



Building A Simple Data Stack

Project Brief

This project demonstrate how to implement a modern data stack, build data pipelines, machine learning and reporting capabilities using a variety of solutions.

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Independent Data Lead &
Engineer



First Things First !!!

Five Key Questions

- I. Where is our data? [Source](#)
- II. Where do we consolidate our data? [Storage](#)
- III. How will we get it there? [Ingestion](#)
- IV. How will we clean it up? [Transformation](#)
- V. How will we analyze it? [Reporting](#)

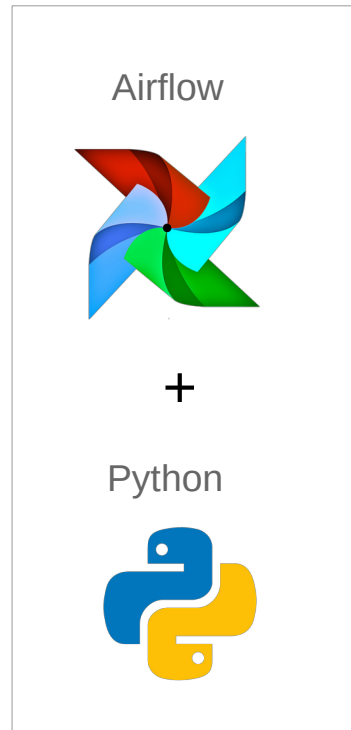
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Data Stack Architecture Design

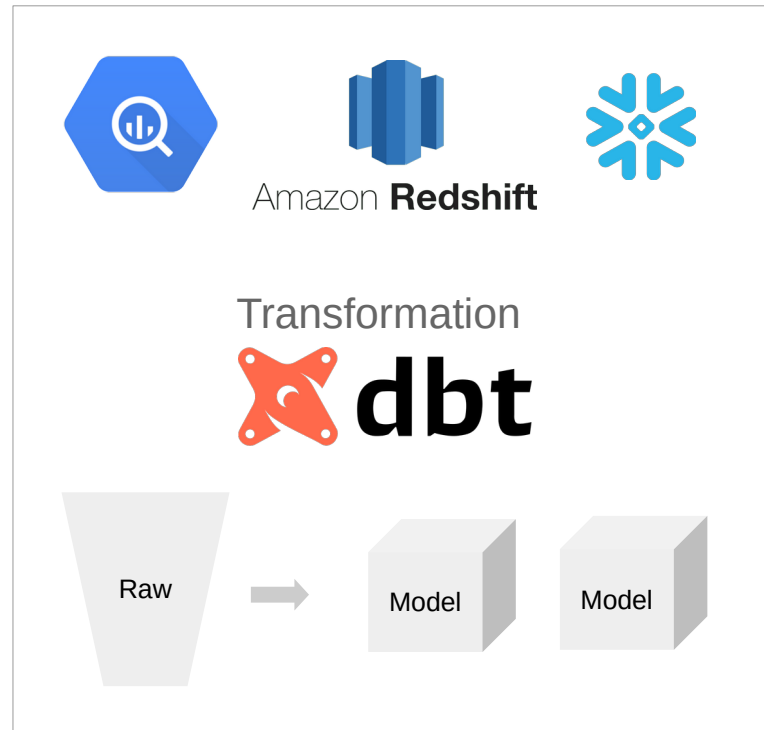
Where is our data?



How will we get it there?



Where do we consolidate our data?



How do we analyze it?



Ultimate End Goal

Data + Insights + Action
= Actionable Insights

Data

Insight

Action

What happened/
will happen?

Why did it happened/
will it happen?

What do we do?

Where

is Our Data?

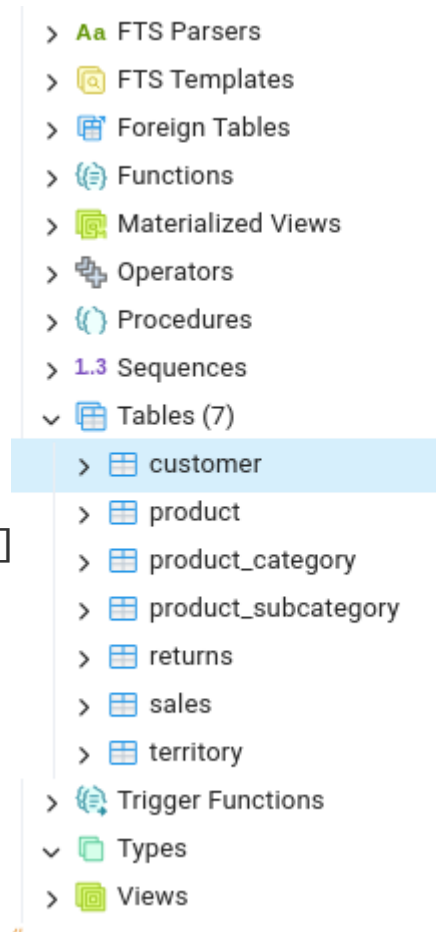
Source : PostgreSQL

Schema : Public

Database Name: adw_db

Tables Count : 7

Tables : [customer,
product,
product_category,
returns,
sales,
territory,
product_subcategory]



Data Output Messages Notifications					
	orderdate date	stockdate date	ordernumber character varying (255)	productkey integer	customerkey integer
1	2022-01-01	2021-12-13	SO61285	529	23791
2	2022-01-01	2021-09-24	SO61285	214	23791
3	2022-01-01	2021-09-04	SO61285	540	23791
4	2022-01-01	2021-09-28	SO61301	529	16747
5	2022-01-01	2021-10-21	SO61301	377	16747
6	2022-01-01	2021-10-23	SO61301	540	16747
7	2022-01-01	2021-09-04	SO61269	215	11792
8	2022-01-01	2021-10-21	SO61269	229	11792
9	2022-01-01	2021-10-24	SO61286	528	11530
10	2022-01-01	2021-09-27	SO61286	536	11530
11	2022-01-01	2021-10-23	SO61298	530	18155
12	2022-01-01	2021-12-02	SO61298	214	18155
13	2022-01-01	2021-12-15	SO61298	223	18155
14	2022-01-01	2021-10-01	SO61310	538	13541
15	2022-01-01	2021-11-08	SO61310	584	13541

How do we ingest Our Data?

Ingestion : python script
Orchestration : Apache Airflow

Apache Airflow Setup

Terminal

```
$ python3 -m venv airflow-env  
$ source airflow-env/bin/activate  
$ export AIRFLOW_HOME=~/.airflow  
$ pip install apache-airflow  
$ airflow db init  
$ airflow webserver -p 8080  
$ airflow scheduler
```

Apache Airflow Webserver UI



Sign In

Enter your login and password below:

Username:

 gwayi

Password:



Sign In

How do we ingest Our Data?

Ingestion : Programatically - Python
Orchestration : Apache Airflow

ELT Python Script

```
pip install google-cloud-bigquery
pip install --upgrade snowflake-connector-python
```

```
# importing libraries
```

```
from airflow.decorators import dag, task
from datetime import datetime, timedelta
from google.cloud import bigquery
import pandas as pd
import psycopg2
```

Insatiate a DAG

```
args={
    "owner": "gwayi",
    "retries": 1,
    "retry_delay": timedelta(minutes=5)
}

@dag(
    default_arguments = args
    Schedule=timedelta(minutes=30),
    start_date=datetime(2024, 7, 29),
    catchup=False,
    tags=['Team B']
)
```

How do we ingest Our Data?

Ingestion : Programatically Script
Orchestration : Apache Airflow

Task I (Get Tables)

```
@task()
def get_tables():
    """extract list of tables in public schema"""
    try:
        cursor.execute(
            f"""SELECT table_name
            FROM information_schema.tables
            WHERE table_schema = 'public'"""
        )
    tbls = [x[0] for x in cursor.fetchall()]
```

Task II (Extract_Load)

```
@task()
def extract|load_bigquery(tbls, conn):
    """loop through tbls then extract & load"""

    client = bigquery.Client()
    job_config = bigquery.LoadJobConfig(
        write_disposition="WRITE_TRUNCATE")

    for tbl in tbls:
        table_id = f"adventureworks-431609.stg.{tbl}"
        sql = f"SELECT * FROM {tbl} WHERE
        updated_at >= {ds}"
        df = pd.read_sql(sql, conn)

        job = client.load_table_from_dataframe(
            df, table_id, job_config=job_config)
        job.result()

    get_tables = get_tables()
    extract_load = extract_load(get_tables)
```


DAG: adw_pipeline



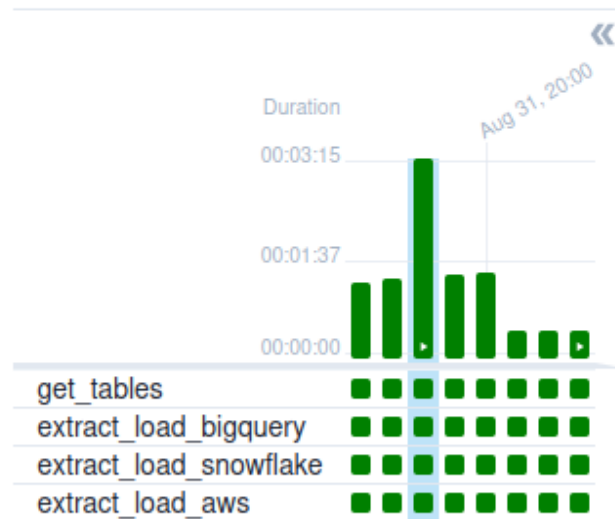
09 / 01 / 2024 05 : 33 : 35 PM

All Run Types ▼

All Run States ▼

Clear Filters

Press **shift** + **/** for Shortcuts



DAG

Run

adw_pipeline / ▶ 2024-08-31, 18:45:56 EAT

Details

Graph

Gantt

Code

Audit Log

get_tables

■ success
@task

extract_load_snowflake

■ success
@task

extract_load_aws

■ success
@task

extract_load_bigquery

■ success
@task

Tables Loaded: BigQuery

Viewing resources.

[SHOW STARRED ONLY](#)

- ▼ **adventureworks-431609** ☆ ⋮
 - ▶ 🔍 Queries ⋮
 - ▶ 📖 Notebooks ⋮
 - ▶ 📄 Data canvases ⋮
 - ▶ ⚙️ Data preparations ⋮
 - ▶ 🔌 External connections ⋮
 - ▼ 🗃️ stg ☆ ⋮
 - 🗃️ **customer** ☆ ⋮
 - 🗃️ product ☆ ⋮
 - 🗃️ product_category ☆ ⋮
 - 🗃️ product_subcategory ☆ ⋮
 - 🗃️ returns ☆ ⋮
 - 🗃️ sales ☆ ⋮
 - 🗃️ territory ☆ ⋮

SCHEMA		DETAILS	PREVIEW	TABLE EXPLORER	PREVIEW	INSIGHTS	PREVIEW	LINEAGE
Row	customerid	firstname	lastname	fullname				
1	1305	A.	Leonetti	A. Leonetti				
2	1305	A.	Leonetti	A. Leonetti				
3	829	Ed	Dudenhoefer	Ed Dudenhoefer				
4	829	Ed	Dudenhoefer	Ed Dudenhoefer				
5	1953	H.	Valentine	H. Valentine				
6	1953	H.	Valentine	H. Valentine				
7	539	Jo	Brown	Jo Brown				
8	539	Jo	Brown	Jo Brown				
9	1917	Abe	Tramel	Abe Tramel				
10	1917	Abe	Tramel	Abe Tramel				
11	323	Amy	Alberts	Amy Alberts				
12	323	Amy	Alberts	Amy Alberts				
13	735	Amy	Consentino	Amy Consentino				
14	735	Amy	Consentino	Amy Consentino				
15	1033	Ann	Hass	Ann Hass				
16	1033	Ann	Hass	Ann Hass				
17	437	Ann	Beebe	Ann Beebe				

How do we transform Our Data?

Transformation : dbt
Orchestration : Apache Airflow
Models 3 : [production,
 machine learning,
 Reporting]

Reporting - Business Case

MTD – Month to Date
PMTD – Previous Month to Date

MTD Sales breakdown
MTD Orders breakdown
PMTD Sales breakdown
Previous MTD Orders breakdown
MTD Return
mom sales

Transformations

```
Join returns
  to territory
    territory
  to product
    Product
  to product_subcategory
    product_subcategory
  to productcategory
as returns_wide table
```

```
Join sales
  to territory
    territory
  to product
    Product
  to product_subcategory
    product_subcategory
  to productcategory
as sales_wide table
```

Search BigQuery resources ?

Viewing resources.

[SHOW STARRED ONLY](#)

▼ adventureworks-431609	☆	⋮
▶ 🔍 Queries		⋮
▶ 📖 Notebooks		⋮
▶ 🏗 Data canvases		⋮
▶ ≡ Data preparations		⋮
▶ 🔗 External connections		⋮
▼ 📊 Business_Reporting	☆	⋮
📊 returns_wide_table	☆	⋮
📊 sales_wide_table	☆	⋮
▶ 📊 ML	☆	⋮
▶ 📊 Production	☆	⋮
▶ 📊 staging	☆	⋮
▶ 📊 stg	☆	⋮

returns_wide_view

```
SELECT returndate,returnquantity,
region,country,continent,productsku,
productname,modelname,productdescription,
productcolor,productsize,productstyle,
productcost,productprice,subcategoryname,
categoryname
FROM returns r
JOIN territory t
ON r.territorykey=t.salesterritorykey
JOIN product
ON r.productkey=p.productkey
JOIN product_subcategory psc
ON p.productsubcategorykey=psc.productsubcategorykey
JOIN product_category pc
ON psc.productcategorykey = pc.productcategorykey
```

Viewing resources.

[SHOW STARRED ONLY](#)

- ▼ adventureworks-431609 ☆ ⋮
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 - ▶ 📖 Notebooks ⋮
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 - ▶ ⚙️ Data preparations ⋮
 - ▶ 🔌 External connections ⋮
 - ▶ 🗃️ stg ☆ ⋮
 - ▶ 🗃️ stg_ml ☆ ⋮
 - ▶ 🗃️ stg_prod ☆ ⋮
 - ▶ 🗃️ stg_reporting ☆ ⋮

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How do we analyze Our Data?

Reporting : [Power BI,
Tableau,
Looker
]

ML Models 2 : [Prediction,
classification
]

dbt Setup

```
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```