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COMMENT
An acerbic attack on Brexit’s impact on the UK’s space industry raises both support and scorn
Researchers develop an ultra-low power hybrid chip that will help to make small robots more capable
UK manufacturer Harwin sets up an engineering academy to encourage aspiring young engineers
Almost 100 IC wafer fabs have been closed or repurposed in the last decade, according to a report from IC Insights
Vehicles in future will need to be able to ‘feel’, as well ‘see’, according to Tactile Mobility’s Boaz Mizrachi

INTERVIEW
Engage, talk and communicate
Tyson Tuttle, President and CEO of Silicon Labs, talks to Neil Tyler about how the trade war between China and the US is affecting business

COVER
A world connected
Mobile World Congress 2019 focused on ‘intelligent connectivity’. Neil Tyler looks back at this year’s congress in Barcelona

THERMAL MANAGEMENT
A heated conundrum
How is thermal imaging and simulation being used to address problems associated with thermal management? By Bethan Grylls

EMBEDDED DESIGN
System success
A new way of testing powertrain ECUs has led to significantly reduced development times. Bethan Grylls reports

DESIGNING FOR THE IOT
Designing with security in mind
Ken Munro of Pen Test Partners talks to Neil Tyler about the need to focus on security when it comes to IoT designs

SECTOR FOCUS
Streamlined security
As passenger number rise, airports will struggle to cope. How can AI be used to enhance security? By Bethan Grylls

RESEARCH & DEVELOPMENT
High performance computing
“In 2035, quantum processors with a few thousand qubits will run small applications.” Iuliana Radu talks quantum computing

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In space, no one can hear you Brexit!

AN ACERBIC ATTACK ON BREXIT’S IMPACT ON THE UK’S SPACE INDUSTRY RAISES BOTH SUPPORT AND SCORN

I’d sworn off covering Brexit, mention it and you’ll end up pulling down criticism or support on your head in equal measure.

But last week Will Marshal, one of the UK’s most successful space entrepreneurs, called the UK’s decision to pull out of the EU an act of “galactic scale stupidity.”

Dr Marshall’s Planet company operates one of the world’s largest satellite imaging networks, with 150 spacecraft able to fully picture Earth on a daily basis.

He said that the UK’s withdrawal from the EU would do immense harm to Britain’s space industry.

The UK will be “lost in space”, he suggested in a blog.

No sooner did his comments hit the wires, than comments – both for and against - poured in. The fact that he operates Planet out of California and Germany drew the ire of many, as did his comment that post Brexit, no CEO would seriously want to locate a space company in the UK.

“Why put your European base outside the single market of the largest trading block in the world? Or likely without access to the main government programmes? Company after company will avoid it,” Marshall said.

Dr Marshall went on to attack the UK government’s actions on Galileo, the EU version of the Global Positioning System (GPS) and poured scorn on the British government’s decision to build its own sat-nav system instead. “Pie in the sky”, according to the good Doctor.

While there are certainly worries that the UK is choosing to pull itself out of a space ecosystem, in which it has become embedded and on which so much of its capability depends, the UK Space Agency (UKSA) said that the pessimism expressed by Marshall was not shared by many in the industry.

In fact, a recent “Size and Health” survey of British space businesses has found that 73% of organisations expected income to grow over the next three years and 48% of those expected that growth to be more than 10% higher than in the previous three years.

A spokesman from the agency said that the UK was committed to close international partnerships on space and science programmes, and that it would remain a leading member of the European Space Agency (Esa).

However, while Esa is separate from the EU, there are concerns that tensions could grow as the agency becomes more aligned with the EU and those tensions may be heightened once the UK leaves the EU.

Should the UK’s voice in Esa diminish, then there has to be real concerns for the UK’s buoyant and remarkably successful space industry and what that could mean for UK science.

Neil Tyler, Editor (neil.tyler@markallengroup.com)
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Combining low power with intelligence

ULTRA-LOW POWER HYBRID CHIPS LOOK TO MAKE SMALL ROBOTS MORE CAPABLE. NEIL TYLER REPORTS

An ultra-low power hybrid chip inspired by the brain could help give palm-sized robots the ability to collaborate and learn from their experiences, according to researchers from the Georgia Institute of Technology.

Combined with new generations of low-power motors and sensors, the new ASIC – which operates on milliwatts of power – could help intelligent swarm robots operate for hours instead of minutes.

The chips use a hybrid digital-analogue time-domain processor in which the pulse-width of signals encodes information. The neural network IC accommodates both model-based programming and collaborative reinforcement learning, potentially providing small robots with enhanced capabilities for reconnaissance, search-and-rescue and other missions.

Researchers demonstrated robotic cars driven by these ASICs at the 2019 IEEE International Solid-State Circuits Conference (ISSCC).

“We are trying to bring intelligence to these very small robots so they can learn about their environment and move around autonomously, without infrastructure,” said Arijit Raychowdhury, associate professor in Georgia Tech’s School of Electrical and Computer Engineering. “We want to bring low-power circuit concepts to these very small devices so they can make decisions on their own.”

Information from the robot’s sensors goes to the hybrid ASIC, which serves as the “brain” of the vehicles. Instructions then go to a Raspberry Pi controller, which sends instructions to the electric motors.

The team is working with collaborators on motors that use micro-electromechanical (MEMS) technology able to operate with much less power than conventional motors.

First haptic robot hand demo

Motion data captured by HaptX Gloves controlled the movement of the anthropomorphic hand, developed by Shadow Robot. SynTouch’s BioTac sensors have been embedded in each fingertip of the robotic hand to collect tactile data that’s recreated as haptic feedback by HaptX Gloves transmitted to the user’s hand.

The international engineering team included members of SynTouch and HaptX in California and Shadow Robot in London and Madrid.

In the demonstration, an operator in California used a haptic glove to control a dexterous robotic hand in London. As the robot typed on a computer keyboard, tactile sensors on the robot’s fingertips detected the press of each key.

Commenting Dr. Jeremy Fishel, Co-Founder of SynTouch said, “This is the first time anyone has ever demonstrated a telerobot with such high-fidelity haptics and control, which is very promising and only possible due to the engineers from this collaboration.”
An independent design consultant selected will be able to engage with the customers’ design teams to plug any knowledge gaps and provide additional expertise that may be required on the project. Alternatively, they can be given the remit to run the entire design project on behalf of the customer. A dedicated section has been launched on Anglia Live, the distributor’s website, which provides more info and a facility for independent design consultants wishing to apply to be part of the programme.

“Design experience is one of the main selection criteria for the programme. Another key requirement for consultants in the Anglia Design Partner Programme is that they must be completely independent allowing them to focus purely on providing the best design solution for the customer. A dedicated section has been launched on Anglia Live, the distributor’s website, which provides more info and a facility for independent design consultants wishing to apply to be part of the programme,” Rawlins explained.

Plextek RFI extends cleanroom facilities

Plextek RFI, a UK design house specialising in microwave and millimetre-wave IC design, has significantly extended the RF-on-wafer (RFOW) clean room facilities at its design centre in Cambridge.

“Our new capability includes equipment suitable for the evaluation of ICs - either as bare die, on undiced wafers or packaged - and modules, at frequencies up to 50GHz,” said Liam Devlin, CEO of Plextek RFI. “In addition to our RFOW probe station with vector network analyser and spectrum analyser for the characterisation of ICs and modules, we also have a fully-automated IP3 measurement set-up.”

Harwin sets up Academy

Harwin has announced the founding of the Harwin Academy.

According to the company, the academy, which has been undertaken in partnership with Havant & South Downs College, will look to provide high quality training to students, opening up career paths for them within the fast-growing STEM sector.

The two-year course has been developed to ensure the content meets the needs of the engineering industry and prepares students for the workplace – providing an internationally recognised engineering qualification.

With the UK having to deal with an ever more acute skills shortage, there is a pressing need to encourage young people into engineering-based professions. Through enrolling with the Harwin Academy, students will get classroom-based tuition at the college campus, along with practical experience at the Harwin production facility in Portsmouth.

To find out more, please visit: www.hsdc.ac.uk/harwin-academy-at-hsdc.

Self-driving electric bus

Nanyang Technological University (NTU), Singapore, and Volvo Buses have launched a full size, autonomous electric bus.

The single-deck Volvo 7900 Electric bus comes with a Volvo Autonomous Research Platform software that is connected to key controls such as its navigation system, as well as multiple sensors. This includes light detection and ranging sensors, stereo-vision cameras that capture images in 3D, and a global navigation satellite system that uses real-time kinematics. This is like any GPS but uses multiple data sources to give pin-point location accuracy of up to one centimetre.

The system is also hooked up to an “inertial management unit”, which acts like a two-in-one gyroscope and accelerometer, measuring the lateral and angular rate of the bus.

An AI system will manage these sensors and GPS platforms, enabling the bus to navigate autonomously through dense traffic and tropical weather conditions.

There are plans for a second bus to be tested to determine suitability for the public road.

FPGA enables 400Gb Ethernet

Intel has unveiled a 58Gbps PAM4 transceiver technology that’s been integrated onto the Stratix 10 TX FPGA, enabling 400Gb Ethernet deployment.

Unveiled at the Optical Fibre Communications conference in San Diego, this technology is said to double transceiver bandwidth performance when compared to traditional solutions. According to Intel, it’s critical for applications where high bandwidth is paramount, including networking, cloud and 5G applications, optical transport networks, enterprise networking, cloud service providers, and 5G.

By supporting dual-mode modulation, 58Gbps PAM4 and 30Gbps NRZ, new infrastructure can reach 58Gbps data rates while staying backward-compatible with existing network infrastructure.

The Stratix 10 TX FPGA with 58Gbps PAM4 transceiver technology provides system architects with higher transceiver bandwidth and hardened IP to address the growing demand for faster and higher density connectivity.
Fab closures

ALMOST 100 WAFER FABS HAVE BEEN CLOSED OR REPURPOSED IN PAST DECADE.
BETHAN GRYLLS REPORTS

The IC industry has been on a mission to pare down older capacity (i.e. ≤200mm wafers) in order to produce devices more cost-effectively on larger wafers. In the recently released Global Wafer Capacity 2019-2023 report, IC Insights revealed that due to the surge of merger and acquisition activity in the middle of this decade and with more companies producing IC devices on sub-20nm process technology, suppliers are eliminating inefficient wafer fabs.

Over the past ten years, semiconductor manufacturers around the world have closed or repurposed 97 wafer fabs, according to the report. Since 2009, forty-two 150mm wafer fabs and twenty-four 200mm wafer fabs have been shuttered, while 300mm wafer fabs have accounted for only 10 per cent of total fab closures since 2009. Qimonda was the first company to close a 300mm wafer fab after it went out of business in early 2009.

Three 150mm wafer fabs were closed or repurposed in 2018, with two belonging to Renesas, which closed one fab in Konan, Kochi, Japan that produced analogue, logic, and some older microcomponent devices and a second in Otsu, Shiga, Japan was repurposed and now makes only optoelectronic devices.

A third fab, Fab 1 belonging to Sanken in Bloomington, Minnesota, also was closed. This fab manufactured analog, discretes, and offered some foundry services.

Given the rising cost of new wafer fabs and manufacturing equipment, and as more IC companies transition to a fab-lite or fabless business model, IC Insights anticipates there will be additional fab closures in the next few years.

Five closures/repurposed fabs have already been publicly announced. Samsung’s 300mm memory fab will be fully converted this year to produce image sensors and Ti’s 200mm analogue GFAB in Greenock, Scotland, is expected to close by June 2019. Renesas plans to close two 150mm fabs (Otsu, Shiga and Ube, Yamaguchi, Japan) in 2020 or 2021, and Analog Devices plans to close its 150mm wafer fab in Milpitas, California in 2021.

THE STRESS TEST

Transphorm, a designer and manufacturer of the first JEDEC- and AEC-Q101 qualified 650V gallium nitride (GaN) semiconductors, has said that its third generation, JEDEC-qualified high voltage GaN platform has passed the Automotive Electronics Council’s AEC-Q101 stress tests for automotive-grade discrete semiconductors.

The Gen III GaN platform has the ability to perform at 175°C during qualification testing.

The company’s Gen III AEC-Q101 GaN FET, the TP65H035WSQA offers on-resistance of 35 mΩ in an industry standard TO-247 package. The devices have been developed to target AC to DC on-board chargers, DC to DC converters and DC to AC inverter systems for plug-in hybrid electric vehicles (EV) and battery EVs.

Launched in 2018, Transphorm’s Gen III devices came onto the market as the highest reliability, highest quality GaN FETs available, and offer lower electromagnetic interference along with increased noise immunity [threshold voltage at 4 V] and gate robustness [at ±20 V].

For this latest automotive qualification, the semiconductor manufacturer stressed the devices’ thermal limits to 25°C more than those of the standard AEC-Q101-qualified high voltage Silicon MOSFET counterparts.

3D harness design optimisation solution

Zuken has introduced E3.WiringSystemLab, a software solution that supports and optimises complex wire harness designs based on inputs from heterogeneous sources.

It can import connectivity information from a range of sources and consolidates them with 3D topology data. The resulting 3D topology can be evaluated and optimised in a consistent 3D environment, designed to support the needs of casual users without requiring specialised training. Functionality tailored specifically to topology exploration provides the ability to create and evaluate different architectural concepts.

Connectivity data can be imported from E3.cable, as well as via industry standard formats such as KBL, VEC, PLMXML, or generic Excel files. Topology information is imported in the form of geometrical bundles defined in the MCAD systems like CATIA, NX or Creo.

Based on these inputs the E3.WiringSystemLab can host the complete wire harness optimisation process within a consistent 3D environment. Comprehensive modifications can be applied to the imported harness, including changes of packaging, partitioning into sub-harnesses and insertion of new routing pathways.

5G automotive platform

Micron Technology is working with Qualcomm to enable an advanced automotive connectivity solution that leverages 5G networks for autonomous driving and direct cellular vehicle-to-everything communication.

Qualcomm’s Snapdragon Automotive 5G Platform will feature a custom Micron 149 ball count multichip package, allowing for speeds of up to 20 times faster than current LTE-Advanced modems. Faster modem speeds widen the possibilities for vehicles to connect to other vehicles, roadside infrastructure and beyond.
Surface DNA

THE VEHICLES OF THE FUTURE MUST NOT ONLY BE ABLE TO “SEE”, BUT ALSO “FEEL”. BETHAN GRYLLS REPORTS

Smart cities are gaining momentum, yet current city street maps aren’t sufficiently detailed to help autonomous vehicles (AVs) get around safely. Before AVs become mainstream, they must have a much better grasp of their surrounding environments – otherwise how can we expect them to safely navigate the streets?

That’s the view of Boaz Mizrachi, founder and CTO of Tactile Mobility, a sensing and data company for AVs, who believes that driverless vehicles must be able to not only “see” the road via intelligent vision systems, but must also “feel” the grip, bumps, curvatures, hazards, inclement weather etc. under their tyres.

“By 2021, many are predicting that we’ll see the launch of level 3/4 AVs that are capable of highway speeds. I don’t see it happening so quickly, and particularly not just with vision systems. Although these capabilities are required to realise an AV, these alone will not be sufficient,” he explained.

Road conditions and speed present two major challenges for AVs, according to Mizrachi. He believes that right now, AVs are not advanced enough to react to certain hazards – for example an aquaplane. To manage this, he points to a type of predictive risk assessment in the form of “crowdmapped tactile (road conditions) maps”.

Tactile Mobility believes it has a solution in the form of its Surface-DNA technology, which it currently implements in a fleet of ‘ordinary’ (that is, not autonomous) vehicles. This software gathers and analyses data about the road surface and uses this data to generate these ‘tactile maps’.

“The software sits inside the electronic control unit (ECU) and connects to the existing sensors found inside a vehicle. We apply physical modelling and machine learning in real-time to create meaningful information,” explains Mizrachi. “The system receives approximately 3000 messages per second, which are processed in the car, and the results are transmitted to the cloud.”

At this stage, the company provides ‘after-market’ smart devices that are installed in fleets to provide the drivers and the fleet managers with meaningful insights about the vehicle and the surface it drives on.

The company is now looking to the AV market, proposing a constantly updating worldwide map that transmits the roads’ surface conditions to the vehicle. The idea is that the system will be able to intelligently assess whether there is a risk and, if so, how much of a risk it is, so the vehicles can react appropriately e.g. slow down, without human interaction.

So far, the project has been a 7-year venture, but Mizrachi hopes for it to become a commercialised reality in 2 more years. The company is therefore seeking to collaborate with OEMs in order to realise this dream.

Over the last few years, the company has also overcome some tough challenges. For example, developing a ‘language’ that can represent the tactile sensing of the road. “This language can be used to describe what one car experienced on a specific road segment and share it with the other cars. In turn, the other cars can drive on the same road and know what to expect,” he explains.

But there are challenges still to be faced. “In order to share tactile information, we need to normalise the sensed data with the parameters of the sensing car. This way we have a nominal formalised way to describe the world’s road surfaces,” he explained.

“This information is being taken from a variety of vehicles and will not always be consistent with one another. For example, one vehicle’s sensors may indicate a slippery road because its tires are worn, rather than the road actually being wet.”

He adds that along with “surface DNA” i.e. road condition, the Tactile Mobility system will also provide “vehicle DNA”. In other words, data that stipulates car condition and is tailored to that specific brand. He foresees this being a useful maintenance tool in the future of automotive, as well as for smart vehicles of today.

As for fully autonomous vehicles, he says it’s hard to predict when these will materialise. He envisions strict regulations that relate to the AVs’ capabilities emerging, for example, AVs restricted to a certain speed, certain roads, or certain times of day or length of times, which he says will gradually become freer as the technology’s safety and reliability improves.
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ews that the US and China might be at the point of signing a formal trade deal, given progress in talks between the two countries, will be welcomed by many as tit-for-tat tariffs have significantly disrupted manufacturing supply chains. Among those welcoming any such agreement would be Tyson Tuttle, the President and CEO of Silicon Labs.

“We are heavily engaged with Chinese customers and having to deal with this ongoing trade war and all the uncertainty that it creates.”

According to Tuttle it’s having a serious impact on business.

“If you look across broad-based semiconductor suppliers, from Microchip and Renesas to Maxim, NXP, ST or Cypress, everybody’s down 15-20 plus percent. Looking at Q3 2018, in terms of revenue, compared to Q1 this year, it’s been much worse than we all thought about a quarter ago.”

It’s not just the US-China trade war that’s creating uncertainty, Tuttle points to Brexit, the recession in Italy, currency turbulence in Turkey and a more general global slowdown.

“For US companies, there’s the additional uncertainty of not knowing whether tariffs are going to rise to 25%, or drop back to 0% - are we going to shut down Huawei or not?”

When it comes to the company’s product strategy, Tuttle remains confident that Silicon Labs is working on all the “right stuff” but, “while we may have great products and great relationships, that counts for little if in the end market demand is uncertain.”

Tuttle is concerned that the electronic supply chain is being used as a pawn in the on-going trade war.

“Companies are literally holding on. They are moving manufacturing sites from place to place to de-risk. It’s like there’s a wave and you’ve created a ripple throughout the supply chain. At some point companies will say that they’ve got enough stock and stop ordering, and that’s the wave that will hit you.”

The business environment can only take so much of this, suggests Tuttle. “It’s hard to plan around.”

High noon
It’s not just the ongoing trade war that is causing concern, however. The issue of security, and questions raised over Chinese companies and their relationship with the Chinese security services, has been an ongoing issue for many months.

“Huawei’s a big customer of ours, as was ZTE,” says Tuttle. “We had to stop shipping to ZTE last year and we could face a similar situation with Huawei. There are plenty of US companies with billions of dollars of exposure in near term business and long-term strategic relationships with Chinese companies. It’s almost like we’ve a gun pointed at each other.”

Not only that, but Chinese businesses are also extremely innovative. Many analysts have warned that the infrastructure associated with 5G is dependent, to some extent, on technology developed in China.

“We’ve seen a number of Western countries saying no to Huawei infrastructure equipment; moving orders over to Ericsson, Nokia and others. There’s massive leverage being applied to address this issue, and the question is, even in the midst of a trade war, are they going to decouple the Huawei situation from the overall objectives of subsidies and trade barriers?”

Tuttle suggests that both China and the West are engaged in espionage but that, “sponsored industrial espionage is unacceptable. We don’t work with the National Security Agency to steal secrets from the Chinese so that we can better our business. I find that distasteful.”

Tuttle, who sits on the Board of Directors at both the Global Semiconductor Alliance and the Semiconductor Industry Association, regularly engages with CEOs from across the industry, as well as with government bodies and officials.

“Interestingly, there is a consensus among business and political leaders about engaging with the Chinese – but we need to ensure that we both play by a common set of rules.

“There are plenty of viewpoints. If you’re a business that’s heavily exposed to the Chinese market or you’re involved in joint ventures and the like, then you’ve got a lot at stake. Companies need to play by the same rules. If you’re not going to, then why should we?”

China has traditionally been seen as where products were manufactured and not where they were designed, but that appears to be changing - today there’s far more product ‘Designed in China’.
Tuttle agrees that this is a growing trend and suggests that a lot of companies in China are showing more interest in IP development and protection as a result.

“It think that’s true, up to a point,” Tuttle contends. “We actually just had a briefing from the US Patent and Trademark office. We had the head of the US Patent and Trademark office come in and talk to us. I actually think it’s very positive that the Chinese patent system is maturing and becoming more aligned with that in the West.

“I believe that at the end of the day, we need a settlement that works for both countries – in truth I think there’s a win-win in all of this. But that depends on everybody coming to their senses.”

Towards the end of our interview, I ask Tuttle whether he remains an optimist.

“I’ve got multiple points of optimism,” he says. “You should let the water flow under the bridge as much as possible.

“Look at the need for semiconductor technology. It’s being driven by the Internet of Things which is creating disruptive business models; electrification, especially around vehicles, as well as by industrial automation.

“Then we have the roll out of 5G and the infrastructure investment associated with that.

“So, like I said at the beginning of this interview, I do feel we’re in the right markets and working with broader global trends.”

According to Tuttle, “We’re not in commoditised areas, like mobile phones or PC’s maybe, or memory, but rather in those areas that are powering the economy and the growth in the semiconductor industry - I think that we’re well positioned.”

When it comes to 5G, Tuttle is more circumspect than some of his peers.

“I think it’s going to take a little bit longer than people think, but there’s also a lot of early deployments taking place.

“We’ve got content in our synchronisation and power businesses there. You’ve got the benefits associated with 5G and that coincides with what we’re doing in terms of IoT.

“So, it’s a very positive trend and we’re starting to see results. We saw 30% growth in our infrastructure business last year, which is now worth over $200million.”

Tuttle suggests that continued strength will help off-set any broader economic weakness.

“China will remain a key driver for our business, whatever happens. There are five times as many people in China as there are in the US. You’ve got a growing sophistication among their companies, whether they’re semiconductor suppliers or system companies. We haven’t even discussed artificial intelligence, but there’s a huge opportunity there too.

“We need each other,” Tuttle concludes, adding, “we have to engage, we have to talk, and we have to communicate. They need our technology, but we need their markets.”

Tyson Tuttle

Tyson Tuttle has been the Chief Executive Officer of Silicon Laboratories since April 2012 and its President since February 2016. He held a number of roles within the business prior to these appointments, including Chief Operating Officer and Senior Vice President, as well as Chief Technical Officer. Tuttle joined Silicon Labs in 1997 as a senior design engineer.

Previously, he held senior design engineering positions at Crystal Semiconductor/Cirrus Logic and Broadcom Corporation where he focused on high-speed mixed-signal circuit design for mass storage and Ethernet applications. Tuttle holds an M.S. in Electrical Engineering from UCLA and a B.S. in electrical engineering from Johns Hopkins University.
This year’s Mobile World Congress (MWC) was described by John Hoffmann, the CEO of the GSMA (the event organisers), as a bringing together of a “global ecosystem spanning multiple sectors and reflecting the expanding role of mobile connectivity.”

The show’s theme was ‘Intelligent Connectivity’ and, unsurprisingly, 5G was prominent with a host of 5G-enabled handsets being unveiled, as well as new products and services on display.

Despite what many see as the “hype” around 5G, analysts believe it is set to account for some 15 per cent of global mobile connections by 2025, as the number of 5G network launches and compatible devices increase.

The 2019 edition of the GSMA’s Mobile Economy report said that 16 major markets worldwide will switch on commercial 5G networks this year, following on from 5G launches in South Korea and the US in 2018. Mobile operators worldwide are investing over $160 billion each year on expanding and upgrading their networks, according to the report.

So 5G, alongside developments in the Internet of Things (IoT), big data and artificial intelligence, is seen as being a key driver of economic growth and over the coming 15 years is expected to add $2 trillion to the global economy.

### eSIM

There were hundreds of announcements at MWC which looked to build on this trend.

Arm and Vodafone announced a strategic agreement to help companies implementing IoT solutions by bringing together Vodafone’s IoT global platform and connectivity, and Arm’s IoT software and services to provide enterprises with programmable, connected system on chip designs, eliminating the need for traditional SIM cards.

Arm and Vodafone announced a strategic agreement to help companies implementing IoT solutions by bringing together Vodafone’s IoT global platform and connectivity, and Arm’s IoT software and services to provide enterprises with programmable, connected system on chip designs, eliminating the need for traditional SIM cards.

Murata and Truphone said that they were combining their technologies and services to take a lead in developing eSIM for IoT and Machine-to-Machine (M2M) devices.

Prior to MWC, Manuel Zepeda, Division President, Amdocs, said that 2018 had proved pivotal for eSIM and consumer adoption.

“With Apple using eSIM technology in the iPhone X, and a growing number of mobile operators across the globe supporting the technology, it’s only a matter of time before eSIM-only becomes the standard in devices,” he said.

According to Zepeda, discussions among operators were focused on offering eSIM technology to the enterprise space. For example, eSIM technology can be used with M2M technology.

“eSIM enables remote provisioning, so a company doesn’t need to install a physical SIM card into each piece of hardware, which can be a painstaking task. It makes it much easier for public utilities to manage their assets and gives communication providers a new source of revenue by providing connectivity solutions,” he said.

In response to that trend, Murata has developed IoT applications and a low-power cellular module for IoT/M2M devices. These modules lower battery consumption, make space for device makers and can help to reduce the cost of production.
These applications incorporate a M2M eSIM from STMicroelectronics, which is a fully compliant GSMA solution suitable for remote SIM provisioning.

Truphone enables the module to connect to low-power wide-area technologies using its connectivity technology, for example, the GSMA-accredited M2M remote SIM-provisioning application. This enables a device to obtain a SIM profile from other mobile operators allowing for continuous connectivity.

Commenting, Steve Alder, Chief Business Development Officer at Truphone, said: “One barrier to mass adoption of IoT is the complexity that device makers face in connecting their devices. Our collaboration is intended to bring together all the elements, packaged together in a way that allows device makers to get connected simply and efficiently."

In a show dominated by the concept of connectivity, Qualcomm Technologies showed off the first 5G customer premise equipment (CPE) reference design for sub-6 GHz and mmWave 5G fixed wireless broadband (FWB) products.

The reference design features a second-generation Snapdragon X55 5G modem and next generation RF front-end (RFFE) components and modules and offers a 5G modern-to-antenna solution for manufacturers wanting to create 5G FWB CPE devices.

“We want to enable our customers to develop the next-generation of 5G products and services and this reference design will allow manufacturers and ISPs to accelerate the deployment of fixed wireless broadband services using 5G,” explained Durga Malladi, general manager, 4G/5G, Qualcomm Technologies.

“With support for both mmWave and sub-6 GHz spectrum bands, manufacturers will be able to address multiple operator’s needs as they look to take advantage of 5G.”

Ingo Flomer, VP Business Development and Technology, Cobham Wireless, said that, “Whilst it’ll be 5G that facilitates the IIoT in the future, this year we’ll see a demand from the IIoT sector for 4.5G, which offers the speed and latency to cope with most of today’s IIoT demands.

“4.5G technology can co-exist with 5G when the networks arrive and will continue to be used for years to come. There will, therefore, be a demand for coverage systems that can support 4.5G today and can support 5G when the technology arrives.

“While a lot of the hype at MWC was around 5G, there was also a huge amount of discussion regarding how today’s technology can support critical IoT systems.”

Foldable fortunes
It’s true to say that almost every major smartphone manufacturer revealed a 5G smartphone, or a special variant of their flagship device, at this year’s show.

Samsung launched its S10 5G variant and LG a dedicated 5G-ready device, the V50 ThinkQ. But they were among a long list of companies showcasing demos of 5G-ready smartphones.

For many of those present these new devices looked to provide a much improved user experience as well as faster performance.

However, it was the launch of foldable phones that caught the headlines.

Samsung was first to launch a foldable smartphone. With two displays and six cameras, the Galaxy Fold was described as a phone-tablet hybrid resembling a conventional smartphone but then opening like a book to reveal a second display, the size of a small tablet.

Samsung was soon followed by its main competitors, with Huawei launching the Mate X, a foldable smartphone with three screens and four cameras.

The device runs on a Hi-Silicon Kirin 980 SoC and is paired with a Balong 5000 5G modem. The three displays on the device comprise of 6.6", 6.38" and 8" foldable panels. The Mate X has four cameras that include a 40 MP sensor, a 16 MP ultra-wide sensor and an 8 MP telephoto lens.

Both Samsung and Huawei said their phones were 5G ready and both are expected to be launched later this year.

As for Apple, while there were no signs of a new foldable phone, it’s expected that a foldable handset will appear from them later this year.

Whatever its plans, there was no denying that the foldable devices unveiled could well be charting a path for the future of smartphones, even if there were concerns at the hinge-durability, weight and thickness of the devices and last, and by no means least, the not inconsiderable cost.

LG’s latest smartphone also impressed, offering a 6.1- inch OLED display and powered by Qualcomm’s Snapdragon 855 with 6GB of RAM and 128GB storage. The G8’s screen is itself the phone’s speaker and uses Crystal Sound OLED technology to vibrate the entire glass panel.

Another feature incorporated into the handset was Air Motion which enabled users to interact with the

“One barrier to mass adoption of IoT is the complexity that device makers face in connecting their devices.”
Steve Alder
phone through using gesture. Nokia unveiled a phone with five lenses on the back - two that shoot in colour and three that shoot in monochrome. Each camera features a 12-megapixel sensor and by pressing down on the shutter, all five cameras are able to shoot different exposures simultaneously, which can then be merged to create a remarkably sharp image.

But while handsets were grabbing the headlines UK company, P2i was at MWC showcasing a range of water protection solutions intended to help handset manufacturers develop much thinner and more flexible smartphone designs.

Speaking to New Electronics prior to the show, Ady Moores, the company’s CEO, unveiled ‘Dunkable’, which he said, “was a world first and represents a step change in the level of waterproofing available to handset manufacturers. But we’re not only targeting handsets, the technology is also applicable to tablets, wearables, consumer devices and industrial systems.”

Unlocking potential
According to Pio Suh, Managing Director, IPCom,”While 5G handset launches and networks stole the limelight at this year’s MWC, there was also a big focus on how 5G can unlock opportunities in vertical sectors.” Across automotive, healthcare, smart cities, agriculture and manufacturing, a whole range of innovative and increasingly lucrative business cases were on show.

However, while 5G offers these sectors many advantages, many business cases remain purely hypothetical.

Despite that, there were plenty of examples of how 5G could be deployed - chief among them, the smart city.

MWC saw a host of plans and prototypes for smart city infrastructure demo-ed and mapped by exhibitors. The exhibition’s Country/Territory pavilions and the Innovation City demonstrated and played out ideas for connected environments - everything from autonomous vehicles to utilities management in smart office blocks was on display, showcasing the advantages and concepts making up the smart city.

“For smart cities to evolve from the ideas stage to reality, there are significant data challenges that must be addressed,” said Richard Baker, CEO, GeoSpock. “Much of the data needed to inform smart city planning currently exists in siloes. Lacking the ability to join the dots between data sets, stakeholders will be unable to derive value from smart city projects.”

According to Baker what’s needed is an approach which marries both macro and micro-level views of the urban environment.

“Visibility of every element and endpoint in a smart city, and the ability to map this onto expansive real-world environments, in real time, is crucial,” he said.

“Visualising and contextualising data will enable a ‘data-first approach’ to planning and development, ensuring connected infrastructure and services that are tailored to their citizens’ needs.”

He continued, “Not only can operators provide the connectivity that will underpin cities, they’ll also have access to unprecedented volumes of data from devices and sensors on their networks. This data could become one of operators’ biggest assets and will enable them to transform from dumb data pipes to powerful data vendors.”

Telensa, a specialist in smart street lighting and smart city applications, unveiled streetlight-based Multi-Sensor Pods, an important part of the Urban Data Project that looks to create a trusted infrastructure for urban data, one that enables cities to collect, protect and use the data that they have generated.

Urban data is the city’s digital twin and maps how people use the city, whether that’s using their car, or monitoring air quality and noise pollution.

All this data is incredibly valuable for designing better city infrastructure, delivering more efficient city services, and making everything more transparent to empower citizens, but it also has potential value to other industries such as retail, real estate and insurance.

The multi-sensor pods are powered by Qualcomm’s SDM845 processor which can support heterogeneous computing and on-device intelligence and can allow the sensors to extract detailed real-time insights from the raw data while reducing the requirement to move data to the cloud.

Commenting, Will Franks, CEO of Telensa, said: “Our focus has always been data, and finding a way for cities to effectively take ownership of their urban data assets.

“Working with Qualcomm for edge AI processing, we’re solving the economic challenges of smart city applications by employing the power and efficiency of the latest smartphone technology.”

At the end of an interesting week, attendees could see the impact 5G and the IoT are starting to have on both business and society.
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How is thermal imaging and simulation being used to address problems associated with thermal management?

By Bethan Grylls

Board engineers are familiar with the trends - smaller, faster, safer. But as electronic systems become more complicated and the demands placed on them increase, creating a system that meets all this criterion is becoming more difficult to manage and deliver.

One of the main challenges today’s engineers face is thermal issues, and early identification of potential problems with thermal behaviour is becoming increasingly important.

According to Ankur Tomar from Farnell element14, one approach is to use thermal imaging cameras. “They can help board and system designers using very high-performance semiconductors or working in power electronic debug problems with prototype boards by identifying difficult areas more quickly,” he contends, “and can be useful in uncovering thermal hot spots, rectifying the issues causing heat and managing heat dissipation.

“In R&D, prototype boards can be examined to find faults in a system. A processor that gets very hot in low-power mode could indicate a software or hardware issue.”

Thermal cameras can also show when components are running colder than expected. “This could mean it’s not being powered correctly or that PCB traces are broken,” Tomar says.

By using a thermal camera, an engineer can spot parts which are reaching their thermal capacity limits or are failing.

Issues such as improper soldering, where poor solder joints prevent the current from flowing, or where the resistance of the solder joint or connector causes heat to be dissipated can also be identified. They can also be used to detect broken traces and reserved polarity, adds Tomar. “They’re a great tool when working with complete systems to identify where mechanical energy losses occur.”

Infra-red (IR) cameras are also being widely adopted, proving a valuable tool in production and diagnostic areas.

“The ability of thermography to view small, irregular shaped objects and to determine thermal characteristics and temperatures remotely has been an asset to electrical engineers and technicians,” according to Tomar.

Test srl, a measurement instrument company has set up a fully equipped lab where engineers are repairing, testing and calibrating a wide range of electronics equipment, including PCBs, power supplies and oscilloscopes using thermal cameras supplied by Flir. The ETS320, has been designed for benchtop environments and combines a high-sensitivity thermal camera with an adjustable, hands-free table stand to provide users with consistent, non-contact thermal testing through the entire electronics design, development and production process.

It offers 76,000 points of temperature measurement and can monitor power consumption, detect hot spots, and identify potential points of failure during product development.

Fluke has also released a series of thermal imagers, such as the TiS20 range and the Ti500 that uses the Fluke Connect system. With this, engineers can wirelessly sync images directly from the camera to the Fluke Connect system and attach it to an asset record or work order.

“Having access to maintenance records simultaneously at the inspection site and from the office or an off-site location enables faster decision making and real-time collaboration between team members,” said Tomar.

The camera display can also be streamed live to a smartphone or PC, which can then be used to remotely control the camera.

Thermal simulation

While Tomar sees potential with thermal cameras, Anders Sellin Strategic Product Manager from Flex Power Modules, believes thermal simulation is the ‘must-have’ tool.

“Our power modules can use up to 1300 watts in a quarter brick and simulation minimises the risk because you can mimic behaviours before you
have any hardware in place, giving engineers a good idea of how the system will behave.”

The Flex Power Designer gives designers and system architects an overview in software of system configuration and the efficiency of the entire power system.

Version 3.0 enables users to simulate thermal behaviours in their power system designs, making it possible to calculate hot spot temperature and overall system efficiency in Flex Power Module boards.

“If you are building a server or some kind of board in a base station, you need the power to power up the memory, the CPU, etc., and the simulator can help you accomplish this. Ultimately, it helps the user to select the right module and make sure the modules are configured correctly,” explained Sellin.

With the 3.0 release, tuning can be optimised with power-stage analysis and design behaviour visualised, demonstrating to the user how a system performs in relation to design requirements such as transient response, output impedance and power dissipation.

The software also features an SMBus tool and sample code bundled for full SMBus control and production programming.

“DC-DC modules and point of loads are configured automatically,” said Sellin, “and if you have discrete solutions in combination with the modules, you can take these configurations and cut and paste it into the production file. This means you have one file that configures everything included on the board.”

When new modules are released, the user is notified via email that they will need to update the system i.e. download the latest ‘product definition files’.

To ensure accuracy of its thermal prediction simulator, Flex Power has created a test chamber (with a wind tunnel) to assess its modules.

“We run a program which enables adjustment of board temperature, the wind speed and the ambient temperature. From this we receive an equation that depicts where the heat will go and be dissipated in all different combinations. For example, what is the thermal resistance in each pin. We then feed that data into the software,” Sellin explained.

The test chamber allows the software to obtain all the modules’ information, meaning the simulation can accurately stipulate how each reacts, both electrically and thermally.

“We were dealing with enormous amounts of data. The software needed to be able to understand how a system will change all of these parameters,” he said.

3.0 users will be able to simulate the key parameters that effect thermal behaviour, enabling engineers to understand what possible routes the heat can take.

Power loss can also be identified during simulation. For example, it may be that a board offers 1300 ‘usable’ watts, but only 1000W are required. Having access to this information means engineers know when to alter parts of their system, and ultimately allow for the creation of a more efficient system.

It is also possible to set all parameters of the control IC, Flex Power Modules has created a number of high-level functions for ease-of-use. So, each and every registry does not have to be changed. Instead, you can automatically set different DC-DC modules for ‘ramp up’.

Phase spreading is also taken care of with the Designer tool. “If you have a lot of different modules on your board, you want to make sure they are not in sync with each other, so you’re able to lower the EMC disturbance,” Sellin explained.

“In our simulator, users simply press a button, and then the software optimises all the different modules and the phase spreading. Whereas, if you have a few modules and you try to do this manually, it can take weeks. The number of combinations is huge.

“Furthermore, you can make sure that the loop compensator is stable. With the filter you have chosen or the filter you have designed, you can add that value.

“If you have a digital module, you can change the loop compensator settings, so you can get it stable based on the filter you have. If you have an analogue module – where you cannot change the loop compensator – you can check whether it will be stable with a specific filter. If not, it provides you with an indicator to change or redesign the output filter.”

To help simplify designs, Flex Power Designer provides graphs which can show the dependencies between multiple quantities, for example to show how temperature varies as a function of output current, output voltage and wind speed.

“The overall result is that the details are provided as a configuration file that can be used in the production later on,” said Sellin.

He concluded: “IC vendors are the only ones that are really making this type of tool, and they’re using it to reconfigure the control circuits for controllers. We are using the IC in an application and have added thermal simulation or thermal behaviour.”
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“S"oftware-defined testers will be critical in keeping up with the evolution in automotive design,” said Jeff Phillips, Head of Automotive Marketing at National Instruments (NI) in an interview with New Electronics last year. “The semiconductor content will only continue to increase and as the technology improves so the ability to quickly reconfigure testers will be critical. Flexibility through software will be the key.”

Chief among those technology trends is the growing electrification of the powertrain, the wide adoption of advanced safety systems and enhanced driving and comfort functionalities – all of which have significantly increased automotive complexity and the software vehicles need to operate.

The components and sub-systems need to work effectively and in synchrony, from the HVAC system to the infotainment system, and each system will likely have a dedicated electronic control unit (ECU) - an embedded computer that controls and manages those functions.

While some manufacturers favour consolidating ECU functionalities with the focus on sensor fusion, infotainment and those functions requiring less data – such as steering, air conditioning etc., others favour a more distributed architecture.

Whichever approach is favoured, a typical vehicle can have as many as 100 ECUs, which control, monitor and alter a car’s various electronic systems.

Today, ECUs are becoming more complex, and a key player among them is the powertrain ECU.

**Powertrain ECU**

The powertrain is made up of the mechanical parts that power the vehicle, for example the engine, axels and drive shafts.

Now, driven by the demand for more efficient, eco-friendly and better performing vehicles, manufacturers have started to add more electric components to the powertrain. This includes electric motors, batteries, power inverters and control units such as battery management systems to make everything work either in sync with the engine in the case of hybrid systems or by itself in fully Electric Vehicles.

“A battery management system, for example, will decide how to deliver the energy from the battery to the electric powertrain based on an algorithm that considers everything from the temperature of the battery, to the levels of charge in its cells. This data allows it to last longer and work more efficiently,” said Arturo Vargas, Solutions Marketing Manager – Automotive, NI.

But, with all its performance benefits, the rise of electrification also means that the automotive industry is now presented with new, complicated challenges when it comes to testing and design.

Hyundai Kefico, which has supplied powertrain automotive electronics since 1972, is among those manufacturers faced with increased test demands and tighter emission regulations, along with having to manage budget and timeline challenges.

**Hyundai Kefico**

When Hyundai Kefico’s powertrain ECUs reached 200 pins and the functional test needed to ensure quality stretched to 20,000 test steps for an increased variety of ECU types, its engineers realised that traditional methods would not suffice.

In the past, an ECU functional tester required Hyundai Kefico to design sensor/actuator emulators, vehicle communication modules, test execution engines and applications, test procedures, and test result management tools for each type of ECU. In other words, the company had to develop a new tester for each new ECU, with minimum reuse of test engineering assets and a negative impact to the cost of test.

To solve this, Hyundai Kefico adopted a customisable, user-defined test system using the NI automated...
test platform.

“NI realised that these challenges are not exclusive to the automotive industry. So why would the technology need to be exclusive to it?” Vargas explained. “Adding wireless capabilities to chips and testing them is not significantly different than doing it for an ECU. The challenges are shared and thanks to our platform approach to technology, the technology is shared as well.”

He continued: “This is made possible through software: sharing developments, IP, test modules, etc. The high level of reutilisation, flexibility and customisation possibilities of the NI automated test platform is what made it ideal for Hyundai Kefico’s challenges.”

By leveraging the NI Automated Test platform, Vargas says that Hyundai Kefico was able to build its system from a higher starting point with every new interaction, saving them time, money and effort.

The Platform consists of three parts – LabVIEW, TestStand and NI PXI. The latter is a modular instrumentation platform used to build compact, high-performance automated test systems, and is the system Hyundai Kefico used to create its solution.

In a PXI system, a chassis provides power, cooling, and a communication bus for modular instruments or I/O modules. These control modules can be controlled from either an embedded controller or an external PC, using one or several of NI’s specialised engineering software tools to customise a system.

The process
The Hyundai engineers started with the development process and created the Common Platform Tester (CP-Tester), and the standardised ECU Functional Tester development process. They based the CP-Tester on standardised test assets called CP-Standard, which define sensor/actuator emulation, vehicle communication, test execution (test engine), operator interface (test application), and test result management.

The CP-Tester has a few key components that streamline the test development process, according to the Hyundai Kefico engineers. R&D or product engineers can use a test scripting modelling tool called CP-Editor to configure each test step and parameter by choosing from over 200 prebuilt functions to develop test sequences. They can map these test steps to the appropriate hardware I/O and reconfigure them for different ECU types.

The CP-Server is another component that engineers can use to effectively manage test result data to improve upon new test requirements.

The solution’s adaptability to various types of powertrain ECUs not only offered shorter test times, but as it is able to reuse and reconfigure test steps from R&D to manufacturing, it also allowed for efficient use of test engineering assets. Moreover, the engineers say the system let them have access to more valuable test data due to data handling and traceability in standard format.

The NI PXI platform was selected as it was “better suited” to deal with the complexity of Hyundai Kefico’s powertrain ECUs.

For example, high and flexible channel counts (over 200 pins) with different layouts; I/O configuration with source and measurement capabilities; and the ability to connect dummy loads (resistance and inductance) to properly test ECUs.

It also provided a variety of switching options and the facility to customise I/O through FPGA to implement special sensor communication protocols such as SENT (Single Edge Nibble Transmission and SAE J2716). Most turnkey ECU testers on the market require 10–12 months to adopt new test plans for new products, and they still necessitate significant interaction with the vendors and high costs.

With short development times of the essence, NI’s platform enabled the engineers to develop their own flexible standard tester within three months. As a result, there was an 80 per cent reduction in development time, while giving the engineering department the ability to add functionality like CAN with flexible data-rate in the future, as product requirements evolve.

At the company level, given the higher demands for ECUs, the NI PXI timing and synchronisation features improved test time by 15 per cent and cut the test system cost by 30 per cent.

Hyundai Kefico can also procure and assemble the CP-Tester at any of its manufacturing sites around the globe due to NI’s worldwide presence, offering the company much more flexibility.

For the first 17 CP-Testers, Hyundai Kefico achieved an estimated 45 per cent better project ROI compared to its previous solution.

“Any development of a test system will have challenges around integration, functionality, etc. Those are inherent to using a technology

“What I see as the most significant challenge that Hyundai Kefico overcame was the decision to change and stick with it through planning, collaboration and vision,” says Vargas.

“Changing a way of doing things is challenging for anyone,” he continued. “For a company that’s been developing automotive electronics since the 1970s, we can imagine the perception of risk and perhaps even the aversion to change.

“Yet, the team at Hyundai Kefico were able to lead that change in the organisation, increase the level of standardisation for the functional test of their ECUs and improve the company’s position as a leader in their market.”
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Pen Test Partners are a U.K. cybersecurity firm that specialises in high-end penetration testing, a systematic process that looks to probe for vulnerabilities in an application or network. It’s essentially a controlled form of hacking in which the ‘attackers’ find weaknesses that could be exploited by criminals.

Penetration testing looks to assess a system for any potential weaknesses caused by what could be improper system configuration, hardware or software flaws, or operational weaknesses in process or technical countermeasures.

An experienced penetration tester looks to mimic the techniques used by criminals without causing damage.

Pen Test is able to take an independent perspective on the security by design recommendations advocated by various regulatory bodies and works with manufacturers to help design in security features.

Awareness of security is certainly growing among consumers. Recent research carried out by online electrical retailer, reichelt elektronik, found that among UK consumers safety and privacy worries were actually dissuading some from buying digital assistants.

The survey found that 72% were concerned with the misuse of data; 56% wanted to know more about how communication was being monitored, while 48% were worried about the risk of hacker attacks.

Commenting Thomas Kruse, product manager at reichelt elektronik, said, “Voice assistants on devices are great pieces of technology that can make our lives easier, but in the wake of data breaches and hacker attacks technology companies and retailers need to communicate security messages better. Brands and retailers have a role to play in helping to inform and educate customers on how to stay safe.”

The need to better educate customers was highlighted by Pen Test last year, when it carried out tests that found that thousands of hot tubs could be hacked and controlled remotely because of a vulnerability in their online security.

The organisation’s ‘ethical hackers’ were able to show that it was possible to make the tubs hotter or colder, as well as control the pumps and lights, via a laptop or smartphone.

The company behind the product, Balboa Water Group (BWG), responded by pledging to introduce a more robust security system for owners and said the problem would be fixed.

However, the company’s failure and the way in which it sought to address the problem was criticised as taking away the users’ right to both privacy and security.

Poor security

This was just one of many devices tested and found to be vulnerable by Pen Test and, according to the organisation’s founder, Ken Munro, “Manufacturers are still not taking security seriously enough, and until they do consumers will have to remain vigilant.”

While the BWG hack, and the vulnerabilities it found, was hardly critical it did highlight the fact that too much of current consumer IoT security is, as Munro says, “Not in a good place….and these findings underline that.”

According to Munro over the past five years that Pen Test has been looking at security in consumer products, things haven’t improved.
“In many cases, especially when it comes to consumer goods, things have actually gone backwards. “I think it would be fair to say that, with the exception of a few companies, very few actually understand the impact that poor security, or getting security wrong, can have. “This has been made worse by new entrants looking to create smart technology and aiming to get to market quickly. The problem of security is simply getting worse.” Munro says that many more companies are now entering the consumer technology space. “Barriers to entry are low and that brings with it a whole new set of challenges,” he suggests. Munro makes the point that many of the companies now working in this space have been involved in developing mobile apps and are use to being able to update apps over the air to fix any security flaws. “That approach will not work with hardware. If you design in a security flaw, you are in a different situation entirely if your device doesn’t support over the air updates. Too many companies are selecting hardware that doesn’t have security features, simply in order to save on cost.” He warns that it’s a problem that besets the consumer space. “Products are vulnerable. Development lifecycles are lengthy when it comes to hardware and if you’ve failed to implement necessary security features, or have chosen the wrong architecture or platform, then to put it bluntly – you’re screwed! “Before Christmas Pen tested some smart Christmas lights; the manufacturer had chosen to use a chip set with zero security functionality. “There was no trust execution, random generation of secure storage for credentials. The company ended up pulling the product and having to start with an entirely new architecture. “A similar thing happened with the Wi-Fi kettle from Smart. There were security concerns with the first architecture, so they brought in a security architect – a very good one – who went back to basics and designed security into a new architecture. If they’d done that in the first place they would have avoided the PR disaster that followed.”

Think secure “When it comes to delivering a secure product the first thing companies need to think about is security – it is easy and relatively cheap to design in at the beginning of the process. It doesn’t have to be expensive, shouldn’t delay you getting to market or obstruct the growth of your business,” says Munro. The key is asking for help early on. “You need only spend a single day arming yourself with questions and better understanding standards in order to avoid pain later,” he says. “Security doesn’t have to be a big overhead. If your device is found to be insecure, or vulnerable, what is the cost to your business of pulling it from the market? Keep shipping it, or face going bust? Too many companies back themselves into a corner.” Munro says that the IoT brings with it the risk of super-systemic vulnerabilities. “Find a fault in one device and it’ll be in all of them; and mobile apps make devices extremely vulnerable and exploitable. A lot of platform providers support multiple manufacturers. So, while a security problem may affect a few thousand devices, because the problem is with the backend service it could actually impact millions.”

The importance of due diligence is critical, according to Munro. “Ask the right questions and better understand the development process; are suppliers following the correct security protocols; ensure that in contracts there’s a clause entitling you to get your money back should security become an issue; ensure you see all documentation and carry out a thorough risk assessment.” Munro suggests that security needs to be built into all procurement processes. “The lack of understanding is shocking, but needn’t be,” he says. “There’s all sorts of advice and guidance available.” Munro points to Secure by Design, which has been published by the UK’s Department for Digital, Culture, Media and Sport (DCMS) and which promises an effective foundation for legislation. “This is broad reaching, providing guidelines for manufacturers, mobile app developers, service providers and retailers. It states default passwords should not be used, credentials and security sensitive data should be stored securely, and software kept updated.” While a good start, he says that there is still work to be done. “For example, the initial proposals recommend a vulnerability disclosure policy but didn’t require vendors to issue a fix; it suggested the use of unique passwords but failed to address the issue of entropy; and it did not address the over-use of permissions on mobile apps.” In the US SB-327 mandates some basic security standards for smart consumer tech and will come into effect from January 2020. In Europe, the Cybersecurity Act, which came into effect in 2018, saw the European Union Agency for Network and Information Security (ENISA) become the permanent EU agency for cybersecurity and the creation of a certification framework for certifying connected cars and smart products across all EU member states. All of these developments should be welcomed, says Munro, but so many of the problems associated with security are simply down to a lack of planning or awareness. “It’s certainly not rocket science,” he concludes.
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By 2037, The International Air Transport Association (IATA) predicts that worldwide passenger numbers will have doubled, reaching over 8 billion. This will place immense pressure on airports not just in terms of capacity, but in processing passengers securely and safely.

Nick Whitehead, head of strategic partnerships at Aurora-AI, which specialises in artificial intelligence (AI) solutions, believes that airports will have to rely on technology to offer more intuitive ways of processing rising numbers of passengers, but without compromising safety.

“Technology has always been a key part of the security implementation for airport and air travel,” he said. “X-ray machines and now CT scanners, metal

**STREAMLINED SECURITY**

As passenger numbers rise, airports will struggle to cope. Here, Bethan Grylls explores how AI is being used to enhance security

detectors and body scanners are all common place in security checks.”

ID checks are also seeing improvements through the implementation of automation.

“Machines are consistent,” Whitehead pointed out. “They don’t get bored or change performance based on an individual’s mood. They’re also quick and able to process larger volumes of people. This leaves the security officers free to do what humans do best – monitor behaviour.”

In an effort to support and improve security, Aurora has developed a number of AI solutions. Among them is Face Recognition which has been used at Heathrow and Manchester airports.

“This technology is required in terminals 2 and 5 and at Heathrow and Terminal 3 at Manchester to separate international and Domestic travellers who share the same terminal space. All Domestic passengers must verify using out Face Recognition or they cannot depart on a Domestic Flight. This prevents boarding pass swaps whilst people wait for their aircraft after clearing security,” explained Whitehead.

The technology has certainly improved over the last three years, with matching performance reducing error rates by more than 95 per cent, according to Whitehead. This could potentially lead to a system by which identification of passengers can be achieved without presenting a boarding pass.

The development platform that Aurora used to enhance Face Recognition has also been introduced to other security related tasks.

Once the camera was built, a large set of images were captured and used to train the AI to differentiate the objects carried by people beneath their clothing.

Next generation imaging

Aurora is now supporting Sequestim, a company looking to commercialise next generation terahertz (THz) imaging technology for security screening applications.

The two came together as part of the Future Aviation Security Solutions (FASS) programme – a Government funding scheme looking to improve passenger experience and safety – where they showcased a new type of body scanner.

Sequestim was responsible for the capture of images and Aurora built (trained) an AI (set of neural networks) to detect objects carried by people beneath their clothing.

Once the camera was built, a large set of images were captured and used to train the AI to differentiate the objects within the image. The final solution delivers the image capture and detection at around 4-6 frames per second (fps), meaning
objects – and potential threats – can be detected without the need for the passenger to stand still.

The technology removes the need to divest outer clothing and personal items, while also reducing false positive detection rates when compared to the existing generation of full body security scanners, Whitehead explained.

The technology uses a series of mirrors to surround the person as they enter the detection area. The camera (or detector) moves in a figure of eight and is pointed at a single mirror which is also scanning backwards and forwards. That mirror is positioned so it is facing four other mirrors. As the individual walks through, the machine captures images from multiple angles.

The camera takes the form of an array of superconducting detectors, called Kinetic Inductance Detectors, which are extremely sensitive to photons in the millimetre-wave part of the spectrum.

“At these wavelengths, clothes are semi-transparent. The body emits radiation at these wavelengths and appears brighter than the background against which we image the person – simply because the body is hotter than the background. The images we generate are essentially temperature maps,” said Ken Wood, sales and marketing director for Sequestim. “Any object, regardless of its material composition, shows up as a shadow against the body.”

The passive imaging technology also has the added benefit of removing the necessity to expose passengers to electro-magnetic radiation.

According to Wood, the camera possesses two critical qualities; the speed and detail of imaging.

The images are both comprehensive and processed quickly, which mean the scanner can gather information from moving targets and is capable of differentiating between objects of different shapes and sizes.

Wood continued: “In order to achieve this, we cool our detectors to a fraction of a degree above absolute zero, which only a few years ago would have required equipment far too delicate and complicated to operate in an airport. Our technology also includes cryogenic engineering that we have developed ourselves to simplify this cooling. The machine operates using only an electrical power supply, and we can monitor and control it remotely.”

This image is converted to a grey scale (0-256). The AI then scans the image using a small window and generates a score for each. This array of scores is then assessed against a threshold to determine if a threat has been detected.

The high resolution of the image, although aiding the process, also presented challenges for Aurora.

“During the first phase, the images were more ‘rough and ready’. We had a fairly simple approach where the AI was identifying whether a person was carrying a mobile or not – 98 per cent of all images were classified correctly,” said Whitehead. “When the image resolution improved, there was a lot more data to process and we had to accomplish this in near-to-real-time.

“We met these challenges with promising solutions by the end of phase two development,” Whitehead confirmed. “Results showed a strong correlation of threat detection greater than 95 per cent with less than 5 per cent false alarm.”

The body scanner remains at prototype stage, but was deployed at Cardiff airport for a two-week, real-life trial. “For some objects the results were near-perfect,” said Whitehead. “But more difficult objects, for example a knife, presented challenges when ‘seen’ side on rather than blade on.” In order to progress, Whitehead explained that Aurora is looking to approach AI training differently. “We’re mostly going to use images where the person has no threat attached to them [e.g. a knife] and teach the system to discriminate an image that doesn’t conform to that normal appearance, rather than have the system classify the objects it sees.”

**Future developments**

Whitehead believes there is a wide application for the camera technology and one which he sees happening before its implementation within airport security.

“Using a much larger lens, the technology could be used to scan much larger objects, for example a lorry. This could be used to determine whether or not there is a heat signature that looks like a person hiding in the back,” he suggested.

As for other forthcoming projects, Aurora will be releasing “Bio-Secure”, a technology designed to enable manufacturers of security lanes to identify passengers and relate that identity to the trays they use to divest their belongings for the X-ray machine.

Expansion of the Face Recognition solution is also underway, with Heathrow looking to use the technology now at every stage of the departing passenger’s journey.

The belief is this could help to reduce the average passenger’s journey time by up to a third.
The PiCorre™ product family has a new member, based on the NXP LMX8M Mini ARM® CPU, called PiCoreMX8M. The small size of 35 x 40mm only makes the module an ideal partner for compact housings. The module was designed for low power consumption and is very well suited for secure cloud connections.

The LMX8M Mini is NXP’s first embedded multi-core heterogeneous applications processor. The heart is a scalable core complex of up to four ARM® Cortex®-A53 cores running up to 2GHz plus Cortex®-M4 based real-time processing domain at 400+ MHz. The LMX8M Mini also packs-in hardware 1080p video acceleration to enable two-way video applications, 2D and 3D graphics to provide a rich visual HMI experience.

The PiCore™ standard uses two plug connectors (Hirose DF40C) with 100 pins each. This results in compact size and low board-to-board distance.

PiCoreMX8MM features:
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- Touch (4 wire-/ PCAP Touch) via I2C
- Up to 8GB LPDDR4 RAM/ 512MB SLC NAND Flash or 32GB eMMC
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Cloud computing and big data analysis will require the development of ever more powerful computing systems, according to Iuliana Radu, program director for beyond CMOS and quantum computing at imec.

If you consider mobile phones, they seem perfectly capable of running any app or mobile game, and of streaming video. Likewise, today’s laptops are able to support us at work or at home.

So, will we need ever more powerful computer chips in 10-20 years from now? And, if we do, what could these high-performance computers look like in 2035?

According to Radu the answer has to be a resounding ‘yes’, as the need for high-performance computing will continue to increase.

“By 2035, we will still be producing massive amounts of data, without deleting any of it. Think of pictures and videos posted on social media – in whatever form – and the huge amount of data processed by companies such as Google, Facebook, and Amazon.

“Wearables and ingestible devices will continuously be monitoring our health and will combine that data with our genetic imprint.

“Add to this the large amount of data generated by emerging IoT applications such as autonomous cars, smart buildings and smart cities, and the demand for high performance computing can only continue to increase.

“Most of this data will be processed and stored in the cloud. And this can only be sustained through increasingly more performant computing and memory solutions.”

Another clear driver relates to big data analysis.

“Applications such as drugs and materials discovery, weather forecasting, or nuclear simulations will continue to demand increasingly powerful computers to handle their ever-expanding sets of data. Today, these applications run on supercomputers, in which hundreds of thousands of classical processors work in parallel to solve different parts of a single large problem. A significant drawback of these supercomputers is the gigantic power consumption: for a typical supercomputer, the power consumption can reach 15-20 megawatts.”

According to Radu, both cloud computing and supercomputing will need solutions that bring computing to a higher level of performance, and this at the lowest possible energy consumption.

New drivers for innovation

“For more than 50 years, the road towards ever more performant computing has been guided by Moore’s Law, which has become an industry synonym for the continuous reduction in size and cost of the transistor. Every two years, the industry introduced a new technology node with more transistors per chip area, leading to ever more performant logic and memory chips.

“Cost reduction per transistor was mainly enabled by reduced device footprint. Nowadays, new technology nodes follow less frequently.

“As it is increasingly more difficult to reduce price per transistor with simple area scaling, new technology drivers are becoming more prominent. The ability to deliver a certain logic (or memory) function for the lowest amount of power is increasing in importance. So, the need for increased performance and reduced power consumption are becoming the main drivers for innovation.”

High-performant chips

In the future, classical device scaling will no longer be the only instrument.
towards higher performance. There is a clear trend towards increased device diversification and circuit customisation.

“In the past, one and the same transistor architecture was used to enable all functionalities on a chip. Today, five to seven transistor options co-exist in the same technology node. Each of the options has different performance specifications, e.g., with specific threshold and performance levels. This enables different applications ranging from ultralow-power in the IoT space, to mobile and high-performance computing.

“In the high-performance realm, we expect chip-level diversification and an increased use of multiple small chips in 2.5D and 3D packaging. As such, more targeted CPUs will be available, leading to the development of even more custom-made chips.

“I expect we will even see different devices either integrated on the same chip or on multiple chips working together, enabled by system technology co-optimisation.”

“Our expectation is that in the 2035 timeframe, technology nodes could include not only Si based transistors, but also other materials and possible ‘beyond-CMOS’ devices that are co-integrated with the classical CMOS-based solutions. The alternative devices could be used along CMOS for specific functions.”

imec is developing majority gates based on spintronics devices. These devices promise a decrease of power consumption by up to two orders of magnitudes but only for specific logic functions.

“We are also developing devices that have 2D materials in their conduction channel, which could be implemented towards extreme device scaling or used as transistors in the back-end.”

On the eve of quantum computing
Some applications are too complex to be solved with classical computing paradigms and here, quantum computing can come to the rescue.

“In a quantum computer, information is manipulated in a fundamentally different way than in a classical computer. Traditional computers operate with bits – that can be either zero or one – and operations on these bits are performed sequentially. Quantum computers operate with qubits that can with a certain probability be zero and with a certain probability be one. Add to this, entanglement, which means that qubits talk with each other and act concertedly, and the number of states in a quantum registry increases like a power law with the number of qubits.

“Operations can be performed on all these states simultaneously, resulting in immense parallelisation capability. Quantum computing promises the ability to solve those big problems, too difficult to solve on a classical computer. However, while quantum computing can go beyond the capabilities of classical computing, it will not be the ‘holy grail’ for solving all issues. It will only be useful for certain applications, for example, for solving problems that have many variables as their input.”

An example of a possible application for quantum computing is materials research. For example, the search for superconducting materials that can replace copper (Cu) in the rotors of windmills. Today’s windmills contain tons of Cu as the winding of the coils in their engines. This significantly contributes to the weight of the windmill head, limiting the size increase in the wing span of the windmills. Therefore, in Europe, supercomputing time is increasingly being used to find new superconducting materials.

“This search could be significantly advanced if a quantum processor could be used as a building block for the supercomputing systems. Besides materials discovery, there are many other useful applications, including weather and climate modelling, space exploration, fundamental science, the modelling of economical or societal phenomena (where complex differential equations need to be solved), machine learning, and the development of personalised medicine. By 2035, I believe we will see processors with a few thousand qubits, allowing us to run some algorithms and some small applications. In that timeframe, we will see materials discovery being done on a quantum computer.

“Ultimately, we will need to embed the growing power of quantum processing into existing computing paradigms to enable the required ‘quantum leap’ in performance.”

Imec’s contribution
Imec is contributing to this future vision with the development of next-generation logic and memory technologies. One option is to push Moore’s Law to the extreme by scaling down logic devices to the 5nm technology node. More specifically, in 2018, breakthroughs were realised in several enabling technologies for scaling, including EUV lithography and sequential 3D integration. With sequential 3D technology, imec was also able to stack FinFETs with 45nm fin pitch.

imec is also looking at ‘beyond CMOS’ devices and is exploring new concepts such as spintronics majority gates. Along with this, imec is developing hardware platforms to enable compute-in-memory and quantum computing. Visit imec’s website to find out more.
Without an IoT security strategy, your data is their data.

- New insights and know-how from Arm’s latest Security Manifesto can help ensure you’re protected. Download your copy at www.arm.com/security-manifesto