NetApp®

ENTERPRISE STORAGE SOLUTIONS

UNIQUE BENEFITS AND COMPETITIVE ADVANTAGES OF NETAPP SNAPSHOT™ TECHNOLOGY

Unique Benefits and Competitive Advantages of NetApp Snapshot Technology

Executive Overview

Snapshot technology is available from a variety of data storage vendors, but not all snapshots are created equal. Snapshot technology from Network Appliance, the first company to offer high-volume, open-systems, "point-in-time" Snapshot capacity, offers unique, important advantages. The NetApp Snapshot technology delivers more stability, scalability, recoverability, and performance than competing technologies. NetApp has leveraged its superior Snapshot technology as a foundation for developing a family of data protection solutions, which includes SnapMirror®, SnapRestore®, SnapManager®, and SnapVault™. These products incorporate and extend the advantages of NetApp Snapshot technology to deliver the highest levels of reliability and functionality in enterprise data protection.

What Is a NetApp Snapshot?

The types of snapshot technology available from different vendors vary widely enough that it is virtually impossible to write a generic definition that accurately describes them all. At the highest level, a snapshot can be defined as "a locally retained point-in-time image of data." At the next lowest level of detail, snapshots begin immediately to differentiate themselves. The following description applies only to NetApp Snapshot technology.

NetApp Snapshot technology is a feature of the WAFL® (Write Anywhere File Layout) storage virtualization technology that is a part of Data ONTAP™, the microkernel that ships with every NetApp storage system. A NetApp Snapshot is a "frozen," read-only view of a WAFL volume that provides easy access to old versions of files, directory hierarchies, and/or LUNs (logical unit numbers). The high performance of the NetApp Snapshot also makes it highly scalable. A NetApp Snapshot is typically created in less than one second, regardless of the size of the volume or the level of activity on the NetApp storage system. After a NetApp Snapshot has been taken, changes to data objects are reflected in updates to the current version of the objects, as if the Snapshot copy did not exist. Meanwhile, the Snapshot versions of the data remain completely stable. Therefore Snapshots incur no performance overhead; users can comfortably store up to 255 Snapshot copies per WAFL volume, consecutive point-in-time images of data, all of which are accessible as read-only and online versions of the data.

NetApp Snapshot Compared to Alternative Approaches

The fundamental difference when comparing the NetApp Snapshot to other approaches is that a NetApp Snapshot does not involve copying of data from one location to another. Almost all other snapshot mechanisms involve the following three steps:

1. THE ORIGINAL DATA (WHICH IS ABOUT TO BE OVERWRITTEN) IS READ FROM THE UNDERLYING DISKS.

2. THE ORIGINAL DATA IS WRITTEN TO THE COPY-OUT AREA IN ORDER TO PRESERVE IT.

3. THE NEW DATA IS WRITTEN OVER THE ORIGINAL DATA ON THE DISKS.

This process triples the I/O burden when data is being copied out (each new write operation becomes a read operation and two write operations) and typically aggregates to a performance penalty of as much as 30–50%. Further, the copy-out area must be manually provisioned (in most cases) and involves complex ongoing maintenance/management in order to preserve older snapshots. Also, the limit on the total number of snapshots is usually well under the NetApp maximum of 255 per volume.

What Users and Administrators Do with NetApp Snapshot Copies

System administrators use NetApp Snapshot copies to facilitate frequent, low-impact, user-recoverable backups of files, directory hierarchies, LUNs, and/or application data. NetApp Snapshot copies vastly improve the frequency and reliability of backups, since they incur minimal performance overhead and can be safely created on a running system.

NetApp Snapshot copies provide near-instantaneous, secure, user-managed restores. Users can directly access Snapshot copies to recover from accidental deletions, corruptions, or modifications of their data. Since the security of the file is retained in the Snapshot copy, the restoration is both secure and simple.

NetApp Snapshot technology lifts a significant burden from the system administration staff, because users request fewer recoveries of files from backup tapes. Consequently, NetApp customers often cite NetApp Snapshot functionality as a resource they could not appreciate fully until they experienced them, but they quickly came to depend on them.

Unique Characteristics of NetApp Snapshot

Compared to competing snapshot technologies, NetApp Snapshot technology offers the advantages of better stability, performance, scalability, user visibility and file recoverability, and storage utilization.

- **Stability.** A NetApp Snapshot is read-only, completely static, and incorruptible. As such, it enables organizations to perform consistent backups from a NetApp storage system while applications are running. Administrators do not need to worry about files changing as they are being copied to tape. The result: completely consistent backups, every time.

- **Performance.** Storing a Snapshot copy on a NetApp system has no performance impact. In addition, creating and deleting Snapshot copies have virtually no performance impact. Alternative approaches need to physically relocate data to preserve snapshots, which significantly impacts performance and complicates system administration.

- **Scalability.** NetApp storage volumes support 255 Snapshot copies. Other vendors can permit fewer than 20 online snapshots, and some permit as few as four. The ability to store a large number of low-impact, frequently taken data images increases the likelihood that the desired version of data can be successfully recovered.

- **User visibility and file recoverability.** The high performance, scalability, and stability of Snapshot copies mean they provide an ideal online backup for user-driven recovery. A user who overwrites or removes data can find and recover data from hours, days, or weeks in the past, and many users recover their own files. Field reports suggest that 80% to 90% of recoveries are single-file recoveries and

that 95% take place within one or two weeks of the file being deleted. Snapshot copies are unsurpassed in ease of use and reliability for this application.

- **Storage utilization.** Two Snapshot copies taken in sequence differ one from the next by the blocks added or changed in the time interval between the two. This block-incremental behavior limits associated storage capacity consumption. Some alternative implementations can consume storage volumes rivaling that of an active file system, raising storage capacity requirements.

How Snapshot Technology Unifies NetApp Data Protection Solutions

The products in the NetApp family of data protection solutions use Snapshot as a core technology and have inherited its unique advantages. SnapMirror, SnapRestore, SnapManager, and SnapVault offer enterprises a range of benefits that competing solutions—not based on NetApp Snapshot—simply cannot match.

SNAPSHOT

NetApp Snapshot itself provides:

- User-initiated recovery of accidentally deleted files and directory hierarchies. NetApp Snapshot offers user-driven recoveries for a simple, highly reliable, self-service data protection strategy.

- Ability to save data more frequently than incremental backups to tape.

- Stability and reliability to replace nightly incremental backups to tape.

- A consistent, stable image of the file system for backup applications to use when creating tape backups. Snapshot copies are especially useful for organizations that cannot close applications that run 24x7.

- Restartable backups. Only NetApp enables restartable backups. Since a NetApp Snapshot is stable and incorruptible, backups survive tape malfunctions, system reboots, and network outages, so users can resume backup operations exactly where they left off.

- The underlying technology for SnapMirror, SnapRestore, SnapManager, and SnapVault software.

SNAPMIRROR

SnapMirror synchronously, semisynchronously, or asynchronously replicates a consistent Snapshot image of a WAFL volume for disaster preparedness and recovery, distribution of information/toolsets, and many other purposes. SnapMirror creates an incorruptible "mirror" of the source data because the mirror is based on incorruptible, highly stable NetApp Snapshot.

SnapMirror allows for easy "fire drill" testing and application upgrade testing. Because Snapshot images, which are the basis of a data set replicated by SnapMirror, are stable, a user can instantaneously resync a broken mirror with the original file system. SnapMirror also permits users to back up the mirror while it is still mirroring the active file system. Other backup solutions require three storage devices to accomplish this; NetApp can do it with two by backing up a stable Snapshot copy on the mirror. In addition, SnapMirror also allows users to create an asynchronous mirror over any time interval. In case of an outage, when the system comes back online it can restart the mirroring process from where it left off, which is crucial over slow communication channels.

SnapMirror can also be used to mirror data to different devices and on different schedules. NetApp users can mirror the contents of an appliance such as a FAS960 to another device, such as a NearStore® appliance, and mirror that NearStore system to another NearStore appliance on a different schedule. Many competing technologies can mirror only from one type of storage system to another system of exactly the same type.

SNAPRESTORE

SnapRestore software uses stored Snapshot copies to enable a multiterabyte file system or single file to be reverted to a previous state and content in a matter of seconds. By not physically relocating any data, SnapRestore can recover entire point-in-time images without impacting system performance. SnapRestore dramatically improves time-to-recovery for file systems or individual applications versus tape-based or other solutions. From a single home directory to a huge production database, SnapRestore restores data in seconds, regardless of file or volume size.

SnapRestore software uses Snapshot technology to perform near-instantaneous data restoration. In contrast, alternative storage solutions may copy all of the data and require much more time and disk storage for backup and restore operations.

With SnapRestore, data can be restored from any one of the Snapshot copies stored on the file system. This allows an application development team, for example, to revert to Snapshot copies from various stages of their design or test engineers to quickly and easily return data to a baseline state. Restoring to the base environment takes only seconds, and the restored environment is identical to the point at which the Snapshot copy was created.

SNAPMANAGER

SnapManager uses Snapshot technology to provide near-instantaneous hot backups and near-online restores, delivering the highest level of availability, scalability, and reliability for a range of application environments at an unmatched low total cost of ownership. Because Snapshot technology is not only reliable and effective but also simple, it is easily integrated with products built by NetApp and its software partners.

NetApp offers SnapManager application-specific data protection solutions for Microsoft® SQL Server, Microsoft Exchange, and Lotus Domino. These products utilize Snapshot to optimize recovery for these applications. For SQL Server, for example, SnapManager dramatically reduces backup times from hours to seconds and makes every backup a full backup. Backups are based on NetApp Snapshot technology, allowing multiple databases of any size to be backed up simultaneously in seconds and requiring minimal disk space for each additional full backup.

With SnapManager, organizations can rapidly recover data and can choose the point in time they want to recover to, up to the minute. SnapManager also allows different points of recovery within a single restore operation.

SNAPVAULT

SnapVault provides backup to online media. Selected Snapshot copies from multiple NetApp systems can be backed up to a common Snapshot copy on a central online repository, enabling high-speed tapeless restores and decreasing the cost of managing backups. Many storage appliances can be backed up to one SnapVault server, and multiple Snapshot copies from each client are saved (analogous to multiple incremental backups). Users can store up to 250 stable online backups with minimal storage consumption. These Snapshot copies are ideal for meeting regulations that require backup data copies that cannot be modified or deleted.

By frequently backing up data stored on NetApp or any other storage platform to Network Appliance™ enterprise storage or NearStore systems, SnapVault provides a centralized disk-based backup solution for heterogeneous storage environments. Storing backup data in multiple Snapshot copies on the SnapVault secondary storage system lets enterprises keep weeks of backups online for faster restoration. SnapVault also gives users the power to choose which data gets backed up, the frequency of backup, and how long the backup copies are retained.

Because it is built on the SnapMirror foundation, SnapVault offers the same flexibility and power as a mirroring application. It also extends the power of the NetApp Snapshot technology on the backed-up system into centralizing remote office backups, storing years of backups, and meeting regulatory-compliance requirements. Most importantly, it extends the benefits of the NetApp Snapshot to open systems.

NetApp Snapshot Technology—The Stable Foundation for Data Protection

Snapshot technology provides a completely stable point-in-time copy of a file system, enabling organizations to implement data protection solutions that meet needs ranging from single file recovery for individual users up to complete disaster recovery for multinational enterprises. While many data storage and management vendors now offer snapshot functionality, the NetApp Snapshot—the original, most highly integrated, and most functional technology—offers the widest range of benefits. Beyond that, it serves as a unifying technology that enables a comprehensive family of products that offer the highest levels of flexibility, reliability, and scalability in data protection and management.
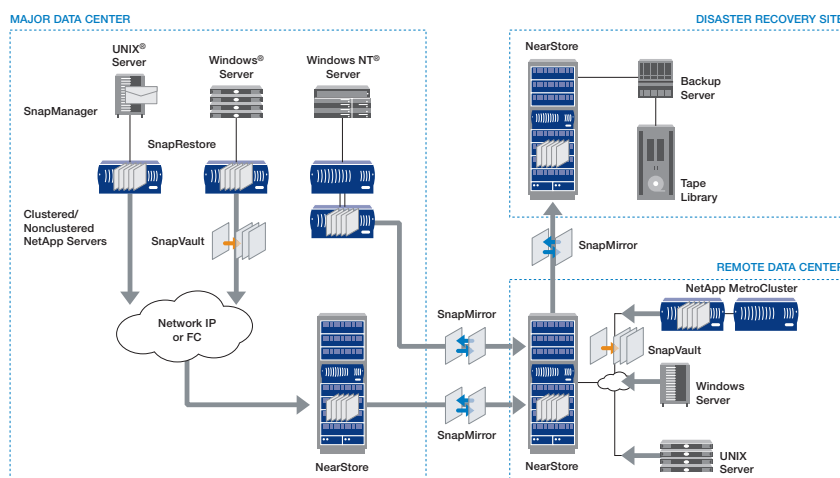

Figure 1) Snapshot unified data protection architecture.