Kindle Training – Major Project

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Overview

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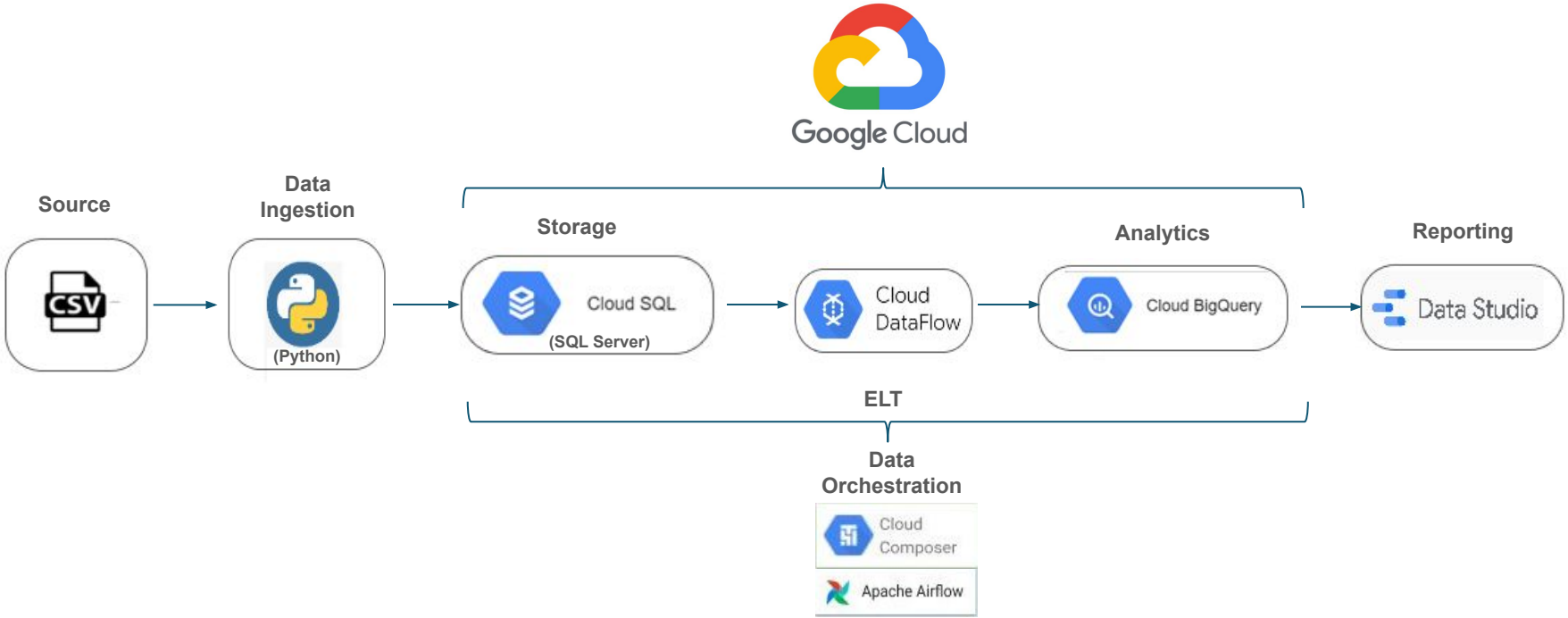
2. Architecture
3. Solution Approach
4. Data Visualization and Reporting
5. Technology Stack
6. Challenges faced and learnings

Problem Statement

- Customer Segmentation to focus on growth
- Find 20% of customers who drive 80% of the company revenue
- Visualize and report the findings
- Analyze the visualized data for insights

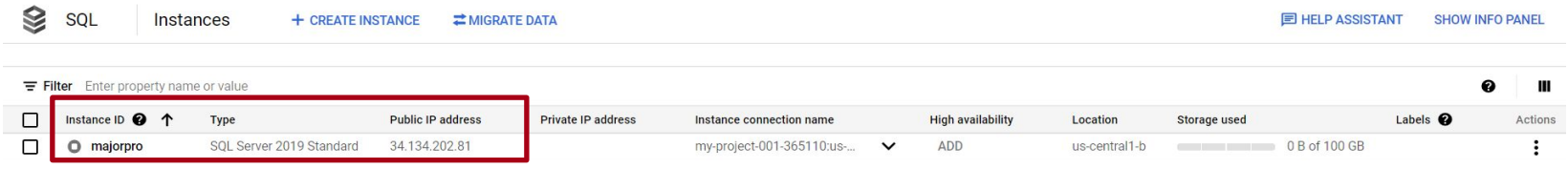
Architecture



Solution Approach

Step -1

- A Cloud SQL Server instance in GCP is created to import data into Cloud SQL.
- Wrote a python code and configured it with server credential to connect to Server instance.
- The below python code will create database and table in it with respective columns.




```
import pyodbc ## Python module for connecting DB from python
import pandas as pd
import numpy as np
```

```
# Connect to SQL Server
conn = pyodbc.connect(Driver='{SQL Server}',
                      Server='34.134.202.81',  # Cloudsqlserver ip
                      Database='MajorProject',
                      UID='sqlserver',
                      PWD='Sandip26@nc',
                      Trusted_Connection='no')
cursor = conn.cursor()
```

```
# Import CSV
data = pd.read_csv("data.csv", encoding='unicode_escape')   ## encoding is used as there are specialchar in the file
df = pd.DataFrame(data)
df.replace({np.inf: np.nan, -np.inf: np.nan}, inplace=True)
df = df.fillna(0)
```

```
df.head(3)
```

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	United Kingdom

```
cursor.execute('''
    CREATE TABLE Sales
(InvoiceNo nvarchar(50),
 StockCode nvarchar(50),
 Description nvarchar(50),
 Quantity int,
 InvoiceDate nvarchar(50),
 UnitPrice nvarchar(50),
 CustomerID float,
 Country nvarchar(50))

   ''')
```

```
#insert records into table

counter=0
#statements = list()
state_list = list()
for row in df.itertuples():
    row_to_insert = [row.InvoiceNo, row.StockCode, row.Description, row.Quantity, row.InvoiceDate, row.UnitPrice,row.CustomerID,r
    rows_normalized = list(map(lambda x: str(x).replace("'", "''") , row_to_insert))
    statement = "INSERT INTO Sales(InvoiceNo, StockCode, Description,Quantity,InvoiceDate,UnitPrice,CustomerID,Country) VALUES (
    state_list.append(statement)
    counter += 1
    if counter == 500:
      statements = ';'.join(state_list)
      cursor.execute(statements)
      conn.commit()
      counter =0
      state_list = []

if not counter == 500:
 statements = ';'.join(state_list)
 cursor.execute(statements)
 conn.commit()
```

Solution Approach

Step -2

- Extract – Designed an Apache beam pipeline and executed it in dataflow to extract data into bigquery table.

```
    p = beam.Pipeline(options=pipeline_options)

    init = p | 'Begin pipeline with initiator' >> beam.Create(['All tables initializer'])
    (init
     # Read the file. This is the source of the pipeline. All further
     # processing starts with lines read from the file. We use the input
     # argument from the command line. We also skip the first line which is a
     # header row.

     | 'Read from a DB' >>  beam.ParDo(ReadSQLTable())

     # This stage of the pipeline translates from a CSV file single row
     # input as a string, to a dictionary object consumable by BigQuery.
     # It refers to a function we have written. This function will
     # be run in parallel on different workers using input from the
     # previous stage of the pipeline.
     | 'Write to BigQuery' >> beam.io.WriteToBigQuery('my-project-001-365110.Major_Project.sqlserver_to_bigquery',
                                        schema='InvoiceNo:STRING,StockCode:STRING,Description:STRING,Quantity:INTEGER,'
'InvoiceDate:STRING,UnitPrice:FLOAT,CustomerID:INTEGER,Country:STRING',
                                        create_disposition=beam.io.BigQueryDisposition.CREATE_IF_NEEDED,
                                        write_disposition=beam.io.BigQueryDisposition.WRITE_TRUNCATE))
    p.run().wait_until_finish()


if __name__ == '__main__':
    logging.getLogger().setLevel(logging.INFO)
    run()
```

Figure : Pipeline Code

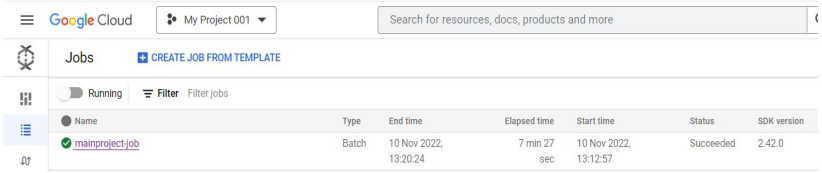


Figure : Pipeline Executed in Dataflow

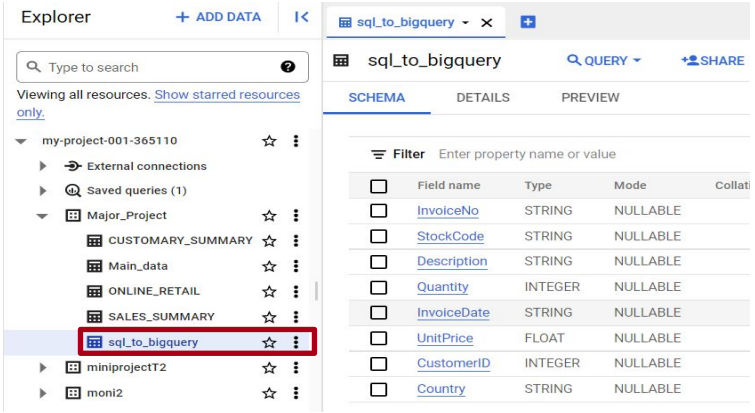


Figure : Table in Bigquery after Pipeline execution

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Solution Approach

Step -3

- Created an environment in Cloud Composer, uploaded the dag(python file) into the dag folder.
- Transform - Queried raw data table and cleaned it using python Dag concept as per the project requirements.
- Load – After transformation the data was loaded into respective tables i.e. (online_retail. Customer_summary, sales_summary)
- The above ETL process is orchestrated using Cloud Composer

```
cloudsql_to_bq = BeamRunPythonPipelineOperator(
    task_id="cloudsql_to_bq",
    runner="DataflowRunner",
    py_file="gs://us-central1-mainpro-a06ea0ba-bucket/dags/sql  to bq _moni.py",
    pipeline_options={'tempLocation' : 'gs://majorpro/temp/', 'stagingLocation': 'gs://majorpro/temp/'},
    py_options=[],
    py_requirements=['apache-beam[gcp]==2.42.0','cloud-sql-python-connector[pytds]==0.6.1','pyodbc==4.0.34','SQLAlchemy==1.4.41','pymssql==
    py_interpreter='python3',
    py_system_site_packages=False,
    dataflow_config=DataflowConfiguration(job_name='mainproject-job', project_id='my-project-001-365110',
    location="us-central1"),
    dag=dag)


query1 = '''
            SELECT InvoiceNo, StockCode, Description, Quantity, PARSE_DATETIME('%m/%d/%Y %H:%M', InvoiceDate) AS InvoiceDate,
            UnitPrice, CustomerID,Country FROM `my-project-001-365110.Major_Project.sql_to_bigquery`
        '''
```

```
query2 = '''
            delete from `my-project-001-365110.Major_Project.Main_data`
            where Quantity  < 0 or CustomerID = 0;
        '''
```

```
query3 = '''
            delete from `my-project-001-365110.Major_Project.Main_data`
            where  EXTRACT(year FROM InvoiceDate)  = 2011 and EXTRACT(month FROM InvoiceDate) = 12;
        '''
```

Figure : DAG with Transformation

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Solution Approach

```
query4 = '''
          SELECT InvoiceNo, StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID,Country,
          Quantity * UnitPrice as ItemTotal
          FROM `my-project-001-365110.Major_Project.Main_data`;
        '''

ONLINE_RETAIL = BigQueryOperator(task_id='ONLINE_RETAIL',
                        destination_dataset_table= "my-project-001-365110.Major_Project.ONLINE_RETAIL",
                        sql=query4,
                        use_legacy_sql=False,
                        create_disposition="CREATE_IF_NEEDED",
                        write_disposition="WRITE_TRUNCATE",
                        dag=dag
                        )

query5 = '''
          select CustomerID, sum(ItemTotal) as TotalSales,count(Quantity) as OrderCount, avg(ItemTotal) as AvgOrderValue
          from `my-project-001-365110.Major_Project.ONLINE_RETAIL`
          group by CustomerID;
        '''

CUSTOMARY_SUMMARY = BigQueryOperator(task_id='CUSTOMARY_SUMMARY',
                        destination_dataset_table= "my-project-001-365110.Major_Project.CUSTOMARY_SUMMARY",
                        sql=query5,
                        use_legacy_sql=False,
                        create_disposition="CREATE_IF_NEEDED",
                        write_disposition="WRITE_TRUNCATE",
                        dag=dag)
```

Figure : Query Creating Tables

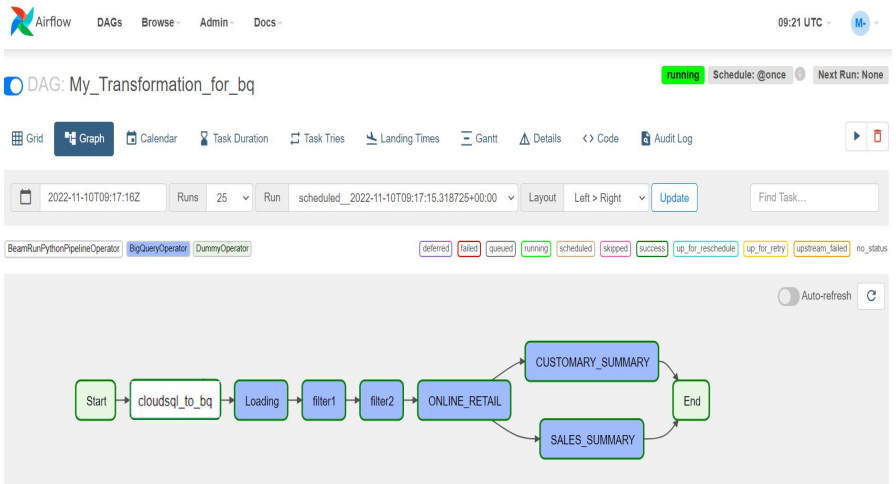

Figure : Air flow UI with Successful Orchestration

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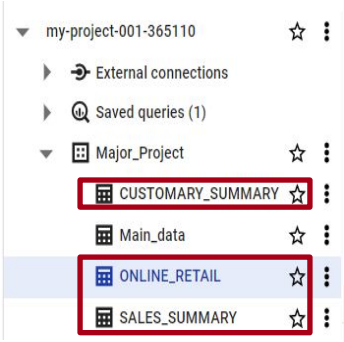
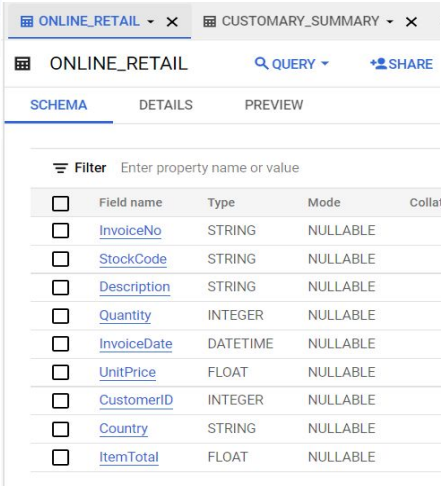
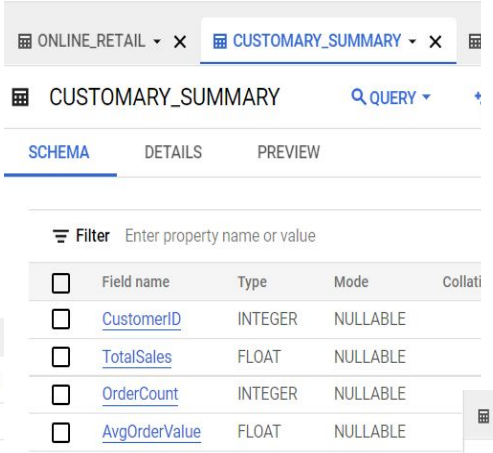
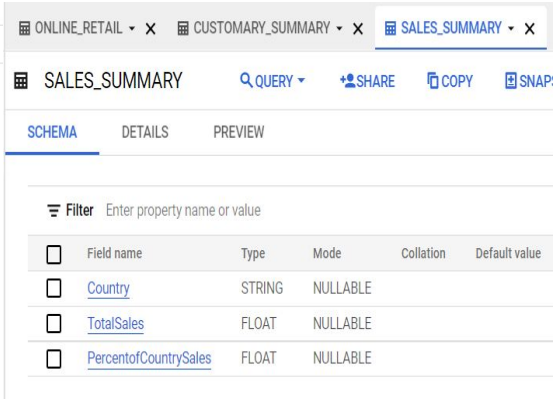
Tables Created









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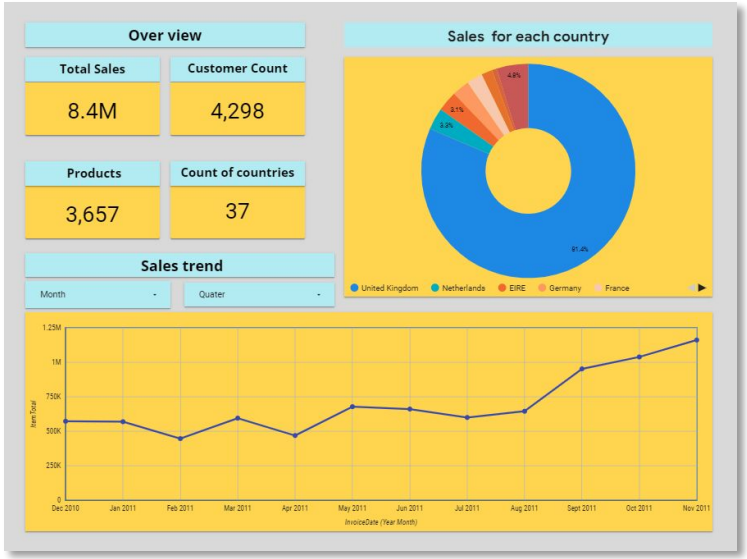
Data Visualization and Reporting

- Using Bigquery as a data source in data studio we can access the tables stored in Bigquery
- The following questions are answered and a visualized which can be accessed from the link below

- What are the sales figures for each country?
- What is the overall sales trend?
- How many new customers are there each month?
- When do customers make the most purchases?
- Which is the best selling product in each country?
- When were the largest orders made?
- Which customers made the largest orders?

Link - https://datastudio.google.com/s/o7bBBOcgd_s



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Technology Stack

Source	Data Ingestion	Data WareHouse	Orchestrion	Reporting
CSV File Cloud SQL	Python Apache Beam Data Flow	Big Query	Cloud Composer Air Flow	Data Studio

Challenges Faced

- Data ingestion Infinite values, Time consuming during record insertion.
- Running pipeline Startup worker pool in zone Asia failed // replaced zone to us central.
- Run time error - error 403 message forbidden Enabled data flow api , cloud sql api , granted permission for service account
- Orchestration Name error "google" not defined Created a requirement.txt file with dependencies

Learnings

- Alternatively we can implement Federated Queries with MySQL option instead of SQL server
- Practical experience working with GCP services like Cloud shell, Cloud Sql, Data flow, Bigquery.
- Building and running Beam Pipeline.
- Creating Dashboard in Data Studio from BigQuery tables.

Thank you !