ARCHITECTURE DESIGN

DELOITTE CASE STUDY

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Contents

Power BI Architecture Document

1. Introduction

Power BI is a powerful business analytics service from Microsoft that helps businesses visualize their data, share insights, and make data-driven decisions. Power BI's architecture is designed to provide a seamless data experience, from data ingestion and transformation to reporting and collaboration.

This document provides an in-depth overview of the Power BI architecture, including its working model, components, services, and key differences in dashboards and reports, as well as insights into DAX (Data Analysis Expressions).

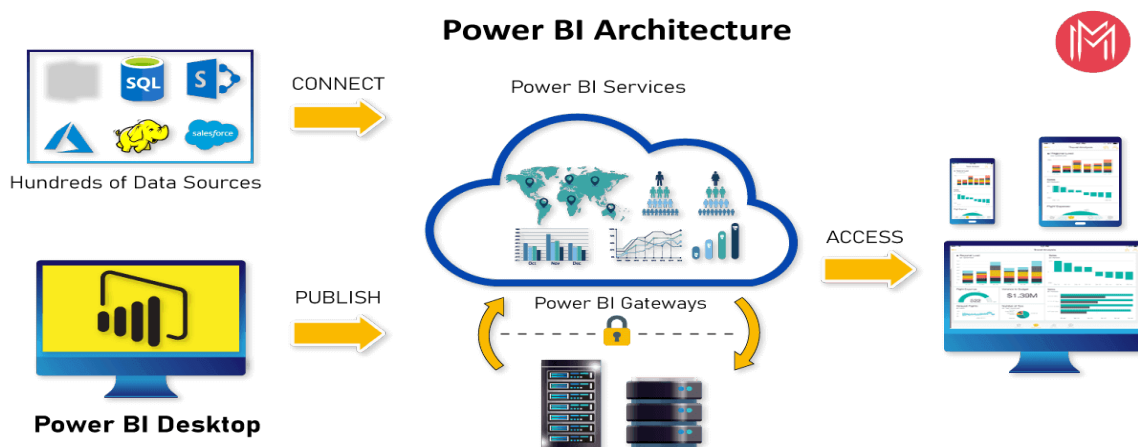
2. Power BI Architecture Overview

Power BI's architecture involves several layers and components that work together to deliver business intelligence solutions. These include data sources, data modeling, Power BI Desktop, Power BI Service, and Power BI Mobile Apps.

2.1 Data Sources

Power BI connects to a wide range of data sources, including:

- On-premises databases (SQL Server, Oracle)
- Cloud-based services (Azure, Google Analytics, Salesforce)
- Excel and CSV files
- Web APIs and OData sources

These data sources are crucial for importing and visualizing data within Power BI.

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3. Working of Power BI Architecture

3.1 On-Premise

In the on-premise environment, Power BI relies on the **Power BI Gateway** to establish a connection between on-premises data sources and Power BI Services. The architecture allows businesses to keep their data secure within their internal infrastructure while still enjoying the benefits of Power BI's visualization and reporting capabilities.

Key components in the on-premise architecture:

- **Power BI Desktop**: Used for data modeling, transformation, and report creation.
- **Power BI Gateway**: Provides secure access to on-premises data sources for real-time data refresh and querying.

Data Flow in On-Premise:

- Data is imported into Power BI Desktop or directly queried through the Power BI Gateway.
- Data models and reports are created locally and then published to Power BI Service for sharing and collaboration.

3.2 On-Cloud

In the on-cloud architecture, Power BI leverages Microsoft Azure's cloud computing platform to store, process, and visualize data. The Power BI Service is hosted on the cloud, which means users can access reports and dashboards from anywhere, at any time.

Key components in the cloud architecture:

- **Power BI Service**: The cloud platform for publishing, sharing, and collaborating on Power BI reports.
- **Dataflow**: This allows ETL (Extract, Transform, Load) processes to run on the cloud, removing the need for on-premises infrastructure.

Data Flow in On-Cloud:

- Data is uploaded to Power BI via the Power BI Service.
- Once in the cloud, data can be refreshed and visualized with minimal latency.
- Collaboration and sharing can occur in real-time, supporting a more agile decision-making process.

Working of Power BI Architecture
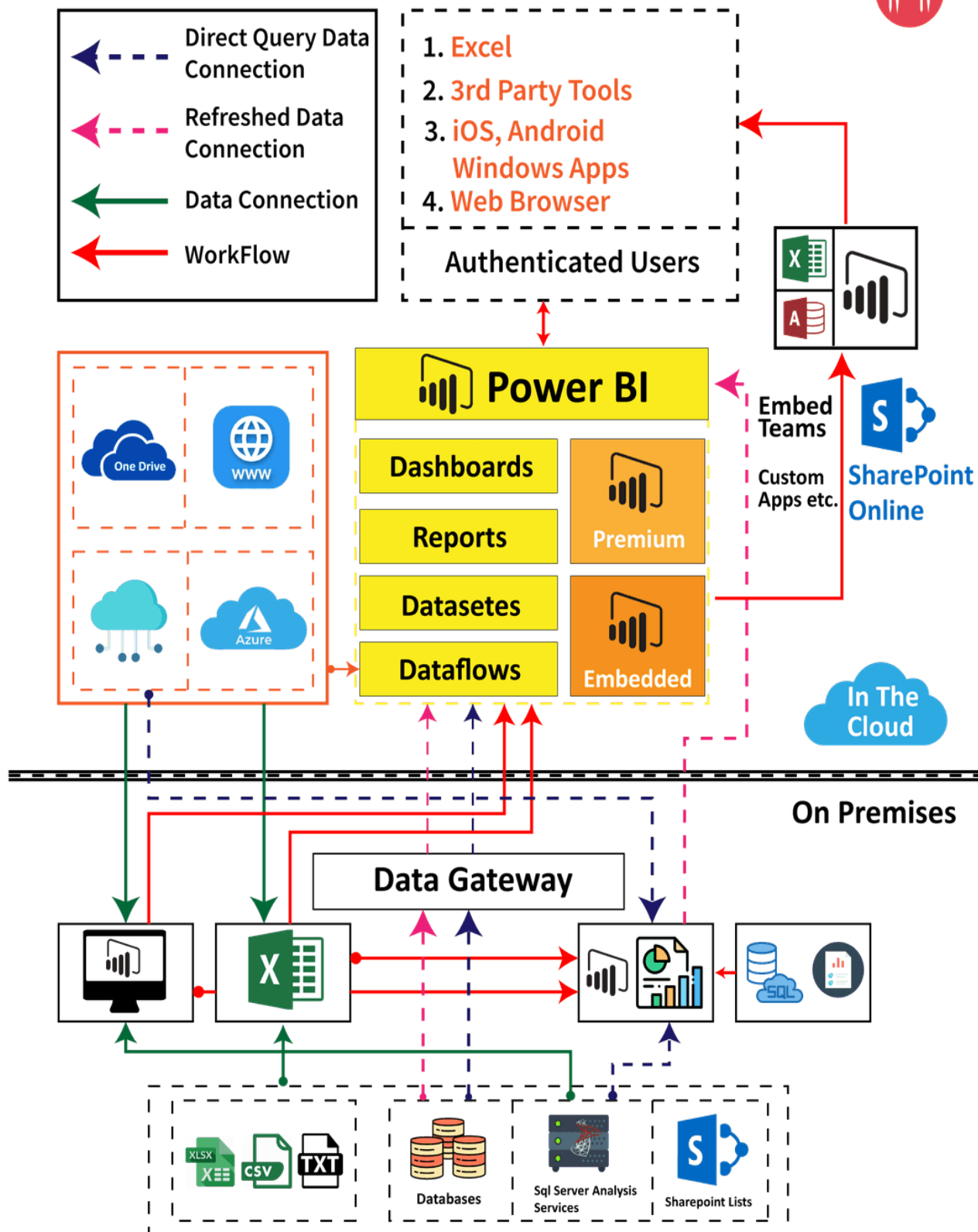
4. Power BI Service

The Power BI Service is a cloud-based environment where users publish, share, and collaborate on reports and dashboards. The service is divided into front-end and back-end clusters for efficient data processing and interaction.

4.1 Front End Cluster

The front-end cluster handles the user interface for report viewing and interaction. It includes:

- **Reports and Dashboards**: Accessible to end users via the web portal.
- **Power BI Apps**: For mobile access, with optimized user experiences on smartphones and tablets.
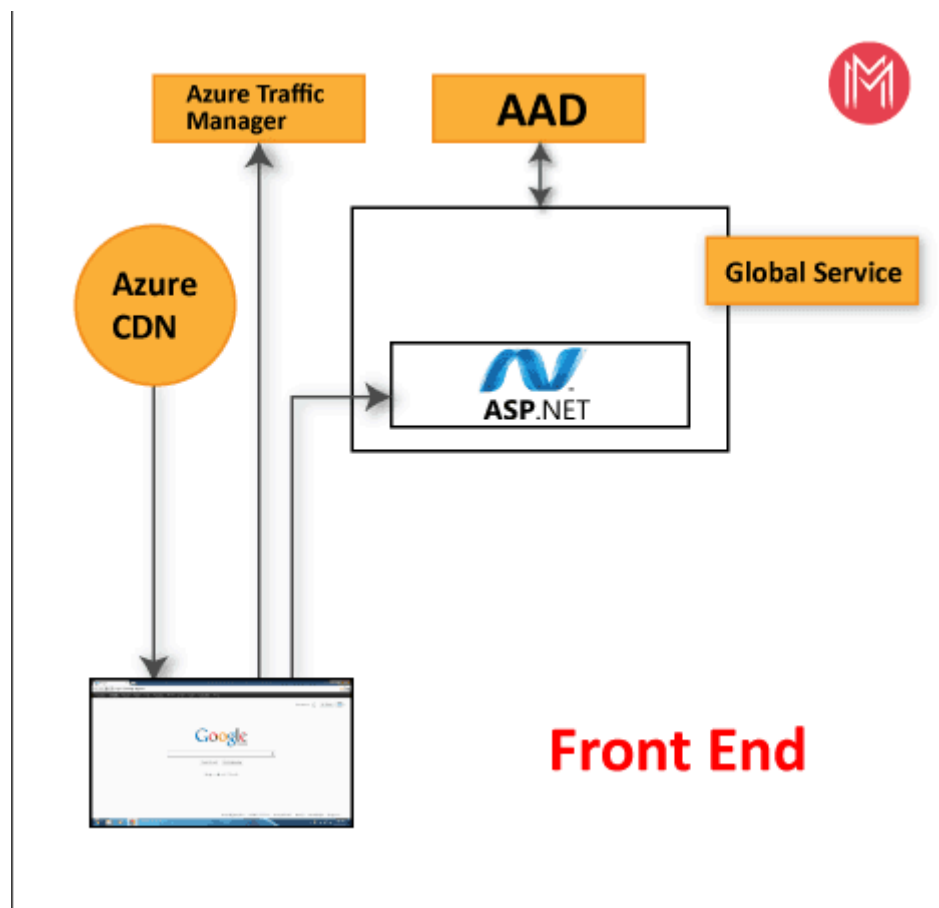
4.2 Back End Cluster

The back-end cluster is responsible for data processing and storage. This includes:

- **Data Refresh**: Scheduling automatic updates for datasets.
- **Data Management**: Handling the connections to various data sources, including on-premises databases and cloud-based sources.
- **Storage**: Provides secure and scalable storage for datasets and reports.
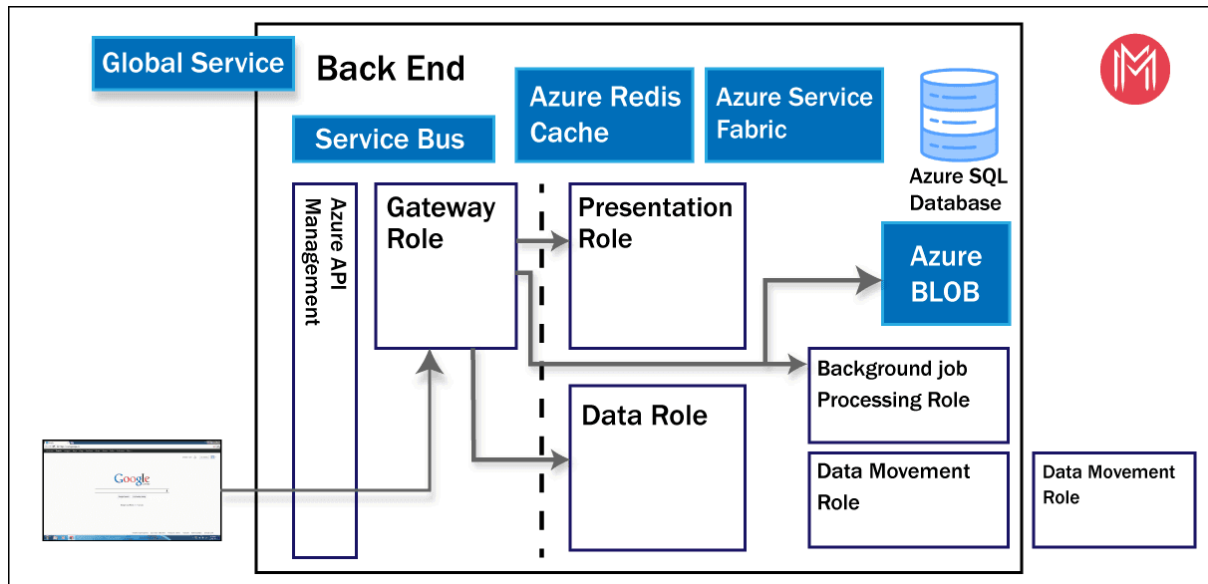
4.3 Working of Power BI Service

The Power BI Service facilitates the following workflows:

- **Data Refresh**: Datasets published to the Power BI Service are scheduled for automatic refreshes.
- **Collaboration**: Users can share reports and dashboards in Power BI Workspaces, where team members can collaborate on data analysis.
- **Real-Time Dashboards**: Data in Power BI is visualized in real time, allowing businesses to respond quickly to emerging trends.

5. Power BI Components

Power BI's architecture is built around several components, each serving a specific function to help users design and share data insights. The main components include:

1. **Power BI Desktop**: A Windows application for creating data models and reports.
2. **Power BI Service**: A cloud-based platform for sharing and collaborating on reports and dashboards.
3. **Power BI Gateway**: A bridge between on-premises data sources and the Power BI cloud service.
4. **Power BI Mobile Apps**: Mobile applications for accessing reports on iOS and Android devices.
5. **Power BI Report Server**: An on-premises solution for report management.
6. **Power BI Visualizations**: Pre-built and custom visual elements for displaying data insights.
7. **Power BI Workspaces**: Containers within the Power BI Service for organizing and managing content.

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6. Difference Between Dashboards and Reports

Reports:

- A Power BI report is a multi-page view of your data, where each page contains multiple visualizations like charts, tables, maps, etc.
- Reports allow interactive exploration and analysis.

Dashboards:

- A Power BI dashboard is a single-page view that collects visualizations from different reports and datasets.
- Dashboards are primarily designed to give high-level insights and summaries of key metrics.

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7. Power BI DAX (Data Analysis Expressions)

DAX is a powerful formula language used in Power BI to define custom calculations in reports and data models. It is used for creating calculated columns, measures, and calculated tables.

7.1 Syntax

The syntax of DAX is similar to Excel formulas but optimized for handling large datasets. DAX uses functions, operators, and constants to define expressions.

Example Syntax:

```
Total Sales = SUM(Sales[Amount])
```
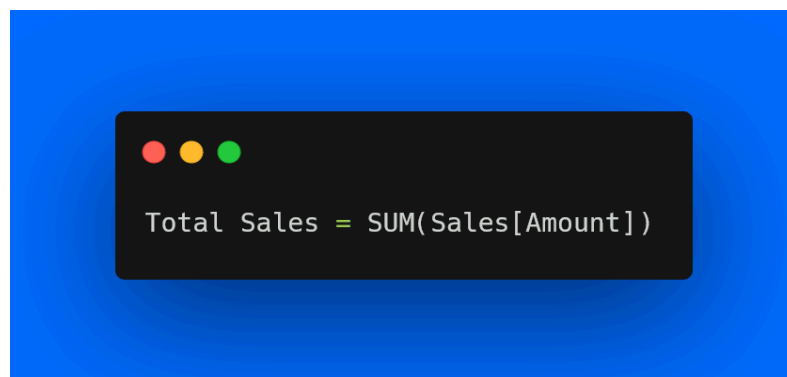
7.2 Context

There are two primary types of context in DAX:

- **Row Context**: The context in which a row of data is evaluated.
- **Filter Context**: The filters applied to a dataset, which can affect the values calculated by DAX expressions.

7.3 Functions

DAX includes a wide variety of functions to perform calculations, including:

- **Aggregate functions**: SUM, AVERAGE, MIN, MAX
- **Logical functions**: IF, AND, OR
- **Date and Time functions**: YEAR, MONTH, DATEADD
- **Statistical functions**: MEDIAN, COUNTROWS

7.4 Calculated Columns and Measures

- **Calculated Columns**: These are new columns added to a table based on an expression. They are computed during data refresh and stored in the data model. **Example**:

```
Profit Margin = Sales[Revenue] - Sales[Cost]
```

- **Measures**: These are calculations used in aggregations or visualizations, evaluated at query time. They are dynamic and do not take up storage space.

  Example:

```
Total Profit = SUM(Sales[Profit])
```
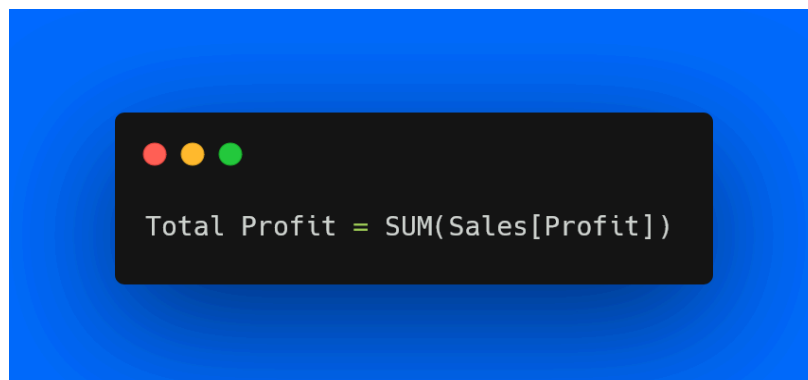
8. Conclusion

Power BI provides a comprehensive architecture that supports both on-premises and cloud-based environments, making it highly flexible for businesses of all sizes. By understanding the components, data flow, and the critical role of DAX in data modeling, users can unlock the full potential of Power BI for business intelligence and decision-making.

This document has explored the key components of Power BI, including its service architecture, the difference between reports and dashboards, and the role of DAX in Power BI's calculations. By leveraging these features, organizations can create powerful data solutions that drive actionable insights.