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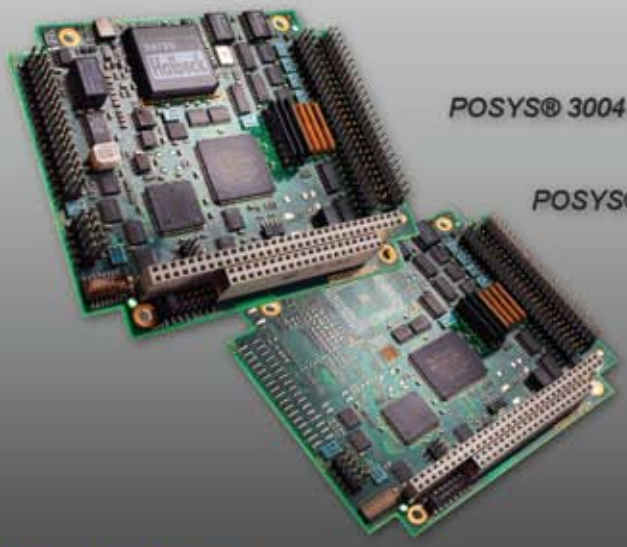

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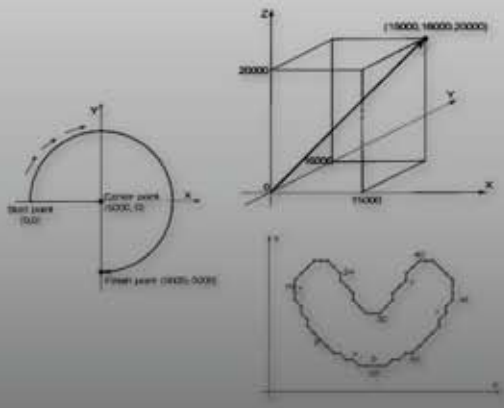

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Patrick Hopper
phopper@opensystems-publishing.com

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
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Regional Sales Managers

Ernest Godsey
Central and Mountain States
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Barbara Quinlan
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Ron Taylor
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International Sales

Dan Aronovic
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OpenSystems Publishing

Editorial/Production office:
16872 E. Avenue of the Fountains, Ste 203, Fountain Hills, AZ 85268
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foreword thinking

By Don Dingee

Questions with too many answers

You know that question you heard in philosophy class: "If a tree falls in a forest and no one is around to hear it, does it make a sound?" The debate is always fun.

Scientific types argue that of course it does; sound is a compression wave in a medium like air or water, and the falling tree certainly produces sound waves. Humanities enthusiasts argue that it absolutely doesn't because sound is a phenomenon that must be detected by a human ear. Animal lovers say their dogs have better hearing than any human and can detect the sound from several miles away. Ecologically sensitive individuals get upset that another tree just died and want a map to the location to set up a protest.

Industrial automation has its own questions right now, and the answers are just as widely varied.

Power

Everyone wants to say they're low power. Compared to what? A nuclear power plant? A server platform? A hummingbird?

Let's face it, low power is in the context of what's available. If you have AC power and forced air, low power can be 50 W. If you want to be fanless, you need to be somewhere under 15 W. If you want to run on batteries or energy harvesting, you can get down into milli- and microwatt levels.

Networking

There's very little difference between "networking" and "not working." (I was working with an OSI 7-layer networking stack at the time. It was mostly not working.) If a networking technology is too complex or won't connect to something you want to talk to, what good is it?

Just on the wireless side of industrial networks, we have Wi-Fi, Bluetooth, ZigBee, 900 MHz, GSM, 6LoPAN, 802.15.4, WirelessHART, ISA100, and many others. Again, choice depends on context and physics – what do you need to connect, what's the distance between nodes, how many nodes are there, how fast does it have to be, and so forth.

But shouldn't networking be getting simpler, conforming to a few specifications with critical mass? We want everything to be able to talk, yet we're generating more and more protocols that perform similar jobs and creating the need for gateways, routers, and switches to move data between them.

Displays

Everyone wants to display information, but there are a variety of ways to do that. Walking around Embedded Systems Conference (ESC) Silicon Valley, there were literally hundreds of booths displaying LCD panels and hardware and software to drive them.

Now that LCD panels are easy to drive, what do we do with them? Most vendors offer some type of library to download fonts and graphics. (Interestingly, Bitstream had a booth at this year's ESC – fonts aren't just for the graphic department anymore.) But there are also higher-level technologies for creating Graphical User Interfaces (GUIs) on small devices – Adobe Flash, Trolltech's Qtopia, Hildon, and more. Again, these are all radically different approaches.

I understand about indecision …

There are more examples – microcontrollers, operating systems, form factors, and the list goes on. Having multiple options to choose from is a good thing. And there's the marketing value-add of being distinctive by being different.

But in any discussion, too many choices – better known as fragmentation – results in no answers and maybe more questions. At some point, meaningful debate comes down to choices you can count on the fingers of one hand.

Speaking of which, I've made a few selections I hope you'll find interesting in our Editor's Choice Products featured on page 74. You'll see why I chose the topics of power, networking, and displays to talk about here.

All I want is to have my peace of mind, and I'm sure you do, too. Is there something you'd like us to dive deeper into that would help clear the confusion? Send me a note at ddingee@opensystems-publishing.com.

Don Dingee

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Creating dynamic HMIs with Adobe Flash

By Paul Leroux and Bill Graham

A Human-Machine Interface (HMI) can make or break an industrial system, and the proliferation of dynamic, graphical HMIs in cell phones and other mobile devices has raised the bar for user interface designs. Everyone now expects HMIs to be slick, intuitive, and even customizable. Fortunately for embedded developers, the same technology behind these graphical interfaces – Adobe Flash – translates well to industrial control systems. Paul and Bill offer some tips on how to make the switch to Flash interfaces.

More than 300 million mobile devices today have Graphical User Interfaces (GUIs) based on Adobe Flash, and that number is projected to exceed a billion by 2010, according to Adobe Systems. Those who design embedded systems for the industrial, medical, and automotive industries are beginning to embrace Flash for one simple reason: it can reduce GUI development time by up to 50 percent. In the past, software teams had to translate their GUI prototypes into C, C++, or Java code, a laborious process that took many weeks or months. Now, teams can design and build GUI components with high-level Flash tools and run those components directly on embedded Flash players without writing graphics code.

Flash is gaining momentum among embedded developers for several reasons, such as:

- More than a million graphics designers worldwide use Flash authoring tools, providing an immense pool of graphics expertise that developers can draw upon. Moreover, developers can easily integrate thousands of Flash components already built for the desktop and handset markets.
- Compared to desktop Flash players, embedded Flash players from Adobe (for instance, Flash Lite 3) use less memory and provide faster rendering with less CPU overhead.
- CPUs and graphics chips for embedded designs now support the frame rates needed for a pleasing Flash experience on VGA and larger displays. For instance, to achieve a smooth 10 frames per second animation, a system needs a CPU with a minimum of 100 MIPS, well below the typical 300-plus MIPS offered by most embedded CPUs today.

To migrate to Flash, embedded developers can choose from an array of tools, many of which they already use. For instance, developers can use CAD tools and desktop word processors to generate Flash content and employ conversion utilities that translate a variety of presentation formats directly into Flash format. Developers also can leverage Flash components that integrate Flash content with ActiveX controls. This breadth of support for Flash content creation and screen control makes for a simple transition to Flash interfaces.

Endless possibilities

Unlike general-purpose programming languages and tools, Flash provides a domain-specific environment for graphics and multimedia, offering almost endless possibilities for building user experiences. Using Flash, developers can create animations and special effects in a fraction of the time traditionally required. Also, Adobe Flash player certification ensures that Flash-based applications work the

same across hardware platforms. As a result, developers can create GUI components once, then deploy them on a range of systems that target different markets or price points.

Nonetheless, to satisfy all the requirements of an embedded system, a Flash implementation must address several issues as to how developers can:

- Combine Flash content with other graphics programs such as Web browsers or 3D visualization applications. Can a single graphics display render both Flash-based and native 2D/3D graphics simultaneously even though they use different draw models?
- Make a Flash-based user interface perform consistently under all load conditions. The GUIs for most embedded systems must respond quickly to user input at all times, which requires a level of priority control and real-time performance.
- Make a Flash-based user interface reliable. Can the system monitor for user interface failures and recover from them gracefully? Can the Flash content coexist reliably with critical processes?
- Control how Flash content interacts with Operating System (OS) services, such as audio output, touch screens, time-critical device drivers, file systems, and networking stacks.

Integrating Flash programs with other graphical applications

Traditionally, a Flash player runs within a Web browser or is launched from a windowing system. However, GUI development can be greatly simplified by turning this model on its head and making Flash the main environment that launches all graphical applications, regardless of whether they are based on Flash. Flash excels as a screen manager, allowing the GUI designer to intimately control menu transitions and audio effects; it also simplifies customization by allowing designers and developers to freely position, resize, and configure graphical components.

Figure 1 shows an example of using Flash as a screen manager. The program

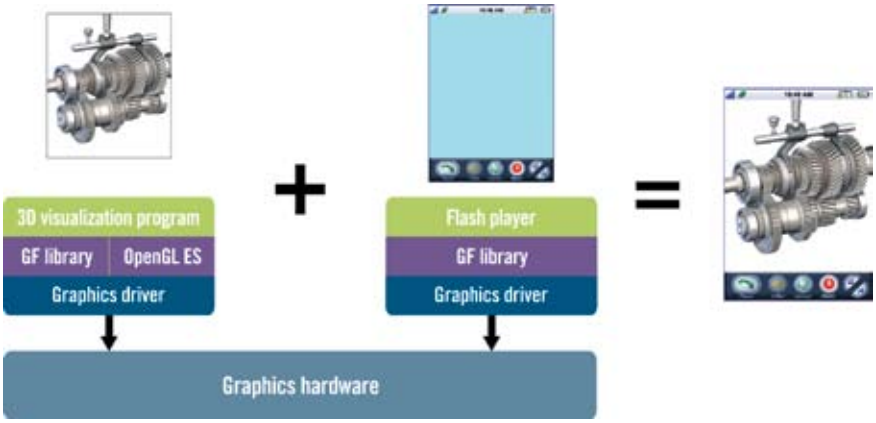

Figure 1

> **Developers can use techniques such as alpha blending and chroma key to make menu buttons and other Flash components semitransparent ...**

on the left draws 3D visualizations in OpenGL ES, a standards-based 3D API for embedded systems. The program has loaded three components directly into its application space: a 2D graphics library, the OpenGL ES 3D library, and a graphics driver that controls the graphics hardware. Loading the driver in this way allows the program to control the graphics chip directly and thereby increase performance. The program on the right is a Flash player. Like the OpenGL ES program, it also directly controls the graphics hardware, ensuring high performance.

Many graphics chips for embedded systems now support multilayering, which allows Flash-based programs to blend seamlessly with other graphics applications on the same display. In Figure 1, the Flash player draws on a foreground layer and controls the drawing of the 3D visualization on a background layer. To make the 3D canvas visible, the developer used a chroma key technique on the foreground layer. Because the 3D rendering and Flash rendering take place on independent layers, the graphics controller can refresh the 3D visualization without redrawing Flash content, thus eliminating flicker and reducing the load on the CPU.

Developers also can use techniques such as alpha blending and chroma key to make menu buttons and other Flash components semitransparent and then place the semitransparent components directly over other content. Figure 2, which shows a semitransparent warning displayed over an animated control console, demonstrates how this approach can help pack more information onto a small screen.

Ensuring predictable response times

An embedded GUI should respond promptly to user commands at all times, even when the system is running CPU-intensive tasks. There is no room for a desktop user experience. The challenge becomes more complicated when multiple graphics programs compete for CPU time. One solution is to create a central display manager that uses thread priorities to determine when each graphics program gets control of the CPU.

In this approach, a program (for instance, a Flash-based player for displaying documentation videos) that needs to join the graphics environment sends the display manager a request. The manager responds with a yes or no, depending on whether the program has sufficient permissions to join. Upon joining, the program gains access to a mutual exclusion lock (mutex).

When the program wants to draw something to the screen, it will wait on the mutex, acquire it, draw directly to the graphics chip, and then release the mutex. Every graphical program competes for this mutex based on its individual priority. Because the highest-priority graphics program will always acquire the mutex first, this approach ensures a level of real-time performance and a consistently fast user experience.

Managing failure conditions

To prevent system downtime, many embedded systems require some level of dynamic fault recovery. Using fault-notification mechanisms provided by the underlying OS, the aforementioned display manager can learn about graphical applications that fail.

If a Flash-based or graphical program fails while holding the mutex, the display manager can release the mutex and give it to the next program in the priority queue. The manager also can recover any resources the failed program used and restart the program.

Interacting with Flash

To integrate Flash successfully, developers must manage two types of interactions:

- Using Flash content to launch and control other Flash content, which requires a mechanism that lets a master Flash application load, position, run, and release secondary Flash applications
- Enabling communication between Flash content and OS services, which requires a mechanism for relaying data requests

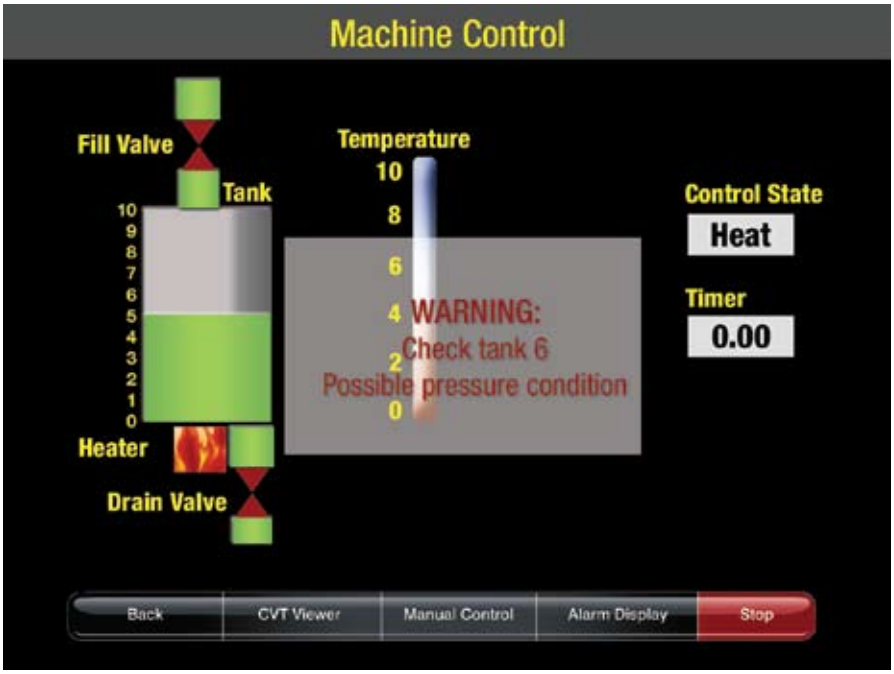

Figure 2

Figure 3 provides an example of how to implement these interactions. An HMI engine allows a master Flash application to manage secondary Flash applications (data point viewer, system configuration manager, and more) while an HMI server provides a gateway to native OS services.

Consider how this design can work in a video player model. As depicted in Figure 4, a user interface consists of the following:

- A viewing area that displays the video (top half of the screen)
- A Flash video player that provides controls for play, next, previous, and so on (middle of the screen)
- An HMI engine written in Flash that controls the main menu buttons (bottom of the screen)

In this example, the HMI engine launches and controls the Flash video player (Flash controlling Flash). The video Flash player then communicates with the video playback OS service through the HMI server (Flash content communicating with native OS services).

The HMI server provides asynchronous communications to OS services. This approach prevents the HMI engine, which runs in the context of the Flash player, from potentially causing the Flash-based GUI to stop accepting input or drawing to the screen.

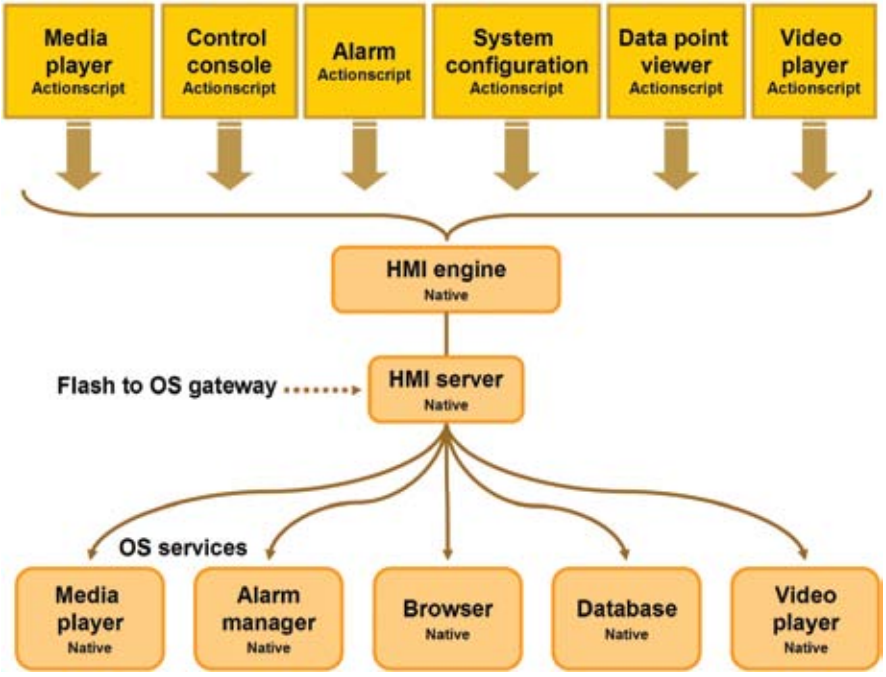

Figure 3

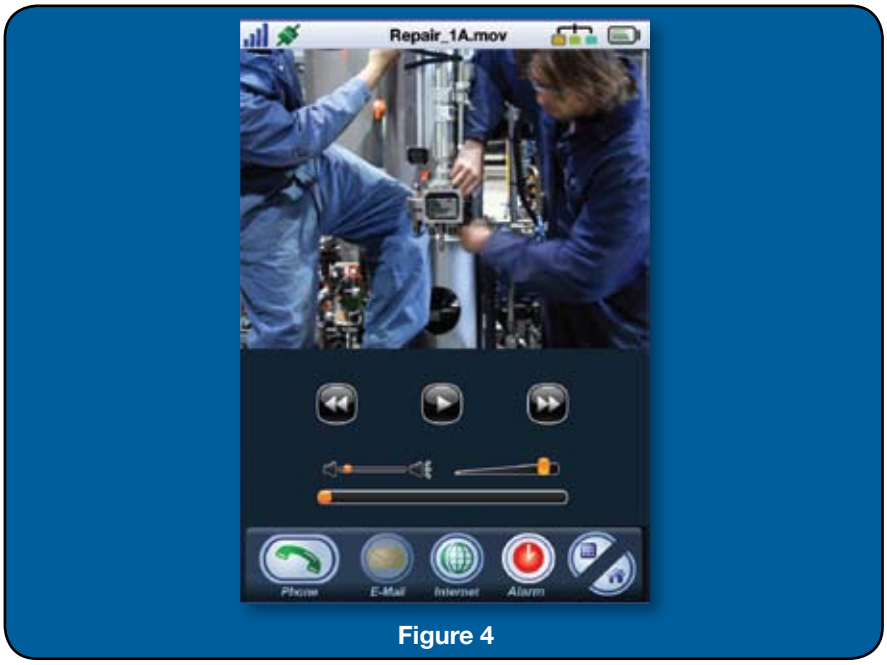

Figure 4

Moving Flash forward in embedded

By combining high-level Flash tools with an appropriate software architecture, embedded teams can leverage Adobe Flash's power and time-to-market advantages while preserving real-time performance and reliability. Moreover, developers can employ component-based HMI frameworks that seamlessly blend 2D/3D applications, Flash applications, and multimedia. IES

Paul Leroux *is a technology analyst at Ottawa, Canada-based QNX Software Systems, with interests in usability, high availability design, multiprocessing systems, and OS kernel architecture.*

Bill Graham *is a senior product line manager at QNX Software Systems. He has more than 18 years of experience in the software industry, including embedded and real-time systems development, UML modeling, and object-oriented design. Prior to joining QNX, Bill held software development, consulting, and product management positions at IBM, Rational, Klocwork, and ObjecTime. Bill holds BS and MS degrees in Electrical Engineering from Carleton University in Ottawa, Canada.*

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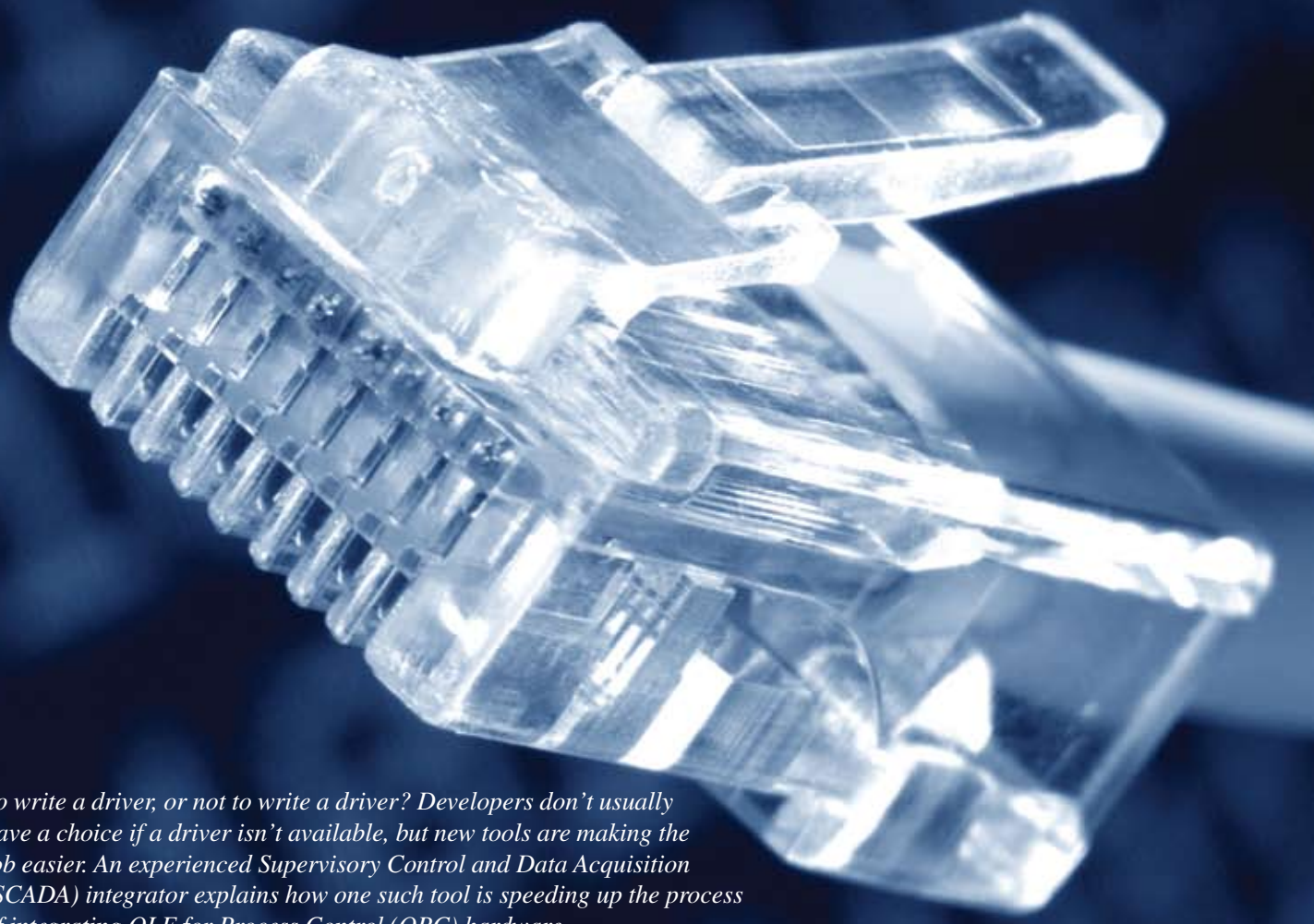
Integrating proprietary serial and Ethernet devices with SCADA/HMI systems

By Stephen Friedenthal



To write a driver, or not to write a driver? Developers don't usually have a choice if a driver isn't available, but new tools are making the job easier. An experienced Supervisory Control and Data Acquisition (SCADA) integrator explains how one such tool is speeding up the process of integrating OLE for Process Control (OPC) hardware.

When starting a SCADA project, developers must first identify the installed devices and controllers to determine how they will interface with the SCADA system. Most of the time, a programmable logic controller with one or more I/O drivers will be available. With OPC's growing popularity, hardware connectivity is becoming less difficult.

However, connecting to devices that lack an available driver often presents the greatest challenge. This is especially a problem with devices that have proprietary serial and Ethernet protocols such as electronic scales, particle counters, controllers, and so forth. Developers traditionally resolved this issue by writing an I/O driver from scratch.

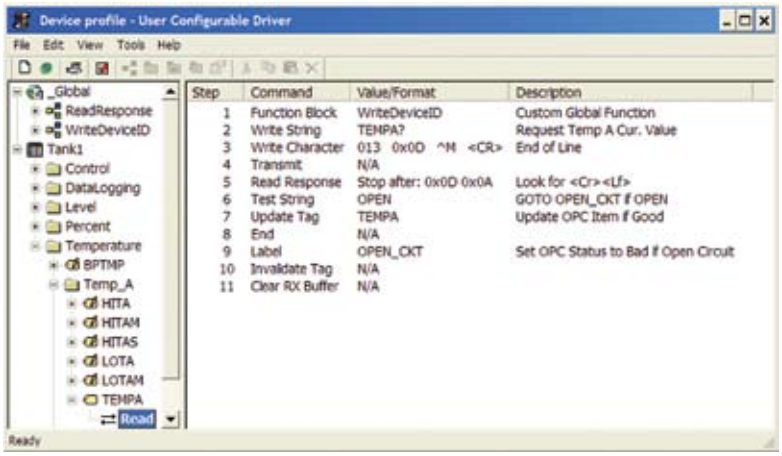


Figure 1

Consequently, developers would do well to heed this advice: Don't bid fixed price. Creating a robust and reliable driver is not trivial, as it requires a keen understanding of hardware and software interfaces and error modes. Additionally, as OPC becomes an industry standard, it only makes sense to undertake the effort if the driver supports the OPC protocol.

Creating drivers without writing them

If developers don't have the time or expertise to write their own drivers, they should consider using the Kepware User-Configurable (U-CON) driver, which has proven useful in two recent development projects. Figure 1 shows the U-CON transaction editor.

U-CON is a universal translator between the proprietary serial world and OPC. With the U-CON driver, developers can easily create OPC data item tags that represent almost any value from the serial device. As with other OPC devices, tags can be read-only or read-write and consist of any data type.

The U-CON transaction editor makes this possible by allowing developers to create the command structure for a tag as a series of simple steps. For example, the screen shot in Figure 1 shows the command structure for reading a temperature probe. The transaction steps are generated using a menu system to create an easy-to-read state machine, as shown in Figure 2.

One of the transaction editor's powerful features is its ability to create global functions that all the tags can reuse. This reduces development time and allows changes to be made in one location for all the tags.

The U-CON driver also enables developers to write the transactions using a device ID variable as opposed to hard-coding the ID for each new device.

U-CON in action

EVSystems developers used the U-CON driver in two recent projects that required integrating GE Fanuc's iFIX SCADA product with legacy devices using a proprietary RS-485 protocol.

A feature common to all Kepware drivers is that all the tags are available via OPC as well as the native *nio* interface in GE iFIX. The latter approach is particularly useful because data can be read directly in iFIX without configuring any OPC items, significantly reducing configuration and validation efforts.

The first application involved 50 cryogenic tank controllers, each with an RS-485 connection and its own ID. Adding a new tank to the U-CON driver was as simple as duplicating an existing tank and changing the ID property. In total, the cryogenic tank driver took developers no more than a week to write, with half of that time spent learning the protocol and gaining familiarity with the product. (Famous last words: "We don't need to read the manual." Sometimes, it helps.)

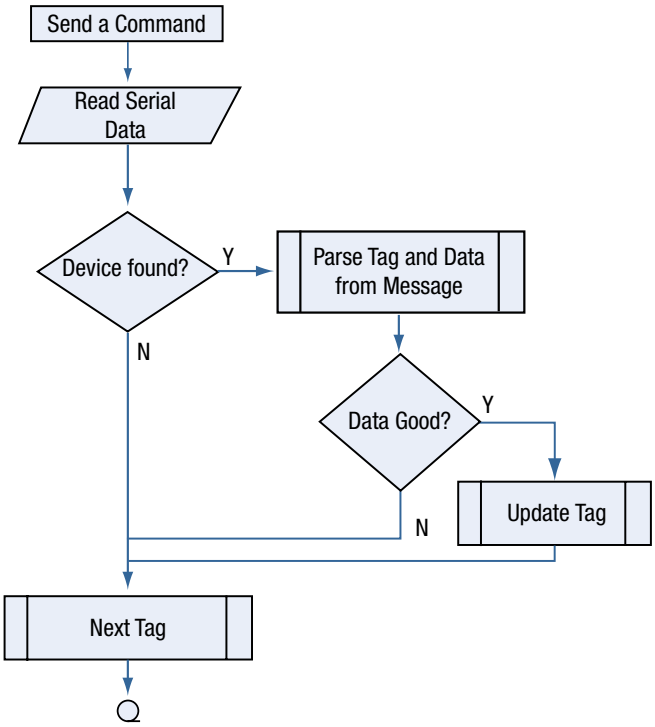


Figure 2

Most recently, the development team used the U-CON driver to talk to a dozen Met One particle counters (see Figure 3). Though the connection remained RS-485, the protocol was entirely different, with a mix of hexadecimal and ASCII components. Nonetheless, total driver development time took about three days.

When developers visited the site to install and commission the system, they discovered that they could not use the internal sample timers in the particle counters. Instead, they had to redesign the driver so that it would command the particle counters to stop, return a record, and start a new count every 10 minutes. Although this was a radical departure from the original design, it took the development team less than a day to implement. A custom driver with code would have required much more effort.

Weighing trade-offs

While using the U-CON driver can be effective in certain applications, writing an I/O driver may be worth the effort in other applications. When approaching each project, developers should consider a few critical questions:

- Is high-speed data processing a requirement?
- How complex is the protocol?
- Is it important to have a branded or proprietary interface?
- Which HMI/historian or client applications will need access to the data, and should they access the data via open standards or a proprietary API?

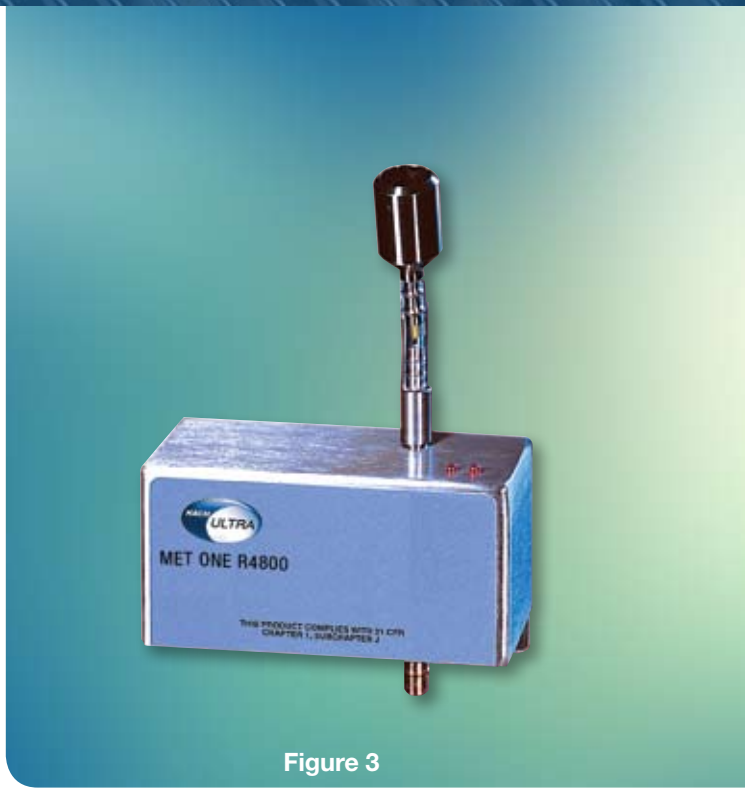


Figure 3

- Does the driver need to be distributed via licensing or royalty-free?
- Do you love writing code (and reading manuals)?

The answers to these questions can help guide developers to the best solution. Using U-CON can prove advantageous for most proprietary serial and Ethernet protocols.

Cutting integration time

OPC's growth has enabled system integrators to easily integrate most programmable logic control and distributed control systems with HMI/SCADA systems. However, many legacy and proprietary systems still do not have an off-the-shelf driver. Previously, the system integrator's only option in this situation was to write a custom driver at a significant cost.

The Kepware U-CON driver introduces a new option that can significantly reduce the time spent and expense paid to integrate a serial device. Using this driver, development time can drop from an estimated six-plus weeks per project to a few days. IES

Stephen Friedenthal *is president of EVSystems Data Solutions in Newton Centre, Massachusetts. He has more than 20 years of experience working with instrumentation and control systems and developing software for industrial applications. Prior to founding EVSystems, he worked as a product manager for GE Infrastructure and managed the GE Proficy Historian. Stephen has a BS in Nuclear Engineering and an MS in Engineering Management from MIT.*

EVSystems Data Solutions
617-916-5101
sfriedenthal@evsystems.net
www.evsystems.net

Virtualization enables multicore platforms for real-time embedded systems

By Paul Fischer

With virtualization getting a lot of play lately, we asked for a perspective on how virtualization can address industrial computing problems. Paul explores how special software can combine real-time code, perhaps even legacy code, with Windows or Linux code running the user interface on a modern platform.

Developers across the wide spectrum of embedded computing applications can benefit greatly from the latest advances in multicore processor technology. Multicore processors fulfill the need to incorporate new features with legacy code and combine multiple operating environments on the same system. A highly integrated system can be constructed with real-time software components and human-directed elements running on separate cores.

Virtual machine management

To make this environment work, developers need special software. Software that hosts multiple operating environments must support virtualization of the processor's hardware interfaces so that multiple software applications can share the multicore processor's I/O without conflict. In this context, virtualization denotes using software to allow a single piece of hardware to service multiple Operating System (OS) images at the same time.

Initially implemented on mainframes decades ago to help administrators avoid wasting expensive processing power, virtualization technology is used widely in servers today. However, virtualization is not as readily embraced in embedded, real-time computing environments because these environments have different needs than those of servers and desktops.

Historically, virtual machine management software has emulated the entire underlying machine, including all the I/O devices, giving each guest operating environment what it thinks is complete control over the hardware. A Virtual Machine Manager (VMM) decides which guest OS should have access to the I/O at any instant, and the VMM handles all the I/O transactions on the guest's behalf.

One problem with this approach is that the VMM must evolve quickly to offer the same functionality as what is available on the latest hardware platforms. New I/O devices are being developed all the time, and emulating the latest features of a high-performance I/O device is a tall order for even the most talented virtual device driver developer.

Even if a VMM can support all the features of contemporary I/O interfaces, using a completely virtualized machine imposes a performance penalty that the guest OS would not have if it interacted directly with the hardware. For example, graphic-intensive applications need access to real hardware for maximum performance. A virtual frame buffer is too slow and inadequate in features for an application that renders 3D moving images. This poses a major problem for applications such as medical imaging systems or robotic assembly machines. In these systems, the guest OS that renders the images needs direct access to the physical frame buffer and its control I/O.

Therefore, developers need a different approach to virtual machine management to support the latest I/O hardware enhancements and yield maximum performance in deterministic processing environments. Addressing this problem requires a VMM that assigns specific devices directly to the I/O tasks that control them, as illustrated in Figure 1.

In this system, the VMM emulates the underlying machine's shared devices, not its entire I/O interface. For all other

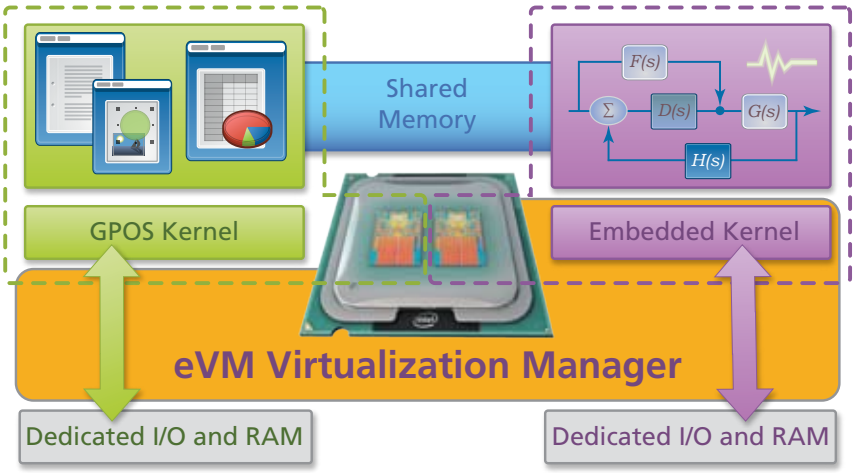


Figure 1

devices, it controls access to the device by guaranteeing that only authorized operating environments can access specific performance-critical I/O. For example, as shown in the diagram, the VMM ensures that the main operator display is only accessible to the General-Purpose OS (GPOS), in this case, Windows.

Assigning I/O exclusively to a specific virtual machine is also essential to guaranteeing real-time responsiveness. Without exclusive physical I/O assignment, developers run the risk of waiting indeterminately for access to key devices. If another virtual machine has access to an I/O device, the wait can be significant because the I/O is multiplexed. Even if only one guest OS ever accesses a specific I/O device, a VMM that virtualizes that I/O must translate the request by the virtual machine into a real I/O access to the physical hardware, an unnecessary and time-consuming process.

Thus, real-time response-critical hardware can only be accessed by the Real-Time Operating System (RTOS) that controls that hardware, and legacy I/O interfaces can only be accessed by the corresponding legacy application software.

Application examples

Consider an application involving a computer numeric control machine tools manufacturer that has spent more than 10 years developing real-time machine control software on QNX and no longer employs many of the original engineers that developed the software. The machine manufacturer wants to add a modern human interface to the system without risking changes to the real-time control software.

To accomplish this, the manufacturer can run the legacy real-time software on one core in a multicore processor and implement the new user interface functionality on the remaining cores. The VMM in this case partitions the processor's I/O, memory, and other resources to ensure that only the machine control software has direct access to the motion control hardware and that it operates on a dedicated CPU core. This creates a separation between the real-time OS and the user interface software, avoiding interference between the two OSs and thereby protecting the timing loops the legacy real-time software manages from being violated by operations the new human interface software performs.

In another application, a robotic material handling system manufacturer wants to upgrade an older product built around multiple hardware computing platforms – an industrial PC using Windows and custom Power Architecture processor-based boards running vision and motion control software on VxWorks. Because the vision and motion software use a set of library functions also available for Intel Architecture (IA) processors, the machine vision subsystem can be recompiled and reconfigured to run as an application core on one of the cores in an IA multicore processor while the motion system and operator interface run on their own dedicated cores in the same processor. Thus,

the expensive, loosely coupled system comprised of multiple discrete hardware boards can be transformed into a single, highly integrated hardware platform, saving substantial hardware costs.

IA processors support virtualization

The most popular multicore processors are those that support the Intel processor architecture because platforms using this architecture are the most prevalent in the market. IA processors support four distinct privilege levels of application execution, named rings 0 through 3. Ring 0 executes at the highest privilege level and ring 3 at the lowest. In typical practice, only the outermost levels are ever used: rings 0 and 3, referred to as *supervisor mode* and *user mode*, respectively.

OSs that utilize these execution modes are referred to as *protected mode* OSs; the OS executes its instructions in supervisor mode and its applications execute in user mode. Drivers might execute either in supervisor or user mode, depending on the OS architecture and the nature of the driver.

Protected mode guest OSs expect to run in supervisor mode with full access to the underlying CPU registers and processor data structures. As a result, a VMM must perform two difficult jobs: intercept guest OS instructions that modify supervisor mode registers and processor data structures and simulate the impact of those instructions inside the virtual machine on which the guest OS is running.

Intel introduced hardware support for solving this problem when it incorporated Intel Virtualization Technology (Intel VT) into its most recent array of multicore processors. This hardware support for virtualization added an overarching execution mode to the CPU, called *VMX root*, where VMM software executes with ultimate control over the CPU hardware. Using Intel VT, a VMM can intercept key supervisor mode operations executed by any software operating outside of VMX root without requiring *a priori* knowledge of the guest OS binaries or internals. Using this hardware assist for virtualization, developers can build a VMM that hosts protected mode OSs executing in ring 0 without giving up control of key CPU resources.

Intel VT also provides a way for the VMM to implement virtual interrupts, an essential feature for hosting a real-time guest OS. The Intel VT hardware in an Intel multicore CPU provides the VMM with the ability to see a hardware interrupt even if it has been masked by a guest OS. This means the VMM can field hardware interrupts and ensure that interrupts for a real-time virtual machine will always be serviced without delay. The ability to monitor interrupts at all times regardless of the state of their mask bits guarantees that real-time interrupt latencies are minimized and that virtual machines cannot interfere with each other.

Low interrupt latency, direct access to specialized I/O, and the assurance that a VMM won't "virtualize away" real-time task determinism and priority are all key requirements for a real-time virtual machine. Combining multicore CPUs and Intel VT forms an ideal platform on

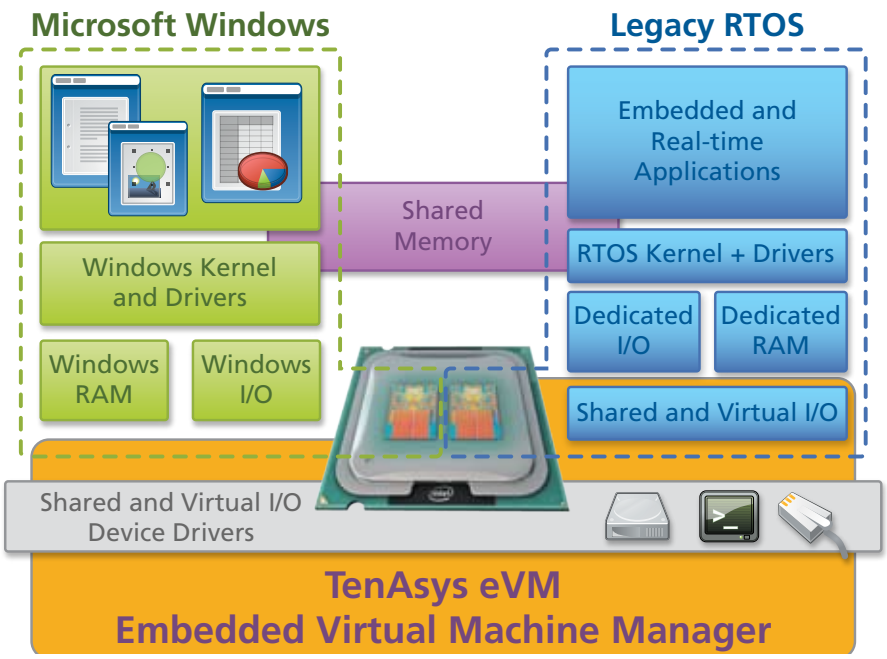


Figure 2

which to consolidate multiple hardware platforms into one, allowing a GPOS to coexist with a real-time OS on a single PC-compatible system.

A real-time VMM

In 1997, TenAsys Corporation introduced INtime, an RTOS that runs deterministically alongside 32-bit and 64-bit versions of Microsoft Windows on a single IA hardware platform. A unique form of virtualization makes this possible, allowing Windows to run unmodified as the lowest-priority task (namely, the idle task) in the INtime real-time task list. This dual-OS, single-platform arrangement gives developers a means to build deterministic embedded Windows systems that can reliably control critical machine functions and simultaneously present high-level interfaces for system monitoring, enterprise connectivity, and complex user interaction.

Recently, TenAsys introduced eVM, a VMM capable of supporting an RTOS's demands while simultaneously hosting a GPOS such as Windows or Linux in an embedded system. By leveraging Intel VT, this VMM allows legacy RTOS environments to be hosted easily on a multicore processor. This has useful implications for applications that need to preserve legacy real-time code, as shown in Figure 2.

Running an RTOS in a virtual, real-time machine on its own processor core enables legacy real-time applications to be migrated from obsolete hardware to modern embedded platforms. Because I/O can be virtualized, developers can simulate old hardware devices and minimize rewriting proven software. For example, a VMEbus system can be converted to a less expensive SBC system by intercepting I/O requests to legacy VMEbus I/O and redirecting it to equivalent onboard I/O devices.

This virtualization software distinguishes resources that can be multiplexed by the VMM from those that must be exclusive to a virtual machine. For example, devices like an enterprise Ethernet interface can be multiplexed and shared between all virtual machines. However, when determinism and performance are more important than equal access, eVM isolates resources for use by a specific virtual machine and its guest OS. Hardware specific to a real-time control application, such as a video capture card, fieldbus interface, or network interface card used as a real-time Ethernet master should not be multiplexed between virtual machines. Specialized real-time I/O must be dedicated to its real-time virtual machine so the guest RTOS and application using that I/O can maintain real-time determinism and control.

Other benefits of using multicore IA CPUs

In addition to having tools and application software support, PC-compatible hardware can run the development software environment directly on the target hardware, conserving development time and effort compared to using separate development workstations. Also, using IA hardware platforms and software technology can save costs and provide access to the latest industry-standard hardware resources, including up-to-date interfaces for communication and I/O such as USB. Additional advantages include the ability to incorporate new communication protocols for interaction with external systems and to adapt more sophisticated data reporting methods.

Because a multicore chip can host multiple operating environments, systems that previously required multiple discrete computing modules can now be combined into a single hardware environment, saving design, manufacturing, and maintenance costs.

Virtual gains

Using virtualization technology on Intel multicore processor platforms can assist developers by eliminating redundant computer and communication hardware, providing faster communication and coordination between RTOS and GPOS subsystems, improving reliability and robustness, reusing proven legacy applications, and simplifying development and debugging. IES

***Paul Fischer** is a senior technical marketing engineer at TenAsys Corporation in Beaverton, Oregon. He has more than 25 years of experience building and writing about real-time and embedded systems in a variety of engineering and marketing roles. Paul has an MSE from UC Berkeley and a BSME from the University of Minnesota.*

TenAsys
503-748-4720
info@tenasys.com
www.tenasys.com

Key functions add appeal to managed switches

By Greg Dixson

With the proliferation of Ethernet-based networks in industrial settings, choosing the right infrastructure is vital for successful network management. Alongside simple switches, gateways, and routers, managed switches have emerged, offering integrated functions that make network configuration and maintenance easier to accomplish. Greg examines the features of a managed switch platform and presents the concept of a lean managed switch.

A managed switch is a powerful tool that gives users control over an industrial network. By implementing a managed switch, users can remotely monitor and administer networks as well as switch functions.

Today's managed switches offer a variety of abilities. While some complicated networks might require higher-end capabilities, traditional managed switches are very expensive. Many smaller networks require more control than an unmanaged switch provides but can get by with just a few key management functions. Some of the most frequently requested management functions include:

- Bootstrap Protocol (BootP)
- Simple Network Management Protocol (SNMP)
- Rapid Spanning Tree Protocol (RSTP)
- Internet Group Management Protocol (IGMP) snooping and query functions, which are especially important for EtherNet/IP applications

A closer look at these features demonstrates how managed switches provide network configuration capability, remote monitoring and diagnostics, and integral IT-compatible network redundancy.

What is BootP?

BootP allows a network device to obtain an IP address over the network. Each device on the network has a unique MAC address, a six-octet ID number assigned by the manufacturer (for example, 00:A0:45:08:CD:8D). When this device is added to a network, it broadcasts a request for an IP address. A BootP server on the network sees the request and sends a BootP reply, assigning an IP address (for example, 192.168.1.10) to the device. This makes the device accessible to higher-level network communications using that IP address.

For Industrial Ethernet, MAC addresses serve as the foundation for networking to establish communication and direct data traffic. This is the Layer 2 level of communications in the Open System Interconnection (OSI) model. IP addresses are assigned to devices and switches to support the higher-layer protocols used to produce complex, functioning networks. Once a managed switch has an assigned IP address, users can easily access, configure, and monitor it via a standard Web browser. In addition, the switch can then respond to standard networking diagnostic tests, such as pinging. A switch without an IP address cannot provide this simple yet powerful network diagnostic capability.

> Many smaller networks require more control than an unmanaged switch provides but can get by with just a few key management functions.

What is SNMP and why does it matter?

Network management systems use SNMP to monitor devices on the network for conditions that warrant administrative action. SNMP managed devices describe configuration and management information in the form of variables called *Object Identifiers* (OIDs). Management applications can query and sometimes set OID variables.

OIDs are natively arranged in a numerical hierarchy, such as 1.3.2.11.11.4. A management information base translates the numeric OIDs into a more human-friendly format, such as SysName. A software component called an *agent* runs on the managed system and reports these variables to the managing system via SNMP through IP. Widely used and multivendor supported, SNMP is the *de facto* standard and most popular protocol for managing diverse networks.

SNMP management capability is useful and important for all Ethernet networks, including EtherNet/IP applications.

ODVA EtherNet/IP infrastructure guidelines require switches with both Web- and SNMP-accessible port status and diagnostics functions for large-scale control enterprise or networking. These functions are also recommended for all general-use applications.

Why should I care about RSTP?

Unless an Ethernet network has a method for providing redundancy, loops can lead to network failure. Multiple active paths or loops in topology between network devices create several problems. First, the MAC address table the switch uses can fail because the same MAC addresses are seen on multiple ports. Second, broadcast packets forwarded in an endless loop between switches can result in a broadcast storm. Broadcast storms can consume all available CPU resources and bandwidth, overwhelm network devices, and cause those devices to fail, requiring a reboot to recover network operation.

RSTP is an OSI Layer 2 protocol defined in the IEEE Standard 802.1D. As its name suggests, RSTP creates a spanning tree within a mesh network containing connected Ethernet switches. RSTP disables the links that are not part of that tree, leaving a single active path between any two network devices. The protocol allows a network design to include spare (redundant) links, providing automatic backup paths if an active link fails without risking the danger of loops or requiring backup links to be manually enabled/disabled.

More vendors support RSTP than any other redundancy method. A switch with RSTP can integrate with existing Ethernet systems and IT practices. Unlike proprietary redundancy mechanisms, RSTP's development as an open standard allows users to integrate RSTP supporting switches from multiple vendors into a single redundancy system. The protocol allows flexible redundancy for any topology: ring, tree, mesh, or a combination of topologies.

What's the big deal about EtherNet/IP and IGMP snooping?

EtherNet/IP is a multivendor Industrial Ethernet technology managed by ODVA. The EtherNet/IP infrastructure guidelines require switches with IGMP snooping and IGMP query functions in all EtherNet/IP applications for general use or large-scale control enterprise and networking.

Under the ODVA standard, a very small, isolated system with a low device count can use an unmanaged switch. However, the standard also clearly specifies that designers must either precalculate the total multicast traffic to which each unmanaged switch will be exposed or test the configuration in advance.

EtherNet/IP devices can generate a great deal of multicast traffic. A multicast packet is a message addressed to a group of nodes. It is necessary to limit which end devices receive the traffic to avoid overloading them and causing them to fail.

When a switch without IGMP snooping receives multicast messages, it floods all ports, potentially overloading end devices and other network switches. A switch with IGMP snooping, however, forwards multicast messages to only the devices that request the traffic.

When an EtherNet/IP device wants to consume multicast data, it will transmit an IGMP join message. All IGMP snooping switches receive these join messages. The switch then snoops on the join messages as they pass to determine which ports will receive the multicast data. This restricts the multicast data to only the ports and connected end devices that expect and can handle the traffic, as shown in Figure 1.

EtherNet/IP requires IGMP query support on at least one switch or router in the network. For IGMP snooping to work properly, the network must have at least one switch or router that supports IGMP query. Periodically, this device will query the end devices in the network regarding which multicasts they wish to receive. The end devices send an IGMP join report, which updates the multicast/port associations.

When multiple IGMP queriers are in the network, the IGMP querier with the lowest IP address acts as the network querier. If the original device fails or is removed, the device with the next lowest IP address becomes the IGMP querier.

If the system does not have a switch or router that supports IGMP queries, multicast traffic problems are likely. For example, IGMP snooping switches can act erroneously by forgetting the learned multicast/port associations and then flooding all ports and devices or neglecting to forward multicast traffic to any devices at all, including those that should receive it.

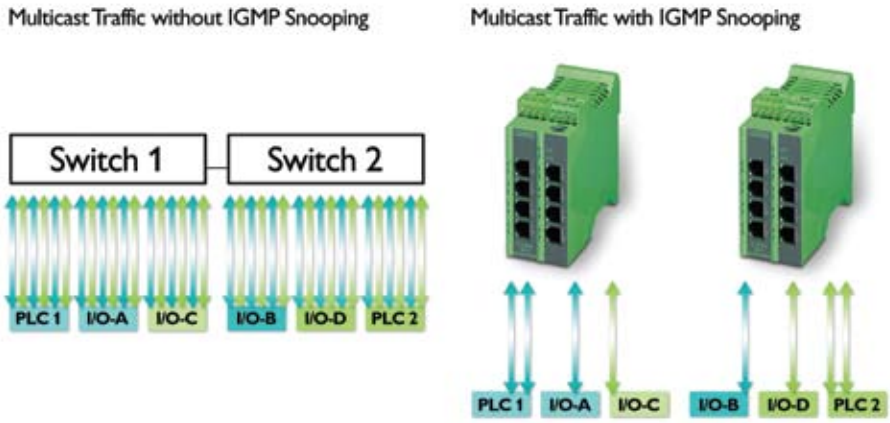


Figure 1

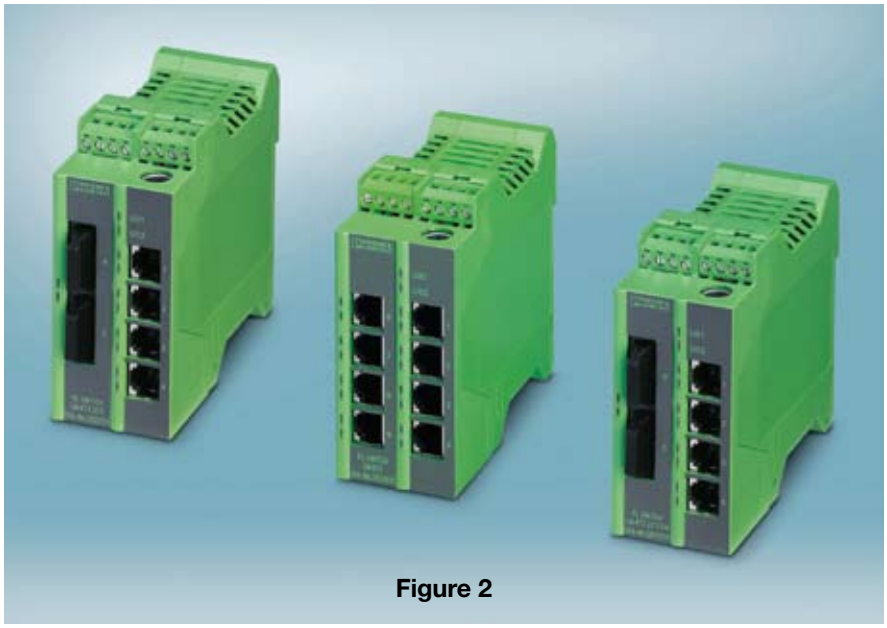


Figure 2

A leaner switch

Many of today's networks require capabilities beyond what an unmanaged switch can provide but do not use managed switches with full functionality because of their high costs. Newer switches such as Phoenix Contact's Lean Managed Switch (Figure 2) provide commonly requested management functions at a lower price.

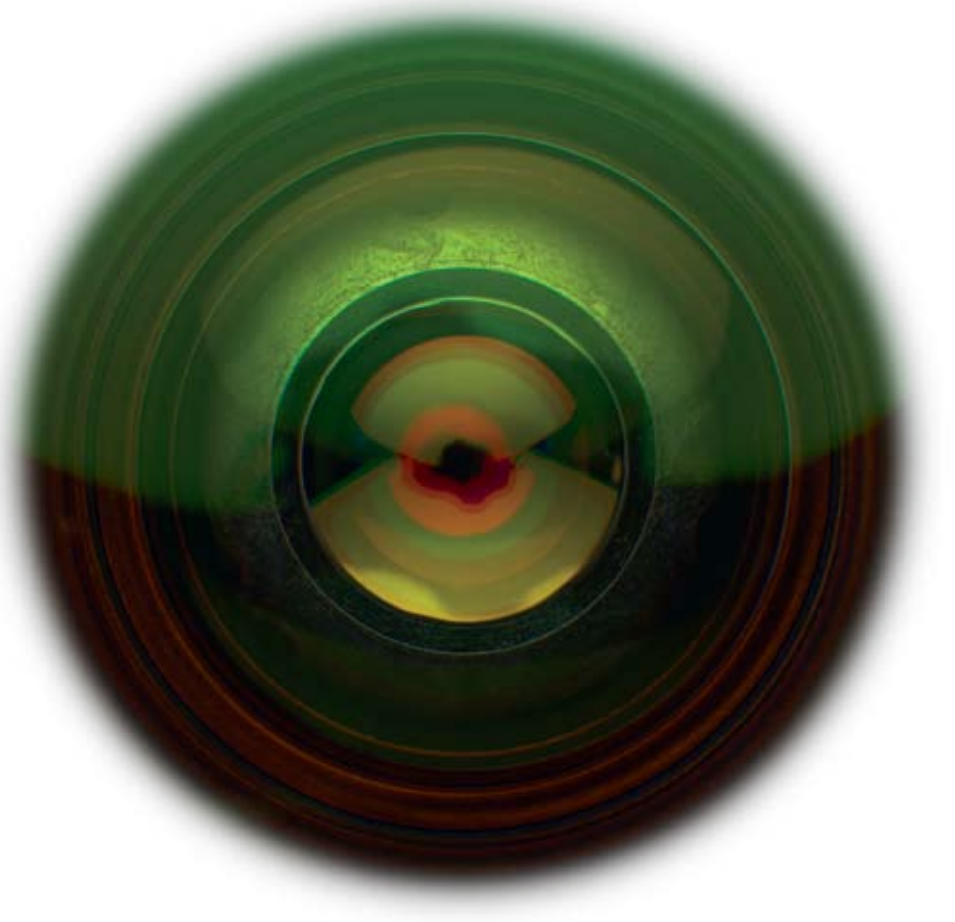
The Lean Managed Switch targets the specific features described earlier – SNMP, RSTP, IGMP, and Web-based management capability. These abilities allow industrial network managers to add resources, monitor and diagnose networks, and provide redundancy as needed. IES

Greg Dixson *has been automation product marketing manager for Phoenix Contact, based in Middletown, Pennsylvania, for three years. He has more than 16 years of experience in the industrial controls industry.*

Phoenix Contact
717-944-1300
info@phoenixcon.com
www.phoenixcontact.com

FPGAs increase machine vision systems' performance

By Kumara Ratnayake



Higher-resolution cameras and faster frame rates are pushing data rates beyond many host PCs' processing capabilities. Kumara describes how acceleration hardware at the right place in the system can make up the shortfall and explains why using FPGAs is the most cost-effective approach to attain the needed performance.

Machine vision systems that depend on a host PC are running out of steam. Higher-resolution cameras and growing demand for faster frame rates are pushing data rates far beyond host processing capabilities, even for simple functions.

Image sizes in high-performance applications now extend beyond 16M pixels (4K x 4K). Frame rates for demanding applications such as high-speed motion capture can range as high as 1,000 frames per second (fps). Even at the modest 30 fps of standard video, the higher-resolution images yield typical system data rates of nearly 500M pixels/second. For simple 8-bit monochrome systems, that represents a data rate of half a gigabit per second; for color systems that typically use 24 to 48 bits per pixel (3 to 6 bytes), the data rate quickly reaches the multigigabit per second range.

Even with the highest-performing CPUs available, a host PC processor can only handle relatively simple image processing functions in real time at the lower end of the data rate range. The alternative of buffering data for subsequent offline processing is not practical in many applications. Acceleration hardware at the right place in the system can make up the shortfall.

Vision system demands

The functions a machine vision system must perform impose many demands on the processing elements, all of which the system must address satisfactorily. Chief among these demands are requirements for substantial processing power, high-bandwidth data I/O, and well-defined determinism and latency in processing.

A typical example of these computational needs is convolution using a programmable mask for applications such as filtering, feature detection, and recognition. Working with a 4K x 4K image at 30 fps requires that the system handle a data rate higher than 490M pixels/second. A typical 5 x 5 convolution mask has 25 coefficients that must be multiplied with stored pixel data for every new pixel that comes in. The resulting processing demand, therefore, is at least 12 GFLOPS.

High-performance I/O may not be as obvious a need, but can be even more critical. One example is the simple histogram, where for each image pixel the system increments a counter corresponding with the pixel's value to build a statistical description of the image's intensity distribution. Though this task does not require any computation, it necessitates fast random access to counters in memory to build the histogram in real time.

An even more demanding example is image rotation by an arbitrary angle (see Figure 1). This rotation task requires only a small computation to determine the pixel's destination address and calls for a huge amount of random memory access to first read a pixel and then write it to its new location. Performing this task in real

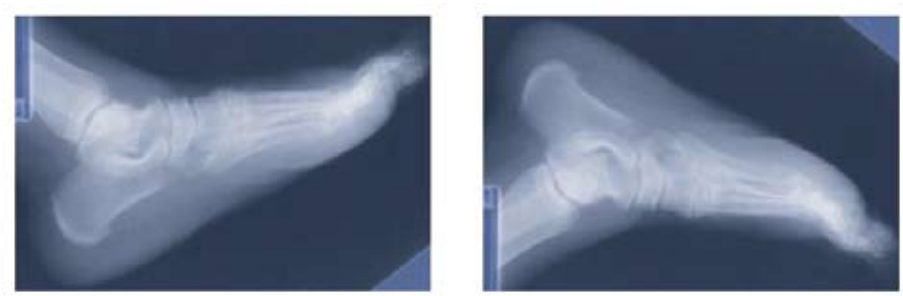


Figure 1

time demands a memory access bandwidth at least twice that of the image data rate. Again, random access is needed, so DMA or other techniques to speed access can't be brought to bear.

Well-defined latency and determinism also are needed to achieve results. A machine vision system that inspects parts moving along on a conveyer belt must decide quickly to accept or reject a part. The faster it can operate, the faster the manufacturing line can run. But the system also needs low latency and the consistent timing afforded by determinism in the process of making its decision. The longer the system takes to make a decision, the farther along the belt the part will travel between the inspection site and the rejection point, so low latency is needed to keep this travel distance within practical limits. Consistent timing allows the system to reach its decision in time to reject the part when necessary.

Multiprocessing options

The specific combination of computational power, I/O bandwidth, latency, and determinism that a machine vision system will need depends on the application. Designing a system to handle only a single application, however, is typically not cost effective. A system capable of handling many different applications will have a larger market and be easier and less expensive for end users to adapt to when a change in their requirements must be addressed, resulting in lower overall costs.

Since a PC host is flexible but not powerful enough, one alternative is to switch multicore or multiple processors in one of several architectures. Different multiprocessor architectures are possible, including cascaded and parallel structures (see Figure 2).

In a cascaded approach (a), each processor in a series handles a portion of the

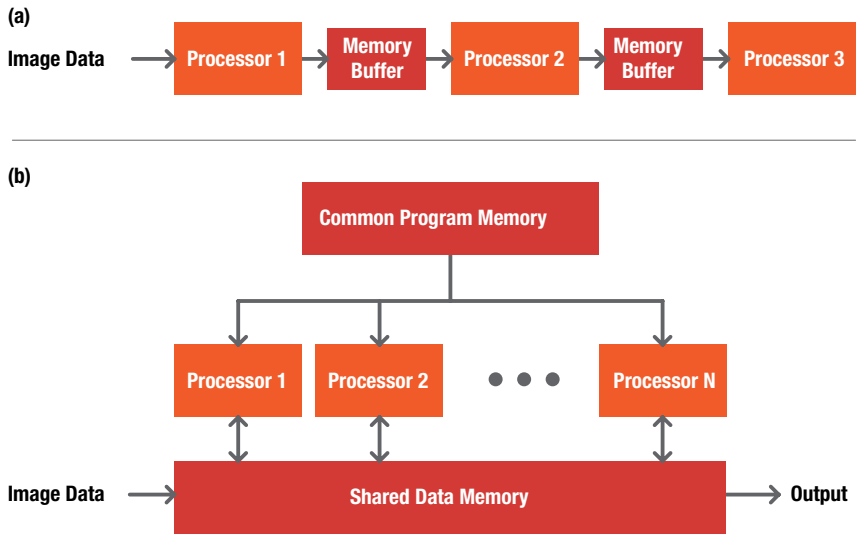


Figure 2

imaging task and then passes the results to the next processor in the series. Memory buffers between processors help accommodate the differences in timing for each step. This approach can be extended as far as needed to achieve the computational speeds required, but each extension adds cost and latency to the system.

In a parallel processing architecture, the image data is separated into blocks, processing each block in the same way in its own processor (b). While this approach is limited by cost and board space, in theory it can be extended as far as one processor per pixel. While such an approach helps minimize latency, it is not suitable for all types of processing. Functions such as feature extraction are extremely difficult to implement with this kind of block-level parallelism.

Acceleration outperforms multiprocessing

Even with the benefits gained using multiple processors, performance is still limited by the sequential nature of processors. An N-fold increase in processor count yields no more than an N-fold increase in performance and often less due to the overhead of coordinating processor operations.

An alternative approach is to combine the host processor with a coprocessor that uses dedicated parallel logic rather than sequential code execution. A hardware-based processing accelerator can provide substantially greater computational performance increases compared to conventional processors.

These performance improvements can be substantial. For instance, a 5 x 5 convolution can be executed using 25 multiply and accumulate structures in parallel, producing a full result each clock cycle rather than requiring several clock cycles for each step. As a result of this parallelism, clock speeds are substantially less than for processors, with a corresponding reduction in heat generation. The dedicated nature of the logic also ensures that the results are deterministic.

With today's generation of FPGAs, implementing hardware-based acceleration logic for a machine vision system that achieves the needed performance while retaining desired flexibility is a possibility.

Reconfigurability gives FPGA-based designs virtually the same degree of flexibility that processors provide with none of the limitations. Developers can adapt an FPGA-based machine vision system to handle a variety of applications. The field programmability of such designs allows users to customize systems to their needs and adapt them as needs change without requiring new hardware. Using FPGAs that can be programmed in-circuit, machine vision systems can even switch tasks once loaded with a new logic program.

Architectural considerations

To begin architecting an FPGA-based machine vision system, developers must analyze the image processing algorithms they need to execute, looking for parallelism to exploit. The structures for implementing these parallel tasks can then be implemented in the FPGA hardware. That hardware should include significant

amounts of memory for buffering image data. Both SRAM-like memory for random access and DRAM memory for streaming and burst access should be made available to the FPGA using dedicated memory interfaces.

Another step in applying the FPGA is to determine the best location within the system for acceleration to take place. When latency is a prime concern in the application, locating the acceleration element closer to the camera can be an advantage. In this position, the coprocessing accelerator can work directly with raw pixel data as it is produced. By the time a full image frame has been captured, it has already been processed.

When latency is not as important and the application requires highly compute-intensive functions, locating the accelerator in the frame grabber is more appropriate. Whereas resources like electrical power and physical space are limited in the camera, the frame grabber can accommodate much larger designs. In addition, resources such as memory and mass storage are more readily available.

Application example: XRI-1200

Sometimes acceleration may be located in several places, each designed to handle a range of functions so that the combination provides optimal placement and resources for every task. An example of this type of design is DALSA's XRI-1200, which targets X-ray imaging and uses a three-stage processing design with acceleration at each stage (see Figure 3).

The XRI-1200's first stage provides programmable shading correction and image warping. The shading correction applies offset and gain on a per-pixel basis to data from the camera, compensating for variations in light intensity and sensor response across the image. The image warping counters the distortions typically encountered at the edges of the image field of view due to lensing effects. Both functions must be programmable to accommodate system-specific variations, and both can operate on a pixel-by-pixel basis on the data coming from the camera.

The second stage provides configurable motion compensation as part of the system's effort to reduce noise in the image capture. Noise reduction can be achieved by averaging several frames together, but the target's movement during averaging can blur the final image. The motion compensation algorithms determine the speed and direction of target motion between frames, then correct for the motion before averaging frames together. This operation requires substantial memory buffering to hold successive images as well as feature detection and motion extraction. The acceleration's position in the middle of the system gives it access to the extensive resources needed.

The third stage provides image rotation in increments of 0.01 degrees, 3 x 3 programmable filter convolution, and output image conditioning. These tasks require extensive I/O and memory resources to handle the rotation as well as computational acceleration; however, they need a different memory structure than stage 2 because of the random addressing involved in rotation. By separating the functions into different stages, the XRI-1200 can address the differences in memory requirements with a simpler design.

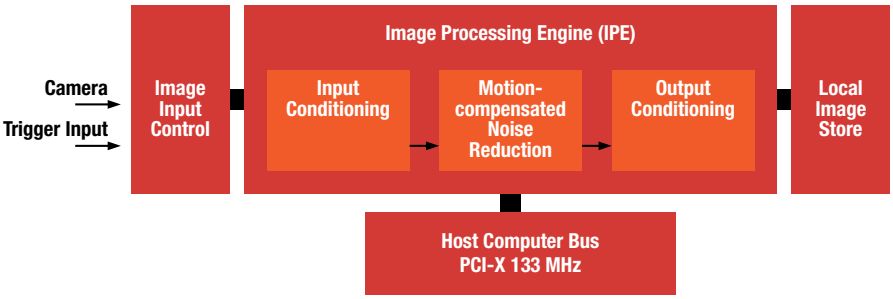


Figure 3

Using FPGA-based coprocessing hardware in the design provides high performance as well as design flexibility. The system can process a 1024 x 1024 pixel image with 12 bits per pixel in real time at 30 fps, well beyond what a conventional processor can provide.

Additionally, the FPGA approach provides considerable flexibility. End users have full control over the settings for functions, such as tuning the image compensation for the system's camera and lens in the first stage, the number of frames to average and motion thresholds in the second stage, and filter parameters and rotation angle in the third stage. The FPGA also allows users to implement custom functions in the system without requiring any hardware changes.

Perfect blend of performance, flexibility

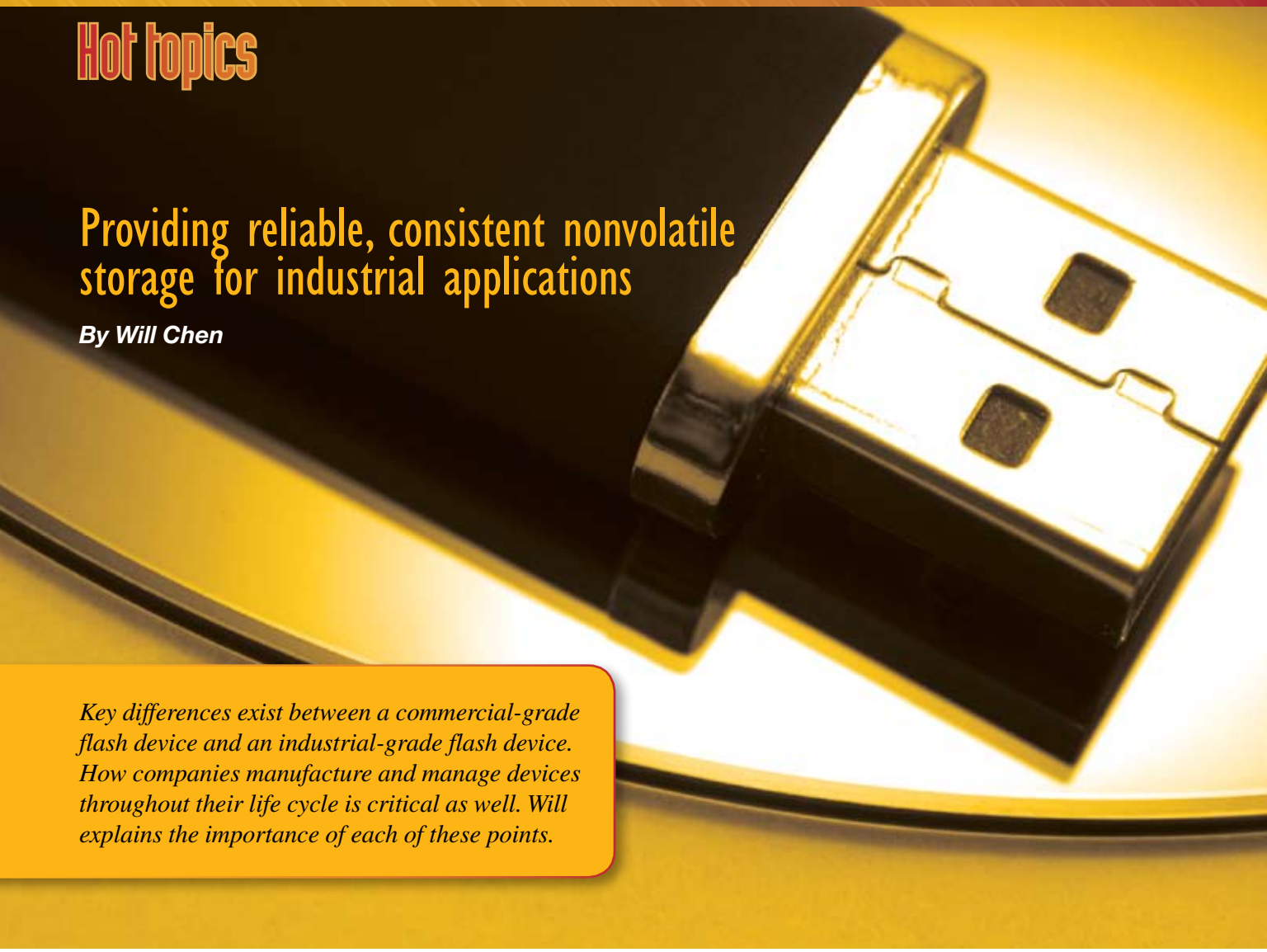
The rise in image resolution and growing user demands for processing capability in applications such as medical imaging are evident in the machine vision industry. These demands have outstripped what can be accomplished simply with a host PC or programmable processors. Hardware acceleration is essential, and of all the performance-boosting options, FPGAs offer the best blend of performance increases and design flexibility. IES

Kumara Ratnayake *is a senior FPGA design architect at DALSA (Montreal, Canada). An active member of the IEEE, Kumara's areas of expertise include reconfigurable computing, image processing, and VLSI architectures for real-time embedded systems. He holds a Bachelor's degree in Engineering from the University of Central Lancashire in England and a Master's degree in Electrical and Computer Engineering from Concordia University in Montreal.*

DALSA
514-333-1301
kumara.ratnayake@dalsa.com
www.dalsa.com

Providing reliable, consistent nonvolatile storage for industrial applications

By Will Chen



Key differences exist between a commercial-grade flash device and an industrial-grade flash device. How companies manufacture and manage devices throughout their life cycle is critical as well. Will explains the importance of each of these points.

High-endurance flash, with its low power consumption and high resistance to environmental factors, is quickly replacing rotational media such as hard disk drives in a wide range of consumer, industrial, telecom, medical, and military applications. Although flash is a commodity product, flash components are not all alike, providing varying levels of performance, reliability, and quality at different price points.

In general, flash can be differentiated into commercial and industrial grades. Some of the differences between commercial and industrial flash are straightforward (see Table 1). However, understanding the core differences between these two types of flash requires a more in-depth look.

Because of the pressure to drive down cost in the commercial and consumer electronics industries, lower price is the primary factor considered when purchasing flash for commercial applications. Not that price isn't important for industrial applications; however, because these systems tend to comprise expensive equipment and/or must consider human safety, factors such as quality, reliability, and robustness take precedence over cost.

Typically, companies do not design directly with flash. Rather, they purchase a card or module designed by a flash manufacturer with the necessary controller and firmware already integrated. While every flash company starts with the same basic building block, the controller and firmware it utilizes determine the device's final quality and cost.

When choosing from the assortment of flash options available, developers will want to evaluate the particular flash memory and controller in use to determine the combination best suited for their applications. In addition, when reliability is important, developers will need to consider how the device implements several key technologies, including wear leveling used to extend flash life, Error Correction Coding (ECC) for maximizing data integrity, and recovery mechanisms to prevent data corruption in the event of power failure.

Wear leveling for maximum endurance

Endurance defines how many times a particular cell can be written to before it wears out and is no longer capable of storing a value. The more a cell is used, the higher the probability of a permanent bit error. If cells wear out too quickly, this reduces not only the flash device's overall capacity but also its reliability. To determine the required endurance for an application, developers must take into account how often data changes and how critical data is to system operation.

	Commercial	Industrial
Bill of Materials (BOM)	No BOM control (always lowest available components)	Controlled BOM: full product traceability, standard part change notification procedure
Architecture	Multilevel cell NAND flash	Single-level cell NAND flash only
Wear leveling	No	Enhanced 8-bit controller: Dynamic 32-bit controller: Static
Error Correction Coding	Basic	Enhanced 8-bit controller: 2-3 errors recovered 32-bit controller: up to 6 errors recovered
Power failure recovery	Limited	8-bit controller: good recovery 32-bit controller: maximum reliability on the order of no errors in 50,000 power failure cycles
Density	Mainstream density only	Low density and very high density support
Consistent manufacturing process	Components can change without notice	Many vendors support fixed firmware version and die revision as well as a robust part change notification process
Additional differences	Lowest price	Quality, reliability, endurance: engineering support and quality reports

Table 1

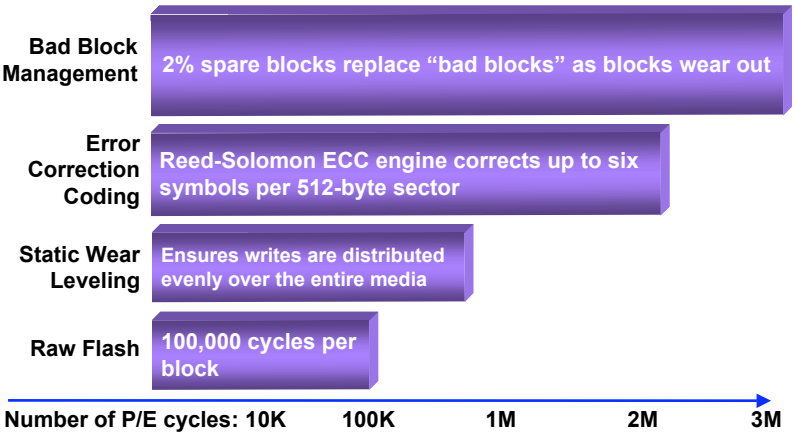


Figure 1

Commercial-grade flash typically uses a multilevel cell architecture with endurance on the order of 10,000 write/erase cycles, which is sufficient for applications that tend to write to flash irregularly (see Figure 1). For example, even if a user completely overwrote all the available flash in an MP3 player on a daily basis, the player could be expected to operate for 27 years without failing due to cell wear out. Additionally, if the data in a song becomes corrupt, while potentially inconvenient, operation can be resumed simply by reloading the appropriate file.

For many industrial applications, however, flash serves as a non-volatile mechanism for preserving mission-critical data in the event of unexpected power loss. As a consequence, key data must be updated continuously, requiring significantly higher endurance to ensure data accuracy and reliability. For this reason, industrial-grade flash uses a single-level cell architecture, which supports on the order of 100,000 write/erase cycles. In addition, wear leveling can further extend cell life to guarantee data integrity and prevent premature cell wear out.

Wear leveling is a technique that spreads data relatively evenly across the flash while optionally taking data update frequency into account. Rather than using the same sectors over and over – accelerating their wear relative to other, less often used sectors – wear leveling ensures that data is written across all sectors throughout a flash device, spreading the wear evenly. This is especially important for data updated with a high frequency.

For example, if a key data parameter is updated 10,000 times a day, the sector in which it is stored will wear out in 10 days. As each sector wears, this reduces the flash device's overall capacity. More importantly, it unnecessarily exposes the system to potential data loss and failure on a regular basis. Wear leveling avoids such potential failure by cycling through the flash device's various sectors. Instead of a few sectors wearing quickly, all sectors wear slowly.

There are two types of wear leveling: dynamic and static. While effective, dynamic wear leveling is limited in that it only spreads wear when data is rewritten. Industrial applications typically have a variety of static data that does not get updated, including operating system files, configuration data, and read-only data such as indexes or reference information. As static data is never or only infrequently updated, sectors containing static data are not included in dynamic wear leveling.

As an alternative, systems with a more powerful flash controller can increase reliability by implementing static wear leveling, which occasionally relocates static information that would otherwise never move using dynamic wear leveling. To efficiently maximize endurance, wear leveling requires internal logical maps that track sector usage rather than simply marking the next available sector. Controllers based on 8-bit processors cannot implement effective static wear leveling because they lack processing resources and have limited ability to address more granular sector maps that precisely track relative sector usage, as is required for static wear leveling. To support the most effective wear leveling algorithms, a 32-bit controller is required.

*[**Editor's note:** Axel Mehnert of Hyperstone describes this type of flash controller in his article, "Managing flash memory with intelligence" in the March 2008* Industrial Embedded Systems *E-letter (www.industrial-embedded.com/eletter).]*

Ensuring data integrity through ECC

Industrial applications often have little tolerance for error. Data loss can lead to system failure, resulting in everything from costly shutdowns to damage to expensive equipment and even human injury or death. Therefore, reliability and accuracy are essential to industrial-grade flash.

While high endurance decreases the potential for errors, it does not completely eliminate them. Data can be verified immediately after it is written, but this process will not identify bit errors that may manifest later. To ensure long-term data integrity, industrial flash controllers must also implement ECC.

In short, ECC provides a means for identifying if data has been subsequently corrupted within a sector. For example, a simple checksum will yield a different result if data has changed since the checksum was first computed. More advanced ECC algorithms, such as those based on Reed-Solomon coding, can also correct a limited number of symbol (8-bit) errors.

Reed-Solomon ECC implemented with 8-bit controllers can correct up to two symbol errors per 512-byte sector. On the other hand, 32-bit RISC-based controllers can employ more compute-intensive algorithms correcting up to six symbol/byte errors. The ability to correct six errors provides more than sufficient correction capability for even the most mission-critical applications.

An important element of ECC is its transparency to developers (see Figure 2). As ECC is implemented within the flash controller and accessed using standard interfaces and drivers, developers need not directly involve themselves with the particulars of error

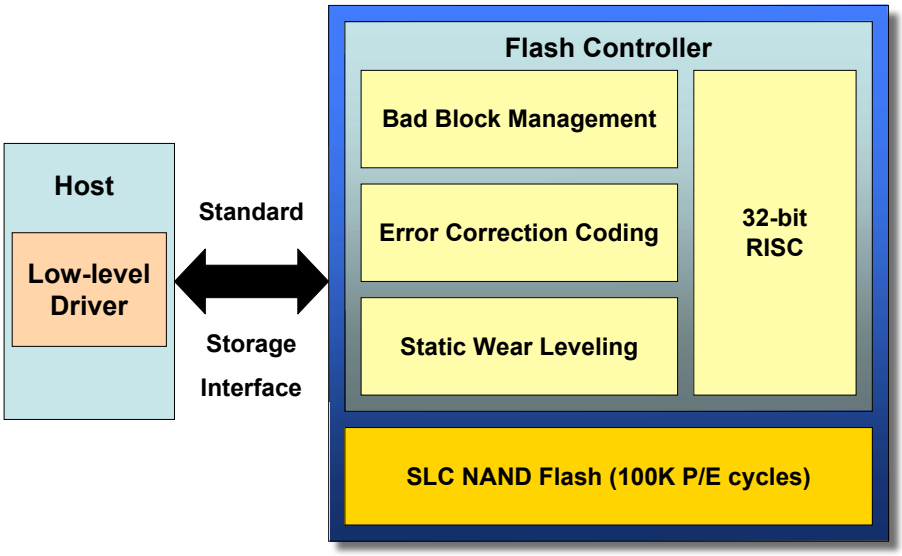


Figure 2

correction mechanisms. However, it is still important that developers make themselves aware of ECC algorithms' capabilities when selecting a flash device to ensure that the proper balance of high endurance and effective ECC are in place to meet the application's reliability requirements.

Preventing data corruption

The third cornerstone of reliability in industrial flash is preventing data corruption caused during power interruptions. Just like ECC, power failure recovery mechanisms are implemented within the flash controller.

All power failure recovery mechanisms shore up vulnerabilities in the data writing process. For example, if a data value needs to be updated, the new value is written in a new sector and then verified before the old value is released. These mechanisms can quickly become complex when larger data sets crossing multiple sectors must be protected; for example, a power failure occurring in the middle of writing a large data set must not result in only a portion of the data being modified.

As power failure recovery mechanisms are often proprietary, this makes it difficult to evaluate their effectiveness from an algorithmic perspective. To verify their robustness, developers will want to run their own test bench to randomly power down the system during the writing process, then power back on and verify data integrity. In general, more powerful controllers are capable of implementing more robust algorithms; for example, Netlist's flash devices utilize a 32-bit controller that can experience 50,000 field power cycles without failure.

Reliability through consistency

When evaluating quality and reliability, developers will want to consider the impact of the manufacturing processes used to build flash devices. For example, consistency is critical for industrial applications as any modification to components – especially those to the controller's firmware – can produce subtle differences in how flash interacts with primary system components.

Consider that while an optimization in firmware may result in more efficient writes to flash, it may have the undesirable side effect of unbalancing timing-based dependencies and leading to noticeable, unintentional changes in application behavior. Worst-case, such changes can lead to unpredictable system behavior and failure. Therefore, even seemingly minor modifications mandate requalification or at least require that developers run a thorough test bench with the modified components.

Consistency in this respect does not refer to homogeneity across an entire product line. Rather, it implies that all the devices shipped to a particular customer are the same, perhaps even guaranteed to a specific firmware version and die revision. In this way, developers can rely upon the consistency of components they receive to ensure consistent product behavior, an important characteristic for industrial applications that must preserve equipment investment or guarantee human safety.

Manufacturers can tightly manage modifications with full disclosure to developers through a rigorous part change notification process. In this way, developers avoid unexpected failures from "silent" changes with a subtle (or not so subtle) difference in performance. This process can extend through the entire supply chain; manufacturers that do not control every stage of the manufacturing line need to oversee third-party suppliers in regards to tracking component changes and firmware modifications. In general, the fewer companies involved in the manufacturing process, the easier it is to guarantee consistency. For the highest reliability, developers should have the ability to access manufacturer's quality procedures and audit their processes.

Transforming data storage

Flash will continue to change the way data is stored in all types of applications as prices continue to drop, densities increase, and reliability improves. With key technologies such as wear leveling, ECC, and power failure recovery, flash memory backed with 32-bit controllers, stable firmware, and consistent manufacturing processes will bring increased reliability and data integrity to industrial designers around the world. IES

Will Chen *is FAE manager for Netlist in Irvine, California. Will has several years of experience as an application engineer in the semiconductor industry and has also worked as a hardware design engineer. He has a BSEE from UCLA and an MSEE from USC.*

Netlist
949-435-0025
wchen@netlist.com
www.netlist.com

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HESC104

The HESC104 is a 60 W DC-DC converter that includes a flash based microcontroller and 4 amp charger for advanced power management and smart battery charging. Combined with a Tri-M standard battery pack or super cap module, the HESC104 can be used as an Uninterruptible Power Source (UPS) for an industrial system. The HESC104 is designed for low noise embedded computer systems, has a wide input range of 6-40 V (>6:1), and is ideal for battery or unregulated input applications. The HESC104 is specifically designed for vehicular applications and has heavy-duty transient suppressors (5000 W) that clamp the input voltage to safe levels, while maintaining normal power supply operation. The ±5 VDC and ±12 VDC outputs are controlled by a constant off-time current-mode architecture regulator that provides excellent line and load transient response.

The HESC104 provides up to four stages of battery charging and can charge SLA, NiCd, and NiMh batteries and level two and three SMBus compatible batteries. Charge currents are up to 4A, and battery charging voltages from 9.5 V to 19.5 V. The HESC104 has advanced power management functions that allow timed on/off control of the HESC104, notification of changes to main power, and changes in the battery status. For example, the HESC104 can be programmed to power-off the main outputs in 60 seconds and then turn them on again 12 hours later. In addition to smart charging and power management, the HESC104 can monitor up to 16 different temperatures using digital temp sensors. The HESC104 is available as RoHS, is PC/104 compliant, and -40 °C to +85 °C is standard.

FEATURES

- 60 W DC-DC converter
- 6 V to 40 VDC input range
- +5 V, +12 V, -5 V, and -12 VDC output
- 4A charger at 9.5 V to 19.5 V
- Multistage charging SLA, NiCd, NiMh
- SMBus level three compatible charger
- Extended temperature: -40 °C to +85 °C
- High efficiency up to 95%
- High transient suppression
- Low output ripple
- Reverse polarity input protection
- Monitor up to 16 different temperatures

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IPC-5120 is an industrial computer chassis specifically designed for factory floors and other harsh industrial environments. It is a wall-mountable or desktop unit that is ideal for system integrators or users who require a compact and rugged computing platform for industrial applications. Standard MicroATX motherboards with up to four add-on cards may be installed in the IPC-5120. With its innovative design, it can be placed on the desk or mounted bi-directionally by the supplied brackets. The shockproof disk drive housing design protects the system against harsh industrial environments or unexpected shock and the front access I/O interfaces and expansion slots make it easier to operate and maintain after installation.

FEATURES

- Streamlined in-chassis airflow design supports LGA775 Pentium® 4 CPU with suggested CPU cooler
- All I/O interfaces are in the front for easy access
- Shock-resistant drive bay holds one 5.25" and two 3.5" drives (one external and one internal)
- Supports up to four half-sized add-in cards in the front
- LED indicators for power status and HDD activity
- Equipped with 1U-high 300 W ATX/PFC power supply

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ARK-1380 is a powerful all-in-one fanless system designed for rugged and space-critical applications. It can be used as a stand-alone, wall-mounted, DIN-rail mounted or VESA mounted system. It accepts a wide range of power supplies and comes in a footprint of only 7.4" x 1.6" x 5.37". The rugged cast aluminum case not only provides great protection from EMI, shock/vibration, cold, and heat, but also passive cooling for quiet fanless operation. It offers four USB 2.0 ports, one LVDS interface, one LAN port and two COM ports, powered by the Intel® Celeron® M processor. Wireless connectivity can be added via the PC card slot. It also supports a wide range of input voltages from 9 VDC to 35 VDC, and is equipped with a solid state onboard CF card of up to 8 GB.

FEATURES

- Built-in Intel® Ultra Low Voltage Celeron® M 1 GHz/600 MHz CPU
- Two serial ports and four USB ports
- One PC card slot for PCMCIA or Card Bus card
- Comprehensive display, communication, and connectivity
- Ultra compact size and VESA mountable
- Robust construction with fanless operation

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7" Vehicle Mounted PC

TREK-743 is a fanless, compact vehicle mounted computer that can be used for a variety of commercial vehicle applications. The AMD Geode™ LX800 processor-based system features a 7" integrated color TFT LCD display with touch screen and with a choice of Windows® CE 5.0 or Windows® XP Embedded. Radio options and programmable function keys make TREK-743 suitable for delivery, fleet management, and warehousing/logistics applications. Mounting and cabling are clean and simple, and the compact size is perfect for vehicles with limited space. In addition, the ruggedized aluminum enclosure does not have ventilation holes, making the unit waterproof and dust-proof. It is equipped with options for real-time communication and data capture in vehicles to improve productivity.

FEATURES

- 7" WVGA TFT LCD with adjustable brightness
- 5 programmable function keys with backlight
- Rugged aluminum enclosure and fanless design, with extreme temperature operating capability
- Embedded OS support (Windows® CE 5.0 or XP Embedded)
- Flexible expansion capability for IEEE 802.11b/g WLAN, GPS, GSM/GPRS
- Reliable wide DC power input for in-vehicle application

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MARS-3100R is a 10.4" industrial-grade tablet computer with a fanless design. It is suitable for applications in manufacturing, warehousing, factory maintenance, field service, transportation and police, fire, or other emergency services. The rugged design of MARS-3100R is shock and vibration resistant to safeguard data while on the move. The entire chassis is fully sealed to IP54 ratings to prevent water and dust damage in outdoor applications. In addition, the optional built-in WLAN, Bluetooth, and GSM/GPRS/EDGE modules facilitate data transfer and communication with others. With a -20°C to +55°C operating temperature, sunlight readable screen, and adjustable brightness features, MARS-3100R can tolerate extreme environments while showing a clear picture.

FEATURES

- Supports ULV Intel® Core™ Duo U2500 1.2 GHz processor
- Rugged design protects system from shock/vibration damage
- IP54-rated, fully sealed chassis for water/dust resistance
- Powerful communication capabilities with optional built-in WLAN, Bluetooth, and GSM/GPRS/EDGE modules
- Supports Windows® XP for easy development
- Wide -20°C to +55°C operation for extreme environments, such as ironworks or icehouses

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ATX Industrial MB

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FEATURES

- Supports Intel® Core™ 2 Duo and Intel® Q965 chipset with 533/800/1066 MHz FSB
- Up to 8 GB of dual channel DDR2 533/667/800 SDRAM
- Chipset integrated VGA sharing 256 MB system memory
- PCIe x16 slot for VGA card
- Five SATA II ports with 300 MB transfer rate
- Supports dual 10/100/1000BASE-T Ethernet via a dedicated PCIe x1 bus

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Mini-ITX Industrial MB

AIMB-256 is an Intel® GME965-based Mini-ITX industrial motherboard that supports advanced dual-core processor technology for increased system performance. The integrated Intel® GMA X3100 graphics controller features up to 384 MB of shared video memory and DirectX® 9 3D hardware acceleration. This combination of features ensures high-quality graphics and smooth visual performance. For multiple displays or future graphics upgrades, a DVI-D connector placed at the rear I/O supports superior performance graphics and permits convenient connection to display devices, without adding extra add-on cards, and drives the TCO even lower.

FEATURES

- Supports Intel® uFC-PGA 478 Core™ 2 Duo/Celeron® M mobile processor and Intel® GME965+ICH8M
- Two 200-pin SODIMM sockets support up to 4 GB dual channel DDR2 533/667 SDRAM
- Supports dual display, VGA, LVDS, and DVI
- Supports 4 serial ports and 3 SATA ports
- Built in dual Gigabit Ethernet
- CompactFlash Type I/II support

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MicroATX Industrial MB

AIMB-564 is an Intel® Q965-based MicroATX industrial motherboard that supports Intel® Core™ 2 Duo processors and implements Active Management Technology (AMT) for remote management. It has seven SATA II drive connections and an eSATA HDD designed with RAID 0, 1, 5, 10 software. AIMB-564 can handle up to 8 GB of dual channel DDR2 533/667/800 MHz memory, with a 1066/800/533 MHz FSB. Also included are one PCIe x16, one PCIe x4, two PCI slots, ten USB 2.0 ports, one serial port, one parallel port, and two IEEE 1394 connectors. LAN connectivity is covered by one 10/100/1000BASE-T Intel 82566DM Gigabit Ethernet port. AIMB-564 is ideal for digital signage, kiosks, and point-of-sale terminals.

FEATURES

- Supports Intel® Core™ 2 Duo/Celeron® M mobile processor and Intel® GME965+ICH8M
- Two 200-pin SODIMM sockets support up to 4 GB dual channel DDR2 533/667 SDRAM
- Supports dual display, VGA, LVDS, and DVI
- Supports 4 serial ports and 3 SATA ports
- One CompactFlash Type I/II support
- Onboard TPM 1.2 support (option)

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FEATURES

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- Onboard DDR 256 MB memory for shock resistance – designed for extreme working environment
- VGA, 24-bit TTL, 18-bit LVDS display interface. Variety of display choices
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- Energy efficient, fanless, shock resistant, supports wide operating temperature (-20 °C ~ +80 °C)
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WILDSTAR 4 VXS

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FEATURES

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

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

Ultimate Modularity – From zero to six Virtex-5 Processing FPGA/Memory Modules, and two Virtex-5 I/O FPGAs. Accepts one or two Standard Annapolis WILDSTAR 4/5 I/O Mezzanines: Quad 130 MSps thru Quad 500 MSps A/D, 1.5 GSps thru 2.2 GSps A/D, Quad 600 MSps DAC, 10 GE, InfiniBand, SFPDP.

Fully Integrated into the IBM Blade Management System – Abundant Power and Cooling to ensure maximum performance.

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

We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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

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

Achieve world-class performance – WILD solutions outperform the competition.

FEATURES

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

For more information, contact: wfinfo@annapmicro.com

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

WILDSTAR 5 PCI E

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, and other processing intensive applications. Twelfth generation WILDSTAR 5 for PCI Express uses Xilinx Virtex-5 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8-bit ADC, Quad 250 MHz 12-bit ADC, Single 2.5 GHz 8-bit ADC, Quad 130 MHz 16-bit ADC, Dual 2.3/1.5 GSps 12-bit DAC, Quad 600 MSps 16-bit DAC, Universal 3 Gb Serial I/O (Rocket I/O, 10 GbE, InfiniBand), and Tri XFP (OC-192, 10G Fibre Channel, 10 GbE). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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

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

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

FEATURES

- Up to three Xilinx Virtex-5 FPGA I/O processing elements – LX110T, LX220T, LX330T, or FXT
- Up to 7 GB DDR2 DRAM in 12 memory banks per WILDSTAR 5 for PCI Express Board or up to 2 GB DDR2 DRAM in two memory banks and up to 40 MB DDRII, QDRII SRAM, or up to 1.4 GB RLDRAM
- Programmable FLASH for each FPGA to Store FPGA Image
- 8x PCI Express bus. High-speed DMA Multichannel PCI Controller
- Supports PCI Express Standard External Power Connector. Available in commercial or industrial temperature ranges
- Full CoreFire Board Support Package for fast, easy application development. VHDL model, including source code for hardware interfaces and ChipScope access
- We offer training and exceptional special application development support, as well as more conventional support
- Includes one-year hardware warranty, software updates, and customer support
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Save time and effort and reduce risk with COTS boards and software
- Achieve world-class performance – WILD solutions outperform the competition

For more information, contact: wfinfo@annapmicro.com

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Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 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 1,280 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 3.3 V PECL, 2.5 V PECL, or 1.65 V PECL
- Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- Cascade boards to provide up to 16 sets of outputs
- Compatible with standard VME64x and VXS 6U backplanes
- Universal clock input supports wide range of signal options, including signal generator sine wave
- Differential clock input permits multiple standards including: LVDS, 3.3 V PECL, 2.5 V PECL, and 1.65 V PECL
- Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. WILDSTAR™ 2 PRO I/O Cards and WILDSTAR™ 4/5 Mezzanine Cards

For more information, contact: wfinfo@annapmicro.com

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

CoreFire

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

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

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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CePOINT Networks, LLC
1 West Otterson Street • Nashua, NH
603-883-7979
www.cepoint.com

CePOINT Networks

Manufacturers of Rugged Portable & Airborne DVR systems w/IRIG-B time stamp

Studio9000™ DVR IRIG-B

Real-time Digital Video Recorder (DVR) system for robust scientific image acquisition and analysis

Studio9000 DVR system performs with blazing speed, featuring uncompressed (or compressed) real-time video capture and recording with optional precision IRIG-B time stamping and GPS interface capabilities. Standard digital or composite analog video acquisition in color NTSC/PAL, SECAM, RGB YCrCB 4:2:2, or in monochrome format – CCIR (625 lines) and EIA (525 lines) – are supported. Optional SDI is also supported. Up to 240 fps (analog), and very high-speed digital video up to 1280 x 1024 resolution and 30 fps up to 500-1,000 fps (digital) is possible. Other features include: simultaneous capture/playback of four video streams; up to two or more channels of real-time simultaneous record and play; unlimited multicam editing and reediting of captured video without degradation or frame loss; captures continuous real-time video directly to system hard disk or memory; compact, rugged 2RU, 3RU, or 4RU MIL-COTS format; capture and stream directly to disk at up to 528 MBps. Capture directly to system hard drive from different video formats and sources supported by Studio9000 DVR. Monochrome or color at 8-bit, 10-bit, 12-bit,14-bit, and more, including area scan, progressive scan, and line scan. Optional interface features include analogue BNC, Digital LVDS, CameraLINK, USB, and 1394 FireWire cameras.

Applications:

- Airborne video recording
- Object tracking and time reference measurement
- Missile range testing
- Endless video program looping
- Security recorder/player
- Bullet explosion testing
- Industrial monitoring
- Portable field production
- Desktop video capture station
- Surveillance recorder

Studio9000 DVR greatly simplifies the process of time referencing object position and timing measurements by integrating real-time video acquisition, real-time IRIG time stamp, and GPS position data.

FEATURES

- Capture continuous real-time video directly to hard disk at up to 528 MBps; 8-bit, 10-bit, 12-bit, 14-bit, 24-bit, mono or color
- Analog RS-170, NTSC/PAL, RGB H and V-sync, and digital LVDS, CameraLINK, USB, FireWire 1394, and RS-644 or RS-422 camera interface options
- Video resolution: 640 x 480, up to 1280 x 1024 pixels; compressed or uncompressed video formats include: AVI, MJPEG, optional MPEG-4
- Digital clock circuitry; capture high-speed, high-resolution images from RGB or composite; progressive scan, line scan, and area scan
- Optional SDI video I/O (SMPTE 259M, 270 Mbps) with embedded AES/EBU audio
- IRIG-B and GPS formats include: Time code generator, IRIG receiver, ANT BNC input connector, and DB-9 pin RS-232 connector
- Real-time simultaneous capture of up to four channels; stream video directly to hard drive, memory, or display output
- RAID 0 storage with capacity up to 4.8 TB option, and expandable with CePOINT's optional NAS RAID storage for extended duration of video
- External event triggers; up to 4- or 8-channel digital I/O for programmable triggers
- External interface ports include: RJ-45 Ethernet, 1 x PS2 keyboard, 1 x PS2 mouse, VGA, RS-232, or RS-422
- Support for Region of Interest (ROI) video manipulation, packed and planar; YUV 4:2:2
- Rugged MIL-COTS format; lightweight, rugged 19" 2U, 3U, or 4U rack mount, airborne or portable with 24 V or 28 Vdc option

For more information, contact: sales@cepoint.com

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Electronic Solutions Associates
803 Stevens Avenue • Oldsmar, FL 34677
561-226-1309
www.486motherboards.com

Industrial 486

Why upgrade when your software and I/O require a 486 platform?

ESA's Legacy Industrial Barebones System is your drop-in replacement for legacy 486 applications and anchored by ESA's own 386/486 legacy TF-486 motherboard, which is ideal for a broad range of legacy industrial and commercial applications utilizing the popular 386/486 class of processors. It supports up to eight expansion cards, all of which can be full-length ISA cards or one can be PCI that is shared, on an industry standard Baby AT motherboard. Its compact size, high reliability, and large number of expansion slots make it an ideal alternative to expensive passive backplane system architectures. One of the most important qualities of the TF-486 is that it is produced under strict revision control guidelines to provide a long and stable product life cycle. Over 40,000 TF-486s have been utilized since 2000 for computer telephony, industrial control, medical instrumentation, surveillance, and other application environments where extensive testing or certification of the system is required. ESA's revision controlled motherboards reduce your long term costs for system testing, documentation, certification, and maintenance.

ESA recently asked Joyance (peter.tseng@joyance.com.tw) to design an OEM/ODM industrial custom, convertible chassis around our TF-486 Baby AT motherboard. This convertible chassis contains a drive bay and control panel that can be rotated according to chassis type. The unit is easily changed to a wall mount, desktop, or mini tower configuration and utilizes all eight slots of the TF-486 motherboard. ESA's partnership with Joyance gives us the opportunity to offer our customers a higher degree of customization and versatility in a USA designed and assembled chassis from a solid 30-year-old company. ESA's new 486 legacy Barebones System and current 486 development projects prove our ongoing commitment to the 486 platform. ESA also offers chassis and power supply customization to complement most any style of motherboard or passive backplane application.

FEATURES

- 7 ISA and 1 shared ISA/PCI slot
- Watchdog timer
- 512K cache and integrated IDE I/O controller
- 32 MB DiskOnChip (Demo version of ROMDOS loaded), other sizes optional, DiskOnModule available
- 120 GB IDE PATA hard drive capability. 1 MB ISA video card, other video cards available
- DX-33 CPU, optional processors in range of SX-25 through 5X-133 available. 8 MB RAM, others optional
- Custom BIOS available
- Custom industrial steel chassis optimized for the TF-486 motherboard
- Chassis convertible to wall mount, tower, or desktop configuration with customizable drive bay
- Seasonic 80+ 300 W power supply, dual redundant optional
- Motherboard revision control
- RTOS Compatible

For more information, contact: info@esapcsolutions.com

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Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

Kontron EasyG5

The Kontron EasyG5 offers an industrial version of the IBM Power Architecture in a convenient 6U format. The EasyG5 provides a dual PPC970 architecture 100% compatible with the existing IBM JS20 computer blade (service processor included).

Where a large blade center cannot fit, the rugged compact approach of EasyG5 offers the same performance in a far smaller form factor. Using PCI Mezzanine Cards, I/O on the EasyG5 can be simply and cost-effectively customized. In addition, Kontron's expertise in PowerPC technology allows for further customization, satisfying more specific embedded application requirements.

FEATURES

- Dual PPC970 architecture (1.6 GHz)
- Up to 1 GB memory
- 100% software-compatible with JS20 blade
- Supports Red Hat Enterprise AS (PPC64 version)
- Peak memory bandwidth: 6.4 GBps
- Compliant with harsh environments

For more information, contact: info@us.kontron.com

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Industrial systems

Industrial Embedded Systems Resource Guide 2008

Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

Kontron OM6040

As part of the Kontron portfolio of MicroTCA pre-integrated platforms, the Kontron OM6040 provides a standard platform to develop and deploy MicroTCA for industrial applications. The five-slot MicroTCA platform has been configured and tested to speed up development of MicroTCA solutions for industrial users.

The backplane supports an MCH slot, a CPU slot, and three PCIe peripheral slots. PCIe is switched by the MCH and available on all peripheral slots. SATA is supported as point-to-point connections between the CPU slot and the next two peripheral slots.

FEATURES

- Compact system for up to 4 AMCs including AC Power and fans
- Single Star backplane including GbE and PCIe/SRIO
- Fully featured MCH including managed GbE switch and PCIe/SRIO switch
- SAS/SATA on backplane
- Well suited for compact size Industrial PC applications
- Systems pre-configured and tested to speed up MicroTCA developments

For more information, contact: info@us.kontron.com

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MEN Micro, Inc.
24 North Main Street • Ambler, PA 19002
215-542-9575
www.menmicro.com

XM1 System-On-Module

MEN Micro Inc., a world-renowned provider of embedded computing and I/O solutions for demanding industrial, mobile, and harsh environment applications, has announced the ESMexpress® System-On-Module Standard, a new computing standard in development to be the ANSI-VITA 59 (RSE Rugged System-On-Module Express) Standard. ESMexpress brings the cost and time savings of Computer-On-Modules (COMs) technology to rugged, harsh, and mission-critical environments.

The XM1, one of the first available ESMexpress products from MEN Micro, features the first-generation Intel® Atom® processor (Z530 at 1.6 GHz or Z510 at 1.1 GHz) based on 45 nm technology coupled with 1 GB of soldered DDR2 SDRAM for significantly lower power dissipation, reduction in design costs, and space-saving design flexibility.

COMs, also known as Systems-On-Modules (SOMs), are complete computers on a mezzanine board that use a standard CPU with I/O configuration only required on a carrier board to allow for individual functionality tailored to the specific application. ESMexpress combines this model with advanced cooling technologies, the latest serial buses, and rugged components to ensure safe, reliable operation in harsh environments found in areas as diverse as the railway, avionics, industrial automation, medical engineering, and mobile industries.

Although the ESMexpress-based XM1 dissipates an impressive 7 W of power using the standard's advanced fanless cooling system, ESMexpress itself enables power dissipation of up to 35 W while providing added EMC protection by mounting the populated PCB to a frame and completely enclosing the module in an aluminum housing.

FEATURES

- Complete computer on a single mezzanine board
- Conforms to new ANSI-VITA 59 RSE Rugged System-On-Module Express standard (in process)
- Safe, reliable operation in harsh environments such as railway, avionics, industrial automation, medical engineering, and mobile industries
- Uses standard CPU with I/O configuration for individual functionality tailored to the specific application
- Exceptional performance: 1.6 GHz CPU, 1 GB RAM, PCI Express®, GB Ethernet, SATA, USB, SDVO, LVDS, and HD audio
- 1 GB of soldered DDR2 SDRAM for significantly lower power dissipation, reduction in design costs, and space-saving design flexibility
- Low power Intel® architecture dissipates a maximum of 7 W from -40 °C to +85 °C
- Non-socketed components enhance rugged design
- Shock/vibration resistant connectors support differential signals up to 8 GHz
- EMC-proof housing for convection or conduction cooling
- Compact 95 mm x 125 mm format
- Fixed pin assignments guarantee that ESMexpress modules remain interchangeable

For more information, contact: Stephen.Cunha@menmicro.com

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

IA261-I/IA262-I Series

In the world of industrial automation, reliability, multiple connections, and communications are critical aspects of any process. More and more, people are seeking multiple forms of communication to increase the efficiency of their processes and to communicate with a multitude of devices. All this should be from one central embedded computer with a way to output critical data instantly. Moxa's new IA261/262 Series delivers top notch performance in all connection and communication areas with Dual Ethernet, dual or quad serial ports, optional dual CANbus ports, and a VGA output. To work with a broad range of applications, Moxa's IA261 and IA262 embedded computers come with the following features:

Powerful embedded computing platform
IA261/262 computers use the Cirrus Logic EP9315 ARM9, 32-bit, 200 MHz RISC CPU. This powerful computing engine supports several useful communication functions, but will not generate too much heat. The built-in 32 MB NOR Flash ROM and 128 MB SDRAM give you enough memory to run your application software directly on the IA261/262.

Multiple connection options for data communication
IA261/262 computers support RS-232/422/485, CANbus (IA262), and digital I/O. They all come with isolation protection and have dual LAN ports, making them ideal as communication platforms for industrial applications that require network redundancy. In addition, the VGA output interface is suitable for use with SCADA systems in industrial applications, such as manufacturing automation and production line process monitoring that require VGA and HMI features.

Wide temperature models for harsh industrial environments
In addition to the standard models, wide temperature (-40 °C to +75 °C) models are available for use in harsh industrial environments.

Windows CE 6.0 pre-installed
IA261/262 computers come with Windows CE 6.0 pre-installed, and support general Windows and .NET 2.0 computing environments. This means that programs developed for standard PC operating systems with tools such Embedded Visual C++ or Visual Studio 2005 can run on the IA261/262 without much porting effort.

FEATURES

- Cirrus Logic EP9315 ARM9, 32-bit, 200 MHz RISC Processor
- Various communications: isolation protected Ethernet, serial, and CANbus ports
- Digital inputs and outputs for integration into factory processes and automation
- Integrated graphics accelerator with TTL graphical signal support and up to 1024 x 768 resolution with standard DB15 connector
- Durable, rugged aluminum housing with IP40 protection ensures protection in an industrial environment
- Shock and vibration testing and resistance along with no moving parts ensure continuous operation regardless of location
- Available wide temperature models operate from -40 °C to +75 °C, allowing operation in extreme conditions
- Wide voltage input range of 12-48 VDC allows multiple types of power supplies
- Flexible mounting options include DIN and wall mount to ensure mounting anywhere
- Generous 5 year warranty to ensure customer satisfaction

For more information, contact: ariana.drivdahl@moxa.com

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Protech Systems
950 Fee Ana Street, Suite B • Placentia, CA 92870
714-996-7200
www.protech-usa.net

PROTECH SYSTEMS
It's the right choice

PPC-7505F/7507F

The many benefits of a touch-screen PC, such as accessibility, user convenience, color, and immediacy, are about to be enhanced for companies and individuals around the world, thanks to the release of a low-energy, high-performance model designed, manufactured, and marketed by Protech Systems Co., Ltd., a leader in computer products for industrial, retail, and automation-based industries.

The new PPC-7505F/7507F marks a significant departure from the ordinary, as well as a step toward the future, with features incorporated for superior performance in virtually any environment where a touch-screen user interface and rapid information retrieval are of paramount importance. Featuring an energy-saving, high-resolution 15"/17" flat panel and an Intel® Celeron® M ULV processor, the PPC-7505F/7507F provides impressive computing power at clock speeds up to 1.0 GHz. Based on the Intel® 852GM chipset, it is built to meet the demands of today's critical PC applications and time-sensitive work tasks.

Compact dimensions and computing power can indeed coexist, as the PPC-7505F/7507F proves. Despite the large, 17" diagonal panel with built-in USB interface and memory support for up to 1 GB RAM, the system takes up no more space than the screen itself. Moreover, the PPC-7505F/7507F is expandable with an onboard IDE interface, Type II CompactFlash slot, and either one or three PCI ports. Accordingly, the PPC-7505F/7507F can function as a stand-alone unit, as the heart of a multi-user, multi-terminal network, or as part of an existing system in the industrial, retail, or service environment. Touch-screen input makes it all easy.

The PPC-7505F/7507F represents a comprehensive yet economical solution for the modern business environment, providing the immediacy of touch-screen operation for employees of all descriptions and all levels.

FEATURES

- Intel® Celeron® M ULV CPU onboard
- Totally fanless and quiet design
- Low power consumption and economical solution
- Onboard IDE interface, Type II CompactFlash slot
- Optional slim CD-ROM drive
- Optional PCI Expansion slot (1 or 3 slots)
- 24 DC power support, optional power adapter for AC power

For more information, contact: sales@protech-usa.net

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Protech Systems
950 Fee Ana Street, Suite B • Placentia, CA 92870
714-996-7200
www.protech-usa.net

PROTECH SYSTEMS
It's the right choice

PSB-701LF

Protech Systems Co., Ltd., one of the world's most respected names in the design, manufacture, and marketing of PCs, boards, and peripherals for use in industry, commerce, and multimedia, has established a new benchmark of performance with its PSB-701LF CPU card, a model designed for maximum performance in today's gaming environments, multimedia, and other memory-intensive applications.

The PSB-701LF is based on the Intel® Q35 + ICH9DO chipset configuration, which ensures its compatibility with the latest processing technology, including the Core™ 2 Duo, Core™ 2 Quad, and Celeron® configurations. Accordingly, the new model can accommodate the need for reliable usage with all leading Windows-based software applications, and can do so at any of various price levels. In fact, the PSB-701LF delivers clock speeds ranging from 1.6-2.0 GHz with the Celeron® processor and up to 2.4-2.66 GHz with the Core™ 2 Quad. Paired with two 240-pin DDR2 DIMM slots supporting Dual Channel memory architecture, plus DDR2 running at 667-800 MHz, the card provides up to 4 GB of RAM.

Connectivity is another of the many advantages built into the PSB-701LF. There are four SATA II interface connectors for high-speed data transfer via RAID 0,1,10,5, along with a 20-pin header for operation via TPM (Trusted Platform Module) 1.2. Two serial ports COM 1 and COM 2 provide RS-232/422/485 compatibility, while 10/100/1000 Mbps ports are provided for LAN 1 and LAN 2, with support for ATX-powered Wake-on-LAN. High Definition Audio is via Realtek ALC202A and a 10-pin header, and two DIN connectors are in place for keyboard and mouse connection.

The PSB-701LF was designed to satisfy the needs of memory-intensive applications, such as gaming, multimedia, medicine and medical imaging, and telecommunications, all of which benefit from the product's Dual Channel memory system.

FEATURES

- Support Intel® Core™ 2 Quad, Intel® Core™ 2 Duo, Intel® Celeron® M
- Equipped with Intel® Q35 Chipset with FSB 1333 MHz
- Memory Supports DDRII 800 SDRAM up to 4 GB
- Support Trusted Platform Module
- Support 4 x SATA II HDD
- Applications such as factory automation, finance, telecommunications, security, storage, multimedia, and more

For more information, contact: sales@protech-usa.net

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Sensoray

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SENSORAY | embedded electronics

Model 2426

Model 2426 is a versatile and compact, multifunction I/O board that simultaneously serves up to five 10/100 Mbps Ethernet clients. Powered from a single 24 VDC supply, it features one RS-422/485 serial communication port, eight optically isolated digital inputs, and sixteen digital outputs (all with signal levels up to 24 VDC), six 12-bit analog inputs, and one 12-bit analog output. A high speed 32-bit counter accepts both quadrature and single phase clocks from devices such as incremental encoders and tachometers.

Numerous special safety features are incorporated, including watchdog and communication timers as well as Sensoray's exclusive "Safety Chain," a highly integrated, fail-safe routing circuit for interlock contacts. Network protocols include telnet and http.

FEATURES

- Versatile, multifunction I/O board supports up to five Ethernet clients via telnet and http
- RS-422/485 serial port accessible via telnet
- 8 optically isolated, debounced digital inputs and 16 digital outputs with PWM mode
- Six 12-bit analog inputs and one 12-bit analog output
- High speed 32-bit counter with incremental encoder interface
- Comprehensive safety systems including integral support for interlock contacts

For more information, contact: melissa@sensoray.com

RSC# 36513 @ www.industrial-embedded.com/rsc

Technobox, Inc.

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

Technobox, inc.®

4733

The Technobox 4733 is a PMC-to-PCI Express adapter that permits use of a PMC card in a 4X, 8X, or 16X PCI Express slot. Built around the 8114 bridge chip, the primary side of the bridge is fixed at 2.5 GHz per lane in each direction. The secondary (PCI/PCI-X) side operates at 33, 66, 100, or 133 MHz (either 64 or 32 bits). XCAP and M66EN signals are supported by DIP switch settings to force operation at non-X or lower PCI clock frequencies. Activity LEDs located at the edge of the board give an indication of key PCI and PCI Express signals and voltages. The DIN connector provides access to the 64-pin user I/O on the mezzanine card. JTAG signals are brought out to headers allowing users the option of connecting the JTAG ports.

FEATURES

- Adapts a PMC or PMC-X to a PCIe site
- PLX 8114 Bridge
- 4 lanes PCIe
- 2.5 Gbps per lane (each direction)
- Industrial temperature
- RoHS compliant

For more information, contact: info@technobox.com

RSC# 35220 @ www.industrial-embedded.com/rsc

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

Panel PC

WinSystems' Panel PC (PPC2) is a compact display subsystem that includes a TFT flat panel display, PC-compatible single board computer with Ethernet and touchscreen integrated into an open-frame enclosure less than 3" thick.

The combination of embedded PC functionality and industrial-grade construction makes the unit ideal for industrial automation and control applications with tight system integration and minimal space requirements. The unit will operate over a temperature range of -20 °C to +70 °C.

The flat panel display is ideal for factory automation use. 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 ensuring color fidelity and superior gray scaling.

The PPC2's resistive touchscreen allows all kinds of touch input devices to activate the screen, including fingers, fingernails, styluses, and gloved hands, all the while maintaining an exceptional tactile feel. A keyboard and mouse can be used for input as well.

It is shipped with a wired Ethernet connection plus it supports expansion with 802.11 wireless Ethernet and/or CDMA/GSM cellular modems, making the Panel PC perfect for networked applications as well.

The PPC2 supports operating systems such as Linux and Windows® XP Embedded, plus real-time kernels compatible with the x86 architecture. WinSystems offers a 30-day evaluation program.

FEATURES

- Compact 12.1" or 15" AM TFT Flat Panel Display
- Includes PC-compatible single board computer 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 allow better fit into your application's 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

For more information, contact: info@winsystems.com

RSC# 33631 @ www.industrial-embedded.com/rsc

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

Trusted ePlatform Services

ADVANTECH

EPIC CPU Module

PCM-4386 is an EPIC single board computer (SBC) with high performance and low power consumption based on Intel® Celeron® M processors. In conjunction with the Intel® 852GM chipset, PCM-4386 supports processors clocked at up to 1.0 GHz, four USB 2.0 compatible ports, up to 2 PCI Fast or Gigabit Ethernet interface, 2 channel LVDS interface, and can accommodate up to 1 GB of DDR RAM memory. PCM-4386 is the first Advantech EPIC SBC that passes the strict Phoebus Design Extended Temperature Testing (ETT) process, which guarantees reliable operation in extreme temperatures ranging from -40°C to +85°C and can resist the most severe shock and vibration.

FEATURES

- EPIC form factor (approximately 4.5" x 6.5")
- Embedded Intel® Celeron® M processor onboard and support for PC/104-*Plus* bus
- SODIMM socket supports up to 1 GB DDR SDRAM (option)
- Supports display combination CRT + LVDS
- Supports four COM and four USB 2.0 ports
- Dual 10/100/1000 Mbps PCI Ethernet interface

For more information, contact: ECGinfo@advantech.com

RSC# 36509 @ www.industrial-embedded.com/rsc

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

Technobox, inc.

5277

The Metering XMC to PCI Express Adapter is a tool for testing an XMC card in a PCI Express slot (1X, 4X, 8X, or 16X). It also can be used to measure current and voltages and the PCI Express bus. The XMC is mounted vertically, allowing access to both sides of the card. All signals on the XMC P16 connector are accessible via two 64-pin headers. PCI Express lanes on the P15 XMC connector are routed to the PCI Express edge finger connector.

A convenient digital metering function measures power supply voltages and current draw of the XMC. The meter can also be used as a frequency counter that measures PCI Express bus clock frequency. Modes include Real-Time display, Minimum and Maximum value capture, Range (Min-Max) display, and sample averaging.

FEATURES

- Adapts an XMC to a PCI Express Slot
- Supports up to 8 PCI Express Lanes
- Permits Access to P16 Signals, I2C, and JTAG
- Provides Multiple Modes to Monitor and Measure XMC Voltage and Current plus PCI Express Bus Frequency
- Additional LEDs Show Status of Key XMC Signals and Voltages
- RoHS compliant

For more information, contact: info@technobox.com

RSC# 36875 @ www.industrial-embedded.com/rsc

American Portwell Technology, Inc.
44200 Christy Street • Fremont, CA 94538
Tel: 510-403-3399 • Fax: 510-403-3184
www.portwell.com

Portwell

PEB-2736

The PEB-2736, an embedded system board utilizing the Intel ECX form factor, is based on the Intel Atom processor Z500 series and the Intel System Controller Hub US15W. The new micro-architecture of the Intel platform benefits a range of low-power systems and handheld mobile devices in applications such as Portable POS, Medical Healthcare, Mobile Kiosk, Entry Gaming, Digital Signage, and In-Vehicle Infotainment. The PEB-2736 is specifically designed to operate at a very low power consumption of less than 10 watts at full loading. It supports dual display by LVDS and SDVO connector. The modular SDVO and SDIO board architecture can be easily customized to meet the customer's time to market and proprietary requirements.

CONTACT US: info@portwell.com OR 510-403-3399.

intel Atom inside

FEATURES

- Intel Atom processor Z500 series and the Intel System Controller Hub US15W
- One 200-pin SODIMM supports DDR2 SDRAM up to 1 GB
- Wireless application can be accomplished via mini-card socket on optional daughter card
- Dual independent display: SDVO and 24-bit LVDS; Multi-stream audio and CH5.1 supported
- Trusted Platform Module (TPM) and USB-Disk Module (UDM) could be added onboard
- One Type II CompactFlash and one IDE connector. QUESTIONS? info@portwell.com OR 510-403-3399

For more information, contact: info@portwell.com

RSC# 36882 @ www.industrial-embedded.com/rsc

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

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... real time solutions!

SBC-ComEx

A Stand-Alone, Dual XMC slot, intelligent carrier card combining an industry-standard COM Express CPU module and dual XMC modules to create the ultimate-performance embedded computer.

The SBC-ComEx is a user-customizable, turnkey embedded instrument/micro-footprint Windows/Linux PC that supports a wide assortment of ultimate-performance XMC modules. With its modular I/O, scalable performance, and ubiquitous PC architecture, the SBC ComEx reduces time-to-market while providing engineers with exceptional computational capabilities.

Primary features include:

- Distributed Data Acquisition – Put the SBC-ComEx near analog data sources to reduce system errors and wiring complexity. Onboard GPS-synchronized timing, triggering, and sample control facilitates limitless, planet-wide I/O expansion.
- Uniquely Customizable – Dual XMC sites for I/O, each with user-programmable FPGAs for custom signal processing, triggering, and timing control.
- Remote or Local Operation – Continuous data streaming to disk arrays at 500 MB/s or via 10 m cabled-PCIe LANs at 250 MB/s, or via wide-area Ethernet networks at 1 Gb/s.
- Rugged – Runs diskless from FLASH drive in a compact, rugged 250 mm x 170 mm footprint that is ideal for embedded applications.
- 12 VDC-Only Operation – Perfect for portable or automotive data loggers or waveform generators.
- Runs Windows or Linux applications. Compatible with the huge body of existing PC applications and user-code.

The SBC-ComEx single board is an ideal choice for embedded control, remote data acquisition, industrial test and measurement, and OEM instrumentation. The SBC-ComEx provides a turnkey solution to developers of wireless communications and real-time IF signal processing applications. By combining Innovative IP cores to perform functions such as down-conversion, demodulation, and decoding within a high-performance PC in such a small form factor, developers are now able to implement real-time instrumentation in portable equipment while mitigating cost, footprint, and engineering effort.

FEATURES

- Combines industry-standard COM Express CPU module and dual XMC modules in a compact, stand-alone design
- Scalable CPU performance from Celeron to dual-core Pentium using COM Express with up to 4 GB memory
- Small form factor: 250 mm x 170 mm. Rugged, stand-alone operation
- Able to operate diskless and headless. Runs Windows or Linux applications
- Configurable I/O uses standard XMC I/O modules. Add anything from RF receivers to industrial control modules
- PCI Express I/O sites (VITA 42.3) deliver >600 MB/s to CPU memory
- Integrated timing and triggering support for I/O includes optional GPS-disciplined clock
- Supports Innovative X3 and X5 I/O module features for private data channels, triggering, and timing features
- USB 2.0 x6, Gigabit Ethernet, SATA x4, VGA, AC'97 audio
- System expansion supported with Cabled PCI Express – use other eInstruments
- Boots from SATA HDD or USB FLASH; Optional GPS module support; AC or 12 VDC operation
- Applications include embedded control, remote data acquisition, industrial test and measurement, and OEM instrumentation

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

RSC# 36881 @ www.industrial-embedded.com/rsc

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805-578-4260
www.innovative-dsp.com

Innovative Integration
... real time solutions!

eInstruments

User-customizable, turnkey embedded instrumentation. You choose the Flexible PMC Module to create your own customized eInstruments.

Assortment of ultimate-performance XMC modules within a rugged enclosure plus XMC carrier card with either cabled-PCIe or Gbit Ethernet bus.

Distributed Data Acquisition: Co-locate instrument and unit-under-test to optimize signal quality/minimize cabling. Limitless expansion via external.

Tethered or autonomous operation.

Continuous Streaming Rates: Up to 220 MB/s (10 meter, cabled-PCIe LAN) or 1 Gb/s Ethernet WAN.

Optional, stand-alone, autonomous operation: FPGA-based real-time (servo) control or analog I/O at rates to 400 MHz. 12 Vdc-only operation.

Perfect for portable or automotive data loggers or wave-form generators.

Enclosure: Rugged, 1U x 1/4 rack width.

Conductive cooling for XMC carrier cards plus optional fan. Optional desktop or automotive mounting.

Applications: Countless.

See SBC-ComEx within this resource guide!

FEATURES

- The following High-Performance PCI Express (PCIe) XMC Modules are available to create a custom eInstrument:
- X3-10M PCI Express XMC Module with 8 simultaneous channels of 10 MSps 16-bit A/D, and 1.8M FPGA with DSP
- X3-25M 2 A/D, 16-bit, 25 MHz, >80 dB SFDR; 2 D/A, 16-bit, 25 MHz, >85 dB S/N; Digital I/O: 48-bits (J16), 16-bits Front Panel; Xilinx Spartan-3A DSP 1.8 Mgate FPGA
- X3-A4D4 4 A/D, 16-bit, 4 MHz, >85 dB S/N – 4 D/A, 16-bit, 10 MHz, >85 dB S/N – Digital I/O: 48-bits (J16) – Xilinx Spartan-3 FPGA, 1 or 2 Mgate
- X3-DIO Digital I/O: SRAM @ 150 MBps, 48-bits (J16), 64-bits Front Panel, LVDS, LVTTL, CMOS33, CMOS25 – Xilinx Spartan-3 FPGA, 1 or 2 Mgate
- X3-SD 16 A/D, 24-bit, 216 kHz, >100 dB S/N – 48-bits (J16) Digital I/O – Xilinx Spartan-3 FPGA, 1 or 2 Mgate – 4 MB SRAM
- X3-SDF 4 A/D, 24-bit, 20 MHz, >100 dB S/N – 48-bits (J16) Digital I/O – Xilinx Spartan-3 FPGA, 1 or 2 Mgate – 4 MB SRAM
- X3-Servo 6 A/D, 16-bit, 250 kHz, >80 dB S/N – 6 D/A, 16-bit, 1 MHz, >80 dB S/N – Digital I/O: 48-bits (J16), 8-bits front panel – Xilinx Spartan-3A DSP 1.8 Mgate FPGA
- X5-400M PCIe XMC Module – 400 MSps; 14-bit A/D and D/A (x2), Virtex-5 FPGA, 1 GB Memory
- X5-210M PCIe XMC Module – Four 210 MSps 14-bit A/Ds, Virtex-5 FPGA, and DDR2/QDR-II Memory
- Available Carrier Cards: XMC to PCI Express Single slot XMCe-PCIe carrier card – PCI Express card XMC to PCI Express (8-Lane) Single slot XMCe-PCIe carrier card – Eight (8) Lane PCI Express card XMC to PCI Single slot XMCe-PCI carrier card – PCI card

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

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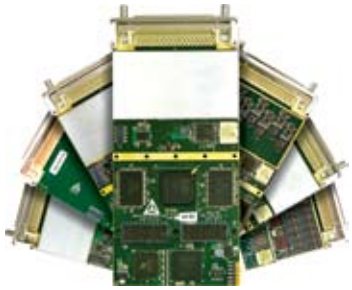

X3 PCIe XMC Modules

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 FPGAs.

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 flow directly into the user-configurable Spartan-3 logic device.

FEATURES

- X3-10M – 8 simultaneous channels of 25 MSps 16-bit A/D and 1.8M FPGA with DSP
- X3-25M – Two 25 MSps A/Ds, Two 50 MSps DACs, and 1M FPGA
- X3-SD – 16-Channels, 24-bit, 216 KSps, Simultaneous Sampling, >110 dB A/Ds, 1M FPGA, and 4 MB Memory
- X3-SDF – 4-Channels of 24-bit, Fast Sigma-Delta A/D >110 dB, 1M FPGA, 4 MB Memory
- All pricing and data sheets can be found at www.innovative-dsp.com

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

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Small form factor modules

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X5-210M

The X5-210M is an XMC I/O module featuring four 14-bit 210 MSps A/Ds with a Virtex-5 FPGA computing core, DRAM and SRAM memory, and eight lane PCI Express host interface. A Xilinx Virtex-5 LX110T (SX95T when available) with 512 MB DDR2 DRAM and 4 MB QDR-II memory provide a very high-performance DSP core for demanding applications such as emerging wireless standards. The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at extremely high rates exceeding 300 GMACs per second.

Get pricing and data sheets online now.

FEATURES

- Four 210 MSps 14-bit A/D channels ±1 V, 50 ohm, SMA inputs and outputs 512 MB DDR2 DRAM
- Xilinx Virtex-5, LX110T FPGA (SX95T coming) 4 MB QDR-II SRAM, 8 RocketIO private links, 2.5 Gb/s each
- >1 GB/s, 8-lane PCI Express Host Interface Power Management features XMC Module (75 mm x 150 mm)
- PCI Express (VITA 42.3) fully customized using VHDL and MATLAB
- Applications: Software tuned radios, wireless receivers (up to 256-ch.), radar, high speed data recording, and FPGA IP development

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

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Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

3.5-inch SBC

Kontron offers two families of 3.5-inch SBCs – JRex and EPIC. The newest addition to the JRex family is the JRexplus-LX that is equipped with the fanless AMD Geode™ LX800 CPU for excellent performance. In addition to PC/104-*Plus* expansion, the JRexplus-LX supports two Serial ATA interfaces for fast hard drives and GbE. All of the other JRex family features are standard on this new addition to the family. The Kontron EPIC/PM boasts an Intel® Pentium® M 745 processor with 1.8 GHz and 2 MB L2 cache. For cost sensitive applications or fanless operation, the Kontron EPIC/PM is also available in ULV Celeron® M 373 with 1 GHz or Intel® Celeron® 800 MHz versions. For more information on Kontron 3.5-inch SBCs, visit www.kontron.com/3.5-inch.

FEATURES

- PC/104 and PC/104-*Plus* 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 within the Kontron JRex and EPIC product families
- Request a sample today and start evaluating immediately

For more information, contact: info@us.kontron.com

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Industrial Embedded Systems Resource Guide 2008
Small form factor modules

Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

Flatpanel SBCs

When a very low profile computer is needed to be directly mounted behind a flat panel, the Kontron ePanel family of mobile flatpanel SBCs is the solution. The Kontron ePanel-PM is a complete SBC with a very low height based on low power Intel® Celeron® M and Pentium® M processors. A wide range of software is available for this proven x86 platform. Along with very low power consumption, many onboard interfaces are available allowing systems to be designed within a very short period and brought to market with minimal engineering effort. Kontron also offers a complete line of flatpanel controllers (aFLAT series), which enables easy plug and display integration of flatpanels in embedded applications. For more information on these solutions, visit www.kontron.com.

FEATURES

- Low profile form factor with Intel® Celeron® M and Pentium® M processors
- Low power consumption
- Wireless LAN/Internet, Bluetooth connections, and more through PC-CARD-Slot or Mini-PCI
- Multi-panel support offering solutions up to WUXGA including HDTV
- Customizable OSD hardware and software solutions
- Request a sample today and start evaluating immediately

For more information, contact: info@us.kontron.com

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PDSi Pinnacle Data Systems, Inc.
6600 Port Road, Suite 100 • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-409-1269
www.pinnacle.com/products2/advancedmc/am2

AMC-A2 PrAMC Board

PDSi's newest AMD Socket AM2 AMC Processor Module (AMC-A2) is a high-performance computing module for use in AdvancedTCA and MicroTCA systems. Designed around AMD Athlon™ processors, the AMC-A2 provides exceptional computing power in the convenient and versatile AdvancedMC (AMC) form factor.

OEMs in telecom, datacom, military, aerospace, and medical industries will appreciate this robust, modular, cost-effective computing platform alternative. With AMD 64 technology and rigorous, innovative design, the AMC-A2 processor AMC represents a new plateau in performance-per-watt. Long-term availability and high reliability are assured for embedded xTCA solutions. Contact PDSi for customization requirements.

For a customized application to your systems, please contact rob.ellis@pinnacle.com.

FEATURES

- High performance hot swappable AdvancedMC processor module conforms to PICMG AMC.0 R2.0
- Supports AMD Athlon™ single- and dual-core processors with true multi-tasking for increased performance
- SOCDIMM socket supports DDR2 667 MHz ECC memory up to 2 GB
- Up to 8 GB optional onboard microDOC flash for local boot drive
- Front panel interfaces – 2x USB 2.0, 1x Serial. Pigeon Point module management
- Extended availability assured

For more information, contact: rob.ellis@pinnacle.com

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Small form factor modules

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Tel: 614-748-1150 • Fax: 614-409-1269
www.pinnacle.com/products2/comexpress/module/

COMX-S1 COM Express Board

PDSi's new AMD Socket S1 COM Express Module (COMX-S1) is a low cost, compact, embeddable computing core with the capability to drive a broad range of OEM applications especially where video output is required. Several performance levels are available, from the ultra low-watt AMD Sempron™ processors (ideal for fanless applications) to the dual-core muscle of AMD Turion™ X2 Mobile Technology. The AMD M690 series chipset delivers exceptional built-in graphics. COMX-S1 significantly reduces initial platform design time while enabling convenient serviceability and future upgradeability – just unplug and update the COM Module and leave your application-specific I/O carrier in place. Bring increased flexibility and modularity to your applications.

For a customized application to your systems, please contact rob.ellis@pinnacle.com.

FEATURES

- Supports AMD Socket S1 family including AMD Sempron and AMD Turion X2 Dual-core mobile technology
- Perfect for embedded OEM applications requiring future upgradeability. Extended availability assured
- AMD M690 Series Chipset for flexible multi-output video including dual LVDS, analog VGA, optional TV Out
- PICMG Type 2 compatible: 4 PCIe, 8 USB, 4 SATA II, 1 Ethernet port
- MicroATX Carrier Board and packaged Development Systems available for rapid startup
- Up to 4 GB DDR2 667 SDRAM (1 – 200 pin SODIMM socket)

For more information, contact: rob.ellis@pinnacle.com

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Tri-M Engineering
100 – 1407 Kebet Way • Port Coquitlam, BC V3C6L3 Canada
604-945-9565
www.Tri-M.com

VSX104

The VSX104 is a 300 MHz fanless CPU module featuring a complement of robust features such as extended temperature operation and soldered DDR2 RAM integrated in a small, low power package. The VSX104 is RoHS compliant and conforms to the PC/104 form factor, which allows users to easily add a wide range of low-cost I/O options.

The VSX104's 300 MHz DM&P Vortex86SX System-on-Chip (SoC) is a high performance and fully static 32-bit x86 processor designed to work with embedded operating systems including Windows® CE, Linux, DOS, and most popular 32-bit RTOS. Standard features of the VSX104 include 128 MB soldered on DDR2 RAM, four COM ports, two USB 2.0 ports, and one 10/100 Ethernet port. In addition to 2 MB onboard SPI flash (floppy emulation), it also includes both a Type I CompactFlash™ socket as well as a microSD socket. An onboard redundancy port allows for two VSX14 modules to be stacked together, and system expansion is supported by the PC/104 interface.

The VSX104 is a compact design measuring 3.55" x 3.775" x 0.9" and has an operating temperature of -40 °C to +85 °C. Single +5 VDC power is supplied through the PC/104 bus or 2-position screw terminal and total power consumption is a mere 1.85 Watts. The VSX104 is in full production with units available from stock.

FEATURES

- 300 MHz Vortex86SX SoC
- 128 MB soldered DDR2 RAM
- Integrated 10/100 LAN, 4x RS-232, 2x USB 2.0, 1x LPT, keyboard, mouse
- 2 MB onboard SPI Flash
- Fanless operation for high-reliability
- 1.85 Watt power consumption
- Type 1 CompactFlash™ and microSD sockets
- Extended temperature operation: -40 °C to +85 °C
- Onboard redundancy port
- RoHS compliant
- Small footprint: 3.55" x 3.775"
- Designed to work with embedded operating systems including Windows® CE, Linux, DOS

For more information, contact: info@tri-m.com

RSC# 35994 @ www.industrial-embedded.com/rsc

DMP Electronics, Inc.
12328 Valley Blvd., Suite B • El Monte, CA 91732
626-444-6666
www.vortex86sx.com

300MHz Vortex86SX

The Vortex86SX System-on-Chip was originally designed, with Long-Product-Life-Cycle support, to provide a product migration path to the existing user of the DMP M6117D chip, a 40MHz 386SX System-on-Chip introduced to the market in the early 1990s, reaching end-of-life in 2007.

The Vortex86SX is a 32-bit 300MHz x86 System-on-Chip (SoC), built with 0.13 micron process and ultra low power consumption design (less than 1 watt). The Vortex86SX SoC integrated many of the common computing I/O and peripherals into a single chip design, a 27 mm x 27 mm 581-pin BGA package.

The Vortex86SX SoC supports Windows Embedded CE, Linux, DOS, and other Operating Systems. The SoC design integrates 32 KB write through direct map L1 cache, native 16-bit ISA bus, PCI Rev. 2.1 32-bit bus interface at 33MHz, SDRAM, DDR2, ROM controller, IPC (Internal Peripheral Controllers with DMA and interrupt timer/counter included), SPI (Serial Peripheral Interface), Fast Ethernet MAC, FIFO UART, USB 2.0 Host, IDE controller, and more into a System-on-Chip (SoC) design.

With its core design based on the matured x86 CPU architecture and rich set of integrated I/O peripherals and designed to function in harsh temperature ranges of -45 °C to +85 °C, the Vortex86SX SoC provides the ideal hardware platform to design new generations of Industrial Single Board Computers and embedded controllers to build Automation Control, Medical, Automotive, Utility Metering, Firewall Router, Security Access, Thin Client, Intelligent RFID reader, RS-232 to TCP protocol converter, Home and Building Automation, and other devices.

FEATURES

- 300MHz x86 Processor Core
- SDRAM and DDR2 Memory Control Interface
- Built-in 256 KB BIOS Flash eliminates the need for external flash for the BIOS
- Built-in ISA Bus, PCI Bus, LPC Bus, SPI, and JTAG
- Built-in 10/100 Fast Ethernet MAC/PHY
- MTBF Counter and Hardware Redundancy Support
- Five FIFO UARTs enable support for 5 serial ports without additional UART chip
- Four USB v2.0 host interfaces
- 40-bits GPIOs
- Support DOS, Linux, Window CE 5.0, Windows Embedded CE 6.0, and other RTOS
- -40 °C to +85 °C Operating Temperature
- 10 Year Life-Cycle-Support, 2007 to 2016

For more information, contact: info@vortex86sx.com

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Grid Connect, Inc.
1630 W. Diehl Road • Naperville, IL 60563
630-245-1445
www.gridconnect.com

PROFINET I/O

Convert a serial Modbus RTU/ASCII (RS-485 or RS-232) client into a PROFINET I/O device with the XPORT-PN-MB component.

Not much larger than a standard RJ-45 connector, this simple component can be added to existing boards and can convert an existing Modbus RTU/ASCII serial TTL port to a PROFINET I/O Ethernet port. Using Ethernet technology every node has the ability to read/write data to each other using PROFINET I/O, thus eliminating the limitations of a serial network.

The XPORT-PN-MB is also available as a finished product as the NET232-PN-MB or NET485-PN-MB.

FEATURES

- Integrated into intelligent RJ-45 connector
- 10BASE-T/100BASE-TX compliant and RoHS compliant
- Auto-Sensing and Ethernet Activity and Status LEDs
- Wide temperature range: -40 °C to +85 °C
- +3.3 Volt Operation
- Customization and OEM versions available

For more information, contact: sales@gridconnect.com

RSC# 36510 @ www.industrial-embedded.com/rsc

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

SFPDP UNI6 I/O

The Annapolis Micro Systems Inc.'s FPGA-based WILDSTAR family provides 24 SFPDP channels per VME slot.

The Annapolis SFPDP Cards (UNI3 or UNI6) come with an easy to use Serial FPDP interface supporting up to 12 lanes of 2.5 Gb full duplex data. Three frame types are supported: Normal Data Fiber Frame, Sync Without Data Fiber Frame, and Sync with Data Fiber Frame in Point-to-Point Mode.

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 up to 7.5 GB full duplex per I/O card and a wide variety of readily available copper and fiber cables.

Up to two serial I/O cards and two LVDS I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS main board, with half that number for the PCI-X or PCIe. The SFPDP card (UNI6) also supports Rocket I/O protocol at up to 75 Gb full duplex per I/O card, three ports of 10G full duplex InfiniBand per I/O card or 10G full duplex Ethernet per I/O card.

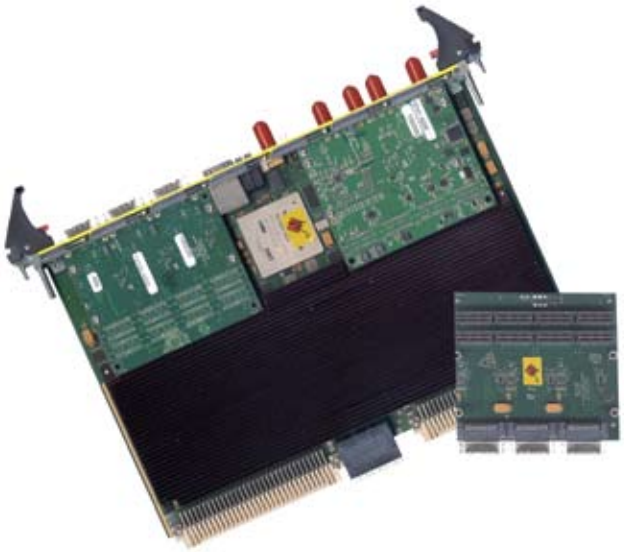
No other FPGA board vendor can match the volume of data we can send straight into the heart of the processing elements and then straight back out again.

An FPGA-based High Performance processing engine thrives on data streaming in and out at high rates of speed. The FPGAs should be part of a balanced and unified system architecture, providing maximum performance, with Memory, Processing Power, and I/O Speeds designed and integrated for performance, scalability and growth.

Annapolis Micro Systems, Inc.'s WILDSTAR 4 (Xilinx Virtex-4 based) and WILDSTAR 5 (Xilinx Virtex-5 based) families of FPGA-based processing boards also support an extensive set of extremely high quality A/D and D/A boards.

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, and other processing intensive applications.

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



FEATURES

- Three individually configurable 4X connectors – four lanes per connector
- Up to four 2.5 Gb full duplex Serial FPDP ports per connector
- Up to 25 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
- Optional Onboard oscillators for other line rates like Fibre Channel
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/IBM Blade Chassis/PCI-X/PCI Express main board
- 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
- We offer training and exceptional special application development support, as well as more conventional customer support
- Full CoreFire Board Support Package for fast and easy application development. VHDL model, source code for hw interfaces, ChipScope Access

For more information, contact: wfinfo@annapmicro.com

RSC# 35968 @ www.industrial-embedded.com/rsc

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 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 customer's 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 connectors
- 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 more information, contact: wfinfo@annapmicro.com

RSC# 35857 @ www.industrial-embedded.com/rsc

Wired networking

HMS Industrial Networks

90 West Jackson Blvd., Suite 2W • Chicago, IL 60607
312-829-0601
www.anybus.com

Anybus CompactCom

The Anybus CompactCom family of interchangeable communication modules uses a common host interface regardless of which network is required. The CompactCom functions as a network coprocessor and is based on HMS' powerful NP30 microcontroller. The compact housing is robust and specially designed for industrial requirements. CompactCom can be implemented in a wide range of products, such as HMI's drives, robot controllers, weigh scales, instrumentation, and more. The CompactCom supports DeviceNet, PROFIBUS, CC-Link, CANopen, Modbus, EtherNet/IP, PROFINET, Modbus TCP, EtherCAT, and additionally supports physical layer interfaces RS-232/422/485, USB, and Bluetooth. You could realize a savings of up to 70% in your development costs and drastically reduce time-to-market.

FEATURES

- Anybus CompactCom starter kit including driver source code is available
- Support all networks with a single design effort
- No licenses, royalties, or stacks to purchase
- All modules are conformance tested and certified by the respective testing agency
- Local support from HMS global organization
- Low risk investment in proven technology

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

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Wired networking

Industrial Embedded Systems Resource Guide 2008

N-TRON Corporation

820 University Blvd., Suite 4E • Mobile, AL 36609
251-342-2164
www.n-tron.com

N-TRON 100 Series

The 100 Series brings the ruggedness N-TRON products are known for to entry level Industrial Ethernet switches and peripheral devices. The 100 Series includes Ethernet switches with 4, 5, or 8 ports, a copper to fiber Media converter, and a Remote Access Server providing connectivity to an industrial LAN via modem. For PoE applications, N-TRON offers a 4 port power injector (Midspan), as well as 2 Endspan products: a 5 port Industrial Ethernet switch with 4 PoE ports, and a 5 port switch with 4 PoE ports, plus a 100BaseFX Fiber port. The 105M12 and 108M12 are IP67 rated for protection against dust and liquid ingress. N-TRON also offers entry level Gigabit Ethernet products in the 1000 Series.

FEATURES

- Compact, Space Saving Package; Hardened Metal DIN-Rail Enclosure
- Full IEEE 802.3 Compliance
- Unmanaged Operation
- Extended Environmental Specs, -40 °C to +80 °C Operating Temperature (model dependent), Redundant Power Inputs
- ESD Protection Diodes on RJ-45 Ports Surge Protection Diodes on Power Inputs
- > 2 Million Hour MTBF

For more information, contact: n-tron_sales@n-tron.com

RSC# 36885 @ www.industrial-embedded.com/rsc

Softing North America, Inc.
29 Water Street • Newburyport, MA 01950
978-499-9650
www.softing.us

FBK-2

Softing's Fieldbus Kit 2 (FBK-2) is an off-the-shelf, proven solution for the rapid development of FOUNDATION Fieldbus H1 and PROFIBUS PA field devices for Intrinsically Safe (IS) and non-Intrinsically Safe environments. The FBK-2 is designed to seamlessly integrate with an existing analog/HART slave device to create a complete fieldbus product. The FBK-2 is small enough (40 mm x 40 mm) to fit into most existing device housings and provides a serial Modbus/RTU interface and a HART interface. Since the hardware is ready to use, no additional costs for fieldbus physical layer testing are incurred. The board is designed according to the specifications of the Fieldbus Foundation and PROFIBUS Trade Organization and is ready to pass all necessary interoperability testing.

FEATURES

- Fast and easy integration of existing HART devices
- Small in size – 40 mm x 40 mm
- ATEX certified
- Certified for installation in hazardous areas of Zone 1 explosion Group IIC/IIB – Outputs may enter Ex-Zone 0
- Physical Layer Compliance Certificate
- Conformance Test Certificate

For more information, contact: info.usa@softing.com

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Industrial Embedded Systems Resource Guide 2008
Wired networking

Softing North America, Inc.
29 Water Street • Newburyport, MA 01950
978-499-9650
www.softing.us

RTE-FPGA-CHIP

Softing's FPGA-based protocol software for PROFIBUS DP, DeviceNet, PROFINET I/O, Modbus TCP, and EtherNet/IP is optimized to work with Altera's NIOS-II Kernel. Softing's protocol software integrated with Altera's Cyclone III FPGA represents a most economical solution for high volume products. Altera's Cyclone III is a cost-effective, yet high performance fieldbus controller that, together with Softing's protocol stacks, represents an ideal choice for designing a robust field device. In addition, Softing's real-time Ethernet stacks offer support for an integrated 2 or 3 port Ethernet switch core, thus eliminating the need for external switching components. If required, Softing is able to offer engineering services for the entire development cycle.

FEATURES

- Protocols – PROFIBUS DP, PROFINET I/O, DeviceNet, EtherNet/IP, and Modbus TCP
- FPGA – Altera Cyclone III series
- Also available as off-the-shelf communication module solution – FPGA-RTEM
- Includes programming file for FPGA with NIOS-II, 2-port switch, and MAC
- Single standardized application interface for all protocols
- Ideal for high volume products

For more information, contact: info.usa@softing.com

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Wired networking

Industrial Embedded Systems Resource Guide 2008

Teridian Semiconductor

6440 Oak Canyon, Suite 100 • Irvine, CA 92618
714-508-8800
www.teridian.com

78Q2133

Teridian's 78Q2133 10/100 Ethernet Phy is the world's smallest Ethernet Phy designed for space constrained applications. It supports an industrial temperature range of -40 °C to +85 °C. It is the industry's low power leader and provides the industry's lowest total cost solution with a minimum number of external components required. Further product information is available on our website and by email to lan.support@teridian.com.

Additional Ethernet Phy and Ethernet controller devices are available from Teridian. We also provide Power Metering, Smart Card Reader, WAN Transceiver, Si DAA, and modem devices described at www.teridian.com.

FEATURES

- World's smallest 10/100 Ethernet Phy, with an industry leading minimum number of passive components required
- Industrial temperature operating range of -40 °C to +85 °C
- Single 3.3 V low power operation with integrated voltage regulation
- 10BASE-T/100BASE-TX IEEE 802.3 compliant
- Register-programmable transmit amplitudes, Interrupt, and LED outputs
- Automatic MDI/MDI-X cross over correction

For more information, contact: support@teridian.com

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Wireless networking

Industrial Embedded Systems Resource Guide 2008

MeshNetics

5110 North 44th Street, Suite L200 • Phoenix, AZ 85018
602-343-8244
www.meshnetics.com

ZigBit RF Module

ZigBit is a low-power, high-sensitivity IEEE 802.15.4/ZigBee module with integrated chip antenna. Ultra compact and easy-to-integrate ZigBit modules are used by OEMs to add wireless connectivity to their products for sensing and control applications. The ZigBit modules are precision manufactured in Germany and carry ZigBee, FCC, CE (ETSI), and IC certifications.

ZigBit Amp, an amplified version, combines the industry-leading range of up to 4 kilometers (2.5 miles) with low power consumption. ZigBit Amp modules are used by OEMs in designing products and solutions in building automation, energy efficiency, AMR, asset tracking, and other application areas. Occupying less than a square inch of space, the ZigBit Amp is exceptionally easy to integrate.

FEATURES

- Operating range of up to 2.5 miles
- Over 10 years of battery lifetime
- Ultra small size
- ZigBee PRO, FCC, CE, ARIB certifications
- Precision manufactured in Germany
- Competent support for both hardware and software

For more information, contact: pete.secor@meshnetics.com

RSC# 36883 @ www.industrial-embedded.com/rsc

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

2.0 GSps 10bit A/D

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

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

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

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

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

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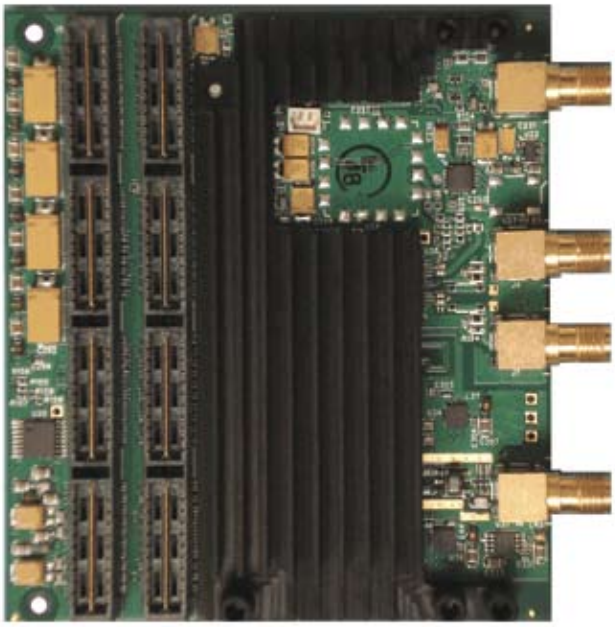

FEATURES

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

For more information, contact: wfinfo@annapmicro.com

RSC# 36021 @ www.industrial-embedded.com/rsc

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

Dual 4.0 GSps DAC

The Annapolis Micro Systems Dual Channel 4.0 GSps D/A I/O Card provides one or two 12-bit digital output streams at up to 4.0 GSps.

The board has one or two Max 19693 for 4.0 GSps, Max 19692 for 2.3 GSps, or Max 5859 for 1.5 GSps.

The Dual Channel DAC board has five SMA front connectors: 2 single ended DAC Outputs, a high-precision trigger input with Fs precision, and a universal single or double ended 50-Ohm clock input. It has excellent Gain Flatness in the first 3 Nyquist Zones, ultra low skew and jitter saw based clock distributions, and main board PCLK sourcing capability.

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

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

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

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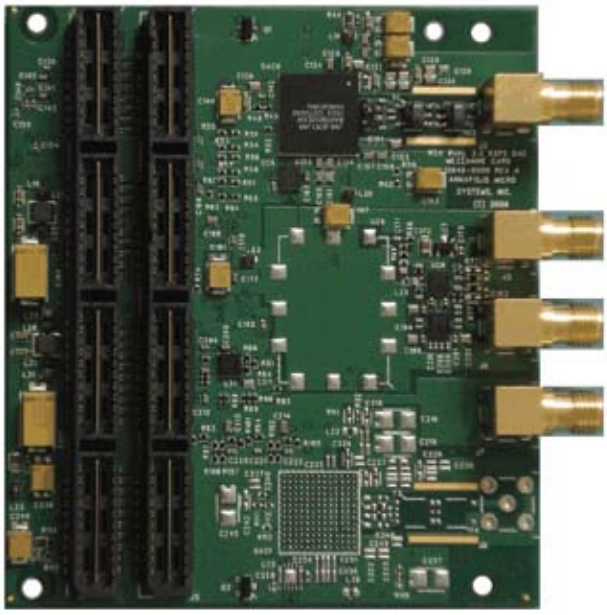

FEATURES

- One or two 12-bit Analog to Digital Converters: MAX 19693 for 4.0, MAX 19692 for 2.3, or MAX 5859 for 1.5 GSps
- Five SMA front panel connectors: 2 single ended DAC outputs, 1 High-Precision Trigger input with Fs precision
- 1 universal single or double ended 50-Ohm Clock input
- High-Precision Trigger input mfg options – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/ PCI Express/IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for board level interfaces
- Proactive thermal management system
- Industrial temperature range
- Includes one-year hardware warranty, software updates, and customer support
- Designed and manufactured in the USA

For more information, contact: wfinfo@annapmicro.com

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

Quad 250/400/500 A/D

The Annapolis Quad Channel 250/400/500 MSPS A/D I/O Card provides four A/D inputs with converter speeds of up to 250, 400, or 500 MHz and resolutions of 13, 14, or 12 bits respectively. The board has four A/D Converters from TI (ADS5444, ADS5474, or ADS5463) fed by onboard analog input circuits which convert the single ended 50-Ohm SMA input into differential signals for the ADC.

There is an onboard ultra low jitter and skew clock distribution circuit to allow all four channels on a single A/D I/O board to be synchronized together. There is also an External Clock input and a Trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O cards can be facilitated by the Annapolis 4 or 8 Channel Clock Distribution Boards.

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

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.

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

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

FEATURES

- Four TI A/D converters of one of the speed and bit size types: ADS5444 250 MSps 13-bit, ADS5474 400 MSps 14-bit, ADS5463 500 MSps 12-bit
- Analog input bandwidths of up to: 500 MHz for the 250 MSps A/D board, 1,400 MHz for the 400 MSps A/D board, 2,000 MHz for the 500 MSps A/D
- Six SMA front panel connectors: Four 50-Ohm analog inputs, one single ended 50-Ohm Clock input, one Trigger input
- Onboard Ultra-low Jitter and Skew Clock Distribution Circuit to allow synchronization of all four channels on a single I/O card
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/ PCI Express/IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Proactive thermal management system. Available in both commercial and industrial temperature ranges
- Full CoreFire Board Support Package for fast and easy application development and technology refresh
- VHDL model, including source code for hardware interfaces
- Includes one-year hardware warranty, software updates, and customer support. Reduce risk with COTS
- We offer training and exceptional special application development support, as well as more conventional customer support
- Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that customer's applications succeed

For more information, contact: wfinfo@annapmicro.com

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Saelig, Inc.
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585-385-1750
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Bargain Test Gear!

Saelig brings you electronic test equipment to fit any budget – choose from our $199 "six instruments-in-one" adapter, $325 LCD bench scopes, low-cost scope adapters for PCs, logic analyzers under $300, mixed-signal adapters and standalone scopes, temperature/humidity loggers, line disturbance loggers, GPS position loggers, wireless voltage/temp loggers, vehicle current loggers, EMC spectrum analyzers, USB bus analyzers, instant DSP filters, etc.

We also have other innovative components to make your design life easier – TCP/IP stack ICs, Bluetooth, USB-serial ICs, USB-On-The-Go ICs, wireless boards for ZigBee, 900 MHz mesh networks, motion control boards, USB-serial adapters, USB-Ethernet adapters, CANbus and LINbus boards, I2C boards, and RF testing enclosures. New products are arriving daily so check out our website at www.saelig.com for the latest news and items that you won't find elsewhere.

FEATURES

- 25 MHz Color LCD Scope: 2-channel + trigger standalone bench scope with 7.8" LCD. PDS5022S: $325! Battery-powered PDS5022S $399!
- 100 MHz Mixed-signal Scope/Logic Analyzer with complex triggering to find tricky glitches. Huge 4 or 8 MSa buffer, optional sig-gen CS328A $1149
- Handheld Rugged Toolkit Scope 2-channel 25 MHz with 3.8" color LCD built-in meter. 20 MHz HDS1022M $499. 60 MHz HDS2062M $699
- 10/25 MHz PenScope – USB-connected oscilloscope-in-a-probe. Great for toolkits PS2104/5 $234/369
- 20 MHz Arbitrary Waveform Generator 14-bit USB-connected 10 built-in waveforms, FM, AM, PM, FSK, Sweep, and Burst. DG2021A $995
- EMC testing enclosures from economical bench top test boxes for RF-free troubleshooting, to large shielding tents for pre-compliance tests
- USB Bus Analyzers let you know what's going on in your USB 1.1/2.0/UWB world. Emulate host/device, verify compliance, etc. TR110/EX200
- SPI Bus Analyzer and protocol exerciser for standard SPI and nonstandard 3 and 4-wire serial interfaces. PC control. SPI Xpress $699
- EMC Spectrum Analyzer Palm-PC-based 2.7 GHz with multiple sweeps settings. Store wfms, use Wi-Fi PC for email, notes, reports, calc. PSA2701T
- ICs to simplify a host of interface difficulties: USB-serial, TCP/IP, RFID, touch-sensing, servo control, FATfile storage, etc.
- Engineering software for designing front panels, Circuit CAD, PCB layout, signal generation, strip-board design, curve plotting, control
- Saelig Co. searches the world for innovative, high-quality products to make an engineer's design life easier. Free technical support!

For more information, contact: info@saelig.com

RSC# 36500 @ www.industrial-embedded.com/rsc

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

5575

The 2.5 inch SATA disk adapter provides an industry standard SATA connector for mounting a 2.5 inch SATA hard drive in the space occupied by a PMC.

This product uses the Silicon Image SiI3512 IC that supports SATA operation of a single hard drive. The Silicon Image SiI3512 controller connects the PCI bus to the one SATA link. The PCI bus can operate at 33 MHz or 66 MHz. Both 5 V and 3.3 V PCI bus signaling are supported.

The Silicon Image SiI3512 controller is programmed with a BIOS image stored in a 512K x8 EEPROM. A green status LED on the PCB conveys the activity of the hard drive.

This product is normally supplied without a hard drive, permitting purchase of drives for installation by the user.

FEATURES

- Accepts 2.5 inch SATA HD or solid-state media
- Silicon Image SiI3512 controller
- Standard mounting
- RoHS compliant
- Lead-free

For more information, contact: info@technobox.com

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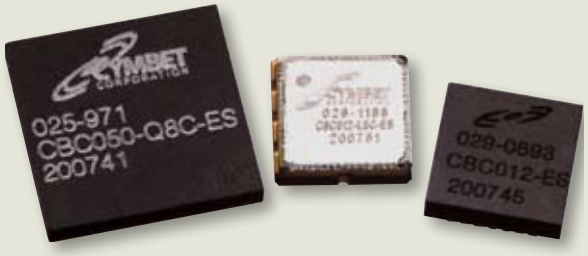
Profile Index

Editor's Choice Products

"I saw a lot in a few days at Embedded Systems Conference Silicon Valley, but these were some of the more unique items with industrial applications."
– Don Dingee

Embedded Systems CONFERENCE SILICON VALLEY



A very different battery

Onboard battery power can be a headache – or worse. In addition to disposal problems, conventional batteries can leak or even explode. SNAPHAT packages are relatively bulky and a hassle to replace. Super caps lose storage life because of leakage currents.

Cymbet's EnerChip batteries, however, are made of a thin-film nanotech material, not a chemical paste, so there's nothing to leak. These batteries come in surface-mount packages, solder to a board just like a regular IC, and can recharge via any number of harvesting techniques. They're a good match for ultra-low-power MCUs.

Cymbet Corporation
www.cymbet.com
RSC# 36922

Java powers M2M box

Put together an Imsys Java processor, Cypress PSoC mixed-signal array, and connection options including a wide selection of cellular, Bluetooth, ZigBee, 900 MHz, and other wireless radio technologies, and you get a powerful Machine-to-Machine (M2M) interface platform.

The AVIDdirector-M2M Model 200 from AVIDwireless supports a complete Java environment, including Java 2 Micro Edition (J2ME), Java Native Interface (JNI), and M2MXML, along with a complete set of networking tools. The system is open for adding wireless radio boards, simple serial or general-purpose I/O-connected devices, or user-developed boards via an expansion interface.

AVIDwireless
www.avidwireless.com
RSC# 36925

Pint-sized powerhouse

Designing a dynamic digital signage system or a Point-Of-Service (POS) kiosk? The Green Calliope Engine from LocoLabs is based on a Marvell PXA310 application processor coupled with a Marvell 88DE2710 1080p HD video processor and the Marvell 88W8688 Wi-Fi/Bluetooth combo chip. Other I/O includes USB, audio, a 2 megapixel camera, and an IR receiver.

The pint-sized system (1.3" H x 4.2" W x 2.4" D) runs Linux, Trolltech's Qtopia application framework, a Web browser and flash player, and networking stacks. The basic package docks to an expansion module for debugging or adding custom logic to complete the final design.

LocoLabs
www.locolabs.com
RSC# 36924

Take a pic, make a GUI

Amulet Technologies is putting its LCD driver chip and Graphical OS in Silicon firmware expertise into next-generation IP running on an Atmel ARM-based CAP7 microcontroller.

The new IP supports a color LCD with touch-panel capability and has been fitted into an Atmel CAP7 customizable MCU, demonstrating a single-chip solution. The LCD controller IP operates independently of the MCU core using a frame buffer bus and DMA. Programming is done via HTML and photo editing tools, and support is included for alpha blending to give interfaces a much more realistic and colorful look.

Amulet Technologies
www.amulettechnologies.com
RSC# 36923

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