

AID-Project

Group 39, 89436 - Diogo Moniz Pacheco, 105180 - Roméo Paul-Loup Axel Legoupil

1. Creation of the airports database

Once connected to the MySQL server, we execute the command to create the provided airport database:

```
source airports.sql
```

In airport database, we create a view called **moreperformance** to use in the fact_flight transformation to be faster.

Here is the query to **moreperformance**:

```
create or replace view moreperformance(flight_id, passengernumber,
total_receive, airline_id, airplane_id, from, to, departure, arrival) as
select b.flight_id, count(passenger_id) as passengernumber, sum(price) as
total_receive, airline_id, airplane_id, from, to, departure, arrival from
flight as f, booking as b where f.flight_id = b.flight_id group by
b.flight_id order by b.flight_id;
```

2. Creation of the airports data warehouse

We create 4 dimension tables and 1 fact table into the data warehouse airports_dw :

- dim_airline : Airline dimension
- dim_airplane : Airplane dimension
- dim_airport : Airport dimension for origin and destination
- dim_time : Time dimension for departure and arrival
- fact_flight : Fact table for flight

Here is the code:

```
DROP DATABASE IF EXISTS airports_dw;

CREATE DATABASE airports_dw;

USE airports_dw;

CREATE TABLE dim_airline (
    AIRLINE_ID INT,
    AIRLINE_NAME VARCHAR(255),
    PRIMARY KEY (AIRLINE_ID)
);
```

```
CREATE TABLE dim_airplane (
    AIRPLANE_ID INT,
    AIRPLANE_TYPE VARCHAR(255),
    PRIMARY KEY (AIRPLANE_ID)
);

CREATE TABLE dim_airport(
    AIRPORT_ID INT,
    AIRPORT_NAME VARCHAR(255),
    CITY VARCHAR(255),
    COUNTRY VARCHAR(255),
    PRIMARY KEY (AIRPORT_ID)
);

CREATE TABLE dim_time(
    TIME_ID DATETIME,
    YEAR_ID INT,
    MONTH_ID INT,
    MONTH_NAME VARCHAR(255),
    DAY_ID INT,
    PRIMARY KEY (TIME_ID)
);

CREATE TABLE fact_flight(
    FLIGHT_ID INT,
    PASSENGERS_NUMBER INT,
    RECEIVE_TOTAL DOUBLE,
    AIRLINE_ID INT,
    AIRPLANE_ID INT,
    ORIGIN_AIRPORT_ID INT,
    DESTINATION_AIRPORT_ID INT,
    DEPARTURE_TIME_ID DATETIME,
    ARRIVAL_TIME_ID DATETIME,
    PRIMARY KEY (FLIGHT_ID),
    FOREIGN KEY (AIRLINE_ID) REFERENCES dim_airline (AIRLINE_ID),
    FOREIGN KEY (AIRPLANE_ID) REFERENCES dim_airplane (AIRPLANE_ID),
    FOREIGN KEY (ORIGIN_AIRPORT_ID) REFERENCES dim_airport (AIRPORT_ID),
    FOREIGN KEY (DESTINATION_AIRPORT_ID) REFERENCES dim_airport
    (AIRPORT_ID),
    FOREIGN KEY (DEPARTURE_TIME_ID) REFERENCES dim_time (TIME_ID),
    FOREIGN KEY (ARRIVAL_TIME_ID) REFERENCES dim_time (TIME_ID)
);
```

Then to create the airports data warehouse we execute the following command: [source airports_dw.sql](#)

3. Transformations developed in PDI

Airline dimension

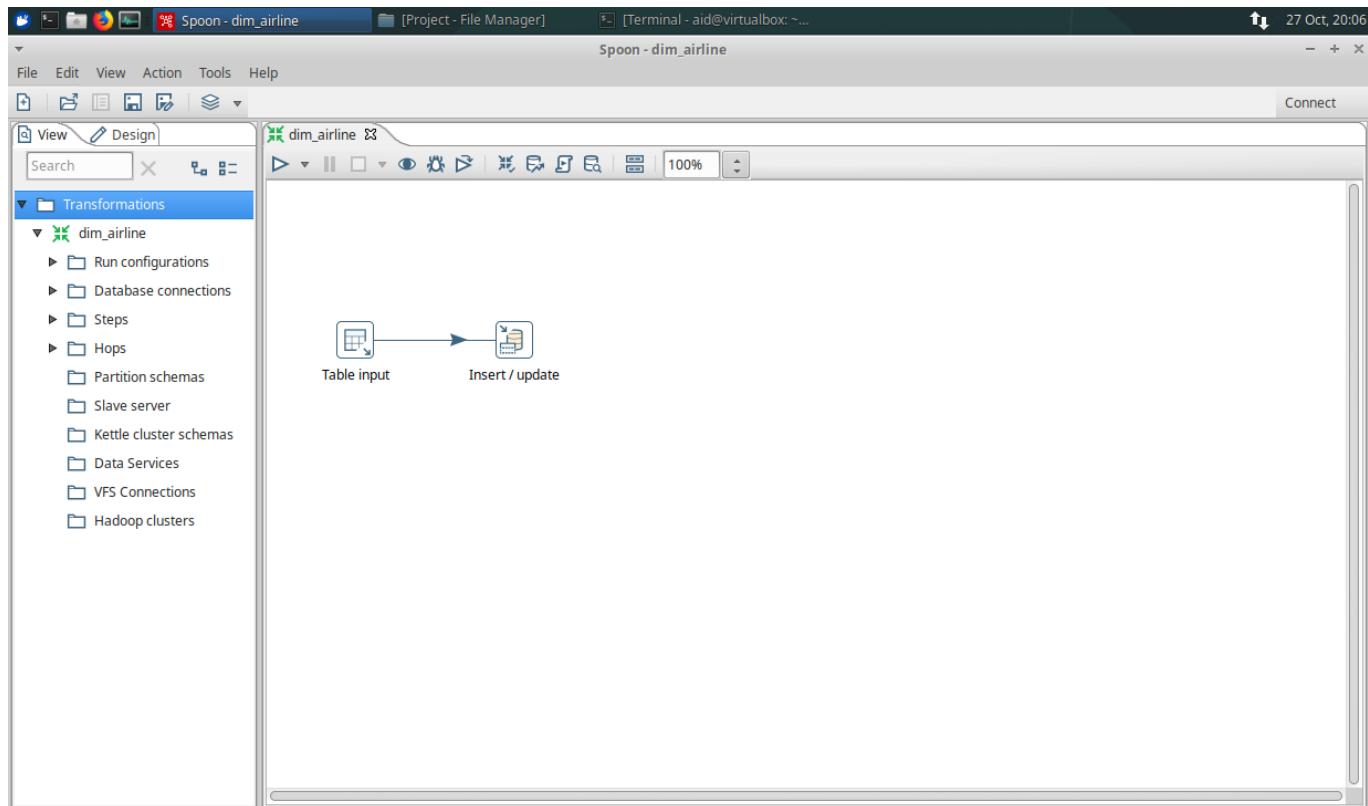


Figure 1 - dim_airline entire transformation

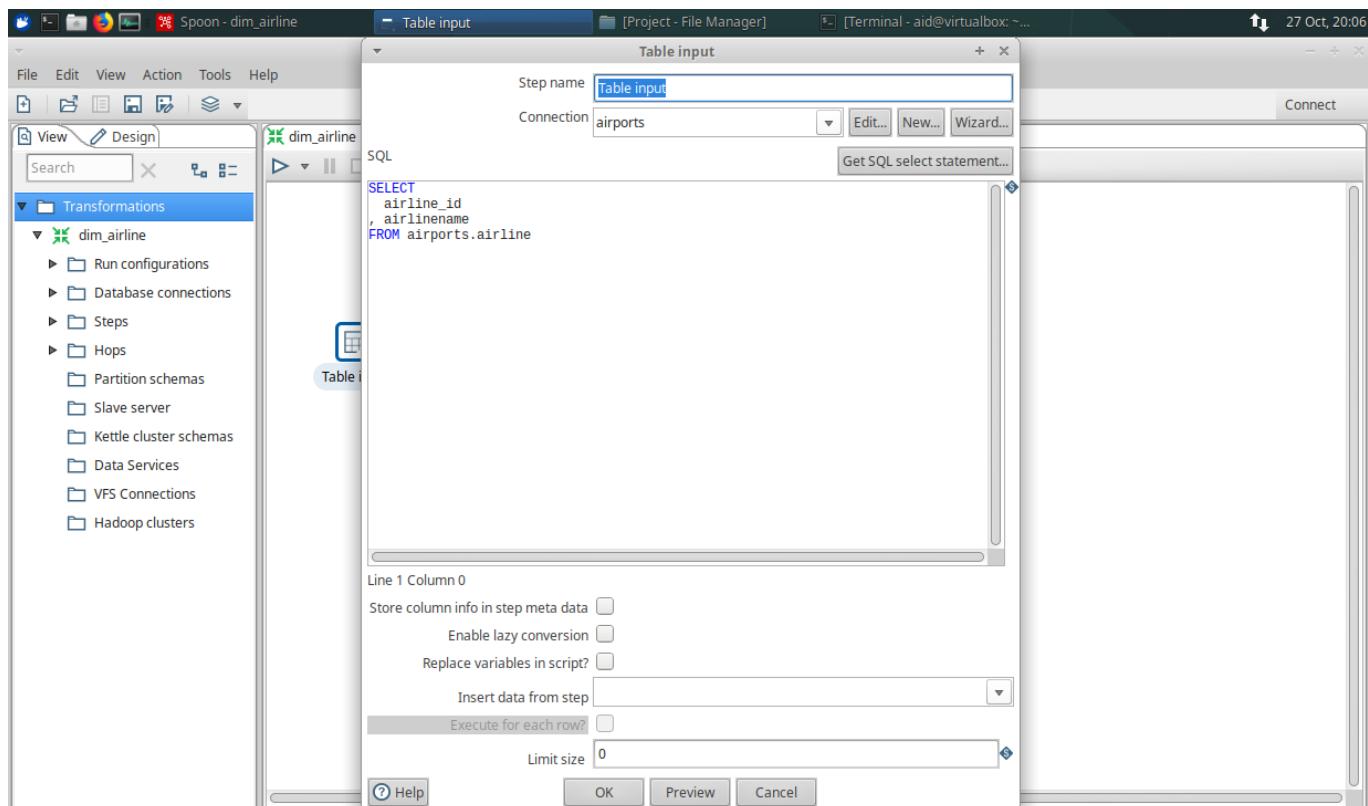


Figure 2 - dim_airline table input window

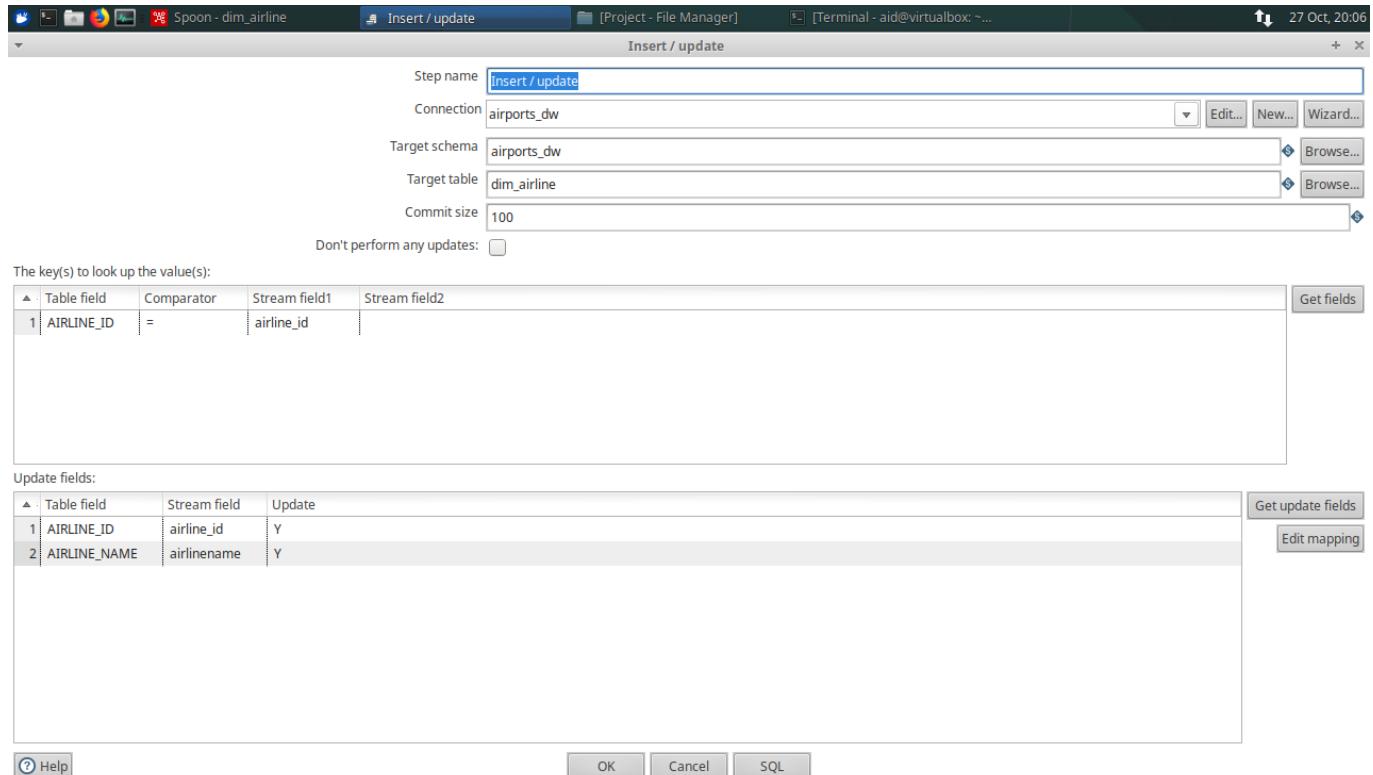


Figure 3 - dim_airline insert/update window

Airplane dimension

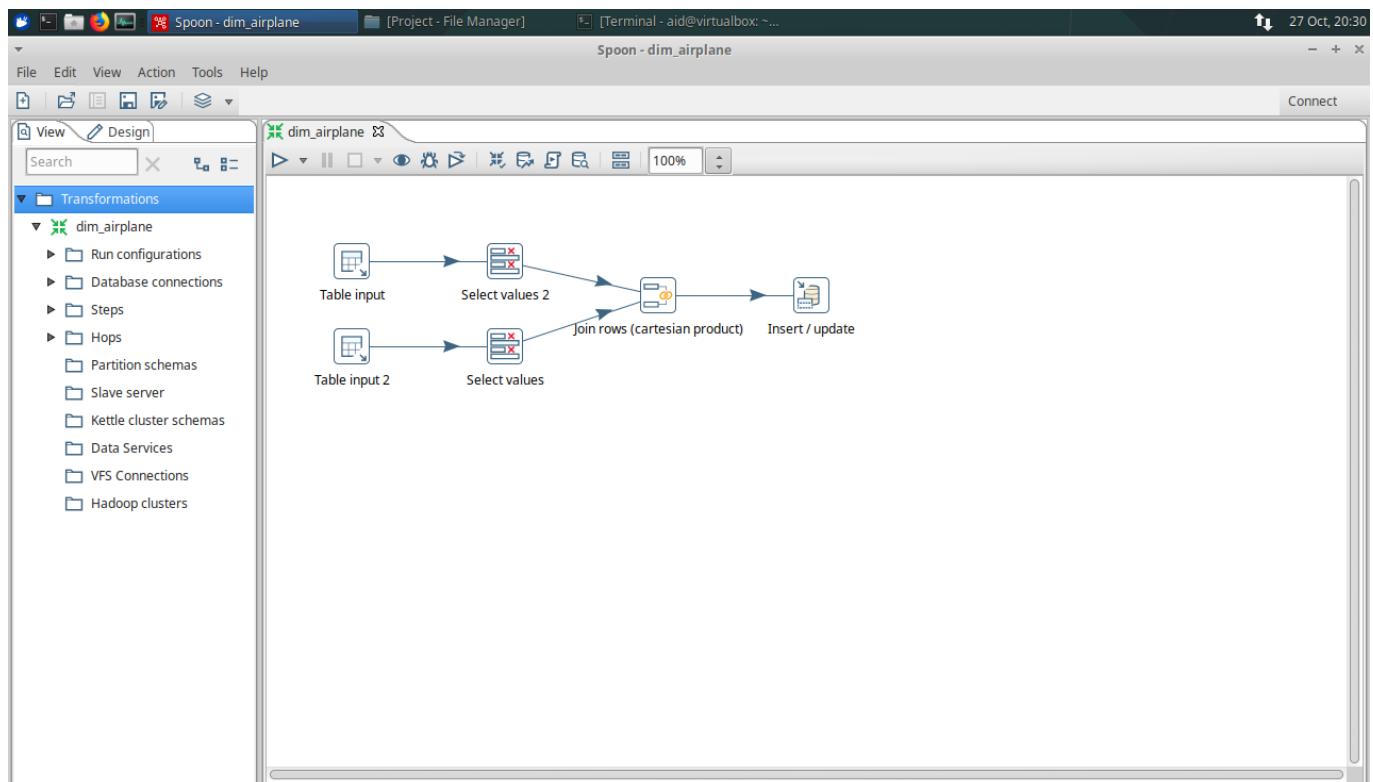


Figure 4 - dim_airline entire transformation

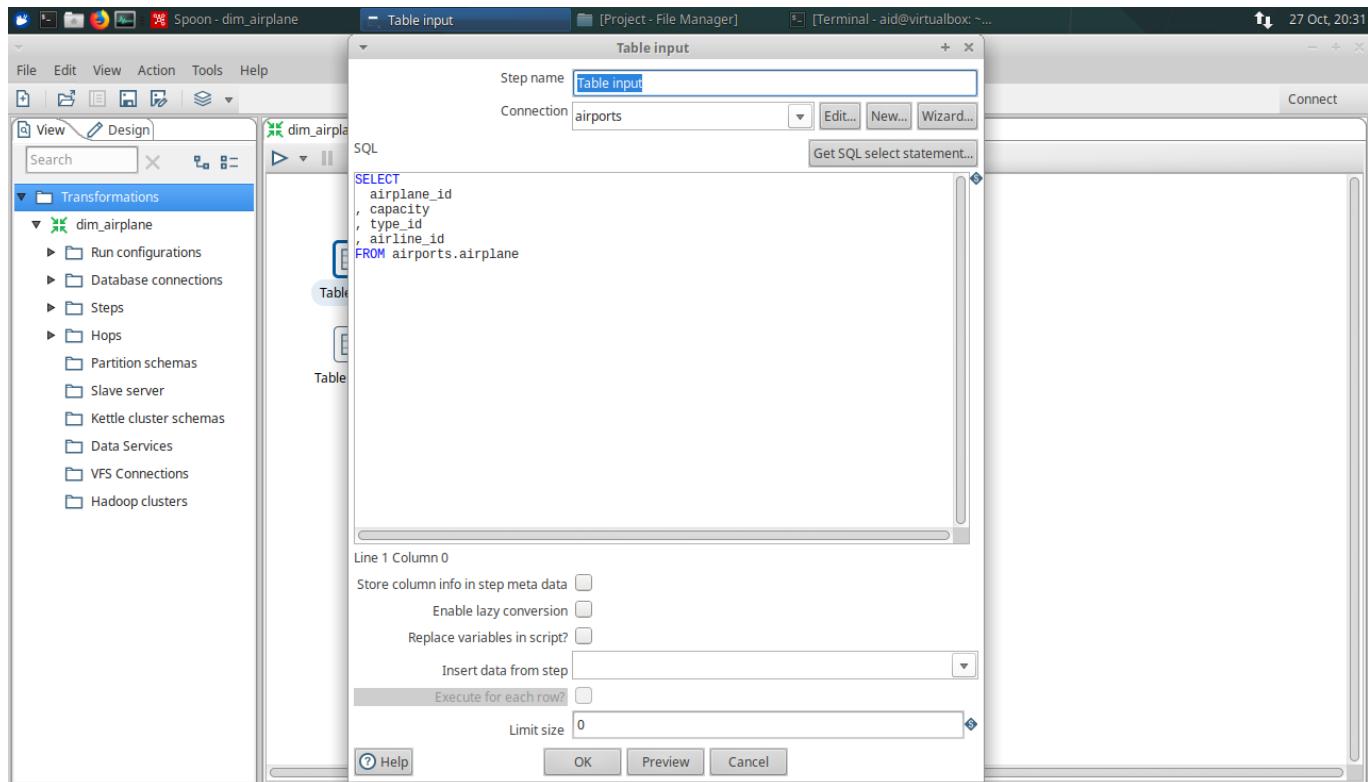


Figure 5 - dim_airplane table input window

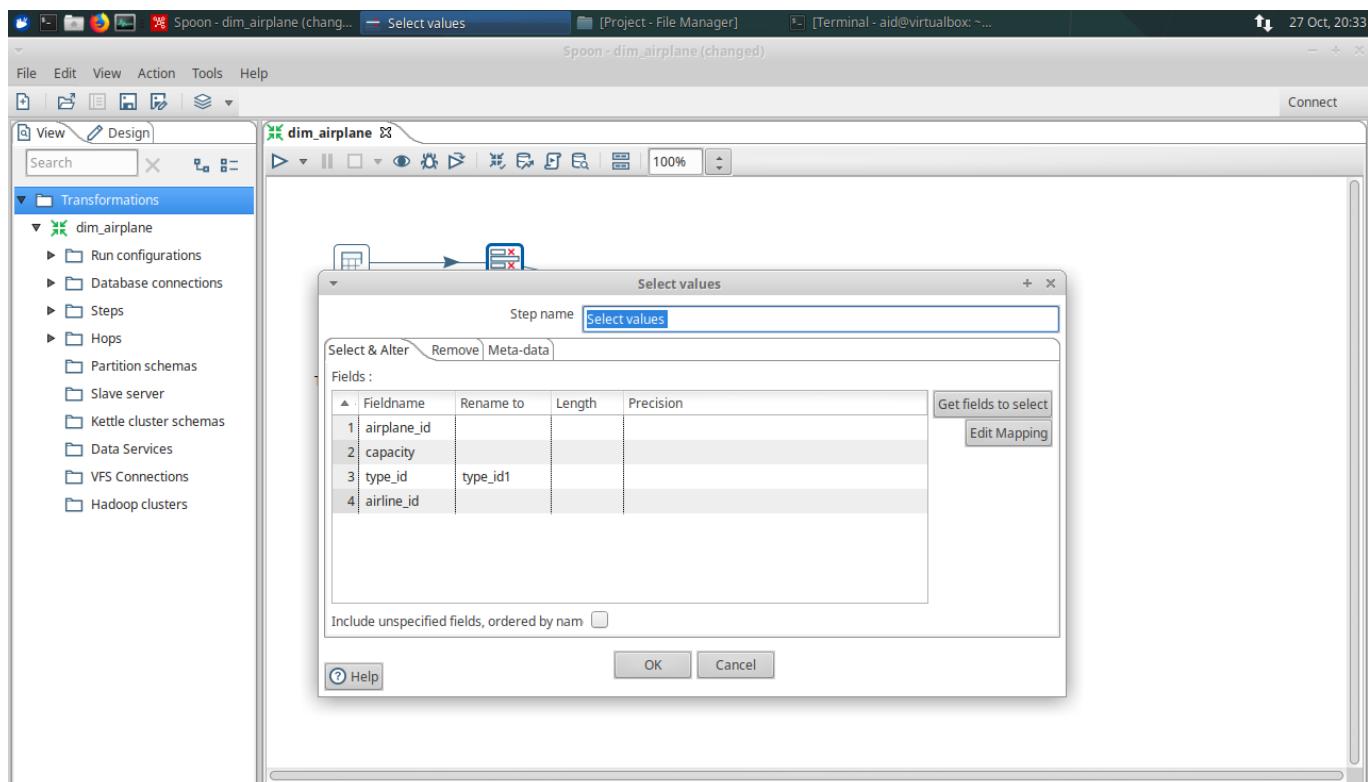


Figure 6 - dim_airplane select values window

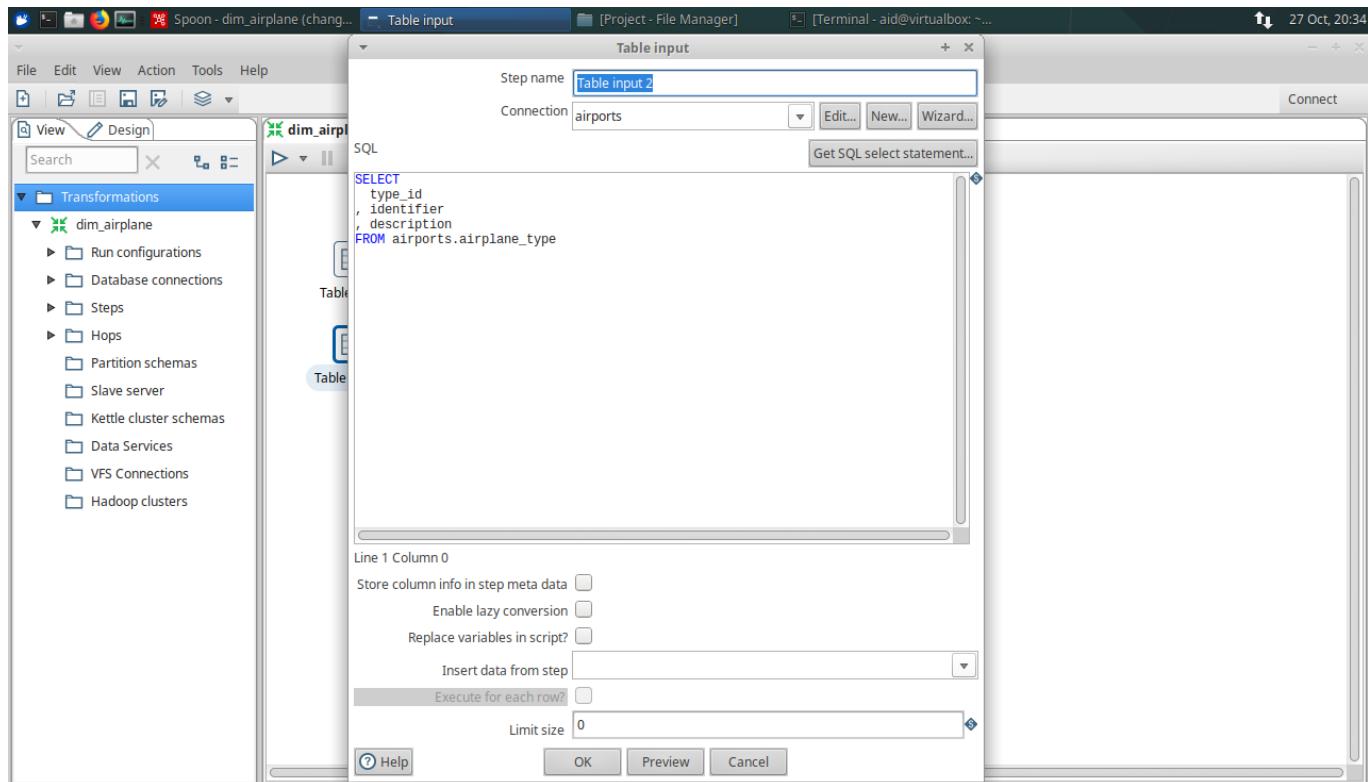


Figure 7 - dim_airplane table input 2 window

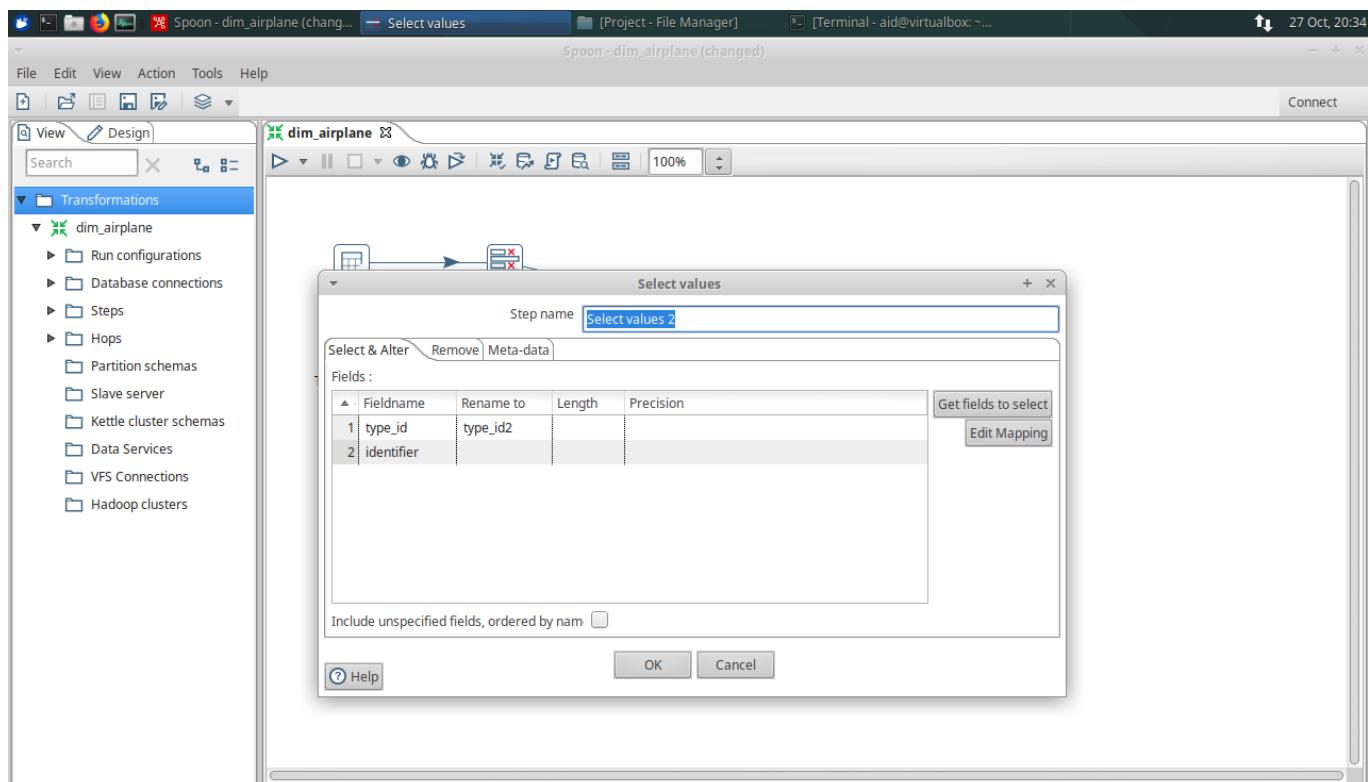


Figure 8 - dim_airplane select values 2 window

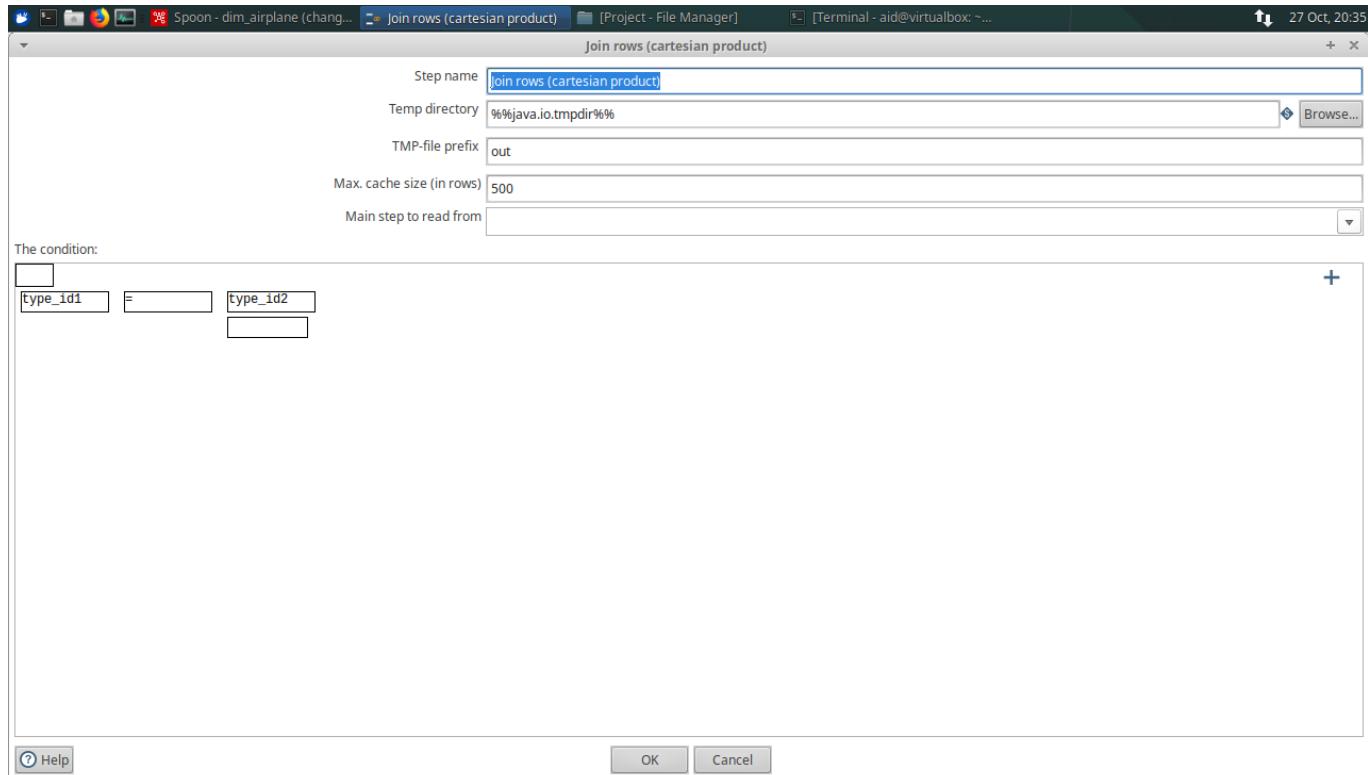


Figure 9 - dim_airplane join rows window

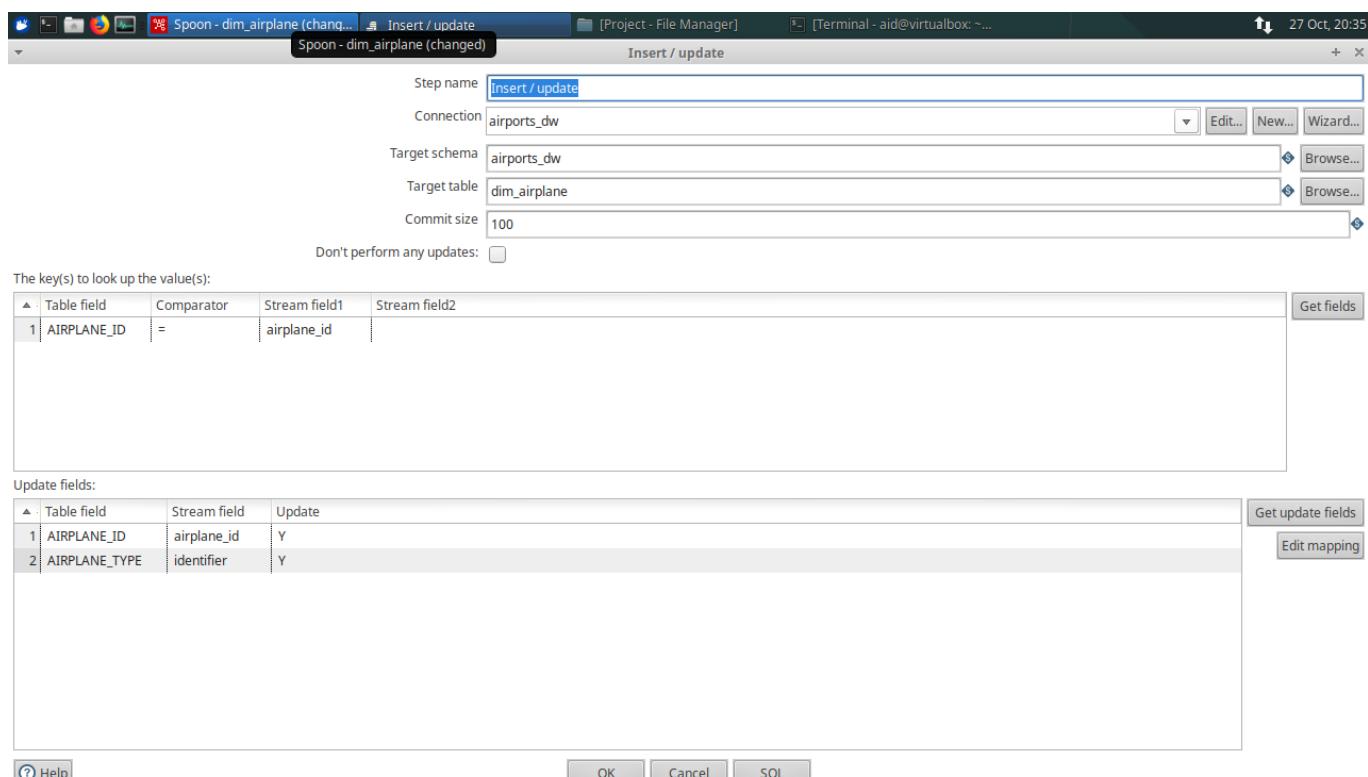


Figure 10 - dim_airplane insert/update window

Airport dimension

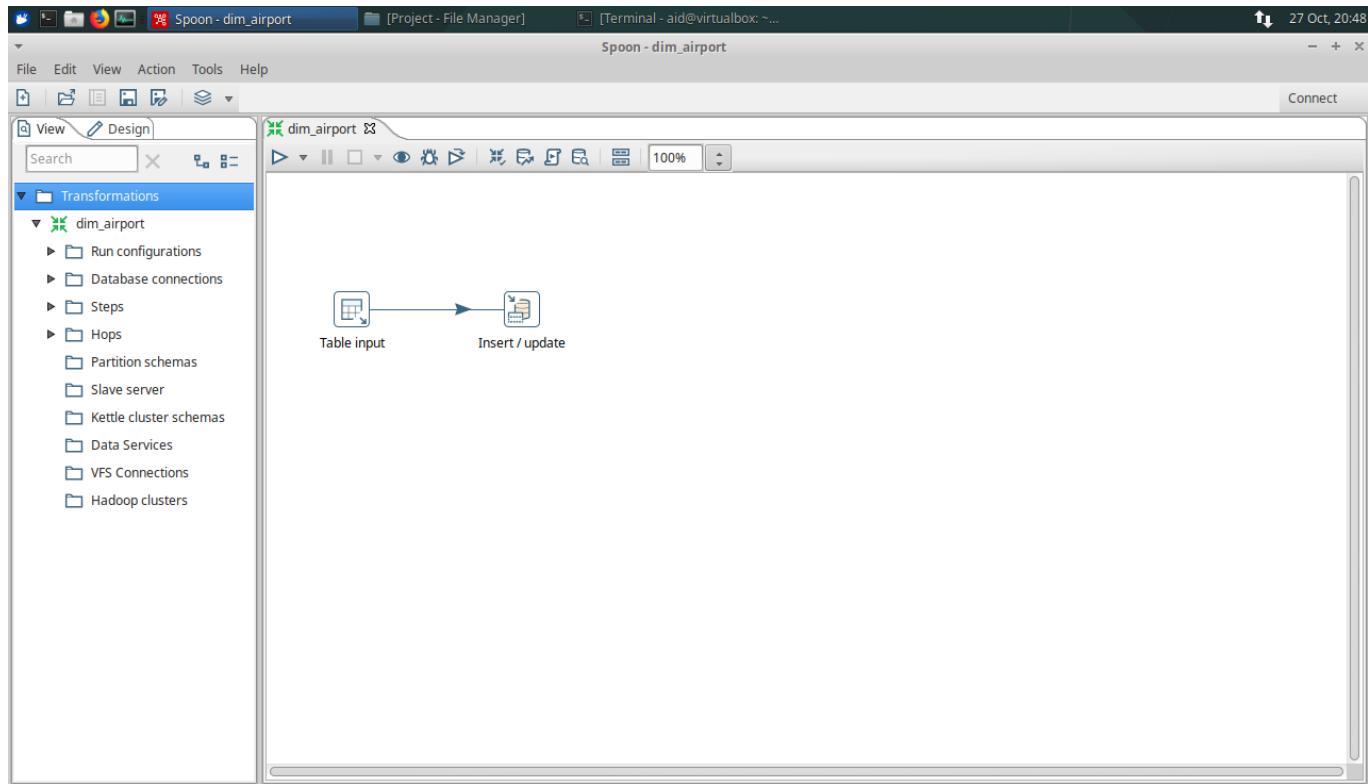


Figure 11 - dim_airport entire transformation

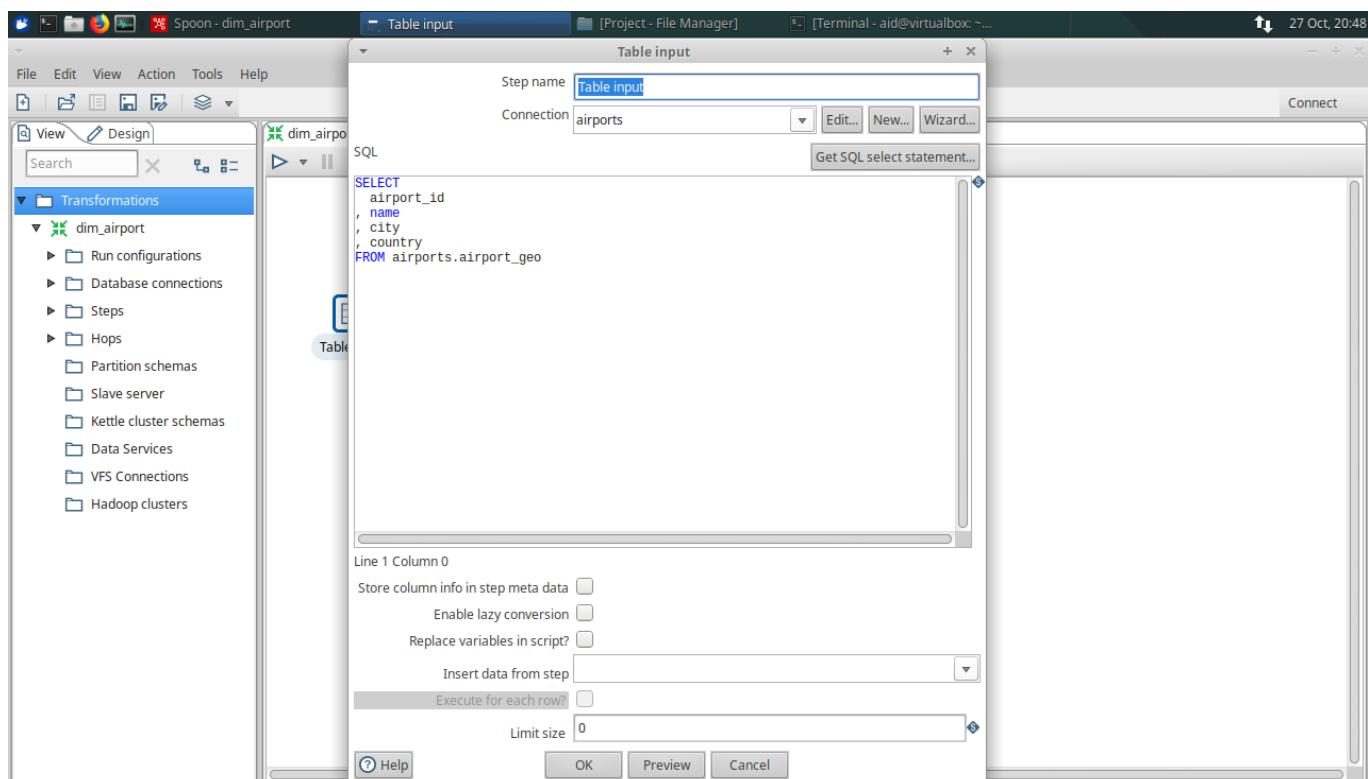


Figure 12 - dim_airport input table window

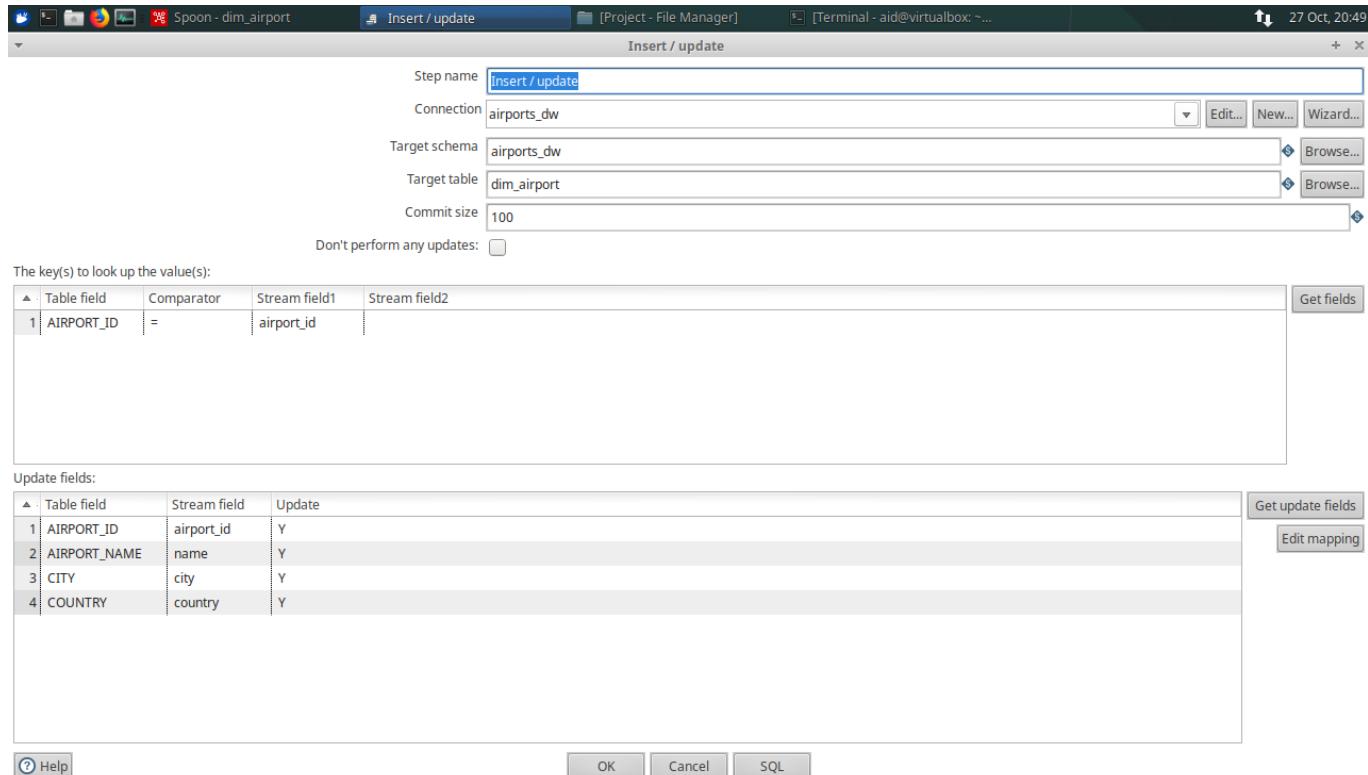


Figure 13 - dim_airport insert/update window

Time dimension

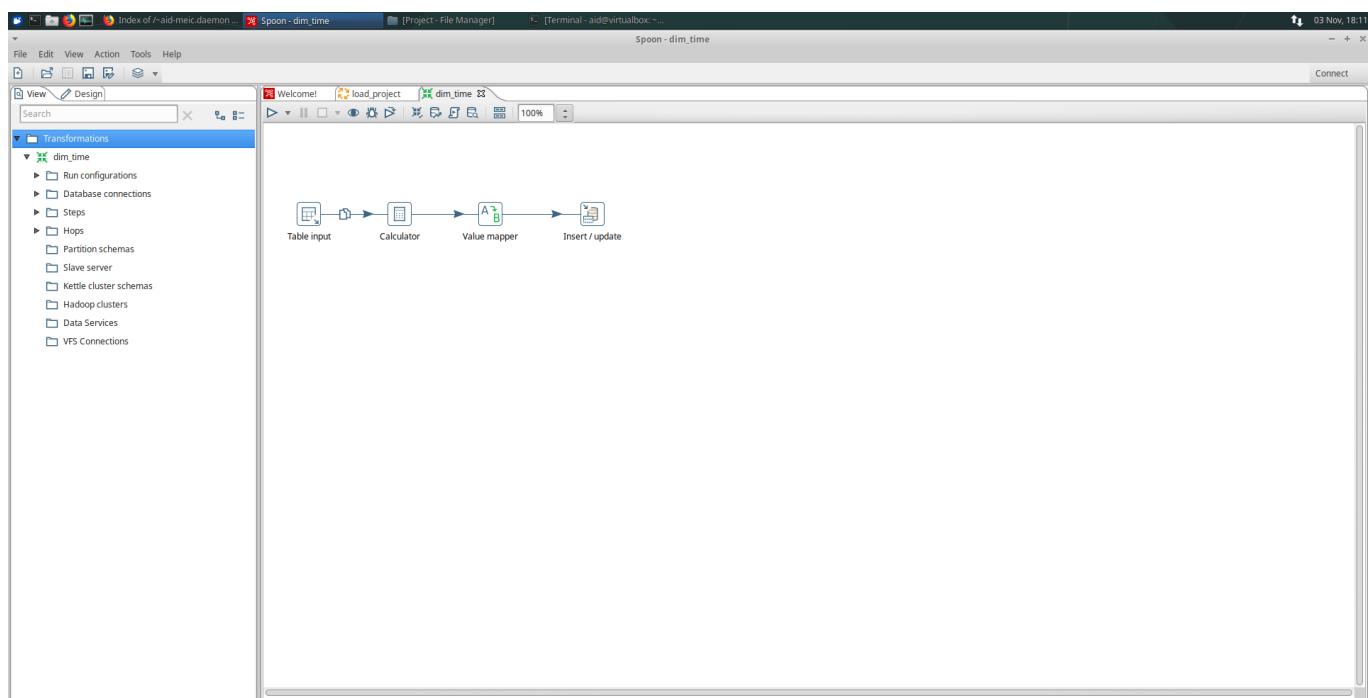


Figure 14 - dim_time entire transformation

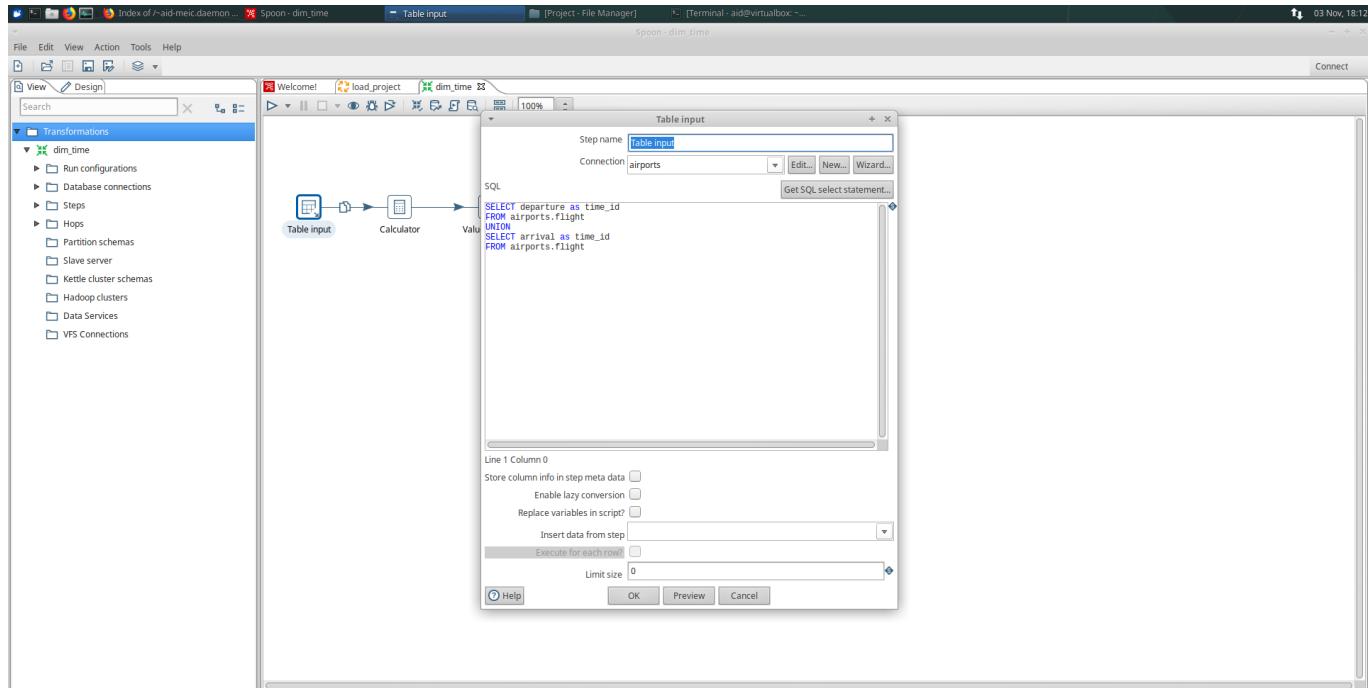


Figure 15 - dim_time table input window (union between departures and arrivals)

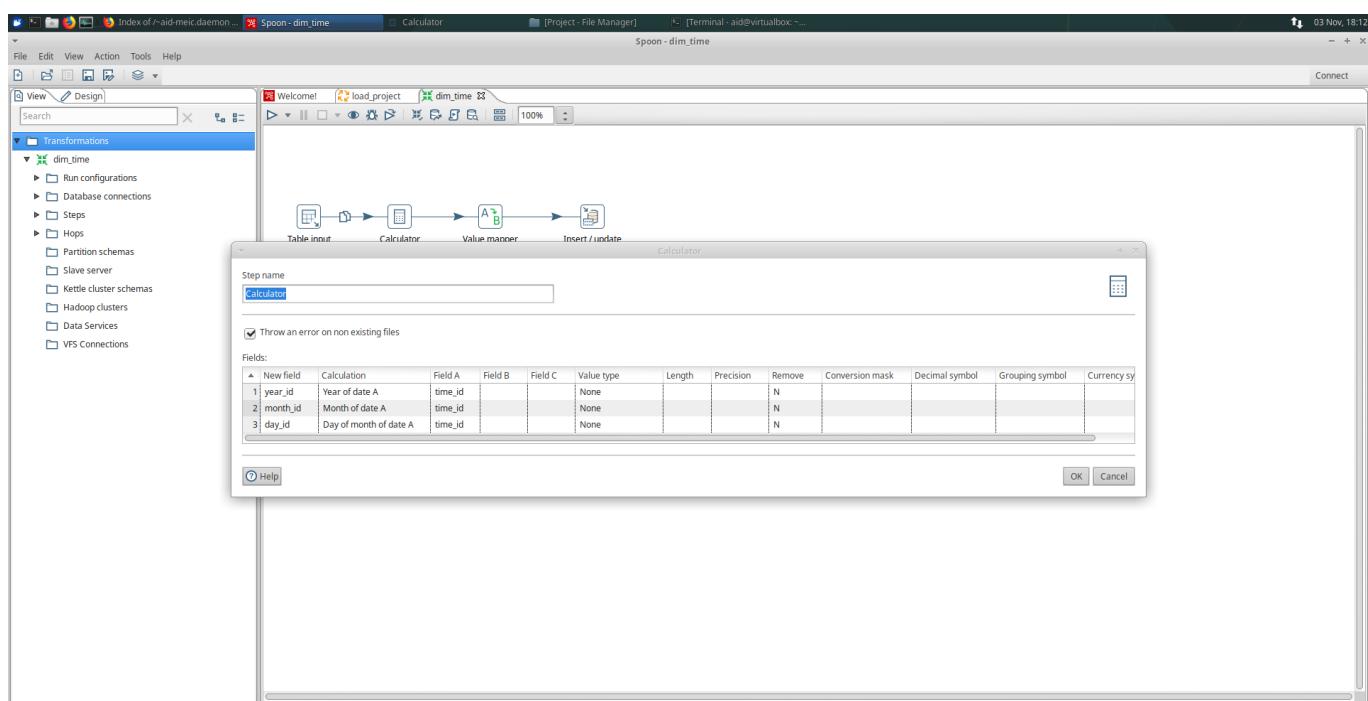


Figure 16 - dim_time calculator window

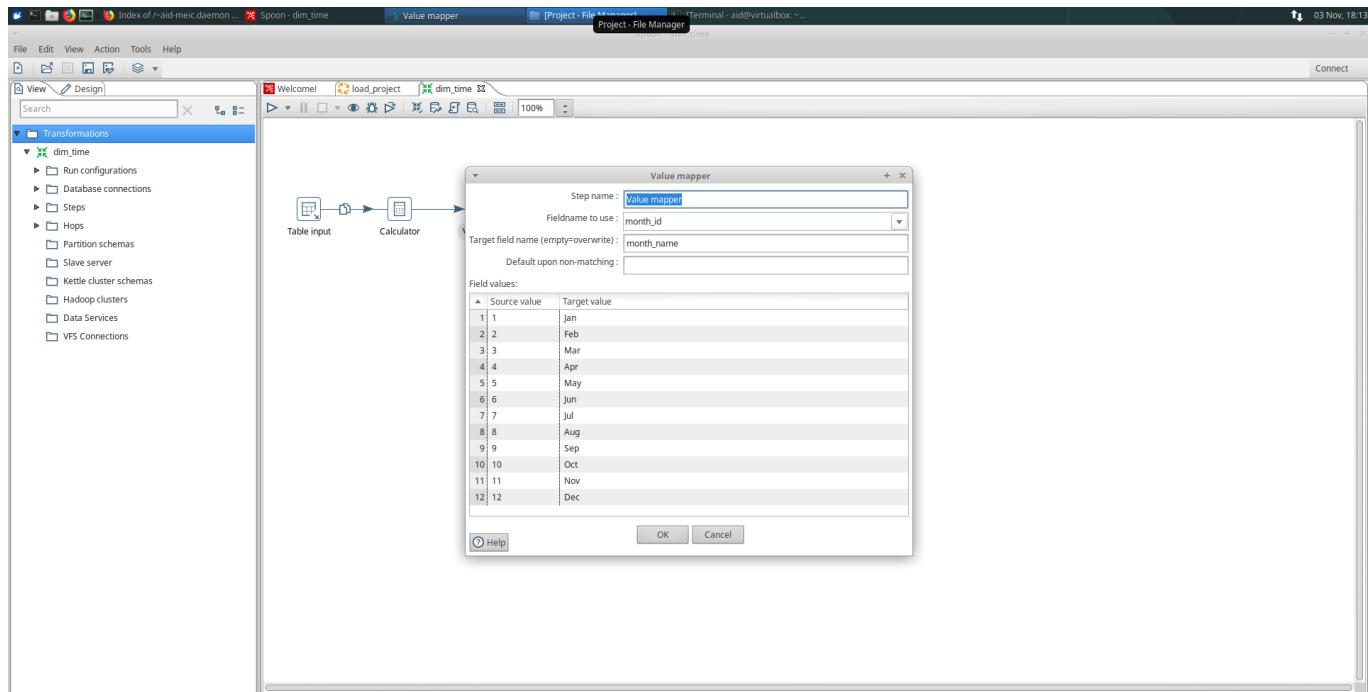


Figure 17 - dim_time value mapper window

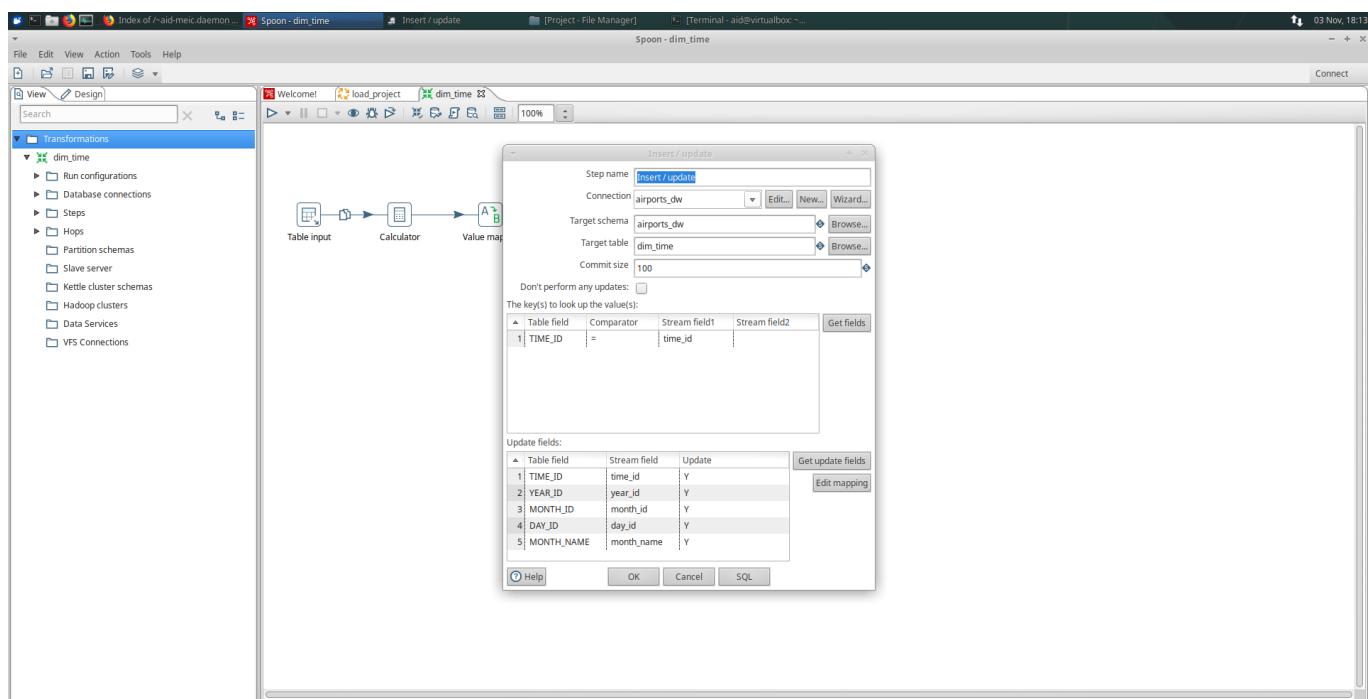


Figure 18 - dim_time insert/update window

Flight fact

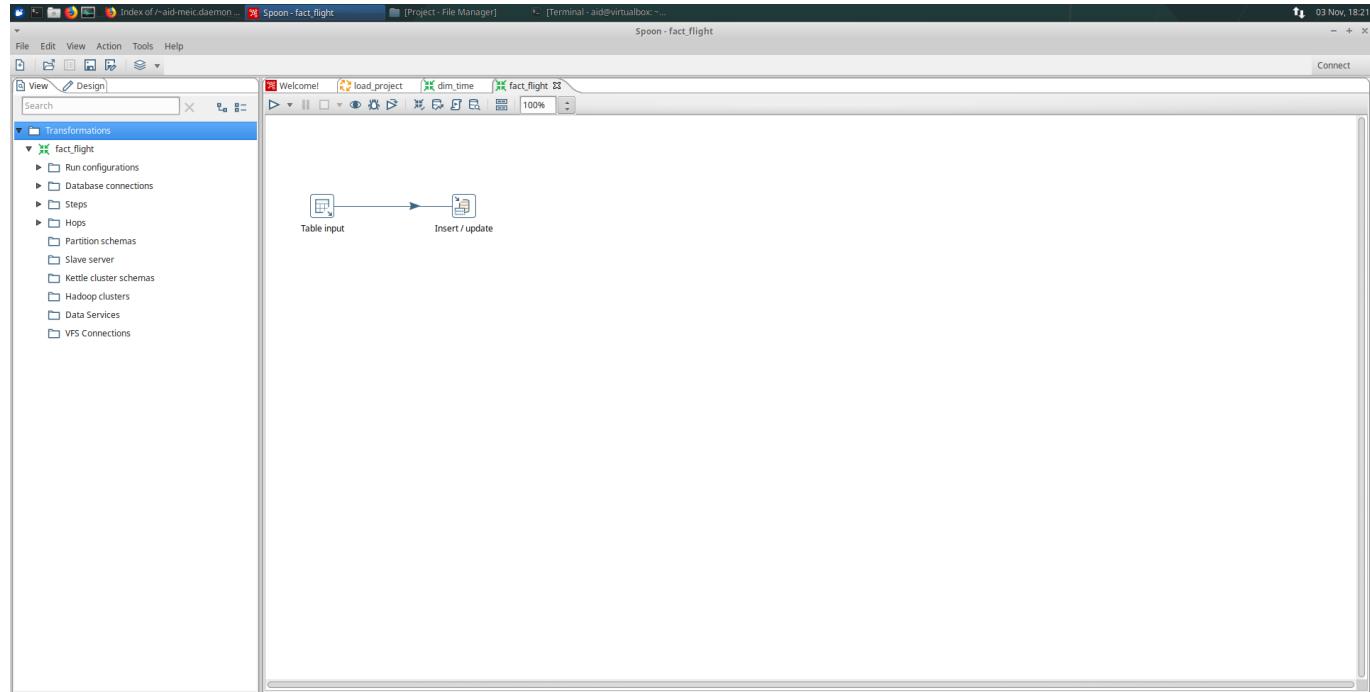


Figure 19 - fact_flight entire transformation

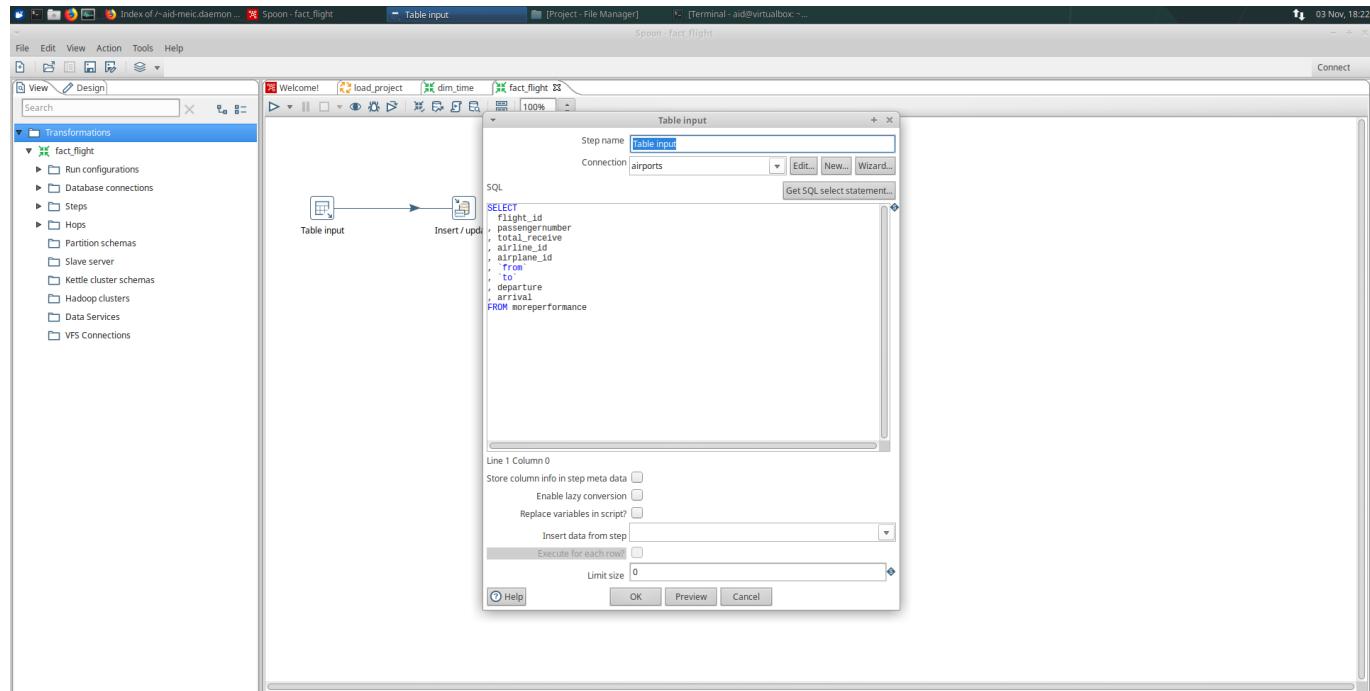


Figure 20 - fact_flight table input window (Here we use the view moreperformance to be faster in the largest databases)

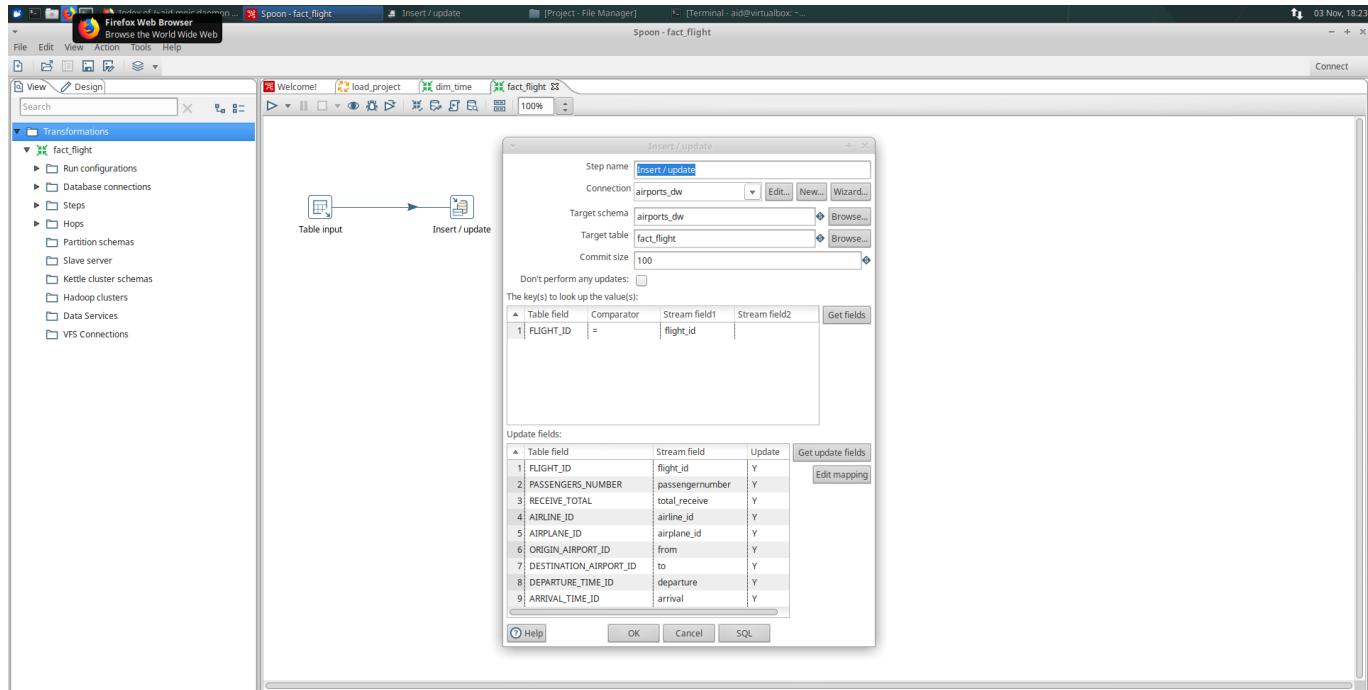


Figure 21 - *fact_flight* insert/update window

Final Job

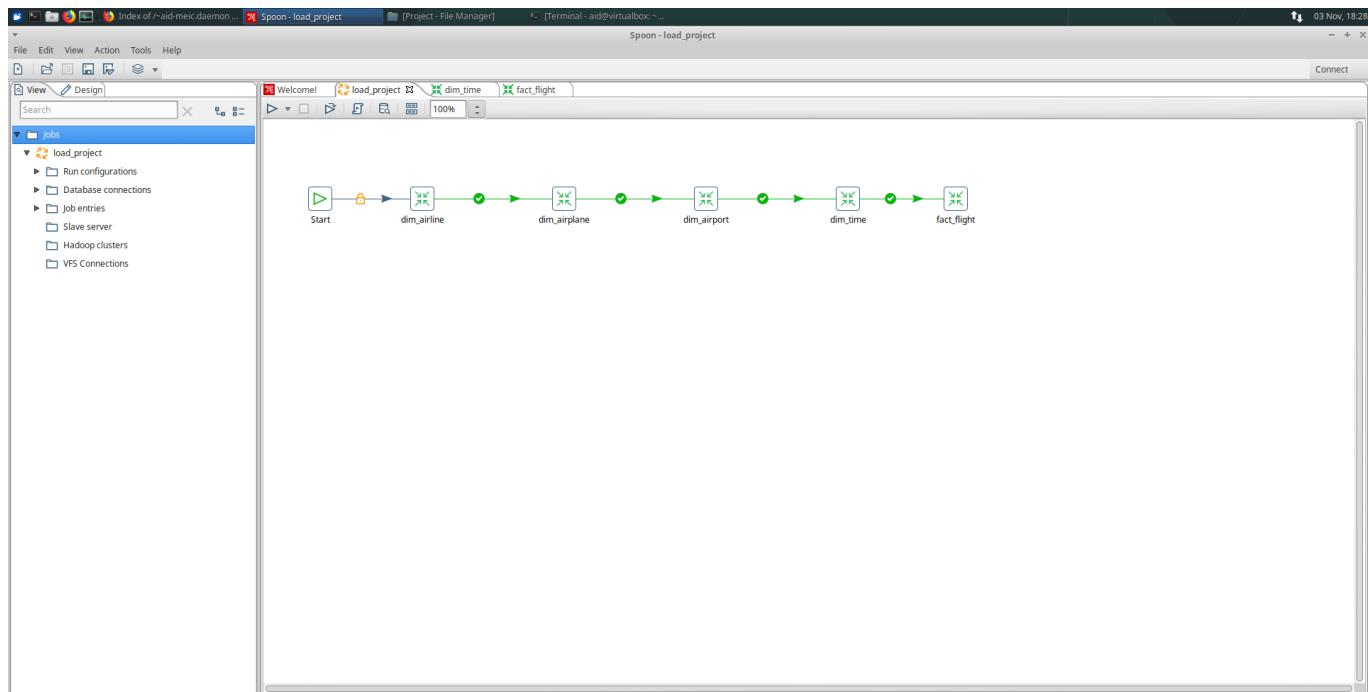


Figure 22 - Complete job

4. XML Code for the cube definition

```
<Schema name="airports_dw">
    <Cube name="Flights" visible="true" cache="true" enabled="true">
        <Table name="fact_flight">
        </Table>
        <Dimension type="StandardDimension" visible="true"
foreignKey="AIRLINE_ID" highCardinality="false" name="Airline">
            <Hierarchy name="Airline Hierarchy" visible="true" hasAll="true"
allMemberName="All Arlines" primaryKey="AIRLINE_ID">
                <Table name="dim_airline">
                </Table>
                <Level name="Name" visible="true" column="AIRLINE_NAME"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
                    </Level>
                </Hierarchy>
            </Dimension>
            <Dimension type="StandardDimension" visible="true"
foreignKey="ORIGIN_AIRPORT_ID" highCardinality="false"
name="OriginAirport">
                <Hierarchy name="Origin Airport Hierarchy" visible="true"
hasAll="true" allMemberName="All Origin Airports" primaryKey="AIRPORT_ID">
                    <Table name="dim_airport">
                    </Table>
                    <Level name="OriginCountry" visible="true" column="COUNTRY"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
                        </Level>
                    <Level name="OriginCity" visible="true" column="CITY"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
                        </Level>
                    <Level name="OriginName" visible="true" column="AIRPORT_NAME"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
                        </Level>
                </Hierarchy>
            </Dimension>
            <Dimension type="StandardDimension" visible="true"
foreignKey="DESTINATION_AIRPORT_ID" highCardinality="false"
name="DestinationAirport">
                <Hierarchy name="Destination Airport Hierarchy" visible="true"
hasAll="true" allMemberName="All Destination Airports"
primaryKey="AIRPORT_ID">
                    <Table name="dim_airport">
                    </Table>
                    <Level name="DestinationCountry" visible="true" column="COUNTRY"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
                        </Level>
                    <Level name="DestinationCity" visible="true" column="CITY"
```

```
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
    </Level>
<Level name="DestinationName" visible="true" column="AIRPORT_NAME"
type="String" uniqueMembers="false" levelType="Regular"
hideMemberIf="Never">
    </Level>
</Hierarchy>
</Dimension>
<Dimension type="TimeDimension" visible="true"
foreignKey="DEPARTURE_TIME_ID" highCardinality="false" name="Time">
    <Hierarchy name="Time Hierarchy" visible="true" hasAll="true"
allMemberName="All Years" primaryKey="TIME_ID">
        <Table name="dim_time">
        </Table>
        <Level name="Year" visible="true" column="YEAR_ID" type="Integer"
uniqueMembers="false" levelType="TimeYears" hideMemberIf="Never">
            </Level>
        <Level name="Month" visible="true" column="MONTH_NAME"
ordinalColumn="MONTH_ID" type="String" uniqueMembers="false"
levelType="TimeMonths" hideMemberIf="Never">
            </Level>
        <Level name="Day" visible="true" column="DAY_ID" type="Integer"
uniqueMembers="false" levelType="TimeDays" hideMemberIf="Never">
            </Level>
        </Hierarchy>
    </Dimension>
    <Dimension type="StandardDimension" visible="true"
foreignKey="AIRPLANE_ID" name="Airplane">
        <Hierarchy name="Airplane Hierarchy" visible="true" hasAll="true"
allMemberName="All Airplanes" primaryKey="AIRPLANE_ID">
            <Table name="dim_airplane">
            </Table>
            <Level name="Type" visible="true" column="AIRPLANE_TYPE"
type="String" uniqueMembers="false" levelType="Regular">
                </Level>
            </Hierarchy>
        </Dimension>
        <Measure name="TotalNumberPassengers" column="PASSENGERS_NUMBER"
datatype="Integer" formatString="#,###" aggregator="sum" visible="true">
        </Measure>
        <Measure name="TotalRevenue" column="RECEIVE_TOTAL" datatype="Numeric"
formatString="$ #,###.00" aggregator="sum" visible="true">
        </Measure>
    </Cube>
</Schema>
```

5. Database queries

Query1: passengers and revenue by airline and month (There is not a query because we don't use MDX mode)

Query2 code: Top5 airlines with better revenue

```
SELECT Measures.Members ON COLUMNS,
TOPCOUNT(Airline.[Name].Members, 5, Measures.TotalRevenue) ON ROWS
FROM Flights
```

Query3 code: Average price per passenger from other countries to germany

```
WITH MEMBER Measures.AveragePricePerTicket AS (Measures.TotalRevenue /
Measures.TotalNumberPassengers)
SELECT Measures.AveragePricePerTicket ON COLUMNS,
ORDER(OriginAirport.OriginCountry.Members, Measures.AveragePricePerTicket,
DESC) ON ROWS
FROM Flights WHERE (DestinationAirport.GERMANY)
```

5.1. Small database (airports.sql) queries

The screenshot shows the Saiku Analytics interface with the following details:

- File, View, Tools, Help** menu at the top.
- Opened** dropdown showing a single cube named "Flights".
- Saiku Analytics** tab is active.
- Cubes** panel on the left shows the "Flights" cube selected.
- Measures** panel shows "TotalNumberPassengers" and "TotalRevenue" selected.
- Dimensions** panel shows "Airline" and "Time" dimensions selected.
- Time** dimension panel shows "Time Hierarchy" selected, with "Year", "Month", and "Day" options.
- Measures** panel shows "TotalNumberPassengers" and "TotalRevenue" selected.
- Columns** panel shows "Time Hierarchy" selected, with "Month" and "Row Hierarchy" options.
- Rows** panel shows "Airline Hierarchy" selected, with "Name" option.
- Filter** panel is empty.
- Results Grid** on the right displays data for July (Jul) with the following columns: Name, TotalNumberPassenger, TotalRevenue, TotalNumberPassenger, TotalRevenue. The data includes rows for Bulgaria Airlines, Croatia Airlines, Cyprus Airlines, Czech Airlines, Denmark Airlines, Estonia Airlines, France Airlines, Greece Airlines, Hungary Airlines, Italy Airlines, Luxembourg Airlines, Poland Airlines, Slovakia Airlines, and Spain Airlines.
- Info**: 17:05 / 5x16 / 0.16s
- User**: admin

Figure 23 - Query1: passengers and revenue by airline and month (small database - airports.sql)

The screenshot shows the Saiku Analytics interface with a query editor window. The query is:

```

1 SELECT Measures.Members ON COLUMNS,
2 TOPCOUNT(Airline.[Name].Members, 5, Measures.TotalRevenue) ON ROWS
3 FROM Flights;

```

The results table shows the top 5 airlines with the highest total revenue:

| Name | TotalNumberPassengers | TotalRevenue | Fact Count |
|---------------------|-----------------------|---------------|------------|
| Luxembourg Airlines | 2,484 | \$ 627,647.82 | 219 |
| Hungary Airlines | 2,232 | \$ 561,767.90 | 132 |
| France Airlines | 1,524 | \$ 383,454.79 | 112 |
| Poland Airlines | 1,150 | \$ 284,672.77 | 97 |
| Bulgaria Airlines | 1,036 | \$ 264,551.23 | 78 |

Figure 24 - Query2: Top5 airlines with better revenue (small database - airports.sql)

The screenshot shows the Saiku Analytics interface with a query editor window. The query is:

```

1 WITH MEMBER Measures.AveragePricePerTicket AS (Measures.TotalRevenue / Measures.TotalNumberPassengers)
2 , D AS [SELECT Airline.[OriginCountry].Members, Measures.AveragePricePerTicket, DESC] ON ROWS
3 , C AS [SELECT OriginAirport.OriginCountry.Members, Measures.AveragePricePerTicket, DESC] ON ROWS
4 FROM Flights WHERE (DestinationAirport.GERMANY);

```

The results table shows the average price per passenger from other countries to Germany:

| OriginCountry | AveragePricePerTicket |
|---------------|-----------------------|
| SWEDEN | \$ 267.06 |
| SPAIN | \$ 255.72 |
| FINLAND | \$ 253.38 |
| GERMANY | \$ 252.10 |
| FRANCE | \$ 251.27 |
| ITALY | \$ 248.89 |
| BELGIUM | \$ 245.28 |
| CZECH | \$ 244.89 |

Figure 25 - Query3: Average price per passenger from other countries to germany (small database - airports.sql)

5.2. Large database (airports-large.sql) queries

The screenshot shows the Saiku Analytics interface with a complex query editor window. The query involves multiple measures (TotalNumberPassengers, TotalRevenue), columns (Time Hierarchy), rows (Airline Hierarchy), and filters.

The results table shows passengers and revenue by airline and month:

| Month | Jun | Jul | Aug | | | |
|----------------------|-----------------------|-----------------|-----------------------|-----------------|-----------------------|--------------|
| Name | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | TotalRevenue |
| Afghanistan Airlines | 15,652 | \$ 3,940,188.27 | 16,136 | \$ 4,069,099.39 | - | - |
| Albania Airlines | 16,112 | \$ 4,032,711.00 | 17,118 | \$ 4,324,768.96 | 3 | \$ 388.45 |
| American Samoa Airfi | 11,367 | \$ 2,850,800.30 | 12,533 | \$ 3,133,840.60 | - | - |
| Angola Airlines | 13,878 | \$ 3,496,674.63 | 14,791 | \$ 3,717,947.55 | - | - |
| Argentina Airlines | 15,943 | \$ 4,019,917.94 | 17,090 | \$ 4,308,636.15 | - | - |
| Australia Airlines | 14,962 | \$ 3,749,919.22 | 15,988 | \$ 3,989,694.33 | - | - |
| Azerbaijan Airlines | 11,824 | \$ 2,980,651.19 | 12,467 | \$ 3,139,555.77 | - | - |
| Bahamas Airlines | 16,924 | \$ 4,249,802.80 | 17,742 | \$ 4,474,399.82 | - | - |
| Belarus Airlines | 13,766 | \$ 3,467,046.92 | 14,063 | \$ 3,521,541.49 | - | - |
| Bhutan Airlines | 17,180 | \$ 4,293,356.44 | 18,176 | \$ 4,570,205.74 | - | - |
| Bolivia Airlines | 10,214 | \$ 2,561,444.19 | 10,272 | \$ 2,563,539.07 | - | - |
| Brazil Airlines | 18,443 | \$ 4,635,629.23 | 18,768 | \$ 4,721,266.14 | - | - |
| Bulgaria Airlines | 14,448 | \$ 3,639,048.42 | 15,176 | \$ 3,833,283.71 | - | - |
| Cacicos Is Airlines | 14,079 | \$ 3,540,404.75 | 13,673 | \$ 3,391,137.51 | - | - |
| Central African Rep | 16,188 | \$ 4,009,794.44 | 16,767 | \$ 4,210,247.98 | - | - |
| Chad Airlines | 13,786 | \$ 3,465,657.02 | 14,641 | \$ 3,664,886.68 | - | - |
| Colombia Airlines | 13,672 | \$ 3,433,198.85 | 14,376 | \$ 3,635,315.61 | - | - |
| Croatia Airlines | 18,177 | \$ 4,549,953.70 | 18,675 | \$ 4,654,697.48 | - | - |
| Cuba Airlines | 14,448 | \$ 3,615,179.78 | 14,691 | \$ 3,679,529.04 | - | - |
| Cyprus Airlines | 18,451 | \$ 4,622,870.34 | 19,321 | \$ 4,865,299.86 | - | - |
| Czech Airlines | 14,626 | \$ 3,665,044.63 | 15,631 | \$ 3,943,585.06 | - | - |
| Dahkla And Laayoune | 14,463 | \$ 3,639,004.82 | 14,626 | \$ 3,669,491.21 | - | - |
| Denmark Airlines | 12,643 | \$ 3,189,576.50 | 13,771 | \$ 3,444,431.09 | 18 | \$ 4,579.95 |
| Djibouti Airlines | 14,776 | \$ 3,670,397.78 | 15,388 | \$ 3,863,264.82 | - | - |
| Dominica Airlines | 11,763 | \$ 2,950,122.14 | 11,515 | \$ 2,887,926.94 | - | - |
| Ecuador Airlines | 15,709 | \$ 3,959,347.00 | 15,965 | \$ 4,015,922.69 | - | - |
| Egypt Airlines | 15,397 | \$ 3,873,915.72 | 15,810 | \$ 3,947,827.58 | - | - |
| El Salvador Airlines | 15,405 | \$ 3,856,648.09 | 15,684 | \$ 3,949,733.58 | 18 | \$ 4,663.34 |

Figure 26 - Query1: passengers and revenue by airline and month pt1 (large database - airports-large.sql)

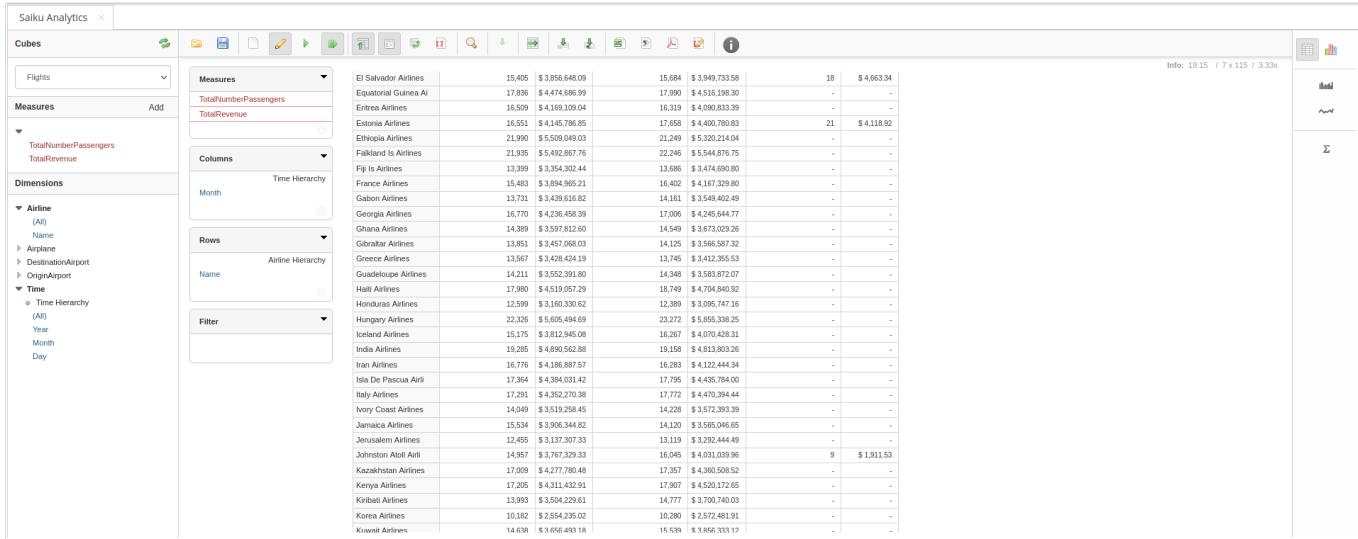


Figure 27 - Query1: passengers and revenue by airline and month pt2 (large database - airports-large.sql)

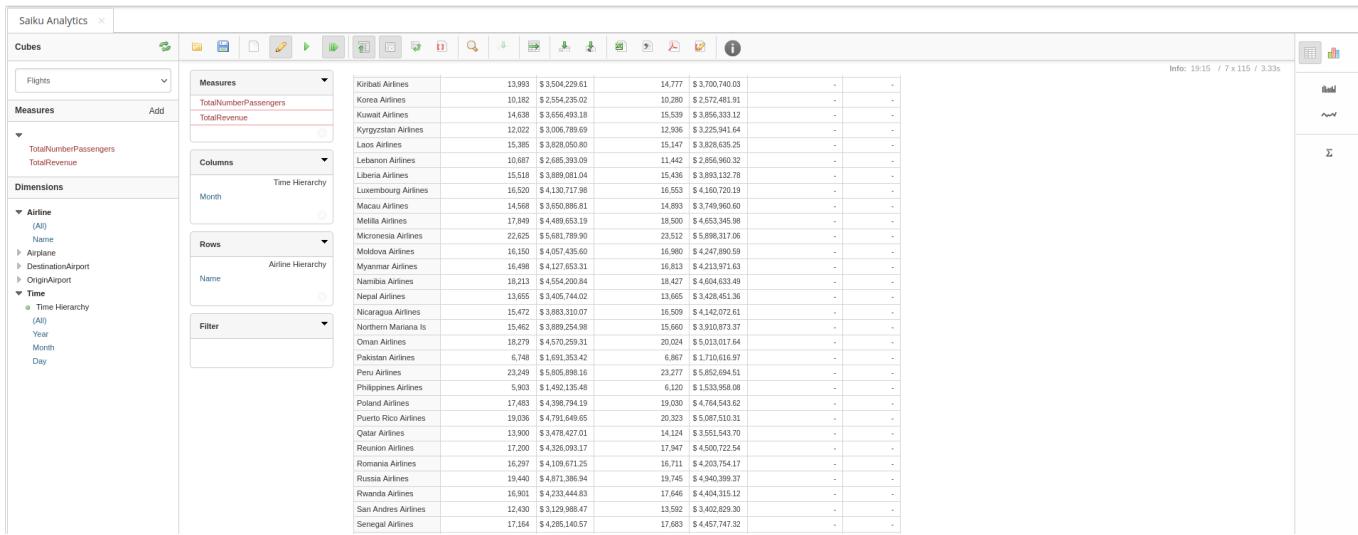


Figure 28 - Query1: passengers and revenue by airline and month pt3 (large database - airports-large.sql)

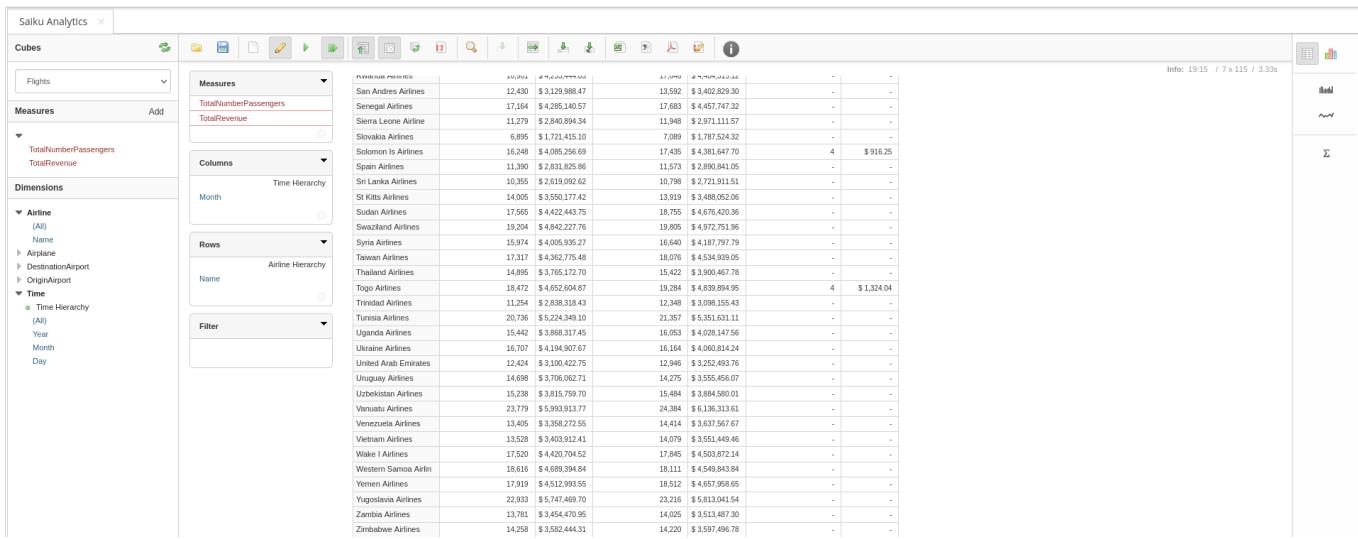


Figure 29 - Query1: passengers and revenue by airline and month pt4 (large database - airports-large.sql)

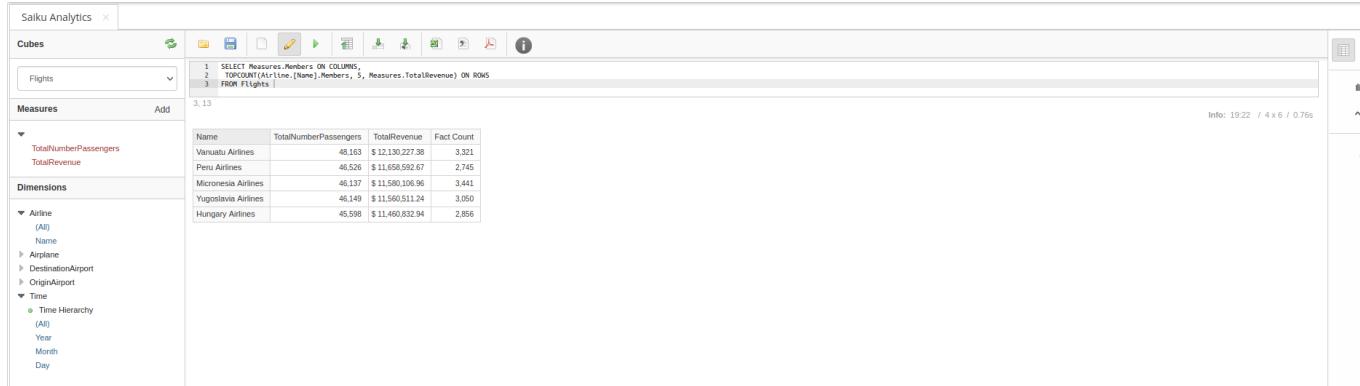


Figure 30 - Query2: Top5 airlines with better revenue (large database - airports-large.sql)

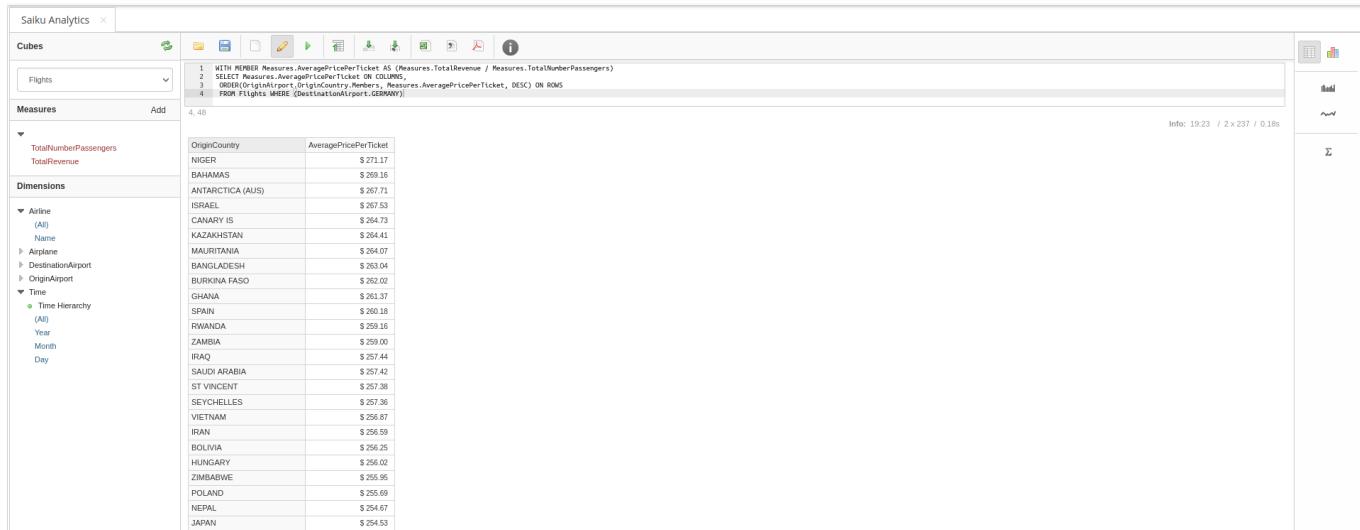


Figure 31 - Query3: Average price per passenger from other countries to germany pt1 (large database - airports-large.sql)

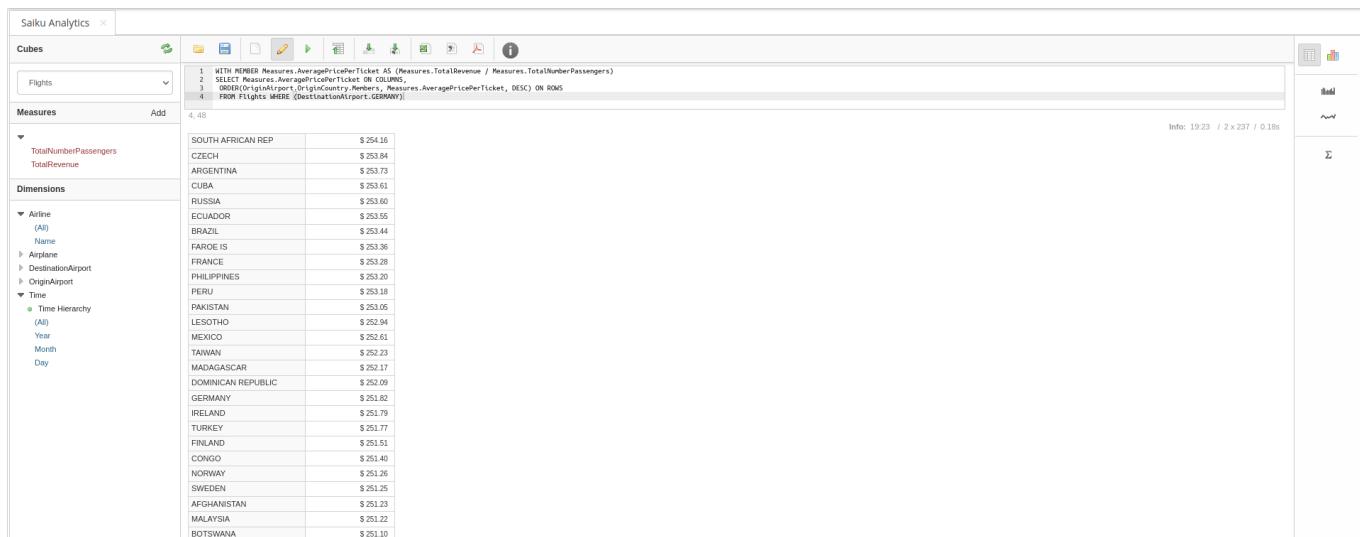


Figure 32 - Query3: Average price per passenger from other countries to germany pt2 (large database - airports-large.sql)

Saiku Analytics

Cubes

Flights

Measures

Add

TotalNumberPassengers

TotalRevenue

Dimensions

▼ Airline (All) Name

► Airplane

► DestinationAirport

► OriginAirport

▼ Time

● Time Hierarchy (All) Year Month Day

1 WITH MEMBER Measures.AveragePricePerTicket AS (Measures.TotalRevenue / Measures.TotalNumberPassengers)
2 SELECT Measures.AveragePricePerTicket ON COLUMNS,
3 DROPS(OriginAirport, OriginCountry, Members, Measures.AveragePricePerTicket, DESC) ON ROWS
4 FROM Flights WHERE (DestinationCountry=GERMANY)

| Country | Average Price per Ticket |
|----------------|--------------------------|
| BOTSWANA | \$ 251.10 |
| LEBANON | \$ 250.88 |
| UNITED KINGDOM | \$ 250.62 |
| KOREA | \$ 250.36 |
| INDIA | \$ 250.15 |
| UNITED STATES | \$ 250.11 |
| CANADA | \$ 249.82 |
| KENYA | \$ 249.71 |
| CHILE | \$ 249.43 |
| GREECE | \$ 249.39 |
| THAILAND | \$ 249.29 |
| SWITZERLAND | \$ 249.17 |
| CAMEROON | \$ 249.17 |
| AUSTRALIA | \$ 249.16 |
| DENMARK | \$ 249.04 |
| LAOS | \$ 248.91 |
| CHAD | \$ 248.83 |
| JAMAICA | \$ 248.71 |
| INDONESIA | \$ 247.73 |
| PORTUGAL | \$ 247.64 |
| COSTA RICA | \$ 246.76 |
| MONGOLIA | \$ 246.17 |
| MOROCCO | \$ 246.04 |
| COLOMBIA | \$ 245.92 |
| ROMANIA | \$ 245.71 |
| CHINA | \$ 245.62 |
| GABON | \$ 245.30 |

Info: 19:23 / 2 x 237 / 0.18s

Figure 33 - Query3: Average price per passenger from other countries to germany pt3 (large database - airports-large.sql)

| Saiku Analytics | | | |
|-----------------------|-------|---|-------------------------------|
| Cubes | | | |
| Flights | | <pre> 1 WITH MEMBER Measures.AveragePricePerTicket AS [Measures.TotalRevenue / Measures.TotalNumberPassengers] 2 SELECT Measures.AveragePricePerTicket ON COLUMNS, 3 ORDER [OriginalAirport,OriginCountry,Members,Measures,AveragePricePerTicket,DESC] ON ROWS 4 FROM Flights WHERE [DestinationCountry,Germany] </pre> | |
| Measures | Add | 4.48 | Info: 19:23 / 2 x 237 / 0.18s |
| TotalNumberPassengers | | COSTA RICA | \$ 246.76 |
| TotalRevenue | | MONGOLIA | \$ 246.17 |
| | | MOROCCO | \$ 245.04 |
| Dimensions | | COLOMBIA | \$ 245.92 |
| | | ROMANIA | \$ 245.71 |
| Airline | (All) | CHINA | \$ 245.62 |
| | Name | GABON | \$ 245.30 |
| Airplane | | URUGUAY | \$ 245.28 |
| DepartureAirport | | BELGIUM | \$ 245.24 |
| OriginAirport | | TAJIKISTAN | \$ 245.21 |
| Time | | MALI | \$ 244.48 |
| a Time Hierarchy | (All) | SWAZILAND | \$ 243.64 |
| | Year | ITALY | \$ 243.57 |
| Month | | NETHERLANDS | \$ 243.35 |
| Day | | VENEZUELA | \$ 243.33 |
| | | LIBYA | \$ 243.27 |
| | | SRI LANKA | \$ 242.02 |
| | | NAMIBIA | \$ 241.25 |
| | | CAICOS IS | \$ 241.06 |
| | | ANGOLA | \$ 240.48 |
| | | CROATIA | \$ 239.36 |
| | | YUGOSLAVIA | \$ 238.79 |
| | | MYANMAR | \$ 238.12 |
| | | NIGERIA | \$ 237.98 |
| | | BOSNIA AND HERZEGOVINA | \$ 237.86 |
| | | ASCENSION | \$ 237.64 |
| | | DOMINICA | \$ 235.28 |

Figure 34 - Query3: Average price per passenger from other countries to germany pt4 (large database - airports-large.sql)

5.3. Large extra database (airports-large-extra.sql) queries

Saiku Analytics

Cubes: Flights

Measures: TotalNumberPassengers, TotalRevenue

Dimensions: Time Hierarchy (Month)

Filter: None

Info: 22-42 / 9 x 115 / 4,965

| | Month | Jun | Jul | Aug | Sep | |
|----------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|---------------------|
| Name | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | |
| Afghanistan Airlines | 156,551 | \$ 39,242,860.06 | 161,431 | \$ 40,506,591.08 | 161,349 | \$ 40,611,189.62 |
| Albania Airlines | 160,900 | \$ 40,317,887.11 | 171,195 | \$ 42,962,087.82 | 169,700 | \$ 42,733,218.77 |
| American Samoa Airli | 113,630 | \$ 28,596,600.25 | 125,485 | \$ 31,481,026.90 | 116,674 | \$ 29,270,331.76 |
| Angola Airlines | 138,719 | \$ 34,824,908.38 | 147,906 | \$ 37,122,540.23 | 139,958 | \$ 35,190,779.40 |
| Argentina Airlines | 159,546 | \$ 40,142,247.36 | 170,885 | \$ 42,907,244.28 | 157,747 | \$ 39,626,874.64 |
| Australia Airlines | 149,644 | \$ 37,496,672.70 | 158,736 | \$ 39,192,355.19 | 153,603 | \$ 38,515,357.81 |
| Azerbaijan Airlines | 118,271 | \$ 29,632,894.91 | 124,665 | \$ 31,318,851.08 | 120,890 | \$ 31,122,486.15 |
| Bahamas Airlines | 169,318 | \$ 42,449,000.51 | 177,526 | \$ 44,579,334.98 | 170,603 | \$ 42,820,015.56 |
| Belarus Airlines | 137,734 | \$ 34,701,151.81 | 140,786 | \$ 35,278,377.66 | 142,016 | \$ 35,652,399.23 |
| Bhutan Airlines | 171,875 | \$ 43,091,333.12 | 181,861 | \$ 45,660,866.80 | 175,559 | \$ 44,031,150.79 |
| Bolivia Airlines | 101,989 | \$ 25,525,520.32 | 102,774 | \$ 25,730,510.00 | 104,177 | \$ 26,162,443.83 |
| Brazil Airlines | 184,387 | \$ 46,204,971.33 | 187,475 | \$ 47,022,488.48 | 187,593 | \$ 47,092,561.44 |
| Bulgaria Airlines | 144,417 | \$ 36,203,399.40 | 151,546 | \$ 38,016,907.34 | 145,685 | \$ 36,522,931.38 |
| Cacicos Is Airlines | 140,912 | \$ 35,390,764.35 | 136,778 | \$ 34,295,969.15 | 136,157 | \$ 34,130,986.28 |
| Central African Rep | 161,799 | \$ 40,488,543.66 | 167,762 | \$ 41,970,680.64 | 172,990 | \$ 43,385,724.97 |
| Chad Airlines | 137,812 | \$ 34,586,008.49 | 146,308 | \$ 36,722,082.91 | 143,238 | \$ 35,922,721.05 |
| Colombia Airlines | 136,671 | \$ 34,778,338.31 | 143,795 | \$ 36,036,949.39 | 145,443 | \$ 36,434,318.41 |
| Croatia Airlines | 181,659 | \$ 45,626,888.54 | 186,755 | \$ 46,814,472.15 | 188,078 | \$ 47,140,923.20 |
| Cuba Airlines | 144,350 | \$ 36,251,177.09 | 147,038 | \$ 36,942,988.08 | 147,720 | \$ 37,096,179.11 |
| Cyprus Airlines | 184,506 | \$ 46,854,495.93 | 193,448 | \$ 48,628,782.41 | 198,545 | \$ 49,857,031.56 |
| Czech Airlines | 146,558 | \$ 36,763,901.01 | 155,993 | \$ 39,181,501.27 | 151,334 | \$ 38,053,130.50 |
| Dakhaia And Leayoune | 144,891 | \$ 36,305,922.47 | 146,183 | \$ 36,703,311.65 | 154,124 | \$ 38,670,043.86 |
| Denmark Airlines | 126,289 | \$ 31,672,702.95 | 137,584 | \$ 34,466,219.46 | 130,000 | \$ 32,648,128.00 |
| Djibouti Airlines | 147,823 | \$ 37,044,375.56 | 153,868 | \$ 38,675,274.18 | 151,068 | \$ 38,451,477.01 |
| Dominica Airlines | 117,872 | \$ 29,686,751.27 | 114,972 | \$ 28,834,943.70 | 120,944 | \$ 30,430,554.27 |
| Ecuador Airlines | 157,204 | \$ 39,407,966.32 | 159,745 | \$ 39,991,811.19 | 166,158 | \$ 41,682,273.76 |
| Egypt Airlines | 154,009 | \$ 38,664,110.71 | 158,041 | \$ 39,699,829.11 | 155,280 | \$ 38,926,047.34 |
| El Salvador Airlines | 153,970 | \$ 38,869,462.85 | 156,882 | \$ 39,414,605.82 | 163,479 | \$ 41,046,486.07 |
| | | | | | | 4,567 \$ 115,029.29 |

Figure 35 - Query1: passengers and revenue by airline and month pt1 (large-extra database - airports-large-extra.sql)

Saiku Analytics

Cubes: Flights

Measures: TotalNumberPassengers, TotalRevenue

Dimensions: Time Hierarchy (Month)

Filter: None

Info: 22-42 / 9 x 115 / 4,965

| | Month | Jun | Jul | Aug | Sep | |
|----------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|---------------------|
| Name | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | TotalRevenue | TotalNumberPassengers | |
| El Salvador Airlines | 153,970 | \$ 36,690,462.85 | 156,862 | \$ 39,414,605.82 | 163,479 | \$ 41,046,486.07 |
| Equatorial Guinea Ai | 178,481 | \$ 44,881,149.68 | 179,921 | \$ 45,088,933.04 | 185,248 | \$ 46,434,610.99 |
| Eritrea Airlines | 165,109 | \$ 41,379,967.47 | 162,997 | \$ 40,993,461.11 | 167,755 | \$ 42,110,639.63 |
| Estonia Airlines | 165,426 | \$ 41,367,935.24 | 176,642 | \$ 44,331,199.90 | 174,014 | \$ 43,748,817.50 |
| Ethiopia Airlines | 219,817 | \$ 55,307,003.61 | 212,707 | \$ 53,387,965.48 | 220,466 | \$ 55,327,206.48 |
| Falkland Is Airlines | 219,392 | \$ 55,262,700.20 | 222,384 | \$ 55,790,603.45 | 217,923 | \$ 54,609,803.48 |
| Fiji Is Airlines | 134,168 | \$ 33,669,447.39 | 136,916 | \$ 34,335,240.26 | 141,508 | \$ 35,503,645.41 |
| France Airlines | 155,096 | \$ 38,867,787.00 | 164,119 | \$ 41,170,318.43 | 162,337 | \$ 40,774,962.90 |
| Gabon Airlines | 137,439 | \$ 34,659,304.06 | 141,624 | \$ 35,637,723.99 | 147,041 | \$ 36,883,823.84 |
| Georgia Airlines | 167,601 | \$ 42,214,192.67 | 170,147 | \$ 42,678,081.33 | 167,572 | \$ 42,085,637.45 |
| Ghana Airlines | 143,961 | \$ 36,138,737.06 | 145,414 | \$ 36,560,050.02 | 150,011 | \$ 37,601,988.91 |
| Gibraltar Airlines | 138,486 | \$ 34,756,812.65 | 141,206 | \$ 35,414,091.53 | 149,813 | \$ 37,541,237.70 |
| Greece Airlines | 135,626 | \$ 34,708,768.11 | 137,428 | \$ 34,478,906.35 | 145,040 | \$ 36,494,696.64 |
| Guadeloupe Airlines | 141,915 | \$ 35,945,154.26 | 145,676 | \$ 36,073,874.65 | 138,838 | \$ 34,848,359.40 |
| Haiti Airlines | 179,710 | \$ 45,501,923.92 | 187,445 | \$ 47,149,655.01 | 178,877 | \$ 44,806,385.62 |
| Honduras Airlines | 126,020 | \$ 31,988,428.11 | 123,863 | \$ 31,089,362.68 | 123,584 | \$ 33,195,795.46 |
| Hungary Airlines | 223,010 | \$ 56,614,602.13 | 232,676 | \$ 58,392,043.03 | 229,186 | \$ 57,499,633.69 |
| Iceland Airlines | 151,872 | \$ 38,150,361.92 | 162,948 | \$ 40,933,874.34 | 160,394 | \$ 40,344,283.17 |
| India Airlines | 192,871 | \$ 48,472,406.44 | 191,388 | \$ 48,009,346.48 | 191,279 | \$ 48,049,744.28 |
| Iran Airlines | 167,748 | \$ 42,105,797.30 | 162,753 | \$ 40,895,584.28 | 168,684 | \$ 42,324,384.10 |
| Isla De Pascua Airl | 173,742 | \$ 43,613,887.22 | 177,738 | \$ 44,488,010.45 | 177,523 | \$ 44,587,281.54 |
| Italy Airlines | 173,125 | \$ 43,589,827.93 | 177,644 | \$ 44,546,891.85 | 174,028 | \$ 43,625,524.78 |
| Ivory Coast Airlines | 140,906 | \$ 35,351,390.32 | 142,203 | \$ 35,953,877.31 | 144,354 | \$ 36,199,775.61 |
| Jamaica Airlines | 155,274 | \$ 38,989,910.22 | 141,452 | \$ 35,625,933.30 | 146,531 | \$ 36,821,271.25 |
| Jerusalem Airlines | 124,569 | \$ 31,294,371.26 | 131,138 | \$ 32,678,135.42 | 124,849 | \$ 31,344,384.77 |
| Johnston Atoll Airl | 149,694 | \$ 37,952,847.83 | 160,467 | \$ 40,175,924.42 | 155,695 | \$ 39,102,259.57 |
| Kazakhstan Airlines | 170,274 | \$ 42,796,794.24 | 175,357 | \$ 43,479,398.53 | 165,954 | \$ 41,692,128.80 |
| Kenya Airlines | 171,991 | \$ 43,395,107.04 | 179,144 | \$ 44,940,464.74 | 178,569 | \$ 44,879,210.15 |
| Kiribati Airlines | 139,912 | \$ 35,127,897.50 | 147,716 | \$ 37,133,055.12 | 144,371 | \$ 36,191,749.25 |
| Korea Airlines | 101,796 | \$ 25,544,228.69 | 102,788 | \$ 25,779,475.39 | 107,308 | \$ 26,911,490.20 |
| Kuwait Airlines | 146,493 | \$ 36,714,969.62 | 150,407 | \$ 38,985,290.50 | 157,976 | \$ 39,614,917.51 |
| | | | | | | 4,494 \$ 111,900.99 |

Figure 36 - Query1: passengers and revenue by airline and month pt2 (large-extra database - airports-large-extra.sql)

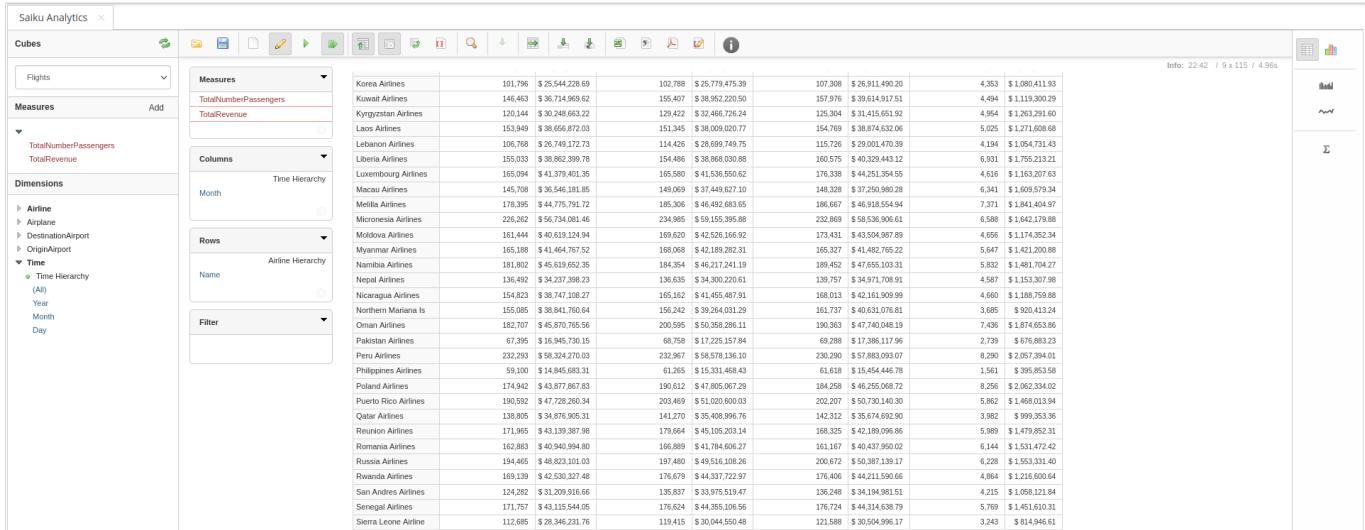


Figure 37 - Query1: passengers and revenue by airline and month pt3 (large-extra database - airports-large-extra.sql)

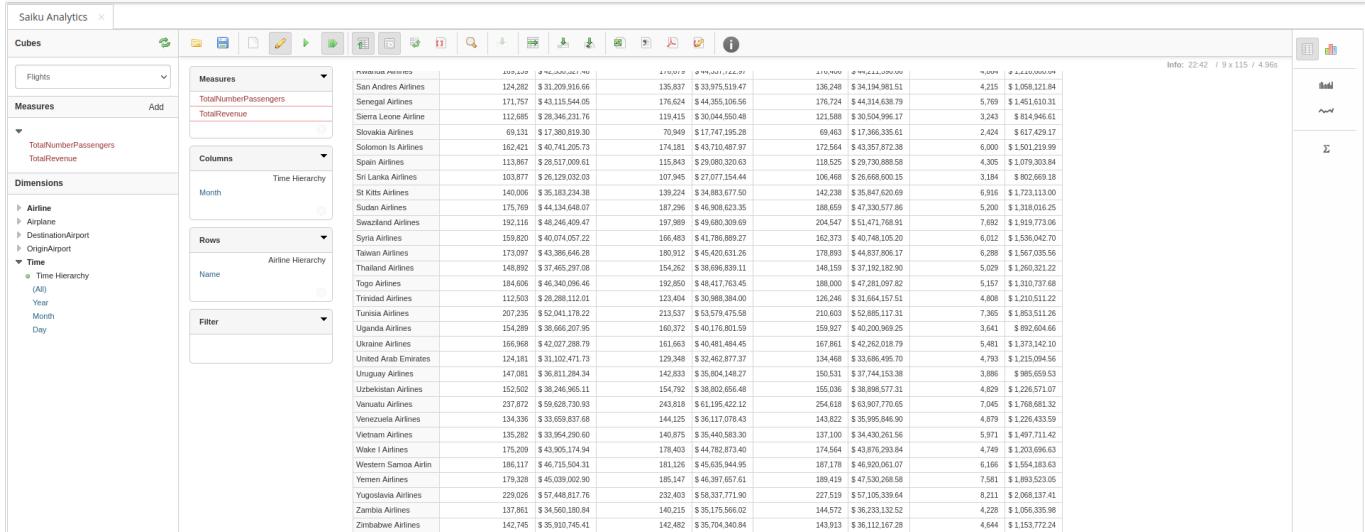


Figure 38 - Query1: passengers and revenue by airline and month pt4 (large-extra database - airports-large-extra.sql)

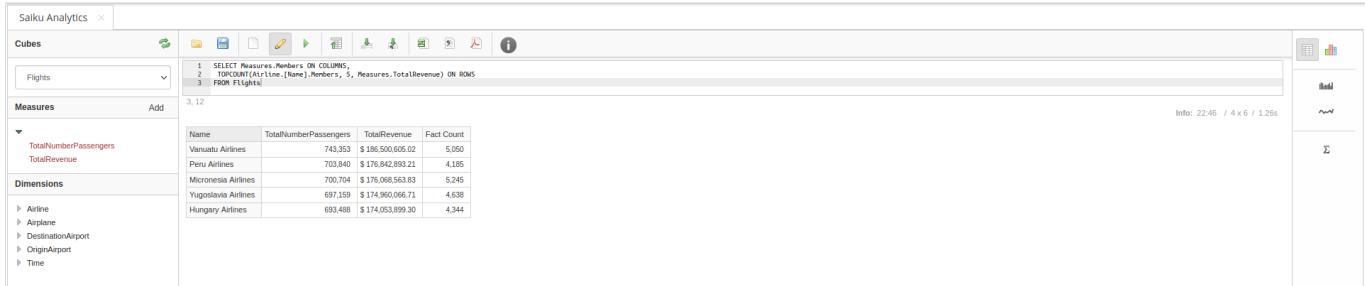


Figure 39 - Query2: Top5 airlines with better revenue (large-extra database - airports-large-extra.sql)

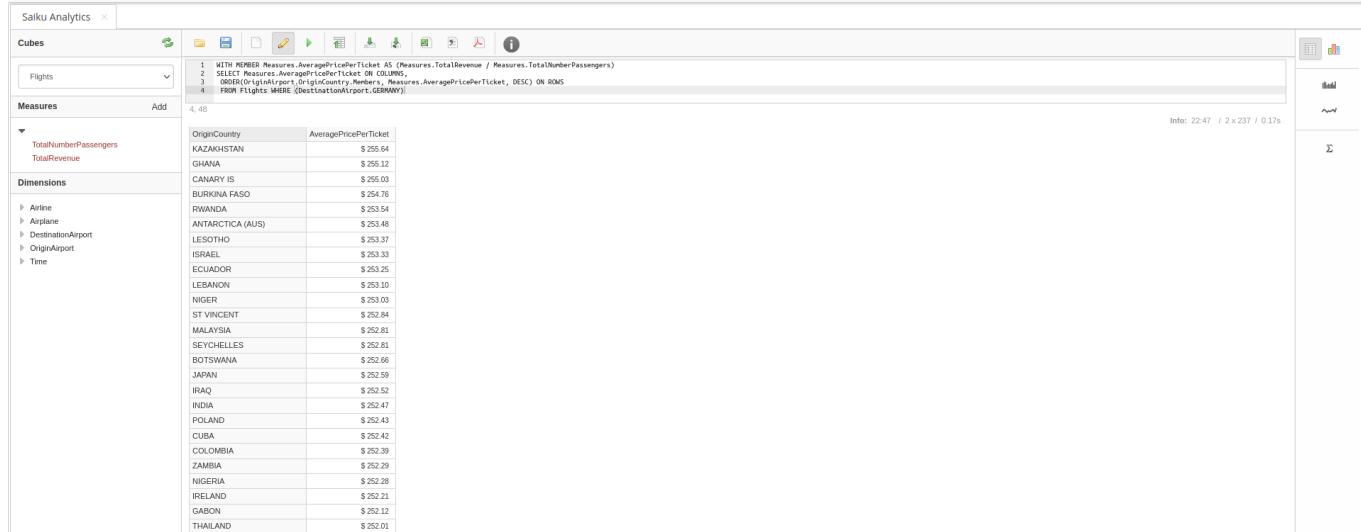


Figure 40 - Query3: Average price per passenger from other countries to germany pt1 (large-extra database - airports-large-extra.sql)

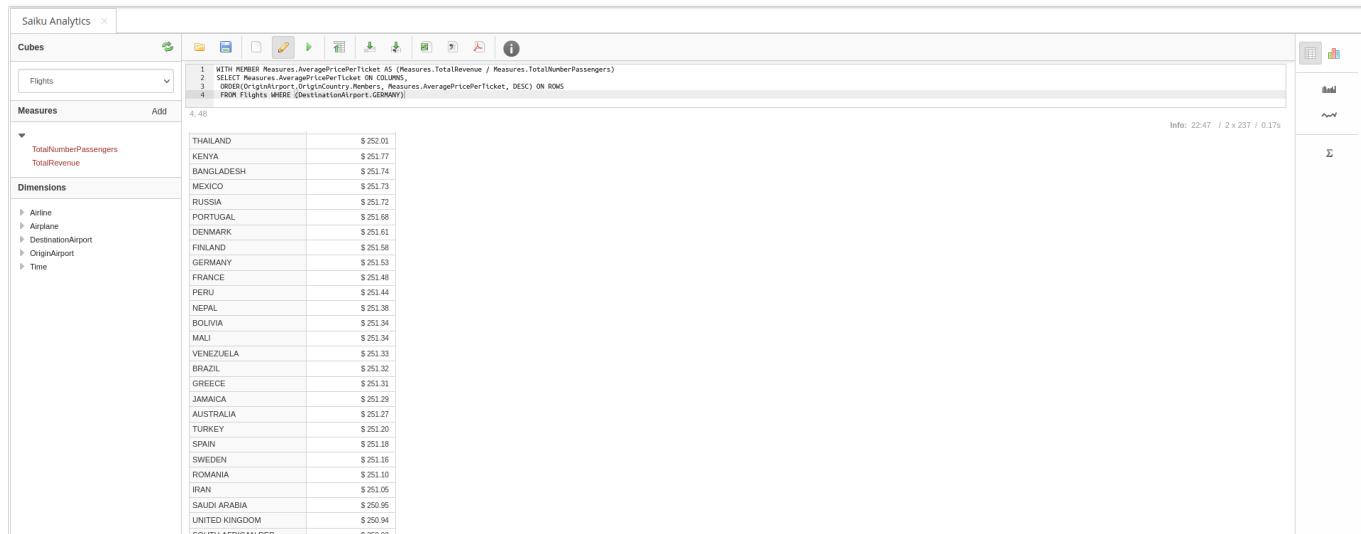


Figure 41 - Query3: Average price per passenger from other countries to germany pt2 (large-extra database - airports-large-extra.sql)

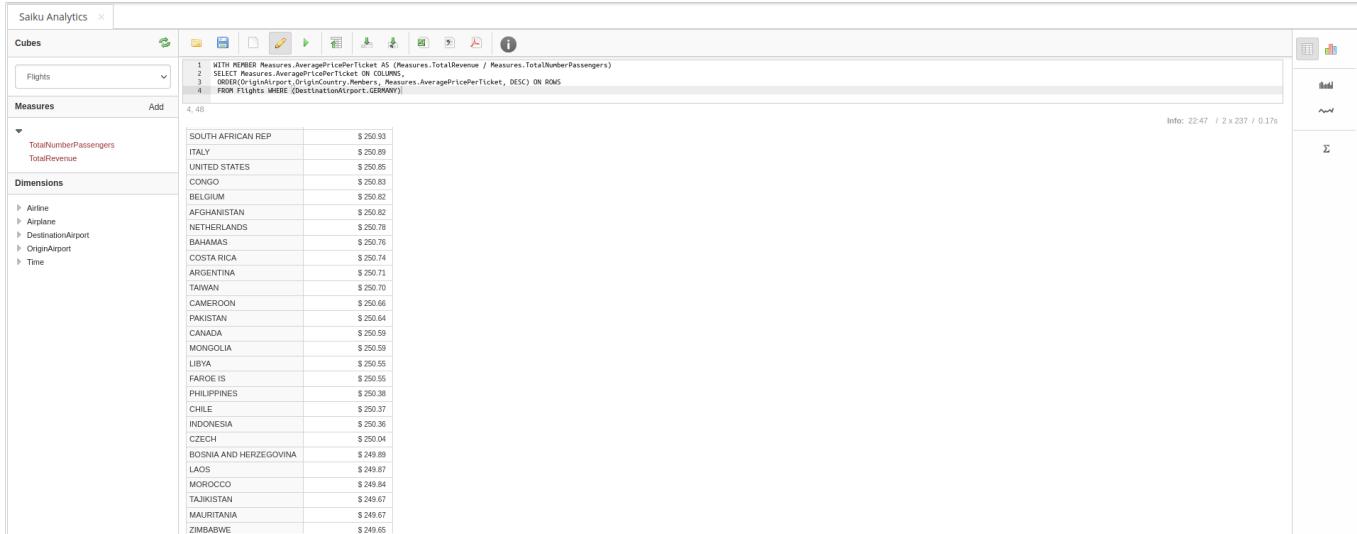


Figure 42 - Query3: Average price per passenger from other countries to germany pt3 (large-extra database - airports-large-extra.sql)

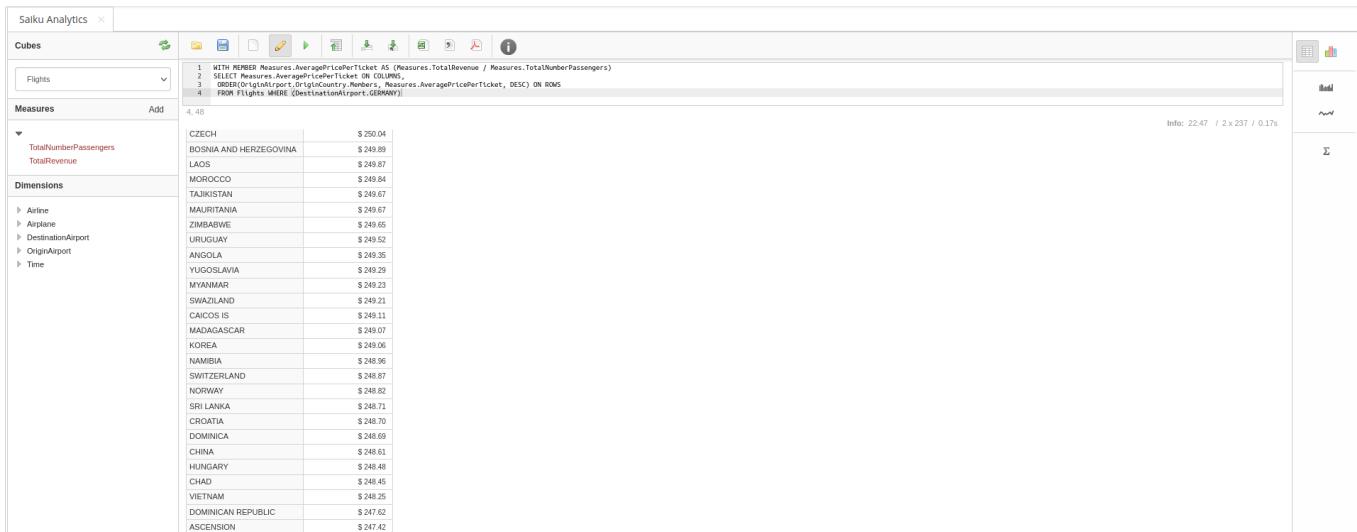


Figure 43 - Query3: Average price per passenger from other countries to germany pt4 (large-extra database - airports-large-extra.sql)

6. Improvements

It is possible to replace the time hierarchy by two hierarchies, departure time and arrival time and we can know more information about time flights. For example the revenue of flights between a certain departure time and a certain arrival time.