Chapter 2
AWS Storage Design

Episode 2.01
Storage Services

Selecting the Storage Service

- Simple Storage Service (S3)
- Glacier
- CloudFront
- Elastic Block Store (EBS)
- Storage Gateway
- Snow family
- Databases

Block Storage

- Used on local networks
  - iSCSI
  - Fibre Channel
- AWS can use block storage with virtual machines within the AWS cloud using EBS

File Storage

- AWS uses similar, called object storage in S3
- Used with NAS devices locally

Selecting Storage

- Size
- Performance
- Cost

Episode 2.02
S3 Storage Class

S3 Storage Overview

- Object storage
- Distributes across at least three Availability Zones
  - Except: 1A (1 zone, least expensive)

S3 Storage Overview

- Supports encryption and automatic data classification
- Big data analytics can run directly against stored data

Getting Data into S3

- API (Application Programming Interface)
- Amazon Direct Connect
- Storage Gateway
- Kinesis Firehose
- Transfer Acceleration

Getting Data into S3

- Snow family
  - Snowball
  - Snowball Edge
  - Snowmobile

Episode 2.03
S3 Terminology

S3 Concepts

- Buckets
- Regions
- Objects
- Keys
- Object URLs
- Eventual consistency
- Works great for static website hosting

S3 Concepts

- Works great for static website hosting

Common S3 Operations

- Creating and deleting buckets
- Writing objects
- Reading objects
- Deleting objects
- Managing object properties
- Listing keys in buckets

REST Interface

- Representational State Transfer (REST)
  - S3 API
  - Maps HTTP methods to CRUD operations
    - Create uses PUT or POST
    - Read uses GET
    - Update uses POST or PUT
    - Delete uses DELETE

Episode 2.04
S3 Advanced Features

S3 Features

- Prefixes and delimiters
- Storage classes
- Object lifecycle management
- Encryption
- Versioning

S3 Features

- Multi-Factor Authentication (MFA) Delete
- Multi-part upload
- Range GETs
- Cross-Region replication
- Logging
- Event notifications

Episode 2.05
Creating S3 Buckets Lab

DEMO

- Creating buckets
- Placing objects
- Managing objects
- Deleting objects

Episode 2.06
S3 Bucket Properties

DEMO

- Didn’t have any slides for this one

Episode 2.07
S3 Managing Objects Lab

DEMO

- Didn’t have any slides for this one

Episode 2.08
Glacier

Glacier Overview

- Archival data storage
- Fractions of a penny per GB/month
- Three access methods
  - Expedited (3-5 minutes)
  - Standard (3-5 hours)
  - Bulk (5-12 hours)

Glacier Overview

- You define the Region for data storage
- Data stored with AES 256-bit encryption

Glacier Integration

- S3 cold data can be automatically moved into Glacier
- Snow devices can be used to import data
- Storage Gateway can connect to Glacier

Glacier Concepts

- Archives
- Vaults
- Vault locks
- Data retrieval
  - Up to 5% retrieved at no charge, no rollover
  - Vault can be configured to limit costs

Episode 2.09
Setting up a Glacier Vault Lab

DEMO

- Creating vaults and archives

Episode 2.10
Elastic Block Store (EBS)

EBS Overview

- Used for durable storage in EC2 instances
- Block-level storage from one AWS service to another

EBS Volume Types

- Magnetic
- SSD (solid-state drive)
  - General purpose
  - Provisioned IOPS
    - PIOPS (provisioned input/output operations per second)
  - EBS-optimized instance should be used

Protecting EBS Data

- Snapshots
- Volume recovery
  - Attaching volumes from one instance to another
- Encryption methods

Episode 2.11
Creating EBS Volumes Lab

DEMO

- Creating EBS Volumes
- Managing EBS Volumes

Episode 2.12
Elastic File System (EFS)

EFS Overview

- Shareable
- Hierarchical
- Can be accessed through NFSv4
  - EBS volumes are dedicated to an instance

EFS Overview

- EC2 instances can use EFS shares
- EFS is not supported on Windows instances

Storage Comparison

		File Amazon EFS	Object Amazon S3	Block Amazon EBS
Performance	Per-operation latency	Low, consistent	Low, for mixed request types, and integration with CloudFront	Lowest, consistent
	Throughput scale	Multiple GBs per second	Multiple GBs per second	Single GB per second
Characteristics	Data Availability/Durability	Stored redundantly across multiple AZs	Stored redundantly across multiple AZs	Stored redundantly in a single AZ
	Access	One to thousands of EC2 instances or on-premises servers, from multiple AZs, concurrently	One to millions of connections over the web	Single EC2 instance in a single AZ
	Use Cases	Web serving and content management, enterprise applications, media and entertainment, home directories, database backups, developer tools, container storage, big data analytics	Web serving and content management, media and entertainment, backups, big data analytics, data lake	Boot volumes, transactional and NoSQL databases, data warehousing & ETL

https://aws.amazon.com/efs/when-to-choose-efs/

Episode 2.13
Creating an EFS File System Lab

DEMO

- Creating an EFS share for an instance

AWS Storage Gateway

- Uses a software appliance to implement the gateway
- Provides three types of storage solutions:
  - File-based
  - Volume-based
  - Tape-based

Episode 2.14
Integrating On-Premises Storage

AWS Storage Gateway

- Software appliance creates the gateway
- Provides three types of storage solutions:
  - File-based
  - Volume-based
  - Tape-based

Utilization Process

- https://docs.aws.amazon.com/storagegateway/latest/userguide/WhatIsStorageGateway.html

Episode 2.15
Storage Access Security Lab

DEMO

- Show storage security management in AWS Management Console
- Review security commands for the AWS CLI
- Contrast with internal security within an instance in an EBS volume

```
{ "Id": "Policy1540923417431", "Version":
"2012-10-17", "Statement": [ { "Sid":
"Stmt1540923412641", "Action": "s3:*",
"Effect": "Allow", "Resource":
"arn:aws:s3:::marketing-widget-2018",
"Principal": { "AWS": [
"arn:aws:iam::989745111221:user/AmyThomas"
] } } ] }
```

Episode 2.16
Storage Performance

Storage Performance

- EBS volume types
  - https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSVolumeTypes.html
- S3 storage classes
  - https://aws.amazon.com/s3/storage-classes/?nc=sn&loc=3

Gibibyte vs. Gigabyte

Decimal Name	Decimal Abbr.	Decimal Power	Decimal Value	Binary Name	Binary Abbr.	Binary Power	Binary Value
Kilobyte	kB	10^3	1,000	Kibibyte	kiB	2^10	1,024
Megabyte	MB	10^6	1,000,000	Mebibyte	MiB	2^20	1,048,576
Gigabyte	GB	10^9	1,000,000,000	Gibibyte	GiB	2^30	1,073,741,824
Terabyte	TB	10^12	1,000,000,000,000	Tebibyte	TiB	2^40	1,099,511,627,776