Release notes

ONTAP 9

NetApp
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Release notes

ONTAP 9 release highlights

Each release of the ONTAP 9 data management software delivers new and enhanced features that improve the capabilities, manageability, performance, and security offerings in ONTAP.

In addition to these highlights, you can find comprehensive, per-version coverage of all the new and enhanced features introduced in recent ONTAP releases.

For details about hardware platform and switch support, known issues, and limitations in all ONTAP 9 versions, or for features introduced in releases prior to ONTAP 9.9.1, refer to the *ONTAP 9 Release Notes*. You must sign in with your NetApp account or create an account to access the Release Notes.

To upgrade to the latest release of ONTAP, see Upgrade to the latest version of ONTAP and When should I upgrade ONTAP?

ONTAP 9.14.1 highlights

ONTAP 9.14.1 delivers new and enhanced features in the areas of FabricPool, anti-ransomware protection, OAuth, and more. For a complete list of new features and enhancements, see What's new in ONTAP 9.14.1.

- WAFL reservation reduction

  ONTAP 9.14.1 introduces an immediate five percent increase in usable space on FAS and Cloud Volumes ONTAP systems by reducing the WAFL reserve on aggregates with 30 TB or more.

- FabricPool enhancements

  FabricPool offers an increase in read performance and enables direct writing to the cloud, lowering the risk of running out of space and reducing storage costs by moving cold data to a less expensive storage tier.

- Support for OAuth 2.0

  ONTAP supports the OAuth 2.0 framework, which can be configured using System Manager. With OAuth 2.0, you can provide secure access to ONTAP for automation frameworks without creating or exposing user IDs and passwords to plain text scripts and runbooks.

- Autonomous Ransomware Protection (ARP) enhancements

  ARP grants you more control over event security, allowing you to adjust the conditions that create alerts and reducing the possibility for false positives.

- SnapMirror disaster recovery rehearsal in System Manager

  System Manager provides a simple workflow to easily test disaster recovery at a remote location and to clean up after the test. This feature enables easier and more frequent testing and increased confidence in recovery time objectives.

- S3 object lock support

  ONTAP S3 supports the object-lock API command, enabling you to protect data written to ONTAP with S3

from deletion using standard S3 API commands and to ensure that important data is protected for the appropriate amount of time.

- Cluster and volume tagging

  Add metadata tags to volumes and clusters, which follow the data as it moves from on-premises to the cloud and reverse.

ONTAP 9.13.1 highlights

ONTAP 9.13.1 delivers new and enhanced features in the areas of anti-ransomware protection, consistency groups, quality of service, tenant capacity management, and more. For a complete list of new features and enhancements, see What's new in ONTAP 9.13.1.

- Autonomous Ransomware Protection (ARP) enhancements:
  - Automatic enablement

    With ONTAP 9.13.1, ARP automatically moves from training into production mode after it has sufficient learning data, eliminating the need for an administrator to enable it after the 30-day period.

  - Multi-admin verification support

    ARP disable commands are supported by multi-admin verification, ensuring that no single administrator can disable ARP to expose the data to potential ransomware attacks.

  - FlexGroup support

    ARP supports FlexGroups beginning with ONTAP 9.13.1. ARP can monitor and protect FlexGroups that span multiple volumes and nodes in the cluster, enabling even the largest datasets to be protected with ARP.

- Performance and capacity monitoring for consistency groups in System Manager

  Performance and capacity monitoring provides detailed for each consistency group, enabling you to quickly identify and report potential issues at the application level rather than just at the data object level.

- Tenant capacity management

  Multi-tenant customers and service providers can set a capacity limit on each SVM, allowing tenants to perform self-service provisioning without the risk of one tenant over-consuming capacity on the cluster.

- Quality of Service ceilings and floors

  ONTAP 9.13.1 allows you to group objects such as volumes, LUNs, or files into groups and assign a QoS ceiling (maximum IOPs) or floor (minimum IOPs), improving application performance expectations.

ONTAP 9.12.1 highlights

ONTAP 9.12.1 delivers new and enhanced features in the areas of security hardening, retention, performance, and more. For a complete list of new features and enhancements, see What's new in ONTAP 9.12.1.

- Tamper-proof Snapshots

  With SnapLock technology, Snapshot copies can be protected from deletion on either the source or

destination.

Retain more recovery points by protecting snapshots on primary and secondary storage from deletion by ransomware attackers or rogue administrators.

- Autonomous ransomware protection (ARP) enhancements

  Immediately enable intelligent autonomous ransomware protection on secondary storage, based on the screening model already completed for the primary storage.

  After a failover, instantly identify potential ransomware attacks on secondary storage. A Snapshot is immediately taken of the data that is starting to be affected, and administrators are notified, helping to stop an attack and enhance recovery.

- FPolicy

  One-click activation of ONTAP FPolicy to enable automatic blocking of known malicious files The simplified activation helps to protect against typical ransomware attacks that use common, known file extensions.

- Security hardening: Tamper-proof retention logging

  Tamperproof retention logging in ONTAP insuring compromised administrator accounts cannot hide malicious actions. Admin and user history cannot be altered or deleted without the systems knowledge.

  Log and audit all admin actions regardless of origin guaranteeing all actions impacting data are captured. An alert is generated whenever system audit logs have been tampered with in any way notifying administrators of the change.

- Security hardening: Expanded multifactor authentication

  Multifactor authentication (MFA) for CLI (SSH) supports Yubikey physical hardware token devices ensuring that an attacker cannot access the ONTAP system using stolen credentials or a compromised client system. Cisco DUO is supported for MFA with System Manager.

- File-object duality (multi-protocol access)

  File-object duality enables native S3 protocol read and write access to the same data source that already has NAS protocol access. You can concurrently access your storage as files or as objects from the same data source, eliminating the need for duplicate copies of data for use with different protocols (S3 or NAS), such as for analytics that use object data.

- FlexGroup rebalancing

  If FlexGroup constituents become unbalanced, FlexGroup can nondisruptively be rebalanced and managed from the CLI, REST API, and System Manager. For optimal performance, constituent members within a FlexGroup should have their used capacity evenly distributed.

- Storage capacity enhancements

  WAFL Space Reservation has been significantly reduced, providing up to 400 TiB more usable capacity per aggregate.

ONTAP 9.11.1 highlights

ONTAP 9.11.1 delivers new and enhanced features in the areas of security, retention, performance, and more.

For a complete list of new features and enhancements, see What's new in ONTAP 9.11.1.

- Multi-admin verification

  Multi-admin verification (MAV) is an industry-first native approach to verification, requiring multiple approvals for sensitive administrative tasks such as deleting a Snapshot or volume. The approvals required in a MAV implementation prevent malicious attacks and accidental changes to data.

- Enhancements to Autonomous Ransomware Protection

  Autonomous Ransomware Protection (ARP) uses machine learning to detect ransomware threats with increased granularity, enabling you to identify threats quickly and accelerate recovery in the event of a breach.

- SnapLock Compliance for FlexGroup volumes

  Secure multi-petabyte datasets for workloads such as electronic design automation and media & entertainment by protecting the data with WORM file locking so it cannot be changed or deleted.

- Asynchronous directory delete

  With ONTAP 9.11.1, file deletion occurs in the background of the ONTAP system, enabling you to easily delete large directories while eliminating performance and latency impacts on the host I/O.

- S3 enhancements

  Simplify and expand the object data management capabilities of S3 with ONTAP with additional API endpoints and object versioning at the bucket level, enabling multiple versions of an object to be stored in the same bucket.

- System Manager enhancements

  System Manager supports advanced capabilities to optimize storage resources and improve audit management. These updates include enhanced abilities to manage and configure storage aggregates, enhanced visibility into system analytics, hardware visualization for FAS systems.

ONTAP 9.10.1 highlights

ONTAP 9.10.1 delivers new and enhanced features in the areas of security hardening, performance analytics, NVMe protocol support, and object storage backup options. For a complete list of new features and enhancements, see What's new in ONTAP 9.10.1.

- Autonomous Ransomware Protection

  Autonomous Ransomware Protection automatically creates a Snapshot copy of your volume and alerts administrators when abnormal activity is detected, enabling you to quickly detect ransomware attacks and recover more quickly.

- System Manager enhancements

  System Manager automatically download firmware updates for disks, shelves, service processors in addition to providing new integrations with NetApp Active IQ Digital Advisor, BlueXP, and certificate management. These enhancements simplify administration and maintain business continuity.

- File System Analytics enhancements

File System Analytics provides additional telemetry to identify top files, directories, and users in your file share, enabling you to identify workload performance issues to improve resource planning and implementation of QoS.

- NVMe over TCP (NVMe/TCP) support for AFF systems

  Achieve high performance and reduce TCO for your enterprise SAN and modern workloads on AFF system when you use NVMe/TCP on your existing Ethernet network.

- NVMe over Fibre Channel (NVMe/FC) support for NetApp FAS systems

  Use the NVMe/FC protocol on your hybrid arrays to enable uniform migration to NVMe.

- Native hybrid cloud backup for object storage

  Protect your ONTAP S3 data with your choice of object storage targets. Use SnapMirror replication to back up to on-premises storage with StorageGRID, to the cloud with Amazon S3, or to another ONTAP S3 bucket on NetApp AFF and FAS systems.

- Global file-locking with FlexCache

  Ensure file consistency at cache locations during updates to source files at the origin with global file-locking using FlexCache. This enhancement enables exclusive file-read locks in an origin-to-cache relationship for workloads that require enhanced locking.

ONTAP 9.9.1 highlights

ONTAP 9.91.1 delivers new and enhanced features in the areas of storage efficiency, multifactor authentication, disaster recovery, and more. For a complete list of new features and enhancements, see What's new in ONTAP 9.9.1.

- Enhanced security for CLI remote access management

  Support for SHA512 and SSH A512 password hashing protects administrator account credentials from malicious actors who are trying to gain system access.

- MetroCluster IP enhancements: support for 8-node clusters

  The new limit is twice as large as the previous one, providing support for MetroCluster configurations and enabling continuous data availability.

- SnapMirror Business Continuity enhancements

  Offers more replication options for backup and disaster recovery for large data containers for NAS workloads.

- Increased SAN performance

  Delivers up to four-times higher SAN performance for single LUN applications such as VMware datastores so you can achieve high performance in your SAN environment.

- New object storage option for hybrid cloud

  Enables use of StorageGRID as a destination for NetApp Cloud Backup Service to simplify and automate the backup of your on-premises ONTAP data.

Next steps

- Upgrade to the latest version of ONTAP
- When should I upgrade ONTAP?

ONTAP 9 release support

Beginning with the ONTAP 9.8 release, NetApp delivers ONTAP releases twice per calendar year. Though plans are subject to change, the intent is to deliver new ONTAP releases in the second and fourth quarter of each calendar year. Use this information to plan the time frame of your upgrade to take advantage of the latest ONTAP release.

Version	Release date
9.14.1	January 2024
9.13.1	June 2023
9.12.1	February 2023
9.11.1	July 2022
9.10.1	January 2022
9.9.1	June 2021

If you are running an ONTAP version prior to 9.9.1, it is likely on Limited Support or Self-Service Support. Consider upgrading to versions with full support.

Support levels

Unresolved directive in release-notes/release-support-reference.adoc - include::./_include/support-levels-table.adoc[]

To upgrade to the latest release of ONTAP, see Upgrade to the latest version of ONTAP and When should I upgrade ONTAP?

What's new in ONTAP 9.14.1

Learn about the new capabilities available in ONTAP 9.14.1.

For details about earlier ONTAP 9 releases, hardware platform and switch support, known issues, and limitations, refer to the *ONTAP 9 Release Notes*. You must sign in with your NetApp account or create a NetApp account to access the *ONTAP 9 Release Notes*.

To upgrade to the latest version of ONTAP, see Prepare to upgrade ONTAP.

Data protection

Update	Description
NVE supported on SVM root volumes	SVM root volumes can be encrypted using unique keys with NetApp Volume Encryption.
Ability to set Snapshot copy locking on long-term retention Snapshot copies and to reinitialize the Compliance Clock	On clusters with a SnapLock license, tamperproof Snapshot copy locking for Snapshot copies with long-term retention can be set for Snapshot copies created on non-SnapLock SnapMirror destination volumes and the Compliance Clock can be initialized when no SnapLock volumes are present.
SnapMirror Business Continuity (SM-BC) supports SCIS3 persistent reservations and Windows Failover Clustering	SCSI3 persistent reservations and Window Failover Clustering for SM-BC supports multiple nodes accessing a device while at the same time blocking access to other nodes, ensuring clustering for different application environments stays consistent and stable.
Copy volume-granular Snapshots with consistency groups	You can utilize consistency groups to replicate Asynchronous SnapMirror Snapshots and volume-granular Snapshots to the destination consistency groups for an extra layer of disaster recovery.
Asynchronous data protection support for consistency groups within SVM disaster recovery relationship	SVMs configured for SVM disaster recovery can replicate consistency group information to the secondary site if the SVM contains a consistency group.
SnapMirror asynchronous support for 20 fanout targets	The number of SnapMirror asynchronous fanout targets supported on A700 and higher systems increases from 16 to 20 when using ONTAP 9.14.1.
CLI support for consistency groups	Manage consistency groups using the ONTAP CLI.

File access protocols

Update	Description
NFSv4.1 session trunking	Session trunking allows for multiple paths to an exported datastore. This simplifies management and improves performance as workloads scale up. It is especially appropriate in environments with VMware workloads.

MetroCluster

Update	Description
S3 object storage support on mirrored and unmirrored aggregates	Enable an S3 object storage server on an SVM in a mirrored or unmirrored aggregate in MetroCluster IP and FC configurations.
Support for provisioning an S3 bucket on mirrored and unmirrored aggregates in a MetroCluster cluster	You can create a bucket on a mirrored or unmirrored aggregate in MetroCluster configurations.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

S3 object storage

Update	Description
Automatic resizing has been enabled on S3 FlexGroup volumes to eliminate excessive capacity allocation when buckets are created on them	When buckets are created on or deleted from new or existing FlexGroup volumes, the volumes are resized to a minimum required size. The minimum required size is the total size of all the S3 buckets in a FlexGroup volume.
S3 object storage support on mirrored and unmirrored aggregates	You can enable an S3 object storage server on an SVM in a mirrored or unmirrored aggregate in MetroCluster IP and FC configurations.
Object locking based on users roles and lock retention period	Objects in S3 buckets can be locked from being overwritten or deleted. The ability to lock objects is based on specific users or time.
Configuring access for LDAP user groups to support external directory services and adding validity period for access and secret keys	ONTAP administrators can configure access for Lightweight Directory Access Protocol (LDAP) or Active Directory user groups to ONTAP S3 object storage, with the ability to enable authentication in LDAP fast bind mode. Users in local or domain groups or LDAP groups can generate their own access and secret keys for S3 clients. You can define a validity period for the access keys and secret keys of S3 users. ONTAP provides support for variables such as `$aws:username` for bucket policies and group policies.

SAN

Update	Description
NVMe/TCP automated host discovery	Host discovery of controllers using the NVMe/TCP protocol is automated by default.
NVMe/FC host side reporting and troubleshooting	By default, ONTAP supports the ability of NVMe/FC hosts to identify virtual machines by a unique identifier and for NVMe/FC hosts to monitor virtual machine resource utilization. This enhances host-side reporting and troubleshooting.
NVMe host prioritization	You can configure your NVMe subsystem to prioritize resource allocation for specific hosts. Host assigned a high priority are allocated larger I/O queue counts and larger queue depths.

Security

Update	Description
Support for Cisco DUO multifactor authentication for SSH users	SSH users can authenticate using Cisco DUO as a second factor of authentication during sign-in.

Update	Description
Enhancements to OAuth 2.0 support	ONTAP 9.14.1 extends the core token-based authentication and OAuth 2.0 support initially provided with ONTAP 9.14.0. Authorization can be configured using Active Directory or LDAP with group-to-role mapping. Sender-constrained access tokens are also supported and secured based on Mutual TLS (mTLS). In addition to Auth0 and Keycloak, Microsoft Windows Active Directory Federation Service (ADFS) is supported as an Identity Provider (IdP).
OAuth 2.0 Authorization Framework	The Open Authorization (OAuth 2.0) framework is added and provides token-based authentication for ONTAP REST API clients. This enables more secure management and administration of the ONTAP clusters using automation workflows powered by REST API scripts or Ansible. The standard OAuth 2.0 features are supported, including issuer, audience, local validation, remote introspection, remote user claim, and proxy support. Client authorization can be configured using self-contained OAuth 2.0 scopes or by mapping the local ONTAP users. Supported Identity Providers (IdP) include Auth0 and Keycloak using multiple concurrent servers.
Tunable alerts for Autonomous Ransomware Protection	Configure Autonomous Ransomware Protection to receive notifications whenever a new file extension is detected or when an ARP Snapshot is taken, receiving earlier warning to possible ransomware events.
FPolicy supports persistent stores to reduce latency	FPolicy allows you to set up a persistent store to capture file access events for asynchronous non-mandatory policies in the SVM. Persistent stores can help decouple client I/O processing from the FPolicy notification processing to reduce client latency. Synchronous and asynchronous mandatory configurations are not supported.
FPolicy supports FlexCache volumes on SMB	FPolicy is supported for FlexCache volumes with NFS or SMB. Previously, FPolicy was not supported for FlexCache volumes with SMB.

Storage efficiency

Update	Description
Scan tracking in File System Analytics	Track the File System Analytics initialization scan with real time insights about progress and throttling.
Increase in usable aggregate space on FAS platforms	For FAS platforms, the WAFL reserve for aggregates greater than 30TB in size is reduced from 10% to 5%, resulting in increased usable space in the aggregate.
Change in reporting of physical used space in TSSE volumes	On volumes with temperature-sensitive storage efficiency (TSSE) enabled, the ONTAP CLI metric for reporting the amount of space used in the volume includes the space savings realized as a result of TSSE. This metric is reflected in the volume show -physical-used and the volume show-space -physical used commands. For FabricPool, the value of `-physical-used` is a combination of the capacity tier and the performance tier. For specific commands, see `volume show` and `volume show space`.

Storage resource management enhancements

Update	Description
Proactive FlexGroup rebalancing	FlexGroup volumes provide support for automatically moving growing files in a directory to a remote constituent to reduce I/O bottlenecks on the local constituent.
Snapshot copy tagging in FlexGroup volumes	You can add, modify, and delete tags and labels (comments) in to help identify Snapshot copies and to help avoid accidentally deleting Snapshot copies in FlexGroup volumes.
Write directly to the cloud with FabricPool	FabricPool adds the ability to write data to a volume in FabricPool so it goes directly to the cloud without waiting for the tiering scan.
Aggressive read-ahead with FabricPool	FabricPool provides aggressive read-ahead of files such as movie streams on FabricPool volumes to ensure that no frames are dropped.

SVM management enhancements

Update	Description
SVM data mobility support for migrating SVMs containing user and group quotas and qtrees	SVM data mobility adds support for migrating SVMs containing user and group quotas and qtrees.
Support for a maximum of 400 volumes per SVM, a maximum of 12 HA pairs, and pNFS with NFS 4.1 using SVM data mobility	The maximum number of supported volumes per SVM with SVM data mobility increases to 400 and the number of supported HA pairs increases to 12.

System Manager

Update	Description
SnapMirror test failover support	You can use System Manager for performing SnapMirror test failover rehearsals without interrupting existing SnapMirror relationships.
Port management in a broadcast domain	You can use System Manager to edit or delete ports that have been assigned to a broadcast domain.
Enablement of Mediator-assisted Automatic Unplanned Switchover (MAUSO)	You can use System Manager to enable or disable Mediator-assisted Automatic Unplanned Switchover (MAUSO) when performing an IP MetroCluster switchover and switchback.
Cluster and volume tagging	You can use System Manager to use tags to categorize clusters and volumes in different ways, for example, by purpose, owner, or environment. This is useful when there are many objects of the same type. Users can quickly identify a specific object based on the tags that have been assigned to it.
Enhanced support for consistency group monitoring	System Manager displays historical data about consistency group usage.
NVMe in-band authentication	You can use System Manager to configure secure, unidirectional and bidirectional authentication between an NVMe host and controller over the NVMe/TCP and NVMe/FC protocols using the DH-HMAC-CHAP authentication protocol.

Update	Description
Support for S3 bucket lifecycle management extended to System Manager	You can use System Manager to define rules for deleting specific objects in a bucket, and through these rules, expire those bucket objects.

What's new in ONTAP 9.13.1

Learn about the new capabilities available in ONTAP 9.13.1.

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To upgrade ONTAP, see Prepare to upgrade ONTAP.

Data protection

Update	Description
Multi-admin verification	Cluster administrator can explicitly enable multi-admin verification on a cluster to require quorum approval before some SnapLock operations are executed.
Enhanced support for managing consistency groups including volume move and geometry	You can move volumes between consistency groups, modify the geometry of hierarchical consistency groups, and gain capacity insights into consistency groups. System Manager supports creating a consistency group with new NAS volumes or NVME namespaces.
NDMP restore with SnapMirror Synchronous	NDMP restore is supported with SnapMirror synchronous.
SnapMirror Business Continuity (SM-BC) enhancements	• Non-disruptively add volumes to a consistency group with an active SM-BC relationship. • Utilize NDMP restore with SM-BC.
xref:./release-notes/Asynchronous SnapMirror support with a single consistency groups	Consistency groups support Asynchronous SnapMirror configurations, allowing vaulting of SnapMirror backups for single consistency groups.

File access protocols

Update	Description
NFSv4.x storepool support	A few clients consume too many NFSv4.x storepool resources leading to other NFSv4.x clients getting blocked due to unavailability of NFSv4.x storepool resources. You can have the option to enable denying and blocking of clients who consume a lot of NFSv4.x storepool resource in their environments.

MetroCluster

Update	Description
Transition from MetroCluster FC to MetroCluster IP using a shared switch for MetroCluster IP and Ethernet attached storage	You can transition nondisruptively from a MetroCluster FC to a MetroCluster IP configuration (ONTAP 9.8 and later) using a shared switch.
Nondisruptive transitions from an eight-node MetroCluster FC configuration to a MetroCluster IP configuration	You can nondisruptively transition workloads and data from an existing eight-node MetroCluster FC configuration to a new MetroCluster IP configuration.
Four-node MetroCluster IP configuration upgrades using switchover and switchback	Upgrade controllers in a four-node MetroCluster IP configuration using switchover and switchback with `system controller replace` commands.
Mediator-assisted automatic unplanned switchover (MAUSO) is triggered for an environmental shutdown	If one site shuts down gracefully due to an environmental shutdown, MAUSO is triggered.
Eight-node MetroCluster IP configurations support	You can upgrade the controllers and storage in an eight-node MetroCluster IP configuration by expanding the configuration to become a temporary twelve-node configuration and then removing the old DR groups.
MetroCluster IP configuration conversion to a shared storage MetroCluster switch configuration	You can convert a MetroCluster IP configuration to a shared storage MetroCluster switch configuration.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

Networking

Update	Description
Expanded hardware support for RDMA cluster interconnect	ONTAP supports AFF A900, ASA A900, and FAS9500 systems for cluster interconnect RDMA with an X91153A cluster NIC, helping to reduce latency, decrease failover times, and accelerate communication between nodes.
Increased data LIF limits	ONTAP provides greater flexibility by increasing data LIF scaling limits for both HA pairs and clusters.
IPv6 support during cluster setup on the A800 and FAS8700 platforms	On the A800 and FAS8700 platforms, you can use the ONTAP CLI to create and configure new clusters in IPv6-only networking environments.

S3 object storage

Update	Description
S3 bucket lifecycle management	S3 object expiration actions define when objects in a bucket expire. This capability enables you to manage object versions so you can meet retention requirements and manage overall S3 object storage effectively.

SAN

Update	Description
Support for NVMe/FC on AIX hosts	ONTAP supports the NVMe/FC protocol on AIX hosts. See the NetApp Interoperability Tool for supported configurations.

Security

Feature	Description
Autonomous Ransomware Protection	• Multi-admin verify functionality with Autonomous Ransomware Protection • Automatic transition from learning to active mode • FlexGroup support, including analytics and reporting for FlexGroup volumes and operations inlcuding expanding a FlexGroup volume, FlexVol to FlexGroup conversions, FlexGroup rebalancing.
SSH public key authentication with Active Directory	You can use an SSH public key as your primary authentication method with an Active Directory (AD) user, or you can use an SSH public key as your secondary authentication method after an AD user.
X.509 certificates with SSH public keys	ONTAP enables you to associate an X.509 certificate with the SSH public key for an account, giving you the added security of certificate expiration and revocation checks upon SSH login.
FPolicy file access failure notification	FPolicy supports notifications for access denied events. Notifications are generated for file operation failed due to lack of permission, which includes: failure due to NTFS permissions, failure due to Unix mode bits, and failure due to NFSv4 ACLs.
Multifactor authentication with TOTP (time-based one-time passwords)	Set up local user accounts with multifactor authentication using a time-based one-time password (TOTP). The TOTP is always used as the second authentication method. You can use an SSH public key or user password as your primary authentication method.

Storage efficiency

Update	Description
Change in reporting of primary data reduction ratio in System Manager	The primary data reduction ratio displayed in System Manager no longer includes Snapshot copy space savings in the calculation. It only depicts the ratio between used logical and used physical space. In prior releases of ONTAP, the primary data reduction ratio included significant space reduction benefits of Snapshot copies. As a result, when you upgrade to ONTAP 9.13.1, you will observe a significantly lower primary ratio being reported. You can still see data reduction ratios with Snapshot copies in the **Capacity** details view.
Temperature-sensitive storage efficiency	Temperature-sensitive storage efficiency adds sequential packing of contiguous physical blocks to improve storage efficiency. Volumes that have temperature-sensitive storage efficiency enabled will automatically have sequential packing enabled when systems are upgraded to ONTAP 9.13.1.
Logical space enforcement	Logical space enforcement is supported on SnapMirror destinations.
Storage VM capacity limits support	You can set capacity limits on a storage VM (SVM) and enable alerts when the SVM is approaching a percentage threshold.

Storage resource management enhancements

Update	Description
Increase in maximum number of inodes	ONTAP will continue to automatically add inodes (at the rate of 1 inode per 32 KB of volume space) even if the volume grows larger than 680 GB. ONTAP will continue adding inodes until it reaches the maximum of 2,147,483,632.
Support for specifying a SnapLock type during FlexClone creation	You can specify one of three SnapLock types, either compliance, enterprise, or non-SnapLock, when creating a FlexClone of a read/write volume.
Enable File System Analytics by default	Set File System Analytics to be enabled by default on new volumes.
SVM disaster recovery fanout relationships with FlexGroup volumes	The fanout restriction of SVM DR with FlexGroup volumes is removed. SVM DR with FlexGroup includes support for SnapMirror fanout relationships to eight sites.
Single FlexGroup rebalancing operation	You can schedule a single FlexGroup rebalancing operation to begin at a date and time in the future that you specify.
FabricPool read performance	FabricPool provides improved sequential read performance for single and multi-stream workloads for cloud-resident data and tiering throughput. This improvement can send a higher rate of GETs and PUTs to the back end object store. If you have on-premises object stores, you should consider performance headroom on the object store service and determine whether you might need to throttle FabricPool PUTs.
Adaptive QoS policy templates	Adaptive QoS policy templates enable you to set throughput floors at the SVM level.

SVM management enhancements

Update	Description
SVM data mobility	Increases support for migrating SVMs containing up to 200 volumes.
Support for recreating SVM directories	The new CLI command `debug vserver refresh-vserver-dir -node node_name` recreates missing directories and files. For more information and command syntax, see the ONTAP Command Reference.

System Manager

Beginning with ONTAP 9.12.1, System Manager is integrated with BlueXP. Learn more about System Manager integration with BlueXP.

Update	Description
Change in reporting of primary data reduction ratio	The primary data reduction ratio displayed in System Manager no longer includes Snapshot copy space savings in the calculation. It only depicts the ratio between used logical and used physical space. In prior releases of ONTAP, the primary data reduction ratio included significant space reduction benefits of Snapshot copies. As a result, when you upgrade to ONTAP 9.13.1, you will observe a significantly lower primary ratio being reported. You can still see data reduction ratios with Snapshot copies in the Capacity details view.
Tamperproof Snapshot copy locking	You can use System Manager to lock a Snapshot copy on a non-SnapLock volume to provide protection from ransomware attacks.
Support for external key managers	You can use System Manager to manage external key managers to store and manage authentication and encryption keys.
Troubleshooting hardware problems	System Manager users can view visual depictions of additional hardware platforms in the "Hardware" page, including ASA platforms and AFF C-Series platforms. Support for AFF C-Series platforms is also included in the latest patch releases of ONTAP 9.12.1, ONTAP 9.11.1, and ONTAP 9.10.1. The visualizations identify problems or concerns with platforms, providing a quick method for users to troubleshoot hardware problems.

What's new in ONTAP 9.12.1

Learn about the new capabilities available in ONTAP 9.12.1.

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Data protection

Update	Description
Support for larger FlexVol volumes with SnapMirror Synchronous	The maximum FlexVol volume size supported in SnapMirror Synchronous configurations has increased from 100 TB to 300 TB. Both the source and destination clusters must be running *ONTAP 9.12.1P2 or later*.
Support for larger file and LUN sizes in SnapMirror Synchronous	The maximum file and LUN size supported in SnapMirror Synchronous configurations has increased from 16 TB to 128 TB. Both the source and destination clusters must be running ONTAP 9.12.1 P2 or later.
Enhanced support for consistency groups	• You can add and remove volumes from a consistency group, clone a consistency group (including from a Snapshot copy). • Consistency groups support application tagging to streamline data protection and management processes. • The ONTAP REST API supports configuring consistency groups with NFS/SMB volumes or NVMe namespaces.
SnapMirror Synchronous NDO	SnapMirror Synchronous supports non-disruptive operations (NDO) of HA takeover and giveback, volume move, and other maintenance-related operations. This feature is available only on AFF/ASA platforms.
ONTAP Mediator 1.5 supports SnapMirror Business Continuity	ONTAP Mediator 1.5 is available for monitoring SnapMirror Business Continuity (SM-BC) relationships.
SnapMirror Business (SM-BC) continuity enhancements	SM-BC supports partial LUN restore from Snapshots. Additionally, SM-BC extends QoS to volumes not in the SM-BC relationship.
Data warehouse rebuild indicator for SnapMirror asynchronous	SnapMirror asynchronous provides an indicator showing how long a data warehouse rebuild takes after a disaster recovery rehearsal by displaying the percentage complete.
SnapLock option to set minimum retention time "unspecified" absolute retention time	SnapLock includes an option to set a minimum retention time when the absolute retention time is set to "unspecified".
Tamperproof Snapshot copies	You can lock a Snapshot copy on a non-SnapLock volume to provide protection from ransomware attacks. Locking Snapshot copies helps ensure that they are not deleted accidentally or maliciously.

File access protocols

Update	Description
Disable weak encryption types for Kerberos communication	A new SMB security option allows you to disable RC4 and DES in favor of Advanced Encryption Standard (AES) encryption types for Kerberos-based communication with the Active Directory (AD) KDC.
S3 client access to NAS data	S3 clients can access the same NAS data as NFS and SMB clients without reformatting, making it easier to serve S3 applications that require object data.
NFS extended attributes	NFS servers enabled for NFSv4.2 can store and retrieve NFS extended attributes (xattrs) from xattr-aware clients.

Update	Description
NFSv4.2 sparse files and space reservation support	The NFSv4.2 client is able to reserve space for a sparse file. Space can also be deallocated and unreserved from a file.

MetroCluster

Update	Description
ONTAP Mediator 1.5 is supported in a MetroCluster IP configuration	ONTAP Mediator 1.5 is available for monitoring MetroCluster IP configurations.
IPsec support for front-end host protocol (such as NFS and iSCSI) is available in MetroCluster IP and MetroCluster fabric-attached configurations.	IPsec support for front-end host protocol (such as NFS and iSCSI) is available in MetroCluster IP and MetroCluster fabric-attached configurations.
MetroCluster automatic forced switchover feature in a MetroCluster IP configuration	You can enable the MetroCluster automatic forced switchover feature in a MetroCluster IP configuration. This feature is an extension of the Mediator-assisted unplanned switchover (MAUSO) feature.
S3 on an SVM on an unmirrored aggregate in a MetroCluster IP configuration	You can enable the MetroCluster automatic forced switchover feature in a MetroCluster IP configuration. This feature is an extension of the Mediator-assisted unplanned switchover (MAUSO) feature.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

Networking

Update	Description
LIF services	You can use the `management-log-forwarding` service to control which LIFs are used to forward audit logs to a remote syslog serve

S3 object storage

Update	Description
Expanded support for S3 actions	The following Amazon S3 API actions are supported: • `CopyObject` • `UploadPartCopy` • `BucketPolicy` (GET, PUT, DELETE)

SAN

Update	Description
Increased maximum LUN size for AFF and FAS platforms	Beginning with ONTAP 9.12.1P2, the maximum supported LUN size on AFF and FAS platforms increased from 16 TB to 128 TB.
Increased NVMe limits	The NVMe protocol supports the following: • 8K subsystems in a single storage VM and a single cluster • 12 node clusters NVMe/FC supports 256 controllers per port and NVMe/TCP supports 2K controllers per node.
NVME/TCP support for secure authentication	Secure, unidirectional and bidirectional authentication between an NVMe host and controller is supported over NVMe/TCP using the DHHMAC-CHAP authentication protocol.
MetroCluster IP support for NVMe	The NVMe/FC protocol is supported on 4-node MetroCluster IP configurations.

Security

In October 2022, NetApp implemented changes to reject AutoSupport message transmissions that are not sent by either HTTPS with TLSv1.2 or secure SMTP. For more information, see SU484: NetApp will reject AutoSupport messages transmitted with insufficient transport security.

Feature	Description
Autonomous Ransomware Protection interoperability enhancements	Autonomous Ransomware Protection is available for these configurations: • Volumes protected with SnapMirror • SVMs protected with SnapMirror • SVMs enabled for migration (SVM data mobility)
Multifactor authentication (MFA) support for SSH with FIDO2 and PIV (both used by Yubikey)	SSH MFA can use hardware-assisted public/private key exchange with username and password. Yubikey is a physical token device that is plugged into the SSH client to increase MFA security.
Tamper-proof logging	All ONTAP internal logs are tamperproof by default, ensuring that compromised administrator accounts cannot hide malicious actions.
TLS transport for events	EMS events can be sent to a remote syslog server using the TLS protocol, thereby enhancing protection over the wire for central external audit logging.

Storage efficiency

Update	Description
Temperature-sensitive storage efficiency	Temperature-sensitive storage efficiency is enabled by default on new AFF C250, AFF C400, AFF C800 platforms and volumes. TSSE is not enabled by default on existing volumes but can be enabled manually using the ONTAP CLI.

Update	Description
Increase in usable aggregate space	For All Flash FAS (AFF) and the FAS500f platforms, the WAFL reserve for aggregates greater than 30TB is reduced from 10% to 5%, resulting in increased usable space in the aggregate.
File System Analytics: Top directories by size	File System Analytics now identifies the directories in a volume that are consuming the most space.

Storage resource management enhancements

Update	Description
FlexGroup rebalancing	You can enable automatic nondisruptive FlexGroup volume rebalancing to redistribute files between FlexGroup constituents. It's recommended that you do not use automatic FlexGroup rebalancing after a FlexVol to FlexGroup conversion. Instead, you can use the disruptive retroactive file move feature available in ONTAP 9.10.1 and later, by entering the `volume rebalance file-move` command. For more information and command syntax, see the ONTAP Command Reference.
SnapLock for SnapVault support for FlexGroup volumes	SnapLock for SnapVault support for FlexGroup volumes

SVM management enhancements

Update	Description
SVM data mobility enhancements	Cluster administrators can non-disruptively relocate an SVM from a source cluster to a destination cluster using FAS, AFF platforms, on hybrid aggregates. Support for both disruptive SMB protocol and Autonomous Ransomware Protection have been added.

System Manager

Beginning with ONTAP 9.12.1, System Manager is integrated with BlueXP. With BlueXP, administrators can manage the hybrid multicloud infrastructure from a single control plane while retaining the familiar System Manager dashboard. When signing into System Manager, administrators are given the option of accessing the System Manager interface in BlueXP or accessing System Manager directly. Learn more about System Manager integration with BlueXP.

Update	Description
System Manager support for SnapLock	SnapLock operations, including Compliance Clock initialization, SnapLock volume creation, and WORM file mirroring are supported in System Manager.
Hardware visualization of cabling	System Manager users can view connectivity information about the cabling between hardware devices in their cluster to troubleshoot connectivity issues.

Update	Description
Support for multifactor authentication with Cisco DUO when logging in to System Manager	You can configure Cisco DUO as a SAML identity provider (IdP), enabling users to authenticate using Cisco DUO when they log in to System Manager.
System Manager networking enhancements	System Manager offers more control over the subnet and home port selection during network interface creation. System Manager also supports the configuration of NFS over RDMA connections.
System display themes	System Manager users can select a light or dark theme for the display of the System Manager interface. They can also choose to default to the theme used for their operating system or browser. This capability allows users to specify a setting that is more comfortable for reading the display.
Improvements to local tier capacity details	System Manager users can view capacity details for specific local tiers to determine if the space is over-committed, which might indicate that they need to add more capacity to ensure the local tier doesn't run out of space.
Improved searching	System Manager has an improved search capability that lets users search and access relevant and context-sensitive support information and System Manager product document from the NetApp Support Site directly through the System Manager interface. This allows users to acquire information they need to take appropriate action without having to search in various locations on the support site.
Volume provisioning improvements	Storage administrators can choose a Snapshot copy policy when creating a volume using System Manager rather than using the default policy.
Increase the size of a volume	Storage administrators can view the impact on data space and Snapshot copy reserve when they use System Manager to resize a volume.
Storage pool and Flash Pool management	Storage administrators can use System Manager to add SSDs to an SSD storage pool, create Flash Pool local tiers (aggregate) using SSD storage pool allocation units, and create Flash Pool local tiers using physical SSDs.
NFS over RDMA support in System Manager	System Manager supports network interface configurations for NFS over RDMA and identifies RoCE capable ports.

What's new in ONTAP 9.11.1

Learn about the new capabilities available in ONTAP 9.11.1.

For details about earlier ONTAP 9 releases, hardware platform and switch support, known issues, and limitations, refer to the *ONTAP 9 Release Notes*. You must sign in with your NetApp account or create a NetApp account to access the *ONTAP 9 Release Notes*.

To upgrade to the latest version of ONTAP, see Prepare to upgrade ONTAP.

Data protection

Update	Description
Cluster external key servers	Clustered external key management servers support is added for NetApp partners who provide a clustered KMIP server solution. This allows primary and secondary KMIP servers to be added preventing duplication of encryption key data. For supported partners, see the Interoperability Matrix Tool.
SnapMirror asynchronous policy in System Manager	You can use System Manager to add pre-created and custom mirror and vault policies, display legacy policies, and override the transfer schedules defined in a protection policy when protecting volumes and storage VMs. You can also use System Manager to edit your volume and storage VM protection relationships.  If you are running ONTAP 9.8P12 or a later ONTAP 9.8 patch release, have configured SnapMirror using System Manager, and plan to upgrade to ONTAP 9.9.1 or ONTAP 9.10.1 releases, use ONTAP 9.9.1P13 or later and ONTAP 9.10.1P10 or later patch releases for your upgrade.
SnapMirror Cloud single directory restore	Enables cluster administers at the admin privilege level to perform a single directory restore operation from a cloud endpoint. The source endpoint UUID must be provided to identify the backup endpoint from which you are restoring. Because multiple backups can use the same `cloud_endpoint_name` as the destination, the UUID associated with the backup must be provided for the restore command. You can use the `snapmirror show` command to obtain the `source_endpoint_uuid`.
Enhanced support for SnapMirror Business Continuity (SM-BC)	• SM-BC supports AIX as a host • SM-BC supports single-file SnapRestore, enabling you to restore an individual LUN or normal file in an SM-BC configuration.
SVM data replication quick resync	SVM data replication quick resync provides storage admins with the ability to bypass a full data warehouse rebuild and to recover more quickly from a disaster recovery rehearsal.
SVM data replication support with MetroCluster	SVM-DR source is supported on both ends of a MetroCluster configuration.
Two-phase consistency group Snapshot copy creation	In the REST API, consistency groups support a two-phase Snapshot procedure, enabling you to conduct a precheck before committing the Snapshot.

File access protocols

Update	Description
TLSv1.3 support	ONTAP supports TLS 1.3 for HTTPS and REST API management protocols. TLS 1.3 is not supported with SP/BMC or with Cluster Peering Encryption.
LDAP fast bind support	If supported by the LDAP server, you can use LDAP fast bind to authenticate ONTAP admin users quickly and simply.

MetroCluster

Update	Description
ONTAP Mediator 1.4 support	ONTAP Mediator software version 1.4 is supported in MetroCluster IP configurations.
Consistency group support	Consistency groups are supported in MetroCluster configurations.
Transitioning from a MetroCluster FC configuration to an AFF A250 or FAS500f MetroCluster IP configuration	You can transition from a MetroCluster FC configuration to an AFF A250 or FAS500f MetroCluster IP configuration.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

Networking

Update	Description
Link Layer Discovery Protocol (LLDP)	The cluster network supports LLDP to allow ONTAP to work with cluster switches that do not support Cisco Discovery Protocol (CDP).
LIF services	New client-side LIF services provide more control over which LIFs are used for outbound AD, DNS, LDAP, and NIS requests.

S3 object storage

Update	Description
Additional support for S3 object actions	The following actions are supported by ONTAP APIs: `CreateBucket`, `DeleteBucket`, `DeleteObjects`. In addition, ONTAP S3 supports object versioning and associated actions with the `PutBucketVersioning`, `GetBucketVersioning`, `ListBucketVersions`.

SAN

Update	Description
iSCSI LIF failover	The new iSCSI LIF failover feature supports automatic and manual migration of iSCSI LIFs in an SFO partner failover and in a local failover. iSCSI LIF failover is available on All SAN Array (ASA) platforms.
Non-destructive migration from LUN to NVMe namespace and from NVMe namespace to LUN	Use the ONTAP CLI to in-place convert an existing LUN to an NVMe namespace or an existing NVMe namespace to a LUN.

Security

Update	Description
Autonomous Ransomware Protection (ARP) enhancements	The ARP detection algorithm has been enhanced to detect additional malware threats. Also, a new license key is used to activate Autonomous Ransomware Protection. For ONTAP systems upgrades from ONTAP 9.10.1 the previous license key still provides the same functionality.
Multi-admin verification	When multi-admin verification is enabled, certain operations — such as deleting volumes or Snapshot copies — can be executed only after approvals from designated administrators. This prevents compromised, malicious, or inexperienced administrators from making undesirable changes or deleting data.

Storage efficiency

Update	Description
View physical footprint savings	When you have temperature sensitive storage efficiency enabled on a volume, you can use the volume show-footprint command to display the physical footprint savings.
SnapLock support for FlexGroup volumes	SnapLock includes support for data stored on FlexGroup volumes. FlexGroup volumes support is available with SnapLock Compliance and SnapLock Enterprise modes.
SVM data mobility	Increases the number of AFF arrays supported to three and adds support for SnapMirror relationships when the source and the destination are both running ONTAP 9.11.1 or later. External key management (KMIP) is also introduced and is available for both Cloud and on-premises installations.

Storage resource management enhancements

Update	Description
Activity tracking at the SVM level in File System Analytics	Activity Tracking is aggregated at the SVM level, tracking read/write IOPS and throughputs to provide instant and actionable insights into data.
Enable file access time updates	When enabled, the access time updates at the FlexCache origin volume only if the age of the current access time is more than user-specified duration.
Asynchronous directory delete	Asynchronous delete is available to NFS and SMB clients when the storage administrator grants them rights on the volume. When async delete is enabled, Linux clients can use the mv command and Windows clients can use the rename command to delete a directory and move it to a hidden `.ontaptrashbin` directory.
SnapLock support for FlexGroup volumes	SnapLock includes support for data stored on FlexGroup volumes. FlexGroup volumes support is available with SnapLock Compliance and SnapLock Enterprise modes. SnapLock does not support the following operations on FlexGroup volumes: SnapLock for SnapVault, event-based retention, and Legal Hold.

SVM management enhancements

Update	Description
SVM data mobility	Increases the number of AFF arrays supported to three and adds support for SnapMirror relationships when the source and the destination are both running ONTAP 9.11.1 or later. External key management (KMIP) is also introduced and is available for both cloud and on-premises installations.

System Manager

Update	Description
Manage SnapMirror asynchronous policies	Use System Manager to add pre-created and custom mirror and vault policies, display legacy policies, and override the transfer schedules defined in a protection policy when protecting volumes and storage VMs. You can also use System Manager to edit your volume and storage VM protection relationships. If you are using ONTAP 9.8P12 or later ONTAP 9.8 patch release and you configured SnapMirror using System Manager, and you plan to upgrade to ONTAP 9.9.1 or ONTAP 9.10.1 releases, you should use ONTAP 9.9.1P13 or later and ONTAP 9.10.1P10 or later patch releases for your upgrade.
Hardware visualization	The hardware visualization feature in System Manager supports all current AFF and FAS platforms.
System analytics insights	On the Insights page, System Manager helps you optimize your system by displaying additional capacity and security insights and new insights about the configuration of clusters and storage VMs.
Usability enhancements	• Newly created volumes are not shareable by default. Instead, users can specify the default access permissions, such as exporting via NFS or sharing via SMB/CIFS and specifying the permission level. • SAN simplification - When adding or editing an initiator group, System Manager users can view the connection status of the initiators in the group and ensure that initiators that are connected are included in the group so LUN data can be accessed.
Advanced local tier (aggregate) operations	System Manager administrators can specify the configuration of a local tier if they don't want to accept the recommendation from System Manager. Also, administrators can edit the RAID configuration of an existing local tier. If you are using ONTAP 9.8P12 or later ONTAP 9.8 patch release and you configured SnapMirror using System Manager, and you plan to upgrade to ONTAP 9.9.1 or ONTAP 9.10.1 releases, you should use ONTAP 9.9.1P13 or later and ONTAP 9.10.1P10 or later patch releases for your upgrade.

Update	Description
Manage audit logs	You can use System Manager to view and manage ONTAP audit logs.

What's new in ONTAP 9.10.1

Learn about the new capabilities available in ONTAP 9.10.1.

For details about earlier ONTAP 9 releases, hardware platform and switch support, known issues, and limitations, refer to the *ONTAP 9 Release Notes*. You must sign in with your NetApp account or create a NetApp account to access the *ONTAP 9 Release Notes*.

To upgrade ONTAP, see Prepare to upgrade ONTAP.

Data protection

Update	Description
Set SnapLock retention period up to 100 years	In releases earlier than ONTAP 9.10.1, the maximum supported retention time is January 19, 2071. Beginning with ONTAP 9.10.1 SnapLock Enterprise and Compliance support a retention time up to October 26, 3058 and a retention period up to 100 years. Older policies are automatically converted when you extend retention dates.
Ability to create SnapLock and non-SnapLock volumes on the same aggregate	Beginning with ONTAP 9.10.1, SnapLock and non-SnapLock volumes can exist on the same aggregate, so it is no longer necessary to create a separate SnapLock aggregate for SnapLock volumes.
Consistency groups	Organize volumes and LUNs in consistency groups to manage data protection policies and ensure write-order fidelity of workloads spanning multiple storage volumes.
Archive backups with the public cloud	SnapMirror Cloud supports tiering of ONTAP backups to lower cost public cloud object storage classes in AWS and MS Azure for long-term retention.
AES support for secure Netlogon channel communication	If you connect to Windows domain controllers using the Netlogon authentication service, you can use Advanced Encryption Standard (AES) for secure channel communications.
Kerberos for SMB domain-tunnel authentication	Kerberos authentication is available for domain tunnel authentications for ONTAP management in addition to NTLM. This allows for more secure logins to the ONTAP CLI and System Manager GUI using Active Directory credentials.

File access protocols

Update	Description
NFS over RDMA (NVIDIA only)	NFS over RDMA utilizes RDMA adapters, allowing data to be copied directly between storage system memory and host system memory, circumventing CPU interruptions and overhead. NFS over RDMA enables the use of NVIDIA GPUDirect Storage for GPU-accelerated workloads on hosts with supported NVIDIA GPUs.

MetroCluster

Update	Description
Configuration of layer 3 MetroCluster IP address in MetroCluster IP configurations	You can edit the MetroCluster IP address, netmask, and gateway for nodes in a layer 3 configuration.
Simplified controller upgrade of nodes in a MetroCluster FC configuration	The upgrade procedure for the upgrade process using switchover and switchback has been simplified.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

Networking

Update	Description
RDMA cluster interconnect	With the A400 or ASA A400 storage system and an X1151A cluster NIC you can accelerate high-performance workloads in a multi-node cluster leveraging RDMA for intra-cluster traffic
Confirmation is required before setting status admin to down for a LIF in a system SVM	This protects you from accidentally taking down LIFs that are critical for proper cluster operation.If you have scripts that invoke this behavior at the CLI, you must update them to account for the confirmation step.
Automatic detection and repair recommendations for network wiring issues	When a port reachability issue is detected, ONTAP System Manager recommends a repair operation to resolve the issue.
Internet Protocol security (IPsec) certificates	IPsec policies support pre-shared keys (PSKs) in addition to certificates for authentication.
LIF service policies	Firewall policies are deprecated and replaced with LIF service policies. A new NTP LIF service policy has also been added to provide more control over which LIFs are used for outbound NTP requests.

S3 object storage

Update	Description
S3 object data protection, backup and disaster recovery	S3 SnapMirror provides data protection services for ONTAP S3 object storage, including buckets mirroring to ONTAP S3 configurations, and bucket backup to NetApp and non-NetApp destinations.
S3 audit	You can audit data and management events in ONTAP S3 environments. S3 audit functionality is similar to existing NAS auditing capabilities, and S3 and NAS auditing can coexist in a cluster.

SAN

Update	Description
NVMe namespace	You can use the ONTAP CLI to increase or decrease the size of a namespace. You can use System Manager to increase the size of a namespace.
NVMe protocol support for TCP	The non-volatile memory express (NVMe) protocol is available for SAN environments over an TCP network.

Security

Update	Description
Autonomous Ransomware Protection	Using workload analysis in NAS environments, Autonomous Ransomware Protection alerts you about abnormal activity that might indicate a ransomware attack. Autonomous Ransomware Protection also creates automatic Snapshot backups when an attack is detected, in addition to existing protection from scheduled Snapshot copies.
Encryption key management	Use Azure Key Vault and Google Cloud Platform Key Management Service to store, protect, and utilize ONTAP keys, streamlining key management and access.

Storage efficiency

Update	Description
Temperature-sensitive storage efficiency	You can enable temperature-sensitive storage efficiency using either "default" mode or "efficient" mode on new or existing AFF volumes.
Ability to non-disruptively move SVMs between clusters	You can relocate SVMs between physical AFF clusters, from a source to a destination, for load balancing, performance improvements, equipment upgrades, and data center migrations.

Storage resource management enhancements

Update	Description
Activity tracking for hot objects with File System Analytics (FSA)	To improve system performance assessment, FSA can identify hot objects: files, directories, users, and clients with the most traffic and throughput.
Global file-read locking	Enable a read lock from a single point across all caches and the origin; affected article in migration.
NFSv4 support for FlexCache	FlexCache volumes support NFSv4 protocol.
Create clones from existing FlexGroup volumes	You can create a FlexClone volume using existing FlexGroup volumes.
Convert a FlexVol volume to a FlexGroup in an SVM disaster recovery source	You can convert FlexVol volumes to FlexGroup volumes in an SVM disaster recovery source.

SVM management enhancements

Update	Description
Ability to nondisruptively move SVMs between clusters	You can relocate SVMs between physical AFF clusters, from a source to a destination, for load balancing, performance improvements, equipment upgrades, and data center migrations.

System Manager

Update	Description
Enable performance telemetry logging in System Manager logs	Administrators can enable telemetry logging if they experience performance issues with System Manager, and then contact support to analyze the issue.
NetApp License Files	All license keys are delivered as NetApp License Files instead of individual 28-character license keys, making it possible to license multiple features using one file.
Update firmware automatically	System Manager administrators can configure ONTAP to automatically update firmware.
Review risk mitigation recommendations and acknowledge the risks reported by Active IQ	System Manager users can view the risks reported by Active IQ and review recommendations about mitigating the risks. Beginning with 9.10.1, users can also acknowledge risks.
Configure administrator reception of EMS event notifications	System Manager administrators can configure how Event Management System (EMS) event notifications are delivered so they are notified of system issues that require their attention.
Manage certificates	System Manager administrators can manage trusted certificate authorities, client/server certificates, and local (onboard) certificate authorities.
Use System Manager to view historical use of capacity and to predict future capacity needs	Integration between Active IQ and System Manager allows administrators to view data about historical trends in capacity use for clusters.
Use System Manager to back up data to StorageGRID using the Cloud Backup Service	As a Cloud Backup Service administrator, you can back up to StorageGRID if you have Cloud Manager deployed on premises. You can also archive objects using Cloud Backup Service with AWS or Azure.

Update	Description
Usability enhancements	Beginning with ONTAP 9.10.1, you can: • Assign QoS policies to LUNs instead of the parent volume (VMware, Linux, Windows) • Edit LUN QoS policy group • Move a LUN • Take a LUN offline • Perform a rolling ONTAP image upgrade • Create a port set and bind it to an igroup • Automatic detection and repair recommendations for network wiring issues • Enable or disable client access to Snapshot copy directory • Calculate reclaimable space before deleting Snapshot copies • Access continuously available field changes in SMB shares • View capacity measurements using more accurate display units • Manage host-specific users and groups for Windows and Linux • Manage AutoSupport settings • Resize volumes as a separate action

What's new in ONTAP 9.9.1

Learn about the new capabilities available in ONTAP 9.9.1.

For details about earlier ONTAP 9 releases, hardware platform and switch support, known issues, and limitations, refer to the *ONTAP 9 Release Notes*. You must sign in with your NetApp account or create a NetApp account to access the *ONTAP 9 Release Notes*.

To upgrade to the latest version of ONTAP, see Prepare to upgrade ONTAP.

Data protection

Update	Description
Storage efficiency support on SnapLock volumes and aggregates	Storage efficiency capabilities for SnapLock volumes and aggregates have been extended to include data compaction, cross-volume deduplication, adaptive compression, and TSSE (Temperature Sensitive Storage Efficiency), allowing for greater space savings for WORM data.
Support for configuring different Snapshot policies on SVM DR source and destination	SVM DR configurations can use the mirror-vault policy to configure different Snapshot policies on the source and destination, and the policies on the destination are not overwritten by the policies on the source.
System Manager support for SnapMirror Cloud	SnapMirror Cloud is now supported in System Manager.

Update	Description
Auditing-enabled SVMs	The maximum number of auditing-enabled SVMs supported in a cluster has been increased from 50 to 400.
SnapMirror Synchronous	The maximum number of supported SnapMirror Synchronous endpoints per HA pair has increased from 80 to 160.
FlexGroup SnapMirror topology	FlexGroup volumes support two or more fanout relationships; for example A→B, A→C. Like FlexVol volumes, FlexGroup fanout supports a maximum of 8 fanout legs, and cascading up to two-levels; for example, A→B→C.

File access protocols

Update	Description
LDAP referral chasing enhancements	LDAP referral chasing is supported with LDAP signing and sealing, encrypted TLS connections, and communications over LDAPS port 636.
LDAPS support on any port	LDAPS can be configured on any port; port 636 remains the default.
NFSv4.x versions enabled by default	NFSv4.0, NFSv4.1, and NFSv4.2 are enabled by default.
Labeled NFSv4.2 support	Mandatory Access Control (MAC) labeled NFS is supported when NFSv4.2 is enabled. With this functionality, ONTAP NFS servers are MAC-aware, storing and retrieving `sec_label` attributes sent by clients.

MetroCluster

Update	Description
IP support for shared link at layer 3	MetroCluster IP configurations can be implemented with IP-routed (layer 3) back-end connections.
Support for 8-node clusters	Permanent 8-node clusters are supported in IP and Fabric-attached configurations. Additionally, AFF ASA platforms support 8-node MCC IP configurations.

To learn about platform and switch configuration enhancements for MetroCluster configurations, see the *ONTAP 9 Release Notes*.

Networking

Update	Description
Cluster resiliency	• Port monitoring and avoidance for two-node switchless clusters (previously available only in switched configurations) • Automatic node failover when a node cannot serve data across its cluster network • New tools to display which cluster paths are experiencing packet loss

Update	Description
Virtual IP (VIP) LIF extension	• Autonomous system number (ASN) for border gateway protocol (BGP) supports a 4-byte non-negative integer. • Multi-exit discriminator (MED) enables advanced route selections with support for path prioritization. MED is an optional attribute in the BGP update message. • VIP BGP provides default route automation using BGP peer grouping to simplify configuration.

S3 object storage

Update	Description
S3 metadata and tag support	The ONTAP S3 server provides enhanced automation capabilities to S3 clients and applications with support for user-defined object metadata and object tagging.

SAN

Update	Description
Foreign LUN import (FLI)	The SAN LUN Migrate App on the NetApp Support Site can be used to qualify a foreign array that is not listed in the FLI interoperability matrix.
NVMe-oF remote path access	If direct path access is lost in failover, remote I/O allows the system to failover to a remote path and continue data access.
Support for 12-node clusters on ASAs	12-node clusters are supported for AFF ASA configurations. ASA clusters can include a mix of various ASA system types.
NVMe-oF protocol on ASAs	The NVMe-oF protocol support is also available with an AFF ASA system.
	• You can create an igroup that consists of existing igroups. • You can add a description to an igroup or host initiators that serves as an alias for the igroup or host initiator. • You can map igroups to two or more LUNs simultaneously.
Single LUN performance improvement	Single LUN performance for AFF has been significantly improved, making it ideal for simplifying deployments in virtual environments. For example, A800 can provide up to 400% more Random Read IOPs.

Security

Update	Description
Support for multifactor authentication with Cisco DUO when logging in to System Manager	Beginning with ONTAP 9.9.1P3, you can configure Cisco DUO as a SAML identity provider (IdP), enabling users to authenticate using Cisco DUO when they log in to System Manager.

Storage efficiency

Update	Description
Set number of files to maximum for volume	Automate file maximums with the volume parameter `-files-set -maximum`, eliminating the need to monitor file limits.

Storage resource management enhancements

Update	Description
File System Analytics (FSA) management enhancements in System Manager	FSA provides additional System Manager capabilities for search and filtering, and for taking action on FSA recommendations.
Support for negative lookup cache	Caches a "file not found" error on the FlexCache volume to reduce network traffic caused by calls to the origin.
FlexCache disaster recovery	Provides non-disruptive migration of clients from one cache to another.
SnapMirror cascade and fanout support for FlexGroup volumes	Provides support for SnapMirror cascade and SnapMirror fanout relationships for FlexGroup volumes.
SVM disaster recovery support for FlexGroup volumes	SVM disaster recovery support for FlexGroup volumes provides redundancy by using SnapMirror to replicate and synchronize an SVM's configuration and data.
Logical space reporting and enforcement support for FlexGroup volumes	You can display and limit the amount of logical space consumed by FlexGroup volume users.
SMB access support in qtrees	SMB access is supported to qtrees in FlexVol and FlexGroup volumes with SMB enabled.

System Manager

Update	Description
System Manager displays risks reported by Active IQ	Use System Manager to link to NetApp Active IQ, which reports opportunities to reduce risk and improve the performance and efficiency of your storage environment.
Manually assign local tiers	System Manager users can assign a local tier manually when they are creating and adding volumes and LUNs.
Fast directory delete	Directories can be deleted in System Manager with low-latency fast directory delete functionality.
Generate Ansible Playbooks	System Manager users can generate Ansible Playbooks from the UI for a few select workflows and can use them in an automation tool to repeatedly add or edit volumes or LUNs.
Hardware Visualization	First introduced in ONTAP 9.8, the Hardware Visualization feature now supports all AFF platforms.

Update	Description
Active IQ integration	System Manager users can view support cases associated with the cluster and download. They can also copy cluster details they need to submit new support cases on the NetApp Support site. System Manager users can receive alerts from Active IQ to inform them when new firmware updates are available. Then, they can download the firmware image and upload it using System Manager.
Cloud Manager integration	System Manager users can set up protection to back up data to public cloud endpoints using the Cloud Backup Service.
Data protection provisioning workflow enhancements	System Manager users can manually name a SnapMirror destination and igroup name when setting up data protection.
Enhanced network port management	The network interfaces page has enhanced capabilities to display and manage interfaces on their home ports.
System management enhancements	• Support for nested igroups • Map multiple LUNs to an igroup in a single task and can use a WWPN alias for filtering during the process. • During the NVMe-oF LIF creation, you no longer need to select identical ports on both the controllers. • Disable FC ports with a toggle button for each port.
Enhanced display in System Manager of information about Snapshot copies	• System Manager users can view the size of Snapshot copies and the SnapMirror label. • Snapshot copy reserves are set to zero if Snapshot copies are disabled.
Enhanced display in System Manager about capacity and location information for storage tiers	• A new **Tiers** column identifies the local tiers (aggregates) in which each volume resides. • System Manager shows the physical used capacity along with the logical used capacity at the cluster level as well as the local tier (aggregate) level. • New capacity display fields allow monitor capacity, tracking volumes approaching capacity or that are underutilized.
Display in System Manager of EMS emergency alerts and other errors and warnings	The number of EMS alerts received in 24 hours, as well as other errors and warnings, are shown in the Health card in System Manager.

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