



mAutomotive

# Turbo-Charged In-Car Connectivity

## White Paper

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### **Abstract**

Automakers are beginning to use superfast LTE technology to provide in-car connectivity. Audi, BMW, GM, Mercedes-Benz, Proton and Toyota have all either launched LTE enabled vehicles or are planning to do so. This high performance Mobile Broadband technology can deliver a wide range of rich multimedia services into the car. As network coverage expands and business models evolve, LTE-enabled cars will become commonplace.



## Turbo-Charged In-Car Connectivity

### **Superfast Mobile Broadband is bringing rich multimedia services into the car**

The fastest growing mobile network technology yet, Long-Term Evolution (LTE, often promoted as 4G) has caught the eye of leading automakers. Audi, BMW, GM, Mercedes-Benz, Proton and Toyota have all either launched cars equipped with LTE or are planning to do so.

The automotive industry's growing enthusiasm for LTE, which can provide peak download speeds of 150Mbps, reflects the popularity of the technology with both mobile operators and consumers. Since the first LTE network was launched in Sweden at the end of 2009, global population coverage has already expanded to 10% and is on track to hit 60% by 2018, according to the latest Ericsson Mobility Report. Moreover, large numbers of consumers are buying LTE-enabled smartphones. Five years from now, the number of LTE connections worldwide is set to reach one billion, up from 110 million today, according to GSMA Intelligence.

In the automotive industry, this superfast Mobile Broadband technology is being used to connect cars, drivers and passengers to an array of multimedia services. The high throughput and low latency delivered by LTE enables automakers to offer new services, as well as the way we interact with in-vehicle services, such as: 3D navigation, natural language processing (enabling the dictation of emails and messages or voice-based Internet search), on-demand video entertainment and other rich multimedia content.

Embedded mobile connectivity for high bandwidth services offer a particularly compelling means to maintain an on-going relationship with customers during the vehicle lifetime. With the customer's permission, the mobile connection can be used to provide personalised information and deliver services and offers based on the customer's profile and preferences. Implemented well, such services could help automakers gain market share in an intensely competitive car market.



### **The first deployments**

In many cases, mobile operators and automakers are working together to bring the benefits of LTE to drivers and their passengers. For example, in Saudi Arabia, Mobily and Toyota have teamed up to add Link Wi-Fi to cars, enabling drivers to create their own Wi-Fi hotspot which passengers can use to connect their tablets and smartphones to the Internet. With the help of a television advertising campaign, Toyota has sold more than 100,000 cars equipped with Link Wi-Fi in Saudi Arabia.

At the end of 2012, BMW began offering its BMW Car Hotspot LTE accessory, which customers can use to create a Wi-Fi hotspot in the car for up to eight devices. “The very fast bit rates and extremely low latency mean that an internet connection supported by the BMW Car Hotspot LTE is often even faster than a PC connection in the home,” enthused Markus Dietz, Project Manager BMW Car Hotspot LTE Development.

The BMW Car Hotspot LTE accessory can be used with the telephone docking station found in BMW vehicles, enabling it to connect to the internet via the vehicle’s aerial. Alternatively, it can be used with an adapter and a mini-USB cable, which can be plugged into any car’s cigarette lighter. BMW also plans to use LTE to bring richer infotainment and navigation services to its existing ConnectedDrive system.

At the Consumer Electronics Show in January 2013, Audi unveiled a new version of its Audi A3 model with an embedded LTE module. Audi says drivers and passengers are able to use the LTE connection to support an in-car Wi-Fi hotspot, Internet radio, web services and “an augmented navigation system that presents street level visual imagery streamed to the vehicle.” Soon afterwards, at the GSMA Mobile World Congress in February 2013, General Motors announced it will begin embedding LTE into models shipping in the U.S. market from 2014, while Mercedes-Benz and Toyota have also said they plan to add LTE connectivity to their vehicles.





### **Keeping pace with network technology evolution**

In most markets, the number of LTE-enabled cars on the roads is likely to grow in line with the expanding LTE network coverage in their region – automakers typically ship the same models across continents, such as Europe or North America.

There are now 223 live LTE networks in 86 countries (including fixed-wireless networks) (October 2013, source: GSMA Intelligence). In some markets, such as Sweden, Japan, South Korea, Saudi Arabia, and the U.S., LTE networks already cover the majority of the population centres and many major roads. Furthermore, LTE will expand to more countries as the right spectrum becomes available.

### **Key role of geographical coverage for automotive**

LTE coverage in a particular market also depends in part upon operators' roll out strategies and the conditions attached to the spectrum license. Therefore, although population centres are generally the first roll-out targets, LTE is also representing a solution for ensuring rural coverage as well. The German government, for example, has made some frequencies available for LTE on the condition they are used to improve broadband penetration in rural areas. As LTE deployments "guarantee" geographical coverage, as well as population coverage, automakers will have the confidence on the viability of this technology for their services. This issue is in fact reflected by the concentration automotive services launched on LTE in North America and Asia.

Whilst the deployment is on-going, embedded LTE modules in cars will be multi-mode with roll-back to 2G and/or 3G to ensure continuity of services. In time, these rollback technologies may become less and less used. Within the 7-10 year lifetime of a typical vehicle, LTE coverage is set to expand dramatically as more spectrum becomes available and the cost of LTE equipment continues to fall as the ecosystem gains economies of scale. LTE connections are forecast to grow from 110 million in 2013 to 1 billion in 2018 (October 2013, source: GSMA Intelligence). Putting that growth in perspective, today, LTE accounts for 1 in 25 mobile broadband connections by 2017 LTE will account for 1 in 5 mobile broadband connections (source AT&Kearney the Mobile Economy Report 2013).

The release of more spectrum will also help to reduce the number of different frequency bands an in-car LTE module will need to support. The GSMA is campaigning for greater spectrum harmonisation in-regions to ensure that LTE-enabled equipment will work across geographies and help generate economies of scale. Specifically the GSMA emphasize the importance of the access to the sub-1GHz bands for LTE (particularly the 700 and 800MHz bands) to support fall back to 3G coverage when needed.



### **Covering costs and raising revenues**

Although LTE/2G/3G modules cost more (about \$120 to \$150 apiece) than 2G and 3G modules, prices are falling steadily – the GSMA expects the cost to fall significantly during 2013. Growing economies of scale are also likely to drive down other costs related to design and integration, distribution and installation, systems and platforms, network transmission and field tests.

One key enabler for embedded high-bandwidth services is the capability to manage differential charging and split billing, so the consumer pays for infotainment services, for example, while the automaker pays for services directly-related to the vehicle, such as remote diagnostics. Split billing is easier with LTE than with its predecessors because the network technology was designed from the start to enable mobile operators to distinguish between traffic.

At the same time, business models are evolving to cover the transmission costs for embedded high-bandwidth infotainment and 3D navigation services, which can consume large volumes of data. Moves by mobile operators in some markets to introduce shared data plans, could also enable consumers to add a car to an existing tariff plan.

The market is also evolving with regards to the opportunities to subsidise the costs of services in the vehicle by leveraging different stakeholders interests in the vehicle data coming off the car (such as dealerships) as well as delivering new services to the vehicle (such as point of interest or location-based services). With the driver's permission, a connected car could capture and relay valuable real-time information the automaker and other service providers could use to deliver personalised offers. For example, a driver who has been on the road for a couple of hours could receive a voicemail offering him or her a discount on a coffee at the next service station.

### **Evolution Possibilities of LTE**

On-going advances in LTE technology could also enhance the value proposition. Mobile operators are already testing LTE-Advanced technology, which can deliver peak download speeds of more than 1Gbps. Some operators are also evaluating LTE broadcast technology, which can turn base stations into the equivalent of mini-digital TV towers that broadcast video and audio to multiple users simultaneously. In this solution, a portion of the LTE bandwidth would be used to multicast a single video or audio stream to multiple devices, thereby reducing the traffic demands on the network and improving the economics for consumers. This could lower the cost of providing some in-car infotainment services.

### **Role of Consumer Demand Impacting Automotive**

As they become accustomed to LTE in smartphones and tablets, more consumers will demand the same superfast broadband experience in their cars. Early adopters are already willing to pay to have the technology retrofitted to their vehicles. There is now a significant after-market for LTE solutions. It is little wonder then that BMW, Audi and other premium automakers are racing to bring out LTE-enabled cars ahead of rivals. In 2013 and 2014, more automakers are likely to turn to LTE to crank up their in-car connectivity and gain a competitive edge.



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