

BI System Specification Document



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Fares Saffouri

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1. General

1.1. Project Objective

The purpose of the project is to provide a Full-Scale BI Solution Creation from PriorityERP Database for HP company.

HP develops and provides a wide variety of hardware components, as well as software and related services to consumers.

This project aims to establish a comprehensive BI solution leveraging data from the PriorityERP system for HP. The solution will encompass summarized data tables, with a focus on sales data, alongside customer information, product details, stores, dates.

Furthermore, the project will facilitate the visual representation of data through dashboards and a reporting system designed to serve the company's sales managers effectively.

Hewlett Packard, or HP, is an American company founded more than 80 years ago that manufactures desktop computers, laptops, monitors, printers, and accessories. Since the 1990s, it has been the world's largest PC manufacturer.

By examining customer data, we could assist HP in better understanding customer preferences, purchasing behaviors. This could lead to more targeted marketing campaigns. Additionally, knowing which products the best-selling, and their categories are allowing for optimizing production quantities for each model.

1.2. Project Contents

In this project, we will build a Data Mart that will contain information about sales data.

1. Data Cleaning and Preparation: Prior to analysis, we will need to perform thorough data cleaning and preparation to ensure their quality and consistency.

2. Main summary tables to be built for the company's needs

- FactSales – Information about all the orders, which product in which quantity. Data loading process for this table will be incremental.
- DimProducts – Information about the products sold by the company. Additionally, a history table (DimProductsHistory) will be included to track changes in products over time using Slowly Changing Dimensions (SCD) Type 2,4.
- DimCustomers – Information about the company's customers
- DimEmployees – Information about the company's employees.
- DimStores – Information about the company's stores.
- DimDate – A table of dates for data analysis over time.(Added in the power BI).

Source To Target document in this link: [S2T](#)

3. The project will contain measures that will contribute to the achievement of the project's goal:

- Sales Department:

The Sales Department will focus on sales-related data, seller performance, sales by countries, sales type, and compare the results with the previous year to gain a better understanding of goal achievement.

- Customer Department:

The company's customers will be interested in data related to their purchases and overall experience. They will have access to information such as which customers purchased the most, total units sold by country, number of customers of each country and more.

- Dashboard:

The company's dashboard will include a high level of details about the company, including sales difference by month and year, and the growth number of customers by month.

2. Gantt

❖ Gantt link: [gantt](#)

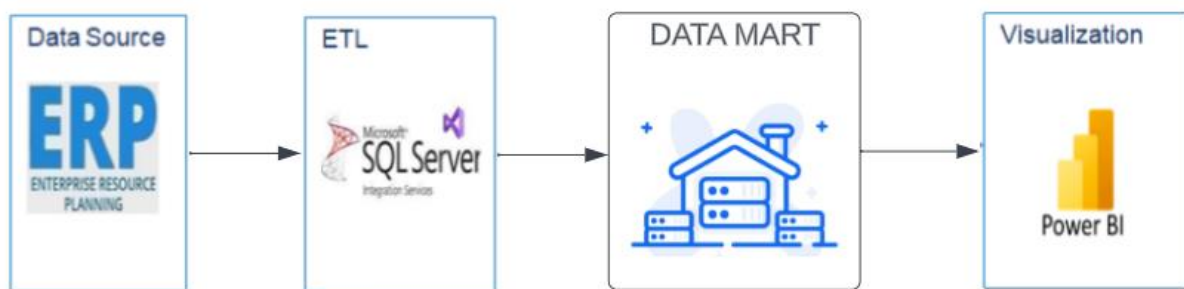
3. Technical Specification

3.1. Prerequisites

- SQL Server: ERP system in the operational DB (PriorityERP).
- SSIS: ETL processes using SSIS in Visual Studio
- Data refresh processes through the definition of JOBS in SSMS
- Power BI: Creating reports and dashboards using Power BI

3.2. Solution Architecture

HLD:



Data collection and exploration from the ERP system will be performed in SQL Server. The data will undergo an ETL process for organization and arrangement into a Data Warehouse using SSIS. Finally, the presentation of measures in reports and visuals will be presented in Power BI.

The report for the Customer Department consists of:

- The top 3 selling by product category.
- The total units sold by Store.
- Number of customers in each Country.
- Top 10 Customers by sales.
- Total Sales by year.
- Average Sale per customer.
- Total orders and total sold units by customers.

The report for the Sales Department consists of:

- Total sales by country.

- percentage of sales type.
- Top 10 salesperson by sales.
- Percentage of sales difference by year.
- Percentage of sale price category by total orders.
- Average sale for order.
- Average units for order.

The Dashboard consists of:

- Percentage of Orders Sales Difference by Year.
- Percentage of Units Sales Difference by Year.
- Percentage of Units Sales Difference by Year.
- Percentage growth Of Customers by Month.
- Percentage of Sales Difference by Month.

4. Functional Specification

4.1. Creation of final Source to Target and ERD models.

4.1.1 Source to Target

❖ Source To Target link: [S2T](#)

The data tables that will be used from the OLTP database consist of a total of 11 tables as seen in the S2T.

4.1.2 ERD model

The ERD of the tables, attached link: [ERD](#)

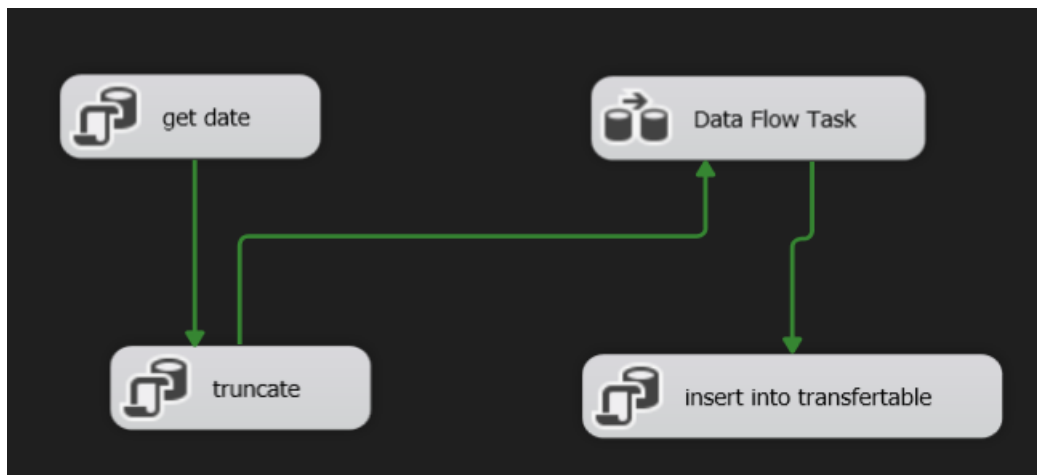
4.2. Detailed description of all ETL processes.

In SSIS I have 6 solutions:

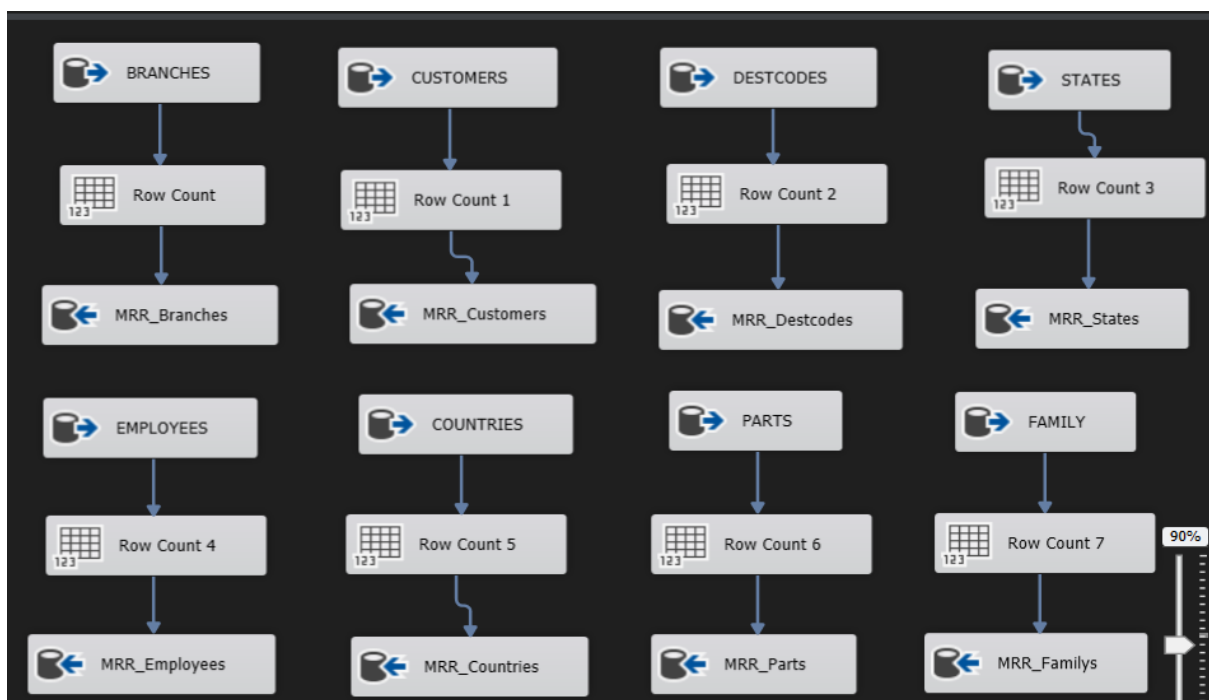
Mrr: in this solution I have 3 packages.

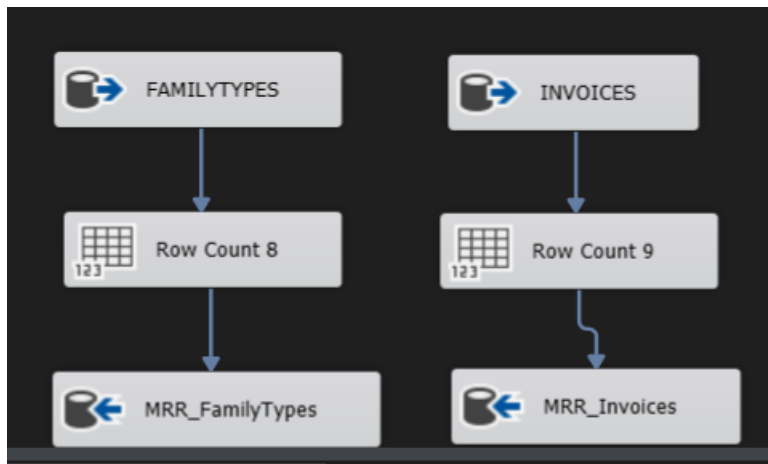
MrrDims: this package for getting relevant columns from different tables to create each dim table.

In the control flow:



In the data flow:

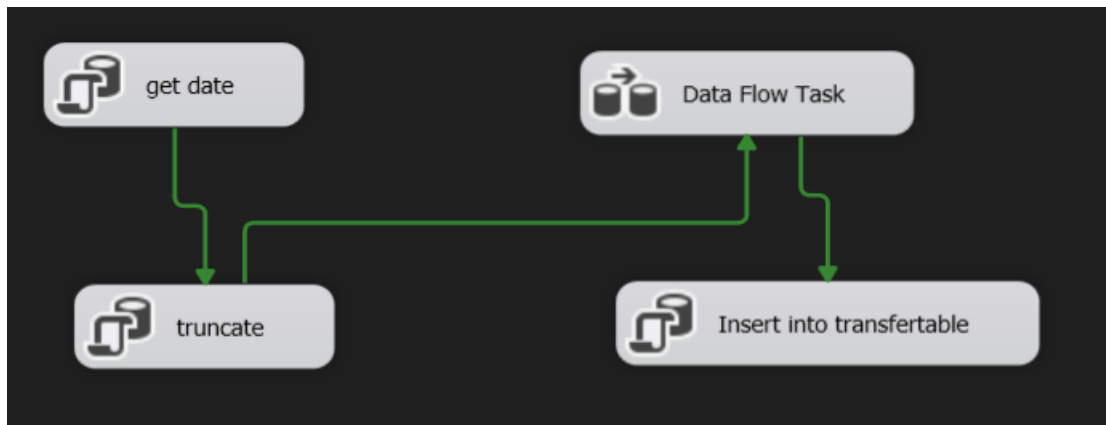




MrrSales:

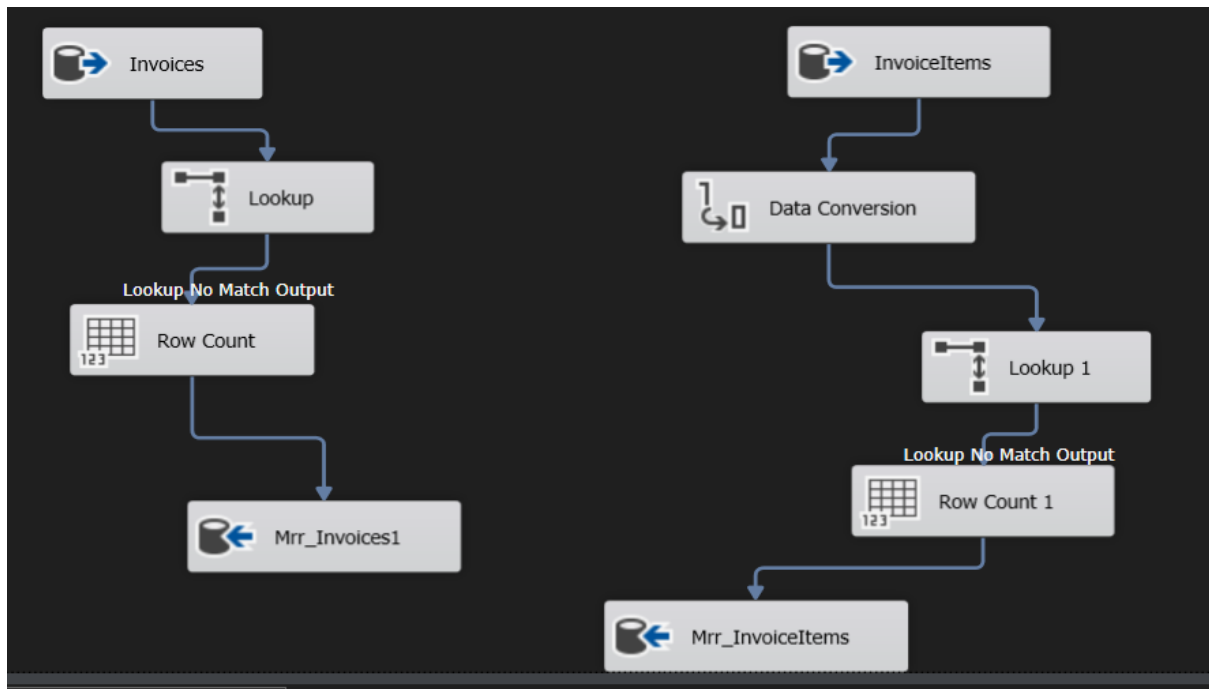
This package for getting columns from the two sales tables to create the fact sales table.

In the control flow:



In the data flow:

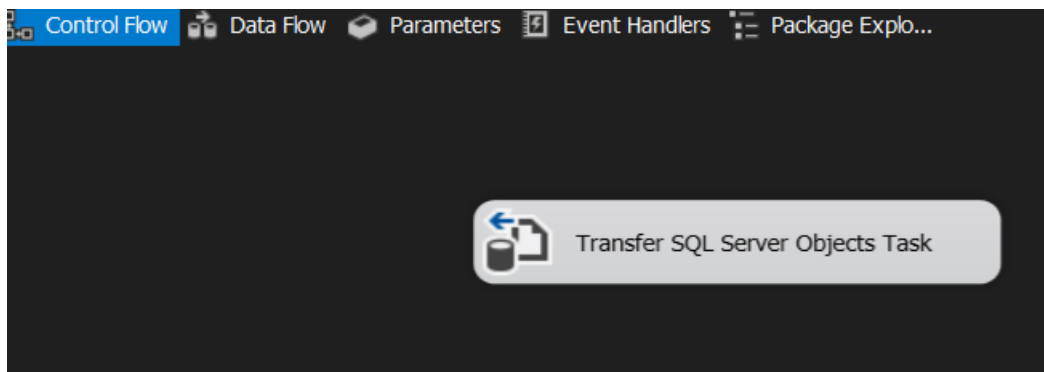
The use of lookup for incremental load:



Transfer db package:

This package is for copying all the data from the DB to another DB (Developing) after the creation of the data mart.

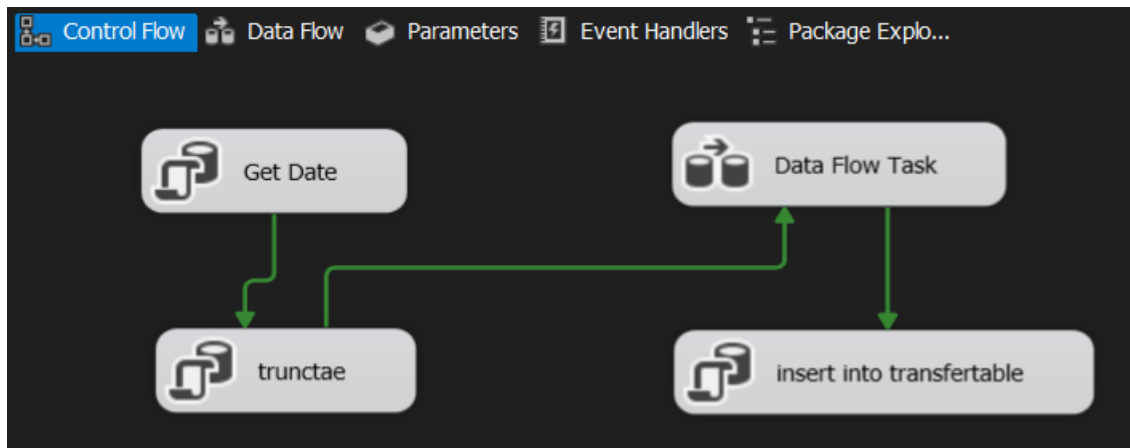
In the control flow:



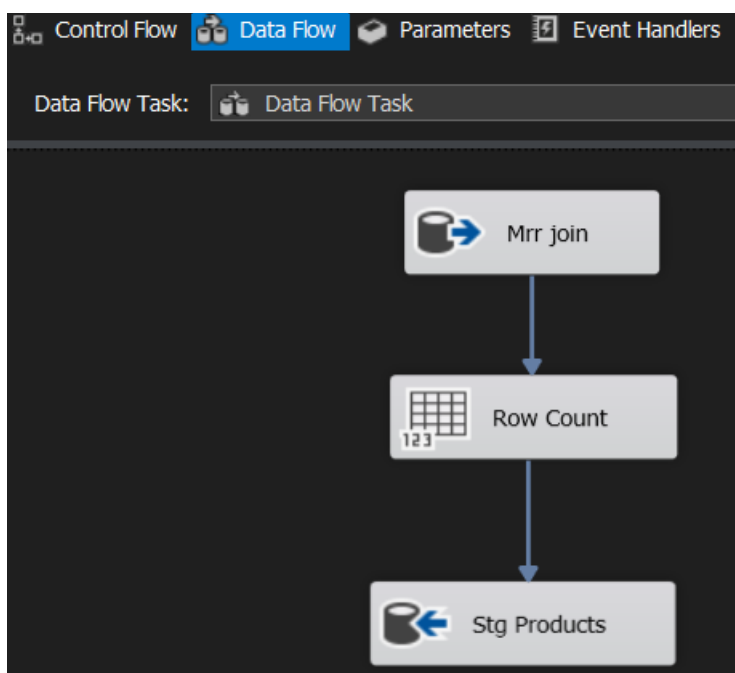
Products: in this solution I have 3 packages.

StgProducts: in this package I load to the StgProducts table the data from SQL Command (join relevant Mrr tables)

In the control flow:

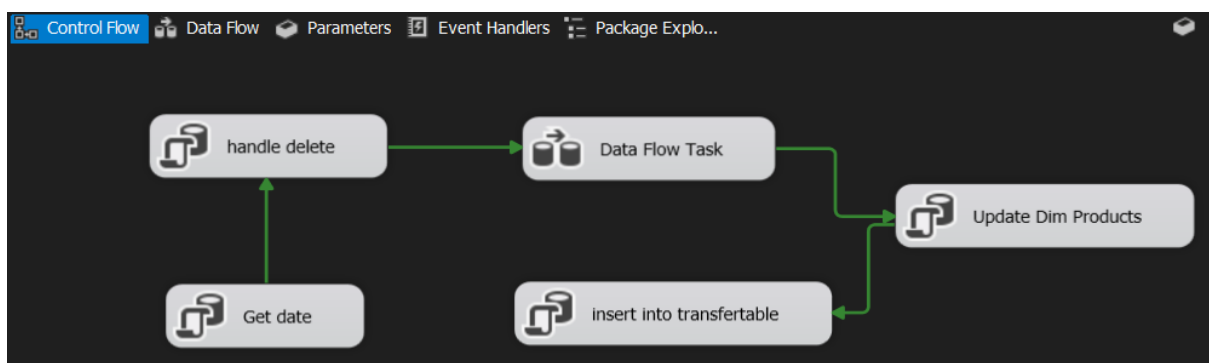


In the data flow:

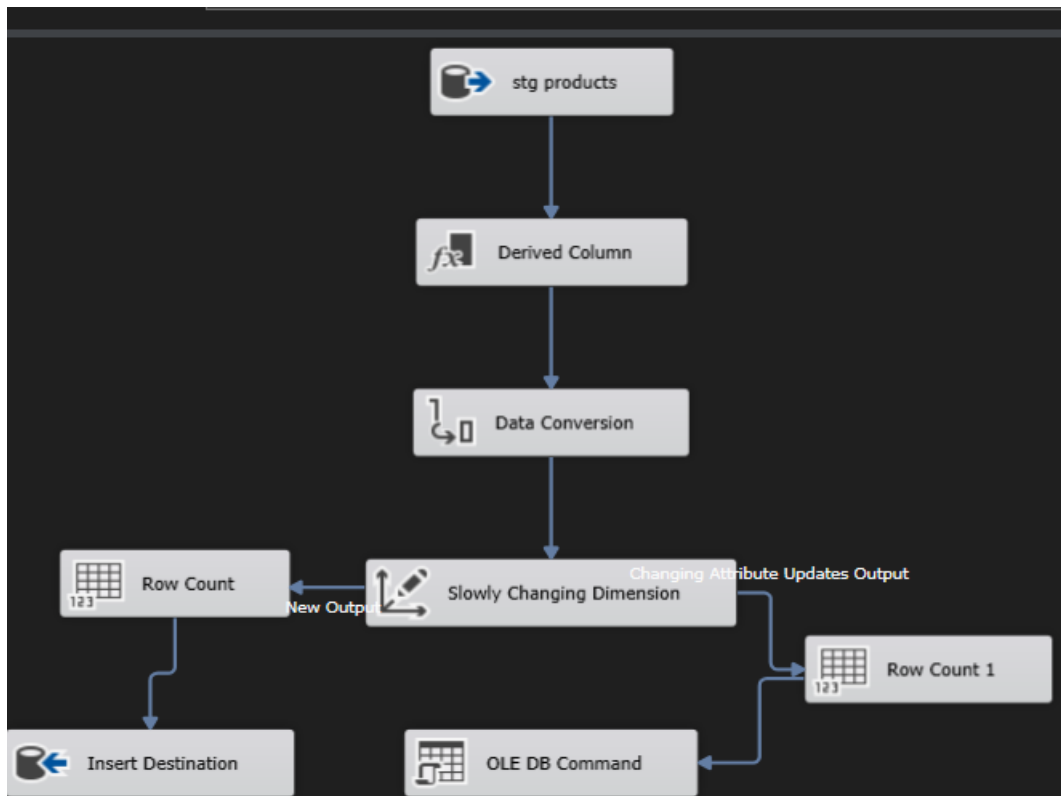


DimProducts: in this package I have loaded the data from the Stg table of products to the DimProducts table.

In the control flow:



In the data flow:

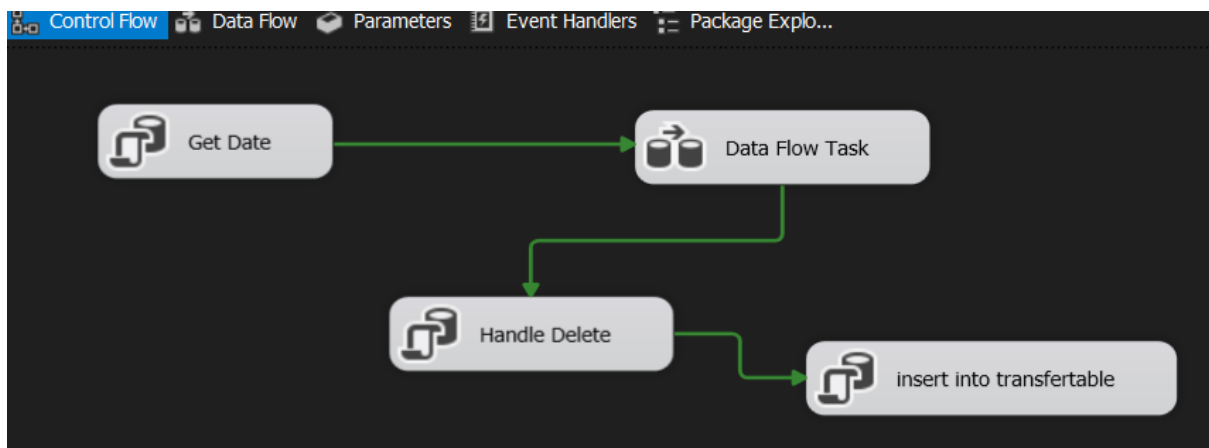


Derived column for replacing NULL values with UnKnown.

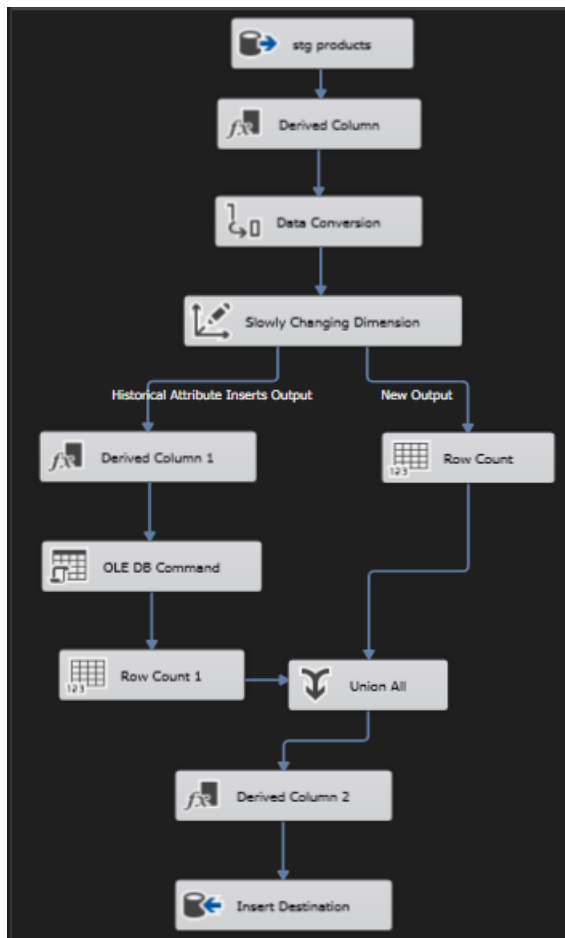
Data Conversion to change the types from Varchar to Nvarchar and to minimize the length.

DimProductsHistory package: in this package I have inserted the changes of products in the history table of the products.

In the control flow:



In the data flow:



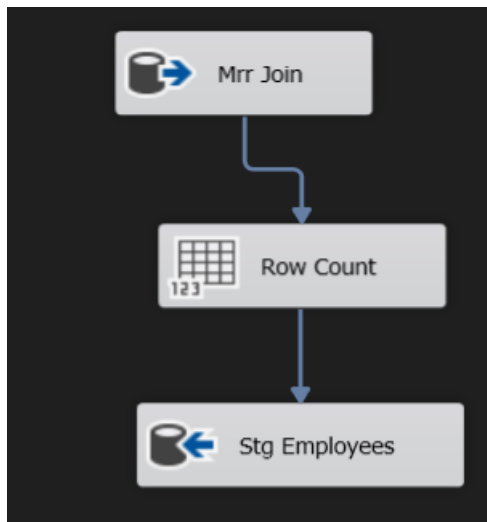
Employees: in this solution I have 2 packages.

StgEmployees:

In the control flow:



In the data flow:



DimEmployees:

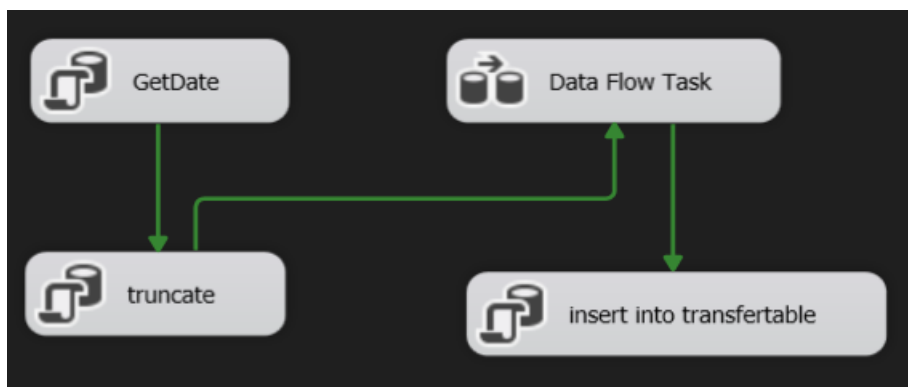
In the control flow:



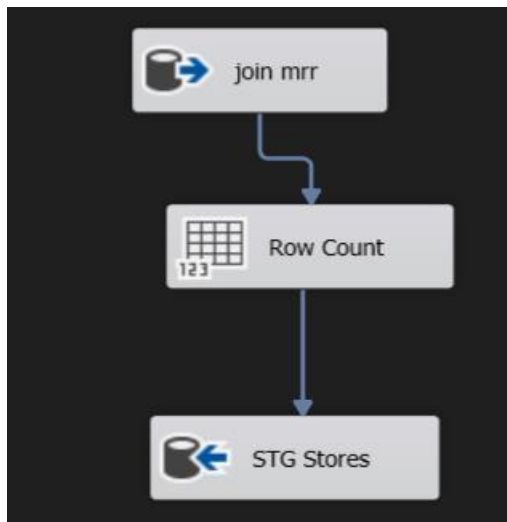
Stores: in this solution I have 2 packages.

StgStores:

In the control flow:

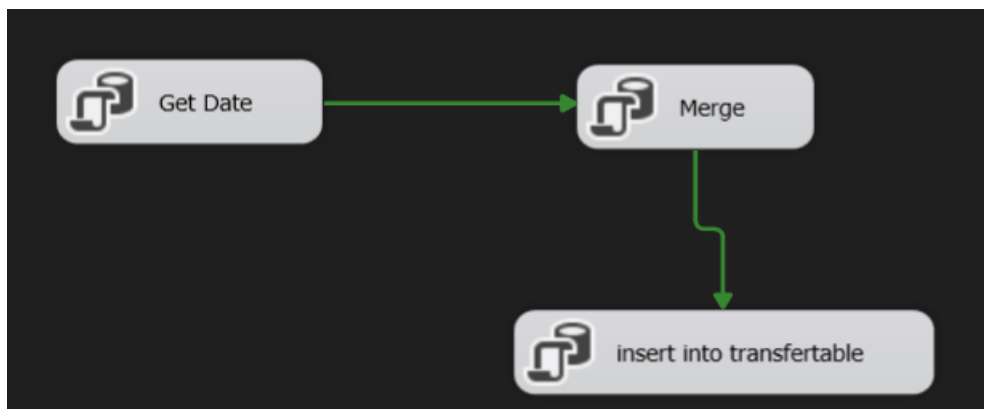


In the data flow:



DimStores:

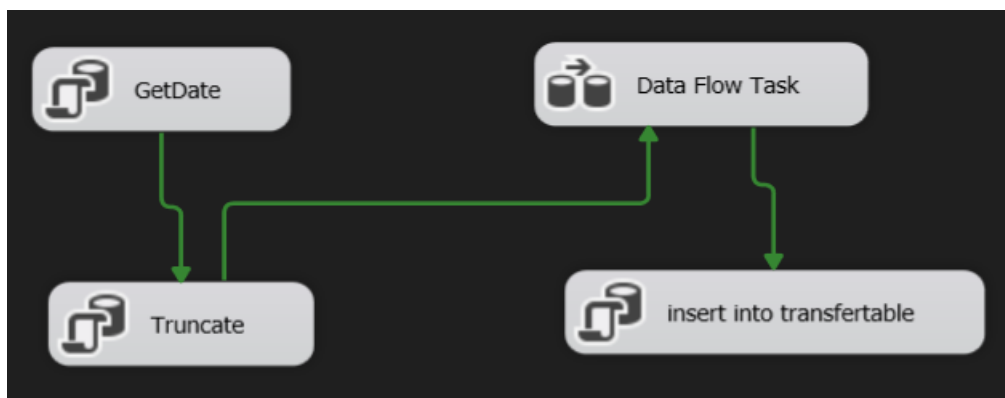
In the control flow:



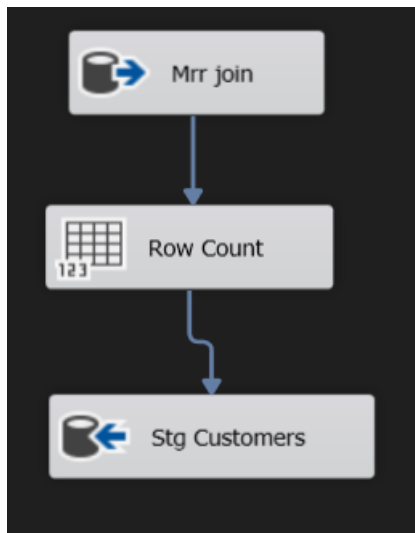
Customers: in this solution I have 2 packages.

StgCustomers:

In the control flow:

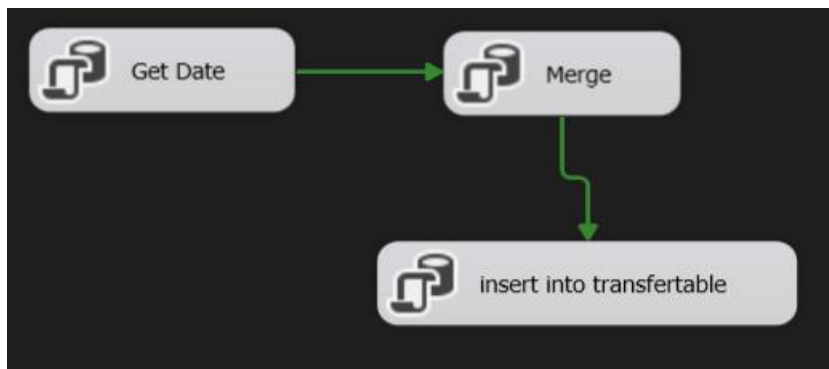


In the data flow:



DimCustomers:

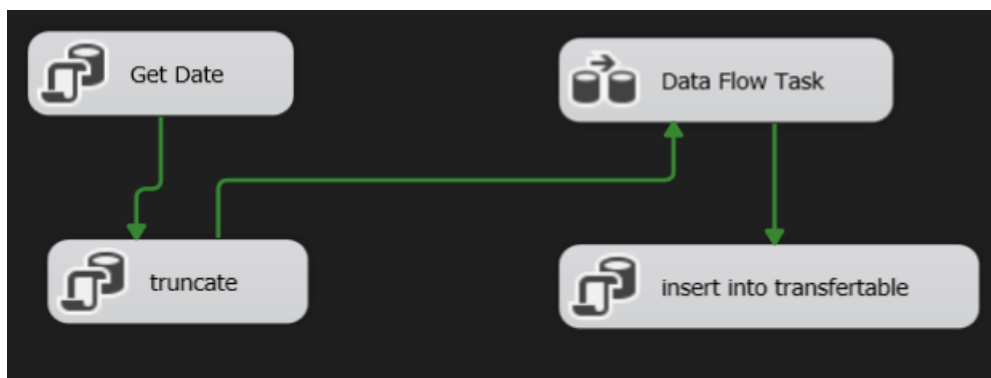
In the control flow:



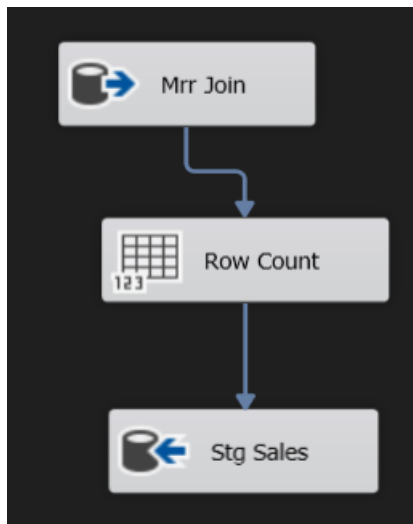
FactSales: in this solution I have 2 packages.

StgSales:

In the control flow:

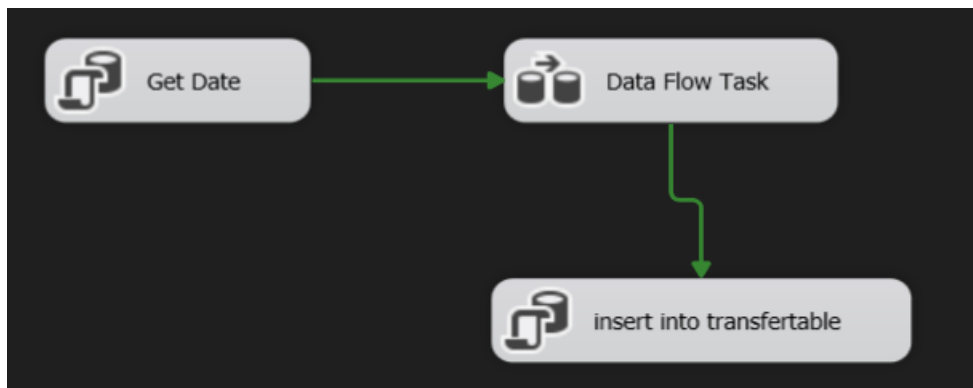


In the data flow:

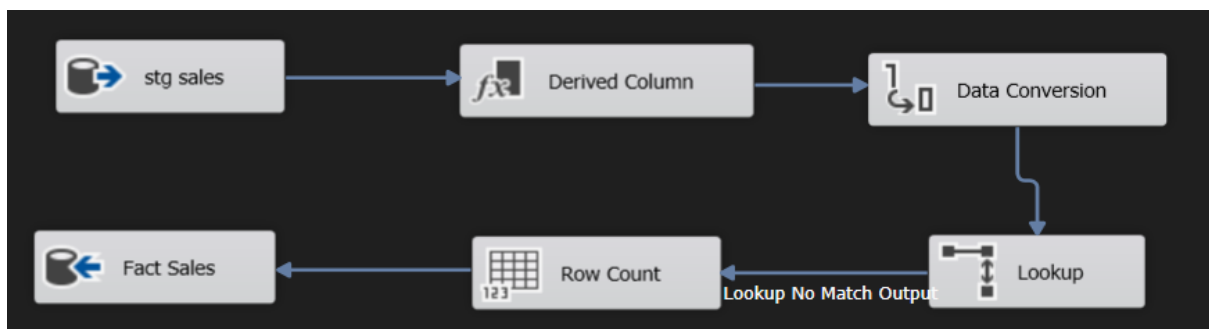


FactSales:

In the control flow:



In the data flow:



Derived column for calculating the Total.

Data conversion for changing the types from varchar to Date and from float to Decimal.

Next step is to deploy the project to SQL Server, create a job by the following steps:

| Date ▾ | Step ID | Server | Job Name | Step Name | Notifications | Message |
|----------------------|--------------------|-----------------|------------------------|----------------------|---------------|-------------------|
| 05/02/2024 23:17:... | | LAPTOP-ULQRU4KB | E2E_HP | | | The job succeeded |
| 05/02/2024 23:... | 13 | LAPTOP-ULQRU4KB | E2E_HP | Fact Sales | | Executed as user: |
| 05/02/2024 23:... | 12 | LAPTOP-ULQRU4KB | E2E_HP | DIM Products History | | Executed as user: |
| 05/02/2024 23:... | 11 | LAPTOP-ULQRU4KB | E2E_HP | DIM Customers | | Executed as user: |
| 05/02/2024 23:... | 10 | LAPTOP-ULQRU4KB | E2E_HP | DIM Stores | | Executed as user: |
| 05/02/2024 23:... | 9 | LAPTOP-ULQRU4KB | E2E_HP | DIM Employees | | Executed as user: |
| 05/02/2024 23:... | 8 | LAPTOP-ULQRU4KB | E2E_HP | DIM Products | | Executed as user: |
| 05/02/2024 23:... | 7 | LAPTOP-ULQRU4KB | E2E_HP | STG Sales | | Executed as user: |
| 05/02/2024 23:... | 6 | LAPTOP-ULQRU4KB | E2E_HP | STG Customers | | Executed as user: |
| 05/02/2024 23:... | 5 | LAPTOP-ULQRU4KB | E2E_HP | STG Stores | | Executed as user: |
| 05/02/2024 23:... | 4 | LAPTOP-ULQRU4KB | E2E_HP | STG Employees | | Executed as user: |
| 05/02/2024 23:... | 3 | LAPTOP-ULQRU4KB | E2E_HP | STG Products | | Executed as user: |
| 05/02/2024 23:... | 2 | LAPTOP-ULQRU4KB | E2E_HP | MrrSales | | Executed as user: |
| 05/02/2024 23:... | 1 | LAPTOP-ULQRU4KB | E2E_HP | MrrDims | | Executed as user: |

The job will run in the production environment every day:

New Job Schedule

Name:

Daily run in Production

Jobs in Schedule

Schedule type:

Recurring

Enabled

One-time occurrence

Date:

07/02/2024

Time:

17:27:51

Frequency

Occurs:

Daily

Recurs every:

1

day(s)

Daily frequency

Occurs once at:

8:00:00

Occurs every:

1

hour(s)

Starting at:

0:00:00

Ending at:

23:59:59

Duration

Start date:

07/02/2024

End date:

07/02/2024

No end date:

Summary

Description:

Occurs every day at 8:00:00. Schedule will be used starting on 07/02/2024.

OK

Cancel

Help

4.3. Description of data tables in the Data Warehouse (DWH):

As seen in the S2T: here is some screenshots of every table in the DataMart.

FactSales:

| Order_ID | Order_Date | CustomerID | AgentID | TerritoryID | ProductID | Qty | Price | Discount | Total |
|----------|------------|------------|---------|-------------|-----------|-----|---------|----------|----------|
| 49893 | 2013-02-28 | 29783 | 276 | 3 | 725 | 2 | 202.33 | 0.00 | 473.45 |
| 49893 | 2013-02-28 | 29783 | 276 | 3 | 762 | 6 | 469.79 | 0.00 | 3297.95 |
| 49893 | 2013-02-28 | 29783 | 276 | 3 | 843 | 2 | 15.00 | 0.00 | 35.10 |
| 49893 | 2013-02-28 | 29783 | 276 | 3 | 760 | 11 | 454.13 | 0.02 | 5727.81 |
| 49893 | 2013-02-28 | 29783 | 276 | 3 | 855 | 5 | 53.99 | 0.00 | 315.86 |
| 49894 | 2013-02-28 | 30096 | 277 | 2 | 780 | 5 | 1242.85 | 0.00 | 7270.68 |
| 49894 | 2013-02-28 | 30096 | 277 | 2 | 787 | 4 | 647.99 | 0.00 | 3032.61 |
| 49894 | 2013-02-28 | 30096 | 277 | 2 | 831 | 1 | 209.25 | 0.00 | 244.82 |
| 49894 | 2013-02-28 | 30096 | 277 | 2 | 783 | 8 | 1229.45 | 0.00 | 11507.73 |

DimStores:

| Store_ID | Name | Location | IsActive | UpdateDate |
|----------|-------|-----------------|----------|-------------------------|
| 292 | Ivory | Tennessee | Y | 2024-02-05 02:46:04.667 |
| 294 | Ivory | California | Y | 2024-02-05 02:46:04.667 |
| 296 | Ivory | Minnesota | Y | 2024-02-05 02:46:04.667 |
| 298 | Ivory | Ohio | Y | 2024-02-05 02:46:04.667 |
| 300 | Ivory | New South Wales | Y | 2024-02-05 02:46:04.667 |
| 302 | Ivory | California | Y | 2024-02-05 02:46:04.667 |

DimProducts:

| ProductID | Product_Name | Sub_Category_Name | Category_Name | IsActive | UpdateDate |
|-----------|----------------------------|-------------------|----------------|----------|-------------------------|
| 753 | HP 250 G9 724K5EA | Laptop | PC | N | 2024-02-05 01:45:45.757 |
| 779 | HP 250 G9 6F1Z7EA | Laptop | PC | Y | 2024-02-05 01:45:45.760 |
| 780 | HP ProBook 440 G10 725H9EA | Laptop | PC | Y | 2024-02-05 01:45:45.763 |
| 781 | HP 200 G3 3VA74EA | Desktop | PC | Y | 2024-02-05 01:45:45.763 |
| 782 | HP All-in-One 27-cr0301nj | Desktop | PC | Y | 2024-02-05 01:45:45.763 |
| 783 | HP All-in-One 24-cr0235nj | Desktop | PC | Y | 2024-02-05 01:45:45.763 |
| 784 | HP 652 F6V25AE | Ink | Ink and Toners | Y | 2024-02-05 01:45:45.763 |
| 793 | HP 51639A | Ink | Ink and Toners | Y | 2024-02-05 01:45:45.763 |

DimProductsHistory:

| ProductID | Product_Name | Sub_Category_Name | Category_Name | startDate | endDate |
|-----------|-----------------------|-------------------|----------------|-------------------------|-------------------------|
| 798 | HP LaserJet M110w | Combined | Printers | 2024-02-05 22:48:55.000 | NULL |
| 797 | HP M551N | Normal | Printers | 2024-02-05 22:48:55.000 | NULL |
| 797 | Road-550-W Yellow, 38 | Road Bikes | Bikes | 2024-02-05 01:55:20.000 | 2024-02-05 22:48:55.000 |
| 796 | HP M551DN | Normal | Printers | 2024-02-05 22:48:55.000 | NULL |
| 796 | Road-250 Black, 58 | Road Bikes | Bikes | 2024-02-05 01:55:20.000 | 2024-02-05 22:48:55.000 |
| 795 | Road-250 Black, 52 | Road Bikes | Bikes | 2024-02-05 01:55:20.000 | 2024-02-05 09:48:20.000 |
| 795 | HP Sprocket 200 | Normal | Printers | 2024-02-05 09:48:20.000 | NULL |
| 794 | HP 142A W1420A | Toner | Ink and Toners | 2024-02-05 09:48:20.000 | NULL |
| 794 | Road-250 Black, 48 | Road Bikes | Bikes | 2024-02-05 01:55:20.000 | 2024-02-05 09:48:20.000 |

DimEmployees:

| Emp_ID | First_Name | Last_Name | Job_Title | Hire_Date | Phone_Number | Email_Address | Territory_Name | IsActive | UpdateDate |
|--------|------------|-------------------|------------------------|------------|---------------------|-----------------------------|----------------|----------|-------------------------|
| 77777 | NULL | NULL | Online | NULL | NULL | NULL | NULL | Y | 2024-02-05 01:26:38.020 |
| 290 | Ranjit | Varkey Chudukatil | Sales Representative | 2012-05-30 | 1 (11) 500 555-0117 | ranjit0@adventure-works.com | France | Y | 2024-02-05 01:26:38.020 |
| 289 | Jae | Pak | Sales Representative | 2012-05-30 | 1 (11) 500 555-0145 | jae0@adventure-works.com | United Kingdom | Y | 2024-02-05 01:26:38.020 |
| 288 | Rachel | Valdez | Sales Representative | 2013-05-30 | 1 (11) 500 555-0140 | rachel0@adventure-works.com | Germany | Y | 2024-02-05 01:26:38.020 |
| 287 | Amy | Alberts | European Sales Manager | 2012-04-16 | 775-555-0164 | amy0@adventure-works.com | NULL | Y | 2024-02-05 01:26:38.020 |
| 286 | Lynn | Tsoflias | Sales Representative | 2013-05-30 | 1 (11) 500 555-0190 | lynn0@adventure-works.com | Australia | Y | 2024-02-05 01:26:38.020 |

DimCustomers:

| CustomerID | Name | Address | City | Region | Country | StoreID | IsActive | UpdateDate |
|------------|-------------------|---------------------|---------------|-----------------|-----------|---------|----------|-------------------------|
| 11000 | Jon Yang | 3761 N. 14th St | Rockhampton | Queensland | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11001 | Eugene Huang | 2243 W St. | Seaford | Victoria | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11002 | Ruben Torres | 5844 Linden Land | Hobart | Tasmania | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11003 | Christy Zhu | 1825 Village Pl. | North Ryde | New South Wales | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11004 | Elizabeth Johnson | 7553 Harness Circle | Wollongong | New South Wales | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11005 | Julio Ruiz | 7305 Humphrey Drive | East Brisbane | Queensland | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |
| 11006 | Janet Alvarez | 2612 Berrv Dr | Matraville | New South Wales | Australia | 1995 | Y | 2024-02-05 01:29:07.313 |

Transfertable:

This table counts the rows that inserted in every table from each stage:

| PackageName | TableName | InsertDate | EndDate | RowsCount |
|--------------------|--------------------|-------------------------|-------------------------|-----------|
| FactSales | FactSales | 2024-02-05 23:20:22.000 | 2024-02-05 23:20:22.890 | 0 |
| DimProductsHistory | DimProductsHistory | 2024-02-05 23:20:08.000 | 2024-02-05 23:20:08.667 | 0 |
| DimCustomers | DimCustomers | 2024-02-05 23:19:55.000 | 2024-02-05 23:19:55.993 | 0 |
| DimStores | DimStores | 2024-02-05 23:19:45.000 | 2024-02-05 23:19:44.860 | 0 |
| DimEmployees | DimEmployees | 2024-02-05 23:19:34.000 | 2024-02-05 23:19:34.200 | 0 |
| DimProducts | DimProducts | 2024-02-05 23:19:20.000 | 2024-02-05 23:19:20.770 | 0 |
| StgSales | StgSales | 2024-02-05 23:19:06.000 | 2024-02-05 23:19:06.370 | 0 |
| StgCustomers | StgCustomers | 2024-02-05 23:18:51.000 | 2024-02-05 23:18:51.790 | 19119 |
| StgStores | StgStores | 2024-02-05 23:18:38.000 | 2024-02-05 23:18:38.330 | 636 |
| StgEmployees | StgEmployees | 2024-02-05 23:18:23.000 | 2024-02-05 23:18:23.120 | 18 |
| StgProducts | Stg_Products | 2024-02-05 23:18:09.000 | 2024-02-05 23:18:08.813 | 241 |
| Mrr_Sales | MRR_Invoiceltems | 2024-02-05 23:17:54.000 | 2024-02-05 23:17:55.507 | 0 |
| Mrr_Sales | MRR_Invoices1 | 2024-02-05 23:17:54.000 | 2024-02-05 23:17:55.503 | 0 |
| Mrr_Dims | MRR_Invoices | 2024-02-05 23:17:37.000 | 2024-02-05 23:17:39.237 | 31465 |
| Mrr_Dims | MRR_Familys | 2024-02-05 23:17:37.000 | 2024-02-05 23:17:39.233 | 38 |
| Mrr_Dims | MRR_FamilyTypes | 2024-02-05 23:17:37.000 | 2024-02-05 23:17:39.233 | 4 |

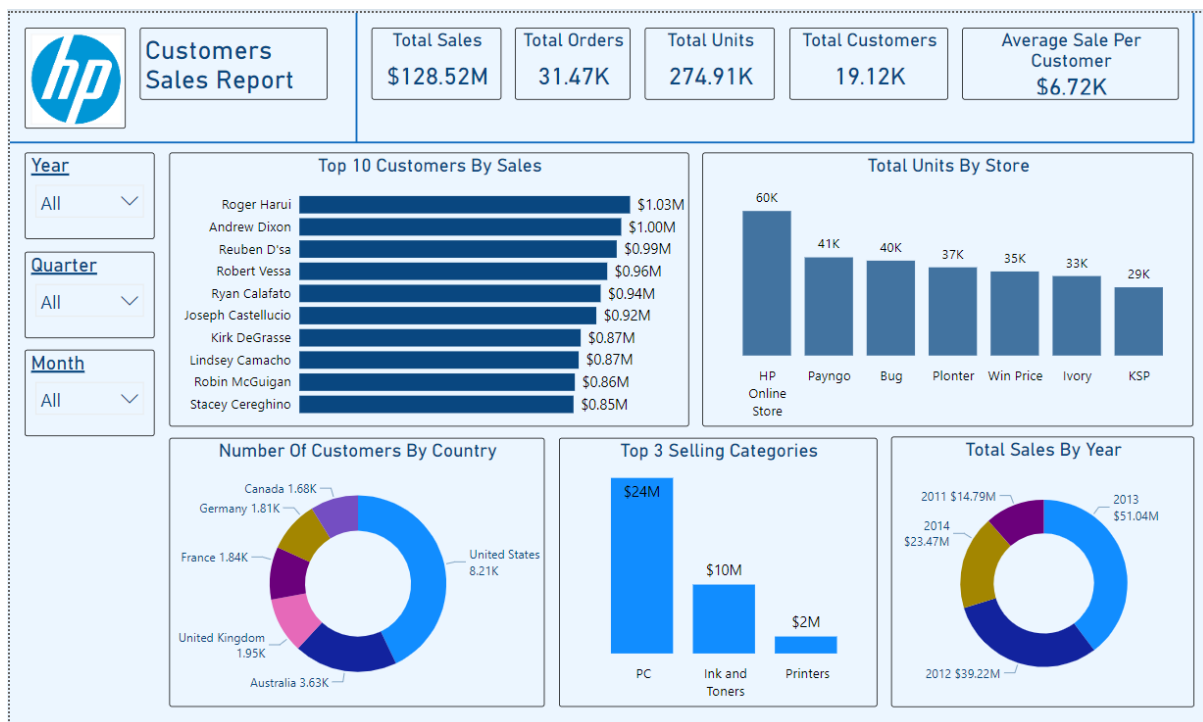
4.4. Power BI

➤ In Power BI, I have created several measures:

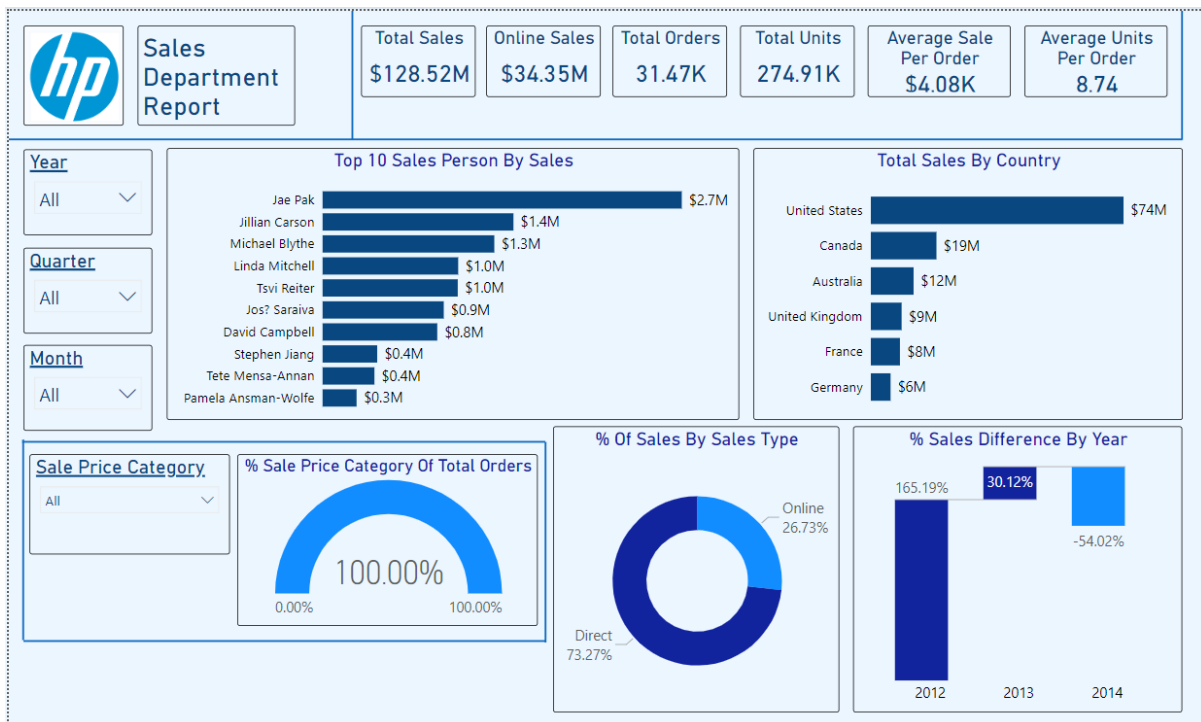
- Total Sales = SUM(FactSales[Total])
- Total Orders = DISTINCTCOUNT(FactSales[Order_ID])
- Total Units = SUM(FactSales[Qty])
- Number of Customers = DISTINCTCOUNT(FactSales[CustomerID])
- Avg sale per customer = DIVIDE('Measures Tbl'[Total Sales], 'Measures Tbl'[Number of Customers], 0)
- Online Sales = CALCULATE([Total Sales], DimStores[Store_ID]=1995)
- Average Sale Per Order = DIVIDE([Total Sales], [Total Orders], 0)
- Average Units Per Order = DIVIDE([Total Units], [Total Orders], 0)
- Total Sales by Employees = CALCULATE([Total Sales], FILTER('DimEmployees', 'DimEmployees'[Emp_ID] <> 77777))
- Online Sales = CALCULATE([Total Sales], DimStores[Store_ID]=1995)
- Direct Sale = CALCULATE([Total Sales], DimStores[Store_ID] <> 1995)
- Online = DIVIDE([Online Sales], [Total Sales], 0)
- Direct = DIVIDE([Direct Sale], [Total Sales], 0)
- Price Category = SWITCH(TRUE(), 'Sales Price Category'[Total Price Per Order] > 0 && 'Sales Price Category'[Total Price Per Order] <= 500, "Low Price (1-500)", 'Sales Price Category'[Total Price Per Order] > 500 && 'Sales Price Category'[Total Price Per Order] <= 5000, "Medium Price (501-5000)", 'Sales Price Category'[Total Price Per Order] > 5000, "High Price (>5000)")
- All Orders = CALCULATE([Total Orders], ALL('Sales Price Category'))
- % price Category = [Total Orders] / [All Orders]
- YTD Sales = TOTALYTD([Total Sales], 'Dim Date'[Date])
- Last Year Sales = CALCULATE([Total Sales], SAMEPERIODLASTYEAR('Dim Date'[Date]))
- % Sales Difference By Year = DIVIDE([YTD Sales] - [Last Year Sales], [Last Year Sales], 0)
- YTD Orders = TOTALYTD([Total Orders], 'Dim Date'[Date])
- Last Year Orders = CALCULATE([Total Orders], SAMEPERIODLASTYEAR('Dim Date'[Date]))
- % Orders Sales Difference By Year = DIVIDE([YTD Orders] - [Last Year Orders], [Last Year Orders], 0)

- $\text{YTD Units} = \text{TOTALYTD}([\text{Total Units}], \text{'Dim Date'}[\text{Date}])$
- $\text{Last Year Units} = \text{CALCULATE}([\text{Total Units}], \text{SAMEPERIODLASTYEAR}(\text{'Dim Date'}[\text{Date}]))$
- $\% \text{ Units Sales Difference By Year} = \text{DIVIDE}([\text{YTD Units}] - [\text{Last Year Units}], [\text{Last Year Units}], 0)$
- $\text{Number Of Customers Prev Month} = \text{CALCULATE}([\text{Number of Customers}], \text{DATEADD}(\text{'Dim Date'}[\text{Date}], -1, \text{MONTH}))$
- $\% \text{ Growth Of Customers} = \text{DIVIDE}([\text{Number of Customers}] - [\text{Number Of Customers Prev Month}], [\text{Number Of Customers Prev Month}], 0)$
- $\text{Total Sales Last Month} = \text{CALCULATE}([\text{Total Sales}], \text{DATEADD}(\text{'Dim Date'}[\text{Date}], -1, \text{MONTH}))$
- $\% \text{ Sales Difference By Month} = \text{DIVIDE}([\text{Total Sales}] - [\text{Total Sales Last Month}], [\text{Total Sales Last Month}], 0)$

Customers Report:



In the customers' report you can filter by year/quarter/month the top 10 customers by sales, total units sold by store, top 3 selling categories, number of customers by country and total sales by year. And the 2 measures above will change accordingly (total customers and average sale per customer).

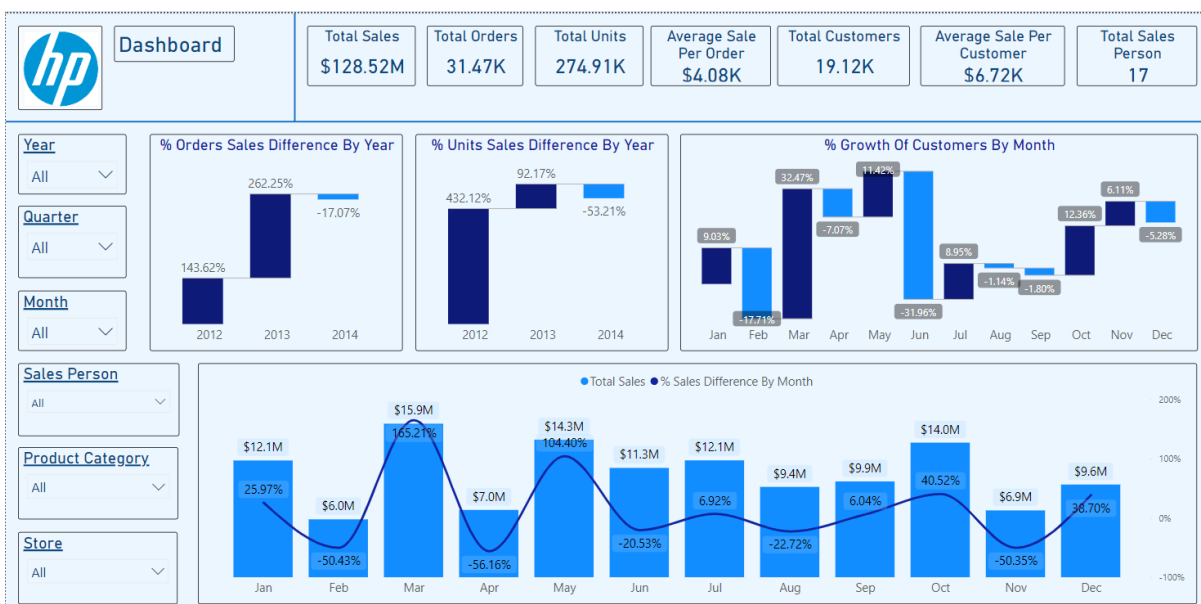


Sales Department Report:

In the sales department report you can filter by year/quarter/month the top 10 salesperson by sales, total sales by country, percentage of sales by sale type, percentage of sales difference by year and percentage of sale price category by total orders.

And the 3 measures above will change accordingly (average sale per order, average units per order, and online sales amount).

Dashboard:



In the dashboard you can filter by sales person, product category, and store for analyzing the changing of sales every month, changing of the orders by year,

changing of the units sold by year and the changing of the customers who have purchased every month.

Publish the reports:

Publishing to Power BI

✓ Success!

[Open 'HP_finalProject.pbix' in Power BI](#)

[Get Quick Insights](#)



Did you know?

You can create a portrait view of your report, tailored for mobile phones. On the **View** tab, select **Mobile Layout**. [Learn more](#)





Got it

Activate the gateway in power bi service:

Gateway connections

Use an On-premises or VNet data gateway

☒ On

| Gateway | Department | Contact information | Status | Actions |
|--|------------|---------------------|--|---|
|   Personal Gateway | | |  Running on LAPTOP-ULQRU4KB |  |

Configuring a refresh schedule:

Refresh

Configure a refresh schedule

Define a data refresh schedule to import data from the data source into the semantic model.

☒ On

Refresh frequency

Daily

Time zone

(UTC+02:00) Jerusalem

Time

9 00 AM

[Add another time](#)

Send refresh failure notifications to

☒ Semantic model owner

☒ These contacts:

F Fares × Enter email addresses

Apply

Discard

HP_finalProject Semantic model BI_HP 2/9/24, 10:51:51 PM 2/10/24, 9:00:00 AM

Then creating the app:

