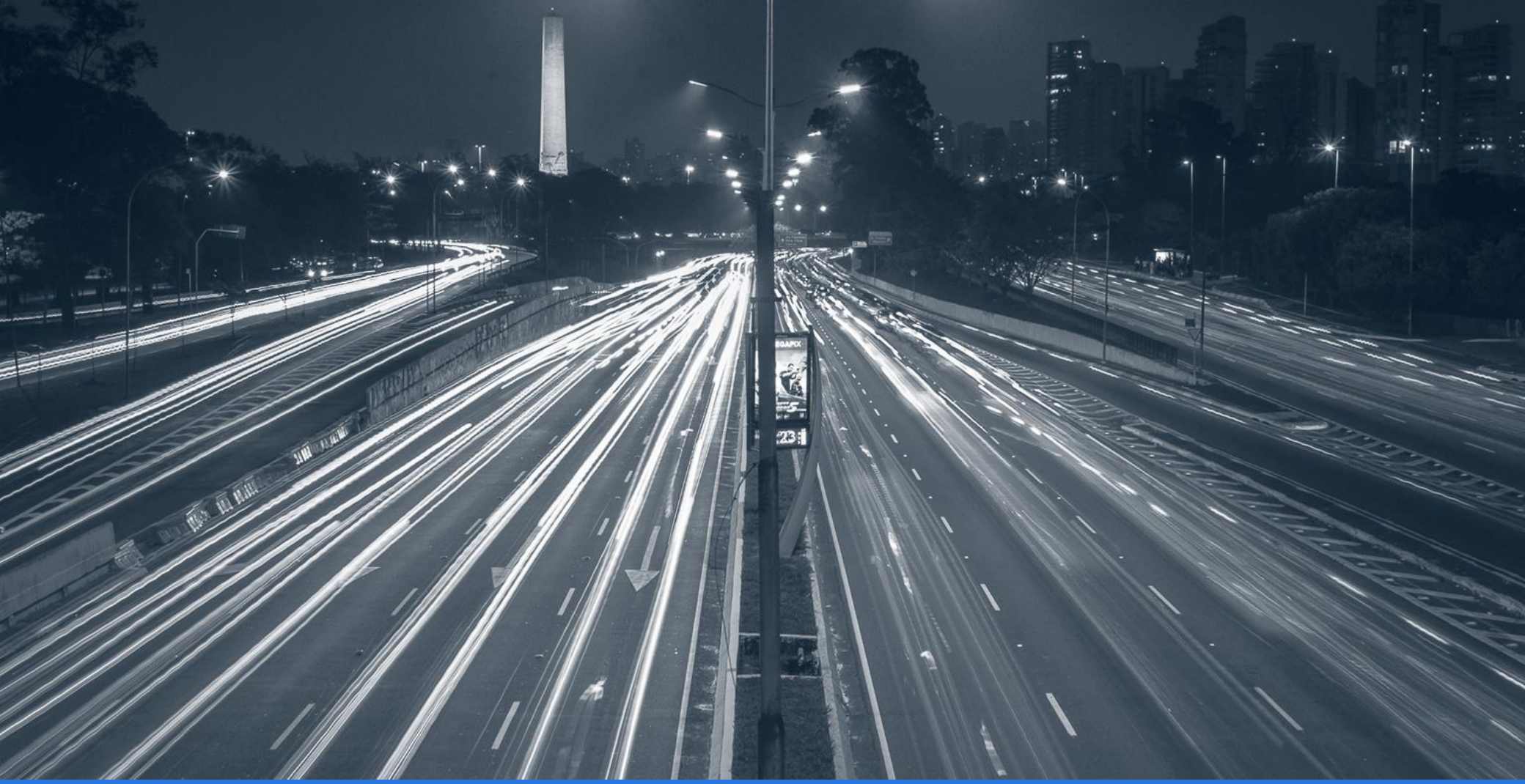

CONNECTED CAR

Market report, March 2017

statista

CHAPTERS

Connected Car Overview.....3

- *Management summary and key takeaways*
- *Global segment performance*
- *Regional development and main drivers*
- *Key player overview and digital development path*
- *Trends*

Connected Hardware.....14

- *Customer benefit, market sizes and future developments*
- *Deep dive: Government legislations, Company profile of the BMW Group, Embedded Telematics*

Infotainment Services.....26

- *Customer benefit, market sizes and future developments*
- *Deep dive: Real-time traffic information, Advanced Navigation features, mobile device integration*

Vehicle Services.....37

- *Customer benefit, market sizes and future developments*
- *Deep dive: Car-related data, Predictive Maintenance, Monetizing opportunities of car-data*

Definitions, About, Imprint.....48

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CONNECTED CAR MARKET

Market Scope

Connected Hardware

- eCall Technology
- Embedded Telematics

Infotainment Services

- Advanced Navigation
- Entertainment
- Comfort

Vehicle Services

- Safety & Security
- Maintenance & Diagnostics

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MANAGEMENT SUMMARY AND KEY TAKEAWAYS FOR THE CONNECTED CAR MARKET

Summary

Increasing internet penetration inevitably leads to **growth of digital services**. This development has also reached the automotive industry. **OEMs[1] equip their cars with multiple digital components,** offering a digital experience and increased driver safety and convenience to their customers. Also, by applying subscription fees for digital services, OEMs aim at getting their slice of that cake too.

In this report, we **define the Connected Car** as a car that has a permanent internet connection based on an **embedded SIM card** (eSIM)[2]. With this underlying definition, we divide the Connected Car market into a **single fee hardware segment** (Connected Hardware) and **subscription based service segments** (Safety & Security, Maintenance & Diagnostics).

From a global[3] perspective, in 2016 more than 10 million newly registered Connected Cars resulted in **27.2 million Connected Cars on roads worldwide**. These cars generated **revenues of US$16.1 billion.**

Comparing the three major car markets, the US, Europe and China, the **US showed highest revenues and the biggest stock of cars** on its national roads.

In the **US**, **10.2m Connected Cars** generated revenues of **US$5.8bn** in 2016. A CAGR[4] of 25.6% to 2021 is expected to further increase revenues to US$18.1bn by then.

Europe was the **second biggest region,** with revenues of **US$5.7 billion**. More than 4.0m newly registered Connected Cars resulted in **10.0m Connected Cars** on European streets. Driven by changes to EU legislation, the number of **Connected Cars** will rise to **80.7m by 2021**.

In 2016, **China** was behind Europe and the US. **2.9m Connected Cars** on Chinese roads generated **revenues of US$1.8bn** in that year. Growth rates are the highest in China and will lead to revenues of **US$16.9bn in 2021**.

Key takeaways – Global market

1. Connected Hardware

Connected Hardware in the form of eCall Technology and Embedded Telematics was by far the biggest segment in 2016. The Connected Car market share of 92.2% corresponded to revenues of US$14.8 billion in 2016. With the predicted CAGR of 37.1% to 2021, revenues will rise to US$71.8 billion by then.

2. Infotainment Services

Infotainment Services, including Advanced Navigation, Entertainment and Comfort services, was the second biggest Connected Car segment accounting for US$1.1 billion in 2016. The average annual growth rate of 49.4% to 2021 is expected to result in revenues of US$7.9 billion in the same year.

3. Vehicle Services

Vehicle Services, which cover Safety and Security as well as Maintenance and Diagnostics subscriptions, accounted for the smallest revenue share in the Connected Car market. Total revenues of US$0.19 billion were estimated in 2016. The growth rate is the biggest in this segment, showing a CAGR of 58.5% to 2021 which is expected to reflect in revenues of US$1.9 billion.

1: OEM = Original Equipment Manufacturer (automobile manufacturer)
2: Connectivity based on mobile device integration is excluded in all numbers.
3: Selected region only includes countries listed in the Digital Market Outlook
4: CAGR: Compound Annual Growth Rata/ average growth rate per year

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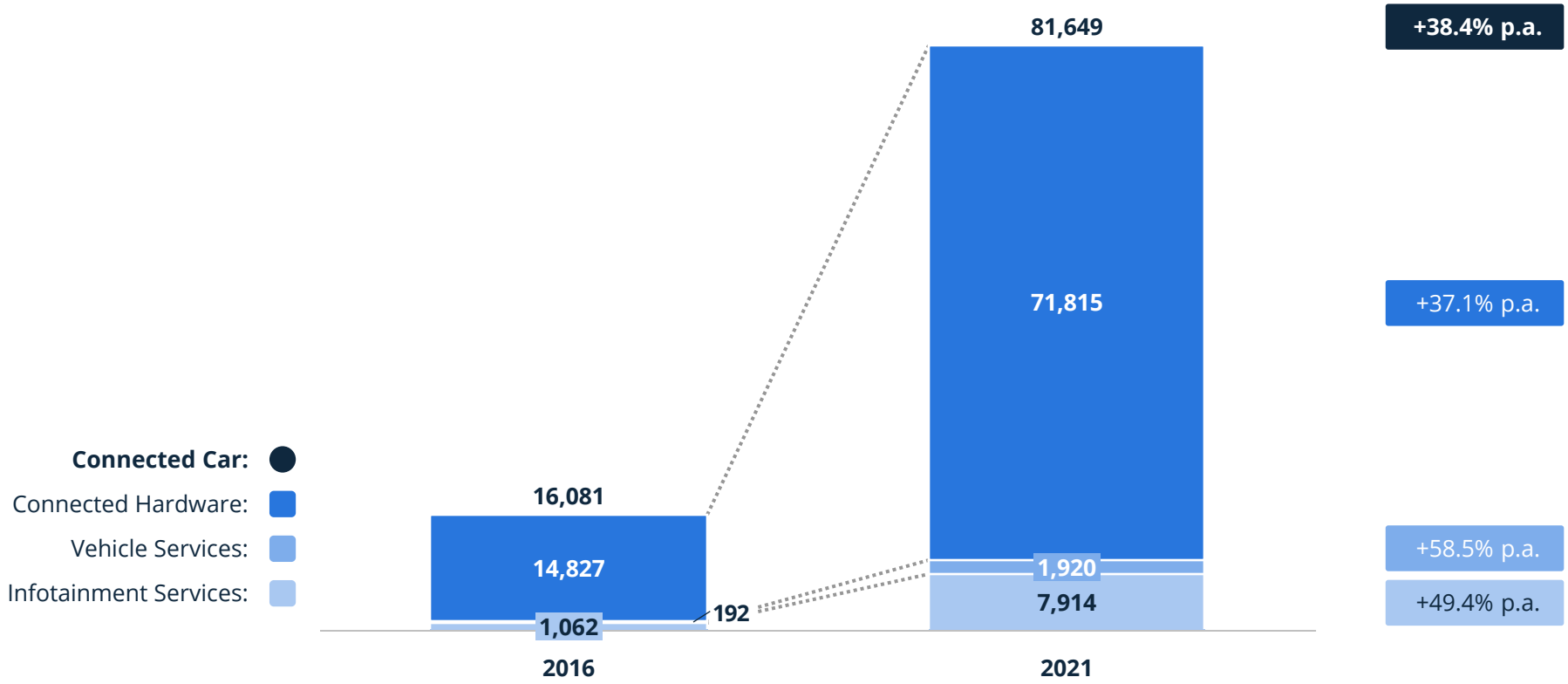
CONNECTED CAR REVENUES FROM '16 – '21

Global segment size and growth rates

Global[1] Connected Car Revenue — *CAGR[2] 16 – 21*

in million US$ by segment



1: Only includes countries listed in the Digital Market Outlook
2: CAGR: Compound Annual Growth Rata/ average growth rate per year
Source: Digital Market Outlook 2016

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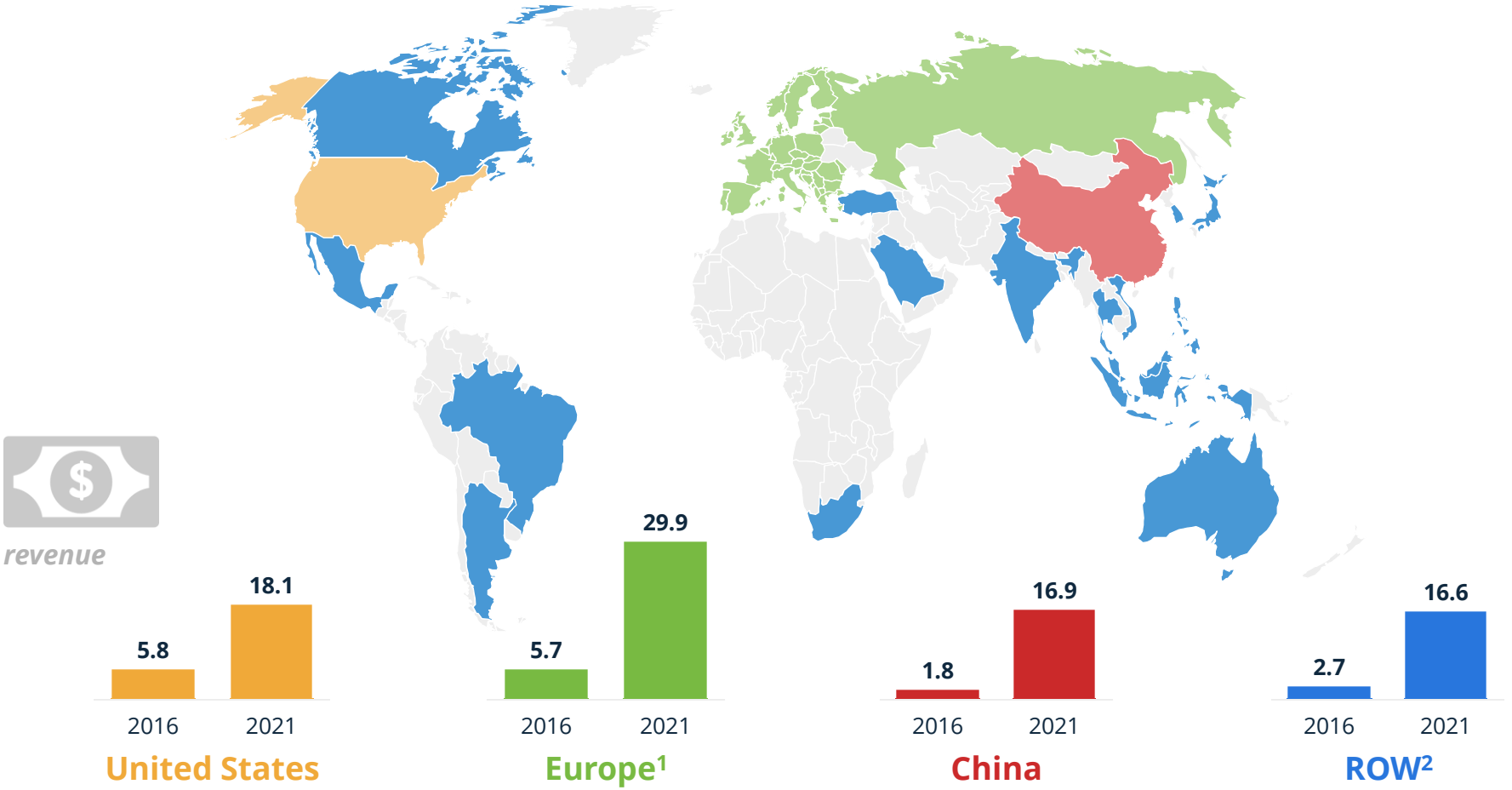
CONNECTED CAR REGIONAL DEVELOPMENT 1/2

Total Connected Car revenue by region in billion US$



1: Outstanding market development is driven by government legislations, for further reading see Chapter "Connected Hardware"
2: Rest of world; selected region only includes countries listed in the Digital Market Outlook
Source: Digital Market Outlook 2016

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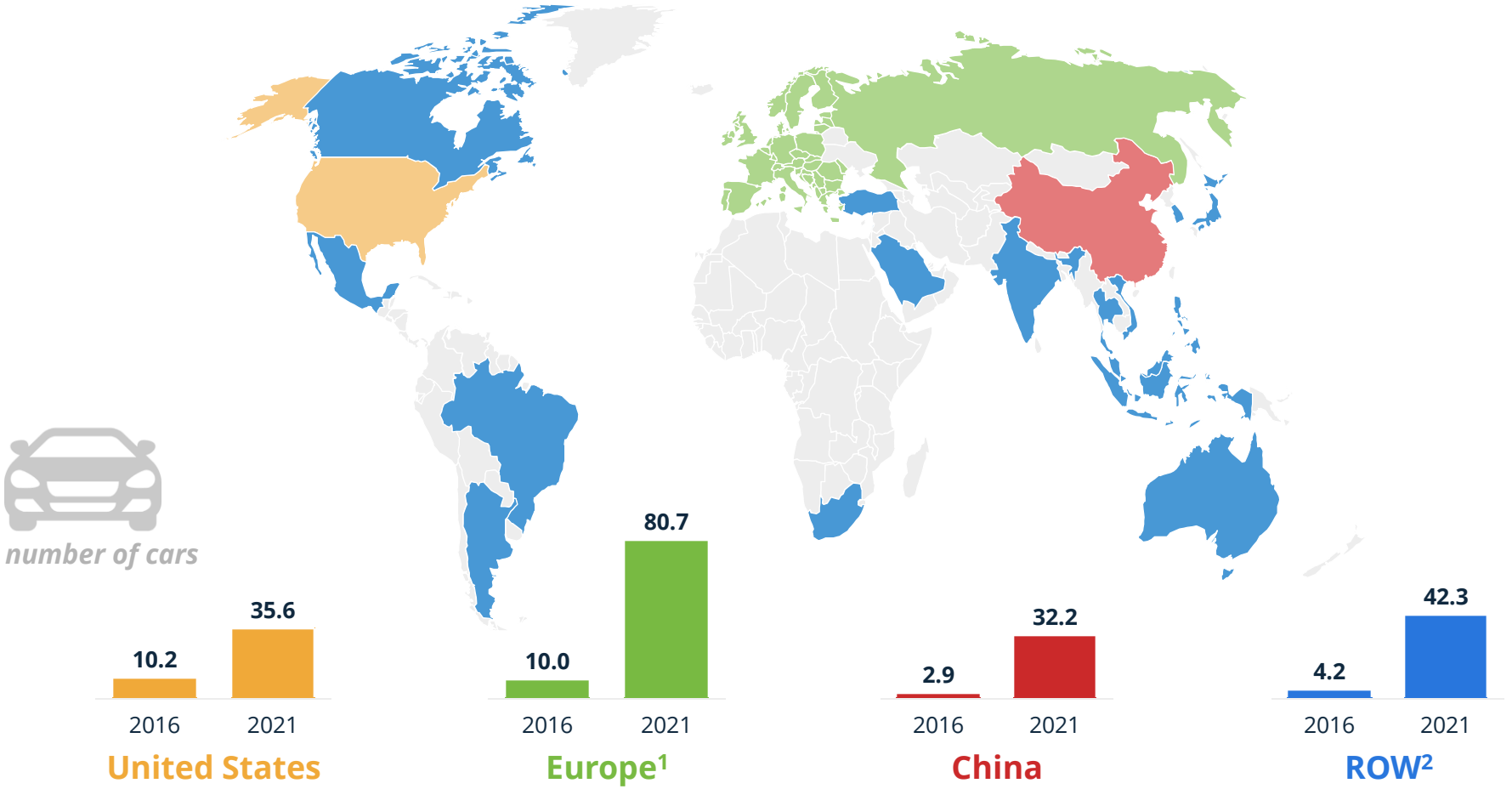
CONNECTED CAR REGIONAL DEVELOPMENT 2/2

Number of Connected Cars by region in million vehicles



1: Outstanding market development is driven by government legislations, for further reading see Chapter "Connected Hardware"
2: Rest of world; selected region only includes countries listed in the Digital Market Outlook
Source: Digital Market Outlook 2016

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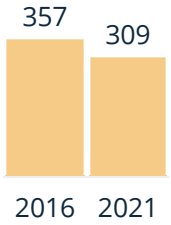
CONNECTED CAR MARKET DRIVERS

Main drivers in regional comparison

United States

Cars / 1,000 inhabitants



Internet penetration[1]

GDP / Capita
US$57,220
Population
323.3m
New Passenger Car Sales
7.82m
Mobile penetration
64.0%
data refers to 2016

Europe[2]

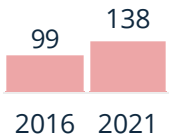
Cars / 1,000 inhabitants

Internet penetration[1]

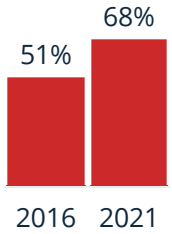
GDP / Capita
US$27,599
Population
671.2m
New Passenger Car Sales
15.3m
Mobile penetration
55.7%
data refers to 2016

China

Cars / 1,000 inhabitants



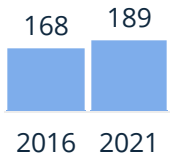
Internet penetration[1]



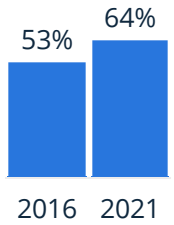
GDP / Capita
US$8,240
Population
1,378.2m
New Passenger Car Sales
22.6m
Mobile penetration
40.9%
data refers to 2016

Global[2]

Cars / 1,000 inhabitants



Internet penetration[1]



GDP / Capita
US$13,216
Population
5,060.2m
New Passenger Car Sales
63.7m
Mobile penetration
38.2%
data refers to 2016

1: Based on the whole population per region using the internet at least once a month
2: Selected region only includes countries listed in the Digital Market Outlook
Sources: Eurostat, World Bank, OECD, Digital Market Outlook

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CONNECTIVITY RELATED SERVICE PACKAGES ARE AVAILABLE AT MOST GLOBAL PLAYERS BY NOW

Representative key players and their digital service programs[1]

Manufacturer	Europe	North America	Asia
	Audi Connect	CHEVROLET OnStar	KIA UVO
	SEAT Connect	Cadillac OnStar	NISSAN Nissan Connect
	Škoda Connect	Jeep UConnect	HYUNDAI BlueLink
	BMW ConnectedDrive	CHRYSLER UConnect	HONDA Honda Connect
	OPEL OnStar	Buick OnStar	TOYOTA Entune
	MyCitroën	GMC OnStar	SUBARU STARLINK
	PORSCHE Porsche Connect	DODGE UConnect	mazda MZD Connect
	Peugeot Connect	Ford SYNC3	MITSUBISHI MOTORS Mitsubishi Connect
	VW Car-Net	TESLA EVE	INFINITI InTouch / Connection
	FIAT UConnect		LEXUS Enform
	VOLVO Sensus Connect		ISUZU Connect World
	LAND ROVER InControl		
	RENAULT Passion for life R-Link		
	MercedesMe		

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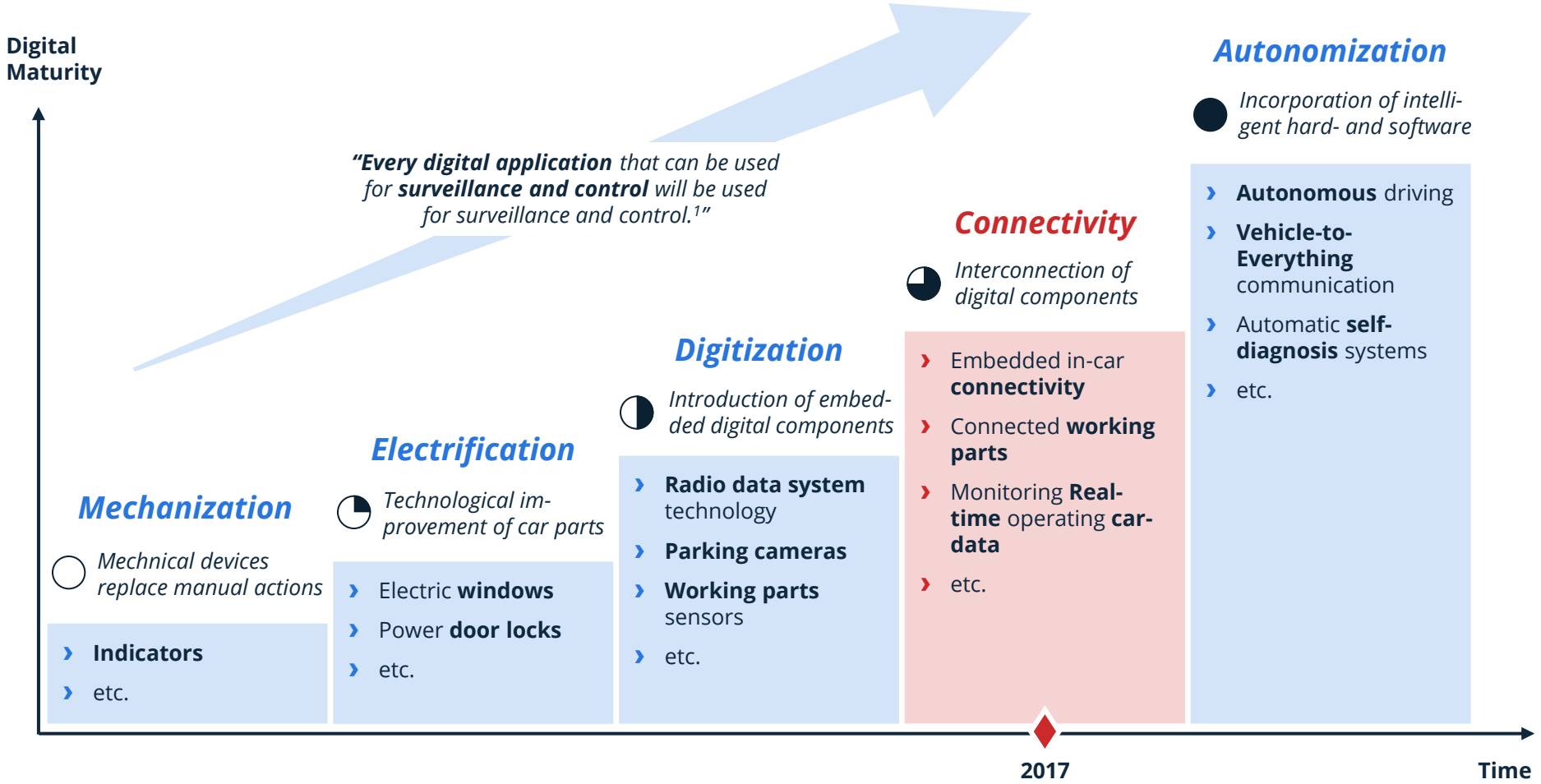
PERVASIVE CONNECTIVITY IS A CRUCIAL STEP ON THE ROAD TO SELF-DRIVING CARS

Gradual automotive development towards autonomous vehicles



1: Following *Zuboff's Laws* about the implications of information technology
Note: Width of bars does not correspond to the actual timeline

ABC Mass market focus
Digital maturity level
Selected focus technologies per stage
Technological status quo in the mass market

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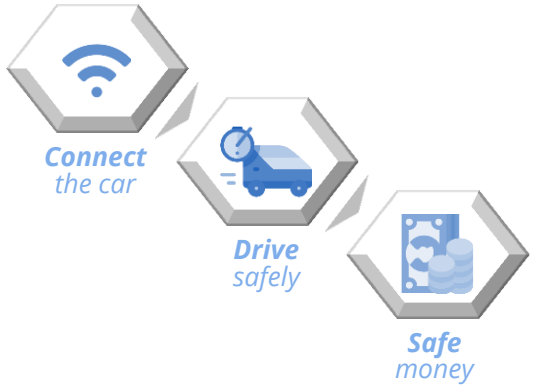
NEW BUSINESS MODELS EMERGE, BENEFICIAL FOR DRIVERS AND INDUSTRY PLAYERS ALIKE

Connected Car trends by segment and solution type (1/2)

Usage-based insurance



Pay-as-you-drive and **Pay-when-you-drive** policies are beneficial to customers and insurers alike.

For policy holders, **transparency about their driving habits** will likely result in **optimized insurance policies**. Utilizing driver-specific data enables the calculation of individual policies, based on the extent of using a car (when you drive) and individual habits (how you drive). **Safe and responsible drivers** will profit from **reduced risk premiums**, as their behavior and time spent behind the steering wheel is transparent to insurers.

Insurance companies in contrast can offer more **personalization in the form of customized policies**. A higher risk premium could be imposed for bad or irresponsible drivers as they cause more accidents and hence more insurance claims.

Once a critical mass for these policies has been reached, **huge spillover is expected**. When driving habits are transparent and insurers extensively reward drivers accordingly, competitors need to follow, as they would other wise be left with the "expensive" policy holders.

Smart Home and business model integration

Lately, a growing number of services **integrating digital technologies from other industries** has emerged.

For example, Tesla and its EVE Connect bring **Smart Home control into the car**. Connected dashboards enable remote control of e.g. thermostats or lights while driving. **Devices can also be automatically controlled**, dependent on certain events, e.g. the car leaving / entering a certain area. Not only would this mean convenience for the customer but also money and energy saved.

Another business model that has been discussed and is being tested via some pilot projects is **trunk / boot delivery**. OEMs like Audi, Volvo and Mercedes have partnered with e-Commerce or logistics players like Amazon or DHL in order to **improve and smarten the delivery process** for the customer. For more convenient delivery purposes, the Connected Car grants access to the trunk / boot of a car to the delivery person for a certain time frame. The customer will **receive ordered items at the car's location without being present**.

Source: nowcar.com

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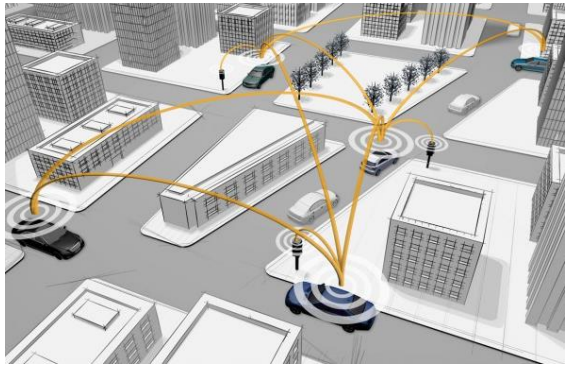
MOBILITY CONCEPTS BASED ON V2X-COMMUNICATION ALREADY LIE IN WAIT

Connected Car trends by segment and solution type (2/2)

Vehicle-to-Everything communication

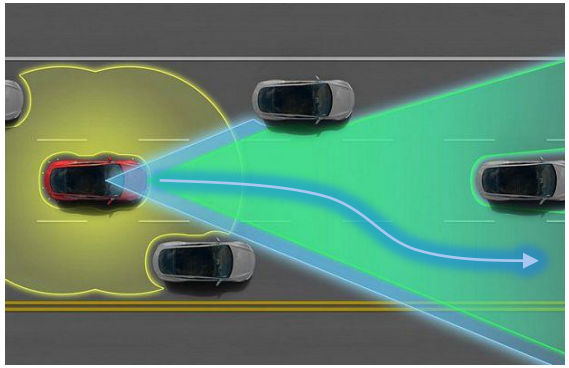


In the future, technologically advanced cars are expected to be equipped with nearly **200 connected sensors**. Combined with the inevitably growing number of connected cars on the roads, **interconnection** of car components will not only take place inside cars but also between cars and their environment – the so called **Vehicle-to-Everything communication** (V2X-communication).

Connected cars will **share data** with each other, e.g. geolocation, current speed, braking torque, and with traffic infrastructure. Hence, **urban traffic management will be optimized** and driving a car will be much safer. Due to V2X-communication, unnecessary red lights on intersections, rear-impact crashes or those with pedestrians or cyclists could be avoided, just to name a few examples.

However, with pervasive V2X-communitcation,, **technology only assists**, but does not replace the driver. With regard to safety improved, technology will "only" advise in the form of alerts or initiated actions. **The actual action is still dependent on the driver**, corresponding to the received information.

Autopilots and Self-driving cars



Autonomous driving is a concept that has not yet reached the mass market. However, the question is not *if* this is going to happen but *when*.

Self-driving car technology is another huge step utilizing vehicle connectivity. Some OEMs, like Tesla or Audi, have already achieved tremendous progress in this field of technology. Going **beyond V2X-communication**, with self-driving cars the next or maybe even the **last stage of driver assisting technology will be reached**. Instead of only giving advice, cars will take over the action.

Based on **intelligent hard- and software** and **extensive vehicle interconnection with the environment**, there will be no more need for drivers to have the steering control. Technology is expected to cause less errors, as well as crashes, hence increasing **road safety.**

Nonetheless, there remains one important yet **unsolved issue: accountability**. As long as it remains unclear who is in charge for errors or malfunctions causing a (severe) crash, autonomous cars will not enter the automotive mass market.

Source: mercedes-benz.com, tesla.com

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CONNECTED CAR: CONNECTED HARDWARE

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CHAPTERS

Subject

Connected Car Overview.....3

Connected Hardware.....14

- *Customer benefit, market sizes and future developments*
- *Market KPI comparison by region in charts and tables*
- *Key Takeaways*
- *Deep dive: Government legislations, The BMW Group, Embedded Telematics*

Infotainment Services.....26

Vehicle Services.....37

Definitions, About, Imprint.....48

Essentials

The global[1] market was worth US$14.8bn in 2016 with 10.0 million new Connected Cars added

Potential is huge due to a growing number of vehicle owners and increasing demand for in-car connectivity

The US was largest single market with revenue of US$5.2bn

China had the highest revenue growth with a 55.0% CAGR[2]

80.7 million Connected Cars will be driving on Europe's roads by 2021

OEMs collaborate with companies in other fields in order to create new, connectivity based business models

Legislations regarding connectivity standards will boost in-car connectivity pervasion in the EU, Russia and Brazil

AI[3]-software might replace conventional touch-interfaces

1: Only includes countries listed in the Digital Market Outlook

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CONNECTED CAR MARKET

Market focus on Connected Hardware

Connected Hardware

- eCall Technology
- Embedded Telematics

Infotainment Services

- Advanced Navigation
- Entertainment
- Comfort

Vehicle Services

- Safety & Security
- Maintenance & Diagnostics

Focus Segment Other Reports

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CONNECTED HARDWARE INCREASES PASSENGER'S DRIVING SAFETY AND PLEASURE

Customer benefit

The definition of a **Connected Car** from our perspective is a car that has a permanent internet connection based on an **embedded SIM card** (eSIM). The **Connected Hardware market** in this report covers all hardware products, enabling connectivity and is divided into two segments: **eCall Technology[1]** and **Embedded Telematics[2].**

eCall Technology is characterized by a permanent, but only basic in-car connectivity. It enables the automated initiation of an **emergency call** or supports **locating a stolen car**. Dependent on further arrangements with retailers or OEMs, owners can subscribe to additional security and maintenance services. **Embedded Telematics** in contrast are more sophisticated devices which act as the interface between car and driver. Touchscreens or head-up displays facilitate the use of infotainment services and online apps.

Connected Hardware enhances the driver's and passenger's safety before and after an accident. The **automated eCall** for example **shortens the time** until rescuers reach crash sides. It can further provide **information** with regard to coordinates or in certain cases the number of affected people. The incorporation of this technology in newly registered cars is or will be mandatory in many countries by law.

Embedded Telematics generate **driver specific added value**. They create a more interesting and convenient **driving experience**. Drivers and passengers can control internet based content like real-time traffic information (RTTI) or media streaming via a user-friendly control panel. In this case, the content is not dependent on a mobile device, as it is an inherent part of the Connected Car.

Another benefit is likely to take off in the future, should insurance companies use driver data profiles comprehensively to optimize and **personalize insurance quotes** and **policies** (e.g. pay-when-you-drive and pay-how-you-drive).

Market size

Global[3] revenue in the **Connected Hardware** market was **US$14.8bn** in 2016. The major share of revenue in this market corresponded to Embedded Telematics. In Europe, these systems cost between US$900 and US$3,000, depending on the new car prices, and were much more expensive, than the basic eCall Technology, which was available for approx. US$400. Of course, actual prices showed country-specific variations in all countries covered, due to price levels and currencies.

Comparing the three biggest car markets, the **US**, **Europe** and **China** and their global shares, **Europe** was **the biggest market** for Connected Hardware in 2016.

In **Europe**, the number of Connected Cars grew to 10.0m vehicles in 2016. With **4.0m newly registered Connected Cars** in this year, revenue of **US$5.3bn** was generated in the Connected Hardware market. Germany was the biggest single market with US$1.8bn revenue and 3.0m Connected Cars.

Second biggest market was the **United States** with revenues of **US$5.2bn** in 2016. There were **2.6m Connected Cars newly registered,** leading to 10.2m Connected Cars on US roads in total. The US is considered a pioneer with regard to in-car connectivity, as GM has already been offering its OnStar in the US market since the mid 90s.

The **Chinese** Hardware market showed revenue of **US$1.7bn** in 2016. The **1.3m newly registered Connected Cars** led to a total number of 2.9m Connected Cars in this year. These lower values compared to the mature markets had their origin in numerous facts. The Chinese car market for example was still emerging and OEMs did not offer the same features and services as they did in western markets. Also, in Europe and the US the share of premium value cars of all newly registered cars was much higher. In this segment, connectivity adaption was higher than in the lower price segments.

1: Every car with eCall Technology is permanently equipped with an eSIM and considered as a Connected Car
2: Cars equipped with an additional, connected Embedded Telematics system are a subset of all Connected Cars
3: Only includes countries listed in the Digital Market Outlook

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IN-CAR CONNECTIVITY IS A MAJOR DRIVING FORCE IN THE GLOBAL AUTOMOTIVE INDUSTRY

Future developments

The **outlook** for in-car connectivity of all kinds reveals huge potentials. A **CAGR[1] of 37.1%,** leading to a **revenue of US$71.8bn** in 2021, is expected in the Connected Hardware market.

Looking at the three major regions again, the **Chinese** Connected Hardware market has the biggest growth rates. A **CAGR of 55.0%** will result in **revenues of US$15.5bn** in 2021. Due to this growth rate regarding Connected Hardware, the **number of Connected Cars** will increase to **32.2m** by then.

Although being a mostly mature car market, huge growth rates can also be observed in **Europe.** With a **CAGR of 37.5%, revenue of US$26.1bn** will be generated in 2021. In terms of **Connected Cars** on Europe's streets, **80.7m** in total are expected by 2021, compared to only 10.0m in 2016. A significant share of this development roots in the EU Parliament's approved eCall regulation, which will come into effect in April 2018.

Double-digit annual growth rates of **24.1% are expected** in the **US** Connected Hardware market. US drivers want their cars to also support their so-called "always on" experience, and are therefore eager for embedded connectivity. This explains a market size of **US$15.3bn** and a total of **35.6m cars being connected** by 2021.

Next to alternative propulsions, the sharing economy and autonomous driving, in-car connectivity is one of the **major driving forces** in the automotive industry. When eCall Technology becomes mandatory in numerous countries, many OEMs will most likely utilize this development to sell more of their expensive Embedded Telematics systems. This is likely as the technology for its functionality already exists in form of eCall and eSIM. OEMs are then complying with governments' regulations and also incorporate features in order to try to differentiate from competitors in a maturing industry.

Assumptions and sensitivity

Baseline of our model is the global[2] development of **passenger car sales**. We expect sales to keep following their recent growth path in emerging economies and only experience moderate market growth in developed economies.

Another assumption is that **OEMs** unchangingly **promote in-car connectivity** all over the world.

> *"In-car connectivity is going to be an as strong argument to the customer's buying decision as it is a car's design or brand."[3]*
>
> *Harald Krüger, CEO of BMW AG (2015)*

Future Embedded Telematics will perform more functionalities and enable countless webbased services and completely new business models. This improvement is supported by **expanding 5G** coverage which is enhancing bit rates.

We further assume all approved **government regulations** in this context coming into effect as planned. However, here is some uncertainty left, as regulations in Russia and Brazil have already been postponed in the past. It is furthermore possible that more countries will establish safety laws utilizing in-car connectivity. This may lead to yet unpredictable shifts in the market development.

Our model additionally depends on the **driver's willingness to pay** for in-car connectivity. The development cycles of passenger cars and mobile devices differ, as the latter one's is much shorter. If mobile device technologies and applications outperform those of in-vehicle ones, drivers might prefer using their mobile device inside their cars, e.g. utilizing Apple CarPlay or Android Auto.

Moreover, concerns centered around **data security**, e.g. motion profiles or remote access, become increasingly important. If these issues should be neglected in the future, drivers may avoid embedded in-car connectivity for data security and privacy reasons.

1: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21
2: Only includes countries listed in the Digital Market Outlook
3: Source: IAA 2015 (English translation)

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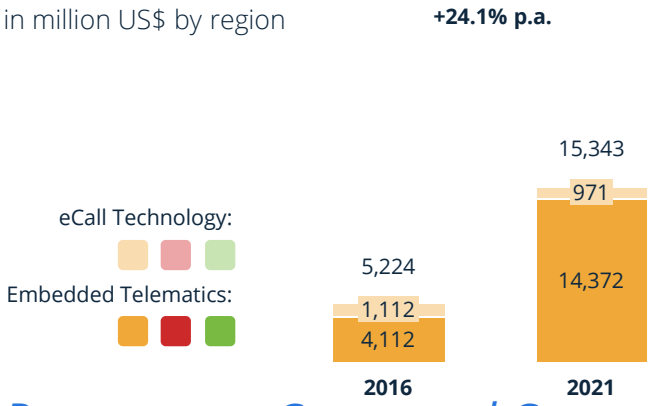
CONNECTED HARDWARE IN MAJOR REGIONS

Market KPI comparison by region

United States

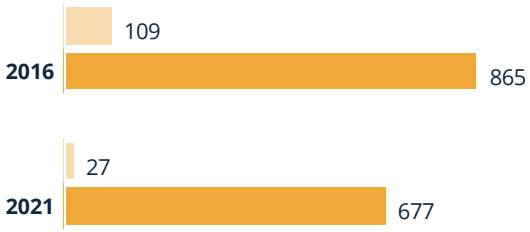
Revenue forecast

in million US$ by region

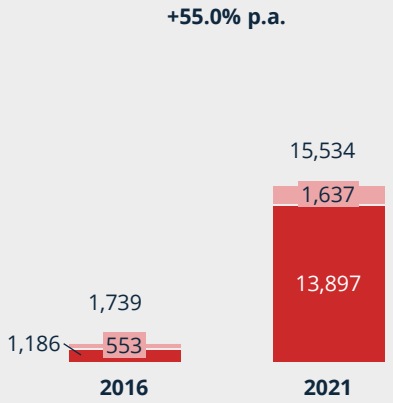


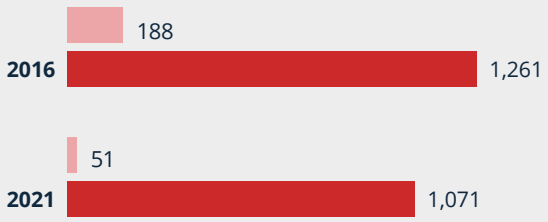
Revenue per Connected Car

in US$ by region

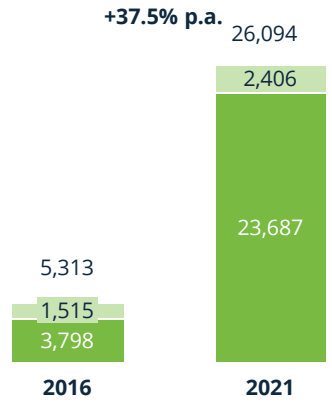


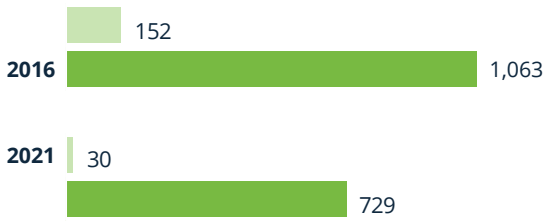
China





Europe





Source: Digital Market Outlook 2016

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CONNECTED HARDWARE IN MAJOR REGIONS

Market KPI comparison by region

Revenue

Segment	Unit	United States 2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21	China 2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21	Europe 2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21
Total:	mUS$	5,224	7,304	9,765	12,059	13,954	15,343	+24.1%	1,739	2,852	4,594	7,248	10,994	15,534	+55.0%	5,313	8,261	16,066	20,454	23,388	26,094	+37.48%
eCall Technology:	mUS$	1,112	1,325	1,390	1,233	1,059	971	-2.7%[2]	553	850	1,111	1,264	1,412	1,637	+24.2%	1,515	2,211	3,753	3,265	2,662	2,406	+9.70%
Embedded Telematics:	mUS$	4,112	5,979	8,375	10,827	12,895	14,372	+28.4%	1,186	2,002	3,483	5,984	9,582	13,897	+63.6%	3,798	6,049	12,314	17,189	20,726	23,687	+44.21%

*Connected Cars**

Segment	Unit	2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21	2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21	2016	2017	2018	2019	2020	2021	CAGR[1] 16 – 21
eCall Technology:	m	10.2	13.6	18.2	23.6	29.5	35.6	+28.5%	2.9	5.1	8.8	14.3	22.0	32.2	+61.4%	10.0	16.7	30.6	46.9	63.6	80.7	+51.95%
Embedded Telematics:	m	4.8	6.8	9.5	13.0	16.9	21.2	+34.9%	0.9	1.6	2.8	4.9	8.1	13.0	+69.0%	3.6	5.8	10.4	16.7	24.1	32.5	+55.52%

* Cars equipped with eCall Technology correspond to the TOTAL number of Connected Cars;
cars equipped with an additional Embedded Telematics system are a subset of all Connected Cars

1: CAGR: Compound Annual Growth Rate/ average growth rate per year
2: Revenue expected to decline as the strongest adoption phase is over and the market by then will be mainly driven by replacement sales
Source: Digital Market Outlook 2016

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KEY TAKEAWAYS BY REGION

Market sizing subjects for Connected Hardware

	United States	China	Europe
Market size	› With US$5.2bn and a global[1] share of 35.2% it was the second biggest region with regard to total revenue › Embedded Telematics generated most of the market value with US$4.1bn and a share in this segment of 78.7% › 2.6m newly registered Connected Cars led to 10.2m Connected Cars in total	› Smallest of the three major regions in 2016 with a revenue of US$1.7bn and a global share of 11.7% › Major share of revenue in the segment corresponded to Embedded Telematics with 68.2% and US$1.2bn respectively › Total number of Connected Cars was 2.9m with 1.3m new Connected Cars	› Biggest of the three major regions accounting for 35,8% of global revenue corresponding to US$5.3bn › 71.5% of the Connected Hardware value worth US$3.8bn respectively was generated with Embedded Telematics › 4.0m new Connected Cars led to 10.0 Connected Cars on European streets
Growth rate	› Smallest major region by 2021 with a CAGR[2] of 24.1% and a revenue of US$15.3bn › Global market share is expected to decrease to 21.4% › Cars being connected show a CAGR of 28.5% and amount to 35.6m in 2021	› High double-digit growth rate expected with a CAGR of 55.0% and a revenue of US$15.5bn in 2021 › Global market share will rise to 21.6% › Number of Connected Cars is expected to grow to 32.2m by 2021 corresponding to a CAGR of 61.4%	› Biggest major region with a revenue of US$26.1bn in 2021 and a CAGR of 37.5% in the same year › Compared to 2016, global market share will slightly increase to 36.3% › Number of Connected Cars will reach 80.7m by 2021, corresponding to a CAGR of 52.0%
Trend signals	› OEMs focus more on online service development than on incremental hardware improvement, e.g. Smart Home integration or Mobile Payment › Connectivity related recording of driver data encourages more and more insurance companies to provide data based policies	› Expansion of connectivity offerings due to Chinese drivers' demand for embedded connectivity and their willingness to switch car brands for better connectivity features › Domestic OEMs partner with tech-companies in order to outperform traditional OEMs in the connectivity race	› Premium OEMs focus on technology improvement regarding Embedded Telematics, e.g. incorporation of virtual reality and smartphone integration › OEMs collaborate with companies in other fields in order to create new, connectivity based business models

1: Only includes countries listed in the Digital Market Outlook
2: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21
Source: Digital Market Outlook 2017

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GOVERNMENT LEGISLATIONS

Regional and national connectivity related requirements

eCall (European Union[1])

In 2014, the European Parliament approved a legislation affecting the entire automotive industry in order to enhance safety on Europe's roads. By March 31st 2018, every newly registered car throughout Europe has to be equipped with an automated emergency call system (**eCall**). Based on this legislation, the number of road fatalities in Europe is supposed to be reduced by 10% p.a..

To perform and ensure full operability of the automated eCall in case of a severe accident, OEMs need to equip all new cars with numerous different technology-parts. These specific parts are:

- Control device
- Aerial
- GPS-receiver
- Accident sensors
- Manual button
- Backup power supply
- Database
- Microphone and speaker

A vehicle equipped with the above mentioned can collect all accident related data (time, location, severity, type of car and propulsion as well as number of affected people) and send the eCall to the Europe-wide standard emergency number 112. Incoming eCalls will be classified as high-priority calls in order to reduce response time and accelerate on-site operations of rescue forces. The underlying satellite navigation system is the Galileo system.

With regard to data security and concerns about privacy issues, the technology does explicitly not record any kind of motion profile of a car or may pass any information to third parties.

ERA-GLONASS (Russia)

The Russian counterpart to the European eCall legislation is the **ERA-GLONASS Accident Emergency Response System,** which came into effect in January, 2017. The installation of the ERA-GLONASS navigation communication terminal is intended to reduce the rescuers' time-to-arrival at an emergency scene and improve the provided information in case of an accident. In contrast to the European eCall, the Russian system is compatible with the national satellite navigation system GLONASS, which is an alternative system to GPS and has been released to civil use in December 2006.

SIMRAV[2] (Brazil)

The Brazilian government has been trying to deal with the huge problem of vehicle theft for several years. With the law initially passed in 2007, nationwide known as **CONTRAN 245/07 legislation**, all newly registered cars, regardless of being manufactured in Brazil or imported, are required to be equipped with an anti-theft system. This system is supposed to track, localize and remotely immobilize vehicles in case of robbery. Although the deadline for its implementation has been postponed for a couple of times, new guidelines intend the legislation to come into effect in a gradual process. By March 2017, 50% of new vehicles and by July 2017 every new vehicle sold in Brazil must be equipped with such a technology device.

1: Declaration of intend has also been signed by Iceland, Norway, Switzerland and Turkey
2: Sistema Integrado de Monitoramento e Registro Automático de Veículos
Source: europarl.europa.eu, glonassunion.ru, denatran.gov.br

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CONNECTIVITY IN THE MASS MARKET

Pioneer: The BMW Group

Facts

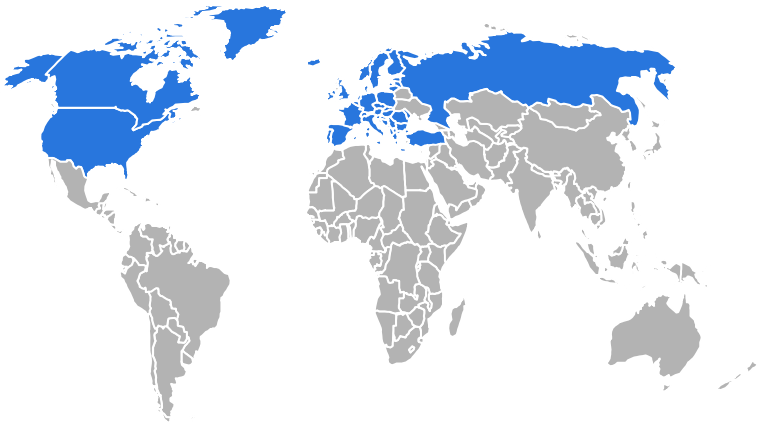
Revenue:	US$102.3 billion
CAGR 06-15:	7.27%
Vehicle Sales :	2.25 million
Connectivity ratio:	95% of new cars
Employees:	122,244
Headquarters:	Munich, Germany
Founded:	1916

Figures referring to fiscal year 2015

ConnectedDrive

The Bayerische Motorenwerke AG is one of the **leading companies** when it comes to **in-car connectivity**. Next to their technology leading Embedded Telematics systems, which are available and widely distributed in all vehicle types and trim levels, their **ConnectedDrive** package offers multiple connectivity based services. These include particular vehicle related services, e.g. remote control, as well as services focusing on the driving experience, e.g. real time traffic information or media streaming. Customers can simply chose a specific service via the BMW online store and customize their desired service package on a modular basis.

Availability[1] BMW ConnectedDrive



Analyst opinion

In-car connectivity is a main driving force in the automotive sector and of huge relevance. There is growing evidence that drivers are not shy of changing brands for connectivity related features.

Against this background, BMW is very well positioned as they have been **promoting in-car connectivity** from technology and service perspective for many years.

Furthermore, collaborations with tech companies reveal their strategy to further **connect mobile devices** and services with each other in order to create a **seamless connectivity experience**, regardless of a particular device. Paragons of this are the planned **Cortana[2] integration** and the availability of Amazon Prime Now and Apple CarPlay in most of BMW car types.

1: Coverage of 45 markets; actual availability depends on trim level and specific services
2: Digital smart assistant from Microsoft
Source: bmwgroup.com

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EMBEDDED TELEMATICS: CRITICAL APPRAISAL

Current technology level and the question of the actual customer benefit

Continuous technological development

When looking at the current technology level of Embedded Telematics in the mass market, again BMW appears as one of the leading manufacturers. Current generations of Embedded Telematics systems enable drivers to control particular functions with simple gestures. Cameras recognize when the driver swipes or points in an area above the center console. Based on these gestures the car will realize, if the driver wants to take a call or go ahead with navigation, just to name a few functionalities.

When applied correctly, the **Gesture Control System** is expected to **avoid the driver's inattentiveness** and to ensure the direction of sight to the street. This would improve the **passengers' safety**.

Critics centered around the added value

Without any doubt, connectivity will disruptively change the automobile industry. There is also no denying that improvements in Embedded Telematics technology will also enable new opportunities.

While OEMs are insistent on further developing Embedded Telematics, the actual benefit for customers is questionable. The main function they carry out is to control software. The added benefit by doing this via a hologram instead of a touchscreen, as presented at this year's CES, appears to be minor. **Especially when AI, in the form of smart virtual assistants, is introduced as standard equipment in cars, the improvement brought about by touch technology may become obsolete.**

Source: bmwgroup.com

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Incorporation of AI-software will replace conventional touch-interfaces

In-car virtual personal assistants

Automotive OEMs and technology companies alike have been trying to make cars much smarter for several years. Although huge progress can be observed on both sides, a massive obstacle has existed for a long time: as **technologies were developed separately**, it is difficult to merge them and make them compatible with each other. This paradigm changing would be the key to developing more, smarter and more device-independent services.

In this context a **shifting mindset**, especially from automotive sight, can now be observed. The willingness to integrate virtual personal assistants into new cars will offer new services and moreover new business models.

For example, in the future, Renault-Nissan will incorporate Microsoft's virtual personal assistant **Cortana into new Nissan cars**. Voice controlled Cortana, which can also be **connected to Office 365**, may assist with infotainment and productivity enhancing tasks inside the car, e.g. scheduling based on the Outlook calendar, alternative routing due to RTTI[1], automated personalization of in-car settings, controlling of entertainment software etc.

"When you enter the vehicle, Cortana could act as your doorway to a wide range of services to make your life easier and your drive more exciting ."

Ogi Redzic, Senior Vice President, Connected Vehicles and Mobility Services at Renault-Nissan Alliance (CES 2017, Las Vegas)

When AI in the form of virtual assistants will be installed into new cars as a standard, the car industry will change disruptively. Especially in light of autonomous driving, cars will likely transform into the so-called "third space", next to home and office, where people enjoy spare time and can also be productive.

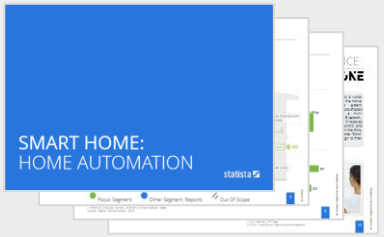
Virtual personal assistants

A virtual personal assistant is a voice recognition software that is incorporated into a technology device, e.g. smartphone, personal computer or car. The software is equipped with a human voice. It interacts with its owner, respectively user, via voice control and can hence understand questions or commands and may respond or execute a task accordingly. The software is able to learn, is "always on", and enables the execution of automated tasks without the user being present at the area of activity.

For further reading

Our report **"Smart Home: Home Automation"** is having an in-depth look at the overall market and functionalities of home automation as well as virtual assistant technologies.

Excerpt: *The use of Home Automation systems is made much easier by the integration of smart assistants and contributes to the intuitive management of the Smart Home. This puts an end to the complicated configuration and operation of devices using graphical user interfaces....*



1: Real-Time-Traffic-Information
Source: nissannews.com, microsoft.com, Digital Market Outlook 2016

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CONNECTED CAR: INFOTAINMENT SERVICES

statista

CHAPTERS

Subject

Connected Car Overview.....3

Connected Hardware.....14

Infotainment Services.....26

- *Customer benefit, market sizes and future developments*
- *Market KPI comparison by region in charts and tables*
- *Key Takeaways*
- *Deep dive: Real-time traffic information, Advanced Navigation features, mobile device integration*

Vehicle Services.....37

Definitions, About, Imprint.....48

Essentials

Global[1] market size was US$1.1bn with 13.2 million service subscriptions in 2016

Global potential is huge with a 49.4% CAGR[2] to 2021, due to a growing pervasion of embedded in-car connectivity

US market was the biggest in 2016 with US$513.7m revenues

China shows the biggest growth rates with a CAGR[2] of 66.4%, exceeding revenues of USD$1.1bn by 2021

With US$3.0bn, Europe will be the largest market in 2021

Interest in mobile and in-car connectivity leads to further development of merging experiences (e.g. adds for local coupons or augmented reality for point-of-interest discovery)

Real-time data improves the quality of navigation

OEMs increasingly offer device-overlapping features

Apple's and Google's mobile device integration solutions threaten revenue sources of OEM-developed services

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CONNECTED CAR MARKET

Market focus on Infotainment Services

Connected Hardware

- eCall Technology
- Embedded Telematics

Infotainment Services

- Advanced Navigation
- Entertainment
- Comfort

Vehicle Services

- Safety & Security
- Maintenance & Diagnostics

Focus Segment Other Reports

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INFOTAINMENT SERVICES WILL BE A KEY REVENUE SOURCE IN THE AUTOMOTIVE MARKET

Customer benefit

The ongoing maturity of the car industry and technology convergence will lead to an inevitable rise of Connected Cars, and subsequently further pervasion of connectivity in the automotive sector.

> *"We are at the start of a new era of technology convergence and hyper-connectivity."*
>
> *Chung Eui-sun, Vice Chairman of Hyundai Motor, (CES 2017, Las Vegas)*

These days, the car is more than just a machine driving people from one place to another. In fact, the car has developed into a **moving space for everyday activities**. Drivers' car buying decisions are shifting towards value-adding technology and services. Expectations center around media continuity across devices, personalization, and context awareness.

Taking a close look at for example navigation services, drivers nowadays want more than simply be navigated from A to B. Internet connectivity is bringing **real-time information** into the car, from traffic-information via alternative routing to learning software. These functionalities result in active driver support, may generate added value and increase the ease of driving a car.

Also, the car is further developing into a securer and more convenient space than ever before. Embedded Telematics systems contain a lot of those applications that drivers and passengers are already utilizing in their spare time. **Media streaming** subscriptions for example are increasingly replacing classic in-car radio, as on-demand streaming online content is more personalized and passenger-centric.

In addition, when the installation of **virtual assistants**, e.g. Echo[1] or Cortana[2] will take off, productivity related services are likely to do as well. Cars will then develop into rolling offices, where e-mails and administrative tasks can be performed over voice control while driving.

Market size

The market for Infotainment Services, including the segments Advanced Navigation, Entertainment and Comfort Services was worth **US$1.1bn** with **13.2m subscriptions globally**[3] in 2016. **Biggest segment** was Advanced Navigation with a revenue of **US$641.0m** and **7.7 million subscribers**.

It needs to be considered that the number of subscriptions in Infotainment Services in total does not equal to the number of Connected Cars subscribed to Infotainment Services. Here, overlappings have to be taken into account, as an owner of a Connected Car is very likely to a be subscriber in more than one particular segment of Infotainment Services.

When comparing the major regions, the **US**, **China** and **Europe**, the **US** had the **highest revenue** and **most subscriptions** in 2016.

The **US** Infotainment market in total showed a **revenue of US$513.7m** and **5.6 million subscriptions** in 2016. The major revenue share in the US market with 59.8% corresponded to Advanced Navigation with a revenue of US$307.1m.

Second biggest region was **Europe** with **4.6 million subscriptions** and **a revenue of US$336.3m** covering all three market segments. Advanced Navigation services accounted for US$200.1m which corresponded to a share of 59.5% of the European market for Infotainment Services.

The **Chinese** market was the smallest of the major regions in 2016, generating a **revenue of US$88.9m** and approx. **1.0 million subscriptions**. These considerably small numbers are rooted in the lack of in-car connectivity-based online service provisions of many OEMs in China. In the near past, proprietary OEM connectivity-based Infotainment Services were mainly offered in the huge developed markets in Europe and North America where connectivity and network coverage had been pervasive for a longer time.

1: Digital smart assistant from Amazon
2: Digital smart assistant from Microsoft
3: Only includes countries listed in the Digital Market Outlook

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THE PROSPECT IS POSITIVE BUT WILL BE AFFECTED BY THIRD PARTY SOLUTIONS

Future developments

The future **prospect** for in-car connectivity related Infotainment Services shows high **double-digit growth** rates in the three major regions and the three segments Advanced Navigation, Entertainment and Comfort Services. From a global[1] perspective, the overall **market size** is expected to result in **106.7 million subscriptions** and with **revenues of US$7.9 billion** in 2021. Advanced Navigation services account for the highest revenue shares in all three major regions.

A comparison of the **US**, **Europe** and **China** will reveal **Europe** as the biggest region in 2021, when it comes to Infotainment Service subscriptions as well as revenue.

The **European** market projection in total shows **42.9 million subscriptions** and a market worth **US$3.0bn** in 2021. Although being a mature automotive market, the **average annual growth rate** to 2021 will be **55.3%**. The global market share will rise to 38.3% from 31.7% in 2016. This development is in particular fueled by the European eCall legislation[2], which will come into effect in April 2018.

Although **China** is expected to remain the **smallest of the three** regions, the market is developing very fast and shows the highest growth rates regarding revenue and number of subscriptions. The market is expected to generate **revenues of US$1.1bn** in 2021, which corresponds to a **CAGR[3] of 66.4%** to this year. As a result, the Chinese global market share will increase to 14.3%, from only 8.4% in 2016.

With a **CAGR of 35.5%** to 2021, the **US** market shows a considerably lower growth rate than Europe or China. The US share in global Infotainment Services revenue will decrease from 48.4% in 2016 to 29.6% in 2021. Nonetheless, the number of **subscriptions** is expected to reach **29.1 million,** generating a **revenue of US$2.3bn** with Infotainment Services in the US market in 2021.

Assumptions and sensitivity

Infotainment services are one of the hot topics when it comes to after-sales revenue sources and value added services in the automotive market.

> *"We are currently at an inflection point within the auto industry, where the passenger experience is becoming just as important to consumers as speed and performance."*
>
> *Michael Mauser, President, Lifestyle Audio at Harman (CES 2017, Las Vegas)*

However, if and moreover to what extent the automotive OEMs are going to gain a profit from services for a better driving experience, highly depends on the development of **aftermarket** and respectively **third party solutions**.

Drivers prefer infotainment services that are as comprehensive and good as they are on their mobile device; easy to control, seamlessly integrated into their car and in the best case they are already familiar with them. Their willingness to pay for additional in-car services is expected to depend on the above mentioned factors. To name only an example: If real-time navigation of Google's competitors TomTom or Here does not remain competitive compared to Google Maps, which comes at no charge, it will not be easy for OEMS to get their customers to subscribe to their own proprietary, fee required navigation services.

Furthermore, due to the expected increasing competition in fields like advanced or real-time navigation and media streaming, prices for these services may even decrease despite a still growing overall market. The development for navigation services is also affected by the OEM's ability to accelerate Vehicle-to-Vehicle-Communication. If there is a comprehensive technology ready for the market, navigation services will undergo a radical change.

1: Only includes countries listed in the Digital Market Outlook
2: For further reading, see the Statista Report "Connected Car: Connected Hardware"
3: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21

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INFOTAINMENT SERVICES IN MAJOR REGIONS

Market KPI comparison by region

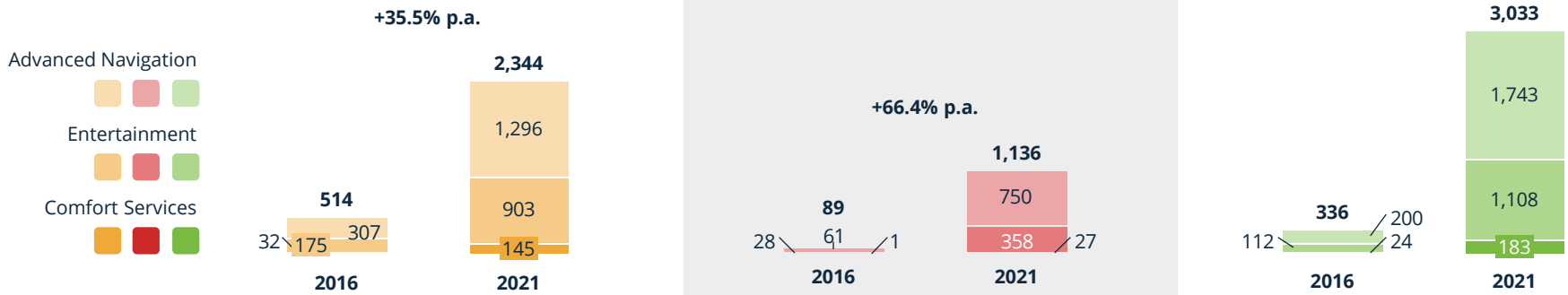
United States

China

Europe

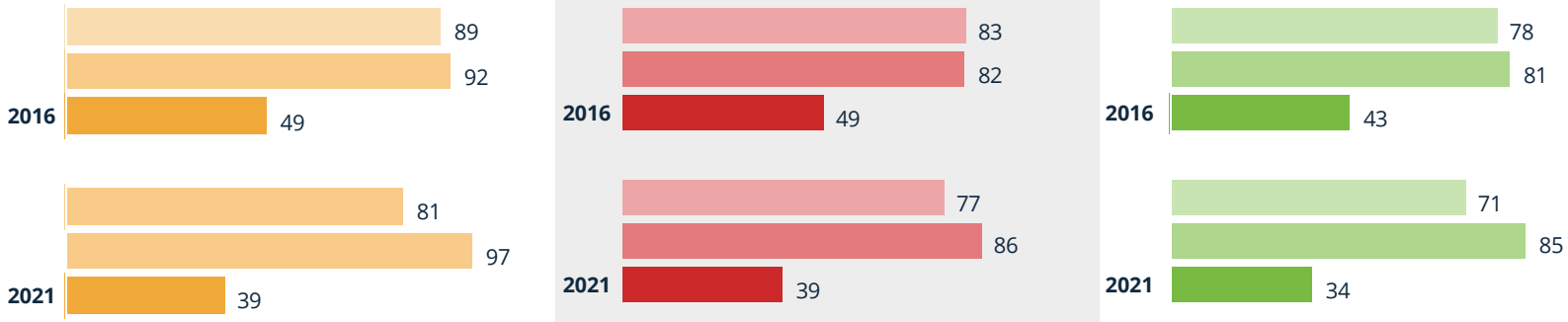
Revenue forecast

in million US$ by region



Revenue per Connected Car

in US$ by region



Source: Digital Market Outlook 2016

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INFOTAINMENT SERVICES IN MAJOR REGIONS

Market KPI comparison by region

Revenue

		United States							China							Europe						
Segment	**Unit**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**
Total	mUS$	514	763	1,081	1,457	1,882	2,344	+35.5%	89	154	266	451	735	1,136	+66.4%	336	572	1,028	1,614	2,284	3,033	+55.2%
Advanced Navigation	mUS$	307	449	624	824	1,051	1,296	+33.4%	61	106	182	307	493	750	+65.5%	200	337	604	941	1,321	1,743	+54.2%
Enter-tainment	mUS$	175	264	385	536	711	903	+38.8%	28	47	80	136	226	358	+66.8%	112	194	353	567	819	1,108	+58.0%
Comfort Services	mUS$	32	50	72	97	120	145	+35.6%	1	2	4	8	16	27	+114.1%	24	40	71	107	144	183	+50.1%

Connected Cars

Segment	**Unit**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**
Advanced Navigation	m	3.4	5.1	7.2	9.9	12.9	16.0	+36.1%	0.7	1.3	2.2	3.8	6.2	9.7	+67.7%	2.6	4.4	8.0	12.9	18.4	24.6	+57.3%
Enter-tainment	m	1.9	2.8	4.1	5.6	7.4	9.3	+37.4%	0.3	0.6	1.0	1.6	2.6	4.1	+65.0%	1.4	2.4	4.3	6.8	9.7	13.0	+56.6%
Comfort Services	m	0.6	1.0	1.6	2.2	3.0	3.7	+41.9%	0.0	0.0	0.1	0.2	0.4	0.7	+124.1%	0.6	0.9	1.7	2.8	4.0	5.3	+57.2%

1: CAGR: Compound Annual Growth Rate/ average growth rate per year
Source: Digital Market Outlook 2016

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KEY TAKEAWAYS BY REGION

Market sizing subjects for Infotainment Services

	United States	China	Europe
Market size	› 5.6 million subscriptions in the Infotainment Services market generated revenues of US$513.7m in 2016 › Advanced Navigation was the biggest segment with a revenue of US$307.1m › US market share accounted for 48.4% of the global[1] market size	› Smallest of the three regions in 2016 with regard to revenue and subscriptions › 1.0 million subscriptions generated a revenue of US$88.9m › With regard to the global market share, the Chinese market accounted for 8.4%	› Second biggest region in 2016 with a revenue of US$336.3m and 4.6 million service subscriptions › Biggest segment was Advanced Navigation with 2.6 million subscriptions and a revenue of US$200.0m › The global market share corresponded to 31.7%
Growth rate	› Revenue is expected to grow to 2021 with a CAGR[2] of 35.5%, and subscriptions at 36.1%. › Advanced Navigation will remain biggest segment with a revenue share of 55.3% in the domestic market › Highest growth is projected in Comfort Service subscriptions with 41.9% CAGR	› Fastest growing major region to 2021 with a CAGR of 66.4% in revenue and 67.7% in subscriptions › Revenue will exceed US$1.1bn in 2021 with Advanced Navigation being biggest segment with US$750.2m › Global market share will increase to 14.3% in Infotainment Services in total	› Biggest major region in 2021 with a global market share of 38.3% › Market is expected to grow in revenue and subscriptions with a CAGR of 55.2% and 57.3% respectively › Biggest segment will be Advanced Navigation with 13.0m subscriptions generating US$1.7bn revenue
Trend signals	› Interest in mobile and in-car connectivity leads to further development of merging experiences (e.g. adds for local coupons or augmented reality for point-of-interest discovery) › Global technology players' third party software is more extensively incorporated into new Connected Cars	› Increasing number of OEMs and technology companies offer Infotainment Services in the Chinese market › New, domestic players rise and compete with foreign OEMs	› Car manufacturers collaborate with technology companies in order to generate added value and integrate mobile devices › Automatic sharing of traffic-specific data and road-conditions between connected vehicles

1: Only includes countries listed in the Digital Market Outlook
2: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21
Source: Digital Market Outlook 2017

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ADVANCED NAVIGATION FEATURES 1/2

Real-time data enhances navigation quality and offers new services

Real-time traffic information

Of all lately developed trends regarding navigation services, **real-time traffic information** is probably the most prominent and has the greatest lever for improved navigation.

When looking at the former **TMC-based navigation systems**, the shortest or fastest way from departure to arrival point was calculated, depending on what the user preferred, and the route was only updated when traffic news were transmitted via radio data. The **accuracy was rough** and the systems were not able to **consider events** as they occurred.

The quality of navigation in general is dependent on the extent and quality of available data to calculate the route. When drivers use navigation systems which are connected to the internet and able to process real-time data, the **quality of routing and navigating will increase**.

The functionality of real-time navigation is as follows: In order to guide the driver to the selected destination in the fastest or shortest way, dependent on what the driver prefers, the **initially calculated route will be updated permanently on the basis of real-time data**. Most connectivity based navigation systems rely on multiple data sources, e.g.

- GPS-navigation systems
- Smartphones / cellular signals
- Fleet management devices
- Road sensors

The collected data is anonymized, processed, steadily updated (e.g. every two minutes), sent to the connected navigation system and utilized to permanently optimize the route, if applicable. The driver will be informed about traffic jams and alternative routes as soon as possible. Hence, this avoids waiting time.

German OEMs' acquisition of HERE

With the pervasion of Embedded Telematics enabling Advanced Navigation services in most of new premium value cars, access to reliable and accurate map data is becoming more and more important for OEMs.

Therefore, in 2015 an alliance of **German premium car brands[1] acquired** one of the biggest providers of map data in the world, for an approx. US$3.0bn,: **HERE**.

HERE is widespread especially in mature car markets. It provides digital map data for more than 190 countries.

The acquisition secures the involved OEMs **independence from Google data**, the biggest competitor in this field, and also avoids the transmission of vehicle data to third parties.

Vehicle-to-Vehicle-Communication

In a project that is scheduled for the first half of this year, HERE-equipped vehicles will start **communicating with each other**.

The data which certain in-car devices e.g. street sign cameras, rain sensors or braking systems, collect will be anonymized and automatically shared with other vehicles equipped with HERE's software. In this way, drivers will be informed about icy roads or black ice, temporary speed limits or the end of traffic jams before reaching relevant road passages.

This technology again relies on embedded connectivity. It will further improve passenger-safety and **prevent road users from accidents caused by circumstances which other drivers were already aware of**.

1: Audi, BMW, Mercedes-Benz
Sources: cio.de, sygic.com

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ADVANCED NAVIGATION FEATURES 2/2

Alternative route guidance, on-site assistance and device communication

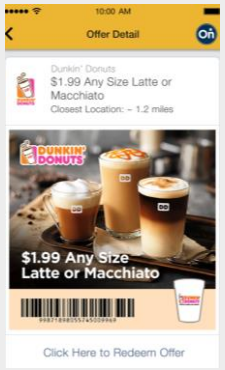
Picturebook Navigation

Audi's Picturebook Navigation allows all customers to enter any destination into the Embedded Telematics systems in the form of a digital picture which contains geolocation information. If an Audi Connect customer finds a photo on the internet or receives a picture of a friend, this file can be send directly to the Telematics system via the Audi Connect app. The provided information replaces the classic entry of a destination via the embedded touchscreen.

AtYourService

General Motors' OnStar package is offering an app that connects cars and smartphones to merge road navigation and on-site discovery.

With the AtYourService app drivers can look for interesting spots nearby or browse for specific offers, e.g. discounts in restaurants or retailers. For an additional subscription fee, OnStar customers can furthermore consult an Advisor just by pressing a button in the car. The advisor can then personally help to find points of interest within the locality, and give advice, e.g. book a hotel room.



Remote destination input

Another feature in the Audi Connect service package is the opportunity to plan a trip with multiple stops or even a complete journey on your mobile device or personal computer. The chosen destination and route is then communicated to the car via the Audi Connect app. Once the driver gets into the car, the necessary information is already available and can be selected in the Embedded Telematics systems touchscreen.

Context awareness

In a Microsoft vision, future cars and manufacturers being connected offer potentials which are not yet possible to exploit.

Assuming a car is monitoring its working parts, a service check is required and data is shared with a local manufacturer. Context awareness is coming into effect, when an earlier appointment is spontaneously available and the customer is nearby by chance: The connection between car and manufacturer enables an alert in the car offering this appointment. As a result, there would be an earlier fixed car and no unproductiveness for the manufacturer.

Although this scenario is a long way off, connectivity is clearly setting the direction for this development in after sales services.

Sources: audi.com, onstar.com, techau.com.au, blogs.microsoft.com

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Utilization of third party content

Smartphone integration

OEM-developed connectivity related service subscriptions are affected by the development of third party solutions and their incorporation into new cars, as already mentioned before.

Understandably, car manufacturers want customers to use their technology and accompanied services, as they would be the profiteer of corresponding revenue sources. However, selling points for manufacturers would be limited, if drivers could comfortably utilize services and apps inside the car which are already available on their smartphones.

Nevertheless, **OEMs have no choice than collaborate with technology companies** in order to bring smartphone contents to Embedded Telematics interfaces, as this is what customers increasingly demand. Apps will be mirrored to the touchscreen of the car and can be controlled without touching the smartphone. This means numerous advantages (e.g. well-known GUI[1], available passenger content) for customers and drivers respectively which are of course offset by certain disadvantages, especially a more extensive smartphone dependence.

Against this background it remains to be seen if proprietary OEM-developments or those of third party technology companies will prevail for the utilization of apps, infotainment services and podcasts.

In this context, there is not only **competition between car manufacturers and tech** companies but also **between the big technology** players Apple and Google, as both of them want to be ***the*** provider of seamless device connectivity in the automotive industry. The question of particular interest is also, if OEMs will decide to collaborate with only one of them or incorporate both solutions inside their cars in the long run.

Google (Android Auto) vs. Apple (CarPlay)

Google (Android) and Apple (iOS) are the globally leading providers of smartphone operating systems and biggest competitors when it comes to the connection of cars and smartphones.

Google developed its **Android Auto** to connect Android phones with cars and furthermore partnered with numerous other technology and automotive companies in the **Open Automotive Alliance**. The goal is to develop software in close cooperation.

In contrast, **Apple** wants to keep control over its **CarPlay,** the interface showing Apple contents in the car. It is more or less the iPhone interface extended to the in-vehicle embedded touchpad. The GUI is the same in all cars and does not allow adjustments.

The race for customer data

Alongside the competition for direct revenues from service subscriptions, **access to driver specific big data** will be another lasting competition.

The large scale of the data (e.g. mobility and driving data, movement profiles) is highly valuable to its owners. Considering data security and privacy policies, this data will likely be worth more than a US$100 fee from a direct service subscription.

Third party players like insurance companies or hotels are eager for this data. They enable multiple additional service offerings, e.g. location-based advertising or customized insurance policies. In this context, it is quite obvious that **who owns the data generates the revenue.**

1: Graphical User Interface

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CONNECTED CAR: VEHICLE SERVICES

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CHAPTERS

Subject

Connected Car Overview.....3

Connected Hardware.....14

Infotainment Services.....26

Vehicle Services.....37

- *Customer benefit, market sizes and future developments*
- *Market KPI comparison by region in charts and tables*
- *Key Takeaways*
- *Driving Forces: Car-related data, Predictive Maintenance, Monetizing opportunities of car-data*

Definitions, About, Imprint.....48

Essentials

Customers benefit in cost and time savings as well as less avoidable vehicle breakdowns

The global[1] market was worth US$191.7 million in 2016, as the market is rather cost than revenue driven

Biggest market in 2016 was the US, with revenues of US$78.7 million

With 74.4%, China showed the highest CAGR[2] to 2021

Europe will be biggest market in 2021, showing revenues of US$805.3 million

Number of cars that are capable for proactive maintenance alerts consistently increases (compared to those only describing condition reports)

Real-time analytics and diagnostics will change the maintenance process

Revenues and costs both come with huge potential

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CONNECTED CAR MARKET

Market focus on Vehicle Services

Connected Hardware

- eCall Technology
- Embedded Telematics

Infotainment Services

- Advanced Navigation
- Entertainment
- Comfort

Vehicle Services

- Safety & Security
- Maintenance & Diagnostics

Focus Segment Other Reports

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CUSTOMERS MAINLY BENEFIT IN TERMS OF SECURITY AS WELL AS COST SAVINGS

Customer benefit

The landscape for fee-based, vehicle related service subscriptions covered in this report is divided into **Safety & Security Services** and **Maintenance & Diagnostics**.

The first includes service offerings that assist drivers, subsequently customers, in case of a breakdown. If for example broken working parts or damaged tires need to be serviced, a straightforward process **ensures the handling of the breakdown and continuation of the journey**, e.g. via including a car rental company. Further included are service extras that go beyond an automated eCall and provide additional benefits to driver and customer.

Maintenance & Diagnostics are beneficial to customers in **three different ways**:

Prevent avoidable breakdowns: In the past, maintenance appointments were usually foreseen after driving a certain distance. Recording the actual condition of car parts leads to a maintenance notification as soon as any damage can be expected, even though the distance that would require the next maintenance appointment has not yet been driven.

Cost savings: As working parts are monitored permanently, severe damages causing very expensive repair services (e.g. a breaking V-belt) can be avoided before actually happening.

Time saving: Remote, in essence over-the-air activities, e.g. software updates, make many on-site appointments with manufacturers obsolete. Furthermore, the customer is always driving with the latest vehicle software.

The key for the latter mentioned benefits is once again **big data analytics**. As this topic is a hot one in the Connected Car landscape, further insights regarding in-vehicle, operating data and their transmission will be given in the "Deep Dive" of this report.

Market size

Global[1] **market size** for connectivity based **Vehicle Services** that are liable to costs accounted for **US$191.7 million in 2016**. The major share of approx. 85% of this amount resulted from Maintenance & Diagnostics services, which was a major segment in all regions.

It should be noted that a **significant share of OEMs' vehicle related services come at no charge** or are already included in the purchase price of the car. Some aspects in this field of services are already regarded as mandatory standard equipment. Opportunities to differentiate from competitors are hence quite limited, especially in the premium value segments.

A close look at the three major regions **Europe**, the **US** and **China** with regard to Vehicle Services revealed the **US** as being the **biggest market in 2016**.

The **US Vehicle Services market** was worth **US$78.7 million** in 2016, corresponding to a **global share of 41.0%** in the same year. Maintenance & Diagnostics generated most of the market value, totaling in US$65.8 million. One reason for the high global market share is of course the United States being the home market for GM's **OnStar**, which is one of the leading companies with regard to Connected Car services subscriptions.

Second biggest region was **Europe** with **revenues of US$70.4 million** and an estimated fee-based service subscriptions of approximately 1.5 million in 2016. Europe's global market share accounted for 36.4% this year.

China was the smallest region with regard to market value and service subscriptions. An estimated 0.3 million subscriptions generated **revenues of US$15.9 million in 2016**. This considerably small market can be explained by the limited regional coverage of proprietary OEM service offerings.

1: Only includes countries listed in the Digital Market Outlook

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IN A GROWING MARKET, EUROPE WILL PUSH THE US FROM THE TOP SPOT

Future developments

The expected development in vehicle services is promising from the global[1] perspective. In 2021, total **market volume in this segment** is expected to reach **almost US$1.9 billion**. However, although revenues are growing all over the world, the regional shares are expected to shift.

In the future, the **major revenue share** in this segment will be generated in **Europe**, pushing the US from the top spot. Subscriptions for vehicle related services in the European car market will exceed 20 million and result in a **total revenue of US$805.3 million in 2021**. This corresponds to a global share of 41.9%. By far, most of the revenue will account for Maintenance & Diagnostics services with US$675.2 million.

Second biggest major region, having a global share of 23.7%, will be the **United States** with more than **10 million fee-based subscriptions** in 2021. US subscribers are expected to generate revenues of US$455.5 million in this year, which corresponds to a CAGR[2] of 42.1% from 2016 to 2021.

China remains the smallest of the three regions with **total revenues of US$255.1 million in 2021**. Despite having the lowest revenue in total, China is expected to show the highest average annual growth rate to this year with regard to revenue and registered customers, showing a **CAGR[2] of 74.3% and about 80%** respectively. China's global market share is predicted to increase to 13.3%, from only 8.3% in 2016. These huge growth rates can, as for other car-related service offerings, be explained by the deepening pervasion of OEMs' service offerings in China in general.

However, it should be noted, that car-related services performed OTA[3] and remote included in these numbers do by far not contain **all** services in this field. Their actual extension will be much bigger but will in many cases come at no additional cost or subscriptions to customers.

Assumptions and sensitivity

Key assumptions in our forecasts with regard to the Connected Car development are further **improvements** of the general internet **connectivity infrastructure** (4G pervasion, 5G development) and increasing customer demand for embedded devices, which enable the seamless utilization of this technology in new cars.

In this report, the examined Vehicle Services revenues (vehicle related, connectivity based services of manufacturers) appear to be quite low at first glance. Particularly, when thinking about the US market (home market of GM's 1996 launched OnStar) with its millions of registered subscribers, one would expect much higher figures.

However, many OEM-reported offerings in this field of service are not included in our numbers. For example, **many connectivity based service packages are automatically included** for up to five years when buying a new car and they do not come with any charges. Assumption here is that OEMs want to lower the bar for customers to subscribe to those services and win new customers in this field. Hope is that fee-based services are added to cart or the subscription will be extended after the free "trial version".

Also, we **exclude offerings** based on voice controlled **interaction between driver and a personal assistant**. The way they are utilized (similar to a telephone service) does not correspond to our definition of a connected service**.** Besides, the **industry shift** toward single fee embedded **virtual personal assistants**, such as Microsoft Cortana or Amazon Alexa, further question the potential of monetization via fee-based subscriptions.

What will further boost vehicle and working parts related services that come at no charge is the fact that they **help OEMs to save a lot of money on e.g. product development, quality assurance or marketing.**

1: Only includes countries listed in the Digital Market Outlook
2: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21
3: Over-the-Air; services can be performed without a physical connection to a certain device

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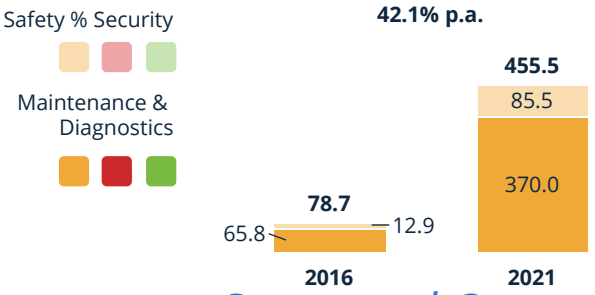
VEHICLE SERVICES IN MAJOR REGIONS

Market KPI comparison by region

United States

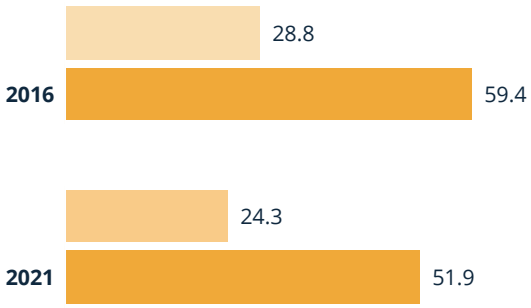
Revenue forecast

in million US$ by region

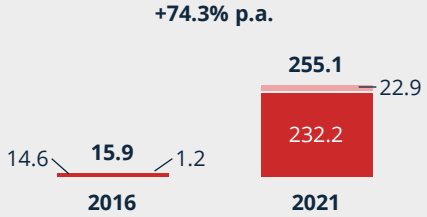


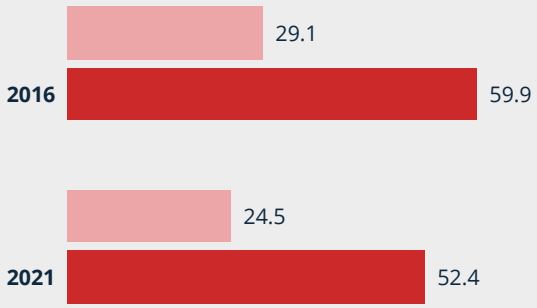
Revenue per Connected Car

in US$ by region

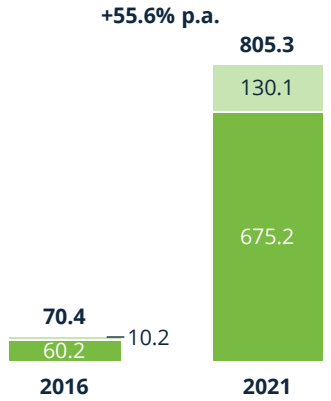


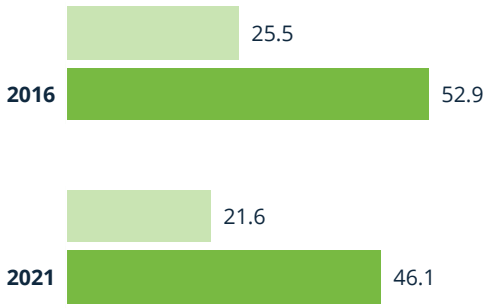
China





Europe





Source: Digital Market Outlook 2016

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VEHICLE SERVICES IN MAJOR REGIONS

Market KPI comparison by region

Revenue

		United States							China							Europe						
Segment	**Unit**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**
Total	mUS$	78.7	127.4	197.3	282.0	370.1	455.5	+42.1%	15.9	32.5	62.5	110.2	175.4	255.1	+74.3%	70.4	132.5	275.3	455.4	635.3	805.3	+62.8%
Safety & Security	mUS$	12.9	22.4	35.8	51.8	68.7	85.5	+46.0%	1.2	2.7	5.5	9.8	15.7	22.9	+79.4%	10.2	20.7	43.8	72.8	102.0	130.1	+66.5%
Maintenance & Diagnostics	mUS$	65.8	105.0	161.5	230.2	301.4	370.0	+41.3%	14.6	29.8	57.1	100.4	159.7	232.2	+73.8%	60.2	111.8	231.5	382.6	533.3	675.2	+62.2%

Connected Cars

Segment	**Unit**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**CAGR[1] 16 – 21**
Safety & Security	m	0.4	0.8	1.3	2.0	2.8	3.5	+51.1%	0.0	0.1	0.2	0.4	0.6	0.9	+85.7%	0.4	0.8	1.9	3.2	4.6	6.0	+72.3%
Maintenance & Diagnostics	m	1.1	1.8	2.8	4.1	5.6	7.1	+45.1%	0.2	0.5	1.0	1.8	2.9	4.4	+78.6%	1.1	2.1	4.5	7.7	11.1	14.7	+66.7%

1: CAGR: Compound Annual Growth Rate/ average growth rate per year
Source: Digital Market Outlook 2016

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KEY TAKEAWAYS BY REGION

Market sizing subjects for Vehicle Services

	United States	China	Europe
Market size	› Biggest single market with revenues of US$78.7 million in 2016 › Global[1] market share was at 40.6% due to a comparably huge stock of Connected Cars on US roads › Major share of revenues corresponded to Maintenance & Diagnostics with US$65.8 million and a share of 83.6%	› Smallest region in 2016 with a total Vehicle Services revenue of US$15.9 million › Only 8.3% of global market share was generated in the Chinese market	› Second biggest region in 2016 with a global market share of 36.7% worth US$70.4 million › 1.5 million subscriptions showed a similar value to the US market › Safety & Security services accounted for 14.4% and were way behind Maintenance & Diagnostics
Growth rate	› Double digit annual growth rates of more than 40% are predicted up to 2021 › Safety & Security Services show higher growth rates due to increasing customer attention	› Highest growth rates of the three major regions with a CAGR[2] of 74.3% in the period between 2016 to 2021 › By 2021, subscriptions exceed 5 million and result in revenues of more than US$255 in the same year	› By far the biggest major region in 2021 with total revenues of US$805.3 million › Main driver is the mandatory eCall legislation which comes into effect in April 2018 › Subscriptions are expected to exceed 20 million by 2021
Trend signals	› Further incorporation of technologies that utilize 4G by the biggest connectivity provider (OnStar) › Increasing number of cars that are capable for proactive maintenance alerts (compared to only describing condition reports)	› Growing number of customers and drivers who are interested in value adding connectivity related services › Customers' increasing willingness to pay for safety features and to switch brands due to better connectivity options	› EU Commission's 5G action plan in order to further increase high speed mobile data transmission › Increasing number of OEMs offering OTA software updates

1: Only includes countries listed in the Digital Market Outlook
2: CAGR: Compound Annual Growth Rate/ average growth rate per year; base years: 2016-21
Source: Digital Market Outlook 2016

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DIFFERENCES IN CAR-RELATED BIG DATA

Overview

General types of car-data

From an overarching perspective, car-related data can be divided into **two different data sources**.

On the one hand, there is **operating data**, **generated from a car itself and its monitored car-sensors (A)**. Operating data excludes all kind of information that is brought into the car by users or passengers. However, with the ongoing trend of vehicle connectivity, the number of connected and monitored working parts is continuously increasing, and subsequently leads to rising amounts of data.

Most interesting is information that contains suspicious values relating to working parts that are stored in the form of a Diagnostic Trouble Code (DTC). Many DTCs have been diagnosed in the past and the solutions are stored with OEMs and repair shops. However, there still is a huge number of problems which have not yet been clearly diagnosed. In this case, the code indicates which car parts in particular are affected and should be examined. Typically, the code is read via the OBD[1]-II interface. In this context, frequency, amount and type of data recorded and stored vary between OEMs.

On the other hand, there is **information about vehicles from manufacturers, retailers and repair shops (B).** Generally speaking, this information is expected to be quite structured (compared to much of the real-time operating data). It relates to specifics of the cars, like engine or fuel type.

Also, historical data, especially when combined from multiple repair shops, contains useful information with regard to past issues. Hence, when a DTC is read out, the solution to this problem might already be apparent to the mechanic.

It is quite obvious that the more structured and integrated data is available, the better is their utilization and incorporation in predictive processes.

(A) – Operating data

- Recorded in **real-time**
- Related to the **actual condition** of the car / working parts
- Stored as **Diagnostic Trouble Code**
- Indicating **defective functions** and their origin
- Baseline for in-car **alerts**
- Referring to actual **car-usage** (only where applicable)

(B) – Retailer and repair shop data

- **Historically** stored
- **Structured** nature
- Containing **vehicle specifics**, e.g. engine and fuel types, year of construction, vehicle section
- **Infers relationships** to DTCs[2]
- Collected and separated per **product series**

Processes performed inside the car

Processes performed outside the car

1: On-Board Diagnostics
2: Diagnostic Trouble Code

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Utilizing car-related big data

A shift towards real-time decisions

In the future, the most advanced connected cars will be extensively equipped with **three features**, which are expected to change the whole maintenance process:

- **Connected working parts**
- **Computing power**
- **Learning ability**

Traditionally, service appointments are scheduled according to a certain distance travelled. The mechanic reads out operating data and the car will be checked or repaired accordingly. However, such a static process leaves many gaps for avoidable car failures. Here comes **predictive maintenance based on big and real-time data** into effect.

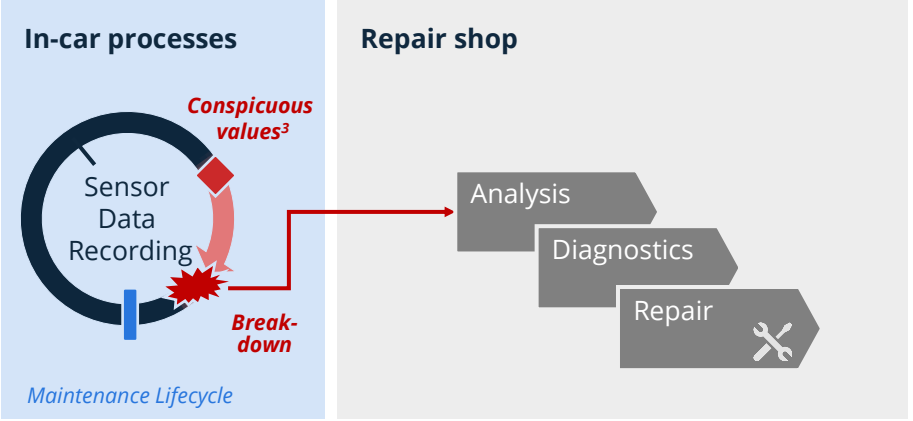
In use, connected working parts produce massive amounts of data[1]. Analytics and diagnostics are permanently performed inside the car. Hence, **decisions and corresponding actions** are based on the car's real-time condition. This leads to **smart handling of irregularities,** which have not already caused failure, as an alert is sent immediately, even if a defective function is only expected to occur.

When cars will further incorporate **historical data** by retailers and repair shops, identify **recurring patterns,** infer **relationships,** and share all generated **insights** again, diagnostics will become even more precise and predictive.

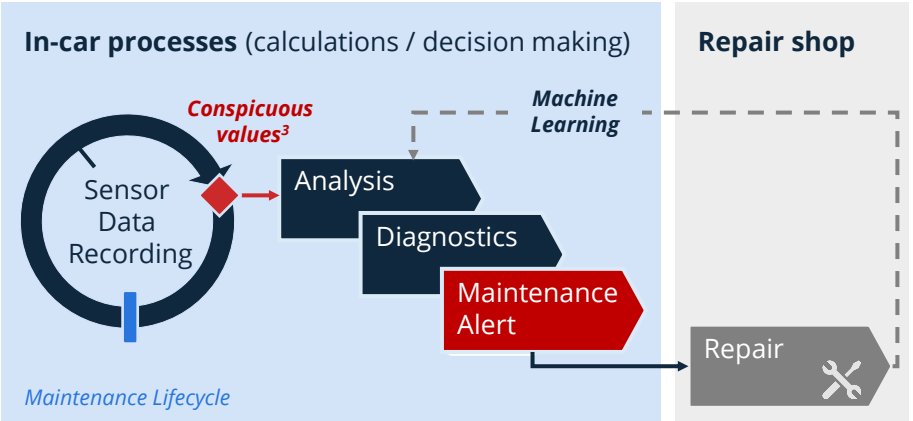
Nevertheless, in order to do so, cars need a lot of computing power and **smart management** of all available data. This is because the amount of data is too big as all of it could go to the cloud.

Also, disregarding the customers' willingness to pay extra money for such services, OEMs will likely pursue this technology anyways, as **"the new oil"[2]** is of such **great value to them**. And despite any privacy concerns, customers may benefit from the utilization of vehicle-data, too.

Traditional Maintenance process



Predictive Maintenance process



Processes performed inside the car

Processes performed outside the car

1: McKinsey predicted connected cars creating 25 gigabytes of data per working hour
2: "Data is the new oil. It's valuable, but unrefined it cannot really be used […]." Clive Humby, UK Mathemetician (2006)
3: In the form of a Diagnostic Trouble Code (DTC), a numerical code for identified defective vehicle functions

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BENEFIT OPPORTUNITIES FOR MANUFACTURERS

Monetizing car-related big data

Third party sales

Impact

Large scale car data is valuable to its owners. If privacy concerns and third party utilization have been sorted out, OEMs' revenue sources are almost infinite.

Many players are able to generate revenues from vehicle-data. Insurance companies can offer customized policies, repair shops get early customer access, gas stations knowing a car nearby needs fuel can offer promotions, just to name a few of them.

OEMs can generally make a profit of the data in two ways, either sell data packages or get a share of data-driven turnover. And the good news is: data privacy does not seem to be a huge obstacle for this development from the drivers' side, as a McKinsey[1] study has revealed.

Product development

Impact

Operating data is a good source in order to further improve a car. For example, manufacturers get to know their customers better:

- How do they drive the car?
- What limits their experience?
- Are there obsolete features?
- etc.

Of course, market researchers could generate much of this information too, but unbiased first-hand data with a sample size of hundreds of thousands is nearly impossible to collect or would come at very high costs.

Also, vehicle modifications could be tracked immediately after their market launch. This may shorten development lifecycles in the long-term, which is crucial when considering the further digitization of the car.

Quality assurance

Impact

Untapped potentials lie in wait with regard to long-term quality improvements.

On-board root cause analytics can identify recurring quality issues the moment they occur. If necessary, related tier-one/two suppliers can be informed about the existing issues and may help solve them immediately. This ensures a permanently rolling quality improvement process.

Furthermore, Connected Cars could save OEMs a lot of costs when it comes to recall actions related to software issues. Those could be sorted out via OTA-updates which are more convenient for the customer and more cost and workload efficient to the manufacturer.

Customer bonding

Impact

According to a recently published KPMG survey[2], customers seem to be more willing to give away vehicle operating data than personal, consumer related data.

Utilizing this data may lead to a closer connection between OEM and customer. An optimized customer touchpoint for the entire aftermarket could be designed more proactive (instead of waiting for the customer to have an issue). Getting in touch with the customer before there is an issue, offering a preventive or additional service that may be required, is valuable and may result in increased customer satisfaction and a good reputation.

Connectivity is once again key to a seamless driving experience covering the vehicle life cycle.

1: McKinsey study "Competing for the connected customer" (2015)
2: KPMG survey "Global Automotive Executive Survey 2017" (2017)

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DEFINITIONS, ABOUT, IMPRINT

CHAPTERS

Subject

Connected Car Overview.....3

Connected Hardware.....14

Infotainment Services.....26

Vehicle Services.....37

Definitions, About, Imprint.....48

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CONNECTED CAR DEFINITIONS

Segment	*Definition*	*Out of scope*
Connected Hardware	Connected Hardware includes the single fee based sub-segments eCall Technology and Embedded Telematics. eCall Technology includes devices that enable the triggering of an emergency call while simultaneously transmitting relevant data such as the location of the vehicle or the direction of travel. Baseline for this technology is a permanently embedded SIM card when leaving the OEMs assembly line. Embedded Telematics systems include extended, integrated telematics solutions like infotainment systems, connective navigation devices etc., which are permanently connected to the internet via an embedded SIM card.	**Sales of used cars** Sales between private persons and of used cars (e.g. via AutoScout24) are not included.
Infotainment Services	Infotainment Services include fees for additional services for navigation, entertainment or other comfort-related services. Advanced Navigation covers those services that contain map updates on a regular basis, containing information about traffic jams or real-time traffic information (RTTI) and route optimization. Entertainment Services include all kind of services related to streaming offers (audio and video), other paid entertainment software. Comfort Services are services with primary focus on remote control or localization of the vehicle, as well as services that are focusing on productivity (e.g. e-mail).	**Aftersales Market** Hardware for updating non connected cars to networking vehicles, e.g. connected OBD2 devices or subsequent infotainment solutions
Vehicle Services	Vehicle Services cover subscription fees for vehicle-related Connected Car services. Safety & Security includes services in addition to an emergency call service, requiring an extra fee and offering additional services, e.g. roadside assistance or breakdown management services. Maintenance & Diagnostics includes services that constantly check vehicle data and, e.g. inform about optimal test intervals. Also included are services at cost which run software updates over-the-air and approximate the remaining service life of wearing parts based on their expected life-duration as well as sensory data	**Tethered Connectivity** Touchscreens or Displays and other interfaces using an external device, like a tablet, smartphone or laptop, to connect to the internet

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ABOUT DIGITAL MARKET OUTLOOK

9 Markets, 34 segments & 85 sub-segments

Digital Media
Video-on-Demand, Digital Music, Video Games, ePublishing

FinTech
Digital Payments, Business Finance, Personal Finance

eTravel
Online Travel Booking, Mobility Services

eServices
Event Tickets, Fitness, Dating Services, Food Delivery

eHealth
Diabetes, Hypertension, Heart Failure

Connected Car
Connected Hardware, Vehicle Services, Infotainment Services

Smart Home
Home Automation, Security, Home Entertainment, Ambient Assisted Living, Energy Management

e-Commerce
Fashion, Electronics & Media, Food & Personal Care, Furniture & Appliances, Toys, Hobby & DIY

Digital Advertising
Banner Ads, Video Ads, Search Ads, Social Media Ads, Classifieds

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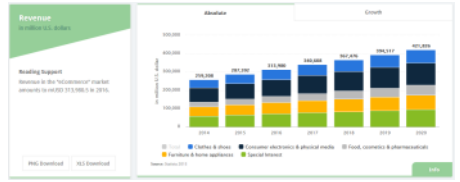
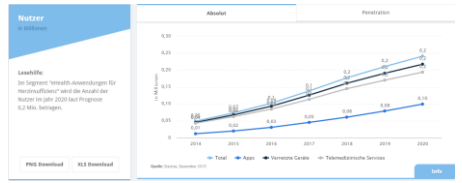
more information

Details

- **50 countries**
- **Direct access & downloads**
- **7-Year coverage: 2015 – 2021**
- **Revenue forecasts**



- **User count & penetration**



- **Comparable data**

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