DALHOUSIE UNIVERSITY

CSCI 5411

Advanced Cloud Architecting

Assignment 1

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Table of Contents

What are the main challenges that Silver Screen Studios faces with their current on-premises storage solution, and how can a cloud-based storage solution address these challenges?

1. **Scalability**
   Challenge: As the amount of video content increases, managing and scaling the on-premises storage system becomes more challenging. Moreover, as the video files are as large as 1TB each, it is challenging to expand their storage capacity quickly and efficiently.
   Solution: Almost **limitless storage** is possible with **AWS cloud storage** services like **Amazon S3[1]**. This allows Silver Screen Studios to scale their storage up or down based on actual demand, without the need to invest in new hardware or infrastructure upgrades.

2. **Cost**
   Challenge: When managing on-premises data centers, a number of elements, including hardware, storage space, and manpower, are related to costs.
   Solution: Cloud-based solutions offer a **pay-as-you-go** basis, making them economical. Only the storage that is used must be paid for by the consumer.

3. **Data Redundancy**
   Challenge: On-premises solutions do not guarantee data redundancy, and there can be cases of a single point of failure.
   Solution: Cloud storage services like Amazon S3, which replicate data storage to various locations, provide **99.99% availability** and data redundancy.

4. **Maintenance and Management**
   Challenge: Managing hardware updates, failures, and data backups is a continuous task for on-premises storage and may be expensive and time-consuming.
   Solution: The maintenance of infrastructure is offloaded to AWS. Services from AWS take care of hardware maintenance, backups, and availability, Silver Screen Studios can concentrate on producing content instead of managing storage infrastructure.

How would you determine the appropriate storage service(s) for Silver Screen Studios to use in their cloud-based storage solution, considering factors such as scalability, performance, and cost-effectiveness?

To determine the appropriate storage services, we consider the following:
● **Scalability**: The solution should be scalable so that it can handle increasing amounts of storage without any interruption.
● **Performance**: Video files should be transferred fast across a long distance
● **Cost-effectiveness**: Comparing pricing of different solutions and matching the best need as per silver solution requirements

Comparing different Storage Services :

AWS Storage Service	Scalability	Performance	Cost
Amazon S3	**Automatically** scales infinitely with virtually unlimited storage.	Quick file transfers are possible with **S3 Transfer Acceleration[2]**.	**$0.023/GB** (Standard version)[3]
Amazon EBS	High-performance block storage is offered by EBS at any size; however, scaling is done **manually** in this case.	EBS-provisioned IOPs can offer sub-millisecond latency, although the price will go up in this scenario[4].	**$0.08/GB** (Standard storage gp3 version)[5] ● It can only store up to 16TB of data.
Amazon EFS	**Manual** Scaling	A wide variety of workloads can benefit from Amazon EFS's high throughput, high IOPS, and low latency.	**$0.30/GB** (Standard version)[6]

- Choose the one that best fits Silver Screen Studios' needs based on the comparison we performed in step 2.

What strategies would you recommend to optimize the transfer speed of large video files between teams, and what AWS storage services and features would you utilize to achieve this?

1. **AWS Snowball for Large Batch Transfers**:
    - AWS Snowball[7] is a **data transport service** that transfers massive amounts of data (terabytes to petabytes) using secure physical devices.
    - Silver Screen Studios places an order for the Snowball device, then loads data onto the device, which is sent to AWS and the data is saved into an S3 bucket.

2. **AWS S3 Transfer Acceleration**:
    - Amazon S3 Transfer Acceleration **speeds up uploads and downloads** to and from S3 by utilizing **Amazon CloudFront's[8]** globally distributed edge locations.
    - Data is **routed to the nearest AWS edge location** and then through AWS's private backbone to the S3 bucket, reducing latency and boosting transfer speeds, especially over long distances.
    - It will **support high-speed data transfer** which ensures that the **editing workstation** at Silver Screen Studios can access the video content quickly.

3. **Multipart Upload for Large Files**:
    - Multipart Upload enables the uploading of large files, such as 1TB video files, by **breaking them into smaller**, more manageable parts.
    - These parts can be uploaded in parallel, significantly improving both upload speed and reliability.

What specific AWS features and services would you implement to ensure the reliability and availability of Silver Screen Studios' storage solution, and what mechanisms would you use to monitor and maintain these features?

- **Amazon S3 for Reliable Object Storage:**
  - Objects in one S3 bucket located in one AWS region are **automatically replicated to another S3 bucket** located in a different region via **S3 Cross-Region Replication**.
  - Because the data will be available from a local region, this **lowers the latency** for Silver Screen Studio teams located in different geographic areas to access large video files.
  - Amazon S3 provides **99.999999999% (11 9s) durability and 99.99% availability** of objects.
  - S3 also offers features like **versioning**, which lessens the chance of files being accidentally deleted, and easy file recovery.
  - For less-frequently accessed data, **S3 Glacier[9]** (for archival) can be used to balance cost-efficiency and durability.

- **Amazon CloudWatch for Monitoring and Alerting:**
  - Monitor AWS Storage Resources: **CloudWatch[10]** will continuously observe and monitor key AWS resources like S3, EFS, and EBS, ensuring **real-time tracking** of performance and usage.
  - Set **Alarms** for Critical Metrics: Automatically trigger alarms for issues such as high IOPS in EBS or **high error rates** in S3, ensuring immediate awareness of potential performance or availability problems.
  - Automated Actions for Performance: Utilize **automated actions** in response to alarms, such as **scaling resources or triggering Lambda** functions for faster resolution of issues.
  - Custom Dashboards for Real-Time Insights: Create dashboards to visualize metrics across all services, improving operational visibility and helping teams stay informed about system health.

How would you ensure that Silver Screen Studios' video content remains secure while being stored in the cloud, and what specific security measures and AWS services would you recommend?

1. **Disable S3 ACL (Access Control List)**:
    - Access Control List is an S3 **bucket-level setting** that controls ownership of objects.
    - By default, **ACL is disabled**, and it's best practice to keep it that way so that the bucket owner retains ownership of all objects in the bucket.

2. **Ensuring S3 is Not Publicly Accessible**:
    - Ensure that S3 buckets are **not publicly accessible** unless explicitly required.
    - Implement strict S3 **bucket policies**, granting permissions only to the necessary identities or roles, thereby limiting access to authorized users.

3. **Encryption of Data at Rest and in Transit**:
    - Encrypt data in transit using **SSL/TLS[11]** and at rest using AWS services like **SSE-S3[12]** for server-side encryption.
    - Use **AWS KMS (Key Management Service)[13]** to manage encryption keys, ensuring secure and audited key handling.

4. **AWS IAM for Access Control**:
    - Use **AWS IAM [14]** to apply **role-based access control**, adhering to the principle of least privilege.
    - Grant only the permissions necessary for each user or system to limit the risk of unauthorized access.

5. **Monitoring and Auditing**:
    - **AWS CloudWatch** and **AWS CloudTrail [15]** are used to monitor access and changes to the S3 bucket, providing an audit trail and real-time alerts on any suspicious activities.

What backup and archiving strategies would you recommend to manage the lifecycle of Silver Screen Studios' video content, and what AWS services would you use to implement these strategies?

Backup and Archiving Strategies for Silver Screen Studios' Video Content Automated Periodic

1. **AWS Backup**:
- To arrange **automatic, recurring backups** of video content, use AWS Backup. These backups can be scheduled to run **daily or every 12 hours**, so no human involvement is required.
- With AWS Backup, you may recover data at any point in time by taking **snapshots** of your data and minimizing data loss in the event of a problem.

2. **S3 Versioning for File Recovery**:
- Enable S3 Versioning to maintain **multiple versions of video files**, enabling the recovery of previous versions in case of accidental deletions or overwrites.

3. **S3 Lifecycle Policies for Archiving**:
- Make use of S3 Lifecycle Policies to **automatically move files** from **S3 Standard** to more affordable archive storage classes (like **S3 Glacier**) after they haven't been accessed in a while—for example, a year.
- This helps in optimizing storage costs by retaining infrequently accessed content in lower-cost storage.

4. **S3 Cross-Region Replication for Disaster Recovery**:
- Configure S3 Cross-Region Replication (CRR) to **replicate video files** to a different AWS region, hence offering redundancy and guaranteeing data accessibility even in case of a regional failure.

Silver Screen Studios can provide frequent data preservation and long-term archiving of their video content, optimizing cost and ensuring security, by combining automated backups, S3 versioning, and S3 Lifecycle rules.

How would you balance the need to meet Silver Screen Studios' storage requirements with cost-effectiveness, and what specific cost optimization strategies and tools would you recommend?

Cost Optimization Strategies for Silver Screen Studios

1. **Transferring Data to Cheaper Storage**:
    - To cut storage expenses, find objects that aren't used as much and transfer them to less expensive storage classes like **S3 Standard-IA** or **S3 One Zone-IA**.

2. **S3 Lifecycle Policies for Automatic Data Transition**:
    - Utilize S3 Lifecycle Policies to automatically move data, based on **pre-established rules**, from S3 Standard to more **affordable storage** classes (such as Standard-IA or Glacier).

3. **S3 Intelligent-Tiering**:
    - By using S3 Intelligent Tiering, you can optimize expenses without the need for manual intervention by **dynamically moving data** between storage tiers based on **access patterns**.

4. **Delete Unused Data**:
    - **Regularly delete** irrelevant or unused files to **free up storage** and reduce costs. Also, clean up **incomplete uploads** to avoid unnecessary cost accumulation.

5. **AWS Cost Explorer for Monitoring**:
    - To gain more insight into where spending is going and chances for further optimization, use **AWS Cost Explorer[16]** to evaluate **cost trends** and **monitor S3 storage charges**.

These strategies will help Silver Screen Studios balance storage requirements with cost-effectiveness by optimizing data management and using appropriate tools.

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