Architecture Design

Data Visualization of Bird Strikes between 2000 – 2011

iNeur⊙n

DOCUMENT VERSION CONTROL:

Version	Date	Author	Comments
1.0	12-April-2023	Md Sahil	First Version of complete Architecture

Contents:

1. Introduction

1.1 What is Architecture design document?

Any software needs the architectural design to represents the design of software. IEEE defines architectural design as "the process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of a computer system." The software that is built for computer-based systems can exhibit one of these many architectures.
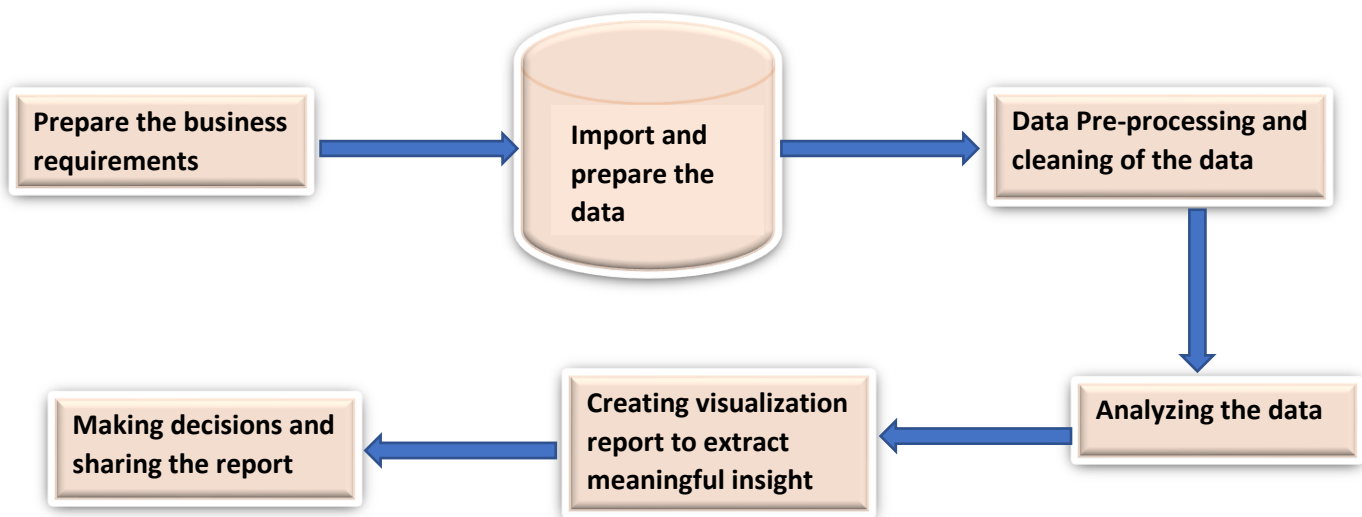
- Each style will describe a system category that consists of :
- A set of components (eg: a database, computational modules) that will perform a function required by the system.
- The set of connectors will help in coordination, communication, and cooperation between the components.
- Conditions that how components can be integrated to form the system.
- Semantic models that help the designer to understand the overall properties of the system.
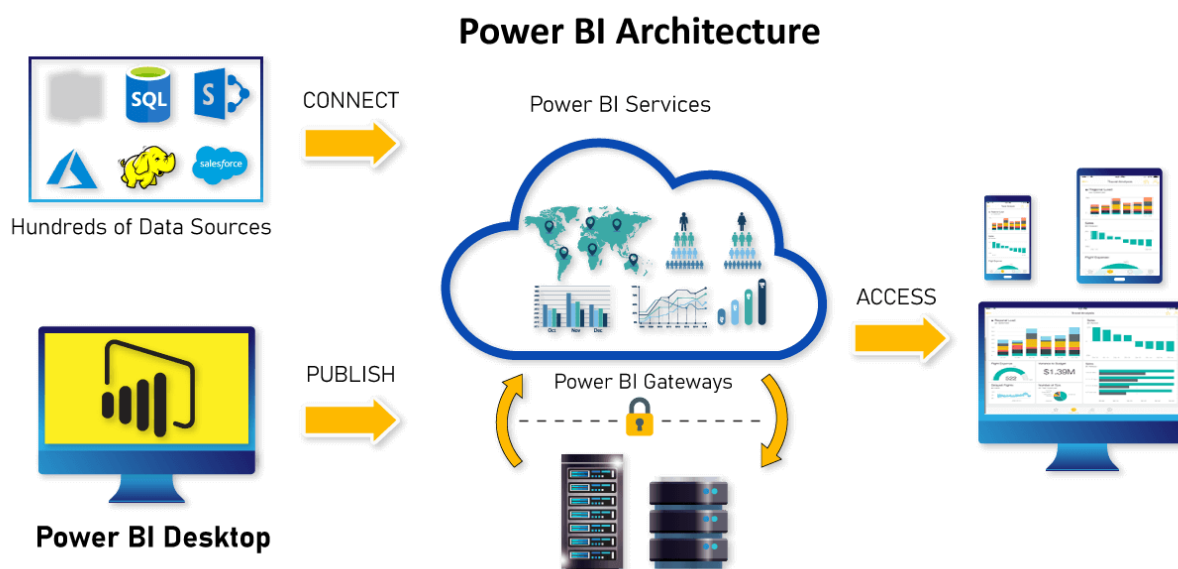
1.2 Scope

Architecture Design Document (ADD) is an architecture 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 design principles may be defined during requirement analysis and then refined during architectural design work.

2. Architecture

Project Architecture:

```
Prepare the business        Import and          Data Pre-processing and
requirements          →     prepare the    →    cleaning of the data
                            data
```

```
Making decisions and   ←   Creating visualization   ←   Analyzing the data
sharing the report         report to extract
                           meaningful insight
```

2.1 Power BI Architecture

Power BI Architecture

Power BI architecture is a service built on top of Azure. There are multiple data sources that Power BI can connect to. Power BI Desktop allows you to create reports and data visualizations on the dataset. Power BI gateway is connected to on-premises data sources to get continuous data for reporting and analytics. Power BI services refer to the cloud services that are used to publish Power BI reports and data visualizations. Using Power BI mobile apps, you can stay connected to their data from anywhere. Power BI apps are available for Windows, iOS, and Android platforms.

The Power BI architecture uses the **Azure Active Directory (AAD)** to store and manage user identities. It manages the storage of knowledge and data victimization **Azure BLOB** and **Azure SQL** information, too.

2.2 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.

2. Power Query

Power Query is the data transformation and mash up the engine. It enables you to discover, connect, combine, and refine data sources to meet your analysis need. It can be downloaded as an add-in for Excel or can be used as part of the Power BI Desktop.

3. Power Pivot

Power Pivot is a data modeling technique that lets you create data models, establish relationships, and create calculations. It uses Data Analysis Expression (DAX) language to model simple and complex data.

4. Power View

Power View is a technology that is available in Excel, Sharepoint, SQL Server, and Power BI. It lets you create interactive charts, graphs, maps, and other visuals that bring your data to life. It can connect to data sources and filter data for each data visualization element or the entire report.

5. Power Map

Microsoft's Power Map for Excel and Power BI is a 3-D data visualization tool that lets you map your data and plot more than a million rows of data visually on Bing maps in 3-D format from an

Excel table or Data Model in Excel. Power Map works with Bing maps to get the best visualization based on latitude, longitude, or country, state, city, and street address information.

6. Power BI Desktop

Power BI Desktop is a development tool for Power Query, Power Pivot, and Power View. With Power BI Desktop, you have everything under the same solution, and it is easier to develop BI and data analysis experience.

7. Power BI Service

Power BI service is the Software as a Service (SaaS) part of Power BI. It is also known as Power BI Online. To access Power BI Service, you need to log in to Power BI service.

It allows you to connect to data, create reports and dashboards, and ask questions about your data.

8. Power BI Report Server

Power BI Report Server is similar to the Power BI Service. It is an On-Premises server platform. Using Power BI Report Server, organizations can secure their data. It enables the users to create reports and dashboards and allows you to share the reports with other users or organizations with proper security protocols. To use this service, you need to have a Power BI premium license.

9. Power Q&A

The Q&A feature in Power BI lets you explore your data in your own words. It is the fastest way to get an answer from your data using natural language. An example could be what was the total sales last year? Once you've built your data model and deployed that into the Power BI website, then you can ask questions and get answers quickly.

10. Power BI Gateway

Power BI Gateway is used to maintain fresh information by connecting to your on-site data sources without transferring the data. It provides secure data and allows you to transfer the data between Microsoft cloud services and on-premise services. Microsoft cloud services include PowerApps, Power BI, Azure Analysis Services, Microsoft Flow, and Azure logic apps. By using a gateway, organizations can maintain the databases and other data sources securely in cloud services.

11. Power BI Embedded

Power BI Embedded is an On-premises service in Azure. It offers APIs for embedding the reports and dashboards into custom applications. Till now, we have been discussing major components of the Power BI, and now, we will talk about the remaining components of Power BI as well.

12. Power BI Mobile Apps

Using Power BI Mobile Apps, you can stay connected with on-premises data from anywhere. Power BI apps are available for iOS, Windows, and Android platforms.

2.3 Working of Power BI Architecture
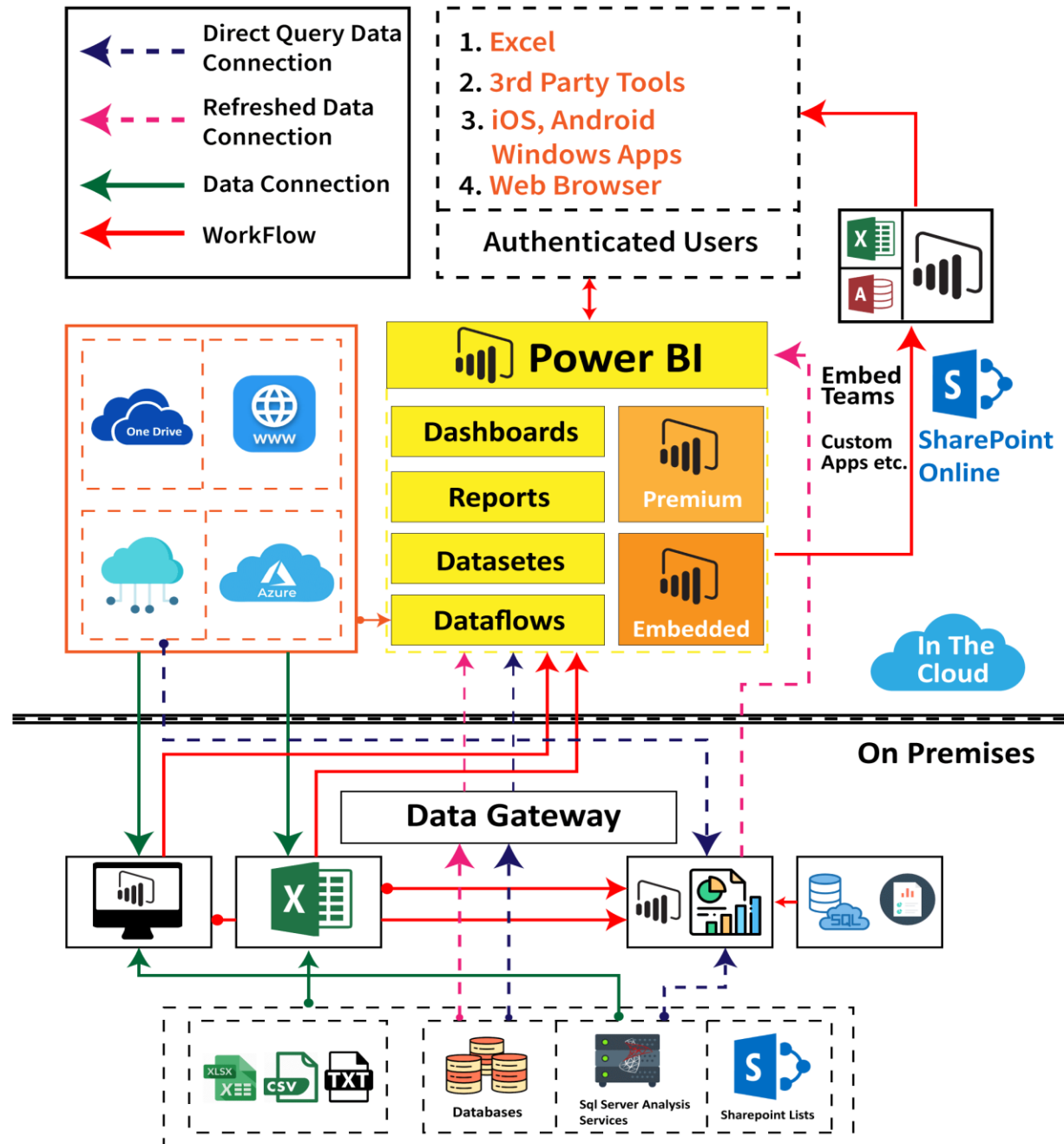
In the above diagram, it is clear that the upper half part represents On-Cloud services, and the lower half part represents the On-Premises services.

On-Premise:

Power BI Desktop is accomplished with the authenticating, development and publishing tools. You can transfer the data from data sources to Power BI Desktop. And also, it allows users to create and publish reports on the Power BI Report Server or Power BI Service.

Power BI Publisher allows you to publish the Excel workbooks to the Power BI Report Server. Report Publisher and SQL server Data tools help in creating the KPIs, datasets, paginated reports, mobile reports, etc. All kinds of reports are published at the Power BI Report Server, and from there, reports are distributed to the end-users.

On-Cloud:

Power BI Gateway is the essential component in the Power BI architecture. The Power BI Gateway acts as a bridge or secure channel to transfer the data from On-premise data to On-cloud data sources or apps.

Cloud side architecture consists of a lot of components including Power suite having datasets, dashboards, reports, Power BI Premium, Power BI Embedded, etc. Users can embed the dashboards, reports into applications, SharePoint, Teams, etc. There are Cloud data sources and they are connected to the Power BI tools.

Deployment

3.1 Power BI Deployment Options

Organizations can choose to deliver and manage their Power BI deployment through IT and standard project workflows or to empower certain business users to take advantage of Self-Service BI capabilities with tools such as Power BI Desktop and Excel. In many scenarios, a combination of IT resources, such as the On-premises data gateway and Power BI Premium capacity, can be combined with the business users' knowledge of requirements and familiarity with data analysis and visualization.

Organizations may also utilize alternative deployment modes per project or with different business teams based on available resources and the needs of the project.

There are three main deployment options when considering Power BI.

- **On-Premises:** Refers to data, applications and infrastructure entirely owned by client at client data center and client has complete control over it.
- **Cloud:** Refers to data, infrastructure and/or services residing in a public cloud environment and completely managed /controlled by third party. Microsoft Azure and web based Power BI service are examples of the cloud offerings.
- **Hybrid:** This denotes to the implementation which spans both on premises and cloud sources which can be services, infrastructure and data sources.

3.2 On-Premises Deployment

Power BI can be deployed on premise three different options . Kindly refer below diagram.

Power BI : On-Premises Deployment Options
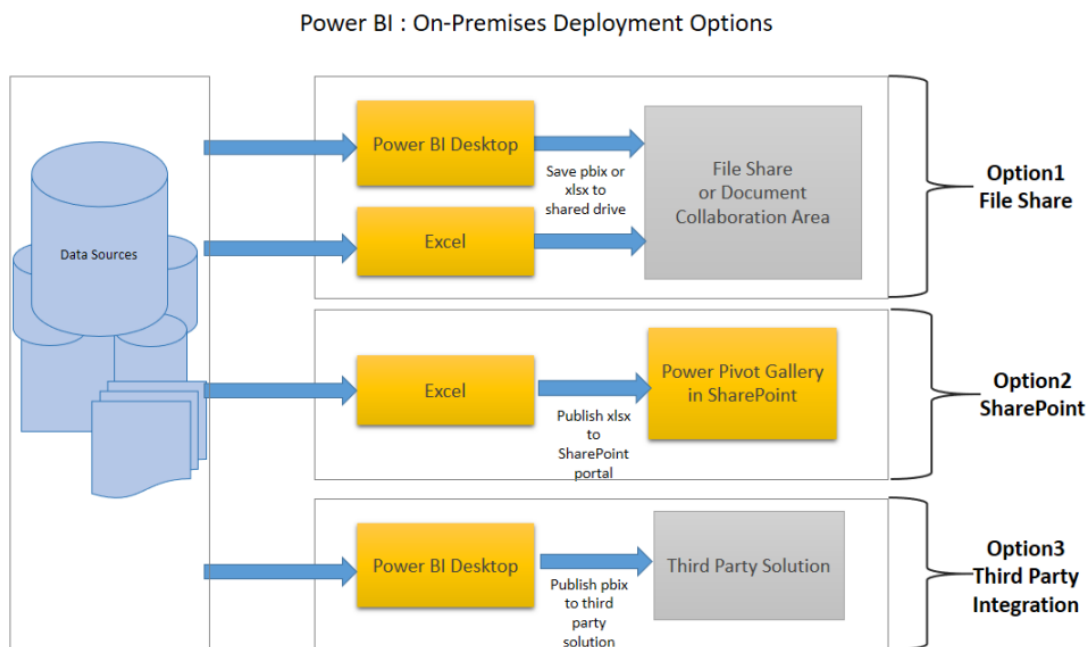
Option 1 : File Share

The first on-premises option involves usage of a file share:

- Data preparation and report creation is done in client tools: Power BI Desktop and/or Excel.

- The completed Power BI Desktop and/or Excel file is published to a file share or a document collaboration area / repository.

- To view the reports, Excel or Power BI desktop has to be installed on the viewer's machine

Option 2 : SharePoint

The second on-premises option involves a specialized document library in SharePoint called the Power Pivot Gallery. Due to my limited knowledge, I am not going in details of this option

- Data preparation and report creation occurs in Excel.

- The completed Excel file is published to SharePoint within a Power Pivot Gallery.

Option 3: Third Party Integration

The third on-premises option involves a third party which integrates with Power BI.

- Data preparation and report creation occurs in Power BI Desktop.

- The completed Power BI Desktop file is published to the third party server

3.3 Hybrid Deployment

Power BI can be deployed in hybrid mode in three different options . Kindly refer below diagram.
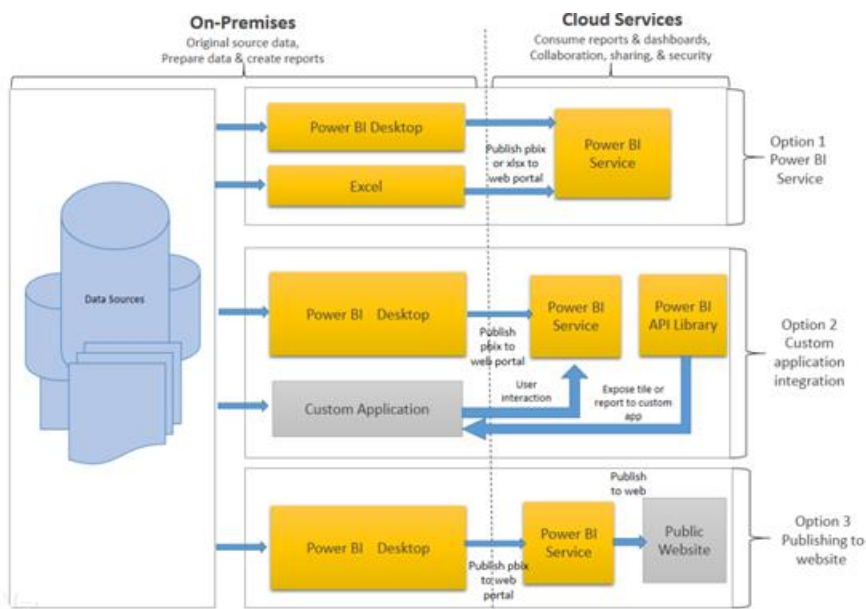
Option 1: Power BI Service

- Data is either from the on premises corporate applications or it might be born in cloud. It can even mix of these two

- Data preparation and report creation occurs in Power BI Desktop or excel

- Completed Power BI reports are then published to Power BI service

- Report consumption, sharing, security, collaboration, data refresh happens in Power BI service

- Dashboards are created in Power BI service and reports can also be edited or created in Power BI service

Option 2: Custom Application Integration

- Data is either from the on premises corporate applications or it might be born in cloud. It can even mix of these two

- Data preparation and report creation occurs in Power BI Desktop or excel

- Completed Power BI reports are then published to Power BI service

- With Power BI API , these reports can be published in custom web application or mobile app within iFrame

- If user interacts with this report, he/she will be redirected to Power BI service

- Application can be on premise or cloud application

Option 3: Public Website

- Data is either from the on premises corporate applications or it might be born in cloud. It can even mix of these two

- Data preparation and report creation occurs in Power BI Desktop

- Completed Power BI reports are then published to Power BI service

- An embed code is generated by Power BI service for selected report and this code can be embedded in web page of the website within iFrame

- Here no security is maintained as its public website, hence suitable for the data which can be made publicly available