What’s Your Low Power Destination?
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Reduce Risk and Time for Safety Critical Systems
Quadcore Processors in Medical Electronics

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X-ES 2nd Generation Intel® Core™ i7 Processor Solutions: Delivering Innovation

In 2010, Extreme Engineering Solutions, Inc. (X-ES) developed more Intel® Core™ i7 processor products based on VPX, CompactPCI, VME, CompactPCI Express, and XMC form factors than anyone in the industry. This year, X-ES has added solutions based on the 2nd generation Intel Core i7 processor. Providing products customers want, when they want them – that truly is innovation that performs.

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2nd Generation Intel® Core™ i7 processors up to 2.1 GHz
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conga-CA6 - COM Express Compact
Lowest power consumption, extended temperature range
Based on Intel® Atom® processor E600 series and Intel® Platform Controller Hub EG20
Embedded Intel® Solutions

SPRING 2011

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Portwell’s extensive product portfolio includes single-board computers, embedded computers, specialty computer platforms, rackmount computers, communication appliances, and human-machine interfaces.

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Processors Divide to Conquer

By John Blyler, Editorial Director

Intel’s latest dual-core embedded Intel® Atom™ processor and single-core, multiple micro-servers follow the trend of “more is better than less” in balancing low power and high performance trade-offs.

Multicore systems continue to migrate from the high-performance PC and server markets to the embedded space. Consider Intel’s recent announcement of the dual-core Intel Atom processor N570. It is intended to give netbook users a more responsive experience than its former single-core version while maintaining the same form factor and roughly the same battery life.

This is not the first embedded dual core Intel Atom processor designed for netbooks. The Intel Atom processor D510 received that honor almost a year ago, back in mid-2010 (see below, “Dual Core Embedded Processors Bring Benefits and Challenges”).

While the latest dual-core N570 version will improve netbook speed for simple applications like email and web-browsing, it still won’t offer laptop grade performance. Conversely, power consumption for the embedded dual-cores is less than most laptop chips, but still slightly higher than a single-core Intel Atom processor. Netbooks with the N570 version processor are available now.

“...whether the software development community is ready to embrace the new programming paradigm...”

Let’s move from the embedded space to the low-end server market. Intel has recently announced a new micro-server chip based on its embedded Intel Atom processor micro-architecture. These chips, targeted at data room infrastructure tasks, should be available by 2012. (see below, “Processor Giants Continue Up And Down Push Into Coveted Embedded Market”).

The premise for micro-servers is that many lower-powered servers may provide greater efficiency than fewer, more robust servers. The company’s troubled Itanium line of high grade servers comes to mind. (See below, “Processor Giants Continue Up And Down Push Into Coveted Embedded Market”).

These 64-bit, micro-server chips will span the gauntlet from 45 watt high performance devices to sub-10 watt families. Intel® Xeon® processors E3-1260L and E3-1220L are in production now.

The benefits of embedded dual-core processors and multiple single-core, low power servers are sufficient to suggest strong growth numbers in the future. What has yet to be addressed is whether the software development community is ready to embrace the new programming paradigm required by the many-to-one scenarios embraced by these hardware platforms.

John Blyler can be reached at: jblyler@extensionmedia.com
**ADLINK Next Generation Intel® Processor-based Platforms**

Power your applications with ADLINK

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<tr>
<td><strong>cPCI-3970</strong></td>
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<tr>
<td>3U cPCI with Intel® Core™ i7 processor, Intel® QM67 Express chipset and ECC support</td>
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<td>Ultra size COM Express™ Type 10 Module with Intel® Atom™ processor E6xx series and Intel® Platform Controller Hub EG20T</td>
<td>Ultra size COM Express™ Type 10 Module with Intel® Atom™ processor E6xx series and Intel® Platform Controller Hub EG20T</td>
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<th>CoreModule® 720</th>
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<td>PC/104 SBC with Intel® Atom™ processor E6xx series and Intel® Platform Controller Hub EG20T</td>
<td>Extended temperature: (-40) to (85^\circ)C</td>
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*Products based on Intel® Atom™ processor E6xx series will begin mass production in Q3, 2011.*
Portwell Bases Mini-ITX Embedded Board on 2nd Generation Intel® Core™ Processor Family

American Portwell Technology, Inc. introduced WADE-8012, a new Mini-ITX form factor embedded system board. The product provides high performance and flexibility for functional expansion and is ideal for applications in gaming, kiosk, digital signage, medical/healthcare, defense and industrial automation and control. The WADE-8012 supports the Intel® Q67 chipset and the latest 2nd generation Intel Core™ processor platform.

MEN Micro CompactPCI Serial SBC Brings Serial Interfaces to Harsh Environments

Micro Inc. has released the G20, its first single-board computer (SBC) based on the newly ratified PICMG CPCI-S.0 CompactPCI Serial specification announced at Embedded World 2011. The G20 uses the extremely fast 64-bit Intel Core i7 with a base processing speed of 2.53 GHz that supports Intel Turbo Boost Hyperthreading technology to provide a maximum speed of 3.20 GHz. A CPU-independent microprocessor in the G20 based on the Intel Advanced Management Technology (AMT) allows remote access via an integrated Ethernet controller, even when the computer is in soft-off or stand-by state.

New congatec COM Express Compact Module Based on Intel® Atom™ E6xx Processor Series

congatec AG introduced the conga-CA6 module, which is based on the new Intel® Atom™ E6xx processor series and the Intel® Platform Controller Hub EG20 for COM Express Type 2. All components of this embedded design are specified for the industrial temperature range of -40 to +85°C, making the conga-CA6 an ideal solution for extreme applications. With a power consumption of less than 5 Watts and a compact size of 95 x 95 mm, the new computer-on-modules are an excellent fit for applications in the medical and automation sector.

X-ES Announces the XPort3300, an XMC Module With Dual 10 Gigabit Ethernet Interfaces

Extreme Engineering Solutions (X-ES) announces the XPort3300, a conduction- or air-cooled, dual 10 Gigabit Ethernet XMC with front-panel or rear I/O support. A x8 PCI Express 2.0 port provides a high-speed interface between the XPort3300 and the host module via the P15 connector. The XPort3300 is engineered to scale from an air-cooled, commercial version (0 to 55°C) to a rugged, conduction-cooled version (-40 to +85°C) in accordance with appropriate environmental test methods.

Expanded Wind River On-Board Program Enables Partners to Develop Unique Development Kits

Wind River expanded its On-Board Program, which provides participating commercial off-the-shelf (COTS) processor board vendors with software tools, documentation and training to develop, test and validate their own unique Embedded Development Kits for the first time. These kits provide customers with processor boards and with optimized configurations of Wind River’s operating systems, development tools, embedded hypervisor and graphics software. Wind River will enable board vendors to create their own Embedded Development Kits using Wind River’s automated board support package (BSP) validation suite, technical support and training.

TenAsys® Announces Networked RTOS for Multi-Core, Multi-Platform Embedded Systems

TenAsys Corporation announced a new scalable real-time OS called INtime® Distributed RTOS at the Embedded World show. Based on the company’s established product, INtime for Windows®, INtime Distributed RTOS enables programmers to write applications that run without modification on different system configurations spanning from single-core or multi-core processor systems to multi-platform systems with multi-core processors.

ADLINK Technology Bases Rugged ETX™ Module on the Intel® Atom™ Processor

ADLINK Technology, Inc. announced the Ampro by ADLINK™ ETX-PVR, its latest Extreme Rugged™ ETX Computer-on-Module (COM). The ETX-PVR module provides scalable processing power by offering a range of Intel® Atom™ processors, from the power efficient single core N450 processor to the high performance dual core D510 processor. Highly integrated with support for legacy I/O, the ETX-PVR delivers the advantage of a standardized form factor.
Embedded PCs COMplete!
COM Modules with Intel® Atom™ Processor E6xxT/EG20T

CoreExpress-ECO2 Module
- Smallest COM module standard, 65x58mm
- Intel® Atom™ processors E620T, E640T, E660T and E680T
- Up to 2 GB soldered DDR2 RAM
- Processor independent standard (sff-sig.org)
- Especially designed for battery-driven mobile systems
- CPU + Chipset: max. 5 watts TDP
- CAN controller
- Shock and vibration resistant
- Wide temperature range (-40°C ... +85°C)
- Fail-safe BIOS support for remote BIOS update
- Condition monitoring using LEMT (new: with power sense)
- Module availability 10 years

Toucan-TC
COM Express-Compact Module
- COM Express form factor, 95x95mm, Type 2 pinout
- Intel® Atom™ processors E620T, E640T, E660T and E680T
- Up to 2 GB soldered DDR2 RAM
- SATA SSD, max. 64 GB, soldered
- MicroSD card slot
- CAN and 4 COM ports on option connector
- Shock and vibration resistant
- Wide temperature range (-40°C ... +85°C)
- Fail-safe BIOS support for remote BIOS update
- Condition monitoring using LEMT (new: with power sense)
- Module availability 10 years
Silicon Photonics Links Traditional ICs
All of the pieces are waiting; it just needs to be done.

The trend in electronics is for ever-faster data transfers between and within system-on-a-chip (SoC) devices. Higher speeds typically mean faster clock cycles, which translate into higher power usage and increased heat generation—a real problem for today’s energy-sensitive data centers. Optical interconnects offer a promising alternative—especially with advances in silicon photonics, which permit the integration of electronic and optical components on the same silicon chip.

Intel is a predominant researcher in the field of silicon photonics. Past Intel senior vice president Pat Gelsinger has stated, “Today, optics is a niche technology. Tomorrow, it’s the mainstream of every chip that we build.” IBM also works in this technology space.

Need for Speed
Terabyte (measured in trillions or 10 to the 12) computing is the norm for many industries, such as telecommunications and data centers. Those centers now manage 15 billion connected devices connected via the cloud. Other markets, such as medical scans, already require peta-bytes (quadrillions or 10 to the 15) for data transfer and storage. Such extremely high data rates present significant challenges for traditional chips and boards that use copper (Cu) interconnects. Data rates for such systems can experience high signal attenuation, which lower data-transfer rates.

Optical interconnects would help ease some of the problems facing Cu-based systems, explained Paniccia. Optical technology is already the standard for telecommunications backhaul networks to transfer data quickly over long distances. The next logical step is to apply optical technology for chip-to-chip and board-to-board data communications. The problem for optical is one of cost. Cu interconnects between chips cost pennies, whereas board-to-board Cu connections have only been slightly higher in cost. Yet optical has been considerably higher.

One area of promise is the laser. Paniccia noted that last year marked the laser’s 50th birthday. Lasers are a requirement for opto-electric systems, such as long-distance communications. But they haven’t been widely adopted into other areas since the creation of the optical transceiver—a chip that transmits and receives data using optical fiber rather than Cu wire. What is needed is a way to combine and economically manufacture low-power laser technology into a silicon chip. But how?

Silicon Doesn’t Lase
Six things are required for optical systems: light source, guide channel, modulation, photo detection, low-cost assembly, and intelligence. The challenge with implementing these functions into semiconductor chips is that silicon has poor optical properties. At this point in the presentation, Paniccia emphasized that the goal of silicon photonics wasn’t to...
replace silicon technology, but rather for optical technology to offer a complementary and equivalent alternative with unique benefits. Silicon photonics must address the 5-m problem (i.e., using optics for chip-to-chip, board-to-board, and server-to-server systems). To compete with existing Cu interconnects, however, optical solutions must be low-cost and manufacturable in high volume.

Today, silicon photonics are being integrated with silicon chips with no optical material or functions within the chip. Integrated optics that connect to the chip include devices like photo-detectors, demodulators, and light channels.

One problem on the transmitting side of this chip-to-chip connection is with the laser. Because silicon doesn’t lase—or produce lasing light—other materials like indium phosphide (InP) must be bonded to the silicon. But InP serves merely as a dumb light source, notes Paniccia.

Conversely, a plus for silicon is that it can be used to create high-performance gratings to control the wavelength of lasing sources. This helps to drive down other costs. The receiving side of the chip-to-chip optical system used germanium grown on silicon for photo-detection.

One of the biggest problems with the manufacturability of optical-communications systems from one chip to another has been the packaging and assembly of such systems. To be cost-effective, the chip-to-chip system (see Figure 2) has now been assembled using printed-circuit-board-like techniques and passive-optical connections. Such an approach allows for assembly-line efficiencies of cost and production. Paniccia noted that a demonstration communications link—a 5-m link with losses of only a few decibels—ran for three days with no errors at more than a 3-petabits data rate. That translates to a bit-error rate of less than 2 to the -15 exponential. No coolers were used, so the lasers did drift a bit due to thermal fluctuation. More importantly, such an approach could be scaled upward by adding more lasers.

Using optical systems would help to mitigate some of the high-data-transfer problems faced by traditional Cu interconnects. But using optical systems would also provide an architectural advantage to certain problems by removing the distance constraint. Paniccia explained that the shared memory of connected systems could be shared instantly. Using optical solutions means that electronics can be designed without the latency added by distance while using smaller form factors with reduced thermal density (i.e., less cooling needed in data centers).

For example, today’s chips have a lot of memory stacked on the same package with the multicore processors. With silicon photonics, that memory could be moved to another board or even another room. This approach opens up new architectures for electronic design—from the chip to the board and even larger systems.

Challenges Remain

Silicon photonics is the next big step in the evolution of optical and electronic systems. But challenges remain—especially in terms of power. Today’s consumer and industrial markets want ever-increasing features with ever-decreasing power. Today’s sub-5-mW embedded processors will soon become tomorrow’s 2-mW processors. But adding optical connections will require more power.

The key, explained Paniccia, is not for optics to replace Cu-based electronics, but to use optical connections where they bring value—as in the server market. Server systems typically operate around 150 W, which could easily support the power needs of opto-electric devices. The challenge is that lasers don’t do well next to high-power systems due to thermal drift. One solution would be to package the silicon-photonics system on the top of other boards and away from the major heat sources.

The long-term goal is to bring silicon photonics into the mass market by first creating an infrastructure for the design, fabrication, test, and assembly of these systems. All of the pieces are there. It just needs to be done.

References:


John Blyler can be reached at: jblyler@extensionmedia.com
### congac-QA6

**Extended Temperature Range**
-40° ... +85°C

**3D Intel® Graphics**

**CAN Bus**

<table>
<thead>
<tr>
<th>Formfactor</th>
<th>Qseven Form Factor, 70x70 mm</th>
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<tbody>
<tr>
<td>CPU</td>
<td>Intel® Atom™ processor E6xx series with 1.6 GHz, 1.3 GHz, 1.0 GHz and 600 MHz</td>
</tr>
<tr>
<td></td>
<td>Intel® Atom™ E680T / E680, 1.6 GHz (45 nm process, 512kb L2 cache, TDP 3.9 W)</td>
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<td></td>
<td>Intel® Atom™ E660T / E660, 1.3 GHz (45 nm process, 512kb L2 cache, TDP 3.3W)</td>
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<td>Intel® Atom™ E640T / E640, 1.0 GHz (45 nm process, 512kb L2 cache, TDP 3.3W)</td>
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<td></td>
<td>Intel® Atom™ E620T / E620, 600 MHz (45 nm process, 512kb L2 cache, TDP 2.7W)</td>
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<tr>
<td>DRAM</td>
<td>Up to 2 GByte onboard DDR2 memory with 667/800 MT/s</td>
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<td>Chipset</td>
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<td>I/O Interfaces</td>
<td>6x USB 2.0, 2x SATA, 1x SDIO, 3x PCIe, LPC Bus, 1x USB client, LPC bus, CAN Bus</td>
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<td>Mass Storage</td>
<td>Onboard SATA Solid State Drive up to 32 GByte (optional)</td>
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<tr>
<td>Sound</td>
<td>Intel® High Definition Audio (Intel® HD Audio)</td>
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<td>Graphics</td>
<td>Intel® Graphics Core with 2D and 3D hardware Accelerator and dual independent display support.</td>
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<tr>
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<tr>
<td>Motion Video Support</td>
<td>Single channel 80MHz LVDS transmitter, support for flat panels with 1x18 and 1x24 bit data mapping up to a resolution of 1280x768@60Hz.</td>
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<td>Single channel 160MHz SDVO interface, supports resolutions up to 1920x1080@60Hz and 1280x1024@85Hz.</td>
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<td>Dual independent display support</td>
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<td>congatec Board Controller</td>
<td>Multi Stage Watchdog, non-volatile User Data Storage, Manufacturing and Board information, Board Statistics, LPC bus (fast mode, 400 kHz, multi-master), Power Loss Control</td>
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<tr>
<td>Embedded BIOS Features</td>
<td>OEM Logo, OEM CMOS Defaults, LCD Control, Display Auto Detection, Backlight Control, Flash Update, based on AMI Aptio UEFI</td>
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<td>ACPI 3.0 compliant, Smart Battery Management</td>
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<td>Operating Systems</td>
<td>Windows® XP, Windows® XP embedded Standard, Windows® CE 6.0, Linux 2.6, QNX 6.x</td>
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<td>Storage: -20 to +80°C (opt. -40 to +85°C)</td>
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<td>Humidity</td>
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<td>Storage: 5 to 95% r. H. non cond.</td>
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<td>Size</td>
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Ethernet applications run from high-performance data centers and military communications, to smart home devices and entertainment systems. And while the proliferation of mobile devices is pushing wireless into more and more areas, Ethernet isn’t going away. We talked to John Neil Thomson, director of software engineering for GE Intelligent Platforms and Rawin Rojvanit, principal applications engineer, Advanced Microcontroller Architecture Division for Microchip Technology Inc. to get some insight into where Ethernet fits in today’s cloud-based-social-media-Internet-of-things.

**Embedded Intel® Solutions:** What challenges are arising in the connectivity of Ethernet to other interfaces such as PCI Express, VME, Advanced TCA, etc. as those technologies evolve?

**Thomson, GE Intelligent Platforms:** Ethernet is becoming very ubiquitous—in all form factors and bus types. It has advantages over other connection types in that it is very flexible, scalable (in range and speed), and—of course—low cost. Combined with the fact that its use is easily understood by application programmers, this means that it is now the default for much system design. The idea of the packet-switched backplane (first introduced in cPCI, then adopted by VME and ATCA) is a powerful one, and we’d expect to see any future form factor allowing for Ethernet (maybe 100 Gbps) as one of its backplane interconnection methods.

**Embedded Intel® Solutions:** What is the role of Ethernet in new smart-grid initiatives in comparison to wireless technologies, such as ZigBee or WiFi?

**Rojvanit, Microchip Technology:** Many technologies will have a role in the smart-grid initiatives. The design choice will depend upon requirements for bandwidth, security, latency, and physical plant considerations. For higher-bandwidth, higher-reliability, backhaul, secured, service-critical parts of the grid, wired Ethernet is the way to go. Wireless protocols’ strength is for the last 50 m of mobile delivery to end nodes. Wireless-technology choices can be ZigBee or Wi-Fi. The ZigBee protocol is preferred for supporting large numbers of very-low-bandwidth nodes. Wi-Fi is a good choice where access is required to the Internet or by an off-the-shelf consumer platform—that is, either a smartphone, iPad-type device, or platform on a consumer home network. Alternatively, we are seeing more embedded devices that now support both Ethernet and wireless technologies. All of these different technologies ultimately enable devices to communicate with each other. This is a main ingredient in what makes a grid smart—the ability to measure, communicate, and control.

**Thomson, GE Intelligent Platforms:** We would expect Ethernet to be “in the mix” for most complex, multi-level project designs for many years to come.

**Embedded Intel® Solutions:** What’s the future of Ethernet compared to WiFi in embedded applications where high bandwidth may not be required?

**Rojvanit, Microchip Technology:** This question is similar to the previous question. Our response is similar. An additional point is that Ethernet and WiFi are complementary technologies. Non-home setups typically involve both Ethernet and WiFi. Future home networks may also utilize more of both technologies. Stationary applications can conserve WiFi bandwidth by using Ethernet instead. As more devices in the home become network-enabled, balancing the setup between Ethernet and WiFi will become more important.

**Thomson, GE Intelligent Platforms:** Our customer base and their range of applications are vast, so we’d expect to see Ethernet, WiFi, and future technologies all being used in various ways. Our most successful customers tend to adopt a “horses for courses” approach.
Fanless 1.66GHz Industrial SBC of EPIC Proportions

The EPX-C380 is a rugged single board computer that provides an open powerful platform for industrial applications. Powered with either a single or dual core processor, it has a wealth of onboard I/O plus expansion options. Also it supports Linux, Windows® XP embedded, and other x86 real-time operating systems.

- 1.66GHz Intel® Atom™ processor N450, single core, or DS10, dual core, available
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- Custom splash screen on start up
- Optional 1MB of battery backed SRAM
- Two, Gigabit Ethernet ports
- Two SATA channels
- Eight USB 2.0 ports
- Four serial RS-232/422/485 channels
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- +5 volt only operation
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Phone 817-274-7553 • FAX 817-548-1358
E-mail: info@winsystems.com
Embedded Intel® Solutions: With new home and video devices pushing the demand for Power over Ethernet (PoE), are there design issues in implementing this technology?

Thomson, GE Intelligent Platforms: Questions are being asked about what power levels can be supported in the future, and we see customers looking for different voltage ranges.

Embedded Intel® Solutions: What kinds of embedded applications will utilize Ethernet in the future?

Thomson, GE Intelligent Platforms: We’d be inclined to ask, “Which won’t?” Ethernet is being used in almost every application field. Even areas that used to be the domain for specific solutions are migrating to Ethernet. Just as one example, many sensor-type devices, which used to sit on RS-485 buses, have now migrated to Ethernet. This is a trend which we are not seeing slow down.

Rojvanit, Microchip Technology: Many devices already utilize Ethernet and the list is growing. Pretty much any embedded application that needs to connect to the Internet could use Ethernet. It is more common to find Ethernet in a stationary device, and a portable device could use WiFi. In terms of security, some applications may prefer Ethernet, as the network cannot be easily sniffed unless someone has direct physical access. In general, protocol security should be the main defense for data security and privacy. Some applications may also prefer Ethernet’s ease of setup, as it doesn’t require a password. High-bandwidth embedded applications are likely to continue depending on Ethernet.

Embedded Intel® Solutions: As IP version 6 is deployed, what compatibility issues with version 4 should device developers be aware of?

Rojvanit, Microchip Technology: We expect both IP version 6 (IPv6) and IP version 4 (IPv4) to coexist for some time. The multitude of existing IPv4 equipment will not become obsolete overnight. New embedded products that support IPv6 will most likely support dual IPv4 and IPv6 stacks, keeping the levels of interoperability high. It will be difficult for developers to predict when end customer and ISP networks will be upgraded to support IPv6. Networking equipment and infrastructure will be upgraded to support IPv6 over time, but new equipment will likely still support IPv4. There could be some reachability issues if a device is IPv4 and wants to reach a server with an IPv6-only address. Having dual IP stacks would maximize interoperability over the long term.

As the migration to IPv6 occurs, there will be dual backbones and stepped changes to the routing infrastructure. A forklift change to the worldwide network is not about to happen. The primary difference between the two protocols is also likely to be the point of contention for compatibility on the migration. This difference lies in the addressing and routing technique that is used. Thus, as developers consider the migration to IPv6, consideration must be given to the limitations of both protocols to expectations of the other. This will apply to addressing (e.g., greater resolution in IPv6) as well as service identification (e.g., greater direct support in IPv4).

Thomson, GE Intelligent Platforms: We have been supporting IPv6 in our product ranges for many years now, and have seen customers roll out IPv6 networks. Various types of tunneling and co-existence strategies have been used. These can be complex, and we would suggest that careful planning is necessary. Seamless migration is possible—but probably not easy.

Cheryl Berglund Coupé is editor of EECatalog.com. Her articles have appeared in EE Times, Electronic Business, Microsoft Embedded Review, and Windows Developer’s Journal. She has developed presentations for the Embedded Systems Conference and ICSPAT. Coupé has held a variety of production, technical marketing, and writing positions within technology companies and agencies in the Northwest.

The Enterprise Effect
Blog By Pallab Chatterjee

In the enterprise it’s all about speed and power—as in more speed and less power—and those changes are forcing shifts in the chip architectures as well as the processes used to develop those chips.

At the Linley Data Center Conference the next generation of network control chips were discussed. The keys for the new networks are 10G data lanes to be used with 10G/40G and 100G applications. For 100G the alternate configuration from 10 lanes of 10G was 4 lanes of 25Gb/s also being designed with 40nm.

The 40nm processes give the advantage of the data speed that was needed, plus power savings that are required to keep the reliability of the die and package. The trend is that these high-speed switches need to be available not as single PHYs, but as duals and quads. The 40nm node allows for target power at about 3W for these parts, which will enable 24- and 48-channel switch products.

The PHY that is being provided by most of the vendors can, with the 40nm process, support security data processing. The architecture for many of the high-throughput data systems includes local data analysis, decryption, policy and authentication testing off the early data bus just after the transceivers. These application processors can be on the same die or separate die from the PHY.

To read the complete story, please visit: http://chipdesignmag.com/sld/blog/2011/02/24/the-enterprise-effect/
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The move to mobile and handheld formats in everything from consumer electronics to industrial and medical devices is a driving factor for low-power embedded designs. But according to Jonathan Luse, director of marketing for the Low Power Embedded Products Division at Intel, there are a couple of megatrends behind the scenes.

“Things that used to be discrete or isolated compute devices are becoming connected,” says Luse. “If you look at some of the devices that were providing automation or intelligence, a lot of them were doing it without being aware of their surroundings. As they become connected, they’re becoming aware of things up- and down-stream from their devices. That megatrend fundamentally changes the role of a lot of these embedded devices.”

But that’s not the only trend in play. Developments in wireless connectivity extend that model even further. In the past, many of these industrial or retail devices were isolated and standalone. Today, they’re likely to be connected to a broader network. So a point-of-sale device is no longer just a cash-transaction terminal; it’s an inventory-control system, an advertising device, and a data-mining system. That phenomenon is occurring in a wide range of traditional embedded segments and is leading to an explosion of innovation, which Luse expects to increase as the range for wireless-broadband connectivity expands.

Intel sees the Atom processor playing a key role as these always-on, always-connected embedded devices demand additional intelligence. “There are a number of different usage models for why people want low power,” Luse explains. “Some people want low power because they have untethered, battery-oriented devices, and their motivation for wanting low power a lot of times is the extended battery life. There’s another aspect of low power as well, which is in many cases for tethered (or even untethered) devices, where the low power is all about performance-per-watt density.” For many embedded applications, performance-per-watt levels have evolved to enable a wide range of new applications for computing in remote and unusual locations in which power delivery is a challenge. Examples include solar-powered mobile-tower applications or rail-car vibration-monitoring systems. These latter systems convert the moving car’s mechanical vibrations to electricity that powers the system.

For these types of applications, the Atom processor offers support for smaller form factors, reduced power consumption, and increased compute horsepower. Compared to a Pentium 2 Xeon, which consumed about 40 W of power nearly 10 years ago, the current generation of Atom processor consumes 3 to 5 W with about twice the compute performance. Luse expects to see a similar performance-per-watt improvement over the planning horizon of roughly the next 10 years, as long as Moore’s Law applies. “There’s a very big strategic thrust for Intel to continue to move down that journey of lowering power and improving performance simultaneously,” says Luse.

Additional innovation within the ecosystem will also help drive opportunities for new applications. From a platform perspective, complementary silicon and board-level devices—including voltage regulators, power-management ICs, and complementary chips supporting new segment-specific I/O—have to progress as well. The other area that is ripe for innovation in the embedded market specifically is the software stack. As embedded-computing devices become more commonplace, Luse predicts that there will be pockets of segment-specific or application-specific software stacks that

There’s a very big strategic thrust for Intel to continue to move down that journey of continually lowering power and improving performance simultaneously.
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will match medical, retail, or industrial protocols, as well as ongoing development in real-time and specialty operating systems. “The innovation engine comes from the ecosystem. I think our role is to bring some amazing technology out there for the ecosystem to invent with and then watch the innovation happen.”

The software architecture is one of the most important ways that developers can optimize power and performance in their designs. And software—rather than hardware—has become the gating factor for many embedded devices. The evolution of multicore designs from desktop and server applications to mobile and low-power devices brings opportunity as well as added complexity. The most important thing developers can do is to make their software scalable. That way, they can take advantage of the technology as it migrates.

Software design done well becomes somewhat future-proof if it can be migrated from one generation of processor to the next. Luse states, “One of the best advantages Intel has is the ability to have that software investment protection from one generation to the next, as well as up and down the Intel architecture stack. That allows customers to develop—and preserve the investment in development—from one generation to the next.” And that permits developers to spend more time on application-specific enhancements.

In the meantime, a common refrain from developers is that if there’s one thing they could still use, it’s lower power. Of course, the term ‘low power’ is relative to the needs of specific applications across the embedded marketplace. While the performance that an Atom processor can deliver at 5 W is impressive, embedded developers are already thinking in terms of what they could accomplish with similar performance at 1 or even 1/2 a watt.

“Look at it as more of a journey than a destination,” says Luse. “I don’t look at it as ever being a situation where you’ve arrived. No matter what power level I’m at, I can always say, ‘I wish I could get 30% less power’ and find applications for that.”

Cheryl Berglund Coupé is editor of EECatalog.com. Her articles have appeared in EE Times, Electronic Business, Microsoft Embedded Review, and Windows Developer’s Journal. She has developed presentations for the Embedded Systems Conference and ICSPAT. Berglund Coupé has held a variety of production, technical marketing, and writing positions within technology companies and agencies in the Northwest.

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**Xeon’s Power Play**

Intel’s Xeon family used to be all about giant leaps in performance, but the needle appears to be leaning far more heavily in power savings.

This is particularly important in the data center, where the Xeon is targeted. Power consumption over the life of a server now greatly exceeds the cost of the server itself, when the cost of running the server and cooling it are combined. The new Xeon E7 uses something Intel calls “Intelligent Power,” which reduces idle power consumption based upon the workload, while adding some power-management capabilities.

Intelligent Power is particularly interesting, and it all seems to be measured by factors of five. Intel says there are now five times as many operating states and five times faster transitions to and from low power states. There’s also a five times reduction in idle power and a five times improvement in power management capabilities. Cores also can run more or less independently of the other cores to reduce power consumption, something that is particularly useful with applications that only take advantage of one or two cores.

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**Deeper Space**

Aerojet and NEC have deployed a low-power microwave ion engine that is 10 times more efficient than other propulsion systems. These engines, which are targeted for spacecraft, use microwaves to ionize xenon fuel.

The engines were jointly developed by U.S. and Japanese companies for low orbits around Earth as well as deep space missions. This could dramatically prolong the length of space missions.

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**Power Of The Pedal**

The Mumbai-based Daily News and Analysis reports that a school in India has developed an exercise bike that will generate power as well as burn calories, no matter how fast the user pedals. The bike is attached to a battery, and one hour of pedaling can power LED lights for six to seven hours.

The bike also can be used to pump water from an underground tank for irrigation purposes. This may be the first exercise bike to pay double dividends.

To read the full story, please visit: [http://chipdesignmag.com/lpd/blog/2011/04/08/power-bits-april-8/](http://chipdesignmag.com/lpd/blog/2011/04/08/power-bits-april-8/)
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Embedded World Illuminates TRON

Advances in the embedded space complement those in high performance computer graphics (CP) animation in latest TRON LEGACY movie.

By John Blyler, Editorial Director

Disney’s original science-fiction classic, “TRON,” is credited with ushering in the age of computer-graphics (CG) animation. Today, improved CG animation quality makes it difficult for viewers to distinguish live-action elements from CG-generated ones, as in “Avatar.” In the recent sequel to “TRON,” called “TRON LEGACY,” CG animation was used to create a convincing younger version of the now-older protagonist, Kevin Flynn (played by Jeff Bridges).

The advances in CG filmmaking reflect the marvels of 30 years of advances in semiconductor high-end, PC-server hardware and computer programming technology. What have gone unnoticed have been equal advances made in the world of embedded systems. Let’s look at just one aspect of the improvements brought by the embedded and sensor technology revolution: illumination control.

**Virtual Light**

By today’s standards, the original “TRON” movie had very little in the way of computer effects. At the time, it was state-of-the-art. Yet many of the computer-generated scenes looked little better than the graphic-limited video games of the day. The suits in “TRON” weren’t illuminated. The “TRON look” was achieved by shooting the movie normally in black and white and then enlarging every frame to 8-x-10, black-and-white film positive cells for rotoscoping. This technique allowed animators to trace over live-action film movement, frame by frame, for use in animated films.

According to Alan McFarland, CTO for Nila—specialists in film and television lighting—the “TRON” animators would then colorize each one of those film cells by hand, using tint dyes and airbrushing and so forth. Each cell was then re-photographed on a backlit animation stand with colored gels. Selective double-exposure techniques gave everything that was supposed to glow its particular aura. Making a feature-length film in that fashion was very expensive by the standards of the day and would be prohibitive in today’s world.

“For ‘TRON LEGACY,’ the suits actually illuminated on their own,” explains McFarland (see Figure 1). “Motion-picture cameras have more than enough sensitivity to capture the illumination as is, making digital rotoscoping of the suits in post-production mostly unnecessary.”

Figure 1: Self-luminescent suits with embedded electronics were used in “TRON LEGACY.” (Courtesy of Disney)
Most suits also contained a detachable Identity Disc or Light Disc that was a key element of the story. Each disc contained all of the memories—everything seen, heard, or experienced—by the anthropomorphized programs in the virtual world of “TRON.” Although a program’s glowing disk could be detached from the body to use as a weapon, it was normally mounted on the user’s upper back.

**Inverting Power**

Light-emitting diodes (LED)-based light discs and self-illuminating suits need power and control—even in the virtual world of “TRON.” This is where the use of tiny, low-power embedded systems can win out over the more costly expense of post-production CG animation.

The light discs used LEDs controlled by Xbee modules for lighting, recalls McFarland. “The only time that Nila controlled the disc lighting was when the disc was attached to the costume. The studio’s prop department handled the disc lighting when it was in the actor’s hand.”

The suits were another matter, since they had to be flexible and tailored to the shape of the actor. To achieve flexibility, each suit was illuminated with custom electroluminescent (EL) material that could be shaped into various patterns. McFarland points out that some of the suits, such as Sam Flynn’s costume and Clu’s outfit, had more than 50 individual pieces of EL material. That material totaled some 1100 square inches per costume—almost half of the entire area of a typical human body.

The EL material required 290 V AC at 1100 Hz—albeit at very low current. This unusual power requirement necessitated the creation of a custom 150-W inverter to convert the direct current (DC) from the battery pack into alternating current (AC). Sam’s costume required two of these inverters while Kevin Flynn’s costume—with fewer but much larger pieces of electroluminescent material—required four inverters. The guards, Quora, and the other suits typically only needed one of the custom inverters.

These inverters were usually located in the Identity Disc hub, which was mounted to the back of the suit (see Figure 2). The available space inside the disc hub was about the same volume as a softball. Each disc contained at least two 150-W EL inverters plus a daughtercard for the wireless-network lighting control and monitoring module. Power for this embedded system was supplied by batteries that were typically located on the waist of the actor and disguised to look like part of the costume.

The new, super-high-energy-density batteries were developed especially for the Tesla Roadster. On the Sam Flynn and Clu costumes, these batteries provided about 11 min. of runtime. They could be fully recharged in 15 min.

The limited disc space meant that all of the electronic components had to be as small as possible. Unfortunately, smaller inverters generate more heat, which limited the maximum runtime of a single movie take to about 8 min. before the suit would overheat, notes McFarland. “Usually, this wasn’t a problem, as Joe Kosinski—the director—set up shots that ran considerably shorter.”

**Keeping Their Cool**

Heat-generating inverters reduce the performance of electronics as well as the actors that wear them. How did the performers, already overheating in rubberized fabric suits, keep their cool?

Coolness was achieved through the use of four 20-ton air conditioners, which chilled the set down to about 40 degrees. As McFarland remembers, “Those of us off-camera had to wear parkas to keep warm on the set.” To further ensure that the electronics and actors didn’t overheat, he used thermal epoxy to attach a National Semiconductor LM34 thermistor temperature sensor to the main inductor on the inverters. Temperature data was input to the wireless monitoring-control system module’s analog-to-digital converters (ADCs) before digitizing and transmission to the offset control computer for display.

Writing the code for temperature monitoring was also pretty cool. “Only one line of code was needed to read temperature from the analog-to-digital converter,” notes Wade Patterson, CEO of Synapse. Because the wireless monitoring system was bi-directional, it could be changed on the fly if it wasn’t working as desired. This ability to read sensor values quickly is important—especially as the number of nodes increases to the hundreds.

**Wireless Control and Monitoring**

An integral part of the embedded system used in “TRON LEGACY” was the wireless-network lighting control and monitoring module, which was developed by Synapse Wireless Inc. By using the company’s “SNAP” network, Nila’s McFarland was able to turn the suit lighting on and off instantly. Furthermore, the SNAP wireless software returned data to the control computer screen, showing battery levels, runtime, and inverter temperature. This real-time data enabled the movie’s director to maximize the use of special effects by monitoring the suit battery life and inverter temperature.

Although 104 suits were built to incorporate the wireless monitor-controller system, no more than 25 were ever used on
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the same day and far fewer used simultaneously. This was not a limitation of the technology, but rather a reality of the demands for shooting a movie. “I doubt I would’ve survived the show if we’d had any days that intense (requiring 104 suits to be controlled simultaneously),” said McFarland.

An appropriately phrased “Sleepy Mesh” state in the SNAP network was used to awaken the radio frequency (RF) transceivers on the nodes as needed. “Sleepy Mesh” didn’t merely put one node to sleep but could issue a network-wide sleep scenario. (Think of the first encounter with the Borg on Star Trek.) The power savings from having the entire network sleeping was significant, far greater than available with a traditional mesh network. In fact, each node’s battery life was extended up to the shelf life of the battery.

Although 104 suits were built to incorporate the wireless monitor-controller system, no more than 25 were ever used on the same day and far fewer used simultaneously. This was not a limitation of the technology, but rather a reality of the demands for shooting a movie. “I doubt I would’ve survived the show if we’d had any days that intense (requiring 104 suits to be controlled simultaneously),” said McFarland.

Each Synapse system contained eight (8) ADC inputs, 10 to 20 digital-output interface control ports, and a low-power, 2.4-GHz, IEEE 802.15.4 personal-area-network (PAN) RF module. Data from each wireless module (see Figure 3) can use AES-128 encryption. “You can even get the SNAP software on a microcontroller the size of a fingernail,” explained Wade Patterson, CEO of Synapse. “We have one customer that has embedded such modules into clothing.”

**Embedded Hollywood**

How did Hollywood learn about Synapse Wireless, a small but growing, Alabama-based wireless control and monitoring company? That’s where Nila fits into our story.

Nila’s Alan McFarland was tasked with engineering the illumination and control of the suits for “TRON LEGACY.” McFarland had seen a Synapse technology demonstration in which the SNAP modules and language were used to radio-control a small tank. After comparing products by Xbee, Red Pine, and W-DMX of Sweden, only the Synapse module met the requirements of limited space, bi-directional communication, and ready access to technical support. Synapse engineers David Ewing and Mark Guagenti helped McFarland throughout the production of “TRON LEGACY” with both the development of Python-based SNAP software and engineering support.

Testament to the ease-of-use feature of the modules is that the code to control the suit lighting was developed in less than two weeks, according to Patterson. The coding was relatively easy, thanks to a Python virtual environment that separates the application development from the underlying network-protocol details. (The combination of SNAP and Python is referred to as SNAPpy.) “End-user wireless applications are compiled into processor-independent ‘byte code’ that is run on the virtual machine. This means that the same application can be run on any processor without the need for recompilation,” explained Patterson.

Virtual machines running on wirelessly connected embedded processors? Doesn’t that sound vaguely like the world of cyberspace in “TRON?” Perhaps the writers of “TRON LEGACY” should’ve included at least one snappily attired program element in the movie to acknowledge the advances in the real world of embedded systems.

John Blyler is the editor in chief of Chip Design and Embedded Intel magazines and the editorial director of Extension Media. John has co-authored several books on technology (Wiley and Elsevier). He has over 23 years systems engineering hardware-software experience in the electronics industry. John remains an affiliate professor in Systems Engineering at Portland State University. Mr. Blyler holds a BS in Engineering Physics from Oregon State University, as well as a MSEE from California State University, Northridge.

Alan McFarland has been doing special-effects lighting on Hollywood movies for over 25 years, starting off in miniature FX lighting for movies like “The Hunt for Red October,” “Speed,” and “The Fifth Element.” He also has years of experience with lighting effects on costumes, having designed the lighting for the Borg suits for “Star Trek: First Contact,” Robin Williams’ robot suit for “Bicentennial Man,” and the blue-glowing motion-capture suit worn by Billy Crudup as Dr. Manhattan in “Watchmen.”

Wade Patterson is responsible for Synapse’s corporate vision, intellectual property, product strategy, and operational execution of the company. Patterson is the former president and CEO of Intergraph Corp.’s worldwide computer business. Prior to this, he was vice-president of engineering for Intergraph. Patterson is a distinguished fellow of the Mississippi State University College of Engineering and holds a BS in electrical engineering. He is a named inventor on 18 U.S. Patents.
Quad-Core Processors Benefit Medical Electronics

Succeeding generations with eight and more physical cores will expand scalability to today’s top-range performance levels.

By Franz Fischer and Larry Carchedi, congatec Inc.

In general, medical appliances and devices must be highly available and reliable. They’re used to perform sensitive and sometimes even vital monitoring and control tasks. Therefore, malfunctions and breakdowns need to be reduced to a bare minimum—and in many cases, completely excluded. This must be verified in lavish qualification processes to obtain formal acceptance. In absolutely critical, life-sustaining functions, networks of several independent computers/processors are sometimes used to ensure continuation of the process even with failure or breakdown of a single unit (redundancy). For economic and practical reasons, it makes sense to bundle several functions within a single device. In most cases, modern quad-core-processor systems offer a safe and economical solutions approach.

Key to this approach is an appropriate (e.g., real-time-capable) and safe separation of the various operating systems (OSs) and functions on each mutually independent physical or even logical processor with dedicated resources. One proven way to do this is by using a real-time hypervisor.

Conflicting Requirements in Medical Applications

The highest demands are credited to the fields of security, reliability, and availability. Traditionally, almost all safety-critical applications run on special, “hardened,” real-time operating systems (RTOSs). Such RTOSs ensure strict deterministic (coercively predictable) behavior—sometimes under real-time conditions.

Vital functions must under no circumstances be affected or even endangered by other processes. Who would want a literal “blue screen of death” in a life-supporting system caused by a simple mis-operation of an accompanying process? This example precisely demonstrates the challenge with system extensions and consolidations.

The most critical function determines the OS. For integration, subordinated functions have to be ported to that specific OS, which calls for both high effort and cost spending. This makes integration extremely difficult using traditional single-processor technology. Another restraint is that usually, there are significantly less “ready-to-use” software templates available for these particular OSs. When there’s a general lack of qualified software engineers—even for mainstream OSs like Microsoft® Windows and Linux—finding engineers with dedicated knowledge quickly becomes like the proverbial search for the pin in a haystack. The results are lengthy and expensive software ports or even new developments.

Development times (time to market) and total cost of ownership (TOC) also are critical success factors in the relatively long-lasting market for medical equipment and devices. Therefore, both should be modest—just as the devices still have to be certified in a burdensome and expensive fashion. Another requirement for the use of medical equipment in the portable and semi-portable field is minimal energy consumption, which permits fanless operation. Apart from the benefits of silent operation, this approach allows hermetically sealed housings, thereby enabling simple disinfection and sterilizing of the devices in clinical environments.

For portable devices, long battery life enabled by low basic energy consumption and elaborate battery management is a good selling point and an immediate cost-saving factor. In general, current-generation devices need to be easily and intuitively usable, despite their richer and more complex functionality. When the requirement for hermetically sealed housings is factored in, using touchscreen-controlled graphical user interfaces (GUIs) and graphical menu navigation appears to be the ideal solution. Yet touch control with high graphics resolution requires traditionally fast but power-hungry graphics hardware. In addition, most common graphics and menu-building toolsets are only available for the mainstream OSs—Linux and Microsoft® Windows. Many manufacturers solve this problem by using additional dedicated control and display computer systems based on these mainstream OSs.

Vision of Integration

In a perfect world, heterogeneous requirements could be easily integrated on a single platform:
• Less safety-critical applications, such as a comfortable user interface, may run on mainstream software platforms like Microsoft® Windows or Unix.
• Critical applications requiring deterministic behavior and real-time capabilities can run on their native RTOS platforms, which require only a minimum of changes (mainly for communication).
• Controller functions can be implemented without additional controller hardware.
• Digital-signal-processor (DSP) functions can run as software implementations without extra DSPs.

Fulfilling these requirements allows best-of-all-worlds solutions to be integrated while running safely. It also requires less integration and porting effort while using a common platform. The basic foundation is a single, scalable, multi-processor platform. As an additional benefit, all hardware and firmware come together pre-integrated on a modular platform. One way to realize this complex task in the real world is to combine Real Time Systems’ product, the “Real-Time Hypervisor,” with embedded second-generation Core™ i5 and Core™ i7 processor-based hardware platforms on an “off-the shelf” Intel® computer-on-module (COM).

What Is a Real-Time Hypervisor and How Does It Work?

Basically, a real-time hypervisor is a low-level, firmware-like software. It manages processor resources on a multiprocessor platform according to specified rules. For each virtual client (e.g., an OS), a specific processor looks and behaves as if it were a single, independent processor system. Beyond the capabilities of traditional virtualization solutions, the real-time hypervisor can manage multiple, individual RTOSs without violating the (hard) real-time requirements on any of these systems.

For this purpose, the real-time hypervisor assigns available memory exclusively to the various OSs. Hardware devices—whether they’re PCI or legacy devices—are configured in such a way that the respective interrupts will be handled exclusively and distributed directly to the individual cores and OSs. The relevant OS can only see and handle those resources that are assigned to it explicitly, such as cores and memory devices. Because the respective interrupts are assigned directly to each OS and directly access their own hardware devices, no special or modified device drivers are required (see Figure 1).

In addition, a real-time hypervisor can choose the boot order facultative and boot, operate, or shut down every single processor or OS independently from the other virtual or physical cores. None of the installed OSs perform tasks for other operating systems or even for the function of the real-time hypervisor itself. Security is therefore guaranteed at all times and under all circumstances.

Because the respective interrupts are assigned directly to each OS and directly access their own hardware devices, there’s no need for special or modified device drivers. It doesn’t matter whether the overall system uses single or multiple instances of the same (real-time) OS. Nor is there impact from a mix of plays from one or more other, different OSs being installed.

Communication between the various virtual machines can be arbitrary. The current state of the art is to use internal TCP/IP-based networks or adequate configured shared memory.

Processor Requirements

Currently available quad-core processors for embedded applications mostly use four physical cores. Another logical separation of these cores into up to eight virtual cores is possible if more separate cores are used to run the applications. This feature, which is known as hyperthreading, has been available with Intel® processors for quite some time. A processor core capable of this feature can be split into two separate virtual cores even without a real-time hypervisor. It has all of the required additional hardware, such as dedicated interrupt controllers, already implemented on the chip. Another significant bonus of the latest multicore Intel processors is their turbo-boost feature. It permits risk-free, specific overclocking, which enables simple load balancing between cores within a certain range.

Benefits of COMs

Some of the greatest benefits of actual processor devices may quickly turn into disadvantages in embedded applications. For example, their ultra-large scale of integration, which results in sub-millimeter pin grids, are hard to handle with conventional design and production tools on one hand and the high frequencies and ultra-steep signal edges on the other. The specific knowledge needed to successfully handle these challenges is rarely a core competency of medical-electronics companies.
From an economical as well as a technical point of view, it therefore makes sense to work with partner companies on these critical sections. Literally, this core competency can be easily acquired with pre-integrated computer-on-modules (see Figure 2). A key point for success is the specific know-how and experience of the COM supplier, which provides typical benefits like:

- Scalability via easily exchangeable modules
- Pre-integrated, “application-ready” platforms (i.e., no problems with sometimes special hardware around the processor drivers). In addition, board-support packages are available “ready to use” for a rich choice of operating systems (including real-time versions).
- Significantly shorter development times and time to market due to big savings on effort in development, test, and debugging.
- Highest quality is derived from specific COM-maker know-how as well as consolidation resulting from feedback from multiple customers and more and bigger lots of modules at the COM manufacturer.

In this specific application, multicore experience is a must or a shared development. At the very least, a close partnership with the respective supplier of the employed virtualization software is highly beneficial. (In our case, the real-time hypervisor came from Real Time Systems GmbH.) Having all significant additional hardware components available on-board or at least optionally configurable is both handy and useful. Such capability translates into powerful and energy-saving graphics as well as smart battery management on portable and mobile devices.

Where Are We Now?

There is a solution today: Combine one of the latest second-generation Intel® Core™ processors, such as the Intel® Core™ i7-2710QE processor (2.1 GHz, 45 W, PGA), with a real-time hypervisor on a congatec COM. Using a real-time hypervisor permits the use of eight virtual processor cores with today’s quad-core technology. Many applications running on X86 processors can be safely used without porting or integration effort. In addition, hardware-accelerated, high-resolution 3D graphics may be used. An Intel® 6 Series chipset with HD Graphics, which can support up to three HDMI display ports, is integrated on chip to save energy. Thanks to the latest Open-GL and Direct-X support, both new and legacy graphics applications can be easily implemented or ported and safely operated on the fourth core.

The high performance level of the used processor cores permits DSP functionality and features to be implemented in software. Typically, additional processor hardware is no longer required. Intel® Turbo Boost technology adds an additional power reserve for high-performance applications by automatically performing safe overclocking.

Also eliminated are some of the additional application controllers, which ensure monitoring and safe operation of critical processes. Their functionality can be substituted by available virtual cores. Under all circumstances, the real-time hypervisor ensures safe and ongoing operation (even in real time) in case an application crashes or hangs an OS on one of the virtual cores.

The result is the easy and reliable reuse of legacy X86 applications combined with the safety and reliability of a pre-integrated, “application-ready” platform with COM and hypervisor.

Succeeding generations of even more powerful, embedded multicore processors with eight and more physical cores will expand scalability to today’s top-range performance levels. Even today, multicore, embedded, ultra-low-voltage processors are available. They enable functional and graphical extensions on small handhelds, which had until recently been bound to AC-powered medical devices. With the benefits available today, multiprocessor technology has taken over the future of most current medical-electronic devices. It will exert the same influence over future medical-electronic devices.

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Surveys have shown that safety-critical device developers can spend as much as 30% of total development time on their own custom runtime platform. This means that roughly one third of their development budget goes into software that, in most cases, isn’t creating value for the company. Less time is spent on creating new innovative capabilities--less time on testing and less time making sure the product is more competitive.

Why aren't these companies using commercial-off-the-shelf (COTS) software? In the past, a general-purpose OS, such as Microsoft Windows or Linux, wasn't small enough and appropriate for the safety-critical market. Moreover, many commercial, embedded real-time operating systems (RTOSs) weren't suitable because they lacked the appropriate testing or certification needed for use in safety-critical systems. However, this is no longer the case. There are very compelling reasons to consider COTS solutions (both hardware and software) for safety-critical systems.

The COTS Advantage
Leveraging COTS software in safety-critical systems provides various advantages over a home-built, custom solution. Consider the following:

- Commercial services and support: COTS products are maintained, serviced, and supported by commercial vendors. In contrast, home-built solutions require in-house maintenance and support.
- Certification and certification evidence: Certifications and certification evidence means that these reused components are tested and documented to the appropriate safety standards. This reduces the overall certification, testing, and documentation burden.
- Commercial tools and middleware: Embedded systems are getting more connected and more complex. The right tools and middleware greatly increase productivity in all parts of software development.
- New technology: Keeping a custom, home-built solution up to date on the latest hardware and software technology is time consuming and expensive. Commercial solutions provide a future roadmap of technological advancement. For example, consider embedded virtualization, multicore, wired and wireless networking, and graphics.

More than just the OS
It’s important to note that the safety-critical device developer is responsible for whatever COTS software is used. In the end, the final device or system is certified—not the individual components. Re-using software in these situations has risks—both safety and technical—that must be mitigated. Developers considering COTS software need to take into account the scope of the certification or certification evidence.

Developers look to their COTS vendors to reduce this risk by supplying certification and certification evidence for the software they provide. Any COTS software that doesn't have the necessary certification evidence is considerably more risky. From an RTOS perspective, it’s important that more than the basic operating-system functions are tested and documented. Any component, such as the file system or network stack, which is used without the necessary certification evidence must then be certified by the device developer. This increases the testing and documentation burden (reducing the value of COTS software).

The advantages to using COTS software for safety-critical systems are clear. Developers can greatly reduce their risk, time, and effort in product development. However, COTS software also needs to meet the stringent standards under which the device will ultimately operate. To get the most out of COTS software, developers need certified software (or components with certification evidence) as well as tools, middleware, and services and support to realize the maximum advantages.

Bill Graham is a software industry veteran with more than 20 years of management and development experience spanning embedded and real-time systems, UML modeling, and object-oriented design.

By Bill Graham, product manager for VxWorks at Wind River
Connected Devices = Security Risks

Embedded developers need a security strategy from the initial stages of device design.

*Connectedness* is a critical theme in every embedded market. So is security. Few markets show the dilemma as well as the industrial market in general and the embedded medical market in particular. The ability to widely share information is critical to both providing better patient care and to cutting the burgeoning cost of medical treatment. Practitioners require complete access to records and treatment at the point of care along with the availability of high-tech diagnostic and treatment options, such as imaging. Patients (and the federal government) demand that all such information is kept secure at every node on the network. Add in the evolution of LTE and IP-based communications networks for an ever-wider array of instant-access wireless devices, and security soars to the forefront.

How do designers guarantee connectivity and security? They have to begin that quest right at the beginning. With every imaginable type of device now connected, security is an issue in embedded applications ranging from high-security military devices to mobile and consumer products. Mark Huang, product marketing manager of American Portwell Technology Inc., and Rohit Sukhija, director of marketing for TeamF1, give their insight on security considerations for embedded developers, how security and performance trade off, and how the migration to multicore architectures will affect security measures.

*Embedded Intel® Solutions:* What changes do you see occurring in embedded designs to incorporate new security measures?

**Rohit Sukhija, Team F1:** With connected embedded devices being practically ubiquitous, secure connectivity and perimeter defense are no longer a concern only for military and specialized applications, but something that the designer of every embedded device has to factor in. Further, embedded devices have more constraints than non-embedded ones in terms of resource usage. Everything from CPU horsepower to memory and power use are much more of a premium for embedded devices in general. This has led to a demand for high-performance and low-resource-usage security implementations as well as “helper” hardware engines to offload many compute-intensive security tasks from embedded CPUs. A major challenge for embedded designers is to develop and use standards-based security technologies in constrained environments without significantly impacting the user experience (e.g., through lower performance or more battery use). Embedded devices also tend to be purpose-built. With the diverse requirements of embedded devices in different verticals, security has many faces and levels with specific implementation needs for each application and market to which the device caters. A push toward more scalable and modular software implementations that address these security challenges along with hardware acceleration and multicore processing is inevitable.

**Mark Huang, American Portwell Technology:** An increasingly greater variety of devices is connected to the network to share information. Embedded security hardware must have more network interfaces to route and control packets from different sources. The number of network-interface port requirements increases to four or more. In addition, a highly efficient CPU with a hardware security acceleration engine enables embedded security platforms to both deliver performance and address the increasing concerns of security issues.

*Embedded Intel® Solutions:* How are developers addressing tradeoffs in optimizing embedded designs for performance versus security?

**Sukhija, Team F1:** To provide the performance needed by security technologies, embedded developers use hardware with co-processors, multiple cores, and accelerator engines to offload the primary CPU from compute-intensive tasks. These systems have to be designed with more complex software for managing various symmetric and asymmetric compute resources, which involve balancing complexity with getting the most performance bang-for-the-buck. After all,
these complexities directly impact time to market, reliability, and quality. Fortunately, with hardware and processing power becoming cheaper every day, a balance can easily be found between the efficient use of processing power and getting enough performance for security requirements to be met. But the onus still is on engineers to find this balance rather than rely on a formulaic tradeoff.

Huang, Portwell: Both performance and security are critical in real-world applications. To address the increasing requirements of both, developers have the options of using a core logic CPU and chipset with a built-in security engine or adding a dedicated security co-processor in the embedded design.

Embedded Intel® Solutions: How are developers addressing new security challenges with the evolution to LTE and IP-based networks?

Sukhija, Team F1: With high-speed packet-switching networks becoming the norm, more devices are interconnecting with each other and with the general Internet cloud conveniently and cost effectively. This expands the traditional connectivity ecosystem to wider horizons with new applications becoming common on connected embedded devices each day. Security is evolving into a natural part of this ecosystem—as a core component rather than an add-on or an afterthought. Embedded developers are addressing these requirements by having a security strategy in mind from the initial stages of device design, so devices are built with a natively secure system. Standardized security software—including everything from secure connectivity to intrusion prevention and even anti-malware technologies (once a mainstay of desktop and server computing)—are now being seen as security features common to embedded devices. On the hardware side, designs have started to include special-purpose hardware (in the form of IP cores on existing chips or additional chips on the board) to enhance the performance of software implementations. The ability to scale up with desired security features is the biggest challenge for designing secure embedded devices in the future.

Huang, Portwell: Embedded hardware design needs to keep up with the demand for performance. Intel’s next-generation Cave Creek (Intel codename) chipset equipped with the Intel QuickAssist 1.5 technology, coupled with the new Sandy Bridge (Intel codename) CPU, will be able to address the demand for computing power and accelerate security packet processing.

Embedded Intel® Solutions: How is the evolution to multicore platforms affecting security issues for embedded designs?

Sukhija, Team F1: Multicore platforms are starting to be a great vehicle for meeting the challenges of high-performance and scalable embedded security. The performance of security protocols relies on the computing muscle of additional cores—especially in asymmetric multiprocessing methodologies. There, the inherent parallelism of many different security technologies, which have to be applied on a stream of network packets, can be leveraged by partitioning dedicated functions to various cores working in their own realm—with the option of dynamically reallocating the compute resources should the need arise. Designers will face major challenges in multicore processing before highly optimized software at every level of the system in embedded devices becomes commonplace. The migration has already started, however. It will inexorably lead to more standardized software architectures of security technologies on multicore platforms, which are not so tightly tied to the specific multicore processors that are in use (as is the case today).

Huang, Portwell: The multicore architecture enables a same-footprint embedded platform to deliver a solution to applications that require greater performance and better security management.

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Medical OEMs Can Upgrade to the Latest Chip Technology while Protecting Legacy Investments

Reap the graphical power of second-generation Intel® Core™ i7 processors through a simple, economical upgrade.

By Colin McCracken, American Portwell Technology Inc.

The demands for medical imaging systems remain consistent. Solutions must contain high-performance, yet power-efficient processors with graphics capabilities that allow medical professionals to correctly and efficiently view and interpret scan results. To provide these solutions, medical original-equipment manufacturers (OEMs) need to deliver high-end processing. They also must meet the medical industry's requirements for long-term supply, revision control, notification of changes, and commitment to quality standards like ISO 13485. Implementing such high-end processing can require an investment in new form factors. Fortunately, viable alternatives exist.

A Journey with Two Paths

Upgrade: In the current economy, medical OEMs are operating under constrained resources. Often, a single engineer is responsible for new designs and upgrades in addition to sustaining products that are already in production. Reuse is therefore key. Any opportunity to upgrade to the latest central processing unit (CPU) without starting over on all other system aspects is a preferred choice. After all, it can speed software development for new features while minimizing validation and FDA certification re-filings.

PICMG: Medical OEMs that have either a brand new product or buy only at the system or chassis level can use a complete solution—single-board computer (SBC), backplane, and chassis—based on PICMG 1.3. It offers proven dependability, long lifecycle support, and functional density when compared to some newer form factors like ATCA. Because those newer form factors are optimized for communications, they’re currently less established in medical markets. The PICMG alternative allows easy field service due to minimized downtime.

Benefits of Both Paths

Both paths can enable medical OEMs to embrace Intel’s new micro-architecture, which is codenamed Sandy Bridge. This micro-architecture features the second-generation Core i7 processor with a choice of high-performance C206 server chipset or Q67 Express desktop chipset. Backward compatibility reduces risks while speeding time to market. The success of both alternatives begins with a commitment to product longevity. In this instance, lifecycle commitment is bolstered by continued product development. Such development uses established form factors, such as PICMG 1.3, to allow OEMs to simply upgrade an existing rackmount or shoebox system to Sandy Bridge. They don’t have to start over with new form-factor blades.

Within the medical environment, there’s still a large amount of superstructure built around these older standards. Many system-host-board (SHB, another term for SBC) manufacturers, such as Portwell Inc., provide solutions that are an excellent upgrade path for existing systems. These solutions function extremely well in today’s low-profile technology.

The Sandy Bridge Solution

With its powerful built-in graphics engine, Sandy Bridge can be the perfect solution to high-end processing needs. Its new architecture embodies a substantial performance benefit over previous generations and can provide a seamless upgrade for the installed base. The new second-generation i7 processor includes several key features that benefit medical imaging without increasing the power/thermal envelope:

- **Scalable or desktop chipset (Q67) and server chipset (C206) options on the same SHB design:** Before Sandy Bridge, a medical-systems manufacturer would have to choose from the following routes: server class, cost-saving desktop, or low-power mobile. Medical imaging generates an enormous amount of graphics data, which needs to be stored rapidly and retrieved and displayed just as quickly. The incredible performance gains over the last three chipset generations (including the architectural improvement of integrating the graphics controller and memory controller into the processor chip) have led to the server chipset offering a superset of the desktop chipset’s...
features—including graphics. The PCIe x16 interface can even be bifurcated into two PCIe x8 lanes.

- **Error-correcting circuitry (ECC):** Previously a feature of server chipsets, ECC is now integrated into the processor and available for mobile platforms like notebook computers. ECC is important for the high-accuracy and high-reliability environments found in medical-imaging applications. ECC also supports both data integrity and rapid storage and redundancy, which protect the data from accidental corruption in the case of power spikes or other threats.

- **Tight integration:** Sandy Bridge unifies the processor cores, memory controller, last-level cache (LLC), and graphics and media processing. This integration improves performance and efficiency in a variety of ways—all of which benefit medical-imaging applications. With fast access by the cores and graphics to shared data in the LLC, graphics processing is accelerated. In addition, signaling and data must travel over fewer buses, which results in faster processing. More memory bandwidth for the cores boosts overall system performance.

- **Built-in visuals:** A powerful graphics engine speeds image processing while hardware-based media accelerators and graphics-execution units significantly enhance performance.

- **Scalable computing:** Among the many advantages that Sandy Bridge's C206 and Q67 chipsets bring to medical OEMs is high-performance, scalable computing performance. This level of performance has been achieved without adversely affecting the platform TDP (thermal design power). Keeping heat output under control—a challenge when designing with previous generation chipsets—is handled capably by Intel’s Turbo Boost Technology 2.0. It dynamically controls the performance and power of both cores and graphics by re-allocating the performance to either/or, depending upon the load. Turbo Boost's energy-saving algorithms boost performance exactly where and when it’s needed by checking constantly the temperature and current draw to determine available power. This is a perfect tool for an environment like medical imaging, which requires a large amount of data capture and almost instantaneous visual display.

- **All-in-one board design:** Sandy Bridge is Intel’s first combined mobile and server-class platform with the same chip packages and pinouts. The result is both time and cost savings. Previously, two different board designs were involved—sometimes even two different chip manufacturers. Sandy Bridge solves this dichotomy with a simple, pin-to-pin-swappable solution at the board-assembly level.

- **Full 32-nm performance:** Sandy Bridge’s 32-nm geometry allows more shrinkage and performance than Intel’s first-generation micro-architecture—a 20% to 30% improvement. This allows for greater integration by combining the processor with the graphics and memory controllers. The previous Calpella platform used the Nehalem architecture with a dual-die Arrandale Core i7 processor family. The multi-chip module (MCM) consisting of 32-nm processor die and 45-nm Northbridge die has now been replaced by a monolithic 32-nm die. This change translates into both space reduction and performance gains (see Figure 1).

**Figure 1: Sandy Bridge combines the processor die and graphics/memory controller die into a single 32nm die.**

### Protect the Legacy Investment

Some SHB vendors provide longevity and commitment to legacy systems that have served medical OEMs well. As a result, medical OEMs know that they can still function with their legacy systems in a time of tighter budgets. They can simply design the latest platforms on older form factors.

For example, Portwell’s ROBO-8110VG2AR, which is shown in Figure 1, is short (338.5 mm) and wide (126.39 mm). As a result, it can stand up in a horizontal backplane within a standard 4U chassis or plug laterally into a vertical backplane to squeeze into a 2U chassis. This chassis includes a low-profile backplane with one PCIe x16 graphics slot to display high-resolution images, one PCIe x4 slot, and three PCI slots to support system OEMs’ legacy cards. The SHB supports both the Core i7/i5/i3 and Xeon processors in an LGA 1155 package.

Due to its benefits, the C206 server was chosen for the standard configuration. It also offers the legacy I/O interfaces needed in this market, such as serial ports, parallel port, and even floppy disk drive (FDD). For greater peace of mind, this one-stop upgrade solution can be provided as board-level or system-level, off-the-shelf, or customized. Most importantly, these solutions comply with ISO 13485, which is more stringent than basic ISO 9001 quality system requirements.

Colin McCracken is the director of solution architecture at American Portwell Technology Inc. in Fremont, Calif. American Portwell is one of the only board manufacturers in Intel's Embedded Alliance Program to be certified to ISO 13485 "Medical ISO" in the U.S. McCracken can be reached at colinm@portwell.com.
New COM Express Platforms Drive Multi-Display Medical-Equipment Advances

The latest lower-power processor architectures enable smaller form factors to do compute-intensive work.

Improved healthcare is possible due to powerful graphics and display technologies. Such technologies are being supplied by the high-performance, lower-power processor architectures integrated on today’s embedded-computing platforms. As a result, medical professionals can access multiple devices with high-resolution displays as they diagnose, treat, and administer patient care. Using one display with patient information, a doctor or other healthcare professional is able to see and chart current health information or have the ability to access records. At the same time, a second display can be used to view the patient’s current health status, such as blood-pressure or glucose level. This type of system provides the interactive, real-time data access required for effective treatment. Implementing these systems using Intel® processors also enables the development of a common, low-power hardware platform for multiple medical devices. Smaller computer-on-module (COM) form factors are ready to take on the compute-intensive requirements of multi-display systems.

The PCI Industrial Computer Manufacturers Group (PICMG®) is enabling a new era of advanced, graphics-based, medical-equipment applications. It added a new Type 6 pinout to the COM Express standard, which more effectively utilizes the expanded graphics capabilities of next-generation processors with respect to display support. This adds to and is based on the Type 2 pinout, which has been the most widely adopted of the COM0 pinout types. Legacy PCI pins from Type 2 have been reallocated in Type 6 to support the digital display interface and for additional PCI Express lanes.

Lower-Power Processors Go Semi-Mobile

Meanwhile, a new generation of lower-power, x86 small-form-factor processors is available with the 32-nm Intel® Core™ i7 processor technology. They’re opening doors to extraordinary improvements in healthcare. Aside from potentially substituting existing stationary electronic-device technology, the newer x86 processors, such as the Intel® Core™ i7 processor, pave the way for applications in the fields of semi-mobile devices.

The new generation of small-form-factor solutions supports the migration to smaller and lower-power devices. For example, the ETXexpress-AI COM Express module implements a Type 2 or Type 6 pinout. It also incorporates the Intel Core i7-620UE processor with 1.06-GHz performance at 18 W (see Figure 1). Because it capitalizes on the improved energy efficiency of the Intel Core i7 processor, this module is an ideal choice for emerging smaller, portable, and smart battery-powered medical devices, which have docking stations for efficient recharging.

There are several key advantages to lower power in the medical space. The first is the ability to incorporate a low-noise active or (with additional heat-dissipation techniques) fanless heatsink passive-cooling solution. Medical devices must be robust. At the point of care, they also must be quiet. Low-noise fans or fanless solutions are therefore desirable in medical environments.

Additionally, many medical devices have the need for backup power. Even in non-critical patient-care situations, this can be beneficial. Equipment is often semi-mobile rather than stationary, and data can be lost if systems get unplugged and moved without being shut down properly. Lower-power devices with smart battery solutions can make systems more robust if one wants to run on rechargeable battery packs for longer periods of time. Now, medical-device designers can have a graphics-intensive application that’s also lower power. This satisfies their requirements for enhanced patient care through a highly reliable semi-mobile/ portable system that features clearer images on multiple displays and with quieter operation.

Medical-Application Needs

Security, data accuracy, and system manageability are of great importance in the medical environment, where patient-record confidentiality and care must be considered at all times. The security and management technology integrated into the Type 6 COM is also an important part of the design equation for medical electronics. Technologies like Intel®
vPro™ technology, which offer hardware- and software-enabled management, virtualization, and a security technology platform, are important tools for medical OEMs. Systems that are Intel® vPro™ technology-capable must have dual-core or better central processing units (CPUs), such as the Intel Core i7-620UE processor. They also demand Ethernet-LAN connectivity, Intel® Active Management Technology, Intel® Virtualization Technology, and Intel® Trusted Execution Technology as well as a Trusted Platform Module (TPM). Intel vPro technology is gaining ground in the embedded marketplace with medical-product OEMs and others that need trusted platform architectures.

COMs with the Type 6 pinout leverage Intel vPro technology by integrating up to 8 GBytes of secure ECC DDR3 system memory and an optional TPM module. As a result, designers creating graphics-intensive applications, such as those found in diagnostic and treatment applications, are able to work even more quickly. The application-specific carrier board can be simplified based on the features already built into the new Type 6 COMs.

**New Technologies Are Enabled**

COMs based on the COM Express standard are design building blocks. They’re known to deliver proven and simple design scalability with the ability to customize for multiple device generations. Originally, PICMG defined five pinouts. Those pinouts have given medical-imaging designers a foundation for signal assignment and design layout for nearly 10 years. The recent introduction of the COM Express Type 6 pinout in the standard’s second revision has great relevance for medical designers. It extends graphics processing and functionality to the point of enabling compelling new medical-imaging devices.

The Type 6 pinout builds in future design options (see Figure 2). The pins previously assigned to the IDE interface in pinout Type 2 are now reserved for future technologies, which are still in development. SuperSpeed Universal Serial Bus (USB) can be implemented to gain faster data transfer for patient-record maintenance. With 16 free pins in Type 6, it offers sufficient lines to implement four of the eight USB 2.0 ports as USB 3.0 ports, which are needed for SuperSpeed USB. The Type 6 pinout definition also offers a configurable Digital Display Interface (DDI) SDVO, DisplayPort, and HDMI/DVI along with 23 PCI Express Gen 2 lanes. As a result, designers have a great deal more functionality including increased native display options and higher serial bandwidth than previously possible. USB 3.0 is implemented in the recently announced ETXexpress®-SC COM platform, which will be in production in the second quarter of this year.

An important new capability provided by the Type 6 pinout is the addition of native support for all of the newest display interfaces. This simplifies carrier-board designs, reducing time to market and total cost of ownership for graphics-intensive applications. The extensive PCI Express support provided by Type 6 matches the industry trend of moving away from legacy parallel interfaces. Today’s designers favor the use of pure, serial embedded-systems designs for their higher bandwidth and reduced latency. From a design perspective, using a COM Express Type 6-based module platform minimizes the need for stationary-only workstations. It also gives medical OEMs a smooth transition to

**Figure 1:** The ETXexpress-AI is Intel® vPro technology-enabled, allowing OEMs to take advantage of new Type 6 or traditional Type 2 COM capabilities as well as integrated security and management technology.

**Figure 2:** The Type 6 pinout builds in future design options by allowing serial COM signals to be assigned to unused power pins.
next-generation devices, which can feature faster storage subsystems and peripherals as well as increased mobility.

Ready to Go to Work: Lower-Power, Small-Form-Factor COMs

Increasingly, designers of medical-imaging equipment are looking for lower-power, small-form-factor platforms as one of the key enablers for multi-display healthcare systems. Integrating COMs in these designs helps OEMs achieve high-performance, small-form-factor devices and systems. Portable devices are leading the way, and COMs have proven to be an ideal match for this industry’s need. In the fast-moving medical-electronics market, COMs are well-positioned to further support designers as stationary devices evolve to semi-mobile. At the same time, they’ll be able to provide the performance needed to deliver essential imaging capabilities in point-of-care settings beyond the walls of traditional hospital facilities. With the addition of extended graphics features and performance enabled by standard Type 6 COMs, designers have a powerful new tool to use in evolving technology-enabled healthcare.

COMs are a proven form factor for an extended range of portable medical-electronic applications. Implementing these small, modular solutions helps to enable faster time to market while reducing development cost. It also can minimize design risk. COMs provide simplified upgrade paths, future scalability, and increased application longevity, which can help medical-equipment OEMs achieve greater market share.

Before (Intel’s) Sandy Bridge, a medical-systems manufacturer would have to choose from the following routes: server class, cost saving desktop, or low-power mobile.

The medical-equipment industry is moving quickly down a path that’s similar to the one taken by consumer electronics. Stationary systems are now evolving to semi-mobile, smart, battery-operated systems that can be easily moved to the patient location to increase efficiency and reduce cost. COMs have proven themselves by satisfying portability requirements with performance, flexibility of design, and easy customizability. Now, designers have access to an even broader range of module-based solutions that further extend the definition of “portable.” With COMs' inherent low power consumption based on the latest processor architectures, embedded small-form-factor solutions make possible a wide variety of multi-display and portable medical equipment. With such equipment, medical professionals can make precise and quick decisions that improve the level of care.

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ATOM Leader Leaves Intel

Blog By John Blyler

Departure of Intel’s Senior VP and GM of the Ultra Mobility Group may cast doubt upon or show commitment to the company’s embedded mobile market strategy.

The man closely associated with Intel’s ATOM-based push into the mobile computing world has apparently resigned from his post as chief of the company’s Ultra Mobility Group (UMG). For now, Anand Chandrasekher’s position will be co-managed by Intel Architecture Group’s Mike Bell and Dave Whalen.

Chandrasekher’s resignation has renewed speculation about Intel’s commitment to the mobile market. The company is competing directly with current mobile IP processor leader ARM. Also, Intel recently faced a software setback when cell-phone giant Nokia announced a partnership with Microsoft over Intel’s Meego mobile operating system platform. (see OSCON Shows Breadth of Open Source Software).

To read the complete story, please visit: http://chipdesign-mag.com/sld/blog/2011/02/24/the-enterprise-effect/
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iVPX7220 VITA 46 VPX & VITA 65 OpenVPX Processor Board

The iVPX7220 VITA 46 VPX & VITA 65 OpenVPX™ processor board from Emerson Network Power features the dual-core 2nd generation Intel® Core™ i7 processor, 2.20 GHz, (designed for quad-core processor) with integrated graphics and memory controller and the Mobile Intel® QM67 Express chipset with leading edge I/O functionality. This high compute density platform offers both high speed fabric connectivity with PCI Express and Gigabit Ethernet control plane connectivity with data transfer rates up to 5Gbps. On-board memory includes 4GB DDR3-1333 memory embedded USB flash, and 256KB non-volatile F-RAM. Additional connectivity includes up to nine USB 2.0 ports, five serial ports, five SATA ports, 10 GPIO, three DisplayPorts, VGA and dual XMC sites for maximum flexibility. An optional 2.5” SATA SSD is also available.

The iVPX7220 is a fully rugged SBC for extreme environments with extended shock, vibration, temperatures and conduction cooling. It is designed for a range of industrial, communication and military/aerospace applications. Software support includes Solid and Stable BIOS with password protection and a wide range of operating systems.

Features:
- 2nd generation Intel® Core™ i7 2.20 GHz (dual- or quad-core) integrated processor and Intel QM67 PCH
- Up to 16GB ECC-protected DDR3-1333 (soldered)
- VITA 48 REDI two-level maintenance (2LM)
- Extended temperature -40 C to +85 C and rugged variants
- Air and conduction cooled

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iVPX7223 VITA 46 VPX & VITA 65 OpenVPX Processor Board

The 3U iVPX7223 VITA 46 VPX & VITA 65 OpenVPX™ processor board features the dual-core 2nd generation Intel® Core™ i7 processor, 2.20 GHz, with integrated graphics and memory controller and the Mobile Intel® QM67 Express chipset with leading edge I/O functionality. This high compute density platform offers both high speed fabric connectivity with PCI Express and Gigabit Ethernet control plane connectivity with data transfer rates up to 5Gbps. On-board memory includes 4GB DDR3-1333 memory (designed for 8GB), embedded USB flash, and 256KB non-volatile F-RAM. Additional connectivity includes three USB 2.0 ports, two serial ports, three SATA ports, eight GPIO, DisplayPort, VGA and one XMC site for maximum flexibility.

The iVPX7223 is a fully rugged SBC for extreme environments with extended shock, vibration, temperatures and conduction cooling. It is designed for a range of industrial, communication and military/aerospace applications. Software support includes Solid and Stable BIOS with password protection and a wide range of operating systems.

Features:
- 2nd generation Intel® Core™ i7 2.20 GHz (dual- or quad-core) integrated processor and Intel QM67 PCH
- Up to 8GB ECC-protected DDR3-1333 (soldered)
- VITA 48 REDI two-level maintenance (2LM)
- Extended temperature -40 C to +85 C and rugged variants
- Air and conduction cooled

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MITX-CORE-800 Mini-ITX Motherboard

The MITX-CORE-800 series of Mini-ITX motherboards is designed for intelligent kiosk, digital signage, medical cart and slot machine applications and offer a flexible mix of features and expansion options. Featuring the 2nd generation Intel® Core™ processor family, the MITX-CORE-800 will have better power and performance for both general and graphics processing and will be fully Intel® vPro™ technology-certified. The MITX-CORE-800 series is designed with future Intel® Core™ processors in mind to allow a seamless performance and display upgrade path to customers.

The MITX-CORE-800 series features a standard latching 12 Vdc power input connector for ease of use and low cost integration by OEMs. It also presents the user with a PICMG® standard Extended Application Programming Interface (EAPI) to simplify the control of essential hardware functionality such as the backlight inverter and the watchdog timer. Emerson Network Power has also simplified the way in which developers can customize and configure the motherboard’s BIOS to speed integration and accelerate time-to-revenue.

Features:
- Single PGA socket for 2nd generation Intel® Core™ processor family
- Up to 8GB memory with two DDR3 SO-DIMM sockets
- Dual display capability from multiple physical display connections
- PCI Express (PCIe) expansion via PCIe slot and PCIe Mini Cards

NITX-300 Series Ultra Low Power Nano-ITX Motherboards

The NITX-300 series of Nano-ITX motherboards from Emerson Network Power feature the Intel® Atom™ processor E6xx series. These ultra low power motherboard solutions offer passive cooling capability for reliable operation. They are designed for use in a variety of applications such as embedded instruments, medical carts, audio visual display systems, and other applications that require an easy-to-use Nano-ITX motherboard with support for a variety of operating systems.

With a size format of 120 mm x 120 mm, Nano-ITX form factor motherboards are very suitable for low power embedded applications. The NITX-300 series has a low height profile to fit into most enclosures and has a wide range of built-in connectivity including LCD and/or CRT displays; SATA for physical or solid state disks; a PCI Express x1 expansion slot and a PCI Express Mini Card slot for Wi-Fi/WiMAX; USB and Gigabit Ethernet networks; audio; and multiple serial ports.

Features
- <7 Watts typical power consumption
- Ideal for low power embedded applications
- Up to 1.0 GHz Intel Atom processor E6xx series
- Up to 1GB DDR2 memory, soldered on board
- Gigabit Ethernet, SATA and USB
- PCI Express x1 and PCI Express Mini Card slot
- Dual display support
- Four serial ports
RapiDex™ Board Customization Service

In addition to standard motherboard and Computer-on-Module (COM) products, Emerson now enables cost-effective embedded solutions by tailoring the motherboard design to match your requirements.

Introducing the RapiDex™ board customization service from Emerson Network Power.

Emerson’s unique design and manufacturing technology delivers quick turns with minimal setup fees. First boards are delivered within eight (8) weeks of the order. Any following production order has a volume commitment of only 100 pieces, with unit costs comparable to standard products.

Emerson’s rapid customization capability can remove the need to use a less optimized standard product, leading to improved cost, space and power profiles.

As one of the most respected vendors in the embedded board space, Emerson is a Premier member of the Intel® Embedded Alliance and collaborates closely with Intel to enable customers to bring products to market quickly. Emerson’s RapiDex service is based on select embedded Intel® processors and chipsets, with custom boards available within a few weeks of silicon launch. The first supported platform is the Intel® Atom™ processor E6xx series coupled with the Intel® Platform Controller Hub EG20T. This ultra low power Intel Atom processor variant supports soldered down memory and a wide variety of interfaces.

The manufacturing setup fee covers a number of services including:

- Custom heat-spreader design
- Custom shield design
- Development support
- Custom BIOS splash screen
- Flat panel support adaptation for common panels
- Three-year supply commitment
- Two-year warranty

Additional services available include:

- Longevity of supply
- Extended warranty
- Major BIOS customization
- BIOS/security updates
- OS certification
- Driver development
- Custom form factor design
- Chassis and power integration

Features:

- Custom motherboards, COMs, or COM Express carriers
- Intel® Atom™ processor E6xx series
- Fast turnaround time
- Designed and built by Emerson
Taiwan Commate Computer Inc. (COMMELL), the worldwide leader of Single Board computers, introduced the Micro-ATX motherboard MS-C72 designed for the new Intel® Core™ i7/i5/i3 processors with 1066/1333MHz FSB in the LGA1156 socket. The Micro-ATX mainboard is based on the Intel® Q57 chipset, paired with a compatible next generation 64-bit, multi-core processor built on 32nm process technology with HD Graphic function or 45nm process technology without graphics. This innovative two-chip solution provides Intel® Turbo boost technology and Intel® Hyper-Threading technology which maximizes performance to match your workload. This platform is designed fully compatible with Windows 7 and ideal for developing high-performance systems for industrial control and automation, PC-based surveillance, gaming, video server, print imaging and digital signage.

COMMELL’s MS-C72 Micro-ATX mainboard provides four DIMM socket for up to 16GB of DDR3 1066/1333 MT/s data transfer rate dual-channel system memory. The 32nm Intel Core i5/i3 processor provides Intel HD graphic function with Dynamic Video memory Technology, MPG2/WMV9/VC1/AVC hardware acceleration, advanced pixel adaptive De-Interlacing and High quality Scaling.

The MS-C72 comes with PS/2 Keyboard and Mouse, FDD, Parallel port, 5 x RS232C and 1 x RS232/422/485. Networking is provided by Intel® 2 x 82574L Giga LAN, 10 x USB2.0 ports. Intel® High Definition Audio enables increased bandwidth for high quality audio. Also support for 6 SATAII ports enables the full SATA interface speed up to 3GB/s and integrate RAID 0,1,5, and 10 enables high reliability for personal data, or maximum storage performance for intensive applications. board includes one Mini PCI, one Mini PCIe, two PCI slots and one PCIE x 16, one PCIE x 4 slot to easily expand any other add-on cards.

About COMMELL
COMMELL is a leading supplier of Single Board Computers and focuses on developing the most advanced and reliable IPC products. In addition to promise our customers constantly stay ahead of this competitive business, we are always in search of disruptive & incremental sustaining innovation. We treat every of our customer as partner and provide the best services and total support. The combination of innovation, superior quality, and excellent services will ensure both Taiwan Commate Computer Inc., and our customers always have the competitive edge in the computer world.

For further information about COMMELL is available at http://www.commell.com.tw

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HR100-CRMT Supports Quad Core Intel® Core™ i7-2710QE processor, Intel® Active Management Technology 7.0 & TPM 1.2

The ITOX HR100-CRMT Mini-ITX embedded board uses the latest Mobile Intel® QM67 chipset supporting the 2nd generation quad core Intel® Core™ i7-2710QE processor and dual core Intel® Core™ i5-2510E processor. This Intel® 32-nanometer architecture family provides higher performance at lower power than previous generation processors, and includes the first quad-core processor with an integrated graphics core. The graphics and processor cores are on a single monolithic die and provide Intel® “iGFX® Gen6 HD graphics support for dual-independent 1080p HD video streaming on DVI, LVDS and VGA display interfaces. Performance is further increased through the introduction of Intel® Advanced Vector Extensions (AVX) to the instruction set, providing acceleration of complex audio, video, and image processing.

ITOX HR100-CRMT Mini-ITX Board Features
- Up to 16GB of DDR3 1333 Dual-Channel Memory
- Integrated Intel® “iGFX® Gen6 HD GPU
- Intel® Active Management Technology 7.0 support
- Integrated Trusted Platform Module 1.2
- Dual Gigabit Ethernet LAN Controllers
- DVI, LVDS and VGA Display Interfaces
- 2 SATA Ports (6Gb/s) and 2 SATA Ports (3Gb/s)
- RAID 0, 1, 5 and 10 Support
- HD Audio With S/PDIF Input and Output

The ITOX HR100-CRM supports Intel® vPro™ Technology in embedded applications such as gaming, security, industrial control automation, digital signage, medical equipment, and KIOSK.

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TRACE32® PowerTools for Intel® Atom™ Processors and Intel® Core™ i3/i5/i7 Processors

Lauterbach TRACE32® with Intel® processor support brings its mature high-end debugging solution to the Intel® Atom™ and Intel® Core™ i3/i5/i7 processors.

The TRACE32® PowerView GUI provides fast assembly debugging and includes a very efficient and user friendly high-level debugger for C and C++. All major compilers are supported, e.g. Microsoft Visual C/C++ and the GNU Compiler Collection (GCC).

A user configurable display system for internal and external peripherals helps examining the target behavior at a logical level.

Integrated Flash support allows programming external and internal Flash memories. Developers can use virtually unlimited software breakpoints, even for code running in Flash memory.

The powerful PRACTICE® scripting language helps to set-up the debug environment and allows creating complex automated test cases.

Lauterbach offers a wide range of TRACE32® PowerTools that can be connected to either Windows or Linux hosts via USB and/or Ethernet 100/1000.

The TRACE32® debug system comes with a highly sophisticated “operating system awareness” debug facility. Operating system awareness for Linux and Windows CE / Windows Embedded Compact is available and allows debugging of the complete target system, including interrupts, drivers, applications and libraries. Also supported are SMP debugging, including hyperthreading.

The TRACE32® PowerDebug system supports platforms based on Intel® Atom™ and Intel® Core™ i3/i5/i7 processors.

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Toucan-QM57

The Toucan-QM57 provides applications using COM Express Type 2 modules with current Intel® Core™ i7 processors. The module is constructed to support operation in rough environments.

With 4 GB DDR3 ECC soldered down RAM and a very powerful processor, the Toucan-QM57 lends itself easily to ruggedized systems requiring lots of memory, for instance mobile image processing. RS-DIMM modules, especially designed to withstand shock and vibration, can be used to expand the total memory size to 8 GB. Standardized by SFF-SIG, these memory modules come with a high-quality connector and are tightly fastened using screws.

The module supports the COM Express standard and includes:
- VGA, dual channel LVDS, 2 DisplayPorts
- Gigabit LAN
- 8 USB 2.0 host ports
- 4 SATA ports with RAID support
- 1 PATA interface
- Intel® High Definition Audio
- PCI Express bus: 6 x1 lanes, 1 x16 lane
- PCI bus
- LPC, SPI, SMB buses

The hardware capabilities are complemented with built-in LEMT functionality. LEMT, short for LiPPERT Enhanced Management Technology, is implemented in all current LiPPERT products and offers features for condition monitoring. Developers can embed LEMT in their applications using the open interfaces provided.

As a special feature, the Toucan-QM57 is able to measure its own supply current and can thus, in real time, determine the actual power consumption of the CPU under different operating conditions.

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MSI IM-QM67 with the latest Intel® Core™ i7/i5 processor Platform Supports Multi-Display for HD

MSI launches IM-QM67 supporting processors using the next-generation Intel® microarchitecture codename Sandy Bridge. This is the multi-display outputs of mini-ITX form factor board with the latest 32nm process technology for the highest HD graphic quality.

MSI debuts the IM-QM67 based on the Intel® Core™ i7/i5 processor and the Mobile Intel® QM67 chipset to provide the slim form factor for solid embedded applications. IM-QM67 supports 6 kinds of display outputs, including LVDS/eDP/VGA/DVI/HDMI/DP, with great 3D graphics performance for a high definition up to 1080P videos and supports Intel® Active Management Technology (Intel® AMT) 7.0, directX10, shader model 4.0 and full Hardware Acceleration.

The MSI IM-QM67 forsook the traditional ATX power source to choose the DC-in for main power source. For the storage application, it supports dual DDR3 1067/1333 MHz SO-DIMM, 5 SATA ports (1 x SATA3, 4 x SATA2 supported Raid 0/1/5/10). Moreover, it features one compact flash slot and one PCI slot enable for expansion capability.

Key Features
- DC Power input
- Supported Intel AMT 7.0
- Supported SATA Raid 0/1/5/10
- AMI UEFI BIOS supported
- Multi-Display ports with Accelerated Encode/Decode

Intel® Core™ 2 Duo processor on standard EBX footprint

VersaLogic’s Mamba SBC provides extreme performance and high reliability for the most demanding embedded applications. It combines a 2.26 GHz Intel® Core™2 Duo processor, high-end graphics and video, and extensive on-board I/O on an industry standard EBX platform.

Standard features include dual gigabit Ethernet, up to 8 GB DDR3 RAM, six USB 2.0 ports, four serial ports, two SATA ports, HD audio, and eUSB flash storage. Data acquisition features include up to sixteen analog inputs, up to eight analog outputs, and thirty-two digital I/O lines. Expansion is available via PC/104-Plus, PCIe Mini Card, and SPX. Analog and LVDS interfaces support flexible display configurations.

- 2.26 GHz Intel Core 2 Duo processor
- Up to 8 GB DDR3 RAM
- Dual gigabit Ethernet
- Mid power – 18.5W typical
- PC/104-Plus expansion
- Industrial temp. (-40°C to +85°C) version
- High-performance video and audio
- Standard EBX format (5.75” x 8”)
- On-board data acquisition support
- MIL-STD-202G shock/vibe
Low power Intel® Atom™ processor Z5xx on a PC/104-Plus form factor

VersaLogic’s Tiger is a compact single board computer on a rugged 3.6” x 4.5” PC/104-Plus form factor. Featuring the low power Intel® Atom™ processor Z5xx (Menlow XL), Tiger packs powerful 1.6 GHz performance backed by legendary VersaLogic quality. Available in both commercial (0° to +60°C) and industrial (-40° to +85°C) temperature versions!

Add VersaLogic’s long-term (5+ year) product availability guarantee and customization options and feel the power of the Tiger!

With more than 30 years experience delivering extraordinary support and on-time delivery, VersaLogic has perfected the art of service, one customer at a time. Experience it for yourself. Call 800-824-3163 for more information!

- Intel Atom processor Z5xx up to 1.6 GHz
- Low power, 8W (typical)
- High-performance video and HD audio
- Gigabit Ethernet
- Up to 2 GB DDR2 RAM
- PCI & ISA expansion
- Fanless operation
- Industrial temp. (-40° to +85°C) version

XPedite7470 Features Quad-Core 2nd Generation Intel® Core i7 processor

The XPedite7470 is a high-performance, low-power 3U VPX-REDI single-board computer based on the 2nd generation Intel® Core™ i7 processor and Mobile Intel® QM67 chipset. With two PCI Express x4 VPX P1 interconnects and two Gigabit Ethernet ports, the XPedite7470 is ideal for the high-bandwidth and processing intensive applications of today’s military and avionics applications.

The XPedite7470 accommodates up to 8 GB of DDR3 ECC SDRAM on two channels to support memory-intensive applications. The XPedite7470 also hosts numerous I/O interfaces including Gigabit Ethernet, USB 2.0, SATA, graphics, and RS-232/RS-422/RS-485 through the backplane connectors.

The XPedite7470 can be used in either the system slot or peripheral slots of a VPX backplane. Wind River VxWorks, Green Hills INTEGRITY, and Linux Board Support Packages (BSPs) are available, as well as Windows drivers.

Product Features
- 2nd generation Intel Core i7 processor with Intel® Advanced Vector Extensions (AVX) delivers highest performance for demanding DSP applications
- 3U VPX form factor provides small footprint
- Two x4 PCI Express VPX backplane interfaces provide high bandwidth system interface
- Conduction- and air-cooled versions support wide range of application requirements
- PMC/XMC site supports additional processing, I/O, or storage requirements
- DVI, SATA, Gb Ethernet, USB, serial interfaces support application I/O requirements
- VxWorks, Integrity, and Linux BSPs and Windows drivers support software development
Define Embedded Memory

Nonvolatile memory (NVM) isn’t a term that easily rolls off the tongue—or one, perhaps, that offers an easy explanation. Even so, it’s an important component of almost all systems-on-a-chip (SoCs) in use today. We estimate that the serviceable, addressable market for embedded NVM will be $500 million by 2015. You’ll find NVM in automotive, analog/mixed-signal, and consumer devices as well as media processors and industrial and mobile — both handheld and home baseband — electronic products. High-security applications, such as mobile banking and conditional access, are adopting NVM too. What’s more, embedded NVM is silicon proven at process technologies ranging from 350- to 40-nm and beyond.

Think of NVM as an on-chip code-storage locker. After all, it’s used for firmware and security code storage, calibration data, and other application-critical information—not just the ID of older memory technology.

Advancements in embedded-memory technology are expanding the market for serviceable, addressable embedded NVM. Innovation is enabling large-capacity solutions to store firmware and boot code that were traditionally stored in external discrete memory—including serial EEPROM and NOR Flash. Embedded NVM is fast replacing popular and widely used memory chips because it can be integrated on chip, providing both savings and greater protection from unauthorized access.

That’s right. By integrating embedded memory into an SoC, memory intellectual property (IP) eliminates the cost, power consumption, and space of external memory—all the while helping to reduce bill-of-material costs. Consider that an estimated 30% of the $6-billion worth of EEPROM and serial-Flash chips shipped in 2010 was used in applications that required capacity to 4 Mbits.

Imagine what a designer could do with an extra 4 Mbits of NVM. With embedded memory, he or she could easily increase performance by 8X over a discrete solution without sacrificing power or area due to an increased I/O pin count.

Poor scalability and reliability from one process technology to the next is a thing of the past and a limitation of traditional embedded memory. Embedded nonvolatile memory easily integrates into an SoC using standard CMOS process technology—a key reason for its widening adoption. New NVM uses standard CMOS manufacturing processes and scales to meet embedded-memory size and complexity challenges, which are growing exponentially as SoCs migrate to 28 and 20 nm. Reliability can be achieved without additional wafer bakes to guarantee 10-year data retention. Gone, too, are capacity limitations below 128 kb. A few different embedded-NVM technologies are available today including mask ROM, floating gate, electrical fuse, and antifuse. Mask ROM is the lowest-cost and highest-performance solution. But the content needs to be known before manufacturing, limiting the content that can be stored in a ROM.

Floating-gate technology is the most flexible with potentially up to 10,000 cycles of endurance. But it’s also the most costly solution. Unless you need NVM that consumes 30% to 50% of your die, it doesn’t make sense to eat the 30% to 40% cost adder associated with floating-gate technologies.

Electrical fuse is readily available from the foundry. But these memories are only suitable for low-capacity solutions, as they’re available to 1 to 4 kb. Also, electrical fuse isn’t portable from one foundry to another. As a result, it isn’t well suited for the multi-foundry strategies deployed for high-volume products.

Antifuse—a one-time-programmable (OTP) memory technology—has been in the market for several decades. Additional process steps were required, however, to create the memory element or bitcell. Kilopass was able to implement antifuse technology in standard CMOS in 2001 without additional mask or process steps. The technology scales with process and is portable from foundry to foundry because no special process steps are required.

Reliability and flexibility are hallmarks of embedded memory. Such aspects help design teams differentiate their products while allowing them to quickly adapt to market changes. By integrating embedded memory into the SoC, design teams worldwide also have found that they’re eliminating the cost, power consumption, and 4 Mbits of space taken up by external memory.

Linh Hong is vice president of marketing at Kilopass, and has 13 years of semiconductor industry experience. She began her career as a component engineer at Sun Microsystems. Hong holds a bachelor of science degree with honors in physics and a master of science degree in electrical engineering—both from University of California, Davis.
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