Improving SAN Backup Performance with ServerFree Option

VERITAS Backup Exec™ 9.1 for Windows Servers

ServerFree Option
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EXECUTIVE SUMMARY

The introduction of Storage Area Networks (SAN) has provided the computer industry the ability to consolidate data and share storage between devices on the network. Now, administrators are tasked with optimizing their SANs to manage and protect the business critical data that is growing at an exponential rate while backup windows are shrinking.

Storage consolidation is a reoccurring theme among businesses with volumes of information stored on networks. Networked attached storage (NAS) and storage area networks (SANs) will eventually replace Direct Attached Storage (DAS) for daily operations within medium to large organizations. According to Charlotte Rancourt, the Storage Systems Research Director at IDC:

“Data continues to grow at unprecedented rates and IDC has forecasted that purchase of new capacity for deployment in external storage systems will grow at a compound annual growth rate (CAGR) of 70% from 2002 - 2006. With this rate of growth, direct attached storage solutions will become increasingly difficult to manage and will no longer adequately meet the needs of many organizations. In fact, by 2006, IDC expects networked storage solutions, such as NAS and SAN, to represent 65% of the money end-users spend on new disk storage systems.”

KEY BENEFITS

- Virtually eliminate server utilization on the backup server
- Releases computing process
- Improves backup performance that reopens the “backup window”

Companies moving to these technologies find substantial economical benefit by reducing Total Cost of Ownership (TCO) and maintaining storage centralization.

A recent technological advancement in the reduction of TCO for SAN deployments is “off-host backup,” which is also referred to as “third party copy” or “server-free backup”. Server-free technology offloads the actual CPU and memory intensive process of moving the data through the network and re-tasks these efforts to an off-host “data moving” engine within the hardware components in the SAN. The actual intelligence of moving the data still resides inside the storage software, but the effort is moved to the SAN hardware.

The ServerFree Option for VERITAS Backup Exec™ for Windows Servers helps protect mission-critical data in SAN environments by moving backup processing operations from the server to off-host third party hardware solutions installed within the SAN. By virtually eliminating server utilization on the backup server, the VERITAS ServerFree Option delivers faster backups and releases computing processing for application, database or other critical needs.

As SAN technology matures, customers will benefit from technologies such as off-host backup by addressing the increasing demand for high performance and scalability of storage applications and developing support for the latest storage technology.

SERVERFREE HIGHLIGHTS

- Online Backup – ServerFree Option provides an advanced backup solution with limited impact on the server.
- SAN Investments Leverage – Fully exploit the SAN architecture by taking advantage of the ability to move data directly from disk to tape.
- Selectable Snapshot Methods – Flexibility to choose from the system provided “frozen-image” or “snapshot” backup method or leverage the VERITAS FlashSnap Option within the SAN environment.
- Advanced Mapping Technology – Mapping the logical files to the physical blocks enables the ServerFree Option to handle unforeseen system events while maintaining data integrity.
BENEFITS OF SERVERFREE BACKUP

REDUCING SERVER CENTRAL PROCESSING UNIT (CPU) USAGE
Traditional server backup operations, for both SAN and direct attached systems, involve reading the data into the computer memory, processing the information and then writing it to the secondary storage device. The computational efficiency is heavily dependent on the CPU and amount/type of memory in the system. At times, the resource drains on CPU processing and memory caching during traditional backup methods can cause the machine to become sluggish, or in some cases, completely unusable while a backup operation is occurring.

By moving the backup transactions to an off-host hardware solution, server processing on the backup server is kept to a minimum. The majority of the processing done by the backup server is at the initiation of the backup job; the duty of moving data from the fibre channel disk array to a secondary storage device falls upon the data mover. A data mover is not a new dedicated component added to the fabric, but a new hardware component capability embedded within fibre-to-SCSI bridges/routers or the SAN attached disk array. The net result is very low CPU and memory usage on the backup server, which is now free to use its processing power for other important business operations.

REDUCING YOUR SERVER BACKUP TIME
The ServerFree Option works in conjunction with other VERITAS Backup Exec™ high-performance options including the SAN Shared Storage Option (SAN SSO) and a point-in-time snapshot provider such as the VERITAS Volume Snapshot Provider™ (VSP). Combined, these technologies create a point-in-time view of the data on the target server, create a compressed image file and then send it directly to the storage device via the data mover.
SERVERFREE OPTION TECHNOLOGY

HOW SERVERFREE BACKUP WORKS – TECHNICAL OVERVIEW

In a traditional SAN environment, the Backup Exec™ media servers on the network are networked to the SAN with a fibre channel disk array (hereafter, referred to as the fibre array) and a SAN attached tape library. Communications and data movement occurs between the devices via the fibre-to-SCSI Bridge or Router.

The ServerFree Option is a backup method for moving data from the source destination, in this case the fibre array, to the destination such as a SAN attached tape library, with minimal involvement from the backup server. The process is dependant on the data mover installed in the SAN. In most cases the data mover resides within the fibre-to-SCSI bridge or router however, the data mover could actually reside in any hardware component in the SAN such as a tape library with built-in routing functionality. The actual determination of its location would be made by the hardware manufacturer and does not impact the operations or dataflow process.

*Depiction of a standard Backup Exec™ Software ServerFree configuration.*
HOW THE SERVERFREE OPTION MOVES DATA IN A SAN

The following steps depict the process by which the Backup Exec™ software works in concert with a data mover to accomplish server-free backup:

**Step 1:** Once the backup job has been created and the job is scheduled, the ServerFree Option initiates a request to create a point in time snapshot, also known as a “frozen image”, of the volume being protected on the fibre disk array. The frozen image is created to insure that the backup operation will complete using a consistent set of the data at the moment the backup job is submitted. Depending on your method of creating the frozen image, a split mirror may be used; in this case, mission critical systems are interrupted temporarily (merely seconds) while the frozen image is created.

The ServerFree Option uses one of two products to create the snapshot – either the included VERITAS Volume Snapshot Provider (VSP) or the optional VERITAS FlashSnap™ Option available with VERITAS Storage Foundation for Windows. More details on the methods and differences between these two products are discussed in “Supported Snapshot Methods” section.

**Step 2:** When the Backup Exec software starts the backup job, the ServerFree Option creates a map of the blocks on the volume and/or files to backup as part of the job.

**Step 3:** The Backup Exec software then allocates the necessary tape media within the library. Image backup control information is written to tape. Data is formatted on the tape using imaging technology to create an efficient format before the actual data transfer starts.

**Step 4:** The Backup Exec software then sends the list of data blocks to backup to the data mover using the SCSI extended copy command. The Backup Exec software coordinates with the data mover on how many blocks can be transferred at a time; which is largely dependent on the memory buffer size within the data mover. Data movement is depicted as a dashed line as the Backup Exec software only needs to send data once the data mover runs out of blocks to move. The Backup Exec software continuously fills the buffer with new data as the buffer empties during the data transfer process. There is no backup CPU activity taking place while the data mover is transferring the data from disk to tape.

*Note: In this depiction, the data mover is shown to reside in the fibre-to-SCSI bridge or router. The data mover may also be a 3rd Party Copy enabled RAID array. When additional requests are sent to move data from the backup server, there will be only a small hit on CPU processing.*

**Step 5:** As part of the backup process, the data mover reads the data blocks directly from the storage array and writes them to the tape(s) that the Backup Exec software had allocated in step 3.

Upon backup completion, the frozen image is released freeing up the reserved space for future backup jobs. In the event that a split mirror is used, after the mirror is broken off for the backup, the mirrors are rejoined and the original volume is prepared for the next backup job.
REQUIREMENTS FOR USING THE SERVERFREE OPTION
Three key components to consider when designing a SAN with off-host backup.

1) The physical hardware to be used – does it support server-free backup?
2) Are the SAN components known to be compatible?
3) Is the hardware solution certified to run with the software running the operations?

APPROVED HARDWARE
In order to utilize the VERITAS Backup Exec™ ServerFree Option technology, the SAN must have certified hardware that will support off-host data movement operations. Data mover technology is provided by the hardware manufacturers. Each deployment should begin with a thorough review of the hardware vendor’s list of required components. Hardware components that may require updating may include:

- Fibre channel host bus adapter (HBA)
- Fibre-to-SCSI bridge or router
- Tape Library containing a Fibre-to-SCSI bridge or router

Note: New device drivers, updated firmware or new hardware may be needed for data mover operations.

VERITAS Software has posted a specific list of SAN-certified components that form a LAN-free network topology in which the environment and the software have been tested for compatibility and reliability. VERITAS certifies new solutions as they become available from hardware vendors. For more information on whether the hardware vendor supports SAN and ServerFree technology, and to review a complete list of requirements, please contact the hardware vendor directly. VERITAS Software maintains a list of tested or certified solutions on its Technical Support web site at: http://support.veritas.com/dsl/dsiselect_ddProduct_BEWNT.htm.

OPERATING SYSTEM & SOFTWARE REQUIREMENTS
The Backup Exec™ ServerFree Option has been designed to support the latest operating system platforms currently supported by Microsoft Windows 2000 Server and Windows Server 2003. It is designed to run on “data mover” hardware within a storage area network (SAN)

To leverage ServerFree backup operations with the Backup Exec software, the following components are required:

Operating System:
- A choice of Windows Server operating system (Windows NT, Windows 2000 Server or Windows Server 2003)

VERITAS Software products for each backup server:
- VERITAS Backup Exec 9.1 for Windows Servers
- Library Expansion Option, for each shared drive on the SAN
- SAN Shared Storage Option
- ServerFree Option

Optional VERITAS products for each backup server:
- VERITAS Volume Manager™ for Windows 2000
- VERITAS Storage Foundation for Windows
- VERITAS FlashSnap™
SUPPORTED VERITAS BACKUP EXEC AGENTS/OPTIONS
Currently, the ServerFree Option supports local file system backups only. The ServerFree Option can leverage split-mirror backups of SQL server databases when performed by the optional VERITAS FlashSnap™ software acting as the frozen image provider. ServerFree backup of Exchange, SAP, Lotus Domino, and Oracle is not supported at this time; however, it is being considered for future releases.

SETTING UP SERVERFREE BACKUP
Configuration of the ServerFree Option is performed once the SAN and the Backup Exec software, with the SAN Shared Storage Option, have been configured and tested. To properly setup the ServerFree Option, enter the ‘Set Application Defaults’ from the Backup Exec “Tools” tab - Tools/Options/Advanced Open File menu inside the Backup Exec for Windows Administrator Client.

To apply ServerFree backups for all backup jobs performed from this server, select the “Use Advanced Open File Option” and then the “Use ServerFree Option”.

Setting the ServerFree default Options from the “Set Application Defaults” screen.

As previously mentioned, the Backup Exec software uses imaging technology to create an efficient format before the actual data transfer starts. Regardless of which frozen image method is chosen, this imaging technology will also be used to package the data in preparation to moving the data to the storage device. When selecting the desired frozen image technology to be used, if the “Use Advanced Open File Option” configuration is set to “Automatically select open file technology”, then the ServerFree Option will use VERITAS Volume Snapshot Provider (VSP) by default. The only other frozen-image technology available for use with the ServerFree Option is VERITAS FlashSnap™.

At this time, the Microsoft Volume Shadow Copy Service (VSS) used by Windows Server 2003 is not supported with ServerFree backups. If this option is selected while the “Use ServerFree Option” checkbox is also enabled, the Backup Exec software will default the snapshot process to VSP.
SUPPORTED SNAPSHOT METHODS

The VERITAS Backup Exec™ ServerFree Option currently supports two frozen image products to snapshot the selected volumes for backup: the included VERITAS Volume Snapshot Provider (VSP) and the optional VERITAS FlashSnap software. The Microsoft Volume Snapshot Service (VSS) is not currently supported for the Backup Exec software’s ServerFree backup.

Since the VERITAS Volume Snapshot Provider and VERITAS FlashSnap technologies are both supported by the ServerFree Option the ultimate choice of which method to use will depend on your needs.

VERITAS VOLUME SNAPSHOT PROVIDER (VSP)

This is the default option for creating a frozen image backup. VSP is a software based snapshot solution that creates a frozen image or picture of the system’s volume at the time of the backup. By capturing the volumes at a given instant and mapping that data to a “scratch disk,” the data to be backed up to tape is guaranteed to be free of open files and a “crash-consistent” backup is created.

Key advantages of VSP include the following:

• VSP has the ability to snap all volumes on the target client, rather than one at a time. Executing a single snapshot captures the entire system data at the very moment of the backup and ensures that the system can be recovered to that very point in time, with all volumes intact.

• Copy-on-Write technology is embedded as part of the snapshot procedure. This enables a snapshot of a volume which packages only the changes made to the volume as part of the snapshot, rather than a full snapshot of the volume, saving on scratch disk space and enabling faster backups.

• Another upside is the ability to restore just those changes made to the volume, rather than having to restore an entire volume – again saving time and space during the recovery.


Customers should choose the VSP technology for those SANs that are:

• Operating in a mixed Windows server environment

• Have data spanning multiple volumes being captured as a single job

• Sensitive to adding additional hardware

• Have concerns over available disk space to execute the snapshot

Note: More details on operations of the VERITAS Volume Snapshot Provider can be found in the VERITAS Advanced Open File Option white paper (“Advanced Protection For Open Files”) available at http://www.veritas.com/products/listing/ProductDownloadList.jhtml?productId=bews#whitepapers.

VERITAS FLASHSNAP™

VERITAS FlashSnap is an option of VERITAS Storage Foundation for Windows™, and is included in VERITAS Edition™ for Microsoft Exchange 2000, which also includes VERITAS Volume Manager. VERITAS FlashSnap is similar to VSP in that it facilitates the creation of point in time snapshots of data, but requires that VERITAS Storage Foundation for Windows software be installed on the same system as the Backup Exec software.

The FlashSnap software is built upon the VERITAS Volume Manager™ technology, which efficiently manages storage resources and serves as the foundation of the VERITAS Software storage virtualization platform. Storage virtualization enables companies to logically manage storage environments without regard to the underlying physical hardware location or vendor type.

The key difference between the FlashSnap software and VSP is that FlashSnap creates a split mirror snapshot instead of a software-based frozen image, which is dependent on the original data. In some environments, creating a split mirror may benefit the user because it has the added benefit of using independent hardware,
which can be imported on any system connected to the SAN. This lowers the impact on the target server by isolating the mirror to another server, so that it can be backed up when convenient and, due to the fact that it is a truly independent copy of the original data, it provides fault tolerance so that, in the event of a disaster, an extremely fast recovery is possible. Once the backup is completed, the VERITAS FlashSnap FastResync™ technology allows the resynchronization of the split mirror so that it will be available for future backups.

The technology offered by the VERITAS FlashSnap software is ideal for those customers that require the least amount of impact on the application server being protected. Using the split mirror technique leverages disk capacity to minimize the backup impact on mission-critical applications. Another key advantage is the integration with VERITAS Storage Foundation for Windows, which enables dynamic allocation of disk space to virtualize disk space across the network. For disaster recovery purposes, being able to restore from the mirror is very fast as opposed to restoring from tape.
PREPARING FOR BACKUP

CONFIGURING ADVANCED OPEN FILE OPTION
The final step prior to using the ServerFree Option is to ensure the frozen image provider is configured with enough space prior to executing the backup. The Backup Exec software provides the ‘Advanced Open File Option Wizard’ to simplify this process of setting up the required space for the static volumes.

If VERITAS Volume Snapshot Provider™ is being used, the default settings may be sufficient. To view the current settings run the Advanced Open File Option wizard from the Backup Exec Administration Console, under Tools/Wizards. The current settings for creating the frozen image will be displayed here. The wizard walks through the process of specifying where the frozen image is to reside, defining its size and determining how long to wait for ‘no disk activity’.

Configuring the VERITAS FlashSnap™ software split-mirror is beyond the scope of this document. Detailed setup and management can be found in FlashSnap software documentation and in the following white paper on at http://www.veritas.com/products/listing/ProductDownloadList.jhtml?productId=volumemanagerwin#whitepapers.

Settings in the Advanced Open File Option Configuration Wizard
SUBMITTING A BACKUP JOB

Once the certified SAN hardware and data mover configurations have been verified and the Backup Exec™ ServerFree Option software has been installed and configured to run with the snapshot provider, the next step is to create and submit the backup job. This procedure involves exactly the same steps as a traditional Backup Exec job creation. A key point to keep in mind is that fibre arrays connected to the same data path as the data mover, will utilize the ServerFree Option technology for the backup operation.

For more information about submitting a backup job, please reference the VERITAS Backup Exec for Windows Servers Administrators Guide.

Backup Exec Backup Job Properties Screen

USING SERVERFREE FROM THE COMMAND LINE

The Backup Exec software includes a robust Command Line Interface (CLI) for many server operations. This gives administrators the flexibility to execute backup and recovery from a system prompt from any computer on the network, rather than use Backup Exec's graphical user interface. Below is an example of how you might use this CLI to do a ServerFree Backup.

```
bemcmd -o2 -j"Operations Weekly" -s"D:\*.*" -fi:2
```

- `-o2` is the operation to create a backup job.
- `-j` specifies the name of the backup job; because the job name is alphanumeric, quotation marks are required around the job name.
- `-s"D:\*.*"` specifies to backup all files and subdirectories under the D:\ drive
- `-fi:2` specifies use of the Intelligent Image Option and execute a ServerFree backup if the method is available

By default, the example above would be performed by the computer from which the CLI is executed. For more specific information on using CLI options, please review the CLI section of the VERITAS Backup Exec for Windows Servers Administrators Guide or type `BEMCMD.EXE /?` from a command prompt.
SERVERFREE BACKUP BEST PRACTICES

The ServerFree Option works with local traditional NTFS file systems and supports server-free backup of SQL server applications and databases when using VERITAS FlashSnap™. Future releases of the ServerFree option will support other database applications such as Exchange server, Oracle, SharePoint Portal server and Lotus Domino.

When submitting a ServerFree backup, it is recommended that the administrator only select data that is supported by the ServerFree feature. If you wish to protect an entire server that contains both data supported and not supported by the ServerFree option, it is recommended that two different jobs be created. When data selected as part of a server-free backup that is incompatible with the ServerFree Option is detected, the Backup Exec software will default to a standard backup utilizing the core technology found in Backup Exec.

For example, if a local machine with user shares and Exchange server data is selected for backup, the best advice is to:

- Create one job for the user shares. You can use ServerFree with this backup job.
- Create a second job for the Exchange data.

Note: Select the Advanced Open File Option and un-check “Use ServerFree Option” for the second job.

RESTORING A SERVERFREE BACKUP

Recovering a file, volume or entire server from a ServerFree backup is accomplished in the same manner that a traditional file-by-file restore is performed within the Backup Exec software. At this time, the recovery process does not use the data mover during the restore process. A file or system recovery will impact server memory and CPU usage as traditional file handling algorithms are used to move the data from the storage device back to the original location on the target server.

Note: Consult the Backup Exec Administrator Guide for details on submitting a restore job.

TROUBLESHOOTING

There are two sources to confirm the success or failure of the ServerFree Option backup job. Backup Exec software will report whether or not a ServerFree backup was successful in the job log and show up as an exception on the Backup Exec Summary Screen. Details of the problems will be given in the job log. In the case of hardware errors, these may show up in the Windows System Event logs.

Should the ServerFree backup job fail, the following three issues are most likely the cause:

- The frozen image method did not work or did not complete properly
- The data mover is not functioning properly
- The SAN hardware is experiencing problems or is improperly configured

Begin by checking the settings for the selected frozen image method utilized for the backup. In the case of VERITAS Snapshot Provider™ (VSP), be sure enough quiet time is specified and that the volume on the specified drive to create the frozen image has enough available disk space to hold the snapshot. If you used customized settings, re-run the Advanced Open File Option Wizard if necessary to prompt for system recommendations. Run the job again and check for success. Modify from the default settings as necessary to customize the resources utilized for the backup.

Troubleshooting the SAN is a time consuming venture. System cohesion is tied heavily to hardware compatibility, be sure the SAN configuration is VERITAS certified. This assures that the many components that interact within a
SAN have been tested and attuned. Make sure that the latest component drivers have been downloaded and installed.

Since the data mover is likely the newest hardware component within the SAN, it should be checked thoroughly. Be sure the “data mover” feature is enabled on the hardware component and installation is adhered to the hardware manufactures guidelines for deployment and configuration. If necessary consult the hardware manufacturer if there is any doubt on how to completely check the SAN setup and data mover configuration.

PURCHASING THE VERITAS SERVERFREE OPTION
This VERITAS ServerFree option is currently available only through Hewlett Packard. To purchase the VERITAS ServerFree Option, contact your Hewlett Packard sales representative and ask about VERITAS ServerFree Option listed on the HP Services Compatibility Price List. To find your local HP sales representative log on to the Hewlett Packard web site at: http://welcome.hp.com/country/us/eng/contact_us.html.

SUMMARY
Storage consolidation is a reoccurring theme among businesses with volumes of information stored on networks. Networked attached storage (NAS) and storage area networks (SANs) will eventually replace Direct Attached Storage (DAS) for daily operations within medium to large organizations. This is because these solutions bring the benefits of reduced total cost of ownership and storage centralization, along with storage consolidation. With the opportunity for “off-host” or “server-free” backup, companies utilizing NAS and SAN solutions can benefit from server-free backup by addressing the increasing demand for high performance and scalability of storage applications and developing support for the latest storage technology. With Backup Exec for Windows Servers, VERITAS offers a ServerFree option that helps organizations protect mission-critical data, as companies simultaneously seek improved data management and reduced cost of ownership.