NetApp ONTAP 9.9.1 Feature Overview

ONTAP What's New

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TR-4894: NetApp ONTAP 9.9.1 Feature Overview

Justin Parisi, NetApp

NetApp ONTAP is the industry-leading flagship data-management software that enables you to seamlessly manage and protect your data wherever it lives, whether on-premises, at the edge, or in the cloud.

NetApp ONTAP offers support for the following features, all on the same platform:

- NAS protocols (NFS and SMB)
- SAN protocols (iSCSI, FCP, and NVMe)
- S3 data access
- Data protection (NetApp Snapshot copy, NetApp SnapMirror, and SnapVault technologies)
- Storage efficiencies (deduplication, compaction, and compression)
- High Availability (HA) failovers (including fast failovers for Tier-1 SAN with the All-SAN Array)
- Support for all-flash, spinning drive, and hybrid disk configurations
- Security features (multifactor authentication, NetApp Volume Encryption, and Secure Purge)

This is not a comprehensive list; if we included every feature offered by ONTAP, this document would be hundreds of pages long!

For more detailed information about NetApp ONTAP, see the ONTAP 9 data management software data sheet and the product documentation.

System Manager enhancements

With the revamped GUI experience for ONTAP introduced in ONTAP 9.8, you might have noticed that some things moved or were no longer available. In ONTAP 9.9.1, we have collected customer feedback and addressed some of the concerns around the GUI and have added some of the missing functionality back in, as well as adding new and improved features. The following section covers some of these changes and new additions. You can also find information about System Manager in the System Manager docs.

Functionality restored/usability enhancements

You asked for it, and we listened. In ONTAP 9.9.1, some of the functionality that was no longer available in ONTAP 9.8 System Manager was added back into the product. Additionally, new usability enhancements were included.

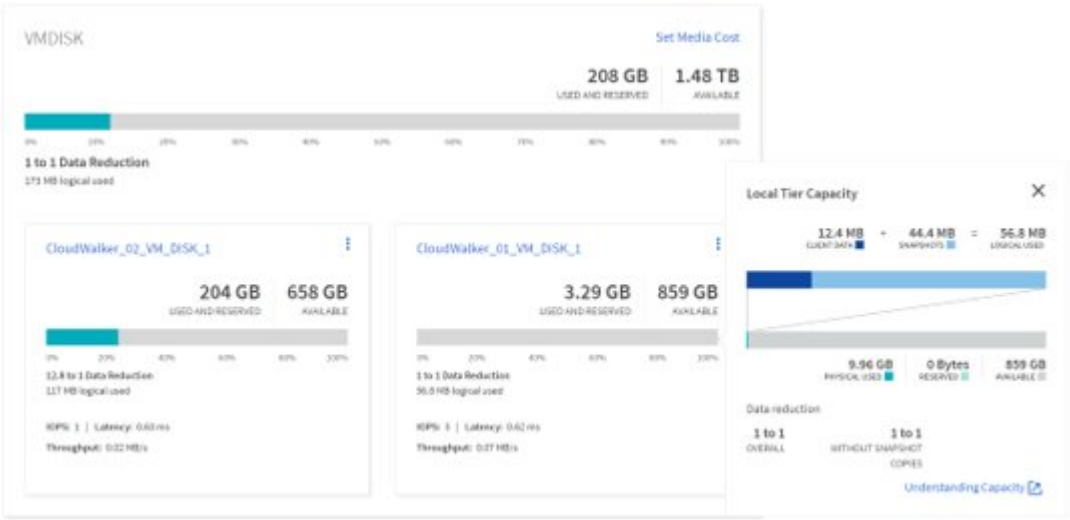
Manual selection of a local tiers/aggregates during volume provisioning

System Manager 9.9.1 allows you to manually select the physical storage tier you want to use when provisioning new volumes, including the ability to specify aggregates during FlexGroup volume creation. Optionally, you can still allow ONTAP and System Manager make selections based on balanced placement logic.

Capacity display enhancements

Now you can view the logical used space by Snapshot copies in ONTAP, as well as seeing what your storage efficiency ratios look like with and without Snapshot copies.

The following figure depicts the ONTAP System Manager 9.9.1 capacity view.



NVMe over Fibre Channel – LIF creation

With System Manager, you can now create and view LIFs used with NVMe over Fibre Channel namespaces, including port statuses, asymmetrical port selection, and the ability to see the number of LIFs created per port to help avoid overloading a physical network interface.

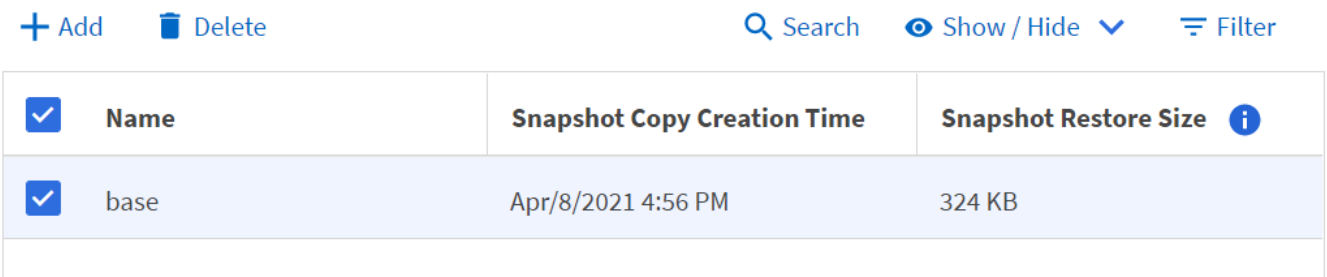
EMS Event Viewer – Dashboard

For a faster view of what issues might be present in your ONTAP cluster, System Manager 9.9.1 adds EMS events on the dashboard when you first log in. This includes errors in the past 24 hours, such as broken disks, network links down, license issues, and shelf or node errors.

You also get warnings from the past 24 hours, including failed volume moves and health monitor alerts.

Snapshot sizes and SnapMirror labels

From the snapshot views in System Manager, you can see snapshot sizes and labels (such as daily, weekly, and so on) on SnapMirror snapshot copies.



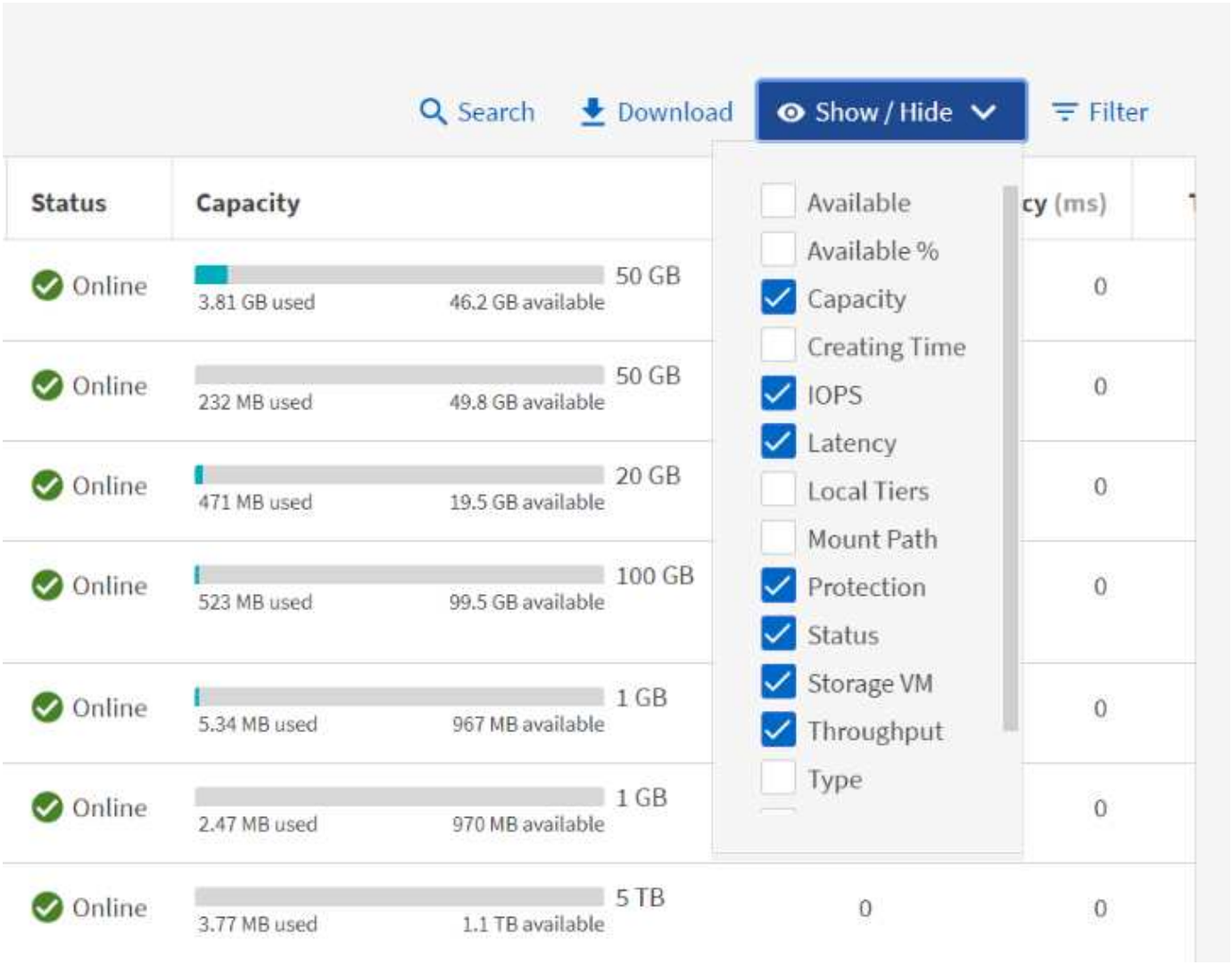
Re-home data LIFs

During failovers or after network outages have been resolved, data LIFs often remain on the failover port, which can create potential performance and resiliency concerns. If you need a simple way to send those data LIFs back home, System Manager 9.9.1 now offers a single-click method to send all data LIFs back to their intended home ports.

New volume fields to show/hide

There are additional ways to view volume information in System Manager 9.9.1 via the Show/Hide button, including local tiers and available/used information.

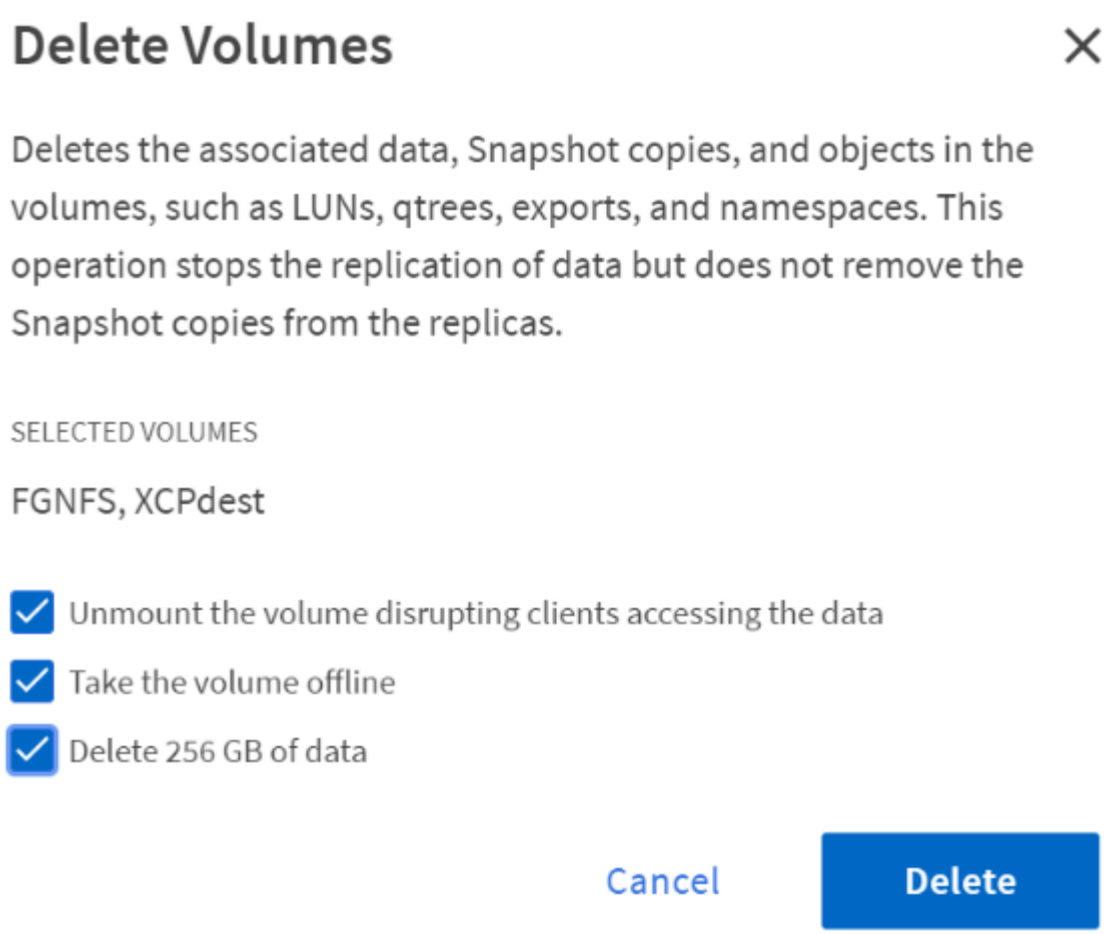
The following figure depict the new volume views in ONTAP System Manager 9.9. 1.



Bulk operations

If you need to perform multiple volume moves or deletions, map multiple LUNs to an initiator group, or add multiple volumes to a cloud tier, you can now select multiple objects and perform tasks. Volume deletions also come with a way to be able to unmount, offline and confirm deletions in a single window.

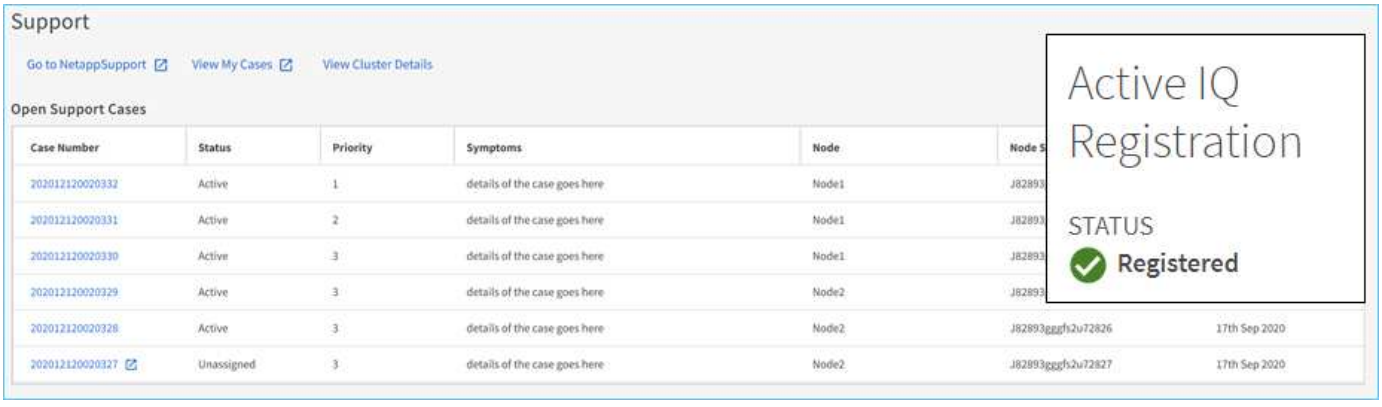
The following figure depicts simplified volume deletions in ONTAP System Manager 9.9.1.



Active IQ Integration

In the interest of giving ONTAP users a single access point for multiple information sources, System Manager 9.9.1 provides integration with the NetApp Active IQ solution. This delivers firmware recommendations as well as a method to download the images directly from the NetApp support site and easy to access support case views for when you want to see what's going on with your cluster. Simply navigate to the Support link under Cluster in the left-hand menu and register the cluster with Active IQ to begin.

The following figure depicts Active IQ views in ONTAP System Manager 9.9.1.



Hardware visualization platform expansion

Hardware visualization includes information such as platform models, serial numbers, takeover/giveback status, disk status, port information and much more. ONTAP 9.9.1 brings added platform support for hardware visualization to include all current AFF platforms.

The following components are supported in ONTAP 9.9.1:

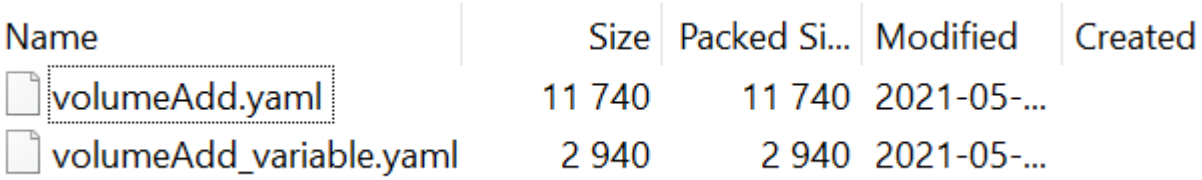
- **Platforms.** C190 / A220 / A250 / A300 / A400 / A700 / A700s / A800 / A320 / FAS500f
- **Disk Shelves.** DS4243 / DS4486 / DS212C / DS2246 / DS224C / NS224
- **Network Switches.** Cisco Nexus 3232C / Cisco Nexus 9336C-FX2

Ansible Playbook workflows

More and more enterprises are turning to automation of day-to-day tasks using applications like Ansible to provide repeatable, error-free workflows. NetApp has an entire library of Ansible playbooks available, and you can find those and more information at the Ansible for NetApp page.

System Manager 9.9.1 adds additional avenues to use Ansible with a new way to generate playbooks with a single click. To use these playbooks, install Ansible and the NetApp Collection from Ansible Galaxy, but you can start creating playbooks by clicking the Save to Ansible Playbook link on select storage provisioning tasks in System Manager.

Clicking that button creates a .zip file with the necessary .yaml files needed for Ansible.



File system analytics enhancements

In high file-count environments, trying to find information about folder capacity, data age, and file counts usually requires time-intensive commands or scripts that run serial operations over NAS protocols, such as `ls`, `du`, `find`, and `stat`.

ONTAP System Manager 9.8 introduced a way for admins to find out file system information in any NAS storage volume quickly and easily by enabling a low-impact scanner for each volume. This scanner crawls the ONTAP file system in the background with a low priority job and delivers a wealth of information that is available as soon as you navigate to a volume that has it enabled.

Enabling File System Analytics is as easy as navigating to the volume you want to scan. Go to Storage > Volumes and then use the search to find your desired volume. Click the volume, and then the Explorer tab.

From here, you see the Enable Analytics link on the right side of the page.

After you click enable, the scanner starts. The time of completion depends on the number of objects in the volume as well as the system load. After it is finished, you see the entire directory structure populated in the System Manager view. This view can be navigated down the directory tree, and it provides access for history information, directory size information, and file sizes.

ONTAP 9.9.1 brings some additional enhancements to the feature, such as filtering by file or directory name and performing fast directory deletes.

Other System Manager 9.9.1 enhancements

ONTAP 9. 9.1 also brings the following enhancements to System Manager:

• Nested igroups • SnapMirror Cloud - backups and restores (ONTAP S3 and StorageGrid only) • All SAN Array expansion • FlexCache pre-populate, DR, view bandwidth savings	• SVM-DR for FlexGroup volumes • SnapMirror cascade and fan-out support for FlexGroup volumes • FabricPool: Adjust or change minimum cooling days

SAN enhancements

ONTAP 9.9.1 delivers some important SAN-related enhancements. This section covers those features and includes links to documentations that go over those in further detail.

All SAN Array enhancements

ONTAP 9.8 introduced the All SAN Array (ASA) to the NetApp product portfolio. In ONTAP 9.9.1, the ASA gets some highly coveted additions.

Scale-out from two nodes to 12 nodes

Prior to ONTAP 9.9.1, the ASA could only be a two-node cluster. However, SAN clusters in ONTAP can scale up to 12 nodes, which provides additional scale-out for performance and capacity in enterprise SAN environments. Now, the ASA can scale up to 12 nodes in a single cluster, provided all nodes in the cluster have the ASA personality. ASA models can be mixed in the same cluster (for instance, a two-node A400 HA pair with a two-node A800 HA pair).

NVMe/FC support

The ASA can now take advantage of ultra-low latency NVMe over Fibre Channel in ONTAP 9.9.1. All that is required is a license for NVMe/FC and 32Gb FC target adapters.

In-place conversion from AFF SAN to ASA

With the assistance of a script and NetApp TME or Professional Services resources, you can convert existing AFF SAN clusters to ASA personalities without needing to migrate data. The only prerequisite is that if the cluster is serving any NAS or S3 data, those protocols and datasets should be removed prior to conversion.

Single LUN performance

Both ASA platforms and AFF SAN clusters gain the benefits of changes in ONTAP 9.9.1 that greatly improve single-LUN performance at peak workloads by way of parallelization of the SCSI stack to the LUN.

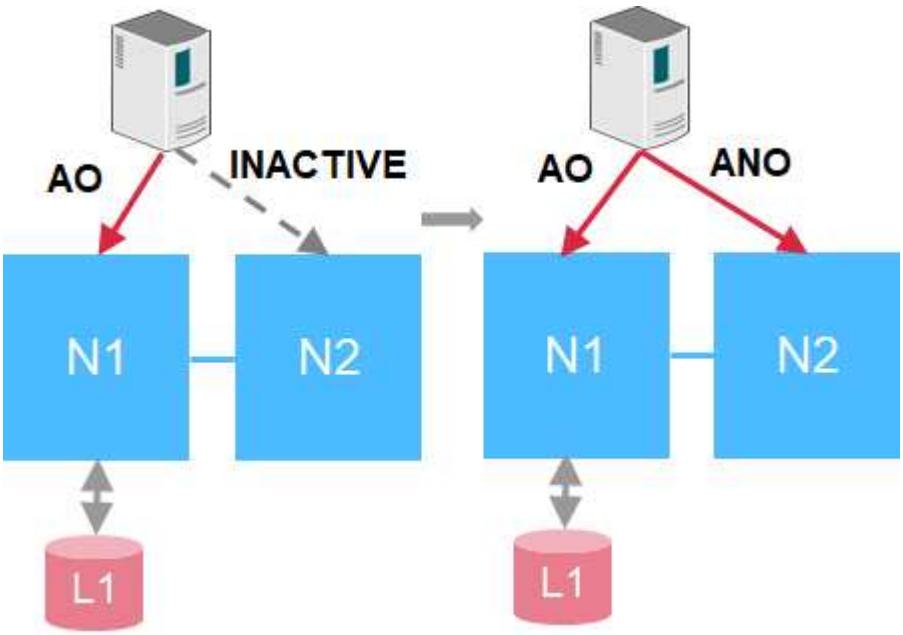
In the following table, tests on an A800 platform and an A300 platform compare performance for a single LUN workload, with nearly 4x performance for reads and 75% better performance for writes on the AFF A800 in ONTAP 9.9.1 against the same workload in ONTAP 9.8.

Platform	Random read peak IOPS	Random write peak IOPS
A800	+393%	+75%
A300	+245%	+3.5%

These improvements do not affect multi-LUN applications (such as Logical Volume Manager).

NVMe over Fibre Channel enhancements

In ONTAP 9.9.1, NVMe over Fibre Channel namespaces can now failover by way of an inactive remote path, providing greater overall resiliency for NVMe/FC applications.



In addition, ONTAP 9.9.1 introduces support for NVMe/FC with VMware virtualization workloads by providing vVol support and provisioning of namespaces through vCenter.

Data protection enhancements

Data protection in the context of this document refers to both the notion of off-site replication of data, as well as automated site infrastructure failovers. This section covers the latest data protection enhancements for ONTAP 9.9.1.

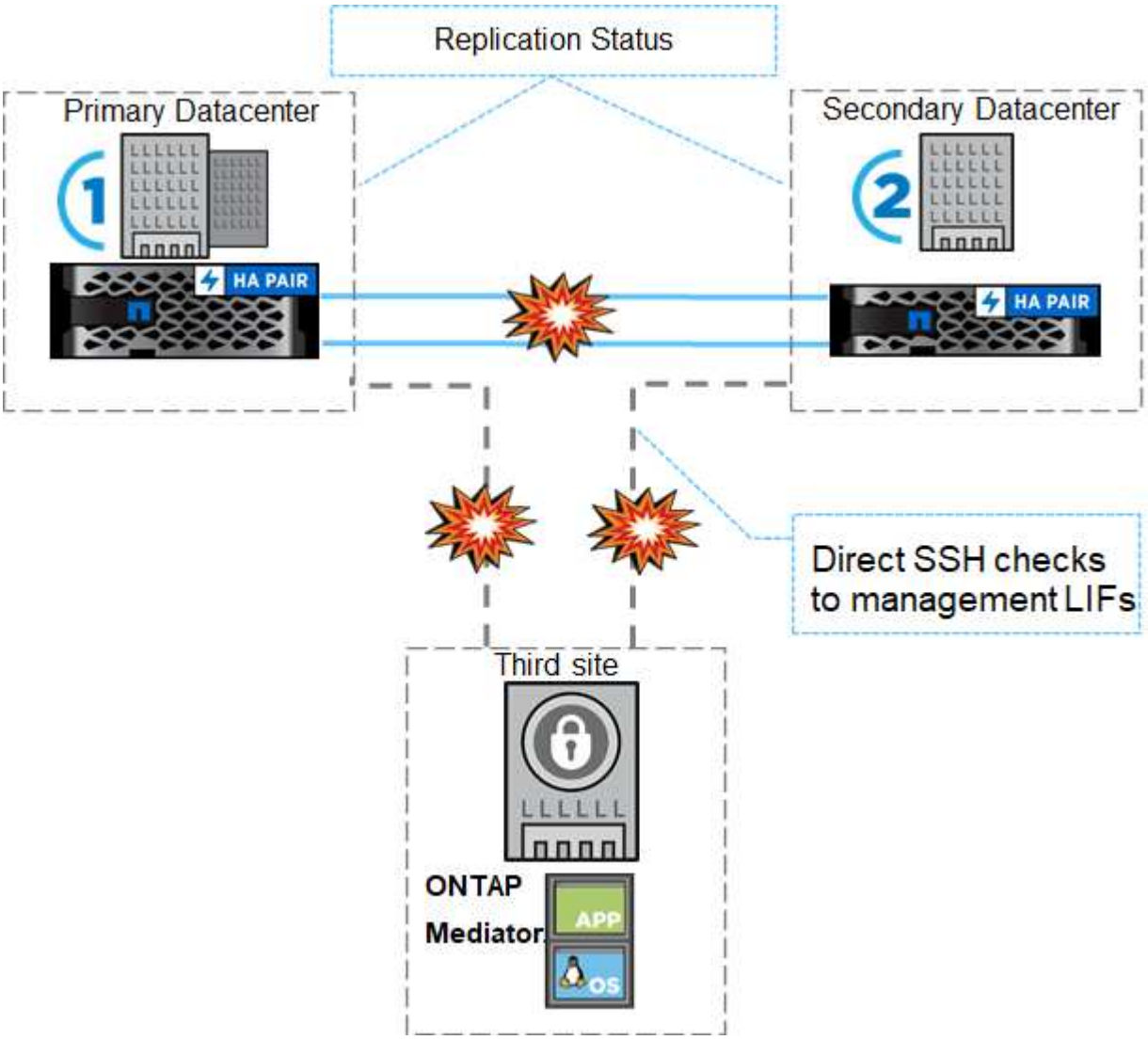
Transparent application failover for SAN with SnapMirror Business Continuity

NetApp SnapMirror is an industry-leading replication technology that can be leveraged for a variety of use cases, including the following:

- Disaster recovery for quick site failovers during an outage and fast resyncs back to primary
- Synchronous replication for up-to-the-second copies of data on a remote site
- Backup and archive use cases (with more Snapshot copies on the destination than on the source)

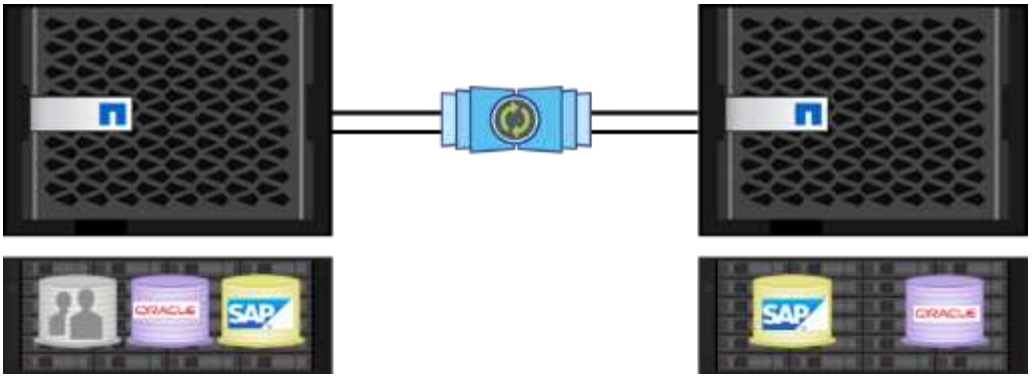
SnapMirror Business Continuity in ONTAP extends what SnapMirror offers and provides fast, easy automated failover of synchronous SnapMirror relationships for application-level, granular data protection.

SnapMirror Business Continuity makes use of a mediator to maintain quorum between sites and avoid split-brain scenarios in the event of a site failure. A new ONTAP Mediator software version (1.2) is now available and supports up to 10 ONTAP systems and automates switchovers of applications between sites within 120 seconds of failure.



MetroCluster over IP

NetApp MetroCluster (MC) software is a solution that combines array-based clustering with synchronous replication to deliver continuous availability and zero data loss at the lowest cost. Administration of the array-based cluster is simpler because the dependencies and complexity normally associated with host-based clustering are eliminated.



MetroCluster immediately duplicates all your mission-critical data on a transaction-by-transaction basis, providing uninterrupted access to your applications and data. Unlike standard data replication solutions, MetroCluster works seamlessly with your host environment to provide continuous data availability while eliminating the need to create and maintain complicated failover scripts.

With MetroCluster, you can perform the following tasks:

- Protect against hardware, network, or site failure with transparent switchover
- Eliminate planned and unplanned downtime and change management
- Upgrade hardware and software without disrupting operations
- Deploy without complex scripting, application, or operating system dependencies
- Achieve continuous availability for VMware, Microsoft, Oracle, SAP, or any critical application

NetApp MetroCluster traditionally was implemented with a Fibre Channel backend, but more recent versions of ONTAP support the use of IP networks for the backend. This not only reduces cost and complexity for site failover infrastructure, but it also extends the range of MetroCluster to approximately 700km (or 300mi).

ONTAP 9.9.1 brings the following advancements to MetroCluster.

- Increased volume counts to 1600 per HA pair
- Shared layer-3 networks
  - No longer dependent on dedicated layer- 2 networks
  - ONTAP must be directly connected to router
  - No dynamic routing support
- Increased nodes per site (four per site, eight per cluster)

When to choose MetroCluster versus SnapMirror Business Continuity

Since MetroCluster and SnapMirror Business Continuity share some of the same feature sets (ability to leverage existing IP networks, automated failovers, synchronous replication), the question of “when should I use each” becomes more relevant.

The answer depends on the following questions.

- What are your service level objectives?
- How granular do you want failovers to be?

MetroCluster provides automated infrastructure failovers for HA pairs and physical aggregates and supports SAN and NAS workloads, while SnapMirror Business Continuity offers application-level granularity for SAN

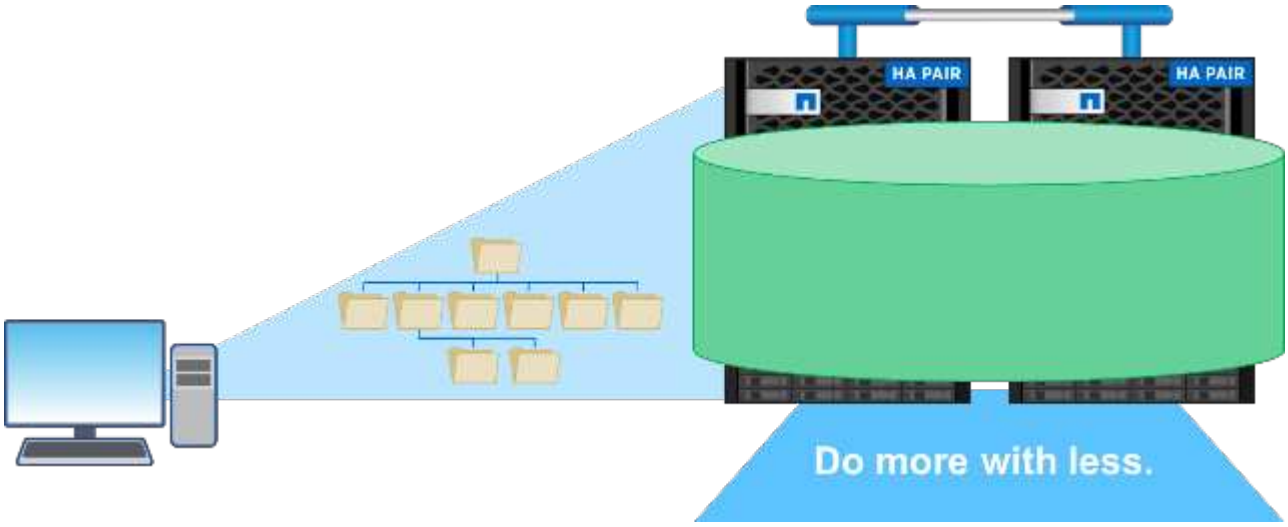
workloads only.

For more information on MetroCluster over IP, see MetroCluster IP Solution Architecture and Design.

For more information on SnapMirror Business Continuity, see SnapMirror Business Continuity in ONTAP.

FlexGroup volume data protection

FlexGroup volumes are the NetApp ONTAP scale-out NAS solution, providing up to 20PB and 400 billion files in a single namespace, while offering automatically load-balanced parallel processing of high ingest workloads for a blend of capacity, performance, and simplicity.

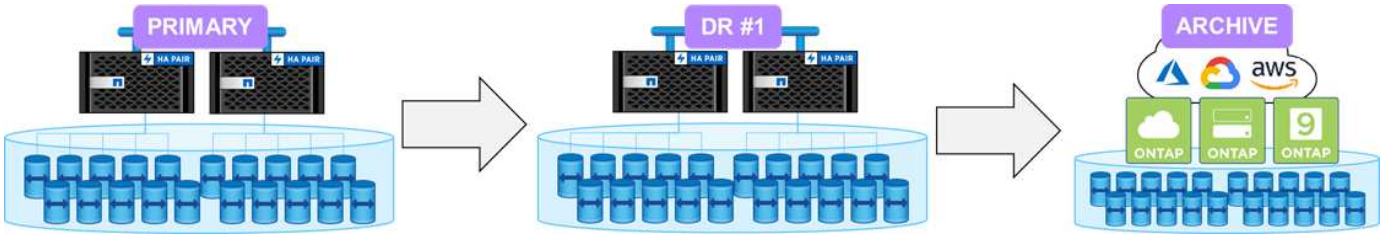


For more information about FlexGroup volumes, see TR-4571: NetApp FlexGroup Volumes Best Practices.

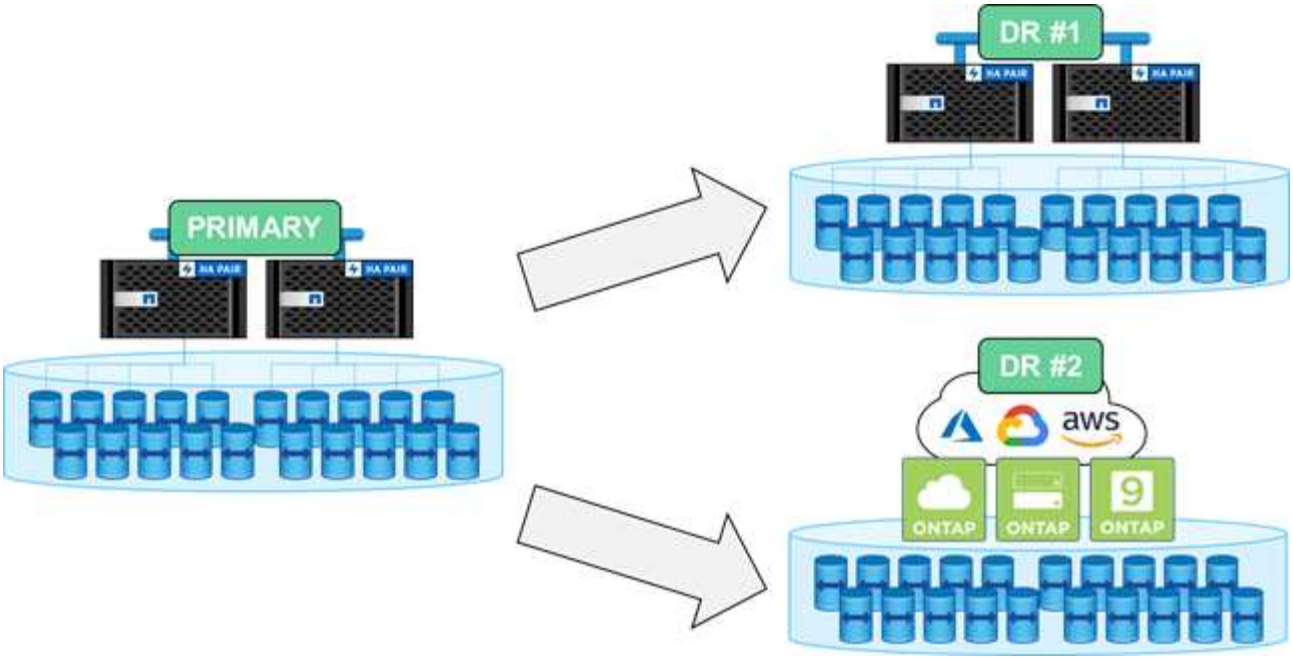
In ONTAP 9.9.1, FlexGroup volumes support a variety of data protection configurations.

Cascading and fan-out SnapMirror

A SnapMirror cascade allows a storage administrator to replicate to multiple sites in serial. For example, site A can replicate to site B (on-prem or cloud) and site B can then replicate that same volume to site C (on-prem or cloud).

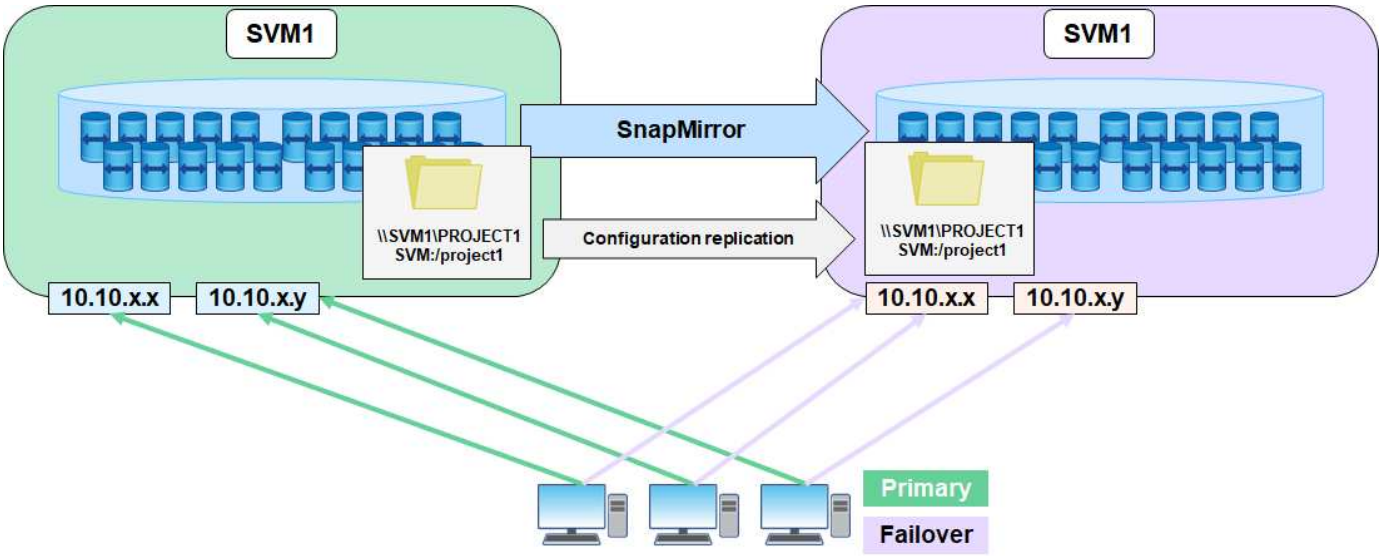


SnapMirror fan-out can replicate from a source volume to multiple destination volumes. So site A can replicate a source FlexGroup to sites B and C (on-prem or cloud). This offers more flexibility and resiliency in data protection configurations.



Storage virtual machine disaster recovery (SVM-DR)

SVM-DR is an ONTAP feature that allows you to replicate not just data volumes to a remote site, but also the SVM configuration details, such as CIFS shares, NFS exports, data LIFs, and even the NFS file handles to avoid remounts when failing over to the DR site.



ONTAP 9.9.1 brings support for SVM-DR to FlexGroup volumes with the following limitations.

- No FabricPool support
- No FlexClone
- No SnapMirror fan-out
- No FlexVol convert without rebaseline

SnapLock enhancements

NetApp SnapLock is the WORM compliance replication solution from NetApp. It provides integrated data protection for workloads that need to adhere to regulatory guidelines such as HIPAA, SEC 17a-4(f) rule, FINRA, and CFTC as well as national requirements for German-speaking countries (DACH).

Snaplock helps provide data integrity and retention, enabling electronic records to be both unalterable and rapidly accessible. SnapLock retention features are certified to meet strict records retention requirements as well as addressing an expanded set of retention requirements, including Legal Hold, Event-Based Retention, and Volume Append Mode.

ONTAP 9.9.1 brings the following improvements to NetApp SnapLock:

- Storage efficiency support on WORM volumes. Support for data compaction, cross-volume/aggregate-level deduplication (AFF only), continuous segment cleaning, and Temperature Sensitive Storage Efficiency.
- Ransomware protection for SnapLock volumes containing snapshot copies of LUNs.For more information on SnapLock, see Compliant WORM Storage Using NetApp SnapLock.

For more information on SnapLock, see Compliant WORM Storage Using NetApp SnapLock.

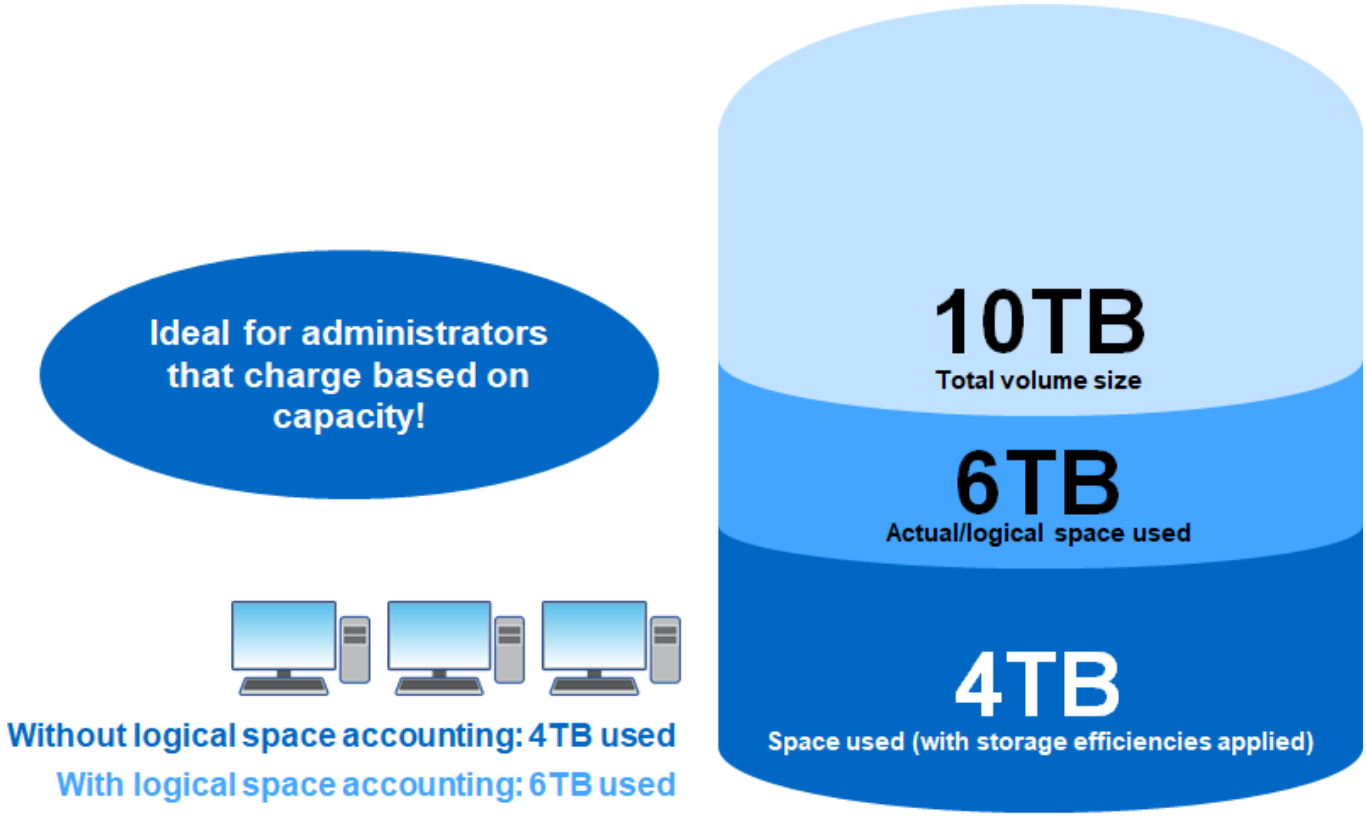
Other major additions

In addition to the System Manager enhancements, SAN enhancements, and data protection enhancements, there are a few other big additions to ONTAP 9.9.1.

Logical space accounting/enforcement – FlexGroup volumes

Logical space accounting was introduced for FlexVol volumes in ONTAP 9.4. It enables storage administrators to mask storage efficiency savings so that end users avoid overallocating their designated storage quotas.

For example, if a user writes 6TB to a 10TB volume and storage efficiencies save 2TB, logical space accounting can control whether the user sees 6TB or 4TB.



ONTAP 9.5 enhanced this feature and added quota enforcement support for FlexVols to give more control to storage administrators by preventing new writes according to the logical space thresholds set. However, FlexGroup volumes were missing this functionality until ONTAP 9.9.1.

ONTAP S3 user-defined metadata tags

ONTAP 9.8 introduced support for the S3 protocol for basic object storage functionality.

Support for S3 in ONTAP 9.8 included the following:

- Basic PUT/GET object access (does not include access to both S3 and NAS from the same bucket)
  - No object tagging or ILM support; for feature-rich, globally dispersed S3, use NetApp StorageGRID.
- TLS 1.2 encryption
- Multi-part uploads
- Adjustable ports
- Multiple buckets per volume
- Bucket access policies
- S3 as a NetApp FabricPool target

ONTAP 9.9.1 and later offers support for metadata tagging of objects when using ObjectCreate and MultiPartUpload calls. When HEAD or GET is performed on an object, the user-defined metadata and count of the number of tags is returned as part of the HTTP header in the response. These tags allow you to better categorize your objects within ONTAP buckets for more robust data management and are compatible with applications that require the ability to create metadata and tags.

For more information, see the following resources:

- Tech ONTAP Podcast: Episode 268 - NetApp FabricPool and S3 in ONTAP 9.8
- ONTAP S3

NFSv4.2 security labels

ONTAP 9.9.1 introduces support for the NFSv4.2 feature called Labeled NFS, which is a way to manage granular file and folder access by using SELinux labels and Mandatory Access Control (MAC). These MAC labels are stored with files and folders and works in conjunction with UNIX permissions and NFSv4.x ACLs. Support for labeled NFS means that ONTAP now recognizes and understands the NFS client's SELinux label settings. Labeled NFS is covered in RFC-7204.

Use cases include the following:

- MAC labeling of virtual machine images
- Data security classification for the public sector (secret, top secret, and so on)
- Security compliance
- Diskless Linux

In this release, ONTAP supports the following enforcement modes:

- Limited Server Mode. ONTAP cannot enforce the labels, but it can store and transmit them.
  - The ability to change MAC labels is also up to the client to enforce.
- Guest Mode. If the client is not labeled NFS-aware (v4.1 or lower), MAC labels are not transmitted.

ONTAP does not currently support Full Mode (storing and enforcing MAC labels).

Technical Resources

This section covers the technical resources available that detail the features mentioned in this document.

Technical Reports

- TR-4067: NetApp ONTAP NFS Best Practices and Implementation Guide

  https://www.netapp.com/us/media/tr-4067.pdf

- TR-4515: ONTAP AFF All SAN Array Systems

  https://www.netapp.com/pdf.html?item=/media/10379-tr4515pdf.pdf

- TR-4526: Compliant WORM Storage Using NetApp SnapLock

  https://www.netapp.com/pdf.html?item=/media/6158-tr4526pdf.pdf

- TR-4569: Security Hardening Guide for ONTAP 9

  https://www.netapp.com/pdf.html?item=/media/10674-tr4569pdf.pdf

- TR-4571: NetApp FlexGroup Volumes Best Practices

  https://www.netapp.com/us/media/tr-4571.pdf

- TR-4597: VMware vSphere with ONTAP

  https://www.netapp.com/us/media/tr-4597.pdf
- TR-4598: FabricPool Best Practices

  https://www.netapp.com/us/media/tr-4598.pdf
- TR-4684: Implementing and Configuring Modern SANs with NVMe/FC

  https://www.netapp.com/pdf.html?item=/media/10681-tr4684.pdf
- TR-4678: Data Protection and Backup - FlexGroup Volumes

  https://www.netapp.com/us/media/tr-4678.pdf
- TR-4689: MetroCluster IP Solution Architecture and Design

  https://www.netapp.com/us/media/tr-4689.pdf
- TR-4705: NetApp MetroCluster Solution Architecture and Design

  https://www.netapp.com/pdf.html?item=/media/13480-tr4705pdf.pdf
- TR-4743: FlexCache in ONTAP

  https://www.netapp.com/pdf.html?item=/media/7336-tr4743pdf.pdf
- TR-4814: S3 in ONTAP Best Practices

  https://www.netapp.com/pdf.html?item=/media/17219-tr4814pdf.pdf

Podcasts

- Tech ONTAP Podcast Episode 288: ONTAP System Manager 9.9.1

  https://soundcloud.com/techontap_podcast/episode-288-ontap-system-manager-991

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