AWS Data Engineering Project - Global Crypto Market Pulse

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Goal: Build an end-to-end pipeline that ingests real-time crypto prices, processes them with Spark, and transforms them into an analytics layer.

Architecture Breakdown

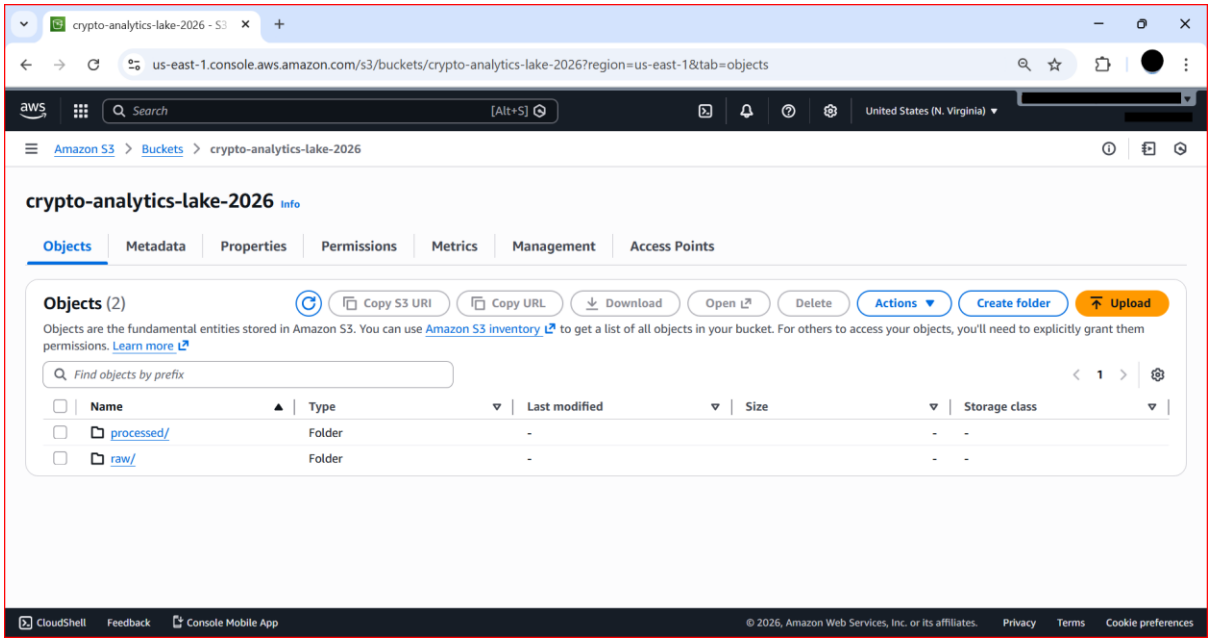
Layer	Service(s)	Role
Ingestion	**Lambda + Kinesis**	Python script fetches price data from a public API (like CoinGecko) and streams it.
Storage	**S3**	The "Raw" (Bronze) zone for stream logs.
Processing	**Glue (PySpark)**	A Spark job cleans the JSON logs and saves them as Parquet (Silver layer).
Governance	**Lake Formation**	Manage permissions for the Glue Data Catalog.
Orchestration	**Step Functions**	A visual workflow to trigger pipeline, prepare gold layer in Athena.

Phase 1: Ingestion (Lambda ➔ Kinesis ➔ S3)

Create your S3 Data Lake

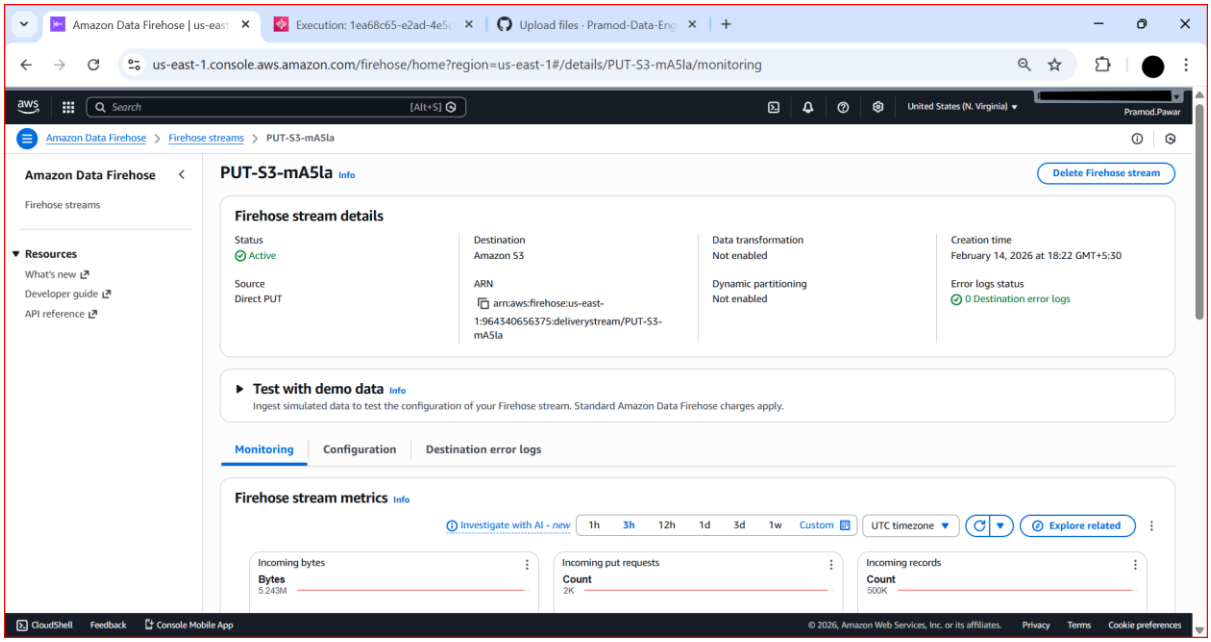
First, create an S3 bucket with a unique name (e.g., crypto-analytics-lake-2026). Inside this bucket, create two folders:

- raw/: This is your **bronze** layer (raw JSON data).
- processed/: This is your **silver** layer (cleaned Parquet data).



Set up Kinesis Data Firehose

1. Go to the **Kinesis Console** -> **Select Amazon Data Firehose - new Formerly Kinesis Data Firehose → Create Firehose Stream**.
2. **Source:** Direct PUT (this allows Lambda to send data directly).
3. **Destination:** Amazon S3.
4. **S3 Bucket:** Choose the bucket you just created and set the prefix to raw/.
5. **Buffer Hints:** Set to 1 MiB or 60 seconds (this ensures data shows up quickly for your testing).



Note: - During setup of Kinesis Data Firehose; AWS itself creates required Role. Sometime we receive an error saying that “role does not exist”. If we press the create button once again; it successfully creates firehose.

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The Lambda "Producer" (Python)

This script will act as your data generator. It fetches the current price of Bitcoin and Ethereum and pushes it to Kinesis.

Code (lambda_function.py):

https://github.com/Pramod-Data-Eng/Real-Time-Crypto-Analytics/blob/main/lambda_function.py

Note: To run this in Lambda, you'll need to add a **Layer** for the requests library or bundle it in a ZIP. You can also use urllib.request (built-in) to avoid the extra step.

mkdir python

pip install requests -t python/

zip -r requests_layer.zip python

- Go to AWS Lambda → Layers → Create Layer.

- Upload `requests_layer.zip`.

- Attach the layer to your function.

- Keep your function zip containing only `lambda_function.py`.

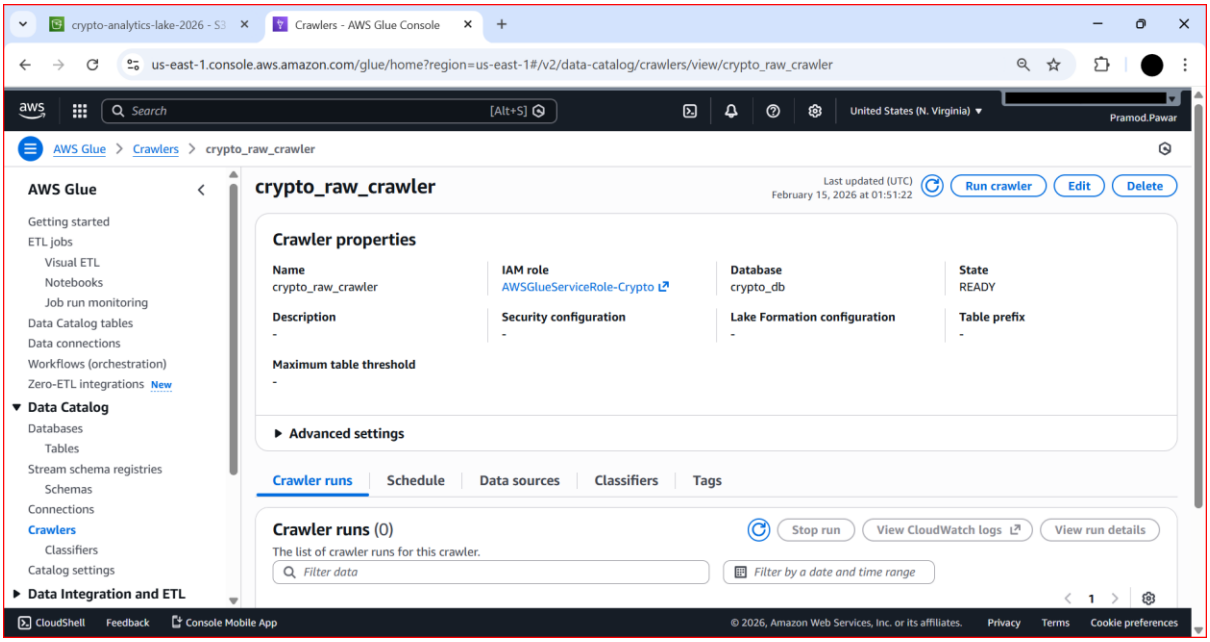
Attach role that will have default lambda execution role as well as Firehose S3 Put Object Role.

Phase 2: Cataloguing & Spark Processing

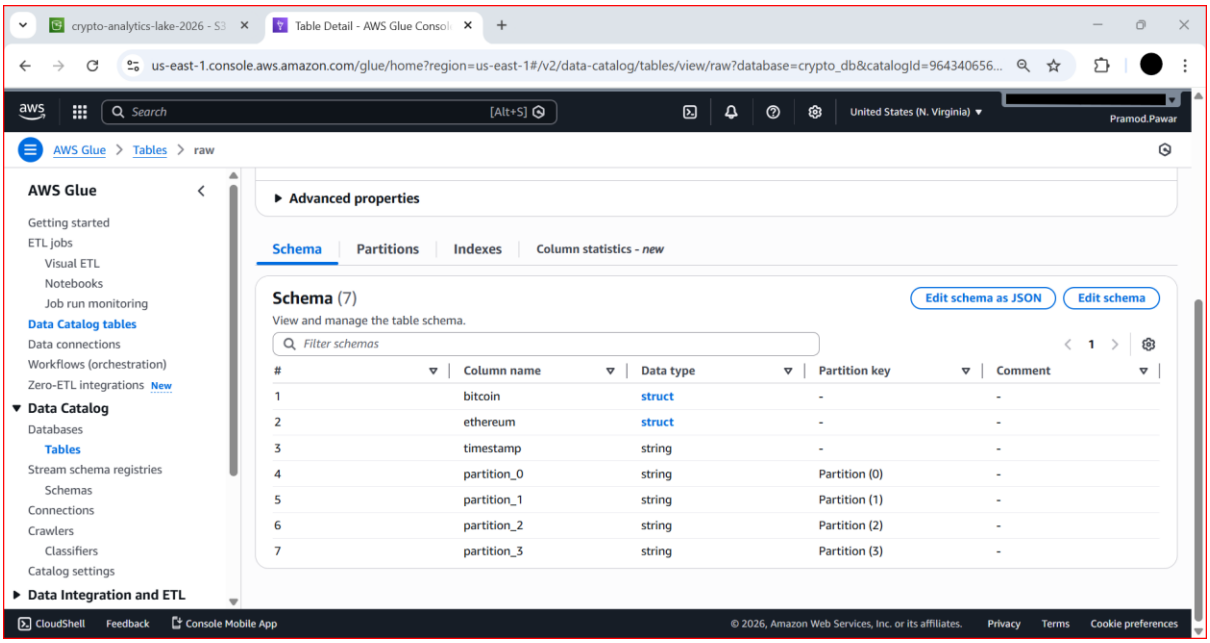
The Glue Crawler (Schema Discovery)

Before Spark can process the data efficiently, AWS needs to "understand" its structure.

1. Go to **AWS Glue Console** -> **Data Catalog** → **Crawlers** -> **Create crawler**.
2. **Name:** crypto_raw_crawler.
3. **Data source:** Add your S3 path (s3://crypto-analytics-lake-2026/raw/).
4. **IAM Role:** Create a new role (Glue will suggest this). Ensure it has access to your S3 bucket.
5. **Output Database:** Create a new database called crypto_db.
6. **Run it:** Once created, click **Run crawler**.



- *Wait 1-2 minutes.* When it finishes, go to **Tables** in Glue. You should see a table (e.g., raw) with the schema inferred from your JSON.



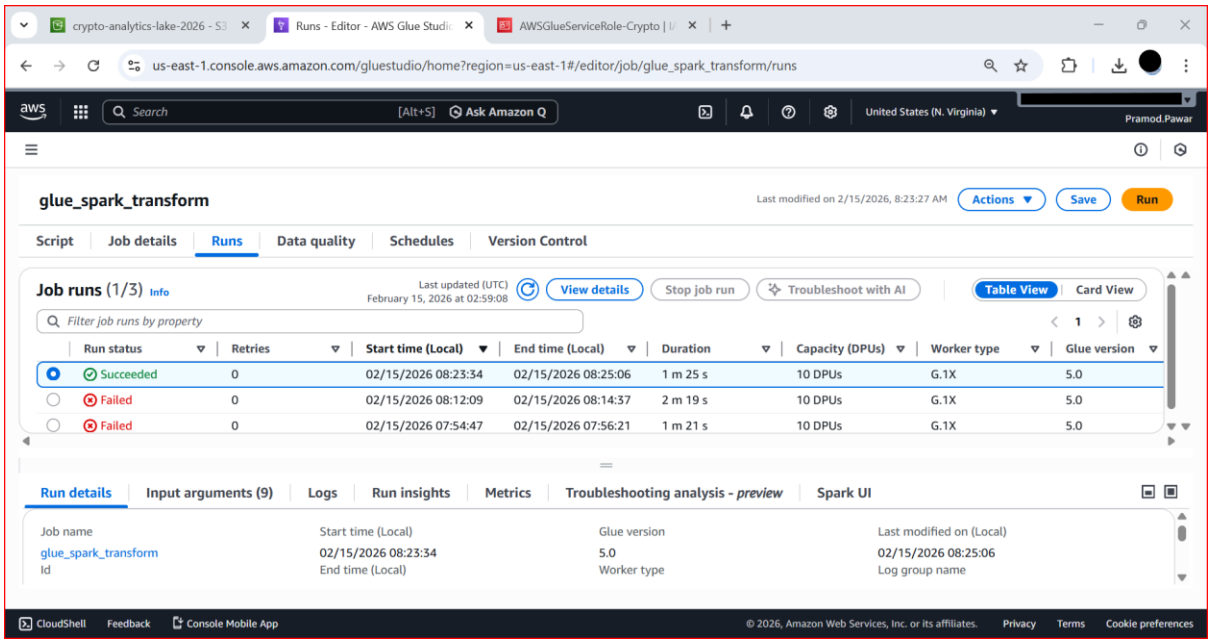
The Spark Transformation (Glue ETL Job)

Now we write the **PySpark** script to flatten the JSON and save it as Parquet in your processed/ (Silver) folder.

1. Go to **Glue ETL jobs** -> **Visual ETL** (or Script editor if you prefer coding directly).
2. Select **Python Shell** or **Spark script**. Let's use Spark for your GitHub portfolio.

The PySpark Logic (glue_spark_transform.py):

https://github.com/Pramod-Data-Eng/Real-Time-Crypto-Analytics/blob/main/glue_spark_transform.py



Note: - Before execution of AWS Glue Job; please ensure that the job is having appropriate S3 Put object permission in order to write output parquet file in S3 processed folder

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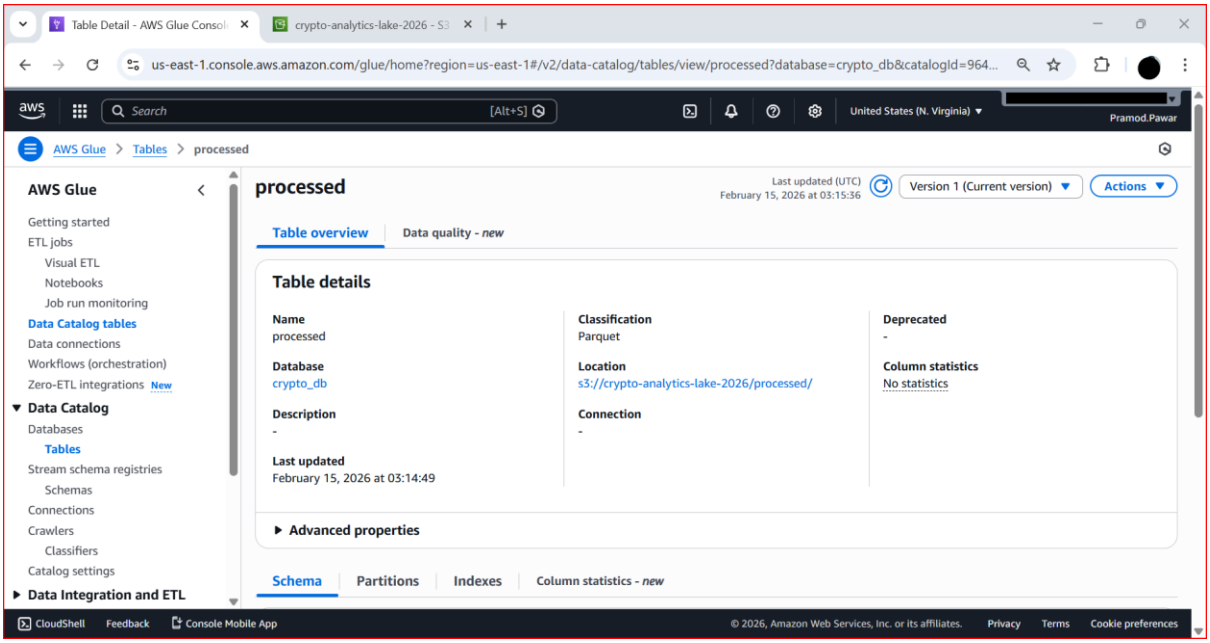
Phase 3: The Athena Validation (Sanity Check)

Before moving to Redshift, we need to ensure the Glue Catalog correctly maps to your Parquet files.

1. **Run a Glue Crawler** on your processed/ folder.

   This will create table processed in Glue



2. Once finished, go to the **Athena Console**.

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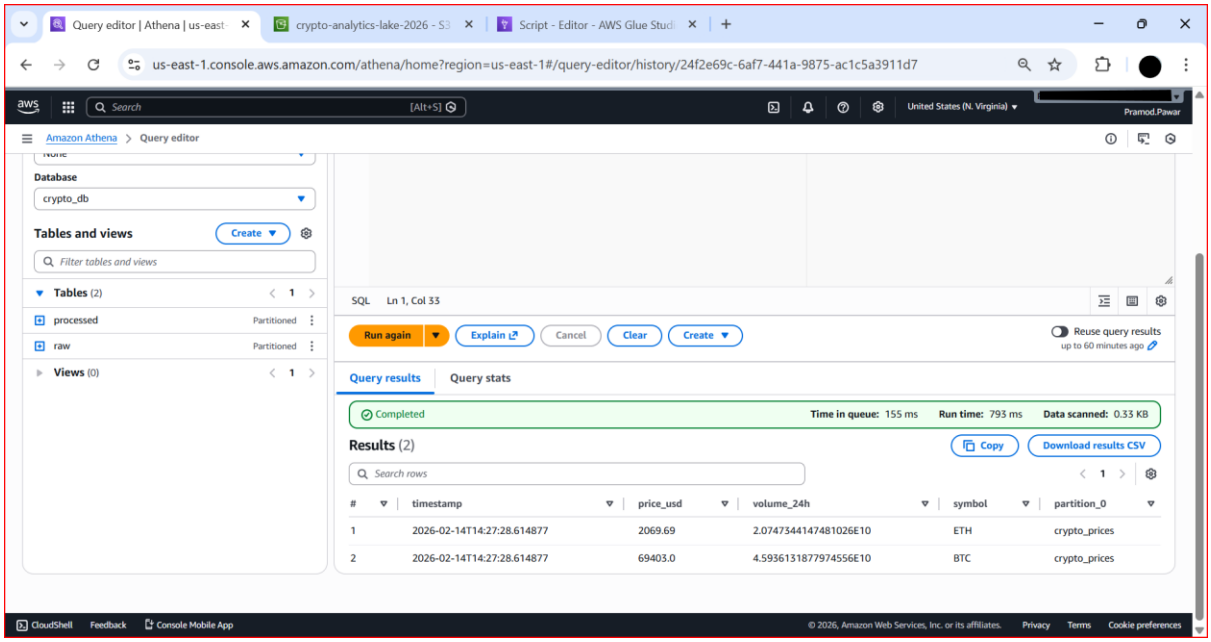
3. Select your crypto_db database.
4. Run this SQL:

SQL

select * from processed limit 10;



Phase 4: Orchestration with AWS Step Functions

We will create a State Machine that acts as the "conductor" for your entire pipeline. Instead of running things manually, this will handle the sequence and errors.

1. The Workflow Logic

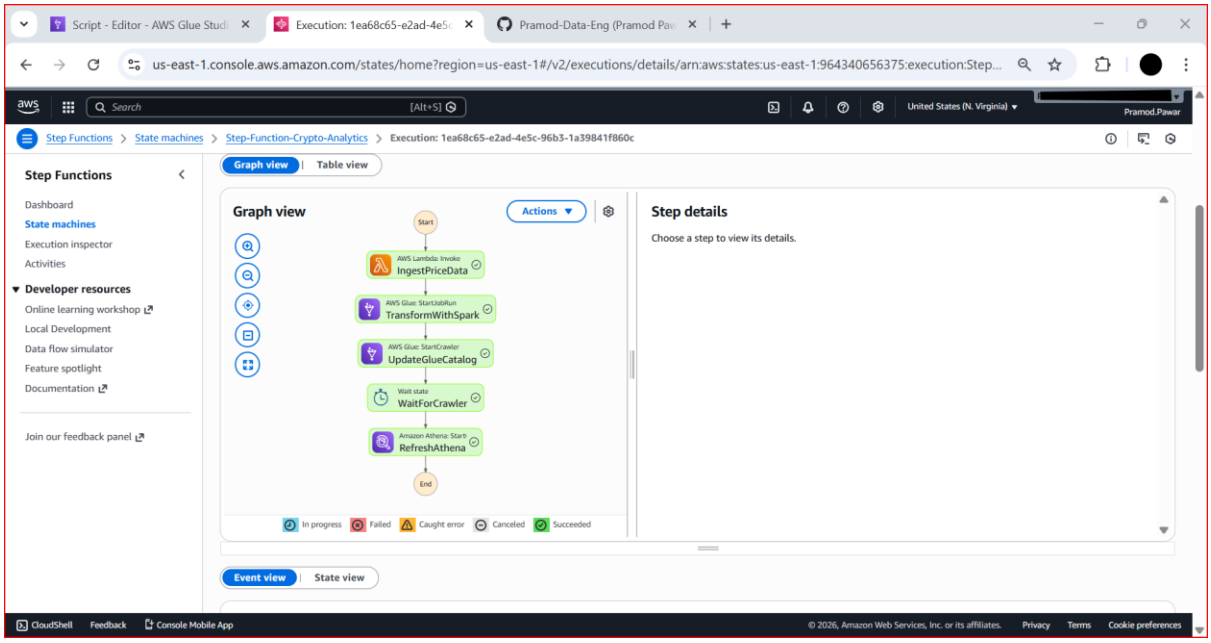
- Step 1: Ingest – Trigger the Lambda to fetch the latest prices.
- Step 2: Transform – Run the Glue Spark job once the data is in S3.
- Step 3: Catalog – Run the Crawler to update the schema.
- Step 4: Load – Use Athena as Gold layer

2. The Step Function Code (ASL)

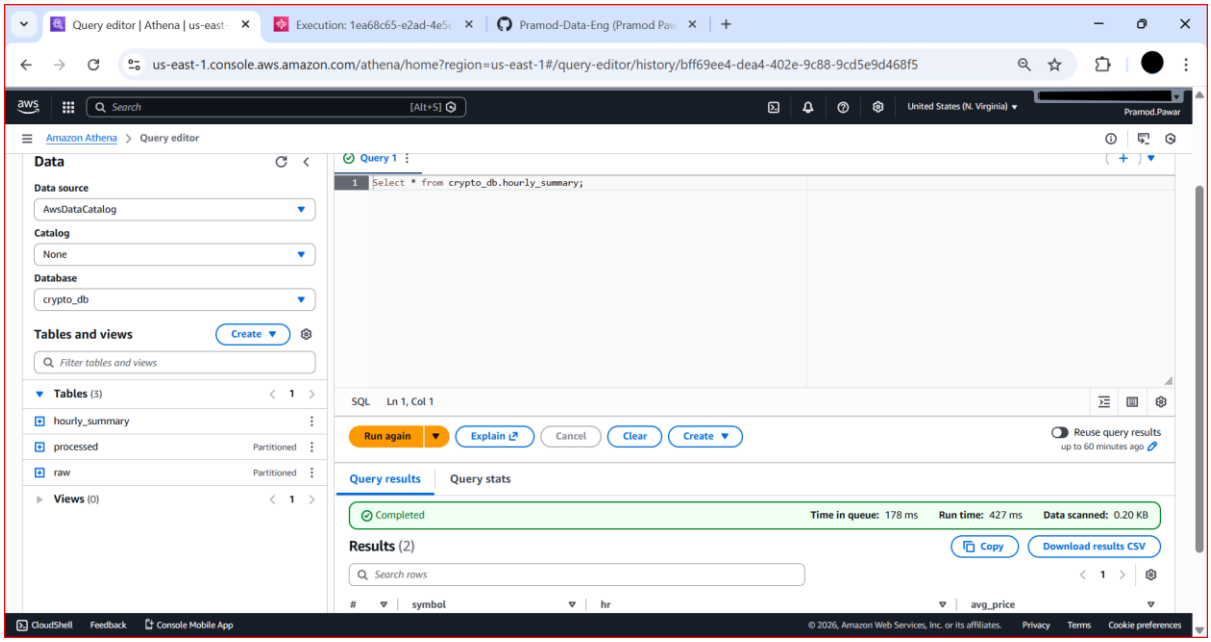
Go to Step Functions > Create state machine > Blank > Code tab. Paste this (replace placeholders with your actual ARNs):

JSON

https://github.com/Pramod-Data-Eng/Real-Time-Crypto-Analytics/blob/main/Step-Function-Crypto-Analytics.json



Final Output



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