



The leading magazine
for content delivery

Focus sponsored by:



Connected cars

Joining the dots

Car makers are seeing increased demands for connectivity and are faced with a range of options in this field. Chris Pickering reports



If there's one thing we can learn from looking back at the past, it's that the future rarely turns out quite the way we'd hoped. All those chrome-rimmed visions of progress from the atomic age with flying cars and robot butlers turned out to be hopelessly wide of the mark. But in one area, at least, we're witnessing the start of a revolution that could turn out to be every bit as far-reaching as those 1950s fantasies.

The concept of the connected car is, as the name implies, all about joining the dots between a range of converging technologies, some of which are already well established. In-car internet access has been with us in one form or another for well over a decade, but for a long time it was largely the preserve of high-end luxury cars. Now, though, most major manufacturers offer this function.

"We're seeing an increased customer demand for connectivity," comments Christian Röss, technical specialist in connectivity for Ford's Research & Advanced Engineering Group. "We already have the ability to pair the user's mobile phone with the vehicle, but the next step is to evolve that."

In Europe, forthcoming legislation will require all new cars sold from 2018 to come with an eCall module. This is an embedded

communications device, capable of automatically sending details of the car's location to the emergency services if a crash is detected. It means that all cars sold in the EU will have a degree of connectivity in less than three years, while market research firm Gartner estimates that 20 per cent of all cars will be connected by 2020.

V-to-V and V-to-X communications

So what type of device do you use to connect? Updates and app releases for mobiles and tablets emerge at a rate the car industry could only dream of, plus it simplifies the business model if everything apart from the (free) eCall system is handled through the user's existing contracts. On the other hand, an embedded system can make use of a much larger antenna, it has no issues with battery life and it is potentially a more secure option.

Röss is in no doubt: "In the future we plan to go for an embedded modem. The world of the mobile phone is changing so fast that what we would like to avoid is a situation where the user downloads a new app or a new operating system on their mobile and it's no longer compatible with the car."

Emerging standards like 4G promise mobile connection speeds that could better current

broadband services, but coverage and performance vary, Röss points out: "The network coverage is not yet sufficient to rely on 4G all over Europe, so the basic service will use 3G, but the technology will evolve as 4G becomes more widespread and we're looking closely at what's currently going on with 5G."

Enhanced connectivity opens up a multitude of options. An increasing number of navigation systems already have the ability to re-route around heavy traffic. Using data from the cloud, the car could also pick out the cheapest fuel stations to visit en route and even pre-pay using an e-commerce add-on. It could cross reference your progress with an online calendar and warn other attendees if you're going to be late for a meeting. And that's just the start.

"In the long term, we're looking at direct vehicle-to-vehicle (V-to-V) communication. In Europe that's already specified by ITS-G5 (Intelligent Transportation Systems) standard – a WiFi-based communication protocol running at 5.9 GHz," explains Röss.

Ford is by no means alone. Most manufacturers are contemplating V-to-V communications and the consensus is that it will be with us in the next five to 10 years.

There's already a standardised message set in

"In the future we plan to go for an embedded modem. We would like to avoid a situation where the user downloads a new app or a new operating system on their mobile and it's no longer compatible with the car." Ford

place, known as the Cooperative Awareness Messaging (CAM). This includes the vehicle position measured by GPS (or Galileo in the future) and various vehicle parameters like speed, heading and acceleration, plus a number of status indicators such as whether or not the hazard lights are switched on.

“CAM will allow us to build a kind of vicinity map in the vehicle,” Ress explains. “Are there other vehicles potentially on a collision course or is there any evidence of a broken down car ahead? Has anybody had to do an emergency stop nearby? We could also look at things like windscreen wiper usage and traction control intervention to suggest if there might be bad weather or a slippery surface ahead.”

By the time the first V-to-V systems emerge, it's likely that some of the high end manufacturers will also be offering an autonomous driving function. Most of the technology required to make this happen can already be found in functions like adaptive cruise control, automated parking, lane departure warning and autonomous emergency braking.

Last year Mercedes R&D boss Dr Thomas

Weber said that he could envisage a fully autonomous mode in a production car by 2020. Others, including BMW, Volvo and Tesla are also in the running to produce a self-driving car. When that happens it will be a relatively small leap to combining it with V-to-V and vehicle-to-infrastructure (V-to-X) functions.

Given access to data on traffic light phasing, for instance, the car could adjust its speed to pass through each one on green. With a plethora of different sensors required for autonomous driving, each car could also feedback a lot of data about its environment, for instance identifying potential parking spots and sharing them with other vehicles in the cloud.

Again, the technology isn't as far away as you might think; the BMW 7-Series already has a system that uses onboard cameras to update a central database of street signs. If one car notices a sign that's not on the map or an incorrect speed limit, it can automatically notify the mapping company for an update to be sent out to all users.

Security and hacking

Downloadable content and over the air updates

Google car pulled over

Earlier this year, one of Google's self-driving cars was pulled over by the police for driving slowly.

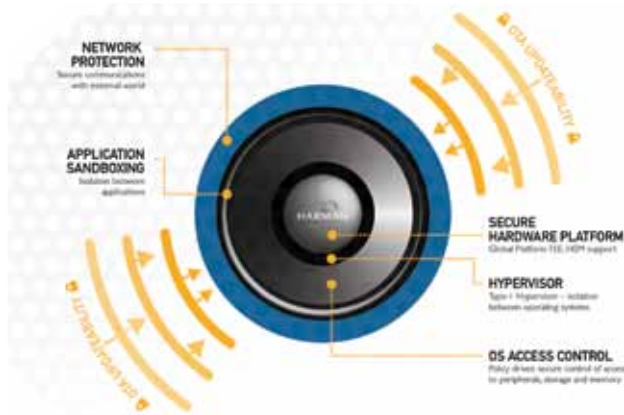
The vehicle was caught driving 24 miles per hour in a 35 mph zone, according to a police report, and was pulled over after a traffic officer noticed traffic backing up behind it.

A ticket was not issued even though it is in any case not yet clear who should have been issued a ticket if a self-driving car does commit a serious violation.

The legalities are still ambiguous as to who should be accountable with driverless cars. One of many questions to be answered is whether we should hold self-driving cars to the same standard as a human driver? Another is as cars become more autonomous, what kinds of decisions are factored into algorithms to decide what action the vehicle takes in the event of an unavoidable accident – who does the car run over?

Google has performed 1.2 million miles of autonomous driving tests.





but one in which we have been investing heavily for several years," comments Hans Roth, director of business development for automotive systems at infotainment specialist Harman.

"We are rolling out a 'five plus one' security strategy, where the vehicle-critical functions are kept in a

"Gartner estimates that 20 percent of all cars will be connected by 2020"

access to what type of data and a sandboxing function that isolates newly downloaded applications. The fifth level is network protection with intrusion prevention and intrusion detection. Finally we have the 'plus one' layer, which provides secure over-the-air updates."

Infotainment suppliers and telematics providers across the board are working on detection systems to flag up anomalies in the data traffic and requests from the apps themselves. It remains to be seen whether these measures will make the car truly unhackable, but it's certainly going to be one of the more secure environments in an increasingly connected world.

So the future may be approaching faster than you think. In ten years' time, cars may be capable of not just driving you to your destination, but also tailoring the experience to your location and even your mood.

It provides a fascinating prospect to drivers and passengers, as well as a potentially vast new range of business opportunities for car manufacturers, mobile networks and app developers. Just don't expect a flying car. **CSI**

provide a potential gateway into the car's various electronic systems. Modern cars can have 40 or more processors that all talk to each other over a central CAN bus, so it's not practical to isolate the hardware. In theory that means a malicious file downloaded through the infotainment system could access safety-critical systems such as the brakes or steering.

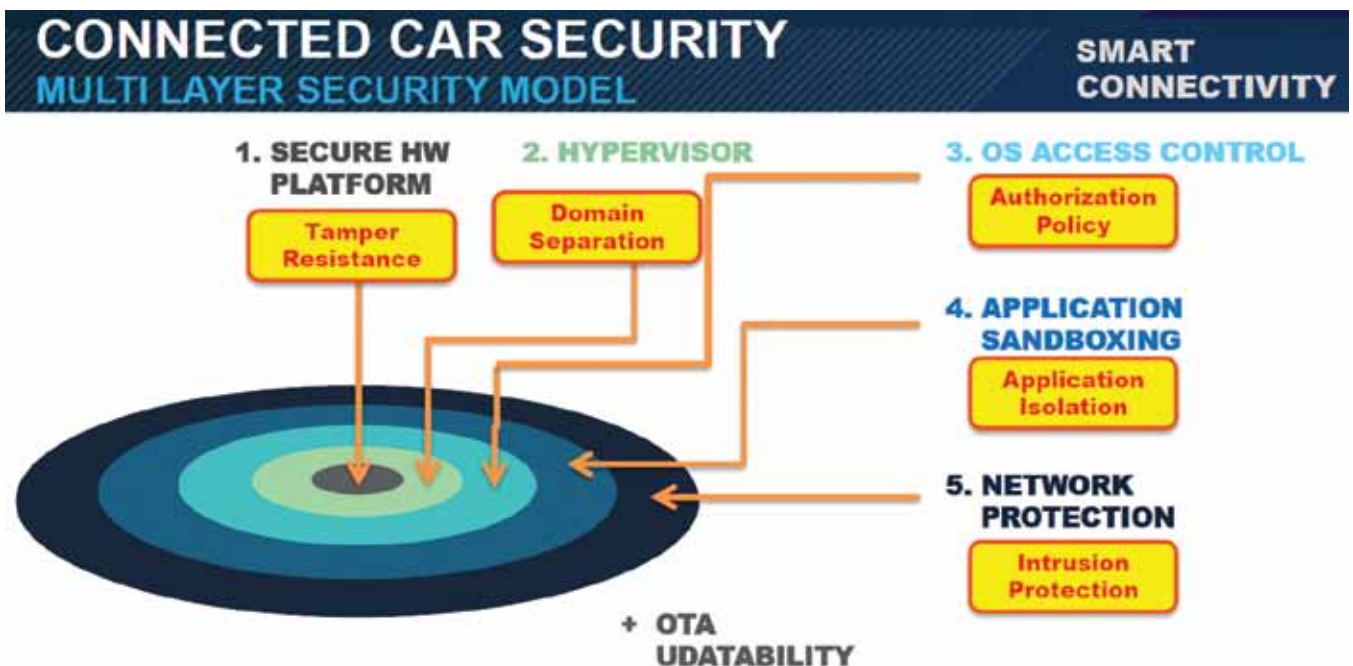
Here, however, it's worth taking a step back for a second. Although there have been several well-publicised incidents of 'car hacking' all to-date have featured researchers deliberately trying to expose potential access paths. Even then, most have involved a cable physically plugged into the car's diagnostic port and several hours' work on a laptop.

Nonetheless, it's a threat the OEMs take very seriously. "Car hacking is a relatively new field

trusted domain, which is independent from the main operating system. It's a virtual environment that even separates the memory space. You could have one domain running on Linux and one running QNX on the same hardware."

The Harman system uses what's known as a hypervisor to create separate virtual machines on the same hardware, splitting the safety-critical functions from the infotainment.

"It's a bit like the layers of an onion," comments Roth. "It starts with a secure hardware platform, including a secure area where the encryption keys are kept. The second element is the hypervisor, which is used to provide secure storage for digital certificates, cryptographic keys, passwords and any other sensitive data. Next you have an authentication policy to control who has



Shifting up a gear

The concept of the connected car is unlocking new infotainment options and potentially shifting the industry towards innovative monetisation and service opportunities, says Dr Neale Foster, COO and VP Global Sales, ACCESS

The automobile is celebrating its 136th birthday next year and its history has been marked by huge technological shifts. From the conception of the combustion engine to the birth of electric vehicles, next year around 90 million new vehicles will be sold, racking up around \$2 trillion in revenue.

Across every facet of the industry, technology has helped to reduce production costs, improve safety and deliver higher levels of fuel economy in vehicles that are more comfortable driving experiences. From an earlier era, where the car was predominately a mechanical construct, today, around 35% of the cost of each vehicle is made up from electronics and software, according to research by the Technical University of Munich.

This trend was more than evident at the recent Tokyo Motor show where 160 companies from across the automotive sector wowed over 800,000 visitors with new models from futuristic concept

“Gaining an understating of a individual’s driving patterns, where they shop, which places they visit along with frequency allows for advertising to become more targeted and effective.”

cars, luxury saloons and tiny, all electric city vehicles. Yet looking inside the sleek exteriors, a common theme emerges of the automotive industry’s desire to meet the needs of increasingly connected and technology savvy customers.

Welcome to the digital age of motoring

From the golden years of the 1950s where performance was king, through the rise of the SUV where size matters, today’s motor show enthusiasts are seeking more digital delights. Advanced features such as parking assistance, in-vehicle entertainment, navigation and systems to help manufactures deliver timely fault diagnosis are part of a growing set of features that car makers are using to tempt buyers.

Although the connected car and high end electronics started in the luxury market, the rapid cost reduction of LCD screens and componentry has meant that the connected car feature set is now in mid-sized and some compact models. A recent BI Intelligence report suggests that 75% of cars shipped globally will be able to connect to the Internet by 2020. Millennials, drivers that reached driving age around the turn of the millennium are particularly attracted by the promise of in-car connectivity. As they represent roughly a quarter of new vehicles purchased today, manufacturers need to ensure that their services adapt to this growing audience.

Alongside swaying consumers’ purchasing decisions, the growth of the connected car fits into an evolution that turns the journey into a more enjoyable and engaged experience. Although sometimes taken for granted, the car is still the most popular mode of transport. According to the UK’s department of transport, in 2014 around 64% of all trips were in a car, which accounted for 74% of the total distance travelled. The average person in England will make nearly 921 trips a year by car, consuming 361 hours.

With 6% of our average waking lives now spent in a car, the automotive industry is responding with more entertainment options aimed at improving the experience. For drivers with eyes on the road, video is not an option, so manufacturers provide better audio options and increasingly the availability of voice recognition technology to access functions from music selection to directing navigation systems. Where the traditional dashboard was fixed, the use of LCD for instrument panels and consoles allows customisation through software-based modules that provide navigation information with guidance on congestion, weather, accidents and vehicle diagnostics.

In the rear passenger seats, the focus has been on delivering enhanced infotainment in a move similar to the systems available for airline passengers. Rear seat entertainment systems offer



access to broadcast TV, DVDs, content from removable USB/SD cards along with wireless headphones and remote control. These entertainment centres also provide device charging and in some models, the option for a mobile broadband router and associated single/bonded 3G/4G data connectivity offering internet access and streaming media content for the infotainment centre and a WIFI hotspot across the vehicle.

However, unlike flying with its disconnection from 3G/4G networks, a car journey still allows passengers to connect to cellular data networks, which are prompting automotive manufacturers to develop in-car connectivity features that welcome a passenger’s own devices. For example, vehicle



entertainment units that allow users to connect via an in-car WiFi network and share content from a personal device such as smartphones and tablets through wireless casting to share music, pictures and in some cases video content.

Always connected

Keeping drivers informed and passengers entertained is just one aspect of the connected car evolution. As the cost of cellular connectivity continues to drop, manufacturers are starting to offer connectivity as a standard feature or within lease agreements to utilise communications to improve safety and security for drivers and passengers, while opening the door to other commercialisation opportunities. The car offers a whole host of data collection possibilities that are useful for a wide range of ancillary services. For example, data from on-board GPS can allow for vehicle insurance policies that provide discounts for drivers based on adherence to speed limits, types and duration of journey. In the event of an

accident, systems that automatically connect occupants to roadside assistance and other emergency services are all enhanced through connectivity.

As more vehicles become equipped with these types of data gathering technologies, the value of crowd sourced intelligence can be used to reduce traffic jams and facilitate congestion charging schemes amongst a whole host of civil planning and transportation policy insights.

With internet users accepting that sharing personal and usage data offers access to free digital services like Google Maps and Facebook, which in turn generate revenue from advertising, the connected car may open up similar operating models. Gaining an understanding of an individual's driving patterns, where they shop, which places they visit along with frequency allows for advertising to become more targeted and effective. Some automotive manufacturers are looking at providing integrated in-car wireless internet access in exchange for the sharing of this data and the acceptance of advertising messages.

Another major benefit of connectivity for the car manufacturer is to maintain a link with the vehicle owner and potentially to subsequent owners as vehicles move through second-hand markets. This longer duration connection between manufacturer and owners is a major shift for the industry and although still at an early stage has the potential to enhance the automotive business model from predominantly a sales focused endeavour towards a more service orientated business.

A sustainable ecosystem

Although the potential is clear, there are still bumps in the road, and the connected car and new concepts like in-car data are still evolving. Although the top 5 manufacturers, which account for around half of all new sales, have all invested in the technology, there are still differences in implementing many of these next generation digital technologies.

When it comes to accessibility and content delivery, unlike the majority of internet websites



that are accessed through browsers using HTML, many early generation car entertainment system use closed and vendor specific technologies. In order to more effectively provide applications and information that consumers need in a timely manner, the automotive industry is now shifting to standards such as HTML5, initially for online services such as news, weather and travel information.

However, the use of internet technologies leads to security and privacy issues considering that the modern car is increasingly software controlled and potentially vulnerable to attacks. Any subsystems within the vehicle that can connect with external sources such as websites must not be able to affect the working of the vehicle. Current platforms address this by having physically separate hardware platforms, but as cost reduction occurs, it is likely that this will change. The need to 'sandbox' systems such as IVI platforms, so they cannot affect the primary vehicle systems, will become more prevalent as mass-market vehicles utilise a common single

hardware platform for vehicle and entertainment functionality.

There are strides being made, especially when it comes to in-car infotainment deployment. The Digital Living Network Alliance (DLNA) has an Automotive Task Force that plans to establish automotive technology, specifically In-Vehicle Infotainment (IVI). The DLNA® is working with member companies from interested industries including automotive and consumer electronics to offer next-generation services such as in-car servers that sync content between the parked car and the home or in-car networks, facilitating media sharing between passenger devices.

Another is the GENIVI Alliance, a non-profit industry alliance committed to driving the broad adoption of specified, open source, In-Vehicle Infotainment software, which is working towards sets of software components, standard interfaces/APIs, flexible technical architecture and pre-integrated and reusable IVI platforms.

W3C, the web's major standardization 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 unprecedented reuse of software between automakers' systems and brands, fostering the growth of the future connected car market.

Standards-based browser solutions enable manufacturers to deploy a single user interface (UI) on multiple platforms. In addition, standards can reduce the testing phase and facilitate in-vehicle interoperability with consumers' personal devices.

Manufacturers are

“The use of internet technologies leads to security and privacy issues considering that the modern car is increasingly software controlled and potentially vulnerable to attacks.”

also looking at ways to build on the potential of IVI. For example, technologies like ACCESS Twine™, a solution already used by TV operators to gather usage information and enable consumers to seamlessly and securely share content between devices is starting to garner interest in automotive scenarios. This enables manufacturers to utilise a solution

that has proven its value in the connected entertainment space, and that can be used to effectively turn the car or consumer's personal connected devices within each vehicle into another end-point for service management and content delivery. The ability to gather, store and transmit vehicle information will also help automotive manufacturers gain insight into consumer usage patterns and develop new revenue streams, such as personalized location based recommendations or targeted advertising.

Built for the future

All these initiatives are ultimately helping manufacturers and supply chain partners to drive down the cost of the next generation connected car elements and enhance the potential for both themselves and ecosystem partners with value added services to offer. The connected car is the foundation for other key technologies such as driverless vehicles, as well new business models like per mile car sharing clubs.

With a report for consulting firm Accenture (ACN) suggesting that technology ranks as the most important selling point for 39% of U.S. car buyers, delivering the right connected car experience could well be the most important decision of the second century of the automotive industry, making it crucial for manufacturers to start deploying relevant and accurate systems to better understand their customers and extend their entertainment services in the near future.

CSI



ACCESS Twine™: Build the Future Connected Car

ACCESS Twine™ enables **secure data gathering and storage** from the car and provides the possibility to **analyze key data points in the cloud**. ACCESS Twine allows the deployment of OEM branded solutions that integrate with Car, Mobile and Cloud services.

Built on more than 30 years' expertise in providing solutions for embedded, applications and server software, ACCESS Twine complements our **HTML5 car platform and secure media sharing** capabilities to provide a **future-proofed and universal choice** to build next generation connected car experiences.

For more information about our products and solutions for the Automotive sector, please contact automotive@access-company.com

Supported industry standards:

