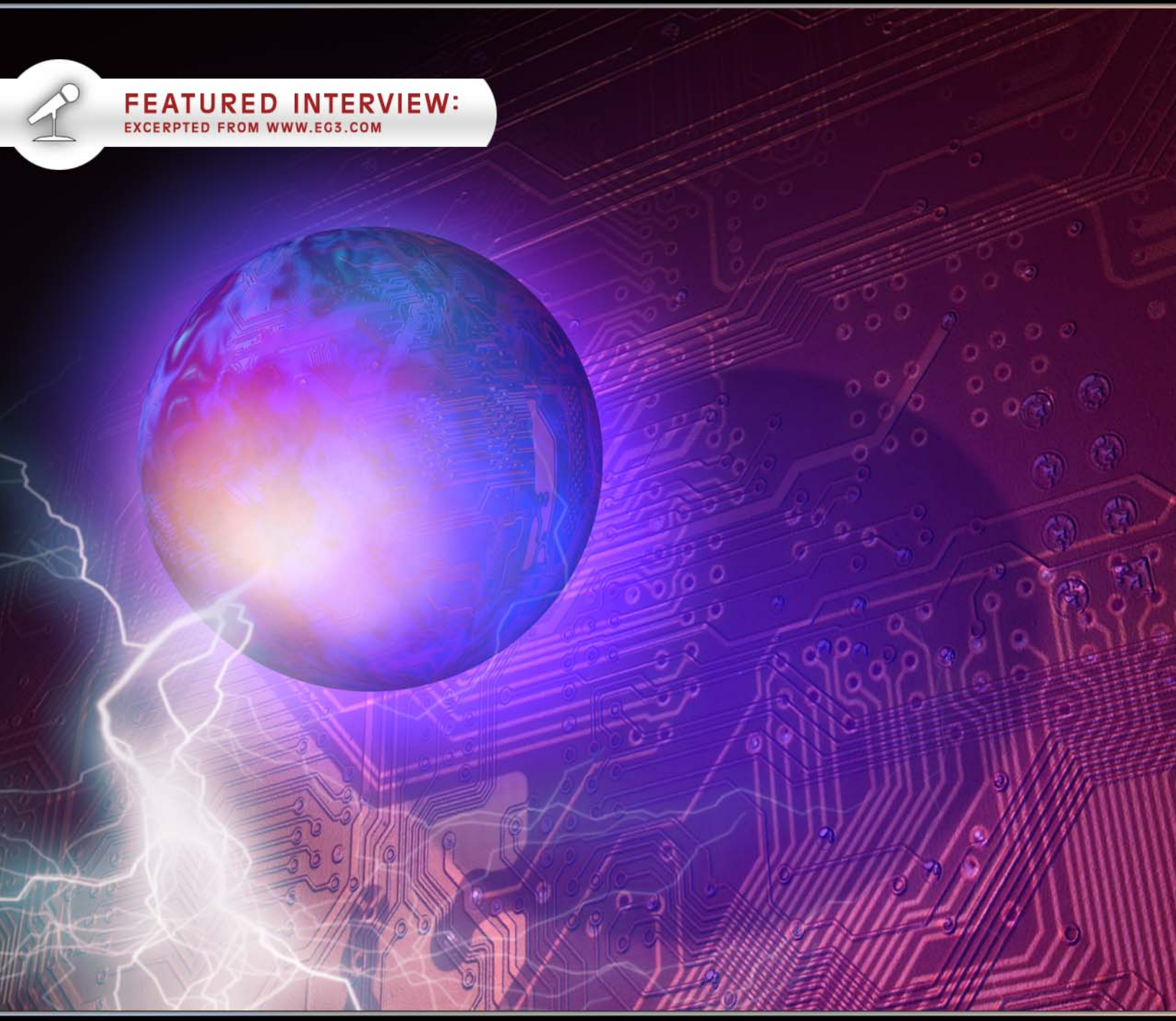
INSIDERS' GUIDE:

FPGAs, TOOLS, AND BOARDS



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MEN MICRO: USER I/O IN FPGA-BASED BOARDS

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Q. **First of all, tell us a little bit about yourself and your responsibilities at MEN Micro.**

A. As vice president, I'm responsible for oversight of MEN Micro Inc.'s US operations throughout North America. Prior to joining MEN Micro, I worked in sales and business development for Motorola's embedded computer business for twelve years. While there, I received multiple awards at Motorola and was twice awarded Motorola's Pinnacle Award for Achievement. I also hold a Bachelor of Science in Electrical Engineering from the University of Virginia.

Our corporate headquarters are in Nuremberg, Germany, which also houses our primary engineering department and our onsite production facility, enabling us to keep close tabs on quality control. Companywide, we have approximately 200 employees, of which more than 100 are engineers dedicated to product and technology development. The company was founded in 1982.

Q. **MEN Micro has quite a broad product range, but please tell us specifically about your product or service offerings that relate to FPGAs.**

A. MEN Micro employs FPGA technology in a variety of our products, since it gives us so much flexibility in configuring both our customized and standard products. We've incorporated FPGA technology into many of our 6U CPCI SBCs, blade servers and PMCs as well as into several 3U CPCI products, ESM (Computer-On-Modules) and their related starter kits.

Most recently, we have developed two specific technologies around FPGA:

The *USM* concept for mezzanine modules: Our *Universal Sub Module (USM)* concept implements a board's desired functionality through one or more IP cores in an FPGA. The *USM* simply plugs into the respective base mezzanine (PMC, conduction cooled PMC, XMC or M-Module), allowing functionality to be changed at any time through the implementation of different IP cores. The corresponding line drivers are located on the *USM*, while its Nios soft core processor is implemented on an Altera Cyclone II FPGA to provide local intelligence where needed. I/O signals are routed through a front-end SCSI connector.

Product development is limited to the *USM* module and the FPGA content, significantly speeding time to market. The *USM* concept protects against component obsolescence, too, since the mezzanine lifecycle no longer depends upon commercially available components. IP cores can be imported into a newer FPGA and tailored to current needs.

ESMexpress®**:** Currently in the process of ANSI-VITA standardization (ANSI-VITA 59, RSE Rugged System-On-Module Express), *ESMexpress* brings the cost and time savings of computer-on-modules (COMs) technology to rugged, harsh and mission-critical environments. It combines the COMs model—developing complete computers on a mezzanine board, limiting development of individual functionality to the carrier board (the carrier board also "carries" the

FPGA – e.g. a Cyclone III - which is connected to the *ESMexpress* module through PCI Express)—with advanced cooling technologies, the latest serial buses and rugged components to ensure safe, reliable operation in harsh and mobile environments.

The advanced design of *ESMexpress* enables power dissipation of up to 35 Watts while providing 100% EMC protection by mounting the populated PCB to a frame and completely enclosing the module in an aluminum housing. A mechanically-robust connector specified for MIL and railway applications supports differential signals with up to 8 GHz, features a stacking height of 5 mm with a minimum tolerance of +/-0.3 mm, is equipped with fixed contacts for power supply and is specified for an operating temperature of -55°C to +125°C.

It's a pretty heavy-duty spec, but one that we felt could really benefit designers who needed cost-effective, future-proof technologies for rugged applications. The current COMs model isn't cut out to stand up in true harsh environments.

Q. **What areas do you and your customers find FPGAs particularly helpful? Can you share with us some application examples or "success stories" that involve FPGAs and involve MEN Micro technology?**

A. Because of their flexibility and high operating temperature, FPGA components are widely used in many industries that require long-term availability as well as in many harsh and rugged applications.

We'll focus on our two latest concepts: *USM* and *ESMexpress*.

When we initially developed the *USM* concept in early 2007, we launched development packages for M-Modules (M199) and PMCs (P599), and within one year, offered the XMC (P699) and conduction-cooled PMC (P598) versions. Going into 2009, we already have four new standard products based on the USM concept:

1. 4x CAN bus (P506)
2. 4x RS422/485 (P507)
3. 2x Fast Ethernet (P511)
4. Reflective Memory (P512)

The *USM* concept has broadened the application areas for FPGAs even further, since the different IP cores allow users to change the functionality of the cards without any hardware modifications to the main module, easily transforming specialized I/O requirements into a series of standard products. Specifically, we are seeing USM products used in a variety of test, measurement, graphics, simulation and control automation applications.

ESMexpress takes a bit of a different approach. It still provides the flexibility and versatility of FPGA technology, but it is specifically designed for rugged and mobile environments. The DC1 display computer is a great example of *ESMexpress* in action.

The first ruggedized panel PC of its kind, the maintenance-free DC1 is a fanless, intelligent display computer that dissipates up to 20 Watts, using the *ESMexpress* design elements combined with the new Intel Atom processor.

The flexible, compact and modular design of the DC1 enables variations in display resolution and size, processor type, I/O configuration and power supply, so users can tailor the system to specific applications. For example, although the DC1 comes standard with a 15" display, optional sizes from 12" to 19" with a wide-range PSU from 9 V to 36 V or, optionally, 18 V to 75 V and 36 V to 154 V are available.

Since these display computers are typically used in mass transit applications, such as trains and busses, they are also tamper-proof to deter vandalism.

An integrated Ethernet switch transfers signals from computer to computer, eliminating expensive cabling installation. Remote upload of new display data is possible via optional wireless functions such as WIFI, WIMAX, GSM/GPRS and UMTS implemented via a MiniPCI Express card slot in combination with an external it can be affixed on any mounting device. As an option, the DC1 can also control a remote display with the same or different content via DVI-D.

Q. **I/O is a technology area that seems to evolve rapidly, and in some applications areas (such as military, regulated, or safety critical industries) "too" fast. What sorts of I/O issues do you see FPGAs helping with? What about product longevity?**

A. Not only does FPGA enable embedded computing products to be upgraded more cost-effectively, but also it allows incredible flexibility in the I/O of a system. This flexibility has a two-fold benefit to protecting an investment in an embedded system.

First, since the technological obsolescence is contained within the replaceable FPGA component, a designer can easily replace IP cores as technology advances. And, as I/O requirements change, the system can be quickly adapted as well. Both of these factors will significantly extend the life of systems and their related components.

In fact, MEN Micro offers a guaranteed *minimum availability* of 10 years on most of its products that incorporate FPGA technology.

Q. **You mentioned in your pre-interview that MEN Micro offers an Ethernet core, and that this has brought some new value to FPGA-based applications. Can you tell us about your Ethernet core? What sorts of applications have you deployed it in?**

A. This new Ethernet core, one of almost 40 standard IP cores that MEN Micro offers, enables communication between an external physical Ethernet chip and a host application.

Some applications that have really benefited from this new Ethernet core include standard net interfaces for embedded CPUs, intelligent Ethernet switches and real-time Ethernet applications like AFDX (in avionics) as well as distributed I/O for industrial applications. Ethernet functionality implemented as an IP core offer the biggest advantage for rugged (high temperature) and long-term availability requirements, typically found in transportation and avionics applications.

We also do a lot of individual core development for our customers, based on application requirements, available logic elements, required pin count, etc. Our FPGA development services include integration of standard MEN Micro or third party IP cores, development of new cores, and integration of customer specific cores.

Q. **That brings us to the topic of "intellectual property" or "IP." What sorts of IP does MEN Micro offer with respect to FPGA-based design? Would you tell us a little about how offering IP can help speed the time-to-market for your customers who want FPGA-boards?**

A. Simply put, IP cores reduce time to market and costs, two of the biggest issues our customers face. As I noted above, we offer almost 40 standard cores that we can easily incorporate into our products to eliminate time consuming, expensive board redesigns.

And cost-savings are exponential for applications that require only small to medium volumes of products. We are actually seeing many of these applications, partly due to the fact that this type

of technology has lowered the entry barrier for many companies that see the benefits and future availability of FPGA technology.

The FPGA behaves just like a standard PCI or PCI Express component. The functions are loaded by software when the system is booted, and therefore are available in less than one second. In terms of system performance, this is critical, since the IP cores encompass so much of the actual system functionality.

Q. **And what about design services? Doesn't offering IP propel MEN Micro into design service issues? Would you share with us your design services' model? What is a typical engagement? How does it work? How would an interested party get started figuring out if MEN Micro offers appropriate design services?**

A. Over our 26-year history, MEN Micro has aimed to develop technologies and products that could be used as open architecture for the industry. The company has pioneered several industry advancements recognized as ANSI-VITA standards including the M-Module mezzanine standard, developed in 1988 and the PC-MIP mezzanine standard, developed in 1992. And as I noted earlier, our ESMexpress technology is currently in the process of ANSI-VITA standardization (ANSI-VITA 59).

We did offer the *USM* concept for VITA consideration in early 2007, but it has yet to be accepted for review. However, we still provide the specification (MEN Micro doc. # 20US00-00) on our web site for any company that wishes to incorporate the design concept into its products:

www.menmicro.com/download/default.asp?prod_dl=20US00-00&lang=1.

We strongly believe in sharing technologies to both move our industry forward as whole as well as to make embedded computing more efficient, and therefore more cost-effective, for systems designers.

We do as much custom work as we do standard product development, including IP core design. One of our many examples is a red light and speed control system where we did the complete JPEG compression algorithm in FPGA. As a result, the system was packaged in a much smaller housing than could previously be accommodated and we replaced an expensive frame grabber card with a lower end CPU card that offered performance more in line with the system's requirements, resulting in less power consumption. This enabled us to meet the requested –40°C to +85°C temperature range. The best way to figure out if we offer the right services is to provide us with the specifics of your application.

Q. **Thank you for this interview.**