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TRANSPORT360

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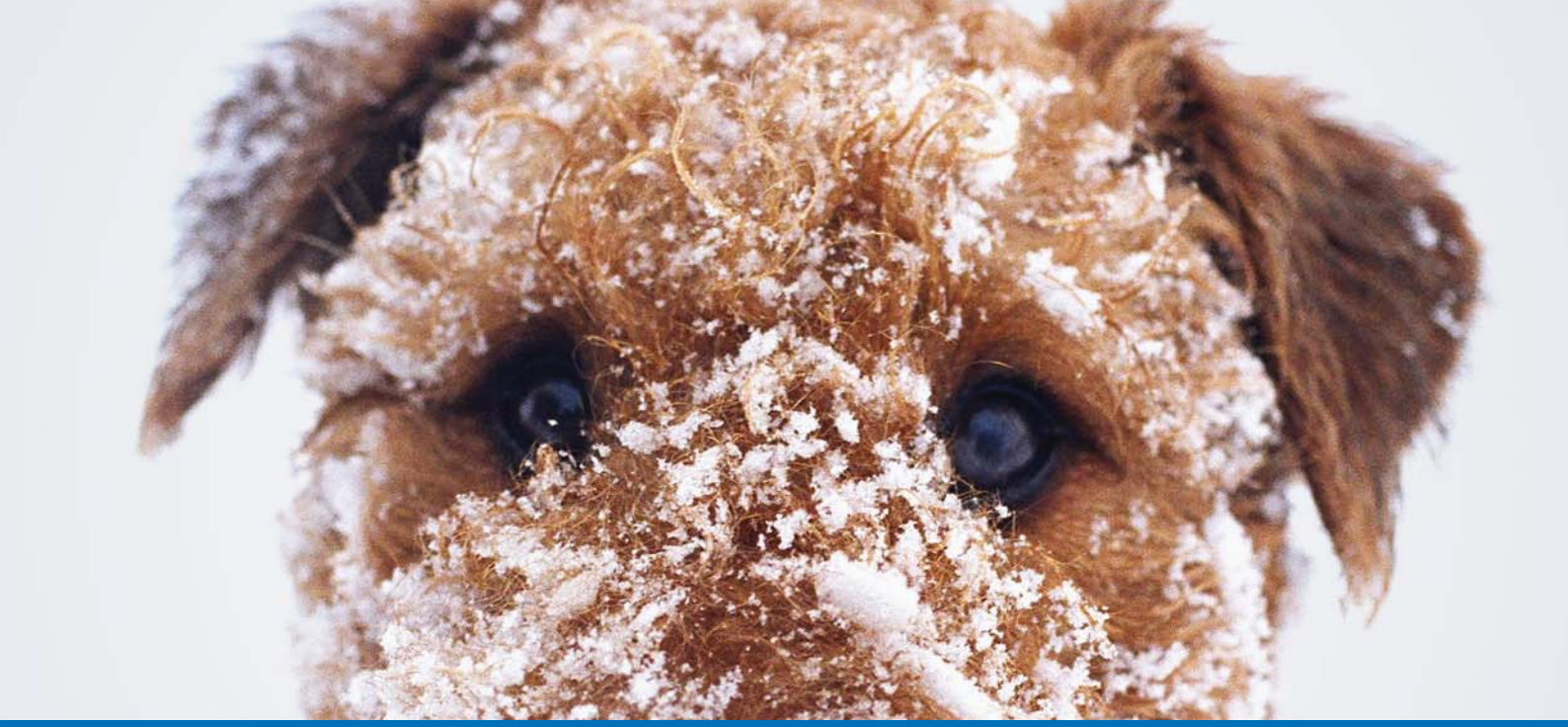
TALKING HEADS
Aeris tells how to gather business value from connected vehicles

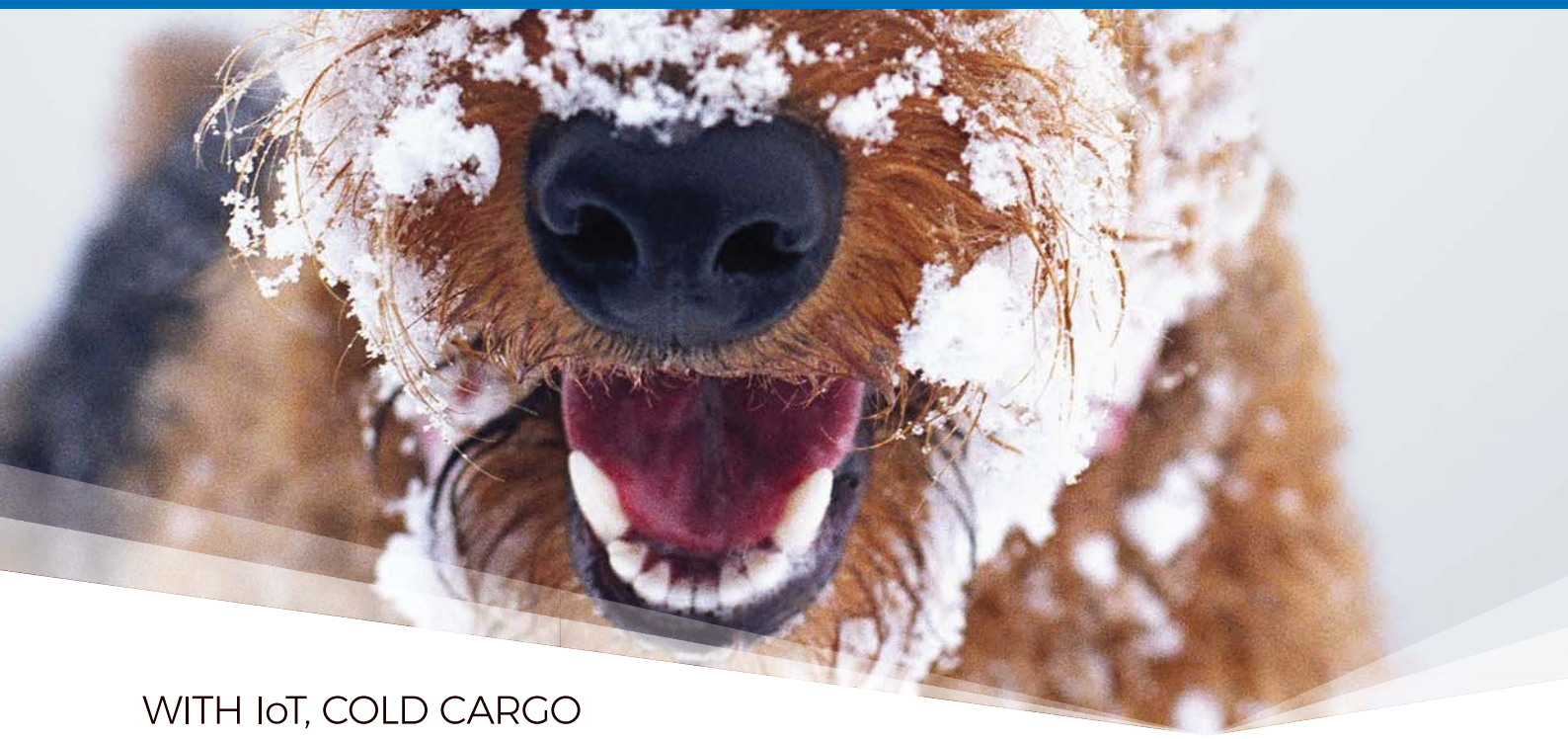
SMART CITIES
Autonomous vehicles' future will be shaped by cities

LONDON CASE STUDY
Emission monitoring helps Transport for London plan for better air

PLUS: IoT enables asset tracking across the supply chain • Cold chain monitoring is more than just temperature control • Company, Product & Contract News • Fleet management in the mix of a great and complex IoT ecosystem • IoT heats up across the cold chain: **www.iotnowtransport.com**



Cold Chains: Your New Best Friend



WITH IoT, COLD CARGO BECOMES INTELLIGENT.

Cold chains for food or pharma are susceptible to mechanical breakdowns, traffic delays, theft, human error, and numerous other factors. With connected cold chain devices, issues can be handled in real time, with the entire cold chain infrastructure reacting as a single unit.

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How smart is your cold chain monitoring solution?

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aeris®

(Cover sponsor) Aeris is a global technology partner with a history of helping companies unlock the value of IoT. For more than a decade, it has powered critical projects for some of the most demanding customers of IoT services. Aeris strives to fundamentally improve businesses by dramatically reducing costs, accelerating time-to-market, and enabling new revenue streams. Built from the ground up for IoT and road tested at scale, Aeris IoT Services are based on the broadest technology stack in the industry, spanning connectivity up to vertical solutions. As veterans of the industry, Aeris knows that implementing an IoT solution can be complex, and the company prides itself on making it simpler.

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Listen to the customer, or you'll just make a faster horse

At a time of political upheaval, business leaders and investors become nervous and search for certainties. Arguments over NAFTA, Brexit, the Middle East, or US vs. the Rest trade wars can unsettle the markets. So, it's good to hear in our lead interview for this issue (pages 8-11) that one company is focusing on the customer. For only when you truly understand your customer, do you have a solid market.

The Internet of Things (IoT) does not mean that automation bypasses the customer. On the contrary, the IoT can and should bring him and her closer to the decision-making process. We're at the start of a revolution in customisation that uses artificial intelligence (AI) to understand and anticipate individual needs, 3D printing to build exactly what we want (not a close approximation that fits as many customers as possible), and augmented reality (AR) to show us how things work. Underpinning it all, connectivity builds an ongoing relationship with the consumer that brings us products more closely aligned to our needs and expectations. It can also lead to innovations that the customer never knew they wanted. Henry Ford once said, "If I'd designed what the customer wanted, I'd have made a faster horse."

Customer Engagement (CE) is a critical measure of the depth of a relationship with connected car makers. As Drew Johnson points out, "The value measurement in the consumer area has been murky. That's one reason why the consumer connected car sector has not expanded as quickly as commercial connected vehicles." It's a refreshingly candid view that the auto industry has not yet offered consumers what they want, but is taking steps to correct that right now.

Jeremy Cowan,
editorial director, Transport360

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Gemalto and Faraday Future work together to deploy secure, connected vehicles

In anticipation of Faraday Future's launch of its first intelligent electric car, **Gemalto** is providing the data security and encryption technology that will help protect software that powers the car and data collected from everyday use of its cars.

Faraday Future is working to deploy Gemalto SafeNet Hardware Security Modules (HSMs) and professional services to build and secure the public key infrastructure (PKI) that will generate digital certificates used to authenticate the communication between the car, the backend systems and people. The PKI system can also store these certificates in a central repository, share them with other stakeholders and revoke them if needed.

Every step of data flow is protected, such as over-the-air software updates and transport of data from the car, without making the data vulnerable to cyberattacks. In the future of autonomous cars and smart cities, the PKI system will prevent hackers from intercepting data passed to other cars, garages, parking meters or other connected infrastructure. Hackers also won't be able to spoof authenticated access to the car itself.

Gemalto is working with Faraday Future to design, configure and deploy a private **Microsoft** Certificate Authority that will integrate into their existing architecture. Gemalto's FIPS certified SafeNet HSMs are expected to be installed with Faraday Future's internal server and are specifically designed to process, store and manage cryptographic keys inside a hardened, tamper-resistant device, making them an anchor for trusted access to networks and individual vehicle data.

"Gemalto's worldwide expertise in security opened the door for this relationship, and the reliability of their HSMs and high quality of support – with a dedicated team to deploy services – sealed the deal," said Connie Zhao, senior director of Vehicle Software at Faraday Future. "With these security measures in place, Faraday Future aims to release our first connected car soon, providing citizens with the convenience and trust needed on the road."

Sheffield and Detroit-based telematics company The Floow aims to reduce road deaths

The Floow has created an app which gives drivers a score for each of their journeys, based on a number of criteria, such as speed, fatigue, and smooth driving. By improving their scores, the app's users can become safer drivers and also reduce their insurance premiums.

A spokesman for The Floow added: "The data scientists at The Floow are experts at understanding driver behaviour on given roads. This knowledge helps understand driver behaviour patterns on key roads and danger areas."

The Floow, which is based in Sheffield, UK and has offices in Detroit, also runs a coaching service for higher risk drivers. "By helping them understand their driver scores and how to improve them, this course reduces 16 accidents in every 100 cases," the spokesman said.

Some 1,792 deaths were recorded in UK road traffic accidents in 2016, which is an increase of 4% on the previous year and the highest figure since 2011, according to data from Britain's Department for Transport.

The spokesman said: "At a time when the number of people killed on Britain's roads has reached a five-year high, The Floow has launched a production-ready telematics platform that opens up the market to all insurance organisations that support safer driving on the roads. The launch of FloowDrive allows all insurance companies, fleet operators and auto manufacturers that support responsible driving to adopt the technology, giving them a platform to launch into the telematics market in a matter of days, rather than taking several months."

"While the current telematics market has grown by 26% in the last year to 17.4 million policies worldwide, the technology that pushes safe driving and lowers insurance premiums has to date been limited to a handful of major insurers.

Aldo Monteforte, chief executive of The Floow added: "As a fast-growing company – and a global leader in shaping the telematics industry – we have the scale and experience to be able to offer a proven, production-ready solution to companies that want to adopt telematics to improve safe driving and better manage insurance risk."

Aldo Monteforte

Connected car services vendor Bright Box expands US presence with Zurich Insurance North America

Today's opening of the new office in Schaumburg, IL is a clear indication of how important this operations unit is, to offer full support for its US customers and partners said Alex Dimchenko, CSO at Bright Box. As part of **Zurich Insurance Group**, the Schaumburg Bright Box team plans to provide integrated connectivity platforms for dealerships and to offer full support for its US customers and partners.

Bright Box has been developing connectivity software for dealerships for about ten years and has analysed the experiences of two million users of its mobile apps. Today Bright Box is a global vendor of connected car platform Remoto, which includes all the necessary components: a Telematic Control Unit (TCU) or OBD dongle to be installed in the vehicle, a web-based control panel, and a customer app for the vehicle's owner to control and track it remotely.

The app allows users to follow up on the latest news and promotions, contact the dealer instantly regarding any problems, sign up for services and maintenance, book a test drive at a convenient time, or receive personalised offers from dealerships. And all this is far from being a complete list of the system's functionality, combined with remote car control.

bright box

As a result, users of the full version of the solution have access to the following features: vehicle tracking, remote car control, driving behaviour, points of interest, Wi-Fi, vehicle self-health check-up, mobile payments, vehicle security, turn off location tracking.

Remoto has already been successfully deployed by several automakers, including **Infiniti**, **KIA**, **Nissan**, **Toyota**, **Honda** and about 1900 dealerships.

Vodafone builds its niche in fleet IoT

Stefano Gestaut
Vodafone

Vodafone has reported higher profits on lower sales for the year, and its progress towards establishing a firm Internet of Things (IoT) business in the transport sector was a key highlight in the results. *Antony Savvas* writes that for the 12 months, Vodafone Group reported operating profits were up 15.4% to €4.3 billion on revenues that were down 2.2% to €46.6 billion. The fall was primarily due to the de-consolidation of Vodafone Netherlands and foreign exchange movements, said Vodafone.

"Organic service revenue was up 1.6%, with good momentum in data, fixed/convergence and Enterprise," Vodafone added.

Vittorio Colao, outgoing group chief executive, said mobile data usage "continues to grow strongly", and that this was "despite roaming headwinds" [the end of European roaming charges]. Colao is stepping down in October after 10 years at Vodafone's helm, but he is leaving with the company making progress in new markets, not least in IoT transport.

Though still relatively small, turnover from IoT connectivity was up 14% year-on-year. Vodafone has now hooked up 68 million active SIMs to its IoT platform, including 14.4 million vehicles, helped by deals with the likes of pan-European and US car insurance firm Admiral and global tyre company Continental.

Continental aims to make roads safer with Vodafone's support through its digital tyre monitoring platform ContiConnect. The companies are using IoT to connect commercial vehicle fleets

to the monitoring platform, which is currently deployed in the US, Canada, Malaysia and Thailand. Markets in Europe and other parts of Asia are to follow this year and next.

Using sensors, ContiConnect communicates tyre temperature and pressure data to a central web portal via the wireless network, allowing fleet managers to continuously monitor the data for their entire fleet. The system sends alerts via e-mail or SMS to fleet managers if tyre pressures or temperatures deviate from set values and suggests corrective measures where necessary.

The platform "helps prevent expensive tyre-related breakdowns affecting commercial fleets and maximises vehicle uptime", said the partners.

Vodafone's IoT director, Stefano Gestaut says this is a "great example" of how IoT can make "real world differences". Waymo, Tesla and Uber are ploughing resources into trying to revolutionise how fleet management eventually goes forward, but it's the here and now that mainly matters for hard-nosed business operators. With this system, drivers don't even need to have a display unit in their cockpits, with everything being done remotely for them, alleviating any need to take their eyes off the road.

Infineon claims highest automotive functional safety grade with one sensor chip

Infineon Technologies AG is launching its first magnetic sensors based on TMR technology. This, says the company, makes it the world's first sensor manufacturer to offer magnetic sensors based on all four magnetic technologies: HALL, GMR, AMR and TMR. Infineon is also said to be the first supplier in the market to achieve the highest automotive functional safety grade, ASIL D, for angle sensors with only one single sensor chip.

The new products are fast analogue TMR-based angle sensors dedicated to automotive applications. Their fields of use range from steering angle applications with the highest functional safety requirements to motors for wipers, pumps and actuators and electric motors in general. They are also ready to be used in industrial and consumer applications like robotics or gimbal.

The TMR technology offers a high sensing sensitivity that comes with a high output voltage realising output signals of up to 0.37 V/V for all XENSIV TLE5501 products. Unlike other technologies, a TMR-based sensor can be connected directly to the microcontroller without any further amplification, thus saving costs for the customer. Furthermore, TMR shows a very low temperature drift reducing external calibration and compensation efforts. In addition, TMR technology is well known for its low current consumption, which is as low as 2 mA for the XENSIV TLE5501 family.

The new sensor family is available at two different qualification levels. The TLE5501 E0001 is qualified according to AEC Q100. This version is pin-compatible to the established Infineon TLE5009 but can enable cheaper systems as no additional amplifier is necessary. The other version, the TLE5501 E0002, offers ISO26262-compliant development, achieving ASIL D level with just one single chip. It incorporates decoupled bridges for redundant external angle calculation and offers highest diagnostic coverage as demanded by functional safety regulations.

MEMS pressure sensor market is still driven by automotive applications, says report

Established automotive applications are increasing MEMS pressure sensor adoption in integrating systems. They are also expanding the geographical adoption especially in China, thanks to new automotive regulations.

The consumer market is the second pressure sensor business with new consumer applications (including wearables, electronic cigarettes, and drones) which are giving attractive perspectives to device manufacturers.

MEMS pressure sensor technologies are basically segmented into piezoresistive and capacitive categories. Both two technologies are not hugely different in terms of performance but capacitive is limited to absolute pressure applications. Today piezoresistive is leading the industry in terms of market share, and that will probably continue in the future despite growing adoption of capacitive technology in consumer application.

To complement the Yole Développement (Yole) technology & market report, MEMS Pressure Sensor Market and Technologies 2018, System Plus Consulting, part of Yole Group of Companies, has conducted a comparative review of pressure sensors chips, modules and TPMS. In this new report, the reverse engineering and costing company provides insights into the structures, technical choices, designs, processes, supply chain positions and costs of a selection of key MEMS pressure sensors.

In all, seven consumer, 14 industrial and 13 automotive MEMS pressure sensor products from leading suppliers are analysed in System Plus Consulting's study. Suppliers include All Sensors, Amphenol, APM, Bosch, Denso, First Sensor, Fuji Electric, Freescale/NXP, Honeywell, Infineon, Melexis, Merit SensorSystems, Mitsubishi Electric, Nagano Keiki, Sensata, Sensirion, SMI and STMicroelectronics.

The MEMS pressure sensors comparison from System Plus Consulting points out the diversity of devices and related technologies, which are a characteristic of this industry. All manufacturing process flows and cost reviews are detailed in the report to highlight the technical choices made by each player, according to the market segments.

Self-driving cars deployed in complex urban environments from Boston to Singapore

For the past 18 months, **nuTonomy**'s autonomous vehicles (AVs) have been racking up miles in Boston's Seaport District, sharing the road with car drivers, plenty of delivery trucks, and even a few errant seagulls. In close coordination with the City of Boston, Massachusetts, nuTonomy has now executed a test plan that has seen the company's vehicles safely tackle increasingly complex driving conditions, day and night, through rain, sleet and snow.

The company has now announced that the City of Boston has granted nuTonomy, and its parent company **Aptiv**, permission to operate autonomous vehicles on public roads city-wide in Boston. Said Karl Iagnemma, president, Aptiv Automated Mobility, "To be the first (and only) company to be allowed to test city-wide is a testament to our exceptional safety record, and our team's focus on building the world's safest and smartest driverless vehicle software. We thank Mayor Walsh for his partnership and vision in creating a more connected Boston. His dedication to improving the efficiency and safety of transportation drives our community closer to achieving the goals of Go Boston 2030. Additionally, it's with the support of Governor Baker and MassDOT that nuTonomy and Aptiv have been able to succeed in working toward our own mission of safer, more accessible transportation in cities worldwide."

When nuTonomy joined Aptiv in 2017, it became part of a company that shared a vision that autonomous vehicles would change the face of urban transportation. nuTonomy put down roots in Boston and Singapore — two cities with diverse infrastructures, weather conditions, and populations — and nuTonomy was the first to test AVs on public roads in both cities. In each city, it was also the first to launch Automated Mobility on Demand pilots, partnering with transportation network providers in North America (Lyft) and Asia (Grab) to offer rides to the general public. Meanwhile, in Las Vegas, Aptiv is operating a commercial programme that allows Lyft customers to hail a self-driving car powered by Aptiv's autonomous driving platform.

Around the globe, Aptiv and nuTonomy are said to have worked closely with civic leaders to ensure that their vehicle testing is accomplished in a safe, responsible, and transparent manner. In its continued partnership with the City of Boston, the company is committed to sharing the results of its driving experience through quarterly reports that are made available to the public.

It is also actively working with the City of Boston and partners to conduct demonstrations and educate new audiences on the promise of autonomous vehicle technologies. Lastly, nuTonomy has taken the initiative to make freely available a dataset (called nuScenes) that will allow individuals and groups to improve their own driverless vehicle software.

SmartDrive chooses Digi platform for driver monitoring and fleet management

Digi International, a global provider of Internet of Things (IoT) connectivity products and services, reports that SmartDrive, a provider of telematics and fleet management services, has selected the Digi ConnectCore 6UL secure, wireless System-on-Module (SoM) as the development platform for its new DriveOps GPS Real-Time Fleet Management system.

SmartDrive faced a significant business challenge in reducing the time-to-market of a production-ready next-generation telematics device that could be easily installed using a car's built-in 12-volt power outlet and the company's own embedded cloud-based software built on **Amazon** Web Services' (AWS) cloud services platform. The new device, which required relatively little development overhead, replaces SmartDrive's existing OBD II dongle.

SmartDrive recognised the value of Digi's complete out-of-the-box software support in the Digi ConnectCore 6UL product development platform, which does not require porting of the OS, the development of wireless drives, or obtaining certifications as part of the development process. These capabilities allowed SmartDrive to spend more time on application development and dramatically less time on hardware development, shortening the process to three months.

The compact 29mm x 29mm x 3.5mm form factor of the Digi ConnectCore 6UL assisted in achieving the target product size, including sensors, GPS, and LTE modem, for a standard 12-volt vehicle power outlet device enclosure. SmartDrive users can reduce accidents as well as the cost of fuel and insurance by optimising their driving behaviour.

"The configuration flexibility of the Digi ConnectCore 6UL SoM is essential to our new hardware platform, allowing us to focus our development resources. The Wi-Fi option allows us to expand our capabilities with new sensors or other hardware such as cameras. The Digi roadmap with cellular connectivity integration is also helpful for future developments," said Retsu Kitagawa, CEO, SmartDrive.

Trackimo selects Sequans' Monarch SiP to design IoT tracker devices

SEQUANS COMMUNICATIONS

LTE for IoT chipmaker, **Sequans Communications S.A**. reports that **Trackimo**, a specialist in GPS tracking, has adopted Sequans' Monarch SiP platform to design several types of IoT tracking devices with LTE connectivity included. The operator-certified Monarch SiP is an ultra-small and thin, all-in-one connectivity solution that integrates Sequans' Monarch LTE-M/NB-IoT Platform with an RF front-end module in the world's smallest form factor.

"Sequans' Monarch SiP is a powerful solution that simplifies adding LTE connectivity to our IoT tracking devices," said Shai Bar-Levi, CEO, Trackimo. "LTE is essential for wide area tracking applications and the very small form factor of Monarch SiP is ideal for adding it to devices where space is constrained."

"Also, Monarch SiP's single-SKU (Stock Keeping Unit) capability gives us all the flexibility we need to design IoT trackers for any market worldwide. We are using Monarch SiP to design many types of trackers, including asset trackers, people and pet wearable trackers, and more, for US and European markets."

"Trackimo is a leader in the tracking space and has established itself as a forward-thinking company with cutting edge tracker products," said Danny Kedar, VP of Sequans IoT Business Unit. "There are many tracker types that need the wide area, low power capabilities of LTE such as drones, fleets, people and pets, and Trackimo can get these LTE-enabled trackers to market quickly thanks to Monarch SiP."

The Monarch-SiP includes an integrated baseband, SRAM, RF transceiver, RF front-end, passives and power management in a single 8.8 x 10.8 x 0.95 mm package with proprietary RF shielding. It is compliant with 3GPP Release 13/14 LTE Advanced Pro specifications, including VoLTE support, is optimised for LTE UE categories M1, NB1, and NB2, and operates across broad frequency ranges (700 MHz to 2.1 GHz) to support global deployment and roaming capability.

Proprietary power management techniques offer improved battery life. Sequans' Single-SKU radio design enables Monarch SiP to operate on any LTE frequency worldwide. Monarch SiP is operator-certified and available now.

Gathering business value from the connected vehicle

Drew Johnson, VP Engineering & Operations, Aeris talks to Jeremy Cowan, editorial director, Transport 360, about the importance of customer engagement in measuring the value of vehicle connections, which industries require it and how to deliver it in a secure, cost-effective ecosystem.

Transport360: As connectivity becomes a base feature on commercial and consumer vehicles, how do you measure and deliver maximum value?

Drew Johnson: As we all know, connected cars and trucks have been around for more than 20 years. On the car front, it started as a niche capability on relatively few models and stayed that way for a very long time. What is changing now is that connectivity is becoming a base feature for all car models. Consumers expect their cars to be connected, and automakers are moving their businesses from unconnected, one-time product sales toward providing a connected service where there is an ongoing relationship with their customers.

When it comes to measuring value, the online connected world predominantly has adopted Customer Engagement (CE) as the primary measure. Customer Engagement is a measure of the depth of relationship that a customer has with the brand. Studies show that CE is driven by frequent positive interactions and can result in significant revenue and profit. We believe this same metric should be applied in the connected vehicle sector.

The typical online CE levels are described as some variation of 1) arrive/adopt; 2) consume/collaborate; 3) understand/create; and 4) apply/socialise. These descriptions of the depth of relationship vary according to the product type. In the connected car space, we envision levels such as 1) purchase/adopt; 2) use regularly; 3) understand and extend; and 4) integrate/socialise. A long article could be written entirely on exploring these definitions and the interactions that drive customers to each level. I will summarise by highlighting that we need to make sure the connected car becomes relevant and useful to the customer on a daily basis, with frequent interactions integrated into their daily life and work. That generally is the case for commercial connected vehicles, but usually is not the case for consumer connected cars.

Transport360: Which industries, in which global regions, are showing the most interest in measuring connected vehicle value? ►

Drew Johnson,
VP Engineering &
Operations, Aeris

DJ: The most mature markets for connected vehicles are North America, Western Europe, and Japan. That is the case both for consumer connected cars as well as commercial connected trucks. While both types of connected vehicles have been around for a similar number of years, the value measurement in the consumer area has been murky. That's one reason why the consumer connected car sector has not expanded as quickly as commercial connected vehicles. However, as connectivity becomes a base feature, the largest global automakers are re-looking at how to assess total value. As I pointed out, we think the CE measure is the best approach.

The value measurements often are clearer in the commercial space where value typically is tied to a direct return on investment (ROI). For example, we are helping customers with cold-chain monitoring where they can directly measure the impact. Currently, we work with a customer who delivers vaccines in remote areas. In the past, approximately half of the vaccines have been lost due to lack of temperature controls (either too hot or too cold). In this situation, the ROI of connected vehicles that monitor and manage temperature and reduce spoilage is very clear and, additionally, the connected capabilities save lives.

Transport360: You have said that an ecosystem can help accelerate delivering more value. Can you give examples of how and where this has been done by Aeris and your partners?

DJ: One of the reasons why Aeris is seeing success in the connected vehicle area is that we are delivering capabilities on top of an Internet of Things (IoT) platform architecture that can deliver value to multiple stakeholders. In contrast, many of the first-generation solutions were built as relatively monolithic silo solutions, focused on a single stakeholder.

One particularly important benefit of this IoT architecture is a clear separation of the device platform, ▶

which handles secure communication with the vehicle, and the services platform, which provides domain-specific primary user services, as well as an ability to securely and privately expose data and data analytics to other third parties for secondary user services.

We have connected vehicle programmes where we are providing all of our capabilities – connectivity platform, device platform, services platform, and data analytics. We also have ongoing programmes where we provide only one or two of the platforms. Overall, this provides much higher velocity and flexibility to the programmes that our customers really like.

Transport360: What's the ideal structure for such an ecosystem, and why? Is close integration or loose coupling best?

DJ: We believe it's good to think about the ecosystem in layers, not unlike an onion. At the centre is the vehicle. Security and privacy are critical everywhere but especially so at the centre. Change, and the velocity of change, is more controlled at the centre. As the layers move further away from the centre, we must have common abstractions that allow for loose coupling rather than tight coupling. The layers away from the centre should not be impacted by changes in the centre and should be free to adapt quickly to new features.

As a specific example, Aeris has a micro-service that learns about the places where a vehicle frequently stops. This service is called "Learning Places". As you can imagine, this micro-service is useful in both the commercial and consumer connected vehicle areas. Our commercial customers often are surprised to learn where their vehicles are spending the most time. The Learning Places micro-service needs some type of identifier for the vehicle along with latitude and longitude. The micro-service has no reason to need a specific vehicle identifier that can be used to directly identify the specific vehicle. This loose coupling is important both for privacy reasons and to protect the service from changes in other parts of the platform. Loosely coupled micro-services should not be impacted by a change in ▶

the exact communication mechanism used with the vehicle. These architectural separations of concerns are extremely important for overall security architecture.

Transport360: How do you protect the overall security of the system in an ideal ecosystem?

DJ: As you can tell from my other answers, security always is at the forefront of any discussion about connected vehicles. The architecture I've described with the vehicle and device platform is an important part. Extensive design and implementation work is performed on the vehicle and device platform to mutually authenticate each to the other, establishing secure communications and authorising particular operations.

This is important for all programmes but even more critical for programmes that allow remote operations. While a security-by-design approach is taken, we must assume that threat vectors change, so ongoing vulnerability testing and monitoring is used. Secure over-the-air (OTA) capabilities must be available to adjust to new attack vectors. These mechanisms must be isolated from other services in a way that still allows those other services to be developed and evolved over the many years of the life of the vehicle.

Since Aeris provides both IoT connectivity services and connected vehicle capabilities, another important aspect we look at is the layers of security at different communication and application levels. For example, most connected vehicles are linked via cellular connectivity. Cellular was designed as a many-to-many communication medium. Specific measures must be taken to change this many-to-many communication mechanism into a secure communication channel. When it comes to the outer layers of the ecosystem, it still is important to mutually authenticate and authorise access. However, these outer layers should be operating on anonymised read-only copies of data. They should have no access to the critical remote operations of the vehicle.

Transport360: What are the key ingredients for bringing down the cost of connected vehicles, increasing overall value, and creating an ecosystem?

DJ: Over the last few years, we have seen decreasing costs of many connected vehicle ingredients, including cellular connectivity, radio modules, and cloud infrastructure, which certainly are helping to further enable the viability of connected vehicles. Beyond these components, we always think that customers will benefit significantly by having choice – not just at programme inception but throughout the lifecycle of the programme. Nearly every programme needs cellular connectivity. We think it's important to support subscription management so that multiple cellular providers can be used according to what makes sense from a business or quality of service perspective.

In the aftermarket of connected vehicle programmes, having choice means having a relatively standard set of device categories that can be made by multiple suppliers with a common non-proprietary local execution environment. Regarding cloud infrastructure, our customers generally are concerned about lock-in to a particular cloud provider. Care should be taken to choose a cloud-portable solution whenever possible. From a services perspective, we believe that sharing common vehicle data models and event models is a very important aspect. So many services in the ecosystem could be built once and reused based on such common vehicle data and event model. Today, many of those services are built and re-built in an inefficient way. Also, as we have seen in the online and mobile platform areas, often the most valuable services come as the multitude of developers are able to use the platform in a way not originally envisioned by the creator of the platform. It's very likely that will be the case in the connected vehicle arena.

In the end, this all ties back to the Customer Engagement value metric mentioned earlier. Whether for consumer or commercial, it is likely to be an evolved and open ecosystem, which will allow the customer to fully integrate the connected vehicle into many aspects of their work and home as part of reaching the most advanced level of customer relationship.

In the consumer area, automakers already have realised that leveraging the ecosystems of Android and Apple are beneficial in infotainment. We also are seeing early extensions from online and mobile platforms to the smart speaker platforms driven by the automakers themselves. What is missing is an ability for third parties not directly tied to the connected car programme to actively participate. ■

From a services perspective, we believe that sharing common vehicle data models and event models is a very important aspect

Jeremy Cowan was talking to Drew Johnson, VP Engineering & Operations at Aeris.

IoT heats up across the cold chain

A ready-made or even government-mandated business case is always a substantial help in generating interest and achieving deployment volumes and IoT is starting to see this in cold chain deployments, writes George Malim

The scale of the cold chain market is enormous and with increased consumer focus on fresh food, it is becoming an attractive market for IoT.

The cold chain – effectively the supply chain for perishable food and drugs – is increasingly relying on IoT-enabled sensors and technologies such as artificial intelligence (AI) to assure that products have remained at a regulation-compliant temperature during transit. This is eliminating spoilage of goods and preventing health threats as organisations are able to certify that their goods have remained at the correct temperature throughout the supply chain. Today, the global cold chain market is valued by research firm **Markets and Markets** at more than US$203 billion and it is projected to reach US$293.27 billion by 2023 because of higher demand for perishable products and growing requirements for fast delivery.

"It is essential to utilise the technology at businesses' disposal to eliminate product and monetary losses," says Ruban Phukan, the co-founder, chief product officer and chief analytics officer at **DataRPM**. "Through the power of automation and IoT, enterprises can maximise product shelf life and maintain refrigerated warehouses. AI-powered platforms can use data collected from IoT devices to control the environment in refrigerated warehouses and vehicles and predict faults before they even occur."

Tom Canning, the vice president of devices and IoT at **Canonical**, also sees IoT unlocking value from the passive data that already exists within chillers and freezers. "By incorporating an IoT layer, businesses can tap into the available data locked within their legacy machines," he explains. "Looking at these so-called cold chain suppliers, by integrating IoT technologies across both merchandising systems and fridge monitoring systems, the temperature of each fridge can be controlled in real-time, allowing fridges and freezers to be adjusted automatically depending on the specific contents. This will not only help suppliers to reduce their energy consumption and associated costs, but also help to ensure that a longer-lasting, higher quality product is delivered – ultimately improving the end customer experience."

The scale of the cold chain market is enormous and with increased consumer focus on fresh food, it is becoming an attractive market for IoT. "The cold chain is absolutely a place where there are real problems that can be solved and IoT is the ideal methodology to do that," says Tim Stone, the venture partner director at IoT investor **Breed Reply**, which has invested in **Tag Sensors**, a provider of a temperature sensor label that can be attached to a single product, package or container, a mobile app which reads the temperature log from the temperature sensor label and a database that stores all temperature logs.

"Companies in the cold chain are all looking for solutions that are simple and give real, usable data," adds Stone. "Tag Sensors are unique because they are stick-on, printed and programmed at the same time and deliver information not just about temperature change but when, where and for how long the change occurred." ▶

Tom Canning, **Canonical**

Ruban Phukan, **DataRPM**

Tim Stone, **Breed Reply**

This is just one demonstration of the capability IoT has to add a new dimension to cold chain control. The early cold chain apps were reactive and reported on historical conditions. What IoT enables is a more proactive approach that can identify if a truck chiller is faulty and enable a repair or replacement to be sent, eliminating spoil and saving costs – as well as the risks of selling food or drugs that have not been handled properly. Instead of being confronted with a truck full of spoiled food, companies can react before the food is spoiled, saving waste and avoiding missed or late deliveries to customers.

"For many businesses, the vital data needed to inform their supply chain strategies already exists, it is simply not being captured or extracted in a way that can unleash its true value," adds Canning. "What businesses need is a way to collect this data, in real-time, at the location where it is being produced. It is here that the combined use of IoT and edge-computing technologies can provide the most value."

A further benefit is that cold chain management systems can cut energy costs by not keeping temperatures at a lower than necessary level. **IMS Evolve** has utilised Canonical's Ubuntu Core to create a cold chain solution to create energy savings of around £5 million (US$3.8m) in one year, through the real-time integration of merchandising and control systems, for some of the UK's biggest supermarkets. This illustrates the rapid return possible for IoT applications that support the cold chain but energy savings only scratch the surface of the opportunity.

Phukan gives another example of a cold chain-related IoT application. "Temperatures in food containers can be monitored in real-time and using AI-based anomaly detection and prediction techniques, the normal baselines can be automatically generated and continuously updated that include information about the type of food, the changing environmental influences and dynamic operating conditions," he says. "When they go outside of those normal baselines, the right people will be notified to immediately take action to prevent the food from spoiling. With that technology in place, even previously unknown problems can be handled proactively just when the early signs start showing up and the end user will receive on time what they have ordered, regardless of any problems that might have occurred."

In spite of the obvious and high value benefits of IoT enabling the cold chain, there are significant challenges to surmount. Among these, probably the greatest problem is the sheer size of the already deployed base of cold chain related vehicles, containers and fridges and freezers. These typically have relatively long lifespans so IoT capability will need to be retrofitted. "Given the significant costs involved, it seems unlikely that replacing every single fridge, freezer or delivery van within the estate of a food retail business would be very appealing for a large retailer," says Canning. "The sheer expense involved in such a drastic transformation of the supply chain will outweigh the immediate business benefits. Instead, for businesses looking to undertake such an industrial transformation, rather than investing in brand new equipment, true transformation lies in updating existing infrastructure and incorporating new connected technologies into an already functioning industrial ecosystem."

For Stone, improved cold chain operation can be as simple as sticking an adhesive tag to a product. "The whole ecosystem benefit is so great," he says. "The impact of getting cold chain right is not just on the company, it's on the supplier, the transport organisation, the retailer and the end customer – everyone benefits." ■

In spite of the obvious and high value benefits of IoT enabling the cold chain, there are significant challenges to surmount

The author is George Malim, managing editor of **IoT Now** magazine.

Cold chain monitoring and IoT- More than just temperature control

Refrigerator trucks and temperature-controlled storage facilities are common sights around the world, and most people assume that cold chains—moving products that require cold storage between manufacturers, suppliers, distribution centres, restaurants, grocery stores and, ultimately, the customer—ensure everything works as planned.

AT A GLANCE:
Cold chains are susceptible to mechanical breakdowns, traffic delays, theft, human error, and numerous other factors. With IoT, issues can be handled in real time, with an entire infrastructure reacting as a single unit.

The truth is much different. According to the Food and Agriculture Organization (FAO) of the United Nations, approximately a third of food perishes worldwide during transit. And that number doesn't include losses of other non-edible, but perishable, cargo like decorative flowers, a US$100+ billion market on its own

While certainly more robust than at any time in history (companies no longer rely on ice as the only temperaturecontrol method), cold chains still are susceptible to mechanical breakdowns, traffic delays (truck runs out of gas or waiting for an accident to clear), theft, human error, and numerous other factors. And it's not just businesses that can be affected. Human lives can be at stake when blood supplies and pharmaceuticals are part of the cargo. All that has changed with Internet of Things (IoT) and Machine-to-Machine (M2M) communications.

A new era of safety and efficiencies

With IoT, cold cargo becomes 'intelligent' thanks to smart sensors and monitoring. Now, temperatures can be measured in exact degrees and correlated with acceptable norms for any given cargo, generating alerts for the driver and other stakeholders when there is an issue. Sensors can distinguish between being in transit and being stolen, even to the point of activating a 'lockdown' mode to reduce theft. And if cargo is stolen, recovery is rapid as it can be tracked to within inches of its location.

Compliance, especially with products highly susceptible to microorganisms, is automated and simplified as both minute-by-minute and historic reports can be generated on-demand. If there is some issue with the transport method (truck, ship, etc.), the cargo itself can state whether it is valid for delivery or not, further enhancing compliance. And depending on the implementation, organic materials can send alerts immediately if they become infected due to air quality. With advanced monitoring techniques, little is left to chance as cargo is surveilled from journey's start through delivery.

A whole ecosystem working as one

Today's IoT allows something not possible before—a smart ecosystem. Devices don't live in a vacuum. They talk to hundreds or thousands of other end points, both machine and human. This is especially vital at hand-off, when cargo is loaded or unloaded, with heat-sensitive goods being the most susceptible to changing environmental conditions. In fact, temperature 'excursions' account for 80% of supply chain problems, with trucking being the most problematic form of transport. With IoT, issues can be handled in real time, with an entire infrastructure reacting as a single unit. For example, a truck attempts a delivery after-hours due to earlier mechanical issues, with cargo that can't wait overnight. Well in advance, a receiving crew would be notified to be ready, or the truck would be re-directed to an available warehouse nearby. ▶

Yet there is one problem

As advanced as IoT / M2M technologies are today, they still are highly dependent on one crucial factor—infrastructure. Smart devices that gather immense quantities of data and communicate in real time require all new levels of internetworking capabilities, including:

Dedicated end-to-end connections

Legacy analog networks cannot handle the amount of data traffic and 24/7/365 usage demands.
Digital remedies from carriers do work, but are built on a consumer infrastructure, with IoT / M2M communications added as an afterthought. Imagine taking a classic car to a local oil change place. They can do the job, but can you trust the results? What's needed is a network dedicated exclusively to the unique requirements of IoT / M2M.

Ease-of-use and zero learning curves

There are so many components to a cold chain supply system that in-depth training and similar efforts aren't practical to the average business. Most users have little or no tech knowledge. That means smart devices and their networks must be up and running right out of the box.

Pay-as-you-go pricing

The dynamic nature of smart devices and their applications require flexible pricing structures. Traditional "one size fits all" pricing models would make IoT / M2M systems cost-prohibitive.

Ironclad security

Security always is of paramount concern but, with smart devices, there are so many components in so many diverse locations that the network always must be the first line of defence.

Future proofing

IoT / M2M technologies are changing constantly, and device software quickly can become obsolete without updates. That's why a network infrastructure must take into account ever-increasing data loads, new device types added, and constant updates among a variety of unplanned events.

What's the solution? Only Aeris IoT Services has the dedicated infrastructure needed to meet even the most demanding cold chain transport system.

AERIS IoT SERVICES IS THE LEADER IN CELLULAR IoT / M2M NETWORKS. HERE'S WHY.

Aeris IoT Services offerings were designed from the ground up, exclusively for IoT / M2M connectivity. That means the solution offers unparalleled flexibility and "future proofing", in addition to remarkably simple operation.

Just look at the advantages:

Reliable and secure dedicated network

Aeris offers an always-on service, anywhere, regardless of the amount of data being generated. And that data is secure as your traffic always is separate from the public internet, unlike competing solutions.

A single provider for all your connectivity needs

With so many devices moving across disparate geographic areas, having different networks can be problematic. Aeris IoT Services is the only carrier-agnostic solution provider that offers both GSM and CDMA connectivity, including 2G, 3G, and 4G LTE. That means with one network, you are connected 24/7, regardless of device type or location.

Device management portal provides complete visibility

Using the Aeris AerPort management portal, Aeris clients have total visibility into every device, including data usage and billing. The AerPort dashboard allows you to manage, monitor, and troubleshoot devices to gain insight into your network operations in near real time. In contrast, Mobile Virtual Network Operators (MVNOs) need hours to register and analyse data going through the network.

Operational support ensures continuous uptime

At Aeris, we back our solutions with industry-leading customer support. Our team is staffed exclusively with IoT / M2M experts ready to help.

Lowest total cost of ownership

Through our flexible pricing and transparent management portal, Aeris IoT Billing ensures "bill shock" never happens. We give you complete visibility into the operation and billing of every device, regardless of device numbers, locations, or how they are dispersed. ■

ABOUT AERIS:

Aeris is a technology partner with a proven history of helping companies unlock the value of IoT. For more than a decade, we've powered critical projects for some of the most demanding customers of IoT services. Aeris strives to fundamentally improve businesses by dramatically reducing costs, accelerating time-to-market, and enabling new revenue streams. Built from the ground up for IoT and road tested at scale, Aeris IoT Services are based on the broadest technology stack in the industry, spanning connectivity up to vertical solutions. As veterans of the industry, we know that implementing an IoT solution can be complex, and we pride ourselves on making it simpler.

www.aeris.com

Fleet management in the mix of a great and complex IoT ecosystem

As the connected vehicles market begins to mature an ecosystem that brings together vehicle markets, connectivity providers, applications and the end users – whether enterprise or consumer – needs to be brought together

The earliest markets have now moved beyond the pioneering phase and offerings are no longer impressive, nice-to-haves but essentials for success

The internet of automotive things is growing continuously and encompassing many more applications to the benefit of organisations and end users. These range from well-established markets such as fleet management to newer ideas such as in-car delivery whereby goods can be delivered to your vehicle. This is a large and varied market and will have even more breadth as smart cities, autonomous driving and pay per use cars become mainstream.

The earliest markets have now moved beyond the pioneering phase and offerings are no longer impressive, nice-to-haves but essentials for success. "Fleet management if you're a truck maker is becoming a ticket to ride," explains Svante Svanberg, the strategic segment manager at Telenor Connexion. "If you don't have the capability to support it, you'll have issues selling your vehicles."

Telenor Connexion, which designs, implements and operates IoT solutions to connect things, machines and people through a global IoT system with more than 400 mobile networks, sees the need for a wide ecosystem bringing together all the different players involved to be developed to support and enable the automotive ecosystem. This will comprise elements of fleet management, connectivity and vehicle-making ecosystems and enable many new opportunities.

"We started working with Volvo cars in 1999 and we're working with several automotive OEMs now but also with other types of organisations such as navigation, insurance and transport companies," says Svanberg. "The large OEMs will continue to take care of themselves for another five to ten years time but thereafter they will transform and offer a very basic service composed of connectivity with a couple of basic services. Importantly, they will also provide a platform where third party service providers can offer their services – there will be many other things to address than OEMs want to take care of."

"The trend now is that more and more providers can offer services but fleet management is fairly straightforward because you connect the vehicle where it is and you draw data from it," he adds. "Everything is becoming connected and that's mandatory if you want to withdraw data but this is no longer just about vehicles – it could be a shipping container or a parcel that is connected, and items with specific requirements such as those that rely on an uninterrupted cold chain are being connected now. In the future more or less every container will be connected and part of the reason for that is every port needs information about what is in a container when it arrives." ▶

Svante Svanberg,
Telenor Connexion

Why MiX Telematics turned to Telenor Connexion

MiX Telematics, founded in 1996, provides fleet and mobile asset management solutions to enterprise fleets, small fleets and consumers with solutions for safety, efficiency, compliance and security. Using the software-as-a-service (SaaS) delivery model, the company delivers its solutions to customers in more than 120 countries, across 6 continents. More than 676,000 mobile assets – from trucks and buses, to vans, cars, motorbikes and trailers – are actively managed by MiX Telematics today via a network of more than 130 fleet partners.

The company initially selected Telenor Connexion to provide connectivity for its telematics services in South Africa but has subsequently increased the number of countries in which it uses the service.

"We were chosen for several reasons," says Tomas Svidén, an international key account manager at Telenor Connexion. "Both companies are truly global and want to offer their customers the same high level of quality across all regions. In addition, MiX wanted a provider who has the ability to be their partner for many years. This is because trucks can be in use for up to 15 years," Svidén adds.

For Telenor Connexion, that means a focus on connectivity – the company does not offer services that compete with its customers. "MiX's customers have a range of connectivity requirements based on their market. Telenor Connexion is able to offer a focused service based on specific requirement which creates the base for a strong partnership between both companies," said Svidén.

Integration with other systems will be a vital capability and Svanberg identifies four macro influences on the automotive sector: autonomous driving, electrification, connectivity and on-demand mobility.

"These all have consequences when it comes to our society and have impacts on infrastructure and city planning," he says. "Big data about vehicle movements and autonomous vehicles can enable cities to be more efficient and public transportation will also change. With electric cars, energy systems will change because the electricity in the car outside your house can be used to smooth the peaks and troughs of power grids. Regulation, legislation and security also present challenges that will have to be overcome."

However, Svanberg thinks these are challenges that can be addressed. "Technology, legislation and even security will all be solved but gaining citizen approval will be the greatest challenge," he says. "Fleet management will be just one application run from a connected vehicle but it will part of the puzzle in the great and complicated IoT ecosystem."

That puzzle involves a longer value chain with multiple participants involved in delivering the experiences that users want. "There will be a B2B2C relationship," Svanberg confirms. "We will sell a service to OEMs and they will sell it to a customer. OEMs can't take in third party services on their platforms so they have to develop hardware to support this and software with application programme interface (API) possibilities to enable these."

Svanberg says this type of structure is three-to-seven years away but when it arrives the market will have opened up new possibilities. Yet significant business challenges remain, in addition to the technical ones.

"Vehicle OEMs don't want to pay for connectivity for a third party service to use connectivity they're paying for so we have to provide split billing for the connectivity so, in effect the user – in this case the IoT service provider – pays," he says. "First OEMs need to fix onboard hardware, second software interfaces are required and third, the split billing and invoicing to service providers. This would all be easy if there were ten global service providers to deal with but this will become a huge market of many local service providers."

For fleet management applications as for consumer and other applications the great and complex ecosystem is also fragmented from location to location and this needs careful navigation. ■

www.telenorconnexion.com

Smart cities will shape the future of autonomous vehicles

We talk a lot about how connected cars and autonomous vehicles are going to shape smart cities, but that's looking through the wrong end of the binoculars, writes Annie Turner. Cities are going to have a profound impact on the automotive industry in future.

"I would like to see more urgency...I believe we can solve a lot of the problems ahead of us... although we've a lot of work to do as we're not in good shape".
Dr Jonathan Reichental

Already they are flexing their muscles with a number of European cities looking to ban diesel cars from their streets by 2025. In June, the Texas Innovation Alliance – made up of various cities in the state along with universities – issued a joint request for proposals for purchase or lease of automated vehicle solutions, primarily focused on the short-trip market. Leveraging their combined buying power to keep costs down is likely to be a widely used model the world over.

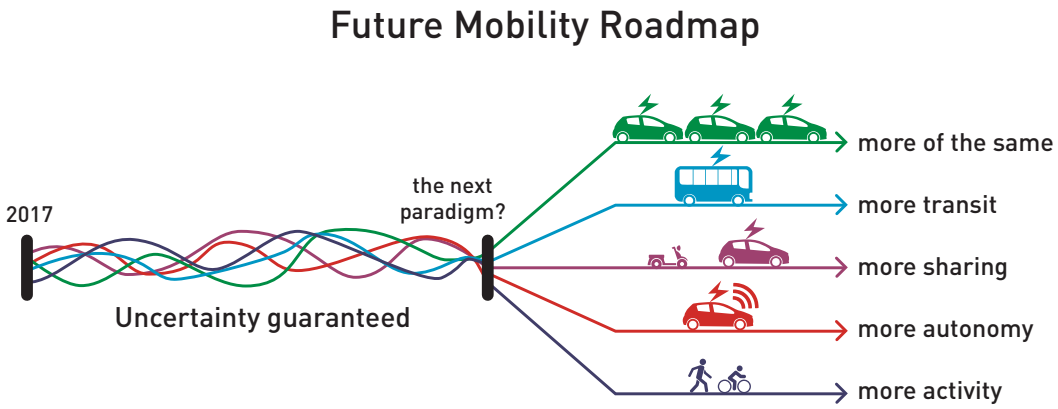
The question is, do the cities have a good enough understanding of the issues and what they need to do to get the best possible outcome for all parties? The Smart Cities Council states that investing in digital infrastructure is critical if cities are to leverage their physical infrastructure and realise the full potential of autonomous vehicles. This includes reducing congestion, pollution and accidents while improving movement around the city to improve its 'liveability' for all citizens and productivity for businesses.

More urgency

Dr Jonathan Reichental, is CIO of **Palo Alto** in California. Speaking at the Smart City Realised event in Liverpool, UK, in June, he commented, "I would like to see more urgency...I believe we can solve a lot of the problems ahead of us...although we've a lot of work to do as we're not in good shape".

He continued, "The coolest thing [we're doing with the sensors on lampposts] right now is counting cars, which is really important. We count what direction they are going in, what type of cars they are, their speed and much more. It answers questions like how do you design the best intersection? How do you help kids on bikes avoid accidents?" And of course, in the longer term, how do we integrate driven cars with driverless vehicles?

Reichental stressed, "AI (Artificial Intelligence) is a big deal – I recommend you get deep into it...right now – even as a small community [Palo Alto has a population of only 90,000] we have a lot of traffic and a lot of traffic signals, which all are just nodes on the internet. We gave the information about what happens at the [traffic] lights away via an API and one company has already worked out the optimal sequence for changing lights. There is just so much opportunity to innovate – we're only at the start." ▶



Picking the right partners

Many cities are working with car makers to better understand the impacts of connected and autonomous cars for their infrastructures and economies, but Professor Adam Beaumont, founder of **aql** thinks this is too inward looking. The company he founded and heads up is part of a consortium in the British city of Leeds that is looking at how to integrate autonomous vehicles. His company has 20 years' experience in cyber security and is responsible for the vehicles' controls and operation and is a great example of his argument – that companies other than automotive should be involved in the process of preparing for the driverless age.

At the launch of the trial of the self-driving public transport pods in April he said, "Until now, much of the software for autonomy has been driven by the automotive industry. We want to embrace other disciplines such as VR [virtual reality] and gaming which have strong transferable spatial awareness skills to help innovate and create the next generation of smart city. Without this technology, driverless cars, for example, will simply join the traffic queues – we need cross-city communication and coordination via the next generation of mobile network technology to unlock the potential of driverless platforms."

Others are questioning many of the assumptions that cities are making about the impact of autonomous vehicles (leaving air-bound ones aside) to get privately owned cars out of city centres and massively reduce traffic, replacing today's vehicles with public ones that run on clean energy. London's Mayor Sadiq Khan has a goal of all the city's journeys being on foot, by bike or public transport by 2041. In Finland, Helsinki plans to phase out private cars altogether by 2050.

More, not less, car travel?

Mark Kleinman, professor of public policy, and Charlene Rohr, senior research fellow, King's College London suggested in The Conversation that in fact, self-driving cars are likely to increase – not reduce – car travel, "as people succumb to the allure of convenience and switch from public transport, or make more journeys. Autonomous vehicles may be able to park themselves away from urban centres, but they still need to be parked – and make return journeys to collect passengers, adding empty cars to the roads and contributing to congestion and air pollution."

In particular, autonomous travel is likely to appeal for the 'last mile' journeys. The overwhelming majority of car journeys are short and the need for transport for the last mile is likely to rise sharply in rich countries with huge, ageing populations, not to mention to provide equal access to people with disabilities who in the past have often been overlooked by transport policy.

Keep your options open

So what should cities be doing to prepare for the connected and autonomous era when so much is unknown and unexpected outcomes are highly likely? Geoff Snelson is director of strategy and futures, **Milton Keynes Council**, UK. A core part of his role is a strategic plan for the long-term development of the city to serve a population of 500,000 by 2050 – almost double the current population.

In his presentation at the Smart Cities Realised event, Snelson said, "We are looking at roadmaps, rather than precise strategies, because, as the diagram shows, you can only look so far ahead – it becomes dangerous to look too far ahead if you make assumptions about the future and bake them into your strategy because they might be rapidly outdated.

"The diagram shows there is a lot of uncertainty, but what we do know is that there are a range of transport modes coming. What we don't know is the scale, size and speed of them so what we're doing is planning a strategy that allows the best dimensions for those things to emerge at a time that might suit us, in an integrated way." ■

Many cities are working with car makers to better understand the impacts of connected and autonomous cars for their infrastructures and economies

Emission monitoring helps Transport for London assess bus and taxi exhausts in bid for better air

Air pollution and its causes have been a topic of discussion and concern across the globe for years, especially regarding the exhaust gas emissions from diesel vehicles

SITUATION

Air pollution and its causes have been a topic of discussion and concern across the globe for years, especially regarding the exhaust gas emissions from diesel vehicles. In response, in 2016, London Mayor Sadiq Khan published his Air Quality Strategy with the goal of setting the most comprehensive and ambitious standards any world city is taking to tackle the problem of air pollution. The ultimate goal from this strategy and following legislation would result in the world's first Ultra Low Emission Zone (ULEZ) in central London by 2020, reducing nitrogen oxide (NOx) emissions by half and ensuring 80 percent of central London meets the tough European legal limits for nitrogen dioxide (NO2).

PROBLEM

In order to reach these air pollution reduction goals, the city needed to address one of the major contributors to the problem, the bus and taxi fleets used for public transportation. Private consumer vehicles are already held to strict emission standards, but London had yet to highly regulate the public transport system, which provided 4.9 billion passenger journeys in bus services alone in 2017. To meet emission standards by 2021, 5,000 Transport for London (TfL) buses, which aren't already hybrid or electric vehicles, were required to be retrofitted with emission reducing technology. This would require quick implementation with trusted technology that could be monitored and tracked in real time across the city to maintain the strict emission standards.

SOLUTION

With the arduous task of updating and tracking a city's entire bus fleet with emissions reduction technology, HJS Emission Technology (HJS) was contracted by TfL to retrofit London buses as part of the Greater London Authority's plans to create an Ultra Low Emission Zone. To achieve this, HJS partnered with Sensor-Technik Wiedemann (STW) to assist with the telemetry component of the solution, and Emission Engineering Ltd. (EEL), an emissions specialist, for the installation and field service portion of the project.

To implement a solution for the remote condition monitoring of exhaust gas treatment systems for London public transport, HJS Emission Technology's SCRT (Selective Catalytic Reduction Technology), which uses particle filters and catalytic converters, would be installed to reduce soot particles and nitrogen oxide (NOx). This would be combined with STW's TC1 Telematics Controller (with built-in GPS) and fitted onto each bus to monitor their emissions at any time or location.

Additionally, because of legally specified certification obligations, the city required that data needed to be recorded centrally and initially stored for 60 days. There must also be live access to current parameters, which must be accessible, if required, with response times of only a few seconds, leaving no room for error or delay. In order to achieve this, real-time condition monitoring needed to be facilitated through the use of the telematics platform TC1 and the device and application management portal "machines.cloud" by STW. Therefore, STW decided to power its solution with Software AG's Cumulocity IoT platform, for remote condition monitoring of exhaust gas treatment systems.

STW white labeled Software AG's Cumulocity IoT platform and rebranded it to 'STW machines.cloud,' as an IoT solution for the collection of data from on-board devices, such as the TC1 and TC3G telematics modules used within the buses. Cumulocity IoT is unique in that it provides an IoT-as-a-Service solution that includes enhanced high availability and multi-cluster deployment options, which strengthen its offering. Additionally, Cumulocity IoT incorporates several carrier-grade features, including code-free integration of devices supporting Low Power WAN (LPWAN) technologies used for long-term low bandwidth remote monitoring, Narrowband IoT (NB-IoT), Lightweight M2M (LWM2M), and Long Range (LoRa).

According to Dr. Michael Schmitt, CEO, STW, "STW machines.cloud provides user and device management and can connect, monitor and analyse operations in real-time. HJS will use it to gain significant insights into the vast amount of data streaming from the embedded devices in retrofitted buses in London. The data are the basis for documented evidence towards TfL. Ultimately, HJS can use the big data to detect patterns alerting them to problems in either their system or the bus engines. Implementing algorithms in the telematics modules evolves the big data into smart data, reduces the amount of data transmitted, and enables predictive maintenance which ensures they can avoid unnecessary preventive actions and breakdowns."

STW machines.cloud can be used on a personal computer or mobile device via a web interface. In this instance, each device on board a bus is monitored and tracks not only engine emissions, but also technical data, faults, routes, locations, and fuel consumption. The data collected can then be visualized using SCADA widgets in real time and present sophisticated diagnostics enabling real-time updates and calibration.

Because of the open and secure architecture of the Cumulocity IoT platform, a vast ecosystem of third-party products and services are available to the STW machines.cloud without the risk of "vendor lock-in," allowing STW to evolve its system with additional technologies as necessary.

Bernd Gross, senior vice president, IoT and Cloud, Software AG noted: "machines.cloud is the perfect combination of STW's industrial sensor technology and machine expertise with Software AG's open, carrier-grade Cumulocity IoT platform. The Cumulocity IoT platform includes a range of pre-packaged solutions such as Condition Monitoring, Predictive Maintenance and Track & Trace, as well as quick and easy device and sensor management, thus bringing the worlds of IT and operational technology (OT) together. Extending these capabilities, Cumulocity IoT customers can take full advantage of Software AG's Digital Business Platform for industry-leading integration, business process management, advanced analytics and machine learning capabilities."

CONCLUSION

With the concerted effort to ensure London has the best air quality of any major world city by 2020, the Transport for London (TfL) buses needed a solution that would allow technology to not only be seamlessly retrofitted into each bus, but also the ability to monitor the results and data from each vehicle in order to reach the proposed standards. HJS Emission Technology was able to achieve the technology implementation through its soot and NOx monitoring emission systems, but it needed to be able to scale the technology for real-time monitoring across the city's entire bus fleet.

To achieve this, HJS leveraged STW's machines.cloud portal, powered by Software AG's Cumulocity IoT platform. With this technology, HJS and STW could be confident that the end-solution would allow for real-time device and sensor management along with condition monitoring and predictive maintenance. This all-encompassing solution would enable London to become an important trailblazer in the implementation of measures for air pollution control. ■

"Machines.cloud is the perfect combination of STW's industrial sensor technology and machine expertise with Software AG's open, carrier-grade Cumulocity IoT platform"
Bernd Gross

IoT enables asset tracking across the entire supply chain

Having the ability to track exactly where any mobile asset is in the entire supply chain is particularly useful when looking for items that have been stolen or lost. The Internet of Things (IoT) can be used to create a more efficient and agile network to support mobile asset tracking, thereby delivering a wide range of business benefits, writes Benoît Tournier, the marketing director for Mobile IoT Solutions at Sierra Wireless.

In the US alone, cargo theft is estimated by the FBI to cost more than $30 billion a year, with even a small improvement on this figure potentially generating hundreds of millions of dollars in savings. However, asset tracking isn't just about eliminating theft and enabling recovery; by improving inventory management, companies can reduce the amount of stock laying idle, thereby lowering the working capital required. In addition, the ability to synchronise all trucks and train shipments to ensure they arrive in the correct time window to allow them to be unloaded with minimal downtime has significant value to add.

Traditionally, it has been difficult to track assets indoors because there is no view to the sky to enable GPS to work. This is now changing as several new technologies come to market. For example, geolocation can be done via Cell ID positioning rather than just relying on GPS. Low power wide area (LPWA) network technologies can slow the data rates and improve trackers' sensitivity so an asset will not lose connectivity even if indoors or in an area with low network coverage. LPWA can be complimentary to other approaches such as Wi-Fi positioning system (WPS) or Bluetooth Low Energy (BLE) devices, which also determine the trackers' location with respect to access points or beacons and enable data transmission with very low power consumption.

This deeper coverage means that if a package has stayed too long in one warehouse, the logistics team can be alerted and make sure the shipment gets out on time. ▶

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By using globally available and secure cellular networks, there is the potential to connect millions of devices around the world to the internet

New business models

Internet of Things (IoT)-enabled asset tracking also has the potential to establish new revenue streams. In fact, consultancy firm **Deloitte** reports that 79% of supply chain leaders record higher revenue growth than their industry average.

The detailed data collected on asset supply and asset usage is immensely valuable when used effectively. As the adoption rate of IoT devices continues to grow, so will examples of enterprises creating new business lines or more accurately pricing their services for clients. Industrial leasing companies could use the data collected by IoT devices to reshape their business models. For instance, a rail wagon that is equipped with a tracker can then be sold as a service, with the lease based on an accurate recording of distance travelled – which is directly related to costs incurred by the wheels and brakes maintenance performed by the leasing company.

Alternatively, instead of providing rental services on a daily or monthly basis, a crane hire company could outfit their machinery with advanced tracking devices that are able to accurately calculate the load lifted and charge based on actual usage, rather than time. Standard LPWA technologies are ideal in these instances as they are low cost, low power and provide broad coverage, even in remote areas.

Improve customer experience

IoT-based asset tracking can allow businesses to create a truly customer-centric supply network and generate a crucial competitive edge. For example, customers can now get complete visibility into where their assets are at any part of the supply chain, including the last mile of delivery.

In order to provide this level of service a key element is device-to-cloud integration. The IoT devices in the supply chain have to be able to connect seamlessly and reliably to the cloud wherever they are located. Also, the data has to be transferred efficiently to the client's IT platform, allowing them to run various applications that can create actionable insights from the information. This requires processing and analytics capability at the source device, so only the most relevant data is transmitted.

Edge computing reduces the amount of bandwidth needed, as well as the demands on cloud processing and cloud storage. It also speeds up the transmission of information, allowing for a real-time view of the supply chain.

Traditionally, it has been considered too expensive to connect IoT devices to a cellular network. However, the development of LPWA has changed the equation. These technologies are perfectly suited for the IoT, as they are designed to transmit small packets of data at lower cost. Although this level of data transmission would be too low for consumer devices, it is suitable for even complex IoT devices, such as sensors.

By using globally available and secure cellular networks, there is the potential to connect millions of devices around the world to the internet. However, when taking this approach there is a need to ensure that all aspects of the system – modules, gateways, SIM cards and the cloud platform – are communicating effectively.

The end-to-end option

To realise the full benefits of IoT-based asset tracking, there is a need to harmonise all of the new supply chain technologies into the existing network infrastructure. Having multiple external providers can complicate the transition to a modern asset tracking system because hardware, software and data insight tools will be supplied by a fragmented range of providers. Managing and integrating all of the different connectivity pieces can cause problems with interoperability or, more seriously, create gaps in security.

One of the main factors that is stopping decision-makers from embracing IoT programmes are concerns around the standardisation of IoT infrastructure and whether it will be compatible with wider business systems. Technical complexity is one of the biggest challenges when it comes to IoT deployments. Having multiple external providers implementing siloed solutions only adds to this and can result in a larger administrative burden with the potential to cause downtime if all elements are not aligned.

In an IoT project, there is a complex ecosystem to manage between hardware, software and service providers. This is where Sierra Wireless is best positioned to make a real difference because we bring all of these pieces together to deliver a seamless integration from device-to-cloud. By using a simplified IoT deployment model based on interoperable standards, our internal data has shown that Sierra Wireless can reduce time-to-market for customer deployments by up to a year.

Most substantial IoT-based projects are expected to streamline business operations, improve connectivity and analyse data more effectively than before – all without exceeding tight budgets. The many layers needed to form a comprehensive asset tracking solution mean companies often fear that they will be complex and difficult to manage. Yet, advanced IoT platforms make tracking assets simple, with seamless data orchestration from device-to-cloud on a single unified platform.

At the same time, LTE-M and narrowband IoT (NB-IoT) technologies have significantly lower processing power requirements. This means that IoT-enabled devices will have lower levels of energy usage and be able to last for up to 10 years, while still offering constant connectivity. In turn, this has the potential to reduce costs significantly, making it an excellent solution for large-scale deployments in the asset tracking market. IoT and the ecosystem of technologies that has developed surrounding are therefore bringing new functionality to the asset tracking sector and benefits to organisations across the entire supply chain. ■

The author is **Benoît Tournier**, Sierra Wireless

www.sierrawireless.com

This article has been abridged from the recent Sierra Wireless whitepaper 'How IoT enables mobile asset tracking throughout the supply chain' which can be downloaded from: **www.sierrawireless.com/resources/white-paper/how-iot-enables-tracking**

Actility, Abeeway, Cisco and Tracktio show IoT geolocation in the Port of Barcelona

Here's the inside story on the deployment and testing of a location and tracking solution for Internet of Things devices in the Port of Barcelona, Spain. As Actility tells IoT Now Transport360, it is using a low power wide area network, which it believes is an ideal communications technology for industrial IoT (IIoT) applications.

LoRaWAN is evolving rapidly, driven by the needs of industrial customers.

Low Power Wide Area Networks (LPWAN) are ideal for industrial IoT as they enable remote sensors and devices with minimum power consumption to be connected using a long-range radio network that is extremely cost effective and straightforward to deploy. Actility is a co-inventor of LoRaWAN, an LPWAN technology which uses unlicensed ISM (industrial, scientific and medical) radio bands for bi-directional communication with IoT devices. The ability to locate and track objects, animals and people using these IoT devices is set to revolutionise industry verticals from agriculture to manufacturing.

"We believe that accurate location capabilities combined with LPWA networks are a game-changer in the logistics sector, delivering increased efficiency in resource and supply chain management, at revolutionary total cost of ownership (TCO) levels much lower than conventional cellular/GPS tracking solutions," says Mike Mulica, the chief executive of Actility. "Geolocation and tracking could possibly be the biggest use case in the whole of the Internet of Things, based on the amount of interest we're seeing in our location service portfolio."

The challenge now is to roll out robust, industrialised solutions that deliver on that game changing potential.

The problem

LoRaWAN is evolving rapidly, driven by the needs of industrial customers. Existing tracking solutions used devices containing a GPS receiver, communicating their location over the LPWA connection. This eliminates the need for a power-hungry cellular connection, and a potentially costly M2M subscription, but the GPS receiver is still a battery hog. Unlike pure LPWA devices, which can have a battery life in the field that is measured in years, a GPS tracker may need recharging every few weeks depending on usage.

Thanks to the work of Actility, Abeeway, Semtech and other members of the LoRa Alliance, there is now a ▶

network-based alternative, able to locate and track any device connected via LoRaWAN. This solution was tested and demonstrated in a real world environment around the ZAL Port of Barcelona, making its debut in the spotlight of Mobile World Congress earlier this year.

The solution

To deliver the network at the ZAL, Actility teamed up with Tracktio, an industrial tracking and IoT solutions specialist based in Barcelona and Madrid. Tracktio already had a LoRaWAN network deployed in the City of Barcelona, but network based geolocation calls for new gateways – the base stations that receive radio signals from connected devices – built to the latest standards. Together, Tracktio and Actility selected Cisco IR829 and IXM LoRaWAN gateways.

In a LoRaWAN network, devices are not connected to a single base station; instead signals are received by any base station in range of the device, and passed to Actility's ThingPark network server. Network-based geolocation relies on measuring the different arrival times of signals from the same device to different gateways, and triangulating the position of the device based on how far it is from each one. The new V2 Cisco gateways are equipped with GPS receivers, which not only allow their location to be very precisely determined, but also provide the synchronised time signal that allows the difference in signal arrival time to be measured precisely.

To enable the triangulation process, the network gateways must be deployed densely enough that the signals from each device are received by several gateways; in the case of the ZALPort, Tracktio and Actility radio planners determined that six gateways would be needed to cover the multimodal logistics facility's approximately four square kilometre area. Thanks to the fact that LoRaWAN uses unlicensed radio spectrum, the network can be deployed very quickly. "The most complicated part is simply getting permission to mount gateways on the roof of the various buildings," says Tracktio's Pablo Recolons. "Actually deploying and commissioning the network only took around two days."

The plan was to use the LPWA network to track security and maintenance vehicles and personnel around the port area. For the tracking devices, Actility turned to long-standing partner in tracking solutions, Abeeway. Established in 2014 to commercialise IoT geolocalisation devices, Abeeway's portfolio includes both consumer and industrial trackers. For this demonstration, a combination of Micro Balise, keyring size trackers, and Master Tracker industrial devices were selected. The smaller devices would be worn or carried by personnel, whilst the larger trackers – which have the same functionality enclosed in an industrial casing with a larger battery – were fixed to security cars and maintenance trucks. Both these trackers have on-board GPS receivers, the goal being to compare the position results obtained using GPS, which will be accurate to within a few metres, with the results from the network-based method.

However, using the Abeeway devices with the ThingPark Location Server also opened up the possibility of real-world testing of a unique new location capability based on patented technology. GPS relies on signals from multiple satellites to locate the receiver, requiring the device to track and lock on to up to six satellite signals, and then perform some complex calculations to determine its location. Abeeway's patented alternative provides a form of Assisted GPS. The network server maintains a database of the location of all GPS satellites, and can instruct the device which ones to lock onto, which speeds up the initial fix time from up to a minute or more to a matter of seconds. Once the tracker has received the GPS signals, they are communicated immediately to the network server, and the position calculations are done in the cloud. This dramatically reduces the processing power needed by the device, bringing down its cost and power consumption substantially. The end result is a technology that promises to deliver the same accuracy as GPS, with a power consumption only 10% higher than purely network-based location.

The complete solution – Abeeway trackers, Cisco gateways, Tracktio network, Actility server and Abeeway application – was up and running on 22 February 2017, a few days before the crowds descended on Barcelona for MWC, and only a few weeks after the project kick-off.

The results

This demonstration network allowed Actility to test the full portfolio of location solutions which go to make up the Thingpark Location service, which exposes locations determined by any method through a single application programme interface (API). The different techniques have different applications: GPS and A-GPS are used where high accuracy is needed and require dedicated device, whereas the network based solution can locate any device, but is likely to be less accurate. The target for network-based geolocation is to achieve an accuracy of better than 100m, which is all that's necessary in many use cases, such as determining whether a vehicle is in one depot or another, for example, or geofencing to detect when an animal strays outside boundaries. According Sitha Oum, Actility's project manager, the results were very encouraging. "We were consistently seeing a network location within around 50-100m of the location determined by GPS," he says. "And we also proved that the A-GPS solution is as accurate as the solution calculated by the device, which is a green light for the roll-out of this best-of-breed technology."

In the near future, ThingPark will also integrate the capability to geolocate Abeeway devices using WiFi network sniffing, in which the combination of network identity and signal strength matched to a global database extends the reach of the solution indoors. "IoT is often touted as a transforming technology for all industries," says Olivier Hersent, Actility's CTO and founder. "Sometimes, it's difficult to decide if it is hype or reality. But for the logistics industry there is no doubt that using LoRaWAN in location is a revolution. Introducing an order of magnitude cost reduction in a price-sensitive industry doesn't happen that often in technology. For tracking, though, it is happening for real, right now."

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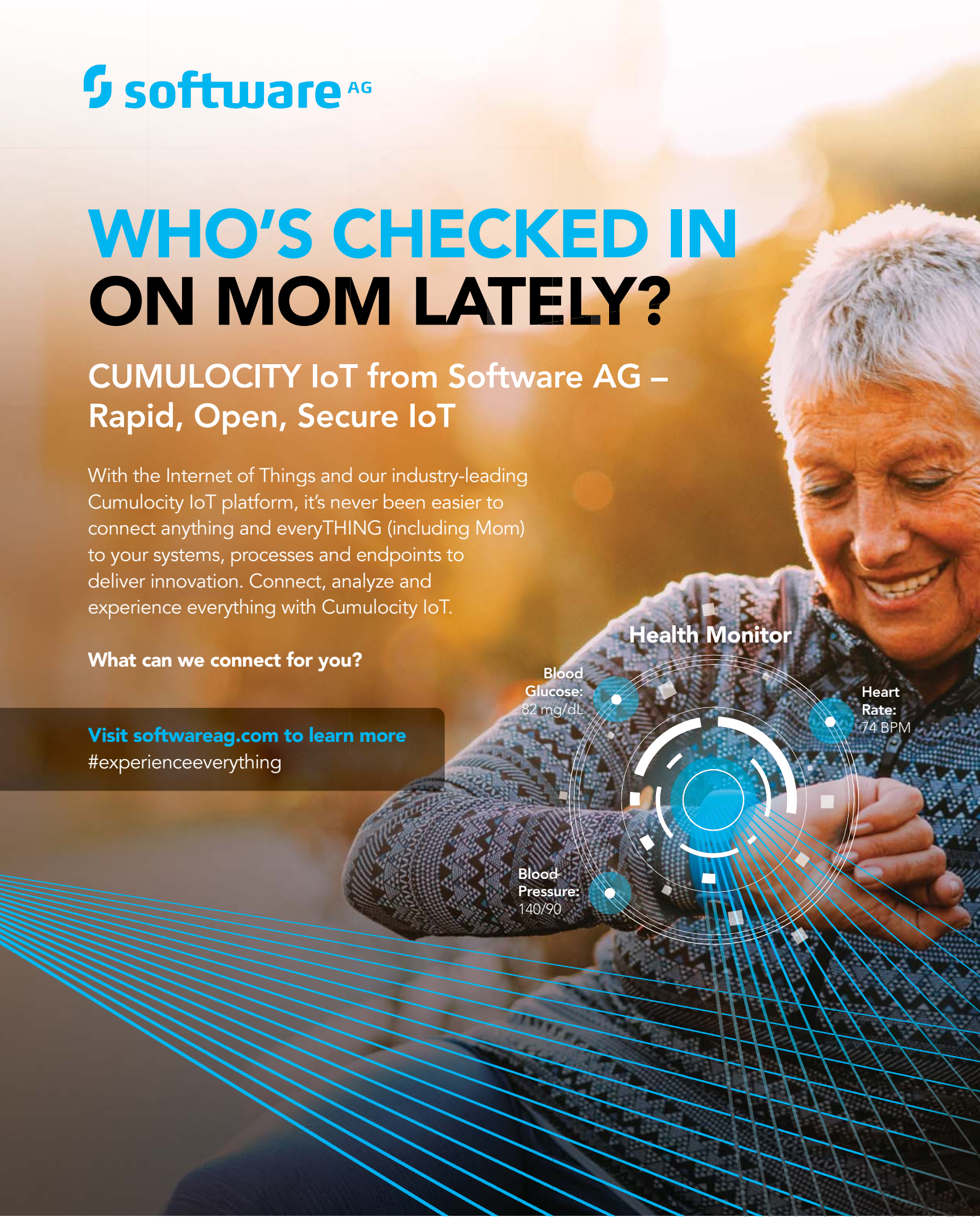

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