

# Low-Level Design

## San Francisco Airport Data Analysis

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## DOCUMENT CONTROL

### Change Record:

VERSION	DATE	AUTHOR	COMMENTS
0.1	28-Jan 2023	H.Achutha Rugvedi	Introduction and architecture defined
0.2	28-Jan 2023	H.Achutha Rugvedi	Architecture & Architecture description appended and updated.

### Reviews:

VERSION	DATE	REVIEWER	COMMENTS
0.2	29-Jan 2023	H.Achutha Rugvedi	Unit test cases to be added

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## 1. Introduction

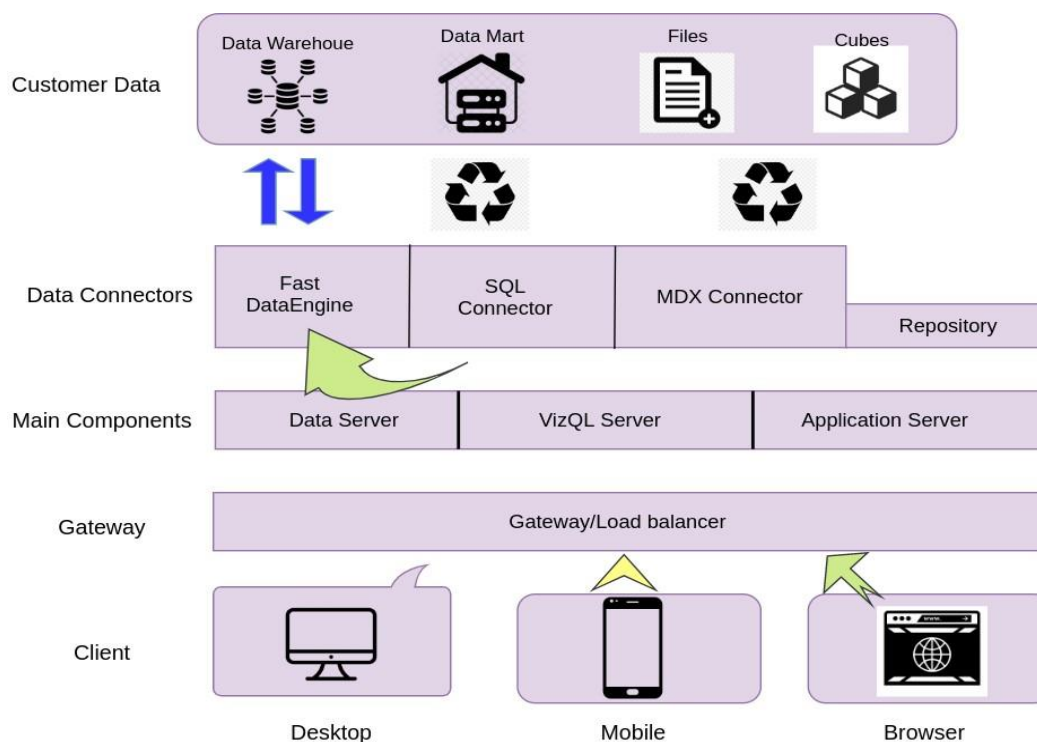
### 1.1 What is a Low-Level design document?

The goal of the LDD or Low-level design document (LLDD) is to give the internal logic design of the actual program code for the Airport Data Analysis dashboard. LDD describes the class diagrams with the methods and relations between classes and program specs. It describes the modules so that the programmer can directly code the program from the document.

### 1.2 Scope

Low-level design (LLD) is a component-level design process that follows a step-by-step refinement process. The process can be used for designing data structures, required software architecture, source code, and ultimately, performance algorithms. Overall, the data organization may be defined during requirement analysis and then refined during data design work.

## 2. Architecture



## Power BI Architecture

### What is Power BI?

Power BI is a suite of business analytics tools that are used to analyse data and share insights. The dashboard provides the users so that they do not miss out on any useful insight. To deliver outstanding business intelligence solutions, the components such as:

- Power Query (for data mash-up and transformation)
- Power BI Desktop (a companion development tool)
- Power BI Mobile (for Android, iOS, and Windows phones)
- Power Pivot (for in-memory tabular data modeling)
- Power View (for viewing data visualizations)
- Power Map (for visualizing 3D geo-spatial data)
- Power Q&A (for natural language Q&A)

A Power BI user takes data from various data sources such as **files, Azure sources, online services, DirectQuery**, and a client development tool such as Power BI Desktop. The imported data is cleaned and transformed according to the requirements.

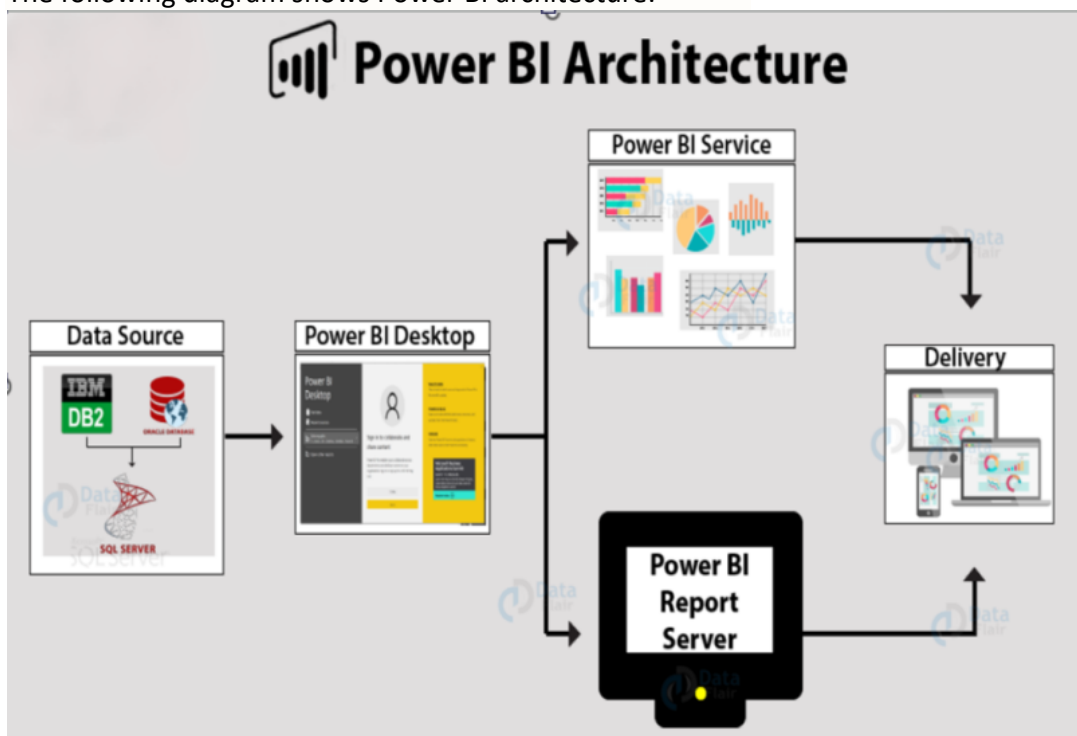
Once the data is transformed and formatted, it is ready to use in making visualizations in a report. A report is then published to the Power BI Service or Power BI Report Server as *slicers*.

Moving on to the chain of processes, you can publish the reports created in the Power BI desktop on two kinds of platforms.

Power BI Service is a cloud-based public platform whereas Power BI Report Server is an on-premise platform.

You can create dashboards on these platforms by pinning visualizations from your published reports. Now it's easy to share the reports with other users from your organization or outside, using delivery options like a *web browser, Power BI on iPad, mobile app*, etc.

The following diagram shows Power BI architecture:



# Components of Power BI Architecture

## *1. Data Sources*

An important component of Power BI is its vast range of data sources. You can import data from files in your system, cloud-based online data sources or connect directly to live connections. If you import from data on-premise or online services there is a limit of 1 GB. Some commonly used data sources in Power BI are:

- Excel
- Text/CSV
- XML
- JSON
- Oracle Database
- IBM DB2 Database
- MySQL Database
- PostgreSQL Database
- Sybase Database
- Teradata Database
- SAP HANA Database
- SAP Business Warehouse server
- Amazon Redshift
- Impala
- Google BigQuery (Beta)
- Azure SQL Database
- Salesforce Reports
- Google Analytics
- Facebook
- GitHub

## *2. Power BI Desktop*

Power BI Desktop is a client-side tool known as a companion development and authoring tool.

This desktop-based software is loaded with tools and functionalities to *connect to data sources, transform data, data modelling, and create reports*.

You can download and install Power BI Desktop in your system for free. Using Power BI Desktop features, one can do *data cleansing, create business metrics and data models, define the relationship between data, define hierarchies, create visuals, and publish reports*.

## *3. Power BI Service*

Power BI Service is a web-based platform from where you can *share reports made on Power BI Desktop, collaborate with other users, and create dashboards*.

It is available in three versions:

- Free version
- Pro version
- Premium version

Power BI Service is also known as, “Power BI.com”, “Power BI Workspace”, “Power BI Site” **and** “Power BI Web Portal”. This component also offers advanced features like *natural language Q&A* and *alerts*.

## 4. Power BI Report Server

The Power BI Report Server is similar to the Power BI Service. The only difference between these two is that Power BI Report Server is an on-premise platform. It is used by organizations who do not want to publish their reports on the cloud and are concerned about the security of their data.

Power BI Report Server enables you to create dashboards and share your reports with other users following proper security protocols. To use this service, you need to have a Power BI Premium license.

## 5. Power BI Gateway

This component is used to connect and access on-premise data in secured networks. Power BI Gateways are generally used in organizations where data is kept in security and watch. Gateways help to extract such data through secure channels to Power BI platforms for analysis and reporting.

## 6. Power BI Mobile

Power BI Mobile is a native Power BI application that runs on iOS, Android, and Windows mobile devices. For viewing reports and dashboards, these applications are used.

## 7. Power BI Embedded

Power BI Embedded offers APIs that are used to embed visuals into custom applications.

## 3. Architecture Description

### 3.1. Data Description

The Dataset contains the San Francisco Flight Dataset which shares the information on flights that were coming and departing from SFO Airport. The Dataset had Coordinates, Base Airline

details, Flight no., Gate No., Date, and Flight Route. By using these parameters we have evaluated the following options

1. Total No of flights: This help to give us the exact number of how many flights travel took place at San Francisco Airport.
2. Total No of flights Landed/ Took Off: This count help to evaluate how many flights landed and taken off from the Airport.
3. Delay time: This help in evaluating the Average Delay time between flights.
4. Busy Route: This help in evaluating the Busiest route for the month of March 2020
5. Arrival Status and Departure Status board: This table gives the arrival status and departure along with its flight number, from the city .
6. Terminal (Gate no.): This information has given us the busiest terminal for the entire month.
7. Reschedule/On-time/Delay: This help in evaluating the no. of flights that got rescheduled or delayed in that month
8. Date: Help to find the Busiest day, and week of the month.

### 3.2. Data Transformation

In the Transformation Process, we have converted our original dataset and added 2 more datasets of airlines and airports with other necessary attributes format. And merge it using Power BI modeling, and manage relationships between the datasets.

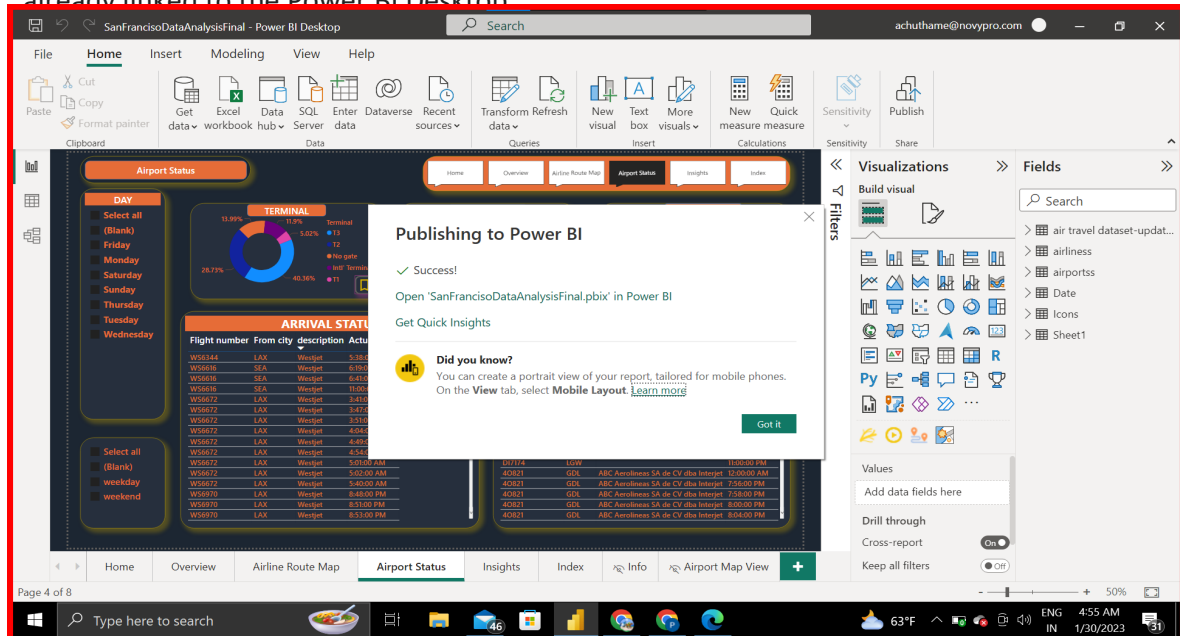
Use the Power query editor to update the dataset did EDA and modify the data as per need.



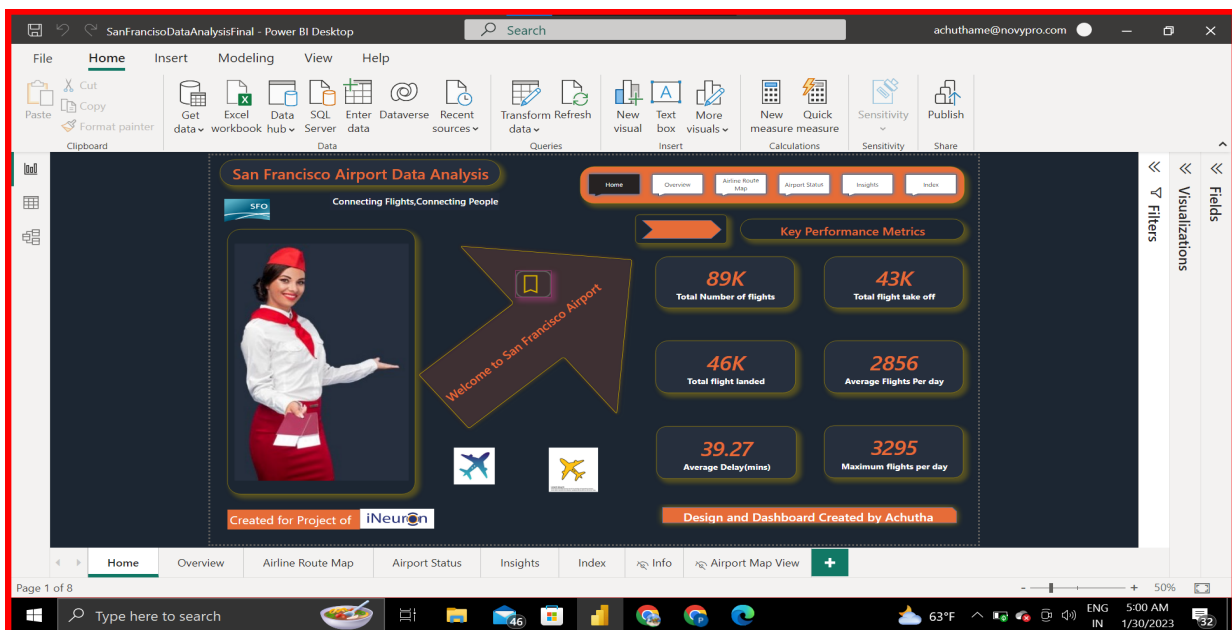
### 3.3 Deployment.

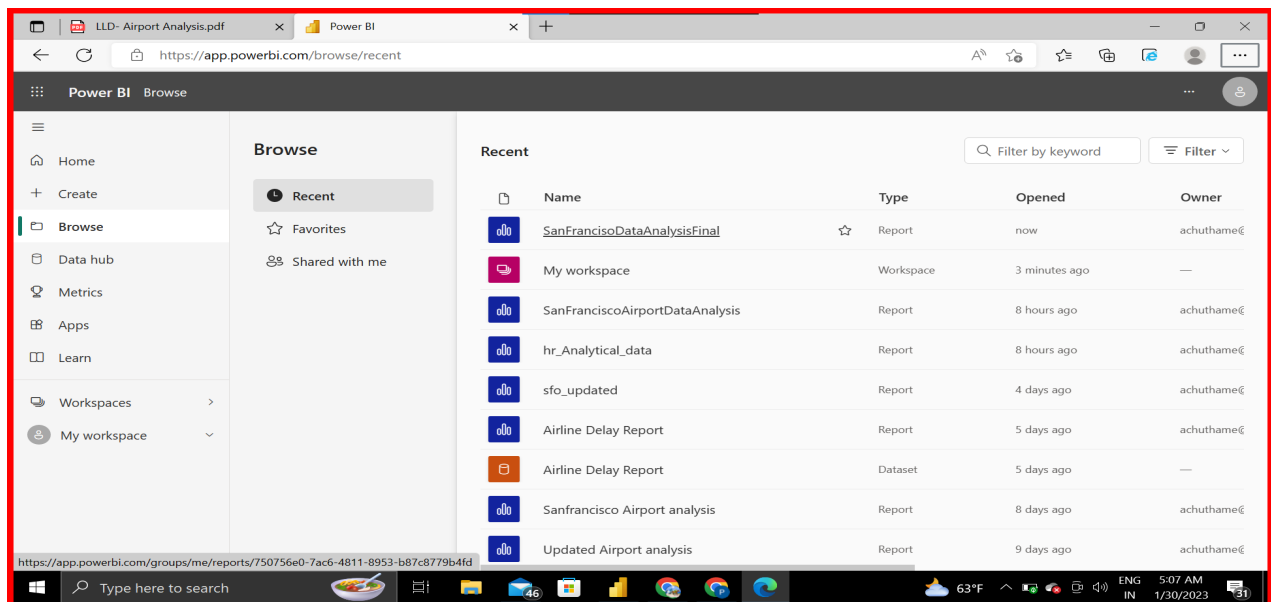
Once you've completed your dashboard, follow these steps - **Power BI Desktop, Publish to Power BI service.**

A screen will prompt with the successful upload of the dashboard in the Power BI service, if it's already linked to the Power BI Desktop.



Next, Login to the Power BI Service and check the workspace in which the Dashboard is published.



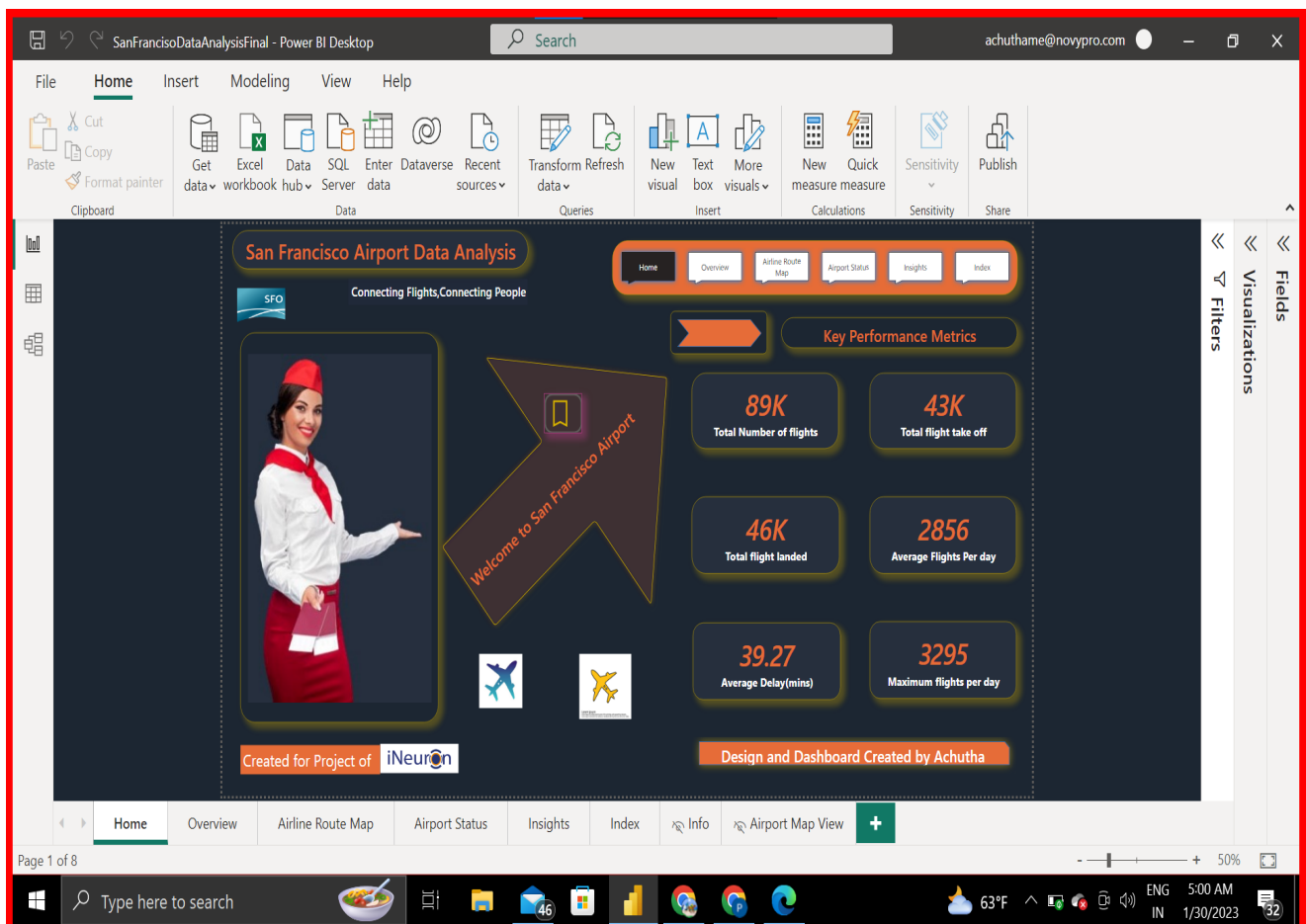


This shows that Report has been published in the workspace and now who so ever will have an ID and the access to check the dashboard will be able to check from anywhere.

Here in the below screenshot, of visualization on the Power BI service.

## 4. Unit Test Cases

TEST CASE DESCRIPTION	EXPECTED RESULTS
Total no. of flights	When we clicked on the slicer, select any specific time and check the no. of flights at that particular period
Average Delay time	When clicked on the slicer, for a particular time period it shows the average delay time for that particular time.
Distance covered	When we clicked on the slicer it show us the bar chart of the distance covered in different regions for a specified time.
Busy route	This parameter shows us the Busiest route that most of the flights at that particular time used.
Total flights Taken off/ Landed	This parameter has shown the most frequent locations that the flights were going to and coming from.
Count of Terminal	When clicked on the slicer for a particular period it shows the count of terminals mostly used at that point.
Busy Day/week + Flight status	This is an important visual in the donut chart which shows the flight status (On-time, delayed, Rescheduled) and shares the busiest day and week of that month.



## San Francisco Airport Data Analysis