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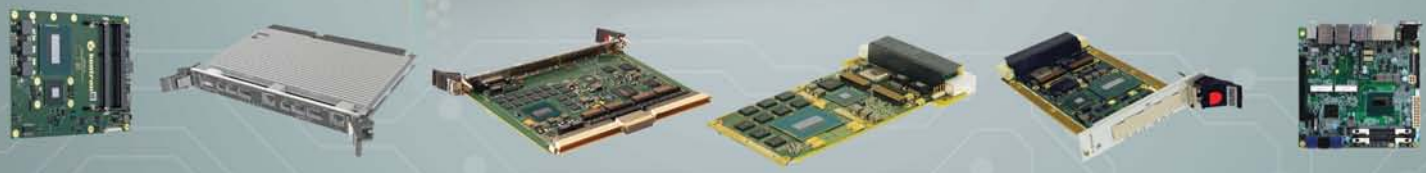

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MOST INNOVATIVE PRODUCTS OF THE YEAR

See page 47 for 2013's Products of the Year and Honorable Mentions

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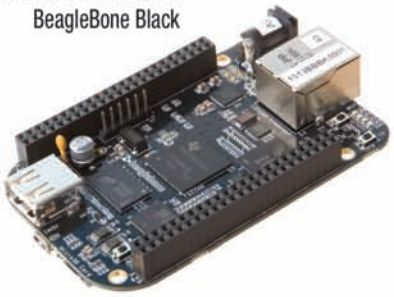
MinnowBoard

Texas Instruments
BeagleBone Black



Cypress Semiconductor
PSoC 4 Programmable System-on-Chip

Annual Resource GUIDE

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Transforming the factory with the Internet of Things

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Do's and don'ts of evaluating 32-bit embedded software IP

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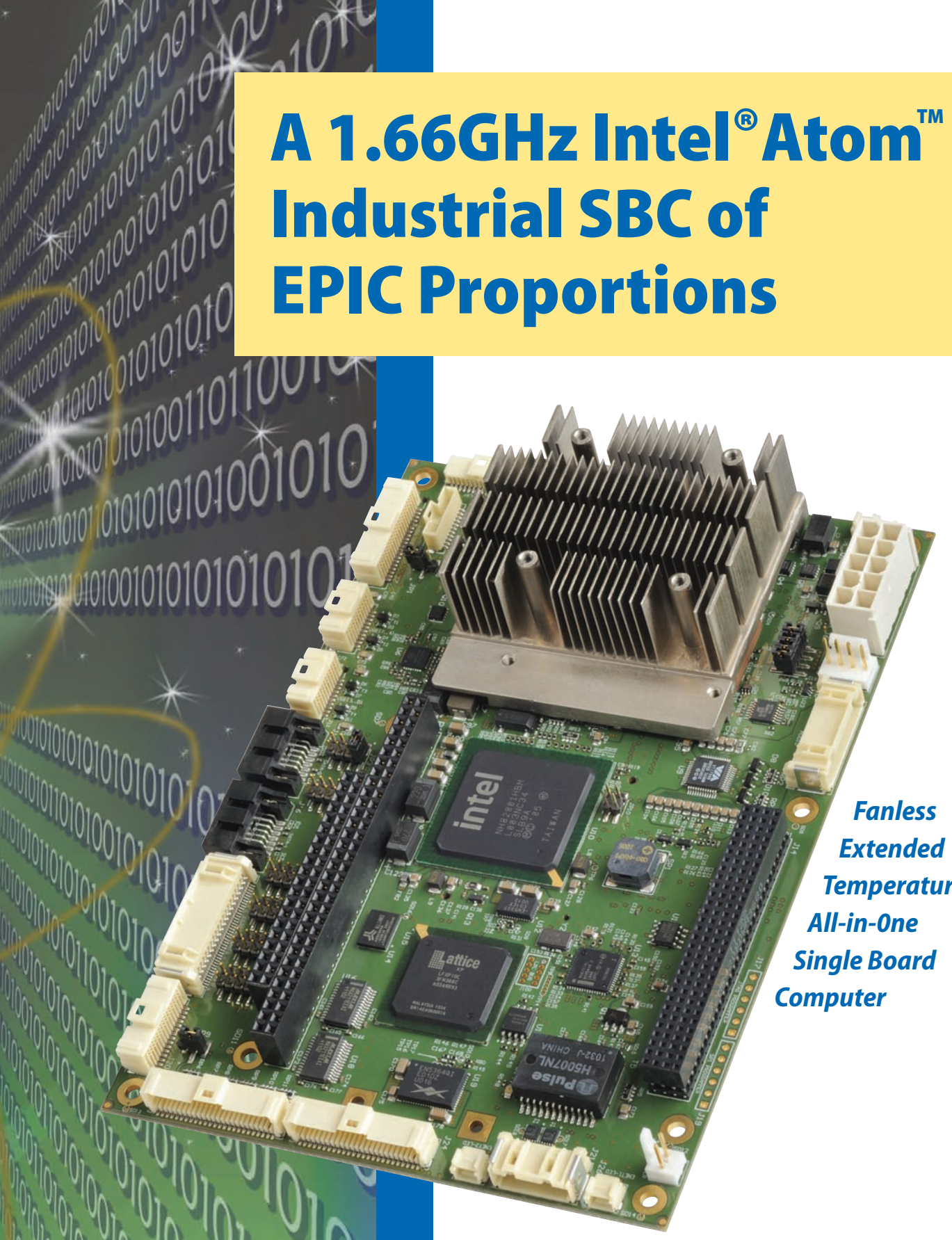
DIY pushes open hardware from kindergarten to Kickstarter

Page 40

A 1.66GHz Intel® Atom™ Industrial SBC of EPIC Proportions



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August 2013 | Volume 11 • Number 5

ON THE COVER

Our 2013 Resource Guide edition at long last announces this year's Top Innovative Product winners, selected from our June edition's collection of product nominees (see page 47). This Resource Guide also features a comprehensive array of top Software, Silicon, and Strategies products (starting on page 49), plus technical articles on hot topics ranging from DIY/maker boards (page 40) to the do's and don'ts of 32-bit software IP evaluation (page 32) to Intel's new Haswell micro-architecture and how it's enabling the Internet of Things in the factory (page 18), among many other topics.

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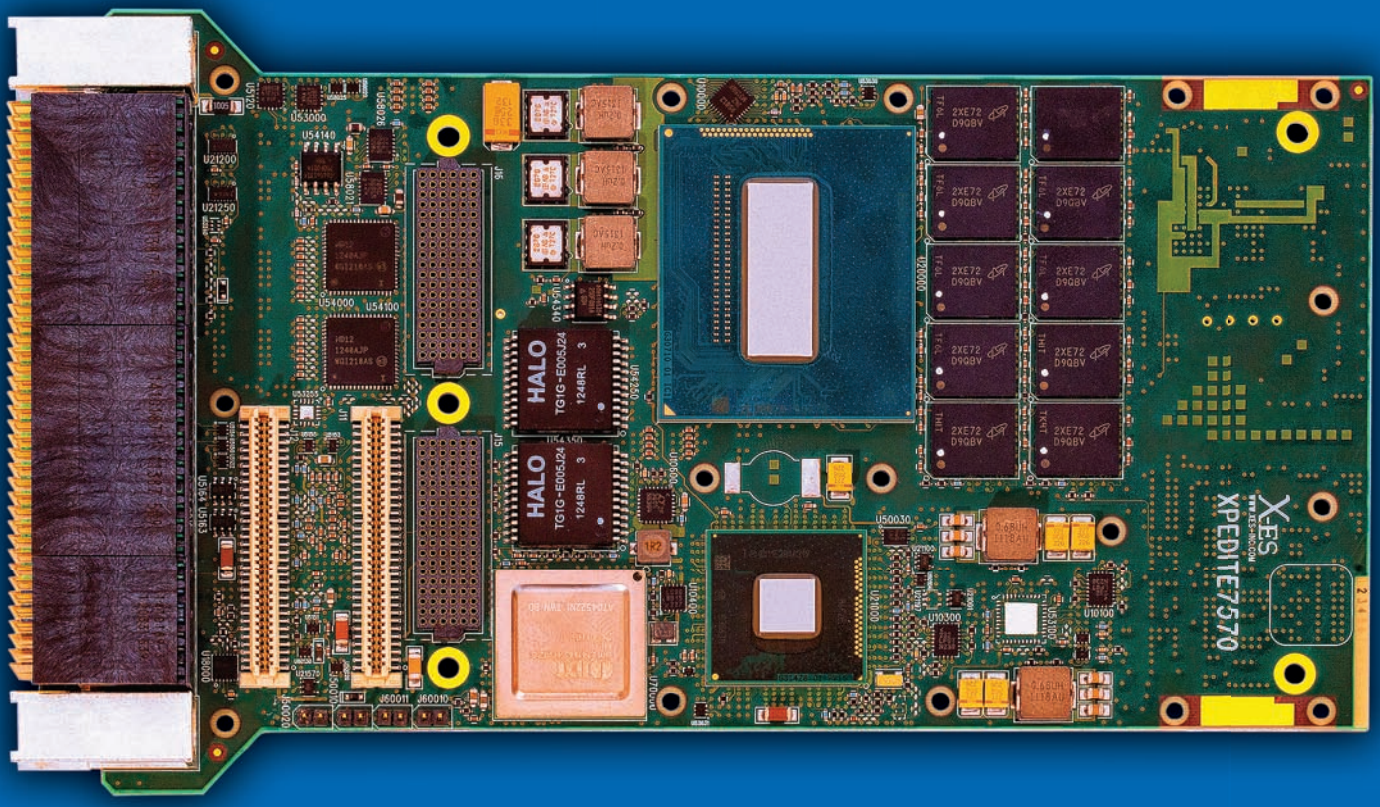
4th Generation Intel® Core™ i7 from X-ES



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5	**X-ES** – 4th generation Intel Core i7 from X-ES

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E-community Post

Joining the embedded conversation

By Sharon Hess

www.embedded-computing.com

BLOGS | MARKET STATS | INNOVATION | VIDEOS | SOCIAL MEDIA

DIY showdown: 'BeagleBone Black vs. Raspberry Pi'

Professional embedded designers and also hobbyists tinkering with DIY/maker boards for their next projects can now get a side-by-side comparison of the genre's duo of popular Linux-based, credit card sized boards – the Raspberry Pi and BeagleBone Black – thanks to a newly released "BeagleBone Black vs. Raspberry Pi" video.

Though the narrator's pseudonym is "TheRaspberryPiGuy," similarities and differences of both boards are presented in a technical, impressively nonbiased manner, with kudos given to each board in the areas in which it excels, including: size, weight, processor, memory, connectivity, I/O, power, price, community, and practical usage.

Watch the video: http://opsy.st/16bN23y

See more videos: video.opensystemsmedia.com

(For more on DIY/maker boards, see the article on page 40.)

E-cast: Understanding the Internet of Things protocols: DDS, MQTT, and AMQP

Presented by: RTI

The Internet revolutionized how people communicate, what they do, and how they work together. The revolution is not done. The next wave of the Internet will connect machines and devices together into functioning, intelligent systems. These interconnected devices, aka the "Internet of Things" (IoT), will link machines together with speeds, scales, and capabilities far beyond what people need or use. The IoT of intelligent connected devices will change the world, perhaps more profoundly than today's human-centric Internet.

However, figuring out where your application fits into the maze of technologies is truly confusing. This webinar will decode the Machine-to-Machine (M2M) technology jumble and explore some of the applications and reasons that high-performance integrated device systems are benefiting from DDS, the Object Management Group (OMG) standard for Data Distribution Service middleware.

Watch: http://opensystemsmedia.com/events/e-cast/archive

ECD guest blog: Software development: Fixed cost or opportunity cost?

By Anthony Pighin, Code Time Technologies

When starting a new project, part of the decision-making process is deciding which components to design in-house, and which are best left to external vendors. Sometimes the dividing line can be as simple as outsourcing the hardware platform, and doing all software development internally, but the choice is often far more complex.

Read more: http://opsy.st/10TUfF1

[To become an ECD (www.embedded-computing.com) guest blogger, send me a one-paragraph abstract for consideration at sharon_hess@opensystemsmedia.com.]

WHITE PAPER

Selecting the right embedded SSD storage solution

By Staff, Virtium Technology

The density evolution of NAND flash components has made enormous SSD capacities a reality in a growing list of small form factors. The reality today is that there is no "one-size-fits-all" SSD technology or form factor poised to take the place of CompactFlash, which impacts future embedded systems designs.

The lack on an SSD "hero" that fully supports the storage needs of embedded systems further complicates the task for designers who must contend with a long list of complex requirements.

Read more: http://opsy.st/14JpQsU

Read other white papers: whitepapers.opensystemsmedia.com

Roving Reporter blog: High Performance Embedded Computing platform choices

Intel® Embedded Community
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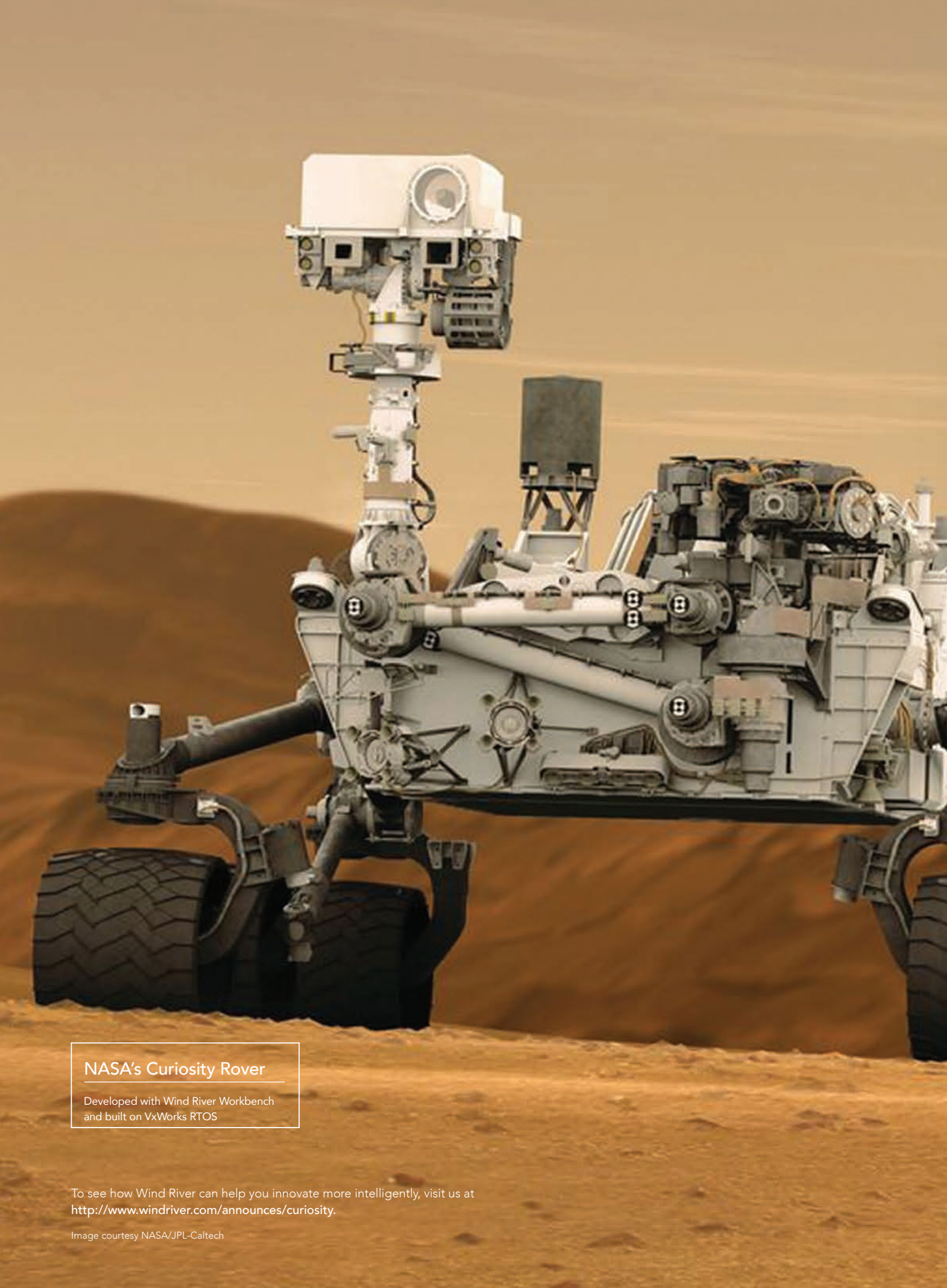
By Jerry Gipper

Embedded computing is moving into the world of "Big Data" and that means lots of scalable, high-performance computing. Radar, signals intelligence, and electronic warfare are data-intensive applications that need embedded computers able to process vast amounts of data and do it quickly. High Performance Embedded Computing (HPEC) takes much of its lead from the High Performance Computing (HPC) technology found in data centers, taking concepts and extending them to the more environmentally demanding conditions in embedded computing applications. Processor offloading, cluster computing, distributed architectures, and open source software are but a few of the traits of High Performance Computing that are being passed on to HPEC. Read more: http://opsy.st/135UtXU



NASA's Curiosity Rover

Developed with Wind River Workbench and built on VxWorks RTOS

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Image courtesy NASA/JPL-Caltech

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INNOVATORS START HERE.

The TurtleCore expansion board drives hobbyist robotics on the iRobot Create platform. It is one of the first expansion boards ever designed with Geppetto, an intuitive design platform. Video screenshot courtesy of Gumstix

Crowdfunding and community design deliver custom-built embedded systems

By Dr. W. Gordon Kruberg and Andrew Simpson

Although possibly inexpensive on a unit-cost basis, designing embedded systems can be costly and intricate. As design tools become less expensive and more widely used, these development costs are dropping to a fraction of their former magnitude. Low-volume usage and even hobbyist customers nevertheless still find the associated development costs beyond their individual reach. The advent of crowdfunding platforms, in addition to community-driven embedded electronics design, makes it possible to promote innovation while enhancing the affordability and accessibility of custom embedded devices.

In the March edition of the *Harvard Business Review*, Richard D'Aveni, Dartmouth College's Bakala Professor of Strategy, published the article "3-D printing will change the world." His vision? That "as applications of [3D printing] technology expand and prices drop, the first big implication is that more goods will be manufactured at or close to their point of purchase or consumption" and "that goods will be infinitely more customized, because altering them won't require retooling, only tweaking in the instructions in the software."

D'Aveni's vision is on its way toward reality. It even foresees consumers making products in their own homes using design plans bought on the Internet. The fulfillment of that prediction, however, hinges on one thing: 3D printers being affordable and practical for the average consumer. While 3D printing has been around for a while, the devices have historically had such a high development cost that their final price tag has left them out of reach for consumers.

However, Staples has begun stocking 3D printers in their stores as of this past June. The price tag on Staples' printer, at $1299.99, is just a fraction of the tens of thousands of dollars the devices previously cost. The drastic price reduction still leaves 3D printers out of reach for all but the wealthiest consumers. The conventional model of product development means that the manufacturer, 3D Systems, has developed, tested, and manufactured the Cube 3D as a generic device capable of doing many things very well, thus appealing to a wide array of purchasers, with a price tag reflecting its functionality.

An alternative to sole ownership of the product development cycle has recently emerged and become popular for everything from 3D printers to music boxes to Arduino-driven robotics: crowdfunding. Within the 3D printing sector alone, many entrepreneurs have been able to develop feasible, working printers that are extremely focused on a specific subset of users via community-driven crowdfunding platforms like Kickstarter (www.kickstarter.com). An example of this is The Buccaneer 3D printer on Kickstarter, developed by Pirate3D, Inc. of Palo Alto. Its creators have developed a functional, user friendly device designed for home users with little to no knowledge of computer-aided design. The Buccaneer has raised almost $1 million in pledges from more than 2,000 backers, well above its initial $100,000 goal. The minimum pledge required to receive a Buccaneer 3D printer? Just $347, just slightly more than one-quarter of the cost of the device offered by Staples.

3D printing is a good example of the shift to crowdfunding. It is also a domain that is uniquely intertwined with embedded systems. Designers of embedded systems, especially hobbyists, have always needed to be able to create cases and form factors as unique as the hardware

within. Printers like the Buccaneer offer this potential, and by tailoring the functionality of a device to the exact needs of a particular community, creators of any crowdfunded device are able to offer that device at a fraction of the cost of devices that have features the target users will never need. The development cost, however, incurred in creating a device like the Buccaneer is comparable to creating one like the Cube 3D. How, then, is it possible that the former costs four times less than the latter?

The answer lies in identifying a community of users for that specific device. The cost of creating a project idea is not substantially different between the two models, but by identifying interested users beforehand, asking them to pledge the desired amount (remember, a supporter only pays if the campaign is successful), and delivering an initial run of products "on demand" to the early adopters, project creators can cut out the middlemen and the associated costs. The risk of a campaign supporter losing money or not receiving the promised product is very low, since crowdfunding platforms generally screen posted projects for plausibility. Kickstarter, for example, has stringent criteria for projects posted on its site, regulated by a selection committee. While Kickstarter does not guarantee projects themselves, its Terms of Use require project creators to fulfill their project's obligations to all backers, or refund any backers whose obligations cannot be fulfilled. Funding is all-or-nothing: A project either gets all of its needed funding, or backers get all of their pledge returned.

What is community design?

Crowdfunding brings new potential to a wide array of projects, especially those in technology. Open source hardware projects are nothing new. The Arduino, Gumstix, and BeagleBoard are all examples of the many established projects geared toward a hobbyist community. Schematics for all of these projects are freely and readily available online, and there is an active community of enthusiasts developing embedded solutions with each platform and collaborating with each other.

Customization, however, is technically challenging for obvious reasons. Anyone wishing to build upon the hardware platform offered by these projects needs to have an advanced knowledge of electrical design to extend or modify it in any way. This isn't a problem for electrical engineers, but hobbyist roboticists or embedded engineers specializing in software might not have the same degree of knowledge. These users are able to ask for help from the community, and are able to reuse solutions developed by other community members as platform extensions in their own projects. This, in essence, is the heart of community-driven design.

Reusing solutions developed by other community members is becoming increasingly feasible as better design tools become available. Gumstix's Geppetto Web-based development platform is one such tool, allowing users to design customized embedded devices with virtually no knowledge of electrical design. A core component of this system is its community feature, where a user can choose to share a design they have created with the community. Any other user is free to copy that design, modify it, use parts of it, or order it themselves. Completed designs can be submitted for manufacturing and are delivered within three weeks.

Crowdfunding community designs

In addition to the customization challenges discussed, another primary concern for hobbyists and other low-volume users of embedded designs is development cost, in terms of money and time. Developing a quality solution by traditional means is not a simple task and requires a significant investment of time and money in realizing an actual product. By sourcing the design and manufacturing onto systems like Geppetto, both of these factors are significantly reduced. In many cases, manufacturing a one-off design by traditional means has a setup cost upwards of $10,000, compared to

approximately $1,999 with an intuitive design application.

To an individual customer, like a hobbyist, this number still seems quite high. At such a low volume, it is still extremely difficult to offset the engineering cost associated with ensuring that a design is functional and well built. This is where crowdfunding becomes advantageous, because a design that is interesting to one hobbyist is also likely to be interesting to another. Instead of each paying the associated setup fees and unit costs, one of the two hobbyists can create a campaign for their design to see if anyone is interested in sharing the costs. If someone is interested in purchasing the design as well, the setup fee is divided proportional to the number of units purchased and then each customer pays for their desired quantity of boards.

As an example (see Figure 1), a customer named Bob can create a design with a $50.18 unit cost and run a campaign for it. Bob wants to buy 5 of the boards himself. Carol and Alice see Bob's design, and Carol decides to buy 3 while Alice buys 2 of the boards. The total setup cost is $1,999, which is divided among Carol, Alice, and Bob according to the percentage of the number of boards they purchased relative to the project's total of 10 boards. Thus, because Bob's 5 boards represent 50 percent of the project's total number of units ordered (10 boards), he pays 50 percent of the $1,999 setup fee plus the cost of his 5 boards at $50.18 each, amounting to $1,250.40. Carol's quantity of 3 boards, constituting 30 percent of the total of 10 project boards ordered, means she pays 30 percent of the setup fee plus the unit costs for 3 boards, totaling $750.24. Alice's fees are figured in like fashion at 20 percent and 2 boards, totaling $500.16.

Similarly, community members can not only collaboratively design embedded applications, but are also able to leverage their collective buying power when enough interested parties participate: The campaigns are designed so that above a threshold of participants,

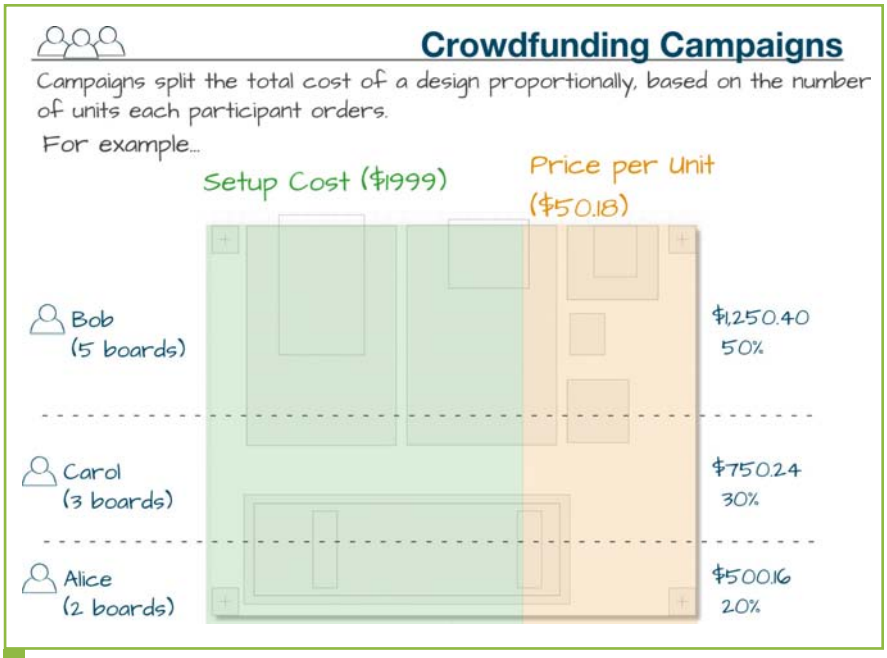

Figure 1 | A breakdown of the cost for a sample community design. This campaign has three participants interested in purchasing a total of 10 units.

the setup fee will be waived altogether and customers only pay for the quantity of boards they desire. This is because, at a sufficiently high volume, the manufacturer is able to assume the development cost of a popular product.

Embedded designers, hobbyists benefit

By designing and collaborating online, designers and users of custom, embedded applications have gained the advantages of sharing their time-saving solutions and innovations while also sharing the cost of making them a reality. With many of the barriers related to funding and manufacturing removed, the embedded computing space is poised to explode with creativity. Just as 3D printing is pre-dicted to change the world of manufacturing, community-driven and intuitive embedded design will change the way hobbyists and professionals think about electronic design. ECD

Dr. W. Gordon Kruberg, *President and CEO, founded Gumstix in 2003. He has been involved in more than 30 U.S.-based companies as a venture investor, member of the board of directors, or executive teammember. He was also CEO of Deersoft, acquired by Network Associates, and spent seven years with Grace Horn Ventures. He holds an AB degree in Human Biology, an MS degree in Industrial Engineering from Stanford University, and an MD degree from Northwestern University.*

Andrew Simpson *is a content developer and writer at Gumstix. He has an avid interest in technology and open source development. Since joining Gumstix in 2012, he has published numerous articles and tutorials on embedded systems. He holds a Bachelor's degree in English from the University of British Columbia.*

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Processors aid in LTE macro and small cells integration – the HetNet factor

By Kin-Yip Liu

The concept of a Heterogeneous Network or "HetNet" is rapidly gaining acceptance as the preferred architecture for LTE network design and service implementation. In basic terms, HetNets have three major components: the macro, or "traditional," base station infrastructure designed to provide ubiquitous mobile broadband coverage; a dense network of small cells that delivers bandwidth, particularly in dense traffic areas; and a layer of network intelligence that ties those networks together. The following examines the processor types that can meet macro and small cell requirements equally well, with particular reference to specific LTE standards.

Base stations form the access network between mobile users' equipment and the wireless core network. When a mobile user makes a phone call or accesses the Internet, the User Equipment (UE) accesses the network through a base station over the air. This base station communicates with the wireless core network through a backhaul network. The wireless core network looks up the user account information when setting up the wireless connection. The wireless core network also routes the user data to the voice network and the Internet, depending on the type of data and connection.

In LTE, base stations are called *eNodeB*, and a core network is called an *Evolved Packet Core* or *ePC*. Backhaul communication between eNodeB and ePC uses Internet Protocol (IP) technology and is packet based. LTE introduces the concept of Self Organizing Networks (SONs), where control of the radio access network is distributed to eNodeBs as opposed to having centralized controllers between base stations and core networks like older-generation wireless technologies. Neighbor eNodeBs detect the presence of other eNodeBs and communicate with each other to exchange information on workload and interference. An eNodeB may hand over a user connection to a neighbor eNodeB to load balance or to provide the user with better signal quality. An eNodeB has three interfaces: air interface to UEs, S1 interface to ePC, and X2 interface to neighbor eNodeBs. Figure 1 shows the LTE access network.

Traditionally, base stations are located in cell sites, which may be a tower structure or on top of a building. Each base station serves a radius from a few kilometers to 20 km and thousands of connected users in one or multiple sectors. Each sector usually supports up to 1,200 connected users. With LTE release 9, each sector can provide up to 300 Mbps downlink throughput (network to UE) and 150 Mbps uplink throughput (UE to network). Moreover, connected users may be moving as fast as 350 km/hr, for example, when riding on a bullet train. With such advanced capabilities and

requiring cell sites, traditional macro base stations are expensive to acquire and to operate.

As mobile usage continues to increase, the traditional macro base stations approach alone cannot scale to keep up with the rising demand. New classes of base stations, collectively called *small cells*, are being deployed to increase capacity and coverage. Individually, small cells support much fewer connected users and cover a much smaller area than macro base stations. The reduced complexity translates to significant cost savings. As a result, small cells increase wireless capacity much more cost effectively and flexibly. The reduction in cell radius provides several important advantages. First, small cells boost spatial efficiency drastically. Spectrum is a scarce resource. When compared to the cell radius served by a macro base station, many small cells can reuse the same spectrum many times by each covering a relatively small radius. In the long run, most of the base stations may be small cells so as to exploit the

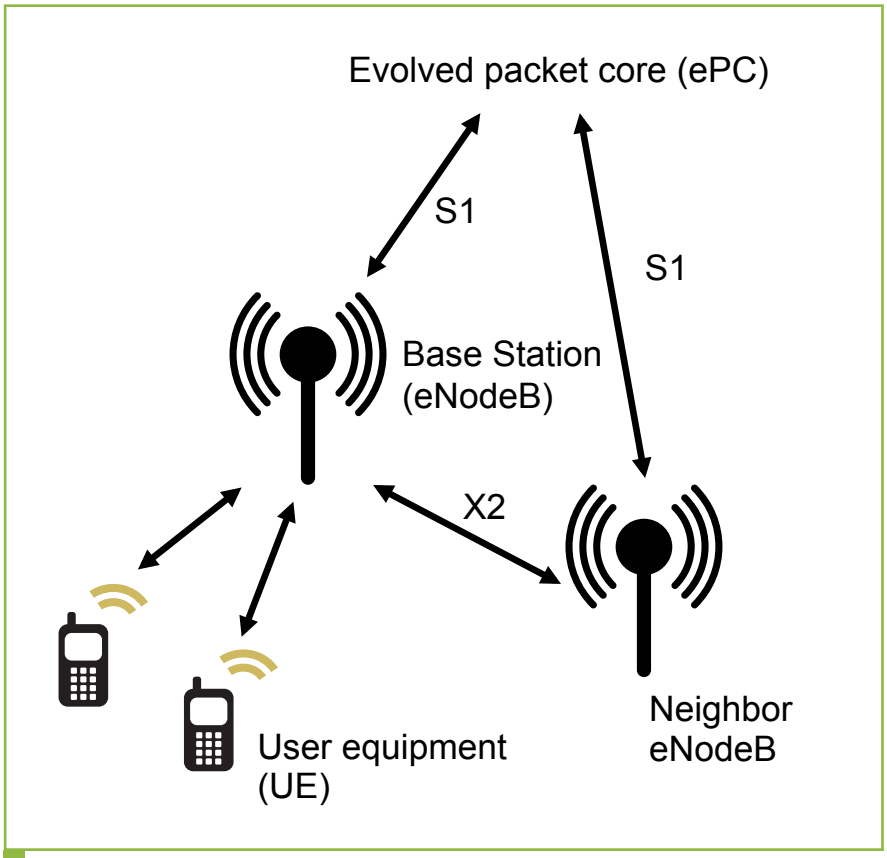

Figure 1 | LTE access network

spatial efficiency advantage to increase capacity. Second, radio signal quality gets exponentially better when the UE is close to the base station. As a result, the actual throughput is much higher for the same spectrum bandwidth used. Third, close proximity between small cells and connected UEs means that power consumption of both UE and eNodeB for radio communication is reduced significantly. However, whether implementing a small cell or macro LTE base station, the right processor is key. A look at the LTE standard lends insight into the right processor choice.

LTE standard impacts the processor choice

The various protocol layers of the LTE standard present very diverse characteristics and requirements to the underlying processor of an eNodeB, small cell, or macro. These characteristics and requirements in turn have a bearing on the type of processor needed.

The LTE standard explained

The LTE standard specifies the following protocol layers for communication between the base station and UEs over the air interface:

- PHY (layer 1): Physical layer. Downlink uses Orthogonal Frequency Division Multiplexing (OFDM). Uplink uses Single Carrier Frequency Division Multiple Access (SC-FDMA).
- MAC (layer 2): The Medium Access Control (MAC) layer schedules usage of the air interface, taking into account the priority and age of pending traffic and requests, and radio signal quality for communicating with the individual UEs. The MAC layer decides and schedules which users use which air interface Resource Blocks (RBs) and how many RBs, and the PHY layer and radio configurations for the scheduled air interface transfers every Transmission Time Interval (TTI). In LTE, each TTI is 1 millisecond. The MAC layer also schedules Hybrid Automatic Repeat Request (HARQ) retransmission based on CRC detection result reported by the PHY layer. MAC layer also directs the connected UEs to collect signal quality information and reports to the RRC layer regularly.
- RLC (layer 2): The Radio Link Control (RLC) sublayer ensures in-order traffic delivery. RLC layer concatenates, orders, segments, and reassembles traffic, and issues requests for retransmission as needed.
- PDCP (layer 2): The Packet Data Convergence Protocol (PDCP) sublayer primarily performs two functions: ciphering of air interface traffic and Robust Header Compression (RoHC). RoHC minimizes the amount of air interface bandwidth taken by packet headers for voice traffic.

› RRC (layer 3): The Radio Resource Control (RRC) layer performs management of UEs and control functions. It sets up and maintains radio bearers. It decides and controls handover of UEs to another base station.

In LTE, base stations communicate with core network using IP packets over GTP-U tunnels. The data is encrypted and secured by IPSec protocol. This layer of processing is usually referred to as *transport*.

The PHY layer involves pipelines of several signal processing functions for uplink and downlink directions. PHY implementation is typically based on hardware implementation of signal processing functions, for example, ASICs or Digital Signal Processors (DSPs) or a combination of both; in other words, DSPs with offload to hardware accelerators.

What kind of processor is needed then?

The MAC layer poses hard real-time processing requirements, because the PHY and MAC layers must complete all the processing within the allocated processing time every TTI. Moreover, the MAC layer generates optimal scheduling of the air interface resources, and this scheduler task is very computationally intensive. The ideal processor needs to provide high performance and programmability. More importantly, the ideal processor needs to have very short and deterministic latencies for cache and memory accesses. Cache partitioning features are essential, because processing for other layers must not pollute the cache content that is consumed by the MAC layer processing, which has a hard real-time requirement.

The RLC and PDCP layers involve real-time processing, segmentation, and reassembly of data, RoHC protocol processing, and LTE air interface crypto processing. The ideal processor should have many bit-wise operators in its instruction set, and should integrate hardware accelerators for RoHC and LTE crypto algorithms, with very short and deterministic cache and memory access latencies.

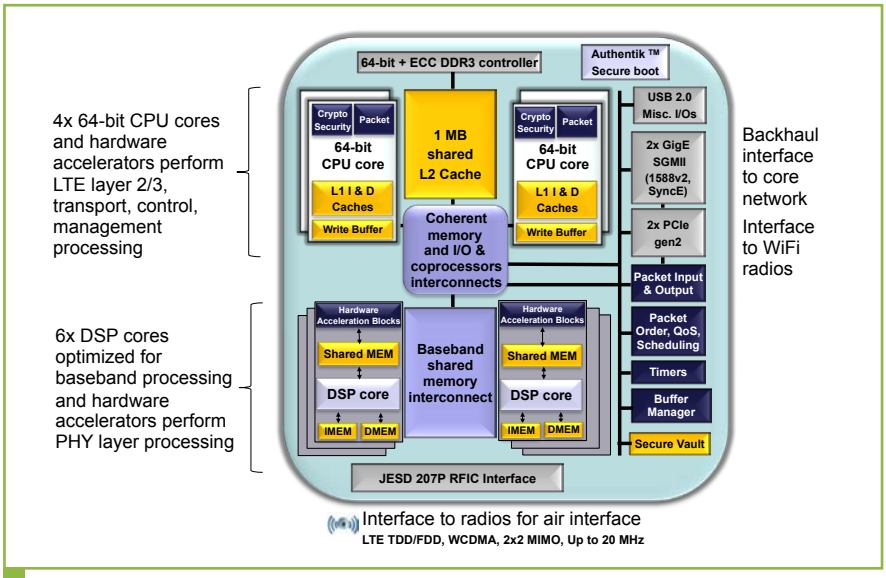

Figure 2 | OCTEON Fusion CNF71XX base-station-on-chip SoC

Transport processing involves primarily packet and network processing. Several years ago, the transport processing alone would require the processing power of an entire network processor. These days, the ideal processor needs to integrate various hardware accelerators and offload engines for packet processing, Quality of Service (QoS) and traffic management mechanisms, and IPSec processing. To manage the precious backhaul bandwidth intelligently, base stations will need to analyze the applications and content types carried by the traffic. As a result, the processor will integrate hardware accelerators for Deep Packet Inspection (DPI) going forward.

Besides the standard details, LTE brings two paradigm shifts to base stations. First, eNodeBs are much more intelligent than previous generation base stations, which could depend on centralized controllers for management functions, for example, a Radio Network Controller (RNC) in 3G networks. The processor needs to provide ample compute bandwidth to deliver the promise of Self Organized Networks (SONs), and to manage radio resources effectively to optimize signal quality for mobile users and to avoid interference with other base stations. Second, LTE backhaul is all IP based, without synchronous interfaces like T1/E1. As a result, eNodeBs must utilize mechanisms like IEEE 1588, GPS, and so on, for time and frequency synchronization. The processor needs to integrate support for these mechanisms.

Making the processor choice

In summary, the ideal processor for base stations, from small cell to macro, is one that integrates multiple efficient CPU cores with very short and deterministic cache and memory access latencies; integrates a comprehensive set of hardware accelerators for packet processing, security processing, and DPI; provides time synchronization support; and consumes very low power.

For PHY layer processing, it is important for the small cells processor family to integrate multiple efficient DSP cores and relevant hardware accelerators, with very short memory access latencies. As a result, a small cell can be powered by a single-chip processor covering all the layers and processing. The Cavium OCTEON II multicore processor families and OCTEON Fusion processor families are designed to excel as base station processors, macro to small cells, and any node in HetNet (Figure 2). **ECD**

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Transform the factory with the Internet of Things

Performance, graphics, and security with 4th generation Intel Core processor

By Murray Slovick

The 4th generation Intel Core processor family is bringing the Internet of Things to the factory floor. With 2x faster signal processing, the processors support analytics applications like machine vision and equipment monitoring. Newly secure communications tie together the factory floor, control room, and supply chain. And the up to 60 percent faster graphics and flexible I/O permit industrial equipment manufacturers to combine previously separate hardware, reducing cost and complexity.

Throughout history, new technologies have transformed the manufacturing industry. From the invention of steam engines to the introduction of computerized controls, these technologies have led to enormous leaps in productivity and quality. Today we are at another turning point. The introduction of intelligent systems and Internet of Things technology are enabling unprecedented data sharing and analysis, turning previously disconnected manufacturing systems into an efficient, highly responsive whole.

The following describes how Intel is enabling the transformation with its 4th generation Intel Core processor family based on the Haswell microarchitecture. Boasting up to 15 percent higher performance, 2x faster image and signal processing, up to 60 percent faster graphics, newly flexible high-speed I/O, and enhanced security, this platform offers major upgrades over its predecessors. As we will see, the new processors deliver scalable, robust performance for applications ranging from machine vision to machine diagnosis, from building controls to operator panels, and even top floor administrative servers (Figure 1). In addition, the platform's new security and manageability features make it well suited for the highly connected, Internet of Things-enabled factories of the future.

Figure 1 | The 4th generation Intel Core processor family improves numerous operations on the factory floor.

> Today we are at another turning point. The introduction of intelligent systems and Internet of Things technology are enabling unprecedented data sharing and analysis, turning previously disconnected manufacturing systems into an efficient, highly responsive whole.

Along the way we'll present examples where members of the Intel Intelligent Systems Alliance are taking advantage of the new processors.

Improved performance

Performance is critical in Internet of Things-enabled factories, as it enables greater analysis of product quality, equipment performance, and other factors. Overall performance is up 15 percent in the new processors, while signal and image processing get an additional 2x boost with Intel Advanced Vector Extensions (Intel AVX) 2.0. As shown in Table 1, Intel AVX 2.0 introduces a fully pipelined Fused Multiply Add (FMA3) that provides twice the floating-point performance of the previous generation for the multiply-add workloads common in image processing. Intel AVX 2.0 also extends integer vector processing from 128 bits to 256 bits, also doubling throughput for many common workloads.

What's more, the 4th generation Intel Core processors are more energy efficient than their predecessors, enabling smaller form factors for constrained spaces and easier heat dissipation. The high performance and low power also make it possible to consolidate multiple automation workloads (such as supervisory control and image processing) on a single computing device – a topic we will revisit shortly.

Visual displays

To keep up with the increasing sophistication of factory equipment, Human Machine Interfaces (HMIs) need to

Feature	Benefits
Fully pipelined Fused Multiply Add (FMA3) on two ports	2x peak floating-point throughput for machine vision applications like automatic inspection, motion control, and other signal processing
256-bit SIMD integer operations	2x peak fixed-point throughput for video and image processing and general signal processing
Gather, scatter, and permute operations	Easier vectorization for many applications
Bit manipulation instructions	Compression, encryption, and general-purpose code

Table 1 | Intel Advanced Vector Extensions (Intel AVX) 2.0 enhancements for image and signal processing

Figure 2 | Kontron's CP6005-SA family uses 4th generation Intel Core i7 processors.

deliver sophisticated 2D and 3D graphics, video, and other media types that clearly communicate a machine's status and intended operation. Advanced visuals are also important in central control rooms, where management needs to understand increasingly complex and distributed Internet of Things-enabled systems at a glance.

4th generation Intel Core processors offer several features that improve its HMI capabilities, starting with an up to 60 percent improvement in 2D/3D graphics. The processors also expand their video decode accelerators, adding support for MJPEG and SVC and for 4K x 2K ultra-high-definition resolution. In addition to supporting up to three independent displays, the processors now offer a Collage Display mode, which presents multiple displays to the Operating System (OS) as a single screen – a feature that is particularly useful for multiscreen HMIs. Together these features reduce the need for expensive and power hungry discrete graphics cards.

Several Alliance members offer off-the-shelf solutions that help designers take advantage of the improved performance. For example, Premier member Kontron offers seven platforms based on the 4th generation Intel Core processors, such as the Kontron CP6005-SA shown in Figure 2. This 6U CompactPCI board offers high computing and graphics performance along with a complement of high-bandwidth I/O that includes five Gigabit Ethernet (GbE) channels for external and internal PICMG 2.16 compliant Ethernet traffic. The board also supports two additional 10 GbE ports combined

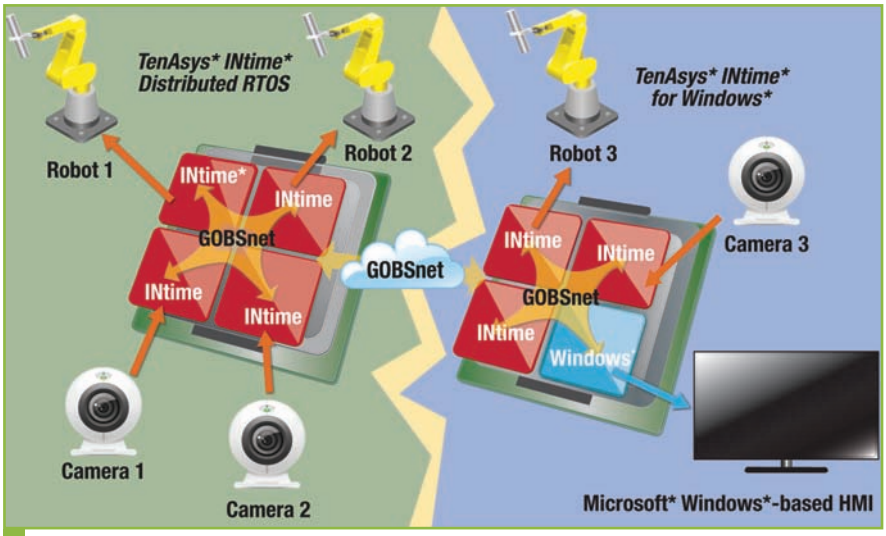

Figure 3 | TenAsys' INtime effectively partitions a multicore platform to perform numerous tasks.

with PCI Express (PCIe) 3.0 x4 on the backplane, all based on PICMG 2.20 for applications with high bandwidth requirements. The features are rounded out with USB and Serial ATA for an onboard 2.5" SATA hard disk or industrial grade NAND flash SSD device – all in a single-slot (4HP) computer.

Consolidation

The performance upgrades will have a positive impact on another factory floor challenge: efficient hardware utilization. Industrial facilities are confronted by the proliferation of servers and controllers that each run a single OS and perform a single function, such as HMI on Linux or motion control on a Real-Time Operating System (RTOS). Virtualization makes it possible to consolidate these workloads onto a single physical platform, lowering overall solution cost and footprint.

Virtualization has many other benefits. By reducing the number of physical systems, virtualization reduces the number and variety of parts and spares required for repairs. For that matter, virtualization can reduce downtime by enabling hot-swappable software spares that can smoothly take over if the main instance fails.

To combine OSs, a virtual machine monitor (also known as a hypervisor) creates a virtual machine (or guest) for each OS. The key challenge for virtualization of industrial applications is ensuring that real-time guests maintain deterministic performance. Intel Virtualization Technology (Intel VT) is available on 4th generation Intel Core processors and addresses this concern with a variety of hardware features that include:

- Memory protection to prevent applications from interfering with one another
- Hypervisor accelerators that ensure deterministic, low-latency responses for real-time guests
- The ability to assign I/O to guest OSs for unimpeded, high-performance access

Several Alliance members provide RTOS and hypervisor products that support the 4th generation Intel Core processors. For example, TenAsys eVM for Windows is a real-time hypervisor that uses Intel VT to enable RTOSs and other guest OSs to run along with Microsoft Windows. TenAsys also offers the INtime RTOS family, which can run as a stand-alone RTOS or alongside Microsoft Windows as shown in Figure 3. Both products enable users to partition a multicore platform to run mixed workloads, making better use of the processor's advanced features to provide highly integrated solutions. (Microsoft and TenAsys are both Associate members of the Alliance.)

I/O flexibility

The chipsets for the 4th generation Intel Core processors introduce Intel Flex I/O for configurable I/O, permitting designers to assign up to four to six SATA 6.0 Gbps ports, six to eight PCI Express Gen 2.0 ports, and four to six USB 3.0 ports. Select processors also support PCIe 3.0 configurations including 1 x 16, 2 x 8, or 1 x 8 + 2 x 4. Portwell takes advantage of this rich I/O with its ROBO-8112VG2AR, a full-size PICMG 1.3 form factor System Host Board (SHB). As shown in Figure 4, the board supports the full range of PCIe 3.0 outputs for flexible expansion, as well as three SATA 6.0 Gbps ports and four USB 3.0 ports. Other I/O includes dual GbE, two serial ports (one RS-232 and one RS-232/-422/-485 selectable), one FDD port, PS/2 interface for keyboard/mouse, and one parallel port for traditional factory automation applications. (Portwell is a Premier member of the Alliance.)

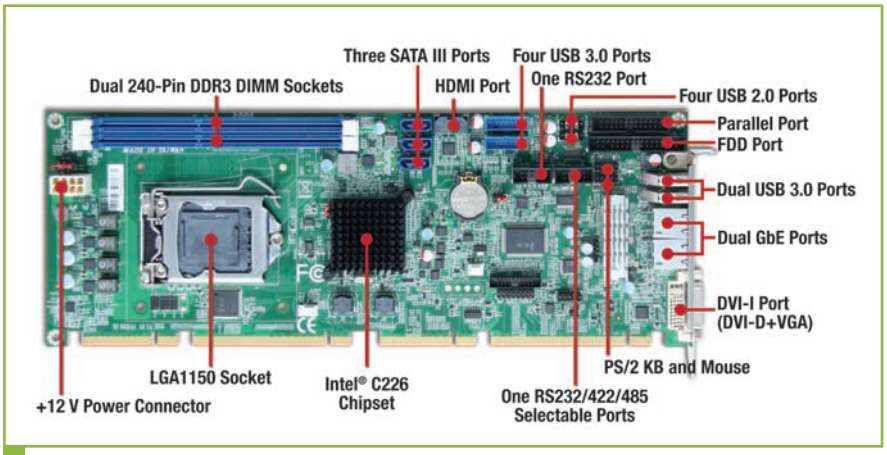

Figure 4 | The Portwell ROBO-8112VG2AR features multiple ports.

Security and reliability

A factory is only as strong as its weakest link, so every Internet of Things client in the factory needs protection from viruses, malware, and hacking to prevent costly interruptions to factory operation. The 4th generation Intel Core processor adds a number of features to its security portfolio, including McAfee's Deep Defender technology, which resides between the memory and OS to perform real-time memory and CPU monitoring without impacting overall system performance. (McAfee is an Associate member of the Alliance.) As shown in Figure 5 (page 22), additional security elements include:

- Intel Platform Protection Technology with BIOS Guard provides authentication and protection against BIOS recovery attacks. BIOS updates are cryptographically verified to ensure malware stays out of the BIOS.
- Intel Platform Trust Technology and Intel Boot Guard are designed to work with Microsoft Windows 8. Available on the forthcoming U-Series processors, Intel Platform Trust Technology supports secure and measured boot, and Intel Boot Guard protects against boot block-level malware.

› Intel Data Protection Technology with Intel Advanced Encryption Standard New Instructions (Intel AES-NI) enables rapid and secure data encryption and decryption.

Virtualization can also improve factory security and uptime because VMs can be segregated into different protection domains so a problem with one I/O device in one domain is isolated from affecting the other domains.

To keep machines running in large, distributed manufacturing systems, operators must be able to remotely monitor and manage their equipment. Intel Active Management Technology (Intel AMT) supports this requirement with out-of-band management that allows remote access to industrial computers even when the OS or firmware is damaged or the unit is powered down. Alliance members provide products that provide additional remote management tools. For example, Associate member NEXCOM's ICES 670 COM Express Type 6 Basic module supports Xcare 3.0, a utility that allows users to track parameters such as fan speed, temperature, voltage, watchdog timer, I/O, and disk status (Figure 6). These parameters can be fed back to a central operating room, alerting operators when an industrial device is in danger of failing so that preventative maintenance can be performed.

The next industrial revolution

The 4th generation Intel Core processor family will enable the transformation of the modern factory with Internet of Things technology – not only because of its higher performance but also because it permits industrial equipment manufacturers to significantly reduce design complexity and cost through consolidation of multiple applications and operations. All told, managers of industrial computing solutions will find that the new processor's performance, signal processing capability, and I/O flexibility are true game changers, enhancing productivity as well as augmenting the security and manageability of industrial PCs, controllers, SCADA systems, and HMI stations. ECD

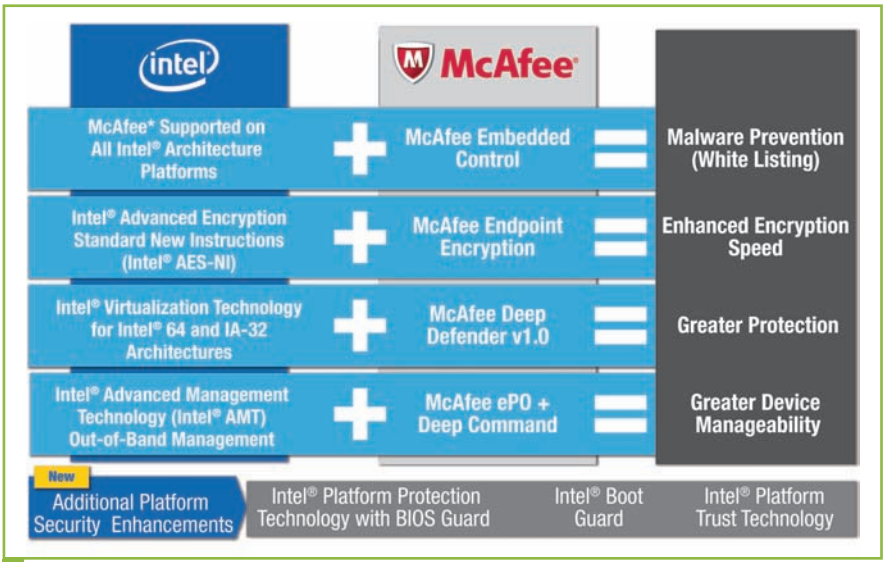

Figure 5 | Intel platforms support numerous McAfee protection elements.

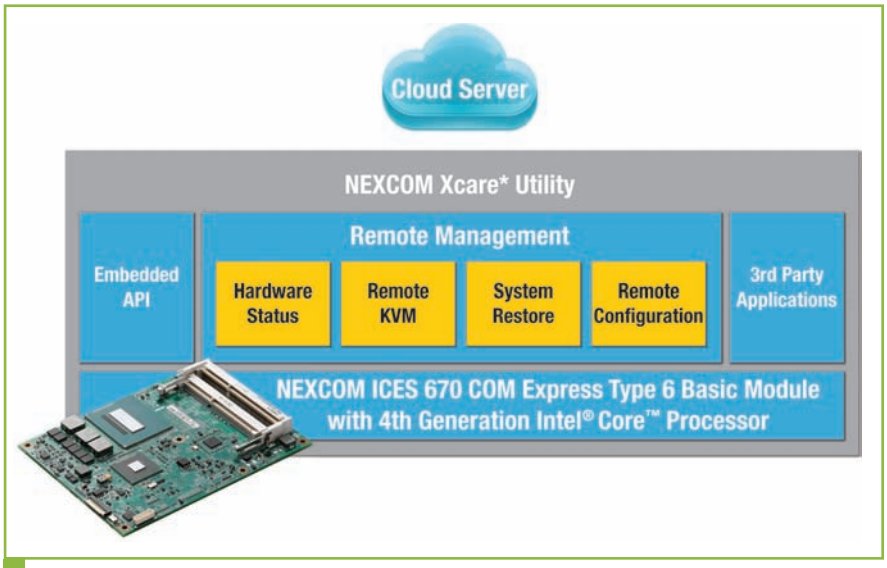

Figure 6 | The NEXCOM ICES 670 supports the NEXCOM Xcare Utility.

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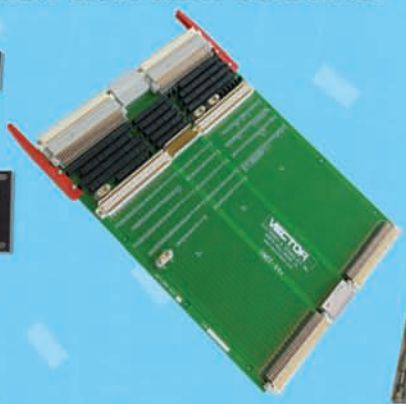

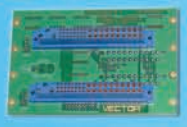

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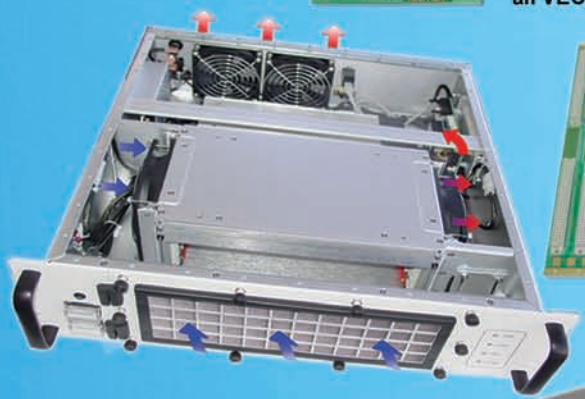

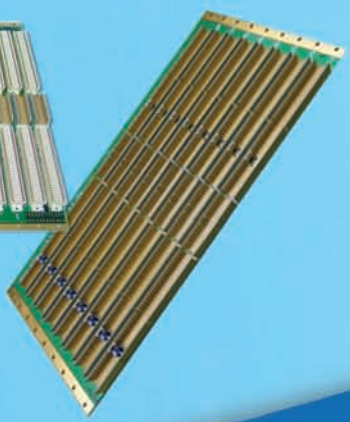

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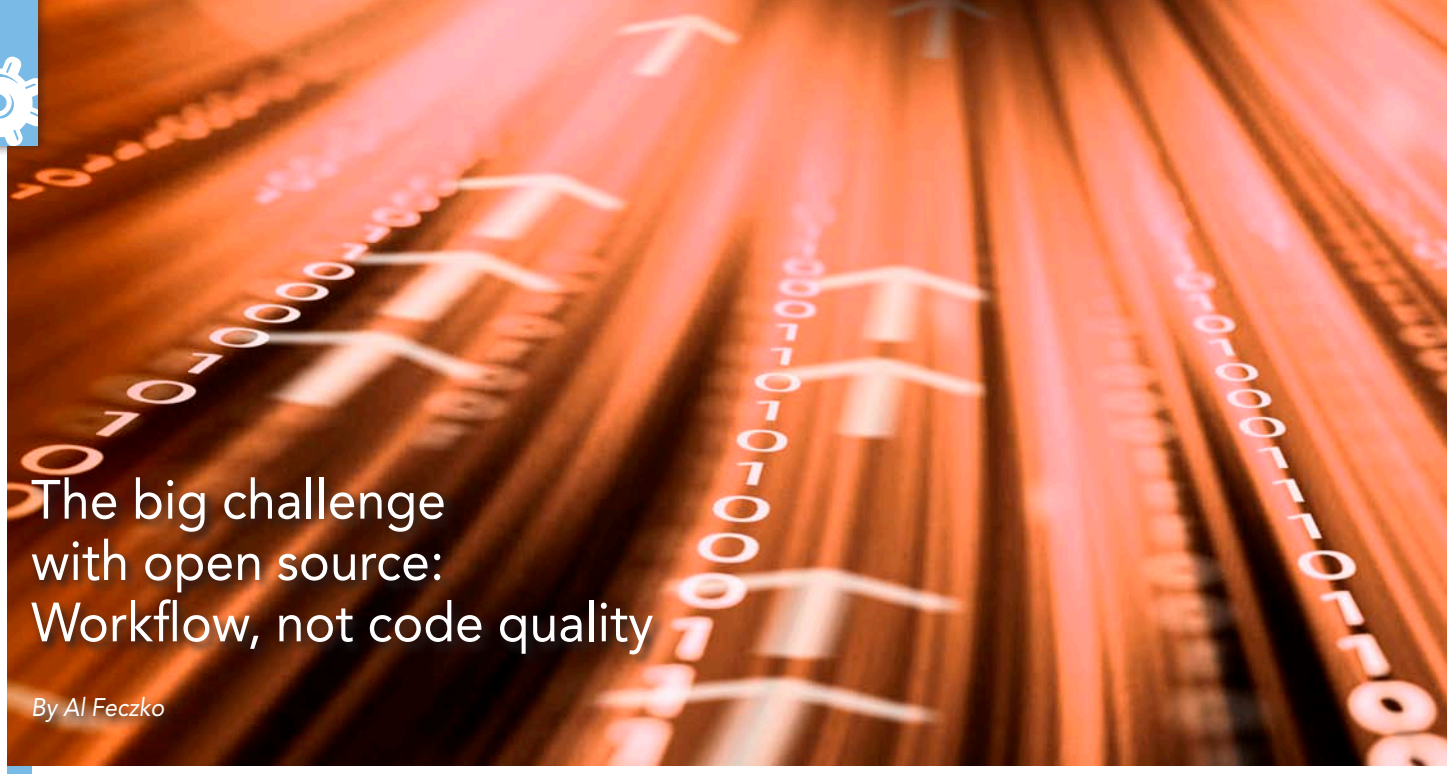

The big challenge with open source: Workflow, not code quality

By Al Feczko

With the increasing availability and associated complexity of a wide variety of 32-bit microcontrollers and microprocessors, the possibilities for embedded product designs are exploding. Leveraging a myriad of connectivity interfaces and integrating advanced graphical user interfaces and multimedia formats requires the availability of supporting software stacks from the underlying operating system. And, more than ever before, embedded software teams are turning to open source software and embedded Linux as the platform on which to base these systems in the "Internet of Things." But while open source has proved itself incredibly technology enabling, it can also make the workflow excessively unwieldy. The good news is that solutions and best practices exist to help development teams improve their software development workflow when open source is an increasingly large part of the mix.

In the early days of embedded Linux development (circa Y2K), a significant part of the effort was to port the open source code to run on the hardware platform being targeted. Unless engineers were running code on an Intel x86 board, it was not a trivial effort to develop the Board Support Package (BSP) and cross-compile the open source middleware to run on the hardware. In the years since, an increasing number of hardware companies have discovered that providing free Linux BSPs is necessary to ensuring the wide adoption of their hardware into embedded applications. Whereas in the early days it might have taken weeks or months to get to a Linux shell prompt over a console port, these days it should only take a few hours.

With a wide variety of proven open source software now readily available to run on the target hardware, the platform engineer's typical day-to-day tasks instead focus on configuration, customization, and integration of existing open source software, rather than design and development of software from scratch. Given this transition, let's review the following four major product lifecycle workflow challenges to consider when deciding whether to build a product based on open source software:

1. Creating a customized Software Development Kit (SDK) for the application team;
2. Keeping track of open source software updates;
3. Rebuilding a platform from source code; and
4. Managing open source software obligations associated with a variety of licenses.

Creating a customized SDK

As engineers increasingly view embedded Linux as a common software platform that can be reused across many of their company's products, creating a customized SDK becomes more important than creating a BSP. Application developers love Android and iOS because Google and Apple do a great job of building and maintaining custom, yet powerful and easy-to-use SDKs for their phone and tablet platforms. Who's building that foundation for development engineers building apps for your hardware platform? A company is ahead of the curve if it has an engineer who is officially responsible for creating and maintaining a custom SDK for the application development teams. If the company has someone responsible for this ongoing task, managers should be able to answer the following questions:

- How well is the engineer doing their job?
- How much time are they spending doing it?
- How do they distribute the SDK to other team members?
- If this person (or a key person on the platform team) left the company, could someone step in and take over this role effectively?

Creating a customized SDK basically comes down to selecting the set of libraries and APIs that application developers should use, and then ensuring that they are built into the application development toolchain in a version-controlled way. If the application will take advantage of dynamic linking, then this also means ensuring consistent versions are built for the developers' desktops as well as into the runtime target images. Delivering the SDK in an easily installable format helps to ensure consistency across all application developers.

Keeping track of open source updates

Who on the team is responsible for keeping track of updates made to the open source software running inside company product? How do they do this, and how often? What kind of updates are they looking for? Do security patches and bug fixes get the same level of attention as new feature releases? How do they share those updates consistently with the rest of the team?

We work with one customer who tackles this particular issue by having three engineers work through lunch one day each week. In an effort to ensure they are aware of all recent updates to the open source software packages they are using in their company's products, the three engineers project a laptop display onto a screen in a conference room, and surf various websites, changelogs, GIT trees, mailing list archives, and download sites. While this isn't necessarily the most effective methodology, it does illustrate a proactive effort to stay current – and also illustrates the engineering time investment required to do so.

Figure 1 | A LinuxLink update engine informs platform engineers when updated versions of open source software packages are available for download.

Automation can be helpful in this area. Subscribing to websites such as Timesys LinuxLink service (linuxlink.timesys.com), CERT mailing lists (forms.us-cert.gov/maillists), or Freecode (formerly freshmeat.org), (see Figure 1), can put some structure around this effort and save time by streaming relevant, filtered open source updates directly into a Web browser or email inbox.

Rebuilding a platform from source code

Ever try to rebuild a desktop distribution from RPM or Debian sources? Good luck. While the distribution folks do provide source code (it's open source, after all), rebuilding from sources is definitely not a use case that they typically support. In most cases, after rebuilding from source packages, the resulting system wouldn't be considered the same distribution and therefore is unlikely to be supported by the vendor.

While this might be acceptable for enterprise or desktop Linux environments, it's not acceptable for embedded product companies. Typical embedded products are in the field for years, and they often need to be maintained and updated after shipping. It's critical to keep a detailed manifest of all of the software included in every shipping build of an embedded product, as well as the tools and scripts that were used to build it. A number of modern Linux build engines provide this capability today, so make sure to select one that does.

Managing open source software obligations

As with most typical embedded products built upon an open source platform, it's likely that the development team will have to keep track of the obligations incurred across many different open source licenses, not just a single license. As one example, we provide "small footprint starting points," which are prebuilt embedded Linux images typically only a few megabytes in size and which simplify getting up and running quickly and easily with embedded Linux. As shown in Figure 2a, a small footprint starting point might only include seven open source packages, but those seven packages actually fall under four different open source licenses.

As another example, consider what might be viewed as a relatively straightforward wireless digital picture frame offered by Sony (www.docs.sony.com/release/VGFCP1_qs.pdf). As shown in Figure 2b, this product is based upon 20 different open source packages (www.sony.net/Products/Linux/VAIO/VGF-CP1.html), again spanning a variety of different open source licenses.

The use of each type of open source license in an embedded product design imposes a unique set of obligations on the development team that is incorporating this software into their products. Because of this, some companies maintain a list of open source licenses approved for use by their developers. Other companies go further, explicitly listing which specific version of each open source package has been approved for possible incorporation into the company's products.

Ensuring that the development team is aware of – and in compliance with – the obligations associated with each of these open source licenses takes time and effort. Tools that can help to identify and track the underlying licenses that apply and enable license obligations to be met can prove quite valuable when trying to hit aggressive product development milestones.

Packages

Category	Package	Version	License
Host Tools	gdbserver	7.4.1	GPLv3
Host Tools	mtd-utils	1.4.6	GPLv2
System	busybox	1.20.2	GPLv2
System	util-linux	2.21.2	GPLv2
Utilities	zlib	1.2.7	BSD
Networking	dropbear	2012.55	MIT
Graphics	ncurses	5.9	MIT

Figure 2a | Open source packages and relevant licenses in a Timesys small footprint starting point image

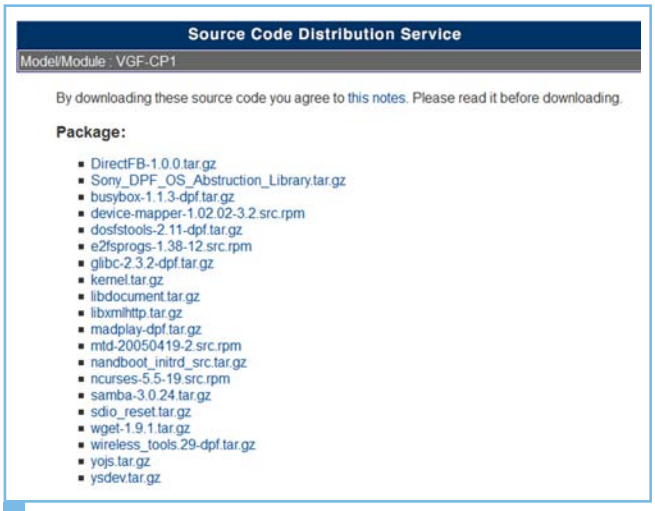

Figure 2b | Open source packages included in Sony wireless digital picture frame

Consider workflow from the start

The use of open source brings a new set of workflow challenges to the overall embedded product development life cycle. By considering these challenges at the beginning of new product development, by designating appropriate engineers to be responsible for the various issues, and by outfitting engineers with the proper tools, managers can ensure a more successful project by minimizing unexpected impact to the schedule. **ECD**

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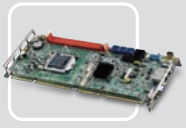

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UI development support software accelerates the development process

By Thomas Fletcher

Embedded UI development teams often struggle with communication barriers, lack of visibility, and siloed workflows throughout the development process. This typically results in extended development timelines and overstretched budgets. However, UI development support software can help teams overcome these hurdles.

No matter how refined the development process, every embedded UI development team has faced the challenge of overcoming communication barriers. What would seemingly be an essential and beneficial part of the development process, the back-and-forth exchange of ideas and information between UI designers and embedded system developers, is fraught with obstacles in these key areas:

- **Siloed workflows:** Designers and developers often work in silos and in a linear fashion. Once the design is completed, designers often move on to another project and adjustments to the UI design then fall into the hands of embedded system developers.
- **Unskilled task performance:** When embedded developers are forced to make design changes, they are no longer "doing what they do best" – which is building the back end of the product.
- **Lack of visibility:** Developers often select hardware and operating systems without a full understanding of UI functionality requirements.
- **Unclear parameters:** Designers, working with no up-front parameters, often conceptualize features that far exceed the capabilities of the systems on which the UI will run. Creating UIs that are difficult or impossible to implement can dramatically drive up development costs.

Whether the development team is creating an interface for an automobile, a dishwasher or a thermometer, it is exceedingly difficult for UI designers to communicate the intent of a dynamic and active UI from the creative vision through its engineering implementation. This communications challenge not only results in friction between the design team and the implementation team, it also threatens the integrity of the end product. The reason: Design changes are an inevitable part of the process. As the team strives to match the original design intent with available technology capabilities (or limitations), the probability of errors increases with each incremental change.

This communication barrier also drives up development time, putting release schedules in limbo and in many cases forcing companies to launch a less-than-desirable UI long after the intended date. The costs of scrapping the UI and starting over are usually untenable. Moreover, for companies that may release a UI once per year (the typical lead time for an embedded UI in the automotive industry is 1.5 years), pushing out the release date can mean the difference between competitive edge and obsolescence.

Simulation is another universal challenge. In many development environments, simulations are created using HTML or flash and run on a desktop rather than on the

target hardware. This creates an obvious lack of visibility into functionality issues that will certainly appear when the UI is running on the embedded hardware. The outcome: Everyone on the team is working toward partial specifications and making assumptions. This method of simulation always results in massive coding required to make the interface function in the embedded hardware environment. In short, simulations typically do not match the functionality and behavior of the embedded environment that will ultimately host the UI.

In most cases today, the final UI is the result of a series of compromises because of a siloed development process, resulting in a lower-quality user experience. The process typically goes as follows. The design team delivers the initial design, and then the engineering team, in the course of implementing what they perceive to be the design, makes changes and adjustments. Sometimes the changes are consciously executed based on hardware/software limitations; other times the changes are not intentional, but are made as developers fill in gaps in the specification of how the UI is "supposed" to perform in all situations. Further complicating the matter is that the original designer (who might be an external resource brought in to help with the UI conception) might no longer be on the project. That resource, effectively, has disappeared.

But it is important to choose the right UI development support software for the job. Accordingly, the sidebar lists the 10 most important questions to consider in this paradigm.

Establishing a common software environment

A better approach to UI design and implementation is to establish a common software environment that spans the entire development team, and their tools, and enables everyone to participate in a discussion around the UI in a consistent manner. In this way, designers and developers can maintain communication from start to finish about the design itself, and manage changes and constraints as they logically appear throughout the process. When designers maintain ownership of the user interface from start to finish, software developers can focus on refining core product functionality, rather than "shifting pixels" to accommodate a changing UI. With full visibility into the design and near-immediate feedback about the embedded implementation, designers can make informed decisions about functionality as it evolves. With a

The UI development software choice: Top 10 factors

The following is a checklist of questions to ask when choosing UI development support software:

1. Does it provide usability by all team members, both developers and nondevelopers?
2. Does it facilitate simultaneous collaboration by all team members?
3. Will the software create a simulation that functions as a runtime engine representing exactly both what the designer intended and how it will run in the target hardware environment?
4. How long does it take for the software to transfer static content to content running in the base application on the target platform?
5. Is there broad support for the preferred development platform?
6. Is there broad application support for the preferred development applications?
7. Does it offer standard base functionality such as composited layers, alpha blending, animations, 3D objects, and so on?
8. Can unique or custom design requirements be accommodated, with support for custom visualization, rendering, and tooling?
9. How does data move from the system to the UI, and vice versa?
10. Is there separation of system and UI logic?

working user interface that is developed under simulation, developers can use a real-world UI to make informed decisions when selecting the hardware and OS. All together, everyone is better able to ensure a consistency of vision when UI adjustments must be made.

Teams that can work collaboratively and simultaneously – with designers maintaining responsibility for the user interface and the system developers retaining ownership of the underlying system interface logic and behavior – can also bring the design to a deployment simulation (reflecting the functionality on the actual hardware and OS) much more quickly. Early simulations deliver a number of advantages. Developers can test the application on various hardware platforms, before committing to the technology. This is critical for today's highly interactive UIs. A touch screen will naturally function much differently from standard "mouse-and-keyboard" desktop inputs and can be modeled very effectively using a tablet OS. Early simulation also forces constraints on designers, which helps bring the UI to fruition more efficiently – as unrealistic features are abandoned much earlier in the process.

Early simulations and improved communication can dramatically condense development schedules. This ultimately helps to increase the quality of the end product, as it opens the door for user experience testing and product refinement based on customer feedback. Moreover, this refinement occurs with the designer, rather than the costly and time-consuming recoding required by a software developer. All of these things enable companies to mitigate handoff costs between designers and software developers.

Getting products to market more quickly

An effective way to ensure that the UI development process is not hindered by the aforementioned obstacles is to use UI development support software. Companies using such software have been able to put this collaborative development environment into action, speeding time to deployment. An example is QNX Software Systems' usage of Crank Software's Storyboard Suite UI development support software to implement a 17", curved, 1080p center console display that was embedded in a Bentley concept car. The digital light projection HMI debuted at the 2013 Consumer Electronics Show and featured content that was originally created in Adobe Photoshop and fully implemented in only eight weeks as opposed to the four to six months of back and forth between developers and designers that a project of this magnitude would normally entail. Auto Meter also used the same UI development software to develop the LCD Competition Dash for NASCAR in less than six months (Figure 1).

What allows this type of rapid development of products is forceful decoupling of the user interface from the implementation details of the system. The Model-View-Controller (MVC) paradigm

Figure 1 | Auto Meter created a working prototype of the LCD Competition Dash using the fully functional evaluation of Storyboard Suite.

is strictly enforced by channeling all user interface changes through an event and messaging system.

The messaging interface allows the UI to be constructed as a contract to future data bindings that will be provided as input/output events. During the initial user interface development, any required inputs can be simulated using synthetic events without any requirement for a functioning embedded hardware system in place.

System development also progresses more quickly because of the clear definition required input and output events. Verifying their inputs and outputs against a definition rather than to a UI presentation more easily validates system components.

Final product assembly and integration are greatly facilitated by such a structured set of event interfaces. Remove the simulated inputs and outputs and replace them with the system components that have been already validated against an event specification.

Delivering a high-quality UI experience

In the highly competitive world of embedded UIs, companies are judged based on their ability to deliver state-of-the-art technology that exceeds consumer expectations. Faster and more cost-effective UI development is critical. Even more important is to produce the highest-quality UI that technology can enable – with each subsequent product generation having to surpass the last. UI development support software can address all of these needs by ensuring full visibility and collaboration between designers and developers during the development process and enabling software simulation functioning similarly to a runtime engine, enabling software test ahead of time on the embedded hardware. Vendors such as Crank Software with its Storyboard Suite UI development support software are aiming to fill these needs and hasten the development process. **ECD**

Thomas Fletcher, *Vice President of Research and Development, cofounded Crank Software in 2007 and is responsible for technology strategy, platform planning, and solutions design, with expertise in embedded system architecture and design, real-time performance analysis, power management, and high availability. Thomas holds a Master of Computer Engineering degree from Carleton University and a Bachelor of Electrical Engineering degree from the University of Victoria.*

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Do's and don'ts of evaluating 32-bit embedded software IP

By Willard Tu

For folks who write code professionally, the process of evaluating "other people's code" might seem simple – but it takes more than reading a manual or inspecting source modules. Properly evaluating choices and their long-term impact means looking at various options with a new, broader perspective. Here is a list of do/don't guidelines that can help in the search for more reliable software.

With pressure on embedded designers to produce billions of reliable devices for the Internet of Things, the approach to hardware and software development is changing. The days of picking a part, grabbing a manual, and sitting down to write code are coming to an end – not because of the difficulty, but as a result of the time involved in doing so. By the time a designer with the old approach gets the basics working, competitors might have already released their finished product.

Changing development practices are further spurred by innovation, which is a two-edged sword. More new microcontrollers and FPGA processor cores are being created and introduced in 32-bit ARM architecture every day, bringing more processing power driving advanced peripheral functions many designers are unfamiliar with at a detailed level. This can be particularly tricky where interoperability requirements dictate thorough testing of peripherals, essential for reliable connections of devices with other devices under all operating scenarios.

In this new landscape where user expectations are high and processing technology is evolving rapidly, unlocking the potential for new devices requires better software that can be produced more quickly. Successful teams, building on the model of reusable hardware Intellectual Property (IP), are now pursuing a build-borrow-buy strategy for each block of software IP. Code can be developed in-house, borrowed from the open source community, or purchased from vendors, with everything blended into a solution (Figure 1).

Do's and don'ts of evaluating software

Beyond specific functional and performance requirements, how should software IP blocks be evaluated? Following are some do/don't guidelines for teams applying a build-borrow-buy approach.

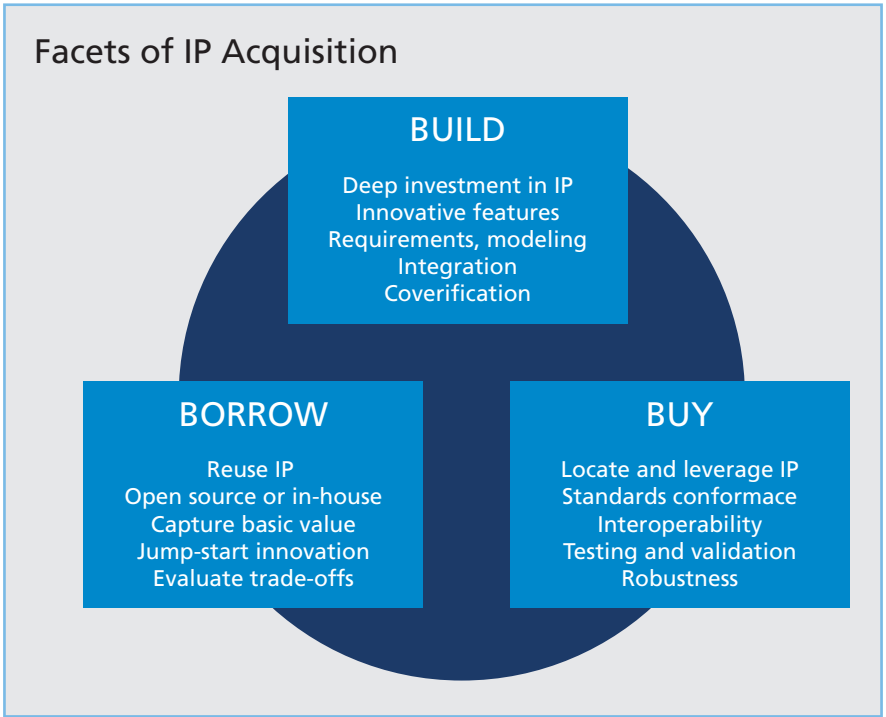

Figure 1 | Successful teams, building on the model of reusable hardware Intellectual Property (IP), are now pursuing a build-borrow-buy strategy for each block of software IP.

DO

Consider the entire software stack

The range of 32-bit embedded software IP is much broader than just compilers and debuggers from the 8- and 16-bit world. IP exists across the spectrum including operating systems, protocol stacks, user interface code, and middleware. Choices of operating system and Application Programming Interfaces (APIs) can enable or inhibit other choices, with implications in test, verification, documentation, and support over the life cycle of the product.

DON'T

Assume everything has to be written

Developers historically have had a code-first mindset, purchasing development tools, perhaps obtaining an operating system, and going to work writing the application. While this gives a team a great deal of control over the code, reusing or acquiring code from reliable sources can actually reduce risk, and definitely speeds up development. More and more off-the-shelf software solutions, especially in the context of ARM architecture, are being created and deployed.

DO

Look for code conforming to specifications

Difficult-to-code peripherals and functions usually fall into networking, user interface, and signal processing categories, with specifications that must be adhered to carefully for proper operation. Obtaining code in areas such as Bluetooth, TCP/IP, USB, HTTP web servers, graphics, and DSP libraries – proven in other applications – can make the difference in a project.

DON'T

Fall into the open source value trap

Open source is often a great starting point; a good example for ARM is the Linaro efforts in Linux for the Cortex-A families. Developers should understand that effort will likely be needed to port, extend, and verify the open source code to complete the value equation. For example, the developer of BTstack – open source Bluetooth expert Matthias Ringwald – readily admits that it is a "minimal set of required protocols" on a limited range of processors and operating systems.

> There are short-term and especially long-term advantages for standards. Generally purchased Commercial Off-the-Shelf (COTS) software is a great place to find software that supports standards, whereas often in-house purpose-built software may be less oriented toward standards. Over time companies want to enhance products; by following standards there is a much greater likelihood that other hardware and software components will be available to aid future development.
>
> – Mike Gee, CEO of Motomic Software

DO

Be open to both object and source modules

Developers often require access to source code, based on a fundamental mistrust of "other people's code" or a need to comply with a source-centric review process. However, having source code doesn't necessarily make code any more trustworthy, or provide any more control over the outcome – but it can definitely increase the expense of a project. Object modules proven in fielded applications for self-contained functions can be highly reliable and cost-effective, and documentation can be provided facilitating reviews.

DON'T

Take licensing for granted

Licensing is a hotly debated and highly misunderstood subject. Many engineers don't even believe there is an issue, suggesting stories of problems with licensing embedded code are urban legends. In an age where lawsuits are flying between mobile manufacturers and the validity of patents for common features is under intense debate, not paying attention to the licensing of IP up front can be a huge and costly mistake. Proper licensing protects both providers and consumers of IP.

DO

Abstract code to APIs where possible

One of the keys to getting the most out of a build-borrow-buy strategy is to work with APIs, abstracting the interfaces between IP blocks. This has two effects: It prevents creating dependencies on implementation-specific code inside a module, and it allows IP blocks to be swapped out as needed for future projects with changing requirements. Another consideration often overlooked is competing timelines in system architecture, where multiple implementations of a functional block are evaluated in parallel and the best approach chosen.

DON'T

Over-engineer to low-level requirements

The temptation to code is so powerful it often leads to a justification: Third-party code doesn't meet every single one of the detailed requirements, so code must be developed in entirety. Certainly, if a major requirement is uncovered by open source or commercial code, or if a dramatic breakthrough in innovation for a particular feature is the objective, a module of code should be written. In the build-borrow-buy scenario, high-level requirements are well worth the effort, but low-level implementation specifics should be rethought to avoid limiting choice.

> The biggest error I have seen people make when deciding to build is they believe that it is not too difficult to write the code, and in some cases that is true. What they completely overlook is how much time and cost it takes to debug and test so that the software (in our case, TCP/IP and related protocols) works properly in every configuration and every network environment. Not only does this result in greater costs, but the projects are most often late, which results in lost revenue, maybe even a lost market opportunity.
>
> – Larry Larder, President of InterNiche Technologies

DO

Focus on core expertise of the firm

A key tenet of any build-borrow-buy strategy is focusing on distinctive competence, which should take the bulk of engineering resources and expertise. By focusing on the right in-house development and reuse or integration of open source or commercial modules, return on investment can be optimized. In fact, if a competence becomes outstanding, a block of software IP may become the standard for reuse, opening new opportunities for revenue.

DON'T

Try to do everything in-house

The flip side: Rarely is any company the expert in all areas required to make a complete product, especially as software becomes more varied and complex. The resistance to outside IP used to be jokingly referred to as NIH – "not invented here" – but savvy organizations are changing that mindset.

> Many companies try to go outside their expertise and stretch themselves to do everything in-house. Commercial IP licensing companies exist for a reason – they have their core expertise in specific areas and are able to do a thorough job of developing, testing, and deploying IP modules for use in end products. Ultimately, commercial IP enables developers with lower-cost, robust solutions; faster time-to-market; reduced troubleshooting; and fewer customer rejections.
>
> – Ashok Setty, CEO of SoftRISC Communication Solutions

Finding software to evaluate

Evaluating code from datasheets isn't feasible for modules beyond trivial complexity – very little can be gleaned about the quality of the implementation. Most engineers will head straight for the manual, evaluating it as a proxy for code quality, but documentation for many of the advanced microcontrollers is hundreds of pages of time-consuming reading. Evaluation code, coupled with a hardware development kit and perhaps even training, can quickly answer questions and move the process forward.

Not only that, the 32-bit ARM ecosystem provides unifying structure making the search for code easier, and has made the Embedded Software Store (www.embeddedsoftwarestore.com) the primary destination. Many products are available in evaluation versions, with prepackaged configurations and one-click licensing making finding and acquiring code quick, easy, and safe. **ECD**

Willard Tu *is Director of Embedded for ARM, and is based in Detroit, the automotive capital of the world. Willard has focused his career on the embedded market segment, accumulating more than 20 years of knowledge. He has worked for Motorola (Freescale), National Semi (TI), and NEC Electronics (Renesas) in business development roles, and has spent the past six years growing ARM's embedded market share.*

Q & A

Keep it cool: Take the heat out of embedded design

Q&A with Darryl McKenney, Vice President of Engineering Services at Mercury Systems

As customers demand increased performance, reduced size, longer battery life, and silent operation, embedded design teams are constantly battling system cooling issues. Covering the latest strategies, Mercury Systems' VP of Engineering Services, Darryl McKenney, answers questions on the thermal management techniques, trends, and materials for current embedded projects, and what changes we can expect in the future.

What are the latest market trends in thermal management?

MCKENNEY: The latest trend in thermal management addresses the challenge of how to do more with less: how to deal with reduced power requirements, in more extreme environments, in less time, with less weight, and at less risk. Size, Weight, Power, and Cost [SWaP-C] analysis, performed at a subsystem level, is driving the trade-offs between module capabilities and chassis capabilities for subsystem optimization. To support these trade-offs, it is important to always start subsystem development work from a baseline of products that complies with open standards. Creating a solution using standards-based products that meet a program's needs significantly reduces cost and lead time. If a solution cannot be made using only standards-based products, trade-off studies can help identify the areas where the solution may be tweaked and new materials introduced that can reduce weight, improve cooling capacity and rigidity, or address other specific system requirements. Creating solutions using standards-based products that include technology insertion options for potential upgrades delivers the optimal solution for the program, while reducing development time and risk.

What impact are new materials having on thermal management techniques and designs?

MCKENNEY: Today's thermal technologies are designed to enable the use of the latest high-performance components in modules in deployed environments. Since the mission profiles for each system are diverse, it is important to have a design that is flexible enough to meet varied program needs and not break the calendar … or the bank. Every available technology has different implications for SWaP-C impact. This makes it even more essential to optimize the solution to address a specific problem and create new leverage points for technology insertions.

- Aluminum is still the dominant solution as it is moderately conductive, inexpensive, and widely available.
- As a rule, copper provides two times the conductivity of aluminum, at three times the weight and four times the cost. But copper is still widely available and an effective solution for increasing thermal conductivity when there are no concerns about paying a thermal and cost penalty.
- Heat pipes are highly conductive and have about the same density of aluminum. However, they have a finite energy-carrying capability, and once they become saturated they are no longer highly conductive. Heat pipes are more widely available than ever, but there are potential long-term reliability concerns and geometry limitations that need to be considered.
- Vapor chambers have a higher thermal capacity than traditional heat pipes, but can suffer from "pillowing" at higher temperatures, as well as orientation and acceleration effects. (Pillowing is the enlargement of the heat chamber and distorts the cooling cavity.)
- Pyrolytic graphite is lightweight and highly conductive in two dimensions, but not very conductive in the third dimension. The material is very brittle and requires an outer shell to be used successfully in a wide range of environments. The materials for this are expensive and the additional processing steps add to material lead times. These are utilized in cases where weight is a primary variable and can override the cost impact.

How do you overcome packaging constraints when it comes to developing efficient thermal management techniques?

MCKENNEY: The first step in overcoming packaging constraints in military or consumer devices is to properly define the design goals of the product or subsystem, what changed from previously successful products, and how to bridge the gap between what has worked in the past and the needs for the current product. It all comes down to identifying and attacking the primary variables, tracking the secondary variables, and maintaining compliance to the tertiary variables. For example, if a processor's power consumption is increasing from 25 W to 45 W, is this a heat-sink cooling capacity problem, or a thermal spreading problem, or both? While they sound similar and can affect each other, there are different techniques for improving each one with different impacts to the solution

as a whole. It's basic: Identify the primary variables, bring it back to the "math," create a solution, and move on to the next challenge.

In terms of electronic design, how do you test and measure thermal management?

MCKENNEY: Different companies approach the test and measurement of their products' thermal capabilities in different ways. Mercury truly believes in the utilization of Computational Fluid Dynamics [CFD] analysis before we build anything. Our modeling approach has a direct correlation and allows us to test products with an expectation of passing qualifications the first time. This design-for-reliability approach allows us to make reductions in the product costs and improvements in reliability during the design process. We also utilize application-specific software to test the products to extreme environmental conditions, including testing at all four corner case conditions (high temperature, low temperature, high voltage, and low voltage) electrically.

Thermal modeling, signal integrity, and component placement are "negotiated" very early in the design process. This allows for technical risk reduction and trade-offs in electrical, mechanical, and reliability analysis to be in the design process to optimize the overall product design, while minimizing rework as the design cycle matures.

Looking into the future, how will thermal management change in light of new materials and designs?

MCKENNEY: The future of electronic component cooling is very hot. As subsystem developers employ new methods, you will see new advances in the mass transfer of thermal energy. Higher-efficiency heat pipes, new materials, hybrid exchangers, and component miniaturization will all have significant impact as we head into higher-power, "thermally managed opportunities."

Finally, in the near future, there will be a definite need for a scalable "Swiss army knife" solution for today's demanding systems: in other words, one solution for use in multiple platforms. The future of thermal management techniques must address not only how to cool more power, but how to cool more, while taking up less space, adding less weight, and functioning successfully across a wider range of environments. **ECD**

Darryl McKenney, *VP of Engineering Services, is responsible for Mercury Systems' electronic packaging and subsystem design, system reliability analysis, and technology improvements. He has more than 25 years of experience in engineering management and product development. He has helped define numerous products and processes for high-speed three-dimensional design, advanced thermal management, and high-reliability Size, Weight, and Power (SWaP) integration. Darryl holds an Advanced Managerial degree from Boston University and completed Advanced Managerial Training from Harvard University. He has been awarded more than a dozen patents in new product development.*

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Q & A

Connected cars rev up to meet today's security, interoperability challenges

Q&A with Anthony Le, Senior Director of Segment Marketing, Spansion

By Sharon Hess, Managing Editor

The ubiquity of connected cars is rapidly accelerating, in spite of the engineering challenges that remain to be conquered. The laundry list includes data security, interoperability with legacy communications systems, and, ironically, consumer expectations in the "instant on, instant everything" era. Spansion's Senior Director of Segment Marketing, Anthony Le, addresses these concerns, tells where NOR and NAND flash fit in, and describes a single IT fabric solution. Will it be a panacea? Time will tell.

Remind us briefly about Spansion – when started, technical focus, industries served, where located.

LE: Spansion has been serving the embedded systems market since 1993 and is headquartered in Sunnyvale, California. We produce flash memory-based embedded systems solutions with more than 2,800 employees and 8,000 customers worldwide. Additionally, we recently announced plans to acquire the Microcontroller and Analog/Mixed Signal Business of Fujitsu Semiconductor, with more than 1,100 engineers and 5,000 products, to provide even more comprehensive solutions for embedded designs.

Spansion's parallel NOR, serial NOR, and NAND solutions are at the heart of electronics systems, connecting, controlling, storing, and powering everything from automotive electronics and industrial systems to highly interactive and immersive consumer devices.

Why is it so much more difficult to provide adequate security for "connected cars" than for smartphones or tablets?

LE: There are multiple reasons why it's more difficult to secure the connected car.

Connected car security is about 20 years behind the rest of the software security industry, including that of mobile and tablet devices. This is partly a result of the much slower design cycles and historical expectations of high reliability and quality within the car. And, unlike the smartphone or tablet, there are many more communications points within and from the connected car. These communications points include not only the newly added functions that mimic or extend those features found on smartphones and tablets (such as making calls, running music or video applications, messaging, or Internet access), but they also include the safety, operational, and sensor systems within a car. These systems or points of contact within the car were built in silos as features have been added to cars over the years.

Legacy communications systems like CAN, MOST, and so on, have slowed down interoperability. While automotive embedded systems designers are beginning to knit these together in a common interface with added security, it's more difficult to fully protect these diverse applications that are not built from a common IT fabric. Security for mobile devices, on the other hand, is built in from the ground up with each design cycle.

However, both connected cars and mobile devices include chips that have security features built into the silicon layer of the chips used, which is a good starting point for design engineers.

Another big challenge is consumer expectation. According to a recent study from Capgemini that captured the opinions of 8,000 consumers across eight countries, buyers expect their new cars to have technology at least as good as they find in other devices in their life. Right now, connected car makers have to deal with managing the expectations of potential buyers with the reality of where the technology is today. In lieu of having the latest technology embedded in the automobile, consumers are bringing their own devices into the car and expecting these systems to be "plug-and-play" (charged by, connected to, and compatible with their vehicles). It is an interim solution to the truly connected car that auto manufacturers can piece together.

How vulnerable is connected car data these days?

LE: There are several real-world examples that show us that connected car data is vulnerable to hacking. For instance, researchers at the University of California successfully hacked into a car's Electronic Control Module (ECM), which interfaces with most of a car's dynamic systems, including the engine and braking systems. Among other things, they were able to perform a full system shutdown where they locked doors, took control of the horn and even disabled and shut off the engine.

It's obvious that there are huge risks here if we don't fix security issues. It's a problem that's even captured the attention of the federal government. In May, David Strickland, head of the National Highway Traffic Safety Administration (NHTSA), stood before a Senate Commerce Committee hearing to discuss these concerns. The Administration is actively researching security challenges of vehicle-to-vehicle and vehicle-to-individual communications of the connected car, the associated risks, and possible solutions.

What needs to be done, technically speaking, to beef up connected car security now and 1 or 2 years from now?

LE: Over the past 10-20 years, auto electronics have mainly been an extension or migration of a consumer technology into an auto-grade version of that technology. Everything has gotten bolted together in the cabin and chassis. While this delivers some good results, if you don't have a single holistic auto platform, it's very difficult to deploy layers of security. It gets very expansive and inefficient because you have a bunch of siloed systems inside the car, so the first step is to make it really secure. For this to happen, the design community must change its design philosophy and this is something we're already starting to see.

It's important to point out that retrofitting the infrastructure and applications of the varied siloed systems of the car to add security will not work. It's probably the most expensive and difficult way to approach the problem and it could still leave vulnerabilities. Instead, we must build a collaborative ecosystem to rearchitect the automotive IT fabric to incorporate security from the silicon level and up.

We must build a single IT fabric that consists of automotive-grade networking capabilities and at least two layers – one aimed at securing the mission-critical controls and highly private data that must be secure at all times and one with lower-level security that enables less-critical applications and communications that do not need the same level of security. With this platform, you have dual network fabrics working in unison in different areas of the wireless spectrum. This is only possible if we can create an automotive network platform that's both network aware and content aware and secured from the ground up.

What are the primary technical limits of NOR and NAND flash memory, as related to the connected car? How will these issues be solved to deliver users' "instant on, instant everything" demands?

LE: NOR and NAND differ in how they are used in the connected car. NOR flash memory is well suited to ADAS, GPS, various sensors, or instrument clusters/display applications where fast boot times, image rendering, and random code access for XiP are necessary. On the other hand, the higher-density storage offered by NAND flash memory is well-suited for media applications in automotive infotainment, telematics, and systems requiring more complex embedded software. NOR and NAND flash memory are complementary in the connected car.

In regard to consumers' desire for "instant on, instant everything," instant on is a wishful goal that is limited by various components of the automotive electronic system, but memory typically is not the bottleneck. The bottlenecks are found in the TFT display, GPS, the cameras, and various sensors that make up the ADAS. Memory can run as fast as people are willing to pay for it. There is a trade-off in cost versus performance. To balance this, automakers are developing ingenious tricks such as prebooting the car as the driver unlocks the car or sensing when the driver approaches from a distance so that there is an appearance of instant on when the car is keyed on. **ECD**

***Anthony Le** has more than two decades of industry experience. As Senior Director of Segment Marketing for Spansion, he is responsible for Spansion's Memory business development in key segments, such as automotive, industrial/medical, communications, and consumer. Prior to Spansion, Anthony held senior marketing and engineering roles with Winbond, Xilinx, Hynix, and AMD. Anthony holds a BSEE from the University of California, Davis and an MBA from the University of Phoenix.*

The Ninja Blocks BeagleBone-based platform allows easy development of mobile and web applications for communicating with hardware and connected devices. Image courtesy of Ninja Blocks

DIY pushes open hardware from kindergarten to Kickstarter

By Brandon Lewis, Associate Editor

Resurgence of the Do It Yourself (DIY) community has driven a range of open hardware platforms, giving aspiring technologists cheap and easy access to embedded development. Outside of hobbyist toys and educational devices, however, "hacker" boards are increasing performance and I/O flexibility, and have become viable options for professional product development.

The "maker" movements of the past few years quickly gained traction in the education and hobbyist markets, as organizations began producing open hardware boards with a "less-is-more" architecture at a price to match. DIY boards like the Arduino, BeagleBoard, and Raspberry Pi provide "known state" programming platforms that allow easy exploring for novice developers, and enough flexibility for advanced hackers to create some pretty remarkable things – which they have.

Now, Kickstarter (www.kickstarter.com) projects like Ninja Blocks are shipping Internet of Things (IoT) devices based on the BeagleBone (see this article's lead-in photo), and startup GEEKROO is developing a Mini-ITX carrier board that will turn the Raspberry Pi into the equivalent of a PC. Outside of the low barrier to market entry presented by these low-cost development platforms, maker boards are being implemented in commercial products because their wide I/O expansion capabilities make them applicable for virtually any application, from robotics and industrial control to automotive and home automation systems. As organizations keep enhancing these board architectures, and more hardware vendors enter the DIY market, the viability of maker platforms for professional product development will continue to increase.

"About five years ago when we launched the original BeagleBoard, what you could do with ARM devices was not as clear," says Jason Kridner, Cofounder, BeagleBoard.org. "Especially as the superscalar ARM core was just coming out, people did not know much about what it was really capable of doing. The closest things out there were things like the Nokia N800-types of devices, but we were really taking a big jump in performance.

"For the most part, the approach was to put this cool technology into people's hands and get out of the way," Kridner continues. "It was really just to try to reach that price point so that folks that wanted to go and play with open source software on these platforms could go and do that. And it was really an industry changer; you can see all the things that have come since then."

ARM boards 'make' their mark

From the beginning, maker board architectures stressed lowest-cost, low-power hardware, with an emphasis on multimedia and graphics. This led the Raspberry Pi Foundation and BeagleBoard.org to adopt ARM architectures for the processing element in their boards, resulting in similar architectures with comparable performance that catered to educational and hobbyist developers. Since then, variants have evolved to increase pin access and optimize performance for a range of development applications.

"All of the DIY ARM boards have broadly the same architecture – a System-on-Chip

(SoC), which contains the processing, multimedia, and I/O in a shared-memory configuration, and one or two external chips to provide functionality that is missing from the core SoC," says Eben Upton, Executive Director, Raspberry Pi Foundation. "There are a number of boards based on a couple of different SoCs that use Cortex-A8 cores at around 1 GHz; these can get ahead of the Raspberry Pi a little on integer and memory workloads, but lag behind on floating-point performance and multimedia, as A8s have a very weak Floating-Point Unit (FPU) (Figure 1)."

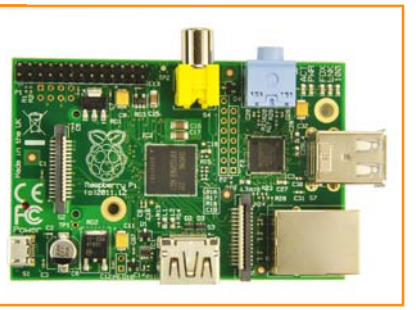

Figure 1 | The Raspberry Pi Model B includes a Broadcom BCM2835 SoC and 512 MB RAM that emphasize multimedia and graphics performance.

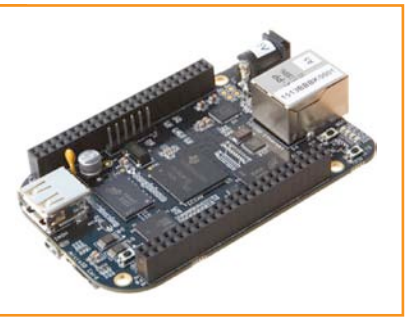

Figure 2 | BeagleBone Black comes equipped with an array of expansion hardware, including A/D converters, pulse width modulators, and 65 digital I/Os and 7 analog inputs.

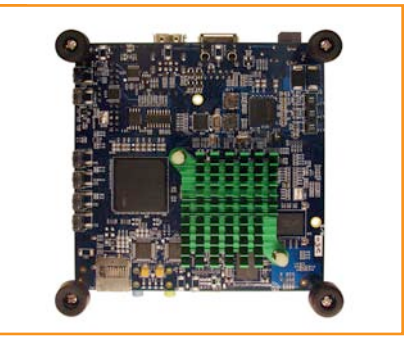

Figure 3 | MinnowBoard is an Intel Atom-based single board computer that has native high-performance I/O interfaces for more demanding development projects.

"Going from the BeagleBoard to the BeagleBoard-xM, we added some extra memory, performance, and expansion capability," Kridner says. "But with the BeagleBone, we kind of reset things and tried to say, 'Let's get down to the bare bones of what is really needed and desired.' This was both in terms of more bones access – low-level expansion, A/D conversion, getting a lot more focused on that low-level I/O capability – and less of a focus on being a multimedia engine; the BeagleBone Black just took that progression further.

"For all the people building robots and drones and wanting to do hardware hacking, BeagleBone Black has all that expansion hardware on there (Figure 2)," Kridner adds. "For some of these platforms, if you wanted to do anything real-time, like precision timing for motor control, you would have to go out and buy an Arduino or some other sort of microcontroller system. Here, there are two 32-bit 200 MHz microcontrollers that have direct access to the pins. They are real-time and can let Linux do some of the things that it is great at like networking, high-level language support, GUI development, and the big number crunching, and let the low-latency stuff live on those 200 MHz microcontrollers. You come to it with whatever development baggage you already have; if you want to go into real engineering design and make an end product out of it, there is no barrier to doing that."

x86 for professional-grade performance

As the DIY market continues filling out with developers of varying skill levels and intentions, the need for different classes of development boards has also emerged. Recently, x86-based maker boards have been released, offering increased compute power and high-speed I/O interfaces. Though slightly more expensive than their ARM-based predecessors, they target more serious development and are capable of scaling into traditional embedded applications.

"The Raspberry Pi and Beagle family have done a lot to bring new people into the world of embedded development, and that is a wonderful thing," says Scott Garman, Technical Evangelist, Intel Open Source Technology Center. "As the embedded community grows and people seek out new projects to pursue, they are inevitably going to run into limitations on one platform or another. Just about every embedded board in the marketplace has something unique to offer, and the MinnowBoard will be a compelling choice for many applications, particularly those that require high I/O throughput."

MinnowBoard is an Intel Atom-based platform equipped with interfaces like SATA, Gigabit Ethernet, and PCI Express, and is suited for applications such as Network Attached Storage (NAS) and network security, Garman says (Figure 3). "Professional embedded developers working on commercial products will like the fact that the MinnowBoard is open hardware, and can be customized without having to sign any Non-Disclosure Agreements (NDAs)," he adds.

GizmoSphere has also entered the maker market with x86 process technology, including an AMD Embedded G-Series APU capable of 52.8 GFLOPS at under 10 W on their Gizmo board. Part of the Gizmo Explorer Kit, the package "was designed to be flexible so that designers can customize the system according to their specific development goals," says Kerry Brown, Vice President and Chief Operations Officer, Sage Electronic Engineering.

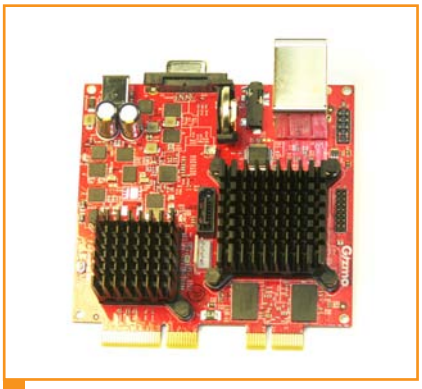

Figure 4 | The Gizmo board leverages an AMD Embedded G-Series APU to provide 52.8 GFLOPS of performance under 10 W.

"Gizmo was created to provide a flexible, multipurpose development board to serve the unique needs of embedded developers," Brown says. "There [is] a wide range of interfaces on the Gizmo board, including PCIe, I²C, USB, and GPIO … to enable each developer's unique design goals (Figure 4). The companion Explorer board provides a sea of holes for prototyping and debugging. The kit can be used by hobbyist developers who want to tinker at home on the weekends, or by entrepreneurs and small businesses developing their next product."

From kindergarten to Kickstarter

Millions of maker boards have shipped to date, mostly as an extension of a thriving young DIY community. However, as open hardware platforms continue to surface as alternatives for commercial product development, it is possible that a generation of embedded engineers is being brought up by maker.

"I describe the target of the Beagle as kindergarten to Kickstarter," Kridner says. "The next billion-dollar idea may not be from someone whose primary job function is writing firmware and Linux drivers and is an electrical engineer or computer science major, but they may be inspired by what they can do with technology. And we want to give them the tools to go out and avoid any barriers – to take their idea, rapidly prototype it, go to Kickstarter, and make their first million." ECD

Reader Resources

ARTICLE:
Case Study: Challenges in incarnating a credit card sized SBC
http://embedded-computing.com/articles/case-card-sized-sbc/

E-CAST:
BeagleBone Black – BeagleBoard.org's $45 1GHz Linux computer
http://opsy.st/BeagleBoneBlackEcast

PRODUCTS:
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Central Standard Timing calls its CST-01, which uses a curved electrophoretic display, the world's thinnest watch. Photo courtesy of Central Standard Timing and E Ink Holdings

'Smart' surface EPD displays raise demanding applications to a new level

By Giovanni Mancini

Advances in technology are enabling a new generation of embedded systems products with features and capabilities previously not possible. A common theme is that these products need to be mobile, consume very little power, and provide a richer set of information to the consumer. However, this is posing a big challenge to the display industry as embedded designers are faced with having to deliver information in places and on surfaces commonly not thought possible and in environments that are very harsh for displays. This is so much so that the display can become the limiting factor in product design. But it doesn't have to be. Electrophoretic Display (EPD) technology has caught up with the imagination of the embedded design community, and companies can now easily enable "smart" surfaces.

Embedded system designers have a host of new options when designing innovative products for consumers, thanks to recent advances in digital technology. Designers are no longer bound by the constraints imposed on them by the power requirements or durability of previous generations of electronic components. As a result, embedded systems today are enabling consumer products with features and capabilities previously not feasible; Electrophoretic Displays (EPDs) are a perfect example of this. EPDs are ubiquitous in eReaders, which were rather uncommon as recently as five years ago. Because of their unique properties, EPDs have created an entirely new consumer electronics product category.

Today, EPDs are appearing in applications far removed from eReaders. Why? Because advances in electrophoretic technology let designers create low-power, flexible displays in unique shapes and sizes using durable plastic substrates instead of glass. The low power consumption coupled with the light weight, ruggedness, and conformability of EPDs is enabling consumer products with information displays that were not thought possible only a few years ago. This is not a surprise as a recent report from IHS shows that the global shipments of flexible displays are projected to reach 792 million units by 2020, up from 3.2 million in 2013.

Display technology is catching up with the creative imagination of the embedded design community, allowing companies to enable "smart" surfaces more easily than ever before. Now, quality displays have superior resolution, color quality, white balance, brightness, reflectivity, screen longevity, power consumption, portability, and compatibility. These displays are being used on smartphones, wristwatches, electronic shelf labels, digital displays, and more – but what about the surfaces we don't think about like the controls and power settings of a power drill, or medical triage bandages that provide caregivers with instant access to patient life signs? The potential uses for flexible displays

> The potential uses for flexible displays are limited only by the imagination of designers. And in today's age compared to years past, this is limitless.

are limited only by the imagination of designers. And in today's age compared to years past, this is limitless.

The past: Display limitations

Today's applications are far more advanced than they were 20 years ago, which is why there is such a need for high-quality, durable, energy-efficient displays. Even as recently as 10 years ago, the power consumption and size of the electronics were often the limiting factors in types of consumer products that could be realized or use embedded systems. With the continued advances in reducing microelectronic components and power consumption, the display was increasingly becoming the limiting factor. Not only are today's microelectronic devices much smaller, they have orders of magnitude more compute power and can easily be networked to other mobile devices for access to databases for storing or retrieving information. The expectation of the end consumer is to be able to see the information where it is relevant, wherever they may be, not where it is convenient to the electronics or the display.

The constraints imposed by typical LCDs have been a barrier to this. The power needs require that they be close to power sources or large batteries. The use of backlights requires that they could only be used in environments that have strong or direct lighting, such as outdoors. The weight and fragility resulting from the use of glass limits their mobility. As a result, consumer products using LCDs had to conform to the limitations imposed by the LCD or not use a display at all.

Consumer products require high-quality, durable displays capable of sharing information in an easy-to-view, efficient manner. Unlike the clunky displays on calculators or watches of years past, today's energy efficient, paper-like electrophoretic displays offer greatly increased readability, making them an enabling option for many diverse electronic products.

How it works: Optimal design, quality

The magic behind the electrophoretic (or electronic ink) display is based on the principle of electrophoresis. The electronic ink is made up of microcapsules that contain positively charged white particles and negatively charged black particles (Figure 1). When a positive or negative electric field is applied across the microcapsule, corresponding particles with the opposite charge move to the top of the microcapsule where they become visible to the viewer, making that area appear white or black. These microcapsules are laminated onto a film called a Flexible Plastic Laminate (FPL). The FPL in turn is cut to the required size and shape and laminated to a Thin Film Transistor (TFT) array or a backplane with predefined segments to create an ePaper display or EPD.

What gives these displays their low-energy profile is what happens when the electric field is removed. The charged particles will move toward the top or bottom of the capsule as long as the electric field is present. When the field is removed or turned off, the charge on the particles causes them to "stick" together and stay where they were when the field was removed. This is similar to the skin effect of water. Because the particles stop moving, the display is persistent or bi-stable. In other words, the image will remain visible until it is changed just as if it had been printed on paper. Hence the term *electronic paper* or *ePaper*. The display will not consume any power until the image needs to be changed. This is in contrast to LCD devices, which continue to draw power because the display

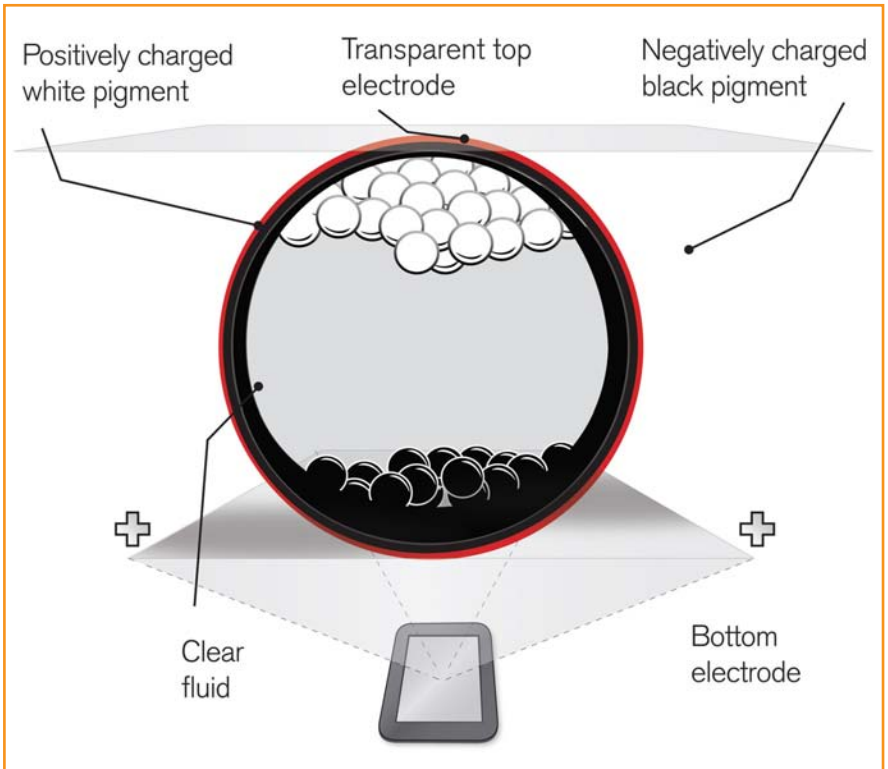

Figure 1 | Microcapsules that are the diameter of a human hair sit between a pair of electrodes in an electrophoretic display.

needs to be refreshed at a minimum rate of 30 times a second to maintain a flicker-free image.

EPD technology is one of the most reliable on the market, boasting low power consumption and a thin, lightweight design with a wide viewing angle. The displays can reduce the size and weight of a device as well as the space and weight needed for batteries. Although there are many factors that control the actual value, an EPD display can require as little as 5 $\mu W/cm^2$ of active area being switched. That is about 36-40x less than LCDs. The product designers can trade off between extra long battery life versus a much smaller and lighter battery. For example, an EPD-based eReader will go for a month. In contrast, an LCD-based tablet might last 1-2 days using a comparable battery.

These features make ePaper ideal for applications where the weight and thickness of the display and its components are critical, a perfect storm for portable electronics including smartphones, watches, medical devices, and other wearable technology. With a long lifespan, electrophoretic displays are the right technology for applications where wear and tear is a factor, because of the flexibility and durability of the ePaper.

The future is today: Flexible displays

Gone are the days when displays were only one shape: rectangular. EPDs such as E Ink's Mobius display use a plastic TFT substrate making them even lighter, conformable to curved surfaces and nonrectangular shapes.

The staid, old displays of yesterday are now replaced with durable, flexible technology that is lighter and more energy efficient. These EPD displays consume less power, allowing consumers to get more use from their favorite devices. How is this possible? EPDS are highly reflective. They work exactly the same way paper does by reflecting the ambient light. There is no need for an energy-consuming, constantly on backlight in the display. In some mobile devices, the backlight can account for more than 40 percent of the overall energy consumption. This property extends the battery life of devices using EPD technology, allowing devices such as smartphones, smart cards, and electronic shelf labels to see battery life extended by 30x or longer, compared to a device using the same battery with a traditional backlight display.

Apart from consumer products, this technology is currently being used or being designed into products such as digital signs, medical devices, information kiosk applications, and electronic shelf labels for retail stores.

Furthermore, research shows displays have the power to dramatically increase consumer appeal. EPDs can enhance the design and functionality of many handheld devices, including automotive key fobs, wristwatches, and remote controls. For example, Central Standard Timing's CST-01 watch uses a segmented flexible display (see this article's lead-in photo). The thinness of the display technology enabled Central Standard Timing to design what they call the world's thinnest watch at only 0.8 mm thick. The energy efficiency allows the watch to run for 1 month off a charge lasting only 10 minutes.

Accordingly, display companies can now take their designs to the next level through the technological innovation made possible by today's superior electronic components. Imagine a future where displays are built right into sporting equipment, instruments, or water bottles. While these displays have been in mass production for the past several years, only a few designers have taken advantage of the full range of benefits offered through this display technology, in particular the ability to shape the display around the device. With the demand for smart, lightweight, and low-power technologies skyrocketing, electrophoretic displays will continue to appear in more innovative and novel places. If you can dream it, now you can build it. ECD

Giovanni Mancini *is the Director of Product Management and Head of Marketing at E Ink Holdings. Since joining E Ink in 2010, he has been instrumental in defining the next generation of ePaper from E Ink. His 25 years of experience in the electronics industry include leading engineering and marketing teams in electronic design automation, communications, signal processing, and semiconductor products. Previously, Giovanni held management positions at Bell-Northern Research, Cadence Design Systems, Mentor Graphics, and MathWorks. Giovanni holds Bachelor of Electrical Engineering and Master of Electrical Engineering degrees from McGill University in Montreal.*

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Strategies

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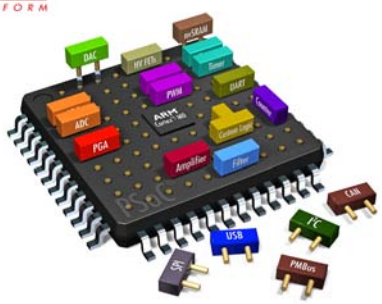

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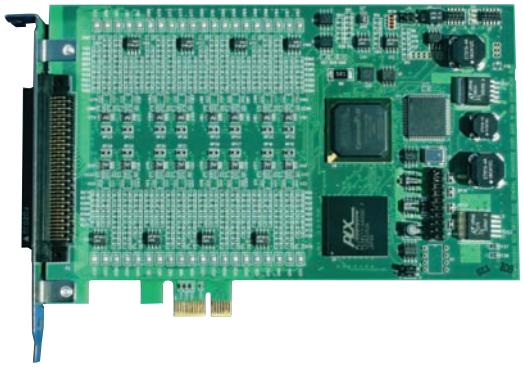

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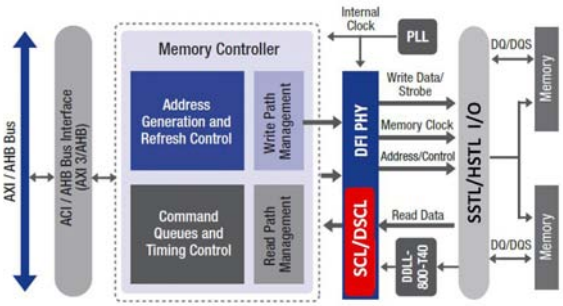

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IGLOO®2 FPGA

Microsemi's IGLOO®2 FPGAs, targeted at the cost-optimized FPGA market, integrate fourth generation flash-based FPGA fabric and high performance communications interfaces on a single chip. IGLOO2 devices offer best-in-class feature integration coupled with the lowest power, highest reliability and most advanced security in the industry. For cost-optimized FPGAs below 150K LEs, IGLOO2 provides a high level of I/O and SERDES integration – which is necessary for I/O expansion, bridging, system management and co-processing – allowing customers to use smaller devices for I/O expansion and bridging solutions. This, coupled with the need for only two power supplies and no external configuration devices, reduces overall system cost and board complexity.

In addition to many mainstream FPGA features, IGLOO2 is the only FPGA with hardened memory subsystem and only non-volatile and instant-on mainstream FPGA. The IGLOO2 FPGA family delivers the industry's lowest static power by providing 10 times lower static power than comparable FPGAs by utilizing a unique Flash*Freeze real-time power management mode. To protect valuable customer IP, the SEU-immune FPGA family includes state-of-the-art design security. Extended temperature ranges of up to 125C Tj are offered.

FEATURES

The IGLOO2 family delivers best-in-class integration, power, reliability & security and mainstream FPGA features including:

- highest number of GPIOs for any given density node for 5G SERDES FPGAs;
- highest number of 5G transceivers density;
- highest number of PCI compliant 3.3V I/Os in the industry; and
- highest number of PCIe endpoints.

Microsemi Corporation | 949-380-6100

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MERCURY SYSTEMS™

www.mrcy.com/HDS6502

Ensemble HDS6502: Rugged, OpenVPX™ High Density Server (HDS) data/graphics processing module

OpenVPX systems operating Serial RapidIO Gen 2 or 10 Gigabit Ethernet data plane architectures can process data and graphic information faster than ever with the HDS6502 (High Density Server) module. HDS6502 is a potent integration of Mercury packaging/cooling technology, implementation of Mercury firmware and the latest Intel processors. Collectively, this leverage of Mercury and Intel solutions produces a singularly robust and powerful commercial processing engine.

Mercury's POET (Protocol Offload Engine Technology) firmware implemented data plane bridge, dual 2.4GHz 4th Generation Quad-core Intel i7-4700EQ processors with native AVX2 (Advanced Vector Extensions 2.0), on-die GT2 GPUs, and Gen 3 PCIe interfaces are supported with 16GB 1600MHz DDR3 SDRAM of system memory to produce a unique combination of processing power, speed and future upgradability.

POET itself underscores a unique feature of this I/O intense module, its ability to upgrade itself or even change data plane fabric completely without affecting any hardware. This data/graphics processing engine is an excellent upgrade option for existing subsystems and a versatile building block for novel high-performance subsystems.

Low I/O latency and reduced module power consumption are gained from the single-die cache coherent memory architecture between the CPU and GPU resources. This is a required characteristic of multidimensional computing applications requiring high throughput, determinism and low latency, such as SIGINT, IMINT, RADAR, EO/IR and large data/graphics rendering with seamless display integration.

The Intel Core i7-4700EQ with AVX2 support and an on-die GT2 GPU enables high volume graphic rendering and simultaneous data manipulation of real-time vector-based information, which is characteristic of signal and image processing-intensive applications. OpenCL support promotes a heterogeneous ecosystem which, packaged within a rugged module, is an ideal cornerstone for embedded system upgrades and new computing-intensive applications alike.

For detailed specifications and general product information, visit www.mrcy.com/HDS6502 or contact Mercury at (866) 627-6951 or info@mrcy.com.

FEATURES

Module:

- Rugged, 6U, single-pitch, OpenVPX data/graphics processing module with built-in Gen 2 Serial RapidIO or 10Gigabit Ethernet fabric compatibility. Support for InfiniBand™ and 40 Gigabit Ethernet-based modules will follow

Processors:

- Dual 2.4GHz 4th Generation Intel i7 Quad-core mobile (Haswell mobile) CPUs (i7-4700EQ)
- On-die GT2 GPU, coherent 128MB cache (DRAM), AVX2, PCIe Gen 3, OpenCL

Memory:

- System 8MB DDR-1600MHz per processor (16GB total)
- Local SATA NAND flash memory: 8GB
- BIOS 16MB (per CPU) NAND flash memory

Host adaptor:

- FPGA: Altera Stratix 5SGXA7
- POET implemented Gen 2 Serial RapidIO and 10Gigabit Ethernet. Future POET upgrades to InfiniBand and 40Gigabit Ethernet

I/O:

- Serial RapidIO Gen 2, Gigabit Ethernet, SATA, USB 3.0, PCIe Gen3 and multiple graphic ports

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www.amd.com/g-series

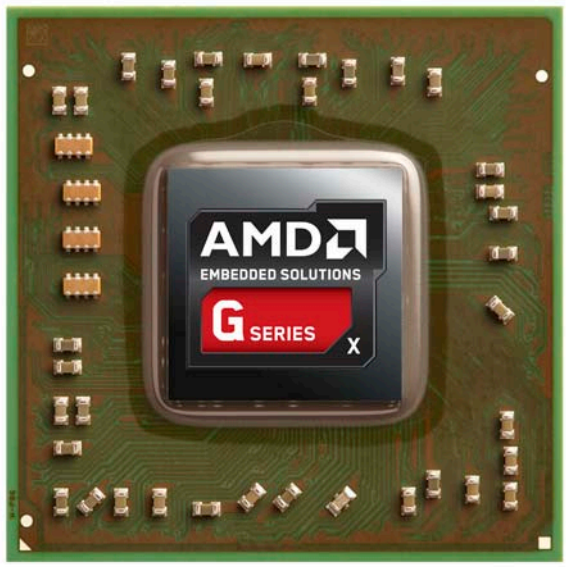
AMD Embedded G-Series System-on-Chip (SOC)

On April 23, AMD announced the new AMD Embedded G-Series System-on-Chip (SOC) platform, a single-chip solution based on the AMD next-generation "Jaguar" CPU architecture and AMD Radeon™ 8000 Series graphics. The new AMD Embedded G-Series SOC platform further signifies a strategic push to focus on high-growth markets outside the PC industry, with an emphasis on embedded systems. The announcement was made at this year's DESIGN West expo, where AMD was awarded the Hardware Embeddy™ award by VDC Research for the AMD G-Series SOC.

The AMD Embedded G-Series SOC platform sets the new bar for SOC design, offering up to 113 percent improved CPU performance compared to the prior generation AMD Embedded G-Series APU, and up to a 125 percent advantage compared to the Intel Atom when running multiple industry-standard compute intensive benchmarks[1]. For embedded applications, the new platform also enables parallel processing and high-performance graphics processing, yielding up to a 20 percent graphics improvement over the previous AMD Embedded G-Series APU and greater than 5x advantage over Intel Atom when running multiple industry-standard graphics-intensive benchmarks[2].

The AMD G-Series SOC combines dedicated resources that enable exceptional performance with shared resources to help reduce power consumption and die space, and provides developers the flexibility to leverage the same board design and software stack for a variety of applications due to the scalability of the new SOC design.

The AMD Embedded G-Series SOC supports Windows Embedded 8 and Linux, and is designed for myriad embedded applications including industrial control and automation, digital signage, electronic gaming systems, SMB storage, IP-TV, medical and network appliances, set-top boxes and more. AMD began shipping the AMD G-Series SOC platform with general availability in the second quarter of 2013, followed by a comprehensive ecosystem of industry-leading embedded solution providers supporting and/or announcing market-ready products powered by the AMD Embedded G-Series SOC.



FEATURES

- Enterprise-class Error-Correction Code (ECC) memory support
- Industrial temperature range of -40°C to +85°C and available with dual or quad-core CPUs
- Discrete-class AMD Radeon™ GPU
- I/O controller

[1] AMD GX-415GA scored 209, AMD G-T56N scored 98, and Intel Atom D525 scored 93, based on an average of Sandra Engineering 2011 Dhyrstone, Sandra Engineering 2011 Whetstone and EEMBC CoreMark Multi-thread benchmark results. AMD G-T56N system configuration used iBase MI958 motherboard with 4GB DDR3 and integrated graphics. AMD GX-415GA system configuration used AMD "Larne" Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom D525 system configuration used MSI MS-A923 motherboard with platform integrated 1GB DDR3 and integrated graphics. All systems running Windows® 7 Ultimate for Sandra Engineering and Ubuntu version 11.10 for EEMBC CoreMark. EMB-37.

[2] AMD GX-415GA scored 864, AMD G-T56N scored 724, and Intel Atom D525 scored 162, based on an average of 3DMark06 1280x1024 and PassMark Performance Test 7.0 2D Graphics Suite benchmark results. AMD G-T56N system configuration used iBase MI958 motherboard with 4GB DDR3 and integrated graphics. AMD GX-415GA system configuration used AMD "Larne" Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom D525 system configuration used MSI MS-A923 motherboard with platform integrated 1GB DDR3 and integrated graphics. All systems running Windows® 7 Ultimate with DirectX 11.0. EMB-38.

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TeamF1

www.TeamF1.com

SecureF1rst Security Gateway Solution

TeamF1's SecureF1rst Security Gateway Solution is a comprehensive turnkey software package combining a rich set of field-proven, standard components with an array of customizable options to provide OEMs/ODMs the ultimate in product flexibility. It enables OEMs to build fully integrated UTM devices allowing users to carve security zones and manage security policies in a centralized manner. A member of TeamF1's SecureF1rst line of innovative prepackaged solutions, SecureF1rst SGS allows OEMs/ODMs to deliver leading-edge VPN/firewall/IPS/Gateway AV devices to the small-to-medium businesses (SMB) market in record time at far less risk than traditional development approaches. Devices built around SecureF1rst SGS offer end-customers ironclad, advanced networking security; easy-to-use device management features; and multiple gateway options and can also be customized, or "branded" with unique graphical user interfaces (GUIs). With SecureF1rst SGS, OEMs can build gateways between multiple LAN, WAN, and DMZ interfaces – plus any other security zones – of several different types where WAN interfaces can be DSL, 3G/LTE, or Ethernet, among others.

FEATURES

- Less risk for OEMs through proven TeamF1 SecureF1rst software components and common framework's comprehensive set of features enabling full customization of devices
- Extensive support for advanced 802.11 standards for security, QoS, mobility, and roaming
- Advanced protocols such as IPsec, VPN, SSL (including OpenVPN compatible SSL), etc. provide ironclad networking security features
- Branding options offer a cost-effective, customized look and feel
- Advanced device management through SNMPv3, CLI, TR-069, and easy-to-use web interface, etc., with the ability to dynamically extend router functionality through TeamF1 and third-party extensions/plug-ins

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Contact: Sales@TeamF1.com
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Development aids: Software licensing

embedded-computing.com/p9911785

SafeNet | SENTINEL SOFTWARE MONETIZATION SOLUTIONS

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SafeNet's Sentinel Embedded Software Monetization Solutions

SafeNet's Sentinel Embedded Software Monetization Solutions provides device and equipment manufacturers with all the tools needed to effectively protect their products from tampering and reverse engineering while also opening up an entirely new world of packaging and opportunities to maximize profitability.

FEATURES

- Tailored specifically to manage software embedded within any hardware
- Protect and control the software that runs your valuable hardware
- Preserve product and brand integrity by preventing tampering and reverse engineering
- Deploy easily, increase revenue, reduce operating costs, improve customer experience
- Implement software licensing to gain control and understanding of intellectual property

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EDA: Modeling

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intel

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Intel® CoFluent™ Studio

System designers use Intel® CoFluent™ Studio for hardware/software system modeling and simulation in consumer devices, communication, transportation, industrial electronics and more.

Intel CoFluent Studio translates graphical diagrams into SystemC for system modeling and validation. The graphical capture process simplifies transaction-level model creation and SystemC generation. Intel CoFluent Studio helps developers exchange design ideas, run "what-if" scenarios, and optimize systems before building prototypes.

Intel CoFluent Studio v5.0 supports new sets of platform components, with richer descriptions and a more natural connection to physical components. Intel CoFluent Studio v5.0 also supports new subsystem, processor, bus memory, router, master/slave interface, wire, and scheduler models. New mapping concepts in Intel CoFluent Studio offer more flexibility and better support for complex architectures.

FEATURES

Intel® CoFluent™ technology is a virtual system modeling and simulation environment that enables predictable designs and lowers development costs:

- Identify hardware and software design constraints prior to development
- Predict system behavior and optimize performance
- Simplify Electronic System Level (ESL) design and Transaction-Level Modeling (TLM)
- Accelerate use-cases models and creation of IP

Intel CoFluent Studio v5.0 includes support for the latest SystemC 2.3 standard and native 64-bit simulation. Intel CoFluent Studio v5.0 also includes native SystemC TLM-2.0 Approximately Timed (AT) code generation and simulation with automatic and extensible generated memory address map as well as improved multiprocessor, multi-core and multi-OS simulation.

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Contact: cof-info@intel.com

Annapolis Micro Systems

www.annapmicro.com

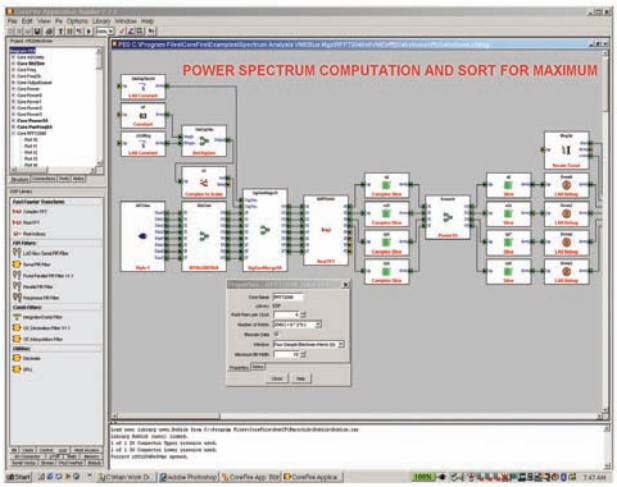
CoreFire

Develop your application very quickly and easily with our **CoreFire™ FPGA Application Builder**, which transforms the FPGA development process, making it possible for theoreticians to easily and quickly build and test their algorithms on the real hardware that will be used in the field.

Use CoreFire's graphical interface to drag and drop library elements onto the design window. Modify your input and output types, numbers of bits, and other core variables by changing module parameters with pull-down menus. The modules automatically provide correct timing and clock control. Insert debug modules to report actual hardware values for hardware-in-the-loop debugging. Hit the Build button to check for errors and as-built core sizes and to build an encrypted EDIF file. Use the Xilinx ISE tool to place and route each FPGA design. Modify and use the jar file or the C program created by the CoreFire Build to load your new file into your WILDSTAR and I/O card hardware. Use the CoreFire Debugger to view and modify register and memory contents in the FPGA and to step through the dataflow of your design running in the real physical hardware.

Our extensive IP and board support libraries contain more than 1,000 proven, reusable, high-performance cores, including FIR and CIC filters, a channelizer, and the world's fastest FFT. We support conversion between data types: bit, signed and unsigned integers, single precision floating point, integer and floating point complex, and arrays. A few of the newly added array cores include array composition and decomposition; slice, parallelize, serialize, repack, split, merge, reorder, rotate, and concatenate transformations; matrix math, sliding windows, and convolutions.

The combination of our COTS hardware and CoreFire enables our customers to make massive improvements in processing speed while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- Dataflow-based – automatically generates intermodule control fabric
- Drag-and-drop graphical interface
- Work at high conceptual level – concentrate on solving algorithmic problems
- Hardware-in-the-loop debugging
- More than 1,000 modules incorporate years of application experience
- Reduce risk with COTS boards and software
- Save time to market
- Save development dollars
- Easily port completed applications to new technology chips and boards
- Training and custom application development available
- Achieve world-class performance; WILD solutions outperform the competition
- Annual node locked or networked license; includes customer support and updates

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Contact: wfinfo@annapmicro.com

www.kozio.com/VTOS

VTOS™

A Complete Software Defined Test Platform

VTOS support for 4th Gen Intel® Core™ Processors (Haswell), 3rd Gen Intel® Core™ Processors (Ivy Bridge), 2nd Gen Intel® Core™ Processors (Sandy Bridge) and Atom.

Embedded system board test has reached a tipping point, where traditional In-Circuit Test (ICT) and boundary scan no longer provide enough coverage to determine whether a PCBA will operate correctly farther down the production line, or in the field. VTOS™ provides a versatile platform for running complete software defined test (SDT) suites on the embedded system PCBA's own processor, testing the system from the inside out, without hardware design changes. This provides far better coverage than previous methods, along with detailed information and diagnostics on any failures found.

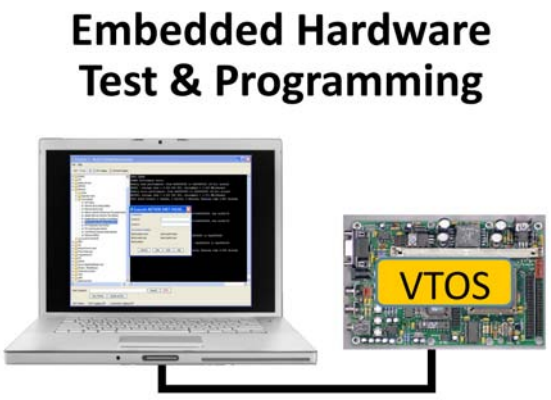
VTOS™ includes a rich set of high level subsystem tests, and support for a wide variety of buses. It can be extended to support new hardware and/or additional SDT elements, either by Kozio's services team, or by your own engineering team using scripting or the available VTOS™ SDK.

Kozio's VTOS™ solution provides fast boot time, small size, flexible device programming features, and scriptable configurability, making it the product of choice for the test of processor-based PCBs in manufacturing.

VTOS™ is also a powerful debug tool for engineering prototypes, and failed units from the manufacturing line.

VTOS™ starts out as a universal binary package for your processor/SOC family. Using VTOS™ Builder, Kozio or your engineering team can configure the package in minutes to conform to your particular hardware design, without compiling. The resulting binary file can be run from your bootloader (U-boot, VxWorks, etc.), or loaded via JTAG.

The cooperative multitasking environment used by VTOS™ is ideal for hardware debugging and fault isolation, since a particular test process is never interrupted by unrelated tasks.



FEATURES

VTOS™ has a small footprint (typically less than 2 MB) and boots very quickly (less than 5 seconds), and it contains many services and features that will accelerate your verification and test processes:

- Connectivity over Serial, USB and Ethernet
- Command line interface
- Instant command creation using scripting
- Automatic memory mapping of processor-bus devices (Local, SPI, I2C, PCI)
- 6 levels of execution tracing for fault isolation
- Fast TFTP file transfers
- Built-in file system (for scripts, FPGA code, device serialization, custom test patterns, etc.)
- Device programming support (Flash, FPGA, CPLD, SPI Flash, etc.)
- Extensive subsystem test library for full data path testing and verifying data integrity
- Available SDK For custom extensions

Production Benefits

- Easily increase your test coverage from today's 30% to 60% and higher with no hardware design changes
- Choose your integration option (API, CLI, GUI) to easily integrate with your existing operator interfaces
- Cut production line boot time and test time saving minutes and dollars per unit under test
- Avoid the scenario where a unit under test passes ICT and/or boundary scan but will not boot
- Quickly script new tests, customize tests, and define test cases that fit your manufacturing process
- Program Flash/FPGA/etc. from the processor, saving minutes and reducing the risk of faulty device programming
- Perform device initialization and serialization under your full control
- Universal fault reporting provides a clear indication of which component failed, and post failure tracing provides detailed diagnostics

Kozio, Inc. | 303-776-1356

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HAPS-70: FPGA-Based Prototyping System

HAPS-70 series is an easy-to-use and cost-effective FPGA-based prototyping system. Enhancements to the HAPS system technology, as well as the use of the latest Xilinx Virtex®-7 FPGAs, provide designers using the HAPS-70 series with superior capacity, performance, and advanced use modes. The HAPS-70 series accelerates early software development, hardware/software integration and system-level validation at near-real-time run rates, using at-speed real-world interfaces.

http://www.synopsys.com/Systems/FPGABasedPrototyping/haps70/Pages/default.aspx

FEATURES

- Modular system architecture scales from 12 - 144M ASIC gates to accommodate a range of design sizes, from individual IP blocks to processor subsystems to complete SoCs
- Enhanced HapsTrak 3 I/O connector technology with high speed time-domain multiplexing delivers up to 3x performance improvement in data throughput over traditional pin multiplexing
- System definition and bring-up utilities speed hardware assembly and ensure the prototype's electro-mechanical integrity
- Design planning tools reduce time-to-prototype by 2-3 months, streamlining the transition from block level IP validation to full system integration
- Improve debug efficiency with 100x greater visibility
- Advanced use modes including co-simulation, transaction-based verification, and hybrid prototyping
- HAPS-70 FPGA-based prototyping systems are available in nine model variants

Synopsys, Inc. | 800-541-7737

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Blue Pearl Software

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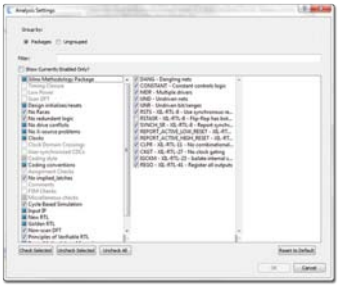
Analyze RTL™

Blue Pearl's Analyze RTL™ combines the ease-of-use methodology and extensive analysis of super-lint tools with the power of formal verification into a single high performance, high capacity design checking solution. With Blue Pearl, you get a unique combination of powerful built-in checks and formal analysis that gives you the most comprehensive and powerful static design checking capability available. Deploy Blue Pearl early and eliminate complex design errors at all stages of your design implementation cycle and drastically reduce the amount of effort you spend finding bugs later using time-consuming traditional test-bench methods.



FEATURES

- Supports any combination of Verilog, SystemVerilog and VHDL
- Enforce your design methodology & customize rules, e.g. Reuse Methodology Manual, Xilinx Methodology Checklist
- Automatically extracted design properties including:
  Three-state bus contention, Floating buses, Register initialization, Set-reset register conflicts
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Select from OVER 1,000 embedded software solutions with Zero Royalty, and Flexible Licensing.

By consolidating a large number of software options that support the ARM architecture within a single domain, the Embedded Software Store will help developers tackle the challenges presented by increased software and SoC design complexity.

- *Accelerate your time-to-market via one-stop shop*
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Advanced Embedded Software

HCC has a unique position in the microcontroller market as a company focused on the development of software for embedded peripherals with no dependence on a single, proprietary operating system. Specializing in middleware for communications and storage, the company has become a leader in high value, reusable software components.

USB Device, Host & OTG: USB solutions from HCC are mature, widely used stacks that can support almost any embedded USB configuration. The USB suite provides highly efficient basic class drivers like HID, Hub and Mass Storage. Support is also available for more sophisticated configurations requiring Isochronous Transfer, Composite Devices and multiple USB interfaces.

Flash Management: HCC has developed robust fail-safe flash management software and file systems with support for hundreds of different kinds of memory types, interfaces and controllers. All NAND and NOR flash can be integrated in a completely fail-safe solution.

File Systems: HCC's highly optimized range of file systems is designed to meet the performance requirements of any application. Using HCC file systems will make your application more reliable and will help to protect your customer's data.

MISRA Compliant TCP/IP: The key to a successful embedded application is to use high-quality software that is verifiably developed and ensures a stable, low-risk development platform. HCC's IPv4 & IPv6 stacks were developed with a rigorous approach to quality using a strongly typed subset of the 'C' language.

eTaskSync Verifiable Kernel: HCC's eTaskSync is a no compromise, MISRA-compliant scheduler used for running tasks in an embedded system. eTaskSync is delivered with detailed MISRA compliance reports, MC-DC analysis and 100% object and statement code coverage tests.

Bootloaders: HCC has developed a range of high quality completely fail-safe bootloader solutions that will fit almost any scenario. The bootloaders can boot using flash, USB or serial interfaces using minimal resources on the target controller. All bootloaders have the option to add an advanced AES encryption module for secure data transfer. It is possible to configure all bootloaders to support multiple, complex interfaces.

FEATURES

- **Future Proof Software:** Every new software development at HCC conforms to a completely flexible and 'future proof' Advanced Embedded Framework (AEF). HCC believes that some of the foremost challenges in embedded development are in dealing with the complexity and incompatibility of peripherals and that legacy software should not be constrained by a single RTOS or processor ecosystem. All of HCC's software components are developed as completely target independent modules, meaning they are independent of RTOS, MCU, hardware, compiler, endianess or tool chain. HCC customers can easily switch RTOS, compiler or MCU in any future project whilst using the same reliable peripheral software. All software is available as a source-code delivery, tested with the customer board, rtos and toolchain, minimizing integration effort.

- **RTOS Abstractions:** RTOS abstractions are available for the following systems: CMX RTX, eCOS, emBOS, EUROS, FreeRTOS, Keil RTX, Quadros RTXC, ThreadX, µC/OS-II, and many others. Importantly, for custom schedulers and super loops, HCC offers an abstraction for 'No RTOS'. We also offer our own eTaskSync, a small cooperative scheduler, which is designed to handle all processing and interface requirements of HCC middleware. This means that developers can choose our robust quality and outstanding performance irrespective of their legacy software.

- **Extensive Compiler Support:** Eclipse/GCC, IAR Embedded Workbench, Keil ARM Compiler, Freescale CodeWarrior, Atmel AVR Studio, TI Code Composer Studio, Mentor CodeSourcery, Atollic True Studio and many more.

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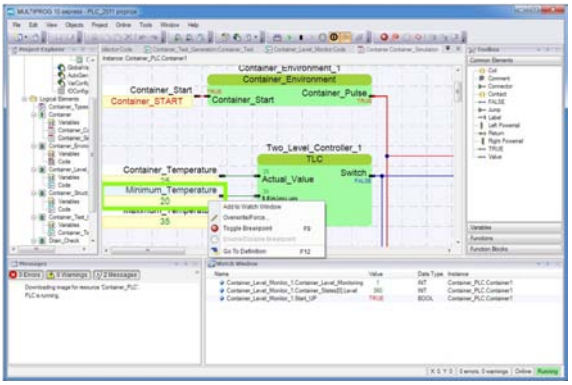
www.kw-software.com/en/iec-61131-control

IEC 61131 Programming and Runtime Systems

IEC 61131 is the international standard for PLCs. It standardizes programming languages, sets of instructions and structures for automation systems and enables easy porting and usage on different platforms. These support programmers in developing, testing, and commissioning their application. MULTIPROG takes care of the project management and helps with the management of fieldbuses, networks and peripheral components.

MULTIPROG is based on automation framework. This enables users to create automation tools in a modular way from a large number of components and combine the IEC 61131 programming system with other .NET-based tools at the same level. Automation Framework ensures consistent workflow and data exchange between modules. Embedded Common Language Runtime (eCLR) provides the functionality required to implement a complete IEC 61131 PLC for an embedded platform or standard PC. Our solutions support multitasking in the sub-millisecond range, jitter in the microsecond range, and extremely fast code execution in the sub-millisecond range.



FEATURES

- IEC 61131 runtime has real-time capability, high performance, and portability
- IEC 61131 runtime is hardware and software platform independent
- IEC 61131 solution provides full PLC functionality
- Easy to use programming tool for projects of all sizes
- Modular integrated platform for 61131 controls
- .NET based IEC 61131 programming system
- Fast and simple programming with high degree of integration
- CIL code opens the control for C# programming with Visual Studio

KW-Software | 734-205-5452

Contact: marketing-usa@kw-software.com
Twitter: twitter.com/KWSoftwareUSA • **Facebook:** www.facebook.com/KWSoftwareUSA
LinkedIn: linkedin.com/company/2534843?trk=tyah

Marketplace: Embedded Software Store (ESS) embedded-computing.com/p9914766

SoftRISC

www.SoftRISC.com

VoIP, VoWiFi and Multimedia Solutions

Today's communication solutions are predominantly implemented on a DSP processor. SoftRISC makes use of innovative techniques and strategies to implement such communication solutions on general purpose and RISC processors, such as the ARM architectures.

- Simpler designs when DSP is eliminated
- Savings in power – vital for handheld devices
- Savings in PCB real estate and Significant reduction in BOM cost

SoftRISC's focus is on software solutions for niche, DSP-less, high volume products that utilize Intel XScale based RISC processors architectures.

• Cell Phones, cell phone chipsets for GSM, PHS, CDMA, 3G with WiFi combinations • VoIP chipsets, IP phones, Soft phone clients (PDA, PC, etc.) • 802.11 VoWLAN (WiFi) phones • Handheld communication devices • Integrated Access Devices (IAD)/Residential Gateways (ATA) • Multimedia Chipsets & Set Top boxes, Mobile Multimedia Products • Toys with multimedia capabilities • IP-PBX

PRODUCTS

VoIP/FoIP Solutions and the associated Modules:

- **Voice Codecs**
  - G.711 A/μ, G.722, G.723.1, G.726, G.727, G.728, G.729AB, etc.
- **Wireless Codecs**
  - GSM-AMR-NB, GSM-EFR, -FR, -HR, etc.
  - AMR-WB (G.722.2), CDMA EVRC, etc.
- **Telephony**
  - G.168 LEC, G.167 AEC full duplex
  - G.169 ALC (AGC), JB/PLC, VAD/CNG
  - DTMF, CallerID, CPT, etc.
- **Fax Relay and Fax modem**
  - T.38 fax relay, V.17, V.21, V.27ter, V.29 fax modems
- **Call Control Stacks**
  - SIP, H.323, RTP, RTCP, MGCP

Multimedia Solutions and associated Modules:

- **Audio Codecs**
  - MP3, MP3-Pro, AAC, AACplus, AC3, WMA
- **Video Codecs**
  - MPEG4 (soon to be added – H.263, H.264, WMV, H.265)
- **Imaging Codecs (soon to be added)**
  - JPEG, JPEG 2000, Motion JPEG

SoftRISC Communication Solutions, Inc. | 408-333-9775 • 408-569-6500

Contact: RISC@SoftRISC.com

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stonestreet one

www.stonestreetone.com

Bluetopia®4.0

Bluetopia®4.0 is Stonestreet One's implementation of the upper layers of the Bluetooth protocol stack. The software is easily portable to all IC platforms and operating systems and is scalable in memory and processing throughput based on the exact needs of the application. Bluetopia®4.0 eases Bluetooth application development by providing a robust and flexible software development tool that implements the Bluetooth Protocols and Profiles above the Host Controller Interface (HCI).

FEATURES

- Fully qualified, supporting all Bluetooth Profiles
- Optimized for embedded applications and available on most operating systems and processors
- Proven Interoperability with excellent product and volume exposure, shipped in millions of devices worldwide
- Fully Thread Safe
- Fully Documented API Interface with direct support options available

Stonestreet One | 502-708-3526

Contact: jwargnier@stonestreetone.com

Operating systems: Java and tools

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SKELMIR
virtual machine technology

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CEE-J® Virtual Machines

CEE-J

CEE-J is Skelmir's fast, compact, proven, clean room virtual machine suite for hosting Java applications on embedded devices. Market-proven since 1998, CEE-J runs on more than 50 million devices worldwide and counting.

CEE-J is available and optimized for a vast array of operating systems, processors, and virtual machine specifications. It is ideal for resource-constrained embedded devices including: digital set-top boxes, onboard navigation and infotainment systems, Point-of-Sale and handheld wireless devices, routers and gateways, M2M, home automation, industrial automation, multifunction printers, and more.

Market Leading Graphics Capabilities
Skelmir's CEE-J graphics technologies are flexible, scalable and easily bring accelerated animations to user interfaces. Our solutions provide options for hardware acceleration, OpenGL and TrueType Font Engine support, a pluggable font engine architecture plus much more. Also available without graphics for headless devices.

FEATURES

- Full VM footprint with advanced graphics starting from 1.5MB
- Host apps written to PersonalJava through J2SE specifications
- Highly optimized interpreters and JIT compilers
- Supported OSs: Linux, VxWorks, WinCE, eCos, Nucleus Plus, STOS20/21, other proprietary RTOSs, Windows, Mac OS X
- Supported CPUs: MIPS, ARM, x86, PPC, SH4, ST & DSPs
- Flexible licensing plus porting, integration, and ongoing support by Skelmir's team of embedded experts
- Resource Management APIs for monitoring and controlling device memory and CPU usage
- Optimized solutions for OSGi implementations

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Operating systems: Linux and tools

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SYSGO
EMBEDDING INNOVATIONS

www.sysgo.com/products/elinos-embedded-linux/

ELinOS Industrial Grade Linux

ELinOS is a comprehensive development environment for embedded Linux software development. Unlike traditional Linux implementations, SYSGO's ELinOS is purpose-built for use in demanding industrial applications. SYSGO brings 15+ years of field expertise to make an embedded Linux offering well suited for real-world complex applications, and to back it up with world-class support.

Many BSPs corresponding to the most successful boards on the market are included as well as BSPs for virtualization engines such as QEMU and VMware, or for the other SYSGO flagship product PikeOS. Besides the widely used x86 version, ELinOS also supports PowerPC-, ARM-, MIPS-, and SH-platforms.

FEATURES

- Industrial Grade
- Integrated Eclipse-based development environment
- Real-time extensions support
- Target configuration editor
- Runs out of the box
- One-year support included
- Validated and tested for PPC, x86, ARM, SH-4, MIPS
- BSPs for major embedded boards and chip vendors included

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Operating systems: Linux and tools

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intel

www.yoctoproject.org

Yocto Project

"It's not an embedded Linux distribution – it creates a custom one for you"

The Yocto Project is an open source collaboration project that provides templates, tools and methods to help you create custom Linux-based systems for embedded products – regardless of the hardware architecture. It provides a common environment to end the fragmented development process of having to use different toolsets for each architecture. The free tools are easy to get started with, powerful to work with (including emulation environments, debuggers, an Application Toolkit Generator, etc.). Community-tested images include the Yocto Project kernel and build profiles supporting multiple architectures including ARM, PPC, MIPS, x86, and x86-64. Specific platform support is via BSP's layers. An Eclipse IDE plug-in and graphical user interface to the build system is also available.

yocto PROJECT

FEATURES

- Designed specifically for embedded development
- Common industry build system and core technology
- Build a complete Linux* system from source in about an hour
- Supported and governed by industry leaders such as Intel, TI, Wind River, Juniper Networks, Huawei, Sakoman Inc., Open Embedded, etc.
- Allows you to spend less time on base requirements and more on value add components
- Compliance program encourages interoperability

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LYNUXWORKS™

www.lynuxworks.com

LynxSecure • LynxOS 7.0 • LynxOS-178

RTOS and Secure Virtualization Software from LynuxWorks

LynxSecure

LynxSecure provides one of the most flexible secure virtualization solutions for use in Intel® architecture based embedded and computer systems, including the new 4th generation Intel® Core™ i7 and Core™ i5 processors. LynxSecure is based on separation kernel technology and was designed from the ground up with security as a key design goal. Adding virtualization to the separation kernel allows for multiple different guest Operating Systems (OSs), both real-time and general purpose, to run in secure domains on a single embedded system. LynxSecure 5.2 is the latest version of this established product and adds a new feature that offers real-time detection of stealthy advanced persistent threats such as rootkits.

LynxOS 7.0

LynxOS 7.0 is a deterministic, hard real-time operating system that provides POSIX-conformant APIs in a small-footprint embedded kernel. LynxOS provides symmetric multi-processing support to fully take advantage of multi-core/multi-threaded processors. LynxOS 7.0 contains new security functionality designed for M2M devices. LynxOS 7.0 supports the most popular reference targets in the Intel and PowerPC architectures, including the new 4th generation Intel® Core™ i7 and Core™ i5 processors.

LynxOS-178

LynxOS-178 is a safety-critical COTS RTOS that fully satisfies the objectives of the FAA DO-178B level A specification and meets requirements for Integrated Modular Avionics developers. LynxOS-178 delivers the security and real-time responsiveness needed for safety-critical systems and provides a low-risk path to DO-178B certification for developers to meet the technical requirements in the production of software for airborne systems.

LynxSECURE FROM LYNUXWORKS

LynxOS® 7.0

LynxOS®-178 FROM LYNUXWORKS

FEATURES

LynxSecure

- LynxSecure runs fully virtualized guest OSs such as Windows®, Solaris, Linux®, Android, and Chromium OS, requiring no changes to the guest OS
- LynxSecure offers the ability to run guest OSs that have Symmetric Multi-processing (SMP) capabilities
- Designed to maintain the highest levels of military security offering a MILS architectural approach

LynxOS 7.0

- LynxOS 7.0 provides the ability for developers to embed military-grade security directly into their devices
- LynxOS contains networking support for long haul networks with TCP/IPV4, IPV6, 2G/3G/4G cellular and WiMax communication stacks. It also supports the short-haul networks common with M2M applications such as 802.11 WiFi, ZigBee wireless mesh and Bluetooth
- LynxOS is a true fully preemptive hard real-time OS with a POSIX application interface

LynxOS-178

- LynxOS-178 provides full POSIX conformance, enabling developers to take advantage of the time-to-market and investment-protection benefits of open standards-based development
- Supported standards include ARINC 653 as well as support for the Future Airborne Capability Environment (FACE) standard currently under development
- LynxOS-178 is the only time- and space-partitioned RTOS that has been awarded the FAA Reusable Software Component (RSC) for DO-178B certifications

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Operating systems: RTOS and tools

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SYSGO
EMBEDDING INNOVATIONS

www.sysgo.com/products/pikeos-rtos-and-virtualization-concept/

PikeOS Safe and Secure Virtualization (SSV)

PikeOS, both hypervisor and RTOS, is the only SSV product on the market being certified or certifiable according to major safety and security standards. It provides an embedded systems platform where multiple virtual machines can run simultaneously in a secure environment.

The PikeOS technology combines safety, security, real-time and virtualization and it allows multiple operating systems APIs to run concurrently on one machine. PikeOS provides the widest range of "personalities" on the market. Its microkernel architecture allows it to be used in cost-sensitive, resource-constrained devices as well as large, complex systems. The simplicity, modularity, and compactness of the PikeOS design results in real-time performance that competes head-to-head with conventional proprietary RTOS solutions while offering innovations in platform independence.

FEATURES

- Based on separation microkernel
- Strict time and resource partitioning
- Combines paravirtualization and hard real-time
- MILS compliant
- Eclipse-based development environment
- Certified DO-178B, IEC 61508, EN 50128
- Certifiable DO-178C, ISO 26262, IEC 62304, CC EAL 5/6
- Can run POSIX, Linux, ARINC-653, RTEMS, Android, iTRON, AUTOSAR, RT Java, Ada, OSEK
- Available for PowerPC, x86, ARM, MIPS, SPARC V8/LEON, V-850, SH-4
- Multi-core support in SMP and/or AMP mode

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Processing and logic: Network, communication processors

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nabto

nabto.com/userver

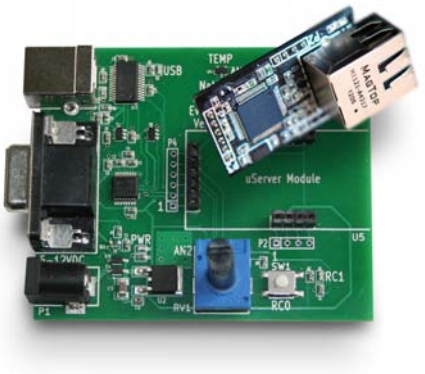
uServer

Based on Microchip's PIC18F67J60 microcontroller the Nabto uServer is a single chip solution with an ultra-compact form factor and a small price tag.

The microcontroller is preprogrammed with Nabto's bootloader allowing for firmware updates over Ethernet in a matter of seconds. A unique Nabto device ID and associated encryption key and a unique MAC address are also proprogrammed, reducing the production steps required when using the uServer in a customer device.

Using the freely available source code for the standard uServer application, custom applications may be created using the uServer either as a communications processor or as the system's main processor. For this the uServer exposes a 10 Mbit Ethernet interface, UART, SPI and I2C serial ports, digital I/Os and analog inputs. The uServer is available either as a single uServer module or as an evaluation kit. For the most compact design, the preprogrammed microcontroller of the uServer may be purchased separately.

Nabto's patented technology automatically creates a direct encrypted connection to a device behind a firewall without configuring the firewall. The connection is established via your standard browser/smartphone and you can use it to control a device or retrieve data in a web interface without firewall hassle.



FEATURES

- Preprogrammed with Nabto's NSLP server
- Preprogrammed device ID and encryption key
- Preprogrammed MAC address
- Preprogrammed with Nabto's bootloader
- Easy to integrate form factor
- Ethernet port (static IP or DHCP assigned)
- Open source code
- Compact form factor
- Based on Microchip's PIC18F67J60
- Also available as a single chip

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ADLINK TECHNOLOGY INC.

www.adlinktech.com

Express-HL COM Express® Type 6 Module

The feature-rich **Express-HL** is ADLINK's most advanced COM Express® Type 6 module, adopting the 4th generation Intel® Core™ processor (formerly codenamed Haswell) and delivering breakthrough CPU performance, stunning graphics, and improved security functions. Massive storage with high-speed data transfer interfaces, multiple display support, and enhanced graphics performance make the module well suited for intelligent systems innovations in retail, gaming, medical, transportation, defense, communications, and industrial automation applications.

The ADLINK Express-HL adopts the PICMG COM.0 rev 2.1 form factor with Type 6 pin-out, a forward-thinking pin-out specification enabling a robust feature set, which – with the introduction of the 4th generation Intel® Core™ processor family – can for the first time be fully utilized. The Express-HL supports the 4th generation Intel® Core™ 2- and 4-core mobile processors (i7/i5) with the Mobile Intel® QM87 Express Chipset and up to 16GB dual channel DDR3L SDRAM at 1600 MHz system memory. The 4th generation Intel® Core™ processors also offer a huge performance gain for floating-point-intensive computations by adding new instructions to Advanced Vector Extensions (AVX); these advanced instructions are especially beneficial for digital signal and image processing applications, such as medical imaging or radar.

To fully tap the benefits of 4th generation Intel® Core™ processors, the ADLINK Express-HL provides rich image output options, including LVDS, analog VGA, and multiple DDI (for DP or HDMI) originating directly from the CPU to provide a considerable increase in bandwidth and resolution over the previous generation Intel® Core™ processor. The new module can support three independent displays, all of which can be DDI (compared to past generation processor requirements of CRT/DDI or LVDS/DDI combinations). The Express-HL also provides a full set of high-speed I/O interfaces – with seven PCIe x1, four USB 3.0 ports, four USB 2.0 ports, four SATA-III (6GB) ports, and a PCIe x16 port for external video cards.

Exemplifying ADLINK's market-proven capabilities in designing Extreme Rugged™ and reliable platforms, the Express-HL module is provided with a SEMA (Smart Embedded Management Agent) controller, which monitors BIOS, power, temperature, watchdog, and board information. The module also supports a wide voltage input range of 8.5V~20V, and an operating temperature range from -40 to +85°C.

FEATURES

- 4th generation Intel® Core™ i7/i5 processor
- Mobile Intel® QM87 Express chipset
- Up to 16GB dual channel DDR3L SDRAM at 1600MHz
- Supports new instructions to Advanced Vector Extensions (AVX) for floating-point-intensive computations
- Three DDI channels supporting 3 independent displays via DDI
- Supports new mode known as stretching to enable virtual resolutions in three adjacent displays
- Supports daisy chaining with HDMI to simplify cabling in multiple display solutions
- Seven PCIe x1, one PCIe x16 (Gen3) for graphics (or general purpose x8/4/1)
- Four SATA 6 Gb/s, Gigabit Ethernet, four USB 3.0, four USB 2.0
- Extreme Rugged™ version with ECC DRAM; -40 to +85°C temperature range
- SEMA (Smart Embedded Management Agent) controller for monitoring of BIOS, power, temperature, watchdog, and board information
- Ideal for intelligent applications in retail, gaming, medical, transportation, defense, communications, and industrial automation

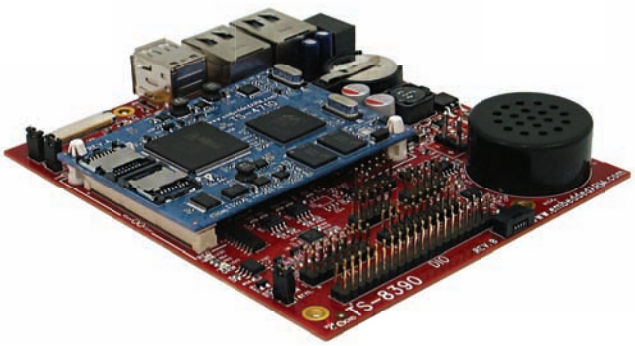
ADLINK Technology | 408-360-0200

Contact: info@adlinktech.com

Technologic Systems

www.embeddedARM.com

pricing starts at $139 qty 1 $99 qty 100



TS-4710 Computer-on-Module

The TS-4710 is a low profile, credit card sized TS-SOCKET Computer-on-Module that features a Marvell ARM9 PXA166 800MHz, or optionally a PXA168 1066MHz. The TS-4710 features a software programmable Lattice XP2 8K LUT FPGA, which, by default, implements several of our controllers such as our high speed SD interface, XUARTs, and SPI controller, and more. With 2 SD card sockets this board is able to utilize our DoubleStore technology, which makes the system extremely reliable. External devices can connect to the TS-4710 using Ethernet, USB host, I2C, SPI, UARTs, or GPIO. We also provide an external 16-bit bus that can be implemented over 21 DIO pins.

TS-SOCKET Computer-on-Module Standard

TS-SOCKET is an embedded computer standard that defines both a form factor and a connection pin-out and is based on two 100-pin low-profile connectors, allowing secure connection between a Computer-on-Module and a carrier board. TS-SOCKET Computer-on-Module features CPU, RAM, NAND Flash, SD Card socket, Ethernet MAC/PHY and requires a single 5 V power source. Peripherals can include USB host and device, I2C, CAN, GPIO, external bus, video, touchscreen, audio, SPI, and UART. All parts are soldered-on and no moving parts are used, ensuring embedded ruggedness and reliability.

TS-SOCKET Specs

- *75 mm x 55 mm (credit card sized)*
- *Dual 100-pin connectors*
- *Secure connection with mounting holes*
- *Common pin-out interface*
- *Low profile with 6 mm spacing*

A TS-SOCKET carrier board can be any piece of hardware, supplied by the customer or Technologic Systems, that interfaces with a Computer-on-Module through the dual TS-SOCKET standard connectors.

JUMP-START YOUR EMBEDDED SYSTEM DESIGN

The TS-SOCKET Computer-on-Modules securely connect to your custom carrier board, enabling drastically reduced design time and complexity. Start your embedded system design around one of our TS-SOCKET Computer-on-Modules to reduce your overall project risk and accelerate time-to-market.

TS-4710 FEATURES

- Up to 1066MHz CPU with 512MB RAM
- User-Programmable 8K LUT FPGA
- Boots Linux in under a second
- Robust DoubleStore Flash storage
- LCD video output to WUXGA
- USB2, Ethernet, PCIE, SPI, 6 UARTS
- Touch Panels available

TS-SOCKET BENEFITS

- Simplifies custom embedded systems
- Rapid design process gets products to market faster
- Several COTS carrier boards for evaluation and development
- Design your own carrier board or use our design services
- Computer-on-Modules are interchangeable for future upgrades

OTHER TS-SOCKET CPUs

- **TS-4200:** Atmel ARM9 with super low power
- **TS-4600:** 450MHz at extremely low cost + 2x Ethernet
- **TS-4712:** like TS-4710 + 2x Ethernet
- **TS-4800:** Freescale iMX515 with video and 800MHz CPU

PRICE AND AVAILABILITY

- Computer-on-Modules are available now.
- Several COTS development carrier boards are also available.
- TS-TPC-8390 is available as a complete touch panel computer product using either TS-4700 or TS-4800 Computer-on-Module.
- Prices start at $99 at quantity 100.

Visit the product page

Technologic Systems | 480-837-5200

Contact: info@embeddedARM.com
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EQUIPMENT MONITOR AND CONTROL

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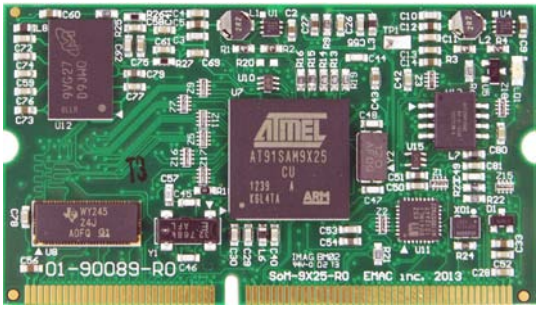
SoM-9x25 – ARM System on Module

Designed and manufactured in the USA the **SoM-9x25** uses the same small SODIMM form factor utilized by other EMAC SoM modules and is the ideal processor engine for your next design. All of the ARM processor core is included on this tiny board including: Flash, Memory, Serial Ports, Ethernet, SPI, I2C, I2S Audio, CAN 2.0B, PWMs, Timer/Counters, A/D, Digital I/O lines, Clock/Calendar, and more. The **SoM-9x25** is designed to plug into a custom or off-the-shelf carrier board containing all the connectors and any additional I/O components that may be required. The System on Module approach provides the flexibility of a fully customized product at a greatly reduced cost. Quantity 1 price for the **SoM-9x25** module is $180.



FEATURES

- Wide Temperature Atmel ARM9 400MHz Fanless Processor
- Up to 128MB of DDR2 SD RAM
- Up to 4GB of eMMC Flash
- Up to 16MB of Serial Data Flash
- 6 Serial ports, 3 with handshake
- 1 USB 2.0 (High Speed) Host port, 1 USB 2.0 (Full Speed) Host port, 1 USB 2.0 (High Speed) Device port
- 2 SPI & 2 I2C ports, CAN 2.0B Controller, 1 I2S Audio port
- 10/100 BaseT Ethernet with on-board PHY (2nd Ethernet Optional)
- Access to Processor Bus
- 4 Channels of 10-Bit A/D & 32 GPIO Lines
- SD/MMC Flash Card Interface
- Timers/Counters, PWM Controller
- Small, 144 pin SODIMM form factor (2.66" x 1.50")

EMAC, Inc. | 618-529-4525

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kontron

www.kontron.com

Kontron KTQ87/mITX

The new embedded Mini-ITX motherboard **KTQ87/mITX** is based on 4th generation Intel® Core™ i7/i5/i3 processors and the Intel Embedded Q87 chipset. The new motherboard offers engineers leading-edge embedded processing performance as well as up to 4K graphics in a compact ATX-compliant footprint. It provides a 35 percent increase in graphics performance compared to its predecessors and a higher floating-point performance as well as improved data en- and decryption while the thermal footprint has practically remained the same. With these improvements and with the long-term availability as well as the high-quality design, the Kontron KTQ87/mITX sets a new benchmark for all mid-range to high-performance embedded applications in markets such as industrial automation, medical, gaming and digital signage.

FEATURES

- **Embedded Mini-ITX Motherboard with Intel®Q87 Chipset and 4th Generation Intel® i7/i5/i3 Dual and Quad Core CPUs**
  - 4th Generation Intel® 22nm Dual and Quad Core i7, i5, i3, Pentium & Celeron® CPUs with Intel® Q87 Lynx Point PCH
  - Long term available Embedded mITX motherboard
  - High performance CPU, graphics, and media performance supporting 3 independent displays pipes
  - Graphics APIs DirectX 11.1, OpenGL 4.x, OpenCL 1.2

Kontron | 888-294-4558

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Annapolis Micro Systems

www.annapmicro.com

2.0 GSps 10-bit A/D

The **Annapolis Single Channel 2.0 GSps A/D I/O Card** provides one 2.0 GHz A/D input with a resolution of 10 bits. The board has one e2v AT84AS004 that is fed by an onboard analog input circuit, which converts the single-ended 50-ohm SMA input into differential signals for the ADC. There is a universal single-ended 50-ohm SMA clock input and a high-precision trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O cards can be facilitated by the Annapolis 4 or 8 Channel Clock Distribution Boards.

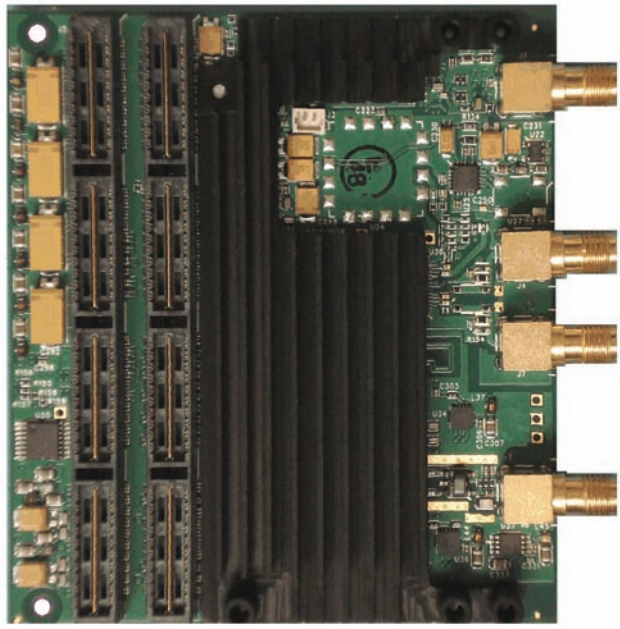
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time continuous sustained processing of the full data stream. Up to two A/D and up to two Serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D and up to one Serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

The combination of our COTS hardware and our CoreFire FPGA Application Development tool allows our customers to make massive improvements in processing speed while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed.



FEATURES

- One e2v AT84AS004 (2.0 GHz, 10-bit) A/D
- Four SMA front panel connectors: one 50-ohm analog input, one single-ended 50-ohm clock input, or differential 1.65 V LVPECL clock input
- One high-precision trigger input with Fs precision; high-precision trigger input – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- Analog input bandwidth is 100 KHz-3.0 GHz
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/ IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for board-level interfaces
- Proactive thermal management system
- Includes one-year hardware warranty, software updates, and customer support
- We offer training and exceptional special application development support, as well as more conventional customer support
- **Designed and manufactured in the USA**

Annapolis Micro Systems, Inc. | 410-841-2514 **Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

Dual 4.0 GSps DAC

The **Annapolis Micro Systems Dual Channel 4.0 GSps D/A I/O Card** provides one or two 12-bit digital output streams at up to 4.0 GSps. The board has one or two MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps.

The Dual Channel DAC board has five SMA front connectors: two single-ended DAC outputs, a high-precision trigger input with Fs precision, and a universal single- or double-ended 50 ohm clock input. It has excellent gain flatness in the first 3 Nyquist Zones, ultra-low skew and jitter saw-based clock distributions, and main board PCLK sourcing capability.

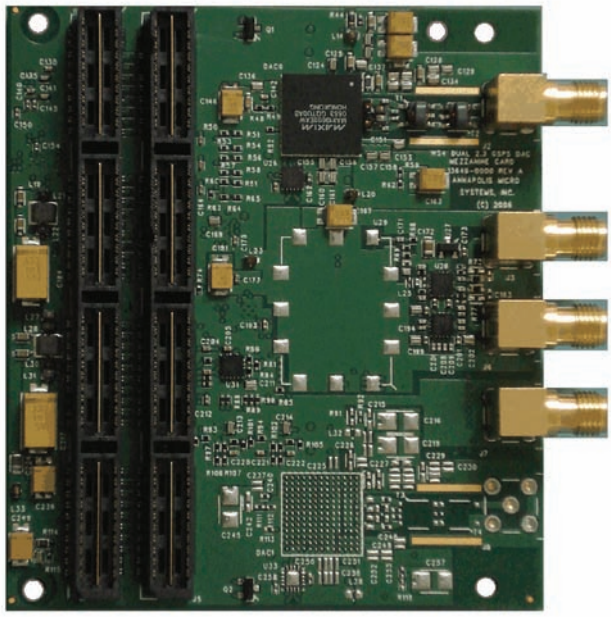
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time A to D conversion and digital output. Up to two A/D or D/A and up to two serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D or D/A and up to one serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

The combination of our COTS hardware and our CoreFire FPGA Application Development tool allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional customer support.



FEATURES

- One or two 12-bit Analog to Digital Converters: MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps
- Five SMA front panel connectors: two single-ended DAC outputs, one high-precision trigger input with Fs precision
- One universal single- or double-ended 50 ohm clock input
- High-precision trigger input manufacturing options – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/ IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for board-level interfaces
- Proactive thermal management system
- Industrial temperature range
- Includes one-year hardware warranty, software updates, and customer support
- **Designed and manufactured in the USA**

Annapolis Micro Systems, Inc. | 410-841-2514 **Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

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WILDSTAR 5 for IBM Blade

Perfect Blend of Processors and Xilinx Virtex-5 FPGAs. Eleventh Annapolis Generation.

Direct Seamless Connections – No data reduction between: external sensors and FPGAs, FPGAs and processors over IB or 10 Gb Ethernet backplane, FPGAs and standard output modules.

Ultimate Modularity – From zero to six Virtex-5 processing FPGA/memory modules, and two Virtex-5 I/O FPGAs. Accepts one or two standard Annapolis WILDSTAR 4/5 I/O mezzanines: Quad 130 MSps through Quad 500 MSps A/D, 1.5 GSps through 2.2 GSps A/D, Quad 600 MSps DAC, InfiniBand, 10 Gb Ethernet, SFPDP.

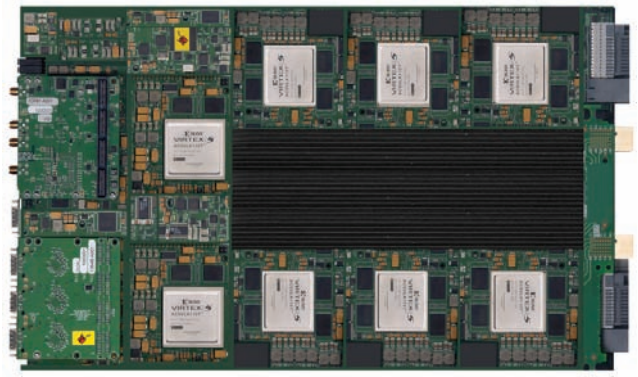
Fully Integrated into the IBM Blade Management System – Abundant power and cooling for maximum performance.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores. Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. A graphical user interface for design entry supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules.

WILDSTAR 5 for IBM Blade, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Achieve world-class performance; WILDSTAR solutions outperform the competition.



FEATURES

- From two to eight Virtex-5 FPGA processing elements – LX110T, LX220T, LX330T, FX100T, FX130T, or FX200T; six are pluggable with power module and memory
- Up to 10.7 GB DDR2 DRAM per WILDSTAR 5 for IBM Blade Board
- 144 x 144 crossbar; 3.2 Gb per line; two external PPC 440s – 1 per each I/O FPGA
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Available in both commercial and industrial temperature grades
- Proactive thermal management system – board-level current measurement and FPGA temperature monitor, accessible through host API
- Includes one-year hardware warranty, software updates, and customer support
- Blade management controller; USB, RS-485, Ethernet, KVM, 16 RIO, Switch to 1 GbE over backplane
- Save time and effort; reduce risk with COTS boards and software
- We offer training and exceptional special application development support, as well as more conventional support
- Famous for the high quality of our products and our unparalleled dedication to ensuring that the customer's applications succeed

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Annapolis Micro Systems

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WILDSTAR A5 for PCI Express

Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections.

WILDSTAR A5 for PCI Express uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is the first of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for PCI Express, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

FEATURES

- Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections
- Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- Up to 4 GBytes DDR3 DRAM in 2 Memory Banks and Up to 192 MBytes QDRII + SRAM in 12 Memory Banks per WILDSTAR A5 for PCI Express Board
- Programmable FLASH for each FPGA to Store FPGA Images
- 16X PCI Express Bus Gen 1, Gen 2, or Gen 3 to Host PC through On Board PCIe Switch
- Supports PCI Express Standard External Power Connector
- Multi Channel High Speed DMA
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support
- Training available

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

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WILDSTAR 6 PCIe

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing-intensive applications. Our fifteenth-generation WILDSTAR 6 for PCI Express uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

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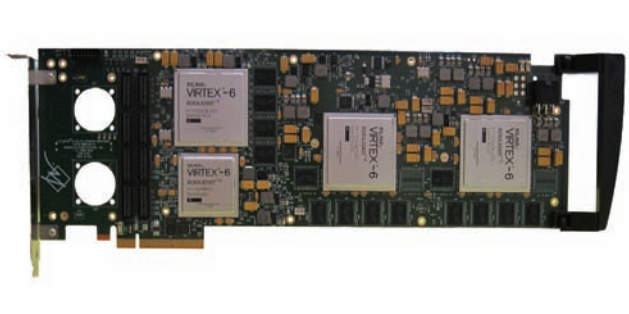
Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



FEATURES

- Up to three Xilinx Virtex-6 FPGA I/O processing elements – LX240T, LX365T, LX550T, SX315T, or SX475T
- Up to 8 GBytes DDR2 DRAM or DDR3 DRAM in 14 memory banks per WILDSTAR 6 for PCI Express board or up to 480 MBytes DDRII+/QDRII DRAM in 15 memory banks
- Programmable FLASH for each FPGA to store FPGA images
- 8X PCI Express Bus Gen 1 or Gen 2
- Supports PCI Express standard external power connector
- High-speed DMA Multi-Channel PCI controller
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support. Training available.

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PCI EXPRESS: THE NEXT GENERATION BUS

SIMPLIFY YOUR TRANSITION

Sealevel's PCI Express asynchronous serial boards are available with 1-16 ports configurable for RS-232, RS-422 and RS-485 serial interfaces.

Our PCI Express synchronous serial boards are engineered with strict attention to timing to achieve the most reliable, high-speed communications possible.

PCI Express digital I/O boards offer optically isolated inputs and Reed relay outputs perfect for industrial applications.

Learn more about Sealevel's PCI Express boards by visiting
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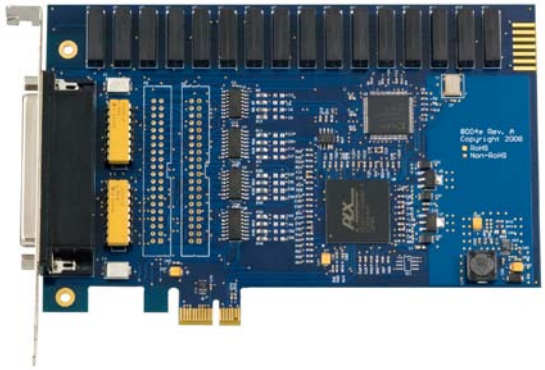
or by scanning the QR code to the right.



FEATURES

- 1, 2, 4, 8 and 16 serial port options
- RS-232, RS-422/485, and RS-232/422/485 interfaces
- Reed relays and optically isolated inputs
- Fully compliant with all PCI Express X1 slots
- Supported in Microsoft Windows and Linux operating systems

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Kontron COMe-bHL6

The brand new application-ready **COMe-bHL6** offers increased performance density and up to twice the graphics performance compared to its predecessors. Up to three independent, daisy-chained displays with up to 4K resolution are supported to create stunning user experiences. Further to this, DirectX® 11.1 and OpenGL 4.x support paves the way for compelling visuals when videos, graphics and interactive content are being displayed. By integrating the new Intel® AVX2 and OpenCL 1.2, Kontron's new Computer-on-Modules additionally not only provide an increase in floating-point performance they also possess improved parallel processing capacities. Typical application areas can be found in markets such as digital signage, professional gaming and entertainment, medical imaging and surveillance and security as well as industrial plant and machine line control on shop floor- and control room-level.

FEATURES

- **COM Express® basic up to Quad Core based on 4th generation Intel® Core™ i-CPUs**
  - 4th generation Intel® Core™ i-CPUs with QM87
  - COM Express® basic Pin-out Type 6
  - Triple Independent Diplay support with Daisy-Chaining
  - Up to 4K resolution and 2 x 24 bit Full LVDS

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Kontron CP6005-SA

The **CP6005-SA** 6U CompactPCI processor board available with Fourth Generation Intel® Core™ Quad Core processors meets the outstanding computing and graphics performance requirements at lowest power budgets.

The powerful processors enable virtualization and multithreading applications to run in full 64-bit mode using Enhanced Intel® Virtualization, Intel® HD Graphics, and Intel® Turbo Boost Technology.

Designed for bandwidth-intensive applications, the CP6005-SA provides hot swap, IPMI (Intelligent Platform Management Interface), TPM (Trusted Platform Module 1.2) support, and meets the highest standards for the management and security of high-availability applications.

FEATURES

- **CPCI/PICMG 2.16 4th Generation Intel® Core™ Processor based System/Peripheral CPU**
  - 4HP, single slot processor board with passive cooling
  - Scalable processor speed, 4th Generation Intel® Core™ Processor based
  - Up to 16GB DDR3L 1600 MHz memory via two SO-DIMM sockets
  - 5x GigEthernet Interfaces via PCI Express

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SET

www.setdsp.com

FIOCOM-S6

COM Express® Compact module with Type 10 connector based on Intel® Atom™ E6xxT CPU and Xilinx® Spartan-6 FPGA

FIOCOM-S6 is a first module of Scan Engineering Telecom's new range of processor boards: CPU and FPGA combination on single board in compact form-factor.

Application areas:
Low power consumption and wide range of input voltages make FIOCOM-S6 an ideal solution for industrial automation, transportation, medical devices and other applications, especially when customers use off-line supply sources or use on-board power in vehicles.

FPGA on FIOCOM-S6 can be used in a wide range of data processing applications from DSP applications that need I/O functions (provided by FMC connector on Carrier board) to data mining and DSP applications. (Total capacity of integrated multiplexers is up to 60GMAS/s.)

FEATURES

- Intel® Atom E6xxT CPU running up to 1.60 GHz
- Up to 2GB DDR2-800 RAM
- Xilinx® Spartan-6 FPGA with up to 150k logic cells and hardcore PCI Express Endpoint
- Up to 512MB DDR3-800 RAM for FPGA by two independent banks
- Integrated SATAII SSD drive up to 32GB
- microSDHC slot with OS boot option
- Compliant to PICMG COM Express® Module Base Specification R2.0
- Wide range of interfaces on COM Express Type 10 connector: Gigabit Ethernet, PCI Express, SATA II, LVDS, SDVO, HAD, USB, CAN, I2C, SPI, GPIO, UART
- 48 bidirectional LVDS pairs and 3 full-duplex Spartan-6 GTP pairs on extended connector called Express Extended

Scan Engineering Telecom GmbH | +49 89 5908 2347

Contact: info@setdsp.com; sales@setdsp.com

www.setdsp.com

SAMC-404 – High performance DSP AMC board

The SAMC-404 Single Mid-/Full-Size Advanced Mezzanine Card (AMC) is designed around high-performance TI TMS320C6457 DSP, combining a wide range of fabric interfaces with colossal external memory. Spartan-3AN FPGA interconnects with DSPs via GPIO lines and supports their configuration via I2C bus.

The SAMC-404 is intended for processing applications that require high performance, high bandwidth, and low latency. The board takes full advantage of the TI TMS320C6457 DSP's power, which makes the SAMC-404 perfect for reducing size, complexity, risks and costs associated with leading-edge software-defined radio (SDR), networking, data processing, telecommunication, industrial, defense and medical applications.

FEATURES

- Four high-performance TI TMS320C6457 DSPs, each running up to 1.20GHz
- Peak performance 38400MIPS
- Integrated Viterbi and turbo-code processors
- Highly efficient EDMA3 controller with 64 independent lines in each DSP
- Total DDRII SDRAM memory capacity 512/1024MB
- Two Gigabit Ethernet channels
- Two Serial RapidIO x4 buses
- Supports CLK1,CLK2 and CLK3
- Single Mid-/Full-Size AMC form-factor
- Available now

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Contact: info@setdsp.com; sales@setdsp.com

Boards/Chassis: PICMG: CompactPCI, MicroTCA, AdvancedTCA, COM Express, AMC **embedded-computing.com/p9915140**

www.setdsp.com

SAMC-514 – High performance Quad-core processor AMC board

The SAMC-514 Single Full-Size Processor AMC board is the second generation of SET's high-performance Quad-core Processor AMC boards. The SAMC-514 is designed around 2nd Generation Intel Core i7 CPU, combining an unsurpassed range of fabric interfaces with a great amount of soldered DDR III memory.

The SAMC-514 is intended for processing applications that require high performance, high bandwidth and variety of interfaces. The board takes full advantage of the 2nd Generation Intel Core i7's power, which makes the SAMC-713 perfect for reducing size, complexity, risks and costs associated with leading-edge telecommunications, networking, data processing, DSP, industrial, defense, and medical applications. The SAMC-514's fabric interfaces offer almost endless interconnect possibilities with other boards in the chassis.

FEATURES

- 2nd Generation Quad-core Intel Core i7 CPU running at 2.10GHz
- Up to 8GB soldered DDRIII memory 1333MHz with ECC
- Up to 128GB onboard SATAII SSD
- Main fabric interface: 2xGigabit Ethernet, 2xSATAIII, 2xPCI Express Gen2 x4
- Extended fabric interface: 2xSATAII, PCI Express Gen2 x4, 2xUSB2.0, 2xUART
- Front panel: 2xGigabit Ethernet, HDMI, 2xUSB2.0, COM via USB
- Single Full-Size AMC board
- Available now

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Contact: info@setdsp.com; sales@setdsp.com

Boards/Chassis: PICMG: CompactPCI, MicroTCA, AdvancedTCA, COM Express, AMC **embedded-computing.com/p9915142**

www.setdsp.com

SAMC-713 – AMC board with FMC site

The SAMC-713 Single Mid-/Full-Size Advanced Mezzanine Card (AMC) is designed around the powerful Xilinx Virtex-6 FPGA LXT or SXT family, combining a wide range of fabric interfaces with colossal external memory. The Board's FMC expansion site offers almost endless I/O possibilities by installed FMC boards.

The SAMC-713 is intended for processing applications that require high performance, high bandwidth, and low latency. The board takes full advantage of the Xilinx Virtex-6 FPGA's power, which makes the SAMC-713 perfect for reducing size, complexity, risks, and costs associated with leading-edge software-defined radio (SDR), telecommunication, networking, data processing, industrial, and medical applications.

FEATURES

- FPGA Xilinx Virtex-6 LXT (LX130T to LX364T) or SXT(SX315T/495T) family
- Four independent 16bit 2Gb DDR III SDRAM memory banks, 8Gb in total
- FMC expansion site for air/conduction cooled FMC boards
- 75 LVDS DDR pairs between FMC and FPGA, data transfer rate 75Gbit/s
- Twelve full-duplex GTX lines
- Supports Gigabit Ethernet, PCI Express Gen1/Gen2 x8/x4/x1, Serial RapidIO x4/x1, XAUI, SATA
- Supports CLK1, CLK2, and CLK3
- Work temperature range: 0 to +50° C or -40 to +85° C

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Contact: info@setdsp.com; sales@setdsp.com

Boards/Chassis: PICMG: CompactPCI, MicroTCA, AdvancedTCA, COM Express, AMC **embedded-computing.com/p9912460**

xes-inc.com

XCalibur4500 4th Gen Intel Core i7 6U cPCI

The **XCalibur4500** is a high-performance 6U CompactPCI single board computer that is ideal for ruggedized systems requiring high-bandwidth processing and low power consumption. With the 4th generation Intel® Core™ i7 Haswell processor, the **XCalibur4500** delivers enhanced performance and efficiency for today's network information processing and embedded computing applications.

The **XCalibur4500** provides up to 32 GB DDR3L-1600 ECC SDRAM in two separate channels, two PrPMC/XMC slots, and up to 64 GB of NAND flash. The **XCalibur4500** also hosts numerous I/O ports, including Gigabit Ethernet, USB, SATA, graphics, and RS-232/422/485 through the backplane connectors.

FEATURES

- Supports 4th generation Intel® Core™ i7 processors
- CompactPCI 6U module
- Complies with PICMG 2.0, 2.1, 2.3, 2.9, 2.16
- Conduction or air cooling
- Up to 32 GB DDR3L-1600 ECC SDRAM in two channels
- Up to 64 GB of NAND flash
- Three Gigabit Ethernet ports
- Three USB 2.0 high-speed ports
- Four SATA ports
- Two RS-232/422/485 serial ports
- Two PMC/XMC interfaces
- Two HDMI/DVI-D or dual-mode DisplayPort interfaces
- Intel® vPro™/AMT support
- Wind River VxWorks BSP, Linux BSP, Microsoft Windows drivers

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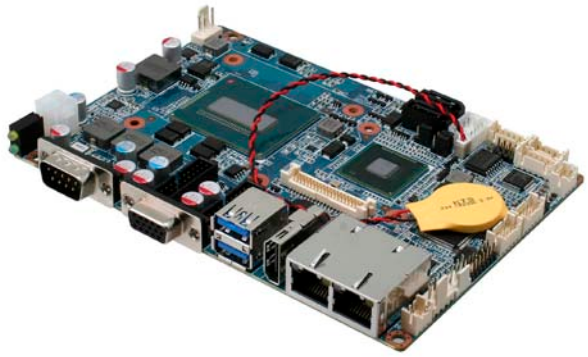
ECM-QM87



Avalue's ECM-QM87 is based on the 4th generation Intel® Core™ processor family and the mobile Intel® QM87 Express chipset. The 4th generation Intel Core processor shows improvements in performance and security, and has taken Intelligent Systems to a higher level for managing and securing devices.

Among other characteristics, ECM-QM87 supports one 204-pin DDR3 SODIMM memory with up to 8GB DDR3 1333/1600 SDRAM, offers a multiplicity of I/O involving 1 x RS-232, 1 x RS-232/422/485, 2 x SATA III, 1x Mini PCIe supporting mSATA expansion, 6 x USB 3.0, 2 x USB 2.0 and 4-bit GPI, 4-bit GPO among others. ECM-QM87 has Dual Gigabit Ethernet: 1x Intel® I210AT Gigabit Ethernet Controller & 1x Intel® I217LM Gigabit Ethernet PHY, Dual-channel 18/24-bit LVDS interface and supports three displays with resolutions of VGA: 1920 x 2000 @ 60Hz, HDMI: 4096 x 2304 @ 24Hz and LVDS: 1920 x 1200 @ 60Hz. Audio interface is provided with 1x Realtek ALC892 Supporting 7.1-CH HD codec. ECM-QM87 supports Intel® Active Management Technology 9.0 for managing and securing PCs, as well as ACPI 3.0 which enables advanced power management for attached devices.

FEATURES

- 4th Generation Intel® Core™ processor and mobile Intel® QM87 Express chipset
- 1 x 204-pin DDR3 SODIMM, Up to 8GB 1333/1600 SDRAM
- Dual-channel 18/24-bit LVDS, HDMI, VGA
- Realtek ALC892 Supports 7.1-CH Audio
- Dual Gigabit Ethernet, Triple Display
- 2 SATA III, 1 Mini PCIe Card (Support mSATA), 6 USB 3.0, 2 USB 2.0, 2 COM, 8-bit DIO
- Intel Active Management Technology 9.0

Avalue Technology Inc. | +886-2-8226-2345 • Fax: +886-2-8226-2777
7F, 228, Lian-cheng Road, Zhonghe Dist., New Taipei City 235, Taiwan

Contact: sales@avalue.com.tw

iBASE
Industry Leader in Embedded Computing

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IB903

The **IB903** is a 3.5-Inch small form factor powered by AMD Embedded G-Series SOC (System-on-Chip) with built-in AMD Radeon™ HD8000 Series. IB903 is compact in size, a superior-performance-per-watt form factor with enhanced multimedia capability. The AMD Embedded G-Series SOC has made IB903 a superior market choice in the areas of: Industrial & Automation, Digital Signage & Kiosks, Thin Client Application and Digital Gaming.

** OEM/ODM service is available*

FEATURES

- Powered by AMD Embedded G-Series SOC (System-on-Chip)
- 1x DDR3 SO-DIMM, Max. 8GB
- Supports DVI-I and 24-bit dual channel LVDS
- 2x Realtek RTL8111G PCI-E Gigabit LAN
- Watchdog timer, Digital I/O, mSATA
- "iSMART" feature: Power saving/resume & auto-scheduling
- 2x USB 3.0, 4x USB 2.0 (via Pin header), 4x COM, 2x SATA III

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Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9914733**

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www.ibase-usa.com

4th Gen Intel® Core™ i7/i5 Mini-ITX Board | MI980

The **MI980** is a Mini-ITX form factor that supports the 4th Gen Intel® Core™ i7/i5 mobile processors with Intel® QM87 and HM86 Express chipsets. The new Intel® Core™ platform provides a boost in graphics and CPU performance over previous generations, and is optimized to provide the industrial and embedded markets with higher processing capability with a lower power consumption rate.

The MI980VF is also available with advanced capabilities such as Intel® Active Management Technology 9.0, Trusted Platform Module 1.2, RAID and state-of-the-art Intel® vPro™ technology, which provides trusted security and out-of-band remote management.

** OEM/ODM service is available*

FEATURES

- Supports 4th Gen Intel® Core™ i7/i5 Mobile Processors
- DDR3 SO-DIMM Memory, Up to 16GB
- Integrated VGA, supports DVI-I/DVI-D/LVDS or eDP/DisplayPort
- 2x PCI-E Intel® Gigabit Ethernet
- Watchdog timer, Digital I/O, TPM 1.2
- "iSMART" feature: Power saving/resume & auto-scheduling
- 6x USB 2.0, 4x USB 3.0, 6x COM, 4x SATA III, 2x SATA II
- Expandable with 1x PCI-E (x16), 2x Mini PCI-E (x1) with one for mSATA
- Intel® vPro™ technology, Intel® Active Management Technology 9.0

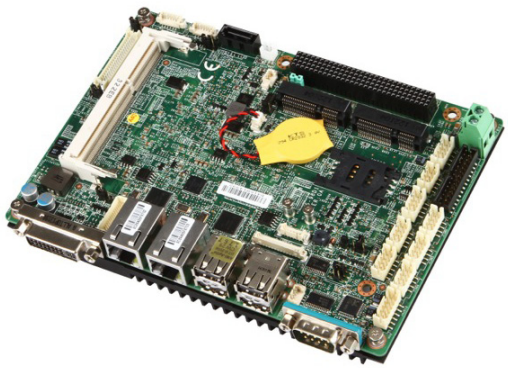
IBASE Technology, Inc. (USA) | 800-292-4500

Contact: info@ibase-usa.com
Facebook: www.facebook.com/ibasetechnology
Twitter: ibasetech

Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9913151**

msi® IPC

www.msi.com/ipc



Scale up your applications unlimitedly with MS-98D1 EPIC stackable solution

MSI proudly announces the release of its new EPIC embedded board – **MS-98D1**. The MS-98D1 is a compact EPIC size embedded board with Intel® Atom™ Dual Core processor for a low-power fanless solution. Featuring dual core, fanless design, rich I/O, and wide input voltage of 9 to 36 VDC, the MS-98D1 is especially ideal for industrial applications that involve control and communications, or any industrial fields that require fanless embedded systems. The dual Gigabit LAN built-in also benefits the target applications by providing broadband communication capability that is required by many industrial fields. For some systems that need additional communication or I/O interfaces, the PCI-104 slot of MS-98D1 allows system integrators to stack more modules with no limits, offering more application possibilities with this small board. Moreover, 2 independent displays with VGA, DVI, and Dual LVDS outputs enable the MS-98D1 to be applied for remote monitoring and control systems as well.

FEATURES

- Intel® Atom™ D2550/N2800/N2600 Dual Core processor for a low-power fanless solution, supporting DDR3 1066MHz SO-DIMM memory up to 4GB
- 9~36 VDC wide input voltage enables more stable power source for industrial applications
- 2 independent displays with VGA, DVI, and Dual LVDS supported
- Dual Gigabit LAN for high-bandwidth networking; dual Mini-PCIe for expansion
- 6 COM ports and 6 USB 2.0 for multiple serial/USB connections
- Stackable PCI-104 to expand industrial modules without limits, such as WiFi, LAN, COM modules

MSI (Micro-Star INT'L Co., LTD.) | Tel: 886-2-3234-5599

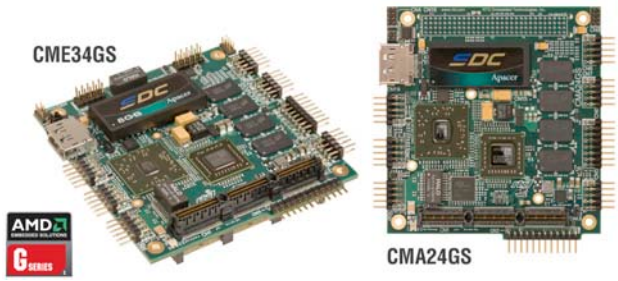
Contact: ipcsales@msi.com

www.rtd.com/gseries

RTD's AMD Fusion G-Series in PCIe/104 & PCI/104-Express

The latest PCIe/104 and PCI/104-Express single board computers from RTD Embedded Technologies, Inc. are based on the AMD Fusion G-Series Accelerated Processing Unit (APU) processor and chipset in 1.0 GHz dual-core and 615 MHz and 1.0 GHz single-core configurations.

The CMA24GS, CMX34GS and CME34GS modules are cost-saving, low-power solutions ideally suited for mission-critical military, industrial, and research applications. Onboard essential embedded PC features include expandable x1 and x4 PCI Express links, high speed USB 2.0 ports, SATA and Serial ports, Gigabit Ethernet, advanced Radeon HD video interfaces for high-end graphics capabilities and onboard advanced digital I/O lines. The G-Series CPUs are available as stand-alone modules, or mounted in passively cooled, stackable, ruggedized modular frames with integral structural heat sinks.



FEATURES

- PCIe/104 and PCI/104-Express Stackable Bus Structures
- Complete PC-compatible Single Board Computer (SBC)
- AMD Fusion G-Series 615 MHz – 1.0 GHz Processors
- Dual-Core and Single-Core Options
- 2 GB DDR3 SDRAM (Surface-Mounted)
- x1 PCIe Links (4 on CME, 6 on CMX, 7 on CMA)
- One x4 PCIe Link (CME model)
- Onboard Industrial SATA Flash Disk up to 32GB (4GB Standard)
- Built-in Error Code Correction (ECC)
- Four SATA Ports and Four Serial Ports (RS-232/422/485)
- USB 2.0 Ports (9 on CME and CMX, 7 on CMA)
- Gigabit Ethernet (Dual GigE on CME and CMX)
- Analog VGA and Dual-mode DisplayPort (DP++) with HD Audio
- Advanced Digital I/O (aDIO)

RTD Embedded Technologies, Inc. | 814-234-8087

Contact: sales@rtd.com

SENSORAY
embedded electronics

www.sensoray.com/products/953.htm

Model 953-ET | PCI/104-Express 4-Channel H.264 A/V Codec

Sensoray has introduced the ultra-low latency, high performance **Model 953-ET: PCIe/104 Form Factor A/V Codec**. It simultaneously captures four channels of analog video and four channels of stereo/mono audio. Each video channel captures at the full frame rate (30 fps for NTSC or 25 fps for PAL), which results in an aggregate frame rate of 120 fps for NTSC or 100 fps for PAL. The Model 953-ET compresses the A/V streams into MJPEG, MPEG-4, H.264, or MPEG-TS format for video, and with G.711 or AAC format for audio.

This extended temperature, small form factor board is ideal for applications where processor performance is critical. The Model 953-ET is well-suited for capture of multiple video sources, such as local/remote video surveillance & traffic monitoring, digital video recording/streaming, and other video processing applications.

FEATURES

- 4 input channels: 4 NTSC/PAL composite/S-Video + 4 stereo audio
- H.264 HP@L3, MPEG-4 ASP, MJPEG video; AAC, G.711, PCM audio
- Ultra-low latency video preview concurrent with compressed capture
- Full duplex hardware encode/decode
- Text overlay, GPIO
- Supports both stack-up and stack-down
- -40° to +85°C extended temperature range
- SDKs for both Linux and Windows

Sensoray Co., Inc. | 503-684-8005

Contact: sales@sensoray.com
LinkedIn: www.linkedin.com/company/sensoray
Twitter: twitter.com/Sensoray

Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9910400**

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-40° to +85°C PC/104 SBC with Dual Ethernet

The PCM-VDX-2 is a highly integrated PC/104-compatible Single Board Computer designed for space-limited and low-power applications. It is a full-featured SBC that includes a 1GHz Vortex86DX, 512KB DRAM, and 1MB battery-backed SRAM. I/O support includes two 10/100 Ethernet channels, four USB 2.0 ports and four serial ports. Its low power dissipation permits fanless operation over a temperature range from -40°C to +85°C. This board is well suited for rugged applications requiring excellent processor performance in an embedded PC design.

The PCM-VDX-2 has x86 PC software compatibility, which assures a wide range of tools to aid in your application's program developments. It supports Linux, DOS and other x86 operating systems. WinSystems provides technical phone support to assist customers with system integration of our SBCs and I/O modules in their designs.

FEATURES

- Fanless 1GHz Vortex86DX processor
- Small size: 90mm x 96mm
- Two 10/100 Mbps Ethernet controllers
- Four USB 2.0 ports with overcurrent protection
- Four serial RS-232/422/485 channels with FIFOs
- 16 digital I/O lines with event sense
- LPT, PS/2 keyboard and mouse support
- CompactFlash and PATA supported
- MiniPCI and PC/104 expansion connectors
- -40°C to +85°C operating temperature

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com
Twitter: WinSystemsInc • **Facebook:** WinSystems • **LinkedIn:** WinSystems Inc.

Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9910506**

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www.WinSystems.com

Dual Channel Isolated CAN PC/104 Module

WinSystems' PCM-CAN-2-ISO is built for operation in high-voltage renewable energy, high-speed industrial control, or unpredictable automotive applications.

This PC/104 module's high-speed isolated data couplers and power supplies provide 1000V protection between its two CAN controllers and the network interface. Each CAN channel can provide isolated +5VDC power or receive isolated +5 to +12VDC power from the interface for additional flexibility.

This module is offered in four off-the-shelf configurations. The PCM-CAN-2 is a dual channel, non-isolated unit. The PCM-CAN-1 is a single channel, non-isolated unit. The PCM-CAN-1-ISO is a single channel, isolated unit. Special OEM configurations are also available.

FEATURES

- PC/104-compatible Control Area Network (CAN) card
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Transfer rates to 1 Megabits per second
- Channel-to-channel and channel-to-system isolation
- Onboard isolated 1W power supply for interface
- -40° to +85°C operating temperature
- Software drivers available for Linux and Windows®
- Non-isolated and single channel versions are available

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Extended Temperature Intel® Atom™ PC/104-*Plus* SBC

WinSystems' PPM-C393, featuring high integration with PC/104-*Plus* expansion, provides a flexible and cost-effective solution for demanding embedded applications. This combination provides designers access to the low power performance of Intel Atom processors and to the thousands of PC/104, PC/104-*Plus*, and PCI-104 modules available worldwide.

It is well suited for new applications and for upgrading existing designs. The PPM-C393's extended temperature operation and low power open up applications for security, Mil/COTS, medical, transportation, data acquisition, and communications in a small, rugged, form factor proven in these industries.

It supports Linux, Windows®, and other x86-compatible real-time operating systems.

FEATURES

- 1.66GHz N455 Intel® Atom™ CPU
- Runs Linux, Windows® and other x86 operating systems
- Up to 2GB of DDR3 SODIMM supported
- Simultaneous LVDS and CRT video
- Intel Gigabit Ethernet controller
- SATA (2.0) channel and CompactFlash supported
- Four serial COM ports (two RS-232, two RS-232/422/485)
- Eight USB 2.0 ports with polyfuse protection
- Watchdog timer adjustable from 1 sec. to 255 min.

WinSystems, Inc. | 817-274-7553

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Multifunction PC/104 A/D, D/A & DIO Module

The PCM-MIO is a versatile, PC/104-based analog input, analog output, and digital I/O board. The board's precision converters and voltage references require no calibration.

It will support up to 16 single-ended or 8 differential analog-to-digital (A/D) input channels. The software programmable input ranges are ±5V, ±10V, 0-5V, and 0-10V. There are also eight, 12-bit digital-to-analog (D/A) outputs with individual software programmable voltage ranges of ±5V, ±10V, 0-5V, and 0-10V. A total of 48 bidirectional TTL-compatible digital I/O lines can be software configured as input, output, or output with readback.

The PCM-MIO operates over the industrial temperature range of -40° to +85°C. Software drivers are available for DOS, Windows®, and Linux.

FEATURES

- 16-bit 100K samples/sec Analog-to-Digital (A/D) converter
- Two quad 12-bit Digital-to-Analog (D/A) converters
- 48 bidirectional TTL-compatible digital I/O lines
- Software drivers in DOS, Windows®, and Linux
- -40° to +85°C temperature operation
- Low cost A/D and digital I/O only version available
- Low cost D/A and digital I/O only version also available
- Product evaluation program

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com
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Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9910504**

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PC/104 DC/DC Modules for Renewable Energy

WinSystems' PC/104 and PC/104-*Plus* highly integrated, power supply modules are built for remote applications requiring renewable power sources. The PS394 series of DC/DC supplies supports two inputs from solar panels, wind turbines, or other DC sources. These modules include a controller for battery charging and uninterruptable power supply (UPS) operation making them ideal for applications not able to run off the standard AC power grid.

Available in three standard configurations, each of the modules requires only convection cooling for extended temperature operation and does not require a heat sink. For applications such as telemetry, pipelines, outdoor signage, military, transportation, and security, these modules are cost-effective, highly integrated solutions.

FEATURES

- Dual fused inputs accept solar panel, wind turbine, or other DC sources
- Wide input range: 9V to 32VDC
- UPS operation with battery pack
- MPPT charging supported for solar panels
- Outputs have short circuit/overload protection
- -40° to +85°C operation supported
- Custom configurations available

WinSystems, Inc. | 817-274-7553

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Boards/Chassis: Small form factors: PC/104, SUMIT, -ITX, FeaturePak **embedded-computing.com/p9910501**

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PC/104-*Plus* ATX-compatible DC/DC Power Supply Module

WinSystems' PPM-DC-ATX-P is a DC/DC power supply designed for PC/104, EPIC, and EBX Single Board Computers (SBCs) that support ATX power controls.

Well suited for harsh, rugged environments, it features a wide voltage input range from 10 to 50 volts. The module will operate from 12, 24, or 48 volt battery-operated or distributed DC power systems. It generates five regulated DC output voltages from one common DC input. The PPM-DC-ATX-P can also support software controlled shutdown and power monitoring for SBCs with advanced CPU chipsets employing sleep modes and active power management.

WinSystems offers this module in three off-the-shelf configurations. All configurations will operate from -40° to +85°C without fans or heat sinks.

FEATURES

- PC/104-*Plus* ATX DC/DC power supply
- Wide 10V to 50VDC input range
- Voltage outputs: +5V, +3.3V, +12V, -12V, and +5VSB
- Power On/Off, Power Good, and +5 VSB supported for power management and sleep modes
- Outputs have short circuit/overload protection
- -40° to +85°C fanless temperature operation
- Custom OEM configurations available
- Off-the-shelf product availability

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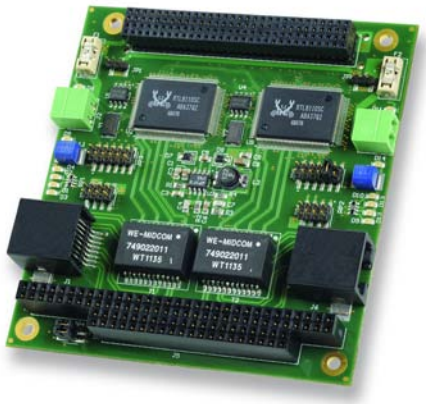
PC/104-*Plus* Dual Gigabit Controller with POE Module

WinSystems' PPM-GIGE-2-POE is a high-performance, PC/104-*Plus* compliant dual channel, Gigabit Ethernet Power over Ethernet (POE) module designed to provide flexible, high-performance Ethernet networking capability. This add-in module allows connection to two 10, 100, and 1000 Mbps networks using standard CAT 5 twisted pair copper cables. Its controller supports Windows®, Linux, and other x86-compatible operating systems.

The module's Gigabit Ethernet controllers combine triple-speed IEEE 802.3 compliant Media Access Controller with a triple-speed Ethernet transceiver, 32-bit PCI bus controller, and embedded memory. WinSystems also offers a single channel Power over Ethernet module.



FEATURES

- Two Gigabit Ethernet channels on a PC/104-*Plus* module
- Automatic switching from 1Gbps to 100 or 10Mbps and full- and half-duplex operation
- Two Ethernet PCI controllers
- IEEE 802.3x-compliant full duplex flow control support
- Each channel is IEEE 802.3at/af POE compliant
- Up to 40W for single port PSE applications
- Two RJ-45 Ethernet interface connectors on board
- -40°C to +85°C fanless temperature operation

WinSystems, Inc. | 817-274-7553

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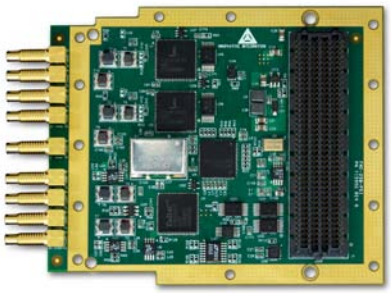
Innovative Integration
a subsidiary of Interconnect Systems, Inc.
... real time solutions!

www.innovative-dsp.com/products.php?product=FMC-250

FMC-250

The FMC-250 is a high speed digitizing and signal generation FMC I/O module featuring two 250 MSPS A/D channels and two 1200 MSPS D/A channels supported by sample clock and triggering features.

The FMC-250 features two 16-bit 250 MSPS A/Ds, plus a dual channel, 1200 MSPS update rate DAC. Analog I/O may be either AC or DC coupled. Receiver IF frequencies of up to 125 MHz are supported. The sample clock is from either an ultra-low-jitter PLL or external input. Multiple cards can be synchronized for sampling.



FMC 250

FEATURES

- The FMC-250 is a high speed digitizing and signal generation FMC I/O module featuring two 250 MSPS A/D channels and two 1200 MSPS D/A channels supported by sample clock and triggering features.
- Two A/D Inputs & Two D/A Outputs
- Sample clocks and timing and controls
- 6W typical (AC-coupled inputs)
- Environmental ratings for -40 to 85C, 9g RMS sine, 0.1g2/Hz random vibration

Innovative Integration | 805-578-4260

Contact: sales@innovative-dsp.com

Annapolis Micro Systems

www.annapmicro.com

Four Channel Clock Synchronization Board

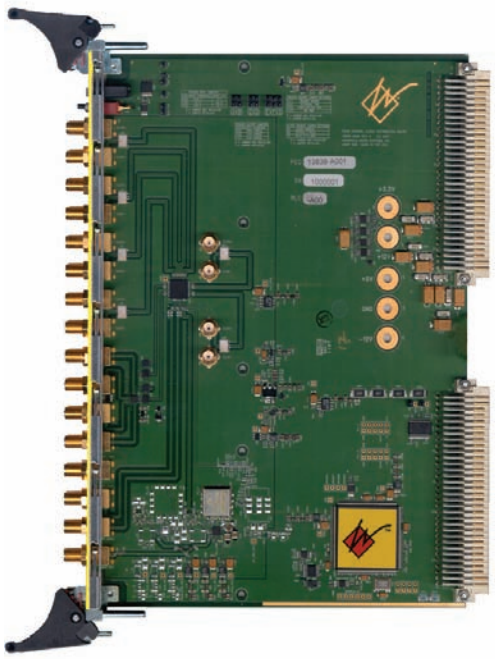
The **Four Channel Clock Synchronization Board** distributes a common clock and synchronized control signal triggers to multiple cards in the system. This 6U VME64x/VXS board provides four high-speed, ultra-low jitter, ultra-low skew differential bulkhead mounted clock outputs, two ultra-low skew differential vertical SMA on-board clock outputs, and four ultra-low skew and clock synchronized single-ended bulkhead mounted control signal triggers.

A jumper set at board installation time or via optional P2 Serial Port determines which one of the two installed clock sources is active. Manufacturing options for Clock Source 0 are Single Ended or Differential External Clock, a PLL ranging from 700 MHz to 3 GHz with an On-Board Reference Oscillator, or a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference. Manufacturing options for Clock Source 1 are a PLL ranging from 700 MHz to 3 GHz with an On-board Reference Oscillator, a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference or an On-Board Low Frequency Oscillator ranging up to 800 MHz.

The four control trigger outputs can originate from a high-precision external source via front panel SMA, from a manual pushbutton on the front panel, or from software via an optional Backplane P2 Connector Serial Port. These trigger outputs are synchronized to the distributed clock to provide precise output timing relationships.

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based boards and processing for RADAR, SONAR, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.



FEATURES

- Four Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- Ultra-low Clock Jitter and Phase Noise – 275 Fs with 1,280 MHz PLL and external 10 MHz Reference
- On-board PLLs Manufacturing Options provide Fixed Frequencies of 700 MHz to 3 GHz, Locked to Internal or External Reference
- On-board Low Frequency Oscillator provides Fixed Frequencies up to approximately 800 MHz
- Four Synchronized Trigger Outputs, always Synchronized with the Output Clock, with Typical Skew of 5 ps
- Jumper Selectable Trigger Output Levels of 3.3 V PECL, 2.5 V PECL, or 1.65 V PECL
- Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- Cascade boards to provide up to 16 sets of outputs
- Compatible with standard VME64x and VXS 6U backplanes
- Universal clock input supports wide range of signal options, including signal generator sine wave
- Differential clock input permits multiple standards including: LVDS, 3.3 V PECL, 2.5 V PECL, and 1.65 V PECL
- Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. WILDSTAR™ 2 PRO I/O Cards and WILDSTAR™ 4/5 Mezzanine Cards

Annapolis Micro Systems, Inc. | 410-841-2514 **Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

WILD OpenVPX EcoSystem

The **WILD OpenVPX EcoSystem**, with its mix and match COTS OpenVPX boards, provides the most FPGA based processing and the fastest and widest bandwidths available, to allow Annapolis customers to input, process, move around and output much more data than has ever been possible before, to enable vastly improved processing in applications such as Signal Processing, Radar, SIGINT, and ELINT.

The WILD EcoSystem begins with a 4 slot chassis with a custom designed high performance mesh backplane, a 6 slot chassis with a custom designed high speed switched backplane with room for 1 switch card, and a 12 slot chassis with a custom designed high speed backplane with accommodation for 2 switch cards. These state-of-the-art backplanes will carry data at up to or greater than 10G on their dataplanes. The EcoSystem also includes WILDSTAR 6 FPGA Processing boards, with 1, 2 or 3 Xilinx Virtex-6 FPGAs, and WILDSTAR A5 FPGA Processing boards, with 1, 2 or 3 Altera Stratix V FPGA Processing boards. Each of the processing cards can have up to 2 A/D or D/A I/O mezzanine cards, up to 5 GSps A/D and 4 GSps D/A, and up to 6 QSFP+ front panel I/O connectors, each capable of up to 40Gb Ethernet. Annapolis has a one slot 8 TB WILD Storage Board, and a one slot WILD Switch Board with up to 4Tbps Non-Blocking Switch Capacity, using 10G/40G/56G Ethernet or SDR/DDR/QDR/FDR InfiniBand. There are several Clock Boards, to allow synchronization of analog signals. There is also an RTM card, which provides additional connectors out the back of the chassis, including 6 more QSFP+ connectors. All chassis are designed with ample power and airflow, to meet the high performance demands of these advanced applications.

Annapolis is famous for the high quality of its products and for its unparalleled dedication to ensuring that the customers' applications succeed. They offer training and exceptional custom application development support, as well as more conventional customer support.

FEATURES

- Up to 3 Altera Stratix V FPGAs Per WILDSTAR A5 Processing Board
  - Up to 6 FDR InfiniBand, 6 40Gb Ethernet or 24 10Gb Ethernet
  - Front Panel I/O per OpenVPX Slot
- Up to 3 Xilinx Virtex-6 FPGAs Per WILDSTAR 6 Processing Board
- 8 TB WILD Storage Board – Up to 16 SATA3 SSDs per Board
  - Up to 4 GB/s of Storage Bandwidth in a Single OpenVPX Slot
  - 8x PCIe Gen3 for almost 8 GB/s Full Duplex to each Adjacent Slot on Backplane (P2)
  - Up to 28 GB/s per Direction of full Duplex Protocol Agnostic Bandwidth (P1)
- WILD Switch – Up to 4Tbps Non-Blocking Switch Capacity with up to 8 Switch Partitions
  - Multiprotocol – SDR/DDR/QDR/FDR InfiniBand, 1/10/20/40 GbE
  - Front Panel I/O – 8 QSFP+ and 2 SFP+
- 4, 6, and 12 Slot OpenVPX Chassis with RTM Support
- Backplanes – 16 Lanes of 10Gbps per Lane on Data Plane
  - 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- RTM for Additional Backplane and Out-of-Chassis Connectivity
  - 6 QSFP+ Connectors
  - Single Ended and Differential I/O
- Integrated Heat Sinks and Fans
- Analog to Digital I/O Mezzanines for Processing Cards
- Digital to Analog I/O Mezzanines for Processing Cards
- Full Chassis Management, with Voltage, Temperature, Fan Monitoring and Control, Front Chassis Display Panel
- Includes Cores for Communication Protocols
- Full CoreFire™ Board Support Package for Fast, Easy Application Development
- VHDL Model including Source Code for Hardware Interfaces, including Debug Access
- Commercial, Industrial and Conduction Cooled

Annapolis Micro Systems, Inc. | 410-841-2514 **Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

WILD OpenVPX Four Slot Mesh Chassis

Annapolis enters the OpenVPX market with **WILDSTAR 6 Xilinx Virtex-6** and **WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards**, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Slot Chassis.

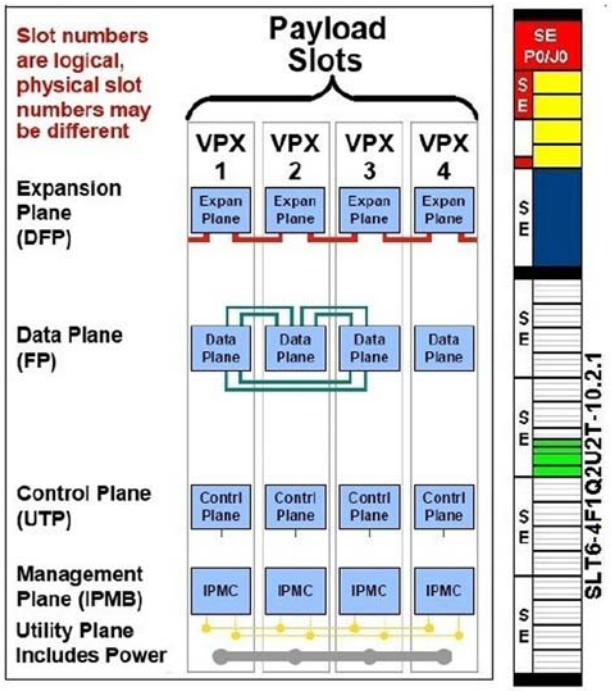
The **Four Slot Mesh Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

The chassis could, for example, be filled with two of the 8 TB WILD Storage Cards, one WILDSTAR A5 Stratix V FPGA Processing Board, and a Single Board Computer.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- 4U High 19" Rack Mount Chassis with Front Mounted Horizontal OpenVPX Card Cage with Four Slots
- 4 Slot OpenVPX High Speed Mesh Backplane with Rear Transition Module Support
- 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- 1000Base-X on Control Plane
- Large Power Supply
- Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- Electromagnetic Shielding
- Includes one year hardware warranty

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

WILD OpenVPX Storage Board

Annapolis leads the **OpenVPX** market with the 8 Terabyte per slot WILD Storage Solution with 4GBps Write and 8GBps Read Bandwidth. The **Storage Board** has a Hot Swappable Canister containing up to 16 Pluggable 1.8" SSD SATA 3.x Drives, with 2, 4 or 8 Terabytes per Board.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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FEATURES

- 4 GBps Write and 8 GBps Read Bandwidth
- Up to 40Gb Ethernet or QDR InfiniBand on each of Four Fat Pipes on P1 for a total of 20GBps on P1
- PCI Express 8x Gen 1, Gen 2 or Gen 3 on P2 and P5 of the OpenVPX Backplane
- 2, 4 or 8 Terabytes per OpenVPX Slot
- Hot Swappable Canister
- Up to 16 Pluggable 1.8" SSD SATA 3.x
- API for Command and Control of the Storage Process
- Includes one year hardware warranty

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WILD OpenVPX Switch Board

Annapolis leads the OpenVPX market with the **WILD 6U OpenVPX** (VITA 65.0 Compliant) **Switch Board**, with up to 4 Tbps non-blocking switching capacity with up to 8 switch partitions.

Supports OpenVPX Switch Profiles: SLT6-SWH-20U19F-12.4.1: 20 Control Plane and 19 Data Plane Backplane Ports; SLT6-SWH 16U20F-12.4.2: 16 Control Plane and 20 Data Plane Backplane Ports; SLT6-SWH-24F-12.4.3: = 24 Data Plane Backplane Ports.

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FEATURES

- 6U OpenVPX Board
- Up to 4Tbps Non-Blocking Switching Capacity with up to 8 Switch Partitions
- Multiprotocol Switch – SDR/DDR/QDR/FDR InfiniBand and 1/10/20/40 Gb Ethernet
- Each Backplane and Front Panel Port can be Configured for either InfiniBand or Ethernet
- Front Panel: Up to 8 QSFP+, Up to 2 SFP+, RJ45 Management Port, USB USART, LED Status
- Supports OpenVPX Switch Profiles
- InfiniBand and IP Routing
- Ethernet Gateways
- ChMc Management Plane Support
- Includes one year hardware warranty

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WILD OpenVPX Twelve Plus 3 Slot Switched Chassis

Annapolis enters the OpenVPX market with WILDSTAR 6 Xilinx Virtex-6 and WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Plus Three Slot Chassis.

With Ten Payload Slots and Two Switch Slots, and an option for Three VME/VPX Slots, the **Twelve OpenVPX Plus 3 Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

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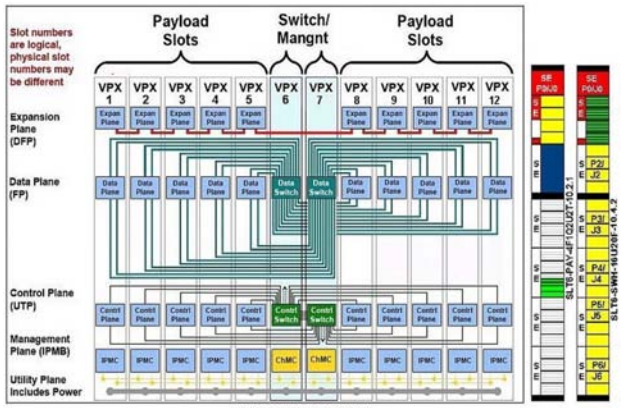

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FEATURES

- 19" Rack Mount Chassis with Front Mounted OpenVPX Card Cage
- Primary Twelve Slot 6U OpenVPX High Speed Switched Backplane with Rear Transition Module Support
- 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- 1000Base-X on Control Plane
- Secondary Three Slot VME/VPX Backplane for Power Only Payload Cards
- Very Large Power Supply
- Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
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WILDSTAR A5 for OpenVPX

Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections.

WILDSTAR A5 for OpenVPX uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is one of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts up to four I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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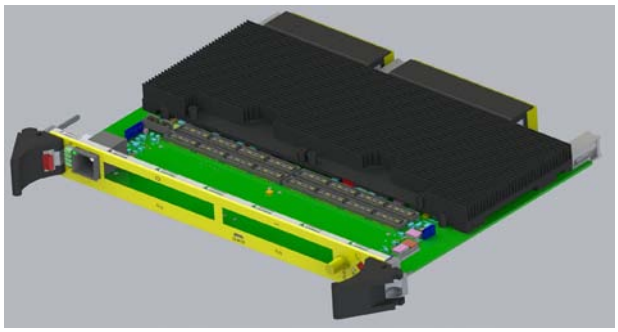

FEATURES

- Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections
- Up to Three Altera Stratix V FPGS Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- Up to 8 GBytes DDR3 DRAM in 4 Memory Banks and Up to 80 MBytes QDRII + SRAM in 5 Memory Banks per WILDSTAR A5 for OpenVPX Board
- Programmable FLASH for each FPGA to Store FPGA Images
- APM86290 PowerPC on Board Host
- PCI Express Bus Gen 1, Gen 2, or Gen 3 to P2 Expansion Plane through On Board PCIe Switch
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support
- Training available

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WILDSTAR 6 for OpenVPX

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FEATURES

- Up to three Virtex-6 FPGA processing elements – XC6LX240T, XC6LX365T, XC6LX550T, XC6SX315, or XC6SX475
- Up to 7 GB DDR2 DRAM in 14 banks or up to 448 MB DDRII or QDRII SRAM
- OpenVPX backplane
- 80 x 80 crossbar connecting FPGAs and VPX backplane
- 1 GHz 460EX PowerPC onboard host
- 4X PCIe controller
- Programmable Flash to store FPGA images and for PCI controller
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Host software: Windows, Linux, VxWorks, etc.
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board level current measurement and FPGA temperature monitor, accessible through host API
- Save time and effort and reduce risk with COTS boards and software; achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support; training available

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Contact: wfinfo@annapmicro.com

CONCURRENT TECHNOLOGIES

www.gocct.com

3U VPX Processor Board – TR B12/msd

The TR B12/msd is a PC-compatible high performance 3U VPX processor board supporting the 4th generation Intel® Core™ processor and the Intel® QM87 PCH with up to 16 Gbytes of DDR3L-1600 ECC DRAM. The **TR B12/msd** features an optional XMC site and a range of I/O interfaces including four SATA600 channels, dual 1000Base-BX, serial and USB2.0/USB3.0 interfaces. The board provides a flexible PCI Express® (Gen 1, Gen 2 and Gen 3) backplane fabric interface for use in systems defined by OpenVPX (VITA 65). For rugged applications, a VPX-REDI Type 1 and VPX-REDI Type 2 conduction-cooled version is available. The board is suitable for a range of applications within the defense, aerospace, security and surveillance market sectors in particular.

Optional front panel providing inclusive I/O:

- 1 x USB3.0, 3 x RS232, 1 x Gigabit Ethernet, 1 x DisplayPort

Optional XMC module interface (with front/rear I/O):

- XMC module interface (2 x4 or 1 x8 PCI Express® Gen 2)
- Optional board security packages

Optional Built-In Test (BIT) supports:

- Power-on BIT, Initiated BIT, Continuous BIT
- Optional Rear Transition Modules
- Commercial and Ruggedized conduction-cooled VPX-REDI versions (RCx-Series)

Complementary products include:

- Switch Fabric boards
- XMC carriers
- Mass Storage Boards
- Development Systems
- Fabric Interconnect Networking Software (FIN-S)

FEATURES

- 3U VPX (VITA 46.0) N-Series single board computer
- 4th generation Intel®Core™ processor
- Up to 16 Gbytes soldered DDR3L-1600 DRAM with ECC

Configurable control plane fabric interface (VITA 46.6) supports:

- 2 x SerDes (1000Base-BX) ports or
- 1 x SerDes plus 1 x Gigabit Ethernet ports or
- 2 x Gigabit Ethernet ports

Configurable PCI Express® (PCIe) data plane fabric interface (VITA 46.4) supports:

- 2 x 4 PCIe ports, 4 x2 PCIe ports or a 1 x8 PCIe port
- Support for Gen 1, Gen 2 and Gen 3
- Compatible with OpenVPX module profiles
- Single non-transparent port
- Compatible with the FR 331/x06 VPX Switch
- Up to 4 x SATA600 mass storage interfaces
- Support for onboard SATA Flash Drive Module
- Up to 4 x serial interfaces and up to 3 x USB interfaces
- IPMI (Intelligent Platform Management Interface)
- Watchdog and long duration timers
- Up to 3 x independent graphics interfaces
- Optional high definition stereo audio

Concurrent Technologies, Inc. | 781-933-5900 **Contact**: info@gocct.com

http://defense.ge-ip.com/products/sbc326/p3713

SBC326

The **SBC326 Rugged Single Board Computer (SBC)** from GE Intelligent Platforms features the high performance, highly integrated 4th Generation Core i7 processor platform from Intel.

4th Generation Core i7 offers integrated graphics and memory controller plus quad core processing up to 2.4 GHz all in one device. Coupled with the Mobile Intel QM87 Express Chipset this provides an unmatched level of I/O bandwidth for both on-board and off-board functions.

Features of the 4th Generation Core i7:

- *Graphics support for DX11.1, OpenCL 1.2, OpenGL 3.2*
- *5 to 15% CPU performance boost over 3rd generation*
- *Intel TurboBoost Technology*
- *Intel AVX 2.0 extensions and AES-NI instructions*
- *Hardware assisted security features*
- *Hyper-Thread Technology – 2 threads per core*

In addition to a comprehensive range of onboard I/O features, the SBC326 also offers an on-board mezzanine expansion site for enhanced system flexibility.

Memory resources include up to 16 GB DDR3 SDRAM, up to 32 GB NAND Flash (SSD), 32 MB BIOS Flash and 16 MB BIOS backup Flash.

The SBC326 is designed to meet the requirements of a wide range of applications from industrial through to fully rugged Defense and Aerospace programs. It offers extended temperature capability and a range of air and conduction cooled build levels.

A rich software choice is planned for the SBC326, including comprehensive Deployed Test Software (BIT and BCS) and AXIS, plus OS support for Windows 7, Open Linux, Wind River Linux, VxWorks®.

FEATURES

- Single slot 3U VPX Single Board Computer
- 4th Generation Intel Core i7 quad core processor (6 MB shared cache)
- Two channels of soldered DDR3 SDRAM with ECC up to 16 GB
- Up to 32 GB NAND Flash
- XMC Site (x8 PCIe Gen 3 capable)
- Rear I/O:
  - Up to 3 Gigabit Ethernet Ports (either one 1000BaseT plus two 1000BaseBX or two 1000BaseT)
  - 1x DVI/HDMI as standard (plus an additional DVI/HDMI port on some variants)
  - 1x SATA 6 Gb/s port as standard (plus additional two SATA 6 Gb/s ports on some variants)
  - 2x COM ports
  - 2x USB 2.0 ports (plus an additional USB 3.0 port on some variants)
  - Audio (available on some variants)
  - Up to 6x GPIO
- Five Levels of Ruggedization (Convection and conduction cooling variants)
- AXIS and Deployed Test Software
- Windows®, Linux® and VxWorks OS support

Video link
http://www.youtube.com/playlist?list=PLnPw6yhGDFtkBoTTh34yojGyZXPiHWD3M

PR URL
http://defense.ge-ip.com/news/new-single-board-computers-from-ge-to-feature-4th-generation-intel-core-i7-processor-technology/n3068

GE Intelligent Platforms, Inc. | 800-433-2682

Contact: GEIP.info@ge.com
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VECTOR ELECTRONICS & TECHNOLOGY, INC.

www.vectorelect.com

VECTORPAK™ "Slimline" CHASSIS – ITAR REGISTERED

19" rackmount, rugged aluminum construction with left to right airflow. Fans installed on left/right for maximum cooling of 6U x 160mm front cards and 6U x 80mm rear transition cards. 1U, 2U, 3U, 4U and 5U (2-10 backplane slots), IEEE 1101.1, .10 & .11 compliant.

Plug-in, hot-swap power supplies or embedded ATX:

- 200W plug-in power supply will provide 5V@25A; 3.3V@35A; +12V@8.0A and -12V@1.5A, AC/DC or DC/DC
- 250W high output plug-in power supply will provide 5V@40A; 3.3V@40A; +12V@5.5A and -12V@2.0A, AC/DC or DC/DC
- 300W embedded ATX-type power supply will provide 5V@30A; 3.3V@20A; +12V@16A and -12V@0.8A

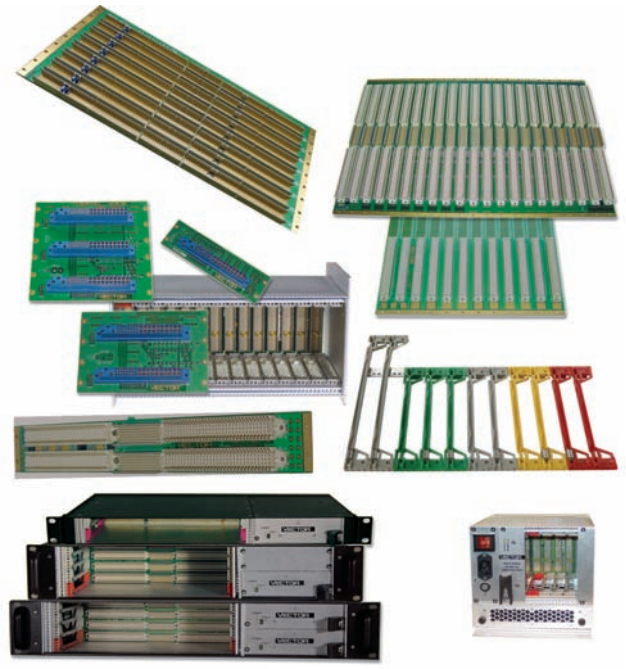
Backplane options:

- cPCI 64-bit/66MHz PICMG 2.0, Rev 3
- cPCI H110
- VME64x with EBG (Electronic Bus-Grant)

Our units are made at our U.S. facility, and we offer short lead times and custom configurations upon request.

Many color options are available.

Please call us at 1-800-423-5659 or e-mail us at inquire@vectorelect.com.



FEATURES

- CompactPCI or VMEbus
- 1U, 2U, 3U, 4U and 5U 19" rackmount
- Push-pull fans for maximum airflow
- Dual-redundant hot-swappable power supplies
- Wide choice of factory colors

Vector Electronics & Technology, Inc. | 800-423-5659 **Contact:** inquire@vectorelect.com

X-ES

xes-inc.com

XPedite7501 4th Gen Intel Core i7 XMC Module

The **XPedite7501** is a high-performance, low-power, XMC module based on the 4th generation Intel® Core™ i7 Haswell processor. With up to three PCI Express Gen3-capable ports and two Gigabit Ethernet ports, the **XPedite7501** is ideal for high-bandwidth data processing applications. Floating-point-intensive applications such as radar, image processing, and signals intelligence will benefit from the performance boost provided by the Intel Advanced Vector Extensions 2.0 (Intel AVX2).

The **XPedite7501** accommodates up to 16 GB of DDR3L-1600 ECC SDRAM in two channels to support memory-intensive applications and hosts numerous I/O ports, including Gigabit Ethernet, USB, SATA, graphics, and RS-232/422/485.

FEATURES

- Supports 4th generation Intel® Core™ i7 processors
- XMC (VITA 42) module
- Conduction or air cooling
- Up to 16 GB of DDR3L-1600 ECC SDRAM in two channels
- Up to 32 GB of NAND flash
- Two x4 or one x8 PCI Express Gen3-capable P15 XMC interface
- One x4 PCI Express P16 XMC interface
- Two Gigabit Ethernet ports
- Four USB 2.0 high-speed ports
- Two SATA ports
- Two RS-232/422/485 serial ports
- HDMI/DVI-D or dual-mode DisplayPort interface
- Intel® vPro™/AMT support
- Wind River VxWorks BSP, Linux BSP, Microsoft Windows drivers

Extreme Engineering Solutions (X-ES) | 608-833-1155

Contact: sales@xes-inc.com
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X-ES

xes-inc.com

XPedite7570 4th Gen Intel Core i7 3U VPX

The **XPedite7570** is a high-performance, low-power, 3U VPX-REDI, single board computer based on the 4th generation Intel® Core™ i7 Haswell processor. With two PCI Express Fat Pipe P1 interconnects and four Gigabit Ethernet ports, the **XPedite7570** is ideal for the high-bandwidth data processing demands of today's military and avionics applications. Floating-point-intensive applications such as radar, image processing, and signals intelligence will benefit from the performance boost provided by the Intel Advanced Vector Extensions 2.0 (Intel AVX2).

The **XPedite7570** accommodates up to 16 GB of DDR3L-1600 ECC SDRAM in two channels to support memory-intensive applications. The **XPedite7570** also hosts numerous I/O ports, including Gigabit Ethernet, USB, SATA, graphics, and RS-232/422/485 through the backplane connectors.

FEATURES

- Supports 4th generation Intel® Core™ i7 processors
- 3U VPX (VITA 46) module
- OpenVPX™ standards based
- Ruggedized Enhanced Design Implementation (REDI) per VITA 48
- Conduction or air cooling
- Up to 16 GB of DDR3L-1600 ECC SDRAM in two channels
- Up to 32 GB of NAND flash
- PMC/XMC interface
- Two PCI Express Gen3-capable Fat Pipe P1 fabric interconnects
- Four Gigabit Ethernet and four SATA ports
- Two HDMI/DVI-D or dual-mode DisplayPort interfaces
- One XMC (P16) SATA port for storage mezzanine
- Intel® vPro™/AMT support
- Wind River VxWorks BSP, Linux BSP, Microsoft Windows drivers

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DIY/Mini boards: Gizmo board

embedded-computing.com/p9913611

www.gizmosphere.org

Gizmo Explorer Kit

Gizmo Explorer Kit, a complete systems solution that includes the following:

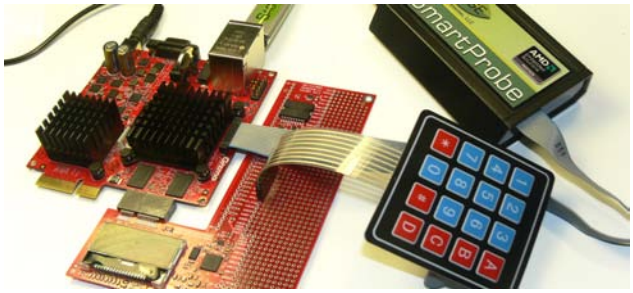
Gizmo: 4"x4" development board for embedded innovators, powered by AMD Embedded G-Series APU. Custom card edge connectors provide access to SATA, USB, DisplayPort, PCIe, SPI, I2C, GPIO, PWM, ADC/DAC, more.

Explorer: Expansion I/O board, attaches to Gizmo via low-speed connector. Alphanumeric keypad, micro-display, sea of holes for prototyping.

Sage SmartProbe® JTAG: For debug and development including access to registers and memory, USB and Ethernet support, remote access, virtual port, field updatable firmware, more. SmartProbe® hardware plus 20+ hours limited time use.

Sage EDK Graphical Interface: 30-day trial license gives developers a chance to try tool. Smart editor, cross-compile toolchain integration, automated image transfer, symbolic software debug, more.

Plus preinstalled SageBIOS™, flash thumb drive ready to boot with SLAX Linux distribution, quick start guide, power supply, USB cable connecting SmartProbe® to your PC, Ethernet cable for remote system development.



FEATURES

- **Gizmo**, a compact, stand-alone development board for evaluating, experimenting and developing in open source, x86 embedded design projects. Leverages features of the AMD Embedded G-Series APU and controller hub for maximum flexibility. Gizmo delivers 52.8 GFLOPS at less than 10W! The power of a supercomputer and I/O functionality of a microcontroller.
- **Explorer**, a companion board for Gizmo that brings out the I/O and enables greater experimentation opportunities.
- **Sage SmartProbe® JTAG Development Tool**, an automated, configurable plug-in software development tool for embedded designs.
- **Sage EDK Graphical Interface**, an intuitive interface that streamlines development and debug. A 30-day trial license is included with the kit.
- **Gizmo comes preinstalled with SageBIOS™**, a distribution of open source coreboot®.
- User guides, spec sheets, schematics, discussion forums and more at www.gizmosphere.org.

GizmoSphere | 877-466-9722

Contact: gizmosphere@gizmosphere.org
Facebook: www.facebook.com/GizmoSphere

DIY/Mini boards: MinnowBoard

embedded-computing.com/p9912045

www.minnowboard.org

MinnowBoard

MinnowBoard is the first open hardware/open software, Intel® Atom™ 1.0 GHz 32-bit CPU with Hyper-Threading and Virtualization Technology based board that introduces the Intel® Architecture to the small and low cost embedded market for the developer and maker community. MinnowBoard combines great performance and a mature ecosystem via X86 compatibility/PC architecture standards (PCIe, SATA and USB), which provide generous I/O, video capabilities and Gigabit Ethernet. MinnowBoard also includes key embedded standards (SPI, I2C, CAN, GPIO) all with Angstrom, a Yocto Project Compatible Linux® Distribution and UEFI firmware with Fast Boot. The board is expandable via a flexible expansion connector that is chassis-friendly and stackable. The MinnowBoard is a powerful, low cost solution for embedded projects.

FEATURES

- Performance
- Openness
- Flexibility
- Standards

Twitter: https://twitter.com/minnowboard

Intel | 503-712-8338

Contact: scott.a.garman@intel.com – *Scott Garman, MinnowBoard Evangelist*
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www.maximintegrated.com/datasheet/index.mvp/id/8052

DS28E35 DeepCover® Secure Authenticator with 1-Wire ECDSA and 1Kb User EEPROM

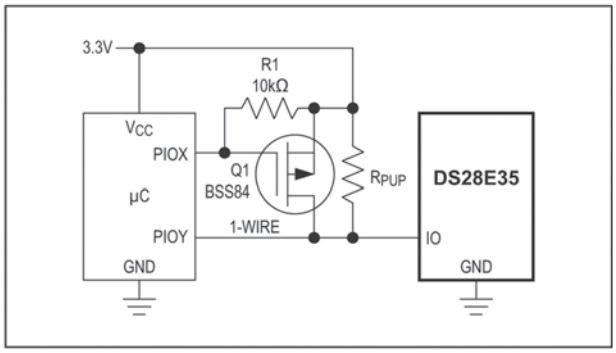
Provides Affordable Elliptic-Curve Public-Key Authentication Security to Protect Your Development Investment

DeepCover® embedded security solutions cloak sensitive data under multiple layers of advanced physical security to provide the most secure key storage possible.

The DeepCover Secure Authenticator (DS28E35) provides a highly secure solution for a host controller to authenticate peripherals based on the industry standard (FIPS 186) public-key based Elliptic Curve Digital Signature Algorithm (ECDSA). The ECDSA engine computes keys and signatures using a pseudorandom curve over a prime field according to the "Standards for Efficient Cryptography (SEC)". The private and public key can be computed by the device or installed by the user and optionally locked. Separate memory space is set aside to store and lock a public-key certificate as it is needed to verify authenticity. In addition to ECDSA-related memory, the device has 1024 bits of user memory that is organized as four pages of 256 bits. Page protection modes include write protection, read protection, and one-time-programmable (OTP) memory emulation modes. The DS28E35 also features a one-time settable, nonvolatile 17-bit decrement-on-command counter, which can be used to keep track of the lifetime of the object to which the DS28E35 is attached. Each device has its own guaranteed unique 64-bit ROM identification number (ROM ID) that is factory programmed into the chip. This unique ROM ID is used as a fundamental input parameter for cryptographic operations and also serves as an electronic serial number within the application. The DS28E35 communicates over the single-contact 1-Wire® bus at overdrive speed. The communication follows the 1-Wire protocol with the ROM ID acting as node address in the case of a multi-device 1-Wire network.

Applications:

- *Authentication of Consumables*
- *Peripheral Authentication*
- *Medical Sensors*
- *Printer Cartridge Identification and Authentication*



FEATURES

- Public-key cryptography simplifies implementation
  - Eliminates the need for host-side key storage
  - Avoids the difficulties of key distribution faced in multislave environments
- 1-Wire interface reduces interconnect complexity
  - Allows operation from a single dedicated contact
- High integration reduces cost and complexity
  - ECDSA engine with 1-Wire interface
  - Nonvolatile (NV) memory
  - Hardware random-number generator
  - Tamper protection circuitry

Maxim Integrated | 408-601-1000

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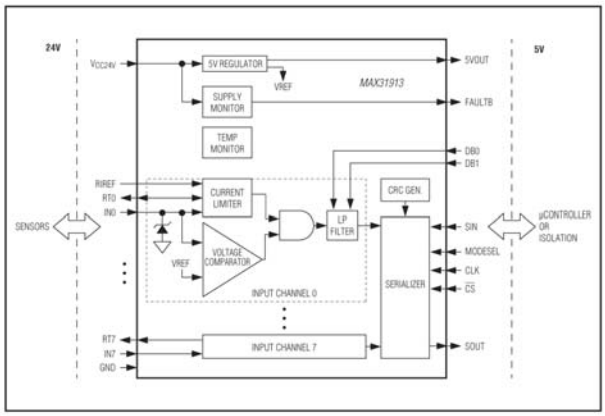
www.maximintegrated.com/datasheet/index.mvp/id/8069

MAX31913

Industrial, Octal, Digital Input Translator/Serializer

Industry's Most Robust Low-Power Industrial Digital Input Serializer



The MAX31913 industrial interface serializer translates, conditions, and serializes the 24V digital output of sensors and switches used in industrial, process, and building automation to 5V CMOS-compatible signals required by microcontrollers. It provides the front-end interface circuit of a programmable logic controller (PLC) digital input module. The device features integrated current limiting, lowpass filtering, and channel serialization. Input current limiting allows a significant reduction in power consumed from the field voltage supply as compared to traditional discrete resistor-divider implementations. Selectable on-chip lowpass filters allow flexible debouncing and filtering of sensor outputs based on the application. On-chip serialization allows a drastic reduction in the number of optocouplers used for isolation. The device serializer is stackable so that any number of input channels can be serialized and output through only one SPI-compatible port. This reduces the number of optocouplers needed to only three, regardless of the number of input channels. For enhanced robustness with respect to high-frequency noise and fast electrical transients, a multi-bit CRC code is generated and transmitted through the SPI port for each 8 bits of data. The on-chip 5V voltage regulator can be used to power external optocouplers, digital isolators, or other external 5V circuitry. Field-side LED drivers recycle the current from the eight inputs to provide visual input status indication without any additional current or power consumption.

For ultra-low-power applications, and for the lowest possible heat dissipation Maxim Integrated plans to offer a pin-compatible version of this device, the MAX31912. The MAX31912 uses patent-pending circuit techniques to achieve further reduction of power beyond what is possible by input current limiting alone. Contact the factory for availability.

Applications:

- *Digital Input Modules for PLCs*
- *Industrial, Building, and Process Automation*
- *Motor Control*

FEATURES

› Programmable current limiting for each input
  – Reduces system heat dissipation and power consumption
  – Eliminates PCB hot spots
  – Enables higher channel density
  – Reduces system cost
  – Smaller power supply
  – Less stringent cooling requirements

› On-chip data serializer with CRC to ensure data integrity
  – Reduces the number of galvanic isolators (optocouplers)
  – Minimizes I/O module component count

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eNOVA TECHNOLOGY CORPORATION

www.enovatech.net

Enigma 2 – USB Hardware Crypto Module Securing Cloud Storage

The **Enova Enigma 2 HCM** is a USB hardware crypto module capable of encrypting selective files and folders of any computer detectable storage devices including boot drive, external drive such as USB or 1394, network attached drive and virtual drives such as Dropbox, Windows SkyDrive and Google's GoogleDrive. It deploys **Enova's X-Wall DX256** (AES ECB) and **X-Wall DX256C** (AES CBC) real-time USB-to-USB hardware crypto modules, which are NIST/CSE certified.

Unlike software encryption that relies on CPU and other system resources, the **Enigma 2 HCM** performs authentication and cryptographic operations on the chip level that completely eliminate security weakness found on all software encryption products. It encrypts existing data in place. The user gets to send the encrypted files/folders through the public network with confidentiality. Only the right recipient who has possessed the same key can successfully decrypt those received encrypted files and folders.

FEATURES

- NIST/CSE certified AES ECB & CBC 256-bit hardware engines
- Supports 2-factor authentication
- Capable of encrypting selective files/folders of any OS detectable storage drives, including boot drive, external drive such as USB or 1394, network attached storage and virtual drives such as Dropbox, SkyDrive and GoogleDrive
- Capable of encrypting full disk, any number of connected USB storage devices
- Simple to use GUI of Windows and Macintosh; requires no software and/or driver download and installation
- Compliance to any USB 1.1/2.0/3.0 protocols

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Designed to perform in the most extreme environments, these compact, lightweight and high-speed interconnect solutions from TE Connectivity support increasing bandwidth requirements and withstand increasing shock and vibration conditions of emerging military, aerospace and marine applications.

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- 10 Gb/s
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- 360° EMI protection

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- 5 GHz+
- 500 mating cycles
- Solder joints
- 4-point contact redundancy

Fortis Zd Connector
- 12 Gb/s+
- 4-point contact redundancy
- Ruggedized for harsh environments

MULTIGIG RT 2-R Connector
- Quad-redundant contact system
- Rugged survivability – High level shock and vibration beyond VITA 47
- "Pinless" Interface tested to 10,000 mating/unmating cycles

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Military/Aerospace: Signal processing

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CHAMP-AV9 6U OpenVPX quad-core Intel Core i7 4th Gen DSP Card

The **Curtiss-Wright CHAMP-AV9** combines the floating point performance of the latest Intel Core i7 processors, with the processors with the substantial bandwidth and system-enabling features of the 6U OpenVPX form factor. Providing a pair of quad-core 4th generation Core i7 (Haswell) processors, featuring the updated AVX 2.0 instruction units and redesigned on-chip graphics execution units, the CHAMP-AV9 offers a 2-4X performance per size, weight and power improvement over previous DSP modules. A dual-channel 25 GB/s (each) DDR3 memory per CPU provides ample bandwidth to simultaneously serve CPU access and streaming I/O from the VPX backplane interfaces.

The CHAMP-AV9 is the DSP multi-processing component of Curtiss-Wright Controls Defense Solutions' High-Performance Embedded Computing (HPEC) solution set, and is ideal for demanding defense applications such as radar, sonar, signal intelligence and image processing.

FEATURES

- 6U OpenVPX compliant
- Two Intel Core i7 quad-core 4th generation processors
- 664-1369 GFLOPs peak computing performance
- 16 GB DDR3 SDRAM with ECC
- Four 40 Gb Ethernet Data Plane interfaces at an aggregate 112 Gbps
- Two 16-lane Gen3 PCI Express Expansion Plane interfaces
- Power management features
- VxWorks BSP and Linux LSP
- Rugged air-cooled and conduction-cooled versions - Trusted COTS

Curtiss-Wright Controls Defense Solutions | 703-779-7800

Contact: defensesales@curtisswright.com

www.maximintegrated.com/datasheet/index.mvp/id/7240

MAX11040K/MAX11060

24-/16-Bit, 4-Channel, Simultaneous-Sampling, Cascadable, Sigma-Delta ADCs

The MAX11040K/MAX11060 are 24-/16-bit, 4-channel, simultaneous-sampling, sigma-delta analog-to-digital converters (ADCs). The devices allow simultaneous sampling of as many as 32 channels using a built-in cascade feature to synchronize as many as eight devices. The serial interface of the devices allows reading data from all the cascaded devices using a single command. Four modulators simultaneously convert each fully differential analog input with a programmable data output rate ranging from 0.25ksps to 64ksps. The devices achieve 106dB SNR at 16ksps and 117dB SNR at 1ksps (MAX11040K). The devices operate from a single +3V supply. The differential analog input range is ±2.2V when using the internal reference; an external reference is optional. Each input is over-voltage protected up to ±6V without damage. The devices use an internal crystal oscillator or an external source for clock.

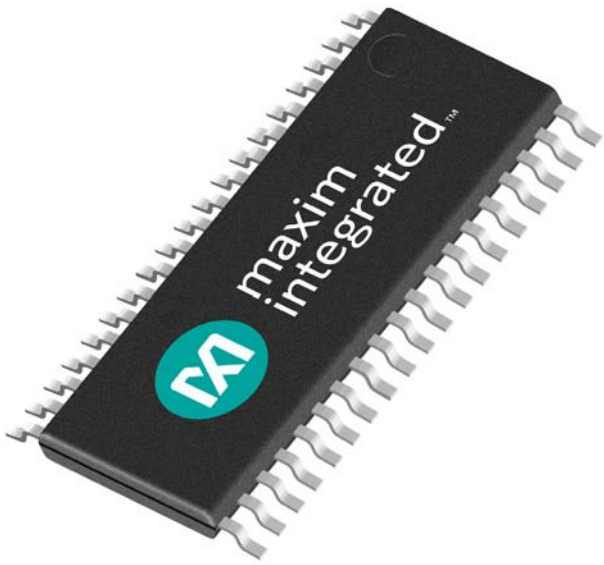
The devices are compatible with SPI, QSPI™, MICROWIRE®, and DSP-compatible 4-wire serial interfaces. An on-board interface logic allows one serial interface (with a single chip select) to control up to eight cascaded devices or 32 simultaneous sampling analog input channels.

The devices are ideally suited for power-management systems. Each channel includes an adjustable sampling phase enabling internal compensation for phase shift due to external dividers, transformers, or filters at the inputs. The output data rate is adjustable with a 0.065% resolution (at 16ksps or below) to track the varying frequency of a periodic input. An active-low SYNC input allows periodic alignment of the conversion timing of multiple devices with a remote timing source.

The devices are available in a 38-pin TSSOP package specified over the -40°C to +105°C industrial temperature range.

Applications:

- *Power-Protection Relay Equipment*
- *Multiphase Power Systems*
- *Industrial Data-Acquisition Systems*
- *Medical Instrumentation*



FEATURES

- 24-bit, 4-channel simultaneous sampling Sigma-Delta ADC Cascadable up to 8 devices and with per channel programmable phase adjustments
  - Greatly exceeding class 0.2 (0.2% error) accuracy for 220V and measures surge voltage up to 6000V
  - The per channel programmable phase adjustment guarantees true simultaneous sampling of the signal sources and true bipolar input simplifies design.

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Storage: DRAM DIMMs

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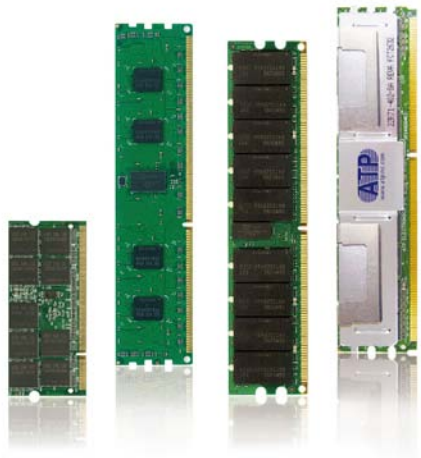
www.atpinc.com

ATP DRAM MODULES



ATP DRAM Modules are designed for high-performance, mission-critical applications such as industrial PC, telecom, medical, healthcare and enterprise computing, where high levels of technical support, operating consistency, and wide operating temperature ranges are required. Built with high quality IC components and 100% tested, the ATP DRAM module family includes a full spectrum of form factors including VLP, ULP, UDIMM, RDIMM, SODIMM, and MINI-DIMM, as well as multiple generations of DRAM technologies.

ATP is a true manufacturer with over twenty years of experience in the production of NAND Flash memory solutions and DRAM memory modules. ATP offers in-house design, testing and product tuning, as well as extensive supply chain support with controlled/fixed BOMs and long product life cycles.

FEATURES

- JEDEC compliant
- Extensive support on DDR3, DDR2, DDR1, and PC133 SDRAM generation memory modules
- Industrial Grade temperature range (-40°C to 85°C)
- Conformal coating for environmentally rugged applications
- Long-term supply chain commitment upon module qualification
- Customization/SPD tuning available
- Simulation model files available upon request

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Storage: Hard drives

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Flash Card Series

Among many varieties of memory devices, MicroSD & SD & CF cards are very popular for embedded devices in such fields as medical, military, gaming, automotive and POS applications to date due to their cost effectiveness, reliability and stability. Apacer's new flash card series expands its capacity up to 128GB, performance up to 115/80 MB/sec, making it the best choice for industrial computers. It provides superb convenience in terms of matching with systems and expansion of capacity. To give a performance boost, this product series comes equipped with an industry-leading Error Correcting Code (ECC) function, S.M.A.R.T technology, and ATA Secure Erase command, all of which enhance the product's reliability and stability.

FEATURES

- Compliant with CFA 6.0 & SD 2.0 specification
- Advanced wear-leveling and block management
- Built-in ATA secure erase and S.M.A.R.T. functions
- Intelligent power failure recovery
- MLC extended temperature support

Apacer Memory America, Inc. | 408-518-8699

Contact: ssdsales@apacerus.com

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SATA 3 Series

SATA interfaced SSDs have been the reliable partners for industrial and embedded computing systems in data cache, storage and system boot. Performance and I/O efficiency play extremely critical roles in industrial and embedded operations. Millions of daily data are processed and the host systems require storage media with even faster performance. Apacer has launched SATA III interfaced SSD series to break the performance bottleneck.

FEATURES

- SATA 3 (6Gb/s) interface
- Global wear-leveling and block management
- Built-in ATA secure erase and S.M.A.R.T. functions
- TRIM command Support

Apacer Memory America, Inc. | 408-518-8699

Contact: ssdsales@apacerus.com

ATP®

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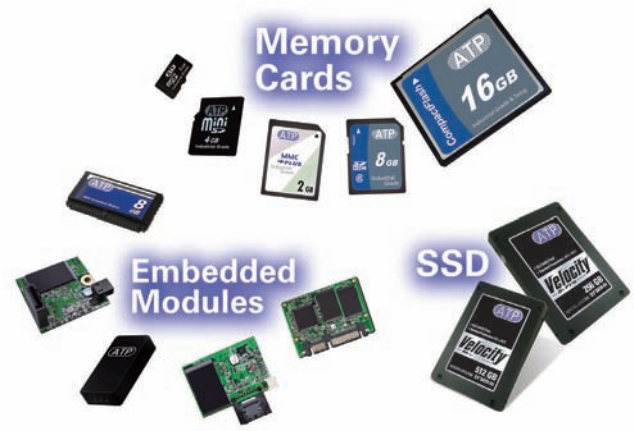
ATP INDUSTRIAL GRADE FLASH PRODUCTS

Flash Product Line Summary: Memory Cards (micro/mini/SD, MMCplus), **Embedded Modules** (SATA, USB, eUSB), and **HDD Replacement SSD** (2.5" SATAII/III).

ATP Industrial Grade Flash Products are designed for high-performance, mission-critical applications such as enterprise computing and mobility, healthcare, transportation, and military/aerospace, where high levels of durability, operating consistency, and wide operating temperature ranges are required. All ATP Industrial Grade Flash products implement ECC and wear-leveling algorithms to maximize Flash component utilization and long-term data integrity. The product line is also built using SLC (Single Level Cell)-type NAND flash components, which are specified to at least 20 times the rating for program/erase cycles (lifetime) compared to commercial and consumer level MLC-type NAND Flash.

Commercial grade products are also available for most form factors and densities.



FEATURES

- SLC NAND Flash Components
- Patented Power Protector Technology – Data integrity during a sudden power down
- SMART Life Monitor Technology – Flash health status feedback to host
- Integrated Secure Erase Technology
- Industrial Grade temperature range (-40°C to 85°C)
- Supply chain road maps by BOM upon product qualification
- Onboard AES Encryption (SSD Products)

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Storage: Solid state disks

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Elma has the broadest selection of storage solutions in the embedded computing industry. Our high performance, feature-rich products are used in all sorts of applications that require reliable, tested storage solutions. Available in convection cooled, rugged extended temperature and conduction cooled configurations, featuring standard and rugged rotating drives in SAS, SATA rotating or SLC, MLC and eMLC solid state drives for virtually any application.

FEATURES

- Support for high capacity/performance, low profile solid state, NAND and HDD drives
  - Latest solid state drive technology including SLC, MLC and eMLC
  - SATA, SAS and PCIe
  - Legacy interface support
- Front removability, security features, NAS/RAID support
- XMC, PMC, CPCI, VPX, VME & custom form factors
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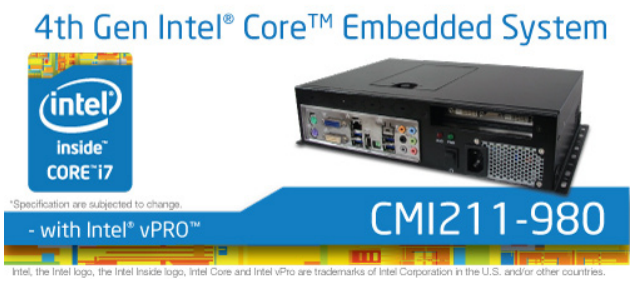
4th Gen Intel® Core™ i7/i5 Embedded System | CMI211-980

The **CMI211-980** is an expandable embedded system that supports 4th Gen Intel® Core™ i7/i5 mobile processors and Intel® QM87 chipsets. The new Intel® Core™ processor provides a boost in graphics and CPU performance over previous generations. The enclosed new board design is optimized to provide the industrial and embedded markets with higher processing capability with a lower power consumption rate.

The CMI211-980 has a sleek dimension of 300mm(W) x 205mm(D) x 72mm(H) making it an impressive addition to applications requiring top performance where space is an issue. The system is also available with Intel® vPro™ technology, which provides trusted security and out-of-band remote management.

** OEM/ODM service is available*



FEATURES

- Supports 4th Gen Intel® Core™ i7/i5 Mobile Processors
- DDR3 SO-DIMM Memory, Up to 16GB
- Integrated VGA, supports DVI-I/DVI-D/LVDS or eDP/DisplayPort
- 2x PCI-E Intel® Gigabit Ethernet
- Watchdog timer, Digital I/O, TPM 1.2
- "iSMART" feature: Power saving/resume & auto-scheduling
- 6x USB 2.0, 4x USB 3.0, 6x COM, 4x SATA III, 2x SATA II
- Expandable with 1x PCI-E (x16), 2x Mini PCI-E (x1) slots
- mSATA available (via Mini PCI-E)
- Intel® vPro™ technology, Intel® Active Management Technology 9.0

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iBASE
Industry Leader in Embedded Computing

www.ibase-usa.com

Fanless AMD Embedded G-Series SOC System | SI-22

The **SI-22** is an ultra slim, fanless embedded system powered by AMD Embedded Quad-Core G-Series SOC (System-on-Chip) with AMD Embedded G-Series SOC built-in GPU, AMD Radeon™ HD8000 Series. SI-22 is compact in size, a superior-performance-per-watt form factor with enhanced multimedia capability. The AMD Embedded G-Series SOC has made SI-22 a superior choice in Digital Signage & Kiosks types of markets where size, low-power consumption and graphics performance are mission critical.

The SI-22 fanless system is only 7.5"(W) x 5.1"(D) x 0.77"(H) in size, comes with 1x DDR3 SO-DIMM, supports up to 8GB of system memory. Standard offering supports 2x HDMI, 2x Mini PCI Express-E (x1) slots for further expandability. I/O of 2x USB 3.0, 1x USB 2.0, mSATA (via mini PCI-E slots), also with Gigabit LAN support, allows comprehensive peripheral and networking features.

AMD, the AMD logo and the AMD Embedded G-Series logo are trademarks of Advanced Micro Devices, Inc in the U.S. and other countries.

FEATURES

- Powered by AMD Embedded Quad-Core G-Series SOC (System-on-Chip)
- Fanless Aluminum Design, Ultra Slim and Compact
- 1x DDR3-1600 SO-DIMM, Max. 8GB
- 2x USB 3.0, 1x USB 2.0, 2x HDMI
- 1x RJ45 Realtek Gigabit LAN, 1x RS232
- 2x Mini PCI-E slots for optional Wi-Fi, Bluetooth, 3G Wireless or TV Tuner connectivity
- Watchdog timer, Digital I/O, mSATA (via Mini PCI-E slot)
- "iSMART" feature: Power saving/resume & auto-scheduling
- DASH – Remote Dignostics and Repair

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rtd®

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HiDAN HDC5915-5 Cisco Embedded Services Router

The **HiDAN HDC5915-5** is a 5-port Fast Ethernet router system based on the Cisco 5915 ruggedized embedded router. This system enables the deployment of Cisco Mobile Ready Net capabilities in mobile, air, ground and unmanned applications. RTD's waterproof, milled aluminum packaging and cylindrical connectors create an ideal chassis for this advanced Cisco 5915 system.

This compact system pairs the proven ruggedness of RTD products and enclosure technology with the robust quality and performance of Cisco's 5915 Router. The HiDAN HDC5915-5 offers reliable operation in extreme temperatures and under high shock and vibration conditions.

FEATURES

- Rugged waterproof enclosure
- -40° to +85°C Operation
- Integrated Cisco 5915 Embedded Services Router (ESR)
  - *Cisco IOS Software*
  - *Cisco Mobile Ready Net capabilities*
  - *Highly secure data, voice, and video communication*
- 5x Fast Ethernet Ports (10/100)
  - *3x Switched Ports for local connections (Layer 2)*
  - *2x Routed Ports for remote connections (Layer 3)*
  - *Supports auto-negotiation of speed and duplex*
- 1x Serial Console Port
- LED indicators
- Console port for programmability

RTD Embedded Technologies, Inc. | 814-234-8087

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- Supports popular virtualization technologies
- IPMI v2.0 support
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- Operating Humidity: 8% to 90% non-condensing
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FEATURES

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FEATURES

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The TS-TPC-8390 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 4 USB Host ports, 3 RS-232, up to 2 RS-485 ports, up to 2 CAN ports, DIO, I2C, built-in speaker, RTC, and 6 channels of 16-bit A/D. Quantity 100 starts at $415.

7" 800x480 – TS-TPC-8380 Low Cost Fully Enclosed Touch Screen Computer
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10.4" 800x600 – TS-TPC-8900 Touch Screen Computer
The TS-TPC-8900 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 2 USB ports, 2 RS-232, up to 2 RS-485 ports, an XBee socket, DIO, I2C, built-in speaker, and RTC. The TS-TPC-8900 also includes a 64 pin PC/104 bus that can be used to expand the functionality to many of Technologic Systems off-the-shelf PC/104 peripherals. Quantity 100 starts at $599.

FEATURES

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Systems: Panel computers

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PPC-E4+ Ultra Compact ARM Panel PC

The **PPC-E4+** is an ultra compact Panel PC with a 4.3" WQVGA TFT color LCD and 4 wire resistive touch screen. The dimensions of the **PPC-E4+** are 4.8" by 3.0", about the same dimensions as that of popular touch cell phones. The **PPC-E4+** compact Panel PC utilizes a System on Module (SoM) for the processing core. This allows the user to easily upgrade, if more memory capacity, storage capacity or processing power is required. The **PPC-E4+** includes an embedded ARM 9 SoM; this ARM System on Module features a 400MHz Fanless Low Power Processor with video and touch. The SoM provided with the PPC-E4+ supports up to 256MB of SDRAM, up to 1GB of Flash, and up to 8MB of serial data flash. Typical power consumption is less than 5 Watts and the LED backlight can be shut off when not in use to further decrease its power consumption. Pricing starts at $375 for Quantity 1.

FEATURES

- ARM9 400MHz Fanless Processor
- Up to 1 GB Flash & 256 MB RAM
- 4.3" WQVGA 480 x 272 TFT LCD
- Analog Resistive Touch Screen
- 10/100 Base-T Ethernet
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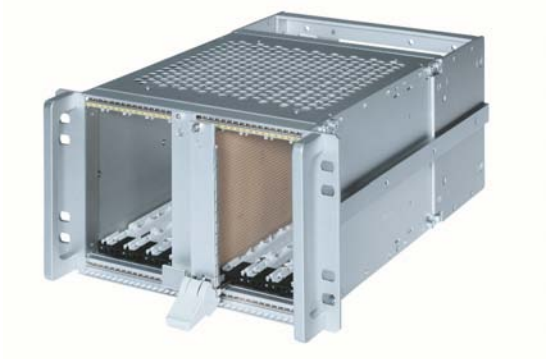

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Tracking Trends in Embedded Technology

By Rory Dear, Technical Contributor

rdear@opensystemsmedia.com

XP Embedded: Alive and kicking, or dead and twitching?

I have a longstanding frustration with commercially pushed "obsolescence"; I define this as a migration path pushed for nontechnical motivations, sometimes even flying in the face of technical reason.

The retail industry has been guilty of this for decades, cleverly scripted advertisements to convince one that the usually minor, usually superfluous features of the shiny "new" product are the opposite, with the purpose of leaving the individual wondering how they had coped so long without them.

However, the embedded/industrial computing industry is a far cry from that world. Reliability, longevity, and stability are kings here, but the ever increasing need to drive profit from new products constantly threatens to corrupt these fundamentals – particularly when coupled with falsified scaremongering about the "old" product's impending demise, designed to panic the customer. This then starts bordering on the unethical.

Whilst parallels can increasingly be drawn in so many industrial product ranges, as an MCTS of XP Embedded/WES 2009 (from here on "XPe"), I must fight on the side of one of the most popular GUI-based embedded operating systems of our time.

Following a call from a panicked client, having heard on the grapevine of XPe's looming quietus, it transpired he had seen press releases relating to the retail, desktop version, XP Professional. This is an ambiguity we should first resolve, such that we can be confident in what is supplier scaremongering and what is more client confusion.

The purely desktop versions of XP, "Professional" and "Home," had an announcement of a cessation of "support" of April 8, 2014. Whilst in my learned view Microsoft's announcement wasn't ambiguous, a proportion of the embedded public erroneously took this to cover all versions of XP, including our own, cherished, XPe.

It's important that we understand what is meant by the announcement itself, before we concern ourselves with what versions it affects: Simply, this refers to no further Service Pack or security updates. Embedded developers abhor updates, which can threaten the stability of a deployed, inaccessible, system and one that is rarely connected to the Internet directly, such that a need to protect itself (at source) is necessary, akin to the very small percentage of such systems running resource hungry antivirus software.

The other aspect is the advised lack of new hardware driver support; this is ambiguous and could easily be perceived to be equally true of new embedded hardware. Embedded manufacturers still ensure their systems support long-consumer-forgotten legacy OSs (even DOS) as the continuation of the OS platform is so often desired for customers forced to upgrade, through hardware obsolescence, for example.

Changes to both naming conventions and licensing arrangements by Microsoft have made a disjointed product range more coherent to fresh faces, though to seasoned developers, the road map became somewhat perplexing.

It's worth noting now that a well-known global electronics distributor adds fuel to the fire of ambiguity by stating openly on their website "Windows XP Embedded (Now Windows XP Professional for Embedded Systems)," which is simply false.

Having addressed those two aspects, we find neither has significant bearing in the embedded marketplace. With no announcements regarding cessation of availability of licenses (and why would they, logically?), one has to question exactly in what way is this highly flexible OS now suddenly unsuitable? Its low-performance requirements, wide driver support, low licensing costs, and excellent embedded-only features make it ideal for so many mid-range applications.

Thus, it's disappointing that XPe is dragged into the cloud of confusion regarding its obsolescence to create fear and pressure customers to upgrade. One wonders if actually, having perceived they "must," would a developer first consider the latest variants too resource and storage hungry? Could these concerns be a major shot in the foot for those pushing these agendas? A recent embedded survey suggested only 15 percent of developers intend to use a Microsoft OS for their next project. This must be addressed.

Whilst writing, I received a newsletter from another major electronics distributor entitled "XP is about to expire: Discover the alternatives," pushing unsurprisingly, Windows 8 Embedded. At a risk of being branded a Luddite (though I would counter this with an in-depth understanding of what our industry needs), I would suggest that a very small percentage of embedded applications would utilize any of the new features offered by these latest versions, whilst all having to embrace higher hardware and licensing costs in addition to increased power consumption, heat dissipation, and storage needs. All this reduces market competitiveness – purely because one was pushed to jump on the new technology bandwagon. How is this good for our industry?

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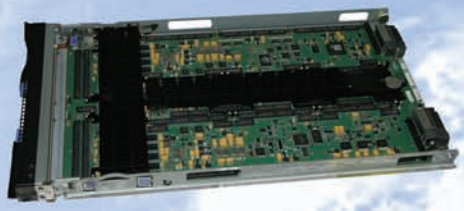

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