Embedded Intel® Solutions
Spring 2013

Internet-of-Things (IoT) Advances Home Healthcare for Seniors

Embedded Moves Towards Intelligent Systems

The Expanding Threat Landscape of Connected Medical Devices

Accelerate Deep Packet Inspection with Standard Servers

www.embeddedintel.com

Gold Sponsors

[Logos of various sponsors]
Intel® System Studio

Accelerate time to market.

New tools for embedded and mobile system developers.

Intel® System Studio provides deep system-level insights into power, performance, and reliability.

- Speed development and testing
- Enhance code stability
- Boost power efficiency and performance

Reduce your risk using Computer-on-Modules.

Module-based designs have decreased risk factors, allowing for:
- Reduced hardware and software design time to meet your deadline
- Predictable outcomes with concurrent testing and qualifying
- Risk-free upgrading by replacing the COM without touching the board
- Open standards with multi-vendor hardware and software support
- Continuous board monitoring and management with SEMA technology

Continuous board monitoring and management with SEMA
ADLINK’s Smart Embedded Management Agent, a set of deeply embedded functions built into all ADLINK modules, offers vital information and control functions to enable board management and early failure detection.

Express-IB
Intel® Core™ i7/i5/i3 Processor and QM77 Express Chipset

Express-CVC
Dual Core Intel® Atom™ and Intel® NM10 Express Chipset

LEC-3517 + LEC-BASE
SMARC-based LEC-3517 module with low power ARM CPU + SMARC Reference Carrier Board

Learn how ADLINK’s complete line of Computer-on-Modules can enable your risk-free design at www.adlinktech.com.
Flexible Yogurt-Lid Electronics Become a Reality

Truly flexible electronics from processor, memory, interface, and battery components are here, thanks to IBM, STMicro, Leti, Imec, Kaist, Kovio, and others.

By John Blyler, Editorial Director

Truly flexible electronics from processor, memory, interface, and battery components are here, thanks to Intel, IBM, STMicro, Leti, Imec, Kaist, Kovio, and others. As leading-edge semiconductor companies race toward ever-smaller, atom-sized chips, it’s easy to overlook the amazing advances made in higher nodes – especially in plastic and organic electronics. This is good news for the chip design community, as the implementations of flexible and organic electronics will renew interest in existing semiconductor-intellectual-property (IP) designs.

Earlier this year, Intel Labs, Plastic Logic and Queen’s University announced joint work to create a “paper” tablet computer. Developed at Queen’s University, the flexible tablet called “PaperTab” looks and feels like a sheet of paper. It is powered by a second generation Intel Core i5 processor. Unlike today’s tablets where several apps or windows can appear on the single display, the PaperTab would have one paper per application but users could have several displays – like pages in a book.

For example, IBM recently demonstrated a thin-film-like flexible circuit that resembled a “yogurt lid.” This extremely flexible film, which is rooted in a silicon-on-insulator (SOI) based plastic substrate, contained nearly 10,000 transistors. Adele Hars, Editor-in-Chief of Advanced Substrate News, described it as follows: “IBM has developed a new, low-cost technique that starts with the Full-Depleted (FD)-SOI technology developed with ST and Leti, for manufacturing silicon-based electronics on a flexible, plastic substrate. IBM’s Gary (Patton) showed a sample (at CPT 2013), and said that ‘research suggests that flexible, affordable electronics can be made with conventional processes at room temperature.’”

IBM’s flexible electronics and related semiconductor advances were part of my brief conversation with Sean O’Kane from Chipestimate. TV: Common Platform 2013—Walk and Talk —Sean O’Kane and John Blyler (http://www.youtube.com/watch?v=K-jd23DoAMo).

Of course, it will take more than just a processing circuit to create viable commercial products from flexible and organic materials. What about a memory system, interfaces, and power source? All of these other components are now available: Printing low-power, low-performance microprocessors onto organic materials will open a wide range of cost-effective alternatives to traditional silicon wafers.

Memory Challenges In the Extreme

Another example of an extremely low-power, low-performance memory application is in the emerging market of flexible, plastic electronics. A team from the Korea Advanced Institute of Science and Technology (KAIST) recently reported such a device [i.e., a fully functional, flexible, nonvolatile, resistive random-access memory (RRAM)].

Stretchy Battery Drawn to Three Times Its Size

As consumers, the age of flexible, “yogurt-lid” electronics may finally be here. With these advances, everything from our clothes to cereal boxes may serve as personal computers and communication systems.

John Blyler is the Editorial Director of Extension Media, which publishes magazines, websites and email newsletters covering the electronics market - including Embedded Intel® Solutions, Chip Design and the EECatalog network - which covers more than 30 embedded electronics market segments.
SEARCHING FOR Intel® Core™ i7 PROCESSOR SOLUTIONS?

Your search is over!
CompactPCI • COM Express • VME • PrPMC/XMC • VPX • Custom

X-ES delivers the latest 3rd generation Intel® Core™ i7 processor solutions on the widest range of standard and custom form factors in the industry. With our proven record of meeting aggressive schedules, you can count on X-ES to deliver Intel Core i7 processor solutions on time, and with unparalleled customer support. Call us today to learn more.

You need it, we have it! That’s Extreme.

X-ES
Extreme Engineering Solutions
608.833.1155 www.xes-inc.com
IN THIS ISSUE

Embedded Intel® Solutions

SPRING 2013

DEPARTMENTS

FROM THE EDITOR

2 Flexible Yogurt-Lid Electronics Become a Reality
By John Blyler, Editorial Director

NEWS

6 Product News
By Jennifer Burkhardt

8 conga-TS77
By congatec

FOCUS ON INTEL

10 Embedded Moves Towards Intelligent Systems
Intel launches initiatives to help customers.
By Mark LaPedus, Senior Editor

FOCUS ON INTEL

14 Tizen OS for Smartphones – Intel’s Biggest Bet Yet
Samsung hedges Apple, Google bets with Intel’s HTML5-based Tizen.
By Chris A. Ciufo, Senior Editor

STANDARDS WATCH

42 The Expanding Threat Landscape of Connected Medical Devices
The medical device industry is in the earliest stages of addressing medical device security today, but developers should expect to see many changes over the next several years.
By Nate Kube, Wurldtech Security Technologies

SPECIAL FEATURES

17 Accelerate Deep Packet Inspection with Standard Servers
The Intel® Platform for Communications Infrastructure offers OEMs and platform developers a powerful alternative to traditional NPU offerings, with resources that will help developers deliver first-to-market solutions while saving time and money.
By Austin Hipes, NEI

22 The Art of DRAM Module Testing
If there are no challenges to produce memory modules, why are there differences in quality and price?
By Ulrich Brandt, Swissbit AG

25 Intel-Altera Deal to Shake Up Foundry Landscape
But does Intel have staying power?
By Mark LaPedus, Senior Editor

26 HTML5 Is What’s Needed To Rapidly Develop IVI Automotive Apps
Is HTML5 the right answer for the rabid consumer’s taste for car tech, while still giving the auto manufacturer the safety and security they’re required to offer by law?
By Chris A. Ciufo, Senior Editor

28 Analyzing Ultra-Low Power Microcontroller Efficiency
Following the microcontroller datasheet specs for energy or power measurements may lead to disastrous conclusions.
By Markus Levy, Multicore Association

TECHNOLOGY APPLICATIONS

30 Internet-of-Things (IoT) Advances Home Healthcare for Seniors
Open, modular systems deploy quickly and improve monitoring and security.
By Satish Ram, Kontron America Inc.

33 Versatile System Design for Medical Video Applications: A Blueprint
High-performance engines from Intel’s embedded roadmap, along with powerful graphics cards to capture a variety of medical modality and camera images, offer an ideal platform for medical video wall applications.
By Allen Sha, American Portwell Technology

37 Enabling Accurate Glucose Measurement
Designing a glucose monitoring device is made easy with an 8-bit, 8051-based programmable SoC.
By Ross Fosler and Chris Keeser, Cypress Semiconductor Corporation

40 Needed: Self-Protecting, Security-Aware Mobile Applications with Anti-Tamper Technology
Application providers need to step up and begin building in sufficient security for mobile devices, including vulnerability mitigation, re-evaluation of trust and incorporation of secure authentication channels.
By Andrew McLennan, Metaforic

PRODUCT SHOWCASE

44 ADL Embedded Solutions Inc.
45 AXIOMTEK
46 DFI-itoX, LLC
46 Emerson Network Power
47 Emerson Network Power
47 X-ES
48 iEi Technology USA Corp.

COVER IMAGE: Intel Health Guide - Blood Pressure Cuff Image
**Intel® Atom™ Processor**  
**Small, Fanless Embedded PCs**

For your next design consider WinSystems’ single board computers powered with a single- or dual-core Intel® Atom™ processor. Our Industry Standards-based SBCs have a wealth of onboard I/O, plus PC/104, SUMIT, and MiniPCI(e) expansion connectors.

- **Industry Standard Platforms**  
  - EPIC – 4.5 x 6.5 inches
  - EBX – 5.75 x 8.00 inches
  - PC/104 – 3.6 x 3.8 inches
  - SUMIT-ISM™ – 3.6 x 3.8 inches

- **Software Support**  
  - Windows® CE, XPe, and WES7
  - Linux
  - x86-compatible RTOS
  - Quick Start Development Kits

- **Stackable Input/Output Modules**  
  - A/D and D/A
  - Digital and Serial

- **Accessories Include**  
  - Cables and Adapters
  - Power Supplies and Memory

- **Communication Expansion**  
  - 802.11 a/b/g Wireless
  - 10/100/1000 Mbps Ethernet
  - Supports MiniPCI and MiniPCI(e)

- **Long-life Product Availability**  
- **Extended Temperature Operation**

Our SBCs are the right choice for industrial, pipeline, transportation, instrumentation, medical, and MIL/COTS applications. Call us today.

*Call 817-274-7553 or Visit [WinSystems.com/AtomEIS](http://WinSystems.com/AtomEIS)*

*Ask about our 30-day product evaluation*
**Product News**

**Intel Launches System-on-Chip Storage Solution**

*Designed for Simple Video Transcoding and Streaming*

**New Storage Solutions Based on the Intel® Atom™ Processor CES5300 Series Simplifies HD Content Sharing and Delivery Between Mobile Devices and Smart TVs**

With consumers increasingly sharing and viewing content among different devices, Intel Corporation has recently introduced storage solutions based on the Intel Atom processor CES5300 series. The new low power system-on-chip (SoC) enables high definition (HD) video to be simultaneously watched on smartphones, tablets and other smart devices, in real time, while also shared with consumer devices such as a Smart TV.

**DFI’s Complete Line of Computer-On-Module Products**

Due to the increasing demand of Computer-On-Module products, aside from Type 2, DFI completed its COM Express product line by adding Type 6, Type 10, and Mini form factor. In addition, we added several COM Express products that use BGA-package processor to satisfy vertical markets that require product stability. We now offer Type 2, Type 6, and Type 10 in Mini, Compact and Basic form factors.

**Mini-ITX Motherboard – Model: X9SBA-A-F**

Supermicro’s new Intel® Atom™ processor-based mini-ITX form factor motherboard model X9SBA-A-F with ECC is designed for single purpose Intel® architecture server appliance that offers the lowest power and highest density server that is feature rich in a compact form factor. The X9SBA-A-F is built using the Intel Atom™ processor S1260, a 2 core/4 Thread 64-bit processor with Intel® Virtualization Technology for x86, SSE3 (streaming SIMD Extensions 3) and Intel® Hyper-Threading Technology support that is performance optimized. The low power SoC (System on Chip) processor is rated at 8.5 Watts and supports DDR3 ECC SODIMM memory for server class application reliability. The Mini-ITX X9SBA-A-F is built with an Intel® Ethernet Controller i350-AM2 Dual LAN controller that supports Intel® Virtualization Technology and a IPMI (Intelligent Platform Management Interface 2.0) port over a dedicated LAN for network connectivity and remote server management.

**ADLINK Launches Latest Smart Touch Computer BFS-15W02**

*The 15.6” ultra-slim Smart Touch Computer in stylish aluminum alloys fits a variety of industrial applications*

ADLINK Technology, Inc. has recently launched the 15.6” Smart Touch Computer BFS-15W02. With a low-power Intel® Atom™ processor D2550, the BFS-15W02 allows fanless operation up to 50°C while guaranteeing longevity support. Unlike conventional panel PCs, this ultra-slim Smart Touch Computer does not only look appealing, but also provides IP54 protection and outstanding reliability. Sleek, full-flat touch screen, chemical resistance and ease-of-maintenance and cleaning are just a few examples of this panel PC’s superior features. Arm-mount capability and

**By Jennifer Burkhardt**
an optional customized, integrated desktop stand enable the BFS-15W02 to fit anywhere—on a working bench, on the wall or on a swing arm—and still stay connected via built-in Wi-Fi or dual Gigabit Ethernet.

**congatec’s entry-level module for COM Express Type 6 with Intel® Atom™ dual-core processors**

The conga-TCA offers lower power consumption and significantly improved graphics performance.

Congatec announces the conga-TCA, an entry-level model of its Type 6 Pin-out COM Express module range. The conga-TCA is available in three variants of the new dual-core Intel® Atom™ processor generation, which are manufactured in 32nm technology – the Intel Atom N2600 with only 3.5W TDP (1M Cache, 1.6 GHz); the Intel Atom processor N2800 processor (1M Cache, 1.86 GHz) with 6.5W TDP; and the Intel® Atom™ D2550 (1M Cache, 1.86 GHz) with 10W TDP and up to 4GB single-channel DDR3 memory (1066 MHz). The chipset module, which is based on the Intel® NM10, Express chipset, provides improved memory, graphics and display functionalities plus intelligent performance and greater energy efficiency.

**Rugged COM Express® Module with 3rd Generation Intel® Core™ i7 Processor for Small Form Factor Systems**

Extreme Engineering Solutions (X-ES) introduces the XPedite7450, a rugged COM Express® module that complies with the PICMG COM Express Basic form factor (95mm x 125mm) and supports an enhanced Type 6 pinout. It is available with the quad-core Intel® Core™ i7-3612QE processor or dual-core Intel Core i7-2655LE, Intel Core i7-2610UE, Intel Core i7-3555LE, or Intel Core i7-3517UE processors. The XPedite7450 features up to 16 GB of DDR3-1333/ DRR3-1600 ECC SDRAM, an integrated high-performance 3D graphics controller, five Gen2 PCI Express ports, four USB 2.0 high-speed ports, six SATA 3.0 Gb/s ports, and an Intel® High Definition Audio port. BSPs for Linux, INTEGRITY, and VxWorks and Windows drivers are available.

**Axiomtek Launched 3rd Generation Intel® Core™ Processor-Based ATX Motherboard with B75 PCH – IMB204**

Axiomtek has announced the launch of IMB204, its ATX industrial motherboard based on the Intel® B75 Express chipset and designed for the 3rd Generation Intel® Core™ i7/i5/i3 processors in LGA1155 socket. The IMB204 meets the requirement of optimum performance with cost-effectiveness. This industrial-grade ATX motherboard supports Trusted Platform Header 1.0 and Intel® Anti-Theft Technology for better security protection. This embedded board also supports 32 GB DDR3 1333/1600 system memory and PCI Express x16 Gen. 3 as well as SATA-600 interface. With the new Intel® HD Graphics with DX11 support, the IMB204 features powerful graphic processing and dual-view capability. With these incredible capabilities and features, the platform is excellent for industrial automation, gaming, DVR, NVR, and signage markets.

**ADL Embedded Solutions Announces ADL-3GQM67HDS, 3rd Generation Intel® Core™ i7 Processor-Based Quad/DC 3.5” SBC**

ADL Embedded Solutions, a leading provider of customizable, high-performance embedded solutions for demanding thermal and rugged environments, today has announced its New 3rd generation Intel® Core™ processor-based 3.5” SBC – ADL3GQM67HDS. The ADL3GQM67HDS incorporates 3rd generation quad and dual-core socketed Intel Core Quad and Dual-Core socketed processors with the new Intel® HD4000 graphics engine. Platform features include mini-PCI and PCIe expansion ports, support for up to 16GB DDR3 DRAM and video ports including DisplayPort, HDMI, DVI and VGA. Extended temperature operation of -40C to +85C with ADL Embedded Solutions’ thermal solutions is also available.

**NEXCOM ICES 667 COM Express Powered by the 3rd Generation Intel® Core™ Processor**

NEXCOM COM Express Type 6 Basic module, the ICES 667 features the 3rd generation Intel® Core™ processor family paired with the Mobile Intel® QM77 Express chipset. It supports socket-type processors ranging from the dual-core Intel® Celeron® processor B810 to quad-core Intel® Core™ i7-3610QE processor and up to 16GB DDR3 1333/1600MHz SDRAM.

**AAEON Releases the EMB-H61B Mini-ITX Embedded Motherboard with Intel® 2nd/ 3rd Generation Core™ Processor, Dual HDMI and Onboard TPM Security**

AAEON recently announced the EMB-H61B Mini-ITX board based on the 3rd generation Intel® Core™ processor: The high performance EMB-H61B supports 65W TDP, using the Intel® H61 Express chipset for highly reliable embedded systems.
conga-TS77

- Highest Performance COM Express® Type 6
- 3rd Generation Intel® Core™ processor-based platform
- Better transcoding HD-HD, HD Video conferencing
- Improved Graphics Performance, DirectX®11

Formfactor: COM Express® Basic, (95 x 125 mm), Type 6 Connector Layout

<table>
<thead>
<tr>
<th>Formfactor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel® Core™ i7-3615QE processor (4x 2.3 GHz, 6MB L2 cache, TDP 45W)</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i7-3612QE processor (4x 2.1 GHz, 6MB L2 cache, TDP 35W)</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i7-3555LE processor (2x 2.5 GHz, 4MB L2 cache, TDP 25W)</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i7-3517UE processor (2x 1.7 GHz, 4MB L2 cache, TDP 17W)</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i5-3610ME processor (2x 2.7 GHz, 3MB L2 cache, TDP 35W)</td>
</tr>
<tr>
<td></td>
<td>Intel® Turbo Boost Technology 2.0, Intel® Hyper-Threading Technology</td>
</tr>
<tr>
<td></td>
<td>Integrated dual channel memory controller, up to 25.6 GByte/sec, memory bandwidth</td>
</tr>
<tr>
<td></td>
<td>Integrated Intel® HD Graphics 4000 with dynamic frequency up to 1.0GHz, Intel® Clear Video HD Technology</td>
</tr>
<tr>
<td>DRAM</td>
<td>2 Sockets, SO-DIMM DDR3 up to 1600MT/s and 16 GByte</td>
</tr>
<tr>
<td>Chipset</td>
<td>Mobile Intel® 7 Series chipset: Mobile Intel® QM77 Express chipset</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Intel® 82579 Gigabit Ethernet PHY with AMT 8.0 support</td>
</tr>
<tr>
<td>I/O Interfaces</td>
<td>7x PCI Express™ GEN. 2.0 lanes, 1x PEG, 4x Serial ATA® with 6 Gb/s, 2x Serial ATA® with 3 Gb/s (AHCI) RAID 0/1/5/10 support</td>
</tr>
<tr>
<td></td>
<td>2x ExpressCard®, 4x USB 3.0 (XHCI), 8x USB 2.0 (EHCI), LPC bus, I²C bus (fast mode, 400 kHz, multi-master)</td>
</tr>
<tr>
<td>Sound</td>
<td>Digital High Definition Audio Interface with support for multiple audio codecs</td>
</tr>
<tr>
<td>Graphics</td>
<td>Intel® Flexible Display Interface (FDI), OpenCl 1.1, OpenGl 3.1 and DirectX11 support, Three simultaneous independent displays. High performance hardware MPEG-2 decoding, WMV9 (VC-1) and H.264 (AVC) support. Supports 60 Hz refresh rates</td>
</tr>
<tr>
<td>LVDS</td>
<td>Dual channel LVDS transmitter, Supports flat panels 2x24 Bit interface, VESA mappings, resolutions up to 1920x1200, Automatic Panel Detection via EDID/EPID</td>
</tr>
<tr>
<td>Digital Display Interface (DDI)</td>
<td>1x SDVO / DisplayPort 1.1 / TMDS (DVI, HDMI)</td>
</tr>
<tr>
<td></td>
<td>2x DisplayPort 1.1 / TMDS (DVI, HDMI)</td>
</tr>
<tr>
<td>CRT Interface</td>
<td>350 MHz RAMDAC, resolutions up to QXGA (2048x1536 @75Hz)</td>
</tr>
<tr>
<td>congatec Board Controller</td>
<td>Multi Stage Watchdog, non-volatile User Data Storage, Manufacturing and Board Information, Board Statistics, BIOS Setup Data Backup, I²C bus (fast mode, 400 kHz, multi-master), Power Loss Control</td>
</tr>
<tr>
<td>Embedded BIOS Features</td>
<td>AMI Aptio® UEFI 2.x firmware, 8 MByte serial SPI firmware flash</td>
</tr>
<tr>
<td>Security</td>
<td>The conga-TS77 can be optionally equipped with a discrete &quot;Trusted Platform Module&quot; (TPM). It is capable of calculating efficient hash and RSA algorithms with key lengths up to 2,048 bits and includes a real random number generator. Security sensitive applications such as gaming and e commerce will benefit as well with improved authentication, integrity and confidence levels</td>
</tr>
<tr>
<td>Power Management</td>
<td>ACPI 4.0 with battery support</td>
</tr>
<tr>
<td>Operating Systems</td>
<td>Microsoft® Windows7, Microsoft® Windows XP, Microsoft® Windows® embedded Standard, Embedded POS Ready (WEPOS), Linux 3.0</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Typ. application: tbd., see manual for full details, CMOS Battery Backup</td>
</tr>
<tr>
<td>Temperature:</td>
<td>Operating: 0 .. +60°C    Storage: -20 .. +80°C</td>
</tr>
<tr>
<td>Humidity Operating:</td>
<td>Operating: 10 - 90% r. H. non cond.    Storage: 5 - 95% r. H. non cond.</td>
</tr>
<tr>
<td>Size:</td>
<td>95 x 125 mm (3.74&quot; x 4.92&quot;)</td>
</tr>
</tbody>
</table>
conga-TS77

Mobile Intel® QM77 Express Chipset
Intel® BD82QM77 PCH

### Article | PN | Description
--- | --- | ---
conga-TS77/i7-3615QE | 046506 | COM Express Type 6 basic modul with quad-core Intel® Core™ i7-3615QE processor with 2.3GHz, 6MB L2 cache and 1600MT/s dual channel DDR3 memory interface. Processor TDP 45W.
conga-TS77/i7-3612QE | 046501 | COM Express Type 6 basic modul with quad-core Intel® Core™ i7-3612QE processor with 2.1GHz, 6MB L2 cache and 1600MT/s dual channel DDR3 memory interface. Processor TDP 35W.
conga-TS77/i7-3555LE | 046502 | COM Express Type 6 basic modul with dual-core Intel® Core™ i7-3555LE processor with 2.5GHz, 4MB L2 cache and 1600MT/s dual channel DDR3 memory interface. Processor TDP 25W.
conga-TS77/i7-3517UE | 046503 | COM Express Type 6 basic modul with quad-core Intel® Core™ i7-3517UE processor with 2.3GHz, 6MB L2 cache and 1600MT/s dual channel DDR3 memory interface. Processor TDP 17W.
conga-TS77/i5-3610ME | 046504 | COM Express Type 6 basic modul with dual-core Intel® Core™ i5-3610ME processor with 2.7GHz, 3MB L2 cache and 1600MT/s dual channel DDR3 memory interface. Processor TDP 35W.

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR3-SODIMM (1GB)</td>
<td>068750</td>
</tr>
<tr>
<td>DDR3-SODIMM (2GB)</td>
<td>068760</td>
</tr>
<tr>
<td>DDR3-SODIMM (4GB)</td>
<td>068765</td>
</tr>
</tbody>
</table>

---

### Engineering Tools / Accessories

<table>
<thead>
<tr>
<th>Article</th>
<th>PN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>conga-TS77/FEVAL</td>
<td>065800</td>
<td>Evaluation carrier board for Type 6 COM-Express modules</td>
</tr>
<tr>
<td>conga-SB/MC-module</td>
<td>014141</td>
<td>SMART Battery Manager Module for COM Express</td>
</tr>
<tr>
<td>conga-SB/MC-kit</td>
<td>029874</td>
<td>Starterkit to evaluate SBM-Features for COM Express with SMART Battery Manager Module and cable set</td>
</tr>
<tr>
<td>conga-SB/MC Licence and Design Kit</td>
<td>025478</td>
<td>SMART Battery Manager Module Design Kit for COM including licence agreement for customer integration, Hardware design files (Schematics, Bill of Materials), Battery Manager Firmware (incl. commented source code), Avr-Programming Tool AT90 JTAG ICE MKII</td>
</tr>
<tr>
<td>conga-LDV/EP</td>
<td>011115</td>
<td>LVDS to DVI converter board for digital flat panels with on-board EEPROM</td>
</tr>
<tr>
<td>COM-Express-carrierboard-Socket-5</td>
<td>400007</td>
<td>Connector for COM-Express carrier boards, height 5mm, packing unit 4 pieces</td>
</tr>
<tr>
<td>COM-Express-carrierboard-Socket-6</td>
<td>400004</td>
<td>Connector for COM-Express carrier boards, height 8mm, packing unit 4 pieces</td>
</tr>
</tbody>
</table>

---

### Contact Information

congatec, Inc.
6262 Fenns Square
San Diego,
CA 92121 USA
+1 858-457-2600 Phone
+1 858-457-2602 Fax
www.congatec.us

---

www.embeddedintel.com | Embedded Intel® Solutions — Spring 2013 | 9
Embedded Moves Towards Intelligent Systems

Intel launches initiatives to help customers.

A new wave of applications is causing a sea of change—and a multitude of challenges—in the embedded market.

For years, suppliers of embedded systems have traditionally sold unconnected and fixed-function devices for a range of applications. But more recently, the demand is rapidly shifting from fixed-function to so-called intelligent systems. By definition, intelligence systems are devices that are connected, managed and secured over a network.

“The big challenge is to connect and manage a plethora of these systems, many of which are using proprietary components and incompatible operating systems from a multitude of vendors.”

“In the embedded industry, this presents a very interesting challenge,” said Jim Robinson, general manager of the Segments and Broad Market Division at Intel Corp. “The industry is trying to understand how to drive this wave of connectivity in a way that provides consistent connections, ensures security of this all data, and allows for remote management for all these applications that were never required in the past.”

The network of these intelligent systems falls into a loosely defined market called the Internet of Things (IoT). The overall IoT segment represents a whopping $14 trillion business opportunity, according to Cisco. Consequently, Cisco, IBM, Intel and many others are entering or expanding into the broad and fragmented IoT business.

For example, Intel sees IoT as a means to expand its sizable embedded systems business. As part of its strategy, Intel last year launched the Intel® Intelligent Systems Framework (Intel® ISF), an initiative that helps customers speed up the development of intelligent systems for embedded and related applications. More recently, Intel has updated the specifications for ISF, expanded its ecosystem, and rolled out a pair of software tools in the arena.

Shift to intelligent systems

Others are also developing new and rival products to get a piece of the booming market. According to Intel, 15 billion or more devices are expected to be connected to the Internet by 2015, with roughly one-third of those being intelligent systems. The number of intelligent systems is expected to grow to 20 billion in the next decade, up from more than 1.8 billion units in the field today, according to IDC.

IDC defines an intelligent system as a device that is securely managed, runs a high-level operating system, and is autonomously connected to the Internet. Intelligent systems also execute native or cloud-based applications and analyze data in real time.

“There are two major issues that exist in the intelligent system area,” said Patrick Moorhead, founder and principal analyst at Moor Insights and Strategy. “The first is what to do with all the incredible amount of data that is captured. Data without insight is worthless. The second challenge is security. Every sensor and connector between every sensor must be secured.”

For the most part, there is no simple method to connect and manage all of the pieces in a secure network. And to complicate matters, several vendors have rolled out new—and sometimes rival—products to address the fragmented market. “There are many competing efforts across different planes,” Moorhead said. “ARM has SOC and security-based efforts, while IBM has a data center-based effort. Cisco operates in the networking space in the machine-to-machine market.”

The challenge is especially daunting in the embedded space. For example, in the computer market, there are a limited number of processor architectures, computer vendors and operating systems to deal with. In contrast, embedded is a fragmented world that consists of a bevy of different platforms, software programs and standards. Embedded also involves a multitude of diverse and complex markets, such as automotive, communications, digital signage, industrial, point-of-sale, retail, transportation and video surveillance.

“The market that has been historically called embedded is undergoing a significant transformation. The transformation is really about how fixed-function embedded devices, which typically are used to perform just one specific task in a very isolated manner, are now changing,” said Intel’s Robinson. “They are now connecting so they can start to share data with each other. And it’s about sharing data with each other in a machine-to-machine fashion or a cloud environment.”
Building Blocks Solutions


Small Form Factor
X9SPV, X9SCQ, X9SCAA, X9SBA

High-Performance Application-Optimized
C7B75, X9DRD-EF, X9DR7-TF+, X9DRE-TF+, X9SRH-7F/7TF

Compact Form Factor
Short-Depth
SC512F-203F
SC505-203F

Compact, Mini-ITX
Box PC
SC101i

• Standard Form Factor and High Performance Motherboards
• Optimized Short-Depth Industrial Rackmount Platforms
• Energy Efficient Platinum and Gold Level Power Supplies
• Fully Optimized SuperServers Ready to Deploy Solutions
• Remote Management by IPMI or Intel® AMT
• Worldwide Service with Extended Product Life Cycle Support
• Supports Intel® Xeon® Processor E5-2600 product family

Industrial PC
Short-Depth
SCB42XTQ-R606B

Design West - ESC 2013 April 22-25th
San Jose, CA, McEnery Convention Center
Booth # 1123

© Super Micro Computer, Inc. Specifications subject to change without notice.
Intel, the Intel logo, Xeon, and Xeon Inside are trademarks or registered trademarks of Intel Corporation in the U.S. and/or other countries.
All other brands and names are the property of their respective owners.
Last year, Intel began to put the pieces in place to help customers make the transition towards the development of intelligent systems. In September, Intel launched the Intelligent Systems Framework or ISF. The initiative isn’t a standard per se, but rather ISF is a guide or recipe of hardware and software products from Intel to streamline and speed up the product development process.

Basically, ISF lists Intel-based products that have been validated and tested to ensure they are secure, managed and interoperable. “Initially, we are trying to ease the pain the industry is facing right now,” Robinson said. “The specification itself is really a set of flexible recipes that are utilizing scalable, off-the-shelf elements.”

The ISF 1.0 specification was released in June of 2012. The newer 1.05 version of ISF was established in December. In the specification, Intel lists three types of major applications or profile classes: private cloud, client and gateway. The ISF also lists which of Intel’s hardware, BIOS, and software have been approved to support each profile.

“Intel’s effort is very comprehensive, going all the way from the simple sensor at the end point, through the network, and to the ‘big data’ data center. They also have security at the very lowest level with McAfee, combined with hardware-level security,” Moor Insights’ Moorhead said.

In one example, three of Intel’s processor lines—Intel® Xeon®, Intel® Core™ vPro, and Intel® Atom™ processors—are targeted for the cloud, client and gateway, respectively, according to the ISF document. For security, Intel® Virtualization Technology for IA-32 and IA-64 is listed as a “requirement” for the cloud and client, but is “optional” for the gateway, according to the ISF.

These are just a few of the many examples listed in the ISF spec. “What we are trying to do is define the basic capabilities of a platform,” said Ryan Brown, product manager at Intel. “Let’s say you were thinking of a gateway, a client, or even a cloud. What should that device consist of? What are the security elements that should be included? What are the connectivity elements that should be included?”

Getting traction
To date, ISF is gaining traction, as some SO ISF-ready platforms have been deployed in the market. Intel’s ecosystem partners in ISF include Advantech, Arrow, Avnet, Axeda, Dell, Digi International, Kontron, McAfee, Portwell, WebHouse and Wind River. More recently, Adlink and Eurotech have joined the group.

Reflecting the changes in the market, embedded systems specialist Advantech recently realigned its organization and divided the company into three groups: automation systems, embedded and intelligent services. Over the next decade, the market will move towards the intelligent era, in which “intelligent services” will replace conventional products, said Ken Yu, vice president of Advantech Intelligent Services.

Meanwhile, in another effort to help reduce development costs and time-to-market, Intel has rolled out two new software tools—Intel® System Studio and Intel® Firmware Support Package. The tools are not part of ISF, but support the framework. Intel System Studio includes system and application debuggers, a memory and thread error checker, and tools to optimize code.

The Intel Firmware Support Package provides processor, chipset and memory firmware initialization capability using a standardized interface. The package can be integrated into any boot loader of the developer’s choice, such as coreboot, Wind River VxWorks, BIOS, real-time operating systems, Linux and open source firmware. The Intel System Studio single user license is available for $3,499 and a floating license (one seat) is available for $5,299. The Intel Firmware Support Package and the Intelligent Systems Framework are free.

Mark LaPedus has covered the semiconductor industry since 1986, including five years in Asia when he was based in Taiwan. He has held senior editorial positions at Electronic News, EBN and Silicon Strategies. In Asia, he was a contributing writer for Byte Magazine. Most recently, he worked as the semiconductor editor at EE Times.
Leading provider of Single Board Computers

**CMB-576(574)**
Network Computers with 6 x Gigabit LAN port
- Support 2nd & 3rd generation mobile Intel® Core™ i7/i5/i3 processors
- Mobile Intel® CM77/QM67 Express chipset
- DDR3 up to 16GB, DVI & VGA display ports
- 1 x internal 2.5” HDD space, 120W adapter
- 6 x COM, 6 x Intel® Gigabit Etherent controller, Audio
- USB2.0, LPT, PS/2, Dimension: 250 x 160 x 65 mm

**CMB-378(378)**
3.5” Microboard Barebone systems
- Support 2nd & 3rd generation mobile Intel® Core™ i7/i5/i3 processors
- DC 9V~24V, DDR3 up to 8GB, 1 x 2.5” HDD space
- 1 bracket for Mini-PCIe, VGA, DVI, COM, USB
- Gig Lan, Audio, Dimension: 100 x 160 x 75mm

Embedded Boards based on 2nd & 3rd generation Intel® Core™ processors

**PCI-bus & PICMG1.3 Computers**
- 3rd generation Intel® Core™ i7/i5/i3 processor (Mobile)
- Mobile Intel® CM77 Express chipset
- DDR3 up to 16GB, VGA, DVI, LVDS
- 2 x Giga LAN, SATAIII, HD Audio
- RS232/422/485, USB 2.0 & USB 3.0
- PCIe mini card, GPIO, LPT (FS-A77)

**5.25” & 3.5” Form Factor Boards**
- 3rd generation Intel® Core™ i7/i5/i3 processor (Mobile)
- Mobile Intel® CM77 Express chipset, VGA, DVI, LVDS
- DDR3 up to 16GB (LS-576) or up to 8GB (LS-37B)
- 6 x Giga LAN (LS-576) or 1 x Giga LAN (LS-37B)
- RS232/422/485, USB 2.0 & USB 3.0, HD Audio
- Mini-PCIe socket, Full range DC 9V~24V input

**Micro ATX & ATX mainboard**
- 3rd generation Intel® Core™ i7/i5/i3 processor (Mobile/Desktop)
- Mobile Intel® CM77 / Intel® Q77 Express chipset, VGA, DVI
- DDR3 up to 16GB (MS-C75) or up to 32GB (AS-C76)
- 2 x Giga LAN, SATAIII, HD Audio, LVDS (MS-C75)
- 6 serial ports, one Parallel port, USB 3.0 & USB 2.0
- PCI, PCIe x 4, PCIe x 16, PCIe mini card, Mini-PCI

**PCIE mini card & Mini-PCI interface card**
We offer a complete family of Mini-PCI and Mini-PCIE interface cards,
includes Gig LAN, RS232/422/485, IEEE 1394A/B, SATAIII, USB3.0, GPIO, Video capture and more

**MPX-24794S**
- SPI & I2C master
- CAN 2.0B
- 15-bit GPIO, Counter
- 1Mba operation

**MPX-2515**
- Video capture card
- 4-CH Video & Audio IN

**MPX-6864**
- 4-CH HW Video capture card
- H.264 HW compression, SDK

**MP-6100**
- 8-CH SW Video capture card
- 240fps @ CIF, 120fps @ D1, SDK

**MP-6816D8**
- 2D graphic card

**MP-29S**
- DVI/CRT output

---

TEL: +886-2-26983909
Email: info@commell.com.tw, sales@commate.com.tw
19F., No. 94, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City, Taiwan
Tizen OS for Smartphones – Intel’s Biggest Bet Yet

Samsung hedges Apple, Google bets with Intel’s HTML5-based Tizen

Just when you thought the smartphone OS market was down to a choice between iOS and Android, Intel-backed Tizen jumps into the fray (Figure 1). Tizen is Intel’s next kick at the can for mobile, and it’s joining several OS wannabes: Microsoft Windows Phone 8, RIM Blackberry’s whatever-they’re-going-to-announce on 31 January 2013, and eventually the Ubuntu phone platform. (Figure 2.)

Samsung Prepares to “Date” Other Partners

Samsung Electronics announced on 3 January that it will start selling smartphones sometime this year using Tizen as the OS platform. Samsung’s spokesperson didn’t elaborate on timing or models, but said in an emailed statement “We plan to release new, competitive Tizen devices…and keep expanding the lineup.”

Tizen is the third incarnation of Intel’s attempts at building an embedded ecosystem which included MeeGo and Moblin. Tizen, in collaboration with The Linux Foundation, was announced mid-2011 and has been quietly gestating in the background and is now on Release 2.0. One of the largest supporters of Tizen is Samsung, so the recent announcement is no surprise.

Samsung no doubt seeks a back-up plan as Google’s Android OS has flown past Apple’s iOS as the predominant operating system for mobile devices plus tablets (75%; Figure 3).

As Samsung is now the world’s largest smartphone supplier (Figure 4), the company might be following a play from Apple in seeking to control more of its own destiny through Tizen.

And with Samsung and Apple’s patent dispute nastiness, along with rumblings over whether Samsung may or may not continue to supply processors for iPhones, Tizen represents one more way for Samsung to control its own destiny separate from Google and Apple.

Intel’s Mobile Imperative Needs HTML5

Intel, on the other hand, desperately needs more wins in the mobile space. Last year I blogged how the company gained some traction by announcing several Intel® Atom™ processor SoC-based handset wins, but the company has gone on record stating its real goal is to be inside mobile devices from Apple, Samsung or both. In fact, it’s a bet-the-farm play for Intel and it most likely pushed Intel CEO Paul Otellini into his future retirement plans.

The general embedded market is closely following what happens in mobile, adopting low-power ARM SoCs and Intel Atom processors, using wireless Wi-Fi and NFC radios for M2M nodes, and deploying Android for both headed and headless systems such as POS and digital signage. If Tizen moves the needle in smartphones for Samsung, chances are it’ll be used by other players. With HTML5, it will be straightforward to port applications and data across hardware platforms—a goal that Intel’s EVP Renee James touted at 2012’s Intel® Developers Forum (IDF) (Figure 5).
FOCUS ON INTEL

Tizen is based upon HTML5 with plans to achieve the old Java “write once, run anywhere” promise. For Intel, the Tizen SDK and API means that applications written for the most popular mobile processors—such as Qualcomm’s Snapdragon or nVidia’s Tegra 3—could easily run on Intel® processors. In fact, at IDF Intel posited a demo of a user’s application running first on a home PC, then a smart phone, then a connected in-vehicle infotainment (IVI) system, and then finally on an office platform. Intel’s Renee James explained that it matters not what underlying hardware runs the application—HTML5 allows seamless migration across any and all devices.

Figure 3: Android is now the predominant smartphone OS in 2012, according to IDC.

Figure 4: IC Insights – and most other analyst firms – rank Samsung as the world’s largest smartphone supplier. This data is from 28 November 2012.
**Tizen Stakes for Intel and Samsung**

This pretty much sums up the Tizen vision, both for Intel and for Samsung. Tizen means freedom, as it abstracts the hardware from any application.

If successful, Tizen opens up processor sockets to Intel as mobile vendors swap CPUs. Tizen also allows Samsung to choose any processor, while relying on open source and open standards-based code supported by The Linux Foundation.

*Chris A. Ciufo is senior editor for embedded content at Extension Media, which includes the EECatalog print and digital publications and website, Embedded Intel® Solutions, and other related blogs and embedded channels. He has 29 years of embedded technology experience, and has degrees in electrical engineering, and in materials science, emphasizing solid state physics. He can be reached at cciufo@extensionmedia.com.*

---

*Designing with Intel® Embedded Processors?*

Visit [www.embeddedintel.com](http://www.embeddedintel.com)

*Embedded Intel® Solutions* delivers in-depth product, technology and design information to engineers and embedded developers who design with Intel® Embedded processors

Subscribe Today at [www.embeddedintel.com](http://www.embeddedintel.com) Free!
Accelerate Deep Packet Inspection with Standard Servers

The Intel® Platform for Communications Infrastructure offers OEMs and platform developers a powerful alternative to traditional NPU offerings, with resources that will help developers deliver first-to-market solutions while saving time and money.

In the past, organizations looking for high-performance deep packet inspection (DPI) typically turned to dedicated network processing units (NPUs). This specialized hardware presented numerous drawbacks, such as difficult programming models and infrequent silicon upgrades. OEMs can solve these challenges with the Intel® Platform for Communications Infrastructure (formerly code-named “Crystal Forest”), which combines multicore Intel® architecture (IA) packet processing with new encryption and compression hardware acceleration, all on standard server platforms. This optimized platform delivers multi-gigabit network security performance without dedicated NPUs. For instance, in Layer 3 packet forwarding, the platform is capable of over 160 million packets per second compared with the typical NPU’s 100 million packets per second.

This new platform gives developers the ability to scale their solutions from low-power, low-cost, single-core designs with sub-1 Gbps of bulk encryption capability and dual DDR3 memory channels, all the way up to large 16-core platforms with 80 Gbps+ of bulk encryption capability and 8 DDR3 memory channels. This scalability allows independent software vendors (ISVs) to develop once and deploy equipment achieving various performance and price points, quickly evolving their platforms in concert with Intel’s industry-leading “tick-tock” product cycle. What’s more, OEMs and ISVs can leverage products and services from Intel® Intelligent Systems Alliance members like NEI to further accelerate development, helping them deliver first-to-market solutions.

The Growing Need for Deep Packet Inspection (DPI)
Packet-based data continues to increase year after year. The growth of mobile 4G device use, cloud computing, cloud storage and streaming video are all pushing networks to their limits, requiring network operators to more efficiently use the their resources. DPI allows network operators to take a more comprehensive look into the data traveling on their networks and, when necessary, control how each data packet is handled. By inspecting each packet in real-time as it travels through the network, content rules can be more accurately enforced, security threats can be more easily identified, high-priority traffic can be more effectively prioritized, and usage statistics can be more accurately gathered.

For example, a corporate IT department may have a policy prohibiting streaming video on the company network. A standard firewall and policy enforcement tool without DPI typically limits the IT administrator to blocking certain sites such as YouTube, and blocking common TCP ports used for streaming video such as port 554. Adding DPI enables the enforcement tool to inspect the packet structure all the way down to the application layer, and thereby detect, block and report services like the real-time streaming protocol (RTSP) regardless of the port or web address it attempts to use.

Other uses for DPI include stateful load balancing, where each session needs to “stick” to the original server processing it until that session completes. Such solutions are common to transaction processing and video on demand (VoD) services.

DPI-based solutions are also widely used for network security by allowing network traffic to be scanned for viruses, worms and spyware in real time. With the increased use of mobile devices and notebook computers connecting into corporate networks through VPNs, new threats can be introduced into the network directly if they are not discovered first. DPI can allow for security policy enforcement at all layers of the network, allowing for a much more robust security solution.

The Increasing Need for Encrypted Data
The need for data encryption in data-plane services is increasing as networks load up with mobile devices, cloud computing and cloud storage. Increasingly, sensitive data must traverse the Internet or other unsecured networks between secure endpoints. Whether it is a salesperson accessing the company’s cloud-deployed customer relationship management (CRM) system from a smartphone, an IT professional using a remote terminal application on a tablet to control a corporate server, or a home user backing up important data to cloud-based storage, encryption is an important part of the way we live and work today. Because of the tremendous
growth in these types of encryption-driven network services, DPI and encryption often go hand in hand. That is, DPI implementations often need to decrypt and encrypt network data in real-time in order to analyze packet payloads and make intelligent data-plane traffic decisions.

Traditional Approaches

Until now, high-performance DPI and encryption required NPUs specifically designed for these tasks. These devices can be found in network devices ranging from intrusion detection and prevention systems (IDPS) to session border controllers and network monitoring systems. In addition to employing an NPU (or several NPUs), many such platforms incorporate traditional CPU-based server hardware to provide full system-level control plane functionality.

While NPUs offer certain advantages, they also have important drawbacks. Most notably, NPUs use proprietary architectures that complicate the programming model. For one thing, NPUs typically require specialized programming skills and can be difficult to program. As a result, networking hardware often requires two separate programming teams—one for NPU software and another for CPU software. Coordinating these teams can be a major challenge, and the disparate code bases significantly limit design flexibility. NPUs also complicate hardware design which can raise system cost, and NPU silicon is refreshed on a longer timeline than typical mainstream microprocessors and peripherals—potentially leaving OEMs stuck with “trailing edge” technology. Recent advances in server hardware, however, are now allowing OEMs to reach multi-gigabit DPI performance levels without the need for specialized and costly NPU solutions.

The Intel® Platform for Communications Infrastructure

Enter the Intel Platform for Communications Infrastructure. Specifically designed for workload consolidation, the platform consists of multicore IA processors combined with new Intel® QuickAssist Technology hardware accelerators for encryption and data compression/decompression (Figure 1). The platform is capable of performing operations on applications, control plane and data plane concurrently, with very high throughput. In Layer 3 packet forwarding, for example, the platform is capable of over 160 million packets per second, compared with the typical NPU’s 100 million packets per second. (For more details on the platform, see “Tech Review: Intel® Platform for Communications Infrastructure” http://embeddedinnovator.com/2012/10/tech-review-intel%C2%AE-platform-for-communications-infrastructure/.)

This new platform allows OEMs to achieve a new level of DPI and encryption design flexibility while often achieving cost reduction compared with expensive NPU-based add-in cards. By using a single, common architecture, software developers can more effectively spend their time on application development and less on learning new hardware.

The processors used in this platform provide the basis for excellent performance. A dual-socket configuration with Intel® Xeon® processors E5 2600 series can provide up to 16 cores, up to eight 1600 MHz memory controllers, and a PCI Express (PCIe) Gen 3.0 root complex with up to 80 channels, giving the platform the lowest memory latency and highest available I/O throughput of any mainstream Intel platform to date.

Adding to the optimized design is the Intel® Communications Chipset 89xx Series (formerly code-named “Cave Creek”). This chipset combines traditional platform controller hub (PCH) compute I/O functions with communications hardware accelerators. It can be used as a PCH in an embedded motherboard design (as shown in Figure 1), or as a standalone PCIe device added to a traditional server platform (Figure 2). In both cases, the accelerators can off load both encryption and data compression from the system’s main CPUs so that they, in turn, are free to perform other work.

Spared from these workloads, the IA cores are now available for processing both DPI and application tasks, effectively performing work on both data and control planes.
See the future of mobile security at CTIA 2013.
Register now at CTIA2013.com/Security

CTIA2013
THE Mobile Marketplace
May 21-23, 2013 Sands Expo & Convention Center Las Vegas, NV

Prepare for tomorrow. Get smarter. Think big.
The platform gives developers the ability to scale their solutions from low-power, low-cost, single-core designs all the way up to large 16-core platforms. The chipset offers similar scalability, with configurations ranging from a single device with 5 Gbps of bulk encryption capability up to quad-device configurations with 80 Gbps+ of bulk encryption capability. (Note that total system throughput depends on both the processor and accelerator. Thus, total throughput starts at <1 Gbps for implementations with single-core processors.)

This huge range of performance is all available while using the same code base, which allows OEMs and ISVs to address multiple market segments without having to make a significant investment in developing new code simply by scaling the number of CPU cores and accelerators in a given platform. As well, existing server platforms can be transformed into high-performance DPI and encryption machines by adding PCI Express cards containing the Intel Communications Chipset 89xx Series (as shown in Figure 2).

**Intel® Data Plane Development Kit**

But the scalable hardware is only part of the story: How does one best take advantage of this new design? The answer is the Intel® Data Plane Development Kit (Intel® DPDK). Designed specifically to assist developers in migrating traditional NPU packet processing applications to IA, Intel DPDK helps maximize application throughput and minimize development time. The software kit is a series of highly optimized libraries and programming primitives that, when packaged within a virtual machine, allows developers to easily scale by instantiating multiple virtual machines (VMs).

As an example, Figure 3 shows multiple virtual data plane processors and a single control plane processor spread across two four-core processors. Seven of the cores run Intel DPDK instances dedicated to data-plane tasks such as DPI, packet forwarding, routing and so on. Four of the cores are controlling 1/10 Gigabit Ethernet ports, while a single core remains available to run Linux for control plane or higher-level "housekeeping" functions. The CPUs are connected via Intel® QuickPath Interconnect (Intel® QPI) for high-speed out-of-band data transfers.

Intel DPDK is designed to be compatible with any IA platform, allowing OEMs and platform developers to choose the class of CPU that best meets their performance needs at the most effective price point. As future processors become available, OEMs can quickly take advantage of new advances in processor performance and core counts.

**Accelerating Design with the Alliance**

OEMs and ISVs can extend the advantages of the Intel® platform by working with Intel® Intelligent Systems Alliance members like NEI, a high-level systems integrator specializing in upfront consulting and design services in the security, telecom and storage markets. With more than a decade of experience in designing security appliances and more than eight years specifically designing DPI-based appliances, NEI understands the market needs and technology trends specific to DPI applications:

- **Solution Design:** Targeting physical, virtual and cloud system designs, NEI services include hardware selection, OS customization, image creation, remote management and regulatory and compliance certifications.
Over the coming months, NEI will release a wide variety of Intel Communications Chipset 89xx series-based systems, including small form factor appliances, enterprise- and carrier-grade rack mount servers, and ATCA reference solutions. Two examples include NEI’s E1800R3 and E2900R3 server platforms, both based upon Intel® Xeon® processor E5-26xx series, which can integrate the Intel Communications Chipset 89xx series via PCIe add-in cards (Figure 4). These scalable 1U and 2U rack mount platforms support up to six full-height, full-length PCIe expansion cards and up to 24 disk drives, providing excellent performance for medium- to high-density applications. Integrated RAID, hot-swap drives, and redundant hot-swap power supplies ensure maximum reliability and uptime. What’s more, NEI’s design services can help OEMs and ISVs rapidly create frame-level products based on these servers.

On the software side, NEI offers a virtual appliance model designed to optimize deployment across physical, virtual, and cloud models (Figure 5). NEI creates a single controlled image that incorporates a virtualization layer. This virtual appliance can be deployed across physical, virtual, and cloud models with the same performance and lifecycle, saving valuable time and money. In addition, the use of a single image enables NEI’s unique application management, which delivers automated remote health, update and backup tasks.

**Accelerating DPI Design**

The Intel Platform for Communications Infrastructure offers OEMs and platform developers a powerful alternative to the traditional NPU offerings. By using a single, common architecture, developers can spend less time on hardware and software basics and more time creating innovative applications. Likewise, system designers can more effectively scale their solutions for different market segments by adjusting the CPU class and number of hardware accelerators. OEMs and ISVs can extend the advantages of the Intel platform by working with the Alliance members like NEI, which provide hardware, software and services that can significantly accelerate design. By taking advantage of the expertise of Intel’s Intelligent Systems Alliance, developers can deliver first-to-market solutions while saving time and money.


Austin Hipes is vice president of technology at NEI, where his primary focus has been on designing systems for network equipment providers requiring carrier-grade solutions. He was previously director of technology at Alliance Systems and a field applications engineer for Arrow Electronics. He received his bachelor’s degree from the University of Texas at Dallas.
The Art of DRAM Module Testing

If there are no challenges to produce memory modules, why are there differences in quality and price?

By Ulrich Brandt, Swissbit AG

Building DRAM memory modules doesn’t seem to be a difficult task. The DRAM technology is well known, components are fully standardized products and the product commodity definition forces the product to be manufactured with low cost materials and assembly lines.

If there are no challenges to produce memory modules why are there differences in quality and price?

DRAM components are quite complex, although the functionality is somewhat simple. A memory component just has to store information and return it when being read. On the other hand, customers require higher and higher density at the same cost. It almost impossible to find any other electronic component which increases in capacity yet remains the same price as quickly as DRAMs or flash components. This is accomplished by shrinking the silicon process to smaller feature sizes, each time pushing the predicted manufacturing limits further to the next generation. Where just a couple of years ago a DRAM component with a silicon die area of a few square millimeters offered megabits of storage, it now offers up to 8 GB density.

We have lost some of the significance of this. On a state-of-the-art 8GB module there are 68,719,476,736 cells, and not one of them is allowed to fail.

The negative side effects of the shrinking roadmap are smaller and smaller electrical charges being stored in the DRAM cells. The memory core operates with lower voltages, increased crosstalk and coupling to neighboring structures. The cell dielectric uses more exotic substances, textures and aspect ratios to enhance the capacitance, and the highly interwoven cell architecture makes it more susceptible to interference than with older technology.

On a state-of-the-art 8GB module there are 68,719,476,736 cells, and not one of them is allowed to fail.

DRAM Chip Testing and Sorting

DRAMs are tested multiple times. First they are tested at wafer level where the test looks for weak cells in order to replace them by redundant bits, rows or columns. In most cases, this test is executed not at target speed but with lower frequency settings, and with support by built-in self-test (BIST). The needle prober to contact multiple DRAM dies on the wafer limits the timing frequency. The most complex speed and pattern testing is performed at the packaged level. This testing is often performed at wider temperatures, where the DRAM technology is at the weaker corners. During this testing the speed grade of the DRAM chip is determined, called speed sorting. The component is also tested against known failure modes and with internal test modes to make the test as fast and effective as possible. The optimization of the test is one of the major cost improvements and is addressed by big teams at the DRAM manufacturer.

Some DRAMs see special additional tests, while others receive a reduced test flow. This defines if a component is suitable for industrial, automotive or consumer use. The same DRAM part number may have seen different testing depth, and the quality of DRAM components on the spot market can differ from lot to lot.

But even if you buy top-quality DRAMs from the manufacturer, there is still a handicap to produce top-quality modules.

As mentioned earlier, DRAMs are built with delicate technology. Exposing the DRAM component to the high temperatures of a solder process causes a lot of stress to the cell capacitor and its dielectric. The cell capacitance and retention time of the DRAM typically degrades during the assembly process. The DRAM manufacturer covers that by applying margins to the testing. There is always a fight between increasing test margin, and a resulting higher yield loss, and the price pressure dictating to keep the margins as small as possible.
Our experience from years of module testing has shown that there are always some weak cells which pass the outgoing test at the DRAM manufacturer and degrade during assembly of the module. These cells have a reduced storage capability and they fail when operated at high temperature and with disturbing write and read patterns. The combination of temperature and noise causes weak cells to lose the information and to sporadically fail in an application.

Many module manufacturers rely on the extensive component testing by the DRAM supplier and consider a DRAM as good even after being soldered to a module PCB. Their purpose for testing modules is to detect assembly issues, not weak DRAM cells. To check if the assembly was done correctly, simple tests on a module tester or in application boards is enough, and often that is all that is done.

But this neglects the degradation effects that the assembly caused to the DRAMs. To verify that no damage has been done to the DRAM components you need to perform quite powerful tests on the module level and not just at room temperature, but at the specified maximum operating temperature corners or beyond, if you test with guard band.

For DRAM components the operation conditions are given as min and max case temperature. This is by default 0°C to 85°C, and for industrial operation -40°C and 95°C.

The failure modes at low and high temperature are different. At low temp, there are mainly internal contacts failing. At high temperature, the cell retention time is the critical parameter. There is no common approach that targets both effects with one test condition. The only guarantee to verify the full functionality of the DRAM cell after assembly is to test the module both at high and low temperature.

There are two different approaches to module testing: dedicated DRAM testers or application testing. Both have their respective advantages and limitations.

A module tester has a pattern generator, parametric unit and driver interface. The pattern generator can create address and data sequences, but is often limited to linear addressing modes. There is no possibility of creating more random sequences. On the other hand, the tester is very flexible to tweak timing and voltage levels, and is excellent for debugging. Often the tests are very synthetic and do not resemble the real operation behavior in a PC system.

**DRAM Application Testing**

This is the strength of motherboard application testing. The tests can be very similar to the real operation conditions. Fails that you see are relevant, because they occur under conditions that can equally be found during user operation. The application test runs at target speed, and with all the noise and imperfections that differentiates a $200 motherboard from a $1,000,000 high speed tester.

The disadvantage of pure application testing is the impossibility to change timing settings or I/O voltages.

There is a more hidden handicap of application testing that many are not aware of.

In application testing you run the test pattern on the same system that incorporates the device under test. First of all you cannot test 100% of the memory area, since the test program and the OS reserve some memory for themselves. But more than that, the CPU has to generate the DRAM test pattern with code written in assembly language. It is not very difficult to write fast pattern that linearly walk through the memory and write and compare. But as soon as you go for...
complex sequences like random address pattern, using calculation-intensive operation code with a lot of XOR operations, the CPU is most of the time busy generating the next address, and not accessing the memory. You need to distribute the test to multiple threads and cores to increase the bandwidth to the DRAM module, and to test it with critical conditions. Using simultaneous multi-threading (SMT) in a low-level OS like DOS for memory testing is a real challenge and it needs years of experience to write memory test programs that exercise the memory with critical patterns in a short test time. If you have this expertise, then multi-threaded application testing with pseudo random pattern is a very effective tool to find weak cells and to guarantee top quality of a memory module.

Another hurdle to overcome in application testing is the support for ECC. This error correction can detect and correct single bit errors of memory modules, something that you want to use as an additional security against bit fails and data loss.

In a motherboard that supports ECC, the memory controller permanently corrects all single bit errors that occur during testing, effectively hiding all fails from the test program. The test will report “pass” although the memory module had bit errors. This can lead to the situation that ECC modules already have undetected fails that consume most of the error-correction capability of the system, rending the ECC worthless. You need to implement support for the chipset ECC generator into your memory-testing code in order to detect corrected errors and flag the module as fail.

The optimum test flow combines all of the best of these variables in module testing. Each module should first be tested on a dedicated memory tester, varying timings and I/O voltages and measuring leakage.

And then each module should be tested on a main board with a high-performance memory test that causes maximum cell disturbance and long access pauses in order to drain weak cells and isolate DRAM components that may fail in customer applications at critical high temperatures. ECC supported in the test program is indispensable in order to detect correctable bit fails.

**Every weak cell, component or module that a module manufacturer screens out in his testing line is one module less that could fail in the field**

**Total Cost of Ownership**

There are a lot of small things to be observed if you want to get the best quality memory modules. The quality differences are not always obvious; often fails only occur sporadically under extreme temperature or operation conditions.

Every weak cell, component or module that a module manufacturer screens out in his testing line is one module less that could fail in the field. This retained module is a yield loss for the manufacturer and results in higher overall module price, but it outweighs the cost of a module failing in a customer application. System manufacturers either need to invest in their own testing know-how or rely on a DIMM supplier that offers this service. Observing the total cost of ownership and not just the module price is highly recommended when using DRAM technology.

Ulrich Brandt has 29 years of expertise in the DRAM business as a memory system architect, DRAM chip designer, application engineer and technical marketing manager at Siemens, Infineon and Qimonda. His current position is head of business unit, DRAM Products at Swissbit.
Intel-Altera Deal to Shake Up Foundry Landscape
But does Intel have staying power?

By Mark LaPedus, Senior Editor

Intel is expanding its efforts in the foundry business. Recently, Altera entered into an agreement for the future manufacturing of its FPGAs, based on Intel’s 14nm tri-gate transistor technology. Intel will provide foundry services for the FPGA giant.

Until now, Intel has been a bit player in the foundry business. Now, the chip giant is on a direct collision course in the foundry business against the likes of GlobalFoundries, Samsung, TSMC and UMC.

The move could change the landscape in the foundry business, in which Intel will likely become a much bigger player in the arena. Plus, Intel is already in production with finFETs at the 22nm node and the foundries are still stuck in the planar transistor era.

Still, there are some questions regarding Intel’s foundry efforts. First, does the chip giant have the staying power to remain in the foundry business? The foundry business is different than Intel’s current model. The foundry segment is a service business and customers are fickle and demanding.

Intel is known for entering new markets. Then, when the market fails to pay dividends, Intel has a habit of exiting various businesses. The list is countless.

In addition, IDM foundries also have a spotty track record. When the IC market is slow, the IDM foundries are aggressively pursuing business. But then, when demand is hot, they tend to allocate fab space for their own products, leaving foundry customers in limbo.

On the other hand, the current leading-edge foundries fear Intel and for good reason: It adds another big and formidable competitor to the mix. And Altera could become the first in a wave of new foundry customers for Intel.

In fact, Intel gave Altera a good deal, which could lure other customers. “Under the agreement terms, Altera gets exclusive access to 14nm tri-gate for manufacturing FPGAs for a limited period of time. Altera receives a 12-year product support commitment from Intel with last-time buy rights and substantial termination fees and Intel is restricted from acquiring any other FPGA company,” said John Vinh, an analyst with Pacific Crest Securities.

“Why Altera decided to ultimately move forward with Intel as a foundry partner? 14nm tri-gate provides Altera a way to catch up, particularly at the high end prototyping, after falling behind Xilinx, as initial production will focus on high-end FPGAs. Intel is significantly further ahead of TSMC on finFET, and a dual-sourcing strategy mitigates the risk to finFET at 16 nm with TSMC,” Vinh said.

Hans Mosesmann, an analyst with Raymond James, said: “From the current 28nm portfolio of FPGAs, Altera will migrate its high-end FPGAs to Intel 14nm and we believe its mid-to-lower end portfolio to TSMC’s 20nm. In our view, Altera was able to get what appears to be quite the sweet deal with 14nm exclusivity—(as) Xilinx is locked ou—and a 12-year end-of-life support commitment from Intel.

“The move will likely come as a surprise to the street, as Altera’s relationship with TSMC had long been considered strategic while Xilinx’ was more recent and thus tactical. We do believe the semi industry generally will struggle with finFET technology as it adds ~40 manufacturing steps, and in this framework John Daane’s move may end up looking brilliant,” Mosesmann said.

“Strategically, the more formal entry into the foundry business is an implicit admission that Intel will not be able to fill the ~$10 billion fabs with x86 processors,” Mosesmann said.

Risto Puhakka, president of VLSI Research Inc., has a slightly different viewpoint. Altera gains access to leading-edge technology, but the volumes won’t necessarily fill up Intel’s fabs, Puhakka said. “The volumes are not that big,” he said. “We’re talking about expensive parts.”

Putting the news in perspective, Doug Freedman, an analyst with RBC Capital Markets, said: “On the Altera side, the company is now on -track to reach sub-20nm before competitor Xilinx. We believe the news is an incremental negative for TSMC as more companies could transition toward Intel’s advanced processes.

M.L.
Car manufacturers know that in-car technology like navigation systems sells cars. The pace of the smartphone movement is impacting the painfully slow speed with which automotive manufacturers develop new cars and tech features. Consumers trade out their phones every 2 years, but a two-year-old car is still considered nearly “new” by Kelly Blue Book. So how can the auto OEMs satisfy consumers’ tastes for updated, red-hot in-vehicle infotainment (IVI) systems and add-on apps?

Automotive software supplier Elektrobit thinks HTML5 is the answer. Coincidentally, so does RIM’s QNX division, along with Intel. QNX supplies “CAR 2” software to several auto OEMs, and Intel is behind Tizen, an HTML5-based competitor to Android. While Samsung has endorsed Tizen for a handful of smartphones, Intel has publicly stated that Tizen is also targeting automotive IVI systems.

At a webinar today (5 March 2013) hosted by Automotive World magazine, Elektrobit’s VP of Automotive Rainer Holve, argued that HTML5 is the perfect language in which to develop and deploy the fast-changing IVI HMI software. Most importantly, the car’s core “native” IVI functions should stay separate and subject to safety-critical coding practices.

By partitioning the IVI software in this manner, the two ecosystems are decoupled and can run on their own market- and OEM-driven schedules. This means that native IVI—like GPS navigation, audio, HVAC or OBDII diagnostic information like fuel consumption—can be developed slowly and methodically on the typical 2-5+ year automobile OEM cycle.

But the faster-moving, consumer smartphone-inspired IVI portion, and its fast-moving add-on apps ecosystem, can move very, very quickly. This allows consumers to refresh not only the apps, but allows the OEMs to upgrade the entire HMI experience every few years without having to replace the whole car.

While the OEMs would love for an HMI refresh to force the consumer to replace the car every two years, it’s not going to happen. HTML5 is a reasonable alternative and they know it. According to Elektrobit, Chrysler, GM and Jaguar/Land Rover (JLR) have already started projects with HTML5.

HTML5 is an “evolution and cleanup of previous HTML standards,” said Elektrobit’s Holve, and is composed of HTML+CSS+JavaScript, along with new features for A/V, 2D graphics canvas, a 3D API, support for hardware acceleration, and much more. HTML5 is based upon open standards and is supported by Web Hypertext Application Technology Working Group (WHATWG) and the World Wide Web Consortium (W3C). Independently, W3C is working on a standardized API for JavaScript, which makes the HTML5 value proposition even sweeter.

Besides decoupling the HMI software from the “core” HMI functions,
HTML5 would allow third-party apps developers to swiftly write and deploy applications for IVI systems. Besides Internet connectivity itself, this is the one IVI feature that consumers demand: a choice of what apps to add whenever they so choose. And since every automobile OEM will have to certify an app for safe in-vehicle use with their particular system, HTML5 allows app developers to create one core app that can be easily modified for multiple manufacturers and their myriad (and differentiated) vehicle models. In short: HTML5 makes things easier for everyone, yet still allows a robust third-party market to flourish.

It’s important to note how this is both similar to, and differs from, the current IVI strategy of many OEMs that rely solely on the smartphone for Apps. Chevrolet, Peugeot, Renault, Toyota and others tether the smartphone to the IVI system and “mirror” the phone’s apps on the screen (see my blog on Mirroring at http://eecatalog.com/caciufo/2013/01/). This allows the wildly robust iOS and Android app ecosystems into the car (and soon RIM/Blackberry and Windows 8 Phone), but it comes at a price.

In this scenario, the auto OEM must certify every app individually for use in their vehicle to assure safety or that critical car systems can’t be hacked or compromised. Or, the OEM can allow all apps to run and hope for the best. One hopes a rogue app doesn’t access the CAN bus and apply the ABS or electric steering.

HTML5, on the other hand, gently forces developers to create apps destined for IVI systems, but adds only a slight burden on them to make minor changes for each manufacturer’s certification. In this way they’re not barred from the car indiscriminately, but can develop a business of IVI apps separate from their smartphone iOS, Android and other apps.

Will HTML5 be successful? Is it the right answer for the rabid consumer’s taste for car tech, while still giving the auto manufacturer the safety and security they’re required to offer by law? I was skeptical about Tizen until Samsung’s announcements at Mobile World Congress 2013 last month. With Tizen pushing HTML5 for “openness,” it may just gain traction in automotive, too.

Watch this space. We’ll keep you updated.
Analyzing Ultra-Low Power Microcontroller Efficiency

Following the microcontroller datasheet specs for energy or power measurements may lead to disastrous conclusions.

By Markus Levy, Multicore Association

Vince is a very diligent engineer, so his manager had complete confidence that his medical instrument system design would meet the requirements for the product’s 9-year battery life. But 6 years after the product shipped, customers started complaining that the batteries were depleted. What went wrong with the design? Vince attentively followed the microcontroller datasheet specs which indicated an active current of 100 microamps. However, the datasheet failed to indicate the precise workload that was being applied during this measurement. Unfortunately, Vince’s design had a more computationally intensive workload than the specification utilized, resulting in a significantly increased amount of power consumption, despite the aggressive utilization of low power modes.

For all you ‘Vinces’ out there, have you realized that this is an overly simplified and exaggerated story? However, the key point is that you cannot rely on datasheet numbers. While you might be able to extrapolate the specifications to match your design characteristics, you’ll never be 100% sure until the product is completed. This issue is further exacerbated because microcontroller vendors rarely, if ever, provide specifications that are derived from the exact same system-level stresses. So even at the onset of your system design, when you are selecting the appropriate microcontroller for the job, the variance on specification details makes the comparisons nearly impossible. This topic begs for industry standardization on performance and energy metrics. It also highlights the topic and issue of datasheet values versus real-world behavior.

When designing a product to achieve an extended-battery life, the workloads and duty cycles must be carefully analyzed, and you must fully comprehend what functions dominate the energy consumption. Furthermore, the active periods (and even more important, the inactive periods) must be accounted for in the design—not just from the perspective of the duty cycle, but also with attention to the latency associated with the ramp-up time.

To establish metrics for industry standardization on microcontroller performance and energy, we evaluated more than 200 (small battery) applications and determined that active operating mode differs significantly. When it comes to designing an ultra-low power system, there are many factors to consider. To begin with, we must rationalize what is an ultra-low power system, because obviously this is a relative term. In my view, ultra-low power focuses on systems achieving battery life that is minimally measured in terms of weeks, if not months or years. With this in mind when you begin your system design, you’ll need to carefully examine the factors from the perspective of the microcontroller, software, and/or architecture (i.e., 8-, 16-, or 32-bits).

System designers are often reluctant to migrate to a 16- or 32-bit microcontroller in order to process a growing workload requirement of their company’s products, believing that the amount of work will be excessive. But modern development tools are very sufficient in helping to make this transition. On the other hand, system designers often overestimate the benefit of increased performance relative to the increased power consumption. Consider that 8-bit microcontrollers typically have code efficiency advantages on functions such as I/O control, primarily due to their simpler bus structures. Furthermore, 8-bit devices typically have shorter pipelines, resulting in a lower penalty for tight program loops without adding circuitry for loop unrolling or branch prediction. Additionally, 8-bit microcontrollers have lower RAM requirements (compared to most 16- and 32-bit cores), and smaller core size allows for larger geometry which yields lower leakage current.

In favor of 32-bit microcontrollers, these will generally offer better support for 16- and 32-bit arithmetic. In addition, with the use of a more advanced and layered bus system it becomes easier to do things such as dynamic frequency control to optimize the operating frequency for the lowest average power consumption. One might surmise that the silicon vendors are struggling to differentiate their devices. On the other hand, an MCU is much more than a core, and the differentiation comes from implementation-specific bus systems, memory configurations, and the wide variety of peripheral func-

Figure 1: The blood glucose meter is an example application requiring ultra-low power operation combining an advanced microcontroller and a digital display.
Ideally, these energy measurements should at least allow you to visualize (and subsequently optimize) the performance and energy hotspots in your application program.

Another topic of interest in this area of ultra-low power design relates to the capabilities of intelligent peripherals to offload the CPU. The goal here is to have the peripheral blocks function without waking the main processor core until its services are needed. For example, intelligent peripherals can collect data (i.e. ADC) into their memory buffers and in turn wake the CPU core when the buffer is full. Alternatively, a smart CAN peripheral can wake the CPU only when messages arrive that the CPU actually must handle.

Clearly, designing with low power and ultra-low power microcontrollers has become an extremely important topic for many embedded systems. We are looking forward to a standardized approach to analyzing the microcontroller capabilities.

Although EEMBC CoreMark has become a very popular benchmark to measure microcontroller performance and approximate the typical application workload, it completely dominates the run-time energy of an ultra-low power (ULP) device. To put this into context, the energy consumed by 16MHz microcontrollers running CoreMark at the rate of one iteration per second is the same order of magnitude of the simple function of analog-to-digital conversions (ADC) at a modest rate of 4kHz, but two orders of magnitude more energy than the real-time calendar update function.

Table 1 compares the battery-life time for various functions running on three different microcontrollers. It points out that the real-time calendar function consumes significantly less energy than the CoreMark workload and the ADC. But it also shows that battery-life varies substantially depending on the device used, further complicating the system design choices. To summarize on this topic, EEMBC is developing a new industry standard for ultra-low power applications that will take these factors into consideration to ensure an appropriately balanced run-time and stand-by mode behavior.

In developing this standard, or perhaps even more importantly, developing your application, the energy measurement procedure must be carefully established for ultra-low power devices. The workload defined must be relevant to the intended application, and measurement of the energy must be taken at a high enough sampling frequency to enable comparison of processor features such as low power modes. An important point for ULP applications is that the workload includes not just the work that must be performed, but how often it is performed (this is based on the duty cycle). ULP applications also spend significant time in various low power modes, and the measurement methodology must account not only for the different modes, but also for the transition between different operating modes.

![Figure 2: The current ramps up (green line) when the microcontroller begins executing code, coming out of its low-power mode.](image)

Table 1: Battery-life time for various functions (CR2032-230mAh / 90% usable).

<table>
<thead>
<tr>
<th>Device Type</th>
<th>CoreMark at 1 iteration/second</th>
<th>4kHz ADC</th>
<th>Real Time Calendar</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-bit</td>
<td>34.2 Hours</td>
<td>61.2 Hours</td>
<td>29.5 Years</td>
</tr>
<tr>
<td>32-bit</td>
<td>58.9 Hours</td>
<td>42.5 Hours</td>
<td>11.2 Years</td>
</tr>
<tr>
<td>32-bit</td>
<td>46.6 Hours</td>
<td>21.1 Hours</td>
<td>8.7 Years</td>
</tr>
</tbody>
</table>

Markus Levy is founder and president of EEMBC. He is also president of the Multicore Association and chairman of the Multicore Developer’s Conference. Mr. Levy was previously a senior analyst at In-Stat/MDR and an editor at EDN magazine, focusing in both roles on processors for the embedded industry. Levy began his career in the semiconductor industry at Intel Corporation, where he served as both a senior applications engineer and customer training specialist for Intel’s microprocessor and flash memory products. He is the co-author of Designing with Flash Memory, the one and only technical book on this subject, and received several patents while at Intel for his ideas related to flash memory architecture and usage as a disk drive alternative. He is also a volunteer firefighter.
Advancements in embedded information and communication technologies present enormous potential for the intensified healthcare support of senior citizens at home. By employing these technologies in the home, senior citizens are able to live independently for a longer period of time, helping to reduce costs and the need for additional caregiver resources in the process. Research shows that this is beneficial to both individuals and society as a whole.

So why doesn’t every senior stay at home as long as they are physically and mentally fit to do so? The answer is very often the perceived lack of security—either a senior’s own fear or the fear of their loved ones that something could happen to them and no one is around to help. Thankfully, today retirement homes are not the only answer, and technology is playing an important role in promoting better quality of life for the “greatest generation.” A combination of new Intel® Intelligent Services Framework technologies are available that enable machine-to-machine (M2M)-based cloud applications that can provide the necessary connectivity that leads to safety and peace of mind without the negative aspects of lost freedom or lost privacy.

Technology in Context

IoT may be an unfamiliar term to seniors but today’s smart homecare gateways are making a real difference in their ability to live alone while having the right care at hand. For example, ultrasound-based technology already used in hospitals to locate and track patients can also be deployed as a homecare solution to monitor a senior resident’s activity and detect falls. This battery-operated system is cost-effective, easy to install and requires only a wide area communication interface and the infrastructure to manage emergency calls.

A system that would work well for senior home monitoring could be a small waterproof sensor system that is worn like a wristwatch. At regular intervals of 15 to 20 seconds, the system would send a positioning signal to the ultrasound receiver which communicates over standard wireless WLAN connections to the homecare gateway. The advantage of ultrasound-generated positioning signals is that they are highly precise and deliver three-dimensional data—accurate to 3 centimeters. The smart homecare gateway is constantly monitoring these measurements. Only relevant data is broadcast, and as soon as any critical event is detected, the built-in wireless wide area network connection is used to send out a notification for help.

Keeping Seniors Safe at Home

One important benefit of this type of highly precise home positioning system (HPS) for fall detection is the ease of installation due to its wireless nature. No physical network connection is needed. The battery-powered sensors have a capacity of up to three years, and the units have no power connection for recharging. This ensures the system’s high availability since they would otherwise have to be recharged on a daily or weekly basis. Only one service interval for a new battery is required every two to three years.

As long as the movements and locations registered by the ultrasound receivers are within the thresholds of what is defined as normal for that senior, the emergency call system is idle. If a situation occurs that is not considered
normal, an alert is automatically sent through an M2M platform to relatives, a home care provider or security call center. Proven as tools for asset tracking in hospital deployments, this range of M2M technologies and hardware platforms have already been found suitable for field deployments. The availability of new M2M smart services development platforms now offers a highly cost-efficient starting point for extended field deployment. Using these resources helps OEMs and providers quickly design and deploy new central smart gateways for sensor data acquisition and cellular communication applications.

Getting to the Internet of Things

These types of monitoring systems illustrate how all things can be connected—patients, doctors, emergency services, healthcare facilities—and used to extract the most value from available, real-time data. Sound futuristic? Not really, considering medical device developers have an increasingly sophisticated slate of technologies and tools at their disposal. Major manufacturers are focused on expanding connectivity into new arenas including healthcare, and are committed to reducing development time and speeding products and devices to market, while also reducing costs of healthcare. Intel for example, is working to simplify deployment of the Internet of Things (IoT) with its Intelligent Systems Framework, a set of interoperable solutions designed to address connecting, managing, and securing devices and data in a consistent and scalable manner.

The Intelligent Systems Framework enables OEMs to shift their investments from achieving interoperability to unlocking the value of data. The framework features fundamental capabilities, delivered by components from Intel and ecosystem partners, addressing connectivity, manageability and security including software and middleware from Wind River and McAfee. Intel processors supported in the framework include Intel® Xeon® processors, 2nd and 3rd Generation Intel® Core™ processors with Intel® vPro™ technology and Intel® Atom™ processors.

The framework can scale across applications, reducing fragmentation and speeding time to market. It brings together hardware, operating systems and tools and software for increased connectivity. Advancing the Internet of Things also requires an established ecosystem of system vendors, ISVs, system integrators and cloud-to-device services; the Intel-driven ecosystem will work closely with the Open Data Center Alliance, building on the framework with interoperable solutions that ensure seamless integration of intelligent systems with the data center and cloud.

Achieving Rapid IoT Design and Deployment

Traditional embedded challenges apply in IoT arenas—but they are further complicated by extensive wired and wireless protocols and connectivity requirements. Wireless protocols can vary dramatically and may include LAN, WAN and PAN technologies such as WiFi/WiMax, 3G/4G, Bluetooth, ZigBee and many others. Sophisticated connectivity demands fine-tuning that covers a multitude of design, processing and communication factors. A platform that allows these complex systems to be semi-customized in development, without the need to master complex wireless technologies, is ideal for
healthcare solutions developers. Standards-based, application-ready platforms streamline development, offering ready support for 90 percent of known software options. Reference designs can address these challenges via an intelligent connected device and building blocks that can quickly enable a complete data path. This path moves information from collection to cloud to aggregation to decision-making.

Developer kits that are compatible with the Intel Intelligent Systems Framework can provide a valuable resource for medical device designers. These kits are designed to accelerate the creation of end-user applications and provide a pre-validated platform for M2M software. It also serves as the communication gateway for sending the information used for real-time medical applications supported by a range of wireless connections. This gives designers multiple options for generating, aggregating and transmitting machine-to-machine data to the cloud.

Ideally, R&D engineers are equipped with pre-qualified set-up for mobile network operators by using PTCRB-certified systems; these are validated and approved for use in cellular networks by global carriers such as Vodafone. PTCRB certification on a mobile device ensures compliance with a range of 3GPP mobile network standards; non-certified devices may be blocked by PTCRB operators. This saves R&D time as well as costs because it streamlines the process of carrier approval and vendor certifications before the application can be launched on a carrier network. It also can be manufactured accordingly for use as part of a medical device. The system also provides direct access via WLAN (WiFi) to the platform.

For integration of additional local sensors and other terminal devices, look for a range of interface options including 802.11a/b/g/n WLAN (Wireless Local Area Network) and 802.15.4 WPAN (Wireless Personal Area Network) as well as a mini PCI Express slot for custom-specific extensions. Even face-to-face communication is possible with the optional extension of a smart video and audio module. The modular approach and custom design options of an M2M developer kit enables medical OEMs to reduce development costs and risks; designers can ensure a rapid introduction to the market for devices such as the ultrasound example shown above, delivering the management, connectivity and security features required for effective patient care.

In turn, the demand for high-tech healthcare solutions will grow dramatically, and the goal will be to care for more people in more affordable and effective ways. This looming challenge forces us to take a look at new methods of caring for seniors. Simplified product development, coupled with faster time to market, holds great promise for new technology-based home healthcare solutions, and will continue to drive creative and powerful deployments based on Internet of Things.

The ultrasound system highlighted here has potential beyond its current deployment monitoring movement and safety of seniors living alone. When movement information is combined with other security solutions within the home, a broad range of user scenarios becomes possible. In the future, smart systems could warn residents about leaving the stove on or the bathroom faucet running. Service providers are poised to offer a full slate of robust and reliable home care solutions that lend a true feeling of safety. With this peace of mind growing old at home will be an easier choice for seniors as well as their relatives and caregivers.

**Satish Ram** is the global product line manager for Kontron’s Internet-of-things/machine-to-machine and digital signage product lines. He has extensive experience in wireless connectivity solutions and cloud services, and has worked at leading global technology companies including Qualcomm, HP and Motorola. Satish has a master’s degree in computer science from Syracuse University and MBA from San Diego State University.
Versatile System Design for Medical Video Applications: A Blueprint

High-performance engines from Intel’s embedded roadmap, along with powerful graphics cards to capture a variety of medical modality and camera images, offer an ideal platform for medical video wall applications.

The Opportunity
An increasing number of modern surgical operations benefit from the advanced computing technologies adopted in hospital operating rooms and specifically in the control rooms where technicians assist surgeons and nurses to control various medical, surgical and diagnostic instruments used in the operating room. To provide this aid, the technicians need to view multiple real-time images and video feeds from a variety of specialized equipment such as C-arm, endoscope, intravascular ultrasound (IVUS), surgical navigation systems, video cameras and more. Most establish hospitals—particularly university hospitals—also provide interactive training by displaying real-time images or videos on video walls in their video conference rooms, auditoriums or classrooms so that students can view surgical procedures live outside of the operating room. These video capabilities can also be used for grand rounds, live consultations, real-time collaboration and co-diagnostics with physicians of various specialties, either locally or remotely and have become an intrinsic part of today’s medical applications.

The Technology Challenge
The medical environment has always presented a challenge for system developers or integrators because of its very critical nature. What’s more, in today’s economy, the technology that drives in-hospital video applications needs to be scalable in performance, able to take data from multiple inputs and process it consistently in real time and reliable enough to have a long operational life to keep total costs down. To meet these demands, developers or integrators should look to high-performance engines such as Intel® Core™ and Intel® Xeon® processors from Intel’s embedded roadmap, along with powerful graphics cards to capture a variety of medical modality and camera images, then render them precisely on large LCDs within system configurations that provide flexibility and scalability.

System Scalability and Expandability
The key here is to provide a building-block architecture that can grow dynamically with the application as the need for the number of cameras or image sources to capture videos and the number of the displays for the video wall to render them increases. The first step would be to select the computing core of the system—either a motherboard or a backplane with a plug-in single board computer (SBC), which provides processing power, memory, I/O and slots for plug-in cards. The next step would be to source video/graphics cards with great performance. Finally, add a power supply, thermal management, sufficient PCI Express expansion slots and a rugged chassis that packs it all together seamlessly. (Figure 1)

Standards for High-Throughput Video Applications
When compared to a motherboard, the architecture of an SBC and backplane combination offers many benefits for high-performance applications. One of the major advantages is reduced mean time to repair (MTTR)—an SBC can be removed from the system easily by unplugging the cables and removing one...
screw, without removing the I/O cards. Others include easy-to-install, expandable backplane slot configurations, flexible system space utilization, and the ability to use a broad range of off-the-shelf peripheral cards.

An SBC contains all the functionality of a conventional motherboard only designed onto a single plug-in type card. This SBC plugs directly into a “passive backplane.” PICMG 1.3 is a PICMG specification commonly referred to as system host board or SHBExpress. SHB Express is a modernization of the PICMG 1.0 SBC specification, which uses the same physical form factor as PICMG 1.0 SBCs. The board-to-backplane interfaces are PCI Express instead of PCI and ISA, while the use of PCI remains as an option.

SHB Express delivers a highly integrated feature set: point-to-point PCI Express (or PCIe) serial links, Serial ATA, USB, Ethernet and others. It allows users to take advantage of the latest chipset functionalities to increase computing capability for a flexible and simplified system design.

Implementing a PCIe x16 interface on the backplane, single board computer and video cards is highly recommended for the high bandwidth of graphics video applications, such as video walls.

**Processor Platform Progression: From 2nd to 3rd generation Intel® Core™ and Intel® Xeon® Processors**

Intel embedded processors are ubiquitous in medical applications because they offer four key benefits: Intel’s outstanding reputation, scalability, expandability and longevity (with a lifecycle support of up to seven years). The 2nd generation Intel® Core™ and Intel® Xeon® processor E3 Series series were the perfect solution to meet the needs of the computing engine. In addition, with a new microarchitecture, codename Ivy Bridge, Intel’s 3rd generation Intel Core and Intel Xeon processor E3 series embody a substantial performance benefit and power saving over previous generations (from 32nm to 22nm die shrink) and provide a seamless upgrade path through to the upcoming microarchitecture, codename Haswell.

All of these Intel® processors offer various single-core, dual-core and quad-core configurations depending on performance and power tradeoffs. Furthermore, the 3rd generation Intel Core and Intel Xeon processors E3 series are socket-compatible and pin-compatible between desktop and server-grade processors, and their corresponding chipsets or platform controller hubs, Intel® Q77 Express chipset and Intel® C216 chipset, are also pin-compatible. Such compatibility offers the flexibility for developers to choose the combination of processor and chipset, from a long list of available selections, to best fulfill their design needs of performance, thermal output, cache size, number of computing cores and many other special requirements. This in turn brings unprecedented scalability.

In addition, because of its versatility in functional support, the single board computers with 3rd generation Intel Core and Intel Xeon processors E3 series come with a great portfolio of features including 16GB DDR3 1333/1600 RAM, two SATA 3 (6Gbit/s) ports and two SATA 2 (3Gbit/s) ports with RAID 0, 1, 5 and 10, two Gigabit Ethernet, multiple USB 2.0 ports, serial ports, parallel ports, DVI-I (DVI-D digital plus analog VGA) and HDMI. (Figure 2).

**Purpose-built Graphics Card**

While most graphics cards offer 3D rendering capability, which is good to create medical image-based modeling, a more scalable option is to look at purpose-built graphics cards. Some purpose-built graphics cards, capable of supporting multiple inputs and outputs, are more ideal for large-scale, multi-view display applications and impose only modest demands on the PCIe x16 interface. A chassis with are liable power supply that efficiently manages internal heat dissipation and airflow can function seamlessly with these graphics cards while displaying real-time surgical images and minimizing downtime.

**Figure 3: Portwell’s M9020B4Urackmount chassis offers sufficient cooling and 950W redundant power supply.**
REGISTER
IT'S COMPLIMENTARY!
AND MORE AWESOME THAN WORK!
RTECC.COM

COME TO RTECC
REGISTER
IT'S COMPLIMENTARY!
AND MORE AWESOME THAN WORK!
RTECC.COM

TAKE A DAY TO LEARN ABOUT THE NEWEST IDEAS IN THE EMBEDDED INDUSTRY.
CHECK OUT THE LATEST DEMOS.
LISTEN TO TALKS FROM THE EXPERTS.
GET OUT OF YOUR OFFICE.
RETURN WITH INSIGHT ABOUT THE FUTURE OF THE INDUSTRY.
The best purpose-built graphics cards include both input and output on the same PCIe Gen2 board that can leverage 64 Gbit/s duplex data transfer for the flawless display of HD input captures without sacrificing frame rate, color or resolution. They should include flexible, universal input channel support for both digital and analog video (DVI, RGB/VGA, Component, S-Video and Composite) and be able to capture and display this video at full, true 24-bit color image quality. Ideally, the graphics cards should support bezel management as well as overlap for projectors in both landscape and portrait setups to create a seamless display surface—such as video walls—with a large number of HD output sources.

The Ideal Configuration
The ideal solution for this application will need to be medical-grade quality for operation within a mission-critical environment that demands minimized downtime. It would consist of a PCIe x16 10-slot PICMG1.3 backplane that offers unprecedented data bandwidth for capturing and displaying high-resolution images in various medical environments. Ideally, it will be capable of supporting up to 40 video inputs and outputs in real time running on a popular operating system like Microsoft® Windows® XP, Windows Server 2008 or Windows 7.

The system could be housed in a 4U rack-mount chassis that offers reliable and sufficient power and the requisite ventilation to keep things cool. The engine that drives this system should be a combination of high-performance Intel Xeon and Intel Core processors, video wall controller cards and the 10-slot PICMG1.3 backplane that offer scalability, expansion and longevity. (Figure 3) Not only will this system provide a high-end integrated solution, but it will also enable developers to speed up time to deployment by simplifying the implementation of these large-scale video display wall and remote viewing applications.

Allen Sha is senior program manager at American Portwell Technology where he is responsible for designing solutions for medical devices and new market development. Sha has over 20 years of product marketing and sales experience in the embedded computing, ASIC and electronic design automation (EDA) industries. He holds a master's degree in electrical engineering and a U.S. patent.
Enabling Accurate Glucose Measurement

Designing a glucose monitoring device is made easy with an 8-bit, 8051-based programmable SoC

By Ross Fosler and Chris Keeser, Cypress Semiconductor Corporation

When you go to your local pharmacy, you’ll find glucose measurement strips that, when plugged into a deceptively simple handheld meter, quickly (but not necessarily painlessly) give you a reading of your blood glucose level. Each strip contains a tiny quantity of a substance that reacts with the glucose in your blood. The chemical reaction with your blood yields a tiny charge that enables electrical measurement of your blood glucose level.

Measurement methods vary, but they generally require measuring small electrical currents at specific times, calculating a tiny total charge over a specific period, or measuring impedances under specific conditions. Thus, sensitive analog signal processing, high-resolution data sampling, unique timing control, and digital data processing are often necessary features for glucose meter operation.

The chemical reaction between the blood and the agent on the strip results in a very small charge that is measurable with sensitive circuits. To measure a small current signal, an active trans-impedance amplifier (TIA) is often employed, along with a voltage reference on the TIA to set a bias on the cell. Figure 1 shows a simple schematic example of this idea.

The nature of the chemical reaction with glucose in the blood and the enzymes on the test strip can result in a large initial transient in the current with a much more moderate current towards the tail end of the reaction. In a basic static design such as is shown in Figure 1, the TIA gain is fixed. The TIA feedback resistance, ADC input range, and the ADC resolution will need to be carefully selected in order to meet minimum sensing requirements, which is a challenge with this fixed implementation. The TIA and ADC will need to be able to handle a large transient condition while maintaining the bias on the glucose test strip. In general, this is an order (or more) magnitude higher than the sensing often necessary towards the tail end of the reaction. The transient will limit the resistance of the feedback to smaller values to ensure that the TIA does not clamp at the rail and cause the glucose test cell to lose its bias, and the high sensitivity implies the need for a very high resolution ADC in order to sense the very small changes over the entire operating range.

One advantage with a programmable SoC is the ability to create a programmable gain TIA and dynamic ADC ranging. The availability of a programmable routing fabric enables the TIA to be created with multiple gains; Figure 2 shows a design with two gain settings though more are possible. These gains can be hand-picked to optimize different aspects of sensing a reaction. For example, a low gain setting can deal with large transients while maintaining bias on the strip and providing valid readings to the ADC, while a high gain setting can greatly increase the sensitivity of the TIA without requiring high resolution on the ADC or a low noise amplifier. Figure 2 shows a significantly enhanced programmable signal chain with some additional features thrown in.
The use of a differential ADC in Figure 2 allows the analog routing resistance and op-amp offset to be eliminated from the measurement. This measurement scheme is superior to the single-ended method shown in Figure 1 where the bias voltage narrows the useable ADC input range. Any input offset on the op-amp is eliminated with a differential measurement across the feedback resistance. The analog routing fabric allows true differential measurements across the multiple feedback resistances, providing the maximum possible accuracy for the system, regardless of the selected gain. Other enhancements include an adjustable current offset compensation DAC with precision sensing to provide the ability to sense very small current variations on top of a large DC bias current if desired.

Combining the analog capabilities with the digital fabric and other digital resources such as direct memory access (DMA) further increases flexibility and measurement capability. For example, a make-before-break switching scheme can easily be employed in the routing fabric to ensure that the bias is always applied, even when changing TIA gains. Precise data structuring and movement from the ADC to memory can be managed through DMA. Designers also have the option to program the DACs to manage a time-varying signal on the glucose test strip to gather AC information while simultaneously managing precise data movement.

For example, Figure 3 shows one way to implement a highly integrated data management system. In this example, a PWM block is used as a source for timing management. Like almost any digital PWM, it is quite capable of this type of management given the ability to program exact edge placement of the output signal. Thus the edges can be used to precisely trigger events at specific times. PWM 1 output is used to trigger the DMA to autonomously take a pattern from SRAM and transfer it to the DAC to generate a particular bias signal across the glucose test strip. Synchronous with the bias pattern, the ADC is triggered with PWM2 output to start taking data, with the results being completely managed through DMA. It is even possible to use DMA to manage the amount of data taken (i.e., take five samples then stop until next trigger).

Most of the general timing and data gathering work is directed in the processing subsystem while the harder timing critical work is performed in other parts of the programmable system. The terminal count (TC) of the PWM’s timer in Figure 3 is used in this case for linking timing of the data gathering analog-front-end (everything shown up until now) to the processing subsystem. Thus it is possible to synchronously manage the state flow of the glucose meter process by getting interrupts every cycle.

For example, each interrupt from the PWM (see Figure 4) can be used to manage a bit of information to be shown to the user on an LCD (i.e., processing... 3, 2, 1, done). Thus the processing subsystem— an 8051 in this example— manages the general state flow of the system displaying information, taking information from the user (i.e., a button or a...
chemical strip insert), and most translating acquired data into a user-friendly format (at the very least something friendlier than a lance in the finger). Remember that as the DMA is handling a large portion of the sensing and data management, the processing load is generally minimal, enabling the CPU to disable various functions, including itself, to minimize power consumption for higher battery operating life.

The ability of an SoC to offload tasks into the hardware makes it possible to design extremely power-efficient designs. The system on a chip approach to implementing a glucose meter provides a tremendous flexibility and freedom to implement both essential and value-added features without a significant development investment. Analog-front-end improvements like offset elimination, dynamic customized TIA gains, and a flexibility to adapt to a wide range of sensing approaches with the same hardware are possible when designing with a programmable SoC. Further enhancements made possible by the SoC architecture include fully-customizable hardware based design, thus freeing up firmware designers to focus writing high quality, robust code without micro-managing every sample and transaction that must occur in the sensing design. Just because taking a glucose measurement can be a painful experience doesn’t mean designing a glucose meter has to be painful too.

Chris Keeser is staff applications engineer at Cypress Semiconductor working with the Programmable System on a Chip (PSoC) 3 and 5 platforms. Mr. Keeser has worked on many embedded systems with a special interest and focus on high performance analog-front-ends (AFE) for sensitive analog designs. With his expertise he has developed and assisted the development of several specialized AFES for glucose meter applications using PSoC technology. Chris received his master’s of science in electrical engineering from Washington State University and has over 9 years of experience working with microcontrollers and embedded applications.

Ross M. Fosler is an applications engineer and member of the technical staff at Cypress Semiconductor Corporation. Mr. Fosler has more than 12 years of diverse professional experience covering a wide variety of applications including embedded systems and firmware design, digital design, and power systems control and management design. Mr. Fosler’s research interest resides in control theory, power electronics, and high performance real-time embedded processing. Mr. Fosler has 8 patents credited to him. He is also a veteran of the US Air force as well as a member of IEEE, HKN, AOC, and other organizations.

### Cameras “See” More with Imec Hyperspectral Imaging

**By John Blyler, Editorial Director**

New CMOS-based imagers offer smaller size and cost, but with greater discriminating powers over today’s RGB-based cameras.

Imec, a major researcher in nanoelectronic technology, has announced an evaluation kit for its compact, low-cost, CMOS-based hyperspectral imaging filter system. Hyperspectral technology provides images with greater detail than traditional-visible-spectrum Red-Green-Blue (RGB) camera systems. This additional detail permits the human viewer or machine system to “see” more details about the image (i.e., the materials that make up the image). Application areas for hyperspectral imaging include the medical, optical sorting, remote sensing, and even agricultural markets.

“The added value of hyperspectral imaging is a significant increase in the capability to discriminate between images—to look at the whole spectrum beyond just the visible,” explained Imec’s Senior Researcher, Murali Jayapala. “Now, you have greater discrimination power to distinguish between different kinds of objects.”

How does spectral imaging differ from basic camera systems? The human eye sees visible light in three bands – red, green, and blue. Hyperspectral imaging extends the visible bands into a much wider spectrum, which results in a more complete identification of the materials that make up the scanned object than RBG-based camera systems.

Imec developed the CMOS-based sensor-imaging chip by tiling hyperspectral filter sets onto the sensor chip. In other words, it processes the spectral filters directly on top of the CMOS image sensors at the wafer level. Hyperspectral sensors can be tailored to specific customer requirements during the filter’s design phase.

This approach greatly reduces the size and cost of the overall hyperspectral imaging systems. The resulting camera is able to acquire real-time hyperspectral video.

How does this new sensor impact the world of semiconductor IP? Spectral imaging technology will compete with today’s existing visible RGB-based sensors. This means that new hyperspectral imaging software and algorithms will be needed (e.g., in analogy to current color-correction matrices as offered on Chipestimate.com). Color-correction software is needed to eliminate the color overlap created by most RGB-based channels.

**Read the full story at:** [http://www.chipdesignmag.com/blyler](http://www.chipdesignmag.com/blyler)
Needed: Self-Protecting, Security-Aware Mobile Applications with Anti-Tamper Technology

Application providers need to step up and begin building in sufficient security for mobile devices, including vulnerability mitigation, re-evaluation of trust and incorporation of secure authentication channels.

By Andrew McLennan, Metaforic

During the last 20 years, malware has evolved from occasional “exploits” to a global multimillion-dollar criminal industry. We hear about viruses such as Flame and Stuxnet, which can infect whole country infrastructures with relative ease. It seems to be getting simpler for hackers and malware to breach private companies and government agencies alike. For example, for at least two years, Flame has been copying documents and recording audio, keystrokes, network traffic and taking screenshots from infected computers. And passing all the information to servers operated by its creators. If it’s that easy to attack governments and infrastructures, how difficult do you think it is to hack a smartphone?

In network security, perimeter-based and scanning techniques are penetrated and circumvented with alarming regularity. This has resulted in the more widespread use of application layer security technologies, which are now considered to be a critical component for security engineers who have come to realize how important in-depth defense techniques are in the current threat landscape.

A PC currently can expect between 40 and 200 minutes of freedom before an automated probe reaches it to determine whether it can be penetrated.

And, of course, the latest trend is custom malware for attacking smartphones.

Custom Malware Designed for Smartphones

Application providers need to step up and begin building in sufficient security for mobile devices, including vulnerability mitigation, re-evaluation of trust and incorporation of secure authentication channels.

The need for these techniques is magnified on mobile platforms and perhaps none more so than on Android. A recent study by AV-TEST showed that more than 75 percent of anti-malware solutions ignored at least one in every 10 of the main families of malware in the wild. Add to this that Android malware is increasing dramatically, quadrupling between 2011 and 2012, and it seems that failing to protect mobile applications in general, and Android applications in particular, might be inviting a disaster.

The open source nature of the Android platform means that there are a plethora of free, widely available and powerful tools. While these have legitimate uses, they also make it simple to reverse-engineer unprotected applications or even elements of the OS itself, in order to assess vulnerabilities and create attacks. Add to this the fact that there are a wide range of largely unpoliced Android marketplaces where practically any application can be uploaded, making it unsurprising that the security situation has been likened to the Wild West. Even Google’s own marketplace and its use of its
Mobile Security Critical for Businesses

With the huge growth of smartphones and the applications that run on them, mobile security is becoming a critical area for all businesses. The sheer volume of commercially sensitive, personal employee and other key data both stored in and transmitted via these devices, makes them an attractive target for hackers. They also are an obvious route for threats that seek to penetrate the back office to corrupt data, capture it, or maliciously alter software through mobile application attacks.

Unfortunately, to date, security in Android has been ineffective. Custom malware attacks on Android applications are increasing exponentially and theft of software, data and content is rising to match. Hackers create and input malware that can change the behavior of applications, substitute account numbers, modify amounts, initiate egregious transactions, capture PINs, passcodes and more. Applications running on remote devices, with unknown configurations, need to be able to defend themselves, their communication, and to clearly signal if they have been compromised.

Apple's iOS is not an impervious walled garden that many would have you believe either. A number of malicious applications have been removed from the App Store and Russian malware was recently pulled after managing to pass through Apple's normal protections around their market.

Approaches to Secure Mobile Devices

There are various means to secure mobile device transactions. Strong security for mobile devices offers a comprehensive portfolio of embedded security solutions; the most obvious being anti-tamper technology, to prevent code and data changes. Anti-tamper is the most significant development in information security since the advent of the firewall and is perhaps the most advanced item in the security professional’s toolkit.

The principle behind anti-tamper is quite simple: rather than relying on the security of the environment (by making the assumption that firewalls and virus checkers are installed, correctly configured and updated) anti-tamper ensures that the application can defend itself and its own data.

Clearly this approach will become the standard method for securing applications in the next few years as it is obvious that traditional approaches to security are now insufficient. ‘Defense-in-depth’ is now required for any applications that need to ensure the integrity of their operation.

There are numerous ways anti-tamper technology can help secure smartphone apps for financial transactions:

1. Protect the application itself against subversion. If it is possible to alter the application’s operation, any security methods inherent in it are open to trivial attack; data validation can be avoided, transactions can be altered or rerouted, data can be captured, and routines can be called at will to have previously unintended consequences.

2. Protect application data. In the same way as application code can be prevented from alteration, its data can be protected.

3. Protect data and keys within the application from capture or extraction by using cryptographic primitives, which prevent malware from being able to access the values of keys and other sensitive information by not holding them ‘in the clear’ in memory but instead by holding their values programmatically/algorithmically (e.g., to ensure bank account details are not captured and stolen).

4. Prevent ‘code lifting’ to extract individual functionalities (e.g., hackers might wish to use a code fragment that signs data with a key to sign some of their own data for a Man-In-The-Middle attack to reroute a payment transaction to a bogus account).

5. Trigger a response. Once an application is protected against subversion, any detection of an application level attack can trigger a response. While that may typically be as simple as alerting the user to a problem and exiting the application, anti-tamper technology typically allows custom responses; e.g.; sending a message to a server, perhaps to blacklist a device on which a compromise attempt has been made at the server-side.

6. Repair attacked applications or data. Should even one bit of an application or its data be altered and this be detected, the technology is available to repair the damage in order that the application may still be used.

As malware continues to attack smartphones, financial institutions must strive to provide the needed security to their applications. Malware won’t go away and companies need to be more proactive in securing apps from the inside out using anti-tamper technologies to produce that added level of security. We all know firewalls alone aren’t enough.

Andrew McLennan is an experienced entrepreneur who has founded five start-up companies since 1993, including Metaforic. Andrew has held all the key management roles in startups including CEO, CMO, CCO and COO. Andrew has an honors degree from Strathclyde University in mechanical engineering with aerodynamics.
The Expanding Threat Landscape of Connected Medical Devices

The medical device industry is in the earliest stages of addressing medical device security today, but developers should expect to see many changes over the next several years.

By Nate Kube, Wurldtech Security Technologies

Today’s health care environments contain an extraordinary amount of networked technology, from traditional hard-wired equipment such as monitoring devices and diagnostic equipment (CAT scanners) to wireless connectivity within implanted devices such as pacemakers. The explosion of connected medical devices (MDs) to open networks has created new vulnerabilities for patients and a series of unique security challenges to device manufacturers and medical facilities.

A team of academic researchers in 2008 shook up the connected medical device community by presenting a paper at an IEEE Symposium, which outlined a potential attack on implanted cardiac devices through the wireless interface. While this initially raised some concern, it was not until Jay Radcliffe demonstrated a potential attack through the wireless interface of a patient-worn insulin pump that awareness of medical device security issues “exploded,” prompting a U.S. Government Accountability Office (U.S. GAO) inquiry into medical device security issues, and a media blitz which continues to this day.

Here are a few examples of device types that are subject to security risks:

The Good and the Bad of Connected Medical Devices

Communication technology advances have allowed medical device manufacturers to implement features that radically improve the patient experience. To cite an example, implanted cardiac management devices (e.g., pacemakers) often require adjustments in the therapies they deliver. Early devices required somewhat invasive procedures to make such adjustments, often resulting in increased patient discomfort, or worse, the introduction of infection.

Advances in wireless technologies eventually led to implanted devices that could be monitored and adjusted through radio frequency (RF) communications, increasing patient comfort and reducing the risks surrounding invasive procedures.

Connected devices provide health care professionals with the ability to share this data with other members of health care staff, often in real time, both inside and outside the confines of the medical establishment. There is little doubt that connectivity has tremendously enhanced the health care experience, both from a provider and patient perspective.

The rapid adoption of electronic health records (EHR) while an enabler of better provider/patient interactions through streamlined workflows, has unfortunately opened up new avenues for misuse of medical information. The HIPAA Act was created in the U.S. to force health care organizations and their business partners to protect patient data under penalty of law, and organizations that do not comply with the requirements are subject to stiff fines.

Despite the benefits of these technological advancements, we are now witnessing a gradual emergence of cyber security-related risks to patient safety and privacy. These risks have
consequently caused health care providers, from device manufacturers to hospitals, to dedicate substantial resources for the purpose of discovering and mitigating cyber security risks.

Awareness of the rising problems associated with this technology prompted a recent bulletin released by the National Cybersecurity and Communications Integration Center (NCCIC), a division of the Department of Homeland Security. The bulletin discusses how the exploitation of potential vulnerabilities of MDs, attached to medical IT networks, may result in possible risks to patient safety.

**No More Protection Through Obscurity**

For years, medical device manufacturers have relied on obscurity as a means of protection. This was only adequate until the research and hacking community decided to investigate these devices, wherein they discovered that, in some cases, it was relatively easy to intercept communications and, furthermore, take control of such devices.

RF/wireless-capable medical devices frequently communicate over proprietary frequencies and through unauthenticated (or weakly authenticated) communication links. Additional research has also uncovered firmware updates to medical devices were being distributed over the Internet via malware-infected websites.

**Unique Solutions to Unique Challenges**

Legacy medical devices create interesting challenges, since many of these devices cannot be patched or updated to offer better security. Many legacy devices are in service today because they perform their functional requirement of delivering patient therapy. In some cases devices can be cycled out and replaced with updated devices with better security.

One of the more serious considerations with implanted devices is the extremely limited power supply often available to such devices. These devices operate on batteries that have a long life expectancy and implementing security on such devices can potentially diminish battery life, posing a serious risk to the patient when the therapy is no longer available.

Medical devices must be available to deliver required treatments and perform monitoring functions with urgency. It is important to understand that any security measures implemented must not interfere with availability, as the consequences of limited availability can have far greater impact than the security threats pose. External devices also share the need for availability above all else.

New technologies allow medical device manufacturers to perform thorough vulnerability tests on their systems and devices during the development stage. The best starting point is approaching security in a similar manner used to address industrial control system (ICS) security. These systems control functions such as chemical manufacturing processes, energy management, nuclear power plants and many other mission-critical infrastructures. Failures in such systems can lead to devastating results, and availability of these systems is absolutely paramount.

Securing ICS has been a global effort for nearly a decade, and many of the same principals can be applied to medical device space, since, after all, medical devices are indeed used to control critical functions. Most importantly, it is critical for medical device manufacturers to perform thorough assessments on their systems and devices to determine what vulnerabilities exist and if there is a risk to the patient. While device manufacturers are well-equipped to perform tests that can determine failure modes against functional requirements, commonly accomplished through failure mode effects analysis (FMEA), most cyber security-related failures are non-functional in nature and can be nearly infinite.

Engineering teams in medical device manufacturing organizations have traditionally focused on addressing functional requirements and have not dedicated resources for the purpose of addressing malicious misuse of devices. Even when engineering does take steps to determine malicious misuse cases, it can be quite challenging to prioritize what threats need to be addressed.

**A New Generation**

Some health care organizations/vendors have stepped up their security initiatives dramatically. Others are reacting to the emerging threats with less urgency, focusing chiefly on security as it pertains to HIPAA regulations. Regulatory bodies have stepped up their efforts to address medical device security issues, yet they are currently approaching regulation with caution, because of the unique considerations in approaching security for medical devices.

The industry is in the earliest stages of addressing medical device security today, and we are certainly going to see many changes over the next several years. Organizations have recently been created to specifically address medical device security. Most notably the Medical Device Safety and Security Consortium (MDISS) has garnered the support of several large health care provider organizations and device manufacturers and the US Department of Homeland Security Industrial Control Systems Joint Working Group (ICSJWG) has taken an interest in medical device security.

Nate Kube founded Wurldtech Security Technologies in 2006 and as the company’s chief technical officer is responsible for strategic alliances, technology and thought leadership. Nate is an internationally recognized subject matter expert in embedded device protection for high-availability process automation, medical and health care industries. Nate has created an extensive intellectual property portfolio including numerous patents in formal test methods and critical systems protection.
ADLQM67PC - Industry’s Only PC/104 2nd Gen Intel® Core™ Quad Platform!

The ADLQM67PC is a stackable PC/104-based form factor SBC utilizing second generation Intel® Core™ processors. This small, highly-rugged form factor is ideal for applications where ruggedness and processor performance are critical. It brings unparalleled performance to applications such as radar and sonar processing, image signal processing, tactical command and control, surveillance and reconnaissance, transportation and railway.

Features & Benefits

- Second generation Intel® Core™ processors in dual and quad core variants.
- Extended temperature -40C to +85C available.
- Broad portfolio of alternate PC/104 SBCs based on Intel® Atom™ processors Z510/Z530, D525 and N2600, Intel® Pentium® M, Intel® Core™ Duo, Intel® Core™ 2 Duo processors 2nd and 3rd generation Intel Core processors, and the Mobile Intel® GS45 Express chipset.
- Peripheral possibilities include: GSM, WLAN, WWAN, GPS, 3G cellular, storage drives, power supplies and many more functions including custom board services for specialty applications.
- Small stack footprints ranging from 95mm x 96mm for Intel Atom processors to 96mm x 115mm for Intel Core processors.
- Custom Enclosure Design Services Available!

ADL Embedded Solutions Inc.
ADLQM67PC - Industry’s Only PC/104 2nd Gen Intel® Core™ Quad Platform! .............................................. 44

AXIOMTEK
3rd Gen Mini-ITX Motherboard with Intel® Q77 Express Chipset – MANO872 .............................................. 45

Low-Power Intel® Atom™ Processor N2600/N2800-Based Pico-ITX SBC – PICO831 .............................................. 45

DFI-ITOX, LLC
EC800 Series Palm-Size Fanless Embedded System for In-Vehicle Application ................................................. 46

Emerson Network Power
ATCA-7370 Dual Intel® Processor-based Xeon® ATCA® server blade .......................................................... 46

ATCA-7470 Dual Intel® Processor-based Xeon® 40G ATCA® packet processing blade ........................................ 47

X-ES
Rugged COM Express® Module with 3rd Generation Intel® Core™ i7 Processor for Small Form Factor Systems .................................................. 47

iEi Technology USA Corp.
Introducing 3rd Generation Intel® Core™ i3/i5/i7 Processor and Low Power Dual Core Intel® Atom™ Processor-Based Solutions .................................. 48

ADL Embedded Solutions Inc.
858-490-0597 Telephone
sales@adl-usa.com
www.adl-usa.com
3rd Gen Mini-ITX Motherboard with Intel® Q77 Express Chipset – MANO872

The MANO872 Mini ITX motherboard is designed for the new 22nm 3rd Generation Intel® Core™ i7/i5/i3 processors in the LGA1155 socket with Intel® Q77 Express chipset. With features of Intel® Active Management Technology (Intel® AMT), Intel® Small Business Advantage solution, Intel® Smart Response Technology, and Intel® Rapid Storage Technology, the high-performance MANO872 delivers maximum security and manageability. This industrial-grade Mini ITX motherboard also supports 16 GB DDR3 1333/1600 system memory, PCI Express x16 Gen3, USB 3.0, SATA 6Gb/s with RAID, and Trusted Platform Module 1.2. With the new Intel® HD Graphics with DX11 support, the embedded board features powerful graphic processing and three independent displays using the DisplayPort, DVI-I, and LVDS connectors on board. This platform is ideal performance for high-end industrial applications, such as storage server, POS, kiosk, medical, gaming, digital signage, and surveillance security monitoring.

Features & Benefits
- LGA1155 socket 3rd Generation Intel® Core™ i7/i5/i3/ processor
- 2 x DDR3-1333/1600 MHz max up to 16 GB
- PCIe x16 Gen3 support
- 2 x SATA-600 with RAID 0,1, 5 and 10
- 2 x SATA-300 with 1 SATADOM supported
- 4 x USB 3.0
- Intel AMT 8.0 supported
- TPM 1.2 supported
- Triple view display

Low-Power Intel® Atom™ Processor N2600/N2800-Based Pico-ITX SBC – PICO831

The PICO831 extreme-compact Pico-ITX SBC is designed to support the newest ultra low-power, dual-core Intel® Atom™ processor N2800 1.86 GHz and N2600 1.6 GHz with the Intel® NM10 Express chipset. The PICO831’s compact size, ultra low power consumption, and high performance make it a perfect fit for space-limited and power saving environments. The system memory on PICO831 can support either 2 GB or 4 GB of DDR3, depending on the processor. Its onboard SATA-3Gb/s connector and optional SATA SSD meet storage requirements with ease. Considering to the various demands and networking requests, the tiny embedded board comes with full-size and half-size PCI Express Mini Card slots. It also provides internal connectors for VGA, 18/24-bit single channel LVDS and a Gigabit Ethernet, and a flexible I/O pin-header that integrates audio, four of USB 2.0, two of COM, LED, and power on/off interfaces. This Pico-ITX form factor board offers an excellent solution for in-vehicle PCs, medical imaging, gaming, in-flight entertainment systems, industrial automation systems, and the portable devices.

Features & Benefits
- Intel® Atom™ processor N2800 (1.8 GHz)/ N2600 (1.6 GHz) dual core onboard
- Intel® NM10 Express chipset
- 1 x DDR3 SO-DIMM supports up to 4 GB memory capacity
- 4 x USB 2.0 ports
- 2 x COM ports
DFI Introduces...

Palm-Size Fanless Embedded System for In-Vehicle Application

**EC800 Series**

- Powered by the energy-efficient Intel® Atom™ processor D2550, N2800 and N2600
- Fanless, cableless assembly provides exceptional reliability
- CFast and mSATA for maximum storage
- 1 SIM slot, 4 USB 2.0, 2 RS232/422/485 and isolated 4-bit DIO for device controls
- 9~36V via the optional smart battery pack
- Powerful video processing capability via the DVI-I interface
- Rechargeable smart battery pack (option) for continuous connectivity and safe operation
- Unique thermal and mechanical design supports operating temperature from 0~60°C with air flow

**DFI-ITOX, LLC**
8 Elkins Road, East Brunswick, NJ 08816 U.S.A.
Tel: (732) 390-2815
Toll free: (888) 200-4869
E-Mail: sales@dfi-itox.com
http://www.dfi-itox.com

---

**ATCA-7370 Dual Intel® Processor-based Xeon® ATCA® server blade**

The Emerson ATCA-7370 uses dual 8-core Intel® Xeon® processors E5-2600 in a blade design optimized for compute and thermal performance.

It delivers outstanding performance, using dual Intel® Xeon® processors E5-26xx “EP”, each with four dedicated memory controllers, and two high capacity processor interconnects. For memory and I/O intensive applications, this design provides 33% more memory bandwidth and twice the processor interconnect capacity of other competitive products. The addition of an optional Intel® Communications Chipset 89xx device provides additional offload performance for encryption and decryption using Intel® QuickAssist technology.

The PICMG® 3.1 compliant fabric interface provides 10 Gigabit Ethernet (10Gbps) capability for applications requiring higher network throughput in the backplane.

Main memory configuration and mass storage options can be flexibly configured providing a perfect fit to your applications needs. Hardware RAID 0 and 1 is supported for locally and externally connected disk drives.

Designed for NEBS and ETSI compliance, and with multiple network and storage I/O interfaces Emerson’s ATCA-7370 can be easily integrated into different 1G and 10G network infrastructures such as telecommunication central offices and network data centers. It is built for maximum compatibility with commercial off the shelf software and it supports the use of higher performance processors in temperature-managed environments.

---

Emerson Network Power
2900 South Diablo Way, Suite 190
Tempe, AZ 85282-3222 USA
+1 602 438 5720 Telephone
embeddedcomputingsales@emerson.com
Emerson.com/EmbeddedComputing
AtCA-7470 Dual Intel® Xeon® Processor-based 40G ATCA® packet processing blade

Emerson’s ATCA-7470 is a 40G ATCA® packet processing blade that enables the highest packet processing performance and security features. You can consolidate packet, application and control processing functions in a single blade architecture and benefit from lower development costs and the use of common tool suites. This can get you to market faster and enable you to balance workloads efficiently across available hardware resources.

Main memory and mass storage can be flexibly configured to provide a perfect fit to the needs of your application. Multiple available rear transition modules provide a flexible combination of storage and I/O, with options for high capacity redundant storage or up to 6x10G Ethernet interfaces.

Features & Benefits

- Two 8-core Intel® Xeon® processors E5-2648L, 1.8 GHz or E5-2658, 2.1 GHz
- Up to 128GB main memory
- Redundant 40G active/active ATCA Fabric interfaces, backward compatible with previous 10G systems
- Optional hardware off load module for encryption and compression acceleration with two Intel® Communications Chipsets 8920 devices
- Multiple 1 and 10Gbps network and storage I/O connectivity options

Rugged COM Express® Module with 3rd Generation Intel® Core™ i7 Processor for Small Form Factor Systems

The XPedite7450 is a rugged COM Express® module that complies with the PICMG COM Express Basic form factor (95 mm x 125 mm) and supports an enhanced Type 6 pinout. It is available with the quad-core Intel® Core™ i7-3612QE processor or dual-core Intel® Core™ i7-2655LE, i7-2610UE, i7-3555LE, or i7-3517UE processor. The XPedite7450 features up to 16 GB of DDR3-1333/DRR3-1600 ECC SDRAM, an integrated high-performance 3D graphics controller, five Gen2 PCI Express ports, four USB 2.0 high-speed ports, six SATA 3.0 Gb/s ports, and an Intel® High Definition Audio port. BSPs for Linux, INTEGRITY, and VxWorks are available, as well as Windows drivers.

Features & Benefits

- Supports conduction-cooled and air-cooled applications with a single board design
- Utilizes tin-lead manufacturing process to mitigate tin whisker effects (RoHS-compliant process is also available)
- Provides BIT support

Rugged CoM Express® Module with 3rd Generation intel® Core™ i7 Processor for Small Form Factor Systems

Extreme Engineering Solutions
3225 Deming Way Suite 120
Middleton, Wisconsin 53562, USA
608-833-1155
608-827-8171
sales@xes-inc.com
www.xes-inc.com

Embedded Intel® Solutions — Spring 2013 | 47
Introducing 3rd Generation Intel® Core™ i3/i5/i7 Processor and Low Power Dual Core Intel® Atom™ Processor-Based Solutions

The #1 Industrial PC Manufacturer leads the embedded market into high-performance level

IEI Technology USA Corp. is a leading industrial computing service provider integrating computing platforms and customization services. IEI supplies hundreds of Intel® processor-based industrial computer boards, systems and peripherals in thousands of customer applications, and supports OEM/ODM services to reduce customers’ engineering effort and accelerate the product development process to help customers get ahead of the market competition. IEI has an innovative R&D team, intelligent management system, high quality assurance and over 1400 products providing customers with the fastest time-to-market services all over the world.

### Features

**Hardware:**
- Wide temperature (-30°C - 70°C)
- Water resistant
- Flexible expansion
- Compact ruggedize design
- Wide voltage system
- Redundant power input
- Module design
- USB 3.0

**Software:**
- Complete embedded OS support
- Intel® Active Management Technology 7.0/8.0 support
- Auto recovery
- Intelligent system management module
- Smart fan

---

IEI Technology USA Corp.
138 University Parkway
Pomona, CA 91768
United States
Telephone 909-595-2819
Fax 909-595-2816
sales@usa.ieiworld.com
www.ieiworld.com
FREE ADMISSIONS! Sign up by April 30th

8th ANNUAL
MULTICORE DEVELOPERS CONFERENCE
May 21-22, 2013
Hyatt Regency Santa Clara, CA

Multicore Use in Application Specific Topics
- Android
- Automotive
- Cloud computing
- Networking and LTE equipment
- Mil/aero
- Real-time and safety considerations
- Security
- Smart phones, and more

Evolutionary Topics
- Manycore
- GPGPU
- Futuristic development and optimization tools, etc.

Business Topics
- Predictions
- Trends, etc.

General Multicore Topics
- Debug
- Software frameworks
- Parallel programming
- Protocols
- Optimizations, and more
- Choosing application-specific acceleration or multicore technology
- Interconnect technology for scaling from 4, 8, or 16, to 100s of cores

Register at www.multicoredevcon.com

Platinum Sponsors:
Gold Sponsors:
Silver Sponsors:

Industry Sponsors:
High End COM Express® Type 6

Does beating your competition to market matter? We think so!

Get your product to market quicker with congatec’s conga-TS77.
congatec...we are Computer-On-Modules.

conga-TS77

- 3rd Generation Intel® Core™ processor-based platform
- COM Express® Type 6 Module with PCI Express®, SATA, USB, 3x HDMI / DisplayPort
- Improved Graphics Performance, DirectX® 11

Find more details at:

www.congatec.us

congatec inc. | 6262 Ferris Square San Diego | CA 92121 USA | Phone: 858-457-2600 | sales-us@congatec.com

© 2012 congatec AG. All rights reserved.
conga and congatec are registered trademarks of congatec AG. Intel, Intel Core are trademarks of Intel Corporation in the US and other countries. COM Express is a registered trademark of PICMG.