PowerStream 7000 Processor Module

High Processing Density for Mobile Platforms

- Drastically reduced latency
- Increased processing throughput
- Patented air-cooling system with ManagedAir™ technology

The PowerStream® 7000 processor module from Mercury Computer Systems is based on Freescale™ MPC7447A PowerPC® processors with AltiVec™ technology and the RapidIO® communications fabric, offering a performance density of 40 GFLOPS per 4U slot. Fitting more processing power into tight spaces enables full signal and image processing closer to the sensor in mobile platforms.

Each of the five compute nodes (CN) on the processor module includes an MPC7447A processor, 1 GB DDR SDRAM, and 8 MB flash EEPROM, all connected to the RapidIO switch fabric by a Mercury RapidIO CN ASIC. The MPC7447A includes a 32 KB instruction and 32 KB data L1 cache, and an on-chip 512 KB L2 cache. The double data-rate SDRAM enables overlapping memory access requests from the local processor and remote accesses over the RapidIO switch fabric. The 8-MB flash EEPROM on each node is used for built-in test.

Memory Controller and Switch Fabric Interface Integration

The RapidIO CN ASIC acts as both a memory controller and a network interface to the RapidIO switch fabric interconnect. The CN ASIC includes an enhanced DMA controller, a high-performance memory system with error checking and correcting, metering logic, and a RapidIO interface. By integrating memory control and the network interface, Mercury’s CN ASIC provides functionality and performance not achievable from separate components. The CN ASIC also contains architectural advancements that enhance concurrency between arithmetic and I/O operations.

Lower Latency, Increased Processing Throughput

The true power of the PowerStream 7000 system is realized when applying many processors to a single algorithm step, working as a finely coordinated team. The processors, enhanced DMA controllers, and RapidIO switch fabric combine to drastically reduce the latency while increasing the processing throughput.

Serviceability Features

During power-on self-test (POST), diagnostics run out of the flash 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.

The diagram illustrates the PowerStream 7000 Processor Module functional block diagram.

Figure 1. PowerStream 7000 Processor Module functional block diagram
Patented Air-Cooling System with ManagedAir Technology

The PowerStream 7000 system utilizes patented ManagedAir™ cooling technologies to provide sufficient cooling to satisfy extreme performance density requirements. ManagedAir technology is a system-level approach to meeting the challenges posed by the escalating power consumption of today’s processors and infrastructure chips, especially in military environments.

Implemented at all levels from the component through the chassis, ManagedAir cooling maximizes the effectiveness of unconditioned moving air, allowing the system to support higher-performance processors and their associated circuitry without conduction cooling, liquid cooling, or other exotic cooling techniques. The result is a simpler, lighter system that is easier to deploy and maintain. For example, ManagedAir technology encloses each printed circuit board assembly with a cover that is tailored to the profile, placement, and airflow requirements of the board’s components. The cover’s topography manages the airflow for that board by directing air through the heat sinks, increasing their cooling capacity.

At the slot level, ManagedAir technology manages the airflow to get an even distribution from front to back and across all the slots. The covers for each board regulate the airflow and stay with the board as it is moved or replaced.

![Figure 2. Example of ManagedAir board cover and mounted board](image)