



What is Ethernet Reflective Memory?

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What is ETHERNET REFLECTIVE MEMORY?

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

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

Ethernet Reflective Memory is most relevant in systems where interaction in near real time is a primary concern. Ethernet Reflective Memory uses a low cost Intel x540-T1 10 GB Network Interface Card and a "C" Static Library, intended for Linux Operating Systems. A user API consists of five simple functions to initialize, send data, receive data, obtain node number and exit the application. Example programs are provided to test the network performance and demonstrate the ease of use of this API.

When data is written to the local copy of Ethernet Reflective Memory, high speed logic simultaneously sends it to the all nodes on the Ethernet network. Each node simultaneously writes this new data to its local copy. Local processors can read this data at any time without a network access. In this scheme, each computer always has an up-to-date local copy of the shared memory set.

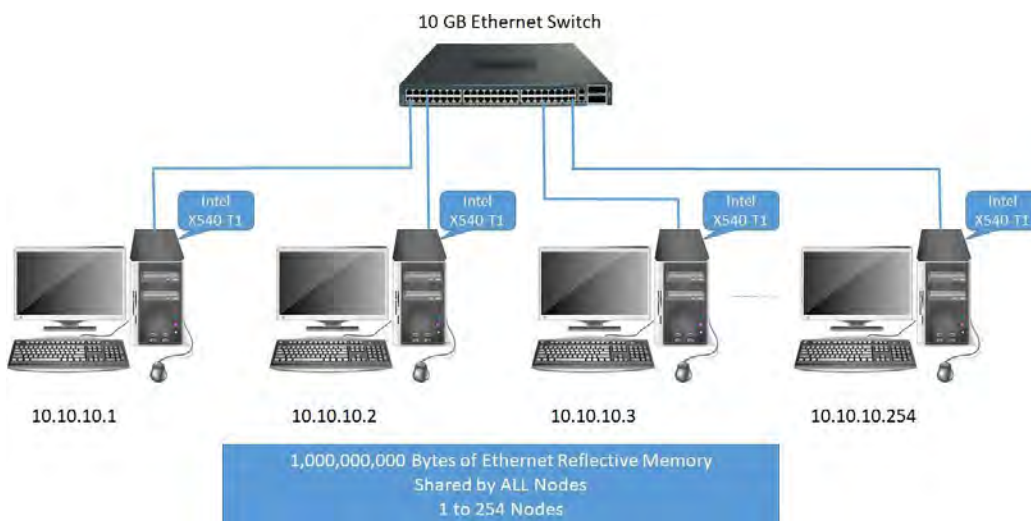


Figure 1 Ethernet Reflective Memory architecture. Data sent from an application is automatically written to local memory and reflected to all network nodes.

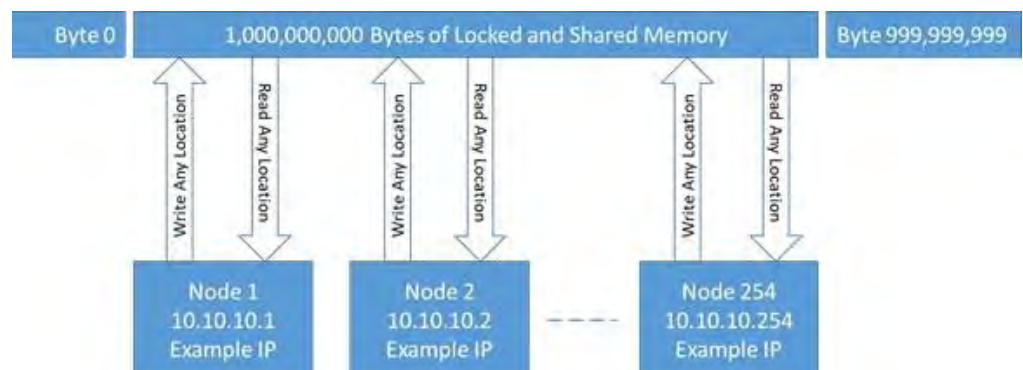


Figure 2 Reflective Memory data flow. Each node can send and receive up to 1,000,000,000 bytes of data from any location.



Ethernet REFLECTIVE MEMORY

HOW DO I USE ETHERNET REFLECTIVE MEMORY?

Using an Ethernet Reflective Memory network requires only a few simple steps:

- » Configure x540-T1 Ethernet NIC's for Desired User IP Address and set MTU Size to 9000 Bytes
- » Create a User "C" Program using the provided "C" Static Library "liberm.a" which contains only five simple functions and runs as a real time Linux process
- » Uses local locked memory of 1,000,000,000 Bytes
- » Write to a memory location with a specific size and all nodes are simultaneously updated
- » Read memory from local locked memory at full memory update rates with no network activity

The benefit of a high-speed network like Ethernet Reflective Memory is very low data latency, both overall and between individual network nodes. This low-latency performance is of paramount importance when building real-time systems such as simulators. Ethernet Reflective Memory runs at full performance rate of 1,200,000,000 Bytes per Second.

WHO USES ETHERNET REFLECTIVE MEMORY?

Ethernet Reflective Memory can be used in hundreds of applications, including the following:

- » Aircraft or Avionics simulators
- » Over-the-horizon radar
- » Control and monitoring
- » Power plant simulators
- » Marine vessel Simulators
- » Engine test stands
- » Automated testing systems
- » High speed data acquisition

WHY WOULD I CHOOSE ETHERNET REFLECTIVE MEMORY?

Ethernet Reflective Memory LANs or Real-time Networks are usually constructed because the designer has needs or problems that are solved by one or more of the following Ethernet Reflective Memory board characteristics:

- » Deterministic data transfers
- » High-speed performance
- » Ease of use
- » Economics and available time-to-build systems
- » Advantages over Standard LAN Technologies



Ethernet REFLECTIVE MEMORY

DETERMINISTIC DATA TRANSFERS

Ethernet Reflective Memory is a software-based, near real time network. All data transferred to a node is stored in local memory and automatically sent out to all the other nodes' memory. There are no software delays and minimal hardware delays associated in the data transfer, limited only by the platform architecture and the effective bandwidth and traffic of the network. Any latency is imposed at the network level and can be predetermined within a very small window of best-to-worst case latency. The determinism of Ethernet Reflective Memory, the guaranteed time in which communication between two or more nodes is completed, allows system designers to build effective real-time LANs that can guarantee data delivery within a tight window of time. This enables guaranteed scheduling of sequential actions and ensures that data is not lost.

HIGH-SPEED PERFORMANCE

The demands of real-time performance dictate that Ethernet Reflective Memory networks must operate at very high speeds. In some cases, this speed and the throughput it generates are compelling reasons to use Ethernet Reflective Memory. As an example, the Ethernet Reflective Memory products supplied by J- Squared, offer a sustained 1.2 Gigabytes per second transfer rate. This compares favorably for both speed and throughput against most data networks.

EASE OF USE

No other high-performance LAN is as easy to install and operate as Ethernet Reflective Memory. An ideal network would allow every computer simultaneous access to every computer's memory. Since this memory is global, access may be simultaneous by multiple computers. All CPU data sends to this common memory space are replicated to all nodes in the network. Ethernet Reflective Memory transparently replicates this data, so that the application(s) can share the data without software overhead penalties.

LINUX OPERATING SYSTEM

Ethernet Reflective Memory is currently available for the Linux Operating System. Users can configure a high-speed network where any desktop workstation, laptop, single board computer, or server can share information directly with ANY other computer.

SUMMARY

Ethernet Reflective Memory is an optimal, cost-effective way to share data in time-critical applications ranging from data acquisition and process control to advanced simulation. Ethernet Reflective Memory networks provide a real-time networking capability that surpasses most communications technologies for low latency and deterministic performance. Ethernet 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.

Comparison

OFF-THE-SHELF NETWORKING TECHNOLOGIES

Ethernet Reflective Memory Network Characteristics

PCIE-5565PIORC

10 Gigabit Ethernet

Transmission Speed	2.1 Gigabits / s	10 Gigabits / s
Data Transfer Speed	170 MB/s	1.2 Gigabytes / s
Software Transparent	Yes	No
Media	Fiber Optic	Wired J-45
Topology	Ring & Star	Star
Network Data Transmission/ Reception Is Deterministic?	Yes	Yes
Network Transfer Scheme	Data Insertion	Simultaneous Send
Memory Mapped Access to Shared Data?	Yes	Yes
Application Must Be Constructed to Share Data?	No	Yes
Application Must Encode/Decode Messages?	No	No
Application Must Perform Error Check/Handling Retransmits, etc.?	No	No
CPU Overhead to Support Shared Data Functionality?	No	Yes
CPU Overhead Required at Transmission Hardware Interface?	No	Yes



TEST STANDARDS:

MIL-STD-167	MIL-STD-461G
MIL-STD-810	60068-2
MIL-STD-108E	60529
MIL-E-5400T	60945
MIL-STD-2164	60598-2-3
MIL-S-901D	



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