Introduction to Storage on AWS

Agenda

- Introduction
- Storage Primer
- Block Storage
- Shared File Systems
- Object Store
- Data Transfer and Edge Processing
- Backup
- Elastic Disaster Recovery Service

Introduction: Why choose AWS for storage

Compelling Economics

Pay as you go

No risky capacity planning

No need to provision for redundancy or overhead

Easy to Use

Self service administration

SDKs for simple integration

No Commitment

Reduce risk

Durable and Secure

Avoid risks of physical media handling

Speed, Agility, Scale

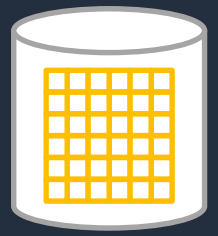
Reduce time to market

Focus on your business, not your infrastructure

Global Scale

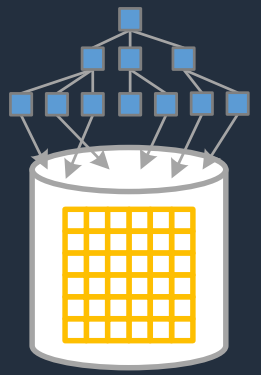
Storage Primer

Block vs File vs Object



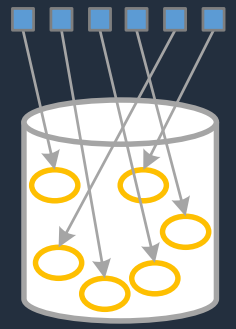
Block Storage

Raw Storage
Data organized as an array of unrelated blocks
Host File System places data on disk
Ex: Hard Disks, Storage Area Network (SAN) Storage Arrays



File Storage

Unrelated data blocks managed by a file (serving) system
Native file system places data on disk
Ex: Network Attached Storage (NAS) Appliances, Windows File Servers, NetApp OnTap



Object Storage

Stores Virtual containers that encapsulate the data, data attributes, metadata and Object IDs
API Access to data
Metadata Driven, Policy-based, etc.
Ex: Ceph, OpenStack Swift

aws

Storage - Characteristics

Some of the ways we look at storage

Durability	Availability	Security	Cost	Scalability	Performance	Integration
Measure of expected data loss	Measure of expected downtime	Security measures for at-rest and in-transit data	Amount per storage unit, e.g. $ / GB	Upward flexibility, storage size, number of users	Performance metrics (bandwidth	Ability to interact via API or with other services

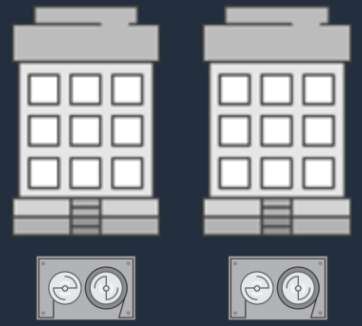
Understanding Durability

Two copies on one site

designed for

99.99%

durability



Copies on two sites

designed for

99.999%

durability

copies in three AZ

designed for

99.999999999%

durability

Availability vs Durability

%	Availability	Durability
99.999	5 minutes 15 seconds	1 in 100,000
99.9999	31 seconds	1 in 1,000,000
99.99999	3 seconds	1 in 10,000,000
99.999999999	300 uSeconds	1 in 100,000,000,000

More choice for more applications

Block storage

General Purpose SSD

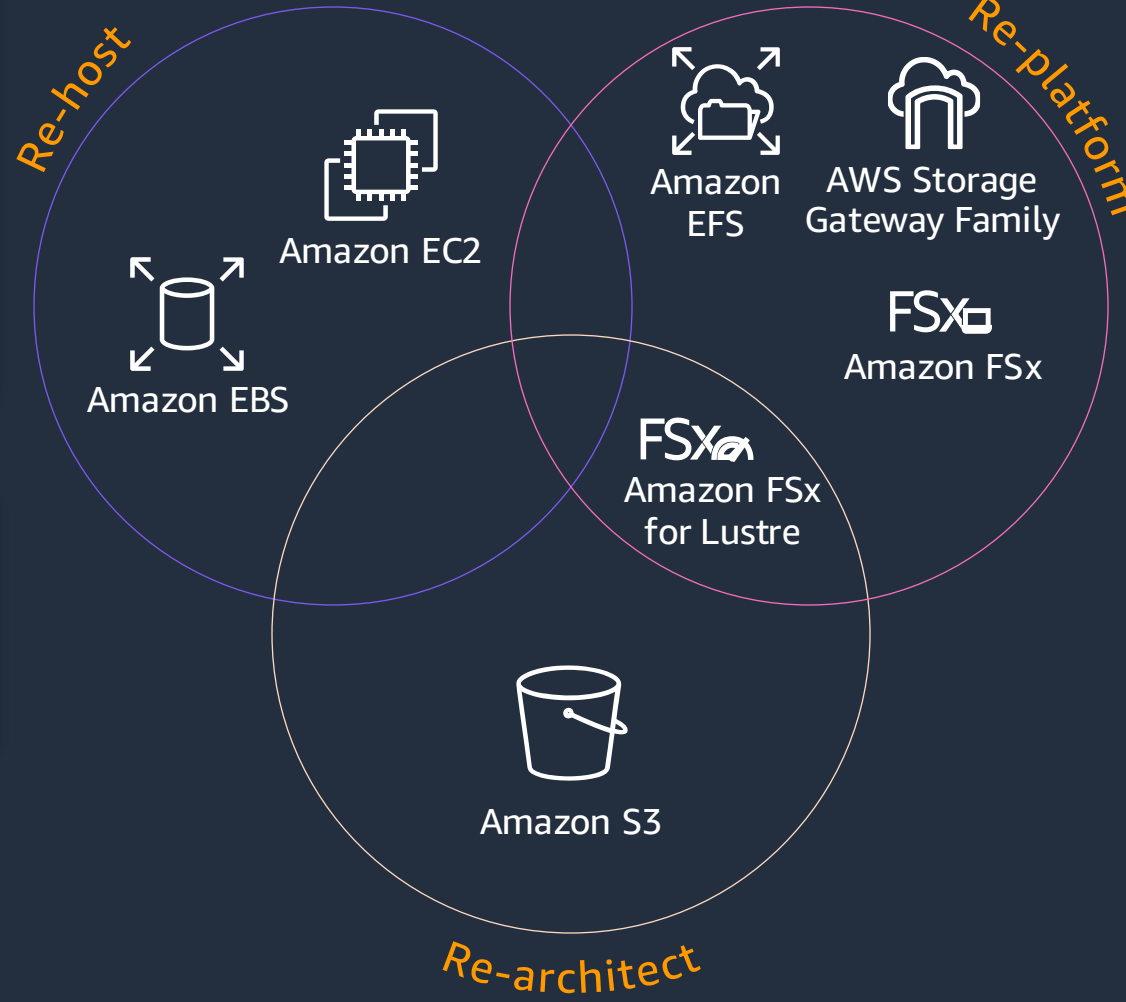
Provisioned IOPS SSD

Throughput-Optimized HDD

Cold HDD

Backup

AWS Backup



File storage

EFS

FSx for OnTap

FSx for Windows

FSx for Lustre

FSx for OpenZFS

Object storage

S3 Standard

S3 Standard-IA

S3 One Zone-IA

S3 Intelligent-Tiering

S3 Glacier Instant Retrieval

S3 Glacier Flexible Retrieval

S3 Glacier Deep Archive

AWS delivers broadest storage portfolio in industry

OBJECT

Amazon S3

BLOCK

Amazon EBS

FILE

Amazon EFS

Amazon FSx for Windows File Server

Amazon FSx for Lustre

Amazon FSx for NetApp ONTAP

Amazon FSx for OpenZFS

Amazon File Cache

BACKUP

AWS Backup

DATA TRANSFER AND EDGE PROCESSING

AWS Storage Gateway

AWS DataSync

AWS Transfer Family

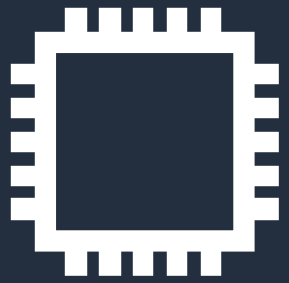
AWS Snowmobile

AWS Snowball Edge

AWS Snowcone

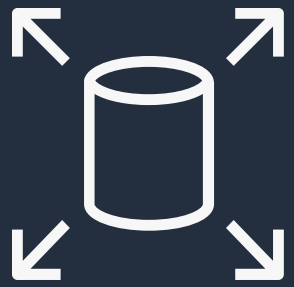
Block Storage

Block storage portfolio



Instance storage

Temporary block-level storage attached to host hardware that is ideal for storage of information that frequently changes or is replicated across multiple instances



Amazon EBS

Easy to use, high performance block storage service designed for use with Amazon Elastic Compute Cloud (EC2) for both throughput and transaction intensive workloads

Snapshots

Incremental, point-in-time copies of your EBS data that can be used to restore new volumes, expand the size of a volume, or move volumes across Availability Zones

EBS is designed for a wide range of workloads on EC2

Enterprise applications	Relational databases	Non-relational/ NoSQL databases	Big data analytics	File/media
				
SAP ERP, Oracle ERP, Microsoft SharePoint, Microsoft Exchange	MySQL, PostgreSQL, SQL Server, Oracle DB, SAP HANA	Cassandra, MongoDB, CouchDB	Kafka, Splunk, Hadoop, Data warehousing	CIFS/NFS, transcoding, encoding, rendering

LOW LATENCY AND CONSISTENT, HIGH IOPS AND THROUGHPUT

SCALABLE WITHOUT DISRUPTION TO YOUR WORKLOAD

99.999% AVAILABILITY AND AN ANNUAL FAILURE RATE (AFR) OF BETWEEN 0.1%–0.2%

Easy to use, high performance block storage at virtually any scale

Performance for any workload

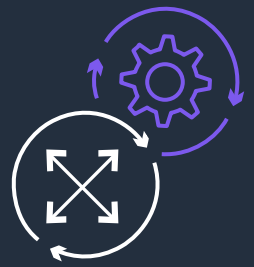
Up to 256,000 IOPS, single digit millisecond latency, 4,000 MiB/s Throughput

Easy to use

Easily add/remove capacity, or change volume types with Elastic Volumes

High reliability

99.999% availability and an annual failure rate of between 0.1%–0.2%



Virtually unlimited scale

Use a single gigabyte or less, or scale up to petabytes of data

Secure

Encrypt all new volumes and data for a region by default with a single setting

Cost-effective

Pay as low as $0.015/GB-month for highly cost-effective dollar per gigabyte block storage

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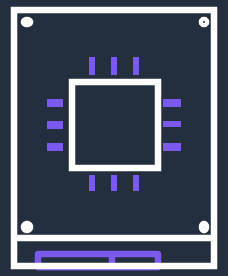
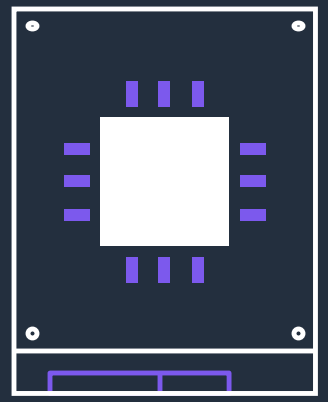
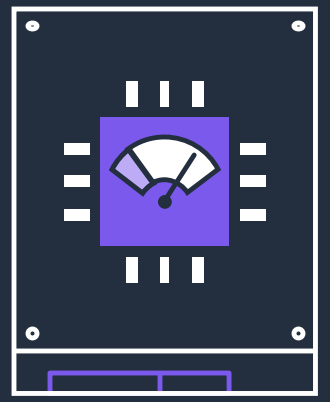
Six different volume types for optimal use



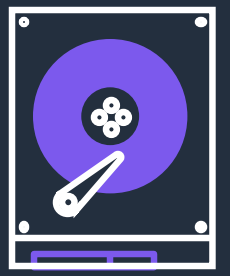
SSD



gp2 – gp3
General Purpose SSD



io1 – io2
Provisioned IOPS SSD

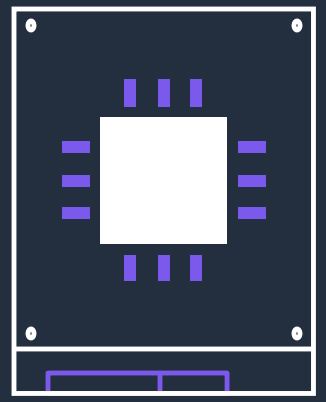


HDD

st1
Throughput Optimized HDD

sc1
Cold HDD

General Purpose SSD - gp2



gp2

General Purpose SSD

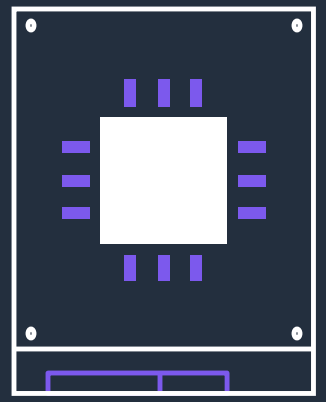
- **Use cases:** Most workloads, relational and non-relational database workloads, boot volumes, development and test environments, virtual desktops
- **Volume size:** 1 GB–16 TB
- **Durability:** 99.8% - 99.9%
- **IOPS/volume*:** 16,000
- **Max throughput/volume*:** 250 MB/s
- **Pricing**:** $0.10 per GB-month of provisioned storage

*Throughput limit is between 128 MB/s & 250 MB/s, depending on volume size

**Pricing is for US East (N. Virgina) Region

aws

General Purpose SSD gp3



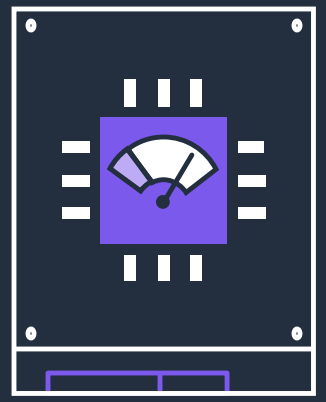
gp3

General Purpose SSD

- **Use cases:** Latest generation general-purpose SSD-based EBS volumes. Provision performance independent of storage capacity, while providing up to 20% lower pricing per GB than existing gp2 volumes.
- **Volume size:** 1 GB–16 TB
- **Durability:** 99.8% - 99.9%
- **IOPS/volume*:** 16,000
- **Throughput/volume*:** 1,000 MB/s
- **Pricing**:** $0.08 per GB-month of provisioned storage, 3,000 IOPS free and $0.005/provisioned IOPS-month over 3,000

**Pricing is for US East (N. Virgina) Region

Provisioned IOPS SSD io1



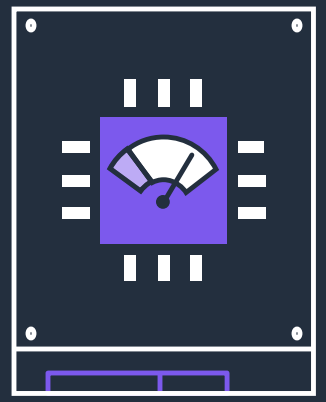
io1

Provisioned IOPS SSD

- **Use cases:** Large database workloads, mission-critical business applications requiring sustained high performance – Supports Multi-Attach
- **Volume size:** 4 GB–16 TB
- **Durability:** 99.8% - 99.9%
- **Max IOPS/volume*:** 64,000
- **Max throughput/volume*:** 1,000 MB/s
- **Pricing**:** $0.125 per GB-month of provisioned storage
  $0.065 per provisioned IOPS-month

**Pricing is for US East (N. Virgina) Region

Provisioned IOPS SSD io2



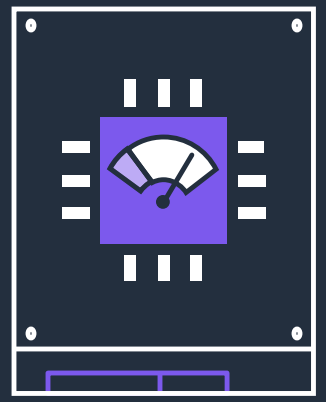
io2

Provisioned IOPS SSD

- **Use cases:** Latest generation of the Provisioned IOPS SSD volumes that is designed to provide 100X durability of 99.999% as well as a 10X higher IOPS to storage ratio of 500 IOPS for every provisioned GB –at the same price as the previous generation (io1) – Supports Multi-Attach
- **Volume size:** 4 GB–16 TB
- **Durability:** 99.999%
- **Max IOPS/volume*:** 64,000
- **Max throughput/volume*:** 1,000 MB/s
- **Pricing**:** $0.125 per GB-month of provisioned storage $0.065 per provisioned IOPS-month up to 32,000 IOPS, $0.046 per provisioned IOPS-month up to 64,000 IOPS

**Pricing is for US East (N. Virginia) Region

Provisioned IOPS SSD io2 Block Express



io2 Block Express

Provisioned IOPS SSD

- **Use cases:** io2 Block Express offers the highest performance block storage in the cloud with 4x higher throughput, IOPS, and capacity than io2 volumes, along with sub-millisecond latency. Block Express is the next generation of Amazon EBS storage server architecture purpose-built to meet the performance and latency requirements of the most demanding applications.

- **Volume size:** 4 GB–64 TB
- **Durability:** 99.999%
- **Max IOPS/volume*:** 256,000
- **Max throughput/volume*:** 4,000 MB/s

- **Pricing*:** $0.125 per GB-month of provisioned storage
  $0.065 per provisioned IOPS-month up to 32,000 IOPS,
  $0.046 per provisioned IOPS-month up to 64,000 IOPS,
  $0.032 per provisioned IOPS-month greater than 64,000 IOPS

*Pricing is for US East (N. Virginia) Region

aws

Throughput Optimized HDD for frequently accessed, throughput-intensive workloads

st1

Throughput Optimized HDD

- **Use cases:** st1 is backed by hard disk drives (HDDs) and is ideal for frequently accessed, throughput-intensive workloads with large datasets and large I/O sizes, such as MapReduce, Kafka, log processing, data warehouse, and ETL workloads.

- **Volume size:** 125 GB–16 TB
- **Durability:** 99.8% - 99.9%
- **Max IOPS/volume*:** 500
- **Max throughput/volume*:** 500 MB/s

- **Pricing**:** $0.045 per GB-month of provisioned storage

**Pricing is for US East (N. Virginia) Region

Cold HDD for infrequently accessed workloads

sc1

Cold HDD

- **Use cases:** sc1 is backed by hard disk drives (HDDs) and provides the lowest cost per GB of all EBS volume types. It is ideal for less frequently accessed workloads with large, cold datasets.

- **Volume size:** 125 GB–16 TB
- **Durability:** 99.8% - 99.9%
- **Max IOPS/volume*:** 250
- **Max throughput/volume*:** 250 MB/s

- **Pricing**:** $0.015 per GB-month of provisioned storage

**Pricing is for US East (N. Virginia) Region

aws

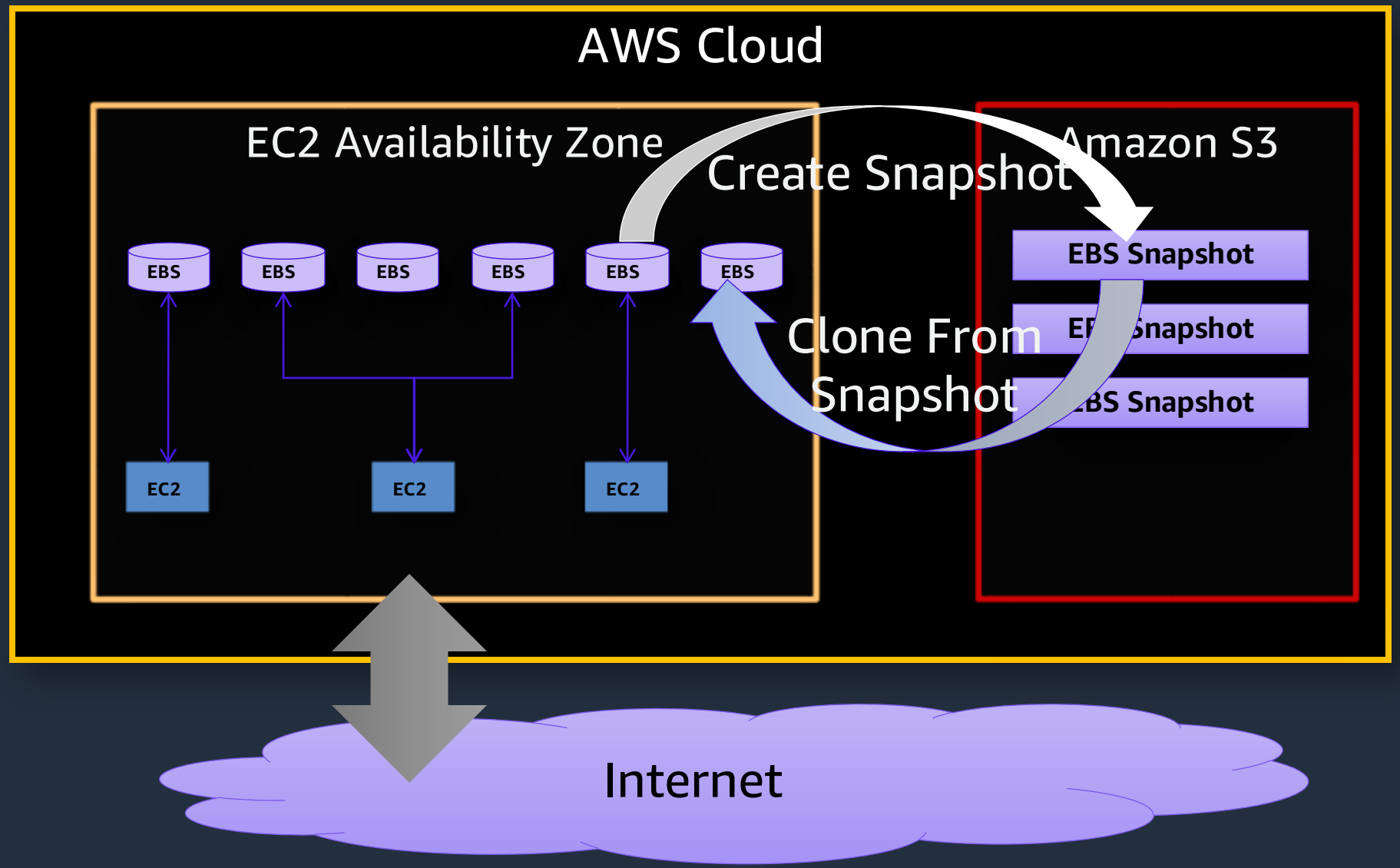
Fully managed backup with EBS Snapshots

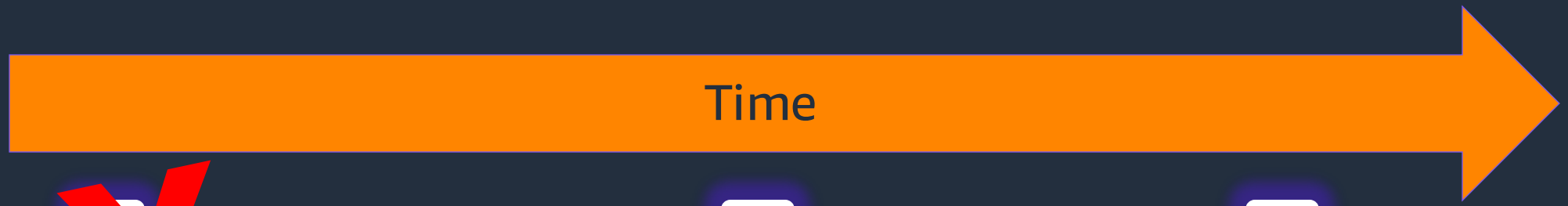
Low cost
Incremental backups do not duplicate data and reduce storage costs

Protection
Snapshots are stored in Amazon S3

Agility
Quickly restore volumes across Availability Zones within a region

EBS Snapshots – Delta Block Changes

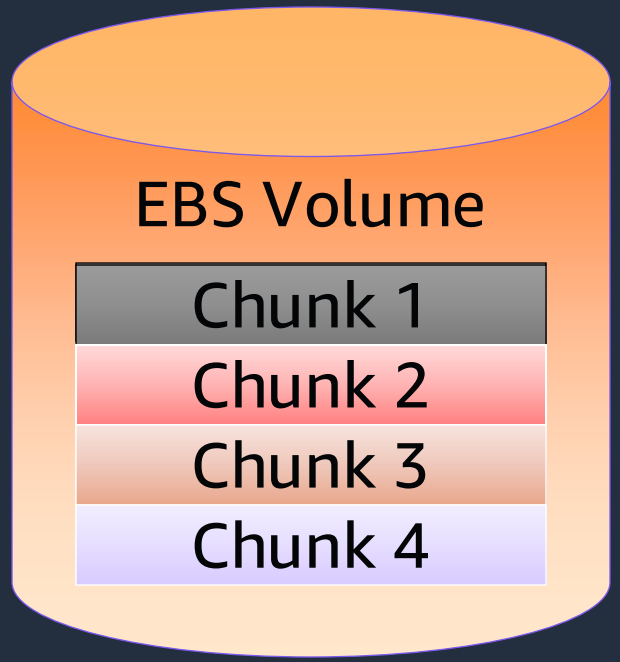


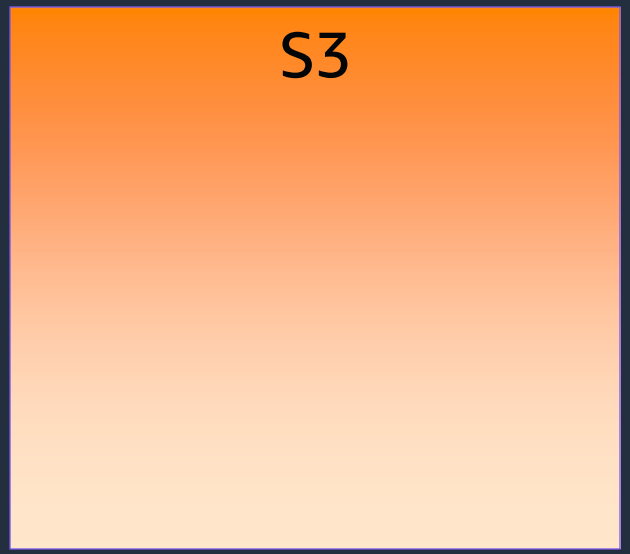


Snapshot

Snapshot

Snapshot





What is Amazon EC2 instance store?

- Local to instance
- Non-persistent data store
- Available on several EC2 families
- Data is not replicated (by default)
- No snapshot support
- SSD or NVMe
- Pricing is included in instance cost

Shared file system

Amazon Elastic File System

Amazon Elastic File System (Amazon EFS)

Simple, serverless, set-and-forget, elastic file system for AWS compute

Serverless shared storage

Serverless and scalable

No provisioning, scale capacity, connections, and IOPS

Full AWS compute integration

EC2 Instances, containers, and serverless

Supports 10,000s of connections

Simple and highly reliable

Elastic

Pay only for capacity used

Performance built-in, scales with capacity

Highly durable and available

Designed for 11 9s of durability

99.99% availability SLA

Performant and cost-optimized

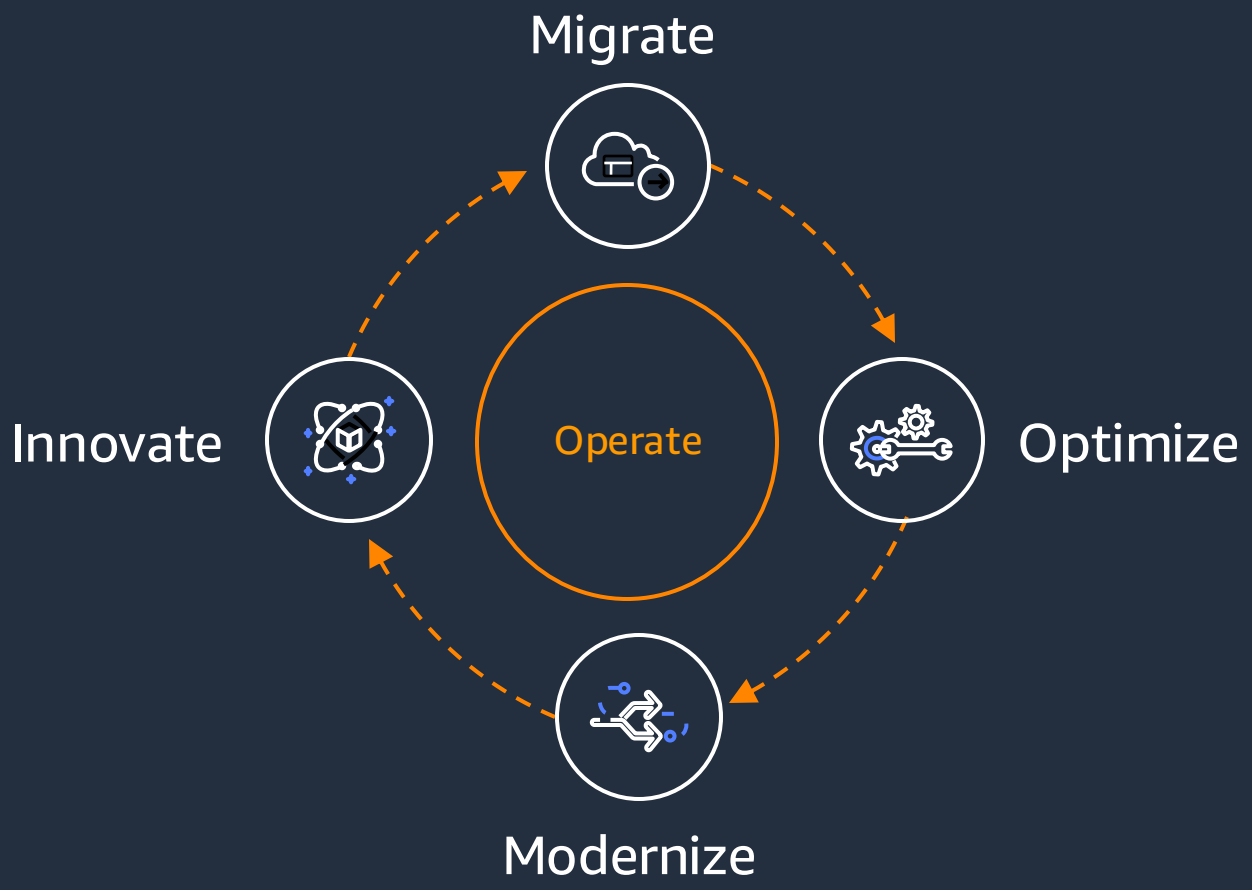
Performant

10s of GB/s of throughput and 500,000+ IOPS

Four storage classes

Automatic lifecycle-based cost optimization

Amazon EFS meets you where you are today and tomorrow



Migrate: lift and shift to AWS cloud without refactoring application

Optimize: enable cost efficiency

Modernize: build micro-services into application with common data platform

Innovate: improve development efficiency, build new features, enter new markets

Use cases for Amazon EFS

Home directories

DevOps

Application dev. & test

Enterprise apps

Database backups

Web serving & content mgmt.

Analytics

Machine learning

Media workflows

Business Criticality

Metadata-intensive jobs

Scale-out jobs

Low latency and serial I/O

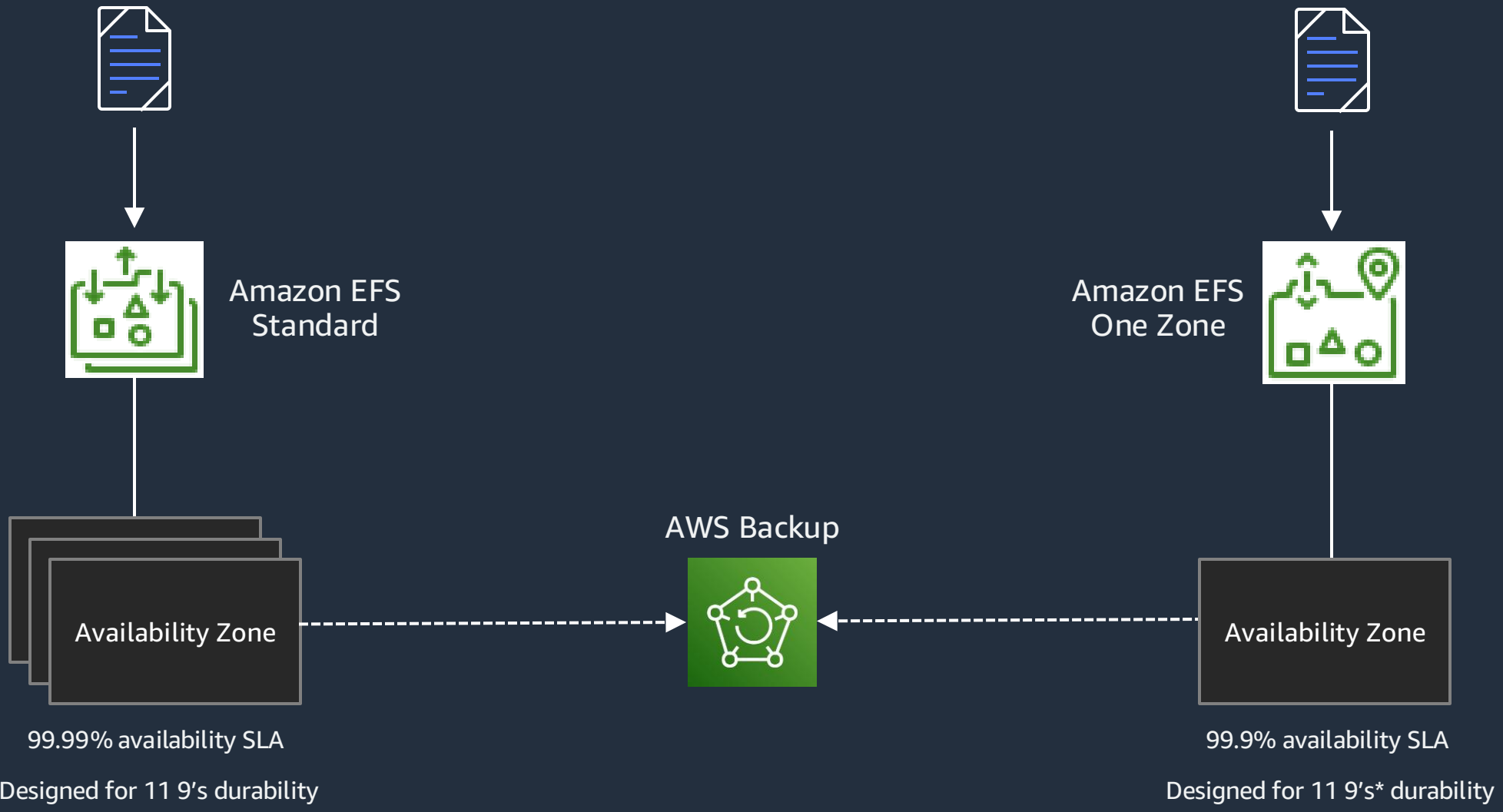
High throughput and parallel I/O

Accelerate modernization and innovation

Highly integrated, serverless shared access

Build and deploy with confidence

Highly available and durable



* Data stored in these storage classes may be lost in the event of a disaster or other fault that affects all copies of the data within the Availability Zone (AZ), or in the event of AZ destruction.

Performance that scales with your application

Amazon EFS can scale up to 10s of GB/s of throughput and unlimited IOPS

Performance Modes

General Purpose
Up to 35K read and 7K write IOPS

Max I/O
Unlimited IOPS (at the file system)

Throughput Modes

Bursting Throughput
Auto-scale throughput based on storage

Provisioned Throughput
User-defined throughput independent of storage.
Additional charges apply.

Automatic cost optimization

Using EFS storage classes and lifecycle management

$0.043/GB-Month*
Effective storage cost

$0.08/GB-Month*
Effective storage cost

EFS One Zone
$0.043/GB-month*

EFS Standard
$0.30/GB-month*

EFS One Zone-IA
Cost-optimized for less accessed files
$0.01333/GB-month* for storage
$0.01/GB* for access

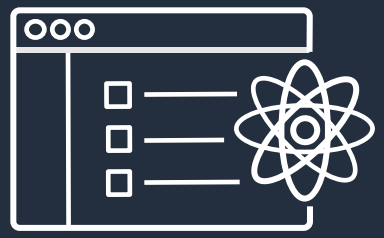
EFS Standard-IA
Cost-optimized for less accessed files
$0.025/GB-month* for storage
$0.01/GB* for access

*Pricing in the US East (N. Virginia) Region. Assumes 80% of the files are infrequently accessed

aws

Amazon FSx

Amazon FSx for Windows File Server



Fully managed file storage built on Windows Server

Easy migration to AWS

Fully managed Windows file storage means you no longer have to …

Managed hardware

Plan capacity

Procure and purchase hardware

Set up storage servers and volumes

Detect and address hardware failures

Incur high upfront costs

Managed software

Install and configure server software

Set up and configure file systems

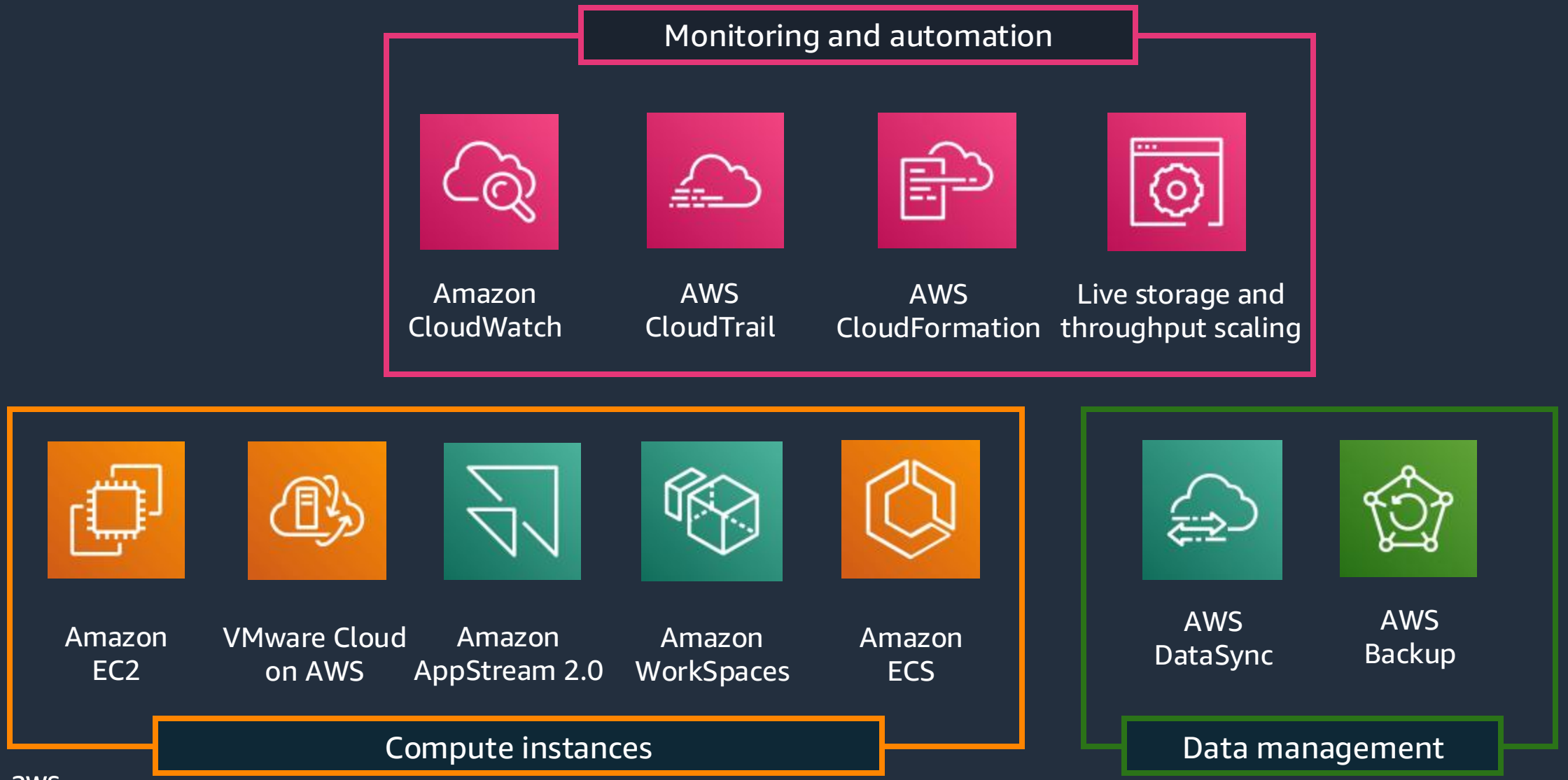
Apply Windows updates

Manage software licenses

Manage backups

Monitor security

Agile, scalable, and automated



Flexible price and performance options

- Storage type flexibility (SSD / HDD)
- Deployment type flexibility (Single-AZ / Multi-AZ)
- Select throughput and storage independently
- Choice of in-line snapshots and backups stored in S3
- Data deduplication and compression

Fully featured, secure, reliable, and scalable

Accessibility
✓ Full SMB protocol support
✓ Windows Server 2008+, Windows 7+, Linux, and MacOS
✓ EC2, WorkSpaces and AppStream 2.0
✓ VMware Cloud on AWS
✓ Amazon ECS and Amazon EKS containers
✓ Cross-VPC / Account / Region access
✓ On-premises access (DirectConnect / VPN)

Administration
✓ Active directory integration
✓ Managing file shares
✓ Monitoring user sessions and open files
✓ Restoring locked files
✓ User storage quotas
✓ Monitoring actions via AWS CloudTrail

Availability and durability
✓ High availability – automatic recovery
✓ High durability – automatic replication
✓ Multi-AZ deployment option
✓ SMB continuous availability (CA)

Performance and scale
✓ Consistent, sub-millisecond latencies
✓ PB-scale storage scalability
✓ Tens of GB/s throughput scalability
✓ Millions of IOPS scalability
✓ Select throughput and storage independently
✓ Server-side and client-side caching
✓ SMB Multichannel
✓ Performance monitoring via CloudWatch
✓ Live scaling of throughput capacity

Cost optimization
✓ Storage type flexibility (SSD / HDD)
✓ Deployment type flexibility (Single-AZ / Multi-AZ)
✓ Live scaling of storage capacity
✓ Data deduplication and compression

Data protection
✓ Snapshots (with end-user file restore)
✓ Backups

Security and compliance
✓ Encryption at rest and in transit
✓ Kerberos authentication
✓ Access controls via NTFS ACLs, share ACLs, VPC, and IAM
✓ PCI DSS, ISO, SOC, GDPR, IRAP, and HIPAA compliances

Amazon FSx for Lustre

Fully managed Lustre file system for high performance workloads

Massively scalable performance

Seamless access to your data repositories

Simple and fully managed

Native file system interface

Cost-optimized for compute-intensive workloads

Secure and compliant

Customers continue to increase the size of their workloads on AWS across industry verticals and application areas

Industries and example use cases

Financial services:
Modeling and analytics

Life Sciences:
Genome analysis

Media and Entertainment:
Rendering and transcoding

Automotive:
ECU simulations and object detection

Semiconductor:
Electronic design automation

Oil and gas:
Seismic data processing

Application areas

Big data analytics

Machine learning

High-performance computing

For every $1 spent on high performance computing, businesses see $463 in incremental revenues and $44 in incremental profit[1]

FSx for Lustre deployment options

High and scalable performance

Amazon FSx for Lustre
SSD Scratch file system

Amazon FSx for Lustre
SSD Persistent file system

Amazon FSx for Lustre
HDD Persistent file system

In all options, we support encryption at-rest and in-transit*

Multiple FSx for Lustre throughput options and deployment types allow customers to optimize storage cost and performance

Storage type	Baseline throughput	Price per GB-month (in IAD) [1]	
		Persistent storage	Scratch Storage
HDD	12 MB/s/TiB	$0.025 $0.041 (with SSD cache)	-
	40 MB/s/TiB	$0.083 $0.099 (with SSD cache)	-
SSD	125 MB/s/TiB	$0.145	-
	250 MB/s/TiB	$0.210	-
	500 MB/s/TiB	$0.340	-
	200 MB/s/TIB		$0.140

- Scratch file systems are ideal for temporary storage and shorter-term processing of data.
- Data is not replicated and does not persist if

- File systems with SSD storage can burst up to 1.3 GB/s per TiB

Sample pricing for - US East (N. Virginia)

[1] *Prices are subject to change without notice. Pricing varies by AWS Region. For current pricing information, see the Amazon FSx for Lustre Pricing page on the AWS website.*

aws

What is Amazon FSx for NetApp ONTAP?

Fully-featured NetApp ONTAP

With the simplicity, agility, and scalability of an AWS service

Amazon FSx for ONTAP: Benefits

Launch and run fully managed file storage built on NetApp ONTAP

Familiar and fully managed

- Fully Managed
- Use AWS and NetApp tools
- Data replication (SnapMirror),snapshot (SnapVault), caching (FlexCache), and cloning (FlexClone) capabilities

Fast and cost effective

- Multiple GB/s throughput, 100K+ IOPS, sub-ms latencies
- Automatic tiering to low cost, reduce costs 90%
- Deduplication, compression, compaction, thin provisioning

Accessible and Integrated

- Multi-protocol (NFS, SMB, iSCSI)
- Accessible from Linux, Windows, MacOS
- EC2, EKS, Workspaces, Appstream 2.0, VMware Cloud
- Concurrent, multi-protocol access

Secure and Compliant

- Encrypted at-rest and in-transit
- Integration with software for Anti-Virus and Auditing
- Active Directory for identity-based authentication
- ISO, PCI-DSS, SOC compliant and HIPPA eligible

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Amazon FSx for NetApp ONTAP: Automatic performance and cost optimization

Intelligent policy-based data movement between tiers

Primary Tier

SSD, Multi-AZ

Up to 192 TB

Optimized for performance

~20%

Bi-directional data movement based on access patterns (hot/cold)

Capacity Pool Tier

Elastic, Multi-AZ

Unlimited capacity (PB+ file systems)

Cost-optimized for less accessed files

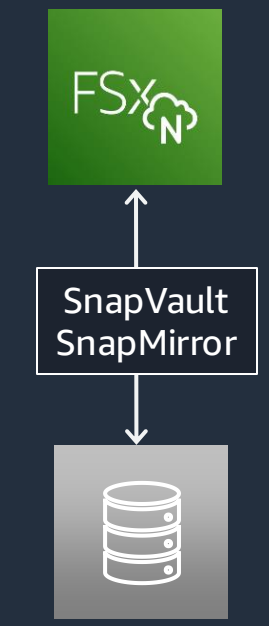
~80%

Automated Tiering Policies

- Snapshot-only (default)
- None
- Auto
- All

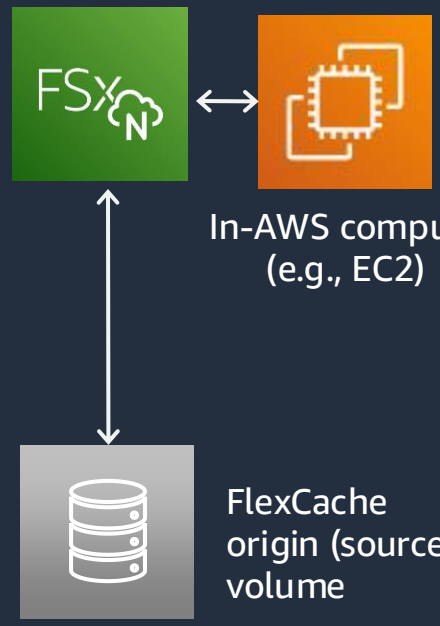
Amazon FSx for ONTAP: Getting Started

Backup, DR Migration



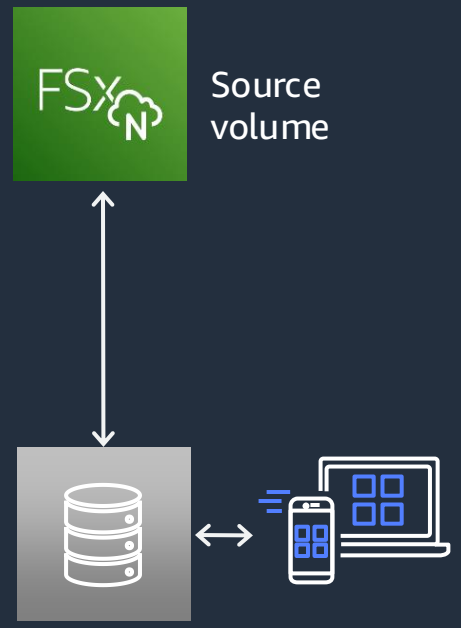
On-prem ONTAP

Hybrid: Cloud bursting



On-prem ONTAP

Hybrid: On-prem caching



On-prem FlexCache
or Global File Cache

On-prem
compute

Cross-region

Replication (in-cloud DR)

Region A Region B

Low-latency caching

Region A Region B

Amazon FSx for NetApp ONTAP: Pricing Dimensions

Provisioned pricing dimensions

- SSD storage ($0.250 per GB-month)
- Throughput capacity ($1.200 per MBps-month)
- [Optional] SSD IOPS $0.0340 per IOPS-month)

Elastic pricing dimensions

- Capacity pool storage ($0.0438 per GB-month stored)
- Capacity pool requests $0.0004 per 1,000 read requests
- Capacity pool requests $.005 per 1,000 write requests
- Backup storage ($0.05 per GB-month stored)

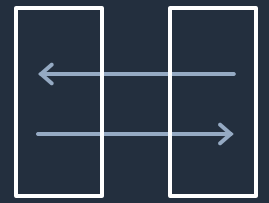
Introducing Amazon FSx for OpenZFS

FSx for ZFS

Shared file storage that delivers **high speeds at a low cost**, accessible through NFS

Built on the **AWS Graviton** family of processors and the popular open-source **OpenZFS** file system

Deliver results faster with high-performance storage



	Latency	IOPS	Throughput
What is it?	Average time to return the first byte of data	Number of operations (I/O) per second	Amount of data transferred per second
What can **FSx for OpenZFS** deliver?	Latencies of a **few hundred microseconds**	Up to **1 million IOPS**	Up to **12.8 GB/s**
When is it important?	Sequential transaction-heavy applications like code repositories (Git) and content management systems (Wordpress)		Scalable data-intensive workloads like data and analytics, as well as ML

Do more with less and adapt faster to changing business needs

Storage and performance scaling in minutes*

SSD storage
$0.09/GB-month
($0.045/GB-month w/ compression*)

Zstandard compression (reduce storage usage by up to ~50%)

Throughput
$0.26/ MBps-month

*Pricing assumes average compression savings of ~50% and is an effective price.
*Pricing is for Single-AZ

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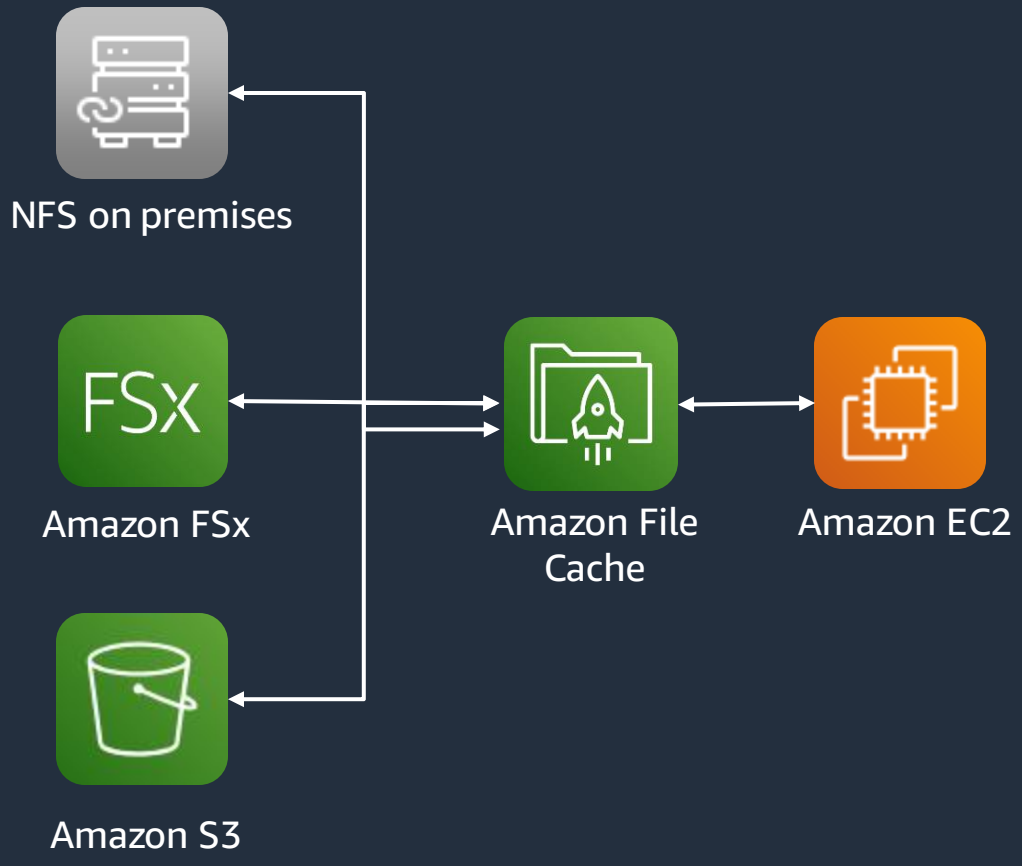
Amazon File Cache

Amazon File Cache

HIGH-SPEED CACHE FOR FILE SYSTEMS



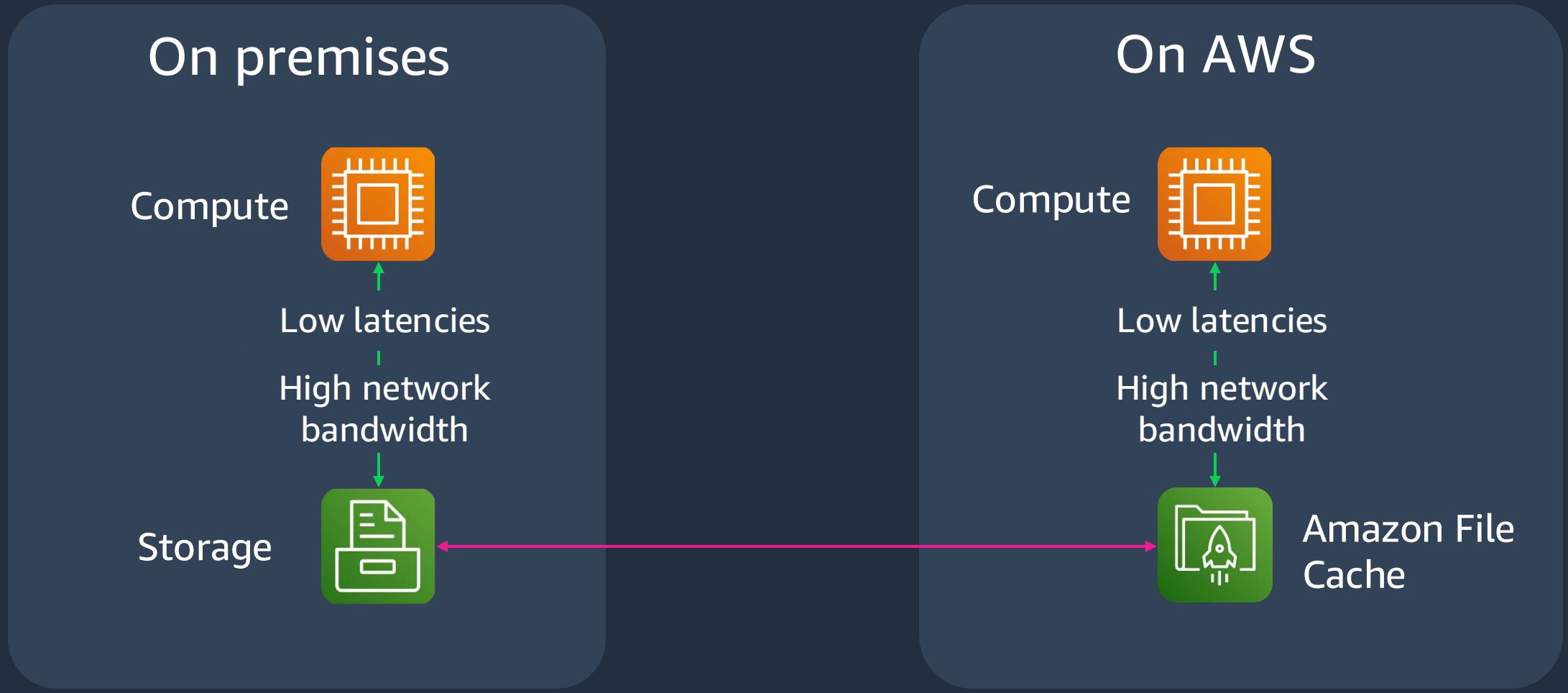
Fast – highly scalable performance

Agile – flexible data access across on-premises, AWS file, and Amazon S3 datasets

Simplified – fully managed, cost effective

Amazon File Cache

FAST ACCESS REGARDLESS OF WHERE YOUR DATASETS ARE STORED



Benefits

Fast

Accelerate workloads

Sub-millisecond latency, millions of IOPS, and hundreds of GB/s of throughput

Agile

Use anywhere

Seamless data access regardless of where your datasets are stored (cloud or on premises)

Simplified

Unify datasets

Link network file systems (NFS) or Amazon S3 buckets for a single view of multiple datasets

Use case: unify disperse datasets in a single view

ACCESS MULTIPLE DATASETS IN A SINGLE PANE OF GLASS AS A FAST FILE INTERFACE

File Cache Pricing

Storage

1000 MB/s/TiB - $1.330 per GB-month*

Data transfer within the same AWS Region

Data transferred "in" to and "out" from Amazon File Cache across Availability Zones or VPC Peering connections in the same AWS Region is charged at $0.01/GB in each direction.*

Data transfer across regions

Data transfer across regions is $0.02**

*Pricing is for US East (N. Virgina) Region

** Prices vary by region

aws

Object Stores

Amazon S3

Amazon S3 (Simple Storage Service)

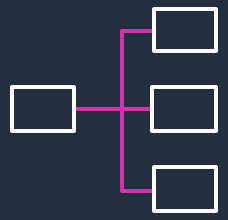
- Web accessible object store (through API or HTTPS)
- Highly durable (99.999999999% design)
- Limitlessly scalable
- Multiple Tiers to match your workload
- Data Lifecycle Rules
- Static Website Hosting
- Security, Compliance, and Audit capabilities
- Standard Storage Pricing (us-east-1) - $0.023 per GB

Your choice of object storage classes

S3 Standard	S3 Intelligent-Tiering	S3 Standard-IA	S3 One Zone-IA	S3 Glacier Instant Retrieval	S3 Glacier Flexible Retrieval	S3 Glacier Deep Archive
• Active, frequently accessed data • Milliseconds access • ≥ 3 AZ • $0.023/GB	• Data with changing access patterns • Milliseconds access • ≥ 3 AZ • $0.023 to $0.0125/GB ($0.004 to $0.00099/GB Archive) • No retrieval fees • Monitoring fee per Obj. • Min storage duration • Min object size	• Infrequently accessed data • Milliseconds access • ≥ 3 AZ • $0.0125/GB • Retrieval fee per GB • Min storage duration • Min object size	• Re-creatable, less accessed data • Milliseconds access • 1 AZ • $0.0100/GB • Retrieval fee per GB • Min storage duration • Min object size	• Archive data instant retrieval • Milliseconds access • ≥ 3 AZ • $0.0040/GB • Retrieval fee per GB • Min storage duration • Min object size	• Archive data • Select minutes or hours • ≥ 3 AZ • $0.0036/GB – ($4.10/TB) • Retrieval fee per GB • Min storage duration • Min object size	• Archive data • Select 12 or 48 hours • ≥ 3 AZ • $0.00099/GB - ($1.01/TB) • Retrieval fee per GB • Min storage duration • Min object size

Frequent ← *Access Frequency* → *Infrequent*

S3 Management Features

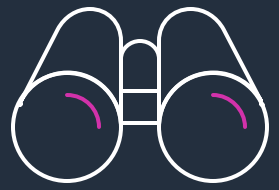


Organize

S3 Tagging

S3 Prefixes

S3 Versioning



Monitor

CloudWatch

CloudTrail

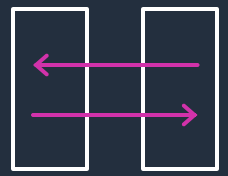
S3 Event Notifications

S3 Inventory

S3 Glacier Restore Notifications

S3 Storage Lens

AWS Config



Replicate & Tier

S3 Lifecycle

S3 Storage Class Analysis

S3 Intelligent-Tiering

Cross-Region Replication

Replication Time Control (RTC)

Modify

S3 Event Notifications + Lambda

S3 Batch Operations

S3 Object Lock

S3 Object Lambda

S3 Access Management & Security

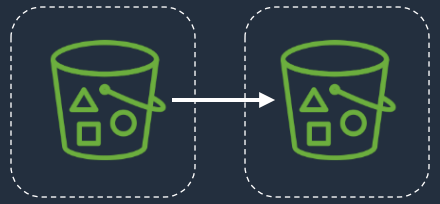
- Deep integration with AWS Identity and Access Management (IAM)
- Access Control Lists (ACLs), S3 bucket policies, and S3 Access Points
- Query String Authentication
- Audit Logs
- S3 supports both server-side & client-side encryption
- S3 Block Public Access to ensure S3 buckets and objects do not have public access
- Amazon Macie to discover, classify, and protect sensitive data stored in Amazon S3
- Access Analyzer for S3
- Amazon S3 Object Lock
- AWS PrivateLink for S3
- Amazon GuardDuty for S3

New S3 Features

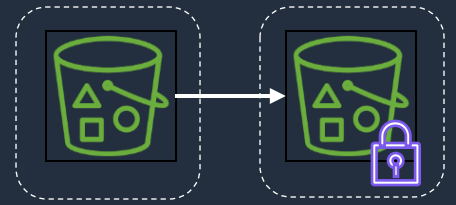
- S3 Mountpoint **(Alpha)**
- Object Replication Status Visibility
- Data Exchange for S3
- Automatic Encryption of New Objects
- VPC Interface Endpoints for S3
- Automatic enabling of S3 Block Public Access on new Buckets
- Automatic disabling of S3 Access Control Lists (ACL's) on new Buckets

S3 Replication

Replicate within the same AWS Region



Replicate to a bucket with retention controls (in the same or different AWS Region)

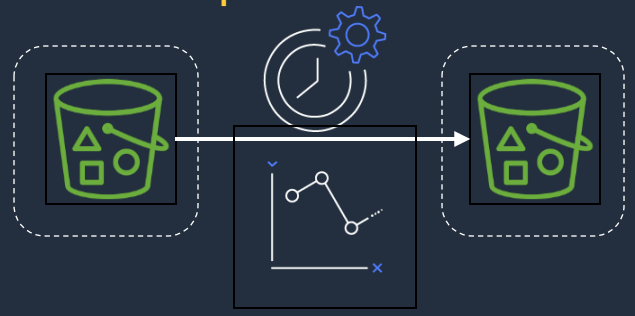


Replication Time Control (RTC) 15 minute replication SLA

Amazon Simple Storage Service

Replicate to a different AWS Region

Replicate faster to a different AWS Region, backed by an SLA + replication metrics



Data Transfer and Edge Processing

Many Options for Data Transfer

AWS Direct Connect

Amazon Kinesis Firehose

Amazon Kinesis Data Streams

Amazon Kinesis Video Streams

Amazon S3 Transfer Acceleration

AWS Storage Gateway

AWS Database Migration Service

AWS Snowcone

AWS Snowball Edge

AWS Snowmobile

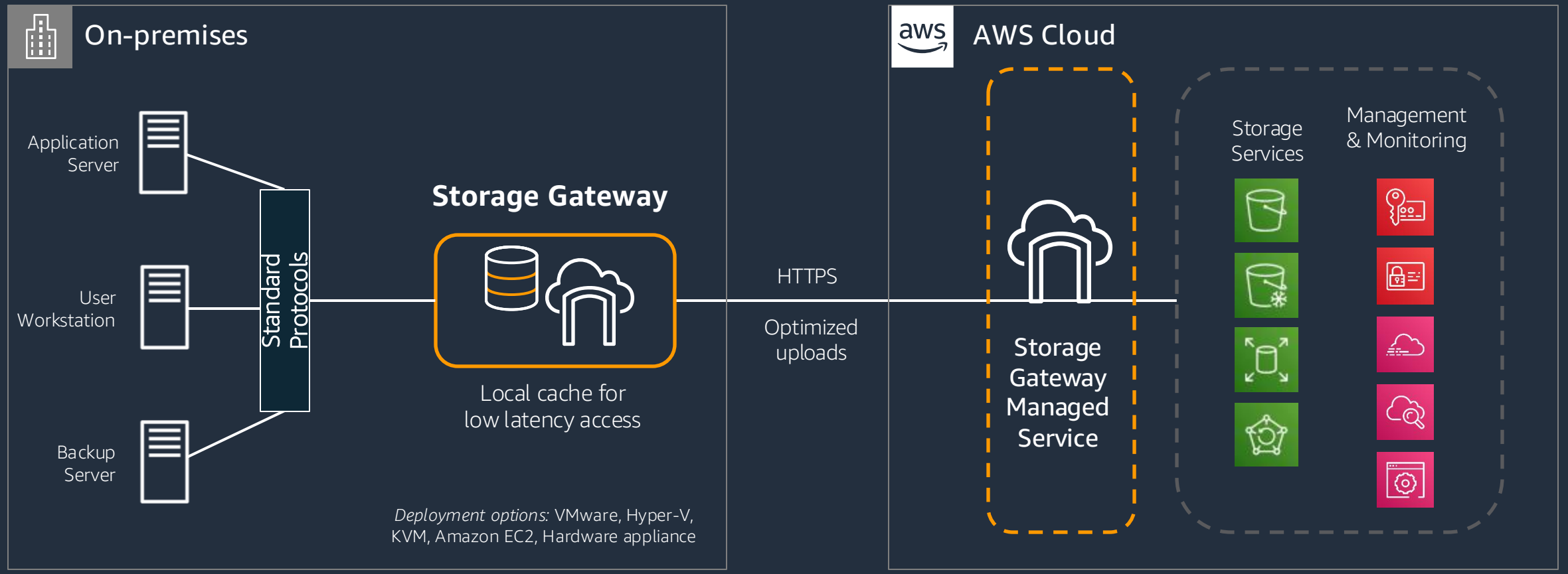
AWS DataSync

AWS Transfer Family

AWS Storage Gateway

AWS Storage Gateway

On-premises access to virtually unlimited cloud storage



Hybrid storage use cases with Storage Gateway

Enabling cloud workloads

Backup, archive, and disaster recovery

Tiered cloud storage

Storage Gateway Family

Amazon S3 File Gateway

Store and access objects in Amazon S3 from file-based applications with local caching

File-based applications work without change

Amazon FSx File Gateway

Native access to Amazon FSx for on-premises group file shares and home directories

Access FSx for Windows File Server from on-premises

Tape Gateway

Drop-in replacement for physical tape infrastructure backed by cloud storage with local caching

Easily switch tape backups to AWS

Volume Gateway

Block storage on-premises backed by cloud storage with local caching, Amazon EBS snapshots, and clones, integrated with AWS Backup

SAN-like with cloud recovery

S3 File Gateway

- Connect using NFS v3/v4 or SMB v2/v3 protocols
- Files stored as native S3 objects
- Metadata is preserved as object user metadata

- Object-level encryption with SSE-S3 or SSE-KMS

- Fully managed local cache
- Read-through, write-back, LRU managed

- Notifications through Amazon CloudWatch (e.g., upload complete)

- Optimized data transfers
- Uploads only sends changes, downloads retrieve file parts needed

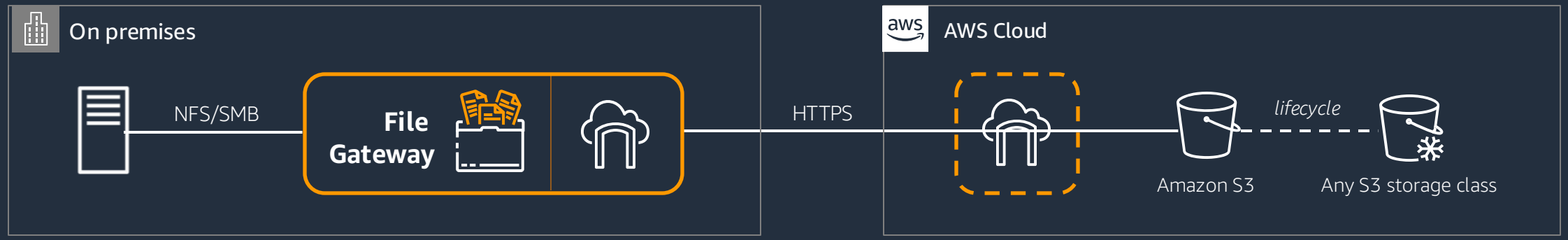
- Refresh cache by prefix
- Optimizes content distribution workloads

- Performance

  Client writes at up to 4 Gbps

S3 File Gateway

Store and access objects in Amazon S3 from file-based applications with local caching



Use cases

- Backup on-premises data to the cloud
- Shift on-premises storage to cloud-backed file shares
- Low-latency on-premises access to cloud storage

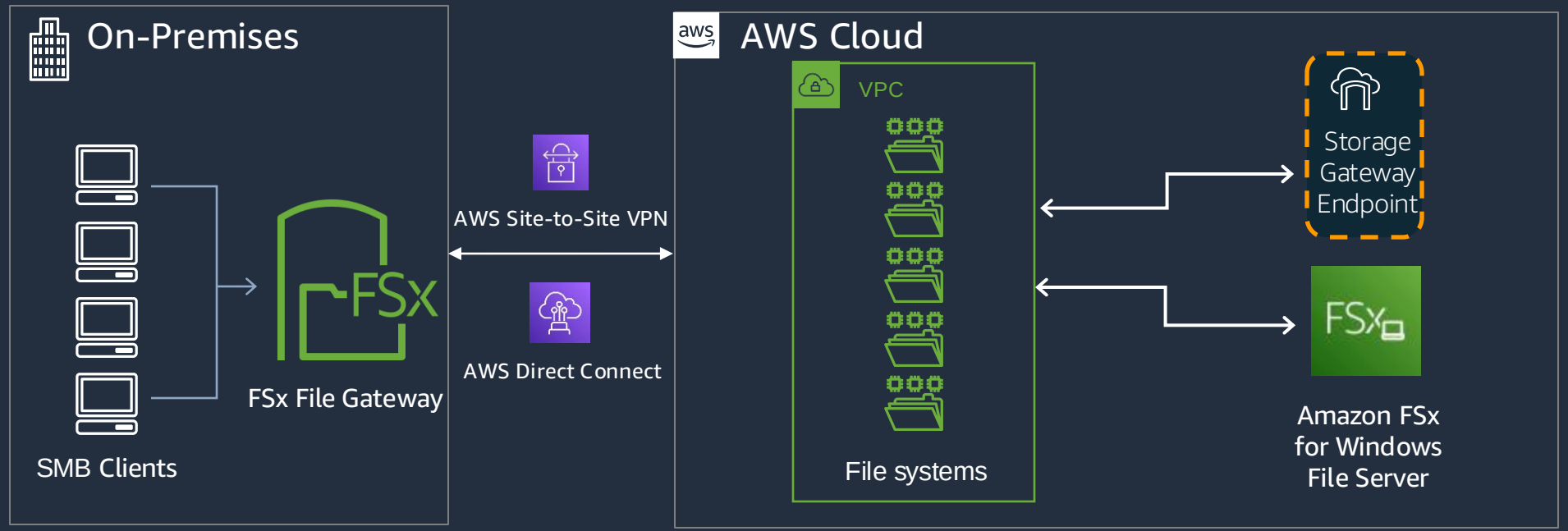
Amazon FSx File Gateway

Amazon FSx File Gateway

- Extend FSx for Windows File Server into your datacenter and remote locations
- Deployed as a VM, hardware appliance, or in EC2
- Local cache of recently used files to improve performance and reduce latency
- Optimized cloud connectivity
- Centrally managed from a single pane of glass in the AWS console

Amazon FSx File Gateway architecture

Low-latency access to Amazon FSx File Shares



Features

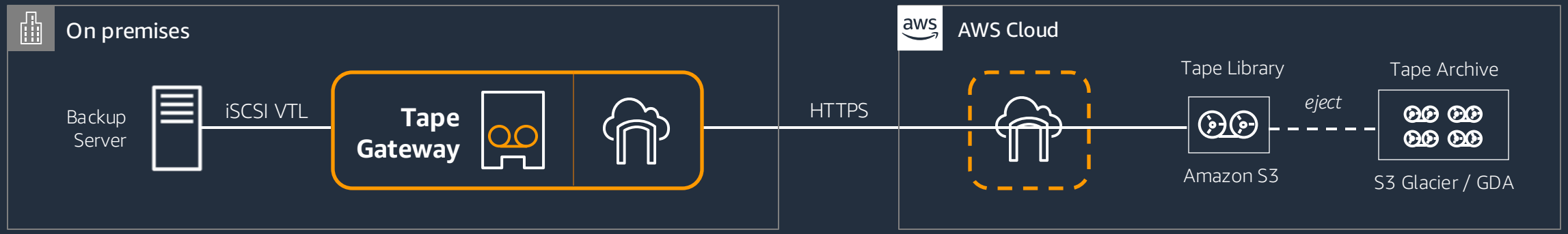
- On-premises cache of commonly accessed files backed by Amazon FSx for Windows File Server
- Deploy multiple FSx File Gateways in multiple offices or remote sites
- Up to 64TB cache and up to 500 clients per gateway
- High availability with on-premises cache on VMware

Tape Gateway

- Emulates physical tape library through iSCSI VTL protocol
- Fully managed local cache for recent backups
  - Read-through, write-back, LRU managed
- Virtual tapes stored in Amazon S3
- Ejected virtual tapes archived read-only in Amazon S3 Glacier or Amazon S3 Glacier Deep Archive
- Retrieve archived tapes to library (3–5 hours)
- Configurable encryption SSE-S3 or SSE-KMS
- Compatible with all leading backup software
- Performance
  - Client writes up to 5.2 Gbps, downloads up to 8.0 Gbps
  - Max supported tape size 15 TiB

Tape Gateway

Virtual tapes presented to on-premises backup applications



Use cases

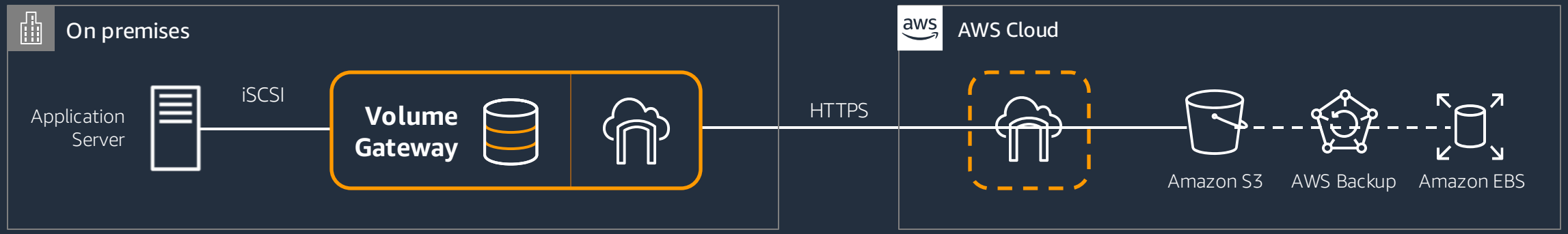
- On-premises backup to cloud
- Drop-in replacement for physical tape libraries
- Archive to Glacier or Glacier Deep Archive

Volume Gateway

- Connect using the iSCSI block protocol
  - Volumes stored in AWS reducing on-premises SAN footprint
  - Thin-provisioned (cached) or local (stored) volume types
- Fully managed local cache
  - Read-through, write-back, LRU managed
- Configurable encryption with SSE-S3 or SSE-KMS
- Volume snapshots stored in Amazon EBS
- Volume Gateway support for AWS Backup
- Volume detach/attach

Volume Gateway

Block storage on-premises backed by cloud storage



Use cases

- Backup on-premises data to the cloud
- Migration of volumes to the cloud
- DR to the cloud

AWS DataSync

AWS DataSync

Online transfer service that simplifies, automates, and accelerates moving data between on-premises storage and AWS

Fast data transfer

Easy to use

Secure and reliable

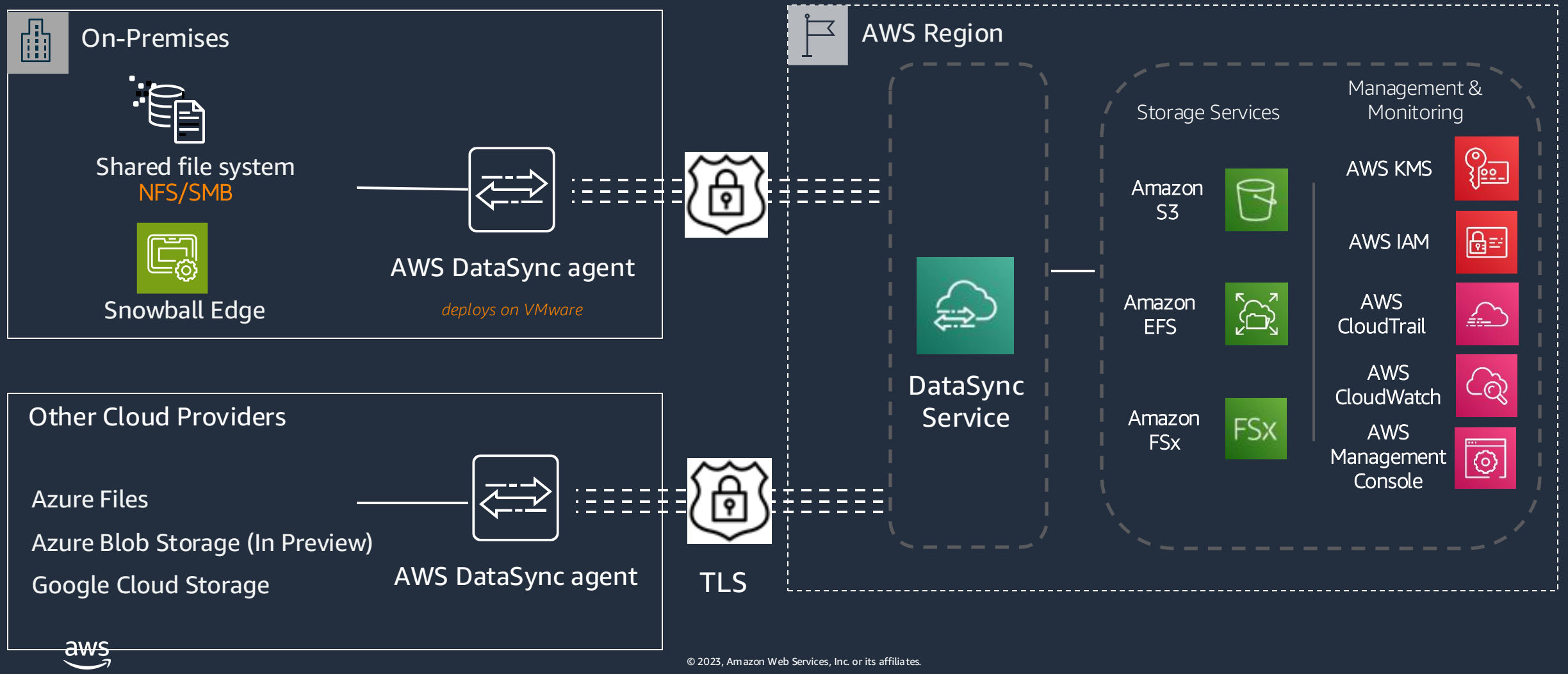
Cloud integrated

Cost-effective

Combines the speed and reliability of *network acceleration* software with the cost-effectiveness of *open source tools*

How does AWS DataSync work?

Simplifies, automates, and accelerates data transfer to or from AWS



The benefits of AWS DataSync

Fast data transfer

- 10x faster than open-source tools
- Highly optimized network transfer
- Up to 10 Gbps per/s per agent

Easy to Use

- No in-cloud infrastructure
- Schedule transfers
- Throttle bandwidth

Secure and Reliable

- Securely transfer to any storage tier
- End-to-end encryption
- End-to-end data verification

Fully managed

- Integrates with AWS Management and monitoring services

Cost-effective

- Pay only for data transferred
- $0.0125/GB or $12.50/TB

AWS DataSync Discovery

Gain insights into storage utilization

- ✓ Automated data collection
- ✓ Dashboards for aggregated views of data
- ✓ Find underutilized resources

Receive recommendations for AWS Storage services

- ✓ Select the right storage for your use case
- ✓ Optimize your AWS storage configuration
- ✓ Meet your performance needs while minimizing costs

Simplify migration planning

- ✓ Minimize time, effort, and costs
- ✓ Use estimated costs to inform your budget
- ✓ Validate assumptions before migrating

Accelerate your data migration

Discover

AWS DataSync Discovery gives you insights about your storage and generates recommendations for moving to AWS

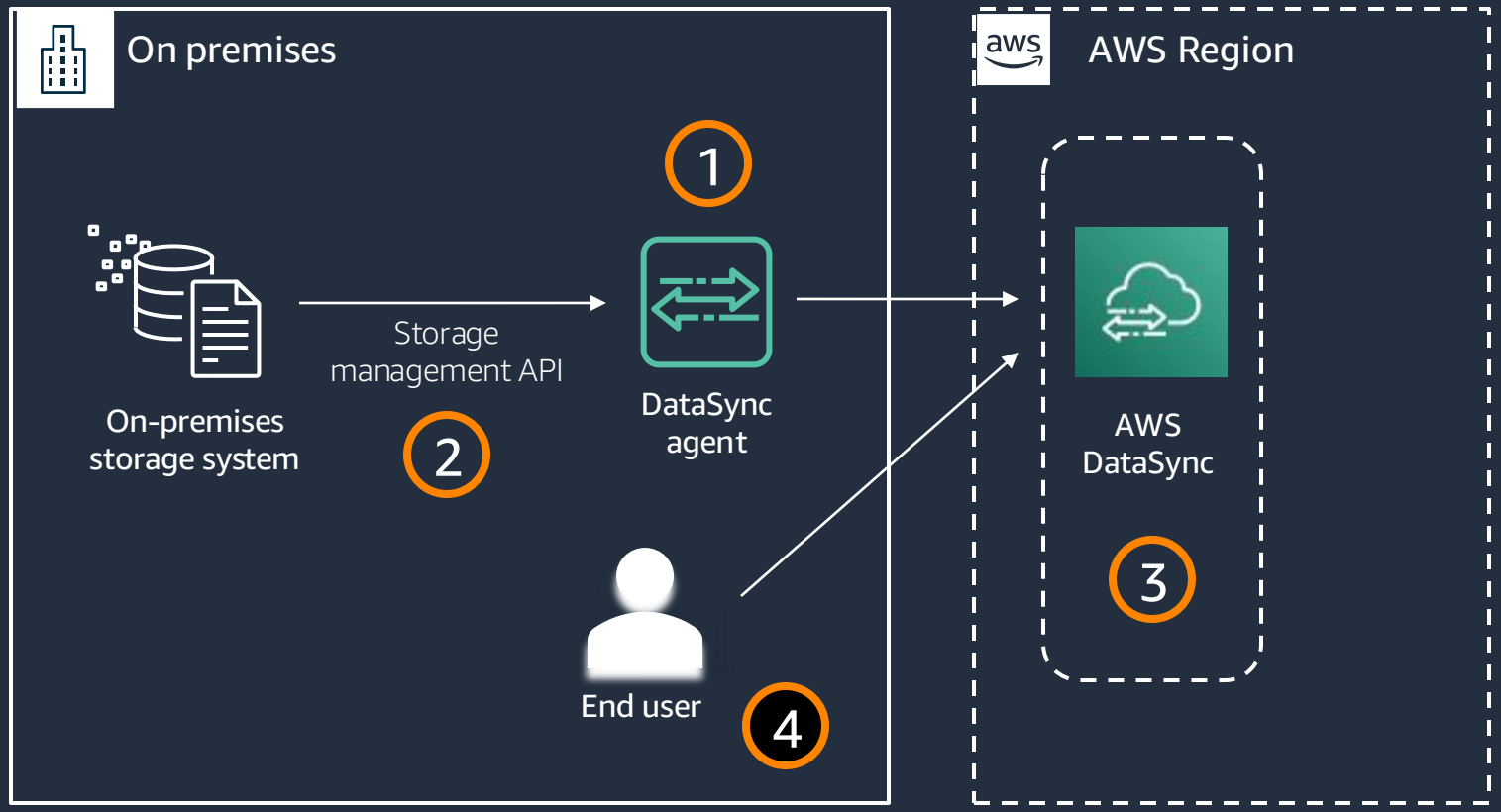
Plan

Evaluate recommended AWS Storage services for your data migration plan

Migrate

AWS DataSync moves your data to AWS quickly and securely

AWS DataSync Discovery: How it works



1. DataSync agent connects to your on-premises storage
2. DataSync Discovery uses management APIs provided by your storage system
3. Run discovery jobs to collect information about your storage
4. View collected data and recommendations in the DataSync console or by using the CLI/SDK

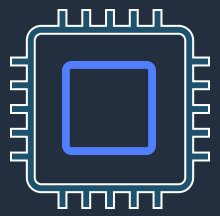
Amazon Snow Family

Amazon Snowball Edge and Snowcone

- Terabyte scale data transport
- Uses secure appliances
- Faster than Internet for significant data sets
- Import into S3
- HIPAA Compliant

Terabyte scale data transport

2 Snowball Edge options



Compute optimized

- 28 TB usable S3 compatible storage
- 104 vCPUs, 416 GB of memory
- Optional NVIDIA Tesla V100 GPU
- sbe-c and sbe-g instances (equivalent to C5, M5a, G3, P3)

Storage optimized

- 80 TB usable S3-compatible storage
- sbe1 instances (equivalent to C5)
- Up to 40 vCPUs, 80 GiB of memory, 1 TB SATA SSD
- Object storage clustering available

Long-term deployment options: 1- and 3-year discounted pricing

Introducing AWS Snowcone

Small, portable, rugged, and secure edge computing and data transfer device

- Military-grade security
- 4.5 pounds (2.1 kg)
- Portable computing, anywhere
- Withstands harsh environments
- Offline & online data transfer
- Snowcone HDD 8 TB of storage
- Snowcone SSD 14 TB of storage
- 2 CPU, 4 GB compute

Use cases

Industrial IoT, healthcare IoT, content distribution, content aggregation, data migration, logistics, autonomous vehicles, and transportation

- Less than 1 day to transfer 250TB via 5x10G connections with 5 Snowballs, less than 1 week including shipping
- Number of days to transfer 250TB via the Internet at typical utilizations

	Internet Connection Speed			
Utilization	1Gbps	500Mbps	300Mbps	150Mbps
25%	95	190	316	632
50%	47	95	158	316
75%	32	63	105	211

AWS Snow Family for data collection & data movement

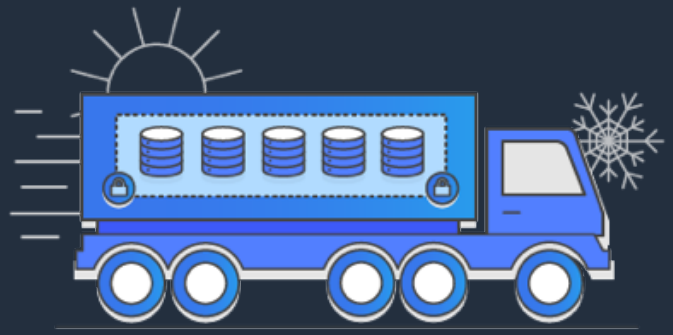


	Snowcone	Snowball Edge Storage Optimized	Snowmobile
Migration size	Up to 24 TB, online and offline	Up to petabytes, offline	Up to exabytes offline
Form factor	Rugged 8.5 G impact cases that are rain and dust resistant, E Ink label for shipping automation		45-foot container, scheduled delivery
Security	256-bit encryption, tamper detection		Encryption, security staff, GPS tracking, video surveillance, alarms
Storage capacity	8, 14 TB usable	210 TB usable	<100 PB
DataSync agent	Pre-installed	-	-
Compute	2 vCPU, 4 GB RAM usable	40 vCPU, 80 GB RAM, 1 TB SSD usable	-
Onboard computing options	AWS IoT Greengrass functions Amazon EC2 AMIs		
Wireless	Wi-Fi	-	-
Portable or Mobile use	Battery based operation	-	-
Clustering	-	Up to 15 nodes	-

Visit the AWS Snow Family page for a more detailed comparison »

Amazon Snowmobile

https://www.youtube.com/watch?v=8vQmTZTq7nw



AWS Transfer Family

Managed file transfer – what is it?

Managed file transfer (MFT) provides secure and reliable transfer of data between systems through a network (e.g., the Internet), enabling exchange of data to meet business critical needs

Attributes

- Focused on secure and flexible file transfers
- Support 3rd party integrations and connectors
- Provide pre-processing for data filtering and encryption
- May support additional protocols (AS2/HTTPS)

AWS Transfer Family benefits

Fully Managed

- Highly available across 3 Availability Zones
- Scales on demand
- Supports thousands of concurrent users

Seamless Migration

- Import host keys
- Use your own IP addresses and hostnames
- Use existing authentication systems

Secure & Compliant

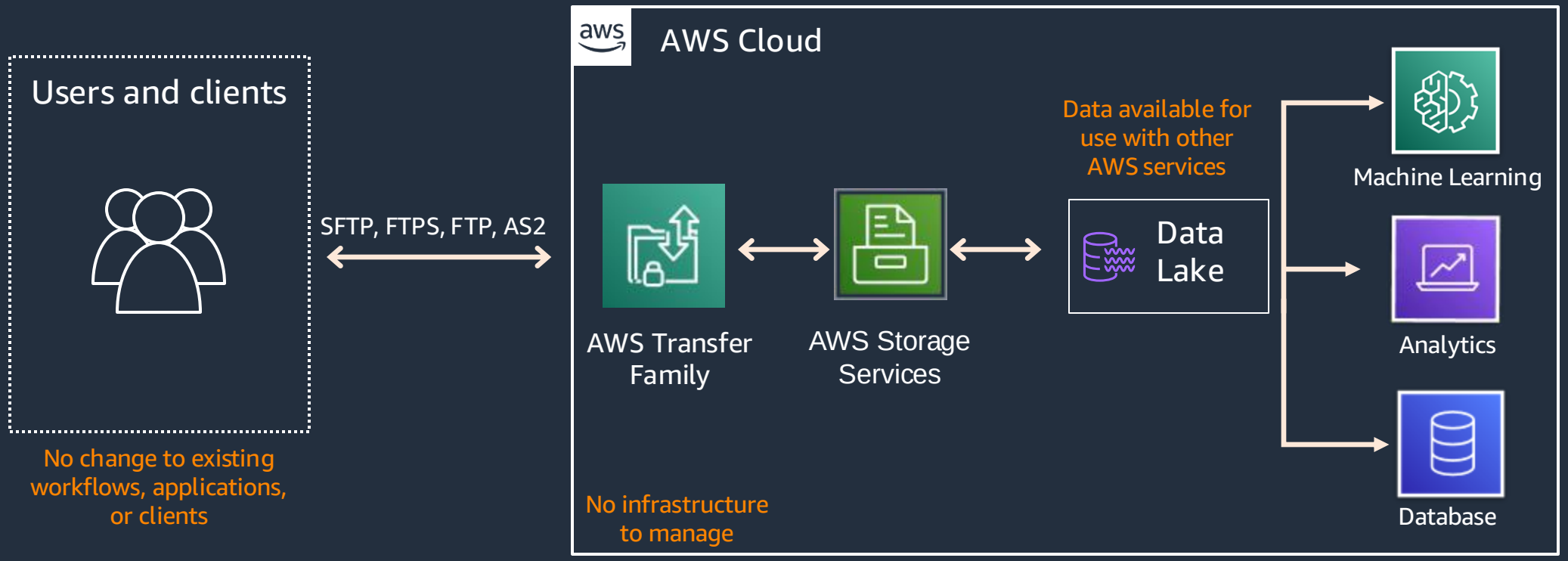
- IP filtering
- Support for VPC endpoints and shared VPC environments
- Data encryption options via SSE-S3 and AWS KMS
- PCI, HIPAA, SOC3, FIPS compliance

AWS Integrated

- Store and access data natively using AWS services
- AWS CloudTrail and Amazon CloudWatch for auditing/logging
- Custom authentication using Amazon API Gateway and AWS Lambda

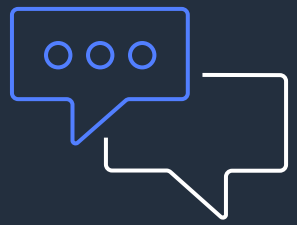
AWS Transfer Family Value

Seamlessly migrate without impacting your workflows



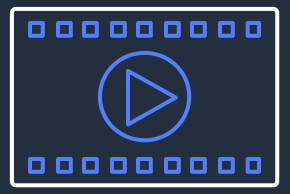
Common use cases

Data lakes and analytics platforms

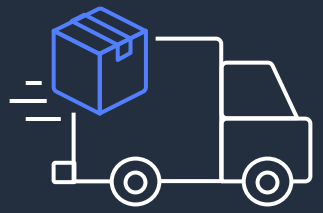


Customer relationship management applications

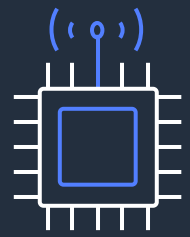
Subscription based data products



Digital media content aggregation and distribution



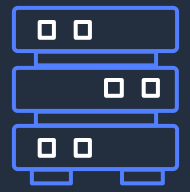
Enterprise resource planning and electronic data interchange for supply chain logistics



IoT services used in remote locations for monitoring

Get started with AWS Transfer Family

1. Launch a server endpoint



2. Select your target S3 bucket(s) or EFS file share(s)

3. Configure your users

Visit console.aws.amazon.com/transfer to get started today!

Pricing

Server endpoint time:
$0.30/protocol/hour

Data uploads and downloads: $0.04/GB

Learn more: aws.amazon.com/aws-transfer-family/pricing/

Examples:

- 10 GB/day costs $2.7K/year
- 100 GB/day costs $3.6K/year

Backup

AWS Backup

AWS Backup – meeting the challenges

Backup operations unified across AWS services

Complexity

Simple & Performant

Policy- and tag-based backup solution

Automated backup scheduling

Compliance

Reliable & Secure

Centralized backup activity monitoring and logs

Backup encryption

Backup access policies

Cost

Cost Effective

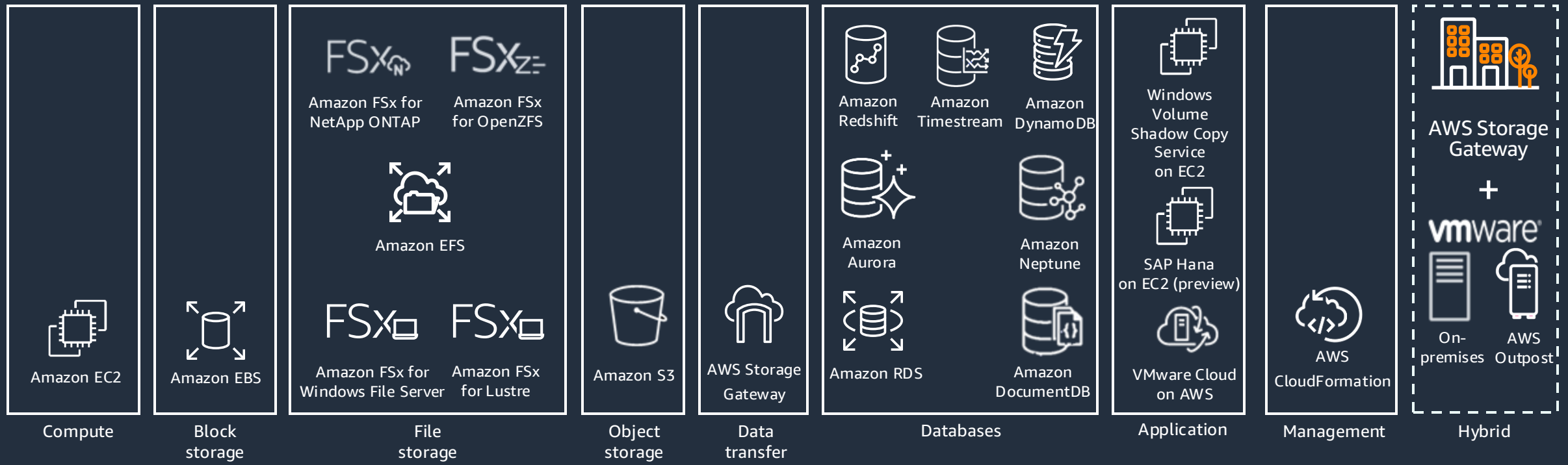
Automated backup retention management

No added cost for orchestration

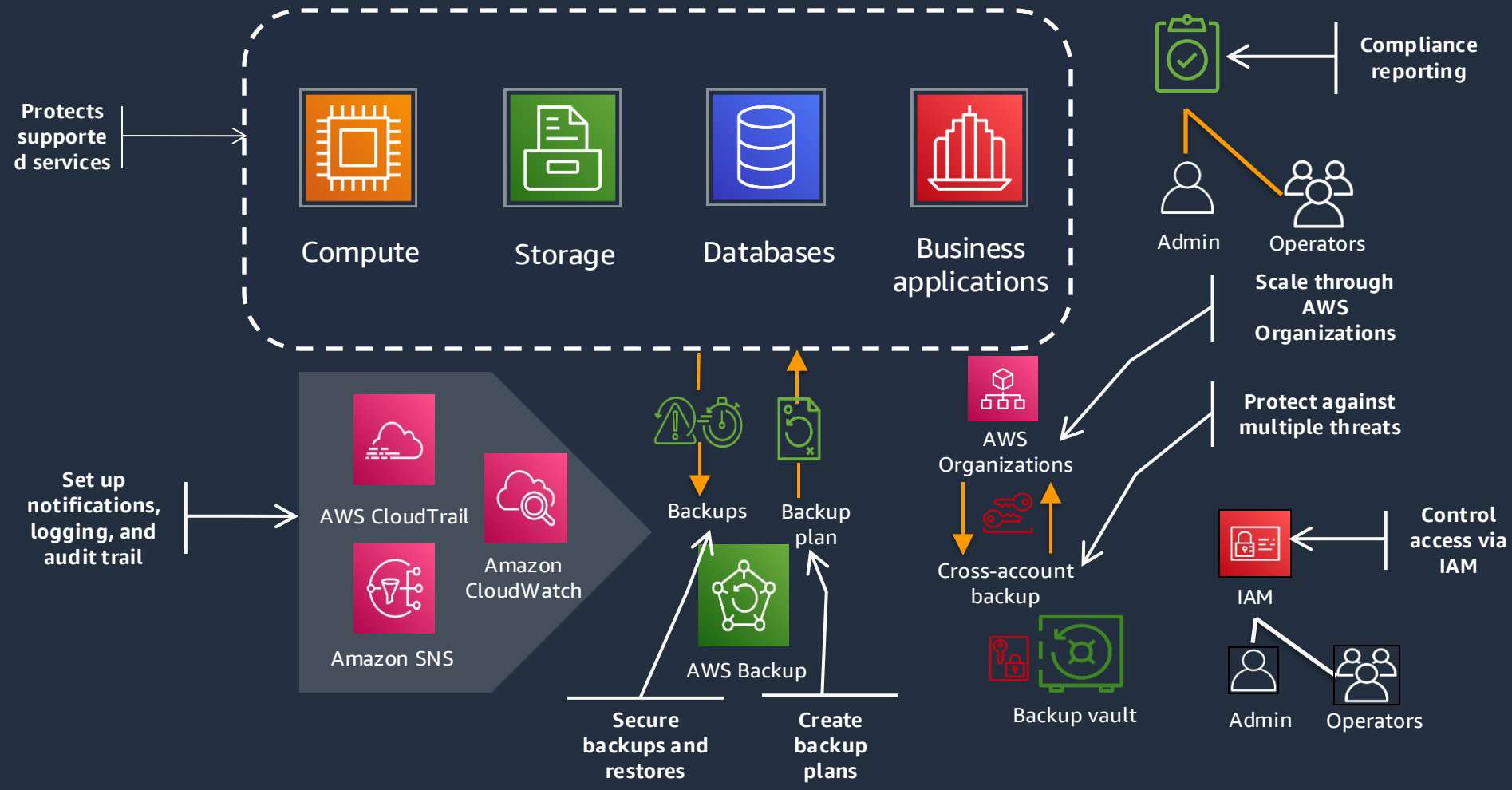
AWS Backup

AWS Backup

A fully managed, policy-based backup service that makes it easy to centrally manage and automate the backup of data across multiple AWS services and hybrid workloads



How AWS Backup works



DR & Ransomware Recovery with AWS Backup

- Vault characteristics:
- Backups are highly efficient incremental forever
- Backup copies cannot be changed or encrypted
- Manage with vault specific CMK/KMS best practices
- Air-gapped backups using vault access policies
- Prescriptive guidance for vault account access provided

- Recovery options:
- Supports 1-to-many, many-to-many, many-to-1, etc.
- Recover from same account locally or from across region
- Recover from cross-account locally or across region
- Recover from RPOs that are hours, days, weeks or months old
- Simple workflow to apply any forensic analysis

Notable Recent AWS Backup launches

Cloud-native and hybrid support
Amazon S3 backup Amazon S3 cross-Region, cross-account backup
Amazon FSx for NetApp ONTAP backup Amazon FSx for OpenZFS backup
VMware Cloud on AWS Outposts backup Amazon Privatelink integration for VMware backup

Compliance and governance support
AWS Backup Audit Manager controls Last recovery point created Backups protected by AWS Backup Vault Lock Cross-account copy scheduled Cross-Region copy scheduled
AWS Backup Vault Lock retention modes Governance mode Compliance mode

AWS Backup re:Invent 2022 announcements

Application-aware Backups

AWS CloudFormation

Data and Analytics

Preview SAP HANA on EC2 backup

Amazon Redshift

Organization-level

AWS Organizations delegated admin support for AWS Backup!

Compliance

Cross-Region, cross-account support for AWS Backup Audit Manager

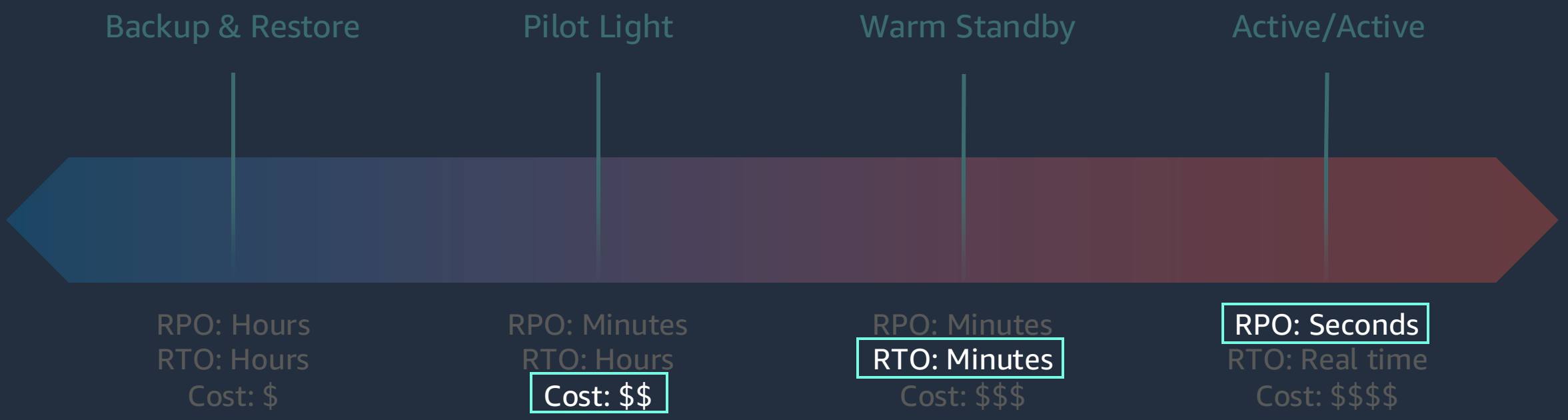
Legal holds for AWS Backup

Cohasset certifies Vault Lock for Sec-17a, FINRA 4511(c), and CFTC 1.31(c).

AWS Elastic Disaster Recovery

AWS Elastic Disaster Recovery

Get the RPOs of Active/Active and the RTOs of Warm Standby at the cost of Pilot Light



AWS Elastic Disaster Recovery

High-performance, cost-effective application recovery

AWS Elastic Disaster Recovery selected as the DRaaS market leader for both innovation and growth in Frost & Sullivan's *2022 Frost Radar: Disaster Recovery as a Service*.

AWS Elastic Disaster Recovery key benefits

Faster recovery

Recovery time objectives (RTOs) of minutes

Easy testing

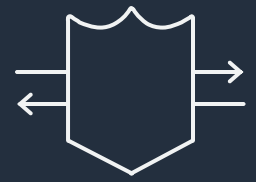
Conduct non-disruptive drills to verify readiness

Lower costs

No need to pay for idle recovery site resources

Ransomware recovery

Launch unlocked and unencrypted versions of your applications



Data protection

Recovery point objectives (RPOs) of seconds

Ransomware mitigation

Use AWS Elastic Disaster Recovery for ransomware protection, detection, response, and recovery

Account isolation

Protect your workloads by isolating your staging account from your production and recovery accounts.

Immutable snapshots

Keep your data safe with immutable snapshots that can’t be altered or overwritten.

Endpoint detection and response (EDR)

Detect and eliminate threats using integrated solutions from AWS Partners CrowdStrike and SentinelOne.

Point-in-time recovery

Recover your servers by using unlocked and unencrypted point-in-time snapshots.

Elastic Disaster Recovery deployment patterns

Q&A

Thank you!