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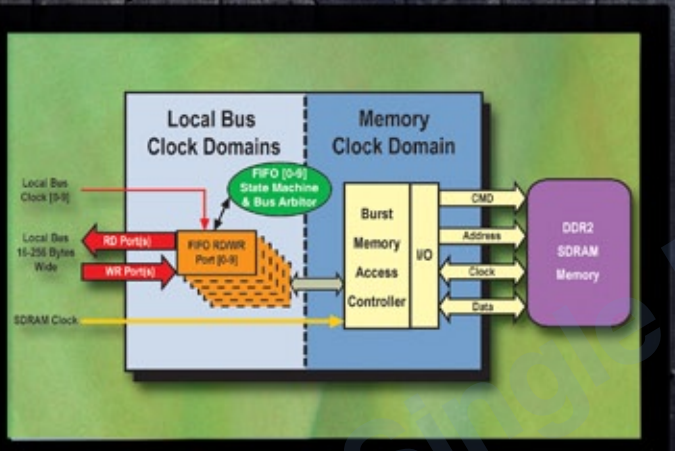

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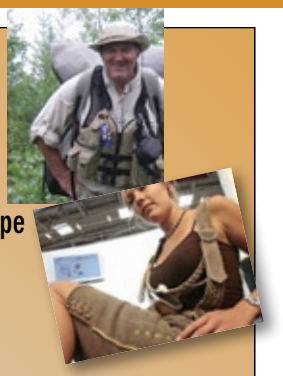

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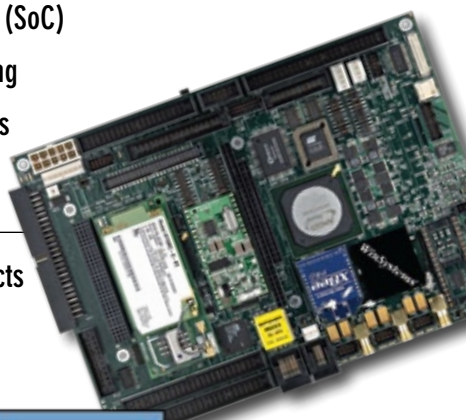

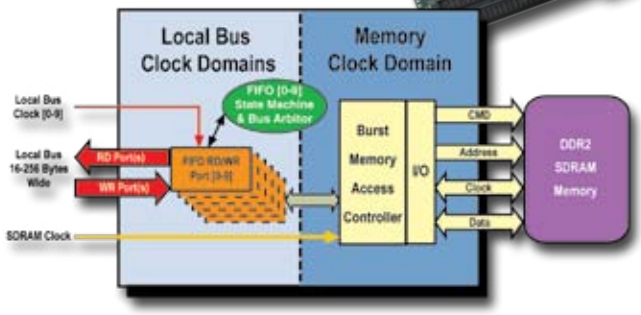

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Editorial Director	Jerry Gipper jgipper@opensystems-publishing.com
Contributing Editor	Don Dingee
Technical Editor	Chad Lumsden clumsden@opensystems-publishing.com
Associate Editor	Jennifer Hesse jhesse@opensystems-publishing.com
Copy Editor	Robin DiPerna
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Special Projects Editor	Bob Stasonis
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Circulation/Office Manager	Phyllis Thompson subscriptions@opensystems-publishing.com

OpenSystems Publishing

Editorial/Production office:
16872 E. Avenue of the Fountains, Ste 203, Fountain Hills, AZ 85268
Tel: 480-967-5581 ■ Fax: 480-837-6466
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Life without embedded computing

Jerry Gipper

Many of us have major attachment issues with our gadgets, probably because we depend so heavily on them to get us through our daily tasks. We're on our cell phones talking to friends and business associates, using our computers for work and communication, jamming to our MP3 players and radios, and sending and responding to a nonstop stream of text messages. We watch television programs live or delayed through DVRs on our HDTVs. Cooking and driving all depend on embedded computing, too.

For many people, life without these devices would seem impossible or difficult at best. And I am no exception. Anyone who knows me knows I am hooked on my many electronic devices. Living without them is something I just don't want to imagine.

But after recently spending a week in the Boundary Waters Canoeing Area Wilderness in northern Minnesota and southern Canada, I can happily report that life is possible without all the high-tech toys. My Boy Scouts and I were able to make it through an entire week without access to any electronic devices except for a few digital cameras, a GPS receiver, and an emergency radio. None of us resorted to using rocks for video games or Blackberries. Though I did see one Scout sitting on a rock while strumming on his air guitar and singing lyrics to some unknown rock song.

Cell phone and wireless Internet coverage was minimal at the base camp and spotty to nonexistent in the wilderness. We were requested to leave all nonessential electronic devices – cell phones, game consoles, and PDAs – behind at base camp. Unless several batteries were carried along, they were nothing but dead weight that would have had to be portaged many times and for sometimes long distances during the week. Reliable and portable power sources for television and video games were just too heavy to portage from lake to lake.

Sure, we lost touch with the news and events of the world, but I didn't miss it. I didn't know which celebrities were in rehab or jail, what the 2008 political candidates were doing, or how the war on terrorism was progressing. I didn't know the latest baseball scores. It was a struggle even to tell what day of the week it was and frankly, we didn't really care. We used garbage bags for our calendar – we had to be back to base camp in seven days, so we knew we needed to return once we accumulated seven bags of trash.

Instead of the usual high-speed, up-to-the-minute daily grind, it was a great week to watch the long and beautiful sunrises and sunsets of the North. To do some fishing and enjoy nature. To take frequent and long naps. To explore the lakes and rivers. To swat at the ginormous amounts of mosquitoes and flies. To just reflect on life.

Often we place too much emphasis on our fast-paced lives and don't take time away from our electronic leashes to enjoy the finer points of life. There is no doubt that your great innovation is making life easier, but at the same time, our days go by too fast and are too wrapped up in staying connected. Take some time once in a while to appreciate the slower side of life.

Often we place too much emphasis on our fast-paced lives and don't take time away from our electronic leashes to enjoy the finer points of life.

Jerry Gipper, Editorial Director
jgipper@opensystems-publishing.com

jgipper@opensystems-publishing.com

Embedded event management

By Hermann Strass

Inside NuernbergMesse

NuernbergMesse, an exhibition, conference, and congress center in Nuernberg, Germany, is one of the fastest-growing modern event centers in Europe. Many fairs, including embedded world, SPS/IPC/DRIVES, and the world's largest toy fair use the facilities. International delegates recently convened at NuernbergMesse's CongressCenter Nuernberg (CCN) for the EU-ASEAN Foreign Ministers' Conference. Figure 1 shows the eastern entrance to NuernbergMesse and the CCN building.

Figure 1

The NuernbergMesse management chose TOP Building Automation GmbH (TOP), an accredited Citect Pty. Ltd. Silver Integration Partner, to install an embedded building management system. Citect, Sydney, Australia, is the world's largest independent supplier of supervisory control and data acquisition, industrial automation, and industrial information management solutions. TOP is using Nexa Monitoring, Citect's building automation system, to centrally monitor and control HVAC and energy metering for NuernbergMesse's 20-plus buildings. Nexa supplies the sole visual, control, and alarm interface (8,700 alarms) and enables seamless integration of facility systems and equipment from Honeywell, Johnson Controls, Sauter, Siemens, and many others.

Technical communication is provided through BACnet, Metering-Bus (M-Bus), and other fieldbus systems. With about 43,000 fieldbus nodes managing real-time variables on the BACnet protocol alone, this system is currently the largest multi-application building automation system in Germany. While Ethernet/TCP/IP is used on the management level, sensor signals are collected and actor signals are distributed via Nexa I/O servers on the device networking level. Energy metering signals travel on M-Bus lines.

M-Bus, a European Norm (EN13757) fieldbus specified for wired or wireless use predominantly in metering devices, utilizes an IEC 870-5 Data Link Layer in compliance with the Open Systems Interconnection (OSI) model. Controller chips for this embedded control fieldbus are available from Texas Instruments and other companies. Gateways for Ethernet or USB provide connectivity to other networking environments.

The Citect/Nexa system purportedly cost NuernbergMesse substantially less than other options because it seamlessly connects embedded hardware systems and equipment (programmable logic controllers, direct digital control, and so on) from multiple vendors.

Wearable MP3s, Bavarian style

MP3 inventors Karlheinz Brandenburg, Heinz Gerhauser, and Dieter Seitzer were recently inducted into the Consumer Electronics Association's Hall of Fame. All three are still professors at the Fraunhofer Institut Integrierte Schaltungen in Erlangen near Nuernberg.

MP3 players are found everywhere these days. (See the May issue of *Embedded Computing Design*, www.embedded-computing.com/departments/embedded_europe/2007/05/, for a brief description of the technology.) Lodenfrey, one of the most prestigious Bavarian makers of Loden coats and lederhosen, has incorporated MP3 players into its lederhosen. This twist on traditional German leather trousers has earphones integrated into the suspenders and buttons located along the seam on the thigh that allow the wearer to operate the MP3 player (see Figure 2). All electronics and cables are water and beer proof.

Integrated approach to saving energy

Energy conservation involves more than just reducing carbon dioxide emission. Energy for mobile embedded devices is extremely expensive, and high energy consumption limits

Figure 2

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usage time. Lauterbach Datentechnik GmbH, Germany, has developed a method to detect software code segments that consume large amounts of energy when executed. Designers use the whole gamut of energy-saving hardware devices and tricks; however, little energy is saved unless software optimizes these energy-saving tools.

When optimizing design software, designers must check under all operating conditions if the microprocessor or microcontroller is in the optimal energy-saving mode, how program changes affect energy consumption, or if unexpected current surges occur. To obtain meaningful results, program, data, and current flows as well as voltage changes must be monitored in real time. Correlation of these parameters, especially with components from different manufacturers, is extremely difficult.

Lauterbach Datentechnik solves this problem with an integrated approach in which a time counter coordinates and synchronizes debuggers, real-time tracers, and logic analyzers. Several channels on a logic analyzer with analog probes record time-stamped current and voltage levels. Sophisticated triggering is possible with such a setup. Automatic statistical evaluations show minimum, maximum, and average energy consumption. Triggering can be used to detect cases where set values are passed. This method is simple and fast because it is integrated into popular user interfaces.

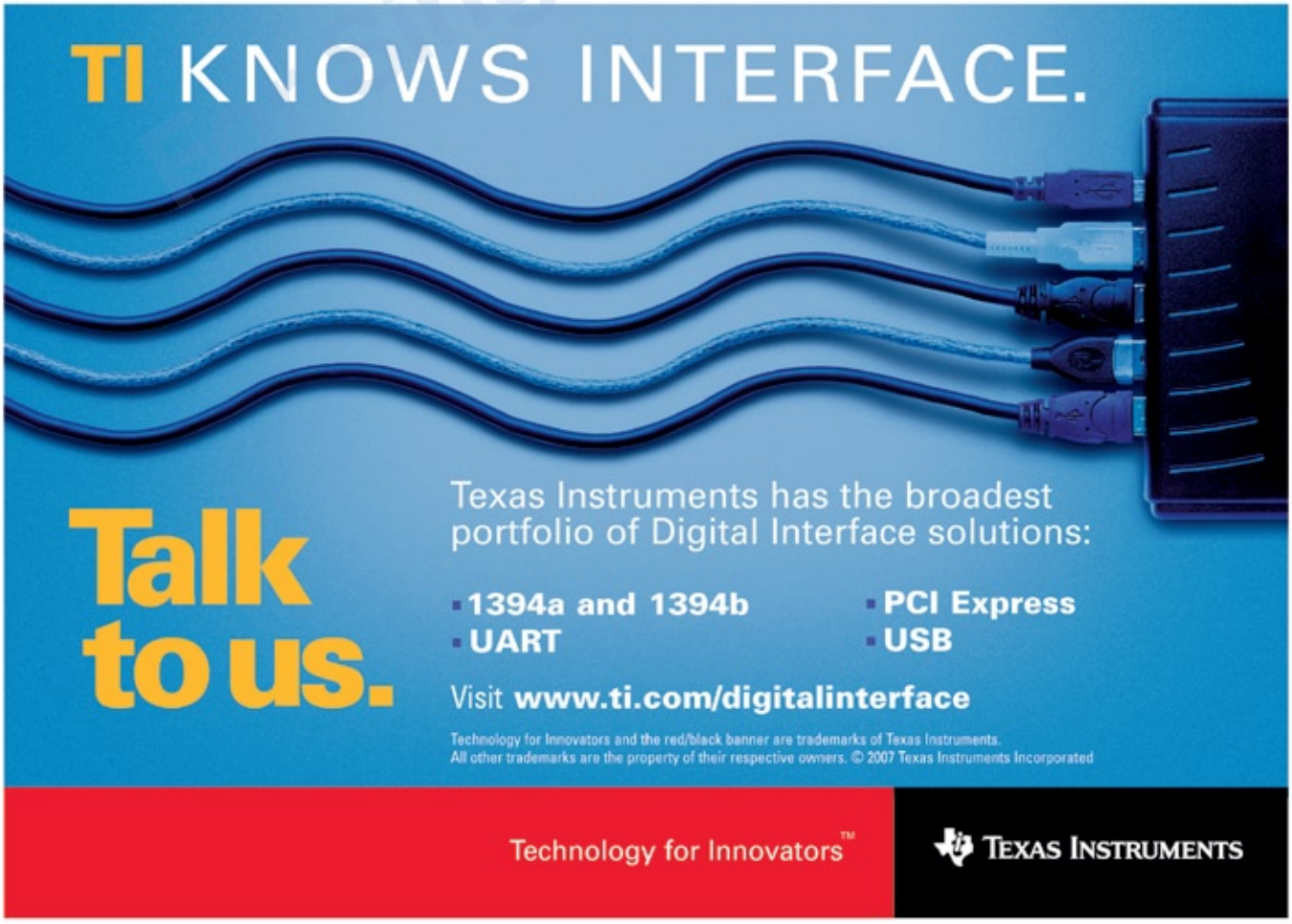
Designers use the whole gamut of energy-saving hardware devices and tricks; however, little energy is saved unless software optimizes these energy-saving tools.

More embedded trade shows

The measurement and test fair SENSOR + TEST 2007 and PCIM Europe 2007 were colocated at NuernbergMesse earlier this year. SENSOR + TEST attracted 15 percent more visitors and 10 percent more exhibitors than last year. ABB Automation, Germany, and Opto-Sense AS & Tomra Systems ASA, Norway, won the top awards for the paramagnetic Micro Mechanical Oxygen Sensor (MIROS) and the HoloChip, a miniature optical spectrometric sensor with a synthetic holographic mirror, respectively. The action hall featured cars equipped with sensor and control equipment driving around to demonstrate measurement and monitoring in real time.

PCIM mainly focuses on power electronics and intelligent motion power quality, but related topics such as green power and hybrid cars also showed up in different exhibits at this year's fair. PCIM increased the number of exhibitors by 20 percent. The European Center for Power Electronics e.V. featured a large multicompany booth.

For more information, contact Hermann at hstrass@opensystems-publishing.com.



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PERFORMANCE TECHNOLOGIES

Platform-driven ESL design: Enterprise enabler for platform customization

By Marc Serughetti

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With much shorter life cycles, the digital consumer industry is turning to platform-based design to be more agile in the changing market environment. The changes must be supported by tools and methodologies that scale to the new demands. Hardware and software development must evolve from the conventional approach to a concurrent engineering approach. In addition, the methodologies and tools must scale across the IP, semiconductor, and device companies supply chain. Marc provides an overview of platform-driven Electronic System-Level (ESL) design as an enterprise enabler for platform customization.

The market dynamics of the digital consumer electronic supply chain have changed significantly during the past few years. A device's life cycle, from introduction through ramp up, maturity, and end of life, used to be three to five years. Now that same device's life cycle is just one year, which means shorter time to market with much higher volume, strong demand fluctuation, and much faster end of life.

Shorter device life cycles are forcing changes in the digital consumer electronic industry's fundamentals. At the same time, designs are becoming more complex, causing development, manufacturing, and go-to-market costs to rise; meanwhile, software content is increasing, pushing development methodologies to move from a hardware-centric to a software-centric methodology. Furthermore, time to design is drastically decreasing. Adopting a platform-driven design may provide a solution to these changing industry fundamentals by enabling companies to adapt to market changes through faster and more differentiated platform derivatives.

Tools to address the new reality

Platform-driven design requires a transition from the conventional design approach, Register Transfer Level (RTL), for hardware design and physical board-based software development. Effecting this change is not easy. However, because the development costs and risks of reworking RTL design and physical board software development are significant, a better understanding of the hardware architecture and the ability to develop, integrate, and test software prior to silicon availability in a more productive way are becoming a necessity. In addition, the ability to affect business processes within the enterprise and throughout the supply chain is becoming critical. Platform-driven ESL design methodologies and tools are providing a way to address this new reality.

From a hardware platform design perspective, designing product platforms poses a new set of requirements for design tools and methodologies. The traditional electronic design automation design flow from RTL to Graphic Design Station 11 is no longer sufficient to capture the platform architecture, explore and evaluate alternatives, or help optimize it. The platform architecture must be captured at a higher level of abstraction. Processors, buses, and peripherals must be modeled in a manner that enables real software applications to be executed on the platform model so the architecture can be properly evaluated and explored. In addition, these models must be reusable so they can be distributed to the software development team as a virtual platform, representing a better alternative to physical hardware.

As software content increases and becomes a key factor in creating differentiated products, strict dependency on the physical development board must be eliminated. Software developers' productivity must also be increased through new tools. Within the context of platform-driven ESL design, capture of the hardware platform architecture must be extended to the environment the device will evolve in and must deliver high simulation performance for software developers. Using simulation for software development is often referred to as a virtual hardware platform for software development. It enables software development for hardware-dependent software as well as system (including application software) integration and testing. It also simplifies the development environment (see Figure 1 next page).

Key benefits of virtual platforms include:

- **Early availability (pre-silicon/ pre-RTL implementation):** Hardware/software integration can be performed without hardware.

- **Easier accessibility:** A virtual platform is a software package that can be sent in an e-mail.
- **Improved productivity:** The simulated virtual platform environment offers better control and observability than physical hardware, as well as determinism and nonintrusive debugging capabilities.

It should also be noted that the virtual platform as a virtual device can be used by engineering-related functions such as documentation and training to accelerate the development of product deliverables.

Connecting with the supply chain

Platform-driven ESL design provides hardware designers and software developers with significant capabilities. However, a third dimension of platform-driven ESL design must be considered. This is the engagement with the supply chain, including suppliers and customers. Generally, this engagement involves the marketing/business development group within these companies.

When an engineering department uses a virtual platform to communicate with a marketing group, that group can better capture and communicate its requirements within the company. And with ecosystem partners, the virtual platform can be used as a tool to accelerate the availability of complementary solutions that can make a company's product more competitive. For example, a semiconductor vendor can ensure the availability of leading commercial operating systems and software component runtime for a product at the time of its commercial release.

In regards to customers, several areas can gain from using virtual platforms:

- In the requirement capture process, the virtual platform provides a more realistic environment to capture customer requirements and enables an iterative approach that increases the confidence that the platform or platform derivative will match the need.
- In the sales engagement process, a virtual platform provides customers a more realistic environment to evaluate the product's capabilities.
- Finally, virtual platforms can be used in the customer development process the same way they are used in a company's own development process, leading to shorter time to market, faster ramp up, and the ability to adapt to changing market dynamics. For semiconductor companies, this leads to faster time to revenue.

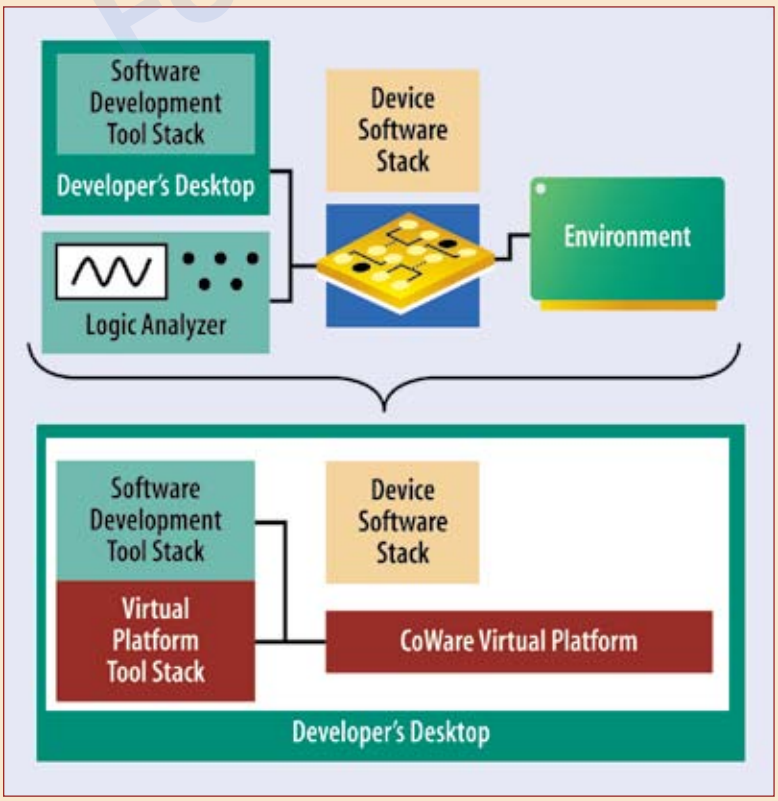

Figure 1

Platform-driven ESL design tools and methodologies enable a more integrated development process within an enterprise and with its supply chain and customers, which is a necessary requirement if companies want to respond successfully to changing market dynamics.

A solution for today's digital consumer world

Implementing a platform-driven ESL design approach requires tools, IP models, services, methodology, and examples. The market for commercial technology is evolving from proprietary technology and point tools to standards-based technology (SystemC for modeling) and solution flow. ESL design software companies such as CoWare provide solutions at the hardware design, software development, and enterprise levels that include the hardware and software architecture link and the distribution capability for deployment within the enterprise and across the supply chain.

The new digital consumer world requires the ability to quickly customize designs (mass customization) for high volume, shorter time to market, and faster ramp up. A platform-driven approach provides a viable solution but also requires changes in development methodologies to mitigate the risk of costly implementation paths and eliminate rework late in the design. Platform-driven ESL design is rapidly becoming the enterprise enabler to make mass customization a reality. ECD

Marc Serughetti *is director of marketing for software development solutions at San Jose-based CoWare, Inc., where he is responsible for driving the company's strategy, entry, and solutions for platform-driven ESL design into the software development market. Prior to CoWare, Marc held several marketing management positions in leading high-growth device software development companies such as Wind River Systems and Integrated Systems. His experience includes a range of device software technologies, solutions, and vertical market strategies. He holds an MS from the University of Washington and the National Superior School of Aeronautical Engineers (ENSICA, France).*

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RESOURCE GUIDE

Overcoming BIOS development challenges in embedded systems

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By Ed Brohm and Mohamad Saleh

Developers designing Intel Architecture-based systems running Windows XP, XPe, CE, or Linux usually can expect a BIOS requirement at some point during the development process. Ed and Mohamad explore the difficulties associated with BIOS development in embedded systems and how the Intel Platform Innovation Framework for Unified Extensible Firmware Interface (UEFI) can help surmount these difficulties.

BIOS is the necessary evil of embedded systems. BIOS developers know too well that while most everyone needs a BIOS, few have the patience, expertise, or budget to develop one. How are your assembly language skills? Are you familiar with the proprietary driver calls for each BIOS developer? Are you spending days debugging your board?

One solution within developers' grasp is Intel's Platform Innovation Framework for Unified Extensible Firmware Interface (UEFI), aka *the Framework* (www.intel.com/technology/framework/). How can the Framework make life easier? How about these perks for starters: faster time to market, less frustration, easier-to-use code, open source drivers, simplified debugging, write once and use many times, modularity, and more.

Transition to the Framework

In the last 25 years, platforms have expanded from 8-bit architectures to 32-bit to 64-bit with multiple cores. Video has progressed from text to color/VGA/SVGA/XVGA to SXVGA, while buses migrated from 8-bit ISA to XP or EISA to PCI Express. And Operating Systems (OSs) have evolved through four generations. While advances have been made in almost every area of embedded systems, the BIOS remained pretty much the same.

The Framework is a mature, reliable architecture available since 2002. Today, millions of units shipped worldwide contain the Framework code. A modular, platform-independent architecture that can perform boot and other BIOS functions, the Framework is driver based, so developers can perform binary linking. It is also written in C, scalable, and modular across different Intel platforms.

In the traditional firmware model, the BIOS discovers and initializes the hardware. The OS relies on the BIOS to discover the hardware and is typically tightly coupled to BIOS boot services. In this model, manufacturers provide hardware-specific reference code that BIOS vendors embed into their products.

In the model utilizing UEFI and Intel's Framework, a layered architecture is implemented with the OS and OS loaders dealing directly with the UEFI, containing a set of standard modular interfaces that replace traditional proprietary BIOS interfaces. The Framework provides BIOS functionality, preboot services in a standards-based environment, and a stage for loading the UEFI drivers in an orderly manner.

Challenges

Three specific BIOS challenges can create perplexing problems that lead to missed deadlines, poor embedded designs, budget overruns, and general emotional distress. These development challenges are in the areas of:

- Thermal management
- Firmware application development (including lack of portable and modular applications)
- Board debugging

Thermal management

As processor technology advances, thermal management for embedded systems becomes essential to ensure that temperatures are maintained within a specified range. When processor power supplies exceed their specified tolerance range, permanent damage to the processor or other components may occur.

The Framework initializes the Intel Thermal Monitor enabled registers

and provides the control methods for Advanced Configuration and Power Interface (ACPI). This in turn enables the processor to support thermal monitoring and performance control. Multiple thermal monitoring capabilities are supported through proper configuration to reduce internal clock frequency via internal clock modulation or perform a transition to lower voltage/bus ratio.

When thermal management is initiated on a platform, the processor's performance decreases as the processor operates in a degraded state. A good thermal design limits the amount of time the processor spends under thermal management, quickly returning to a normal state and maximum processor performance.

The two broad categories of thermal management are active and passive cooling. Active cooling, typically used in PCs, is provided via a fan(s) to lower internal ambient temperature. A system's BIOS can play a role in active cooling and is less of a challenge than passive cooling.

Passive cooling typically utilizes one of three Intel processor-cooling methods:

- Thermal Diode
- Thermal Monitor
- Digital Thermal Sensor (DTS)

The Thermal Diode method simply monitors the processor temperature. Upon reaching the maximum processor temperature, the Thermal Diode can be read by an analog/digital converter. The firmware can read this temperature and set the trip point for an external device to generate an ACPI interrupt that will notify the ACPI-aware OS to take action or, in some cases, shut down. Processor cooling using the Thermal Diode method is considered an unreliable indication of when the maximum processor operating temperature is met because it may not reflect the hottest location on the processor die.

The Thermal Monitor method helps protect the processor when it reaches its maximum operating temperature by controlling temperature via the Thermal Control Circuit (TCC). The challenge facing embedded systems designers is to limit TCC activation, which may decrease the processor's long-term reliability and cause excessive processor performance degradation. Typically, with the help of the BIOS, the Thermal Monitor activates the processor clock throttle and/or processor speed step. Multiple Thermal Monitor capabilities are supported through proper configuration to reduce internal clock frequency via internal clock modulation or perform a transition to a lower voltage/bus ratio. CPU temperature, chassis temperature, fan speed, system voltage, and so on can be monitored and displayed simultaneously in the Setup Configuration Utility.

The last method of monitoring Intel processor temperature, the DTS, is more accurate than the Thermal Diode because it can be located closer to the hottest portions of the processor, providing improved monitoring capabilities and clock modulation activation via the Thermal Monitor. The differences between the DTS and Thermal Diode can be significant because of software, processor power, and mechanical factors. It is also important to note that the BIOS firmware calibrates the DTS temperature reading relevant to the CPU Thermal Diode. This calibration is a major factor in meeting hardware thermal specifications.

Firmware application development

Before the Framework for EFI became available, most BIOS coding was done in a proprietary environment particular to a BIOS vendor using assembly language. An agreed-upon set of APIs, well-defined functions for preboot and runtime services, and modularity to

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allow simultaneous development among software engineers did not exist because each BIOS vendor had a proprietary system.

The UEFI specification defines a standard interface between the OS and platform firmware. Data tables within the interface contain platform-related information plus boot and runtime service calls available to the OS and its loader. Together, these features provide a standard environment for booting an OS and running preboot applications.

The Intel Platform Innovation Framework for EFI Architecture (Figure 1) describes the building blocks needed to develop firmware for platforms based on Intel architecture. The design is characterized by a central framework (the green box shown in Figure 1) that provides services and infrastructure in combination with modular software building block elements. The Framework is designed to allow embedded system developers to use software modules from different vendors and share those modules across platforms and projects.

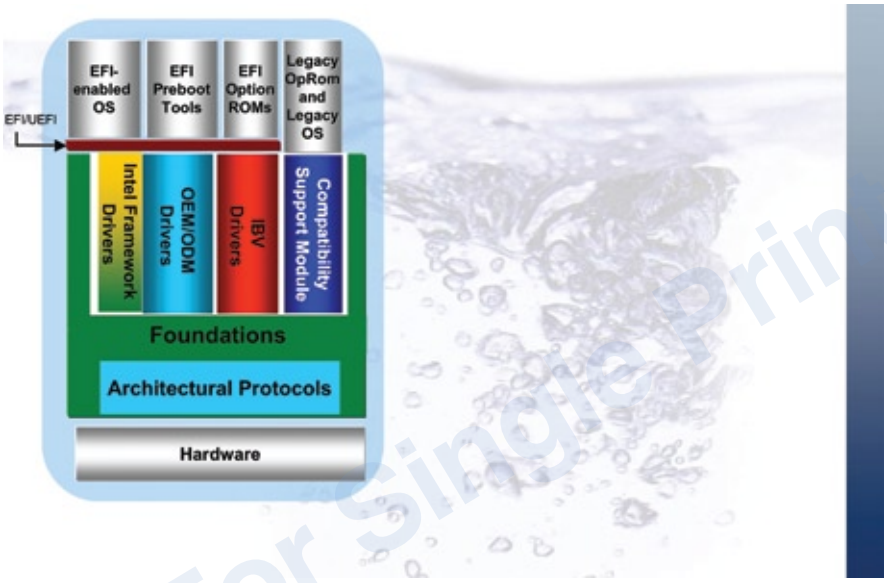

Figure 1

Taken as a whole, the infrastructure code (known as the Foundations) and an appropriate number of modular building blocks comprise a complete platform software implementation designed to initialize the platform and boot shrink-wrap OSs or other custom application environments. The Foundations consist of the Pre-EFI Initialization (PEI) and Driver Execution Environment (DXE) phases. In addition, the Framework specification describes a number of additional design elements to provide a complete set of standard design and services support for auxiliary building blocks that will customize a particular platform firmware image to the hardware and its intended purpose. These additional elements include security services, boot device policy management, runtime services, user interface, firmware integrity services, manageability support, and legacy compatibility.

BIOS based on the Framework provides the following major benefits:

- The BIOS can be built to facilitate the developer's firmware application by incorporating built-in tests, diagnostics, or editing environments – all through the UEFI shell
- Validate the hardware and modular applications from the UEFI shell and use those applications where needed (such as in the preboot sequence)
- Code modularity
- Implemented in C language
- Address space management and protected-mode memory
- Automatic ordering of driver execution
- Preboot applications and EFI drivers enable efficient manufacturing test automation and platform management

Board debugging

A board debugging utility is a powerful tool that enables firmware engineers to easily find bugs, speed development time and board bring-up, and simplify application transfer between boards and project work groups. BIOS debugging options can be classified into two broad categories: firmware status and hardware and firmware debugging.

Firmware status options consist of output codes only and are not considered true debugging. The codes include:

- EFI status codes through the serial console port
- Post codes (from port 80h)
- Beep code (from audio device)

True hardware and firmware debugging options consist of:

- Hardware Integrated Circuit Emulator such as American Arium, providing source-level debugging during the PEI, DXE, and OS boot phases for EFI and native debug support for EFI Framework platforms; users can single step, set break points, see the call stack, set variables, and perform other real-time debugging functions
- Intel In Target Probe/eXtended Debug Port
- InsydeH2O Diagnostic and Debugging Tool (H2ODDT) using the LPT parallel port and USB 2.0

The H2ODDT is a powerful utility enabling firmware engineers to easily trace InsydeH2O code in the target platform. This debugging tool provides a stable connection, flexible debugging method, and easy user interface and can debug at the source code level before system memory is made available.

H2ODDT capabilities include:

- Users can define a project that represents the target platform and/or the firmware image
- Individual windows can be easily docked/tabbed to enhance usability
- Individual windows can be easily invoked to access I/O registers directly or indirectly through I/O ports, PCI register space, base I/O, read/write memory region, show CPU registers, manipulate hardware/software breakpoints, dump postcode, and so on
- Address values of a memory region or register value of an I/O space can be read, written (some registers are write protected and read only), and saved to file or buffer; values stored to buffer or file can then be compared against newly entered values
- Users can view and trace in C source code and assembly code concurrently

The future of BIOS

The Framework for UEFI is the future of BIOS development in embedded systems,

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helping developers overcome major firmware development challenges within thermal management, firmware application development, board debugging, and other areas not mentioned in this article.

The Framework architecture enables ODMs and OEMs to improve efficiency, validate hardware, lower costs to support new hardware designs, and speed up system debugging. Its modularity allows faster migration from platform to platform with less engineering resources and provides development flexibility because work can be done in parallel. Overall, the Framework for UEFI is an EFI that can be used across many platforms for years to come. ECD

Ed Brohm *is director of sales for Insyde Software based in the Southborough, Massachusetts office and is responsible for Insyde's channel partners, managing European sales, and working with major OEMs in the United States. He has previous experience managing large OEMs such as Nortel and Motorola after serving as director of OEM sales at InfoLibria and maintaining sales positions at Harris & Jeffries and FTP Software. Ed has a BS in Marketing from The State University of New York and an MBA in Quantitative Marketing from Boston College.*

Mohamad Saleh *is a senior principal engineer for Insyde Software based in the Southborough, Massachusetts office and is responsible for developing and maintaining InsydeH2O firmware and supporting customers worldwide. Having worked as a principal engineer at SystemSoft Corp. and a senior hardware engineer at Wang Laboratories, Inc., he has experience in system and video firmware/hardware development. Mohamad has a BS in Computer Engineering from the University of Massachusetts Dartmouth and a graduate degree in Computer Architecture Engineering from the University of Massachusetts Lowell.*

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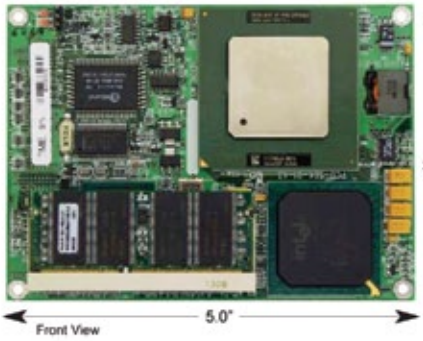

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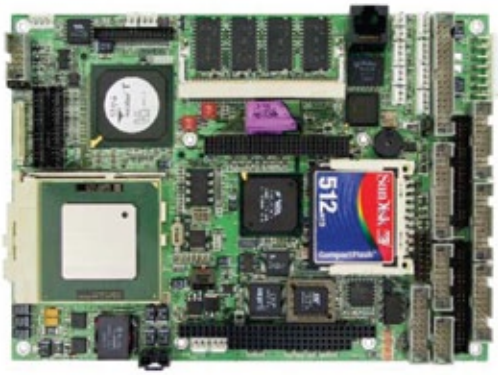

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RESOURCE GUIDE

Layer firmware to increase functionality

By Marc Karasek

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Demands for squeezing more functionality into smaller packages pressure embedded systems developers to deliver feature-rich products in a short amount of time. Taking application programmers' use of APIs and applying this to embedded devices allows developers to modularize firmware code and decrease development cycles.

Anticipate feature requests

In today's embedded designs, more and more functionality is being crammed into smaller packages. As this functionality increases, so does the amount of upper layer Operating System (OS) software needed to run it. With cost always a driving factor, flash devices used for system software must be as small as possible. A combination of cost plus increased system functionality means less space available for the boot/initialization code.

At the same time, developers are pressured to add functionality to the boot/initialization code. Some examples of added features include power status, OS flash image integrity, and system recovery. Each of these features requires a different amount of software support. Some features require notification of the status to the user and some require interaction with the user. In addition to these features, the system must be brought up to a point where an OS and/or application can run.

Embedded systems developers must be able to understand the implications of adding this functionality. Will you need to increase the size of the flash part? Can you live without this feature? Is it a must-have or can you squeeze some more space from your current flash? Embedded systems developers must know what effect a specific feature request will have on the system.

Realizing what choices are available when a feature request hits is only the first step. Developers also must be able to communicate this information to managers and executives. The request for some wiz-bang new feature may come from a manager who is convinced that the end product will be a complete disaster without it. The common argument is "it's only code, what's the big deal?" Developers must be able to explain the trade-offs associated with adding this new feature.

Being prepared to deal with these requests makes putting 10 pounds of functionality into a 5 pound package a lot easier. All developers have to do up front is layer the firmware with a clear plan for the purpose of each layer of code and add debug code while minimizing the impact to the boot process and avoiding code bloat.

Layering the code

Many embedded designs have one large firmware image that is both the boot code and the OS/application rolled into one. This monolithic approach has many limitations associated with it, including:

- Upgrading the firmware is a potentially dangerous problem that could leave the device nonfunctional, breaking the device
- The ability to maintain current and previous revision firmware images, a requirement in some cases, is impossible without some form of hardware support

A better way to organize the firmware is to modularize or layer the code. The first step is to examine the code and figure out where the logical break points are. For this example, the code will be broken up into three layers: platform dependent, system dependent, and OS/application code. To do this, developers can look at what initialization must be done for the specific platform they are working on. This section of code is the first layer. Examine the code further to find any system initialization code, which is the next layer. The final layer is the OS/application of the device.

Each of the three layers in this example firmware (see Figure 1) is completely independent from the previous and next layers.

Each layer requires a mechanism to load the layer above it and should have as much debug capability in the code as possible. Splitting a monolithic firmware image into layers moves from a large-scale way of debugging the code to a more controlled approach. Properly instrumenting the code with well-organized layers and debugging statements allows developers to go from a "load the code and see what happens" approach to one that allows an incremental, well-controlled method of bringing up new hardware and software.

Taking advantage of the fact that most embedded devices use some form of flash device to store firmware, these flash devices are broken up into blocks. Each layer in the boot code should utilize the minimum amount of blocks in the flash part needed to hold it. This has a number of advantages, such as the capability to have multiple firmware images in the flash part. The only part of the firmware that is difficult to have multiple images of is the first layer since that part of the code is normally located at the reset/boot vector for the processor.

Using multiple images allows multiple boot paths. For example, one image for production may have minimal debug capabilities and another may have more robust debug capabilities used for development. A second example is keeping the last known good firmware version when upgrading to a newer version.

An additional advantage to layering the code is the ability to grow a specific section of the code without affecting other regions. This can be done because each layer will not take up a whole flash block(s). So adding a feature to a specific layer can be accomplished without disturbing any of the other layers. Though it appears that layering the code does not really save any space in the flash device, for the majority of cases, it does not take up any more space than what would normally be in a nonlayered implementation. The total size of all the layers added together would be stored in X number of flash blocks. The last flash block has some unused space at the end of it. Layering the code just splits this unused space between the layers, so the total number of blocks for the majority of the cases would remain the same. This does not hold true for some corner cases, but even then, the total flash blocks would rarely exceed X+1.

Debugging

Most embedded firmware has some form of debug monitor capabilities. This monitor is usually accessed by a terminal key sequence during boot time or through a menu system that is part of the default interface for the device. The debug monitor usually requires that the majority of the system be functional for it to work. This does not lend itself to debugging problems that occur early in the boot process and is usually used to help debug OS/application-level problems. Debugging the hardware/boot code more efficiently requires a monitor that needs little to no resources to run. Most processor companies provide a monitor appropriate for their processors. One such monitor is Micromon, developed for the MIPS family of chips by IDT. This monitor as a standalone binary is only 13K in size (including system/chip initialization), yet it provides all the features needed to help debug during system bring-up. It can be very easily adapted to a non-MIPS processor, as it only uses eight general-purpose registers for the stack and input and does not require any memory to run.

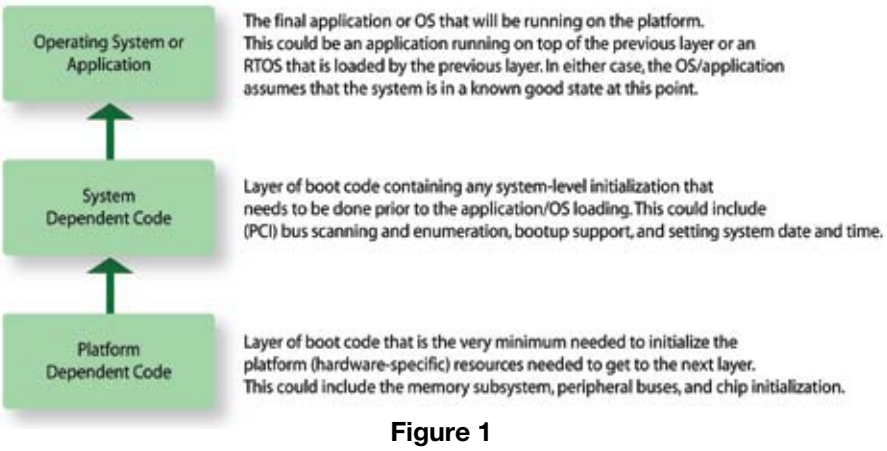

Figure 1

Examining the platform dependent code reveals places in the code where initialization failure is a catastrophic event. This is the perfect place to add a hookup to jump to monitor code. If during the initialization process some part fails, a mechanism is available for debug.

Sometimes developers do not have access to a debug monitor or want to augment the monitor with some form of external display, whether an LED or full alphanumeric display. The important thing to remember is that the hardware engineer designing the product is not a mind reader and does not have a clue when it comes to what is helpful and what is not in terms of software debugging capabilities. It is up to firmware/software engineers to get involved as early as possible in the product design cycle. They must inform the hardware team that two serial ports are needed, that it is a bad idea to pull them from the design, and that one LED can only communicate so much information.

At the same time, developers must keep in mind that the hardware team is always being pushed to keep the cost to a minimum. So when asking for a debug feature to be added to the product or to keep one currently there, be ready to justify it with estimates of how much time it will save in the bring-up, how it will affect the schedule, and how it will affect debugging out in the field once the product is released. Remember that it is too late to make any recommendations when the board is sitting in the lab being brought up.

Go the extra mile

The advantages of code layering are sure to speed development and increase product functionality. The extra effort to analyze and layer the code will quickly pay back the time investment in saved development time and deployed systems support. Next time, make the effort to layer properly. ECD

Marc Karasek *is the senior lead technical engineer at iVivity Inc. in Atlanta, Georgia. He has 13-plus years of experience in embedded software design and presented at ESC Silicon Valley earlier this year. Marc holds a BSEET from DeVry Institute of Technology in Atlanta.*

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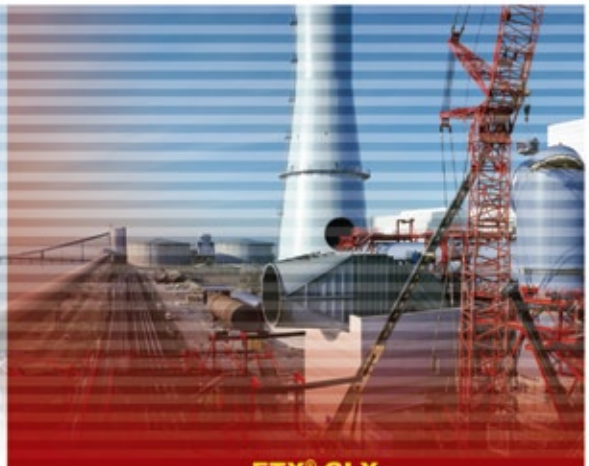

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RESOURCE GUIDE

Embedded OS: A foundation for secure networking

By Syed Gilani

Increasingly, embedded systems are being deployed in a networked environment, prompting commercial embedded software vendors to bundle their offerings with essential networking capabilities. But network connectivity alone is not enough. Syed describes why integrating security services in a single Operating System (OS) platform is essential to ensure a secure embedded environment.

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Networking everywhere

As awareness of network vulnerabilities heightens, embedded devices must be built from the ground up and provide security authentication, encryption, access control, and other security measures. This trend is evidenced across many vertical markets, such as:

- **Business/office automation:** The increased use of device networks in business/office automation is driving the need for secure networking capabilities on these devices.
- **Industrial automation:** The desire to connect islands of information from the factory floor with the enterprise via Web services platforms from anywhere at any time addresses the issue of how to connect smart network devices that collaborate with Internet-based enterprise systems.
- **Medical:** Driven by regulatory certifications, medical devices must demonstrate that they and their network connections are secure.
- **Military/aerospace**: OS security is rapidly rising to the forefront of product design, as networked systems are expected to operate in a resilient and secure fashion.
- **Consumer electronics:** The market will rely on device manufacturers to find a balance in how content is distributed and controlled and to develop new methods for effectively securing copy-protected media content.
- **IT/telecom/datacom:** Secure networking is already paramount in today's enterprise and telecom networks, setting the standard for other industries.

Thus, security services are an essential component of a modern OS for embedded systems. In general, secure communications channels have the following attributes:

- **Authentication:** The ability to identify remote entities on a network
- **Data integrity:** The ability to verify that data received was actually sent
- **Confidentiality:** The ability to prevent unauthorized data viewing

For any security application, the algorithms used will determine the level of security achieved.

Secure multi-application environment

A secure embedded environment requires a fully featured OS platform with integrated security services, including:

- Multiple levels of security and encryption
- A rich set of encryptions algorithms: Message Digest 4 (MD4), MD5, Secure Hash Algorithm-1 (SHA-1), SHA-256, Data Encryption Standard (DES), 3DES, CAST-128, Blowfish, and so on
- Advanced Encryption Standard (AES) for enhanced security
- Pure software encryption
- Hardware encryption acceleration

These security services must be highly configurable to provide a complete off-the-shelf environment for building any security application. With the addition of Memory Management Unit (MMU) services, the platform enables a multi-application environment while completely isolating each application. Designers are offered a choice to leverage services such as encryption, IP security (IPsec), and Secure Sockets Layer (SSL) to encrypt, transmit, exchange, and protect sensitive data.

In addition to security services, a viable OS platform for building networked devices also implements a suite of networking services. These include essential networking protocols such as Gigabit Ethernet, Wireless 802.11x, IPv4, IPv6, and other standard networking stacks.

Encryption acceleration

Code optimization plays a significant role in highly intensive security applications. Having a single OS platform for security algorithms makes the code easy to manage, eliminates code duplication, and provides a standard interface to all applications.

Using pure software encryption capabilities can have an adverse effect on overall system performance. Many applications don't necessarily require high processing power to run the main task. But when security encryption is introduced, this often drags the overall system performance below an acceptable level.

The brute force solution is for a developer to supersize the processor. Unfortunately, this raises the power consumption of the system and increases unit costs. Thus, today's embedded systems must be optimized in terms of processing power. Recognizing that one size does not fit all, silicon providers such as Freescale offer low-, medium-, and high-power versions of their processor families, better tailored to the specific performance needs of an application and coupled with hardware acceleration capabilities to assist encryption.

Having a single OS platform for security algorithms makes the code easy to manage, eliminates code duplication, and provides a standard interface to all applications.

A full-featured OS security platform such as the Nucleus OS from Mentor Graphics seamlessly integrates drivers to take advantage of encryption acceleration hardware. Furthermore, embedded OS vendors must minimize or completely eliminate the need to alter the code when enabling hardware acceleration. The Nucleus OS handles this transparently from an application standpoint.

Not surprisingly, hardware assisted encryption dramatically improves system performance. Robust and complete OS implementations are supported by advanced developer suites, allowing unique insight into the relative performance gains by using the hardware versus software versions of the encryption algorithms. When attached to a network with a Web server resident on the platform, real-time performance metrics can be displayed and evaluated.

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OS platform for embedded applications

As connectivity continues to grow, privacy and security concerns escalate. Embedded OSs are quickly evolving toward full-featured implementations with robust and flexible security services. The ability to select a processor that provides essential performance at the best price point is one factor in deploying a successful product. Equally important, an OS with integrated security services (Figure 1) must be able to take advantage of encryption hardware to maintain optimal performance while keeping power consumption and cost in check.

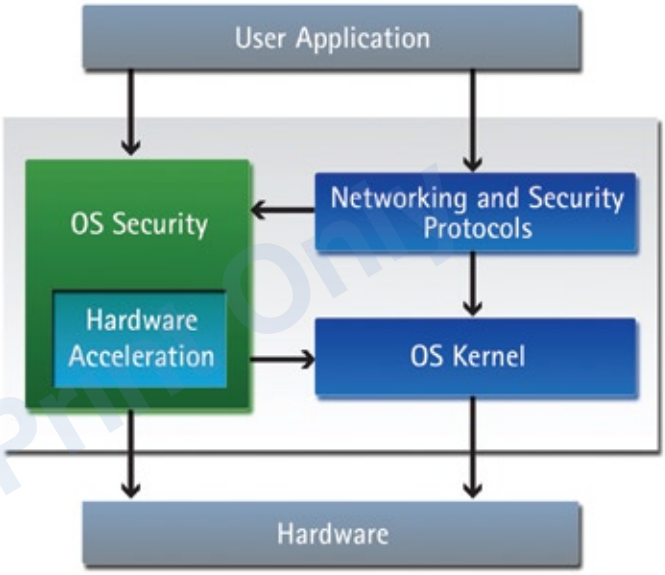

Figure 1

An OS platform developed from the ground up for real-time networked applications must delicately balance capabilities and size. Integrating essential capabilities – kernel services, kernel extensions, graphical services, networking services, file services, security services, and connectivity, all supported by development tools – under one hood makes the application developer's job easier. Keeping the embedded OS lightweight gives it a distinct advantage over large, general-purpose OSs such as Linux. ECD

Syed Gilani *is director of marketing for the Embedded Systems Division of Mentor Graphics in Mobile, Alabama, where he is responsible for product definition and positioning of the Nucleus OS, development tools, and application middleware product lines. He is also responsible for developing the expertise and bench strength necessary to support the division's strategy. Syed has served as general manager for the PADS Business Unit and the director of the Embedded Systems Division operations based in San Jose, California, responsible for leading product development and sales as well as spearheading Mentor Graphics' R&D operations in Pakistan. He holds a BSEE and an MBA from the University of South Alabama and has taken management courses at Stanford University.*

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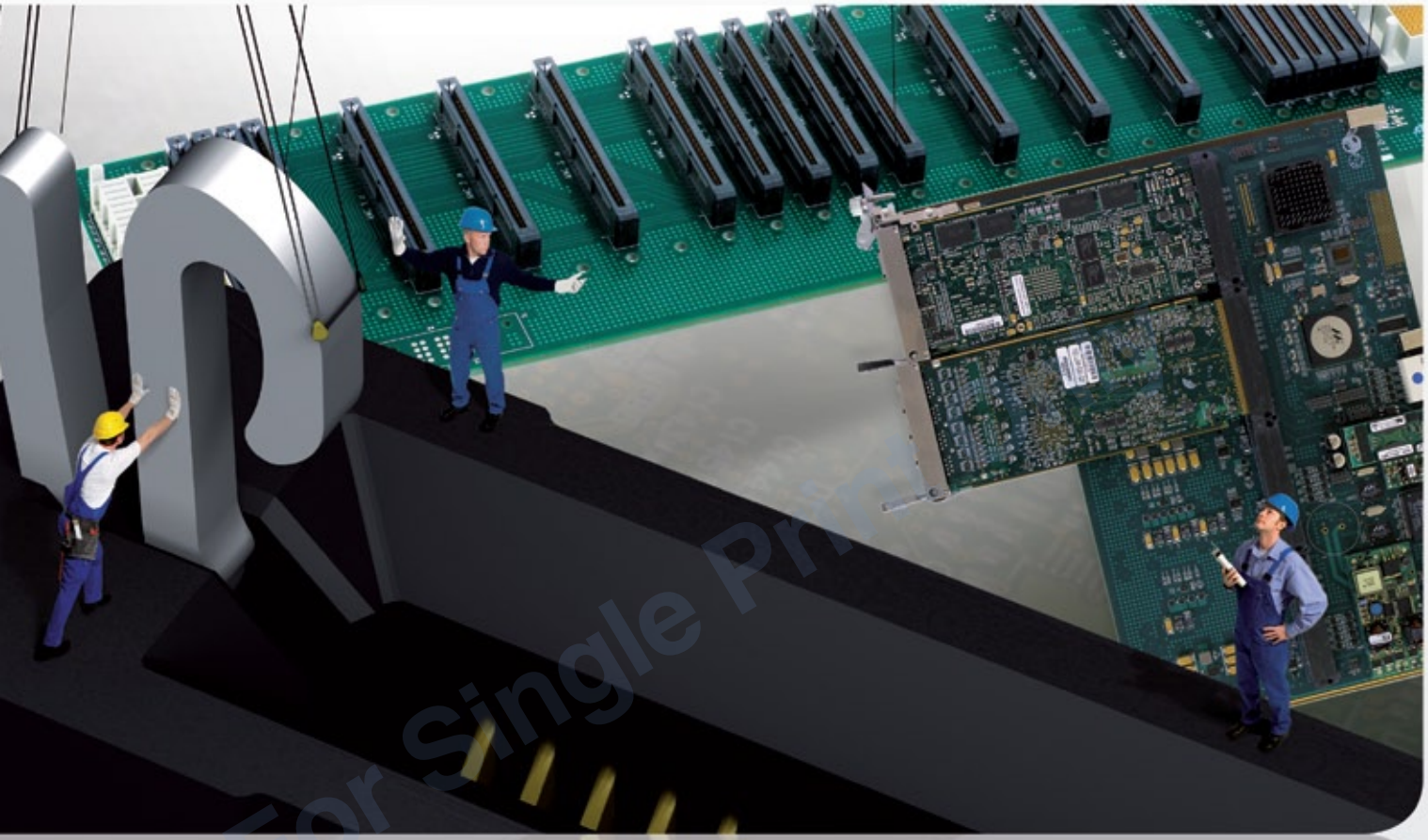

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RESOURCE GUIDE

Modeling for full code generation

By Angelo Hulshout and Juha-Pekka Tolvanen, PhD

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Domain-Specific Modeling (DSM) is an approach for attaining higher software development productivity based on the notion that significant increases in the level of abstraction developers work with achieve the most significant productivity improvements. Two key examples of this include the moves from punch cards to assembler in the 1950s and from assembler to FORTRAN a decade later. In this case study, Angelo and Juha-Pekka explore an application of DSM and discuss the software development improvements achievable through this approach.

DSM overview

DSM is a modeling approach that raises the level of abstraction developers work with by specifying the solution using concepts of the Application Domain. This is achieved through a DSM language that follows domain abstraction semantics, allowing developers to focus on the solution rather than the technical implementation of the solution. Often, these technical implementations can be generated directly from the domain-specific models using a dedicated code generator.

This automation is possible because of domain specificity; both the modeling language and code generators fit the requirements of only a single narrow domain. This can be the domain of a single company or solution provider or a domain extensively covered by standards applied by multiple competing and cooperating companies. Standards such as AutoSAR in the automotive domain and industry efforts such as IP Multimedia Subsystem (IMS) in the telecommunications and networking domain provide great opportunities to increase developer productivity and product quality through DSM.

Telecommunications and networking is the domain of our example case, which will be presented first, followed by a discussion of general issues related to DSM.

The case

The features and services in the telecommunications industry are what phone exchanges and VoIP servers are dealing with at present. Examples of basic features include call forwarding, connect-to-voicemail, and call-back-on-busy. Current efforts toward realizing IMS involve integration of these traditional telecommunication services with the Internet-enabled services such as instant messaging and multimedia communications.

All this functionality must be supported by the machinery and software that forms the telephony network, including phones, exchanges, and computers. Software and test engineers provide the core functionality of this material, but the burden of making it work for end customers lies with telephony providers' service engineers and systems managers. Often, their job is a matter of manually tweaking configuration data and call scripts, a repetitive and ever-more error-prone, manual task.

To facilitate this task while reducing the amount of work and possible errors, we developed a solution based on DSM.

From concepts to language

Before defining a domain-specific language, the domain itself must be defined. In IMS based on our architectural design, we have identified three layered domains (Figure 1). The bottom layer is the Connectivity Domain, which consists of the existing worldwide communications infrastructure: the Internet, wireless networks, fixed-line telephony networks, and so on. The middle layer is the Service Enabling Domain, where the aforementioned features and services are found. Finally, the Application Domain is where end users can access services and where service engineers and technical product managers must set up these end-user services. Therefore, our DSM efforts will focus on this domain.

In the architecture defined for our IMS implementation, the Application Domain layer is populated by *steps*. These steps represent the smallest possible unit of execution in the Application Domain (Figure 2). Examples of steps are *actions* (for example, set up connection), *functions* (for example, transform phone number), and *decisions* (for example, receiver present). All end-user services can be built using these small steps, but because of their granularity, configuring the steps individually is a tedious job.

What makes it even more difficult for our intended service creation users is the fact that steps are connected in flows, but they relate to events handled by various processes (tasks) in the Service Enabling Domain. The differences between the flow-driven Application Domain and the event-driven world underneath is difficult to grasp.

To make things easier, we raise the abstraction one more level by combining steps into larger blocks called *Service Building Blocks* (SBBs). As seen in Figure 3, these represent services in the Application Domain that can simply be connected in a flow model without adding intermediate decisions, checks, translation, and so on.

Concepts

Based on this reasoning, our language will consist of different SBBs, relations between them, and some additional concepts to make flow modeling possible. This results in the following list of items used to model the flow of establishing a connection between a calling party (the caller) and the destination the caller wants to connect to. Graphically, we adopt a flowchart-like approach.

List of concepts

- **Caller:** Despite the extent of IMS services, we still deal with callers as have existed in telephony for years.

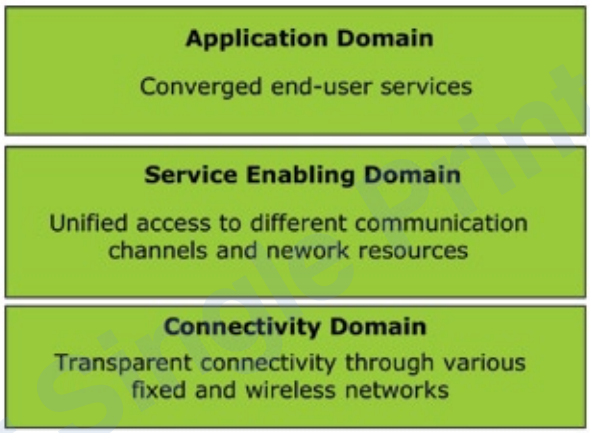

Figure 1

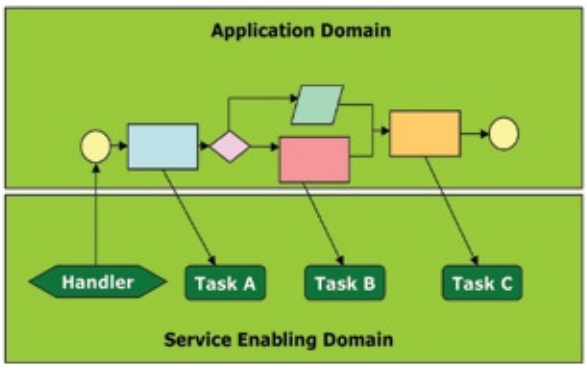

Figure 2

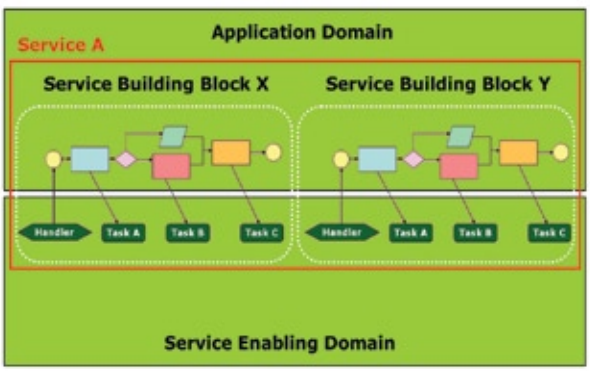

Figure 3

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- **Destination:** The destination being called by the caller or an alternative destination determined by the IMS system.
- **SBB:** A service consisting of multiple steps intended to deliver a certain service to the end user. In reality, we have multiple specific SBBs available, and more may be added in the future.
- **Terminate:** An SBB that terminates the connection for reasons to be defined in the model where it is used.

Relationship between concepts

- **Interlink:** Connection between SBBs.
- **Enter:** The relation between caller and the first SBB encountered.
- **Exit:** The relation between caller and the last SBB encountered.
- **Announcement:** Can be used on any of these relations to play an announcement to the caller.

Each of these concepts has various properties. The most important properties are for concepts that have multiple types, such as switch, and address, for concepts that influence or use addresses. Figure 4 shows the graphical symbols used for the concepts and relations listed using a small sample set of SBBs.

Rules and constraints

In addition to pure modeling concepts we also must identify a set of rules and constraints. These control languages use and enforce model correctness. For instance, we cannot have more than one initiating party for a single call; even in conference calls someone has to make the first move. We are creating modeling languages suitable for configuring and scripting the services, so we define our language such that only one caller can be specified. Also, at least one destination or terminate must be present in each model to have a complete flow. Other constraints may be related to the order in which SBBs are connected, depending on their function.

A sample model

Using our now-defined language, we can draw a sample model that depicts its usage. Figure 5 shows how a script for *presence-based routing* is implemented. Users in IMS can specify whether or not they are present or want to be called at a specified location (for example, their office terminal). In this case, we want to redirect the call to an alternative location, the destination person's cell phone, after playing a notification message to the caller. If the contact has turned off presence at the alternate location as well, the call will be terminated after a standard message is played to the caller.

A service engineer allowed to model this service in this way will not be able to make many mistakes; the tool will prohibit breaking constraints. This engineer does not need to be bothered by the details of the steps or the event-driven nature of the Service Enabling Domain. Also, the customer will be able to discuss desired functionality with the service engineer on the end-user application level.

Generating code and data

Of course, to make this DSM approach truly useful, we must generate the actual scripts that the IMS system can understand and that the service engineer would otherwise have to painstakingly create manually. Figure 6 depicts a more technical

A service engineer allowed to model this service in this way will not be able to make many mistakes; the tool will prohibit breaking constraints.

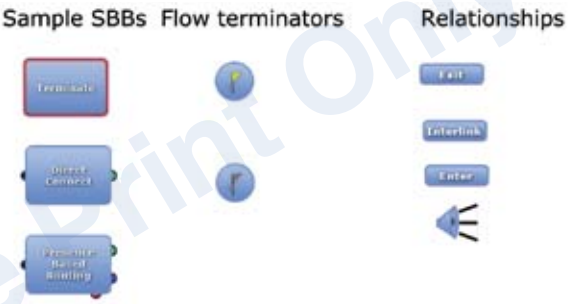

Figure 4

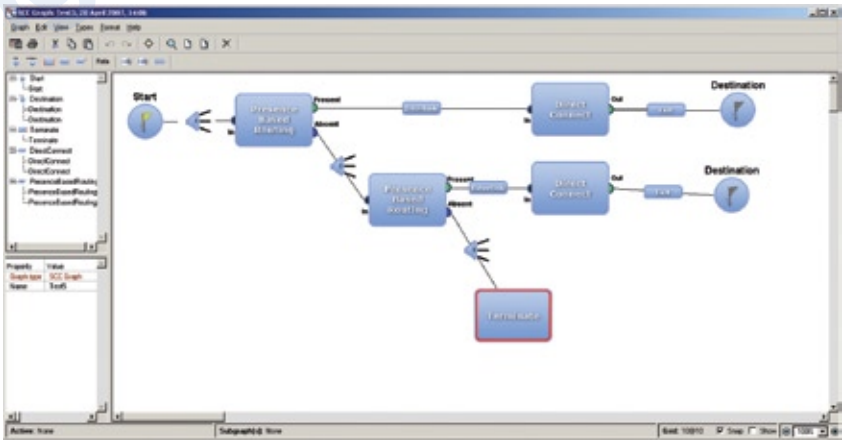

Figure 5

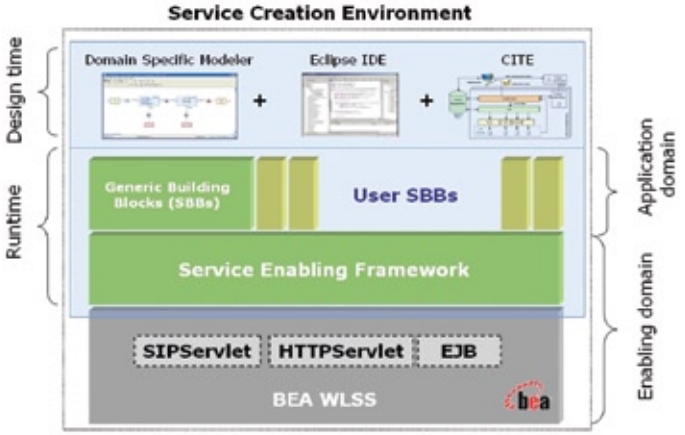

Figure 6

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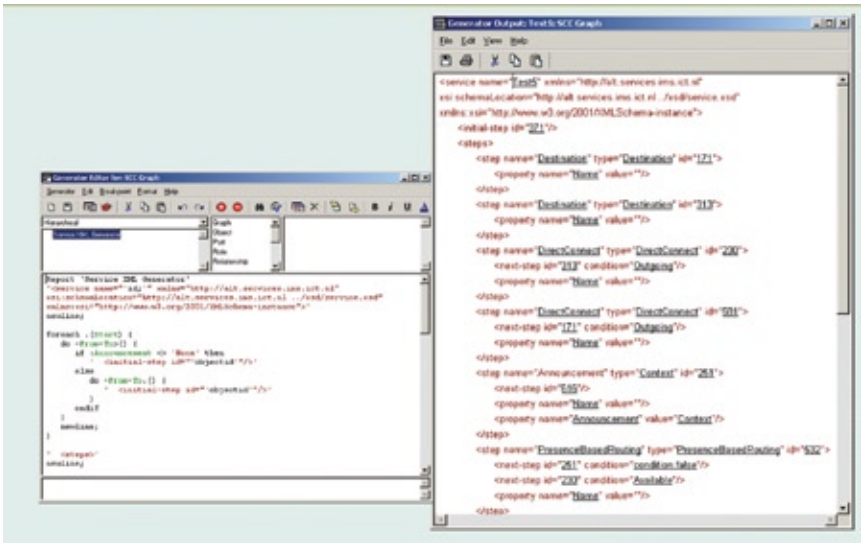

Figure 7

overview of the IMS system's realization of the Application Domain and Service Enabling Domain. The Service Enabling Domain is based on an application server, which combines steps, coded in software, according to XML configuration files.

These configuration files are generated from our models, an example of which can be seen in Figure 7. Next to the XML files, we can also generate end-user and service documentation from the models based on a description property that is part of each element in our modeling language.

A code generator specifies how information is extracted from the models and transformed into code. This process depends on the modeling language, as the models that are made form the input to the generator. The key issue in building a code generator is how the model's concepts are mapped to code. The domain framework and other available libraries can make this task easier by raising the level of abstraction on the code side. In the simplest cases, each modeling symbol produces certain fixed code, including the values entered into the symbol as arguments. The generator also can generate different code depending on the values in the symbol, the relationships it has with other symbols, or other information in the model.

To produce the XML call scripts for IMS, the generator simply must traverse the model elements along the directed relations and fill in the necessary nested elements.

Future options

As our IMS solution is still very young, many possible improvements and changes can be identified. With respect to what is presented in this article, one topic being considered is whether or not it is useful to model SBB internals using DSM as well. Currently, steps are hand coded, and combining them into SBBs is partly done manually (Java code) and partly by the code generator (generated XML). A trap to avoid is so-called visual programming: developers model their solution on an abstraction level that is so close to code that the added value of DSM is lost. In essence, DSM helps generate solutions in such a way that if we test one and it succeeds, all others will work as well. With visual programming, we would need to debug and test each solution separately.

Why DSM?

DSM offers significant advantages over traditional manual approaches. Perhaps the most recognizable benefit is the increase in development productivity, a consequence of a higher level of abstraction. Industrial experiences, especially in areas such as automotive, military, telecom, and various other embedded devices, have demonstrated productivity increases of a factor of 3 to 10 times over traditional manual practices. For example, Nokia states that with DSM, it now develops mobile phones up to 10 times faster. Lucent-Alcatel also claims that domain-specific languages improved its productivity by 3 to 10 times, depending on the product.

In our case, we expect to achieve a significant increase in productivity over current approaches in traditional telephony and VoIP because service personnel are no longer required to handcraft and test configuration scripts. Additionally, they can reduce testing and end-user acceptance time and can discuss the service design directly with the end customer without having to explain technical details.

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It is relevant to remember that these kinds of productivity gains are not new; a similar leap occurred during the transition from machine languages to 3GL. DSM follows this same recipe for success and continues to raise the level of abstraction in which developers work. General-purpose abstractions and languages, however, cannot be used to get closer to the problem domain. Instead, languages must be domain specific. A problem domain of motor control is different than that of IP telephony; therefore, the design abstractions are also different. In DSM, these domain abstractions are part of the languages used to specify the products and features.

Better alignment with the domain also offers a mechanism to improve quality. Because the rules of the problem domain can be included in the language as constraints, specifying illegal or unwanted design models can be prevented. Once experienced developers set these rules to the language, other developers follow the experts' guidelines to produce better quality designs. This is a far cheaper way to eliminate bugs – the earlier the better. The quality also improves when specifications are made using the domain terms. Specifications are then easier to read, understand, remember, validate, and communicate with, allowing customers and other stakeholders to participate in the development work.

DSM versus other solutions

Closer mapping to the business problem and automation with code generators differentiate DSM from general-purpose modeling languages. Most mainstream modeling languages such as UML focus on visualizing the code and thus fail to provide a significant improvement in productivity compared to coding in C, C++, or Java. A recent study by the Modelware project (Dubinsky 2006) that analyzed five companies using UML did not find any significant correlation between UML and increased productivity.

In our opinion, this is because of the low abstraction and modest automation possibilities. For example, UML uses direct programming concepts (classes, return values, and so on) as modeling constructs. Using a rectangle symbol to illustrate a class in a diagram and then equivalent textual presentation in a programming language does not provide real generation possibilities; the level of abstraction in models and code is the same. Furthermore, the code generated from these models requires manual completion, further reducing the already modest productivity benefits. As a consequence, developers easily find themselves making models that describe behavior and functionality, opting to write the code directly. This kills the idea of full code generation and minimizes productivity benefits.

In DSM, modeling languages are made for the purpose of enabling code generation. Instead of visualizing the programming constructs, the models visualize the problem domain. The developer creates a model of the solution in a language that contains the concepts and rules from the problem domain the developer works in. For example, when developing voice-controlled systems, concepts such as *Menu*, *Prompt*, and *Voice entry* are closer to the problem domain than assembler mnemonics. Similarly, while developing a car infotainment system, concepts like *Display*, *Channel*, and *Knob* are closer to the system than any UML concept.

Code generators in DSM read these higher-level specifications to produce the needed code. The way developers write code tends to differ from domain to domain; therefore, code generators must be specific to the given domain. While most modeling tools offer proprietary, fixed-code generators, DSM advocates the use of fully open and customizable generators for generating any type of output – not only code, but also test cases,

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documentation, and configuration files. The idea is for an expert to have the freedom to define these generators supported by the tools offered by DSM modeling environments. Experienced developers in the domain are best suited to write quality code in the company's problem domain.

Based on experiences with various customers, with cases that are far more complex than what is described in this article, it is clear that DSM is a preferable approach for improving software development quality and productivity in many domains. Reference cases include Nokia, ICT Solutions, EADS, Siemens, and Fuji Xerox, where DSM is used to build applications for a variety of applications such as mobile phones, definition and configuration VoIP services, and website creation for insurance products. Companies are also exploring using DSM in software development for silicon chip production machinery, nano research, and logistical systems.

As the previous example demonstrates, it is not difficult to begin using and benefiting from DSM. It is also possible to do so incrementally by first targeting only a small part of the application in the language and code generator, and then gradually adding additional parts. Finally, because the domain changes less rapidly than the underlying technology, the approach is also future proof.

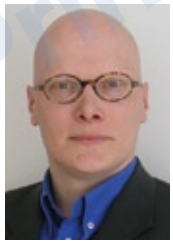
Positive results thus far

During the actual language construction, the first part of the language was constructed and then immediately tested by modeling sample applications. If the result was not satisfying (for example, allowed for the creation of illegal designs), we made the necessary corrections to the metamodel. Here tools can dramatically help. MetaEdit+ made this language testing part agile so that we could quickly test and learn what the language looked like in practice and how easy it was to create and reuse models. This minimizes the risk of making a poor language or a good language created for the wrong task. Tool support for language creation also greatly assists in finding good mappings for code generation.

The example presented in this article is part of an ongoing development project at ICT Solutions, a sister company of ICT NoviQ within the Dutch ICT Group. While the project has not yet reached its final stage of development, experiences with customers so far have been positive. The increasing interest from those involved with IMS strengthens the belief that DSM is a good approach for dealing with the speed and quality requirements of the telecommunications market in the 21st century. **ECD**

Angelo Hulshout *is a senior consultant at ICT Automatisering, which is in The Netherlands. He has worked for Philips Research and ICT Embedded (part of ICT Automatisering) on various topics related to software architecture for digital broadcasting systems and medical equipment. Currently, Angelo is responsible for architecture consultancy and training services at ICT NoviQ, another branch of ICT Automatisering, and is researching possible uses of DSM.*

Juha-Pekka Tolvanen *is the CEO of MetaCase based in Finland. He has been involved in model-driven approaches and tools, notably method engineering and meta-modeling, since 1991. He has acted as a worldwide consultant for method development and written 50-plus articles in software development magazines and journals. As cofounder of the DSM Forum, he plays a leading role in the shift toward model-driven development. Juha-Pekka holds a PhD in Computer Science from the University of Jyväskylä, Finland, where he also serves as an adjunct professor (docent on software development methods).*



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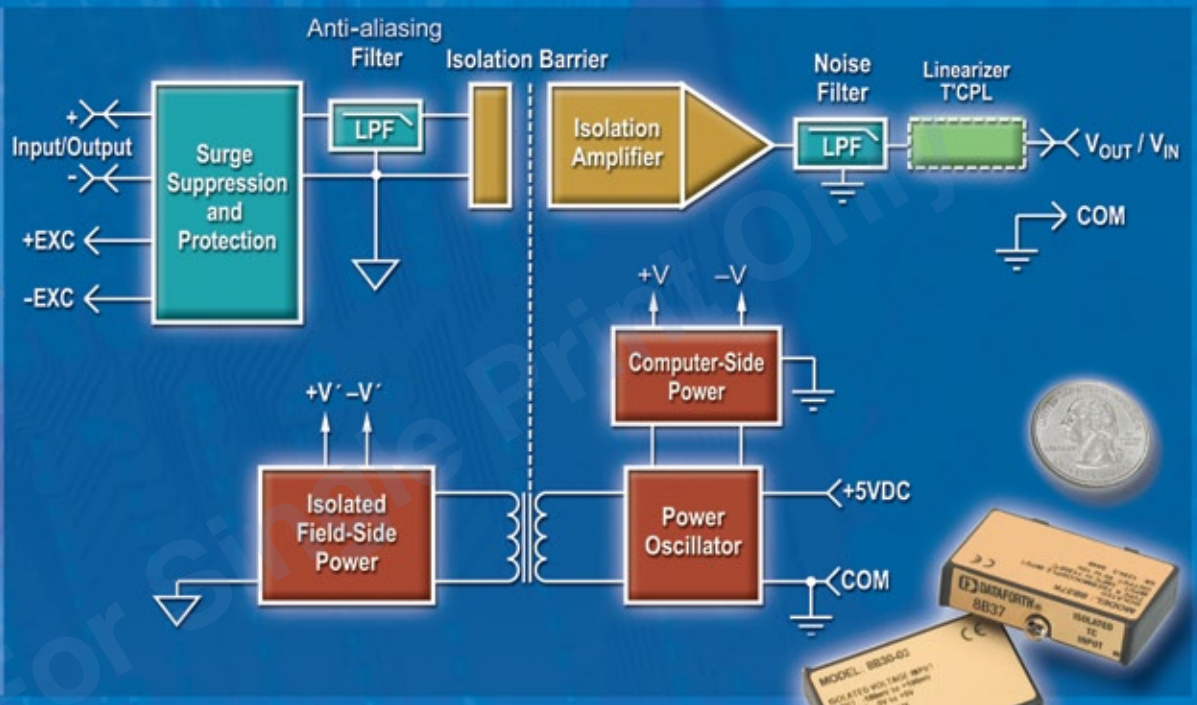

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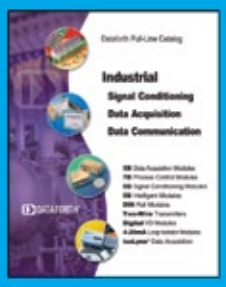

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RESOURCE GUIDE

An overview of the OMG Systems Modeling Language (SysML)

For Single Print Only

By Matthew Hause

Realizing the importance of systems engineering and its critical role in the early phase of systems development, the Object Management Group (OMG) has now standardized the Systems Modeling Language (SysML). Based on a subset of the Unified Modeling Language (UML), OMG SysML enables systems engineers to analyze, specify, design, and verify complex systems. It is intended to enhance systems quality, improve the interchange of systems engineering information, and help bridge the semantic gap between systems, software, and other engineering disciplines. In this article, Matthew examines the four pillars of OMG SysML, including structure, behavior, requirements, and parametrics.

Since its adoption in 1997, UML has proven to be immensely popular with software engineers to the point where it is now the only widely used visual modeling language for software engineering. Unfortunately, UML's software focus has discouraged many systems engineers from adopting it in earnest.

Systems engineers have used various approaches to address UML's shortcomings for systems engineering purposes, but none have been ideal. Some systems engineers have made use of the stereotypes provided in UML to create libraries or profiles of entities in their application domain to express nonsoftware concepts. Others have used additional tools such as Microsoft Visio to model their systems engineering concepts in conjunction with their UML models, but this merely created two separate models that they could not integrate or cross-reference. Some simply ignored the problem or used words to fill the gap. Some tool manufacturers such as ARTiSAN Software Tools extended UML to facilitate the integration of hardware, software, and systems engineering concepts into a single model, but this left them open to the charge of being nonstandard.

As a consequence, the OMG decided to pursue the development of a new version of UML specifically tailored for systems engineering. The OMG's goal was to create a "standard modeling language for systems engineering to analyze, specify, design, and verify complex systems … to enhance system quality, improve the ability to exchange systems engineering information amongst tools, and help bridge the semantic gap between systems, software, and other engineering disciplines." However, the UML modifications systems engineers needed required more than just adding stereotypes. As a result, many of the concepts tool developers created to extend UML for systems engineering purposes have now been integrated into the OMG SysML.

SysML diagrams

OMG SysML reuses a subset of UML 2.0, adding new diagrams and modifying others. It includes diagrams that can be used to specify system requirements, behavior, structure, and parametric relationships, known as the four pillars of OMG SysML. Only two of these pillars are entirely new – the requirements and parametric diagrams. One of the design goals was to avoid making changes unless absolutely necessary.

Figure 1 makes use of cross-cutting constructs that apply to both structure and behavior. Cross-cutting constructs support concerns that cut across the different views and may be addressed by all or disparate parts of the model.

System structure is represented by block definition diagrams and internal block diagrams. A block definition diagram describes the system hierarchy and system/component classifications. The internal block diagram describes the internal structure of a system in terms of its parts, ports, and connectors. The package diagram is used to organize the model.

The behavior diagrams include the use case diagram, activity diagram, sequence diagram, and state machine diagram. A use case diagram provides a high-level description of the system functionality. The activity diagram represents the flow of data and control between activities. A sequence diagram represents the interaction between collaborating parts of a system. The state machine diagram describes the state transitions and actions that a system or its parts perform in response to events.

The requirement diagram captures requirements hierarchies and the derivation, satisfaction, verification, and refinement relationships. These relationships provide the capability to relate requirements to one another and to system design models and test cases. The requirement diagram provides a bridge between typical requirements management tools and system models.

The parametric diagram represents constraints on system parameter values such as performance, reliability, and mass properties to support engineering analysis. OMG SysML includes an allocation relationship to represent various types of allocation including allocation of functions to components, logical to physical components, and software to hardware. Figure 2 illustrates the SysML profile in ARTiSAN Studio 6.2, showing blocks, constraints, port flows, and requirements.

> Cross-cutting constructs support concerns that cut across the different views and may be addressed by all or disparate parts of the model.

SysML extensions

Additionally, OMG SysML provides extensions that can be very loosely grouped under the term *continuous*, but are generally applicable to any sort of distributed flow of information and physical items through a system. These include:

- Restrictions on the rate at which entities flow along edges in an activity or in and out of parameters of a behavior. This includes both discrete and continuous flows, either of material, energy, or information. Discrete and continuous flows are unified under rate of flow, as is traditionally done in mathematical models of continuous change where the discrete increment of time approaches zero.

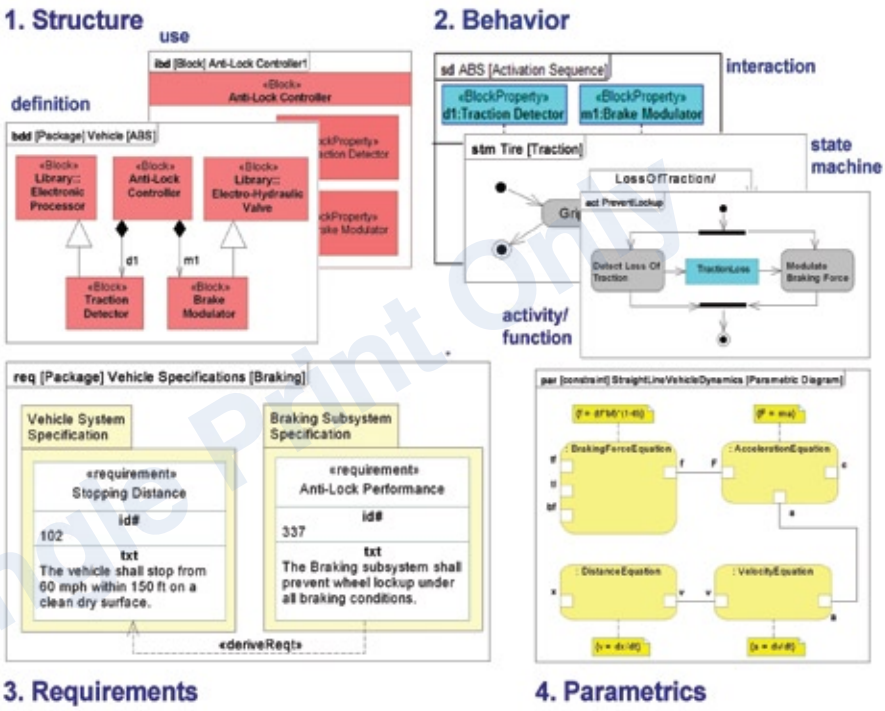

Figure 1

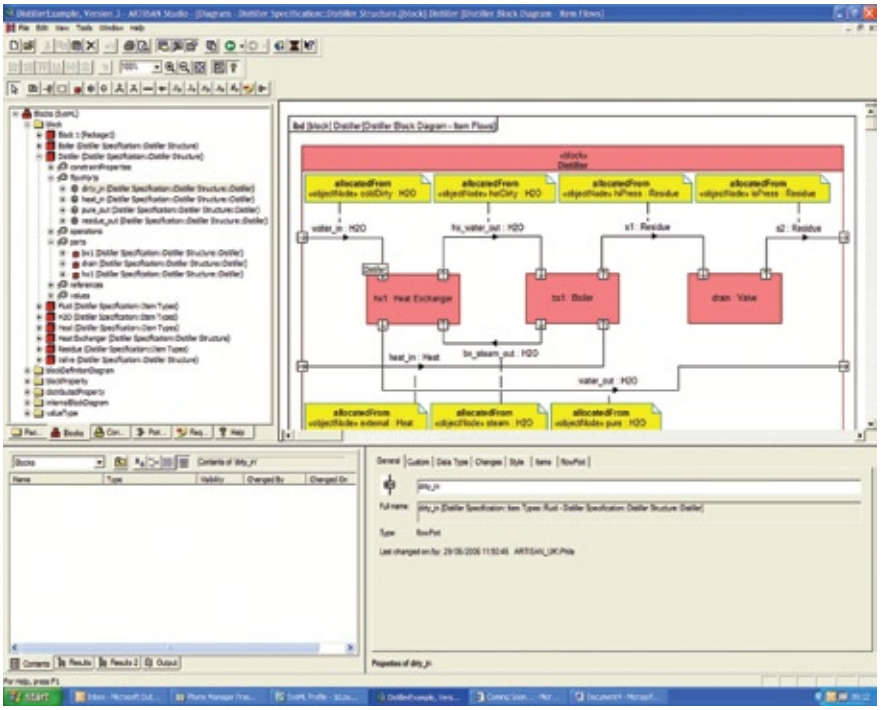

Figure 2

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- Extension of object nodes including pins with the option for newly arriving values to replace values that are already in the object nodes. OMG SysML also extends object nodes with the option to discard values if they do not immediately flow downstream. These two extensions are useful for ensuring that the most recent information is available to actions by indicating when old values should not be kept in object nodes and for preventing fast or continuously flowing values from collecting in an object node, as well as modeling transient values such as electrical signals.

OMG SysML introduces probability into activities through extending:

- Edges with probabilities for the likelihood that a value leaving the decision node or object node will traverse an edge
- Output parameter sets with probabilities for the likelihood that values will be outputted on a parameter set

It also includes an allocation relationship to allocate one model element to another. *Allocation* is the term used by systems engineers to denote the organized cross-association (mapping) of elements within the various structures or hierarchies of a user model. Often, this is the allocation of function to form, such as the deployment of software on a hardware platform, or a use case to an organization or system entity. From a systems engineering perspective, this is applicable to abstract system specifications as opposed to a particular constrained method of system or software design. Allocations can be used early in a design as a precursor to more detailed, rigorous specifications and implementations.

The allocation relationship can provide an effective means for navigating the model by establishing cross relationships and ensuring the various parts of the model are properly integrated. The OMG SysML specification includes some specific subclasses of allocation for allocating behavior, structure, and flows, but these serve as examples rather than an exhaustive list. A typical example is the allocation of activities to blocks (for example, functions to components).

The allocation relationship can provide an effective means for navigating the model by establishing cross relationships and ensuring the various parts of the model are properly integrated.

Supporting the whole life cycle

The OMG SysML specification is intended to be compatible with the evolving ISO AP233 standard, a data exchange protocol for systems engineering data based on ISO 10303. STEP (ISO 10303)

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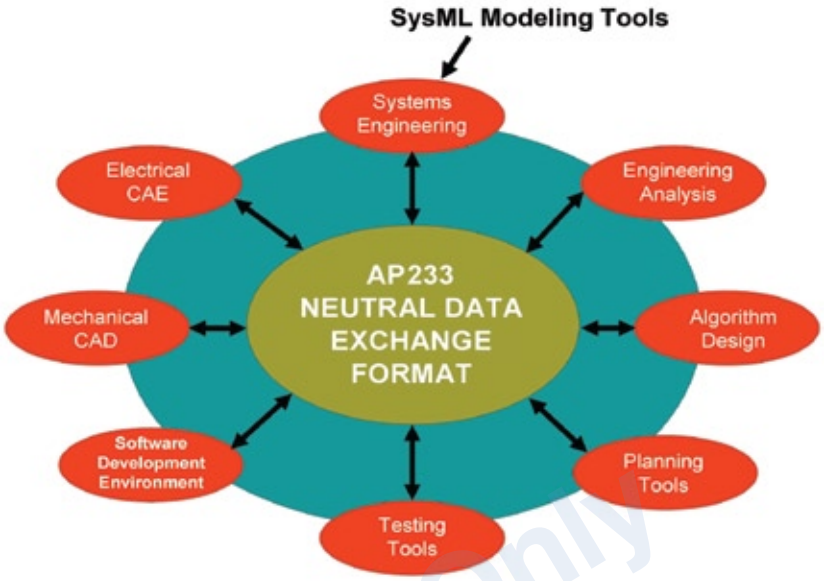

Figure 3

is a standard to describe, represent, and exchange industrial data in a computer interpretable format. For data exchange among different application domains, a neutral (that is, tool independent) data model must be defined. This is called *Application Protocol* (AP). ISO 10303 provides APs for representing this data exchange. Currently, about 40 different APs are defined.

The intent of AP233 is to support the whole system development life cycle, ranging from requirements definition to system verification and validation. Different application areas include engineering analysis, algorithm design, planning tools, testing tools, software design, mechanical CAD, and electrical CAE. This goal is consistent with that of systems engineering in general, which is to tie together the different domain engineering disciplines into one consistent view of the system. Figure 3 shows how OMG SysML is intended to share data with other engineering tools using AP233 as the neutral data exchange format.

Extensions made to UML 2.0 in the OMG SysML profile will provide systems engineers with a robust language for modeling systems that include models of requirements, behavior, structure, and parametrics. At the same time, the profile's extensive reuse of UML will facilitate a much smoother flow down from systems engineering to software engineering than otherwise possible. **ECD**

For more information on the complete SysML notation, contact info.us@artisansw.com.

Matthew Hause *is principal consultant at ARTiSAN Software Tools in Cheltenham, United Kingdom, where he handles mentoring, sales presentations, and training courses. He has been developing real-time systems for almost 30 years with experience in power systems, process control, communications, supervisory control and data acquisition, distributed control, and other areas of real-time systems. He has written a series of white papers on project management, systems engineering, and systems development with UML and has been a regular presenter at INCOSE, the IEE, and other conferences. Matthew studied Electrical Engineering at the University of New Mexico and Computer Science at the University of Houston, Texas.*

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RESOURCE GUIDE

A look at the marital state of semiconductor IP providers and SoC vendors

By Tony King-Smith

For Single Print Only

Tony explains why IP is increasingly accounting for significant System-on-Chip (SoC) area, how IP and semiconductor companies are working together, and what trends are shaping the market.

The semiconductor IP industry is entering something of a renaissance. It's not because of any dramatic new inventions, disruptive new technology nodes, or amazing economic realizations. It boils down to something much simpler. Get a group of gurus who live, eat, and breathe a specialized area of expertise, back them up with additional resources to build on that core, and you'll get class-leading technology that, if nurtured, will continue to lead the market segment for years to come.

Since its early days when the main products were manufacturing processes and low-level gate libraries, the semiconductor IP industry has traveled a pretty tough road. Today, the industry covers an incredibly rich and diverse range of applications, including optimized logic libraries, advanced memory compilers, mixed-signal blocks, embedded CPUs, dedicated high-performance accelerators for graphics, communications, and other key functions.

Semiconductor companies don't like relinquishing control of any part of their product development; that's what makes their products unique. So when designers create major SoC products, utilizing key technology patented and owned by third parties, product planners start to squirm. To make matters worse, these third parties often sell the same technology and key feature sets to various competitors. Doesn't sound like a good business to be in.

And yet, more and more SoCs rely on third parties for large parts of the total chip. Take for example the industry-leading OMAP family of applications processors from Texas Instruments (TI). While many of OMAP devices' advanced capabilities such as DSPs and highly integrated video are home-grown TI, the main CPU comes from ARM and the 2D/3D graphics come from Imagination Technologies – both companies that license their technologies to several of TI's competitors. Surely a company the size of TI could do it all themselves, couldn't they?

The answer is: perhaps. However, it is far more cost effective to get key blocks that implement industry standards or highly specialized functions from dedicated teams of engineers who are experts in their fields. Considering TI's other strengths – process technology, systems integration, application-level systems knowledge, and supply-chain management – OMAP products' key universal signal processors come from what each block does *and* from the way they are put together and delivered to TI's customers, with full hardware, software, and applications support.

Maturing to meet needs

Semiconductor IP providers have built up levels of expertise in their core technologies that few semiconductor companies can rival. An experienced and successful IP provider can produce a progressive IP roadmap with each generation offering better performance, higher functionality, and a track record of shipping millions of devices embedded in hundreds of different products. By choosing a small number of highly focused market segments, an IP provider can mature to meet the increasing needs of the target market segments.

One major benefit a mature IP provider offers SoC licensees is a strong support capability intent on solving problems in the specific design space. That is often found in the software provided, which typically ranges from drivers for key APIs over multiple operating systems to system integration reference code, tutorial

Variety of cores

Imagination Technologies has produced five generations of graphics engines during the past 12 years. The company has grown beyond its initial PowerVR family of 3D/2D/vector graphics cores to add video codecs, multistandard demodulation receivers, and hardware multithreaded embedded processing cores. Each core embodies years of accumulated experience and effort, resulting in capabilities that attract the interest of several large players in these markets.

examples, and more. In fact, as much as 50 percent of the total staff-power for complex hardware IP is likely to be software of some form.

Other advantages to working with a mature IP provider are the complementary marketing resources and focused ecosystems. These capabilities, when properly integrated and aligned with the SoC vendors' own infrastructure, deliver a total presales promotion and postsales support offering that is hard for end users to resist. As next-generation consumer devices such as the iPhone (Figure 1) continually demand advanced graphics, video, and other complex features, IP companies and their ecosystems are ideally placed to achieve the tough time-to-market demands driven by intense competition.

Added depth, knowledge

A new model is emerging: IP providers as a key part of innovative start-up funding. Increasing numbers of venture capitalists are recognizing the in-depth market knowledge gained by working closely with highly focused IP providers. Pair that capability with a start-up's innovative, fast-moving management and engineering team and, with the right commercial deal, IP vendors can add a tremendous amount of experience and complementary skills to start-ups. That mix can enable the start-up to concentrate on its particular value-add and, more importantly, deliver its new products to lead customers. As the start-up matures, the IP vendor can transfer knowledge to that company. With everyone pulling in the same direction from the start, the added depth of a strategic IP provider could buy investors a time-to-volume advantage of as much as 12 to 18 months.

Given the overall drive to target market/application specialization and close alliances with lead customers, intensely focused attention to investment in unique value-add is critical to success for any semiconductor company, no matter what size. With the sheer number and complexity of major cores on many consumer, mobile, and automotive SoCs, the marriage of semiconductor IP providers and SoC vendors – fabless through Tier 1 – looks set for a rosy future. ECD

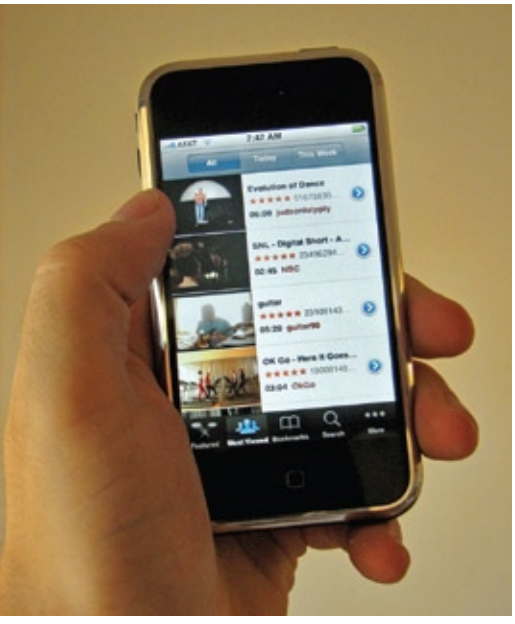

Figure 1

Tony King-Smith *is VP of marketing at Imagination Technologies, a Kings Langley, UK-based developer and licenser of silicon and software IP for multimedia and communication devices. During his previous stint at Panasonic, Tony was involved in global business and technology development in the consumer, automotive, and mobile phone market segments. He has also held senior management positions at Renesas (Hitachi), LSI Logic, Inmos, and British Aerospace. Tony has a BSc, First Class Honors, in Electrical and Electronic Engineering from the University of Melbourne in Australia.*

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RESOURCE GUIDE

RTOS-to-Linux application migration

By Jim Ready

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Application migration from one Operating System (OS) to another is often a daunting task, even in the best of cases. Migrating a real-time embedded application to a new OS is arguably among the most difficult tasks. To aid developers planning to move to embedded Linux in the near future or considering the level of investment necessary to convert their existing applications to run on embedded Linux, Jim explains the transition process, assesses the challenges involved, and presents the benefits realized from such a move.

More and more companies that previously used a Real-Time Operating System (RTOS) as their embedded OS are turning to embedded Linux as the OS for their next generation of products. In fact, industry analyst Venture Development Corporation shows embedded Linux and open source garnering up to one-third of 32- and 64-bit designs, more than twice the share of any other embedded OS.[1]

Clearly, questions about the feasibility of application migration from older RTOS-based products to Linux must be answered so this migration can be managed efficiently.

Characterizing the challenge

A typical RTOS-based application is dependent upon many factors. Among the most significant are the programming/memory model, API set and performance, and especially real-time responsiveness. Another serious consideration is the software development environment, but that is a discussion worthy of its own article.

Programming model

Virtually all widely used RTOSs have a simple programming model consisting of multiple threads of execution (often called *tasks*, as in multitasking) all contained in a single address space. For example, a C language program has a single main function from which all other threads are created. Each thread in turn is defined as a C function within the overall program. Typically both the RTOS and the application reside in unprotected memory, where physical and logical addresses are the same. There may be some use of supervisor/user modes of operation that restrict applications in user mode from issuing certain instructions, thereby adding modest protection. Fundamentally, though, all memory is visible to all the application, which has both pluses (performance and simplicity) and a big minus (vulnerability to memory corruption bugs).

In the past, most embedded microprocessors did not have a Memory Management Unit (MMU), so the single address space RTOS model was a necessity. However, most mid- and high-end microprocessors today are equipped with MMUs, so the MMU can manage memory if desirable.

This architecture description suggests a straightforward architecture for porting RTOS code to Linux:

- The entirety of RTOS application code (minus kernel and libraries) migrates into a single Linux process.
- RTOS tasks translate to Linux threads.
- RTOS physical memory spaces (that is, entire system memory complements) map into Linux virtual address spaces.

- A multiboard or multiprocessor architecture such as a VME rack migrates into a multiprocess Linux application, as in Figure 1.

Architectural considerations: process and thread creation

Whether using RTOS emulation kits for Wind River VxWorks and pSOS (a discussion of which follows in the API section) or performing the port unaided, developers ultimately must decide whether to implement RTOS tasks as processes or threads. At its heart, the Linux kernel treats both processes and threads as coequal for scheduling purposes. However, different APIs create and manage each type of entity, and performance, resource costs, and benefits are associated with each.

In general, processes are heavier than threads because they carry more context. A Linux thread context such as an RTOS task consists primarily of a subset of CPU registers, stack, current program counter, and some entries in the kernel's data structures (task control blocks in an RTOS). A process adds a complete virtual address space. Thus, at a minimum, the kernel must also create and track page translations and types for all code, constant text, and data used by the process. The major impact of this weightier process context comes at two junctures: process creation time and interprocess context switch time.

RTOS code strives for lightweight execution whenever possible. As such, while many RTOSs offer dynamic task creation APIs, others feature only static task definition tables, and all RTOS vendors discourage frivolous and frequent task creation to save time and space. Linux process creation is not intentionally more cumbersome; Linux processes are heavier because they offer greater protection and reliability.

This timeworn and familiar architecture, while simple, is highly exposed to corruption. Runaway tasks can overwrite application code and data, accidentally write into peripheral device registers, corrupt kernel data structures, and overwrite the kernel code. Tightly packed task stacks can easily underflow and overwrite one another or charge down through memory to corrupt the top of the heap, other data, or code laid out nearby.

At a higher level, this informally organized and highly exposed architecture presents two key challenges to code quality: the scope of the failure itself and the association of second-order failures with the primary event.

When an individual task or other software component fails, the scope of its failure is almost impossible to determine, let alone realize that it failed at all. Even when a failure is detected and recovery attempted, the granularity of failure ends up being the entire system. Monitor code cannot usually restart tasks safely, and the RTOS cannot recover resources dynamically allocated by failed tasks. The result is that recovery is most often accomplished through the brute-force use of watchdog timers that reboot the entire system or software-induced panics.

Most often when a program goes awry, it does so silently. An errant task can corrupt data and code anywhere in the RTOS system. With luck, the impact of such corruptions arises immediately (illegal instructions generating exceptions), but it is more likely that the damage will only surface after the fact – seconds, hours, or months later. When aberrant symptoms appear, it will be extremely difficult to associate unexpected program behavior, whether subtle or crash and burn, with the original cause.

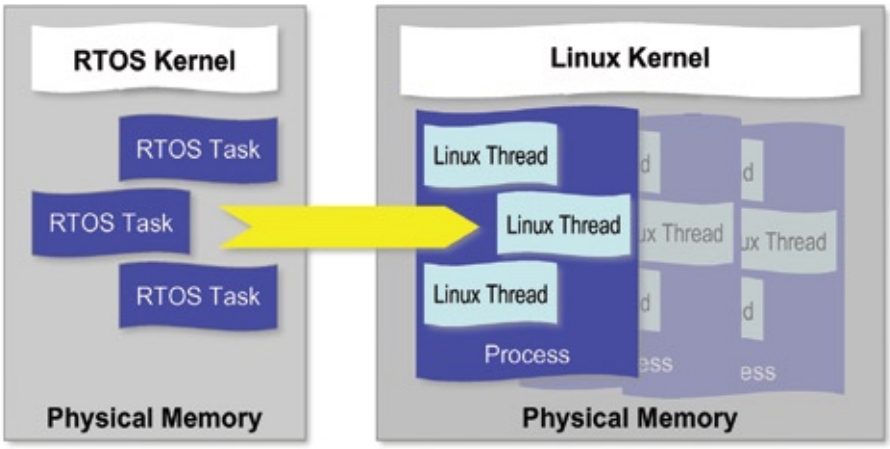

Figure 1

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Built-in reliability from the Linux programming model

Linux, as a UNIX-compatible OS, presents a much more robust application and system programming model. Applications execute in their own protected address spaces, for the most part invisible to one another, and are prevented from overwriting their own code through hardware-based MMUs present on most modern 32- and 64-bit processors.

While they share this virtual address space with the Linux kernel, they cannot overwrite kernel code or data. Since applications/processes cannot "see" one another (they reside in unique virtual address spaces), they cannot corrupt each other's data or code.

API (native and standard) and runtime libraries

Before open standards, RTOS makers defined their own system call set or API, which was proprietary and unique to each maker. Interface libraries were supplied for popular programming languages such as C and C++, which made APIs accessible to the programmer writing in a high-level language. In the past decade, most RTOS makers also supplied libraries compliant with the well-established standard Portable OS Interface (POSIX), although typically only the portion of the POSIX specifications relevant to embedded applications. Many customers also layered the native RTOS interface with their own API set to gain some independence and portability, not wanting to be locked into a proprietary, vendor-specific interface.

Developers build applications that leverage standard APIs to achieve two complementary purposes: allow code to be ported to standards-based OSs like Linux and allow that same code later to be ported from such an environment more easily than with proprietary APIs.

Many commercial RTOSs include standard call sets from POSIX or Berkeley Software Distribution (BSD), but those APIs often exist only as window dressing. The proprietary closed APIs particular to a given kernel are the most used, and it is these that lock projects to a particular platform or solution.

If developers are porting standards-based code or considering which API options to choose for new code, it is important to understand the most common standards in use under Linux and other open systems.

POSIX

POSIX is prevalent in UNIX-based open systems and government and military arenas. However, POSIX has had limited impact on the traditionally closed and proprietary world of embedded RTOSs. The POSIX family of standards originated by the U.S.-based National Institute of Standards and Technology now falls under the auspices of IEEE as IEEE 1003 and other standards. In the past decade, POSIX has undergone several revisions, most recently to POSIX 2000.

Two important notions associated with POSIX are compliance and conformance. *Compliance* implies that a given OS platform implements some subset of the standard and that the implementation is documented. Even those platforms implementing a trivial subset can be termed POSIX compliant. POSIX *conformance*, conversely, presents much stricter criteria, meaning that an OS subjected to a certification test passed.

SVR4, BSD, and other UNIX APIs

UNIX System V, Revision 4 (SVR4) and versions of BSD UNIX are prevalent *de facto* system standards that greatly influence Linux. Linux implements large subsets of those UNIX APIs (for example, the Linux ipc() system call for shared memory, queues, and semaphores and the BSD sockets calls and TCP/IP stack).

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C language libraries

Many of the APIs in embedded designs, RTOS-based and otherwise, are simply standard C libraries that either directly implement functions or act as wrappers for system calls. Linux has the familiar libc/glibc, although larger in scope and more comprehensive than in RTOS implementations (for instance, pREPC for pSOS).

The glibc runtime can present memory footprint challenges to embedded applications, migrated and otherwise. Many Linux suppliers offer reduced code-sized libraries for size-sensitive applications.

RTOS interface layers

At the heart of an RTOS-based application is the use of InterProcess Communication (IPC) calls that supply the mechanisms to synchronize and communicate among tasks. Although the acronym uses the word *process*, in an RTOS, it really refers to *tasks*.

Table 1 provides a summary of the mapping between typical RTOS IPC calls and their equivalent Linux calls.

Although the mapping between an RTOS call and its equivalent Linux call is straightforward, the migration effort may be further accelerated using RTOS emulation libraries that supply the identical call interface for a Linux application as found on the RTOS being migrated from. One such emulation technology is available at the Xenomai Open Source project (www.xenomai.org). Here, various emulation layers, called *skins* in the Xenomai parlance, are supplied for POSIX, VxWorks VRTX, and Itron, which are widely used RTOSs. Note that like many open source projects, Xenomai and its skins are a work in progress and may be incomplete and/or subject to change. Nevertheless, it represents a starting point of potentially high value in streamlining the migration process.

For example, the POSIX module on top of Xenomai aims at providing an (almost) PSE51-compatible API. To help porting applications from other PSE51-compatible APIs, it contains some nonportable extensions to the POSIX specification.

This POSIX skin already contains these basic features:

- Threads
- Mutexes
- Semaphores (anonymous and named)
- Condition variables
- Support for real-time signals
- Cancellation, cancellation handlers
- Thread-specific data
- Message queues
- Timers support
- Shared memory

The POSIX skin creates real-time threads running either embodied into Linux kernel modules or inside regular applications in user space.

The APIs of real-time kernels allow both kernel and user space programming. When using these, developers generally prefer user space programming because the latency gap between both spaces is small, especially on hardware where MMU context switching is cheap. The ease of user space programming outweighs by far any gain one could expect from running an application directly from kernel space. User space programming brings memory protection and GNU Debugger support to debug real-time applications in this environment.

Real-time performance

Perhaps the most important requirement for embedded applications is meeting

RTOS IPCs	Linux IPCs
Semaphores (counting and binary)	SVR4 semaphores
Mutexes	POSIX.1c mutexes, condition variables, futexes
Message queues and mailboxes	Pipes/FIFOs, SVR4 queues
Shared memory	Shared memory
Events and RTOS signals	Signals, RT signals
Timers, task delay	POSIX timers/alarms sleep() and nanosleep()
Watchdogs, task regs, partitions/buffers	Emulated by tool kits

Table 1

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real-time deadlines. Considerable effort has gone into both designing RTOSs to make them responsive enough to meet real-time deadlines and into measuring RTOS system calls, so developers can be sure the systems perform quickly enough to meet deadlines. The RTOS calls are in the loop in the sense that an application synchronizes with an interrupt using services supplied by the RTOS. Consequently, the time it takes the RTOS to process a synchronization call is part of the timing-dependent sequence of handling the interrupt.

Before 2002, Linux's real-time performance was poor. Its throughput, especially in networking, was good; however, that's throughput, not real time. The reason was the basic Linux kernel and UNIX implementation architecture. These systems were designed for the kernel to execute what it needed to at the expense of the application. The reason was that kernel code is easier to write if developers know it won't be preempted by an execution path interruption.

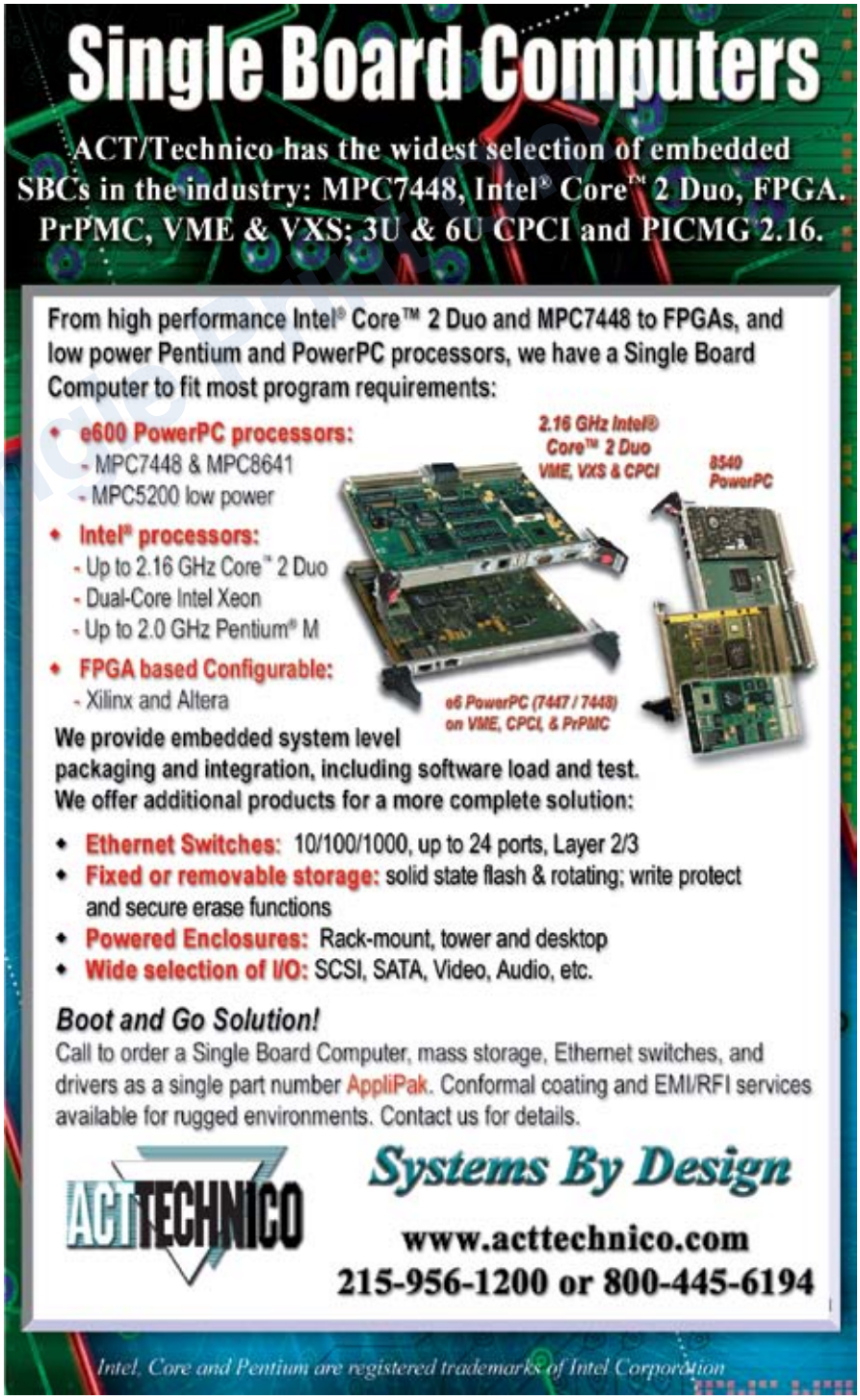
This approach served UNIX and early Linux to a degree, but there was a downside: It made running on multiple CPUs inefficient. At the same time, nonpreemptible Linux made meeting real-time requirements difficult because even though an interrupt may have occurred and an application was scheduled to run, the kernel would finish whatever work it was doing at the expense of that application. To fix the problem of running efficiently on multiprocessor systems, Linux kernel developers started breaking the internal paths of the Linux kernel into smaller nonpreemptible paths so that more of the kernel could execute in parallel and perform better on multiprocessor machines.

Those interested in improving the real-time performance of Linux piggybacked on the multiprocessing work and used the now-preemptible Linux kernel to accelerate native real-time response. That step alone reduced delays from many hundreds of milliseconds down to the 1 millisecond range. Further improvements included shortening the nonpreemptible sections to reduce any delay these smaller sections might add.

Linux has supported real-time applications since 2002, when Linux developers began enhancing its real-time capabilities. Since then, a continuous improvement process has dramatically accelerated the real-time response capabilities of standard Linux. Current real-time capabilities of Linux are equivalent to that of most dedicated real-time kernels.

A significant boost in moving Linux to real-time capability occurred recently when spin locks, which are synchronization mechanisms that consume CPU cycles but protect nonpreemptible sections, were replaced by a more reliable synchronization mechanism called *priority inheritance mutexes*. Mutexes make sure that CPU time is always allocated as closely as possible to the highest-priority application. This further shortens the processing path from interrupt to real-time application.

The last major real-time Linux improvement was to elevate the processing of the bulk of interrupt handling to the application level. Previously, the Linux design had all the interrupt handling at a higher priority than any application. By moving the bulk of the interrupt handling to application level, once again priority could take hold and the highest-priority application could get time before a lower-priority interrupt handler.



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Now that these changes have been completed, the performance and reliability improvements have made native Linux applications as fast and reliable as those based on traditional RTOSs.

Moving forward

Developers are leaving first-generation RTOSs for more reliable and open embedded platforms like Linux. While the migration from these traditional systems presents challenges, the benefits far outweigh the investment needed. The real risk doesn't arise from leaving behind familiar environments, tools, and APIs; it lies in standing still while the embedded systems development community moves forward.

By following the steps outlined in this article and leveraging RTOS migration technology, developers can successfully migrate existing legacy RTOS code to a modern embedded Linux platform with minimal effort and time. ECD

Jim Ready *is the founder and CTO of MontaVista Software, Inc. in Santa Clara, California. With 25-plus years of technical and entrepreneurial experience, Jim is a recognized authority in the embedded systems and real-time software industries. Cofounder of Ready Systems, he pioneered the development of the first commercially viable RTOS product, the VRTX real-time kernel. During the period when Ready Systems merged with Microtec Research, which later was acquired by Mentor Graphics, Jim served as Ready Systems' president and CTO at Microtec/Mentor Graphics. He founded MontaVista Software in 1999 to offer the Linux OS to the embedded systems market and provide embedded system expertise to the open source Linux community. Jim has BA and MA degrees in Physiological Psychology from the University of Illinois at Urbana-Champaign and the University of California, Berkeley, respectively.*

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References

[1] Venture Development Corporation (VDC), 2006 and 2007.

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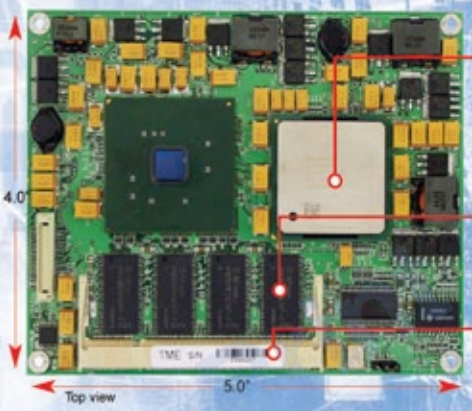

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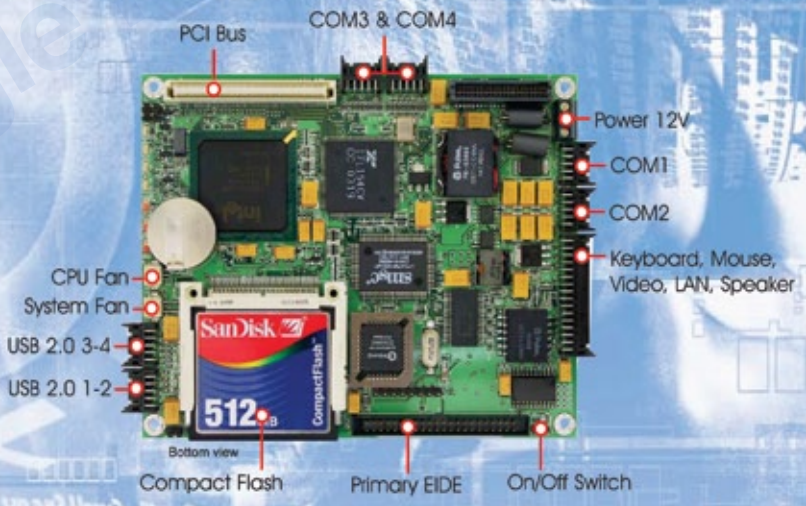

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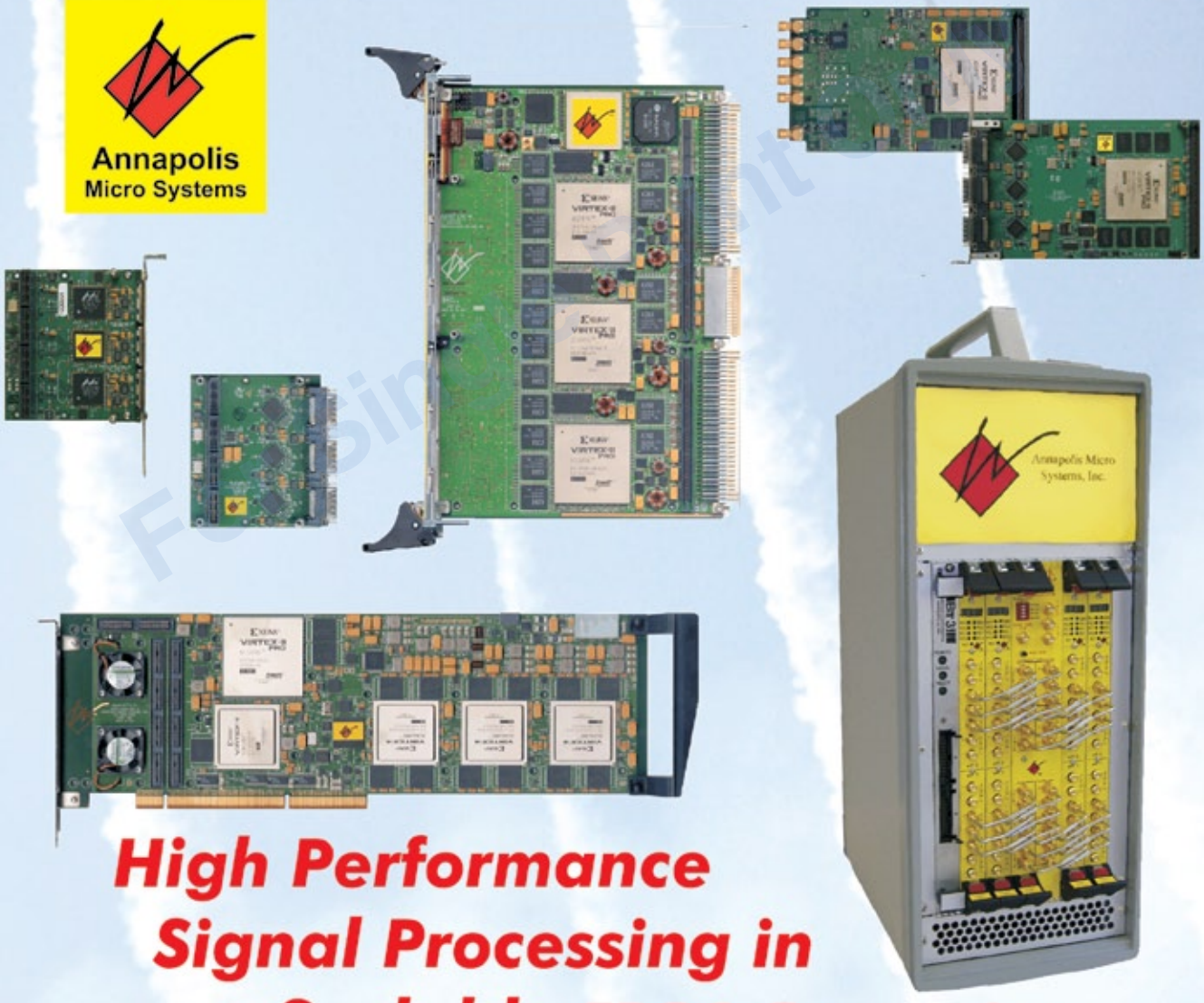

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RESOURCE GUIDE

Change control: A new framework for embedded systems

By Monica Chauhan

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Determining if an embedded system will operate securely in the field as shipped can be difficult to accomplish as standardization has allowed devices to become more interconnected and thus more open to security, software control, and compliance pitfalls. Change control software can help overcome these challenges by giving device manufacturers greater jurisdiction over what software gets changed on an embedded system.

Technology is revolutionizing every industry, from retail to health care to finance. The need for reduced time to market and advanced hardware/software technologies is driving the embedded systems market, including devices such as Point-Of-Sale (POS) terminals, self-checkout terminals, point-of-care medical modalities, ATM machines, thin client computers, and gaming systems, to create a richer customer experience while keeping the total cost of ownership low.

While embedded systems of the past used specialized hardware running proprietary software, a shift has been made toward standardizations such as Unified Point-Of-Sale (UPOS) in the retail industry. Standardization has enabled devices to become increasingly interconnected and allowed off-the-shelf software to be used in commoditized hardware running commercial or open Operating Systems (OSs) such as Windows XP Embedded, Windows Embedded for Point of Service, and Linux. Both these standards and general-purpose OSs have provided greater flexibility for software selection, faster time to market, and midcycle adoption of new technologies.

Yet this flexibility has come at the expense of security, software change control, and compliance challenges associated with these difficult-to-service embedded systems. Similar to a PC in a networked environment, today's embedded devices are susceptible to security risks, constant patching, and performance-draining antivirus software applications. Embedded systems also have become vulnerable to unauthorized and inappropriate changes as they flow through a typical multiparty distribution channel, which often results in field breakage. These factors can lead to noncompliant devices operating in the field. Figure 1 illustrates how increased functionality is creating the need for more control.

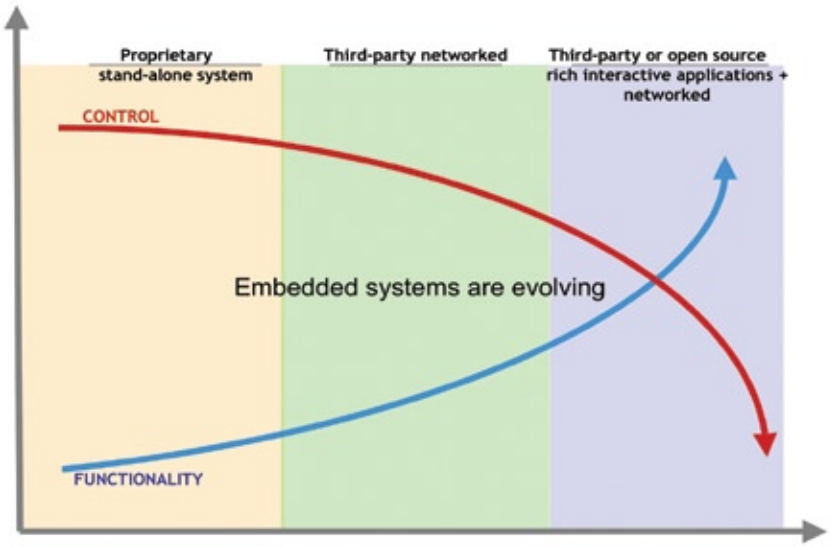

Figure 1

Until recently, device manufacturers did not have control over what software is installed and who installs it after the device leaves the manufacturing process, leaving no way to ensure the device will continue to work in the field as shipped.

Controlling the production image

When installed as a foundation of an embedded system, change control software controls what software can change and how, when, and by whom it can be altered as well as what software can run based on authorized change control policies and procedures. It ensures that only the changes done by approved and authorized change control procedures get added to the production software image of the embedded system. This includes in-process approved and documented changes and undocumented emergency changes. It automatically denies any *ad hoc*, unapproved, undocumented changes that may be done via internal unapproved administrator changes, or attacks or external malware, including zero-day attacks (see Figure 2).

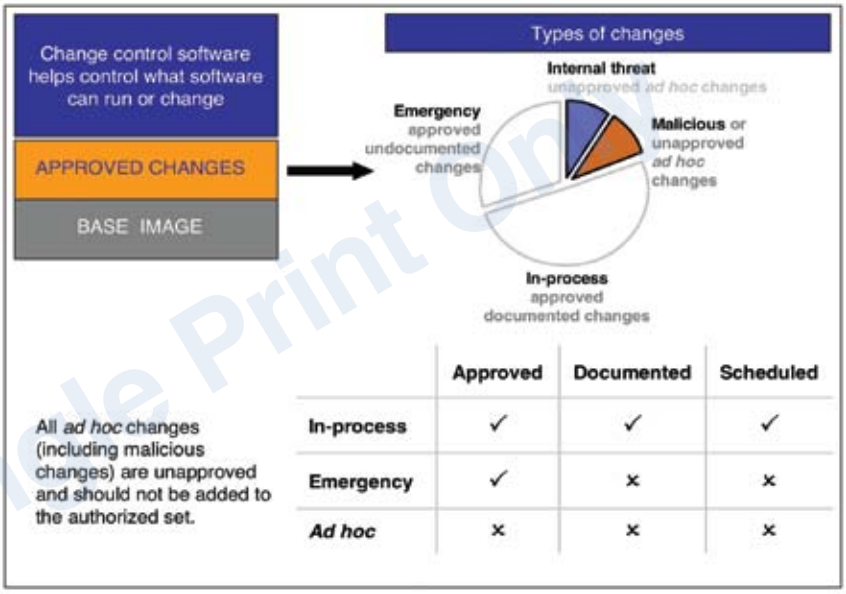

Figure 2

Change control software is a low-footprint, low-overhead piece of software that runs transparently on an embedded system. It generally is installed and set up quickly with low initial and ongoing operational overhead and is designed to lock down or harden a device's gold base image certified by the device manufacturer. Change control allows device builders and manufacturers to dictate the degree of flexibility given to the distribution channel, which translates into greater control over what is installed on an embedded system once in production.

Change control technology offers the capability to enforce what is installed, uninstalled, upgraded, or modified to the base software image of a networked device in production in two distinct workflows. First, the software provides control as a device flows through its multistage manufacturing life cycle and as various channel vendors attempt to install their own software. Second, it controls the state of a device once in production to ensure operational maintenance and support are conducted in accordance with the device manufacturer's policies.

No need for antivirus

From a security perspective, change control helps manage what can run, providing protection against existing and unknown zero-day polymorphic threats. By acting as a "concrete wrapper" around the gold base image of an embedded system, change control software can ensure a device in production is secure and cannot be compromised. And because changes attempted by malicious code or unauthorized users are prevented, the need for antivirus and other security software packages is eliminated. This lock-down mode cuts down on emergency patching, reduces the number and frequency of patching cycles, and allows more time for testing before patches are deployed to in-production systems.

Patch systems on schedule

The runtime control element of change control software can help minimize operating costs by reducing both planned patching and unplanned recovery downtime, thereby

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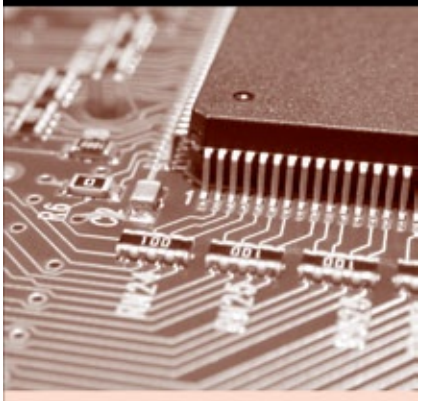
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increasing device availability. This often becomes an ideal feature for difficult-to-service, remote, and lower-margin devices running vulnerable commercial OSs and applications. The capability can lower support costs by reducing the number of touch points needed.

*[**Editor's note:** Solidcore Systems, Inc. recently announced the creation of an embedded change control advisory council. Members include representatives from Microsoft, NCR, Confirma, NEC, StoreNext, and Wyse Technology. The advisory council will help drive new innovations in change control and work to accelerate the adoption of standards for controlling change on embedded systems in diverse vertical markets.]*

Case study: locking down POS systems

NEC Infrontia (NEC-i) is one example of change control software implementation. The POS device manufacturer wanted to provide an enhanced customer experience with its devices by building Windows XP Embedded-based POS terminals. However, because these devices were more highly networked and dependent on general-purpose OSs, they became more vulnerable to unauthorized changes and constant patching. NEC-i also faced a significant performance drain on its POS devices because of antivirus software running on the systems.

To alleviate these problems, NEC-i built devices with change control from Solidcore as the foundation, which enabled the company to transparently control devices as they passed through multiple dealers. With change control installed at the heart of these systems, NEC-i prevented unauthorized code from breaking unpatched systems and removed the antivirus software that was diminishing its devices' performance.

Foundation for better management

Change control is quickly becoming a new standard to ensure embedded device uptime and reduce support costs. By providing complete command over what is allowed to change on the device, change control is proving to be a beneficial tool for embedded device manufacturers.

As the market continues to evolve, leaders in the embedded systems space are coming together to develop standards for architecting embedded systems with change control as the foundation. In the future, embedded systems may converge in enterprise, with IT organizations managing embedded devices like ATMs and POS systems in remote locations such as bank branches and grocery stores. **ECD**

***Monica Chauhan** is director of embedded solutions for Solidcore Systems in*

Cupertino, California, where she is responsible for product management, strategic alliances, and outbound marketing activities for embedded solutions. She has been active in defining, delivering, and marketing software solutions in the arena of security and enterprise management for more than eight years. Prior to Solidcore, Monica was director of engineering for four product lines at Ensim and in development at Sun Microsystems. Monica holds an MS in Computer Science from Stanford University.

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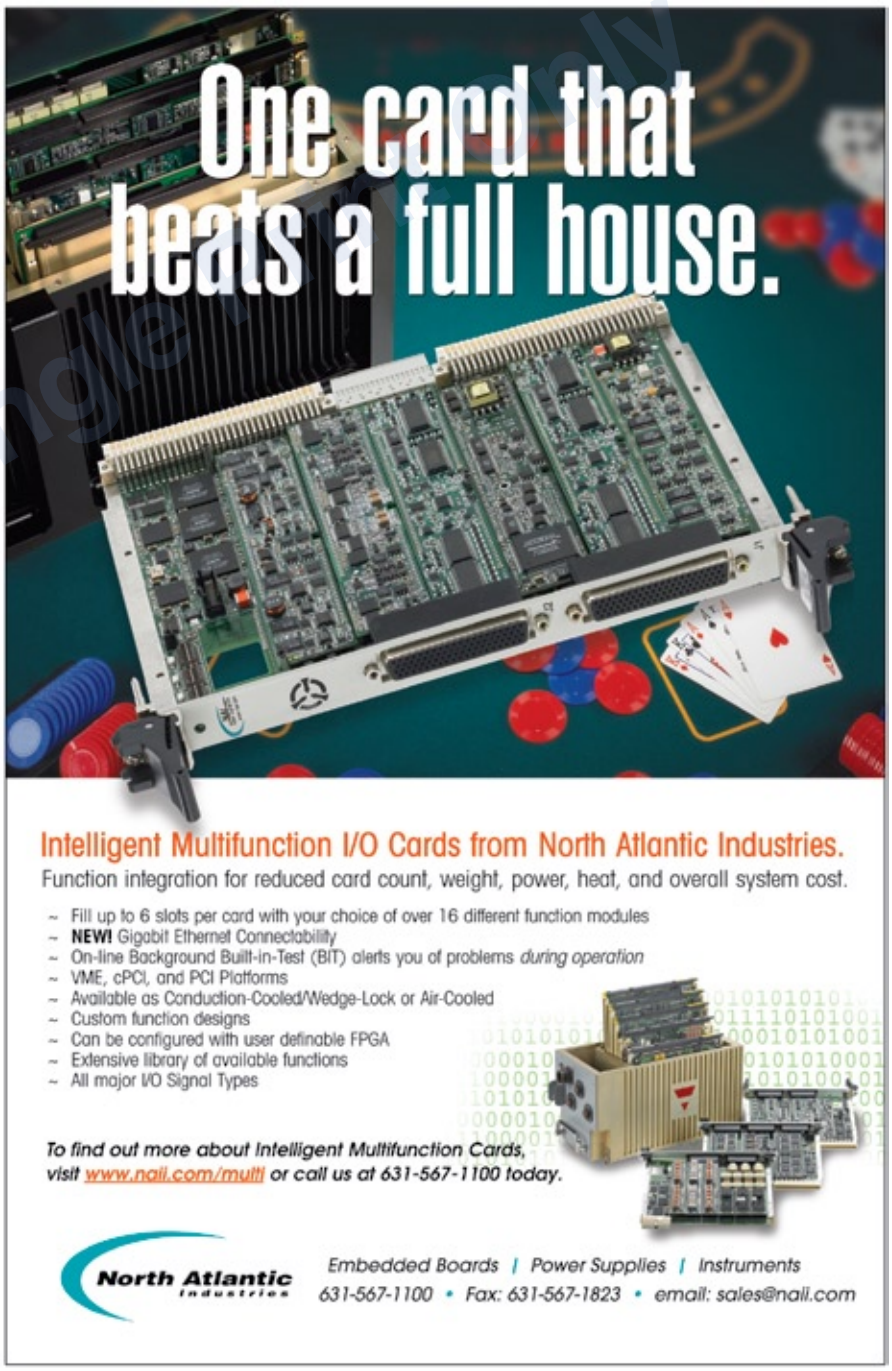

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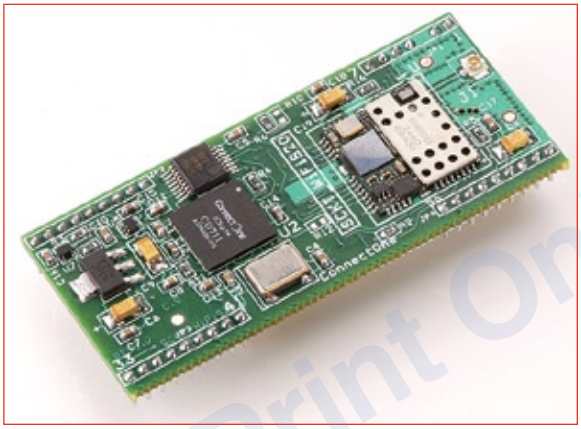
Editor's Choice • Embedded Computing Design • PRODUCTS

Module guards M2M applications

Simplifying security is one way to ensure embedded devices are better protected from attacks. Embedded systems designers welcome the ability to overcome time and complexity barriers so they can spend more time adding core value to their designs.

Connect One Ltd. offers the Socket iWiFi, a secure serial-to-Wi-Fi embedded device server that connects devices running Machine-to-Machine (M2M) applications to 802.11b/g wireless LANs and protects them from network attacks. Socket iWiFi uses Connect One's iChipSec C0711AG IP communication controller chip with encryption, security, and IP protocols to act as a firewall and Wi-Fi controller for the onboard Marvell 88W8385 Wi-Fi chipset. Socket iWiFi enables devices that use communication modules in the industry-standard SocketModem form factor to be integrated into a wireless LAN network with minimal programming.



Socket iWiFi frees up host processing time by offloading connectivity, cryptography, and security from the application processor. Developers can take advantage of 10 simultaneous TCP/UDP sockets; two listening sockets; SMTP, MIME, POP3, FTP, Telnet, and HTTP clients; a Web server with one website for the application and another for configuring iChipSec; and serial-to-IP bridging. Socket iWiFi supports 64-/128-bit WEP encryption, SSL3/TLS1, WPA1, and WPA2.

Connect One Ltd. • Socket iWiFi

RFID tag keeps info private

Security in embedded devices is more than encryption; it also includes confidentiality. Preventing information from being disclosed to unauthorized contacts is a vital part of the security chain.

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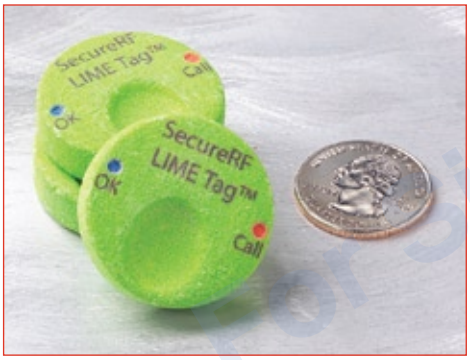


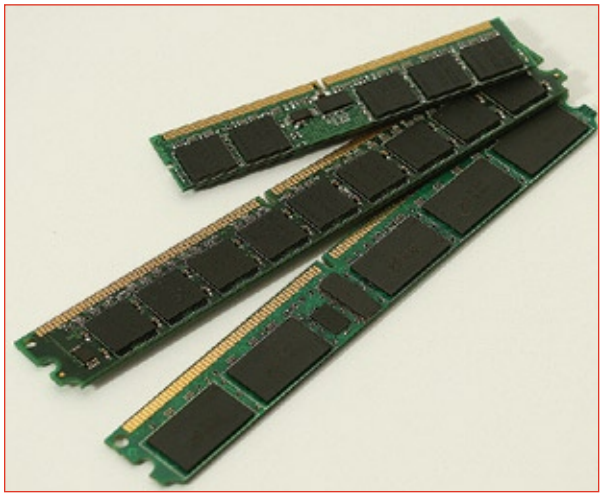
data storage and ensures privacy by allowing only authorized readers access to sensitive information. SecureRF technology makes the tag an active participant in authenticating and protecting its contents.

The LIME Tag includes a temperature sensor and addresses cold-chain management issues by monitoring and securely recording an item-level temperature history, which comes in handy when tracking temperature-sensitive, high-value pharmaceuticals and biological materials from production to use. The SecureRF solution provides strong privacy protection for consumers and helps address Health Insurance Portability and Accountability Act (HIPAA) privacy requirements. The SecureRF LIME Tag also protects privacy by preventing unauthorized reading of the information in the tag with strong authentication, something today's RFID tags cannot do.

SecureRF Corporation • LIME Tag

Maximizing memory density

Space is a premium in most embedded computing designs. Finding room for enough memory is always a challenge. Add the requirement for upgrades and expansion on top of that, and the challenge becomes even greater. Lower-height and higher-density memory is a major advantage when designing for demanding and complex embedded applications.



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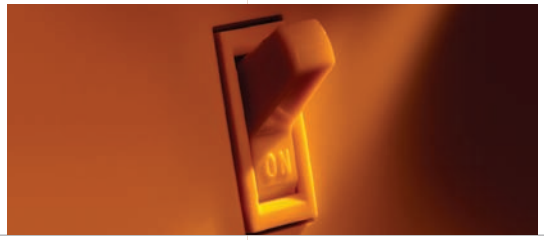

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- Robust, high-performance Windows instant-on and off: boot time is virtually eliminated
- Microsoft Windows Support: Windows XP Pro, XP Embedded, Server 2003, including all current service packs
- Integrated appliance environment: OEM can implement multipurpose functionality on a single system
- Support for "Ghosting": Simplifies manufacturing and speeds time to market
- Comprehensive GUI-based configuration and management: Intuitive interface results in reduced time to configure

For more information, contact: info@ardence.com

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BIOS, firmware, middleware

Embedded Computing Design Resource Guide 2007

Embedded Business Group, Hitachi America

750 Central Expressway MS 3224 • Santa Clara, CA 95050
408-970-1340
www.hitachi.us/entier

Entier RDBMS 2.0

Hitachi Entier has unique capabilities that allow you to "search the way you think" and delivers 50-1000 times faster performance than products used today in many mobile and converged devices. Its unique design greatly reduces the number of SQL commands required to perform common tasks, enabling data to be located faster at execution time, and for applications to be developed more rapidly.

A lightweight, powerful, small-footprint data manager, Hitachi Entier creates an application-optimized platform for embedded applications across all consumer devices: cell phones, PDAs, navigation systems, and television/cable set-top boxes.

View Entier in action at:
http://www.hitachi.us/Entier/MeetJoe.html.

Entier

FEATURES:

- Complex Text Search: Hitachi Entier allows users to efficiently search for combinations of key words
- Incremental Text Search: Executes searches as letters are entered, narrowing down likely results
- Alias Search: Allow users to find alternatives and catch typos
- Conceptual Search: Uses tagging/indexing features to enable users to find "something like this"
- Spatial Search: Allows users to search for location-based data in the database such as roads and POI

For more information, contact: entier-info@hal.hitachi.com

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Insyde Software
153 Cordaville Road • Southborough, MA 01772
508-983-0983
www.insydesw.com/embedded.htm

InsydeDiY – EFI Firmware

InsydeDiY – "Do-It-Yourself" firmware – is aimed specifically at embedded systems makers who are using Embedded Intel® Architecture, who do not need a complete BIOS implementation, and who want to develop a platform-specific set of initialization and boot code themselves.

Designed as a lightweight and easy-to-implement set of firmware components that deliver unique value and benefits to embedded developers and solutions providers worldwide, the InsydeDiY solution provides multiple benefits: reduced project development time with a pre-packaged set of source and binary components, compatibility with the industry's latest EFI methods of booting an Operating System, improved boot speed, and a robust environment for running and managing pre-boot applications.

FEATURES:

- Royalty free
- Facilitates in-house development of UEFI Firmware
- Lightweight, easy-to-implement, and cost effective
- Built-in software debugger
- Reduces overall project development time
- Seamless transition path to full InsydeH2O Framework solution

For more information, contact: nancy.baptiste@insydesw.com

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Insyde Software
153 Cordaville Road • Southborough, MA 01772
508-983-0983
www.insydesw.com/embedded.htm

BIOS, firmware, middleware

InsydeH2O – UEFI/EFI Firmware

InsydeH2O, a next-generation firmware replacing traditional PC BIOS, enables ODMs/OEMs to increase efficiency, lower costs, accelerate system debugging resolution, and differentiate their products in the pre-boot.

This WHQL-compliant product is the first system software that provides the "Hardware-2-Operating System" bridge using the modern UEFI Framework technology and is designed to have a useful life over the next 20 years.

Unlike traditional 16-bit real mode BIOS technology, InsydeH2O's BIOS Replacement Drivers (BRD) run in 32-bit protect mode. Its Compatibility Support Module (CSM) provides all necessary backward-compatibility including the runtime BIOS interface, support for option ROMS, and USB legacy features.

FEATURES:

- Standard industry-wide architectural interfaces via open specifications
- "C" vs. Assembly language maximizes engineering productivity
- Reusable S/W modules – write firmware once, shorten project development time
- Built-in software debugger
- Better support for pre-boot applications with built-in EFI environment

For more information, contact: nancy.baptiste@insydesw.com

RSC# 24316 @ www.embedded-computing.com/rsc

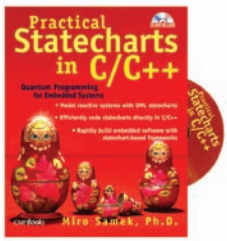
Quantum Leaps, LLC
103 Cobble Ridge Drive • Chapel Hill, NC 27516
866-450-LEAP
www.quantum-leaps.com

QP

Quantum Platform™ (QP) is a family of lightweight, open source, state machine-based, event-driven frameworks for real-time embedded (RTE) systems.

QP™ enables developing well-structured embedded applications as a set of concurrently executing hierarchical state machines (UML statecharts). With QP™, coding of modern state machines directly in C or C++ is a non-issue. No big design automation tools are needed.

QP™ can work with or without a traditional OS/RTOS. In the simplest configuration, QP™ runs on bare-metal completely replacing the RTOS. The QP/C and QP/C++ frameworks can also work with a traditional OS/RTOS to take advantage of existing device drivers, communication stacks, and other middleware.



FEATURES:

- Support for hierarchical state machines (UML statecharts) in highly portable C and Embedded C++
- Up to 63 concurrently executing state machines (active objects) with preemption capabilities
- Small memory footprint of only 4KB of code (ROM)
- Very clean, lint-free source code 98 percent compliant with the MISRA guidelines
- Comprehensive documentation, sample applications, and Development Kits available online
- Dual-licensing model with choice between the open source license (GPL) and royalty-free commercial licenses

For more information, contact: sales@quantum-leaps.com

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BIOS, firmware, middleware

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TeamF1, Inc.
39159 Paseo Padre Pkwy, Suite 121 • Fremont, CA 94538
510-505-9931
www.TeamF1.com

Managed Access Point Solution

TeamF1's turnkey-solution for secure embedded WLAN access points is a production-ready software package that provides a web management interface GUI, a powerful command line interface (CLI), and an SNMP interface for remote management.

The software is equipped with device-friendly features such as its concurrent support for different generations of 802.11 security technology, from WEP through WPA™/WPA2, in either Personal (Pre-shared Key) or Enterprise (802.1X) mode, support for popular EAP methods, and with QoS capabilities using 802.11e/ WMM™.

The Managed Access Point Solution allows embedded device OEMs to bring business-class wireless AP products to market faster than ever before, combining a rich feature-set with the latest security technologies.

FEATURES:

- Complete turnkey-solution reduces OEMs' development costs, risk, and time to market
- Add-on SMBware networking and security modules from TeamF1 enable OEMs to easily differentiate products
- Adherence to standards enables 802.11 a/b/g/n support for maximum flexibility and high performance
- Comprehensive management capabilities including secure remote management
- Support for a broad range of Wi-Fi® chipsets
- Branding options offer a cost-effective, customized look and feel

For more information, contact: sales@TeamF1.com

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TeamF1, Inc.
39159 Paseo Padre Pkwy, Suite 121 • Fremont, CA 94538
510-505-9931
www.TeamF1.com

Secure Gateway Solution

TeamF1's turnkey-solution for virtual private network (VPN) and unified threat management (UTM) gateways is a fully managed solution providing a web management interface GUI, a powerful command line interface (CLI), and an SNMP interface for remote management.

It provides a rock-solid router platform that acts as a gateway between one or more WAN interfaces of different types and multiple LAN/WLAN interfaces. It includes a variety of filtering modules such as a firewall, NAT, IDS, or IPsec VPN. The GUI management capability also includes device administration features such as upgrade capability, traffic monitoring, and logging.

The Secure Gateway Solution enables embedded device OEMs to bring VPN/UTM products to market faster than ever before.

FEATURES:

- Pre-integrated software to reduce risk and time to market
- Robust feature set and small footprint
- Standards-based implementation, tested for compliance and interoperability
- Modular components allows scaling out of unneeded functionality such as cipher and hashes not in use
- NAT, FW, Remote access (client-to-site) and site-to-site VPN with Hub and spoke/mesh configurations
- Extensible through additional available modules such as Kerberos, 802.1x/EAP, IKEv2, and SSH

For more information, contact: sales@TeamF1.com

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Embedded I/O Solutions for:
IndustryPack®, PMC, CompactPCI, PCI with Outstanding Software Support.

- CPU Carriers
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- Communication
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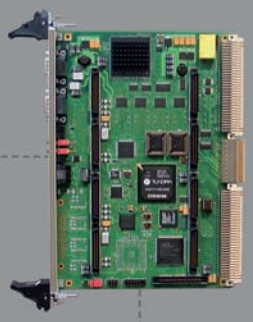
- Field Bus
- Digital I/O
- Analog I/O
- PC Card/CardBus
- Motion Control
- Memory
- User-programmable FPGA



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- Windows
- LynxOS
- QNX
- OS-9

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TEWS TECHNOLOGIES GmbH: Am Bahnhof 7 • 25469 Halstenbek/Germany
Phone: +49 (0)4101-4058-0 • Fax: +49 (0)4101-4058-19 • E-mail: info@tews.com

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Intel Corporation
intel.com/design/intarch

New Intel® Chipset Offers Outstanding Graphics, I/O Bandwidth and More

The Mobile Intel® GME965 Express chipset provides excellent flexibility for developers of embedded applications by offering outstanding graphics and I/O bandwidth, asset management capabilities, storage speed, and reliability. It addresses requirements of a broad range of embedded applications including interactive clients, gaming, industrial automation, and medical and print imaging platforms. Embedded lifecycle support protects system investment.

The Mobile Intel GME 965 Express chipset is optimized for and validated with the following Intel® processors for embedded applications:

- Intel® Core™ 2 Duo processor T7500 at 2.2 GHz with 35 watts thermal design power (TDP)
- Intel Core 2 Duo processor L7500 at 1.6 GHz (17 watts TDP)

The chipset includes an integrated 32-bit 3D graphics engine with eight graphics cores, enabling up to 500 MHz graphics frequency. Additional features include a 533/800 MHz front-side bus delivering a high-bandwidth connection between the processor and platform, up to 4 GB of 533/667 MHz DDR2 SODIMM system memory, Intel® Active Management Technology (Intel® AMT), and Intel® Matrix Storage Technology. It delivers outstanding system performance through high-bandwidth interfaces such as PCI Express®, Serial ATA, and Hi-Speed USB 2.0 connectivity.

To speed development on this platform, the Intel® Core™ 2 Duo processor T7500 and Mobile Intel® GME965 Express chipset development kit provides an excellent choice for developers of a wide range of low-power embedded applications. This and other development kits from Intel provide a fully working system with a range of performance options that can be modified or used immediately for product development.

For complete details on these products and the Intel® technologies included, go to http://developer.intel.com/design/intarch

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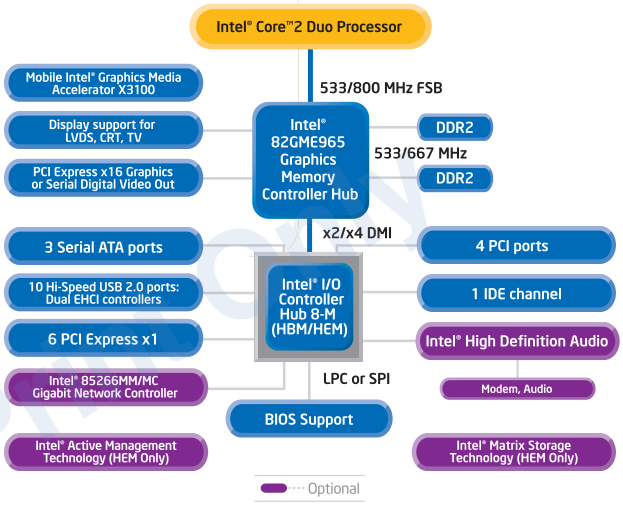

FEATURES:

- Single- or dual-channel, non-ECC, 533 MHz or 667 MHz DDR2 SODIMM high-speed system memory provides greater platform performance
- Graphics core speeds up to 500 MHz provide enhanced graphics and 3D rendering performance, and improved high-definition video playback
- Dual independent display support provides a wealth of options for high-resolution displays
- x16 PCI Express graphics or a dual-channel Serial Digital Video Out (SDVO) graphics interface support high throughput
- Advanced packaging and electrical design innovations deliver long-term system reliability over a broad spectrum of operating conditions
- Six PCI Express ports are configurable as six x1 or one x4 and two x1 ports on ICH8-M
- Intel® High Definition Audio interface delivers premium digital multi-channel sound
- LAN connect interface (LCI) provides flexible network solutions such as 10/100/1000 Mb/s Ethernet with LAN manageability
- Integrated Serial ATA host controller supports three ports for increased storage capacity
- Intel Matrix Storage Technology provides both AHCI and RAID functionality for improved storage speed and data redundancy
- Intel® AMT supports asset management capabilities such as remote management of unmanned sites
- Chipset supported by the Intel® Embedded Graphics Drivers and video BIOS, developed specifically for embedded products and applications

For more information, contact: intel.com/design/intarch

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Tundra Semiconductor
603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Tundra PCI Bridges

Tundra's PCI System Interconnect portfolio includes a wide range of high performance, industry standard, 32-bit PCI-to-PCI bridges. The product family includes:

The Tsi340™– A small form factor (17 mm x 23 mm) 128-pin PQFP package, synchronous, 66 MHz PCI bridge
The Tsi350™ – An asynchronous 66 MHz PCI bridge
The Tsi352™ – A synchronous 33 MHz PCI bridge

Backed by Tundra's world class service and support, these bridges provide a high-quality, competitively priced alternative to existing 32-bit PCI-to-PCI bridges. Designed as pin-for-pin and drop-in software compatible, the Tsi340/Tsi350/Tsi352 may be used on existing boards without software or hardware modification.

FEATURES:

- Industry standard 32-bit PCI bridges
- Operate up to 66 MHz on primary and secondary buses (up to 33 MHz on the Tsi352)
- Asynchronous PCI operation on the Tsi350
- Support for up to nine bus masters on the Tsi350, up to four on the Tsi352 and Tsi340
- Compatibility with existing 32-bit PCI bridges to fit on existing board footprint using existing software
- RoHS compliant and standard package options available

For more information, contact: sales@tundra.com

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Tundra Semiconductor
603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Chipsets

Tundra Tsi109™ Host Bridge for PowerPC®

The Tundra Tsi109™ is a high-performance host bridge for PowerPC® that supports DDR2 memory, integrated clock generation, and advanced I/O such as PCI-X and Gigabit Ethernet. With dual processor support and 200 MHz bus speeds, the Tsi109 is the ideal companion chip for both Freescale MPC74xx and IBM PPC750xx PowerPC processors. System performance is enhanced through the Tsi109's advanced switch fabric, and system cost is minimized via an array of integrated functionality.

The Tsi109 simplifies system design through flexible configuration options and provides effective power management through DDR2 memory support. Customers are offered the best system performance-per-watt as well as the best system performance-per-dollar by choosing the Tsi109.

FEATURES:

- 200 MHz 60x/MPX processor bus with dual CPU support and advanced pipeline architecture
- DDR2 Memory Controller: Up to 50 percent memory power savings compared to DDR
- Integrated Clock Generator with Spread Spectrum capability
- Designed for 200 MHz operation with only 8 PCB layers
- Low latency non-blocking internal switch fabric
- Pin compatible with Tsi108™

For more information, contact: sales@tundra.com

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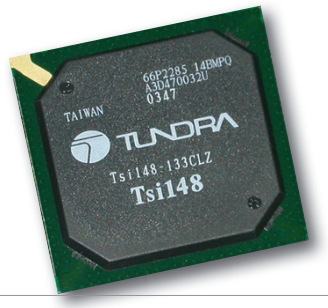
Tundra Semiconductor

603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Tundra Tsi148™ VME-to-PCI/X Bridge

The Tsi148 is the industry's leading PCI-X to VMEbus bridge and the successful next generation offering to the Universe™ II, the leading VMEbus bridge for embedded systems customers. Fully compliant with VMEbus standards, the Tsi148 implements the 2eSST protocol that allows the VMEbus to run at a bandwidth up to 320 MBps. The Tsi148 is a full featured master, slave, and system controller that can be used in any VME application and provides an increase in overall processing capability on legacy backplanes, while transparently enabling the high performance distributed processing that new applications demand.



FEATURES:

- Industry's best sustained transfer rate of 305 MC/x in 2eSST – higher system bandwidth
- Multithreading – capable of a number of simultaneous transactions while optimizing bus utilization
- Full-featured master, slave, and system controller – can be used in any VME application
- PCI-X local bus supports two loads at 133 MHz – reducing component count
- Small device footprint – saves board space
- Proven VME backwards compatibility – preserves legacy investment

For more information, contact: sales@tundra.com

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Critical Link: MityDSP Solutions

6712 Brooklawn Parkway • Syracuse, NY 13211
315-425-4045
www.MityDSP.com

MityDSP Platform

MityDSP is a customizable off-the-shelf CPU platform with configurable I/O. A high performance, small form-factor processor card, MityDSP features a TI DSP integrated with a Xilinx Spartan FPGA, FLASH, and SDRAM memory subsystems. An all-in-one instrumentation and data collection solution deployed in a wide range of instrumentation and scientific applications, MityDSP has several versions. The original meets standard requirements; with 4-5 times the processing power, a higher performance version is used for data and processing-intensive applications like image and signal processing and radar. The MityDSP Developers Kit, with its available on-board I/O and wide selection of plug-on modules, allows you to configure custom electronics with the ease of off-the-shelf.

FEATURES:

- Wide selection of available I/O: analog, digital, Ethernet, serial, stepper motor, LCD, touch screen, RTC
- Begin to develop your software today with the MityDSP Developers Kit and I/O that meets your specific needs
- Using the MityDSP off-the-shelf technology, we can deliver electronics specific to your needs in 6 weeks
- Using our robust set of I/O modules proven in many products, designs are built on a foundation of quality
- Save 80% over the cost of complete, from-the-ground-up development
- With the MityDSP, Critical Link proves you can simultaneously develop with speed, quality, and price

For more information, contact: info@mitydsp.com

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Hunt Engineering

Chestnut Court, Burton Row • Brent Knoll, Somerset, TA9 4BP
United Kingdom
+44 (0)1278 760188
www.hunt-dsp.com

HERON DSP Systems

HERON high-performance modular signal processing systems for PCI based, USB connected and embedded use are programmable and reconfigurable, using common APIs to provide compatibility and complete flexibility.

Choose one or combine any number of our off-the-shelf modules to create the system you need for your application. We have modules with Xilinx Virtex FPGA (with external memory options plus digital and analog I/O choices) and TI 'C6000 DSP.

Mount your selected modules on a HERON module carrier which provides real-time data connections with 400Mbytes/second possible in each direction simultaneously. Using the APIs, extensive tutorials, examples, software frameworks and IP we supply with every system, you can create your unique solution quickly and easily.

FEATURES:

- Modules with Xilinx Virtex-II, Virtex-II Pro & Virtex-4 SX, LX and FX can be combined or used alone
- All FPGA modules have user programmable digital I/Os; SDRAM options also available
- DSP module with 2400 MIPS TMS320C6000, SDRAM, Flash-ROM, I/O; can be combined with FPGA modules
- FPGA modules with two channels each of 125-210Msps A/D plus 125-160Msps D/A available
- Choice of cPCI, PCI, USB, and embedded carriers with real-time data connections at up to 400Mbytes/sec
- APIs, system development tools, software frameworks, IP and tutorials included

For more information, contact: sales@hunteng.co.uk

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Digital Signal Processing (DSP)

Innovative Integration

2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

Quadia 64bit cPCI

Quadia is a quad-DSP, dual FPGA, dual PMC sites, CompactPCI board with an advanced architecture that provides the best inter-processor connectivity and access to the finest external interfaces available today, to deliver blazing performance and extreme flexibility for advanced signal capture and real-time processing applications.

The board features four C6416 DSPs split in two independent clusters each hosting a PMC site and one large FPGA for end-user code, a central FPGA routing inter-processor communication, end-user FPGA communication, external port serial I/O for PCI Express or other private link, global memory and PCI interface. Quadia is an ideal platform for integrating high performance DSP and I/O into advanced signal processing, data acquisition and more!

FEATURES:

- 1GHz TMS320C6416 DSP (x4) – 64MB SDRAM per Processor
- Flexible internal/external communication mesh – 64-bit/66MHz CompactPCI
- Two PMC Sites with Jn4 to FPGA – External Data Port, up to 12Gbit/s
- Two 4M Gate FPGAs reserved for end-user code – Up to two 2MB private DDR SBSRAM
- Up to two 128MB private DDR SDRAM – Up to 512MB Global DDR SDRAM
- PMC/XMC Modules are available – See Mezzanine cards in this guide

For more information, contact: sales@innovative-dsp.com

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Traquair Data Systems, Inc.
114 Sheldon Road • Ithaca, NY 14850
607-266-6000
www.traquair.com

micro-line C641x DSP/FPGA Boards

The micro-line series of embedded DSP/FPGA boards provides embedded systems developers with a tightly integrated suite of programmable DSP, FPGA, and I/O resources in small, stand-alone capable board formats.

micro-line C6412Compact and C641xCPU DSP/FPGA boards target high-performance integer DSP applications, using the Texas Instruments TMS320C6410, TMS320C6412, TMS320C6413, and TMS320C6418 DSPs.

The C6412Compact combines a powerful 720 MHz TMS320C6412 DSP processor, up to 128 MB SDRAM, 8 or 32 MB boot program FLASH ROM, and a high-density 1 MGate or 4 MGate Spartan-3 FPGA. The optionally programmable FPGA greatly expands processing as well as hardware interfacing possibilities. Two independent 400 Mbps 1394a FireWire interfaces are included, enabling simultaneous high-bandwidth video-in and video-out for a completely integrated video processing system. A 64-bit bus connects the DSP, FPGA, SDRAM, and FireWire resources. On-board USB 2.0 and 10/100BaseTx Ethernet interfaces round off the impressive array of features available on the C6412Compact.

The C641xCPU family of boards features a smaller (98 mm x 67 mm footprint) and leaner configuration, with up to 64 MB SDRAM, 8 MB boot program FLASH ROM, and a high-density 500 kGate, 1 MGate, or 1.6 MGate Spartan-3E FPGA.

10/100BaseTx Ethernet support is optionally provided using Windmill Innovations' eXpressDSP™-compliant bf3Net TCP/IP protocol stack and bf3Web embedded web server (SC100BaseTx Ethernet daughtercard is required when using C641xCPU boards).

Optional Analog I/O daughtercards can also be used with the C6412Compact and C641xCPU boards:

ORS-112 (16-bit A/D/A)
- 4-ch A/D 2.5 MSps; 4-ch D/A 625 KSps

ORS-114 (14-bit A/D/A)
- 2-ch A/D 65 MSps; 2-ch D/A 125 MSps

ORS-116 (16-bit A/D/A)
- 12-ch A/D 250 KSps; 12-ch D/A 100 KSps

micro-line C6412Compact

FEATURES:

› C6412Compact Features:
- 720 MHz TMS320C6412 integer DSP
- 1 MGate or 4 MGate Spartan-3 FPGA
- Up to 128 MB SDRAM; up to 32 MB boot program FLASH ROM
- Two independent IEEE1394a FireWire interfaces for streaming data in/out simultaneously
- 10/100BaseTx Ethernet interface
- USB 2.0 and RS-232 interfaces
- 16-/32-bit host port interface

› C641xCPU Features:
- 400MHz TMS320C6410, 500MHz TMS320C6413 or 500MHz TMS320C6418 integer DSP
- 500 kGate, 1.2 MGate, or 1.6 MGate density Xilinx Spartan™-3E FPGA; up to 98 configurable digital I/O pins
- Up to 64 MB SDRAM; 8 MB boot program FLASH ROM
- RS-232 interface
- 98 mm x 67 mm footprint; ISO9001:2000 accredited production and CE certification

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For more information, contact: sales@traquair.com

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Traquair Data Systems, Inc.
114 Sheldon Road • Ithaca, NY 14850
607-266-6000
www.traquair.com

micro-line C6713 DSP/FPGA Boards

The micro-line series of embedded DSP/FPGA boards provides embedded systems developers with a tightly integrated suite of programmable DSP, FPGA, and I/O resources in small, stand-alone capable board formats.

micro-line C6713Compact and C6713CPU DSP/FPGA boards target high-performance floating-point DSP applications, using the powerful Texas Instruments TMS320C6713 DSP.

The C6713Compact incorporates up to 64 MB SDRAM, 8 MB boot program FLASH ROM, and an on-board, high-density 250 kGate, 500 kGate, or 1 MGate Virtex-II FPGA (optionally programmable). The FPGA greatly expands processing as well as hardware interfacing possibilities. A 400 Mbps IEEE 1394a FireWire interface is also included on-board, for communications with other embedded DSP resources, cameras, sensors, and PCs. Software APIs are available to utilize the FireWire interface for general purposes, video frame capture from cameras, and data storage to hard drives and CompactFlash memory.

The C6713CPU offers a smaller (98 mm x 67 mm footprint) and leaner configuration, with up to 64 MB SDRAM, 2 MB boot program FLASH ROM, and a high-density 400 kGate or 1 MGate Spartan-3 FPGA.

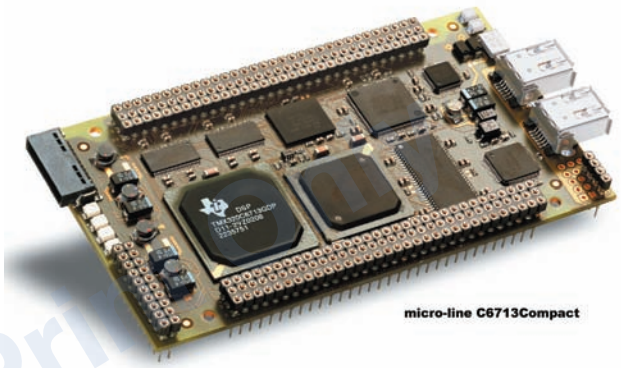
10/100BaseTx Ethernet support is optionally available using Windmill Innovations' eXpressDSP™-compliant bf3Net TCP/IP protocol stack and bf3Web embedded web server (requires SC100BaseTx Ethernet daughtercard).

Optional Analog I/O daughtercards can also be used with the C6713Compact and C6713CPU boards:

ORS-112 (16-bit A/D/A)
• 4-ch A/D 2.5 MSps; 4-ch D/A 625 KSps

ORS-114 (14-bit A/D/A)
• 2-ch A/D 65 MSps; 2-ch D/A 125 MSps

ORS-116 (16-bit A/D/A)
• 12-ch A/D 250 KSps; 12-ch D/A 100 KSps



FEATURES:

› C6713Compact Features:
- 300 MHz TMS320C6713 floating-point DSP
- 250 kGate, 500 kGate, or 1 MGate Virtex-II FPGA; up to 160 configurable digital I/O pins
- Up to 64 MB SDRAM; 8 MB boot program FLASH ROM
- On-board 400 Mbit/sec IEEE1394a FireWire interface
- RS-232 interface
- External access to TMS320C6713 DSP I/O interfaces: 32-bit EMIF, XF0/1 pins, Timer input/output pins, McASP and McBSP ports, I2C, and HPI
- 67 mm x 120 mm footprint; ISO9001:2000 accredited production and CE certification

› C6713CPU Features:
- 300 MHz TMS320C6713 floating-point DSP
- 400 kGate or 1 MGate Spartan-3 FPGA
- 64 MB SDRAM; 2 MB boot program FLASH ROM
- RS-232 interface
- 98 mm x 67 mm footprint; ISO9001:2000 accredited production and CE certification

For Sales Prom

For more information, contact: sales@traquair.com

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VMETRO Inc.
1880 South Dairy Ashford, Suite 400 • Houston, TX 77077
281-584-0728
www.vmetro.com/ad3000

VMETRO
innovation deployed

AD3000 3GSPS ADC

The AD3000 is a Xilinx Virtex-5 SXT or LXT FPGA closely coupled to a high-speed analog input front end providing processing and acquisition in a single XMC/PMC card. The Virtex-5 FPGA controls the analog to digital converter and provides the off-board digital interfaces of PCI-X and the multi-Gbit serial I/O used for the XMC interface. The combination of user programmable FPGA closely coupled to both data I/O sub-systems and multiple banks of fast memory provide a platform for acquiring and processing the data in one board. An LVPECL trigger input, an LVPECL output, an LVTTL output, and the sample clock input are provided on the front panel. This connectivity allows the AD3000 to be operated in a range of modes, including multi-board synchronous sampling.

FEATURES:

- 3 GSPS, 8-bit ADC in PMC/XMC form factor
- Xilinx Virtex-5 LX110T or SX95T FPGA (user programmable)
- Dual banks of QDR and SDRAM memories
- Windows, VxWorks and Linux support
- Rugged and Commercial build options

For more information, contact: info@vmetro.com

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Digital Signal Processing (DSP)

Embedded Computing Design Resource Guide 2007

Xilinx
2100 Logic Drive • San Jose, CA 95124
408-559-7778
www.xilinx.com/dsp

XILINX®

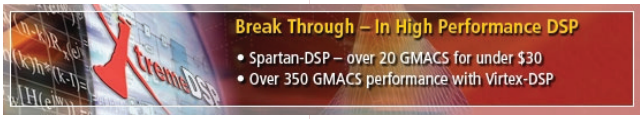
Xilinx XtremeDSP

The Xilinx XtremeDSP™ initiative helps you develop tailored high performance DSP solutions for aerospace and defense, digital communications, multimedia, video, and imaging industries.

- High-performance configurable FPGAs for DSP designs
- Development boards and Intellectual Property (IP)
- System Generator and AccelDSP design and development tools
- Complementary programmable logic and embedded processing functions
- Strategic industry and university partnerships for training and support

The XtremeDSP platform portfolio is comprised of two price/performance/power optimized families – Virtex-DSP and Spartan-DSP.

To learn more about our XtremeDSP offerings, please visit: www.xilinx.com/dsp



FEATURES:

- Virtex-DSP FPGAs with high performance DSP MAC blocks
- Spartan-DSP FPGAs with DSP MAC blocks optimized for volume/cost
- DSP design tools System Generator and AccelDSP streamline development
- Development Kits and Boards accelerate design with pre-verified examples
- DSP specific IP Cores and Blocks available

For more information, contact: jay.gould@xilinx.com

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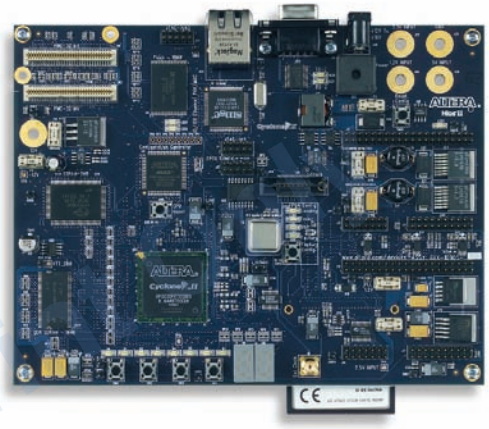
Altera Corporation
101 Innovation Drive • San Jose, CA 95134
408-544-7000
www.altera.com

Nios II Development Kit, Cyclone II Edition

Altera® Cyclone® II FPGAs are optimized for low cost, extending the reach of FPGAs further into cost-sensitive, high-volume applications and continuing the success of the first-generation Cyclone device family. Cyclone II FPGAs offer a customer-defined feature set, industry-leading performance, and low power consumption. They also offer greatly increased density and more features, all at significantly lower cost. Featuring up to 150 embedded 18 x 18 multipliers, Cyclone II FPGAs can be used alone or as digital signal processing (DSP) coprocessors to improve price-to-performance ratios for DSP applications, including video and image processing, communications systems, and common DSP functions.

The Nios® II Development Kit, Cyclone II Edition, offers a variety of intellectual property (IP) cores to speed development, including three Nios II 32-bit RISC processors. The Nios II processors – fast, standard, and economy – are each optimized for a specific price and performance range, allowing designers to choose a system configuration that is an exact fit for their embedded needs. With these processors, you can upgrade system performance at any stage of the product life cycle without having to redesign the board or develop hand-optimized software. All three processors use the same instruction set architecture and are 100 percent binary code compatible. Nios II processors can be added to a designer's system using the SOPC Builder system development tool in the Quartus® II development software. The Nios II C-to-Hardware Acceleration (C2H) Compiler boosts performance of time-critical C subroutines, converting them to powerful hardware accelerators with a simple "right-click to accelerate" interface. This kit includes 12 months of upgrades so you can keep your system up-to-date with the latest enhancements to the Nios II processor, peripherals, and system design tools. This development kit is now RoHS-compliant.

Visit www.altera.com/nios for more information.



FEATURES:

- Complete embedded FPGA development environment featuring the versatile Nios II embedded processor and the low-cost Cyclone II family
- Embedded software development tools:
  - Nios II integrated development environment (IDE) and debugger, and the Nios II instruction set simulator (ISS)
  - GNU tool chain, MicroC/OS-II real-time operating system, and NicheStack TCP/IP network stack
- Hardware design tools, including the Quartus II design software with the SOPC Builder system development tool
- Library of standard embedded IP cores and suite of pre-built hardware and software reference designs, including:
  - Three Nios II 32-bit RISC CPU cores (fast, standard, economy)
  - DDR, SRAM, timer, UART, SPI, JTAG UART, GPIO, DMA, 10/100/1000 Ethernet, interface-to-user logic, custom instruction, and more
- Complete embedded development board with Triple-Speed Ethernet PHY daughtercard featuring:
  - Cyclone II EP2C35 FPGA and 10/100 Ethernet PHY/MAC
  - 1-Mbyte SSRAM, 16-Mbyte DDR SDRAM, 16-Mbyte flash, JTAG connectors for FPGA and CPLD, Mictor trace/debug connector, 32-bit PMC headers
- No license or royalty fees when developing with the Nios II processor in Altera FPGAs and HardCopy® series structured ASICs

For Single Print Use

For more information, contact: nios_info@altera.com

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408-544-7000
www.altera.com

Nios II Development Kit, Stratix II Edition

Altera® 90-nm Stratix® II devices are the industry's biggest and fastest FPGAs with an innovative logic structure packing more functionality into less area to dramatically reduce device costs. With internal clock frequency rates up to 500 MHz and typical performance > 250 MHz, these devices deliver on average 50 percent faster performance and more than 2x the logic capacity than first-generation Stratix FPGAs. Stratix II FPGAs deliver 50x higher multiplier bandwidth than single-chip, standalone digital signal processors. The DSP blocks have the flexibility and performance to implement fast, arithmetic-intensive applications such as image processing, wireless communications, military, broadcast, and medical. Each DSP block has dedicated multiwidth multipliers to implement DSP algorithms and functions, including filtering, video and image processing, correlation, transforms, encryption, and error correction.

The Nios® II Development Kit, Stratix II Edition, offers intellectual property (IP) cores to speed development, including three Nios II 32-bit RISC processors. The Nios II processors – fast, standard, and economy – are each optimized for a specific price and performance range, allowing designers to choose a system configuration that is an exact fit for their embedded needs. You can upgrade system performance at any stage of the product life cycle without having to redesign the board or develop hand-optimized software. All three processors use the same instruction set architecture and are 100 percent binary code compatible. Nios II processors can be added to a designer's system using the SOPC Builder system development tool in the Quartus® II development software. The Nios II C-to-Hardware Acceleration (C2H) Compiler boosts performance of time-critical C subroutines, converting them to powerful hardware accelerators with a simple "right-click to accelerate" interface. This kit includes 12 months of upgrades so you can keep your system up-to-date with the latest enhancements to the Nios II processor, peripherals, and system design tools. This development kit is now RoHS-compliant.

See www.altera.com/nios for more information.

FEATURES:

- Complete embedded development environment featuring the Nios II embedded processor and high-density, high-performance Stratix II FPGAs
- Embedded software development tools included:
  - Nios II integrated development environment (IDE) and debugger, and the Nios II instruction set simulator (ISS)
  - GNU tool chain, MicroC/OS-II real-time operating system, and NicheStack TCP/IP network stack
- Hardware design tools, including the Quartus II design software with the SOPC Builder system development tool
- Library of standard embedded IP cores and suite of pre-built hardware and software reference designs, including:
  - Three Nios II 32-bit RISC CPU cores (fast, standard, economy)
  - DDR, SRAM, timer, UART, SPI, JTAG UART, GPIO, DMA, 10/100/1000 Ethernet, interface-to-user logic, custom instruction, and more
- Complete embedded development board with Triple-Speed Ethernet PHY daughtercard featuring:
  - Stratix II EP2S60 FPGA and 10/100 Ethernet PHY/MAC
  - 1-Mbyte SSRAM, 16-Mbyte DDR SDRAM, 16-Mbyte flash, JTAG connectors for FPGA and CPLD, Mictor trace/debug connector, 32-bit PMC headers
- No license or royalty fees when developing with the Nios II processor in Altera FPGAs and HardCopy® series structured ASICs

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For more information, contact: nios_info@altera.com

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Annapolis Micro Systems
190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

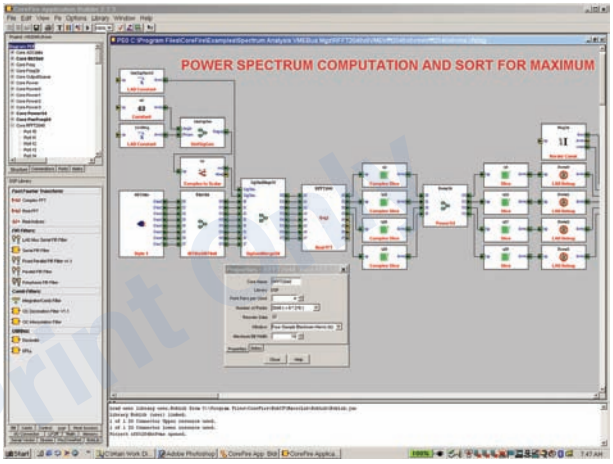
CoreFire FPGA Tool

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 II 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.



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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

For more information, contact: wfinfo@annapmicro.com

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190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Dual 2.3 GSps DAC

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.

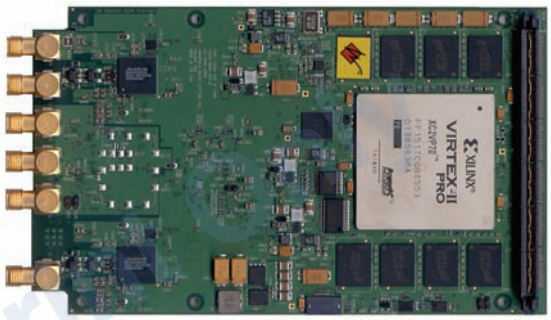
The Annapolis Dual 2.3 GSps DAC I/O card provides two 12-bit output streams at up to 2.3 GSps per stream.

The board has both a high-precision trigger for inner-board or board-to-board synchronization and a low-precision trigger. The card supports three modes: NRZ, RF, and RZ.

The Xilinx Virtex-II Pro 70 on the board provides user-configurable, real-time continuous sustained processing of the full data stream. Up to two of these I/O cards can reside on the Annapolis WILDSTAR II or WILDSTAR II Pro FPGA-based VME and PCI bus boards, which provide up to 30 million user-reprogrammable FPGA gates for onboard processing. 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 interfaces to SRAM, LAD bus, I/O bus, and DACs. CoreFire users will have the usual CoreFire board support package.

Develop applications with CoreFire (more than 1,000 cores), 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. 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.

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



FEATURES:

- Choice of up to 2.3 GSps or 1.5 GSps output per channel
- Two individually configurable output streams of 12-bit data
- High output power and exceptional gain
- Flatness in multiple Nyquist zones
- One Xilinx Virtex-II Pro 70-5, -6, or -7
- Up to 2 GB DDR SDRAM in four banks
- Supports three modes: NRZ, RF, and RZ
- Both high-precision and low-precision triggers
- JTAG and serial port access
- Proactive thermal management system
- Available in both commercial and industrial temperature grades
- Includes one-year hardware warranty, software updates, and customer support

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For more information, contact: wfinfo@annapmicro.com

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Annapolis Micro Systems
190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Four Channel Clock Synchronization Board

The Four Channel Clock Distribution 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 singled ended bulkhead mounted control signal triggers.

A jumper set at board installation time or via optional P2 Serial Port determines which one of the 2 installed clock sources is active. Manufacturing options for Clock Source 0 are Single Ended or Differential External Clock, a PLL ranging from 700 MHz – 3 GHz with an On-Board Reference Oscillator, or a PLL ranging from 700 MHz – 3 GHz with a 10 MHz External Reference. Manufacturing options for Clock Source 1 are a PLL ranging from 700 MHz – 3 GHz with an On-Board Reference Oscillator, a PLL ranging from 700 MHz – 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:

- 4 Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- Ultra-low Clock Jitter and Phase Noise – 275fs with 1280 MHz PLL and external 10 MHz Reference
- On-board PLL's Manufacturing Options provide Fixed Frequencies of 700 MHz – 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 3.3V PECL, 2.5V PECL, or 1.65V 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, 3.3V PECL, 2.5V PECL, and 1.65V PECL
- Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. Wildstar™ 2 PRO I/O Cards and Wildstar™ 4/5 Mezzanine Cards

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For more information, contact: wfinfo@annapmicro.com

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Annapolis Micro Systems
190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
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www.annapmicro.com

Quad 16 Bit 160 MHz A/D

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

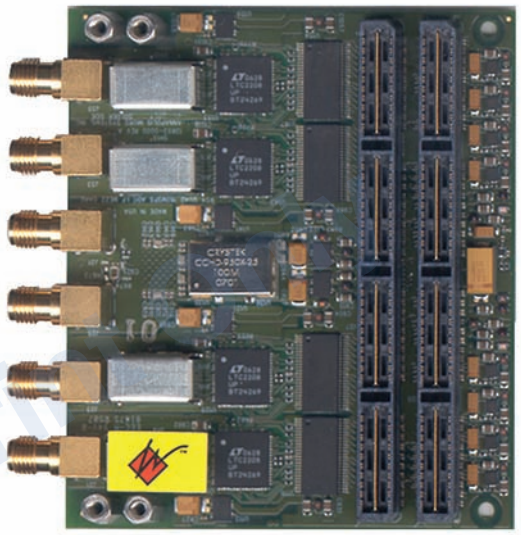
The Annapolis Quad 130/160 MHz A/D I/O card provides four channels of 130 or 160 MHz input with 16-bit resolution. The board has four LTC2208 (130 MHz) or four LTC2209 (160 MHz), each fed by its own analog input signal. There is a universal single ended 50 ohm clock input. Multiple I/O cards can by synched together via the Annapolis 4 or 8 Channel Clock Distribution Boards.

In concert with the WILDSTAR 4 for PCI-X, VME64X or VXS board, which provides Xilinx Virtex 4 FPGAs, this I/O mezzanine board supplies user-configurable, real-time continuous sustained processing of the full data stream.

Our boards run on many different operating systems. We support our board products with a standarized set of drivers, APIs and VHDL simulation models. VHDL source is provided for hardware interfaces such as SRAM, LD bus, I/O bus, and A/Ds. 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 is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customers' applications succeed. We offer training and exceptional special application development support, as well as more conventional support.



FEATURES:

- Four LTC2208 (130 MHz) or Four LTC2209 (160 MHz) 16 Bit Analog to Digital Converters
- Six SMA Front Panel Connectors – Four Analog Inputs, High Precision Trigger Input, Universal Single Ended 50 ohm Clock
- Main Board PCLK Sourcing Capability
- Typical 12.5 Effective Number of Bits
- Ultra-Low Skew and Jitter Clock Distribution
- Excellent SFDR Performance – SFDR > 95dBc, @Fs=130 MHz and Fin=30 MHz
- 700 MHz Input Bandwidth per Channel
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for board level interfaces
- 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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For more information, contact: wfinfo@annapmicro.com

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190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

WILDSTAR 4 for PCI

Annapolis Micro Systems 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 10th-generation WILDSTAR 4 for PCI-X uses Xilinx's newest Virtex-4 FPGAs for state-of-the-art performance. It accepts one I/O card in one, or up to two I/O cards in two, PCI-X slots, including single 1.5 GHz 8-bit ADC, quad 250 MHz 12-bit ADC, dual 2.3/1.5 GSps 12-bit DAC, Universal 3 Gbit serial I/O (Rocket I/O, 10 GbE, InfiniBand), and Tri XFP (10 GbE, 10G FC). Our boards work on a number of operating systems, including Windows, Linux, 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.

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 4 for PCI-X, 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.

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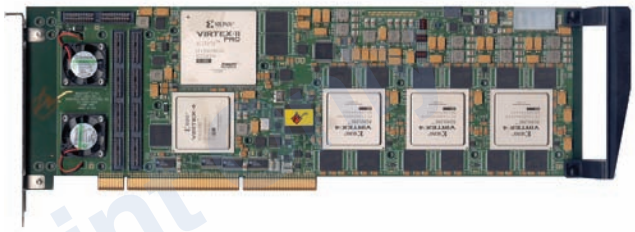

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FEATURES:

- Four Virtex-4 FPGA processing elements – One XC2VP70, XC2VP100, XC4VFX100, or XC4VFX140, and three XC4VSX55 or XC4VLX40 – 100
- Up to 3.5 GB DDR2 DRAM in 14 Banks or up to 96 MB DDRII or QDRII SRAM
- PCI or PCI-X bus – 133 MHz
- High-speed DMA multichannel PCI controller
- Programmable flash for each FPGA to store FPGA images and for PCI controller
- Auxiliary connector for additional power/Integrated heatsink for cooling and stiffness
- 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
- Save time, effort, 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

For more information, contact: wfinfo@annapmicro.com

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190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
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WILDSTAR II Pro VME

Annapolis Micro Systems 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 ninth-generation WILDSTAR II Pro for VME uses Xilinx's newest Virtex-II Pro FPGAs for state-of-the-art performance. It accepts up to two I/O cards in one VME slot, including Dual 1.5 GHz A/D, Dual 1.5 GSps D/A, Quad 105 MHz, Universal 3 Gb (Rocket I/O, 10 GbE, InfiniBand), Quad FC2, Quad GbE, and LVDS. Our boards work on a number of operating systems, including Win NT, 2000, XT, 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. 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 II Pro for VME, 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.

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

For Sample Print

FEATURES:

- One to three Virtex-II Pro Xilinx FPGA processing elements – XC2VP70 or XC2VP100
- Up to 144 MB DDRII or QDRII SRAM
- Up to 768 MB DDR SDRAM
- Programmable flash for each processing element to store FPGA images
- Works with VME64x backplane
- High-speed multichannel DMA controller
- Host software: Win NT, 2000, XP, Linux, VxWorks
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- 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

For more information, contact: wfinfo@annapmicro.com

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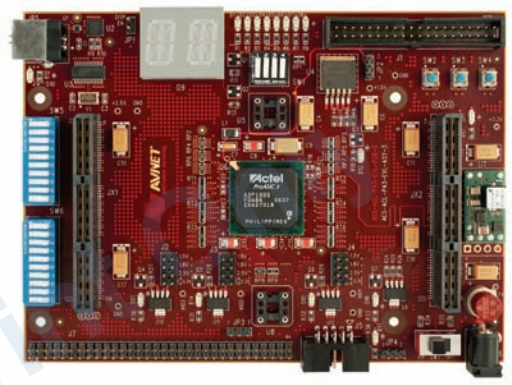
Avnet Memec
2211 South 47th Street • Phoenix, AZ 85034
800-408-8353
www.em.avnet.com/memec

Design/IP Support

Avnet Memec helps specify, develop, and design FPGAs by serving as an extension of your design team. Avnet Memec provides the additional resources and knowledge base during the critical implementation phase, so you can meet aggressive time-to-market milestones. Avnet Memec offers a wide set of intellectual property (IP) cores to assist your design.

Avnet Memec has locations across North America and features FPGAs from Actel. Avnet Memec's factory trained and certified field applications engineers are readily available to support all of your design requirements.



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FEATURES:

- Core Integration: Avnet Memec has developed high-level building blocks that can be easily adapted to new designs
- Design Optimization: Avnet Memec can optimize existing designs, improving performance, density, power consumption, and reliability
- Technology Migration: Avnet Memec can take older technology designs and target to newer devices, saving money and improving availability
- Complete System Design: Avnet Memec can do complete system designs, adding support and interface devices to implement an entire application
- C Code Conversion: Utilizing Celoxica's DK1 Design Suite, Avnet Memec can convert C code to an EDIF netlist or RTL VHDL

Innovative Integration
2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

P25M 64-bit PCI

P25M is a powerful and flexible DSP + FPGA for signal processing and real-time control in PCI systems. The P25M PCI card features a 300MHz floating point DSP and 1M gate FPGA with 4 channels of 25MSPS, 16-bit A/D and 4 channels of 50MSPS, 16-bit D/A. Supporting this open-architecture hardware platform, the Pismo software tool set provides target and host libraries, practical utilities and numerous example programs that illustrate the use of all board peripherals.

The FrameWork Logic development tools provide comprehensive support for adding signal processing to the FPGA. The full-featured logic and DSP programming tools greatly accelerate all facets of the system development.

FEATURES:

- 300MHz TMS320C6713 DSP PCI 64-bit/66MHz Xilinx 1M gate Spartan3 FPGA >85db SFDR analog I/O
- 4 A/D, 16-bit, 25MSPS & 4 D/A, 16-bit, 50MSPS 65 bits digital I/O Precision, low jitter sample clock
- Extensive software support in source form. Custom logic development supported for FPGA
- DSP/BIOS peripheral drivers
- Excellent choice for PCI based real-time control, Industrial high-speed controls
- Perfect for Stimulus Response Measurements!

For more information, contact: sales@innovative-dsp.com

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FPGAs, reconfigurable processors

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LynuxWorks, Inc.
855 Embedded Way • San Jose, CA 95138
800-255-5969
www.lynuxworks.com

BlueCat Linux

BlueCat Linux for Xilinx Virtex-4 and BlueCat-ME Linux for Xilinx MicroBlaze. BlueCat Linux based on the 2.6 kernel is an implementation of the Linux model enhanced for use in embedded systems ranging from small consumer-type devices to large-scale, multi-CPU systems.

FEATURES:

- Linux support for MicroBlaze – BlueCat-ME is a port of the 2.6 kernel to the Xilinx MicroBlaze processor
- Gives the same flexibility and cost benefit of open-source Linux without requiring an MMU
- A seamless integration with the Xilinx EDK and out of the box support for Xilinx Spartan and ML401 boards
- Linux support for FPGA based PowerPC cores – supporting the Virtex-4 from Xilinx

For more information, contact: inside@lnxw.com

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Octagon Systems

7403 Church Ranch Blvd. • Westminster, CO 80021
303-430-1500
www.octagonsystems.com/products/xmb-1.aspx

NEW XMB SERVER

HIGH RELIABILITY XMB MOBILE SERVER

The XMB is part of Octagon's line of IND-CORE™ systems that offer out-of-the-box solutions for military, security and transportation applications. The XMB is a "no-compromise" design that optimizes the electrical, thermal, and mechanical components for maximum reliability. The result is a powerful, yet fanless system in a rugged extrusion. The basic unit includes the processing power, power supply, memory, and I/O for most applications. Yet, it can be easily expanded using PC/104 I/O function blocks or Octagon's XBLOK™ half-size PC/104 expansion modules. Applications include planes, trains, buses, military, homeland security, police, communications, and SCADA markets.

FEATURES:

- Fanless system in a rugged extrusion
- Shock and vibration mounting options
- -40 °C to +75 °C operating temperature
- Removable option panel allows for custom connectors, annunciators, and controls
- Linux and Windows® XPe accepted; size is 6" (W) x 4.2" (H) x 10.8" (D)
- Tell us about your application; call Ray Agnew in Sales at 303-430-1500

For more information, contact: sales@octagonsystems.com

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FPGAs, reconfigurable processors

VMETRO Inc.

1880 South Dairy Ashford, Suite 400 • Houston, TX 77077
281-584-0728
www.vmetro.com/fpga/pmc-fpga05

PMC-FPGA05 Module

The PMC-FPGA05 is a Xilinx Virtex-5 XC5VLX110 platform FPGA-based PMC module with high-speed digital I/O and PCI-X interface to the host computer. Three banks of 4Mb x 18 (4MB) QDR II SRAM support DSP functions in the Virtex-5. Two independent banks of 1024Mb x 16 (128MB) DDR2 SDRAM are directly connected to the FPGA. There are 138 signals routed to a 180-way connector near the front panel. These lines are routed so that they may be used as single-ended signals or differential pairs. I/O modules available include ADC, DAC, LVDS, FPDP II, CameraLink and RS-422.

Example VHDL code blocks are provided to show how the PMC-FPGA05 resources can be used, along with utilities for configuring flash. The PMC-FPGA05 is supported under Windows XP, VxWorks and Linux.

FEATURES:

- Xilinx Virtex-5 LX110 FPGA
- Multiple banks of SRAM for DSP
- Multiple banks of SDRAM for large buffers
- Customizable digital I/O
- I/O module options including 105MSPS ADC, 210MSPS DAC, CameraLink, L-band Receiver, RS-422/485, LVDS, FPDPII
- Windows XP, VxWorks or Linux support

For more information, contact: info@vmetro.com

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Xilinx
2100 Logic Drive • San Jose, CA 95124
408-559-7778
www.xilinx.com/processor

FPGA Processing

Xilinx delivers an innovative and flexible range of processing solutions for your unique embedded application requirements.

- High performance PowerPC® 32-bit hard processors
- Flexible MicroBlaze™ 32-bit and PicoBlaze™ 8-bit soft processors
- Small footprint PicoBlaze 8-bit soft processors
- Award winning Platform Studio Embedded Design Tool Suite
- Broad range of Intellectual Property (IP) and processing peripherals
- HW/SW embedded development kits with reference examples
- Robust third party ecosystem support

Our processing capabilities provide performance and customization across a wide range of end markets. To learn more about Xilinx embedded processing solutions, please visit: www.xilinx.com/processor.

FEATURES:

- PowerPC hard processing cores optimized for performance
- MicroBlaze soft processing cores optimized for customization
- Embedded Development Kit (EDK) and the Platform Studio tool suite
- Robust library of Processing IP Cores
- Development Kits and Boards with preverified example designs ramp development
- Extensive Embedded Partner Program for RTOS and Tool Support

For more information, contact: jay.gould@xilinx.com

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408-559-7778
www.xilinx.com/dsp

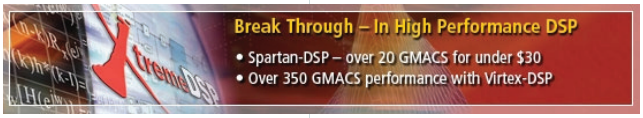
Xilinx XtremeDSP

The Xilinx XtremeDSP™ initiative helps you develop tailored high performance DSP solutions for aerospace and defense, digital communications, multimedia, video, and imaging industries.

- High-performance configurable FPGAs for DSP designs
- Development boards and Intellectual Property (IP)
- System Generator and AccelDSP design and development tools
- Complementary programmable logic and embedded processing functions
- Strategic industry and university partnerships for training and support

The XtremeDSP platform portfolio is comprised of two price/performance/power optimized families – Virtex-DSP and Spartan-DSP.

To learn more about our XtremeDSP offerings, please visit: www.xilinx.com/dsp



FEATURES:

- Virtex-DSP FPGAs with high performance DSP MAC blocks
- Spartan-DSP FPGAs with DSP MAC blocks optimized for volume/cost
- DSP design tools System Generator and AccelDSP steamline development
- Development Kits and Boards accelerate design with pre-verified examples
- DSP specific IP Cores and Blocks available

For more information, contact: jay.gould@xilinx.com

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Advantech Corporation
38 Tesla, Suite 100 • Irvine, CA 92618
800-866-6008
www.advantech.com

Trusted ePlatform Services

ADVANTECH

10.4" Vehicle Mounted PC

TREK-775 is a vehicle mounted platform with a 10.4" TFT LCD designed to withstand the harshest environments. TREK-775 has a rich variety of optional wireless and wide area network modules for real-time communication and data capture in warehouses, freezers, docks or container yards. The rugged die-cast aluminum enclosure replaces the fan as it helps dissipate heat. Specially designed to comply with IP65 standards, TREK-775 is resistant to dust and water. Exposed I/O ports are placed on the bottom of the unit to protect connectivity from vertically falling water. With temperature tolerance components and a heater for low temperature operation, TREK-775 can even operate in freezing environments.

FEATURES:

- Onboard Intel® ULV Celeron® M 600 MHz or Pentium® LV M 1.1 GHz CPU
- Rugged aluminum enclosure with IP65 dustproof and waterproof seals and fanless design
- VESA standard for flexible mounting kits
- Compatible with Windows® 2000/XP
- Flexible expansion capability for IEEE 802.11b/g, GPS, GSM/GPRS
- Optional sunlight readable capability

For more information, contact: ECGinfo@advantech.com

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www.advantech.com

High-performance computing, clusters, packaging

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ADVANTECH

17" Slim Medical PC

POC-S175 is a medical multimedia panel computer that is UL60601-1/EN60601-1 approved. The low audible noise of the POC-S175 makes it an ideal point-of-care solution for patients and hospital practitioners. POC-S175 is specially designed to resist spills and water damage, and ensures dust resistance with its protected LCD, sealed ports and card slots. The 500:1 contrast ratio of POC-S175 makes it a perfect image terminal for PACS and DICOM applications.

FEATURES:

- 17" LCD display
- Low audible noise
- Spill and dust resistant (IPX1)
- UL60601-1/EN60601-1, CE and FCC Class B certified
- 802.11b/g WLAN module and touchscreen (optional)
- 4100 mAh Li-battery pack (optional)

For more information, contact: ECGinfo@advantech.com

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Advantech Corporation
38 Tesla, Suite 100 • Irvine, CA 92618
800-866-6008
www.advantech.com

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ADVANTECH

19" Medical PC

POC-195 is a medical-grade multimedia panel computer that is UL60601-1/EN60601-1 approved. The low current-leakage power supply of POC-195 makes it an ideal and safe point-of-care solution for patients and hospital practitioners. POC-195 is specially designed to resist spills and water damage, and ensures dust resistance with its protected LCD, sealed ports and card slots. The high contrast ratio (1300:1) of POC-195 makes it a perfect image terminal for PACS and DICOM applications. POC-195 is user-friendly, with a book light, touchscreen on/off button and optional features like an alarm light and trim knob.

FEATURES:

- Point-of-care terminal for eHealthcare/medical applications
- 19" LCD display
- Spill and dust resistant (IPX1)
- UL60601-1/EN60601-1, CE and FCC Class B certified
- 802.11b/g WLAN module and touchscreen (optional)
- Alarm light and trim knob (optional)

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For more information, contact: ECGinfo@advantech.com

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ADVANTECH

GX1 Fanless Box PC

ARK-1350 is an ultra-compact, fanless, fully-sealed and robust embedded box computer, designed for space critical applications that require low power consumption. All electronics are protected in a ruggedized, sealed enclosure. No external cooling is needed. It features one LAN, two USB, and four Serial communication ports, as well as PC Card interfaces that bring comprehensive control and communication capability to fulfill diverse application requirements. ARK-1350 is an ideal solution for stand-alone and embedded gateway applications.

FEATURES:

- Built-in GX1-300 MHz CPU with 128 MB SDRAM
- Four serial ports and dual USB ports
- One PC card slot supports PCMCIA and CardBus card
- Comprehensive communication and connectivity capacity
- Ultra-compact size, robust construction with fanless operation
- Windows® CE. NET ready solution

For more information, contact: ECGinfo@advantech.com

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Advantech Corporation
38 Tesla, Suite 100 • Irvine, CA 92618
800-866-6008
www.advantech.com

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ADVANTECH

Rugged Handheld Terminal

Designed as a compact handheld mobile terminal, MARS-1030 is equipped with Intel® XScale® PXA255 400 MHz processor and Windows® Embedded CE 4.2 operating system for the highest performance and trusted reliability in retail, warehousing, logistics and ordering service applications. The optional 1-D/2-D barcode scanner allows users to collect information efficiently and communicates with back-end host data servers seamlessly through 802.11b and Bluetooth. Wireless connectivity with peripheral devices such as portable printers or other devices is supported. To cope with harsh environments, MARS-1030 is rated as IP54 water and dust resistant. It is also designed for ruggedness and can withstand a 1.5 meter (5 ft.) drop onto concrete.

FEATURES:

- Intel® XScale® Bulverde processor (PXA255 400 MHz)
- Windows® Embedded CE 4.2 OS pre-installed
- Equipped with 1-D/2-D barcode scanner
- Optional WLAN 802.11b and Bluetooth function
- Long battery life capability for up to eight hours of operation
- Slim, palm-sized and lightweight

For more information, contact: ECGinfo@advantech.com

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38 Tesla, Suite 100 • Irvine, CA 92618
800-866-6008
www.advantech.com

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ADVANTECH

ULV Fanless Box PC

The ARK-3389 fanless embedded box computer is the ideal application-ready system platform. All electronics are protected and sealed inside a robust, compact housing ideal for either embedding or installation as a stand-alone unit. ARK-3389 is intended to save space while meeting the demands of harsh environmental conditions.

FEATURES:

- Built-in Ultra Low Voltage Intel® Celeron® or Low Voltage Intel® Pentium® M processor
- Sealed construction with fanless operation
- Anti-vibration to ensure maximum reliability under harsh conditions
- Easy integration, easy maintenance, minimal parts, and wide input voltage range
- Maximum mounting height of 69 mm, making it ideal for space critical installation conditions
- Long product life cycle support

For more information, contact: ECGinfo@advantech.com

RSC# 33507 @ www.embedded-computing.com/rsc

Eurotech S.p.a.
Via Fratelli Solari 3/a • Amaro (Udine), 33020 Italy
39-0433-485-411
www.eurotech.it

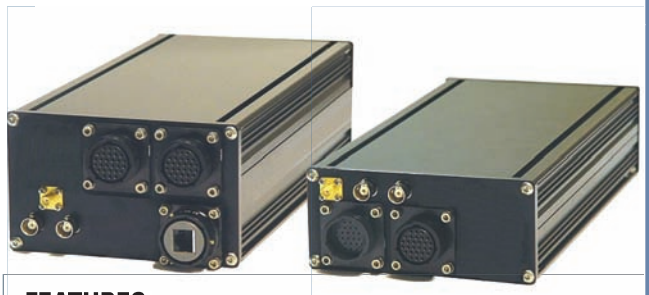
AVL-Light

The AVL-Light is a Eurotech low power system designed to be a complete solution for enhanced communications and real-time vehicle tracking (fleet management). It can be used in harsh environmental conditions where the use of rugged devices is essential.

The AVL-Light system is compliant with the EN50155 and ECE standards; it can withstand shocks, vibrations, and high humidity, maintaining high reliability and precision. It is resistant to extended temperature ranges, -25°C/+55°C (+70°C for 10 minutes), without using any active cooling systems.

The rear panel of the system is provided with 3 SMA antenna connectors, the 12 channel GPS for localization, Wi-Fi (802.11b, g) and Tri-band GSM/GPRS (EGSM900/GSM1800/GSM1900) for enhanced communications.

EuroTech
A MEMBER OF EUROTECH GROUP



FEATURES:

- Wireless features for high precision vehicle localization and enhanced communications
- Compliant with the EN50155 and ECE standards
- Temperature range: -25°C/+55°C, +70°C for 10 minutes (EN50155 class T1)
- Fanless cooling system
- Rugged chassis design
- Protection IP54 (can be extended to IP65)

For more information, contact: sales@eurotech.it

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High-performance computing, clusters, packaging

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LV Power
Salit Industrial Area, 2 Power Road
D.N. Sharon Tichon, 45885 Israel
972-9-7494495
www.lvpower.com

Power Supplies

LV Power specializes in developing and manufacturing advanced power conversion topologies. Our specific focus is on the needs of the compact PCI, Server, and Storage markets. The company manufactures standard and custom DC input CPCI supplies from 200-350W. LV Power is an approved supplier to Fortune 500 companies in the USA and its CPCI supplies are field deployed by the tens of thousands in telecom installations throughout the USA. We produce the world's highest density, highest efficiency CPCI supplies, specifically designed to allow maximum free airflow through the chassis. LV Power is one of the first companies to completely implement the entire PICMG 2.11 IPMI specification in the power supply which controls and monitors the supply via an I^2C bus.

LV POWER

FEATURES:

- PICMG Spec 2.11 compatible
- Universal DC telecom input 36-72VDC
- 5V@30A 3.3V@40 12V@5A -12V@1A
- Highest power density in the industry 350W @ 300LFM @ 50°C
- Efficiency =/ > 85% @ 48VDC
- 3U X 1 slot or 3U X 2 slot front panel
- Intelligent Platform Management Interface (IPMI) option
- Certified: UL, CUL, CE, CB, FCC Part 15 Class B, EN300 386 RoHS 5

For more information, contact: Sales@lvpower.com

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Moxa Technologies, Inc.
3001 Enterprise Street, Suite 210 • Brea, CA 92821
714-528-6777
www.moxa.com

ThinkCore IA240

NEW! ThinkCore IA241/IA240 embedded computers for industrial automation feature 4 RS-232/422/485 serial ports, dual Ethernet ports, 4 digital input channels, 4 digital output channels, a PCMCIA cardbus, and SD socket in a compact, IP30 protected, industrial-strength rugged chassis. The DIN-Rail vertical form factor makes the IA241/240 a cost-effective solution for installation in small cabinets. This space-saving solution also facilitates easy wiring, and is the best choice of front-end embedded controllers for industrial applications.

In addition to the standard model, the ThinkCore IA241/IA240 also comes in wide temperature models. The IA241-T and IA240-T have an operating temperature range of -40 °C to +75 °C, making them appropriate for harsh industrial automation environments. The industrial mechanism of the ThinkCore IA241/IA240 design provides robust, reliable computing. Due to the RISC-based architecture, the ThinkCore IA241/IA240 will not generate too much heat while being used. The high communication performance and fanless design make the IA241/IA240 ideal for industrial automation environments.

The highly reliable ThinkCore IA241/IA240 comes with Moxa's solid 5-year warranty, which is 2.5 times longer than the more common 2-year warranty for industrial PCs.

Applications:

- Manufacturing Automation
- Power/Electricity Management System
- Intelligent Transportation System
- POS/ATM/Kiosk
- Environmental Monitoring System
- Medical System

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FEATURES:

- Reliable and industrial-grade design meets IP30 requirements
- Patented Software Encryption Lock protects intellectual property
- -40 °C to +75 °C wide temperature models available
- 4 software-selectable RS-232/422/485 serial ports
- 4 digital input channels and 4 digital output channels
- Dual 10/100 Mbps Ethernet for redundant networking
- PCMCIA, wireless LAN expansion (supports 802.11b/g)
- SD socket for storage expansion
- Ready-to-run Linux communication platform
- DIN-Rail installation to save cabinet space; wall-mount installation is also possible
- Linux 2.6.9 Support; Supports Linux Tool Chain: Gcc, Glibc, GDB
- Windows Tool Chain: Gcc, Glibc, Insight

For more information, contact: usa@moxa.com

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Moxa Technologies, Inc.
3001 Enterprise Street, Suite 210 • Brea, CA 92821
714-528-6777
www.moxa.com

MOXA®

ThinkCore W341

The ThinkCore W341 embedded computer features 4 software-selectable RS-232/422/485 serial ports, 802.11a/b/g for WLAN communication, 1 Ethernet port, 2 USB 2.0 hosts, 1 relay output, and an SD socket for external storage expansion. The MOXA ART 32-bit ARM9 processor and the built-in Linux OS provide a powerful and reliable platform for any harsh, industrial environment, promising an ideal solution for industrial M2M applications such as data acquisition, protocol conversion, and remote device control and monitoring.

Hardware Specifications - System:
CPU: MOXA ART ARM9 32-bit 192 MHz
Memory: DRAM 64 MB, Flash 16 MB
Storage Expansion: SD socket x 1
USB: USB 2.0 Host x 2
Console Port: RS-232 x 1 (TxD, RxD, GND)
Button: Reset button x 1
Other: RTC, buzzer, Watchdog Timer
OS: Embedded Linux with MMU support

Environmental Specifications:
Operating Temperature: -10 to 60°C (14 to 140°F), 5 to 95% RH
Storage Temperature: -20 to 80°C (-4 to 176°F), 5 to 95% RH
Anti-Shock: 50G @ IEC-68-2-27, half sine wave, 30 ms
Anti-Vibration: 5G @ IEC-68-2-6, sine wave, 5-500 Hz, 1 Oct./min, 1 hr/axis

Regulatory Approvals:
EMC: FCC Part 15, CISPR 22 Class A
CE Class A: EN55022 Class A, EN61000-3-2 Class A, EN61000-3-3, EN55024
Safety: TÜV: IEC/EN60950
UL/cUL: UL60950, CAN/CSA-C22.2 No. 60950-00
Other: RoHS, CRoHS, WEEE
Warranty: 5 years

FEATURES:

- MOXA ART ARM9 32-bit 192 MHz processor
- On-board 64 MB RAM, 16 MB flash disk
- 802.11a/b/g wireless LAN
- WEP, WPA, and WPA2 encryption
- Robust, fanless design
- WLAN Repeater function supported
- 4 software-selectable RS-232/422/485 serial ports
- Ready-to-run Linux 2.6 platform
- Relay Output for external alarm connection
- DIN-rail or wall-mount installation
- SD socket for storage expansion supported

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For more information, contact: usa@moxa.com

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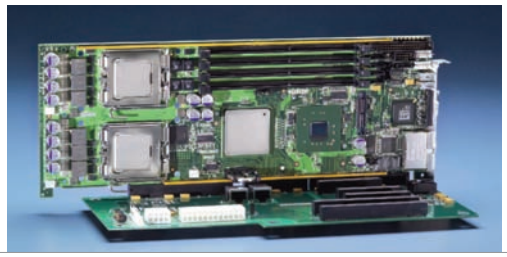
Trenton Technology

2350 Centennial Drive • Gainesville, GA 30504
770-287-3100
www.TrentonTechnology.com

MCX/MCG Series

Trenton's MCX/MCG series of PICMG® 1.3 or SHB Express™ System Host Boards (SHBs) offers a wide variety of board configurations designed to excel in your most demanding and diverse server-class and graphics-class computing applications. Dual-Core processor options provide two and Quad-Core processors provide four execution cores per CPU. For dual-processor board configurations, each CPU has its own independent system bus to reduce data bottlenecks while maximizing processing throughput. The four-channel memory interface features DDR2-667 FB-DIMMS with a maximum of 16 GB. An extended memory SHB configuration is available that supports up to 32 GB of system memory.



FEATURES:

- One circuit board plus two quad-core processors deliver eight execution cores of outstanding performance
- Single circuit board SHB design featuring dual- or quad-core Intel® Xeon® processors with independent FSBs
- Quad channel DDR2-667 Memory Interface supports up to 32 GB of system memory
- Supports 32-bit/64-bit applications and x16, x8, x4, and x1 PCI Express links to a PICMG® 1.3 backplane
- Six Serial ATA/300 Interfaces with RAID 0, 1, 5, and 10 support and seven USB 2.0 interfaces
- Supports three Gigabit Ethernet interfaces: two to the board's I/O bracket and one down to the backplane

For more information, contact: jrenehan@TrentonTechnology.com

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AdaCore

104 Fifth Avenue, 15th Floor • New York, NY 10011
212-620-7300
www.adacore.com

High Integrity

AdaCore's GNAT Pro is the leading Ada development environment on the market today and is available for more platforms than any other Ada environment.

Along with general development environments, AdaCore offers specialized environments to meet stringent safety and security application development. The GNAT Pro High-Integrity Edition for DO-178B is a complete development environment with full DO-178B Level A certification materials. It has passed formal certification as a part of multiple avionics flight critical systems. It is the ideal solution for any safety-critical development effort for avionics, high speed rail, nuclear shutdown, medical, and other industries where top levels of safety must be assured.

FEATURES:

- GNAT Pro High Integrity Edition for DO-178B
- When lives depend on safe and secure software
- Certified to DO-178B Level A multiple times
- Independent safety certification
- Configurable runtime library
- Supports Ada83, Ada95, and now Ada2005

For more information, contact: sales@adacore.com

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For Sample Purposes Only

First Silicon Solutions
1260 N.W. Waterhouse Avenue #100
Beaverton, OR 97006-5794
503-597-5091 x103
www.fs2.com

Navigator IDE for MIPS

Eclipse-based Navigator debugger IDE for MIPS Technologies MIPS32® and MIPS64® Cores.

The FS2 Navigator™ IDE (Integrated Development Environment) supports all MIPS32® and MIPS64® processor cores (including 4K™, 5K™, 24K™, 34K™, and 74K™) and is fully integrated with the MIPS® GNU-based SDE toolkit, providing a complete development environment and a rich set of software utilities that are easy to install and use. The Eclipse environment has rapidly become the embedded industry standard for IDEs with software tools and plug-ins from many vendors integrating sophisticated editing, compiling, debugging, and program management tools. FS2 has leveraged this power and extensibility as a control environment and user interface for the System Navigator debug probes.

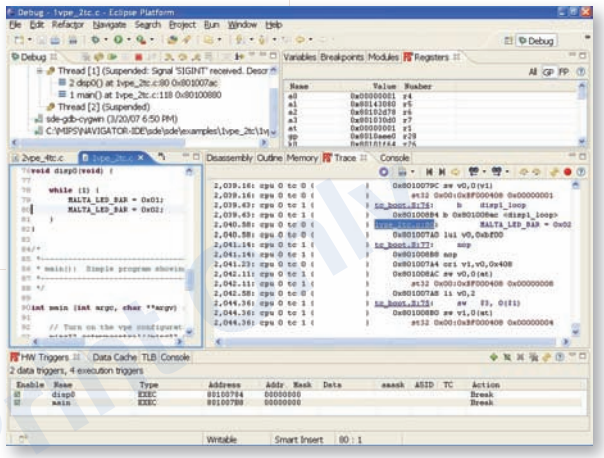
FS2 Navigator IDE completely automates the installation process for the MIPS SDE toolkit. The Navigator IDE installs the necessary components of the GNU tools with all of the appropriate switches and options, installs the GNU compiler and utilities, and launches the Eclipse-based Navigator IDE ready to use with the System Navigator probe.

Navigator IDE runs on Windows 2000/XP or PC Linux, and flexible licensing options are available.

To download our Navigator IDE Datasheet go to: www.fs2.com/pdfs/NAV-IDE.pdf

To evaluate Navigator IDE FREE for 30 days go to: sl.fs2.com/licenserequest/navigatoreval.html

To order Navigator IDE please email: info@fs2.com



FEATURES:

- Includes industry standard Eclipse-based CDT and plug-ins
- Provides complete control center for debugging with FS2 probes
- Supports all MIPS32 and MIPS64 cores, including 4K™, 5K™, 24K™, 34K™, and 74K™
- Simplifies debugging applications with advanced MIPS features such as Multi-VPEs and TCs
- All on-chip and off-chip probe trace features are integrated with the IDE
- Multi-core debug supported with multiple MIPS cores on the EJTAG chain
- Mixed core debug with MIPS and other cores supported as an option
- Flexible licensing options
- Windows and Linux host support

For Sale Preview

For more information, contact: info@fs2.com

RSC# 33539 @ www.embedded-computing.com/rsc

LynuxWorks, Inc.
855 Embedded Way • San Jose, CA 95138
800-255-5969
www.lynuxworks.com

Luminosity IDE

Luminosity IDE is a Linux®, Windows, and Solaris™-based IDE powered by the latest Eclipse platform, giving developers complete control over creating, editing, compiling, managing, and debugging C/C++, Ada, and Java real-time applications. Luminosity delivers an array of features that provides embedded system developers a flexible yet powerful platform to accelerate product time to market.

FEATURES:

- Provides RTOS support for Linux and the LynxOS family of RTOS
- Based on the popular Eclipse platform – for ultimate flexibility and vendor options
- Faster time to market – delivers a complete open-source solution for quick, simplified development
- Supports multiple host-OS combinations – giving users a common IDE environment regardless of OS
- Provides a fast and easy way to create, edit, compile, manage, and debug C/C++ embedded and real-time applications
- Automated wizards – to help speed product development

For more information, contact: inside@lnxw.com

RSC# 19683 @ www.embedded-computing.com/rsc

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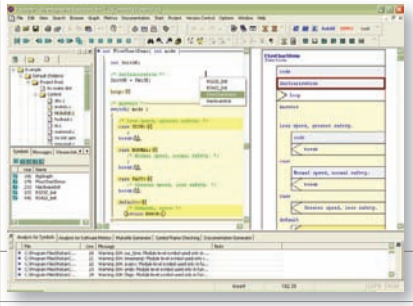
RistanCASE GmbH
Widenholzstrasse 1 • Wallisellen, 8304 Switzerland
+ 41 44 883 35 70
www.ristancase.com

DAC IDE

Development Assistant for C (DAC) is an integrated development environment (IDE) that supports the development and maintenance of embedded software written in the C and assembler languages.

It is clear that the development and maintenance of quality software is a very complex process that can be viewed from many angles. We have selected, thought out, and designed DAC features so that they represent support for the most important activities in this complex process.

DAC allows easy editing and control of source quality, as well as detailed review and documenting, saving your time and energy.



FEATURES:

- Editor keeps up with the latest trends in the world of editors
- Flow Chart is the graphical-logical presentation of the edited source
- Call-Hierarchy and Data Flow Graph provides an overview of the function-data relation in the program
- Type Hierarchy Graph enables you to distinguish relations in the often tangled web of data on project
- Software metrics in DAC are easy to use; allows a visual overview of metrics parameters
- Documentation generator synchronizes the development process with the software documentation process

For more information, contact: ristancase@ristancase.com

RSC# 33653 @ www.embedded-computing.com/rsc

Active Silicon Ltd.
17 Wilson Street, Suite 13 • Chelmsford, MA 01824
978-244-0490
www.activesilicon.com

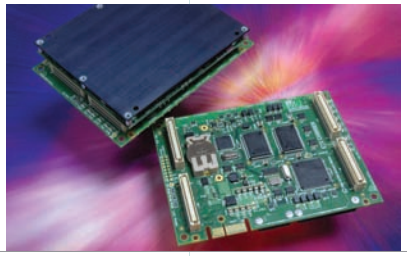
ETX-LFG

Active Silicon has broadened the market for rugged and embedded vision systems with the launch of a new product based on the ETX form factor from Kontron.

The ETX system comprises of a processing module (provided by Kontron) and a carrier card. One of the benefits is that as processor power increases and cost reduces, the plug on module can simply be replaced without affecting anything else in the system.

Targeted for volume embedded applications, the Active Silicon custom designed carrier card has two simultaneous (PAL/NTSC/CCIR/RS-170) video inputs, 10 serial ports, VGA/flat panel output, Ethernet ports, USB2, CompactFlash, 8 channel ADC and I/O lines. Other boards in the ETX range support PCI Express and offer high speed Camera Link and GigE interfaces.

Active Silicon
COMPUTER IMAGING PRODUCTS



FEATURES:

- 2 Simultaneous PAL/NTSC/CCIR/RS-170 video inputs
- 10 Serial ports
- VGA/flat panel output
- USB2
- 8 Channel ADC
- Software support for standard Windows XP, XPe and Linux

For more information, contact: info@activesilicon.com

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Innovative Integration
2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

PMC/XMC Modules

Speed, Fidelity, Flexibility
The VelociaPMC family integrates ultra-fast signal capture, generation and co-processing on an advanced PMC architecture. Each card combines new generation analog devices with large user-reconfigurable Virtex-II Pro FPGA, ample DDR memory and low jitter clocks/triggers on a 64/66 PCI with a private JN4 64-bit user I/O port and a XMC 4-lane Rocket I/O (per VITA 42) that connects straight to the FPGA of our Velocia CompactPCI boards or other carriers. This ultimate connectivity allows for rapid deployment of the most advanced systems in SDR, signal intelligence, RADAR, and radio test equipment.

Innovative Integration
... real time solutions!

FEATURES:

- SIO ModuleC6416 DSP, 1GHz – Two PowerPC, 600MHz – Xilinx Virtex II Pro – PCI (64/66)
- TX Module 4 D/A, 16-bit, 1GHz – two PowerPC, 600MHz – Xilinx Virtex II Pro – PCI (64/66)
- UWB Module2 A/D, 12-bit, 250MHz – two PowerPC, 600MHz – Xilinx Virtex II Pro – PCI (64/66)
- DR (Digital Rec.e) Module4 A/D, 14-bit, 125MHz – two PowerPC, 600MHz – Xilinx Virtex II Pro – PCI (64/66)
- CG Clock Generator PMC module
- Carrier Cards include: PMC to PCI, PMC to CompactPCI, PMC to PCI Express, XMC to PCI Express

For more information, contact: sales@innovative-dsp.com

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Annapolis Micro Systems
190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Tri XFP I/O Card

Annapolis Micro Systems, Inc. is a world leader in high-performance Commercial Off-the-Shelf 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.

The Annapolis Tri XFP I/O Card, which works with the WILDSTAR 4/5 Family Architecture, has three 10 Gb individually configured XFP connectors, each with its own XAUI to XFI converter. Industry-standard pluggable fiber optic transceivers can be purchased from Annapolis or from other vendors. The Tri XFP provides up to 30 Gb Full Duplex I/O directly between the outside world and the Rocket I/O pins on the Xilinx Virtex-II Pro or Virtex-4 I/O FPGA on the WILDSTAR 4 main board. No other vendor provides that volume of data straight into the heart of the processing elements and then back out again.

Two I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VXS or PCI-X/E board, with up to 30 million user reprogrammable gates.

The Tri XFP card will support 10 Gb Ethernet, 10 Gb Fibre Channel, and OC 192. Although the protocols will be provided as black box solutions with few modifications by users allowed, more adventurous users who choose to develop their own communications protocols from the basics already have access to all the board resources through VHDL source for the interfaces to SRAM, signal conditioners, LAD bus, I/O bus, and PPC flash. CoreFire users will have the usual CoreFire board support package.

The Tri XFP is the first of many I/O cards Annapolis will be releasing for its new WILDSTAR 4/5 Architecture Family, which uses Xilinx Virtex-4 and Virtex-5 FPGAs for processing elements. WILDSTAR 4 is the 10th generation of Xilinx FPGA processing-based COTS boards from Annapolis.

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

FEATURES:

- Up to 10 Gb Full Duplex Ethernet per connector
- Up to 10 Gb Fibre Channel
- OC 192
- Three 10 Gb XFP connector
- Accepts industry-standard pluggable transceivers
- Available in both commercial and industrial temperature grades
- Includes one year hardware warranty, software updates, and customer support
- One or two I/O cards fit on a single WILDSTAR 4/5 processing board
- New I/O form factor for improved thermal performance
- First of many WILDSTAR 4/5 Family I/O cards, including superior performance A/D, D/A, and additional high-speed communication cards
- Save time and effort and reduce risk with COTS boards and software
- Achieve world-class performance; WILD solutions outperform the competition

For Single Print

For more information, contact: wfinfo@annapmicro.com

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Mezzanine cards

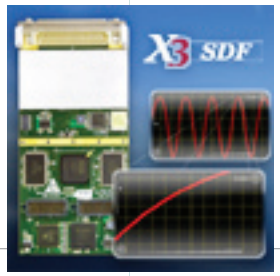
Innovative Integration
2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

X3 PCI Express

The X3 PCI Express modules are industry standard XMCe devices that deliver performance with lower system cost and less development effort than custom designs. Use X3 XMCe modules in any PCI Express system or any XMCe-compatible carrier card. Eliminate custom hardware by harnessing the power of PCI Express and customizable FPGA.

All X3 modules utilize the common bus interface to deliver high data throughput to the Host, along with the flexibility of user-customizable FPGA signal processing. Board specific analog or digital I/O flows directly into the user-configurable Spartan 3 logic device.

Download data sheets and pricing at:
www.innovative-dsp.com/bypciexpress.



FEATURES:

- FPGA 1M/2M Spartan3
- Many choices in A/D Channels: 2ch., 4ch., 6ch., or 16ch. Also 14, 16, or 24-bit
- D/A 2 channels are 2 16-bit, or 4 16-bit or 6 16-bit. 16-bit, 25MSPS >85dB S/N
- Digital I/O 48 bits (J16) 16bits Front panes different options available
- Using FrameWork Logic VHDL source code or MATLAB board support package you can readily customize
- The functionality of the FPGA. MATLAB/Simulink can be effectively used by anyone

For more information, contact: sales@innovative-dsp.com

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Mezzanine cards

Innovative Integration
2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

X5 XMC PCI Express

The X5 module family integrates high performance I/O with a Xilinx Virtex5 FPGA computing core on an IEEE 1386 CMC mezzanine module with a PCI Express interface. The Virtex5 SXT FPGA provides up to 640 DSP48 elements combined with memory blocks and logic that support a complete DSP system on a chip. QDR SRAM and DDR2 DRAM memory pools provide the FPGA with deep, fast memory that is critical to implementing efficient signal processing algorithms and data acquisition. X5 modules offer a new level of performance for data logging & system integration using either PCI Express or a private data link capable of over 1GB/s sustained transfer rates.

Download data sheets and pricing now at:
www.innovative-dsp.com/bypciexpress.

FEATURES:

- Input: ±2V, DC-coupled 50Ω inputs, 2GHz bandwidth – Output: ±2V, DC-coupled 200MHz bandwidth
- 1GB DDR2 DRAM FIFO – Power Management Controls – Front panel trigger and clock
- A/D 2 Channels 14-bit, 400MSPS >68dB S/N @ 350MHz
- D/A 2 Channels 14-bit, 400MSPS 80dB @ 400MHz – Digital I/O 48 bits (J16)
- Ideal for Wireless RX/TX, WLAN/WCDMA/WiMAX front-end, RADAR, Electronic Warfare
- High Speed Data Rec./Playback, High Speed Servo, IP Development

For more information, contact: sales@innovative-dsp.com

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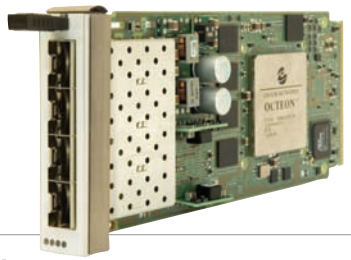
For Single Print Only

RadiSys Corporation
5445 N.E. Dawson Creek Drive • Hillsboro, OR 97124
503-615-1100
www.radisys.com

PROMENTUM AMC-7211

The AMC-7211 is a single width, mid-size AdvancedMC that provides up to 4 Gigabit Ethernet interfaces through SFP connectors supporting copper and optical interfaces. The hardware design incorporates state of the art packet processing technology from Cavium, OCTEON™ Plus. The OCTEON™ Plus processor is a multi-core processor with significant hardware acceleration engines for both packet and security processing. Leveraging the multi-core capabilities of the processor and its silicon based hardware acceleration, the AMC-7211 can handle full line rate processing for various packet processing functions including forwarding, load balancing, traffic management and IP Security.



FEATURES:

- Single, Mid-Size AdvancedMC for high density line interface applications
- Multi-core processor onboard with hardware accelerators enable L2-L7 wire-speed packet processing
- AdvancedMC is compliant with AMC.0, AMC.1 and AMC.2 with support for front or front I/O or rear I/O through build options
- Carrier Grade Linux operating system support for both management processor and AdvancedMC
- AdvancedMC includes hardware and software – includes full complement of blade management/optional data-path software

For more information, contact: info@radisys.com

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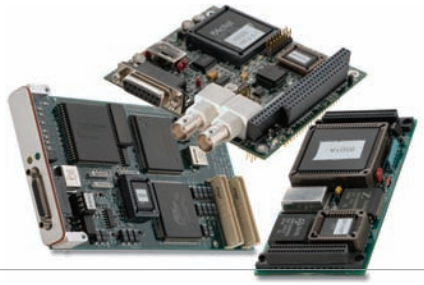
Spectracom Corp.
95 Methodist Hill Drive • Rochester, NY 14623
585-321-5800
www.spectracom-boards.com

Mezzanine cards

PMC, PC104, IP Time Card

The TPRO/TSAT board series synchronize embedded computing systems to an external GPS time and frequency reference for calibration, test and measurement, simulcast, and telecommunication networks. Applications include communications, satellite ground stations, aerospace, test ranges, power utilities, and process control.

These mezzanine boards perform timing and synchronization functions referenced to an input timecode signal. The PMC and PC104 form factors optionally support a GPS input signal with the included GPS antenna and cable. Synchronizing an on-board clock to the incoming signal, time and all outputs are synchronized to the selected source. A propagation delay offset can be specified to compensate for cable delays. Drivers are available.



FEATURES:

- Complete GPS and timecode synchronized reader/generator system
- Autodetects IRIG-A, IRIG-B, and NASA36 timecodes and generates IRIG-B
- High-performance, 2.5 ppm oscillator with Freewheel capability
- Event Capture/interrupt input (supports up to 2000 events per second)
- Programmable alarm and frequency (stable 1, 5, or 10 MHz) outputs
- Comparable VME, CPCI, and PCI form factors

For more information, contact: boards@spectracomcorp.com

RSC# 31111 @ www.embedded-computing.com/rsc

Technobox, Inc.
140 Mount Holly Bypass - Unit 1 • Lumberton, NJ 08048-1114
609-267-8988
www.technobox.com

4876 PCIe-to-XMC Adapter

The Technobox PCIe-to-XMC Adapter (P/N 4876) permits an engineer to adapt an existing PCIe solution to an XMC site on a carrier or single board computer. This is an especially useful tool for software development where an existing PCIe solution is to be ported to an XMC equivalent. Side One of the 4876 has a pair of XMC connectors for the P15 and P16 interfaces that mate with the host XMC site. A single 8x PCIe connector is located on the opposite side of the adapter, along with some headers and jumpers. Two 64-pin headers are provided to permit probing of various XMC signals from the P15 and P16 connectors. Pin assignments conform to VITA 42.0-2005 and VITA 42.10-200x. Headers allow access to I2C, JTAG, plus several XMC signals that do not pass over the PCIe bus.

FEATURES:

- Adapts a PCIe card to an XMC site
- Supports up to 8 PCIe lanes
- 2.5 Gbps per lane (each direction)
- Permits access to P16 Signals, I2C, and JTAG
- LEDs show key XMC signals and voltages
- Accommodates external power
- RoHS compliant

For more information, contact: info@technobox.com

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Mezzanine cards

Embedded Computing Design Resource Guide 2007

Technobox, Inc.
140 Mount Holly Bypass - Unit 1 • Lumberton, NJ 08048-1114
609-267-8988
www.technobox.com

4972 Dual-channel SCSI Ultra 320

The Dual-channel SCSI Ultra 320 Controller (P/N 4972) supports two channels – one directed to the 68-pin SCSI front panel connector, the other to the rear I/O PN4 connector. Termination is provided for each SCSI bus, and the termination will automatically configure to support either Single Ended or LVD devices. As delivered, the board termination is programmed as active. However, termination state may be changed by reprogramming the module. Built around the LSI 53C1030, the 4972 features a 16 Kb serial EEPROM, which is used to store user configurable parameters by the LSI BIOS. A 512Kx8b Flash memory holds the BIOS for Intel platforms. A 32Kx8b NVRAM holds mirroring data. LEDs indicate channel activity, ARM heartbeat, and termination voltage.

FEATURES:

- Provides two Ultra 320 interfaces (front and rear)
- Supports SE and LVD Parallel SCSI
- LSI 53C1030
- LEDs show SCSI activity and termination voltages
- Compatible with PCI-X
- RoHS compliant

For more information, contact: info@technobox.com

RSC# 32978 @ www.embedded-computing.com/rsc

Technobox, Inc.
140 Mount Holly Bypass - Unit 1 • Lumberton, NJ 08048-1114
609-267-8988
www.technobox.com

4978 SAS/SATA Dual Interface Controller

The 4978 SAS/SATA controller is based on the LSI Logic 1068 controller and provides 8 lanes of either SAS or SATA connectivity at 3.0 Gb/s per lane. Two SFF-8470 connectors at the PMC front panel are used for connectivity, with each connector supporting 4 lanes. To accommodate rugged, vibration-sensitive applications the 4978 has a jack-style cable retaining mechanism and additonal mounting holes, located per VITA 20 specification.

The 4978 features a 64Kb serial EEPROM which is used to store user-configurable parameters. A 2Mx8b FLASH memory holds the BIOS for Intel platforms. A 32Kx8b Non-Volatile RAM holds mirroring data. On-board LEDs convey activity and fault status for each of the 8 attached devices.

FEATURES:

- Supports up to 8 lanes of SAS or SATA
- Rates up to 3 Gb/s per lane
- LSI SAS1068
- Dual SFF-8470 front panel connectors
- On-board storage of user-defined parameters, BIOS, and mirroring data
- RoHS compliant, lead-free

For more information, contact: info@technobox.com

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Mezzanine cards

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

Multifunction A/D

The PCM-MIO is a versatile, PC/104-based analog input, analog output, and digital I/O board designed for industrial applications requiring high-accuracy analog I/O. Yet it requires no external calibration. It supports optically isolated analog and digital I/O modules for use in harsh industrial environments.

It has two separate 16-bit A/D converters. Each supports 8 channels for a total of 16 single-ended, 8 differential channels, or various combinations of both. Analog input ranges are: 0-5V, 0-10V, ±5V, and ±10V. There are eight, 12-bit D/A converters. The output ranges are: 0-5V, 0-10V, ±5V, and ±10V. Also, 48 bi-directional digital I/O lines are onboard. Free software drivers are available for C, Windows®, and Linux.

FEATURES:

- No adjustment or calibration required
- 16-bit A/D converter
- Eight, 12-bit D/A converters
- Onboard low noise DC/DC converter
- 48 bi-directional digital I/O lines
- -40°C to +85°C temperature operation

For more information, contact: info@winsystems.com

RSC# 33633 @ www.embedded-computing.com/rsc

Avnet Memec
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www.em.avnet.com/memec

Embedded Solutions

Avnet Memec provides a complete portfolio of solutions for your embedded designs. Our selection includes microcontrollers and microprocessors featuring a wide range of industry standard instruction sets, development hardware and software tools, and operating systems. We also have a team of locally deployed, factory trained and certified field applications engineers who are available to assist in developing the right solution for your application.

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FEATURES:

- World-Class Supplier Portfolio
- Factory Trained and Certified Field Applications Engineers
- Complete Hardware and Software Tools
- Design Chain and Supply Chain Expertise

For more information, contact: CustomerCare.Feedback@avnet.com

RSC# 33658 @ www.embedded-computing.com/rsc

Intel Corporation
intel.com/design/intarch

Industry's First Intel® Architecture Quad-Core Processor with Extended Lifecycle

The Quad-Core Intel® Xeon® processor 5300 series is the industry's first Intel® architecture quad-core processor with extended lifecycle support. Validated with the Intel® 5000P chipset, the platform doubles compute density over Intel® dual-core processors+, providing an excellent solution for compute- and I/O-intensive workloads within high-end communications and enterprise systems such as rack-mount (1U/2U) and blade servers, NAS and SAN systems and high-end medical imaging equipment.

Based on 65nm technology, this quad-core processor with dual-processing capabilities offers significant performance headroom for multi-threaded applications, using up to eight high-performance cores per platform to run parallel tasks. Dual-processor platforms based on the Quad-Core Intel Xeon processor 5300 series deliver eight-thread, 32- and 64-bit processing capabilities. Two 4 MB L2 caches, shared by the two cores, are allocated dynamically based on application load. Increased efficiency of L2 cache-to-processor data transfers maximizes main memory-to-processor bandwidth and reduces latency.

Utilizing next-generation dual-processor server chipset technology, the Intel® 5000P chipset enables low-power consumption with improved platform reliability, accessibility, serviceability and system manageability. Fully buffered FB-DIMM technology supports a high-bandwidth memory subsystem, enabling a large capacity, high-speed memory interface. The quad channel memory subsystem with four FB-DIMMs per channel provides excellent memory flexibility.

Additionally, the Intel® 5000P memory controller hub features PCI Express® and serial I/O, while the highly integrated Intel® 6321ESB I/O controller hub packs server-class I/O features into a condensed piece of silicon. Trusted Platform Module 1.2 device support enhances platform security.

+ For complete details on this product and the Intel technologies included, go to intel.com/design/intarch/quadcorexeon/5300/index.htm.

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FEATURES:

- Quad-core processor with dual-processing capabilities offers significant performance headroom for multi-threaded applications
- Extended lifecycle product support protects system investment
- 1333 MHz front-side bus speed enables faster data transfer between physical memory, I/O and cores for increased throughput
- Intel® Core™ microarchitecture technology supports improved performance on multiple application types and user environments
- Enhanced energy efficiency enables equipment manufacturers to optimally balance processing capabilities within power/space constraints
- Executes four instructions per core per clock cycle and allows each core to access full on-die L2 cache
- Intel® Smart Memory Access maximizes main memory-to-CPU bandwidth and reduces latency
- Intel® Advanced Digital Media Boost executes 128-bit SSE/2/3 instructions in a single clock cycle
- Intel® Virtualization Technology+ enables migration of more environments to virtual environments on the same hardware
- Greater isolation and security between different applications and operating systems for added protection against corruption
- Intel® I/O Acceleration Technology+ supports highly efficient movement of data to and from applications
- Intel® 64 Architecture+ provides access to larger physical address spaces for reduced system load and faster data access

For more information, contact: intel.com/design/intarch

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Microprocessors, microcontrollers

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FPGA Processing

Xilinx delivers an innovative and flexible range of processing solutions for your unique embedded application requirements.

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- Small footprint PicoBlaze 8-bit soft processors
- Award winning Platform Studio Embedded Design Tool Suite
- Broad range of Intellectual Property (IP) and processing peripherals
- HW/SW embedded development kits with reference examples
- Robust third party ecosystem support

Our processing capabilities provide performance and customization across a wide range of end markets. To learn more about Xilinx embedded processing solutions, please visit: www.xilinx.com/processor.

XILINX®

FEATURES:

- PowerPC hard processing cores optimized for performance
- MicroBlaze soft processing cores optimized for customization
- Embedded Development Kit (EDK) and the Platform Studio tool suite
- Robust library of Processing IP Cores
- Development Kits and Boards with preverified example designs ramp development
- Extensive Embedded Partner Program for RTOS and Tool Support

For more information, contact: jay.gould@xilinx.com

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For Single Print Only

Operating systems – embedded

Ardence, a Citrix Company

266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

Phar Lap ETS

The Phar Lap ETS Real-Time Operating System (RTOS) provides system designers with the most reliable, highest performing, and easy-to-deploy hard real-time development environment. Based on x86 architectures, ETS offers a comprehensive suite of tools that smoothly integrates into the well-known Microsoft Visual Studio IDE – minimizing development and debugging time.

With support for all standard BIOS implementations and the industry's smallest operational footprint, the Win32 API-compliant Phar Lap ETS RTOS enables developers to install, configure, and start developing within two to four hours. ETS has proven itself in thousands of demanding environments, such as multimedia streaming solutions, ocean vessel location systems, submicron scanning systems, and RFID products.

Ardence
a Citrix Company

FEATURES:

- Real-time file system: High-speed media access with FAT16 and FAT32 support
- Fully Win32 compliant: No need to use code wrappers for API mapping
- Complete IA32 x86 support: 386, 486, Pentium I, II, III, 4, Multicore, M, Xenon, as well as AMD CPUs
- Smallest operational footprint: < 500 KB with I/O graphics and TCP/IP
- Support for all standard BIOS implementations: Support includes ACPI-compliant PIC and uniprocessor APIC
- Integrated WinSock-compliant real-time TCP/IP stack: Fully Windows independent

For more information, contact: info@ardence.com

RSC# 24196 @ www.embedded-computing.com/rsc

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266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

RTX

Ardence RTX is a real-time extension for Windows-based devices. Military and aerospace OEMs that demand uncompromising performance and reliability on standards-based platforms rely on RTX to deliver full control – pre-empting Windows and providing precise control of IRQs, I/O, and memory. RTX's deterministic performance ensures that specified tasks execute with proper priority and 100 percent reliability – including the ability to survive Windows crashes (blue screens).

As a true extension to Windows, not an RTOS ported to Windows, developers can benefit from the familiar standards-based Windows development environment and tools. On multi-core architectures, RTX can be configured to run in "dedicated" mode, where it can leverage the processing power of an entire core.

Ardence
a Citrix Company

FEATURES:

- Robust, High-performance Windows RTOS Extension in Ring 0: sustained interrupt rates of 30 KHz
- Support for all standard Microsoft HALs: including ACPI compliant PIC, uni-processor and multi-processor APIC
- Comprehensive Microsoft Windows OS support: Windows Vista, XP Pro, XP Embedded, 2000, Server 2000, and 2003
- Complete x86 CPU support: including multi-processor and multi-core in either shared or dedicated mode
- Visual Studio 6.0, .NET 2002, 2003 and 2005: develop, compile, and debug in well-known development environment
- WinSock-compliant TCP/IP stack: independent of Windows; support for IPv4 and IPv6

For more information, contact: info@ardence.com

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Ardence, a Citrix Company
266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

Operating systems – embedded

Software Streaming

The Device Edition of the Ardence Software-Streaming Platform revolutionizes the traditional software deployment and management model, which assumes that the OS/application image is loaded onto each embedded device. Uniquely, Ardence virtualizes the OS/application image and streams the selected image to a diskless device from the network. By eliminating the need to pre-install or maintain any software (OS or apps) on the device, military and aerospace OEMs benefit from unparalleled reliability, flexibility, security, and productivity.

Because the OS/applications are processed on the devices locally, optimal system performance is maintained (including real-time applications), while centralized management enables simplified upgrades, maintenance, and scalability.

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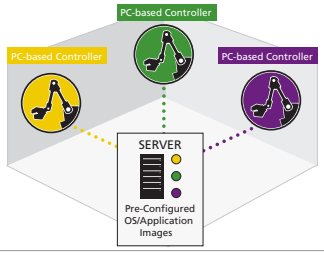

FEATURES:

- Enables devices to change functionality in the time it takes to reboot
- Target devices process applications locally, yet require no hard disk
- Eliminates the need to make hands-on visits to devices for maintenance and upgrade
- Devices do not rely on the network for control of peripherals
- Works with existing hardware, applications and network
- Allows additional devices to plug into the network and start streaming immediately

For more information, contact: info@ardence.com

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Avnet Memec
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800-408-8353
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Embedded Solutions

Avnet Memec supports both the Linux and Windows Embedded platforms – enabling you to get the maximum performance from your system. Combine this with our rich portfolio of embedded processors to get your product to market faster with a complete, integrated solution. Our team of locally deployed, factory trained and certified field applications engineers can assist in helping you select and implement the right operating system for your application.

Franchised Operating System Vendors:
- Microsoft
- MontaVista

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FEATURES:

- Local Coverage: Avnet Memec has trained local field applications engineers and account managers for consulting and support
- Professional Services: Avnet Memec has a dedicated Software Services department offering quick consultation to full image creation
- Competitive Value: Avnet Memec offers a cost-effective solution with competitive license pricing and sourcing for your entire BOM

Express Logic, Inc.

11423 West Bernardo Court • San Diego, CA 92127
858-613-6640
www.rtos.com

expresslogic

ThreadX RTOS

ThreadX is the leading royalty-free Real-Time Operating System (RTOS) for embedded applications running on 32-bit microprocessors and DSPs. ThreadX provides basic thread and interrupt management functions and advanced technology for efficient real-time performance. With more than 450 million deployments, ThreadX is one of the most widely used commercial RTOSs on the market.

ThreadX has an extremely small memory footprint, low overhead, high performance, low cost, and is easy to learn and use. ThreadX and its companion NetX TCP/IP networking stack, FileX file system, PEGX GUI development kit, and USBX USB stack enable developers to focus on the application and to achieve cost-effective solutions for their embedded development needs.

FEATURES:

- Small and scalable – The minimal ROM size of ThreadX is approximately 4 kB
- High performance – ThreadX context switch times are less than 1 microsecond
- Ease of use – ThreadX has the best documentation and the easiest-to-use API
- Certifiable – ThreadX is certified in many applications, including medical, avionics, automotive, and defense
- Advanced debug integration – ThreadX is integrated with almost every major compiler and debugger in the industry
- Value – ThreadX is royalty free
- ThreadX is delivered with complete, highly structured source code

For more information, contact: jcarbone@expresslogic.com

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Operating systems – embedded

LynuxWorks, Inc.

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LynxOS RTOS Family

Embedded operating systems for the most demanding real-time and embedded applications.

LynxOS – POSIX and Linux compatible hard real-time operating system.

LynxOS-178 – Safety certified DO-178 operating system. Unique FAA Reusable Software Component (RSC) certification.

LynxSecure – MILS separation kernal uses Intel VT technology to run multiple guest OSs in separate virtual partitions. Supports Linux and LynxOS APIs. Certifiable to EAL Level 7.

FEATURES:

- Optimal security and safety – the only operating system family to support CC EAL 7 and DO-178B level A
- Virtualization technology – supports multiple heterogeneous OS environments on the same hardware
- Complete Eclipse-based Luminosity product suite gives a consistent IDE across all LynxOS products
- Hard real-time performance for all POSIX and Linux applications
- Support for open standards – supports 100% binary compatibility for Linux or POSIX-based software application

For more information, contact: inside@lnxw.com

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Micrium
949 Crestview Circle • Weston, FL 33327-1848
954-217-2036
www.micrium.com

Micrium

Embedded Software

Micrium's vision is to provide the highest-quality embedded software components in the industry, in the form of engineer-friendly source code with unsurpassed documentation and customer support. Micrium's products consistently deliver on that vision to shorten time-to-market throughout all product development cycles.

Micrium's world-renowned real-time operating system, the Micrium µC/OS-II, was the first product to embrace this vision. The company's flagship product, it features the highest-quality source code available for today's embedded market.

Today, Micrium delivers to the embedded marketplace a full portfolio of embedded software components that complement µC/OS-II. A TCP/IP stack, USB Device, Host and OnTheGo stack, CAN stack, File System (FS), Graphical User Interface (GUI), as well as many other high-quality embedded components are now available.

Micrium has also brought to market the µC/Probe universal embedded systems monitoring tool. This award-winning product enables embedded developers to monitor embedded systems in a live environment allowing them to see the internals of a running embedded application.

The development process at Micrium enforces strict coding standards, code reviews, and clear and concise documentation. This process was instrumental in creating a Validation Suite™ for µC/OS-II that provides all documentation necessary to deliver µC/OS-II as a pre-certifiable software component for such safety critical systems as avionics RTCA DO-178B and EUROCAE ED-12B, medical FDA 510(k), and IEC 61058 standard for transportation and nuclear systems.

Micrium's µC/OS-II is certified for the highest criticality systems. Even when products under development are not safety critical, the certifications represent proof points that Micrium's µC/OS-II is the most robust and reliable RTOS available.

FEATURES:

- All products come with outstanding documentation, source code, and customer support, and offer royalty-free licensing
- Try-before-you-buy: No obligation, time-limited trials available for µC/OS-II, µC/TCP-IP, and µC/Probe
- µC/OS-II certified for avionics RTCA DO-178B and EUROCAE ED-12B, medical FDA 510(k), and IEC 61058 standard for transportation/nuclear
- µC/TCP-IP is a compact, reliable, high performance TCP/IP protocol stack that enables rapid configuration of required network options
- µC/Probe is a universal Windows application for monitoring live embedded systems; it retrieves and graphically displays global variables
- µC/FS is a file system for embedded applications that can be used with any media to provide basic hardware access functions
- µC/GUI is a graphical user interface for embedded systems, offering a universal GUI to any application
- µC/USB offers complete, portable, high-quality USB software for all configurations: Host, Device, or OnTheGo (OTG)
- µC/FL is software for program updates for embedded applications via serial interface from a PC
- µC/Modbus is a Modbus Slave or Master software stack that allows embedded systems to communicate using the MODBUS protocol
- µC/CAN is a CAN protocol framework that enables easy and clean implementation of CAN communication paths
- µC/Building Blocks are basic embedded software modules that include µC/Clk clock and µC/LCD to control LCD modules

For more information, contact: info@micrium.com

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www.pt.com

NexusWare

NexusWare® is a carrier-grade Linux (CGL) 3.2 registered Linux distribution that provides a full OS on Performance Technologies' hardware platforms, as well as a robust application development environment that is tightly coupled to Performance Technologies' broad range of COTS embedded hardware solutions. This powerful combination allows system engineers, architects, and designers in the telecommunications, aerospace and defense, and commercial markets to create applications and bring to market solutions such as media gateways, managed WAN gateways, voice over IP (VoIP), lawful intercept, radar servers, wireless base station controllers, HA communications systems, monitoring solutions, TDM switches, and signaling gateways.

FEATURES:

- Complete suite of development tools, including the NexusWare Studio™ (Eclipse based IDE) IPv6 support
- Linux kernel is specifically tailored toward embedded applications
- Powerful APIs for all onboard hardware resources
- Application development with Windows® XP or Linux
- Pre-packaged applications and protocols

For more information, contact: sales@pt.com

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Operating systems – embedded

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RadiSys Corporation

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503-615-1100
www.radisys.com

MICROWARE OS-9

Fault-tolerant embedded RTOS with BSD-based IPv4/IPv6 networking, Posix threads, graphics, and Unix-like I/O subsystem. Microware® OS-9® is modular and allows updating system components even on a running system. Applications and drivers can be dynamically loaded and unloaded during development or after deployment without a reboot. OS-9 can be scaled from a completely diskless environment without I/O, to a full system supporting serial, disk, internet and more. The kernel is also easily extendable at run-time for customization.

Now supporting Intel Multicore Processors – run Linux and OS-9 simultaneously.

FEATURES:

- OS-9's dynamic, modular architecture allows configuration changes and OS enhancements during development
- OS-9's process-based model provides system security and reliability
- OS-9's priority-based preemptive scheduler provides real-time responsiveness to real-world interrupts and events
- OS-9's support for lightweight processes using the POSIX threads API provides thread support for easy portability
- OS-9's extensible I/O architecture supports a wide range of devices and protocols
- OS-9 supports many additional capabilities including: Java™, graphics and browsers, networking and communication

For more information, contact: info@radisys.com

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WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

Panel PC

WinSystems' Panel PC is a compact display subsystem that includes a TFT flat panel display, PC-compatible SBC with Ethernet and touchscreen integrated into an open-frame enclosure less than three inches thick. The combination of embedded PC functionality and industrial-grade construction makes the unit ideal for automation and control applications with tight system integration and minimal space requirements.

The flat panel display is ideal for factory automation use because of its high luminance of 320 cd/m (nits). The display supports a wide-viewing angle of 65° horizontal and 75° vertical. This wide viewing angle permits easy panel placement with maximum operator viewing flexibility. Also, its contrast ratio is 550:1 thus ensuring color fidelity and superior gray scaling.

The Panel PC's resistive touchscreen allows many kinds of touch input devices to activate the screen, all the while maintaining an exceptional tactile feel.

The Panel PC is also perfect for networked applications since it is shipped with a wired Ethernet connection plus expansion is available for 802.11 wireless Ethernet and/or CDMA/GSM cellular modems.

Just like a standard desktop PC, a Panel PC provides a man-machine interface. A keyboard and mouse can be used for input plus with user-specific software, the touch panel can be included as well. This is determined by the user's application and operating environment.

The Panel PC supports operating systems such as Linux and Windows® XP embedded, plus real time kernels compatible with the x86 architecture.

FEATURES:

- Compact 12.1" or 15" AM TFT Flat Panel Display
- Includes PC-compatible single board computer (SBC) with PC/104 I/O expansion capability
- Supports Linux, Windows® XP embedded and other x86-compatible operating systems
- Resistive touchscreen supported
- Rugged and reliable construction will not rust
- Unpluggable terminal strip for power supply input
- Easy to mount, open-frame design
- Gasket material supplied to user for better fit into user's application enclosure
- Memory, CompactFlash, 802.11 MiniPCI card, and cable sets available
- Optional 2.5" hard drive for larger storage requirements
- Free technical and configuration support
- Long-term product availability

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For more information, contact: info@winsystems.com

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Advantech Corporation
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800-866-6008
www.advantech.com

Trusted ePlatform Services

ADVANTECH

COM Express Module

SOM-5782 is an embedded COM Express Type 2 CPU module that provides scalable high performance and an easy to integrate solution for customers' applications. SOM-5782 offers advanced I/O capacity, serial differential signaling technologies and more choices for applications requiring higher computing speeds, while maintaining a compact form factor. SOM-5782 complies with the "Green Function" standard and supports Doze, Standby and Suspend modes. SOM-5782 is a highly integrated multimedia SOM that combines audio, video, and network functions with Intel's latest dual-core processors for high computing.

FEATURES:

- Embedded Intel® Core™ Duo/Solo/Celeron® M processor
- Intel's new graphics core based on GMA 950 and external PCI Express x16 graphics interface
- Supports the upcoming primary data path PCI Express
- Supports eight host USB 2.0 compliant ports
- Supports two SATA ports, with data transfer rates up to 1.5 Gb/s (150 MB/s)
- Supports dual channel LVDS panels

For more information, contact: ECGinfo@advantech.com

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Single board computers and blades

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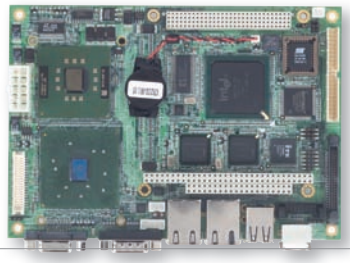
ADVANTECH

EPIC SBC

PCM-4380 is an EPIC SBC (Single Board Computer) with high performance and low power based on Intel® Celeron® M processors. In conjunction with Intel® 855GME chipset, PCM-4380 supports processors clocked at up to 1GHz, four USB 2.0 compatible ports, 2 PCI Fast or Gigabit Ethernet interface, 2 Channel LVDS interface, one MIO expansion connector, and can also accommodate up to 1GB of ECC DDR RAM memory. SpeedStep (EIST) technology is another important feature of PCM-4380, which can save energy and ensure longer battery life, since it allows the operating system to reduce the processor clock speed when less work is being done.



FEATURES:

- Embedded Intel® Pentium® M processor on board and support for PC/104-*Plus* bus
- SODIMM socket supports up to 1GB DDR SDRAM (optional)
- Display combination: CRT and LVDS display support
- Supports four COM and four USB 2.0 ports
- Dual 10/100/1000 Mbps PCI Ethernet interface
- Supports CompactFlash/uDOC (optional)

For more information, contact: ECGinfo@advantech.com

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38 Tesla, Suite 100 • Irvine, CA 92618
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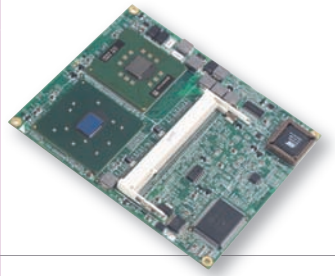
Trusted ePlatform Services

ADVANTECH

ETX Module System

SOM-4486 is an ULV Intel® Celeron® M processor system on module that features power management for low power consumption. It complies with the "Green Function" standard and supports Doze, Standby and Suspend modes. Its watchdog timer automatically resets the system or generates an interrupt if the system unexpectedly stops. Four high capacity connectors allow the ETX modules to be easily and securely mounted onto a custom solution board. SOM-4486 offers highly integrated multimedia that combines audio, video, and network functions. It provides 16-bit half-duplex, 8-bit full-duplex, integrated 3D audio, and up to 1024 x 768 resolution at 16.8 M colors with 8/16/32 MB system memory. Major on-board devices use PCI technology for outstanding computing performance.



FEATURES:

- Embedded Ultra Low Voltage Intel® Celeron® M processor
- Supports DDR (Double Data Rate) memory, 128 MB to 1 GB
- Vcore two phase design for a more stable system
- Supports four USB 2.0 compliant ports
- Supports dual channel LVDS panel
- Supports PCI and ISA interface for expansion

For more information, contact: ECGinfo@advantech.com

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Single board computers and blades

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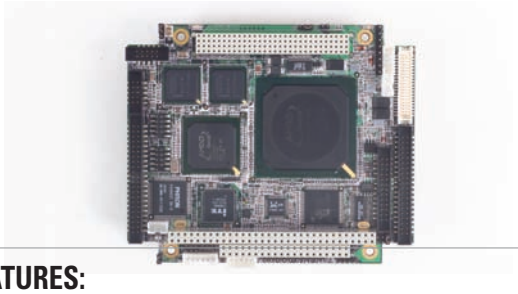
ADVANTECH

PC/104-*Plus*

PCM-4153 is a fanless, cost-effective, high performance PC/104-*Plus* SBC (Single Board Computer) geared to fulfill the needs of industrial computing equipment. PCM-4153 is ideal for communication, gaming, and medical applications that require flat panel support using digital displays with TTL interfaces and two Ethernet ports. For those who want superior performance for low-power embedded applications, PCM-4153 uses an AMD LX-800 processor clocked at 500 MHz, in conjunction with on-board DDR333 system memory. PCM-4153 offers convenient connector layout, easy assembly and multiple I/O connectors, including two 10/100Mbps Ethernet, four USB 2.0, and four serial ports for easy system expansion.



FEATURES:

- Phoebus design for durability in extreme temperature environments, -40 ~ +85˚C
- AMD low power LX800/500 MHz processor
- Supports DDR memory
- Supports dual 10/100Base-T Ethernet
- 24-bit TFT LCD interface
- Supports three RS-232, one RS-232/422/485, and four USB 2.0 ports

For more information, contact: ECGinfo@advantech.com

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WILDSTAR 4 VXS

Annapolis Micro Systems 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 tenth-generation WILDSTAR 4 for VME64X/VXS uses Xilinx's newest Virtex-4 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards in one VME64x or VXS slot, including 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 3 Gbit Serial I/O (Rocket I/O, 10 GbEthernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on Windows, Linux, Solaris, IRIX, ALTIX, VxWorks and others. 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 Build. It 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. With a graphical user interface for design entry, hardware-in-the-loop debugging, and proven, reusable, high-performance IP modules, WILDSTAR 4 for VME64x/VXS, with its 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.

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 Virtex-4 FPGA Processing Elements – Two XC4VFX100 or XC4VFX140, and two XC4VSX55 or XC4VLX40, LX80, LX100 or LX160
- Up to 6 GB DDR2 DRAM in 12 Banks or up to 2 GB DDR2 DRAM and up to 64 MB DDRII or QDRII SRAM
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- Programmable Flash to store FPGA images and for PCI Controller
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- 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/ Integrated heatsink for cooling and stiffness
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
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- Includes one-year hardware warranty, software updates, and customer support; training available

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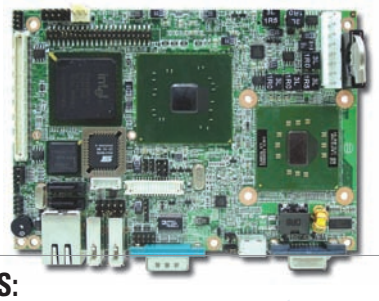
Portwell

PECX-2730VL



Portwell's PECX-2730VL, based on Intel's Embedded Compact Extended (ECX) form factor (size of 5.75"x4.0"), is an ideal embedded computer board for industrial OEMs. It features an Intel® 915GM chipset paired with a low voltage Pentium® M or Celeron® M processor, IDE, two SATA, dual video interfaces, Fast Ethernet, RS-232, and four USB 2.0 ports. Its daughterboard provides expandable functions of PCIe, I2C, and SDVO. The PECX-2730VL is a compact, fully-integrated, expandable solution for applications that need low power, fan-less, or energy saving.

FEATURES:

- Intel initiated compact 3.5" ECX form factor
- Intel low power chipset 915GM paired with low voltage Pentium M or ultra low voltage Celeron M processor
- Chassis solution is available as a complete embedded system
- Dual independent display of CRT, LVDS or SDVO (SDVO through PMIO expansion interface)
- Configured as a fan-less solution
- PMIO module (PCI, PCI Express, I2S, LPC, AC-97, USB and SDVO) for functional expansion

For more information, contact: info@portwell.com

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Industrial Mainboard

WINMATE
A270 Mini-ITX Board

- Supports AMD Athlon 64 X2 35W
- Hyper-Transport Technology
- Integrated VGA / LVDS / DVI, ATI Graphic
- Dual Gigabit LAN
- High Performance and Anti-Vibration to ensure maximum reliability

Single Board Computer

WINMATE
A830 3.5"SBC Board

- AMD LX800 500 MHz CPU, Fanless Design
- Highest Performance Per Watt (CPU core power)
- Integrated TTL / LVDS / VGA function
- Integrated 10/100 Mbps Base T Ethernet

7"Fanless Panel PC

WINMATE
7" Fanless Panel PC

- 7″ TFT LCD Solution
- Value embedded appplications with low power, Fanless Design support Windows®XP/CE/XPe
- Durable Housing with IP65 option
- The Best Choice for Thin Client
- Other Panel Size from 5″ to 19″ Available

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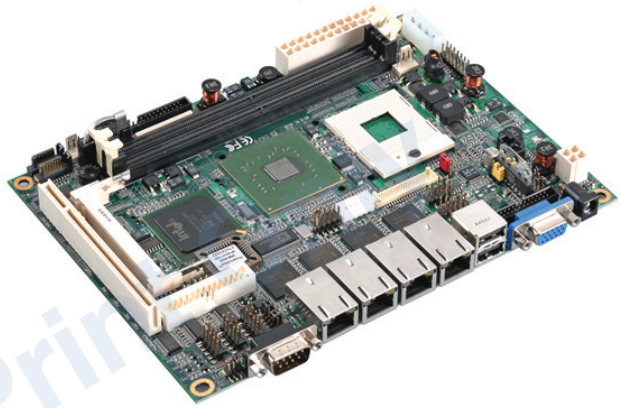
GEMINI

The GEMINI is a 5.25" EBX form factor single board computer for use in embedded and industrial applications. Utilizing Intel Core 2 Duo technology and Arcom's design expertise makes the GEMINI the latest in high performance and technology. The GEMINI has all the requirements for enterprise and residential network applications as well as the processing power to handle today's demanding software, such as graphics-intensive applications or serious number-crunching programs.

In addition to the Core 2 Duo processor options, the GEMINI is packed full of advanced features such as 4 x Gigabit LAN, up to 3GB of DDR2 RAM, dual video output, 6 x USB 2.0 and simple 8 - 24V DC power input requirements, making the GEMINI suited for almost any high-end embedded processing application.

Also available now a ready-to-go, 1U rack mount PC based on the GEMINI. This slim-line unit offers all the features of the GEMINI in a package that also integrates CD-RW/DVD and HDD drives together with a universal mains/ 8 - 24V DC PSU and even offers 2 x PCI expansion slots.

Rapid application Development Kits for Windows XP Embedded, Embedded Linux, Windows CE 5.0, and an entry-level ROM-DOS option are available. These kits include preconfigured operating system images, device drivers, libraries, cable sets, power supplies, resource CDs, and remote development tools, saving weeks or even months of development effort.



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FEATURES:

- Intel Core 2 Duo processor
- 4 x Intel Gigabit LAN interface
- VGA, DVI, LVDS and TV multi-display
- Integrated CompactFlash interface
- Flexible PSU requirements (ATX and 8 - 24V DC)
- Integrated GMA 950 (Graphic Media Accelerator) technology
- 3 year product warranty

For more information, contact: us-sales@arcom.com

RSC# 33648 @ www.embedded-computing.com/rsc

Cogent Computer Systems, Inc.
17 Industrial Drive • Smithfield, RI 02917
401-223-3441
www.cogcomp.com

CSB726

The CSB726, designed, developed, and manufactured by Cogent Computer Systems, Inc., is a highly integrated XScale™ SODIMM System On a Module (SOM). The CSB726 provides an ultra small, powerful, flexible engine for embedded control systems of all kinds.

The CSB726 is supported by a Windows CE 5.0 BSP based on BSquare SchemaBSP technology and a Linux 2.6.16 kernel BSP from renowned Linux architect, Bill Gatliff. Complete development kits with I/O and LCD options are now shipping for both OS'es.

Cogent also offers custom design services as well as IP licensing of this module for volume manufacturing. Please contact Cogent for more details.

FEATURES:

- 520MHz PXA270 CPU with 32K I-Cache and 32K D-Cache
- 128Mbyte Mobile SDRAM (<5mW Power Consumption in Sleep Mode)
- 64Mbyte S29GL512N FLASH, with Secure 256 Byte Sector and 128-Bit Electronic Serial Number
- SM501 2D LCD Controller (up to 1280 x 1024, 18-Bit) with onchip 8Mbyte Frame Buffer
- 8-Bit Video Input via SM501 ZV Port for YUV4:2:2/CCIR656 with on the fly YUV to RGB conversion

For more information, contact: sales@cogcomp.com

RSC# 33667 @ www.embedded-computing.com/rsc

Embedded Computing Design Resource Guide 2007

Cogent Computer Systems, Inc.
17 Industrial Drive • Smithfield, RI 02917
401-223-3441
www.cogcomp.com

Single board computers and blades

CSB735

The CSB735, designed, developed, and manufactured by Cogent Computer Systems, Inc., is a highly integrated ARM926EJS SODIMM System On a Module (SOM). The CSB735 provides an ultra small, powerful, flexible engine for embedded control systems of all kinds.

The CSB735 is supported with a Linux 2.6.16 kernel from our Linux tools partner, Microcross. A complete development kit with I/O and LCD options is now shipping. In addition, a 350MHz version of the CSB735 will be available in Q4'07.

Cogent also offers custom design services as well as IP licensing of this module for volume manufacturing. Please contact Cogent for more details.

FEATURES:

- 350MHz i.MX21 ARM926EJS CPU with 16K I-Cache and 16K D-Cache
- 64Mbyte SDRAM (Core Clock/3 = 117MHz)
- 64Mbyte (128Mbyte by special order) S29GL512N FLASH
- OnChip LCD Controller up to 800x600 (depending upon bits/pixel chosen)
- OnChip MPEG4 Acceleration HW optimized for CIF (352x240) @30 frames/sec
- 8-Bit Video Input Port supporting YUV4:2:2, CCIR656 and Standard CMOS Sensors

For more information, contact: sales@cogcomp.com

RSC# 33668 @ www.embedded-computing.com/rsc

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congatec AG
2033 Bruceala Court • Cardiff by the Sea, CA 92007
760-635-2602
www.congatec.us

conga-B945

Dual Core COM Express module with dual channel memory support up to 4 GB DRAM. The conga-B945 features many processor variants up to the latest Intel® Core™ 2 Duo 2x 2.16 GHz with 4 MB shared L2 cache and measures only 95 x 125 mm², as defined by the PICMG COM Express specification. Two serial ATA® ports provide the ability to configure drives as high performance RAID 0 or RAID 1. In order to support economical and robust CompactFlash cards, parallel ATA is also available.

The conga-B945 supports 5x x1 PCI Express lanes, 1x x16 PCI Express Graphic port (PEG), Gigabit Ethernet, 8x USB 2.0, 2x SATA, PCI, fast mode I²C, LPC and can utilize several high definition audio (HDA) codecs in order to provide the highest sound quality and numerous channels.

congatec
the rhythm of embedded computing

FEATURES:

- Dual channel memory
- Up to Intel® Core™ 2 Duo 2x 2.16 GHz with 4 MB cache processors
- 5x x1 PCI Express lanes, 1x x16 PCI Express Graphic port, Gigabit Ethernet
- 8x USB 2.0, 2x SATA, PCI, Fast Mode I²C, LPC
- ACPI Power Management, ACPI Battery Support, Multistage Watchdog, Flat Panel Auto Detection
- LVDS flat panel interface, analog VGA interface, SDVO
- Latest 3D and 2D video capabilities, TV-Out is also possible

For more information, contact: congatec@rfm-corp.com

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Single board computers and blades

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congatec AG
2033 Bruceala Court • Cardiff by the Sea, CA 92007
760-635-2602
www.congatec.us

conga-E855

ETX® embedded CPU module with Intel® Pentium® M/ Celeron® M and ISA support. The conga-E855 features Intel® Pentium® M processors up to 1.6 GHz. High memory bandwidth is provided by supporting up to 1 GB memory (DDR333). The complete conga-E855 design is geared around low power consumption. The Ultra Low Voltage Intel® Celeron® M 600 MHz and Intel® Celeron® M 1 GHz variants are very well suited for mobile solutions. The congatec Embedded BIOS offers ACPI 2.0 support. Enhanced Intel® SpeedStep® Technology is supported for Pentium® M versions. The conga-E855 features all ETX® interfaces including the ISA bus. Although the Intel ICH4 has no direct ISA support, the ISA bus is generated by an additional PCI to ISA bridge device.

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FEATURES:

- Integrated Intel® Extreme Graphics controller with two independent pipelines featuring the latest 3D video capabilities
- Automatic flat panel detection
- LVDS flat panel interface, analog VGA interface, DVO
- 4x USB 2.0, 2x COM, LPT, FDC, PCI, ISA, I²C, LAN, 2x EIDE
- congatec Embedded BIOS with ACPI 2.0 support
- Enhanced Intel® SpeedStep® Technology support for Pentium® M processors

For more information, contact: congatec@rfm-corp.com

RSC# 32038 @ www.embedded-computing.com/rsc

congatec AG
2033 Bruceala Court • Cardiff by the Sea, CA 92007
760-635-2602
www.congatec.us

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conga-X945

Dual Core XTX™ embedded CPU module with four PCI Express lanes and SATA. The conga-X945 features the latest Intel® Core™ 2 Duo processors up to 2x 1.5 GHz with 4 MB shared L2 cache. It offers all XTX features including 4x x1 PCI Express lanes. The conga-X945 offers the highest computing performace available on an ETX® module size. It's completely ETX® compatible and offers PCI Express, SATA, and much more state of the art features by using the ETX® ISA pins. Thanks to the four PCI Express, six USB 2.0, 2x SATA®, two COM ports, PCI, I²C, and LPC the conga-X945 offers more connectivity than most other computer modules.

FEATURES:

- Up to Intel® Core™ 2 Duo processors up to 2x 1.5 GHz with 4 MB shared L2 cache
- LVDS interface with automatic flat panel detection, analog VGA interface, SDVO
- ETX® compatible and offers PCI Express, SATA and more state of the art features by using the ETX® ISA pins
- Six USB 2.0, two COM ports, PCI, Fast Mode I²C, and LPC
- congatec Embedded BIOS
- ACPI Power Management, ACPI Battery Support, BIOS flashing via serial port

For more information, contact: congatec@rfm-corp.com

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Embedded Computing Design Resource Guide 2007

Diamond Systems
1255 Terra Bella Avenue • Mountain View, CA 94043
650-810-2500
www.diamondsystems.com

Single board computers and blades

DIAMOND SYSTEMS
CORPORATION

Hercules II/Athena II

The Athena II and Hercules II single board computers combine a processor and high accuracy data acquisition onto one board yielding a more reliable, less costly embedded system. These SBCs are fully featured, including up to 800MHz CPUs with Ethernet, video, USB, serial ports and IDE with PC/104 or PC/104-*Plus* expansion. Both are extremely rugged, featuring soldered SDRAM for increased resistance to shock and vibration and an operating temperature range of -40°C to +85°C without a fan.

FEATURES:

- Power-efficient, Pentium III class CPU, plus data acquisition on a single board
- Fully featured, including Ethernet, CRT and flat panel support, USB, four serial ports and IDE
- Includes up to 32 analog inputs, 4 analog outputs with autocalibration and up to 40 digital I/O lines
- Extremely rugged, with soldered RAM and fanless -40°C to +85°C operating temperature

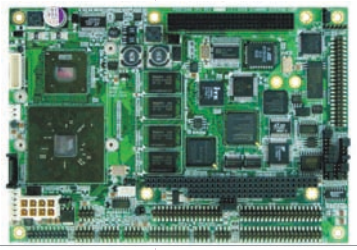
For more information, contact: info@diamondsystems.com

RSC# 32915 @ www.embedded-computing.com/rsc

Diamond Systems
1255 Terra Bella Avenue • Mountain View, CA 94043
650-810-2500
www.diamondsystems.com

Poseidon

The Poseidon EPIC form factor single board computer is a high performance CPU that combines Diamond Systems' renowned high accuracy data acquisition with new VIA C7 and VIA Eden ULV processors. With up to 512MB RAM, four USB 2.0 and serial ports, gigabit Ethernet, SATA and IDE, CRT, flat panel and LVDS support and AC97 audio, the Poseidon is designed to meet the needs of your demanding applications. This rugged SBC with soldered RAM for increased resistance to shock and vibration operates at an extended temperature range that is ideal for harsh environments.



FEATURES:

- Low power, high performance PC/104-*Plus* expandable SBC to 2.0GHz with 400MHz FSB
- 256MB or 512MB 533MHz DDR2 RAM soldered on board
- Fully featured, gigabit Ethernet, CRT and LVDS support, USB 2.0, four serial ports and SATA/IDE
- Optional data acquisition featuring 32 16-bit A/D, 4 12-bit D/A, 24 DIO and two counter/timers
- Extremely rugged, with soldered RAM and -40°C to +85°C operating temperature

For more information, contact: info@diamondsystems.com

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Single board computers and blades

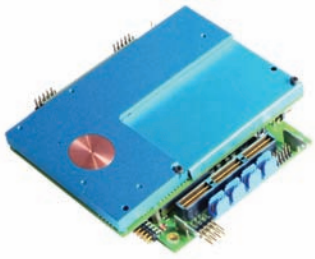
Embedded Computing Design Resource Guide 2007

DIGITAL-LOGIC AG
Nordstrasse 11/F • CH-4542 Luterbach/Switzerland
++41 (0)32 681 58 00
www.digitallogic.com

MICROSPACE® MSM945, PC/104-EXPRESS

DIGITAL-LOGIC AG offers the PCI-104 Express CPU module with Celeron® M LVU Core™ Duo and Core™ 2 Duo. Designed for harsh environments, the MSM945 provides 4x 1-lane PCI Express and PEG (RA6) – all the interfaces for modern applications. CPU and RAM are protected to resist shock and vibrations. With a typical power consumption as low as 10W to 20W, extended temperature solutions (-40 °C to +70 °C) can be realized. Many smart technical details in hardware and BIOS support the integration and make the engineer's life easy.

The MSM945 module is perfectly suited for embedded computing with high CPU and graphics performance in transportation, telecommunication, medical, aerospace or military applications.



FEATURES:

- MICROSPACE® MSM945 baseboard with exchangeable Computer-On-Module, smartModule SMX945
- Intel® Processor Celeron® M Core™ Duo and Core™ 2 Duo 1 GHz up to 2x 1.6 GHz
- Intel® 945GM, ICH7-M, 512-204 8MB DDR-RAM, Extreme Graphic, 8-224MB (UMA), DirectX 9 compliant, CRT and DVO/LVDS
- 4x1 Lane PCI Express, 1x P-ATA, MS, KB, FD, 2x S-ATA, COM1-2, LPT1, 6x USB V2.0
- LAN Ethernet 10/100BASE-T, AC97-7.1HDA, EEPROM support
- Optimized thermal concept and cooling feature for operating temp. of -25 °C to +60 °C, opt. -40 °C to +70 °C

For more information, contact: brigitte.kocher@digitallogic.com

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EI Technology
www.elt-ipc.com

IPC-B3A730

The IPC-B3A730 has a high-performance Intel 852GM chipset, supports ULV Celeron M processors, and delivers excellent performance and low power consumption. It also offers a Mini PCI slot for flexible expansion.

Intel 853GM has a built-in 2D/3D Graphics Accelerator, offers a high-resolution display quality, and supports CRT and LVDS TFT LCD panels. The IPC-B3A730 has many integrated features such as LAN, Audio, USB, COM, LPT, CF, IDE, Watchdog, and more.

A 3.5" size, low power, and flexible expansion interface, the IPC-B3A730 is the best choice for a limited space environment.

FEATURES:

- Supports Intel ULV Celeron M 600MHz up to 1.4GHz processor
- One DDR SO-DIMM socket supports up to 1GB memory
- Intel 82562ET 10/100Mbps
- Supports CRT and LVDS
- Four serial ports. Four USB 2.0 ports
- One IDE interface and one CompactFlash Type I/II socket

For more information, contact: sales@elt-ipc.com

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Single board computers and blades

EMAC, Inc.
2390 EMAC Way • Carbondale, IL 62902
618-529-4525
www.emacinc.com

iPac-9302

The iPac-9302 is a low power, inexpensive Single Board Computer based on the Cirrus EP9302 Processor. This feature packed board contains a wide variety of I/O including A/D, PWM, Digital I/O, Serial, USB, and Ethernet all on a board that is the same footprint as a PC/104 module at 3.77" x 3.54". This industrial strength SBC is perfectly suited for just about any embedded data acquisition and control application, and is ideal for engineers and students looking to develop low-cost embedded applications in Linux, Windows CE, or utilizing the .Net Micro Framework.

Single unit pricing for the iPac-9302 begins at $150.00 USD. For more information, please visit: www.emacinc.com/sbc_microcontrollers/ipac_9302.htm.

FEATURES:

- Cirrus Logic EP9302 ARM 9 200MHz Processor with Math Co-processor
- 1 RS232 Serial Port and 1 RS232/422/485 Configurable Serial Port
- 1 10/100 Base-T Ethernet Port & 2 USB 2.0 Ports
- 5 Channels of 12-bit A/D & 48 Digital I/O Lines
- 9 Synchronous Serial I/O Lines (SPI/AC97/I2S)
- SD/MMC Flash Card Socket

For more information, contact: info@emacinc.com

RSC# 33649 @ www.embedded-computing.com/rsc

Emerson Network Power Embedded Computing
8310 Excelsior Drive • Madison, WI 53717
800-356-9602
emersonembeddedcomputing.com/products/KAT4000.html

EMERSON. Network Power Embedded Computing

KAT4000

KAT4000 is a single-slot, Advanced Telecom Computing Architecture (AdvancedTCA) carrier with up to four Advanced Mezzanine Card (AdvancedMC) expansion modules. This expansion capability enables a wide variety of control and packet processing applications such as WAN access, traffic processing, signaling gateways, media gateways, and many others.

The KAT4000 features onboard Ethernet and PCI Express switches for the AdvancedMC Common Options Region, where the majority of control plane data flows, and a flexible modular Fat Pipe Switch (FPS) to address data plane traffic in the AdvancedMC Fat Pipes Region. The FPS is implemented using a plug-over module, enabling simple maintenance and a rapid upgrade path when a newer switch fabric is required. An optional onboard processor gives users additional processing power and can be used to offload system management or OA&M functionality.

In telecom network elements, system management is essential. KAT4000 is an intelligent Field Replaceable Unit (FRU). It fully supports the Intelligent Platform Management Interface (IPMI), allowing it to be monitored by a local shelf management controller or by a remote OA&M system over Ethernet.

For quality in real time, choose the performance, reliability, and responsiveness of Emerson Network Power Embedded Computing products. Our customer support group is available to answer your questions.

Please call 800-356-9602 or visit our Website at www.emersonembeddedcomputing.com for more details.

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FEATURES:

- AdvancedMC carrier up to four AdvancedMC modules
- (Optional) Freescale MPC8548 PowerQUICC III running at up to 1.3GHz
- (Optional) Up to 2GB of DDR2 553 memory
- (Optional) Up to 1GB of NAND flash
- Ethernet and PCI Express switches for the AdvancedMC Common Options Region
- Flexible GbE Modular Fat Pipe Switch module
- Up to two GbE to ports 0 and 1 in Common Options Region
- One PCIe to port 1 in Common Options Region
- Four GbE to ports 4-7 in Fat Pipes Region Carrier Grade Linux
- Carrier Grade Linux RoHS/WEEE compliant
- Quality assured by more than 30 years of design experience and a TL-9000 and ISO 9001:2000 certified quality management system (FM 26789)
- Our customer support group is available for your questions. Call 800-356-9602 or visit our Website at www.emersonembeddedcomputing.com

For more information, contact: info@artesyncp.com

RSC# 30194 @ www.embedded-computing.com/rsc

Emerson Network Power Embedded Computing
8310 Excelsior Drive • Madison, WI 53717
800-356-9602
emersonembeddedcomputing.com/products/KAT6200.html

KAT6200

AdvancedTCA® is a collaboration of major telecom OEMs and suppliers to create an optimal platform for telecom infrastructure equipment that provides an open specification based solution with an ecosystem of off-the-shelf functions in hardware and software required to implement highly available equipment.

KAT6200 is an AdvancedTCA server node based upon dual high performance Intel Xeon LV5100 series (Woodcrest) processors, Carrier Grade Linux support, and flexible AdvancedMC expansion. The KAT6200 server blade is ready for the most demanding telecom applications with features such as persistent memory for event logging and redundant firmware for protection against unsuccessful firmware field upgrades.

KAT6200's AdvancedMC (AMC.0 R2.0) mid-size expansion slot gives telecom OEMs access to a wealth of third-party AdvancedMCs for I/O, storage and co-processing. This off-the-shelf expansion capability makes it easy to configure the KAT6200 for a wide variety of control and packet processing applications including application server and database intensive applications in wireless infrastructure.

In telecom network elements, system management is essential to support high availability. KAT6200 is an intelligent FRU and implements a redundant System Management Bus (SMB). It also fully supports the Intelligent Platform Management Interface (IPMI) with AdvancedTCA extensions to support standards-based shelf management.

Our customer support group is available to answer your questions. Please call 800-356-9602 or visit our Website at www.emersonembeddedcomputing.com for more details.

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FEATURES:

- 2 Dual-core Intel Xeon processors, LV 5100 series, 2.13GHz
- Intel 5000P Memory Controller Hub
- Intel 6321ESB I/O Controller Hub
- Up to 16GB using 4GB fully buffered DIMMs
- 1GB NAND Flash
- Redundant firmware hubs
- 16MB persistent memory for event logging
- 1 AdvancedMC® slot, single, midsize (x4 PCI Express, x2 SAS, x2 1Gb Ethernet) or Onboard 2.5" SAS Hard Drive
- Intelligent Platform Management Controller
- AdvancedTCA PICMG 3.0 form factor
- RoHS/WEEE compliant
- Quality assured by more than 30 years of design experience and a TL-9000 and ISO 9001:2000 certified quality management system (FM 26789)

Emerson Network Power Embedded Computing
8310 Excelsior Drive • Madison, WI 53717
800-356-9602
emersonembeddedcomputing.com/products/KosaiPM.html

EMERSON. Network Power Embedded Computing

KosaiPM

KosaiPM is an AdvancedMC module based on the Intel Pentium M processor, providing a complete processor subsystem. It is designed to allow communication equipment manufacturers to add modular and upgradeable compute functionality to their AdvancedTCA or proprietary baseboards and provide the localized horsepower necessary for applications such as protocol processing, packet processing, data management and I/O management.

To support high-speed packet data transfers on and off the card, KosaiPM features both PCI Express and dual GBit Ethernet interfaces to the baseboard. With ever-increasing application and data transfer requirements, this combination of more traditional GBit Ethernet interfaces and the emerging PCI Express interface allows developers to easily migrate existing applications to PCI Express.

KosaiPM is hot-swappable, which allows modules to be replaced by operators or service organizations in the field without bringing down an entire AdvancedTCA blade or system. This reduces spares costs and Mean-Time-To-Repair (MTTR), lowering both CAPEX and OPEX. KosaiPM also provides an IPMI-based system management interface, which enables operators to pinpoint and fix problems at the module level, also lowering MTTR and OPEX.

Please call 800-356-9602 or visit our Website at www.emersonembeddedcomputing.com for more details.

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FEATURES:

- Intel Pentium M® running at up to 1.8GHz
- Full-height and Half-height PICMG AdvancedMC form factor
- Up to 2GB DDR or DDR2 DRAM with ECC
- 256MB On-board USB Flash device
- Dual GBit Ethernet connectivity to AdvancedMC connector
- PCI Express connectivity to baseboard
- Full hot-swap support
- USB and Console serial ports via front panel
- Intelligent peripheral management functionality
- Carrier Grade Linux support
- RoHS/WEEE compliant configuration available
- Quality assured by more than 30 years of design experience and a TL-9000 and ISO 9001:2000 certified quality management system (FM 26789)

Eurotech S.p.a.
Via Fratelli Solari 3/a • Amaro (Udine), 33020 Italy
39-0433-485-411
www.eurotech.it

COM-1452

The COM-1452 is a PC/104-*Plus* Version 2.0 compliant communications module that features 5 Fast Ethernet ports and allows the host CPU module to perform bridging operations with the possibility to manage up to five different LANs using the Ethernet protocol. There is also a hardware bypass between Ethernet ports 1 and 2 that can be activated automatically when the COM-1452 is powered off. Thanks to the internal PCI-to-PCI bridge the board just needs one PCI slot in the PC/104-*Plus* stack ensuring system expandability. Each Ethernet port is managed by an Intel® 82551 controller that can provide fast data transfers by offloading TCP, UDP, and IP checksums from the main processor.

FEATURES:

- PC/104-*Plus* Version 2.0 compliant
- Five Intel® 82551 Fast Ethernet controllers
- Texas Instruments PCI2060 PCI-to-PCI Bridge
- Hardware bypass between Ethernet ports 1 and 2 (relays normally open)
- Programmable management of an external WDT signal
- Fully RoHS (2002/95/CE) compliant

For more information, contact: sales@eurotech.it

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ICOP Technology Inc.
12328 Valley Blvd., Suite B • El Monte, CA 91732
626-444-6666
www.icoptech.com

Single board computers and blades

Vega86-6270 SBC

This SBC uses a Via Mark CoreFusion 533MHz CPU with integrated 2D/3D AGP-4X graphics with MPEG accelerator and VT1612A AC97 CODEC to support multimedia applications. The onboard Realtek-8100 is 100 percent compatible with the Realtek-8139, which has a large existing library of device drivers to support legacy and modern OS. With integrated Audio, Video, IDE, RS-232/485, Parallel, USB, LAN, and BSP to support popular embedded OS, this SBC is suitable for a broad range of embedded applications.

FEATURES:

- Integrated VGA, with LCD support, AC97 audio, IDE, FDD, RS-232/485, Parallel, USB, and Ethernet
- 128MB soldered-on system memory
- 2D, 3D, AGP-4X video with MPEG accelerator support
- -20°C to +60°C operating temperature range
- Single 5VDC power requirement make it easy to adapt this board to existing design
- Board-Support-Packages (BSPs) available to support Windows Embedded CE 6.0, Windows XP Embedded, and Linux OS

For more information, contact: info@icoptech.com

RSC# 31255 @ www.embedded-computing.com/rsc

ICOP Technology Inc.

12328 Valley Blvd., Suite B • El Monte, CA 91732
626-444-6666
www.icoptech.com

VSX-6154

This SBC in PC/104 format is based on Vortex86SX System-On-Chip (SoC), an x86-based SoC designed for embedded applications. At 300MHz, this low-power SBC draws 250ma at 5VDC. The SBC's soldered-on RAM, fanless design, using low profile heat-sink to meet PC/104 stacking specification, along with the integrated Video/LCD, Ethernet, USB 2.0, 4 serial ports, Parallel, IDE, Keyboard/Mouse, RTC and more, make it an ideal platform for embedded applications. In addition to supporting popular modern embedded OS and RTOS such as Linux and Windows CE, support is available for legacy applications running on older version of Linux, Windows, and DOS. (Available during Q4/2007.)

FEATURES:

- Integrated VGA with LCD support, IDE, 4 Serial ports, Parallel, USB 2.0, Ethernet, Keyboard/Mouse, 16 GPIOs
- Soldered-on system memory (available in 32MB, 64MB, or 128MB)
- Two sets of watchdog timer
- Single 5VDC @ 250ma power requirement making it easy to adapt this board to existing design
- -40°C to +85°C industrial operating temperature range
- Board-Support-Package (BSP) available to support Windows CE 5.0 and 6.0

For more information, contact: info@icoptech.com

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Embedded Computing Design Resource Guide 2007

Single board computers and blades

Innovative Integration

2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

SBC6713e

SBC6713e is a high-performance, flexible, standalone DSP board with Ethernet connectivity, loaded with I/O peripherals. Built around the powerful, C-friendly, 300 MHz floating-point C6713 DSP, it is a fully open platform with 15+ off-the-shelf OMNIBUS I/O modules available that provide a wide choice of A/D and D/A and also support simple EMIF bus interface to custom I/O daughter cards. TCP/IP is running on a dedicated DM642 coprocessor to preserve the C6713 for user code and other peripheral controls. System-level integration is facilitated with onboard digital I/O, DDS time base, external clock input, multicard sync, FPDP port data links, 2 MB flash ROM, and watchdog.

FEATURES:

- 300 MHz TMS320C6713 DSP (floating point)
- Two OMNIBUS I/O expansion sites
- 10/100 Ethernet, RS-232 port
- FPDP data port to 200 MBps
- Capable of 100 percent standalone operation
- 600K gate Spartan-IIE for user code (optional)

For more information, contact: sales@innovative-dsp.com

RSC# 21162 @ www.embedded-computing.com/rsc

Inova Computers, Inc.
610 Ten Rod Road • North Kingstown, RI 02852
401-667-7218
www.inova-computers.com

cPCI Express CPU Board

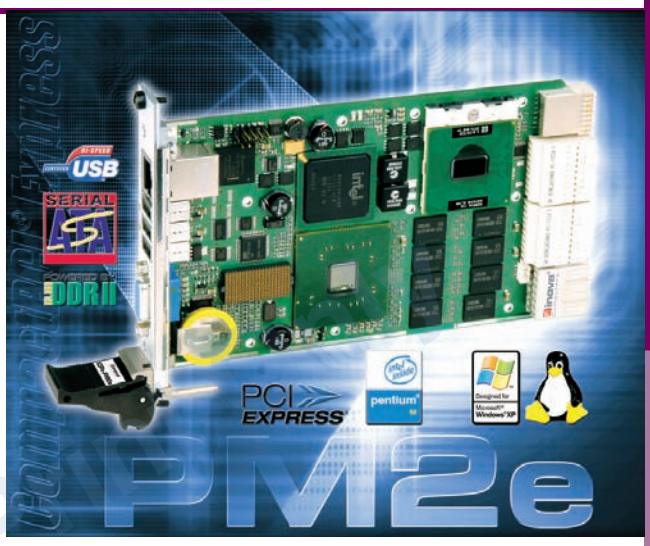
The new ICPe-PM2e (GoldMine) from Inova Computers is part of a new family of highly-integrated, 3U CompactPCI Express CPUs offering performance and functionality levels typically reserved for 6U boards.

During the board's design phase, Inova Computers considered, in particular, the requirements of the embedded server market and, as a result, integrated a baseboard management controller (BMC). Hence, for the first time, features such as remote diagnostic or remote, OS-free serviceability, crash recovery, and self-healing functions have been introduced to the 3U world.

Inova customers profit from the GoldMine CPU two-fold from the µLinux Kernel (SuSe) integrated in the BIOS Flash. It can be used as a free stand-alone operating system with total cost of ownership reduction through zero OS license costs. Or, if the Linux OS is integrated fully, then system commissioning in the field becomes a whole lot simpler. As an added free bonus, boot times are kept to a minimum and the OS is immunized against vibration and the extreme climatic conditions typically found in mobile (transportation) or outdoor applications.

The single slot, 4HP CPU has three USB 2.0 interfaces, a gigabit Ethernet interface and DirectX 9.0 compatible video from the i915 chipset available on the front panel. In addition, a bootable USB µDOC device can be installed for very robust, embedded applications. An 8HP version has an additional independent gigabit Ethernet, three more USB 2.0 interfaces, a configurable RS232/RS485 COM port and legacy PS/2 mouse/keyboard interface. Both CPU variants can extend their already rich I/O feature set through rear I/O, which offers Fast Ethernet connectivity alongside a serial ATA, which suits RAID systems for example, and additional USB, COM and legacy PS/2 support.

These CPUs open the door for CompactPCI Express to address high-end server, mission-critical or high-availability applications, such as those found in demanding control systems, video servers, or data servers in production areas.



FEATURES:

- 1 GHz ULV Celeron M/2.0 GHz Pentium M CPU CompactPCI Express Architecture Throughout Supports all 1 GHz to 2.0 GHz Dothan Processors
- Intel 915GM chipset with DirectX 9 H/W Support
- Up to 2 GByte 533 MHz DDR2 RAM Clocked at 400 MHz or 533 MHz
- VGA/DVI/TFT Supported Video Formats
- Up to 2048 x 1536 Pixel Video Resolution
- Up to two Independent Gigabit Interfaces
- Up to 8x USB 2.0 Interfaces CPU extension with HD, COM & PS-2 Single-Slot, Inline Serial ATA µDOC Technology or CompactFlash
- µController for System Management Serial ATA HD Support up to 160 GByte Devices LPC Routing through the Backplane
- Integrated IPMI Bus Comprehensive & Intelligent Rear I/O
- The 1 GHz Celeron version is just 4HP wide and is suited to applications in harsh environments or extremes of temperature
- For more information and customized applications of your system, send your requirements to Debra Sturdevant-Toher at deb.st@inova-computers.com or call 401-667-7218
- For our European customers: Contact Andrew Brown at abrown@inova-computers.de or call +49 (8341) 916265 x15
- Inova is ready to fullfill your needs when you are ready. Contact us today

For more information, contact: deb.st@inova-computers.com

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Kontron CP307[64]

The Kontron CP307[64], a 3U CompactPCI CPU board, incorporates Intel's latest processor chip based on a new 65 nm technology – the Intel® Core™ 2 Duo processor – delivering optimized power-efficient computing and breakthrough dual-core performance with amazingly low power consumption.

With its two execution cores and 64-bit access, the Intel® Core™ 2 Duo processor is optimized for multi-threaded applications and multitasking. Multiple demanding applications can run simultaneously, such as a graphics-intensive program, while at the same time handling serious number-crunching programs. Furthermore, the two cores give the capability to execute two operating systems independently – one core dedicated to one OS – starting a new era of software implementations.

FEATURES:

- 4HP or 8HP CPU with passive cooling
- Support of latest PSB performance with 667 MHz
- 2x GigEthernet Interfaces via PCI Express
- Latest I/O technology with up to 6x USB 2.0 channels and 4x SATA
- Dual screen graphics, DVI and CRT
- Onboard CompactFlash socket and comprehensive rear I/O support

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Kontron CP6012[64]

The latest addition to Kontron's 6U CompactPCI family, the Kontron CP6012[64] boasts an Intel® Core™ 2 Duo processor and meets the highest performance standards. In combination with the E7520 chipset, the Kontron CP6012[64] manages data throughput with server quality. The PICMG 2.16-compatible Kontron CP6012[64] features an L2 cache that is twice as large (4 MB), a much improved internal architecture, and 64-bit Intel technology for increased performance over the Intel Core Duo option.

Designed for bandwidth-intensive applications, the Kontron CP6012[64] provides hot swap, IPMI (Intelligent Platform Management Interface) support, and meets the highest standards for the management of high-availability military applications.

FEATURES:

- Scalable processor speed, Intel® Core™ 2 Duo up to 2.16 GHz; support of latest PSB performance with 667 MHz
- 4HP, single slot CPU with passive cooling
- Up to 4 GB DDR2 400 MHz SDRAM via two SODIMM sockets
- 4x GigEthernet Interfaces via PCI Express
- Latest I/O technology with USB 2.0 channels and SATA; rear I/O supporting PICMG 2.16
- XMC/PMC + onboard HDD + CompactFlash configuration possible

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Kontron ETX®-CD

The Kontron ETX®-CD is the new highest performance Computer-On-Module based on the ETX® 3.0 standard. The new Kontron ETX®-CD module is built around the Intel® Core™ 2 Duo processor and Intel® Celeron® M processor as well as the Intel 945GM and ICH7M chipset. Kontron ETX®-CD modules will provide the following interfaces that are always located in the same physical position on each board: PCI 2.3, USB 2.0, Serial ATA, Parallel ATA, LVDS, as well as an ACPI (Advanced Configuration and Power Interface) for optimized power management. This consistency of design ensures scalability between ETX® product family modules.

The new Kontron ETX®-CD COM takes advantage of the new ETX® 3.0 specification that allows for 2 Serial ATA ports without calling for the ETX® pins to be redefined. The JILI display interface technology ensures automatic setting of the video controller parameters for the attached LCD panel. The mounting holes on the board provide secure mounting to allow the module increased shock and vibration resistance.

Other Kontron ETX® modules available include:

- **ETX®-PM:** Embedded modules that take applications to the next level built around the Intel® Pentium® M processor up to 2GHz
- **ETX®-LX:** Highly integrated and fast CPU module that can be used without active cooling and features the benefits of the AMD LX800 processor

Coming in the near term future is the ETX®-CN8 that will feature the VIA C7 processor paired with the CN800 chipset.

To learn more about Kontron ETX® modules and the ETX 3.0 standard, please visit www.kontron.com.

FEATURES:

- Highest performance for Computer-On-Modules
- With Intel® Core™ 2 Duo processor
- Support for up to 2GB DDR2 SO-DIMM
- 2x Serial ATA for high-speed drives
- 4x USB 2.0 for the integration of fast peripherals
- Graphics (integrated 950GMA), audio and more
- ETX 3.0 – Long Term Support
- Sampling – Now
- Production – Q3 2007

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Kontron ETXexpress®-MC

Built around the Intel® Core™ 2 Duo processor (4MB L2, 800FSB) and Intel® GME965 chipset, the Kontron ETXexpress®-MC – a COM Express solution – is the most robust and power-efficient Computer-On-Module currently available. The Kontron ETXexpress®-MC offers support for GEN4 graphics to meet the requirements of embedded applications that require advanced video capabilities. The Kontron ETXexpress®-MC is one of the first COM Express pin-out Type 2 compliant modules supporting dual-channel memory up to 4GB via two DDR2 SO-DIMM sockets positioned on the top side of the module. This module has 5x PCI Express x1 lanes, 3x Serial ATA ports, and 8x USB 2.0 ports along with Gigabit Ethernet to round out the list of standard features. The inclusion of onboard TPM 1.2 ensures that the Kontron ETXexpress®-MC is a perfect fit for power and thermal sensitive designs.

Other Kontron ETXexpress® – a COM Express solution – modules available include:

- **ETXexpress®-CD:** High-performance, state-of-the-art embedded module with the Intel Core 2 Duo processor and the Intel 945GM Express chipset
- **ETXexpress®-PM:** Next-generation embedded modules based on the PICMG COM Express standard featuring the Intel Pentium™ M processor and Intel® 915GM Express chipset
- **ETXexpress®-WPM:** Offering the highest I/O bandwidth on a COM Express solution built around the Intel Pentium M processor and Intel 3100 chipset
- **microETXexpress®-PM:** The COM offering smoothest entrance into future technologies with the Intel Pentium M processor with the Intel 855GME chipset

Coming in the near term future is the ETXexpress®-CN8 that will feature the VIA C7 processor paired with the CN800 chipset.

Application Areas for Kontron ETXexpress® – a COM Express solution – products are: Point of sale/information kiosks; mobile data acquisition systems; medical 3-D image scanners; automation systems; multi-display entertainment/infotainment units; Digital Healthcare; Medical; Automotive; Communications; Digital Security; Surveillance; In-vehicle Infotainment; Industrial; Interactive Client; Military, Aerospace, and Government.

FEATURES:

- With Intel® Core™ 2 Duo and Intel® Core™ Solo processors
- Integrated GEN4 graphics with 24-bit LVDS support
- Up to 4GB system memory possible
- 5x PCI Express Lanes, 8x USB 2.0 and 3x Serial ATA
- Wide input supply support – 8.4V-18V
- Onboard TPM 1.2
- Gigabit Ethernet for high connectivity
- Sampling – Now
- Production – Q3 2007

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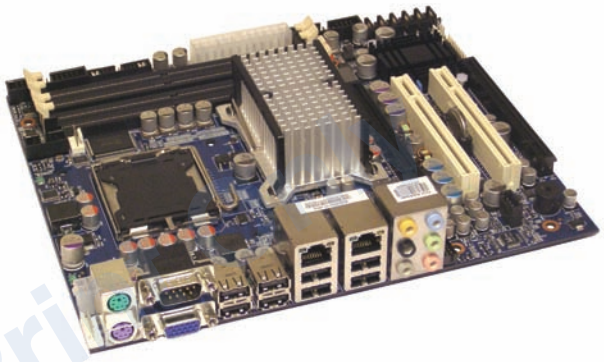
mITX, FLEX, ATX

Kontron motherboards are the ideal solution for embedded applications. As the options for embedded computing continue to expand, identifying the right choice becomes more complicated and can be very confusing. In applications where longevity and risk avoidance must be optimized, Kontron's experience in a variety of markets can lead customers to the solution that meets their needs and meets critical programming and cost objectives.

Earlier this year Kontron launched a family of embedded motherboards that supports the new Intel® Core™ 2 Duo Processor T7400. This new 2 x 2.16GHz processor delivers 64-bit technology and 4MB shared L2 cache that can be dynamically assigned to each of the cores. The new product family consists of three basic products in different form factors: ATX, Flex-ATX and Mini-ITX. The Kontron 986LCD-M/mITX is the smallest and most dense board with a compact size of only 17cm x 17cm and one extension slot. The Kontron 986LCD-M/FLEX and the Kontron 986LCD-M/ATX offer the same feature set, but have three and six I/O slots respectively. All three boards are based on the Intel® 945GM Express + ICH7R Embedded Chipset. The Intel Core 2 Duo mobile processor and on-board Intel Graphics Media Accelerator 950 provide extreme performance for embedded applications with low power consumption. Each board is designed for processor and graphics intensive applications such as: infotainment, medical technology, multimedia, point of information, point of sale, data communications and high-end thin clients.

Kontron also announced the Kontron KT965/ATX, a new long life ATX motherboard based on the latest Intel® Q965 Express chipset that supports the high-performance, low power 64-bit Intel® Core™ 2 Duo E6400 desktop processor and 2MB L2 cache.



FEATURES:

- Longevity and risk avoidance are optimized
- Up to Intel® Core™ 2 Duo processors
- Long-life support
- Low power consumption levels are achievable
- Solutions that meet performance, critical programming and cost needs

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2006 PLATINUM VENDOR

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PC/104 & EPIC SBCs

Kontron offers a diverse range of PC/104 and PC/104 compatible embedded single board computers (SBCs). Among the offerings are the following:

MOPS-PM

Earlier this year, Kontron introduced the Kontron MOPS-PM PC/104-*Plus* card, the industry's first fully PC/104-*Plus* compliant single board computer equipped with Intel® Pentium® M processors. The new Kontron MOPS-PM emphasizes the company's long term commitment to PC/104-*Plus*, which utilizes PCI and ISA busses. The new Kontron MOPS-PM for PC/104-compliant expansion modules is equipped with Intel® Pentium® M class processors and 855/852 GME/ICH4 chipset. Additional information for this SBC is available online at www.kontron.com/mops-pm.

MOPSlcdLX

The Kontron MOPSlcdLX (Minimized Open PC System) with its AMD Geode™ LX800 processor at 500MHz offers high reliability and performance at low power consumption – only passive cooling if at all – with no moving parts. Additional information for this SBC is available online at www.kontron.com/mopslcdlx.

EPIC-PM

The Kontron EPIC/PM boasts an Intel® Pentium® M 745 processor with 1.8GHz and 2MB L2 cache for excellent performance. For cost-sensitive applications or fanless operation, the Kontron EPIC/PM is also available in ULV Celeron M 373 with 1GHz (512KB L2) or Intel processor Celeron 800MHz (0KB L2) Versions. Additional information for this SBC is available online at www.kontron.com/epic-pm.

As a leader in embedded computing technology, Kontron is dedicated to continuing to offer these SBCs and seek out ways of continually advancing the technology.

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FEATURES:

- PC/104 and PC/104-compatible embedded single board computers
- Scalable performance ranging from low end all the way up to Intel® Pentium® M processors
- Support for onboard and add-on memory
- Drop in replacements with in the Kontron MOPS and EPIC product families
- Products available for evaluation

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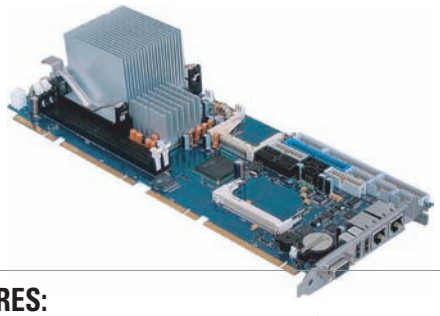
Kontron PCI-960

The Kontron PCI-960 combines Intel®'s latest low-power processor, the Intel® Core™ 2 Duo, with the 945GM chipset to deliver outstanding performance and bandwidth. The Kontron PCI-960 allows you to set the pace with innovative applications today; while the PCI-Express on-edge connector offers enough I/O headroom for next generation requirements.

The Kontron PCI-960 has a broad range of software support, easing the process of product integration and maximizing your competitive advantage to meet time-to-market windows. By providing six high-speed USB 2.0 channels and three Gigabit Ethernet interfaces, the Kontron PCI-960 also supports comprehensive connectivity features at full bandwidth. And the standard miniPCI connector offers unlimited adaptability with options like network, FireWire, SCSI 320®, and WLAN.



FEATURES:

- Supports Intel® Core™ 2 Duo mobile CPUs
- PICMG 1.3
- Intel® 945GM Chipset and Intel® Graphics Media Accelerator 950
- 3x Gigabit LAN
- Up to 4 GB DDR-II memory
- 4 SATA-ports supporting Raid0,1,5

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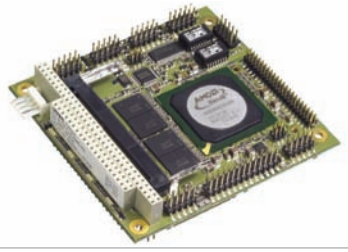
Cool LiteRunner 2

The Cool LiteRunner 2 is an affordable PC/104 single board computer, powered by an AMD Geode™ GX 466@0.9W Pentium-compatible processor running at 333 MHz. It features 256 MB soldered RAM, AC97 sound and 4 USB 2.0 host ports. Together with a CS5536 I/O companion and a Super I/O, the Cool LiteRunner 2 forms a complete PC. A built-in miniPCI slot facilitates expansion with standard cards. Two Ethernet controllers are integrated, too. A graphics controller using UMA handles the graphics for the built-in VGA and LVDS connectors. A floppy disk adapter, PS/2 connectors, parallel printer, and three serial ports with selectable RS-232 and RS-485 standards are built-in, too. Eight freely usable I/O pins for application defined signals are available on a flat cable connector.



FEATURES:

- AMD Geode™ GX 466@0.9W with 256 MB soldered RAM
- miniPCI slot and CompactFlash socket
- 2 x 10/100 BaseT Ethernet
- 4 x USB 2.0 host ports, 3 x serial RS-232/422/485
- Very low power consumption
- Models for the extended temperature range -40 °C to +85 °C

VDC 2006 PLATINUM VENDOR

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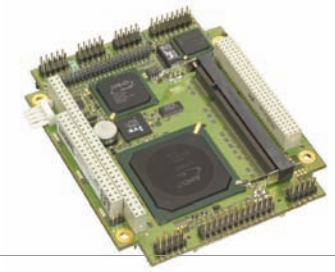
Cool RoadRunner-LX800

The Cool RoadRunner-LX800 is a PC/104-*Plus* board, based on the very energy-efficient Geode LX800 processor, handling 1 GB RAM. It comes with a graphics controller with VGA, LVDS, and parallel TFT adapters. Backlighting is provided for LCD modules. The board communicates through an Ethernet port, RS-232/422/485 serial ports, or four USB 2.0 host ports. Legacy ports like PS/2 and a parallel printer port are available. AC97 sound, an IDE adapter, and CompactFlash socket are integrated, too. I2C bus, PWM outputs, and programmable general purpose digital signals are provided. A 5 V-only power supply is sufficient. The Cool RoadRunner-LX800 runs Windows, Linux, and VxWorks operating systems. Models for the extended temperature range of -40 °C to +85 °C are available.



FEATURES:

- AMD Geode™ LX800 Processor @ 500 MHz
- 1 GB DDR333 RAM max
- Graphics up to 1920 x 1440 pixels. CRT, TFT, LVDS adapters
- 100/10BaseT Ethernet, USB 2.0
- Only 6.5 W power consumption
- Optionally extended temperature range -40 °C to +85 °C

For more information, contact: info@lippert-at.com

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Cool RoadRunner-PM

The Cool RoadRunner-PM is a complete PC/104-*Plus* single board computer with PCI and ISA bus. Several processor variants are available: Pentium M with 1.4 GHz or 1.8 GHz, or Celeron M with 1.0 GHz. The i82855GME chipset features a fast graphics engine with 2D and 3D capabilities and delivers outstanding graphics performance. Up to 1 GByte RAM is supported. There is a Gigabit Ethernet controller integrated on-board as well as two serial ports. USB, ATA-100 and AC97 sound come as standard. SVGA-monitors and TFT Flat Panels can be connected through the dual channel LVDS interface. LEDs for power, watchdog, Ethernet, and life signalization support troubleshooting. Models for the extended temperature range of -40 °C to +85 °C are available.

FEATURES:

- Intel® Pentium® M or Celeron® M processors
- 1 Gbyte DDR-SODIMM RAM maximum
- SXGA: 2048 x 1536 pixel
- Dual channel LVDS for displays
- 100/10 BaseT Ethernet, 6 x USB 2.0, 2 x RS-232 or RS-485
- Low power consumption, 16-32 W depending on processor
- Passive cooling possible. Extended temperature range available for 1.0 GHz version

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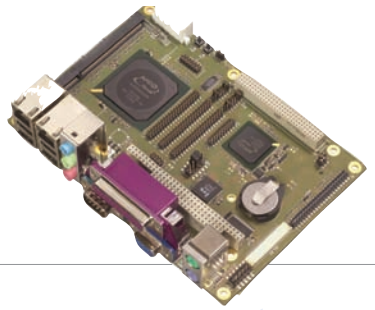
Hurricane-LX800

The Hurricane-LX800 is an EPIC board utilizing an energy-efficient Geode LX800 processor. This processor is integrated with CS5536 companion and a Super I/O chip to form a complete PC, with all the standard peripherals already on-board. There is graphics controller with VGA, LVDS, and parallel TFT adapters. Two Ethernet ports, RS-232/485, and four USB ports handle communications. PS/2 and a parallel printer port are available, as well as AC97 sound. IDE, a Mini PCI slot, and a uDOC interface handle storage. Digital and analog I/O is available, too. There is a high speed data input port data capture or video input. The Hurricane-LX800 runs Windows, Linux, and VxWorks operating systems. Models for the extended temperature range of -40 °C to +85 °C are available.



FEATURES:

- AMD Geode™ LX800 Processor @ 500 MHz
- 1 GB DDR333 RAM maximum
- Graphics up to 1920 x 1440 pixel. VGA, LVDS, parallel TFT adapters
- Two Ethernet ports, 4 x USB 2.0 host ports, 1 device port
- Only 5.25 W power consumption
- Optionally for extended temperature range -40 °C to +85 °C

For more information, contact: info@lippert-at.com

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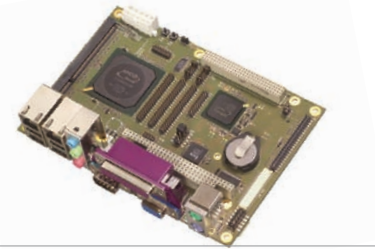
Hurricane-PM

The Hurricane-PM is an EPIC board using Intel's Pentium M processor. The board comes as a complete embedded PC including a graphics controller with VGA and LVDS adapters and backlight for LCD modules. The Pentium M is combined with the 855GME chipset and an ICH4 hub. Two Fast Ethernet ports, RS-232/485 serial ports, and USB 2.0 ports are on-board. PS/2 connectors and a parallel printer port are also available. AC97 sound, an IDE adapter, and a built-in uDOC interface are provided. The on-board power supply generates all necessary voltages from the ATX compliant power supply unit. ATX or single voltage (5V DC) supplies will be supported via an adapter cable. ACPI and PCI power management are supported, too. The Hurricane-PM runs Windows, Linux, and VxWorks operating systems. Models for the extended temperature range of -40 °C to +85 °C are available.



FEATURES:

- Intel® Pentium® M or Celeron® M processors
- 1 GB DDR333 RAM maximum
- Graphics up to 2048 x 1536 pixel, VGA and LVDS adapters
- Two Ethernet ports, 6 x USB 2.0 host ports
- PC/104 (ISA) and PC/104-*Plus* (PCI) buses
- Optionally for extended temperature range -40 °C to +85 °C

For more information, contact: info@lippert-at.com

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Toucan

The COM Express CPU board Toucan is a powerful yet versatile processor kernel for custom specific base boards. The board conforms to the COM Express specification for SOMs. The Toucan features Intel Core (2) Duo processors, supporting parallel processing, and thus giving outstanding performance. The 945GM Express chipset gives the Toucan the best functionality possible. Built-in Active Management Technology allows handling the computer from a central station. The Toucan's chipset sports an integrated graphics and display controller. A PCIe x16 lane allows the usage of an external graphics controller. Troubleshooting is easy using LEDs for power supply and life signalization. The Toucan can optionally be used in the extended temperature range of -40 °C to +85 °C.

FEATURES:

- Intel® Core™ Duo or Core™ 2 Duo (Merom) Processor
- Up to 4 Gbyte dual channel DDR-SODIMM
- Graphics: Intel GMA950, 2048 x 1536 pixel. Dual channel LVDS
- Gigabit Ethernet and 8 x USB 2.0
- Active Management Technology (AMT)
- Low power supply requirements

For more information, contact: info@lippert-at.com

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MESA ELECTRONICS

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3C20

The MESA 3C20 is a single axis 100W smart servo motor controller on a 2"x2" PCB. The 3C20 uses a serial RS422/RS485 host interface. The 3C20 is command compatible with SoftDMC, allowing the same position and velocity control modes and trapezoidal profile modes. The HBridge uses current feedback, allowing torque control modes. The 3C20 will drive brush type servo motors up to 50V and 2A. Logic and 5V encoder power is provided by a local step down regulator from motor power, simpifying 3C20 wiring. In addition to the encoder inputs (A,B, Index), motor drive output, and limit switch input, the 3C20 has 3 analog inputs, 2 high current (500mA up to 50V) digital outputs and 2 Digital inputs.

FEATURES:

- RS422/RS485 host interface supports up to 1.84 MBaud
- DSP based single-axis 100W smart servo motor controller
- Velocity and trapezoidal modes compatible with SoftDMC
- Drives brush type servo motor up to 50V and 2A
- Current feedback for torque control modes
- Step down regulator provides Logic and 5V encoder power

For more information, contact: sales@mesanet.com

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Octagon Systems

7403 Church Ranch Blvd. • Westminster, CO 80021
303-430-1500
www.octagonsystems.com/products/xe-900-1ghz.aspx

EPIC XE-900

The XE-900 single board computer offers the mid-sized EPIC form factor with an x86 processor. It is a high-performance, low-power SBC that supports PC/104 and PC/104-*Plus* expansion. For fanless applications, an integrated conductive cooling system conducts heat to a base plate. This embedded PC offers a rich family of industrial I/O functions. It integrates video, serial ports, Ethernet, digital I/O, CompactFlash, and USB networking into a single card. Support for three hard drives gives this card the versatility to adapt to any application. The CPU provides enough computing power for virtually any embedded application, while operating in extreme temperatures and under heavy shock and vibration. The XE-900 is ideal for military and security applications.

FEATURES:

- Conduction cooling kit for the XE-900 permits 1.0 GHz operation without a cooling fan
- Significant I/O expansion capabilities for PC/104 and PC/104-*Plus* systems
- -40 °C to +75 °C operating temperature
- Small footprint, all connectors are vertical; Linux and Windows® XPe accepted
- All Octagon EPIC cards are bootable from CompactFlash
- Tell us about your application; call Ray Agnew in Sales at 303-430-1500

For more information, contact: sales@octagonsystems.com

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Single board computers and blades

Performance Technologies

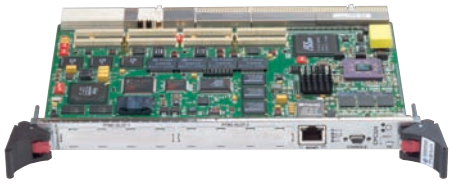
205 Indigo Creek Drive • Rochester, NY 14626
585-256-0200
www.pt.com

CPC324

The CPC324 is the most powerful, flexible access controller on the market. Scalable DSP/CPU processing via the PTMC sites combined with onboard TDM/IP switches make the CPC324 an ideal replacement for several lower density products currently used in PICMG® 2.16 and PCI backplanes.

Offering 24 fully programmable T1/E1/J1 interfaces, the CPC324 offers a comprehensive design supporting voice, data, signaling, and monitoring applications all via one architecture.

The CPC324 is ideal for applications needing to handle large volumes of voice circuits for protocol processing or for transfer to the H.110 bus, PCI bus, Ethernet, or the onboard PTMC sites.



FEATURES:

- PICMG® 2.16 or standard PCI bus operation
- 24 fully channelized T1/E1/J1 Spans (768 Software Programmable Channels)
- Onboard octal Gb Ethernet switch
- 800 MHz PowerPC® with L1/L2 cache
- Extensive support software available

For more information, contact: sales@pt.com

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Performance Technologies
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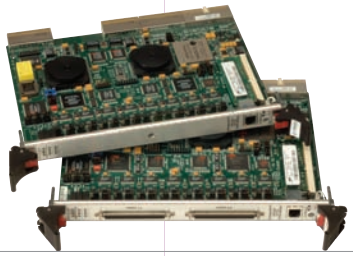
CPC358

The CPC358 is an eight-port serial communications processor designed to operate in CompactPCI® systems as a peripheral or in a PICMG® 2.16 chassis as a stand-alone communications system. It provides OEMs, integrators, and end users with a high performance platform for use in server farms or datacom/telecom applications.

Featuring the Motorola MPC8255 PowerQUICC II™ processor, the CPC358 can independently process protocols such as X.25, Frame Relay, LAPD, and Radar Receiver in an Internet/WAN environment. In Telecom applications, the CPC358 will also support MTP-2 on all eight links.

The CPC358 supports either front or rear panel I/O. As is with the case of all IPnexus products, the CPC358 supports hot-swap (PICMG 2.1) and SMB/IPMI (PICMG 2.9) standards.



FEATURES:

- Multipurpose intelligent Sub-system communications for 6U CompactPCI® systems
- Eight fully programmable high speed channels
- Supports standard PCI bus and PICMG® 2.16
- Ports fully programmable to support V.35, RS-530, RS-449, RS-422, and RS-232
- WAN protocol software support
- Front or rear panel I/O options

For more information, contact: sales@pt.com

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Single board computers and blades

Embedded Computing Design Resource Guide 2007

Performance Technologies
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CPC5564

The CPC5564 is the first 64-bit single slot CompactPCI® SBC to feature the AMD Opteron™ 940 single core at 2.2 GHz or the dual core 1.8 GHz processor. The board is fully compliant with PICMG 2.16, 2.9, 6/6 RoHS and WEEE requirements.

The multi-core AMD Opteron processor provides a highly scalable x86 architecture that delivers next-generation performance and a flexible upgrade path from 32- to 64-bit computing. It offers advanced processing speed while addressing power and heat constraints.

Designed to run Linux, Solaris™, and Windows® applications, the CPC5564 is the ideal platform to support high-end packet processing or multi-threaded software used in IMS, wireless, softswitch, aerospace, defense or other compute-intensive environments.

FEATURES:

- High performance computing solution for PICMG® 2.16 systems
- 128-bit memory addressability to 8GB, PC3200 DDR SDRAM with ECC
- Onboard eight-port gigabit switch
- PMC expansion port with support for 2x1000 Mbps Ethernet, eight lane PCI Express and PCI-X 64/133
- CompactPCI® hot-swap and IPMI BMC controllers
- Ruggedized and conformally coated versions are also available

For more information, contact: sales@pt.com

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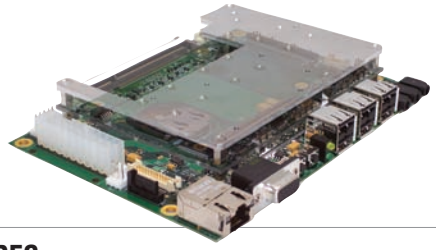
PFU Systems, Inc.
2600 Fernbrook Lane North • Plymouth, MN 55447
763-551-8261
www.PFUsystems.com

PFU Systems™

a Fujitsu company

LITE Carrier Board

The Universal LITE Carrier Board is a COM Express Type 2 Basic form factor carrier board in a space saving 162.56mm x 116.84mm (6.4" x 4.6") footprint. It provides standard connectors for easy access to COM Express compliant interfaces such as SATA, IDE, LVDS LCD, CRT, LAN, USB, and audio with the stringent quality standards that the industry has come to expect from PFU. The Universal LITE Carrier Board is designed for ease of use and priced at a fraction of the module cost to simplify the creation of a universal embedded platform with drastically reduced deployment time and cost.



FEATURES:

- Combines all of the interfaces commonly found on today's basic computing platforms
- Analog monitor connector and LVDS monitor header including inverter power
- Six USB 2.0 ports and 10/100 Ethernet connector
- SATA and PATA Hard Drive Connectors
- Audio in and out with high definition audio Codec
- ATX power connector supports low profile all-in-one power supply for single input voltage solution

For more information, contact: sales@pfusystems.com

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Single board computers and blades

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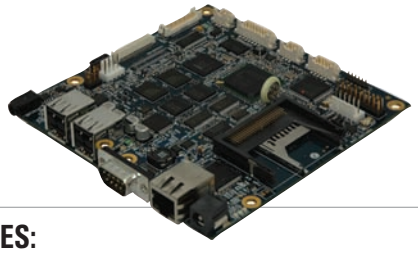
Media Engine

The Media Engine™ is based on the Intel® XScale® RISC microarchitecture featuring 128MB of SDRAM and 64MB of Flash memory, Intel® Wireless MMX™ Technology and a large number of integrated peripherals. In addition to the processor integrated LCD display controller, Media Engine™ includes an on-board Intel® 2700G Multimedia Accelerator with its own 32MB of video memory for low power, high performance graphics and video acceleration.

The peripheral interfaces on the Media Engine™ include Fast Ethernet, LCD, Touch Screen, Stereo Audio, USB, CompactFlash, SD Card, Serial, SPI, I2C, Microphone Input, and General Purpose I/O. The Media Engine Try-Out Bundle. Now at a small price. For information, visit www.pfusystems.com/metryout or call 877-240-3543.



FEATURES:

- Intel XScale® Technology for scalable, low power/high performance embedded computing
- Intel® 2700G Accelerator and Wireless MMX™ technology for high performance 3-D graphics and full-motion video
- Single voltage power requirement and tightly integrated peripherals for a complete compact 5" x 5" solution
- Low thermal output and wide temperature operating environment minimizes cooling demands
- Five year product availability and RoHS compliance for application development payback
- The Media Engine Try-Out Bundle. Now at a small price. www.pfusystems.com/metryout or call 877-240-3543.

For more information, contact: sales@pfusystems.com

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www.PFUsystems.com

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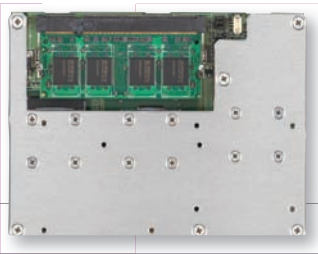
Plug-N-Run G4 COM

PFU Systems' COM Express Type 2 compliant Plug-N-Run G4 Computer-On-Module provides an open standards-based solution with serial differential signaling technologies such as PCI Express®, SATA, SDVO, LVDS, and USB. Plug-N-Run G4 modules are available with Intel® Pentium® M and Celeron® M processors. The Plug-N-Run G4 ensures scalability and long product life cycles by providing legacy PCI bus and PATA (IDE) next to PCI Express and SATA interfaces. This allows OEMs to benefit from existing PCI and PATA solutions, while adopting and migrating to next generation PCI Express and SATA based solutions. The Plug-N-Run G4 significantly simplifies the design complexity of advanced embedded systems, accelerating time-to-market with reduced cost and risk.



FEATURES:

- Intel® Pentium® M and Celeron® M processors, 533MHz FSB, and integrated Intel® Graphics Media Accelerator 900
- Enhanced Intel® SpeedStep®, CPU throttling, selectable core frequencies, power optimized logic, and ACPI 2.0
- Interfaces include USB 2.0, AC'97/HD audio, realistic 3D graphics rendering, and MPEG-2 decode
- Integrated 10/100Base-TX Ethernet with boot over LAN for diskless operation reduces total cost of ownership
- Phoenix® BIOS enables multiple system configurations and innovative power management schemes
- Basic form factor modules provide for up to 1GB DDR2 and Extended use dual DIMM sockets for up to 2GB DDR2

For more information, contact: sales@pfusystems.com

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Single board computers and blades

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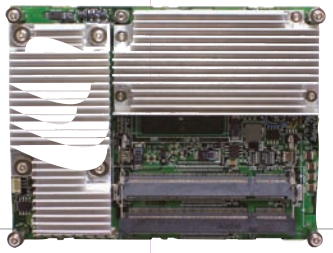
Plug-N-Run G5 COM

PFU Systems' Plug-N-Run G5 is the next generation COM Express Computer-On-Module offering the latest Intel Core 2 Duo technology in the standard's Basic Type 2 form factor. The G5 offers Core 2 Duo processors at 2.2 and 1.6GHz. CPU performance is augmented with the Intel® GME965 graphics and memory controller and the ICH8M-DO I/O controller. These components provide 800MHz FSB support for access to 2GB of DDR2 memory, 1-x16 and 5-x1 lanes of PCI Express, and 2 Serial ATA channels. In addition to these major throughput features, the G5 includes Gigabit Ethernet, 8 USB ports, a CRT monitor port and dual channel LVDS LCD support.



FEATURES:

- Intel® Core™ 2 Duo processor at 2.2GHz or 1.6GHz (low voltage), 800MHz FSB, and 4MB of L2 cache
- Intel® GME965 Graphics/Memory Controller Hub with Intel® Graphics Media Accelerator
- Two 200-pin DDR2 slots providing for up to 2GB of memory
- ICH8M-DO Enhanced I/O Controller Hub
- PCI Express with 1-x16 Lane and 5-x1 Lanes, eight USB 2.0 ports, and 10/100/1000Base-T Ethernet port
- Intel® High Definition Audio, two Serial ATA channels, and dual channel LVDS LCD support

For more information, contact: sales@pfusystems.com

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RadiSys Corporation
5445 N.E. Dawson Creek Drive • Hillsboro, OR 97124
503-615-1100
www.radisys.com

ENDURA TP945GM Mini-ITX

HIGH PERFORMANCE

The Endura TP945GM Mini-ITX delivers exceptional performance with Intel's latest Core™ Duo T2500 2.0GHz embedded processor. Support for Intel® Celeron® M, LV and ULV processors also provides cost effective and ultra-low power options.

The Intel® 945GM Express chipset has a 667MHz front-side bus and supports dual-channel DDR2-667 DIMM memory, which enables a 25% higher data rate compared to the previous generation. The integrated Intel® Graphics Media Accelerator 950 delivers exceptional 3D graphics performance, 2X that of the previous generation.

LOW POWER

The Endura TP945GM is optimized for use with the Intel® Core® Duo processor T2500 with a thermal design power (TDP) of 31W and the Intel® Core® Duo processor L2400 with a TDP of 15W. Use of the Intel® Celeron® M ULV 423 BGA processor enables an even lower TDP of just 5.5W. This delivers up to 28% less average power consumption compared to the previous generation. With extended temperature operation up to 70ºC, the Endura TP945GM is ideal for use in rugged, space constrained applications with demanding thermal performance characteristics. Components are also selected for a more ruggedized design to support embedded applications running 24/7.

HIGHLY INTEGRATED

With the integrated Intel® GMA 950 graphics controller, dual independent video support, Intel® High Definition Audio with 7.1 surround sound and interfaces for VGA, LVDS, DVI (via a Media Expansion Card), TV-out (composite, component, S-video) and S/PDIF digital audio output, the Endura TP945GM is well suited to all types of multi-media applications.

LONG LIFE

With a projected life time of up to 7 years, the Endura TP945GM is designed for the needs of embedded system designers. This is backed up by strong engineering support, sustaining and full product life cycle management from RadiSys.

ROHS COMPLIANT

The Endura TP945GM is fully RoHS 6 compliant to meet the latest legislative and environmental standards.

FEATURES:

- Mini-ITX form factor
- Intel® Core™ Duo, Celeron® M, LV and ULV processors
- Intel® 945GM Express chipset
- 667/533MHz Front-Side Bus
- Two DIMM sockets
- Up to 4GB DDR2-667 memory
- Dual-Channel memory
- Intel® GMA950 Graphics
- x16 PCI Express graphics slot
- 18-bit, dual channel LVDS
- Dual independent displays
- Intel® High Definition Audio

For Online Print

For more information, contact: info@radisys.com

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PROCELERANT CE3100

PRODUCT DESCRIPTION

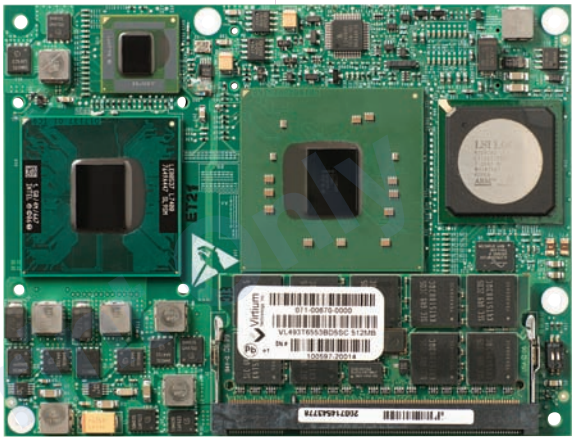
Based on the open PICMG standard, the RadiSys Procelerant CE3100 COM Express basic size (95mm x 125mm) modules combine Intel® Core™ 2 Duo L7400 processor performance with ECC enabled memory, a key feature for today's embedded communications applications. Paired with a RadiSys Procelerant carrier board, RadiSys COM Express modules provide a ready-to-use development platform.

PICMG STANDARD

COM Express is the PICMG standard for a Computer-On-Module (COM) based on high speed serial differential signaling technologies such as PCI Express, Serial ATA, USB 2.0, LVDS, and Serial DVO while retaining legacy PCI bus support to ease migration from existing modular designs. COM Express enables OEMs to reduce time to market by reducing the time spent on processor design and enabling focus on core competencies and product differentiation. Planned feature changes, demand fluctuations and performance upgrades can be handled without product re-designs. COM Express modules can reduce service repair inventories, and simplify upgrades, contributing to the success of the product over its lifetime.

APPLICATIONS

The Procelerant CE3100 allows developers of enterprise-class and carrier-grade equipment to take advantage of a proven computing platform for a variety of wireless and wireline applications. The CE3100 is ideal for embedded applications that require a standard processor module and Error Correcting Code (ECC) memory without the added expense of video and audio functions while delivering the robustness required for demanding telecom applications. When incorporated with the RadiSys Promentum™ ATCA-2210, system designers gain a switch and control module well suited for Radio Network Controller, Media Gateway, IMS and IPTV applications. The CE3100 features a Core 2 Duo L7400 processor and offers flexible storage options with Serial ATA (SATA) and Serial Attached Small Computer System Interface (SAS) configurations in an effort to meet reliability and cost requirements of both equipment manufacturers and service providers. The Type 3 module also provides dual gigabit Ethernet capabilities to maximize IO bandwidth.



FEATURES:

- Intel® Core™ 2 Duo L7400
- Intel® Core™ Duo U2500
- Intel® Celeron® M ULV 423
- Intel® 3100 Chipset
- PICMG COM Express Compliant
- Basic Form Factor
- Type 3 COM Express Pin-out
- Up to 2GB ECC Memory
- 2 10/100/1000Base-T Ethernet
- Up to 8 PCI Express lanes
- 4 SATA ports or 4 SAS ports option
- Optimized Passive and Active Heatsinks

For Single Processor

For more information, contact: info@radisys.com

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RapidIO® Trade Association

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RapidIO www.rapidio.org

RapidIO Standard

The RapidIO interconnect architecture is an ISO-certified open standard that seamlessly enables the chip-to-chip, board-to-board, control, backplane, and dataplane interconnections needed in high-performance systems. This established, scalable, packet-switched fabric addresses the needs of equipment designers in the wireless infrastructure, edge networking, storage, military, and industrial markets. Developers will find that the RapidIO ecosystem offers a critical mass of products on the market today – including a wide assortment of endpoints, which can minimize the amount of bridging required in a design. Detailed information about the RapidIO ecosystem products, design tools, and member companies is featured in the Company Showcase at www.RapidIO.org.

FEATURES:

- The RapidIO standard is defined in three layers – Logical, Transport, and Physical:
  - Logical – Defines the protocol and packet formats necessary for endpoints to initiate/complete a transaction
  - Transport – Provides the necessary route information for a packet to move from endpoint to endpoint
  - Physical – Describes device level interface specifics: packet transport mechanisms, flow control, and so on
- RapidIO Trade Association Steering Committee members: AMCC, EMC2, Ericsson, Freescale Semiconductor, Lucent Technologies, Mercury Computer Systems, PMC-Sierra, Texas Instruments, Tundra, and Wind River

For more information, contact: Tom.Cox@RapidIO.org

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System designers and OEMs worldwide have made SCIDYNE® their source for reliable and cost effective PC/104 products.
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- I/O Coprocessor
- Fully Programmable PIC16C74/77
- Analog, Digital, and Communications
DIO24-104
- 24 Digital I/O
- 85ma Sink Capability
- All Bi-directional Channels
PROTO8
- PC/104 Prototyping
- Solderless or Solder Pad
- Access all PC/104 Signals
ADIO-104
- 8 Analog Outputs
- 16 Analog Inputs
- 24 Digital I/O
Add I/O functions to any digital port with our XIO Series
RELAYIO-104
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- 8 Opto Inputs
- External Interrupt
XIO-RO8
Eight 10A Relays
DIO96-104
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- Four 82C55A Chips
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Eight AC/DC Opto Inputs
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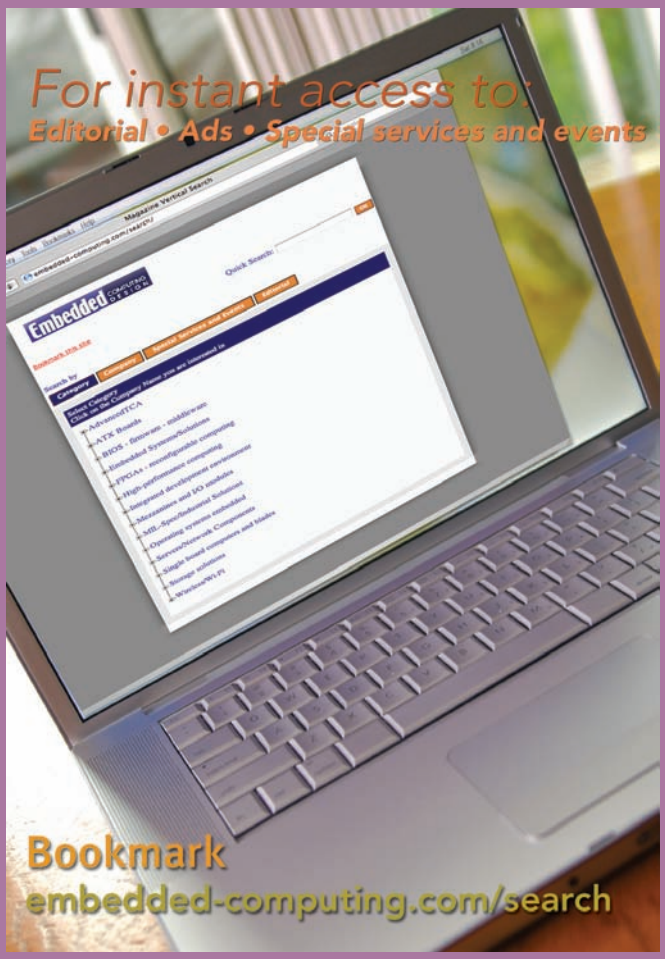


Technologic Systems
16610 E. Laser Drive, Suite 10 • Fountain Hills, AZ 85268
480-837-5200
www.embeddedARM.com

TS-7000 SBCs

With low power, reliability, and extreme performance at great prices

Technologic Systems' TS-7000 series SBCs run on a 200 MHz ARM9 processor. These rugged, low power computers run without fans or heat sinks in the standard operating range of -40 °C to +85 °C. In a programmable power-save state, the TS-7260 ultra low power model can draw less than 1/2 watt of power, allowing it to be powered by small solar panels or inexpensive batteries. Our SBCs are available in thousands of configurations that are Commercial-off-the-Shelf and available to ship today. The industry standard 8/16-bit PC/104 bus on our SBCs allows you to easily add features to your project by stacking feature-specific peripheral boards from any third party vendor. Technologic Systems has a broad line of peripherals including Video, CAN Bus, DIO, Ethernet ports, cellular/line modems, and battery backup. We also offer custom peripheral and SBC designs at competitive prices.

Software

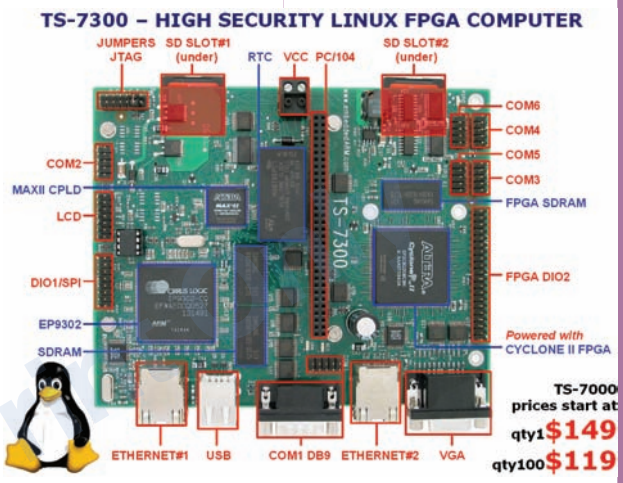
The TS-7000 series uses eCos/RedBoot to load the TS-Linux. This is based on the 2.4 Kernel and optionally supports the RTAI real-time extension. TS-Linux includes the Apache web server, SSH, FTP, and telnet servers. A full-featured Debian Linux distribution is also available using larger flash media. It is identical to the desktop version and enables fast application development in a C/C++ embedded environment. In addition, fast-bootup Linux solutions are available, enabling boot times as low as 1.10 seconds.

New TS-7400 Special Embedded Design

The TS-7400 is a small embedded computer module that is designed to provide extreme performance for applications that demand high reliability, fast bootup/startup, and connectivity at low cost and low power. The TS-7400 specific software solution is optimized for boot time and boot flexibility. It boots Linux in 1.10 seconds and uses Linux as a bootloader to load the system from the SD Card, Flash, NFS root, USB, and more.

Applications

Energy generation, manufacturing process control, traffic management, printing system management, communication infrastructure, website hosting, and data gathering.



FEATURES:

- 200 MHz ARM9 processor with MMU, up to 128 MB of RAM and up to 256 MB of onboard flash, user-programmable onboard FPGA
- Two USB, up to two 10/100 Ethernets, up to 10 COM ports, 800x600 VGA video, SD Card or CompactFlash slot(s), SPI bus
- LCD and Keypad ports, A/D converters, up to 55 GP-DIO lines, TS-XDIO for PWM and quadrature counter, watchdog timer
- PC/104 bus with many available peripherals – VGA video, CAN Bus, GSM/line modems, serial ports, DIO lines, battery backup
- Out-of-the-box productivity – Quick boot to full-featured Linux Kernel 2.4.26 through eCos/RedBoot boot-loader
- Runs TS-Linux compact file system and the Debian Linux embedded distribution; supports RTAI/C/C++/Java
- Under 2 seconds fast bootup to Linux solutions available along with Linux-based bootloader
- Cool-running – no fan or heat sink from -40 °C to +85 °C
- Ultra low power – 4.5-20 Vdc input voltage (default 5 Vdc) with power as low as 1/4 W; under 2 W at full speed default
- Options include larger flash memory drives, RTC, USB 802.11g Wi-Fi, 12-bit 8-channel ADC, temperature sensor, etc.
- Full-featured TS-ARM Development Kit enables rapid application dev
- Extended product lifetime – Technologic Systems has never discontinued a product in more than 20 years of business

For Single Pr

For more information, contact: info@embeddedARM.com

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16610 E. Laser Drive, Suite 10 • Fountain Hills, AZ 85268
480-837-5200
www.embeddedARM.com

TS-7800 SBC

Overview

The TS-7800 is a RoHS compliant Single Board Computer (SBC) based on a Marvell 500 MHz ARM9 CPU with internal PCI bus and provides a standard set of on-board peripherals such as Gigabit Ethernet, dual SATA, and dual High-Speed host/slave USB 2.0. The TS-7800 also features a 12,000 LUT on-board FPGA that is user programmable via Linux software and provides extra peripherals such as 110 GPIO lines and additional serial ports. On the software side, the TS-7800 uses a Linux 2.6 Kernel that allows 2 seconds bootup and provides driver support for all on-board hardware. In addition, the 512 MB on-board Flash enables a full Debian distribution to be installed with a complete embedded development environment. The TS-7800 is backward compatible with our TS-72xx computers, providing 3 times more performance and higher-end features with identical footprint, thus allowing quick platform migration for customer applications.

Fast Bootup Firmware

The TS-7800 bootstrap uses a unique and clever combination of FPGA hardware logic, specific boot-up firmware and Kernel tweaks that ensure fast boot time, security, high board recoverability, and more:

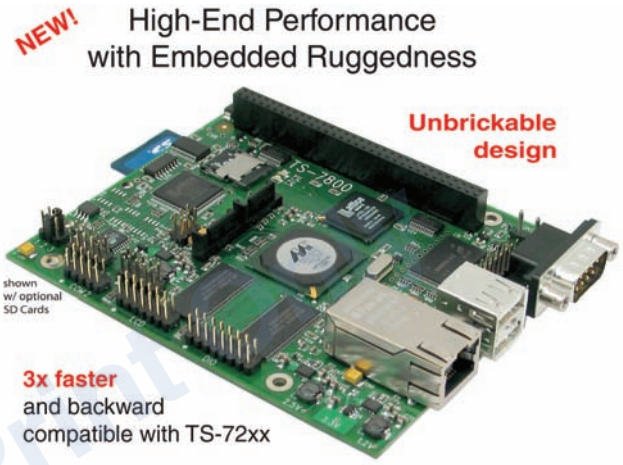
- Linux-based bootloader boots Linux 2.6 kernel to shell-prompt in less than 2 seconds after power-on from either SD card or on-board Flash
- Full Debian can be installed into on-board Flash from a USB flash dongle – no need for Busybox
- Unbrickable design ensures 100% recoverability from SD card in case of on-board Flash erasure

12,000 LUT FPGA

- Linux utility loads FPGA from user file in 0.6secs
- Connects to CPU via 50 MHz local PCI bus
- Default load uses GPIO pins as a PC/104 bus
- Additional FPGA file available for an external PCI bus using overridden PC/104 bus pins

Linux 2.6 and Debian

The TS-7800 is shipped with Linux Kernel 2.6 and the Debian distribution on on-board Flash, enabling a wide range of server services, desktop-like applications and developments tools to run on a embedded real-time system.



FEATURES:

- 500 MHz ARM9 CPU
- 128 MB DDR-RAM
- 512 MB high-speed NAND Flash (17 MB/sec)
- Internal PCI bus, PC/104 connector
- 12,000 LUT user-programmable FPGA, Linux utility loads FPGA from user file in 0.6secs
- 1 Gigabit Ethernet 10/100/1000 speeds
- 2 SD sockets (1 micro-SD, 1 full-size SD)
- 2 USB 2.0 480 Mbps High-Speed host/slave ports
- 2 SATA ports
- 110 GPIO lines (86 as a PC/104 bus in the default FPGA load)
- 5 10-bit ADC channels
- 10 serial ports with 2 optional RS-485
- Matrix Keypad and Alphanumeric LCD interfaces
- Optional sealed-battery backed RTC
- Optional on-board Temperature Sensor
- Fanless: -20 °C to +70 °C
- Low power 4 W @ 5 V, sleep mode uses 200 microamps
- Optional 8-30 V input voltage range (default is 5 V)
- Boots to a Linux shell-prompt in < 2 seconds, Linux-based bootloaders runs Kernel 2.6 and Debian Linux by default

For Single Print

For more information, contact: info@embeddedARM.com

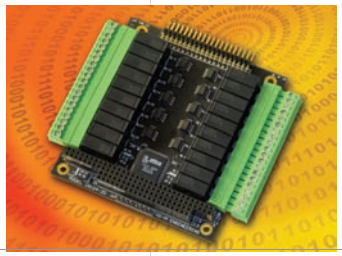
RSC# 33645 @ www.embedded-computing.com/rsc

Tri-M Engineering
100 - 1407 Kebet Way • Port Coquitlam, BC V3C 6L3 Canada
604-945-9565
www.tri-m.com

IR104

The IR104 is a PC/104-compliant industrial control module providing a convenient means to control external digital devices requiring electrical isolation.

The IR104 features 20 opto-isolated digital inputs and 20 relay outputs, sufficient for many industrial control applications. Each input can accept either AC or DC voltages as low as 3 V and as high as 24 V. The relays have a long lifetime (20,000,000 operations, 100,000 at full load) and quick actuation time (6 ms maximum operation, 3 ms release). The output relays are supplied with a contact rating of 5 A @ 250 V AC, giving the IR104 the ability to directly control switches for small motors or solenoids. The IR104 operates on a single 5 V DC.



FEATURES:

- 20 opto-isolated inputs and 20 relay outputs
- Input range: 3-24 V AC or V DC
- Output rating: 5 A @ 250 V AC or 30 V DC
- Detachable connectors for easy installation
- Up to four IR104 modules can be stacked together
- Available in Pb and Pb-free (RoHS) versions

For more information, contact: info@tri-m.com

RSC# 20950 @ www.embedded-computing.com/rsc

For Single Print Only

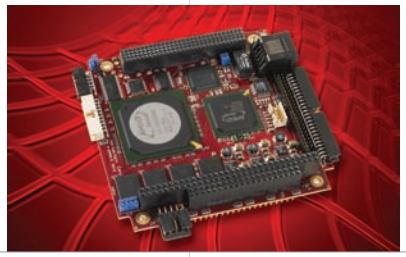
VersaLogic Corporation
3888 Stewart Road • Eugene, OR 97402
541-485-8575
www.VersaLogic.com

Puma PC/104-Plus

The Puma is an extremely compact and rugged single board computer that combines a high degree of functionality with low power requirements. A low power AMD GX500 processor and fanless operation make this board great for portable devices, vehicular/aircraft controls, medical equipment, and other OEM applications.

The Puma has an impressive list of on-board features, including integrated high-performance video, 10/100 Ethernet, four high-speed USB 2.0 ports, three COM ports, LPT port, and an IDE interface, CompactFlash socket, and TVS devices that provide enhanced ESD protection.

The Puma is manufactured and tested to the highest quality standards, is RoHS compliant, and backed by a two-year limited warranty and a five-year availability guarantee.



FEATURES:

- PC/104-*Plus* form factor
- GX500 processor
- High-performance video
- 4 USB 2.0 ports and a CompactFlash socket
- RoHS version available
- Fanless operation

For more information, contact: info@VersaLogic.com

RSC# 30337 @ www.embedded-computing.com/rsc

VersaLogic Corporation
3888 Stewart Road • Eugene, OR 97402
541-485-8575
www.VersaLogic.com

Python EBX

The Python features the AMD LX800 processor, which offers Celeron-equivalent performance (800 MHz) while drawing less than eight watts of power. This highly integrated processor, along with its companion chip, provides the majority of the Python's on-board I/O, including USB support, audio, and video. The high resolution video output can be configured for either standard desktop-type displays (CRT) or LVDS flat panels.

For cost-effective I/O expansion without the need for additional PC/104 modules, the Python includes a Serial Peripheral Interface (SPI) connector that can be used in conjunction with VersaLogic's SPX modules to supply additional Analog and Digital I/O, CAN bus support, and other options. Alternately, with little engineering development, proprietary SPX devices can be developed to suit specific needs.

Entirely RoHS compliant, the Python is ideal for medical devices, MIL/COTS, homeland security, industrial control, and data acquisition applications.

Like all VersaLogic products, this small and efficient SBC is designed to support OEM applications where high reliability and long-term availability are required. From application design-in to five-plus years production life, its quality and longevity provide a cost-effective, long-term solution. Customization is available on as few as 100 pieces. The Python is manufactured and tested to the highest quality standards, is compliant with RoHS regulations, and is backed by a two-year limited warranty.

FEATURES:

- RoHS compliant
- High reliability and design
- Fanless operation
- Extended temperature models available -40˚ to +85˚C
- EBX form factor with multi-vendor support
- High-retention CompactFlash socket
- Low power AMD LX800 processor
- Flat panel support LVDS
- 200-pin SODIMM socket for up to 1 GB DDR RAM
- Integrated high-performance video, up to 1600 x 1200 with 24-bit color; MMX™ + 3DNow!™
- Shock/vibration: MIL-STD-202G

For Single Pl

For more information, contact: info@VersaLogic.com

RSC# 33194 @ www.embedded-computing.com/rsc

VersaLogic Corporation

3888 Stewart Road • Eugene, OR 97402
541-485-8575
www.VersaLogic.com

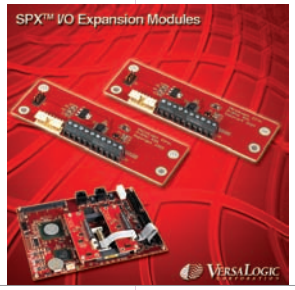
New SPX Modules

VersaLogic's SPX™ expansion modules provide a new level of economy and convenience for routine I/O expansion. Their small size (1.2" x 3.775"), low cost, and simplified system interface is possible due to newfound levels of integration and miniaturization.

SPX expansion modules can be mounted remotely up to two feet from the host via a 14-pin cable, or directly to the board using PC/104 stand-offs.

SPX modules can be used with baseboards (single board computers) that include an SPX expansion connector.

All VersaLogic SPX modules are fully RoHS compliant, and are backed by VersaLogic's standard two-year limited warranty. All SPX modules are rated for extended temperature operation (-40° to +85°C).



FEATURES:

- Multiple function options available
- Small (1.2" x 3.775")
- Compatible with several form factors
- Entirely RoHS compliant
- Daisy-chain connection
- Extended temperature operation

For more information, contact: info@VersaLogic.com

RSC# 33533 @ www.embedded-computing.com/rsc

Single board computers and blades

Embedded Computing Design Resource Guide 2007

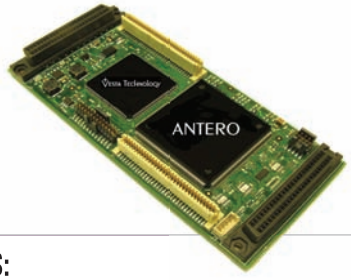
Vesta Technology, Inc.

11049 W. 44th Avenue • Wheat Ridge, CO 80033
303-422-8088
www.VestaTech.com

Antero

The Antero controller from Vesta Technology is optimized for embedded control applications. Based on 32-bit ARM7 technology, it offers high performance with low power, small size, and low cost. It features a rich I/O set that includes Ethernet, CANbus, USB, IRDA, I²C, SPI, serial, PWM, Quadrature, analog and digital. Antero is ideal for machine and industrial control, equipment monitoring, process control, instrumentation, and many other applications.

The Antero Development Kit provides everything needed to develop your application including Processor module, Baseboard with connections to the many I/O ports, Power Supply, Enclosure, JTAG debugger, Royalty-free RTOS and a complete development environment with GNU/GCC compiler all for $999.00.



FEATURES:

- Single Board Computer based on Philips LPC2292 ARM7 32-bit microcontroller running at up to 60 MIPS
- I/O: CANbus x2, Ethernet, USB, IRDA, I²C, SPI, RS232 x3, RS485, PWM x16, Quadrature, analog x10, digital x24
- RUGGED: including operation over the Industrial Temperature Range (-40 to +85°C)
- Very low power; calendar and alarm functions in very-low power standby; suitable for battery operation
- Industry Pack Standard mezzanine board (1.8" x 3.9")
- On-Board memory options include 1-16MB FLASH and 1-8MB RAM

For more information, contact: sales@vestatech.com

RSC# 33536 @ www.embedded-computing.com/rsc

For Single Print Only

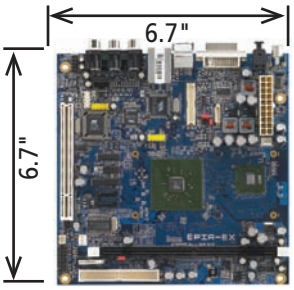
VIA Technologies, Inc.
940 Mission Court • Fremont, CA 94539
510-683-3300
www.viaembedded.com

VIA EPIA EX Mini-ITX

Targeted at the fast-emerging market for x86-based consumer electronics, the VIA EPIA EX boasts leading edge multimedia, memory, and peripheral support, as well as a complete consumer I/O, all contained within the signature compact platform and very low thermal envelope, with an average operating power consumption of less than 14W.

The VIA EPIA EX is powered by the highly efficient 1.5GHz or fanless 1.0GHz VIA C7 processor and is the first mainboard to feature the new VIA CX700M2, an all-in-one digital media IGP chipset integrating the VIA UniChrome Pro II 3D/2D graphics core and an extended array of high end video and audio technologies for the ultimate digital media device.

For information, contact embeddedmkt@viatech.com or call 510-683-3300.



FEATURES:

- Integrated VIA UniChrome™ Pro II 3D/2D graphic with MPEG-2/4 and WMV9 decoding acceleration
- Up to 1GB DDR2 533 SDRAM DIMM; Support IEEE 1394
- Support HD Audio, with back panel I/O RCA to support 2CH stereo; with S/PDIF output to have 8CH audio experience
- Support onboard, single-channel LVDS and back panel DVI-I connector
- Support HDTV resolution TV-out and with Composite, S-Video and Component connectors available in the back panel
- Support 10/100Mbps Ethernet, or manufacturing option for Gigabit Ethernet

For more information, contact: embeddedmkt@viatech.com

RSC# 33627 @ www.embedded-computing.com/rsc

Embedded Computing Design Resource Guide 2007

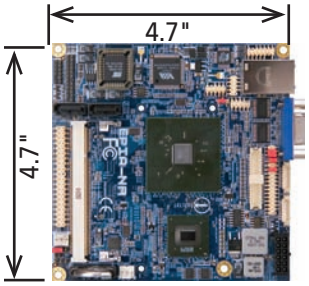
VIA Technologies, Inc.
940 Mission Court • Fremont, CA 94539
510-683-3300
www.viaembedded.com

Single board computers and blades

VIA EPIA NR Nano-ITX

The VIA EPIA NR is an ultra compact native x86 platform optimized for today's demanding embedded and productivity applications. The mainboard is based on the VIA CX700 chipset featuring an embedded hardware MPEG-2 accelerator and integrated VIA UniChrome Pro II 3D/2D graphics for rich digital media performance. With the sizable memory bandwidth of DDR2 533MHz SDRAM DIMM and the high data transfer speed of ATA-133 and SATA and further enhanced by support of VIA VT1708A High Definition Audio codec, the VIA EPIA NR delivers the increased performance levels required by today's embedded digital media applications.

For information, contact embeddedmkt@viatech.com or call 510-683-3300.



FEATURES:

- Integrated VIA UniChrome™ Pro II 3D/2D graphic with MPEG-2 decoding acceleration
- Up to 1GB DDR2 533 SDRAM SO-DIMM; Support HD Audio
- Support 10/100Mbps Ethernet, or manufacturing option for Gigabit Ethernet
- Low profile design: All back panel I/O in pin header format except for the RJ-45 LAN and VGA port
- One LVDS connector for two single-channel or one dual-channel LVDS panel
- For more information, contact VIA at embeddedmkt@viatech.com or call 510-683-3300

For more information, contact: embeddedmkt@viatech.com

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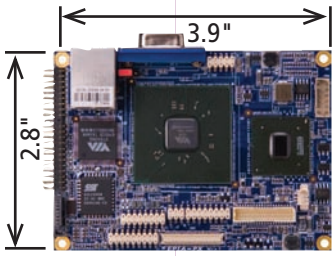
VIA Technologies, Inc.
940 Mission Court • Fremont, CA 94539
510-683-3300
www.viaembedded.com

VIA EPIA PX Pico-ITX

The VIA EPIA PX Pico-ITX is the first commercial mainboard based on VIA's Pico-ITX form factor measuring just 3.9 inches x 2.8 inches. Designed to enable x86 to be built into embedded systems where it was previously impractical for space reasons, the VIA EPIA PX provides a full complement of multimedia and connectivity options on a platform smaller than any standard mainboard or x86 system on module.

Powered by the 1GHz VIA C7 processor and supporting up to 1GB of DDR2 533 SO-DIMM system memory, the VIA EPIA PX is based on the single-chip VIA VX700, which boasts the VIA UniChrome Pro II IGP 3D/2D graphics core, MPEG-2/-4 and WMV9 hardware decoding acceleration and display flexibility. The onboard VIA VT1708A HD Audio codec also contributes a rich entertainment.



FEATURES:

- Pico-ITX form factor: 3.9 inches x 2.8 inches
- Integrated VIA UniChrome™ Pro II 3D/2D graphic with MPEG-2/4 and WMV9 decoding acceleration
- Up to 1GB DDR2 533 SO-DIMM
- With a Audio connector for line-out, line-in, mic-in, S/PDIF in, and 7.1 channels audio output
- Low profile design: All back panel I/O in pin header format except for the RJ-45 LAN and VGA port
- Power efficient: Running standard productivity and multimedia applications at under 13W

For more information, contact: embeddedmkt@viatech.com

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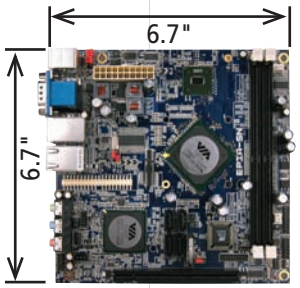
Embedded Computing Design Resource Guide 2007

Single board computers and blades

VIA Technologies, Inc.
940 Mission Court • Fremont, CA 94539
510-683-3300
www.viaembedded.com

VIA EPIA SN Mini-ITX

Combining extra performance with the signature quiet, cool operation, and comprehensive feature set integrated into a small form factor, the VIA EPIA SN is the solution of choice for next generation digital home, business, and embedded devices. Based on the VIA C7 processor, the VIA EPIA SN Mini-ITX mainboard delivers leading performance per watt, and utilizes the new 800MHz V4 bus. Fully compatible with Microsoft® Windows®, and Linux operating systems, the VIA EPIA SN Mini-ITX mainboard also offers advanced hardware security features through the VIA PadLock Security Engine integrated into the VIA C7 processor or the optional TPM (Trusted Platform Module), boasting a comprehensive set of military-grade cryptography tools. For information, contact embeddedmkt@viatech.com or call 510-683-3300.



FEATURES:

- Integrated VIA Chrome9™ HC 3D/2D and Video Accelerator
- Up to 4GB DDR2 667 SDRAM DIMMs
- 1x 16 lane PCI Express, 1x mini-PCI
- 1x IDE, 1x CF Type 1
- 4x SATA II connectors for multiple RAID configurations
- Onboard TPM support
- 2 LAN ports including 1x PCI Express Gigabit Ethernet
- For more information, contact VIA at embeddedmkt@viatech.com or call 510-683-3300

For more information, contact: embeddedmkt@viatech.com

RSC# 33642 @ www.embedded-computing.com/rsc

WDL Systems
220 Chatham Business Drive • Pittsboro, NC 27312
800-548-2319
www.wdlsystems.com

eBox Embedded PC

WDL Systems, The Embedded Products Source, distributes eBox from ICOP Technology. eBox is a complete Embedded PC in a rugged aluminum chassis. The eBox 2300 series is the smallest eBox, and can be attached to any VESA mounting fixture. eBox 2300 features include: Vortex86 System-on-Chip, 200MHz CPU Speed; 128MB SDRAM; 3 x USB (1 on back); 2 x RS-232 (eBox 2300J); CompactFlash; Wireless LAN (eBox 2300J); Mini-PCI Slot (eBox 2300J). WDL Systems also distributes the eBox 2600 series and the eBox 3800 series. The entire line of eBox Embedded PCs from ICOP Technology offers economical low power solutions for any embedded project or industrial application. Obtain specifications and ordering information by visiting www.ebox-pc.com, or www.wdlsystems.com.

FEATURES:

- Fanless operation
- Low power
- Onboard 10/100Mbps Ethernet
- AC/DC power supply included
- 44-pin IDE connector
- Linux, Windows CE, Windows XPe compatible

For more information, contact: sales@wdlsystems.com

RSC# 31246 @ www.embedded-computing.com/rsc

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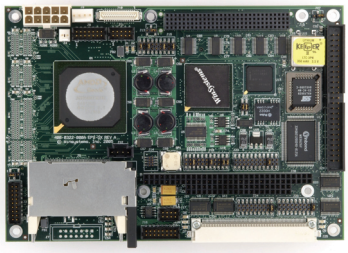
Embedded Computing Design Resource Guide 2007

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

Single board computers and blades

I/O-Intensive EPIC



The EPX-GX500 is an AMD Geode 500@1.0W SBC. The processor has extremely low power dissipation that allows fanless operation in rugged, industrial applications. The board features a 10/100 Ethernet controller, video with CRT and flat panel interfaces, 2 USB ports, 4 COM channels, 24 digital I/O lines, 6 channel AC97 audio, CompactFlash memory, and standard AT peripheral feature set. A MiniPCI socket is onboard for 802.11 wireless networking plus an optional 12-bit A/D converter is available.

The board measures 4.5 x 6.5-inches and is compliant with the EPIC standard. It supports PC/104 and PC/104-*Plus* module expansion for more I/O options. The EPX-GX500's x86 PC software compatibility assures a wide range of tools to aid in your program development.

FEATURES:

- AMD GX500@1W processor
- Video with CRT or flat panel support
- Ethernet, two USB, four COM and 24 DIO channels
- Optional, wireless 802.11, GPS, and 12-bit A/D
- -40°C to +85°C operating temperature
- Small, rugged, EPIC-compliant board

For more information, contact: info@winsystems.com

RSC# 33635 @ www.embedded-computing.com/rsc

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

Embedded Connectivity

Selected by Electronic Products Magazine's editors as a 2006 Product of the Year, WinSystems' LBC-GX500 achieves significant advancement in the application of wired and wireless connectivity technology applied to single board computers. The LBC-GX500 connectivity options include 802.11 wireless Ethernet, GSM/GPRS/CDMA cellular modem, ZigBee wireless RF module, 10/100 wired Ethernet, global-compliant dial-up (POTS) modem, six USB ports, and six COM channels. It provides an open and powerful industrial platform for management of geographically distributed machinery and sensors with a operational temperature of -40°C to +85°C.

In addition to its networking capability, the LBC-GX500 is a full-featured SBC with a variety of on-board peripherals which eliminate the need for other I/O cards. Features include 48 parallel digital I/O lines, CRT and digital flat panel video controller, keyboard controller, PS/2 mouse support, LPT port, and AC97 audio plus an optional 12-bit A/D converter.

Its Pentium-class CPU with a x86-native instruction set and 32KB of integrated L1 cache efficiently runs Windows® CE, Windows® XP embedded, Linux and other x86-compatible operating systems such as VxWorks and QNX. It is a low power device that supports Advanced Power Management (APM and ACPI) for even less power during standby and suspend modes.

The LBC-GX500 draws typically 1.6A at +5V (≈8W) during normal operation and it does not require a fan. The LBC-GX500 also has software developer kits that provide the necessary hardware, software, and cables to help designers with their program development. WinSystems offers a 30-day product evaluation program. Their products are designed and manufactured in the United States, and are backed by outstanding customer and technical support.

FEATURES:

- AMD Geode GX500@1W processor
- Supports CompactFlash as solid state memory storage
- Video controller supports CRT or LCD panels
- 10/100 Mbps Ethernet controller and wireless 802.11
- Supports POTS modem, GPRS/CDMA cellular modem, and ZigBee
- Optional Trimble GPS receiver module supported
- Six serial ports and six USB ports
- 48 bi-directional digital I/O lines
- IDE, FDC, keyboard, and PS/2 mouse interface
- EBX-size board, 5.75" x 8.00" (146mm x 203mm)
- -40°C to +85°C Fanless operational temperature range
- Outstanding technical support

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For more information, contact: info@winsystems.com

RSC# 33634 @ www.embedded-computing.com/rsc

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

Fanless 1GHz SBC

The EBC-855-G-1G-0 is a highly integrated, low cost ($595), single board computer designed for rugged, performance-driven applications. It operates over a temperature range of -40°C to +70°C without a fan and is designed for applications including industrial automation, security, medical/diagnostic equipment, MIL/COTS, test and measurement, and transportation. WinSystems uses chipsets from Intel's long life embedded road map to ensure longevity of the core technology.

The EBC-855-G includes support for both wired and wireless Ethernet (with remote boot capability), simultaneous support of both SVGA and LVDS flat panel video, four USB 2.0 ports, four serial COM ports, AC97 audio, PS/2 keyboard, LPT, and 48-lines of digital I/O. It supports a maximum of 1GB of industry-standard PC2700 SDRAM, up to 8GB of CompactFlash, plus support for hard and floppy disk drives. PC/104 and PC/104-*Plus* expansion is on board for additional special I/O requirements.

It includes advanced features such as custom splash screen, APM 1.2 and ACPI 1.0b power management modes, PXE boot, and multi-language support. The BIOS also supports legacy operation of a USB keyboard and mouse, as well as booting from a USB floppy disk, USB keys, and other USB-connected mass storage devices.

The board runs Windows® XP embedded, Linux, and other x86-compatible RTOS. The EBC-855-G requires only +5V and typically draws 2.1A with 1GB of DDR SDRAM installed.

For even higher performance, a 1.8GHz Pentium® M version is also available. It will operate from -40°C to +70°C with a fan.

FEATURES:

- Intel® 1GHz CPU (fanless), or higher-performance 1.8GHz Pentium® M is available
- Intel® Extreme Graphics 2 technology supports CRT and LVDS flat panels simultaneously
- Custom splash screen on start up
- 10/100 Mbps Intel Ethernet controller
- 802.11a/b/g wireless supported
- Four serial COM ports and four USB 2.0 ports
- 48 bi-directional TTL digital I/O lines
- Bi-directional LPT port, AT keyboard and FDC controller
- PC/104 and PC/104-*Plus* expansion
- 5.75" x 8.0" (146mm x 203mm) EBX-compliant SBC
- Long-term product availability
- Quick Start kits for software development

For Single Print

For more information, contact: info@winsystems.com

RSC# 33637 @ www.embedded-computing.com/rsc

Single board computers and blades

WinSystems, Inc.

715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

I/O-Intensive SBC

WinSystems' PPM-GX500 is a highly integrated, PC/104-*Plus* SBC designed for deeply embedded, space-limited, low power applications. It is a full-featured SBC that includes an AMD GX500 x86-compatible CPU, CRT and flat panel video controller, 10/100 Ethernet, USB, and four COM channels.

It also includes the standard PC controllers for floppy disk, IDE hard disk, CompactFlash, mouse, keyboard, AC97 audio, and LPT. Its x86 PC software compatibility assures a wide range of tools to aid in your application's program development and checkout.

The PPM-GX500's extremely low power dissipation permits fanless, extended -40°C to +85°C temperature operation. Its small size and rich feature set make it ideal for harsh industrial environments.

FEATURES:

- AMD GX500@1W processor
- Video with CRT or flat panel support
- Ethernet, two USB ports, and four COM ports
- -40°C to +85°C operating temperature
- Small, rugged PC/104 board
- Windows® and Linux supported

For more information, contact: info@winsystems.com

RSC# 33629 @ www.embedded-computing.com/rsc

Storage solutions

Performance Technologies

205 Indigo Creek Drive • Rochester, NY 14626
585-256-0200
www.pt.com

CPC5900

The CPC5900 is a high availability NAS or SAN storage blade solution for CompactPCI®, PICMG® 2.16 systems supporting 800GB of storage. Each blade features two 3.5" enterprise SATA hard drives with both board-level and drive-level hot-swap for complete flexibility, high reliability, and high storage capacity. The onboard high-performance PowerPC® processor operates on Performance Technologies' NexusWare® CGL 3.2 registered/ POSIX compliant Linux development environment. Block Disk I/O is supported over iSCSI for SAN applications and File I/O is supported using NFS and SAMBA for NAS applications. Network connectivity is provided by dual Gigabit ports connected to the PICMG 2.16 Ethernet backplane. The board is fully compliant with 6/6 RoHS and WEEE.

FEATURES:

- Supports RAID 0/1/0+1/4/5/6
- Headless operation for Drive Removal and Insertion
- Block Disk I/O over iSCSI
- Dual 10/100/1000 Ethernet Ports routed to the Mid-Plane
- AMCC® High Performance PowerPC® Processor
- Ruggedized and conformally coated versions are also available

For more information, contact: sales@pt.com

RSC# 33606 @ www.embedded-computing.com/rsc

For Single Print Only

WDL Systems

220 Chatham Business Drive • Pittsboro, NC 27312
800-548-2319
www.wdlsystems.com

EE25.1 Hard Drives

WDL Systems, The Embedded Products Source, distributes the EE25.1 Ruggedized Hard Drive from Seagate. The new Seagate EE25 Series® gives OEMs new options for high-capacity HDD storage. RunOn Technology reliably delivers multimedia content under high-vibration, high-humidity, and extreme temperature conditions. EE25 Ruggedized Hard Drives are cost-effective solutions where large storage capacities are required in "extreme environments" such as automotive, industrial PC, field computing, and military applications. Seagate Design Service Centers offer manufacturers and system designers an array of services to assist in the design and testing of new HDD-capable systems. Contact WDL Systems for more information and to order EE25.1 Hard Drives.

FEATURES:

- 20-, 30-, and 40-Gbyte capacities
- -30˚ to 85˚C operating temperature range
- High-humidity and high-altitude operation
- Up to 2.0 Gs operating vibration tolerance
- Long-duration shock of 110 Gs
- PATA Interface

For more information, contact: sales@wdlsystems.com

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ACT/Technico

760 Veterans Circle • Warminster, PA 18974
215-956-1200
www.acttechnico.com

Network Solutions

Network-centric computing is the new standard in embedded systems, providing speed, scalability, reliability, and security. Ethernet Switches are the backbone of this network-centric system architecture. ACT/Technico's line of Ethernet switches, Single Board Computers, storage, and our expertise in embedded sub-systems integration help mitigate development risks.

New network requirements such as IPv6 and multicast are supported by ACT/Technico's complete line of Ethernet switch and interface products. Custom designs are also available. PowerPC and Pentium are both supported on our SBCs, and a host of solid state and rotating storage solutions are available. All this can be assembled and shipped tested in a chassis. Please visit our website or call us for details.

FEATURES:

- Up to 26 ports in a single slot 10/100 or Gigabit on VMEbus, VXS, VITA 31.1, PICMG 2.16
- Extended temperature and conduction cooled versions for rugged environments; LED and thermal sensors
- Configurable, fully managed Layer 3, IPv6, multicast, wirespeed, and low-cost unmanaged versions
- Single Board Computers supporting the latest PowerPC and Pentium technologies
- Wide range of solid state flash and rotating storage solutions on PMC, 3U and 6U platforms
- A fully configured, integrated, assembled and tested subsystem can be delivered ready for development

For more information, contact: sales@acttechnico.com

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ACT/Technico

760 Veterans Circle • Warminster, PA 18974
215-956-1200
www.acttechnico.com

Rugged Switches

Ethernet Switches are the backbone of network-centric system architecture. Access to real-time information is critical in today's network applications. ACT/Technico's line of Ethernet switches and our expertise in embedded sub-systems integration help mitigate the risk in your development time line. Whether managing joint operations in a theater of war or a transportation logistics network, network-centric computing is the new paradigm in embedded systems, providing the speed, scalability, reliability, and security necessary.

New network requirements such as IPv6 and multicast are well supported by ACT/Technico's complete line of Ethernet switch and interface products. Custom designs are also available. Please visit our website or call us for details.

FEATURES:

- Up to 26 ports in a single slot 10/100 (Fast) or 10/100/1000 (Gigabit)
- Extended temperature and conduction cooled version for rugged environments
- Solutions based on VMEbus, VITA 31.1, VXS, PICMG 2.16, and CompactPCI
- Configurable, fully managed (Layer 3), IPv6, multicast, wirespeed, and low-cost unmanaged versions
- Flexible management tools such as user-defined, built-in tests
- LED and thermal sensors for easy networking

For more information, contact: sales@acttechnico.com

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Switch network fabrics

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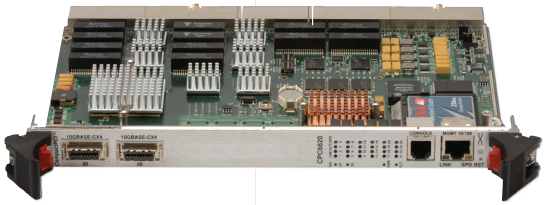
Performance Technologies

205 Indigo Creek Drive • Rochester, NY 14626
585-256-0200
www.pt.com

CPC6620

The CPC6620 is the most advanced PICMG® 2.16 embedded Ethernet switch on the market. Featuring support for IPv6 routing and 10Gb switch ports, it is the latest addition to Performance Technologies' line of award-winning switches and continues our long tradition of offering high-availability, fault-tolerant solutions to the telecom, aerospace, defense, and commercial markets. It is the ideal interconnect and uplink for today's network-centric, packet-based embedded systems. While overall switch throughput is approximately twice that of prior generation Gb switches, users retain the inherent robustness, reliability, and hot-swap capabilities of the 2.16 standard invented by Performance Technologies. The board is fully compliant with 6/6 RoHS and WEEE.



FEATURES:

- 24 10/100/1000 Base-T + 2 10Gb CX-4 Ethernet ports
- 96 Gbps switching speed
- Real-Time continuous integrity checks for non-stop networking
- Rapid Spanning Tree, Link Aggregation, VRRP and jumbo Frame Support
- Advanced fast Filter Processor for wire speed layer 2-7 packet classification and filtering
- Ruggedized and conformally coated versions are also available

For more information, contact: sales@pt.com

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Annapolis Micro Systems
190 Admiral Cochrane Drive #130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Universal 3 Gbit I/O

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. The Annapolis Universal 3Gbit I/O Card provides up to 36 Gb full-duplex I/O directly between the outside world and the Rocket I/O pins on the Xilinx Virtex-II Pro FPGA processors. No other vendor provides that volume of data straight into the heart of the processing elements and then back out again. The card has three individually configurable, industry-standard 4x connectors, providing four lanes per connector, with dedicated signal conditioners to ensure clean communication. It supports a wide variety of readily available cables: copper for short haul (.3-5 m) or fiber for long haul (10-300 m). Two I/O cards can reside on each WILDSTAR II Pro or WILDSTAR II FPGA-based VME or PCI board with up to 30 million user reprogrammable gates.

Initial release of the Universal 3Gbit Card will come with an easy-to-use Rocket I/O protocol supporting up to 12 Gb full duplex per connector. Available protocols are up to 10 G full-duplex InfiniBand per connector, up to 10 G full-duplex Ethernet per connector, and Serial FPDP. Although the InfiniBand, Ethernet, and Serial FPDP protocols will be provided as black-box solutions with few modifications by users allowed, more adventurous users who choose to develop their own communications protocols from the basics already have access to all the board resources through a VHDL source for the interfaces to SRAM, signal conditioners, LAD bus, I/O bus, and PPC flash. CoreFire users will have the usual CoreFire board support package.

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

FEATURES:

- Up to 12 Gb full-duplex Rocket I/O per connector
- Up to 10 Gb full-duplex InfiniBand per connector
- Up to 10 Gb full-duplex Ethernet per connector
- Three individually configurable 4x connectors – four lanes per connector
- Three fundamental oscillators – 100.00 MHz, 125.00 MHz, and 156.25 MHz
- One Xilinx Virtex-II Pro 70-5, -6 or -7, or Industrial 70-5I or 70-6I
- Up to 4 GB DDR SDRAM in four banks
- Two PowerPC 405s in FPGA with onboard flash for program storage
- JTAG, ChipScope, and serial port access
- Proactive thermal management system
- Available in both commercial and industrial temperature grades
- Includes one-year hardware warranty, software updates, and customer support

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For more information, contact: wfinfo@annapmicro.com

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Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.gavazzi-computing.com

5359 FabricPac SM

The FabricPac SM is a CompactPCI 2.16 compliant Switch Fabric Platform that contains redundant IPMI System Management Cards, along with dual AC or DC input 600 W or 400 W PICMG 2.11 power supplies. This platform provides the system integrator with flexibility of designing a system, using both legacy bus based and next generation fabric base boards.

At the heart of the system are two PICMG 2.9 IPMI compliant System Managers in an over/under slot configuration. The IPMI System Managers are integrated into the chassis' electronics, providing an environment that is fully system managed and includes the cooling unit, system temperature, power supplies, fabric switches, and boards.

FabricPac SM contains a PICMG 2.16 Switch Fabric Backplane that delivers a maximum data throughput of over 40 Gbits/second. To ensure forward and backward compatibility the backplane contains 10 2.16 fabric node slots (eight slots contain the 64-bit /33 MHz PCI bus) and two switch slots.

The FabricPac SM chassis has been designed to meet the requirements of NEBS Level 3, FCC-B, CE and UL, as well as being completely RoHS compliant. The chassis comes standard with front and rear panel mounted ESD jacks along with a pair of recessed rack adaptors that set the entire rack back 2 inches to create a cable management area for the cables that are connected to the front of the CompactPCI cards.

FabricPac SM cooling system features an evacuation cooling design that is supported by a front removable fan tray, which contains three high-powered fans that are speed-controlled and monitored by the IPMI System Manager. Airflow is front intake with rear exhaust with an average of 400 LFM per slot to all node, switch, and power supply slots.

Versatile. Reliable. Carlo Gavazzi's 5359 FabricPac SM Series CompactPCI enclosures are designed to meet the needs of embedded, telecommunications, development, testing, military, and measurement.

FEATURES:

- Redundant IPMI System Manager
- CompactPCI 2.16 fabric backplane with two fabric switch slots and legacy 64-bit/33 MHz Bus
- RoHS and NEBS Level 3 compliant
- Hot Swap 400 or 600 watt power supply
- Front replaceable speed-controlled and monitored fan tray
- 19-inch or 23-inch rack mountable
- 15.75" (9U) high x 12" deep enclosure

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For more information, contact: pr@cg-cs.com

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Tundra Semiconductor
603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Tundra Tsi384™ PCI/X-to-PCI Express Bridge

The Tundra Tsi384 is a high-performance PCI Express-to-PCI/X bridge. The Tsi384's PCI Express interface has superior performance and supports 1, 2, or 4 lanes and enables the bridge to offer exceptional throughput performance of up to 1 GBps. The Tsi384 has low latency with its advanced queuing and buffering architecture, maximizing throughput and minimizing latency. The device's PCI/X interface offers designers extensive flexibility by supporting transparent, opaque, and non-transparent addressing modes. The Tsi384 has a typical power consumption of 1.3W, and incorporates advanced power management to minimize power consumption during operation.

Typical applications include: server motherboards, server add-in cards, storage HBAs, routers, and single board computers.

FEATURES:

- Superior system performance
- Low latency, high throughput
- Low 1.3W power consumption (typical)
- Non-transparent, transparent and opaque bridging support
- PCI/X Interface can operate up to 133 MHz in PCI-X mode, or up to 66 MHz in PCI mode
- Industrial temperature standard and RoHs compliant packages

For more information, contact: sales@tundra.com

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Tundra Semiconductor
603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Switch network fabrics

Tundra Tsi578™ Serial RapidIO Switch

The Tsi578 Serial RapidIO® Switch is setting industry benchmarks for high performance and low power consumption through an innovative feature set. It supports RapidIO version 1.3 and is ideally suited for AdvancedTCA® and MicroTCA™ backplane or local DSP connectivity. These platforms will benefit from the switch's ability to route packets to more than 64,000 endpoints, independent unicast and multicast routing mechanisms, as well as error management extensions. Scalable for a broad spectrum of wireless, networking, military, and video infrastructure applications, the Tsi578 Serial RapidIO switch enables designers to take advantage of configuration options to optimize link speed and power consumption for the application.

FEATURES:

- Supports 80 Gbps aggregate bandwidth
- Up to eight 4x mode ports or 16 1x mode ports
- Port frequency configuration to 1.25, 2.5, and 3.125 Gbaud with 8b/10b encoding
- Integrated high-speed, full duplex SerDes with 120-200 mW per port power
- High-performance hardware multicast
- Advanced traffic management features

For more information, contact: sales@tundra.com

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Xilinx
2100 Logic Drive • San Jose, CA 95124
408-559-7778
www.xilinx.com

Xilinx Virtex-5 LXT FPGA Development kit for PCI Express®

The Virtex-5 LXT FPGA Development kit for PCI Express® supports PCIe®/PCI-X™/PCI™. This complete development kit passed PCI-SIG compliance for PCI Express v1.1 and enables you to rapidly create and evaluate designs using PCI Express, PCI-X and PCI interfaces.

Virtex™-5 LXT XC5VLX50T-1FF1136 (production silicon)

Serial Connectivity:
PCIe: 8-lane add-in card connector

- SFP: 2 transceiver module ports (SFP modules not included)
- SATA: 1 Serial ATA disk drive interface connector
- SMA: 1 SMA port off-board GTP transceiver connectivity
- USB: 1 USB 2.0 port (USB interface cable not included)

Parallel Connectivity:
- PCI/PCI-X: 64-bit 3.3V add-in card connector
- LVDS: 2 SAMTEC LVDS interface connectors

Additional Connectivity:
- Xilinx Generic Interface (XGI) headers support installation of Xilinx daughter card (sold separately)

Memory Resources:
- 200-pin 1.8V SODIMM socket with 256 MB (32M x 64-bit) DDR2 SDRAM 256MB 200-pin SODIMM

Device Configuration:
- Static or dynamic device reconfiguration support with the XC2C32 CoolRunner™ II CPLD
- Device configuration through on-board Platform Flash, or download using Xilinx Platform Cable USB

Xilinx IP LogiCOREs supported:
- PCI Express endpoint designs in X1, X2, X4, and X8 configurations
- PCI-X 64b @ 66/100/133 MHz
- PCI 32b @ 33/66 MHz, 64b @ 33 MHz

Clocking:
- Three on-board clock sources
- Two programmable clock synthesizer chips to support DDR2 memory interfaces, 10/100/1000 Mb Ethernet protocols, SATA, Fibre Channel, Aurora, and other serial GTP baud rates
- PCI clocking support for global and regional clocking applications

FEATURES:

- Virtex™-5 LXT XC5VLX50T-1FF1136
- Platform USB programming cable
- Xilinx Tools and Design Resources
- ISE Evaluation Software
- Resource CD (Reference Designs, Labs, Demonstrations)
- Getting Started
- Welcome Letter
- Quick Start Guide
- PCIe Customer Class information
- Xilinx Productivity Advantage document
- Designs for Xilinx LogiCORE Endpoint Block and Endpoint Block Plus IP for PCI Express
- Evaluation licenses for the Xilinx PCI-X, and PCI64 LogiCORE™ IP solutions
- Device Driver development kit from Jungo Software Technologies

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For more information, contact: alex.goldhammer@xilinx.com

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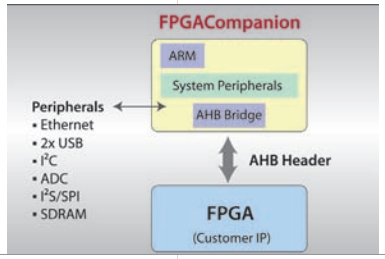
FPGACompanion™

Faraday's FPGACompanion™ (FC) is a highly integrated SoC that combines a 190MHz ARM™ v4 compatible ISA CPU and peripherals with an ARM AMBA™ 2.0 AHB transaction bridge, enabling direct connectivity to external FPGA devices.

The FC addresses a common issue for system companies that generally start with an x86™-, PowerPC™- or MIPS™-based FPGA and are required to migrate to an ARM™ SoC for volume cost reduction that entails considerable software porting effort and risk. By using the FC, designers can start with a low cost prototype model, while keeping the chance to smoothly migrate their FPGA RTL to an architecturally compatible structured ASIC, to achieve their long term goals of BOM, power dissipation and board area reduction, without software complications.



FEATURES:

- 190MHz ARM CPU and peripherals
- External AHB bus for FPGA connectivity
- 10/100 Ethernet MAC
- 2x USB 2.0 controllers and PHY
- 484-pin PBGA (23 x 23mm²)
- EVB and documentation

For more information, contact: moezzi@faraday-tech.com

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System-on-Chip (SoC)

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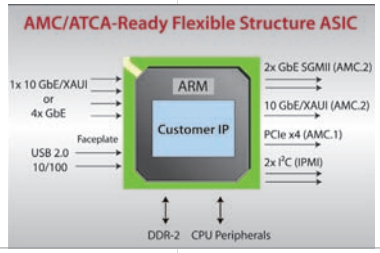
Faraday Technology
490 Deguigne Drive • Sunnyvale, CA 94085
408-522-8888
www.faraday-tech.com

NC Express™

The NC Express™ is a highly integrated 90nm Structured ASIC SoC platform that combines Faraday's industry leading Metal Programmable Cell Array™ (MPCA) technology with high-speed multi-protocol Serial I/O optimized for complex networking and communication ASIC, ASSP, and SoC designs.

With 1/3 the NRE of standard cell 90nm ASIC, 3x faster turnaround time, and use of standard ASIC design tools and flow, NC Express offers a rapid time to market silicon development alternative with attractive ROI economics. Faraday's NC Express™ is a suitable platform for a number of applications including AdvancedTCA and AdvancedMC, communications, enterprise networking, telecom, embedded, security, storage, and blade server markets.



FEATURES:

- 16x 1.25-3.125G SerDes, 5.5M usable gates/7M bits SRAM
- Pre-diffused 363MHz ARM926EJ CPU, DDR-2 PHY, USB 2.0 PHY
- On-demand diffused IP: 10GbE MAC, GbE MAC, PCIe x4/x8, DDR-2
- 860-pin FC-BGA 31 x 31mm
- FPGA-based Evaluation board
- NRE covers Metallization, chip assembly, packaging and test

For more information, contact: moezzi@faraday-tech.com

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First Silicon Solutions
1260 N.W. Waterhouse Avenue #100
Beaverton, OR 97006-5794
503-597-5091 x103
www.fs2.com

System Navigator for MIPS

System Navigator tools for MIPS Technologies MIPS32® and MIPS64® Cores.

FS2 System Navigator supports all the latest MIPS cores from the 4K™ and 4KE™ trace enhanced through the 24K™, 34K™ and 74K™ cores.

FS2 System Navigator is designed to support the special features and integrated peripherals of the MIPS family of synthesizable cores. On-Chip Instrumentation (OCI®) extensions are provided in the PDTrace block with many of the MIPS cores. Both on-chip and off-chip trace capabilities are integrated into the synthesizable IP model for the core. This allows FS2 to provide a powerful debug tool with advanced features at a competitive price.

FS2 System Navigator is contained in a compact chassis that connects to the target system using a standard 14-pin EJTAG debug connector or 38-pin Mictor connector. Two versions are available. System Navigator supports on-chip trace only requiring some resources in the SoC to capture and store the trace messages on-chip. The System Navigator Pro™ probe supports both on-chip and off-chip trace features. In off-chip trace capture mode, trace data is streamed off the SoC device and captured in the FS2 system analyzer probe hardware with up to 2 GB of trace data.

Extensive debugger support including Eclipse, GDB/Insight Debugger on Windows and Linux

The System Navigator has several software debugger options. It is integrated with the FS2 Eclipse-based Navigator IDE. The probe also runs on the GDB/Insight debugger running on Windows and Linux. FS2 tool features are available from the Eclipse, GDB or Insight debugger interfaces. This provides an excellent source level debugger at a low cost. It is also integrated with the Viosoft embedded Linux Arriba debugger. Now you can use the FS2 System Navigator with the best-in-class software tools for an intuitive, easy to use interface. The system runs on a PC with Windows® 2000/XP or RedHat Linux and requires a USB 2.0 or 10/100 Ethernet connection (optional). For designs requiring both on-chip and off-chip trace capture, the System Navigator Pro is available with both USB2.0 and 10/100 Ethernet host connections.

FEATURES:

- Utilizes On-Chip Instrumentation (OCI®) debug extensions in the synthesizable core
- One tool supports all MIPS cores cores including 4K™, 4KE™, 5K™, 24K™, 34K™ and 74K™ cores
- Supports multiple source level debuggers including: Eclipse, GDB Insight and Viosoft Arriba debuggers
- On-chip trace and optional off-chip trace with some core implementations
- On-chip trace depth up to 1024 words (PC trace only)
- Real-time PC execution trace, load/store address, and data trace (off-chip mode)
- Trace can be gated on/off by on-chip triggers
- Scalable internal trace depth or external trace port width and speed
- Off-chip trace up to 128K 32-bit words
- Unlimited software breakpoints via SDBBP instruction
- Single step by assembly or C source line, read-write all CPU registers, read-write memory whether CPU is stopped or running
- Multi-core debug with multiple MIPS cores – mixed core debug with MIPS and other cores supported as an option
- To download the System Navigator datasheet go to: www.fs2.com/pdfs/SNAV-MIPS.pdf

For more information, contact: info@fs2.com

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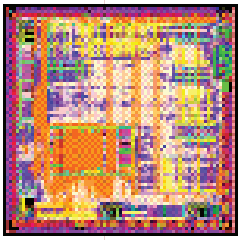
4690 Millennium Drive • Belcamp, MD 21017
800-533-3958
www.safenet-inc.com/ip

SafeXcel IP

SafeXcel IP - Inline Security Engine
The SafeXcel IP Inline Security Engine is the ideal choice for communications processors and general-purpose processors that require maximum data plane offload to dedicated security hardware. The Inline Security Engine delivers precisely the throughput levels the market requires, ranging from 400 Mbps for small 64-byte packets to 1 Gbps for 1500-byte packets. For designs that already include or don't require packet classification and flow processing, the product is also available in a configuration that includes only the inline cryptographic processing functionality.



FEATURES:

- Silicon proven IP design
- Reliable and easy to integrate
- Robust, high-speed implementations of Complete Security processing systems and individual algorithms
- Includes packet classification and flow processing
- Superior throughput across all packet sizes
- Get to market faster, while reducing design time and cost

For more information, contact: info@safenet-inc.com

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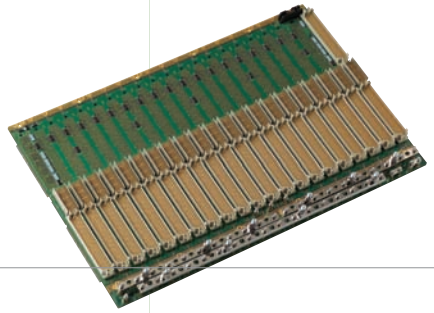
Hartmann Elektronik GmbH
Motorstrasse 43 • Stuttgart, D-70499 DE
+49-0711-1398-90
www.hartmann-elektronik.com

VME64x 6.5U ADC

The VME64x is an extension of the VME family according to ANSI/VITA 1.1-1997 and permits 64-bit data traffic. Automatic daisy chain wiring with OR gates makes manual setting of jumpers unnecessary. ALL Hartmann VMEbus boards are based on the HIGH-SPEED DESIGN concept. Shielding of each individual signal line assures minimal coupling and, therefore, guarantees trouble-free operation. Low reflection is achieved by means of uniform signal line surge impedance. The board thickness of 4.3 mm guarantees mechanical stability during assembly insertion. Power is supplied via screw connections and terminal bars. It is also available without the J0 connector.



FEATURES:

- Available as a 2, 5, 7, 9, 12, or 21-slot backplane, with or without a J0 connector; automatic daisy chain, active termination
- +5 V 7 +3.3 V/GND is supplied via terminal bars
- Outer layers designed as shielded areas (best HF); HF coupling of card, rack, and system ground
- Maximum loading of terminal bar = 200 A; screw = 25 A
- Termination: active -20 °C up to +85 °C
- Impedance checked transfer characteristics

For more information, contact: info@hartmann-elektronik.de

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Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.gavazzi-computing.com

646 5U aTCA System

The 646 Series of 5U AdvancedTCA systems is designed to the PICMG 3.0 AdvancedTCA specification. The systems support six slots at 30 mm pitch front and rear with a 5-slot high-performance backplane, which is configured as a 3X Replicated Full Mesh extended fabric topology, maximizing bandwidth with a 10 Gbps transfer rate.

All of the systems in this series have front accessible cooling modules, a feature which enables them to optimize power dissipation while minimizing MTTR. The high-performance thermal management system contained within the 646 Series is comprised of two 6-fan modules that are configured in a push-push orientation to provide the required airflow to cool 250 watts front side and 30 watts back side. The 646 Series also features a front removable NEBS filtered intake.

Dual Redundant Shelf Management Modules, featuring Pigeon Point System or Intel technology, are available in the 646 Series. These Shelf Management Modules reside in a dedicated front panel slot, allowing the chassis and backplane to accommodate six slots of full size AdvancedTCA boards and five of their RTMs. All field replaceable units are intelligent devices and communicate to the Shelf Managers through the IPMI.

Rear access dual redundant EMC filtered -48 V power entry modules are capable of handling 30 A each and include intelligent IPMI Controller and FRU data module.

The 646 Series systems are designed to meet RoHS, NEBS, FCC Class A/B, UL 60950, and CE requirements.

Pantagruel Printing

FEATURES:

- 8.75" (5U) H x 17.5" W x 16.4" D
- 6-slot 3X Replicated Full Mesh extended fabric backplane
- Front and rear removable push-push intelligent cooling
- Cooling system that provides redundant cooling for 250 watts per slot front side and 30 watts back side
- Front replaceable dual redundant Shelf Management Modules
- 6-slot, 8U x 280 mm, 6HP (30 mm) sub rack
- 5-slot, 6U x 100 mm, 6HP (30 mm) rear transition rack
- Front/rear ESD jacks
- Dual redundant -48 V input intelligent power entry modules

Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.gavazzi-computing.com

709 Rugged Chassis

Carlo Gavazzi Computing Solutions 709 Series Rugged Rackmount Enclosures are engineered for dependability in some of the most severe and extreme environments involving airborne, shipboard, and ground mobile applications. Designed as a rugged solution to meet a broad spectrum of Military Standards, the 709 has a longstanding reputation as a commercial-off-the-shelf (COTS) product that can be easily configured to meet the most challenging deployed requirements.

Enclosures are configured as a 19" rack mount system capable of supporting a wide variety of industry bus standards such as VME, VME64x, VXS, VXI, CompactPCI, and custom bussed backplane technologies. Available in heights ranging from 8U to 14U, these systems are configurable for either rigid mount or shock isolated card cages. The 709 Series utilizes an aluminum, welded design incorporating EMI "honeycomb" filters and environmental gaskets on all access panels to meet stringent emissions requirements. Power supply options provide a wide range of inputs from AC single and three-phase to DC and provide output power up to 2400 watts. The internal rack infrastructure has been designed to meet IEEE1101.10/.11. All systems can be designed to accommodate application specific I/O requirements. Rugged, Reliable and Ready for deployment, Carlo Gavazzi Computing Solutions 709 Series of Enclosures.

FEATURES:

- VME, VME64x, VXS (VITA 41.0), VXI, CompactPCI compatible
- 8U to 14U height offerings
- 125" Aluminum welded construction
- 187" Aluminum front panel
- 350-1600 watt power supply options
- AC Input: 85-264VAC, 47-440Hz
- DC Input: 18-36VDC options
- Shock Isolated card cage
- Removable shock isolated drive bays

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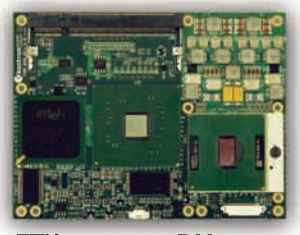

ETXexpress-PM

microETXexpress-PM

Kontron ETXexpress modules give embedded designers the ability to meet all their application requirements. Whether it's high performance, fast communication or a pathway to future expansion, ETXexpress modules are the needed components. When you have the right building blocks – the possibilities are endless!

Endless Possibilities...

- High performance processors
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Harting Connectors

HARTING AdvancedTCA® & MicroTCA™ Connectors

The HARTING AdvancedMC™ connector (B+ style) is fully compliant with the PICMG AMC.0 specification for use with AdvancedTCA® carrier boards or related applications; the HARTING MicroTCA™ connector is fully compliant with the PICMG MicroTCA™ specification for use with MicroTCA™ backplanes. Both connectors are designed to support the full range of AdvancedMC™ data transmission speeds up to 12.5 Gbps while sharing a precision press-fit compliant pin designed for 0.55 mm plated PCB holes. This provides significant reliability advantages over other termination technologies. The footprints minimize PCB layer count, leading to PCB mfg cost reductions. HARTING AdvancedMC™ connectors feature **con:**card+® technology for enhanced mating reliability.

con:card+® Technology

con:card+® is a quality seal for AdvancedMC™ connector that delivers a significant increase in the reliability of MicroTCA™ and AdvancedTCA® systems. To reach the target availability of 99.999 percent, all system components must be coordinated, and functionally reliable. Today, it is virtually impossible for series production to meet tolerances for AdvancedMC™ modules as defined by PICMG specs. To address this, **con:**card+® offers five key reliability enhancements* highlighted by the innovative GuideSpring.

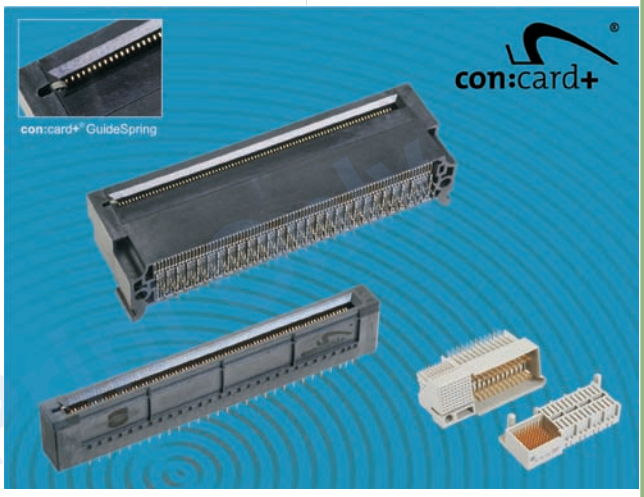
GuideSpring

The HARTING **con:**card+® GuideSpring offsets module tolerance deviations by constantly pressing the module against the opposite wall. With this displacement toward the middle, the AdvancedMC™ module is optimally positioned and the mating reliability increases tremendously. In addition, the GuideSpring secures the module position in the case of shock and vibration. This prevents loss of contact and surface wear.

Power Connectors

HARTING also offers the full range of power connectors specified for use within AdvancedTCA® or MicroTCA™ systems.

Press-in Tooling – The different demands of system design are covered by HARTING's highly adaptable tooling system for AdvancedTCA® or MicroTCA™ connectors. HARTING has a special tooling system for the AdvancedTCA® B+ AdvancedMC™ connector for a reliable and safe press-in process.



FEATURES:

- AdvancedTCA® and MicroTCA™ Connectors: Press-fit termination technology for a reliable connection; Assembly with standard flat rock
- High availability: MicroTCA™ and AdvancedMC™ B+ connectors are in serial production; High-speed differential applications up to 12.5 Gbps
- Optimized footprint enables routing on low layer count; Fully compliant with PICMG AMC.0 and MicroTCA™ specifications
- Excellent routing capabilities with wide-routing channels and low cross talk

***con:**card+® Design Enhancements

- The GuideSpring offsets PCB finger tolerance deviations by constantly pressing the module against the opposite wall
- The GuideSpring slot is optimally designed for the AdvancedMC™ module, and increases mating reliability
- GuideSpring secures the module position in the case of shocks and vibrations. This prevents loss of contact and surface wear.
- Increased wear resistance with corrosion-resistant contact plating, special contact surface and relaxation-resistant material; ruggedized press-fit connection
- Meets the AdvancedMC™ 200 mating cycles specification using Harting's experience in stamping and components to minimizing gold pad wear

For more information on **con:**card+® visit www.concardplus.com

For more information, contact: Remy.Trotabas@HARTING.com

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AdvancedTCA Enclosure Family

Rittal Electronic Systems – the complete know-how.
What really counts is reliability. Rittal Shelf Management Concepts incorporates innovative components to produce reliable systems available up to Level 5 for AdvancedTCA and MicroTCA. Everything is fully assembled, ready to run, and individually configured. The same naturally applies equally for CompactPCI, VME, and VME64x. One supplier, one manufacturer, one quality standard. As the leading system supplier, Rittal is your one-stop partner for electronic know-how and a reliable promise of all-inclusive competence – worldwide.

Case solutions in 5U, 12U, 13U, or cube design. Climate control concepts up to 200 W/board and more. High speed backplanes up to 10 Gbps.

FEATURES:

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- Case solutions in 5U, 12U, 13U, or cube design; climate control concepts up to 200 W/board and more
- High speed backplanes up to 10 Gbps – Variable Shelf Management Concepts – Rittal incorporates innovative components to produce reliable systems available up to Level 5 for AdvancedTCA and MicroTCA
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Industrial Box PCs

Kontron has an impressive array of Box PCs in various form factors which cover a broad range of applications. From an embedded Mini-ITX box chassis like the Kontron KB-2100 to the Kontron VBox-Express which supports the Modular ETX-Express® technology, Kontron systems do it all.

We realize that projects are as individual as you are, with their own specific requirements and goals. That is why Kontron works with each customer to develop customer-specific variants or ground-up custom systems for many of our customers.

If you have any specific chassis or box needs let our talented sales department know. Kontron can identify the proper product for you and also discuss how you can get your own customized system developed to your specifications.

FEATURES:

- Key Box PC Product Focus:
- Kontron VBox-Express: Kontron ETX-Express® based system w/ PCI or PCI-Express expansion and support for Core Duo Processors
- Kontron Intelligent Minicomputer: Mini-ITX based system with 1 PCI slot expansion and support for Intel® Core™ 2 Duo Processors
- Kontron Think-I/O: Automation based product with I/O Expansion and support for Core Duo Processors
- Kontron KB-2100: Slimline embedded Mini-ITX Solution with support for Intel® Pentium M based Processors

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KISS Rack Family

The Kontron Industrial Silent Server or KISS family is the latest generation of industrial-grade rack mount systems from Kontron. These systems offer up a host of built in features, and the most remarkable feature is their sound. Compared to ordinary rack mounts, these systems are whisper quiet. In addition to the quiet operation, their other notable features include; shock-mount drive bays, redundant power supplies, hot-swap fans, flexible drive options, and also a specialized card retension system.

These systems take advantage of the latest technolgies like hot-swap SATA RAID and PCI-Express. Kontron KISS also support ATX, Flex or MITX Motherboards, PICMG 1.0 SBCs as well as the latest PICMG 1.3 SBC's.

FEATURES:

- Quiet operation, as little as 35db
- Use as rackmount, desktop or tower
- Hot-swap SATA Raid 0/1/5 Subsystems available
- Long-life RoHS-compliant systems
- Wide array of custom capabilities
- Available in black

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System packaging

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Kontron MicroTCA Systems

MicroTCA is a new PICMG standard for open modular systems designed to address cost sensitive and physically small applications. In addition to the wide variety of form-factors offered by Kontron, MicroTCA offers extremely high communication bandwidth, high processing capacity, and high availability.

Deployed into a wide range of application spaces, including: defense, government, aerospace, industrial automation, and medical, Kontron's MicroTCA proves itself as a versatile and affordable form-factor. Applications in these spaces present similar requirements, including very high communication bandwidth and/or very high availability in a small form factor. All of these factors combine to help make Kontron's MicroTCA Systems a leading choice for demanding applications.

FEATURES:

- Wide range of form-factors from 2 slot 1U systems through 12-slot 8U systems
- Use of AdvancedMCs provides for a vast amount of computing resources
- No single point of failure and hot-swappable components
- Offers designers compute power, communication bandwidth, high availability
- Modular and serviceable

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Molex

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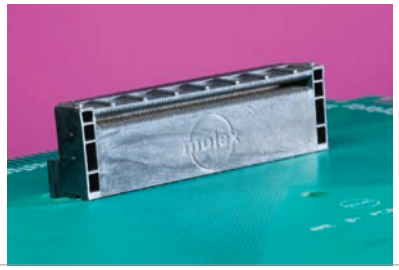
630-969-4550
www.molex.com

AdvancedMC B+

AdvancedMC™ B+ connectors from Molex support the next generation of mezzanine card standards and speeds of 12.5 Gbps.

These 170-circuit connectors support the AdvancedMC (Advanced Mezzanine Card) base specification as developed by PICMG. Molex AMC.0 B+ connectors feature controlled impedance and reduced crosstalk, plus a footprint launch optimized for high-speed data rates. The design enables the connector to achieve 12.5 Gbps signal transmission.

This enhanced footprint further reduces crosstalk by managing inter-pair affinity and incorporating additional ground vias for isolation, resulting in crosstalk of less than 3% at 12.5 Gbps.



FEATURES:

- B+ style connector meets PICMG AdvancedMC™ specification and industry-standard requirements
- Controlled impedance and reduced crosstalk
- Press-fit contacts for simpler application to PCB and superior signal integrity
- Footprint launch optimized for high-speed data rates
- Design enables 12.5 Gbps signal transmission
- Crosstalk of less than 3%, with adjacent Tx and Rx

For more information, contact: microtca@molex.com

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Tri-M Engineering

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www.tri-m.com

FlexTainer

The FlexTainer is a flexible enclosure system for EPIC, 3.5", Mini-ITX and EBX single board solutions. The FlexTainer ensures the payload receives maximum shock and vibration protection through a dual system of isolating and absorbing rubber mounts. Internally, the SBC solution is mounted to a carrier plate that is held in place with rubber guides, thereby isolating the cards from the extruded aluminum enclosure. Externally, the enclosure mates with a thick rubber mounting pad, allowing the FlexTainer to be attached to a bulkhead. The FlexTainer is constructed of 0.125" aluminum with a cross-section measuring 7.00" (W) x 4.00" (H), allowing ample room for the SBC, up to two PC/104 peripheral modules and one 3.5" HDD.

FEATURES:

- Rugged anodized aluminum
- Securely holds EPIC, 3.5", Mini-ITX and EBX single board solutions
- Dual system of shock and vibration isolation
- Ample room for expansion for up to two PC/104 modules and one 3.5" HDD
- Available in 4.55", 6.75" and 10" lengths
- Easily customized to fit your application – Sizes, Colors, Logos, Endcaps

For more information, contact: info@tri-m.com

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HE104-DX

The HE104-DX is a 60 W PC/104 DC-DC converter with ±5 V and ±12 V DC outputs. The HE104-DX is designed for low-noise embedded computer systems and has a wide input range of 6 to 40 V DC.

The HE104-DX is a state-of-the-art MOSFET based design that provides outstanding line and load regulation with efficiencies up to 95 percent. Organic semiconductor capacitors provide filtering that reduces ripple noise below 20 mV. The low-noise design makes the HE104-DX ideal for use aboard aircraft or military applications, or wherever EMI or RFI must be minimized. The HE104-DX has an opto-isolated on/off input, SD, enabling remote control. Extended temperature operation, -40 °C to +85 °C, is standard.

FEATURES:

- 60 W DC-DC power supply
- 5 V, 12 V, -5 V, -12 V DC outputs
- 6 to 40 V DC input
- Up to 95 percent efficiency
- Extended Temperature (-40 ˚C to +85 ˚C)
- Pb and Pb-free (RoHS) versions available

For more information, contact: info@tri-m.com

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HE104+DX

The HE104+DX rugged 108 W PC/104-*Plus* is the power solution for embedded applications. The HE104+DX is a high efficiency, high performance DC-to-DC converter that supplies +3.3 V, +5 V, +12 V and -12 V outputs to the PC/104 and PC/104-*Plus* bus. The HE104+DX is designed for low noise embedded computer systems, has a wide input range of 6 V to 40 V DC and is ideal for battery or unregulated input applications. The HE104+DX is specifically designed for vehicular applications and has heavy-duty transient suppressors that clamp the input voltage to safe levels, while maintaining normal power supply operation. The HE104+DX is a compact, PC/104-*Plus* compliant design and comes with an extended operating temperature of -40 °C to +85 °C.

FEATURES:

- 108 W DC-DC Converter
- 6 V to 40 V DC input
- +3.3 V, +5 V, +12 V and -12 V DC output
- PC/104-*Plus* compliant
- Extended Temperature (-40 ˚C to +85 ˚C)
- Pb and Pb-free (RoHS) versions available

For more information, contact: info@tri-m.com

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VME and VME64x cPCI or PXI chassis available in many configurations from 1U to 12U, 2 to 21 slots. Many power options up to 1200 watts. Dual hot-swap available in AC or DC versions. We have in-house design, manufacturing capabilities and in-process controls. All Vector chassis and backplanes are manufactured in the USA and are available with custom modifications and the shortest lead-times in the industry.

Series 2370 chassis offer the lowest profile per slot. Cards are inserted horizontally from the front and 80MM rear I/O backplane slot configuration is available. Available in 1U, 2 slots up to 7U, 12 slots for VME, CompactPCI, or PXI. All chassis 1101.10/11 compliant. Hot-swap, plug-in AC or DC power options.

Our series 400 enclosures feature side filtered air intake and rear exhaust, for up to 21 vertical cards. Options include hot-swap, plug-in AC or DC power and system voltage/temperature monitor. Embedded power supplies available up to 1200 watts.

Series 790 is MIL STD 461D and E compliant and certified, economical and lighter weight than most available today. It is available in 3U, 4U and 5U models up to 7 horizontal slots.

All Vector chassis are available for custom modification in the shortest timeframe. Many factory paint colors are available and can be specified with Federal Standard or RAL numbers.

For more detailed product information go to www.vectorelect.com or call 1-800-423-5659 and discuss your application with a Vector representative.

FEATURES:

- COTS or Ruggedized EMI/RFI models
- Vertical or horizontal card insertion
- Card sizes up to 9U X 400mm
- System monitoring option (CMM)
- AC or DC Power Input
- Power options up to 1200 watts

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USB BitScope 100

BS100U is the newest member in BitScope's family of PC-based mixed signal storage oscilloscopes. It has a 100 MHz input bandwidth and supports concurrent analog and logic capture.

BS100U is opto-isolated. Unlike comparable USB instruments, it can be referenced independently so ground-loops or USB dropouts are never a problem.

An independent user programmable DSP waveform generator is built-in for simultaneous waveform output and the Smart-POD connector allows many expansion options.

BS100U comes with the BitScope DSO and Library software for Windows or Linux. An external trigger input, calibration pin, and indicator LEDs complete the picture for a powerful test and measurement system in a compact and affordable package.

FEATURES:

- Digital oscilloscope: 100 MHz, dual channel, four inputs (via BNC and POD); Up to 64kS every channel
- Logic analyzer: 40MSps, eight channels, 25nS capture, up to 64kS every channel
- Mixed signal: 9 channels (eight logic plus one analog) displayed time synchronized with cross-trigger
- Multiband real-time spectrum analyzer: Up to 100 MHz with live update split screen waveform/spectrum display
- Waveform generator: DSP based arbitrary concurrent operation. Flash based, user programmable
- Expandable, electrically isolated, user programmable with data recording included; ideal for custom DAQ solution

For more information, contact: sales@bitscope.com

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T560

HIGHLAND TECHNOLOGY

The T560 builds on Highland Technology's family of small digital delay generators, intended for use in embedded OEM applications. The T560 standard, packaged versions are usable in many OEM applications and as evaluation units for custom versions. It uses the technology developed for the Highland models V851 VME module, V951 VXI module, and P400 (benchtop) digital delay generators, with basic TTL/CMOS input and output levels and simplified logic.

The T560 accepts an internal or external trigger and generates four precise output pulses, each user programmable in time delay and width. It is ideal for laser sequencing, radar/lidar simulation, or sequential event triggering.

FEATURES:

- Four TTL-level delay outputs, individually programmable for delay and pulse width
- 10 ps delay resolution, 10-second range, 20 ns insertion delay, 20 MHz maximum trigger rate
- Low jitter, DSP phaselock system has crystal clock delay accuracy w/ zero indeterminancy from external trigger
- Time base with external lock capability, optional TCXO; DDS synthesizer for internal trigger rates
- COMM: RS-232 serial interface standard, Ethernet optional PWR: External universal power supply or 12 Vdc pwr
- Easily mounted enclosure allows short cable runs and reliable unattended operation; custom OEM package

For more information, contact: info@HighlandTechnology.com

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NCI Logic Analyzers

GoLogic

NCI's GoLogic PC Hosted Logic Analyzers provide powerful analyzer performance in a portable package at a low cost. With the choice of 36 or 72 channels and up to 4 Meg samples per channel, our Logic Analyzers can meet most requirements and can trigger oscilloscopes giving mixed signal analysis.

Each engineer can afford to have their own analyzer or can easily share one as no restrictions are placed on copying the software and all software upgrades are free.

The GoLogic can be operated over the internet or LAN using TCP/IP. Custom display windows can be created using the Plug-in Development Kit. The Software Development Kit allows custom applications.

With I2C Bus Analysis Mode view up to 4 million I2C packets with time stamps.

FEATURES:

- 36 Channels @ 500 MHz Timing 1 Meg Samples per Channel, 72 Channels @ 250 MHz up to 4 Meg Samples per Channel
- Portable – weighs less than 1 pound and comes in carrying case
- Prices from $2,995.00: 36 Channels 1 Meg $2,995.00, 72 Channels 1 Meg $4,300.00, 72 Channels 2 Meg $5,500.00
- Flexible Clocking: Clocks in normal or transitional modes. State mode can clock on single or multiple edge
- Scope LinkTrigger DSO and view waveforms. See analog and digital data aligned together timewise
- Extensive Triggering Capabilities: Trigger on Patterns, edges or ranges. 8 Sequence levels with counters

For more information, contact: contact@nci-usa.com

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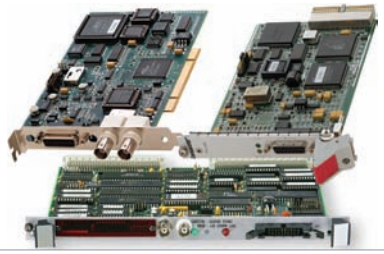

The TPRO/TSAT products provide high-accuracy timing functions on the VME, PCI, or CPCI bus. The boards automatically synchronize an on-board clock to the time transmitted by the GPS satellites or the automatically detected timecode. Several timing functions are derived from the on-board clock, including a programmable periodic pulse rate output (heartbeat), a programmable start/stop output (match), a selectable frequency output (oscillator out, 1 kHz, 1, 5, or 10 MHz), and a time-stamping input (time-tag). The boards also output a timecode signal in IRIG-B format and may also be used as stand-alone timecode generators in "freewheeling" mode using the on-board oscillator as the timebase reference. The TSAT products include an external GPS antenna and cable. Drivers are available.

FEATURES:

- Complete GPS and timecode synchronized reader/generator system
- Autodetects IRIG-A, IRIG-B, and NASA36 timecodes and generates IRIG-B
- High-performance, 2.5 ppm oscillator with Freewheel capability
- Event Capture/interrupt input (supports up to 2000 events per second)
- Programmable alarm and frequency (stable 1, 5, or 10 MHz) outputs
- Comparable PMC, PC104, and IP form factors

For more information, contact: boards@spectracomcorp.com

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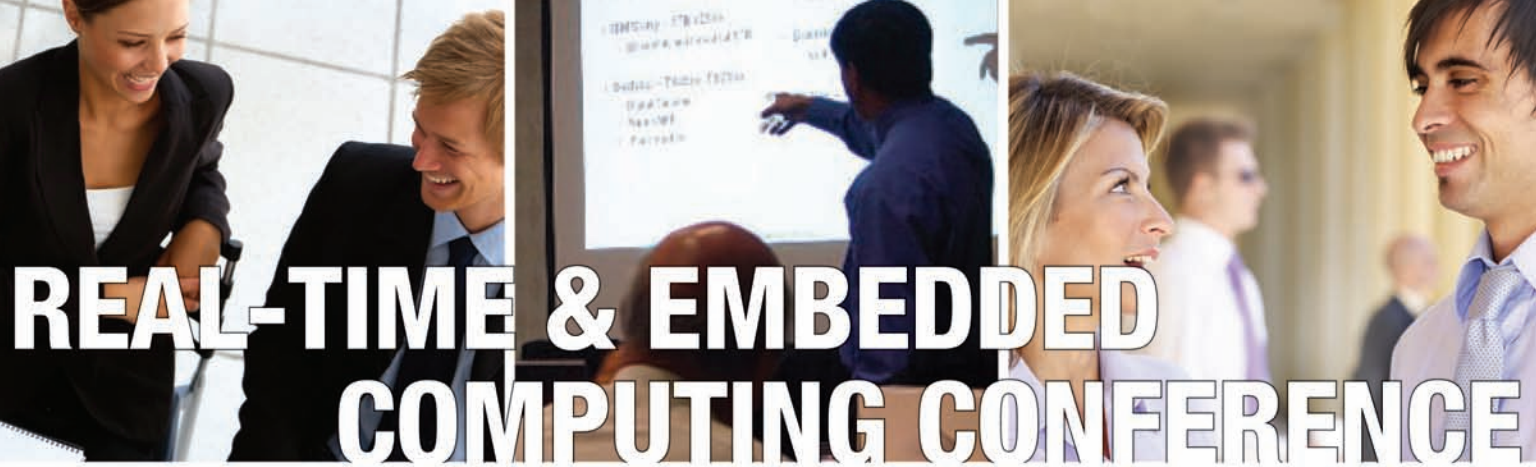

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Vice President Marketing & Sales
Patrick Hopper
phopper@opensystems-publishing.com

Business Manager
Karen Layman

Sales Group

Dennis Doyle
Senior Account Manager
ddoyle@opensystems-publishing.com

Tom Varcie
Senior Account Manager
tvarcie@opensystems-publishing.com

Doug Cordier
Account Manager
dcordier@opensystems-publishing.com

Andrea Stabile
Advertising/Marketing Coordinator
astabile@opensystems-publishing.com

Christine Long
E-marketing Manager
clong@opensystems-publishing.com

Regional Sales Managers

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New England
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Midwest/Southwest
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Headquarters
IEI Technology Corp.
No. 29, Jhongsing Rd.,Sijhih City,Taipei County, 221, Taiwan
Tel: +886-2-86916798 Fax: +886-2-66160028
sales@ieiworld.com www.ieiworld.com

America
IEI Technology USA Corp.
168 University Parkway, Pomona, CA 91768
Tel: +1-909-595-2819 Fax: +1-909-595-2816
sales@usa.ieiworld.com www.usa.ieiworld.com

China
IEI Technology SH Corp.
515 Shen Fu RD. XinZhuang Industrial Develop Zone
Tel: +86-21-5442 9000 Fax: +86-21-5442 9100
sales@ieiworld.com.cn www.ieiworld.com.cn

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