J SQUARED TECHNOLOGIES INC.

Reflective Memory Applications

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J SQUARED Reflective **Memory**

What is REFLECTIVE MEMORY?

A Reflective Memory network is a special type of shared memory system designed to enable multiple, separate computers to share a common set of data.

Reflective memory networks place an independent copy of the entire shared memory set in each attached system. Each attached system has dull, unrestricted rights to access and change this set of local data at the full speed of writing to local memory.

When data is written to the local copy of Reflective Memory, high speed logic simultaneously sends it to the next node on the ring network. Each subsequent node simultaneously writes this new data to its local copy and sends it on to the next node on the ring. When the message arrives back at the originating node, it is removed from the network and, depending on the specific hardware and number or nodes, every computer on the network has the same data at the same address within a few microseconds.

Local processors can read this data at any time without a network access. In this scheme, each computer always has an up to date copy of the shared memory set. In the four-node example shown, it takes 2.1 µs for all computer to receive the data that was written to Reflective Memory.*

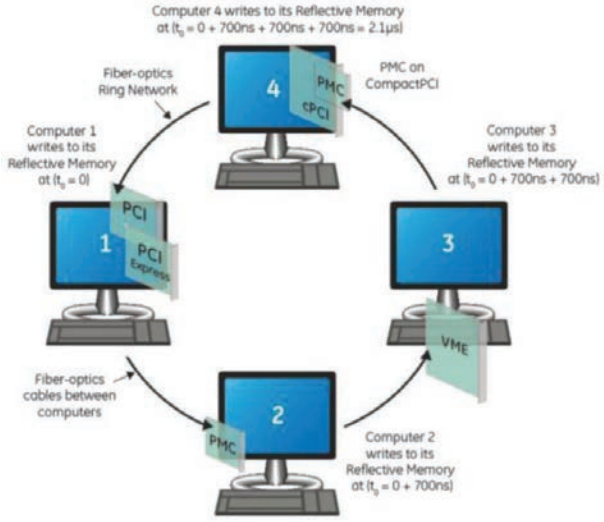


***Figure 1** Reflective Memory provides very low latency between nodes.*

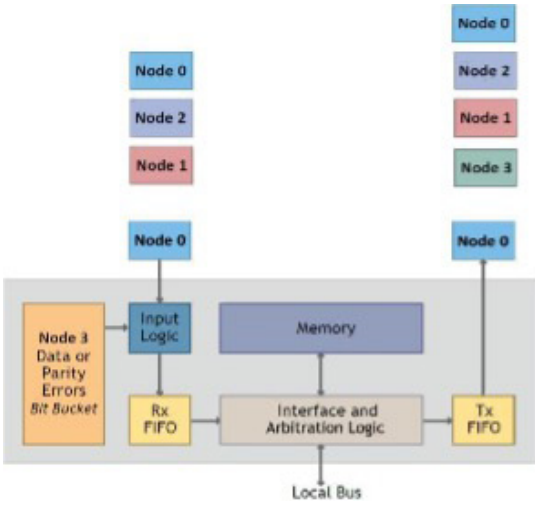


***Figure 2** Reflective Memory data insertion. Data from the network is automatically written to local memory and transmitted on to the next network node by embedded logic.*

A Reflective Memory board (node) consists of local memory, an embedded interface, and arbitration logic which provides access for both the host computer and the Reflective Memory.

The Reflective Memory boards may be physically installed or connected to a variety of computer buses, including VME, and PCI/PCI-X, Compact PCI, PCI Express or any standardized or proprietary system capable of hosting a PMC site. This allows most popular workstations and single board computers to be connected via Reflective Memory regardless of their interoperability.

** This latency is calculated assuming no network traffic, short cable lengths and the largest packet size is possible. Cable length and network traffic can cause the latency to increase, but as long as the bandwidth of the network is not exceeded, the latency should not increase significantly.*

Where DO I USE REFLECTIVE MEMORY?

ROCKET ENGINE TESTING

A rocket engine test stand uses hundreds of transducers to measure various parameters. Operators need a lag-free connection to the testing, but for safety reasons, the instrumentation/viewing center may be located 3,000 meters away. With Reflective Memory, a single link can send data to the main computer in the control room, eliminating hundreds of discrete wires spanning the 3,000 meters. Operators can observe and react to changes as they occur, with minimal delays imposed by the connection, minimize risks to personnel and equipment with no degradation of test performance.

FLIGHT SIMULATION

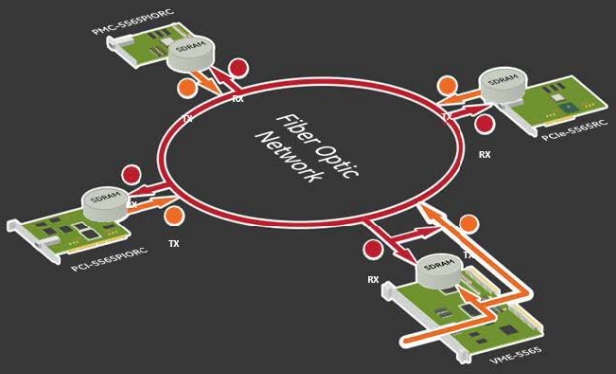
An interactive combat flight simulator highlights the importance of low-latency performance.Separate computing system are responsible for generating a display, managing individual participants' inputs, generating terrain, managing weapons systems, or a variety of other functions, and multiple participants perform dynamic movements at extremely high speeds. It is imperative that the system is fast enough to present a lifelike simulation of reality. By minimizing latency, Reflective Memory ensures that the simulation can withstand the sensory scrutiny of the participants.

ALUMINUM ROLLING MILL

On a 3,500 ft/min rolling mill, a standard PLC Control loop had a response time that allowed 2 to 3 feet of aluminum to pass through before actuators could respond. These actuators were applying and releasing pressure on the aluminum to vary the thickness. Using Reflective Memory, the response time was reduced to 4 inches, resulting in tremendous waste reduction & quality improvement in the final product.

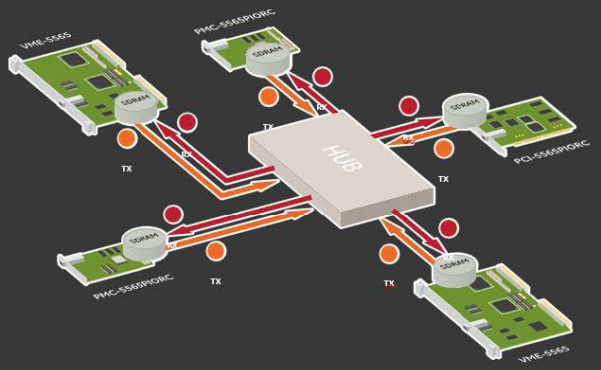
Ring Topology

Choose the network topology that matches your needs. The reflective memory ring architecture is capable of data transfer rates of 170 MB/s over fibre-optic media. It is not a collision-based bus arbitration system as most Ethernet systems are, so it avoids the complexities of queuing and checking data packets. This topology also ensures proper connectivity and does not impose additional loading restrictions or termination requirements. Distances between nodes may be up to 10 km.



Star Topology

With a fibre-optic hub, the reflective memory network will continue to operate even if a node has been turned off. The hub automatically bypasses any network node which
ceases operation to ensure data continues to the next node in the network, thus maintaining the integrity of the ring. Hubs can be cascaded, permitting a managed hub array with up to 256 nodes. Each port regenerates the serial optical signal, eliminating problems with insertion losses and cable attenuation. Signal regeneration also reduces jitter.



EXTREMELY LOW LATENCY

Data written to the local copy of Reflective Memory is simultaneously sent to the next node on the ring network, until each computer has an up-to-date local copy of the shared memory set. In the four-node example shown in Figure 1 above, it takes 2.1 µs for all computers to receive the data. This latency is calculated assuming no network traffic, short cable lengths and the largest packet size possible. Cable length and network traffic can cause the latency to increase, but as long as the bandwidth of the network is not exceeded, the latency should not increase significantly.

SUMMARY

Reflective Memory is an optimal way to share data in time- critical applications ranging from data acquisition and process control to advanced simulation. Reflective Memory networks provide a real-time networking capability that surpasses most communications technologies for low latency and deterministic performance. Reflective Memory networks connect systems with minimal update delays and no access restrictions, to enable multiple, remotely located nodes to share a single data set in real time.