StoreVault™
A NetApp Division

StoreVault Advanced Protection Architecture

NetApp technologies working together

Advanced data protection

Advanced system protection

introduction

StoreVault **Advanced Protection Architecture** combines protection for your data with technologies that maintain your system to ensure maximum availability. The NetApp technologies work together, providing StoreVault products with peace-of-mind data protection and system availability rarely found outside the data center.

There are two key parts to Advanced Protection Architecture. First, StoreVault **Advanced Data Protection** is composed of core NetApp data protection components that have been hardened in some of the most rigorous data center environments in the world. Second, StoreVault **Advanced System Protection** is a collection of NetApp technologies that work together to provide a high level of system uptime, ensuring maximum data availability.

StoreVault Advanced Protection Architecture is just one of the ways that the StoreVault S500 delivers peace-of-mind data storage, allowing you to spend more time on your business and less time worrying about your storage.

For more information, please visit **www.storevault.com**

advanced data protection

Overview

With StoreVault products, your data is protected in many ways. NetApp Snapshot™ technology provides the ability to maintain 255 snapshot images per volume. Snapshot images are taken without disruption to normal operations and with no performance impact. SnapRestore® StoreVault Edition provides a way to almost instantaneously restore individual files, a directory, or even a multiterabyte file system. Data ONTAP® StoreVault Edition is based on the highly optimized, scalable, and flexible operating system that powers NetApp enterprise storage solutions. The WAFL® (Write Anywhere File Layout) file system provides availability, flexibility and high performance. Integrated NVRAM (nonvolatile memory) protects data in cache even in the event of sudden power loss. NetApp FlexVol™ technology simplifies storage allocation and ensures much higher levels of storage utilization, so that you purchase additional storage only when you need it.

NetApp Snapshot Technology

A Snapshot copy is a point-in-time image of the file system, which is taken instantly with no impact on system performance and with very little impact on storage capacity. Snapshot copies can be browsed in a directory structure that looks just like the original; in fact, the only difference is that the Snapshot directory is a read-only image of the file system frozen in time. A Snapshot copy can be recovered instantaneously to "revert back" to that point in time for an individual file, a folder, a directory, or even for the entire file system. Research has shown that the majority of restore requests are for individual files, but reverting the file system might be useful in the event of a virus infection or to reestablish a baseline environment for testing. The power of NetApp Snapshot technology is its simplicity—end users can even be authorized to recover their own files and directories from a Snapshot copy without the intervention of a system administrator.

NetApp Snapshot technology is unique in the way that it captures images of data, resulting in reduced storage costs and system administration time.

NetApp Snapshot technology is integral to the way the file system works. The WAFL file system was developed by NetApp to enable high-performance, high-integrity storage systems. By using a set of pointers to the individual blocks of data, the file system knows where everything is. By making a copy of those pointers, and not the data, an instantaneous image of the entire file system can be captured. As data blocks are changed, pointers in the live file system are redirected to new blocks; however, the Snapshot pointers still point to the original blocks to preserve that point-in-time image. When another Snapshot copy is taken, the new pointers are recorded against the current live file system.

Also, the backup window becomes a thing of the past, because backups to tape can be performed on a Snapshot copy at any time, not just nights and weekends!

Data ONTAP StoreVault Edition

At the heart of StoreVault products is a robust operating system that is based on Data ONTAP, the highly optimized, scalable, and flexible operating system that powers NetApp enterprise storage solutions. Although it is tailored to meet the needs of small and mid-sized businesses, the performance, reliability and peace-of-mind data protection remain the same.

Data ONTAP StoreVault Edition provides support for key underlying NetApp technologies, including Snapshot technology that enables instant backup and restore; RAID-DP™, which provides protection from concurrent disk drive failures; the WAFL file system, which provides availability, flexibility, and high performance; integrated NVRAM for data protection; and seamless integration into existing Windows® and UNIX® installations. The combination of Data ONTAP StoreVault Edition with StoreVault Manager provides a simple-to-use yet robust, scalable, and flexible environment. All storage management commands are preformed exclusively through StoreVault Manager; no command-line interface knowledge is required.

SnapRestore StoreVault Edition

Today there are many threats to critical business data. Files can be overwritten or deleted, or they can become corrupted. With traditional data recovery methods, recovery can take hours or even days. Using NetApp Snapshot technology, SnapRestore StoreVault Edition provides a way to almost instantaneously restore individual files, a directory, or even a multiterabyte file system; and because no data is copied, recovery time is the same. In contrast, alternative storage solutions copy all of the data and require much more time and disk storage for the backup-and-

restore operations.

SnapRestore StoreVault Edition is tailored to the needs of small to medium-sized businesses and provides a simple interface to enable IT generalists to quickly revert an entire volume to a previous point in time without restoring individual files and directories.

FlexVol

Allocation of storage to applications and user groups can be challenging: Users rarely predict the right levels of storage, and changes in business circumstances change the requirements frequently. In a direct-attached storage environment, the spare storage seems to always be in the wrong place. Storage is typically allocated in fixed volumes based on predicted needs. If there is a need to change that volume size, then typically a new volume must be set up; the contents must be migrated to the new volume; and users and applications must be mapped to the new volume. For these reasons, storage is usually over-provisioned. This prevents users and applications from running out of storage soon, but it is very inefficient in terms of utilization.

Data ONTAP StoreVault Edition contains unique NetApp technologies, including FlexVol, which allow capacity to be allocated on the fly without disrupting users or applications. Volumes can also be easily resized on the fly, both up and down, also without disruption to users or applications. FlexVol also enables a technique called thin provisioning, so that the total storage allocated can exceed the physical storage. As storage is consumed, StoreVault Manager monitors the level of the central pool and provides alerts when defined thresholds are reached, enabling more physical storage to be added only when it is needed.

The result is more efficient use of storage, lower costs, and reduced management effort, because the storage allocation is essentially set to autopilot.

Block Checksums

NetApp uses an advanced method of ensuring the consistency of data written to the disks. For every eight data blocks, each of 512 bytes, the ninth block contains checksum information about the preceding eight data blocks. The checksum information is read in the same I/O request, so there is no performance hit. The checksum information is compared to what was expected, and if it does not match, then the bad block can be immediately reconstructed from the other drives. With RAID-DP this can be done even if a disk has failed or is missing!

Block checksums can be monitored to ensure the continuous integrity of the data on the disk. If multiple inconsistencies are detected, then Data ONTAP StoreVault Edition can initiate a Rapid RAID Rebuild in the background.

advanced system protection

Overview

StoreVault products use a combination of NetApp technologies that work together behind the scenes to ensure the highest levels of data availability.

Continuous disk drive monitoring and periodic automated maintenance can alert the system to a potential disk drive failure before it happens. If a drive is diagnosed as being likely to fail, then a global hot spare can be instantly brought online. Rapid RAID Rebuild enables the contents of the potentially bad drive to be copied in the background to the spare before it fails. If it fails before the full contents are copied, then only the remainder needs to be rebuilt from parity calculation, dramatically reducing the time to full recovery.

Single-drive power cycling allows a hung drive to be temporarily shut down and restarted without disrupting the entire array. Even the firmware for an individual drive can be updated without disruption to the system.

With RAID-DP, your data remains protected even in the event of dual concurrent drive failures. StoreVault products with RAID-DP can even withstand a second drive failure during the recovery rebuild operation.

RAID-DP

Conventional single-parity RAID schemes provide protection in the event of a disk drive failure. If a drive fails, the data can still be constructed from the surviving drives; and when the failed drive is replaced, the entire array can be rebuilt to its protected status. However, if a second drive fails before the array is rebuilt, then all of the data can be lost. With today's high-capacity disk drives, the rebuild time is typically many hours, increasing the probability of a second drive failure before recovery is complete.

NetApp RAID-DP (double parity) technology prevents data loss in the event of a second drive failure without excessive redundancy costs. In an elegantly simple solution, a second parity drive is added to the array, and parity for this drive is calculated differently from the first parity drive.

A key advantage of RAID-DP is its flexibility. Like RAID 4, a RAID-DP group can be expanded on the fly without disruption to users or applications. A RAID 4 group can be converted to RAID-DP with the addition of a drive and a few mouse clicks. A RAID-DP group can even be downgraded to RAID 4 if necessary.

With RAID-DP, your data remains protected even during a recovery rebuild and can even withstand a second drive failure during rebuild. RAID-DP is just one of the ways that StoreVault products deliver peace-of-mind data protection.

Global Hot Spare

Having a hot spare reduces the time to full data protection by automatically starting the rebuild process as soon as a failed drive, or a drive that is about to fail, is detected. Typically, in the event of a disk drive failure, the failed disk is replaced with a new drive and the RAID group is rebuilt. As the name suggests, a hot spare is a spare drive that is in the StoreVault product, and ready to be used, but not currently used for data. Data ONTAP StoreVault Edition detects the presence of a drive that has failed or is showing signs of imminent failure. The hot spare is immediately brought online and built in the background to replace the failed drive. The administrator is notified of the event and can physically replace the failed drive at a convenient time.

This immediate failover significantly reduces the likelihood of a second drive failure occurring while the array is being rebuilt. Protection from dual drive failure can be provided by the NetApp RAID-DP implementation.

Rapid RAID Rebuild

The capacity of disk drives is growing significantly faster than the data rates to the drives, with the result that the time to rebuild is extended to many hours. Rapid RAID Rebuild is a NetApp technology that combines drive monitoring and global hot spare. When potential failure of a drive is detected, Rapid RAID Rebuild enables the contents of the potentially bad drive to be copied in the background to the hot spare before failure occurs. If the flagged drive fails before the full contents are copied, then only the remainder needs to be rebuilt from parity calculation, dramatically reducing the time to full recovery.

This background rebuild does not incur the performance penalty that a normal RAID rebuild inflicts on users and applications.

Drive Power Cycling

Hard disk drives are very complex devices with their own software or firmware and sophisticated error correction and data protection algorithms. Occasionally a drive may get hung while trying to retrieve data. Most systems would call the drive out as a bad drive, which would require replacement of the drive and system rebuild. StoreVault products have the capability to individually power cycle the hung drive (similar to rebooting a PC). Very often this clears the problem and the drive behaves normally. This power cycling is logged, and if the drive continues to exhibit problems it is flagged for replacement. If there is a global hot spare, then the system goes into Rapid RAID Rebuild, as described in the previous section.

Nondisruptive Firmware Updates

Occasionally the firmware on the drives needs to be updated to provide system improvements. Unlike competitive systems, the StoreVault products can keep working without disruption to normal operations. The disk drives can have their firmware updated without bringing down applications or preventing users from getting to their data.

Drive Monitoring and Maintenance

The disk drives are continuously monitored for health and performance. If any of the parameters exceed predefined limits, then the drive can be flagged for replacement as previously described. The individual drives also periodically execute self-maintenance routines to ensure longevity and data integrity.

Environmental Monitoring

The temperature of the system is constantly monitored to ensure that it operates within safe limits to protect data integrity. If the correct working limits are exceeded, then the system sends an alert. A change in temperature may occur through internal fan failure or external sources of heat.

If there is no response to the alert, then the unit is gracefully shut down to prevent overheating and to protect data.

summary

StoreVault Advanced Protection Architecture is designed to protect your data and maintain data availability. It is made up of two parts: StoreVault Advanced Data Protection and StoreVault Advanced System Protection. These two combine elements of NetApp technology to provide protection for your data and maintenance of your system to ensure maximum availability.

StoreVault Advanced Data Protection is composed of core NetApp data protection components that have been hardened in some of the most rigorous testing data center environments in the world.

StoreVault Advanced System Protection is a collection of NetApp technologies that include monitoring, predictive failure analysis, and self-healing elements, which work together to maintain the availability of your networked storage.

The new StoreVault S500 is an all-in-one scalable network storage solution that allows first-time NAS and SAN users to simplify not only the installation process, but also the day-to-day protection and management of their data. StoreVault products provide access to the powerful data storage management tools and capabilities that have previously been available only to large IT shops, but without the complexity normally associated with enterprise-class storage.

To find out more about how StoreVault Advanced Protection Architecture can provide additional security for your business data, please visit www.storevault.com.

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About Network Appliance

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For more information on StoreVault, A NetApp Division, go to **www.storevault.com.**

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