Smooth Scaling to Two-Gigabit Performance

QLogic provides a migration path for high-performance SANs

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The move towards 2-Gigabit Fibre Channel is underway. This paper explores the benefits of adding 2-Gigabit switches and other 2-Gigabit components to SAN fabrics while protecting the investment in a storage environment that is predominantly 1-Gigabit based. It also examines the impact of 2-Gigabit infrastructures on ease-of-use, performance, and reliability characteristics. Additionally, this paper presents performance results achieved by running configurations in QLogic's interoperability test lab that are consistent with early implementations of 2-Gigabit infrastructure components.

Legacy Device Protection

Installing a 2-Gigabit switch infrastructure with QLogic's SANbox2? is an excellent way to protect the investment in existing storage assets while maximizing ease-of-use, performance, and reliability. Because QLogic's SANbox2 automatically senses and manages the connection speed of each individual port, the 2-Gigabit switch also runs at 1-Gigabit speeds for components that are not 2-Gigabit capable. Storage managers can implement the SANbox2 immediately and add 2-Gigabit devices as needed without impacting current 1-Gigabit devices, ensuring high performance-ready SANs when new higher-speed devices are added to the SAN. Additionally, because of the superior SANbox2 switch design, significant performance gains can be achieved with existing 1-Gigabit storage devices.

The SANbox2-16 further protects existing investments with support for all private devices, both initiators and targets. QLogic enables customers to seamlessly migrate these devices, enabling them to integrate them into the public fabric or continue to operate them as private zones.

Fewer ASICS—Lower Cost, Higher Reliability

Another factor in the quick adoption of 2-Gigabit devices will be its lower cost. QLogic has been able to reduce the number of ASICs (Application Specific Integrated Circuits) required to build a 16-port switch. Only one QLogic ASIC is required for the SANbox2-16, while other switch vendors need as many as 16 ASICs per switch. This is a significant cost differential – a savings that's being passed on through the reduction in per port pricing.

Performance and Reliability

QLogic's SANbox2 is fueled by powerful advancements in ASIC design and fabrication to deliver significantly greater performance and reliability than previous Fibre Channel switch products. Integrating all 16 ports on a single ASIC—the only Fibre Channel switch vendor able to accomplish this technical feat—means QLogic can deliver industry-leading performance and reliability. With the SANbox2 switch, QLogic improves on the latency of its previous generation of products by over 50 percent, to less than 400 nanoseconds on a 2-Gigabit-to-2-Gigabit connection. Because of the innovative design, the SANbox2 switch performance never degrades or bottlenecks SAN performance, even when under the heaviest data traffic.

More Performance in Less Space

QLogic's SANbox2 delivers twice the connections in the same space required for the previous SANbox offering. The SANbox2 16-port model is only 1U high. By upgrading to the SANbox2, storage managers can double their device connections within the same footprint. And some configurations that previously required the interconnection of multiple chassis can now be implemented within a single chassis, reducing configuration complexity and preserving valuable rack space.

Multi-switch environments can also take advantage of QLogic's SANbox2 performance. The connections between switches, called the Inter-Switch Links (ISLs), now have double the bandwidth capacity, running at 2-Gigabit speeds. Therefore, the number of ISLs needed to support the throughput requirements is cut in half. The unused ISLs can now be used as I/O ports, greatly reducing the overall cost per port of multi-switch fabrics and returning more ports to the users. Loop devices also benefit from the switch's ability to perform True Address Translation. QLogic's Translative Loop mode provides for a heterogeneous SAN environment where both public and private devices can co-exist on the same SAN is fully supported on Sanbox2[1].

Scalability and Management

QLogic offers in- and out-of-band management capability, serial (RS-232) or Ethernet (RJ-45) access and is made simple with either the SANsurfer2™ Open Management System GUI or Telnet. Full compliance with all T11 Fibre Channel, Fibre Alliance, and IETF standards ensures seamless Fibre Channel interoperability and eases management in heterogeneous environments. Specifically, QLogic conforms to the latest T11 ANSI standards, FC-GS-3 and FC-SW-2 (including E_port and switch-to switch zoning). In addition, support for the latest Fibre Alliance MIB plus full SNMP compliance ensures interoperability with all third-party management applications.

The SANsurfer2 Open Management System is the industry's most intuitive GUI-based management system. It includes improved interfaces and eases the implementation of fabric zoning. The full Telnet stack, which also comes standard with the SANbox2, allows all GUI functionality to be performed remotely via the telnet interface, allowing the scripting of repetitive management functions.

SAN management is easy with auto-sensing, auto-negotiating, self-configuring GL_ports (E, F, FL and P ports) with the industry's most powerful and flexible loop support—SANbox FLS™ (Full Loop Support). Administrators can simply plug and play other switches, and private or public devices. The data rate (1 or 2 Gigabit per second) and port type are automatically configured. Regardless of the data rate, full fabric, loop (public and/or private) and switch-to-switch connectivity on all ports is completely supported.

Interoperability Lab Test Results

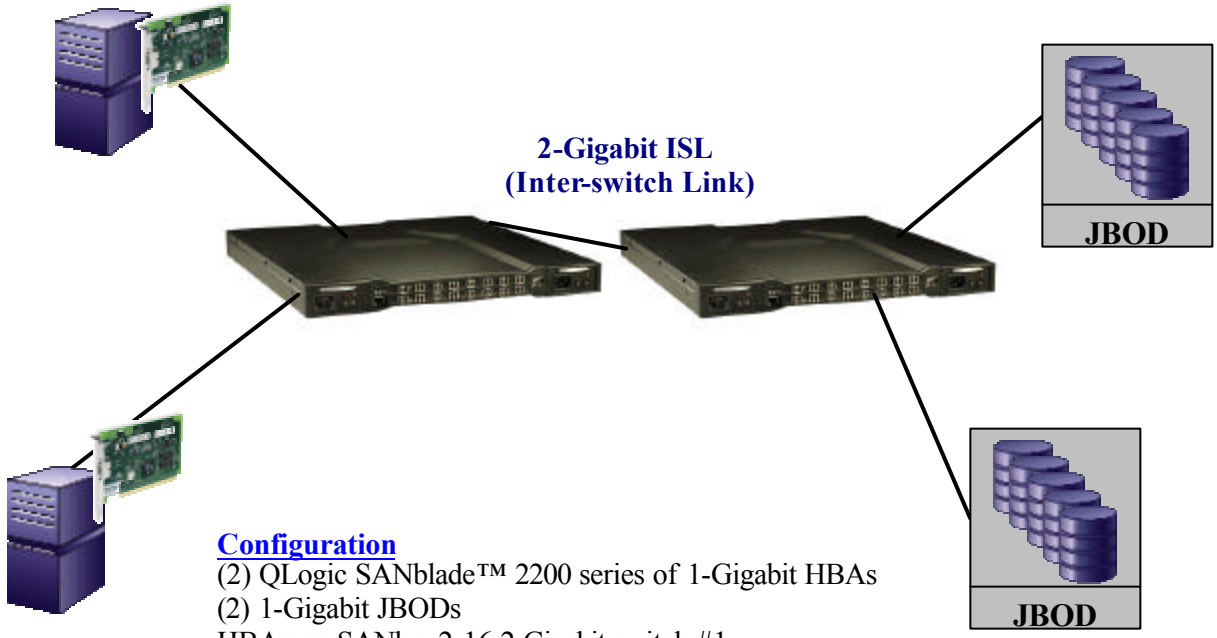
All the numbers in the various tests below were achieved in QLogic's interoperability lab under configurations expected in early 2-Gigabit environments.

[1] For further details, see "Reducing the Complexity of Managing Private Loops," Brent Knight, QLogic

Performance of 1-Gigabit in 2-Gigabit Environments

The following results confirm the SANbox2's ability to utilize multiple 1-Gigabit device connections through a single 2-Gigabit ISL and aggregate full bandwidth on the 1-Gigabit connections.

Read/Write	Block size	Number of I/O devices	Number of ISLs	Total throughput Mb/Second
Read	32 Kbytes	2 per chassis	1	185.55
Read	64 Kbytes	2 per chassis	1	189.32
Write	32 Kbytes	2 per chassis	1	179.29
Write	64 Kbytes	2 per chassis	1	180.70



Configuration
(2) QLogic SANblade™ 2200 series of 1-Gigabit HBAs
(2) 1-Gigabit JBODs
HBAs on SANbox2-16 2-Gigabit switch #1
JBODs on SANbox2-16 2-Gigabit switch #2
(1) 2-Gigabit ISL between switches
Each HBA reads off of one of the JBODs

Performance of 2-Gigabit Host Bus Adapters in the SAN

While many storage devices are not likely to be immediately upgraded to 2-Gigabit speeds, newer servers have the I/O capability to handle multiple connections at high bandwidth. These servers can take advantage of 2-Gigabit host bus adapters (HBAs). For example, by installing 2-Gigabit HBAs, such as QLogic's SANblade™ 2300 series in the servers, two storage connections can be aggregated with throughput rates of 190 Megabytes -- a performance increase of 2X. These high-powered server connections could be the answer for applications that continually push bandwidth limits, such as video editing and online transaction processing. Additionally, the number of instruction operations per second (IOPs) that can be pushed through the 2-Gigabit adapters is increased by a factor of 4X. The combination of the SANbox2 with the selective use of 2-Gigabit HBAs, gives storage managers the ability to move data at twice the current speed without negatively impacting other devices on the SAN.

The numbers below, achieved in QLogic's interoperability lab, confirm the performance enhancements derived by using QLogic SANblade™ 2300 series of 2-Gigabit host bus adapters in a 1-Gigabit storage environment.

Read/Write	Block Size	Disk Configuration	Total Throughput Mbytes/Second
Read	16 Kbytes	Two 1-Gigabit JBODs	177.59
Read	32 Kbytes	Two 1-Gigabit JBODs	185.66
Read	64 Kbytes	Two 1-Gigabit JBODs	189.28

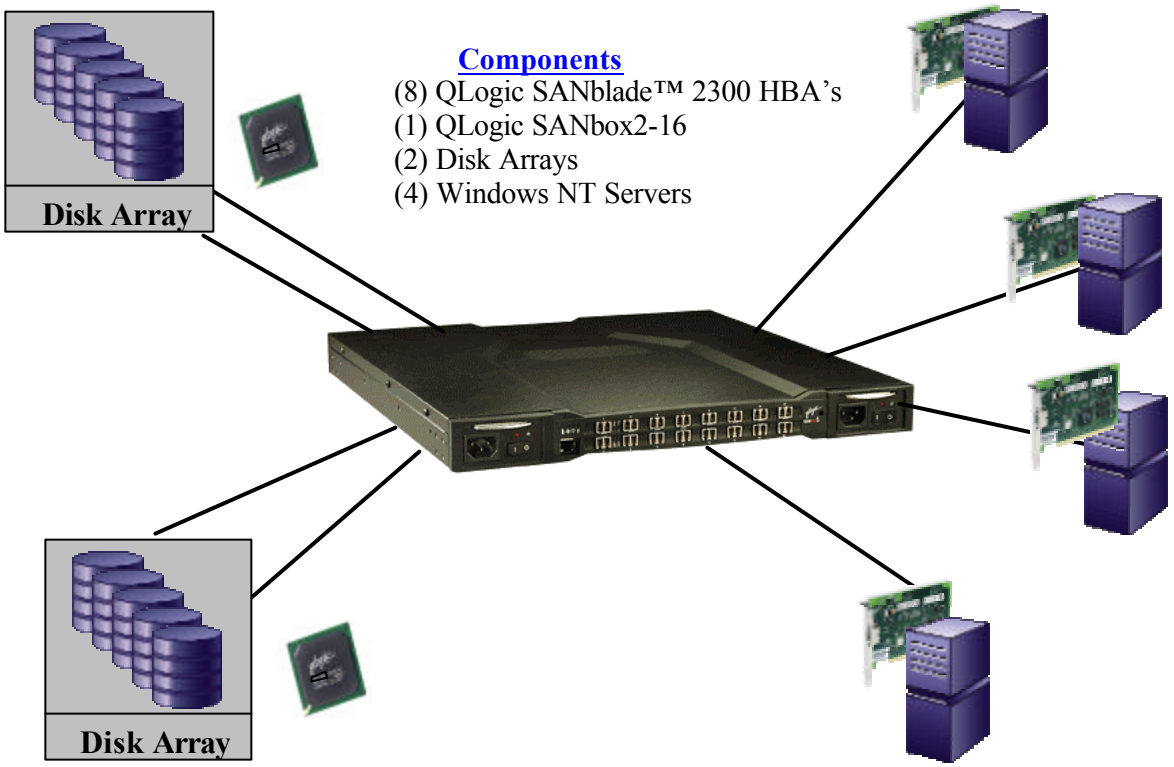
Performance of 2-Gigabit Disk Drives in the SAN

Adding 2-Gigabit drives to the SAN fabric increases performance, manageability and reliability. These drives can be added in a cost-effective manner in the form of JBODs, enabling private loop devices to run at full speed with only six drives. This allows for high-speed storage to be added in manageable increments. Additionally, since fewer devices have to be attached to the loop to drive it, the stability and manageability of the SAN is improved.

Adding 2-Gigabit storage devices delivers similar SAN benefits as adding 2-Gigabit HBAs to the new servers. These new devices can be added to an existing SAN and can be accessed at 2-Gigabit speeds by multiple servers that require higher speed access. This again gives the storage manager tremendous flexibility in applying new resources in conjunction with existing devices to solve throughput issues immediately. Additionally, the new storage devices should be able to provide storage to twice the number of servers at the same throughput rates as before.

Performance of 2-Gigabit High Performance SAN fabric

The biggest performance gain is realized when deploying QLogic-based end-to-end 2-Gigabit infrastructure in your SAN. The following test conducted in QLogic's interoperability lab illustrates the performance advantage of the SANbox2 over a 1-Gigabit switched SAN. You can expect 2X performance gains throughout the entire SAN. For high-speed data applications such as AV (Audio/Video), this configuration provides double the throughput of a 1-Gigabit SAN – a requirement for uninterrupted video streaming and real-time video editing functions. Other applications, like database access can realize the benefits of an end-to-end 2-Gigabit SAN with up to 4X performance gains. All of this is available TODAY from a single vendor and backed by a single support team providing a foundation for the fastest time to market.



	Sanbox2	Typical 1-Gigabit	Performance Gains
Bandwidth through a single channel	197 Mb/s	95 Mb/s	2X increase
Sustained bandwidth through 4 channels	788 Mb/s	<200 Mb/s	~4X increase
Transactions through a single channel	39,650	~10,000	~4X increase
Sustained transactions through 4 channel	158,600	~40,000	~4X increase

Summary

Even in SAN environments that contain predominantly 1-Gigabit components, a 2-Gigabit Fibre Channel switch and 2-Gigabit Fibre Channel HBAs can greatly improve current SAN performance and manageability as well as pave the way for future advancements.

In short, QLogic's SANbox2 switch delivers:

Investment protection, with auto sensing and auto managing of both 1-Gigabit and 2-Gigabit connections

Fewer ASICs for lower cost and higher reliability

Lowest switch latency in the industry

Double the port density in half the rack space

Ability to trade ISL ports for more user ports

Ease-of-management, especially zoning, with SANsurfer2

Double the performance, quadruple the transaction speed when using QLogic SANblade™ 2300 series of HBAs

Maximum I/O bandwidth on newer servers

By implementing QLogic's SANbox2-16 2-Gigabit switches and other 2-Gigabit devices today like QLogic's SANblade 2300 HBAs, the storage manager has the powerful flexibility of quickly adding bandwidth where it is most needed while maximizing the capability of the installed storage legacy.