
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

STG201

Network-attached storage in the cloud with Amazon FSx

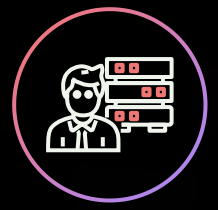
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FSx for Windows File Server
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FSx for NetApp ONTAP
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The Vanguard Group

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File workloads: Broad spectrum



Storage and IT admins and application owners

Builders and data scientists





Enterprise IT applications



User shares



Line-of-business applications



Machine learning



SaaS applications



Software build environments



Backup and disaster recovery



Web serving and content management



Data science and analytics



DevOps platforms

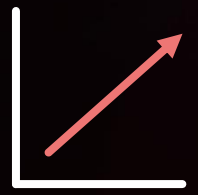
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Three usage patterns for file storage in the cloud



Network-attached storage



Virtually unlimited compute scale



Cloud-native apps and workflows

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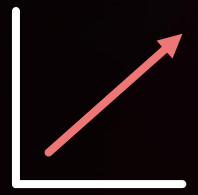
File solutions to serve the three usage patterns



Network-attached storage

FSx

Amazon FSx



Virtually unlimited compute scale

FSx

Amazon FSx



Cloud-native apps and workflows



Amazon EFS

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Network-attached storage

FSx

Amazon FSx

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Why have your NAS data in the cloud?



Improve reliability without the operational heavy lifting



Increase agility – launch and scale storage in minutes



Raise security bar



Automate storage deployment workflows using infra-as-code



Optimize and fine-tune TCO



Leverage innovative new data processing in the cloud

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Switching NAS solutions can take months to years

Each NAS solution offers unique:



Data access features



Performance profiles



Data management APIs

Migrating to a different NAS solution often requires
re-architecting, re-certifying, and re-training

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FSx = File System x

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What does x represent?



Your choice
for
your workload

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What do we mean by your choice?



Launch, run, and scale . . .



feature-rich, high-performance, cost-effective, and fully managed storage . . .

NetApp ONTAP

OpenZFS

Windows File Server

Lustre

powered by **your choice** of the world's most popular file systems

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Amazon FSx is the easiest path to run NAS in the cloud



Migrate to like-for-like storage with the same capabilities and APIs

- Re-architect
- Re-invent
- Re-certify
- Re-train

NetApp ONTAP

Windows file server

ZFS or Linux-based file servers



Build and run NAS workloads leveraging the capabilities and performance of popular file systems

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Amazon FSx for Windows File Server

Makes it easy and cost-effective to deploy Windows-based applications

Storage built on Windows Server, delivering full compatibility for your Windows-based workloads

Used for a variety of Windows workloads . . .



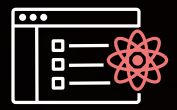
.NET-based Enterprise IT applications



User/team shares



SQL Server cluster deployments



IIS web serving and content management



Media editing and rendering



Virtual Desktop Infrastructure (VDI)

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Amazon FSx for NetApp ONTAP

THE ONLY COMPLETE, FULLY MANAGED ONTAP FILE SYSTEM IN THE CLOUD

The only fully managed cloud service with full support for…



ONTAP's data management features and APIs



ONTAP's storage efficiency features

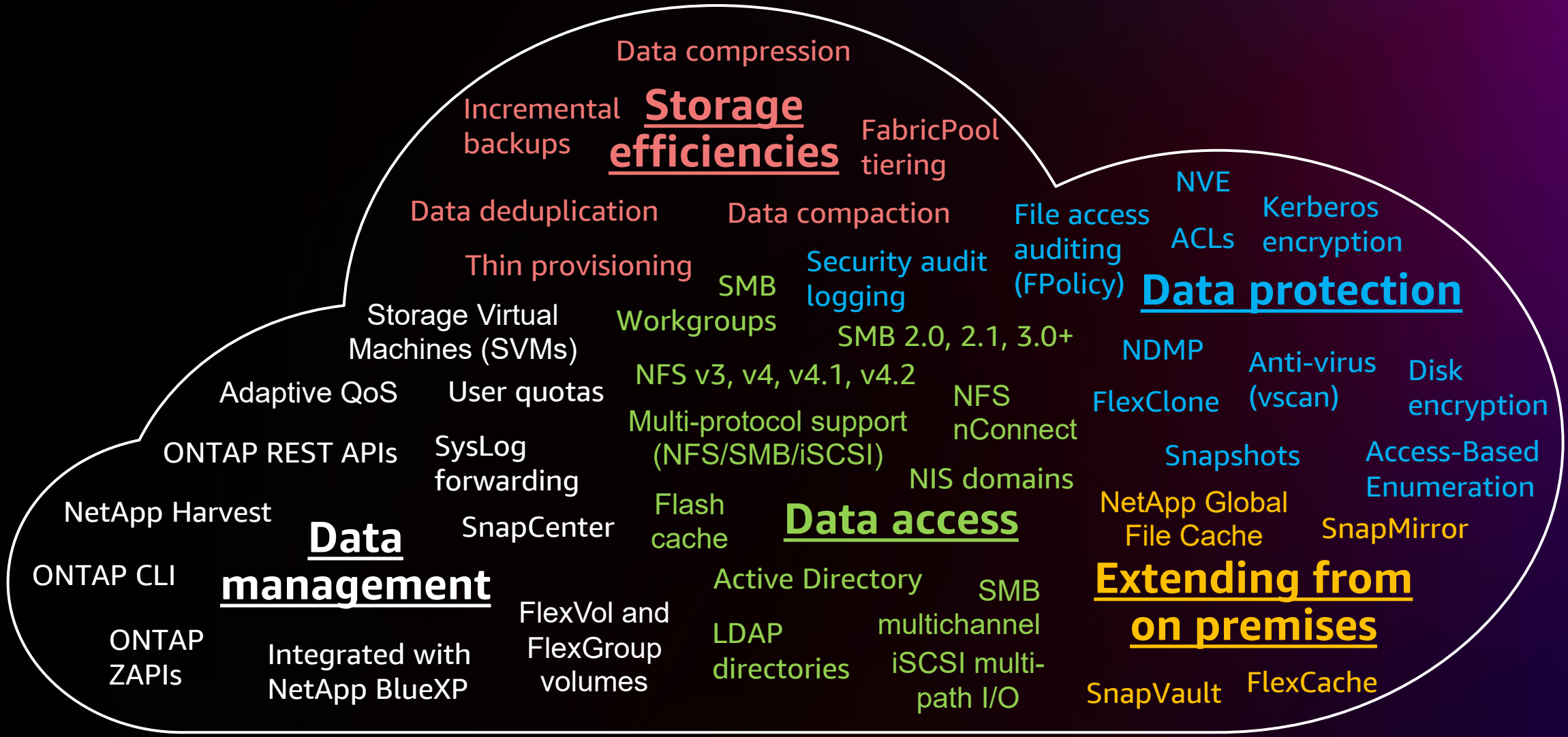


ONTAP SnapMirror and SnapVault replication

Easiest path to **migrate or extend** NetApp deployments to the cloud

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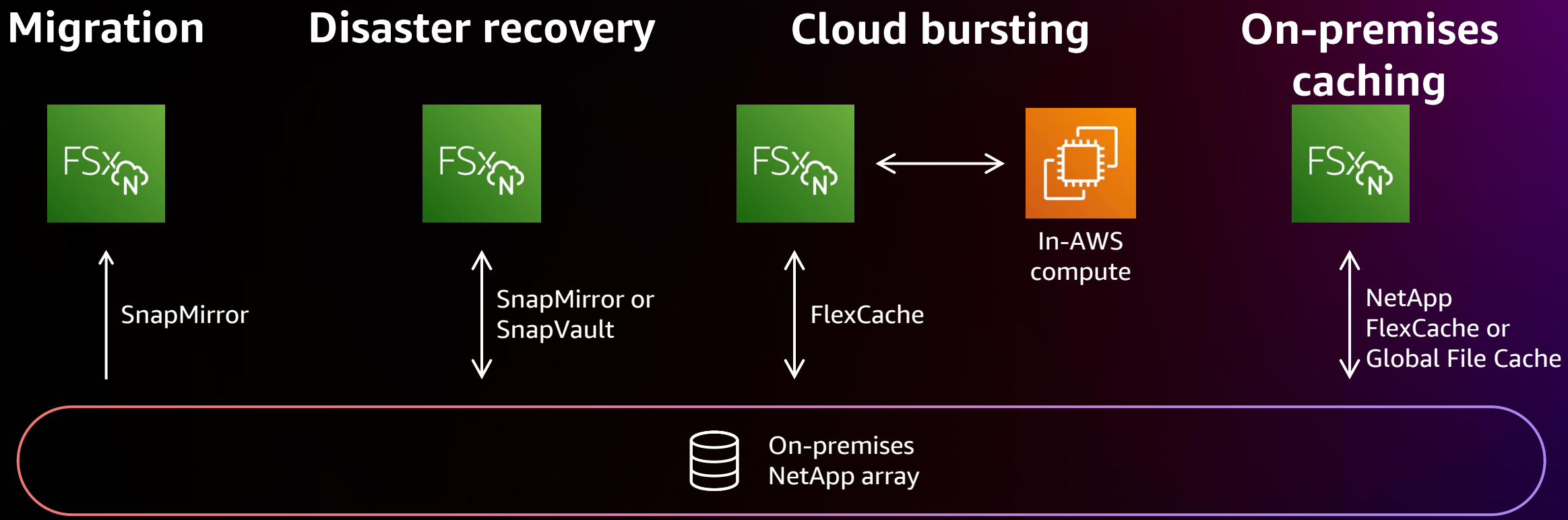
FSx for ONTAP: A complete ONTAP file system



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FSx for ONTAP: Easily extend ONTAP to the cloud



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Amazon FSx for OpenZFS

WHAT IS OPENZFS?

OpenZFS

Powerful open-source file system that is purpose-built for **high performance and scale**



Copy-on-write architecture
Foundation for fast, efficient snapshots and data cloning



Dedicated, efficient caching
ARC, L2ARC, ZIL



Cost efficiency features
Thin-provisioning, user quotas, data compression

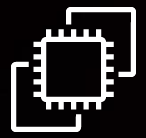
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OpenZFS is traditionally used for a variety of data-intensive workloads . . .



ML training



Chip design



Financial analytics



Media rendering



Game development and streaming

Why? These workloads . . .

- Require highly-performant NFS accessible storage → **OpenZFS** was designed to deliver the highest levels of performance
- Don’t need all the enterprise features of commercial offerings → **OpenZFS** commonly delivers 20–40% better price performance than commercial offerings

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Amazon FSx for OpenZFS



Delivers the power of ZFS without the complexity of configuring, tuning, and maintaining it



Like with other FSx offerings, leverages the latest AWS innovations to deliver continual performance improvements

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Migrate on-premises NAS to the cloud: Construction and Infrastructure

John Holland Group (JHG) lost access to over 90 critical business apps due to a legacy storage environment failure

JHG performed an emergency migration of these critical apps to FSx for Windows File Server within 48 hours

Moving to a fully managed solution has freed up engineers to focus on driving business value

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Deploy high-performance NAS in the cloud: Game development

- Using Amazon FSx for OpenZFS as shared storage, Vela Games accelerated build times by 60% from an average of 56 minutes/build down to 24 minutes/build

- The simplicity and performance of FSx for OpenZFS made it easy for Vela Games to update their build farm to run on shared NFS file storage

- By sharing data across individual jobs, Vela Games was able to parallelize and accelerate builds, increasing their team's development velocity and enabling faster iteration

VELAGAMES

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Some of our FSx launches since re:Invent 2021

Improve reliability
- [ONTAP] [OpenZFS] AWS Backup integration

Raise security bar
- [Windows] FedRAMP authorization

Optimize and fine-tune TCO
- [ONTAP] Capacity pool data compression
- [ONTAP] Reduce min. throughput capacity by 4x
- [ONTAP] Single-AZ deployment type
- [OpenZFS] LZ4 data compression

Automate storage deployments
- [ONTAP] CloudFormation integration
- [ONTAP] AWS Launch Wizard integration

Increase agility
- [ONTAP] Storage and IOPS scaling
- [OpenZFS] Storage and IOPS scaling
- [ONTAP] Throughput scaling
- [OpenZFS] Fully-copy volumes
- [Windows] Enhanced CloudWatch metrics
- [ONTAP] CloudWatch metrics integration

Leverage innovative data processing in the cloud
- [Windows] Amazon Kendra integration

Expand workload coverage
- [ONTAP] SAP HANA certification
- [ONTAP] VMC certification for supplemental datastore

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FSx for ONTAP: New ease-of-use capabilities

NEW



Access Multi-AZ file systems from on premises without additional routing changes

NEW



Nitro-based encryption in transit (in supported regions)

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FSx for ONTAP: Performance enhancements

NEW

2x

Higher SSD throughput and IOPS

2 → 4 GB/s throughput
80K → 160K IOPS

NEW

NVMe

Read caching now available for Single-AZ

Up to 6 GB/s throughput and 650K IOPS (for cached data)

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FSx for OpenZFS: Performance enhancements

Today, we're announcing next-generation file systems . . .

NEW

2x

Higher SSD throughput and IOPS

4 → 10 GB/s throughput
160K → 350K IOPS

NEW

NVMe

Read caching

Up to 21 GB/s throughput and
1M+ IOPS for cached data access

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How is Amazon FSx helping customers make the best use of their NAS data?

A. Improve reliability without the operational heavy lifting

B. Raise your security bar

C. Optimize and fine-tune TCO

D. Increase agility

E. Automate your storage deployments

F. Leverage innovative new data processing in the cloud

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A Improve reliability without the operational heavy lifting



Testing and operations at an unprecedented scale



Automatic infrastructure monitoring and replacement



Unified support experience



Built-in Multi-AZ resiliency



Automatic and secure backups



Availability SLA

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B Raise your security bar



Automatic software scanning and patching



Encrypt automatically and without penalty



Flag anomalous activity with CloudTrail and GuardDuty



Control and monitor admin access with AWS IAM



Simplify file audit logging with CloudWatch Logs and Kinesis



Industry-standard compliance eligibility

PCI-DSS, ISO, SOC, IRAP, GDPR, HIPAA, FedRAMP

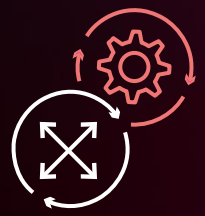
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C Optimize and fine-tune TCO



Pay only for the resources you use



Use the most optimized service for each workload



Benefit from continual price-performance improvements



Benefit from the lowest-cost NAS options in the cloud

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C Optimize and fine-tune TCO

THE LOWEST-COST NAS OPTIONS IN THE CLOUD: CAPACITY NAS

	Lowest-cost fully managed . . .	ONTAP-based NAS in the cloud	NAS in the cloud for Windows workloads
		 NetApp ONTAP	 Windows File Server
Example storage pricing (per GB-month)		2.2 cents (capacity pool)	1.3 cents (HDD)
With data compression / deduplication (per GB-month)		0.77 cents (capacity pool)	0.65 cents (HDD)

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C Optimize and fine-tune TCO

THE LOWEST-COST NAS OPTIONS IN THE CLOUD: PERFORMANCE NAS

	Lowest-cost fully managed . . .	SSD-based NAS in the cloud
		FSx for OpenZFS
Example storage pricing (per GB-month)		9 cents (SSD)
With data compression (per GB-month)		4.5 cents (SSD)

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D Increase agility



Deploy, run, and scale storage in minutes (vs. days/weeks)



Test and build with no strings attached



Easily spin up separate storage for each team/project

- Facilitate rapid, cost-effective experimentation
- React to changing business needs more quickly
- Simplify upfront planning

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E Automate your storage deployments



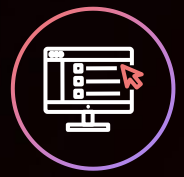
Deploy infra-as-code with CloudFormation



Standardize and automate storage deployments



Automate, test, and deploy infrastructure with CI/CD



Enable end-users to create their own file systems based on pre-approved templates

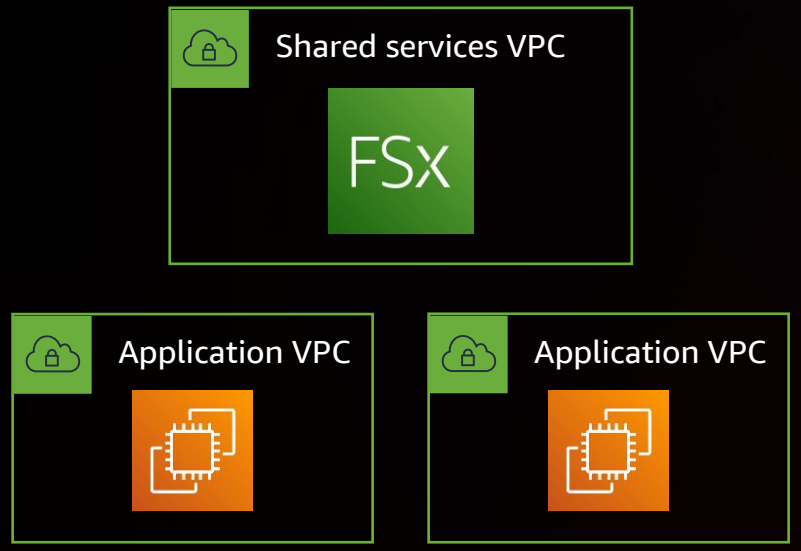
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E Automate your storage deployments

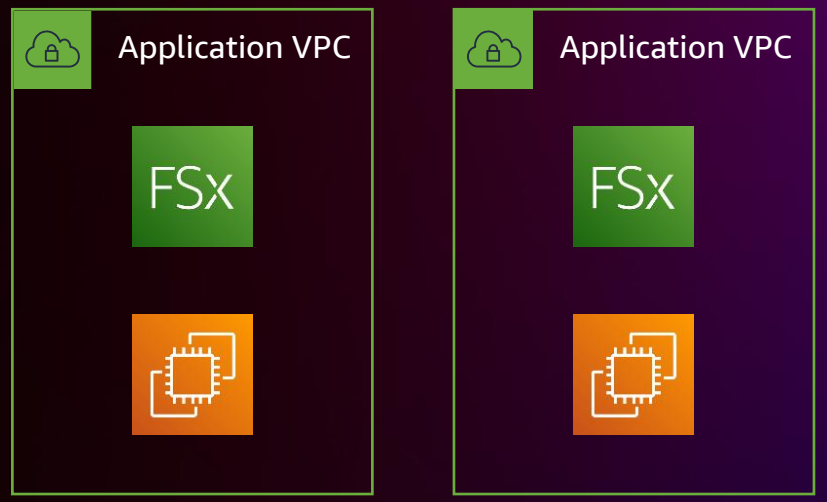
FILE SYSTEM DEPLOYMENT PATTERNS IN AWS

Centrally owned storage



- Storage owners can spend less time managing infrastructure and more time onboarding and supporting application teams

End-user-owned storage



- Storage owners create repeatable and pre-approved deployment patterns for application teams to use
- Application owners can scale and test even faster

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F Leverage innovative, new data processing in the cloud

A FEW EXAMPLES



Intelligently search files with Amazon Kendra



Automate data movement using AWS DataSync



Produce media content with Amazon Nimble Studio



Run modern, containerized workflows (Amazon ECS, EKS)



Automate SAP & SQL Server deployments using AWS Launch Wizard

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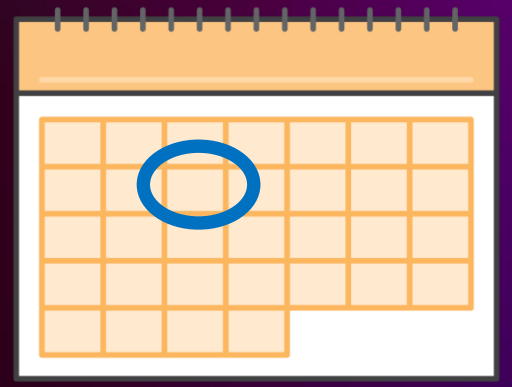
Vanguard's move to NAS in the cloud with Amazon FSx

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Vanguard: Background

One of the world's largest investment companies, offering a large selection of low-cost mutual funds, ETFs, advice, and related services





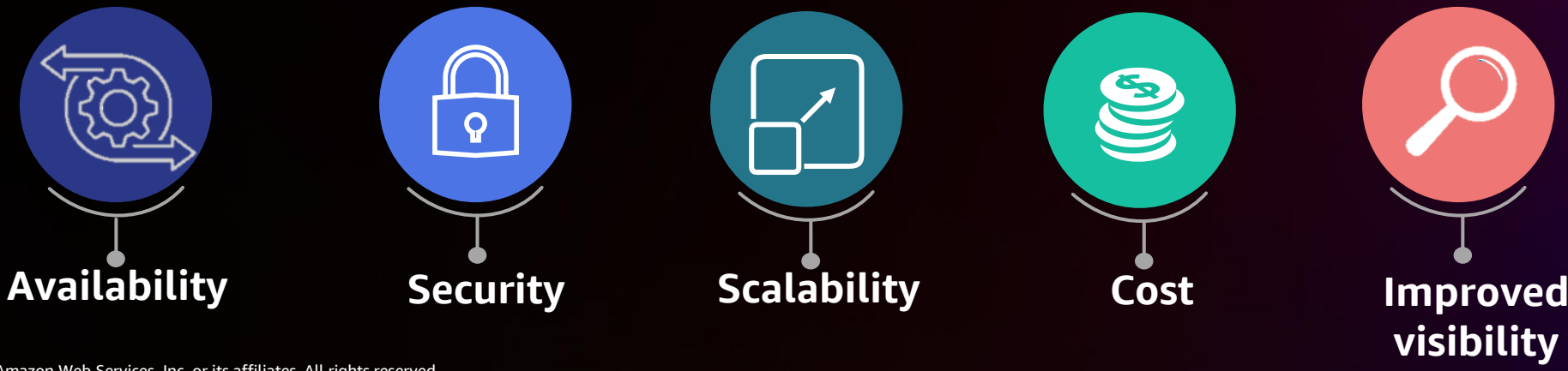
Began operations on May 1, 1975, in Valley Forge, PA

Headquartered in Malvern, PA, with operations in Arizona; London, UK; and Sydney, Australia

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Vanguard's file storage journey

- Since 2016, Vanguard has embarked on a journey to modernize our applications, systems, and data and migrate to the public cloud
- Our file storage hardware was set to go end of life at the end of 2023, and we were looking at a new 5-year purchase
- Evaluated solutions to meet both current and future requirements including continuing to host on premises or migrating to the cloud
- At re:Invent 2021, Vanguard spoke to AWS and NetApp about the challenges we were facing, and we picked the solution they had partnered on and delivered together



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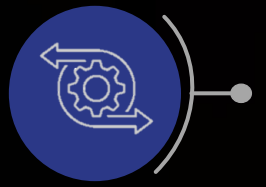
Vanguard's storage solution: FSx for NetApp ONTAP



Data security with end-to-end encryption (at-rest on FSx and in-transit via NetApp FlexCache and AWS Direct Connect)



Seamless capacity scaling by utilizing elastic Capacity Pool Storage on FSx



Ability to automate Multi-Region replication with failover/failback via NetApp SnapMirror improves Vanguard's cross-region recovery capabilities



Tiering and elasticity have enabled cost savings over time as users and applications migrate storage

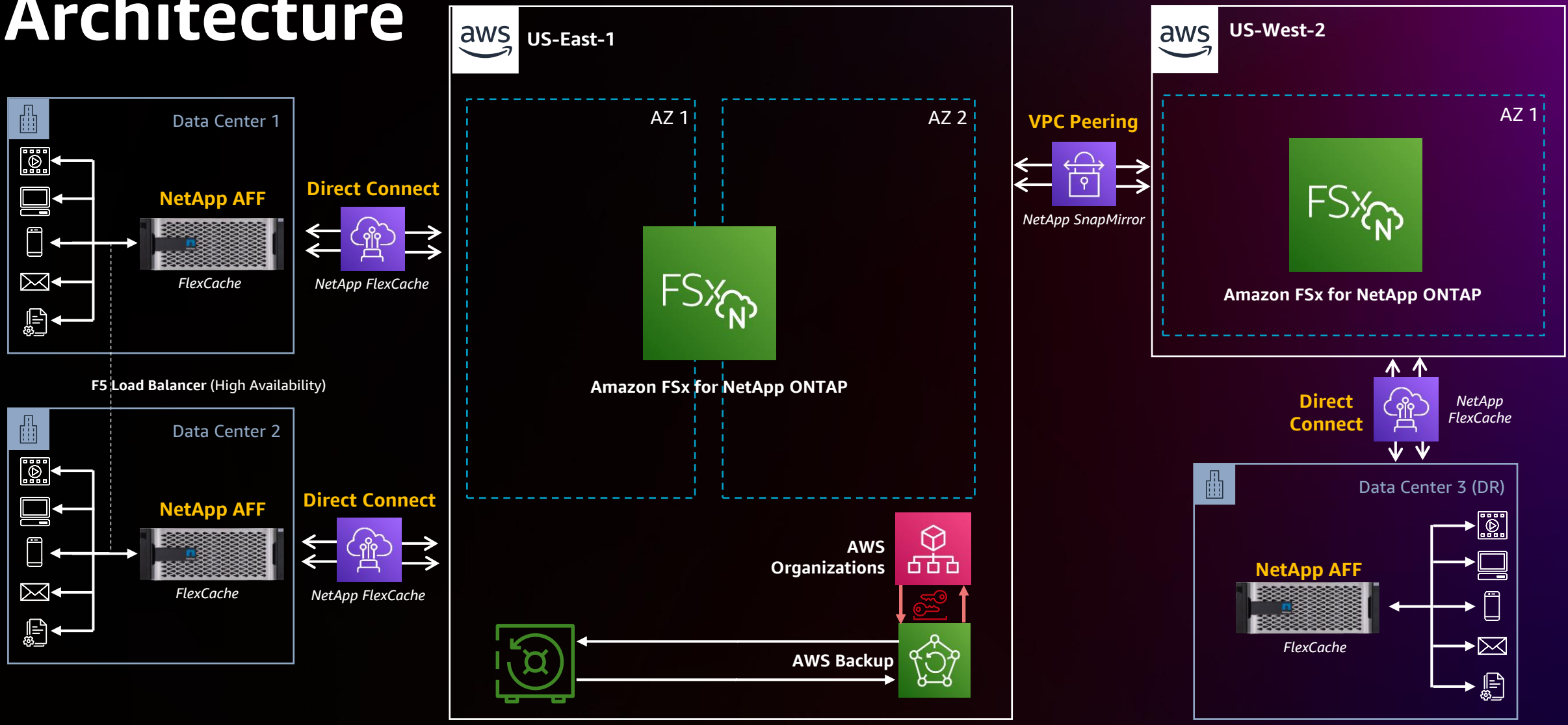


Improved visibility into users and applications allows Vanguard to better service end customers

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Vanguard file storage modernization: Architecture



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Thank you!

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