

Make the RapidIO®
Connection

*RapidIO Global Design
Summit*

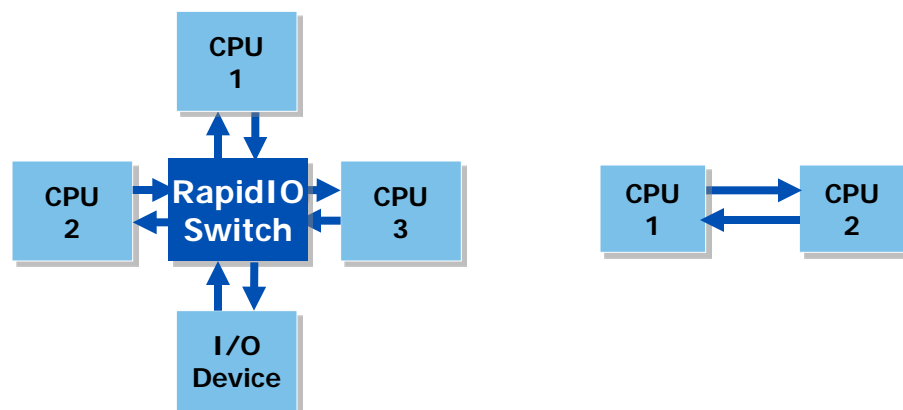
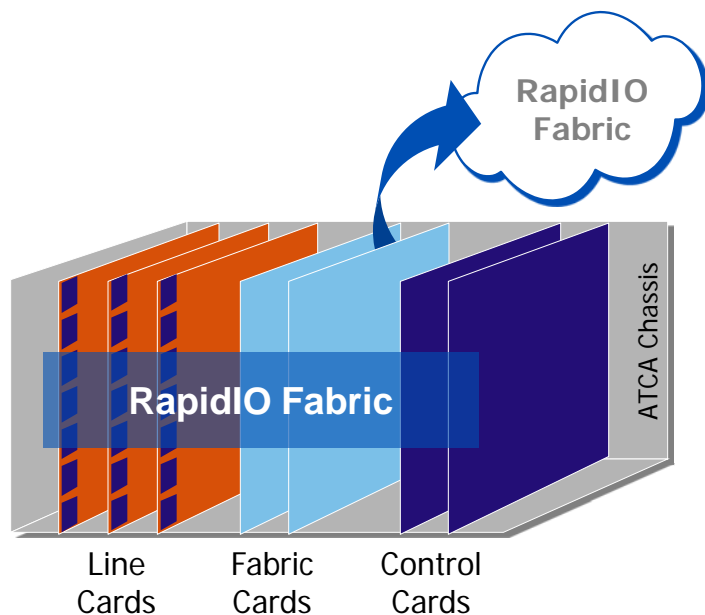


The Embedded Fabric Choice

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 Processor and DSP Ecosystem



Processors



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



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



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



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



AMCC PPC460GT
 1.2GHz Power
 800MHz DDR
 Dual PCIe
 Single SRIIO



Cavium Octeon II
 1.2GHz Multicore MIPS
 DDR2/3 Controllers
 PCIe
 Serial RapidIO



WinPath3
 1.2GHz PPC
 DDR Controllers
 PCIe
 Serial RapidIO

| | | | |
|-----------|-----------|-----------|---------------|
| AMCC | PPC460GT | RMI Corp. | XLS404 |
| | | | XLS408 |
| | | | XLS416 |
| | | | XLS608 |
| | | | XLS616 |
| Cavium | Octeon II | TI | TMS320C6455 |
| | | | TMS320TCI6482 |
| | | | TMS320C6457 |
| | | | TMS320TCI6484 |
| | | | TMS320TCI6486 |
| | | | TMS320C6474 |
| | | | TMS320TCI6487 |
| | | | TMS320TCI6488 |
| | | WinPath 3 | 'W' |
| Freescall | MPC8540 | | |
| | MPC8560 | | |
| | MPC8548 | | |
| | MPC8548E | | |
| | MPC8543 | | |
| | MPC8543E | | |
| | MPC8547E | | |
| | MPC8545 | | |
| | MPC8545E | | |
| | MSC8144 | | |
| | MPC8641D | | |
| | MPC8640D | | |

DSP's



FSL MSC8144E
 Quad 800MHz DSP
 Single SRIIO



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

RapidIO Switch and Bridge Ecosystem



Switches



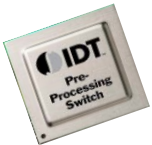
Tundra Tsi578
Switch w/ Multicast
16 ports 1x or 8 ports 4x



IDT 80KSW2000Z
Switch + Pre-processing
16 ports 1x or 4 ports 4x



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



IDT 70K2000Z
Switch + Pre-processor
22 ports 1x or 10 ports 4x



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



Mercury MC432
Switch
8 ports 4x



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



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

| | | |
|------------|------------|--------|
| IDT | 70K2000BR | Tsi574 |
| | 80K SBR200 | Tsi576 |
| | 80KSW0001 | Tsi577 |
| | 80KSW0002 | Tsi578 |
| | 80KSW0003 | Tsi620 |
| 80KSW0004 | | |
| Mercury | MC432 | |
| PMC-Sierra | PM6352 | |
| Tundra | Tsi400 | |
| | Tsi500 | |
| | Tsi564 | |
| | Tsi568 | |
| | Tsi572 | |

Bridges



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

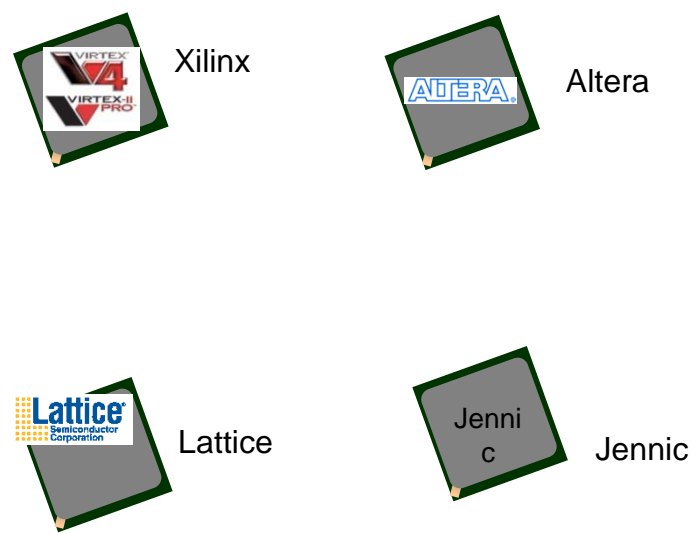


Mercury XSB FPGA
RapidIO to PCI Express
Single 4x RapidIO
Single x8 PCI Express

RapidIO FPGA's, Memory and IP Ecosystem



FPGA



Memory



| | | |
|----------------------|---|------|
| GDA Technologies | RapidIO 1.3 IP | |
| Jennic | RapidIO 1.3 IP | |
| Mercury | RapidIO 1.3 IP | |
| Tundra | RapidIO 1.3 IP | |
| <u>FPGA's</u> | | |
| Altera | Stratix GX Stratix II GX Arria GX | |
| Jennic | Altera Stratix GX | |
| Lattice | LatticeSC LatticeECP2M LatticeECP3 | |
| Xilinx | Virtex II Virtex II Pro Virtex 4 FX Virtex 5 LXT | |
| IDT | 80KSBR200 | SRAM |
| Serial Buffer Memory | | |

RapidIO Semiconductors and IP



| | | | | | |
|------------------|--|-------------------|--|-----------------|--|
| Altera | Stratix GX Stratix II GX Arria GX | Jennic | Altera Stratix GX | Tundra | Tsi400 Tsi500 Tsi564 Tsi568 Tsi572 Tsi574 Tsi576 Tsi577 Tsi578 Tsi620 RapidIO 1.3 IP RapidIO Gen 2 IP |
| AMCC | PPC460GT | Lattice | LatticeSC LatticeECP2M LatticeECP3 | Xilinx | Virtex II Virtex II Pro Virtex 4 FX Virtex 5 LXT |
| Freescale | MPC8540 MPC8560 MPC8548 MPC8548E MPC8543 MPC8543E MPC8547E MPC8545 MPC8545E MSC8144 MPC8641D MPC8640D | Mercury | MC432 Xilinx Vertex II | GDA | RapidIO 1.3 IP |
| IDT | 70K2000BR 80K5BR200 80KSW0001 80KSW0002 80KSW0003 80KSW0004 | PMC-Sierra | RSE160 | Wintegra | WinPath 3 'W' Series |
| | | RMI Corp. | XLS404 XLS408 XLS416 XLS608 XLS616 | | |
| | | TI | TMS320C6455 TMS320TCI6482 TMS320C6457 TMS320TCI6484 TMS320TCI6486 TMS320C6474 TMS320TCI6487 TMS320TCI6488 | | |

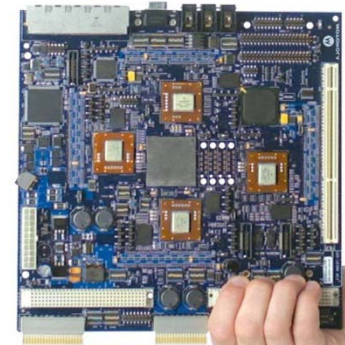
RapidIO Development Systems

- **Mercury Computer Ensemble™ AdvancedTCA:**
 - Serial RapidIO over Advanced TCA mesh backplane
 - Carrier card using Tundra Tsi500 and 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
 - Tundra SRDP
- **Texas Instruments**
 - DSP C6455 EVM
- **Xilinx Advanced TCA Development 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

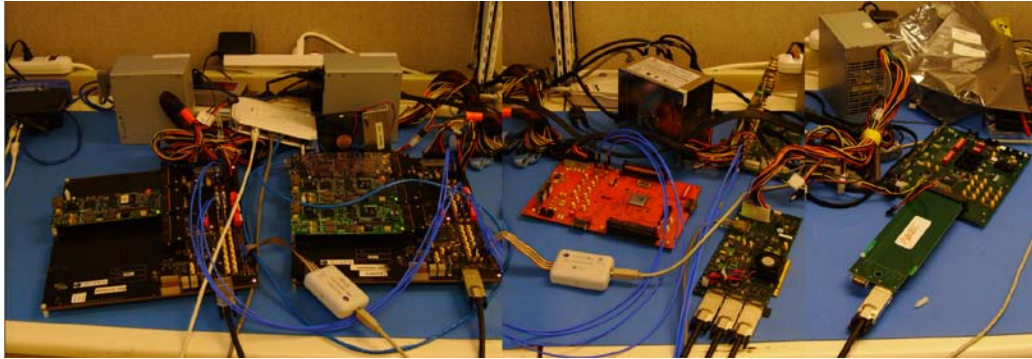
*Dozen's more -
Available Today!*



Sample

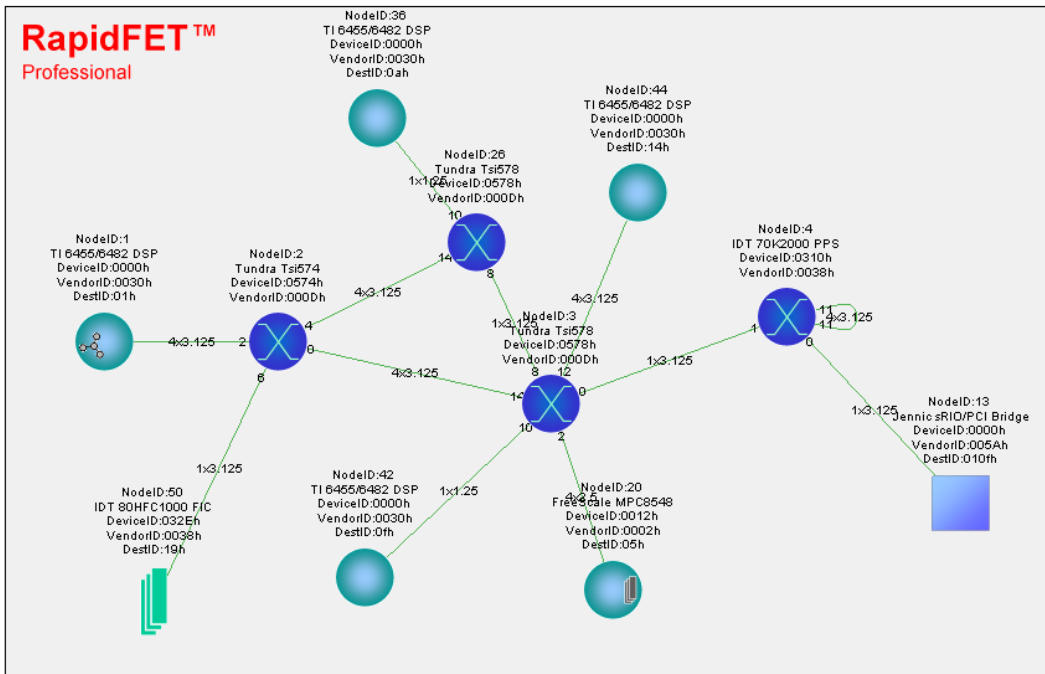


Prototyping with RapidIO



- 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



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:

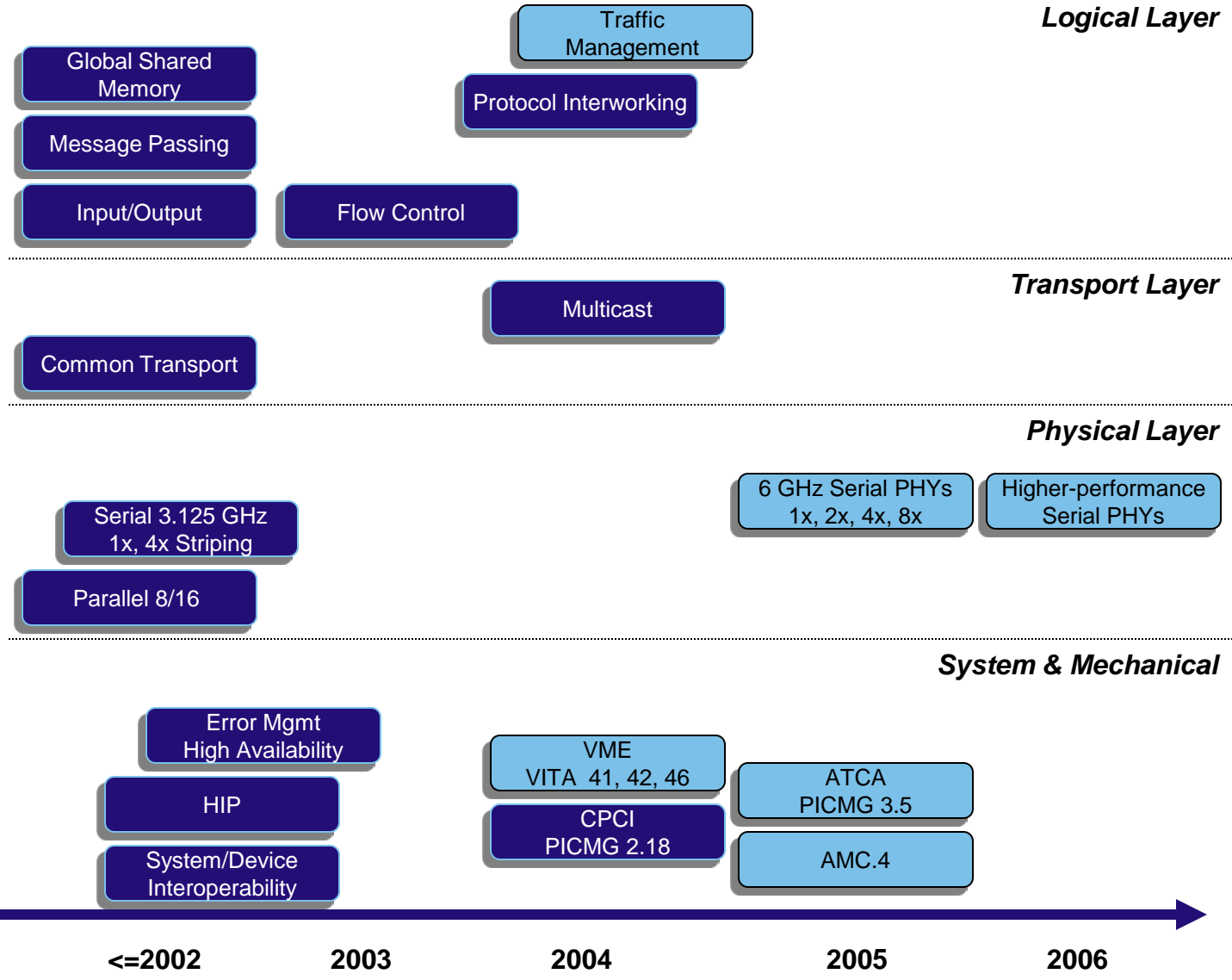
- Modular: Physical, Transport and Logical layers
- Common logical layer across physical interconnects
- Easy migration to higher performance physical interfaces
- Industry standards PHYs

True Embedded Connectivity:

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

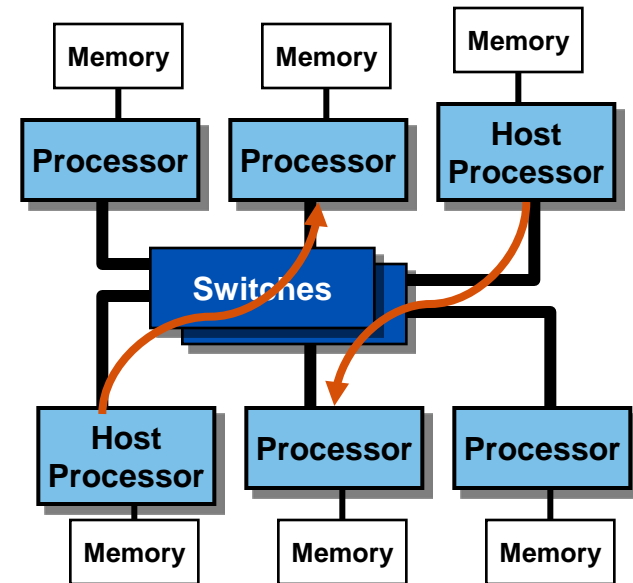
Broad Application Support:

- 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



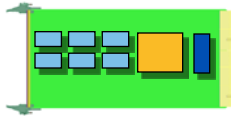
AdvancedTCA[®] Platform

PICMG 3.5 RapidIO Standard

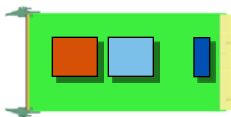


*AdvancedTCA
Mezzanine Cards*

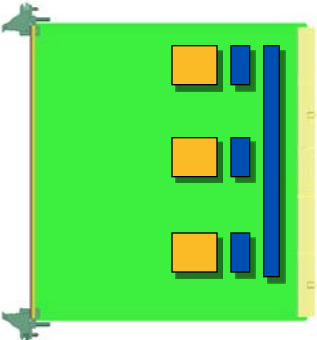
RapidIO connecting
the DSP farm AMC
to the ATCA card



RapidIO connecting
the control AMC
to the ATCA card

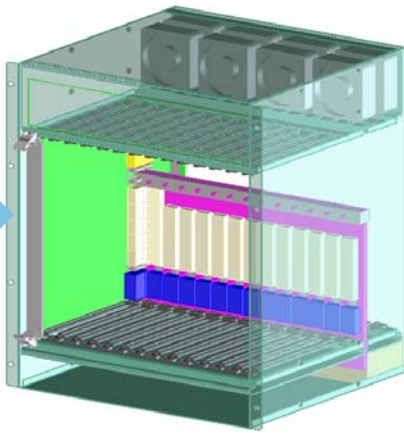


+



*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.