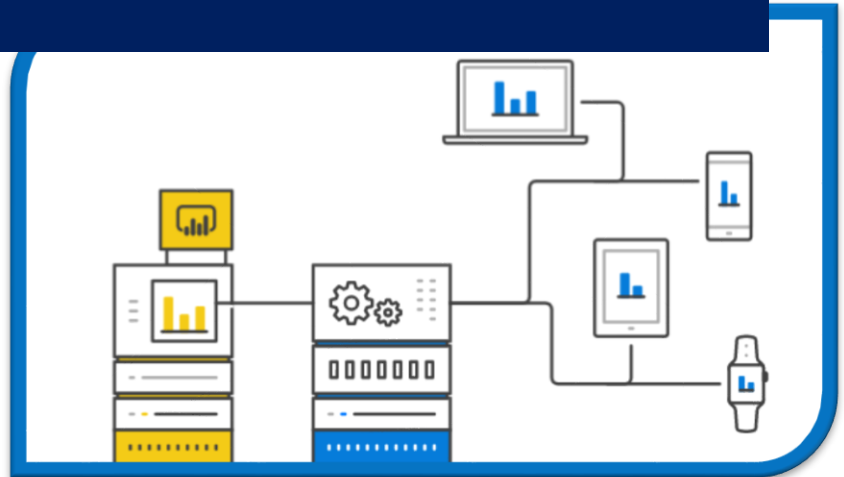


Power BI Consulting Services



Cognitive Convergence

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Cognitive Convergence is Subject Matter Expert in Office 365, Dynamics 365, SharePoint, Project Server, Power Platform: Power Apps-Power BI-Power Automate-Power Virtual Agents.

We offer Power BI consulting services covering solution architecture refinement, customization, integration, transformation, visualization and analytics to uncover insights hidden within data and enhance data exploration.

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OBJECTIVES

The objective of this white paper is to identify consulting services regarding Power BI that Cognitive Convergence offer.

Power BI

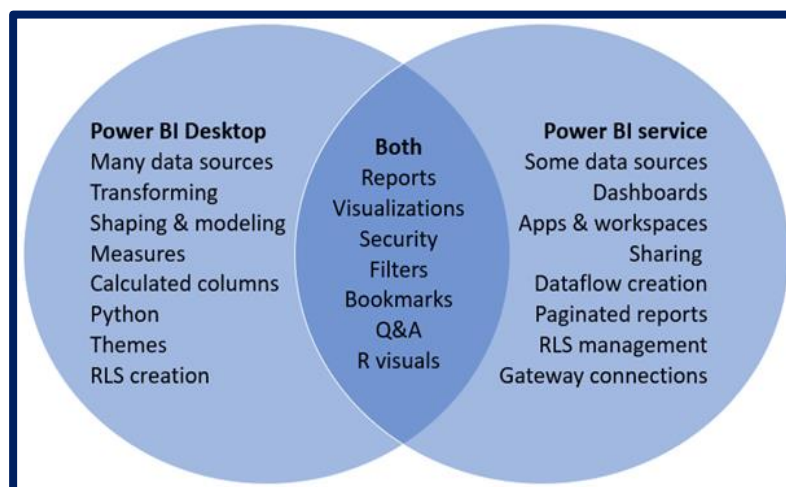
Microsoft Power BI is a business intelligence platform that provides nontechnical business users with tools for aggregating, analyzing, visualizing, and sharing data. Power BI's user interface is intuitive for users familiar with Excel and its deep integration with other Microsoft products makes it a very versatile self-service tool that requires little upfront training.

SOLUTION ARCHITECTURE

One of the most famous BI solutions is Power BI which provide a large range of services. Which provides its own unique and some common functionalities. Usually reporting and analysis of data is linked with data scientists or analysts, Power BI allow users to transform and analyze data, create reports of it without having extraordinary strong technical background. It allows data from both cloud and from on-premises. "Power BI is a cloud-based business analytics suite provided by Microsoft, helping users pull different data sources into one dashboard where they can extrapolate insights from immersive visuals.

Different Editions of Power BI

Usually reporting and analysis of data is linked with data scientists or analysts, Power BI allow users to transform and analyze data, create reports of it without having extraordinary strong technical background. It allows data from both cloud and from on-premises. "Power BI is a cloud-based business analytics suite provided by Microsoft, helping users pull different data sources into one dashboard where they can extrapolate insights from immersive visuals." Power BI have different editions to connect data and upload it in form of report, dashboard, or app after required transformation, whether it is on-premises data or cloud base. It provides Power BI Desktop, Power BI Service, (Power BI Pro, Power BI Premium), Power BI Mobile, Power BI Embedded, Power BI Report Server.



Power BI Desktop and the Power BI service

Power BI desktop is used to transform and modeling of data, Power BI online services is used for sharing and collaboration of data. Power BI gateway is used to refresh the data and corresponding report and Power BI mobile applications are used for mobile view of dashboards in app. All these services play a vital role in BI.

Power BI Desktop is a window (on premises) version also known as Power BI Designer. It provides capability to create reports and analysis of data. It enables data connection from a wide range of sources along with transformation of data in Query Editor without any need of internet connection, which only requires for report publishing or importing custom visuals.

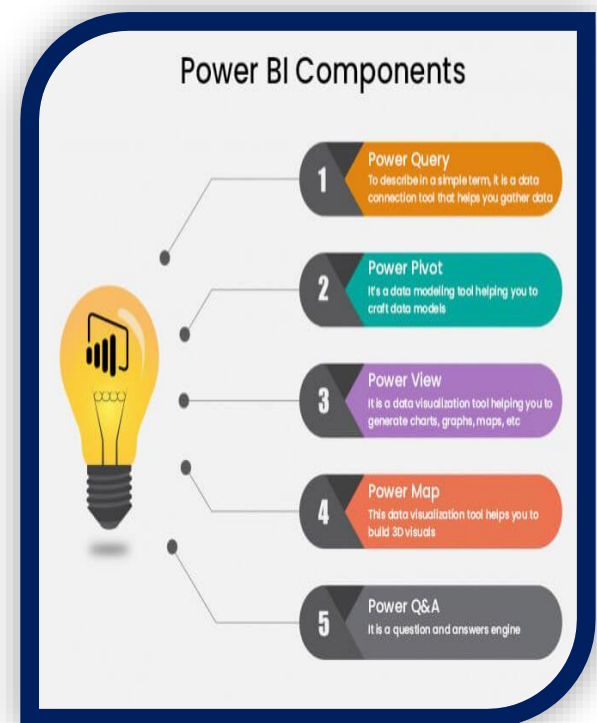
Power BI services enable report editing and creation along with collaboration, it is a cloud base service also known as Power BI Portal or Power BI Online. But there are a lot of limitations when comes to data modeling but provides a wide range of data connections. It allows to share reports and get notifications of report after every update in data.

Different Components of Power BI

Power BI have different editions to connect data and upload it in form of report, dashboard or app after required transformation, whether it is on-premises data or cloud base. It provides Power BI Desktop, Power BI Service, (Power BI Pro, Power BI Premium), Power BI Mobile, Power BI Embedded, Power BI Report Server. Power BI made of 5 main components, these components released in the market separately, and they can be used even individually. Components of Power BI are:

- Power Query: Data mash up and transformation tool.
- Power Pivot: In-memory tabular data modelling tool
- Power View: Data visualization tool
- Power Map: 3D Geo-spatial data visualization tool
- Power Q&A: Natural language question and answering engine.

Data mash up can be done with Power Query and load the result set into Power Pivot model. Power Pivot helps in understanding the relationship among data. This data is then use for data visualization in Power View or Power Map. There is fortunately a great development tool that combines three main components of Power BI. Power BI Desktop is the tool that gives combined editor of Power Query, Power Pivot, and Power View. Power BI Desktop is available as stand-alone product that can be downloaded separately. With Power BI Desktop you will have all parts of the solution in one holistic view.



POWER BI CONSULTING SERVICES

Power BI have several consulting services that enhances the range of functionalities that power BI provide. These services allow integrating a number of resources with Power BI and generate a wide range of solution.

1. APPSOURCE POWER BI VISUALS

Power BI comes with many out-of-the box Power BI visuals. These visuals are available in the visualization pane of both Power BI Desktop and Power BI service, and can be downloaded from AppSource, these visuals can be used for creating and editing Power BI content. These visuals are needed to meet the advance and complex requirements of data representation. Custom visuals available in AppSource and within the integrated custom visuals store for Power BI Desktop are all approved for running in browsers and on mobile devices via the Power BI mobile apps. Additionally, certified custom visuals have met a set of code requirements and have passed strict security tests.

1.1. ADDING A CUSTOM VISUAL

Custom visual can be added in Power BI either by direct import from store, or download .pbviz file from AppSource or import in Power BI as file.

1.2. Development of custom visual

Developers can create custom visual for Power BI to meet their complex requirements and data needs. Power BI visuals are packages that include code for rendering the data served to them.

2. APPSOURCE POWER BI APPS

Power BI apps allow to create collections of dashboards and reports and publish these collections as apps to whole organization or to specific people or groups. For a report creator or admin, apps make it easier to manage permissions on these collections. Access data from anywhere with the Power BI app. Get notifications, annotate, and share, and dive deep into data with powerful features for decision making on the go. Get the full Power BI suite and never miss a beat with Power BI Desktop, the Power BI web service, and Power BI Mobile. Template Apps provide the option to explore the app with sample data or we can use our own data, it also provide the facility to customize the app and save it as an organizational app

2.1. Using Power BI Apps

Microsoft and community members contribute Power BI Apps for organization benefit and publish them to the AppSource. Download these apps and a Power BI report from them or find and install apps from Microsoft AppSource. Only apps that can access are displayed.

Our Power BI consulting service is based on 10+ years of experience.

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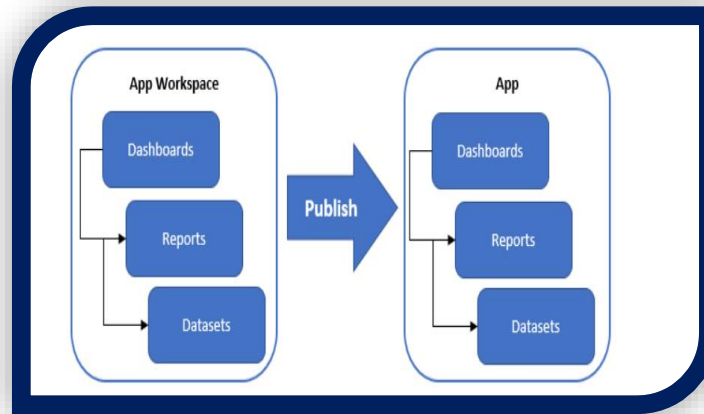
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2.2. Creating APP and publish on AppSource

App Workspaces are a place to collaborate in Power BI and create new Power BI Apps. Users can add the app by going to Get Data. The app created can be used in these workspaces and can also be published in AppSource.



3. APPSOURCE POWER BI TEMPLATE APPS

The new Power BI template apps enable Power BI partners to build Power BI apps with little or no coding, and deploy them to any Power BI customer which they can download from AppSource. If create Power BI reports and dashboards, can become a template app builder and builds and packages analytical content into an app. Power BI tenant admins govern and control who in their organization can create template apps, and who can install them. Those users who are authorized can install template app, then modify it and distribute it to the Power BI consumers in their organization.

3.1. Get the Template app from Microsoft AppSource

Power BI tenant admins govern and control who in their organization can create template apps, and who can install them. Those users who are authorized can install template app, then modify it and distribute it to the Power BI consumers in their organization.

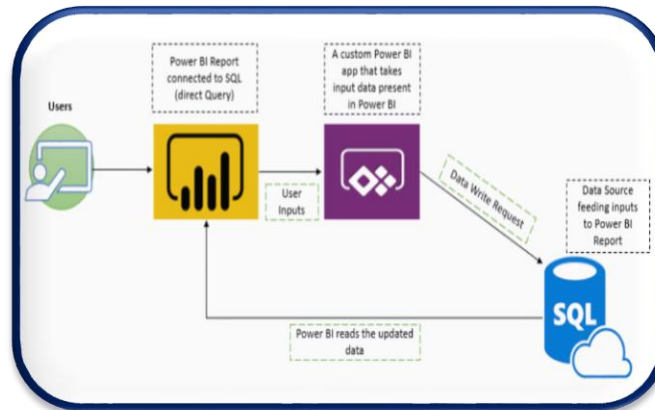
3.2. Creating a Template APP

A template can be created in Power BI Desktop as a Report using custom visual or built-in visual, with visual interaction and then creating a template app. These template apps can be published on AppSource.



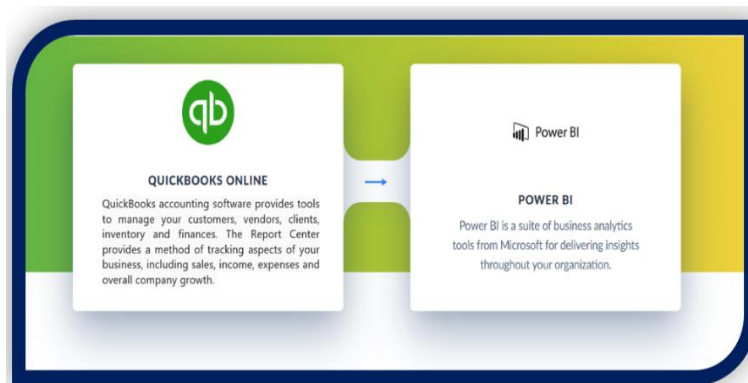
4. POWER APPS VISUAL FOR POWER BI

Power BI visual contains a default visual of Power Apps in it in the Visualization pane, by click on it one may add the visual and select either to create a new app using the current data loaded in Power BI or use the already created app. Power app visual provide a pathway to get power apps in Power BI or create a fully new Power App with selected data fields of data used in Power BI reports. It removes the limitation to data analysis in Power BI but now enables Data entry app, scenario simulation, order management app of own data in Power BI using Power Apps. The beauty of this visual lies in how it tells about the step need to perform with it, it gives you instructions on how to use it.



5. POWER BI INTEGRATION WITH QUICKBOOK

QuickBooks Online has become the go-to cloud-based accounting service. With Power BI content pack for QuickBooks Online, can immediately visualize finance data and uncover new insights into cash flow, profitability, and customers. Share QuickBooks Online data with colleagues in a Power BI report and dashboard, refresh data on a schedule or on demand, and monitor the latest income and expenses on the go with the native Power BI app for mobile device



5.1. QuickBook App in AppSource?

QuickBook app is available in AppSource which is free app provided by Microsoft. QuickBook app provided in AppSource. When connecting QuickBooks data to Power BI, it immediately gets a Power BI dashboard and Power BI reports. These dashboard and report can be used as they are or customize them to highlight the information needed most. The data is refreshed automatically once a day. The QuickBooks Online content pack in Power BI enables to connect to your QuickBooks Online account in just minutes.

5.2. QuickBook (BETA) data

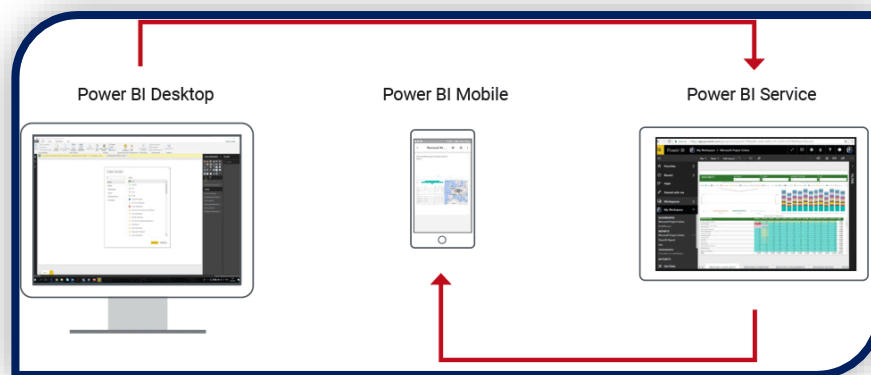
The alternative method to connect QuickBook data with Power BI is through fetching QuickBook (BETA) data in Power BI Desktop. In this way we can make our own QuickBooks App for our custom use as Microsoft provided QuickBook app.

6. POWER BI DASHBOARD - MOBILE STRATEGY

Power BI mobile apps is used to view and work with shared dashboards and reports in a mobile environment. It is available for iOS and Android. Thanks to the real-time reports and dashboards, always keep an overview regardless of location and time. Access local data stored in SQL Server and data in the cloud. Keep an eye on KPIs and reports: with Power BI Mobile apps, have an overview of data on the go. Power BI offers a set of mobile apps for iOS, Android, and Windows 10 mobile devices. In the mobile apps, connect to and interact with cloud and on-premises data.

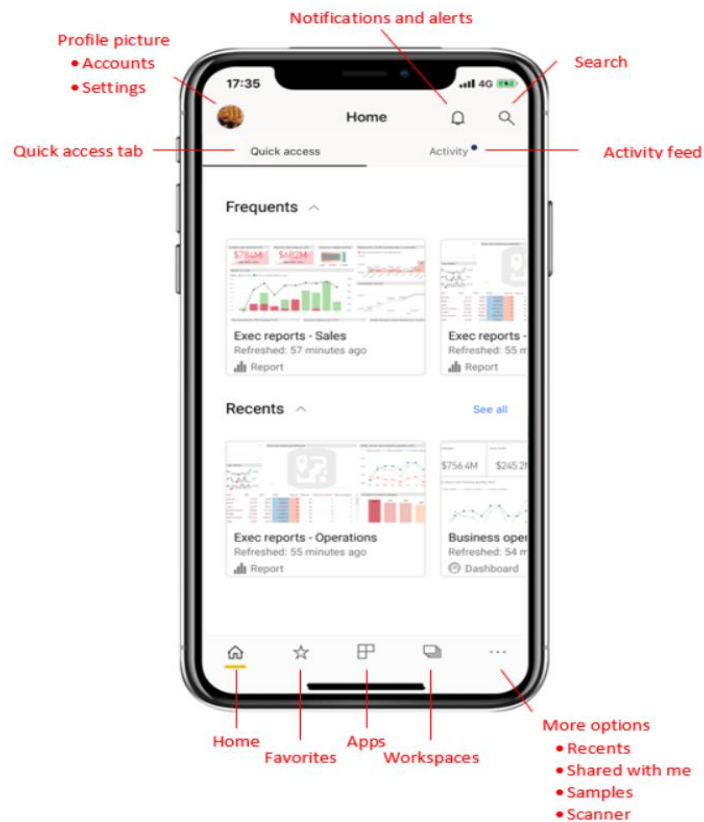
6.1. Development Lifecycle

Development lifecycle starts with either creating mobile view (optimized/unoptimized) in Power BI Desktop and then view it in Power BI Mobile or posting in Power BI Service and then creating a Mobile View Dashboard.



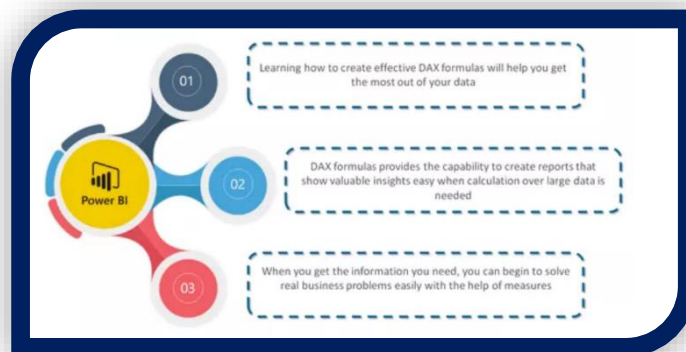
6.2. Mobile app

When Power BI Mobile app open, it lands on the home page, where it has quick access to most frequently or recently visited reports, dashboards, and apps. In addition, there is an activity feed that keeps up to date about.



7. POWER BI - DATA ANALYSIS EXPRESSIONS (DAX)

DAX (Data Analysis Expressions) is a formula expression language and can be used in different BI and visualization tools. DAX is also known as function language, where the full code is kept inside a function. In DAX, functions can contain other nested functions, conditional statements, and value references. Execution in DAX starts from the innermost function or parameter, and works outward. DAX is designed to work with tables.



There are two primary calculations that can be created using DAX:

7.1. Calculated Columns

The calculated columns create a new column in your existing table. The only difference between a regular column and a calculated column is that it is necessary to have at least one function in the calculated column. These are used when you want to create a column with filtered or sorted information.

7.2. Calculated Measures

A calculated measure creates a field having aggregated values such a sum, ratios, percentages, averages, etc.

8. EMBED POWER BI IN APPS, WEBSITES, AND PORTALS

With Power BI Embedded, for application developers, it allows to embed visual analytics in products, so users and customers can gain valuable insights, and can get to market fast. To embed Power BI in application or portal, it requires a Power BI pro account with a master user, or a service principal enabling app to securely access Power BI dashboards, reports, and visualizations. Create rich, interactive reports with visual analytics for embedding with Power BI Desktop, or visit AppSource to find a workshop or a Power BI expert to help get started.

8.1. Embed a report web part in SharePoint Online

With Power BI's new report web part for SharePoint Online, allow easy embed interactive Power BI reports in SharePoint Online pages. When using the new Embed in SharePoint Online option, the embedded reports are fully secure, in order to create secure internal portals.

8.2. EMBED POWER BI REPORT IN MICROSOFT TEAMS

With the Power BI tab for Microsoft Teams, embed interactive reports in Microsoft Teams channels and chats is easy. Use the Power BI tab for Microsoft Teams to help colleagues find the data, team uses and to discuss the data within team channels. When paste a link to reports, dashboards, and apps into the Microsoft Teams message box, the link preview shows information about the link.

8.3. EMBED IN A WEBSITE OR BLOG

With the new Embed option for Power BI reports, it allows easy and secure embed reports in internal web portals. These portals can be cloud-based or hosted on-premises, such as SharePoint 2019. Embedded reports respect all item permissions and data security through row-level security (RLS). They provide no-code embedding into any portal that accepts a URL or iFrame. The Embed option supports URL filters and URL settings. It allows to integrate with portals using a low-code approach requiring only basic HTML and JavaScript knowledge.

Our Power BI consulting team stands for high quality and results that drive innovation and empower

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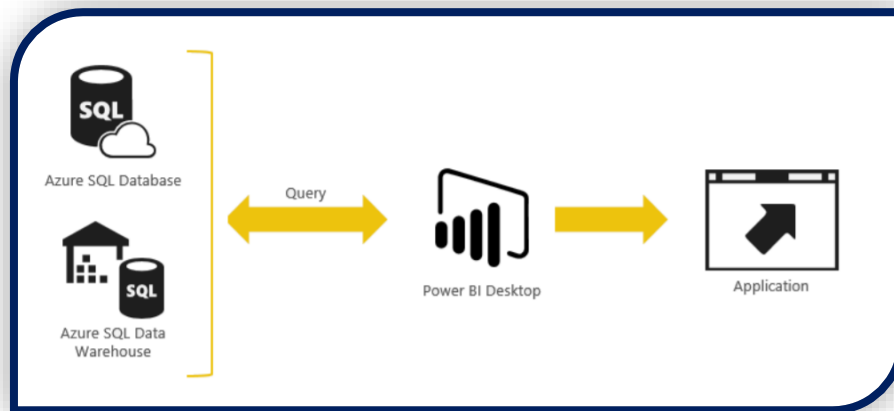
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8.4. EMBED ANALYTICS IN OWN APPLICATION

With Power BI Embedded, integrate Power BI reports right into web or mobile applications. Power BI Embedded is an Azure service that enables ISVs and app developers to surface Power BI data experiences within their applications. Developer, built applications, and those applications have their own users and distinct set of features. Those apps may also happen to have some built-in data elements like charts and reports that can now be powered by Microsoft Power BI Embedded. It does not require a Power BI account to use app.



9. MICROSOFT.POWERBI.API

MICROSOFT.POWERBI.API is a .NET Client library for Microsoft Power BI public REST endpoints providing access to Workspaces, Reports, Datasets and more. Power BI API provides service endpoints for embedding, user resources, and administration.

9.1. AZURE-HOSTED SERVICE

Power BI Embedded is an Azure-hosted service which allows users to embed the reports into external applications. The most important advantage of Power BI Embedded is that users don't need to have a Power BI service accounts and licenses to access Power BI reports via the application.

9.2. NuGet client tools

To work with NuGet, as a package consumer or creator, can use command-line interface (CLI) tools as well as NuGet features in Visual Studio. Packages are installed into a Visual Studio project using the NuGet Package Manager, the Package Manager Console.

9.3. Install Package from NuGet

```
Install-Package Microsoft.PowerBI.Core
```

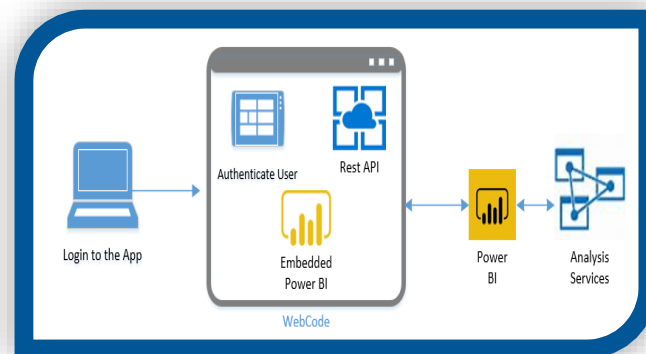
10. MICROSOFT POWERBI REST API

Using Power BI REST API, create apps that integrate with Power BI reports, dashboards, and tiles. With Power BI REST API, it is possible to perform management tasks on Power BI objects like reports, datasets, and workspaces. IT allows to embed reports, dashboards, and tiles for Power BI users and Non-Power BI users. Perform management tasks on Power BI objects. Extend an existing business workflow to push key data into a Power BI dashboard. Authenticate to Power BI.

10.1. Development Patterns of Microsoft Power BI Rest API

Power BI Rest API provide different development methods all demand Authentication of Power BI, either direct authentication to Power BI server or first registering app in Azure and then authenticate the app with help of application id. The use these rest API HTTP in development patterns to achieve required results.

1. Register Power BI App in Azure
2. Test in Power BI Rest API Try-it Window
3. Test API in Postman
4. Implement Rest API in PowerShell.
5. Querying Rest API using C#



11. POWER BI WITH PYTHON

The addition of Python integration in Power BI is one of the greatest things that Microsoft could have done. This gives the user the ability to utilize amazing visual libraries such as Seaborn. Beyond visualization, you can also utilize some of the machine learning packages.

11.1. Development Patterns of Microsoft Power BI Rest API

Power BI Rest API provide different development methods all demand Authentication of Power BI, either direct authentication to Power BI server or first registering app in Azure and then authenticate the app with help of application id. The use these rest API HTTP in development patterns to achieve required results.

1. Register Power BI App in Azure

2. Install libraries
3. Get Access Token
4. Use API

11.1.1. *Pypowerbi*

A python library for Microsoft's Power BI.

Installation command:

```
pip install pypowerbi
```

11.1.2. *Microsoft Azure Active Directory Authentication Library (ADAL) for Python*

The ADAL for Python library enables python applications to authenticate with Azure AD and get tokens to access Azure AD protected web resources.

Installation command

```
pip install adal
```

11.2. Python scripts in Power BI Desktop

To run Python scripts in Power BI Desktop, need to install Python on local machine. The current Python scripting release supports Unicode characters and spaces in the installation path. The Power BI Python integration requires the installation of two Python packages:

```
pip install pandas  
pip install matplotlib
```

- Python script can use to create dataset in Power BI Desktop
- Python Script can use for modeling of data in Power BI Desktop.
- Create attractive visuals in Power BI.

Our BI consultants with vast experience in adoption and customization of Power BI.

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12. MICROSOFT.POWERBI.JAVASCRIPT

JavaScript library for embedding Power BI into your apps.

12.1. Installation

12.1.1. *Install via Nuget:*

```
Install-Package Microsoft.PowerBI.JavaScript
```

12.1.2. *Install from NPM:*

```
npm install --save powerbi-client
```

12.1.3. *Installing beta versions:*

```
npm install --save powerbi-client@beta
```

12.2. Include the library via import or manually

The library is exported as a Universal Module and the powerbi.js script can be included before app's closing `</body>` tag as:

```
<script src="/powerbi-client/dist/powerbi.js"></script>
```

When included directly, the library is exposed as a global named powerbi-client. There is also another global named powerbi which is an instance of the service.

REASONS TO USE POWER BI

There are a number of business intelligence tool available which owns fascinating features but Microsoft provided Power BI is best choice among all. Microsoft's data analysis tool Power BI is especially suitable for analyzing data from Dynamics NAV, data visualization and reporting reports.

1. Power BI provides a strong backend data manipulation feature with access to simple visualizations.
2. Power BI has a limit of 1GB data in free version.
3. Power BI covers most of the data sources available in Tableau. It is closely integrated with Office 365, hence provides connectivity to SharePoint.

4. Power BI online version also supports direct visualization on Search Engine, though, only Bing is supported at this point
5. Power BI provides a free version with 1GB limit on dataset. Power BI Pro is also a cheaper solution when compared with any other BI tool.
6. Power BI uses cloud storage and includes simple implementation process.
7. Once have a dashboard created can access it from just about anything. The web app is excellent for both displaying and editing reports from the desktop. The iOS and Android apps allow you to use reports on the go. For those who are after something with enough features to write a book on then there is the Microsoft Power BI Desktop, where can model, transform, and visualize data to heart's content.

KEY FEATURES

Microsoft has added a number of data analytics features to Power BI since its inception and continues to do so. Some of the most important features include:

Artificial Intelligence

Users can access image recognition and text analytics in Power BI, create machine learning models using automated machine learning capabilities and integrate with Azure Machine Learning.

Hybrid deployment support

This feature provides built-in connectors that allow Power BI tools to connect with a number of different data sources from Microsoft, Salesforce and other vendors.

Quick Insights

This feature allows users to create subsets of data and automatically apply analytics to that information.

Common data model support

Power BI's support for the common data model allows the use of a standardized and extensible collection of data schemas (entities, attributes and relationships).

Customization

This feature allows developers to change the appearance of default visualization and reporting tools and import new tools into the platform.



APIs for integration

This feature provides developers with sample code and application performance interfaces (APIs) for embedding the Power BI dashboard in other software products.

Self-service data preparation

Using Power Query, business analysts can ingest, transform, integrate and enrich big data into the Power BI web service. Ingested data can be shared across multiple Power BI models, reports and dashboards.

Modeling view

This allows users to divide complex data models by subject area into separate diagrams, multiselect objects and set common properties, view and modify properties in the properties pane, and set display folders for simpler consumption of complex data models.

LIMITATIONS OF POWER BI

Complex in nature

This is one of the major drawbacks as Microsoft has designed Power BI in a very complex manner. Power BI has a long list of components and it is difficult to understand which component you may need. To name a few, there's Power Bi Desktop, the Power BI Gateway, the Power BI Services etc.

Inappropriate behavior with bulky data

If you have a large data set which needs to be analyzed, Microsoft Power BI will not be the best option for you. You might face trouble in connecting and importing large datasets, as well as problems such as slow performance and time-outs.

Performance Issues

Sometimes Power BI might face performance issues as it has been observed that it has not been able to process more than 20000-30000 rows without running into issues for some queries. It might just timeout during the processing.

User Interface

The formula help window and side bar often block the view of vital, making the user interface of Power BI to be very bulky. The making of scrolling dashboard will require a lot of efforts since it is not a native feature.



Limited Sharing of Data

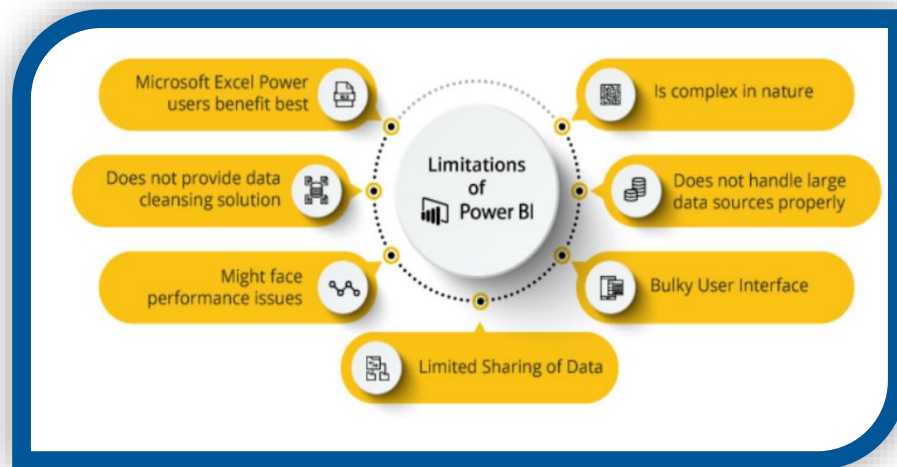
Reports and dashboards can be shared only with those users who have the same email domains or the ones who have their email domains listed in your Office 365 tenant.

Visuals Configurability

Although the native visuals and to a large part the custom visuals are not configurable. There is often a desire to optimize a visual but there are limitations in what can be changed.

Rigid Formulas

As we know, the expression language used to deal with data in Power BI is DAX. However, can perform a lot of actions using the DAX formula in Power BI, it is still not the easiest language to work with. Sometimes the formulas create work well in Power BI, sometimes they do not. Can concatenate up to two elements but concatenating more than two elements needs nesting statements.



CONCLUSION

This paper discusses consulting services of Power BI that Cognitive convergence work with. This paper describes solution architecture as well as the services like custom visuals, AppSource app and integration with other services and use of Power BI APIs and many more. Why power BI is best choice beside its limitations are also discussed.

Cognitive Convergence will provide consulting services that help in designing, deploying, managing, enhancing or troubleshooting on-premises, cloud-based or hybrid Power BI environment. Cognitive Convergence will provide help to start fresh with Power BI to modernize current business analytics solution or revamp existing Power BI deployment by incorporating new data sources or adding new services.

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