Lab: Creating a High-Performance Banking Database with Cassandra / DataStax Astra

Introduction

In today's banking industry, data is the lifeblood of operations. From managing transactions to ensuring compliance, banks rely on powerful databases that can handle vast amounts of data with speed and reliability. Traditional relational databases often struggle to keep up with the scale and complexity of modern banking applications. This is where **Apache Cassandra**, powered by **DataStax Astra**, comes into play.

In this lab, you will go through the process of creating a database in DataStax Astra using a compelling banking use case. We will explore why Cassandra is the ideal choice for this scenario, and setup your database.

The Banking Use Case: Real-Time Fraud Detection System

Use Case Overview:

Imagine a bank that handles millions of transactions daily. With increasing cyber threats, the bank needs a real-time fraud detection system that can analyze transactions as they occur, flag suspicious activities, and take immediate action. The system must process high volumes of data with minimal latency, ensuring that fraudulent transactions are detected and prevented instantly.

Why Apache Cassandra?

1. **High Availability and Fault Tolerance:** In a banking environment, downtime is not an option. Cassandra's distributed architecture ensures that the system remains available even if multiple nodes fail. This is critical for a real-time fraud detection system that must be operational 24/7.
2. **Scalability:** Cassandra is designed to scale horizontally, meaning you can add more nodes to handle increased transaction volumes without impacting performance. As the bank grows, the system can seamlessly scale to accommodate more transactions.
3. **Low Latency:** With Cassandra's distributed nature, data can be replicated across multiple regions, ensuring that transactions are processed close to the user, reducing latency. This is vital for detecting and responding to fraudulent activities in real-time.
4. **Flexible Data Model:** Cassandra's support for a flexible schema allows the system to adapt to new fraud detection algorithms and evolving data structures without significant redesigns.

Step-by-Step: Creating a Database in DataStax Astra for Our Use Case

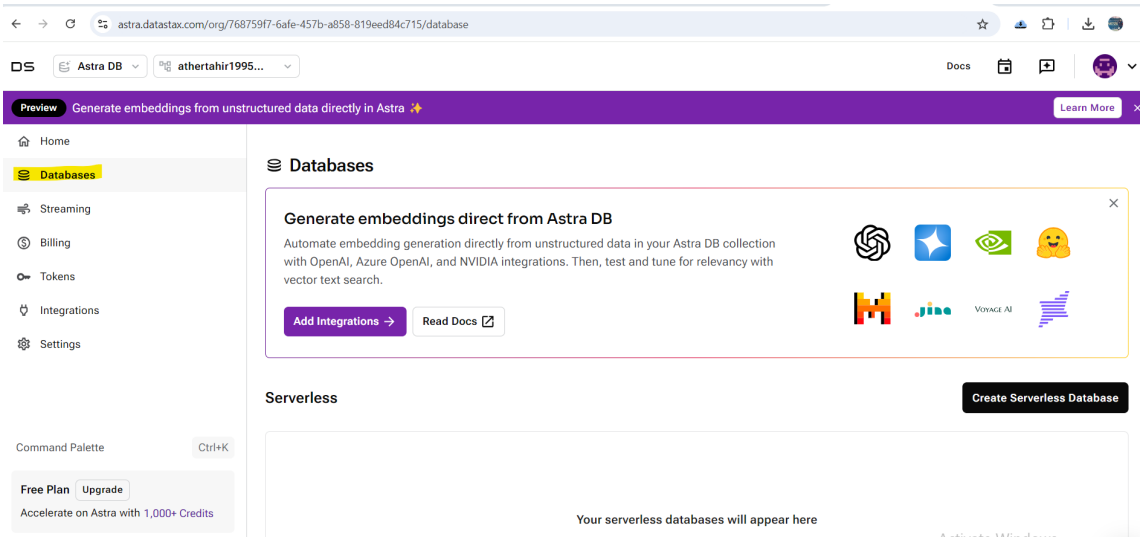
Step 1: Sign Up for DataStax Astra

Start by signing up for a free account on DataStax Astra. You'll get 10 GB of free storage, which is more than enough to begin setting up your fraud detection system.

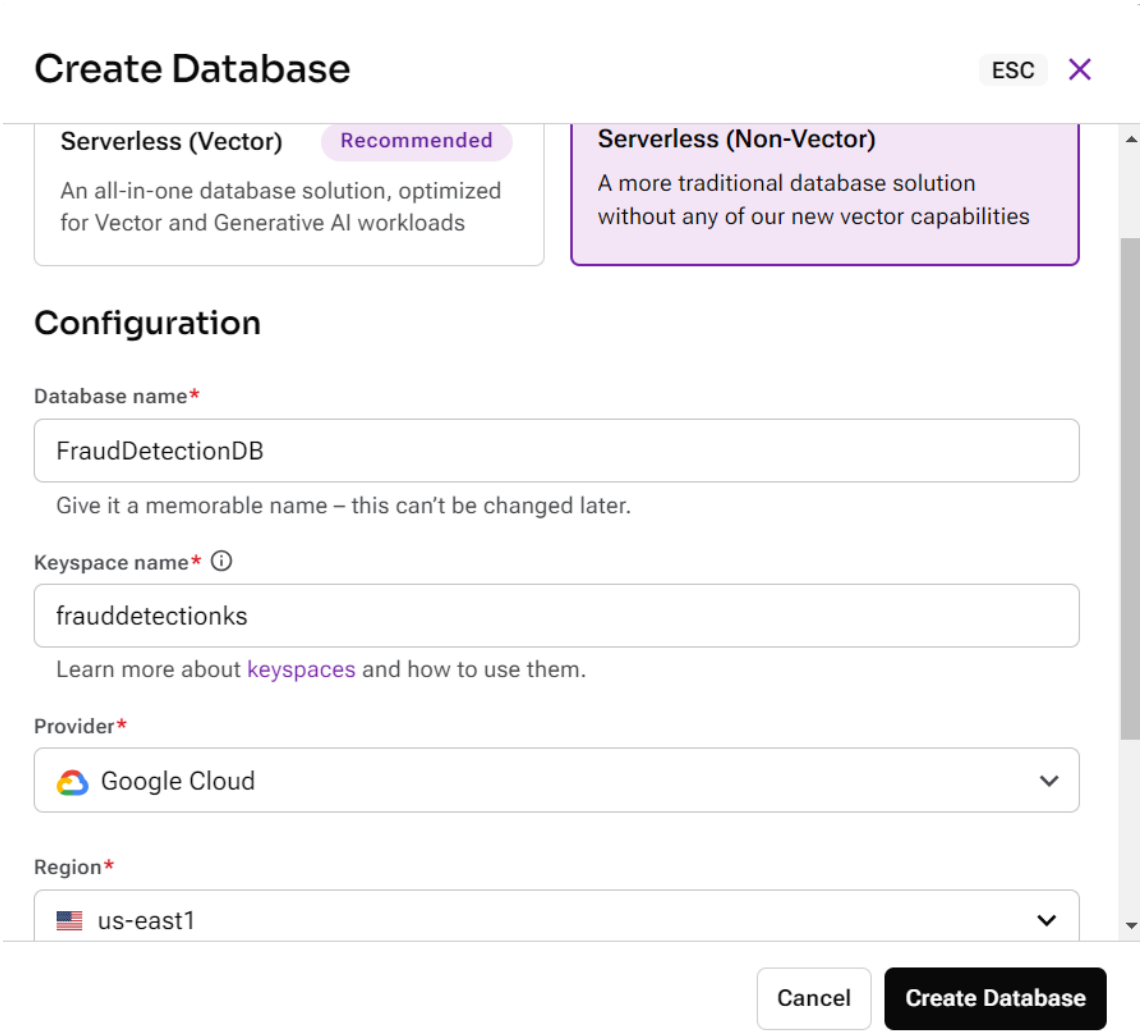
Step 2: Create a Serverless (Non-Vector) Database

For this use case, we'll create a **Serverless (Non-Vector) Database** since our focus is on transactional data rather than vector-based data.

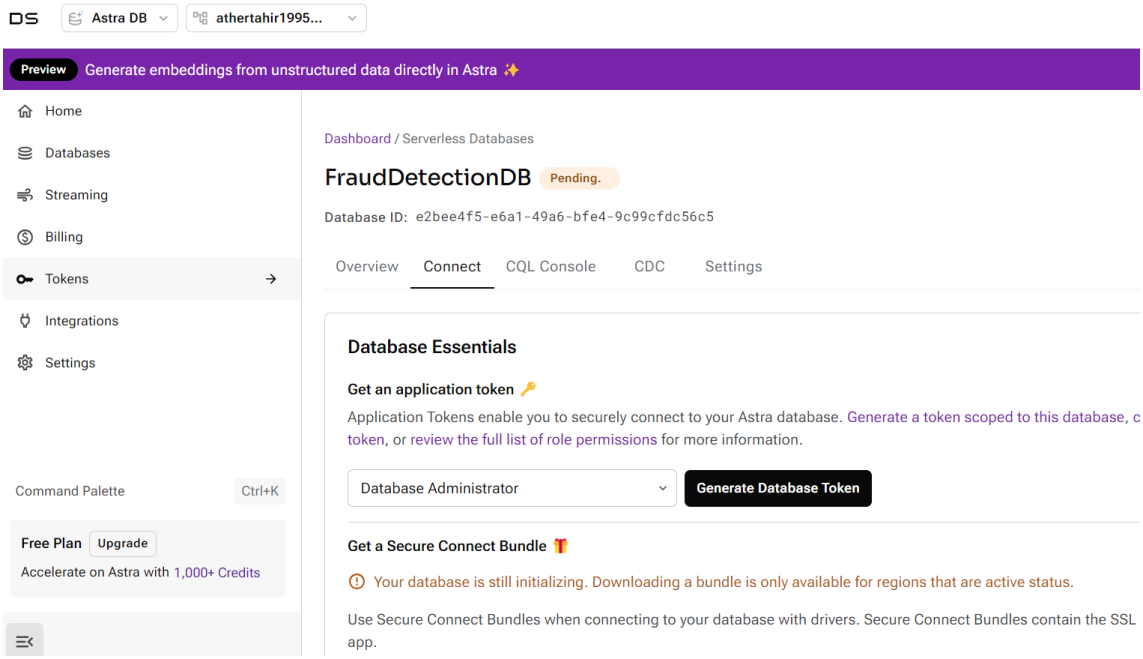
1. **Navigate to Databases:** Once logged into the Astra Portal, select **Databases** from the main navigation.
2. **Create Database:**



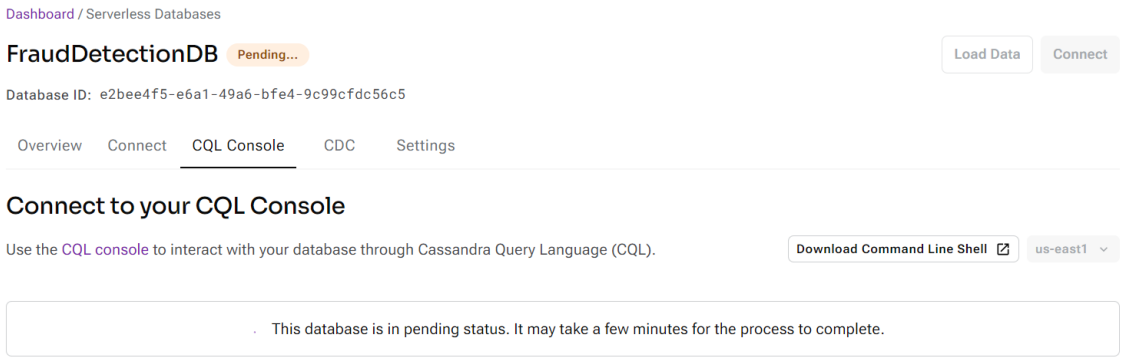
- Click on **Create Serverless Database**.
- In the **Create Database** dialog, select the **Serverless (Non-Vector)** deployment type.
- **Configuration:**
- **Database Name:** Enter a meaningful name like `FraudDetectionDB`.
- **Keyspace Name:** Name the keyspace `frauddetectionks`. The keyspace will contain all the tables related to our fraud detection system.
- **Provider and Region:** Choose a cloud provider and region that best suits your needs. For example, if your bank operates primarily in North America, you might choose `us-east1` in Google Cloud. Choose any available provider and region (that is not locked).



1. **Click Create Database:** Your database will start in Pending status and move to Initializing. Once the database reaches Active status, it's ready to use.



Click **CQL Console** and wait for sometime while database is in `Pending` state.



Step 3: Designing the Data Model

For our fraud detection system, we'll need several tables to store transactions, flagged activities, user profiles, and more. Here's a simplified version:

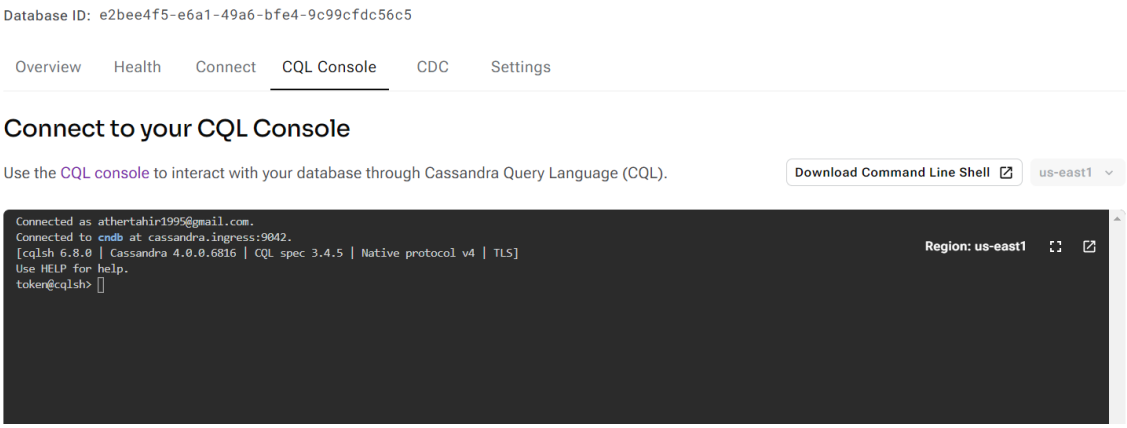
- **Transactions Table:** Stores all transaction data.
- **Table Name:** `transactions`
- **Primary Key:** `transaction_id`
- **Columns:** `account_id`, `transaction_amount`, `transaction_time`, `merchant_id`, `location`, etc.
- **Flagged Activities Table:** Stores suspicious activities flagged by the system.
- **Table Name:** `flagged_activities`
- **Primary Key:** `flag_id`
- **Columns:** `transaction_id`, `account_id`, `flag_reason`, `flag_time`, `resolved`, etc.

- **User Profiles Table:** Stores user-related information for context during fraud detection.
- **Table Name:** `user_profiles`
- **Primary Key:** `account_id`
- **Columns:** `name`, `address`, `phone_number`, `email`, `risk_score`, etc.

Step 4: Creating Tables and Loading Data

1. **Access the CQL Console:**

- In the Astra Portal, navigate to your newly created database and click on **CQL Console** to start defining your tables.



1. **Create the Transactions Table:**

```
CREATE TABLE frauddetectionks.transactions (
    transaction_id TEXT PRIMARY KEY,
    account_id TEXT,
    transaction_amount DECIMAL,
    transaction_time TEXT,
    merchant_id TEXT,
    location TEXT,
    fraud_status TEXT
);
```

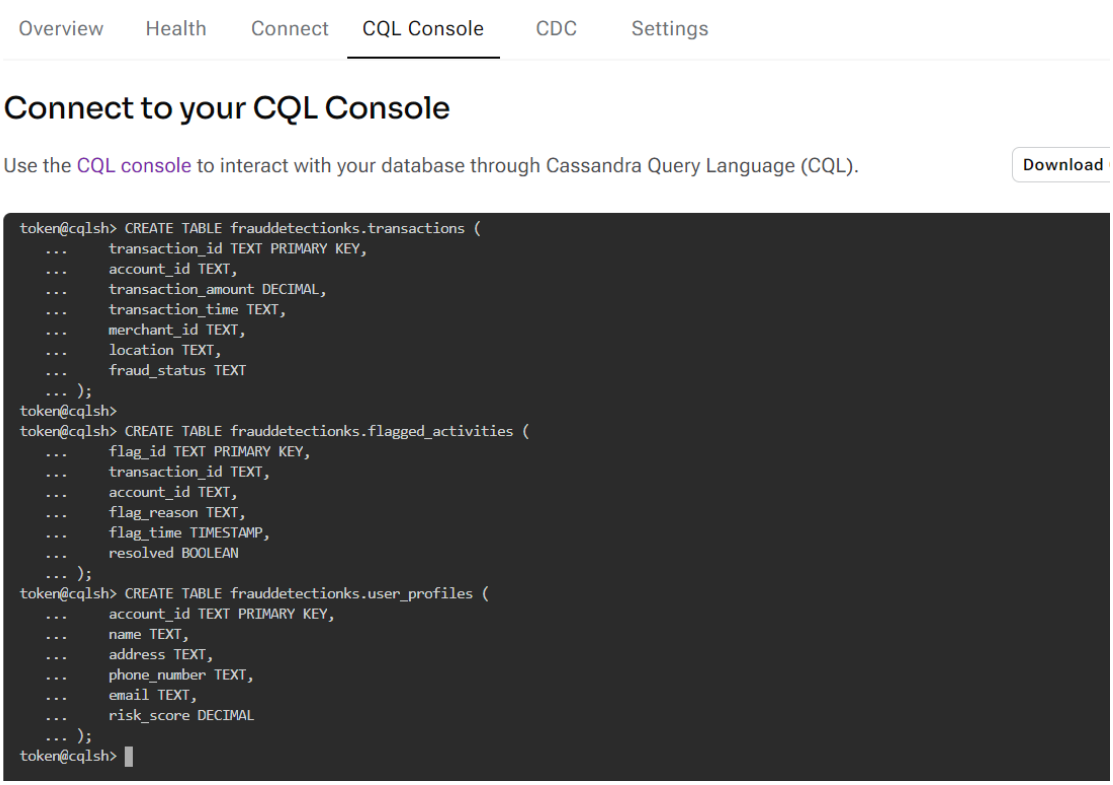
1. **Create the Flagged Activities Table:**

```
CREATE TABLE frauddetectionks.flagged_activities (
    flag_id TEXT PRIMARY KEY,
    transaction_id TEXT,
    account_id TEXT,
    flag_reason TEXT,
    flag_time TIMESTAMP,
    resolved BOOLEAN
);
```

1. **Create the User Profiles Table:**

```
CREATE TABLE frauddetectionks.user_profiles (
    account_id TEXT PRIMARY KEY,
```

```
    name TEXT,
    address TEXT,
    phone_number TEXT,
    email TEXT,
    risk_score DECIMAL
);
```



1. **Loading Data:** You can load data into these tables using the CQL `INSERT` command or by uploading CSV files through the Astra Portal's data tools.

Step 5: Connecting to Your Database

Once your tables are created and data is loaded, you can connect your application to the Astra database using the provided connection information in the Astra Portal. Astra supports multiple connection methods, including CQL, REST, and GraphQL APIs, making it easy to integrate into your existing systems.

Conclusion

By following this guide, you've set up a powerful, scalable, and resilient database tailored to a critical banking use case: real-time fraud detection. With DataStax Astra and Apache Cassandra, you've laid the groundwork for a system that can handle massive amounts of data with the speed and reliability necessary for modern banking applications.

Whether you're building a fraud detection system or any other high-performance application, Cassandra and Astra offer the flexibility, scalability, and power needed to succeed.

Part 2: Loading Data into Your DataStax Astra Banking Database

Introduction

In previous lab, we walked through the process of setting up a Serverless (Non-Vector) database in DataStax Astra, tailored to a real-time fraud detection system for a banking application. Now that your database is up and running, it's time to load it with data. In this part, we'll guide you through the process of preparing your data, creating the necessary resources, and finally loading the data into your database.

Step 1: Preparing Your Data

For this example, we'll use sample data that simulates banking transactions. If you have your own data, you can use that instead. Otherwise, follow along with the sample data provided below.

Sample CSV Data

We'll create a CSV file that contains transaction data. Here's what the contents of the `transactions.csv` file will look like:

```
transaction_id,account_id,transaction_amount,transaction_time,merchant_id,location,fraud

1e75a5b1-ec5a-4c32-a1b2-b6a67940f5a4,acc_001,250.75,2024-08-27 14:35:20,merch_001,"New
York, NY",false
2d85b6b2-ec6a-4d42-a2c3-c7b78950g6b5,acc_002,1450.00,2024-08-27
15:00:00,merch_002,"Los Angeles, CA",false
3f95c7c3-fd7a-5e52-b3d4-d8c79961h7c6,acc_003,560.25,2024-08-27
15:15:30,merch_003,"Chicago, IL",true
4g16d8d4-ge8b-6f63-c4e5-e9d8aa72i8d7,acc_004,80.00,2024-08-27
15:45:10,merch_004,"Miami, FL",false
5h27e9e5-hf9c-7g74-d5f6-faebbb83j9e8,acc_005,320.50,2024-08-27 16:10:45,merch_005,"San
Francisco, CA",true
6i38f0f6-ig0d-8h85-e6g7-gbecbc94k0f9,acc_006,270.00,2024-08-28
10:00:30,merch_006,"Austin, TX",false
7j49g1g7-jh1e-9i96-f7h8-hcfcdd05l1g0,acc_007,130.75,2024-08-28
11:15:50,merch_007,"Seattle, WA",false
8k50h2h8-kj2f-0j07-g8i9-idgdee16m2h1,acc_008,990.40,2024-08-28
12:30:10,merch_008,"Boston, MA",true
9l61i3i9-lk3g-1k18-h9j0-jehfee27n3i2,acc_009,245.00,2024-08-28
13:45:25,merch_009,"Houston, TX",false
0m72j4j0-ml4h-2l29-i0k1-kfifff38o4j3,acc_010,675.25,2024-08-28
15:00:45,merch_010,"Atlanta, GA",false
1n83k5k1-nm5i-3m30-j1l2-lgjggg49p5k4,acc_011,1340.00,2024-08-29
09:15:10,merch_011,"Denver, CO",true
2o94l6l2-on6j-4n41-k2m3-mhkhhh50q6l5,acc_012,410.90,2024-08-29
10:30:20,merch_012,"Orlando, FL",false
3p05m7m3-po7k-5o52-l3n4-niilli61r7m6,acc_013,230.65,2024-08-29 11:45:35,merch_013,"Las
Vegas, NV",false
4q16n8n4-qp8l-6p63-m4o5-ojjmmm72s8n7,acc_014,990.00,2024-08-29 13:00:55,merch_014,"San
Diego, CA",true
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14:15:15,merch_015,"Portland, OR",false
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09:30:30,merch_016,"Phoenix, AZ",false
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10:45:45,merch_017,"Salt Lake City, UT",true
8u50r2r8-ut2p-0t07-q8s9-snnqqq16w2r1,acc_018,890.25,2024-08-30
12:00:10,merch_018,"Charlotte, NC",false
```

```
9v61s3s9-vu3q-1u18-r9t0-toorrs27x3s2,acc_019,210.80,2024-08-30
13:15:25,merch_019,"Dallas, TX",false
0w72t4t0-wv4r-2v29-s0u1-upptts38y4t3,acc_020,1050.00,2024-08-30
14:30:40,merch_020,"Nashville, TN",true
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09:45:55,merch_021,"Memphis, TN",false
2y94v6v2-xy6t-4x41-u2w3-wrruuu50a6v5,acc_022,135.75,2024-08-31
11:00:10,merch_022,"Baltimore, MD",false
3z05w7w3-yz7u-5y52-v3x4-xsstvv61b7w6,acc_023,750.00,2024-08-31
12:15:25,merch_023,"Indianapolis, IN",true
4a16x8x4-z01v-6z63-w4y5-yuutvv72c8x7,acc_024,495.30,2024-08-31
13:30:40,merch_024,"Cleveland, OH",false
5b27y9y5-a12w-7a74-x5z6-avvvww83d9y8,acc_025,330.00,2024-08-31
14:45:55,merch_025,"Kansas City, MO",false
6c38z0z6-b23x-8b85-y6a7-bwwwxx94e0z9,acc_026,890.15,2024-09-01
09:00:20,merch_026,"Columbus, OH",true
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10:15:35,merch_027,"Milwaukee, WI",false
8e50b2b8-d45z-0d07-01c9-dyyy0116g2b1,acc_028,270.00,2024-09-01
11:30:50,merch_028,"Louisville, KY",true
9f61c3c9-e56a-1e18-12d0-ezzz1227h3c2,acc_029,420.45,2024-09-01
12:45:10,merch_029,"Oklahoma City, OK",false
0g72d4d0-f67b-2f29-23e1-faaa2338i4d3,acc_030,670.00,2024-09-01
14:00:25,merch_030,"Minneapolis, MN",false
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09:15:40,merch_031,"St. Louis, MO",true
2i94f6f2-h89d-4h41-45g3-hccc4550k6f5,acc_032,490.80,2024-09-02
10:30:55,merch_032,"Cincinnati, OH",false
3j05g7g3-i90e-5i52-56h4-iddc5661l7g6,acc_033,230.65,2024-09-02 11:45:10,merch_033,"New
Orleans, LA",true
4k16h8h4-j01f-6j63-67i5-jeee6772m8h7,acc_034,760.90,2024-09-02
13:00:25,merch_034,"Pittsburgh, PA",false
5l27i9i5-k12g-7k74-78j6-kfff7883n9i8,acc_035,150.75,2024-09-02
14:15:40,merch_035,"Raleigh, NC",false
6m38j0j6-l23h-8l85-89k7-lggg8994o0j9,acc_036,235.90,2024-09-03
09:30:55,merch_036,"Richmond, VA",true
7n49k1k7-m34i-9m96-90l8-mhhh9005p1k0,acc_037,990.00,2024-09-03
10:45:10,merch_037,"Tampa, FL",false
8o50l2l8-n45j-0n07-01m9-niii0116q2l1,acc_038,580.75,2024-09-03
12:00:25,merch_038,"Jacksonville, FL",true
9p61m3m9-o56k-1o18-12n0-ojjj1227r3m2,acc_039,270.00,2024-09-03
13:15:40,merch_039,"Buffalo, NY",false
0q72n4n0-p67l-2p29-23o1-pkkk2338s4n3,acc_040,420.45,2024-09-03
14:30:55,merch_040,"Fort Worth, TX",false
1r83o5o1-q78m-3q30-34p2-qlll3449t5o4,acc_041,670.00,2024-09-04 09:45:10,merch_041,"El
Paso, TX",true
2s94p6p2-r89n-4r41-45q3-rmmm4550u6p5,acc_042,1300.50,2024-09-04
11:00:25,merch_042,"Detroit, MI",false
3t05q7q3-s90o-5s52-56r4-snnn5661v7q6,acc_043,490.80,2024-09-04
12:15:40,merch_043,"Charlotte, NC",false
4u16r8r4-t01p-6t63-67s5-tooo6772w8r7,acc_044,230.65,2024-09-04 13:30:55,merch_044,"San
Antonio, TX",true
```

```
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09:00:25,merch_046,"Tucson, AZ",true
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Vegas, NV",false
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09:15:40,merch_051,"Omaha, NE",true
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10:30:55,merch_052,"Tulsa, OK",false
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11:45:10,merch_053,"Wichita, KS",false
4e16b8b4-d01z-6d63-67c5-dzzz6772g8b7,acc_054,495.30,2024-09-06
13:00:25,merch_054,"Arlington, TX",true
5f27c9c5-e12a-7e74-78d6-eaaa7883h9c8,acc_055,330.00,2024-09-06 14:15:40,merch_055,"New
Orleans, LA",false
6g38d0d6-f23b-8f85-89e7-fbbb8994i0d9,acc_056,890.15,2024-09-07
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7h49e1e7-g34c-9g96-90f8-gccc9005j1e0,acc_057,580.75,2024-09-07
10:45:10,merch_057,"Aurora, CO",false
8i50f2f8-h45d-0h07-01g9-hddd0116k2f1,acc_058,270.00,2024-09-07
12:00:25,merch_058,"Anaheim, CA",false
9j61g3g9-i56e-1i18-12h0-ieee1227l3g2,acc_059,420.45,2024-09-07
13:15:40,merch_059,"Santa Ana, CA",true
0k72h4h0-j67f-2j29-23i1-jfff2338m4h3,acc_060,670.00,2024-09-07
14:30:55,merch_060,"Riverside, CA",false
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09:00:25,merch_061,"Stockton, CA",false
2m94j6j2-l89h-4l41-45k3-lhhh4550o6j5,acc_062,490.80,2024-09-08
10:15:40,merch_062,"Henderson, NV",true
3n05k7k3-m90i-5m52-56l4-miii5661p7k6,acc_063,230.65,2024-09-08
11:30:55,merch_063,"Chula Vista, CA",false
4o16l8l4-n01j-6n63-67m5-njjj6772q8l7,acc_064,760.90,2024-09-08
12:45:10,merch_064,"Irvine, CA",false
5p27m9m5-o12k-7o74-78n6-okkk7883r9m8,acc_065,150.75,2024-09-08
14:00:25,merch_065,"Fremont, CA",true
6q38n0n6-p23l-8p85-89o7-plll8994s0n9,acc_066,235.90,2024-09-09 09:15:40,merch_066,"San
Bernardino, CA",false
7r49o1o7-q34m-9q96-90p8-qmmm9005t1o0,acc_067,990.00,2024-09-09
10:30:55,merch_067,"Modesto, CA",true
8s50p2p8-r45n-0r07-01q9-rrrr0116u2p1,acc_068,580.75,2024-09-09
11:45:10,merch_068,"Fontana, CA",false
9t61q3q9-s56o-1s18-12r0-ssss1227v3q2,acc_069,270.00,2024-09-09
13:00:25,merch_069,"Moreno Valley, CA",false
0u72r4r0-t67p-2t29-23s1-tttt2338w4r3,acc_070,420.45,2024-09-09
14:15:40,merch_070,"Glendale, CA",true
```

```
1v83s5s1-u78q-3u30-34t2-uuuu3449x5s4,acc_071,670.00,2024-09-10
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2w94t6t2-v89r-4v41-45u3-vvvv4550y6t5,acc_072,1300.50,2024-09-10
10:45:10,merch_072,"Huntington Beach, CA",true
3x05u7u3-w90s-5w52-56v4-wwwx5661z7u6,acc_073,490.80,2024-09-10
12:00:25,merch_073,"Santa Clarita, CA",false
4y16v8v4-x01t-6x63-67w5-xxxy6772a8v7,acc_074,230.65,2024-09-10
13:15:40,merch_074,"Garden Grove, CA",true
5z27w9w5-y12u-7y74-78x6-yyyw7883b9w8,acc_075,760.90,2024-09-10
14:30:55,merch_075,"Santa Rosa, CA",false
```

To create this CSV file:

1. Open a text editor or spreadsheet application (such as Excel or Google Sheets).
2. Enter the above data into the appropriate cells/fields.
3. Save the file as `transactions.csv`.

Note: File is also available in GitHub repo:
`https://github.com/fenago/cassandra/blob/main/labs/lab2_database/transactions.csv`

Step 2: Load Data Using the Astra Portal

With your data prepared, we can now load it into the `transactions` table you created in Part 1.

Load the CSV Data into Astra

1. **Log in to the Astra Portal:**

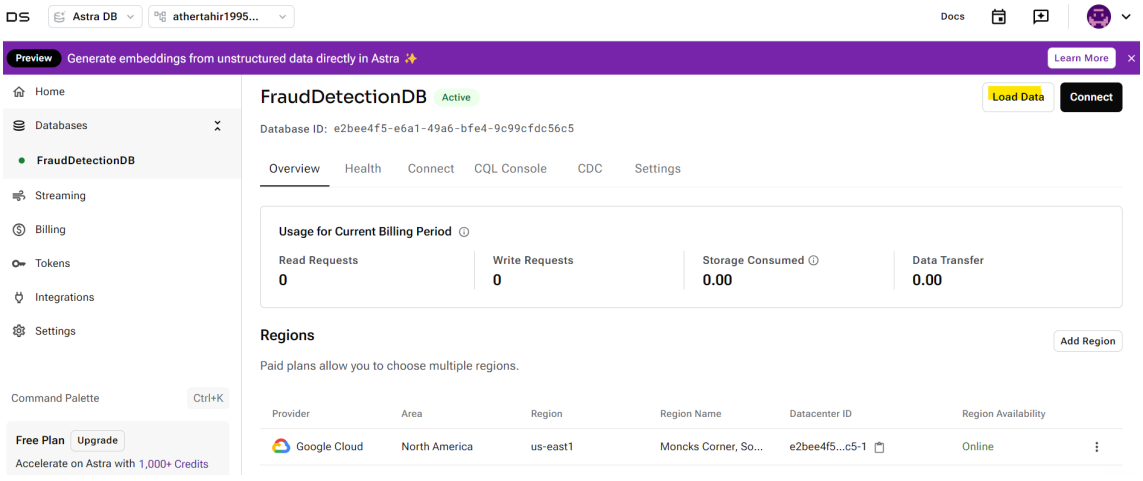
- Navigate to the Astra Portal and log in with your credentials.

1. **Navigate to Your Database:**

- In the Astra Portal, go to **Databases** and select your `FraudDetectionDB` database.

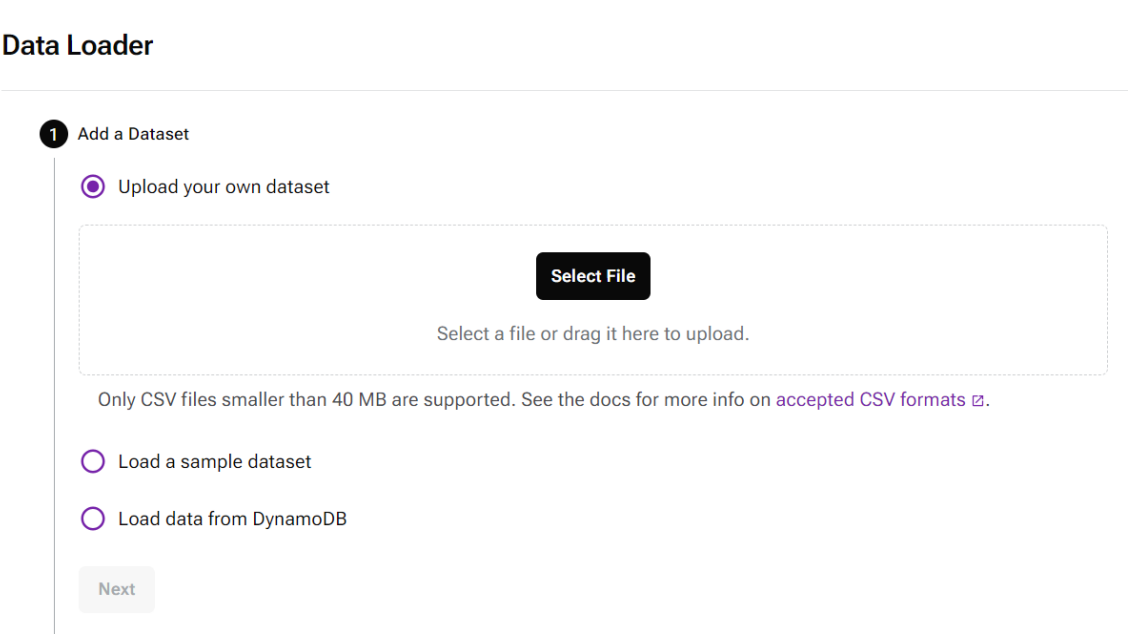
1. **Access the Data Loader:**

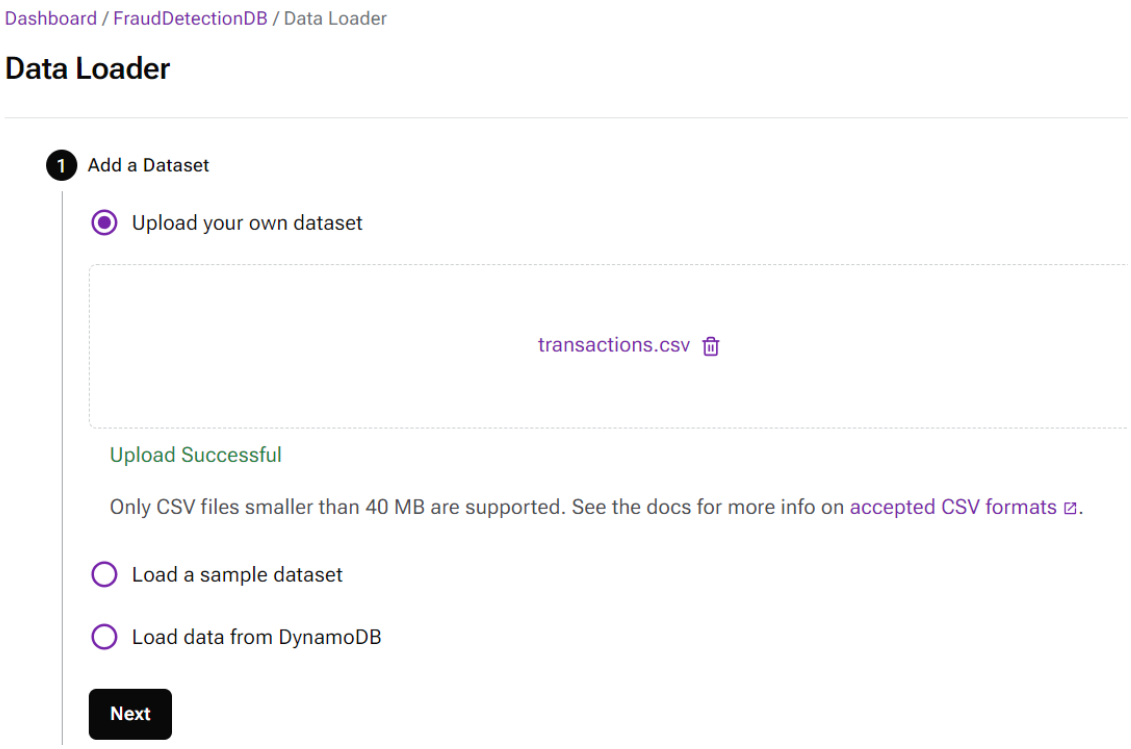
- Click on **Load Data** to access the data loading tools.



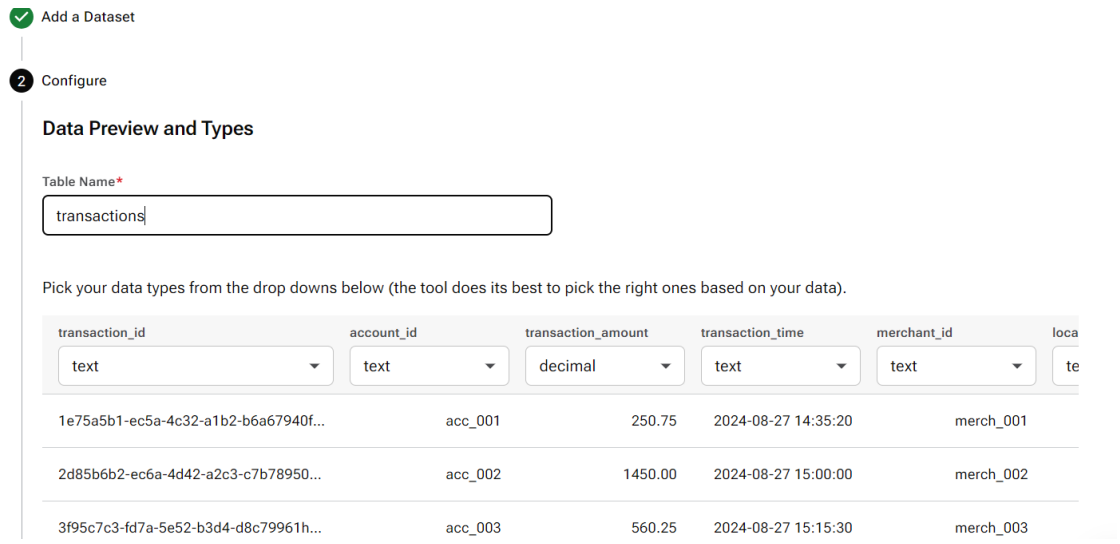
1. **Upload the CSV File:**

- In the Data Loader, click **Select File** and choose the `transactions.csv` file you created earlier.





- Wait for the file to upload. Once uploaded, you'll see a preview of the first ten rows in the **Data Preview** section.



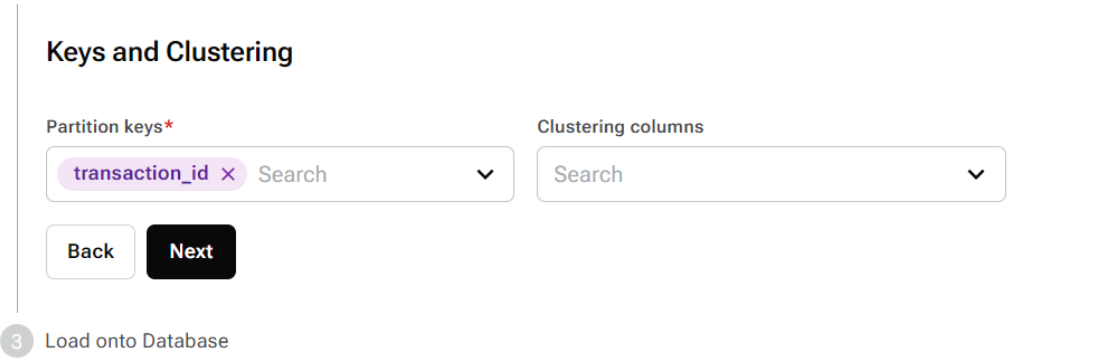
1. **Review Data Types:**

- Review the data types for each column. The Data Loader will automatically detect the types. Ensure that the types match the schema defined in the `transactions` table:

- `transaction_id` : TEXT
- `account_id` : TEXT
- `transaction_amount` : DECIMAL
- `transaction_time` : TEXT
- `merchant_id` : TEXT
- `location` : TEXT
- `fraud_status` : TEXT

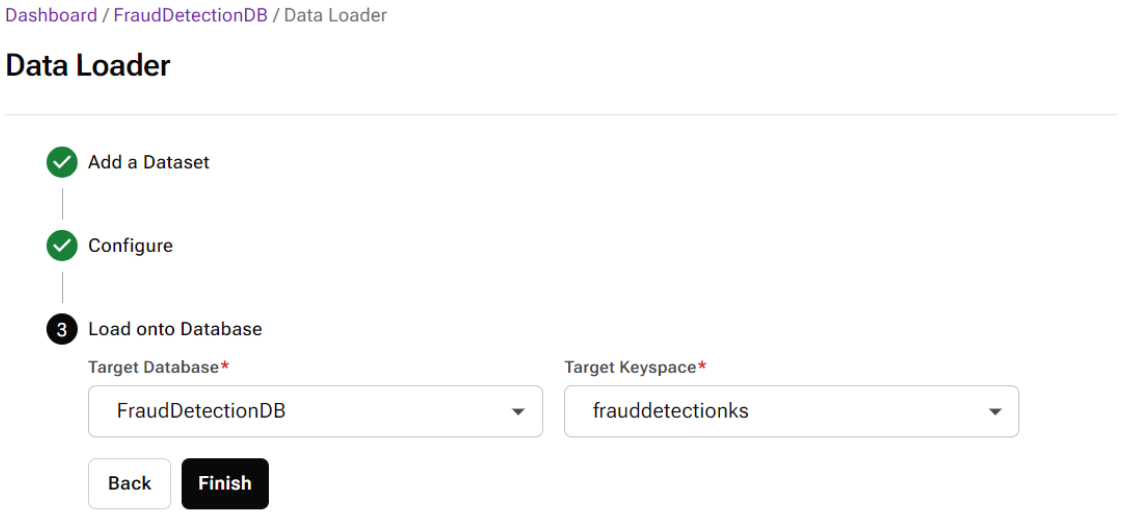
1. **Partition Keys and Clustering Columns:**

- From the **Partition keys** drop-down, select `transaction_id` as the partition key.
- You can skip clustering columns for this example, as the `transaction_id` serves as a unique identifier.

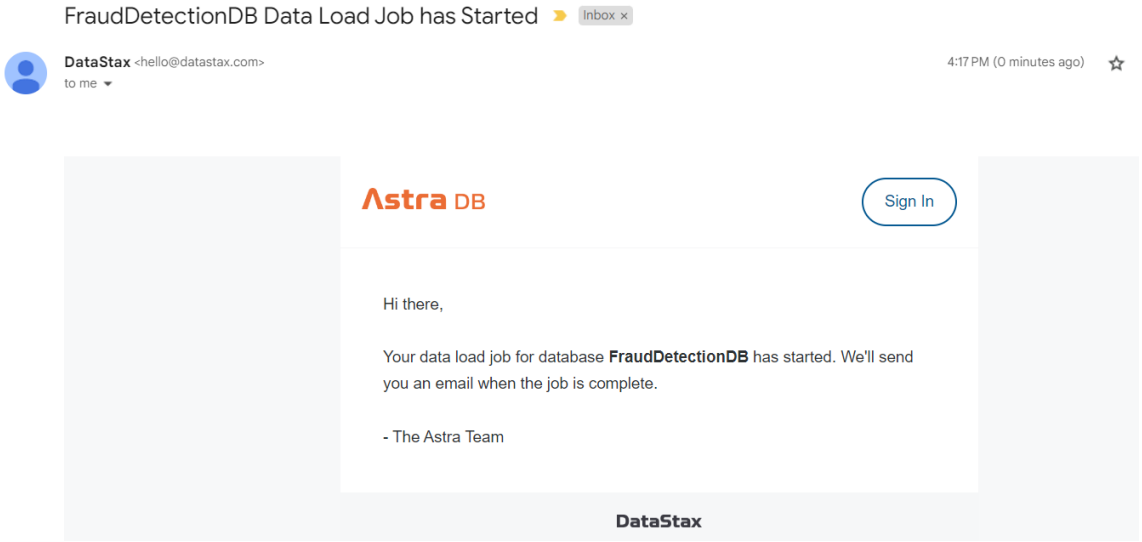


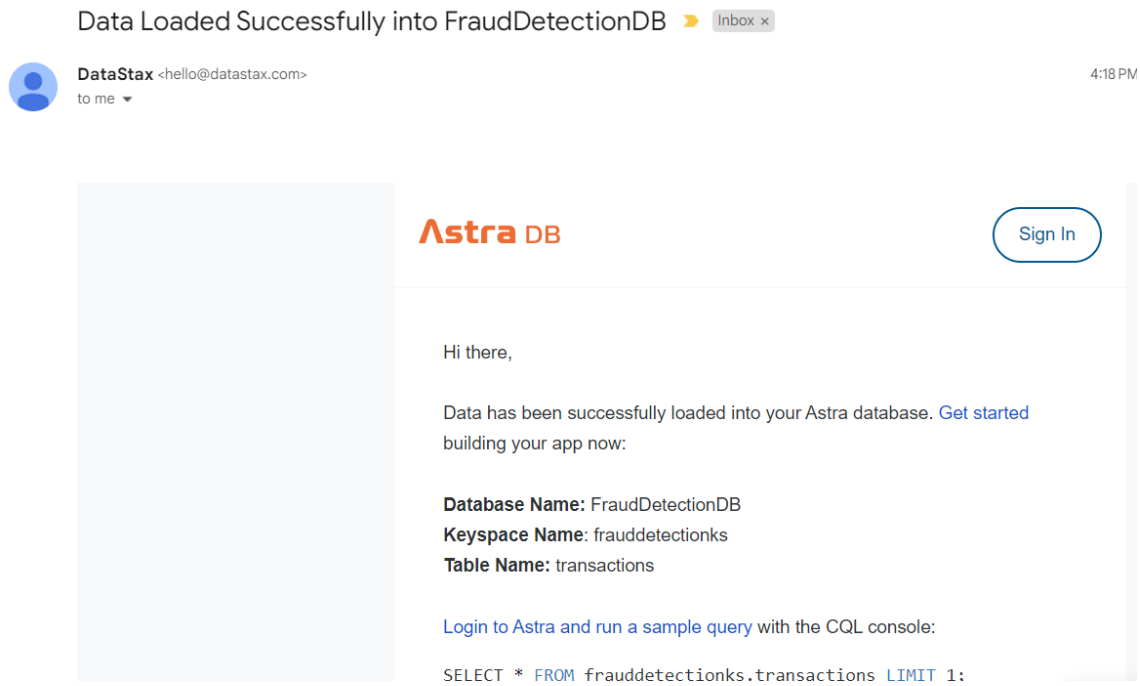
1. **Load the Data:**

- Click **Next** and then **Finish** to start the data import process.



- You'll receive an email notification once the data import is complete.





Note: It will take time for data import to complete. You can start the next steps after data import is completed.

Step 3: Verify the Loaded Data

After loading the data, it's essential to verify that the data has been loaded correctly.

Use the CQL Console to Verify

1. **Open the CQL Console:**

- In the Astra Portal, navigate to your `FraudDetectionDB` database.
- Click on **CQL Console**.

1. **Select the Keyspace:**

- At the `token@cqlsh>` prompt, use the following command to select your keyspace:

```
USE frauddetectionks;
```

1. **Run a Query to Verify Data:**

- Execute the following query to retrieve the first few rows from the `transactions` table:

```
SELECT * FROM transactions LIMIT 5;
```

1. **Review the Results:**

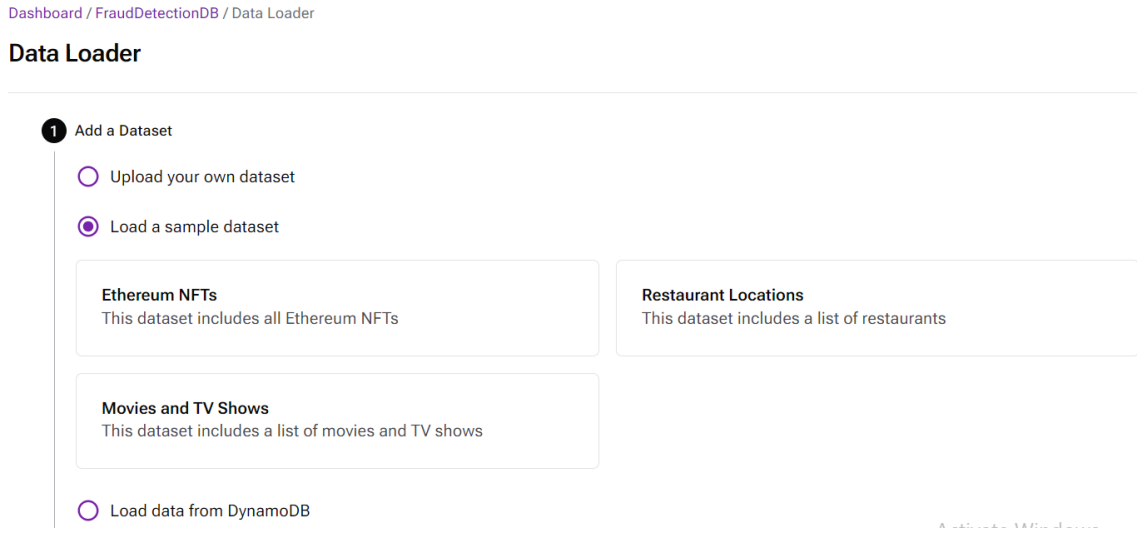
- The console should display the rows from your CSV file. Verify that all columns and data types match your expectations.

Step 4: Load a Sample Dataset (Optional)

If you prefer to test with a pre-built dataset, Astra provides sample datasets that you can load to explore features before using your own data.

1. **Load a Sample Dataset:**

- In the Astra Portal, go to **Databases** and select your database.
- Click on **Data Loader**.
- Choose an empty namespace, or create one if needed.
- Click **Load a sample dataset** to load a sample dataset.
- You can now interact with this sample data.



Conclusion

Congratulations! You've successfully loaded your transaction data into your DataStax Astra database, laying the foundation for a powerful, real-time fraud detection system. By following these steps, you've moved from database creation to data ingestion, ensuring that your banking application is ready to handle and analyze transactional data at scale.

Part 3: Connecting to Your DataStax Astra Banking Database Using Google Colab

Introduction

In previous lab, we created a Serverless (Non-Vector) database in DataStax Astra for a real-time fraud detection system in a banking use case. Then, we loaded sample transaction data into the database. Now, in this final part, we'll guide you through connecting to your Astra database using Google Colab and Python. This connection will allow you to interact with your database programmatically, making it easier to integrate with applications or perform data analysis.

Prerequisites

Before we dive into the code, ensure you have the following:

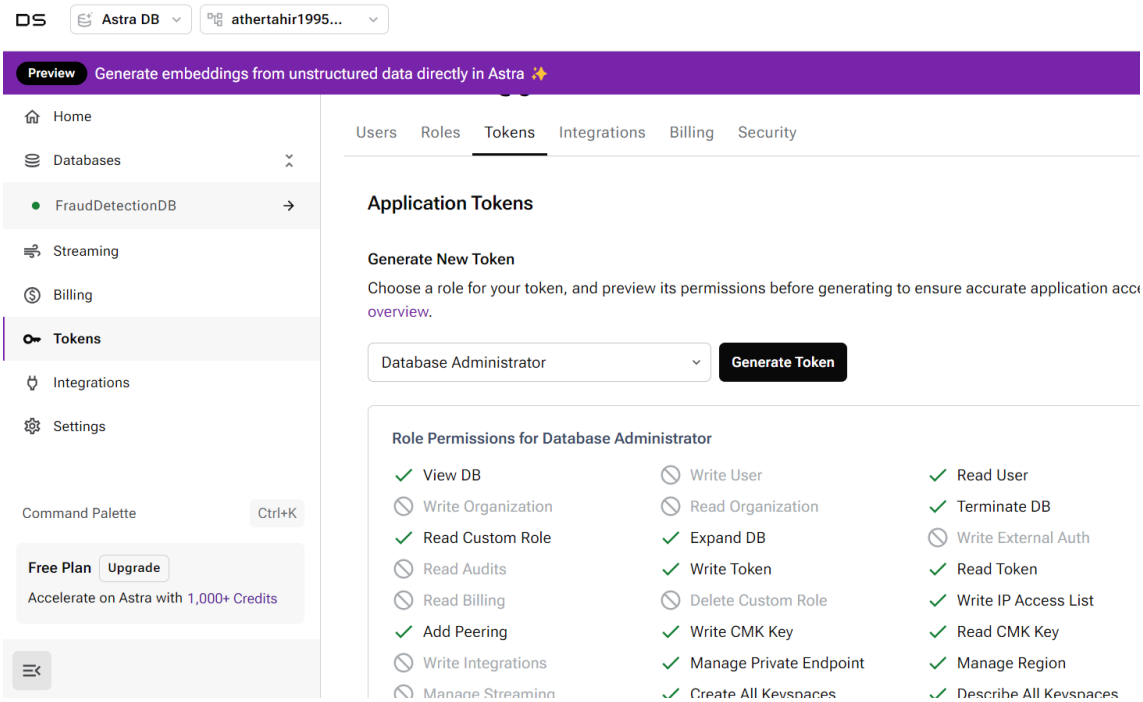
1. **Astra Account**: You should already have an active Astra account from Part 1.
2. **Astra DB Serverless Database**: Your `FraudDetectionDB` database should be set up and loaded with data.
3. **Application Token**: You need an application token with the Database Administrator role.
4. **Google Colab Account**: A Google account to use Google Colab.

Step 1: Generate an Application Token

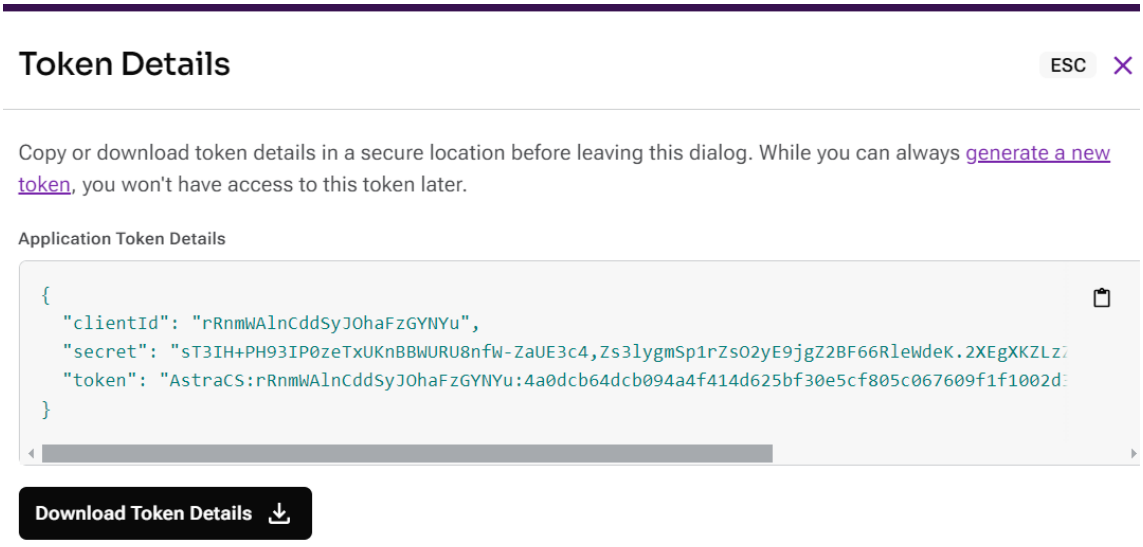
To connect to your Astra database, you'll need an application token. Here's how to generate one:

1. **Log in to the Astra Portal**: Visit Astra Portal and log in.
2. **Navigate to Tokens**: In the left navigation, click on **Tokens**.
3. **Generate Token**:

- Select **Database Administrator** as the role.
- Click **Generate Token**.



- Download the json file. You will need these for authentication.



Step 2: Set Up Google Colab

Now that you have your token, let's set up Google Colab to interact with your Astra database.

1. **Open Google Colab**: Go to Google Colab and start a new notebook: `https://colab.research.google.com/`
2. **Install Cassandra Driver**: Install it using the following command:

```
!pip install cassandra-driver
```

1. **Import Required Libraries**: In your Colab notebook, import the necessary libraries:

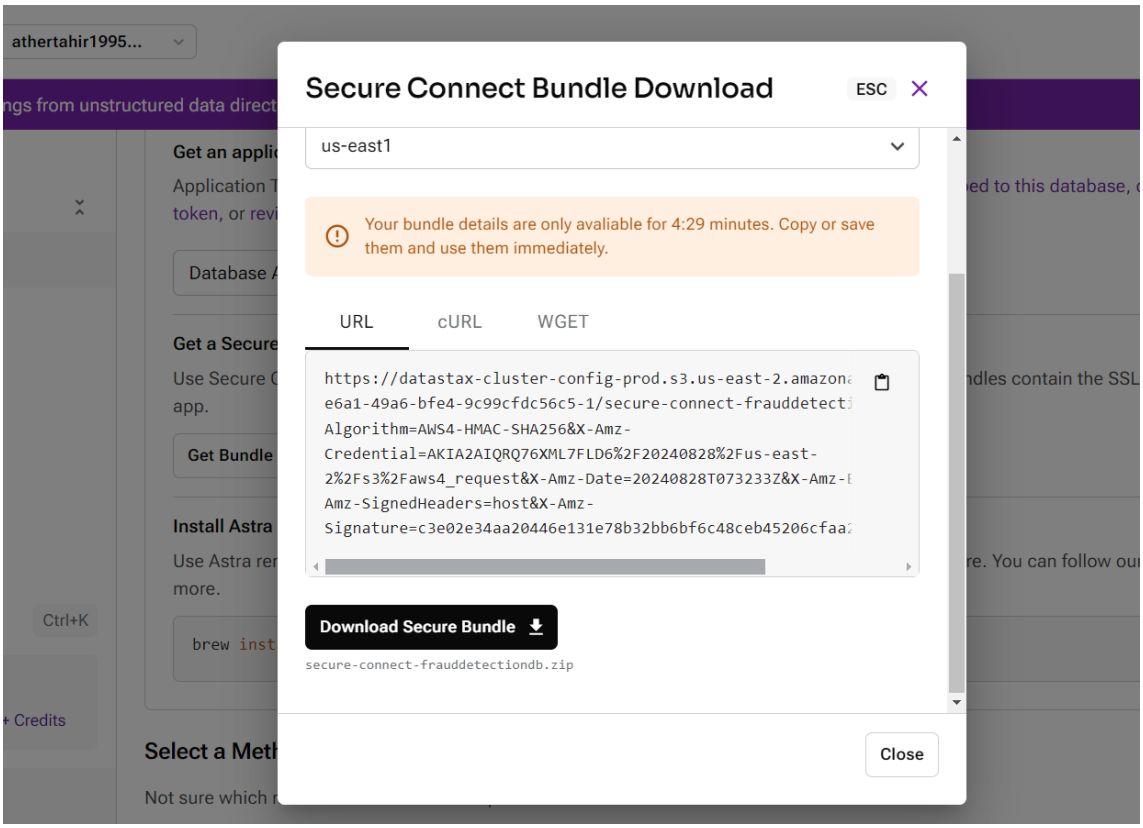
```
from cassandra.cluster import Cluster
from cassandra.auth import PlainTextAuthProvider
import json
```

Step 3: Setup

You'll need to set up connect bundle and token json.

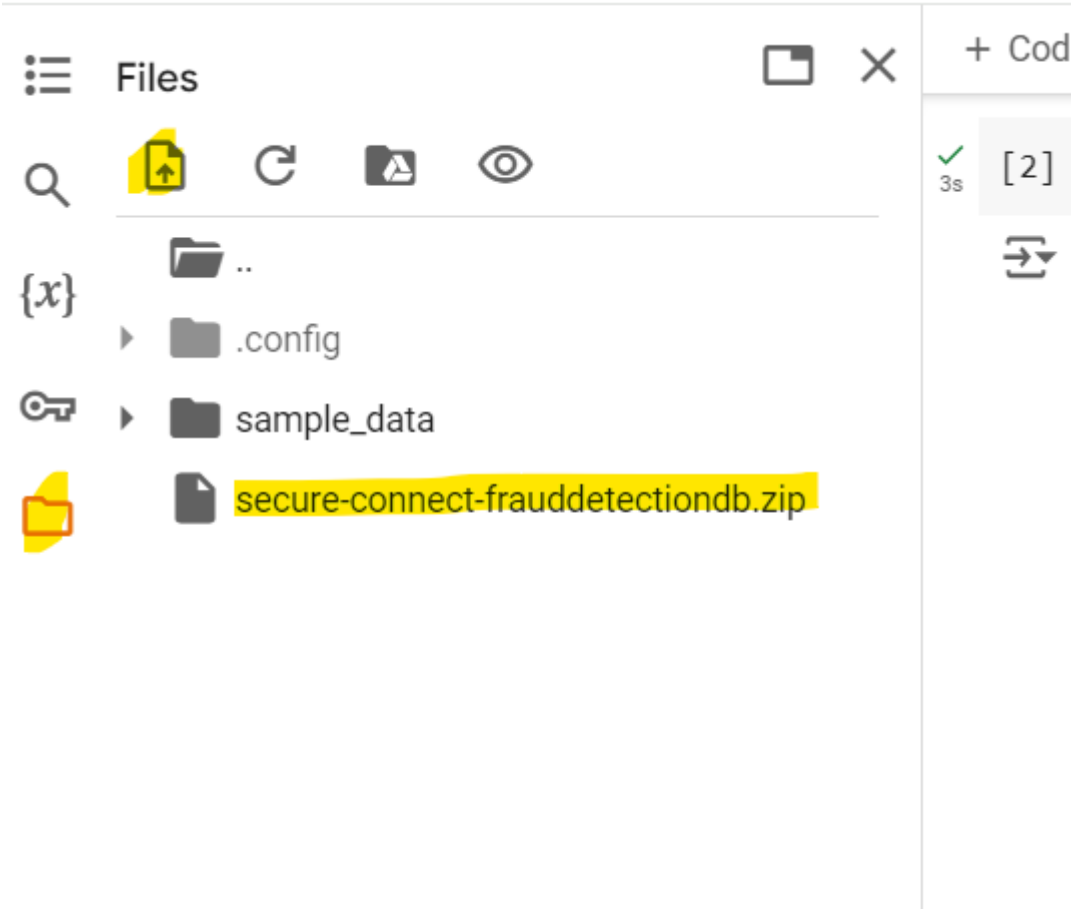
1. **Secure Connect Bundle**: If you haven't downloaded the Secure Connect Bundle (SCB) yet, follow these steps:

- In the Astra Portal, go to **Databases**.
- Select your `FraudDetectionDB`.
- Click **Connect** and download the Secure Connect Bundle for your region.



1. **Upload the SCB to Google Colab**:

- In Google Colab, click the **Files** tab on the left side.
- Upload your SCB file (it will have a `.zip` extension).



1. **Upload the SCB to Google Colab**:

- In Google Colab, click the **Files** tab on the left side.
- Upload your token file (it will have a `.json` extension).

1. **Set Secret Paths**: Set bundle and token in your Colab notebook:

```
# This secure connect bundle is autogenerated when you download your SCB,
# if yours is different update the file name below
cloud_config= {
  'secure_connect_bundle': 'UPDATE_FILE_NAME.zip'
}

# This token JSON file is autogenerated when you download your token,
# if yours is different update the file name below
with open("UPDATE_FILE_NAME.json") as f:
    secrets = json.load(f)

CLIENT_ID = secrets["clientId"]
CLIENT_SECRET = secrets["secret"]
```

Step 4: Connect to Your Cluster

```
auth_provider = PlainTextAuthProvider(CLIENT_ID, CLIENT_SECRET)
cluster = Cluster(cloud=cloud_config, auth_provider=auth_provider)
session = cluster.connect()
```

1. **Verify Connection**: To ensure everything is working:

```
row = session.execute("select release_version from system.local").one()
if row:
  print(row[0])
else:
  print("An error occurred.")
```

Step 5: Perform Operations on the Database

With the connection established, you can now perform various operations. For instance, let's query the `transactions` table to retrieve the first few records.

1. **Query the Transactions Table**:

```
transactions = session.execute("SELECT * FROM frauddetectionks.transactions LIMIT 5")
for transaction in transactions:
    print(transaction)
```

This will print out the first five records from the `transactions` table, allowing you to inspect the data you loaded in Part 2.

Step 6: Save and Share Your Colab Notebook

Once you've successfully connected to your database and run some queries, you might want to save and share your work.

1. **Save the Notebook**: Click on **File** > **Save a copy in Drive** to save your notebook in Google Drive.
2. **Share the Notebook**: Click on **Share** to generate a shareable link, making it easy to collaborate with others.

Conclusion

Congratulations! You've successfully connected to your DataStax Astra database using Google Colab and Python. This setup allows you to leverage the power of Astra and Python together, enabling you to build, test, and deploy applications efficiently. Whether you're analyzing data, building machine learning models, or integrating with other systems, Google Colab provide a robust environment to achieve your goals.

In the next steps, you might want to explore more advanced queries, integrate with other tools, or start developing a full-fledged application. The possibilities are endless with DataStax Astra and Python!

Addendum: Viewing and Managing Metrics in DataStax Astra

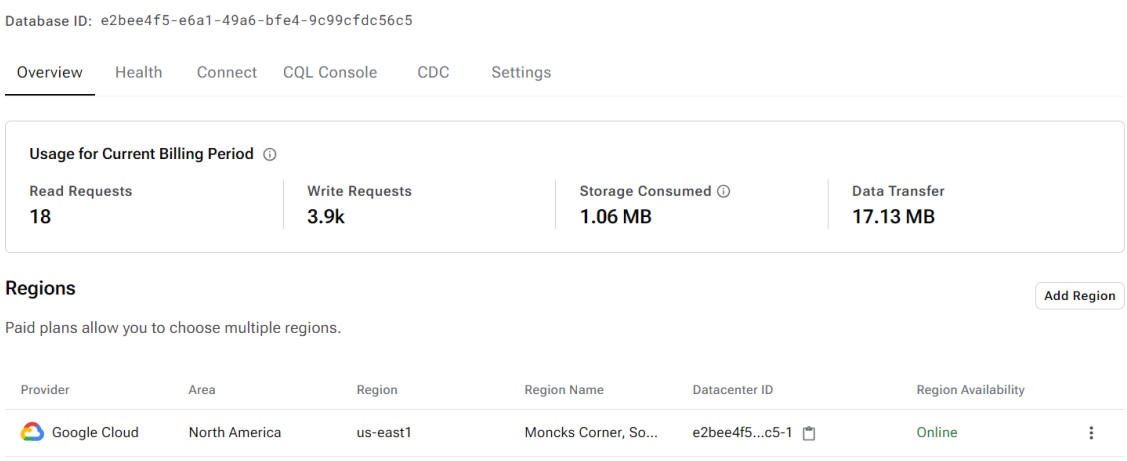
To ensure your database is performing optimally and to gain insights into your data operations, it's crucial to monitor and analyze various metrics within DataStax Astra. This addendum will guide you through the process of viewing key metrics in Astra. These metrics will help you better understand the health, performance, and usage patterns of your database.

Step 1: Accessing Database Metrics in Astra Portal

1. **Log in to Astra Portal:**

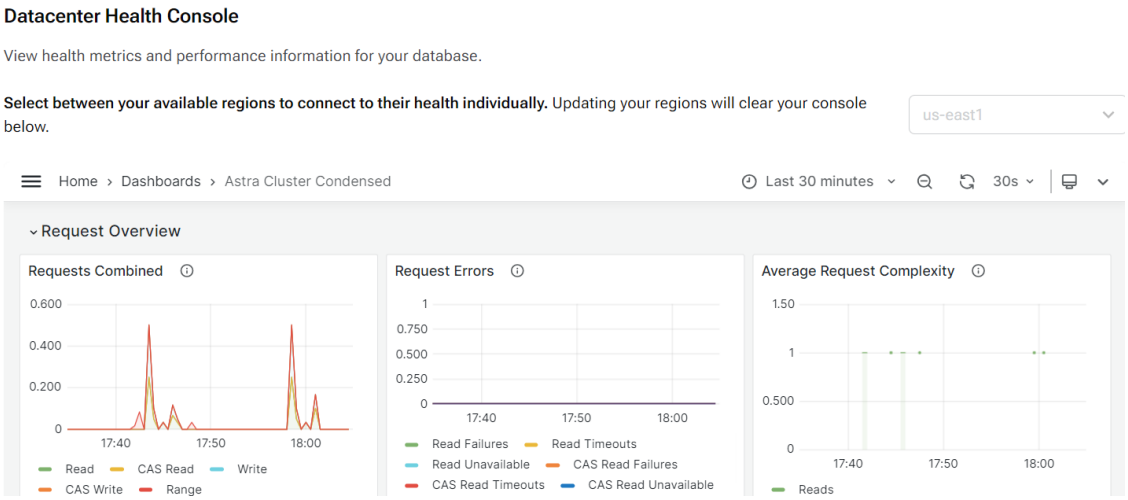
- Visit Astra Portal and log in with your credentials.

1. **Overview**



2. **Datacenter Health Console**

View health metrics and performance information for your database.



Regular Monitoring and Maintenance

1. **Regular Review:**

- Regularly review the dashboard to keep an eye on the health of your database.
- Pay special attention to any spikes in latency or throughput, as these could indicate potential performance bottlenecks.

2. **Perform Maintenance:**

- Based on the metrics, perform necessary maintenance tasks such as compaction, repair operations, or scaling of resources.

Conclusion

By closely monitoring the metrics provided by DataStax Astra, you can ensure that your database operates efficiently and effectively. This proactive approach allows you to detect and resolve potential issues before they impact your application, ensuring a smooth and reliable user experience. Keep in mind that regular review and maintenance are essential for maintaining optimal database performance.