

Make the RapidIO[®] Connection

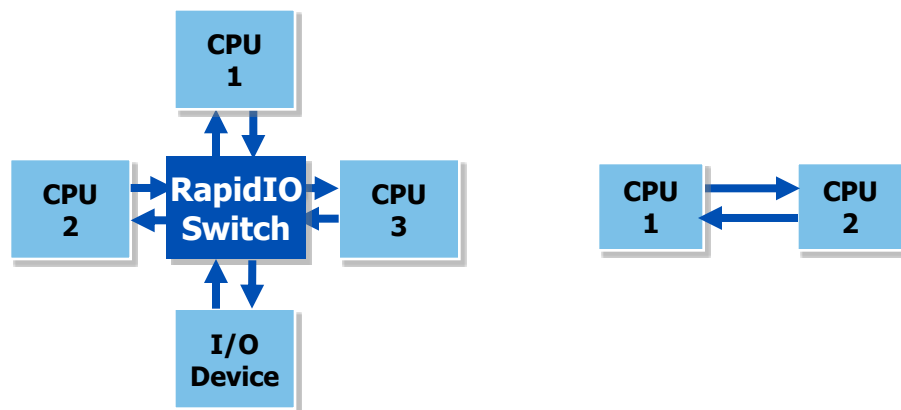
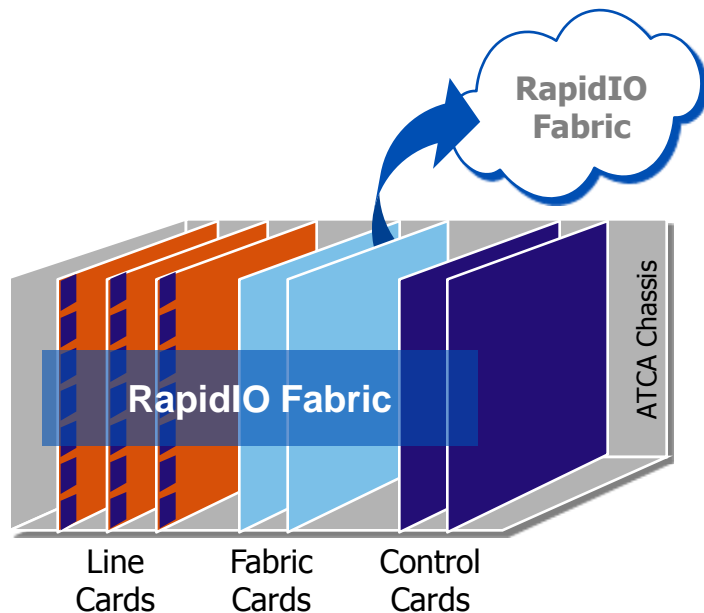
*RapidIO Global Design
Summit*



The Embedded Fabric Choice

What Is RapidIO Technology?

- Specifically designed to scale system connectivity: chip-to-chip, card-to-card, chassis-to-chassis
- Focused on embedded applications including those for control, data and signal plane
- The only internationally certified embedded interconnect standard (ISO/IEC 18372)
- Developed by the RapidIO Trade Association, a member-driven organization
- Available widely today in processors, FPGAs, systems, software, and test equipment



Where Does RapidIO Fit?



Interconnect Use

Characteristics

LAN/WAN		Ethernet	<i>IPv4/IPv6, 48-bit MAC Address</i>
Traffic-Managed Fabric		RapidIO	<i>Hundreds of classes, millions of flows, end-to-end flow control, interworking, scalable</i>
Switched Interconnect		ASI	<i>Message passing, architectural/topological independence, one flow, protocol tunneling</i>
Serial Local Bus	PCI Express		<i>Serialized Input/Output Transactions/DMA</i>
Parallel Local Bus	HT PCI-X		<i>Parallel Input/Output Transactions/DMA</i>



Basis for RapidIO Technology



- Need for an interoperable standard focused on the unique needs of the embedded infrastructure
- An organization focused on
 - infrastructure requirements
 - system level interconnect
 - appropriate framework
 - appropriate ecosystem



RapidIO Trade Association Organizational Structure



RapidIO Technology and Applications Roadmap



Legacy

RapidIO 1.0

Parallel -LVDS
Serial - XAUI

- Multi-processor
- DSP Cards
- CompactPCI
- ATCA, VME
- Military
- Medical
- 2.5 G Wireless
- Wimax Modem
- SDRadio

Today

RapidIO 1.2, 1.3, 2.0

Serial – XUAI, CES
1.25, 2.5, 3.125GBaud
5, 6.25GBaud
1X, 2X, 4X, 8X, 16X
Dataplane Extensions

- 10GBaud 4X backplanes
- DSP and Processor Farms
- Wireless 3G, WiMax and LTE Systems
- Video servers, IPTV, HDTV, Media Gateways
- microTCA, AMC, PMC
- VME, VXS, VPX systems
- Storage/ Server Systems
- RapidIO on Fibre

Growing into:
20GBaud 4X backplanes
25 to 100GBaud interconnects
Dataplane extensions- Flow control, VoQ

Future

RapidIO 3.0

Serial – CES
8, 10, 12GBaud
?

- 40GBaud+ Backplanes
- Multicore Processor Farms
- Wireless 5G, LTE2....

RapidIO Semiconductor Ecosystem



FPGA



Xilinx

Altera

Lattice

Processors



FSL MPC8543
1.0GHz Power
400MHz DDR2
Single PCIe + PCI-X
Single SRIO



FSL MPC8548
1.33GHz Power
667MHz DDR2
Single PCIe + PCI-X
Single SRIO



FSL MPC8572
Dual 1.5GHz Power
Dual 800MHz DDR2
Three PCIe
Single SRIO



FSL MPC8641/D
Dual 1.5GHz Power
Dual 600MHz DDR2
Dual PCIe
Single PCIe



RMI XLS416/616
1.2GHz MIPS64
2-4 DDR Controllers
PCIe
Serial RapidIO
Samples Q3 '08, Prod Q1'09



AMCC PPC460GT
1.2GHz Power
800MHz DDR
Dual PCIe
Single SRIO
Samples Q4'07

Bridges



Tundra Tsi620
Switch + RapidIO to PCI 64/66
4 ports 4x, 6 ports 1x
Samples Early '08



Mercury XSB FPGA
RapidIO to PCI Express
Single 4x RapidIO
Single x8 PCI Express



IDT 80HFC1000
RapidIO to CPRI
Single 1x/4x RapidIO
Three CPRI Links

DSP



Tundra Tsi578
Switch w/ Multicast
16 ports 1x or 8 ports 4x



Tundra Tsi564A/574
Switch
8 ports 1x or 4 ports 4x



Tundra Tsi568A
Switch
16 ports 1x or 8 ports 4x



Tundra Tsi576
Switch
12 ports 1x or 8 ports 1x
plus 2 ports 4x



IDT 80KSW0001
Switch + Pre-processing
16 ports 1x or 4 ports 4x



IDT 70K2000
Switch + Pre-processor
22 ports 1x or 10 ports 4x



IDT 80KSW0005
CPS 10Q Switch
16 ports 1x or 10 ports 4x



FSL MSC8144E
Quad 800MHz DSP
Single SRIO



TI TMS320C6455
DSP
4 ports 1x and 4x
1.25, 2.5 & 3.125 GB



TI TMS320TCI6482
DSP
4 ports 1x and 4x
1.25, 2.5 & 3.125 GB



IDT 80KSW0002
CPS Switch
16 ports 1x or 4 ports 4x



Mercury MC432
Switch
8 ports 4x



PMC-Sierra PM 6352
Switch
16 ports 1x or 4x

Memory



IDT 80KSB201
10Gbps serial buffer
18Mb QDR SRAM

RapidIO Silicon Product Pipeline



- **Serial RapidIO Switches**
 - 4 vendors with production switches
- **Processors and DSP's**
 - 6 vendors with 12 processors and 6 DSP's
 - 3 more Vendors coming soon!
- **Bridges/Adapters**
 - 3+ ASSP vendors (not including programmable devices)
- **Programmable Devices / Structured Arrays**
 - 5 Vendors: Altera, Lattice, LSI Logic, NEC, Xilinx
- **Silicon IP**
 - 9+ vendors have product now: LSI, TI, Cadence, GDA, Jennic, Rapid Prototypes, Mercury Computer Systems, HDL-DH, Tundra, etc.

RapidIO Development Systems

- **Mercury Computer Ensemble™ AdvancedTCA:**
 - Serial RapidIO over Advanced TCA mesh backplane
 - Carrier card using Tundra Tsi500 + 4 XMC slots
 - GDA Technologies PowerQUICC™ III XMC
 - Xilinx Virtex-II Pro RapidIO parallel to serial support
 - FET RapidFET GUI-based fabric management tool
 - Tundra Tsi500 RapidIO switch
- **Silicon Turnkey Express SRDP, GPIO & HIP:**
 - PowerQUICC III with Xilinx Virtex-II Pro
 - Tundra Tsi500 switch chip
 - Tundra SRDP
 - IDT Baseband AMC
- **Texas Instruments**
 - DSP C6455 EVM
- **Xilinx Advanced TCA Development Kit Board:**
 - Virtex-II Pro FPGA Backplane Controller
 - Proven interoperability with Mercury Ensemble
- **Altera High-Speed Development Kit:**
 - Stratix II and XMC Slot
- **Freescale Torridon™ AdvancedTCA Platform:**
 - ATCA carrier supporting PowerQUICC™ III XMC, Tundra Tsi500 RapidIO switch, Altera FPGA serial/parallel RapidIO

Dozen's more - Available Today!

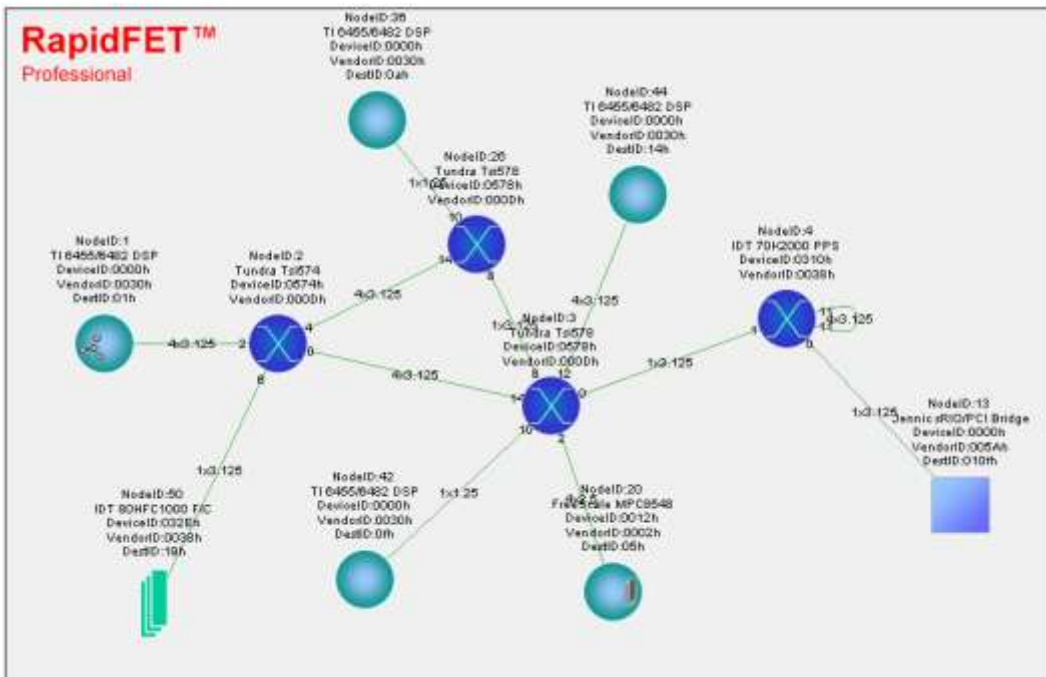


Sample

Prototyping with RapidIO

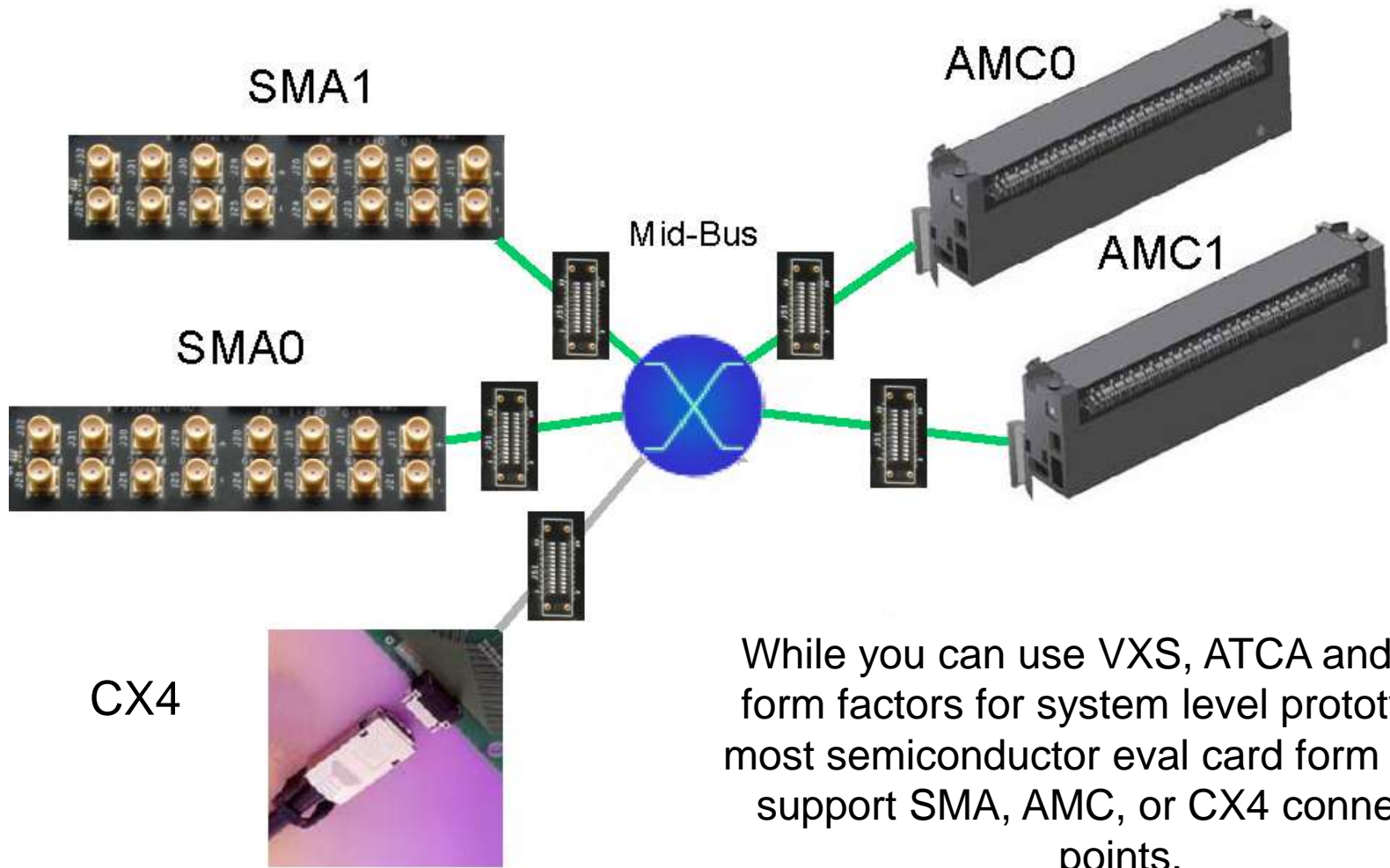


- An example of what a few ATX power supplies, SMA cables, CX4 cables, and evaluation boards can quickly produce in terms of a reasonable and cost effective prototype system



- 11 node system:
 - 4 DSPs,
 - 1 PPC Microprocessor,
 - 4 Switches,
 - 1 Bridge and,
 - 1 Memory

Eval card Form factors/Physical interconnects



While you can use VXS, ATCA and other form factors for system level prototyping, most semiconductor eval card form factors support SMA, AMC, or CX4 connection points.

RapidIO Trade Association Milestones



Mar 2007 **2.0 Specification released**

Oct 2006 **2.0 Specification Ballot**

Jun 2005 **1.3 Specification released**

Aug 2004 **Multicast & Data Streaming (Phase I) Specifications released**

Sep 2003 **Flow Control Extensions Specification released**

Jun 2002 **1.2 Specification released**

Nov 2001 **Serial PHY Specification released**

Mar 2001 **1.1 Specification released**

Jun 2000 **First RTA General Meeting, TWG formed**

Feb 2000 **RapidIO Trade Association (RTA) announced at ESC**

Fall 1999 **1.0 Specification released**

Aug 1998 **Motorola partners with Mercury Computer**

Jun 1997 **Motorola initiates work on a next generation interconnect**

RapidIO Technology Roadmap

Scalable Standard:

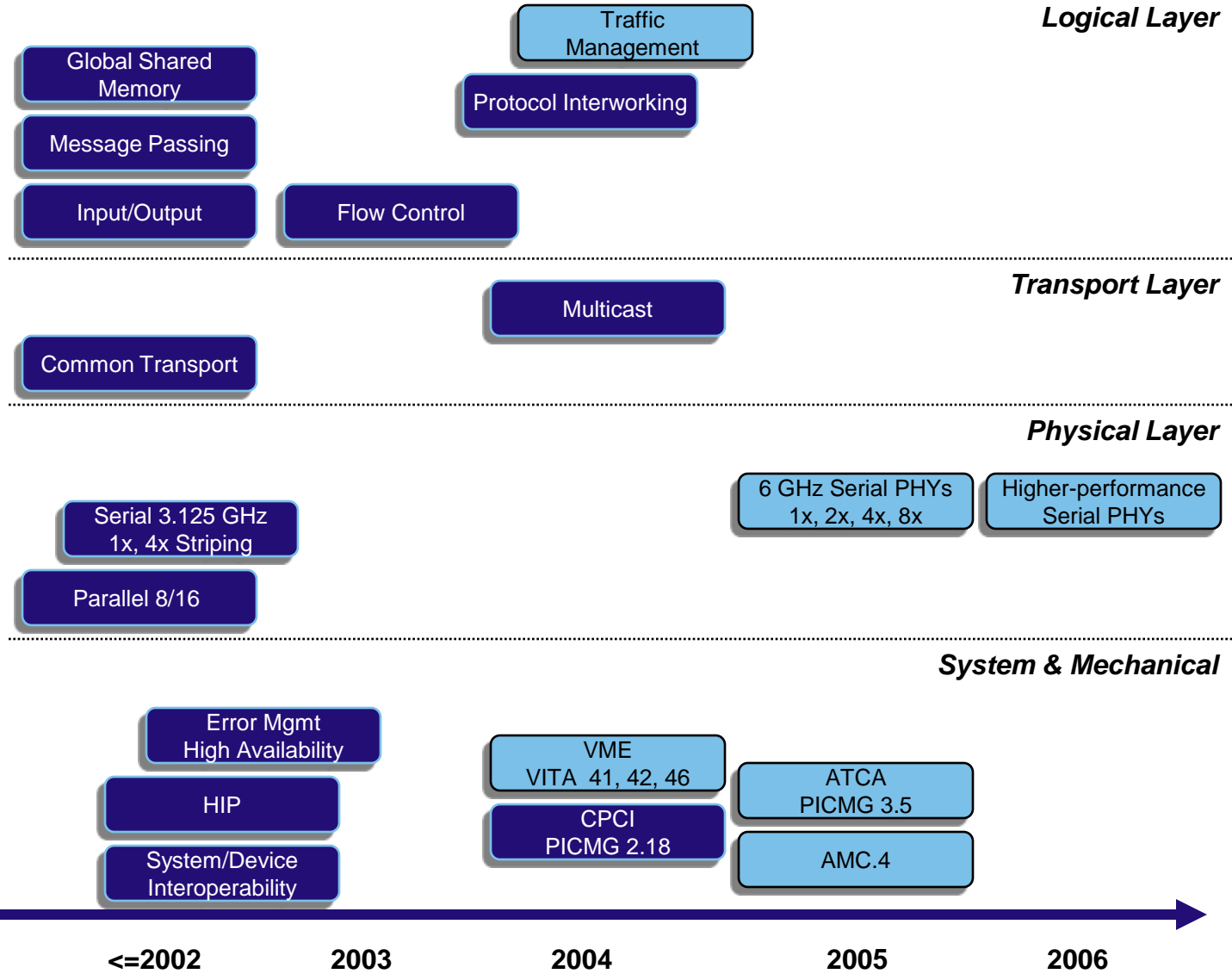
- Modular: Physical, Transport and Logical layers
- Common logical layer across physical interconnects
- Easy migration to higher performance physical interfaces
- Industry standards PHYs

True Embedded Connectivity:

- Data and control plane
- Real-time applications
- Distributed computing
- Mission critical systems

Broad Application Support:

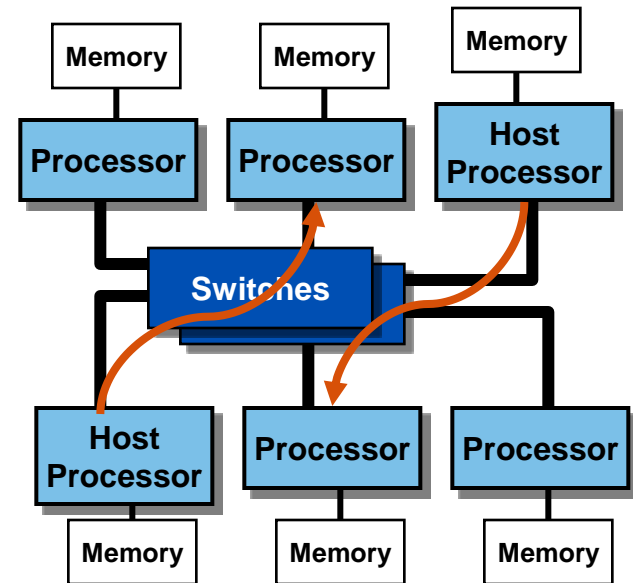
- Wireless infrastructure
- Broadband access
- Network access devices
- Multi-service platforms
- High-function routers
- Storage equipment
- Signal & image processing
- Military & aerospace
- Industrial computing
- Scientific computing



RapidIO Technology System Value



- Scalable, modular architecture
 - Layered architecture with common transport layer
 - Chip-to-chip, board-to-board, backplane
- High-speed connectivity
 - Physical layer defined for backplane interconnection
 - ~80-100 cm + 2 connectors (Serial)
 - Up to 10Gbps bandwidth today
- Robust feature set
 - Carrier-grade reliability
 - Traffic management
 - Multi-protocol/convergence



Serial RapidIO[®] Overview



Serial RapidIO is a high-performance, packet-switched, interconnect technology that addresses the embedded industry's need for:

RELIABILITY

INCREASED BANDWIDTH

FASTER BUS SPEEDS

Serial RapidIO allows chip-to-chip and board-to-board communications at performance levels scaling to ten Gbps and beyond



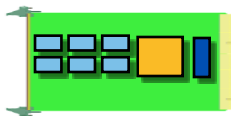
- C64x+™ Serial RapidIO Support – IEEE 1149.6 Compliant
 - 1.25, 2.5, 3.125 GBaud/sec per link (1.0, 2.0 and 2.5 GBits/sec w/ 8B/10B encoding)
 - Up to four 1x links (each 1x link is bidirectional) – **OR** –
 - One 4x link (bi-directional pipe), which provides up to 12.5 GBaud/sec raw
 - Up to 10Gbps for 4x link with 8B/10B encoding
 - Resulting data range 4 - 10 Gbits / sec in each direction (up to 1.25 GBytes/sec)
 - Supports DSP to DSP on the same board, DSP to Switch, etc.
- Layered architecture to minimize impact on software
- Non-proprietary multi-vendor support
- Flexible and scalable
- Reduces chip count, board area and system cost

AdvancedTCA[®] Platform

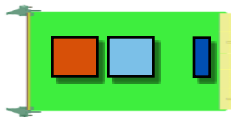
PICMG 3.5 RapidIO Standard

*AdvancedTCA
Mezzanine Cards*

RapidIO connecting
the DSP farm AMC
to the ATCA card

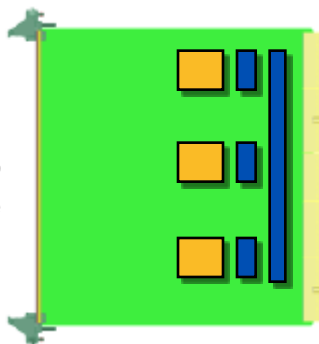


RapidIO connecting
the control AMC
to the ATCA card



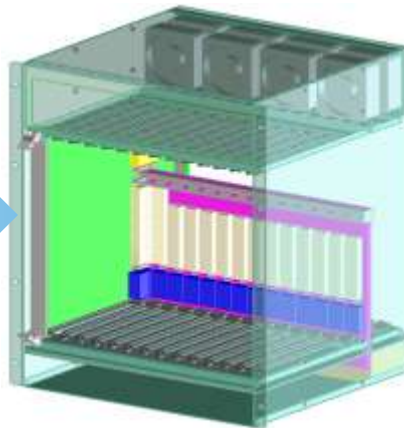
+

RapidIO switch card
connecting the AMCs to
the RapidIO backplane



*AdvancedTCA
Card*

*PICMG 3.0
ATCA Platform*



*Real-World
Deployment*



Standards-Based Solutions

E.G., AdvancedTCA[®] Platforms



- Leveraged for development and deployment in a wide range of application areas including routers, wireless infrastructure, soft switches, media gateways, optical transport systems
- RapidIO interconnect is the best option for chip, card and backplane connectivity in ATCA platforms
 - High-speed (up to 3.125Gbps/lane)
 - No software overhead
 - Hardware-based reliability
 - Built-in traffic management
- PICMG 3.5 RapidIO Standard

ATCA Fabric Requirements:

- Bandwidth
 - 10 Gbps per blade slot
 - 4 channels at 3.125 Gbaud using 8b/10b encoding = 10 Gbps
- Cost-effective switch silicon
 - Integrated SERDES (1600 mV maximum)
 - Large enough for a multi-chassis configuration
 - 20-24 ports (16 slots + fabric extension)
 - Around 300 Gbps switch throughput
- Fabric Characteristics
 - Congestion management
 - Quality of Service (QoS)
 - Low overhead, jitter
 - Error reporting
- Mesh, Star topology options

Edge Boxes and Other High-Availability Systems



- The interconnect is the backbone of a system's fault tolerance architecture
- RapidIO technology designed for 24/7 with hardware-based reliability:
 - Redundancy – supports all sparing schemes
 - Hot-swap support
 - Fault detection
 - CRC
 - 8B/10B encoding
 - Performance and reliability monitors to detect degradation
 - Fault isolation – physical layer handshaking
 - Fault containment – table-based routing algorithm

Wireless Infrastructure and Other Areas of Convergence



- Includes systems such as RNCs, mobile switching centers, and DSLAMs – where the increase and mix of voice, video and data continue to push compute density
- RapidIO technology provides high-speed, low latency, multi-protocol connectivity for:
 - DSP farms, processors, ASICs and FPGAs in peer-to-peer or master/slave configurations
 - Control and data backplane
 - Baseband to RF board
 - Chip to symbol rate processor

Storage Systems and Other Compute Intensive Environments



- RAID arrays and other mass storage devices serving as repositories for imaging on-demand, high-definition video streaming, news groups, clustering environments, financial applications and more
- RapidIO technology offers the throughput and reliability required for these applications

2009 RapidIO Systems Deployment!



- RapidIO dominates the new VME backplane systems.
- RapidIO gaining a strong footing in ATCA and microTCA systems.
- Applications in Video, Triple Play and Storage join the wireless infrastructure applications.