# Agilent 2 Gb/s Fibre Channel Solutions for Storage Networking



Semiconductor Solutions for the Connected World

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# Agilent 2 Gb/s Storage Networking Solutions

With ever increasing storage needs and data transmission rates, storage networking systems are under increasing pressure to deliver higher performance. Today, 2 Gb/s Fibre Channel systems are needed to keep pace with increasing demands on corporate data centers.

As a pioneer of the Fibre Channel protocol, Agilent provides the industry's broadest suite of 2 Gb/s solutions. We deliver protocol ICs, fiber-optic transceivers, physical-layer ICs, software drivers, and integrated, host bus adapter HBA products for the leading server and storage companies worldwide. Agilent's logic-to-light solutions offer the most complete line of storage network solutions for maximizing performance and interoperability.



Agilent Technologies is a leading provider of innovative technologies for communications and life sciences. Agilent delivers a wide range of solutions and services, including semiconductors, test and measurement, and chemical analysis, for the leading corporations around the world.

Agilent's communications solutions include leading-edge semiconductor products, test, monitoring, management, and sub-systems for optical and wireless systems and networks. Agilent has an extremely broad range of technology and system expertise to help customers stay ahead in the fastmoving communications industry.

Agilent's semiconductor solutions for the connected world include fiberoptic and IC products for networking, radio frequency and infrared devices for mobile communications, image sensors and processors for cameras and optical computer mice, storage area network devices and subsystems, and application specific ICs for select networking and imaging applications.

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**Protocol ICs** 

Agilent's Tachyon Fibre Channel controllers are the market leaders, commanding a market share estimated at well over 50 percent. Tachyon ICs have become the industry's most popular Fibre Channel controllers because of Agilent's proven finite state machine (FSM) architecture (see sidebar). Unlike other RISC-based Fibre Channel architectures, Agilent's FSM scales proportionately with system CPU resources to avoid performance bottlenecks associated with on-chip processors.

The 2 Gb/s Tachyon XL2 ICs require no external SRAM, reducing cost, power, board space, and design complexity. In addition the FSM architecture uses hardware automation – a fast method of managing I/O operations – to execute the Fibre Channel protocol and SCSI command operations.

In addition, the entire Tachyon family features an open architecture – in both hardware and firmware – that is more user-friendly and versatile than typical RISC-based solutions. The Tachyon Software Development Kit (TSDK), which features fully-commented C source code, is available at no charge to developers seeking quick time to market for their products. Agilent Tachyon 2 Gb/s XL2 requires no external memory, reducing cost, power, board space and design complexity.

#### **Tachyon XL2 Controller Features**

- Single-chip PCI-to-FC solution
- 32-bit/64-bit, 66 MHz PCI backplane
- •2 Gb/s / 1Gb/s integrated transceiver and external SERDES interface (High Speed Parallel Interface)
- No external SRAM required
- •FC-AL-2 compliant
- BIOS support
- Supports inbound frame buffers for eight 2 KByte (payload) frames
- Full 8-bit data parity protection
- Ability to send High Priority frames
- Hardware support for Class 3 and Class 2 (ACK\_0 and ACK\_1 model)
- Enhanced SCSI (FCP) hardware assists
- Secondary Port Interface for control (optional)
- Supports all FC topologies (point-to-point, loop, and fabric)
- Multiple outbound and inbound sequence support
- Tachyon Product Software Developer's Kit (TSDK) available
- SAN interoperability

# FSM Architecture

A Finite State Machine can be thought of as a customized microcontroller, cycling through a hardcoded execution path. Inputs to the FSM allow it to make branching decisions, and since branches are hard-coded, no code fetching performance penalties are introduced. An FSM output allows it to control surrounding data-path and control logic, and to communicate status and commands to other FSMs.

FSMs make all decisions and execute commands once in each cycle. A single FSM running at 66 MHz executes at an equivalent rate of 66 million instructions per second. Tachyon protocol chips contain over 30 significant master and slave FSMs, enabling over 1 billion instructions per second. This processing power provides the performance foundation for the Tachyon ICs.

FSM-based Fibre Channel controllers function at many different levels. They manage data words at the FC-1 layer; frames, sequences and exchanges at the FC-2 layer; and protocol mappings at the FC-4 layer. For maximum performance, both inbound and outbound channels must operate independently. The Tachyon FSM architecture is ideally suited for this multi-level concurrent operation, as no portion of the chip ever needs to wait on other portions unless required by the protocol itself. Furthermore, an FSM architecture handles I/O control and data movement concurrently, increasing parallelism and overall performance.

#### **New Dual-Channel Tachyon DX2**

**Agilent Tachvon DX2** 

provides 2 Gb/s,

control with one

"bridges." It also

memory, reducing cost, power and

board space.

requires no external

Agilent

Tachyon DX2

dual-channel

chip and no

Agilent has recently announced the industry's first dual-channel 2 Gb/s controller, the Tachyon DX2. The Tachyon DX2 essentially combines two of Agilent's 2 Gb/s single-channel controllers into one chip with no increase in chip size, no reduction in performance, and no compromise in functionality. No other solution can deliver this functionality in less than three chips (see chart below). Each channel is completely independent and does not rely on the other channel for any of its functionality. This allows a single Tachvon DX2 to perform unique functions on each channel. For example, one channel can be the target on a RAID controller while the other can be an initiator to the disk drives.

The Tachyon DX2 dramatically reduces the size, cost and complexity of HBAs, disk arrays, and embedded systems that it empowers. It operates with either 1 Gb/s or 2 Gb/s Fibre Channel components, and interfaces directly to 33/66 MHz PCI or 50/100/133 MHz PCI-X backplanes with both 32 and 64-bit support. The integrated DX2 controller eliminates the need for bridges and their associated interoperability problems. It also provides a simple, efficient way to implement failover protection. The Tachyon DX2 offers full backwards compatibility to Agilent's line of 1 and 2 Gb/s single-channel controllers, protecting investments in existing legacy systems.

Table 1. Devices required for 2 Gb/s dual-channel Fibre Channel interface solution – Agilent vs. competition. Agilent's Tachyon DX2 is the market's only single-chip solution

	Competitive Solutions				
	A	В	C	D	Tachyon DX2
Protocol engines	1	2	2	2	1
Processor				2	
SRAM	1 – 2	2		2-4	
FLASH memory	1	2	2	2	
SerDes			2	2	
Total chips required in solution	3 – 4	6	6	10 – 12	1
Total required chip area (in.2 )	3.1	5.4	6.2	10+	2

#### **Tachyon DX2 Features**

- Dual channel Fibre Channel operation on a single chip for the lowest overall FC solution costs
- •Dual function industry standard 33/66 MHz PCI or 50/100/133 MHz PCI-X backplane interface with 32/64 bit support
- Full duplex operation for each channel
- Concurrent channel operation at full link rate
- •1 and 2 Gb/s Fibre Channel operation support via internal transceiver or external HSPI-compatible transceivers (SerDes)
- •3.3 V PCI/PCI-X I/0
- Compliance to PCI Local bus Specification, Rev 2.2
- •MSI (Message Signaled Interrupt) support
- Compliance to PCI-X Addendum, Rev 1.0A
- PCI/PCI-X hot plug compatible
- Output impedance control on PCI-X I/O for point-to-point or multi-point connectivity
- Signaling to indicate the channel that is mastering transactions on PCI-X
- Eight GPIO pins per channel
- Loss of signal indication (per channel) during internal SerDes mode
- Multiple split read transaction support on PCI-X

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#### 2 Gb/s Fiber-Optic Transceivers

Agilent is the number one supplier of fiber optic transceivers in the world. As part of the industry's only complete physical layer solution for Fibre Channel, our new 2 Gb/s pluggable and pin through-hole smallform-factor fiber-optic transceivers allow designers to implement a wide range of SAN solutions from high-end switching systems to high-speed peripheral interfaces. The pluggable transceiver's "hot-plug" capability supports configuration changes or maintenance without having to power down the system. Designed for multimode applications up to 300 meters, the 3.3 V device complies with both the 1 Gb/s and 2 Gb/s Fibre Channel standards.

> Agilent's 2 Gb/s Fibre Channel transceivers provide "hot-plug" capability for maximum flexibility and availability. Agilent's 2 Gb/s SerDes and port bypass ICs are part of the industry's only complete 2 Gb/s Fibre Channel solution.

#### 2 Gb/s Fiber-Optic Transceiver Features

- Compliant with 2.125 GBd Fibre Channel FC-PI standard
- FC-PI 200-M5-SN-I for 50/125 mm multimode cables
- FC-PI 200-M6-SN-I for 62.5/125 mm multimode cables
- Compliant with 1.0625 GBd VCSEL operation for both 50/125 and 62.5/125 mm multimode cables
- Industry standard Small Form Pluggable (SFP) or Small Form Factor (SFF) package
- LC-Duplex connector optical interface
- Link lengths at 2.125 GBd:
  0.5 to 300 m 50/125 mm MMF
  0.5 to 150 m 62.5/125 mm MMF
- Link lengths at 1.0625 GBd:
  0.5 to 500 m 50/125 mm MMF
  0.5 to 300 m 62.5/125 mm MMF
- Reliable 850 nm Vertical Cavity Surface Emitting Laser (VCSEL) source technology
- Laser AEL Class I (eye safe) per: US 21 CFR (J) EN 60825-1 (+All)
- Single 3.3 V power supply operation

#### **Physical Layer ICs**

To complete our physical layer solution, Agilent provides 2 Gb/s port bypass circuits and Serializer/ Deserializer (SerDes) chips. The SerDes products convert 10-bit wide parallel data to and from a serial data stream. Port bypass circuits allow users to bypass or replace individual disk drives without powering down the entire system, especially important in mission-critical storage networking applications. Agilent is the industry leader in physical layer circuits for Fibre Channel applications.

Agilent's new quad port bypass circuit is the first chip of its kind targeted at 2 Gb/s SAN applications. Designed to minimize part count and reduce cost, the HDMP-0552 simplifies the migration from 1 Gb/s to 2 Gb/s designs by supporting both data rates with the same reference clock. The device's "CDR (Clock and Data Recovery) Anywhere" technology gives designers the flexibility to place the CDR after any point in the Fibre Channel loop.

The Agilent HDMP-2630 and 2631 are the first SerDes ICs capable of supporting both 1 Gb/s and 2 Gb/s data rates. Designers can set the transmit channel to a different data rate than the receive channel to support auto-negotiation.



#### 2 Gb/s Fibre Channel Host **Bus Adapters**

Agilent's Host Bus Adapters (HBAs) offer integrated Fibre Channel solutions for servers and storage systems. Building the entire solution from its own suite of Fibre Channel components, Agilent offers unparalleled value, performance, and reliability. Today Agilent is delivering price/ performance leading 2Gb/s HBA solutions with an unmatched 57,000 input/output operations per second and 194 MB/s throughput.

Agilent's 2 Gb/s HBAs are available with both fiber-optic and copper cable connections. For applications where performance and reliability are critical, Agilent offers a Small Form Factor (SFF) pin through-hole LC optical transceiver for use with multimode optical cable. For costsensitive applications, Agilent offers both a High Speed Serial Data Connector (HSSDC) interface for copper cabling and a receptacle for a Small Form Factor Pluggable (SFP) LC transceiver. The SFP option allows customers to upgrade to optical media as their applications change to higher performance requirements.

Agilent's 2 Gb/s HBAs offer drivers for Microsoft® Windows® 2000. Windows NT® , Linux. For 64-bit applications, Agilent provides drivers for Windows<sup>®</sup> 2002, Linux and AIX 5L. Agilent's drivers also support the Storage Networking Industry Association (SNIA) application program interfaces (APIs) for storage management applications.

#### 2 Gb/s Fibre Channel Host Adapter Features for HHBA-5220 and **HHBA-5221**

- Fibre Channel data transfer rates:
- up to 200 MB/s (Half duplex)
- up to 400 MB/s (Full duplex)
- Two physical interface styles
- HHBA-5220: Standard HSSDC copper connector and Small Form Factor Pluggable (SFP) LC optical transceiver
- HHBA-5221: Small Form Factor (SFF) LC optical connector
- BIOS Support, EFI Support
- Auto-negotiation 1 or 2 Gb/s
- •2 Gb/s LED link speed indicator
- Supports Fibre Channel Arbitrated Loop (FC-AL) including Public Loop and Fabric (F- and FL-port login)
- •FC Class 2 and 3
- •64-bit, 66 MHz Universal PCI interface (2.2 compliant)
- Compatible with IA-64 processors



provide industry leading price/performance.

#### 2Gb HBA Performance Comparison











Graph 1 through Graph 4 show the results of a database simulation. Graph 5 and Graph 6 show audio/video server simulations.

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#### Find out more

Agilent is the leader in 2 Gb/s semiconductor solutions for storage networking applications. We leverage our protocol, HBAs, fiber optic, IC, and software technology expertise to deliver integrated products that speed time-to-market, reduce development efforts, and save money for our customers. We combine this rare capability with world class manufacturing, global sales and support, and uncompromising service. Agilent components and HBAs are essential ingredients in today's leading-edge storage networking equipment, and we have the broadest range of technologies to deliver solutions for all the major architectures of tomorrow.

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