

Fibre Channel—the Standard for Modern Computer Connection Systems

Rodney Taylor
Fibre Channel Systems, Inc
P.O. Box 1596, Culver City, CA 90232

Today's challenge for computer systems designers and integrators is to provide an economical system capable of meeting the information exchange demands of the modern user.

Introduction

Information interconnection and data communication, rather than CPU performance, are now the bottleneck of many application problems. This is true for a diverse range of applications from commercial video production and storage, remote real-time backup, and on-line transaction processing to military command and control, real-time data collection, and signal and image processing. Today's computer technology is impressive with processor clock speeds approaching 300 MHz; low cost multi-gigabyte disk drives; and graphics coprocessors or multimedia subsystems as standard equipment. Missing in today's systems is a low cost and high performance connection technology. There is enormous incentive to both end users and suppliers to identify a connection technology with the performance and flexibility to address modern challenges. Such a technology would boost productivity to the end user through better network communications between workers and through faster peripheral access. To integrators it would provide added value and product differentiation with only a small increase in systems cost. A standardized, high performance, and well accepted connection technology will enable modern processing systems to meet future challenges.

Fibre Channel — a standard-low cost gigabit link technology — bridges the gap between high performance processor systems and modern applications with demanding data and user connectivity requirements. Fibre Channel enables true networked computing and distributed connection

between processors, peripherals, and input/output components. Fibre Channel technology can be applied equally well to server or clustering systems, networked storage systems, and imaging and graphics systems. It is also an ideal solution for many real-time data collection or control applications as well as real-time image and data processing systems; particularly those requiring distributed processing architectures.

What Is Fibre Channel

Fibre Channel is a connection technology that provides a balanced interconnection system with the combined features of a channel and network. A channel is typically a point-to-point connection between communicating devices, such as a processor and peripheral, designed to transmit data at the highest possible rate with low latencies. A network is an aggregation of distributed nodes, such as workstations, servers, and peripherals with its own protocol that supports interaction among these nodes. While a channel provides guaranteed communication bandwidth it is somewhat restrictive about system topologies and configurations. A network, on the other hand, allows greater flexibility at reduced performance since each node must compete for communication bandwidth. Fibre Channel supports point-to-point, switched, and loop connections as well as several classes of data delivery that provide guaranteed bandwidth, guaranteed delivery, or connectionless circuits. In other words, it combines the features of a channel and network to produce a system with great flexibility and maximum performance at economical prices.

Fibre Channel Performance

Fibre Channel's performance may be best illustrated using a simple example. One hour of uncompressed video takes about 41 GBytes (41,000

MBytes) of storage space. Listed in table 1 are the transfer times, in minutes, it would take to move this data from one place to another using various transfer methods.

The Fibre Channel standard (ANSI X3.320-1994) specifies full speed links at 1.063 Gb/s, half speed links at 531 Mb/s, and quarter speed links at 266 Mb/s for unidirectional transfer rates of 100, 50, and 25 MBytes/s respectively. Furthermore, Fibre Channel links are full duplex so simultaneous bidirectional communication is supported. This means that a single full speed link can transmit

years away, but it is likely to adopt Fibre Channel as the transport mechanism. Most promising for Fibre Channel is that nearly all major hard drive manufactures have adopted Fibre Channel Arbitrated Loop (FC-AL) as the standard interface on many new high performance disk drives. This fact alone insures that Fibre Channel will become the dominant connection technology on mid-range and high-end file servers, compute servers, and networking systems.

Financial and Market Data

Dataquest² called Fibre Channel the fastest growing interconnect standard to date. Another marketing and opportunities report³ predicts that the Fibre Channel market may reach \$10 billion annually — and could be as high as \$18 billion annually — by 2000.

Transfer Method	Transfer Rate (MBytes/s)	Transfer Time (minutes)
100 MBytes	100	0.01
50 MBytes	50	0.02
25 MBytes	25	0.04
10 MBytes	10	0.10
5 MBytes	5	0.20
2.5 MBytes	2.5	0.40
1 MByte	1	0.80
0.5 MByte	0.5	1.60

data at a combined rate of 200 MBytes per second. Several transmission media are supported depending on link speed and distance. Information may be transported over shielded twisted pair copper and coax cable as well as single- and multi-mode optical fiber cables.

Compatibility

The Fibre Channel Specification defines upper layer protocols that connect Fibre Channel services to other standard protocols. In other words, protocols such as serial SCSI, Intelligent Peripheral Interface (IPI Disk/Tape protocols), HIPPI, ATM AAL5 are supported as part of Fibre Channel. Internet Protocols (IP 802.x) are specified as a subset of Fibre Channel and many vendors have Fibre Channel to IP bridges and routers under development. Additionally, the *Gigabit Ethernet Alliance* is drawing on Fibre Channel to define the next generation Ethernet¹. Gigabit Ethernet is several

Industry acceptance of Fibre Channel has been rapid and broad. Many major hard drive and controller manufacturers (Seagate, Conner, WD, HP, IBM, Emulex, Fujitsu, and Quantum) have adopted Fibre Channel as the interconnect standard on their high performance drive lines. Several manufactures are shipping drives now and most will have drives available by 1997. Currently, a large number of companies are manufacturing or developing Fibre Channel physical media chips. These include ATT, AMCC, Cypress, HP, IBM, National, Triquint, Vitesse, LSI Logic, VLSI, Methode, Finisar, and others. With rapidly increasing demand for Fibre Channel products and a rush by suppliers to capitalize on this demand, current pricing is affordable and costs are falling rapidly. This is a example of demand by high-end PC integrators and suppliers forcing price competition to the advantage all developers.

Emerging market opportunities for Fibre Channel switches, routers, and hubs as well as bridges between Fibre Channel and other network standards are rapidly being addressed by many companies. Adapters between Fibre Channel Arbitrated Loop (serial SCSI) and Fast SCSI or SCSI-40 are available now. Many parallel processing, data acquisition, and high-end embedded controller systems are moving quickly to adopt Fibre Channel for inter-processor and processor-to-peripheral

communications and nearly every branch of the military is using Fibre Channel in new system developments. Boeing and other aircraft companies are conducting internal R&D programs to evaluate Fibre Channel for commercial and military avionics usage. It is clear from its enthusiastic acceptance and rapid growth that Fibre Channel provides a solution for a wide range of application problems; it may be the solution to your connection problems.

Conclusions

Fibre Channel bridges the gap between modern high performance computers and application requirements. Data communications (datacom) and telephone communications (telecom) are merging to produce a new information culture. Information demands have increased so that data requirements of hundreds of megabytes, even gigabytes, are common, and the requirement for terabytes is not far off. Fibre Channel is the connection between computes, networks, storage resources, and peripherals; it moves data to where it needs to go — the user. It is a technology with the scope to merge datacom, telecom, networks, and video within the context of a single system. This increases performance, increases flexibility, and simplifies networking services within an enterprise. Since networks, servers, and clustering are so important to many businesses an increase in communication performance translates to increased productivity and profits.

The payoff from Fibre Channel is enormous: business benefit immediately from higher performance data communications through faster online transaction processing, remote real-time backup, file and compute serving. They also benefit from enhanced services such as integrated voice, data, video over the same media. Smaller businesses benefit equally well from high performance communications through enhanced data bandwidth and more efficient sharing of expensive computer resources and peripherals.

For more information about Fibre Channel or our Fibre Channel products, please contact:

DSP, Fibre Channel Systems, Inc.
P.O. Box 1596
Culver City, CA 90232
(310) 838-8308 Fax (310) 280-0697
email: 76231.3421@Compuserve.com

² Fibre Channel Marketing and Opportunities. Dataquest (1994).

³ Fibre Channel 96. emf Associates and AP Research (1996).

¹ Apt Data Services (UK), 1996