

# **NOVASTOR** **OPEN FILE MANAGER**



## **Microsoft® Volume Shadow-Copy Service and Its Role in an Organization's Total Backup Strategy**

**A White Paper**

**For IT Managers, CTOs, and Security Administrators Concerned About Data Loss Due to Corrupt or Incomplete Backup**

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## **Executive Summary**

Volume Shadow-Copy Service (VSS) is an open file backup framework included in Microsoft® Windows® XP and Server 2003. It supplies an in-box snapshot provider and a shadow volume service that coordinates and performs an open file backup at a defined point in time.

As such, it is a compromised alternative to the two traditional approaches to the open file problem: application-specific agents and generic open file solutions.

As with any new technology, there are reported pros and cons to VSS. Companies that want to use Windows-based NAS and SAN products will undoubtedly be interested in this Windows 2003 innovation. Likewise, companies with open file backup solutions already in place will want to know how VSS differs from the product they are already using.

This paper provides Information Technology executives an overview of the strengths and weaknesses of Microsoft's VSS. It also reviews the problem of backing up data while files and applications are open --known as the open file problem-- and describes the pros and cons of current industry solutions to this dilemma.

## Introduction

Simplifying the enterprise's storage environment and removing interoperability barriers are the self-proclaimed goals of Microsoft Corporation as it gears up to debut its latest Windows operating system, Windows® Server 2003 (formerly .NET Server). The company began this path by offering a 'lite' version of Windows 2003 to manage files in network-attached storage (NAS) products for Dell Computer, Hewlett-Packard, IBM and others. With Windows Server 2003, Microsoft will continue this course by offering functionality that will make the operating system and Microsoft core applications perform better when used in fibre channel Storage Area Networks (SANs), in addition to NAS devices.

Included with Windows Server 2003 is a Volume Shadow-Copy Service (VSS), previously called Volume Snapshot Service. The need for VSS arose from Windows' former inability to handle snapshots of data, files and applications that are typically used in SAN and NAS environments to enable recovery and restoration of data after hardware failures or other disasters. According to one analyst quoted in a recent *Information Week* article, Windows is an operating system that "customers are afraid to run in storage environments," mainly because the operating system lets users access files while backups or snapshots are occurring<sup>1</sup>. This corrupts the data on the snapshot, like the blurred image in a photo taken at the moment when an object moves.

The fact that many storage products are used with non-Windows servers (such as Unix) negates this problem in many enterprises, at least for the present. But, for companies who want to use Windows-based servers within their enterprise storage environment, or who want to avoid the proprietary snapshot technology native to storage vendors, it is a real issue that must ultimately be addressed.

VSS, and other innovations, are Microsoft's response. They will be available with the launch of Windows Server 2003, which is expected to be released on April 24, 2003.

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<sup>1</sup> Nancy Marrone, analyst at the Enterprise Storage Group, as reported in Informationweek.com, Dec 2, 2002 article by Martin J. Garvey: "Microsoft Eyes Storage Market."

## Overview of Microsoft's Volume Shadow-Copy Service

Microsoft's Volume Shadow-Copy Service (VSS) provides a framework for creating a point-in-time copy of a single volume or multiple volumes. It specifically aims to eliminate the problem of corrupt snapshots or backups due to open files.

Open files have historically been a backup administrator's biggest challenge, as they are often skipped or corrupted during the backup process. The alternative – forcing open files closed or asking users to log out so applications can be shut down – is no longer viable. Microsoft Windows Server 2003 VSS partially addresses this problem by allowing users to access certain files while a backup is taking place, without compromising the fidelity of the backup. (A drawback to VSS is that the files must be related to a VSS-aware application in order for all volumes to be synchronized to a single point in time, as discussed in more detail later in this paper.) Another feature of VSS is the ability for users to view and recover previous versions of their files without IT intervention.

By enabling read-only, point-in-time copies of an entire volume, the problem associated with backing up files that are open or in use would seem to be taken care of. That is Microsoft's intent, and in some situations, it is an intent that has the potential to be fulfilled.

### A Brief History

The Windows XP operating system, both home and professional, includes a client version of VSS, which has to be installed separately on XP desktops via an installer package.

The shadow copy under XP's version of VSS only holds one level of undo, however, and the shadow doesn't persist across reboots. In addition, the service can only be used in conjunction with XP's backup software.

### The VSS Hype

With Windows Server 2003 comes expanded functionality and the promise of using VSS with more than just one kind of backup software and across various types of storage environments. According to an October 8, 2002 press release from Microsoft, heralding the imminent launch of Windows Server 2003:

*Volume Shadow-Copy Service (VSS) and Virtual Disk Service (VDS) technologies are part of a storage services architecture ... that enables heterogeneous interoperation and cooperation between storage hardware, storage software and business applications. Leading enterprise hardware vendors have already committed to developing products that will utilize the new technologies to deliver innovative enterprise storage solutions to their customers.*

*With Windows .NET Server 2003, customers will have the flexibility to incorporate products from multiple vendors into a single, interoperable storage infrastructure. The architecture provides the ability to coordinate business applications and storage hardware to deliver higher-quality data management functionality such as backup, recovery and data mining.*

Such goals, though worthy, do not come easily. In order for Microsoft to deliver on such a promise, the company must forge a broad set of industry partnerships with storage, application and storage management vendors. To understand why this is so, one must first understand how VSS works.

## How VSS Works

Microsoft Windows Server 2003 VSS works with applications that are in use to determine when a volume shadow-copy (snapshot) can be made. A snapshot is a copy of some data set, for example, a disk volume, at a point in time. VSS then communicates with the operating system and applications and freezes computing tasks to perform “copy on write” tasks on a sector-by-sector basis. Without the freeze function, data could become corrupted when the snapshot is taken because the system might be in the middle of a task. Meanwhile, applications continue to run uninterrupted. The original volume continues to change as the process continues, but the shadow copy of the volume remains constant. VSS also gives permission to the backup application to access the volume and back it up in its “frozen” state. The shadow copy volume is then used for the actual backup. After the shadow copy volume is saved on the backup device, the shadow copy is deleted.

The process uses free disk space on any NTFS volume (the file system used by Windows NT for storing and retrieving files) to store a record of the differences between the original volume and the shadow copy volume. If there isn't enough temporary disk space, the volume shadow copy cannot be completed and the backup program skips open files.

In order to ensure absolute data integrity for all volumes, especially those that are interrelated, the application, the backup program *and* the backup device should be “VSS aware.” This means that the components participating in the backup must be specifically programmed to work with VSS. Towards this end, Microsoft is providing a software development kit (SDK) to enable independent hardware and software vendors to interface their components, including applications, data stores, snapshot engines, and backup applications, with VSS.

These components (the application, backup program, and storage software/hardware) are called writers, requestors, and providers, respectively, as described in more detail in the table below.

VSS Component	Description
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VSS Component	Description
Requestor	The requestor is backup software that initiates the creation and destruction of the shadow copy.
Writer	The writer is any application software that participates in the shadow copy process and whose files and data are included in the process.
Provider	The provider is the storage technology that does the actual shadow copy (snapshotting).

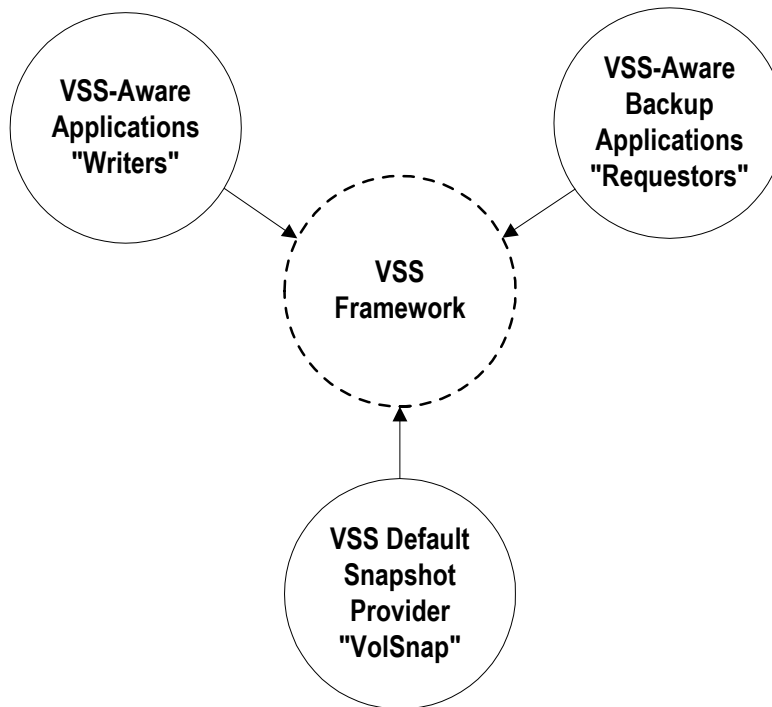
**Table 1: VSS Components**

***All components of VSS --writers, requestors, and providers-- must be VSS-aware in order for VSS to be able to orchestrate the communication among them.***

The following diagram shows the three-way orchestration among shadow copy-writers, requestors, and providers, as performed by VSS.

VSS-aware applications are known as writers. In order to guarantee a coherent backup for all applications, especially those that are interrelated and span multiple volumes, writers for each application should be present.

Backup applications that request a snapshot through the VSS framework are known as requestors. Requestors will obtain coherent backups for applications that have associated writers.



VolSnap is the default VSS snapshot provider that ships as part of Windows XP/2003. Third-party snapshot providers are free to integrate to the VSS framework in order to provide additional functionality.

**Figure 1: How VSS Works**

As the figure shows, VSS is a platform for managing snapshots, which are static copies of a data set (i.e., disk volume) at a point in time. It does so in the following way:

- The requestor (VSS-aware backup software) signals to VSS that it wants to take a snapshot.
- VSS determines which writers (VSS-aware applications) will be involved and collects their metadata. A restore method is defined.
- The writer provides an Extensible Markup Language (XML) representation of backup elements and parameters needed for restoring the data.
- VSS gives snapshot priority, first to hardware providers, then to software providers, and lastly to VolSnap, the in-box snapshot provider.
- The requestor asks VSS to initiate the shadow copy or snapshot process.
- VSS “freezes” the writers so that backup copies are internally consistent.
- VSS commands the provider to make a shadow copy of the current disk state. Note that the provider does the actual snapshotting; VSS just talks to writers and providers and fixes a point in time.
- VSS “thaws” the writers.
- The provider updates the snapshot volumes using a copy-on-write technique.
- The requestor backs up the snapshot volume.
- Upon completion, the requestor asks VSS to delete the snapshot volumes.

### **How Relevant is VSS to Today’s Businesses?**

As with most new releases of its operating system, Microsoft has heralded Windows Server 2003 as being more stable and secure. Whether this is the case will only be answered over time. In the short term, most companies will probably stick with their existing Windows operating system, unless they want to make explicit use of Windows 2003’s inherent “.NET” functionality, such as .NET servers and Web-based data storage and device software.

In addition, most third-party backup programs have an add-on that addresses the open file problem. (See later section on “Overview of Traditional Solutions to the Open File Dilemma.”) As

a result, many companies have already addressed their storage management and open file backup issues with these solutions. These companies will likely not change in midstream to an unproven Microsoft solution until there is sufficient enough reason to do so.

Yet the fact that Microsoft's Windows-powered NAS captured 32% of the NAS market in the second quarter of 2002, just a little more than 18 months after its launch, is an indication that many companies are looking for the Windows operating system to play a more important role in storage, backup and restore processes. However, until third-party vendors develop Windows-based applications and drivers that provide additional value-added storage services, above and beyond the proprietary ones already available, it is not likely that this will happen in large numbers.

On the other hand, companies just beginning to look for a solution to 24x7 access and the open file backup dilemma may find the VSS component attractive enough by itself to migrate to Windows Server 2003, particularly if they are architecting a large-scale storage solution from scratch.

No matter which of these categories a company falls into, it may want to consider other time-tested alternatives that involve less overhead and offer a more global approach to the problem of backing up open files and eliminating the need for scheduling a backup window. Companies will also want to assess VSS's strengths and limitations and compare them to conventional approaches. Before turning to these issues, it is important to review the general nature of the open file problem as well as the conventional approaches that exist to address the problem.

### **The Open File Problem: Skipped, Corrupt, or Unsynchronized Files**

For most companies, there is no such thing as a clear backup window. Backups must be done when systems are up and running, which means 24x7 in today's global economy.

Files that are open or in use during a backup get skipped. Some backup programs will try to access them again at the end of backup, but if the files are still open, they will be ignored, and critical data will not be backed up.

And, even if the backup software backs up previously open files during a later attempt, synchronization problems can occur. In particular, groups of open files that contain related data at the beginning of a backup will lose relational integrity if they are changed after backup has commenced.

For example, consider a company whose customer relationship management (CRM) system is linked to the enterprise's accounting database. As transactions occur within the CRM database – such as new customer information being added – modifications are automatically written to the

accounting database. In this way, data from one system is always present and current in the other.

If these integrated databases are backed up while files are open and transactions are still going on, the backup may capture a transaction that occurred in the CRM database but, because of timing issues, it may be forced to skip the related open or locked file on the accounting database side. If there is a subsequent system failure and the files need to be restored, they will no longer match up.

Alternatively, backup software may lock users out of applications or force a backup of open files, creating a corrupt image on tape. Each of these scenarios can have staggering financial, legal, and productivity ramifications on an organization.

## Overview of Traditional Solutions to the Open File Dilemma

There are two conventional ways to deal with the open file dilemma. (1) One solution is to purchase an **application agent** that works with specific applications to solve the open file dilemma. (2) Another solution is to install a **generic open file utility** that provides the backup software with a “window” to the data in the open files.

### Application Agents

Dedicated application agents are available for a handful of database and email applications. They typically are designed by backup software companies to support open file backup of a specific application’s data using their backup program. Because of a direct integration, they provide powerful capabilities, such as object-level restores.

Pricing typically runs from \$695 to \$2,995 per agent, which can be a costly investment since each dedicated application agent only works with its one defined application. Additionally, agents require ongoing maintenance, as they often must be upgraded when the application or backup software is updated.

### Generic Open File Utilities

Unlike application-specific tools, generic open file tools are *application agnostic*. They give backup software access to open files across the board, regardless of originating software application.

However, many generic open file tools are designed to function only with a single specific backup package. If the backup package changes, or a company switches backup tools, an upgraded generic agent is often needed.

## Compatibility Issues in Selecting an Open File Solution

Choosing between a generic open file tool, an application-specific agent and a framework such as VSS raises important compatibility issues.

### Compatibility Issues of Conventional Open File Solutions

A major strength of generic open file tools, as compared to application agents, is that they work with all software applications.

Unfortunately, many generic open file tools are not compatible with all types of backup software. Generic open file tools that function regardless of backup package being used are therefore at a distinct advantage, especially if an enterprise frequently changes versions or types of backup software, or its primary backup package fails.

For example, consider a company that normally uses third-party software for backup purposes. If the company has deployed a generic open file tool that only works with that particular backup package, it would be unable to support other emergency backup solutions such as the standard operating system default backup utility. With a generic open file tool that works with all backup programs, the company could conduct a reliable backup even if its third-party software suddenly failed.

In addition, customers with multiple platforms (such as migrations between NetWare and NT servers) must often purchase a new generic agent license in order to protect open files on the new system.

Because of this, companies must be wary about the type of generic open file tool they choose. If they do not select wisely, they may have to obtain frequent updates to their generic open file agents or be unable to obtain complete backups using alternate backup programs.

Application-specific open file agents have different compatibility issues. Because they function only with specific applications, changes to the application or backup package might require a corresponding change in the agent. As a result, the customer is always playing catch-up, installing new software and then going through extensive testing to ensure that it is working and configured properly.

Additionally, because they work with specific versions of specific applications and only with designated backup software, upgrading an application version or changing backup software will generally require replacing the original agent.

## Compatibility Issues of VSS

VSS has similar compatibility shortfalls as application agents. Without widespread support from writers, requestors and providers who are willing to revamp their products to fit the VSS scheme of things, VSS will not be a feasible answer to closing down the backup window. The more third-party vendors who jump on the VSS bandwagon, the more comprehensive VSS will be in providing a viable across-the-board backup solution that addresses the open file problem. Without unanimous support, companies will not be able to use VSS to address all their open file backup needs. They will have to continue to search out open file backup tools that work with all applications and all backup programs.

### ***Applications That Are Not Candidates for VSS***

In addition, there are some applications that cannot be integrated into the VSS framework. These non-VSS aware applications are at risk of being backed up in an incoherent state through the VSS framework, especially when these applications are interrelated and span multiple volumes.

- Client-server (thick client) applications. VSS does not support writers that store their data on one system but execute on another, such as “thick client” and productivity applications.
- Legacy applications. It is not likely that legacy applications will be rewritten to make them VSS-aware. These legacy applications will be backed up on a volume-by-volume basis, which does not preserve the relational integrity of databases that span several volumes.
- Applications that choose not to support the VSS framework.

## Vulnerability Issues in Selecting an Open File Solution

Another factor to consider is whether the open file solution is capable of providing *system-wide synchronization*, which ensures the most complete and reliable backup and restore.

System-wide synchronization is at the root of transactional integrity. A “transaction” is a set of multiple operations that are logically inseparable. Either all or none of the operations must occur for the system state to remain logically consistent.

If only some but not all of the changes that comprise a logical set are tracked, this is considered a “partial transaction.” Partial transactions can exist anywhere that relationships between data exist – e.g., within a single file, between files, within databases distributed across multiple volumes, between file content and file attributes, or within file system metadata.

A backup set has transactional integrity if it contains no partial transactions; and conversely, a backup set is corrupt if it does contain partial transactions.

### **Vulnerability Issues of Traditional Open File Solutions**

Most generic open file agents are limited in their synchronization capabilities. Instead of system-wide synchronization, the best they can offer is file-by-file or volume-by-volume synchronization, which does not work for logically-related data that is physically-distributed across multiple volumes.

In some cases, administrators can overcome the shortcomings of partial synchronization processes by manually grouping related files that need to be handled in a synchronized manner. However, this is a time-intensive solution that requires considerable knowledge. In addition, applications that support links to other applications' data can create relationships that the administrator cannot predict or protect.

### **Vulnerability Issues of VSS**

The open file backup framework of VSS is a compromise between application-specific agents and general open file solutions. Not all applications can or will be able to be integrated into the VSS framework. Applications that aren't VSS-aware are backed up in an unsynchronized state, which results in backup sets containing skipped or corrupt data due to partial transactions. The final outcome is a backup that is not fully coherent or complete.

Applications that are not integrated with the framework --that is, that are non-VSS-aware-- have their data backed up in a "crash consistent" state. This euphemism means that backup sets will contain partial transactions. As previously explained, backup sets with partial transactions do not meet the primary purpose of a backup: total data recovery in a restore. Only system-wide synchronization ensures data consistency across all applications during the backup process. Therefore, any non-VSS aware applications and databases will be vulnerable to corrupt backup data.

## **Other Issues Influencing the Choice Between VSS and Traditional Methods**

### **Use of Legacy Applications**

Whether VSS is a good choice for a company considering an open file backup solution is determined by a variety of factors, not the least of which is the number of legacy software programs they are using. Companies who rely on mission-critical legacy applications obviously will not be adopting Windows Server 2003 for its VSS capabilities. If adopted, these companies will still require an open file tool that works across all applications.

### **Technology Adoption Rates**

Windows Server 2003 includes software code for VSS that vendors will have to use to retrofit their own snapshot software to work with the VSS service. In order for a customer to be guaranteed a completely coherent backup using the VSS framework, they must have Windows XP/2003, applications that have developed VSS-aware writers and a VSS-aware backup package. The time it will take for vendors to add the VSS functionality to their applications, followed by the slow rate at which customers adopt these solutions, impacts VSS as a short-term solution.

In fact, a recent online newsletter article (Windows and .NET Magazine UPDATE) reported on a survey of companies who responded to the question "When will your organization roll out Windows Server 2003?" Of the 254 companies who participated, 55 percent said they had no plans to implement Windows Server 2003, and only 22 percent had plans within six months of its release.

### **Ease of Use: The "Heavyweight Framework" Issue**

Ease of use is another criterion that often dictates how quickly a new technology is adopted. Frameworks like VSS are "heavyweight." Because they must provide interfaces and protocols that support all customer solutions, the end result is often either conceptually complex or not easy to use.

Given the usability disadvantage, the adoption rate of frameworks is understandably slow. This further limits the motivation for adoption. VSS "requestors" derive benefit to the extent that there are VSS "writers," and vice versa. Adoption of a technology that is dependent on widespread support, in short, is not worthwhile until others have adopted it.

Companies will need to find solutions to the open file backup problem today, no matter what the size of their business, the state of their storage systems, or the types of programs in use. They

will need an all-purpose open file management tool that works with all applications and all backup packages during the backup process, as well as with a variety of storage media.

## **An Alternative: NovaStor Corporation's Open File Manager™**

Open File Manager™ by NovaStor Corporation addresses all these issues, while bringing closure to the open file problem. It is a partner utility that helps backup software consistently capture open and in-use files and relational applications, even if they are changing during the backup – all without locking users out of applications or forcing them to log off the network.

Open File Manager supports coherent backup of corporate data while it remains in use and serves system administrators in their most critical mission – assuring secure, efficient, round-the-clock operation of their corporate infrastructure.

With Open File Manager working alongside a company's backup software, popular databases like Oracle and Lotus Notes, SQL servers, and email servers can be in use and running while backup occurs. Because backups can be run at any time without the risk of skipped or corrupt files, the need for a specific "backup window" has now been "closed."

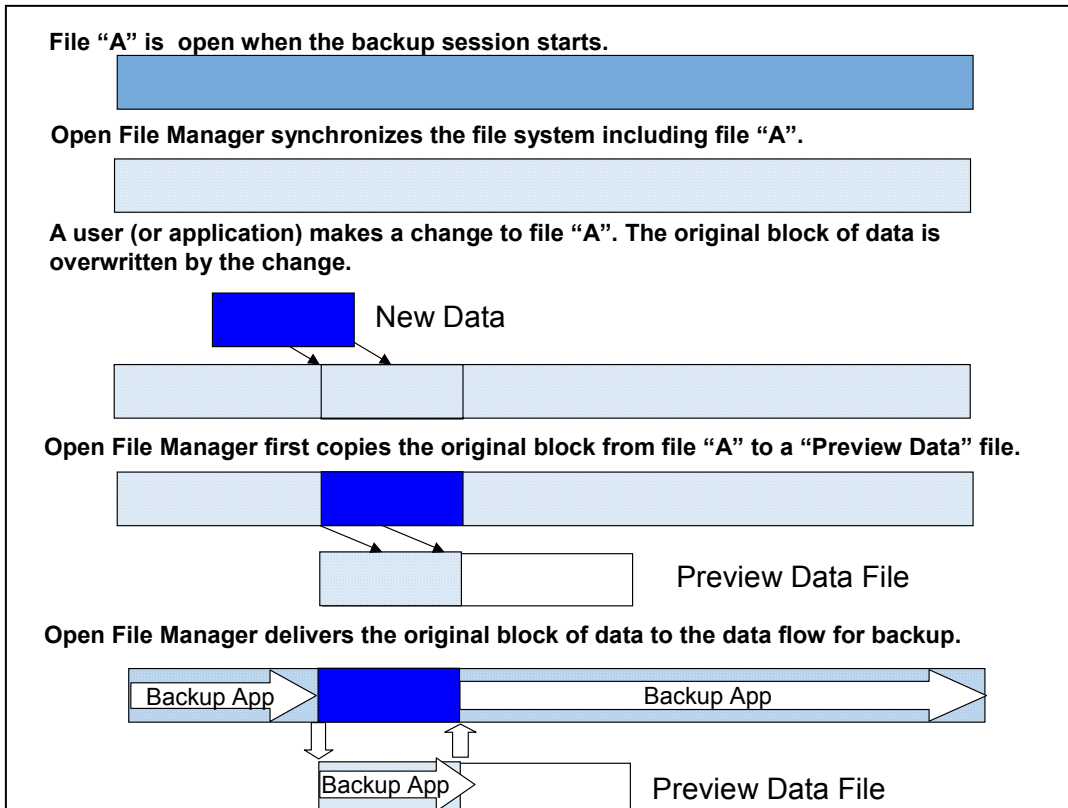
## **How Open File Manager and the Backup Application Work Together**

Open File Manager works with an enterprise's backup software and accurately manages open files during the backup, without interrupting disk access.

1. Open File Manager monitors the file system for read requests coming from the backup program. When the backup operation is initiated, Open File Manager determines when there are no partial transactions pending.
2. When it discovers this state, Open File Manager synchronizes the data at a point in time when it is stable across the entire file system, therefore maintaining the relational integrity among groups of related files, even if they are located on different volumes.
3. Once system-wide synchronization has been achieved, any file-write operation from another application goes directly to the proper file, while a copy of the Preview Data (the data that will be overwritten) is placed by Open File Manager into a dynamically allocated Pre-Write Cache.
4. When the backup application reaches a part of a file that has been changed, Open File Manager substitutes the original (pre-write) data from the Pre-Write Cache to fulfill the backup request.

- As a result, the file on tape will look exactly like it did when the backup application started, guaranteeing a complete and accurate backup and restore.

The diagram below illustrates how Open File Manager maintains the Pre-Write Cache for use by the backup program.



### **Write Inactivity Period**

Before performing system-wide synchronization, Open File Manager uses a Write Inactivity Period (WIP) to detect when there are no partial transactions across the file system. The WIP is measured in seconds. If data is modified more frequently than the WIP, then the modifications are treated as being related. As long as this frequency of modification persists, the data is not synchronized – it may contain only a part of a series of related modifications, and therefore must be regarded as transiently corrupt and not ready for backup.

Conversely, when modifications are separated by a period of time greater than the WIP, then the modifications are treated as unrelated, and the data is coherent. The data is synchronized and reliable for backup and restore. If the backup attempts to access a changing file before the system is synchronized, Open File Manager will delay that access, until the WIP occurs.

VSS does not have the notion of a WIP, and therefore writes may be cut off in the middle of a transaction, posing the risk of corrupt data in the backup.

### **Open File Manager's Copy Feature**

Open File Manager can also be used to make copies of open files for system management purposes other than backup. A system manager might, for example, wish to place a copy of a live database on another machine for training or testing purposes. Normally, this cannot be done if the database is in use, and even if access is allowed, the problem of integrity over one or more files remains. The administrator can use the Open File Copy feature by simply logging into the server containing the live database, using a login ID that has been registered in the Open File Manager agent configuration (a login agent called "Open File Copy" is provided for this purpose). The system manager can then use any normal copy utility (e.g. Windows Explorer, or the DOS COPY command) to easily copy the live files.

### **Advantages of Using Open File Manager Over VSS**

There are several major advantages of using Open File Manager over heavy frameworks such as VSS. All advantages stem from the compatibility and vulnerability issues previously discussed. Each is summarized again below.

#### **Open File Manager Works with All Backup Software**

Open File Manager is the only generic open file tool that works with *all* backup programs, providing a stable piece of a company's data protection strategy, even if the backup solution changes.

In order to obtain a fully synchronized and coherent backup through the VSS framework, a VSS-aware backup application and VSS-aware writers for all applications to be backed up should be present.

#### **Open File Manager Works with All Applications, Including Client-Server and Legacy Applications**

Open File Manager supports *all* applications, providing reliable open file protection for all data types.

As discussed, not all applications can or will integrate into the VSS framework. Client-server applications cannot be rewritten to be VSS-aware, and software vendors will likely choose not to retrofit legacy applications, for obvious reasons. These types of applications that are not VSS

aware may be backed up in an unsynchronized state, resulting in backup sets that contain skipped files or corrupt data due to partial transactions.

### **Open File Manager Supports Multiple Platforms.**

Open File Manager supports multiple Windows platforms including Windows NT Server 4.0 (Standard and Enterprise Edition), Windows 2000 Server (Standard and Advanced), Windows Server 2003 (Standard and Enterprise Edition), Windows NT Workstation 4.0, Windows 2000 Professional and Windows XP, Professional and Home Edition. Additionally, Open File Manager supports NetWare 4.x, 5.x and 6.x.

VSS is only supported on Windows Server 2003 and Windows XP. Customers with heterogeneous environments who prefer that all their data (across the entire file system) be synchronized to a single point in time should not rely on the VSS framework.

### **Open File Manager Provides Transactional Integrity Via System-Wide Synchronization**

Open File Manager is the only open file tool that reliably provides total transactional integrity. It does this through “system-wide synchronization.” The process behind Open File Manager’s approach to system-wide synchronization involves identifying a point in time when no partial transactions exist in a data set. The changing, or dynamic, data is maintained in a Pre-Write Cache. These changes are tracked so that a stable point-in-time view can be presented to backup applications. In effect, Open File Manager takes a transient state of the data, as it existed without partial transactions, and makes that state persistent for at least the duration of the backup.

VSS only captures related files for VSS-aware applications, leaving data for those applications that are not VSS-aware at risk of being skipped or corrupted during the process. This puts enterprises with linked databases in jeopardy in situations where one database is VSS-aware and the other database is not. In this scenario, VSS would not provide the expected open file backup protection, as only the data in the VSS-aware database would be synchronized. The data in the second, non VSS-aware database would be unsynchronized and possibly corrupt.

## Summary of Benefits of Using Open File Manager

Enterprises that deploy Open File Manager can enjoy the following additional benefits:

- **Data integrity and reliability.** Open File Manager does not skip files and ensures your backup set is free from corrupt data due to open files. It also handles relationally dependent files such as transaction logs, accounting systems, and customer databases with transactional integrity. Open File Manager not only allows these files to be backed up, it also ensures they are synchronized to a single point in time.
- **Increased uptime and productivity.** Mission-critical applications such as email, Web applications and groupware all require continual access. Corporate personnel from every time zone can rest assured that they will never be forced off the network when it is time for backup.
- **Ease of administration.** With Open File Manager there is no need for administrators to manually group related files, like database applications or other examples of linked files that need to be handled in a synchronized manner. Related files are automatically treated as a logical set, and sets of related files that are updated together by an application are treated as a single unit to insure a coherent backup.
- **Compatibility leads to cost savings.** Open File Manager supports both Novell and Windows and is compatible with more than 80 backup agents from more than 50 companies. It is also backup hardware independent. The choice of tape drives, controllers, autoloaders, etc. is solely dependent on backup software. A change in platform or in backup package does not mean reinvesting in a new open file solution. And, there is no need to buy costly application-specific agents.
- **No noticeable overhead is added to the system.** The speed of the backup is fully dependent on the backup software, tape drives and network bandwidth available (when backing up across a LAN). Open File Manager only caches data necessary to ensure an accurate image of open files for backup.
- **Installation is quick and easy.** Open File Manager is installed by loading either a NetWare Loadable Module (NLM) or Custom Device Module (CDM) (in the case of NetWare 6 NSS), or a Windows driver and executable on the system, generally with no changes to the existing backup configuration required. Using the Mass Deployment feature, Open File Manager can be pre-configured once, then installed to many computers with no additional user interaction.
- Includes the **Open File Copy** capability to copy open and dynamic files to other locations.

- Provides **license flexibility**. Open File Manager's license stays in effect even if a company changes backup software, applications, or versions of applications. Under the Enterprise Server License, users can easily move a license from one supported operating system to another.

## Conclusion

Microsoft's Volume Shadow-Copy Service represents a compromised approach to backing up data. It is, essentially, a driver that third-party companies can use to write solutions involving storage hardware snapshots. To be successful, it will need widespread support from application developers, backup software developers and storage solution vendors, and even then, managing multiple components in this heavy framework environment can become quite complex for the IT administrator to manage and maintain.

Considering the quality of general solutions available today, the extensive technical lead these solutions have over VSS, their greater opportunities for future technical enhancements, and the cost of combining application-specific functionality with a general framework API, the value proposition and ROI potential of VSS warrant scrutiny.

NovaStor Corporation's Open File Manager is a tried-and-true open file backup solution that works with all backup software packages, allowing them to accurately capture files that are open and in use during the backup process. It is the only open file solution that supports all applications, providing reliable open file protection for all data types.

Open File Manager is a "one size fits all" solution, offering complete support of both VSS-aware and non-VSS-aware backup packages and applications -- today.