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November 05/16



Cover Story:  
Optimizing next-gen machine vision  
platform to enhance automated inspection

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## Dear Readers,



The year 2016 draws to an end and leads once again to cool, cloudy, rainy, and foggy weather conditions typical for autumn. But is there nothing else to see under these adverse conditions? Aren't there computers in the cloud and servers in the fog! This proves that there is now also once again the final spurt for the embedded industry in the current year. Two important events for the embedded community – the exhibitions electronica in Munich and SPS/IPC/Drives in Nuremberg – are the highlights to indicate this final spurt.

And due to the Internet of Things and Industrie 4.0 respectively, you'll find Cloud Computing and Fog Servers and discussions about how they will fit in future into the embedded market at both of these events.

When the electronica will open its gates on 8th of November this year exhibitors will present the latest embedded solutions and products that pertain to key themes such as the Internet of Things (IoT), industrial electronics and automation. Embedded is one of the most important focal points of this fair. Besides the Embedded exhibition sector in Hall A6, the Embedded Platforms Village is another visitor highlight where companies can demonstrate their know-how. The Embedded Platforms Conference is a communications platform that revolves around components, tools and software. The first day of the conference focuses on "IoT and Security" and "Microcontrollers and Peripherals." On the second day of the conference, participants will discuss the "Power and Sensors" and "Embedded Communication" sectors. You see electronica transformed into a "must visit" exhibition for developers of embedded systems.

Just two weeks after electronica 2016, SPS/IPC/Drives will open its gates on November the 22nd at the exhibition centre in Nuremberg – the second important event for the embedded community – especially for the designers of embedded systems for use in industrial automation. Once again this fair will provide their industry visitors with a comprehensive overview of individual components and complete solutions for electrical automation. Furthermore it highlights the pioneering technologies of the future – say Industrie 4.0. Due to the positive reception in the previous year, and the increasing challenges faced by industrial production, Hall 3A is once again the showcase for the Industrie 4.0 Area. This Area offers visitors a wide range of opportunities for obtaining information focusing on digitalization and intelligent networking of production. The „Automation meets IT“ joint stand and forum presents data-based business models as well as IT-based solutions from the world of automation en route to the digital production of the future. On the joint stands „AMA Center for Sensor Technology, Measurement and Testing Technology“ in Hall 4A and „Wireless in Automation“ in Hall 10, visitors can obtain specific and comprehensive information on the respective topics which are also close tied to Industrie 4.0.

I hope, you as a member of the embedded community, are well trained for the final spurt we all have to overcome. If you need some relaxing between the two spurts please join the AspenCore booth 471 in Hall A6.

*Yours Sincerely*

Wolfgang Patelay  
Editor





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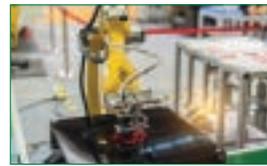
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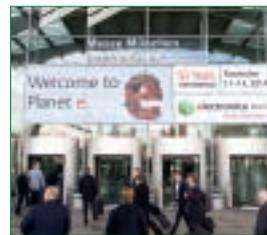
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**Oscilloscope for complex measurement tasks and multi-domain applications 32**



Developers of electronic designs want to perform complex measurement tasks quickly and successfully. And they also want to do so with a powerful, highly versatile and intuitive lab oscilloscope. The new R&S RTO2000 oscilloscope gives them what they need.

**Code coverage in automated test of embedded systems 35**

By means of code coverage, it is not complicated to determine test quality in parallel to software and system tests on real hardware. In any case, a continuous and seamless workflow for the software and system testing, which logically requires open interfaces for efficient tool coupling, is essential for correct and reliable results.

**Multi-protocol controller for Industry 4.0 38**



With the R-IN Engine architecture described in this article, a device can process both network communications and complex applications simultaneously, with extremely low delays, low jitter and minimum power consumption. Thus a multi-protocol industrial automation product can be simply implemented using a flexible, low-cost R-IN single-device approach.

**New COM Standard SMARC 2.0 starts with Apollo Lake 44**

At the beginning of June, the Standardization Group for Embedded Technologies (SGET) released the new SMARC 2.0 specification. congatec is offering its first modules for this form factor equipped with the new Intel Atom, Celeron and Pentium processors developed under the code name Apollo Lake.



Cover Photo: ADLINK



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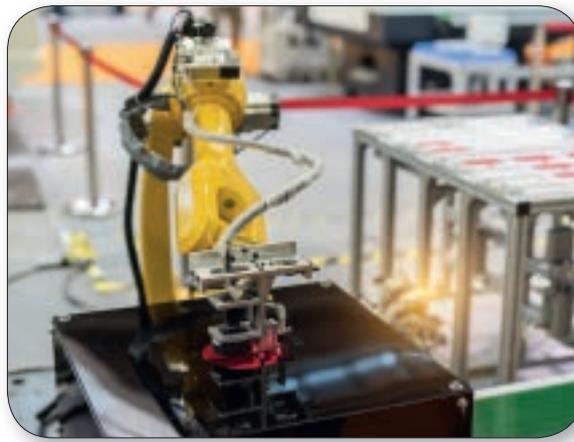
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# Optimizing next-gen machine vision platform to enhance automated inspection

By Sam Chiu, Product Manager, ADLINK

*This article shows how specialized embedded computer hardware products are able to simplify dramatically the task of machine vision in various industries.*



■ As the Industry 4.0 initiative encourages manufacturers to actively implement smart automation, machine vision has become indispensable to quality control of automated production. Gradual increases in implementation of related applications have resulted, leveraging continual advances in machine vision accuracy to grow production efficiency. With increasing requirements for simultaneous acquisition of multiple subject angles through multi-channel cameras for the purposes of inspection, alignment, identification, gauging, pattern match, and others at diverse workstations, density of camera deployment in the production environment expands accordingly, and burdens on machine vision application platforms become heavier. In addition to demands for increased processing speeds of large amounts of image data, motherboard architecture itself can further determine whether the system configuration can exact maximum benefit with minimum investment.

Machine vision systems are depended upon to help increase production efficiency by, among other tasks, detecting extremely small and intricate devices under test (DUTs), acquiring high resolution images at high speeds, and expanding FOV (field of view). The associated hardware must therefore significantly enhance reliability, to guarantee smooth

operation of the production line. The newest ADLINK IMB-M43 industrial ATX motherboard, in addition to the latest Intel 6th generation Intel Core processor with Intel Q170 chipset and ninth generation graphics display engine (Intel Gen9 graphics), further circumvents previous design bottlenecks, making it a uniquely ideal computing platform for high-speed machine vision applications.

With the 6th generation Intel Core processor, IMB-M43 delivers not only better CPU computing performance, its iGPU performance is also increased significantly, by 30%. What's more, since the new generation processor supports high-speed energy-saving DDR4 memory, ADLINK has equipped the IMB-M43 motherboard with dual-channel DDR4 2133MHz modules, to buffer large amounts of data and beef up overall performance. The 6th generation Intel Core processor also provides independent PCIe data channels, freeing PCIe slots from sharing bandwidth and sacrificing speed, enabling the IMB-M43 to increase data transmission speeds.

ADLINK prioritizes expansion slot flexibility for high-end machine vision applications, such that the IMB-M43 provides up to five PCIe slots allowing multiple frame grabbers to be configured on a single motherboard, managing large amounts of data acquired

from multiple cameras, or, alternatively, supporting installation of additional graphics cards to enhance image processing capability.

With flexible PCIe configuration, from the 6th generation Intel Core platform CPU PCIe bifurcation and lane reversal mapping and flexible I/O features, PCIe slots can be assigned to 4 PCIe 3.0 x4 lanes plus 1 PCIe 3.0 x8 lane, 2 PCIe 3.0 x4 lanes plus 2 PCIe 3.0 x8 lanes, or 2 PCIe 3.0 x4 lanes plus 1 PCIe 3.0 x16 lane, optimizing placement options to fulfill a wide variety of tasking requirements. To facilitate integration, ADLINK's complete portfolio of off-the-shelf motion, vision and I/O cards are fully pre-verified to guarantee maximum compatibility and convenience.

For enhanced durability and reliability, unlike common applications in which gold flash process is used to plate PCI/PCIe/DIMM /LAN/SATA/USB\* connectors on the motherboard, the IMB-M43 undergoes gold plating with higher corrosion resistance, plated to at least 15µin thickness, ensuring that the interfaces can withstand a much wider range of environmental conditions and wear. The IMB-M43 also complies with EN55022 Class B standard and EN55024 Class A certifications to deliver more robust electromagnetic interference and tolerance compared to similar market offerings in its class, ensuring security and stability.



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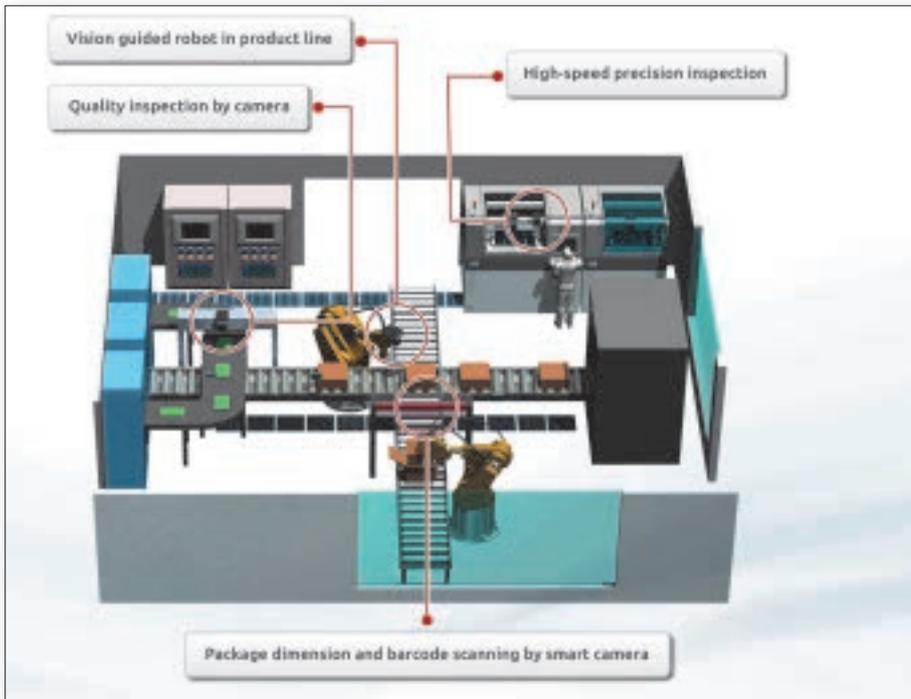


Figure 1. Multi-inspection sites, leverage the resources software for development

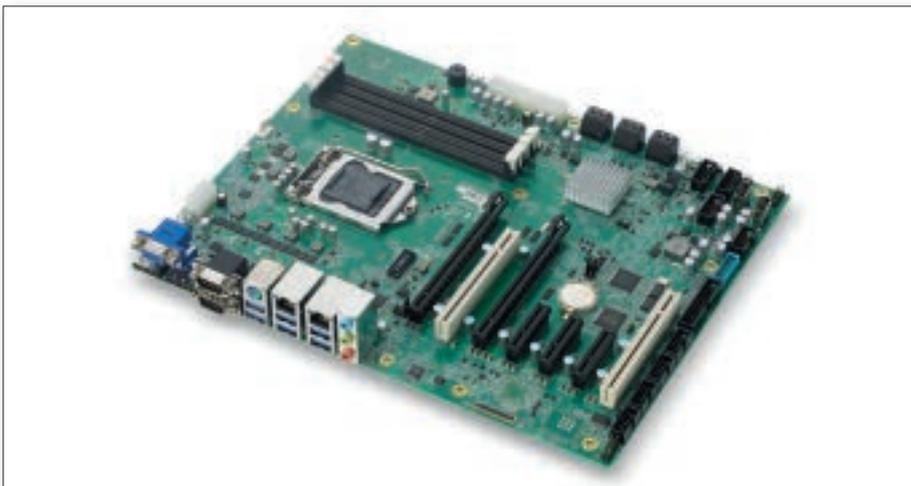


Figure 2. Ideal for high-speed machine vision applications - the IMB-M43 industrial ATX motherboard with 6th Gen Intel® Core™ i7/i5/i3 Processor

The IMB-M43 further reduces TCO by ensuring stable 2A power supply for each USB port at 5V +-5%, with all 14 USB ports supporting up to 14A total, even from a 300W supply, unlike other platforms requiring a 460W PSU to drive the same system due to motherboard consumption exceeding 5V current.

ADLINK provides not only high-end industrial motherboards, but also frame grabbers with various interfaces, such as the PCIe-GIE74+ 4CH with PoE+ interface enabling transmission of 1Gb/s, and supporting connection to a GigE Vision camera, and the Euresys CoaXPressframe grabbers to process high bandwidth and long-distance data transmission of frame grabbers that use the CoaXPress standard interface to process high bandwidth

and long-distance data transmission. These complete solutions can help to configure fully-optimized machine vision systems. As an example, in a smartphone manufacturing facility and electronic component foundry, machine vision is essential on the production line to execute QA inspection and alignment correction. Conventionally, to process the data from as many as 16 cameras would require a hardware configuration with several computers. Now much more effectively a multi-slot IMB-M43 motherboard with five PCIe-GIE74+ frame grabbers can accommodate connection of multiple cameras to a single host computer. Furthermore, since additional software licensing is required for every computer configured, with licensing fees usually several times the cost of the hardware itself, ADLINK solutions

further reduce costs of machine vision systems by eliminating the need to deploy multiple host computers. In another example, in an IC packaging and testing plant, machine vision is used to perform appearance inspection and alignment operations, in which a total of 16 cameras need to be installed at three different stations, every station using four or five cameras to acquire images simultaneously. Multiple graphics cards are required to perform the computations required to process the large amounts of image data. ADLINK's high CP value IMB-M43 utilizes server-grade motherboard specifications to support installation of four PCIe-GIE74+ cards with an additional graphics card in five PCIe slots, thereby saving space while achieving the required level of computing performance.

Panel manufacturers have previously used the Euresys Camera Link solution to build machine vision inspection systems on the production line. As modules supporting the new generation CoaXPress ultra-high speed standard have become available, users have been able to upgrade their original systems. High performance IMB-M43 industrial motherboard with EuresysCoaXPressframe grabbers have tripled data transmission speeds, further accelerating production speeds for vastly improved yield and throughput.

For machine vision applications focusing on factory automation, user priorities include maximizing image capture, transmission, and processing. The 6th generation Intel Core processors provide not only maximum computing performance, but also increased RAM and bandwidth. Thus equipped, the flexible slot configuration of the IMB-M43 delivers sufficient expansion slots to eliminate the need to furnish server-grade motherboards while simplifying onsite configuration of the machine vision system. Installation space is conserved, system building costs are reduced, and robust construction allows it to withstand the most rigorous manufacturing environments, ensuring stability, reliability, and maximum performance on the production line.

With machine vision development expected to become even more dynamic in the future, ADLINK is ideally positioned to continue to provide complete industry support, irrespective of machine vision operations growth and evolution, whether for native PC USB and GigE applications or ultra-speed applications such as Camera Link and CoaXPress, from industrial platform and image capture, to motion control and I/O module and even image processing and software-based analysis. The one-stop-service capability and extensive field integration and support experience of ADLINK continue to enable reliable, high-speed machine vision inspection applications. ■

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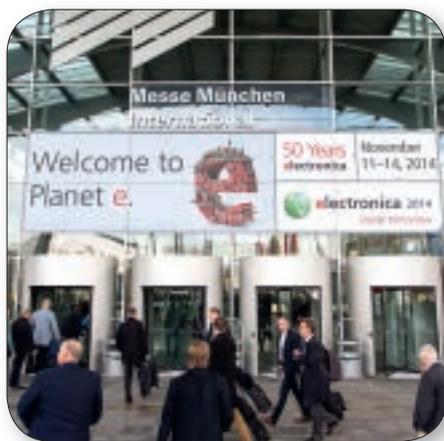
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# electronica - more than 2,800 exhibitors and an extensive supporting program

*The International Trade Fair for Electronic Components, Systems and Applications, electronica, will be held from November 8 to 11, featuring this year an additional hall and thus occupying a total of 13 halls at the Messe München trade-fair center. However, that is not the only new development at electronica 2016.*



■ Besides more than 2,800 international exhibitors, visitors can expect an extensive supporting program with four conferences and five forums. From the Cyber Security Forum and the electronica Automotive Conference to the CEO Roundtable: Experts and exhibitors will present and discuss the latest developments from around the world at electronica. With an eye on current trends, electronica 2016 will focus on its main themes, i.e. Automotive, Embedded Systems, Solid State Lighting, Wearables and Healthcare as well as the related topics of cyber security and the Internet of Things. All of these topics will also be reflected in the supporting program.

“Connected Worlds—Safe and Secure” is the motto of an exhibition sector at electronica that revolves around the latest operating systems and networking technology in the electronics applications sector. When the fair opens its gates exhibitors will present the latest embedded solutions and products that pertain to key themes such as the Internet of Things (IoT), industrial electronics and automation. Embedded is one of electronica’s most important focal points. The last time that the fair was held, 35 percent of its 73,189 visitors came from the sector for hardware and software development. Besides the Embedded exhibition sector in Hall A6, the Embedded Platforms Village is another visitor highlight where companies can demonstrate their know-how. Visitors can also expand their technical knowledge within the scope of the conference and forum program.

The **Embedded Platforms Conference** is a communications platform that revolves around components, tools and software. It takes place at the Press Center East during the fair, i.e. on November 9 and 10. Participants at this year’s conference will exchange information on four key topics: The first day of the conference focuses on “IoT and Security” and “Microcontrollers and Peripherals.” On the second day of the conference, participants will discuss the “Power and Sensors” and “Embedded Communication” sectors. The conference schedule is available at [www.electronica.de/en/embeddedplatforms](http://www.electronica.de/en/embeddedplatforms). The Embedded Platforms Conference is supported by Texas Instruments, Infineon Technologies and e2v.

From chips and components to tools and software to circuit boards and modules for various applications: The electronica **Embedded Forum** in Hall A6 will present a diverse range of technologies, trends and product innovations that pertain to the latest issues and challenges. The focus of this year’s presentations will include IoT, industrial electronics and automation. The event primarily addresses designers, technical specialists and technical managers. Details about the Embedded Forum program are available on page 19.

One of electronica’s highlights is on the first day of the fair: the **CEO Roundtable**. The theme is “Connected Worlds—Safe and Secure”, and leading industry representatives will gather at the electronica Forum from

11:00 to 12:00 on November 8 to discuss the role of the electronics industry when it comes to the security of intelligently networked devices. The participants at this year’s CEO Roundtable are Carlo Bozotti from TMicroelectronics, Rick Clemmer from NXP, Prof. Frank H. P. Fitzek from TU Dresden and Deutsche Telekom Professor for Communication Networks and Dr. Reinhard Ploss from Infineon Technologies.

The **Cyber Security Forum** will allow experts in the sectors for software, hardware and measuring and testing equipment to present and explain the latest hardware and software solutions for ensuring optimum security in IT systems. It will also shed light on the topics of embedded security, automotive applications and medical electronics. The event takes place at the electronica Forum on November 9.

When it comes to developing high-performance LED systems, various technologies are used. The **Solid State Lighting Forum** at the electronica Forum on November 10 will give participants an overview. Besides the current state of the art, presentations will deal with interaction between the various technologies that are involved and how they related to one another. After the keynotes and presentations on topics such as “Solid State Lighting and Green Product Design” or “Methods and Concepts for Optimized LED Drivers”, technical panel discussions will give experts a chance to examine trends and future prospects.

## Exhibition Highlights

On the afternoon of November 8, everything at the electronica Forum will revolve around **wearables and healthcare**. While the panel discussion on “Wearables for Health: Components for Digital Medicine” will explore the demands that wearables are placing on electronic components, Prof. Markus Haid from TU Darmstadt will explain how inertial sensors can help elderly people in assisted living facilities. Lectures on topics such as “Printed Electronics: Key Enabling Technology for Healthcare and Wearables” and “Mechatronic Solutions for People with Disabilities and the Cybathlon” are also on the agenda.

Whether it comes to design, component cleanliness or supply-chain management, the **PCB & Components Marketplace** is an important gathering for the PCB, components and EMS industry. ZVEI (German Electrical and Electronic Manufacturers' Association) member countries will report on their latest solutions and products—from sensors and microsystem technology to interconnection technology. The technical information they provide will be rounded out by market data and development scenarios. The PCB & Components Marketplace takes place in Hall B4 on all four days of the fair.

The **Exhibitor Forum** gives companies a chance to present their latest product news, developments and services in compact, half-hour lectures in Hall B5. From PCBs & EMS on November 8 to sensor technology and power supplies on November 9 to passive components on November 11: Each day focuses on a different branch of industry.

Start-ups provide important impetus for economic and employment growth. But they often face major challenges when it comes to finding the right partner for their own ideas or securing financing. Organized in conjunction with “Elektor” magazine, the **electronica Start-up Platform** gives the fair a new forum that brings the concentrated innovative strength and solution expertise of start-ups together with interested industries at a single location.

From electromobility and power electronics to connectivity in the future: The **electronica Automotive Conference** at the ICM – Internationales Congress Center München on November 7 will allow participants to gather information about future-oriented technologies in the automotive industry. This year's conference will focus on topics such as safety, autonomous driving and interior electronics. It will include lectures on automotive software updates and 360-degree surround-sensing technologies and their relevance to safety.

The **electronica Automotive Forum**, which takes place in Hall A6 on all four days of the fair, rounds out the conference perfectly. Can piloted driving become a reality in the next few years, and will laser light assert itself in motor vehicles? Experts will discuss the latest hot topics at the Automotive Forum. Whether sales engineers, electronics developers or supply-chain managers: Innovative solutions will be presented to everyone involved in automotive development process at the Forum.

**IT2Industry**, the International Trade Fair and Open Conference for Intelligent, Digitally Networked Working Environments, will be embedded in electronica for the second time in 2016. The program of this accompanying conference includes current case studies and innovative solution approaches. IT2Industry is being held in the West Entrance at the same time as electronica. The perfect complement to the conference is the Industrial Internet of Things (IIoT) Forum, which takes place at the electronica Forum on November 8. It gives experts a chance to examine questions about hardware, software, security and data transmission in the context of industrial applications. For example, they will discuss the differences between currently available microprocessors and explain which wireless transmission media meet the latest requirements.

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The **Wireless Congress: Systems & Applications** revolves around wireless technologies for industrial use. The congress addresses developers, system designers and those responsible for wireless systems and focuses on technology trends, security aspects and certification and licensing issues. The conference takes place at the ICM – Internationales Congress Center München on November 10 and 11.

They could be the electronics professionals or corporations of the future: **High-school and college students, potential founders and successful start-ups**. To encourage them, electronica's supporting program has events such as Student Day and the electronica Fast Forward start-up platform that are tailored specifically to young people's and new companies' needs. They give start-ups and aspiring founders a chance to present their ideas

and projects, and experts will be on hand at the fair to support them. For example, other founders will share their experiences, and business angels and investors will give them valuable tips. And it all culminates in the electronica Fast Forward Award. ■

*All events, lectures and information regarding the speakers are available in the electronica event database at the following link: [www.electronica.de/event-database](http://www.electronica.de/event-database).*

## electronica News

### ■ Silicon Labs: smart home connectivity and wireless sensing

Silicon Labs will demonstrate its latest embedded and wireless sensing innovations for the Internet of Things. Silicon Labs will showcase a comprehensive home automation mesh network, enabling smart home connectivity without complexity and will also unveil a Bluetooth-enabled biometric sensing wearable design based on its latest Bluetooth low energy system-in-package module. Discover how to create Bluetooth-enabled wearable heart rate measurement devices, featuring Silicon Labs' best-in-class optical sensors, advanced HRM algorithm, Bluetooth low-energy wireless stack, and the company's latest Blue Gecko module providing a complete Bluetooth connectivity solution including the antenna in an ultra-small form factor.

[News ID 4607](#)

### ■ Sensirion exhibits sensor portfolio

Sensirion will exhibit new and refined sensor solutions for measurement of humidity and temperature, differential pressure, as well as gas and liquid flow. Sensirion is expanding its environmental sensors portfolio and focusing on key environmental indicators for measurement of indoor air quality. The monitoring of indoor air quality improves people's health and comfort, while simultaneously enabling optimal energy efficiency – and thus new possibilities in the development of smart air quality devices. The new SHTW2 humidity sensor comes in a flip chip package – an established technology that represents one of the simplest and smallest methods of packaging a semiconductor chip, resulting in a tiny footprint of 1.3 x 0.7 x 0.5 mm<sup>3</sup>. The SHTW2 also pioneers a new category of ultra-small humidity sensors suitable for applications with the tightest space constraints.

[News ID 4606](#)

### ■ Würth: components and services for electronics of the future

Würth Elektronik eiSos is appearing at electronica 2016 together with its subsidiaries Würth Elektronik iBE and Würth Electronics Midcom. With a Formula E racing car and the

motto "WE speed up the future", the manufacturer of electronic and electromechanical components showcases its broad spectrum of products on twelve themed islands. On twelve Design & Solutions Islands, experts unveil innovative product and system solutions, reference designs and the REDEXPERT simulation software, with which engineers in electronic companies can quickly and easily find the suitable component for their application. The component selection assistant from the REDEXPERT tool is not only based on simulations, but also on extensive measurement series in typical applications and therefore delivers more accurate results. Other themed islands are devoted to EMC and inductive automotive products from Würth Elektronik iBE, the custom capabilities of Würth Electronics Midcom, electromechanical components, LED solutions and the themes of Internet of Things & Wireless Communication. Furthermore, important future themes like E-Mobility, Wireless Power, Energy Harvesting, as well as Power Management Solutions will be presented.

[News ID 4602](#)

### ■ Avnet Silica: advanced solutions for the IoT and automotive development

Avnet Silica will showcase its advanced solutions for the Internet of Things and automotive development. Three demonstrations highlight the power and flexibility of its Visible Things IoT platform, which delivers rich functionality from edge to enterprise with outstanding cost, power and size specifications. Leading-edge features of Visible Things include embedded vision, security, cognitive analytics and application-specific elements aimed at industrial markets. On show for the first time will be a brand new gateway product focused on the industrial space, and a unique security architecture that delivers true enterprise-grade security from the IP network core all the way to smart sensor configurations at the network edge – including low-power non-IP-based sensors. The third demonstration, an embedded vision system, combines image capture from low-cost non-intelligent sensors with high-end cognitive analytics in the cloud,

to deliver a unique combination of real-time analysis and long-term business intelligence. Featured in the automotive area, Avnet Silica's automotive offering encompasses a broad range of solutions from both established market leaders and technology pioneers – including gesture control, embedded vision, in-vehicle networking, and gateway products. The company's uniquely comprehensive line-card made for an unrivalled capability to support customers in the increasingly complex automotive landscape.

[News ID 4565](#)

### ■ Altium updates TASKING VX-toolset for TriCore with latest AURIX technology

Altium announces its new TASKING VX-toolset for TriCore release 6.1, bringing a wealth of improvements and new features to maximize development performance for TriCore/AURIX-based applications. The TASKING VX-toolset for TriCore 6.1 is available immediately with a 14-day trial version on request. Existing customers with a maintenance contract can upgrade to the new release for free. The TASKING toolset is a complete Eclipse-based embedded development toolchain with integrated compiler, multi-core linker, debugger and safety checker for optimizing every bit of Infineon's powerful microcontroller. Its specialized tools help streamline multi-core application design, allow functional safety verification, and develop fast and efficient embedded code. The TASKING VX-toolset for TriCore 6.1 is available immediately with a 14-day trial version on request. Existing customers with a maintenance contract can upgrade to the new release for free. Product demos will also be available at the Altium booth at electronica.

[News ID 4585](#)

### ■ Arrow to highlight digital business and services for IoT innovators

Arrow Electronics will have a special focus on its eVolve offering that supports every aspect of the IoT. The company will also showcase digital services for customers, with visitors invited to attend one of Arrow's breakout sessions hosted by Arrow executives and tech-

nical experts. As the industry's focus on IoT shifts from prediction to delivery, creative thinkers are building working solutions with support from Arrow's eVolve IoT approach. This is an end-to-end solution enabling businesses to deploy, manage, monitor, analyse and monetise secure connected devices throughout their entire lifecycle globally. Arrow will demonstrate a number of different IoT applications, showing how eVolve can cover the connectivity, cloud services and value recovery needed to deliver functioning commercial IoT solutions. Arrow has transformed arrow.com into a comprehensive source of electronic components, datasheets, design tools, online engineering collaboration, reference designs and how-to content on the Internet, delivering digital dividends for its customers. Visitors to the booth can get a first-hand demo of Arrow.com to see the significant impact of combining the company's vast online resources with the its talented team global field teams and technical experts. Arrow has also built successful links with digital disruptors such as crowdfunding pioneer, Indiegogo. Teaming up with Indiegogo, Arrow is putting critical resources in the hands of entrepreneurs, such as components procurement, online

design tools, and expertise from design to production. Visitors will see demonstrations of noteworthy Indiegogo product successes enhanced with leading technology from TE Connectivity and Analog Devices. Visitors will also learn how Verical helps users get access to hard-to-find components and be entrepreneurial with procurement, all with total confidence in suppliers and products.

[News ID 4596](#)

### ■ Logic Technology to showcase TouchGFX GUI framework

Drapner Graphics has appointed Logic Technology as distributor for its advanced TouchGFX Graphical User Interface framework. Logic Technology will help to further establish TouchGFX as the industry standard in Netherlands, Belgium, Luxemburg, Germany, Austria and Switzerland. TouchGFX is a unique software framework that unlocks the graphical user interface performance of low-resource hardware. The revolutionizing technology breaks existing restraints, as it lets developers create sophisticated GUIs that fully live up to today's smartphone standards at a fraction of the cost. Draupner and Logic are already gearing up their activities by hosting a series of hands-on seminars in Germany

together with STMicroelectronics and Arrow. At this year's Electronica, the TouchGFX team will join Logic's to showcase TouchGFX and the latest demos.

[News ID 4594](#)

### ■ U-Reach launches PCIe duplicator for M2 modules

U-Reach is launching a PCIe duplicator and eraser for the M2 modules. The M2 modules will be used in compact laptops and very powerful PCs which are needed for virtual reality for example. The product is based on the high-speed duplicators for SATA/SAS hard drives and SSD. Two models are available. The smaller unit comes with 5 targets and the bigger solution offers 20 targets at a time. The unit is very easy to use with a 4 button controller and LCD display. You just slide in your master M2 module and your empty targets and press the copy button. Besides the PCIe solution U-Reach can cover almost all memory formats in the market. There are products to duplicate, test and erase USB-sticks, SD & micro SD-cards, CF-, CFast- Cards, SATA DOM, eMMC, HDD, SASHDD, SSD, mSATA, NGFF and many more. U-Reach will attend electronica.

[News ID 4574](#)

# Sensors for Imaging and Display



Omron's light and sensing technology will be coming together at Electronica where we will be showcasing some of the most innovative and truly revolutionary sensors available. Including:

The Human Vision Component. Utilising Omron's Okao software, face and body detection functionality can be added to any embedded system. Not only is it possible to detect a human face, hand or body but gender detection, age, mood and facial pose estimation is a reality.

Our Spatial Project Display - Imagine 3-D images floating in the air, clear precise signs that stand out in the crowd, augmented reality making features really stand out, well imagine no more. All are possible with our Spatial Projection Display with customized solution in size and design.

Our Light Convergent Reflective Sensor is a high performance precision optical sensor for object detection. An object's material or colour doesn't influence this sensor, it can even detect mirror reflective surfaces or transparent objects.

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### ■ Mouser inspires with free development kits and virtual reality

Mouser Electronics is showing how it inspires with exciting, informative and innovative products, technologies and ideas. First with the latest products for electronic design engineers, this year Mouser is offering visitors the chance to win a development kit from a leading manufacturer of their choice, showcasing its Empowering Innovation Together highlights, including a 3D printed car; announcing the winners of its International Space Station Design Challenge and sharing a Virtual Reality journey through its warehouse. In Mouser's demo area, the latest sensing and connectivity solutions for IoT applications will be shown, together with Hexiwear, the IoT development platform for next generation smart devices, and MikroElektronika's fully-featured range of development tools and expansion boards. Continuing the theme of innovation and inspiration, Mouser is showing this year's highlights from its Innovation Lab, showcasing projects developed under its hugely popular Empowering Innovation Together™ programme featuring Grant Imahara. Visitors will be able find out which designs won the International Space Station Challenge and are to be 3D printed in space, plus see a 3D printed car and watch components being built. Whilst remaining firmly in Munich, the wonders of Virtual Reality will enable visitors to take a journey through all 70,000 m<sup>2</sup> of Mouser's state-of-the-art warehouse in Texas, The 3D 360° video will give visitors an insight into its warehouse processes, from stocking the newest products, to pulling, packaging, and shipping orders – following the marvellous journey each component makes to the customer's doorstep. Presentations from key manufacturers Red Pittaya, Silicon Labs, Broadcom, Bourns, Sensirion and Würth will feature the on the stand and include a chance to see their latest products, development kits and solutions across a wide variety of applications. The many Electronica visitors interested in the IoT, whether for Smart Factory, Smart Building or Smart Energy projects should attend the Embedded Forum.

[News ID 4549](#)

### ■ TQ: Connected Worlds - Safe and Secure

Completely in keeping with this year's electronica motto of "Connected Worlds - Safe and Secure," the TQ Group will be showing new and efficient embedded solutions at the fair. These solutions meet the growing challenges in the areas of security, high-resolution multi-touch HMI systems, IoT and Industry 4.0. From the ARM area, the TQ Minimodules TQMa6ULx, based on the i.MX6UL processor from NXP, and TQMa7x, based on the i.MX7 processor from NXP, will be presented. Both have an integrated graphics controller and support applications with display

and touchscreen requirements. The modules are very well suited for networks, industrial automation and applications for high-speed, reliable data processing with low energy consumption. In addition, a new module version of the already proven TQMa6x will be displayed. This version also supports the i.MX6 Plus CPU version from NXP. In the case of the i.MX Dual and Quad Plus CPUs, increased internal memory and graphics performance is to be expected. The new TQMT1040 Power Architecture processor module is intended for developers looking for maximum performance in all areas combined with reliable data transmission and long-term availability. It uses the 64-bit T1040 Quad Core processor from NXP. This processor, with the integrated 8-port gigabit switch, offers even more Ethernet interfaces while retaining the smallest form factor as before. This is ideal, for example, for telecommunications applications in industry, in the area of (passenger) transport and for IoT solutions.

[News ID 4609](#)

### ■ Fujitsu Electronics: Accelerating Global Innovation

Fujitsu Electronics Europe will be attending this year's electronica under the slogan "Accelerating Global Innovation", informing about the current supplier portfolio and range of product linecards, developed by the value added distribution partner for key sectors such as the automotive, industrial, medical & wellness and telecommunication industries. An additional focus will centre on FEEU's consultancy services. A strong focus on choosing the right supplier is one key element of the company's global distribution strategy because FEEU relies on best-in-class instead of off-the-shelf solutions. Nevertheless, solutions which are not included within the FEEU portfolio can still be delivered through the company's network of manufacturers. To showcase a significant subset of its line card FEEU will set up a supplier area.

[News ID 4548](#)

### ■ Pickering to showcase ultra-high density reed relays at electronica

Pickering Electronics will be showcasing its latest high density range. The Pickering Series 115, Series 116 and Series 117 are three ranges of small Single Pole (1 Form A) reed relays ideal for the construction of high density matrices or multiplexers. These three ranges have identical pin configurations allowing a common PCB for all types but allowing the designer a range of switch ratings according to which part is fitted. The reed switches are vertical within the package which permits a common footprint with a board area of only 3.8 x 6.6mm. Only the profile height changes with the increasing power or current ratings.

[News ID 4547](#)

## Exhibition Highlights

### ■ ROHM: innovative products and concepts for power and energy management

ROHM Semiconductor will showcase cutting-edge power management solutions for numerous applications in the automotive, industrial and residential/home arenas. Utilising the latest SiC and Si technologies, proprietary processing and packaging technologies, these devices maximise efficiency and compactness, paving the way for cost and component reduction while delivering optimum performance. Combining ROHM's knowhow in analogue and digital power technology, they represent the most advanced developments of ROHM's global R&D centers and joint designs with industry partnerships. All these products are manufactured in the company's fully owned, vertically integrated production sites. Among others, key topics will include 3rd Gen SiC MOSFETs, Schottky barrier diodes and Modules, LED-Drivers for exterior Lighting, Design Kits for wireless power delivery and the technology partnership with Formula E-car developer Venturi. Utilising a proprietary double trench gate structure, ROHM's new generation of SiC MOSFETs reduces ON-resistance by 50% and input capacitance by 35% in the same chip size compared with planar-type SiC MOSFETs. Optimum performance is achieved by combining exceedingly low loss with high-speed switching performance. As a result, conversion efficiency is improved, contributing to increased miniaturisation, weight reduction, and greater energy efficiencies. The 3rd Gen of SiC Schottky Barrier Diodes realise lowest forward voltage and lowest reverse leakage current over the entire temperature range among all of the SiC SBDs currently available on the market. In addition to this, they feature high surge current capability which is ideal for power supply applications. Adding to the recently announced TO220AC devices at 650V/6, 8 and 10A, ROHM will introduce D2pak devices also adding lower current options, 2A and 4A to the family. ROHM's new full SiC modules including a chopper type module for converters integrating both, Trench SiC MOSFETs and SiC SBDs.

[News ID 4522](#)

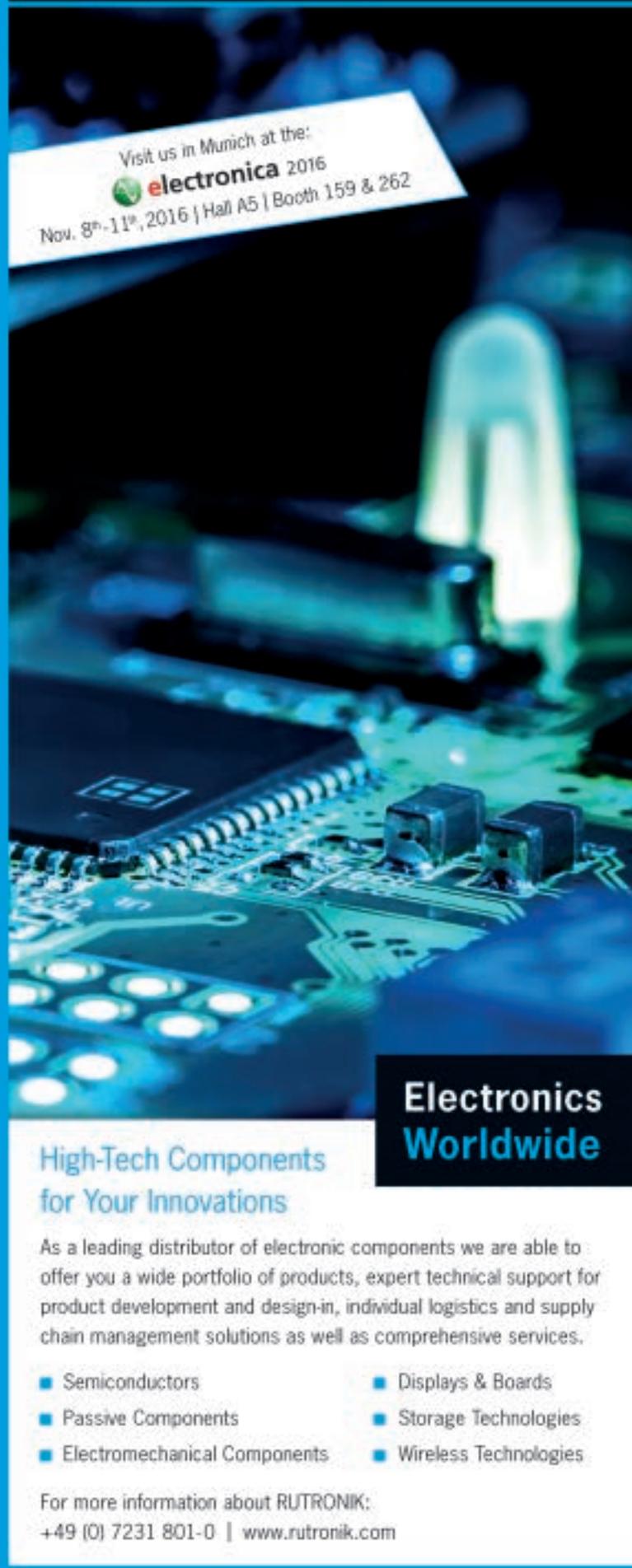
### ■ Polyrack Tech-Group: partner for enclosure and system solutions

The Polyrack Tech-Group will be presenting itself as a cross-technological partner for standard and customized enclosures and system solutions for a wide variety of markets. The wide range of expertise of the Polyrack Tech-Group in mechanics, plastics technology, surface treatment, electronics and assembly is represented through different solutions and demonstrated in a mix of materials. POLYRACK supports their customers starting with the process development through the design of products and systems including consultation for the most efficient technologies and materials. Solutions range from various sizes for applications in automation, automotive engineering (certificate in accordance to ISO/TS 16949), railway, transportation and traffic technology, aerospace technology (certificate in accordance to ISO 9100 in process), broadcasting, medical technology as well as test, measurement and control technology.

[News ID 4523](#)

### ■ TI: industrial and automotive innovation

Texas Instruments will showcase innovation focused on the future of industrial automation and automotive technologies. Visit the industrial demo showcasing TI technology enabling Industry 4.0 and the smart factory of tomorrow leveraging TI solutions for real-time Ethernet with EtherCAT. Take a closer look at sensor communications with wired technologies like IO-Link and wireless technologies such as Bluetooth low energy, and explore how TI's gallium nitride technology significantly increases the efficiency in variable speed motor drives. Discover innovation in automotive all in one car. The Evolution Car 2020 (EvoCar) showcases how TI's automotive portfolio, including DLP products, enables advanced



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driver assistance systems, infotainment, haptic feedback and adaptive LED headlights. Come and take a ride. TI will also be offering an engineer-to-engineer experience where attendees can visit any of four different technology workbenches to meet TI experts. Each workbench is dedicated to a different topic: power management, sensing, wireless connectivity, MCUs and processors.

[News ID 4488](#)

■ **PLS: UDE 4.6 supports ST's SPC570S family of automotive MCUs**

By introducing version 4.6 of its Universal Debug Engine (UDE) at electronica, PLS Programmierbare Logik & Systeme provides a testing and debugging environment optimally matched to the comprehensive internal error-checking functions of STMicroelectronics' current SPC570S family of automotive MCUs based on the 32-bit Power Architecture. The latest controllers in the automotive MCU portfolio of the Franco-Italian chip manufacturer were primarily designed for use in anti-lock braking systems and airbag controllers. Applications like these are characterized by elevated functional safety requirements up to ASIL D (Automotive Safety Integrity Level) according to the ISO 26262 standard. To meet these challenges an additional checker

core – serving as a safety core – supplements the e200z0h computational core. The devices of the SPC570S MCU family operate at clock frequencies of up to 80MHz and are available in different feature sets.

[News ID 4530](#)

■ **ON Semi: solutions ranging from autonomous vehicles to IIoT**

ON Semiconductor driving energy efficient innovations, will focus on four key market segments at this year's Electronica in Munich. Visitors to the over 400 square metre booth will see the company's latest products and innovations for automotive, the Internet of Things, motor control and wearable devices. Sixteen live demonstrations will show how the various products and technologies can be utilised and combined to enable energy efficient innovations in integrated systems. In the automotive sector, ON Semiconductor's broad portfolio of products and technologies continue to address the latest applications throughout the vehicle, as active (ADAS) safety, LED lighting, motor control, vehicle connectivity and vehicle electrification evolve at a rapid pace. In addition, the company's products help enable progress towards semi and fully autonomous vehicles. The Internet of Things and the Indus-

trial Internet of Things represent a high profile and burgeoning market sector. ON Semiconductor is able to address the key IoT areas of sensing, wireless communications, embedded control, motor drive and power management with a growing portfolio of products including image sensors, smart passive sensors and 2.4GHz and sub-1GHz transceivers supporting the leading wireless communications protocols for the IoT. Finally, ON Semiconductor will showcase its products that include advanced integrated power modules and controllers, as well as a broad portfolio of discrete power devices to provide complete motor control in the consumer appliance, industrial, and automotive markets. This includes solutions for exciting new applications like drones, robotics and industrial automation.

[News ID 4507](#)

■ **Tektronix: latest test solutions at upcoming electronica**

Next generation TBS2000 oscilloscope with best-in-class signal visualization feature the longest record length and largest display in its class for faster signal evaluation and troubleshooting. It puts expanded capabilities into the hands of budget-constrained design engineers and educators who can now use a wide

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range of Tektronix probes to prototype, debug, validate and troubleshoot new product designs. The new modular and fully integrated Keithley 4200A-SCS parameter analyzer for faster and easier characterization. The system provides fast insight into semiconductor devices, materials and processes and reliable test results. Featuring a new graphical user interface, a range of helpful self-learning tools, embedded measurement expertise and IV/CV switch module, the system reduces characterization complexity and simplifies test setup. The result is up to 50 percent reduction in test setup times and significantly easier and more intuitive operation. IsoVu optically isolated measurement system technology combines 1 GHz bandwidth and a wide common mode range with superior common mode rejection to make previously hidden signals visible.

[News ID 4537](#)

■ **Pickering Interfaces: switching solutions and software**

The new 2-slot USB/LXI modular chassis offers a small lightweight form factor, making it ideal for portable, benchtop and space restrictive applications. It supports one or two 3U PXI modules and accepts the majority of Pickering's PXI products. The USB compatible and LXI compliant interfaces enable the chassis to be controlled directly through standard interfaces found on most personal computers—allowing for a very cost effective route into the modular test and measurement market. The LXI Simulation Tool provides users with a simple and highly portable platform for application development. Supported products include Pickering Interfaces' PXI & LXI switching modules as well as partial support of their PXI simulation and instrumentation products. This tool allows programmers to develop and debug test code for Pickering's LXI switching devices prior to receiving the devices or before installing the LXI switching in a test system.

[News ID 4536](#)

■ **ZETTLER: solar-power relays and switching power supplies**

ZETTLER electronics showcases its full range of products. The manufacturer and distributor of electromagnetic and electronic components will once again be present at the ZETTLER Group booth. Here, ZETTLER will be demonstrating the full breadth of its extensive know-how in the business areas: Relays, Displays, Magnetics und Controls. With its wide range of powerful solar relays (e.g., AZSR180) ZETTLER electronics is responding to continually increasing need for inverter-design driven specifications related to physical size, energy efficiency and relay safety features. ZETTLER will also introduces its portfolio of innovative TFT panels with capacitive touch technology, LCD modules as well as PMLCD and OLED. The wide spectrum of TFT Modules is made for numerous applications such as Avionics, Medical, Navigation Systems, Industrial Controls, Irrigation Controls, Testing/Measurement devices and Smart Metering.

[News ID 4531](#)

■ **Murata showcases "technologies that enable innovations"**

Murata invites visitors to Electronica 2016 to come to their stands to view their latest innovations and developments that create enhancements in your applications. With the theme of "Enabling your innovation", all the demonstrations and new products will be based on a variety of concepts suitable for use in automotive, consumer, healthcare, industrial, security and energy applications. The demonstrations will include MEMS sensors for Healthcare, Industrial and Automotive applications, IoT connectivity and sensor networking, Energy Management as well as RFID solutions for PCB related Industry 4.0 applications. Murata will exhibit their latest product line up including new connectivity modules, power products and MEMS sensing products that will be launched at the show.

[News ID 4514](#)

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### ■ Rohde & Schwarz: T&M solutions for latest technologies

At electronica 2016, Rohde & Schwarz will showcase test solutions for advanced technologies, including those for fifth-generation mobile radio and wireless gigabit, along with state-of-the-art test systems for embedded designs and automotive systems. Rohde & Schwarz will present the first over-the-air (OTA) power measurement solution for 5G and wireless gigabit components. These wideband communications technologies require the use of phased array antennas at access points, base stations and in wireless devices. These antennas use beamforming to control the direction of radiation of the transmit antenna so as to maximize the power level at the receiver. The new R&S NRPM OTA power measurement solution from Rohde & Schwarz allows users in development and production to calibrate the transmit antenna's output power and test its beamforming function using a simple test setup. The R&S NRPM operates in the frequency range from 27.5 GHz to 75 GHz. A compact 19" EMC test box (R&S TS7124) additionally allows shielded RF measurements. For measurements on highly integrated embedded designs, Rohde & Schwarz will present its R&S RTO2000 digital oscilloscope, which is designed for multi-domain applications. The oscilloscope allows developers to analyze the interaction between the various functional units of these complex designs. The R&S RTO2000 displays the correlations between time, frequency, protocol and logic analysis results like no other oscilloscope can. The R&S RTO2000 and R&S RTE digital oscilloscopes can now be used in combination with the new, extremely low-noise R&S RT-ZP1X probe to carry out power measurements down to the millivolt range. Also on display is the R&S Scope Rider, the first handheld oscilloscope with the functionality and touch and feel of a state-of-the-art lab scope.

[News ID 4640](#)

### ■ Infineon: AURIX TC3xx family fuels automated driving and electromobility

Serving the requirements of automated cars and electric vehicles Infineon launched the next generation of its AURIX microcontroller family. The TC3xx microcontrollers offer the highest level of integration on the market and real-time performance that is three times higher than that available today. With its high-performing hexa-core architecture and its advanced features for connectivity, security and embedded safety, the AURIX family TC3xx is ideally suited for a wide field of automotive applications. In addition to engine management and transmission control, powertrain applications include new systems in electrical and hybrid drives. Specifically hybrid domain control, inverter control, battery management, and DC-DC converters will benefit from the new architecture.

[News ID 4646](#)

### ■ DATA MODUL showcases high-tech embedded modules

Based on the current Embedded product strategy, COM Express products in the low power and high end divisions at DATA MODUL are undergoing large-scale expansion. All the new Intel processor platforms (following the Intel IOTG roadmap) are implemented based on the COM Express module standard. These reference modules can immediately be used serially on baseboards or as building blocks for customized single board computers. Two additional building block baseboard modules or customized ODM designs will be available just in time for electronica: COM Express compact modules with cutting-edge Intel Pentium/Celeron and Atom processors (code-name Braswell) for low power applications and the Com Express Basic module with Intel Core i3/i5/i7 and Xeon E3 6th generation processors (codename Skylake) for the high performance division. Among other things, this controller provides the defined feature set specified by COM Express. Additional useful features are also realized, turning this module into an Embedded module:

[News ID 4645](#)

# Embedded Forum



**Preview Embedded Forum at electronica - Munich, Nov 8-11, 2016**

The **Embedded Forum** is a theater-style presentation area with free access for all electronica visitors. It is located in Hall A6, Stand 460.

At the **Embedded Forum** ICC Media is staging a 4-day forum programme with technical presentations covering the whole range of embedded technologies.

Today, embedded systems are found almost everywhere. They range from devices such as digital watches to large installations like factory controllers, and complex systems like avionics. Simply stated, all intelligent electronics systems other than general purpose computer and general purpose IT are embedded systems. An embedded system has software embedded into hardware, which makes a system dedicated for specific application(s). Embedded systems are normally devices used to control, monitor or assist the operation of some kind of equipment. "Embedded" reflects the fact that they are an integral part of the system.



The **Embedded Forum** in the electronica hall A6 will present technical papers about technologies, trends and product innovations covering the whole range of embedded technologies from Chips & Components over Tools & Software to Boards & Modules.

Various papers will touch on the Internet-of-Things and discuss key challenges to IoT development and introduce solutions from the sensor to the cloud. Other presentations will be focusing on topics like Tools & Software, Embedded Computing, Analog & Power, Microcontrollers and more.

**[electronica-forum2016.embedded-know-how.com](http://electronica-forum2016.embedded-know-how.com)**

## Tuesday, November 8

- 12h30 - 13h00**    **Accelerating time to market with an open, integrated end-to-end IoT platform**  
*Frank Harder, VP Business Development, Samsung*  
In this session we will cover how the Samsung ARTIK™ smart IoT platform can help companies quickly bring new solutions and services to market, get intelligence from their connected products, and create new revenue streams to grow their business.
- 13h00 - 13h30**    **Transformation that is enabled by Internet of Things**  
*Jason Lynch, Director of IoT Strategy, Analog Devices*  
Widespread IoT adoption within industrial, healthcare and automotive markets will only accelerate if there is clear value from the investment. Value creation at the sensor is a key enabler of IoT. Smart value creation across an IoT chain transforms data into knowledge and insight but is dependent on leading edge technology and solutions to unlock this value. We will discuss some key challenges to empowering “Smart” IoT development. Solutions need to solve complicated system and domain problems all the way from the sensor to the cloud. We will share some examples.\*
- 13h30 - 14h00**    **Securing machine identities in Industry 4.0 throughout the whole lifecycle**  
*Dr. Josef Haid, Principal Technical Marketing, Infineon Technologies*  
With the growth of smart factories, connected systems are used to transfer critical information. This communication must therefore be secured from manipulation and eavesdropping. To protect communication solutions supporting authenticity, confidentiality and integrity are required. Related cryptographic keys and processing algorithms have to be protected. Safeguarding key material has to be ensured for the whole lifecycle of the automation device, already starting in the production when keys are injected into the device. In this presentation you will learn more on how embedded, personalized security controllers improve security of related devices and reduce the cost for security measures in manufacturing. Besides that, their application in different system types and use cases are illustrated and solutions are shown.
- 14h00 - 14h30**    **Predictive Analytics, Simulation and the Digital Twin**  
*Fabrice Pena, Senior Vice President, ANSYS*  
The Industrial Internet of Things (IIoT) is changing the way the world designs, connects and optimizes industrial assets. The IIoT combines the industrial sector — which includes countless pieces of industrial equipment, machines, production facilities, plants and networks — with the power of data gathering, computing, communications and information technologies. Bringing together the power of data analytics and simulation, the creation of a digital twin allows to achieve predictive and prescriptive maintenance and to optimize industrial assets management. Discover how simulation-driven product development can assist you in design and

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analysis of your equipment and the systems that control them so you can meet your IIoT engineering and business objectives. Topics will include the creation of a digital twin through system-level modeling and simulation, integration with 3-D physics analysis and model-based systems and embedded software engineering (MBSE).

14h30 - 15h00

**60GHz Sensing with Infineon Transceiver**

*Uwe Rüdtenklau, Director Program Management mm-Wave, Infineon Technologies*

Infineon's mm-wave transceiver product family allows one to send >1 GB/s data rates over a wireless mm-wave link. Infineon's RF expertise and technology capability enable more applications such as sensing and RADAR. Both GaAs and SiGe technologies are used to realize mm-wave transceivers. Infineon's V-band transceiver chip integrates all RF building blocks into a single chip. This single chip solution combines both data communication and sensing. By co-developing the chip and package using eWLB (embedded Wafer-Level Ball Grid Array), Infineon realizes a compact design in a plastic housing. Furthermore, integrating the antenna in a package allows a simpler design at lower cost. These transceivers allow new 60 GHz sensing applications. These new applications include camera, time-of-flight, pressure, and others to create new „wow-features“ in customer devices.

15h00 - 15h30

**MIPAQ Pro - A new dimension in smart protection**

*Björn-Christoph Schubart, Product Marketing Manager, Infineon Technologies*

This High Power (1.3MW) IPM integrates IGBTs, gate drivers, a heat sink, sensors, digital control electronics as well as digital bus communication. Its embedded protection technologies and  $T_{vj}$  calculation on the integrated industrial microcontroller XMC4500, monitor all key operating parameters continuously and issue warning or switching signals. At the  $T_{vj}$  simulation the switching and conduction losses are accumulated synchronously for each switching operation and a time-dependent, transverse thermal model is employed based on the measurement of the NTC temperature on DCB, even cross-talk between IGBT and diode is taken into account. Moreover up to four paralleled MIPAQ™ Pro occur as one unit for the controller, since they are paralleled by daisy-chain and facilitated by adjustable delay settings that ensure a balanced set-up of the overall inverter. Furthermore an Infineon security microcontroller is integrated to assure the high quality and reliability of the original system in the long run and benefit system manufacturers with control over the after-sales business, since power stages can also be authenticated.

15h30 - 16h00

**Next Generation SAR ADC Simplifies Precision Measurement**

*Maithil Pachchigar, Product Applications Engineer, Analog Devices*

This talk will discuss the common pain-points encountered in designing a precision data acquisition signal chain and how to address them using the AD400x family. This talk will cover the ease-of-use system-level benefits of the AD400x family, its product roadmap and performance results (including 20-bit). We will also cover key application examples and how the AD400x creates application-level impact in multiple end markets.

16h00 - 16h30

**Ultra Compact Intelligent Power Module for High Efficiency Refrigerator Compressor Drives**

*Danish Khatri, Principal Technical Marketing & Applications Engineer, Infineon Technologies*

We introduce a new family of ultra-compact 8x9mm surface mount Intelligent Power Modules (IPM) designed for refrigerator compressor drives. Utilizing Infineon's CoolMOS™ line of ultra-low RDS(ON) MOSFETs greatly improves efficiency at light-load conditions while maintaining high efficiency at nominal load conditions. With a thickness of only 0.9mm, the new  $\mu$ IPM™ family is the smallest form factor available for refrigerator compressor drives. The family consists of half-bridge modules making it a flexible solution for both single-phase linear compressors and 3-phase rotary compressors. The module family also features overcurrent protection, fault reporting and shutdown functions that can be daisy chained to interface with one microcontroller.

16h30 - 17h00

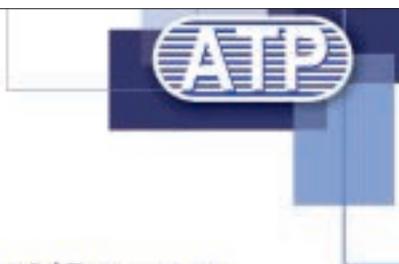
**Electrometer-grade op amp enables simple measurement of the photoelectric effect**

*Scott Hunt, System Applications Engineer, Analog Devices*

The Photoelectric Effect, discovered in 1887 by Heinrich Hertz and later explained by Albert Einstein, was a major step in the development of Quantum Physics. This talk will explain a photoelectric effect demonstration using the ADA4530-1 (Electrometer-grade Op Amp) and AD5791 (20-bit DAC), and how they are used to measure photon energy, the flow of electrons ejected in response to light, and the determination of the work function of the surface of the photoemissive material.

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## Wednesday, November 9

11h00 - 11h30

### **A LF-3 GHz Signal Analyzer with 100 MHz Signal Bandwidth and as much as 90 dB of dynamic range**

*Bob Clarke, Systems Applications Engineering Manager, Analog Devices*

Even basic signal analyzers tend to be expensive. This analyzer use a variety of novel circuit techniques to maximize dynamic range and minimize cost, including quad, synchronized PLL/VCOs for 6 dB improvement in phase noise, differential signal paths to eliminate the need for shielding, microwave bandpass filters, a frequency plan that minimizes the number of needed LOs and spurs, and a bandpass Sigma Delta ADC with programmable center frequency and bandwidth.

11h30 - 12h00

### **Designing end to end IoT solutions in a digital age**

*Aiden Mitchell, Vice President IoT Global Solutions, Arrow and Matt Anderson, Chief Digital Officer, Arrow*

For many companies IoT investment is likely to be one of the biggest financial and strategic commitments for their organisation. Critical factors and considerations for the IoT system selected will be security, scalability, longevity to meet future business opportunities and overall system integration. To address these critical selection factors, Arrow will present Arrow IoT Things Evolved a solution which can accelerate customers into the IoT market and address business efficiencies and new business opportunities

12h00 - 12h30

### **Automated debugging and test on production hardware**

*Jens Braunes, Product Marketing Manager, PLS*

Tool automation and tool connection is an important feature users won't miss anymore. With its powerful, flexible and open interface PLS's Universal Debug Engine (UDE) addresses that demand. For scripting, the interface provides users an easy access to all internal functions of UDE. Tool partners can use it to build up a complete toolchain from the direct access to a real embedded system up to the model level covered by model based test tools.

12h30 - 13h00

### **A femtoammeter reference design and development module for charged particle detection**

*Gustavo Castro, System Applications Engineer, Analog Devices*

Different transducers employed in analytical instrumentation often require conditioning circuits that allow them to detect infinitesimal concentrations of certain analytes, which in turn produce extremely low currents that are difficult to measure. A reference design based on the state-of-the-art electrometer grade ADA4530 solves many of the design challenges, delivering a simple and ready to use development platform. This talk will cover all the design aspects that must be considered in the development of this type of front-end.

13h00 - 13h30

**Using LoRa® technology for connecting Embedded Applications**

*Hakim Jaafar, STMicroelectronics - in co-operation with Mouser Electronics*

Connectivity has become very important in many domains of embedded applications. There are several RF technologies and protocols available today. This presentation aims to introduce the LoRa® technology to all interested engineers and system designers.

The first part of the presentation describes the main features and benefits of LoRa and practical use cases in the existing LoRa implementations.

The second part attempts to answer the following questions: "How can LoRa be quickly evaluated?" and "Which hardware tools, products, and software packages can be used for easy and seamless LoRa implementation?"

13h30 - 14h00

**Power solutions for wearable technology**

*Florian Feck, Texas Instruments & Flavio Sestagalli, Coilcraft - in co-operation with Mouser Electronics*

Modern battery-powered applications, ranging from IOT, like wireless sensors and wearable to industrial applications, are continually driving compact packaging and the highest efficiency standards for longest battery life. This presentation will feature power design examples like new package technologies as well as the combined wide VIN and 400nA Iq innovation - especially where the perfect matching of silicon and magnetic components achieve the twin goals of miniaturization and efficiency. We will also discuss the use of innovative composite material to minimize the impact of ambient temperature changes on key inductor parameters.

14h00 - 14h30

**Reliable data matters in serious IoT applications**

*Christoph Kaemmerer, Analog Devices - in co-operation with Mouser Electronics*

Intelligent sensing starts with good data. Analog Devices (ADI) advanced sensing and measuring solutions deliver more accurate and reliable data in applications where data quality is mission critical. We will bring you through the sense, measure interpret and connect cycle of an IoT signal chain. With sensing technology such as MEMs, in applications where low noise combined with low power is critical. Intelligent sensing is about extracting insights. ADI has a series of ultra low power processors, optimized for different performance. Optimized partitioning maximizes cloud value. This leads to better insights and solves security, latency, storage, and other system-level problems. For connectivity within IoT ecosystems, the key needs are for reliable radio connections and extended battery life.

- 14h30 - 15h00**     **LoRa: The Technology, the alliance and real world applications.**  
*Jonathan Pearce, Microchip - in co-operation with Mouser Electronics*  
LoRaWAN has become established as the leading technology within the LPWAN space, with a fast growing ecosystem of solutions ready to use today. This presentation will provide an overview of the technology and its capabilities, a view in to the LoRa Alliance and its growing membership, plus real world examples of both public and private deployments."
- 15h00 - 15h30**     **Content, Context, and Control – Involved in Obsolescence or Committed to Solving it?**  
*Rob Picken, EMEA Director, FOM (Future of Obsolescence Management)*  
In the embedded electronics industry we are often struck with unexpected, highly disruptive obsolescence events, over which we seemingly have no influence. Looking more widely at the resources in the electronics industry, how can we start to intelligently utilise our supply chains and the huge amount of data they generate to bring control back from the marketplace when responding to obsolescence problems? Once you have regained control, what does this mean for future development, spend, and your business?
- 15h30 - 16h00**     **Designing end to end IoT solutions in a digital age**  
*Aiden Mitchell, Vice President IoT Global Solutions, Arrow and Matt Anderson, Chief Digital Officer, Arrow*  
For many companies IoT investment is likely to be one of the biggest financial and strategic commitments for their organisation. Critical factors and considerations for the IoT system selected will be security, scalability, longevity to meet future business opportunities and overall system integration. To address these critical selection factors, Arrow will present Arrow IoT Things Evolved a solution which can accelerate customers into the IoT market and address business efficiencies and new business opportunities
- 16h00 - 16h30**     **To IO-Link and Beyond - Enabling New Pathways to Adaptive Manufacturing and Improved Productivity**  
*Jeff DeAngelis, Maxim Integrated*  
A true evolution in manufacturing is upon us, where different products entering the manufacturing line will communicate their unique recipes so the equipment adapts to the specific products needs vs setting up dedicated manufacturing lines to accommodate an array of different products. At the heart of this revolution is an exciting new technology called IO-Link and it enables traditional sensors to become intelligent sensors. This article will discuss how IO-Link technology can reduce loss productivity in a factory through the power of Adaptive Manufacturing.

**16h30 - 17h00**    **Accelerating time to market with an open, integrated end-to-end IoT platform**  
*Ashish Sethi, Senior Manager Strategic Business Development, Samsung*  
 In this session we will cover how the Samsung ARTIK™ smart IoT platform can help companies quickly bring new solutions and services to market, get intelligence from their connected products, and create new revenue streams to grow their business.

## Thursday, November 10

**11h00 - 11h30**    **Designing end to end IoT solutions in a digital age**  
*Aiden Mitchell, Vice President IoT Global Solutions, Arrow and Matt Anderson, Chief Digital Officer, Arrow*  
 For many companies IoT investment is likely to be one of the biggest financial and strategic commitments for their organisation. Critical factors and considerations for the IoT system selected will be security, scalability, longevity to meet future business opportunities and overall system integration. To address these critical selection factors, Arrow will present Arrow IoT Things Evolved a solution which can accelerate customers into the IoT market and address business efficiencies and new business opportunities

**11h30 - 12h00**    **Embedded Computing, Design Support from the first concept idea**  
*Markus Mahl, Data Modul, Head of Product Marketing Embedded*  
 The basic question before starting a new product development is whether to develop an own baseboard or entirely customized SBC, or to use an already existing standard board. Based on two real-life applications, a medical ultrasound system and a low cost HMI, we will illustrate a very time and cost effective way to come to the best solution. We will outline how to best consider the main concerns in every new project which are cost, design quality, certification, effective fast support and very importantly the time to market.

**12h00 - 12h30**    **Peering through the fog - IoT, Industry 4.0 & Fog Computing**  
*Christian Blersch, Managing Director, E.E.P.D*  
 This paper will talk about the most common standards for IoT and Industry 4.0: OPC UA, Powerlink, MQTT, etc. In addition it will answer the questions whether Fog computing is the "uninterruptable data supply" for cloud data and whether TSN will become the new real-time Ethernet-Standard.

- 12h30 - 13h00**    **Make the most out of your IoT devices with Samsung ARTIK Cloud**  
*Adrien Peronnet, Software Engineer ARTIK Cloud, Samsung*  
In this session will present how ARTIK Cloud provides developers easy-to-use, open, and enterprise grade APIs, SDKs, and powerful tools to collect, store, and act on any data from any device or cloud service. Using these APIs and tools, you can connect all your devices and services, even those that haven't been invented yet. Manage your fleet of deployed devices, quickly bring new IoT apps to market, and grow your business.
- 13h00 - 13h30**    **Power Electronic and ARM® Cortex® Microcontroller in one IC**  
*Tobias Otter, Head of Application Engineering, Infineon Technologies*  
This presentation shows application and use cases for integrated motor control electronics in automotive. The Infineon Embedded Power system-on-chip product family provides an integration of power electronic with an ARM® Cortex® microcontroller. The presentation will show a range of automotive DC and BLDC motor control applications, for which our Embedded Power IC is the product of choice. We are going to complete this talk with a presentation of the latest tool chain and support Tools, that will help you to easy integrate this device into your application.
- 13h30 - 14h00**    **Time Sensitive Networking for Industrial Applications**  
*Volker Goller, Manager Europe Real-Time Communications, Innovasic*  
TSN is widely hailed as a standard that will converge the networks in the factory with the front office. But how can the real-time networking requirements of the factory coexist with the best-effort chaos of the office environment? This presentation discusses what TSN is, what pieces can be applied to existing Industrial protocols, and how compatibility with standard networks can be achieved.
- 14h30 - 15h00**    **Automotive Audio Bus - Digital Bus Technology for Emerging Infotainment Applications**  
*Ken Waurin, Strategic Marketing Manager, Analog Devices*  
Vehicles of the future will significantly improve the driving experience by delivering superior in-cabin acoustics, reduced ambient noise via advanced ANC systems, improved speech recognition performance, and efficient in-cabin communications. The A<sup>2</sup>B technology, with its capability to transmit multiple discrete channels of digital audio over low-cost, unshielded twisted pair cable, is extremely well suited to deliver the most cost efficient system implementations.

15h00 - 15h30

**Designing end to end IoT solutions in a digital age**

*Aiden Mitchell, Vice President IoT Global Solutions, Arrow and Matt Anderson, Chief Digital Officer, Arrow*

For many companies IoT investment is likely to be one of the biggest financial and strategic commitments for their organisation. Critical factors and considerations for the IoT system selected will be security, scalability, longevity to meet future business opportunities and overall system integration. To address these critical selection factors, Arrow will present Arrow IoT Things Evolved a solution which can accelerate customers into the IoT market and address business efficiencies and new business opportunities

15h30 - 16h00

**Accelerating time to market with an open, integrated end-to-end IoT platform**

*Ashish Sethi, Senior Manager Strategic Business Development, Samsung*

Today, businesses struggle to build IoT solutions in-house, grappling with the tasks of building a development infrastructure, adding new expertise, and managing cumbersome integrations. The Samsung ARTIK Smart IoT end-to-end platform provides companies with all the upfront hardware and software needed, allowing companies to quickly bring new IoT solutions and services to market, get intelligence from their connected products, and create new revenue streams to grow their business.

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# Friday, November 11

11h00 - 11h30

## **Lifecycle-costing and hidden costs in embedded systems**

*Ulrich Ermel, Director New Business Development, PULS*

This presentation will guide you through a complete Lifecycle-Costing model of an embedded system. It will discuss all three major Lifecycle-Stages (Design / Usage and Removal) and provide insights into cost effective designing (Buy vs. Build) and detailed views on minimizing running costs (Obsolescence, Efficiency and Upgrading). Last but not least system removal cost will be discussed in order to enable a sustainable and ecofriendly solution. Dependencies between all three major Life-Cycle-Stages are presented and countermeasured.

11h30 - 12h00

## **Buy vs Build**

*Wolfgang Heinz-Fischer, International Business Development, TQ-Systems*

Using modules alleviates many of the challenges facing engineers and project managers when designing complex applications. Some of the obstacles and costs associated with designing complex computing platforms - certification, design and development time and production costs - can be overcome by using an off-the-shelf embedded modules.

12h00 - 12h30

## **Prevent, detect and fix lifecycle challenges of embedded systems**

*Oliver Hoffmann, SiliconExpert*

Embedded Solutions are more than the sum of their parts. They live longer than until the first obsolescence among their parts. This presentation talks about avoiding to embed future deprecation into your Embedded Systems. You will learn how SiliconExpert supports you to prevent, detect and fix lifecycle challenges.

12h30 - 13h00

## **Open Standards for Embedded Computing Technologies**

*Mark Swiecicki, SGET*

SGET, Standardization Group for Embedded Technologies is an independent organization with more than 50 members of the embedded industry. The main goal is to create new open and freely available specifications defined by the members of this industry group. Up 'til now SGET created standards like Qseven, SMARC and eNUC. The presentation will offer an insight to the standards and the work of the SGET team. SGET is represented on the electronica with a booth in A6-549.

## electronica News

■ **ROHM: PMIC optimized for Intel’s next-generation Apollo Lake chip architecture**

ROHM has recently announced the availability of a power management IC (PMIC) developed for the latest announced Intel processor designed for 2-in-1 tablets and cloud books where reduced power consumption and a thinner, smaller form factor are increasingly demanded. The BD2670MWV provides all power supplies required by Apollo Lake platforms while contributing to lower power consumption.

[News ID 4644](#)

■ **HEITEC renames former Rittal packing systems products**

In 2010 HEITEC took over the customer-specific products from Rittal. Then, at the beginning of 2013, the complete product portfolio of electronic packaging systems, including design, manufacturing and marketing of all standard products, was transferred from Rittal to HEITEC as well as the domestic sales of these products. Since 2015, HEITEC has been establishing step by step their own international network of distributors who now distribute the standard products and are able to realize system solutions. Actually 25 countries are covered by 14 new distributors who can provide local customer support. Only in Russia, Italy and the UK sales are still handled by Rittal.

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# Oscilloscope for complex measurement tasks and multi-domain applications

By **Guido Schulze**, Rohde & Schwarz

*Developers of electronic designs want to perform complex measurement tasks quickly and successfully. And they also want to do so with a powerful, highly versatile and intuitive lab oscilloscope. The new R&S RTO2000 oscilloscope gives them what they need.*



*Figure 1. Engineered for multi-domain challenges: the new R&S®RTO2000 oscilloscope*

■ The new R&S RTO2000 oscilloscopes offer excellent signal fidelity, up to 16-bit vertical resolution and high acquisition rates in the 600 MHz to 4 GHz class. A broad range of tools along with user-friendly operation and documentation functions facilitate time-correlated analysis of the wide variety of signals found in embedded designs.

The staggering need for cost-efficient and powerful communications and control electronics for industry, motor vehicles and the entertainment and smart home sector is driving the integration of electronic circuits. These advanced embedded designs integrate a variety of functional units and technologies. The processor, power management, digital communications interfaces, local program memory, data memory and sensors all operate in the smallest of spaces. The next integration step is radio modules. The variety of signal waveforms is quite large, ranging from RF radio signals, analog signals from sensors or protocol-coded signals from the control interfaces (figure 2). This complexity represents a challenge for developers because highly integrated designs are significantly more prone to mutual interference. Undesirable interactions must be eliminated with an exact time reference at the system level. Therefore embedded designs, i.e. the large-scale integration of components based on a variety of technolo-

gies, represent the greatest T&M challenge in development and service today. These demanding measurement tasks require intelligent solutions such as those offered by the new oscilloscope, the all-in-one test instrument for multi-domain applications. Its comprehensive toolset includes functions for time, frequency, logic and protocol analysis – a variety that in the past required several single-purpose test instruments.

The low-noise front-ends and high-resolution A/D converters allow the analog input channels to perform highly accurate measurements in the time domain across a large dynamic range. Users benefit from reliable results, whether performing easy voltage level checks over time or specialized measurements such as jitter analyses on clock or data signals or power analyses on switched-mode power supplies. The 16 digital channels extend the oscilloscope test resources, e.g. to precisely measure the logical level (high, low) on digital interfaces over time. Even timing errors in parallel interfaces are quickly detected. The many tools for analyzing protocol-based serial interfaces provide a broad spectrum of trigger and decoding options for a variety of standards, including I2C, SPI, USB and Ethernet. The oscilloscope allows both analog and digital channels to be used for protocol decoding. And it uses its hardware-assisted protocol

triggering to reliably and quickly trigger on details such as addresses or data.

Even in situations where spectrum analyzers are the first choice for precise measurements on radio interfaces, the oscilloscope is highly suitable for acquiring radio signals thanks to the high dynamic range of its analog channels. When testing at the system level, the channels deliver a precise time correlation to the other functional units in embedded designs. Figure 3 shows the variety of measurement options in an Internet of Things (IoT) application with a Wi-Fi radio module. Channel 1 (yellow) acquires the Wi-Fi signal and displays it in the time domain. However, the signal waveform is not clearly recognizable until it is viewed in the spectrum (Math4). Channel 3 (orange) shows how the radio activity affects current consumption. The timing of the USB interface control commands is also visible. A decoding option decodes the signals acquired on channels 2 and 4 (green and blue) into readable USB data.

Once the initial functional tests on the electronic design are completed, circuit optimization starts. For mobile applications, minimizing current consumption is paramount. This requires a measurement instrument that can resolve low currents down into the 1mA range while also correlating the tim-

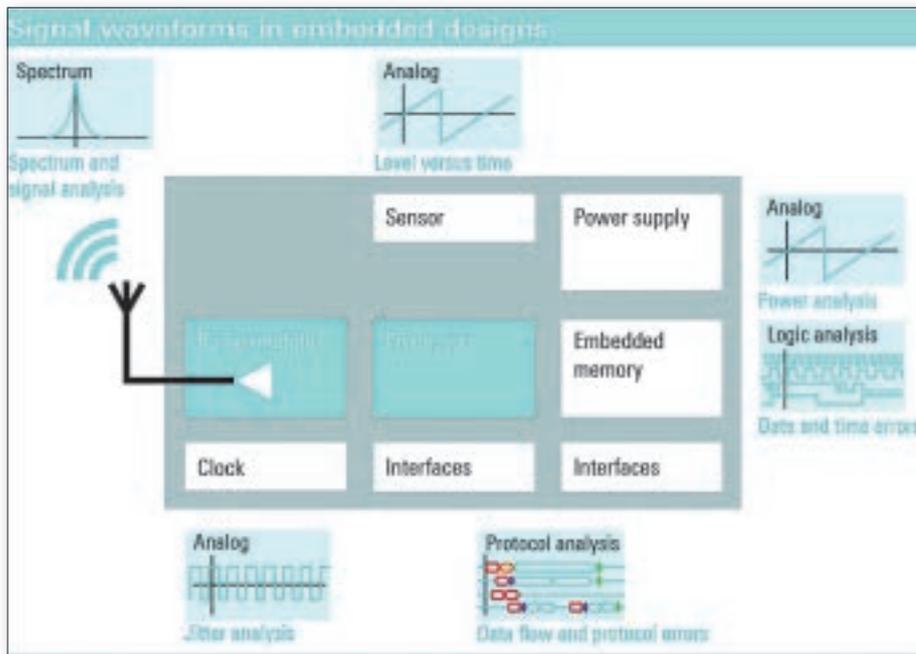


Figure 2. Example of a multi-domain application – IoT module with Wi-Fi radio module, battery-operated power supply and USB interface

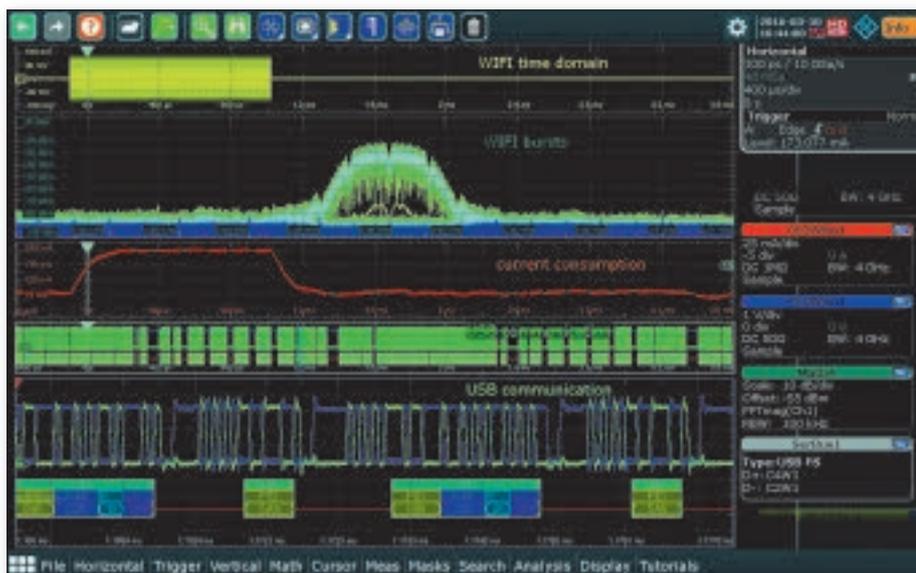


Figure 3. Multi-domain application in a state-of-the-art embedded design: analog measurements in the time domain, measurements in the spectrum as well as protocol and logic analysis

ing of current changes to switching activities, e. g. when transmitting radio sequences or entering power save mode. The large dynamic range and high sensitivity of its analog input channels make this oscilloscope suited for measuring low voltages and currents. A sensitive current probe can measure currents down to 1mA at 120 MHz bandwidth. In HD mode dynamic variations as small as 100  $\mu$ A can be resolved. Using an analog channel to perform current measurements provides a fixed time reference to the other measurement signals. Figure 4 shows an example of a current probe in channel 3 (orange) measuring a current of 1.7mA during a sleep sequence. The current consumption is correlated with the radio sig-

nal output on channel 1 (yellow) and the system activity at the UART interface. During the sleep sequence, the module does not transmit any radio signals, but it receives regular paging signals from the base station. The current consumption briefly increases to 105mA and the module transmits a UART-coded communications signal on the clear-to-send (CTS) line, which is acquired with a digital channel.

The powerful FFT-based spectrum analysis function on all analog input channels opens up additional possibilities, e.g. analyzing radio signals, EMI debugging to find interferers in the spectrum or spectral analysis of power supplies. In contrast to conventional

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Figure 4. Measurement of the current consumption of an embedded design in sleep mode. The base station remains in contact with the GSM radio module via paging (short current pulses).

FFT implementations in oscilloscopes, the R&S RTO2000 achieves a greater resolution and display speed with its digital downconversion (DDC), in which the FFT calculation can be limited to a selected frequency range. User-friendly functions such as automated measurements, peak lists, maximum hold detectors and mask tests support debugging in the spectrum. One unique characteristic is the spectrogram, which visualizes the changes in frequency components over time.

Another unique function is the new zone trigger, which can be used to graphically differentiate between events in the time and frequency domains. Up to eight zones of any shape can be defined and logically linked as trigger conditions. A trigger is initiated when test signals intersect defined zones or when those zones are not touched. This makes it possible to

detect interferers in the spectrum during EMI debugging or to separate read and write cycles in memory controllers. The example in figure 5 shows how the zone trigger is used in the spectrum to measure the current and voltage load during a GSM radio burst.

The basis for the high degree of sensitivity and dynamic range offered by the R&S RTO2000 are the low-noise frontends and the proprietary 10GHz single-core A/D converters. The minimum effective noise of  $<100\mu\text{V}$ , the A/D converters' more than seven effective bits (ENOB) as well as the channel-to-channel isolation of  $>60\text{dB}$  are just a few examples. Such characteristics make the analog channels ideal for analyses in the frequency domain as well as for measurements in the time domain. Investigating signal details often requires a higher vertical resolution. The oscilloscope

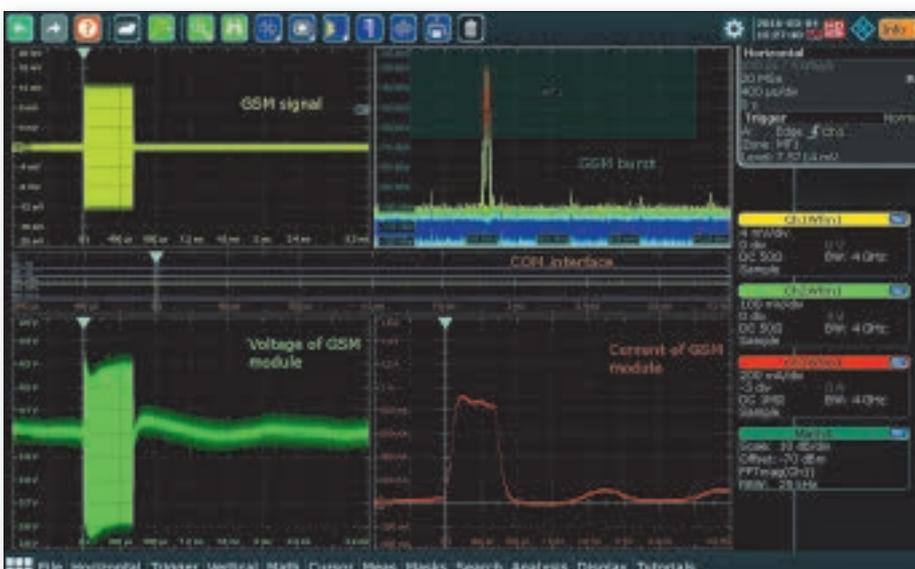


Figure 5. The zone trigger in the spectrum focuses the measurements on the GSM burst signals.

achieves up to 16 bits in high-definition (HD) mode. In HD mode, high-quality, adjustable low-pass filters downstream of the A/D converter limit the signal bandwidth. The user can select the appropriate combination of resolution and bandwidth. Even the digital trigger system benefits from the high resolution in HD mode and can trigger on the smallest of signal details.

The oscilloscope offers not only high-performance analog signal processing. It also features powerful digital signal processing based on a proprietary ASIC. Its fast parallel signal processing is clearly superior to external PC-based postprocessing. The oscilloscope acquires, processes and displays up to 1 million waveforms per second, even when histograms, masks or cursor measurements are running. This capability, which is unique in the lab oscilloscope class, is the key to fast and successful detection of sporadic errors. The acquisition memory can be extended up to 2 Gsamples, also unique in this class. Sufficient memory is available for acquiring long pulse or protocol sequences. The history function also benefits from this memory depth because more waveforms are available for detailed analyses.

The oscilloscope is versatile enough to adapt to specific applications. 2-channel and 4-channel models are available with bandwidths of 600 MHz, 1 GHz, 2 GHz, 3 GHz and 4 GHz plus optional acquisition memory upgrades. Bandwidth upgrades are available for all models. All hardware options, including the digital channels for logic analysis and a 10 MHz OXCO reference clock, are plug-ins that can be installed on-site. For specialized tasks, software options can be enabled on the oscilloscopes at any time. Available software options include, for example, triggering and decoding options and automated compliance tests for serial interfaces, as well as options for jitter, power and spectrum analysis.

In spite of its power and functional range, the instrument remains extremely easy to use thanks to its brilliant 12.1" touchscreen. The R&S SmartGrid function ensures that all waveforms and other information are clearly and understandably displayed. Important tools such as cursors, measurements and undo/redo are on a toolbar for quick access.

The app cockpit provides access to applications such as the triggering and decoding functions, compliance and signal integrity tests, I/Q analysis and even customer-specific development tools. The R&S RTO simplifies documentation of measurements. Screenshots, waveforms, events and instrument configurations can be stored with a simple press of a button. ■

# Code coverage in automated test of embedded systems

By Jens Braunes, PLS

*By means of code coverage, it is not complicated to determine test quality in parallel to software and system tests on real hardware. In any case, a continuous and seamless workflow for the software and system testing, which logically requires open interfaces for efficient tool coupling, is essential for correct and reliable results.*

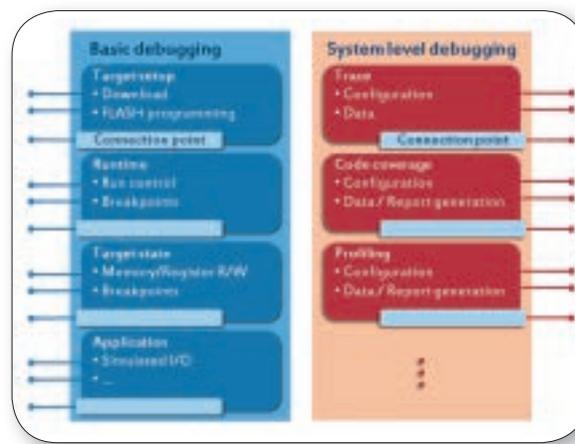


Figure 1. The UDE object model provides access to almost all debugger functions.

■ Today the complexity of SoCs presents many new challenges for developers, especially with regard to software quality and software security. This means for effective software testing, it is not only automatic generation of test results and their evaluation that are essential. To reliably determine the quality of the tests, it is also necessary to measure and document the achieved code coverage.

Software errors can never be completely avoided during the development of complex applications with megabytes of source code. It is therefore all the more important, especially with safety-critical applications, to detect and eliminate these bugs as early as possible using modern methods. Testing is one of the most crucial parts of this process. With good reason, a great deal of attention is given to testing in relevant standards such as ISO 26262 for the automotive industry, EN/IEC 62061 for safety of machinery or DO-178 for the aviation industry.

Whether a software solution is finally released for use by the customer or needs reworking by the development department, however, does not only depend on the successful completion of testing. In addition, the quality of the testing performed has to be right. The decisive factor here is test coverage. What is the proportion of the application, module or individual func-

tions, which the respective test has stressed, compared to the proportion, which could not be stressed at all due to an unfavourable choice of test cases? To explore this question more thoroughly, which is extremely important for software quality and security nowadays, in the area of software development code coverage is generally used to assess test quality. Since the standards mentioned at the beginning not only demand the documentation of test results but also the degree of coverage achieved, it is of course sensible to determine the code coverage for the function or module under test in parallel to the test execution.

To calculate code coverage, for example of a function, information is required that can only be gathered from executing the code. In the simplest case, only those pieces of code that are actually executed and those which are not must be recorded. The latter is of course implicitly given if the sources or at least the binary are available. In turn, the statement coverage - meaning how much code is tested by the test cases in relation to the total code - can be directly derived from this information. Program code that is not executed (dead code) can therefore be detected with this comparatively simple method; however, the current test quality requirements of the standards ISO 26262, EN/IEC 62061 or DO-178 are generally not fulfilled.

Branch coverage is significantly more meaningful with regard to test quality. The execution of all possible program branches is used for this. In the case of a simple IF statement, both the TRUE and the FALSE branch have to be executed. Because all pieces of code are implicitly reached, the statement coverage can be directly derived from the result of the branch coverage.

Modified condition/decision coverage (MC/DC) goes another step further in looking at branches. In simple terms, for MC/DC, all individual conditions contained in each composed condition must take every possible outcome in order to be regarded as tested. This ensures that each individual condition affects the overall result, independently of the other individual conditions involved. However, this method proves to be extremely cumbersome in practical use, because an extremely high number of paths have to be considered, especially within loops containing conditional code sequences. In practice, there are now a number of possibilities to obtain code coverage, as follows.

Simulation of executable code on a virtual platform and determining the necessary information for the calculation. Fairly simple data about runtime behaviour can of course be determined from simulations. For this

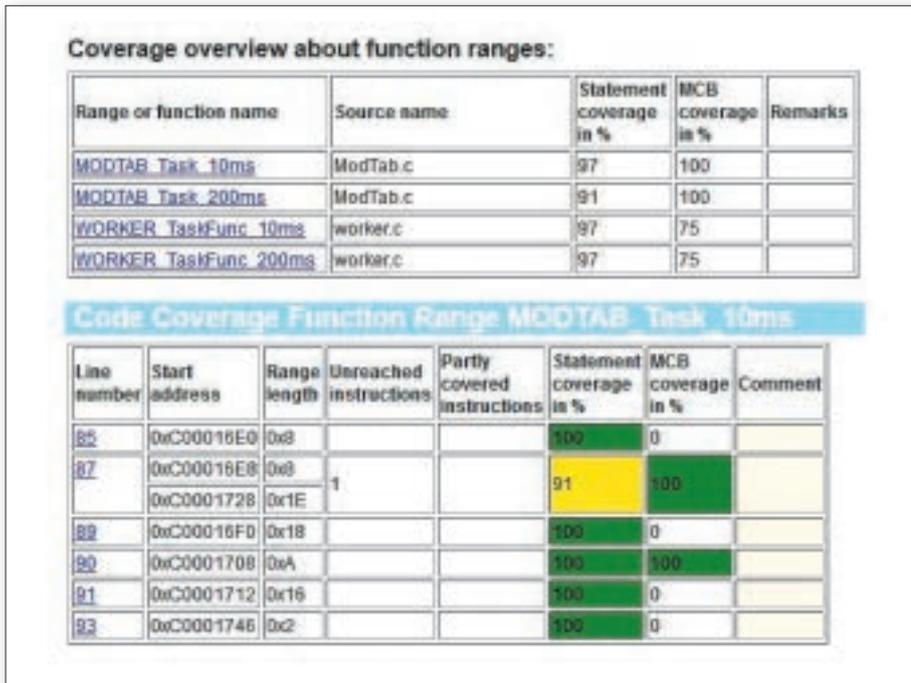


Figure 2. By means of trace, the code coverage achieved can be determined in parallel with the actual testing. The reports generated from this serve as proof of the test quality.

reason, this method is also very widespread with many test tools. A disadvantage, however, is that the actual test is not carried out on the real embedded system; the actual timing behaviour is therefore not taken into consideration.

Instrumentation of the code to be tested and execution on real hardware. Additional test code, which collects information necessary for calculating the code coverage and stores this in the target memory, is inserted in the software for this. However, as a consequence the test code not only influences the runtime behaviour and code size but possibly even the memory layout. This is certainly a crucial point in safety-critical applications or systems with hard real-time requirements.

Execution of original code on real hardware with simultaneous program trace. The target system must provide suitable trace hardware for this including a trace interface to the coverage tool. This method requires absolutely no instrumentation and the timing behaviour of the application to be tested also remains unchanged.

However, suitable high-performance debugging solutions, such as for example the Universal Debug Engine (UDE) from PLS, are crucial for successful test execution and determining the code coverage on real target hardware by means of instrumentation or trace. This is because in the instrumented case, the target memory, which contains the data for the coverage calculation, must at least be read out by the debugger. For the trace-based solu-

tion, the debugger even uses the entire trace infrastructure on the chip.

For tests on real hardware, tight coupling between the debugger, which of course enables the actual access to the target system, and the test tool, which takes over test case management and the test documentation, is of essential importance. Only in rare cases do debuggers also offer complete project management for the test. Test tools, on the other hand, often lack suitable possibilities to communicate directly with the target system via the debug interface. Modern high-end debuggers, like the UDE, therefore provide an automation interface for the tool coupling. That interface allows test tools to utilize the debugger functions for controlling the target system and for reading out the target state as well as manipulating it.

In the case of the UDE, this interface is based on the Component Object Model (COM) from Microsoft. For a long period of time, COM has been established as the de facto standard in the world of Windows. Even Microsoft itself offers a large part of its newly added Windows functions via COM interface. The object model of the UDE encompasses almost all functions of the debugger such as flash programming, run control, reading and writing of the target system memory contents, trace data acquisition and analysis, and of course also code coverage. Therefore, via the said interface, with the UDE it is possible to establish a tight coupling to test systems of different vendors and thus build a complete tool chain for testing on real hardware. Fur-

thermore, COM offers the major advantage that it can be used with a very large number of different languages. These include C, C++, C# and other .NET languages as well as scripting languages such as JavaScript, Python, Perl and VB Script or Windows PowerShell. Therefore, the UDE can also be automated by the users very easily and controlled remotely via own scripts without the aid of a test tool.

As is already known, instrumentation of the executed code is not really advisable for obtaining code coverage in safety-critical applications or systems with high real-time requirements. For most of these cases already mentioned trace-based solutions are inevitably used. Also for this the automation interface of UDE offers appropriate functions. For example, if UDE is controlled by a test system the recording of trace for code coverage can be enabled already during the configuration of test tasks within the test tool itself. The other settings for code coverage are subsequently made in the debugger itself, as follows.

Used coverage level: here it is possible to choose between statement coverage and branch coverage. For both levels, the coverage can be calculated solely based on program trace and from debug information of the application.

Accumulation of sequentially performed coverage measurements: if multiple runs are necessary for testing all functions of an application, for example because the trace memory is not sufficiently large for the coverage, an accumulated calculation of the code coverage for all runs makes sense. In this case, the results of the individual runs are then combined to form an overall result.

Settings for report generation: depending on the user needs, separate reports for all functions tested or an overall report can be generated. Furthermore, it is possible to define basic things such as file name conventions or locations for the respective reports.

All settings can be done by the user directly via the user interface of the debugger. In addition, they are also accessible via functions of the COM-based automation interface. The code coverage can thus also be used by third party tools or by own scripts. Modern high-end debuggers, like the Universal Debug Engine (UDE) from PLS, play an increasingly key role in this close interaction of different components and tools. Thanks to a wide variety of COM-based internal functions of UDE for example, virtually all settings can optionally be made via third party tools or via own scripts and there is nothing else standing in the way of fully automated testing including documented test quality. ■



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# Multi-protocol controller for Industry 4.0

**Andreas Schwope**, Renesas Electronics Europe

*With the R-IN Engine architecture described in this article, a device can process both network communications and complex applications simultaneously, with extremely low delays, low jitter and minimum power consumption. Thus a multi-protocol industrial automation product can be simply implemented using a flexible, low-cost R-IN single-device approach.*



■ The automation industry is currently stepping into a new era often referred to as Industry 4.0. This revolutionary step in production facilities is based upon cyber physical systems. These combine available technologies like internet communication and automated operation controlled by sensor networks under real-time processing conditions. Industry 4.0 requires the provision of big internal and external databases in secured environments, and allows just-in-time production of highly customized products with a lot size of one. Having this in mind it's easy to see that the new industry phase needs a much higher degree of automation than before. To facilitate cooperation inside a complex production plant, the different system components must be safely interconnected via a high-speed network guaranteeing deterministic and fast data exchange.

A frequent production requirement at this point is real-time processing with extremely short cycle times. In addition to the pure speed necessary, further time-critical parameters must be met under all circumstances. The most important of these are low jitter (small deviations in the system causing recurring delays) and isochronous behaviour (identical timebase for synchronized processes in all network nodes). In particular this extreme real-time capability of dedicated system components requires special hardware functions

in certain points of the communication layer. This allows fast and smooth data exchange under all possible system conditions targeted by Industry 4.0.

Is communication always the same? Looking at the different standards used in automation the answer is quite simple: unfortunately not, we have different types of communication in the industrial network arena. In the past many communication protocols were developed, which are nearly all based on the same Ethernet standard IEEE 802.3. Due to different company interests, strategies and local distribution in the world, only the bottom two layers of the OSI model are roughly compatible between the different Industrial Ethernet (IE) standards. However the physical layer of the IEEE 802.3 Ethernet and the general frame format are in fact the same through the different standards. Some examples of established industrial network protocols are EtherCAT, Profinet, EtherNet/IP, CC-Link IE, Modbus TCP, Sercos III and Powerlink.

Applying a simplified model all of these communication technologies can be divided into two groups. In one group we find those protocols which are running with the "standard IEEE 802.3" hardware which you can also find in each and every PC of the world. In most implementations this communication

hardware consists of an Ethernet MAC and an Ethernet switch with one internal and two external ports. The two external ports are customary in industrial networks to realize secured ring structures, while the single internal device port inserts and extracts data from the network traffic to run the local node functions. Only the upper communication layers of this first group include the special protocol functions in software. Members of this group are Profinet, Profinet RT (Real-Time), EtherNet/IP and Modbus TCP. To be even more precise most of these protocols are based upon the same TCP/IP and UDP/IP software stacks running on the standard IEEE 802.3 hardware. Others, like Profinet RT use a modified stack with lower processing latencies optimizing their speed and real-time capability.

The lower communication layers of the second IE protocol group require certain special, non-standard and sometimes unique functions. Among others these functions are used for real-time time management including network synchronization, and control the automatic extraction and insertion of Ethernet frame data. Since this runs under high speed real-time conditions, these protocols deviate from the Ethernet standard and can be implemented only in hardware in the form of a protocol controller. The port structure of such controllers used in protocols like Profinet IRT (Isochronous Real

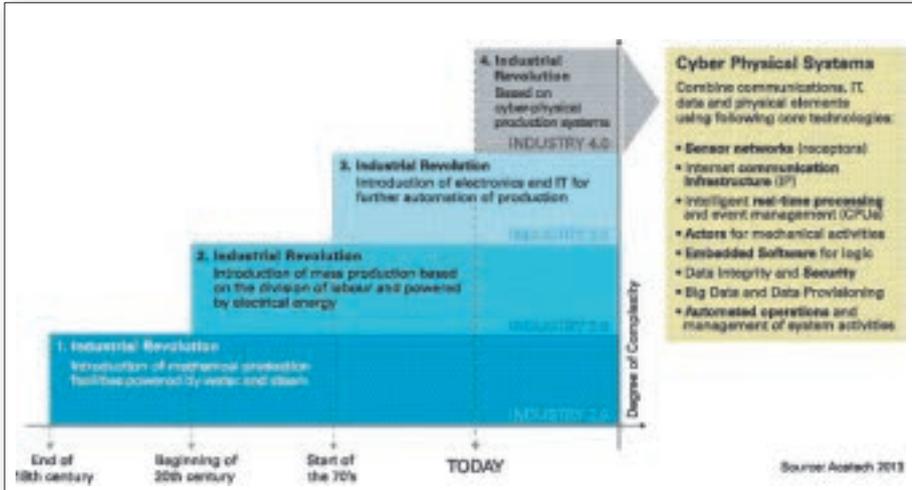


Figure 1. Industry 4.0 - The fourth industrial revolution

Time), EtherCAT, Sercos III and CC-Link IE is generally the same as for group 1. For both groups figure 2 compares the protocol hardware/software layers of the Industrial Ethernet standards mentioned above.

From the perspective of a manufacturer, bearing all the various protocols in mind, it is of particular importance to be able to cover all these communication types with own network products. Aside from the functional view, commercial aspects are also import-

ant for success in the industrial automation market. Looking to product cost parameters like system simplicity, time to market, support, maintenance and many others, a product change from one protocol to the other should be possible with the identical product hardware. In this context one also speaks of the term multi-protocol device. Such devices can be easily adjusted to a certain protocol by just a simple replacement of the SW without any hardware modification. Multi-protocol support of an industrial automation prod-

uct can follow various strategies. Companies have developed different solutions to run several industrial automation protocols in their products. All those solutions are generically described in this article, a mixture between them is possible of course. They have their own pros and cons as described later. Sometimes the focus of the ideal solution can change, especially when taking into account different product phases and volumes in their overall lifetime.

FPGAs are very flexible components which allow a hardware function change while using the same device. This is true in different situations when changing the function as such (specification change), when modifying a certain part of it (customization or optimization) or when applying a hardware fix (removing a bug). They are also a good choice when certain system components are to be combined in one device in order to save board space and reduce the PCB complexity. Sometimes boards have single gates or other low-complexity logic (also known as glue-logic) which can be completely integrated into the FPGA. FPGAs are also flexible when the complexity level of an implemented function has to be changed. Pin-compatible FPGAs allow the selection of the right number of usable gates. With a bigger FPGA a more complex func-



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Figure: CodeMeter license containers are available in software and hardware form to store cryptographic keys and entitlement rights

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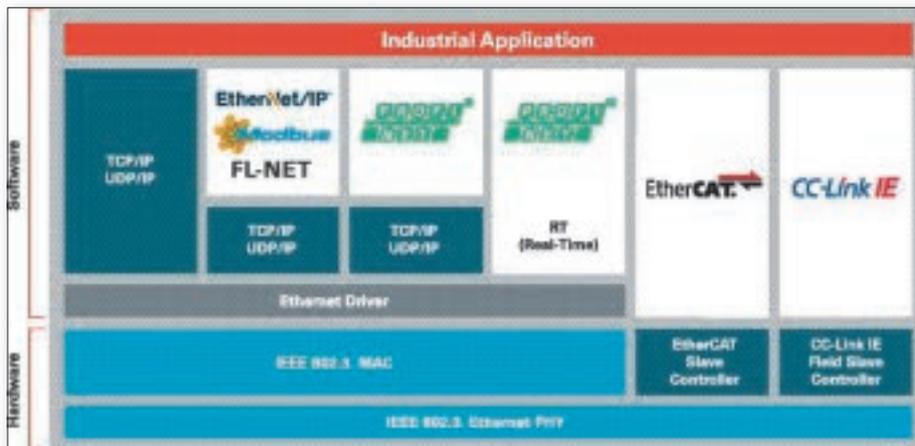


Figure 2. Industrial Ethernet protocol layers

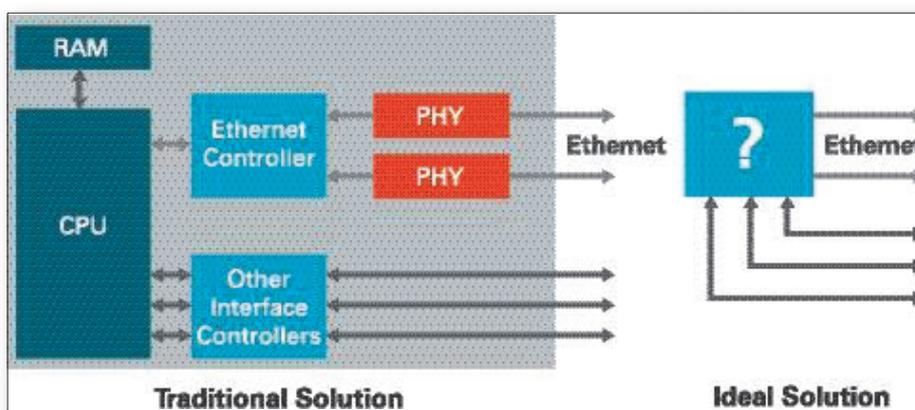


Figure 3. Traditional vs. ideal solution

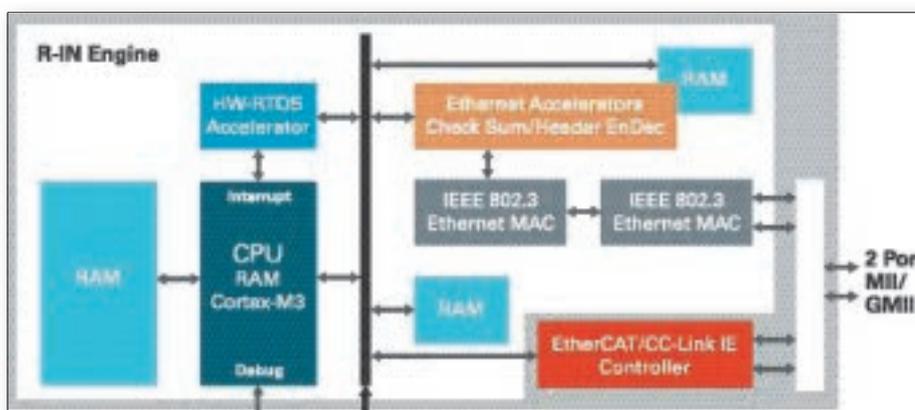


Figure 4. Block diagram R-IN Engine

tion can be implemented when replacing the smaller FPGA. This allows the reduction of hardware cost in case of an optimization and the new function can be implemented with the right number of logic gates. Being very expensive, FPGAs are primarily used in the prototype phase of a product ahead of any cost optimization.

Application-specific devices are sometimes referred as ASSP (application-specific standard products). They normally have a high degree of integration with some or many dedicated functions required for a specific

application. In contrast to an ASIC (application-specific IC), ASSPs can be used for a wider range of products in the dedicated market segment. Nevertheless many ASSPs often have an important commercial focus. They need to be as cheap as possible, but with every piece of flexibility or function enhancement their price increases. With the focus on a specific function and only the required logic, ASSPs do not generally provide that much flexibility. Based on such devices a traditional PCB design may result in a complex board integrating many different components as indicated in figure 3. This is directly followed

by a huge amount of effort for the development, testing and certification, and last but not least for system support and maintenance during the product lifetime.

ASICs on the other hand provide with their specific function set the ideal solution for a certain device. By definition an ASIC is specified and developed by a particular company for its own products. ASICs are normally not sold to other companies. Seen from the development perspective it takes a long time and a huge amount of money to develop such devices today. Thus ASICs are the right choice only for very high volumes.

Another solution in the sense of multi-protocol can be seen as a combination of the two mentioned solutions. A module-based approach in an automation product foresees the exchange of rather small communication modules when another communication protocol is required. Using small modules from an external provider to modify the higher-level protocol of a system only partially follows the idea of an unmodified hardware: the more complex main system remains unchanged while only the less complex module is changed. This is a really good approach for prototype systems and low-volume products. But having regard to legacy products which cannot be changed, a module approach can easily allow the adaptation of a legacy system to a new communication protocol. Another advantage of the module approach is completely separating the application side from the communication hardware and stack software. As communication modules are relatively expensive, they are at a big commercial disadvantage. Mechanically they sometimes need more space and volume (area x height of module plus its connector) to be integrated into a system. This is often the module-killer criterion for a small product with a narrow or flat housing.

As described, all these approaches to multi-protocol have their own strength and are a good choice under certain conditions or in certain product phases (prototype, legacy product extension). But looking into the detail, all solutions have a common disadvantage: pricing, especially under high volume conditions!

How to escape from this conflict? Let us now think about an ideal solution which allows the simple product structure in figure 3 compared with the traditional approach. First our solution should be based on a single-chip device with more or less the characteristics of a small communication module provided by a single and well-defined hardware connection with different interface options. The application processing can be seen as an option in case

our device has to provide just the communication part of the system. In this case the device must support a flexible and high speed interface to the system CPU (host) with certain synchronization capabilities for event handling and data exchange. To support also a wide range of legacy systems, other lower speed interfaces like UART and SPI should be available too.

Turning to small network nodes requiring low- to mid-performance to compute an application, our ideal device should be a SoC (System on Chip) with its own CPU able to process both the communication protocol and the application. Performance often comes along with high power dissipation. Many products in the automation arena are sensitive with respect to power and temperature. Reasons include that they run in a high-temperature environment, use small housing without active cooling measures, and others. Thus our solution should include certain power-saving features in order to relax the typical performance/power barrier. Last but not least our ideal single-chip device provides a kind of communication-specific flexibility to support a multi-protocol capability for a wide range of the industrial Ethernet protocols. This should cover both groups as already described. All this should be available in an ASSP-type device to enjoy a price advantage from low to high volumes. OK, so far so good. Does anybody have this ideal device?

At this point, thinking about the requirements of Industry 4.0 networks and multi-protocol capabilities, Renesas developed the R-IN Engine hardware (R-IN: Renesas Industrial Network). The architecture of this function is perfectly suited for different Industrial Ethernet protocols and is more or less, as a distinct and independent block, already used in different Renesas product families.

The R-IN Engine architecture shown in figure 4 is first and foremost a sub-system with an ARM Cortex-M3 CPU and all on SoC-required components: memory blocks for instructions, data and other functions, interrupt controller and the corresponding multi-master bus system to different internal and external device re-sources, as well as the ability to debug. The multi-master bus allows concurrent data transfers between different areas without the requirement to interrupt the internal or external host CPU. When looking to the networking further components for Ethernet communication are included as well:

a Gigabit Ethernet switch with three ports, one internal and two external (as already described). Further on the R-IN Engine includes an Ethernet MAC with associated DMA controller and required buffer memory explicitly used for Ethernet data transfers. In order to implement one protocol of the second group, the communication data path can be switched with respective multiplexers from the standard Ethernet path (IEEE 802.3 Switch and MAC) to the IE protocol controller of the second group.

Beyond this purely functional approach to support industrial networks, the R-IN Engine includes some accelerators replacing functions which nowadays are typically implemented solely in software. In terms of real-time requirements the processing of network functions is decisively speeded up with these accelerators at central points in the communication.

The HW-RTOS accelerator primarily supports the software execution with automated and prioritized task scheduling. Moreover this special hardware supports task synchronization via event flags, semaphores and mailboxes, as well as a general task and time management. Last but not least certain RTOS functions can directly be executed by a number of interrupt signals without any involvement of the R-IN CPU. Being closely connected to the CPU, HW-RTOS can sometimes highly accelerate both the processing of the stack software and the actual application. As the term accelerator clearly indicates, everything inside HW-RTOS is calculated by hardware in a very fast and deterministic way without the typical delays and jitter found in software solutions. From the software perspective the use of the HW-RTOS accelerator is based on a  $\mu$ Tron library with a documented API and the related SW parts allowing a smooth project start. Therefore HW-RTOS is completely transparent for the user and does not require a detailed knowledge of the control structures of this accelerator.

When receiving or sending a frame byte the CheckSum accelerator automatically calculates on-the-fly the 4-byte checksum placed at the end of Ethernet frames. This calculation is solely done by the accelerator without loading the R-IN CPU. In the receive direction the correctness of the data can be checked in a single step by comparing the calculated FCS (frame check sequence) value with the frame FCS field in the received frame. By contrast



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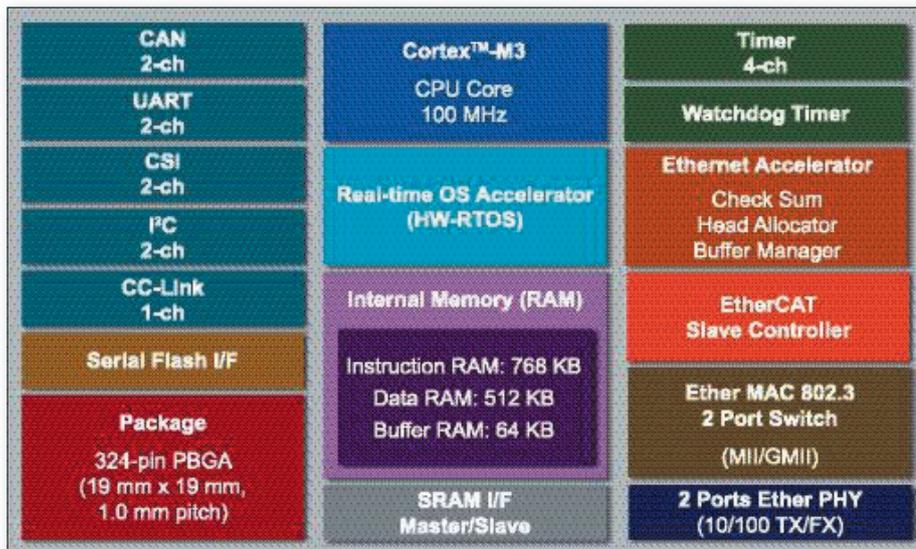


Figure 5. Block diagram R-IN32M3-EC

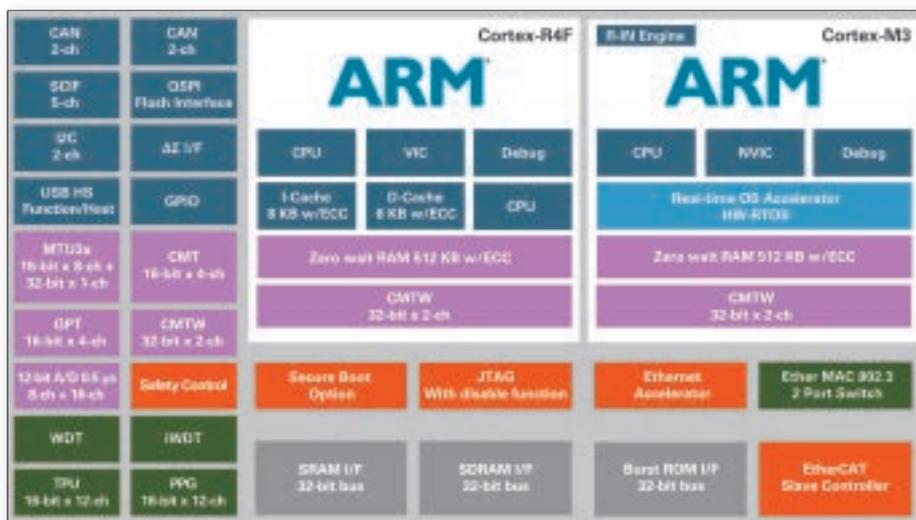


Figure 6. Block diagram RZ/T1 (derivative including R-IN Engine)

a typical software solution calculating the 32-bit CRC value consumes nearly 30% of the overall performance that is generally required for the Ethernet communication. Thus the CheckSum accelerator obtains a correspondingly large saving in CPU performance in high Ethernet traffic situations.

The organization of the frame data buffer for transmission or reception is normally byte-wise. Read-access to certain frame header information requires the collection of all necessary bytes in the frame buffer and their rearrangement into the right sequence. For the transmit direction the rearrangement must be done in the opposite direction into a compressed frame format. This data processing typically requires about 15% of the overall CPU performance for a pure software-based TCP/IP stack. The Header EnDec accelerator has the task of automatically rearranging the data between the compressed frame format and the CPU-oriented 32-bit aligned format.

With this accelerator the CPU has a well-suited, fast and direct read and write access to all frame header information without any latencies.

The Buffer Management accelerator automatically controls the buffer allocation and release functions in hardware for the Ethernet processing.

The basic structure of the R-IN Engine also provides the capabilities of a flexible host interface with required functions for process synchronization and fast and direct access to the communication data. For a single-core implementation this interface can be used for an external host running the system application. In a dual-core implementation it is a chip-internal interface between the R-IN Engine (communication part) and the main CPU of the device (application part). In this sense the R-IN host interface is of course not an accelerator, but without the need of a

typical communication interface it allows direct and zero-latency access into the R-IN Engine and its resources.

Compared with other architectures, the advantages of the R-IN Engine with its different accelerators are reflected in higher CPU performance and increased stability while cutting the overall power consumption. The special hardware works much more efficiently and greatly relieves the CPU load. Thus R-IN architectures optionally run the network communication at significantly reduced power dissipation, or they deliver a significant margin to compute additional complex tasks in the application.

With the R-IN Engine architecture described, a device is able to process at the same time both network communications and complex applications, with extremely low delays and low jitter and minimum power consumption. Due to the network functions and underlying structures the R-IN Engine covers not only all the protocols of the first group using a standard IEEE 802.3 hardware, but also one protocol of the second group using a specific communication controller. Thus a multi-protocol industrial automation product can simply be implemented using the flexible and low cost R-IN single-device approach.

Designed for industrial networks the R-IN Engine is already successfully integrated into the R-IN32M3 and in the RZ/T1 families. While R-IN32M3 is a single-core solution with members for EtherCAT and CC-Link IE protocols, the RZ-T1 family is conceptually dual-core architecture. It basically has two separate CPUs for communication (ARM Cortex-M3 inside the R-IN Engine) and Application (ARM Cortex-R4). RZ/T1 comes with several derivatives for different product types. Other devices based on R-IN Engine are already under preparation or are being planned.

A further but not negligible advantage for R-IN software development is the quite simple protocol porting based upon the re-use of R-IN Engine hardware in different families. This is especially true for all protocols of the first group which run basically on the identical standard Ethernet hardware. When looking to the R-IN32M3-EC device example (EC: including EtherCAT Slave Controller, the basic structure directly correlates with the ideal solution as shown in figure 3. It also includes the 100 Mbit/s Ethernet PHYs and requires only a few external components to run the application and protocol in a single device. Thus R-IN32M3-EC is indeed a very good candidate for use in many small industrial Ethernet products. At the same time it is also perfectly suited for Industry 4.0. ■

## Product News

### ■ Renesas: EtherCAT dedicated communication SoC for remote I/O slave applications

Renesas Electronics Europe announced a low-cost EtherCAT dedicated communication system-on-chip that will help boost production efficiency in factories. The EC-1 SoC is intended for high-speed, high-precision control of slave applications that require higher CPU performance such as intelligent I/O modules equipped with EtherCAT communication functions. The certified remote I/O solution kit which is based on the EC-1 simplifies the adaptation of EtherCAT by cutting down the development time for slave devices such as remote I/O by up to 60 percent.

[News ID 4558](#)

### ■ Janz Tec: Secure Appliance offers modular system for customised industrial security

Industrial security plays a key role in the implementation of new production and business models in the Industrie 4.0 environment. Janz Tec now offers the Secure Appliance as a platform solution, which was developed with maximum data protection in mind. Its modular architecture allows a flexible and custom-made system. Connectors to different enterprise platforms and industrial interfaces enable seamless integration into any IT landscape. Secure Appliance solutions at different security levels are available for all current Janz Tec systems.

[News ID 4533](#)

### ■ ICOP: EBOX Box-PC series now also available with DM&P Vortex86DX3 processors

ICOP Technology has now extended its EBOX Box-PC series – which was introduced last year – with 40 further system configurations. New interfaces include variants with 4G LTE, CAN Bus support and CF card slots as well as a classic printer interfaces. Additionally the highly successful systems – which to date were exclusively available with DM&P Vortex86DX2 processors – can now be purchased with higher performance DM&P Vortex86DX3 processors.

[News ID 4481](#)

### ■ ADLINK: rugged, high storage density and easy maintenance fanless Embedded computers

ADLINK Technology announces its new MXC-6400 Series of high-performance expandable fanless embedded computers, featuring 6th generation Intel Core i7/ i5/ i3 processors and the QM170 chipset. Along with leading performance, high storage density from 4x 2.5" SATA drives, and rugged fanless construction withstanding operating shock

up to 50G and vibration to 5Grms, the MXC-6400 Series fully meets the needs of Intelligent Transportation Systems for rolling stock, maritime operations, in-vehicle infotainment, and high-speed data processing and mission-critical industrial automation.

[News ID 4469](#)

### ■ Neosys: industrial-grade platform supports nVidia GeForce GTX-950 and 6th gen Intel Core

Neosys Technology has announced Nuvo-5095GC, a compact and wide-temperature GPU-computing platform supporting nVidia GeForce GTX-950 and 6th-Gen Intel Core processor. It is the first embedded controller targeting at emerging applications of CUDA computing, autopilot, deep learning and virtual reality. Nuvo-5095GC integrates all features required for a compact, reliable and powerful GPU-computing platform.

[News ID 4603](#)

### ■ IBASE: EN50155-certified 28-inch all-in-one bar-type fanless Panel PC

IBASE Technology has introduced the ARD-028-N all-in-one fanless panel PC with a 28-inch bar-type display powered by an 1.33GHz Intel Atom E3825 dual-core processor. Designed for use in buses and train cars, ARD-028-N, with its ultra-wide TFT active matrix LCD screen, is also a digital signage display and media player that delivers advertising, time schedules and location of the vehicle where it has been installed.

[News ID 4570](#)

### ■ Vecow: Skylake rugged expandable embedded system

Vecow launches her latest powerful rugged embedded computing engine with Intel 6th Generation Skylake platform, ECS-9200/9100 series expandable fanless embedded system. With quad-core Intel 6th Generation Core i7/i5/i3 processor (Skylake-S), fanless -40 to 75°C operating temperature, outstanding system performance, excellent mobile availability, all-in-one integrated features, multiple I/O connection, flexible expansion features, smart manageability, 6 to 36V power input with 80V surge protection, ignition power control, intelligent circus protection and rugged reliability in harsh environments, the ECS-9200/9100 series is an excellent solution for Machine Vision, Rolling Stock, Intelligent Automation, Smart Manufacturing, Intelligent Surveillance, Vehicle Computing, Robot Control, and any Industry 4.0 performance-driven real-time embedded computing applications.

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# New COM Standard SMARC 2.0 starts with Apollo Lake

By Christian Eder, congatec

*At the beginning of June, the Standardization Group for Embedded Technologies (SGET) released the new SMARC 2.0 specification. congatec is offering its first modules for this form factor equipped with the new Intel Atom, Celeron and Pentium processors developed under the code name Apollo Lake.*



*Figure 1. The conga-SA5 Computer-on-Module features Apollo Lake processors and provides optional onboard WiFi and Bluetooth (BLE).*

■ With the revision of 1.1 to 2.0, SMARC has evolved from a specification that was partially outdated and rather arbitrary due to the Alternate Function Blocks to a basically new standard with a clear profile and unique positioning. With its numerous graphics, camera, sound, network and optional wireless interfaces, the new specification is suited for IoT-enabled multimedia platforms as well as many other graphics-intensive low-power applications. SMARC 2.0 positions itself exactly between the two well established module standards, Qseven and COM Express. Compared to the Qseven standard, which allows low-cost entry into the world of computer modules and integrates various x86 and ARM low-power processors for the process and field levels, SMARC offers more interfaces – in particular, more multimedia interfaces. Compared to the high-performance COM Express modules that make up the COM performance class, SMARC 2.0 is positioned in the low-power processor segment and also supports fewer interfaces than COM Express.

SMARC 2.0 provides predominantly modern serial I/Os as well as video and network interfaces, making it a choice for many multimedia and graphics-oriented IoT applications (Internet of Things). To make life particularly easy for developers of such applications, con-

gatec also offers optional WiFi and Bluetooth in compliance with the M.2 1216 interface specification, thereby rounding off the interface portfolio of SMARC 2.0 modules for IoT designs. Applications can be found in digital signage systems, commercial streaming clients, industrial thin clients and HMIs, all kinds of GUI devices, POS systems, professional gaming machines, infotainment platforms, as well as IoT gateways.

With 314 pins, the SMARC 2.0 connector – which is also used in the MXM 3.0 graphic card standard – can support up to four video outputs thereby affording SMARC 2.0 a strong multimedia orientation. 2x24-bit LVDS/eDP/MIPI DSI plus HDMI/DP++ and DP++ are further provided, plus 2x MIPI camera interfaces and two audio interfaces over HDA and I2S. New features include additional USB ports for up to six USB, including two USB 3.0, a second Ethernet port for segmented IoT connection or line and ring structures, a fourth PCI Express Lane and one ESPI. Discontinued is the support for the obsolete parallel camera and display interfaces, external eMMC, SPDIF, one of the three I2S channels, and the Alternate Function Blocks. The latter was perceived as too open by many vendors and customers, since it allowed manufacturers to implement whatever they wanted and no standardisation efforts were made prior to

the SMARC 2.0 specification. This is also why SMARC 1.1 modules offer very little design security if the module interfaces are executed on these pins.

SMARC 2.0 offers a large selection of internal and external graphic interfaces. For the connection of external screens two Dual Mode DisplayPorts (also called DisplayPort++ or DP++) are provided. The advantage: Systems supporting DP++ functionality for external displays can be controlled via DisplayPort, HDMI and even VGA signals. SMARC 2.0 is also very flexible and forward-looking with regard to the control of internal displays. The interface most commonly used today is LVDS. However, thanks to the two 24-bit data channels it is also possible to control panels with very high resolutions. In addition to the display signals, a complete set of support signals is available. As an alternative to LVDS, SMARC 2.0 modules also provide two independent embedded DisplayPort (eDP) signal sets to control two internal panels. A third, forward-looking alternative is the option to control panels via MIPI DSI (display serial interface) as specified by the Mobile Industry Processor Interface Alliance. Displays that support MIPI DSI are mostly used in smartphones. While generally smaller, these displays still feature high resolutions and are produced in very large

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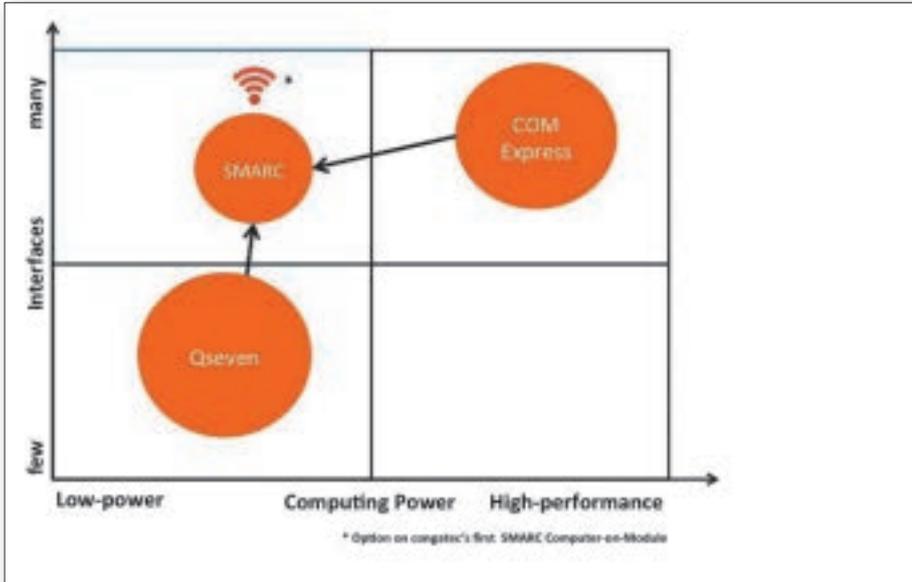


Figure 2. SMARC 2.0 fits between COM Express and Qseven in the competitive landscape.

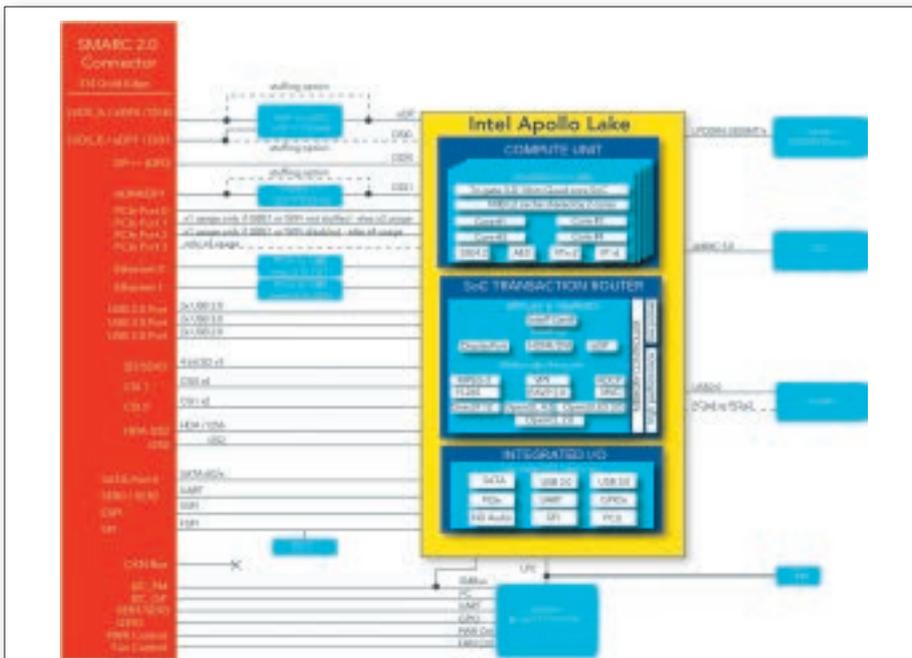


Figure 3. Block diagram of the conga-SA5 including Intel Apollo Lake processor

quantities. Like eDP, MIPI DSI consists of fast serial differential wire pairs, but uses different data rates and protocols. Two Gigabit Ethernet ports provide a particular advantage for IoT or Industry 4.0 applications, because no additional hardware is required to realize two separate network segments for the logic and the security functions. The two GbE ports are handy to implement cable-saving line and even redundant ring topologies. The SMARC 2.0 connector also provides SDPs (software defined pins) for both Ethernet ports. These configurable I/Os can be used for hardware-based implementation of the Precision Time Protocol (PTP) in accordance with IEEE 1588, thereby achieving accuracies in the nanosecond range.

Today, wireless connectivity is a must even for demanding automation applications. In recognition of this trend, the SMARC 2.0 specification defines a dedicated area on the module for the placement of the necessary miniature RF connectors for high frequency signals (short U.FL connector).

All SMARC 2.0 modules that require antenna connections for wireless interfaces implement these connectors in the same position to ensure consistent interchangeability. Congatec modules additionally provide the appropriate logic interfaces, such as WLAN and Bluetooth, via the M.2 1216 interface specification. This widens the choice of radio protocols and gives maximum flexibility for

customizing end-user applications. The feature set is a good fit for the new Intel Atom, Celeron and Pentium processors. The first congatec SMARC 2.0 module integrates with the brand new processor generation launched in late October. The new module not only sets new standards in terms of low-power processor performance but also impresses with pre-integrated wireless interfaces supporting up to 433 Mbit/s of WiFi, Bluetooth Low Energy and, as an additional add-on upon request, NFC. When coupled with the dual GbE interfaces, any demands from current IoT-enabled embedded computing devices can be met. Developers of SMARC 1.1 devices can request a free upgrade check from congatec that specifies the required design effort. The new SMARC 2.0 Computer-on-Modules (conga-SA5) are equipped with the Intel Atom processors x5-E3930, E3940 and x7-E3950 for the extended temperature range of -40°C to

+ 85°C; or with the Intel Celeron N3350 and quad-core Intel Pentium N4200 processors. All versions integrate the latest Intel Gen 9 graphics for displays that support up to 4k and can be controlled via dual channel LVDS, eDP, DP++ or MIPI DSI. The modules feature up to 8 GB LPDDR4 RAM with up to 2,400 MT/s. Thanks to the M.2 1216 interface, wireless IoT connectivity becomes an optional standard feature of the new SMARC 2.0 modules.

Depending on the requirements of the application, connectivity modules can be soldered onto the module with 2.4 or 5 GHz WLAN b/g/n/ac and Bluetooth Low Energy (BLE). The new SMARC 2.0 modules further provide 2x Gigabit Ethernet with hardware-assisted real-time support for the Precision Time Protocol (PTP). For highly integrated designs, the modules provide up to 128 GB of flash memory via the powerful eMMC 5.0 interface.

Compared to eMMC 4.0, this doubles the data rate to 3.2 Gbit/s, thereby shortening boot and load times. Six Gbps SATA and SDIO interfaces provide yet additional memory space. Generic extensions can be implemented via four PCIe lanes, two USB 3.0 and four USB 2.0; and a further two SPI, four Serial and two MIPI CSI camera interfaces are provided. Audio signals are transmitted via HDA.

The new modules support Microsoft Windows 10, including all MS Windows 10 IoT distributions and Android for mobile applications. To make entering the world of SMARC 2.0 even easier, congatec will soon be complementing its SMARC 2.0 ecosystem with a starter kit and a comprehensive set of accessories. congatec's comprehensive Embedded Design and Manufacturing services for application-specific carrier board and system designs further simplify application development. ■

## Product News

### ■ netX ASIC combines industrial realtime ethernet with IoT communication

Hilscher netX technology now offers integrated OPC/UA and MQTT communication parallel to PROFINET, Ethernet-IP and other industrial Realtime Ethernet protocols. The netIOT product range opens the way to transparent IoT communication from the sensors and actors in the OT area up to the companies IT platforms via new netIOT Edge gateways.

[News ID 4627](#)

### ■ Renesas: 32-bit RX65N and RX651 MCUs provide safe and secure communication capability

Renesas Electronics announced the RX65N and RX651 Groups of 32-bit microcontrollers, which will be the new mainstream among Renesas' next-generation RX Family lineup. The RX65N/RX651 Groups can be used in various application fields such as networked industrial machinery, building automation, and so forth.

[News ID 4625](#)

### ■ acceed: scalable i7 controller with 5 PCIe/PCI slots

The new industry controller Nuvo-6000 convinces as a fanless embedded PC with its five PCIe/PCI extension slots. In the Nuvo-6032 version, the compact system can be equipped respectively with an x16 PCI card and an x8 PCIe card as well as three PCI cards. Various 6th generation (Skylake) Intel core processors are available. Two gigabit Ethernet interfaces, four USB 3.0 and five COM ports (RS232/485/422) enable database communication in the network and with peripheral devices.

[News ID 4471](#)

### ■ acceed: flat industrial Box PC with 6 GigE ports

The Nuvo-5000 series industrial Box PCs only introduced in 2016 has already had a further model added: the especially flat Nuvo-5000LP with a mere height of 77 mm. LP stands for low profile and with this the new embedded controller convinces, despite the large number of interfaces, primarily as a system-integrated controller which can be located in cable ducts, small switch boxes and machine shafts.

[News ID 4586](#)

### ■ Axiomtek: rugged IP67-rated fanless embedded system for outdoor critical applications

Axiomtek introduce the eBOX800-841-FL, a fanless embedded system with IP67 protection for mission-critical market. The rugged embedded system is designed for fanless operation at temperatures from -30 to 60°C. Its 9-36V wide range DC input with various power protection, M12 lockable connectors and N-jack waterproof antenna connectors meet the performance needs for industrial Internet of Things applications.

[News ID 4577](#)

### ■ Maxim: Pocket IO PLC development platform increases productivity for Industry 4.0

Significantly increase manufacturing productivity with the Pocket IO programmable logic controller development platform from Maxim Integrated Products. The platform provides customers with the ability to achieve the smallest form factor and highest power efficiency for next-generation PLC designs.

[News ID 4568](#)

### ■ EKF: CompactPCI Serial quad PCI Express mini card carrier board

The SP4-MAMBO is a peripheral board for CompactPCI Serial systems and serves as a universal quad PCI Express Mini Card carrier, for both PCIe and USB driven Mini Cards. With the SP4-0980-MAMBO version EKF now introduces an 8-port CAN 2.0B controller. The carrier card comes with four dual port CAN modules (Peak PCAN), which are wired to a common D-SUB 25-pin front panel connector.

[News ID 4505](#)

### ■ AAEON: latest intelligent solutions for Industry 4.0 Automation

AAEON signed a contract with NACHI-FUJIKOSHI and other major manufacturers and founded "The Advanced Motion Control Team". Robotics technology is playing a key role in Industry 4.0 Automation manufacturing. AAEON's Box PCs and Industrial Panel PCs were particularly designed for such applications. AAEON's All-in-One products allow complicated instructions to be precisely executed.

[News ID 4528](#)

### ■ Softing shows know-how and solutions for Industry 4.0

Under the motto „integrating“, Softing shows products and solutions for digital data exchange in Industry 4.0 applications at the SPS IPC Drives 2016 and introduces new product families. In the course of the re-branding which was started in the first half of 2016, Softing Industrial is structuring its portfolio into four product families.

[News ID 4624](#)



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# How embedded system products define roughness in industrial computing

By Kevin Wang, AAEON

*This article introduces the embedded computer product portfolios of a Taiwanese supplier, which cover nearly every aspect of industrial applications including Industry 4.0 and the Internet of Things.*



*Figure 1. BOXER-6639: a fanless embedded Box PC with Intel Gen6 Skylake socket type processor and Q170 chip set*

■ Embodying ruggedness and stylishness, all of Aaeon system products are crafted to introduce enhanced usability and aesthetics to a workspace. With features such as wide temperature support, extreme computing power and graphic display capability, IP-rated enclosures, multi-touch capability, and anti-scratch screens, the line of system products is suited for both industrial and infotainment purposes. The company also endeavors to bring new ideas to the panel PC market and conventional panel PCs with modular panel PCs as well as other new, exciting designs, raising the bar in the design of panel solutions and helping the user lower development and implementation costs.

One of the key missions is to lead the IoT (Internet of Things) in industrial automation which means to be able to connect machines to the cloud. However, each machine speaks its own language. As a leading developer and manufacturer of professional IoT solutions, Aaeon provides industrial box PCs and human-machine interfaces. By integrating HMS communication modules into the solutions it allows the products to control and communicate with the machines. The partnership with HMS - the leader in industrial communication - bridges the gap for both sides. The BOXER-6639 serves as a good example of the solutions offered. It is a fanless

embedded controller incorporating a high-value desktop processor, wide range operating temperature, and broad power input to offer high computation power for industrial environments. This newly released product comes with a long-term supported sixth Gen Intel Core Desktop Processor, and thanks to an innovative mechanical design it is extremely scalable by changing the CPU to fulfill customer needs. The embedded controller is designed to address specific vertical applications: 3 fully independent GB LAN ensure maximum bandwidth to sustain high resolution camera data flow, a paramount feature to carry on high precision vision applications. Visualization of high quality content is guaranteed by the outstanding dual HDMI output that achieves 4k resolution. With features supporting extended operating temperature from -20°C to 55°C and 9 ~ 36V wide range DC input, this Box PC offers continuous operation in any kind of environment, regardless of unstable voltage or extreme temperatures.

It incorporates a variety of serial I/O connectors, including 6 COM ports, 4 USB 3.0 and 32 channel DIO, and offers flexible configuration and expansion capability. Hence, customers can efficiently wire-up multiple systems to the central controller for various automation applications. The BOXER-6639, powered by a high-end Intel desktop processor and

integrated with rich I/O ports, helps users to achieve a delicate balance between cost and performance in the automated production business. This new generation industrial Box PC is conceived to fit specific markets in the automation area. Specific features like independent GBE LAN and wide range input make it suited for machine vision and factory automation applications amongst others.

For greater performance, the Embedded Box PC BOXER-6638U is an economical model designed to give you more bang for your buck. While performance is assured with the Intel Core i3-5010U driving the device, the U-series chip comes with greater power-savings and cost-efficiency. This enhanced processing power is used to power the many I/Os of the device, which include four COM ports for facilitating instant deployment for users in the industrial automation field. Compared with its predecessor, the AEC-6638, it features the smaller dimensions of 197x174x55mm, a 30% reduction. Its operating temperature and electrical support ranges are also extended to -20 ~ 60°C and 9 ~ 24V, respectively. Supporting these enhanced operational parameters are the construction and features of the device, which are designed with convenience in mind. Users wishing to access the device interior can do so effortlessly by removing screws at the base, with no specialized method or tools



Figure 2. BOXER-6638U: an economical model.



Figure 3. OMNI-Modular HMI Panel PC

required. Thanks to their superior performance and attractive pricing, the fifth generation chips are well suited to upgrade from the former embedded PC models. With the great performance and reduced energy requirements conferred by the new chips, as well as the more compact design and convenient selection of features, the BOXER-6638U is first to consider.

Featuring a modular design, the OMNI Series can be fitted with a number of modules to expand its base capabilities. This line belongs to expandable panel PCs with the pioneering model. While customizable panel PCs are nothing new, they often involve stripping the system device down to its individual components and reassembling it to its requested specifications. The OMNI shortens the lead time involved by adopting a modular design,

making the customization process as easy as building Lego toy bricks. To bridge the gap between industrial networks and IIoT, Aaeon cooperates with HMS IXXAT INpact solution to enhance the industrial Ethernet ability. IXXAT INpact allows you to connect a PC to any industrial network. It combines proven Anybus technology with years of know-how in the area of PC interfaces. Under the IXXAT INpact brand, HMS delivers communication solutions for machines, safety and automotive. IXXAT INpact solutions are especially tailored for communication within machines, safety systems and the automotive sector. This offering from HMS Industrial Networks includes the products and services needed to solve advanced communication issues. Powered by Intel Celeron, Atom and Core-i processor, the OMNI series deliver enhanced performance over its preceding models with

high display resolution, up to 32G memory support and VESA 100/panel mount design. Some of the most popular expansion interfaces and I/Os, such as USB type A x 1 for USB 3.0, USB type A x 3 for USB 2.0, HDMI x 1, and 3-pin terminal block x 1 for 9~30 V DC power input, are also featured in the device, making it suited for any industrial or HMI display applications.

The panel accomplishes this with a simple connector on the main CPU box, which houses the CPU as well as other essential components on the rear of the panel. Dubbed the OMNI-slot, each module is connected to the CPU box through this slot-like USB device. This plug and play approach not only makes customization and expansion much easier, it enables the device to be NRE free, hence driving the overall cost down. A total of eight modules are currently available: a USB/ COM/ LAN combo module, a dual LAN module, a Mini-Card and SIM card module, an RS-232/422/485 module, an isolated RS-232/422/485 module, a digital I/O module, a CAN Bus module, and an audio module.

The OMNI series offer multiple choices from 10.4" to 21" supporting 4:3 and 16:9 projective capacitive (P-CAP) and full-flat 5 wire resistive touch-screen (RTS) with a full aluminum chassis that offers wider operating temperature and superior cooling over other contemporaries out in the market. The everlasting popularity in toy bricks serves as the basis for this design concept. Through the use of modules, including/excluding certain features on the device can be done effortlessly, which is the direction AAEON is taking for future OMNI-products.

Aaeon has had outstanding achievements in delivering intelligent system products, such as rugged Panel PCs, expandable industrial computers, full-HD infotainment displays, rugged tablets, embedded computers and related accessories. These products can be applied today in all facets of digital signage, transportation, industrial automation, healthcare, hospitality, harbor/marine, military/government and energy sectors. The company offers fast customization services for its range of slim embedded computers and fanless embedded controllers (BOXER Easy program), and all other system products according to customer requirements and regulations. Having earned the highest degree of trust from tier-1 customers, it has furthered this service to end-to-end DMS services that can assist large customers with volume production, beginning with design to contract manufacturing. Quality assurance of our system products ensuring excellent product performance has been the key to our growing global customer base in all areas. ■

# Focus on security in embedded computing systems

By Harald Maier, TQ Group

*In the future, everything will be networked to everything else. The Internet of Things and Industry 4.0 are the key terms in this case. This creates new vulnerabilities for spying and tampering. To counter this, system designers and developers view security as the focus of new developments.*



*Figure 1. Security plays a central role as early as the product definition and development phases and can sometimes be crucial for the success of the product.*

■ The success story of embedded PC systems began many years ago. Standardization together with the compatibility and replaceability of hardware and software all played and still play a decisive role in this success. Existing printed circuit board assemblies and circuit elements are reused as are software functions and applications. This reduces development costs and schedules. However, it is precisely these advantages that present the greatest vulnerabilities for malicious attacks, abuse, manipulation, the theft of intellectual property (IP) and plagiarism. The topic of the Internet of Things (IoT) and the networked future are exacerbating the situation more and more.

Everyone is talking about IoT. This provides the motive to consider topics such as security with more deliberation. In the networked future, there will be various communication paths together with a large number of interfaces and standards. Being linked to the internet presents a new type of accessibility, too. Going hand in hand with this, several new vulnerabilities for unauthorized access, piracy and abuse are looming. And this is just what is stopping many companies from launching into the new era. The fear of spying and tampering is enormous. Sensitive data, but mainly the systems themselves, need adequate protection and security. Hardware and software

packages coordinated with one another to the maximum extent are the best solution to minimize the risks.

Systems and infrastructures used until now were cut off from the outside world and had security measures that were weak or non-existent for this reason. Sensitive data, both user data and special application programs, algorithms and licenses, were stored and managed in the system or in local networks. Even the systems themselves presented little vulnerabilities for tampering or piracy. Direct, on-site access was needed to maliciously cripple a system. Specialized knowledge on the system level was often implemented using a combination of proprietary hardware components and special purpose applications. It was very difficult to copy this.

The possible access modes to systems and data have changed. In addition, IP that should be protected is found more and more in the upper application layers, in the area of software. The desire for update and service demands new concepts and potential access modes. The demand for flexible use and licensing models requires new mechanisms to manage these models. All in all, system designers and developers are facing new challenges and security is playing a major role in all of this. It is necessary to put the focus on

the topic of security for new developments and this is not just being driven by buzzwords like IoT and Industry 4.0.

Embedded PC technology can be used in a lot of areas and handles broad application areas due to the flexibility coming from expansions, software compatibility and the availability of the most varied performance classes. The spectrum extends from an intelligent IoT gateway to high-performance computers for demanding automation tasks. Embedded PC applications can also often be found in the medical area. This is precisely where demands for security on extremely different levels come together. These demands include the protection of sensitive data, protection against tampering, protection of application intellectual property, flexible licensing of additional options, usually implemented as software features, and secure communication with the environment.

The system can only satisfy requirements nowadays when the security aspect has been incorporated during the development phase or when embedded PC components are used that already contain the necessary security components and mechanisms. If data and programs are to be stored on a local drive in an encrypted form, functions such as BitLocker from Microsoft – available since Windows 7



Figure 2. The medical PC platform from TQ shows one example of the implementation of all basic security features: TPM support, security controller and wireless options that allow for secure communication and comprehensive protection.

makes access to this IP substantially easier in the case of systems with weak security. Once the core software is extracted or the license key cracked, the software can be transferred completely or in parts to other systems and used there. Individual algorithms and special functions can be extracted from unprotected program code using reverse engineering and then integrated into other applications. This represents tremendous damage that must be prevented. Security controllers can provide protections here. These are soldered into the system and integrated there.

inserted into a USB port. For embedded PC systems, however, it is advisable to implement this feature using permanently integrated chips. This ensures a fixed assignment to the device or system. Secure licensing processes can only be implemented and the IP and extra options for a fee be appropriately protected against abuse if this has been specified during the development phase.

Hard-wired communication paths are usually used within local networks or IT infrastructures. These paths are well protected from the outside world by firewalls or the like. However, there is a greater risk if the communication is wireless. This is mainly the case if the communication path runs directly to the internet. When selecting communication components, pay attention to which security features are already included, especially when cellular communications (2G/3G/LTE) is used to expand integrated IoT solutions. The entire communication chain, from the system to the cloud, should be considered during development. It is usually advantageous in this case to use manufacturers who offer the communication modules with suitable software routines for connecting to the cloud together with the cloud services as a package deal.

– can be used. These tools access hardware components such as the TPM (Trusted Platform Module) chip to protect the keys used for decryption. The data are only accessible to authorized users. The encryption is also linked to the device so that hackers cannot read any passwords or data even if they remove the hard disk or SSD (solid state drive) and install it into a different system.

Functions that need to be specially protected, usually small blocks of code suffice, are encrypted during compilation so that they later cannot be executed on the computer CPU but only in the dedicated security controller of the target system. The software can only run on the intended target system. The encrypted program code blocks can also not be tracked and reverse-engineered during runtime.

In addition, a TPM chip integrated into a system can be used for encrypted communication and for uniquely identifying the hardware to higher-level systems. TPM can also be used to detect hardware and software tampering and, based on this, initiate a secure boot or Roots of Trust. TPM cannot be retrofitted because, besides the hardware chip, the needed functions must be implemented in the BIOS (basic input/output system). More and more intellectual property is in the software, making this a favorite target for hackers and reverse engineering. The ever-increasing network density

The same applies to optional added features that can be activated with a license. If the activation only uses software, it is usually just a question of time and effort until the needed license strings or activation routines are cracked. For secure protection, hardware and software must be coordinated and the license activations (license keys and activation routines) must be run remotely, for example, in the security controller mentioned already. A similar feature is known from the end user arena in the form of hardware dongles that are

New applications in the IoT area and for the networked future often give rise to uncertainty and doubts because it is difficult to judge the topic of security. Security plays a central role and, as a basic requirement, must be incorporated as early as the product definition phase and during development. To close any gaps in experience and to answer open questions, it can be smart to include partners in the process and to use platforms already in existence. This can happen both on the component level and on the system level. ■

## Web-based Remote I/O

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# The SMARC evolution in embedded COM form factors

By Martin Unverdorben, Kontron

*In this article the author describes SM-ARC2.0, the new SGET version of the popular Computer-on-Modules small form factor standard of his company, and highlights the changes which it incorporates.*



*Figure 1. SMARC-sAMX6i: Ultra-Low Power ARM and SOC-based SMARC Module based on Freescale i.MX6-Family with Single-, Dual and Quad-Core versions*

■ The final Version 2.0 of the Smart Mobility Architecture (SMARC) embedded computing format was announced by the Standardization Group for Embedded Technologies (SGET) SDT 0.1 in June 2016. In just three years, SMARC has proved to be an innovation boost for the ultra-low power embedded market and it is this rapid success which has largely contributed to the requirement for Version 2.0 in a relatively short period. Essentially, the SMARC2.0 specifications provide an enhanced pinout to better accommodate customer needs and processor interfaces, perfectly matching the original standard set in 2013 for low-profile form factor modules. While SMARC was born out of the necessity for further development of Computer-on-Modules (COMs) standards for energy-saving ARM System on Chip (SoC) processors, Intel subsequently improved the power efficiency of its processors with Atom-based SoCs and allowed x86 architecture products to also benefit from the SMARC format. Consequently, SMARC modules have rapidly emerged as scalable building blocks for enabling an entire new generation of embedded computing applications.

Using SMARC, Systems Integrators can take full advantage of the user-interface options available to mobile device OEMs, providing access to the smaller, low-cost display mod-

ules employed in smart phones, tablets and advanced human machine interfaces. Aimed at manufacturers of COMs, carrier board and system developers requiring SoC-based ultra-low power COMs in miniature format, the area of application for SMARC modules is continually expanding, from solutions in the automation market to graphics and image-centric devices which also require extremely low energy consumption and have to withstand extreme environmental conditions. The modules also serve as building blocks for very small portable handheld devices as well as for larger devices where consumption must not exceed a few watts and the computing power has to be particularly high.

Of course, Kontron is no stranger to SMARC. As part of the SGET manufacturer-independent initiative, it has always played a leading role in its development going back to 2012 when the company completed the original SMARC specification under the working title Ultra Low Power Computer-on-Modules (ULP-COM). Looking back, it is remarkable how smoothly SGET was established and able to quickly eliminate the usual standardization bottlenecks. Clearly market demand played an important role in this, allowing the embedded market to benefit from an additional standards body for contributing to innovative specifications, and totally capable of bringing

new standards to market within just a matter of months. With the SMARC standard in place, Kontron was quick to address pent-up market demand by launching in 2013 its first highly scalable SMARC module families with ARM SoC processors including the Freescale i.MX 6, Texas Instruments Sitara 3874, and NVIDIA Tegra 3. These enabled developers to begin work immediately on engineering innovative ultra-low power devices.

In fact, the smooth ratification of the SMARC standard also underlines the power of Kontron to innovate in its role as an international technology leader and as a standardizer of COMs. With over 15 years of experience in the development of COMs, the company has always provided extensive support along with notably long-term product availability, allowing industrial customers, partners and module manufacturers to profit from the high level of investment security available. Its success story with COMs began in 1998 with DIMM-PC which, in 2000, led to the ETX standard being licensed worldwide. The X-board specification followed in 2002 and ETX Express as the technological basis for PICMGs COM Express technology was launched in 2003. COM Express was finally developed by members of the PICMG standards consortium, and Kontron was a major contributor to the technology. Over the years COM Express has been



Figure 2. IndraControl L45: Kontron COMe is an essential core element in the new PLC controller of Bosch Rexroth

consequently adapted to meet the increasing need for miniaturization on a high performance level: COM Express basic was complemented by the smaller COM Express compact and in 2008, Kontron introduced the technological basis for the credit card sized COM Express® mini.

Further success came in February 2014 when Kontron introduced the first ultra-low-power SMARC Computer-on-Modules with Intel Atom processors E3800 series. This was significant as at that time only ARM processors had been available and therefore the new launch opened up completely new possibilities for developers in terms of the form factor scalability, software re-use and compatibility. Now firmly established, Kontron SMARC-sXBTi Computer-on-Modules offer excellent graphics, high processor performance and x86 compatibility on the smallest SMARC footprint combined with very low power consumption (5 to 10 watts). Both the flat profile of the module and its mobile feature set are tailored for the smallest portable handheld devices. The modules can, however, be deployed in any application where power consumption has to be kept at just a few watts but high-level computing and graphics performance are required.

SMARC2.0 - why the changes? In order to assess the changes to the SMARC standard it is necessary to first take a step back. Utilising the proven Mobile PCI Express Modules (MXMs) edge connector, SMARC was originally established to define two sizes of modules - a full-size module that measures 82 mm by 80 mm, and a short module for more compact systems measuring 82 mm by 50 mm. In contrast to the PCI Express focus of COM Express, SMARC provided the flexi-

bility for handling different types of video and graphics output, serial buses, general purpose SPI, client and host forms of USB, serial and parallel camera interfaces, and support for standard flash-memory card formats such as SD and eMMC. Today, however, the 314 electrical contacts of the SMARC connector need to support and provide compatibility with not only ARM, but also x86 - two distinct SoC architectures. With ARM, for example, the connector must guarantee a high degree of signal integrity as required by the high-frequency serial interfaces, as well as support a parallel TFT display, MIPI display interface, camera interfaces, multiple SPI links and SDIO interfaces. At the same time it must offer full compatibility with X86 requirements such as many USB and PCI Express lanes, LPC bus and more.

In response to this challenge SGET has been able to update the original specification based on three years valuable market feedback from a broad range of developers and users. As part of its policy of continuous improvement this has culminated in various modifications and enhancements to be included in SMARC 2.0. Furthermore, some interfaces which were rarely used or considered as almost outdated, have been removed from the specification including the Parallel Camera Interface, Parallel Display Interface, PCI Express Presence and Clock Request signals, Alternate Function Block, SPDIF, one I2S (out of 3) and eMMC interface to the carrier. Throughout this process, the goal of SMARC 2.0 has been to create a new pinout version while maintaining compatibility with the V1.1 pinout as far as possible. Accordingly, there has been a repurposing of selected, previously under-utilized, V1.1 pins for accepting new interfaces.

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The guiding principal has been that there should be no damage if a V1.1 compliant module is placed into a V2.0 compliant carrier, or if a V2.0 compliant module is placed into a V1.1 compliant carrier.

SMARC 2.0 – what's new? The new version V2.0 will repurpose selected V1.1 pins that are underused for new interfaces in order to keep the compatibility with the V1.1 pins. No damage will be caused to modules that were placed in a V2.0 compliant carrier or

inverse with a V2.0 compliant Module in a V1.1 compliant Carrier. New interfaces include 2nd channel LVDS, a 2nd Ethernet port, IEEE1588 Trigger Signals, a 4th PCI Express Lane, extra USB ports (now up to 6x USB 2.0 + 2x USB SS signals), x86 power management signals, eSPI and DP++. Three digital displays: as primary display, 2x 24 bit LVDS or eDP (4 channels) or MIPI DSI (4 channels) can be used, the secondary display can either be HDMI or DP++ and the third display can be DP++.

Undoubtedly, SMARC 2.0 will be the basis of many innovative and sophisticated applications over the next few years and Kontron, as one of the world leading embedded computing technology manufacturers, fully intends to remain at the forefront of SMARC innovation. The company already has Version 2.0 product introductions scheduled for late 2016 and these, like all current Kontron embedded boards and controllers, will be Internet of Things ready and benefit from deep software integration. ■

## Product News

### ■ Avalue: Bytec's second gen Geni-Tec power solution for healthcare market

Avalue Technology's healthcare alliance partner Bytec has released for sale their G2 Geni-Tec Mobile Power solution designed for use in healthcare environments. Bytec's core focus is to 'Mobilise Healthcare', bringing a reliable and safe power solution to hospitals, integrators and medical device manufacturers to add value to their systems, products and solutions.

[News ID 4615](#)

### ■ CES: dual processor Intel Core i7 6U OpenVPX SBC

Creative Electronic Systems announces the CIO5-2040: a SWaP optimized dual processors SBC combining 1.5 TeraFLOPS and 210K DMIPS of processing power, 40Gb of Ethernet throughput and a composite frame enabling the board to provide its entire capacity all the way up to 85°C. Aimed at serving High Performance Embedded Computing applications such as radars, COMINT, SIGINT or ELINT, the CIO5-2040 is built using a mirrored architecture implementing two Intel Core i7 Gen5 processors. The processors are fed with data through four 10Gb Ethernet links and three PCIe Gen3 x8 links routed in the backplane.

[News ID 4595](#)

### ■ Manhattan Skyline: compact NXP Cortex A7 module designed for easy plug-in

The efusA7UL module from Manhattan Skyline is built around an NXP i.MX7 Ultralite processor using an ARM Cortex A7 Core. The 47m x 62mm form factor combined with low power consumption makes it very suitable for compact designs. The module is designed with up to 1GB SLC NAND Flash, 1GB RAM, 32GB eMMC. Interfaces include 2 x SD Card Slot, Wi-Fi, Bluetooth, 4 x serial, USB 2.0, 2 x CAN, 2 x I2C, 2 x SPI, I2C audio and an LCD interface for TFT plus touch 4-wire and PCAP via I2C). Available operating systems are Linux (Buildroot/ Yocto) and Windows Embedded Compact 2013.

[News ID 4575](#)

### ■ IBASE: compact fanless system powered by 5th gen Intel Core processor

IBASE Technology announces the release of ASB200-909, a new compact fanless system based on the IBASE IB909 3.5-inch SBC powered by a 5th Generation Intel Core i75650U or ir-5350U processor with 4GB DDR3L memory on board. Designed for automotive and factory automation applications, the ASB200-909 comes with low power consumption and supports an optional 60W power adaptor, VESA mount bracket, as well as a 12V~24V DC wide-range power input terminal block on the rear of the system. Other external I/Os include four serial ports, two USB 3.0, two USB 2.0, one DVI-I, two RJ45 Gigabit Ethernet connectors, a CFAST socket, HDD LED and power button.

[News ID 4489](#)

### ■ Concurrent: new 10 GbE switch enables 3U VPX server configurations

Concurrent Technologies announces FR 351/m06, a new 3U VPX switch with 10 Gigabit Ethernet connections for up to six server grade payload boards and designed to optimize the Size, Weight and Power metrics of rugged server configurations. When used in conjunction with Concurrent Technologies' TR C4x/msd, which is based on the Intel Xeon processor D-1500 and includes native 10 Gigabit Ethernet connectivity, solutions can include up to 96 Intel Xeon cores and 192GB of DDR4 memory.

[News ID 4584](#)

### ■ PEAK-System: 8 CAN channels for CompactPCI Serial

In cooperation with PEAK-System, the company EKF offers the carrier card SP4-0980-MAMBO for CompactPCI serial backplanes, applied, for example, to automotive test systems or industrial controls. With four CAN interfaces PCAN-miniPCIe from PEAK-System, the carrier card provides eight CAN channels at its front panel. They are galvanically isolated from the remaining circuits and against each other.

[News ID 4578](#)

### ■ u-blox: LTE Cat 1 module for IoT featuring proprietary LTE modem technology

u-blox unveiled the UBX-R3, its proprietary LTE modem technology platform. The platform supports the LARA-R3 module series, the only cellular product in the market to feature a combination of a Cat 1 LTE modem and GNSS technology, all developed by a single supplier.

[News ID 4540](#)

### ■ Manhattan Skyline: PicoITX SBC featuring NXP i.MX6 processor

The armStoneA9r2 is a compact and very powerful Single Board Computer in PicoITX form factor. It comes with NXP i.MX6 Solo/DualLite/ Quadplus ARM Cortex -A9 with max 1GHz; up to 4GB DDR3L RAM, 1GByte SLC Flash, 32GB eMMC; TFT via 2 x LVDS and DVI; capacitive and resistive touch panels via I2C; SD card, Ethernet, USB, CAN, serial, WLAN, Bluetooth.

[News ID 4539](#)

### ■ congatec: first COM Express type 7 modules with Intel Xeon D processors

congatec is introducing new Server-on-Modules with Intel Xeon D processors parallel to the preview release of the COM Express Type 7 specification. Based on the COM Express Basic standard form factor (95 x 125 mm), the modules feature 10 Gigabit Ethernet interfaces, 32 PCIe lanes and headless server performance currently with up to 16 server cores and 48 gigabytes of DDR4 ECC RAM.

[News ID 4622](#)

### ■ S.I.E: individual embedded computing system for the medical environment

The expert focuses on an individual approach: In addition to the local expertise, the process entry and the service depth can be chosen for all the phases of the product development process - individual elements consisting of hardware, a software platform and services through to the full development of a sophisticated embedded computing system in the medical environment are possible.

[News ID 4623](#)

■ **ARBOR launches Gigabit Industrial Ethernet switch with four PoE+ ports**

ARBOR Technology announce the availability of the ARBOR AES-5204, an industrial Ethernet Switch with four IEEE 802.3at PoE (Power over Ethernet) ports. The AES series is a new addition to ARBOR's industrial automation product lineup, designed to fulfill the requirements of PoE-enabled devices such as IP security cameras in vehicle, office and other surveillance applications. The AES-5204 offers up to 25.5 watts per PoE+ port, which satisfies the growing demands of high power-consuming network devices, and ensures stability and safety in operation.

[News ID 4487](#)

■ **ADLINK: 6U processor blade offers a 16-core CPU and enhanced graphics**

ADLINK introduces the cPCI-6940 processor blade featuring the Intel Xeon processor D-1500 and AMD Radeon E8860 embedded GPU. The cPCI-6940 6U CompactPCI processor blade offers up to 16-core computing power and high-performance graphics in a robust design. With an extended operating temperature range of -45 to 85°C and 16GB of DDR4 soldered memory, the cPCI-6940 is ideal for the rugged environments encountered by military field vehicles and naval or aerospace carriers.

[News ID 4569](#)

■ **ATP: DDR4 ECC Mini-UDIMM including ECC**  
ATP announces DDR4 ECC VLP Mini-UDIMM, a 2400 MHz high-speed, cost-effective Mini-DIMM, featuring 16GB high capacity with 1.2V operating voltage. The new DDR4 ECC VLP Mini-UDIMM is suited for high-performance applications requiring high density and better power efficiency consumption management, such application includes: Telecommunication infrastructure, networking systems, Micro/Cloud servers and Industrial PCs.

[News ID 4493](#)

■ **ARBOR: COM Express Compact type 6 module with 2nd gen AMD G-series SoC**

ARBOR Technology releases the EmETXe-a58M0 COM Express Type 6 module, based on the 2nd generation AMD Embedded G-Series SoC processors. Compared to the current AMD Embedded G-Series SOC platform, they provide higher performance and a lower power draw thanks to an improved Jaguar+ CPU architecture and AMD Radeon 8000 graphics core. Graphics engine speed has been increased up to 800 MHz and the DDR3 interface up to 1866 MT/s. A new function of the G-Series includes Core Boost Frequency to ensure appropriate processor overclocking.

[News ID 4588](#)

■ **S.I.E: customer-specific technology for intuitive instrument control**

The development of customer-specific HMI solutions in the normative areas of medicine as well as analysis technology, bio technology and laboratory technology requires many years of experience. With the internally developed, continuously expanded HMI platform consisting of highly functional software and hardware modules and a variety of touch screens and displays it is possible to combine individuality and a platform-based approach.

[News ID 4618](#)

■ **Moxa: modular programmable controller for railway applications**

Moxa's new ioPAC 8600 all-in-one controller, which combines serial, I/O, and Ethernet interfaces into a single device, is particularly well-suited for railway applications. It also supports the C/C++ and IEC 61131-3 programming languages and ready-to-run services, including data logging, Modbus TCP Master/Slave, CAN CiA 301, Active Tag to OPC, and SNMP V1/V2c/V3. Packing all of these features into one product helps sustain system reliability, seamless data transmission, and simplified deployment and maintenance.

[News ID 4483](#)



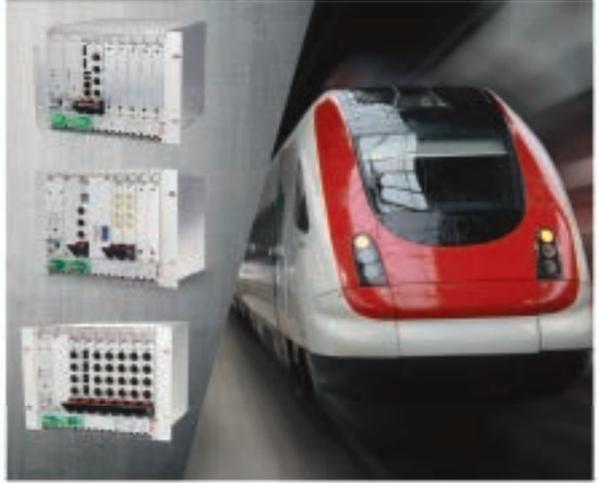
## Computer Center for Trains MEN Railway Data Center menRDC

Modern Trains are equipped with increasingly complex embedded systems to run and monitor onboard equipment, enhance passenger comfort, and deliver new functions.

The MEN Rail Data Center menRDC is based on a family concept, which offers a robust and powerful platform for all non-vital functions in a train with complementary components – including virtualization to combine many different functions like passenger information, onboard internet, predictive maintenance, etc.

The heart of the CompactPCI Serial main server is an Intel-Xeon-based SBC with up to 16 cores with integrated virtualization functionality.

It is supported by a modular storage system, which can be equipped with up to 5 HDD/SSD shuttles with individually configurable RAID functionality. Third in the family is a GBit



Ethernet switch supporting up to 25 Ethernet ports via robust M12-connectors and offers – just as its two family members – space for two (redundant) PSUs and can be flexibly configured on a BTO basis.

The combination of virtualization, a complementary family concept, flexibility, open standards and qualification for the railway market can be a worthwhile alternative compared to many different single systems.

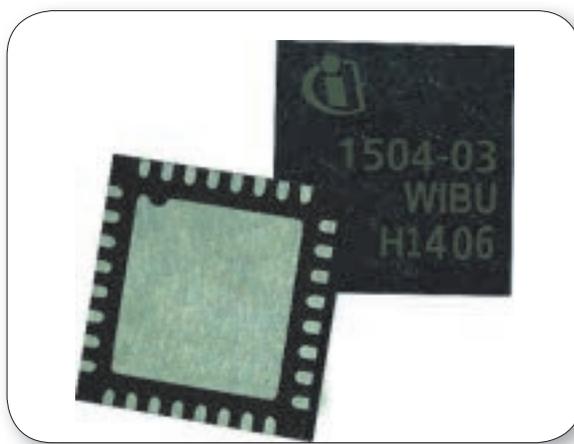
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# IoT requirements for embedded system protection, licensing, and security

By Oliver Winzenried, WIBU

*More and more functions of IoT devices and machines are realized with software executed in embedded systems. This article introduces CodeMeter, a scalable solution that secures and monetizes any type of IoT software running on computers, embedded systems, and even small microcontrollers.*



*Figure 1. CodeMeter ASIC in VQFN-32 package with USB and SPI interface and extended temperature range from -40°C...+105°C with integrated smart card chip and full CodeMeter functionality*

■ The Industrial Internet business has ignited a technological revolution and an economic renaissance that are advancing at an unprecedented pace. When the McKinsey Global Institute mapped out the real value beyond the hype, they estimated that the IoT has a total potential economic impact of USD 3.9 to 11.1 trillion a year. From a less visionary and more analytical approach, Ernst & Young has come to an additional observation: a combination of digital disruption and slow organic growth has propelled the global Tech M&A to a record second quarter in 2016, with deals worth more than USD 1 billion.

Analysts of Gartner Inc. estimate that 4.9 billion connected devices were in use at the end of 2015, which is 30 percent more than 2014. Five years from now, this is expected to rise to 25 billion devices. By then, the same analysts expect 10 billion connected devices (excluding PCs, smart phones and tablets) will ship each year.

These devices require protection against counterfeiting and product piracy, either in the form of simple 1:1 reproduction or, more specifically, in the form of reverse engineering, which remains the number one threat according to surveys done by the German Engineering Federation VDMA. Furthermore, secure licensing enables manufacturers to configure

the features that can be executed individually per user. With simplified logistics, a larger number of devices with identical design can be produced; the units are then customized as the last manufacturing step, possibly even at the user side. By using standard hardware and software platforms, the time to market and development resources can be reduced. By the same token, new business models can also be introduced, such as pay-per-use or subscription models that create recurring revenue streams for device makers, instead of simple one-time sales. With a form of app store, additional features can be offered and more after-sales business can be created, as is already done with consumer smart phones. Additionally, security is getting top priority, as increasing connectivity is increasing the risk of attacks. Secure firmware updates, secure identities, and key storage are required for the protection of code, parameters, and data.

While protection solutions for applications running on standard computers have been in the market for almost three decades, the different nature of embedded systems requires a different approach. They are using a variety of embedded and real-time operating systems, they are often limited in terms of system resources like RAM and storage space, and they are using different low-power CPU platforms, like ARM, PPC, or X86.

CodeMeter is the universal technology for software publishers and intelligent device manufacturers, upon which all other solutions from Wibu-Systems are built. It offers protection, licensing, and security capabilities. It needs to be integrated into established software or business workflows at a single point in time only. Applications and libraries can be encrypted and signed with Protection Suite. In addition, CodeMeter offers an API for custom integration, and CodeMeter License Central can be connected to existing ERP, CRM, and e-commerce systems. Once integrated, manufacturers can create licenses automatically and deploy them seamlessly to connected target systems or distribute them via a separate license portal. Essentially, each user or device receives the same software, but a different license that entitles them to use the product in a tailor-made way for their needs.

CodeMeter offers maximum flexibility in how licenses are stored. CmActLicense stores licenses in an encrypted and signed file, bound to a fingerprint of the target system or to any type of secure element like TPM or technologies like Intel SGX or ARM Trustzone. CmDongles store licenses in a highly secure fashion in a smart card chip. The secret keys never leave this chip. These CmDongles are available in a chip size package with SPI and USB interface, as USB devices, microSD

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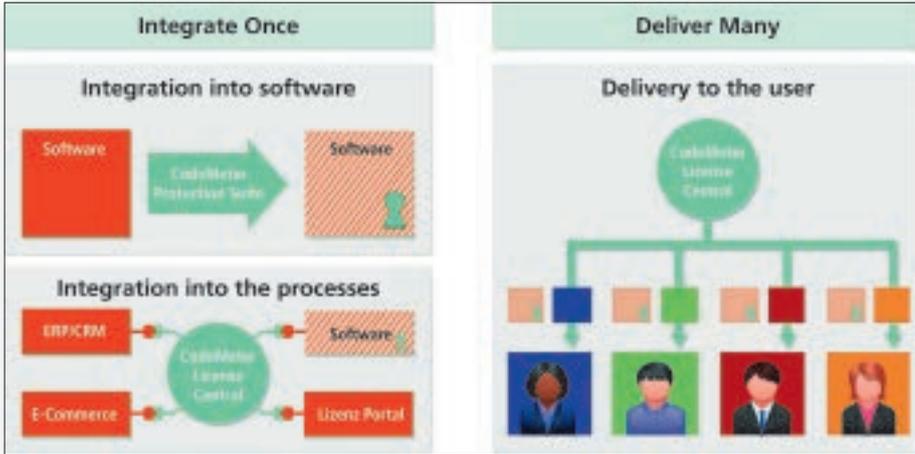


Figure 2. One-time integration into software and business processes and multiple delivery



Figure 3. CmEmbedded modules can be chosen by OEMs to tailor their perfect solutions

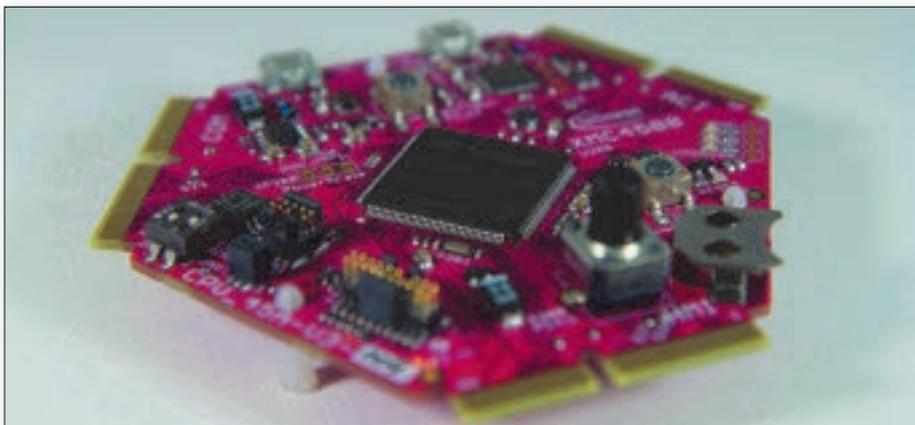


Figure 4. Infineon XMC4500 development board with CodeMeter μEmbedded

cards, SD cards, CF, or CFastcards. The cards offer additional industrial-grade flash memory in the same device.

To be able to use CodeMeter technology on any kind of system, the so-called CodeMeter Runtime is required. It offers access to the CodeMeter licenses and keys for the applications executed on the target system. Several different runtime versions are available. CodeMeter Runtime is intended to be used on servers, PCs, IPCs, and powerful embedded systems. It offers maximum functionality,

e.g. including an integrated network license server and a web administration front-end, and is available as a ready-to-use installation package for all Windows variants, Linux, and macOS. It requires 10...30 MByte of RAM.

CodeMeter Embedded is intended for systems from IPCs, PLCs, and embedded systems down to powerful microcontrollers. It is available in the form of libraries and shared objects for many embedded OS, like Windows, Linux, Android, VxWorks, and QNX for Intel, PPC, and ARM processor platforms. It is also

on offer in Ansi-C source code for portability to any OS and any platform. It contains different modules for tailoring to the OEM's system requirements with the lowest possible footprint. The available modules are as follows.

**CmDongles:** this module allows the use of CodeMeter smart card hardware as a safe repository for keys and licenses. It can be tailored to support CmSticks with a USB connector (with and without flash memory), CmCards for microSD, SD, CF, and CFast interface that contain additional industrial flash memory, and CmASIC, the chip in a small VQFN package that can be connected via a USB or SPI interface.

**CmActLicenses:** this module allows the use of a CodeMeter via binding to specific properties of an embedded device. The OEM defines the type of binding for the device in question by using a specific adapter. Support for TEE, Trustzone, and SGX or secure elements like TPM (OPTIGA or Iridium) is an option for secure binding.

**Network Client:** this module allows access to licenses on a network server using TCP communication. Runtime Bridge ensures that the software compiled with CodeMeter Embedded integrated detects when a CodeMeter runtime is active on a target system and automatically uses this for communication.

**Encrypted Communication:** this module enables encrypted communication between CmDongles and protected applications using

CmEmbedded. License Cache: this module holds information about available licenses in memory to give faster access to them and allow multiple processes to access licenses. All keys and encrypted data, e.g. hidden data, never need to leave the CmDongle or CmAct License.

CodeMeter  $\mu$ Embedded is the variant made especially for field programmable gate arrays (FPGAs) and microcontrollers. It is characterized by an extremely small footprint for the loader code, amounting to less than 60 kBytes. This code contains the entire handling of CmAct Licenses, including transfers, symmetric and asymmetric cryptography, and a subset of the CodeMeter API. Within another about 16kByte of nonvolatile memory, CodeMeter  $\mu$ Embedded can store up to 30 licenses, each from two different vendors. Only a few kByte of RAM are required. The licenses generated are fully compatible with all variants and can all be handled by CodeMeter License Central. The license is bound to a unique ID of the FPGA or microcontroller. Licenses can be activated directly in a production environment during manufacturing itself. In addition, features-on-demand can be enabled later via remote file update. Transferable licenses can be moved from a CmDongle or a CmAct License onto a device. Furthermore, with CodeMeter  $\mu$ Embedded, the application firmware is protected by strong encryption and cannot be read by external devices trying to copy the firmware. The symmetric and asymmetric keys as well as the secure loader are located in a protected

memory area of the target controller and can only be used on the device with a matching ID. The code size of CodeMeter Embedded ranges from 150 to 350 kByte depending on the CPU platform and the chosen modules and 500 kByte of RAM depending on the cache size for license information from the CmDongle or CmAct License. CodeMeter  $\mu$ Embedded has been successfully integrated with the XMC4000 Infineon microcontroller family. Developers can protect their code against piracy and license their applications. The tools for the protection of the application code are fully integrated in the development platform DAVE. Typical use cases of CodeMeter  $\mu$ Embedded are: license for devices and device functionality (microcontrollers and FPGAs), monitoring of production volumes through the licensing of individual devices, and secure encrypted transmission of application code into devices.

IoT devices require protection and licensing mechanisms that can be implemented in limited-footprint embedded systems just as much as in cloud-based license deployment solutions. Powerful protection tools enable IoT device developers to implement these complex cryptographic processes in an easy and fast process. The fully scalable runtime variants of CodeMeter fit any type of target system. CodeMeter Embedded is a market-proven solution used in PLCs from B&R, Codesys, and Rockwell Automation, in DAVE microcontroller development tools, in Wind Rivers VxWorks and Workbench, and many other scenarios. ■

## Product News

### ■ Logic Technology: create high-end graphics with TouchGFX on STM32 hardware

The upcoming seminars focus on the challenges of doing modern looking graphical user interfaces on microcontroller hardware and how to overcome these challenges by using the TouchGFX framework on top of STM32 hardware. Target participants are GUI developers with basic software experience. Seminars will take place in October or November in Germany, Denmark and France.

[News ID 4598](#)

### ■ Wibu-Systems: OPC UA SDK makes use of CodeMeter hardware secure elements

At this year's edition of SPS IPC Drives, Wibu-Systems introduces the OPC UA Security Extension. The collaboration between Unified Automation and Wibu-Systems has resulted in Unified Automation's ANSI C based OPC UA SDK, a ready-to-use set of tools that helps incorporate the secure licensing features of Wibu-Systems' CodeMeter in any OPC UA

project. One of the main benefits in terms of security is the ability to store the private encryption keys for creating OPC UA security profiles no longer in a file, but rather in the smart card embedded in any of CodeMeter's hardware secure element (CmDongles).

[News ID 4612](#)

### ■ SEGGER: J-Trace PRO for Cortex-M, ready to trace and profile in just 15 minutes

In order to make it easy to get true instruction trace up and running, SEGGER has just introduced the new Cortex-M Trace reference board. This compact board now ships with every J-Trace PRO for Cortex-M. It can also be purchased apart from the J-Trace PRO unit, so every customer can take advantage of the new reference board.

[News ID 4590](#)

### ■ QA Systems: Cantata version 7.1 eases on-target configuration

Cantata unit and integration testing tool for C and C++, is now available as version 7.1.

The new version makes it very easy for customers to deploy Cantata for use in any target environment as well as introducing the latest developments in bi-directional requirements traceability. The release of Cantata 7.1 was announced today by leading software quality company QA Systems. This release introduces a deployment wizard and editor to make it simple for users to set up Cantata for testing on embedded platforms.

[News ID 4589](#)

### ■ Logic Technology: develop an advanced software platform on STM32F7

Arrow Electronics in conjunction with ARM's Distributor Logic Technology invites you to their latest hands-on workshop designed to help you learn to efficiently develop projects for STM32F7 devices. In the 'hands on' section of the seminar you'll learn about the Industry leading Keil MDK-ARM toolchain, the MDK V5 software packs and how to write and debug a simply program based on CMSIS RTOS.

[News ID 4597](#)

■ **LDRA and Konatus partner with Embraer to accelerate launch of E2 Jet Aircraft family**

LDRA and Konatus, LDRA's engineering partner in Brazil, unveiled the details of the flight system control safety testing methodology that contributed to the launch of Embraer's next-generation E2 jet aircraft months ahead of schedule. Experts in aviation control system safety requirements and certification methodologies, the Konatus engineering team deployed LDRA's comprehensive safety verification tool suite to optimize testing, mitigate certification risks and dramatically reduce Embraer's safety verification schedule.

[News ID 4587](#)

■ **Silicon Labs acquires Micrium**

Silicon Labs announced the acquisition of Micrium, a leading supplier of real-time operating system software for the Internet of Things. This strategic acquisition helps simplify IoT design for all developers by combining a leading, commercial-grade embedded RTOS with Silicon Labs' IoT expertise and solutions. Micrium's RTOS and software tools will continue to be available to all silicon partners worldwide, giving customers a wide range of options, even when using non-Silicon Labs hardware. Micrium will continue to fully support existing as well as new customers.

[News ID 4576](#)

■ **Rohde & Schwarz: analyzing CXPI interfaces for automotive applications**

The new R&S RTx-K76 CXPI serial triggering and decoding option from Rohde & Schwarz allows users to analyze the clock extension peripheral interface (CXPI) communications bus with R&S RTE and R&S RTO oscilloscopes. Users can decode all protocol details and isolate anomalies by triggering on the corresponding details. This significantly accelerates design verification and implementation of CXPI interfaces. CXPI was standardized in 2015 under SAE J3076 as a communications bus for diverse automotive applications. The bus uses pulse width modulation to transmit data over a single wire at 20 kbit/s. The characters used are based on UART.

[News ID 4564](#)

■ **Arrow adds LoRa development board to long range IoT connectivity solutions**

Arrow Electronics has extended its support for developers of Internet of Things products with the introduction of the SmartEverything LION board. The LION board supports a range of functions required in an IoT sensing node and enables simple, low power connection to the Cloud via the LoRa protocol. It was developed by Arrow Electronics in association with Axel Elettronica and is designed to simplify and speed the development processes of companies producing nodes for the IoT.

[News ID 4491](#)

■ **Cadence announces general availability of Tensilica Xtensa LX7 processor architecture**

Cadence Design Systems announced general availability of the 12th generation Tensilica Xtensa base processor architecture. The Xtensa LX7 architecture makes new technologies available for customization by Xtensa customers and increases floating-point choices from 2 to 64 FLOPS/cycle, meeting the growing need for precision and portability in today's demanding DSP (digital signal processing) applications.

[News ID 4561](#)

■ **ON Semi: software-less fan motor drivers to simplify and accelerate appliance design**

ON Semiconductor has announced three new devices for driving 3-phase BLDC motors via 180 degree sinusoidal waveforms. Designed for use in cooling fans of household appliances such as refrigerators, as well as games consoles and computing equipment, the LV8811, LV8813, and LV8814 have voltage ranges of 3.6 volts to 16 V, 6 to 16 V, and 3.6 to 16 V respectively.

[News ID 4560](#)

■ **LieberLieber: LemonTree – fresh model versioning**

LemonTree is the ultimate solution for the diffing and merging of different model versions. Based on scientific work and several years of practical experience with pilot customers, LieberLieber has now officially released this fresh, new approach to solving all-too-familiar challenges associated with the parallel editing of models in teams. Stefan Mueller, HIMA Paul Hildebrandt, Safety-Related Automation Solutions: "In general, standards such as IEC 61508 demand the application of configuration management. This applies to all artifacts, including UML models. LemonTree from LieberLieber is our key to revealing the changes that have been made to a revision."

[News ID 4524](#)

■ **Cadence: fast implementation and signoff of ARM Cortex-R52 CPU with Rapid Adoption Kit**

Cadence Design Systems announced the availability of a Cadence Rapid Adoption Kit (RAK) for the new ARM Cortex-R52 CPU, which targets complex embedded designs for safety applications in markets including automotive, medical and industrial. The Cadence RAK, which consists of a complete digital implementation and signoff flow, is optimized to work with ARM Artisan physical IP and helps designers reach the highest frequency or lowest power during implementation or create a balance between power, performance and area—all with reduced turnaround times.

[News ID 4538](#)

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■ **Infineon: OptiMOS 5 150 V delivers reduction in on-state resistance and reverse recovery charge**

Aiming at high efficiency designs and applications, Infineon introduces the OptiMOS 5 150 V portfolio. This product family further expands the OptiMOS 5 generation of power MOSFETs. The new 150 V product family is especially optimized for high performance applications which require low charges, high power density and yet high ruggedness. It is an important contributor to Infineon's system solutions for low voltage drives, synchronous rectification in telecom rectifiers and brick converters as well as solar power optimizers.

[News ID 4617](#)

■ **TI: 4-A synchronous DC/DC buck converter shrink system size in automotive**

Texas Instruments introduced the industry's first fully integrated power management solution for double data rate (DDR)2, DDR3 and DDR3L memory subsystems in automotive and industrial applications. The TPS54116-Q1 DC/DC buck converter is a 2.95-V to 6-V input, 4-A synchronous step-down converter with a 1-A peak sink/source DDR termination and buffered reference that reduces system size by up to 50 percent compared to discrete implementations.

[News ID 4620](#)

■ **Keysight: continuous-sweep signal analysis to 110 GHz**

Keysight Technologies announced a breakthrough in spectrum and signal analysis at millimeter-wave frequencies. The Keysight N9041B UXA X-Series signal analyzer is the first to provide frequency coverage to 110 GHz with a maximum analysis bandwidth of up to 5 GHz. Developing off-the-shelf tools for extremely high frequencies requires Keysight's proven blend of measurement science and millimeter-wave expertise. The N9041B UXA exemplifies the company's unique capabilities with attributes such as advanced front-end circuitry that achieves low loss and efficient mixing, providing a displayed average noise level as low as -150 dBm/Hz when characterizing wideband modulated signals in the millimeter-wave band.

[News ID 4582](#)

■ **Rogue Wave Software to improve open source software support with IBM**

Rogue Wave Software announces it is working with IBM to help make open source software (OSS) support more available. This will help provide comprehensive, enterprise-grade technical support for OSS packages. With open source prevalent in critical applications and systems, access to expert support can mean the difference between seamless operations and revenue-impacting downtime.

[News ID 4559](#)

■ **Silicon Labs: updated Simplicity Studio simplifies IoT development**

Silicon Labs has released a major update of its Simplicity Studio software development tools, representing a significant redesign of the software infrastructure, making the tools faster to download and easier to install and use. A more intuitive user interface improves the overall developer experience. Simplicity Studio is the only embedded development environment that broadly supports 8- and 32-bit microcontrollers, multiprotocol and multiband wireless SoCs, and fixed-function devices.

[News ID 4554](#)

■ **NI: latest version of LabVIEW Communications drives rapid prototyping for 5G**

NI announced LabVIEW Communications System Design Suite 2.0, a development environment specifically designed for prototyping wireless communications systems. This new version adds NI Linux Real-Time capability for all software defined radio products including the NI USRP RIO and FlexRIO. The added capability empowers engineers to develop real-time algorithms for execution on the NI Linux Real-Time operating system, work with other tools to move up the protocol stack to MAC and network layers, and access the vast repositories of open source tools and technologies needed to build complete system prototypes – concepts critical to advance the 5G initiative.

[News ID 4552](#)

■ **Lynx Software Technologies supports launch of IIC Security Framework**

Lynx Software Technologies announced its support for the Industrial Internet Consortium and specifically the Industrial Internet Security Framework, unveiled in Heidelberg. Lynx is a member of the IIC Security Working Group and played an active role in drafting of the Security Framework. The IIC Security Working Group announced the new the Industrial Internet Security Framework at its members meeting in Heidelberg on September 19, 2016. IISF provides a common security framework developed to address security issues in Industrial Internet of Things systems.

[News ID 4541](#)

■ **Wind River announces VxWorks integration with IBM Watson IoT platform**

Wind River announce availability of the VxWorks real-time operating system client for the IBM Watson IoT platform. This is part of the IBM/Wind River collaboration to advance IoT deployments for industrial customers with new "edge-to-cloud" recipes designed to simplify and accelerate the development of smart connected devices. This integration marks the first in a series of VxWorks clients for cloud service providers to follow.

[News ID 4535](#)



**Editors**

Jürgen Hübner  
phone +49(0)8092-2477413  
fax +49(0)8092-2477429  
[jh@iccmmedia.com](mailto:jh@iccmmedia.com)

Wolfgang Patelay  
[wp@iccmmedia.com](mailto:wp@iccmmedia.com)

Tony Devereux  
[devrex@teyboyz.freemove.co.uk](mailto:devrex@teyboyz.freemove.co.uk)

**For Reader Inquiries and Address Changes please contact:**  
[info@iccmmedia.com](mailto:info@iccmmedia.com)

**Sales & Marketing Director**  
Manfred Blumoser  
phone +49(0)8092-2477411  
fax +49(0)8092-2477429  
[mb@iccmmedia.com](mailto:mb@iccmmedia.com)

Claudia Mellein  
[cm@iccmmedia.com](mailto:cm@iccmmedia.com)

Christiane Lockner  
[cl@iccmmedia.com](mailto:cl@iccmmedia.com)

**Sales Office - UK and USA, Benelux, Scandinavia**  
Blue Sky Communications  
Malcolm Cameron  
21 Cliffe Avenue  
Westbrook,  
Margate, Kent CT9 5DU, UK  
phone +44 (0)77 88-10 84 11  
fax +44 (0)80 82-8010 57  
[mc@blue-sky-communications.com](mailto:mc@blue-sky-communications.com)

**Sales Office - Asia**  
Jean Cheng, [jean@i-media.com.tw](mailto:jean@i-media.com.tw)  
Vivian Hung, [vivian@i-media.com.tw](mailto:vivian@i-media.com.tw)  
Innovative Media Information & Services  
7F-3, No. 26, Sec. 2, Ming-Quan East Rd.  
Taipei 104 Taiwan  
phone +886 2 2563 1186

**Head Office**



ICC Media GmbH  
Rauwagnerstr. 5  
85560 Ebersberg / Germany

**Editorial Office UK**  
36a Blackacre Road  
Theydon Bois  
Essex, CM16 7LU

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■ **SEGGER: J-Trace PRO now enables live profiling and code coverage**

SEGGER has made enhancements to its J-Trace PRO and Ozone debugger products. The new functionality incorporated will enable continuous trace, endless streaming and live analysis of application trace data for ARM Cortex-M projects. This updated solution presents engineering professionals with the most effective tool for code coverage and code profiling to be found on the market, as the analysis data is taken from firmware running on the intended target hardware.

[News ID 4511](#)

■ **Rutronik: RealSense camera from Intel for real 3D scanning and data output**

At the Innovation Center RUTRONIK EMBEDDED, Rutronik Elektronische Bauelemente shows the RealSense Camera from Intel. It enables real 3D scanning and data output. The digital Intel RealSense Camera combines a 1080p-HD-camera, the smallest Infrared Laser Projector with an improved range by 60%, as well as an Infrared Camera with an optimized IR sensor, up to 200fps support, more than 18M 3D points per second and a three times improved signal quality. With these, the camera “sees” like the human eye to sense depth and track human motion.

[News ID 4626](#)

■ **Infineon: Mocana Security of Things Platform integrates support for OPTIGA TPM**

Infineon and Mocana take IoT security to the next level. Embedded systems security specialist Mocana integrates support for the Infineon OPTIGA TPM security controller as a standard feature into its latest Security of Things Platform. The Mocana Security of Things Platform secures manifold aspects of connected devices through a comprehensive collection of services such as pre-boot verification, certificate management, cryptographic engines, secured data transport and secured firmware updates.

[News ID 4476](#)

■ **Mathworks: Simulink introduces sensitivity analysis tool**

Simulink Design Optimization now includes a new sensitivity analysis tool to support design space exploration. The tool, introduced as part of Release 2016a, allows design engineers using Simulink Design Optimization to interactively conduct design of experiments and Monte Carlo simulations of Simulink models. Design engineers frequently need to determine how changes to the parameters in their model impact behavior. By identifying which parameters have the greatest influence on design characteristics such as fuel efficiency, engineers can gain confidence that their design meets the specified requirements.

[News ID 4495](#)

■ **Gemalto expands big data security offerings**

Gemalto announces a major expansion of its SafeNet data protection portfolio that makes it easier for enterprises to protect big data deployments in the cloud, data center, and virtualized environments. SafeNet data encryption and tokenization solutions can now be used to secure data in the most widely used big data environments through technology integrations with leading providers including MongoDB, Cloudera, Couchbase, DataStax, Hortonworks, IBM, and Zettaset.

[News ID 4473](#)

■ **IAR expands ARM tools for developers focused on the Internet of Things**

IAR Systems announces an expansion of its wide range of supported microcontrollers in the complete development toolchain IAR Embedded Workbench for ARM. The updated support includes several MCUs based on ARM Cortex-M3/M4 and ARM Cortex-A15 particularly targeted for connectivity and the Internet of Things, from for example NXP Semiconductors, Silicon Labs, Texas Instruments and Toshiba.

[News ID 4482](#)

■ **TI: ultra-low power dual-band wireless MCU in production**

Expanding the functionality of Internet of Things networks, Texas Instruments announced availability for mass production of its lowest-power dual-band wireless microcontroller supporting Sub-1 GHz and Bluetooth low energy connectivity on a single chip. As part of TI’s pin-to-pin and software compatible SimpleLink ultra-low power platform, the new SimpleLink dual-band CC1350 wireless MCU enables developers to move from a three-chip solution to a tiny single chip, while reducing design complexity, saving power, cost and board space.

[News ID 4621](#)

■ **Intersil: 14-channel programmable gamma buffer for infotainment and ADAS displays**

Intersil announced a low power 14-channel programmable gamma buffer for automotive TFT-LCD displays. The automotive-grade ISL76534 delivers the highest accuracy gamma calibration to ensure consistent brightness and color matching of every LCD panel inside a vehicle. The ISL76534 is ideal for next generation LCDs designed for infotainment displays, advanced driver assistance system smart mirrors and instrument cluster displays.

[News ID 4611](#)

■ **Mouser and SOMNIUM Technologies sign global distribution agreement**

Mouser Electronics has entered into a global distribution agreement with SOMNIUM Technologies, a company focused on evolving software development tools to a new level, solving real problems faced by embedded developers. The SOMNIUM Technologies product line, now available from Mouser Electronics, provides developers with the company’s Device-aware Resequencing Tools (DRT) software that supports devices from leading semiconductor manufacturers, including Atmel, NXP, STMicroelectronics and others.

[News ID 4572](#)



■ **MathWorks announces release 2016b of MATLAB and Simulink**

MathWorks introduced Release 2016b (R2016b) with new capabilities that simplify working with big data in MATLAB. Engineers and scientists can now more easily work with data too big to fit in memory. R2016b also includes additional features in Simulink; a new product, Risk Management Toolbox; and updates and bug fixes to 83 other products. Tall arrays now provide a way to work naturally with out-of-memory data using familiar MATLAB functions and syntax, removing the need to learn big data programming. Engineers and scientists can use tall arrays with hundreds of math, statistics, and machine learning algorithms. Code can run on Hadoop clusters or be integrated directly into Spark applications.

[News ID 4534](#)

■ **Mouser: Cypress FM4 S6E2H-series MCUs for motor control**

Mouser Electronics is stocking the FM4 S6E2H-Series microcontrollers from Cypress Semiconductor. Designed for motor control and industrial automation applications, the 32-bit S6E2H-Series offers highly integrated hardware-based features, provides superior performance needed for Industry 4.0 applications, and delivers the scalability to minimize design costs and accelerate time-to-market.

[News ID 4604](#)

■ **Toshiba: single-chip, low pin-count MCUs control multiple motors**

Toshiba Electronics Europe has developed a new range of microcontrollers that allow a single-chip, with a low pin-count (32 to 64 pins), to control multiple motors. The MK4 group is the second offering in Toshiba's TXZ family of high-speed, low power consumption microcontrollers that incorporate the ARM Cortex-M core.

[News ID 4600](#)

■ **Maxim: protect systems with secure authenticator**

Developers of industrial, medical, and IoT products now have an added level of IP and device integrity protection with the DS28C36 DeepCover secure authenticator from Maxim Integrated Products. With rampant product counterfeiting, unsafe reuse of medical accessories, and vulnerable network connected sensor nodes, companies recognize the need to integrate strong defenses into their products and systems.

[News ID 4593](#)

■ **HEITEC: HeiCase enclosure family available in customized maxi versions up to 30 U**

With immediate effect, the electronics division of HEITEC offers the opportunity to receive customized versions of its successful modular HeiCase standard enclosures family (formerly RiCase) featuring a height of up to 30U and a depth of up to 900mm. In consequence, these variants are particularly suitable for packaging-intensive applications with a lot of electronics or as a mobile "cabinet replacement" which, in comparison with conventional solutions, has numerous advantages:

[News ID 4591](#)

■ **Socionext launches new offices in Swindon, UK**

Advances in cloud computing, the proliferation of streaming and broadcast of 4K videos via the Internet, and an increase in data and voice services, all place demands on network capacities. Today, optical data transmission rates of 100Gbps and above are required to support the growth in fiber-optic networks to deliver the increased levels of traffic. In response to growing network demand, Socionext announce the opening of a new R&D Center in Swindon in UK mainly for its global Network SoC Business Unit and the high performance analogue IP.

[News ID 4579](#)

■ **Renesas: general-purpose MCUs in 24-pin compact package support up to 13 sensors**

Renesas Electronics announced the RL78/G11 Group of microcontrollers, a group of small-package, low-power MCUs that will enable users to easily and more quickly prototype and develop systems that support low-power sensor hubs and sensor application systems. Designed to connect to multiple sensors and convert the sensor output signals to digital data, these compact sensor hubs are used in a wide range of applications.

[News ID 4571](#)

■ **Adeneo Embedded changes its name to Witekio**

Adeneo Embedded announced the change of its name to Witekio. This new identity signifies a new market positioning for the company based on the belief that the future success of embedded projects will no longer mainly depend on technical expertise but the ability to optimize the system software integration.

[News ID 4516](#)

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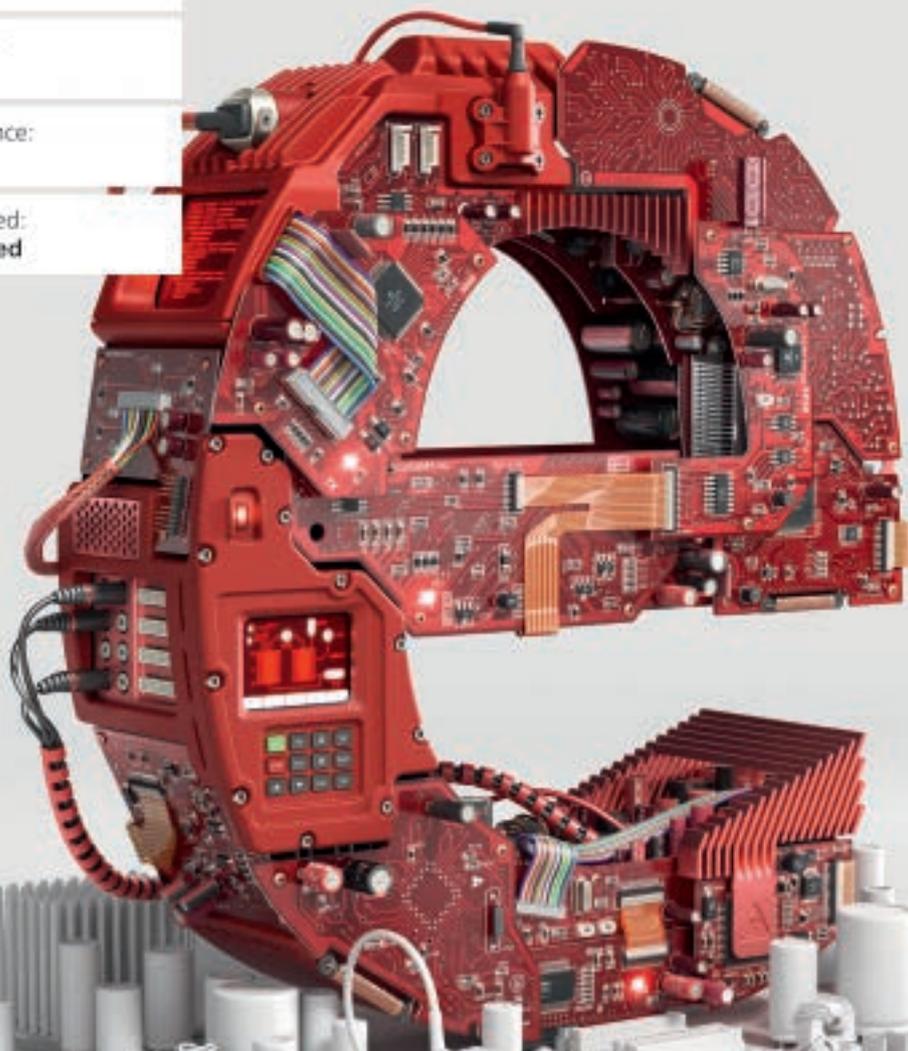
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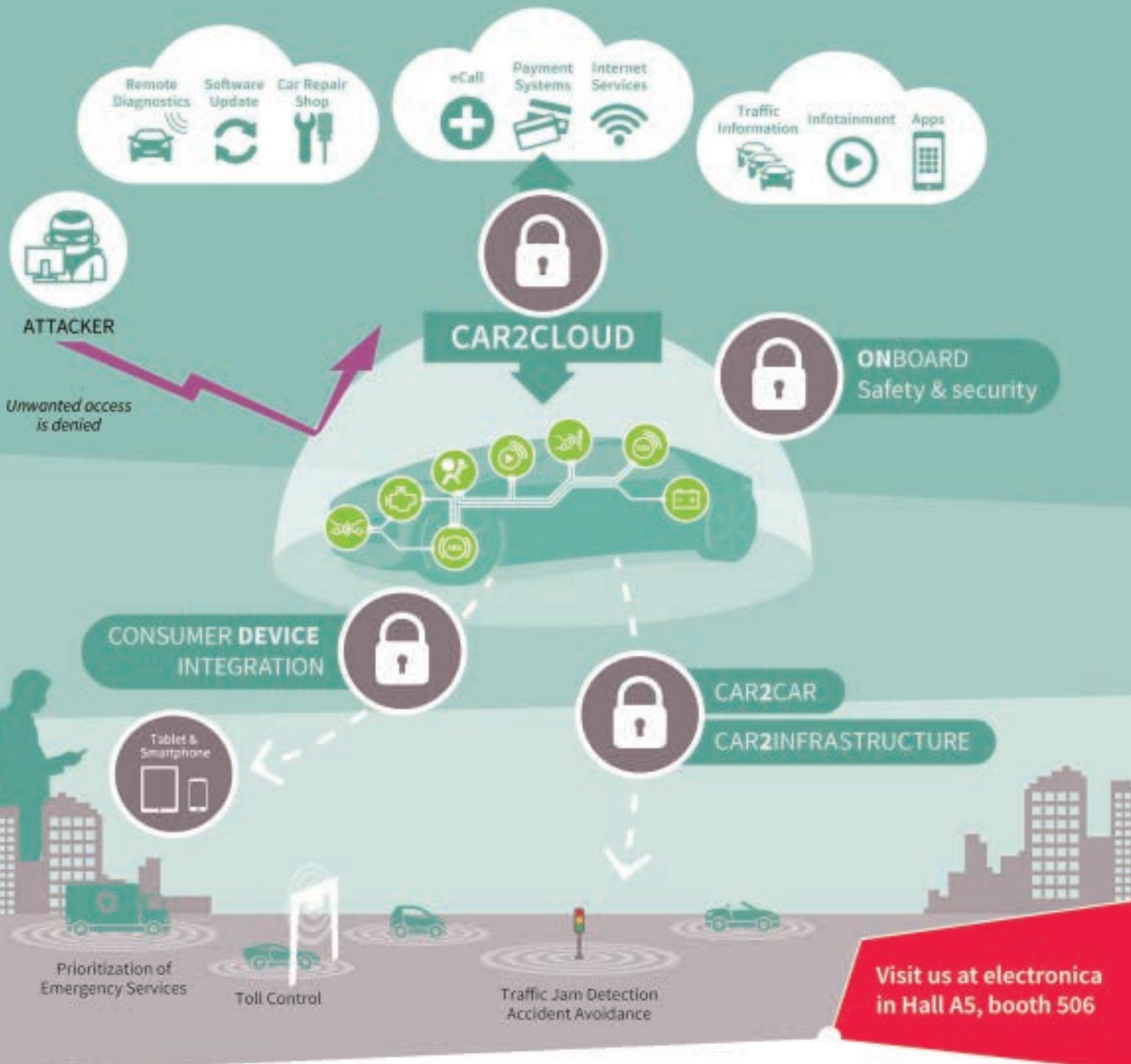
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