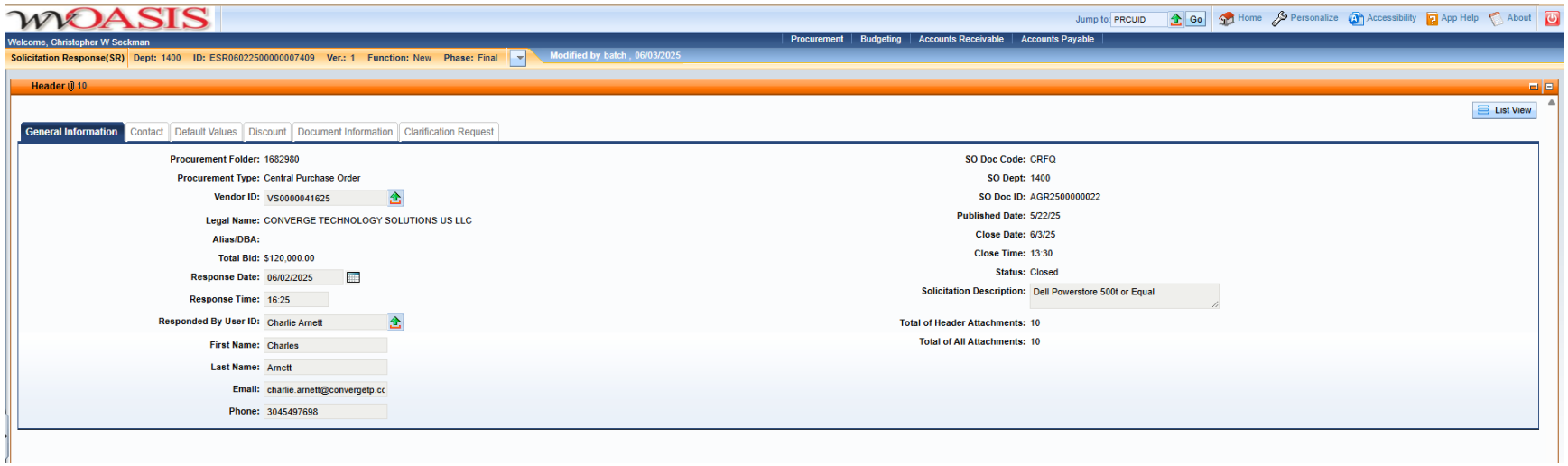
The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.


WVOASIS
Jump to PRCUID Go
Home Personalize Accessibility App Help About
Welcome, Christopher W Seckman
Procurement Budgeting Accounts Receivable Accounts Payable
Solicitation Response(SR) Dept: 1400 ID: ESR06022500000007409 Ver.: 1 Function: New Phase: Final
Modified by batch , 06/03/2025
Header @ 10
List View
General Information
Contact
Default Values
Discount
Document Information
Clarification Request
Procurement Folder: 1682980
Procurement Type: Central Purchase Order
Vendor ID: VS0000041625
Legal Name: CONVERGE TECHNOLOGY SOLUTIONS US LLC
Alias/DBA:
Total Bid: $120,000.00
Response Date: 06/02/2025
Response Time: 16:25
Responded By User ID: Charlie Arnett
First Name: Charles
Last Name: Arnett
Email: charlie.arnett@convergetp.cc
Phone: 3045497698
SO Doc Code: CRFQ
SO Dept: 1400
SO Doc ID: AGR2500000022
Published Date: 5/22/25
Close Date: 6/3/25
Close Time: 13:30
Status: Closed
Solicitation Description: Dell Powerstore 500t or Equal
Total of Header Attachments: 10
Total of All Attachments: 10

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Solicitation Response

Proc Folder:	1682980
Solicitation Description:	Dell Powerstore 500t or Equal
Proc Type:	Central Purchase Order

Solicitation Closes	Solicitation Response	Version
2025-06-03 13:30	SR 1400 ESR06022500000007409	1

VENDOR

VS0000041625
CONVERGE TECHNOLOGY SOLUTIONS US LLC

Solicitation Number: CRFQ 1400 AGR2500000022

Total Bid: 120000 **Response Date:** 2025-06-02 **Response Time:** 16:25:34

Comments:

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor
Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Dell Powerstore 500t or Equal	1.00000	EA	120000.000000	120000.00

Comm Code	Manufacturer	Specification	Model #
43210000			

Commodity Line Comments: Bidding NetApp AFF-A30

Extended Description:

Please see 3.1.1 in Specifications
See attached documentation for further details.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
2	Dell Pro Support 24/7 ProSupport or equal	1.00000	EA	0.000000	0.00

Comm Code	Manufacturer	Specification	Model #
43210000			

Commodity Line Comments: Bidding NetApp AFF-A30

Extended Description:

Please see section 3.1.1.11 in Specifications
See attached documentation for further details.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
3	Dell Pro Support Next Business Day on-site service or Equal	1.00000	EA	0.000000	0.00

Comm Code	Manufacturer	Specification	Model #
43210000			

Commodity Line Comments: Bidding NetApp AFF-A30

Extended Description:

Please see 3.1.1.12 in Specifications
See attached documentation for further details.

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Request for Quote
Info Technology

Proc Folder: 1682980	**Reason for Modification:**
Doc Description: Dell Powerstore 500t or Equal	To post Addendum no. 04
Proc Type: Central Purchase Order	

Date Issued	Solicitation Closes	Solicitation No	Version
2025-05-22	2025-06-03 13:30	CRFQ 1400 AGR2500000022	5

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:
Vendor Name : Converge Technology Solutions US, LLC
Address : 130
Street : Technology Parkway
City : Peachtree Corners
State : GA **Country :** US **Zip :** 30092
Principal Contact :
Vendor Contact Phone: **Extension:**

FOR INFORMATION CONTACT THE BUYER
Larry D McDonnell
304-558-2063
larry.d.mcdonnell@wv.gov

Vendor Signature X DocuSigned by: Karen Smallwood 05BA48166D344AA... **FEIN#** 82-2782457 **DATE** 6/2/2025

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION
Addendum no. 04 To provide revision to specification and clarification (see attached). Bid opening date has been extended from 05/27/2025 to 06/03/2025. The bid opening time still remains at 1:30PM EST/EDT No other changes

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON US	WV	AGRICULTURE DEPARTMENT OF INFORMATION TECHNOLOGY DIVISION 163 GUS R DOUGLAS LN, BLDG 1 CHARLESTON US	WV

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Dell Powerstore 500t or Equal	1.00000	EA	$120,000	$120,000

Comm Code	Manufacturer	Specification	Model #
43210000	NetApp	AFF-A30	see attached

Extended Description:
Please see 3.1.1 in Specifications

See attached documentation for further details.

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON US	WV	AGRICULTURE DEPARTMENT OF INFORMATION TECHNOLOGY DIVISION 163 GUS R DOUGLAS LN, BLDG 1 CHARLESTON US	WV

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
2	Dell Pro Support 24/7 ProSupport or equal	1.00000	EA	included	

Comm Code	Manufacturer	Specification	Model #
43210000	Net Add AFF A-30		

Extended Description:
Please see section 3.1.1.11 in Specifications

See attached documentation for further details.

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF ADMINISTRATIVE SERVICES 1900 KANAWHA BLVD E CHARLESTON US	WV	AGRICULTURE DEPARTMENT OF INFORMATION TECHNOLOGY DIVISION 163 GUS R DOUGLAS LN, BLDG 1 CHARLESTON US	WV

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
3	Dell Pro Support Next Business Day on-site service or Equal	1.00000	EA	included	

Comm Code	Manufacturer	Specification	Model #
43210000	Net Add AFF. A-30		

Extended Description:
Please see 3.1.1.12 in Specifications

See attached documentation for further details.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Vendor Questions due by 2:00PM EST/EDT	2025-05-06

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Printed Name and Title) Charlie Arnett, Account Executive

(Address) 165 Barr Street, Lexington, KY 40507

(Phone Number) / (Fax Number) 859-554-3270

(email address) charlie.arnett@convergetp.com

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through *wv*OASIS, I certify that: I have reviewed this Solicitation/Contract in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation/Contract for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that this bid or offer was made without prior understanding, agreement, or connection with any entity submitting a bid or offer for the same material, supplies, equipment or services; that this bid or offer is in all respects fair and without collusion or fraud; that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; that I am authorized by the Vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on Vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law; and that pursuant to W. Va. Code 5A-3-63, the entity entering into this contract is prohibited from engaging in a boycott against Israel.

Converge Technology Solutions US, LLC

(Company) DocuSigned by: Karen Smallwood 05BA48166D344AA...

(Signature of Authorized Representative)

Karen Smallwood, Director, Contracts And Contract Governance

(Printed Name and Title of Authorized Representative) (Date)

(Phone Number) (Fax Number)

ksmallwood@convergetp.com

(Email Address)

NetApp AFF-A30 for Unified Storage and AI Data

For West Virginia Department of Agriculture

Meets or exceeds all specifications

Line	Item Number	Description	Qty Quoted	Months of Service
1	AFF-A30	Header Line	1	
2	AFF-A30-001	AFF A30 HA System	2	
3	AFF-A30A-100-C	AFF A30 HA System,-C	1	
4	X4025A-2-A-C	Drive Pack 2X3.8TB,NVMe4,SED,-C	8	
5	SW-ONTAPO-FLASH-A30-C	SW,ONTAP One Package,Per TB,Flash,A30,-C	60	
6	X60132A-C	IO Module,4PT,10/25GbE,-C	2	
7	X60130A-C	IO Module,2PT,100GbE,-C	2	
8	X66211A-05-N-C	Cable,100GbE,QSFP28-QSFP28,Cu,0.5m,-C	2	
9	X66240A-2-N-C	Cable,25GbE,SFP28-SFP28,Cu,2m,-C	8	
10	X5532A-N-C	Rail,4-Post,Thin,Rnd/Sq-Hole,Sm,Adj,24-32,-C	1	
11	X800-42U-R6-C	Jumper Crd,In-Cab,C13-C14,-C	2	
12	X97602A-C	Power Supply,1600W,Titanium,-C	2	
13	DATA-AT-REST-ENCRYPTION	Data at Rest Encryption Capable Operating Sys	2	
14	PS-DEPLOY-STD-ONTAP-L	PS Deployment ONTAP Standard Low	1	
15	CS-ADVISOR-PLUS-SYS-A	Advisor Plus for System	1	60
16	CS-NBD-REPLACEMENT-A	Next Business Day Parts Replacement	1	60
17	CS-G1A-SE-ADVISOR	SupportEdge Advisor	1	60
18	SW-SMIRROR-CLD-ONTAP-ONE	SW-SMIRROR-CLD-ONTAP-ONE	1	
19	SW-S3-SM-ONTAP-ONE	SW-S3-SM-ONTAP-ONE	1	

Charlie Arnett

Senior Client Executive

Converge Technology Solutions

m: 304.549.7698

convergetp.com| charlie.arnett@convergetp.com

Total: $120,000.00

CONVERGE TECHNOLOGY SOLUTIONS

Join the NetApp club of WV Office of Technology, WV State Treasurer, WV Attorney General, WV DEP and WVOasis

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ AGR25*22

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[✓] Addendum No. 1	[ ] Addendum No. 6
[✓] Addendum No. 2	[ ] Addendum No. 7
[✓] Addendum No. 3	[ ] Addendum No. 8
[✓] Addendum No. 4	[ ] Addendum No. 9
[ ] Addendum No. 5	[ ] Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Converge Technology Solutions
Company

Authorized Signature

6-2-2025
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

To: West Virginia Department of Agriculture

Reasons whys NetApp?

Unmatched Reliability with Enterprise-Grade NAS+SAN: NetApp A30 is the only unified NAS+SAN storage solution with an independently certified 99.9999% (6x9's) availability, ensuring near-zero downtime—unavailable on Dell PowerStore 500T.

· Seamless Scale-Out Clustering: Scale up and out with mixed media types (spinning disk, QLC, MLC flash) in a single cluster. Dell PowerStore 500T lacks NAS protocol scalability, creating silos or requiring a separate PowerScale purchase.

· Cost-Effective, Flexible Tiering: Built-in tiering to cloud or any NetApp ONTAP-based system (spinning disk, QLC, MLC flash) optimizes costs and performance—capabilities absent in Dell PowerStore 500T.

· Versatile Media Support: Mix spinning disk, QLC, and MLC flash in one system for maximum flexibility, unlike the restrictive Dell PowerStore 500T.

· Universal Protocol Support: Native S3 protocol support alongside NAS and SAN, enabling broader application compatibility—unavailable on Dell PowerStore 500T.

· True Multi-Cloud Integration: NetApp runs natively in AWS, Azure, and Google Cloud, delivering seamless cloud integration. Dell PowerStore 500T has no native public cloud OS support.

· Built-In Autonomous Ransomware Protection: ONTAP's integrated, proactive ransomware detection and prevention safeguards your data—a feature Dell PowerStore 500T lacks.

· NSA-Validated Security: NetApp A30 is the only storage solution certified by the U.S. National Security Agency (NSA) for Top Secret data, offering unparalleled security trusted by the most sensitive government agencies—unavailable on Dell PowerStore 500T.

· Predictable Performance with QoS: Deliver consistent, high-performance results for both NAS and SAN protocols with NetApp's advanced Quality of Service (QoS), ensuring optimal resource allocation—a capability Dell PowerStore 500T lacks.

· Application-Consistent Snapshots: Protect critical applications with NetApp's snapshots that ensure data integrity and seamless recovery, a feature not supported by Dell PowerStore 500T.

· Wizard-Driven Simplicity: Streamline setup and volume creation with NetApp's intuitive, wizard-driven interface, reducing deployment time and complexity—unavailable on Dell PowerStore 500T.

· Immutable Snapshots Without Backdoors: Safeguard data with NetApp's tamper-proof, immutable snapshots, free of security vulnerabilities, providing ironclad protection not offered by Dell PowerStore 500T.

· Flexible Hardware and Software Integration: NetApp ONTAP delivers both hardware and software solutions in a unified platform, offering unmatched versatility compared to the limited Dell PowerStore 500T.

· Zero-Downtime Replication: Achieve true zero Recovery Time Objective (RTO=0) with both synchronous and asynchronous replication for NAS and SAN protocols, ensuring continuous operations—a feature Dell PowerStore 500T cannot match.

Subject: Why NetApp A30 is the Superior Choice for Your Storage Needs

We are thrilled to present our "or equal" proposal featuring the NetApp AFF A30, a storage solution that not only meets but significantly surpasses the capabilities of the Dell PowerStore 500T. Here's why the NetApp A30 is the clear choice for your organization:

Unmatched Security, Certified by the NSA

The NetApp A30 is the only storage solution certified by the U.S. National Security Agency (NSA) to safeguard Top Secret data, making it the most secure storage platform available. With built-in malware detection and prevention, plus FIPS 140-3 certification, NetApp outshines all competitors in protecting your critical data.

Trusted by Industry Leaders

As the leading storage provider to the U.S. Federal Government, NetApp powers mission-critical operations for organizations like NASA, the IRS, Social Security, and the NSA. Globally, industry giants such as NVIDIA, SAP, Salesforce, Microsoft, and IBM rely on NetApp—both Microsoft Azure and IBM Cloud leverage NetApp as their backbone for NAS-as-a-service, a distinction no other storage vendor can claim.

Proven Local Impact in West Virginia

NetApp is already a trusted partner to prominent West Virginia institutions, including West Virginia University, WVNET, WVOASIS, the WV Office of Technology, the West Virginia Investment Management Board, the WV Attorney General, and the WV State Treasurer's Office. This local expertise ensures seamless integration and support for your needs.

Cutting-Edge Performance and Innovation

The NetApp AFF A30 delivers unparalleled performance, scalability, and reliability, outpacing the Dell PowerStore 500T in every critical metric. Its advanced features empower your organization to operate with confidence, efficiency, and future-ready flexibility. Choose NetApp A30 for a storage solution that combines world-class security, proven reliability, and unmatched industry trust. We are confident it will exceed your expectations and deliver exceptional value for this bid.

Thank you for considering NetApp. We look forward to partnering with you to meet your storage needs.

NetApp includes many features in the A30 storage with ONTAP operating system not available with the Dell PowerStore500t:

Enterprise-grade NAS+SAN – NetApp is the only NAS+SAN unified storage with an independently certified 6x9's of availability which is not available on Dell PowerStore500t

Scale-out clustering – NetApp can scale both up and out and mix media types in the cluster. Dell PowerStore cannot do this for NAS protocols creating silos or forcing purchase of a separate Dell PowerScale product if a scalable NAS solution is required

Cost-effective tiering – NetApp has built in tiering and can tier to the cloud, or any NetApp ONTAP based product including spinning disk, QLC and MLC flash which is not available on Dell PowerStore500t

Any media – NetApp supports mixing of spinning disk, QLC and MLC flash which is not available on Dell PowerStore500t

Any protocol – NetApp supports S3 protocol which is not available on Dell PowerStore500t

Any cloud – NetApp runs natively in AWS, Azure and Google which is not available on Dell PowerStore500t as there is No PowerStore OS running natively in public clouds

Autonomous ransomware protection is included and built into the operating system which is not available on Dell PowerStore500t

NSA-validated security which is not available on Dell PowerStore500t

Predictable performance with QoS for both NAS and SAN protocols which is not available on Dell PowerStore500t

Application-consistent snapshots which is not available on Dell PowerStore500t

Simple wizard driven set up and volume creation which is not available on Dell PowerStore500t

Immutable Snapshot w/o Security Backdoors which is not available on Dell PowerStore500t

Both hardware and software is available with ONTAP which is not available on Dell PowerStore500t

Both Synchronous and Asynchronous Application-Level RTO=0 replication for both NAS and SAN protocols which is not available on Dell PowerStore500t

Thank you.

Charlie Arnett

304 549-7698

DATASHEET

NETAPP AFF A-SERIES

Powerful. Intelligent. Secure.

Unified data storage built for the AI era

Welcome to the future of intelligent data infrastructure.

NetApp® AFF A-Series systems easily power your most demanding workloads—from the mission-critical apps that run your business today to the AI and GenAI workloads that will unlock innovation and productivity in the future. With the advanced data management, industry-leading ransomware protection, and cloud integration that GenAI and other modern workloads demand, only NetApp delivers true unified storage architected for the next generation.

The AFF A-Series storage family, powered by NetApp ONTAP® data management software, delivers the same NetApp simplicity and reliability that tens of thousands of organizations of every size, in every industry, around the globe, have trusted for years. It's the same technology that the top three public clouds rely on to drive all your apps and data across hybrid cloud. No more silos, no more storage complexity. Just powerful, intelligent, secure storage to seamlessly accelerate your business.

Transform to meet the needs of business today

Data-driven organizations require an agile and efficient hybrid IT infrastructure to meet the demand for fast, secure, and continuous access to distributed data in the hybrid cloud. NetApp's intelligent data infrastructure delivers the industry's richest suite of data services across hybrid multicloud, enabling teams to seamlessly consume the services they require, on premises or in the cloud.

NetApp technologies, including the AFF A-Series, are anchored in unified data storage, which enables businesses to run any data type, and any app workload, across their premises and cloud with a single OS: ONTAP. A unified management experience provides ease of use and efficiency, eliminating infrastructure silos and data bottlenecks and delivering unmatched simplicity at scale.

Emerging workloads, such as AI and GenAI, data analytics, and deep learning, demand extreme performance. AFF A-Series systems deliver industry-leading speed, massive scalability, and best-in-class integration with public clouds, NVIDIA, and the MLOps ecosystem to help you accelerate, manage, and protect your next-generation apps across hybrid cloud.

Organizations of every size, in every industry, rely on AFF systems to:

- Accelerate and consolidate every workload (VMware, database, AI, and more) with unmatched performance, efficiency, and scale
- Drive transformation with a future-proof intelligent data infrastructure that seamlessly manages, protects, and mobilizes data across hybrid cloud
- Protect business-critical data against internal and external threats with real-time ransomware detection, guaranteed recovery, and business continuity

Turbocharge every workload without trade-offs

NetApp AFF A-Series systems deliver industry-leading performance, verified by SPC-1 and SPEC SFS industry benchmarks. These systems are ideal for everything from VMware environments, to highly transactional applications (such as Oracle, Microsoft SQL Server, and MongoDB databases), to the most data-intensive AI training, tuning, inferencing, and retrieval-augmented generation (RAG) workloads.

With the power of front-end NVMe/FC and NVMe/TCP host connectivity combined with back-end NVMe-attached SSDs, the high-end AFF A1K modular system delivers up to 40 million IOPS and 1TBps throughput in a single cluster through a unified, scale-out architecture.

The AFF A90 system also delivers high-end performance—in an integrated form factor that's especially well suited for AI (including GenAI), EDA, and media/entertainment workloads. It also enables in-chassis nondisruptive upgrades.

The integrated midrange AFF A70 system puts outstanding performance and flexibility (more I/O on network connection) within your budget.

The midrange AFF A50, AFF A30, and the entry-level AFF A20 all-flash storage systems offer high performance at an aggressive price point.

KEY BENEFITS

Powerful

- Turbocharge every workload—VMware, database, AI—with 40 million IOPS, 1TBps throughput, and massive scale.
- Enable unmatched power and consolidation for all your workloads with hyperefficient, unified storage that supports block, file, and object.
- Accelerate without trade-offs through consistent performance, AQoS, and proven 99.9999% data availability.

Intelligent

- Transform with an AI-ready ecosystem built on data-driven intelligence, future-proof infrastructure, and deep integrations with NVIDIA and the MLOps ecosystem.
- Seamlessly manage, protect, and mobilize data, at the lowest cost, across hybrid cloud with a single storage OS and the industry's richest data services suite.
- Simplify and automate hybrid operations with AIOps, efficient AI model versioning, and intuitive hybrid multicloud control delivered by BlueXP.

Secure

- Protect valuable data from cyberthreats with built-in AI/ML-based real-time ransomware detection designed for industry-first 99%+ accuracy, SIEM/XDR integrations, and guaranteed recovery with end-to-end orchestration.
- Trust in the only hardened enterprise storage that's validated to store top-secret data.
- Prevent app disruptions, even during site failures, with integrated business continuity.

With the new AFF A-Series systems, you'll never need to choose between performance and efficiency. You'll have always-on improved data compression and no performance impact, thanks to QuickAssist Technology (Intel QAT). The systems allow you to achieve exceptional storage efficiency while delivering the consistent high performance needed for mission-critical workloads. In addition, the new systems come with faster front-end 200Gb Ethernet and 64Gb FC networking connectivity.

All AFF A-Series systems offer advanced reliability, availability, and serviceability to keep your critical data available. They also provide comprehensive data management and data protection capabilities for your enterprise applications with industry-leading ONTAP software.

Leverage unmatched consolidation and scale
Consolidate all your workloads on AFF A-Series systems, which can:

- Deliver up to 2x better performance compared to previous generations of systems, with latency as low as 100µs
- Support any data type, any app workload, across hybrid cloud
- Provide consistent performance, adaptive quality of service (AQoS), and proven 99.9999% data availability to safeguard SLAs even in multiworkload and multitenant environments
- Scale nondisruptively to 185PB in a single namespace
- Improve the speed and productivity of collaborative teams across multiple locations and increase data throughput for read-intensive applications with NetApp FlexCache® software

Enable your AI workloads

AI holds the promise of new levels of innovation and productivity—and AFF A-Series systems are the ideal storage solution to power your AI initiatives and other data-intensive workloads. The AFF A-Series gives enterprises five critical AI capabilities:

- Unify data across hybrid cloud and efficiently and securely serve data science teams.
- Deliver abundant levels of performance, efficiency, and scalability to power every segment of the AI data pipeline, up to and including AI-as-a-service model training tasks in enterprises.
- Streamline AI workflows with model interpretability, simple versioning, and clear visibility into data lineage.
- Get seamless, proven data management across hybrid multicloud to enable hybrid cloud workloads.
- Improve GenAI accuracy and insights by training large foundational models with your secured data sets.

NetApp warrants Snapshot data recovery if a ransomware attack occurs. If you can't recover your data copies with help from NetApp or partner assistance, NetApp offers compensation.

Find details here

With AFF A-Series systems, you can add AI workloads to your existing ecosystem as needed without creating new silos or complexity.

Keep important data available, protected, and secure

For data-driven enterprises, the business impact of data loss can be dramatic—and costly. Organizations must protect their valuable data from ransomware and other external cyberattacks, and from internal threats, to keep their data available, eliminate disruptions, and quickly recover from failures.

AFF systems are the only hardened enterprise storage validated to store top-secret data. They deliver a comprehensive suite of integrated and application-consistent data protections, including:

- Robust protection through multifactor authentication, immutable tamperproof NetApp Snapshot™ copies, end-to-end encryption, and automatic blocking of malicious file types
- Real-time autonomous ransomware detection, enhanced by embedded (ML) models, designed for industry-first 99%+ accuracy
- SIEM/XDR integrations
- Guaranteed recovery with end-to-end orchestration through the NetApp Ransomware Recovery Guarantee and Ransomware Recovery Assurance Service
- Integrated active-active business continuity
- Cyber-vault capability that combines advanced encryption, immutable backups, and air-gapped storage
- Application-consistent data protection and clone management with the NetApp SnapCenter® licensed capability
- Replication to any NetApp AFF or FAS system on the premises or in the cloud with NetApp SnapMirror® technology

NetApp is the only storage vendor that can give you this level of comprehensive, automated protection and guaranteed recovery.

Integrate business continuity and get fast disaster recovery
With AFF, you can maintain constant data availability with zero data loss and zero downtime if disruption or disaster occurs. NetApp MetroCluster® software replicates your data synchronously to a separate location to protect your entire system. If something goes wrong at one site, your applications automatically and instantaneously switch to the other site. For a more tailored approach, choose NetApp SnapMirror active sync to cost-efficiently replicate the most critical data while taking advantage of the increased performance, greater flexibility, and enhanced load-balancing capability that come with the symmetric active-active architecture.

With NetApp's comprehensive security solutions, you can achieve FIPS 140-2 compliance (Level 1 and Level 2) with self-encrypting drives. And you can meet governance, risk, and compliance requirements with security features such as secure purge, logging and auditing monitors, and write once, read many (WORM) file locking.

Increase operational efficiency for your business

With NetApp ONTAP advanced data management, you can lower IT costs by simplifying operations, consolidating workloads, and lowering overhead.

NetApp AFF A-Series systems offer broad support of application ecosystems and deep integration for enterprise applications, virtual desktop infrastructure, databases, server virtualization, and MLOps. Infrastructure management tools simplify and automate common storage tasks:

- Easily provision and rebalance workloads in minutes with one-click automation and self-service.
- Upgrade your OS and firmware with a single click.
- Import LUNs from third-party storage arrays directly into an AFF system to seamlessly migrate data.

In addition, the NetApp BlueXP™ digital advisor enables you to optimize your NetApp systems with predictive analytics and proactive support.

Flexibly consume storage resources
NetApp AFF A-Series systems are unified data storage built for the AI era. This intelligent data infrastructure enables you to architect for the future while powering all of your workloads today.

Like the rest of the NetApp portfolio, the new AFF A-Series systems are available through traditional capex or as a service with the NetApp Keystone® portfolio. Gain financial flexibility as you modernize, and better align IT expenditure to business needs.

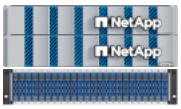
Get more business value with services
Whether you're planning your next-generation data center, need specialized know-how for a major storage deployment, or want to optimize the operational efficiency of your existing infrastructure, NetApp Professional Services and NetApp Certified Partners can help.

NetApp Storage Lifecycle Program

Eliminate the headache of tech refreshes with the Storage Lifecycle Program: Get a new controller every 3 years with support-managed updates included, or move to the cloud—whichever best meets your needs.

Find out more

Table 1) AFF A-Series technical specifications






	AFF A1K	AFF A90	AFF A70	AFF A50	AFF A30	AFF A20
Maximum scale-out	2–24 nodes (12 HA pairs)	2–24 nodes (12 HA pairs)	2–24 nodes (12 HA pairs)	2–24 nodes (12 HA pairs)	2-8 nodes (4 HA pairs)	2–6 nodes (3 HA pairs)
Maximum SSDs	2880	2880	2880	1440	288	144
Maximum effective capacity[1]	185PB	185PB	185PB	176.47PB	19.3PB	9.3PB
Controller chassis form factor	2X2U	4U; 48 internal SSD slots	4U; 48 internal SSD slots	2U; 24 internal SSD slots	2U; 24 internal SSD slots	2U; 24 internal SSD slots
Power consumption (median)	2718W[2] (with NS224)	1950W[2]	1232W[2]	Results pending	Results pending	Results pending
PCIe expansion slots	18	18	18	8	8	8
FC target ports (64Gb autoranging)	48	56	56	24	24	24
FC target ports (32Gb autoranging)	48	56	56	24	24	24
FC target ports (16Gb autoranging)	48	56	56	24	24	24
FCoE target ports, U TA2	n/a	n/a	n/a	64	n/a	n/a
200GbE ports (100GbE/40GbE autoranging)	24	24	24	n/a	n/a	n/a
100GbE ports (40GbE autoranging)	36	36	36	16	16	12
25GbE ports (10GbE autoranging)	48	56	56	24	24	32
10GbE ports	48	56	56	24	24	24
10GBASE-T (1GbE autoranging)	48	56	56	24	24	24
12Gb/6Gb SAS ports	n/a	n/a	n/a	16	16	16
OS version	ONTAP 9.15.1 or later	ONTAP 9.15.1 or later	ONTAP 9.15.1 or later	ONTAP 9.16.1 or later	ONTAP 9.16.1 or later	ONTAP 9.16.1 or later
Shelves and media	NS224 (2U, 24 drives, SFF NVMe)	NS224 (2U, 24 drives, SFF NVMe)	NS224 (2U, 24 drives, SFF NVMe)	NS224 (2U, 24 drives, SFF NVMe)	NS224 (2U, 24 drives, SFF NVMe)	NS224 (2U, 24 drives, SFF NVMe)
Host/client OS supported	Windows Server, Linux, Oracle Solaris, AIX, HP-UX, macOS, VMware, ESX					

[1] Effective capacity based on 5:1 storage efficiency ratio with the maximum number of SSDs installed; space savings will vary dependent on workload and use cases.
[2] Estimate under typical conditions - awaiting field data for new product.

Table 2) AFF A-Series software

Data access protocols	• FC, iSCSI, NVMe/FC, NVMe/TCP, NFS, NFSv4/RDMA, SMB, S3
High availability	• Active-active controller architecture • Nondisruptive maintenance, upgrade, and scale-out clustering • Multisite resiliency for continuous data access
Storage efficiency	• Inline data compression, deduplication, and compaction • Space-efficient LUN, file, and volume cloning • Automatic data tiering
Data management	• Intuitive onboard GUI, REST APIs, and automation integration • AI-informed predictive analytics and corrective action • QoS workload control • Easy provisioning and data management from market-leading host operating systems, hypervisors, and application software • Multisite copy caching for improved read and write performance over distance
Scalable NAS	• Large-scale single namespace management with local and remote caching
Data protection	• Application-consistent snapshot copies and restore capabilities • Integrated remote backup and disaster recovery • Synchronous zero-data-loss replication • Symmetric active-active multi-site replication for business continuity
Security and compliance	• Automatic ransomware protection • Multifactor administrative access, multi-admin verification, dynamic authorization framework • Secure multitenant shared storage • Tamper-proof snapshots with SnapLock • In-flight and data-at-rest encryption • Regulatory-compliant data retention
Cloud integration	• Seamlessly tier, back up, replicate, and cache data to private and public clouds

Contact Us

About NetApp

NetApp is the intelligent data infrastructure company, combining unified data storage, integrated data services, and CloudOps solutions to turn a world of disruption into opportunity for every customer. NetApp creates silo-free infrastructure, harnessing observability and AI to enable the industry's best data management. As the only enterprise-grade storage service natively embedded in the world's biggest clouds, our data storage delivers seamless flexibility. In addition, our data services create a data advantage through superior cyber resilience, governance, and application agility. Our CloudOps solutions provide continuous optimization of performance and efficiency through observability and AI. No matter the data type, workload, or environment, with NetApp you can transform your data infrastructure to realize your business possibilities. www.netapp.com

NetApp

ONTAP RANSOMWARE CAPABILITIES

Ransomware threats are dangerous and pervasive. They disrupt access to production data and may also destroy backup data to prevent quick recovery. For state and local governments, having the right data protection and security solutions is crucial to an overall cyber-resilience strategy.

NetApp® is a leader in data management solutions and datacentric security. Protection and security are built into our DNA. Our integrated solutions and services for ransomware align directly with the National Institute of Standards and Technology (NIST) framework to help you protect and secure your data with the ability to recover rapidly in the event of an attack.

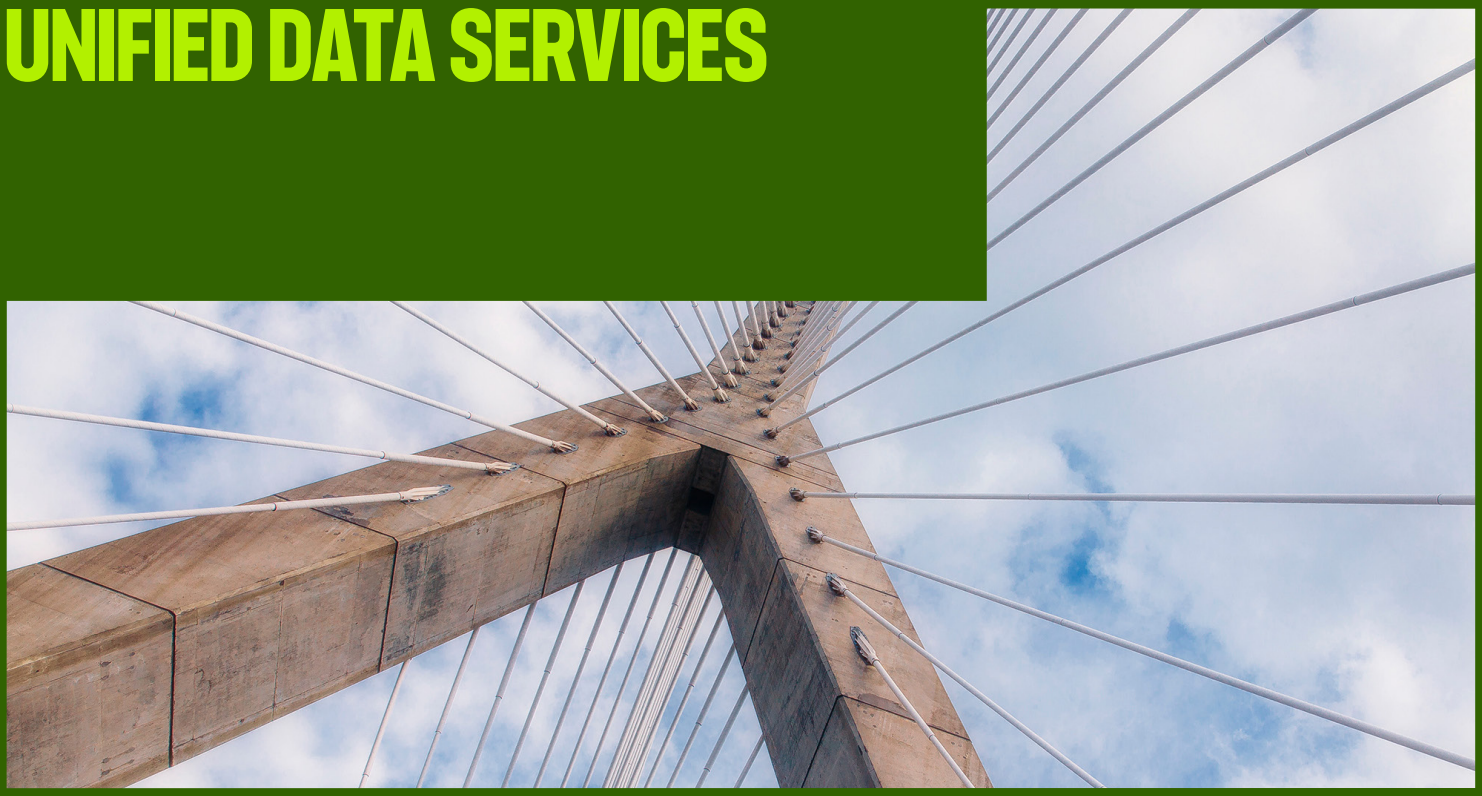
The following table shows the five pillars of the NIST Cybersecurity Framework.

Table 1: NIST Cybersecurity Framework pillars.

FIVE PILLARS OF THE NIST CYBERSECURITY FRAMEWORK				
IDENTIFY	**PROTECT**	**DETECT**	**RESPOND**	**RECOVER**
• Scan for vulnerabilities • Assess data protection and security posture • Classify data type, location, and permissions	• Build a Zero Trust architecture with logical air gap; write once, read many (WORM) retention; and detailed logging • Create indelible, immutable data copies • Block malicious data from being written to disk	• Monitor infrastructure for ransomware attacks • Monitor user and storage behavior anomalies • Generate regular reports • Alert for suspicious activity	• Block malicious accounts • Advise on the proper remediation approach • Initiate NetApp Snapshot copies if an attack is identified	• Restore data seconds and bring applications back online • Apply intelligent forensics to identify the source of the threat

DATASHEET

ONTAP ONE: UNIFIED DATA SERVICES



The industry's simplest, most comprehensive data services license

What is ONTAP One?
NetApp® ONTAP® One is a comprehensive, unified data services suite that brings together all NetApp data management capabilities in a single software license bundle. Combining the contents of the former Core bundle, Data Protection bundle, Security and Compliance bundle, Hybrid Cloud bundle, and Encryption bundle, ONTAP One delivers a complete, easy-to-buy, easy-to-consume data services license bundle for every NetApp customer.

ONTAP One includes access to ONTAP unified data storage protocols (block, file, object), as well as ONTAP technologies such as SnapRestore®, SnapMirror®, SnapCenter®, FabricPool (ONTAP-S3 and StorageGRID®), FlexClone®, encryption[1], Autonomous Ransomware Protection, SnapLock®, and multitenant key management. (ONTAP FlexCache® and FPolicy do not require licenses.)

Leverage ONTAP One for simplicity and security
A single, all-in-one ONTAP software license dramatically simplifies the storage procurement and management experience for customers, providing simplicity and predictability while slashing license management complexity. ONTAP One makes NetApp software licensing a breeze, with one line item and one price.

In addition, ONTAP One means that every NetApp customer benefits from all the industry-leading data protection capabilities of ONTAP. NetApp has a reputation as the most secure storage on the planet. We believe that robust data protection and strong defenses against ransomware and cyberattacks are crucial for today's storage environments. That's why we've integrated them into ONTAP One.

Nothing else like it
ONTAP One delivers all the core multiprotocol goodness of ONTAP powered NetApp unified data storage, and much more. It includes our leading replication software, SnapMirror and SnapMirror S3; the ability to easily back up and tier to the cloud with SnapMirror Cloud; application-integrated data protection with SnapCenter; integrated Autonomous Ransomware Protection; and primary storage compliance with NetApp SnapLock.

Beginning with ONTAP 9.10.1, NetApp delivers all licenses as a NetApp license file (NLF), which is a single file that enables multiple software features.

All AFF A-series and C-series systems and all FAS systems are sold with either the ONTAP One software suite or the ONTAP Base software suite. (ONTAP Base is described later in this datasheet.) All ASA systems are sold with ONTAP One for SAN. Each software suite is delivered as a single NLF.

Power ASA with ONTAP One for SAN
ONTAP One for SAN is available for NetApp ASA A-series and C-series systems and is the only software suite available for SAN.

ONTAP One for SAN contains the following licenses:

- FlexClone
- SnapRestore
- FC, iSCSI
- NVME-oF
- MTKM
- SnapLock
- SnapMirror (asynchronous, synchronous, Business Continuity)
- SnapMirror Cloud
- SnapCenter
- NetApp Volume Encryption
- Trusted Platform module

ONTAP Base for limited use cases
ONTAP Base is an alternative software suite designed for specific use cases in which data protection technologies such as SnapMirror and SnapCenter, as well as security features like Autonomous Ransomware Protection, are not required – for example, in nonproduction systems for dedicated test or development environments. Note that additional licenses cannot be added to ONTAP Base. If you need additional licenses, such as SnapMirror, you must upgrade to ONTAP One.

KEY BENEFITS

With a single, unified software license, ONTAP One delivers unmatched value.

- **Comprehensive feature access.** Use all ONTAP features without additional licenses, including multiprotocol (block, file, object) storage, guaranteed storage efficiency, guaranteed data availability, data protection, disaster recovery, business continuity, cloud integration, and security.
- **Simplified license management.** Streamline the licensing process by replacing multiple individual licenses with a single NetApp license. ONTAP One provides a single line item on quotes, one price, and no add-ons, making it easier to purchase and deploy.
- **Cost-effective data services.** Access the complete suite of ONTAP data management features at lower cost than individual bundles.
- **Easy activation.** Simplify feature activation with a complete license bundle for all the ONTAP capabilities you need.
- **Easy compliance.** Achieve Primary storage compliance with NetApp SnapLock.
- **Enhanced data security.** Take advantage of advanced security features like Autonomous Ransomware Protection with highest accuracy and guaranteed recovery at no extra cost.
- **Enhanced data protection.** Automatically access all of the industry-leading data protection and business continuity capabilities of ONTAP.
- **Hybrid cloud support.** Enable seamless cloud integration with ONTAP One features such as SnapMirror, SnapMirror S3, and SnapMirror Cloud.
- **Simplified system clustering.** Easily add new systems to existing clusters; ONTAP One provides compatibility licenses for older systems.
- **Future-proof investment.** Leverage a comprehensive license that gives you access to new features and capabilities as they're released, without requiring additional purchases.

Former bundle name	ONTAP keys included
Core bundle	• FlexClone • SnapRestore • NFS, SMB, S3 • FC, iSCSI • NVME-oF
Security and Compliance bundle	• Autonomous Ransomware Protection • MTKM • SnapLock
Data Protection bundle	• SnapMirror (asynchronous, synchronous, Business Continuity • SnapCenter • SnapMirror S3 for NetApp target
Hybrid Cloud bundle	• SnapMirror cloud • SnapMirror S3 for non NetApp targets
Encryption bundle	• NetApp Volume Encryption • Trusted Platform module

Table 1) Licenses included with ONTAP One.

ONTAP Base contains the following licenses:

- FlexClone
- SnapRestore
- NFS, SMB, S3
- FC, iSCSI
- NVME-oF
- NetApp Volume Encryption
- Trusted Platform module

ONTAP One for existing systems
NetApp has tens of thousands of installed systems around the world. ONTAP One is available at no additional cost to almost all of our customers who have existing systems under support. To take advantage of any of the capabilities in ONTAP One, log in to the NetApp Support Site, download and install an updated license file, and you're good to go. Some older versions of ONTAP may require you to either upgrade to ONTAP 9.10.1 or later, or work with your account team to get older license keys manually.

Streamline management with BlueXP
Manage all your hybrid multicloud ONTAP intelligent data infrastructure with the NetApp BlueXP™ unified management platform. From a single control plane, leverage unified control, powerful AIOps, integrated data services, and consolidated license and subscription management.

Check out BlueXP

Cloud services are separate from ONTAP One
The ONTAP One license does not include NetApp's cloud-delivered services, including the following:

- BlueXP tiering (previously known as cloud tiering)
- BlueXP backup
- Data Infrastructure Insights (formerly Cloud Insights)
- Data governance

Learn more about NetApp Cloud Services

Contact Us

About NetApp
NetApp is the intelligent data infrastructure company, combining unified data storage, integrated data services, and CloudOps solutions to turn a world of disruption into opportunity for every customer. NetApp creates silo-free infrastructure, harnessing observability and AI to enable the industry's best data management. As the only enterprise-grade storage service natively embedded in the world's biggest clouds, our data storage delivers seamless flexibility. In addition, our data services create a data advantage through superior cyber resilience, governance, and application agility. Our CloudOps solutions provide continuous optimization of performance and efficiency through observability and AI. No matter the data type, workload, or environment, with NetApp you can transform your data infrastructure to realize your business possibilities. www.netapp.com

NetApp

1 NETAPP AFF A-SERIES SYSTEMS

From mission-critical applications to AI and GenAI, NetApp AFF A-Series systems easily power your most demanding workloads. AFF A-Series simplifies data storage with powerful management tools, handling workloads like VMware, databases, and media and entertainment with significant performance and throughput increases, improved efficiency, and reduced maintenance and downtime.

Data storage demands are expanding exponentially, leaving organizations with many challenges. These challenges include escalating costs, sophisticated security threats, increased complexity caused by siloed infrastructures, and artificial intelligence (AI) revolution disrupting traditional ways of working.

Organizations require an IT infrastructure capable of providing quick, secure, and reliable access to data, no matter where it lives—one that can deliver extreme performance for emerging workloads, such as AI and generative AI (GenAI), data analytics, and deep learning.

For the 12th year in a row, Gartner® has recognized NetApp® as a Leader in the Magic Quadrant™ for Primary Storage Platforms for our innovation and proven reliability in storage and data management.[1] NetApp is also positioned 1st for Containers Use Case in the 2024 Gartner Critical Capabilities for Primary Storage Platforms.[2]

UNIFIED DATA STORAGE BUILT FOR THE AGE OF AI

NetApp® AFF is a robust scale-out platform for virtualized environments. It combines low-latency performance with comprehensive data management, built-in efficiencies, integrated data protection, multiprotocol support, and nondisruptive operations. NetApp AFF A-Series systems easily power your mission-critical applications and AI-driven tasks, delivering industry-leading speed, massive scalability, and top-tier integration with public clouds, NVIDIA, and the MLOps ecosystem. This helps you to more easily accelerate, manage, and protect your next-generation applications across hybrid cloud environments.

With the advanced data management, ransomware protection, and cloud integration that GenAI and other modern workloads demand, only NetApp delivers truly unified storage that is architected for the next generation. It's the same technology that the top three public clouds rely on to drive all your applications and data across hybrid cloud. No more silos, no more storage complexity—just powerful, intelligent, secure storage to seamlessly accelerate your business.

Powered by NetApp ONTAP® data management software, the NetApp AFF A-Series storage family helps businesses accelerate infrastructure transformation and fuel data-driven strategies. These systems accelerate, manage, and protect business-critical data and provide an easy transition to flash as you move to a hybrid cloud environment.

NetApp's intelligent data infrastructure provides a comprehensive suite of data services across hybrid multicloud environments, so teams can seamlessly access the services they need, whether on premises or in the cloud.

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[1] Gartner, Magic Quadrant for Primary Storage Arrays, September 17, 2024, Jeff Vogel, Chandra Mukhyala.
[2] Gartner, Critical Capabilities for Primary Storage Platforms, September 19, 2024, Jeff Vogel, Chandra Mukhyala.

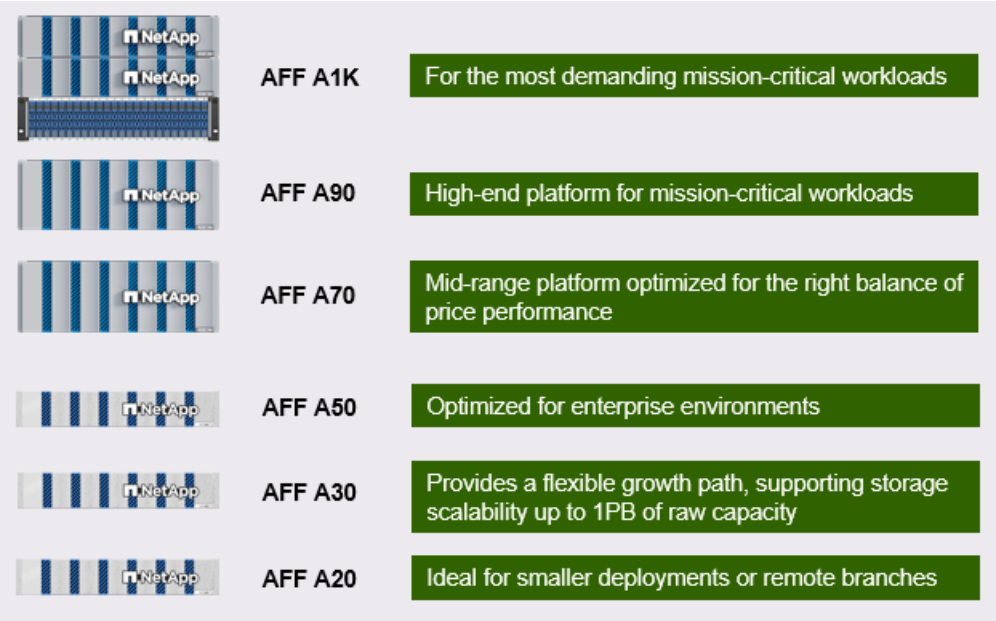

Figure 1: AFF A-Series *– Designed to help organizations transform their infrastructure more quickly and fuel data-driven strategies.*

With AFF systems, you can:

- Accelerate and consolidate every workload seamlessly
- Enable your AI workloads
- Keep important data available, protected, and secure
- Increase operational efficiency for your business

ACCELERATE AND CONSOLIDATE EVERY WORKLOAD SEAMLESSLY

In today's modern data center, IT departments are tasked with improving performance for business-critical workloads, scaling without disruption, and helping the business take on new data-driven initiatives. NetApp AFF systems deliver industry-leading performance proven by SPC-1[3] and SPEC SFS industry benchmarks. They are ideal for everything from VMware environments to highly transactional applications such as Oracle, Microsoft SQL Server, MongoDB databases, and even the most data-intensive AI training, tuning, inferencing, and Retrieval-Augmented Generation (RAG) workloads.

With the new AFF A-Series systems, you don't have to choose between performance and efficiency. Thanks to QuickAssist Technology (Intel QAT), you get always-on improved data compression with no performance impact. These systems provide exceptional storage efficiency and consistent high performance for mission-critical workloads. Additionally, they feature faster front-end 200Gb Ethernet and 64Gb FC networking connectivity.

Comprehensive Data Management and High Availability with AFF A-Series Systems

The AFF A-Series systems are designed to deliver robust data management and high availability for modern workloads, including AI, machine learning, and big data analytics. Each model integrates seamlessly with various cloud environments, supporting hybrid and multi-cloud

[3] Link to SPC-1 report: http://spcresults.org/benchmarks/results/spc1-spc1e#A32007.

deployments to facilitate smooth data movement and access to cloud services. These systems feature comprehensive security measures, such as encryption for data at rest and in transit, secure multi-tenancy, and role-based access controls, ensuring the protection of sensitive information. With support for NVMe over Fabrics in higher-end models like the AFF A90, A70, and A50, these systems offer enhanced data access speeds and reduced latency. Lower-end models like the AFF A30 and A20 still provide excellent performance with traditional SAS-based SSDs. All models are designed for energy efficiency, reducing power and cooling costs, and support SAN and NAS protocols for flexible deployment. Additionally, features like automated tiering, efficient data cloning, and robust backup and recovery options are standard across the series, ensuring comprehensive data management capabilities. The AFF A-Series is built for high availability with redundant components and non-disruptive operations, making it a reliable choice for mission-critical applications.

AFF A-Series Systems from Entry-level to High-end Platforms

AFF A1K

The NetApp AFF A1K delivers high performance all-flash storage, making it ideal for low-latency, high-throughput workloads such as databases, virtual desktops, and analytics. Its scalability options mean businesses can start with a smaller configuration and expand as storage needs grow. Leveraging NetApp's ONTAP software, the AFF A1K also offers advanced data management features like data deduplication, compression, and compaction for optimized storage efficiency. With the power of front-end NVMe/FC and NVMe/TCP host connectivity combined with back-end NVMe-attached SSDs, the high-end AFF A1K modular system delivers up to 40M IOPS and 1TB/ps throughput in a single cluster through a unified, scale-out architecture.

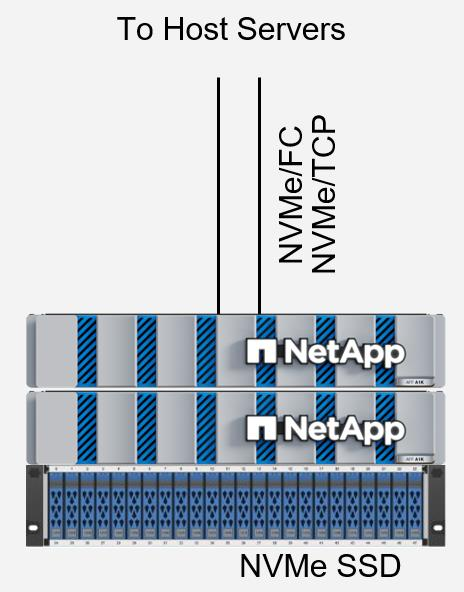

Figure 2: End-to-end NVMe storage *– For your most demanding workloads.*

AFF A90

The NetApp AFF A90 is a high-end model in the AFF series. It delivers exceptional performance and scalability for enterprise environments. Engineered for extreme performance, the AFF A90 is ideal for demanding workloads such as AI (including GenAI), Electronic Design Automation (EDA), media/entertainment, high-frequency trading, real-time analytics, and large-scale

databases. It provides ultra-low latency and high throughput, supporting large-scale deployments that can scale up to multiple petabytes of storage. Its advanced data reduction technologies, like inline deduplication, compression, and compaction, help maximize storage efficiency and reduce costs. The system also supports in-chassis nondisruptive upgrades for continuous performance and availability.

AFF A70

The NetApp AFF A70 is a high-performance, scalable storage system designed to deliver outstanding performance and flexibility while remaining budget-friendly. Due to its ultra-low latency and high throughput, it is ideal for demanding applications such as databases, virtualized environments, and large-scale analytics. The AFF A70 offers substantial scalability so organizations can expand their storage infrastructure as needed, supporting scale-out to multiple nodes and scale-up with additional storage shelves. Advanced data reduction technologies, such as inline deduplication, compression, and compaction, optimize storage efficiency and reduce costs.

AFF A50

The NetApp AFF A50 is designed to deliver high performance and low latency storage solutions for enterprise environments. Engineered for demanding applications such as databases, virtualized environments, and analytics, the AFF A50 offers low latency and high throughput to meet performance-intensive workloads. It provides good scalability options, so organizations can start with a smaller configuration and expand as storage needs grow. It supports both scale-up with additional storage shelves and scale-out with multiple nodes. Advanced data reduction technologies such as inline deduplication, compression, and compaction maximize storage efficiency and reduce costs.

AFF A30

Designed to provide high-performance, all-flash storage solutions for enterprise environments, the NetApp AFF A30 delivers low latency and high throughput, making it suitable for various applications, including databases, virtualized environments, and general-purpose enterprise workloads. It offers scalability options, allowing organizations to start with a smaller configuration and expand as needed, supporting both scale-up with additional storage shelves and scale-out with multiple nodes. Advanced data reduction technologies such as inline deduplication, compression, and compaction optimize storage efficiency and reduce costs.

AFF A20

The entry-level NetApp AFF A20 is designed to deliver high-performance, all-flash storage solutions for smaller enterprise environments or specific workloads within larger organizations. It provides solid performance with low latency, making it suitable for applications such as databases, virtualized environments, and general-purpose enterprise workloads. The AFF A20 offers scalability options, allowing organizations to start small and expand as needed, supporting scaling up with additional storage shelves. Advanced data reduction technologies like inline deduplication, compression, and compaction optimize storage efficiency and reduce costs.

Leverage Unmatched Consolidation and Scale

By consolidating your workloads onto AFF A-Series systems, you can:

- Deliver up to 2x performance compared to previous generation systems, with latency as low as 100µs.

- Support any data type, any app workload, across hybrid cloud.
- Provide consistent performance, adaptive quality of service, and proven 99.9999% data availability to safeguard SLAs even in multi-workload and multitenant environments.
- Scale nondisruptively to 185PB in a single namespace.
- Improve the speed and productivity of collaboration across multiple locations and increase data throughput for read-intensive applications with NetApp FlexCache® software.

> *"Given the exponential demand for CG animated content, we are excited for the unprecedented performance and flexibility of the new NetApp AFF A-Series, and how it will support our most active, business-critical production data."*
>
> — *Skottie Miller, Technology Fellow for Systems Architecture, DreamWorks Animation*

ENABLE YOUR AI WORKLOADS

AFF A-Series systems are the ideal storage solution to power your AI initiatives and other data-intensive workloads. The AFF A-Series equips organizations with critical AI capabilities, including:

- Unify data across hybrid cloud and efficiently and securely serve data science teams.
- Deliver performance, efficiency, and scalability to power every segment of the AI data pipeline, up to and including AI as a service model training tasks in enterprises.
- Streamline AI workflows with model interpretability, simple versioning, and clear visibility into data lineage.
- Leverage seamless, proven data management across hybrid multicloud to enable hybrid cloud workloads.
- Improve GenAI accuracy and insights by training large foundational models with your secured data sets.

With AFF A-Series systems, you can add AI workloads to your existing ecosystem as needed and without creating new silos or complexity.

> *"With NetApp All Flash FAS, we can improve the quality of healthcare in our own hospitals and others throughout the region by offering high-performing electronic patient records and virtual desktops to healthcare providers."*
>
> — *Reinoud Reynders, IT Manager, Infrastructure and Operations at UZ Leuven*

KEEP IMPORTANT DATA AVAILABLE, PROTECTED, AND SECURE

The more data-driven an organization becomes, the more costly the business impact of data loss will be. Ensuring data availability, eliminating maintenance disruptions, and quickly recovering from failures is imperative. Organizations must also protect valuable data from ransomware, external cyberattacks, and internal vulnerabilities.

AFF systems are the only hardened enterprise storage validated to store top-secret data. They offer a comprehensive suite of integrated and application-consistent data protection.

Figure 3: NetApp is the only enterprise storage vendor validated to store top-secret data.[4]

Key capabilities and benefits include:

- Robust protection through automatic blocking of malicious file types, multifactor authentication, immutable tamperproof NetApp Snapshot™ copies, and end-to-end encryption.
- Real-time autonomous ransomware detection, enhanced by embedded machine learning models, designed for industry-first 99%+ accuracy.
- SIEM/XDR integrations.
- Guaranteed recovery with end-to-end orchestration through the NetApp Ransomware Recovery Guarantee[5] and Ransomware Recovery Assurance Service.
- Integrated active-active business continuity.
- Cyber vault capability that combines advanced encryption, immutable backups, and air-gapped storage.
- Unified, scalable platform and plug-in suite for application-consistent data protection and clone management with NetApp SnapCenter®.
- Reduced overall system costs with NetApp SnapMirror® replication software, which replicates to any FAS/AFF system on premises or in the cloud.

NetApp is the only storage vendor with this level of comprehensive, automated protection and guaranteed recovery.

[4] Visit security.netapp.com/certs/ for the latest lists of all certifications, and for a list of Common Criteria certified products, visit netapp.com/esg/trust-center/compliance/common-criteria.

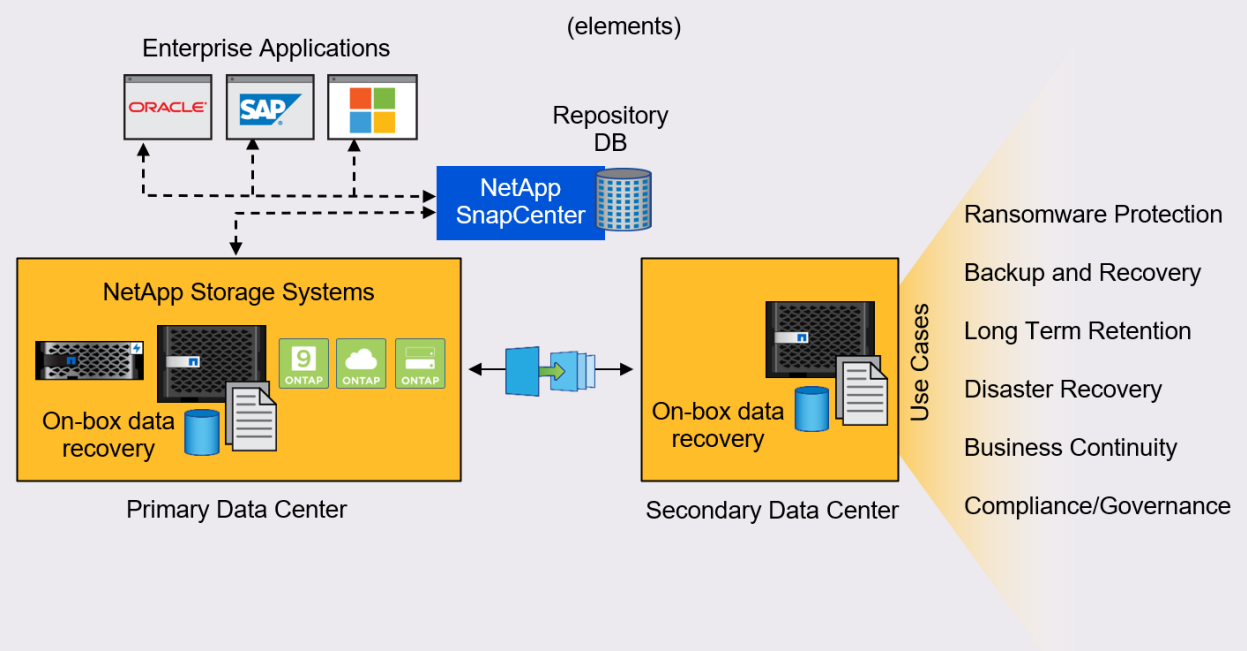

Figure 4: NetApp integrated data protection – *Offers one data management flexible platform that provides data availability to keep applications running, mitigate risk, control costs, and improve data protection processes.*

Integrate Business Continuity and Get Fast Disaster Recovery

With AFF, you maintain constant data availability with zero data loss and zero downtime. NetApp MetroCluster™ software provides synchronous replication to protect your entire system. NetApp SnapMirror active sync cost-efficiently replicates critical data, leveraging the increased performance, flexibility, and enhanced load-balancing capabilities of the symmetric active-active architecture.

Figure 5: Cost-effective choices for business continuity.

> *"NetApp's multiprotocol capability was a major draw for our colleges. With NetApp, we can enable our colleges to retain their skillsets. They don't have to learn something new or put in a mix of products just to accommodate their protocols."*
>
> *— Daniel Black, Director of Engineering, Technical College System of Georgia*

With NetApp's comprehensive security solutions, you can:

- Achieve FIPS 140-2 compliance (Level 1 and Level 2) with self-encrypting drives and use any type of drive with software-based encryption.
- Meet governance, risk, and compliance requirements with security features such as secure purge, logging and auditing monitors, and write-once, read-many (WORM) file locking.

INCREASE OPERATIONAL EFFICIENCY FOR YOUR BUSINESS

With NetApp ONTAP advanced data management, you can reduce IT expenses by simplifying operations, consolidating workloads, and reducing administrative costs. NetApp AFF A-Systems offer broad support of application ecosystems and deep integration for enterprise applications, virtual desktop infrastructure, databases, server virtualization, and the MLOps ecosystem. Infrastructure management tools simplify and automate common storage tasks, including:

- Easily provision and rebalance workloads in minutes with one-click automation and self-service.
- Upgrade your OS and firmware with a single click.
- Import LUNs from third-party storage arrays directly into an AFF system to seamlessly migrate data.

In addition, the NetApp BlueXP™ digital advisor empowers you to optimize your NetApp systems with predictive analytics and proactive support.

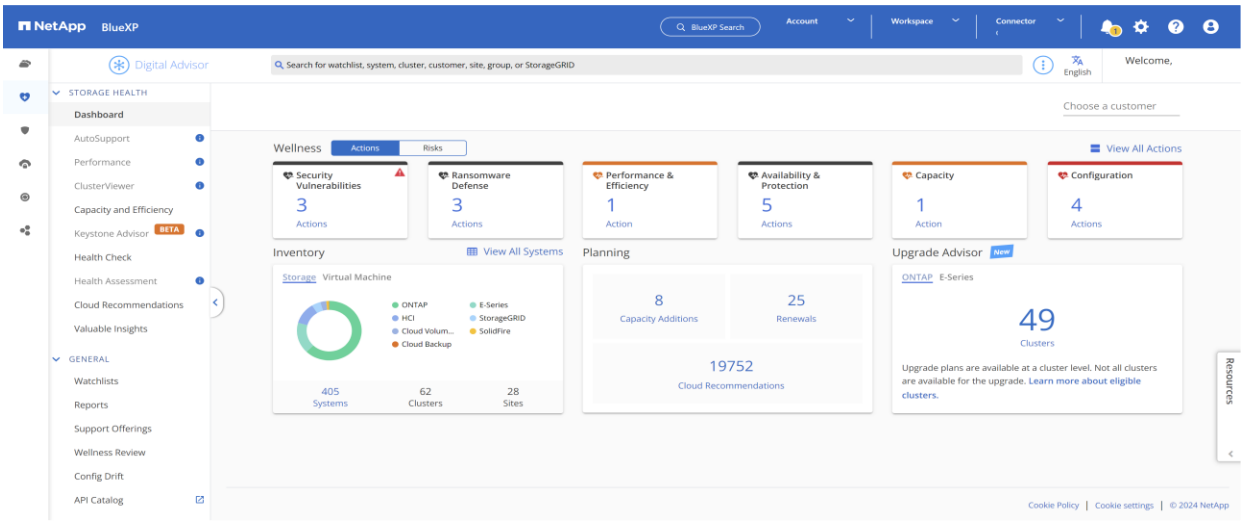

Figure 6: BlueXP digital advisor – *Active IQ Digital Advisor integration.*

> *"With the NetApp solution, we can slash the time needed to create an environment from 6 hours to 5 minutes regardless of scale, while provisioning additional environments simultaneously. That translates to a time savings of 70% for each product line."*
>
> — *Sandrine Kalk, Director of Global DevOps and Operations, Verint*

INVESTMENT PROTECTION

Investing in NetApp AFF storage systems gives you the ability to future-proof your investments and stay ahead of the technology curve with a portfolio of programs and guarantees. It includes:

- **Storage Lifecycle Program**. Eliminate the headache of tech refreshes. You get a new controller every three years with support-managed updates included, or move to the cloud, whichever best meets your needs.
- **Storage Efficiency Guarantee**.[5] Achieve high performance while minimizing storage costs. If we don't meet your workload goals, we'll make it right at no cost to you. For more information, click the following link: Storage Efficiency Guarantee.
- **Nines (99.9999%) Data Availability Guarantee**. [5] If you have unplanned downtime in excess of 31.56 seconds per year, we provide remediation.
- **Ransomware Recovery Guarantee**.[5] Guarantee data recovery in the event of a ransomware attack through NetApp's Ransomware Recovery Guarantee and ransomware assurance service. If we can't help you restore your data, we will compensate you.
- **Ransomware Detection Program**.[5] Under this program, NetApp commits to providing data recovery assistance if you experience a successful ransomware attack that evades detection by NetApp Autonomous Ransomware Protection. For more information, click the following links: Ransomware Detection Program and NetApp Autonomous Ransomware Protection.

  "The NetApp ASA was perfect for our customer's block VMware workloads. The 4:1 Storage Efficiency Guarantee delivered unbeatable space and power savings to help them achieve their sustainability and cost-saving goals."

  — Rocco Scaturchio, Director, Sales and Marketing, Amidata

FLEXIBLY CONSUME STORAGE RESOURCES

NetApp AFF A-Series systems are unified data storage built for the AI era. With this intelligent data infrastructure, you can architect for the future while powering your workloads today. Like the rest of the NetApp portfolio, the new AFF A-Series systems are available through traditional capital expenditure (capex) or as a service with the NetApp Keystone® portfolio . Gain financial flexibility as you modernize and better align IT expenditure to business needs.

AFF A-SERIES SYSTEMS

Table 1: AFF A-Series systems technical specifications.

AFF TECHNICAL SPECIFICATIONS						
	AFF A1K	AFF A90	AFF A70	AFF A50	AFF A30	AFF A20
Maximum scale out	2–24 nodes (12 HA pairs)					
Maximum SSD	2880			1440	864	576

[5] Terms and conditions will apply.

AFF TECHNICAL SPECIFICATIONS						
	AFF A1K	AFF A90	AFF A70	AFF A50	AFF A30	AFF A20
Max effective capacity[6]	185PB			176.47PB	59.05PB	39.37PB
Controller chassis form factor	2x2U	4U; 48 internal SSD slots		2U; 24 internal SSD slots		
OS version	ONTAP 9.15.1 RC1 or later			ONTAP 9.16.1 or later		
Shelves and media	NS224 (2U, 24 drives, SFF NVMe)					
Host/client OS supported	Windows Server, Linux, Oracle Solaris, AIX, HP-UX, macOS, VMware, ESX					

Table 2: AFF A-Series software.

AFF A-SERIES SOFTWARE	
Data access protocols	FC, iSCSI, NVMe/FC, NVMe/TCP, FCoE, NFS, SMB, Amazon S3
High availability	Active-active controller architecture Nondisruptive maintenance, upgrade, and scale-out clustering Multisite resiliency for continuous data access
Storage efficiency	Inline data compression, deduplication, and compaction Space-efficient LUN, file, and volume cloning Automatic data tiering
Data management	Intuitive onboard GUI, REST APIs, and automation integration AI-informed predictive analytics and corrective action QoS workload control Easy provisioning and data management from market-leading host operating systems, hypervisors, and application software Multisite copy caching for improved read and write performance over distance
Scalable NAS	Large-scale single namespace management with local and remote caching
Data protection	Application-consistent snapshot copies and restore capabilities Integrated remote backup and disaster recovery Synchronous zero-data-loss replication Symmetric active-active multi-site replication for business continuity
Security and compliance	Automatic ransomware protection Multifactor administrative access, multi-admin verification, dynamic authorization framework

[6] Effective capacity is based on 5:1 storage efficiency ratios with the maximum number of SSDs installed. The actual ratio can be higher depending on workloads and use cases.

AFF A-SERIES SOFTWARE	
	Secure multitenant shared storage Tamper-proof snapshots with SnapLock In-flight and data-at-rest encryption Regulatory-compliant data retention
Cloud integration	Seamlessly tier, back up, replicate, and cache data to private and public clouds

SOFTWARE

ONTAP One is the software suite for ONTAP systems with the full functionality of ONTAP in one easy-to-order, comprehensive bundle. It includes all protocols (SAN/NAS/ Object) and ONTAP technologies.

Table 3: ONTAP One software suite.

NETAPP ONTAP ONE
DATA PROTECTION FEATURE
Snapshot: Application-consistent tamper-proof instant backups
SnapRestore: Near-instant restore of backups on demand
SnapMirror: Integrated remote backup/disaster recovery
Security Feature
ARP: Autonomous ransomware protection
SnapLock: Regulatory-compliant data retention
NSE/NVE/Encryption: In-flight and data-at-rest encryption
MFA/MAV: Multifactor admin access & multi-admin verification
Data Management
Active IQ: AI-informed predictive analytics and corrective action
QoS: Quality of service workload control
SysMgr/GUI/CLI/API: Intuitive management and automation integration
FabricPool: Reduce the total cost of ownership and optimize the use of your high-performance storage with automated tiering to more cost-effective storage tiers
Core Capability
Efficiency: Inline data compression, deduplication, and compaction
Unified: FC, iSCSI, NVMe-oF, NVMe/TCP, NFS, SMB, S3

1 ONTAP DATA MANAGEMENT SOFTWARE

NetApp ONTAP is a complete data management software solution that seamlessly manages data as it flows to and from wherever you need it most. It provides enterprise-class support for multiple protocols and multiple deployment methods. You get a common set of features across on-premises and cloud storage, simplifying operations and unifying storage management across a hybrid multicloud spanning flash, disk, and cloud, running SAN, NAS, and object workloads.

In today's data-centric world, companies are striving to become more data-driven. To achieve this, they need to ensure that data is easily accessible to users and applications, maintain a balance between performance and efficiency, and protect data from both natural and human-made disasters—all while working within tight IT budgets. Many businesses find it challenging to meet these objectives. Data scattered across different systems or clouds create silos and complexity. The mismatch between performance and application needs creates inefficiencies, and the need to secure data adds another layer of complexity that can hinder its use.

To address these challenges, organizations need a storage infrastructure that unifies data and eliminates silos, supports any data anywhere at the right price for performance, and protects against data loss, destruction, or theft with integrated and intelligent AI-based security.

NETAPP ONTAP BREAKS DOWN SILOS AND UNIFIES STORAGE AND DATA

NetApp® ONTAP® simplifies data management by eliminating the complexity of silos, which helps reduce administration costs. ONTAP seamlessly manages your data wherever it's needed—on premises or in the cloud. It supports a wide range of applications through a unified data management platform, bringing the simplicity and flexibility of cloud to your data center and all the enterprise capabilities of your data center to the public cloud.

With ONTAP 9, you can create an environment that covers flash, disk, and cloud. You can easily deploy storage on your choice of architectures—hardware storage systems, software-defined storage (SDS), and public clouds—while unifying data management across all of them.

Use ONTAP to:

- Simplify operations and reduce costs
- Adapt to changing business needs
- Protect and secure data across the hybrid cloud

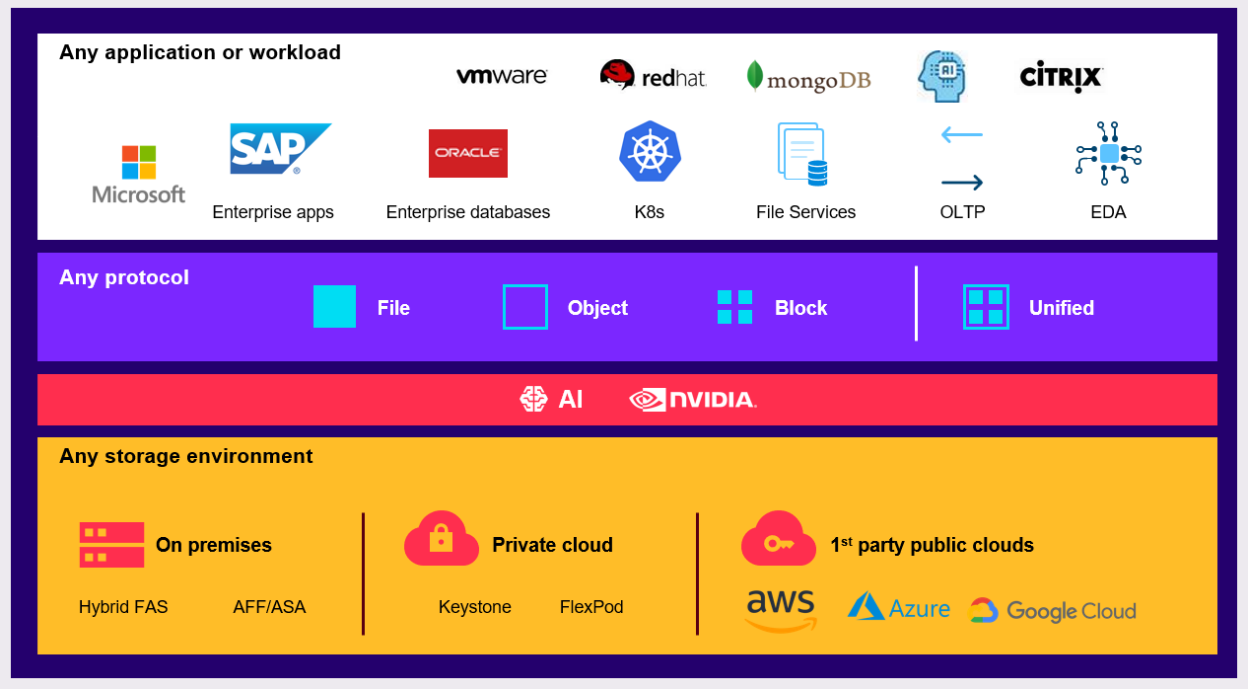

Figure 1: ONTAP: foundation for a seamless hybrid cloud – *Simplify across block, file, object, or unified. Across all-flash, hybrid-flash, and cloud deployments. Across your enterprise and modern applications.*

SIMPLIFY OPERATIONS, REDUCE COSTS, AND STREAMLINE DATA MANAGEMENT

Whether adding new workloads or managing an existing environment, simplifying your processes is important to maximizing your staff's productivity and responsiveness. You can do that with ONTAP, which has a standard set of features across deployment architectures that simplify complex tasks. You can even unify data management across a hybrid cloud that can span flash, disk, and cloud, running SAN, NAS, and object workloads. In addition, data can easily be moved within or between storage clusters or to the cloud—wherever it is most useful. ONTAP is the foundation for an intelligent data infrastructure, empowering your data to drive innovation.

> *"Because we use NetApp, our engineers are able to concentrate their efforts on the needs of our creative and production teams, instead of focusing all of their attention on data management."*
>
> — *Skottie Miller Technology Fellow and VP of Platform and Services Architecture, DreamWorks Animation*

Deploy Workloads in Less Than 10 Minutes

You can deploy key workloads such as Oracle, SQL Server, and SAP, as well as virtual desktops and servers, in under 10 minutes, from power-on to serving data. The System Manager wizard and factory configurations are loaded with exactly what you need, so you can quickly set up new configurations by answering just a few questions. For optimal deployment of new workloads, ONTAP even gives you the visibility to know which node has the most performance capacity available.

Gain Storage Efficiency

ONTAP provides a comprehensive portfolio of storage efficiency capabilities, including inline data compression, deduplication, and compaction to reduce storage costs and maximize the data you can store. These features, coupled with space-efficient NetApp Snapshot™ copies, thin provisioning, replication, and cloning technologies, significantly reduce required disk capacity (varies by workload) when compared with traditional storage technologies.

Save Time with our User Interface

ONTAP System Manager delivers a streamlined, unified experience across NetApp platforms such as AFF, ASA, FAS, ONTAP Select, and NetApp Private Storage. The System Manager dashboard is more intuitive and ideal for IT generalists. It's based on REST APIs and displays richer information so you can easily see the health status of your cluster and take quick actions to complete management tasks or mitigate risks. ONTAP System Manager saves you time by showing key system information about capacity, hardware health, networking, and performance history on up to one year of data. Only one screen is needed for provisioning LUNs or NAS volumes. System Manager makes it easy to use ONTAP features such as FabricPool, FlexCache®, synchronous replication, and many more. It enables one-click firmware upgrades and helps administrators reduce the number of decisions, balance resources, and get their job done more effectively and efficiently.

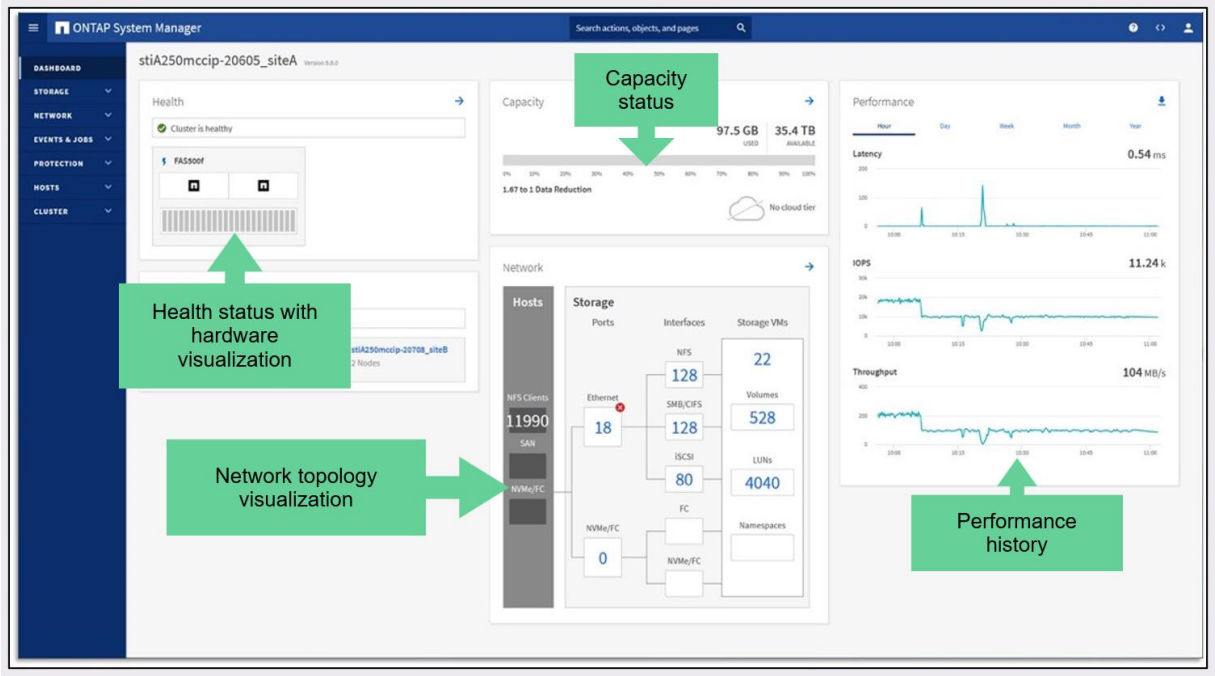

Figure 2: Intuitive ONTAP System Manager.

> *"Using the brand-new copy-free transition process to achieve both the hardware refresh and upgrade to ONTAP with minimal business disruption was the perfect option. It reduced risk, slashed migration time, and cut costs and was something we were able to fully justify."*
>
> *— Andrew Bentley, Infrastructure Lead, Repsol Sinopec Resources UK*

Optimize Performance and Costs with Automated Tiering to Cloud

Your applications will run faster, and you can further reduce storage costs by automatically tiering cold data from the performance tier to NetApp StorageGRID® object storage solution or a public cloud. You can consolidate more workloads by freeing up space on your performance tier, such as NetApp AFF, ASA, and FAS systems, or NetApp Cloud Volumes ONTAP instances in a public cloud. In addition, for new all-flash purchases, data tiering gives you the ability to buy a smaller initial AFF or ASA configuration.

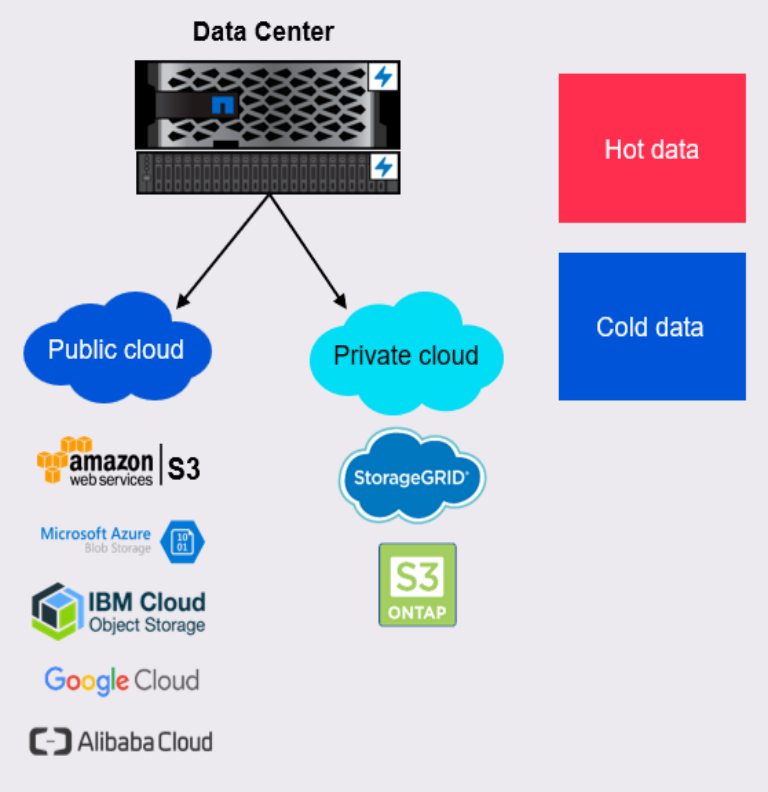

Figure 3: Automatic cloud tiering of cold data – *Temperature-sensitive storage efficiency technologies in ONTAP further reduce the footprint of cold data, giving you up to 33% greater storage efficiency.*

Maximize Investment Protection

With ONTAP, you can create an integrated, scalable storage environment by clustering your on-premises storage controllers from different families—AFF all-flash and FAS hybrid-flash systems—as well as from different generations. Grow with the latest hardware and continue to use your older hardware, and connect all of it to an ONTAP environment in the cloud. When it's time to retire the storage system, you can upgrade the controllers and keep data in place on the existing disk shelves.

Get Simple, Powerful Management Capabilities

ONTAP integrates with NetApp BlueXP™ to provide unified control of your storage and data services, supporting an intelligent data infrastructure across your hybrid multicloud. It enables you to discover, deploy, optimize, and manage your infrastructure and data anytime, anywhere, across both on-premises and hybrid multicloud environments. Powerful AIOps drive operational simplicity with automated workflows, predictive analytics, and intelligent, actionable insights that

improve system health, performance, and security. Integrated services maximize data protection and cyber resilience while minimizing costs.

Additionally, it includes flexible consumption and investment management, offering centralized control, protecting investments, and delivering real-time return on investment (ROI) details.

ADAPT TO CHANGING BUSINESS NEEDS

Critical applications require a storage environment that delivers high performance and availability. However, you also need versatility to scale and adapt as your business changes. ONTAP delivers on all these requirements with performance at scale and nondisruptive operations.

Optimized for Flash

ONTAP delivers high throughput and low latency required by enterprise applications while providing comprehensive data services. ONTAP is optimized for flash, including AFF and ASA systems with NVMe solid-state drives, NVMe over TCP, and NVMe over Fabrics. AFF running the most recent versions of ONTAP provides up to twice the performance compared to the same workloads running on prior ONTAP releases, while still receiving consistent submillisecond latency.

Consistent Performance

To maintain high customer satisfaction, adaptive quality of service (AQoS) helps you deliver consistent performance by automatically adjusting storage resource levels to respond to changes in workloads (number of terabytes of data, priority of the workload, and so on).

AQoS simplifies the implementation of policies to keep your workloads within prescribed minimum and maximum throughput targets.

Seamless Scalability

ONTAP is key to delivering maximum on-demand scalability for your shared IT infrastructure, offering performance, price, and capacity options. You can start small and grow with your business by using high-capacity solid-state drives, hard disk drives, or public clouds to scale your ONTAP storage environment.

On-premises systems that run ONTAP can handle SAN, NAS, and object workloads ranging from a few terabytes to 707 PB. You can scale up by adding capacity or scale out by adding additional storage controllers to expand your cluster up to 24 nodes seamlessly. You can also quickly deploy an ONTAP environment in public clouds using Cloud Volumes ONTAP.

In addition, ONTAP makes it easy to manage massive NAS containers. With NetApp ONTAP FlexGroup volumes, a single namespace can grow to 60 PB and 400 billion files while maintaining consistently high performance and resiliency.

> *“Ease of use is the most valuable feature for us….With ONTAP we have more shelves, more disks, and aggregates.”*
>
> *— Peggy Baladera, Storage Tec, General Dynamics Mission Systems Inc.*

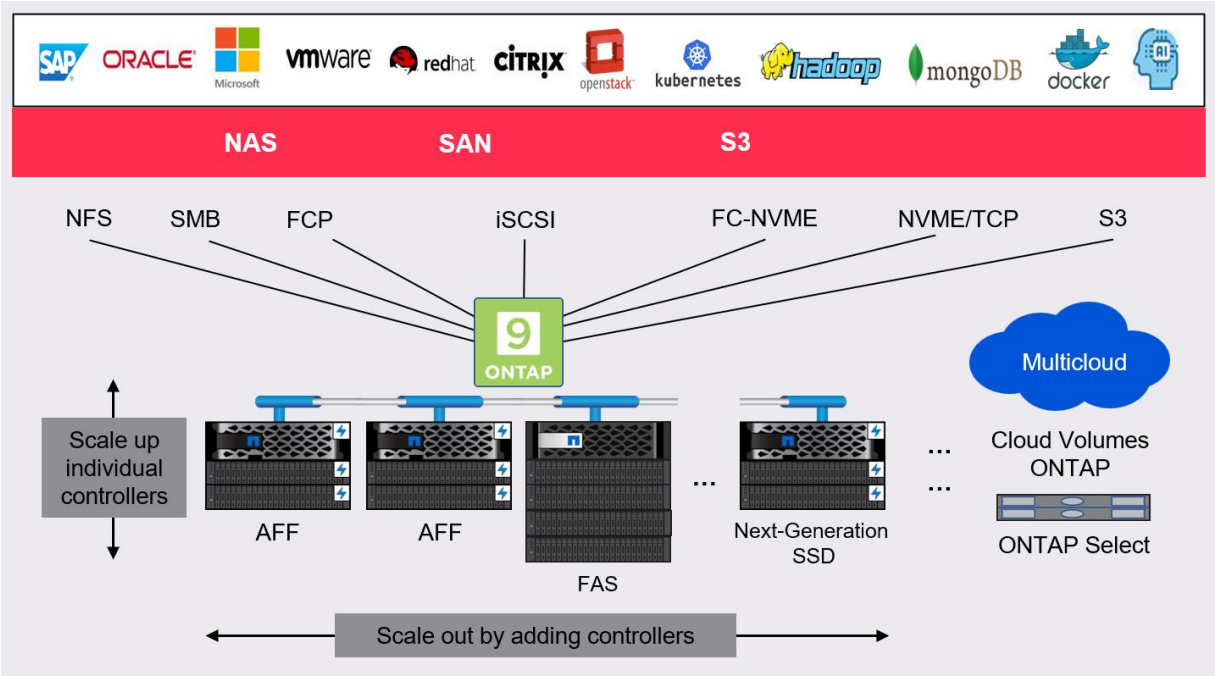

Figure 4: Scale up or scale out capacity and performance—no disruption, no silos.

Future-proof Your Data Infrastructure

With ONTAP 9, you can design and deploy your storage environment across a wide range of architectures:

- On NetApp hardware systems
  - AFF all-flash systems for the best latency for demanding performance
  - ASA all-flash systems for block-optimized workloads
  - FAS systems for a balance of performance and capacity
- Within a converged infrastructure
  - FlexPod® converged infrastructure solution from NetApp and Cisco
- As software-defined storage on commodity servers
  - ONTAP Select
- In the cloud
  - Cloud Volumes ONTAP, Amazon FSx for NetApp ONTAP, Azure NetApp Files, Google Cloud NetApp Volumes

You can move your data seamlessly between architectures to place it in the optimal environment for performance, capacity, and cost efficiency.

PROTECT AND SECURE YOUR DATA ACROSS THE HYBRID CLOUD

Security is an integral part of ONTAP, so you can protect data on your premises, in the public cloud, and in transit, while adhering to industry best practices. In a world full of threats—whether human-made (such as ransomware) or natural disasters—ONTAP provides the security and availability you need to eliminate risk from operations and enhance business continuity.

ONTAP data management software contains over thirty security features. It helps you enhance data confidentiality, integrity, and availability while strengthening your company's security. In

addition, you can protect your data from ransomware attacks and avoid paying ransoms, meet compliance requirements with ease, and create a Zero Trust perimeter around your organization's data—no matter where it lives.

NetApp offers a Ransomware Recovery Guarantee that guarantees data recovery in the event of a ransomware attack. If we can't help you restore your Snapshot data, we will compensate you.

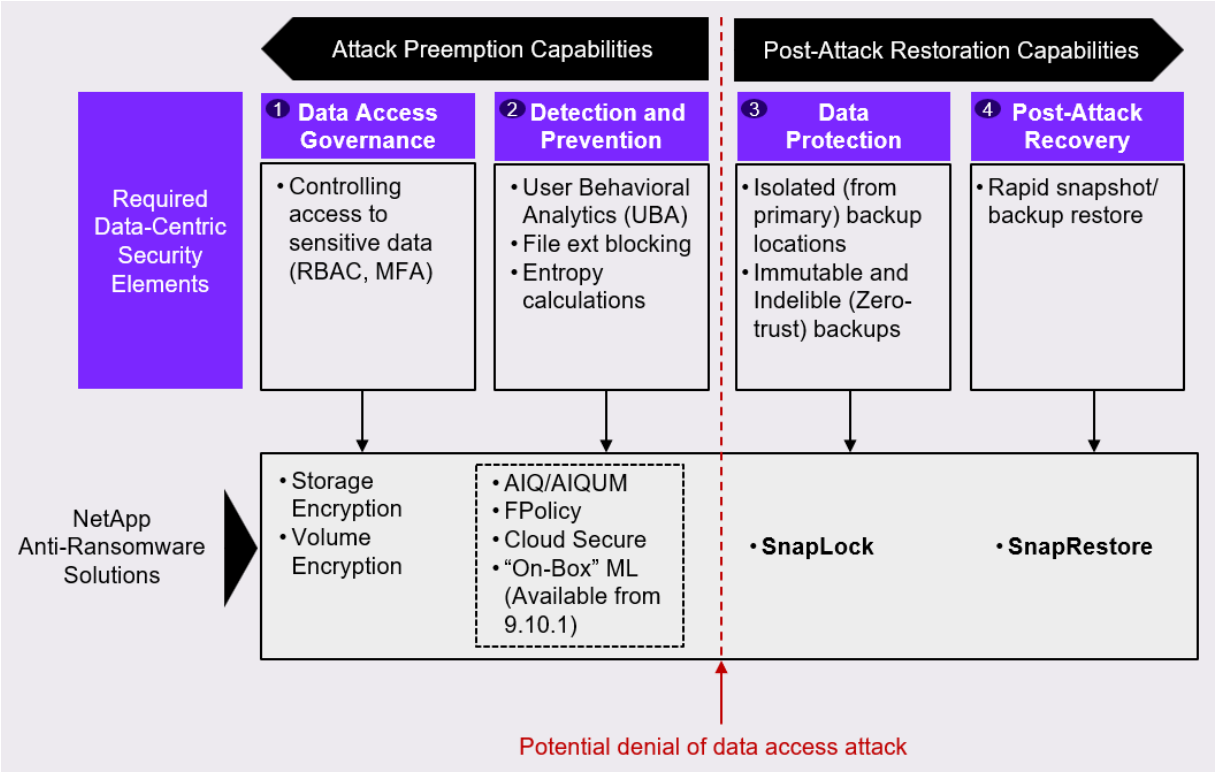

Figure 5: NetApp delivers the market-leading anti-ransomware solution *– Unique Zero-Trust data access for detection and prevention with FPolicy and cloud/"On-box" AI/ML.*

> *"ONTAP has really reduced our costs because we learned that we could use our storage with fewer machines and drive down data center costs."*
>
> *— Oliver Fuckner, Systems Administrator, Strato AG*

Integrated Data Protection and Nondisruptive Operations

ONTAP provides NetApp integrated data protection (IDP) to safeguard your operations and keep them running smoothly with:

- **NetApp Snapshot copies**. Meet your requirements for local backup with nearly instantaneous recovery.
- **NetApp SnapMirror® asynchronous replication**. Achieve remote backup/recovery and disaster recovery.
- **SnapMirror Cloud**. When replicating data to a cloud object store in a public or private cloud.
- **SnapMirror synchronous replication**. For zero data loss protection (RPO=0).

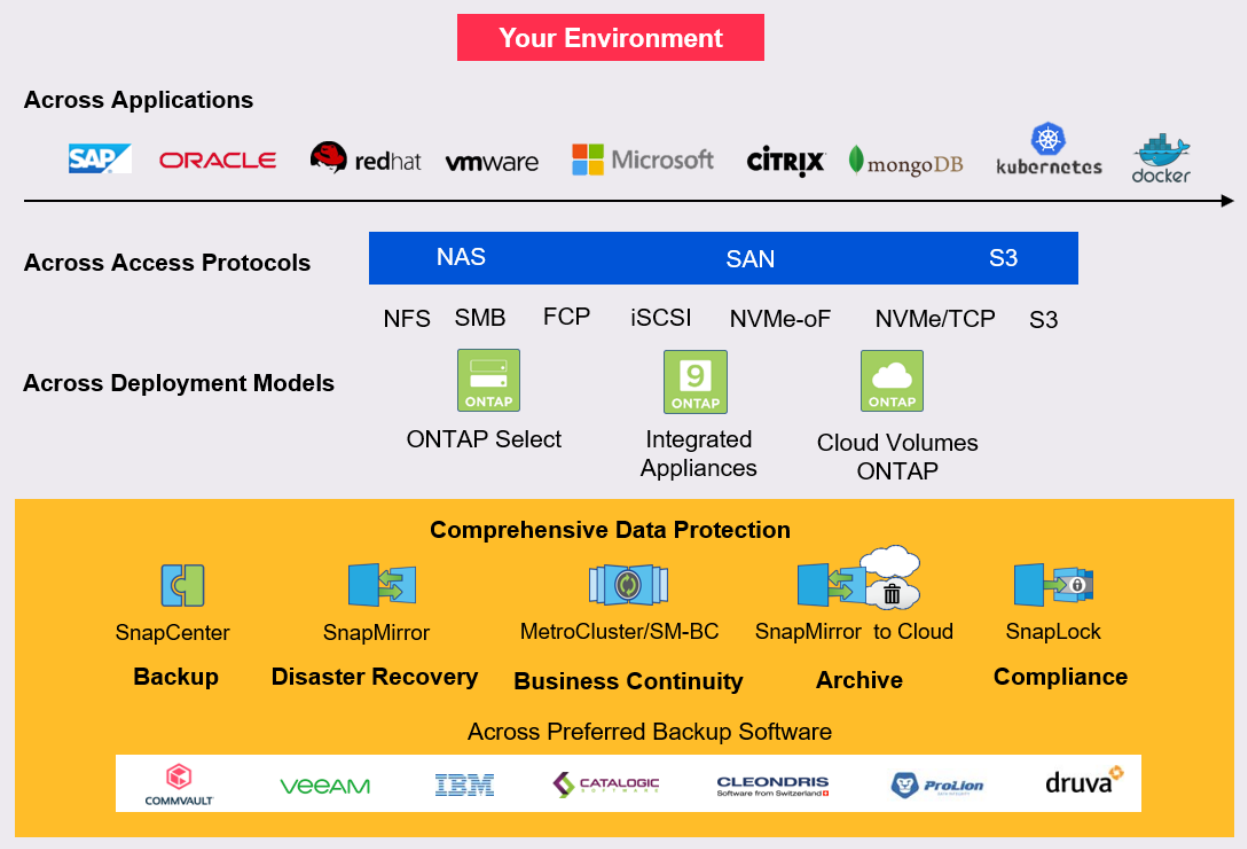

Figure 6: "Enterprise-grade" data protection integration into your ecosystem.

For critical applications that require continuous data availability, NetApp MetroCluster™ and SnapMirror active sync technologies synchronously mirror between locations to provide business continuity against human-made or natural disasters.. The storage arrays can be deployed at a single site, across a metropolitan area, or in different cities. MetroCluster is a full-system infrastructure for SAN and NAS workloads. SnapMirror active sync gives you the flexibility to consolidate multiple workloads and then granularly choose the most critical SAN applications to support with continuous availability if a data center disaster occurs.

Scale and maintain nondisruptively

With ONTAP, you can service and update your infrastructure during regular work hours without disrupting your business. You can also dynamically assign, promote, and retire storage resources without downtime over the lifecycle of an application. Data can be moved between controllers without application interruption, so you can place data on the node that delivers the optimal combination of speed, latency, capacity, and cost.

Security and Ransomware Protection

Security capabilities in ONTAP help you integrate data security and ransomware protection across your hybrid cloud and avoid unauthorized data access and ransomware attacks. Autonomous ransomware protection quickly identifies malware threats, and multi-admin verification prevents malicious and accidental changes to your data by requiring multiple approvals for critical admin tasks.

You can easily and efficiently protect at-rest data by encrypting any volume on an AFF, ASA, or FAS system with NetApp Volume Encryption—a built-in feature in ONTAP. It does not require special encrypting disks. In-flight encryption for backup and replication protects data in transit. Other features, such as multifactor authentication, role-based access control, and onboard and external key management, increase the security of your data.

> *NetApp ONTAP data management software is the industry's first Commercial Solutions for Classified (CSfC) validated enterprise-class storage solution. This solution enables you to protect data at rest at the hardware layer (with NSE) and the software layer (with NVE) for enhanced rugged security.*[1]

Secure Consolidation

Save time and money with the ability to share the same consolidated infrastructure for workloads or tenants with different performance, capacity, and security requirements. With ONTAP, you don't have to worry that the activity in one tenant partition will affect another because, with multitenancy, a storage cluster can be subdivided into secure partitions that are governed by rights and permissions.

> *"The secure multitenancy built into ONTAP is key to our cloud business model."*
>
> *— Frank Bounds, Senior Storage Engineer, TCDI*

Rigorous Compliance

To meet stringent compliance and data retention policies, NetApp SnapLock® software enables write once, ready many (WORM) protected data for your ONTAP environment. In addition, NetApp provides superior integration with enterprise backup vendors and leading applications.

With cryptographic shredding by the NetApp secure purge technology, you can remediate data spillage online while the system is still in use. It also provides "right-to-erasure" capability for General Data Protection Regulation (GDPR).

MULTIPROTOCOL UNIFIED ARCHITECTURE

ONTAP multiprotocol unified architecture provides the capability to support several data access protocols concurrently in the same overall storage system across a range of controller and disk storage types. ONTAP protocol support includes:

- SMB 1.0, 2.0, 2.1, 3.0, 3.1.1 (CIFS)
- NFSv3, v4, v4.1, v4.2 (with ONTAP 9.8), including pNFS
- iSCSI
- FCP (Fibre Channel Protocol)
- FC
- FCoE (Fibre Channel over Ethernet)
- NVMe over FC (NVMe/FC), starting with ONTAP 9.4
- NVMe/TCP, starting with ONTAP 9.10.1
- ONTAP S3, starting with ONTAP 9.8

Data replication and storage efficiency features in ONTAP are seamlessly supported across all protocols.

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[1] https://www.netapp.com/blog/netapp-ontap-CSfC-validation/.

SAN Data Services

With the supported SAN protocols (FC, FCoE, iSCSI, and NVMe/FC), ONTAP provides LUN services. This is the capability to create LUNs and make them available to attached hosts. Because the cluster consists of numerous controllers, there are several logical paths to any individual LUN. Support for multipath I/O is also available from leading OS and third-party driver vendors.

NAS Data Services

ONTAP can provide a single namespace with the supported NAS protocols, such as SMB [CIFS] and NFS (NAS clients can access a large data container using a single NFS mount point or CIFS share). Each client, therefore, needs only to mount a single NFS file system mount point or access a single CIFS share, requiring only the standard NFS and CIFS client code for each operating system.

The namespace of ONTAP is composed of potentially thousands of volumes joined by the cluster administrator. To the NAS clients, each volume appears as a folder or subdirectory, nested off the root of the NFS file system mount point or CIFS share. Volumes can be added at any time and are immediately available to the clients, with no remount required for visibility to the new storage. The clients are unaware they are crossing volume boundaries as they move about in the file system because the underlying structure is completely transparent.

ONTAP can be architected to provide a single namespace, yet it also supports the concept of several securely partitioned namespaces called Storage Virtual Machines or SVMs. This accommodates the requirement for multitenancy or isolation of specific sets of clients or applications.

> *As the leader in NAS solutions, NetApp is the only vendor that provides integrated caching across a hybrid cloud environment. Even more efficient collaboration is possible between teams, no matter where they are physically located.*

Objects in ONTAP

With the rapid growth of object data, particularly with the Internet of Things (IoT) devices, autonomous vehicles, and 5G technology, an increasing number of customers need ONTAP to support the S3 API. You can use familiar manageability tools such as ONTAP System Manager to rapidly provision high-performance object storage for development and operations in ONTAP, taking advantage of ONTAP's storage efficiencies and security.

The ONTAP S3 protocol is based on a subset of the AWS S3 API and allows data to be represented as objects in ONTAP-based systems, including AFF, ASA, FAS, and ONTAP Select.

ONTAP 9: A ROBUST SET OF STANDARD AND OPTIONAL FEATURES

The following table shows the functions and benefits of ONTAP standard and optional features.

Table 1: ONTAP 9 software and features table.

ONTAP 9 SOFTWARE AND FEATURES		
	FUNCTION	BENEFITS
Data compaction	Packs more data into each storage block for greater data reduction.	Works with compression to reduce the amount of storage you need to purchase and operate.
Data compression	Provides transparent inline and post-process data compression for data reduction.	Reduces the amount of storage that you need to purchase and maintain.
Deduplication	Performs general-purpose deduplication for the removal of redundant data.	Reduces the amount of storage that you need to purchase and maintain.
FabricPool	Automates data tiering to a NetApp StorageGRID object storage solution or a public cloud.	Decreases storage costs for cold data and frees up space on your high-performance tier.
FlexCache®	Caches actively read datasets within a cluster and at remote sites.	Accelerates read performance for hot datasets by increasing data throughput within a cluster and improves the speed and productivity of collaboration across multiple locations.
FlexClone®	Instantaneously creates file, LUN, and volume clones without requiring additional storage.	Saves you time in testing and development and increases your storage capacity.
FlexGroup	Enables a single namespace to scale up to 60 PB and 400 billion files.	Supports compute-intensive workloads and data repositories that require a massive NAS container while maintaining consistent high performance and resiliency.
FlexVol®	Creates flexibly sized volumes across a large pool of disks and one or more RAID groups.	Enables storage systems to be used at maximum efficiency and reduces hardware investment.
MetroCluster™	Robust infrastructure that combines array-based clustering with synchronous mirroring to deliver continuous availability and zero data loss for SAN and NAS workloads, up to 700km distance between nodes.	Maintains business continuity for critical enterprise applications and workloads if a data center disaster occurs.
Multi-Admin Verification	Require multiple approvals for critical admin tasks, such as	Prevent malicious and accidental changes to your data. A single cluster administrator or a

ONTAP 9 SOFTWARE AND FEATURES		
	“volume snapshot delete” or “volume delete.”	ransomware attacker with a compromised administrator account cannot execute critical commands without approvals from one or more additional administrators.
Dynamic authorization framework	Uses additional environmental factors such as IP address, location, or time to authorize actions of highly sensitive or powerful accounts, such as administrator.	Creates an additional layer of protection to prevent malicious actors using compromised credentials from performing highly controlled or destructive actions.
Performance capacity	Provides visibility of performance capacity that is available for deploying new workloads on storage nodes.	Simplifies management and enables more effective provisioning of new workloads to the optimal node.
QoS (adaptive)	Simplifies setup of QoS policies and automatically allocates storage resources to respond to workload changes (number of terabytes of data, priority of the workload, and so on).	Simplifies operations and maintains consistent workload performance within your prescribed minimum and maximum IOPS boundaries.
Ransomware Protection	Provides built-in, robust features that detect ransomware activity, prevent its spread, and enable quick recovery—including automatically taking snapshots and alerting administrators when ONTAP detects abnormal file activity.	Protects automatically against ransomware attacks and enables quick recovery to avoid paying the ransom.
SnapCenter®	Provides host-based data management of NetApp storage for databases and business applications.	Offers application-aware backup and clone management; automates error-free data restores.
SnapLock®	Provides WORM file-level locking, preventing changes and deletion of the file.	Supports regulatory compliance and organizational data retention requirements. Plus, it enables air-gap separation of Snapshot copies for enhanced ransomware protection and quick recovery from an attack.
SnapMirror®	Provides integrated remote backup/recovery and disaster recovery with incremental asynchronous data replication; preserves storage efficiency	Provides flexibility and efficiency when replicating data to support remote backup/recovery, disaster recovery, and data distribution.

ONTAP 9 SOFTWARE AND FEATURES		
	savings during and after data transfer.	
SnapMirror active sync	Combines flexible array-based clustering with application granularity for synchronous mirroring to deliver symmetric active-active multisite replication for business continuity of mission-critical SAN workloads.	Cost-effectively protects the most critical SAN applications with continuous availability to maintain business continuity if a data center disaster occurs.
SnapMirror Cloud	Provides integrated remote backup/recovery and disaster recovery with incremental asynchronous data replication leveraging S3 cloud resources.	Provides flexibility and efficiency when replicating data to a cloud object store in a public or private cloud to support remote backup/recovery, disaster recovery, and data distribution.
SnapMirror Synchronous	Delivers incremental, volume-granular, synchronous data replication; preserves storage efficiency savings during and after data transfer.	Achieve zero data loss protection (RPO=0).
SnapRestore®	Rapidly restores single files, directories, or entire LUNs and volumes from any Snapshot copy.	Instantaneously recovers files, databases, and complete volumes from your point-in-time Snapshot copy.
Snapshot™	Makes incremental data-in-place, point-in-time copies of a LUN or a volume with minimal performance impact.	Enables you to create frequent space-efficient backups with no disruption to data traffic.
NetApp Volume Encryption	Provides data-at-rest encryption that is built into ONTAP.	Easily and efficiently protect your at-rest data by encrypting any volume on an AFF or FAS system; no special encrypting disks are required.

Table 2: ONTAP standard and optional features table.

ONTAP SOFTWARE LICENSING	
SOFTWARE REQUIRED	**FEATURES**
ONTAP One (only for NetApp AFF A-Series, AFF C-Series, and FAS systems)	A comprehensive, unified software suite that includes all protocols (SAN/NAS/Object), as well as ONTAP technologies such as SnapRestore, SnapMirror, SnapCenter, FabricPool (to ONTAP-S3 and StorageGRID), FlexClone, FlexCache, FPolicy, Encryption[2], autonomous ransomware protection, SnapLock, and multi-tenant key management.

[2] Encryption availability is subject to Global Trade Compliance.

ONTAP SOFTWARE LICENSING	
ONTAP One for SAN (only for NetApp ASA systems)	A comprehensive software suite that includes SAN protocols as well as ONTAP technologies applicable for SAN workloads such as SnapRestore, SnapMirror, SnapCenter, FabricPool (to ONTAP-S3 and StorageGRID), FlexClone, FlexCache, FPolicy, Encryption[2], SnapLock, and multi-tenant key management.

1 ONTAP SECURITY FEATURES

As NetApp® ONTAP® data management software continues to evolve, security remains an integral part of the solution. You can simplify and strengthen your security posture by integrating data security throughout your hybrid cloud. You can also meet governance, risk, and compliance requirements such as HIPAA, PCI-DSS, and GDR and cost-effectively secure your NetApp ONTAP environment by incorporating industry-standard, built-in security that meets FIPS 140-2 compliance.

ONTAP software is central to protecting your data and meeting compliance requirements. The latest releases of ONTAP contain security features and functions that are invaluable for protecting your security posture and helping your organization protect its data across your hybrid cloud, prevent ransomware attacks, and adhere to industry best practices.

These features make data confidentiality, integrity, and availability top priorities. The security features and functions in the ONTAP solution give you the ability to:

- **Enhance data confidentiality, integrity, and availability.** With ONTAP hybrid cloud security technologies, you can protect your organization's most important resource: data.
- **Strengthen your organization's security posture.** Establish a secure foundation across your organization's hybrid cloud by leveraging the visibility and security functions that create a secure infrastructure.
- **Apply NetApp and industry best practices for security and ransomware protection.** Establish a vetted security footprint with help from NetApp expertise and industry knowledge.
- **Satisfy governance and compliance requirements.** Apply established security best practices to adhere to and support industry regulation and security compliance.

These features also support your organization's move toward a Zero Trust model. To learn more about hardening the ONTAP solution, see TR-4569: Security Hardening Guide for NetApp ONTAP.

The following table outlines the function and impact of ONTAP security features.

Table 1: ONTAP security features.

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SOFTWARE OR FEATURE	**FUNCTION**	**IMPACT**
Autonomous ransomware protection	Autonomous ransomware protection is an on box capability with machine learning preemptive detection against attacks.	ONTAP automatically takes a Snapshot copy and alerts the administrator if an anomaly is detected.
NetApp Snapshot™ copies	An ONTAP Snapshot is an efficient, point-in-time, read-only copy of your data. A Snapshot represents exactly what your data looked like at the moment	Because Snapshot copies are read-only, they can't be infected by ransomware. To recover from a ransomware attack, you can

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	that the Snapshot was taken, whether it was hours, days, weeks, months, or even years ago.	restore from a Snapshot taken before the attack occurred.
NetApp SnapLock® technology	NetApp SnapLock protects Snapshot copies using NetApp SnapVault® by enabling a truly indelible logical air-gapped backup.	SnapLock eliminates the risk of Snapshot copies being deleted by an administrator through human error, a disgruntled employee, or a bad actor leveraging stolen credentials.
Snapshot copy locking	Snapshot copy locking uses SnapLock technology to either manually or automatically make Snapshots indelible for a specified time period.	Snapshots can be deleted by an administrator through human error, a disgruntled employee, or a bad actor leveraging stolen credentials.
NetApp FPolicy technology	FPolicy is an infrastructure component of ONTAP that enables partner applications to monitor and set file access permissions. File policies can be set based on file type. FPolicy determines how the storage system handles requests from individual client systems for operations such as create, open, rename, and delete. Note: In ONTAP, the FPolicy file access notification framework is enhanced with filtering controls and resiliency against short network outages.	Access control is a key security construct. As such, visibility and the ability to respond to file access and file operations is critical for maintaining your security posture. To provide visibility and access control to files, the ONTAP solution uses the FPolicy feature. External FPolicy servers, including NetApp Data Infrastructure Insights/Storage Workload Security, a feature of NetApp Data Infrastructure Insights, use user behavioral analytics to identify malware and ransomware to mitigate the effects of broader compromise to data.
NetApp Volume Encryption (NVE)	NVE is a software-based encryption mechanism that enables you to encrypt data on any disk with a unique key per volume.	Data encryption at rest continues to be an industry focus. NVE satisfies this focus while maintaining a strong security posture across the full breadth of your hybrid cloud.
NVE secure purge	This feature enables a command to cryptographically shred deleted files on NVE volumes by moving good files and deleting the key used to encrypt infected files.	You can remediate data spillage online while the system is still in use. This feature provides state-of-the-art “right-to-erasure” capability for General Data Protection Regulation (GDPR).
NetApp Aggregate Encryption (NAE)	NAE is a software-based encryption mechanism that	Like NVE, NAE enables data encryption at rest. Aggregate

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	enables you to encrypt data on any disk with unique keys per aggregate shared across encrypted volumes.	deduplication is enabled with NAE because volumes share keys across the aggregate, thus providing greater storage efficiency.
Data at Rest (DAR) Encryption by Default	DAR encryption, by default, is enabled if either an external key manager or the onboard key manager is defined. Either NVE or NAE software-based encryption will be used. If NSE drives are part of the cluster configuration, DAR encryption is in place, and software-based encryption will not be used by default.	DAR encryption, by default, simplifies the maintenance of a strong security posture across the full breadth of your hybrid cloud.
NetApp Storage Encryption (NSE)	NSE is the NetApp implementation of full-disk encryption (FDE) using FIPS-140-2 level 2 self-encrypting drives. NSE provides a nondisruptive encryption implementation that supports the entire suite of NetApp storage efficiency technologies.	Data encryption at rest continues to be an industry focus. NSE provides FDE, which satisfies this focus. The NetApp data fabric maintains a strong security posture from end to end.
SMB encryption that uses Intel Advanced Encryption Standard New Instructions (AES-NI) acceleration	Intel AES NI improves on the AES algorithm and accelerates data encryption with supported processor families.	Accelerating security functions increases efficiency. Efficient use of resources is vital to providing successful security solutions.
NetApp Cryptographic Security Module	This module provides FIPS 140-2 validated cryptographic operations for select Secure Sockets Layer (SSL)-based management services. Starting with ONTAP 9.11.1 and TLS 1.3 support, FIPS 140-2 can be validated.	Dedicated security modules improve resource efficiency. In addition, FIPS 140-2 is the recognized industry standard for cryptography products and solutions.
NetApp CryptoMod	This module provides FIPS 140-2 validated cryptographic operations for NVE, NAE, and the onboard key manager (OKM).	FIPS 140-2 is the recognized industry standard for cryptography products and solutions.
SHA-2 (SHA-512) support	ONTAP supports the SHA-2 password hash function to enhance password security and defaults to using SHA-512 for hashing newly created or changed passwords.	SHA-2 has become the industry standard for hash functions because of its improved security posture relative to the often-infiltrated SHA-1 standard.

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Secure log forwarding (syslog over Transport Layer Security [TLS])	The log-forwarding function enables administrators to provision targets or destinations to receive syslog and audit information. Because of the secure nature of syslog and audit information, ONTAP can send this information securely through TLS using the TCP-encrypted parameter.	Log and audit information is invaluable to an organization for support and availability. In addition, the information contained in logs (syslogs), audit reports, and outputs are typically sensitive. To maintain security controls and posture, you must manage log and audit data in a secure manner.
TLS 1.1 and TLS 1.2	ONTAP uses TLS 1.1 and TLS 1.2 for secure communication and administration functions.	NetApp does not recommend using TLS 1.0 because its significant vulnerabilities make it incompatible with compliance standards such as PCI-DSS. NetApp recommends using TLS 1.1 and TLS 1.2 because of their strength and integrity.
Online Certificate Status Protocol (OCSP)	When OCSP is enabled, ONTAP applications that use TLS communications, such as LDAP or TLS, can receive the digital certificate status. The application receives a signed response that signifies whether the certificate requested is good, revoked, or unknown.	OCSP helps determine the current status of a digital certificate without requiring certificate revocation lists (CRLs).
Onboard Key Manager (OKM)	OKM in ONTAP provides a self-contained encryption solution for data at rest. OKM works with NVE, which offers a software-based encryption mechanism that gives you the ability to encrypt data and use any disk. OKM also works with NSE, which performs FDE by using self-encrypting drives.	OKM provides key management for NSE and NVE. Using this encryption technology in ONTAP, you can secure data at rest, which is critical for any security solution.
OKM Secure Boot	This option can require a passphrase for unlocking drives and decrypting volumes after a node is rebooted.	When NSE and NVE use the OKM, secure reboot protects against the entire storage array being stolen, not just the drives. It also allows secure physical transport of entire clusters and secure equipment return.
External key management	External key management is handled using a third-party system in the storage environment that securely	External key management centralizes an organization’s key management functions and stores keys away from system

SECURITY FEATURES IN ONTAP 9		
	manages the authentication keys and encryption keys used by encryption features in the storage system, such as NSE, NVE, or NAE. The storage system uses an SSL connection to contact the external key-management server to store and retrieve authentication keys or volume data encryption keys through the Key Management Interoperability Protocol (KMIP).	assets, reducing the possibility of compromise.
Secure multitenancy	Secure multitenancy is using secure virtual partitions within a shared physical storage environment for sharing the physical environment among multiple distinct tenants. In ONTAP, these partitions are called storage virtual machines (SVMs).	Secure multitenancy enables ONTAP as a shared platform, with SVMs securely isolating all tenants within the platform.
Multitenant external key management	Multitenant external key management provides the ability for individual tenants or storage virtual machines (SVMs) to maintain their keys through KMIP for NVE.	With multitenant external key management, you can centralize your organization's key management functions by department or tenant while confirming that keys are not stored near the assets. This approach decreases the possibility of compromise.
Clustered external key managers	External KMIP server redundancy is supported by clustering capabilities provided by NetApp KMIP key server partners. Prior to ONTAP 9.11.1, up to four external KMIP servers could be defined where ONTAP wrote keys to each server to provide redundancy.	ONTAP customers are widely adopting clustered external key managers. ONTAP support allows these customers to use this capability flawlessly.
Enhanced file system auditing	ONTAP increases the number of auditing events and details reported across the solution. The following key details are logged with the creation of events: • File • Folder • Share access • Files created, modified, or deleted	NAS file systems have increased their footprint in today's threat landscape. Therefore, the visibility provided by audit functions remains critically important, and the increased audit capability in ONTAP provides more CIFS audit details.

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	• Successful file read access • Failed attempts to read fields or write files • Folder permission changes	
CIFS SMB signing and sealing	SMB signing helps protect the security of your data fabric by protecting the traffic between storage systems and clients from replay or man-in-the-middle attacks. It also confirms that SMB messages have valid signatures. In addition, ONTAP supports SMB encryption, also known as sealing.	A common threat vector for file systems and architectures lies within the SMB protocol. Signing and sealing allow unadulterated validation of traffic, in addition to secure data transport on a share-by-share basis.
Kerberos 5 and krb5p support	ONTAP supports 128-bit and 256-bit AES encryption for Kerberos. The privacy service includes the verification of received data integrity, user authentication, and data encryption before transmission.	Krb5p authentication protects against data tampering and snooping by using checksums to encrypt all traffic between client and server.
Lightweight Directory Access Protocol (LDAP) SMB signing and sealing	ONTAP supports signing and sealing to protect session security on queries to an LDAP server.	Signing confirms the integrity of the LDAP payload data using secret key technology. Sealing encrypts the LDAP payload data to avoid transmitting sensitive information in clear text.
Ed25519 and NIST curves in Secure Shell (SSH) (updated algorithms and hash-based method authentication codes [HMACs])	ONTAP provides updated SSH ciphers and key exchanges, including AES, 3DES, SHA-256, and SHA-512.	As the threat landscape evolves, the strength of the protocol algorithm, cipher, and key exchanges is vital to the integrity of the protocol and product function.
Ability to configure the maximum number of unsuccessful SSH login attempts	ONTAP adds parameter-max-authentication-retry-count with the security ssh modify command to set the maximum number of login attempts. The default maximum allowed per SSH connection is six, but NetApp recommends three as a security best practice.	This feature helps protect against brute-force attacks.
Multifactor Authentication (MFA)	MFA is enabled for NetApp ONTAP System Manager and NetApp Active IQ® Unified Manager for administrative web access through Security Assertion Markup Language	Weak administrative access credentials account for most system compromises. MFA makes it impossible to gain administrative access with simple password-based accounts.

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	(SAML) and external identity providers. Administrative command-line access to ONTAP is enabled through local two-factor authentication methods that employ a user ID/password and a public key as the two factors. You can use nsswitch with a public key as one of the two factors for SSH command-line administrative access. FIDO2 can also be used for SSH authentication using a YubiKey hardware authentication device or other FIDO2-compatible devices.	
NetApp SnapLock technology with NSE and NVE	ONTAP supports NSE and NVE with the SnapLock feature, which provides administration and storage for write once, read many (WORM) data.	SnapLock technology creates special-purpose volumes in which files can be stored and committed to a nonerasable, nonrewritable state. This state can be preserved indefinitely or for a designated retention period while maintaining the NSE and NVE solution's secure posture (encryption).
Upgrade image validation	Upgrades for ONTAP verify that an image is genuine ONTAP at upgrade time.	This validation detects corrupt or counterfeit images used as part of the upgrade process.
Unified Extensible Firmware Interface (UEFI) Secure Boot	Image validation is done each time the system boots.	Signed ONTAP images are verified by the boot loader, thus preventing counterfeit images at every boot.
Cluster peer encryption	Cluster peer encryption uses TLS 1.2 to encrypt all data in transport over the wire between cluster peers and the underlying ONTAP features that use cluster peering for replication of data (NetApp SnapMirror®, SnapVault, FlexCache®).	Data-in-flight encryption is available for ONTAP features that replicate data. In addition, customers who use data at rest encryption (NVE/NSE) can use end-to-end encryption between ONTAP clusters that use cluster peer encryption.
IPsec encryption	IPsec offers data encryption in flight for all IP traffic, including the NFS, iSCSI, and SMB/CIFS protocols.	IPsec ensures data in transit is continuously secure and encrypted. Network traffic between the client and ONTAP is protected with preventive measures to combat replay and

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		man-in-the-middle (MITM) attacks.
Role-based access control (RBAC)	RBAC in ONTAP gives administrators the ability to limit or restrict users' administrative access to the level granted for their defined role. It allows administrators to manage users by their assigned role.	Access control is a foundational element for creating a security posture. Functions such as RBAC give you the ability to determine who has data access and to what extent they have such access. This capability limits vulnerabilities and exploitation opportunities, including data exfiltration and escalation of privileges.
Multi-admin verification (MAV)	MAV prevents a single cluster administrator from executing sensitive commands such as “volume snapshot delete” or “volume delete” without approvals from one or more administrators.	MAV stops malicious or compromised administrators from destroying valuable data. This is essential for fortifying the ONTAP data centric Zero Trust environment.
Antivirus connector (virus scanning)	Virus scanning is performed on Vscan servers that run the antivirus connector and antivirus software. Typically, the system running ONTAP is configured to scan files when they are modified or accessed by a client.	Threat and attack vectors continue to grow. Inline virus scanning of accessed or modified files protects the integrity of an organization’s files.
Login and message of the day (MOTD) banners	Login banners are printed in the output prior to authentication. These banners give your organizations and administrators the ability to communicate with system users.	Login banners enable organizations to present operators, administrators, and miscreants with terms and conditions of acceptable use for a system. The banners also indicate who has permission to access the system.
Disk sanitization	With disk sanitization, you can remove data from a disk or set of disks so that the data can never be recovered.	Security protocols often require you to make data unrecoverable from a disk. The disk sanitization function provides this capability.

DATASHEET

ONTAP UNIFIED DATA STORAGE MANAGEMENT

Powering the data that drives your business.

The challenge

Data-driven businesses outperform their competitors by 20% (McKinsey, "The Data Dividend: Fueling Generative AI" (2023)). To achieve the data-driven ideal, data needs to be easily accessible by users and applications, achieve a balance of performance and efficiency, and be protected from both natural and human-made disasters. And businesses typically must do all of this while fitting into constrained IT budgets.

Many businesses struggle to achieve all three of these goals. Data spread across disconnected infrastructure or clouds creates silos and complexity. Mismatch of performance and application needs creates inefficiencies. And the layer of complexity to secure data creates barriers to use.

The solution

To address these challenges, you need a storage infrastructure that unifies data and eliminates silos; supports any data, anywhere, at the right price for performance; and eliminates the risk of data loss, destruction, or theft with integrated and intelligent AI-based protection. NetApp® ONTAP®, the industry's leading storage management software, breaks down silos and unifies storage and data, providing a single platform for all of your data across all your locations throughout the lifecycle of the data.

ONTAP makes storage simple

Eliminate the complexity of silos to reduce administration costs
ONTAP gives you a common set of features across your on-premises and cloud storage, which simplifies operations so that your IT team can focus on strategic business priorities. Unify storage management across a hybrid multicloud that can span flash, disk, and cloud running SAN, NAS, and object workloads. Easily move your data within or between storage clusters, or to the cloud—wherever it's most useful. ONTAP is the foundation for the intelligent data infrastructure that will power your data to drive your innovation.

Get proven storage efficiency
With ONTAP, you get a comprehensive portfolio of storage efficiency capabilities. Inline data compression, deduplication, and compaction work together to reduce your storage costs and maximize the data you can store. Plus, you can multiply your savings with space-efficient NetApp Snapshot™ copies, thin provisioning, replication, and cloning technologies.

Tier automatically to cloud
ONTAP lets you deliver high performance to your applications and reduce storage costs by automatically tiering cold data from the performance tier to NetApp StorageGRID® object storage or a public cloud. Free up space on your performance tier, such as NetApp ASA, AFF, and FAS systems, or Cloud Volumes ONTAP instances in a public cloud so you can consolidate more workloads. For new all-flash system purchases, data tiering means that you can buy a smaller initial AFF or ASA configuration.

Maximize investment protection
ONTAP gives you the flexibility to create an integrated, scalable storage environment by clustering your on-premises storage controllers from different families—AFF all-flash and FAS hybrid-flash systems—and from different generations. You can grow your system with the latest hardware, continue to use your older hardware, and connect all of it to an ONTAP environment in the cloud. When it's time to retire a storage system, you can simply upgrade the controllers and keep your data in place on the existing disk shelves.

Get simple, powerful management capabilities
ONTAP integrates with NetApp BlueXP™ to provide unified control of your storage and data services to support an intelligent data infrastructure, across your hybrid multicloud. It enables you to discover, deploy, optimize, and manage your infrastructure and data, anytime, anywhere, across your on-premises and hybrid multicloud environments. Powerful AIOps drive operational simplicity with automated workflows, predictive analytics, and intelligent, actionable insights that improve system health, performance, and security. Its integrated services maximize data protection and cyber resilience, while minimizing costs.

KEY BENEFITS

Simple. Eliminate complex silos for greater data access and reduced costs.

- Provide a common set of industry-leading data services
- Support any data; block, file, and object from one platform
- Manage everything from a single user-friendly GUI or automate with CLI and APIs

Powerful. Serve any data, anywhere, with the right performance and price.

- Support for a wide range of platforms, including all-flash and hybrid
- Integrated into all major clouds as a first-party service
- The best of software-defined and appliance storage to support core, cloud, and edge workloads

Protected. Mitigate risk with secure and available storage.

- Replication, Snapshot technology, and multisite high availability
- Integrated AI to automatically detect anomalies and threats to your data
- Zero Trust architecture with complete access control and fully integrated at-rest and in-flight data encryption technology

It includes flexible consumption investment management that unlocks control, protects investments, and delivers real-time return on investment (ROI) details, centrally.

ONTAP is powerful

Serve any data, anywhere, with the right performance at the right price.
To support your critical applications, you need a storage environment that delivers high performance and availability across your hybrid multicloud. But you also need the versatility to scale and adapt as your business changes. ONTAP delivers on all these requirements with performance at scale and nondisruptive operations.

Get flash optimization
ONTAP delivers the high throughput and consistent, submillisecond low latency that enterprise applications require, while providing comprehensive data services. ONTAP is optimized for flash, including ASA and AFF systems with NVMe solid-state drives (SSDs), NVMe over TCP, and NVMe over Fabrics.

Deliver consistent performance
To maintain high customer satisfaction, adaptive quality of service (AQoS) helps you deliver consistent performance by automatically adjusting storage resource levels to respond to changes in workloads (number of terabytes of data, priority of the workload, and so on). AQoS simplifies the implementation of policies to keep your workloads within prescribed minimum and maximum throughput targets.

Stay ahead of business changes with seamless scalability
You can start small and grow with your business by using high-capacity SSDs or HDDs or public cloud to scale your ONTAP storage environment. On-premises systems that run ONTAP can handle SAN, NAS, and object workloads that range from a few terabytes to up to 707PB. You can scale up by adding capacity to existing storage controllers or scale out by adding controllers to seamlessly expand your cluster up to 24 nodes. Or quickly deploy an ONTAP environment in public clouds using Cloud Volumes ONTAP. ONTAP also supports massive NAS data containers that are easy to manage. With NetApp ONTAP FlexGroup volumes, a single namespace can grow to 60PB or 400 billion files while delivering consistent high performance and resilience.

ONTAP protects your data

Reduce risk with the most secure and available storage
In a world full of threats, whether human-made (such as ransomware) or natural disaster, ONTAP provides the security and availability you need to eliminate risk from operations and enhance business continuity.

Integrated data protection and nondisruptive operations
With ONTAP, you can meet your requirements for local backup with nearly instantaneous recovery by using space-efficient Snapshot copies. Achieve remote backup/recovery and disaster recovery with NetApp SnapMirror® asynchronous replication or with SnapMirror Cloud when replicating data to a cloud object store in a public or private cloud. Or, to step up to zero-data-loss protection (RPO=0), use SnapMirror synchronous replication.

Protect business operations from regional outages
For your critical applications that require continuous data availability, NetApp MetroCluster® and SnapMirror active sync technologies synchronously mirror between locations to provide business continuity against human-made or natural disasters. The storage arrays can be deployed at a single site, across a metropolitan area, or in different cities. MetroCluster is a robust, full-system infrastructure for your SAN and NAS workloads. SnapMirror active sync enables the flexibility to granularly protect the most critical SAN applications with continuous availability if a data center disaster occurs.

Scale and maintain nondisruptively
With ONTAP, you can service and update your infrastructure during regular working hours without disrupting your business. Dynamically assign, promote, and retire storage resources without downtime over the lifecycle of an application. Data can be moved without application interruption, so you can get the data on the node that delivers the optimal combination of speed, latency, capacity, and cost.

Support your workloads efficiently wherever they run

With ONTAP, you can design and deploy your storage environment across the widest range of architectures, so you can match the approach that's right for your evolving business needs.

- **On NetApp hardware systems.** Employ AFF all-flash systems, for the best latency for demanding performance; ASA all-flash systems for block-optimized workloads; and FAS systems, for a balance of performance and capacity.
- **Within a converged infrastructure.** FlexPod® from NetApp and Cisco is a secure, smart, sustainable, hybrid-ready converged infrastructure platform that helps customers accelerate a large and growing portfolio of modern and enterprise reference architectures.
- **As software-defined storage on commodity servers.** ONTAP Select.
- **In the cloud.** Cloud Volumes ONTAP, Amazon FSx for NetApp ONTAP, Azure NetApp Files, Google Cloud NetApp Volumes.

You can move your data seamlessly between architectures to place it in the optimal environment for performance, capacity, and cost efficiency.

Secure consolidation
You can save time and money by sharing the same consolidated infrastructure for workloads or tenants that have different performance, capacity, and security requirements. And with ONTAP, you don't have to worry that the activity in one tenant partition will affect another. With multitenancy, a storage cluster can be subdivided into secure partitions that are governed by rights and permissions.

Robust security and ransomware protection
The industry-leading portfolio of security capabilities in ONTAP helps you integrate data security and ransomware protection across your hybrid multicloud. Autonomous Ransomware Protection, based on machine learning, quickly identifies malware threats. And multi-admin verification, an industry-first native approach, prevents malicious and accidental changes to your data by requiring multiple approvals for critical admin tasks. With the NetApp Volume Encryption feature that is built in to ONTAP, you can easily and efficiently protect your at-rest data by encrypting any volume. In-flight encryption for backup and replication protects your data in transit. And other features such as

multifactor authentication, role-based access control (RBAC), and onboard and external key management increase the security of your data.

Rigorous compliance
To meet your stringent compliance and data retention policies, NetApp SnapLock® software enables write once, read many (WORM) protected data for your ONTAP environment. NetApp also provides superior integration with enterprise backup vendors and leading applications. In addition, cryptographic shredding by the NetApp secure purge technology enables you to remediate data spillage online while the system is still in use. It also provides state-of-the-art "right-to-erasure" capability for General Data Protection Regulation (GDPR).

Industry-leading support at every stage of your journey
Make a simple, straightforward transition to ONTAP. No matter what your starting point is, NetApp streamlines your move to ONTAP. Consult our experts to plan and implement your transition and gain the latest ONTAP advantages from day one. You can use NetApp Professional Services or NetApp Services Certified Partners, you can do it yourself by using our proven tools and processes, or you can combine these approaches. Plus, when you're running ONTAP, you can use the Managed Upgrade Service to get the most from your investment by keeping your ONTAP software always up to date.

	Function	Benefit
Data compaction	Packs more data into each storage block for greater data reduction	Works with compression to reduce the amount of storage that you need to purchase and operate
Data compression	Provides transparent inline and postprocess data compression for data reduction	Reduces the amount of storage that you need to purchase and maintain
Deduplication	Performs general-purpose deduplication for removal of redundant data	Reduces the amount of storage that you need to purchase and maintain
FabricPool	Automates data tiering to a NetApp StorageGRID object storage solution or a public cloud	Decreases storage costs for cold data and frees up space on your high-performance tier
FlexCache®	Caches actively read datasets within a cluster and at remote sites	Accelerates read performance for hot datasets by increasing data throughput within a cluster, and improves the speed and productivity of collaboration across multiple locations
FlexClone®	Instantaneously creates file, LUN, and volume clones without requiring additional storage	Saves you time in testing and development and increases your storage capacity
FlexGroup	Enables a single namespace to scale up to 60PB and 400 billion files	Supports compute-intensive workloads and data repositories that require a massive NAS container while maintaining consistent high performance and resilience
FlexVol®	Creates flexibly sized volumes across a large pool of disks and one or more RAID groups	Enables storage systems to be used at maximum efficiency and reduces hardware investment
MetroCluster	Robust infrastructure that combines array-based clustering with synchronous mirroring to deliver continuous availability and zero data loss for SAN and NAS workloads; up to 700km distance between nodes	Maintains business continuity for critical enterprise applications and workloads if a data center disaster occurs
Multi-Admin Verification	Requires multiple approvals for critical admin tasks, such as "volume snapshot delete" or "volume delete"	Prevents malicious and accidental changes to your data. A single cluster administrator, or a ransomware attacker with a compromised administrator account, cannot execute critical commands without approvals from one or more additional administrators
Dynamic authorization framework	Uses additional environmental factors such as IP address, location, or time to authorize actions of highly sensitive or powerful accounts such as administrator	Creates an additional layer of protection to prevent malicious actors using compromised credentials from performing highly controlled or destructive actions
Performance capacity	Provides visibility of performance capacity that is available for deploying new workloads on storage nodes	Simplifies management and enables more effective provisioning of new workloads to the optimal node
QoS (adaptive)	Simplifies setup of QoS policies and automatically allocates storage resources to respond to workload changes (number of terabytes of data, priority of the workload, and so on)	Simplifies operations and maintains consistent workload performance within your prescribed minimum and maximum IOPS boundaries
Ransomware protection	Provides built-in, robust features that detect ransomware activity, prevent its spread, and enable quick recovery—including automatically creating Snapshot copies and alerting administrators when ONTAP detects abnormal file activity	Protects automatically against ransomware attacks and enables quick recovery, to avoid paying the ransom

	Function	Benefit
SnapCenter®	Provides host-based data management of NetApp storage for databases and business applications	Offers application-aware backup and clone management; automates error-free data restores
SnapLock	Provides WORM file-level locking, preventing changes and deletion of the file	Supports regulatory compliance and organizational data retention requirements; plus, enables air-gap separation of Snapshot copies for enhanced ransomware protection and quick recovery from an attack
SnapMirror	Provides integrated remote backup/recovery and disaster recovery with incremental asynchronous data replication; preserves storage efficiency savings during and after data transfer	Provides flexibility and efficiency when replicating data to support remote backup/recovery, disaster recovery, and data distribution
SnapMirror active sync	Combines flexible array-based clustering with application granularity for synchronous mirroring across two- and four-node configurations to deliver symmetric active-active multisite replication for business continuity of mission-critical SAN workloads	Cost-effectively protects the most critical SAN applications with continuous availability to maintain business continuity if a data center disaster occurs
SnapMirror Cloud	Provides integrated remote backup/recovery and disaster recovery with incremental asynchronous data replication leveraging S3 cloud resources	Provides flexibility and efficiency when replicating data to a cloud object store in a public or private cloud, to support remote backup/recovery, disaster recovery, and data distribution
SnapMirror Synchronous	Delivers incremental, volume-granular, synchronous data replication; preserves storage efficiency savings during and after data transfer	Achieve zero-data-loss protection (RPO=0)
SnapRestore®	Rapidly restores single files, directories, or entire LUNs and volumes from any Snapshot copy	Instantaneously recovers files, databases, and complete volumes from your point-in-time Snapshot copy
Snapshot	Makes incremental data-in-place, point-in-time copies of a LUN or a volume with minimal performance impact	Enables you to create frequent space-efficient backups with no disruption to data traffic
NetApp Volume Encryption	Provides data-at-rest encryption that is built into ONTAP	Lets you easily and efficiently protect your at-rest data by encrypting any volume on an AFF or FAS system; no special encrypting disks are required

Table 1) ONTAP offers a robust set of standard and optional features.

ONTAP software licensing	Features
Required software:	
ONTAP One (only for NetApp AFF A-Series, AFF C-Series, and FAS systems)	Comprehensive, unified software suite that includes all protocols (SAN/NAS/Object) as well as ONTAP technologies such as SnapRestore, SnapMirror, SnapCenter, FabricPool (to ONTAP-S3 and StorageGRID), FlexClone, FlexCache, FPolicy, encryption[1], Autonomous Ransomware Protection, SnapLock, and multitenant key management
ONTAP One for SAN (only for NetApp ASA systems)	Comprehensive software suite that includes SAN protocols as well as ONTAP technologies applicable for SAN workloads such as SnapRestore, SnapMirror, SnapCenter, FabricPool (to ONTAP-S3 and StorageGRID), FlexClone, FlexCache, FPolicy, encryption[1], SnapLock, and multitenant key management

[1] Encryption availability subject to Global Trade Compliance

Contact Us

About NetApp

NetApp is the intelligent data infrastructure company combining unified data storage, integrated data services, and CloudOps solutions to turn a world of disruption into opportunity for every customer. NetApp creates silo-free infrastructure, then harnesses observability and AI, to enable the best data management. As the only enterprise-grade storage service natively embedded in the world's biggest clouds, our data storage delivers seamless flexibility and our data services create a data advantage through superior cyber-resilience, governance, and applications agility. Our CloudOps solutions provide continuous optimization of performance and efficiency through observability and AI. No matter the data type, workload or environment, transform your data infrastructure to realize your business possibilities with NetApp. www.netapp.com

NetApp

1 PROTECT SENSITIVE DATA IN DATA STORAGE SYSTEMS WITH NO DISRUPTION TO OPERATIONS

NetApp provides a comprehensive suite of encryption and data security solutions designed to protect data throughout its lifecycle. These solutions include regulatory compliance, secure storage consolidation, secure backup and disaster recovery, intellectual property protection, and secure information sharing.

The ability to protect and store critical data is a major focus for today's organizations. Networked storage streamlines accessibility to mission-critical information, but it can leave data vulnerable. Firewalls, intrusion-prevention systems, and other next-generation network security solutions can secure assets at the perimeter. However, data at the storage core can still be exposed to both internal and external threats. By integrating the appropriate data protection technologies, organizations can guard against potential malicious attacks and attempts to steal confidential data.

NetApp® takes a multi-layered zero-trust and immersion approach to embed and uphold the integrity and confidentiality of an organization's most valued assets: its data. With the right data security solutions, you can effectively guard against potential malicious attacks and attempts to steal confidential data. NetApp and our technology partners provide an extended portfolio of cyber-resilient security solutions that have been tested with NetApp storage systems.

NETAPP FLEXIBLE ENCRYPTION SOLUTIONS

NetApp offers several encryption solutions that meet a variety of customer requirements.

ONTAP SECURITY SOLUTIONS

- **NetApp Storage Encryption (NSE)**. NSE uses self-encrypting disk drives (SEDs) for full disk encryption (FDE) of data with NetApp ONTAP®. It provides a hardware-based data-at-rest encryption solution. With NSE, you can benefit from the entire suite of NetApp's leading storage efficiencies, such as compression, compaction, and deduplication, giving you the efficiency savings you see with unencrypted volumes while also leveraging industry-standard 256-bit AES encryption on FIPS 140-3 Level 2 validated drives. NSE is a simple way to automatically encrypt all data, removing the complexity of tracking sensitive data and reducing the risk of data being outside an encrypted volume. As data is written to the drive, it is automatically encrypted, and when data is read, it is automatically decrypted. NSE mitigates several threats, including preventing unauthorized access to encrypted data at rest on powered-off disk drives. This capability prevents unauthorized users from removing a shelf or drives for use with unsanctioned systems. In addition, NSE includes cryptographic shredding of data through disk sanitization commands that render the disk completely unusable. This feature greatly simplifies the disposal of drives and eliminates the need for costly, time-consuming physical drive shredding.

  NSE supports OnBoard Key Management (OKM) and external key management via the industry-standard KMIP protocol, as well as clustered external key management for qualified KMIP partners. Additionally, cloud-provided key management services (KMS)

from Azure and Google are supported, offering flexibility and integration with cloud environments.

NSE also includes robust security features such as array-based antivirus scanning and next-generation antivirus via AI/ML FPolicy integration, which enhances threat detection and response capabilities. In addition, on-box autonomous ransomware protection is also available, providing an additional layer of security to safeguard data against ransomware attacks.

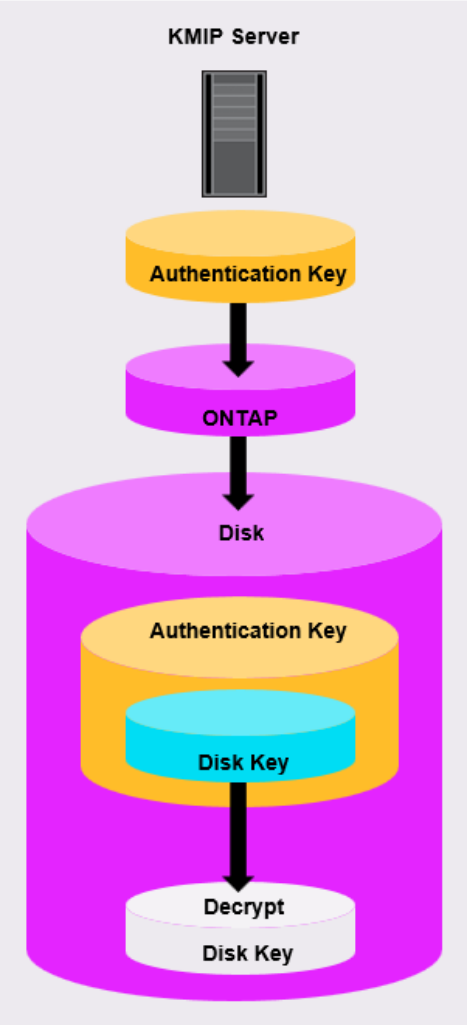

Figure 1: How the KMIP server works with NSE.

- **NetApp Volume Encryption**. NVE is a software-based, data-at-rest encryption solution leveraging industry-standard 256-bit AES encryption with the NetApp FIPS 140-3 Level 1 validated cryptographic module. NVE allows ONTAP to encrypt data per volume for granularity and to have that data be stored on disk without requiring self-encrypting drives, thus eliminating costs. NVE enables you to leverage the majority of storage efficiency features that would be lost if you decided to encrypt at the application layer.
  NetApp Aggregate Encryption. NAE is a software-based, data-at-rest encryption solution that includes all the NetApp storage efficiency features, just like NSE does for

hardware encryption. Cost savings can be achieved by not having to purchase self-encrypting drives. The solution leverages industry-standard 256-bit AES encryption with the NetApp FIPS 140-3 Level 1 validated cryptographic module. Encryption keys are maintained per aggregate rather than per volume and require that all data volumes must be encrypted.

Note: NSE, NAE, and NVE can be used together to provide customers with two distinct layers of software and hardware encryption for double encryption solutions. NSE, NAE, and NVE can use either onboard or external key management. Click on the NSE and NVE datasheet for more details.

- **Encryption in Flight**. ONTAP offers in-transit or over-the-wire encryption for data in flight for NAS and iSCSI protocols. This prevents man-in-the-middle attackers from being able to capture data in clear text while it is being transferred over the network. SMB encryption is supported and uses AES-GCM encryption with SMB 3.1.1. NFS leverages Kerberos krb5p encryption. IPsec offers data encryption in flight for all IP traffic, including the only option for the iSCSI protocol. TLS 1.3 is available for encrypting management plane traffic.
- **Cluster Peering Encryption**: NetApp ONTAP supports encryption for cluster peering, ensuring that data transferred between clusters is secure. This feature uses TLS to encrypt the communication between clusters, protecting data from interception and unauthorized access during transit.
- **Cloud Volumes ONTAP**. Leverages the power of the ONTAP software solution for data-at-rest encryption with ONTAP NVE and NAE to deliver enterprise-class data storage management across cloud vendors while ensuring security through the use of software-based data-at-rest encryption (using the XTS-AES 256 algorithm) and external key management with ONTAP cloud or via Amazon EBS.

ADDITIONAL PORTFOLIO SECURITY SOLUTIONS

- **BlueXP backup and recovery**. Helps securely back up data to any cloud (private or public) at considerably lower cost than on-premise solutions. You can now include both the public and private clouds as backup targets for cost-effective data protection. BlueXP backup and recovery can achieve faster recovery, reduce data loss, and deliver ironclad security, all with minimal management overhead. The solution provides data at rest encryption using FIPS 140-3 with the AES-256 standard for both cloud and local cached data. In addition, BlueXP backup and recovery retains all NetApp storage efficiencies by encrypting data after deduplication and compression, further enhancing the solution's effectiveness.
- **NetApp SANtricity® Full Disk Encryption**. Provides a powerful and simple-to-administer tool for securing critical information and protecting against the constant threats to data at rest. SANtricity FDE utilizes AES 256-bit encryption, FIPS 140-3 level 2 manufacturer-validated drives, and combines local or external key management with FDE-capable drives, protecting data from unauthorized access or modification resulting from theft, loss, or repurposing of the disk drives. The simple and intuitive configuration menus offer an easy way to manage this added security. E-Series systems with FDEs mitigate the risks associated with data loss as disk drives will inevitably be removed from the data center due to returning spares, upgrades, moving, decommissioning, and breaches.

- **NetApp StorageGRID®.** Provides the ability to protect object storage across heterogeneous platforms, address hardware refreshes, and tiering to tape and cloud. The StorageGRID solution does this while encrypting objects with AES-256 software-based encryption. In StorageGRID, each object is encrypted by a unique per-object symmetric key or a client-provided key.

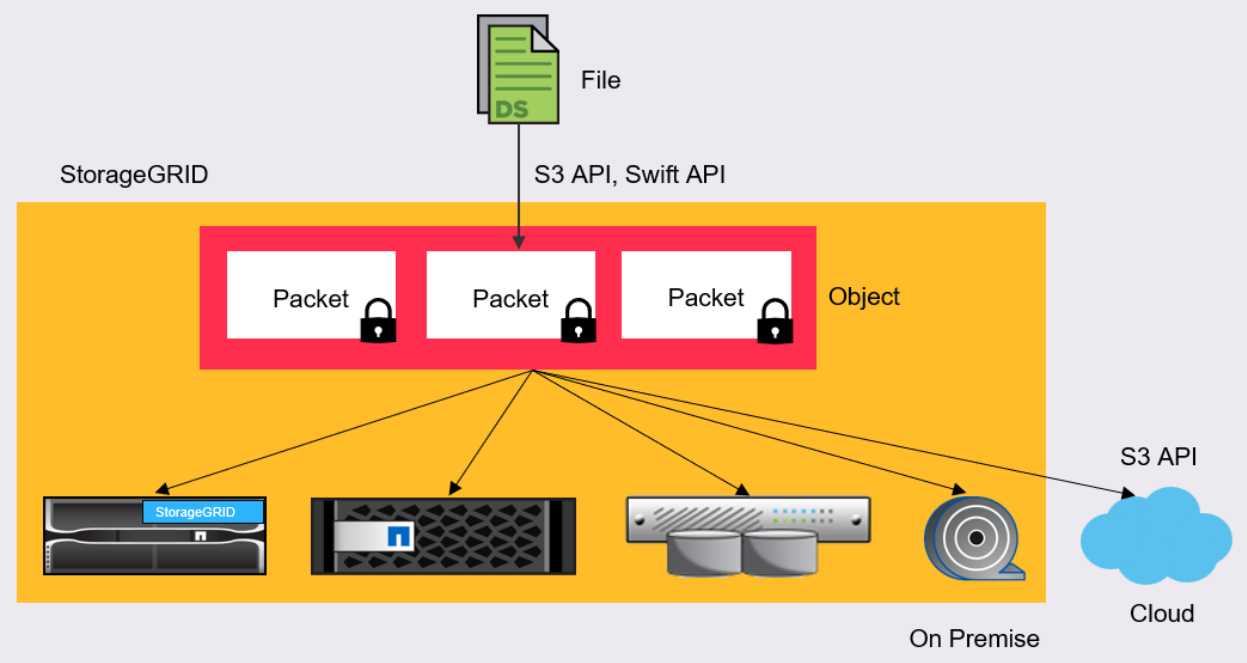

Figure 2: A typical StorageGRID architecture.

- **NetApp Security Services**. NetApp and our partners offer many security services, including the design and implementation of key management appliances for enterprise key management. In addition, the security services team is continually designing and deploying secure solutions throughout the NetApp portfolio, including NSE, NAE, NVE, BlueXP backup and recovery, StorageGRID, SANtricity with FDE, Cloud Volumes ONTAP, and ONTAP select solutions.

  Additional security, ransomware assessment, and data migration services are also available. Please contact your account team for a Security Services engagement to address the needs and requirements of your organization.