

# RapidIO Connections Q1 2007

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## ***The Importance of Standards, More Important Than the Technology Itself?***

*By Tom Cox, Executive Director  
RapidIO Trade Association*



As I return from this year's Bus and Board show in Long Beach, Calif., I find myself reflecting on the keynote delivered by Daniel Hoste, CEO of Tundra. I'm reminded and inspired to recall an early paper written by Sam Fuller and myself, titled: "Anatomy of a Forward-looking Open Standard," published in 2002 in *IEEE Computer Magazine*. This paper was an early reflection of our thoughts on the RapidIO standard, the importance of open standards development, and the market benefits of RapidIO technology.

That paper stated, "The RapidIO interconnect specification represents the state of the art in standards development. This open specification resolves an essential design bottleneck while also creating a clear migration path for systems based on existing or legacy architectures. The process of bringing this specification to market demonstrates that contributing to a collaborative standards development effort can be beneficial to all the participants. Designing to the specification can reduce manufacturing costs and time to market while significantly increasing bandwidth."

In his keynote Mr. Hoste also hammered home a number of good points related to standards development and equally important, to the adoption of these standards:

*Widely adopted standards are a must to generate the volumes that are needed to deliver silicon with quality, reliability and cost targets...*

*Acceleration of standardization is more important than acceleration of technology...*

In his closing, Mr. Hoste delivered a clear call to action:

*We need to drive and contribute to standards definition and adoption...RapidIO has the right features, cost, and ecosystem for the critical embedded systems...It's time to make the right choice with RapidIO...*

These points speak loudly to the founding principals of the RapidIO Association, and point to the wide adoption that RapidIO clearly is generating in the market today, both in terms of design interest and products from leading vendors.

More thought provoking is the statement that standardization is more important than the acceleration of technology. As engineers, marketers and technology junkies, the mere thought of demoting the importance of technology over anything! is akin to treason and attacks our very souls. When it comes to technology we work, live and drive technology as fast as it can go; it's a duty and creed.

Still we are faced with the cost/benefit dilemma: while technology does not stand still, costs are driving a new reality. The NRE and production costs in time and money for chips, boards and systems continue to bring a focus to standardization over customization. This was true in the standardization and commoditization of the PC and in COTs and VME systems for military and now telecom equipment. It was PCI's standardization and wide adoption that delivered success as PCI was just one of a dozen "hot" technologies at the time. Compact PCI and VME, while not technology revolutions, focused on driving the economics and meeting the goals of critical embedded applications.

With the importance of standardization playing such a key role in our market, Daniel Hoste's call to action validates and amplifies the work of the RapidIO Trade Association. While the technical working groups continue to drive the definition of the standard, we all have a role to play in adoption by creating awareness of the far-reaching benefits of the RapidIO technology. The ecosystem for RapidIO at 1G, 2.5G and 3.125G is large and growing, and has the features and cost/benefit proposition that makes it the right choice for chip-to-chip, board and backplane solutions.

### **Extensive Product Announcements and OEM Designs Signal Continued Market Leadership for the RapidIO Standard in 2006**

Design wins, increasing market share, new products, and record attendance at RapidIO Trade Association events mark a banner year for the RapidIO standard. 2006 has been a significant year for designers integrating RapidIO technology into their high performance solutions for storage, wireless communications, military, industrial, triple play and other embedded markets, as products proliferate, the first RapidIO test facility is operational, and Global Design Summits aid in product development.

"2006 has truly been the year of RapidIO deployment from OEM design activity and product deployment, to interoperability and interworking, and, of course, market

share growth," said Tom Cox, executive director for the RapidIO Trade Association. "As we near 2007, it is clear that the powerful RapidIO ecosystem will continue to execute on its technology roadmap and drive applications in new and emerging embedded markets across the globe."

These milestones, combined with a re-affirmation of leading OEMs to the RapidIO standard along with a growing ecosystem, accentuated the continued market momentum for this established interconnect standard. The year's highlights included:

- Lockheed Martin confirms use of Mercury Computer Systems' PowerStream 7000 FCN for use with the Aegis Weapon System for the U.S. Navy (<http://www.rapidio.org/news/membernews/>)
- OEM Emerson Network Power implemented Tundra's Tsi568A Serial RapidIO Switch into the Fat Pipe switch module in its 12-slot MicroTCA development system.
- More than 20 new products encompassing development platforms, switches, processors, DSPs, protocol analyzers and FPGAs made their debut in 2006, rounding out the breadth and depth of RapidIO-based solutions needed to implement high-performance, cost-effective designs in embedded applications (<http://www.rapidio.org/kshowcase/view/>)
- 16 RapidIO ecosystem members including Agilent, Altera, CS Electronics, Embedded Planet, Fabric Embedded Tools, Freescale Semiconductor, FuturePlus Systems, IDT, Jennic, Mercury Computer Systems, PMC-Sierra, and Silicon Turnkey participate in live demonstration of high performance, commercially available RapidIO evaluation boards, software, and test tools ([http://www.rapidio.org/news/pr/view?item\\_key=a2e25c38c5e6faeb6dbecfd765930148329014dd](http://www.rapidio.org/news/pr/view?item_key=a2e25c38c5e6faeb6dbecfd765930148329014dd))
- RIOLAB, the world's first RapidIO interoperability lab commences interoperability testing for vendors and OEMs designing with RapidIO technology; offers DIL-3 testing ([www.rio-lab.com](http://www.rio-lab.com))
- Market leaders AMCC, EMC, Ericsson, Freescale Semiconductor, Lucent Technologies, Mercury Computer Systems, PMC-Sierra, Texas Instruments, Tundra Semiconductor, and Wind River endorse the RapidIO standard ([http://www.rapidio.org/news/pr/view?item\\_key=36b2b7209437c999c37b595d92f9477f37c5f7b8](http://www.rapidio.org/news/pr/view?item_key=36b2b7209437c999c37b595d92f9477f37c5f7b8))
- RapidIO Radio debuts offering in-depth technical insight on a range of topics to embedded design community via Podcasts (<http://www.rapidio.org/wp/>)
- RapidIO Trade Association offers a wide range of design support as global demand grows; Global Design Summits, webinars, and Podcasts attract record attendance (<http://www.rapidio.org/events/list/>)

- New members DFT Microsystems, Continuous Computing, ELVEES, RIOLAB, and Zarlink expand the breadth of eco-system
- The RapidIO Technical Working Group defines the next generation physical layer spec and sends it to ballot; backward and forward compatibility ensured

## **2007 RapidIO Radio Schedule Focuses on Designing with RapidIO; Features Insights from Embedded Industry Leaders**

*Freescale Semiconductor, IDT, Silicon Turnkey Express, Texas Instruments and Xilinx to address design considerations for RapidIO-based systems*

The RapidIO Trade Association announced an expanded schedule of its highly successful RapidIO Radio Podcast program for 2007, promising episodes that will spark discussion and provide valuable information for engineers faced with designing high performance embedded systems. All episodes will be available via [www.RapidIO.org](http://www.RapidIO.org) and iTunes.

"The response to our programs has been exceptional, with downloads doubling in the last quarter of 2006," said Tom Cox, executive director for the RapidIO Trade Association. "The popularity of these programs underscores the explosive traction RapidIO technology has among design engineers across markets as they evaluate technology and finalize design specs."

In 2007, six RapidIO Radio episodes will feature experts from Freescale Semiconductor, IDT, Silicon Turnkey Express, Texas Instruments and Xilinx.

- The 2007 debut episode, available now, previews a new white paper, System Interconnect Fabrics: Ethernet Versus RapidIO Technology, which concludes that for many embedded applications, RapidIO technology outperforms Ethernet. Author Greg Shippen, of Freescale Semiconductor joins RapidIO Trade Association Executive Director Tom Cox.
- Episode 2 in March focuses on a competitive comparison of Ethernet and RapidIO technologies and their applications. Greg Shippen, of Freescale Semiconductor joins RapidIO Trade Association Executive Director Tom Cox.
- Episode 3 in May will feature Xilinx discussing how to future-proof Serial RapidIO solutions through FPGA implementations: configurability, scalability and performance for all form factors.
- July, Episode 4, will introduce experts from Silicon Turnkey Express as they discuss, "Implementing RapidIO Solutions: system integration for ATCA, micro-TCA, and custom form-factor solutions."
- IDT will return in September for its second year to present a "Fabric-based Embedded Systems Designs are now a Reality."

- In November, Texas Instruments will focus on Serial RapidIO in baseband application for Pico, Micro and Macro BTS.

## Industry Insights

### **Foreward to *System Interconnect Fabrics: Ethernet Versus RapidIO Technology*, White Paper**

By Linley Gwennap, principal analyst of The Linley Group

“An important trend in the embedded industry is the move from proprietary solutions toward standard interconnects and mechanicals (e.g. ATCA, Ethernet, RapidIO). Traditionally, Ethernet is the incumbent interconnect technology for embedded systems, yet the existence of alternatives has been driven by the realization that some high-performance applications exceed the limits of this traditional protocol. The RapidIO standard, with growing switch, DSP and processor endpoint support, has been deployed in many applications and continues to gain widespread support. RapidIO is particularly popular in wireless infrastructure equipment, where DSP connectivity is critical. As Ethernet and RapidIO continue to evolve, a comprehensive review and comparison is needed to help designers evaluate and select the protocol that best suits their next-generation designs.

“This white paper, *System Interconnect Fabrics: Ethernet Versus RapidIO Technology*, is a comprehensive compilation of embedded interconnect information. It provides a high-level market perspective and delivers a detailed technical examination of these two technologies. The paper begins with a top-level description of market requirements for the logical, transport, and physical layers, then moves into a thorough discussion of each protocol. The author builds a foundation for comparison and discussion through an historical overview of both RapidIO and Ethernet. Understanding the origin of these two standards helps to clarify their current use in embedded applications. A hierarchical side-by-side comparison of the two technologies provides detailed technical data, starting with the logical layer, and then moving to the transport and physical layers. Within each comparison is a discussion of the various distinctions of the interconnects, highlighting significant differences.

“In addition to the protocol discussions, this paper examines practical considerations such as power usage, throughput and latency as well as economic factors related to silicon die size/cost, the volume of silicon shipped, and the size of the silicon and support ecosystems. The author makes the case for Ethernet to continue gaining strength in the WAN and Internet markets while RapidIO becomes the preferred choice for applications that demand higher levels of performance and quality of service (QoS). In closing, the author provides a list of value propositions that should be analyzed by system designers as they evaluate how each interconnect best meets specific application requirements.

*“System Interconnect Fabrics: Ethernet versus RapidIO Technology delivers a clear and complete analysis that engineers will find useful well into the future of these two successful technologies.”*

## **Technical Insights**

### **A Look To The Future: RapidIO Technical Working Group**

*By Travis Scheckel, Texas Instruments and Chair of the RapidIO Technical Working Group*

As Chair of the Technical Working Group, I'm excited to give you a preview of the soon to be released Rev 2.0 specification. The unique mix of RapidIO TWG members, including system OEMs, silicon and software providers, have invested a great deal of insight, time, and energy into the creation of this specification in order to build on RapidIO standard's current success and take it to the next level in interconnect technology. While maintaining backward compatibility, the new Rev 2.0 specification features significant enhancements concentrated in two major areas: a higher performance serial physical layer and a versatile, higher utilization data plane.

Performance has always been a cornerstone of RapidIO, and Rev 2.0 certainly delivers with abundance. In addition to wider port configuration options, we have introduced higher signaling rates up to 6.25Gbps per lane. The electrical signaling specifications are based on OIF compatible SerDes for optimal technology re-use. With these options, RapidIO is an outstanding choice for virtually all embedded system interconnect solutions, offering scalable bidirectional bandwidth from 2 Gbps to 160 Gbps. The new Rev 2.0 serial physical layer features include:

- Link width options are 1x, 2x, 4x, 8x and 16x
- Data rates of 1.25, 2.5, 3.125, 5.0 and 6.25 Gbaud
- Electrical specifications compatible with XAUI and OIF SerDes
- Support for virtual channels with independently managed buffer resources
- Scrambled and 8b/10b encoded data
- Support for DFE based receivers for greater channel options
- Supports StatEye channel compliance testing
- Auto detection mechanisms for system and link configuration

The new data plane enhancements offer carrier grade functionality and fabric performance. This is accomplished utilizing concepts such as class of service (COS) and Virtual Output Queuing (VoQ) to have finer control on packets, as well as, taking advantage of the newly defined physical layer VCs to achieve higher fabric utilization and guaranteed levels of performance among endpoint applications. RapidIO has introduced a new packet type and employed various levels of flow control and supported traffic management techniques. The new data streaming format supports

large PDU sizes, selectable MTU size, COS field designator, multicast operations, and can optionally support VC applications with allowable data loss. Added data plane support includes:

- Thousands of endpoint data streams with concurrent PDUs up to 64KB
- COS support with hundreds of traffic classes
- Encapsulation of any arbitrary protocol
- Endpoint arbitration of PDU Segmentation and Reassembly (SAR) contexts
- Endpoint management to throttle traffic flows between class/stream based queues
- VoQ support to greatly reduce head-of-line (HOL) blocking

With these enhancements, the RapidIO specification stands out as the interconnect that meets the needs of next generation communication and embedded systems.

## **Serial RapidIO Provides The Features And Performance Necessary To Optimize DSP Cluster Applications**

*By B. Keith Woodard, Product Manager, IDT*

[www.IDT.com](http://www.IDT.com)

Current distributed processing applications that implement digital signal processor (DSP) clusters, such as base stations in the wireless infrastructure market, are faced with the market dynamics for higher performance at the same time they are required to lower cost by their customers. These factors drive implementations that use a high-speed, flexible interconnect. RapidIO technology meets this requirement, currently providing single lane speeds up to 3.125Gbps, with four lane configurations available as needed. Additionally, RapidIO technology will provide a technology roadmap that supports 6 Gbps single lane performance in the near future. The flexibility and scalability of the RapidIO interconnect provides the designer with an opportunity to devise multiple product versions around the same basic platform, saving both development cost and critical time-to-market. In addition, it is important to realize that the robust Serial RapidIO feature set provides significant advantages to the designer further simplifying and improving the overall cost of the design.

Baseband processing in a base station utilizes both digital signal and chip rate processing clusters to perform distributed operations on voice samples arriving in from the antenna. It is crucial that the chosen interconnect provides high performance for the connectivity between the processing elements, and designing with Serial RapidIO in a switched-based architecture easily meets the needs. Serial RapidIO also provides significant additional benefits through its feature set to streamline the design and implementation process.

When using Serial RapidIO, control and data plane operations are merged into the same serial stream, eliminating the need for separate control bus structures by supporting the remote programming and booting of all Serial RapidIO devices within the system.

The RapidIO interconnect support of peer-to-peer system structures eliminates the need for complicated CPU implementations to manage the system and again simplify design implementation and management.

Superior memory management is provided by the RapidIO application specific transactions. These transactions, which include the message passing and mailbox operations that are implemented as part of the RapidIO specification, provide superior functionality enhancements compared to previous implementations that required multiple memories and involved memory management architectures. RapidIO provides commands such as N\_Write, N\_Write\_R, and S\_Write to provide this feature to the designer.

The enhanced interrupt handling features of RapidIO eliminate the need for separate management buses in DSP cluster designs, as devices can generate and respond to in-band interrupts. The doorbell option provides an in-band interrupt capability, and there is automatic interrupt generation in conjunction with Message passing functionality.

In summary, with the combination of high-performance, direct connectivity, and advanced features, Serial RapidIO provides the superior interconnect solution for DSP cluster designs both now and in the future.

## Events

Meet up with RapidIO Trade Association members and see their products first hand at a range of industry events. Dates subject to change, check <http://www.rapidio.org/events/list/> for current details and information.

## In the News

The RapidIO Trade Association, its members and their products continue to be sought after news in the industry.

- **Tundra Semiconductor Corporation**, the leader in System Interconnect, and **Fabric Embedded Tools Corporation** (FET), the leading provider of RapidIO software and tools, announced that FET has acquired the business and operations of RIOLAB™, the world's first RapidIO Interoperability testing facility.  
[www.rapidio.org/news/pr/view?item\\_key=07ea2f66e5ec8a2aa6d0f847ac1de5daa670ef97](http://www.rapidio.org/news/pr/view?item_key=07ea2f66e5ec8a2aa6d0f847ac1de5daa670ef97)

- RapidIO is the Right Serial Interconnect for Critical Embedded Systems said **Tundra Semiconductor Corporation** President and Chief Executive Officer, Daniel Hoste at the VMEbus International Trade Association's (VITA) annual Bus and Board Conference: "RapidIO is the right serial interconnect because the technology provides the optimal performance and reliability for next-generation critical embedded systems. When availability and performance are critical, RapidIO is the serial interconnect of choice for embedded systems."  
[www.rapidio.org/news/pr/view?item\\_key=2776469f5518e7137451c6b2a37d2bc5edff779e](http://www.rapidio.org/news/pr/view?item_key=2776469f5518e7137451c6b2a37d2bc5edff779e)
- **Curtiss-Wright Controls Embedded Computing** has introduced IPC 2.0, the latest version of its popular Inter-Processor Communications (IPC) software library for building high-performance multi-processor DSP VPX and VPX/REDI-based (VITA 46/VITA 48) platforms employing switched interconnect technology. IPC 2.0 is designed for use in demanding signal processing applications such as radar, sonar and signal intelligence. The new IPC 2.0, with its support for Serial RapidIO (SRIO), makes Curtiss-Wright's DSP communications library ideal for DSP applications designed with the latest high bandwidth, switched serial fabric-based VPX technology.  
[www.rapidio.org/news/pr/view?item\\_key=67e8336d998a8fe2e061aa0c6b74b4ce45434068](http://www.rapidio.org/news/pr/view?item_key=67e8336d998a8fe2e061aa0c6b74b4ce45434068)
- **Mercury Computer Systems, Inc.** (NASDAQ: MRCY) announced that **Applied Micro? Circuits Corporation** (NASDAQ: AMCC), a leader in network and embedded PowerPC® processing, optical transport and storage solutions, has licensed Mercury's Serial RapidIO Verification Intellectual Property (IP) and Serial RapidIO IP core products for its chip design and verification efforts.  
[www.rapidio.org/news/pr/view?item\\_key=584d17d7f1ed79e6e9f9661c2ad315a172cc6479](http://www.rapidio.org/news/pr/view?item_key=584d17d7f1ed79e6e9f9661c2ad315a172cc6479)

### **In the Spotlight:**

An abundance of articles focusing on designing with RapidIO technology have appeared in the past weeks. Below, we've included links to some of the best.

- *Electronic Design*, IP Networks and Emerging Video Apps Need Video Transcoding, <http://www.elecdesign.com/Articles/ArticleID/13656/13656.html>
- *VME Bus Systems*, Selecting a Serial Interconnect for Distributed Computing, <http://www.vmecritical.com/articles/id/?1949>
- *Electronic Design*, For Truth in Testing, Try an Independent Lab, <http://www.elecdesign.com/Articles/Index.cfm?AD=1&ArticleID=13802#>
- *Electronic Design*, Design Tip: Use Serial RapidIO to Increase I/O Bandwidth in DSP Applications, <http://www.elecdesign.com/Articles/ArticleID/13799/13799.html>

- *Electronic Design*, RapidIO Gives DSP “Farmers” Something to Crow About, <http://www.elecdesign.com/Articles/Index.cfm?AD=1&ArticleID=13876>
- *Military Embedded Systems*, Multi-function Radar Systems for the Deployed Warrior Using VPX-REDI and RapidIO, <http://www.mil-embedded.com/articles/id/?1985>
- *Electronic Design*, Design It Your Way with RapidIO, <http://www.elecdesign.com/Articles/ArticleID/13875/13875.html#>
- *Military Embedded Systems*, Using Your Existing Test and Measurement Platform to Perform Serial RapidIO Analysis, <http://www.mil-embedded.com/articles/id/?1984>
- *EE Times India*, Indian Designers Focusing on RapidIO, <http://www.eetimes.com/news/latest/showArticle.jhtml?articleID=196600913>
- *Network Systems DesignLine*, Unleash the power of modular base station design with Serial RapidIO, <http://www.wirelessnetdesignline.com/showArticle.jhtml;jsessionid=LZUPC5URJAFBEQSNDLRCKHSCJUNN2JVN?articleID=194300675>
- *Embedded.com*, Using RapidIO IP cores for faster interface design, <http://i.cmpnet.com/embedded/europe/esenov06/esenov06p18.pdf>
- *VMEbus Systems*, Selecting a serial interconnect for distributed computing, <http://www.vmecritical.com/articles/id/?1949>
- *CompactPCI & AdvancedTCA Systems*, Advanced traffic management aids converged IMS applications, [http://www.compactpci-systems.com/columns/Technology\\_Update/pdfs/2006,10.pdf](http://www.compactpci-systems.com/columns/Technology_Update/pdfs/2006,10.pdf)
- *EDN China*, <http://article.ednchina.com/TestMeasure/2007-02/20070215103411.htm/>

## Connect and Contribute

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

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