Critical I/O Fibre Channel Software Support Overview

Abstract

Critical I/O's Fibre Channel products are designed specifically for data intensive real time applications. The Critical I/O Fibre Channel hardware implements full offload of Fibre Channel transfers via a combination of the dedicated on chip hardware processing elements and firmware running on the on chip RISC processors, providing the highest performance, low host CPU loading, and highly deterministic operation.

This paper discusses the protocols and support software offered by Critical I/O for the Fibre Channel product family. SCSI_FCP, FC_AE_RDMA, FC_AE_FCLP, FC_AE_ASM, FC_AV, and FC_IP protocols are supported. Software support includes Fibre Channel drivers for VxWorks, Integrity, Linux and Windows operating systems as well as the company's platform independent Fibre Channel Software Library Application Programmer's Interface (API).

CRITICAL I/O

Protocol and Software Support for the Critical I/O Fibre Channel Product Family

Critical I/O provides extensive protocol and software support for its Fibre Channel products that is specifically designed to provide optimal performance in embedded and real-time applications. The focus of Critical I/Os hardware and support software is to maximize performance (as measured by throughput, latency, and determinism), while minimizing the loading on host CPUs. A second goal is to provide simple and standardized application programming interfaces that allow application developers to easily leverage these capabilities. This paper describes the Critical I/O software library and driver features, and how application programmers can utilize these features and supported protocols.

Critical I/O's Fibre Channel software support is provided in the form of Libraries and Drivers:

- *Critical I/Os Fibre Channel Drivers* for VxWorks, Integrity, Linux and Windows are operating system specific, and connect directly into standard operating system I/O interfaces providing such standard interfaces as read/write block I/O and SCSI support. Additionally, IOCTLs are provided to support additional features.

- *Critical I/Os Fibre Channel Library* provides an API that can be easily accessed directly from application programs, without the need for an intervening driver. The libraries are designed to be operating system, processor, and endian independent. Critical I/O drivers are all built upon the Fibre Channel Library. The library can be provided in situations where customers cannot utilize a driver for their specific application.
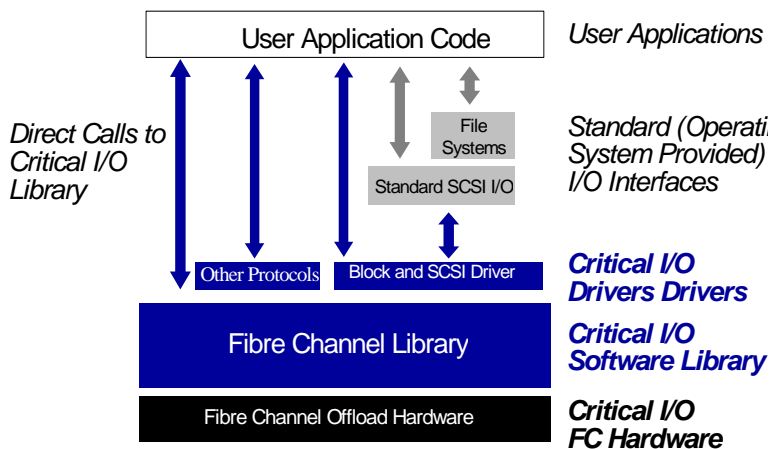

Figure 1: Library vs. Driver Support

Fibre Channel Solutions

Critical I/O's Fibre Channel product family provides a full offload of the Fibre Channel transfers through an integrated hardware engine and firmware running on the on chip processor. Full offload of the SCSI protocol is also supported for storage, data collection, and instrumentation applications. Critical I/O's software support for the Fibre Channel product is designed specifically to allow application programmers to fully exploit the offload capability of the Critical I/O Fibre Channel interfaces, while providing the real-time performance, controllability, and characteristics that embedded real-time systems demand.

Fibre Channel software support consists of the multi-platform software library, and platform specific (VxWorks, Integrity, Linux, and Windows) drivers. Figure 1 illustrates how the Critical I/O support software elements are layered between user application code and the Fibre Channel hardware, and also illustrates how the Fibre Channel drivers tie into standard operating system provided I/O interfaces.

Most Critical I/O drivers and library versions support the concurrent use of multiple protocols. The drivers are constantly being updated with new features. Contact Critical I/O for information on the protocols supported under the various operating systems.

Messaging Protocol - FC_AE_FCLP (FXLP)

The Messaging Driver supports intercommunications between multiple Fibre Channel nodes.

Critical I/O's Standard Messaging is a super set of FC_AE_FCLP (FXLP) and allows a node to read from or write data to any other node. To send data, a transfer request is made specifying the destination node, the amount of data and a pointer to the data buffer to send. The receiver is notified of the transfer request and can determine if it wants to handle the request or not. If it decides to receive the data, it supplies a receive buffer and the transfer continues without host intervention until it completes, at which time both the sender and receiver are notified with the status of the transfer. The process is similar to read data from another node.

RDMA Protocol - FC_AE_RDMA

RDMA allows a node direct access to a remote node's memory for either reading or writing without any intervention by the remote node. The remote node can optionally be notified after the transfer completes. Each node can allocate multiple buffers for other nodes to access. Access can be restricted with size

and read/write attributes. RDMA has lower latency than messaging and provides the direct memory placement paradigm.

SCSI Protocol - SCSI_FCP

SCSI I/O allows for sending and receiving SCSI commands and implementing SCSI Initiator (Workstations) and Target devices (RAIDs). SCSI can be used to support File system I/O to allow the host operating system file systems to access the storage devices and to also support direct access to storage devices without going through the operating systems file system.

IP Protocol FC_IP

The IP protocol supports the transport of Fibre Channel IP type frames. This protocol supports broadcast on an arbitrated loop and fabric and can be used as the base to support TCP/IP over Fibre Channel.

Audio Video Protocol - FC_AV

The Audio Video protocol supports the transport video frames over Fibre Channel typically from sensors to processors.

Anonymous Subscriber Messaging Protocol - FC_AE_ASM

The ASM protocol provides for low latency communications between multiple nodes in a system. Messages can be routed via message ID's embedded in the Fibre Channel frames.

Linux Drivers

Linux drivers are available for most distributions and for both x86 and power pc architectures. Various enterprise and real time versions of linux are supported. File system support is provided.

VxWorks Drivers

VxWorks drivers are available for many versions of VxWorks from 5 on and for both x86 and power pc architectures. File system support is provided.

Integrity Drivers

A number of Integrity drivers have been developed for data communication and file system I/O. However, they were application specific. Any new requirement would likely require some level of NRE.

Windows Drivers

Windows support is via a DLL that provides direct access to Fibre Channel API functions. All protocols are supported, but file system I/O is not directly supported.