

Connected Car

INFOTAINMENT / TELEMATICS / INTERNET OF EVERYTHING

Issue 8 / September 2017  Video Enabled



SPECIAL FOCUS: THE FUTURE OF INFOTAINMENT

PLUS:



VIDEO REVIEW: SEAT ATECA

▶ Examining the SEAT Ateca's connected systems



WAZE NAVIGATION

▶ Can free, community-based GPS, maps & traffic navigation work?



TATA MOTORS IN EUROPE

▶ How does Tata Motors European Technical Centre fit in, and what does it do?



DATA TRADING AND THE CONNECTED CAR

▶ Will the automobile sector be forced to work hand in hand with telecom operators, Internet companies, advertisers and data aggregators?



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NextGen

FROM THE DRIVING SEAT

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Click I.T. Limited
Hampshire Gate, Langley, Rake
Hampshire GU33 7JR, England

CONNECTED CAR IS DISTRIBUTED BY:

NextGen-Connect.com
8600 W. Bryn Mawr Avenue, Suite 500N
Chicago, USA
IL 60631

Connected Car is distributed on a quarterly basis to companies and individuals with an interest in connected car, infotainment and telematics technology.

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Hello, and welcome to the latest issue of Connected Car magazine. In this issue we devote space to some blue-skies thinking. With the automotive landscape changing at a completely unprecedented pace, how will the infotainment systems in our cars change?

It's really not that long ago that a cassette player in the car seemed like a real novelty, then the world went digital and we were presented with the wonder that was the CD player. Audio quality went up, and so did car company revenues as CD multi-players made their way onto the options lists. Today, car companies are quietly deleting CD slots from their cars, this to the chagrin of many of today's car users.

The car companies are aware of this thing called streaming, and of the ability to play content in the car that is either stored on a smartphone or tablet, or that is coming from that mysterious thing called The Cloud, which is all a bit spooky. So now they provide support for infotainment that comes to us through messy USB cables, over Bluetooth (sometimes!) and which will eventually seep into the car via some sort of air-born magic involving osmosis or something.

It's all very, very fluid at the moment, and it is linked with the paroxysm exploding on the automotive ecosystem resulting from the realisation that a war is starting to gather, own, control and monetise data.

So how will all those dads get to listen to their favourite Girls Aloud/Taylor Swift/Def Leppard tracks in future? We talked to some of the industry's gurus to gather their opinions.

Speaking of data, Waze is a company that is taking on the giants to provide a navigation app that is based entirely on data that is gathered, provided for free, updated and maintained largely by an un-paid community of users. Can this really rival established players like TomTom, HERE, Garmin etc? Well, Google, which you would consider a competitor with its own Google Maps – obviously thought so and bought the company for \$1 billion. To put that into perspective, when Indian automotive giant Tata Motors bought Jaguar Land Rover, it paid £1.3 billion. That included the two global brands, multiple factories, thousands of workers and so on. How can a tiny company with a tiny staff and an app be worth a similar amount of money to Jaguar Land Rover? This was just one of many questions on my mind, and so I met with Waze in London. This issue includes my interview.

And, speaking of Tata Motors, the company not only owns Jaguar Land Rover but it has a business called the Tata Motors European Technology Centre. What is that all about? I interviewed them too.

And finally, this month's features include a video review of the SEAT Ateca, which was a follow up to a meeting with SEAT's Global Head of Connected Car in Barcelona, and a thought-provoking article by Stephen Wood, executive director of the Intergetic Forum on data trading and the connected car. Stephen believes that instead of owning and controlling the data trading ecosystem, the automobile sector will be forced to work hand in hand with telecom operators, Internet companies, advertisers and data aggregators under terms that can be influenced, but not controlled. Over.



As ever, if you have any thoughts, get in touch. Oh, and we will have a spanking new web site very soon!

Vince Holton
Editor
Connected Car

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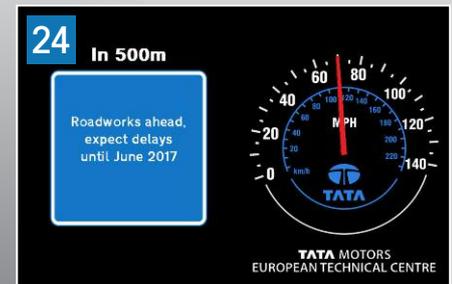
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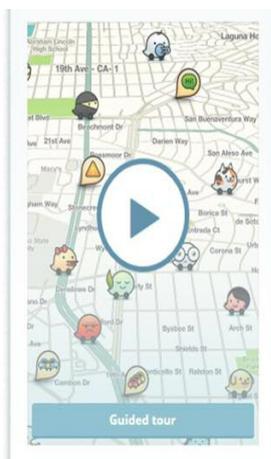
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NEWS

COMMUNITY DATA-BASED NAV APP GOES ANDROID AUTO

Waze launched Waze Android Auto on the 26th July, describing this as 'a long-awaited integration' that allows drivers to use the popular sat nav app directly from the car's console. Waze recommends the fastest routes based on real-time driving data collected from millions of users who, together, help people avoid traffic and save time.

The app integration will enable drivers to use voice commands to start their journey, remembers their "Favourite Navigation" destinations, links to their vehicle's steering wheel buttons and other console-mounted controls.

All key Waze features will be available on Android Auto, including:

- Home, Work and Favourites Navigation (drivers can program home, work and frequently visited "favorites" to quickly start their drive).
- Use voice commands and tell Waze where they want to go.
- ETA Panel: Organizes everything you need in one view before drivers head out. Easily check alternate routes and adjust sound settings.
- Reporting: It's easy to help others on the road with a visual reporting menu.
- Alerts: Receive visual and audio alerts with the open app to keep drivers keep informed and your hands on the wheel.

Waze for Android Auto is built specifically for in-car display, which means a larger map and bigger views of routes, alerts, hazards and more. With this release, Waze says it is expanding user experience to give drivers an additional way to navigate with Waze. What's more, if a driver is in another Android Auto app such as Spotify,

Waze will show a direction notification within Spotify so that she/he will never miss a turn.

Voice control is currently limited to defining your destination, such as "Take me to 123 Main Street" or "OK Google, let's go to Dunkin Donuts." You can also pre-program your Home and Work address, and give the voice command "Drive Home" or "Drive to Work". Waze plans to expand these voice commands in the future.

Waze has worked with its 5,000-person Beta Community to develop the first version of Waze for Android Auto. Below is a list of Waze for Android Auto features that are currently available:

- Voice command navigation
- Customized in-car displays
- Home, Work and Favourites navigation
- ETA Panel
- Reporting and alerts

Not yet included

- Voice command reporting on traffic, hazards and more
- Waze Speedometer
- Social features like send a beep beep, carpool, map chat and gas prices
- Pre- and post-driving features like Share ETA, Planned Drive, or Where Did I Park

Waze will continue to develop Waze for Android Auto and will issue updates with new features as they become available.

See page 6 for Connected Car's interview with Waze.

ROBERT BOSCH VC INVESTS IN IN REAL-TIME ANALYTICS AND EDGE DATA PLATFORMS COMPANY

Robert Bosch Venture Capital GmbH (RBVC), the corporate venture capital company of the Bosch Group, has completed an investment in iguazio. The Herzliya, Israel, based company has apparently worked to accelerate the digital transformation of enterprises and simplifies real-time analytics at the edge, on-premises and in hybrid environments, complementing the offering of cloud providers. The USD 33m investment round was led by Pitango Venture Capital. Additional funds came from Verizon Ventures and CME Group, as well as, the company's existing investors, Magma Venture Partners, Jerusalem Venture Partners and Dell Technologies Capital.

Founded in 2014, the iguazio Continuous Analytics Data Platform has redesigned the data stack to accelerate performance in big data, the Internet of Things (IoT), and cloud-native applications. "Automotive and industrial companies require real-time analytics closer to the edge," says Dr. Ingo Ramesohl, Managing Director and co-head of RBVC. "iguazio's platform is the missing link between on-prem servers and leading cloud providers, effectively complementing existing cloud solutions. It provides a distributed cloud near the edge for the greater simplicity, performance, security and agility required by next generation applications."



QUANTUM INVENTIONS

---mobility intelligence---



INRIX/BMW PROVIDE ON-STREET PARKING SERVICE IN A CONNECTED CAR

INRIX, which develops connected car services and transportation analytics, has announced the availability of its On-Street Parking service in the new BMW 5 Series. INRIX says it is delivering the industry's first real-time on-street parking service in a connected car, which uses historical and up-to-the-minute parking data to predict the availability of parking spaces.

According to recent INRIX research, 72 percent of respondents said real-time parking availability is the navigation feature they desire the most.

Joe Berry, vice president and general manager of automotive at INRIX told Connected Car, "Real-time parking is the most sought-after navigation feature because it addresses a pain point that affects everyone. The first automotive deployment of INRIX On-Street Parking solidifies BMW's position at the forefront of connected car technology with a focus on delivering the services drivers want the most."

The BMW 5 Series also includes a real-time traffic service, powered by INRIX in North America, for up-to-the-minute and predictive traffic flow information for routes, travel times, and alerts to accidents and incidents on over five million miles of roads. INRIX Traffic incorporates information from its network of more than 300 million connected vehicles and devices in over 40 countries.

The INRIX On-Street Parking service is live with BMW Group in 16 cities in Germany and the U.S., with more cities set to launch in 2017. Initially, the service is available in Germany (Berlin, Cologne, Dusseldorf, Frankfurt, Hamburg, Munich and Stuttgart), and in the U.S. (Boston, Chicago, Los Angeles, New York, Philadelphia, Phoenix, San Francisco, Seattle and Washington, D.C.).

INRIX Parking claims to provide the

world's largest parking database with more than 35 million spaces in 100,000 locations spanning 8,700 cities in more than 100 countries. Additionally, the patented INRIX On-Street Parking service leverages machine learning to deliver ground-truth tested dynamic occupancy predictions in nearly 40 cities globally, covering more than 200,000 individual street segments.

CONTINENTAL ACQUIRES MOBILITY INTELLIGENCE PROVIDER QUANTUM INVENTIONS

Continental has completed its acquisition of Singapore based mobility intelligence provider Quantum Inventions. Quantum Inventions will add its city data including next generation navigation systems that respond to real-time information such as traffic data, road incident information and dynamic road pricing. With the closing, Continental will take on approximately 120 employees working across Quantum Inventions' three offices in Singapore, Malaysia and Indonesia, and Quantum Inventions Development Centre (QIDC) in India into its fold.

Helmut Matschi, member of the Executive Board at Continental and head of the Interior Division commented, "Asia continues to play an ever increasing role in our strategy. Initiatives such as the Park & Go real time parking application for Singapore, our recent joint venture with China Unicom, strategic cooperation with Baidu, and now the purchase of Quantum Inventions underline our focus on developing mobility services solutions. We are excited to provide an expanded portfolio of customized solutions in the dynamic mobility services market."

Quantum's solutions are based on its proprietary data technology platform which provides connected navigation, traffic and transportation intelligence, high-speed dynamic routing computation algorithms and real-time probe data processing and analysis. The company

has three business lines – Automotive, Telematics and Intelligent Mobility.

INDUSTRY LEADERS TO FORM INFRASTRUCTURE CONSORTIUM FOR AUTOMOTIVE BIG DATA

DENSO Corporation, Ericsson, Intel Corporation, Nippon Telegraph and Telephone Corporation (NTT), NTT DOCOMO, Toyota InfoTechnology Center, and Toyota Motor Corporation have initiated the formation of the Automotive Edge Computing Consortium. The objective of the consortium is to develop an ecosystem for connected cars to support emerging services such as intelligent driving, the creation of maps with real-time data and driving assistance based on cloud computing.

It is estimated that the data volume between vehicles and the cloud will reach 10 exabytes per month around 2025, approximately 10,000 times larger than the present volume. This expected increase will trigger the need for new architectures of network and computing infrastructure to support distributed resources and topology-aware storage capacity. The architectures will be compliant with applicable standards, which requires collaboration on a local and global scale.

The consortium will apparently focus on increasing network capacity to accommodate automotive big data in a reasonable fashion between vehicles and the cloud by means of edge computing and more efficient network design. It will define requirements and develop use cases for emerging mobile devices with a particular focus on the automotive industry, bringing them to standards bodies, industry consortiums and solution providers. The consortium will also encourage the development of best practices for the distributed and layered computing approach recommended by the members.

THE FUTURE OF INFOTAINMENT

In this feature we ask two specialist automotive suppliers - Harman and Conjure - and one car company - SEAT - to share with us their views on how the infotainment space will change over the coming years.

As in previous Connected Car feature sections, we ask each of the participants to focus on the same topics. This gives an opportunity to understand different levels of thinking on the same key issues.

SEAT is recognised as a car company that attracts a younger audience than most, while Harman is deeply-embedded in the automotive industry, and now part of the Samsung empire.

Conjure is a new company to Connected Car. We came to be in contact with them through a shout-out we did using Twitter - who said social doesn't work for business communications! Conjure is typical of a young, dynamic business that thinks, moves and develops considerably faster than the industry juggernauts. Its thinking is genuinely thought-provoking.





Conjure's cluster design for the Ford GT.



FUTURE TRENDS FOR THE AUTOMOTIVE INFOTAINMENT SYSTEM

INTERVIEWEE: SAM CLARK, MD, CONJURE

Conjure began life as a mobile applications development agency in 2009, building native apps for iOS and Android. The company began work in the automotive sector about three years ago, some would say by starting at the top, with a UK supercar manufacturer with a background in motorsport as its first customer, that company recognising Conjure's skills in designing for small screens on smartphones and tablets. Subsequent contracts saw the company developing screens for Triumph Motorcycles and Ford Performance in Detroit, Conjure having designed the instrument cluster for the Ford GT supercar. Experience in designing automotive HMIs saw Conjure broaden its portfolio to designing apps for further automotive clients, including Jaguar Land Rover, now one of Conjure's largest clients.

Conjure now offers design services across the automotive sector, and here at Connected Car we felt that this was a company that could provide excellent insight into future developments in automotive infotainment systems. We talked, then, with Sam Clark, Conjure's managing director.

CC: How do you see automotive infotainment systems changing in the coming years?

SC: I think that the future of infotainment in the car will be much more inclusive for the passengers. Currently, the infotainment experience is very silo'd. In more advanced vehicles, people in the back have their own screens and headsets on and are tapping away at keyboards. I think that as the vehicle interior changes, and people can sit facing each other, the infotainment experience can be much more shared. Families and friends will be able to participate in group games or watch a film all at once.

CC: On a practical level, how will it work? Will there be a holographic display in the middle of the car, or a flat screen on

the side of the car as we've seen in concept cars from people like Mercedes?

SC: It really depends on what technologies prevail. What I'd love to see is a 21st Century version of 'I Spy' where someone says "I spy with my little eye something beginning with B" and the car's intelligence will use the cameras around the car to highlight on the transparent screens as the car moves along everything starting with the letter B in order to give everyone a chance.

I can also see screens in the centre of the car where people physically place their phones on the screen and all the photos that they have taken while on holiday spill out onto the screen. Each family member would be able to touch the photos and drag them into their own photo album or post them to their own Facebook account. This sort of collective or group sharing and tagging has



FORD GT 2017

HMI / IVI DESIGN AND INTEGRATION

a lot of potential. And I think that games like Clash of Clans, Risk or Monopoly will make their way into this area, where everybody can participate. So I don't know what type of screens will be used – it will be for the OEMs to decide – but the technology is there to allow this to happen.

CC: In the near future, do you think there will be two infotainment development paths – one for conventional vehicles and one for autonomous?

SC: I don't think there will be. In addition to the driver, there will always be passengers in vehicles. Passengers may or may not want to be entertained, but you can make an assumption that there will be a need for entertainment, but also a sales opportunity as well. The interiors of cars will change, as is shown in Jaguar Land Rover's Discovery Vision Concept, which demonstrated how the interior layout can dynamically change. In that way, when a driver switches to autonomous mode in a future vehicle, the conventional infotainment system layout will adapt to a more inclusive experience. Passengers will be able to face each other and there can be a central IVI that can run information, news or entertainment. The car's interior layout will then dynamically change back when they need to be driving. For that reason, I think that no, there won't be two separate development paths.

CC: Does this thinking explain why manufacturers are currently loading vast amounts of technology into today's cars, to prove the tech in conventional cars, which are, after all, what most people will be driving for quite some years to come?

SC: I think that fear of big tech companies caused some of the manufacturers to get a bit ahead of themselves. I think that they (the car companies) thought that once Apple and Google came in, they would never get rid of them. As a result, a lot of tech was crammed in when it wasn't really needed. And some of the OEMs developed proprietary platforms that were never going to be as good as those provided by Google and Apple. A lot of work was put into systems that weren't that great at the time. This has meant that while tech in today's cars will mature over the next few years, by the time today's cars get into the second-hand market the tech will be completely out of date, and I think that a few of the manufacturers might come to wish that they hadn't rushed so much technology out so quickly.

CC: Will user content be imported to the vehicle, either on smartphones or portable storage devices, or will it be streamed?

SC: I think it will be streamed. Streaming essentially means on demand and the wider entertainment industry is moving towards the on demand model – Spotify, Amazon Prime, Netflix etc.. We just have to wait until the technology, and more importantly the coverage, gets there. That means rock-solid Internet connections in tunnels and in remote parts of Scotland. While this is some way off, I think there will be a crossover point relatively soon where hand-off becomes standard so that if you are listening to an Iron Maiden track (!) in your apartment, and a friend calls and you head off to see them, you will walk out of the apartment and where you were on that track will be automatically passed across to your car system without you having to think about it. Smart home systems such as Google Home or Amazon Alexa will know what you are watching or listening to, and as soon as you start streaming or downloading it in the home, they will also start streaming it to the car. This will be robust because the car will be stationary, or the car will be connected to the Wi-Fi. I don't think that the technology barriers to that are very high. We are seeing a bit of an arms race in the living room, and the car companies will be able to piggy-back that, building hand-off features into the car.

CC: Will the automotive industry need to embrace content providers such as Netflix and Amazon Prime?

SC: The entrenched content providers will be part of the scene for the foreseeable future, but more content providers will come along. The content providers are beholden to the platforms. Amazon pushed the FireTV hardware into TVs pretty aggressively in order to get the Amazon Prime services there. Apple of course had Apple TV, which has matured at quite a rate and now both offerings are pretty solid. As long as the auto companies are bringing in the Apple or Android platforms - or even their own proprietary platforms if they are intuitive and easy to use, handle hand-off and embrace streaming where they can – then the content providers can sit on top of those platforms. While Netflix and Amazon are the two giants, more content providers will come along, and as long as the car companies have provided an open door, the users will have a fair bit of choice.

CC: There do seem to be some unlikely alliances happening in this growing content market. Netflix and Amazon Prime would seem to be competitors, yet I can watch Netflix content on my Amazon Fire Stick-enabled TV. It seems to be as much about commercial agreements as it is about technical provision of the service.

SC: I agree. In the past it used to be whoever owned the platform dictated the content, but that's no longer the case. Begrudgingly, the content providers have had to come to terms with this. Think back to the early days of book publishing on e-readers. There were times when something was available on iBooks but was not available on Kindle, and this was a conscious commercial decision. That doesn't happen now. The content owners know that the more platforms they are on, the more sales they will make. Meanwhile, the platform providers know that the more content they have the more likely they are to succeed. So yes, the commercial agreements are important, but the car companies don't really care if it is Netflix or Amazon – it's all about providing user choice.

CC: And how about the HMI? Will the customer be using knobs and switches, touchscreens or voice for control?

SC: My answer is all of them! Knobs and switches will never truly go away. The tactile nature of a knob or a switch is not to be underestimated. When you get a new car, you quickly learn where the key knobs and switches are. The great thing about a knob or switch is that it gives great, tactile, non-visual feedback. You put your hand out, your fingers find the switch and with almost no brain-power or needing to eyeball it, you can make a change to something. That's a powerful thing. We will see much less knobs and switches as time goes on, but they will always be there. For these reasons, things like the eCall legislation coming in mean that these systems will always be controlled by a physical button – it will never be a button on a screen that can smash and break in the event of a crash.

Voice control is really exciting. The way it is coming into its own and maturing in the home is amazing. In vehicles you have a bit more of an issue with background noise and so it will take a little longer for the technology to mature, but if you are able to use voice to initiate actions in the car then that has obvious safety benefits.

Voice control does, however, bring about some changes. When I was growing up, the rule was that whoever was driving the car controlled the music that was being played. Then phones and Bluetooth came along, and there was some democratisation whereby anybody could provide the music. Now, if you have voice control, then in theory anybody at any time could interrupt the music that is being played or what is being shown or even could interfere with the navigation system. For this reason, I wonder if there is going to be a 'voice lock' feature in future cars? You would be encouraged to talk to your car when you first take delivery, and the car would learn your voice. You would then become the voice administrator.

I also think there is a place for the return of skeuomorphic design, which was all the rage a few years ago. Consumers know how apps work these days, so you no longer need icons to look like the action they represent (though will Microsoft ever change the 'save' icon in Word, which is still a floppy disk?) yet I think that skeuomorphism will find a new application in gesture control. Take the situation whereby you have a number of people in the car and you want to have a conversation rather than listening to the music. With skeuomorphic gesture control you will simply raise your hand and make the action of turning a knob. The camera inside the vehicle will recognise the gesture and adjust the volume accordingly. It will bring challenges, though. What is the gesture to move a GPS way point up a route on your nav system? What is the gesture for change film? What is the gesture for lower the lights

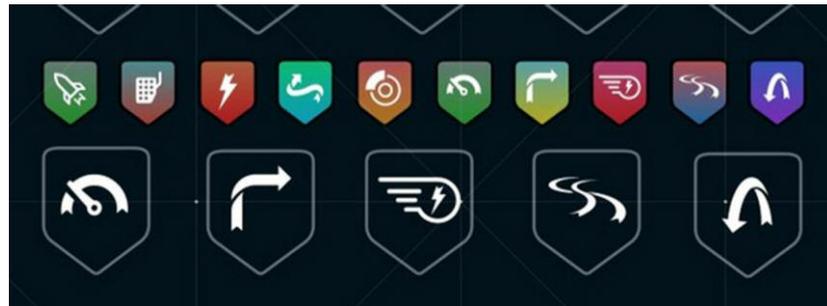
in the vehicle? I'm interested to see how the various manufacturers explore the use of hand gestures. Will there be a universal language, or will you have to learn new gestures each time you change car?

Finally there are screens – there are all sorts of new designs. You can have transparent screens, curved screens, bendy screens. I think the interior of the vehicle will change, breaking away from the black screen between the driver and passenger seats. I think we will see very fluid, clean glass interfaces that will extend almost around the entire interior.

CC: At the moment, though, car companies are using every version of an HMI – switches, knobs, touchscreens, voice control, all at the same time and often there are several different ways of doing the same task. This can be confusing for the customer.

SC: I think this is likely to be where the Apples and the Googles of this world will help the car manufacturers. Because between them they effectively control the mobile space, they set the precedent for how things act and function. Users will expect the same methodologies to flow into the vehicle. Once they have become standard in cars, Apple Carplay and Android Auto will help manufacturers make their HMI more simple and more intuitive.

It won't be completely simple though. If we take voice control, and accept that it is a wonderful thing, then it is vital that consumers know what they can control with their voice. A touchscreen menu system, with multi-level pulldown menus may be clunky by comparison, but how do you replicate this for voice control?



CC: Is the infotainment system destined to become a mainstream advertising platform, and how desirable is this?

SC: I would argue that for a long time the car has been a mainstream advertising platform, via the radio. Looking forward, are we going to see visual adverts popping up on our screens? No, I can't see that. We're already seeing it disappear in mobiles, tablets and TVs. I think there will be a much more subtle form of advertising based on the data that is coming into the vehicle.

For example, if you set off alone, the car will know you are the only person in the vehicle. If you then drive for three or four hours, the car might say 'hey Sam, you've been driving for three hours. There is a service station in 5 miles and you might want to take a break'. You will probably think this is a good idea, and be grateful for the suggestion, but the truth is that the service station has paid to be the one suggested by the recommendation engine in your car. I think that is the direction the advertising aspect in the vehicle will go. Your car will learn your habits. If you have a worn tyre, your car could recommend three different tyre shops that you could stop into along your regular daily commute to have your tyre checked or changed. In the background, the three service providers have all bid to be the one that is recommended. You've been advertised at, but you are not aware that that auction has happened in the background. I think that that is the direction that advertising in vehicles will go, rather than adverts popping up on IVIs.

www.conjure.co.uk



FUTURE TRENDS FOR THE AUTOMOTIVE INFOTAINMENT SYSTEM

INTERVIEWEE: RASHMI RAO, HEAD OF ADVANCED ENGINEERING AND USER EXPERIENCE AT HARMAN

CC: How do you see automotive infotainment systems changing in the coming years?

RR: Infotainment, as we currently know it, is on the brink of a major revolution due to the trend in digitization of the in-car electronics and the progress of autonomous driving. As we have more digitization of the content in the car and connectivity becomes more pervasive in the car, it enables that information to be updated and personalized throughout the life of the car. Further, as we gain 'free' time in the car, the functionality of the infotainment system will edge closer to becoming an entertainment and productivity system.

Infotainment systems are currently well positioned to deliver non-safety critical connected services and apps such as maps, traffic, concierge services, productivity enhancing solutions and personal digital assistants. As we move along the stages of autonomous driving, there will be an increase in Advanced Driver Assist Safety (ADAS) features that will be combined with 3D navigation to enhance user safety. We are seeing a growing focus on bringing in personalized content and experiences into the car. There will be a significant increase in personalized features and voice-based personal assistants to facilitate semi-autonomous driving with minimal driver distraction.

Users want to be connected at all times and across all devices, including the car. It's one of the most important criteria for a positive user experience. You'll see certain regions lead the race. Research from McKinsey suggests 60 percent of respondents in China are even willing to switch car brand for better connectivity. Meanwhile, according to a BITKOM study, 85 percent of respondents predict that consumers in 2025 will take more care to ensure the car's user interface is compatible with current

smartphones. Additionally, 81 percent believe that a connected entertainment system will be a decisive purchase consideration. For HARMAN, it's crucial to make full integration available across the wide range of smart devices, while simultaneously reducing complexity for the user. An intuitive, intelligent and extremely customizable solution that allows for a connected lifestyle across various environments is required.

If we look at how we'll receive and interact with all this new data streaming into a more autonomous vehicle, we expect that we'll need to look to novel ideas to interact and engage the occupants. Visually, the full windscreen Head-Up Display (HUD) offers huge possibilities for the infotainment user interface in an autonomous vehicle. In the interim, HARMAN is working on additional displays to intensify the user experience in the cockpit. Smartphone OLED displays with organic light-emitting diodes provide rich, bright colors that users have become accustomed to. HARMAN is pursuing this trend while also looking at alternative quantum dot display technology which allows for high-gamut deep colors. However, an increase in the number of screens is a growing trend. We are working on a concept for an OEM customer to install up to 22 displays in a luxury car. This is an exceptional case, with displays in the door panels or side screens but the idea of replacing conventional mirrors with camera systems is another indication of how electronics will change so many of the areas of the car.

Away from the car itself, this rise in connectivity and autonomy is likely to feed a multitude of new business models and monetization opportunities. Expect more driving apps and we'll start to see the ones that will add the most value to customers. Expect to see car makers look at their business models and at securing revenue from ongoing services. There will be much more ▶

competition as new entrants have identified the car as the most attractive place to enter this industry. It's an exciting time.

CC: Will there be two paths – one for conventional vehicles and one for autonomous?

RR: Autonomous driving must not be equated with monotony and the infotainment system will evolve accordingly to offer new experiences for the 'driver' that no longer needs to concentrate on the road. The car will become a conference room, a concert hall or cosy living room – an increasingly personalised space.

As we see increasing semi-autonomous features in conventional vehicles, the infotainment system will make the same progression, following the growing level of autonomous features. Eventually, in the fully autonomous car, full windscreen HUDs could be how passengers view and interact with the infotainment content.



HARMAN is pursuing two concepts for HUD technology: the first is the content on the windscreen. The second is augmented reality content through the windscreen. This makes

augmented reality navigation possible with holographic displays and provides live videos with graphical elements. For example, other cars which require special attention may then be marked for the driver. An augmented reality sound can also be used in the navigation: when the driver is approaching a school, for instance, school-specific, virtual sounds can be played. Children's voices or a school bell help in addition to visual signals to get the full attention of the driver.

However, in conventional cars in the meantime, you will typically find information split between a large central screen, the instrument cluster and it's becoming increasingly common to find a HUD. We recently conducted research to see how best to divide the information output between these various screens with the response showing that the HUD was the preferred interface for incoming message alerts and short pieces of information relating to instantaneous and short notifications. The cluster was the favoured display for the car's status, as well as more lengthy notifications and events happening in the immediate future. Meanwhile, the central display was reserved for more graphically intensive information such as maps, along with longer notifications and things happening further into the future as well as in some cases duplicating the information for the passenger's use.

CC: Will user content be imported to the vehicle, either on smartphones or portable storage devices, or will it be streamed?

RR: Although the smartphone is still the most common form of connectivity, we are seeing that brands are working hard to embed connectivity in the car itself and focus on being able to seamlessly translate the experience on the portable brought in device to the in-car devices. We'll see both playing their parts for some time.

For streaming to grow, I see three elements are needed to achieve that: an infrastructure, the services that assist or manage the vehicle and its safety, and lastly connected device services, such as ride hailing or music streaming.

We expect there will be simpler and better-connected services that will help the consumers decide how they get their data.

Further, many OEMs are also working on next generation smart apps that reside on the portable devices but enable interaction between the car functions and the portable devices.

CC: Will the automotive industry need to embrace content providers such as Netflix and Amazon Prime?

RR: Yes, such services – and not just entertainment services – will become much more prevalent and could encroach on the revenues OEMs are hoping to achieve from connected services packages. We have already seen OEMs investing in third party services, notably ride sharing, but others too as a way of staying part of the game. Third party providers are nimbler and have different models for monetising their services. Working with suppliers such as HARMAN can enable them to stay competitive. Content will always be king. One of the offerings Harman has developed is Aha Radio, which allows for users to bring collated music services into one platform. This allows the users to port their music preferences from different services such as Amazon music, Spotify etc: into one platform.

CC: Knobs and switches, touchscreens or voice for control?

RR: In the car, buttons are conventional interfaces, but HARMAN is looking to create a complete digital cockpit experience. Besides digital screens and a digital 3D instrument unit that HARMAN will soon bring to market conversational interfaces will be the new 'buttons'. Instead of using a physical button you will use your voice. Through natural language understanding (NLU) and automated speech recognition (ASR), the communication between human and machine works in a very accurate, scalable way.

Accurate understanding depends not only on which commands people give machines but on how they do it. Speech, intonation, dialect – every driver is different, but still wants to be understood by the machine. HARMAN works together with partners such as IBM Watson, Microsoft Cortana and Amazon Alexa to achieve this intelligent personalisation.

The type of control will still vary according to the functionality required, but conversational interfaces will greatly increase and will be key to the user experience and consumer engagement.

CC: Is the infotainment system destined to become a mainstream advertising platform, and how desirable is this?

RR: The analytics in future infotainment systems will recognise interaction patterns and determine what is important to the user. Through services such as the Augmented Reality Concierge it will learn that the driver always drinks a coffee on the way to work and will be able to recommend their favourite coffee shop, or suggest local points of interest based on previous journeys. This information will be extremely valuable for companies looking to identify and target existing and potential customers for advertising purposes. It has the potential to open up a new world of opportunity for marketers and cross-screen advertising tactics, which would reach many more people than typically possible with out-of-home advertising.

Preferred brands could target occupants for promotions and offers based on location or could help with suggestions to solve problems, such as where the nearest fuel station is. With increased smart technologies and connectivity, your fridge knows that you're out of milk and notifies your car, which in turn reminds you to pick up milk when your route passes a service station or supermarket. Some will find this beneficial but others will find it intrusive. To make it a success, the balance will need to be found between the two and allow for personalised preferences.

FUTURE TRENDS FOR THE AUTOMOTIVE INFOTAINMENT SYSTEM

INTERVIEWEE: LEYRE OLAVARRIA, GLOBAL HEAD OF CONNECTED CAR, SEAT



CC: How do you see automotive infotainment systems changing in the coming years?

LO: I think we will see a big trend towards voice assistants. It's already starting to happen with Siri and Alexa. That is how the interface with the infotainment system will be handled. In terms of the infotainment system itself it will be more personalised. The car will know who is driving – whether it is the owner of the car or another driver, and also who is sitting in the car. This way, the infotainment system can deliver a more customised and personalised approach.

CC: Do you think the car companies will limit themselves to the current, best known personal assistants – you mentioned Siri and Alexa – or will they feel the need to develop their own, in-house alternatives?

LO: Speaking for Seat, certainly we will continue to support those well-known systems as our policy is to be compatible with everything. We wouldn't expect an Apple customer to switch to another system because his car didn't support Siri, so we will continue down this road, supporting all key platforms.

CC: Will there be two paths – one for conventional vehicles and one for autonomous?

LO: Today it is hard to say, but probably not. It will merge into one. Perhaps there may be more separation in areas of infotainment versus car systems and functionality, but they will be developed in parallel.

As we move towards multi-person infotainment platforms, development will be transformative, and it will take a little time.

CC: Will user content be imported to the vehicle, either on smartphones or portable storage devices, or will it be streamed?

LO: Both will continue to be possible, but in the future I think that content will be more cloud-based. A fully connected car will have access to your playlists, your contacts, everything. You can continue to use your smartphone, of course, in case you want to access locally stored content, but pretty much everything you will be able to download from the cloud.

CC: Will the automotive industry need to embrace content providers such as Netflix and Amazon Prime?

LO: Certainly, and I don't think that we will have to be pushed into this, we are willing to make these partnerships. The car companies don't have to be the centre of the universe, and we don't have to develop everything on our own. Our policy is to work with the experts in ecosystem so that we can offer the best services and the best content to our customers. Even if this content and these offerings are not developed by ourselves, they can be part of our ecosystem.

CC: Could you see a day when car companies such as Seat become involved in revenue sharing with content providers such as Netflix and Amazon Prime?

LO: Yes, of course. We are moving from a product based business model where the car was the centre of our universe to one that is

more service based. We believe that instead of a one-shot interaction, where after the initial purchase we lose contact with our customers, we will become involved in many, many transactions with them.

Being a service provider puts us in a different situation, and will allow us to build a relationship with the customer. Those transactions could happen as often as every day. We're talking streaming content, parking services, mobility services, all of which can be new sources of revenue for the car company. It's a changing world, and the automotive industry is being disrupted. Inside Seat we see that connectivity is vital and we want to be one of the frontrunners, particularly as our customer-base is one of the youngest. Our customers demand to be always connected, hence Seat's focus.



CC: And how about the HMI? Will the customer be using knobs and switches, touchscreens or voice for control?

LO: We think it will be mainly voice control, though touchscreens and switches will be retained for some of the more critical functions where there may be security considerations. But I think things are changing, and in the future, more and more functions will use voice control.

CC: At the moment, though, car companies are using every version of an HMI – switches, knobs, touchscreens, voice control, all at the same time and often there are several different ways of doing the same task. This can be confusing for the customer.

LO: Yes, that's true, but at Seat we're doing away with switches and knobs. If you look at the new Ibiza, for example, this has a full screen and everything is controlled by touch. This move is already happening.

CC: Is the infotainment system destined to become a mainstream advertising platform, and how desirable is this?

LO: Good question! It could do, but I don't think so. We see the car's infotainment screen as what we call the 'fifth display'. To access your content you have your smartphone, then your tablet, then your PC or laptop, your smart TV and in the future you will have access to all this content in your car. This has pros and cons. Yes, you can access all your content in the car, content that you can't get today, but you could also have content pushed at you. This is not something we are going to rush into. We need to find out whether our customers want to see push content or advertising. If we do decide to allow advertising into the car, then it will only be if the customer has opted to accept this, and only if there is a genuine customer benefit.

This is a very big subject, and very much under discussion at the moment.

See Connected Car's video review of the SEAT Ateca infotainment system on p19 of this issue



ATAM: Automated Interoperability Testing System

Introducing ATAM from NextGen – an innovative new solution to address the challenges of validating interoperability between mobile, media, computing and communications devices.

- Automated Testing for all CE Devices
- Remote control of hardware devices
- Unique visual UI Test flow designer
- Emulate end user interactions
- High volume repetition testing
- Modelling of complex use cases.





DOES THE VIRTUAL PERSONAL ASSISTANT BELONG IN THE CAR?

CONNECTED CAR TALKS TO ABDULKARIM BELHOULA,
HEAD OF ADVANCED TECHNOLOGIES, INFOTAINMENT & CONNECTIVITY
BUSINESS UNIT, CONTINENTAL AUTOMOTIVE

CC: What do you see as the benefits – or negatives – of using third party personal assistants (PAs) in the car from companies such as Google, Amazon and Apple?

AB: I'll start with the benefits, as I think there are more benefits than negatives. I think that voice personal assistants can facilitate the driving process and improve the experience as the driver does not have to deal with the distraction of using touch screens. The driver can obtain information not only about the car status but also about Points of Interest (POI), fuel etc., and can send or receive messages to or from friends, family and colleagues – all using natural speech voice control and all the time with his or her eyes on the road.

The more you use the voice assistant, the more it will learn about you, your practices and preferences. This means that as time goes by, any enquiry you make can be more accurately targeted to you.

The downside could be that the user will be aware that his data is being captured, stored and used elsewhere, and so we have to work hard to build the confidence and trust of the user that the data is always being handled with privacy and security in mind.

CC: Do you think we can trust the Googles, Amazon and Apples of this world to be responsible and to make sure that all data is captured and used only as a result of opt-in on the part of the user?

AB: Today, and when used in the home, there is already a question mark over that because we don't know what those stakeholders are doing with the data once they have it. If we put these PAs in the car then the question extends there too. Car manufacturers will have to decide if they are happy that these assistants are collecting data that is then stored on servers that they (the car companies) don't own.

CC: Give us your overview of current use of personal assistants in cars – the state of today's market?

AB: Today, different systems exist for different cars and different models in an OEM's range. Current personal assistant systems aren't backed by full artificial intelligence but are using natural language. This saves the user having to train the personal assistant via certain vocabulary. Some of these assistants are already connected with services such as weather, parking and fuel.

In the future, these systems will combine with artificial intelligence to take the results of enquiries from the driver and to then direct them to services he or she needs. If they are asking about hotels they will be routed to a hotel booking service. If they

are asking about petrol, they will be routed to petrol station data services. The systems will use the information that they have about the driver – food preferences, petrol retailers he is obliged to use and so on – and will use those preferences to deliver a short, tailored list.

The AI will track the user continuously, so if their habits or preferences change, they will adapt the results that are delivered.

CC: Will Alexa and Siri rule, or will other PAs have a place?

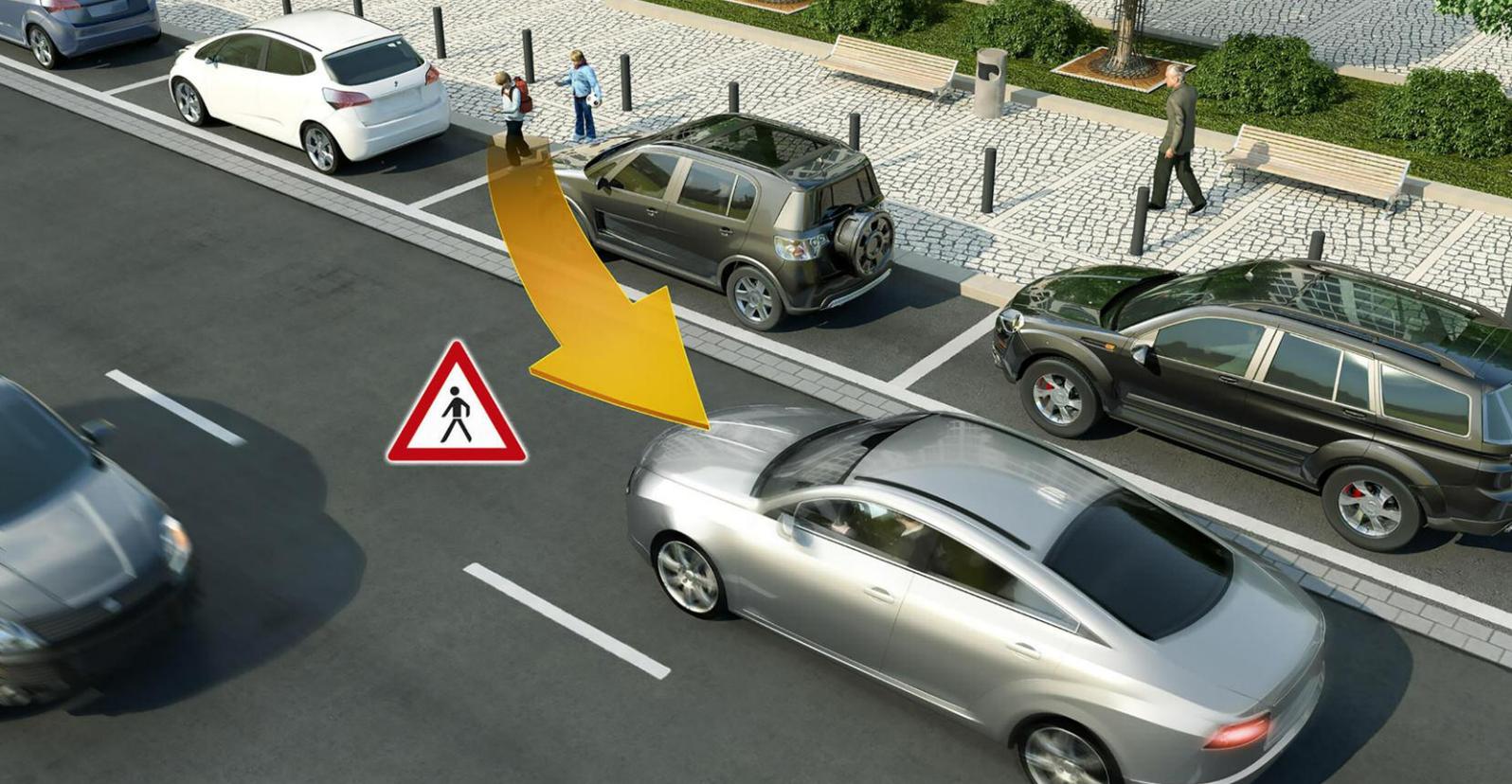
AB: Well, Alexa and Siri are both on trend and are certainly being implemented at the moment. It depends whether the manufacturers decide that these voice assistants are meeting all of the needs of the customer and of the manufacturer. If they do, then the existing options could continue to dominate. If they are not meeting all needs, or an OEM has developed its own artificial intelligence sufficiently, this could change.

CC: There is a widely acknowledged wariness about letting Google, Apple and Amazon into the car. Do you think car companies will consider developing their own PAs?

AB: I think this could be decided by two issues. First, what is done with the car and user data that is given to a giant like Google, Amazon or Apple? Today there is no control over what happens, and that could be a problem. And then there is tailoring. If an OEM wants to tailor the personal assistant to its own needs and to provide certain specifics, will these giants be willing to tailor their own ecosystem for one OEM? The tech companies could decide that by comparison with the handset and smartphone market, automotive is very small and could tell the OEMs to take the existing solution, or leave it. In that situation, the OEM may go back to the Tier 1 supplier and say 'this is what we want our PA to do and what it should look like, if you want to bring in your own back office system, or use another existing platform, that's fine'. These are the two situations in which I think an OEM could decide to develop its own PA.

CC: Do you think that third party PAs can fit into the fully autonomous vehicle ecosystem, which the manufacturers are likely to want to own/control?

AB: I believe so. Autonomous driving will be controlled by the environment, the sensors in the car, its connectivity. PAs can continue to be part of the autonomous driving ecosystem, whichever mode you are in – driver in the loop, or driver out of the loop. He can use speech to request information, to issue



instructions or whatever, whether he is driving or in fully autonomous mode.

However, while I can see that a fully autonomous vehicle could use a third-party PA to control infotainment, web-services et cetera, I think it is unlikely that an OEM would allow one to issue dynamic control commands to the car. There would be concerns about whether you were continuously/always connected to the back-end, which you would need to be. We believe that PA systems for these fully autonomous applications will have to be hybridised. Part will run in the car and part will run in the back-office system. Each will handle different aspects. This degree of hybridised PA will be important in order to side-step the type of customer frustration and dissatisfaction that was experienced with early voice-control in the car. Users were finding that it just did not work as it should, or all of the time. The same would be true if systems accessed by the PA worked some of the time, but not all of the time. This will require a lot of work on the part of the OEMs and the Tier 1s to integrate this properly into the car.

CC: Would that really work? If a driver is used to having fully-capable Siri or Alexa in the car, and finds himself in an area with no network connectivity, how could a hybrid situation deliver what he needs?

AB: The hybrid situation does not replace the conventional PA. The hybrid system would have a restricted sub-set that would work in the car, without the back-end and the data processing. Should you become disconnected, the local part of the PA would fulfil a basic subset of functionality. The driver will be aware that if the car is not connected, he will not get certain information – weather or whatever, and that would be fine – but if he wants information such as maybe the water temperature in the coolant system or the oil pressure, then the local part of the hybrid PA would handle that.

CC: Are you talking about a situation where there would be a local element of Siri and Alexa, or are you suggesting that there would be an 'If This Then That' –type situation whereby if the car was not connected, and therefore the third party PA would not work, then the car would default to a local resource that was part of the OEM's embedded system?

AB: Yes, the second scenario is the way I would see it working. The on-board speech recognition would be managed by a system developed for the OEM by a Tier 1 and the off-board voice recognition could be managed by one of the third-party PAs. That way you will always have a voice recognition system even when you are not connected.

CC: Is this type of hybrid system that brings together and combines an OEM/Tier 1 speech recognition with handover to/from a third-party PA in development today? Or is this something for the future?

AB: Such systems are in development today, and so, yes, this is already reality, but not yet with the connection to the third-party PA.

CC: We all know that at the end of the day, everything to do with the Internet of Things, smart devices and PAs such as Google Home, Alexa and Siri is all about capturing data to target advertising and to make money. The car companies are as aware of this as anybody else. Are PAs the tech company's gateway to the automotive ecosystem and to allow them to capture data in the car?

AB: If you make the decision to implement such a PA in your car, then you are accepting that you have to provide the tech companies with data. The OEMs are aware of this. Not only do you have to provide car data, but you are also providing user data. Technically, there is no way of getting around this if you are going to be able to provide answers to the car driver's questions.

From a commercial point of view, how the car and user data is processed, whether it is being managed in a way that will satisfy the user, these are the questions that have yet to be answered in order to allow the commercialisation to happen. The tech companies and the OEMs have to decide how they are going to deal with each other. Data privacy, ownership and security is a big question and always will be where PAs and artificial intelligence are concerned, and that applies in the car as well as outside.



AUTOMATED PRODUCT TESTING FOR THE INTERNET OF THINGS

BY ANDOR MILES-BOARD
MARKETING & BUSINESS DEVELOPMENT MANAGER, NEXTGEN TECHNOLOGY

NextGen ATAM is the leading system for automated interoperability testing. Automated interoperability testing ensures a better experience for the end user by removing the reliance on manual processes. The high repetition cycles possible using automation provide a faster and deeper testing of the performance of connected devices in real world use. Automated test processes are now able to recreate complex consumer use cases, where multiple factors can be simultaneously at play.

AUTOMATED INTEROPERABILITY TESTING WITH ATAM IS ABOUT CREATING NEW MULTI-FACTOR TEST CASES, HIGH REPETITION TEST SEQUENCES AND FASTER RESULTS DELIVERY, HIGHLIGHTING PERFORMANCE ISSUES EARLY IN THE DEVELOPMENT CYCLE.

Use cases and applications for ATAM are broad, with ATAM being used across multiple industries. ATAM is used extensively in automotive testing for the connected car, evaluating infotainment system performance with a wide variety of mobile phones. Mobile manufacturers use ATAM to ensure stability and interoperability of new devices with the connected devices and services. Manufacturers of Bluetooth speakers, headsets and wearables use ATAM to evaluate their platforms and ecosystems for the Internet of Things (IoT).

ATAM controls and automates a wide variety of mobile devices including Apple, Android, Windows Mobile and Blackberry, allowing end user interaction to be modelled highly accurately. In all cases, ATAM controls target devices and mobile phones by emulating real end-user interactions, just as the end-user would.

SYSTEM OVERVIEW

At ATAM's core is the ATAM System Controller, a processing hub for automation and control, and the ATAM Desktop Manager software

suite, which is installed on a PC and used to design and control the test sequences. ATAM System Controller automates connected mobile devices, media players and other consumer hardware. ATAM System Controller is synchronised to the ATAM Desktop Manager for test sequence creation and development, data management of results and project control.

ATAM automation means a more efficient test process, exercising the connectivity features and functions of today's connected devices. ATAM's built in test sequences verify and validate functions for all connection technologies including Bluetooth, USB, Wi-Fi and proprietary interfaces.

Multiple connections on the front and rear of the ATAM System Controller provide USB, Bluetooth, Ethernet, Wi-Fi, Audio IO, CAN, LIN and switching interfaces. Support for video based visual monitoring of tests in progress for further analysis is optional and ATAM integrates with other industry standard test equipment such as Bluetooth analysers, USB, Wi-Fi and audio analysis tools. ATAM aggregates control, data channels and transports into a single analysis layer, providing an integrated approach to test data analysis and debug, allowing deeper insight.

ATAM Desktop Manager features a logical graphical UI for creating and executing tests and analysing device performance. Desktop Manager's function-based approach enables engineers to

define test configuration, with execution and data analysis modes by using a logical and intuitive workflow.

ATAM's user interface presents test sequences and project data by using a drag and drop graphical display that shows tests as a logical flow. The intuitive interface allows the engineer to focus on creating the test, without requiring a steep learning curve, complex scripting or coding.

FLEXIBLE WORKFLOW

The engineer can load an existing project, modify or create new test projects from the beginning. A graphical test flow is created by dragging and dropping elements to build up complex test sequences and prepare for test execution.

ATAM Desktop Manager transfers the test sequences to the ATAM System Controller to begin testing. The System Controller executes the test plans and can be left to run overnight or across a weekend, and for even faster test throughput several ATAM Controllers can work in parallel. As the ATAM Controller performs the automated test program, complex simultaneous end-user interactions and high repetition tests are executed in controlled order.

Once the test sequences complete, ATAM System Controller returns the results to ATAM Desktop Manager for analysis. Individual test results can be examined in detail with the status of all interoperability modes highlighted. Results and datasets are time stamped to be aggregated for later analysis. This powerful feature allows different datasets to be correlated, providing deeper insight in issues analysis.

Intelligent management of the background tasks and automating test processes means ATAM can execute test sequences continuously and with high repetition. The resulting data highlights issues faster than ever before, allowing engineering teams to focus on the core issue and analysis.

ATAM FOR AUTOMOTIVE APPLICATIONS

Inside the connected car, connected services and smartphone integration bring exciting possibilities, but ensuring compatibility with the diversity of devices available to consumers poses multiple challenges. With infotainment systems supporting Apple CarPlay, Android Auto and others, ATAM automation is ideally placed to address the challenges of interoperability with OEM integrated systems and services. System developers use ATAM to provide the pre-certification requirements for Apple CarPlay and Android Auto implementations, vastly reducing time to market and ensuring the best quality user experience.

ATAM automation represents a new generation of interoperability test processes. ATAM models complex test scenarios by allowing simultaneous device control to recreate a variety of possible end user interactions. This new class of test cases has not been possible with manual testing, demonstrating the new insights that ATAM automation brings.

A further new class of testing is ATAM's ability to build an entire aging profile for a product early in the lifecycle. To understand device behaviour over time, ATAM's test routines replicate extended periods of consumer use, allowing the ageing profile of a product or system during the product lifecycle to be characterised.

STREAMLINE, AUTOMATE AND SIMPLIFY

These are just some examples of how ATAM automation of the test processes not only improves efficiency but creates brand new test scenarios that model complex interactions and multi-use cases which have previously never been possible.

The key benefits of ATAM automation include:

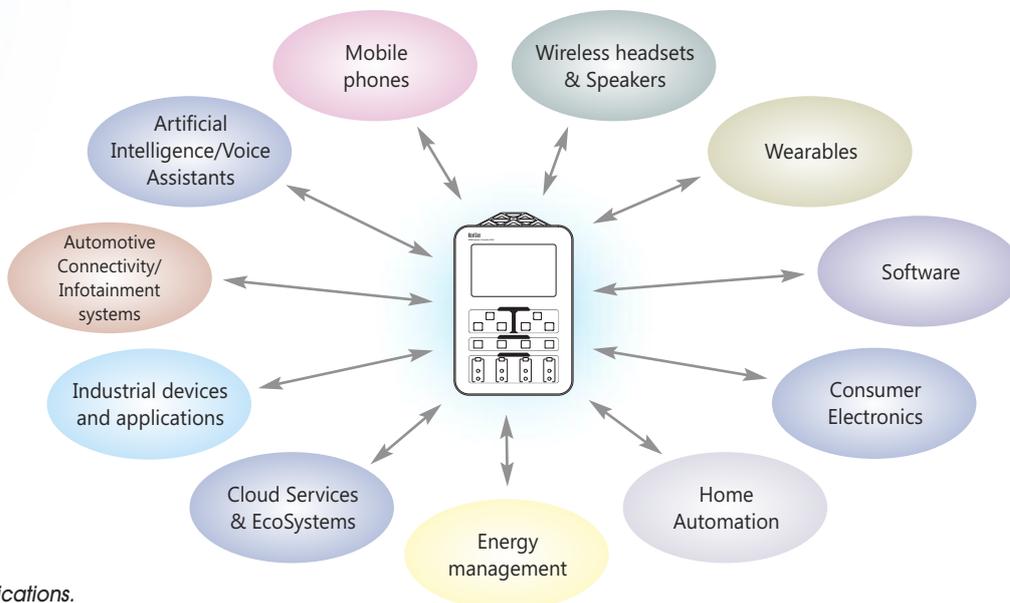
- Reduce costs by testing core functionality faster, increasing test efficiency and coverage.
- Rapidly benchmark products to ensure robust and reliable performance.
- Creation of new automated test plans which allow high repetition and complex use cases.
- Developing new types of test cases and aggregating results for new levels of insight.
- Frees engineering teams from manual test effort to focus on key development issues.

Developers and engineers are required to deliver robust connectivity between cars, mobile devices and infrastructure and to meet the equally important demands of safety, reliability and consumer satisfaction. These are ever increasing challenges.

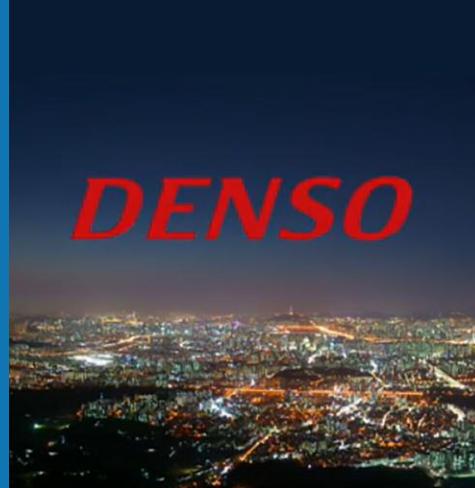
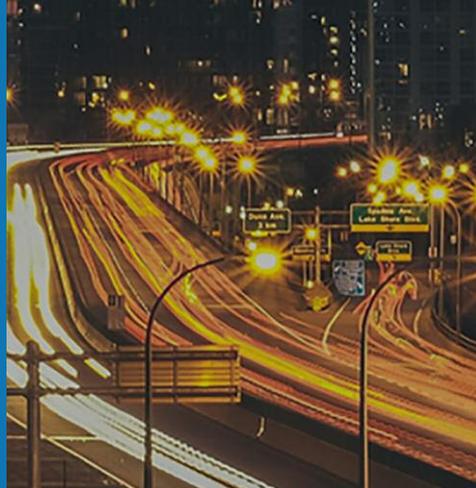
The ATAM automation solution provides an innovative answer to interoperability testing that is built to be intuitive and flexible. ATAM automated testing provides deeper levels of analysis, and ATAM is a cost-effective means for engineering teams and developers to get maximum results by reducing manual workload.

In the connected car space ATAM's ability to control automotive infotainment systems and mobile devices provides auto makers with new processes and techniques for testing and validating the performance of next generation connected infotainment systems.

Click here for more information



ATAM applications.



NEWS

HERE LAUNCHES SUPERCHARGED REAL-TIME TRAFFIC SERVICE

HERE Technologies has announced the launch of the new generation of its HERE Real-Time Traffic service, which it claims is the first global service on the market to integrate live vehicle sensor data from Audi, BMW and Mercedes-Benz vehicles with traffic probe information, resulting in significantly higher accuracy and more precise information about traffic conditions.

HERE Real-Time Traffic, available to all current and future customers from any industry and covering more than 60 countries, offers significant improvements in traffic flow data, especially on arterial roads. For more than 30 of those countries, the service also provides incident information with features such as Traffic Safety Warning. Aided by new hard-braking sensor data HERE is now processing, this feature now allows more relevant and timely notifications to the vehicle.

Ralf Herrtwich, Senior Vice President Automotive at HERE Technologies told Connected Car, "This is the world's first traffic service to aggregate live rich vehicle sensor data from competing car brands and it represents a major step by HERE to make driving safer and more efficient for people everywhere. While it helps drivers making informed decisions behind the wheel today, it also moves us closer to realizing our vision of a live representation of the road environment needed for both advanced driver assistance systems (ADAS) and self-driving applications."

HERE already gathers billions of GPS data points every day and leverages over 100 different probe and incident sources to provide a foundation for HERE Real-Time Traffic. Now, HERE is also integrating data from millions of Audi, BMW and Mercedes-Benz cars, with the fleet size expected to further grow during 2018 and beyond. To further enrich the service, HERE is apparently expanding

the number of commercial vehicles from which it gathers conventional probe data.

HERE Real-Time Traffic provides information about traffic conditions to drivers and can also be ingested by vehicle ADAS applications. The service is also widely used by ride-hailing companies, cities, road transport agencies, logistics companies, and air quality analytics specialists.

INRIX SIGNS DEAL WITH U.S. FEDERAL HIGHWAY ADMINISTRATION FOR TRAFFIC DATA

INRIX has announced that its traffic data will be used by the United States Federal Highway Administration (FHWA), and state and regional agencies to assess travel reliability, congestion and emissions.

FHWA's National Performance Management Research Data Set (NPMRDS) is used by states to monitor system performance. Beginning in July 2017, all state departments of transportation and metropolitan planning organizations can use INRIX travel time data to establish performance targets and report on progress. NPMRDS provides comprehensive and consistent data for passenger and commercial freight roadway performance across the National Highway System, as well as over 25 key Canadian and Mexican border crossings. NPMRDS is defined as the baseline dataset to meet the newly established federal congestion and freight performance reporting regulation.

"We are proud to supply the underlying traffic data that will be used to monitor, measure and improve many of our nation's key roadways," commented Scott Sedlik, vice president and general manager – global public sector at INRIX. "This federal win is further proof of the breadth and quality of our world-class traffic services."

INRIX makes information available by using advanced fusion technologies to

integrate the full range of traffic data sources to create high quality traffic services. INRIX aggregates GPS probe data from a wide array of commercial vehicle fleets, connected cars and mobile apps.

INRIX has partnered with the Center for Advanced Transportation Technology Laboratory (CATT Lab) at the University of Maryland and other industry leaders to support NPMRDS through 2022.

DENSO ESTABLISHES A NEW COMPANY DESIGNING KEY COMPONENTS FOR AUTOMATED DRIVING

Denso Corporation is forming a new company, NSITEXE, Inc., to design and develop semiconductor IP cores, which are key semiconductor components enabling automated driving.

Advanced electronic controls are key for in-vehicle environment and safety technologies, such as ADAS and automated driving in next-generation vehicles, says Denso. When automated driving becomes the norm, high-performance, low-power semiconductors will be required to monitor the situation around the vehicle by processing large amounts of data from sensors and external communications at high speed. This data will help make decisions for automated driving functions.

The new company will develop a next-generation processor which can analyse large amounts of data from sensors and external communication to determine the optimal vehicle operation. The semiconductor IP cores optimized for in-vehicle applications will be licensed to in-vehicle microcomputer and SoC manufacturers.

Denso explained that it has refined in-vehicle semiconductor technologies as part of its ongoing mission to develop the advanced technologies delivering an environmentally friendly, safe and secure automotive society.

SEAT ATECA SE 2.0 TDI 150 PS

At Automobile Barcelona in May, Connected Car met up with SEAT's Leyre Olavarria, Global Head of Connected Car for the Spanish company ([see our interview here as part of the Automobile Barcelona video review](#)).

During our conversation with Leyre we discussed SEAT's latest connected car systems, including a recent announcement about the company's partnership with community data-based navigation company Waze.

Back home in England we took the opportunity to try SEAT's systems – and Waze – in a SEAT Ateca supplied by the UK press team. This car was with us for a week, during which time we experienced tropical rain forest conditions for virtually the whole 7 days – not ideal when we are trying to film cars!

Regardless, we managed to film our report, and experienced the Ateca's comprehensive infotainment and driver assistance systems. Some of these are similar with or familiar from other vehicles in the VW Audi group, but SEAT is working hard to pitch it's themes in a way that will synch with what is recognised as a somewhat more youthful set of customers. As part of this thinking, the Ateca provides support for Android Auto, Apple CarPlay and Mirrorlink, so there should be no problem getting content and apps from smartphones working.

What happened in practice? Well, please watch the video feature to find out.



Click on the movie screen to watch the SEAT Ateca systems review.

CONNECTED CAR TALKS TO WAZE

FREE COMMUNITY-BASED GPS, MAPS AND TRAFFIC NAVIGATION

Waze claims to be the world's largest community-based traffic and navigation app. Today it has about 85 million users around the world. Out on the roads, these drivers are working towards a common goal: to outsmart traffic and to get everyone the best route to work and back.



THAT LARGE USER-BASE, WHICH HAS POSSIBLY BEEN FUELLED BY THE APP BEING FREE (BUT WHICH POKES ADVERTISING AT YOU), SEEMS TO SUGGEST THAT WAZE HAS BEEN GAINING TRACTION. BUT CAN A FREE NAVIGATION APP REALLY COMPETE WITH THE BIG-NAME NAVIGATION BRANDS AND WITH THE SYSTEMS PROMOTED BY THE CAR COMPANIES? TO LEARN MORE, AND TO KEEP UP TO DATE AS WAZE EXTENDS BEYOND THE SMARTPHONE AND TABLET AND INTO THE CAR DASHBOARD BY EMBRACING ANDROID AUTO, VINCE HOLTON MET WITH JENS BARON, PRODUCT LEAD, IN-CAR APPLICATIONS AT WAZE.

VH: OK, tell us the Waze story!

JB: Waze started in 2005 when founder Ehud Shabtai created an app to report speed traps in his home country of Israel. Like Waze today, there was a map and users could report the location of speed traps. He passed it over to a community and within two weeks they had tagged all the speed traps in Israel. However, at that point he received a cease and desist letter instructing him not to use the map he had chosen, and there was no alternative. Not to be outdone, Ehud thought "OK, in two weeks I was able to map all of the speed traps in Israel. How long will it take me to create a map of the country using GPS waypoints?" So he started an open



Jens Baron

source project called FreeMap Israel, and this was how he started the process - drawing maps just using GPS waypoints. This is how it works today, and this is the essence of Waze. A community-based navigation and traffic app with the whole map coming from the community. If someone is driving on a street that he realises does not exist on the Waze map, he can notify Waze' map editors who will check satellite images - or perhaps even drive to the location - and then amend the Waze map with the street and street name. I remember in 2005 I was working for Nokia on Nokia Maps, and when someone needed to amend the map it could take a year to do so. Waze is totally different. Our entire worldwide map is updated every 24 hours.

VH: This is a huge task and you are not a big company. How are you managing it?

JB: That's true! We are only 350 people at the moment, but we

have 400,000 map editors who do this in their free time. You could never do this with paid people. It only works as a community project, and the community manages itself. In fact, we find places where a map has been created and we have had no involvement. The system works autonomously without us doing anything. There is, for example, an island where taxi drivers needed some form of navigation, and they used Waze and just did it for themselves.

VH: So now you are launching Waze and Android Auto. Waze has been for smartphones and tablets until now - what is your thinking?

JB: We have worked for quite a while on this. The software remains on your phone, but you are connected to the car, and we render a special screen on the Android Auto platform.

VH: I guess working with Google - your owner - on Android Auto was a big help. We've heard that Apple is not quite so helpful to app developers!

JB: Yes, working on Android Auto was very straightforward for this reason. As far as CarPlay is concerned? Currently CarPlay only supports third party apps for audio and messaging. Will they ever open this up to open applications on their platform, I just don't know. But if it did become possible today, then it would be at least a year before we (Waze) could go live.

VH: How important was supporting Android Auto to Waze?

JB: We see putting Waze in the dashboard as just more convenient for our users, and we certainly had a lot of requests from users for Android Auto.

For us it was very important to be in the car, we see it as the future of Waze. For this reason we've also been looking at other options like SmartDeviceLink and other mirroring solutions. Up until now, the vast majority of our 85 million customers have used Waze on their phones. In the UK, you are starting to have cars with systems embedded. By contrast, in Israel, every car has Waze on board, even if it is only an old version - in which case, people still use their phones as it has the latest and fastest version! We do support embedded versions, but only if it is guaranteed that that version is updateable.

VH: And has there been take-up from manufacturers for the embedded version?

JB: In some regions, yes. In Israel, for example, Kia is an official partner, and Go Mobile equips new Mercedes vehicles with Waze, fitting a special touchscreen. So, in-car is small for us today, but with this Android Auto announcement we expect it to become much bigger. We're really pleased that Over The Air (OTA) updates are becoming more commonplace because until now cars have been unable to replicate the regular updates that are possible for apps on smartphones and mobile devices. This will be a big help, but we still operate in a different world to the car companies. If I am talking to OEMs about cars that won't be launched until 2019 and I then start talking to my CEO about doing work now for a car that won't appear for two years he will just say 'no' as we operate on a much faster development cycle. His view would be 'let them come back at the end of 2018!' It's just so different. We recycle every 21 days as opposed to car company's 5 year cycle.

VH: OK, let's be honest, Waze like pretty much every other app, is about capturing data. Is Waze for Android Auto your way of getting into the car and gaining access to a lot more data?



JB: Well, yes, we are entirely about data, but this is a really sensitive issue. The end goal is to have a better service. But, yes, it's true. This data could also be used to provide you with information about the nearest gas station or the cheapest gas price, so in the end, it is about advertising. And so is Spotify and so are other apps. But we have to be super careful. We don't want to spam you, and we don't want a BMW driver to be pushed an advert from a Mercedes dealer. We are, though, talking to OEMs about potential opportunities such as connecting to the car's service schedule and perhaps targeting their own customers, but even this is not settled yet.

There are differences, though, between Waze on the handset and Waze running on Android Auto. On the handset, if you are standing still, we can pop advertising up on the screen. We are not allowed to do that when Waze is running in the car using Android Auto.

VH: Looking at the broader data picture, do you think that attempts to protect consumer privacy are likely to go the same way as with cookies on computers? Regulation there was supposed to require web companies to ask permission to put cookies on people's computers. In fact, the tech companies instead put messages on their web site saying 'We use cookies. If you want to continue to use our web site you accept this'. This is totally not the same. I fear that data collection and commercialisation in cars will go exactly the same way.

JB: Well, the truth is that if you switch Waze on you know you are providing data. But when it is switched off it is not. That's the way it is. We did have one request to say could we please make Waze run in the background so that it was always running, which would reduce boot-up times. We said no, it is against our privacy standards. The customer must have the option to switch it off. We try to take a very responsible attitude. We have a partnership with Spotify, for example, so that via Waze our users can control the basic functions of Spotify. When the user does this, we show the terms on Spotify so that the user is aware that he will be sharing data. We are really sensitive about this.

VH: So what data do you share with Spotify? Route data?

JB: No, just turns, not full routing data because we don't share destinations, for example, nor do we share GPS info, so Spotify doesn't know where you are.

VH: And do you share any data about the user, or is it anonymous?

JB: No, it's anonymous.

VH: Er, but Spotify will know who its user is, yes?

JB: Well, yes, but as we don't share the GPS location, there's only so much they can learn. We agree that it is important to maintain privacy, and that we should not share positioning information with third parties – at least not without having asked the user. The whole point of using Waze though is that you give over your data – it doesn't work without it.

VH: So I have installed Waze on my phone but not used it yet. What will the user experience be like, compared to other smartphone navigation apps?

JB: The first difference you may notice is that unlike other apps, it does not take up a lot of memory on your phone and it does not use much of your data allowance. I did a multi-city US driving tour, for example - thousands of miles of driving - and only used 30MB of data. That's tiny compared to other apps. Admittedly, our maps are less detailed, but to us it is very important to keep the overhead small. This is one reason why we are successful in Asian countries like Indonesia, where they just don't have the infrastructure – Waze still works, even with a slow data connection.

Then, well, you will see a lot going on on your map. We get criticised for it a lot, but we say that Waze is a 'living map'. You see other Wazers on the street and you see the alerts that they upload. Sometimes it may be hard to see the route you are following, but overall these alerts are helpful. It is hard for us to decide what to take off, but sometimes we do clean it up.

VH: How on earth do you curate that?

JB: Well, we do that by cluster reports. If we see that 500 people have reported an accident, we may change that to one alert. This really is a crowdsourced, social network.

VH: So have you managed to build active Waze communities?

JB: Yes, there are communities in different countries, with Wazers, map editors, chief map editors and so on, and they have meetings to discuss developments – they are very passionate and knowledgeable. They don't get paid, but as they go up in rank we share more with them.

Waze also has the Connected Citizen programme. This already brings 250 cities, departments of transport and authorities all over the world together with citizens. Transport for London (TfL), for example, says that it is now faster to get data from Waze than it is to get data from its own systems.

VH: Waze is becoming known for these partnerships. Is this practice – trading data with DoTs and other authorities important to Waze?

JB: Yes, it is extremely important for us, and for the more than 250 partners that we already have. Rio de Janeiro planned its highway strategy for the Olympics using Waze data, for example, and Washington asked Waze users to report potholes – in one week they had 10,000 reported and now they have 10,000 potholes to fix!

VH: Be careful what you ask for, eh!

JB: Exactly! If you ask a Waze community to do something, they do it! We can tell an authority how their traffic is really operating.



From the other direction, what Waze gets is planned data. If a DoT is planning a road closure, we know about it in advance. This is how we grow a better service. Many organisations ask us to sell our data, but we will never do that. Exchanging data for common good is another matter.

VH: So I can quote you, can I? "Jens Baron said Waze would never sell user data".

JB: Errr Well, Google bought us, and they have the data on their map now, so

VH: All of this sounds great, and very collaborative, but what happens when an update is incorrect, either by accident or deliberately?

JB: This is something that really happens very rarely. There was one example in Israel where a map editor closed the ramp of a highway, but he had mixed up PM and AM, so according to the map the ramp was closed into the evening. This created a huge traffic jam that was on TV and everything!

VH: Well, that was an unfortunate accident, but are you not worried that such events could be faked and triggered for nefarious or sinister reasons?

JB: This is why we have the map editor hierarchy, so that we can identify and weed out bad information, whether it has occurred by accident or intentionally.

VH: We've reported in previous issues that car companies really, really want to retain control of the nav systems in their cars as they a) roll out advanced driver assistance systems (ADAS) and then autonomous vehicles and b) seek to retain ownership and control of the data that their cars are generating. Could this be an area of conflict between companies like Waze and the car companies?



JB: We are working closely with some car companies right now, but I see it as very important to work out the ways we can cooperate with them. I believe that to solve traffic problems then the car companies do have to work with the tech and nav companies and with each other.

VH: OK, and I am guessing this could be a touchy subject. There has been criticism of the ability to use Waze as a police locator. Waze users can identify and post the location of speed traps and police checkpoints. It has been suggested that criminals could use this to track police. What do you think?

JB: Our view is that Waze improves safety, because it is widely accepted that if people are aware of the presence of police officers they will slow down and drive carefully. So we have the police alert on our map, and at the same time we work and cooperate with the police. Consider that we don't tell police where people are speeding!

VH: Isn't it only a matter of time before speed data is shared, and the first time you know you have been caught speeding is when you see that your traffic authority has direct debited money for a fine from your bank account!

JB: Well, as I say, we don't share speed data. If we were to do so, we would effectively lose control. This is at the core of Google and giving away this data would probably ruin us. Others could take the data and position themselves as 'as good as/as useful as Waze'.

VH: Waze sounds like an excellent product, but one of its backbones is that Waze includes advertising. In light of the restrictions relating to advertising in the car, tell us how your policy works in practise.

JB: Both we and our advertisers are very sensitive. For example, we won't allow any advertising that launches another app or installs anything else. We may allow an app that pops up when you reach your destination or which sends you a reminder that you were interested in something, but we are very cautious about allowing anything to distract the driver.



VH: On an advertising and data sharing basis, how will the relationship between Waze and Google Maps work on an ongoing basis? Aren't they competing with each other?

JB: As a starting point, I think that Waze and Google Maps are two separate businesses. We focus 100% on driving. Our goal is to keep the data focus clear. Google maps uses our data, and if you plan a route on Google Maps it will take only milliseconds to appear on your screen. If you use Waze, it will take longer, but the reason is that we are planning the route using real time data. So yes, I guess we're competing ever so slightly, but we also work very closely together. They use some of our data on their maps, we use their maps in some regions where we are not so strong. Germany is one example. I don't know why we aren't strong there, but we're not. Maybe it has been because until now, we haven't been in the car there – maybe Android Auto will change this.

VH: Maybe it is because the major German manufacturers cooperated to buy and promote another navigation system – HERE.

JB: Well, yes. But consider that if you buy a new car in Germany, the first thing you have to do is accept the dealer's instruction to buy the Euro 3,000 navigation package because otherwise 'you will never be able to sell the car when the time comes'! And then when you have bought the Euro 3,000 navigation package you feel compelled to use it because you have paid for it. Maybe this is the explanation for why Waze is less strong in Germany, but I really don't know. Now that we will be on the car's infotainment screens, maybe things will change.

Anyway, in regions like this where we don't have a lot of registered users, we fall back on Google Maps data in order to continue to provide a good service.

Connected Car magazine will be reviewing Waze for Android Auto in a future issue.

More information: www.waze.com



NEWS

VISTEON SUPPLIES VIRTUAL INSTRUMENT CLUSTER AND REAR SEAT DISPLAYS FOR RANGE ROVER VELAR

Visteon is launching its latest generation high-definition (HD) digital display technologies on the Range Rover Velar, which was unveiled by the British automaker in March 2017.

The Velar features Visteon's 12.3-inch fully reconfigurable HD "virtual" cluster with retina-class resolution, demonstrating what Visteon claims are leading automotive grade levels of luminance and color gamut.

As the primary driver interface, the virtual instrument cluster presents the driver with the option to personalize information in different configurations in the large display area, incorporating a combination of dials, information display zones and a full-view map when in navigation mode.

For rear seat passengers, Visteon has equipped the Velar with dual 8-inch displays for the entertainment system, which utilize vertically aligned (VA) liquid crystal technology, achieving contrast levels in excess of 2000:1, which – combined with full 24-bit color rendering and high luminance – deliver a superb user experience.

Sachin Lawande, Visteon president and CEO commented, "The Velar is the first vehicle to feature Visteon's latest-generation fully reconfigurable instrument cluster technology, which incorporates significantly enhanced software capabilities and processing power."

The cluster is powered by multicore platform technology designed for superior multimedia and graphics performance with an exclusive HMI created especially for the Velar. Developed in collaboration with Jaguar Land Rover, the HMI is based on the Kanzi UI development toolchain – designed by Rightware – which facilitates development of custom shaders for unique Velar graphic effects in support of a wide range of brand themes, navigation and off-road features, as well as album art for music played.

Additional cluster functionality includes

video and Ethernet network links to the in-vehicle infotainment system, multimedia interface, language support and a connection to the Velar's new steering switch touch pad.

NXP AND HARMAN EXTEND PARTNERSHIP FOR CONNECTED CAR OF THE FUTURE

NXP Semiconductors and HARMAN International have expanded a 15-year collaboration to develop connected car solutions.

Connected car systems are key decision drivers for consumers accustomed to the rich user experiences they encounter in their everyday digital lives. The resulting expectations have triggered a transformation in infotainment systems from bulky, purpose-built devices into sleek, connected, upgradeable and integrated platforms. NXP and HARMAN believe that their partnership recognises the broad implications of this new reality and its potential to impact almost every technology field and application.

To tackle infotainment of the future, NXP and HARMAN will expand on a proven track record of delivering to customers and a strong history of collaboration in emerging technology areas, including over-the-air updates, secure V2X communication and software-defined radio. The two companies will further expand their partnership in technologies supporting the connected in-car experience, including tuners, digital signal processors, amplifiers and applications processors. As a lead customer for NXP's latest generation of NXP infotainment solutions, HARMAN says it will work with NXP on pre-development work, including co-writing the product specs, the exchange of early samples and continuing to demonstrate new vehicle concepts with partners such as Rinspeed.

David Slump, EVP Operations at HARMAN told Connected Car, "The automotive transformation is happening at an incredibly rapid pace with the ascent of the connected car, autonomous driving and convergence of technologies and devices."

TRUSTONIC AND MEDIATEK ANNOUNCE CO-OPERATION IN AUTOMOTIVE SECTOR

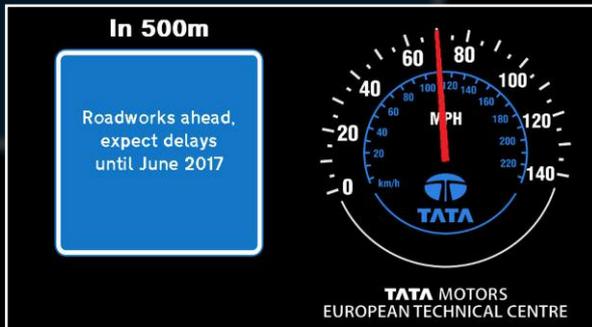
Trustonic will collaborate with systems-on-chips (SoCs) specialist MediaTek to provide the automotive industry with highly secure telematics and in-car entertainment systems for connected vehicles. According to the two companies, this partnership ensures that security is fundamental, in an environment that has seen massive increases in external connectivity and in the number of features delivered by systems connected to in-car networks.

Increasing car connectivity is bringing value but also presenting challenges to the automotive industry. The ecosystem is therefore working to address a range of security and privacy challenges. For example:

- Device connectivity & data privacy - cars can now connect to multiple mobile devices, potentially exposing large amounts of personal sensitive data. There is, however, an opportunity for drivers and manufacturers to gather and monitor large volumes of useful data, such as location, speed, diagnostics, fuel consumption, tyre pressure or emissions.
- In-car services - cars are a growing part of the "app economy", opening up opportunities to combine generalist applications, such as social networking, payment and premium content, with car-centric apps, like journey planning, tolls and parking.
- Automotive monitoring - other data, such as location, speed and driving characteristics, may be of use to authorities or insurance companies – but with obvious concerns over privacy.

Trustonic's TEE technology is apparently already embedded in more than one billion devices, and is said to address these challenges by offering a hardware-secured operating system which is completely isolated from the device operating system.

THE ROLE OF TATA MOTORS EUROPEAN TECHNICAL CENTRE



TMETC was created in 2005 as a wholly-owned subsidiary of Tata Motors. Its facilities in the UK's West Midlands region include an engineering centre, design studios and vehicle test and development workshop

CONNECTED CAR HAS NOT HAD ANY CONTACT WITH TATA MOTORS UP UNTIL NOW, ALTHOUGH WE HAVE HAD PLENTY OF DEALINGS WITH ONE COMPANY THAT IT OWNS - JAGUAR LAND ROVER. WE THOUGHT IT WAS ABOUT TIME WE PUT THAT RIGHT. TATA HAS A DEVELOPMENT CENTRE HERE IN THE UK, CALLED TATA MOTORS EUROPEAN TECHNICAL CENTRE (TMETC), AND VINCE HOLTON TALKED TO DAVID HUDSON, THE COMPANY'S HEAD OF PROPULSION AND INNOVATION.

VH: Tell us where Tata Motors European Technical Centre fits into the Tata organisation.



Tata - David Hudson.

DH: We are part of the Tata Engineering Research Centre, which is based in India. We were established 12 years ago by former chairman of Tata Group Ratan Tata to provide a European perspective on development of vehicles for Tata Motors which, since its inception has been building vehicles primarily in and for India. We were formed as part of a major initiative to take the company more global. That has taken

some twists and turns because the acquisition of Jaguar Land Rover in 2008 fulfilled some of the dreams of Ratan Tata at a stroke. So our role has changed a little and we now provide support through Tata Motors to develop vehicles and technology that are more in line with European requirements rather than necessarily to allow Tata to sell cars in Europe. That is still on the agenda, but as a longer term plan.

VH: What are your areas of specialisation?

DH: We often refer to ourselves as a small but complete car company. We currently have 250 or so people covering everything you need to produce and sell a vehicle – interior and exterior styling, body engineering, electrical system design, chassis dynamics, NVH and powertrain development and manufacturing feasibility support. Over the last 5 years or so our main focus has been on some of the emerging technologies. We are very active in electric vehicles (EVs), and have done a number of EV projects, but now we are focusing heavily on autonomous

and connected vehicles. Alongside JLR and Ford we are part of the OEM contingent within the UK Autodrive consortium, for example. We are looking for future opportunities as connected and autonomous vehicles become more a part of the automotive landscape and we are ready to implement our technology in vehicles for India and for the rest of the world.

VH: Okay, and did you land in Coventry - a centre for UK automotive manufacturing expertise - by coincidence, or have you used that location in order to be able to bring people in from other companies in the area? I know that your base is the University of Warwick - are you drawing from the pool of graduates there as well?

DH: It's not an entirely coincidental location. The choice was very definitely influenced by the fact that Warwick Manufacturing Group here in Coventry has had a long relationship with Tata Motors and prior to TMETC's creation had already been providing Tata with some consultancy support in manufacturing processes. And you are right, Coventry is not a bad location when you are looking to recruit automotive talent. That said, in recent times we have had a large number of new members of staff join us from other European countries.

VH: TMETC provides R&D for selected partners in the industry. Is the business about providing services for other companies, like Lotus Engineering, or is TMETC mainly a resource for Tata, and perhaps Jaguar Land Rover?

DH: Historically we have mainly been a resource within and for Tata Motors, but we also have all those projects for Jaguar Land Rover and have collaborated with them. Not necessarily on a 'for hire' basis but as a collaboration. However, yes, we have done work for external third parties, and that is part of our mandate. We've got skilled teams which are interesting to other people. For example we did a large interior trim program for a UK luxury sports car manufacturer which required us to bring in people who've got trim engineering expertise. We are open for discussions and, like Lotus Engineering or Ricardo, we are available to work on third-party projects.



VH: At the Geneva show Tata unveiled the Tamo Racemo, a sports car that was intended to be India's first connected car. We understand that that car will now not be built. A number of cars were proposed using what was called the MoFlex platform. Will that platform be used for other vehicles?

DH: The PR that was generated by the Tamo announcement at Geneva was quite significant, you are correct. It showed what could be done with connectivity, and how Racemo could be used as a halo product if it were to be brought into low-volume reality. Since then we have looked at the business model for Tamo and have decided that it would be tough to make it work. However, as a more abstract venture it still exists within the company – a digital horizons business. We are looking for opportunities where Tata Motors as a wider business can capitalize on the huge amount of start-up and incubator activity in the world of digital, as it may apply to future business models for automotive industry. The automotive world is in a time of transition at the moment, participating in an expanded mobility environment and becoming more dependent on the data that can flow from – and to – vehicles. We are anticipating the day when the vehicle OEM is not at the centre of value creation, but will still be required to put the wheels underneath the antenna that provides the connectivity.

So the concept of Tata Motors being involved in the world of vehicle connectivity is still very much alive and we are running that from offices here in the UK, in Israel and in Silicon Valley. We are maintaining a foothold in the development hotspots in order to be able to engage with some of the investment-hungry start-ups. If we can move quickly with some of the right businesses we can be better positioned in the next 5-7 years.

VH: So in that instance your company is looking to be an investor in such businesses?

DH: Yes indeed. Early-stage investment is one of the models, as well as providing practical use-case information for companies that have an interesting idea but aren't very automotive industry aligned. We have already done that with a few companies, where money hasn't changed hands in either direction, but in return for us providing information about automotive use cases, they have shared with us information about their vision for the future of the digital economy as it may affect automotive. This is deliberately an area that has very soft boundaries and internally we are using it as a way to develop some of our young people by seconding them into this area for short periods of time to help us learn more about it.

VH: Okay, just to circle back for a moment - the Racemo was presented as a connected car for the Indian market. What is your awareness as to whether the Indian market is ready for connected cars?

DH: Well, we think there is an inevitability to the likelihood that the global automotive market will be more and more connected. I think that India is an interesting example, because some of the things that we read about today as being at the heart of connected car - the driverless car, as an example – some of our own people

say "Oh, that will never come to India". In fact, the Indian Transport Minister has recently said "Connected cars will never come to India. I won't allow it". I think in reality, as an industry we have dumbed down what these developments are all about in order to grab the headlines. The automotive ecosystem and the media are divided into those that say it won't work and it won't happen, and those that believe in the shift in the business paradigm and want to learn more.

If you take the broader definition of what connected really means, India is already a fairly highly connected society. Mobile phone adoption is already extremely high in India, partly because they leap-frogged the whole landline/wired network world. Demand for phones was extremely high, and it was just much more cost-effective to build wireless networks. As a result, India is not likely to be behind any other markets in the roll-out of 5G networks. That will give those of us in the automotive sector the opportunity to use that bandwidth to do some things that India consumers will find really helpful. That could be improved traffic information, the ability to help the driver make smarter decisions about the safe operation of the car or, in the longer term, bringing some of the driverless technologies into play. So, while to some, India may seem an unlikely hub for connected vehicle technology, it is already a highly mobile and connected country and the infrastructure is already in place. There is already a significant hardware and software development resource in India and so much of the back-office work is already being done for mobile players.

It does not take much of a leap of faith to believe that the automotive industry of India is going to have the opportunity to deploy low-cost spin-offs from the personal telecoms sector.

VH: Is there a likelihood that sophisticated levels of connectivity could extend to more 'consumer friendly' -priced cars in India than in some other territories? The most sophisticated connected cars you can buy in Europe and America are high-end, generally German cars. It would be wonderful to see some of this technology becoming available in more mainstream, low-cost cars.

DH: Absolutely. The centre of gravity of the Indian car market is much lower. So the debate is going on. How much can be handled by a 'bring your own device' strategy where you aren't charging people for another gateway to the connected world by adding to the car – as has been the model to date? How integrated can you make the existing handset- or tablet-based connectivity in order to mean that the capital cost of the vehicle doesn't rise significantly? That delivers you into the heartland of the connected car model, where the service is where you actually make money. Providing and maintaining that service is where you make your ongoing revenue, rather than simply relying on the original purchase and any income from maintenance.

So, yes, I see that there will be a higher implementation of connected car features in a higher proportion and in less expensive cars in the Indian market. It will not just be available to the high-end adopters in other markets who have been able to pay the thousands of dollars needed to be able to use connectivity features.

VH: We have talked about the general markets. Can tell us more about Tata's own plans for connected cars?

DH: What we are trying to do is bring market-appropriate technologies into our future ecosystem, knowing that there are some that are not appropriate to the



Indian market. For example, think about Lane Assist, an Advanced Driver Assistance System (ADAS) technology that pre-supposes that a car runs along a road with lines that have been painted down along it. You cannot guarantee this in large parts of India. But there are definitely features with road-safety benefits that we have a moral duty to make sure that we provide to Indian customers for our cars. Some of today's ADAS systems could have real benefits on Indian roads, such as systems that deal with unlit vehicles on the roads, times when pedestrians and animals are sharing road-space. This could be seen to be providing real benefits to the safety of road users. By working on the high-end systems first, we are learning how they can be optimized for use in lower entry-cost vehicles.

So, going back to the Transport Minister's comments, it may be true to say that Level 5 autonomous vehicles are unlikely to be viable on Indian roads, but some of the developed features that in a different market can give you that functionality, can be used to bring a major reduction in accidents and road deaths in India. This is, of course, in addition to the connected car benefits that can be enjoyed by Indian drivers, who spend a disproportionate amount of time sitting in traffic jams. This is where the battleground will be in the future, and Tata, as an indigenous car manufacturer without a tie-up to a large, external car company (Ed. - Tata's Indian competitor Maruti gets its technology from Suzuki) has to develop all of its technology in-house – or buy it in from other companies.

VH: We understand that Tata intends to develop new cars in an innovation hub, and will carry out virtual 'phy-gital' (Ed. physical launch plus inclusion in online gaming platform) releases to the online community. Can you explain?

DH: The innovation hub approach relates to what we were doing with Tamo. This means making sure that our hubs around the world are properly connected to our mainstream product development function. It is an inevitable consequence of the move away from the traditional situation whereby 40 people sat at drawing boards in an office. Today, digital development in all its forms – from the virtual validation of a vehicle, extensive simulation of a vehicle before you ever cut metal, 3D printed cars – they all have their place in the future. To us, the use of an innovation model to do some of the engineering of the cars is an inevitable development of the automotive industry. We are moving from a traditionally structured industry to one that is trying to keep up with today's pace of development.

However, we cannot change the fact that there are some elements of the 'cradle to grave' life-cycle of the car that you cannot cut down in the same way that you can with some tech devices. As an industry we are very much bound by legislation that has grown up over the entire 120 year existence of the car. You can't just put anything you like into the car, there are regulations and hurdles to climb over and there have to be tests and approvals. Most of these tests are things that you have to do physically, not digitally. You can't present engineering data to validate crash tests – you still have to crash cars. These steps



take time and money. In the time it takes to carry out a series of crash tests on a car, Apple and Nokia will develop and launch new handsets. These consumer devices may then go wrong in the market, and it may be embarrassing for the user, but nobody has been hurt. Car companies are not allowed to do that, the decision having been taken out of our hands by the legislators.

So, maybe the change will not be as dramatic as we portray, but digital development is a trend that is going on in the automotive world.

VH: And 'virtual phygital' releases to the online community – will that happen?

DH: That was largely built around the model for the Racemo sports car. We had an agreement with Microsoft that saw Racemo released as part of the Microsoft gaming platform at the same time that we released it to the public at the Geneva motor show. That was a first for Microsoft too, which is why they were interested. Within 24 hours of Racemo being released we had all the gamers coming back to us with customized versions of our car! This was an exciting project for Tata to be part of as it presented an opportunity to engage with pre-car-buying age people in discussions on the future of automotive. We could learn from them the features they would be looking for when they are buying cars.

How mainstream this will become, I don't know, but we do think that with vehicles becoming a mobility commodity as opposed to an aspirational purchase, there is going to be a need for a greater and more innovative online presence. The traditional car industry has to achieve a peace with the fast-moving companies that can build software platforms and communications channels in a matter of days if they become the people that are earning money. Otherwise we could become irrelevant. That is not something we want to do.

VH: Absolutely not, I don't think anyone in the industry wants that. A couple of things, though, have occurred to me from the way you described things - it sounds to me as if TMETC is something like Tata Motors' in-house Tier 1 supplier, but you also have a remit to work with external companies as well?

DH: Our focus is on mainstream engineering, focusing on the longer-range horizons and filtering some of the innovation opportunities into advanced engineering and then into early-stage products.

VH: So, when a member of TMETC staff comes in to work in the morning, is he thinking about developing technology for Tata, or for the wider industry?

DH: Primarily for Tata as that is where most of our funding is coming from. However, these are broadly experienced automotive engineers that can bring new thinking to solve problems for Tata Motors. We are a commercial enterprise that is working largely for Tata Motors, helping Tata create and implement a strategy that will make it a relevant part, first of all, of one of the World's fastest-growing automotive markets, but also to make sure that this merger of the world of connectivity, automotive and alternative mobility and new business models is all brought together as quickly and as successfully as possible.

www.tmetc.com

DATA TRADING AND THE CONNECTED CAR

STEPHEN WOOD, EXECUTIVE DIRECTOR, INTERGETIC FORUM



The connected and autonomous vehicle is becoming one thread in a highly interwoven tapestry of data collection, exchange and analytics which are pervading every aspect of the world economy. Instead of owning and controlling the data trading ecosystem, the automobile sector will be forced to work hand in hand with telecom operators, Internet companies, advertisers and data aggregators under terms that can be influenced, but not controlled. They will need to collaborate on a shared system of data exchange that works seamlessly across regulatory domains and market segments.

TO GET A BETTER FEEL FOR THIS EMERGING SYSTEM, SUPPOSE THAT A CONSUMER RETAIL FIRM WISHES TO OPTIMIZE THE PLACEMENT OF A NEW STORE ALONG THE TRAFFIC PATH OF THEIR TARGET CUSTOMERS. TO DO THIS, THEY COULD PURCHASE GPS INFORMATION AS WELL AS ESTIMATED VEHICLE VALUE FROM AUTOMOBILE MANUFACTURERS.

For that data sale to occur there has to be an agreement about who owns the data and whether consumer opt-in is required. There has to be a shared understanding of location precision. Location is not a single value. Location data can have a resolution of <10m (beacons), <150m (E911) or kilometers (cell tower ping). The retailer will likely need to purchase the same data from telecom network operators to get a more complete understanding of the individuals making up traffic flows in locations being evaluated. From the retailer's perspective, the ideal situation would be for every data vendor to provide equivalent datasets under a common understanding of privacy and data quality.

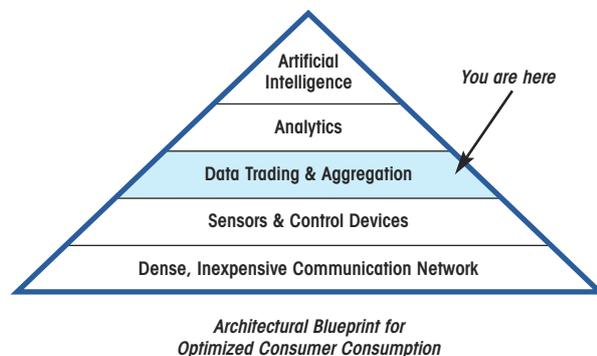
STANDARDISED/NON-STANDARDISED?

Even within the autonomous vehicle ecosystem, there will be challenges with data fusion. The data associated with speed and traffic jam identification needed for autonomous vehicles to work with intelligent traffic systems will be standardized. But, non-essential services may not be. Traffic management systems, parking management, consumption profiling, EV charging management, Internet services and other functions are unlikely to reflect the same standardization rigor that safety features do. Just because a system does not affect passenger safety does not mean that it is inconsequential. The data from these non-essential services will have a material impact on the autonomous vehicle's profitability.

Whereas a vehicle is sold one time, services have the potential to be sold for the life of a car. In the same vein, the profit margin on an average car is approximately 6-8%. The profit margin on data services is potentially ten times that level. Manufacturers of autonomous vehicles have the potential to use the additional margin to drive down the purchase price of vehicles. Manufacturers that maximize their data revenues have the potential to differentiate themselves. To capitalize on this source of revenue, manufacturers need to simplify the sale of data in the same way that they optimize the driving experience.

Every inconsistency that occurs between purchased datasets represents friction in the data trading ecosystem. Additional time, effort and expense must be spent by the buyer to detect and correct for any data mismatches. Potential data consumers including Insurers, advertisers and regulators will all experience a common set of challenges.

To get a better understanding of the expansive data trading/monetization ecosystem that will emerge, it is useful to step back in order to get the big picture. If you were to imagine that the market was following a literal blueprint in the construction of ecosystem, the data trading system fits as a component within a larger whole.



The data trading system that is emerging is part of a larger architecture that exists in part to enable and optimize the systems supporting consumer consumption. This system depicted in the figure is building from the bottom up. In the first layer, dense wired and wireless communication networks were deployed. Telephone, television and Internet networks combined under the banner of the IP protocol to form this capability. Advanced technologies such as Zigbee, Wi-Fi and 5G continue to increase the network density.

Sensors and control devices are deployed in the second layer. This is the Internet of Things (IoT). This phase of the system only began to deploy in earnest in the last few years. It permits information to be gathered about every aspect of consumption including electricity, online browsing, and television. It also permits the collection of data about the state of assets (example: home security, auto maintenance).

As sales of IoT devices grow, data will begin to be collected in increasing volume. The data is already generating value for select companies. But, it quickly becomes apparent that the data has value to others as well. Data trading systems will emerge in layer three that mine the data as raw materials and process it for consumption as a product.

In layer four, analytics will begin to ramp and increase in complexity. The volume of data being generated requires automated techniques to extract actionable data. The data collected in layer four is relatively low resolution. As the resolution of data increases, the amount of information that can be extracted does so as well. For instance, a monthly reading of electric consumption tells very little about how the electricity is being used. But data extracted every thirty seconds tells a great deal about the devices that are active. Extracting these insights from raw data requires analytics.

As the volume of connected systems increases, the fifth stage, artificial intelligence, is added. The AI functionality in this layer connects between systems, to increase the reliability of the whole and to improve the ease of use for consumers. As an example, a networked carbon dioxide sensor in the home may trigger the energy management system to shut off the furnace. At the machine intelligence layer, these systems are interwoven into a combined experience with shared data. The data exchange ecosystem that is just emerging permits the flow of data between the elements of the system.

One of the more interesting things about this evolutionary process is that it recurs at different scales. This pattern occurs on a small scale in the design of a modern automobile. It is also occurring at the level of national economies as well. Retailers, internet advertisers, financial services and insurers are moving data between and within market segments.

This clearly draws a very promising picture in terms of the potential for auto manufacturers to sell the data that they are collecting. For this system to emerge quickly and to reach profitability soon there is a compelling need for standardization that reaches across market segments. Just as the standardization of the IP protocol merged wireless, telephony and television networks into the Internet, standardization is needed to permit data to flow effortlessly throughout the system. Specifically, there are two major areas requiring attention; data integrity and privacy.

To have data integrity, it is necessary to agree on what and how measurements are being taken. When that is settled, additional mechanisms are required to ensure that companies remain in compliance.

Once it is determined how a given measurement is correctly established, there is still the problem of companies who knowingly provide incorrect data in an effort to gain advantage. To remove such data from the system, a set of mechanisms is required to track data to its source for removal and for the punishment of the offenders. One mechanism required in pursuit of data quality is traceability. Every data element that is traded should have a provenance. If it is ever found that the data is fraudulent or flawed, a mechanism must exist to remove the

flawed data and to trace the flaw back to the responsible party. Continued participation in the trading system should be contingent upon good faith efforts to maintain data integrity.

The artificial intelligence systems that emerge in layer five are only as good as the data that is used to train them. If bad data is fed into them either by poor design or fraudulent manipulation, bad recommendations will result. The consumer's trust in these systems is entirely dependent upon the quality of its recommendations and by extension, the quality of the data.

The second major challenge is privacy. More specifically, the gradual proliferation of audio and video data streams will dramatically amplify the level of sensitivity that consumers exhibit. A video camera pointed at the driver to monitor wakefulness has the potential to be exposed to a lot of unintended information (did the driver put on makeup while driving?). Microphones used to control the entertainment system have the potential to monitor conversation occurring in the car. As with data integrity, there is a financial incentive for companies to exhaustively mine these unintended data sources and to sell the resulting insights.

This opens the question of the consumer's expectation of privacy. An automobile manufacturer can easily set guidelines for the component suppliers within its vehicles. But this is not enough. Automobile data will pass to insurers, entertainment content providers, electric utilities, dealers and others. If today's Internet privacy models are used here, the consumer would be required to approve privacy terms from each of these groups. Those terms are likely to change every time a software revision is downloaded.

If one or two vendors in this supply ecosystem behave unethically, the consumer's trust in the entire ecosystem is placed in jeopardy. The consumer has a right to expect that there is a shared value proposition regarding privacy and that it is policed by the industry.

The Intergetic Forum is a special interest group that is being created to focus on data integrity and privacy. As part of our efforts to establish a uniform consumer experience, we are creating liaison relationships with organizations in automobiles, health, computing and throughout the smart home. Liaisons permit best practices to be shared between the industry organizations. If a data field is needed to convey provenance, that requirement will be passed uniformly to the groups working in each field for implementation. Likewise, each industry group has the potential to generate privacy requirements that would be fed into the Intergetic Forum for work and for proliferation. Details about the group's charter and its efforts can be found at www.intergetic.org.

The data trading system that we are building together is essential to the efficient operation of tomorrow's economy. Analytics and automation can only achieve their potential if they have ready access to high quality and ethically obtained data. The purpose of our efforts in developing these systems is not exclusively about generating incremental margin off of data. It is also about building competitive economies.

www.intergetic.org



AUTOMOTIVE INDUSTRY EVENTS

Connected cars feature at events all over the world, and not just at traditional car shows. Connected Car maintains a list of significant shows. If you are aware of events we have missed, please feel free to let us know.

2017

12-24 September 2017

Frankfurt International Auto Show

Frankfurt, Germany
www.iaa.de/en/

26-27 September 2017

Bluetooth Asia 2017

Shenzhen, China
www.bluetooth.com/news-events/events

9-12 October 2017

Bluetooth SIG UnPlugFest 58

Barcelona, Spain
www.bluetooth.com/news-events/events

9-13 November 2017

Dubai International Motor Show

Dubai World Trade Centre, Dubai, UAE
<http://10times.com/dubai-motor-show>

2018

9-12 January 2018

CES 2018

Las Vegas, USA
www.ces.tech/

10-18 February 2018

Chicago Auto Show

McCormick Place, Chicago, USA
<http://www.chicagoautoshow.com/about-the-show/>

8-18 March 2018

Geneva International Motor Show

Geneva, Switzerland
www.gims.swiss/en/

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In Connected Car magazine each quarter readers are able to access market-specific phone/smartphone data and detailed regional summaries from our sponsor NextGen Technology's global market research (see pages 30-31).

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NextGen



TOP HANDSET RELEASES BY REGION – Q3 2017



EUROPE

MANUFACTURER	MODEL
Honor	9
Honor	8 Pro DUK-L09
HTC	U11
Huawei	P10 Lite WAS-LX1A
Nokia	5
OnePlus	5 A5000
Samsung	Galaxy J5 (2017) J530F/DS
Samsung	Galaxy J7 (2017) J730F/DS
Samsung	Galaxy Xcover4 G390F
Sony	Xperia XZ Premium G8141



NORTH AMERICA

MANUFACTURER	MODEL	CARRIER
HTC	U11	Sprint
Lenovo	Moto Z2 Play	Verizon
LG	Stylo 3	Sprint
LG	Stylo 3 Plus	T-Mobile
Samsung	Galaxy J3 (2017)	AT&T
Samsung	Galaxy J3 Eclipse	Verizon
Samsung	Galaxy J3 Prime	T-Mobile
Samsung	Galaxy J7 (2017)	AT&T
Samsung	Galaxy J7 V	Verizon
ZTE	Max XL	Sprint



Honor
9 STF-AL00



Oppo A77



Oppo R11



Oppo R11 Plus



Vivo X9s



Vivo X9s Plus



Vivo Y53



Xiaomi 小米 Max2



Xiaomi 小米5X



Xiaomi 小米6



CHINA

MANUFACTURER	MODEL
Honor	9 STF-AL00
Oppo	A77
Oppo	R11
Oppo	R11 Plus
Vivo	X9s
Vivo	X9s Plus
Vivo	Y53
Xiaomi	小米 Max2
Xiaomi	小米5X
Xiaomi	小米6

au Samsung
Galaxy S8 SCV36



au Samsung
Galaxy S8+ SCV35



au Sony
Xperia XZs SOV35



docomo Samsung
Galaxy S8 SC-02J



docomo Samsung
Galaxy S8+ SC-03J



docomo Sony
Xperia XZ Premium SO-04J



docomo Sony
Xperia XZs SO-03J



Softbank HTC
U11 601HT



Softbank Sharp
Aquos R 605SH



Softbank Sony
Xperia XZs 602SO



JAPAN

NETWORK	MANUFACTURER	MODEL
au	Samsung	Galaxy S8 SCV36
au	Samsung	Galaxy S8+ SCV35
au	Sony	Xperia XZs SOV35
docomo	Samsung	Galaxy S8 SC-02J
docomo	Samsung	Galaxy S8+ SC-03J
docomo	Sony	Xperia XZ Premium SO-04J
docomo	Sony	Xperia XZs SO-03J
Softbank	HTC	U11 601HT
Softbank	Sharp	Aquos R 605SH
Softbank	Sony	Xperia XZs 602SO

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