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Another week, another report highlighting the industry’s apparent inability to grasp the importance of security. The latest report, from the UK’s Department of Culture, Media and Sport (DCMS), urges companies making products for the IoT to build strong security measures into their designs and not to ‘bolt them on’ as an afterthought.

The report – part of the Government’s National Cyber Security Strategy – picks up on a projection that more than 400 million smart devices could be deployed in UK homes within three years and that many of these could be exploited as part of a cyber attack.

The security flaws in consumer electronics products were highlighted by Which? in a ‘snapshot’ investigation. It set up a network of smart gadgets and found eight of the 15 appliances on the network had at least one security flaw.

New Electronics also reported last year on a survey which found that 65% of medical device makers believed an attack on one or more of the products built by or in use in their organisation was likely in the near future. Yet only 17% of respondents said they were taking ‘significant’ steps to prevent attacks.

Meanwhile, the Barr Group’s latest report determined that one in five embedded system developers don’t list security as a requirement in their latest project. Other failings included a lack of regular code reviews and no coding standards. No wonder the Barr Group found the results to be ‘highly concerning’ and that there was ‘a lot more work to do’.

The DCMS report, created in association with the National Cyber Security Centre, recommends all devices should have unique passwords, that companies should have a vulnerability policy, that data should be encrypted and software updated automatically.

You might think these measures would be ‘front and centre’, but they aren’t. Art Dahnert from Synopsys summed it up nicely: “Smaller companies often don’t have a clue about security or the resources to devote to it. And, to be honest, many larger companies are also behind the curve.”

It’s no wonder we’re all beginning to talk about the Internet of Insecure Things.

Graham Pitcher, Group Editor (graham.pitcher@markallengroup.com)
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Fuelling photonics

A PHOTONICS INNOVATION HUB SAYS IT WILL CREATE 750 JOBS.
BETHAN GRYLLS REPORTS.

An innovation hub designed to help SMEs become ‘intelligent digital businesses’ believes it’s set to create 750 new hi-tech jobs over the next four years.

Having secured €10 million from the EU’s H2020 programme, the hub intends to support 100 product innovations based on photonics. Called ACTPHAST 4.0, the hub will provide bespoke prototyping solutions to companies with all levels of photonics expertise. It also claims that it will boost the research and innovation investment of the companies involved by 2.8 times, generate more than €700 million in increased company revenues and create 750 jobs across Europe.

ACTPHAST 4.0 says it will continue the work of its predecessor ACTPHAST, which has supported more than 100 companies and created more than 700 jobs since 2013. Looking to go further, ACTPHAST 4.0 plans to transition from an access centre for photonics technologies into a full-service photonics innovation incubator for European SMEs.

Meanwhile, photonics specialist Rockley Photonics has raised a further $40 million in its latest funding round, taking the amount invested in the company since its launch in 2013 to $100 million.

The cash will help Rockley to expand design and production of its platform for optical networking solutions, imaging and sensor photonics and custom photonics for consumer applications.

Microchip buys Microsemi

Microchip is to buy Microsemi in a deal which values the latter at about $10 billion. The move follows a period of speculation about Microsemi being an acquisition target.

“We are delighted to welcome Microsemi to become part of the Microchip team and look forward to closing the transaction and working together to realise the benefits of a combined team pursuing a unified strategy,” said Steve Sanghi, pictured, Microchip’s chairman and CEO.

Microchip has been building its portfolio for some time, with one of its most recent acquisitions being Atmel. Acquiring Microsemi is likely to create further opportunities in the data centre, communications, defence and aerospace markets. It also brings access to FPGA technology.

“Microchip continues to view accretive acquisitions as a key strategy to deliver incremental growth and stockholder value,” Sanghi noted. “The Microsemi acquisition is the latest chapter of this strategy.”

MIPI sets up automotive working group

Growing complexity in automotive applications, including many more sensors, is driving the need for more capable interface specifications. Looking to meet this need, MIPI has established an Automotive Working Group (AWG).

MIPI Alliance chair Joel Huloux said: “While MIPI’s focus is foremost on developing interface specifications for mobile devices, automakers already rely on MIPI’s industry-standard interfaces to enable a variety of applications. This additional focus on automotive is a natural extension to broaden MIPI specifications’ applicability.”

One of AWG’s first tasks will be to collaborate with other MIPI working groups to develop an automotive physical layer specification for longer reach applications. This work will, according to MIPI, build on the successful development of high-speed physical layer specifications for mobile and other devices. The group will also see whether other MIPI specifications can be adapted to automotive applications.

Matt Ronning, chair of the MIPI AWG, said: “AWG will help to align key interfaces for cameras, lidars, radars, displays and more with OEMs’ specific requirements in automotive. As new MIPI interfaces are developed, while rooted in mobile, they will now also have an eye toward automotive.”
A clever connection

HARWIN SHOWCASES ROBUST AND ADAPTABLE CONNECTORS TO EMBEDDED AUDIENCE. BETHAN GRYLLS REPORTS.

ow in its 16th year, Embedded World showed no signs of slowing. For the first time, the Germany-based exhibition saw more than 2000 conference participants and speakers, discussing news and products relating this year’s theme: ‘Embedded Goes Autonomous’.

Stretching across six halls, more than 1000 companies from around the world exhibited at the international event to an audience of more than 32,000 embedded experts.

Among the exhibitors was Harwin, which announced durable, versatile and stackable high density board-to-board connectors.

Harwin demonstrated how its Archer Kontrol family could be connected to boards seamlessly and in more than one orientation, enabling easy connection and reducing the likelihood of pin breakage. The fully shrouded design adds to the robustness and should allow these connectors to withstand the lateral and twisting forces encountered in vibration prone application settings.

The Archer Kontrols are designed to provide engineers with a robust, yet flexible interconnect solution for industrial tasks and can be supplied horizontally or vertically.

Covering 12 to 80 contact pin formats, these 1.27mm pitch connectors are said to have a current rating of 1.2A per contact.

The connector family, designed with space in mind, includes parallel board-to-board, or right-angle mother-to-daughterboard configurations and is compatible with popular standard connector types.

The connectors are said to feature a minimum insulation resistance of 1000MΩ, and an operational temperature range spanning from 55 to 125°C. Up to 500 mating/un-mating cycles are supported.

Next-generation solutions

Socionext and Varjo used Embedded World to announce an ongoing co-operation around Varjo’s next-generation VR/XR solutions.

The VR/XR headset is based on a combination of Varjo’s patented human-eye resolution technology and Socionext’s Milbeaut image signal processing solutions.

Varjo tested the limits with its headset display, which is said to be able to visualise images at 70MP with a 100° field-of-view, a capability far beyond current first-generation VR headsets.

The camera processing is extremely complicated and so required a high quality imaging resolution, provided by Socionext’s Milbeaut image signal processor technology.

Real-time measurements

Performing real-time measurements was the promise from Rigol, who released a family of cost-effective spectrum analysers.

The RSA5000 devices are based on the Rigol-developed Ultra-Real technology and are developed for those who have demanding analysis tasks, but limited budgets.

Due to the addition of a 3.2/6.5GHz tracking generator, the device can be used as both a spectrum analyser, with a maximum bandwidth of 40MHz, and as a scalar network analyser.

It also includes fully digital Intermediate Frequency technology, which Rigol said will offer accurate and high resolution measurements from 9kHz to 3.2GHz and 6.5GHz respectively.

Compression makes an impression

SEGGER extended its compression software family with the addition of emCompress-ToGo and believes with its present line-up, it has the optimum compression solution for any application.

SEGGER based the latest addition on its compression algorithm, which has been specifically developed for embedded systems with almost no RAM.

The emCompress-ToGo is said to feature high speed, low memory usage on target compression and decompression with no RAM used other than a buffer holding uncompressed data.

Although geared towards embedded systems, the emCompress family can also be used to embed data in a PC or other applications. It also offers support for standard compression schemes.

Ultimate Cloud access

Express Logic announced it will be the first to enable sensor and edge/gateway device connectivity to all leading Cloud providers, including Amazon Web Services, Alibaba and Microsoft Azure.

Partnering with Brightside, a security lab, Express Logic said it will perform the deeply embedded industry’s first EAL4+ security certification for Cloud connectivity.

It added that its ThreadX RTOS is at the heart of the X-Ware IoT platform, which is designed to provide embedded developers with priority-based pre-emptive scheduling, pre-emption-threshold scheduling, optimised context switching, real-time event trace, downloadable memory-protected application modules and full determinism – all accessed through an API.

The X-Ware IoT Platform is said to include NetX Secure TLS/DTLS to provide an industrial-grade, secure IoT connectivity solution that allows a choice of access to all cloud providers using these protocols.

Mission critical applications

Silicon Motion Technology rolled out the FerriSSD, a single-chip SSD, featuring a PCIe Gen 3 NVMe 1.3 interface for high-performance mission critical applications.

The SM689 supports PCIe Gen 3x4 interface, while the SM681 supports PCIe Gen 3x2 interface - exhibiting sequential read speed of up to 1.45GB/s and sequential write speed of up to 650MB/s.

Both are designed to support multiple capacity configurations, ranging from 16Gbyte to 256Gbyte and include enterprise-grade advanced data integrity and reliability capabilities using Silicon Motion’s proprietary end-to-end data protection, ECC and data caching technologies.

Socionext and Varjo used Embedded World to announce an ongoing co-operation around Varjo’s next-generation VR/XR solutions. The connectors are said to feature a minimum insulation resistance of 1000MΩ, and an operational temperature range spanning from 55 to 125°C. Up to 500 mating/un-mating cycles are supported.
Security proved to be an area of particular interest for many attending this year’s Embedded World.

Barr Group’s Embedded Systems Safety & Security Survey, now in its fourth year and whose release coincided with the exhibition, certainly generated interest. It found that only 25% of safety critical device developers follow all industry recommended software development practices for increasing safety, and that among embedded systems developers working on internet-connected IoT projects, 22% do not list security as a product requirement for their current project.

While those figures also suggest that 70% of embedded systems developers take the issue seriously, there was an acceptance that, with a growing number of security breaches and attacks, security was becoming increasingly important.

Art Dahnert, a cybersecurity expert with Synopsys, said that while software was driving embedded technologies to deliver more features and functionality all code would need to be secure.

“The trouble is, it often isn’t,” Dahnert said. “Smaller and more nimble companies often don’t have a clue about security or don’t have the resources to devote to it. And, to be honest, many larger companies are also behind the curve.

“Most people still don’t ‘know’ security and not enough people understand what is good or bad when it comes to software development.”

According to Dahnert, education has a crucial role to play if management and engineers are to better understand security.

“We need to change the development culture,” he said.

The growing focus on software was highlighted by Cypress Semiconductor’s CEO, Hassane El-Khoury, who spoke with New Electronics at the show.

“We are seeing a significant shift, with companies like Cypress supplying not only the hardware, but also the software,” he said. “We are looking to grow significantly in key markets such as automotive, industrial and consumer and to be successful in those markets you have to understand that customers don’t simply want silicon but solutions and software.”

To push home that point, Cypress unveiled a unified software tool suite to streamline product designs for the IoT.

“The IoT cuts across a diverse range of markets and applications but these smart products all share common, basic building blocks: connectivity, processing, sensing and security,” explained Sudhir Gopalswamy, a senior vice president of the company’s Microcontrollers and Connectivity Division.

“Our ModusToolbox provides a single, easy-to-use software suite that will enable customers to integrate these building blocks while leveraging the differentiating features of Cypress’ IoT connectivity and MCU solutions. It gives developers a familiar design experience and the flexibility to choose partners from our IoT ecosystem that fit the specific needs of their designs.”

Other companies to launch new software included Lattice Semiconductor, which unveiled new support for its FPGA portfolio.

The Lattice Radiant targets the development of low power embedded applications and offers an extensive feature set, providing ease-of-use and comes with support for the company’s iCE40 UltraPlus FPGAs.

“We are seeing more customers who are seeking to benefit from the features of iCE40 UltraPlus FPGAs,” said Choon-Hoe Yeoh, Lattice’s senior director, software marketing, and our Lattice Radiant software will provide them with a range of enhancements for designing with iCE40 UltraPlus, helping to drive innovative designs in emerging embedded applications.”

Renesas also announced a number of enhancements to the e² studio integrated development environment tool for its Synergy Platform.

Working with IAR Systems, Renesas’ Synergy customers will now be able to integrate IAR Systems’ advanced IAR C/C++ Compiler into the Eclipse-based e² studio IDE.
Earlier this month, the EnOcean Alliance celebrated its 10th anniversary, having been created in 2008 to promote innovative maintenance-free wireless solutions that could be used primarily in sustainable building projects.

According to Graham Martin, the Alliance’s chairman and CEO: “Over that period, our focus has been on promoting and enabling intelligent green buildings through the creation of a broad range of interoperable products. Our aim was to make buildings more energy-efficient, flexible and more cost effective.”

The EnOcean Alliance has expanded and looked to strengthen its programme in the building automation and IoT sectors. “We were founded with just seven members; as of today, we have more than 400,” Martin says. “New partners include IBM, NTT Communications and Bouygues Construction and the Alliance can now offer more than 1500 interoperable products as we look to promote the standardisation of intelligent building solutions for the IoT.”

Energy harvesting wireless technology can generate a signal using an extremely small amount of energy and a standard energy harvesting wireless module can transmit a signal up to 300m in free field. The signal process – from start, execution to completion – takes no more than 1ms.

Despite the technology being well established, the market has been a lot slower to take off than expected, concedes Martin. “To be honest, the smart home and building markets haven’t grown in the way we expected. It’s got nothing to do with the technology; rather, it is to do with that fact that we are dealing with a slow-moving market.”

Decision makers haven’t been keen to change,” he adds. However, Martin says he’s beginning to see growing interest and claims that 2017 was the Alliance’s best year to date. Traditionally, the market has focused on energy efficiency, security and safety and comfort. But, according to Martin: “We’re now seeing trends such as cognitive self-learning buildings, a focus on workspace comfort and efficiency, the deployment of IoT applications in the residential space; a move in construction towards new business models in which they provide services; and the growing use of outdoor monitoring applications.”

Recent surveys are said to show the costs associated with poor working conditions. “By focusing on issues like light, noise and air quality, research has shown that introducing automation can improve productivity significantly and cut absenteeism. While using our technology to help automate a workspace will cost up to $40 per person,” says Martin, “the productivity benefits are, according to research by the Harvard Business Journal, around $6500.”

The deployment of wireless sensors, measuring data and communicating with an intelligent system, can save businesses up to 40% in energy costs, Martin says.

“Our work with IBM combines our expertise in sensor technology with its ability, via the Cloud, to process vast amounts of data. Our sensors can easily be hooked up via a gateway to the IBM cloud.”

The next decade promises significant growth, Martin believes. “We’ll be working to further enhance a higher security of the EnOcean wireless standard, as well as delivering an advanced optimised profile structure.

“We’ll continue our work in developing an IoT certification, further supporting the organisation’s IoT approach, helping to develop interoperable, easy-to-install self-powered wireless solutions as a standard for the Internet of Things.”

A combination of new regulations, the rise of big data and the transition to cognitive buildings suggests, to Martin, that EnOcean is now entering a more dynamic phase.
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The future’s datacentric

Intel’s Reynette Au tells Neil Tyler that programmable logic has a bright future and that it will play a central role in the company’s strategy to become a datacentric business.

As vice president of marketing in the Programmable Solutions Group at Intel, Reynette Au is among a handful of women to have held a number of senior roles in the electronics industry over the past 30 years.

At Intel, she is leading the company’s marketing efforts as it looks to broaden its portfolio of programmable logic solutions, spanning silicon, software, intellectual property and hardware platforms.

Au is responsible for defining strategy, developing corporate business and marketing plans and in creating new business opportunities for Intel.

“It’s an interesting time to be at the company,” Au suggests. “Over the past seven years, Intel has pivoted to become a datacentric business and that progression continues today. It’s fair to say that last year we substantially moved the needle towards datacentricity and Intel’s presence in that market.”

That does not to imply that Intel no longer believes in the viability of the PC market. “Rather,” Au notes, “we recognise that the world is being run on data.”

Au believes the acquisition of Altera, which forms Intel’s Programme Solutions Group (PSG), strengthens that pivot.

“As Intel PSG looks to meet the demands of a rapidly changing market, PSG sits at the very centre as we look to address changing customer experiences and the rise of pervasive connectivity,” Au explains.

“Silicon is the foundational technology upon which Intel was built and it’s crucial that we understand the importance that is now being attached to FPGA technology in this space. We, as a business, are constantly having to look at ways to expand and reach new markets.”

According to Au, it’s that adoption of programmable logic and the scaling of FPGA technology that will play a key role in the business as it goes forward.

“FPGAs are notoriously difficult to work with. Although they have incredible power to deliver new user experiences it’s a challenge to extract the benefits. We need to make the adoption of FPGA technology easier and we need to lower the barriers and enable much broader access to it,” says Au.

The way in which industries are adopting technology is changing dramatically and Au points to the financial sector as a prime example.

“Look into the IT department of any major bank, they now employ hundreds of software developers working on software that is intended to help differentiate itself from its rivals and data use has become a significant business advantage.

“90% of the data we use today didn’t exist two years ago; that exponential growth, that generation of growth, is frightening. For many companies, the challenge is how to use this data. What do they do with it?”

Data, which is described as the ‘new oil’ in terms of its value, requires companies like Intel to solve the technology issues that will help customers better address business’ problems, Au argues.

“Our products need to be appealing to the software developer, because they are the ones cranking out the added value. It’s at that level that you can solve business problems with technology. How do we deploy technology to answer those questions and meet our customers’ needs to boost compute optimisation?”

The conversations Intel is now having are changing, concedes Au, as are the customers with which it is dealing. “There needs to be a business use for the technology we are developing. Intel’s view – and mine – is that the closer we are able to bring technology to the end user, the more value it will have.”

Turning to the Internet of Things, Intel is adapting to a fast-changing market in which the development environment is very different to that which went before.

“Developers for the IoT are focused on efficiency and speed,” says Au, “so how does a hardware company, which is what we are at the end of the day, figure out how to address that and make our capabilities appealing?”

The key question for companies is how do you get software engineers to embrace FPGA technology?

“Intel is working to create programming models that are common and general purpose. When you look at the programming languages engineers are trained in, you need to align with that so they don’t have to re-learn or re-train to solve problems.”

According to Au, Intel wants to enable engineers to adopt its technologies by aligning programming models with tools and references with which they are familiar.

“This allows for much greater flexibility and provides a route by which engineers can truly exploit the inherent flexibility and benefits of programmable logic,” she explains.

Au points to the importance of ecosystems and partnership programmes.

“We need to have partners who are subject matter experts and able to support developers who have identified a market segment in which to work. These companies have spent their business cycles refining and honing their expertise. You can’t develop everything independently.”

Intel is heavily engaged with Microsoft and with what are described as the super seven cloud providers. According to Au: “Each...
Reynette Au is vice president of marketing in Intel’s Programmable Solutions Group, leading the marketing of its programmable logic solutions, spanning silicon, software, IP and hardware platforms.

Prior to joining Intel in 2017, Au held a number of senior positions in the electronics industry, including: vp of marketing for the mobile business unit at Micron Technology; president and CEO at Triscend; vp of worldwide marketing at ARM; vp of navigation products within the mobile business unit at NVIDIA, and chief marketing officer at Phoenix Technologies.

Reynette Au is looking to exploit FPGA technology in different ways. But I do think that when it comes to the deployment or concept of acceleration via a cloud model, we are just scratching the surface. It’s not a mature market, but Intel wants to take a thought leadership position in it. We want to be able to tap into a technology where we have already a strong presence."

When it comes to the cloud, the overall idea has to be that it will make the delivery of services more efficient.

“Valuable cloud services will continue to evolve,” Au says. “Beyond the existing players, there is a second wave of cloud providers getting ready to participate as part of that drive towards a more datacentric world, many industries in the future will benefit from cloud services.”

According to Au, there remains considerable ‘runway’ left when it comes to FPGAs. “While the technology isn’t new, its versatility can certainly be extended further. FPGA technology has been very self-limiting, due to its complexity, but there is so much value and power that can still be had and exploited. And while I don’t see anything ‘revolutionary’ in terms of the core IP I do believe we will see a steady evolution and expansion into new and varied areas.”
At this year’s Mobile World Congress (MWC) in Barcelona, it appears the leading handset manufacturers were outshone by the telecommunications networks, who spent the show pushing the development and deployment of 5G services.

While 5G has been discussed for many years, it appears that, at MWC, the prospects for 5G and the next generation of mobile networks and services are getting close to becoming a reality.

US telecom carriers and Asian networks such as T-Mobile USA, Sprint and SK Telecom all announced they would begin testing live networks later this year and several used Barcelona to demonstrate the possibilities of the technology.

US networks have certainly been the most active in terms of planning for 5G, with several launches expected this year. Speaking at MWC, Ronan Dunne, chief executive of Verizon Wireless suggested that 5G would not only help to accelerate the levels of investment being seen in the networks, but also provide operators with the opportunity to differentiate themselves from their competitors.

In contrast to US operators and their Asian opposite numbers, European operators appear stuck in the slow lane when it comes to 5G. Slow regulatory reform is blamed for making it harder for carriers in Europe to justify the costs associated with upgrading their networks to deliver 5G.

Many companies in the mobile space – such as ARM, Qualcomm and Intel – appear to be focused less on the smart phone consumer market and more around the broader digital transformation and its impact on businesses and industry. Examples include how the use of 5G-enabled smart devices in the work environment could impact on working practices and productivity.

It appears that, for those companies, it’s businesses and not consumers that are starting to weigh up the benefits of the new networks. Ericsson, for example, partnered with automation company Comau to demonstrate 5G-enabled factory robots capable of working wirelessly and of carrying out maintenance in real-time.

While regulators outside Europe seem to ‘get’ the idea that 5G is going to be more about industrial applications than consumer devices, business leaders and industry watchers in Europe are highly critical of policy makers in European Union for not understanding this and, as a result, are failing to create an environment for investment similar to that being seen elsewhere.

Prior to MWC, John Strand, of Strand Consulting warned that ‘over-regulation’ and a £130 billion gap in investment was holding back 5G in Europe.

But it’s not just the regulatory environment in Europe that’s an issue. Many investors in the telecoms space remain doubtful about the value of 5G and are unlikely to move until the consumer business case becomes more apparent.

5G NR standard
The 3GPP officially released a first draft of the 5G New Radio (5G-NR) standard at the end of last year. This is being seen as an important first step in setting up new 5G ecosystems that will enable manufacturers and networks to test new equipment so that any implementations will conform and achieve the interoperability that’s required.

“The work of the 3GPP and 5G standardisation is crucial,” explained Sarah Yost, National Instruments’ principal product marketing manager for software defined radio. “The ratification of the new standard will support new 5G devices, the infrastructure and the delivery of innovative applications. It will help to...
The work of the 3GPP and 5G standardisation is crucial. The ratification of new standards will support 5G devices, the infrastructure and the delivery of innovative applications.”

Sarah Yost

developer CEVA, which said it was supporting Nokia in the development of its ReefShark baseband SoCs, which are set to be deployed to support 5G wireless infrastructure.

CEVA revealed that it would be adapting its widely-deployed XC architecture framework to address the massive increase in signal processing complexity in multi-RAT (Radio Access Technology) network architectures.

Based on the latest 3GPP 5G-NR specifications, the Nokia ReefShark looks to reduce the size, cost and energy consumption at each cell site, while at the same time boosting the intelligence and performance of massive MIMO antennas.

ReefShark can boost baseband compute capacity through plug-in units fitted into Nokia’s AirScale baseband modules, which are software-upgradeable to full 5G functionality and can triple the throughput to 85Gbit/s per module.

Commenting, Henri Tervonen, Nokia’s CTO and head of R&D Foundation, Mobile Networks, said, “We have collaborated closely with CEVA on developing a custom version of the CEVA-XC for ReefShark, adopting new practices, methodologies and advanced process nodes that will allow us to fully realise the capabilities that the new 5G standard will bring.”

5G is expected to revolutionise mobile communications through the deployment of millimetre wave technology, massive MIMO and beam-forming, all of which will allow for far greater precision, much higher data rates and significantly enhanced levels of network capacity.

According to most industry watchers, because of the massive overhaul to existing networks that will be required by the introduction of 5G, most use cases will be in the industrial sector, including robotics, autonomous vehicles and virtual reality, rather than in consumer sector – at least to begin with.

At MWC, Qualcomm Technologies unveiled its Snapdragon 5G Module Solution to support OEMs looking to capitalise on 5G technologies.

By aggregating the fundamental components of 5G into modules, Qualcomm said it wanted to simplify end device designs, lower total cost and accelerate new OEM entrants’ ability to adopt 5G in their systems.

According to Dr Roawen Chen, senior vice president, QCT global operations, Qualcomm Technologies: “As 5G aims to vastly expand wireless enablement into new vertical markets, our 5G modules make it simpler for newer entrants to take advantage of 5G networks and the new opportunities they will enable.”

These modules integrate more than 1000 components and will allow OEMs to combine a few simple modules to cover digital, RF, connectivity and front-end functionality in their designs.

According to Qualcomm, customers could see a reduction in footprint of up to 30%, compared to designs using discrete components.

Meanwhile, specialist RF solutions developer Qorvo announced that it was testing the first commercially available 5G RF front end module for mobile devices operating in the 3.4GHz spectrum, which would support customers designing and testing 5G technologies for early deployment in 5G mobile devices.

Smartphones

Prior to MWC, Qualcomm’s president Cristiano Amon said the company was ‘working with a growing number of OEMs that have smartphone launches scheduled for the first half of next year’.

That could explain why, at least at this year’s show, the handset industry generated so little interest. But, that’s not to say that new phones weren’t on show.

Many of the innovations from the
likes of Samsung, Sony and Nokia were, however, limited in scope and raised the question of whether innovation in the mobile space has slowed to a virtual halt.

Samsung unveiled the Galaxy S9, while Nokia continued with the successful ‘retro’ theme it developed last year, with the launch of the 3310. This year, it unveiled the ‘Banana’ phone; the 8110 Matrix phone featuring a sliding cover.

Nokia is an interesting example of a once dominant phone maker going into a steep decline with the advent of the iPhone, but then making a strong comeback. Last year, it sold more than 70million devices, helped in no small part by the release of the 3110.

The decision by the company’s owner HMD Global to bring back another old favourite, together with a range of new smartphones, may be risky, but the 8110 is inexpensive and comes with a range of apps including Google Assistant, Google Maps, Twitter and Facebook. Its most eye-catching feature, however, has to be the claim that it can provide standby time of up to 25 days.

Samsung focused on the camera in its new mobile devices. The Galaxy S9 Plus and S9 phones came with a new duel aperture camera, as well as a fingerprint reader.

However, there was criticism of the incremental nature to the improvements announced by Samsung and many of the other phone manufacturers.

Critics said that, unlike the launches of the S6 and S7 in previous years – where the differences were obvious and significant – the improvements to the S9 were less so, although there was certainly more intelligence behind the screen. The S9 can now be connected to a screen, mouse and keyboard and can offer a tracking pad capability.

Smartphones looked the same

What was true of many of the devices on offer though was that they all looked very much the same. While they offered better screens and cameras, it appeared that most improvements were incremental in nature.

That could suggest that device manufacturers are coming to terms with the fact that consumers are no longer looking to replace their phones as often and are more focused on getting better deals with network providers.

Impressing consumers is certainly getting much harder, especially when today’s devices are all about consuming content.

The Groupe Spéciale Mobile Association (GSMA), which hosts MWC, devoted much of its Innovation City booth to the possibilities for 5G technology.

So, rather than handsets being the centre of attention at this year’s show, the focus appeared to be on what 5G could improve, such as demonstrating the difference in video streaming quality between 4G and 5G networks.

Full-body immersive VR experiences were on display at MWC, suggesting that even more gadgets would be required to track different body motions, as well as even more processing power to accurately render movements in real time.

Transportation was also a theme and amongst those companies promoting the benefits of 5G for transportation was one showing a flying drone. Capable of carrying a passenger, the device will debut this year in Dubai, ferrying people from the airport to their hotels.

While MWC has been hailed a success by its organisers, following the attendance of more than 107,000 visitors from 205 countries and territories and with almost 8000 CEOs in attendance, critics believe it has lost its edge.

Is it still the event that shapes the industry or should the focus be turned towards the Consumer Electronics Show in Las Vegas?

Whichever show takes the mantle, what is true is that as mobile technologies have now become ubiquitous and integrated 5G is expected to play an important part in the future mobile landscape.

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Reality check

Augmented reality is an old technology with new hopes – and could change the face of electronic design. By Bethan Grylls.

The markets for augmented and virtual reality (AR/VR) are thriving, with market researcher IDC predicting demand for both will reach $17.8 billion in 2018.

While VR is making rapid inroads into the consumer electronics world, AR is poised to have a similar impact in industry – and PCB design is one of the potential beneficiaries, where it could address issues such as fitting electronic packages into unconventional shapes, ensuring circuit connections work properly and reducing the time-consuming process of place and route.

Unlike VR, which fully immerses the user in a digital world, AR sees digital content overlaid onto the existing reality. Virtual objects are oriented so they appear to have real places in the world.

If electronic design could benefit from AR, the question is why hasn’t it been put into practice already?

“People are solving software issues where there is high value,” David Harold, VP marketing and communications at Imagination Technologies, said. “They will pay for the issues they want to be resolved, such as ones that aid protection and health.”

Harold highlighted several areas where he believes AR could be used in the future. The first he labelled ‘procedure’, the idea that a designer could flick between the finished, virtual version of a board and the real-life work-in-progress. He suggested this could help the designer establish what still needs to be done and remind them of the finished article.

The second area is ‘non-distraction’. “People forget how finely detailed some of the work we do is,” he said. “The ability to have a set of virtual instructions in your field of vision, so you don’t have to keep manually turning pages would be very useful.”

He described a theoretical system where a user could access a ‘tunnel’ view, in which areas of their vision could be darkened in favour of particular highlighted areas.

In the future, transparent screens could enable AR supported PCB design

He also proposed combining AR with artificial intelligence (AI), offering a scenario in which an AR AI-enabled system could recognise the parts a designer was working on and provide optimisations. This imagined system could suggest alternatives, identify missing elements, offer solutions others have solved and shared previously, as well as search and highlight stress and failure points in a design.

The ability for an AR system to distinguish between necessary and needless motions would also be crucial in electronic design. Real world movement isn’t always logical, so a system would have to be intelligent enough to categorise these, so to avoid delay and error.

“Ultimately,” said Harold, “the technologies being developed in the health and consumer markets will start to trickle through to other industries.”
Much like the integration of 3D into PCB design would have been in the late 1980s, AR is a solution to problems we probably don’t yet have.”

Ben Jordan

Heather Macdonald Tait, marketing communications specialist at Ultrahaptics, believes one reason why AR has not been implemented in electronic design is due to the ‘chicken and egg situation’ between software and hardware development. “We need the right tools to develop content,” she explained. “But we also need the hardware to support it and this has affected market acceptance.”

Ultrahaptics’ technology enables haptic feedback in mid-air. Using a speaker array controlled by an FPGA and a microcontroller, ultrasound is emitted at 40kHz. The system controls when each speaker fires, creating an array of pressure points which enables a user to ‘feel’ a virtual object.

“Until we add a mechanism for interacting in a collaborative way,” Dr David Fee, an Ultrahaptics applications engineer, added, “I don’t think we’re opening up the full potential of AR and VR. We believe we are opening that potential with haptics and it’s up to people using this tool to leverage the technology.”

Altium is also experimenting with ways AR can be used in design. In previous tests, it linked 3D glasses to the 3D PCB editor view in its software, so the designer’s facial position could augment the control of the PCB design workspace.

However, it was never carried beyond experimental phase because it was hard to establish any true value or efficiency gains.

“It’ll take time for electronic engineers to think of ways in which AR could help them day-to-day. We’re waiting for some better technology,” Ben Jordan, senior manager product and persona marketing at Altium, said. “It’s like the laser; they didn’t know what to do with it at first and now it’s everywhere.”

Jordan believes the answer could lie in the creation of light emitting touchscreens. He imagines a technology where an image would be projected in front of the user, allowing them to interact through gestures. “One day, we’ll design software into transparent touchscreens and people will be able to hold them over a prototype of a board and plug it in. There will be test applications where designers can verify their work in prototype against the actual design in the software simultaneously.”

He also explored the idea of training and using AR with simulation software. He suggested augmented PCBs could be used in the future to reduce cost and wastage of material used in current training methods, as well as for replicating magnetic and electric fields generated by a product as an alternative way to ensure a product would meet regulations.

“AR could potentially play a role in making the electronics design more intimate with industrial design,” Jordan added. “For example, a product designer may create a clay mockup of the product idea and then the electronics designer may use AR views of that mockup combined with the clusters of parts in the PCB design software in real-time to begin shaping the PCBs and figuring out where some of the bulkier components would fit inside of it, or make alternative part choices to replace them with smaller components.

“Much like the integration of 3D into PCB design would have been in the late 1980s, AR is a solution to problems we probably don’t yet have,” Jordan ventured. “Today, everyone knows you must have 3D PCB design viewers at a bare minimum for efficient design, but that was not so obvious 20 years ago. As the technology and our design patterns evolve, it will become more apparent,” Jordan ventured.

“I could see that AR will become far more useful for PCB design as 3D MID technology becomes mainstream,” he continued. MIDs – Mechatronic Integrated Devices – are 3D bodies with integrated circuit structures. “With the 3D MIDs, you want to take a plastic or clay mockup of the moulded shape and, with the CAD and an AR camera view, in 3D, superimpose the track routing and component placements.”

“But maybe that isn’t necessary,” he countered. “You could simply bring in the STEP or Parasolid model of the MID design into the editor environment, place the parts and route them. Only time will tell.”

While AR may have a place in electronic design in the future, it seems that progress needs to be made in developing suitable hardware. Until then, AR in electronics may remain a mere gimmick.
The search for a breakthrough display technology that addresses the needs of next generation products could be over. By Keith Strickland.

A growing number of emerging applications, such as Head Up Displays (HUDs), AR/VR headsets and general wearables, are looking at new display technologies to enable the development of next generation products that will meet growing global demand. According to research consultancy Yole Développement, the market could reach as many as 330 million units by 2025.

Although augmented and virtual reality are probably being seen as consumer technologies, they are increasingly used in industrial and manufacturing applications, providing skilled and semi-skilled workers with access to information that can assist them in a range of tasks. Examples may include showing a worker the correct sequence for fixing and tightening bolts in an engine, or rivets in a larger structure such as a fuselage. When tools are also connected, the process becomes altogether more integrated, delivering quality assurance as each fixing is recorded or highlighting those that haven’t yet been secured.

Head-mounted displays not only add a level of realism to the scene, they can further increase productivity by allowing workers to move around unencumbered by large handheld displays or tablets.

Display technology is evolving in order to meet demand for smaller, lighter headsets that can be worn for an entire shift without becoming a burden or potential health hazard. The drive for more efficient displays is pushing innovative manufacturers towards microLEDs; a technology that promises lighter, smaller and more efficient displays.

**Emerging applications**

Headsets are one important and emerging application area for smaller displays, but others include HUDs, which are now being integrated into road vehicles. Existing applications include general wearables such as smart watches and, of course, displays have always been part of the Human-Machine Interface. This will continue, as smaller displays will allow them to be embedded within a wider range of devices.

Displays generally fall into one of two categories; reflective or emissive. Reflective displays typically require a separate light source and mirror arrangement, while emissive displays, such as LEDs, generate their own light.

Today’s headsets are often based on reflective display technology due to the lack of available emissive displays, which is why they appear large and heavy and are generally power-intensive. Moving to an emissive display solution for headsets will reduce the overall size, weight and power consumption, leading to a significant change in market dynamics.

Like other forms of emissive display technology, microLEDs feature three LEDs per pixel – red, green and blue – in order to provide the full spectrum of visible light. The name reflects the small size of each LED, often 10 μm or less, on a pixel pitch of less than 40 μm. While this makes them suitable for HUD applications, they can, in theory, be applied to any display of any size; scalability is one of the technology’s many benefits.

For larger displays, such as TVs, tablets or mobile phones, pixel pitch is less demanding. However, applications such as HUDs in vehicles, head-mounted displays and wearables, require pixel densities of hundreds of pixels per inch, which means the pitch...
shrinks significantly. In manufacturing terms, this presents challenges with respect to incumbent technologies such as OLED.

The main advantages that make microLED technology worth pursuing in the face of those technical challenges include higher luminosity; typically, an OLED produces in the region of 1000 Nit (1Nt is equal to 1candela/m²), while microLEDs can produce upwards of 100,000 Nit. In simple terms, this means the same luminance can be achieved for much lower power – a critical parameter for the target applications.

**Manufacturing challenges**
Conceptually, manufacturing a display comprising three LEDs per pixel involves combining LED chips and an active matrix to drive each chip individually. Today, the vast majority of LEDs are manufactured using gallium arsenide (GaN) on sapphire wafers.

In display applications, each LED needs to be attached to the active matrix. However, GaN on sapphire doesn’t lend itself to integration with CMOS circuitry, so each LED chip needs to be physically placed on a silicon substrate implementing thin film transistors. In larger displays with a pixel pitch of 70μm or more, this isn’t too difficult. But as display sizes reduce and pixel pitches shrink, the manufacturing equipment becomes less efficient.

Effectively, the process involves picking the LED chips up and placing them with extreme accuracy on the silicon substrate. While the cost of developing and manufacturing the pick and place equipment is one factor, a more important question is the ability of companies to make pick and place equipment that is accurate and efficient at pixel pitches of 20μm or less.

A major concern is the yield that can be achieved, both in terms of selecting working LED chips (and removing those that do not work) and placing them accurately. Reworking a microLED display would likely be economically unviable, so the total yield will be determined by both factors.

The alternative tactic is to use a monolithic approach with multiple emitters on a single chip. This requires moving the LED manufacture to a substrate that accepts silicon more readily and the most promising technology in this respect is GaN on silicon. It provides the ability to make larger LED emitters, with better contrast, thanks to the technology’s surface-emitting properties. The technique can easily be scaled to 200mm wafers and larger, improving cost and yield.

**Monolithic approach**
Monolithic in this context means there is no need to use pick and place machines; LEDs are manufactured on a silicon wafer which is directly bonded to another silicon wafer containing the active matrix. Removing the need to pick and place individual LED chips means the entire process becomes much more efficient in manufacturing terms, as well as economically scalable.

This includes wafer size; sapphire wafers are typically available economically up to 6in (150mm), but silicon wafers of 200mm and 300mm are commonplace, as is the manufacturing equipment used in the fabrication of CMOS devices.

The technology and intellectual property developed by Plessey Semiconductors is attuned to the large-scale manufacture of microLEDs using GaN on Si.

The company’s background in developing CMOS sensors also lends itself to microLEDs, as much of the underlying technology is transferable. While pixels become emitters instead of sensors, a lot of the addressing technology is comparable.

Another advantage is that GaN on Si LEDs are surface-emitting devices, as opposed to GaN on sapphire, which is a volume-emitting technology. In simple terms, this means more of the light generated is emitted in the desired direction. Although a waveguide is still required, less of the light is lost due to alignment or the photon’s exit vectors, further improving the power efficiency of the display.

Current waveguide interfacing is a very lossy process with very little of the light entering a HUD usable by a viewer. Monolithic micro LED arrays could mean a transformation from typical VR headsets to something more akin to a pair of glasses.

**Conclusion**
Demand for smaller, power-efficient displays is building, from applications including HUDs and AR/VR headsets. This will put pressure on the incumbent technologies, which will struggle to scale down to the sizes required both in practical terms and economically.

The availability of a robust GaN on Si process is now enabling the manufacture of monolithic microLED displays. This technology is proven to meet the demands of emerging display applications and is now being made available through technology licensing agreements.

As the dimensions of displays reduce, GaN on Si is emerging as the most technically and commercially viable approach to meeting demand for microLEDs that deliver high efficiency, high pixel density and low power.
The rise of what is being described as the intelligent connected world has brought with it an explosion in data, the growing adoption of artificial intelligence and a move to more heterogeneous computing.

The electronics industry is seeing exponential change and that brings with it certain challenges; in particular, having to address the fact that the speed of innovation is now beginning to outpace silicon design cycles. This brings a growing need for acceleration and a move towards programmable logic and FPGAs.

These devices can provide massive computational throughput with very low latency, which means they can process data at wire speeds and implement complex digital computations, with power and cooling requirements an order of magnitude less than than either CPUs or GPUs.

Earlier in 2018, at a developers’ forum in Frankfurt, Xilinx’s senior director for software and IP, Ramine Roane said design teams were increasingly turning to FPGAs when CPU architectures are seen to be failing to meet the demands of increasing workloads.

According to Roane: “As CPU architectures fail to meet demand, so there’s growing interest in heterogeneous computing with accelerators. The breadth of apps being developed is also requiring different architectures. Designers are addressing the need for both higher performance and lower latency and, while we saw a move to multicore architectures to address this, we’re now seeing multicore architecture scaling beginning to flatten.”

With the growth in new applications, so the demand for application specific accelerators has increased. But, according to Roane: “Whether for video, machine learning or search applications, we have reached a point when specific accelerators can no longer be justified on economic grounds. Why? Because workloads are becoming more diverse and demand is constantly changing.”

Roane suggested there’s been a move away from application specific accelerators towards more reconfigurable ones and that trend has played to the strengths of FPGAs and SoCs.

“By using FPGAs, it is possible to provide configurable processor sub-systems and hardware that can be reconfigured dynamically. Their key advantages are that design engineers can build their own custom data flow graph, which can be customised to their own application with its own custom memory hierarchy, which is probably the biggest advantage as it lets you keep data internal to your pipeline,” he explained.

While FPGAs can offer massive computational advantages, programming them has traditionally been been seen as a challenge, despite various application tools being available.
which is available on the Cloud via secure cloud services platforms,” said Roane.

**The growing role of the Cloud**

To increase application processing speeds, hardware acceleration is being helped by Cloud platforms such as Amazon Web Services’ (AWS) FPGA EC2 F1 instances. This new type of compute instance can be used to create hardware accelerations for specific applications.

F1 comes with the tools which will be needed to develop, simulate, debug and compile hardware acceleration code and it includes an FPGA Developer AMI and Hardware Developer Kit.

“Pre-built with FPGA development tools and run time tools to develop and use custom FPGAs for hardware acceleration, our FPGA developer AMI provides users with access to scripts and tools for simulating FPGA designs and compiling code,” explained Amazon’s senior director of business development and product, Gadi Hutt.

According to Hutt, the AWS Cloud provides greater agility and speed, cost savings and the ability to scale up and down quickly, as needed. “By using the Cloud,” he continued, “we are providing on-demand delivery of compute, storage and networking services.”

“Engineers will no longer have to worry about hardware, networking, power and cooling,” Hutt said.

Amazon EC2 F1 instances are offered in two sizes that include up to eight FPGAs per instance.

“F1 instances include 16nm Xilinx UltraScale Plus FPGAs with each FPGA including local 64Gbit DDR4 ECC protected memory, with a dedicated PCIe x16 connection,” Hutt explained. “The ability to code applications in C, C++, and OpenCL programming languages is possible through the availability of Xilinx’s SDAccel development environment.”

Each FPGA contains 2.5million logic elements and approximately 6800 DSP engines.

According to Hutt: “AWS will allow your company to ‘get out of IT’ and focus on providing specialised services where you can add value. It means you can focus on your core business.”

The benefit of using EC2 F1 instances, Hutt added, are that it’s a quick way to deploy custom hardware solutions. “Literally with just a few clicks in the platform’s management console,” he claimed.

Because F1 instances can have one or more AFIs associated with them, designers will have much greater speed and agility and be able to run multiple accelerations on the same instance. “It’s also very predictable,” said Hutt.

Connected via a dedicated PCI Express fabric, FPGAs can share the same memory space and communicate with each other at up to speeds of 12Gbit/s. The design ensures that only the application’s logic is running on the FPGA while the developers are using it; possible because the PCI Express fabric is isolated from other networks and FPGAs are not shared across instances, users or accounts.

With respect to EC2 F1 instances, Hutt made the point that it is possible to deploy hardware acceleration without having to buy FPGAs or specialised hardware to run them. “That reduces the cost of deploying hardware accelerations for an application dramatically.”

“There’s a tremendous opportunity for FPGAs to shine in a number of areas,” Hutt concluded. “It’s about democratising FPGA development and increasing the number of use cases. The platform is continually evolving and I believe users are turning to F1 because it offers access to thousands of servers in a matter of seconds, which means you can roll out applications quicker, complete your work faster and cut costs.”
Power at your fingertips

Benchtop power supplies have had to evolve rapidly to provide the features needed to test PCBs integrating complex components. By Graham Pitcher.

The first instrument which comes to the mind of most engineers when it comes to testing a new board is an oscilloscope. While that will help to assess many aspects of the board’s performance, it’s not the only device that will be needed – a good benchtop power supply is just as important.

One reason for this is the range of more advanced components being integrated onto PCBs. Mark Edwards, managing director of electronics test and measurement specialist Aim-TTi, said: “Big FPGAs, for example, draw a lot of current. While bench power supplies must be capable of providing up to 60V, they also need to be able to supply up to 20A at lower voltages. Meanwhile, voltage rails are changing and there’s not just one supply rail to a PCB any longer.”

According to Edwards, the need for engineers to control voltage and current more accurately during test has evolved. “Having said that,” he continued, “many Aim-TTi power supplies introduced some 40 years ago are still in regular use. But the technology used in recent designs has brought new features.”

He also said the range of test voltages required today isn’t fully met by the nominal 0 to 30V, 0 to 2A supplies used commonly in the past. “We are now seeing increased demand for supplies that provide more than 60V and more than 20A, with overall power levels ranging from 300W to 1kW.”

Looking to address more complex requirements, Aim-TTi is now offering multichannel supplies with time managed output switching. These help test engineers to ensure that supply rails are in place to protect the power cycling of circuits at the prototype stage of development. “We have a range of three output supplies,” Edwards pointed out, “and will shortly be releasing a four output model, with equal power available on each multi range output.”

**Power supply flexibility**

A traditional three output supply might have two 30V outputs, with an auxiliary output of around 5A, Edwards explained. “Now, because of demand, we have introduced two main rails and third fully controllable rail for specific voltages. And, with the MX range, the 315W model can be set in multiple ranges. So you could parallel internally to give 35V at 6A, with a third output giving 70V at 3A. It’s all about flexibility.”

Benchtop power supplies in the past were predominantly linear devices. However, despite providing low noise and good stability, linear supplies tended to be large and relatively inefficient.

“TTi produced its first digital version in 1978,” Edwards remarked. “Since then, the technology has evolved and switch mode has become the norm – particularly for higher power devices. At first, switch mode wasn’t popular because it generated more noise and had a
longer response time. But modern technology has changed that. Today, mixed mode devices can convert 240V AC into DC using switch mode, then pass that through a linear output stage that regulates the supply in a traditional way. This combines the efficiency and size benefits of switch mode with lower noise and less ripple on the output.”

Doug Lovell, sales director of distributor Telonic agreed. “Historically, engineers would have selected a linear power supply, but switch mode technology has advanced to the point where it is approaching linear performance. That’s a huge advantage because switch mode supplies are smaller.”

According to Edwards, most power supplies rated at more than 100W use switch mode technology. “The QPX and CPX ranges use our PowerFlex architecture to provide higher currents as the set voltage is reduced. While PowerFlex uses mixed mode regulation, the PowerFlex+ architecture uses a multiphase conversion technique to eliminate the need for a linear output stage and this provides a wider voltage-current combination. Using this technology, the QPX600D can provide up to 80V or up to 50A within its 600W operating envelope.”

Lovell said that, typically, a bench power supply used to offer 0 to 50V and 0 to 10A – a total load of 500W. “Today, devices are smarter, with a wider voltage range and a wider current range. That means engineers can use a higher voltage at lower current and vice versa. In this way, one power supply can replace several units that might have been needed in the past. But range is most important.”

“Telonic carries Kikusui’s PWR-01 range,” he offered, “which meets the latest CE standards. It has four ranges – 0 to 40, 80, 240 and 650V – with power ratings of 400, 800 and 1200W, autoranging and sequencing.”

There’s also increasing demand for greater accuracy. “In some ways,” Edwards contended, “this runs against power. So, while people want more power from a device, they also want to be able to measure lower currents – standby consumption, for example.”

Lower power supplies are often required to supply and measure currents of less than 1A with good resolution. “Our PL and QL models,” Edwards explained, “offer a selectable 500mA range to provide increased resolution and the MX series has meter resolutions as low as 1mV and 0.1mA.”

Resolutions in the mA range also enable measurement of non load conditions to see if there are faults. “Previously,” Edwards highlighted, “this was done with a DMM and you can now do away with that.”

Lovell believes stability is also an important feature. “If you compare top of the range supplies with others, you’ll find they have stable, clean outputs. If you want 20V, then you’ll always get 20V.”

And it’s in product quality that Lovell has an issue with some manufacturers. “A common issue with lower cost supplies is that when you turn the output on and set, say, 12V, a cheaper supply will ramp beyond 12V and then settle. That overshoot can result in an overvoltage being supplied to the board under test and we’ve seen examples of expensive boards being ‘fried’ in this way.”

**Knobs or touch technology?**

With touch technology being applied in a wide range of applications, is there demand from users for touch interfaces in bench power supplies? Lovell said that, in the past, there would have been a pot for voltage and a pot for current. “That changed to one pot, but customers didn’t like that, so the latest supplied have gone back to having pots for voltage and current.”

Edwards said the front panel didn’t change significantly for many years. “But, while many engineers agreed that the set ability of digital interfaces offered advantages, many still preferred rotary controls for quick adjustments and threshold testing. The consensus amongst engineers is that they like knobs; if they are ramping a voltage, they like to be able to turn a knob and see the effect.”

For all the technology integrated into a benchtop power supply, another factor dominates – size. “Five years ago,” Lovell observed, “supplies were probably twice the size they are today, but with less connectivity.” Edwards noted: “Front to back length needs to be minimised to ensure the device doesn’t take up unnecessary bench space. While many power supplies are only 1U high, they are deep and have high forced air noise.”

Looking to the future, Lovell noted a trend towards universal supplies. “If a company makes an autoranging supply,” he concluded, “it only needs to make one model. It can concentrate on developing that, making it in higher volume and selling it for less.”
The VME bus is one of the longest lasting standards in the electronics world. Unveiled in the early 1980s, the bus was intended to be a flexible environment, capable of supporting a variety of computing intensive tasks. Yet despite the development of other standards – such as VPX – VME has not only survived, but continues to see new products being developed.

One of the companies which is supporting VME is Curtiss Wright Defense Solutions (CWDS). Asked why VME is surviving, Andrew McCoubrey, CWDS’ networking product manager, said the concept enabled the creation of modular systems which can be upgraded as necessary. “One of the benefits of VME is that users can replace things one at a time.”

“All chassis have technology that is often hard to replace, but users still have emerging needs; they want to find ways to put new boards into a qualified rugged box and VME gives them a way to do it.

“As long as there are new products being made available in the VME form factor, there will continue to be a market.”

VME’s long heritage conveys the impression that it’s a legacy technology. Aaron Frank, senior manager, Intel single board computers (SBCs), with CWDS, disagreed. “There are certainly legacy systems – there’s a huge installed base in the defence sector, for example – but VME isn’t a legacy technology. Users are more interested in adding capability than taking chassis out. Users may have legacy systems, but they can still bring the latest technology to VME.”

High performance SBCs
Frank said some users were making use of the latest high performance single board computers, often with Xeon processors, and bringing them into their VME systems. “Users can take advantage of the power of today’s software in a familiar environment. The one issue is that these boards can’t interact with the backplane.”

An attractive aspect of VME since its launch has been the board format. Frank said: “There are a lot of advantages with the 6U format. One of them is the fact that you can incorporate more than twice as much circuitry in the 6U format and not waste space using multiple 3U boards.”

Yet VME has not been without its challenges. One of the largest bumps in the road came a couple of years ago with the announcement by IDT that it was discontinuing production of the Tsi148 VME bridge chip. This chip was originally developed by Canadian company Tundra Systems, which was acquired by IDT in 2009. “Most VME vendors have now moved to an FPGA based interface with the same abilities,” Frank noted.

CWDS is no exception and has developed the Helix interface to fill the gap. “In order to get data from the processor to the VME bus, we used to use the Tsi148. We’ve replaced that with an FPGA. There’s no functional difference between the two approaches, but as it’s an FPGA, we can upgrade it as necessary,” Frank added.

Helix supports the use of the PCIe Gen 2 interface, along with the complete set of VME data transaction types – SLT, BLT, MBLT, 2eVME and 2eSST. It also integrates an embedded interrupt controller which can manage up to 64 internal interrupt sources, and provides programmable VME slave support on two address spaces.

The VME-690 is a 24 port Gigabit Ethernet switch module which brings enhanced security to VME systems.

“VPX is the one thing which might kill VME, but it’s going to be a very slow death.”
Aaron Frank
Frank noted that the VME interconnect is fixed. “You can’t get higher data rates through the interconnect,” he said. “A legacy system may feature an old Power Architecture processor running at 5 or 10DMIPs; the Core i7 processor on some of our latest boards runs at hundreds of thousands of DMIPs. While you can do more processing on the board, the amount of data you can get in and out is limited to the bandwidth of VME. But today, it’s not always necessary to use the VME backplane; you can bring data in and out using a mezzanine card.”

McCoubrey added: “While a lot of systems will use VME as their base, there are just as many systems where cards connect using Ethernet, PCIe and so on. These systems are taking advantage of VME’s pins and protocols, allowing users to build systems with all sorts of interconnect.”

Is there a ‘sweet spot’ for VME systems? Frank said he didn’t think so. “We have customers using three or four slots, but we also have those with 16 boards. It really depends on the original application and how the architecture can be used to bring the required capability.

“Many systems are also software driven, which lends itself to the use of higher performance processing in the same amount of space.”

Frank pointed out that new VME products were being introduced across the board. “We are introducing the latest processing technologies,” he said, “as well as network switching and routing in VME. Users can now have 0Gbit – even 10Gbit – communications, where legacy systems may only support 10Mb/s. So the ability to update the communications rate, plus use the latest operating systems, is a boost.”

McCoubrey pointed to another benefit of upgrading VME systems. “It brings security,” he said. “Security has always been a concern for users of VME, but there haven’t been that many solutions.”

Andrew McCoubrey

“Security has always been a concern for users of VME, but there haven’t been that many solutions.”

Three orders confirm VME’s popularity

While Southampton based Verotec acknowledges the debate around VME’s future, it says VME is still going strong. The ability to use 21 slots, coupled with an efficient interrupt scheme, is said to still make VME attractive.

Evidence for VME’s popularity comes from orders for three bespoke VME systems.

The European Spallation Source has ordered horizontal 3U six slot EMC screened, thermally managed and powered 19in rack mount systems for data capture and measurement.

A major US based corporation has ordered desktop nine slot VME64x systems to provide a secure environment for the development, testing and debugging of new single board computers, while a US marine defence contractor has ordered three isolated 6U/six slot VMEbus systems in a 21 slot 9U chassis. Each of the three sections has independent thermal and power management, bringing operational flexibility and efficiency.

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Andrew McCoubrey

The SVME/DMV-196 features CWDS’ FPGA based Helix PCIe to VME64x interface

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<th>Part</th>
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<tr>
<td>LTC6655</td>
<td>0.25ppm Noise Voltage Reference</td>
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