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COMMENT
While the UK’s Brexit science position paper calls for continued co-operation with the EU, worries mount over a ‘brain drain’

NEWS
Movandi announces RF front end intended to help speed up the development of 5G networks

A thermal far infrared (FIR) sensing solution is set to accelerate the roll out of fully autonomous driving

Ricardo and Roke Manor team up to deliver cyber security for autonomous vehicles

The shortlist is announced for this year’s British Engineering Excellence Awards

INTERVIEW
Connecting with the future
The deployment of products designed for the Internet of Things is booming, but software is bringing a set of fresh challenges for developers, as Canonical’s Mike Bell tells Neil Tyler

COVER STORY
The glue in the middle
After five years, the UK Electronic Skills Foundation is beginning to see the fruits of its efforts to better align the needs of students, school, universities and business

M2M
New challenges, new solutions
With the M2M giving way to the IoT, OEMs must address a much broader range of issues as they look to design, deploy and manage a range of new platforms

INTERNET OF THINGS
Meeting the PCB design challenge
While the Internet of Things presents engineers working on PCB designs with a number of difficult challenges, a range of solutions is available to them

DIGITAL DESIGN
Optical zooms in on Big Data
Data rates are climbing, fuelled by data centres and the use of social media. Photonics is set to play an increasingly important role in helping digital designers to create solutions

MICROS
Core competence
As applications become more complex and the need for more connectivity grows, Cortex-M4 based MCUs are meeting today’s power and performance requirements

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Last week the UK government published its Brexit science position paper in which it said that it wanted to “build a new, deep and special partnership with the European Union.”

According to the paper, European collaboration is particularly important for science as, “All EU member states benefit from these close relationships.” Science Minister Jo Johnson said: “It’s in our mutual benefit to maintain this successful partnership, and our desire is to have a full and open discussion with the EU to shape our joint future.”

Reports suggest that the government is prepared to pay upwards of £1 billion a year into European funded research bodies including the flagship €80bn Horizon 2020 programme but, as yet, no specific funding commitments have been made.

While Venki Ramakrishnan, president of the Royal Society, described the paper as “encouraging in both its tone and aspirations for an ambitious agreement,” he went on to say that it was, “a first step and much work needs to be done to work out the conditions that ensure our continued close collaboration with the EU”.

More work? For sure. The government’s various statements regarding Brexit appear incoherent and contradictory.

The EU’s Brexit negotiator Michel Barnier has said that one of the reasons for the impasse in the exit bill negotiations was Britain’s failure to commit to seven-year funding cycles for science or projects running potentially beyond 2020 and while the Secretary of State David Davies, who is leading the UK’s Brexit negotiations, talks about the government’s desire to attract the brightest minds to the UK, leaked Home Office proposals for immigration suggest otherwise, detailing significant curbs and raising the drawbridge on future immigration.

Sarah Main, executive director of the Campaign for Science and Engineering (CaSE), said of the proposals, that if the UK government was serious about science it was vital the UK remained open if it wanted to attract the talent it would require.

She warned that immigration is one of the top concerns of scientific businesses and universities and the leaked document had raised serious concerns in the sector that this would deter future recruitment and result in a brain drain of talent.

Scientists have warned that “science collaboration needs an immigration system to match”, but is the government listening?
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Move to speed up 5G network development

MOVANDI ANNOUNCES RF FRONT END INTENDED TO SPEED DEVELOPMENT OF 5G NETWORKS.
GRAHAM PITCHER REPORTS

In a move intended to speed the development of 5G networks, Movandi has announced a scalable RF front-end system solution called BeamX. According to the newly launched company, the performance of its RFIC, phased array antenna and beamforming techniques will enable 5G and multi-gigabit connectivity.

Maryam Rofougaran, Co-CEO and COO of Movandi, said: “We are looking to develop complete front end solutions for 5G; anything from the interface with broadband to antennas. Our mission is to develop core technology that can access gigabit data rates. We want to make 5G successful.”

The BeamX front-end integrates RF, antenna, beamforming and control algorithms into a modular solution. The configurable system supports different baseband/modern SoC solutions and can also be used with satellite networks.

“So far,” Rofougaran told New Electronics, “everything has worked and significant range improvements.

BeamX is a 64 element array designed to operate initially at 28GHz, but will support 39GHz in the near future. It combines RF technology designed in low-cost bulk CMOS with a high efficiency antenna. BeamX is said to achieve ‘breakthrough levels’ of performance and significant range improvements.

Boost to Li-ion battery performance

Researchers at the Okinawa Institute of Science and Technology have publish work exploring the use of silicon anodes in lithium-ion batteries.

The team has designed an anode featuring nanostructured layers of silicon. Said to resemble a multi-layered cake, the construction is claimed to retain the advantages of a silicon anode while preventing its physical collapse.

The problem is that while an atom of silicon is 3 times heavier than lithium, it is lighter than graphite. Researchers have made much of the high energy density of silicon, which is 3 times higher than graphite. However, they have found that the large volume changes of silicon during charge and discharge, lead to fracturing and structural collapse.

To address this, the team deposited alternate layers of unstructured silicon films and tantalum metal nanoparticle scaffolds. The result sees silicon sandwiched in a tantalum frame.

“We used cluster beam deposition,” said researcher Dr Marta Haro Remon. “Materials are deposited on the surface with great control and is a purely physical method.”

The work, led by Professor Mukhles Sowwan, is an anode with higher power, restrained swelling and excellent cyclability. The silicon anode has a porosity that allows lithium ions to travel at higher speeds, while silicon channels in the tantalum scaffold allows lithium ions to diffuse through the structure.

Pressure-based fingerprint sensor

Leti has announced that the European R&D project known as PiezoMAT has developed a pressure-based fingerprint sensor that enables resolution more than twice as high as currently required by the U.S. Federal Bureau of Investigation (FBI).

The project’s proof of concept demonstrates that a matrix of interconnected piezoelectric zinc-oxide (ZnO) nanowires grown on silicon can reconstruct the smallest features of human fingerprints at 1,000 dots per inch (DPI).

“The pressure-based fingerprint sensor derived from the integration of piezo-electric ZnO nanowires grown on silicon opens the path to ultra-high resolution fingerprint sensors, which will be able to reach resolution much higher than 1,000 DPI,” said Antoine Viana, Leti’s project manager. “This technology holds promise for significant improvement in both security and identification applications.”
FPGAs power deep learning platform

Microsoft is using Intel’s Stratix 10 FPGAs in Project Brainwave – its accelerated deep learning platform that is said to be capable of delivering ‘real-time artificial intelligence’. This, according to Microsoft, will allow cloud infrastructure to process and transmit data as fast as it comes in.

“We exploit the flexibility of Intel FPGAs to incorporate new innovations rapidly, while offering performance comparable to, or greater than, many ASIC-based deep learning process units,” said Doug Burger, distinguished engineer at Microsoft Research NEXT.

Microsoft notes that many silicon AI accelerators require multiple requests to be grouped (called ‘batching’) in order to achieve high performance. Using FPGA technology, Project Brainwave achieved a performance of more than 39Tflop/s on a single request.

Dan McNamara, general manager of Intel’s Programmable Solutions Group, noted: “Microsoft chose Stratix FPGAs for their added communication blocks on the chip, as well as synthesisable logic, to provide high performance in deep learning across many types of data.”

Ultra-wideband antenna range

Taoglas, a provider of IoT and M2M antenna products, has launched a range of small-form-factor ultra-wideband (UWB) antennas specifically designed to enable centimeter-level positioning and angle-of-arrival applications, including asset tracking, follow-me drones, healthcare monitoring, smart home services, and other applications requiring high-performance indoor localisation capabilities.

The antennas offer high efficiencies across a wide spectrum of frequency bands from 3GHz to 10GHz.

UWB is a low-power digital wireless technology that offers significant increases in location precision and range while transmitting large amounts of digital data short distances across a wide spectrum of frequency bands. UWB’s low-power requirements offer increased battery life of sensors and tags, leading to reduction in overall operational costs.

Far infrared sensing solution

A THERMAL FAR INFRARED (FIR) SENSING SOLUTION IS SET TO ACCELERATE FULLY-AUTONOMOUS DRIVING. NEIL TYLER REPORTS

AdaSky, a start-up specialising in infrared technology, has announced what it describes as a breakthrough in sensor and computer vision algorithms, which will enable self-driving cars to see and understand the road in every weather and driving condition.

The company, which recently came out of stealth mode, has launched Viper, a Far Infrared (FIR) perception solution, that has been specifically designed for the automotive industry in order to deal with dynamic lighting conditions. It combines an FIR thermal camera with advanced computer vision algorithms to let autonomous vehicles see and understand the road and their surroundings in any conditions.

Viper passively collects FIR signals through detection of thermal energy radiated from objects; algorithms process the signals collected by the camera to provide accurate object detection and scene analysis, giving the vehicle the ability to precisely detect pedestrians at a few hundreds of meters, allowing more distance in which to react to driving decisions.

Viper generates a new layer of information, originated from a different band of the electromagnetic spectrum, significantly increasing performance for classification, identification, and detection of objects and of vehicle surroundings, both near and far range.

“The most basic need for an autonomous vehicle is to be able to see and interpret what is happening around it, regardless of road conditions. Existing sensors and cameras can’t meet this need on their own,” said AdaSky Founder, President and CEO, Avi Katz. “To address this, we turned to FIR technology. We adapted the technology for the automotive industry and have been able to create a solution that performs at its best in use cases where other sensors fail.”

‘Key’ 5G building blocks

Two building blocks launched by Belgian research centre imec are said to be key for future 5G applications. The first is a fast and compact successive approximation A/D converter for consumer electronics applications operating at frequencies of less than 6GHz. The other block is a 60GHz front-end with RF phase shifting and on-chip transmit-receive switching. This block is intended for use in 5G fixed wireless access and small cell backhaul applications.

Wim Van Thillo, imec’s programme director for perceptive systems, said: “These building blocks show state-of-the-art performance, excel in low-power operation and are low cost by leveraging scaled CMOS technologies.”

The A/D converter, pictured, which has a core area of 350 × 325µm, is fabricated using a 16nm CMOS process. Dynamic power consumption is said to be 3.6mW at 300Msamples/s, with a signal to noise and distortion ratio of 70.2dB at 204Msamples/s.

Meanwhile, the 60GHz RF front-end features eight way calibration-free beamforming to support a large number of antennas. This, says imec, makes it attractive for fixed wireless access and small cell backhaul applications. On-chip transmit-receive switching allows the antenna array to be shared. With an area of 9.6mm², the chip is targeted at a 28nm CMOS process. Power consumption is said to be 231mW in receive and 508mW in transmit mode.
RICARDO AND ROKE MANOR TEAM UP TO DELIVER CYBER SECURITY FOR CONNECTED AND AUTONOMOUS VEHICLES. GRAHAM PITCHER REPORTS

A partnership between Ricardo and Roke Manor Research is looking to develop solutions that will make autonomous and connected transport robust against cyber attack.

Roke’s managing director David Cole said: “A new approach to connected and autonomous vehicle (CAV) technology design and implementation is essential. From infotainment, maintenance and navigation, to vehicle to vehicle systems for fully autonomous driving – all provide a potential opportunity for malicious hacking attack.”

The companies are already partners in the UK 5Stars project which aims to develop a consumer rating framework for automotive cyber security. Under the terms of their latest partnership, Ricardo and Roke will contribute additional resources to develop joint product and service opportunities, building upon the synergies of their combined capabilities.

“I am pleased that we have been able to conclude this agreement with Roke Manor Research,” said Ricardo’s CEO Dave Shemmans. “Through this partnership, our two companies are jointly demonstrating a commitment to delivering world-class solutions that leverage future technology and innovation while also ensuring the highest standards of safety and cyber security.”

Cyber security is now seen as a fundamental requirement of CAV technology, with many new vehicles connected over the air. “The key is to design security into the product, right from the start,” Cole added. “Our partnership with Ricardo means that we can rapidly develop new tools, processes and assurance schemes which will allow consumers to have confidence in their new, smarter vehicles.”

Magnesium batteries offer greater storage capacity

Researchers at the University of Houston say they have developed a new design for the cathode in magnesium batteries. The move is said to increase storage capacity ‘drastically’.

“We are combining a nanostructured cathode and a new understanding of the magnesium electrolyte,” said associate professor Yan Yao. “That’s new.”

In the new approach, the battery stores energy by inserting magnesium monochloride into a host, such as titanium disulphide. By retaining the magnesium-chloride bond, said Yao, the cathode demonstrated much faster diffusion than traditional magnesium versions.

According to the team, the battery has a capacity of 400mAh/g, compared with 100mAh/g for earlier magnesium batteries. This compares with the 200mAh/g stored by commercial lithium ion batteries.

The new battery, however, operates at about 1V, while lithium batteries operate at 3 to 4V.

HGV platoons to be trialled

TRL is to lead an £8million trial of heavy vehicle platooning under real-world operational conditions. The trials, tailored to the requirements of UK roads, will look to understand issues such as fuel efficiency and reduced emissions and safety, as well as the commercial case for adoption.

Rob Wallis, TRL’s chief executive, said: “The UK has an unprecedented opportunity to lead the world in trialling connected vehicle platoons in a real-world environment. TRL and its partners have the practical and technical knowledge gained from previous projects to understand what is required to put a connected vehicle platoon on to UK roads safely. The team are now taking that expertise and applying it within live traffic operations.”

The consortium, which includes DAF Trucks, Ricardo and DHL, expects trials to take place in 2018, following driving simulations, driver training and test track trials. Once completed, the on-road trials will form part of DHL’s regular logistical operations.

Up to three HGVs will travel in convoy, with acceleration and braking controlled by the lead vehicle. All lorries in the platoon will have a driver ready to take control.

Acoustic waves to shrink antennas

Antennas that are up to 1000 times smaller than currently available could be enabled by research conducted at Northeastern University in the US.

“A lot of people have tried hard to reduce the size of antennas. This has been an open challenge for the whole society,” said Professor Nian Sun.

Traditional antennas are built to receive and transmit electromagnetic radiation, which has a relatively long wavelength. That means antennas must maintain a certain size to work efficiently.

Instead of designing antennas to work with electromagnetic radiation, Prof Sun’s team tailored the antennas to work with acoustic resonance. Because acoustic resonance waves have a wavelength some 10,000 times smaller than electromagnetic waves, this is said to enable an antenna to be created that’s orders of magnitude smaller than the most compact antennas currently available.

Importantly, since acoustic resonance and electromagnetic waves have the same frequency, acoustic antennas will work with wireless communication devices. And, according to the researchers, their antennas performed better than traditional kinds.

Apart from application in mobile phones and similar devices, Prof Sun’s team believes tiny antennas could lead to better injectible, implantable or ingestible medical devices.
More than 50 companies and individuals have reached the shortlist for this year’s British Engineering Excellence Awards, which includes two new categories – the Engineering Ambassador of the Year and the New Product of the Year (Aerospace).

Entrants into Aerospace category will be developing products or subsystems that have made a difference in the sector, preferably through a significant technical advance. Meanwhile, the Engineering Ambassador of the Year could be an individual or a company. In either case, the judges will be looking for innovative approaches to engaging with students and convincing them of the benefits of a career in engineering.

Since the British Engineering Excellence Awards were launched in 2009, the winning entries have ranged in size from chip designs to earth moving vehicles, with the Grand Prix – the best of the best – awarded to a kinetic energy recovery system, an engineer who designed a system to save water on a massive scale, a marine communications company and, in 2016 a young medical company developing imaging technology to improve outcomes for cancer patients. It demonstrates the breadth and vitality of the UK’s engineering and innovation capabilities. And every year the quality of entries improves.

We’ll be announcing the winners at the Awards Luncheon, taking place on Thursday 5 October at the Honourable Artillery Company’s base in the City of London.

For more on the British Engineering Excellence Awards, go to www.beeas.co.uk

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**Consultancy of the Year**
- Circuitworx
- Drive System Design
- GRM Consulting
- Integrated Technologies
- Penso Group
- Spacechips

**Design Engineer of the Year**
- Graham Rick
- Vernon Kerswell
- Dave Swan
- Louis Verdegem
- Jake Wallis

**Design Team of the Year**
- Extreme Fliers
- Jaguar Land Rover
- Kliklok ITC
- PRaVDA
- RackEye

**Engineering Ambassador of the Year**
- Designability
- Iulia Motic
- Rapid Electronics
- RS Components
- TDK-Lambda UK

**Materials Application of the Year**
- GRM Consulting: Hybrid engine sump
- Kinneir Dufort: Abbey Well water bottle
- Northumbria University: Metallic glass composites
- Penso: Composite lightweight door
- Plessey: Lucian LED

**New Product of the Year**
- **(Aerospace)**
  - Exclin: Vertex
  - Extreme Fliers
  - Micro Drone 3.0
  - Smiths: Artemis system
  - Spacechips: Next generation satellite receiver

- **(Electronic)**
  - Gas Sensing: SprintIR6S
  - Harwin: Gecko-SL connectors
  - Peratech: 3D multitouch matrix sensor
  - Plessey: Lucian LED
  - XJTAG: DFT Assistant

- **(Mechanical)**
  - Active Needle: High visibility biopsy needle
  - Aeristech: uCharger
  - Innovative Physics: Hot Spot Locater
  - Libralato: Rotary hybrid engine
  - Russell Finex: Sieve Station
  - TT Electronics: mag-Net wearable connector

**Small Company of the Year**
- Diamond Hard Surfaces
- Emblation
- Open Bionics
- Spacechips
- Synergie Environ

**Start up of the Year**
- Bristol Braille Technology
- CircuitWorx
- Libralato
- Open Bionics
- Spacechips

**Young Design Engineer of the Year**
- David Cullimore
- Sarah Dempsey
- Rob Hanson
- Liam Harrison
- Tom Kelley
- Sam Scargill
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Meeting IoT challenges

As software is becoming increasingly important, the IoT is bringing fresh challenges for developers. Mike Bell discusses some of them with Neil Tyler.

It’s fair to say that over the past 12 months the IoT and big data technologies have progressed significantly and we are seeing an analytical revolution.

Market analysts expect businesses, governments and consumers and the way they interact with the world to change dramatically and companies are forecast to spend upwards of $5billion on the IoT over the next five years.

For Mike Bell, executive vice president at Canonical Group, the company behind open source software platform Ubuntu, the opportunities going forward are enormous.

According to Bell, with embedded or cloud software being the only way to realistically deliver the services the IoT can bring, new business models are going to be required and these models will effectively turn hardware product into a ‘thing as a service’.

“We’re already seeing a massive shift in where value is derived and it is moving sharply towards software,” Bell suggests. “Software is an obvious and profitable route to take. Chipsets have dominated manufacturing costs when it comes to IoT devices and, with every generation, IoT hardware is getting faster, smaller and cheaper. In theory, this trend should bring with it potential reductions in the bill of materials that should see higher margins for hardware vendors.

“That, at least, was the theory, but the reality is very different,” he argues.

“The pressure of commoditisation that hardware manufacturers are confronted with means that without product differentiation, the downward pressure on price is stronger than the reducing cost of the bill of material. This leaves hardware vendors with little choice – they either have to choose more expensive custom components with a price premium and serve less price sensitive, niche markets, or they have to use commoditised components and try to differentiate.”

He believes that more and more IoT device manufacturers are choosing general-purpose single-board computers or SoCs. “As a result, what we’ll see,” he explains, “is the share of IoT revenues represented by hardware going into freefall.”

So, where can businesses look to differentiate and create revenue out of the opportunities coming from the IoT?

“It’s going to have to come from the monetisation of connected devices – by which I mean services. If businesses want to make money out of the IoT, they will have to create and then maintain value added services.”

Bell joined Canonical in 2016, having spent six years at Jaguar Land Rover (JLR) where he had held a number of senior roles including chief technology officer. Latterly, he was the company’s future infotainment and connected car director. In that role, he had responsibility for managing the company’s growing end-to-end connected car business.

“During the time I was with JLR, the car became an expensive IoT device,” Bell says, “and one requiring much greater connectivity, data integration and the deployment of hundreds of sensors. So much needs to be ‘knitted together’, with so many components and services, that I found it frustrating that the deployment of IoT technology wasn’t really being thought through from end-to-end.

“Canonical appealed because there’s more of a platform play in what it does.”

Founded 15 years ago, Canonical has been responsible for delivering the open source Ubuntu platform. “We work to ensure that Ubuntu is certified and can be used on PCs, servers and across cloud infrastructure,” Bell explains.

“The rise of the IoT brings with it data and opportunities to monetise that data and one thing we can be sure about is that unpredicted methods of monetisation are sure to emerge.”

Canonical’s approach to the IoT encourages the adoption of a single operating system and, crucially, one that can be upgradable over the air.

“The adoption of a single IoT operating system means that it will be easier to deliver future advances and new functionalities and our work has given rise to the Ubuntu Core, which uses the same kernel, libraries and system software as classic Ubuntu.”

According to Bell, Ubuntu Core has been ‘built for the IoT’. “It is a small, transactional version of the Ubuntu platform designed specifically for IoT devices and large container deployments.”

Ubuntu Core runs a new breed of super-secure, remotely upgradeable Linux app packages known as snaps. Bell says it’s intended for IoT players, from chipset vendors to device makers and system integrators. “Security should be a priority,” he suggests. “Make sure you think about security from day one. From my experience and understanding, the IoT has been running ahead of business needs and security, which has often been an afterthought, especially in the consumer space where it’s all about getting products to market, market share and volumes.”

According to Bell, Canonical is focused on delivering cloud services to support Ubuntu. “As we deploy with more device makers, gaps will be filled and opportunities opened up. Ubuntu Core has opened the platform to new users unfamiliar with Ubuntu.

“As Ubuntu is open source, it is managed by a community ecosystem and that has certainly helped to encourage greater adoption. Working via a community, we get a lot of feedback in terms of how to build out the open source component and to develop a future road map.”

To succeed in the IoT companies need to better understand the needs of customers. “Understanding potential customers and the market you want to enter is crucial; focus on the business case, and be cost conscious in terms of what you are doing,” he suggests.
Prior to joining Canonical, Bell spent six years at Jaguar Land Rover in a number of senior management positions including chief technology officer and future infotainment and connected car director.

Bell has more than 20 years of experience in business transformation, product and technology leadership roles across a variety of vertical markets such as utilities, oil and gas, public sector and healthcare.

Mike Bell
In July 2017, the UK Electronics Skills Foundation (UKESF) met with partner universities and companies to celebrate and look back on the five years since its first cohort of scholars graduated in 2012.

A charitable foundation that was set up in 2010 by NMI, Semta, the then Department for Business, Innovation and Skills (now the Department for Business, Energy and Industrial Strategy) and industry partners, UKESF has two main objectives: to support electronics undergraduates; and to reach out to schools to promote electronics.

While the electronics sector is growing strongly and contributes upwards of £100 billion to the UK economy, the demand for capable and employable graduates is continuing to significantly outstrip supply.

“We are an educational charity,” explains Stew Edmondson, UKESF’s CEO, “and we work collaboratively with major companies, leading universities and other organisations to try and tackle that skills shortage. “UKESF works to ensure that more schoolchildren are aware of electronics and the opportunities available to them and to help them to develop their interest through to university study. At university, we look to support undergraduates and prepare them for the workplace.”

Under the UKESF’s scholarship scheme, companies are able to mentor selected students providing a bursary, summer and annual placements, as well as full-time job opportunities.

The UKESF is also involved in organising a week-long training programme of skills development every summer in non-technical areas such as communication, project management and negotiation techniques to better understand the needs of business.

“Every year, I make the students do a presentation after their second week and one at the end of the 13 week placement and the progress I see is quite remarkable,” said Neil Raphael, head engineer at Leonardo MW.

Leonardo MW brings together AgustaWestland, Selex ES, DRS Technologies UK and Finmeccanica UK, with M standing for Marconi and W standing for Westland, recognising its heritage.

“These placements teach them communication and organisational skills, how to work in teams and how a business works,” he said.

As building a network of contacts, students contribute to real projects during their internships and try different roles to get a better understanding of the opportunities available to them in electronics.

Jonathan Bland, the first UKESF undergraduate to join Leonardo’s graduate scheme, was eager to have some practical experience before leaving university.

“It was through my first placement that I discovered that I enjoyed RF and microwave engineering so, when I went back to university, I chose related modules. It helped me decide what I wanted to do in the future,” Bland explained.

The scheme also benefits participating companies, who can profit from extra staffing while, more importantly, training students and helping to shape their skills and ideas, hopefully aligning them in the process to the needs of the business going forward.

“Through our previous experience of placements, we realised they are a great way to find the best people” Raphael added.

“The programme also helps to extend our reach into universities – such as Southampton or Surrey – that we’d not normally engage with.”

Ultimately, the aim is that students will continue to work for the company once they graduate. But Raphael agree
that, even if they don’t, contributing to the workforce pool means they’re more likely to get something back.

Edmondson says the scheme offers a cost effective and easy way to connect students with smaller companies that may not have the necessary resources.

The programme also requires students to commit to promoting electronics at schools.

“The scheme is a symbiotic relationship between the university and the company, with UKESF – and the student – being the glue in the middle,” suggested Raphael. “For example, microwave wasn’t taught at Jonathan’s university; we had to convince them to add it to the syllabus. It means that universities become more attuned to the needs of industry.”

“There’s a disconnect between the output of universities, student expectations and the expectation of the employer. I think our

scheme helps to narrow that,” said Edmondson.

Starting with five universities and six companies, the scholarship scheme now includes 18 universities and 40 companies – with Rolls-Royce set to join next year.

“In 2012, just eight scholars graduated; in 2017 there were almost 50,” said Edmondson.

Over the last five years, the scheme has supported almost 400 students, 80% of which are now said to be working in the electronics/technology sector, while 12% are currently studying for PhDs.

UKESF is looking to bring more companies into the scheme, including those in the automotive sector, such as JLR, who are increasingly in need of electronics graduates.

According to Warren East, Rolls-Royce’s CEO, while 50% of the company’s business is now dedicated to aero engines, it also deals in rail and marine technology – all of which are becoming more dependent on electronics.

Speaking at the event, East said: “If we are ever to build an electric aircraft, we have a number of issues to overcome – eliminate failures in electrical systems, reduce the weight of conductors, the cost of electric components and improve the energy density of batteries. Today, batteries are 35 times less effective than kerosene.

“We need a little magic to make the impossible possible. For that, we need to both encourage and nurture a new generation of brilliant engineers. That’s why we decided to join UKESF.”

Competing for talent

Indro Mukerjee, chair of the UKESF steering board, believes there is a risk that UK companies will become uncompetitive because they won’t have the necessary talent. He also believes there is a generational gap, with an older electronics workforce struggling to understand and adapt to new approaches to electronics design.

“The world has changed completely. Young people see electronics as the means – not the end – to save the planet, entertain themselves, communicate, be secure, help other people, cure diseases. It is why the Raspberry Pi was such a success; the idea comes first, the technology second.”

Edmondson has co-written a

A scholar’s journey

Josh Oldfield is a member of the UKESF Scholars Council, which was set up to give scholars a say in the shaping of the scheme and future UKESF activities. He first heard about UKESF when he attended an Engineering Development Trust (EDT) Headstart residential course at the University of Bristol.

“The course inspired me to study electronic engineering at university,” he said. Oldfield went on to study at the University of Southampton, where he applied for the UKESF scheme in its second year. He was offered a position with ARM working with a systems and software group verification team, then transferred the following summer to join a processor group implementation team, where he now works as a graduate engineer.

An enthusiastic mentor, Oldfield volunteered for the UKESF EDT Headstart course he attended in 2011, first as student mentor in 2014 and then as EDT Headstart Supervisor in 2015, as well as helping out at various career fairs.

His dedication and hard work saw him named UKESF Scholar of the Year award in 2015. ARM has since encouraged him to continue volunteering with the EDT in local Cambridge schools.
white paper with Steve Watts, head of electrical and electronics at Cardiff University, which proposes that equal prominence be given to electromagnetic forces as well as mechanical forces in the A-level mathematics curriculum.

“An overly heavy focus on mechanical forces explains why students have a bias towards studying mechanical engineering, rather than civil or electrical and electronic engineering, once they are at university,” explained Watts.

Making electronics a core part of the A-level mathematics curriculum will not only make it more visible, but could also encourage more female pupils to take up electronics as they represent 40% of mathematics A-level pupils as opposed to around 22% in physics.

According to UKESF, 69% of companies in the sector complain that a lack of suitable candidates is affecting recruitment and Cardiff University claims it is at only 50% capacity for E&E students.

Building on its experience, UKESF offers five tips to attracting more graduates. Firstly, they need to provide an (honest) profile focusing on the kinds of activities a new recruit would be involved in and how their career could progress with them. They then need to improve the working environment and consider offering additional perks. Companies also need to offer stimulating assignments to interns and to offer competitive compensation, such as professional qualifications and opportunities for progress and recognition. Finally, they need to use social media as well as attending networking events and recruitment fairs.

Pilot project
UKESF is also looking to increase its involvement in schools to promote electronics – focusing on A-level students although Edmondson warns, “We have to be careful that what we’re doing is relevant and has a positive impact.”

RF competition winner
The winner of the RF competition was Sheffield University undergraduate Mihnea Trifan who won £1000 for his project focusing on 5G and the next generation of wireless communications.

Trifan helped develop an antenna using frequency selective surfaces technology to directly modulate the signal and achieve QPSK modulations, which are said to be an enabler for the 5G.

“In this antenna, we managed to eliminate the mixer and the power amplifier because we did all the modulation and all the mixing of the signals on the antenna,” Trifan explained. “As it’s more integrated, we can replicate the antenna into big arrays – or a huge MIMO, which Nokia and other companies are looking to develop.”

Merv Haynes, UK head of electronics for Leonardo MW, claims RF is core to half of the company’s departments and that one third of UKESF companies are interested in RF. There is therefore a big market for RF skills, but the number of students studying these subjects at university is dropping.

“We’re shining a light on it, but we need universities to offer more courses,” said Edmondson. “For that to happen, we need to show them students are interested, as well as companies.”

In the meantime, Leonardo has decided to do things its way. “As an engineering manager, I spend my life trying to recruit experienced RF engineers and I can’t find them,” said Neil Raphael, lead engineer at Leonardo. “Instead, we’re doing something different – developing them internally.”

To that end UKESF, working with universities, runs summer schools targeting pupils who have already chosen to study A-level physics.

The University of Southampton has taken the concept further and developed a programme of residential taster courses for students at the end of which all those attending can apply for the university’s Zepler Scholarship, worth £1000.

As part of the university’s outreach programme it has also developed a ‘music mixer’ kit, which enables students to mix music from a variety of different sources.
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Today, it is a given that businesses are embracing the possibilities that the IoT can bring, whether that’s collecting data, using data analytics or developing and providing new services or improving existing ones.

While the IoT’s economic potential is huge, that value will only be realised if companies deploy and then manage IoT platforms and systems at scale throughout their life cycle.

“In the industrial space, terminology is changing and M2M has now been superseded by the IoT,” explains Sanjeev Datla, CTO at Lantronix, a provider of secure data access and management solutions. “While M2M was about connectivity, IoT means much smarter connectivity and staying engaged with the customer for longer. It means bringing together applications and requires OEMs to address new issues such as software complexity.

“OEMs are struggling to take data and make it useful. That is where the hardware, embedded software, the user experience, packaging, documentation and the warranty before a product was ready to be shipped.

Today, they also need to consider the development, deployment and operation of IoT solutions and be able to navigate the rapid evolution of technology. And they are under pressure to provide IoT devices with a single unified platform.

“Everything has changed,” Datla claims. “Industrial and commercial customers now expect their IoT products to run in the field for years. That means developers need to anticipate what these connected devices will require in the future and plan for the life cycle of the products – from initial product development, to integration with other systems and platforms, as well as deployment in the field at scale. They will also need to consider maintenance and upgrades, as well as eventually decommissioning.”

New challenges, new solutions

As M2M gives way to the IoT, OEMs must address a much broader range of issues as they look to deploy and manage new platforms. By Neil Tyler.

The IoT’s impact was highlighted in a recent report commissioned by Inmarsat, the mobile satellite company. It found the IoT is considered the number one priority for 92% of organisations and the study – conducted by Research Programme – also revealed that machine learning, robotics and 3D printing were seen as other key requirements for business.

The report – The Future of IoT in Enterprise 2017 – surveyed respondents from a range of industries and found that almost all (97%) were experiencing, or expecting to experience, significant benefits from the deployment of IoT technologies.

But, while the report found considerable optimism about what the IoT could deliver, there were concerns about a lack of necessary skills, particularly when it came to the deployment of IoT, as well as the ability to deliver smarter connectivity.

The majority of IoT products being built today are using connectivity technologies that have been around for more than 10 years. The top connectivity technology desired in microcontrollers by industrial IoT decision makers surveyed in 2016...
“OEMs are struggling to take data and make it useful. That is where the main challenge is today.”
Sanjeev Datla

interconnectivity of devices, teamed with a heightened cyber-security landscape and a short supply of relevant skills, brings an array of issues,” he said.

According to Datla: “OEMs have to consider new requirements such as security, scalability, hosting and manageability, which in the past were rare considerations for an ‘unconnected’ product.

“Few of our customers understand the complexity of deploying connected devices and services. They take it for granted; they use Wi-Fi every day and don’t understand the amount of work that is required to address different protocols and certifications (up to 80 in a smart building, for example). As a result, we are seeing customers struggling to control, manage and maintain their products.

“Developing modern web-scale software applications can be complex and require substantial investment in time, engineering and other resources,” Datla explains. “That complexity is a result of having to develop, operate and maintain software applications that are capable of providing a secure service to thousands of customers and to thousands of products.”

To be successful, OEMs will need to develop compatible application front-ends capable of working with web browsers and mobile devices that use different technologies and programming languages; they will need to build scalable, distributed application back-ends and databases using a different set of technologies and programming languages; they will need to configure and maintain the platforms that host these applications and build the complex software infrastructure for multi-tenancy, multi-user identity and access control such as user management, device management, device authentication, metering and billing as well as remote diagnostics.

Looking to address these challenges, Lantronix has launched a development platform called MACH 10, intended to help OEMs to deliver successful IoT solutions – establishing secure end-to-end connectivity and providing secure control, monitoring and maintenance of connected devices.

“MACH 10 is an application development and deployment platform intended to simplify the deployment of web-scale applications,” explains Datla. “It’s about helping OEMs deliver a configured product that is actually of use to the end customer.

“That is the challenge for companies. They may be able to produce hardware prototypes in six months and provide the firmware and software on one device, but they’re struggling to deliver software that can manage thousands of end user points.”

“By using APIs built on industry standard protocols, MACH10 allows OEMs to reduce the amount of time spent in developing IoT applications. We’re providing ready-to-use management applications that can be deployed immediately. MACH10 also provides a suite of microservices that allow OEMs to jumpstart IoT application development, while preserving any existing IoT software investments.

“Pre-tested, these software building blocks will enable OEMs to develop web-scale applications much faster and allow them to avoid building applications from scratch.”

According to Datla, platforms like the MACH10 will transform the way in which OEMs deliver and maintain new products and services and make it easier to meet the needs of different stakeholders, partners and customers throughout the product’s life cycle.

“Platforms are essential in managing IoT application development,” he concludes, “and will simplify the process by which OEMs deliver web-scale software applications dramatically. They will enable the full potential of the IoT to be realised.”
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Meeting the PCB design challenge

The Internet of Things presents engineers working on printed circuit board designs with a number of difficult technical challenges. By Mark Forbes.

Although the IoT is still in its early days, applications developers are already looking to put more electronics into smaller packages. Not only that, many products are being designed to fit into odd shapes or to fit into whatever space may be available in existing devices.

That’s one challenge; designers are also trying to anticipate the expansion of features within existing hardware, as well as making their products capable of being upgraded when new technology becomes available.

Given that costs must be kept low in most instances, expensive connectors and complete board swaps are not the way forward, so what should designers be thinking about when it comes to designing PCBs for IoT applications?

**Multiple boards**

Distributing the electronics among several PCBs is one solution to most of the challenges associated with IoT devices. From a mechanical perspective, multiple boards allow the electronics package to fit into ‘unconventional’ spaces. Products such as wearable devices, controls at manufacturing plants and safety and control devices deployed in a vehicle all may need to fit the available space. Figure 1 shows a typical IoT device with its electronics distributed over several boards, which are then folded together for final assembly.

In other applications, the electronics must fit into an existing package that may not have been designed to house additional components, so integrating them, as well as finding power, can be a challenge.

In this case, rigid-flex PCB components is a potential solution, with designs looking to fit multiple boards into unusual spaces.

In Figure 2, designers were challenged to add Bluetooth capability to a heart pump so that it could be connected to the Internet for remote monitoring. After searching for space to contain the circuitry, they found unused space in the connector. As a result, they designed small rigid boards connected by flex circuitry to make the necessary components fit, with a short flex segment fitting over the existing pins to tap into power.

While some applications will use multiple rigid boards in traditional ways, techniques such as 3D PCBs, mother/daughter boards and – soon – 3D printing techniques will be necessary to make designs fit into constrained spaces. Other applications will require a combination of rigid and flex.

One area that relies heavily on rigid-flex technology is wearable IoT devices, which must not only be small and lightweight, but also have to adapt to go and cope with the user’s movements. Designers can not only use flexible circuitry to conduct signals, but also to allow the entire package to flex while...
not breaking, shorting out or being uncomfortable to wear.

However, rigid-flex designs are challenging and their development can be assisted with 3D modelling, now found in many design tools. Being able to view multiple boards in place in the enclosure helps to eliminate problems such as clearance issues. Not only is 3D visualisation critical for ensuring that the finished PCB will fit into the package, but full-motion 3D simulation views also help the designer to clearly communicate the assembly to manufacturing. In the case of wearables, the 3D simulation has been used by designers to model movement exactly and how the rigid-flex circuitry flexes with that movement.

**Future expansion**
Product evolution is inevitable if designs are to offer better functionality and to take advantage of better technology. Building on experience, designers are now incorporating ways to allow products to be updated without rendering legacy versions obsolete.

Expansion is twofold: expanded features and functions, and expanded technology. *Features and functions:* Features and functions are often updated on products as new uses, apps and requirements appear. Increasingly, features and functions are added via software updates – and this is important for IoT devices, since many will be difficult to access.

It is already common for phones, tablets and similar devices to receive regular updates via the internet or mobile network. For IoT devices that operate wirelessly, updates that add features and functions will be applied via over the air (OTA) updates. This approach may require hardware security and additional PCB layout considerations to prevent hacking.

Adding some features or functions may require hardware updates. Here, designers must consider the possibility that a port or connector might be changed in the future and look to make that process as painless and quick as possible. Other techniques, such as leaving areas of the PCB unpopulated for future updates, have been used for some time.

**Technology Updates**

*In the future,* we are likely to become reliant upon many IoT devices and will expect them to evolve with technology and to be capable of being updated in a relatively convenient and inexpensive way.

The trivial solution – but also likely to be most expensive – would be to swap out the entire device. More palatable solutions would look at swapping out the updated components. To support this, designers must be more conscious of development trends and component manufacturers more conscious of easy-to-perform upgrades.

With multiple-board solutions, the technology more likely to be updated could be isolated to a particular board and that could be made more accessible. For example, the processor and memory could be considered most likely to be upgraded and confined to one board. Considering how and what might be upgraded in the future will become a more common PCB design issue.

**Many boards, little space**

The near future for IoT devices with respect to PCB design is clear: circuit complexity and speed will continue to increase, while the space available for the electronics diminishes. For most IoT devices, the solution is likely to include electronics distributed across multiple boards, often employing flex circuitry to make it all fit. Meanwhile, designer will need to take advantage of 3D visualisation tools in order to create imaginative solutions.

Fortunately, these tools and design methodologies are fast becoming part of the mainstream because, without them, IoT designs are likely to present insurmountable challenges.

**Author profile:**

Mark Forbes is director of marketing content for Altium.
MIPI Interface TFTs
Winstar have announced a new range of TFT LCDs with a MIPI Interface

The MIPI Display Serial Interface (MIPI DSISM) defines a high-speed serial interface between a host processor and a display module. The interface enables manufacturers to integrate displays to achieve high performance, low power, and low electromagnetic interference (EMI) while reducing pin count and maintaining compatibility across different vendors. Designers can use MIPI DSI to facilitate brilliant colour rendering for the most demanding imagery and video scenes and to support transmission of stereoscopic content. Sizes are 5 inch, 7 inch and 8 inch.
SHINING A LIGHT ON

ELECTRONICS DESIGN

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Earlier this year, HP Enterprise unveiled the architecture of its supercomputer The Machine project. It breaks up the classic design of computers, moving processors and memories into separate units, with photonics links to ferry data between them. HP is not alone in pursuing the idea; Facebook, Microsoft and Google are working on similar approaches as they see conventional computer designs running out of steam.

“The cloud drives disaggregated architectures that, in turn, drive enormous bandwidth demand. Things have been going well but we’re rapidly approaching a wall. We have to find a way to take off and skip that wall,” Urs Hölzle, Google’s senior vp of infrastructure, told delegates at this year’s OFC conference for optical communications.

While optical interconnect promises to consume less power per bit per second at high speed than electrical transceivers, the problem is that existing fibre technology and transceiver assembly technologies are too expensive.

Discussing a study on the future of photonics at the industry’s World Technology Mapping Forum (WTMF) earlier in 2017, Lightwave Logic’s CEO Michael Lebby said: “The metric of $1 per gigabit per second at 400Gbit/s comes up time and time again.”

Optical suppliers and data-centre operators are now looking to see what the IC industry can do to hit that target. “The push is for more automation and lower unit cost,” says Hölzle.

The idea of using IC technology is far from novel. For more than 20 years, companies have tried to exploit silicon’s abilities to pass light to build integrated photonic components. This was Bookham Technology’s strategy to build cheaper components for optical telecom equipment when it started in the 1990s.

José Pozo, director of technology with the European Photonics Industry Consortium, told WTMF attendees that momentum for integrated silicon-based photonics has grown quickly in the past couple of years. “Until 2016, there were very few companies involved with photonic integrated circuits. But this year at OFC, I think 70 to 80% of companies there were interested in photonic ICs.”

Silicon is an excellent material for handling light. The substrate is more or less transparent to the wavelengths used in optical communications and the ratio of dielectric constants between silicon and easily grown silicon dioxide makes it easy to get the kind of total internal reflection otherwise found in silica-based optical fibres. Passing a current through the silicon hinders the flow of photons. This can be used to make modulators and switches.

“We don’t have silicon lasers, but it can pretty much do everything else,” Lebby says.

Professor Lionel Kimerling of MIT believes a number of issues need to be addressed in making silicon photonics cost effective, such as how to make onboard connections and how to deal with problems that cause unwanted losses during transmission. “We need more rigidity for photonics than for electronics. And we need to get rid of fibre-attach. For onboard connections, it can’t be flyover fibre forever. We know that’s going to go away.”

Work at the UC Berkeley Wireless Research Center (BWRC) has looked at the tradeoffs for photonic inter-chip links and how dense wave-division multiplexing could be used to handle much higher bandwidths than are available with electrical interfaces. One of the continuing headaches is that, although photonics makes it easy to pass multiple high-speed signals down a single connection, which will make inter-chip routing easier, tradeoffs can lead to a near doubling in energy cost per bit for the wrong choice of per-wavelength datarate. The group identified two major energy costs other than the laser – serialisation and the tuning of waveguides.

Tuning is necessary because silicon’s interaction with light depends heavily on temperature. That calls for the use of heating circuits or, in the case of the BWRC work, actively controlled tuning rings working in concert with heaters that are smaller but have a lower operating range. The energy consumption of the ring tuners dominates the equation when many slower transceivers are combined. But at higher per-wavelength datarates, serialisation and the need to use higher-energy lasers to deal with modulation losses take over.

The need to define shapes such as rings accurately is leading to changes in design tools used for ICs that, traditionally have been optimised for rectilinear objects. That is changing as companies such as Cadence
and Mentor build support for curved objects into their tools and integrate tools from specialist photonics software companies.

Tom Daspit, product marketing manager for custom ICs at Mentor, points to the use of controlled leakage out of the waveguide rings in photonic switch fabrics as an example of the need for accurate curve control and why more advanced tools are needed for PICs. As part of its efforts, Mentor has implemented design-rule checks (DRC) for curved objects in its Calibre tool that account for the imperfections of lithography.

The involvement of integrated photonics from foundries is, so far, sparse. Michael Buehler-Garcia, Mentor’s director of marketing, says the main foundry with an interest in integrated photonics so far is GlobalFoundries. The issue for foundries is one of investment versus wafer sales. For the existing market for PICs in transceivers, the die area needed per device is tiny. “For the current generation of photonics, you get a bazillion die per wafer,” Buehler-Garcia says.

Where the market could begin to take off is with multichip packages with optical connections used between chips to save power compared to electrical interconnect or in specialist applications. “What’s driving this effort is people using the interposer in a 2.5D or 3D IC as the photonics chip. At that point, the volumes get interesting for the foundries,” Buehler-Garcia says.

Daspit adds: “You will see the first step being between two chips on an interposer and then followed by inter-chip communications. There are other interesting markets emerging for integrated photonics, such as LIDAR for self-driving and applications in medicine.”

In the short term, electrical interconnect is fighting back. At the end of 2016 Aquantia announced it was developing technology, with help from GlobalFoundries, to push 100Gbit/s across copper cables up to 3m in length between servers. CEO Philippe Delansey says optical suffers badly on cost for these types of links at the moment.

For individual servers and switches, high-end backplane maker Rogers is developing a PCB construction that will support 50Gbit/s serial interconnects. “This means networks will be able to handle much more internet traffic without the expense and risk of adopting optical backplanes,” Robert Daigle, CTO, said in a summer conference call.

But the integrated photonics market is most likely to be driven by the data centre, with the techniques developed spilling into other sectors. “Of all the next-generation things we are looking at, such as nanotubes, photonics is the closest we have seen to speeding up Moore’s Law. And we can use old process nodes to do it. You may only need 130nm. GlobalFoundries is using 65nm because that’s the oldest fab it has. But, to make sure you can print it to the quality required, you do need 40nm-accuracy DRC,” Buehler-Garcia says. “We need to be ready for it. But the big players have yet to weigh in.”
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Core competence

Cortex-M4 MCUs are meeting the performance and power requirements of modern applications. By Graham Pitcher.

It will probably be no surprise to discover that applications are becoming more complex, with connectivity just one of the drivers. And, as applications become more complex, the number of sensors grows, as does the need for more capable user interfaces. Meanwhile, algorithms need more processing power, wireless stacks mandate larger memories and power budgets are shrinking.

So how are MCU manufacturers coping with the growing list of demands? A number of leading companies have recently launched MCUs built around the ARM Cortex-M4 core.

Øivind Loe, senior strategic marketing manager with Silicon Laboratories, said: “If you look at the Cortex range, the M3 is general purpose and the M0+ is low cost, but the M4 is a more capable core in general.”

Anand Rangarajan, product marketing manager in Microchip’s 32bit MCU business unit, commented: “Something that sat around without the need to communicate now needs connectivity. When that happens, you need more flash and RAM, as well as graphics capability and perhaps the ability to support a touch interface. All this has to be offered at good power/performance and an attractive price.”

Silicon Labs has expanded its EFM32 Gecko portfolio with what it calls ‘industrial strength’ MCUs. It says the EFM32GG11 Giant Gecko MCU family offers the ‘most advanced’ feature set available in the low-power MCU market.

Loe noted that MCU development isn’t just about power. “It’s also about executing tasks efficiently. A simple program with a few clocks will run efficiently on an M0+ core. But if the workload is larger, the M4 core has some special instructions that can allow it to use less energy than the M0+ and more efficiently than some larger cores – and that’s crucial for a range of applications.”

Silicon Labs says GG11 Geckos offer up to 2Mbyte of flash and 512kbyte of RAM to accommodate more code and comms stacks, such as a 10/100 Ethernet MAC and a dual CAN interface. Looking to meet power budgets, the parts boast an active power consumption of 77μA/MHz, while drawing 1.6μA in deep sleep mode.

Microchip’s SAM D5x/E5x MCUs also take advantage of the Cortex-M4’s floating point unit (FPU) to increase system efficiency. Running at up to 120MHz, the D5x and E5x MCUs come with up to 1Mbyte of dual-panel flash and up to 256kbyte of SRAM.

Rangarajan noted: “We’ve listened to our customers, so we’ve included more connectivity in these MCUs. But it’s not just about adding memory, it’s also about more performance and the ability to provide more flexible peripherals, interfaces and connectivity options.”

He pointed out that the original SAM D MCUs – developed by Atmel prior to its acquisition by Microchip – were based on the Cortex-M0+. “But we’ve always wanted to take the product line to the next level of performance. This allows Microchip to address a broader range of consumer and industrial automation applications.”

Bucking the trend to a certain extent, both Silicon Labs and Microchip have limited the clock rate in their latest MCUs. Giant Geckos, for example, have a maximum clock of 72MHz. “These products are focused on energy efficiency,” Loe claimed. “If you build an MCU to run at 200MHz, for example, then each clock cycle will consume more energy than in an MCU running at 72MHz. A lot of MCUs will be used in battery powered apps, so we need to be energy efficient and to enable the CPU to sleep a lot.”

Rangarajan agreed that clock rate is not always the primary factor...
when it comes to developing MCU portfolios. “We hear our customers saying don’t give me faster clock rates, make sure the MCUs meet my requirements. An app that runs from a battery requires a power efficient MCU. If you want a fast MCU, then you have to make trade offs.”

In Loe’s views, MCU selection is all about the ability to perform certain tasks at a particular power efficiency. “That is always going to involve trade offs, but an M4 based MCU will generally be good for embedded applications with challenging energy consumption requirements.”

Both companies have adopted the concept of smart peripherals in their recent products. Loe explained: “Twenty years ago, most MCUs saw the CPU doing everything. That took a lot of CPU cycles, which meant you couldn’t do as much as you might have liked.

“Today, most apps will take advantage of DMA, which offloads the CPU. In turn, this allows the CPU to do more.”

Rangarajan said Microchip provides what he called ‘sleepwalking’ peripherals. “If there’s a requirement for them to do small numbers of transactions, this can be done without waking the CPU.”

In Silicon Labs’ case, Loe noted: “It’s all about when you have to wake up the M4 core. We’re trying to allow it to sleep for as much as possible. More than half of the peripherals in a Giant Gecko can run autonomously in deep sleep mode.”

With this approach, a Giant Gecko’s A/D converter can operate while the CPU is in deep sleep mode. “It can sample and use DMA to pull the data into RAM,” Loe continued.

How does an MCU developer differentiate their products from similar devices with an M4 core? Rangarajan pointed to the integration of a buck regulator. “This brings better power efficiency,” he claimed, “which means lower active power consumption; as little as 65µA/MHz. The parts also support flexible pin options.”

Loe highlighted a couple of aspects. “We have included a cyrotimer that runs in shut off; the lowest energy mode. It’s a simple timer that’s useful when you need the CPU to be asleep for minutes.

“And there’s the Peripheral Reflex System, which allows peripherals to talk. For example, the real time clock could tell the A/D converter to take a sample. It gives a level of determinism which you don’t get from a CPU.”

But as the world gets more connectivity, security grows in importance and both companies are keen to highlight their provision.

“We’re offering the best integrated security features,” Rangarajan contended. “SAM Dx/Ex MCUs have crypto hardware acceleration – symmetrical and asymmetrical – and public key encryption, amongst other features. It’s something Microchip has taken to heart and has made sure it’s all in the MCU.

“There’s also tamper detection based on the real time clock and an integrity check monitor, which is like cyclic redundancy check, but which runs at a higher level.”

Loe pointed to the security management unit (SMU) as an ‘upgrade’ to the memory protection unit (MPU) associated with the M4’s core. “While the MPU allows you to segment memory into eight regions, the SMU takes that further. The MPU is restricted to eight regions, so there is limited granularity. The SMU allows you to selectively say which pieces of code can access each peripheral.”

“All of this is important,” Rangarajan concluded, “as security will become standard in the next few years.”
An MSc in Engineering Management might be worth considering if you want to progress. By Graham Pitcher.

Engineering companies are becoming more complex as trade becomes more global, logistics grows in importance and technology becomes more advanced. All of this needs management, but for many in UK industry, the terms ‘engineering’ and ‘management’ are mutually exclusive. While engineers are good at engineering, they may not consider becoming a manager of something beyond their immediate department.

But, for those who want to, ‘climbing the greasy pole’ isn’t an easy task. So how can aspiring managers get the skills they need, apart from learning ‘on the job’? One way is to take a course in Engineering Management; something which is offered by a number of UK universities.

Anglia Ruskin University, for example, offers an MSc in Engineering Management at its Chelmsford campus. According to the University, technical competence alone is not enough for the successful management of engineering companies; wider professional skills are needed. No matter what your technical expertise, it contends, if you want to progress towards a managerial role, you should consider such an approach.

Dr Rajshree Hillstrom is the course leader. “It’s for those who want to climb the corporate ladder,” she said, “and while it’s aimed at those looking to manage companies or departments, the course will also be useful for those looking to gain project management skills.”

People management is one of the skills which Anglia Ruskin’s MSc hopes to impart to students. “Management of operations and production tend to be predictable compared to managing people,” Dr Hillstrom asserted. “Managers need to have ‘soft skills’ and those skills aren’t something which are learned during a first degree in pure engineering.”

Those soft skills will be needed when managers start having to interact with people from different departments and those with different career experiences. “They are needed when you might need to talk with the HR department or with those in purchasing,” Dr Hillstrom suggested. “Engineers might be thinking about designing and building a robust product, but the financial people might be thinking more about the bottom line. So, they need to be able...
to talk with each other and to take their overlapping skills into account.”

Beyond people management, Anglia Ruskin says its MSc in Engineering Management will develop a student’s practical skills and intellectual understanding in such areas such as finance control, operations management and basic contract law.

Another institution offering an MSc in Engineering Management is Brunel University London, which says its course allows students to understand how engineering organisations are managed internally and how they operate from a corporate perspective.

It claims that employers are not only looking for those with a strong understanding of technology, but also candidates who can understand business models, especially when it comes to the supply chain and corporate strategy. Like Anglia Ruskin, it welcomes established engineers who are faced with new areas of responsibility following promotion to management positions.

A spread of students
Dr Hillstrom said Anglia Ruskin’s course attracts a spread of students. “We have those who have just graduated, but also those with more than 20 years of experience. Having a mix of people brings an exchange of ideas. When it comes to project management, it’s good to have work experience, but not essential. And new graduates can get a flavour of what’s it’s like to be involved in ‘real’ projects.”

An MSc in Engineering Management is also offered by the University of Greenwich at its Chatham campus. It suggests the programme is a substitute for a Masters in Business Administration (MBA). The course, it believes, will support the progression of engineers of all disciplines to management roles in the private and public sectors, as well as promote the importance of entrepreneurship and intrapreneurship – said to be key skills for leadership and management of change – along with the core values of ethical enterprise in modern economies.

How does Anglia Ruskin’s course content compare with that of an MBA? “There’s an overlap,” Dr Hillstrom accepted, “particularly when it comes to financial management. But this course is aimed at engineers, so there’s a greater focus on cost management and we do look at environmental management issues in greater depth. Overall, I’d say that there’s a 40% overlap with an MBA.”

Neither is Anglia Ruskin’s MSc course static. “It’s been running for some years,” Dr Hillstrom noted, “and its content has continued to change over that time, based on what industry wants. Feedback from industry is important and we meet with companies at least once a year to determine what they are looking for.”

Brunel’s course, like many others, can be followed on a full time or part time basis. For full time study, the course combines lectures, tutorials and group/seminar work, with the final four months spent working on a dissertation. Part time students can take up to five years to complete the course, with no requirement to attend lectures. This means students can create their own schedule, but Brunel says they should plan to study for 12 hours a week.

Dr Hillstrom said most of Anglia Ruskin’s students are part time, attending the Chelmsford campus one day a week for lectures. “Amongst the things they learn is how to do structured research, which can then be applied in their project. This project could be something which their company needs and they can take advantage of the university’s resources.”

Whilst Anglia Ruskin’s course is fixed, Brunel’s students can select optional modules to complement core studies (see box).

All courses require some kind of project and these constitute a significant part of the credits awarded. At Anglia Ruskin, students will conduct a significant research project which may involve a literature review, data collection and analysis. The dissertation at Brunel is an in-depth study of a manufacturing problem or situation, requiring a high standard of investigation and presentation. Students are expected to analyse a ‘real’ problem involving a company or workplace. At Greenwich, students will be expected to demonstrate independent thinking consistent with the expected research content of a Masters level project.

So why do students sign up for an MSc in Engineering Management? “They do the course because they want to get on,” Dr Hillstrom concluded. “Industry is getting more and more competitive and, when they finish the course, students should have the theory and knowledge needed to take on a challenging future.”

**Brunel’s course content**

**Core modules**
- Logistics and global supply chain management
- Manufacturing systems design and economics
- Quality management and reliability
- Managing people and organisations
- Project management
- Systems modelling and simulation
- Dissertation

**Optional modules (choose two)**
- Advanced manufacturing measurement
- Sustainable design and manufacture
- Global manufacturing
- Robotics and manufacturing automation
- Financial management

**Dr Hillstrom**
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