



## **Data Center Storage Consolidation with 4Gb Fibre Channel (FC) SANs**

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### **Executive Summary or Abstract**

Storage consolidation with 4Gb Fibre Channel is a natural evolution for SANs and this document describes how the use of 4Gb FC infrastructure from NetApp and Brocade can improve storage consolidation and focuses on how deploying a next-generation 4Gb consolidated SAN can benefit organizations.



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## 1. Overview

Information is a dynamic force in the enterprise and the rapid acceleration in the amount of data being collected and generated at most companies requires a strategic approach to storage infrastructure. How information is stored, managed, protected and distributed directly impacts a company's success in lowering costs and accelerating revenues.

In many large enterprises, Windows® server applications have been proliferating rapidly, often becoming critical to business operations and requiring a highly reliable and simple-to-manage storage infrastructure that delivers maximum data availability. Rapid data growth and the lack of affordable, easily managed SAN solutions have resulted in many Windows servers with direct attached storage. The results are high administrative overhead costs, unreliable backup and restores, poor performance, inefficient storage utilization and unacceptable system availability.

The Windows environment with some customers is as extensive as UNIX® in the data center. Now, IT organizations must protect and manage their Windows applications and data as core corporate assets just like their UNIX environment.

NetApp and Brocade 4Gb data center SAN solutions provide enterprise-class SAN functionality for consolidating a mixed environment and offer a comprehensive suite of hardware, software and services to save money, increase data availability, and regain control of backup and recovery, as well as help prepare your environment for future requirements.

## 2. Storage Consolidation

There are many technical and business advantages to consolidating servers and storage with SANs. A SAN infrastructure enables any-to-any connectivity between heterogeneous server and storage systems. This allows much more efficient use of storage and server resources by consolidating widely distributed or underutilized resources into centrally managed environments and provides the following benefits:

- **Increased storage utilization**
- **Decreased storage capital expenditures** by enabling the purchase of storage on an "as-needed" basis
- **Increased administrative staff productivity** by managing more storage with fewer personnel
- **Reduced application downtime** and minimized business impact for storage upgrades
- **Simplified storage management** with centralized storage and server platforms
- **Lower cost of operation by using denser, energy efficient systems**

By enabling any-to-any server and storage connectivity via switches, SANs decouple dedicated devices and facilitate storage resource sharing. This cost-effective open systems approach enables SANs to help organizations grow their storage environments much more quickly because storage capacity can grow independently of server usage. This approach provides a high degree of efficiency in utilizing resources while simultaneously enabling growth without system disruptions and the selection of best-of-breed heterogeneous equipment.

Storage consolidation is the process of combining scattered storage resources into fewer centralized resources. A pre-consolidation environment might have hundreds of small storage subsystems throughout a building, and after consolidation might have a dozen located in the primary data center, even if the hosts using the storage are still spread out. This approach provides ongoing Total Cost of Ownership (TCO) benefits through improved manageability as well as a high Return on Investment (ROI) through direct cost savings. Storage Area Networks (SANs) built using hosts, Fibre Channel switches, routers, and storage systems are the primary enablers for this category of business solution.

### 3. Business Case for Storage Consolidation

Inherent in Storage Consolidation is the concept that many hosts will access a storage array via each interface. The ratio of hosts to storage interfaces is known as the “fan-in ratio”. When more hosts use each interface, the cost of storage goes down because fewer arrays need to be purchased. The main ROI benefit of storage consolidation comes through more efficient utilization of storage assets: fewer storage interfaces, less unused disk space, and fewer storage systems to buy, maintain, and manage.

Consolidation also allows administrators to work more efficiently, for example, by reducing the number of systems which require them to perform daily management tasks. In fact, the TCO and ROI benefits of storage consolidation are so straightforward and pervasive that storage consolidation accounts for or is at least involved with a very high percentage of the total SAN market today.

Enterprise can realize the following benefits by undertaking storage consolidation with NetApp and Brocade solutions:

- **Improved storage utilization** – by serving multiple applications from a single pool of storage.
- **Reduced management overhead** – through software automating common data management tasks.
- **Superior data protection** – through solutions that simplify backup and speed up recovery time.
- **High data availability** – with highly reliable, proven solutions.
- **Growth on demand, without disruption** - fast and easy expansion without interfering with business operations.

### 4. Impact of Changing FC Speeds

When Fibre Channel first entered the mainstream market, devices operated at 1Gb per second. A few years later, 2Gb FC technology became widely available. Because 1Gb FC and 2Gb FC were compatible, consumers had three options: they could stick with their 1Gb infrastructure, upgrade to 2Gb all at once, or upgrade over a period of time. Today, a similar situation exists with 4Gb. Some customers fall into each of these categories initially, but the majority eventually will end up in the third category. Staying on 2Gb technology in the long term will mean losing out on new features, as well as missing out on network performance.

Since 2Gb FC and 4Gb FC are compatible, a customer can plug new 4Gb acquisitions into 2Gb installed-base products. They will still have the functionality that would have been available if they had purchased a new 2Gb product, plus the benefits of new features on the 4Gb platforms. 4Gb switches from Brocade and 4Gb systems from NetApp have many enhancements. Some examples include:

- Improvements to traditional inter switch link trunking which allow up to 32Gbs (64Gbs full duplex) on a single trunk group.
- Enhancements to hardware zoning which allow more hosts to be zoned together with any given storage port.
- Hardware acceleration for many common fabric service operations, resulting in greater fabric stability and scalability.
- End-to-end interoperable 4Gb FC SANs that offer higher performance with no increase in price.
- Simple 4Gb field upgrades with the addition of a 4Gb target HBA.

When adding the 4Gb line rate and features to a consolidated SAN, or creating a new “green field” SAN with 4Gb, there are many advantages. The most obvious is that any 4Gb device attached to 4Gb switches will run up to four times as fast as its un-upgraded counterparts. Some environments might not need superior

performance today, but might be on a growth path towards needing it in the future. For these customers, deploying 4Gb technology today will provide substantial future-proofing against future performance needs.

However, some of the advantages of these high-performance networks which are specific to storage consolidation might be less obvious. For example, the enhanced zoning feature allows a higher fan-in ratio of hosts to storage ports while still maintaining full hardware enforcement.

Performance itself also affects fan-in. As mentioned before, the new 4Gb line rate is backwards compatible with the previous technology which means that users can choose to add 4Gb technology into existing environments, as well as having the option to replace 1Gb or 2Gb infrastructure entirely.

The expectation in the industry is that most customers will take a similar approach to the 1Gb to 2Gb migration: they will start buying 4Gb technology for all new purchases, and gradually upgrade old 1Gb and 2Gb devices over time. The first devices likely to be upgraded are switches, then storage controllers, with hosts coming last.

For a substantial period of time, most environments will have a mixture of speeds. If a customer has some or all hosts operating at 1Gb or 2Gb, while switches and storage devices are running at 4Gb, it is possible to support up to four times as many hosts per storage controller port for a given performance requirement. A higher fan-in ratio of host to storage ports means lower cost, since more hosts are sharing a storage resource, but can also mean lower performance, since more hosts are competing for the bandwidth on that interface. If the storage interface is upgraded, for example, from 2Gb to 4Gb, the cost savings of increasing fan-in remains, but the performance impact is negated.

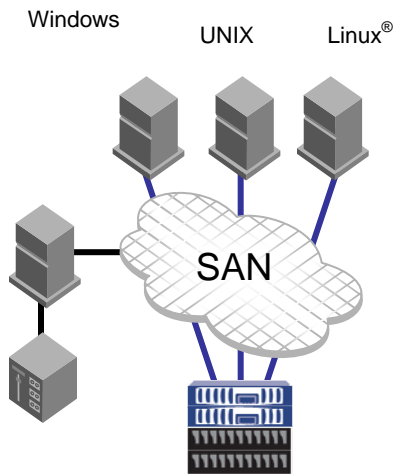
Another problem 4Gb technology will help solve is oversubscription which happens when several ports in a switch communicate with one particular port. This can occur when several hosts are connected to one storage device. Upgrading to 4Gb products will help eliminate this bottleneck.

Upgrading to 4Gb should not require upgrading the power supplies, fan modules or buying a special chassis for air flow. 4Gb switches have substantially lower power consumption compared to older products. The net results are much lower cooling and power costs for the data center.

Because of the factors noted, the best way to achieve high ROI and TCO benefits from applying 4Gb FC to storage consolidation solutions is to:

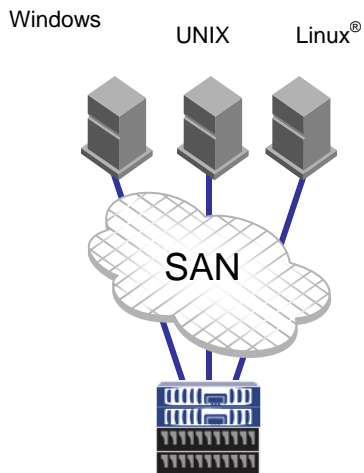
1. Purchase 4Gb FC switches.
2. Purchase 4Gb FC storage systems.
3. Over time, upgrade the rest of the SAN when upgrades are needed for other reasons such as expiring support contracts or needed features.

## 5. Examples of Storage Consolidation



**Figure 1) Back-end consolidation**

No changes are made to production systems, but back-end functions such as backup and disaster recovery are offloaded to a NetApp solution, centralizing and streamlining these critical operations for improved data security and decreased operation costs.



**Figure 2) One-to-one consolidation**

Storage for each individual application is consolidated into a single pool. This approach is a first step toward more aggressive consolidation and provides the benefits of improved manageability, reliability and data protection for each application.

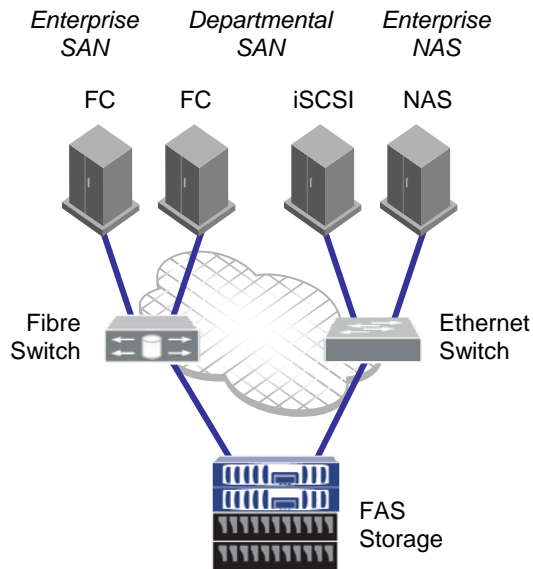


Figure 3

**Figure 3) Many-to-one**

Greater benefits can be achieved by consolidating the storage of multiple applications on one centralized storage solution, dramatically simplifying management and data protection for an enterprise without sacrificing performance. Levels of data availability often improve because of better data management and the reliability of the storage. The NetApp unified storage architecture uniquely supports this configuration since a single system can simultaneously support multiple protocols required by different applications.

**6. Conclusion**

Although SAN environments continue to evolve, their rapid widespread acceptance reflects their unlimited value in the efficient management of information. Today, SANs are providing an unprecedented way to manage explosive data growth — improving storage management, configuration flexibility, and cost-effectiveness. NetApp and Brocade 4Gb SAN solutions are currently helping organizations around the globe transform their storage environments into strategic, consolidated infrastructures that greatly enhance information access, management, and protection.