White Paper

Stratix GX in Storage Applications

Introduction

The storage market is driven by a convergence of storage and networking technologies, information growth, and advances in storage and infrastructure bandwidth. The traditional lines between networking and storage are blurring due to the increased adoption rate of networked storage. There are two main architectures for storage networking: Storage Area Network (SAN) and Network Attached Storage (NAS).

The SAN architecture efficiently uses storage assets by decoupling server and storage capacities from a dedicated network. A SAN inserts a dedicated storage network between servers and various storage subsystems. The storage network is composed of switches that connect servers and storage.

The NAS architecture uses software to resolve storage challenges. NAS uses existing server technologies and networking technologies (Ethernet) and adds file intelligence. Unlike SANs, where data is managed by traditional operating systems and databases, the NAS software engine manages data and distributes the data over Ethernet wires to users, servers and databases.

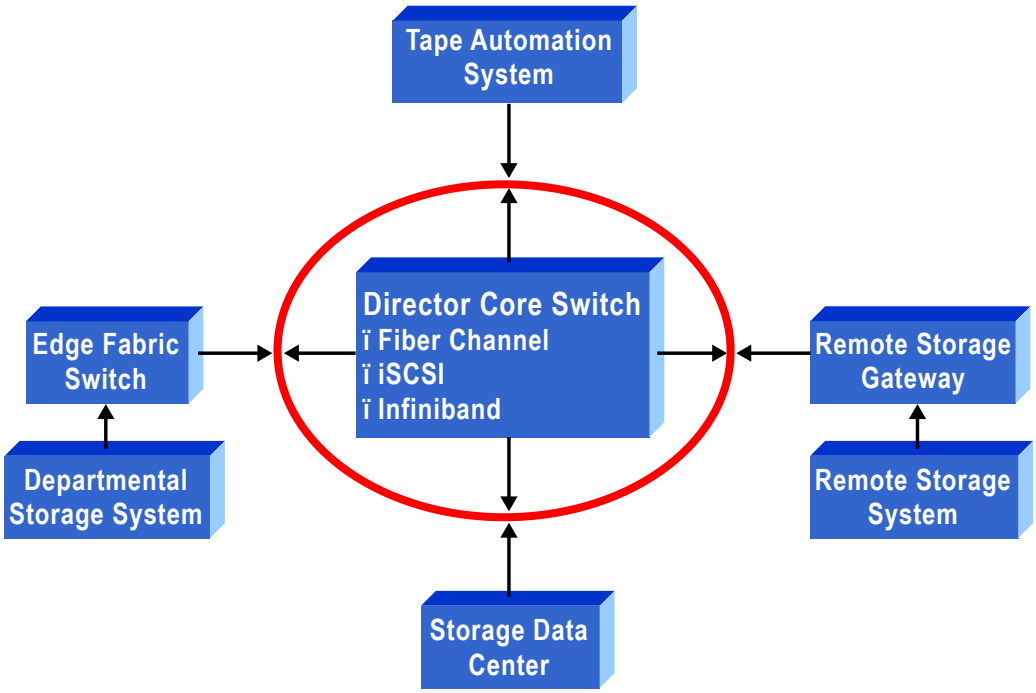
Storage infrastructure (switch) vendors are challenged with the convergence of SAN and NAS. Users want a virtualized storage repository where they can view and manage all storage assets from one place regardless of technology implementation (NAS or SAN), physical location, or vendor brand.

The Stratix GX device family integrates high-speed data transmission and programmable logic for storage switches and storage systems. Built on Altera's new Stratix architecture, Stratix GX devices are available with up to 20 transceiver channels capable of operating at up to 3.2 gigabits per second (Gbps) per channel (3.2-Gbps performance is pending silicon characterization). The Stratix GX solution provides system designers with flexibility, performance, integration, and low power that are not available in any other solution.

System Overview

Storage systems contain hard disk drives, redundant arrays of independent disks (RAID) controllers and storage shelves (see Figure 1). The tape automation system (backup libraries) duplicates data in tape-medium storage systems. These libraries have many tape drives and can accommodate hundreds of tape cartridges. Director core switches are high-port-count (between 64 to 512 ports) switches that control the data flow to and from the main data centers. Director core switches offer features such as redundant power supplies, processor boards and multi-path connections to eliminate any single point of failure.

Figure 1. Storage Networking System Overview



Director core switches contain multiple cards plugged into a backplane. The cards are either port (line) cards, processor cards, or virtualization cards. The switch fabric routes the signals to other cards plugged into the system. Some chassis have cards that plug in at the front and in the back of the box. In this case, a mid-plane is used to route the signals to the cards in the box. The number of cards varies from vendor to vendor.

Using Stratix GX in Storage Switches

The port modules (line cards) in storage switches support multiple ports. These are typically Fibre Channel ports for Fibre Channel switches or Ethernet ports for NAS or IP storage switches. The following figures illustrate how Stratix GX devices can be implemented on typical port module cards for Fibre Channel and multi-protocol switch cards.

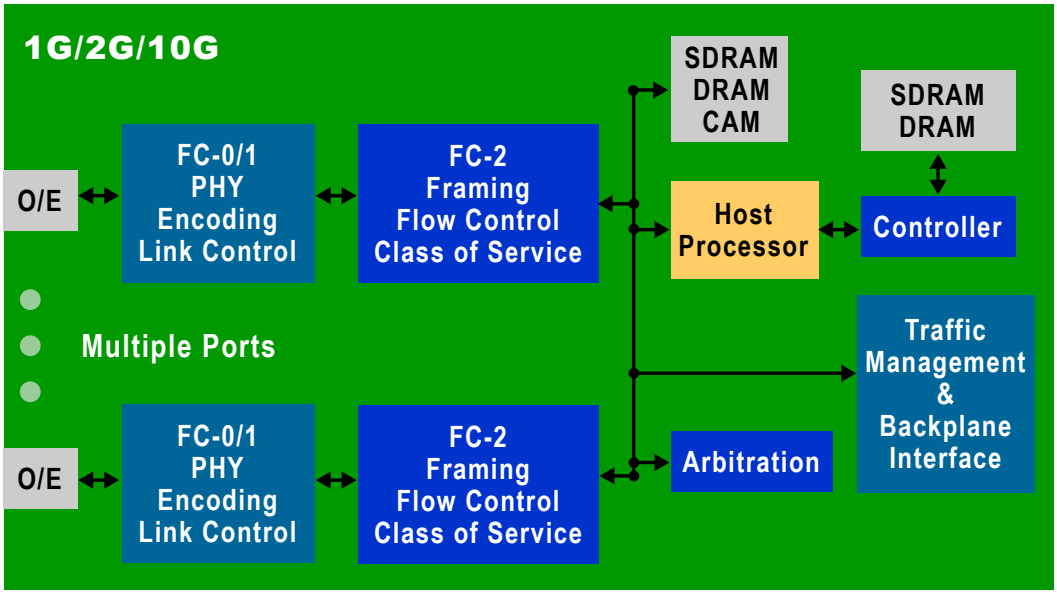
Fibre Channel Port Card

Fibre Channel is a data transfer interface technology that maps several common transport protocols, including Internet protocol (IP) and SCSI, allowing it to merge high-speed I/O and networking functionality in a single connectivity technology. The Fibre Channel standard operates at up to 10 Gbps.

The basic data flow on a Fibre Channel port card is shown in the functional blocks of Figure 2. GigaBit Interface Converters (GBICs) convert optical data to electrical data at the line interface. GBICs pass the data on to devices that handle FC-0 through FC-2 layer functionality such as encoding/decoding, framing, flow control, service classes, traffic management, and queue/buffer management. Current systems use a combination of ASICs, ASSPs, and FPGAs to handle these data path functions. Since Fibre Channel is an evolving protocol, the design platform must be flexible to accommodate any changes. FPGAs offer the flexibility required for a Fibre Channel solution. FPGAs also allow you to differentiate your storage equipment from competitors and allow you to go beyond the protocol specification.

Designers can use Stratix GX devices for the backplane interface and traffic management functions in the Fibre Channel storage line card shown in Figure 2. Stratix GX devices can also support the Fibre Channel physical interface, PMA (FC-0) and transmission protocol, PCS (FC-1) for a single or multi-port Fibre Channel line card.

Figure 2. Fibre Channel Storage Line Card



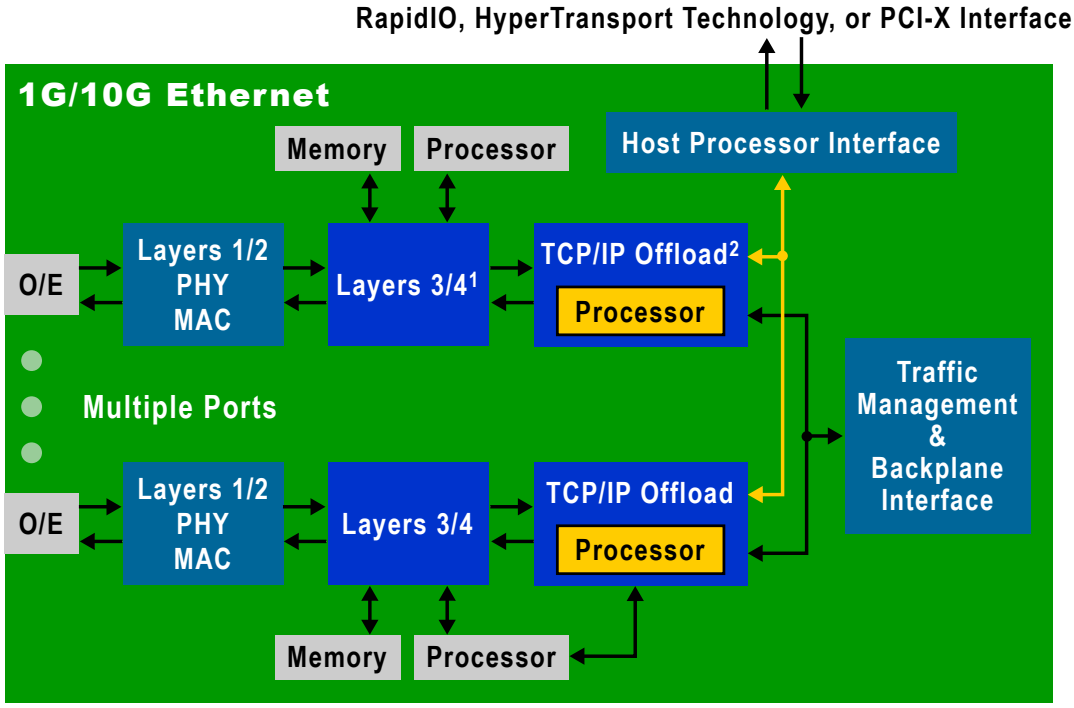
Current designs use FPGAs in the data path for processing Fibre Channel frames. This involves framing, flow control, and queue and buffer management. You can implement framing and signaling protocol (FC-2) in Stratix devices.

iSCSI Port Card

An iSCSI port card functions similarly to line cards in the networking / access space. Therefore, PHYs and MACs are layer 1 and 2 functions and TCP/IP stack processing, IPSec, IP packet processing, traffic management, and queue/ buffer management are layer 3 and 4 functions.

You can use Stratix GX devices for the backplane interface and traffic management in the iSCSI port card (see Figure 3). Stratix GX devices can also support the physical layer (layer 1) electrical requirements for connection to the communications media, encoding/decoding, clock recovery, and data transmission and reception. Stratix GX devices can also implement layer 2 functions. You can implement the layer 3 (network) and layer 4 (transport) functions in Stratix devices.

Figure 3. iSCSI Port Card



Notes to Figure 3:

(1) Layers 3 and 4: Ipv4/Ipv6/TCP IPSec Packet Forwarding

(2) TCP/IP Offload: link established/teardown, data transmission/reception, error handling, session timers

Conclusion

Stratix GX devices were designed to combine high performance programmable logic with high-speed transceiver interface capabilities. Stratix GX offers up to 20 full duplex 3.2-Gbps transceiver channels (3.2-Gbps performance is pending silicon characterization). In addition, high-speed chip-to-chip interfaces are supported through 1-Gbps source-synchronous channels with dynamic phase alignment (DPA). Stratix GX offers the flexibility, time-to-market, low power, and customizable solutions for high-speed storage switch applications.

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