



Tech OnTap

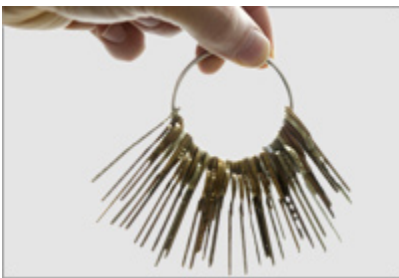
Highlights

April 2008

- › [What's New in NFSv4](#)
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The Buzz from VMworld Europe 2008

NetApp VMware Team



IP storage and data management, including Site Recovery Manager (SRM), were the hot topics at the first ever European VMworld. Find out what's hot from NetApp.

Plus, check out the latest NetApp® demos, including Open Systems SnapVault® and SnapManager® for Virtual Infrastructure and the latest NetApp and VMware® tech reports.

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Tips from the Trenches

What's New in NFS Version 4?

Bikash Choudhury, Solutions Architect



NFSv4 is ready for prime time, and significant features include:

- ACLs for Windows®
- Mandatory security
- Enhanced client-side caching

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Blogging with Dave



Dave Hitz
NetApp
Founder
and EVP

NetApp is a Well-Kept Secret

We focused on the technical folks who use our products, but the higher-level business people are equally important.

› [Dave's Blog](#)

Get Involved With NetApp

We want You: Join Our Online Community

The NetApp Technology Network (Beta!)



Share best practices, exchange ideas with other storage users, access open interfaces including ONTAP SDK 3.0, and more.

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Tech OnTap Spotlight

› Exclusive Early Access: Open Systems SnapVault Report

Get early access to the Open Systems SnapVault technical report for protecting virtual infrastructure.

› VeriTest NAS Comparisons

Not a performance benchmark, but a real-world comparison of NAS features and functionality.



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The Buzz from VMworld Europe 2008

By [the NetApp VMworld Europe Team](#)

VMworld Europe 2008 in Cannes, France, was the first-ever VMworld conference in Europe, and it exceeded all expectations. According to French fire code, the venue held a maximum of 4,500 people, but an additional 1,500 people struggled to cycle through the event.

As a result of the steady traffic, the NetApp team was able to take the pulse of the crowd. Now that many IT shops have significant experience with virtualized servers, two major new themes emerged:

- A growing interest in **IP-based storage**, sparked by the search for the next area for cost cutting
- **Data management**—new tools are needed to manage data in virtual environments, and this need will increase as virtualization continues to grow

Because you're a Tech OnTap member, we're pleased to bring you the latest updates from the show, including early access to many of the new technical reports and demos that NetApp featured at VMworld.

IP-Based Storage

The identification of underutilized physical servers led to the adoption of server virtualization within the enterprise. If you virtualized your server infrastructure, you probably reduced your total server count and increased server utilization; you may have also virtualized your storage environment for similar benefits.

Many of the visitors to our VMworld booth were looking for new areas within their IT infrastructures in which they could further optimize and cut costs, and many seem to have concluded that storage networks are the next area they should address.

Most people continue to believe that Fibre Channel offers the best possible storage network performance and like their FC SANs, but they have observed that per-port utilization rates for VMware® hosts are typically low—presenting an

Explore

Deduplication and VMware

Want to learn more about the synergy between NetApp deduplication and VMware? Our January 2008 special edition featured three articles dedicated to various aspects of this important topic:

- [The Perfect Virtual Marriage](#)
- [Virtualizing Storage for VMware Success](#)
- [Deduplication and VMware DR](#)

Or read the entire issue (PDF).

› [More](#)

SnapManager for Virtual Infrastructure

SnapManager for Virtual Infrastructure is the latest addition to NetApp's SnapManager suite of products for managing data stored on NetApp storage.

Like all SnapManager tools, SnapManager for Virtual Infrastructure enables VMware admins to carry out important storage tasks, such as backup, recovery, and replication, without needing to involve a storage admin.

Rather than get involved in every operation, the storage admin can simply define policies that govern which activities are allowed. Regular data management activities can be fully automated.

› [More](#)

opportunity to improve efficiency.

IP-based storage infrastructures such as iSCSI and NAS serve the same functions as an FC SAN, but the IP infrastructure is considerably less expensive, IP networking expertise is more widespread, and technologies such as NAS offer significantly simpler data management.

The potential synergy between NAS running NFS and VMware is starting to be appreciated as IT groups discover that NFS can reduce complexity, simplify management, and accelerate recovery in virtual environments.

Because both NetApp and VMware support many storage protocols, including Fibre Channel, iSCSI, and NFS, we allow you to choose the technology that best addresses your needs. NetApp is the only storage vendor that supports all these protocols on a single storage platform, so we can help you make solid decisions today without locking you into a storage architecture. Many of the resources provided in [section 3](#) can help you understand your deployment options when choosing a storage infrastructure for VMware.

Data Management

Now that most IT groups are comfortable with the basics of the virtual infrastructure, the next frontier is data management for this infrastructure. A lot of new tools are out there to help with a variety of VMware management issues, including migration, data protection, and provisioning.

At the NetApp booth we highlighted the efficiency and economy of our approach to data management in VMware environments. NetApp can provide production storage, local backup, a remote copy of your full VMware environment, and a remote backup history—using the same amount of storage that most vendors would need for production storage alone.

(We provide links to technology demonstrations and other technical resources relevant to the following discussion in [section 3](#).)

- **Data deduplication.** Our solution starts with NetApp® deduplication, which eliminates the redundant data that is inherent in virtual server environments—reducing your production footprint by an average of 50% to 70%. ([A recent issue of Tech OnTap](#) (PDF) was devoted to the use of deduplication with VMware.) The cost savings that result from data deduplication can actually finance additional elements of your virtual infrastructure—elements you might not otherwise be able to afford.
- **Local data protection.** The next element of our solution is SnapManager® for Virtual Infrastructure. This product provides policy-driven backups and automates the recovery and replication of virtual machines. By combining application backups for many common applications, such as Microsoft® Exchange, SQL Server™, and others, NetApp enables the virtual infrastructure to scale beyond today's limits without eating up server resources and bandwidth.
- **Data protection for storage other than from NetApp.** Open Systems SnapVault® is a disk-to-disk backup solution that can protect virtual infrastructures on storage not from NetApp. It moves data incrementally in very small chunks (4KB data blocks), making it especially suitable for remote offices with slow network connections.

With Open Systems SnapVault 2.6, there are two ways to back up and recover a virtual machine:

- You can install Open Systems SnapVault on any virtual machine and back it up just as you would a physical server.
- You can install it in the ESX Server Service Console.

[A new technical report](#), exclusive to Tech OnTap readers, provides the details.

- **Disaster recovery.** Maintaining redundant applications is often impractical. While server virtualization simplifies the server side of business continuity, the cost of storage can still be a financial hurdle. The savings realized by NetApp data deduplication can finance the remote storage required for disaster recovery. For the same amount of storage you would otherwise need to run production, NetApp gives you production, local backup, and remote storage.

Using SnapManager for Virtual Infrastructure you can manage your replication schedules as well as your local backups. When you replicate your production environment using NetApp SnapMirror managed by SnapManager for Virtual Infrastructure, you also replicate the backups of your production environment. If a single virtual machine (VM) fails, you can restore it quickly using SnapManager for Virtual Infrastructure.

- **VMware Site Recovery Manager (SRM).** For site failures that impact many VMs, you can restore services simply with VMware SRM, an integrated site- failover solution that leverages NetApp SnapMirror® and other capabilities to automate recovery of your virtual data center. VMware—which had by far the largest booth of all participants at VMworld—featured NetApp as their exclusive storage partner for their Site Recovery Manager demos and as the storage provider for their Hands-On lab sessions. In fact, NetApp’s storage was the only storage displayed in the VMware booth.

Many of the people we talked to at VMworld suggested that thus far they’ve only virtualized about 20% of what they have targeted. By leveraging NetApp’s unique approach to data management for virtual infrastructures, many believe they can convert anywhere from 60% to 90% of their physical servers.

More on Site Recovery Manager

Because SRM was such a hot topic at this VMworld, we want to say a few more words about it. SRM has three components: discovery/setup, failover, and test. One of the most powerful benefits of SRM is that it allows you to preprogram your disaster response.

Powering hundreds of servers up or down can be a challenge, especially in the middle of a crisis. The recovery plan that is created during the setup phase of SRM configuration allows you to preconfigure everything:

- Which machines to bring up
- Who to notify
- Specific steps to take
- The allocation of appropriate CPU/memory
- Which specific port groups and VLANs to bring online

Creating this type of plan normally takes months, even years. Because of its discovery capabilities and close integration with Virtual Center, SRM allows you to create the plan in a short period and allows you to execute the plan flawlessly with minimal user intervention. NetApp has worked closely with VMware to ensure that SRM is able to leverage the unique features of NetApp storage in all phases of operation. For instance, SnapMirror provides fast and efficient data replication to your remote site; NetApp cloning is used during SRM testing so that tests are nondisruptive and don’t require huge amounts of additional storage.

VMworld Europe Resources

Featured Technology Demonstrations

- [SnapManager for Virtual Infrastructure \(SMVI\)](#)
 - Backup and recovery with minimal infrastructure overhead
 - Crash-consistent images using NetApp Snapshot™
 - Replication of VMs off site for DR
 - Recovering VMs quickly and easily
- [Open Systems SnapVault](#)
 - Ability to backup a virtual environment from the ESX level
 - Backing up an entire ESX server rather than individual VMs
 - Bare metal recovery
 - Central management via Protection Manager

Featured Technical Reports

- [Exclusive Early Access: Open Systems SnapVault Design and Implementation Guide for Protecting Virtual Infrastructure](#) (PDF). Open Systems SnapVault is NetApp's solution for remote, disk-to-disk backup for Windows®, Linux®, UNIX®, and other system platforms. Open Systems SnapVault 2.6 now supports VMware, providing a new approach for data protection in virtual environments. This paper discusses design strategies and best practices for Open Systems SnapVault deployment with virtual infrastructures.
- [Making IT Invisible: NetApp Storage for Virtual Server Environments](#) (PDF). This Enterprise Strategy Group white paper from Mark Bowker examines the deployment of NetApp storage from a virtual infrastructure perspective. It includes details on current protocol considerations and discusses specific NetApp technologies, such as deduplication, FlexClone®, and DR.
- [NetApp and VMware ESX Server 3.0: Building a Virtual Infrastructure from Server to Storage](#) (PDF). This NetApp white paper from 2006 discusses ways to reduce VMware infrastructure cost, increase storage utilization, improve fault tolerance, and address backup and restore challenges.
- [NetApp and VMware VI3 Storage Best Practices](#) (PDF). This updated paper discusses best practices for NetApp storage and VMware, including Fibre Channel, iSCSI, and NFS environments; deduplication; thin provisioning; backup; and more.
- [High Availability and Disaster Recovery for VMware Using NetApp SnapMirror and MetroCluster](#) (PDF). This paper discusses VMware disaster recovery in terms of varying levels of desired data protection.
- [NetApp and VMware Virtual Desktop Infrastructure](#) (PDF). This document discusses the virtual storage solutions that reduce cost while increasing storage utilization and administration efficiencies when implementing VMware VDI environments using NetApp technology.



VMWORLD EUROPE
2008

This feature was a collaborative effort of members of the NetApp technical team who attended and presented at VMworld Europe 2008, including:

- Darrin Chapman, Product Engineer
- Adam Fore, Marketing Manager
- Claude Steinmayer, Product Marketing Manager
- M. Vaughn Stewart, Virtualization Evangelist



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What's New in NFS Version 4?

By [Bikash R. Choudhury](#)

Since its introduction in 1984, the Network File System (NFS) has become a standard for network file sharing, particularly in the UNIX® and Linux® communities. Over the last 20 years, the NFS protocol has slowly evolved to adapt to new requirements and market changes.

For most of that time, NetApp has been working to drive the evolution of NFS to better meet user needs. NetApp Chief Technology Officer Brian Pawlowski coauthored the NFS version 3 specification—currently the most widely used version of NFS—and is cochair of the NFS version 4 (NFSv4) working group. NetApp's Mike Eisler and Dave Nioveck are coauthors of the NFS version 4 specification—the latest available version of NFS—and are editors for the NFS version 4.1 specification that is currently under development.

	NFSv3	NFSv4
Personality	Stateless	Stateful
Semantics	UNIX only	Support UNIX and Windows
Authentication	Weak (AUTH_SYS)	Strong (Kerberos)
Identification	32 bit UID/GID	String based (xyz@netapp.com)
Permissions	UNIX based	Windows like access
Transport	UDP & TCP	TCP
Caching	Ad-hoc	Delegations

Table 1) Comparison of NFSv3 and NFSv4.

NFS consists of server software—for instance, the software that runs on NetApp® storage—and client software running on hosts that require access to network storage. Proper operation requires that both sides of the connection, client and server, are mature and correctly implemented. Although NFS version 4 has been shipping from NetApp since Data ONTAP® 6.4, our code base, underwent a lot of changes

Explore

What's New in Data ONTAP 7.3?

In addition to a production-ready version of NFSv4 as described in this article, Data ONTAP 7.3 includes a variety of additional enhancements, including:

- Expanded support for deduplication: now includes V-Series and MultiStore®
- Ability to support both NetApp *and* third-party disks on V-Series storage systems
- Enhanced disk aggregate efficiency: parity disks are no longer counted in aggregate sizing
- MultiStore enhancement: SnapMover® support for disk aggregates
- Enhanced cluster takeover and giveback times

Stay tuned to Tech OnTap for more information on Data ONTAP 7.3 in coming months.

NetApp NFS Blogs

Updates and observations on many of the topics discussed in this article are available on [Eisler's NFS Blog](#) by NetApp technical director Mike Eisler. In addition, NetApp founder Dave Hitz and others regularly contribute to [NetApp blogs on a wide variety of topics](#), including frequent mentions of NFS.

and matured substantially, NFSv4 has now reached a point at which we believe it is ready for production use. Today, client implementations are becoming stable. NetApp has also made some significant changes and enhancements in Data ONTAP 7.3 to support NFSv4. In this article, I'm going to explore three significant features of NFSv4 that have gotten a lot of attention:

- Access control lists (ACLs) for security and Windows® compatibility
- Mandatory security with Kerberos
- Delegations for client-side caching

While this discussion will largely apply to any NFSv4 implementation, I'll also describe some details that are unique to NetApp and discuss best practices where appropriate.

Oracle on NFS?

There are still skeptics in the database world, but today thousands of NetApp customers choose a storage infrastructure based on NFS for their busy Oracle® applications. Find out why the simplicity and manageability of NFS, when coupled with targeted enhancements that NetApp has made over the years, make NFS an ideal platform for Oracles.

[More](#)

NFS Version 4.1

NFSv4.1 will offer a number of new features on top of NFSv4, including:

- Delegations on directories
- Sessions to ensure NFS operations only occur once
- Parallel NFS (pNFS) to enable files to be striped across multiple data servers

Mike Eisler gave a detailed explanation of the last two items in a recent blog post.

[More](#)

	AIX Client Server	BSD/OSX Client Server (not sup. by apple)	EMC Server	Humingbird Client	Linux Client Server (RHEL5)	NetApp Server	Solaris 10 client Server
Delegations	Yes		Yes		Yes	Yes	Yes
Access Control lists	Yes		Yes		Yes	Yes	Yes
Kerberos V5	Yes	Yes	Yes	Yes	Yes	Yes	Yes
File Streams						Yes	Yes
I18n	Yes	Yes		Yes	Yes	Yes	Yes
Global Namespace/ Referrals	Yes				Yes	Future	

Table 2) NFSv4 client and server implementation status.

Access Control Lists

ACLs are one of the most frequently requested features by NetApp customers seeking greater compatibility for Windows clients. NFSv4 ACLs significantly improve NFS security and interoperability with CIFS. ACLs allow access permissions to be granted or denied on a per-user basis for every file object, providing much finer-grained access control and a greater degree of selectivity than traditional UNIX mode permission bits. NFSv4 ACLs are based on the NT model, but they do not contain owner/group information. NFSv4 ACLs

are made up of an array of access control entries (ACEs), which contain information regarding access allowed/denied, permission bits, user name/group name, and flags.

Because NetApp already offers ACL support for CIFS clients, the addition of ACLs in NFSv4 creates some unique considerations. NetApp provides three types of qtrees—UNIX, NTFS, and mixed—for use by different clients. The way that NFSv4 ACLs are handled depends on the type of qtree:

UNIX Qtree

- NFSV4 ACLs and mode bits effective
- Windows clients cannot set attributes
- UNIX semantics win

NTFS Qtree

- NT ACLs and mode bits effective; UNIX clients cannot set attributes
- NFSv4 ACLs are generated from the mode bits for NFS clients accessing files with an NT ACL
- NT semantics wins

Mixed Qtree

- NFSv4 ACLs, NT ACLs, and mode bits effective
- Windows and UNIX clients can set attributes
- NFSv4 ACL is generated from the mode bits for files having NT ACLs

Obviously, you should choose the type of qtree you use carefully to get the desired results:

- NFS access only: UNIX qtree
- Mixed access: mixed qtree
- Mostly CIFS access: NTFS qtree
- CIFS only: NTFS qtree

The only other best practice with regard to ACLs is to use no more than 192 ACEs per ACL. You can increase the number of ACEs per ACL to a current maximum of 400, but doing so could present problems should you need to revert to an earlier version of Data ONTAP or if you use SnapMirror® to go to an earlier version.

Mandatory Security

In addition to including ACLs, NFSv4 improves on the security of previous NFS versions by:

- Mandating the availability of strong RPC security that depends on cryptography
- Negotiating the type of security used between server and client via a secure in-band system
- Using character strings instead of integers to represent user and group identifiers

NFS security has been bolstered by the addition of security based on the Generic Security Services API (GSS-API), called RPCSEC_GSS [RFC2203]. All versions of NFS are capable of using RPCSEC_GSS. However, a conforming NFS version 4 implementation must implement RPCSEC_GSS. RPCSEC_GSS is allocated analogous to the commonly used AUTH_SYS security that was the standard method of authentication in previous NFS versions.

RPCSEC_GSS differs from AUTH_SYS and other traditional NFS security mechanisms in two ways:

- RPCSEC_GSS does more than authentication. It is capable of performing integrity checksums and encryption of the entire body of the RPC request and response. Hence, RPCSEC_GSS provides security beyond just authentication.
- Because RPCSEC_GSS simply encapsulates the GSS-API messaging tokens—it merely acts as a transport for mechanism-specific tokens for security mechanisms such as Kerberos—adding new security mechanisms (as long as they conform to GSS-API) does not require rewriting significant portions of NFS.

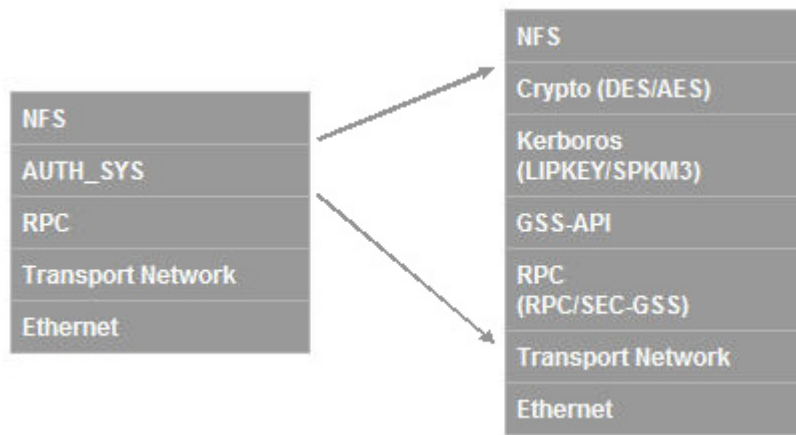


Figure 1) NFS with AUTH_SYS versus RPCSEC-GSS security.

Both NFSv3 and NFSv4 can use RPCSEC-GSS. However, AUTH_SYS is the default for NFSv3.

The only security mechanism that NetApp or most NFSv4 clients currently provide under RPCSEC_GSS is Kerberos 5. Kerberos is an authentication mechanism that uses symmetrical key encryption. It never sends passwords across the network in either cleartext or encrypted form and relies on encrypted tickets and session keys to authenticate users before they can use network resources. The Kerberos system utilizes key distribution centers (KDCs) that contain a centralized database of user names and passwords. NetApp supports two types of KDCs: UNIX and Windows Active Directory.

You still have the option of using the weak authentication method of previous NFS versions (AUTH_SYS) should you require it. You can accomplish this by specifying `sec=sys` on the **exportfs** command line or in the `/etc/exports` file. Data ONTAP only supports a maximum of 16 supplemental group IDs in a credential plus 1 primary group ID when AUTH_SYS is used. A maximum of 32 supplemental group IDs is supported with Kerberos.

Delegations for Client-Side Caching

In NFSv3, clients typically function as if there is contention for the files they have open, (even though this is often not the case). Weak cache consistency is maintained through frequent requests from the client to the server to find out whether an open file has been modified by someone else, which can cause unnecessary network traffic and delays in high-latency environments. In situations in which a client holds a lock on a file, all write I/O is required to be synchronous, further impacting client-side performance in many situations. NFSv4 differs from previous versions of NFS by allowing a server to delegate specific actions on a file to a client to enable more aggressive client caching of data and to allow caching of the locking state. A server cedes control of file updates and the locking state to a client via a delegation. This reduces latency by allowing the client to perform various operations and cache data locally. Two types of delegations currently exist: read and write. The server has the ability to call back a delegation from a client should there be contention for a file. Once a client holds a delegation, it can perform operations on files whose data has been cached locally to avoid network latency and optimize I/O. The more aggressive caching that results from delegations can be a big help in environments with the following characteristics:

- Frequent opens and closes
- Frequent GETATTRs
- File locking
- Read-only sharing
- High latency
- Fast clients
- Heavily loaded server with many clients

Data ONTAP supports both read and write delegations, and you can separately tune the NFSv4 server to enable or disable one or both types of delegations. When delegations are turned on, Data ONTAP will

automatically grant a read delegation to a client that opens a file for reading, or a write delegation to a client opening a file for writing.

The options for enabling or disabling read and write delegations have been provided to give you a level of control over the impact of delegations. Ideally, the server determines if it will provide a delegation to clients or not. Turning on read delegation in a highly read-intensive environment will be beneficial. Write delegations in engineering build environments in which each user writes to separate build files and there is no contention will also improve performance. However, write delegations may not be helpful in scenarios in which there are multiple writers to the same file.

Finding Out More

If you're concerned about data security (and who isn't?), new NFSv4 features such as ACL support and mandatory security can significantly reduce the risk of unauthorized data access. Another important design goal for NFSv4 was improved performance on the Internet. Improved client caching behavior through delegations was intended to help satisfy this goal.

In addition to the highly visible changes I've described, NFSv4 includes a number of other significant changes, including:

- Elimination of the independent mount daemon and other accessory services that require additional open ports
- Compound requests that group common tasks into a single operation to accelerate response and reduce network traffic

If you want to learn more about these and other features of NFSv4, [TR-3085](#) (PDF) provides a good general reference.



Bikash R. Choudhury

Solutions Architect
NetApp

In his current role as NFS/technical application solutions architect, Bikash spends his time designing architectures for technical application solutions that use NFS, performing functional testing and certifications, and providing Global Partner Alliance support for NFS best practices. Bikash started at NetApp eight years ago as a technical support engineer, and later became the technical global advisor (TGA) for one of NetApp's largest customers.



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The (Beta!) NetApp Technology Network

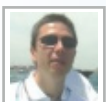
You told us loud and clear in our recent member survey that you wanted more opportunities to interact with NetApp technical staff plus easy ways to exchange ideas and best practices with other storage users.

Well, you asked for it, and you got it!

In early March, NetApp quietly launched our very first online user community - [the NetApp Technology Network](#). If you regularly talk about things like "clones," "virtual machines," and "disaster recovery" (and everyone knows you're talking storage and not world domination), this is the place for you.

Not only does the site provide central access to NetApp® open interfaces such as Manage ONTAP® SDK, SMI-S Provider, and SNMP, this public forum makes it easy to share resources ranging from scripting solutions to best practices to free third-party tools. NetApp systems engineers, product engineers, and other technical experts monitor the site frequently and want to hear from you.

Popular recent threads include:



[Data Explosion: From 500GB to 500TB in 7 Years](#)

An IT manager's Storage Expo presentation detailing his organization's storage strategy and deduplication savings in key application areas (e.g., 49% for VMware® with VCB, 66%–68% for SQL/Sybase, etc.).

Explore

NetApp Blogs— Check Them Out!

Did you know that, in addition to Dave's Blog, there are over 15 NetApp employee blogs?

[Recent posts include:](#)

- "My last post included a tutorial on how to use VMware server on NetApp storage to clone OS configurations. A hiccup I ran into with the FC7 on VMware server 1.0.4 involved SCSI drive issue..." ([read full blog](#))
—**Simple Steve**, by engineering developer Steve Klinkner
- "I've been getting a lot of questions about the upcoming SnapDrive® 6.0 release, which supports VMware Windows® GuestOS. SnapDrive 6.0 is based on the new MMC 3.0 and ..." ([read full blog](#))
—**Storage Nuts & Bolts**, by global systems engineer Nick Triantos
- "Before I get into a few of the cool ways to manage your paths using the Data ONTAP® DSM, I think it's important to discuss load balance policies, since they play a very important role in managing your LUNs." ([read full blog](#))
—**WHU Who!?**, by SW technical staff member James Burke

► [Full list of NetApp blogs](#)



How are you using hierarchical groups in Ops Manager?

NetApp users exchange feedback about how they organize and report on storage groups.



Manage ONTAP SDK 3.0 Introduction and Download

Manage ONTAP SDK provides resources to develop applications that monitor and manage NetApp storage systems. SDK 3.0 supports the Data ONTAP 7.3 API set and three new platforms while featuring updated decision guides, dynamic link libraries for C/C++, and new sample code.

The site is publicly available, even though it's in the initial beta phase. We invite you to join and tell us what you think. We are excited about this project, and excited about partnering with Tech OnTap members to make the NetApp communities great.

Try It Now and Get a T-shirt with the Brand-New NetApp Logo!

Experience has shown that not only do Tech OnTap members love to give feedback, they also love NetApp stuff! So we're offering a bit of an incentive for you to check out our new communities sooner rather than later.

The first 25 people to start a thread that spurs comments from others will get a new NetApp t-shirt. When at least two comments* have been posted to your thread, please e-mail the link, your shirt size, and address to techontap@netapp.com and we will send you a cool new shirt!

*Only the first 25 new threads to generate 2 or more comments are eligible. While you can respond to your own posts all you like, two people other than yourself will have to respond to your post for you to qualify for the shirt.