The ONTAP Advantage

## Real-World Use Cases from NetApp IT

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Prologue

Storage as Strategy:
The Foundation of IT Modernization

In today's enterprise landscape, data is ubiquitous, existing both on-premises and in the cloud. With workloads distributed across hybrid and multi-cloud environments, IT leaders face the challenge of managing increasing complexity while maintaining control. The key questions have shifted from merely where data resides to how it is managed, protected, and utilized as a strategic asset.

Dave Blodgett, the VP of IT at NetApp, argues that storage should be viewed not just as infrastructure but as a strategic component of a successful organization. With NetApp ONTAP as a foundational tool, companies can unify their storage operations across different environments through a single, intelligent control plane. This approach simplifies how IT delivers performance, safeguards critical data, and ensures compliance, all while fostering innovation at scale.

As this volume explores the evolving role of storage, each chapter demonstrates how NetApp IT leverages storage to create a strategic advantage. From maximizing efficiency and consistency with ONTAP and FlexPod, to simplifying cloud operations with Amazon FSx for NetApp ONTAP, to modernizing storage management with StorageGRID, these real-world use cases illustrate how streamlining and unifying data management multiplies IT effectiveness. Together, they show how a strong storage foundation enhances cyber resilience, improves cloud agility, and drives innovation at scale.
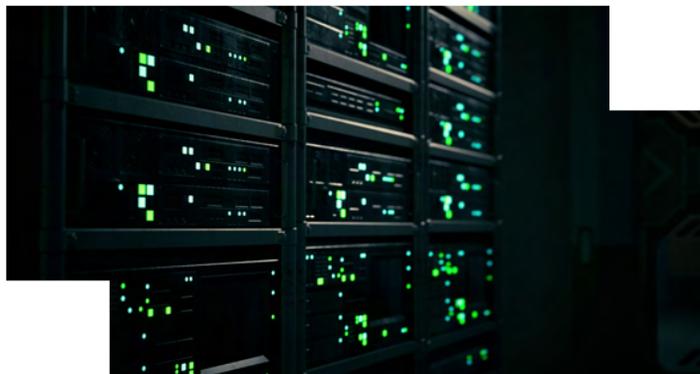
The Backbone of FlexPod: ONTAP

Maximizing Efficiency and Consistency

Efficiency and consistency in IT infrastructure management are paramount for businesses striving to stay competitive in today's digital landscape. NetApp ONTAP storage systems, integral to the FlexPod architecture, are central to achieving these goals. Let's explore how ONTAP and FlexPod work together to optimize infrastructure performance and reliability

NetApp ONTAP: The Backbone of FlexPod

NetApp ONTAP is the backbone of FlexPod's storage capabilities, providing advanced features that ensure efficient unified storage management, data protection, and disaster recovery capabilities.

- Data Deduplication and Compression: ONTAP offers data deduplication and compression, reducing storage footprint and optimizing resource utilization.
- Snapshotting: ONTAP's snapshotting capabilities enable point-in-time copies of data, facilitating quick backups and recovery.
- Replication: ONTAP supports data replication, ensuring data availability and disaster recovery readiness across distributed environments.

Efficient Data Management & Protection

By leveraging ONTAP within FlexPod, organizations can achieve efficient data management and protection:

- **Efficient Storage Utilization:** Deduplication and compression reduce storage requirements, optimizing resource utilization and lowering costs.
- **Data Protection:** Snapshotting and replication features ensure data integrity, availability, and rapid recovery in case of failures.
- **Disaster Recovery Readiness:** ONTAP's replication capabilities enable disaster recovery readiness by replicating data to remote sites

or cloud environments.

Automation and Orchestration with FlexPod using Terraform and Flexbot

FlexPod's integration with automation and orchestration tools like Terraform and Flexbot enhances efficiency and consistency in infrastructure management. Terraform, a popular infrastructure automation tool, is pivotal in implementing immutable infrastructure and Infrastructure as Code (IaC) practices. It allows IT teams to define and manage infrastructure as code, providing a single source of truth for their environment.

How They Work Together:
- **Infrastructure as Code (IaC) with Terraform:**
    - → Define FlexPod infrastructure as code, providing a single source of truth.
    - → Use configuration files for version control and change management.
- **Automation and Provisioning:**
    - → Flexbot automates the provisioning and management of FlexPod resources.
    - → Terraform scripts ensure consistent, rapid deployments.
- **Streamlined Configuration and Deployment:**
    - → Flexbot simplifies interaction with FlexPod, ensuring the desired state matches the actual state.
    - → Define infrastructure in Terraform, and Flexbot enforces it.
- **Consistency and Reliability:**
    - → Achieve consistent, repeatable deployments with immutable infrastructure practices.
    - → Reduce configuration drift, increasing reliability.
- **Scalability and Flexibility:**
    - → Scale FlexPod resources easily with Terraform and Flexbot.
    - → Adapt to changing demands with flexible, automated management.

FlexPod and Flexbot enhance infrastructure management by providing automation, consistency, and scalability, ensuring reliable and optimized performance for various workloads. The Flexbot Terraform provider developed by NetApp IT's Igor Feoktistov is available on the Terraform registry, and you can find it here.

Real-World Implementation and Success Stories

Traditional bare-metal implementations often rely on complex processes like PXE boot and dynamic host configuration protocol (DHCP), introducing potential points of failure and delays. However, leveraging NetApp FlexPod architecture and innovative storage features has

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improved our deployment processes, achieving unparalleled efficiency and reliability.

NetApp FlexPod Solution
Most bare-metal implementations traditionally rely on the PXE boot process, involving multiple steps and dependencies on DHCP infrastructure. This process can be unreliable and prone to breakdowns, leading to delays and inefficiencies in deployment.

Instead of relying on DHCP and the traditional PXE boot process, we turned to NetApp simplified storage features, which were integrated into our FlexPod architecture. This allowed us to store and retrieve images directly from the storage system, bypassing traditional boot processes' complexities and potential pitfalls.

Streamlined Deployment Process
Our deployment involves an application programming interface (API) to access the storage and push images to servers. This streamlined approach significantly reduces deployment time and ensures reliability by eliminating dependencies on DHCP and additional infrastructure components.

Cloud-Init for Configuration Management
To enhance efficiency and consistency further, we utilize cloud-init for pre-configuring settings and applying network configurations during the build process. This eliminates the need for manual configurations and ensures uniformity across deployed systems.

Benefits Achieved
  •   Faster Deployment Times: Direct image retrieval from storage and cloud-init configurations have significantly reduced deployment times.
  •   Improved Reliability: Our deployments have become more robust and less prone to breakdowns by removing PXE and DHCP infrastructure dependencies.
  •   Consistency Across Systems: Using cloud-init templates ensures consistent configurations across all deployed systems, reducing configuration errors and enhancing manageability.

We have transformed our bare-metal deployment processes by embracing NetApp FlexPod architecture, leveraging innovative storage features, and adopting cloud-init for configuration management. The result is a more efficient, reliable, and streamlined approach that sets modern IT infrastructure management standards.

FlexPod and Kubernetes: Enabling Efficient Automation

FlexPod is pivotal in enabling efficient automation and seamless infrastructure management in NetApp IT's Kubernetes-based environment. FlexPod enhances our operations and contributes to our success by providing a robust, scalable foundation for our Kubernetes clusters.

Workload Portability: Bridging On-Premises and Cloud

One of the key advantages of NetApp ONTAP and FlexPod is the ability to manage and move workloads between on-premises and cloud environments seamlessly. This workload portability ensures that organizations can leverage the benefits of both environments, optimizing for performance, cost, and scalability.

- Replication and Backup: ONTAP's replication features enable data to be replicated between on-premises and cloud environments, ensuring data availability and disaster recovery readiness.
- Flexibility and Agility: Organizations can adapt to changing demands by dynamically moving workloads to the cloud or back on-premises as needed.
- Cost Optimization: By balancing on-premises and cloud resources, organizations can optimize costs while maintaining high performance and reliability.

Staying Competitive and Future-Ready

In an era where data management, protection, and agility are critical for business success, the partnership between NetApp ONTAP and FlexPod offers a compelling solution. By optimizing infrastructure performance, automating management tasks, and ensuring data integrity and availability, organizations can stay competitive, agile, and future-ready in an increasingly digital world.

About the Author

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Ed Wang is the Senior IT Manager of DevOps Services at NetApp. Ed and his team design and implement NetApp IT's hybrid cloud, containerized application-hosting platform. Ed's team is responsible for the implementation of Kubernetes, building CI/CD pipelines, infrastructure as code (IaC), and other automations to provide our application developers an easy-to-consume solution for deploying containerized applications with a DevOps focus.
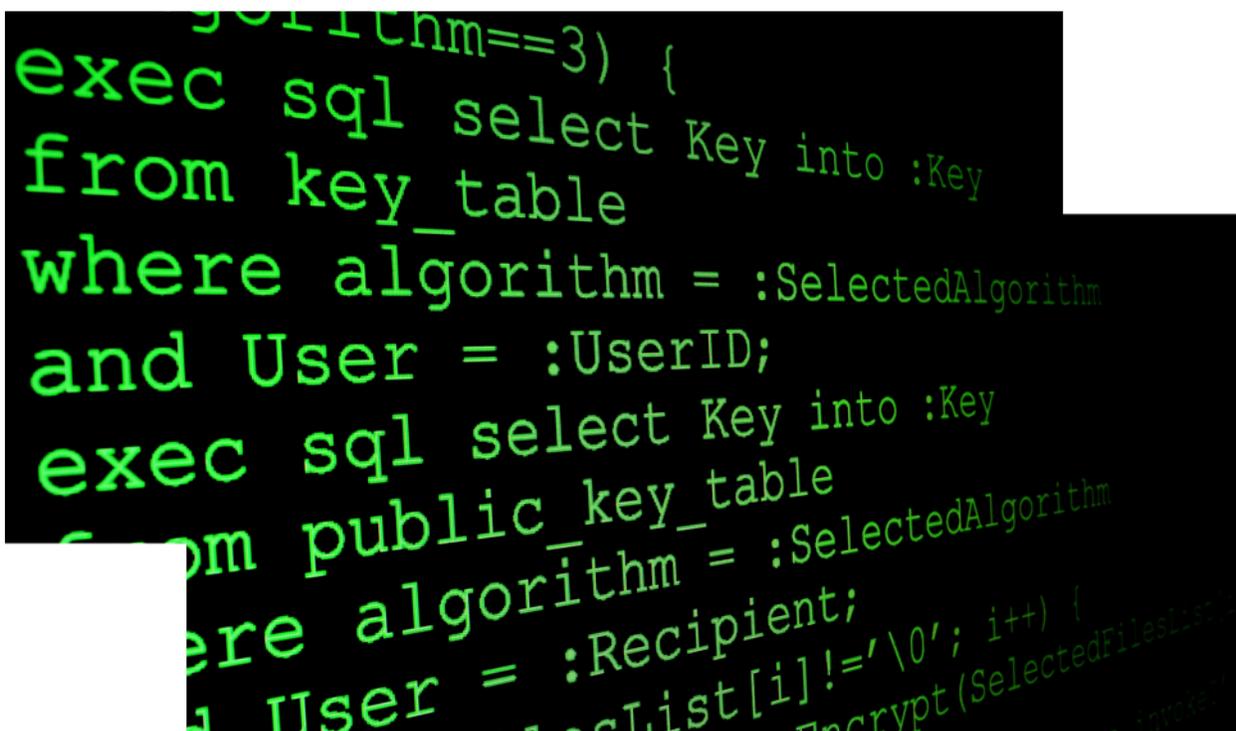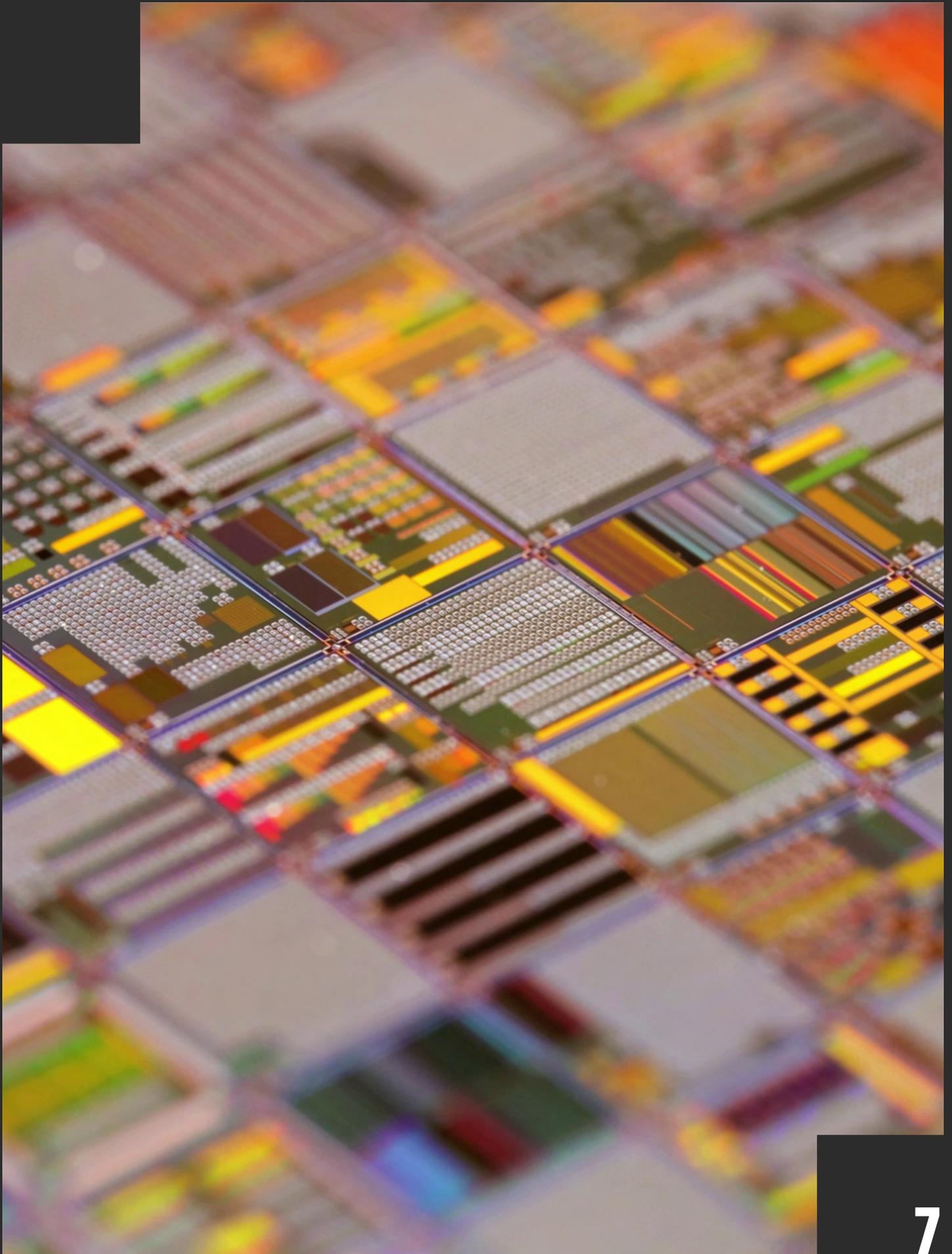
Amazon FSx for NetApp ONTAP

How NetApp IT Leverages the Service

As organizations accelerate their cloud adoption, they seek solutions that enhance efficiency, scalability, and data protection. At NetApp IT, we share the same journey as our customers—evaluating, deploying, and refining cloud solutions to optimize performance and reduce operational complexity. One of our most impactful innovations has been leveraging Amazon FSx for NetApp ONTAP, a fully managed service that simplifies storage while delivering enterprise-grade performance and resiliency.

The Evolution of NetApp IT's Cloud Strategy

Our cloud journey began in 2019 with NetApp Private Storage (NPS), where NetApp controllers were deployed in a colocation facility and connected to AWS compute. While effective, this approach required extensive management, including manual storage provisioning, networking, and lifecycle operations.

In 2021, we transitioned workloads to Cloud Volumes ONTAP (CVO), deploying it in AWS and Azure. This move reduced CapEx, introduced a cloud consumption model, and leveraged ONTAP's powerful data management capabilities. With SnapMirror, migrations became seamless, and CVO's flexible deployment options—including single-node and multi-AZ configurations—enhanced resilience.

Despite these benefits, CVO still required licensing, software updates, and administrative oversight. The launch of Amazon FSx for NetApp ONTAP in 2022 was a game-changer, providing a fully managed service while retaining the full feature set of ONTAP.

Why NetApp IT Chose FSx for ONTAP

Our decision to adopt FSx for ONTAP was driven by its ability to provide enterprise storage capabilities with minimal overhead, and to

make data management between on premise and cloud-based work-loads seamless.

Key Benefits

- Fully managed service – Automates hardware management, software patching, and lifecycle updates, freeing IT resources for innovation.
- High availability and resiliency – Multi-AZ deployment ensures built-in redundancy, automatic failover, and data durability.
- Faster provisioning – Storage requests that took months with NPS and days with CVO are now fulfilled within an hour.
- Seamless ONTAP integration – Supports multi-protocol access (NFS, iSCSI, SMB), deduplication, compression, and ransomware protection.
- Advanced data protection – We use ONTAP snapshots with SnapLock for tamper-proof backups and AWS Backup for disaster recovery.
- Scalability and cost efficiency – Thin provisioning, deduplication, and automatic data tiering to Amazon S3 optimize storage costs while maintaining performance.
- Integration with AWS services – FSx for ONTAP integrates with Amazon ECS, EKS, and VMware Cloud, enabling a hybrid cloud approach.

Deployment and Operations

At NetApp IT, we operate a hybrid cloud environment, balancing workloads across on-premises storage, CVO, and FSx for ONTAP. Our deployment model includes:

- Multi-AZ FSx for Production – Ensures high availability and failover protection.
- EC2 instances with FSx for ONTAP – Supports Linux and Windows workloads using NFS and iSCSI.
- BlueXP and Data Infrastructure Insights for management – Enables centralized monitoring, alerting, and automation via Service-

Now.

Our automated workflows dynamically provision storage, optimizing costs by leveraging FSx for ONTAP's S3-based tiering for cold data while maintaining SSD performance for active workloads. BlueXP policy-based automation ensures data lifecycle management aligns with cost and performance goals.

Lessons Learned & Key Takeaways

FSx for ONTAP has been transformational for NetApp IT, offering performance, flexibility, and ease of management. Its intuitive deployment options simplify provisioning, while SSD-backed storage ensures low latency.

A significant advantage is the elimination of manual administrative tasks. Automated ONTAP upgrades, integrated security, and AI-driven tiering reduce complexity, allowing teams to focus on innovation. Additionally, intelligent tiering moves inactive data to cost-effective storage, reducing SSD consumption and total cost.

FSx for ONTAP seamlessly integrates into our hybrid cloud strategy, connecting on-premises and cloud-native services. This synergy enhances agility, resilience, and scalability, ensuring our infrastructure is ready for the future.

As we continue our cloud journey, FSx for ONTAP remains a cornerstone of our storage strategy, bringing together the simplicity of the cloud with the enterprise capabilities of ONTAP.

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Faisal Salam is a Senior IT Storage Engineer at NetApp and a member of the NetApp Customer-1 team, which acts as the first adopter of NetApp solutions and services. Faisal supports software-defined storage solutions for enterprise data management in addition to the use of ONTAP Adaptive QoS.

How NetApp IT Uses StorageGRID

Modernizing Storage Management

Modern IT infrastructure must be flexible, scalable, and resilient—especially when managing massive volumes of data. At NetApp IT, we've taken on this challenge head-on by evolving our use of StorageGRID to meet the increasing needs of our organization and our customers. From supporting global file uploads to transforming our data lake architecture for Active IQ, StorageGRID has become a cornerstone of our data infrastructure strategy.

A Journey from Backups to Strategic Backbone

When we first introduced StorageGRID over a decade ago, it was a cautious step. We started by backing up static ONTAP data using NetBackup and AltaVault. Once AltaVault was sunset, we retained the environment to meet SOX retention requirements. StorageGRID's object storage capabilities soon proved ideal for more than just backups—it became a reliable backend for Splunk logs, Git repositories, and Veeam VM backups.

Today, our architecture includes three distinct StorageGRID environments:
- Corp StorageGRID (Internal-only, 6PB, 67 nodes)
- DMZ StorageGRID (Customer-facing, 6PB, 23 nodes)
- Bare-metal StorageGRID for Active IQ (6PB, 24 nodes)

These environments are deployed across multiple sites, with careful consideration given to security posture, load balancing (via Avi or VM gateway nodes), and hardware lifecycle management.

Global Secure File Uploads

A recurring challenge for NetApp Support was enabling customers to securely upload large core files (up to 2TB) for troubleshooting

ONTAP issues. The original browser plugin-based solution was clunky, error-prone, and frequently failed, particularly for customers outside the United States.

We designed a new browser-based upload system using StorageGRID and key platform services:
   • Multi-part uploads allow pause/resume capabilities and faster transfers.
   • Pre-signed URLs grant secure, session-based access.
   • CloudMirror replicates uploaded files from DMZ to our internal grid without compromising security.
   • SNS (Simple Notification Service) notifies our system immediately when a file is uploaded, triggering an automated workflow to move it into the engineering domain.
   • Cloud Sync transfers files from AWS S3 into internal StorageGRID instances when needed.

This architecture improved reliability and enabled us to scale globally, utilizing AWS S3 as a transient upload platform in regions without data centers. Once data lands in AWS, it's replicated to the U.S. via the AWS backbone and quickly moved into StorageGRID.

The result? Seamless, secure uploads for customers worldwide, without plugins, firewall exceptions, or infrastructure changes.

Transforming Active IQ with Object Storage
Our second primary use case involved migrating Active IQ's data lake from a massive Hadoop-based architecture to a Kubernetes-native Dreamio platform backed by StorageGRID.

The numbers tell the story:
   • Compute resources dropped by 60%
   • Storage footprint reduced by 2PB
   • Query times improved 10–20x, with the largest query going from 45 minutes to 2.5 minutes

We deployed a bare-metal StorageGRID environment using E-Series storage arrays reclaimed from the Hadoop system. We optimized for performance, resiliency, and maintainability using erasure coding (4+2) and Red Hat 9.4.

Lessons from the Field

NetApp IT's journey with StorageGRID mirrors our customers' challenges: legacy infrastructure, security constraints, evolving requirements, and tight budgets. We've learned that:

- Platform services matter – tools like CloudMirror and SNS unlock automation and flexibility.
- Hybrid design is key – balancing internal grids with cloud-native services extends reach without excess cost.
- Reuse accelerates ROI – reusing hardware and smartly transitioning workloads keeps innovation cost-effective.

We're not just building solutions for today but laying the foundation for future scalability and agility.

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