VERITAS Backup Exec™

Shared Storage Option

TECHNICAL BRIEF:

Leveraging the Capabilities of Storage Area Networks (SAN)

VERITAS

BUSINESS WITHOUT INTERRUPTION™

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Abstract

The Backup Exec™ *Shared Storage Option* from VERITAS® enables Backup Exec servers to share centralized storage devices connected over a *Storage Area Network* (SAN). This Technical Brief will explain how the Shared Storage Option works to combine Backup Exec with emerging SAN technologies and deliver a backup solution with dramatic improvements in performance and manageability.

Introduction

We are at a turning point in the evolution of storage management. Data is growing at an unprecedented rate, stressing the limits of current technology. IT professionals are barely able to tread water in an ocean of information. They need a lifeboat.

Along with the rapid proliferation of data across the network, IT professionals face several other equally imposing challenges:

- Mission critical applications deployed across the network demand increasingly greater levels of availability
- Management of storage dispersed across a wide area is difficult to automate and requires significant manpower to manage properly
- Network users are less and less tolerant of impacts to their productivity caused by traditional backup methods impinging upon “their” LAN systems

The emergence of *Storage Area Networks* (SAN) offers significant advantages over the traditional approaches used for backup today. Backup Exec has been enhanced with the *Shared Storage Option* to take advantage of this new storage paradigm, combining the benefits of high performance with centralized management. Data movement during backup processes occurs off the LAN, freeing up network resources and reducing the impact on network users while improving business productivity.

Shared Storage Option allows multiple distributed backup servers to share common, centralized storage devices that are connected over a fibre channel SAN for greater efficiency and fault tolerance. With the Shared Storage Option, Backup Exec servers can load balance activity across all available storage devices, increasing performance and backup speeds, centralizing management tasks and lowering the total cost of ownership.

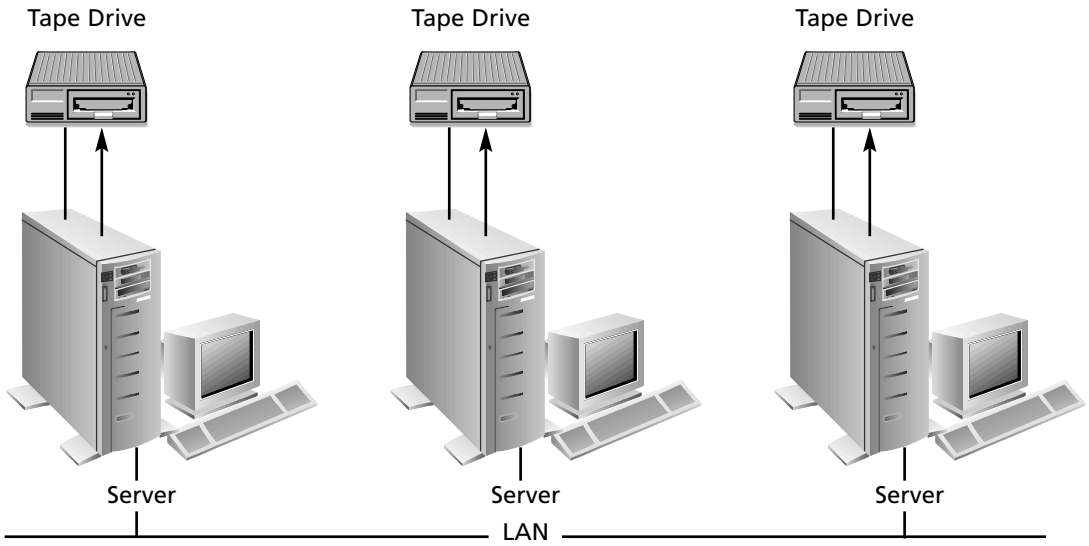
Traditional Approaches to Backup

There are two primary approaches commonly used to back up server data on the corporate network, distinguished by the data path between disk and tape. The two approaches are commonly referred to as *local backup* and *network backup*.

Local Backup

A local backup moves data directly from the server disk to a locally attached tape drive or other backup device. This approach offers excellent performance because data does not need to be packaged up and sent over the network to another server before being copied to tape.

Local Backup - each server backs up to locally attached tape device over a SCSI bus.

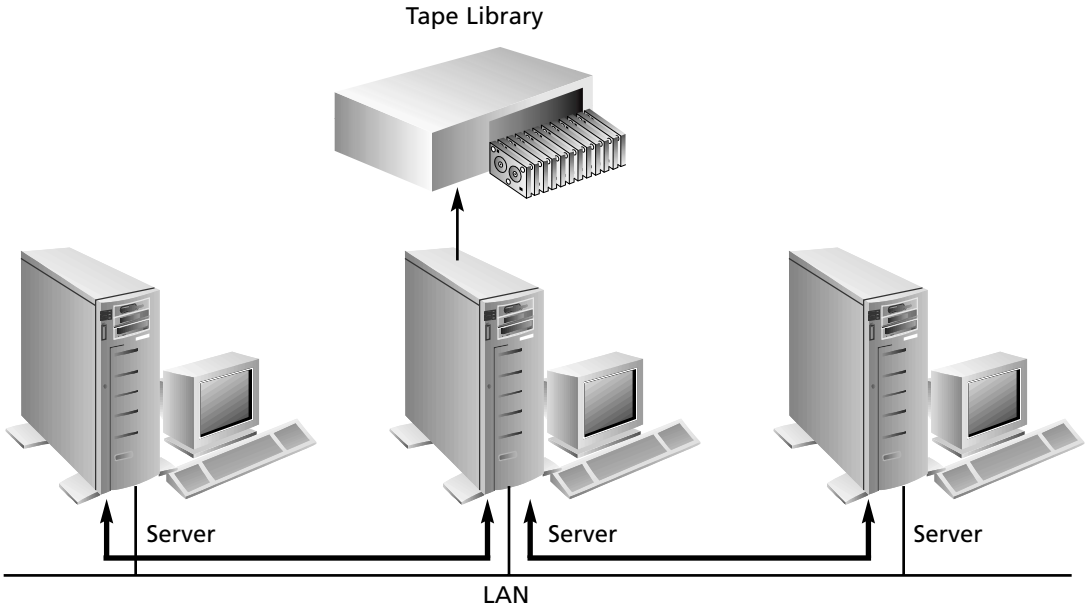


Unfortunately this approach requires extensive manpower and is difficult to automate, leading to high potential for human error. Every server must be touched on a regular (often daily) basis to ensure that media is available and the system is operating properly. In addition, this approach requires a significant investment in hardware for each server.

Network Backup

A network backup moves data across the network to a backup server where a tape library or other backup device is attached. This approach offers the benefits of centralized management where all administrative and maintenance operations can be performed at a single location, enabling greater levels of automation and reduced management cost.

Network Backup - each server backs up to a dedicated backup server over the LAN.

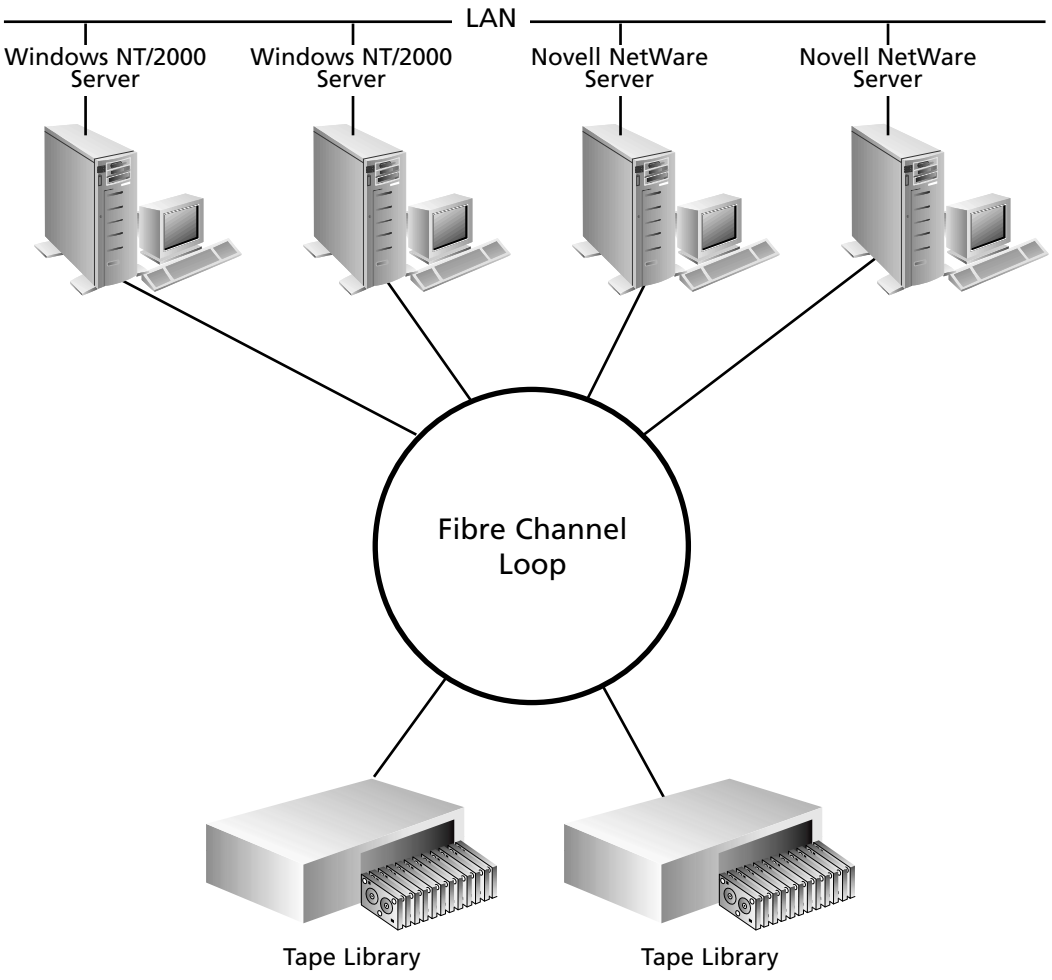


Unfortunately this approach suffers from poor performance and consumes significant network bandwidth, leading to longer backup times and reduced availability of mission critical applications while backups occur. Modern tape drive performance far exceeds the limits of modern network performance, resulting in a bottleneck caused by the network.

A New Approach

The emergence of fibre channel-based *Storage Area Networks* has the potential to redefine server backup. A Storage Area Network, or SAN, interconnects storage devices to servers in a many-to-many configuration, making it possible for servers to share the same storage devices, including, for example, a tape library. Data movement does not occur over the LAN, but occurs over a separate network attached to the "back end" of the server. In essence, the SAN acts as a more sophisticated SCSI bus allowing several distributed servers to directly attach to a centralized storage repository over a high-speed connection.

Backup over a SAN - each server backs up to shared storage devices over a Storage Area Network (SAN).



SCSI over Fibre Channel

A SAN replaces the SCSI bus that normally connects a server to a storage device. Most SANs are constructed using advanced fibre channel (FC) technology rather than the conventional ethernet technology used in most LANs. Current SAN architectures use either a fibre channel-arbitrated loop (FC-AL) or a switched fabric topology. Fibre channel offers several benefits that enhance the flexibility and scalability of a SAN when compared to "tethered" devices connected to servers over a SCSI bus:

- Capacity – up to 126 nodes or devices may coexist on a single fibre channel network, while a switched fabric could potentially include millions of nodes
- Performance – up to 100 MegaBytes/sec
- Distance – up to 10km with single mode fiber

A fibre channel SAN is constructed using several basic components that make up the network:

- Servers
- Storage devices (e.g. tape libraries)
- FC Hub – connects devices into a fibre channel network
- FC Switch – connects devices into a switched fabric
- FC Host Bus Adapter (HBA) – allows a server to connect to the FC SAN
- FC-to-SCSI Bridge – allows a conventional SCSI device to connect to a FC SAN

Storage applications simply execute their SCSI commands over the fibre channel SAN. The FC HBA driver packages SCSI commands into the proper format for the fibre channel network. At the other end, the FC-to-SCSI Bridge firmware extracts the SCSI commands from the fibre channel packets and forwards the SCSI commands to the attached storage device.

Benefits of this New Approach

This new approach offers several compelling benefits over the traditional approaches to backup:

- Centralized storage, enabling greater automation with reduced manpower
- Achieve performance comparable to local backup performance
- Network (LAN) bandwidth is not impacted
- Low impact to network users during backup operations

This approach combines the benefits of both traditional backup approaches without the limitations.

Challenges of this New Approach

The ability to directly attach a number of servers to a single tape library has several consequences:

- Servers may request services from the library simultaneously, leading to potential device contention
- Servers may accidentally overwrite recent backup tapes created by other servers

Clearly a software solution is needed to resolve these issues and deliver the benefits of SAN-enabled backup to the IT professional.

Backup Exec Shared Storage Option

VERITAS has developed an option to Backup Exec, the *Shared Storage Option*, designed to allow multiple distributed backup servers to share common, centralized storage devices interconnected over a SAN. This solution delivers the following benefits:

- All the benefits of backup over a SAN to centralized storage devices and libraries
- Device conflicts and contention are handled automatically
- Backup devices attached to the SAN may be grouped together to allow backup operations to be load balanced across several devices thereby enhancing performance and device utilization
- In the event of device failure, other devices can be configured to automatically perform any remaining backup operations
- Media may be centrally configured and managed, enabling media sharing and preventing backup operations from accidentally overwriting media recently used by other Backup Exec servers
- Device and media information is tracked centrally, providing accurate reportable statistics on device and media usage (Windows NT/2000 only)
- Media catalogs for all backup servers are stored centrally, enabling the backup operator to perform restore tasks from any convenient location on the SAN (Windows NT/2000 only)

Backup Exec for Windows NT/2000
The Windows NT/2000 version of the Shared Storage Option is designed around VERITAS' *Advanced Device and Media Management* (ADAMM) database, which provides a single unified view of all backup devices and media within the SAN. Instead of each backup server having its own dedicated ADAMM database, all Backup Exec servers are configured to use the central ADAMM database. The end result is that all device and media information is shared with all Backup Exec servers on the SAN.

To allow sharing of storage devices and media between multiple Backup Exec servers, a single central ADAMM database resides on one Backup Exec server referred to as the *central ADAMM database server*. All Backup Exec servers on the SAN connect to this database and see a single unified view of all shared devices and media. Backup Exec uses this shared database to arbitrate all device and media requests with comprehensive overwrite protection policies to prevent accidental media overwrites. To ensure against potential access conflicts between multiple backup servers, Backup Exec "reserves" library arms and tape devices while operations are being performed.

Backup Exec for NetWare
With the NetWare version of the Shared Storage Option, one server is designated as the *Primary Group Server*. This Primary Group Server is responsible for coordinating access by the other Backup Exec servers, or Group Servers.

To allow sharing of storage devices and media between multiple Backup Exec servers, the partition definitions for the shared devices are centralized on the Primary Group server so that all Group Servers connected to this database see a single, unified view of all partitions and devices that exist within the fibre channel network. The Primary Group server arbitrates all device and media requests.

Device Conflict Resolution
Yesterday's shared storage solutions required the user to cable backup servers directly to dedicated tape drives within a tape library and delegate one server to act as the controller for the robotic arm. Since each server could only access the devices it was cabled to, it was impossible to use other devices or load balance activity across several devices as needed. In addition, if the server that controlled the robotic arm failed, the library was essentially useless, as media could not be moved between slots and drives.

The Shared Storage Option allows any Backup Exec server to dynamically control any one or more tape drives available within the library, and also allows each Backup Exec server to independently issue commands to the robotic arm. All device activity is controlled through software.

Device conflicts are managed by issuing *SCSI Reserve/Release* commands to devices during use. The Reserve/Release mechanism is defined in the SCSI specification and is a way to share devices in *multi-initiator* configurations. In this way, the sharing intelligence built within the SCSI devices provides arbitration of potential device contention instead of servers attempting to perform this function.

When a Backup Exec server attempts to use a tape drive or a robotic arm, a *reservation conflict* occurs if another server is currently using that device. This causes the Backup Exec server to either wait in a pending state or utilize other devices if they are available.

By using the SCSI Reserve/Release mechanism, Backup Exec servers can process jobs independently from one another. *Even if the primary group server or central ADAMM database server fails, jobs currently in progress will run to completion.* This is a truly unique advantage of the Shared Storage Option.

Pooling Devices
All Backup Exec servers on the SAN share the same device configuration, including which devices belong to which pools. As with the standard edition of Backup Exec, backup devices can be pooled together as a unit to offer benefits of fault tolerance (if a device is unavailable) while enabling job activity to be load balanced across all available devices within a pool. Device pools are highly recommended to optimize the overall performance and fault tolerance of the system.

Sharing Media
All Backup Exec servers on the SAN share the same media configuration, including all of the different media sets and corresponding overwrite protection periods that have been defined. Media created and used by one Backup Exec server will be recognized by all other Backup Exec servers on the SAN and will not be overwritten before the configured overwrite protection period has expired. Once the overwrite protection period has expired, any Backup Exec server can reuse the media.

Device and Media Statistics (Windows NT/2000 only)
All historical information for device and media usage is tracked in the central ADAMM database. Reports may be generated showing read/write statistics and error counts. Furthermore, all reports can be created from a single location since there is a common database for all Backup Exec servers.

Sharing Devices Between Windows NT/2000 Servers and NetWare Servers
In mixed environments that contain both Windows NT/2000 servers and NetWare servers, it may be desirable to share a single tape library between both types of servers. With both Backup Exec for Windows NT/2000 and Backup Exec for NetWare it is possible to organize the slots of a tape library into different slot partitions. Media are not moved between partitions, so partitions can be thought of as invisible “walls” separating groups of tapes. To share a tape library between Windows NT/2000 servers and NetWare servers, simply create separate slot partitions for each operating system, taking care to ensure that these partitions do not overlap. Servers will only use the tapes within the partition dedicated to that operating system. Drive allocation is managed by using SCSI Reserve/Release commands, so all servers can access all drives regardless of the operating system. For more information on the proper procedure for sharing a library in mixed Windows NT/2000 and NetWare environments, please refer to the documentation.

Centralized Catalogs (Windows NT/2000 only)
With the Windows NT/2000 version of the Shared Storage Option, media catalogs are stored in a central location on one of the backup servers. As a result, restore operations can be performed from any convenient location on the SAN. It is not necessary to perform restore operations from the same server that performed the backup.

What Happens If the Central Database or Primary Group Server Fails?
Even though the Shared Storage Option requires a central database server (Windows NT/2000) or a Primary Group server (Novell NetWare) to initiate jobs across the SAN, it is easy to “promote” another Backup Exec server to assume control should the original server fail.

Windows NT/2000
Each Backup Exec server on the SAN is configured with the location of the central ADAMM database. This information is kept in the registry for each Backup Exec server.

In the event that the server housing the central ADAMM database fails, another Backup Exec server may be quickly promoted to become the central ADAMM database server by using a special utility called BEATTACH. This utility will simultaneously reconfigure all Backup Exec servers on the SAN to attach to a central ADAMM database located on another Backup Exec server.

To enhance the availability of the solution, the ADAMM database may be replicated to another Backup Exec server in real time to ensure a duplicate database is always available. If the ADAMM database server should ever go down, the other server may be promoted in a very short period of time. VERITAS recommends Replication Exec™ from VERITAS as an excellent companion solution providing ultra high availability for the Backup Exec Shared Storage Option.

Novell NetWare

If the original primary group server is not operational, simply designate one of the other group servers as the primary group server at the console. If the original primary is brought back online later, it will recognize the newly designated server as the primary group server.

Compatibility

Backup Exec Shared Storage Option is certified for use with specific end-to-end hardware configurations. Care should be taken to ensure that all hardware components are certified together as a complete solution and that the proper driver and firmware revisions are used. New devices are certified regularly, so please refer to the latest Hardware Certification List for details on which hardware combinations are currently supported by the Shared Storage Option. An updated list can be found at:

http://support.veritas.com/

Summary

Storage Area Networks will change the way IT organizations serve their customers, providing higher availability and more centralized management of storage resources. This Technology Brief explained the concepts and operation of Backup Exec Shared Storage Option, a SAN-enabled backup solution that delivers significant improvements in performance and manageability over the traditional methods commonly used for server backup. VERITAS will continue to leverage the capabilities of SAN technologies to build innovative storage management solutions for the 21st century.

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