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Connecting to a Databricks SQL Warehouse from Dash

This page documents how to connect to a Databricks SQL Warehouse from Dash. We've also published a series of blog posts that demonstrate different ways to use Dash with Databricks:

- **Building Plotly Dash Apps on a Lakehouse with Databricks SQL** walks through the steps to build a database on Databricks SQL and connect to it from a Dash app.
- **Build Real-Time Production Data Apps with Databricks & Plotly Dash** demonstrates building a Dash app with streaming data from Databricks.
- **Molson Coors Streamlines Supply Planning Workflows with Databricks & Plotly Dash** looks at how to read and write data from a Databricks SQL Warehouse using the Databricks SQL Connector and SQL Alchemy Engine.
- **Building Plotly Dash Apps on a Lakehouse with Databricks SQL (Advanced Edition)** revisits the first article in the series and demonstrates building Dash apps that query a Databricks SQL database using SQL Alchemy.
- **Visualizing a Billion Points: Databricks SQL, Plotly Dash... and the Plotly Resampler** demonstrates how to visualize large time-series datasets using Databricks, Dash, and the Plotly Resampler.

Retrieve data living in Databricks to use in your Dash app with the **SQL Connector for Python**. With this connector, you can run queries on a Databricks SQL warehouse, a cluster designed for efficient data-warehousing style workloads.

Prerequisites

The examples on this page show how to run queries on a Databricks SQL warehouse within a Dash app. Before getting started, you'll need to have access to Databricks SQL and have a Databricks SQL warehouse configured. See the **Databricks docs** for more details on how to set up SQL warehouses.

Configuring Environment Variables

Configure your SQL warehouse's server hostname and HTTP path as well as your personal access token as **environment variables** wherever you are running the app.

The environment variable names are: `SERVER_HOSTNAME`, `HTTP_PATH`, and `ACCESS_TOKEN`.

Use the information in Databricks for their values. For details on where to find this information, see the **Get started section in Databricks SQL Connector for Python**.

Installing SQL Connector

Install Databricks SQL Connector for Python:

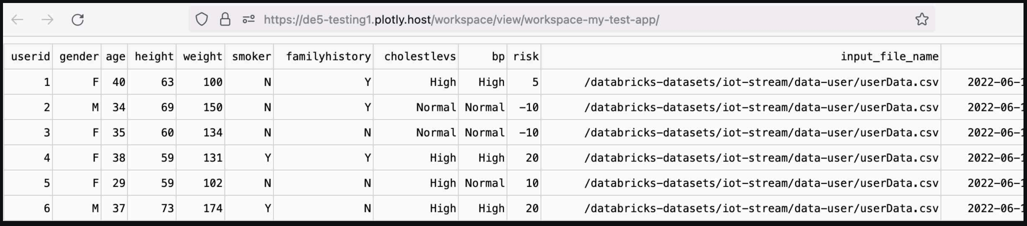
```
pip install databricks-sql-connector
```

Example 1 - Loading a Static Data Set

You can load a given dataset globally in your app for static visualization. This code demonstrates the basics of connecting your app to a Databricks table, but is not the recommended approach for storing data in an interactive Dash app (see the **Why Global Variables Will Break Your App** section for more details).

In this basic example, we output the first 100 rows from our table in Databricks to a **Dash DataTable** component.

```python
from dash import Dash, dash_table
from databricks import sql
import os

app = Dash()
server = app.server

# Set these as environment variables in Dash Enterprise or locally
SERVER_HOSTNAME = os.getenv("SERVER_HOSTNAME")
HTTP_PATH = os.getenv("HTTP_PATH")
ACCESS_TOKEN = os.getenv("ACCESS_TOKEN")

# Configure according to your table and database names in Databricks
DB_NAME = "plotly_iot_dashboard"
TABLE_NAME = "silver_users"

with sql.connect(
    server_hostname=SERVER_HOSTNAME, http_path=HTTP_PATH, access_token=ACCESS_TOKEN
) as connection:
    with connection.cursor() as cursor:
        cursor.execute(f"SELECT * FROM {DB_NAME}.{TABLE_NAME} LIMIT 100")
        df = cursor.fetchall_arrow()
        df = df.to_pandas()

app.layout = dash_table.DataTable(
    df.to_dict("records"), [{"name": i, "id": i} for i in df.columns]
)

if __name__ == "__main__":
    app.run(debug=True)
```

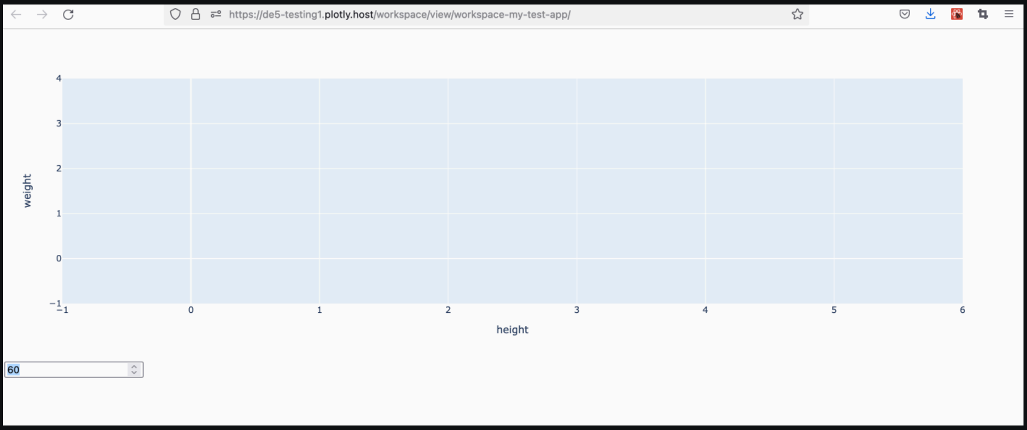

https://de5-testing1.plotly.host/workspace/view/workspace-my-test-app/

userid	gender	age	height	weight	smoker	familyhistory	cholestlevs	bp	risk	input_file_name	
1	F	40	63	100	N	Y	High	High	5	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-
2	M	34	69	150	N	Y	Normal	Normal	-10	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-
3	F	35	60	134	N	N	Normal	Normal	-10	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-
4	F	38	59	131	Y	Y	High	High	20	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-
5	F	29	59	102	N	N	High	Normal	10	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-
6	M	37	73	174	Y	N	High	High	20	/databricks-datasets/iot-stream/data-user/userData.csv	2022-06-

Example 2 - Dynamically Building an SQL Query Using Callback Inputs

This example builds the SQL queries within the callback and demonstrates how to dynamically create SQL queries based on callback inputs.

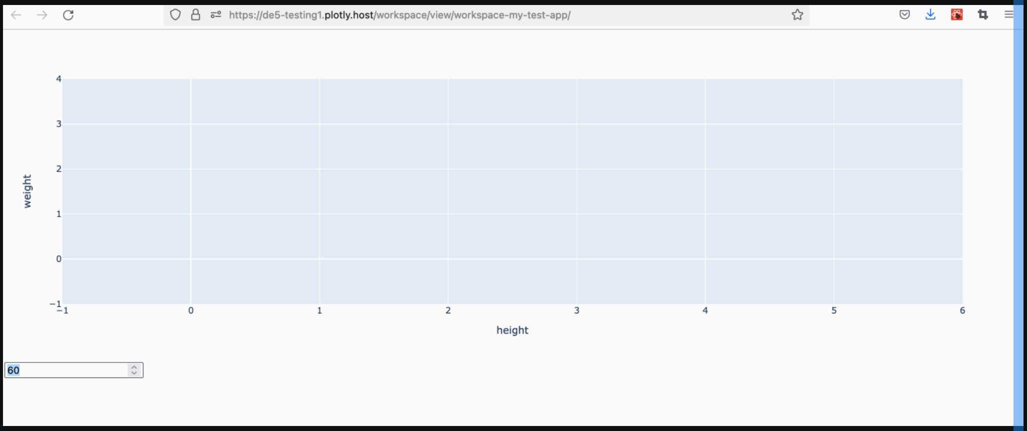
```python
import dash
from dash import Dash, html, dcc, Output, Input, callback
from databricks import sql
import plotly.express as px
import os

app = Dash()
server = app.server

# Set these as environment variables in Dash Enterprise or locally
SERVER_HOSTNAME = os.getenv("SERVER_HOSTNAME")
HTTP_PATH = os.getenv("HTTP_PATH")
ACCESS_TOKEN = os.getenv("ACCESS_TOKEN")

# Configure according to your table name in Databricks
DB_NAME = "plotly_iot_dashboard"
TABLE_NAME = "silver_users"


app.layout = html.Div(
    [
        dcc.Loading(dcc.Graph(id="sample-chart-2")),
        dcc.Input(id="val-selector-2", type="number", min=20, max=80, step=5, value=40),
    ],
    style={"background-color": "white", "height": "100vh"},
)


@callback(Output("sample-chart-2", "figure"), Input("val-selector-2", "value"))
def create_chart(selected_val):
    connection = sql.connect(
        server_hostname=SERVER_HOSTNAME, http_path=HTTP_PATH, access_token=ACCESS_TOKEN
    )
    cursor = connection.cursor()
    cursor.execute(
        f"SELECT * FROM {DB_NAME}.{TABLE_NAME} WHERE age > {selected_val} LIMIT 100"
    )
    df = cursor.fetchall_arrow()
    df = df.to_pandas()

    cursor.close()
    connection.close()

    return px.scatter(df, x="height", y="weight")


if __name__ == "__main__":
    app.run(debug=True)
```


https://de5-testing1.plotly.host/workspace/view/workspace-my-test-app/
weight
height
60

Example 3 - Using SQLAlchemy

This example demonstrates how to rewrite the previous example to use the **SQLAlchemy** ORM. Run `pip install sqlalchemy-databricks` to register the Databricks SQL dialect with SQLAlchemy.

```
from dash import Dash, html, dcc, Output, Input, callback
import plotly.express as px
import os
from sqlalchemy.engine import create_engine
from sqlalchemy import Table, MetaData, select
import pandas as pd

app = Dash()
server = app.server

# Set these as environment variables in Dash Enterprise or locally
SERVER_HOSTNAME = os.getenv("SERVER_HOSTNAME")
HTTP_PATH = os.getenv("HTTP_PATH")
ACCESS_TOKEN = os.getenv("ACCESS_TOKEN")

# Configure according to your table and database names in Databricks
DB_NAME = "plotly_iot_dashboard"
TABLE_NAME = "silver_users"


app.layout = html.Div(
    [
        dcc.Loading(dcc.Graph(id="sample-chart")),
        dcc.Input(id="val-selector", type="number", min=20, max=80, step=5, value=40),
    ],
    style={"background-color": "white", "height": "100vh"},
)


@callback(Output("sample-chart", "figure"), Input("val-selector", "value"))
def create_chart(selected_val):
    # Set up SQL Alchemy engine
    engine = create_engine(
        f"databricks+connector://token:{ACCESS_TOKEN}@{SERVER_HOSTNAME}:443/{DB_NAME}",
        connect_args={
            "http_path": HTTP_PATH,
        },
    )

    # Get a full table with SQL Alchemy
    sensor_table = Table(TABLE_NAME, MetaData(bind=engine), autoload=True)

    # Get some distinct values on app load for filters
    stmt = select(
        [
            sensor_table.columns.age,
            sensor_table.columns.height,
            sensor_table.columns.weight,
        ]
    ).where(sensor_table.columns.age < selected_val)

    df = pd.read_sql_query(stmt, engine)
```


https://de5-testing1.plotly.host/workspace/view/workspace-my-test-app/
weight
height
60

Performance Tips

- Filter or aggregate your data as much as possible before bringing it into your Dash app in the browser.
- Configure a Databricks cluster for rapid startup. See the Databricks docs on **serverless compute** for more details.

Dash Python **>** *Databricks Integration* **>** ***Connecting to a Databricks SQL Warehouse from Dash***