



DEA-C01^{Q&As}

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QUESTION 1

A financial company wants to use Amazon Athena to run on-demand SQL queries on a petabyte-scale dataset to support a business intelligence (BI) application. An AWS Glue job that runs during non-business hours updates the dataset

once every day. The BI application has a standard data refresh frequency of 1 hour to comply with company policies.

A data engineer wants to cost optimize the company's use of Amazon Athena without adding any additional infrastructure costs.

Which solution will meet these requirements with the LEAST operational overhead?

- A. Configure an Amazon S3 Lifecycle policy to move data to the S3 Glacier Deep Archive storage class after 1 day
- B. Use the query result reuse feature of Amazon Athena for the SQL queries.
- C. Add an Amazon ElastiCache cluster between the BI application and Athena.
- D. Change the format of the files that are in the dataset to Apache Parquet.

Correct Answer: B

Explanation: The best solution to cost optimize the company's use of Amazon Athena without adding any additional infrastructure costs is to use the query result reuse feature of Amazon Athena for the SQL queries. This feature allows you to run the same query multiple times without incurring additional charges, as long as the underlying data has not changed and the query results are still in the query result location in Amazon S3. This feature is useful for scenarios where you have a petabyte-scale dataset that is updated infrequently, such as once a day, and you have a BI application that runs the same queries repeatedly, such as every hour. By using the query result reuse feature, you can reduce the amount of data scanned by your queries and save on the cost of running Athena. You can enable or disable this feature at the workgroup level or at the individual query level¹. Option A is not the best solution, as configuring an Amazon S3 Lifecycle policy to move data to the S3 Glacier Deep Archive storage class after 1 day would not cost optimize the company's use of Amazon Athena, but rather increase the cost and complexity. Amazon S3 Lifecycle policies are rules that you can define to automatically transition objects between different storage classes based on specified criteria, such as the age of the object². S3 Glacier Deep Archive is the lowest-cost storage class in Amazon S3, designed for long-term data archiving that is accessed once or twice in a year³. While moving data to S3 Glacier Deep Archive can reduce the storage cost, it would also increase the retrieval cost and latency, as it takes up to 12 hours to restore the data from S3 Glacier Deep Archive³. Moreover, Athena does not support querying data that is in S3 Glacier or S3 Glacier Deep Archive storage classes⁴. Therefore, using this option would not meet the requirements of running on-demand SQL queries on the dataset. Option C is not the best solution, as adding an Amazon ElastiCache cluster between the BI application and Athena would not cost optimize the company's use of Amazon Athena, but rather increase the cost and complexity. Amazon ElastiCache is a service that offers fully managed in-memory data stores, such as Redis and Memcached, that can improve the performance and scalability of web applications by caching frequently accessed data. While using ElastiCache can reduce the latency and load on the BI application, it would not reduce the amount of data scanned by Athena, which is the main factor that determines the cost of running Athena. Moreover, using ElastiCache would introduce additional infrastructure costs and operational overhead, as you would have to provision, manage, and scale the ElastiCache cluster, and integrate it with the BI application and Athena. Option D is not the best solution, as changing the format of the files that are in the dataset to Apache Parquet would not cost optimize the company's use of Amazon Athena without adding any additional infrastructure costs, but rather increase the complexity. Apache Parquet is a columnar storage format that can improve the performance of analytical queries by reducing the amount of data that needs to be scanned and providing efficient compression and encoding schemes. However, changing the format of the files that are in the dataset to Apache Parquet would require additional processing and transformation steps, such as using AWS Glue or Amazon EMR to convert the files from their original format to Parquet, and storing the converted files in a separate location in Amazon S3. This would increase the complexity and the operational overhead of the data pipeline, and also incur additional costs for using AWS Glue or Amazon EMR.



References: Query result reuse Amazon S3 Lifecycle S3 Glacier Deep Archive

Storage classes supported by Athena

[What is Amazon ElastiCache?]

[Amazon Athena pricing]

[Columnar Storage Formats]

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QUESTION 2

A company has a production AWS account that runs company workloads. The company's security team created a security AWS account to store and analyze security logs from the production AWS account. The security logs in the production

AWS account are stored in Amazon CloudWatch Logs.

The company needs to use Amazon Kinesis Data Streams to deliver the security logs to the security AWS account.

Which solution will meet these requirements?

- A. Create a destination data stream in the production AWS account. In the security AWS account, create an IAM role that has cross-account permissions to Kinesis Data Streams in the production AWS account.
- B. Create a destination data stream in the security AWS account. Create an IAM role and a trust policy to grant CloudWatch Logs the permission to put data into the stream. Create a subscription filter in the security AWS account.
- C. Create a destination data stream in the production AWS account. In the production AWS account, create an IAM role that has cross-account permissions to Kinesis Data Streams in the security AWS account.
- D. Create a destination data stream in the security AWS account. Create an IAM role and a trust policy to grant CloudWatch Logs the permission to put data into the stream. Create a subscription filter in the production AWS account.

Correct Answer: D

Explanation: Amazon Kinesis Data Streams is a service that enables you to collect, process, and analyze real-time streaming data. You can use Kinesis Data Streams to ingest data from various sources, such as Amazon CloudWatch Logs, and deliver it to different destinations, such as Amazon S3 or Amazon Redshift. To use Kinesis Data Streams to deliver the security logs from the production AWS account to the security AWS account, you need to create a destination data stream in the security AWS account. This data stream will receive the log data from the CloudWatch Logs service in the production AWS account. To enable this cross-account data delivery, you need to create an IAM role and a trust policy in the security AWS account. The IAM role defines the permissions that the CloudWatch Logs service needs to put data into the destination data stream. The trust policy allows the production AWS account to assume the IAM role. Finally, you need to create a subscription filter in the production AWS account. A subscription filter defines the pattern to match log events and the destination to send the matching events. In this case, the destination is the destination data stream in the security AWS account. This solution meets the requirements of using Kinesis Data Streams to deliver the security logs to the security AWS account. The other options are either not possible or not optimal. You cannot create a destination data stream in the production AWS account, as this would not deliver the data to the security AWS account. You cannot create a subscription filter in the security AWS account, as this would not capture the log events from the production AWS account. References: Using Amazon Kinesis Data Streams with Amazon CloudWatch Logs AWS Certified Data Engineer - Associate DEA-C01 Complete Study Guide, Chapter 3: Data

Ingestion and Transformation, Section 3.3: Amazon Kinesis Data Streams

QUESTION 3

A company uses Amazon Athena to run SQL queries for extract, transform, and load (ETL) tasks by using Create Table As Select (CTAS). The company must use Apache Spark instead of SQL to generate analytics.

Which solution will give the company the ability to use Spark to access Athena?

- A. Athena query settings
- B. Athena workgroup
- C. Athena data source
- D. Athena query editor

Correct Answer: C

Explanation: Athena data source is a solution that allows you to use Spark to access Athena by using the Athena JDBC driver and the Spark SQL interface. You can use the Athena data source to create Spark DataFrames from Athena tables, run SQL queries on the DataFrames, and write the results back to Athena. The Athena data source supports various data formats, such as CSV, JSON, ORC, and Parquet, and also supports partitioned and bucketed tables. The Athena data source is a cost-effective and scalable way to use Spark to access Athena, as it does not require any additional infrastructure or services, and you only pay for the data scanned by Athena. The other options are not solutions that give the company the ability to use Spark to access Athena. Option A, Athena query settings, is a feature that allows you to configure various parameters for your Athena queries, such as the output location, the encryption settings, the query timeout, and the workgroup. Option B, Athena workgroup, is a feature that allows you to isolate and manage your Athena queries and resources, such as the query history, the query notifications, the query concurrency, and the query cost. Option D, Athena query editor, is a feature that allows you to write and run SQL queries on Athena using the web console or the API. None of these options enable you to use Spark instead of SQL to generate analytics on Athena. References: Using Apache Spark in Amazon Athena Athena JDBC Driver Spark SQL Athena query settings [Athena workgroups] [Athena query editor]

QUESTION 4

A manufacturing company collects sensor data from its factory floor to monitor and enhance operational efficiency. The company uses Amazon Kinesis Data Streams to publish the data that the sensors collect to a data stream. Then Amazon Kinesis Data Firehose writes the data to an Amazon S3 bucket.

The company needs to display a real-time view of operational efficiency on a large screen in the manufacturing facility.

Which solution will meet these requirements with the LOWEST latency?

- A. Use Amazon Managed Service for Apache Flink (previously known as Amazon Kinesis Data Analytics) to process the sensor data. Use a connector for Apache Flink to write data to an Amazon Timestream database. Use the Timestream database as a source to create a Grafana dashboard.
- B. Configure the S3 bucket to send a notification to an AWS Lambda function when any new object is created. Use the Lambda function to publish the data to Amazon Aurora. Use Aurora as a source to create an Amazon QuickSight dashboard.
- C. Use Amazon Managed Service for Apache Flink (previously known as Amazon Kinesis Data Analytics) to process



the sensor data. Create a new Data Firehose delivery stream to publish data directly to an Amazon Timestream database. Use the Timestream database as a source to create an Amazon QuickSight dashboard.

D. Use AWS Glue bookmarks to read sensor data from the S3 bucket in real time. Publish the data to an Amazon Timestream database. Use the Timestream database as a source to create a Grafana dashboard.

Correct Answer: C

Explanation: This solution will meet the requirements with the lowest latency because it uses Amazon Managed Service for Apache Flink to process the sensor data in real time and write it to Amazon Timestream, a fast, scalable, and

serverless time series database. Amazon Timestream is optimized for storing and analyzing time series data, such as sensor data, and can handle trillions of events per day with millisecond latency. By using AmazonTimestream as a source,

you can create an Amazon QuickSight dashboard that displays a real-time view of operational efficiency on a large screen in the manufacturing facility. Amazon QuickSight is a fully managed business intelligence service that can connect to

various data sources, including Amazon Timestream, and provide interactive visualizations and insights¹²³.

The other options are not optimal for the following reasons:

A. Use Amazon Managed Service for Apache Flink (previously known as Amazon Kinesis Data Analytics) to process the sensor data. Use a connector for Apache Flink to write data to an Amazon Timestream database. Use the Timestream database as a source to create a Grafana dashboard. This option is similar to option C, but it uses Grafana instead of Amazon QuickSight to create the dashboard. Grafana is an open source visualization tool that can also connect to Amazon Timestream, but it requires additional steps to set up and configure, such as deploying a Grafana server on Amazon EC2, installing the Amazon Timestream plugin, and creating an IAM role for Grafana to access Timestream. These steps can increase the latency and complexity of the solution. B. Configure the S3 bucket to send a notification to an AWS Lambda function when any new object is created. Use the Lambda function to publish the data to Amazon Aurora. Use Aurora as a source to create an Amazon QuickSight dashboard. This option is not suitable for displaying a real-time view of operational efficiency, as it introduces unnecessary delays and costs in the data pipeline. First, the sensor data is written to an S3 bucket by Amazon Kinesis Data Firehose, which can have a buffering interval of up to 900 seconds. Then, the S3 bucket sends a notification to a Lambda function, which can incur additional invocation and execution time. Finally, the Lambda function publishes the data to Amazon Aurora, a relational database that is not optimized for time series data and can have higher storage and performance costs than Amazon Timestream. D. Use AWS Glue bookmarks to read sensor data from the S3 bucket in real time. Publish the data to an Amazon Timestream database. Use the Timestream database as a source to create a Grafana dashboard. This option is also not suitable for displaying a real-time view of operational efficiency, as it uses AWS Glue bookmarks to read sensor data from the S3 bucket. AWS Glue bookmarks are a feature that helps AWS Glue jobs and crawlers keep track of the data that has already been processed, so that they can resume from where they left off. However, AWS Glue jobs and crawlers are not designed for real-time data processing, as they can have a minimum frequency of 5 minutes and a variable start-up time. Moreover, this option also uses Grafana instead of Amazon QuickSight to create the dashboard, which can increase the latency and complexity of the solution. References:

1: Amazon Managed Streaming for Apache Flink

2: Amazon Timestream

3: Amazon QuickSight : Analyze data in Amazon Timestream using Grafana : Amazon Kinesis Data Firehose : Amazon Aurora : AWS Glue Bookmarks : AWS Glue Job and Crawler Scheduling

QUESTION 5



A security company stores IoT data that is in JSON format in an Amazon S3 bucket. The data structure can change when the company upgrades the IoT devices. The company wants to create a data catalog that includes the IoT data. The company's analytics department will use the data catalog to index the data.

Which solution will meet these requirements MOST cost-effectively?

- A. Create an AWS Glue Data Catalog. Configure an AWS Glue Schema Registry. Create a new AWS Glue workload to orchestrate the ingestion of the data that the analytics department will use into Amazon Redshift Serverless.
- B. Create an Amazon Redshift provisioned cluster. Create an Amazon Redshift Spectrum database for the analytics department to explore the data that is in Amazon S3. Create Redshift stored procedures to load the data into Amazon Redshift.
- C. Create an Amazon Athena workgroup. Explore the data that is in Amazon S3 by using Apache Spark through Athena. Provide the Athena workgroup schema and tables to the analytics department.
- D. Create an AWS Glue Data Catalog. Configure an AWS Glue Schema Registry. Create AWS Lambda user defined functions (UDFs) by using the Amazon Redshift Data API. Create an AWS Step Functions job to orchestrate the ingestion of the data that the analytics department will use into Amazon Redshift Serverless.

Correct Answer: C

Explanation: The best solution to meet the requirements of creating a data catalog that includes the IoT data, and allowing the analytics department to index the data, most cost-effectively, is to create an Amazon Athena workgroup, explore the data that is in Amazon S3 by using Apache Spark through Athena, and provide the Athena workgroup schema and tables to the analytics department. Amazon Athena is a serverless, interactive query service that makes it easy to analyze data directly in Amazon S3 using standard SQL or Python¹. Amazon Athena also supports Apache Spark, an open-source distributed processing framework that can run large-scale data analytics applications across clusters of servers². You can use Athena to run Spark code on data in Amazon S3 without having to set up, manage, or scale any infrastructure. You can also use Athena to create and manage external tables that point to your data in Amazon S3, and store them in an external data catalog, such as AWS Glue Data Catalog, Amazon Athena Data Catalog, or your own Apache Hive metastore³. You can create Athena workgroups to separate query execution and resource allocation based on different criteria, such as users, teams, or applications⁴. You can share the schemas and tables in your Athena workgroup with other users or applications, such as Amazon QuickSight, for data visualization and analysis⁵. Using Athena and Spark to create a data catalog and explore the IoT data in Amazon S3 is the most cost-effective solution, as you pay only for the queries you run or the compute you use, and you pay nothing when the service is idle¹. You also save on the operational overhead and complexity of managing data warehouse infrastructure, as Athena and Spark are serverless and scalable. You can also benefit from the flexibility and performance of Athena and Spark, as they support various data formats, including JSON, and can handle schema changes and complex queries efficiently. Option A is not the best solution, as creating an AWS Glue Data Catalog, configuring an AWS Glue Schema Registry, creating a new AWS Glue workload to orchestrate the ingestion of the data that the analytics department will use into Amazon Redshift Serverless, would incur more costs and complexity than using Athena and Spark. AWS Glue Data Catalog is a persistent metadata store that contains table definitions, job definitions, and other control information to help you manage your AWS Glue components⁶. AWS Glue Schema Registry is a service that allows you to centrally store and manage the schemas of your streaming data in AWS Glue Data Catalog⁷. AWS Glue is a serverless data integration service that makes it easy to prepare, clean, enrich, and move data between data stores⁸. Amazon Redshift Serverless is a feature of Amazon Redshift, a fully managed data warehouse service, that allows you to run and scale analytics without having to manage data warehouse infrastructure⁹. While these services are powerful and useful for many data engineering scenarios, they are not necessary or cost-effective for creating a data catalog and indexing the IoT data in Amazon S3. AWS Glue Data Catalog and Schema Registry charge you based on the number of objects stored and the number of requests made^{6,7}. AWS Glue charges you based on the compute time and the data processed by your ETL jobs⁸. Amazon Redshift Serverless charges you based on the amount of data scanned by your queries and the compute time used by your workloads⁹. These costs can add up quickly, especially if you have large volumes of IoT data and frequent schema changes. Moreover, using AWS Glue and Amazon Redshift Serverless would introduce additional latency and complexity, as you would have to ingest the data from Amazon S3 to Amazon Redshift Serverless, and then query it from there, instead of querying it directly from Amazon S3 using Athena and Spark. Option B is not the best solution, as creating an Amazon Redshift provisioned cluster, creating an Amazon



Redshift Spectrum database for the analytics department to explore the data that is in Amazon S3, and creating Redshift stored procedures to load the data into Amazon Redshift, would incur more costs and complexity than using Athena and Spark. Amazon Redshift provisioned clusters are clusters that you create and manage by specifying the number and type of nodes, and the amount of storage and compute capacity¹⁰. Amazon Redshift Spectrum is a feature of Amazon Redshift that allows you to query and join data across your data warehouse and your data lake using standard SQL¹¹. Redshift stored procedures are SQL statements that you can define and store in Amazon Redshift, and then call them by using the CALL command¹². While these features are powerful and useful for many data warehousing scenarios, they are not necessary or cost-effective for creating a data catalog and indexing the IoT data in Amazon S3. Amazon Redshift provisioned clusters charge you based on the node type, the number of nodes, and the duration of the cluster¹⁰. Amazon Redshift Spectrum charges you based on the amount of data scanned by your queries¹¹. These costs can add up quickly, especially if you have large volumes of IoT data and frequent schema changes. Moreover, using Amazon Redshift provisioned clusters and Spectrum would introduce additional latency and complexity, as you would have to provision and manage the cluster, create an external schema and database for the data in Amazon S3, and load the data into the cluster using stored procedures, instead of querying it directly from Amazon S3 using Athena and Spark. Option D is not the best solution, as creating an AWS Glue Data Catalog, configuring an AWS Glue Schema Registry, creating AWS Lambda user defined functions (UDFs) by using the Amazon Redshift Data API, and creating an AWS Step Functions job to orchestrate the ingestion of the data that the analytics department will use into Amazon Redshift Serverless, would incur more costs and complexity than using Athena and Spark. AWS Lambda is a serverless compute service that lets you run code without provisioning or managing servers¹³. AWS Lambda UDFs are Lambda functions that you can invoke from within an Amazon Redshift query. Amazon Redshift Data API is a service that allows you to run SQL statements on Amazon Redshift clusters using HTTP requests, without needing a persistent connection. AWS Step Functions is a service that lets you coordinate multiple AWS services into serverless workflows. While these services are powerful and useful for many data engineering scenarios, they are not necessary or cost-effective for creating a data catalog and indexing the IoT data in Amazon S3. AWS Glue Data Catalog and Schema Registry charge you based on the number of objects stored and the number of requests made⁶⁷. AWS Lambda charges you based on the number of requests and the duration of your functions¹³. Amazon Redshift Serverless charges you based on the amount of data scanned by your queries and the compute time used by your workloads⁹. AWS Step Functions charges you based on the number of state transitions in your workflows. These costs can add up quickly, especially if you have large volumes of IoT data and frequent schema changes. Moreover, using AWS Glue, AWS Lambda, Amazon Redshift Data API, and AWS Step Functions would introduce additional latency and complexity, as you would have to create and invoke Lambda functions to ingest the data from Amazon S3 to Amazon Redshift Serverless using the Data API, and coordinate the ingestion process using Step Functions, instead of querying it directly from Amazon S3 using Athena and Spark. References: What is Amazon Athena? Apache Spark on Amazon Athena Creating tables, updating the schema, and adding new partitions in the Data Catalog from AWS Glue ETL jobs Managing Athena workgroups Using Amazon QuickSight to visualize data in Amazon Athena AWS Glue Data Catalog AWS Glue Schema Registry What is AWS Glue? Amazon Redshift Serverless Amazon Redshift provisioned clusters Querying external data using Amazon Redshift Spectrum Using stored procedures in Amazon Redshift What is AWS Lambda? [Creating and using AWS Lambda UDFs] [Using the Amazon Redshift Data API] [What is AWS Step Functions?] AWS Certified Data Engineer - Associate DEA-C01 Complete Study Guide

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