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COMMENT
Is the market power of US tech giants threatening to stifle innovation due to their market power?

Electrocomponents unveils new business to focus on single board computing and the Internet of Things

Cadence has entered the system analysis and design market with the launch of its Clarity 3D solver

Trackwise ships a 26-metre multilayer flexible printed circuit for an unmanned aerial vehicle

With an evident lack of interest in counterfeit, the problem is getting worse, according to the Anti-Counterfeiting Forum

TOY TECH
One of the key drivers for the toy market, which is predicted to see massive global growth in the next four years, will be STEM. By Bethan Grylls

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Is the power of US tech giants such as Google, Amazon, Apple and Facebook threatening to stifle innovation, due to their market power?

According to a report from the International Monetary Fund it is.

The IMF has voiced the opinion that we should be very concerned about any further increase in the ‘clout’ of these already dominant firms.

The Fund makes the point that there is a need for stronger competition policy to ensure that established firms are unable to block the entry of potential rivals and has called for excess profits to be targeted by a tougher international tax regime.

The study was conducted for the IMF’s forthcoming World Economic Outlook (WEO) and found that over the past twenty years there had been a growing concentration of market power, among a smaller and smaller number of productive and innovative firms.

The IMF concedes that the impact of rising market power on innovation has so far been positive, but warned that the impact would become: “increasingly negative if the market power of high mark-up firms, in particular, were to continue to rise in the future.”

It’s certainly true that the leading technology companies have been buying up competitors as well as smaller, innovative businesses but, so far, any impact on consumers has been limited and in fact has been positive – with falling prices due to economies of scale.

However, the IMF does warn that this may not continue and that there is a possibility that successful firms seeking to block potential rivals, means that there is a very strong case for structural reforms to keep competition strong.

At a time when some politicians are calling for the big Silicon Valley platform firms to be broken up and a growing number of national governments questioning them over their approach to issues like privacy, fake news and tax isn’t greater competition, rather than stifling regulation or break-ups, more likely to benefit all those concerned – both companies and consumers alike?

Neil Tyler, Editor (neil.tyler@markallengroup.com)
New Global Technology Company

Electrocomponents launches OKdo

New Business will focus on Single Board Computing (SBC) and the Internet of Things (IoT). Neil Tyler reports

Electrocomponents has launched OKdo, a new global technology business, to focus on single board computing (SBC) and the Internet of Things (IoT). The business will look to provide end-to-end support for all SBC and IoT segments, spanning makers, entrepreneurs, industrial designers, educators and re-seller partners.

Under the banner ‘Design the World’, it will deliver a combination of hardware, software, development support and manufacturing services.

According to CEO, Lindsay Ruth: “It will bring SBC and IoT customers the latest products, solutions and ideas to inspire and enable them to create innovative technology.”

OKdo will build on existing relationships with SBC leaders including Arduino, BeagleBone and Raspberry Pi but will also include new partnerships with some influential technology companies, including Arm, NXP, Broadcom, Intel, and Seeed, plus rising tech start-ups.

The new global website (www.okdo.com) is now live in seven countries: the UK, France, Germany, Italy, Netherlands, US and Japan.

A projects portal will help makers connect and share ideas, while entrepreneurs and industrial designers will benefit from industry-leading support, including manufacturing, prototyping, and a free cloud-based IoT development platform.

Commenting Richard Curtin, OKdo’s SVP, Technology, said: “OKdo is a business built on partnerships. We’re working with some of the best technology companies to bring the latest products and innovations to more people around the world.”

Printed electronics gets a boost

The Danish Technological Institute (DTI) is to lead a new European innovation hub and has been awarded, through Horizon 2020, €10.6 million to develop an open innovation test bed (LEE-BED) to focus exclusively on printed electronics, a market valued at $32billion.

“Printed electronics opens up a whole world of new opportunities, as complex constructions can be embedded just like using 3D printing, at prices able to compete with mass-produced goods. Quite simply because electronics can be produced from CAD drawings and printed on flexible materials, as already used in architecture and 3D print,” said DTI’s Project Coordinator, Zachary James Davis.

“All the partners in LEE BED will provide their various skills and facilities within printed electronics to enterprises that want to integrate and embed electronics into their products,” said Davis.

Intel unveils new FPGA family

Intel has launched Agilex, a new family of field programmeable gate arrays (FPGAs) intended to provide customised solutions for the embedded, network and data-centre markets.

“The race to solve data-centric problems requires agile and flexible solutions which can move, store and process data efficiently. Agilex delivers customised connectivity and acceleration while delivering much needed improvements in performance and power for diverse workloads,” said Dan McNamara, Intel senior vice president, Programmable Solutions Group.

The Intel Agilex family combines FPGA fabric built on Intel’s 10nm process with heterogeneous 3D SiP technology that provides the capability to integrate analogue, memory, custom computing, custom I/O, and Intel eASIC device tiles into a single package.

The fabric has been designed to deliver a custom logic continuum with reusable IP across a migration path from FPGA to structured ASIC.

New capabilities include: Compute Express Link; 2nd Generation HyperFlex Architecture; PCIe Gen 5 and advanced memory support.
Cadence unveils Clarity 3D Solver

CADENCE ENTERS THE SYSTEM ANALYSIS AND DESIGN MARKET.
NEIL TYLER REPORTS

Cadence Design Systems has entered the system analysis and design market with the launch of the Clarity 3D Solver to tackle electromagnetic (EM) challenges encountered when designing complex 3D structures on chips, packages, PCBs, connectors and cables by bringing 3D analysis to the engineer.

The Solver reads design data from all standard chip, IC package and PCB implementation platforms while also providing integration benefits for design teams using the Cadence Allegro and Virtuoso platforms.

Highly complex structures need to be modelled accurately in 3D for structure optimisation and high-speed signalling compliance, both of which entail extensive research including complex extractions and simulations.

Legacy field solvers have been run on massive, high-performance servers but, according to Cadence, the use of a distributed multiprocessing technology means that the Solver is able to deliver virtually unlimited capacity and a 10X speed up to efficiently and effectively address larger and more complex structures. It creates highly accurate S-parameter models for use in signal integrity (SI), power integrity (PI) and EMC analysis, enabling simulation results that match lab measurements. The Solver’s smaller memory also means it can use cost-effective cloud and on-premises distributed computing.

**World’s longest multilayer FPC**

Trackwise has shipped a 26-metre long multilayer, flexible printed circuit (FPC), believed to be the world’s longest ever produced, for distributing power and control signals across the wings of a solar-powered, unmanned aerial vehicle (UAV).

The entire interconnect system (power and signal) of the vehicle is made of FPCs representing an estimated total systems weight saving of 60% over traditional wire harness. This will enable the UAV, which is being manufactured in the US, to achieve higher payload and/or improved speed and range.

The FPCs are manufactured using Improved Harness Technology (IHT), a patented, reel-to-reel manufacturing technique. Conventional FPCs are rarely more than two metres in length, primarily due to limitations of manufacturing processes. IHT overcomes these limitations, enabling FPCs of unlimited length to be produced.

The UAV’s flexible circuit is based on a polyimide substrate. The planar structure of the circuit dissipates heat better than conventional wiring, enabling higher current carrying capacity for a given weight of copper conductor. Printed manufacturing ensures circuit consistency, fewer connection points are needed so reliability is enhanced, and the FPC is easier to install than wire harnesses, reducing a vehicle’s assembly time and cost.

According to Trackwise CEO, Philip Johnston: “There are many new applications emerging for long, lightweight FPCs but aerospace is a natural fit: weight savings, high reliability and cost effectiveness are critical.”

**Cadence aims for tactical cloud usage**

Cadence Design Systems has set up a second cloud-based service in an attempt to entice users who want extra compute capacity to run tools with high runtime demands but who cannot easily incorporate cloud computing into their existing EDA environments.

Craig Johnson, vice president of cloud business development at Cadence said customers have looked at using cloud computing to run tools that need tens or even hundreds of processors to complete in a reasonable time but who have encountered problems with making the transition.

“What makes it challenging in our space is that EDA is extremely complex. Many have significant investments in their compute environment and the flow is often tightly coupled to their IT solution,” Johnson said.

Cadence’s answer is to have the remote tools access through a web browser. The emphasis is on tools that can be deployed tactically with minimal effect on the overall flow. Design files are copied to the cloud for processing and the results copied back so that they can be used an inputs for locally run jobs.

“The approach doesn’t require any IT involvement on the customer side: it’s 100 percent web-based,” Johnson said.

Although using web-based access reduces the IT overhead, the approach still calls for large files – often terabytes in sized – to be moved around quickly. To try to avoid bottlenecks caused by running transfers through one connection, the upload and download mechanism is akin to that of BitTorrent. The files are broken down into chunks, encrypted and then relayed using multiple machines on the client’s networks.

“If you try to move all that data around and you don’t have the right transfer technology, the compute capacity is no use to you,” Johnson said.

The launch of CloudBurst coincides with the launch of a tool that exemplifies the kind of workload that Cadence has in mind for the service. Clarity is a 3D field solver designed to spread the load of simulation across hundreds of nodes so that it can tackle the electrical interactions that affect high-speed connections through a large system, such as a rack-mounted server or a vehicle chassis.
“You need a disaster for people to care and nobody wants a disaster,” so said Ian Blackman, co-owner of the Anti-Counterfeiting Forum (ACF) speaking at the organisation’s annual event last month.

It was a brutally honest comment, and a viewpoint that many of the speakers shared at this year’s event.

“Things appear to have got worse,” he admitted, “but we don’t have a lot of evidence to support that. We do think, however, that standards are being applied better, so people are more aware. But people tend to ignore the problem.

“They see it as subset of obsolescence management,” he added. “Nearly 70 per cent of counterfeits are obsolete items so you can’t really divorce the two. I also believe that some people mistakenly think that they have a handle on the situation and don’t have to be proactive.”

Online sites are still an issue, with 64% of electrical fakes being bought via the Internet. Blackman highlighted smart methods that counterfeiters are using such as complex supply chains and non-branded goods. “It isn’t counterfeit until it’s marked,” he explained. “Also, digital currency platforms can be used to hide identity.”

Commenting on the impact of the Internet, Peter Marston of Rochester Electronics said, “We need to ensure that components are legitimate to avoid cyber-attacks,” and he pointed to the growth in autonomous vehicles, smart cities and smart homes and the threat counterfeiters posed. “Current testing methods are just not good enough,” he warned.

One possible solution was presented by start-up company, Quantum Base.

“We have developed quantum Q-IDs and electronic quantum EPUFs that use unique arrangements of atoms and imperfections in their nano structures to create 100% unclonable devices, which are simple, small and cheap,” David Howarth, head of engineering at Quantum Base explained.

“Simulation is not possible due to the inherent atomic randomness of quantum confinement and we can harbour secret identities on the nanoscale in devices that can then be incorporated into current microelectronic processes.

“This is a unique quantum signature and it provides the basis for our identification and cryptography functionality. We believe that these devices could provide the ultimate in provable security and all without the need for large scale computation, accompanying infrastructure or processing requirements.”

“People see counterfeit as a victimless crime, it isn’t. People haven’t died from a counterfeit handbag, but they could from faulty electronics,” said Helen Barnham from the Intellectual Property (IP) Office, who expressed the need for the industry to be proactive and actually report IP issues during her speech.

But Marston expressed doubts: “We have been trying to get authorities interested in electronics and counterfeit, but they aren’t concerned. They want to get hold of those items with the most value – fake consumer goods in large shipping containers are easier to track than the small parcels you’d find a counterfeit semiconductor in.”

Although Marston said Rochester Electronics was actively notifying the authorities of counterfeits, it seems that there has been a decline in the overall number of reports.

“In 2017 we saw a rise in semiconductor growth,” said Warren Shore, UK BDM of Converge, “yet counterfeit reports appear to have fallen.”

Although he did not have a definitive answer as to why, he reasoned that companies may be anxious about reporting counterfeits because any association with fake products could be damaging to the business and its brand.

Whether the answer lies in innovative manufacturing and security techniques, or a better relationship between industry and authorities, the jury remains undecided.

The only thing that’s certain is that counterfeiting is getting worse and as Blackman said, that is “everyone’s problem”.
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TECH TOYS

As STEM toys increase in popularity, Bethan Grylls looks at the key drivers in this market

When one considers the word ‘toy’, technology might not be the first thing to come to mind, but according to analysts, TechNavio, one of the key drivers for the toy market, which it predicts will see global growth of £1.15 billion between now and 2023, will be the adoption of STEM.

“Parents are always looking for products that can assist in the intellectual development of their children,” the report reads, “and this will further boost the demand for smart toys.”

A report from Juniper Research also revealed that as connected toys become more affordable, educational toys will find a place in the school curriculum. Osmo, for example, a system which enables an iPad or iPhone to merge physical play with digital real-time feedback, has been adopted in over 30,000 schools in 42 countries around the world.

Osmo games revolve around improving English, Maths, Art and Coding – and with coding now being part of the school curriculum, toys that can help develop not just students’ coding know-how but also teachers’, are increasing in popularity.

“Teachers’ skillsets aren’t at a point yet where they can pick up a robot and design a lesson around it. They need support,” said Binary Bots’ Head of Business Development Tim Hill.

Binary Bots’ resources and activities are all based around the UK curriculum, providing an accessible scheme of work for teachers. Its ‘Cardboard to Code’ kit is designed to deliver basic knowledge of inputs, outputs and how the code interacts with a real-life object.

The products were, in fact, developed around teacher and child feedback, according to Hill, and based on something he describes as ‘integrated and engaged learning’. Coding in school is usually screen-based, he noted, yet the enjoyment and benefits, i.e. retention, children reap when they can see the actual physical reactions of their work is a far more effective teaching technique.

“Approximately 70% of attention is lost with didactic teaching. If you introduce interactive learning, you’ll capture about 90% of the class’ attention.” He highlighted the Binary Bot ‘Flat Pack Robot’ set as a prime example of this ‘new’ learning style – a toy where the child builds the robot, adds the components, and then codes it in order to bring it to life.

To code the robots, the kits employ the BBC micro:bit, which has seen huge success, with 90% of users saying it showed them anyone can code, and 50% of teachers who used the technology reporting they now feel more confident teaching coding.

“We feel that coding and computational thinking are a key foundation skill for the 21st century,” remarked Gareth Stockdale, micro:bit Educational Foundation CEO, “and that physical computing as epitomised by the micro:bit is key to making those first steps easy and engaging.”

Hill added: “The micro:bit is a great kit which eases users into coding and offers a stepping-stone into the more complex levels – and that’s why we built our kit around it.”

“Teachers’ skill sets aren’t at a point where they can pick up a robot and design a lesson around it. They need support.”

Tim Hill

Below: Binary Bots’ flat-pack robot DIMM teaches children how to code. The kit includes a bbc:microbit, croc clips and a range of sensors.

Binary Bots is a typical example of why the tech and toy world has started to merge. Starting out in education, where the company solely sold kit to schools, Hill said it became evident that there was a consumer demand.

“Parents were asking where they could get these ‘toys’ from. They are starting to realise we are in the midst of a digital age.

“The kids are an ‘Alexa’ generation; everything is at our fingertips, and kids want to know how and why it all works. Our company saw a demand and extended its offering into the retail market two years ago, where we branded Binary Bots as a STEM toy.”

He admitted that although STEM toys aren’t new to the sector, they have had to evolve in order to maintain relevance. “When I was young it was ‘grow a crystal in the bathroom’,” said Hill. “Now we are getting more robotics-based toys. The problem is that a lot of these products are very expensive, so companies are presented with the challenge to try and make them more affordable.”

Coding kits

Great Gizmos has also identified STEM as a trending product, and as such, offers coding kits like ‘Code A Maze’. This includes a robot – that poses a challenge e.g. get from point a to b – a mat on which the robot travels, and a set of cards with arrows on.

Once a challenge has been set, the child programmes the robot’s route by placing the appropriate (direction)
cards against the mat.

According to Judith Dayus, MD of Great Gizmos, this will help young children to start thinking about what steps are required to move a robot in a certain direction – skills that can be transferred to coding. She adds that it also offers a young person the upper hand when they do start school, a valuable and sought-after quality in STEM toys.

However, like Hill suggests, Dayus says Great Gizmos has also identified a need for giving teachers an upper hand too. Its Logiblocs kit, which aims to teach children about electric circuits, comes in smaller packs for the toy market, as well as a bigger educational kit that features a teaching guide. “Teachers don’t necessarily know about electric circuits or how to teach it – it’s quite new for them,” she said. “This kit explains it in an easy way, giving them a series of class projects.”

She continued: “Kids are using technology more and more, so the toy industry has had to keep up with this. We embrace screen time, but at the same time, we realise it’s important to have play that is technology based yet not attached to the mobile or iPad.”

In fact, according to a report from Ofcom on Media Use and Attitudes, 21% of children aged 3-4 now have their own tablet, this increases to 55% among 12-15 year olds. Furthermore, 83% of children aged 12-15 have smartphones, with 99% of them spending an average of 21 hours online a week.

And, according to Juniper Research, smart toys will represent an $18bn hardware and software market by 2023, driven by the growing popularity of smartphone connected toys and related in-app purchases, which are projected to grow by 69% annually over the next 5 years.

Graham Spark, Sales Director at TrendsUK, like a lot of tech toy companies, has acknowledged the increased screen time, admitting that it has influenced some of their products. “For 2019, we have introduced a lot of augmented reality (AR) toys. With children becoming so involved with technology it was an obvious decision.”

It also allows for an increasing learning opportunity, he added, pointing to TrendsUK’s V8 engine kit as one example. In this pack users are provided with the tools to not just build a working motor, but have the opportunity to extend learning with a complementary app that augments the engine through a phone. This means the user can see how the engine works from different angles, pull layers away and read about each component.
Positive screen time

Oliver Claxton, EMEA Sales for Tech Will Save Us, a company that solely focuses on educational toys, noted that as a result of increased mobile device usage, it is vital for toy firms to encourage ‘positive screen time’. This refers to the amount of time spent on a device such as a tablet.

The British Toy and Hobby Association (BTHA), has revealed that screen time is a massive concern among parents. In a survey of 1500 parents, 75% stated that they believe excessive screen time will make their children less sociable later in life, while 65% say they think it will make them less active. Despite this, many parents confessed that they are struggling to find the right balance between screen time and unstructured play, with 37% saying that their child was spending less time playing with traditional toys than last year.

To help accommodate for this, Claxton said that Tech Will Save Us has designed all of its toys to have practical as well as screen-based tasks. For example, its Electro Dough Kit, provides step-by-step guidelines on how to make your own dough, and includes LEDs and batteries to teach children about how electricity works and what a conductive is. While its ‘Sew and Glow’ kit provides children with an ‘electro thread’, teaching them not just about electronics but also the skills needed to sew.

Osmo, which has also embraced the merge of digital and physical play, actually set out to address what it describes as the “concern of many parents” regarding “how their children interact with technology” by developing a product which utilises technology “without losing the value of hands-on play”.

For example, one of its iPad/iPhone enabled games, involves ‘Awbie’, a digital character which is controlled via physical blocks the user lays out in front of the screen. These blocks control Awbie’s movements, with the aim of the game to get him to reach the strawberry trees.

Using the same premise, its Coding Jam game allows users to lay out physical blocks into sequences and patterns to create music on screen. The idea behind this is to develop both musical and coding skills.

Despite coding being a clear objective for many of these toys, it is apparent that the toy sector is also influenced heavily by the technology trends emerging in everyday consumables, such as wearables.

Tech Will Save Us leverages the popularity of such technology with its ‘Creative Coder’, a device that lets children make their own wearable device through manipulation of the accelerometer and LED lights. “One child programmed theirs to prove to their parents they had brushed their teeth,” Claxton remarked.

Like many of the tech-focused toy companies, Tech Will Save Us, was originally formed as an educational business, running workshops about technology. “There was a demand to buy the products,” explained Claxton. “It went from workshops, to being used in the Science Museum, and then retailers became interested.”

As for the future, experts and future forecasts remain optimistic - despite the UK suffering a 7% drop in toy sales last year to 3.3billion, which can be attributed to the closure of Toys R Us, a poor year for licensed products, and Brexit uncertainty.

Claxton predicts growth within the AR and virtual reality toy market, adding that he does not foresee an obvious “peak” in technology-based toys anytime soon. “Coding will become the new language,” he suggested, “but there will always be a place for the traditional toy. As technology grows, it will become more mainstream in children’s toys.”

He pointed to robotics as an example. “Five years ago it was considered purely an industrial tool. As the tech became more advanced, the components became cheaper, and this enabled the toy sector to utilise it at a soft level. The only limitation for the toy industry right now is the price point. We’ll never have the most up to date technology in toys. But as technology evolves, like it did with robotics, the price of integrating it will become cheaper.”
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Last month TechWorks, the UK’s industry association for deep tech connected communities, announced that Alan Banks would be taking over from Gary Travers as CEO, with immediate effect. TechWorks, which is the parent organisation to the NMI (semiconductors and electronic systems), Power Electronics UK, AESIN (automotive electronics innovation) and the IoT Security Foundation, was set up to strengthen the UK’s leadership in deep tech.

Banks’ appointment has been welcomed and he brings to the role a wealth of leadership, business and industry experience across automotive electronics, IT and telecommunications.

“We’ve certainly succeeded in creating a better understanding about the need for greater collaboration and the need to foster communities as the way forward, but we haven’t always been as clear when it comes to the needs of the technology sector in the UK,” Banks admits.

Banks has chaired the AESIN stream since its inception in 2012. He’s played a key role in developing and implementing its vision and strategy for the UK automotive electronic systems sector, building on his 17 years spent at the Tier 1 automotive supplier Visteon, where he was engineering director and developed, then delivered, vehicle cockpit electronics.

According to Sir Hossein Yassaie, TechWorks’ chair: “Advances in deep tech, underpinned by engineering excellence and scientific discoveries, are fuelling growth in many contemporary and emerging markets. The UK plays a leadership role in the research, development and application in this field and TechWorks is dedicated to supporting and helping to strengthen this vital role.”

Once-in-a-generation
In his first interview, following news of his appointment, Banks explained to New Electronics that at a time when the UK was facing once-in-a-generation changes, whether in terms of technology; the emergence of new business models or the prospect of new trading arrangements with our withdrawal from the EU, the only way to ensure UK companies can address these fundamental changes and not only survive but actually thrive, would be through driving much greater collaboration.

“It’s only through collaboration that we will succeed and TechWorks is the ideal model for this. We can act as a catalyst and create non-competitive connected communities where we can build successful partnerships and lead innovation in exciting, emerging technology markets,” enthuses Banks.

“That’s the challenge and despite being a small organisation TechWorks is doing a lot to achieve and deliver on these issues. Where the membership has stepped up and engaged we have achieved alot – the question, going forward, is how do we keep them engaged? A lot of what our membership does is done free of charge – we only have limited resources.”

Banks says that the success of AESIN, which he has been running since it was first established, provides a suitable benchmark for the organisation.

“Despite limited resources AESIN succeeded in engaging with the industry in the form of OEMs and Tier 1 suppliers and with government – we’ve helped to attract funding and I want to see that same success replicated across TechWorks and the multiple sectors we look to serve and support.”

At present there are only four streams: NMI, Power Electronics UK, AESIN and the IoT Security Foundation and Banks wants to add to their number.

“We need to effectively relaunch TechWorks,” he concedes, “as we look to get the brand ‘out there’ and what we do is better understood. We are a hub that brings people together from different industries, where problems can be discussed, and ideas shared.

“Unprecedented change is all around us and TechWorks can help develop and build on the government’s Industrial Strategy. That strategy plays to the strengths of the electronics industry whether AI, autonomous driving, clean energy etc. All of them require technology to deliver on some ambitious goals.

“TechWorks can play a leadership role in aligning different industries but looking beyond technology, business itself is changing.

“Traditional business models are having to adapt, and we are seeing whole industries being turned on their heads.

“Take the automotive industry. New entrants, with no traditional automotive design experience, are challenging industry norms,
bringing technology and product to market much faster. In this fast-changing business environment, how do traditional companies compete? Massive technological change is coming, from autonomous vehicles to the demise of the combustion engine and the rise of electric vehicles, so we can play an important role in providing a bridge between industry and government and help in the re-alignment of policy to better address the needs of industry.”

IP retention
The UK has a good track record when it comes to creating IP but with the advent of AI, robotics and machine learning the UK needs to be better at retaining that IP, according to Banks.

“I want IP created in the UK to stay in the UK, owned by UK companies and consortia. We need to ensure that the UK retains its reputation for R&D, especially at a time of upheaval.”

Banks believes TechWorks should look to build on its programme of events and to engage more with the bodies that have sprung up in recent years to support and promote technology and industry in the UK.

“Through that engagement we can put TechWorks front and centre and attract new members in the process.”

Of the four streams TechWorks supports, IoT Security has established a strong international reputation, which Banks wants to see replicated.

“But we also need to introduce new streams. For example, with regards to robotics and machine learning there is extensive cross over between different sectors that we can use to build communities and co-operation.”

His appointment comes at a time when TechWorks, like many other organisations, has been struggling to get its voice heard.

“We have been crowded out by events,” he suggests. “Because of Brexit we can’t get to the people we need to and as a result we’ve struggled to get the full engagement we’d been promised, and had hoped for, with the launch of the Industrial Strategy back in 2017.”

He makes the point that without that engagement and some degree of funding it’s hard to get the traction needed.

“A lack of dialogue is hampering our efforts.”

Banks concedes that his appointment comes at a difficult time.

“Working as a collective we can generate and do more and I believe that whatever happens in the coming months, TechWorks can develop a powerful voice for change and engagement in the UK.”

Alan Banks

Alan Banks was recently appointed CEO at TechWorks, the UK’s industry association for deep tech connected communities. With a wealth of leadership, business and industry experience in automotive electronics, IT and telecommunications Banks has chaired AESIN since its inception in 2012. He spent 17 years at automotive supplier Visteon, where he was engineering director. Prior to this, he developed telecommunications and product development systems for Ford.
Smart home technology is intended to solve a variety of issues and make our lives easier but while we have been promised various versions of the smart home going back decades, the necessary technology and the supporting structures have never really been readily available, until today.

Clumsy initial attempts with smart home technology failed to ignite the market as they were relatively expensive, and installation was difficult, often involving disruptive rewiring.

The situation has changed as the prices of smart devices, like sensors and controllers, have fallen and as suitable wireless technologies have emerged. These developments have helped to transform the prospects of the sector with a growing range of easily integrated, multi-purpose but simple, solution-based devices.

When it comes to connectivity, Bluetooth mesh networking is being widely adopted in smart home solutions. At the Consumer Electronics Show (CES) earlier this year, the Bluetooth Special Interest Group (SIG) established a new Smart Home Subgroup in response to the growing number of OEMs looking to adopt Bluetooth mesh networking as the communications protocol for their smart home solutions.

The Subgroup is looking to create additional Bluetooth mesh model specifications for the smart home and related applications and define the behaviour of devices that are connected to a Bluetooth mesh network.

“Mesh models will be able to define how a Bluetooth mesh light is controlled by a Bluetooth mesh switch,” explained Martin Wooley, Developer Relations Manager, EMEA, Bluetooth SIG, “and like all Bluetooth technology specifications, the mesh models that are developed will then be available to all member companies for use in conjunction with the Bluetooth mesh networking specifications.”

The aim of which is to provide, “multi-vendor interoperability in the smart home,” said Wooley.

These mesh models are seen as playing an important role in strengthening the connectivity and interoperability in smart home devices and over 60 companies have already joined the Subgroup.

“For the smart home market to develop, it needs true global wireless mesh networking standards that can meet the reliability, security, and performance needs of the market,” said Dian Fan, General Manager of Xiaomi IoT Platform, one of the companies that have joined the Subgroup. “Bluetooth mesh is one of those standards and will enable tremendous growth and innovation in home automation.”

“The release of Bluetooth mesh networking and the recent formation of the Smart Home Subgroup are important milestones in the development of the smart home market,” explained Mark Powell, Bluetooth SIG Executive Director. “With mesh networking support, Bluetooth is in a position to help the home automation market reach mass scale.”

So how is the smart home evolving and what are the key applications and technologies that are driving it?

Key drivers are home disaster management, home security and deeper integration, all of which are helping to drive the market but possibly the most potent driving force has been the advent of voice control, which has helped to transform the market over the past two years - voice-controlled AI-powered speakers have taken the industry by storm.

“If any confirmation were needed at the impact of voice, Amazon’s keynote at IFA 2018 fired out a few key stats - there are now more than 20,000 compatible Alexa devices - up from 12,000 in May and 4,000 at the end of 2017. Alexa now has over 50,000 skills, and there were 50 new Alexa devices announced at IFA 2018 alone,” recalled Martin Keenan, the Technical Director at Avnet Abacus.
According to Keenan, however, the importance of AI and voice to the future of the smart home is not just about those impressive numbers, significant though they are, but it is due to the ability of voice control to bridge the technological gap, removing the need for users to grapple with the details of each device and solution in order to access their benefits. This applies to everything from navigating TV EPGs to controlling disparate in-home devices.

Voice is now perceived as the essential channel of the future, and the current levels of manufacturer integration tend to support that assumption.

Security drivers
The global smart home security market has been estimated at $670m and is expected to reach $2.7 billion by the end of 2025, that represents growth of almost 20 per cent, year-on-year, making it among the more successful niches for the smart home.

According to Keenan, a major factor in the success of this sector has been in overcoming the upfront hardware costs and installation fees.

“The highly modular structure of today’s smart home security systems allows them to be expanded with new sensors, lights and cameras incrementally, rather than in the single, costly financial hit required by the traditional security industry system install model,” Keenan suggested.

And it is true to say that there has been a rapidly improving array of sensors available to manufacturers, from incredibly sensitive pressure sensors through to ultrasonic and various types of light sensors, all of which have become significantly smaller, easier to integrate and most importantly, much cheaper, over the last few years.

The Eyes Outdoor Camera from Bosch, for example, is able to stream 1080p HD video straight to a smartphone or tablet and has integrated sensors so that clips are not filled with swaying tress or pets inadvertently walking past, instead it only records the events that are significant.

Another trend has been in home disaster management, which is closely associated with home security and which covers a wide range of potential incidents, from the security-related, through to moisture detectors such as Notion and GROHE Sense in key locations.

“Interesting examples include integrated pressure sensors in boiler systems and also in bathroom fixtures. The latter delivers two benefits - the flow control (to remotely run a bath), and perhaps more importantly, the ability to alert the user if low or high thresholds are breached. Sudden loss of water pressure could indicate a serious leak, while a sudden increase could indicate a local issue such as a blockage, or a more serious failure,” Keenan explained.

In the early days of the smart home market single-use devices were common, now smaller sensors and multi-purpose chipsets mean that more complex and capable devices are now available.

Samsung’s Family Hub fridge, for example, is not only fully integrated with Samsung’s SmartThings IoT ecosystem, but also provides a touchscreen control interface and AI voice control thanks to Bixby.

Smart home technology is also being sold as having a critical role to play in helping to reduce waste, so smart heating systems are being encouraged by national regulators and utility companies as they demonstrate clear efficiency benefits, while consumer devices, like washing machines, are specifically designed for not only convenience, but to exploit cheaper energy tariffs and which minimise water usage.

The increasing proliferation of smart devices in our homes, however, raises concerns over security and researchers are regularly uncovering fundamental vulnerabilities in many off-the-shelf products.

Reports have revealed that devices are insecure and can be compromised in a matter of minutes whether that’s a baby monitor, home security cameras, doorbells or thermostats – one of the simplest methods of hacking was found to be tracking down the default factory-set passwords.

According to Stuart Spice of B9 Systems, which has developed a threat intelligence platform to monitor and identify possible attacks, “The use of encryption and polymorphism and the large scale and systematic distribution of attacks at a commercial level, means that most anti-virus software is redundant as it continually fails to identify and prevent attacks.”

B9 has developed a Wi Fi router that sits outside an existing router and allows the user to monitor applications and websites showing them where an internet connection is communicating in real-time – highlighting possible suspect virus or malware attacks.

As we reported in New Electronics last month, surveys are finding that consumers are increasingly concerned by reports of data breaches and hacker attacks and companies need to do more to inform and educate consumers on how to stay safe.

But despite concerns over security, the smart home market is continuing to mature fast and, as such, we can expect the technology in our homes to continue to improve and evolve incredibly rapidly.
When selecting and using electronic components in space, they will need to be reliable and capable of surviving the harsh conditions they’ll experience over an extended period of time.

In space, components need to be able to overcome vibration imposed by the launch vehicle and any further large shocks that could occur in the satellite’s body structure.

Pyrotechnic shock, for example, is the response of a structure to high frequency, high magnitude stress waves that can spread throughout a structure as a result of an explosive charge, like the ones used in a satellite ejection or when the stages of a multistage rocket are separating. This can lead to damaged circuit boards, electrical components shorting as well as a range of other issues.

Temperature extremes are another challenge for designers with geostationary orbiting satellites facing much greater temperature variations than a satellite in low earth orbit (LEO).

How you dissipate the heat generated by the electronics is crucial as electronic devices can be degraded by sustained high temperatures.

The vacuum of space is also a favourable environment for tin whiskers, so materials will be a concern as some are responsible for the spontaneous growth of whiskers that can cause electrical shorts.

**Space imaging**

Teledyne e2v has been responsible for delivering three variants of its CCD314 image sensors for the Sentinel-5/UVNS instrument, which will be launched onboard Second Generation MetOp (MetOp-SG) satellites.

“This is a collaborative program between the European Space Agency, ESA and EUMETSAT, and comprises of three flight sets of two low earth polar-orbiting satellites with complimentary payloads, MetOpSG-A and MetOpSG-B,” explains Paul Jerram, the company’s Chief Engineer in space imaging.

Space imaging is at the heart of the work that Teledyne e2v carries out at its facility in Chelmsford, Essex.

“We currently employ 200 people and supply devices to all the world’s space agencies,” says Jerram.

“The Sentinel-5/UVNS instrumentation is focused on the global monitoring of key air quality trace gases and aerosols as a part of the Copernicus program,” explains Jerram. “It uses our custom CCD image sensors which have been optimised for different wavelengths, and have been built around a proprietary enhanced quantum efficiency backside thinning process,” according to Jerram.

These image sensors include a graded anti-reflective coating unique to Teledyne e2v, and sit at the heart of the Sentinel-5/UVNS instrument, which is a high-resolution spectrometer operating in the ultraviolet to near-infrared range.

“These CCDs are essential to the mission’s goals of monitoring air quality and supporting climate modelling by measuring atmospheric trace gases such as Ozone, Nitrogen dioxide, Sulphuric dioxide and others, on a daily basis,” says Jerram, “and have been designed to provide unprecedented accuracy and resolution.

“Over the years Teledyne has built up extensive experience in the deployment of sensors into space,” Jerram explains.

“The key challenges tend to be sustainability and reliability. We’ve never had a sensor fail which is critical when you consider that these missions can cost billions and there is no possibility of building in any type of redundancy.”

According to Jerram, “Space is a nasty environment. You have vibration on launch, that can be severe, and when it comes the components you have to take into account the radiation levels that they will need to be able to work in.

“Testing to destruction is a critical aspect of the design process.”

When it comes to radiation the effects are many fold, according to Jerram.

“Ionising radiation causes an increase in leakage current, so we need to look at keeping sensors colder. In the design phase you can...
get round that and it has become less of an issue in modern electronics.

“With imagers sensors, however, a key challenge is ‘hot pixels’ and that is near impossible to solve – all you can do is ensure that they are able to work at lower temperatures.

“There is also the issue of latch-up damage and the creation of parasitic varistors, dumping high levels of current into a device very quickly from high energy particles. That can only be addressed through innovative design techniques.”

Of concern to designers is the effect of radiation over an extended period of time.

“Most semiconductor manufacturers use a modern standard process, so we need to change the design.

“When it comes to CCDs, we look to make the gate oxide thinner to reduce the impact of threshold shift - that’s one example; another issue is that CCDs suffer from charge transference degradation, so we need to make the transfer channels narrower.”

By making sensors more efficient, gathering every photon that’s detected, means that missions can become more efficient and the technology sent into space smaller and more economic.

**Quantum technology**

Under a project called the Cold Atom Space Payload (CASPA), Teledyne is involved in developing a small satellite, measuring 30 x 20 x 10 cm, which aims to demonstrate cold atom technology in space. A space flight ready variant of a cold atom chamber subsystem is set to begin space qualification later this year.

Explaining the work the company is doing in terms of quantum technology, Richard Murray, Teledyne e2v’s Business Development Manager for quantum technologies, said: “While the physics for this has been around for some time, we are only now really beginning to take the research into industrial sensors.

“We are looking to bridge the gap between the fundamental research being undertaken at universities and working with the supply chain to develop the necessary manufacturing techniques to ensure quantum technology is suitable for use in space.”

As Murray explains, by cooling atoms and creating their ‘super position’ it is possible to build sensors that are ultra-sensitive.

“New developments in quantum technology have resulted in the ability to cool atoms close to absolute zero by using lasers. By looking at atomic energy levels any quantum interference effect can be measured.

“We are working to miniaturise the technology so that the sensitivity and accuracy can be deployed more widely in inexpensive space vehicles and rather than being deployed in once-in-a-life time missions, this will allow us to launch cheaper space vehicles capable of providing continuous measurement.”

The ability to measure gravity, by deploying quantum gravity sensors, will enable satellites to finely monitor the movement of mass within the Earth.

“This project brings benefits to multiple applications, including polar ice mass monitoring, ocean currents and sea level monitoring along with water table monitoring for flood and drought prediction,” according to Murray.

“We have taken a leading role in the National Quantum Technology Programme and our Quantum Group is part of a large academic and industrial collaborative effort,” Murray explains.

**Space projects**

Alongside gravity sensing, Teledyne is also looking at precision timing, and space hardware development for Earth Observation (EO) with potential applications in detecting and monitoring underground resources from Earth or Space, as well as navigation, synchronisation of distributed resources and networks, and Global Navigation Satellite System (GNSS resilience).

“We’re involved in upwards of 40 projects, at present,” says Jerram.

“For example, we have provided a key component for the Atmospheric Laser Doppler Instrument (ALADIN) on the European Space Agency’s Aeolus Satellite which launched recently,” continues Jerram.

“For that project we developed a unique Charge Coupled Device (CCD) type detector. The CDD69 ultraviolet detector will look to gather wind data profiles of the Earth to improve the accuracy of global weather forecasts.”

Rather than traditional methods to gather this type of data - weather balloons, cloud tracking etc. – the satellite uses a powerful laser in its instrumentation that works by emitting an ultraviolet laser beam through the Earth’s atmosphere and measuring the reflected return signal from particles, or aerosols in the atmosphere.

“The detector can simultaneously measure the distance of the returned ultraviolet laser pulse to resolve the altitude of aerosols in the atmosphere, and the Doppler shift that equates to the wind speed at each altitude.

“While the returned signal is extremely weak, the detector is able to add together a number of returned pulses to improve the accuracy of the measurements,” Jerram explains.

The detector consists of a 16 x 16 pixel CCD with a novel storage region that accumulates the signal from several successive laser pulses. The detector is housed in a hermetically sealed package with an integrated Thermoelectric Cooler (TEC) that uses the Peltier effect to transfer heat away from the sensor.

“Teledyne e2v is developing detectors for a number of European program’s and playing a key role in the UK’s burgeoning space industry.”
Breaking up is hard to do

Accelerators are changing the way servers are being put together, putting the focus on fast interconnects. By Chris Edwards

In mid-March, graphics processor maker NVIDIA decided to outbid Intel by close to a reported $1bn in the pursuit of networking chipmaker Mellanox. For the NVIDIA of several years ago, it would have been an acquisition that made little sense, but today it is no longer serving just framerate-hungry players of Call of Duty.

CEO Jen-Hsun Huang sees the future of the company as being bound increasingly to data-centre servers.

The Mellanox purchase is part of a trend that is remaking the server from the inside out, driven half by the inability of designers of general-purpose processors to squeeze much more performance out of their architectures or Moore’s Law and half by the massive growth in demand for machine learning among the likes of Baidu, Facebook, Google and Microsoft.

In this new model, data-centre servers begin to look more like supercomputers where local memory is mainly just cache. What used to be closely coupled DRAM moves into dedicated storage subsystems connected by a predominantly serial interconnect matrix, often represented by PCIe inside the shelves and blades. At the rack level and above, Ethernet is the carrier.

Huang told analysts on a conference call to explain the planned acquisition: “The dynamic that is happening here is that, in the future, it won’t just be server-scale computing that people do, but it will be data centre-scale computing, where the network becomes an extension of the computing fabric.”

Days later, the data-centre owners and component suppliers gathered at a conference 10km southeast of NVIDIA’s HQ in downtown San Jose to demonstrate how they are breaking up the server to remake it.

A decade ago, it would have been big-iron vendors of the likes of Hewlett-Packard and IBM who dominated discussions about server architecture. Today, it is the data-centre owners themselves who are designing and building the hardware that goes into their racks, all the way from chips to enclosures, albeit with a great deal of reliance on contract manufacturers.

The rise of machine learning in the cloud has done much to make the designers rethink how their systems are put together. In his keynote at the OCP Summit, Facebook’s director of technology strategy, Vijay Rao, claimed the half the company’s data warehouse feeds into machine-learning algorithms that handle translations and numerous other services. He claimed some six billion translations requests a day go through Facebook’s AI.

Domain specific acceleration

General-purpose processors would collapse under that level of demand. So, Facebook and others have embraced domain-specific acceleration as the way to access the huge number of matrix multiplies needed to handle deep-learning models. But raw compute throughput is only half the story. Some of the models are enormous, demanding memory footprints of up to 2TB, according to Rao. No single accelerator can deal with such a large model. The processing needs to be spread across multiple chips, putting much greater emphasis on the interconnect between processing engines than ever before.

“Engineers designing a server used to make trade-offs between four basic elements: compute, storage, memory, and the network. Accelerators have now joined this group and trade-offs are between compute, memory, accelerators and buffers,” Rao said.

Rao described how Facebook’s main server design is now “tricked out with accelerators” that are assembled onto carrier cards that act as slot-in replacements for Intel Xeon processor cards, all connected by PCIe.

PCIe is likely to be supplanted by one of the growing number of communications standards vying for a place in high-performance computing. They include CCIX, Gen-Z, NVIDIA’s proprietary nvLink and OpenCAPI, all of which are intended to provide high-speed paths between processors and memory. Just last month, Intel and a group of allies put another option in front of system designers: Compute
Express Link (CXL). A key distinction between these protocols and PCIe is that they support various forms of cache coherency between processor subsystems and the memory they use. This makes it possible to make accelerators peer of the processors that manage and, more importantly, avoid the need for software to explicitly shuttle data in and out of each accelerator’s buffers. The software can simply provide a link to the incoming data and the coherency protocol will ensure the most up-to-date elements are mirrored into the accelerator’s scratchpad.

Gaurav Singh, corporate vice president of silicon architecture and verification at Xilinx, says the kinds of cache coherency supported in CCIX are likely to be important for data-centre designers: “NVIDIA has made a case for how \( m \text{vLink} \) can benefit the machine-learning training use-case by allowing many GPUs to work on the same data set. CCIX enables the same functionality. With machine-learning inference, as datasets increase in size and with the move towards higher resolution images, CCIX can allow multiple accelerators to share data.”

There are, however, potential downsides to the approach. Caused by increased inter-memory traffic that may lead to unwanted high energy consumption. For this reason, Open Domain-Specific Architecture (ODSA), an OCP group working on ways to wire up accelerator chiplets inside a single package expect there to continue to be a mixture of non-coherent and coherent protocols in use in these systems. Facebook’s Zion server design uses a coherent interconnect to link general-purpose processors to accelerators. But the accelerators have their own non-coherent fabric.

The question facing both groups like the ODSA and the server builders is which high-speed protocols and interfaces to support. According to Bapi Vinnakota, director of silicon-architecture programme management at network-processor specialist Netronome and a member of the ODSA workshop, one way to avoid having to make that decision as a group is to back PCIe’s digital interface to physical-layer modules, known as PIPE. Chipmakers will be able to decide which electrical-layer links to support underneath and also pick and choose between various protocols that can sit on top of PIPE.

**Fewer differences**

In practice, there are fewer differences between the various protocols being put forward at the electrical level than at first appears. CCIX and CXL, for example, are both built on top of PCIe. CXL happens to focus on the as-yet uncomplete version 5.0 of PCIe. Anthony Torza, distinguished engineer at Xilinx, points out that the company can use the existing 32Gb/s serdes found in its 16nm UltraScale+.

“Accelerators have now joined traditional elements and trade-offs are between compute, memory, accelerators and buffers.”

Vijay Rao

> Products to support PCIe version 5.0.

GenZ focuses on longer-distance memory transfers and is focused more on physical-layer interfaces similar to those used for high-speed internet. According to Dell senior architect Greg Casey, GenZ will support the same kind of 112Gb/s PAM4 interface as that needed for the 400G Ethernet that will interconnect server racks. That will let Gen-Z most likely serve as a longer-distance fabric that joins together CCIX or CXL-linked subsystems.

Work at Facebook to move beyond its existing PCIe-based mezzanine accelerators is taking a similarly interface-agnostic path to that of ODSA. Developed in conjunction with Baidu and Microsoft, the Open Accelerator Module (OAM) is a design that, when packaged with heatsink power, occupies the space of a small lunchbox. These modules will slide into docks from the front of a rack to allow easy upgrades.

“We are proposing to build a universal baseboard [to host OAM daughterboards] that supports different interconnect topologies,” Siamak Tavallaei, principal architect at Microsoft, said at the OCP Summit.

By building switches into the daughterboards, the baseboard should be able to handle many of the topologies used by large ML workloads, such as 3D mesh and torus connections. “Topologies have dependencies on the types of accelerators being used as well as the application,” Tavallaei noted. As far as the baseboard itself is concerned: “Wires should be just wires.”

Facebook hardware engineer Whitney Zhao said the team opted to use Molex’s Mirror Mezzanine connector to link base and daughterboards. “It can support 56Gb/s NRZ or 112Gb/s PAM4 signalling. We don’t know what speed we will need to support on OAM but we know, whatever it is, the connector will be able to handle it.”
Delivering a successful product from the ground-up in 14 short months requires a hardworking team, especially when that team is made up of 90 engineers located around the globe.

Imagination, who took home the Design Team of the Year award at last year’s British Engineering Excellence Awards (BEEAs), overcame these challenges with the development of its PowerVR Series2NX.

According to Imagination, its team of engineers were looking for an industry solution capable of executing the compute-intensive operations required for neural network acceleration (NNA) on edge devices.

The PowerVR project was designed to deliver high performance computation of neural networks (NN), but with very low power consumption across a smaller silicon area.

Begin in 2016, two years were allocated to the project from initial concept to evaluation, and by October 2017, despite a geographical spread team, the first evaluation systems were released. While the first production release of the 2NX IP, the AX2180, was achieved soon thereafter.

Given its experience in designing GPUs for mobile and embedded systems, Imagination started the design by modifying the PowerVR GPU architecture to achieve the performance levels needed for NN acceleration. However, this resulted in a solution that was too large, so the team started to work on a new system from the ground-up – the 2NX, which was intended as a specific, optimised hardware acceleration unit for convolutional NN.

Once they made the decision to create a new design, the target was to achieve ~10-100x higher performance per mW and performance per mm² compared to other embedded NNA solutions then on the market.

According to Russell James, VP vision and AI, Imagination, who led the business unit, success could be attributed to a combination of: strong leadership, clear communication and a well-organised timeline of work.

“At each stage we had to check that our product was still valuable,” James said. “We had to keep abreast of new developments because the market for NNA on edge devices emerged so quickly – that was a challenge. As we moved forwards, we kept adding more detail to the concept, checking it, adding more detail and so on.”

Every feature of the 2NX was designed specifically for it. With no pre-existing flows, tools or system architecture to help ease or speed up the process.

“Because everything needed to be custom designed, it presented the team with a unique opportunity to create the most efficient and competitive product they could without any constraints,” James said.

More with less

Initially, the project started off as a small, dedicated group of engineers with limited resources. “As a British IP developer in semiconductors we don’t have the resources or the budget. We have to do a lot more with a lot less.”

During the first stages of the development process, James said it became evident that the market opportunities for the solution were vast, and it was a clear-cut decision to grow the team.

“I did expect that it would become a big project,” James said. “The technology is absolutely crucial. Providing you have enough compute and performance, you can apply NN to some very interesting tasks. Once we had a proof-of-concept and knew the direction we were going in, we had to grow the team.”
But “you can’t hire a good team overnight,” James admitted – particularly in a smaller company. “Quite often we have bought small companies just to get a team together quickly. Organic growth in this industry takes a while – especially when you want to build a good team. That’s why you start small – you don’t really have much choice.”

For the 2NX, James said they were able to allocate people internally, re-tasking in-house engineers as the project progressed. But he confessed that it did take several months to integrate the groups as one focused team because many of them were accustomed to executing projects in smaller subgroups.

“When you have a large, segregated team you have to divest efficient responsibilities and accountability to the team leads in each area, so they are empowered to take ownership of their tasks,” he said. “This means they can press on with work independently and take on the responsibility that the team you have to divest efficient smaller subgroups.

He continued: “With teams in different time zones, you also don’t want to be waiting 8 hours for them to resolve a problem.”

James pointed to “clear and regular communication at the right level of granularity,” as crucial. “You don’t need to recite an essay on every single thing that happens during your meetings, you just need a concise report on what’s been done, what is going to be done next, and what the blocking issues are. With those three questions answered, provided you keep up that regular communication, most issues can be resolved.”

In this particular project, James said that video conferencing was a key form of communication. “Of course, email is the most common way of connecting, but I am very much in favour of video. You gain something from being able to see someone’s face.”

He emphasised the importance of relevant communication too. “If you have a follow-up meeting about an issue that was flagged, only involve those who need to be involved. “You need compromise too,” he advised. “When you have a geographical split someone somewhere is going to have to get up early or stay late. In those situations, it’s not just about accepting that, but also rotating that responsibility fairly.”

James also pointed to limiting the need for awkward combinations of time zones. “If an issue arose, we made it so there was something else a team could work on in the meantime, so that the time difference didn’t hold up overall progress.”

Despite the challenges it presented, James said the geographical divide also had its advantages in the form of “diversity of thought”, as he described it, and with teams able to handle work in multiple time zones, he said that the speed of development, research and customer support increased.

Focus was also a key element of James’ management process. “It’s very easy to give attention to the most interesting parts of a system. But, they aren’t always the most used by the end-customer. Get the key functionality in place first and then add the lower priority parts later.”

He continued, “It’s also about knowing when to stop. You can always add new features, but if you keep doing that, you’ll never actually deliver a project. Pick the right balance between features and deadlines. Identify key customers to work with and remove as many obstacles for your team as you can.”

Despite being a seasoned manager and successfully coordinating the 2NX team, James admitted that he did learn a thing or two during the process. “There is always opportunity to bring new ideas whether they’re yours or someone else’s.”

He added, thoughtfully: “A day without learning something new is a very sad day indeed.”

Since taking home Design Team of the Year, Imagination is set to release the 3NX, an update to the IP that incorporates a flexible processing element. “We are, in fact, already working on the next generation beyond that,” James said, “it’s moving extremely fast.”

Left. The 2NX is a new architecture from Imagination, designed from the ground-up as a dedicated inference engine across a range of markets including mobile and surveillance.
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New Electronics talks to distributors about the support they are providing engineers, in the industrial space, when it comes to using artificial intelligence. By Neil Tyler

Over the past ten years artificial intelligence (AI) has moved from pure research into a technology that is now revolutionising the world of information technology.

Deep learning has the ability to process images, video and speech, and deliver results similar to those of humans and is now a core part of numerous online services.

The potential of AI is immense and is seen by designers of industrial systems as an important tool to improve the efficiency and performance of their systems because of its ability to detect trends and anomalies in complex data in real time.

“The concept of using AI in a production environment can be very daunting,” explains Richard Jeffers, Technical Director for RS Components in Northern Europe.

“Engineers will need to learn a whole new language, which will be very different to what design and maintenance engineers may be familiar with. They will also need to be able to see through the hype and understand the problems that the technology can help solve. These are just some of the common issues.”

According to Jeffers customers need support from the industry, and distributors are in the perfect position to offer this.

“Rather than just focusing on the technology, it’s important for distributors to understand the problems a customer is looking to overcome, and then look at the technology that can help them,” he suggests.

However, an understanding of the tools and development platforms available to engineers is vital.

“The availability of cloud-oriented development tools such as Caffe, MXNet and TensorFlow provide a major boost for developer productivity,” suggests Michaël Uyttersprot, Market Segment Manager Artificial Intelligence and Vision, Avnet Silica.

“They make it easier to evaluate different AI techniques, particularly for those based on deep learning. The shape of the pipeline in a deep-learning network, for example, has a strong influence on its performance for a given application. When it comes to an image-recognition pipeline, for example, it will often be quite different to the networks employed for time-series data such as audio streams. It is important to be able to try different structures on sample data in a convenient manner, and these environments make it possible.”

Even when the prototype has been shown to be working in a workstation or cloud implementation, the developer, in this case an embedded developer who wishes to make use of AI techniques in their application, still faces challenges. One of the main issues is that of local processing resource.

“Deep learning has a requirement for a large number of matrix multiplication operations for any of its operations. Training can be readily offloaded to powerful cloud servers. But inferencing requires low-latency responses that will, in most cases, mean execution either on the target device itself or on a gateway module,” according to Uyttersprot.

“There are a growing number of manufacturers, such as NXP, building support for deep learning into their embedded processors that are capable of high-throughput matrix multiplication. However, these will have significantly less compute power than the cloud servers in use today.”

**Embedded systems**

To implement machine learning on embedded systems requires a number of additional steps beyond those required of developers working on cloud systems, which is creating a skills gap in the industry.

“But this is a gap that can be filled with help from partners, such as design-in distributors, who can provide in-depth assistance,” explains Uyttersprot.

“One approach used by Avnet Silica is to take the available components and wrap machine-learning software IP around them to create building blocks that can easily be integrated into a target system. In assembling these building blocks, distributors can pass on the benefit of their experience.”

One of the key lessons from deploying machine learning in embedded environments is that, when used for inferencing, deep-
As a result, Avnet Silica has been working on solutions for AI for several years and through platforms, such as Xilinx’s Zynq UltraScale+ MPSoC, we have built development systems that make it easier to create AI-accelerated applications.

What data?
For artificial intelligence to work, it needs data.

“At RS, we’ve invested in the capability to support customers through the development and delivery of an Industrial IoT strategy, supported by our recent acquisition of Monition, a specialist reliability and condition monitoring business,” says Jeffers. “We have had experienced maintenance and operations professionals engage customers, suppliers and industry thought leaders in how they see industrial IoT unlocking value in the factory environment. Through these conversations, we know customers are looking for support on what data to collect, how to collect the data and then how to apply AI to the data.”

To support the ‘what data?’ question, RS works with customers to conduct a ‘Criticality Assessment and Technology Selection (CATS)’ Survey.

“Through this, we jointly identify the critical assets and assemblies in the customer site and the right technology and parameters to measure to get an early indicator of failure,” explains Jeffers.

Below: Artificial intelligence is helping to revolutionise the world of information technology

“The easiest way to collect data is to harvest from existing PLCs, industrial PCs and historical databases. Only where the data does not exist, locked in the control environment, would we advocate installing new sensors.”

According to Jeffers, having collected and aggregated the data, and executed any appropriate local processing, it can then be passed to the cloud for in-depth analysis.

“We are working with data from our distribution warehouses and with data from customers who are interested in co-developing solutions. Prior to deploying any AI tools, we pass the data through rule-based streaming analytics to identify any immediate issues. After this, we take a multi-faceted approach: physics based simulation of the real-world environment to build a digital twin of the system, e.g. we know that, as bearings wear, power consumption in a motor increases, and that can be represented in a model; machine learning to look for correlations in the data sets, and to build algorithms based on these correlations to predict future events; real world domain expertise to validate the outputs of the digital twin and machine learning and to accelerate the training of the system.”

Having completed a round of training on a relatively simple data set, RS repeats the exercise on a more complex data set to understand how much of each model can be ported between use cases, and how much needs to be built new each time.

“RS is working to build a solution that can be applied to a range of common industrial plant and processes, to make it cost effective to deploy to a range of customer problems. “It is this kind of support that distributors must look to offer to customers if AI is to thrive and progress in the industrial space,” Jeffers concludes.
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