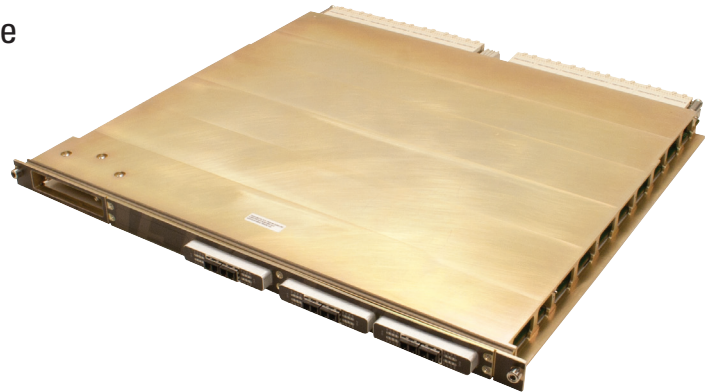# PowerStream 7000 Switch Module

RapidIO® Connectivity and Extreme Performance

- 15 GB/s RapidIO® bandwidth per module
- 8 mezzanine sites for I/O and expansion
- 4 PowerPCs® for drivers and control
- 4 Gigabit Ethernet and 4 100-Mbit Ethernet connections

The PowerStream 7000 Switch Module from Mercury Computer Systems provides the PowerStream 7000 system with RapidIO connectivity for extreme performance and reliability. In PowerStream® 7000 systems, the RapidIO® fabric is formed by switch modules within the chassis card cage. Each switch module provides 24 connections across the passive backplane to processor module slots, and up to four switch modules can be interconnected within a system. The full configuration provides 60 GB/s of peak bisection bandwidth through the backplane and switch modules. The RapidIO interconnect is an open standard certified by ISO and IEC, but only Mercury has the experience to deliver it as a reliable, low-risk, high-performance embedded multiprocessing solution.

As the pioneer of heterogeneous switch fabric-based computing and co-developer of RapidIO technology, Mercury is uniquely equipped with the system and application expertise, and the support and consulting resources to craft RapidIO-based systems that achieve unprecedented performance for individual customer requirements.

Mezzanine Sites

Switch modules provide the sites for mezzanine cards that support standards-based extensibility for functionality such as sensor I/O and inter-chassis communications. The four mezzanine sites along the front panel of each switch module can accept IEEE 1386.1 standard PMCs or RapidIO XMC cards. The VITA 42.1-2006 standard addresses XMC cards with RapidIO communications. The four mezzanine sites at the back of the modules are RapidIO XMC sites, with optical connections available to the front panel.

Each of the four PMC sites has an associated PowerPC® 440GX microprocessor running VxWorks® for I/O control and driver support. Each PowerPC 440GX has 256 MB of DDR SRAM and 64 MB of flash memory for fast booting. Each PowerPC 440GX also has one Gigabit Ethernet connection and one 100-Mbit Ethernet connection.

Ethernet Connections

The Ethernet connections from the PowerPC 440GX chips are each connected to eight-port switches, with four connections from each switch to the backplane. The four 100-Mbit high-availability Ethernet connections provide system communication, and the four 1-Gbit Ethernet connections provide high bandwidth data movement and standard I/O.

With a full system configuration of four switch modules, the four 1-Gbit Ethernet connections and one of the 100-Mbit Ethernet connections from each switch module are available from the backplane. The three remaining 100-Mbit connections from each switch module connect to the other three switch modules and are used for a system management network.
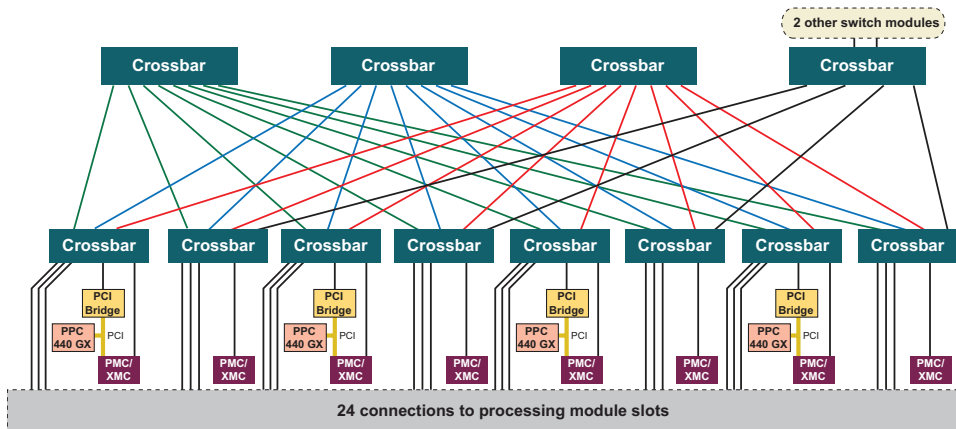

Figure 1. RapidIO Connections

Sensor Data FPDP I/O

The PowerStream 7000 system provides streaming sensor data I/O through RapidIO XMC cards that implement the serial front-panel data port (SFPDP), ANSI/VITA 17.1-2003 protocol. This industry standard enables SFPDP communications over fiber media. RapidIO-connected serial SFPDP XMC mezzanine cards can be mounted in both front and rear positions on the switch module, for up to 32 cards on four switch modules. Each XMC card provides two bi-directional I/O ports per card, each with peak data rates of 250 MB/s and sustained data rates of 247 MB/s per port in either direction. With up to 16 GB/s of streaming I/O in a single-chassis system, the PowerStream 7000 system matches I/O performance to its exceptional computational power.

Inter-Chassis Communication

The PowerStream 7000 switch modules support communications among multiple PowerStream chassis through the use of inter-chassis XMC modules. Scalable inter-chassis bandwidth is provided by varying the number of inter-chassis modules present on a switch module. The inter-chassis communications are transparent to the user; no special application programming is required to engage the inter-chassis XMC modules.

The PowerStream inter-chassis XMC modules have two interfaces for communications: the in-chassis side, which communicates with the near-end chassis; and the fiber-side, which communicates with the far-end chassis. The peak data rate per XMC module is 1.244 GB/s (full duplex).

Built for Deployment

The PowerStream 7000 system is designed to satisfy the reliability, availability, and serviceability (RAS) needs of field applications. Internally, PowerStream 7000 systems use the industry-standard intelligent platform management bus (IPMB) and PICMIG 2.9 IPMI over LAN (100-Mbit Ethernet) as the out-of-band fabric for system control and monitoring, and fault isolation and recovery. System configuration, monitoring, and reset can also be accessed by the application software through a Mercury API. The switch module includes temperature sensors that can be used by the application to shut down the system if a module is getting too hot.

Serviceability Features

During power-on self-test (POST), diagnostics run out of the flash memory on each module. The results of these diagnostics are available out-of-band before the modules are joined together to form a multicomputer. This testing from the inside out provides excellent fault isolation. Slot keying ensures proper replacement of boards during service.

Specifications

Switching Function

Protocol	8-bit parallel RapidIO (ISO/IEC DIS 18372)
Bandwidth	622 MB/s per link in each direction
	15 GB/s total per switch module

Industry-Standard Mezzanine Sites

Number	4 PMC or XMC in front row
	4 XMC only (no PCI) in back row, 8 sites total
PMC type	IEEE 1386.1-2001
PMC bus	64-bit/66-MHz PCI
XMC type	VITA 42.1, 8-bit parallel RapidIO

I/O Processors

Number	4, one for each PMC site
Type	500 MHz IBM PowerPC 440GX
DRAM size	256 MB DDR DRAM
DRAM bandwidth	2.67 GB/s peak
Flash size	64 MB EEPROM

Ethernet

Four 100-Mbit to the backplane   (1 available for user I/O)
Four 1-Gbit to the backplane

Electrical

Input voltages	48.0 VDC ±5%, main power
	5.0 VDC ±5%, management power

Environmental

Air flow	38 CFM minimum (sea level)*
Temperature	
Operating	-25°C to +55°C (sea level)*
Storage	-40°C to +85°C
Humidity	5-95%, non-condensing
Random vibration	7.6 g

Frequency	Level
20 Hz	0.04g2/Hz
1000 Hz	0.04g2/Hz
2000 Hz	0.01g2/Hz

Shock
   x and y axes, 50g,11 ms, half-sine; z axis, 30g, 11 ms, half-sine
Altitude
   Operating   <30,000 ft* (sea level)

*As altitude increases, air density decreases and, therefore, the cooling effect of a particular number of CFM decreases. Different limits can be achieved by trading among altitude, temperature, performance, and airflow. Contact Mercury for more information.

Challenges Drive Innovation®