RapidIO® Connections Q2 2006

In This Issue:

RapidIO® Hardware Everywhere!

By Tom Cox, Executive Director, RapidIO Trade Association

Everywhere I travel I see RapidIO hardware! It's like the experience you have when you get a new car – you start to see the exact same model and color on every street and in every city. Is it simply the trappings of the job or could it really be so? Check for yourself. I challenge every one of you to take the test. Look around as I believe you too, will see an abundance of RapidIO hardware, systems and software proliferating the embedded marketplace.

Recently, I have been on the road traveling far and wide to semiconductor vendors, software developers, systems component manufactures and embedded equipment manufactures in the military and telecom industries. Labs are bustling with prototyping, testing and applications development of sometimes simple, but often complex systems using the RapidIO architecture. A common thread rings true; whether it's two chips exchanging data or a massively scalable military communications intelligence application with hundreds of processors and thousands of high-speed inputs, the RapidIO technology is solving the problem at hand. RapidIO components are in the labs and ready to do the job.

Tradeshows and technology conferences abound with hardware demonstrations of RapidIO components and infrastructure. As vendors wind up their marketing efforts, product presentations and educational tracks permeate the embedded systems landscape. Questions of 'What is RapidIO?' have been replaced with inquiries on complex implementation details for applications in medical imaging and triple play video communications. I can no longer name all the vendors and their plethora of products and have

succumbed to handing out lists of manufacturers and resources, too numerous to count on so few fingers and toes.

The media, print, electronic and now audio, rings out with stories of RapidIO products; my phone is a-buzz with requests for interviews and contributions of technical dissertations. It is no wonder as this entire activity can easily be traced down to a simple but important fact. RapidIO hardware is everywhere, and engineers are tuned in, turned on and innovating a generation of new and exciting hardware solutions to a broad range of problems.

RapidIO is an established, scalable, open-standard, switched fabric, designed by the leaders in embedded computing specifically for OEMs building equipment in the wireless infrastructure, edge networking, storage, scientific, military and industrial markets. RapidIO delivers the reliability, cost effectiveness, performance and scalability required in these markets. RapidIO also supports a roadmap which is attuned to the changes affecting designers of embedded infrastructure.

As the Executive Director of the RapidIO Trade Association I challenge you to look, touch and take the test – you, too, will see that RapidIO is Everywhere!

RapidIO Radio Hailed A Success; June Program To Feature Tundra Semiconductor on Interoperability

RapidIO Radio successfully debuted in March 2006 with a poignant message from Executive Director Tom Cox. The next podcast will feature Tom Wilson of Tundra Semiconductor, the company that recently announced the formation of the RIOLAB, an independent RapidIO Interoperability Test Facility. Mr. Wilson will speak on the critical issue of interoperability and adherence to standard specifications.

Additional podcasts are scheduled for September and December 2006 with IDT focusing on the benefits of Serial RapidIO in the wireless infrastructure in September and Wind River focusing on software considerations in December. To hear Tom Cox's presentation, visit http://www.RapidIO.org and click on the RapidIO Radio button at the top of the screen.

Industry Insights

RapidIO's Bus Architecture Complements ATCA's Platform Development

By Ernie Bergstrom, Vice President Research And Chief Analyst, Crystal Cube Consulting

The combination of Advanced Telecommunications Computing Architecture (ATCA) and RapidIO's serial I/O high-speed bus architecture can make telecommunications networks faster and more robust. The efforts of groups such as the PCI Industrial Computer Manufacturers Group (PICMG), and RapidIO Trade Association, as well as the other high-speed architectures under development, complement the ATCA open standard that specifies

high-speed backplanes and chassis. RapidIO's deployment strategy for 2006 includes focusing on supporting ATCA's high-speed backplane, which offers better middleware, management-ware, and host-based options, making it easier to build feature-rich, scalable, high-availability converged communications applications.

At the application level, the industry, driven by customer demand, has focused recently on simplifying open systems development. The idea has been to provide backplanes, as in the case with the RapidIO interconnect, as well as, chassis, housings, resource components, middleware, and management systems that interoperate in standard ways, and offer high performance at reasonable cost.

The telecommunications industry is moving toward an environment in which application and design engineers can confidently assemble platforms from off-the-shelf hardware and software solutions. Such key ingredients as density, bus types, DSP and CPU horsepower, and operating systems, will all be governed by well-established standards. To date RapidIO has taken the lead in developing a high-speed bus standard solution shipping in products operating well above the Ethernet 1GigE bus offering and certainly way ahead of any 10GigE standard. Additionally, standardization for power and cooling, form factor, connector types, cable routing, maintainability, availability, and security will be essential. The Telecommunications Equipment Manufacturers (TEMs) need to know that customers can simply pick and choose the platforms they need with high-speed standards available and on board.

ATCA will be a major driver, along with RapidIO's serial I/O standard high-speed bus architecture, in helping the telecom sector in fueling future growth for the entire supply chain. ATCA is an ambitious effort, but the move to standards fulfills an obvious need. As the PICMG 3.X specifications progresses toward standardizing a hardware platform and interconnects, OEMs will embrace starting new designs due to the direct savings in their development cycles. Standards-based technology plays an essential role, enabling equipment manufacturers to realize substantial cost savings – and service providers to benefit directly from those savings.

A next-generation, high-bandwidth, low-latency local interconnect standard is without question a definite necessity. Each competing standard will stand or fall based on its own merits in its target applications or market segments. The high-speed bus standards will be evaluated individually in terms of cost, support infrastructure, performance, scalability, ease of use, time to market, and capabilities. Crystal Cube Consulting (CCC) has been researching the high-speed bus architecture standards since 2003, and projected then that RapidIO would lead the charge in the embedded space, which has proven to be the case.

CCC offers several reports on AdvancedTCA, Advanced Mezzanine Cards (AMC), and MicroTCA. Our reports include profiles of the major TEMs, chip providers, and module suppliers, and a five-year forecast of growth and unit shipments for the major application areas. We are very encouraged by the new open-system standards and see the opportunity for a $14

billion market for AMC's and a 40 billion dollar market for ATCA by year-end 2010. For more details, please visit our site at www.crystalcubeconsulting.com.

Deployment of RapidIO in the Merchant Embedded Computing Market

By Steve Berry, Principal Analyst, Electronic Trend Publications

Unlike most competing standards, the RapidIO standard was designed with its primary mission being the support of board- and box-level embedded applications. Such applications are the primary market for RapidIO technology's original creators—Motorola Semiconductor (now Freescale) and Mercury Computer Systems.

Compared to the PC market, the embedded market moves at a glacial pace. PCI Express—which was developed several years after the RapidIO standard—will be deployed in all PCs by the end of 2007. RapidIO, by contrast, exists in only a handful of applications to date. But based on discussions with numerous vendors at the Bus & Board Conference in January 2006, there is considerable enthusiasm for the long-term future of RapidIO technology and products.

Product announcements with RapidIO technology as a central feature are gaining momentum within the group of merchant board vendors that will likely provide many of the RapidIO-based products. A quick review of some of the latest board-level product announcements from this group of vendors finds the following:

Mercury Computer Systems, Inc.—a provider of high-performance embedded, real-time digital signal and image processing solutions—recently announced an expanded PowerStream integrated multi-computer family with the PowerStream 6100, the industry's first 6U VME system based on the Serial RapidIO interconnect fabric and compliant with the VXS (VITA 41.2) form factor standard. At 761 GFLOPS and 42 Gbps sustained fabric throughput, the PowerStream 6100 sets a new record for performance available in the VME form factor.

Mercury and Texas Instruments recently announced collaboration on the development of the Mercury MTI-203 AMC (Advanced Mezzanine Card) for WiMAX wireless infrastructure digital base band applications. The Mercury MTI-203 will be anchored with three TCI6482 DSPs and a supporting compute node to create a WiMAX infrastructure base band solution. The MTI-203 DSP/FPGA AMC expands the capabilities of the Mercury Ensemble2 family of blades and AMC modules. The Ensemble2 AdvancedTCA platform is specifically designed around the performance, scalability, and reliability of the Serial RapidIO embedded system interconnect for data plane applications.

BittWare, Inc.—a provider of hybrid (DSP and FPGA) board-level solutions based on Analog Devices' SHARC and Altera's FPGA technology—recently announced that it has teamed up with Mercury Computer Systems to utilize Mercury's Serial RapidIO endpoint on Bittware's B2-AMC (B2AM) board. The B2AM combines Analog Devices TigerSHARC with

Altera's Stratix II. This quad ADSP-TS201 AMC board supports universal base band processing for any wireless application including WiMAX, Software Defined Radio, and Super 3G.

Curtiss-Wright Controls Embedded Computing (CWCEC)—a supplier of embedded boards and integrated electronics subsystems for diverse markets and applications, including defense and aerospace, medical imaging, and industrial process control—recently announced the CHAMP-AV6, a VITA 46 (VPX)-based DSP engine. The CHAMP-AV6 combines quad PowerPC 8641 devices with four Serial RapidIO ports to provide 10 Gbps full duplex bandwidth.

Micro Memory, LLC, is a provider of high performance board-level products for streaming signal and image processing, real time data acquisition, and enterprise network storage. For signal processing systems and real time data acquisition, Micro Memory's Othello line of VMEbus carriers have optional connectivity to switch fabrics such as Serial RapidIO.

Thales Computers supplies military and aerospace companies and government programs with COTS-based VMEbus and CompactPCI system solutions. Thales recently introduced a Serial RapidIO system into the embedded computing marketplace, the PowerMP4-60. This system consists of combined PowerPC and Pentium technology. Its RapidIO high-performance, packet-switched interconnect technology addresses the embedded industry's need for reliability, increased bandwidth, and faster bus speeds in an intrasystem interconnect. Thales also recently introduced the PMC-RIO, which complements Thales' standard PMCs by offering a Serial RapidIO crossbar solution. This PMC provides an efficient and off-the-shelf way to interconnect computing nodes inside a signal processing calculator.

In the coming years, we can expect a steady stream of announcements involving RapidIO products from the merchant embedded computing community. These announcements will be followed by steadily increasing shipments of RapidIO-based products.

For the latest information on the RapidIO standard, members, and products, visit http://www.RapidIO.org.

Technical Insights

OpenSystems Publishing Taps RapidIO Trade Association Members For Series Of Technical Articles

OpenSystems Publishing, whose mission is to promote the development and use of open standards and new technologies in the embedded computing industry, has tapped the RapidIO Trade Association and its members to create a series of RapidIO-based technical articles for four of its publications. Articles will appear in *Embedded Computing Design, Military Embedded Systems, DSP-FPGA.com,* and *CompactPCI and AdvancedTCA Systems* throughout 2006 and will address a wide range of design and application topics.

- *CompactPCI and AdvancedTCA Systems* will feature a two-part article called "Fabric Technologies For ATCA - No "King" In An Agnostic World" by Partha Datta Ray of GDA Technologies; "RapidIO, a High Performance Solution for IP Multimedia Services" by Peter Yan of Erlang Technologies, and "Protocol Testing Needs Of The RapidIO Standard" by Barbara Aichinger of FuturePlus Systems.
- *Embedded Computing Design* will publish "PowerPC, RapidIO and Wireless Communications" by Victor Menace of AMCC, as well as a "State of RapidIO" special issue that will include perspectives from the RapidIO Trade Association and many of its members.
- Tracy Richardson of Mercury Computer Systems will contribute piece on the "Value of RapidIO Cores and SOCs" and Bill Beane of IDT will pen "Complementary Solutions for FPGAs and DSPs in Wireless Infrastructure," both for DSP-FPGA.com.
- *Military Embedded Systems* will run "Probing for Standard Logic Analyzers" by Barbara Aichinger of FuturePlus Systems along with "VPX-REDI in Radar Applications" by Eran Cohen Strod of Mercury Computer Systems.

Check the publications, this newsletter and www.RapidIO.org for more information and links as the pieces are published.

The February issue of *VMEbus Systems* another OpenSystems Publishing magazine included an article by Eran Cohen Strod of Mercury Computer Systems entitled, "RapidIO Fabric Unifies VITA And PICMG Platform Architectures." To read the complete article, visit: http://www.vmebus-systems.com/articles/search/fm/.

Design Tips

Plan Ahead for Serial RapidIO Validation

By Barbara Aichinger, Vice President, FuturePlus Systems

Serial-interface designers are facing higher speeds and denser designs. With these challenges come the complexity of design validation and test. Serial RapidIO designers need to look no further than their favorite logic analyzer vendor for a solution to these problems. Engineers have relied for decades on logic analyzers as an integral part of their validation and debug strategy. Today is no different. For the tried and true logic analyzer to interface to the new multi-gigabit (Gbps) architectures analysis probes are essential. Analysis probes translate high-speed serial interfaces into signals that can be understood by the traditional logic analyzer. Such products come complete with software that runs on the logic analyzer to give the user a complete decode of the bus traffic. There is no need to look at cryptic hex or binary characters.

Analysis can be done from a high level graphical view or from a detailed text view (see Figure 1).

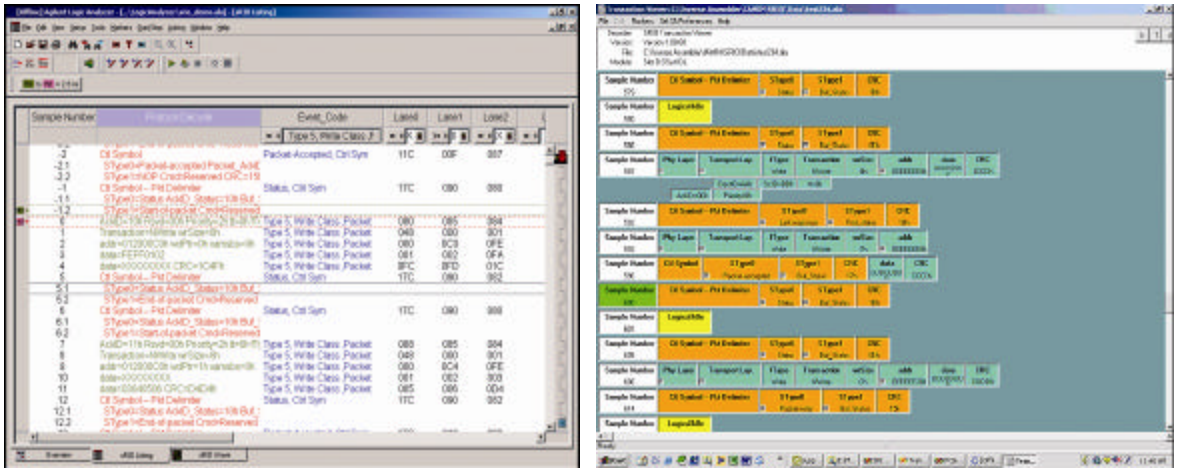

Figure 1. Detailed text and high level graphical view of Serial RapidIO data. (Photos courtesy of FuturePlus Systems)

How to connect

Up front planning is required to connect the Analysis probe to the Serial RapidIO target. Connectorless probing was adopted in order to non-intrusively probe 1.25 Gb ps to 3.125 Gb ps speeds. The footprints, or pads that are incorporated onto the PCB are standardized so that multiple vendors' test equipment can attach to them. This is a win for the industry, since engineers can design in one footprint at design time, and then pick the test equipment vendor when they are ready to test. In the past the footprints were different between the vendors, so the design engineer had to make a commitment to a test vendor during design time. If that vendor delivered late or ended up not having the best equipment, the project team was in trouble.

Figure 2: Connectorless footprint and compression probe. (Photo courtesy of Agilent Technologies)

For Serial RapidIO the industry is using the same connectorless footprint that was used for the PCI Express industry. This allows design reuse and opens up the test equipment field to new players. This new style of connectorless probing includes a compression interconnect from the analysis probe to the target. The fact that there is no connector lowers the electrical loading of the analysis probe on the target. This leads to higher signal fidelity for the analysis probe and less electrical loading on the target. Figure 2 shows an example of a connectorless footprint and a compression probe.

Since Serial RapidIO is a single lane or a four-lane, bidirectional link, all signals can fit on what is commonly referred to as the half sized footprint. Complete details concerning the size of the footprint and pinout for Serial RapidIO can be found on the FuturePlus Systems web site at: http://www.futureplus.com/download/appnotes/an_srio_fs4410.pdf

No room for a footprint?

Even though the Serial RapidIO footprint is small there may not be enough room on some smaller and more densely packed designs for this footprint. Due to this constraint vendors have made a flying lead set available that is small and flexible. Figure 3 shows this flying lead set.

Designing Gbps links into today's products need not compromise testing. Information and tools are available to help design engineers tackle the most difficult test scenarios. Planning ahead for validation and debug is the key to successful product introduction.

About the Author:

Barbara P. Aichinger is Vice President of FuturePlus Systems, the leading worldwide analysis probe provider. She has over 20 years experience with various bus architectures and has spoken on Test and Measurement topics world wide. Barbara can be reached at Barb.Aichinger@futureplus.com. FuturePlus Systems product line can be seen at www.futureplus.com.

Figure 3: Flying lead set for high performance probing. (Photo courtesy of Agilent Technologies)

Design Tip For RapidIO Product Development- Addressing Electromechanical Implementation Challenges

By Robert Applebaum, President, Silicon Turnkey Express

Mechanical complexity is pervasive today in high-speed interconnects required careful and often meticulous design. Serial RapidIO uses several variants of a standard compression connector available in permutations of 85 pins (170 and 340), which supports speeds of up to 12.5 Gbps.

In manufacturing Serial RapidIO carrier and switch cards, Silicon Turnkey Express (STx) uses Yamaichi Electronics' connector series CN074-170-0005. In doing so, caution must be taken when installing the connectors on a board as they make contact through compression force versus a "soldered connection." The proper torque (30-40 cN - M) must be applied to the

mounting screws to ensure that proper contact is made. The mounting screws can only be tightened and loosened a maximum of three times; otherwise the spring force of the contacts is compromised. The connector insulators on the secondary side of the board must be installed properly to prevent shorting of the connector. No passive components can be placed under the insulator. Finally, the connectors are only rated for a maximum of 200 insertions and extractions; therefore they must be replaced if the limits are exceeded. One example of board that uses these connectors is the STx SSRP, which is currently used by the RIOLAB™ for interoperability testing between vendors.

Parallel RapidIO uses a "HIP" or Tyco HM-ZD connector such as the AMP_1469002-1. A special press fit tooling from Tyco must be used and adapted by the OEM into a custom fixture than can apply at least one ton of force. Care must be taken to align the connector onto the board, prior to press fitting, and uniform constant pressure must be applied or the connector will be destroyed. An example of a product that uses this connector is the STx GP3 PowerPC processor board, which is part of the Tundra Semiconductor HIP development system.

AMC card mechanical support is required in carrier and switch cards so that the insertion of the AMC cards does not destroy their hosts. Customized top and bottom covers, guiderails, and backstops need to be modified (i.e. sheared / drilled out) to allow for proper clearance and installation to meet AMC standards specification. Guide pins such as Tyco's 223985-5 must be ordered in the proper size to ensure the screws do not "bottom" before they attach the guide posts, which can cause damage. Finally, proper standoffs are required to make sure the PCB is not in contact with any surface, in order to prevent shorting. STx's SRDP and SSRP cards provide both the lateral and longitudinal reinforcement to safely allow AMC cards to be inserted by a novice user without the possibility of damage.

Printed circuit boards for Serial RapidIO must be unusually thick to provide sufficient mechanical rigidity. The thickness of the PCB should be a minimum of .093 to minimize flex of the board and ensure full contact of Yamaichi connectors. The STx SRDP board, which is a reference system for the Tundra Semiconductor's Tsi568a switch, meets these requirements.

AMC cards (the blades) for both ATCA and microTCA systems, have special mechanical requirements of their own. Standard faceplates (half and full height) need to have specific cutouts added in order to provide access for serial, Ehternet and other IO. AMC standard ejection switches must be used and component height must be watched carefully per specificaion to ensure the AMC card doesn't bump into something inside the chassis. For EMI sensitive AMC cards, shields and RF gaskets need to be applied. The biggest AMC card challenge is thermal management; today's devices produce more current draw and heat than ever before. STx has developed specialized knowledge in thermal management for PICMIG standard systems to address the needs of leading edge semiconductor manufacturers.

These Serial RapidIO products and many others soon to be announced, are fully industry standard, PICMIG compliant, and commercially available from Silicon Tunrkey Express. For information, visit www. SiliconTKx.com.

Events

Executive Director Tom Cox staffs the RapidIO Trade Association booth at Embedded Systems Conference (ESC), "Interest and inquiries were high from engineers, designers, media and industry leaders," he said. ESC was held April 3 – 7 in Silicon Valley. The RapidIO Trade Association joined industry leaders as shared leading-edge technologies covering every aspect of design as through exhibits and in educational forums.

Meet up with RapidIO Trade Association members and see their products first hand at a range of industry events.

Freescale Technology Forum - US	The RapidIO Trade Association will be an active participant in the forums, technology training, and demonstrations that are a hallmark of this annual event.	July 24-27, 2006 in Orlando, FL
ATCA	The RapidIO Trade Association will be hosting a number of technical and application sessions focusing on the RapidIO technology and standard.	Oct. 17-19, 2006 in Santa Clara, CA

In the News

During the last two months, The RapidIO® Trade Association, its members and their products continue to be sought after news in the industry. Following are some of the many places where the RapidIO Trade Association made headlines between March 2006 and April 2006.

- *CommsDesign.com*
- *CompactPCI and AdvancedTCA Systems*
- *Design News*
- *Embedded.com*
- *Houston Chronicle*
- *Light Reading*

- *Design News E-newsletter*
- *Design & Reuse* (Paris)
- *DSP-FPGA.com*
- *EDN*
- *Eg3*
- *EE Times*
- *EE Times Asia*
- *EE Times UK*
- *EE Times Online*
- *Electronic News*
- *Electronics Talk*
- *Electronique International*
- *Electronic Component News*
- *Embedded Computing Design*
- *Linley Group*
- *LinuxElectrons*
- *Nikkei Electronics Asia Online*
- *Network Systems Design Line*
- *RTC Magazine*
- *SOCcentral*
- *Test & Measurement World*
- *Test & Measurement World Online Webzine*
- *The 451 Group*
- *TMCnet*
- *VMEbus Systems*
- *Yahoo! News*
- *Yankee Group*

Visit these links to read a sampling of the articles that include RapidIO technology, its members and RapidIO-based products:

- *Design News:* Lab Tests Interoperability of RapidIO Chips, *http://www.designnews.com/article/CA6319233.html?text=rapidio*
- *EE Times*: FACE-OFF Cisco challenges interconnect industry, *http://www.eet.com/news/latest/showArticle.jhtml?articleID=184417475*
- *Light Reading:* RapidIO Interop Demo Staged,
- *http://www.lightreading.com/document.asp?doc_id=89867*
- *SOCcentral:* Xilinx Delivers High-Speed Interoperable Interfaces for Latest Texas Instruments DSPs, *http://www.soccentral.com/results.asp?EntryID=18176*

- *Test & Measurement World:* Move DSP signals with RapidIO, *http://www.reed-electronics.com/tmworld/article/CA6316465.html*

Connect and Contribute

RapidIO Connections welcomes your comments, ideas, questions and contributions.