

# Exploring the Benefits of Fibre Channel

BY TERRY M. FLANAGAN

Fibre Channel is becoming the connection of choice for storage device-to-network servers, as it promises extraordinary performance improvements, scalable connectivity, multi-protocol capability, and robustness.

**NETWORK** and systems professionals have been hearing the rumblings of the Fibre Channel device connection standard coming down the track for several years, with its promise of extraordinary performance improvements, scalable connectivity, multi-protocol capability, and robustness.

Fibre Channel is delivering on the promises now with more than 150 vendors offering Fibre Channel products and implementations underway in hundreds of companies in all industries.

For those charged with optimizing, supporting, specifying and purchasing today's networks and storage systems, Fibre Channel is a very real option. Thus, a review of what it is, its benefits and where it is headed is more timely than ever.

## WHAT IS FIBRE CHANNEL?

Fibre Channel was born out of the need to increase data transfer speeds between computers and among servers and mass storage subsystems. The standard got its

start 10 years ago when the American National Standards Institute (ANSI) chartered the Fibre Channel Working Group. By 1994, the new high-speed computer interconnection standard had been developed and the Fibre Channel Association (FCA) was founded with 70 charter member companies. The following year, a handful of companies began building and shipping Fibre Channel products.

The speed of Fibre Channel is its first and most obvious feature, offering data transfer rates of 100MB per second, or approximately 60,000 pages of text per second. Fibre Channel interconnects outperform even Ultra-SCSI in storage system communications and are 10 to 250 times faster than typical local area network (LAN) speeds today. In full duplex, Fibre Channel is capable of moving data in both directions simultaneously for a combined speed of 200MB, compared to simplex SCSI at a maximum of 40MB per second.

Fibre Channel systems are assembled from familiar types of components: adapters,

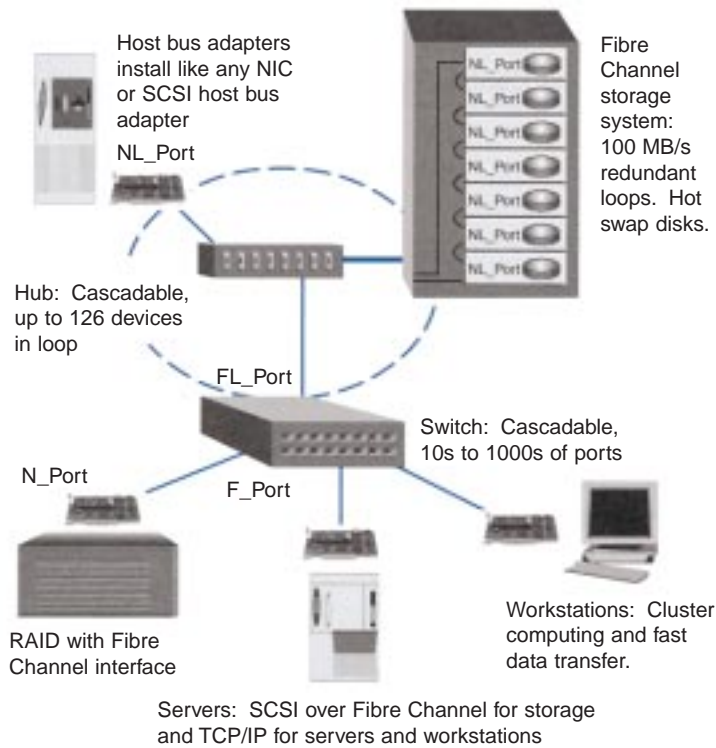
hubs, switches and storage devices. Host bus adapters are installed in computers and servers in the same manner as a SCSI host bus adapter or a network interface card (NIC). Hubs link individual elements together to form a shared bandwidth loop. Fibre Channel switches provide full bandwidth connections for highly scalable systems without a practical limit to the number of connections supported (16 million addresses are possible). See Figure 1.

## WHAT IS FIBRE CHANNEL BEING USED FOR TODAY?

Fibre Channel technology is already providing solutions across a wide spectrum of industries and applications. Some of the current applications may strike the observer as not surprising, such as Storage Area Networks (SANs), while other applications such as audio-video, editing and broadcasting may at first glance seem less likely.

Possibly the most active application space for Fibre Channel today is storage

Figure 1: Fibre Channel Systems Are Built From Familiar Elements



area networking. Often referred to as “the network behind the server,” a SAN is a high-speed network, linking one or more servers to one or more storage devices. SANs with Fibre Channel are providing unprecedented improvements in fast access to stored data while reducing server loads and increasing topological flexibility.

In another leading application, broadcast audio and video are rapidly moving to an all-digital format. See Figure 2. Due to high bandwidth requirements of digital media and the common practice of editing between remote groups, Fibre Channel networks are increasingly being called upon to support fast file transfers and audio/video stream transfers.

Fibre Channel has even found its way into professional sports. The Kansas City Chiefs football team uses a Fibre Channel network to rapidly edit videotapes from the Chiefs’ games. In creating replays of alternate scenarios for the coaches, the use of Fibre Channel reduced typical editing time from nine hours to 15 minutes.

#### GETTING STARTED WITH FIBRE CHANNEL

So, where does the network and systems professional begin with a Fibre Channel implementation? The flow of stored data to users is the lifeblood of the network and is often constricted by current SCSI-connected storage systems. A good place to look for the initial benefits provided by upgrading to Fibre Channel is in the connections to data storage units.

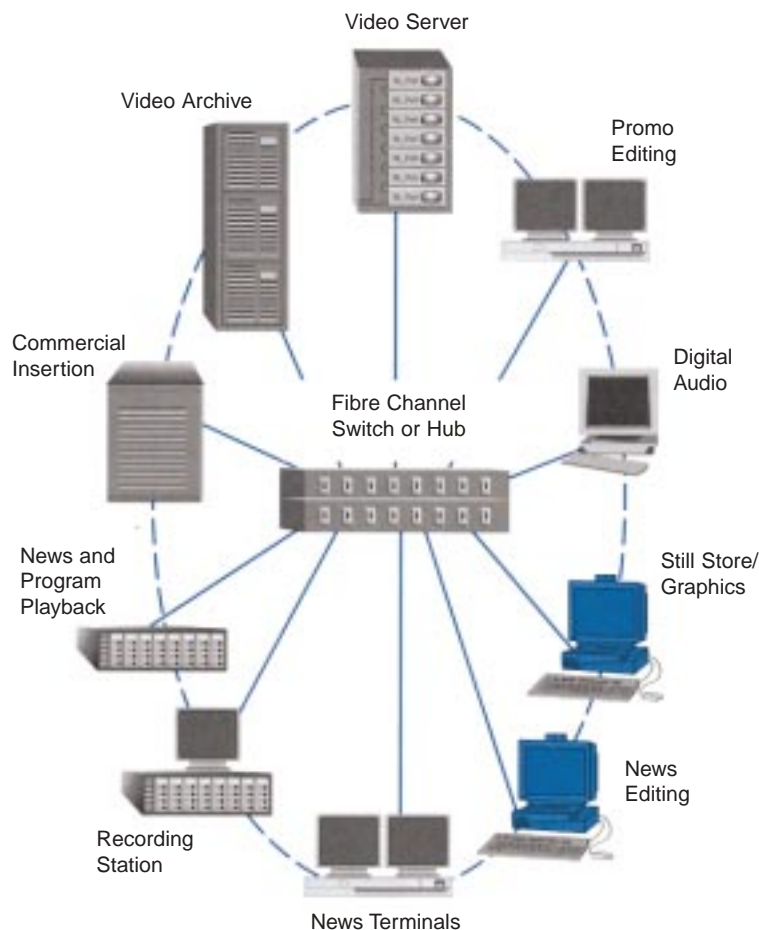
The need to upgrade from SCSI-connected to Fibre Channel-connected storage is typically driven by shortcomings in one or more areas:

- ◆ data transfer speed
- ◆ access latency
- ◆ cabling distance between network and hardware nodes — SCSI cabling is short and cumbersome
- ◆ connectivity — the number of drives or RAID systems that can be connected to a single SCSI bus is limited to 16 units
- ◆ all of the above

A basic Fibre Channel solution for overcoming SCSI system limitations involves three components:

1. a Fibre Channel host bus adapter with a software driver for the server operating system

Figure 2: Fibre Channel Makes the Digital Newsroom Practical



Three factors — speed (or “performance” as categorized below), distance and connectivity — typically drive the need for a system upgrade. Fibre Channel addresses these problems, and from that starting point, all the other advantages of this new connectivity standard come into play. From all these considerations, I have compiled a “Top 10 List” of Fibre Channel benefits:

**1 Performance Improvement:** As previously emphasized, Fibre Channel is fast; the speed of Fibre Channel is inherent in the standard. Fibre Channel’s fast data transfer speeds and low overhead also facilitate lower system latency (the computer’s response time from request to initiating actual data transfer).

**2 Reliability:** One of the major advantages of Fibre Channel is that it provides an inherently low error rate via a reliable data transport mechanism (Fibre Channel’s FC-2 Framing and Signaling protocol). The standard also assures the user of safe data delivery via an acknowledgment of receipt. Further, it is a very robust solution. If a cable breaks, a disk drive stops, or the power goes down to one of the disk controllers, Fibre Channel will recover when power or connections are restored, without the loss or corruption of any data.

**3 Enhanced Connectivity:** As previously mentioned, SCSI is limited to 16 connections per SCSI bus. In a loop topology, Fibre Channel can go up to 126 connections and an amazing 16 million connections are possible in mixed switched and looped environments.

**4 Flexible Topology:** Fibre Channel’s smooth, fast enterprise-wide operability is facilitated by its ability to function in a variety of topologies, including point-to-point, loop and switched. See Figure 3. Fibre Channel can be used with a point-to-point connection, for instance, to effect a dedicated connection between a server and a RAID system. In a looped network configuration, Fibre Channel provides a low-cost method for allowing multiple devices to share gigabit bandwidth. And, a Fibre Channel switch (or “Fabric”) can be employed in switched topologies. Finally, Fibre Channel functions with equal efficiency in an environment with a mix of topologies.

**5 Distance:** One of the major advantages of Fibre Channel is that you are replacing (in the case of connections to storage) a SCSI cable and its limited distance capability with a long distance copper or fiber optic cable. SCSI cables are about the diameter of a person’s index finger. So, you are replacing a bulky cable with smaller,

more flexible connections about the size of the cables that connect your stereo components at home.

The distance capability also impacts availability and reliability in that it permits very high-speed back up to a remote site and facilitates disaster recovery.

**6 Centralized Storage Management:** One of the major challenges facing network professionals today in the distributed computing environment is that storage units can be located throughout the enterprise, increasing IT support costs, creating a back up problem and making timely distribution of software an ongoing problem. Distributed storage also wastes disk resources.

With the installation of a centralized storage solution using Fibre Channel, network administrators can physically consolidate storage units to multiple remote site users with no degradation in data access, convenience or speed.

**7 Multi-Protocol Capability:** In addition to topological flexibility, SCSI, TCP/IP, video and raw data can all take advantage of high-performance Fibre Channel technology. Significantly, Fibre Channel can handle both networking (TCP/IP) and peripheral input/output (specifically storage — SCSI) communication over

a single channel. This results in fewer I/O ports and fewer unique ports — the traditional bottleneck of other server connection technologies.

**8 Interoperability:** Fibre Channel networks have been demonstrated to function across multiple operating systems and multiple platforms.

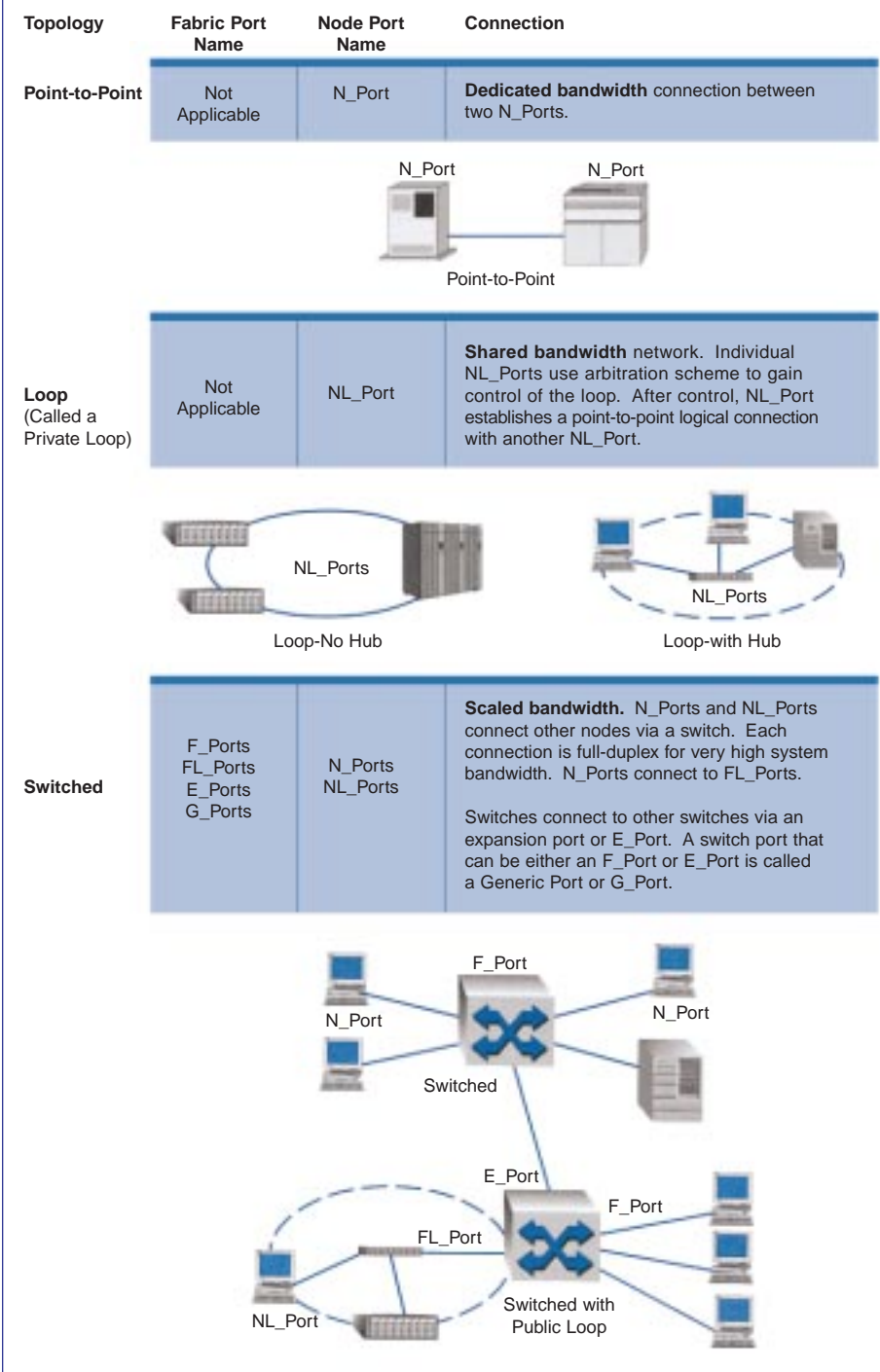
**9 Clustered Networks:** Due to the speed and simplicity of the Fibre Channel standard, clustered networks of servers are possible. Load sharing among the servers can be implemented, allowing the system to dispatch tasks to idle units and put unused compute cycles to work.

Fibre Channel also enables the network and system administrator to cluster relatively inexpensive servers. Working together at very high speeds, the clustered network can emulate the performance of a super computer.

**10 Open Standard:** Finally, Fibre Channel is an ANSI open standard that is supported by products from more than 150 companies. There is no shortage of products and services available to achieve desired results.

## The 10 Benefits of Fibre Channel

Figure 3: Fibre Channel Topologies



a server is less than 30 meters, then copper cabling is an acceptable, low-cost choice. If the distance exceeds 30 meters, or if you want the ability to scale upward in distance at a later time, then fiber optic cables should be employed. Relatively inexpensive connections with multi-mode fibers permit transmission to distances of 500 meters, while use of long wave lasers and single mode fibers allows transmission distances of 10 kilometers.

**Fibre Channel is much more than a serial SCSI replacement. The network administrator can take advantage of Fibre Channel's flexible topologies using point-to-point connections, shared bandwidth loop connections through hubs, switched connections for full bandwidth transmission, or a mix of the three connection topologies within the same network.**

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#### WHAT'S NEW IN FIBRE CHANNEL?

In addition to the increasing acceptance of Fibre Channel as the connection of choice for storage device-to-network servers, a number of new products and developments promise to extend the applications where Fibre Channel is being utilized:

2. a storage subsystem such as a RAID or just a bunch of disks (JBOD) with a Fibre Channel target controller
3. an interconnecting cable

Fibre Channel host bus adapters are available from a number of manufacturers with SCSI software drivers for common operating systems. Disk storage cabinets that accept Fibre Channel disk drives, as

well as cabinets for SCSI drives with a Fibre Channel-to-SCSI bridge built into the cabinet are also readily available.

Fibre Channel operates via both copper and fiber optic cables and selection depends on the distance to be spanned by the cable. The network administrator needs to determine how many RAID systems will be connected to how many servers and what the distance is between them. If the distance between a RAID system and

## Cost Comparisons

A recent survey of IT managers found that reliability and performance rank in first and second place respectively as the most important factors for implementing Fibre Channel, while price ranked in fifth place. No single measure exists that can be applied to all networks to determine the cost-effectiveness of Fibre Channel as an upgrade option. So much depends on individual applications.

In terms of dollars per bandwidth, I have found that an NASI (NetWare Asynchronous Service Interface) port costs \$1,500 and runs at 155MB per second, or \$10 per MB per second. A Fibre Channel port, meanwhile, is also priced at about \$1,500 and runs at 800MB per second. So, in terms of transport the cost using Fibre Channel drops to about \$1.60 per MB per second.


However, this is only a “snap-shot” of one aspect of network performance. Network and systems professionals, then, must look at the parameters of their individual application to determine the true value of Fibre Channel to an organization, factoring in high availability and speedy, reliable delivery of mission-critical data throughout the enterprise.

- ◆ The introduction of new switch products (“Fabrics” as they are known in Fibre Channel terminology) from a number of vendors offer a wider range of capabilities and costs. In particular, there are several new and very good low-cost entries. Relative to this, a significant advance is the availability of FL\_Ports, or Fabric Loop Ports, allowing shared bandwidth loops to be connected to switches.
- ◆ Managed switch and hub products provide network managers with remote configurability and status monitoring that can be integrated with existing network management tools.
- ◆ Switch-capable, Fibre Channel Class 2 (guaranteed delivery) communication software for host bus adapters and targets, which extends high reliability data delivery to large SANs.
- ◆ As mentioned previously, audio-visual companies, including some TV networks, are currently discovering Fibre Channel for digital media production, editing and transmission.

## THE FUTURE OF FIBRE CHANNEL

Fibre Channel technology is constantly improving transport capabilities while maintaining compatibility with existing Fibre Channel implementations. Near-term future developments include the following:

- ◆ Fibre Channel has a growth path specified by the standard at two and four times the currently available 1.063Gbit/second speeds to meet the needs of new higher speed processors.
- ◆ The multi-protocol capability of Fibre Channel will blur the boundary between the SAN and the client network, which is already beginning to occur in the areas of digital media production, editing and broadcasting.
- ◆ Products that support Fibre Channel Class 4 (providing guaranteed bandwidth allocation for specific users) will be introduced soon.
- ◆ Fibre Channel solutions will continue to be installed and supported routinely by system integrators.

Taking into consideration the “Top 10” benefits as presented in the accompanying sidebar as well as future capabilities, Fibre Channel is in position to become the dominant interconnect standard for the early part of the next century. 

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*Terry M. Flanagan, president and CEO of Jaycor Networks, Inc., San Diego, Calif., has led the development of Fibre Channel products since 1991. From 1977 to 1995, he marketed and managed electronics programs at Jaycor, becoming senior vice president of the Systems Development Group in 1992.*

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