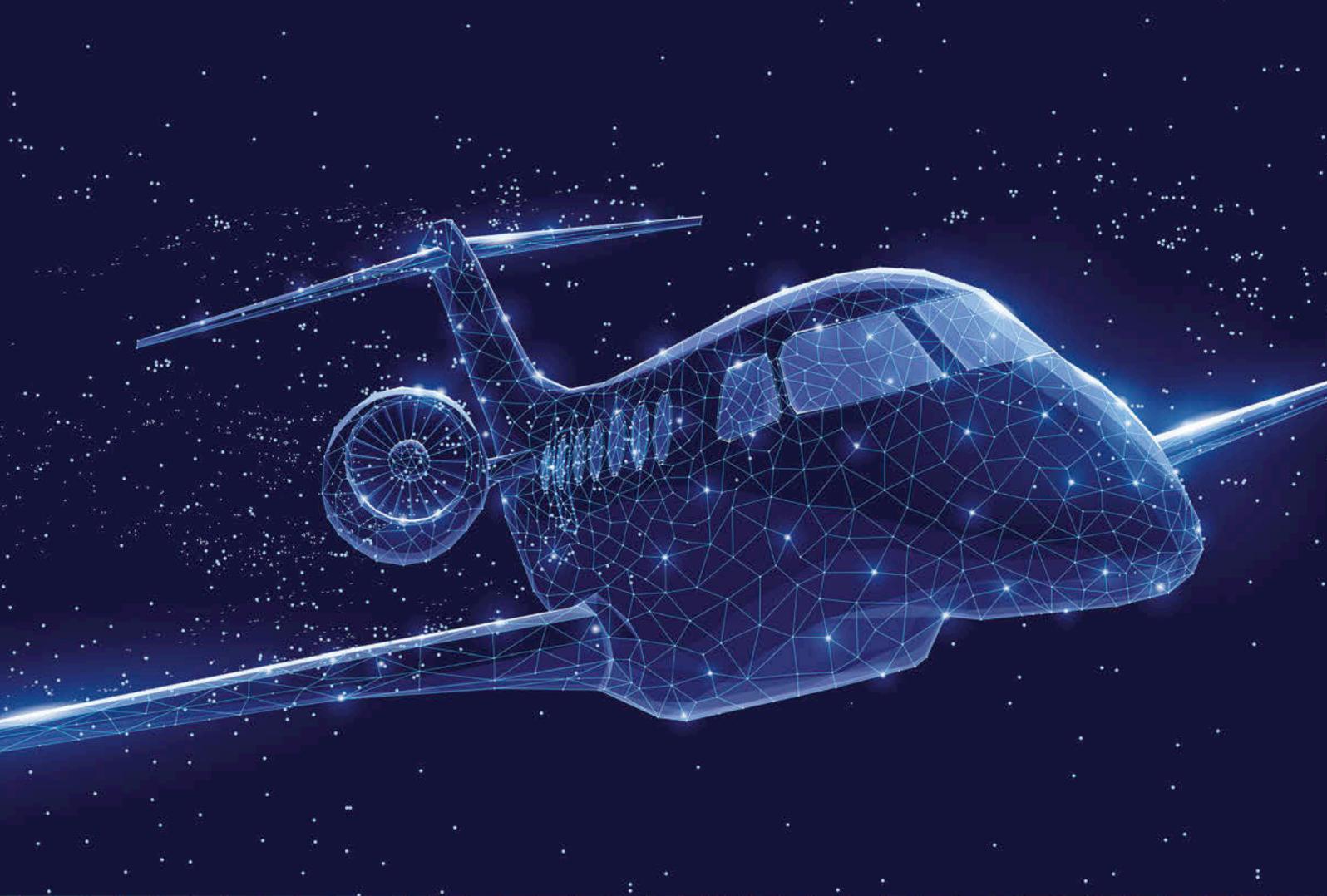


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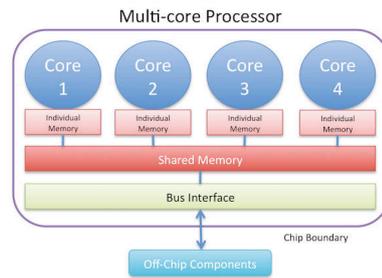
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MISSION STATEMENT

'New Electronics keeps designers and managers abreast of the latest developments in the world's fastest moving industry'



Mentor, a Siemens Business, is a technology leader in electronic design automation (EDA), provides software and hardware design solutions that enable companies to develop better electronic and mechanical products faster and more cost-effectively.

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Introducing PAVE360: System-of-Systems Development for Autonomous Vehicles

By Lauro Rizzatti and Jean-Marie Brunet

System-of-systems is a collection of systems, each with a specific function that need to work together. In addition to the traditional digital environment seen in systems-on-chip (SoCs), system-of-systems designs combine physical world elements like sensor inputs and mechanical interactions. A perfect example is the autonomous vehicle (AV) as Figure 1 shows.

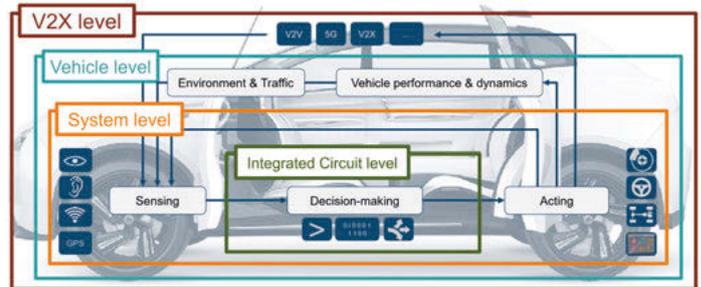


Figure 1: The AV design.

The AV design levels:

- The integrated circuit (IC) level that can include one or more system-on-chip (SoC) designs.
- The system level consists of multiple interconnected electronic control units (ECUs) that encapsulate a few or several ICs and supervise vehicle operations under different driving scenarios.
- The vehicle level that encompasses the entire car.
- The top level is the connectivity level that encompasses all three levels.

Is it possible to test an AV design with real time scenarios? Estimates say it would take billions of miles of road testing. Instead, what is needed is a high-performance verification/validation platform that operates on accurate digital models in a

virtual environment that mimics real-time scenarios: PAVE360.

PAVE360 (Figure 2) is built on the concept of a digital twin, and it consists of a complete AV verification and validation environment modeled at the system level that represents a twin image of the physical vehicle and its driving surroundings. The digital twin is made of digital models representing the AV environment, including sensors, processors, actuators, ECUs, connectivity networks, and driving scenarios. This digital twin can validate the system-of-systems without driving billions of miles.

Simcenter PreScan generates the driving scenarios and sensor data which drives the compute system on the Veloce emulation platform. Simcenter AMESim provides system simulation to form a closed-loop environment. Pre-silicon validation of an autonomous vehicle design is a real possibility today using PAVE360.

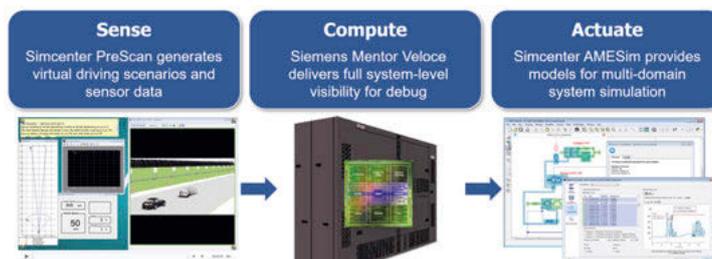


Figure 2: The PAVE360 solution.

To learn more, view this seminar.
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'A crisis, but not of our making'

THE NEWS THAT ROLLS-ROYCE IS TO CUT 9,000 JOBS IS A BODY BLOW TO ENGINEERING IN THE UK.



UK engineering has taken a serious blow with the news that Rolls-Royce is to cut over 9,000 jobs, nearly a fifth of its workforce.

Speaking to the media Warren East, the company's CEO, said that the losses were the result of Covid-19 and while it was not a crisis of the company's making, "it is the crisis that we face and must deal with."

The firm, based in Derby, is likely to shed 3,000 jobs this year, with the remaining 6,000 going in 2021. It looks like the majority of those losses will occur in the UK at its Derby facility which is focused on the company's civil aerospace business.

Rolls-Royce not only employs thousands across its 9 sites in the UK but has a critical role to play in training engineers and supporting apprenticeships.

Unions have responded with anger and accused the company of opportunism, but while the company has furloughed over 4,000 staff and looks like it may also turn to the government's taxpayer backed Covid corporate financing facility, which could allow it to borrow up to £1bn, it is difficult to see what else it could do, considering the circumstances.

These job losses are hardly unexpected considering the fact that airlines have cut their flying hours by over 90% and production, by the likes of Airbus and Boeing, has been cut back significantly.

Not only is there the loss of jobs but there is also the prospect that a number of the company's factories in the UK will also face closure, as East warned that it will also be re-assessing its manufacturing footprint.

While Rolls-Royce is cutting back its civil aviation division its defence business remains robust, according to East, and would be unaffected by the cuts programme.

While the company may tap government funds it's also likely that it will have to turn to its shareholders for more money – these cuts are part of a plan to make savings of £1.3bn, but will that be enough for a company so heavily exposed to the commercial aviation industry which is facing such uncertain times?

Many investors are now asking not just about when the sector will recover but whether it will recover at all.

Passenger numbers are down significantly and the chances of either business or holiday travel returning to pre-Covid-19 levels are remote.

Airlines around the world have announced steep job cuts and they are expected to lose £250bn in revenues in 2020.

East warned that the impact of the pandemic has been unprecedented and that it is unlikely that activity in the commercial aerospace market will return to the levels seen, just a few months ago, for several years.

Whatever the future holds, this announcement highlights the impact of Covid-19 and is a heavy blow to one of the UK's few world-class manufacturing companies.

Neil Tyler, Editor (neil.tyler@markallengroup.com)

"Many investors are now asking not just about when the sector will recover but whether it will recover at all."

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UK's first car battery 'gigafactory' planned

TWO UK START-UPS SET TO INVEST £4BN IN PLANT SIMILAR TO TESLA FACILITY IN US. **NEIL TYLER** REPORTS

Two British start-ups, AMTE Power and Britishvolt, have announced plans to invest £4bn in building the UK's first large-scale battery factory. The companies have signed a memorandum of understanding saying they will work together on plans for a plant to make lithium ion batteries.

Britishvolt's chief executive, Lars Carlstrom, said the companies had an ambition to build facilities producing batteries with capacity of as much as 30 gigawatt hours (GWh) a year, which would be roughly equivalent to the joint Tesla-Panasonic Gigafactory operating in Nevada. If the factory becomes a reality it could create as many as 4,000 jobs, according to Carlstrom.

With growing demand for electric vehicles the automotive industry is looking to secure supplies of lithium ion batteries and with no large-scale battery manufacturing facilities in the UK, fears had been raised over the long term future of the country's automotive industry.

The government-backed Faraday Institution estimates 130 GWh of annual capacity will be required by 2040 if the UK is to retain a large automotive sector.

While European and UK carmakers have tended to import battery cells from China and South Korea, many are now looking to increase domestic manufacturing.

Securing investment in a UK gigafactory has been a top priority for the government's automotive industry officials, and the Advanced Propulsion Centre helped to organise the tie-up between two start-ups.

AMTE Power runs a small facility in Thurso, northern Scotland, and is looking at sites for a larger plant capable of 1GWh a year. It focuses on specialist markets such as high-performance cars.

Britishvolt has been looking to invest in a larger plant with an annual capacity of 10GWh for batteries aimed at mass-market cars, with the possibility of adding another 20GWh after that.

Britishvolt said that it was confident it could raise the necessary funds, despite the looming coronavirus recession, as investors remain keen on green investment opportunities.

X-FAB expands offering for silicon-based microfluidics

X-FAB Silicon Foundries has taken steps to simplify the integration of microfluidic elements with CMOS and SOI dies.

Part of its extensive MEMS-oriented technology offering, the company is now providing a large variety of process capabilities for silicon-based microfluidic systems.

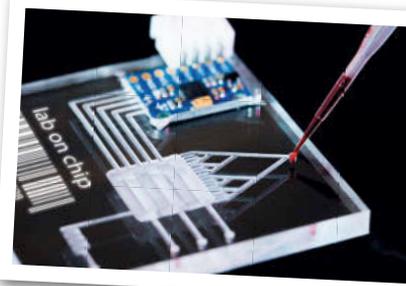
Over the past five years X-FAB has invested over \$25million in this area and has established itself as a leading foundry with regard to the integration of silicon-based microfluidics.

The company has undertaken numerous projects for medical and industrial clients including: applications such as lab-on-a-chip, DNA sequencing and synthesis and cancer diagnostics and as a result, its engineering team has gained experience in areas like noble metal processing, high aspect-ratio deep reactive ion-etching (DRIE) and the deposition of both organic and inorganic materials. The team has also become adept at tailoring the interfaces needed to connect CMOS dies and their accompanying microfluidics elements.

It has extended its process capabilities to now include: noble metal electrode arrays; inorganic layers for surface passivation and protection; deep silicon trenches and cavities; bonded silicon or glass lid wafers and polymeric fluidic structures.

X-FAB said that it continues to expand its portfolio of standard process blocks covering these capabilities. Rather than beginning complex microsystem design projects from scratch, it will now be possible to re-use existing process IP, which will help to accelerate product development cycles and the scaling up of volume production.

Among the new opportunities being envisaged are development of MEMS solutions for drug administering, flow metering and pollution monitoring.



Xilinx unveils space-grade FPGA

20NM SPACE-GRADE FPGA DELIVERS FULL RADIATION TOLERANCE AND ULTRA-HIGH THROUGHPUT AND BANDWIDTH PERFORMANCE. **NEIL TYLER** REPORTS

Xilinx has announced the industry's first 20nm space-grade FPGA, capable of delivering full radiation tolerance and ultra-high throughput and bandwidth performance for satellite and space applications.

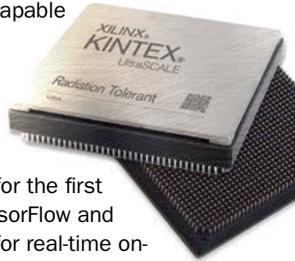
The Kintex UltraScale XQRKU060 FPGA provides unlimited on-orbit reconfiguration, a10x increase in digital signal processing (DSP) performance and full radiation tolerance across all orbits.

It also brings high performance machine learning (ML) to space for the first time. With a broad portfolio of ML development tools, including TensorFlow and PyTorch, it's able to support neural network inference acceleration for real-time on-board processing in space.

The XQRKU060's power-efficient compute and large on-chip memory, provides 5.7 tera operations per second (TOPs) of peak INT8 performance that's been optimised for deep learning, representing a nearly 25X increase compared to the prior generation. The launch of this 20nm part has advanced the space industry by three process node generations and, according to Xilinx, delivers a significant reduction in size, weight and cost.

Its on-orbit reconfiguration capabilities, together with real-time on-board processing and ML acceleration, will allow satellites to update in real-time, deliver video-on-demand, and perform compute "on-the-fly" to process complex algorithms. These ML capabilities are also suitable for a variety of problems spanning scientific analysis, object detection, and image classification – such as cloud detection – enabling improved processing efficiency and reduced decision latency both in space and on the ground.

The XQRKU060 also comes with a simplified development environment in the form of the Vivado Design Suite and, in addition, the Vitis unified software platform provides support for embedded software development on the Triple Modular Redundant (TMR)-capable MicroBlaze soft processor. Future extensions will add support for Vitis AI, the Xilinx unified software platform for AI inference on Xilinx devices and production cards.



Next generation UWB technology

imec is expanding its secure proximity research program and has unveiled a next-gen ultra wideband (UWB) technology that achieves a ranging accuracy of less than 10cm in challenging environments while consuming 10 times less power than today's implementations.

"UWB's power consumption, chip size and associated cost have been prohibitive factors to the technology's adoption, especially when it comes to the deployment of wireless ranging applications," said Christian Bachmann, program manager for Secure Proximity and Sensitive Networks programs at imec.

Imec's new UWB chip has seen a significant reduction of the technology's footprint based on digital-style RF-concepts.

"We have been able to integrate an entire transceiver – including three receivers for angle-of-arrival measurements – on an area of less than 1mm². Our new design also targets very low power consumption, less than 4mW/20mW (Tx/Rx) – which is up to 10 times better than today's implementations."

Complementing these hardware developments, researchers from IDLab (an imec research group at Ghent University) have come up with software-based enhancements that significantly improve UWB's wireless ranging performance in challenging environments.

"Using machine learning, we created smart anchor selection algorithms that detect the (non) line-of-sight between UWB anchors and the mobile devices that are being tracked. Our approach also comes with machine learning enabled features that enable adaptive tuning of the network's physical layer parameters, the right steps can then be initiated to mitigate those ranging errors – for instance by tuning the anchors' radios," explained Professor Eli De Poorter from IDLab.



Cadence delivers new verification IP

Cadence Design Systems is making available 10 new Verification IP (VIP) solutions that will allow engineers to efficiently verify their designs to meet the specifications for the latest standards protocols.

The expansion of the Cadence VIP portfolio will provide support for customers developing SoCs and microcontrollers for automotive, hyperscale data centre and mobile applications, including with CXL, HBM3, TileLink and MIPI CSI 2sm 3.0.

Cadence VIP are part of the Cadence Verification Suite which is comprised of core engines and verification fabric technologies that increase verification throughput and design quality, addressing verification requirements for a wide variety of applications and vertical segments.

The new Cadence VIP offer customers a comprehensive verification solution for the most complex protocols. Customers have access to a consistent API across all VIP

with complete bus functional models (BFMs), integrated protocol checks and coverage models, ensuring they can rapidly adopt the appropriate VIP needed for their design.

In addition, all Cadence VIP include Cadence TripleCheck technology, which provides users with a specification-compliant verification plan that is linked to comprehensive coverage models and a test suite to ensure compliance with the interface specification.

"The requirements for higher bandwidth, lower power and more effective cache coherency management are growing exponentially, driving a new set of protocols to address them," said Paul Cunningham, general manager of the System & Verification Group at Cadence. "With these new VIP, Cadence is providing customers with smart verification solutions that ensure the designs comply with the standard specifications as well as deliver application-specific performance."

IAR extends security compliance

IAR Systems has announced the addition of support for a number of MCU devices from NXP Semiconductors within its security development tool C-Trust.

This enhanced support will help embedded developers to implement security, and ultimately meet new compliance standards from recent security legislations for IoT products that are already in development or production. In an additional release, C-Trust will also integrate support for i.MX RT1064 crossover MCUs, easing the development of secure industrial and consumer applications with outstanding real-time performance and memory.

In both the US and Europe the authorities are passing laws that require manufacturers of connected products to, “equip them with reasonable security features to protect the device and its information from unauthorized use.”

C-Trust will ease the design-in of NXP MCUs in products that will have to meet these new security requirements.

C-Trust is as an extension of the complete development toolchain IAR Embedded Workbench, and will help developers protect an existing or new application without having to master the complexities that are so often associated with security. It will improve the security of an application with robust protection against Intellectual Property (IP) theft, malware injection, counterfeiting and overproduction.

The latest version of C-Trust adds support for NXP's K22, K24, K64, KV56 and KV58 MCU devices building on existing K65/66 support.



Machine learning to improve software quality

CODE DEFECT AI TOOL IS ABLE TO PREDICT LIKELIHOOD OF BUGS IN SOURCE CODE. NEIL TYLER REPORTS

Altran has released a new tool, available on GitHub, that can predict the likelihood of bugs in source code created by developers early on in the software development process.

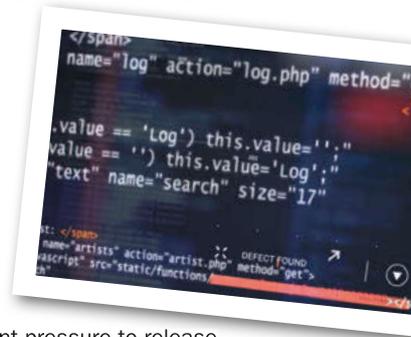
The Code Detect AI tool works by applying machine learning (ML) to historical data and is able to identify areas of the code that are potentially prone to bugs and then suggests a set of tests to diagnose and fix the flaws, resulting in higher-quality software and faster development times.

“It is well known that software developers are under constant pressure to release code fast, but without compromising on quality,” said Walid Negm, Group Chief Innovation Officer at Altran. “The reality, however, is that the software release cycle needs more than automation of assembly and delivery activities, it needs algorithms that can help make strategic judgments – especially as code gets more complex.”

Code Defect AI relies on a variety of ML techniques including random decision forests, support vector machines, multilayer perceptron (MLP) and logistic regression. Historical data is extracted, pre-processed and labelled to train the algorithm and curate a reliable decision model. Developers are then given a confidence score that predicts whether the code is compliant or presents the risk of containing bugs.

Code Defect AI can be integrated with third-party analysis tools and can itself help identify bugs in a given program code.

In addition, it allows developers to assess which features in the code have higher weightage in terms of bug prediction, i.e., if there are two features in the software that play a role in the assessment of a probable bug, which feature will take precedence.



Intelligent sensing products

The analogue machine learning IC specialist, Aspinity, has joined with Infineon to combine its Reconfigurable Analogue Modular Processing (RAMP) technology with Infineon's XENSIVTM sensor family.

Aspinity's RAMP chip is the first compact, ultra-low-power, analogue machine learning chip that can analyse raw, unstructured analogue sensor data to determine which data are important at the start of the signal chain — introducing an architectural approach to system design that saves significant battery power in end devices.

Functioning like an intelligent gate keeper, the RAMP chip is able to analyse analogue data from Infineon's XENSIV MEMS sensors to determine what is relevant. It then triggers the analogue-to-digital converter and downstream digital signal processor or microcontroller to perform more complex analysis only on the relevant data, eliminating the power inefficiencies typical of

other systems that waste power digitizing all of the data, relevant or not.

According to Aspinity, designers will be able to easily program a RAMP chip for application-specific inferencing, and the combination of the RAMP chip with the XENSIV sensors will enable a more power-efficient analyse-first architecture in a whole new generation of small, power- and data-efficient always-on devices.

“Infineon's high-performance XENSIV sensors allow electronic devices to see, hear, feel, and understand their environment - attributes that have become increasingly important for our customers,” said Rosina Kreutzer, director of business development at Infineon. “Combining the RAMP IC and our XENSIV sensors promotes high accuracy in combination with power efficiency in a broad range of always-on smart products. Our aim is to provide users with the features and functionality they can rely on.”

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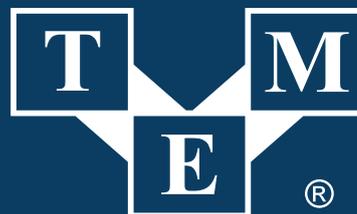
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In recent years every sector of the economy has seen a move towards cleaner and more efficient forms of production and delivery. When it comes to aviation, however, it has been the fastest rising source of carbon emissions over the past ten years, despite the development of more efficient and cleaner aircraft.

Air travel is rapidly coming under the spotlight for its pollution footprint and, for the first time, an airline recently made the top 10 list of Europe's largest carbon emitters.

According to figures from the European Union, the aviation industry contributes around 3 per cent of the EU's total greenhouse gas emissions and, with demand from new markets like China and India accelerating, the environmental impact, at least prior to the Covid-19 crisis, was expected to increase significantly.

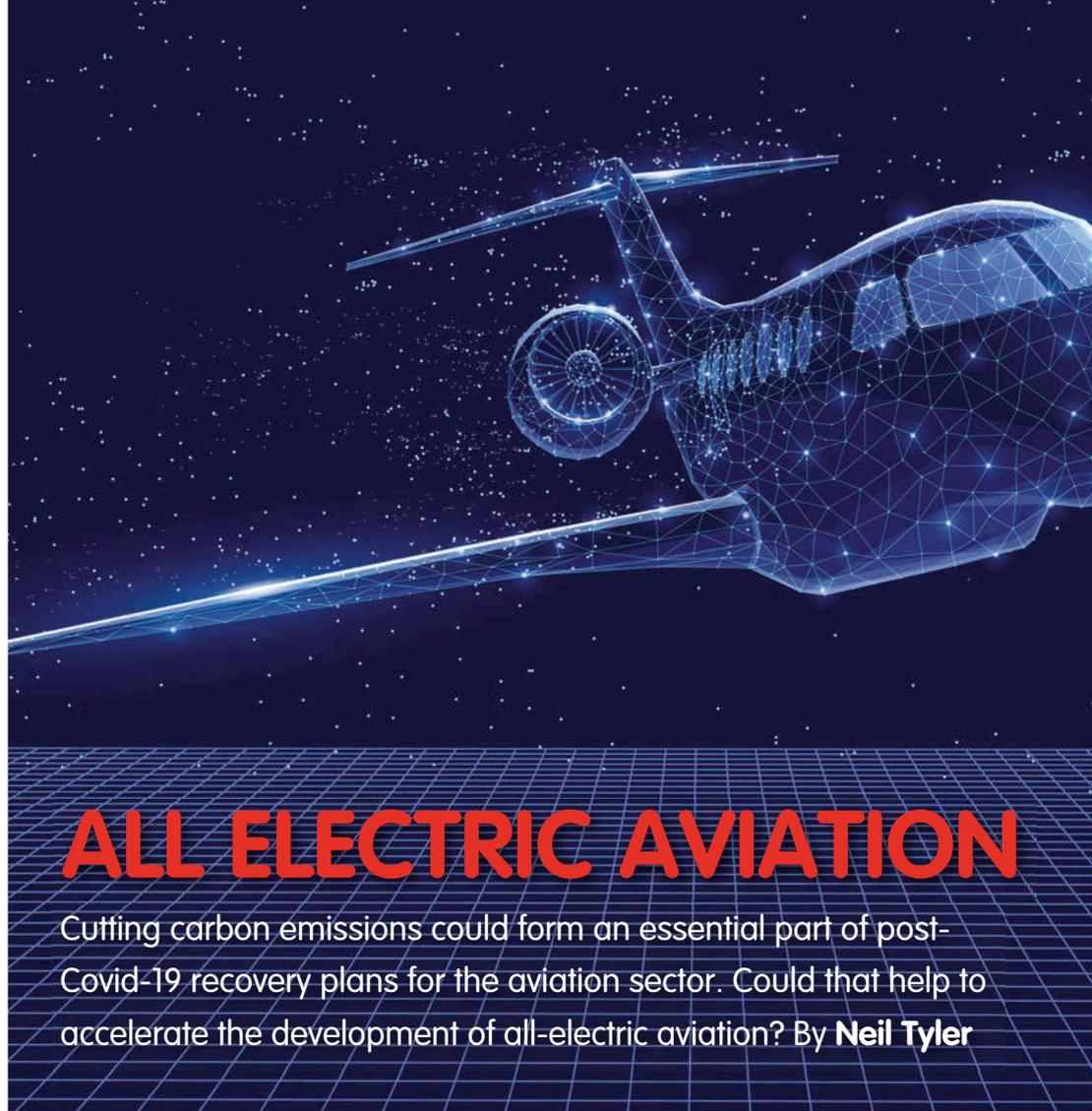
As a result, this global rise in CO2 emissions has led to calls for the faster de-carbonisation of the sector.

In Europe, the move to greener aviation has seen a number of projects set up to deliver new solutions. The Advisory Council for Aeronautics Research in Europe, whose members include Rolls-Royce and Airbus, has set itself some challenging environmental goals through its Flightpath 2050 initiative, which is looking to achieve a 75 per cent reduction in CO2 emissions per passenger.

Many see the Covid-19 epidemic as an opportunity to completely change the aviation industry and its relationship with the environment.

As the airline industry has called for government support many analysts, environmental campaigners and industry insiders argue that any rescue package should come with green strings attached.

For industry critics, if airlines do receive significant financial support, they should no longer be treated as profit-seeking independent companies. Rather, in return for any public funding, they should be required to focus on



ALL ELECTRIC AVIATION

Cutting carbon emissions could form an essential part of post-Covid-19 recovery plans for the aviation sector. Could that help to accelerate the development of all-electric aviation? By Neil Tyler

reducing their environmental impact.

According to John Holland-Kaye, the CEO at Heathrow, the UK should take the current crisis as an opportunity to, "accelerate the decarbonisation of aviation by helping to scale up new energy sources."

Role of engineering

Engineering has long been involved in exploiting new opportunities in the aviation sector, and when it comes to the development of greener and more efficient aircraft there is a 'real sense of purpose', according to the engineers involved.

Electrification of aircraft has been a focus for many years but that research has not been on propulsion but rather on power for on-board systems such as actuation systems, cabin pressurisation, wing de-icing, and electric ground taxiing.

Both the Airbus A350 and Boeing's 787 have increased the use of electric power to power on-board systems, and the 787 also uses power generated

from engine installed generators.

There is also a growing interest in hybrid options, which are seen as laying the groundwork for fully electric propulsion systems.

A good example is the E-Fab X project, involving Siemens, Rolls-Royce and Airbus which has raised the prospect of radically changing aircraft design and the development of all electric short-haul planes.

From a technological perspective the challenges associated with the electrification of propulsion are huge, and require investment across the whole ecosystem.

It will require fundamental research, notably into the development of electrical power systems which can operate at kilovolt levels; electrical machines and power converters able to deliver megawatts at a fraction of the weight of current state-of-the-art technologies; denser batteries and alternative fuels that will be able to store more energy.

To be able to deliver electrical



it comes to electrification, which is power to weight ratios.

In truth, many involved in the push for electric propulsion believe that it won't be until the 2030s, at the earliest, that the necessary battery technology will become available and it'll be the 2040s before we see the integration of this technology into actual aircraft designs.

Not only are there technological challenges to overcome, but electrification will also need new manufacturing processes, supply chains and standards.

Among those experts involved in this work is Chris Gerada, Professor of Electrical Machines at the University of Nottingham, which is part of the UK Aerospace Research Consortium (UK-ARC) that's aligned to the Aerospace Technology Institute's four technology pillars: Aircraft of the Future; Future Propulsion; Smart, Connected and Electric Aircraft of the Future; and Aero Structures of the Future.

Professor Gerada's expertise is in aircraft electrification – especially all-electric and hybrid propulsion and the technical challenges these present – and Nottingham university has a 400-strong team of researchers playing key roles across a number of R&D programmes.

As part of UK-ARC, which was set up in 2018 with the aim of advancing UK aerospace research through much greater university collaboration, Nottingham plays a leading role in research into aerospace technology and has a close working relationship



“The current crisis is an opportunity to accelerate the decarbonisation of aviation by helping to scale up new energy sources.”

John Holland-Kaye

with Rolls-Royce.

“While we have a reputation for high quality research, the UK has struggled with limited co-ordination in terms of research and a lack of suitable facilities,” explains Professor Gerada, “there was no real co-ordination at a strategic or national level in the UK, unlike in the US, Germany and France.

“We needed a much stronger ecosystem - one that brings universities and companies together - and while UK-ARC doesn't define what research is carried out, it does now provide that platform for much greater co-ordination.”

At Nottingham research is focused on five areas: transmissions; manufacturing, electrical systems; future propulsion and future operations.

“My area of expertise is the electrification of aircraft and it's been an on-going area of research over many years - in particular the electrification of non-propulsive systems of existing and near-future aircraft platforms, but today there is an acceleration in work into electrification in terms of propulsion,” says Professor Gerada.

Speaking before the impact of Covid-19 on the aviation industry became apparent, he added that, “a growing number of stakeholders including large, regional and small aircraft manufacturers, system integrators, engine manufacturers, electrical component and systems suppliers, regulatory and certification bodies, technology institutes and universities are now focused on the electrification of propulsion which is seen as fundamental in meeting future aviation emission targets and the demand for alternative mobility modes.”

According to Professor Gerada, when it comes to electrical systems the biggest challenges are that they are far less reliable and tend to fail more often, while they also tend to be heavy.

propulsion, components will have to operate at significantly higher power densities and efficiencies compared to existing technologies, and they will be required to operate within high voltage distribution networks.

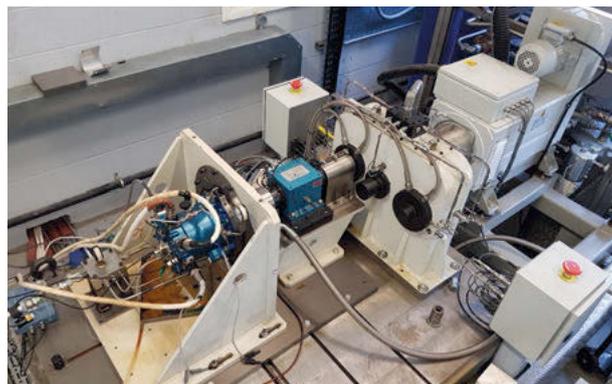
Hybrid-powered solutions, which bring together gas turbine and electrical generators, are being developed and are likely to deliver real environmental and cost benefits, while providing a route towards electric propulsion motors.

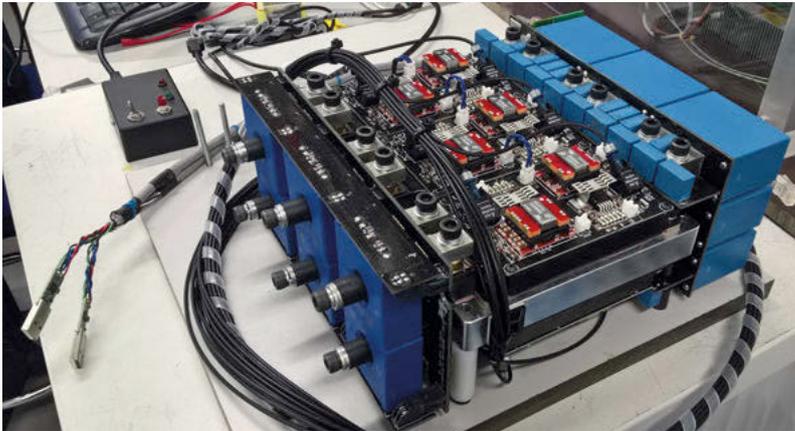
A big issue here, however, is the reliance on unproven power distribution systems and the need for high power electric motors.

In response, Siemens has developed a 50kg electric motor using a hybrid-electric propulsion system, which is capable of delivering continuous output of 260kw, which is five times better than comparable conventional systems – these are small, but not insignificant steps.

These projects are all looking to address the key problem when

Below: High power density aircraft generator enabling the move to electrification





“The industry has been pretty successful in delivering improvements and addressing these problems, so we are seeing more electrical systems being deployed throughout modern aircraft. That success has been achieved by better understanding the technology, designing for more fault tolerance, designing in resilience and, underpinning all of this, improving thermal management. We’ve also got a better understanding of the physics of failure and how to mitigate it.”

Despite progress there are still safety considerations when it comes to electrical systems, from wiring routes to electrical interference.

Professor Gerada makes the point that when it comes to propulsion engineers will have to address problems that involve megawatts of power, not just kilowatts.

Design freedom

An additional benefit associated with the electrification of propulsion will be greater design freedom, which will be brought about by the ability to distribute propulsors across the aircraft. Batteries, unlike fuel, will retain a fixed mass during flight so in terms of wing design, for example, it should be possible to make them more aerodynamically efficient.

Another area that is seeing considerable development in terms of new aircraft design concepts is in autonomous electric vertical take-off and landing (eVTOL) vehicles, which are intended to compete with urban

ground transportation.

“I need to make a distinction here,” says the professor. “While there’s a lot of work taking place with eVTOLs, as an area it is very different to when you start talking about commercial jets. The propulsion technology used in these devices is more like the tech you find in the automotive industry.”

Small platforms, such as these, have the advantage that the technology is relatively mature compared to high power electrical systems because it is translatable from automotive and existing aircraft electrification technologies.

“This space has seen a myriad of technologically advanced concepts. Whilst there is much improvement to be made from the technological aspect, the key barriers to successful deployment tend to be things like regulation, airspace management, public perception and successful business models to make them viable.”

By contrast the development of commercial jet electrical propulsion comes with innumerable technical challenges which, according to the professor, will range from the “evolutionary to the simply disruptive,” depending on the level of power and voltages needed.

A lot of research is focused on regional, or medium sized, aircraft which might be looking at powers in the megawatt (MW) range, while larger aircraft will require power in the tens of MWs.

Left: Innovative high frequency converter utilising Silicon Carbide technology for greater efficiency and power density

“In terms of R&D these mid-range commercial aircraft, the sort that provides regional services and carry up to 150 passengers, is really exciting,” he acknowledges.

Aircraft electrification will impact existing supply chains and create new aerospace market segments, but it will also require new testing facilities and certification standards.

“There is a lack of infrastructure and facilities to test and demonstrate key electrical propulsion components, sub-systems and their integration into larger systems, especially at high power and voltage levels,” says Professor Gerada.

To help address this, the University of Nottingham is opening a Power Electronics and Machines Centre this year to test and develop MW-class electrical machines and power electronics.

“The facility will be one of the first non-proprietary platforms able to support the development and testing of electrical machines and power electronics systems for all-electric and hybrid electric aircraft platforms,” says the professor.

UK-ARC is also looking at establishing open, distributed test and development facilities that will be capable of serving the needs of the aerospace industry in this new era of electrified aerospace.

These kinds of facilities will be critical but they will only form part of the solution.

The challenges going forward when it comes to electric propulsion will include issues around integration – how will new technology integrate with legacy systems, design and infrastructure – and how will the industry support in-service operation?

The impact of Covid-19 means that business models are going to have to change and it is likely that too will impact on the supply chain and, in the longer term, on aircraft design.

Disruption is never the preferred option but it can bring opportunity, as companies develop and exploit new technologies.



“The industry has been pretty successful in delivering improvements and addressing these problems, so we are seeing more electrical systems being deployed throughout modern aircraft.”
Professor Chris Gerada

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Automatic identification with the use of RFID readers from Elatec

Devices that utilise RFID technology for identification purposes are widely applied in warehouse logistics, shipping or management. A number of available solutions and a ceaseless need to integrate them into a single, coherent system tends to be problematic and time-consuming. Thanks to the solutions proposed by Elatec, the costs and time that are essential to integrate new devices in the existing systems can be reduced.

The dynamically developing markets of RFID systems and wireless communication constantly pose new challenges to manufacturers and integrators of devices. These challenges are only related to the electromagnetic compatibility, but also to the choice of identification standard or type of transponder systems and readers or programmers supporting them. Whatever the area of application, the key step is to choose a proper RFID technology for identification. Its choice depends on a number of factors, such as the expected range, type of objects to be identified or the need for the two-way transponder communication. Apart from storing a unique identifier in the read-only memory, some of these systems enable non-volatile data storage and encrypted communication with the master system.

The choice of identification technology is crucial also because of the fact that there exist numerous distinct RFID standards which differ in terms of some specific properties, e.g. frequency band (which leads to differences in antenna and transponder system size), range, modulation type, data transfer speed and so on. This may lead to a situation when the newly introduced solutions have a different communication standard than those used previously. An example of such a case may be an office building where



Fig. 1. External reader, TWN4 Multitech Legic 42

RFID technology is applied in recording employee's working time and room access control. In such an environment, a need may arise to integrate an additional system to give some specified workers access to printers or photocopiers equipped with RFID readers. However, the readers installed in these devices will work with different data transfer standards than those applied in the access control system. These circumstances may force the workers to use two or more access cards: one enabling access to the workplace and another one (or more) to be identified by a printer or a photocopier.

Multi-technology readers/writers

This issue has been noticed by Elatec, a famous manufacturer of solutions for

RFID systems. Elatec offers universal and ready-to-use reader/writer devices attachable to the master systems via serial ports, and also caseless RFID modules designed for OEM manufacturers. The readers/writers operate mostly using RS232 or USB communication protocol, while OEM modules are suitable for many other communication standards, which gives the designer a solid dose of flexibility and makes it easy to adjust the reader/writer to the existing devices.

It is worth analysing a concrete example. The TWN4 Multitech LEGIC 42 (Fig. 1) reader, available at TME, supports many different ranges of frequencies, i.e. 125 kHz, 134.2 kHz, 13.56 MHz. The reader is equipped with RS232 and USB interfaces, and the manufacturer provides drivers for Windows and Linux operating systems. This reader type is offered also as an OEM module. In this version it can cooperate with the master system via serial ports (3.3 V logic level, 5V-tolerant CMOS, I2C). In certain special versions, the reader can also support interfaces such as SPI, Wiegand CAN and 1-wire. The radio interface support is available for transponders manufactured by e.g. Atmel (now Microchip), EM, ST, NXP, Texas TI, HID, LEGIC and many others that are compatible with standards such as ISO14443A/B, ISO15693, ISO18092/ECMA-340 (NFC), HITAG, UNIQUE, ISO14443

A+B (Mifare DESFire EV1, Mifare Plus, Mifare SmartMX, my-d move, PayPass etc.), ISO15693 (EM4035, Tag-It, my-d vicinity, ICODE SLI), Mifare Classic, Mifare Ultralight, Sony FeliCa, NFC Forum Tag Type 2-4, PicoPass, HID iCLASS. Moreover, an antenna operating in frequencies 125kHz / 134 kHz / 13.56 MHz supported by the standards mentioned earlier is integrated on the reader PCB. Apart from being fitted with a master system interface, the reader consists also of eight GPIOs which can be applied to control a corresponding lock, a signal diode, an audio signal and many more. Their operations can be programmed with the aid of a script language.

Identification by smartphone

Apart from supporting the majority of RFID technologies, the reader/writer supports NFC and Bluetooth Low Energy (BLE) technologies, which are commonly applied in devices such as smartphones or tablet. Thanks to that, one does not have to utilise RFID card but e.g. a smartphone with a suitable application. The reader supports most popular models, such as iPhone and smartphones with Android or Windows operating systems. Now, let us come back to the example of the office building – in such a situation, the application of Elatec readers helps avoid identification-related issues. Instead of having to carry a card or a set of those, it is enough to install a proper app on employees' smartphones.

It will be certainly of great significance to those who utilise OEM modules that they are manufactured by Elatec. The company guarantees that the standards for electromagnetic compatibility and production norms are met (e.g. RoHS 2). The company ensures the devices' reliability as well. More information is available on the website of TME – the distributor of Elatec products.

Script language

The manufacturer makes available a software package to develop applications for readers. Thanks to that, the reader functionality can be automatized with the use of scripts supported directly by the reader's processor. What is more, the

script can be modified at any time, hence the reader can work with some other RFID standard after alteration of the operating mode in the script. In the case of the TWN4 module, changes can be introduced via a wireless interface or a configuration card offered by Elatec. This option is a great convenience for repair specialists and technicians, who will be able to proceed smoothly with the required reconfiguration without having to waste time to disassemble the integrated devices.

Identification of RFID technologies

Just like in the example with the office building, wherever migration from one system to another is the case, it is essential to identify the current RFID technology to propose a new and optimum solution. A typical procedure in such cases begins with sending a currently used RFID

card to the supplier or integrator. Such a time-consuming procedure is no longer required thanks to Elatec devices for RFID analysis,

e.g. TechTracer Lite, which can identify the currently applied RFID technology on the spot and thus help both the supplier and the client save time, costs and avoid the risk of potential identification errors.

Further information about RFID readers/writers by Elatec is available at <http://tiny.cc/qlgoiz>



Fig. 2. OEM reader/writer module, TWN4 Multitech 2

EnOcean, a pioneer in energy harvesting, has been developing and manufacturing maintenance free wireless switches and sensors for over 20 years, and its products have been installed in over 500,000 buildings around the world.

“We’re a pioneer in energy harvesting technology,” says John Corbett, the company’s UK sales director for Northern Europe and the Middle East, “and in the past few years have significantly grown our portfolio. We’ve got something like 4 million kinetic energy harvesting products deployed and our technology is seen as a key driver for the billions of IoT sensors that are expected to be deployed over the coming five years.”

The company’s switches and sensors gain their energy from their surroundings, so from movement, light and temperature.

“The products are based on open standards and are becoming a key foundation stone for the trend we’re seeing towards greater building digitalisation and production processes,” explains Corbett. “We’re looking at building automation, smart homes, lighting controls and industrial applications.”

At the heart of the IoT is the generation of data from which actions can be taken and EnOcean looks to provide, what Corbett explains as being, “a mass of data in a resource friendly way, that’s self-powered and maintenance free. We’re looking to deliver a low maintenance sensor network at scale that can then be integrated into a flexible IoT network.”

With the rapid growth in IoT devices Corbett says that EnOcean is seeing annual growth rates in excess of 20 percent.

“That level of growth is spread across various applications and we’re likely to see it accelerate as the number of sensors and applications grow.”

Data is used to better manage facilities and operations, whether



THE SELF-POWERED IoT

A new multisensor looks to enable more sustainable buildings and systems. By **Neil Tyler**

that’s turning lights on and off or controlling air conditioning units and, typically, that data is sent to the cloud. Artificial intelligence is also increasingly being deployed to better understand that data and to take more effective actions based on it.

“IoT business is typically cloud based and AI driven,” says Corbett. “IBM along with Microsoft are key partners, both offer AI technology. But for us that’s not what’s critical. It’s the gateway that matters and the raw data that our sensors are able to supply. With increased amounts of data being made available, the more analysis can be conducted.”

A new multisensor

To address this more efficiently EnOcean has launched a new multisensor – the STM 550 - which combines five sensor functions in one, small package.

“It can monitor temperature, humidity, Lux, vibration and magnetic contact in a single item, but it has multiple purposes,” explains Corbett.

“Rather than providing different sensors we’ve been able to design a compact single unit that can do an awful lot.”

The sensor’s capabilities are impressive. In terms of temperature it can provide accuracy better than +/- 0.3C; for humidity the sensor offers accuracy of better than +3% r.h; it has two vibration modes, acceleration or orientation and can detect if it’s been moved or shaken; it is able to report the light level directly underneath the sensor and can detect the presence of a magnetic field for either door or window operation.

Solar-powered, the sensor represents a step change in capability, according to EnOcean, with its ability to provide monitoring and reporting across these five separate parameters.

“The device’s integrated solar cell means it can generate all the energy it needs to operate - both for measurement and for data communication – and that energy is



“Growth in spend across various applications will accelerate as the number of sensors and applications grow.”

John Corbett

SYSTEM DESIGN **SELF POWERED MULTISENSOR**

gathered and then stored internally to ensure that the sensor will function even when there is little or no light,” says Corbett.

Being self-powered the sensor can be used far more flexibly in various settings and because it comes in two formats – finished, or as a module – it’s easy to add to an existing building or a new structure.

The multisensor is available both for the EnOcean wireless standard and for Bluetooth systems, which makes it suitable for a variety of applications in the IoT and in digitised buildings, according to Corbett.

“For the first time, we have transferred the original PTM form factor of our proven PTM switch module to sensors, so the multisensor module fits into all common switch frames.

“As a result manufacturers of existing switch solutions based on the PTM module only need to develop new front panels adapted to the respective frame design – and if you’re only looking at limited numbers it’s quite possible to 3D print a tailored design.”

Because of that flexibility the multisensor can be installed anywhere and can be integrated directly into a wide variety of assets.

“It makes it much easier to get access to the data that’s required,” explains Corbett, “as it can be located on a wall, ceiling, window, door, in furniture, or on active devices and objects such as air conditioners, medical equipment or vending machines.”

“The multisensor comes with an integrated NFC interface for easy configuration and commissioning,” Corbett explains. “All that’s needed is a computer with an NFC reader or an NFC-capable smartphone or tablet.”

The “EnOcean Tool” app serves as the configuration interface between the multisensor and a smartphone and can be used to determine product parameters, as well as integrating the multisensor into



existing systems.

When it comes to the use of NFC, EnOcean has also added an NFC interface and additional safety functions to its standard PTM switch module.

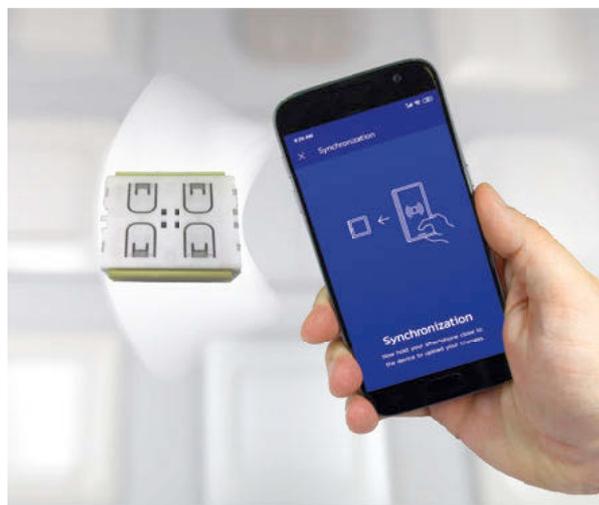
“This module has been installed worldwide and with an integrated NFC interface and state-of-the-art safety functions, it means that in addition to its traditional “press button” function, these battery-free switches can now be operated automatically with NFC readers, smartphones or tablets.”

It is now possible to apply individual settings and activate safety mechanisms, using the app.

“The module does not have to be removed from the switch housing, so even switches that are already installed can be configured with the app. The original PTM form factor has been retained, so that the new PTM module continues to fit into common switch designs to control

Above: The STM 550x combines the main sensors required for digitised buildings and the IoT

Below: The PTM 215 series now comes with NFC



lights or shutters in terms of building automation and the smart home.”

The PTM 215 switch module meets the latest EnOcean Alliance safety standards and provides additional setting options, allowing the devices to be integrated automatically into existing systems.

Using the “EnOcean Tool” app a security mode can also be activated which enables a project to be digitally documented and all relevant data for encryption can be stored in a project database.

“Commissioning via the NFC interface allows for clear product identification,” says Corbett.

An optional function, the product ID can be inscribed with all characteristics such as switch design and function, which means that the installer will know in advance whether the switch module has been preconfigured for single or double rocker switches. For remote commissioning, the app also receives all the necessary information via the NFC interface.

In addition, the rolling code is sent as a sequence code with each telegram, as is common with other protocols, which means that the initial teach-in telegram is no longer necessary.

A high level of data protection is guaranteed when exchanging data via NFC because the NFC device and reader must not be more than two centimetres apart.

The fact that the device keys for EnOcean radio communication via NFC can be changed, but not read, also contributes to increased data protection.

In addition, a de-synchronisation of transmitter and receiver is impossible because the rolling code, a continuously incrementing counter for concealment and authentication, is sent with each transmission.

In addition, the PTM switch module is 100 % backwards compatible with the functional modes of the previous generation of the PTM 210/215.

The explosive growth in Internet of Things (IoT) solutions and advanced Cloud-based applications require next-generation functionalities in “smart” systems such as Edge Computing, already migrating to AI at the Edge, and the increased demand for intelligent security in IoT devices.

This need for advanced computing is currently addressed with multicore devices.

As the cores embedded in a single chip increase, while many are heterogeneous there has been growth in the use of homogenous cores. Considered an optimal way to attain better performance per watt, application-specific heterogeneous solutions may not necessarily scale to another application, creating an opportunity for more scalable homogenous cores.

While a chip will be heterogeneous as a whole, a typical configuration is to have clusters of large general purpose, graphic, special-purpose accelerator cores, as well as multiple clusters of small homogeneous cores. There will also be a variety of memory sub-systems.

Each core may feature a core local memory, which can be accessed from other cores, forming a distributed shared memory, or each chip may host a multi-level cache and a globally shared memory (Figure 1).

The rise in the number of cores requires more software processing and the most popular approach to manage runtime software is to use an Operating System, and in this case, a manycore OS. For multicore processors, where the number of cores is usually up to four, either a Symmetric Multiprocessing (SMP) or Asymmetric Multiprocessing (AMP) model is used.

SMP does not have a fixed role determined for each CPU core and because it dynamically divides and executes between multiple cores, real-time capabilities cannot be fully guaranteed.

ADDRESSING MANYCORE ISSUES

Addressing IoT device development by using a semi-priority scheduling manycore RTOS. By Masaki Gondo and Rolland Dudemaine

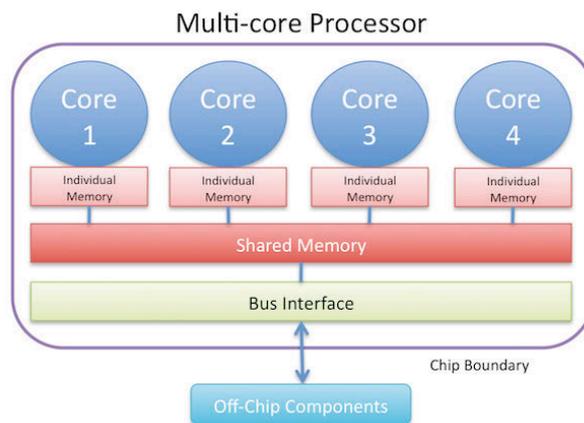
For its part, AMP is a function-distribution type software structure with a fixed role assigned to each core, so that each core processes separate programs. Its design cost - statically allocating all the threads to each core, dealing with core-to-core thread communication, device sharing, and service sharing - can be significant.

Some OS' attempt to solve this by blending AMP into SMP and the increasing number of cores calls for an SMP model manycore OS from the software system point of view.

Issues of using an SMP OS on a manycore processor include cache coherency, as quite a few do not offer hardware cache coherency. SMP requires hardware cache coherency and a globally shared memory.

Another challenge for a manycore OS is that of scheduling. Load-

Figure 1: A generic multi-core processor



balancing improves throughput, but degrades realtime capability from the inherent overhead of thread-migration and its unpredictability. The scheduling challenge must leverage the OS implementation architecture, as it significantly affects the design of the scheduler.

Scheduling

A manycore real-time scheduling policy, named semi-priority based scheduling (SPBS), addresses manycore processor issues such as cache coherency, memory sharing, and inter-core transport.

The application doesn't need to be aware of how many cores are there, nor on which core it runs. A true manycore real-time OS architecture sees a small micro-kernel resides on each core, creating a distributed-kernel system. The micro-kernel features message manager, core-local scheduler with basic task management, core-local interrupt manager, and core-local memory manager (Figure 2).

Core-transparent Kernel APIs present an SMP view to the application, providing portability and performance scalability over a flexible number of cores. OS services are implemented as server threads distributed over multiple cores. For services that require resources, the server is not only distributed, but also hierarchical, and any service request that cannot be fulfilled by a local server is promoted to a higher-level server. Threads and servers are named and managed by a Name Service.

A thread-based scheduler manages threads over all the cores within a scheduling cluster, while each kernel only schedules threads within its core. Clustering or core-grouping can be used to partition resources and server instances. Non-interrupt driven, fast inter-core communication primitives are available for use by the higher priority hard real-time threads, or for a set of threads that have a high

frequency of communication

Achieving real-time scheduling with high throughputs involves competing factors. Higher throughputs require load-balancing, affecting the real-time capability. However, prohibiting load-balancing to assure the real-time capability will lead to lower average throughputs. SPBS assures real-time scheduling of higher priority threads, while other lower-priority threads are load-balanced based on work performed (Figure 3).

eMCOS, a product developed by eSOL, features a scheduling algorithm - "Semi-priority-based Scheduling" - that ensure the real-time determinism that is important in many embedded systems, while achieving higher performance through load balancing.

In Semi-priority-based Scheduling, two types of schedulers work in parallel, high-priority thread group scheduling and lower-priority thread group scheduling, with a priority-aware workload balanced among available cores.

Task importance is expressed as thread priority, a dynamic property handled by load balancing. This scheduling in effect considers threads with longer execution times as heavier loads, if the thread priorities are the same. The first scheduler runs independently on each core, and uses a classic priority-based algorithm to select the thread to run. Because each kernel is running independently, scheduling and context-switching happens in an optimised way, comparable to a single-core system, and without need for inter-core synchronization.

The second scheduler distributes the load by periodically measuring the CPU usage of each thread, and executes thread groups with low priority using the remaining processor cores based on the threads' relative throughput and priority. When appropriate, this second scheduler can relocate low-priority threads to other, less busy cores, to optimise performance. High-priority threads

are left untouched, to maintain the system determinism.

Because cross-core thread migration and execution interruptions do not occur, developers can calculate the time each thread takes to complete processing within the required real-time boundaries.

A comparison using an eMCOS prototype shows that semi-priority-based scheduling significantly outperforms other scheduling methods in thread configurations with high variation between thread workloads.

The goal of semi-priority scheduling policy is to honour the thread priorities while maximizing the overall throughputs. N-highest threads mapped to different N cores do not suffer from thread migration, and are always the highest priority thread on the cores they are mapped to. The rest of the threads use priority-based scheduling for load-balancing, where higher priority threads are favoured over lower ones, giving more weight to thread priority than the number of threads per core.

The scheduling overhead can be quite significant and also non-deterministic as the number of threads increases. Therefore, with semi-priority-based scheduling, the thread scheduler approximates this

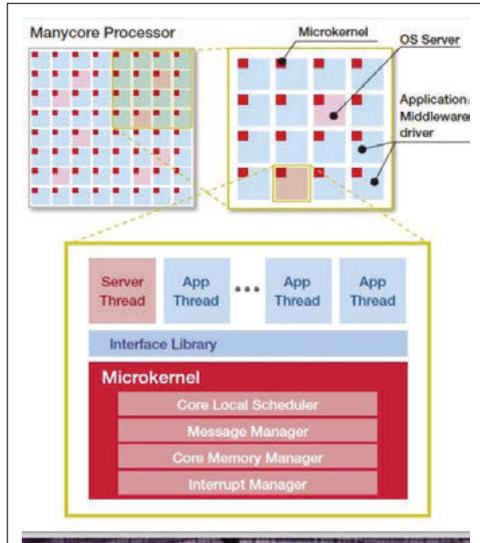


Figure 2: A distributed microkernel architecture

Author details:
Masaki Gondo is CTO and GM Technology and Rolland Dudemaine, VP Engineering, eSOL Europe

so that the scheduling cost is minimum and more deterministic. Data dependencies are currently not taken into account in the scheduling of threads. Therefore, it is necessary for applications to create strongly data-dependent threads in the same cluster, instead of distributing over multiple clusters.

The SPBS approach for a manycore real-time OS also uses thread-count levelling, where the number of threads per core is maintained to be the same, and sheer

random mapping, where each new thread is mapped randomly to a core.

Fully-preemptive fixed-priority based scheduling normally found in a commercial RTOS requires constant messaging among cores, resulting in significant messaging overhead and low performance.

Looking forward

A many core real-time OS, with semi-priority scheduling, performs effectively compared to other algorithms. The optimal value of the factor used to calculate a thread workload, currently the thread priority raised to the power of two, should be dependent on a particular set of thread properties. This includes thread priority distribution over different thread counts with thread execution time distribution, among others.

The amount of software executed on a manycore processor continues to grow, requiring some of the threads to be dynamically created or deleted. Processor power optimisation will certainly require dynamically-controlled power supplied to cores independently. This will introduce another parameter to the load-balancing independent from the throughput optimization.

Semi-priority scheduling can also address this, and other developing needs going forward.

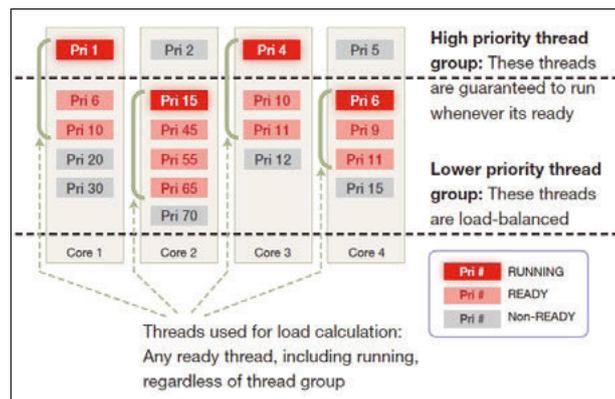


Figure 3: Semi-priority scheduling overview

Delivering support for care homes

How can technology be employed to support care homes and help address the devastating impact of Covid-19? By **Neil Tyler**



Well before the Covid-19 crisis the care home sector in the UK, as well as elsewhere in the world, had been approaching what many described as a 'perfect storm' caused by a combination of issues such as rising costs, increased demand and reduced funding.

In the UK, there are estimated to be over 21,000 nursing homes and residential care homes providing accommodation for upwards of 500,000 people.

How can technology be used in helping to make the sector more efficient and more sustainable?

There has certainly been growth in the deployment of digital and mobile health services, as well as in the development of telehealth, telecare, telemedicine and self-care services for

patients in need of long term care.

However, the uptake in technology – particularly in the UK – is many years behind its potential, partly due to a lack of awareness but more likely because of low levels of investment in the sector.

According to charities and the health authorities Covid-19 has devastated care homes across the UK, and official reports suggest that outbreaks of the virus have occurred in one in twelve care homes.

The health and care sectors have responded by using technology and technological advancement is accelerating. In fact, as a result of the virus and the need for social distancing, seeing a GP in the UK is now 99% virtual – for many, telemedicine has become the 'new

Above: The CareHome platform looks to bring greater independence to the elderly

normal'.

Within the NHS telemedicine has been implemented quickly and with efficiency and it's likely that the demand for both will remain high, even as the pandemic recedes.

Staff working in care homes, have had a key role to play in the response to Covid-19 and many have rapidly implemented new ways of thinking and of working.

Few homes in the UK use technology to deliver therapy or rehabilitation but a growing number are using telecare and environmental sensors such as fall alarms, or movement sensors. While few appear to use telemedicine a sizeable number have deployed some form of telehealth for self-reporting of health and wellbeing among residents.

So, by building on these trends could we be looking at a fundamental shift in how the care sector operates in the UK, with much greater use of technology?

Smart healthcare

The Essence Group is a global provider of IoT connected solutions for communication, security and healthcare and is seeing its technology being adopted across the world in support of the elderly.

Essence SmartCare, its healthcare subsidiary, is focused on allowing the elderly to live independently and it has developed a suite of products for monitoring people remotely.

"Our main market is the elderly who want to live independently in their own homes," explains Rafi Zauer, the Head of Marketing at Essence. "But in the past few years we have focussed on the care home market, where there is a very strong case for our technologies and communication products.

"The Covid-19 virus has accelerated this trend and we are looking at ways to apply our technology more effectively in this space."

Earlier this year the company announced that their technology was being deployed at a care facility in

Australia, in partnership with the care home provider Homestay.

The project looks to provide a 'robust response' to the challenges posed by Covid-19 and uses the Essence SmartCare platform, and its advanced monitoring technology, in conjunction with thermal cameras to detect virus symptoms.

"Our platform combines security and safety for those in care, but as a result of the pandemic it also provides effective support for care givers, by reducing the need for person to person contact and activity. Crucially it is being used to ensure that no new diseases are able to enter the care home," says Zauer.

The company's activity monitoring technology, which is at the heart of its platform, is based on the Cloud, AI and audio and is part of an integrated system that provides nurse call functionality and it uses thermal cameras to detect individuals with a high temperature.

"We want to be able to provide an improved level of safety in the care home environment by adding advanced layers of protection," Zauer explains.

Similar technology will soon be rolled out in the UK, after the company signed a deal with a leading UK provider of care homes.

In terms of fall detection, the use of panic devices or monitoring daily movement artificial intelligence is being used to provide activity pattern and behavioural analysis, in order to better predict things should they happen outside a regular pattern of behaviour.

"Privacy is at the heart of our platform and we don't actively promote the use of cameras. All of our analytics is done on the edge, and nothing is sent to the Cloud until it's authorised," explains Zauer, who says that a lot of data and intelligence is generated inside its platforms whether from multi-sensors, motion sensors, radar sensors and the like.

While cameras aren't part of the platform they can be part of a specific deployment. "It depends on the individual deployment and the needs of the care home, but if cameras are deployed they won't be transmitting to the Cloud or connected to the local Wi-Fi network – for example, thermal cameras will only be connected to the internal ecosystem."

Corona Hotels

Essence's technology has also had a more direct role in combating Covid-19 and was deployed in "Corona Hotels" that were set up in the Netherlands to help take the strain off ICU beds. In fact, the company's advanced remote-monitoring technology has been deployed across numerous care spaces to provide support.

"The crisis has demonstrated a need for quick and flexible deployments and the need to be able to integrate efficiently into various command and control services – our APIs need to be flexible," says Zauer.

A key part of its SmartCare offering is the Care@Home monitoring platform which uses radar technology to track the whereabouts of the elderly, and more importantly, provide immediate detection in case of falls.

"This multi-sensor fall detector uses a mmWave sensor developed by Texas Instruments and by using radar technology we can track the positioning of an individual and deliver accurate fall verification – so it's now possible to immediately alert healthcare providers if a person falls," explains Zauer. "This is a significant improvement on wearable devices



"Our platform combines security and safety for those in care, but also provides effective support for care givers, reducing the need for person to person contact."

Rafi Zauer

which tend not to be able to verify when a fall occurs. With this new device we can detect the individual is moving, how often and whether they have just fallen. But we can also monitor the movements of that person to build a pattern of daily life, so when anomalies happen they're easily identified."

Falls can have serious consequences, with almost 90% resulting in hospitalisation and many can go unnoticed for several hours. Research has found that 60% of people spend 12 hours on the floor and 50% of falls are not reported to a doctor at all.

In terms of deployment the sensors can be placed throughout a home/care home to enable extremely accurate activity monitoring.

The Care@Home platform can also be used to help combat Covid-19 by reducing the need for physical contact, while still allowing family members and professional care providers to monitor the elderly remotely 24/7. The platform keeps everyone safe, reduces the risk of infection, and takes pressure off essential services.

While digitalisation is set to transform the care home market, nothing will happen unless the necessary funding is in place, says Zauer.

"The challenge of deploying technology in care homes is the range of applications that you have to address, often it will have to be on a case by case basis.

"The impact of Covid-19 will mean that homes will now have to provide enhanced services and additional health and safety checks on visitors, anything that will help to reduce person to person interaction, especially during emergency situations."

Technology, according to Zauer, will not only be critical in providing improved levels of care, but will be essential should another crisis happen as we look to address this 'new reality'.

Below: The CareHome telecom services platform



Combating evolving security threats

What measures are being taken to secure complex automotive systems as threats continue to evolve? By **Nikola Velinov** and **Stephan Janouch**

Preventing miss-use and theft of vehicles has been on the agenda of car manufacturers for many years.

Today with the advent of the fully connected car these activities have reached the next level, as not only can a single vehicle be stolen, but ultimately an entire fleet of vehicles could be targeted by a sophisticated attacker.

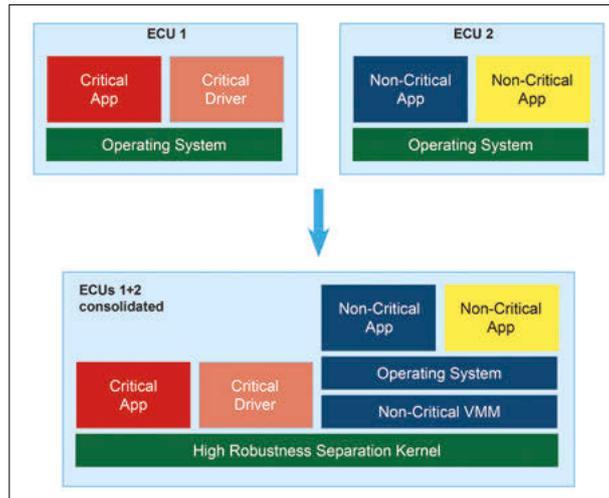
The following lists the various personas, and their motivation for attacking a connected vehicle

- **Car tuner:** their business is to remotely unlock specific features or improve performance
- **Black hat hacker:** perform publicly visible hack to gain community recognition
- **Competition:** use industrial espionage to gain competitive advantage (or close technical gap)
- **Terrorist:** use individual cars or a fleet for targeted terrorist attack.

To understand how potential adversaries could attack a connected vehicle it is critical to understand to whom or what such a vehicle is connected.

Of course, there are the obvious connections, like those to the driver or passengers via their mobile devices using Bluetooth or Wi-Fi, to GPS/GNSS/Galileo satellites, to the cloud using 3G, 4G or in the future 5G networks or to other instances as part of the C2X/V2X activities.

However, there are other ways a car can be connected to the environment. All vehicle sensors – radar, lidar, camera – provide information that will be used to perform specific actions. The decision-making process behind those actions can be influenced by



modifying the sensor data.

There are further connections which are only used periodically during the car's lifecycle, but still provide potentially dangerous attack surfaces, e.g. the connection to a tester whenever the car is brought in for maintenance or even the production equipment at the OEM plant where ECUs receive their final configuration.

When talking about all these potential attack surfaces it is worth taking a second to explain the fundamental difference between security and (functional) safety in this context as they are both closely related but yet completely different.

Safety's goal is to make sure that any system at any time will behave according to its requirements, which generally defines potential safety threats and how they are handled. To achieve the highest levels of safety, tools and methodologies like requirements tracing, design/code reviews, testing and verification and system redundancy are used.

Security on the other hand is going a step further: besides the goals of

safety, security also wants to make sure that at any time the system does not do anything it is not supposed to do. In addition to all the activities to guarantee safety, measures like security policy definition/enforcement, penetration testing or covert channel analysis need to be performed.

So, how to maintain security?

To maintain security in a system a few basic principles need to be followed:

Authentication: information can only be exchanged with trusted partners.

Encryption: information to be stored and transferred between trusted partners needs to be encrypted

Device Lifecycle Management: This ensures that the keys used to secure both the ECU and back office processes can be revoked and replaced in the case of compromise.

Separation: to minimise the number of devices or functions that need to be secured, secure separation should be utilized to separate secure and non-secure components

This list contains the basic principles to be applied for developing a secure system. However, it is important to mention that the concepts of security need to be applied from the start of the design phase and at every level in the system to ensure a robust device that can withstand an attack or recover quickly if it is overcome. This is known as 'security in depth'.

Software separation

Growing interdependencies between signals and functions inside a vehicle, as well as growing system

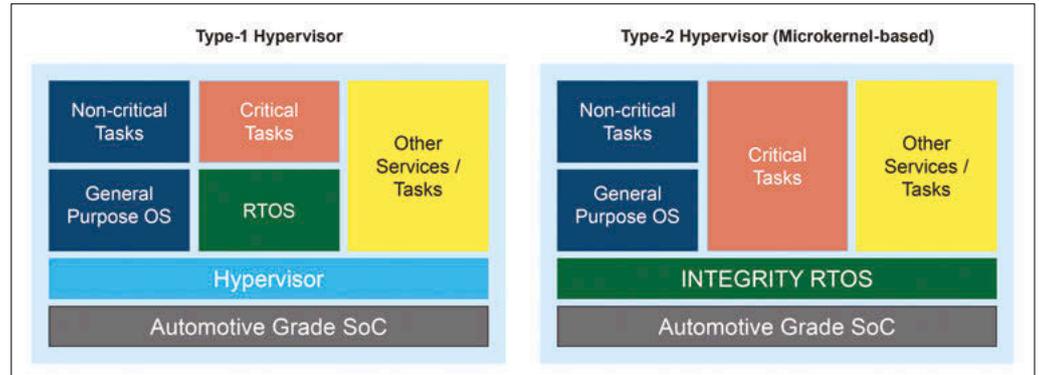
Figure 1:
Consolidation of ECUs is one of the means to tackle the rising complexity of automotive EE architectures

complexity, are driving the need to consolidate multiple functions or features on a single ECU (See Figure 1). Ensuring that secure and safety critical functions remain free from interference by non-critical/non-secure functions is one of the key aspects of embedded security.

Real-time operating systems like INTEGRITY enable this by providing safe and secure separation in time and space as part of its underlying microkernel architecture.

Communication channels between different address spaces only exist if defined and configured up-front, stopping an attacker forcing a connection from a vulnerable function to a critical one or sensitive data which is a common threat vector in other operating systems.

Besides this advantage for securing the software architecture, INTEGRITY's type-2 hypervisor approach brings



other benefits: as the separation kernel is already secure, providing full hypervisor functionality in a secure partition means less complexity and code than a typical type-1 hypervisor solution (Figure 2).

This means less context-switching and higher performance, less latency and better predictability. Also, potential harm in this software architecture is limited to the specific

Figure 2: A comparison of hypervisor architectures. Green Hill's INTEGRITY acts as a type-2 hypervisor allowing the highest levels of safety, security and performance

software partition it is running in.

Secure OS – why so important?

Looking at various attack vectors of recent attempts to penetrate systems they all end up at the operating system - often the last line of defence preventing an attacker taking control of or accessing secure information in the system.

The OS, while it should be able to defend against attacks coming in from various applications, not only controls the hardware resources of the system and the interfaces between software partitions, i.e. user spaces, it may also add – depending on the specific type or version of the OS – a significant number of vulnerabilities.

So, it is highly recommended to evaluate all the operating systems of choice not only regarding functionality but take a close look at security related certifications, like the common criteria security evaluation. For high-value assets suffering from significant risks, e.g. cars that pose a very high potential threat, it is recommended to use an OS with a rating of at least EAL6 (Evaluation Assurance Level).

Of course, making the right choice regarding a secure OS is only one aspect of security and does not solve all the security issues in a system – more effort and caution needs to be applied on all levels of a project. Neglecting the need for using a secure OS equals the building of a skyscraper without a proper concrete foundation.

It's not the question if, but when security would be breached.



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In-Vehicle Intrusion Detection and Prevention System (IDPS) on CAN

The CAN bus is the main data carrier in vehicles today. Each device can send or receive a message on the bus. There is no designated bus master and each device may initiate transmission, which is subject to arbitration. Since the number of ECUs in vehicles has grown significantly and the criticality of the different devices has widely diverged, vehicle network architectures separate the different ECUs on different CAN buses which in many cases are connected via a gateway.

For hackers the CAN bus provides an attack surface that enables them to completely take control over a vehicle. After getting access to the gateway, malicious messages can be injected on practically any CAN bus segment – even to critical ECUs like engine controllers, brake controllers, etc.

To prevent a security violation through a malicious message the Israeli cybersecurity provider, Arilou (part of the NNG group) has developed an in-vehicle intrusion detection and prevention system (IDPS). It enables any ECU to distinguish between legitimate and malicious frames by providing a security agent. The agent compares messages with a model of the OEM-specified CAN traffic on a given CAN bus segment and filters out unwanted messages on the lowest layers of ECU software before they can be processed in the targeted ECU. With such a solution, CAN bus security is moved to the lowest layers of the ECU software. In addition, the agent can provide security audits of other components in the vehicle, which can then be used to remove the vulnerability and update the ECU. This can be done via an OTA service (over-the-air update), where the software of any ECU, from which the malicious messages originate, is updated by the OEM to patch the security issue.

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Buy cheap, buy twice

Vehicle connectivity is driving demand for EMI shields with high IP ratings, as **Tim Kearvell** explains

An inherent part of the digital age, the emergence and development of the 'connected' or 'smart' vehicle is gaining ground around the globe, both in the commercial and military arenas.

However, the digitalisation of vehicle functionality brings with it the need not only for ever more sophisticated electronic and software systems, all of which need protecting, not just from electromagnetic interference (EMI), but also from environmental elements such as dust, dirt and water. Having a suitable IP (Ingress Protection) rating, which indicates the resistance of a product to such hazards, is becoming an increasingly important characteristic of the latest EMI shielding gaskets and seals and EMI sealed enclosures often have to meet a variety of environmental requirements as part of their application.

The trick for designers of

vehicle assemblies and systems is to consider these needs at the conceptual stage of a project, rather than the common industry scenario of giving it a cursory thought towards the end.

By working from the beginning with a specialist in EMI shielding technology will pay significant dividends as materials can be developed purposely for the application.

Below: EMI shields with high IP ratings



Contrast this to specifying a budget solution at the last minute, and the levels of compromise (and cost) will be plain to see.

As an old adage goes: 'buy cheap, buy twice'.

A considered approach

By taking a considered approach to gaskets, the brand of a vehicle manufacturer can be protected. After all, customers quickly become disgruntled when faced with failures due to poorly designed systems.

Military vehicles are also becoming more aware of the need for gaskets and seals able to provide both electrical and environmental protection. Today, more than 20% of vehicle designers (commercial and military) who have approached Parker Chomerics for an EMC (electromagnetic compatibility) solution, also require a suitable IP rating, and this percentage is growing year-on-year.

With such a marked customer-

driven trend, it is important to specify the optimum IP rating for an EMI shield. However, the rating depends very much on where the EMI shield will be located on the vehicle, and to what threats it will be exposed.

Typical vehicle applications range from automotive control boxes through to a host of requirements in the engine and undercarriage, with the latter proving particularly demanding from an environmental perspective.

At Parker Chomerics, we are finding that among the common IP ratings increasingly requested for vehicle applications include IP65, IP66, IP67 and IP69.

The first numeral of an IP rating, in this case '6', indicates full protection against dust and other particulates even with a vacuum inside the enclosure. In short, the unit is deemed to be dust tight.

The second numeral is the differentiator in applications of this type. For example, if the second number is '5', it means the product is protected against low-pressure jets of water from any angle. Here, solutions such as CHO-SEAL Co-Extruded gasket profiles LD55 and LH10, when used as elastomer gaskets in a groove, have proved themselves to be suitable. Stepping up to an IP rating with a second numeral of '6' means protection is assured against more powerful jets of water – as issued by a 12.5mm diameter nozzle, rather than 6.3mm for IP65.

A second numeral of '7' equates to protection against temporary immersion for up to 30 minutes at depths between 15 and 100cm. Again, a CHO-SEAL Co-Extruded gasket in a groove provides a very good all-round solution to this requirement. Some stipulations here include making sure the EMI gasket is of sufficient size, and that the surface finish of the enclosure is good enough to create an effective seal.



Left: A co-strip

As an aside, the '8' rating is not applicable in vehicle applications as it relates to protection against continuous immersion.

So, what of IP69? Well, the '9' equates to protection against both high-pressure and high-temperature jets of water, while an IP69K rating adds resistance to wash-down and steam-cleaning procedures.

In an application such as a car door, the door itself will of course deflect most of the water pressure encountered during road use, with the rubber seal being secondary (jets of water will not come into direct contact with the gasket). However, this fact does not mean the seal is of secondary consideration.

Elastomer gaskets with deflection characteristics, along with appropriate mechanical design factors, are recommended for IP69 and IP69K requirements.

Cost effective

For all applications where a cost-effective solution is required, a well sized – preferably 3mm rather than 1mm – solid O-section that is paired correctly (galvanically) would deliver protection against both EMI and water. In fact, trying to maintain a rating such as IP69 with a 1mm flange width would be exceptionally difficult.

The galvanically treated aspect is vital in applications where the gasket

might be in contact with a component such as a military vehicle hatch, as conductivity factors come into play. Compatibility between metals must be ensured.

Aside from dust and water, there are many other threats to be considered when specifying a suitable shield/seal. For instance, in undercarriage applications, extreme temperature requirements can be experienced in certain countries, particularly in the height of winter or summer. Heavy rain or flooding events are also increasingly commonplace, while coastal locations mean that vehicles could be subject to salt spray. In addition, fire retardant and chemical resistant products are required in specific circumstances.

There is of course a solution at hand for all applications, no matter how challenging: work closely with a specialist experienced in solutions for both EMI and environmental protection.

At Parker Chomerics, for example, materials are subject to comprehensive internal spray and immersion tests that are application-specific, in line with customer requirements.

Using an expert resource will identify what EMI materials and sizes are best suited to the task in hand, taking the guesswork out of the gasket/seal selection process. And although the growing connected vehicle and electric car markets are currently driving up demand for IP-rated EMI shields, even standard vehicles need to be protected environmentally and electrically.

Ultimately, the principal aim is to shift the current mindset on gasket requirements from an afterthought to that of a forethought.

Leaving it late, in the design cycle, means that customers could end up with gaskets that are not sufficiently robust. After all, what price can be put on customer satisfaction and brand reputation?



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i.MX8 SoM from Direct Insight delivers excellent performance in production-friendly package

Solder-down QS8M increases miniaturization, thermal efficiency and EMI performance



Direct Insight, the UK-based, technical systems integrator and reseller of system-on-module (SoM) and other embedded systems, has launched the QS8M Solder-down module, manufactured by their long-standing partner, Aachen-based Ka-Ro Electronics with NXP i.MX8M quad- or dual-core Cortex-A53 64-bit processor, plus RAM, Flash memory and power management. The module features a QFN-style pin-out with 100 edge-located pads on a 1mm pitch providing excellent miniaturization, thermal efficiency and EMI performance.

As well as optimising size and cost, QS modules expedite production in a number of ways. Contact pads around the edge aid inspection and enable easy routing, even permitting a two-layer baseboard including a base plane. A special ground-plane layout means that the modules effectively "float" into position during reflow, unlike a BGA which sits on its bumps, and may require X-Ray inspection. Furthermore, measuring just 27mm x 27mm, they are small enough to avoid warping which can adversely affect larger packages.

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New Lattice mVision Solutions Stack Accelerates Low Power Embedded Vision Development

Lattice Extends its Leadership in Delivering Complete, Easy-to-Use Solutions Stacks



Lattice Semiconductor Corporation (NASDAQ: LSCC), the low power programmable leader, today extended its position as a global provider of FPGA-based embedded vision solutions with the introduction of the Lattice mVision™ solutions stack. The complete solutions stack includes the modular hardware development boards, design software, embedded vision IP portfolio, and reference designs and demos needed to implement sensor bridging, sensor aggregation, and image processing applications. The Lattice mVision solutions stack accelerates and simplifies the implementation of embedded vision systems such as machine vision, ADAS, drones and AR/VR for the industrial, automotive, consumer, smart home, and medical markets.

Industry analyst firm Grand View Research forecasts the global machine vision market will reach over \$18 billion by 2025.

The Edge AI and Vision Alliance is committed to fostering the adoption of embedded vision in new products.

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New PCB-mount current transducer from Danisense features high stability and accuracy

Compact and lightweight – suits 1U PSUs



Danisense, the leader in high-accuracy current transducers for demanding applications, has launched its ultra-stable, high-precision DP series of PCB-mount current transducers for isolated DC and AC current measurement up to 72A. With a footprint of 64.9 x 60mm, a height of 32mm and light weight of 250g, this compact device is suitable for 1U power supplies and other space-constrained applications.

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Nexperia launches P-channel MOSFETs in robust, space-saving LFPAK56 package

AEC-Q101-qualified for automotive applications



Nexperia, the expert in essential semiconductors, has launched industry's first family of P-channel MOSFETs in the robust, space-saving LFPAK56 (Power-S08) package. AEC-Q101 qualified for automotive applications, the new devices are an ideal replacement for DPAK MOSFETs, offering a reduction in footprint of over 50% whilst maintaining high performance levels. The new products are available in 30 V–60 V, with RDS(on) down to 10 mΩ (30 V)

The LFPAK package, featuring a copper-clip structure, was pioneered by Nexperia and has been used in demanding applications such as automotive for almost 20 years. It is proven to be significantly more reliable than is required by the AEC standard, exceeding key reliability test by 2x, whilst increasing board level reliability due to the unique package construction. Previously, only N-channel devices have been available in LFPAK packaging. Now, due to industry demand, Nexperia has extended its LFPAK56 portfolio to also include P-channel options.

Maite Struck, Nexperia's product manager commented: "The new P-channel MOSFETs target automotive applications such as reverse polarity protection and as a high side switch for seat adjustment, sun roof and window operation."

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OMC's FDE851HLBF infra-red fibre optic emitter optimises long-term reliability in challenging environments

OMC's new hermetically-sealed FDE851HLBF infra-red fibre optic emitter optimises long-term reliability in challenging environments



Specialist 850nm device delivers signal integrity with high intensity beam

OMC, the pioneer in optoelectronics design & manufacture, has released a hermetically-sealed 850nm fibre optic transmitter diode which delivers a high intensity output for coupling into multimode fibres even in challenging environments. Designed for applications where long term reliability is paramount, this device is highly specialised with very few similar products available on the market globally. It suits a wide range of fibre optic applications including datacomms, sensing, encoding, instrumentation and signalling, ensuring speed and integrity of signal over a long operating life.

The FDE851HLBF 850nm emitter features a hermetically-sealed TO-can body with glass optical window that helps protect the device internals from atmospheric conditions.

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Power Integrations' GaN Technology Increases Output Power of High-Efficiency Display PSUs to 75 W



Higher-power TVs, monitors and appliances benefit from 91% efficiency, reduced BOM, elimination of heatsinks, smaller size, lower weight

Power Integrations (Nasdaq: POWI), the leader in high-voltage integrated circuits for energy-efficient power conversion, today announced that its InnoSwitch™ 3-MX isolated switcher IC family has been expanded with the addition of three new PowiGaN™ devices. As part of a chipset with Power Integrations' InnoMux™ controller ICs, the new switcher ICs now support display and appliance power supply applications with a continuous output power of up to 75 W without a heatsink.

The InnoMux chipset employs a unique single-stage power architecture that reduces losses in display applications by 50% when compared to conventional designs, increasing overall efficiency to 91% in constant-voltage and constant-current LED backlight driver designs. Additionally, by eliminating the need for post regulation (i.e. buck and boost) stages, TV and monitor designers can halve component count, improving reliability and reducing manufacturing cost.

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Space-saving DMM Micro D Mix Connectors from Nicomatic available on short lead times

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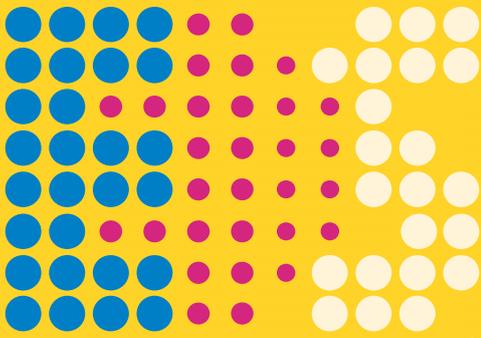


The DMM Series from Nicomatic, the leading manufacturer of high performance interconnect systems, is a highly modular AS/EN9100 aerospace quality miniature connector series, combining a wide choice of signal, power and coax contacts into a 2mm pitch ruggedized form factor. This highly reliable, space-and-weight saving series is MIL-DTL-83513G compliant and offers electromagnetic and mechanical protection for mission-critical, harsh environment aerospace, defence & security, telecoms and energy applications among others.

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