



IT3021 – Data Warehousing and Business Intelligence
Assignment 2

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Data Source

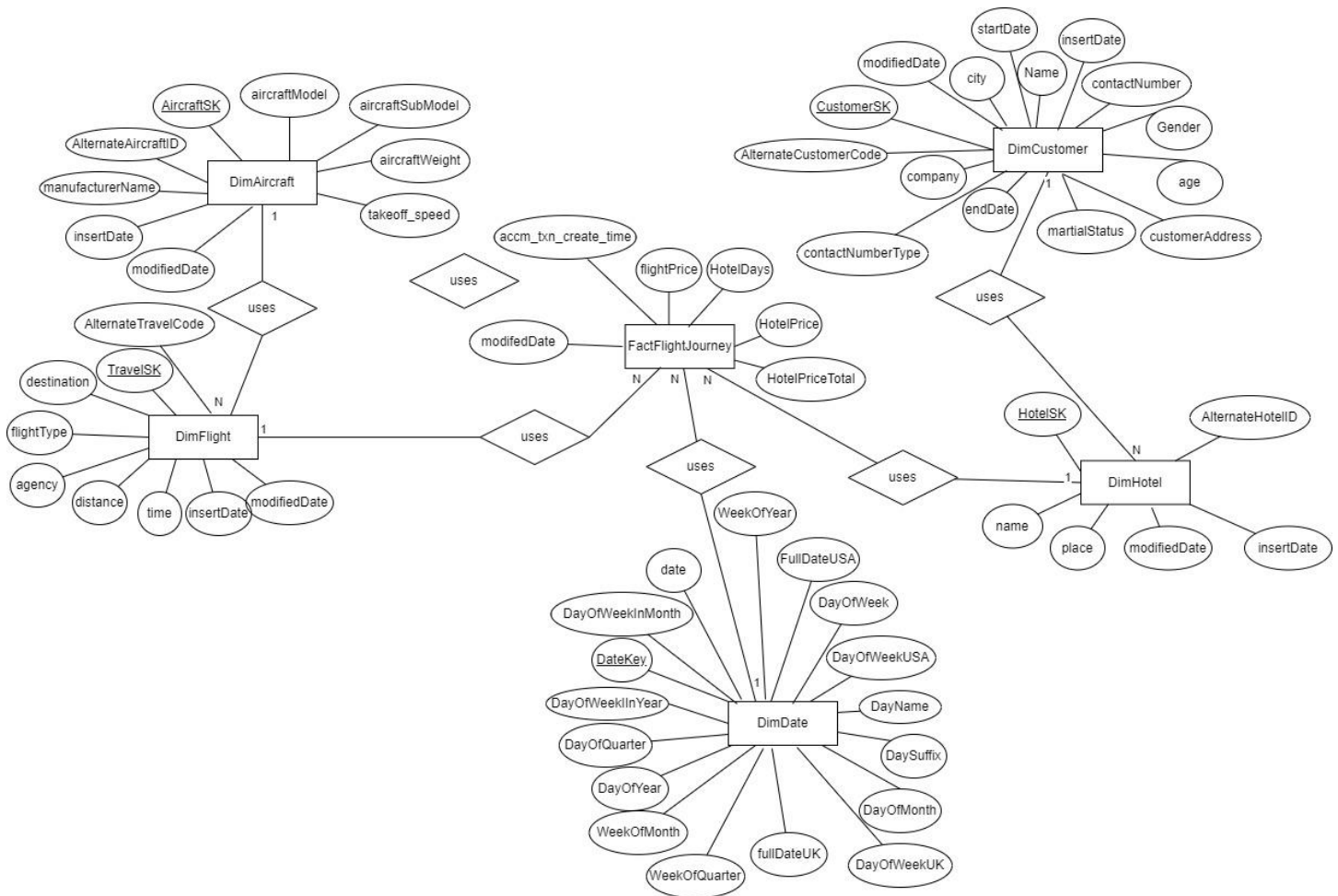
The data source for this assignment is an OLTP dataset which contains fact tables and dimension tables in a data warehouse. In this data warehouse there are five dimension tables and a single fact table. The dimension tables are namely : DimAircraft, DimCustomer, DimDate, DimFlight, DimHotel and the name of the fact table is FactsFlightJourney.

Table name	Column Name	Data type	Column type
DimDate	DateKey	int	Primary Key
	Date	datetime	Non-key column
	FullDateUK	char(10)	Non-key column
	FullDateUSA	char(10)	Non-key column
	DayOfMonth	varchar(2)	Non-key column
	DaySuffix	varchar(4)	Non-key column
	DayName	varchar(9)	Non-key column
	DayOfWeekUSA	char(1)	Non-key column
	DayOfWeekUK	char(1)	Non-key column
	DayOfWeekInMonth	varchar(2)	Non-key column
	DayOfWeekInYear	varchar(2)	Non-key column
	DayOfQuarter	varchar(3)	Non-key column
	DayOfYear	varchar(3)	Non-key column
	WeekOfMonth	varchar(1)	Non-key column
	WeekOfQuarter	varchar(2)	Non-key column
	WeekOfYear	varchar(2)	Non-key column
	Month	varchar(2)	Non-key column
	MonthName	varchar(9)	Non-key column
	MonthOfQuarter	varchar(2)	Non-key column
	Quarter	char(1)	Non-key column
	QuarterName	varchar(9)	Non-key column
	Year	char(4)	Non-key column
	YearName	char(7)	Non-key column
	MonthYear	char(10)	Non-key column
	MMYYYY	char(6)	Non-key column
	FirstDayOfMonth	date	Non-key column
	LastDayOfMonth	date	Non-key column
	FirstDayOfQuarter	date	Non-key column
	LastDayOfQuarter	date	Non-key column
	FirstDayOfYear	date	Non-key column
	LastDayOfYear	date	Non-key column
	IsHolidaySL	bit	Non-key column
	IsWeekday	bit	Non-key column
	HolidaySL	varchar(50)	Non-key column
	isCurrentDay	int	Non-key column
	isDataAvailable	int	Non-key column
	isLatestDataAvailable	int	Non-key column
DimAircraft	AircraftSK	int	Primary key
	AlternateAircraftID	int	Business key
	manufacturerName	nvarchar(50)	Non-key column
	aircraftModel	nvarchar(50)	Non-key column
	aircraftSubModel	nvarchar(50)	Non-key column
	aircraftWeight	decimal(28,0)	Non-key column
	takeoff_speed	decimal(28,0)	Non-key column
	insertDate	datetime	Non-key column
	modifiedDate	datetime	Non-key column

DimCustomer	CustomerSK	int	Primary key
	AlternateCustomerCode	int	Business key
	Company	nvarchar(200)	Non-key column
	Name	nvarchar(200)	Non-key column
	Gender	nvarchar(30)	Non-key column
	age	numeric(18,0)	Non-key column
	Customer_address	nvarchar(200)	Non-key column
	startDate	datetime	Non-key column
	endDate	datetime	Non-key column
	insertDate	datetime	Non-key column
	modifiedDate	datetime	Non-key column
	city	nvarchar(100)	Non-key column
	contactNumber	nvarchar(30)	Non-key column
	contactNumberType	nvarchar(30)	Non-key column
	maritalStatus	nvarchar(20)	Non-key column
DimFlight	TravelSK	int	Primary key
	AlternateTravelCode	nvarchar(50)	Business key
	userKey	int	Foreign key references DimCustomer(CustomerSK)
	source	nvarchar(50)	Non-key column
	destination	nvarchar(50)	Non-key column
	flightType	nvarchar(50)	Non-key column
	agency	nvarchar(50)	Non-key column
	distance	float	Non-key column
	time	float	Non-key column
	insertDate	datetime	Non-key column
	modifiedDate	datetime	Non-key column
	aircraftKey	int	Foreign key references DimAircraft(AircraftSK)
DimHotel	HotelSK	int	Primary key
	AlternateHotelID	int	Business key
	travelKey	int	Foreign key references DimFlight(TravelSK)
	userKey	int	Foreign key references DimCustomer(CustomerSK)
	name	nvarchar(50)	Non-key column
	place	nvarchar(50)	Non-key column
	insertDate	datetime	Non-key column
	modifiedDate	datetime	Non-key column
FactFlightJourney	CustomerKey	int	Foreign key references DimCustomer(CustomerSK)
	aircraftKey	int	Foreign key references DimAircraft(AircraftSK)
	flightJourneyDateKey	int	Foreign key references DimDate(DateKey)
	flightPrice	float	Non-key column
	HotelDays	int	Non-key column
	HotelPrice	float	Non-key column
	HotelPriceTotal	float	Non-key column
	accm_txn_create_time	datetime	Non-key column
	modifiedDate	datetime	Non-key column

ER Diagram

The diagram below shows the ER diagram for the data source showing the connections between the dimension tables and the fact table.

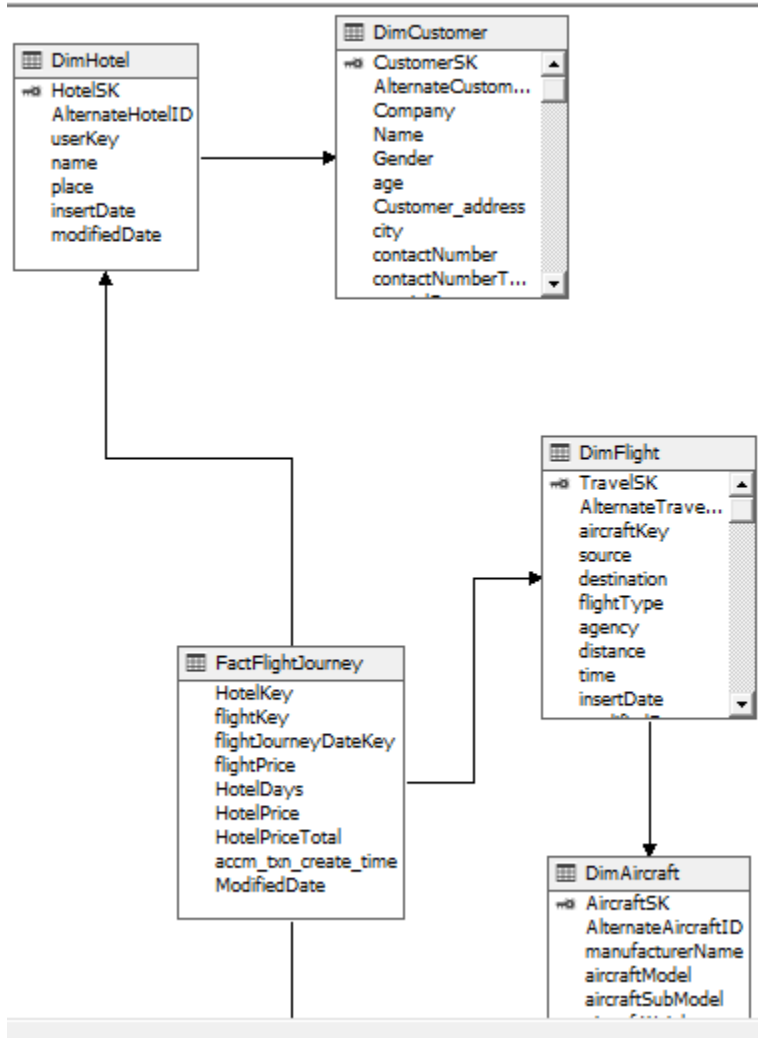


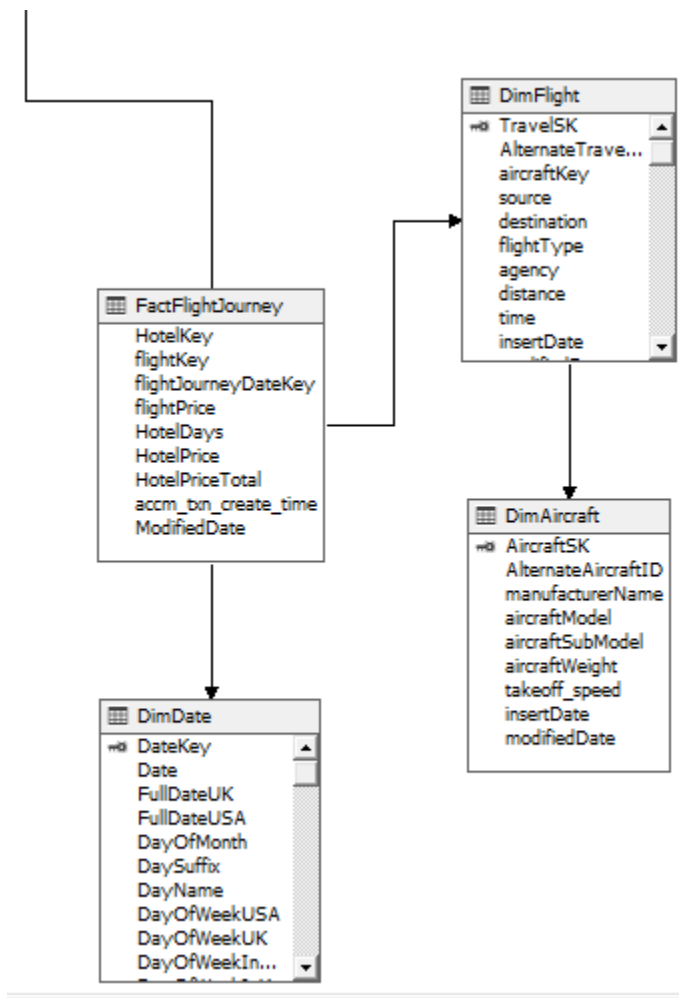
Note : There are lots of attributes for the date dimension so all the attributes of the date dimension are not included in the ER diagram.

SSAS Cube Implementation

Before creating a cube we should; first we should create a data source and the name of the data source is DS_Flights_DW_Test. The next step is to create a data source view; in this case the name of the data source view is DSV_Flights_DW_Test. In the next step we are going to create the cube and the dimensions are created automatically; in this case the name of the cube is Cube_Flights.

The diagram below shows the data source view:





The cube was processed and it was successful as shown below.

Deployment Progress - DWBI_Assignment2_SSAS

Server : localhost

Database : DWBI_Assignment2_SSAS

Command

- [-] Command
 - [-] Processing Database 'DWBI_Assignment2_SSAS' completed.
Start time: 5/17/2022 2:47:57 AM; End time: 5/17/2022 2:48:26 AM; Duration: 0:00:28
 - [+] Processing Dimension 'Dim Date' completed.
 - [+] Processing Dimension 'Dim Flight' completed.
 - [+] Processing Dimension 'Dim Hotel' completed.
 - [-] Processing Cube 'DSV_Flights_DW_Test' completed.
Start time: 5/17/2022 2:48:04 AM; End time: 5/17/2022 2:48:26 AM; Duration: 0:00:21
 - [+] Processing Measure Group 'Fact Flight Journey' completed.

Status:



Deployment Completed Successfully

As shown in the image below the data is successfully being viewed on the browser.

Cube_Flights_DW_Test [Browse] DSV_Flights_DW_Test [Browse] SQLQuery41.sql -...PSHFE\PCView (84)) SQLQuery40.sql -...PSHFE\PCView (83))*

Language: Default

Edit as Text Import... MDX

Cube_Flights_DW_Test

Metadata

Search Model

Measure Group:

<All>

Cube_Flights_DW_Test

Measures

KPIs

KPI Hotel Price

Value

Goal

Dim Date

Date

Date Key

Day Name

Day Of Month

Day Of Quarter

Day Of Week In Month

Day Of Week In Year

Day Of Week UK

Calculated Members

Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Day Of Month	KPI Hotel Price Value	KPI Hotel Price Goal
1	67671000.72	True
10	84030490.0000002	True
11	75164883.3700001	True
12	78220688.8500001	True
13	77159134.0100001	True
14	79070900.4400002	True
15	66829757.03	True
16	82178211.6300002	True
17	82947391.0000003	True
18	74816651.0000001	True
19	78720261.1000002	True
2	83408899.8000003	True
20	75588308.1000001	True
21	78648073.6100001	True
22	65891175.54	True
23	82091207.6000002	True
24	82464842.6200002	True
25	74542947.39	True

After creating a KPI the cube was run in the browser and to display the details on the browser Source from DimFlight, AircraftModel from DimAircraft, AircraftSubModel from DimAircraft, FlightType from DimFlight, Agency from DimFlight, FlightPrice from FactFlightJourney, and value and goal from KPI Payments below and this was sorted using the DimDate as shown below.

Cube_Flights_DW_Test

Metadata

Search Model

Measure Group:

<All>

Cube_Flights_DW_Test

Measures

Fact Flight Journey

Fact Flight Journey Count

Flight Price

Hotel Days

Hotel Price

Hotel Price Total

KPIs

KPI Payments

KPI Flight

Dim Date

Dim Flight

Dim Hotel

Calculated Members

Dimension	Hierarchy	Operator	Filter Expression
Dim Date	Month	Equal	{ All }
<Select dimension>			

Month	Source	Aircraft Model	Aircraft Sub Model	Flight Type	Agency	Flight Price	KPI Payments Value	KPI Payments Goal
1	Araca...	Bombardier	Challenger 300	economic	CloudFy	1916480.28	1612654.84	True
1	Araca...	Bombardier	Challenger 300	economic	Rainbow	934718.58	778729.42	True
1	Araca...	Bombardier	Challenger 300	firstClass	CloudFy	3040236.29	1448214.55	True
1	Araca...	Bombardier	Challenger 300	firstClass	Flying...	2743556.83	1261985.15	True
1	Araca...	Bombardier	Challenger 300	firstClass	Rainbow	1749091.12	807498.61	True
1	Araca...	Bombardier	Challenger 300	premium	CloudFy	1843880.89	1101450.16	True
1	Araca...	Bombardier	Challenger 300	premium	Rainbow	2041942.86	1242618.54	True
1	Araca...	Bombardier	CRJ-1000	economic	CloudFy	1089213.52	1023864.47	True
1	Araca...	Bombardier	CRJ-1000	economic	Rainbow	1569548.32	1345656.71	True
1	Araca...	Bombardier	CRJ-1000	firstClass	CloudFy	2903427.16	1391800.87	True
1	Araca...	Bombardier	CRJ-1000	firstClass	Flying...	2119606.32	1052124.89	True
1	Araca...	Bombardier	CRJ-1000	firstClass	Rainbow	2636877.07	1313095.51	True
1	Araca...	Bombardier	CRJ-1000	premium	CloudFy	1804038.14	1077763.03	True
1	Araca...	Bombardier	CRJ-1000	premium	Rainbow	2378629.76	1538336.25	True
1	Araca...	Bombardier	CRJ-900	economic	CloudFy	5951486.87	3462459.96	True
1	Araca...	Bombardier	CRJ-900	economic	Rainbow	5175930.97	3153263.06	True
1	Araca...	Bombardier	CRJ-900	firstClass	CloudFy	8594846.93	2951860.56	True
1	Araca...	Bombardier	CRJ-900	firstClass	Flying...	11469146...	3811523.65	True

The MDX query that was used to create the connection to the PowerPivot in Microsoft Excel is shown below.

```
SELECT NON EMPTY { [Measures].[Flight Price], KPIValue("KPI Payments"), KPIGoal("KPI Payments") } ON COLUMNS, NON EMPTY { ([Dim Date].[Month].[Month].ALLMEMBERS * [Dim Flight].[Source].[Source].ALLMEMBERS * [Dim Flight].[Aircraft Model].[Aircraft Model].ALLMEMBERS * [Dim Flight].[Aircraft Sub Model].[Aircraft Sub Model].ALLMEMBERS * [Dim Flight].[Flight Type].[Flight Type].ALLMEMBERS * [Dim Flight].[Agency].[Agency].ALLMEMBERS ) } DIMENSION PROPERTIES MEMBER_CAPTION, MEMBER_UNIQUE_NAME ON ROWS FROM ( SELECT ( { [Dim Date].[Month].[All] } ) ON COLUMNS FROM [Cube_Flights_DW_Test]) CELL PROPERTIES VALUE, BACK_COLOR, FORE_COLOR, FORMATTED_VALUE, FORMAT_STRING, FONT_NAME, FONT_SIZE, FONT_FLAGS
```

Demonstration of OLAP Operations

When creating the pivot table using Excel in PowerPivot :

1. As the filters MeasureKPI Payment, DimFlightType, and DimFlightAgency were included.
2. As the columns Dim DateMonth is included.
3. As the rows DimFlightAircraft Model, DimFlightAircraft SubModel, and DimFlightSource were included.
4. As the values SumOfMeasuresFlightPrice and SumOfMeasuresHotelPriceTotal were included.

The screenshot below shows a part of the pivot table.

[illegible]

Using a pivot table we can perform the OLAP operations such as roll-up, drill-down, slice, dice, pivot. Initially we can perform a roll-up.

Roll-up

The screenshot below shows a roll-up. According to the aircraft model the total costs of flight price and hotel price is calculated.

19	Measures	KPI Payments Goal	All																	
20	Dim Flight	TypeFlight Type	All																	
21	Dim Flight	AgencyAgency	All																	
22																				
23			Column Labels																	
24			Sum of Measures	Flight Price																
25	Row Labels		1	10	11	12	2	3	4	5	6	7	8	9						
26	Airbus		182318734.3	211171702.2	189245575.6	193145775	167535784.4	175723645.6	173562386.5	161953517.5	151730347.6	156572266	138075825.1	150136820.3						
27	Antonov		27627517.13	30798728.65	29147178.07	31669239.06	23722671.61	25052850.46	26215335.78	22850425.06	22648796.41	23327015.62	22309175.76	23082245.64						
28	ATR		16344907.85	14662962.26	15102387.76	19444224.69	14833075.75	14401898.24	13715448.22	12026731.77	11764746.13	12532984.58	14079265.07	14095090.33						
29	Beechcraft		19166878.05	20359979.73	17091214.23	17890236.89	14581253.43	14827512.4	15500922.19	14722191.77	13240652.26	15185139.45	14334565.61	15138639.15						
30	Beriev		22711844.3	25104746.07	25006900.59	24055496.65	20406736.6	19902777.93	21383817.5	20131637.58	19652468.86	18075433.51	16134797.14	19862986.34						
31	Boeing		5891210.32	6383554.2	5243347.71	4969568.72	4120240.28	5174911.61	4262543.02	3857413.25	4035330.61	3585577.29	4223895.05	4786264.48						
32	Bombardier		414562922.4	454933495	410662074	433094189.9	370643378	381621401.2	380834720.7	363985397.7	334122932.8	358110254.1	321200708.7	333957944.4						
33	British Aerospace		4935819.98	6176929.23	5207484.23	5741310.87	3371024.63	5043557.03	4092706.24	3465349.02	3256377.57	4306103.4	3794788.99	3577536.59						
34	Comac		6552609.96	8248804.37	7408544.8	6935300.38	6840889.18	6132100.29	5064247.14	5592869.72	5847983.45	6171097.98	6022364.09	5715754.7						
35	DHC		26720215.05	3938082.59	26428595.83	27564209.14	28212165.55	26846860.82	25065779.13	21364941	21131801.61	23707925.82	20541921.67	21882530.42						
36	Douglas		32767564.37	35062902.28	28862451.6	31478774.36	29415543.97	28271635.79	28604286.08	30922236.87	23269626.27	24996764.5	22953309.01	26530682.79						
37	Embraer		144215859.6	155076648.7	139547401.8	146635713.8	125224016.7	129601463.8	125726031.7	118576989.8	112131559.8	118017478.2	96694872.55	107165750.1						
38	Irkut		6321406.62	4963214.22	6119801.54	5982150.33	4734642.11	4340152.3	6267106.29	5436050.5	4132877.01	4417629.57	4089719.98	4772310.83						
39	Tuploev		59246099.04	66694114.34	59002958.03	57770136.98	53001515.66	54746192.13	55242404.35	51548161.98	46694218.64	48483887.68	44619940.95	48709991.94						
40	Grand Total		969383589	1071115864	964075915.8	1006646327	866642937.9	891686959.6	885537734.8	836433913.5	772839719	817489557.7	729075149.6	779414548						

As the next OLAP operation a drill-down will be performed.

The screenshot below shows a drill-down. The aircraft is divided into subtypes; aircraftModel and for each aircraftModel the starting point of the journey is shown.

Slice

Row Labels	1	10	11	12	2	3	6	7	8	9		
Airbus												
Airbus-321												
Florianopolis (SC)	210395.79		145416.51	91519.31								
Recife (PE)	102126109.6	116838224.9	104969809.2	106873493.5	92869501.21	9						
Airbus-330												
Florianopolis (SC)	15617259.52	17873341.38	15014886.19	16587238.1	11580864.95	1						
Airbus-340												
Brasilia (DF)	44383369.2	53327755.96	46875668.78	49579485.95	44583310.39	4						
Airbus-350												
Florianopolis (SC)	15667656.86	17556160.04	17981576.26	14994510.81	14524674.55	12497824.55	14801097.05	11683061.23	13518500.38	14255059.79	11899506.82	12848357.61
Airbus-380												
Brasilia (DF)	4313943.35	5576219.94	4258218.7	5019527.25	3977433.29	3696764.87	4811868.89	3825655.94	3510065.98	3250980.94	2801411.13	3320269.05
Grand Total	182318734.3	211171702.2	189245575.6	193145775	167535784.4	175723645.6	173562386.5	161953517.5	151730347.6	156572266	138075825.1	150136820.3

Dice

- MeasuresKPI Payments Goal is set to True.
- Dim FlightFlight TypeFlight Type is set to firstClass.
- Dim FlightAgencyAgency is set to Rainbow.

SSRS Report

The data set is chosen from the flights_dw_test and the query used to create the dataset is shown below.

```
select da.manufacturerName, dc.AlternateCustomerCode, da.aircraftModel,
da.aircraftSubModel, da.aircraftWeight, da.takeoff_speed, dc.Company, dc.Name, dc.Gender, dc.age,
dc.Customer_address, dc.contactNumber, dd.Date, dd.Month,dd.MonthName, dd.Year, df.source, df.destination,
df.flightType, df.agency, df.distance,
df.time,dh.name,dh.place,fj.flightPrice,fj.HotelDays,fj.HotelPriceTotal
from FactFlightJourney fj
    inner join DimFlight df on fj.flightKey= df.TravelSK
    inner join DimAircraft da on df.aircraftKey = da.AircraftSK
    inner join DimHotel dh on fj.HotelKey = dh.HotelSK
    inner join DimCustomer dc on dh.userKey = dc.CustomerSK
    inner join DimDate dd on fj.flightJourneyDateKey = dd.DateKey
```

After the query was executed the following output was being displayed :

manufacturerN...	AlternateCusto...	aircraftModel	aircraftSubModel	aircraftWeight	takeoff_speed	Company	Name	Gender	age	Customer_addr...	contactNumber	Date	Mor
Zachary Cordin...	992	Bombardier	Learjet 60	71774	168	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	3/7/2021 12:00:...	3
Zachary Cordin...	992	Bombardier	Learjet 60	71774	168	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	3/7/2021 12:00:...	3
Zachary Cordin...	992	Bombardier	Learjet 60	71774	168	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	3/7/2021 12:00:...	3
Zachary Cordin...	992	Bombardier	Learjet 60	71774	168	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	3/7/2021 12:00:...	3
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	100	Embraer	ERJ 140	65264	146	4You	Carla Puskar	female	36	30610 Mosinee...	786-382-5499	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9
Goldia Singyard	264	Embraer	ERJ 140	65264	146	4You	Prince Webster	male	40	759 7th Circle	919-902-6596	9/23/2021 12:0...	9
Goldia Singyard	100	Embraer	ERJ 140	65264	146	4You	Carla Puskar	female	36	30610 Mosinee...	786-382-5499	9/23/2021 12:0...	9
Goldia Singyard	992	Embraer	ERJ 140	65264	146	Acme Factory	Claudia Liang	female	27	528 Scott Aven...	469-870-6773	9/23/2021 12:0...	9