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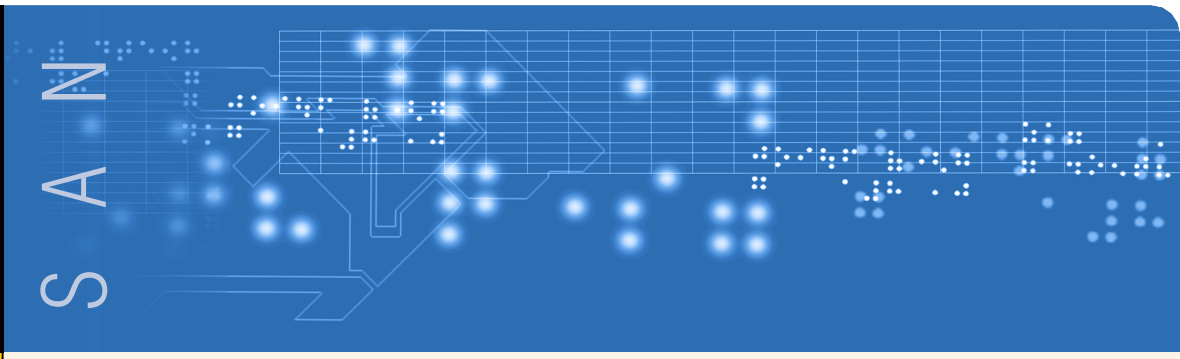

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Intel® Server Platform SB-HE Fibre Channel SAN Solutions Guide

Version 1.0

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Introduction

The *Intel Server Platform SB-HE Fibre Channel SAN Solutions Guide* provides you with solutions that incorporate the advanced features of the Intel Server Platform SB-HE. These solutions address the most common objectives of today's information technology (IT) departments. Today, efficiency and managing the bottom line are paramount to success. You need your IT infrastructure to do more than ever before under tighter budgets. You need to do it in less time, with less space. You need to meet increasing user demands for greater availability and higher quality of services. And you need to get it all done with a smaller and less-skilled staff. Intel can help.

The *Intel Server Platform SB-HE Fibre Channel SAN Solutions Guide* offers many powerful SAN solutions with the Intel Server Platform SB-HE. If you are interested in deploying an Intel solution, please contact Intel customer service.

The Storage Area Network

Traditionally, organizations have paired storage resources with specific servers on a local area network (LAN), primarily because of technical restrictions. This is known as direct-attached storage (DAS). As a result, free disk space on one server cannot be used by other storage-constrained servers.

A storage area network (SAN) is a separate network dedicated to storage, enabling disk and tape storage to be isolated from the LAN. A SAN is a high-speed network dedicated to information management. It is a combination of technologies, including hardware, software, and networking components, that provide any-to-any interconnection of server and storage elements. A SAN can help improve security, reliability, and management of a company’s critical data. The benefits of a SAN can be achieved without impacting the company’s primary communication network.

Intel Server Platform SB-HE with Fibre Channel SANs offer a powerful solution for consolidating storage resources to boost storage management, flexibility, and cost effectiveness. SANs link multiple storage systems and servers over a secure, high-speed network that is data-centric rather than server-centric. Storage devices, such as tape libraries and disk arrays, can be shared. With Intel Server Platform SB-HE with Fibre Channel SANs, storage capacity can grow independently of server usage, helping companies grow their storage environments much more quickly and without system disruption. SANs can improve data availability, reduce downtime costs, significantly decrease management and administrative costs, and improve asset utilization.

Intel Server Platform SB-HE Features and Benefits

The Intel Server Platform SB-HE offers the following features:

- Up to 14 blade servers in a 7U chassis
- Blade servers featuring 2-way Intel® Xeon™ processors for enterprise application serving
- Designed for business continuity with highly available shared resources
- Optional Ethernet (Gigabit) switch and optional integrated Fibre Channel switch modules
- Autonomic systems management features
- Blade servers can boot directly from the SAN

The Intel Server Platform SB-HE architecture provides a highly manageable, modular infrastructure that is designed to help maximize productivity, minimize IT administration, and lower your total cost of management.

The Intel Server Platform SB-HE holds up to 14 two-way blade servers that connect to shared resources, such as power, cooling, switching and management, through a redundant midplane. Six Intel Server Platform SB-HEs can fit into an industry-standard rack, allowing you to scale up to 84 two-way servers in a single rack. This doubles the density of most of today's 1U servers.

The benefits include:

- **Modular scalability.** This modular approach can help save space and consolidate resources while allowing you the pay-as-you-grow scalability needed in today's dynamic marketplace. You can simply add new blades into open bays as you need them, eliminating the need to physically install and cable individual servers.
- **Simplified management.** Through managing the Intel Server Platform SB-HE using centralized management and technologies that enable autonomic computing and grid computing, the Intel Server Platform SB-HE can help deliver distributed computing while at the same time simplify management.
- **Performance density.** Dual Intel Xeon processors allow for high-density packaging with the same Intel Xeon processors found in today's 1U servers.
- **Fast installation and deployment.** Physically inserting new blades into a chassis is designed to be much easier and faster than mounting new servers, along with their slides or rails, Intel Server Platform SB-HE solutions also allow for automated installation and refreshing of operating systems and applications within as little as a few minutes.
- **High availability and ease of serviceability.** High-availability features maximize up time, simplify failure diagnosis, and reduce servicing time. Critical components can be redundant and/or hot swappable, including the blades.
- **Boot directly from the SAN.** With Fibre Channel boot capability, Intel Server Platform SB-HE blade servers can boot directly from the shared storage that resides on the SAN. Booting from the SAN simplifies storage management and allows storage to be consolidated, resulting in ease of backup and recovery.

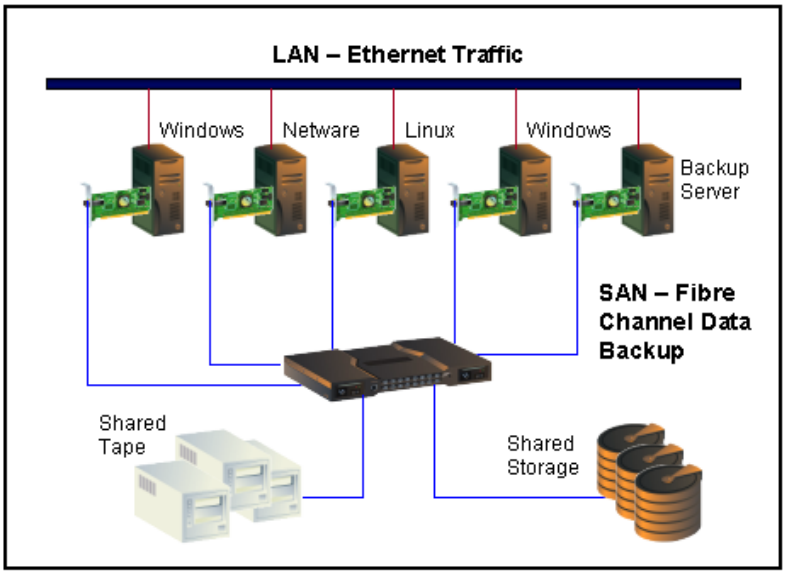
Backup and Restore Solutions

Data Protection with SAN-based Backup and Restore

As your company's data becomes a crucial business asset, ensuring its stability and protection with Intel Server Platform SB-HE is more critical than ever. Many organizations have faced the challenge of backing up more and more data while backup windows continue to be reduced. Most IT departments have come to the conclusion that a cost-effective and efficient backup strategy must be put into place to protect vital business data. Not having such a strategy could result in complete loss of data and business.

Traditionally, most backup and restore solutions revolved around a backup strategy that included a dedicated backup server that used a LAN to transfer data from the various servers to the tape backup servers. This approach has many drawbacks, including poor resource utilization, increased traffic on your company's Ethernet LAN, and, in most cases, straining the existing IT infrastructure by not keeping up with the amount of data that is being generated.

The following figure depicts a traditional backup and restore configuration—separate servers, Fibre Channel host bus adapters, and Fibre Channel switches are attached to shared tape libraries and storage.



Traditional Fibre Channel Backup and Restore Configuration

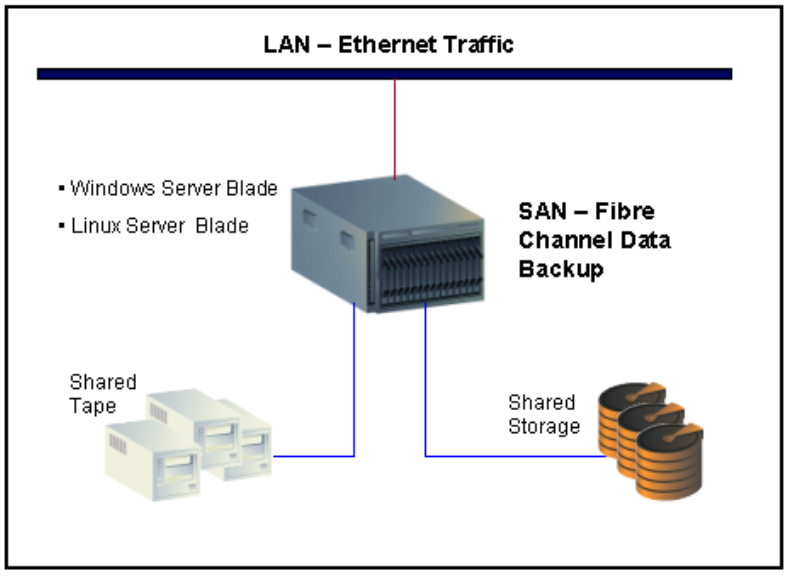
To solve this problem, an Intel Server Platform SB-HE Fibre Channel SAN can be implemented to dramatically increase backup performance as well as increased bandwidth, virtually eliminating the need for the Ethernet LAN. SANs can speed up and simplify the data backup process. Two solution models that can be implemented using Intel Server Platform SB-HE with Fibre Channel SAN technology are as follows:

- SAN-based LAN-free backup and restore
- SAN-based Server-free backup and restore

SAN-based LAN-free Backup and Restore Solution

With this approach, the backup traffic on your Ethernet LAN moves to the SAN. The existing LAN is used only for meta data communication traffic between the servers, which frees up the LAN for other business applications. The SAN attached tape drives and libraries can be implemented so that each server sends its own backup data directly to the shared tape resources, making use of the advanced features in today's backup applications. This approach results in a faster, more scalable, and more reliable backup and restore solution that has more effective utilization of storage, server, and LAN resources.

The following figure depicts an Intel Server Platform SB-HE configuration. Intel integrates Fibre Channel Switch Modules, eliminating the need for external SAN connectivity components and reducing complexity, setup time, and cost.



Intel Server Platform SB-HE Backup and Restore Configuration

SAN-based Server-free Backup and Restore Solution

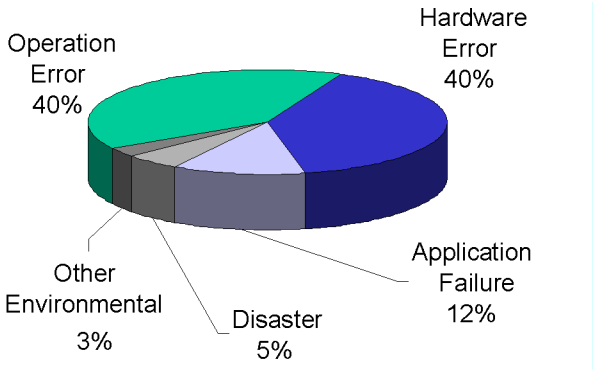
This model is a more advanced approach. Data is transferred directly between storage devices (i.e., from Fibre Channel disk to Fibre Channel tape) without requiring host server intervention. This process is enabled by a technology called Third-Party Copy. The server-free backup and restore model significantly reduces application host CPU cycles, thereby freeing up valuable CPU cycles to improve operating efficiency and enable higher workloads across the enterprise.

Business Continuance Solutions

Business Continuance in a SAN Environment

Disaster recovery has never been more important than it is today. In the wake of recent global events, companies are scrambling to implement viable, cost-effective solutions to ensure data integrity and reduce or eliminate vulnerabilities.

Until recently, disaster planning for businesses focused on recovering centralized data centers following a catastrophe. While these measures remain important to disaster planning, the protection they provide is far from adequate for today's distributed computing environments. The goal for companies today is to achieve a state of business continuity, where critical systems and networks are always available. To attain and sustain business continuity, companies must engineer availability, security, and reliability into every process from the outset. System downtime can be caused by a number of factors, including hardware errors, operation error, application failure, or disaster (see the figure below).



System Downtime Factors

As organizations search for ways to improve the availability of critical enterprise data, they are turning to Intel Server Platform SB-HE with Fibre Channel SANs. Many features deemed necessary for disaster recovery configurations are native to Intel Server Platform SB-HE SAN solutions—Intel-supported configurations, simplified implementation, seamless integration, and a wide range of application and end-to-end management options. Disaster recovery configurations can be integrated into existing data center infrastructure, increasing return on investment (ROI) and reducing total cost of ownership (TCO).

A viable Intel Server Platform SB-HE SAN solution addresses business continuance requirements, including:

- Eliminating single points of failure
- Utilizing multi-pathing failover software
- Streamlining data backup and recovery processes
- Enabling high-performance remote backup, electronic vaulting, and mirroring at or between data centers separated by long distances

Business continuance solutions that can be implemented using the Intel Server Platform SB-HE with Fibre Channel SAN technology include

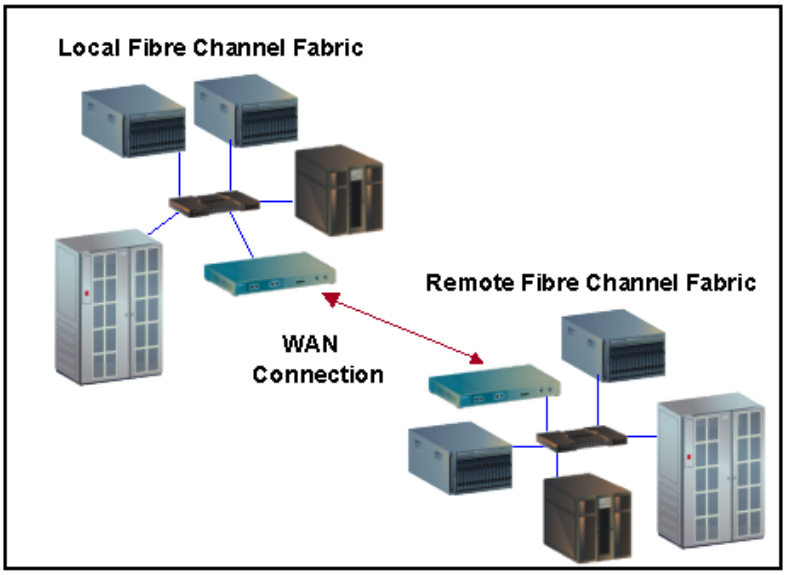
- Remote mirroring
- Distance solution using Fibre Channel technology
- MAN using WAN

Remote Mirroring Solution

Remote mirroring is an automated method of making your storage entirely redundant in a remote location. Mirroring key data center infrastructure at a disaster recovery site helps protect against complete data center outage in the event of a disaster—business can be re-routed to the replicated secondary site in the event of a primary site outage.

In data mirroring, data is written to two separate physical devices (such as disks) within a RAID array simultaneously. This mirroring technology helps protect an organization's data against disk subsystem loss or, in worst case, complete site failure. Remote mirroring also allows data failover from the primary site to the remote site and to fail back to the primary site once it has been restored. For example, if one of the mirrored drives fails, the data is available via the remaining disk. A hot-spare drive, a physical drive defined for automatic use when similar drive fails) can then be used to reestablish the mirror relationship and the redundancy that results while the failing drive is being replaced.

The following figure illustrates remote mirroring using a wide area network (WAN) connection.

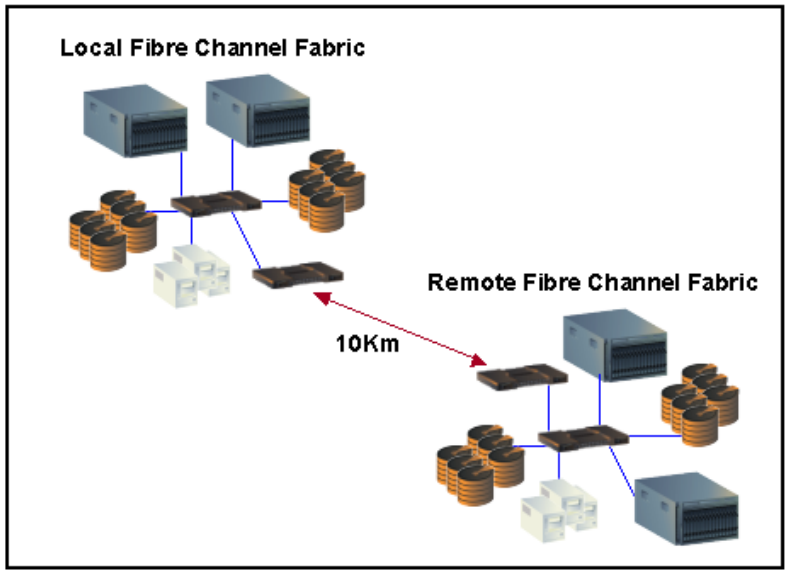


A SAN with Remote Mirroring Using a WAN Connection

Distance Solution Using Fibre Channel Technology

A sensible disaster recovery plan incorporates a distance solution in the event of a disaster. Data access over long distances is necessary for any business continuance solution. Fibre Channel technology can provide distance connectivity of up to 120 km, enabling enterprise customers to maintain geographically separate disaster recovery facilities or mirroring operations. Intel Server Platform SB-HE with Fibre Channel SANs can utilize wide area networks (WANs) or metropolitan area networks (MANs) to cover even longer distances.

See the figure below for a sample configuration of a viable Intel Server Platform SB-HE SAN solution that addresses business continuance.

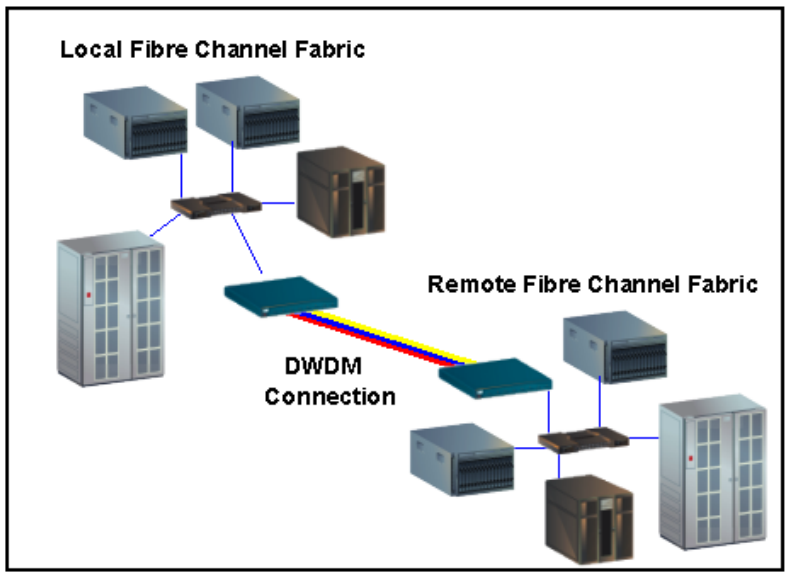


A MAN with Native Fibre Channel Connectors Over Longer Distances

MAN Using DWDM Solution

Companies are expanding their infrastructure even in the current economic downturn. Data growth continues to expand at an unprecedented pace. Companies are diversifying their localities and looking for ways to mitigate geographical distances while controlling infrastructure costs.

Dense wave division multiplexing (DWDM) is the solution to these issues. Wave division multiplexing (WDM) is an optical technology that combines many wavelengths of light onto the same strand of fiber, increasing the total bandwidth of the fiber to the sum of the bit rates associated with individual wavelengths. DWDM might allow for more than 40 wavelengths to be coupled on to the same fiber. Using DWDM header equipment, data can traverse distances of up to 100 km with little or no impact on performance. The following figure illustrates a SAN solution using DWDM.



A SAN with Remote Mirroring Using a DWDM Connection

Utilizing dark fibre available in most metropolitan areas, greater geographic distances can be achieved, and at lower cost, than similar solutions. DWDM technology allows multiple SAN links to be multiplexed into a single fiber strand, lowering communications infrastructure cost. Multiple sites can be connected through DWDM, allowing flexibility in scalability and better utilization of resources. Resources once geographically separated can now be easily shared across the SAN. management and application software ensure seamless and cost-effective management and application support.

High-Availability Solutions

Clustering Servers Provides Higher Availability

A cluster is two or more interconnected servers (sometimes called nodes) that create a solution to provide higher availability, higher scalability, or both. The advantage of clustering servers for high availability is seen if one server fails, another server in the cluster can assume the workload of the failed server and users see no interruption of access. The advantages of clustering servers for scalability include increased application performance and a greater number of users that can be supported. You can think of a cluster of servers as if they were a single, unified computing resource. With the total redundancy of multiple servers, the cluster can help achieve greater system uptime.

Clustering can be implemented at different levels of the system, including hardware, operating systems, middleware, systems management, and applications. The more layers that incorporate clustering technology, the more reliable, scalable and manageable the cluster. The layers are:

- **"Cluster-aware" applications** can offer failover/failback capability. Some also offer workload balancing and parallel support features.
- **Systems management** helps maximize cluster uptime by monitoring and managing applications, operating system and hardware. All the servers in a cluster are managed from a single point of control.
- **Middleware** for clusters provides improved data protection, data recovery and failover transparency to end users.
- **Operating system** cluster implementations usually offer improved management of cluster operations and greater uptime.
- **Servers, interconnect hardware, and storage hardware** in a clustered configuration can provide data mirroring, component redundancy, component self-monitoring and alerting, and resource sharing to virtually eliminate any single point of hardware failure.

High-Availability Solution Using Storage Hardware

In today's competitive environment, information is the lifeblood of any corporation. Data must be kept available, reliable, and safe at all times—24/7/365. To reduce ongoing maintenance costs, data management must be integrated and centralized data networks must be fault-tolerant and self-healing. No IT solution can deliver on these stringent requirements better than a SAN.

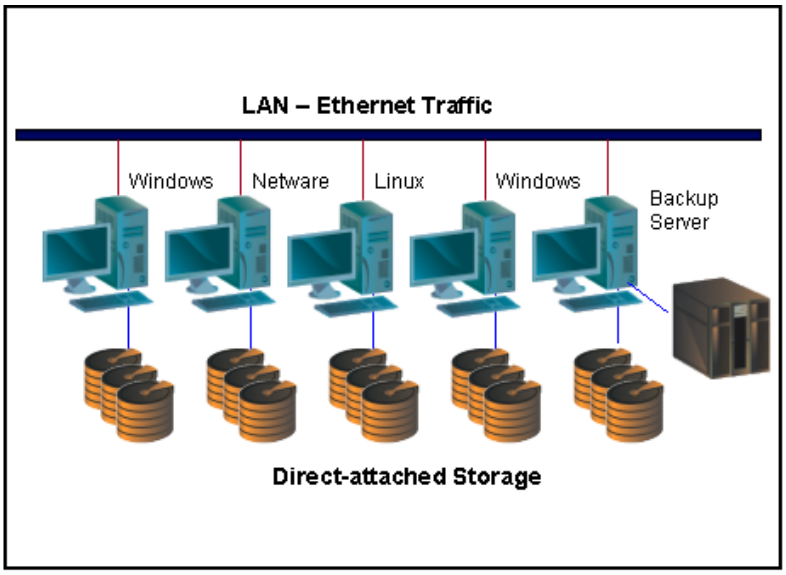
No matter how reliable the system, redundancy is a must when it comes to the protection of data. Native SAN solutions support multiple switch elements within the SAN, as well as redundant connections from hosts and storage to switch. However, these redundant elements do not sit idle waiting for a failure to occur. Using multi-pathing software, Intel Server Platform SB-HE can take advantage of redundant data paths; in the event of a failure, traffic is transparently rerouted to the next available open path. In addition, a SAN is tolerant of component failures and self-healing in case of a switch or HBA failure, provided the SAN was designed with redundancy.

For example, with a high-availability SAN, all components have redundant elements. There are multiple servers, storage subsystems, HBAs, and switches. The SAN is able to tolerate a failure of any one of these components.

Storage Consolidation and Data Sharing Solutions

Storage and Data Consolidation in SAN Environments

Traditionally, organizations have paired storage resources with specific servers, primarily because of technical restrictions. As a result, free disk space on one server cannot be used by other storage-constrained servers. The following figure shows a site with storage directly attached to the servers. Data is then accessed through the LAN.



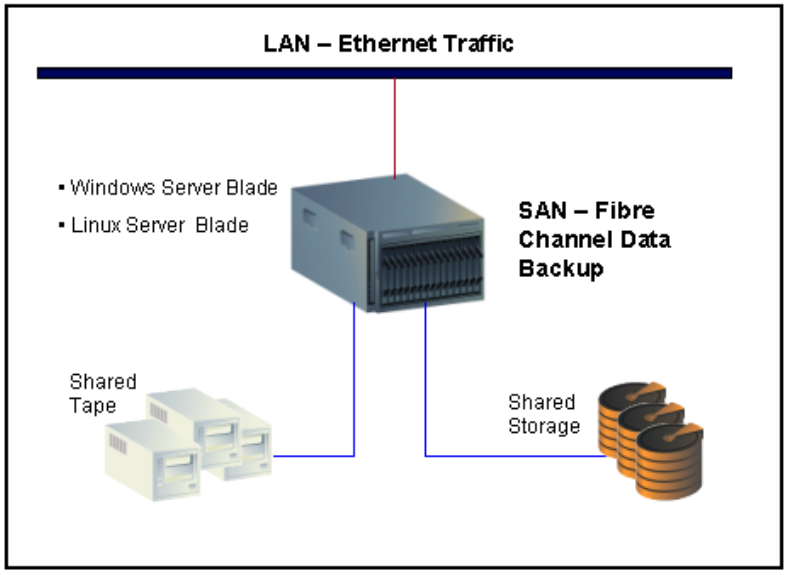
Direct-attached Storage Across Multiple Hosts

Intel Server Platform SB-HE with Fibre Channel SANs offer a powerful solution for consolidating storage resources to boost storage management, flexibility, and cost effectiveness. SANs link multiple storage systems and servers over a secure, high-speed network that is data-centric rather than server-centric. Storage devices, such as tape libraries and disk arrays, can be shared. With Intel Server Platform SB-HE with Fibre Channel SANs, storage capacity can grow independently of server usage, helping companies grow their storage environments much more quickly and without system disruption. SANs can improve data availability, reduce downtime costs, significantly decrease management and administrative costs, and improve asset utilization. More specifically, benefits of Intel Server Platform SB-HE with Fibre Channel SAN storage solutions and data consolidation include:

- Improved productivity, by reducing retrieval time to data content
- Reduced infrastructure and storage costs through more efficient data management

- Online storage configuration and administration
- Logical views of storage for easy monitoring of disk configurations
- Increased server availability and eliminated associated server downtime
- Zero downtime for storage growth and administration
  - Grow volumes dynamically with no downtime
  - Reduces storage costs by combining the unused space on multiple arrays
  - Protects investment and lowers total cost of ownership

See below for a sample diagram of an Intel Server Platform SB-HE with Fibre Channel SAN that has heterogeneous server and storage resources.



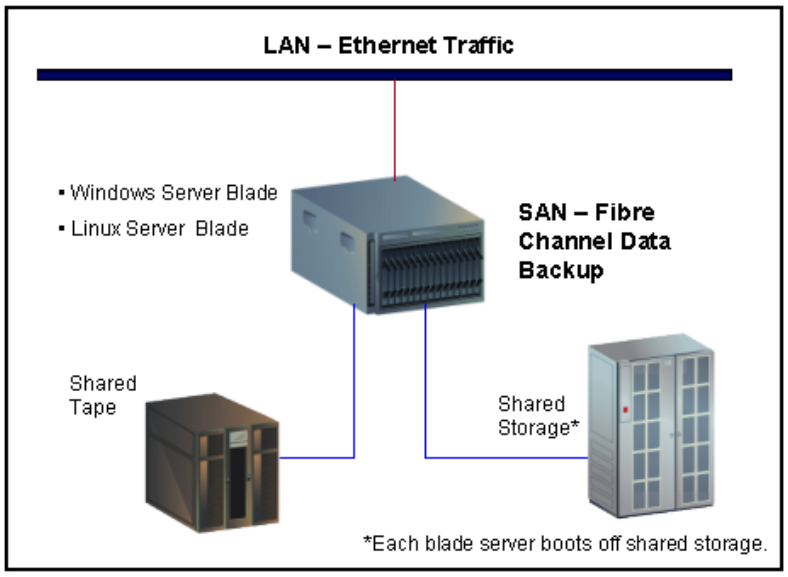
A Simplified SAN with Heterogeneous Server and Storage Resources

The following sections discuss Intel Server Platform SB-HE storage consolidation and data sharing.

Storage Consolidation Solution

Storage consolidation is the practice of transforming direct-attached host storage to networked SAN storage. Direct-attached storage spread across multiple hosts poses several problems. Management is difficult and valuable resources are not as easily shared. In addition, sharing data over a congested Ethernet LAN can cause resource bottlenecks. Unused “white space” on storage volumes leaves valuable resources unutilized.

With storage consolidation, the problems of direct attachment are eliminated. Storage is de-coupled from the server to which it was traditionally attached. With storage moved to an Intel Server Platform SB-HE with Fibre Channel SAN, the benefits of this are numerous and immediate—simplified and cost-effective management, seamless scalability, increased reliability, added redundancy, and enhanced performance. These benefits translate into quantifiable return on investment (ROI) and reduced total cost of ownership (TCO). This results in greater end-user satisfaction with the corporation’s IT department. In the following example, storage has been moved to a shared SAN.



A SAN with Pooled Storage

Storage consolidation can be viewed as two consecutive tasks:

1. **Physical consolidation.** Data from disparate storage subsystems can be combined on to large, enterprise class shared disk arrays, which can be located some distance from the servers. The capacity of these disk arrays can be shared by multiple servers, and users may also benefit from the advanced functions typically offered with such subsystems. This may include RAID capabilities, remote mirroring, and instantaneous data replication functions, which might not be available with smaller, integrated disks. The array capacity may be partitioned, so that each server has an appropriate portion of the available storage. Available capacity can be dynamically allocated to any server requiring additional space. Capacity not required by a server application can be re-allocated to other servers. This avoids the inefficiency associated with free disk capacity attached to one server not being usable by other servers. Extra capacity can be added in a non-disruptive manner.
2. **Logical consolidation.** It is possible to achieve shared resource benefits from the SAN without moving existing equipment. A SAN relationship can be established between a client and a group of storage devices that are not physically co-located (excluding devices that are internally attached to servers). A logical view of the combined disk resources can allow available capacity to be allocated and reallocated between different applications running on distributed servers, to achieve better utilization.

Storage consolidation is not a simple task. Each platform, along with its operating system, treats data differently at various levels in the system architecture. Considerations include:

- Different data formats, such as Extended Count Key Data (ECKD), blocks, clusters, and sectors
- Different file systems, such as Virtual Storage Access Method (VSAM)
- Journal File System (JFS), Andrew File System (AFS), and Windows NT File System (NTFS).
- Different file system structures, such as catalogs and directories
- Different file naming conventions, such as AAA.BBB.CCC and DIR/Xxx/Yyy
- Different data encoding techniques, such as EBCDIC, ASCII, floating point, and little or big endian

Data Sharing Solution

True data sharing across heterogeneous environments at SAN speeds allows data to be accessed and updated by multiple users and different operating systems. The ability to store, catalogue, search, and retrieve digitized images and large files is significantly enhanced with the speed and open connectivity of a SAN. The solution is composed of content management software for the cataloguing, searching, and management of information, and SAN-connected disk and tape devices for the storing and high speed delivery of information.

Storage consolidation is the starting point of the data sharing approach. When consolidating storage for homogeneous servers, data could really be shared. There are three categories of data sharing:

- **Storage sharing** splits the storage into physical partitions that are each owned by an individual attached platform. Participants in storage sharing may be aware of the presence of the other participants, but need not be.

  With storage sharing, two or more homogeneous or heterogeneous servers share a single storage subsystem whose capacity has been physically partitioned so that each attached server can access only the units allocated to it. Multiple servers can own the same partition, but this is only possible with homogeneous servers.

- **Data-copy sharing** involves replicating the data through some type of copy process so another platform can access it. Data-copy sharing allows different platforms to access the same data by sending a copy of the data from one platform to the other. There are two approaches to data-copy sharing between platforms: flat file transfer and piping.

- **True data sharing** refers to data in a continuous storage space that can be concurrently accessed by different platforms without any replication. This implies concurrent access to files with potentially a mixture of readers and writers.

  In true data sharing, only one copy of the data is accessed by multiple platforms, whether homogeneous or heterogeneous. Every platform attached has read and write access to the single copy of data. Participants have to be aware of the presence of other sharers to ensure data integrity. This is usually implemented by some type of locking mechanism.

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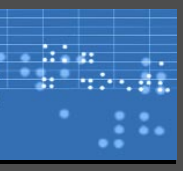

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Bloomberg Top 10 High Tech Company
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Network Computing
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