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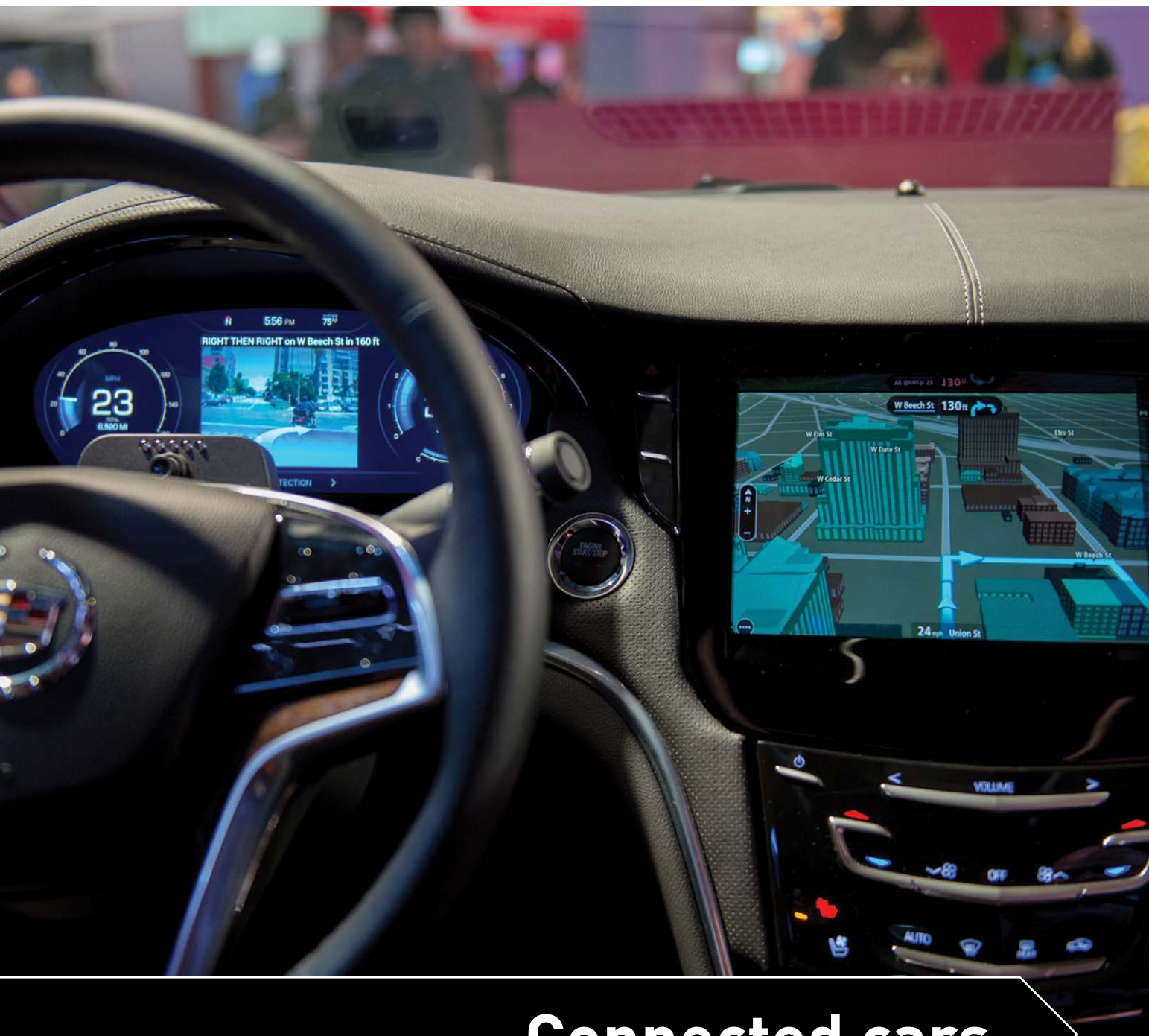

Connected cars

Battle for the connected car

Car makers and tech companies view your car as a giant mobile with navigational aids, apps, living room-style entertainment and connectivity to the wider IoT. By Adrian Pennington

The connected car has become the next platform for the evolution of mobile technology – a 'mega trend' for the automotive industry as recently described by the CEO of Renault-Nissan, Carlos Ghosn, at Mobile World Congress. According to analyst firm ABI, 60% of cars shipped will be connected through mobile technology by 2017, and one in five cars on the road will be 'aware' by 2018, according to Gartner.

As a sign of the times, MWC was this year awash with IoT and connected car products and demos. Qualcomm had a Maserati on its stand and AT&T showed off an Audi. The Fiat 500 was also a popular model on display.

The reasons aren't hard to fathom. Innovative in-car technologies are being developed to make journeys safer, easier and more entertaining, and this includes semi-autonomous and eventually driverless technology, which are two key trends going forward.

For a generation brought up tethered to Facebook, any connectivity blackhole is a big negative. "People don't want to buy something that's not customisable any more," says Mike Edwards, product manager - car audio, JVC Kenwood. "We are having to produce units that are customisable for their lifestyle."

"For millennials, the smartphone is the centre of their lives," agrees Timur Pulathaneli, Connected Services at Ford. "A major factor affecting their judgement of whether a car is good or bad is how they can connect up their smartphone."

BMW-owning parents, for example, can download the myKIDIO app onto their children's tablet and show them a 'Kids Cockpit' illustrating the car's speed, the amount of remaining petrol and – crucially - how long the trip will take.

US consumers are lining up to buy. According to a Harris poll in January for AutoTrader.com, a majority of drivers would pay up to $1,500 to have new entertainment and safety features in their vehicles. Moreover, research done by AT&T and General Motors suggests that people want cars that are connected to the extent they are willing to wait a year to make sure the car they buy has this functionality.

Back-up cameras, USB ports and smartphone charging are among top desires. Accenture says in-vehicle tech is the top selling point for 39 percent of buyers, while just 14 percent are most concerned with horsepower and handling.

"Every major auto maker has a connected car programme as part of their strategy. In-car connectivity has become a market differentiator," says Nakul Duggal, VP product management for automotive and M2M at Qualcomm.

This is a point underlined by Ford CEO Mark Fields at CES this year: "We're thinking of ourselves as a mobility company and not only a car and truck company." Ford has a wide ranging 'smart mobility' strategy that takes into account everything from connected bicycles to smart cities.

Back to the drawing board

The first attempts at in-car connectivity tended to copy the smartphone experience direct to the dashboard and failed to take-off, either because the user experience was complicated or because it was simply easier to get access using the smartphone.

"As long as consumers find it easier to use their smartphones they will not adopt any services in the car," states Holger G Weiss, CEO of internet radio service Aupeo. "It needs to be a very intuitive setup, and the use cases have to be perfectly optimised for in-car usage. It's not an experience to switch between three different music apps, the FM radio (traffic and news) and – let's say – an audiobook being stored on an iPod. Everything has to come through a single, personalised and integrated experience."

The chief consideration for any in-car connected service is safety. For the driver, this means applications must be non-distractive yet contextually meaningful.

Most automotive manufacturers offer a means of connecting a driver's smartphone to the car head unit, via HDMI or hot spot, where the applications are mirrored. For example, JVC Kenwood, which supplies head unit displays to Mitsubishi, VW and Kia, ensures that navigation is hands-free by speech to text. Another example: Fords slimmed down version of Spotify offers a limited number of tracks to ensure that driver distraction is kept to a minimum

Augmented reality head up displays (HUDs) project information in the driver's line of sight on the windscreen. Continental, for example, manufactures them for BMW and uses camera and radar data from vehicle sensors, combined

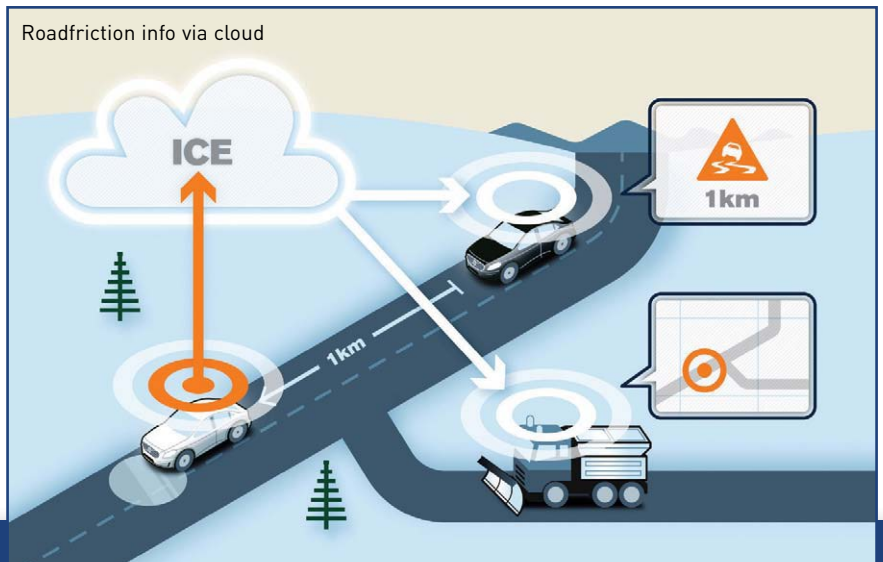

Image courtesy of Volvo

Image courtesy of Qualcomm

with digital map data and GPS. This is designed to keep the driver's eyes on the road but don't include control over in-car entertainment systems.

As for passengers, rear-seat scenarios can be a completely different, lean back experience. What's more connectivity is ideally personalised to the tastes of different drivers and passengers. "For content owners, the car will turn into a multi-billion dollar opportunity, simply because the consumer will be able to choose and consume," reckons Weiss.

Fragmentation

The car has become a battleground for the likes of Google and Apple, each promoting platforms which tailor Android or iOS specifically to the in-car experience. At the same time, car makers are developing their own platforms to try to control the consumer experience. Some of them offer SDKs to third party developers to create services while a group of German car makers are in talks to buy Nokia's Here mapping unit in order to avoid losing control to the likes of Google, Facebook and Apple.

With dozens of car manufacturers with their own programming requirements, today's developer environment mimics that of the fragmented smart TV landscape. Apple CarPlay which integrates iPhone, Apple maps and Siri into the car dashboard vies with the Google-led Open Automotive Alliance (OAA) whose members include Audi, Honda, Hyundai and Nvidia and support Android Auto.

Both Apple CarPlay and Android Auto primarily run on the customer's phone and will project an image on the car's screen. A new version of Google OS - Android M - is reportedly being engineered to be built directly into cars, independently of a paired smartphone.

Then there's Microsoft which powers three different car manufacturers' in-car systems, including Ford's Sync. This includes AppLink which enables drivers to access smartphone apps via voice control.

Auto-makers can also take part in the GENIVI Alliance, a non-profit group that includes Nissan, Volvo, and BMW.

MirrorLink is an in-vehicle connectivity standard created by the Car Connectivity Consortium whose members include Toyota, VW plus LG, Sony, HTC and Samsung. It also enables consumers to connect compatible smartphones and apps for display on car head unit.

Several auto-makers have wheels in different camps. Ford uses Microsoft systems but is also signed up to CarPlay. Kia uses Android for its in-car systems, but is also a CarPlay member. GM is signed to CarPlay, MirrorLink, OAA and GENIVI. Honda and Hyundai are both MirrorLink and GENIVI members. This means drivers might get the choice of Android or iPhone compatibility at the point of buying a new car.

"One of the big issues is to what extent manufacturers are happy to cede control over how services are provided and to what extent are tech companies trying to own the ecosystem," says Dan Peters, SVP product & design, Saffron Digital. "There is a tension similar to that being played out in the home."

Volvo is outfitting all its models, starting with the XC90, which now boasts a redesigned touch-screen interface using touch and swipe navigation of the car's infotainment system Volvo Sensus, and integrates content from Apple and Google.

"Customers will be able to use smartphone apps in a convenient way, while we focus on developing integrated services that are relevant to the driving experience as well as to the ownership of a car," explains Martin Kristensson, director connectivity strategy, Volvo Car Group. "We will offer other, unique and integrated services that are relevant to the driving and car ownership experience. These maybe existing services like our Park & Pay solution for connected service bookings, or over the air software updates or future services to the car like 'Roam Delivery - the possibility of having goods delivered directly to the trunk of your car by handing out a temporary digital key."

Mobile connectivity

As with the Internet of Things, a pre-requisite for in-car connectivity is ubiquitous fast mobile broadband. The jury is out on whether in-car WiFi hot spots (as opposed to reliance on LTE networks) are necessary, although research firm iSuppli expects a surge to 7.2 million worldwide units by 2017. GM's 2015 models come fitted with hotspots capable of connecting to 4G LTE networks.

Mobile networks are not designed to optimise connection when moving at high speed, so that challenge needs to be overcome and the take-up of in-car connected experience is based on that.

"For a group of people with devices in a vehicle a hotspot is currently a better idea than reliance on LTE," says Qualcomm's Duggal. "That said, everyone is working on an in-car connectivity 4G platform, leapfrogging 2G and 3G."

Probably the answer lies in 5G which is scheduled for rollout around 2020.

Also important is the update cycle, which for cars is typically ten years, compared to just weeks when it comes to servicing mobiles. While phone apps can update automatically over the air, a car only gets maintained manually.

"Hardware and software have to become updatable in cars," says Weiss, who suggests that companies like Aupeo will play a role in

Jaguar XE

Jaguar thinks that in-car technologies in this increasingly connected world are an integral part of the driving experience. With the new XE, the company is introducing a new suite of driver aids and cutting-edge entertainment systems. They have been designed to make journeys safer, simpler, more relaxing and enjoyable.

The XE is the first of a line of Jaguar vehicles to run on the company's InControl Touch Infotainment system for a new 8-inch touchscreen. It supports smartphone technology and InControl apps, which synchs Apple and Android phones to the car and allows the driver to access entertainment and information apps installed on their phone for up-to-the-minute parking information, conference calls, hotel bookings and traffic warnings. These apps can all be accessed at the touch of a screen, according Dr Mike Bell, Jaguar's connected car director.

Passengers can also make use of the in-car WiFi hotspot which allows multiple devices to connect to the internet by the best possible mobile connection using a roof antenna.

The XE features plain speech voice control and Jaguar has ensured the driver can access any level of the system by speaking to avoid navigating multiple menus.

The car will also come with an optional head-up display that displays driver information directly onto the windscreen without causing distraction. The display can be set to configure a range of information, from speed, navigation guidance, traffic sign recognition and cruise control settings.

The system can be controlled remotely so that for example, climate control is operated before entering the car.

connecting the complex structure of a car with the dynamic speed of ICT services.

Ford's Sync Services is one solution. It operates over Microsoft Azure and wirelessly delivers traffic reports, vehicle to dealership diagnostics, plus navigation, sports scores (via Perform) and other services like movie listings.

Taking the living room for a drive

The mega-trend set to transform the entire industry is autonomous driving. The target is to reduce the 90% of car accidents caused by human error.

Renault-Nissan CEO Ghosn explained that this will happen in three waves. Sensor-based semi-autonomous technology to navigate traffic jams will be introduced in 2016. In 2018, autonomous drive will expand to include change of lanes on the highways. Automated city driving will happen around 2020 and in a decade, driverless cars will start to emerge. Renault-Nissan is working on autonomous driving with NASA and is among auto-makers with offices in Silicon Valley.

"We have a building block approach with more and more tasks being taken over by the car," says Pulathaneli of Ford, which runs a test fleet of automated cars. "With systems based on radar, Lidar or cameras you need to be in direct contact with the object (a neighbouring vehicle or parking bay, perhaps) but with M2M connections you can look 'around the corner', or look 'through' the truck hiding danger ahead of you. It will be a technical enabler for a lot of diverse applications in future."

Semi-autonomous features already available in Ford cars include lane-keeping assist, adaptive cruise control and pre-collision 'pedestrian detection'. Experimental technology transmits dashboard alerts to drivers about vehicles braking ahead – even around corners and through traffic. Its Smart Device Link, an open-source version of Applink operated by the GENIVI Alliance, offers software developers and fellow OEMs to directly interface with Ford vehicles.

"We need a standard that is powered by the car maker for car-to-car or car-to-infrastructure connections, and at present, it's only enabled in Ford cars," says Pulathaneli. "We need a standard that connects Ford to Opal, Ford to Mercedes and so on." Among signatories are Baidu and AutoNavi, app developers working in the world's largest market for both smartphones and automobiles – China.

In a Qualcomm-powered concept car (Cadillac XTS) head-tracking software alerts drivers should their gaze wander for more than a few seconds, while a gesture-sensing camera allows them to control music at the wave of a hand. Incoming data from a camera plus GPS and graphic overlays let drivers know where they're heading and when to make a safe lane change.

Volvo is building a test-fleet of 1,000 cars able to detect slippery road conditions, transmitting this information to other Volvo cars, to forewarn them of the danger ahead, and to road maintenance authorities via the Volvo Cloud.

"Such connected car services will, in the near future, deliver both personal and societal benefits by reducing the potential for accidents, allowing a more relaxed journey and lowering the costs of road maintenance," says Kristensson.

Greater safety is only one part of the picture though. It doesn't take a great leap of imagination to predict that current restrictions on driver enjoyment of entertainment in vehicles will fade to the background.

"One day you will see automated cars although the timing depends on the development of the wider M2M environment but when you do then, of course, you could think about using the time spent in car in much the same way as you spend it sitting at home," says Pulathaneli.

Peters agrees: "The car is an extension of the family space and it's where we spend most of our time together outside of the living room. In 15-20 years the consumer will expect to have the exact same experience in the car as if they are at home on the couch."

Mercedes-Benz modelled this scenario with auto-pilot concept car F015. "Anyone who focuses solely on the technology has not yet grasped how autonomous driving will change our society," said Mercedes-Benz chairman Dieter Zetsche in a CES2015 keynote. "The car is growing beyond its role as a mere means of transport and will ultimately become a mobile living space."

Even Volvo, the brand that purrs middle of the road safety and comfort, says it is on a journey where the 'living room experience' in its cars will develop. "Think of self-driving cars and all the possibilities you will have from the moment you are not actively driving," says Kristensson. "You will be able to enjoy the infotainment offers you prefer, connect with friends or your loved ones, work or simply relax a bit."

Traffic and navigation apps like Inrix (Porsche is an investor) and Waze, use crowd-sourced networks to cull data from road users. Inrix can link drivers to social networking sites and alert them when friends are near to determine the best way to meet up. It is only a short step before location-based advertising starts to drive serious in-car revenue.

Going forward, cars will also be integrated with wearables. BMW prototyped a smartwatch that will allow wearers to exit their vehicle and then tell it to go park itself. CSI

Personalising tomorrow's car

Dr Neale Foster, COO and VP Global Sales, ACCESS, looks at standardised solutions for a connected generation of vehicles and consumers

Integrated computer systems and cars are no strangers to one another. Since 1996, on-board diagnostics systems have been standard in all vehicles, allowing technicians to diagnose problems by tapping into the basic data stored by the car. However, for the first time in two decades, an opportunity has emerged for manufacturers to finally capitalise on the full capability of this technology.

Sophisticated computing has enabled technology to pervade every facet of our lives, extending the in-car experience to unprecedented levels with data and media sharing. There are now more mobile enabled devices in the world than actual human beings, which means that solutions for the connected car need to take into account the overwhelming choice of devices that consumers may utilise in the in-car environment.

The perks and challenges of in-car data

According to a recent BI Intelligence report, 75% of cars shipped globally will be able to connect to the Internet by 2020, demonstrating the scope and the market opening on offer.

About two-thirds of today's new cars are already equipped with sensors and communications systems that send and receive data in real-time from each component, enabling manufacturers to better understand how drivers use their cars. These systems also enable the car to automatically store information about its various parts, allowing mechanics to better respond to driver concerns and offer personalised solutions tailored to the individual. The latest generation of cars can even track miles driven, speed and destinations, ensuring that satnav systems provide up-to-date personalised information based on the driver's habits.

Taken in tandem with advanced analytics, this data-gathering feature enables the car to automatically self-diagnose, allowing drivers to quickly identify troubling information with mechanics, without waiting for the annual technical checkup. In addition, manufacturers can use car data to offer customised services, such as adaptive maps informing the driver of the next petrol station or health and security measures such as notifications when the driver needs to take a break.

These new services complement the plethora of automated features that are already available to drivers, including emergency warning systems, GPS navigation, integrated hands-free cell phones, wireless safety communications and automatic driving assistance systems. To make these features more easily accessible, manufacturers and Tier 1 automotive technology vendors are increasingly integrating them directly with the car's head unit, enabling smarter, safer and more eco-friendly driving.

While drivers and manufacturers are the main beneficiaries of automated data collection, it is also valuable to other companies in the industry

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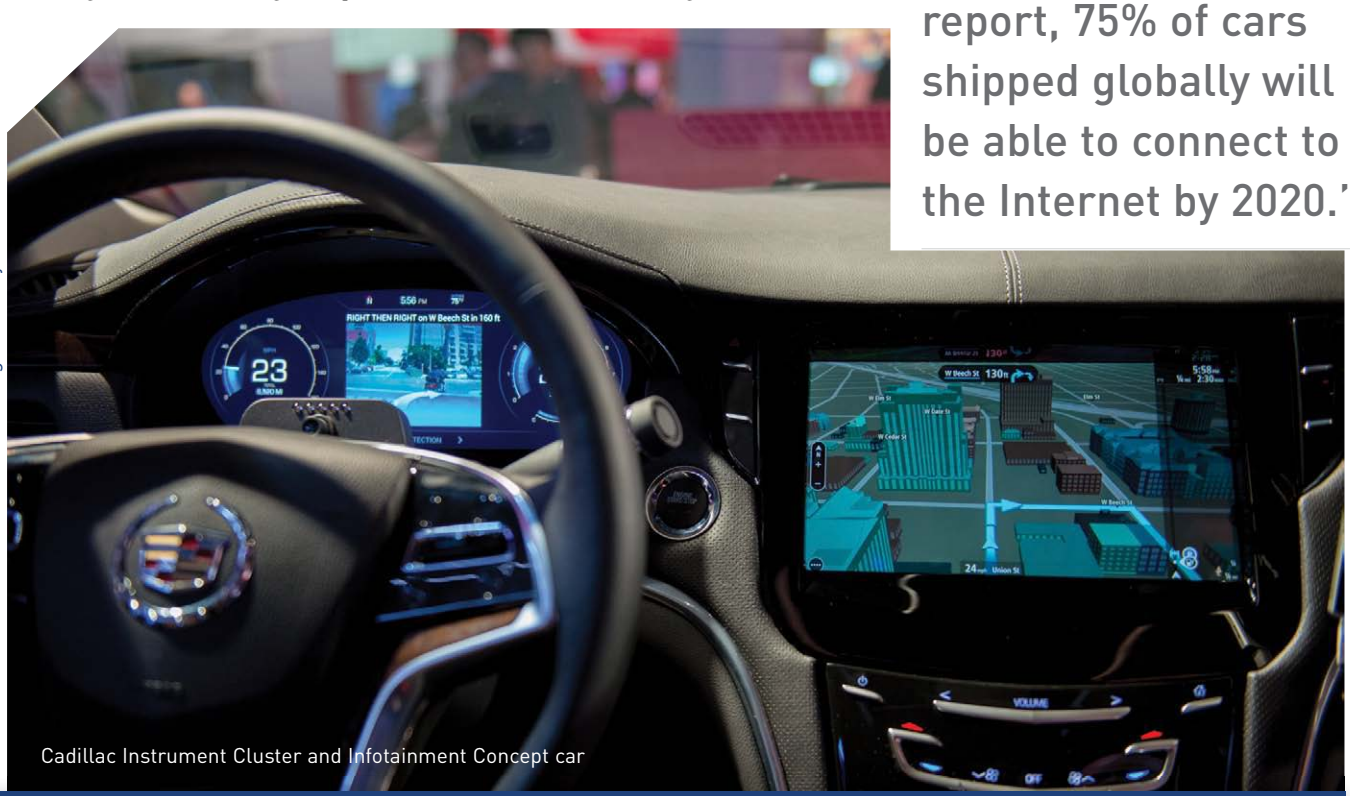
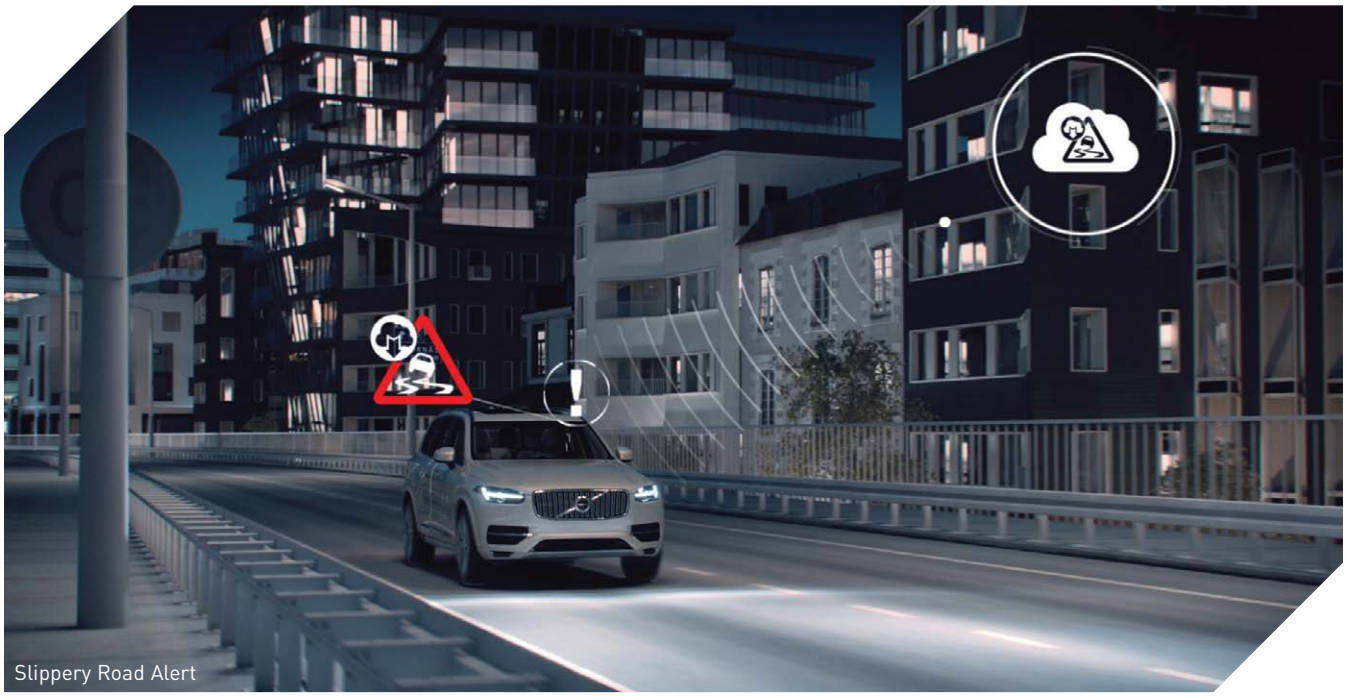


Image courtesy of Qualcomm

Cadillac Instrument Cluster and Infotainment Concept car



Slippery Road Alert

Image courtesy of Volvo

such as insurance providers, who can better understand their customers' driving habits. This enables them to offer more bespoke policies rather than pigeon hole customers through standard identifiers such as age and location. Real-time self-diagnosis can even help automotive brands become more responsive to the immediate needs of their customers and offer tailored advertising via the head unit.

However, compiling that amount of data needn't leave the driver in a vulnerable position. To provide the utmost level of security for the sensitive data transiting through their servers, manufacturers often use Transport Layer Security. Typically involving HTTPS, TLS and SSL, the solution ensures that all data is encrypted, guaranteeing the identity of all parties involved to prevent data manipulation and third party access to driver data, also limiting the risks of hackers accessing connected and driverless cars.

Extending In-car Infotainment with BYOD

The global automotive electronics market is expected to reach $279.96 billion by 2020, according to a new study by Grand View Research, with advancements in infotainment systems expected to help drive revenues even further through this period. According to the report, the proliferation of in-car infotainment systems is due to a number of factors, including eco-efficiency, security and comfort factors. These will all combine to positively impact the electronics market's growth, while demand for in-car data storage is expected to be a key growth driver for infotainment systems.

A prerequisite for sophisticated in-car features, in-car data storage enables manufacturers to offer bespoke infotainment combining locally stored information on the driver's preferences and cloud-based services such as Google Maps, Spotify and more. Consumers are already bringing these services in the car via their personal connected devices, including smartphones, tablets, wearables and eReaders.

Manufacturers are increasingly developing hybrid infotainment systems, relying on embedded functionality and integration with the user's device to project a driver-optimised version of popular apps from the driver's smartphone onto the dashboard screen. This feature relies on the car's capacity to store the data from these apps, which can then be uploaded to the manufacturer's servers. The data is then automatically analysed to enable tailored services, such as music catalogues and additional maps, or suggest offers at a local supermarket.

Manufacturers need to ensure that the infotainment experience they offer adapts to their customers' evolving requirements. Currently, the embedded system provided by the manufacturer is able to remember data such as menus frequently used, radio stations listened to, genre specific music and artist types, use of CDs, USB sticks and rear seat video. Complementing the embedded system and these main data points with custom-built apps enables the manufacturer to better understand how the system is used and enhance the service with more advanced versions of commonly used features, while also introducing new use cases. The mobile app development ecosystem enables OEMs to save on hardware costs. Mobile apps leveraging the user's smartphone or tablet, allowing for Bring-Your-Own-Device (BYOD) behaviours, also have the advantage of allowing frequent updates, so that in-vehicle entertainment can adapt to rapidly shifting consumer preferences.

However, BYOD in the car does have challenges that need to be overcome. They must ensure that different screen sizes and types, security specifications, browsers and interaction methods are all catered for. The user interface (UI) and user experience (UX) also play a crucial role in enabling OEMs to provide a branded experience across all screens in the connected car, helping retain customers and attract new ones. However, the multiplicity of devices means that the UI needs to scale to each device, requiring multiple developments to adapt to each screen brought in the car.

"W3C is also increasingly involved in the evolution of the automotive market, and is working towards defining a standard for automakers around HTML5 interfaces."

How standards can help streamline in-car infotainment

Advanced connectivity and data analytics have played a crucial role in enabling these new services. However, the infotainment market has also faced increased competition and seen numerous players launch proprietary solutions. To respond to the increasing complexity of car infotainment systems, a number of consortiums have also emerged in the automotive space to facilitate the development and propagation of open standards and common platforms.

The GENIVI Alliance, a non-profit automotive industry alliance, aims at driving the broad adoption of an In-Vehicle Infotainment open-source development platform. The Car Connectivity Consortium, a standards-based organisation designed to interoperate technologies, is also building a standard interface to allow mobiles to connect and display info on the infotainment unit. W3C, the web's major standardisation body, is also increasingly involved in the evolution of the automotive market, and is working towards defining a standard for automakers around HTML5 interfaces. This move towards common platforms and shared standards will allow an interchange of software between automakers, fostering the growth of the future connected car market.

Standards-based browser solutions can support multiple device specifications and allow manufacturers to deploy a single user interface (UI) on all platforms, making them particularly suited to the multiscreen world. In addition, standards reduce the testing phase and facilitate in-vehicle interoperability. The DLNA provides a crucial standard with its VidiPath guidelines, which allow device discovery and remote user interfaces (RUIs). This eases consumer adoption and helps promote the OEM brand on unmanaged devices within the car, while bypassing the need to write a new app for every screen.

Utilising a single browser supporting industry standards such as HTML5 - mixed with responsive design functionality - can solve the UX and UI issues within the car. This combination provides manufacturers with an efficient platform on which to design a UX that can dynamically adjust to any screen without manual interaction.

HTML5 already standardises video playback and its host of new features, such as encrypted media extensions (EME) and media source extensions (MSE), offers a unique path to access content. This allows operators to leverage open standards to ensure reliable and consistent memory handling capabilities for non-PC devices, even with limited processing resources, enabling the advent of BYOD infotainment services.

Standards-based manufacturer infotainment solutions ensure a more dynamic and flexible car market. It will provide more and more people with the capacity to share data via the connected car such as web browsing and social media history. Manufacturers will also be able to better understand consumption habits such as preferred device and type of programmes watched, alongside providing granular information on driver-focused data such as performance and distance travelled.

Added connectivity and improved infotainment in the car will radically transform the relationship between the manufacturer and consumers, allowing recurring exchanges through app updates, additional features and regular data sharing. The ability to offer personalised services on every device is equally as attractive for passengers as it is for car owners and is a potential differentiator for manufacturers. However, challenges must be overcome in order to make this a reality, and a standards-based approach is the best way to achieve these results in short time frames. Those who are able to address these problems and offer personalised services will be best placed to win this burgeoning connected car race. CSI

Since 1984, ACCESS CO., LTD. has provided advanced IT solutions centered around mobile and network software technologies to the automotive industry, telecom carriers, consumer electronics manufacturers, broadcasting and publishing companies, and energy infrastructure companies around the world. The company has developed mobile software that has been installed on over one billion devices, and network software that has been used by over 250 telecommunication equipment manufacturers.

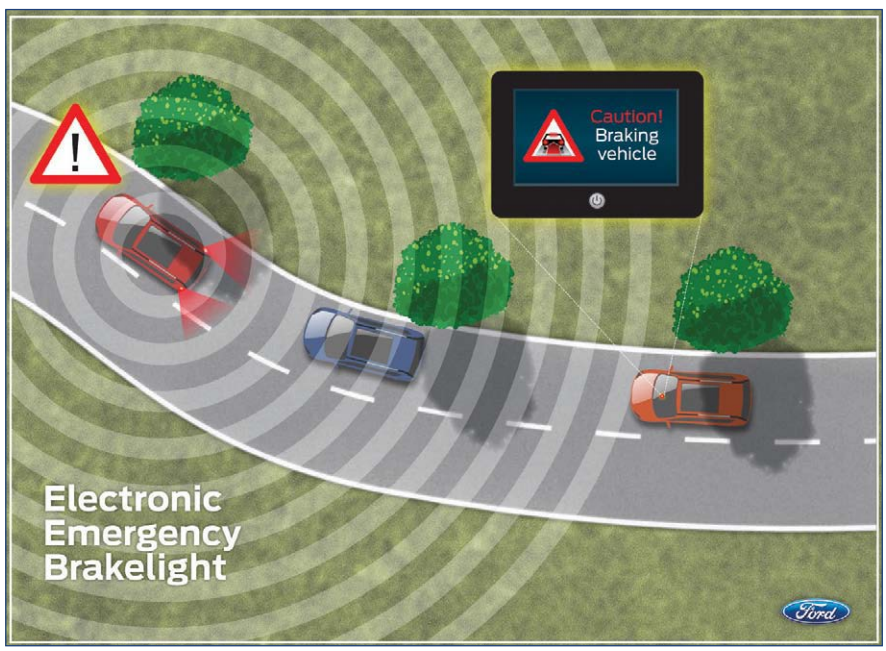


Image courtesy of Ford