MERCURY COMPUTER SYSTEMS

CUSTOMER REFERENCE STORY

Mercury's 10 GigE-to-RapidIO Solution Enables Powerful Network-Centric Sensor Processing for a Complex Combat System

Integrates Electronic Imaging, Video, and Weapon Systems

Situation

A large, worldwide Prime supplier of defense applications won a contract to develop an integrated, networked combat system. The Prime's customer wanted the ability to access a variety of sensor data – including electronic imaging, video, and weapon systems – from several visual display subsystems linked together by a 10 Gigabit Ethernet network.

Critical Issues

When the Prime met with its customer to discuss their critical requirements, they isolated several important issues. First, using 10 Gigabit Ethernet as the network protocol for their streaming sensor applications was necessary, so that users could view all the resulting data and images on physically dispersed visualization and processing subsystems. Second, the customer insisted on a sophisticated failover capability with redundancy as a safety precaution. In case of hardware failure, the system needed to automatically switch to the redundant equipment without any downtime.

A related technical issue was the need for real-time signal processing of sensor input to create useful images. Multiple processors would need to work together on this function. But, despite its considerable bandwidth, 10 Gigabit Ethernet did not deliver the low-latency, deterministic communications required by real-time processing. A different type of protocol, such as RapidIO®, would need to be used for the real-time signal processing. The design challenge was to create a network-based solution that seamlessly and transparently moved data between 10 Gigabit Ethernet and RapidIO, so that the advantages of each could be exploited for maximum performance and flexibility.

What Mercury Provided

After assessing the needs of its customer, the Prime approached several suppliers, including Mercury, to request proposals for the network-centric signal processing component of the system. Mercury engineers went to work immediately and collaborated with the Prime's engineering team to create a proof-of-concept demonstration. Based on this proposal, the Prime chose Mercury for the program, because of our unique ability to provide 10 Gigabit Ethernet connectivity to a RapidIO fabric, thereby combining network-wide availability of data with high-performance signal processing.

After acceptance of the proposal, the Mercury engineers continued their close contact with the Prime's engineering team, meeting with them at least weekly to hammer out their requirements, understand their needs, and ensure the quality and appropriateness of the resulting designs within schedule.

Because multiple types of sensor data were collected and distributed via 10 Gigabit Ethernet, the Mercury engineering team proceeded to develop a conversion protocol to give the RapidIO-based Power Architecture™ processors access to the outside network. This Ethernet-over-RapidIO protocol gave the system designers the flexibility to mix and match the use of Ethernet where it made sense, while leveraging the robust RapidIO fabric to perform the rigorous high-speed signal processing.

RapidIO encapsulation was employed to stream all types of data through the Mercury embedded computing system, while 10 Gigabit Ethernet was the conduit that enabled the distributed visualization subsystems to display the resulting images.

The engineering teams jointly designed the software to perform the failover capabilities. The Mercury team then went on to make several modifications to the processor board. They enabled the board to use the Linux® operating system and also increased the size of the FPGA, programming it to operate in the presence of failover.

Capabilities of the Mercury Solution

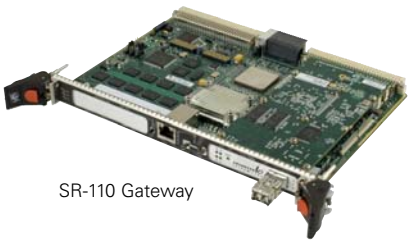
Mercury incorporated several critical components in the networked sensor processing system:

- The SR-110 10GE VXS Gateway was the network-centric building block that brought the flexibility and extensibility of 10 Gigabit Ethernet to the embedded processing system. Employing the Ethernet-over-RapidIO protocol, the Gateway was used to stream the data from the external network into the RapidIO intra-chassis network, where the data processing took place on several VPA-200 single-board computers (SBCs).
- The VPA-200 Dual 7448 VXS SBCs were integrated to do the high-speed data computation. The SBCs, each with two independent processing nodes, were programmed to work together as a tightly coupled compute cluster using RapidIO. The FPGA on each VPA-200 was programmed via software to allow failover to another VPA-200, and a RapidIO switch was added on the board to enable the failover capability.
- Two Serial RapidIO VXS Switch Modules, each with six 8-port serial RapidIO crossbar ASICs in a 2-level hierarchy, were included in the system to facilitate the low-latency, deterministic RapidIO communications.

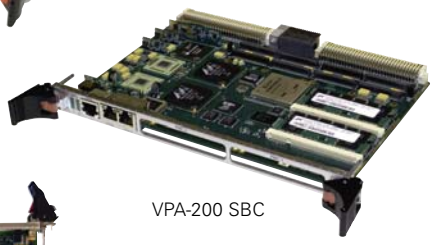
Results

By deploying the Mercury network-centric sensor processing system in the complex combat system, the Prime was able to implement a single, platform-wide Ethernet network for streaming sensor data through the system. The Ethernet-over-RapidIO protocol let them take full advantage of the RapidIO fabric to support real-time signal processing.

The Mercury system will uniquely afford the Prime's customer the benefits of a sensor network architecture that enables system-wide translation among different communications protocols. Data from various sensors can be processed in real time via RapidIO, and the results made available to users via the high-bandwidth 10 Gigabit Ethernet network.



SR-110 Gateway



VPA-200 SBC

VXS Switch Module

1746.01E-0908-CRS_Gateway

MERCURY COMPUTER SYSTEMS

Corporate Headquarters
199 Riverneck Road
Chelmsford, MA 01824-2820 USA
+1 (978) 967-1401 • +1 (866) 627-6951
Fax +1 (978) 256-3599
www.mc.com

Worldwide Locations
Mercury Computer Systems has R&D, support and sales locations in France, Germany, Japan, the United Kingdom and the United States.

For office locations and contact information, please call the corporate headquarters or visit our Web site at **www.mc.com**.

Challenges Drive Innovation™