BMW Group
Information
2002

ConnectedDrive

Communication and information technologies are taking on ever-increasing significance in the automotive industry, opening up new perspectives for intelligent mobility in future. Precisely this is why the BMW Group's ConnectedDrive concept networks telematics, online communication and driver assistance systems, in the process enhancing both safety and efficiency in transport. Better information means fewer accidents and less traffic congestion on the road. This is the objective of the BMW Group – the vision of free, uncongested motoring.

BMW Group

ConnectedDrive: the future of intelligent mobility
The emerging 21st century is characterised by two developments: growing mobility and the process of all the worlds and dimensions we live in coming together. While the automobile provided a new definition of mobility in the last century, we now see a world building up an increasing number of networked areas and activities. Introducing ConnectedDrive, the BMW Group is combining these two global trends with one another. Growing traffic density on the one hand and the availability of an increasing volume of information on the other present new demands both of the individual driver, our transport infrastructure, and the automotive industry as a whole. So to ensure the usual standard of sheer driving pleasure also in future, the BMW Group is using the benefits of networked information and communication tools in the interest of enhanced mobility. With the help of the most advanced telematics systems, intelligent data processing, online services with local information, and the ability to recognise and monitor the surroundings of a vehicle by means of high-performance sensors, the BMW Group is creating an innovative, comprehensive system in support of the driver.

The ConnectedDrive Project rests on a solid foundation within the BMW Group. Introducing numerous innovations ranging from the first navigation system all the way to BMW Online, the internet-based service in the new 7 Series, BMW has succeeded in holding and even expanding its leadership in technology not only in the area of electronics. Indeed, this rapid development within the automotive industry is quite comparable to the pace of innovation we see, for example, in the PC and internet world as well as in the telephone and mobile communication sector. With BMW Online forming an essential part of ConnectedDrive, the BMW Group is now closing the gap between intelligently networked PCs at the office and at home.

The overall concept of ConnectedDrive encompasses three sectors seeking to achieve the same objective in various ways: telematics, online services, and driver assistance systems make motoring safer, more efficient and more comfortable.

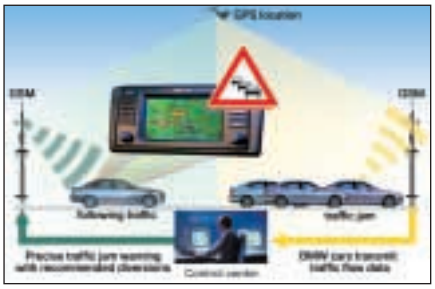
Networking the driver, the vehicle and the surroundings
The term ConnectedDrive stands for the BMW Group's future-oriented concept bringing together the driver, the car, other users of transport systems, and the surroundings. While in the past it was the task of the individual and his personal flexibility to combine and coordinate various items of information and areas of interest, ConnectedDrive now leads us into a new era. The target is to give the driver as much information as he requires, while processing such information as individually as possible. So ConnectedDrive is like a virtual co-driver presenting the right information at the right time and in the right way. This relieves the driver of the usual burdens, instead of giving him additional tasks. But he nevertheless remains fully in control, retaining full responsibility for all driving manoeuvres. Like a horse and its rider, the car and driver form an intelligent team. The car “thinks” with the driver, but the man – or woman – at the wheel still remains in control.

Just like individual computers have been linked with one another in recent years to form the worldwide internet, ConnectedDrive integrates the car into an intelligent network transmitting all traffic- and mobility-relevant data quickly and efficiently, and adjusting in each case to the current situation on the road.

A concept looking into the future: the vision of free, uncongested motoring
ConnectedDrive thus not only means extra comfort, but also extra safety, the additional information provided to the driver enabling him to take the right decisions at all times. The active gas pedal, for example, tells the driver in good time, by building up slight counter-pressure, to reduce his speed under specific conditions.

Intelligent route guidance taking even more detailed traffic information into account also helps to reduce road congestion and makes individual mobility even more efficient. By additionally linking the navigation system with online information services providing, say, parking information, this philosophy is also very helpful in reducing the number of vehicles looking for parking space.

In a nutshell, therefore, ConnectedDrive introduced by the BMW Group sets the foundation for the vision of free, uncongested motoring.

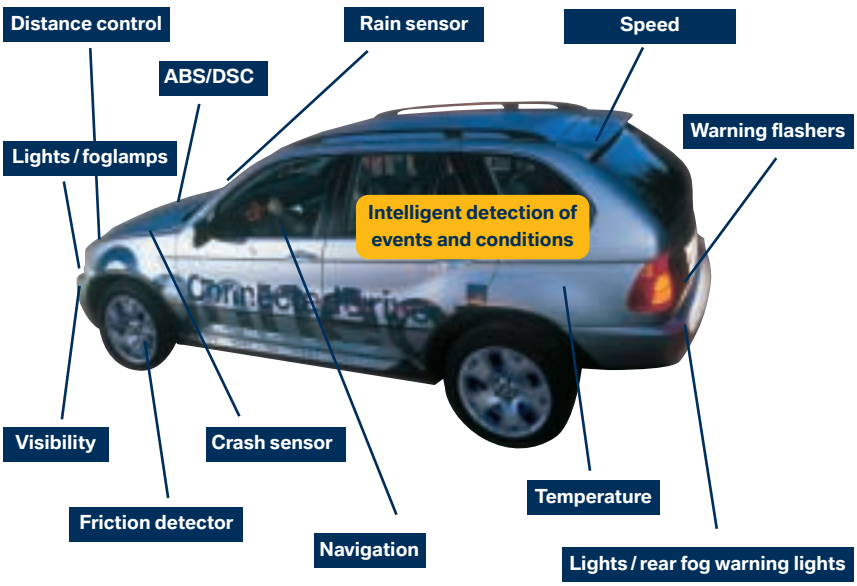


Telematics services
The BMW Assist telematics service providing on-location information (location-based services) is an essential element of ConnectedDrive crucial to the interaction of the driver, the car and the surroundings. Whether the service rendered is an automatic emergency call locating the car in the event of a severe accident, an on-location standby service, the latest traffic information, or mobility-enhancing inquiry services, the driver always receives the information he needs. An emergency call locating the car is made automatically in the event of an accident in which the crash sensors activate the airbag function, the car's coordinates being transmitted immediately to a rescue centre. Such clear information on the location of an accident then enables helpers to identify and reach the location as quickly as possible. The BMW standby service, in turn, provides assistance in the event of technical problems, transmitting data on the condition of the car and its current location to the Service Headquarters by SMS. This ensures that a BMW Service Mobile will be on the spot to provide the support required as quickly as possible.

The BMW inquiry service offers up-to-date local service information, for example on restaurants, hotels, interesting sights or cultural programmes. The information required, together with the exact destination and telephone numbers, is transmitted to your BMW straight from the Headquarters by SMS. Then all the driver has to do is press a button to download the data directly into the BMW navigation system or the car telephone.

BMW traffic information services keep the driver informed of current traffic conditions on the route he has chosen. In addition to the usual radio data, the BMW Assist user receives information from numerous sensors already serving on the German Autobahn, for example, to measure the flow of traffic. This makes the supply of traffic information even more reliable. And introducing Floating Car Data, the BMW Group already offers another innovative system making in-dividual mobility even safer, more efficient and convenient by means of mobile data acquisition.

Database for Extended Floating Car Data (XFCD)

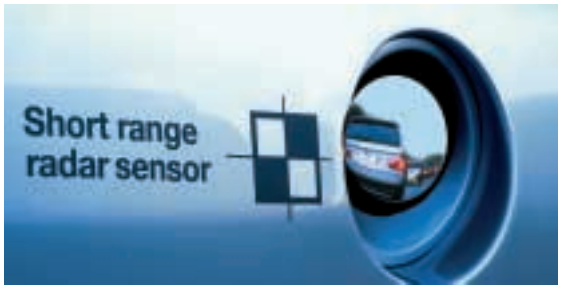


Floating Car Data (FCD) providing the latest traffic information with the car serving as a mobile sensor on the road
"Floating cars" serve as mobile sensors in road traffic, collecting Floating Car Data as they move along. To provide this service, BMW cars use the existing navigation and telematics platforms in order to determine traffic conditions on the basis of position and speed data while on the move - provided, of course, the driver wants to have this service in the first place. Traffic information obtained in this way by the car is automatically transmitted to the processing centre by SMS together with local and time information - naturally fully anonymous and free-of-charge. At the centre, the information received is integrated in the overall pool of traffic data and thus benefits all BMW Assist users. Receiving such precise data provided by "floating cars", the BMW navigation system can immediately determine an alternative route should there be any traffic congestion or obstruction on the planned route. A further advantage of Floating Car Data is that traffic conditions are fully covered on the entire digitalised road network, without requiring any additional data acquisition infrastructure such as sensors along the Autobahn.

Extended Floating Car Data (XFCD)
BMW is developing Extended Floating Car Data (XFCD) in order to judge the entire driving environment in even greater detail in future, considering traffic conditions as well as other information on road conditions and the weather in the interest of optimum route planning. Apart from road speed and the current location, a modern car also offers a wide range of further data provided by specific systems in the vehicle and allowing the extrapolation of traffic and weather information. Typical examples are data on the use of the low-beam and high-beam headlights as well as the fog-lamps, the ABS anti-lock brake system, Dynamic Stability Control with anti-wheel spin effect, as well as data from the outside thermometer or the screenwipers. By means of evaluation and algorithmic processes, such data provides clear indications not just on the flow of traffic, but also on weather condtions, road conditions and the current situation around the car itself, such as icy roads, fog or rain. Whenever, say, the ABS brake system is activated although the driver pressed down the brake pedal only moderately, while at the same time the outside temperature is relatively low, the screenwipers are active and the car is moving at an appropriate speed, the system will "know" that the roads at the location involved are slippery.

Applying the position data of each car transmitting such information, the control centre is able to provide a clear and detailed overview of current conditions and hazards on the entire road network.

A further step in future would be for vehicles to communicate directly with one another, not having to go through some kind of control centre. Like swarms of birds able to perform complex manoeuvres together and pass on information to one another, cars could also be networked by spontaneous, ad-hoc communication systems, exchanging the latest information in the process.

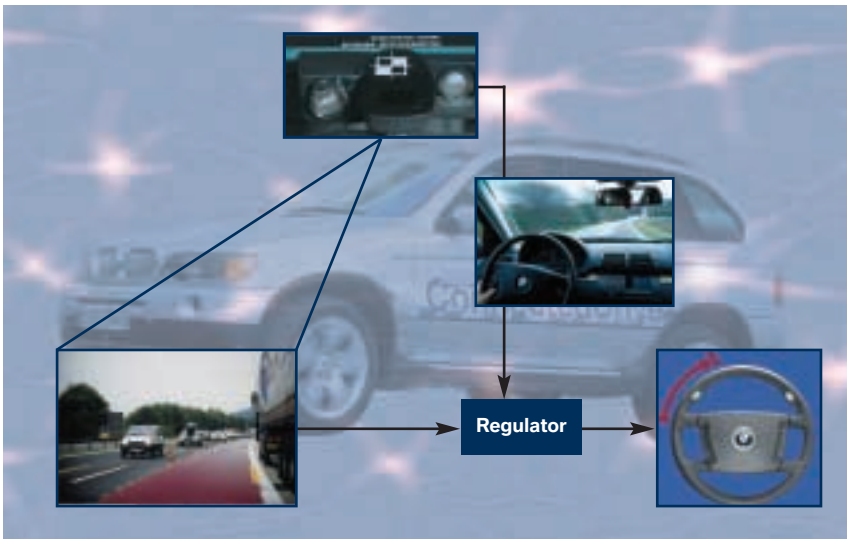


ConnectedDrive: online services network the car with the outside world
Online services enhance the telematics service in the ConnectedDrive Project consistently to an even higher standard. For the first time in the new 7 Series, internet-based services provide access to a mobile internet portal supplying the driver with exclusive information and service benefits tailored to his specific requirements. In cooperation with suitable partners, BMW offers a wide range of useful services and benefits such as an e-mail account, online addresses and directory services, the latest news, information on stock prices and travel news. The BMW Group also offers special internet services such as the parkinfo.com parking information system enabling drivers throughout Germany to find free parking space.

Networking is the name of the game also in the provision of online services. In his car, the BMW driver is able, say, to obtain a specific address either from the online service or through his personal address book via the BMW portal, simply pressing a button to download the information required directly into the navigation system. BMW online services are furthermore available not only in the car itself, but also at home on the user's PC or over his mobile phone while on the road. To connect his car online, the driver just has to specify his requirements via BMW's website and personalise the services he needs in order to access specific data quickly and conveniently in his car.

The BMW X5: the cutting edge in driver assistance systems
The BMW Group's driver assistance systems enlarge the range of ConnectedDrive services in the interest of even greater safety and comfort. The car itself is thus in a position to recognise specific situations and offer the driver various options. But here again, the main principle is that the driver always takes the final decision.

To give the assistance systems the information required, it is essential to carefully monitor the surrounding area. This is done by specially developed sensors serving as the car's “eyes and ears”, measuring vehicle-relevant parameters such as wheel grip or lateral acceleration as well as external data in the area around the car.



BMW's research specialists use several spearheads in technology to test and develop various innovative driver assistance systems under practical conditions. Specially equipped versions of the BMW X5, for example, provide a glimpse of the future even today, various advanced sensor and communication systems constantly compiling data on driving conditions and informing the driver accordingly. The various assistance systems process such information either to ensure a specific response - for example through the active gas pedal or steering wheel - or to give the driver clear-cut information for his specific requirements.

Modern sensors monitoring the environment
The sensors already used today will be supplemented in future by additional sensor concepts based on radar, laser or image processing technologies and monitoring in particular the area around the car and at a certain distance. Short- and long-range radar sensors as well as video cameras are thus able to detect other road users and obstacles, even measuring the distance between the vehicle and the kerb. Just like a driver uses all his senses interacting with one another, such monitors support and check each other in their process of supervision. The high standard of data reliability ensured in this way is of fundamental significance to future systems providing enhanced active safety.

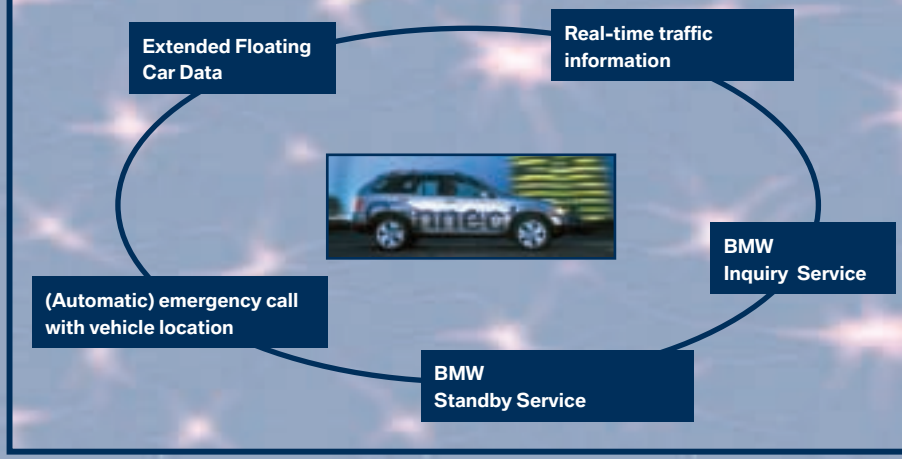
Data provided by sensors is translated by the car into active information for the driver. The steering wheel, for example, not only conveys the driver's movements to the front wheels, but also gives the driver active feedback in specific situations. Should the driver, for example, exceed the optimum steering angle in a specific situation, he will feel light forces acting on the steering wheel, “telling” him to make suitable corrections. Data is provided for this purpose to the Heading Control System by a digital camera measuring the distance between the car and the kerb.

Acting in a similar manner, the active gas pedal, building up slight counter-pressure, “tells” the driver that it would be advisable to reduce his speed, for example when entering a built-up area, when approaching a tight bend, or when coming close to a slow vehicle ahead. The active gas pedal is controlled by radar and video sensors in conjunction with the GPS satellite navigation system and ultra-precise digital road maps. A short-range radar sensor serves additionally to locate objects in the direct vicinity of the vehicle, providing data for the stop-and-go cruise control and thus ensuring that the driver need not constantly apply the brakes in dense traffic and automatically remains at a safe distance from the vehicle ahead. Further systems monitoring the driver's attention and warning him of fatigue in an emergency are currently being tested.

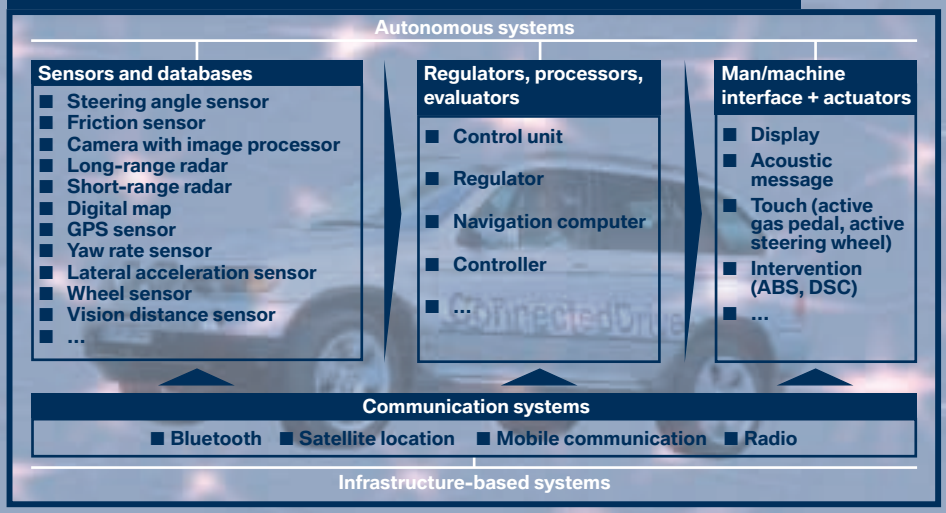
Wireless communication through Bluetooth
The X5 spearhead in technology is equipped with innovative Bluetooth systems marking a quantum leap in communication linking individual terminals with one another. Bluetooth thus converts all information links so far provided by cables into a wireless network. This makes it easy and very convenient to connect navigation systems, audio systems and the car telephone with other units such as the driver's laptop, his mobile phone or organiser, without having to plug one unit into the other. An organiser is therefore in a position to transmit addresses smoothly and easily, without any kind of special infrastructure.

ConnectedDrive
Powered by Intelligence

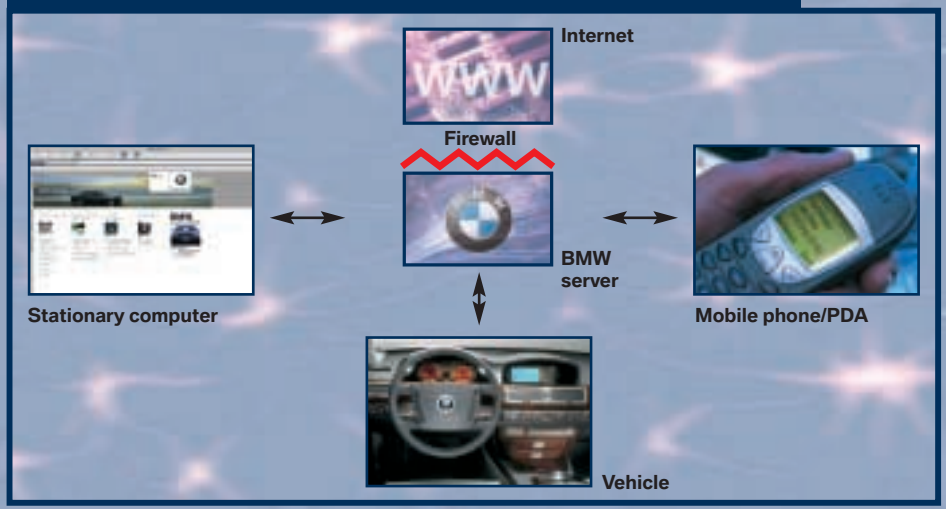
Telematics services



Components of driver assistance systems



Online services



Intelligent lights
Adaptive Light Control (ALC) scheduled to reach production standard soon is another example of new and innovative functions provided by the interaction of driver assistance systems under the guidance of ConnectedDrive. The concept behind ALC is to direct two variable headlights on to the road, enabling the driver to see the road ahead better and thus with greater safety when approaching and driving round bends. When approaching a road section, in turn, the system broadens the light beam to provide a better view of the crossroads and pedestrian paths. ALC even considers which direction the driver might take and thus illuminates even tight bends through swivelling headlight elements. The system is masterminded by ConnectedDrive information such as the steering angle, road speed and lateral acceleration, GPS satellite navigation and digital road maps.

"Intelligent" light serves to enhance safety and driving conditions not only in the direction of travel, but also to the rear: The Brake Force Display, a dynamic display unit geared to the brake force applied by the driver, varies the size and intensity of the brake lights as a function of brake force. This tells drivers following the car how hard the driver ahead is applying the brakes and helps to reduce the risk of a pile-up. BMW is introducing the Brake Force Display as a standard feature in some countries for the first time with the new 7 Series.

ConnectedDrive: an ongoing process of developoment
The future of ConnectedDrive has already begun, the BMW driver is already able to use the innovative benefits of ConnectedDrive today. But this process of development is by no means over. On the contrary - proceeding from the telematics, online services and driver assistance systems already introduced, the BMW Group is researching further options provided by a network of modern technologies.

ConnectedDrive is therefore a flexible concept constantly developing to an ever-increasing standard.

To use the components and modules integrated in the car for several purposes wherever possible, the BMW Group is pursuing an ambitious objective: Information provided by the components already available today is to be networked with data coming from other systems in future, thus providing new functions and options not possible today. In its process of development, ConnectedDrive is therefore following in the footsteps of Mother Nature, ongoing evolution ensuring an ever-increasing standard with new skills and abilities.

All of the services provided by ConnectedDrive are tailored specifically to the driver. He can use these services whenever he wishes, or perform the individual operations himself. This freedom reflects the philosophy of the BMW Group not to deprive the driver of his responsibility, but rather to support him in his decisions by providing the necessary tools and additional information. Particularly in complex decisions, human intelligence and common sense are indispensable, the human being taking decisions also under ethical considerations even the most advanced computer is unable to take into account. A microprocessor, for example, cannot "see" whether a certain manoeuvre to avoid an obstacle might endanger a road user approaching in the opposite direction, meaning that in this case the right alternative would be to accept material damage to the car. The driver thus remains the essential key element of this BMW Group philosophy seeking to achieve the ideal standard of accident-free motoring.

ConnectedDrive is an all-round concept providing the latest technological options and benefits in practice – in the interest of safety, efficiency, comfort and, not least, that proverbial sheer driving pleasure so characteristic of BMW.

Technology Communications
presse@bmw.de