communication if it has not proven its value at this point of time. We assume for this scenario that the technology is quite mature and that the legislator will have set incentives for the implementation of these wireless network devices.

7.3.2.4 Description of Scenario

The next part will focus on describing how communication will look like due to the development of the key drivers mentioned above. Considering the development of broadband networks like LTE services like VoIP will surely be standard in high populated areas. In rural areas UMTS will supply sufficient bandwidth for VoIP up to a certain maximum of users. Therefore we assume that it will be difficult to use VoIP on highways, if other types of data will be transmitted simultaneously. For video communication the bandwidth will not be sufficient. However, almost all types of data transmission will be available in urban areas. This includes the up and down stream of video and music content. As mentioned before the technology needed for Car-to-Car Communication will be available for cars. Nonetheless it can be assumed that almost only premium cars will be equipped with the necessary devices, because of the high initial price. The effectiveness of this communication system is therefore very limited since information can only be delivered to every car if the chain is not interrupted by cars which do not use the technology.

7.3.3 Technology Driven Society

When talking about the third and our last scenario it is important to know that we see this as the best possible scenario with our key drivers developing in favor of our new product idea. It is called Technology Driven Society. The business environment in which our product will be introduced can be described as very mild and friendly one for new products. Most negative impacts of the last years, like financial crisis have been overcome and factors influencing our business environment will be described in this chapter. The main goal of this chapter will be to describe our last scenario as detailed as possible with all unstable drivers, a couple of stable drivers and their potential impact on each other. Afterward a listing of our scenario's characteristics will show what options telcos have to offer new communication based services.

7.3.3.1 Unstable Drivers

Globalization in Terms of Standards and Frequencies

Starting with the description of the uncertain drivers of this scenario we begin our analysis with the "globalization in terms of standards and frequencies". This means that all countries have to find a consensus concerning frequencies being used for mobile communication technologies. It could be achieved by creating special consorts including all relevant parties having the goal to set up global standards. First signs therefore can already be seen in the Car-to-Car Communication sector, where a specially created consortium is trying to setup European standards [214]. Additionally by introducing global standards for mobile communication in cars the interoperability between external communication devices themselves and the in-car communication systems could be improved intensively. As past experiences revealed it is essential that a technical standard has to be created if a high market penetration is the ultimate goal. A well known example is the competition between HD-

DVD and Blue Ray for the dominance on the video market. Customers and device manufacturers are mainly being distracted by the fact that no technology has so far been able to become standard. Market penetration and further improvements are being slowed down massively. Although this example is from a different industry it shows the importance of a standard for a successful deployment of a new technology. A better suited example for the importance of a standard, especially for communication in cars is the Car-2-Car Communication Consortium, which is already trying to create and introduce several standards into the car domain. Without this standard setting consortium every car manufacturer would introduce his own technology, which would lead to a standard setting battle between the different companies. This again would highly distract customers and equipment manufacturers. This Consortium is a first step in the right direction, when talking about standardization in car. Therefore we are optimistic and see standardization of mobile phone frequencies, interoperability between cars and devices happening, although it is very hard to predict how they will develop precisely.

Interconnectivity Between External Devices and the In-car Interface

The next driver that is highly influencing the introduction and the deployment of any communication product idea is the interconnectivity between external devices and the in-car interface. By interconnectivity we mean two things: first of all it is the seamless interaction between the car interface and external devices, for example the smooth transfer of commands from the car interface to the external device. Secondly it is the trouble-free technical integration of devices into the car environment, so that every external device can easily be plugged into the car environment and also operates trouble-free.

As today car interfaces are mostly offering voice recognition as main alternative to manual input via typing we see this trend to remain constant, but with increased functionality like voice input not only for calling people, but also to write SMS and E-Mail messages via a seamlessly integrated mobile phone to the car interface. We do not see any other mode of interaction between external devices and the in car system, than input via hands or voice, at least not as a stand alone solution. The only certain thing we see evolving is the implementation of voice input in all cars, allowing new products and technologies an easy and convenient way of interaction with external devices like MP3 players, mobile phones and navigation systems. Other options of interaction like gesture control will not be implemented in the car environment, as the value added in terms of safer driving is very questionable, at least if it is the only input available. Distraction of drivers via gesture input-only seems to be much higher than via voice and would infringe possible future no "single-handed" driving laws, which will be discussed in the "Legal & Legislation" part. As only a small amount of commands can be performed via gesture control we think that a voice-only input will successfully be implemented in the car environment to facilitate interaction between communication devices and the car. A combination with gesture control could also be possible, but because of limited commands we do not know if it will be implemented and used for communication aspects.

The second part of this driver, the technical integration of external communication devices, being the basis of a seamless communication between external devices and the car interface will mainly be influenced by standardization. If global mobile phone communication standards are being created, what we already explained in our analysis, the differing product life cycles between cars and for example mobile phones can be matched a lot better. Additionally created standards will improve seamless integration and functionality of new devices in current car interfaces. Major changes in communication standards, especially mobile phone standards, can be updated on the car interface by software updates. A very attractive use case of standardized frequencies and standardized technology is the market for business people. As most members of this group travel a lot and often use different cars in different countries (rental cars) an easy and seamless integration of their mobile phones would add a lot of value for this group of people.

Financial Crisis

The current developments on global financial markets have also to be taken into account when describing this scenario. Although we think there will be an impact on the economy during the next couple of years we are confident that this will not delay any major technologies by more than a couple of years. Actually the financial crisis might even push the development of standards in the communications industry and many other industries, as in times of uncertainty, people are looking for security and things that they can count on. Therefore the global efforts for creating a safe and secure environment could also lead to the setup of many different standards and investments in infrastructure. This fact can be observed by recent developments in Germany. Chancellor Angela Merkel announced a package of some billion € that will be invested in infrastructure [216]. As efforts for countering the impacts of the financial crisis are only successful on a cooperative base, these cooperations will lead to the establishment of consorts consisting of industry and political representatives. This base will eventually lead to the definition of new standards, also in the communication sector. If other countries follow this strategy a global effort could support the developments of global standards. Therefore the next couple of years will be very interesting as they could push standard creation processes a lot. This will be discussed in a more detailed way in the following parts.

Car-2-X Communication

Current research topics at the Car-to-Car Consortium are primarily about reducing road fatalities Europe wide which can be considered as main topics, whereas hands-on communication applications are not in the focus at the moment. Before a platform for offering services and applications will be available the consortium is focusing on the promotion of a royalty free European wide exclusive frequency band, the development of prototypes for active safety applications, the harmonization of Car-to-Car Communication standards and the development of realistic deployment strategies and business models. Nevertheless when first security applications have made their way to market and have proven to be successful the creation of additional value adding services, as for example calling the car next to you in a traffic jam could easily be implemented. We see the deployment of Car-to-Car Communication in the analyzed time frame, but it still remains questionable if it would create additional value for the driver, especially when talking about communication services. There will definitely be value adding services for the driver, but we do not see them in the analyzed time frame.

The Ability of the Eldering Population to Adapt to New Technologies
When talking about the ability of eldering people to adapt to new technologies in this scenario we suppose that the ability will increase in the analyzed time frame. An interesting statistic dealing with this fact is the result of a study conducted by Germany´s Federal Statistics Office in 2005. It shows that people over 54 years of age use the Internet on a more regular basis than the group starting at 10 years [220]. Another fact supporting our assumption that ability to adapt will increase is that more and more devices and software is becoming more intuitive than before. A good example is the iPhone which offers an intuitive way of navigation by simply touching the screen allowing an easy navigation. Another example is the new Vista from Microsoft which claims to be more intuitive than older versions and much easier to be learned if u never used a computer before. Furthermore people that will be old in about twenty years from now on will be a group of experienced computer users which are familiar with technology and therefore will easily be able to adapt to new technologies.

7.3.3.2 Stable Drivers

After having described the unstable drivers which are strongly influencing our scenario, the most important stable drivers, which will most likely not change, have to be discussed shortly, as they will also have an impact on our scenario and influence our new product idea. This part could be seen as a short reminder of the stable driver´s analysis.

Presence of Cars
Talking about the presence of cars, which has already been discussed in our driver analysis we can recapitulate that cars will still be present as we know them today. According to our performed analysis the major thing changing will be the means how they will drive. This will most likely mean a switch

to hybrid or even completely new technologies like electric cars. Increasing demand, which will mainly be driven by new technologies like hybrid cars or electric cars are the basis for a successful introduction of a car related application.

Means of Communications
When looking at the means of communications we have to say that they did not change dramatically during many decades. There has always been oral and written communication, which will not change anymore. The only thing that will evolve is that most communication methods will be done electronically and be done hybrid (speech & written). In our opinion most written communication forms (E-Mail, SMS) will allow their operations by voice input and typing, due to security reasons while driving a car. This will allow to lower driver distraction that is typically very high when typing text or commands in any device, be it Mobile Phone or the car´s interface. To integrate voice input into the car environment the maturity of voice recognition has to be high, which it actually already is today from the technological point of view. Analyzing the market penetration we can observe a limited one these days, which will change due to many standard setting efforts taking place during the next few years.

7.3.3.3 Key Drivers

After having discussed the development of our unstable drivers and repainted the picture that our stable drivers will give to our scenario it is time to discuss the impact of our most important drivers, our key drivers. Key drivers are the most important ones, but also the most unstable ones. As already discussed in the previous scenarios our key drivers are legal issues and regulations, the deployment of a mobile broadband network and the time people spend in their car.

Deployment of a Mobile Broadband Network
The first key driver, the successful deployment of a mobile broadband network in the car depends on many different things. But first of all we have to define the term successful. In this scenario we are talking about a best case where a nearly full coverage will be reached in Germany. This would allow a constant streaming or a smooth download of content of any kind in most locations. This could be realized via two technologies: UMTS and LTE. WiMax does not seem to be a alternative in Germany, as the German Internet Industry (eco-Verband) states. Companies that obtained licenses for UMTS only have until the end of 2009 for the successful development of UMTS infrastructure, which seems to be unrealistic according to the German Internet Industry [217]. UMTS is using new signaling technology called Wideband Code Division Multiple Access (WCDMA) currently allows speeds of up to 7.2mbit/s downstream and 1.4 mbit/s upstream. This does not seem to be suited for the best communication

experience, as the speed is being divided between users sharing the same base station [225, p. 186]. Nevertheless it could be used as replacement for other mobile broadband connections in remote locations where no other reception is possible and usage per base station is also quite low. So for locations where the number of users per base station is too high another technology is needed to guarantee a trouble-free communications experience. This is where a successful deployment of a Long Term Evolution (LTE) network is being needed. The Association of German Internet Industry (eco-Verband) is expecting LTE deployment in two to three years. As reason it cites LTE's capability to support ten times as many users as currently possible, while still being an evolution of HSPA and hence therefore the cheapest version of current competing technologies [217]. As this outlook seems to be a little too overconfident and it is not talking about full coverage in Germany we have to take into account that a full deployment of LTE, especially in Germany still depends on many factors, like investments in infrastructure, possible standards and supporters of the technology.

As we are about to experience, and are already experiencing, the impacts of the global financial crisis during the next couple of years it is very important to analyze this impact on the deployment of a mobile broadband network which will be used for in-car communication services. As already discussed before, main impacts of the financial crisis are decreasing private and institutional investments, as the trust in the economy and job safety is quite low. This phenomenon is being reflected in many financial and economic ratios. Most demand indices, export numbers, etc are currently going down and will most probably follow a similar development during the next couple of years. Additionally the lack of capital and past mistakes committed by banks are making it harder to obtain money to finance investments. People, companies and institutions are therefore looking for the safest investments possible. These peculiar economical preconditions could nevertheless be seen as a huge opportunity for our scenario and especially the successful deployment of a mobile broadband network. Although financial resources and credits are limited it could turn out to be a positive development, as individual efforts might be replaced by "collective" efforts. Collective efforts allow not only cost sharing, but also risk sharing, which is very important in economically unstable times. Instead of not investing at all due to unstable preconditions companies share their risks and invest together. Several studies comparing individual efforts with collective efforts are supporting this theory. They say, that in most cases collective efforts result in better and faster product development, integration, deployment and innovation *[213].* The result would be a faster deployment and a higher penetration of mobile broadband technologies. LTE, WiMax and UMTS would be deployed much faster and a smooth communication experience will be the result. Nevertheless we can not predict which one will be the first one to be completely implemented in Germany.

Another factor positively influencing the successfully deployment of a mobile broadband network is the fact, that most mobile frequencies, standards, etc will already be standardized according to our analysis done before. Therefore high operability in many different countries is being guaranteed, additionally driving the mobile network deployment on a global basis. Further enhancing a successful full deployment of a mobile broadband network is the influence of the Car-2-Car Communication Consortium, which is currently looking for ways to communicate between cars via wireless LAN technologies, with the goal to setup a Europe wide standard for Car-2-Car communication. Although the Car-2-Car Consortium does not explicitly state their opinion according further developments of the communication technology being used it seems highly probable that the next step will be the use of broadband networks instead of ad-hoc networks between the cars themselves. As Ad-Hoc networks between cars only offer a limited range of a couple of hundred meters the use of mobile broadband networks instead would highly increase potential ranges and therefore open up new ways of navigation, auto-pilot, etc. This will not happen during the analyzed time frame, but will nevertheless drive the deployment of mobile broadband networks in our opinion.

Legal Issues & Regulations

Our second key driver, legal issues and regulations does also have a relatively high impact on our last scenario. Recapitulating the definition of legal issues we have to divide it into two parts. The first part is how laws will develop in the future, especially when talking about driving and communication at the same time. Will it be allowed to use mobile phones during car travels, or will it entirely be forbidden by law (hands-free solution)? This decision will have a huge impact on the communication behavior in cars. If the hands-free solution will be enforced then we have to think about new communication methods, that replace existing ones, like voice input. The second part of this key driver is the question if the European Commission will push any communication technology, device or whatsoever.

Analyzing the first part of this key driver, current safety regulations in Germany the Paragraph 23, 1a of the German Highway Law has to be pointed out as it forbids the use of a mobile phone or an integrated car phone if the driver holds the receiver in his hand while using the device [219, § 23]. It does not apply for vehicles that do not move and for those whose motors do not run. The term “use” does not only imply the use of mobile phones for making phone calls, it even forbids to use any function of mobile phones, including the use of Internet service, the checking of notes and the writing of messages, as recent jurisdictions have shown. This particular decision has been made by the judges because they had the intention to prevent drivers from driving single-handed, due to safety concerns. Additionally this judgment was not only including mobile phones, but also multi-functional devices like integrated organizer-phones, which main functions are not telecommunication but having equipment to allow phone calls. These decisions might have a huge impact on the development of future laws. Although it is unclear how regulations and laws will change during the analyzed time frame we suppose that the hands-free laws will still remain in the future and probably might even be extended to no handling of any devices or whatsoever at any given time, to avoid single-handed driving. As single-handed driving seems to take an important role in current judgments concerning usage of mobile phones we think that this will be integrated into German and perhaps even European jurisdiction. Another point which makes the integration of the "no single-handed" or "hands-free" law into European jurisdiction likely is the fact that the the European Commission has initiated the eSafety Program to drastically reduce road fatalities and further improve the efficiency of road traffic. Therefore it is highly probable that the European Commission will try to do everything to further decrease the number of accidents and integrate a much harder and no-tolerance jurisdiction when it comes to device usage in car. These laws would make new ways of interaction between drivers and devices in car necessary.

Discussing the second part of the legal issues and regulation we see a quite plausible scenario where the European Commission will push the development of the E-Call, including a technology which guarantees flawless operations of the E-Call all over Europe. First signs that point into that direction have already been made by the signing of a memorandum of understanding by 14 European member states that will commit to the eCall. Results of the Kick-off meeting of the European eCall Implementation Platform in Brussels in February 2009 will definitely give a more detailed answer to further developments [218]. Once a communication technology standard for the E-Call has been set up and is being pushed by the European Commission the deployment will be much faster. The selected technology could then be used by other communication applications or services, depending on the available bandwidth. A possible scenario would be the development or enhancement of an area-wide mobile broadband network for the eCall. Hence the deployment of a mobile broadband network will then among others positively be influenced by the laws and regulations key driver.

Time spend in car

We suppose the total time spend in car will most probably stay the same. Competing ways of transportation like public transportation will still take an important role in the way of transportation. Nevertheless we do not think that more people will switch to public transport instead of driving a car. Main reasons for this assumption are the flexibility that cars offer and the freedom of choice where to go to. This could be seen as a first evidence that people are still seeing cars as number one choice to get from A to B. Also the appearance and the resources cars are using might change, car usage will still remain very high. Hybrid or electric cars will definitely have a positive impact on car usage, as increasing costs for gas and oil can therefore be avoided. As the acceptance of hybrid cars is currently steadily increasing we see a huge impact on future car demand that will come from this source. Without any alternative to non renewable energy sources for cars and a low acceptance we would see the demand for cars decreasing and the usage of public transport increasing. But this is not the case at all. The Toyota Prius has proven that there are already new solutions available with a surprisingly relatively high adoption. Hence we do not see the demand for future car models in any danger and the time spend in car will most probably not change significantly.

Nevertheless one could argue, that ever increasing car numbers would cause more traffic jams than nowadays and therefore a lot of people might switch to public transport to avoid traffic jams, especially in city centers. This again would mean a decrease of demand for cars and at the same time reduce the time spend in cars. This is a reasonable argumentation but their are already several initiatives that are aware of this fact. These initiatives have the goal to improve traffic flow, or at least keep current flow in areas where car penetration highly increases, via Car-2-Car Communication, as for example does the Car-2-Car Communication Consortium in Europe. By improving traffic flows, or at least keeping them as fluid as we know them today, drivers will not change to public transport and the time spend in car will be about the same as we know it today, with a few people spending more time in cars and a few spending less time in cars. But on an average time spend in cars will not change exceedingly.

7.3.3.4 The Scenario

After having discussed the development and influence of our drivers on the scenario and on each other it is essential to summarize the key findings and describe the scenario´s characteristics, possible technologies and implications being essential for our new product idea. The scenario itself could be described by the term of "Technology Driven Scenario". This means an availability of nearly every technology that is being needed for a smooth operation of new communication services in car. Be it the successfully deployed mobile broadband network or new technologies obeying the "hands-free" laws. Moreover the hybrid and electric car will guarantee the stability of future car demand and support the fact that time spend in cars will stay the same.

The scenario´s technologies will include mature LTE and UMTS mobile broadband networks that will be able to offer an experience that is close to the broadband experience at home. Streaming and downloading of video and music content will be possible at nearly every location, enabling an enriched multimedia experience. The technologies being offered easily allow communication services, without any restrictions or delays. Current communication forms like Voice, SMS, MMS and E-Mail will still exist and will most probably not be replaced by any other means of communication. The only thing that will evolve is the way of interaction between devices and the driver. It will tend to be be done mainly by voice input, so that the driver can even send messages of any kind without infringing any of the "hands-free" or even possible future no "single-handed" laws. Therefore the already very mature voice recognition technology will most likely become standard and be integrated into every car. A solution to upgrade older cars with on board voice technology will most likely be offered, whereas it is unclear how much these extra devices equipped with special software will cost.

When looking at standards and frequencies, especially when it comes to mobile phones or Car-2-Car Communication we see a standardization process which will increase market entry attractiveness for equipment manufacturers, because devices can work on the same frequencies and standards on a global basis. This significantly lowers costs to introduce devices in many different countries, as devices will be able to work everywhere, without any major changes in functionality or with respect to local laws. Also the interoperability between cars and external devices will be of a very high nature, so that drivers always have the possibility to plug in their handsets without any worries if it is working or not. This is a very value adding development, especially for business men, needing a guarantee that they can always be able to contact business partners or the head office via their mobile phones. A possible use case for this scenario are business men that are traveling a lot and stay in different cars (e.g. rental cars) and even different countries. Therefore this scenario would allow these people to simply plug in their handsets into the car interface, without any problems allowing them to use Voice Services, SMS, MMS and E-Mail. No difficulties or whatsoever with the functionality of their external devices in different cars and different countries. The communication experience will not change at all. An additional technology that will probably be implemented and be ready to be used will be Car-2-Car communication, but only in a very limited way, as current research only fosters communication via Ad Hoc networks, which limits possible communication solutions to very basic services which do not seem to add any additional value for the driver´s communication. These possible developments could now all be combined to find a matching product idea which increases the value for the driver´s communication with the outside world.

7.4 Product Prototype for the Technology Driven Society

After the description for our technology driven scenario, you can realize that it is interesting and will bring a lot of profit to the car manufacturers, telecommunication operators and vendors, service providers, product manufactures, as well as other players in this market. About realization of this scenario, with enormous economy and strong government push, we can actually expect this to come. Consequently our product idea is based on this scenario.

As a matter of fact, what people would appreciate for the future cars, in the means of communication, would include the following segments: an advanced car which can support the electronic parts in order to set up telecommunication; a strong and stable network, providing the basis of communication; multiple and meaningful services provided by several service providers; last but not least, the data privacy and security provided by the network. So we will now present you our product CallYouCallMe which fits into this scenario, giving people the pleasure to communicate in the cars, and with no worries about security and privacy.

7.4.1 Functionality Foreseen

7.4.1.1 Basic Functionality

CallYouCallMe is a software which aims on helping people to easily communicate with each other while driving. As the name implies, it aims on calling services which are simple and interesting. It does not require high education level to understand the principle and it does not require people's attention during driving, thus it is easy and safe to use. Due to the mature voice recognition, drivers can use voice to do the instruction for CallYouCallMe, and CallYouCallMe will convert the electronic responses back into human voice, because humans understand voice with less distraction than any visual representation.

Basically, our product is a context-aware telephone book you can customize by yourself. It can include the private contacts, the business contacts and location based commercial contacts.

For the private contacts, you can add your family members and the friends into the list. The business contacts, including the employees in the company you are working in, as well as international contacts that you might need. Regarding to the commercial contacts, it is basically a location based service which helps the user to get the things he wants more easily. He can contact the nearest repair shop to ask when he can go there to wash his car, or he can call a nearby restaurant to do a reservation.

So how to search for one contact is most interesting part. The telephone book in this product is build with different lists, so the contacts are belonging to different groups. For example, assume your mom is Ana Smith. She is belonging to the group of family contacts and the most frequent called list. So you can just simply say: I want to call my mom", or you can also say: "Call Ana Smith", it gives the same result: calling your mom Ana Smith. This is what happens when you want to call your family. For calling friends, it is the same procedure.

When you want to call your business contacts, it is different. Normally you don't remember all their names, and it will cause some trouble when you want to contact someone who is within the same company you are working in, but you don't remember his or her full name. So here keywords could be the first name or last name of the person, as well as their department. So you could simply say "I want to call Bob in the IT department in Munich", then it will search for someone who is in your company, in the IT department in Munich, but also with the first name Bob. So you don't have to remember their full names, you just simply give it the keywords. Usually two to three are sufficient.

For the context aware commercial service, CallYouCallMe also needs to be aware of your current position. Of course this would work together with the GPS system. The software can contact the GPS receiver to be aware of your position in real-time. What you have to do when you need some services, is to simply tell the software, that you for example want to find the cheapest food store close to you. So it will automatically search for the stores which sell food within your neighborhood, and maybe tell you the on-sale stuff in advance. Simple, easy and nice.

7.4.1.2 Add-on Functionalities and Services

There exist possible add-on functionalities which also bring additional revenue potential. Especially for the old people, who call their families much more frequent than others. So a family tree would help them a lot. Also, old people normally can not see so clearly, so there could be an add-on projector to project their family tree to the windshield, and they can press the picture of the person they want to call. Anyone who needs this service could be provided with an additional agreement enabling the additional software features. This functionality can also be combined using the already present head-up display in ones car using a standardized interface between mobile devices and in-car systems.

With regards to the location based commercial services, you can define the categories according to your preferences. You can choose from several categories including food, gas and oil, car repair, etc. Imagine you choose food as your preference, and of course it needs you to allow it to announce special offers. So when you drive close to some restaurant, the software announces it by itself like: "Restaurant Malita has special for their dishes today, half price!". It is a good opportunity for you if you are on the way and you are also hungry. But most important you can choose whatever you like, no spam, no advertisement, only the information you need.

7.4.1.3 Call Confirmation

Due to the uncertainty of human voice recognition and other reasons, the software can make mistakes. So this is why we need some confirmation schemes. Simply speaking, it should work like this:

User: I want to call Bob in IT department.

Software: Calling Bob White.

User: No, no, it's wrong. I don't think his last name is White.

Software: Please wait... OK. Bob White works in Berlin. Bob Black works in Munich. Call Bob Black?

User: OK.

This is some assumption that we use in our software. First we assume the searched contact is right, until the rejection from the user. And when it comes to the mistake, make sure to search again with a different combination of the key words to avoid the same mistake happening again.

7.4.1.4 Product Mock-Up

In figure 7.3 you can grasp our idea by a visual mock up of the product.

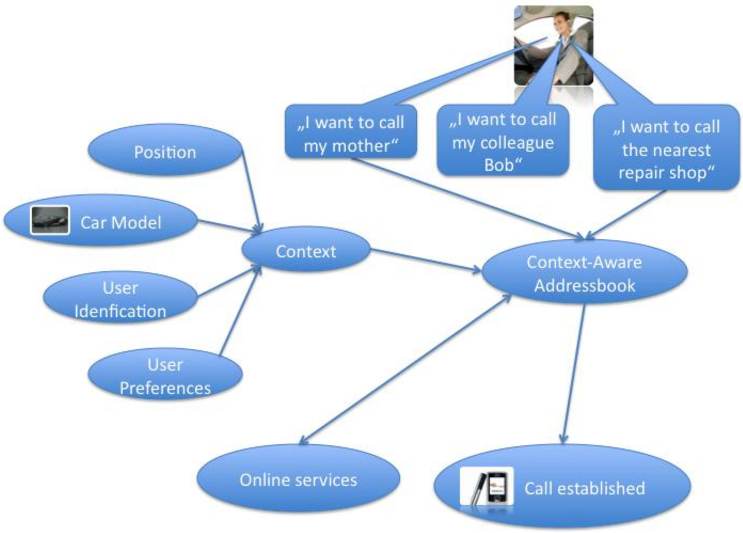

Figure 7.3: Product Mock Up
Source: Own Illustration

7.4.2 Product Implementation

First we focus on the device part. Because the device could be implemented in the car by the car manufacturer, if they are really interested in this market and want to split part of the profit for themselves. But normally, the car manufacturers would prefer something else like a device using a standardized interface to get the connection, simply because they don't have to worry about all the complexities of communication devices in addition to the rest of the car.

As for the device, it could be an electronic component which can be easily connected to the car. It should not be very large. It should contain a microphone, which can collect the voice data. Of course there would be a lot of noises included in the collected sound. That is why this component should also use a filter inside, to do the sampling and resharpening for the signals to be recognizable by the central processor. The processor should be able to process the data and exchange information from the customers with a centralized infrastructure. The data could be voice data or electronic data and there should be some converter in between of them.

On the other hand all these functions can be implemented in a mobile phone, although the phone should have a faster processor to process all the data, but since it already has a microphone, filter and other electronic devices implemented, it is the simplest way to implement all the functionality we want by just using means of software.

7.4.3 Technical Preconditions for the Product

Long Term Evolution (LTE) is the coming communication network system after UMTS. And within this system, we can expect seamless and stable communication possibilities all over the world. Without the existence of the LTE, it is impossible to provide the car with a fast and stable connection, which is exclusively for data purposes. Although there is still doubts and discussions about the exact time for LTE to be present in EU, or in Germany, it is going to be the there at some time. So this network is the basis for our communication, which is also the main aim of our product.

Another precondition for the product is the mature voice recognition technology. Although voice recognition technology is already being developed on a very advanced level, it is still not mature enough to differentiate human conversation with neglectable error rate. But on the other hand, the machine can now understand partially the conversation, although still with some problems in terms of speed and accuracy. But in the near future, the machine should understand the human conversation with an acceptable error rate.

Also, when we talk about voice recognition, we should not forget the language barrier. We know that the voice recognition is based on the language model information, which means that the model for English and German are totally different in the part of the word as well as the connection between the words. So we have to consider the additional effort required to adapt our product to different languages and countries.

Last but not least, there should be a central database which provides you with the data, including the company contact database as well as the location based service database. Without this, our CallYouCallMe is just the phone book in your cell phone, it does not bring any profit and it also doesn't provide any additional convenience for the user.

7.4.4 Pricing Model

Since our product includes three parts: the personal contacts, the business contacts as well as the location based commercial contacts, we figure that it is important we bring some valuable service for free in the beginning and then charge for additional services. So in our pricing model, the customized personal contacts are free of charge. People can easily import their contacts for their own usage. The business contacts for one person are coming from the company you are working in, and the company should pay for all their employees for the sharing of this database. As for the location based commercial services, we would charge the commercial service providers, for example, it could be a restaurant, or a car repair store, or a gas station to be represented in the system and to be the preferred choice if more alternatives are present. We think the major profit should come from the business service.

7.4.5 Risks and Opportunities

Our product idea is to establish an easy and comfortable environment for communication. It therefore has certain risks, but it also brings a lot of opportunities. In the following section, we will introduce you with the risks and opportunities of our product and also do some analysis of them.

7.4.5.1 Risks

First, to be honest, our product is easy to copy, basically it is just a software implemented in one of the devices using services provided either by the telecommunication provider or the service providers. We can expect some similar products from potential competitors to appear after our product is brought to the market. So it requires a strong partnership with car manufacturers and service providers to prevent too simple copying. Also, being passive is not enough, we also have to constantly search for new add-on services which will stabilize the revenue.

Another risk is concerning the data privacy. Any data stored by the database has the possibility to be stolen. So when this happens, who is taking responsibility? Who is liable for that? Is the telecommunication network provider most liable, or the service provider? This is a discussion that might become a trouble in the future.

Since there is a possibility for the data to be exposed, customers might have doubt about the system, thus being reluctant to give out the data to the service. On the one hand, the customers have reason to doubt that the service provider will keep the data for no other usage as they promised; on the other hand, even if the service providers want to do that, there is no 100 % safe system. So this is definitely a risk for our product.

7.4.5.2 Opportunities

As for opportunities, it is obvious this product has some potential market. Our opportunity could be a partnership with the mobile phone manufacturers, to preinstall our software onto their devices. Or we could also have a partnership with the car manufacturers, or even telecommunication service providers to offer our product bundled with their services or cars. Strong partnerships give us a better position in the market.

Another opportunity, but also a risk for us, is the actual date for the deployment of LTE. People have doubts about the final date for LTE, and it is not fixed yet. Since it takes UMTS so long to be implemented, and yet now it is still not deployed in most rural areas, it is natural to question any estimations for LTE deployment. Luckily our product does not rely on LTE that much, since the current UMTS system is able to afford the data rate, even the current GSM system is OK for that, although we might have to wait a long time for response using these slower networks which would actually lower the user experience. This is because we only require data from the central database for the telephone numbers, and this has no strong requirement on data rates. And we have already mature voice recognition technology now, so if the LTE can not be deployed on time or just is not available at the user's location, we can simply use UMTS as a replacement. Implemented as a software on the cell phone only little changes are required (if the phone supports both technologies of course). So we think this is a great opportunity for us, if the development of the new communication system does not happen as expected, we can still bring the product into the market.

7.4.6 Legal Issues

With regards to the legal issues concerning our product, the only thing that might need special attention is the data security part. As we all know, currently there is no 100% safe system, and there is not going to be one ever. So the point turns to how secure the system is to provide the customer with comfortable use and no leakage for the private information.

For the private usage, it should require a user name/password-combination or a fingerprint of the user. For encryption a private/public key-pair should be assigned to every person specifically, and in the central database, the key is connected to the driver with all the necessary information. The key should be at least 1024 bits. These keys would be used for encrypting data transmission and storage comparable to encrypted emails.

For company usage the key distribution should be founded on a public key infrastructure managed by the company itself or offered as a service by the service provider. Maybe even the same technologies like for email can be used, thus leveraging existing investments.

7.4.7 Product Summary

As we discussed from the previous part, we developed a software named CallYouCallMe, and this software is basically a context aware phone book which aims on helping people to communicate during driving. This software can be implemented in the car, or in some device which can be plugged into the car, or more simply, can be a program that runs on a mobile phone. The one thing which makes it special is that you don't have to dial, all you have to do is to make a spoken instruction, and the software will simply do it for you.

The functionality of this software is divided into the personal contacts, business contacts and the location based commercial services. With this software, drivers can call their family and friends easily, and they can also call the people from their company. Additionally they can call the services in the neighborhood with user defined preferences.

Our core business comes from the company contacts. The car is a relatively safe space, businessman love to call in the car. Thus we can make the profit by charging the company which will buy this service. We think another profitable part for this product is the location based commercial service, we can charge for the one who is willing to make advertisement.

7.5 Conclusion

In this report we first analyzed the relevant drivers for our communication scenarios and divided them into stable and unstable drivers. As key drivers - the most important and most unstable ones - we identified the deployment of a mobile broadband network, the legislation regarding in-car communication and the time people spend in their cars.

After the driver analysis we developed three scenarios explaining different possibilities for future development. In the Public Transport Generation scenario we assumed that many people will turn away from using cars and use public transport instead. In the scenario Role Model America the development is quite different, where new technologies and car developments lead to an even higher car usage. In our last scenario Technology Driven Society we assume that the time in cars will basically stay the same, but all other developments are very friendly for new technologies. Legislation will allow usage of in-car communication technologies and the mobile broadband network will be deployed very soon. We consider this last scenario as very likely, so we also based our product idea on this scenario.

Our product CallYouCallMe is a revolutionary context-aware phone book. It builds up a context that is based on the identity of the user, his current position, his company and additional data (e.g. the used car). With this data in the background it is possible to formulate call requests like “Call the next repair station” or “Call my mother”. Using mature voice recognition technology and combining the request with the context, the system determines the number to call and establishes the call. This supported by a central database the in-car system communicates by using a broadband mobile network.

CallYouCallMe also offers several business models. Whereas the private service should be free of charge, companies will need to pay for providing their employees this service. On the other hand, points of interests like repair shops or restaurants can promote their contact information so that the system prefers them when end users prefers this promotion information. Add-On services and products will offer additional business possibilities at a later stage.

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Chapter 8

8 Safety / Telematics

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The safety and telematics sector is expected to undergo severe changes over the next decade. The following report identifies three possible outcomes all of which are determined by a total of ten driving forces. These forces range from technical topics like car IT and architecture, global positioning and car2x over socioeconomic developments including an aging society, the perception of technology, standardization and traffic volume to environmental aspects such as extreme weather conditions and the infrastructure. The latter is in a very bad shape in the first scenario and a threat to the driver and the dense traffic. In contrast to the first, standardization of car electronics is a main feature in the second scenario alongside the well maintained infrastructure. The most likely and interesting scenario, however, is a Germany of few economic centers which absorb the population of the surrounding areas. An aged society chooses the car as its main means of transportation due to overburdened public transportation. Based on the conditions of the last scenario the "Safety Factor" was developed. Embedded in the car's sensoric system and connected to a remote database the "Safety Factor" provides the driver with an intuitive understanding of his current safety situation. Additionally the product gives advice on how to reduce the risk of having an accident. The task of the telecommunication providers in this scenario is to ensure a reliable, secure and fast data connectivity.

8.1 Introduction

People need to get to work, to the mall, to the doctor or drive their kids to a soccer game. Goods need to be transported from suppliers to manufacturers and eventually to the consumers. Mobility and communication have become two important elements in today's society. An efficient, sustainable, and safe ride is a precondition for well being. The automobile has been the most dominant means of transportation as it gives passengers and drivers a sense of protection and enables more flexibility and mobility. Worldwide, more people die in road accidents than from AIDS or wars. Advances in the sector of telematics have made life more comfortable for motorists. Many systems are now in use to protect the life of passengers. ABS and ESP as well as seat belts and airbags are considered as passive and less intelligent safety-systems. The following part will analyze in two steps what drivers are influencing the development of the safety and telematics sector in the next 11 years. These drivers were determined by their importance for the customers including drivers and car manufacturers as well as every market player that might be concerned by car telematics. In the following Trend Report on "Safety and Telematics", three scenarios for the next decade are described. These scenarios analyze the impact of the determined drivers and the different correlations between them. The Safety and Telematics sector is related to cars, their technologies and their drivers on one side and to the environment and the global infrastructure on the other side. We consider the obvious influence of the aging society and its perception of sophisticated technologies as an important factor that changes the costumer's needs in the car telematics sector. The development of more accurate Global Positioning Systems like Galileo is clearly a push to enhance the research for new applications as far as remote recovery systems are concerned. The extreme unstable weather conditions in the next decade will make many regions unsafe and unpredictable and will consequently have a significant influence on the car industry and its manufacturing standards, too. Alongside the confirmation of Moore's law and the exponentially increasing calculation speed of microchips the capabilities of computerized systems is enabling more reliability when it comes to real time and quick reacting computer-based safety systems. However, some drivers are still uncertain due to their dependence on governmental regulations or financial resources. Software systems embedded in vehicles are traditionally complex and a unified software platform in a world of networked vehicles is likely to change the whole telematics sector. In addition to that everybody agrees about the influence of roads infrastructure and its attractiveness to motorists. Obviously, this factors together with the unknown number of cars in 2020 will determine different pictures of the customers and the different market players in the next decade. Based the analysis of these drivers in each scenario several customer profiles and markets are described in detail.

8.2 Main Drivers

Our research identified ten drivers to be pivotal to future trends in the car safety and telematics sector. Six of these ten drivers are assumed to be stable, four are uncertain in their development. The stable drivers include IT-Capabilities, Climate Change, Global Positioning, Standardization of ICT, Demographics and Technology Perception. As uncertain are considered Car IT Architecture, Car2x, Infrastructure and Traffic Intensity. The following sections elaborate the driver's impact on the paper topic, their correlations with each other and their potential development.

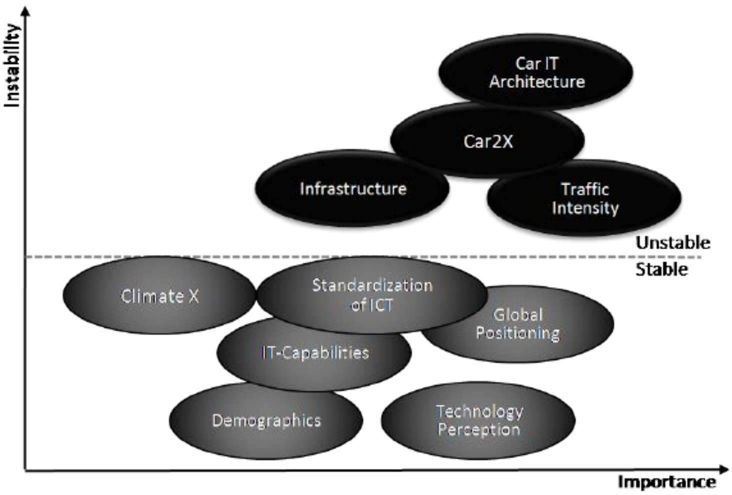

Figure 8.1: Classification of drivers according to their stability and importance
Source: Own Illustration

8.2.1 Stable Drivers

8.2.1.1 IT-Capabilities

Moore's Law leverages enhanced car safety systems
IT capabilities are crucial to the development of car safety products. A lot of new systems like real time visual analysis of the car's environment need an incredible amount of computing power as they have to process tons of sensor data in only few milliseconds to avoid an imminent crash or to reduce its consequences if it is inevitable. As more and more data about the car's environment is collected, especially by cameras, the demands on computing power keep rising [255]. In 1965 Intel co-founder Gordon E. Moore discovered that the number of transistors which can be placed inexpensively on a chip

approximately doubles every two years [245]. According to Intel this rule, which is also known as Moore's Law, will remain valid at least until 2029. Although the computing power isn't directly correlated to the number of transistors on a chip it shows that we are likely to have enormous capabilities in the future which allow us to implement unprecedented safety technologies.

New wireless technologies ensure real time data delivery
But car safety products often also depend on wireless data transmission. Most of us are used to getting wrong-way-driver or glaze warnings through the radio. Of course this isn't satisfying as the information doesn't contain any details or simply arrives to late. New wireless technologies could solve this issue by providing a fast and reliable data channel to distribute vital information not only from the authorities but also directly from car to car [229]. LTE, the successor to UMTS is already under heavy development and is expected to be available in 2010 [249]. It provides massively increased data rates of 100Mb/s down- and 50Mb/s upstream. If you consider that the development of LTE will have took around 6-7 years it seems realistic that 5th generation networks might appear in 2017 and reach a moderate market share in 2020. New technologies for short range communication are also under development. The new WiFi standard IEEE802.11n is expected for January 2010 and will offer an increased range and increased raw data rates of up to 600Mb/s (compared to 54Mb/s) [244, 234].

8.2.1.2 Global Positioning

Global Navigation Satellite Systems (GNSS)
Satellite positioning has become the standard way of navigating. If the operators switched off the transmission signals tomorrow, a huge number of users would find it difficult to revert to traditional navigation methods. As the use of satellite navigation spreads, the implications of signal failure will be even greater, jeopardizing not only the efficient running of transport systems, but also human safety.

GPS: The Global Positioning System is a Global Navigation Satellite System (GNSS) developed by the United States Department of Defense (Pentagon). It is the only fully functional GNSS in the world at the moment.

Galileo: Satellite navigation users in Europe today have no alternative other than taking their positions from US GPS or Russian GLONASS satellites. Yet the military operators of both systems give no guarantee to maintain an uninterrupted service. The European Union is currently developing a GNSS called Galileo. The system will provide worldwide coverage using multiple low-band frequencies. It will be inter-operable with GPS and GLONASS, the two other global satellite navigation systems. The successful deployment of the first 2 Satellites GIOVE-A and GIOVE-B in the last 2 years and the high quality and the precision of the signals ensured that Galileo meets the frequency-filing allocation, which a real proof of the success of this project [240].

Accuracy, Availability and Reliability

Terms such as availability, accuracy, reliability, and integrity are often used to quantify the performance of navigation systems. These properties of Global Navigation Satellite System (GNSS) navigation solutions are of great importance to sea, air and especially land users [250]. Accuracy is a measure of how close the navigation solution provided by the system is to the user's true location and velocity. Having access to more than one independent GNSS provides many availability and reliability advantage, since the use of GPS and Galileo together is known to provide both improved accuracy and reliability, especially in extreme masking environments. In this context Galileo will guarantee positions to be determined accurately even in high rise cities where buildings obscure signals from satellites low on the horizon. Galileo will also achieve a better coverage at high latitudes. This will be an advantage for the north European area, which is not well covered by GPS [240]. As far as the GPS accuracy is concerned, the average position error ranges from 2 meters on an open square to 15 meters even in wide streets with four story houses on both sides which is not enough and cannot be usable in safety systems [248].

More than Positioning

The development of the Global Positioning Systems and the improvement of their accuracy are very meaningful for car telematics in the next decade and until 2020. GNSS will provide not only positioning and navigation but also several new features in the future such as search and rescue services on a global base. GNSS and especially Galileo are supposed to provide these services by combining many signals-in-space. Users are expected to get feedback about their connection-status to the satellites through provision of timely warnings when certain margins of accuracy can not be reached [240].

8.2.1.3 Demographics

For years the demographic change is a big issue in Germany with regard to economic topics e.g. the pension system [239]. The population is shrinking and will shrink in the future due to the fact that the death rate exceeds the birth rate. But our society is not only shrinking but also becoming older and older, thanks to developments in medical science, better hygiene and nutrition which lead to a higher expectancy of life. The number of people of employable age will decrease by the year of 2015 dramatically. This means there will be a broad market of relatively young, unemployed and healthy seniors which the economy has to take care of. It entails among other issues an adjustment of products and services to satisfy the needs of this "new" type of consumer group.

8.2.1.4 Standardization of ICT

Standardization is necessary but also has some drawbacks
Developing and using standards has various effects like ensuring quality, reliability, and interoperability [256]. The latter is especially important. Due to the specification of physical or logical interfaces it is possible to choose from various co-existing proprietary component solutions which leads to an increased level of competition and innovation. A lack of standards leads to proprietary complete solutions where the customer often cannot interchange components by better or cheaper ones. But standards also have negative effects like reduced product variety. This is mainly caused by the exclusion of smaller companies due to the huge amount of capital necessary to achieve high production volumes.

The car industry learned that they have to cooperate
A good example of a whole industry trying to reduce costs by developing a common standard is AUTOSAR [243]. Their slogan "Cooperate on standards, compete on implementation" shows that there is a broad willingness to cooperate in the automobile sector. This is important for emerging technologies like car2x communication. The development of the IEEE 802.11p standard which is supposed to apply the available IEEE 802.11 standards, like WiFi, to rapidly changing physical environments thus making it usable for inter vehicle communication, shows that there is no chance for proprietary solutions. [233] The conclusion is that there is a stable trend towards ICT standardization, especially in the automotive sector.

8.2.1.5 Technology Perception

The best and sophisticated technology is worthless if it's not accepted by the end user. Already in 1989 Fred D. Davis wrote down principles about the acceptance of new information system technologies [238]. He found out that the success of a technology depends largely on the perceived ease of use and perceived usefulness. Nobody wants to spend hours reading manuals or to deal with annoying errors. Hence product designers are thinking more and more about how to ensure these properties which often means removing features and concentrating on core components which do their job well and reliably. Especially in the automotive sector reliability is crucial as malfunctioning devices could easily lead to an unintentional stop in the middle of nowhere or - in the worst case - to fatalities. In-car IT systems are the most frequent cause for breakdowns [232]. Thus car manufacturers have to put a lot of effort in this are as future cars are relying more and more upon electronics and software.

8.2.1.6 Climate X

Global Warming and Temperature Increase
In recent usage, especially in the context of environmental policy, "climate change" often refers to changes in the current climate, which is highly correlated with the term "global warming". Indeed human activity over the past 100 years has increased the concentration of atmospheric trace gases, which in turn have elevated global surface temperatures by blocking the escape of thermal infrared radiation [252]. A common view is that the global average temperature has increased by approximately 0.74 degrees Celsius and is projected to continue to rise at a rapid rate. A lot of research was done so far, and "clean tech" is at the center of public discussion because continued greenhouse gas emissions at or above current rates would cause further warming. This would induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century. However, humanity is unlikely to experience a major shift in global temperatures over the upcoming decade. The most important change are ever more extreme weather-conditions such as blizzards, extreme heat, heavy rainfall and strong winds.

Sea level is rising
The sea level has been rising at a rate of around 1.8 mm per year for the past century, mainly as a result of human-induced global warming [236]. The IPCC (Intergovernmental Panel on Climate Change) report of 2007 estimated that accelerated melting of the Himalayan ice caps and the resulting rise in sea levels would likely increase the severity of flooding in the short-term during the rainy season and greatly magnify the impact of tidal storm surges during the cyclone season [246].

Nature Catastrophes
The climate change as a driver for our scenarios is justified by its important contribution as a main cause for extreme weather conditions and natural disasters. There have been a large number of recent high-impact cyclone events around the globe. These include 10 tropical cyclones in Japan in 2004, five tropical cyclones affecting the Cook Islands in a five-week period in 2005, Cyclone Larry in Australia in 2006, Typhoon Saomai in China in 2006, and the extremely active 2004 and 2005 Atlantic tropical cyclone seasons - including the catastrophic socio-economic impact of Hurricane Katrina in the USA. This development can potentially also threaten Europe, although in a less devastating way.

In view of the fatalities and the material damage done by natural disasters such as cyclonic storms, floods and tsunamis, we all wonder how we can protect our selves. Many car producers are changing their manufacturing standards according to these accelerating changes. Pre-warning systems, traffic control, tire standards, carbon dioxide emissions and many other topics would relate climate change to car telematics.

8.2.2 Uncertain Drivers

8.2.2.1 Traffic Intensity

The uncertain driver “traffic intensity” describes the development of the traffic on roads, which takes only cars and trucks into consideration. Traffic intensity on roads generally is mainly influenced by governmental initiatives and the development of the world and regional economy. Recent prognosis assume that car and truck traffic will increase by 20% and 34% within the next 12 years, based on the average economic growth of the past decade [258]. People tend to put up with longer distances to go to work or to do free time activities. But simply the drastic increase of the oil price, caused by some war in the Middle East for example, can turn the whole scenario upside down. The people will become more flexible, the more the oil price goes up. They will do car pooling or just switch to public transportation. Due to the fact that cars perform nine times the traffic of trains, a high amount of car drivers will shift rapidly onto the cheaper rail [231].

Not only the oil price but also the regional concentration plays a major role in respect of the traffic. Regions of economic growth pull new workers and families; in other words the traffic in economic growth centers increases and traffic in other regions decreases simultaneously. According to the geographical development of the economy, traffic follows the economy which needs an extension of recent infrastructures to avoid traffic disruptions. Due to the long planning phase of new infrastructure, the capacity will always be behind the demand which causes high traffic intensity. Besides the economical issues which affect traffic intensity, the general mood of the people and, in representation of their beliefs, politics can have a huge influence on traffic intensity. Environmental prevention and according laws are able to reduce the traffic within a short period of time. For example tax increases on fossil fuels or the prohibition to drive a car within a city can have major influence onto the traffic around the city. People will rethink to possess or to use a car rather than to use public transportation and to save a lot of money [254, 235].

8.2.2.2 Infrastructure

Cracks, ruts, bumps or blown surface on the road greatly influence the immediate safety of any traffic participant as they make steering less dependable, other participants less predictable and are draining concentration from a driver challenged in his abilities to control an otherwise perfectly handled car. This makes the road infrastructure's condition a crucial driver behind general traffic safety. A bad condition increases a general and unavoidable risk of having a car accident due to external factors like a hole in the highway which allows for no counter measures but fixing the crack in the first place. Moreover, a run-down lane raises the driver's risk of making an error which escalates the danger in a situation with high traffic intensity.

High traffic intensity could be addressed by building more roads but in the medium run with a time horizon of about ten years the number of street-kilometers does not rise significantly due to a project-duration of two decades or more in the road-construction business [247]. However, the condition of the available roads depends to a great deal on monthly or even weekly fixture and can decline as fast as water in existing cracks freezes and breaks open a highway's surface. In summer a hot surface makes tires wear down more quickly. At the same time the tires do more damage to a heated tar than they do to a cold one.

The shape of 2020's road infrastructure is therefore totally contingent on the road work done in 2019 and this is a variable that depends on many factors such as the government's budget for road maintenance which in turn depends on the state of the economy. The highway's condition is also influenced by the traffic intensity, as a more dense and frequently used road is worn down quicker, and any privatization policy that leaves the ownership and maintenance duty in private hands. Toll collection, the actual way of building roads and the material used in 2020 are three more unpredictable factors. Eventually the extent to which weather becomes extreme in variation leaves streets more or less vulnerable to heavy use. All this makes the future condition of highways, federal-, state- and freeways uncertain, yet it plays a major role in traffic safety even in a decade from now and is therefore both important and uncertain a driver for the 2020's safety and telematics sector.

8.2.2.3 Car2X

As far as safety systems in the car are concerned, today's cars are well equipped with many passive safety systems such as seat belts or airbags as well as active ones like ABS ans ESP. These systems enable the car to "feel" and to "see" any danger. However, we can even improve the safety level in the car, if we enable it to "hear" and to "speak" using wireless technologies. Many accidents could be avoided if the driver would get the information necessary to evaluate the situation quicker. Networked safety and telematic systems will provide drivers with uninterrupted up-to-date information on road signs and congestion, which will be transmitted and displayed on board. Today's sensors are warning drivers from dangers that could be seen, however communication between vehicles will warn drivers from hidden dangers. Hence the CAR 2 CAR

COMMUNICATION CONSORTIUM is developing a new standard which allows cars to communicate with each other and with fixed infrastructure. To achieve the objectives of the Car2X project it is necessary to make a system which guarantees a cooperative function that connects cars with more than one network i.e. GSM, WiFi or some radio communication networks [229]. Possible application scenarios would include warning messages signaling a slippery street, obstacles, sudden halts, accidents, an extreme weather condition, lane changes or approaching emergency vehicles. To make this technology working about 10-15% and to make it really useful half of the cars have to be equipped with it. Even if all new cars would have Car2X modules installed it would take many years until the 15% barrier is reached. Hence many cars are already resold before their owners could take any advantages of the Car2X equipment. As almost nobody is ready to pay extra money for a system he may never use the market entry for C2X is still disputable. Another problem is that Car2X systems need without doubt to be tested in a real traffic environment. Possibilities to solve this deadlock are legal enforcement or infrastructure which supports the communication between the cars until the barrier is reached.

8.2.2.4 Car IT Architecture

Up to 90% of all innovations in the automotive sector are due to electronics and software [253]. Current cars consist of dozens of electronic control units (ECUs) and their number is increasing rapidly. The resulting complexity can only be handled by investing a huge amount of work. This is the reason why several vehicle manufacturers and their suppliers started to rethink. The result is AUTOSAR, a common platform which allows the reuse of software and hardware components thus reducing development and integration costs dramatically. As already mentioned before this is a perfect example for co-operations between various companies.

A possible next step would be to open this platform for third party software developers which would allow car owners to install new features after buying the car. It is conceivable that in a few years car manufacturers provide an online shop - like the iPhone App Store - where third party firms can sell their software solutions which are directly downloaded onto the car. Right now this doesn't seem realistic as most of the money is earned with accessories like navigation or multimedia systems. If anybody could offer software which provides the same functionality as the original features, which are often sold at a high extra charge, car manufacturers would lose a lot of revenue. But on the other hand mobile phones experienced a similar development. Often the major sales argument is an enhanced software including more features. An open software platform allows users to add new features thus eliminating the need for buying a new phone. But the phone manufacturers did it anyway as they realized that it provides an unprecedented feature variety which could be used as a sales argument. By selling all third party applications over an online shop controlled by the manufacturers they can not only earn money with it but also prohibit software which interferes with their business model. Maybe we will experience the same development in the automotive sector as users will learn that it provides a lot of advantages. Another possibility would be to introduce common interfaces which can be used by handsets to interact with the car thus eliminating the need for an open car software platform. These interfaces are already available in the form of Bluetooth which for example allows the driver to use the car as hands-free kit or to operate the phone via buttons on the steering wheel.

8.3 Scenario Development

8.3.1 My Car, My Coffin

8.3.1.1 Scenario Overview

In this scenario, the roads are time-worn and dangerous, although still in every-day use of a high number of cars as an increased traffic intensity has a tight grip on Germany's road infrastructure of 2020. Despite the great popularity of a personal ride opposed to public transport, innovations in car2x communication as well as in the standardization process of a common in-car software architecture are as scarce as the government's efforts to bring such a development on its way or to penalize the use of fossil fuels, introduce a toll-system for federal-roads or increase road-maintenance in the face of a sluggish economy and missing tax revenues.

Cars are the ride of choice
And mainly it is due to this recent economical down turn , induced by Europe's general business cycle and reinforced by missing export-profits from a roiling Eastern Asia, that municipalities and the states had to cut their budgets for public transportation which made the use of suburban trains, railroads and subways not only less comfortable and safe but also more expensive relative to 2020's 60 miles a gallon, low-emission, high-powered cars. Moreover, these fossil fuel driven opportunities of self-actualization offer a maximum of safety-standards, as EU and federal government initiatives, laws and regulations demand ever more from a partly state-owned car manufacturing industry.

The responsible authorities chronically underfinanced the road-network
However, there is a dire need for such safety-measures when driving on German roads. Facing a downturn in the tax-revenues, the owners of the road infrastructure, be it the federal government, the state or the municipality, had to further cut down their budgets for road maintenance from a level that

already was too low since over a decade to keep the highways safe. While the extension of the toll system on federal and state- roads was an unpopular measure regarding the menacing recession, the privatization of important parts of the infrastructure seemed to be a smart move. The new, private owners of these roads, of course, either imposed tolls or did not comply with the requirements of maintaining a minimum of surface quality. In 2020, the chronically underfinancing of the road infrastructure combined with wrong or missing incentives in the privatization of infrastructure makes driving the adventure it was a century ago.

Shortsighted policy creates an unfortunate situation for technological advancement

For a common in-car software architecture to come it was not so much the economical slow-down that prevented a break-through or multilateral agreement and co-operation within the industry. The governments across the Europe of 2020 and the Americas but also the emerged Asian league of developed countries have increased their protectionist measures, partly due to high unemployment and slow growth that create political pressure at home, but partly also because of some bad experience they made during a decade of harsh adjustments in quality of live and a re-balancing of global power and trade. This protectionism includes not only regulations on foreign products but also the support of so called national champions and the control or nationalization of security relevant industry. Co-operations or joint-ventures are often denied by market-regulators or made impossible or unprofitable by restrictions on the trade or development of technology with foreign partners. A standardization of an in-car architecture for all markets or even for all car-manufacturers within a single market is not feasible and does therefore not exist.

The car's popularity is the midwife of car2x technology

While a common, open, software-platform was never really under way, car2x communication technology experienced an incredible success in the early 2010s. In the wake of a great restructuring and re-thinking in the car industry that took place in 2009, cars became not only much more affordable in price and maintenance, but also highly fuel-efficient and therefore cheaper to use. The following jump in car sales and use paved the way for an incredibly fast market-penetration of cars that had a car2car communication feature and car to infrastructure was even easier to realize. After several incidents of malfunction, decisive sabotage and data-fraud, all imposing a threat to privacy, property or even life, car2x was dropped by the auto industry as it was deemed to bring more harm than it would serve humanity and caused more trouble than was expected.

8.3.1.2 Market Analysis

Six major players dominate the sector

In 2020's car safety and telematics market, six types of players can be identified within the industry. Most important, there is the end user. Moreover, the sextet contains the telematics and safety sector itself, sided by the car manufacturers on the one and the suppliers of basic material and services for the telematics industry on the other hand. Eventually, these four players have to put up with the government on national and European level above all and the input they get from the education sector at the very beginning of this chain.

End-users exert a strong influence on developers

His high average purchasing power, the good education and well defined needs equip the consumer of the end product with significant bargaining power and make innovations mainly market driven. Companies are therefore very customer oriented and offer along the actual product a variety of services like financing or consulting for free. Furthermore, the market pull is the main force behind most new technologies and products and firms compete less over the price and much more over value-added services and complete solutions.

The telematics-sector has grown into a multi-faceted industry, yet dwarfed by a Goliath car-industry

In the middle of the value chain stands the safety and telematics industry, which has become a broadly defined term as there are both software and hardware firms in this sector. These firms address needs that range from driver-assistance like expert-systems over pre-warning and pre-crash solutions like augmented reality in head-up displays and camera-supported all-round sight to immediate crash safety like airbags and emergency-call-systems. No matter how strong the customer pull for this kind of products, the telematics sector has little or no bargaining power against the few, big, partly state-owned car manufacturers and lives of short term contracts that leave little room for negotiations. This is mostly due to the monopolistic market structure in this industry and the fact that the well protected and subsidized car industry engages in fierce competition in the end market but is under no pressure when dealing in the telematics sector. The competition there is hard, too, and the number of potential suppliers is big. The car manufacturers therefore hand over the issues that come with a contested market to the safety and telematics sector and leave it to the companies there to give it over to the next rank in the value chain, the suppliers of basic material.

Big and old, the suppliers of basic electronics are strong and subsidized

These basic suppliers, however, are in a good position. They, too, remain few and strong within their business as they are heavily supported by a protectionist administration. Producing electronics for a world-market and therefore defending the nation's economic honor while providing a massive amount of work places is deemed worth subsidizing and monopolizing. However, these subsidies come with a catch as they are tied to strong government control in an industry highly sensitive to national security issues. For the telematics sector, of course, this makes things hardly better. Indeed, firms in this sector, too, have to comply with many security regulations without receiving similar aid and find themselves squeezed between the basic suppliers on the one side and the car-manufacturers on the other.

For few, jobs are many
There is a general scarcity of jobs in a stressed economic situation with borders closed and the working-age rising. For most high school and college graduates the job-outlook is grim. This is, however, only true for the average. All sectors compete fiercely for the top-educated under the engineering and business majors and recruiting costs are often equal to two or more annual salaries. These costs include tuition for employees-to-be that are supported throughout college, co-operations with universities and research funding.

8.3.2 It's Not My Car, It's My Computer

8.3.2.1 Scenario Overview

This scenario is particularly characterized by a wealthy state of the high-tech industry. Many state-companies have been privatized in the last decade. This had a good impact on the competition level in many industry-fields especially the research and development in the technology sector. Moreover, companies of the same activity domain have started a huge cooperating after the financial crisis. In the middle of this harmonization wind the complexity of car architecture and the seek to have a common car platform was the center of discussion. Not only car manufacturers but also independent software developers agreed on the need for an open platform. Such an IT platform gave the car manufacturers as well as the software developers more freedom and independence. Several IT-services in the car have emerged and many applications regarding safety, navigation and communication have become popular. The new car architecture was a big revolution in the car telematics sector.

Car2X technologies need to wait
The majority of attempts at a successful cooperation between companies from different branches fails in the next decade. This failure could be explained by the huge differences between their market strategies and benefit level they might reach after cooperating. A success of the Car2X technology needs a high collaboration and consolidation not only between car manufacturers but also between different telecommunication providers in the same region. Although Car2X systems can be executed in different embedded hardware

environments the severe standardization regulations do not give Car2X any chance to be developed without the presence of an open car platform. However, the presence of a unified IT system in this scenario could not make the success of Car2X technologies and especially Car2Car communication. The failure of this project can be explained by the delay of its introduction and its low data integrity level. Car2X will be rejected by the consumers due to its threat to the anonymity and the privacy sphere of the drivers. Therefore alternatives like R2R-Com (Road user to road user communication) will be also unthinkable in this context.

Traffic intensity remains stable

Traffic intensity is in general influenced by governmental strategies, roads infrastructure and the number of vehicles, which has almost the biggest impact. In this scenario and despite the surge of oil prices, which is justified by its scarcity on one side and conflicts between exporting countries and consumers on the other side, the car industry has always been encouraged and supported by governments in Europe and particularly in Germany. In the past decade Germany did a significant amount of research to reduce the consumption of combustion engines and to lessen their gas emissions. So the car industry remained stable and successful and the number of cars and car owners has increased. Alongside this success governments have made big efforts to re-establish efficient public transport services especially by integrating more ecological buses and studying their traffic strategies. The improvement of the road condition and the quality of the infrastructure encouraged people to travel by cars, too. In this scenario we consider an augmentation of the vehicles density but also an improvement of the general infrastructure which made navigation systems and traffic regulation systems more interesting than telematics and safety products.

A more intelligent infrastructure

This scenario assumes a good infrastructure. Roads, streets, bridges and rails are well maintained. Although car traffic has not shown any major changes in the past decade, the extreme weather conditions have had a bad impact on the quality of the roads, therefore the whole infrastructure has to be always renewed and a higher budget would be considered for repairing the deteriorated roads. Besides, governments have given more attention to the general infrastructure and have been offering a high quality service too. As far as the number of streets and roads is concerned, the stability of traffic intensity will not lead to big projects such as the construction of new roads. Nevertheless, they will focus on the optimization of gas emissions and the reduction of the travel duration from A to B by decreasing the number of traffic lights and replacing most of them by traffic circles.

The car is the ride of choice

The general condition of the economy in this scenario is well-balanced. Income and wealth are broadly distributed, which has made cars affordable for many more households. While a common car IT platform exists in 90% of the vehicles Car2X technologies suffer from the high market entry barriers. Because this new open car IT platform is able to learn and to store customized preferences, driver and traveler acceptance has also risen clearly. As software development has become faster, easier and more reliable, car software applications have been employed in more and more safety functions. Consequently, transportation has become safer for every motorist, despite ever increasing traffic density. Due to the instability of the global security, the price of raw materials and especially petroleum has been continuously increasing. But the improvement and the maintenance of the roads infrastructure will continue. The privatization of state companies led to a higher competition level, many innovations and more similar products on the market. consumers will choose between diverse car-ICT products especially in terms of navigation systems and telematics. After the success of the open car IT platform many software applications oriented towards the car industry will emerge and offer more driver support and several intelligent services. Consumers will appreciate this comfort in the car and the easy way of driving. Consequently the average duration of time spent in the car will increase considerably. Some value added services such as infotainment applications will benefit from this consumer behavior. This comfort will be also enhanced by the good quality of the infrastructure. The extremely high oil prices will have an impact on the volume of car sales in the first half of the next decade, however there will be a strong need for more fuel efficient engines and particularly intelligent drive systems that can regulate the oil consumption average. As far as demographics are concerned, the number of people of employable age will decrease and by 2020 50% of the population in Germany for example will be aged over 50. This changing age structure will change the perception to products and services. New value prepositions such as personal care, wellness and car safety will be more important for the consumer.

8.3.2.2 Market Analysis

Besides the car industry, the telecommunications and high tech sector is one crucial part of the value chain. For this analysis we combine a macroeconomic view with analyzes of individual industries. First of all, as an globally active market player, the automotive industry will be an engine of innovation. German car manufactures have to adapt to international trends and the convergence of the open car IT platform. Global security in terms of energy will lead to a surge in the oil prices. Despite the increasing number of cars in this scenario consumers have shown a marked preference for “green products” because of environmental impacts, air pollution and oil prices. As a response to this consumer activism, legislators have paid more attention to green regulation. European governments as well as car manufacturers and research centers will react by accelerating their research on reducing fuel consumption and gas emissions in the cars. The infrastructure sector has profited from the globalization and the opened entry barriers between EU-states. This advantage has been preserved by accelerating approval procedures, deploying more flexible regulations and promoting investments. Mobility will become a crucial competitive factor and governments will finance transportation infrastructure but private companies will remain responsible for running and maintaining this infrastructure. In the telecommunication sector, cell phones and ubiquitous Internet access will reach high penetration rates. However, revenues will fall and employment will decline. This instability will be overcome by the installation of a new modern and more sustainable infrastructure. Classic services will less successful and innovations that merge with other branches i.e. car industry will be more attractive. However, the lack of collaboration between companies from different branches will dwindle the success chances of ICT-based safety technology keys like Car2X communications.

8.3.3 Silver Generation, Golden Wallet

8.3.3.1 Scenario Overview

Through the past decade, the economy had to suffer a long term economic crisis triggered by the financial crisis at the end of the first decade of the century. This caused a major rethink about the cooperation between companies of the same branch. It was no longer possible to keep up the competition under the economic circumstances.

Creation of co-operations to save resources and to bundle money
The driving force for the soaring development of co-operations was the bundling of money for research and development. Parallel to the crisis, the complexity of the software for cars has reached a level where hardly a single company was able to deal with development costs by its own. This also lead to the cooperation between former competitors and to the creation of joint ventures. Money was raised for the development of an open car IT platform.

A common IT platform as technical foundation
A common IT platform for all vehicles on which the car manufacturers can install their own applications which should ensure an individual branding. The car IT platform is not only open to the car manufacturers but also to independent software developers. This initiated the generation of a whole new software supplier industry, enabled by the open platform which lowered the entry barriers into the car software market drastically. Thereby a variety of tools and applications regarding safety and driving assistance have emerged.The

aperture of the car IT also impacted the development of car2x technologies. Due to bad economic conditions, discussions about traceability of each individual car user and the legislation on the use of private data and signals for car2x technologies has loosened and contributed to the fast development and acceptance of this kind of technology. The co-operations and the low legal barriers help to reflate the market and to overcome the economical crisis.

Economic centers as a result of economic downturn

Nevertheless due to the difficult times, few economic centers and locations built up in order to concentrate capacity and resources. A movement from economically weak parts of Germany to healthier locations emerged. The people settled around these economic centers and areas with metropolitan character developed. In order to get to their work place inside the city, people living in the suburbs have to cover high distances due to the huge comprehensiveness of the economic centers. The overstrained public transportation which cannot adjust to the exploding density of population only leaves the car as alternative for most people. The oil price moved with the economy and is at an affordable level to use the car.All in all, the infrastructure, roads and rails, only adapt very slowly to the increased demand and are in the surrounding of the economic centers used to capacity, whereas big parts of infrastructure in other parts of Germany are not used at all. The adaption and reaction of the infrastructure to high demand is delayed and very slow since it takes a lot of time to plan and construct new roads, rails and motorways.

Active traffic management to cope with high traffic volume

Not only the people have to suffer under the tense traffic but also the infrastructure itself through the intensive use and extreme weather conditions. Many roads are deteriorated and badly need to be renewed. The increasing concentration of the population requires new technology to handle the increased traffic volume. The open car IT and Car2X technologies are the technological foundation for active traffic flow management systems to use the whole infrastructure, not only the motorways but also roads and smaller streets. To avoid traffic jams and further accidents, commuters only enter their destination and are led automatically by traffic management systems, using many different ways and options to get to the same destination every day. The car IT and its many applications have become more complicated and sophisticated but not their handling. Intuitive use has become the main focus for the handling of systems in order to adjust to the increasing age of the consumers. Inevitable, the society is aging. However, the broadest society stratum already has a basic technical understanding which certainly supports the technological perception.

Scenario evaluation

This scenario is considered to be the most interesting one among the three described ones. The driver specifications in this scenario particularly the well developed Car2X technologies and the open car IT platform are acting together to change the whole safety and telematics market, their players, their products and its customer profile. The car safety sector has been a melting pot of the car manufacturing and telecommunication technologies. Considering the increased traffic intensity the need to safety systems in the cars will be more important. Although this scenario is not significant more likely than the other two. The telematics sector would be less important either because of the absence of Car2X technologies or the failure of developing a open car IT platform.

8.3.3.2 Consumer Analysis

In the year 2020, the economic crisis has allowed for the development of only a few economic centers within the country. The delayed effects of the financial crisis have triggered a state of emergency at the beginning of the second decade of the century. This initiated a concentration of resources and capacity and led to few core economic centers. First of all this implicated a huge population movement to the economic centers, chasing the places of employment. This tremendous settlement around these economic cities let the density of population rise rapidly and caused metropolitan characters. The creation of new accommodations was able to keep pace with the rapid settlement but due to the planning complexity, the infrastructure still lags behind. In the last five years, it turned out that the governmental initiatives worked well and could recover economic stability and growth. Through the circumstances in the past years the economy is recovered but the distribution of population has been unchanged. The high population density and the bad infrastructure conditions generate high traffic volume and chaotic conditions on the road.

The car is an office

The lack of sufficient public transportation prompts or even forces the people to use the car to go to work or to do their shopping. Especially the workpeople are affected by the bad traffic conditions. They have to spend a long time in their car to go to work in the morning and to return home in the evening. Consequently the working day doesn't start in the office but in the car. Due to the open car IT platform, they can use applications which enable them to complete routine work while driving the car; this work typically contains answering emails or the update about recent projects on which was worked during the night on the other side of the globe.

Technology is widely accepted and used

On average the technological perception of the population is high, due to the fact that even 70 year old people somehow had to come into contact and had to engage with the technological development to keep up with society. This implicates that although the society is becoming older and older, it keeps up with technology and stimulates the demand for technological applications and developments.

Every other person is over sixty

Inevitable, the German population is becoming older and older and is not growing at all. Through the fact, that the baby boom generation of the late seventies is almost in its mid fifties in the year 2020, there is a huge part of the society which is financially able and willing to buy cars equipped with safety applications. Furthermore almost all age-groups ahead of the baby boom generation feature higher birth rates than the age-groups after them. This implicates that the biggest part of the population is fifty years or older and is in need of car safety applications. The capability of the safety systems balances the shortcomings of the age and the fast-paced and chaotic traffic.

A high population density causes fast-paced traffic

The successful intuitive handling of car IT systems facilitates their use for the car driver significantly. To pick up the “working-in-car” example from above, the car driver is confronted with fast-paced, intense and exhausting traffic on the way to work and simultaneously starts his working day. This kind of car driving demands a huge amount of assisting systems which support the driver passively to avoid accidents. Additionally the driver seldom uses a similar way to work due to the active traffic management system, which adjusts its navigation to the current traffic conditions and leads or indicates him the fastest way to his destination. The huge number of ways which all lead to the same destination makes it impossible for the driver to remember the characteristics of the particular streets. Characteristics of roads and streets include beside the course of the streets also the dangerous and broken sections of the roads which can be hazardous for inexperienced users of those tracks. Furthermore, the frequency of broken segments or sections which are under repair will increase extremely by the massive traffic density for which the infrastructure was not supposed to be. However, not only the intensity of use influences the road conditions but also the weather conditions do not play an inconsiderable role. The increasing appearance of extreme weather conditions is one of the main influences on road conditions. Incidents like floods or frost shattering can cause major impacts on road conditions. To make matters worse, the maintenance and reparation of broken roads is hardly possible because of the high traffic volume.

Many applications assist the overstrained driver
The more time one spends in a car, the more likely he makes or is involved in an accident. To save his employee from this danger and to assure a safe way to the working place and back, the employer is very interested to support its employees with safety and driving assisting systems. These systems should not only care for the safety, especially on the way back home when the employee is very tired and unconcentrated from work, but also regarding the comfort of the employee. A healthy, relaxed and rested employee is worth more. This again drives the demand for safety and assisting applications. Due to the open car IT platform, there is enough capacity and supply to satisfy the demand.

Customized applications are flourishing
To meet the demands of the "working" car drivers, there are customized car IT applications which take the driving and working habits of the user into account. Factors for the choice and combination of the applications can be the age of the driver, activities executed while driving, the car itself, driving habits and abilities.

8.3.3.3 Car IT Platform

Every new car until 2020 is equipped with the common car IT platform which was created by a consortium of European car manufacturer in the middle of the second decade of the second century. The background of the cooperation was the savings of resources and capacities and the rapidly increasing complexity of car IT systems which could hardly be afforded and accomplished by one single manufacturer and its suppliers. A joint venture was founded and a common car IT platform was developed with the financial and technical contribution of each of these car manufacturers. The concept is, that there is one single core system which is the same for every automobile. On top of this core system, the car manufacturer develops different software systems for every car in his portfolio with its individual Graphical User Interface by his own. In general, about 80% of an average car IT system should be covered by the common car IT platform, the remaining 20% are left to the car manufacturer for individual adjustments. Consequently every car maker has a slightly different car IT platform, but their foundation is the same. Each car maker has furthermore his own itunes-like application-store where every customer can download additional applications onto his car IT system. These applications relate to topics like entertainment, communication or safety. They offer extra value to the customer and are supplementary installable.

8.3.3.4 Market Analysis

In general you can identify six different players on the safety and telematics market. On the one hand, there are car manufacturers, suppliers, independent developers and telecommunication companies. On the other hand, the government acts as a control and supervising instance and educational institutions ensure the supply of knowledge, staff and innovations. The specific characteristics of the particular players are elucidated in the following.

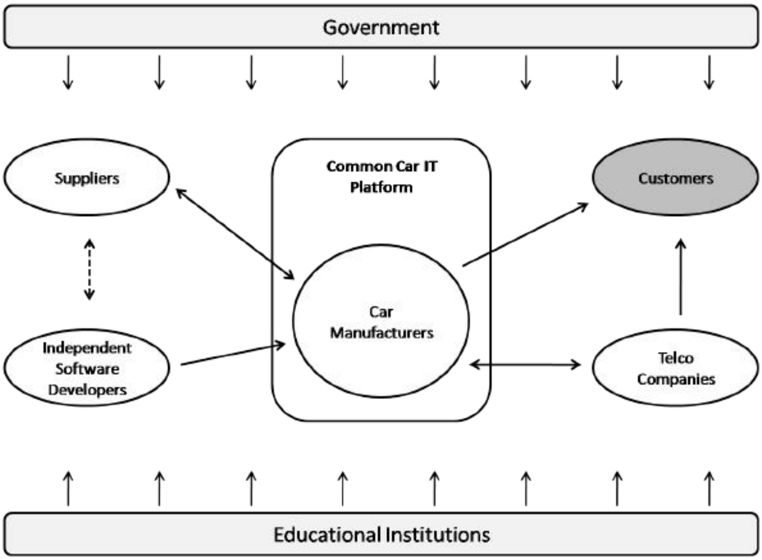

Figure 8.2: Overview of player inter-dependencies
Source: Own Illustration

Car Manufacturer

In spite of the open car IT platform, the car manufacturers have created together, the automotive companies outsource the development of new applications for their cars. Based on a recreated and growing economy, it is more efficient and cheaper for the manufacturers to concentrate on their core business and to give parts of the software development to external companies. Besides telecommunication companies in this sector, the car manufacturer are the only player who do direct marketing to the customer. Through the different surfaces and individual software architectures on top of the common car IT platform of the single manufacturers, it is impossible for the suppliers or the independent developers to bypass the automotive companies and to sell their products directly to the customer. In order to be able to develop software for the cars of a specific car maker, suppliers and independent developers can acquire licenses and software toolkits. All the sales and distribution is carried out by the car companies.

Suppliers

The supplier usually works hand in hand with the car maker. A supplier-car maker cooperation is normally based on a long relationship in which every partner gained trust over the years which tightens and enhances the cooperation. To protect all the insights and internals the supplier gains, the car manufacturer has exclusive long term contracts with the supplier to prevent the misuse of sensitive data. In addition to complementary applications for the car maker's car IT system, the supplier develops and improves the kernel car IT system for its customer. As far as the exclusive contracts between the supplier and the manufacturer allow, the suppliers cooperate with several car manufacturers at the same time to diversify their risk not to depend on a single customer and to benefit from economies of scale.

Independent Developers

In comparison to suppliers, the independent developers only create complementary products or applications and are not involved in the development process of the individual car IT system of the each car maker which is based on the common car IT platform. The relationship between car manufacturer and independent developer is usually temporary but can of course emerge to a long term relationship. As mentioned above, the developer can acquire a license and a toolkit to be able to develop applications for the particular car maker's IT platform. Furthermore the independent developer can acquire more than one license from different car makers and can consequently sell one product to several different customers. Thanks to the common car IT platform, the applications can be converted to the different specifications of each car maker with little effort. Due to the loose cooperation with the car manufacturers, the independent developers are more flexible and are less influenced by the car makers. Depending on their financial resources, applications and products offered by independent developers normally interact less with the car and are less complex than applications from suppliers are.

Telecommunication Companies

The Telco companies take over a quite passive role concerning the development of applications. In addition to the common car IT platform, their services present the basis for most car applications. They assure the data transfer between the application of the car and databases or information centers outside the car. Besides the communication infrastructure, they offer the data and information which is essential for most car applications. The sourcing, processing and provision of data is mainly accomplished by the Telco companies themselves. Those value added services imply a cooperation with the car manufactures, suppliers and independent developers to assure the compatibility of each different system. Consequently, there exists a reciprocal dependence between Telco companies, car manufacturers, suppliers and independent developers. Since most car applications work and only make sense when they are fed by recent, preprocessed and external information, the contractors of car applications strongly depend on the services of the Telco industry. On the other hand, the Telco companies depend on the offer and demand on applications for the car in order to close contracts with the car owners and to get the chance to generate profits by offering value added services.

Government

Since the car applications are used in public traffic, it has to be assured that the applications cause no danger or harm to other traffic participants and the car occupants themselves. The government operates as a controller to ensure the quality and reliability of car IT applications. Through the use of organizations like the TÜV or the DEKRA, the state sets a certain quality and minimum safety level each application has to meet. The safety requirements premise for example the separation of entertainment and car control electronics to avoid possible interferences. In order to be used by a customer, the application has to be approved by the state.

Educational Institutions

Universities and other educational institutions take over the role as suppliers of knowledge, innovations and talents. They are responsible for the development of new technologies and for the solution of technological problems and barriers. Besides the research, the establishments educate the prospective employees of every other player. Ideally, small start-up companies are founded out of the universities and take the position as independent development companies or later on as suppliers.

8.3.3.5 Business Web

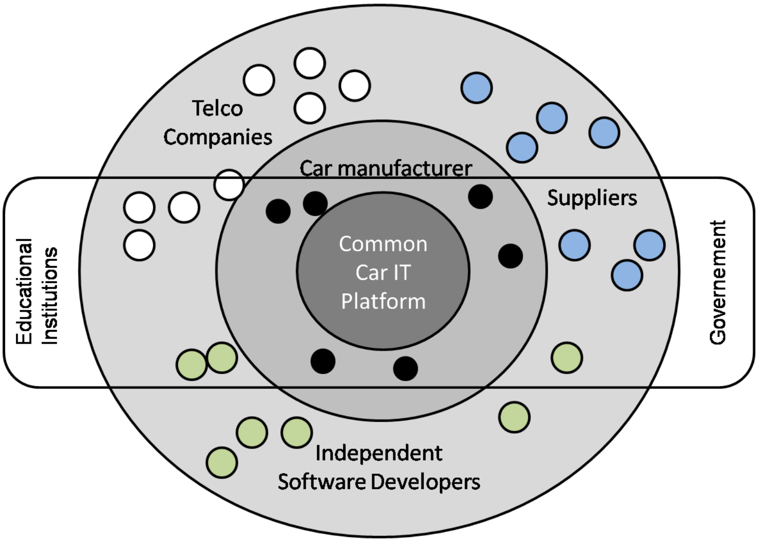

Figure 8.3: Business Web
Source: Own Illustration

Depiction of the Business Web

As depicted in figure 8.3 the core of the business web builds the common car IT platform, a joint venture of several car makers (shaper of the market). It was created to be used as general car IT platform. The manufacturers themselves are located in the circle around the core as adapters of the inner circle. The adapters of the inner circle are surrounded by adapters of the outer circle. Those are represented by the supplier, Telco companies and the independent developers. The suppliers are mostly outsourcing partners of the car makers in contrast to the independent developers which are usually licensees of the automotive companies. A cooperation in the outer circle between suppliers and independent developers is also possible. By outsourcing development to the independent developers, the suppliers are able to shift capacity to external companies and to focus on core development issues. The telecommunication companies are cooperating partners with the car manufacturers.

Entry barriers through licensing

Through the application-store and a license system, which is further illustrated below, the car makers are able to create market barriers for potential competitors. This downstream foreclosure should avert the direct sale from the suppliers or independent developers to the car maker's customers. By giving licenses and toolkits to independent developers and giving them the chance to sell their products over the car makers applications-store , the variety of applications is flourishing. This in turn creates additional benefit for current customers and incentives for potential customers.

Telco companies' important role as connectors
To make things work, the car maker has to interact with the telecommunication company which enables the data transfer and communication. The Telco companies have on the one side contracts with the car manufactures to define their cooperation and on the other side the single contracts with the car owners. Further applications can be installed supplementary and wireless on the car IT platform through the application-store without going to the car dealer. Besides the usual contract fees for using their infrastructure, the telecommunication companies offer additional services to both the car manufacturer and the customer. They provide and maintain databases with essential information for the car applications. These databases contain for example current and recorded track information for the use with safety systems. The government supervises the whole value chain and engages in case of technical or economical disorders. The educational institutions take over support activities in terms of know-how, technological innovations and qualified workers. All in all the value chain of the Safety Telematics Market can be described by series connected companies supervised and supported by the government and educational institutions.

8.3.3.6 License System

Car IT structure: individual and common part
The structure of the individual car IT systems consist of two parts: 80% of the system is contributed by the common car IT platform and 20% represent the individual part of each car manufacturer. In cooperation and on base of long term confidential contracts, the car makers maker develops these 20% together with its IT suppliers. The suppliers can be seen as partner companies of the car maker and have deep insights into the car IT technology of their customer.

Licenses and toolkits for market entry
In comparison to the suppliers, the independent developers do not have a long term relationship with the car maker or the car maker has no interest to involve these companies more into its business. But simultaneously the car maker wants to profit from good ideas and product developments of these independent developers. Therefore the automotive company distributes licenses and toolkits for developers with good product suggestions and ideas. The toolkit allows the developer to adapt its applications to the individual car IT of the car maker and the license allows him to offer his product via the manufacturer's application-store. The application design has to be adjusted to the IT design

of the car manufacturer to perpetuate the corporate design. Through the selected distribution of the licenses, the car maker has always control of which applications run on his cars.

Freedom of choice through licenses
Before the applications is offered for download in the application-store, it has to be approved by the TÜV or the DEKRA. The expenses for this approval have to be raised by the independent developer.By contrast to the car maker-supplier relationship, the independent developers are allowed to offer their product to as many car makers as they want. They are not bound to confidential contracts. They only have to acquire each single license for every different car maker and to fit their application via the provided toolkits to the individual car IT systems. The distribution of the applications is only possible over the application-store of each car maker. The profits are shared between the car manufacturer and the independent developer.

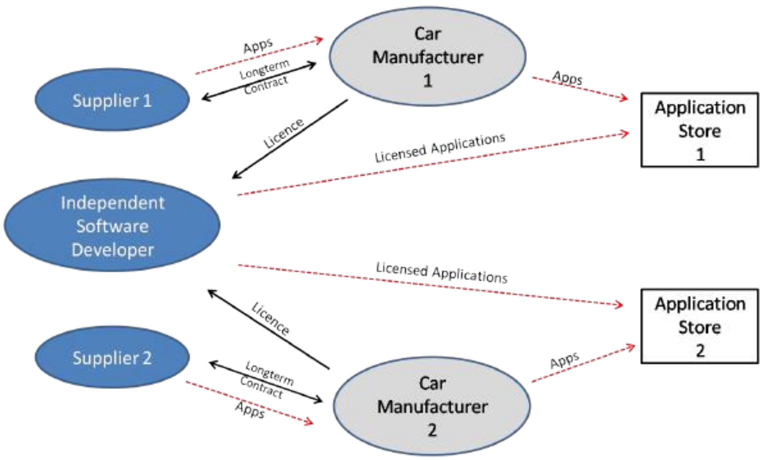

Figure 8.4: License System in the car and telematics sector
Source: Own Illustration

8.4 Product Idea: The Safety Factor

8.4.1 Introduction

Most accidents are not anticipated by the driver at all
Regarding the fact that more than 40% of accidents with serious injuries occur in intersections or junctions it is interesting to hear that in a large part of intersection accidents there is no breaking attempt, or not even a steering

attempt by the driver [237]. Aquaplaning increases the risk to have an accident by up to 100% [257] but is often not even recognized when it is already taking place. Moreover, there are nearly twice as many accidents at night than in daylight [230], underlining the importance of a driver's ability to fully analyze his or her environment in order to effectively predict the impact of his or her actions. On the road, being surprised by a slippery surface that was wet during the day but is covered by a thin ice-film as soon as the sun's disappearance made temperatures drop is as much a problem as the difficulty to evaluate distances in twilight.

Safe driving is a very complex task that exceeds human capabilities

To overcome the shortfalls of our senses when it comes to steering a vehicle scientists and smart inventors have developed a variety of assistance tools, some of them being passive safeguards like the ESP or ABS systems and some of them very actively supporting the driver in his or her decision by providing one or the other piece of information on the car, its environment and the traffic. Still, drivers obviously can't always judge how safe or dangerous they are driving in a particular moment. Many may think anyways they drive safe and would be surprised if they knew in what danger they put themselves and others. Many others know they are taking a great risk as soon as they by entering a car but cannot help: they need to drive. But they would also need information on their safety and how they can make their driving safer in a particular situation. At the same time they need this information in a concentrated, intuitive and easily accessible form that does not add to the already huge information input and does not distract even further from driving like a navigation or sound system might do.

The Safety-Factor might provide a solution

A display that gives the driver in one number an idea of how safe he or she is at any particular moment in the car would take care of much of the information-collection and processing problem that causes almost every accident. Taking into account a variety of factors, the Safety- Factor computes an accumulated measure of safety. Some of these factors are already accessible to the driver like speed and temperature but many more complex pieces of information like immediate aquaplaning-hazard or a dangerous traffic-situation ahead are new. Moreover and equally important, the software analyzes the data used to compute this factor and gives advice to the driver of how to increase his or her Safety-Factor at a given moment. It is quick, immediate and supposed to be intuitive, in order to address the driver in the minute before a potential accident.

8.4.2 Customer Analysis

8.4.2.1 Silver Society is Likely to Come

The so called baby boomer generation in Germany is expected to retire in the end of the second decade of the 2000s and is estimated to account for about a third of the population [241]. Although there are no sources available for Germany, several Swiss studies suggest that this large, homogeneous consumer group controls a significant share of the total assets [228]. On the one hand, no matter what the state of 2020s pension funds or economy is, most baby boomers have spent most of their lives working in well-paying white-collar jobs in the prosperous service-society of the first two decades of the second millennium and accumulated a significant amount of wealth. On the other side, the parents of these wealthy senior citizens also benefited from a historical economic growth over half a century and saved most of it up. These savings make the retirees of the year 2020 rich heirs and makes them even more powerful purchasers [259]. Additionally, an aged society profits from many of its older members working as consultants or mentors for younger professionals and students. Elderly people are valued in many sectors of life and engage in business and political activity both of which are not only means of self-actualization but also yield further income. All these sources factor into an accumulated income that may well exceed that of young professionals. As a result, the largest homogeneous age group in 2020s society also has the highest income. The gray group of senior citizens at society's fringe has turned into a silver segment, well-heeled and well-defined. From an purchasing power perspective, senior citizens are the most interesting group of customers in 2020's silver society.

8.4.2.2 If Age is a Burden, you haven't got the Right Gadget

A new self-concept among old people has developed over the course of the first two decades in the second millennium. They acknowledge their need for assistance and are more aware of their impairing and less willing to accept these as given. They buy anything that promises relief from a burden, improvement of quality of life, health-enhancement and help in a task that has become difficult in the 60s. As a result, health and safety is the one central point of selling to the silver consumer and therefore to over a third of the population and beyond. It is a trend that has reached a new height as the first members of the baby boom generation entered retirement and thereby increased the total market size by nearly one fourth. Many tools, applications and programs are ever since in daily use to make becoming old as comfortable as possible. MS Health Vault 2019 home edition, Siemens micro-health systems and the Samsung pill-phone are prominent examples of the health sector and products like the Aldi every-day-life care-package or the 3M e-fridge with mature household AI demonstrate service-progress. Also, a Toyota walk-bot sends wheel-chairs to the museum and the fastest growing silver sector is the games industry with a newly released Call of Memory 2 Alzheimer Assault for Xbox and the PS-fone as well as a wii-PT: The Home Physio-Therapist. Clearly, the 2020s senior citizens are willing and able to buy what they need to enjoy life. This also includes cars, which have remained the most important means of transportation and have become increasingly usable even for people with impaired senses or mobility thanks to a variety of services and tools. Indeed, a majority of the silver sector drives a sedan or limousine of the premium class.

8.4.2.3 The iPod-user of Today is the Retiree of Tomorrow

Among 2020's most popular senior citizens will be Steve Jobs and Bill Gates. These two oldtimers are surely not representative for an average consumer but demonstrate one thing: this generation has brought the Internet including e-mail and search-engines, the cell-phone, lap-top and mp3-player into society and has actively experienced at least two decades of video-gaming in their youth and smart-phones during work life and are unlikely to stop demanding ever new and more innovative products when they reach their 60s. By 2020 they might be old but they are still the same people that have transformed many industries including the car-manufacturing and even created new ones, namely the entertainment and media electronics sector, one of the strongest branches of 2020s economy. If the frontier of this industry-branch lies within the health and safety sector for the silver society, the baby boom generation are the trappers and scouts of this new field of products and technologies. They are likely to adapt quickly compared to today's senior citizens and technic-savvy, especially the highly educated, wealthy part of this customer segment. A general openness to innovative solutions and affinity to well designed products are key attributes of this generation of ipod and iPhone users. They are demanding, their experiences dominate their expectations towards new products, their trust belongs to the established and well-known firms of the early 21st century and so does a good deal of their money.

8.4.2.4 Eldertronics Dominate the Market

Although very well educated, the target customer of 2020 does not like sophisticated, multi-button-single-use gadgets or over-designed itoys. A decade of differentiation over optical features has educated a customer that has high expectations towards the design but knows very well to look at functionality and usability first. Especially the silver sector with many members having impaired sight or hearing has special demands towards the product design. Simple solutions like big buttons or large letters are not sufficient, but plain standard. A bluetooth gateway for connecting a hearing device is as pivotal to any smart-phone as a single emergency-call button that directly addresses a preset doctor-contact or relative. Besides these obvious features, any product must be rather passive, supporting and easy to understand in its benefits. All these attributes amount to a term called Eldertronics which stands for the kind of device or electronic service that not only addresses the needs of an high-age target customer-group but also fits their requirements that are determined by the shortfalls of their advanced age. Clearly, any product has to accommodate the customer with certain specifications in order to be successful in a silver market.

8.4.3 Product Design

The product's main component is the safety factor which is a simple number in the range 0 to 100. A safety factor of 0 means that you're driving so risky that your license should be revoked immediately and 100 means that you are the perfect driver and your environment is perfectly save. This number is calculated by various parameters which are discussed in depth in section 8.4.5.1. The following sections show the product's input, output and user interaction possibilities.

8.4.3.1 Visual Output While Driving

As the safety factor is a major indicator of your driving performance it is displayed directly on the car's head up display (HUD) allowing the driver to concentrate on the road while not losing sight of the most important parameters. The safety factor display area consists of a gauge chart visualizing the actual factor and an area below reserved for driving hints. The gauge chart consists of a semicircle where the left end represents 0 and the right end 100. The current value is displayed by a hand which is reduced to the chart itself leaving the inner area usable for further information. The hand divides the chart into a lower and an upper half. The latter is displayed in a sallow gray while the former is displayed in a bright color which is chosen from red, yellow and two kinds of green. The actual color depends on the current safety factor and is chosen according to table 8.1. Figure 8.5 shows an example of a dial chart displayed on the head up display. To avoid distraction of the driver the system always chooses one driving hint at most to display. This hint appears in the form of a short text directly below the dial chart.

Range	Color
0 .. 30	Red
31 .. 60	Yellow
61 .. 95	Dark green
95 .. 100	Light green

Table 8.1: HUD chart color assignment.
Source: Own Illustration

Figure 8.5: A colored dial chart shows Safety Factor and hint on the HUD.
Source: Own Illustration

8.4.3.2 Audio and Voice Output

To avoid any form of distraction the driver gets the the most important hint along with its consequences presented as voice output. If the factor responsible for that hint is rated as urgent (e.g. a severe speed limit violation) the voice output keeps repeating every few minutes. To provide the voice output the product makes use of the car's speaker system. If the driver is listening to music it stops during the voice output and resumes afterwards. If the driver is using her cell-phone the voice output is replaced by a discreet beep along with a blinking hint on the display. Optionally every change of the safety factor can also be indicated by a short beep.

8.4.3.3 Detailed Information While Stopped or on Your Handset

Of course the driver can get the full hint list available if he wants but this is only possible if the vehicle is stopped. The list is sorted by severity showing the most important hint at the top. Along with each hint its impact on the safety factor is displayed. If the hint was for example "Slow down" the consequence would be explained as "If you reduced your speed by 23km/h your safety factor would increase by 35 points." Next to each hint an "Info" button allows the user to display advanced information for each issue including facts about how the particular misbehavior influences the chance and the severity of an accident. To allow the driver an in-depth analysis of each hint it is possible to transfer all the data into her handset where an increased usability can be provided due to the enhanced interaction possibilities.

8.4.3.4 User Interaction

As the product is designed to improve safety it has to be as little distractive as possible. Along with the already mentioned ways to reduce distraction the system refuses each kind of interaction while driving except switching the output completely on or off. While halting the user has a variety of interaction possibilities. As mentioned before the hint list can be transferred to the user's handset if it is Bluetooth capable and has the safety factor software installed. The transfer is initiated with the corresponding menu entry on one of the car's terminals. It is also possible to view a history of all hints displayed in the past and to sort them according to severity, frequency or chronology. To ensure usability the software has only a limited amount of configuration options. To comply with data privacy laws the user can set how long her data is stored and has the possibility to delete all private data whenever he wants to. Beyond that the driver is able to set a minimum severity level to avoid uninteresting hints and warnings or to completely disable particular hints. Last but not least it is possible to deactivate either the visual or the voice output or both.

8.4.4 Value Added Services

To increase the product's value for the driver additional functionality is provided in the form of an online forum. This allows to generate additional revenue besides the software acquisition costs.

8.4.4.1 The Online Safety Forum

Every Safety Factor user is allowed to join the online safety forum free of charge. By using a pseudonym data privacy is preserved. Every registered user has an online profile where she can publish information. The software is capable of uploading the safety factor, average driving distances or most used roads automatically while the driver retains full control over his private data by choosing what exactly is published. The forum is dedicated to safety topics thus providing special groups like “General safety topics”, “Winter hints”, “Driver’s education classes“ or “Safety accessories”. As the system knows where the user is driving it can calculate lists with the most used roads. This allows to create special forum groups where the participants can discuss about a particular road and its advantages and disadvantages and safety risks. By displaying the driver’s safety factors a competition is started which will lead to increased safety factors of all participants. The Online Safety Forum provides a database where especially dangerous spots on the road network are marked. Every registered user can contribute to this database by adding new spots, rating existing ones or by adding comments. Every spot can be tagged with one or more reasons like “confusing”, “bad road conditions”, “deer pass” and many more. By allowing everybody to comment and rate the road database wrong data is effectively eliminated but high quality data remains.

8.4.4.2 Context Sensitive And Personalized Advertisement

The consumer can use the forum free of charge therefore it has to generate money on a different way. As the system knows detailed information about all its users context sensitive advertisement is the perfect solution. Each user profile consists of detailed information about his car like its brand, model, ongoing defects or the type of tires. Personal data like the safety factor, her age, average driving distances and most used roads is also part of the profile. This allows to display advertisements that really matter to the user. For example if the car has the wrong type of tires the platform could display a tire ad. Or if the user has an exceeding low safety factor the platform could chose advertisement for driver’s education classes. The advertisement algorithm also takes into account the most used roads of the particular driver. For example if it realizes that you need winter tires and you pass a registered tire retailer every day its ad would be preferred over others.

8.4.5 Technical Specification

This section gives an overview how the safety factor is calculated and how the product is realized technically. Furthermore the technical preconditions which are necessary to realize the product are exposed.

8.4.5.1 Safety Factor Input

The safety factor is calculated out of various input factors which are described in the following paragraphs. Each factor is weighed individually according to empiric safety studies which determined the significance of all the categories on the feasibility of having an accident. Due to the variety of measurements it is virtually impossible to reach the maximum safety factor which emphasizes that 100% safety is unreachable.

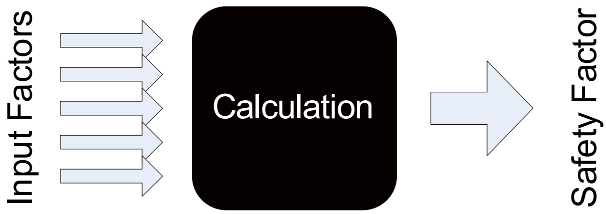

Figure 8.6: The Safety Factor is calculated from various input values.
Source: Own Illustration

The driver is influenced by various factors:

- Tiredness

  A camera monitors the driver's eyelid closing frequency. If it increases the driver is getting tired which is punished by a lower input parameter to the safety factor formula.

- Alcohol

  Small sensors near the driver's head measures the fraction of alcohol in the air. If it is not null the parameter decreases to 0 rapidly.

- Length of a Journey

  The system measures how long you have been driving without making a break. If you excess a certain duration this parameter decreases to zero.

- Touching the Steering Wheel

  It is recognized if you use both hands to hold the steering wheel, just one, or none at all. This parameter takes also the driving speed into account. If you are driving only slowly e.g. in a traffic jam it isn't as important to have both hands at the wheel all the time.

- Attention to the Road

  A camera recognizes what you are looking at and calculates the fraction of the time which you aren't looking at the road. If this amount of time gets to high this parameter decreases.

- Mobile phones

  If you are using a mobile phone your attention is affected significantly, even if you have a hands-free set.

- Music / Radio

  Listening to aggressive music or to the radio can lead to a more aggressive driving style. Thus the system queries the volume from the car's audio system and calculates a lower value for this parameter if it is too high.

Vehicle parameters
The car safety depends on several vehicle parameters:

- Tire Pressure

  Too low or too high tire pressure is a safety risk as it can lead to a burst.

- Appropriate Tires

  This parameter is reduced if you are driving with winter tires during the summer or vice versa.

- Disregard of Maintenance Intervals

  If you haven't had your car inspected for too long this parameter is reduced significantly.

- Ongoing Defects

  The system queries known defects like a broken headlight, worn out brake-pads or insufficient tire profiles from the car.

- Speed and Speed Limits

  Your current speed and the effective speed limit is recognized. If you are driving faster than allowed this parameter decreases with the square of the amount you are over the limit. If there is no speed limit like it is the case on Germany's Autobahn the speed limit is considered to be 130km/h.

- Lane Usage

  The fraction of time you are using the passing lane on a motorway is measured.

Environmental factors

The environment greatly influences safety conditions through factors like:

- Weather

  Snow, glaze, moistness or wind load are measured and evaluated negatively onto this parameter.

- Temperature

  If the temperature is near or below 0°C it is considered to be dangerous and this parameter is reduced.

- Lighting conditions

  Driving during night hours is considered more dangerous than driving during daylight hours. If the sun is near the horizon thus blinding you it is considered even more dangerous.

- Road conditions

  If you are driving on a road which is in bad conditions it negatively affects this parameter.

- Distance to the Car Ahead

  As mentioned above a lack of distance is one of the main reasons for accidents.

- Range of Sight

  If your range of sight is reduced due to fog or rainfall this parameter is reduced.

8.4.5.2 Software and Infrastructure Components

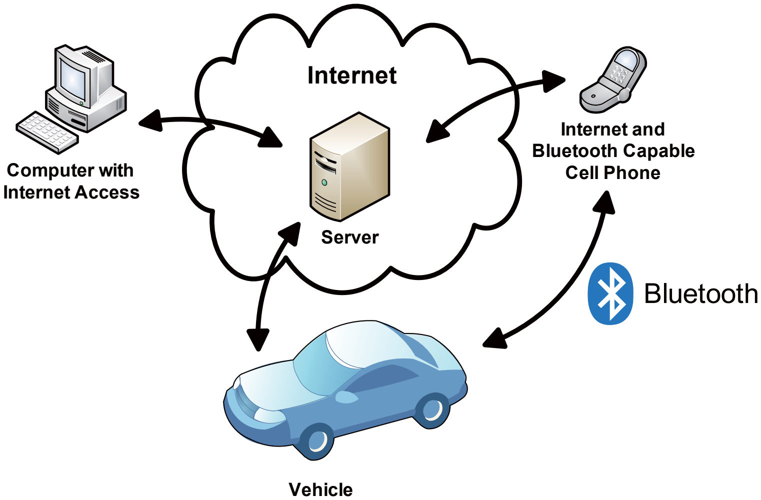

Figure 8.7: Product components overview
Source: Own Illustration

The product consists of four main components which are explained in the following paragraphs. Figure 8.7 gives a good overview over all the components.

The software's main party runs on the vehicle
The main part of the product runs directly on the vehicle. Due to the somehow open software platform provided by most cars the software can easily access some core functionality. The component's responsibilities can be divided into the following groups:

- Gathering information from the various input factors

  As described above information is collected from a huge set of input factors which can be accessed through the car's Application Programming Interface (API).

- Calculating the safety factor and useful hints

  The safety factor is calculated from the collected data once every few seconds to provide up to date feedback to the driver. Every input factor which falls out of its specific range rated as normal generates a hint. The hint list is saved for later in depth analysis by the user. The most important hint i.e. the hint caused by the input factor furthest away from its normal range or by a dangerous spot notice from the server is chosen to be displayed.

- Rendering the visual output

  The safety factor and the chosen hint is rendered to an easily understandable image as described earlier. The completed image is transferred to the car's HUD through an offered API.

- Playback of the audio notifications

  If not deactivated by the user the chosen hint is also presented as voice output which is generated by the car's speech engine offered through an API. If prevented by the user or by a phone call a new hint is announced through a beep.

- Downloading dangerous spot information

  The software pulls information about dangerous spots on the road ahead from the server. This information is cached and displayed when the car reaches the specified location. To avoid unnecessary data traffic and to ensure on time notifications the software queries the route from the navigation system and downloads the information for that route in advance.

- Uploading user profile data to the online forum

  As mentioned before the user is able to register at an online forum where he can interact with other drivers and compete for the highest safety factor. Therefore and to enable context sensitive advertisement the software has to upload usage information to the server.

- Transferring hints and time lines to a handset

  All hints produced while driving can be transferred to the driver's handset via Bluetooth. This allows the customer to calmly study his driving behavior when he has some time left for it. Additionally a time line showing the safety factor's past development and the hint appearance can be copied to the handset.

A handset can be used for additional output
As already mentioned detailed information can be transferred ed to the handset which serves only as viewer. The software component running on the handset therefore is relatively lightweight and the hardware requirements are very low as it only has to store and render the received information. As a common Software Development Kit for handsets exists the software can be developed cheaply for all available devices.

The server provides a forum and a road condition database
The online forum is hosted on a central server platform which gathers all the user generated information and distributes the dangerous spot notifications

directly to the vehicles. The servers storage requirement is estimated to be relatively moderate. Assuming that one dangerous spot per kilometer is registered, the inter city road network having a length of about 230,000km and each dataset including the discussion and ratings needing about 1MB of space the database would get 225GB large [242]. This could even be handled today without any special hardware requirements. To provide context sensitive ads the server software contains a special algorithm developed specifically to work with the data generated by cars. Similarly to Google's AdWords companies can buy specific words, key attributes or geographic locations. The algorithm picks the companies which fit best to the user's profile and displays their ads.

8.4.5.3 Technical Preconditions

Of course the product has certain preconditions listed in the following paragraphs which may or may not get realized but are definitely available in the chosen scenario.

The car software platform is a crucial premise
The first major point on which the product depends is a somehow open and common car software platform. It has to be possible to install third party applications on a car like it is currently the case with the Apple iPhone or Google's Android platform. In the chosen scenario this is possible provided that the car manufacturers approve the applications and admit them to their application store.

Access to sensor data, HUD, voice output and navigation system provides important information
The second major point is the access possibility to the car's peripherals. To work properly the software has to query a huge amount of sensor data which isn't available to usual car software. Therefore special contracts have to be established with the car manufacturers to allow our software to access the sensor data. Beyond that the software has to access the HUD to display the information which is not possible for most applications, too and requires special contracts. Another requirement is the access to the car's audio and voice output system to provide audio advice. Every car equipped with the common software platform provides appropriate services in the chosen scenario.

An always on Internet connection ensures real time database access
For various aspects of the product it is essential that it has a continuous connection to the Internet. This connection is especially important for the dangerous spot warning mechanism. As mentioned earlier it is possible to use caches but to provide the most up to date information the Internet connection has to be used every few minutes. To be online is also necessary for the online forum which depends on the data provided by the car.

8.4.6 Competition and Product Issues

In order to analyze the market for the product described above the report employs M. Porter's concept of forces that exert influence on a given market. These five forces are industry competition, potential entrants, consumer power, supplier's power and substitutes to the product. [251]

8.4.6.1 Industry Competition

Competition in safety market is high, especially through direct competition by the car manufacturer's own safety warning and advice products. Moreover, there are many other products with similar features like warnings, hints, expert advice and news.

- STRENGTH: The product's vantage point is its independence from car-manufacturers. Also, it is assumed to have an intuitive and appealing design compared to the strongly pre-branded and inflexible manufacturer's solutions. Diversification takes place over value added services and data-bank properties and size.

- WEAKNESS: Our product has no access to exhaustive car-data like manufacturer do. Also, we are new to the market with no branding, alliances or supplier-co-operations and it is yet another safety product in huge safety market with no good-will spill-over effects from already successful products in the health, safety or car sector.

- OPPORTUNITIES: Setting a safety-standard by providing an innovative tool with a good potential for value added services would be a huge reward. This requires forging strong relationships with all major car manufacturers to be the sole supplier for the Safety-Factor computation and Driver-Advice software with full access to the car's data and long-term contracts.

- THREATS: The car manufacturers may close the access to the car's sensor data in order to rule out competition in the driver-assistance market or for liability and security reasons. Furthermore, the product marketing could be due to fierce competition too costly to make the product profitable as a whole.

8.4.6.2 Potential Entrants

Potential entrants are many: the software is not difficult to create, the knowledge used is generally available, the platform is relatively open and the information input is mostly general input, available to all licensed suppliers.

- STRENGHT: Our product has a first mover advantage: once a certain market penetration is reached or even a standard set or long-term contracts achieved, market entry is difficult and costly. Potential patents are ours, users might not want to switch and are used to our product. Also, the creation of a similar database and formula takes time.

- WEAKNESS: The idea and software are easy to copy and the patents unlikely to cover much of the idea. Furthermore, there are many firms in the safety business with massive resources and extensive experience in this sector as well as an assumed strong brand, big customer base and a strong incentive to enter this market.

- OPPORTUNITIES: Building an established, well-known brand for a new near-standard product provides a strong position in the market and multiple entry-barriers can be set which could prevent costly competition until a hardly breakable technology and branding advantage is reached.

- THREATS: The car manufacturers might support multiple suppliers of Safety-Factor software rather than rely on a single contractor and therefore foster competition and make entry easier. The first mover disadvantage of bearing all costs of a new product introduction including consumer education, branding and acceptance creation and making unpredictable but crucial mistakes in designing or launching the product poses a major threat. The second mover can learn from our mistakes and also employ the latest technique. This issue, however, might not occur before late after product launch.

8.4.6.3 Substitutes

Substitutes are many in the safety market, including both the car manufacturer's own safety equipment and the safety solutions on a ever growing, independent, safety and telematics market.

- STRENGHT: Our product has a weak advantage: its unique, new way of enhancing in-car safety and the easy-to-interpret, low-profile advice, tailored to a special group of customers, the "silver riders", makes it a directed and well-aimed shot at the consumer's savings. Also, the employment of all available data presents a wholesome solution to a complex problem which is fairly unmatched so far. Moreover our product benefits from a strong advantage: it is a low-cost high-value product with a long chain of value added services. Its serious, wholesome approach might get support from car-manufacturers or even authorities.

- WEAKNESS: Many substitutes, some of them well established and many somewhat similar to our product create a strongly contested market.

The core service of Safety-Factor is a new concept that has to find its place in this sector.

- OPPORTUNITIES: The general acceptance of safety-products and new technology is high, positive spill-over effects from already successful products that share a function or feature or look similar are likely. It is also a mature, educated market with well developed distribution and marketing channels.

- THREATS: Cheaper or even free products or services may be too similar for users to make them switch to our product. Moreover, price-setting becomes an issue since prices might be generally low. Products that share a function or look similar might have already gained bad reputation and now spill-over this bad-will to our product. Substitutes add to general competition and make differentiation difficult and costly a task.

8.4.6.4 Consumers

The consumer's power is high due to highly developed distribution channel since BMW-tunes greatly removes any information asymmetry on the market. It provides an instant price-check and sorting by prices or functionality and allows for strong competition.

- STRENGHTS: A well-defined and analyzed target-customer allows for targeted marketing and a product design tailored towards his or her special needs. Also, our premium-product with value- added services profits from an educated and well-informed customer.

- WEAKNESS: in an iTunes-store like way of distribution, featuring and pricing plays a great role. For a premium-product like ours, featuring is the way to go but makes distribution a lot more costly and value-added services not easy to sell in the first place. Moreover, the customer might be suspicions or at least cautions towards a program that measures his or her safety and data-privacy concerns might lead to a rejection.

- OPPORTUNITIES: Once it reached general acceptance and proved its reliability and benefit, the Safety-Factor may achieve a very high market penetration and gain momentum that reduces marketing costs while still generating growth in sales. A strong brand with many value-added services might moreover be the basis for product extensions. In general, the Safety-Factor product profits from almost any innovation in the telematics and car-safety sector that adds to its sensor-data, the database or improves the algorithm that processes this data and generates advice.

- THREATS: Data-privacy issues might play a great role in transmitting and receiving customer-sensitive data or even storing it and either the consumer rejects the product right away or the government restricts its functionality.

8.4.6.5 Suppliers

Supplier's power is limited to the scarcity of well educated college-graduates in IT, Math, Electrical and Mechanical Engineering and related fields. Other than researchers and software-developers there is no input factor the software behind the Safety-factor requires.

- STRENGTHS: None.
- WEAKNESSES: Being a small start-up does not make things easier on the job-market, as good people are contested and the recruiting costs of an engineer of choice are sometimes multiple annual salaries. Clearly, established players have a huge advantage over a small entrant.
- OPPORTUNITIES: Having an innovative product in a popular sector may attract exactly the kind of entrepreneurial, technician kind of employee the start-up needs to develop a successful product.
- THREATS: Not being able to find or pay the right persons might smother the idea in an early stage.

8.5 Conclusion

In a society of silver surfers and super cities, 2020 is the second millennium's rush hour on Germany's streets and frequencies. While a seniority bulge in the statistics describing Europe's age structure represents the huge number of techno savvy over 60s that populate the telco's bandwidths, the car is the ride of choice and its place in society is somewhere in a traffic jam. Obviously, the car has become ever more important. Moreover, a convincing 60% of Germany's population uses the Internet frequently, an estimated 33% is addicted to either facebook, online-games or news. These two factors combined make Internet in the car a necessary standard, sim-cards in all new sedans and limousines a logical next step and a sim-locked Golf VII GTI a smart business model. Implications for telecom providers are twofold. First and most obvious, the provision of sufficient bandwidth has become a huge but demanding market. Second, due to the big and contested software and service market that evolved around a silver customer and a iTunes like platform for car-software, this bandwidth business is the way to go for the telcos of 2020: a new, competitive and highly specialized industry has sucked up the market for value added services in the communication sector and telecommunication companies are merely providers of transmitting-power, -quality and -reliability.

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Chapter 9

Entertainment / Infotainment

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Our trend report is concerned with entertainment and infotainment in the service-centric car in 2020. We elaborated in our report three scenarios and focused on the scenario “Let me infotain you!” as we perceive it as being the most likely one. Here, both the car driver and the passenger want to enjoy infotainment. The scenario is characterized by a broad range of user-generated infotainment content, services being advertisement-funded and therefore for free for the consumer and regulations putting restrictions on the car driver interacting with his infotainment devices.
We also developed a service idea for the “Let me infotain you!” scenario: our online community travel-guide platform “Travelino”. Our service together with geo-positioning data and the photo/video taking function of mobile devices acts as an intelligent agent for users who are traveling to alien places. Recommendations, information, media files such as photos and videos - which can be uploaded or accessed instantly on the mobile device via the Internet - are all user-generated as they are provided by the community. The basic service is funded by user- and context-related advertisement and therefore for free for the users. Premium services provided by selected travel-guide publishers can additionally be purchased. We then close with some recommendations for telecommunication providers who basically have to accept that content will primarily be generated by the web community.

9.1 Introduction

The domain of info- and entertainment within cars is booming. So it is time to wonder which developments could be possible within the next ten to 15 years.

We will analyze within this report how the info- and entertainment industry within cars will develop until 2020. For that purpose we will first analyze the relevant drivers for this industry. We will subdivide them into certain and uncertain drivers.

We expect a stable development regarding the trend of personalized products and services. This includes the trend towards individualization which is also perceivable within social networks and online communities. We also predict that the desire and the need for lifelong learning will be constant as the society ages - among others this fact will lead to a rising information demand. As already visible today the awareness of limited resources and the fact of rising energy prices will lead to a more eco-friendly behavior and "green thinking". As last certain driver with relevance to the in-car entertainment sector we defined technological improvement or more precisely ubiquitous access to the Internet.

Within our analysis we also found five uncertain drivers, which means that it is unpredictable in which direction they will develop: There is no indication, if our society will in future prefer entertainment to infotainment or vice versa. The developments could also arouse antipathy. This applies also to the tendency of certain groups to optimize life or to adopt rather a "laisser faire" attitude. Just as well it is unpredictable what attitude towards payment the people will have adopted in more then ten years: Will all software services have to be free or will there be a willingness to pay for it? Furthermore it is unsure if a ubiquitous mobile broadband Internet will be available by 2020 and what legal regulations will be implemented in the European Union. All these drivers will have an influence on the info- and entertainment sector situation then.

Based on these specified drivers we developed three likely scenarios what the world of entertainment within cars will look like in 2020. The combination and specifications of drivers thereby vary: In the first scenario we presume that the hastiness in the people's lives will have increased and that the car driver will consciously schedule relaxation and silence breaks during car drives. In the scenario "Play the world" the car driver as well as the passengers desire to be entertained throughout their journey. In the third scenario the regulations are high and prohibit a distraction of the driver like in the previous scenario. Therefore entertainment providers have to concentrate on infotainment or edutainment services.

As we chose the third scenario as our orientation for developing a new product we also finally designed a infotainment service. Travelino is an interactive, user oriented, social online travel guide. It provides a basis for all those people who want to share their knowledge about places and for those planning a trip or being just *on place* and looking for information.

Finally we will elaborate recommendations for a telecommunication operator in our conclusion.

9.2 Driver Analysis

A driver is according to the definition of Investorwords.com an aspect of a business that effects a change on another aspect of the business. Most commonly a driver is a factor that contributes to the growth of a particular business [291]. In this chapter we will analyze, which certain and uncertain drivers are supposed to influence the domain of info- and entertainment within cars within the next decade.

9.2.1 Certain Drivers

Certain drivers have a stable, relatively predictable development. In this section we will present the certain drivers influencing future developments of in-car info- and entertainment.

9.2.1.1 Designing the World

When industrialization started in the 18th century, standardization and anonymous mass production went side by side [304]. Economic reasons were the main driving force. In our times, where we can afford so many various products and styles of living, people start to think about what they really want. Users take an active, emancipated role, instead of passive receptiveness [263]. This means that they want to create more content on their own as well as that they demand highly personalized products which are tailored to their needs. Today the main driving force is the will of people to participate and to self-actualize - in short: They want to design their world and not buy a prefabricated solution, which often does not fit to their preferences. This creates the demand for mass customization, which comes down to efficiently serving customers uniquely [304]. Also from a company´s point of view it makes sense to get closer to the customer and include him into the development process of new products [263] in the sense of democratic- or open innovation as Eric von Hippel, Professor at MIT, calls it [324].

Everyone is different. This results in heterogeneous user needs, which means that consumers demand differentiation in the products. A smaller number of users will tend to want exactly the same thing. In this case it is likely that mass produced products will not meet the needs of many users. People will expect a much higher fit by products to their personal needs in 2020. Especially digital systems can provide this adaptiveness and flexibility. We can distinguish between two types of customizations: mass customization and smart personalization [324].

Mass Customization

Mass customization means that the user can select the product features on one standard platform by himself. This can be done before he buys the product or while he is using it. Nonetheless, mass customization requires that the user knows what he wants to buy and - which is even more important - understand how to virtually create what he wants. That means that users will change requirements of web- or software based interfaces [304]. Spreadshirt.net, an online portal where you can design your own clothing, is an existing and successful example for virtual customization in the Internet. As more services like this one are constantly being created in the Internet and the number of Internet users[1] is growing [300], we estimate that these kind of services will strongly increase in the future alongside with mobile Internet.

Semantic Customization

On the other hand people do not like to change too many things themselves, because they often would have to get a deeper understanding of the system provided. The complexity of Internet usage would increase. Thus there is a need for semantic customization, because of people's technologically agnostic behavior. As humans' ability to process information is limited, services will need to be established which filter the information and recommendations in an intelligent way by the individual's peer group [261]. Content finds the customer and not vice versa. Portals like Amazon already today offer additional semantic information about products which might be interesting for the user according to his profile. As the mobile usage of the Internet gets more reliable, there will be a demand for this in the car as well. Manfred Broy, Professor of Informatics at TU Munich, states that car manufacturers have to offer the increasing number of functions to drivers and passengers in a way where they do not have to operate all the complexity explicitly [265]. This means that content is semantically preselected and adapted to the user´s needs. In the future context aware functionality may convince end-users to accept and to pay for added value personalized applications, tailored to their requirement and circumstances, always choosing the optimal communication means and serving the user with appropriate assistance. Furthermore, these context-aware systems could support the user's intentions, needs and goals.

9.2.1.2 Increasing Awareness of Limited Resources

This driver deals with the increasing awareness of people´s limited resources - especially related to the environment. This relates to a more ecologically

[1] currently over 52 million in Germany

conscious buying behavior and the trend of living in cities but also in a shift of the perception of the car as a mere way of transportation.

Firstly, with energy prices rising and the climate changing, people are more and more willing to drive less or at least consume petrol more conscious. According to Frank Weber, a GM Manager, this will happen especially in the daily routes like driving to school, university, work or to the next supermarket, which is mostly below 60km per day [317]. Prices will rise because the crude oil resources of the planet will expire in the next 50 years. According to a study of the U.S. government, less than half of the remaining reserves will be preserved in 2030 [271].

A major reason for the green trend besides energy shortage is that global warming increases. Hans Schellnhuber, director of the Potsdam-Institut für Klimafolgenforschung, estimates that the sea level will rise about one meter in this century [318]. According to the E.U., the global average surface temperature is likely to rise by up to four degrees Celsius this century without further actions to cut emissions. This will lead to natural catastrophes like floods, droughts and forest fires [273]. Aiming at reducing emissions still lack political back up because of fears of negative effects for the economy. The United States of America have not ratified the Kyoto Protocol, for instance. The E.U. on the other hand aims at supporting European car manufacturers to develop eco-friendly cars as automotives account for 14% of European CO2 emissions [276]. As a consequence, cars will not have the same status as today. All in all, there is a certain driver towards a more eco-conscious society.

This is reflected in the increasing popularity of car pooling. Car pooling means the shared use of an owned or rented automotive by the driver and additional passengers. Its major benefit is that it has low incremental costs. The transportation of one additional passenger on a seat which otherwise would have been empty costs almost nothing. It would be a lot more expensive for this person if he would ride alone in his own or rented car. This obviously will get increasingly attractive with rising energy costs in the future. This concept of automotive mobility is particularly appropriate in rural areas where there is a lack of transport connection with public services but people find their work in cities. With routing systems of providers getting more and more flexible and the usage of the Internet for booking trips increasing, the lead time required for trip requests continuously drop. This will push car pooling towards a common form of traveling in the future [270].

Therefore, we will likely experience a shift of the perception of automobile mobility from many individuals towards depersonalization: While cars have formerly widely been a status symbol - and still are for many people - this changes when one uses one of the car sharing operators' offerings. The emotional tie is far less pronounced if it is not "my" car anymore [313]. This raises the question how people's demand for info- and entertainment will shift under these new circumstances. Depersonalization in this respect also holds true for car sharing, the renting of cars often for a short period of time, a concept related to car pooling.

Car sharing represents a major trend in automotive mobility as well. Even William Clay Ford, the executive chairman of the board of directors of Ford Motor Company says: “If you live in a city, you don’t need to own a car” [284]. The Bundesverband CarSharing represents 75 car sharing operators in Germany like dbCarsharing[2] and cambio[3].

The increasing importance of car sharing is reflected by recent statistics: In 2007, the number of people registered at one of the providers reached 116.000, a plus of over 22% compared to 2006. At the same time, the number of automobiles for car sharing grew by over 10%. These developments are likely to proceed: With energy sources shrinking and gas prices increasing in the future, owning an own car gets increasingly expensive. With car sharing on the contrary, the fixed costs of maintaining a car get distributed over a huge number of people. Thus, the bigger this number gets, the lower are the cost for the individual for renting a car. This could very likely push demand for the possibility to at least take someones personalized entertainment environment with oneself into the rented car. Naturally, the demand for car sharing offerings is peaking in cities where it is seen as an alternative to cycling or public transport. Thus, this development is supported by the global trend towards urbanization. [313]

The rapid urbanization of the world’s population over the twentieth century is described in the 2005 Revision of the UN World Urbanization Prospects report: While the global proportion of the urban population in 1900 was 13 percent[4], it was 49 percent[5] in 2005. At the end of 2008 half the world population will live in urban areas, by 2050 it will be about 70 percent [323]. Urbanization occurs to reduce time and expense in commuting and transportation while improving opportunities for jobs, education, housing and transportation. It raises concerns about pollution and the development of slums on the other hand.

All in all, we perceive people’s increasing awareness of limited resources as a stable driver for our scenario analysis.

9.2.1.3 Rising Information Demand

We nowadays face the necessity but also the desire of individuals for intellectual input throughout their lives. There are various reasons for the imperative of lifelong learning: The demographic change and the fast pace of life today make it necessary for many people to keep information and knowledge up to date to survive in the labor markets. The age structure and pyramid in the Western

[2] c.f.: http://www.dbcarsharing-buchung.de/kundenbuchung/
[3] c.f.: http://www.cambiocar.com/cambio/carsharing/de/1/stdws_thema/intro/intro0.html
[4] 220 million in numbers
[5] 3.2 billion in numbers

world have altered enormously within the last century: We nowadays face the problem of a slanting demographic pyramid, meaning that less children are born in comparison to the number of elderly people. The life expectancy in Germany nowadays in Germany is 77.32 year[6] [266]. Due to this fact labor laws have changed in the last years and people retire later. But this is not the only factor which makes lifelong learning so important nowadays. Another one is the acceleration of knowledge duplication: The possibilities to communicate through the Internet and to have access to a broad band of information very easily result in a doubling of the knowledge of mankind every five to seven years – in 1800 the duplication needed a time of 100 years [308]! These two factors contribute to the necessity of lifelong learning. Lifelong learning is defined as "all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civic, social and/or employment-related perspective [272]."

The term recognizes that learning is not confined to childhood and school, but takes place throughout life. Lifelong learning is also about providing "second chances" to update basic skills and also offering learning opportunities at more advanced levels. Moreover, there is a rising desire and need of many people to educate themselves after their school or university time as well. Never in history a similarly broad mass of people strove to learn for example a language in adult education centers [262]. In addition TV programs fostering the interest in knowledge as “Wer wird Millionär?”[7] experience a hype throughout the society.

Lifelong learning is a phenomenon triggered by sociological and work-related circumstances. Furthermore it is also an attitude of people towards the information they encounter. More and more people have an interest to reach out to different areas of knowledge whenever they feel like it. Learning happens whenever there is a break in the daily-routine, i.e. whenever individuals reflect their situation or resolve a problem [310]. People more and more use the Internet, often while on the move via portable devices. They search in special forums or encyclopedias such as wikipedia for instance. Thus, the rising information demand is linked to an increasing demand for the ubiquitous availability of a broad range of information.

One has to recognize that these learning processes are often not competitive but rather collaborative as shown in the examples of forums or wikipedia. People belong to different communities, in work or private life and in each of these communities learning takes place. The Internet hugely expands the possibilities to connect with other communities [310].

All in all, there is a distinguishable driver towards lifelong learning. The resulting rising demand for information is closely linked to the expansion of communities in the Internet and the development of fast, mobile and ubiquitous

[6] male: 74 years, female: 81 years

[7] c.f.: http://www.rtl.de/quiz/quiz_werwirdmillionaer.php

Internet technologies.

9.2.1.4 Socializing

"Socializing" is the act of meeting for a social purpose [306]. This need for social contact has always been a major driver in the world. In comparison to the past the way of "Socializing" has changed, but not the need for it itself. Also personal contact or at least using the telephone were the medium of choice. The Internet has had a huge impact on this demand, leading to the so called "Web 2.0". The term describes the development towards web communities, containing Internet pages like social communities, blogs or video sharing sites [301].

We divide this driver into two different segments: the direct communication part and the community aspect.

Direct Communication

Direct communication means every kind of direct social contact. This contains services like instant messaging and social communities. Instant messaging services like Skype[8] enable direct chatting or even voice and video communication, similar to the telephone. The second segment focuses on portals like Facebook or XING[9], enabling users to stay in contact online with a lot of different persons and finding new friends. Within these communities, mailing systems provide a messaging possibility. Additionally there is a personal contact page containing further information about the user. The impact is not only limited to the private life. Social business portals like XING focus on the work life, allowing to stay in contact with business partners or even get to job offers.

Community Aspect

Community aspect means the huge variety of possibilities to produce content and to provide it to a huge number of users. In the past provision of personal content was mainly focused on the discussion of special topics on community boards. Nowadays, a popular evolution are the "Question & Answer" portals[10], where users are asking questions and get free advise from helpful users. Using the "crowd intelligence" is one of the basics of wikis, where every user is allowed to edit articles and create new ones. A famous example is Wikipedia[11], a huge encyclopedia created and edited by normal users without receiving any material incentives. This so called user generated content enables every user to participate in the development of the Internet. Only driven by the motivation to share content with others, services like YouTube[12] or Flickr[13]

[8] c.f.: http://www.skype.org/intl/de/
[9] c.f.: http://www.facebook.com/ or http://www.xing.de/
[10] c.f.: http://yedda.com/
[11] c.f.: http://en.wikipedia.org/wiki/Main_Page
[12] c.f.: http://www.youtube.com/
[13] c.f.: http://www.flickr.com/

were able to be become one of the most used Internet portals in the world. Some commercial pages are using the knowledge of the users, for instance the possibility to recommend hotels[14] or books[15] , enhancing the service of the portal. Even software is developed in open source, offering it for free and allow everybody to participate in the development. Regarding the mobile sector, operating systems like Google Android[16] are already open source, offering a lot of additional applications which are for free as well. A new segment of video gaming, the “Massive Multiplayer Online Games” are also a huge community, where individuals play together and meet each other. A famous example is “World of Warcraft”, which has about 11.5 million users who are paying a monthly fee for participating in the game, showing the huge potential of socializing in games [264].

This driver has a huge impact on the Internet and this development will continue with the provision of mobile services for mobile phones. Current discussions evolve around the question if newspapers could be substituted or at least complemented by testimonial reports or comments[17]. In cars, you can already share your favorite points on a interactive map like Google Earth[18]. Another interesting solution to support businessmen who have to travel to unknown cities is a service to get people in contact with each other to meet for lunch[19].

9.2.1.5 Technological Improvement

The technological improvement has always been the booster of innovation and new products. This massive influence is also present in the in-car info- and entertainment market. Therefore the most important parts are the Internet, convergence to All-In-One devices and connectivity between the car and mobile devices:

Internet

The Internet is already present in everybody’s life, both at the workplace and at home. In the time during the transport to or from work via train or car, Internet access is still very rare. Mobile Internet has been a small market based on expensive and complex cost models which reduced the attractiveness of using it for customers for a long time [316]. However, these circumstances are in the process of changing. Various mobile phones, like the iPhone, are able to go online using an Internet flat-rate of T-Mobile[20]. The new 7-series of

[14] c.f.: http://www.holidaycheck.de/
[15] c.f.: http://www.amazon.de/
[16] c.f.: http://code.google.com/intl/de-DE/android/
[17] c.f.: http://www.zoomer.de/ or http://www.twitter.com/
[18] c.f.: http://earth.google.de/
[19] c.f.: http://www.lunchclub.de/
[20] c.f.: http://www.t-mobile.de/iphone/tarife/0,17181,21410-_,00.html

BMW is also able to access the Internet by using "Connected Drive"[21]. But all these services are still limited, due to low connection speed, bad coverage or regulations limiting the provision of special online services for mobile users.

Until the year 2020 we expect a huge improvement of the overall mobile connectivity in combination with the LTE[22], a project within the "Third Generation Partnership Project" to improve the mobile phone UMTS standard. There are already various successful tests of the usage of LTE inside of cars [320].

The Internet itself enables a huge variety of new services, starting at the direct access to movies, music or games. Especially information concerning your journey or plainly general news would be more recent and accurate. The driver would not have to wait any more for the radio news to know the latest sport scores for instance. We expect online applications called "Software as a Service", meaning that software does not have to be installed on the mobile phone. Thus, new kinds of services are possible. Popular examples for this are "Google Apps" which are a web based substitute to "Microsoft Office"[23]. [267]

In the year 2020, we expect that even high performance applications will run online accessing it via mobile handset or desktop computer. Movie portals will feel like a local installed application, streaming or downloading the favored movie. It will no longer make a difference if you use your mobile phone or your desktop computer, you could access the same portal experiencing the same usability.

Overcoming the problem of varying connection speed, files like HD movies can be prefetched on your system.The result is the comfort of enjoying a not interrupted movie.[325]

Convergence to All-In-One Devices

Nowadays the majority of consumers are using a small digital camera, a MP3-Player and a mobile phone in parallel. One strategy to increase the customers benefit is to add more functions to the handheld, trying to create a All-In-One device. This strategy can already be observed, considering that mobile phones usually have a camera installed and are able to play music files. Expecting that this development continues, in the future mobile devices will replace various different devices because it is more comfortable for the user. Surely there will still be a market for specialized products, because of the demand by special interest groups. But the development is definitely driving to All-In-One devices. [296]

To summarize, the majority will use their mobile device because of commodity reasons. These new phones will be some kind of a "hybrid multi-platform medium", which allows a whole new variety of services [299].

[21] c.f.: http://www.bmw.com/com/de/insights/technology/connecteddrive/open_internet.html
[22] Long Term Evolution
[23] c.f.: http://www.google.com/a/help/intl/de/users/user_features.html

Connectivity between Car and Mobile Device

Cars and mobile devices already have various possibilities to communicate with each other like Bluetooth or integrated, simple plug-in solutions. This results in simple connectivity between car and mobile phone, which is used for telephoning via a integrated microphone and using the car antenna. This basic interface will be extended in the future, allowing far more functionality to be done by the mobile phone. Therefore, it is obvious why a standardized interface is so valuable both for the handheld and the car manufacturers. [260]

9.2.2 Uncertain Drivers

Uncertain drivers are characterized by unsure development. As some of them have high relevance for our scenarios, we mark them as key drivers.

9.2.2.1 Ubiquitous Mobile Broadband Internet

Ubiquitous mobile broadband Internet is considered to be an uncertain driver, because it implies that you have a complete coverage of stable high-speed Internet connection within an area, a country or the like. This is not state of the art now [319]. Special locations like tunnels or isolated streets are a huge challenge, because they limit availability. Being inside a fast moving vehicle makes the situation even more complicated.

Ubiquitous mobile broadband Internet would enable the full flexibility Internet is able to provide [282]. Watching the desired movie or music in an instant, connecting to various online applications or uploading the latest pictures of your hiking trip. Nonetheless it is hard to predict if telecommunication operators will be willing to invest the needed amount of money to achieve a full coverage in Germany as many areas are sparsely populated.

Considering the current situation with the UMTS technology it is close to impossible to predict the degree of effort the telecommunication operator will make to expand mobile broadband coverage [319].

9.2.2.2 Optimization and Efficiency of Life

This driver describes mainly a development within the group of educated people or higher social classes respectively. We define optimization of life in this context as the pursuit of a perfect organization of one's life with the goal to organize it as efficiently as possible.

There are two opposing trends visible in society and it is uncertain which one will be dominant in future: One group is striving for the permanent optimization of life - as being described firstly - while others are focusing on slowing down the speed within their lives:

Optimization of life

The possibilities to design one´s professional and private life according to individual preferences have increased enormously: This development produced a need for the so called career planning. Nowadays the strategic planning in terms of professional development already starts in the university. Special courses for time and career management started to be standard [295]. But even in private live people tend to strive for an optimal time management: The huge number of possible leisure time activities literally forces them to do so. In addition the choice of leisure time activities rarely is random. The motive when deciding for or against a program is by now even sometimes the fact that there is a long term goal the activity serves for. For example playing golf in the leisure time is sometimes even seen as business activity [293]. Another interesting trend these days is the conscious scheduling of breaks or relaxation. Never before in history of wellness centers or yoga schools – generally speaking places where you are forced to relieve stress – succeeded as they have been doing for approximately ten to 15 years now [288]. Furthermore the awareness for health issues has grown. The demand for healthy and biological food has increased tremendously. Only some ten years ago there were only few supermarkets selling ecological products. Nowadays they can be found everywhere, even in the discount stores such as Aldi, Lidl or Penny [285].

Slowing down the speed of life

Another development goes, as already mentioned, in the opposite direction. In France as well as in Britain a rural re-population has been observed within the last decade. The people moving from cities to the countrysides are looking for a greener and simpler life. They are tired of the hectic life in the cities. By partially living in the countryside they appreciate the peace, the quietness and the nature [281].

It is impossible to predict how these two different social currents will develop in future: Either it could prevail, but a continuing coexistence or a retrogression of both is possible too.

9.2.2.3 Attitude towards Info- or Entertainment

The people's attitude towards info- and entertainment is one of the decisive drivers for possible developments in the in-car info- and entertainment sector. A "trend" which is already visible today is the restlessness within society. People are nowadays almost incessantly looking for diversion. They have unlearned how to do "nothing" but contemplate, plus – maybe even more important for the driver analysis – faineance and boredom are seen as lost time. As a consequence there is a permanent desire for entertainment, insecure is only which kind of entertainment will prevail. Below three characteristics shall be described.

Amusement and Entertainment

It is incorrect to claim that we are living in a hedonistic society, but still the pursuit of joy and fun is seen as highly important – maybe even as one of the key goals of life. The trend towards gaming within big groups is clearly visible. Meeting up for playing singstar or gaming with the Wii for example have become a free time activity. Considering the success of these means of amusement indicate the increasing importance of "social computer games". Video games is a market with growing importance and considering the market size and growth rates, it will also play a major role in the car industry. Recent surveys showed that 97% of teenagers plays video games and even 53% of the adults are playing [294]. Just to keep in mind, a video game called "Grand Theft Auto 4" was able to generate $500 million in sales in it's first week [268]. Another popular example for the spread of video games is the PC game "World of Warcraft", a massively multiplayer online role-playing game which hit the number of 11 million subscribers worldwide in October 2008 [264].

Infotainment and Education

As already mentioned within the stable drivers there is a rising demand for information. We are living in a so called knowledge and information society which means inter alia that a high percentage of the society is eager to learn throughout their whole life [272]. A visible result is the amazing success of language learning centers, adult education center classes or language learning Cd's. TV-programs such as "Who wants to be a millionaire?" evoked a hype and entailed a run for knowledge based board-games.

Furthermore, people always want to be provided with the latest information on what is happening around the globe and on what their friends and family are doing [292]. Highly interesting within these developments is that there is the desire that all kind of information, knowledge and education should be provided in a way that the "consumption" of it is convenient and joyful.

Relaxation

Another characteristic regarding entertainment and leisure time organization is the desire for relaxation and wellness. It is a widely recognized symptom of our times that the pace of living and working is increasing. The world economy globalizes and thus more productivity and social capabilities are demanded from the individual. This increase in complexity in working and social interactions means for many people that they perceive their workload to be increasing on the one hand and their capability to get things done to be decreasing on the other hand. Thus, stress situations and the disability to relax become an everyday experience for many people. Consider the burnout syndrome. The most widely used definition describes this phenomenon as long-term emotional exhaustion and depersonalization [298]. The British Health and Safety Commission found that 12.8 million working days have been lost in the U.K. in 2004/05 through stress, depression or anxiety caused or made worse by work [286]. This may result in a loss of nearly 10% in the U.K. gross national product [287]. As the global economy strives both for maximizing productivity and individual efficiency, the need to counterbalance the increasing stress related illnesses and deficiencies is evident. All in all, there is as well a trend in society towards relaxation.

As seen there are several developments regarding entertainment but it is not sure which occurrence will prevail or if maybe the three mentioned developments will be constant and coexist.

9.2.2.4 Attitude towards Online Payment

The "German Entertainment and Media Outlook: 2007-2011" by PricewaterhouseCoopers (PWC) forecasts that earnings in the media and entertainment sector including advertising will rise till 2011 up to 62,4 bill.€ per year, which is an annual growth of about 3% [305]. Drivers are especially Internet- and video games with rates of 5,5 and 6,6 percent per year till 2011. How are these earnings created? Especially regarding the Internet it is extremely difficult to predict how users will pay for content or if they will demand all content for free. There are several options:

Pay Once

You pay and you get what you want to have. This is the oldest business model. Mostly it is favored by older people. A study by the Institut für Demoskopie Allensbach indicates that around 85% of users older than 40 years do not often use the Internet as a source for free content [290]. This shows that this age segment has a high probability for favoring paying once. The perceived advantage for older people is convenience and security. For many people the Internet offers literally too much information. They feel overwhelmed because they find it hard to find a structure in the Internet. In 2007 people in Germany spent about 1.7 bill.€ for games, which was the first time exceeding the music sales [305]. According to the study by PWC, till 2011 the sales of console- online- and mobile-games will rise annually at about 6,6% up to 2 bill.€, while music sales will continue to shrink.

Pay Monthly

The digital transfer of new Pay-TV-Channels make the offers even more attractive and revenues of cable-satellite and Pay-TV will rise. An annual growth rate of 7,4% is fore casted by PwC in Germany till 2011, which will exceed five bill. € [305].

Pay Voluntary

Crowd-funding means that people participate and invest money and time to build something [263]. It is almost like donation, which is the business model of wikipedia. The reason why people pay voluntary is because they gain a real profit from it. If you take wikipedia as an example, people know that it is a valuable source of information and therefore worth the monetary support.

Pay on Demand
This is for example observed in Facebook: You can acquire virtual objects for 1$ as a gift for anyone. Facebook is already making about 30 to 40 mil.$ per year just by selling these virtual gifts, which have no real physical value [311].

Content for Free
A study by the Institut für Demoskopie Allensbach shows that 55% percent of users who often use the Internet as a source for free software and updates is below 30 years old [290]. These people have a much higher tolerance for embedded advertising. They may even see advertising as entertainment. In an analysis of 2007 by Jupiter Media Metrix even 70% of online being adults claimed that they can not understand why anyone would pay for any online content [309].

As a result we see it highly uncertain, if and for which content users will pay money. Nevertheless it is a highly important point, because it determines the whole business model.

9.2.2.5 Regulations

One should not oversee the impact of regulations. Regulations - such as laws and directives - can put heavy constraints on the usage of mobile devices in the car. Moreover, the outcomes of legislator's processes are often unclear and new initiatives may arise whenever new studies on car safety are conducted or any other relevant development comes up. Additionally, new technical inventions always trigger an adaption process in legislation.

The paragraph 23 1a of the StVO, the German Highway Code[24], is a good example for the complex consequences of legislation on usage of mobile in-car services. It forbids the use of any mobile phone in the car if the driver has to handle it with his hands [278, § 23]. This paragraph does not apply to situations like standing at a red traffic light while the engine is turned off [307]. However, it is also prohibited to use any other function of the device like text-messaging or Internet services as well, as long as it has to be performed by use of a function key of the device. It does not apply to hands-free equipment on the contrary [269]. When new forms of info- or entertainment come up in the future, the legislator may see the necessity to adjust safety regulations to these new circumstances. A study by the Fraunhofer Institut Analyse- und Informationssysteme for instance found out that more than half of the people find it unpleasant to phone in the car if many actions have to be performed at the same time [283]. This example shows that regulations often impose extensive restrictions on the usage of any technological possibilities. In how

[24]German: Straßenverkehrsordnung

far new studies and new functions of mobile devices will entail new traffic rules in the future is impossible to predict.

Another relevant regulatory aspect referring to mobile phones is *data privacy*. The European Parliament and the European Council stated in the directive 2006/24/EC that data generated or processed in connection with the provision of publicly available electronic communications services or of public communications networks - such as numbers dialed, time, date, duration of communication, telephone/Internet services used, user IDs etc. - need to be retained at least six months but not longer than two years [302]. According to §88 (Fernmeldegeheimnis) of the TGK, the German telecommunication law[25], the content and closer circumstances of the communication are private [279, § 88]. Recent data scandals such as the illegal monitoring of phone calls by Deutsche Telekom employees [315] show the relevance of these laws but may also increase people's sensibility for their private data. Individual-related data can only be used by public or non-public institutions if they are in compliance to the BDS, the German federal Data Protection Act[26] or other relevant laws and if the person concerned gave his or her consent [277, § 4]. This restricts for example the selling of individual private data gathered by service providers from its customers to related companies for personalized advertisement. In how far future scandals or other technical developments will result in new regulations concerning data privacy is unclear. It certainly does already impose restrictions on the provision of mobile services if these include the usage of individual-related data, and could put further restrictions in the future if new legislator's initiatives come up.

Another interesting issue are *mobile roaming fees* in the European Union which are still higher for individuals phoning or messaging abroad than in their home countries. The European Commission has already set maximum prices for mobile roaming charges in the Union. Further price cuts are planned [275][274]. The underlying concept is the so called "European home market approach" which means that roaming charges are not unjustifiably higher than mobile charges in the individual's countries of residence [289]. The question is how far these regulations will be implemented in the future, for example to what extend mobile Internet surfing within the E.U. will become cheaper. This obviously has considerable effects on the amount and level of mobile services which could be offered within the Union across the individual national boarders. One will only post videos of his holiday in Spain on his blog for his German friends to watch if this data upload is reasonably priced, for instance.

To sum up, regulations are one of our key drivers because they have a considerable impact on which info- or entertainment services are possible in the automotive. Future developments in this field are very unclear.

[25] German: Telekommunikationsgesetz
[26] German: Bundesdatenschutzgesetz

9.3 Scenario Development

Based on the certain and uncertain drivers described before we developed three likely scenarios. First we will describe a scenario in which the driver is interested in little, respectively no entertainment. Then the possibly high importance of gaming will be accentuated in the scenario "Play the world". Finally the third scenario will concentrate on the desire of lifelong learning and infotainment in our main scenario "Let me infotain you!".

9.3.1 Relaxing in a fast moving world

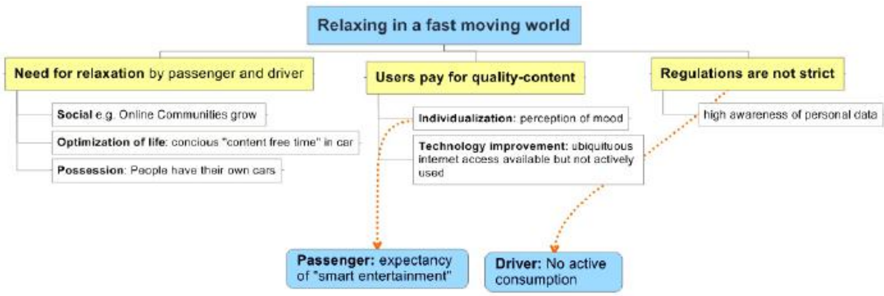

Figure 9.1: Scenario 1 - Relaxing in a fast moving world
Source: Own Illustration

For the info- and entertainment industry this would be the "worst case" scenario, because it assumes that car drivers want to relax and not actively consume.

9.3.1.1 Development of Uncertain Drivers

In the non-entertainment scenario[27] the future car driver will strive for relaxation and forgetting the daily stress while driving - his preference is to let his mind wander without being entertained. "stress management" will be widely in use.

Regulations regarding the use of Internet and entertainment means in the car will be stricter, but not seriously affect the driver and his behavior. There will be the willingness of the driver to pay a certain amount to arrive at the destination laid-back. While the driver himself does not wish to be entertained at all, passengers could desire the contrary. As for the car driver the possibility

[27]The term non-entertainment scenario refers to the attitude of the driver only, passengers might still have the wish to be entertained

for ubiquitous mobile broadband Internet plays a minor role whereas it could be an important feature for the passenger's entertainment.

9.3.1.2 Development of Certain Drivers

The particular influences of the stable drivers shall be described in the following:

- Awareness of Resources

  Driving one´s own car is still very popular. Resources only play a role when looking at emissions. It has no major influence on how people use cars. Even driving itself is even seen as recreation or relaxation.

- Individualization

  The fit of products and services to the user's preferences will be high in 2020 and the content will find the consumer. That is to say that the mobile phone or the car respectively will likely "feel" in which mood the consumer is and provide him or her with the appropriate entertainment. This perception function will play a major role in the non-entertainment scenario, especially when looking at the passenger.

- Technological Improvement

  Connectivity to the Internet is available every time and everywhere. However it will have a minor active influence on this scenario due to the "unwillingness" of the driver to be entertained - the role of the Internet changes as soon as it is necessary for the passenger's entertainment or for passive relaxation.

- Rising Information Demand

  The desire for incessant access to information and education plays a minor role for the car driver.

- Socializing

  Even though the factor of socializing plays no role for the driver, it might do for the passengers. They could actively use the time while driving to chat with other people in other cars for instance.

9.3.1.3 Characteristics of the Car Driver

The car driver in 2020 will have a perfect organized and scheduled life in a fast-moving world. Every spare minute will be used for spontaneous info- or entertainment - as the "importance" of these activities will even rise. As has been shown during the uncertain driver analysis, there is a distinguishable need for relaxation among an increasingly stressed work force. As there are no indicators that this issue will become irrelevant soon, there is a strong argument for the future desire of many individuals to have certain times during the day where they do not bother themselves with any info- or entertainment services. Therefore conscious relaxation will partly be scheduled for driving times. During these periods the driver will try to back out of the "real" world.

But how to do so? He will try not to answer or do any phone calls while driving the car, he will be unwilling to deal with any programs - even light entertainment programs such as radio or CD. He will try to not have any conversation with potential passengers - especially if they are rather unknown persons.

Therefore the role and importance of drivers might vary when it comes to the according needs and desires of the passengers. They shall all have the possibilities to entertain themselves without bothering the car driver with loud music or extreme agitation.

9.3.1.4 Characteristics of the Passenger

As most of the people will still be driving by themselves only, passengers are not that important as a user-group. Nevertheless, car-pooling is an important trend. The passenger might want to be entertained but also to relax in the car. Therefore he expects a highly smart environment which adapts to his needs and moods. His individual temper could be influenced by color or mood-sounds like ocean waves. Passengers might even want to sleep, so it should be possible that others do not bother him with noise.

It will be popular for passengers to chat with other people from car to car. This is not considered as being info- or entertainment but rather relaxation and socialization.

9.3.1.5 Conclusion

In the future, providers need to take care that they do not bother the user. It will be difficult to literally sell him content. Instead he demands services which fill his need for relaxation. If the user acknowledges that the service might have positive effects on his stressed mood, he will even pay for it. The environment will have the character like a little "wellness - temple". So techniques like "red light relaxation" will be considered very valuable and services could focus on teaching these relaxation techniques and tell the user something about different breathing styles or muscle relaxation. So the car becomes something like a personal trainer for feeling well.

For some users the best service will be the one which is not considered as being a service. This means that it has to be integrated into the car in an intelligent way, so that it can smartly and silently adapt to the user's needs.

9.3.2 Play the world!

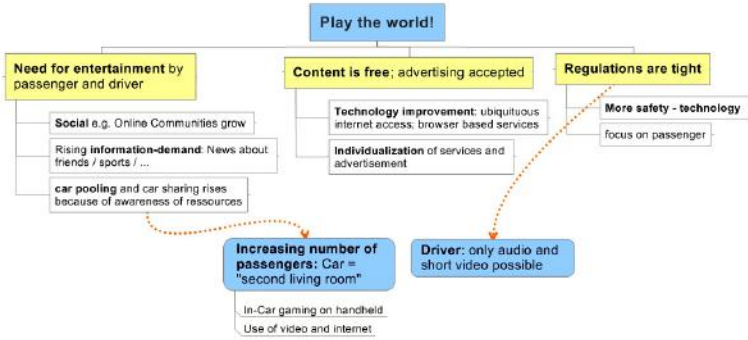

Figure 9.2: Scenario 2 - Play the world!
Source: Own Illustration

In contrast to our first scenario, both the driver and the passenger have the desire to be entertained during their journey in this scenario.

9.3.2.1 Development of Uncertain Drivers

According to the previously described trend in online payment, the user demands that content and service is provided for free in this scenario. In exchange he accepts various kinds of personalized advertisement and privacy and safety concerns come second. The regulations regarding the distraction inside the car will be tightened, which has huge influence on the offered services. As the driver's entertainment is limited to audio and at least short movies, ubiquitous mobile broadband Internet has no major influence.

9.3.2.2 Development of Certain Drivers

The particular influences of the stable drivers shall be described in the following:

- Awareness of Resources

  Given the increasing popularity of car pooling and car sharing, drivers and passengers want to be entertained. It has to be taken into consideration that the media consumption possibilities naturally differ a lot for these two target groups .

- Individualization

  The demand for personalized services will play a major role in this scenario. In the year 2020, the user expects individualized services which perfectly match his need on the one side. On the other side, advertisement does fit the user's interests as good as the product itself, which guarantees higher satisfaction for the user and better success for the advertising companies. It is also an advantage for the provider himself, because perfectly matched advertisement achieves higher prices than the not individualized one.

- Technological Improvement

  The ubiquitous connection to the Internet is very important as the driver wants to be entertained and influence the entertainment program at the same time. In this scenario we expect a huge variety of services to be completely browser-based in 2020, meaning that the portal can be used on every device with Internet access. In addition to that, Internet access allows location based advertisement. The development towards All-In-One devices in combination with enhanced connectivity between car and handheld devices will allow the user to use same applications inside the car as well as outside.

- Optimization and Efficiency of Life

  The trend to plan every detail of your life is not that important for the entertainment sector. Being entertained during the journey can be a very pleasant and enjoyable diversification to the everyday life.

- Rising Information Demand

  The need for getting the latest information also has an influence on the entertainment service sector. Content which is time-critical, like the sport news, can be directly downloaded via the Internet connection. TV channels like "Premiere" gain a lot of attractiveness by delivering sport games at any time, for instance. As we focus on the entertainment and amusement sector, other kinds of information, like politics, are not very important.

- Socializing

  Socializing already has a major influence on the entertainment sector, starting at services like YouTube and ending with online gaming. In the year 2020, a whole variety of services which are based on the social aspect will be developed and offered.

  The entertainment scenario displays a change of customer behavior, but as the regulations are getting even stricter than nowadays, there is a huge difference between the car driver and the passenger.

9.3.2.3 Characteristics of the Car Driver

The driver wants to enjoy his ride as much as possible using various forms of entertainment. An obstacle for innovations are the heightened regulations, which limit the possibilities for offering completely new services. This means that the primary media format for the car driver will still be audio, as video will not be allowed during driving. Furthermore the entertainment service has to adopt immediately to different drivers if cars are being shared. The best way to accomplish these targets is the usage of Internet profiles which allows highly flexible and exchangeable services.

The business model also changes in this scenario. The customer does not put high priority on keeping his personal information private and safe. He offers a lot of this private data as exchange for free services. This model is already used by various service providers like the well-known search engine Google. Almost all of Google's services are for free. The company earns money by selling individualized advertisement. This allows the user to switch from one provider to another without the need to spend money.

The biggest thread for service providers are likely safety regulations, which are likely to be increased. They will limit the possibility for the driver to enjoy entertainment. Because of that, audio is the best way to entertain the driver. It may be possible that during a short break at traffic lights or in a traffic jam, small videos are displayed on the head-up display. As has been depicted in the analysis of the key driver "regulations", phoning by using your hand is still possible at red traffic lights for instance. However, these security regulations might get tightened any time.

To put it in a nutshell, the car driver in this scenario is a difficult customer. Successful and distinguished new products and innovation in this market are hard to achieve. An interesting sector could be the individualization in combination with socializing. Considering developments in the Internet, a lot of innovation processes can be seen in this sector.

9.3.2.4 Characteristics of the Passenger

Until now, we concentrated on the car driver but especially the passenger offers a huge market potential which is not yet covered. This market becomes interesting especially when it comes to buying a new car in an increasingly competitive market [297]. Additionally, car pooling and car sharing is getting common. This leads to various new challenges for the service provider and the car manufacturer as passengers want to be entertained in another way than the driver.

As there are no regulations concerning the distraction of passengers, it is theoretically possible for the car to become a second living room for them. If the passengers have their own display in combination with an interface for their mobile phone, everybody could pick the content he likes to enjoy, streaming his favorite movie, watching photos which are stored on the handheld or simply enjoying user generated video content and surfing through the Internet.

Therefore it is important that regulations do not limit the possibilities to audio or video consumption only so that it can become more interactive and flexible. Especially the mobile games sector will rise in popularity. According to the PricewaterhouseCoopers Global Entertainment and Media Outlook, the sales figures of Consoles and portable gaming devices will rise at a compound annual rate of 6.3% to $11.7 billion in the U.S. in 2012 [305]. The global growth rates for video gaming are even higher. The overall video gaming sales volume is expected to rise at a compound annual rate of 10.3% from $41.9 billion in 2007 to $68.3 billion in 2012. [321] These figures will likely rise further the following years before this market will reach a point of saturation.

Naturally, the advertising industry has already identified games as an ad-platform. [312] This segment has even reached politics. During the U.S. presidential race in 2008, Barack Obama promoted his ambitions in the video game "Burnout Paradise". [314] The in-game advertising market is expected to rise at 16.7% annually from $1 billion in 2007 to $2.3 billion in 2012. [321] As the performance of the mobile devices are increasing, games which are at the moment limited to desktop computers or video game consoles can find their way to the handheld. For the popular iPhone, Apple is offering an online application store[28] where games are already one of the most popular applications [303].

All in all, we can say that the passenger entertainment market will experience a huge change. Games, videos and Internet will find its way in the main car entertainment market and dominate it. As the technology inside of cars differs, not every service can be used in every car.

9.3.2.5 Conclusion

In the year 2020, the provider of new services and content has to make a trade-off. On the one side there is the huge market of bored car drivers, who want to have a more pleasant and entertaining ride. On the other side are the passengers, a relatively small group which will steadily be increasing because of the increasing awareness of limited resources. The last group is far more interesting for the service producer, because the limitations are lower and the recent offerings are very focused on the car driver.

The usual business model will be advertising, which is personalized on the customer needs and also location sensitive. Restaurants might make a special deal for every driver in a range of 5km. The customer only shows willingness to pay for services if they offer a real benefit which is distinct from offers for free.

[28] c.f.: http://www.apple.com/de/iphone/appstore/

The best possible service would be the one which is able to adopt to different situations - no matter if it is used by the driver or the passenger.

9.3.3 Let me infotain you!

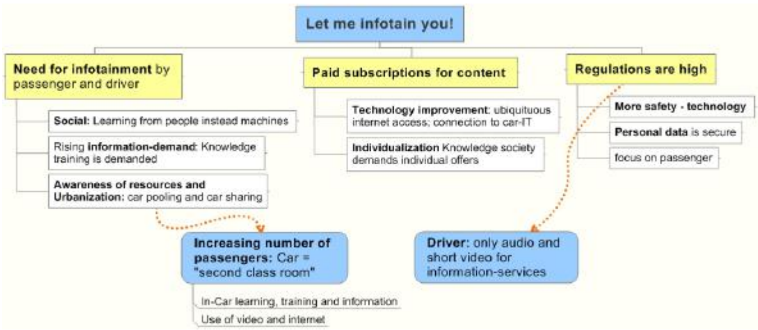

Figure 9.3: Scenario 3 - Let me infotain you!
Source: Own Illustration

For the year 2020 this scenario is considered to be the most important and most fitting one. So we decided to put our focus on it.

9.3.3.1 Development of Uncertain Drivers

We expect a high growth-rate of *i*nfotainment services, because of the shift towards a knowledge and information society on the one hand and the entertainment boom on the other hand. This means that users will demand integrated services which provide them with information in an entertaining and intuitive manner.

People will only pay monthly rates for premium content and services used in their devices if at all. Much more widespread will be an advertising-based infotainment service, which will even be for free.

Safety-regulations will merely allow any distraction by entertainment while driving, so only small features can be presented to the driver. Passengers will be not affected by these. When it comes to data privacy we expect a higher sensibility for private data. Services are only used if the private data is secure and not sold or used for revenue-generating services. It is likely that services will be rated by independent and trustworthy institution to show users if the services are trust-able.

9.3.3.2 Development of Certain Drivers

The particular influences of the stable drivers shall be described in the following:

- Awareness of Resources

  The mobility concept changes from cars being a as status-symbol for many people to a more depersonalized attitude. Due to the increasing ecological awareness of users, governments and manufacturers, the use of car-sharing and all-in-one devices instead of an own car and several single gadgets will gain high importance.

- Individualization

  People will demand personalized content which guides them through the increasing amount of offers and overwhelming information. As more and more services become digital, the demand for high usability will rise, as different individuals want to use interfaces in different ways for instance. So not only content but also the interface have to adapt to the user.

- Technological Improvement

  Software will exist as a service (SaaS) in most cases. Also due to the stable ubiquitous Internet connection, it will be possible to use all services with just one device almost in the whole of Germany. Most people will use their mobile all-in-one devices also in the car. They will be able to connect it to the car-IT, so they can have access to bigger screens, navigation and the like.

- Rising Information Demand

  There will be a huge shift towards the knowledge society, so individuals want to efficiently use their spare time for information, stories and the like. Lifelong learning has a high influence. People will want to know literally everything that comes to their mind. They think a lot about their environment and want to actively understand it. They are also forced to do so because of the high level of knowledge they are expected to be up-to-date on in their jobs. What is information today, will be presented in an infotainment manner in the future. People will not want to learn boring and chippy facts, but rather be infotained in a joyful, time worthy way by more than just facts and figures. Users contribute to knowledge platforms even more than today. The concept of Wikipedia was just the beginning.

- Socializing

  It will be a big trend to learn from mates or friends in online communities rather than to listen to machines. Already existing examples for this are social communities where drivers share their favorite journeys, give hints for a pleasant ride or just meet for car pooling.

9.3.3.3 Users in 2020

Due to the technological improvement, users of the future will have something like a personal "digital aura". Telephone-numbers, electronic keys, personal data, interests, pictures and the like are stored and can be used automatically. We think of intelligent information posters, which for example can show you where to go and so adapt their content because they sense what you are interested in in this particular situation. This concept is called "*pervasive computing*", meaning a new time of the information-era. So people will be able to interact with digital technology a lot easier than today, where the computer mouse and keyboards form quite complex models of interaction.

9.3.3.4 Market in 2020

As there will be more virtual services, the market gets highly international, because the service can be accessed from everywhere. So it also gets more competitive, because not only companies from one country try to outplay each other, but this happens on the whole international stage. Because the services will mostly be based on social communities, user numbers and market penetration will be crucial for the survival of a product in the market.

9.3.3.5 Companies in 2020

In 2020 the differentiation between "company" and "user" will be a lot harder than today. The user becomes a worker for the company via open innovation processes and companies have understood that they need to actively seek for the user's ideas. On the other hand it will be possible for employees to work out of office even more. Travel will increase, because the work in the service society of the future will not be location-based. With highly developed technological devices all software can be used as a service and no fixed computers will be necessary. As a result spare time highly merges with labor time.

To improve technology, many companies will found strategic alliances with partners. The resulting "best of breed" products will have no single origin, but rather a network of breed-companies, which enables them to gain more trust by the user. For the companies this dramatically reduces costs as well as risks.

9.3.3.6 Services / Products

The service and product world will be packed with an incredible amount of offers. The task will not be to offer this service, but to organize information for the user. As a result a lot of products will be placed in the information sector, like augmented reality. These products add knowledge or organize information in an understandable way.

For fulfilling the needs of the customer for individualization, most of the products adapt automatically to the users´ interests. The importance will lie in how usable, but also entertaining a service is. The user will expect exactly the information he searches, so the content has to find the customer and not vice versa.

9.3.3.7 Characteristics of the Car Driver

Car driving will be considered as a inefficient way to spend ones time as regulations will be too high to distract oneself by entertainment or infotainment means in the same way as the passenger can. Nevertheless, especially in cities are many red-light stops. This time is actively used by car drivers to consume short info-blocks in video format, or for a quick surf in the net. Audio services will play the major role for the driver, because no physical interaction is needed.

What could be interesting is to present infotainment in augmented reality, which refers to computer displays that add virtual information to a user's sensory perceptions, e.g. for navigation via head-up displays. [280]

9.3.3.8 Characteristics of the Passenger

When entering the car, the user wants to start for example infotaining short movies, which matches his interests. It is important to note that simple individualization is not sufficient for most individuals. Instead they want "individualization on-demand" like choosing in the morning what they want to learn throughout the day. The mobile device therefore gets the role of an "knowledge brain-assistant". A personalized attitude to ones device is likely. The reason beside individualization and customization is its broad range of information and knowledge which it can present via speech. So people will start to think of it like a virtual person, who tells what to learn and why.

The equipment of cars will largely differ from today. But it will not play an important role for the user, because he brings his own device and the provision of services and content is also independent from the automotive itself. He is so to say not dependent on car-IT.

9.3.3.9 Conclusion

For both, the car driver and the passenger will be three different Infotainment services:

- Brain Training
- General news and information
- Specific knowledge about personal topics, like traveling or work

As many people do not buy cars anymore there is high competition especially in providing training and information-services. It will play a major role how good the services will adapt to the different users information-needs. It will be essential to provide high-quality information to ensure the trust of the users.

We estimate that specific knowledge about topics closely related to the user's interests has the highest potential for future-product services.

9.4 Product Idea: Travelino

We developed a service for our the scenario "Let me infotain you!" with a high potential in 2020. We will describe the use of our service "Travelino" *onplace*, i.e. at the traveling destination, and *offplace*, i.e. at home or on the road, within the next pages. First we will explain the product idea and analyze potential consumer groups as well as competitors. We will continue with technical aspects, our business model and a analysis of risks and opportunities showing potential challenges and chances. Finally we will illustrate the fit of the product to the scenario.

Figure 9.4: Travelino Mock-Up
Source: Own Illustration

9.4.1 Product Idea

9.4.1.1 Current Developments: The Modern Web 2.0 Culture and a Society on the Move

With the development of the Web 2.0 phenomenon, the Internet has become both the most important source of information and a central social meeting place for many people. Examples of Web 2.0 culture communities include forums, user based question-and-answer websites (e.g. Yedda[29]), music, photo and video sharing platforms (e.g. MySpace[30], Flickr[31], YouTube[32]), social communities and networking sites (e.g. Facebook[33], XING[34]), wikis (e.g. wikipedia[35]) and blogs. These examples show the distinct need of individuals of the modern, digitized society to express themselves through various manners, to socialize and take part in other people's lives and retrieve information through non-institutionalized and non-commercial sources. In the future, people will increasingly demand intelligent mobile solutions for these Web 2.0 services.

Moreover, people become increasingly mobile and flexible. Especially Germans travel a lot and to more and more remote, exotic locations[36]. Also, the modern labor market demands more flexibility and the willingness to spend a lot of time on the road and to work abroad. With a broad range of information already being provided by the Internet, people will exceedingly wish for convenient content provision while they are on the move.

9.4.1.2 The Future Service Gap: The Need for a Web 2.0 Travel Platform

Though these phenomena are already visible today, there is no online service which addresses and integrates both phenomena so far. Conservative, printed travel guides (e.g. Marco Polo, Lonely Planet) often do not meet the special interests and preferences of many people. They often recommend rather expensive restaurants but do not offer any information on the random, cheap Italian restaurant you are just facing on your city tour through Amsterdam, for instance. On the other hand, existing online solutions (e.g. worldtravelguide[37], mytravelguide[38]) are too inflexible when you are already at your destination.

[29] http://yedda.com/
[30] http://profile.myspace.com/index.cfm?fuseaction=music
[31] http://www.flickr.com/
[32] http://youtube.com/
[33] http://www.facebook.com/
[34] http://www.xing.com/
[35] http://en.wikipedia.org/wiki/Main_Page
[36] c.f.: http://www.dresdner-bank.de/dresdner-bank/presse-center/medienservice-hoerfunk/archiv/080306-usa-reisen/Dresdner-Bank-Reisestudie-2008.pdf
[37] http://www.worldtravelguide.net/
[38] http://www.mytravelguide.com/

Although the Internet offers practically all information, it is often hard to find. When you are standing somewhere in a Asian city for instance, you do not want to browse through complex websites. You want to know your options on where to go next from your specific location right now. All existing online services also do not comprehensively address the dynamics of the web 2.0 culture. This is no pressing issue today as the mobile Internet access is far from being ubiquitous and rather expensive - especially abroad. In 2020 however, this service gap will becoming evident with a broader and faster mobile Internet coverage and likely lower data roaming charges.

9.4.1.3 Our Solution: The Online Platform “Travelino”

Our service offer “Travelino” is an interactive online travel guide platform for the future mobile traveler. It is community-based which means that we provide the basis both for users to produce and consume travel-relevant content. Users can upload their travel videos, pictures and audio files and post information and their experiences and recommendations while they are at the travel site (“*onplace*”) or at home (“*offplace*”). All data is connected with global positioning information from Galileo. By this both people at home or on their way to the traveling destination (“*offplace*”) and people who are already at the site (“*onplace*”) instantly only get relevant location-based information. Our platform clusters and categorizes all information and media submitted by the users to intelligently fit it to the individual’s needs and complements this data content by additional (premium) travel-guide offers provided in cooperation with professional guide book publishers. Apart from selling premium services, the basic service is for free for the users of the platform to quickly reach a critical mass of participants in the travel-community. The revenue will mainly be generated by giving companies an opportunity to sell both location-based and user- and context-sensitive advertisement to a large base of mobile individuals.

The functionality of our service will be described in detail in the following by the distinction between *offplace* and *onplace* use.

Onplace

Although “Travelino” has a high usability for planning one’s travels, its major strength lies in mobile usage. The photo or video-taking function of the mobile phones in connection with Galileo-sensors serves as an intelligent agent for the user in tagging photos or videos with geo-positions or in searching such tags alike. Therefore, people can use our platform onplace to orient themselves in the new environment. The user simply uses the photo or video-taking function of his device. According to his preferences, recommendations are highlighted by colored arrows on the display of his handheld. Different symbols show the different additional media available, i.e. information only or multimedia data such as pictures or videos. The arrows also hold information on the name of the highlighted options and the remaining distance. While in the new environment, the user therefore has the possibility to access information from the posts of people who share their interests for which sites to see, which cultural offers such as theaters or museums to visit or which bars or restaurants to eat or drink at any time, given he has Internet connection. By user's videos or photos he can make his own picture of sightseeing spots and the like. He also has access to a plane map such as he has offplace. The user selects which places he wants to see. Our service calculates the best route or the user sets his own route. There is also an arrow shown which turn in the direction the user has to move and the distance left to cover in case there is no geo-data for a road or the like. In case of commercial places, the user can also access ticket buying functions and the like, given that these services have been linked on our platform. He also gets further recommendations and advertisement adapted to his interests and the given context. He may see an advertisement of our example above, the Italian restaurant in Amsterdam, together with a special offer of the restaurant that he gets a certain discount if he eats there.

Offplace

People can use our platform offplace to plan their trip or holiday and to design their own travel guide according to their interests and preferences. For doing this, they can select certain regions, countries or cities or request recommendations according to a set of features according to their preferences. Highlights are shown to them according to user ratings. By either following recommendations of the community or self-selection, the user has access to the whole range of content provided by the community, such as videos, photos, audio files and other additional information. Our platform also provides a global map based on satellite pictures. The geo-data on this map is connected with all content provided on the website. Therefore, users have access to the same functionalities also via the map, making it easy to plan city tours for example. Other than planning his own trips or following recommendations by users, our platform also provides pre-defined sets of tours for popular places. Moreover, the user can buy further travel information and other premium services from our professional partners in exchange for small fees. Planned trips can then be saved on the user's personal profile and be consulted any time. For traveling to the selected locations and the like, the user has a selection of links to third partner services such as airlines or train companies.

To sum up, our travel guide platform “Travelino” fills an existing service gap. It will meet the increasing future demands of the mobile web and traveler community for content diversity, personalization and flexibility.

Figure 9.5: The mock-up shows the in-car usage of “Travelino” in combination with a head-up display.
Source: Own Illustration

9.4.2 Market and Competition

In the following section we will analyze the potential market of our product and define different market segments. Then we will analyze the value for the different user types. After that a brief competitive analysis will be carried out, showing the strengths and weaknesses of our competitors.

9.4.2.1 Market and Consumer Value

Due to the fact that the markets for most products are composed of consumers whose needs differ, a market segmentation is a useful tool to better understand the consumer’s needs and hence to deliver the highest user value possible to each group. We will now summarize the different user groups who will benefit from our service in different ways. In doing so we will again distinguish between onplace and offplace service.

Onplace
We identified three potential consumer groups who have different interests in our service. We differentiate between them calling them *“quick consumers”* and *“producers”* of our service as well as the group *“consumers/producers”* who does both - generating content and using the service as a provider of information.

- *Quick consumers* are characterized by having only little time, but striving after seeing as much as possible. They can be for example travelers having a stop-over or business people who want to “squeeze in” a sightseeing tour between their appointments. What they have in common is that they do not have the intention of generating any content after or while they are visiting. What they want is packed information: If they have one hour time to walk or drive around the city the service has to provide them with suggestions for a tour the desired information on all sights or places. They are potential consumers of chargeable services set up in cooperation with partners like travel guide publishers.

- *Producers* are characterized by the desire to share information, stories or experiences about a particular location. They can be for example locals who want to recommend a restaurant or people who want to let the world know that they just proposed at a certain highly romantic place. What they have in common is that they have the intention to generate content and that they want to upload it immediately. What they want is a simple tool to do so. They are potential users of all "Travelino" features connected with instant onplace action.

Consumers/Producers are characterized by the interest in getting and sharing information. They can be tourists who visit a place and use the "Travelino" service as a information provider[39]. Parallel they might make a video (for example of a sightseeing tour) and want to upload it immediately to make it available to friends at home or they could desire to rate another video or information just when having visited the respective place. What they have in common is that they want to use the information functions of our "Travelino" platform, to share their experiences made at a certain place and to evaluate the experiences with the service and the information provided there. What they want is an easy tool to do so. They are potential users of all services provided by "Travelino".

Offplace

Regarding the offplace service there are again the three distinguishable groups of people: those, who only consume, those, who deliver all kind of information and those, who use the services and accordingly evaluate and amend them.

- Mere *consumers* are characterized by looking for information about certain places on the Internet. They can be future travelers who want to read up on their travel destinations in advance and normal Internet users and therefore potential travelers who just “click around” and gather impressions. What they have in common is their general interest in the destination. What they want is to get a thorough picture of the destination including mainstream travel information and insider hints as well videos and pictures. They are potential consumers of all "Travelino" offplace services.

- *Producers* are - as also described in the onplace section - characterized by the desire to share information, stories or experiences about the

[39] We want to stress that there are certainly also lots of travelers and tourists who use our service only in one way meaning that they consume only and do not upload any information.

particular location. They can again be locals who want to share insider knowledge about less or unknown places, they can be art historians who know a lot in detail about a certain location or building et cetera. They have a profound knowledge regarding the destination in common. What they want is to share their specific knowledge with a broad mass of people and to make a contribution to the education of these. They are potential generators of the content provided on the platform.

- *Consumers/Producers* are characterized by utilizing the travel information on the platform as well as amending and expanding it. For example they can be travelers who add personal hints and advices after returning from their trip. What they have in common is their desire to have a more comprehensive travel-guide platform. Therefore they want contribute to the accuracy of the information given as well as to the expansion of the knowledge base. They are potential consumers and generators of all "Travelino" offplaces services.

9.4.2.2 Competition

In this chapter we will analyze who is going to be a competitor of "Travelino". Moreover we will detect the strengths and weaknesses of our rivals and based on this analysis the advantages of "Travelino". We will again separate between onplace and offplace services.

Onplace
We see guidebooks, sightseeing buses, bicycle tours and city walks as well as private travel guides as competitors. Furthermore location based services[40] could mean a certain thread to "Travelino".

- Guidebooks: The main disadvantage of guidebooks is that they have to be read what means that usually only one person can get the information at the same time. Furthermore the information is only available in a written version and might be not up-to-date depending on the age of the book. In spite of these handicaps an outstanding advantage of guidebooks is their price performance ratio. [41]

- Sightseeing buses: The advantage of guidebooks is the disadvantage of sightseeing buses. The prices range between 10 Euro for one hour tours in smaller cities as for example Munich[326], to 25 Euro in London[322] - the prices apply for one person in both examples. Another disadvantage is that all the information given cannot be reread and that tours start at certain times what means less flexibility. In addition to these points,

[40] c.f.: www.where.com or www.whrrl.com

[41] On amazon.com can be found a broad band of guidebooks which usually cost between 8 and 15 Euro depending on where you plan to go.

there is also a fixed route which means that the user cannot chose what he is interested in. On the other hand, it is very comfortable to book a bus tour as it does not require any own participation or input.

- Bicycle tours and city walks: The problem of a determined route also applies to bicycle tours and city walks. Even though in the case of those tours the guide can always be asked to repeat or precise certain information other disadvantages occur: The probably greatest annoyance can be bad weather conditions.

- Private travel guides: Although a private travel guide delivers repetitions, detailed information, a personalized route et certera, there is a catch in it: the costs are high. Furthermore the travel guide normally has to be booked well in advance.

- Location based services: As mentioned above there are already offers which provide some services "Travelino" will proffer too. Users can upload recommendations of various kinds such as restaurant tips for example. Furthermore people can allow their friend to see where they are at the moment. Still, what is missing is a travel guide feature. And also the service is restricted to some huge cities until now.

To summarize, "Travelino" has a lot of advantages as well as some features which satisfy hitherto unmet needs: the service is for free or very cheap even when using the cooperation partner's premium services. There is no dependence neither from time tables nor from predefined routes. The information provided can be reread or re-listened as often as desired. The user has the choice between video, audio or written information. The user can retrieve further, more detailed information. The actuality of the information is guaranteed. Weather conditions play a minor role since the service can be used in cars as well as when walking around. "Travelino" helps the user to orientate himself. The service is always available. Every user can upload recommendations or ratings at any time. And finally the possible immediate-reservation tool is not available in any other service until now.

Offplace

There are several existing potentially competitive services available which can be divided into travel information platforms and picture or video platforms. Also groups within social networks such as studiVZ or facebook can be found and services helping travelers to get in contact with locals.[42] Still there is no such combination and service as provided by "Travelino".

[42] A very famous and successful example is www.couchsurfing.com. Also www.insideragency.com tries to build up the connection between people traveling and people living in a city.

- Travel information platforms: There exist lots of portals providing information and insider tips - but they offer this service either only for a defined region or one city[43] or they keep the information very general and basic[44].

- Picture and video platforms such as flickr or YouTube contain also travel videos but they are too huge to allow a specified research. Even though people can rate or comment videos and pictures the information provided is - relating to quality and quantity - very low.

- Social network groups are mostly specified on one country, region or city. The information consists usually of insider tips only.

- Couchsurfing and other services trying to bring travelers and locals together have the same lack: they do not provide the people offplace with any relevant information.

Figure 9.6: The mock-up visualizes the offplace and onplace orientation mode. Additional information, media and user ratings can easily be accessed.
Source: Own Illustration

9.4.3 Technical Aspects

The technology has a huge impact on the product, which may determine if it can be successful or not. The technical aspects will be divided in the *offplace* and *onplace* mode, just as in the previous sections.

[43]c.f.: http://www.portugal-reiseinfo.de/ or http://www.einfach-paris.de .
[44]c.f.: http://www.topreiseinfos.com .

Onplace

In contrast to the offplace service, this mode has significantly higher requisitions. As a basic functionality, the device has to provide a Galileo[45] receiver, sensors to know in which direction you are heading and possibilities to visualize that. At this point we can distinguish between the use on a mobile device or inside of a car.

The onplace mode inside of a car will have less features than on the mobile device. This is based on the regulations concerning distraction, where the driver has to focus on the traffic. Interesting points can be visualized on the head-up display or on the display of his navigation system.

The mobile device can be considered as far more flexible and versatile, offering the full functionality of the onplace mode. The mobile device should have a camera, otherwise creating and uploading own videos or pictures is not possible. In addition to that, augmenting your own sight requires the combination of a camera, a screen and our software. To guarantee high usability, a big touchscreen is needed. To reach as many users as possible, the onplace service is running in the browser like the offplace mode does. This allows functionality on various systems without adapting to each system in particular. On the downside, this needs a steady Internet connection. If these technical aspects can not be met, it is possible to change the strategy to a installed software on the device and pre-caching the interesting sight and points. But this is limiting the functionality and flexibility.

Offplace

As the *offplace* mode is another description for the online portal, the requisition is similar to already existing platforms. Therefore it should not be a problem to realize it. We expect a detailed map as the main visualization, which should be switchable between 2D and 3D. In addition to that, it needs the basic elements of a social video community, like the possibility to "tag" videos and rate them, the subscription of certain movie creator or seeing videos only according to chosen tags. As it is based on user generated content, everybody can participate by uploading videos or pictures or only write some information about his favorite location.

9.4.4 Business Model

Our service "Travelino" is completely based on the Internet. Therefore our business is positioned in the center of an interwoven value network of content generators, our function as a service provider, network operators, handheld manufacturers and third party service providers who use our platform as an advertisement base. The content is basically provided by the users themselves. Premium contents are available through co-operations with guide book pub-

[45] We focus on Galileo, because GPS is not accurate enough.

lishers. The data transfer both for committing and retrieving content from our travel-guide platform is done by the network operators.

Our revenue in this network is generated primarily by selling ad-space for personalized and context-related advertisement to third parties. When users inform themselves about the trips they want to make or when they are already at their traveling destination, it is very attractive for companies to sell their products and services which are related to the special interests and context of the user. A popular example for this business model is Google. Webspace for advertisement does cost us practically nothing. Therefore the fee demanded by us from third parties is also our profit. The users also have the options to buy special offers from our selected business partners. These guide book publishers gain a certain amount of money from us by providing high-quality articles to our users. The users pay for these premium services a small fee with different payment models being possible. For example, the user may only want to purchase a special article dedicated to a certain sightseeing spot or a travel-guide for a whole city. Instead of paying for downloading these articles, he can also spend less money and buy access to certain information on our website for a limited time span only. Our profit margin will be easy to achieve as "Travelino" also serves as a good advertisement platform and online distribution channel for travel-guide publishers who are interested in reaching online-customers.

By providing the basic service and access to the platform for free, it is easier to quickly gain a critical mass of users for our service to be a success. Moreover, we will concentrate our public relations and advertising on social online communities and specialized Internet focused online magazines. By this means we instantly address our customer target group.

9.4.5 Risk analysis

Every product not only has strengths and weaknesses related to its competitors, it is additionally massively influenced by external factors. This leads to various risks, but may also offer opportunities, resulting in an expansion in a scale which was not predictable. The risk analysis differs between threads and opportunities. If not mentioned it refers to onplace as well as to offplace.

9.4.5.1 Threats

The risks may have their basis on the user side, the business model, the market and its competitors, the technical aspects as well as legislation.

Focusing on the user it can be said that these are the most important and at the same second the least predictable factor. Our product idea is based on the idea of user-generated content. This means, if we lack users who like to upload movies, our platform loses attractiveness. A related danger is that the videos are not interesting for the majority of the consumers. They may not contain sufficiently relevant information or hints. In short the customers benefit may not be high enough.

The business model which is mostly based on advertising also contains various risks. Advertising as a successful business model is at the moment proven by various Internet platforms like Google. A possible danger is that the business model is not generating enough money to cover all the costs which are being generated by the necessary server infrastructure. However, considering the current developments and the possibility of our service to offer *onplace* marketing, this is not very probable.

The fact that Internet-based services can easily be duplicated is a general problem. Furthermore there are already competitors who are offering similar services which can combined mean a considerable threat. They may have the advantage that they can use their famous brand or already have a huge existing user base which is a must have for portal based user-generated content.

Technical aspects can only be a risk regarding the onplace section. The Internet portal is based on technology which is already available and used by various services. To provide the service needed for the *onplace* use is far more difficult. The application should be browser based, as this provides highest flexibility between platforms and allows an easy access by any user. But this also means that the browser needs access to certain parts of the device like the Galileo sensor or the camera. The calculations to recognize the sky need a bettor performance of the browser. Most of these obstacles can be overcome by the installation of an additional software on the handheld device. But on the other hand this necessity could represent a risk to lose potential users. Usability is also an important factor which has to be taken into account. Furthermore, the availability of affordable ubiquitous Internet may be possible in your home country, but still represents a high problem when visiting foreign countries. These high costs could reduce the probability that people use our platform.

Above all, legislation is always a difficult issue as it differs from country to country. A big advantage may be that the European Union harmonizes the national regulations of its member states. Therefore, as it is already limiting the charges for SMS and telephone connections all over the European Union, it may be probable that this will happen with the data segment as well. How the legislation will deal with privacy rights of persons who will be seen on the video is not clear yet.

9.4.5.2 Opportunities

The opportunities are based on the user, the business model and the market.

First, it is unsure how our platform will develop. In the history of Web 2.0 services users sometimes thought out of the box and used portals for services which the creators initially had not intended to provide. This might happen to “Travelino” as well. Users could experience for example that videos are the perfect way to report about events[46]. Even the location or town government itself could profit from the portal by providing advertising movies about the city and thereby increase its attractiveness for tourists.

Second, our service is financed by a traditional business model with very innovative features. Travelino would be able to offer very specialized and personalized *onplace* advertisement. This represents an unmet marketing need of companies and an ideal means for point of sale marketing activities.

It is also possible that the portal proves to be a perfect travel agency for the offplace users. As the travel market is already a mature web market, these opportunities are estimated to be relatively small.

Last but not least, we see opportunities to collaborate with competitors. Collaborations with big players in the market could open up the portal to a bigger market, which could leads to a win-win situation for both partners.

9.4.6 Product Fit to Scenario

The product matches the drivers of the “Let me infotain you!” scenario, as we describe in the following passage.

9.4.6.1 Product Fit to the Key Drivers

The product matches our three key drivers:

- Attitude towards Payment

  Users will in most cases accept advertising in the infotainment service. Our product offers possibilities for many companies to do personalized or context-related advertising, e.g. via self-produced video or picture data. On the other hand we will also offer a premium service for users with high expectations, where they get charged a small fee in return for high-quality travel guide information or media.

- Attitude towards Info- and Entertainment

  The society has clearly developed into a knowledge society. This is the reason why people want to be informed about their environment, especially during trips. Therefore our product offers the possibility to intuitively search and explore the city. The demand of people to gain knowledge and to be infotained is satisfied.

- Regulations

  "Travelino" does not significantly distract the driver when information is projected into the windshield. As data-privacy regulations will be

[46] Thus representing a new kind of a location based news service.

relatively strict, we will use software to make license numbers unrecognizable in videos, for instance. Google is already doing this. Still, data privacy regulations have a high importance in this scenario and may impose restrictions on our product.

9.4.6.2 Certain Drivers

The product matches five certain drivers:

- Awareness of Resources

  For the usability of our product we assume that people will predominantly use all-in-one devices. Also people will use eco-friendly transportation systems like trains or even walk instead of driving by car. However, this is no problem as our product will also be usable in these circumstances.

- Individualization

  Our product literally turns boring facts and figures into vivid, highly individual stories. As well as users consume, they also generate individual content. This is considered to be an essential part for our product. We can also provide information according to the user's specific interests.

- Technological Improvement

  "Travelino" uses the mobile Internet, which will be available in-car by 2020. We also use the Galileo positioning system, which we expect to be ready to use within our time-frame.

- Rising Information Demand

  Lifelong learning is of high significance for people. Our product satisfies this need by providing informative content. Users are infotained in a joyful way. Our product helps them to get to know more about their environment by more than just facts and figures.

- Socializing

  To learn from other people´s knowledge is considered to be of high significance. People can produce informative video-content and upload it. If they are interested, they can also rate the videos according to their personal preferences and thereby give hints to other people on which locations to visit.

9.4.6.3 Conclusion

Our product idea “Travelino” matches the drivers and developments mentioned in our scenario “Let me innovating you!” to a very large extend. Based on our evaluation of the future, we see great potential in this idea - not just from a user's point of view, but also from the business side.

9.5 Recommendations for Telecommunication Operators

We have shown how much potential our product idea "Travelino" offers. Now we will elaborate the steps needed to be taken by an telecommunications provider to make the service possible.

- A start-up in the travel market should be founded.
- Co-operations with guidebook publishers should be initialized for being able to provide the premium service Travelissimo.
- Telecommunication operators have a huge existing user base. For bringing the new service to the market **and** for creating costumer loyalty (CRM) telecommunication operators should provide our premium service for free to their existing costumers.
- Focus on the provision of innovative services. The customers of the future will demand the whole range of content provided by the online community.
- Data roaming charges in the EU will drop further. Be prepared to take advantage of this situation before new competitors conquer the market.

To sum up, our product "Travelino" perfectly fits to the "Let me infotain you!" scenario we developed in this trend report. It meets the high demands of the future mobile traveler. If telecommunication operators use the power of their existing user base and concentrate on the provision of innovative services, they will be able to generate huge profits in the year 2020. It may even be the starting point of a new era of mobile service provision.

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Chapter 10
Community Services

Jonas Huckestein, Sarah Merz, Christopher Scheubel

In this report we discuss developments of community services specifically designed for the service-centric car in 2020.

Having conducted a scenario analysis, we found network technology, end devices used and changes in car-ownership to be the key drivers shaping future scenarios. Based on the key drivers, we discuss three distinctive scenarios, of which the scenario of "Seamless Mobility" is the most promising in considering our product idea. In this scenario, mobile broadband and standardized computer systems in cars are broadly available and car-ownership has been partly replaced by the much cheaper model of car-sharing.

For this scenario we propose a real-time ubiquitous mobility platform based on an advanced real-time car-sharing service and intelligent car-pooling. Members use their mobile phone to request a route to their destination. That request is instantly matched against all online driver's routes. Both the driver on a similar route and the passenger can in real-time agree upon the trip, thus planning of shared trips in advance can be avoided.

We have conducted a market analysis and propose a business model with gross earnings of over 8.6 million euros in a city like Berlin with assumed participation rates of only 6%.

10.1 Introduction

Communities Services are IT-Services, that are jointly used by a community and include the relationships of the community members [358]. When discussing the service-centric car in 2020 it is reasonable to consider community services; as technological advance continues to push connectivity, exact location awareness and advanced software into the car, manifold opportunities to build communities around the cars of tomorrow emerge.

In order to evaluate the possible requirements and possibilities of car-centered community services, we used the methodology of "scenario analysis". The idea is to develop possible futures, the so-called scenarios, to examine community services in an assumed future world. Scenarios need to be distinctive and therefore a driver analysis is conducted prior to the development of the scenarios.

Drivers, shaping scenarios, can be issues or trends in the fields of politics, economics, society, technology or legislation. In order to avoid cluttering the scenario, only drivers most relevant to the topic are considered, the most uncertain of which are the key drivers. While both the key drivers and the other relevant drivers (the stable drivers) are required to depict a conclusive picture of a possible future, only the key drivers can differentiate the scenarios.

In the following sections we will conduct a driver analysis characterizing the developed scenarios. Consequently we will select the most interesting scenario, under the assumption of which we will develop a business plan for a possible community service. Within the conclusion, we evaluate the developed community service concept.

10.2 Driver Analysis

In the scenario analysis we aspire to draw a conclusive picture of distinctive possible futures. In order to do so, we first need to identify a set of drivers. The drivers we identified in our preliminary analysis are: Accurate Positioning Methods, New Technologies Concerning Data Privacy Protection, Rising Mobility Costs, Proceeding Technophiles and Sustainable Mindset, Urbanization and Governmental Support of Car-Sharing Initiatives.

We have analyzed the identified drivers and rated them with regard to importance and stability (comp. Figure 10.1). We did not include irrelevant drivers in our analysis.

In our scenario analysis it is not necessary to include relatively stable drivers in the definition of scenarios; if the development of a driver is certain, it cannot be the defining property of a possible future. Drivers in the upper right quadrant of the figure are considered key drivers, they are most relevant to the future with regard to community services in the car and their development is very uncertain.

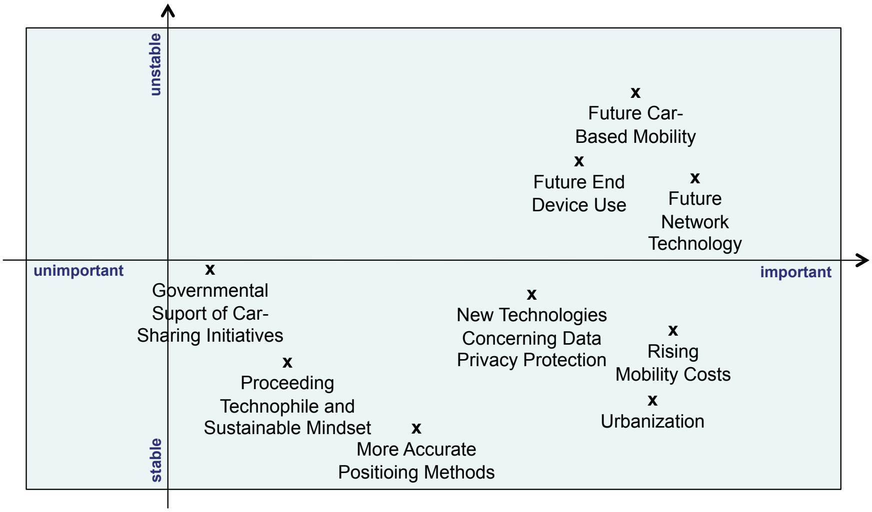

Figure 10.1: Rating of the drivers with regard to stability and importance. The upper right quadrant contains the key drivers.
Source: Own Illustration

We will continue describing each driver in more detail. While stable drivers cannot be used to differentiate scenarios, they are still of great importance and we need to understand how they will develop. For each key driver we have identified a fixed number of distinctive possible developments. Consequently, we can develop several scenarios by aggregating any subset of the key driver developments. These scenarios show distinctive characteristics and can thus be used for the scenario analysis.

10.2.1 Stable Drivers

In the following section we will describe which stable and important trends influence our future scenarios. These include accurate positioning methods, data privacy protection, the rising costs of individual mobility, a psycho graphic change in society, urbanization and governmental support for car-sharing initiatives.

10.2.1.1 Accurate Positioning Methods

An important factor which has to be considered when talking about mobile community services is the positioning of its users. Mobile communities not only add value by ubiquitous accessibility, but also by integrating the current position or even geographic relation of its users [353]. Problems to be solved are accuracy, efficiency and data security [358].

There are two overall categories of positioning, namely the network-based and the handset-based positioning. Network-based positioning like for example Cell-ID use signals and hardware of telecommunication systems. The accuracy depends on the size of each cell, which can vary from 50 m in a town to 20 km in rural areas [345]. Due to this inferior accuracy, only a restricted range of services can be offered. Yet, network operator have a core position in the value chain of network-based positioning. By contrast, handset-based positioning methods rely on independent positioning systems like GPS or Galileo. Therefore, they can identify the current position of its users with an accuracy of up to 10 to 15m [358].

We presume that handset-based positioning will be the predominant technology in 2020. Not only an increasing number of mobile phones is equipped with GPS-chips [358]. But also more and more cars have either a portable or preinstalled navigation system that has access to satellite positioning systems.

10.2.1.2 New Technologies Concerning Data Privacy Protection

For the topic of mobile community services, especially enhanced by localization technologies, data security plays a critical role. In order to provide these services, permanent tracking of its users is required. It becomes necessary to collect, process and store a huge amount of location and context sensitive information, which obviously is a potential source of misuse by both unauthorized parties and the service provider itself. Therefore, informational self-determination should be a definite goal for the development of mobile community services [356]. Users should be guaranteed complete transparency and control regarding their personal data and the question "to whom, when and in which form it is made available to other actors" [348].

As data security more and more becomes an issue of universal awareness, community service providers definitely have to consider effective technical mechanisms to ensure the user's data privacy. Accordingly, Kuepper identified secure communication, the specification of privacy policies and anonymization as fundamental fields in order to ensure the user's data privacy [348]. Using secure communication protocols which guarantee confidentiality, integrity and authentication should protect the user's data against unauthorized parties. Defining individual privacy policies should make it possible for users to determine how the legitimate actors use location data and to whom they forward it. Anonymization containing identifier abstraction and information content abstraction should further protect users against violation.

However, these mechanisms are not satisfactorily developed yet and need further improvement in the upcoming years. To mention only one example, "practicable and system-independent privacy policy rules and languages for

LBSs are still missing" [348]. Nevertheless, we regard it as certain that at least satisfying solutions to the above explained problems will exist.

10.2.1.3 Rising Mobility Costs

The costs of mobility will be rising beyond costs of living and real wage increases in the future. This development is driven by the shortage of fossil fuels and the technological progress of automobiles. Crude oil prices have shown an exponential upward movement till the financial crisis started leading into a worldwide recession, which drastically lowered prices. Nonetheless, demand for oil being a limited resource, will soon exceed supply again. Nick Butler, the chairman of the Center for Energy Studies, Cambridge Judge Business School, reckons an oil price of 50$ to 75$ to be the short term fair price [338]. For 2030, the US Energy Information Administration calculates a crude oil pricing of 130$ Euro per barrel [341]. Dependent on technological progress, this calculation seems rather conservative.

The other driving force which expenses cars is the future technological development. Legal safety and pollution regulations, as well as performance and comfort innovations push the prices per car up. Guenther Verheugen expects the new car price to rise by 2,000 Euro when environmentally friendly features will become compulsory in 2012. The VDA rather expects regulation costs rising by 6,000 Euro that year. On the other hand, fuel consumption would be lowered by approximately one third [330]. A steady upward trend in new car prices is clearly detectable [332]. Due to mentioned legal requirements and many necessary innovations, the increase will accelerate its pace until the year 2020.

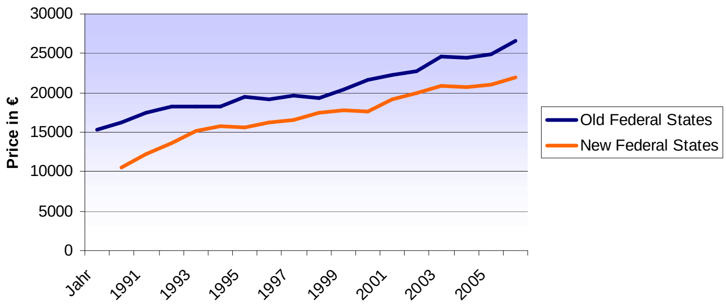

Figure 10.2: Developments of New Car Prices
Source: Bluemer and Puetz [332]

In aggregation, these trends will increase the cost of mobility significantly above the average cost of living and real wage growth. The operating cost for a lower priced car is currently about 38.5 Cents per kilometer [329]. These costs are estimated to be at 45 Cents per kilometer in 2020 [334]. This indicates, that in developed countries like Germany fewer people will be able or willing to finance the costs of mobility imposed by usage of a personal car.

10.2.1.4 Proceeding Technophiles and Sustainable Mindset

For the development of future scenarios, important characteristics like trends in our society have to be included. In the past we have seen strong socio-demographic changes impact on society and consequently on economy as well. These include not only the demographic composition of population, but also the changing identity, life style and attitudes.

Regarding these psychographic issues, the scientist Horst Opaschowski predicts the most radical changes in society's values since 30 years [349]. Also the market research institution Sinus Sociovision assumes that in 2020 a far-reaching change of society will have taken place. Based on the sinus milieu method, the institution examined the future shape of our society. It reasoned, that sustainability, social responsibility and commitment in combination with a high level of education and technological development will probably characterize our society in 2020 [349].

10.2.1.5 Urbanization

Urbanization is one of the most prevalent trends influencing worldwide living and society. Urban agglomeration is a phenomenon which concentrates on developing and emerging countries [327].

But even in developed market economies, the population growth and migration rates show trends towards agglomeration developments [335]. In Germany as a small country with a very well developed transport infrastructure, urbanization processes will remain at a slow pace. Nonetheless in 2020, more than 75% of the German population will be urban [359]. Mega Cities impose major challenges on their inhabitants and authorities. These include a stress on infrastructure, water and energy supply and sufficient administrative bodies. German urbanization will hence concentrate on sub-centers with 0.5 and 5 million inhabitants. Urbanization is consequently positively influencing the market for transportation community services.

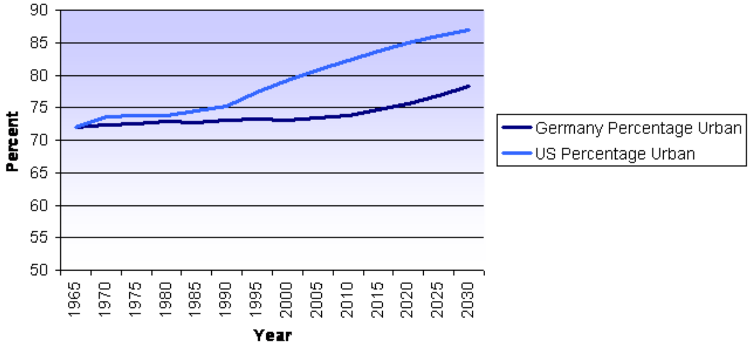

Figure 10.3: Urbanization Processes in Germany and the US
Source: United Nations [327]

10.2.1.6 Governmental Support of Car-Sharing Initiatives

As commonly known, we are facing a period of profound climatic change. Mainly due to the emission of greenhouse gases the average temperature is constantly rising. Consequently a number of countries including Germany agreed on a set of internationally binding commitments to reduce these emissions. In the recent years Germany managed to cut down the nationwide emissions in various areas. However, the share of traffic on a pro rata temporis basis increased from 13% in 1990 to 16.5% in 2005 [336]. Therefore, governmental institutions are searching for effective methods of reducing traffic-based emissions.

One example is the limitation of the permitted CO_2 emissions per single car. Beyond that, the government has recognized the importance of supporting alternative ways of mobility as car sharing is one. To a limited extent cities and communities already today supply car sharing providers with public space for car sharing stations or financial aid. Freiburg, for example, incorporated a local car sharing initiative in its municipal campaign for environmentally friendly mobility [337]. At the moment, a bill of the German Federal Ministry of Transport, Building and Urban Affairs regarding an adaption of the road traffic regulations waits for its introduction. The bill should facilitate the installation of car sharing stations in public areas [337]. However, these efforts still are at the beginning and one can presume that they will increase in the upcoming years, especially comparing the German with the international situation.

10.2.2 Key driver 1: Future Car Based Mobility

When considering community services in 2020, it is important to know how the market for car-based mobility will develop in the future. We have seen how the costs of mobility will continue to rise until 2020 and drivers correspondingly will be interested in cutting their costs.

10.2.2.1 Car-Ownership and Alternatives

Already today, there are car-rental/car-sharing services which are allegedly cheaper than buying a car for a significant amount of the potential drivers[1]. Consequently, it seems possible for rented cars to contribute greatly to the road traffic in 2020. For community services in the car it is crucial to be aware of that possibility. In case of a large car-rental market, the community services must include the possibility of drivers sitting in a different car every day. Following our analysis, the development of car-based mobility comes down to the question of how car-ownership will develop.

10.2.2.2 Development of the Key Driver

We have identified two distinctive paths of development which open interesting perspectives for car-based mobility:

- The majority of road users owns the car they are using
- A significant number of road users does not own the car they are using

The first alternative in many ways resembles today's situation on the roads. People buy cars and use them to get to work, go shopping or on vacation. Of course, there will be differences in comparison to today; probably the cars will be smaller and have more efficient engines, perhaps a more efficient public transportation system will cause a decrease in the average number of trips by car per person. We have found these differences to be insignificant in terms of community services; any community service which seems plausible today would also work in that future.

The second alternative, a development in which a significant number of road users drive a car which they do not own, presents a lot of interesting use-cases for possible car-based community services. The road users would probably share cars in some sort of car-sharing service. Incidentally, even today car-sharing is of great interest to researchers, governments, car-manufacturers, consumers and environmentalists.

While the costs of mobility surely encourage a shift towards car-sharing, the costs of mobility have steadily increased since the 1950s, without causing a major revolution in car-based mobility. Therefore it remains to be seen how car-based mobility develops in the future.

[1] http://www.zipcar.com

10.2.3 Key driver 2: Future End Device Use

As the second key driver we identified the different end devices that will be in use in the upcoming years. For successfully designing car-specific community services, it is crucial to know the respective end devices as well as their decisive features. Generally spoken, there are two main categories of end devices operating in car environments and thus addressable for community services. These are on the one hand all kinds of mobile devices such as mobile phones, smart phones or even enhanced navigation devices and on the other hand preinstalled Onboard Units (OBUs) in the cars, that support infotainment features.

Each of these devices offer respective advantages and disadvantages. Especially the five features market coverage, network connectivity, supported positioning methods, standardized platforms or Application Programming Interfaces (APIs) and in-car-usability have major impacts on possible community services offered. As we want to enable as much users as possible to take part in the services and we know, that community services belong to the field of network-effect goods, the diffusion of the devices should be rather high. To get the users connected, the network technology support of each device is crucial. One major opportunity of mobile communities in comparison to traditional communities is the integration of the position of users or also further context-sensitive information. Therefore, end devices have to support one of the different positioning methods. Standardized platforms or at least Application Programming Interfaces are necessary to enable third party service providers to develop services for the respective devices. Finally, we think that convenience and perfect adaption to the in-car usage situation decides upon the success of car-specific community services.

10.2.3.1 Mobile Devices

Mobile phones dispose of a high market coverage in Germany as the number of mobile phones in use will exceed 101,500,000 devices in 2008 [355]. They already allow users to access the Internet via mobile radio networks such as GPRS or UMTS. According to the survey “Mobile Life 2012” by Golemdia, about 60% per cent of all mobile phones will support UMTS in 2012 [328]. With LTE, a more powerful network technology regarding bandwidth is in development. A growing number of devices support GPS and in the future maybe also Galileo and therefore make it possible to be located not only via network-based, but also handset-based positioning methods. For our future scenarios we assume that in any case, at least 50% of all mobile devices will support Internet connectivity and handset-based positioning. Furthermore, it is easier for Telcos to design services for mobile phones, as they have access to the APIs of mobile phone operating systems and directly cooperate with mobile phone manufacturers. Due to this cooperation it is possible for telcos to integrate services into mobile phones before selling them to their customers or to adapt the hardware accordingly. Mobile phones tend to become high performance devices with numerous features and accompany users through their whole day [328]. Despite that, they unfortunately lack comfortable in-car usability due to their small keys and displays.

10.2.3.2 Onboard Units

Nearly every car is equipped with a wide range of embedded systems. However, the diffusion of onboard platforms with infotainment functions such as Microsoft Auto[2] is still low compared to the market coverage of mobile phones. The question, whether these OBUs will rather support decentralized car-2-car-communication via ad-hoc networks or offer real Internet access in 2020, is also very interesting. As the first car maker world wide, BMW enabled the owners of BWM 7er series to enter the world wide web via their OBU, but one does not know how far Internet connectivity in the car will be diffused in 2020 [333]. As cars increasingly possess navigation systems [339] and OBUs like the Microsoft Auto platform makes the integration of portable solutions possible, cars become locatable via satellite positioning with rising quality. Nevertheless, community service providers like telcos face another problem when trying to address OBUs, that is to say the lack of open and standardized platforms across the different car makers. If platforms or APIs are not open, telcos will experience difficulties in developing respective services and contracts with each car manufacturer will have to be negotiated. This, however, will not be easy, as car manufacturers probably do not want to include third party service providers into the value chain. The added value regarding for example BMW's telematics services almost entirely belongs to BMW and its subsidiaries [346]. Without standardization, it is difficult to offer community services which embrace the different car brands. Compared to mobile devices, OBUs, however, offer a wide rage of advantages such as the convenient in-car usability, the direct access to further information connected with the car or the assured energy supply.

10.2.3.3 Device Integration

For different community services different device specifications are required. A simple instant messenger or friend finder may be realized via devices, that just support ad-hoc networks. Whereas these services already exist for mobile phones, car-specific solutions for OBUs still have to be developed. More enhanced services require, for example, real Internet connectivity. As we consider convenience and easy in-car usability as decisive for car-specific solutions, it is very important to address OBUs in the service conception.

[2] cf.: http://www.microsoft.com/auto/default.mspx, accessed on 17.1.2009

However, the greatest opportunities definitely open up by designing services, that integrate both mobile phones and OBUs and are accessible from inside and outside the car. Service mobility is a keyword that often appears in the research literature in this context and postulates the opportunity to use services independent from networks and end devices [346].

10.2.3.4 Development of the Key Driver

Summing up the above explained findings regarding end devices, we see that mobile devices can be addressed with community services in any of our scenarios. Whether OBUs will already be a reasonable end device for services depends on the development of mainly two parameters - the further diffusion of Internet-connected OBUs in cars and the standardization of those embedded platforms.

Firstly, we consider it as possible, that only a restricted number of cars may be equipped with an Internet connected OBU. Maybe only the premium car models fulfill the mentioned requirements. Notwithstanding, a sustainable number of cars may have OBUs that also support Internet connectivity. Car manufacturers have realized the importance of infotainment applications including Internet connectivity for differentiating themselves from competitors. Therefore they really push this area forward.

Furthermore, standardization is a crucial factor. The situation for service providers will be completely different depending on whether the car industry will have agreed on a standardized platform for OBUs or not.

10.2.4 Key driver 3: Future Network Technology

Principally, there are two different approaches towards connecting cars among each other. The first is to create a network based on routers along the roadside infrastructure. The second is to leave infrastructure and use WLAN (IEEE 802.11) for the inter car communication [340, 350].

10.2.4.1 Car-2-Car Communication Technology

WLAN would be the more favorable option for safety relevant services, as the network would not collapse when one knot fails and due to reduced costs of implementation. As the range is very limited, each car would serve as a router. Of course, for safety relevant applications a 100% coverage would be of great importance. But a on-board WLAN communicating with near vicinity like traffic lights or approaching emergency vehicles could be of high customer value in a low penetration environment [340]. Several aspects concerning physical layer, mac layer, network layer and safety challenge the feasibility of ad-hoc WLAN technology [350].

10.2.4.2 Car-2-Infrastructure Communication Technology

LTE and WiMax are expected to become the prevalent mobile networks of the future [347]. They would achieve an excellent coverage in Germany.

Nokia Siemens Networks just recently presented the LTE Advanced technology which is predicted to be installed in 2011+. Normal LTE will provide up to 300Mbit/s, whereas the advanced version will support up to 1Gbit/s. These data rates enable mobile use of sophisticated Internet applications. One key to its success will be the installation of cost effective relay-stations, constituting a middleman between the expensive base stations and the end user. They could be easily integrated to existing infrastructure like traffic signals and street lighting. That way quality of service can be enhanced when several base stations serve one user and high data rates can be achieved. Of course, the maximum capacity of 1Gbit/s can only be reached under optimum conditions (no excessive number of connections) [354].

WiMax is offering long range mobile services like WLAN. The most predominant problem of WiMax is the actual poor coverage in Germany. Users share an enabled bandwidth of around 108 Mbit/s. Currently offered WiMax Internet services have a transmission rate of 1.0-2.0 Mbit/s. The reached distance is 3km in cities and up to 50km in rural areas [343, 357].

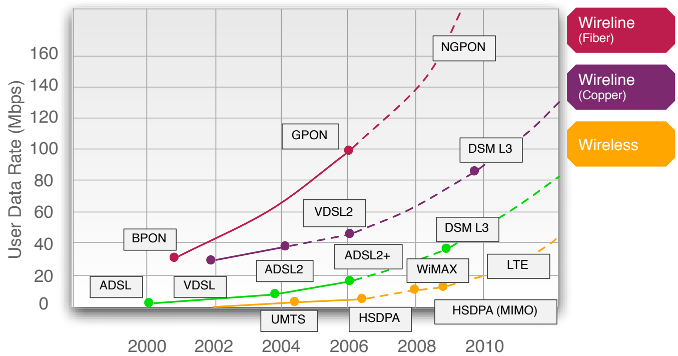

Figure 10.4: Bandwidth development of access technologies
Source: Nokia Siemens Networks[351]

10.2.4.3 Development of the Key Driver

The mobile network technology faces different traffic related problems which have to be solved to make this technology feasible for in-traffic use. The main obstacles are reliability of service, quality of service, safety and coverage.

These problems can either be overcome by 2020 or still remain challenges for the future.

For car-to-car communications mainly the problems of signal reliability, safety and the creation of enough customer value in the implementation phase would have to be concerned [340]. In 2020 there will most probably be vehicular ad-hoc networks using WLAN fulfilling all requirements.

Mobile network technology exists, but to support sophisticated community services and applications, a high bandwidth and coverage of the network is necessary. The breakthrough of high speed Internet access in the car would come by the implementation of LTE and Advanced LTE. This would offer enough bandwidth as well as the increased coverage. It would either displace WiMax or will be supplemented by it. For mobile community services access to the Internet is of major importance as it would be hampered by slow connections. By 2020, LTE and Advanced LTE could either be implemented or still wait for sufficient funding.

10.3 Scenario Development

After having analyzed the various drivers both stable and unstable we now would like to describe three distinctive scenarios for the year 2020.

10.3.1 Hampered Innovation

The scenario of Hampered Innovation is defined by the following key driver characteristics:

- An insignificant number of OBUs with Internet access is reached and they are not standardized across different car-manufacturers
- No changes in car-based mobility
- Low LTE coverage and no availability of ad-hoc network technology

In this scenario, technological progress is hampered by several crises which influenced worldwide societies. The credit crunch of 2008/2009 led into a worldwide recession which lasted until 2015. The economic turmoil caused low scientific and infrastructure budgets which hampered technological and social progress. Since 2015 the worldwide economy is growing again, but in Germany the economic development is still slow.

Nonetheless, most of the mobile phones are equipped with advanced positioning methods. Though facing financial distress, the European Space Agency managed to set up the Galileo positioning system in 2012. It offers more accurate positioning than the American counterpart GPS. The constant possible Internet connection and the awareness of the possibility to be tracked, let a new branch of industry arise which develops encrypting software for mobile phones. This reassured people to consume mobile services. It even created a technophiles mindset as benefits of information technology continuously entered society. This development led, in combination with energy scarcity, to a environmentally conscious society. Constant urbanization processes led to a search for efficient transport alternatives. Nonetheless, car ownership is still predominant in the scenario, as the mindset of people did not change much.

After the sales crisis of automobile manufacturers from 2008-2012 cars became less expensive again. Not all technical innovations were installed, as the consumer's purchasing power declined. New cars are equipped with OBUs, but only upper and middle class cars can connect to the Internet. A standardized operating system across the brands is still missing. Network infrastructure does not support high bandwidth coverage over Germany as there was a lack of investments in previous years.

Due to the lack of connectivity between cars themselves and infrastructure, mobile community services would have to be based on cell phones. There could be maps with recommendations for restaurants or cheap fuel stations. Car-pooling websites could also be accessible via mobile phones, but real-time instant share of rides or pick up are not possible due to the lack of automobile connectivity and limitation of bandwidth transferring navigation data and instant calculations of the most convenient traveling opportunities. As the attitude towards car-based mobility did not change, there is no main stream interest in car-sharing concepts.

10.3.2 Chaotic Innovation

The scenario of Chaotic Innovation is defined by the following key driver characteristics:

- A significant number of OBUs with Internet access is reached, but they are not standardized across different car manufacturers
- No significant changes in car-based mobility
- LTE coverage and ad-hoc network technology are available and widespread

In the proposed scenario, technological advance and innovation has outpaced the car-manufacturers efforts to standardize their car-IT-infrastructure across brands. The widespread availability of new network technologies enables a myriad of interesting community services.

Due to the lack of standardization, the community services must be offered and developed by car-manufacturers themselves or direct affiliates. It is difficult for small third parties to bring their ideas to the market and the complexity of bringing a service to different brands and perhaps even different generations of vehicles is disproportional.

As a result, we witness the dawn of individual "brand communities"; there are for example The BMW Community, The Porsche Community or The Audi Community. The features and complexity of the services offered vary greatly depending on the respective brand. Popular cheap brands become equipped with fun features and a focus on user-generated content, while luxury brands concentrate more on supporting the stress-free driving experience. The available community services for a car are of great importance to the consumer and may even decide upon the success or failure of a new model.

10.3.3 Seamless Mobility

The scenario of Seamless Mobility is defined by the following key driver characteristics:

- High percentage of cars feature OBUs with Internet access
- Onboard platforms have reached a high degree of standardization also across the different car manufacturers
- Due to the decline in car-ownership a large constituent of individual mobility needs are covered by car-sharing options
- Full coverage of Advanced LTE as well as ad-hoc network technology

In our driver analysis we found out that environmental change has a major impact on the future concept of mobility. As the ongoing process of global warming is directly connected with the rising CO_2-emissions, the car industry is put under increasing pressure. The countries of the European Union and especially Germany postulate a reduction of the CO_2-emissions caused by traffic. Closely related to this is the tightening shortage of fossil fuels, that lead to a profound incline of energy prices. Additionally, rising costs for purchasing a car due to technological developments make car ownership more expensive. So there is a group of people that cannot afford an own car anymore and is forced to switch to other means of transport like for example public transportation or car-sharing.

Not only this development leads to our assumption that the future car-based mobility will have completely changed till 2020. As urbanization is proceeding, smaller models of city cars will dominate the roads and a significant percentage of people will no longer have their own cars, but use more flexible ways of mobility. At the moment, the ratio of cars per inhabitant in Germany is 0.57 [329], which we presume to fall to a level of 0.4 cars per inhabitant. Still car-ownership belongs to the very important means of transportation. However, alternative ways like car-sharing move into the focus due to its comparatively low costs, its high flexibility and its correspondence to the risen environmental awareness.

Also public bodies helped car-sharing to its success. A national legislation was passed facilitating the implementation of car-sharing stations on public ground as well as strategically important points in the cities. Furthermore, several communities amongst others the cities of Berlin, Hamburg, Munich and Frankfurt integrated car-sharing initiatives in their environmental action plans and thus it became possible to apply for additional funding when building up a car-sharing service.

Regarding socio-demographic change, we of course identified the trend to advancing age of the German population. Of no less importance is the shift of predominant values and attitudes. For this scenario we expect terms like sustainability, social commitment and environmental awareness to become more important among society and thus determining factors for purchase decisions. For a significant share of the German society it will be important that their life style is consistent with their environmentally friendly attitudes. This becomes not only apparent in buying wholefood-products but also in other fields of life like mobility. There are people that not only use car-sharing or public transport due to cost benefits but also due to their opinion. Unlike former environmentalists, it is naturally to this new generation to combine their environmentally friendly attitudes with the use of high technology. Furthermore, about 75% of the Germans will live in cities in 2020 - a fact that expresses the trend of urbanization, which is especially prevailing in the eastern parts of Germany.

These developments are accompanied by profound technological advances. Mobile phones will have developed to high performance devices with numerous features. A very high percentage will be equipped with Internet access and support handset-based positioning. Furthermore, a significant number of cars will be equipped with Internet-connected OBUs. For this scenario and especially our further calculations we presume that at least 40% of all cars will possess an OBU with Internet access. Due to security reasons, car manufacturers will not reveal the APIs of their board computers. Strategic alliances with car manufacturers still will be necessary in order to address OBUs as end devices for community services. Yet, car manufacturers will be open to those kinds of alliances, as they recognized a usable and value-adding service environment in their cars to be essential for their success. To facilitate the development of services across different car brands there will be a standardized platform. Seamless and straightforward integration of one's mobile devices to the car infrastructure will be provided. Of course, mobile phones will be used as electronic keys, the content of mobile phones will be displayed in a convenient way by the OBUs and services will be accessible from the OBU as well as one's mobile phone. In this scenario we also observe the breakthrough and nationwide coverage of Advanced LTE, so that mobile Internet with high bandwidth is available all over Germany. Additionally, all cars are capable of ad-hoc networking and thus, nearly unlimited mobile connectivity becomes reality.

In combination with advanced handset-based and more accurate positioning methods, a wide range of opportunities for mobile community services open up. Applications can be designed, that address users both in- and outside the car independent of the respective car brands and supports them in their whole mobility. As we presume mechanisms to protect the user's data privacy to be technically mature and there are positive predictions regarding the revenue potential of mobile and car-specific community services, this seems to be a really promising field of activity.

10.3.4 Scenario Selection

We regard the scenario "Seamless Mobility" to be the most promising for a technologically challenging community service concept. As it shows very advanced technology developments and socio-economic progress, it will be the best medium for the success of our product idea. Additionally we consider the specific driver developments to shape this scenario with a reasonable probability.

10.4 Product Idea: SMART

Based on the selected scenario of "Seamless Mobility", we have developed a car-centered community service and analyzed its business potential.

10.4.1 Product Description

We are proposing the ubiquitous real-time mobility platform SMART (Shared Mobility Assistant in Real Time), a real-time car-sharing service which incorporates pedestrians, private car owners and a fleet of rentable Pool Cars. The product has been designed to meet the following goals:

- Lower costs for drivers owning a private car
- Increased flexibility (as opposed to traditional car-rental services) for drivers who do not own a car
- Increased mobility and flexibility for the non-driving population
- Increased efficiency of overall car-based transport

We believe that our model can meet all of these goals, by directly addressing many of the issues usually associated with car-sharing services. Consider the following representative example of how our service works:

1. Patrick is a member of our community. He would like to drive to Garching but he has no car.

2. Patrick uses his mobile phone to locate the next Pool Car and remotely reserves it.
3. At the car, Patrick uses a wireless RFID chip to unlock the car.
4. Patrick submits his route in the car's computer and starts driving. The billing is automatically taken care of.
5. At the same time, Marie, who does not have a car either, wants to go to Studentenstadt. She uses her mobile phone to request a route from her location to Studentenstadt.
6. The service matches Marie's request against all active driver's routes and displays a real-time list of possible drivers. The list shows Patrick and Karl. Karl is driving in his private car and he is also using our software.
7. Both Karl and Patrick get a message in their car that Marie needs to be picked up. Because picking her up will save them money, both agree to pick her up.
8. Marie can see this information in real-time on her mobile. Now she needs to quickly commit on who she would like to be picked up by. In the interface Marie can see, that Patrick has received many positive ratings and is also a verified driver, so she decides to share a car with him.
9. Both Patrick and Karl are notified. Patrick's route is automatically changed to incorporate Marie's route and Patrick picks Marie up a few minutes later.
10. Patrick drops Marie off in Studentenstadt and both are asked to accept and rate the transaction, which the software is presenting to them. Billing takes place automatically.
11. Patrick continues to drive to Garching. Because he is out of time he turns off the passenger notifications. In Garching he logs out from the system and leaves the car in a public parking space. He does not need to drive it back to where he first picked it up.

Some of the steps involved offer additional security and convenience features, which will be discussed in the next sections.

The service will be based on a software which runs on mobile phones and OBUs in cars. Additionally a web interface will be available for stationary use. The software operates in three different modes: pedestrian mode, rental car driver and private car driver. The mode of a mobile device can be switched at any time, if e.g. a user takes his phone into his car and suddenly becomes a driver. We will go on to discuss the features for each of the modes and the administrative and management functions.

10.4.1.1 Pedestrians

The software assists the passenger in arranging a trip to his destination. The only required function is a search interface. After the passenger has submitted his route request, a real-time list of possible trips is displayed, including online drivers in the area with similar routes. The user chooses a trip and the software arranges it for him. Figure 10.5 shows a mock-up of the user-interface for pedestrians.

The Search Interface

The search interface resembles a traditional route planning interface. The passenger can input his destination or select his route on a map. It is possible to recall previous routes and select addresses from the address book. Advanced options include planning a trip for a later time, planning a return trip and adding more passengers to the trip.

The List of Results

a) The search interface b) Search results c) Car-sharing details d) Confirmation dialogue

Figure 10.5: Pedestrian use-case
Source: Own Illustration

A list of available trips is displayed according to the passenger's account settings and the search options. For each result the estimated cost and duration of the trip is displayed. Clicking on a result shows the details. Clicking on the gray bar at the top allows to refine the search. Results are grouped as follows:

- Share a Car

  lists members of the community driving on a similar route. The percentile of positive ratings, the validation status, a picture and whether the driver has agreed to pick the passenger up are displayed. Route details include a map with the driver's current position and the newly calculated route, as well as the driver's profile and the car he is using. In case the driver has agreed to pick the user up, he can directly call him from our software.

- Drive Yourself

  lists the nearest Pool Cars. Details include a map and instructions how to get to the car. Walking time is added to the estimated driving time. The passenger can remotely reserve the car, so nobody can use it for a short period of time.

- Alternatives

  lists possible alternatives to using our service. This offers an opportunity to integrate with other services, e.g. public transport and taxis.

The user chooses a trip and is instructed accordingly; the most interesting case is when the passenger decides to share a ride with a driver, who has accepted to pick him up. In that the driver's current location and estimated time of arrival are tracked on a map in real-time.

After the Shared Trip
After the shared trip, the passenger is asked to confirm the ride and the resulting financial transaction and rate the driver. In case the driver is a validated member, the passenger can ask the driver to validate him as well. The driver has to check the passenger's ID against his registered information. If they match, the passenger will henceforth be a validated user.

10.4.1.2 Drivers of Private Cars

a) Passenger notification b) Passenger details

Figure 10.6: Car-sharing interface for drivers
Source: Own Illustration

Drivers of private cars use the software either on their mobile phone or on their OBU. The mockup's represent an implementation for mobile phones.

The interface is superimposed upon a regular navigation interface with a button to turn on the car-sharing feature or access management and administrative functions. In car-sharing mode, every route the driver enters will be uploaded to the service. Figure 10.6 shows a mock-up of the user-interface for private car owners.

Passenger Notification

When in car-sharing mode, the driver will be presented with possible passengers he can pick up. The passenger notification is superimposed upon the map, including the estimated additional time required for the detour, the new estimated time of arrival to the driver's own destination, the amount of money the driver saves, as well as the passenger's picture and name.

Clicking on a passenger notification opens a detailed view of the car-sharing opportunity. The passengers current location as well as the required detour to pick him up/drop him off are shown on the map. The driver can agree to pick the passenger up, but he still has to wait for the passenger to confirm. Only then is the new route logged into the navigation system.

After the passenger is dropped off at his destination, the driver is asked to confirm the transaction and rate the passenger experience. Billing and transaction fees are taken care of automatically.

10.4.1.3 Drivers of Pool Cars

The experience of driving a rented car is very similar to the experience of driving a private car. The software is installed on all OBUs of the Pool Cars. The only difference in user experience is the picking up and parking of the car.

Picking Up the Car

In order to rent a car, the driver must be registered at a physical service desk, where he will receive an RFID tag to open up the car. The driver can also register his NFC enabled handset to unlock the cars.

All a registered driver needs to do is approach a Pool Car which is not reserved for anybody else and it will automatically open. Inside, the driver will need to enter a PIN for added security. From then on, the driver can use this car as long as he wants to. Billing is automatically taken care of. The user-interface for the car-sharing service is the same as the one for private cars.

Parking the Car

The driver can park the car in any publicly available parking space and log out from the service. We will then automatically determine the probability of a user picking the car up from that location in the near future and will decide whether or not the car needs to be retrieved. The original driver pays a fee if the car has to be retrieved.

10.4.1.4 Administrative and Management Functions

The following functions are available on all devices and additionally through a web interface for home-access.

Registration
Every user of the community has to register before he uses the service. Registration includes setting up a profile and payment options. In case the user has a driver's license and wants to use one of the rental cars, he needs to register at a physical service desk.

Account Management
Grouped under account management are all non-community personal features. The following functions are available:

- Manage cars

  drivers need to administer a list of cars they regularly use

- Manage billing settings and transactions

  transactions include benefits from sharing a ride with other user

- Change registration information

Configuration
Configuration options include:

- Privacy Settings

  How much personal information should be publicly available. Ranges from age, gender, picture, driven miles and list of shared rides to nothing at all. Ratings are always shown though.

- Global Trip Settings

  These can also be changed on a per-trip basis. Specifically the driver can configure the maximum detour he is willing to make to pick somebody up, if he does not want to share his car at all or available luggage space. All these settings can be changed on a per-trip basis.

- Rented car settings

  The rented cars will automatically be configured according to your settings (music, seats, ventilation) as soon as you enter them.

Community
Every user has his own customized profile complete with picture, meta-data and so forth. Users share comments and ratings through the community platform. The community will add a personal touch to the service.

Trip Planning

Users can plan their trips in advance, which helps the system match trips both in real time and in advance. User can:

- Request a trip

  The search similar is identical to the pedestrian's search interface. The user is directly notified when a trip is available. The system can calculate the odds of the availability of such a trip at the given date.

- Submit a trip

  Interface is similar to the route planning interface for drivers. He can set the trip to be regularly, set waypoints etc.. The service automatically checks, if there are any car-sharing opportunities and notifies the driver in case.

10.4.2 The Market

10.4.2.1 Market Potential of Car-Specific Community Services

In order to evaluate the market potential of car-specific community services, we examined two crucial parameters, that highly impact the potential revenues. These are firstly the possible number of users of our service and secondly the future expenses for mobility.

As already explained, our services mainly address three groups of users, namely customers without a car wanting to use the ride-sharing services, the private car owners offering passengers a free seat and the users of our car-sharing vehicles. In order to roughly quantify our overall target group, we had a closer look at the size of these singular groups.

Definitely the largest group are the potential users of our ride-sharing service, as every person above 14 years having an Internet-connected and locatable mobile phone can basically take part in. Calculating that number we presumed the German population to be 82 million people [342]. About 60% of those will be aged between 14 and 65 years [342], which we considered to be the age limit of someone participating in that service. The mobile phone coverage in the give age group we assumed to be 100% [328], 50% of those being Internet-connected and locatable. Furthermore, our users have to live in cities, which 75% of the German will do. Including all these assumptions, it results in a potential number of 18.45 million ride-sharing users.

The number of private car owners offering a free seat at the best equals the number of private cars being equipped with an Internet-connected OBU. At the moment the ratio of cars per inhabitant in Germany is 0.57 [329]. According to our "Seamless Mobility"-Scenario, we presume the ratio to decline to 0.4. Today, only the BMW 7er series possess free Internet connectivity, which is a really evanescent number. However, we assume this number in our scenario to have risen to 40%. Presuming that also only the 75% of urban people can effectively take part in our service, the number of potential customers in this field amounts to 9.84 million.

Quantifying the number of potential car-sharing users we relied on the survey “Bestandsaufnahme und Moeglichkeiten der Weiterentwicklung von Car-Sharing” conducted by the Oeko-Institut e.V., that predicts the potential car-sharing users to range in between 1.5 and 2.0 million persons [352]. Yet, we adjusted that number upwards to about 5 million people, as we have different underlying assumptions in this scenario, which are for example the trend from predominant car-ownership to car-sharing or the enhanced technological opportunities.

Reconsidering these calculations, we can say, that there is a high number of potential users of our services. We are, of course, aware of the fact, that effectively only a share of those will call on our services, as they may, for example, decide in favor of completely different means of transportation or become customers of direct competitors. Yet, we definitely see market potential for community services in the area of mobility.

Additionally, we were interested in the potential revenues one can generate with this kind of community services. As we directly realize mobility of our customers, we thought it reasonable to learn about the future expenses of people for mobility. The average price payed for one kilometer gone with an own car added up to 38.5 Cents per kilometer in 2007 [329]. According to the “Institut fuer Mobilitaetsforschung” these costs will rise with about 1% per year till 2025 so that in 2020 one has to spend nearly 45 Cents per kilometer [334]. Assuming that the average number of kilometers gone by one person per year lies still with about 12,630 kilometers, this adds up to yearly expenses of 5,683.50 Euros. With our services we clearly have to underprice these expenses. However, this constitutes a benchmark for the pricing of our services.

10.4.2.2 Competitors

With our mobility service we are facing a wide range of competitors, that goes from public transport over taxi companies to the private car. In the following paragraph we had a closer look at our three direct competitors, namely agencies for arranged lifts, car-rental agencies and car-sharing providers.

In Germany, established agencies for arranged lifts based on Internet platforms are for example www.mitfahrgelegenheit.de, www.mitfahrzentrale.de or www.pendlernetz.de. Out of those, www.mitfahrgelegenheit.de is the most established one having about 850,000 registered users, permanently 170,000 offers online and about 1.9 million visits per month [3]. Via these platforms, drivers and passengers can arrange joint trips. Furthermore, our service competes with car-sharing providers. In Germany, about 100 car-sharing agencies

[3] Cf.: http://www.mitfahrgelegenheit.de/press_releases/view/27, accessed on 17.1.2009

exist, which are mainly organized locally. Only a few of them have 2,000 customers or more, which are for example Stadtmobil, cambio CarSharing or Greenwheels. Additional to their local organization they also do not support real-time, dynamic ride-sharing. One interesting example among car-sharing providers certainly is the Deutsche Bahn with its DB Carsharing [352]. They have posted cars at over 100 major railway stations, which can be rent on an hourly basis[4]. Finally, we have to consider car rental services like Europcar, Avis, Hertz or Sixt. They are mainly operating nationwide or even established international co-operations.

10.4.2.3 Differentiating our Service from Competitors

With our modular service, we can outpace the singular offers of all of those players, as we seek to organize car-based transport more efficiently always including the current position and direction of all users, on a real-time basis and taking into consideration community effects.

Internet-based agencies for arranged lifts like www.mitfahrzentrale.de already connect drivers and passengers. Yet, they do not enable spontaneous and real-time appointments. Furthermore, we think to enhance the readiness of users participating in our service by implementing enhanced features for the authentication of users. Sometimes no fitting offers can be found. For this case, we enlarged our offer by company-owned cars, which, compared to the cars of traditional car-sharing or car-rental services, also support dynamic ride-sharing. Additionally, car-sharing services are mainly organized locally, whereas our service shall be available in bigger cities all over Germany. It offers high flexibility and usability as ticketing for example is handled completely automatically. Or you can just leave one of the car-sharing vehicles anywhere against surcharge. Its uniqueness is underlined by the fact, that it connects the hitherto separated target groups of private car users, car-sharing users, car-rental users and also passengers who are searching for a lift.

10.4.3 Business Model

10.4.3.1 Value Creation

Fundamentally, value is created, when the product is worth more after the production process, than its raw materials and the work involved. Effectively, the customer pays an additional price for obtaining benefits of the difference between the product and its ingredients, the customer value added. Our product idea of a community service, offering real-time ubiquitous mobility, can be analyzed for two participation cases.

[4] Cf.: http://www.dbcarsharing-buchung.de/kundenbuchung/process.php?proc=info&f=3&key=efb93c34d1856158ee390a5db98c6ac1...00000, accessed on 17.1.2009

To identify a maximum price for the service, we consider the main competitor of our service - the privately held car. If a community seeks to ensure its individual mobility, there are 0.57[5] cars per inhabitant needed in Germany [329]. On average these cars go 34.6 km per day [329]. Operating expenses range from 301 Euro for a Toyota Aygo to 592 Euro for a VW Passat per month [331]. Maintenance, fuel, insurance, depreciation and taxes are included. Hence the customer value created by offering individual mobility comparable to a car's, would be around 400 Euro per month or 38.5 Cents per kilometer in 2007 [329]. As we assume the costs of mobility to rise by 12% until the year 2020, a competitive price is given by 45 Cents [334]. Inflationary effects are not regarded in all subsequent calculations.

10.4.3.2 The Business Case

For the business model calculations, methodology is based on a Nokia Research Paper and data regards to statistics from the ADAC or own assumptions [329, 344]. The model is not verified by solid market research, but it shows, how the business model concept works.

To launch the community platform, which will be a supplement to private cars and public transport, we consider the largest German City, Berlin. The open mindedness of its people and the huge mass of automobiles will foster the progress of this new concept of mobility. In our selected Scenario (No. 3), total inhabitants will remain at three million people. Cars in the city will amount to 1.2 million. The calculation is based on the ratio of cars per inhabitant in Germany (0.57 in 2007) which will have decreased to 0.4 cars per inhabitant by the year 2020. The privately commuted kilometers roughly remain at actual levels of 12,630 km yearly [329]. For our calculations we assume that 6% of private cars will participate in our ride sharing platform. Supplementing the population of privately held cars we offer an additional car-sharing pool of 5,000 vehicles in the Scenario. We believe that these two amounts of involved vehicles constitute the critical mass of traveling cars, that will enable ad-hoc mobility for the community platform user.

To incentive people to participate in the platform and pick up requesting users, traveling costs are shared among the passengers. They will amount to 45 Cents per kilometer in 2020. This figure serves as a basis for the calculation of individual passenger charges and service fees. The heavily used pool cars impose slightly higher operating costs. They rise to 50 Euro-Cents per kilometer due to higher fuel consumption and more depreciation. When 6% of the car population in the city would participate in the community platform and 30% of all trips were shared, the cost advantage for a private-car community member would be 940 Euro at a yearly coverage of 12,630 km. Calculating with a cost of 45 Cents per kilometer and a service charge of 5%,

[5] Figures from 2007

a total cost of shared trips of 1,790.75 Euro results. Assuming an average vehicle occupancy ratio of 2.1 persons, the passenger charges payed to the driver would amount to 937.75 Euro[6]. If he has a middle class car, this could be the operating cost of two month for his vehicle [331].

For the community member not using a private car, the platform offers the options of traveling with a pool car of the company or joining an already commuting traveler. This would include private as well as pool cars. Presumably the most convenient option in term of distance will be offered. A commuter who covers a distance of 10,000 km per year would be charged 2,475 Euros when he solely joins private community members. When cars of the sharing-pool are used exclusively, he would pay 3,062.5 Euro[7]. This number is calculated with a cost of 50 Cents per kilometer and an average vehicle occupancy rate of 2.4. Compared to the cost of traveling with a private lower priced car (4,500 Euro for 10,000 km) this would still be a very attractive price.

The community platform would charge a 5% fee based on the total cost of traveling. This fee is shared by the passengers as well. Regarding the above made assumptions, a community platform provider in the Berlin area would generate yearly revenues of more than 58.6 million Euro. Deducting an assumed cost for the IT-Support of 5 million Euro and an operating cost of the pool vehicles of 0.45 Euro-Cent per traveled kilometer, leaves the service provider with gross earnings of 8.6 million Euro in the given Scenario. Hence we conclude the community service platform offering mobility, to be a highly attractive business opportunity.

[6]Including 5% service charge based on the cost of the trip

[7]Both figures including 5% service charge based on the cost of the trip

Assumptions:	Private Cars	Pool Cars	Comments	
People living in Berlin	3.000.000	3.000.000		
Nuber of Cars	1.200.000	5.000	cars per inh.	0,4
Av. Kilometers per Year	12.630	20.000		
Participants	6,00%	100,00%		
Number of Shared Trips	30,00%	50,00%		
Av. Vehicle Occupancy	2,10	2,40		
Cost/Price per Kilometer	0,45 €	0,50 €		
Service Fee (in % of Trip Cost)	5,00%	5,00%		
Turnover of Service Provider per Year	6.138.180 €	52.500.000 €		
Cost of IT-Platform	2.500.000 €	2.500.000 €	€ 5 m p.a.	
Cost of Pool Cars	0	45.000.000 €	€ per km	0,45
Gross Earnings of Service Provider	3.638.180 €	5.000.000 €		
Savings of Private Car Owner	937,78 €	0	Yearly km	12630
Average Cost of Community Member	2.475,00 €	3.062,50 €	Yearly km	10000

Table 10.1: Mobility Platform Business Case Calculations
Source: Own Illustration

10.4.3.3 Liability and Insurance

Only community members who have a driver's license can act as drivers of pool-cars. Passengers can be young people aging between 10 and 18 years with authorization of their parents and persons of age. The passengers have to be older than 10 years to be made liable for damages done to the car according to Par. 828 II BGB. Additionally they need the authorization of their attorney as they have only limited ability to enter into a contract (Par. 106 BGB). Of course they would also need a telecommunications provider and a verified bank account. For ethic reasons we set the minimum age to 14 years.

Drivers have to be registered at a central community office. As the car owner is always to be made liable for any damages done to man or property (Par. 7 I StVG), the insurance company of the private car community member and the one of the community platform company is liable. Nevertheless the violation of law done in traffic which results in fines and official registering, will always be charged to the driver (Par. 21-27 StVG). This principle holds for either case, the privately held car drivers and the pool-car drivers. If a pool-car is fined for a law violation, the responsible driver is charged a fee and is downgraded in the driver-evaluation of the community platform. A fine of a privately held car is covered by the driver. For any missed or late pick-up of a requesting traveler, the driver cannot be made liable, but it will result in a downgrading of his platform profile as well.

The type of insurance of private community member's cars is decided by the car owner. It will be displayed on the community platform as a part of the member's profile. All pool-cars have a comprehensive insurance. The cost is covered by the kilometer charges. If there a several cases of damage done to the car by the same driver, it will result in a downgrading of his community profile.

10.4.4 Value Added Services

So far we have presented our product idea focusing on organizing car-based mobility more effectively by building up a dynamic ride-sharing community and offering company-owned car sharing vehicles. Additionally to this core idea, our service can be enhanced by a wide range of value added services.

One possibility would be the combination of our ride-sharing community with a multimode navigation tool like it is presented by the Navigation Team. Thus, it would become possible to enter the personal route or destination in one's multimode navigation tool. A central platform would match each request and finally offer a wide range of transportation means including the own car, public transport but also ride-sharing options. Both products would therefore ideally complement one another.

Another opportunity opens up by integrating location-based marketing services. As the community members have to be tracked in any case to be able to take part in the service, their location can furthermore be used to recommend nearby petrol stations, garages or restaurants. Ideally, these adds are personalized as far as possible by considering the available user profiles and preferences as well as context-sensitive information such as the current petrol level of a user's car.

10.5 Conclusion

This report demonstrates how trends in technology and society can determine future and open up progressive business opportunities. It identifies six stable drivers and three key drivers. The evolution of the latter is very uncertain. Consequently, three possible scenarios are created according to specific key driver developments. We chose the third scenario of “Seamless Mobility” as a basis for our product idea in the field of community services relating to the service-centric car 2020. As it is the technologically most advanced and sociologically most interesting scenario, a great success of our product is highly supposedly in this environment.

A great demand of over 18 m possible users is shown in the market analysis and the profitability is demonstrated with a business model calculation for the city of Berlin. The concept and visualization are shown to be simple and effective. Hence we consider our social community platform offering ubiquitous real-time mobility, to be the most efficient means of transportation in the future. It will surely become a very strong supplement to the private use of cars as well as public transport.

In the other scenarios of “Hampered Innovation” and “Chaotic Innovation”, the implementation of the product will not be that easy. The possible lack of mobile Internet coverage, the missing attitude of people towards ride-sharing and not enough Internet enabled OBUs and end devices certainly limit the progress of our mobility platform. Nonetheless, its advantages in price of transport, convenience and positive social interaction will also open growth opportunities in the less favorable scenarios. It would certainly have to concentrate on the major cities in the beginning.

For the implementation of the mobility platform, large initial investments are needed. Additionally, a very good front-loaded marketing campaign is necessary, as the efficiency of our platform highly depends on a critical mass of participants. But as there are huge profits and social as well as environmental benefits created by launching this platform, there will be governmental aid and the interest of strategic and financial investors.

Hence we see SMART as an effective system to ensure tomorrow's individual and social mobility.

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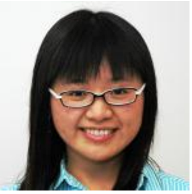

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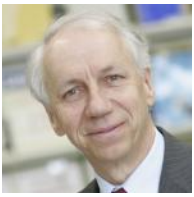

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