

Power BI Architecture End-to-End

July 22, 2020

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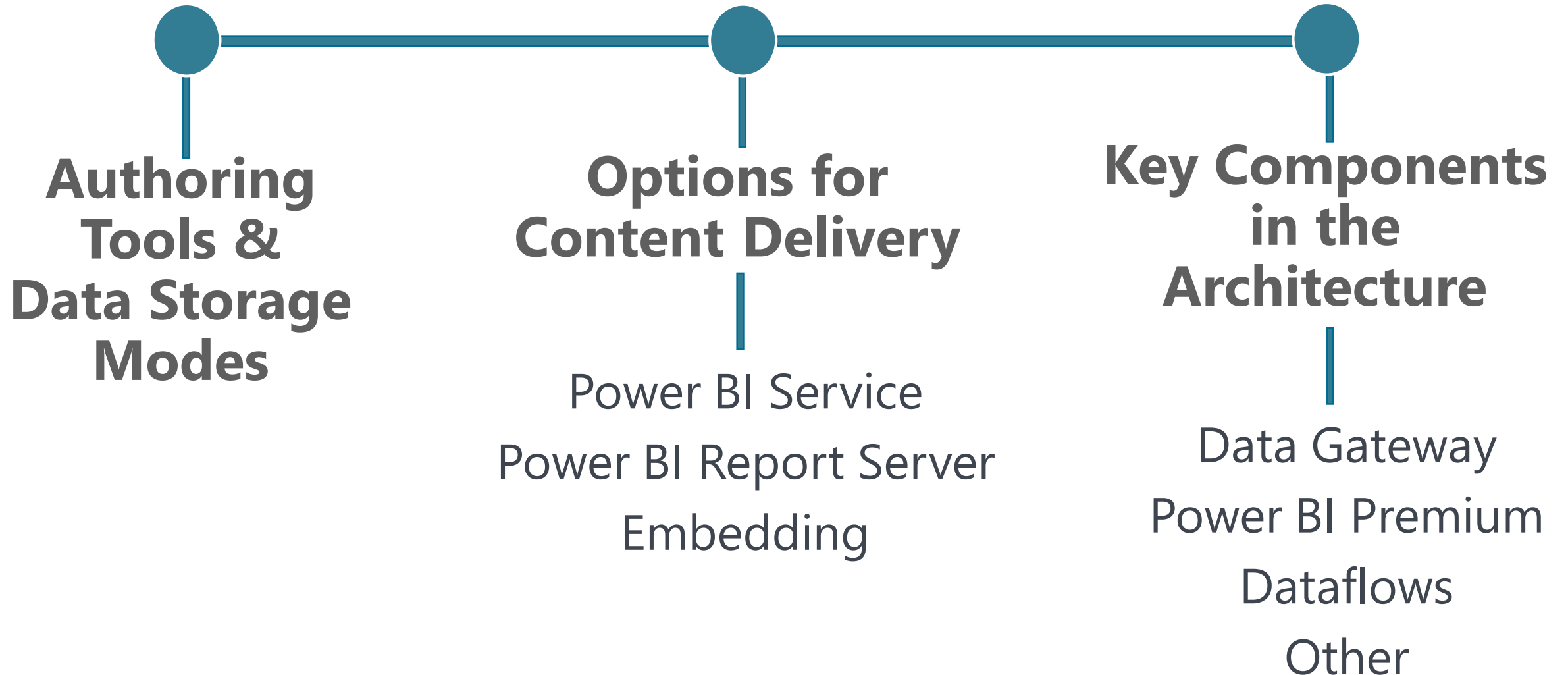
CoatesDataStrategies.com

@SQLChick | @CoatesDS



Power BI Architecture End-to-End

Agenda



Where to Download Materials



Slides:

CoatesDataStrategies.com/Presentations

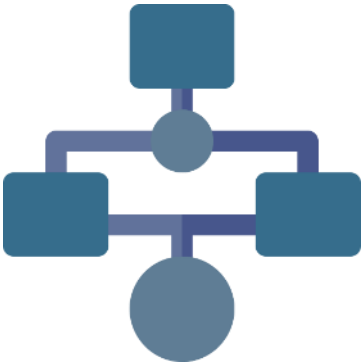


Diagram:

CoatesDataStrategies.com/Diagrams



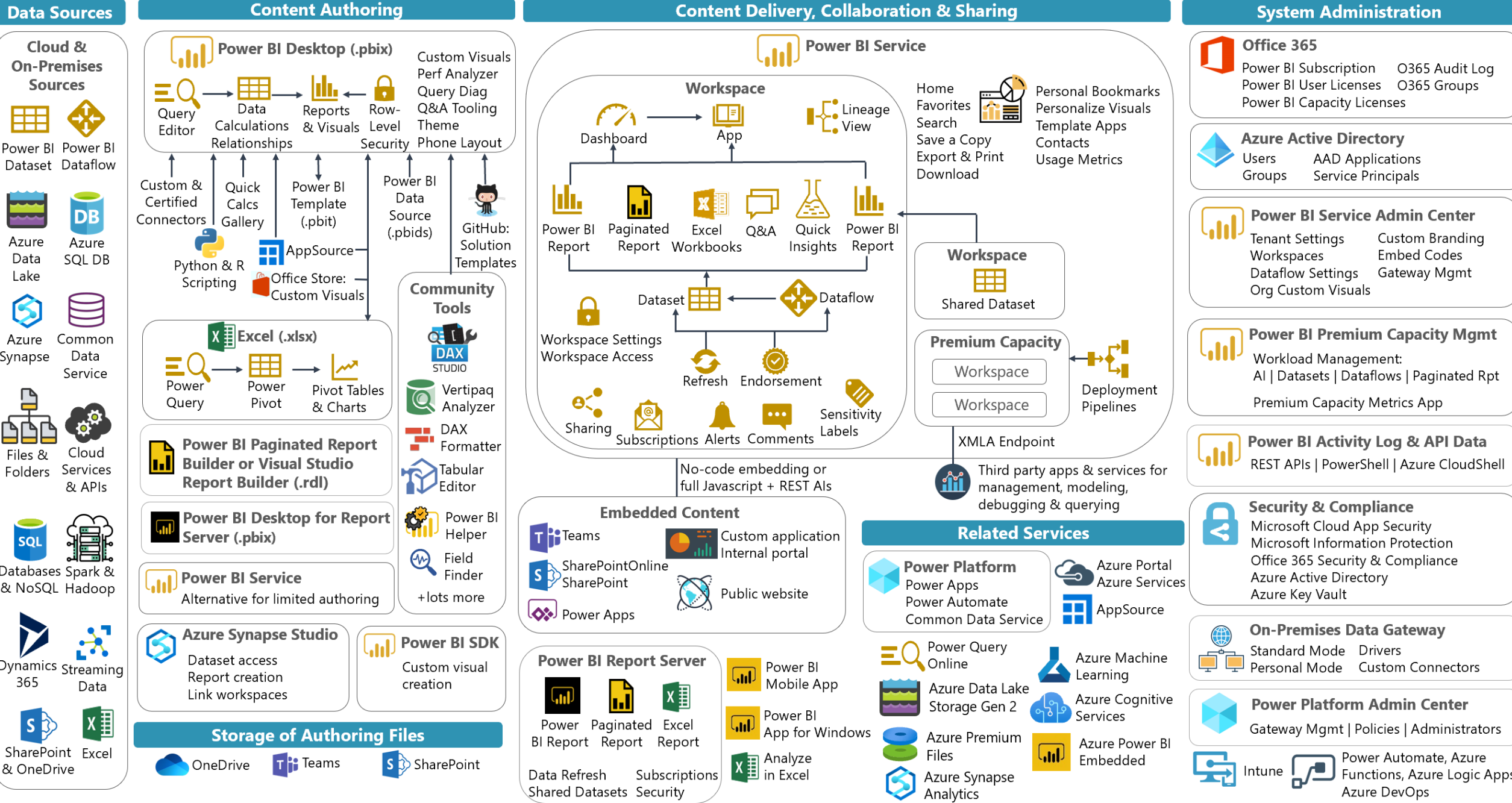
What is Power BI?

A **suite of tools** to support **both** self-service BI and corporate BI:

- Data acquisition
- Data preparation and cleansing
- Data modeling
- Calculations
- Reports and visuals
- Content delivery and viewing

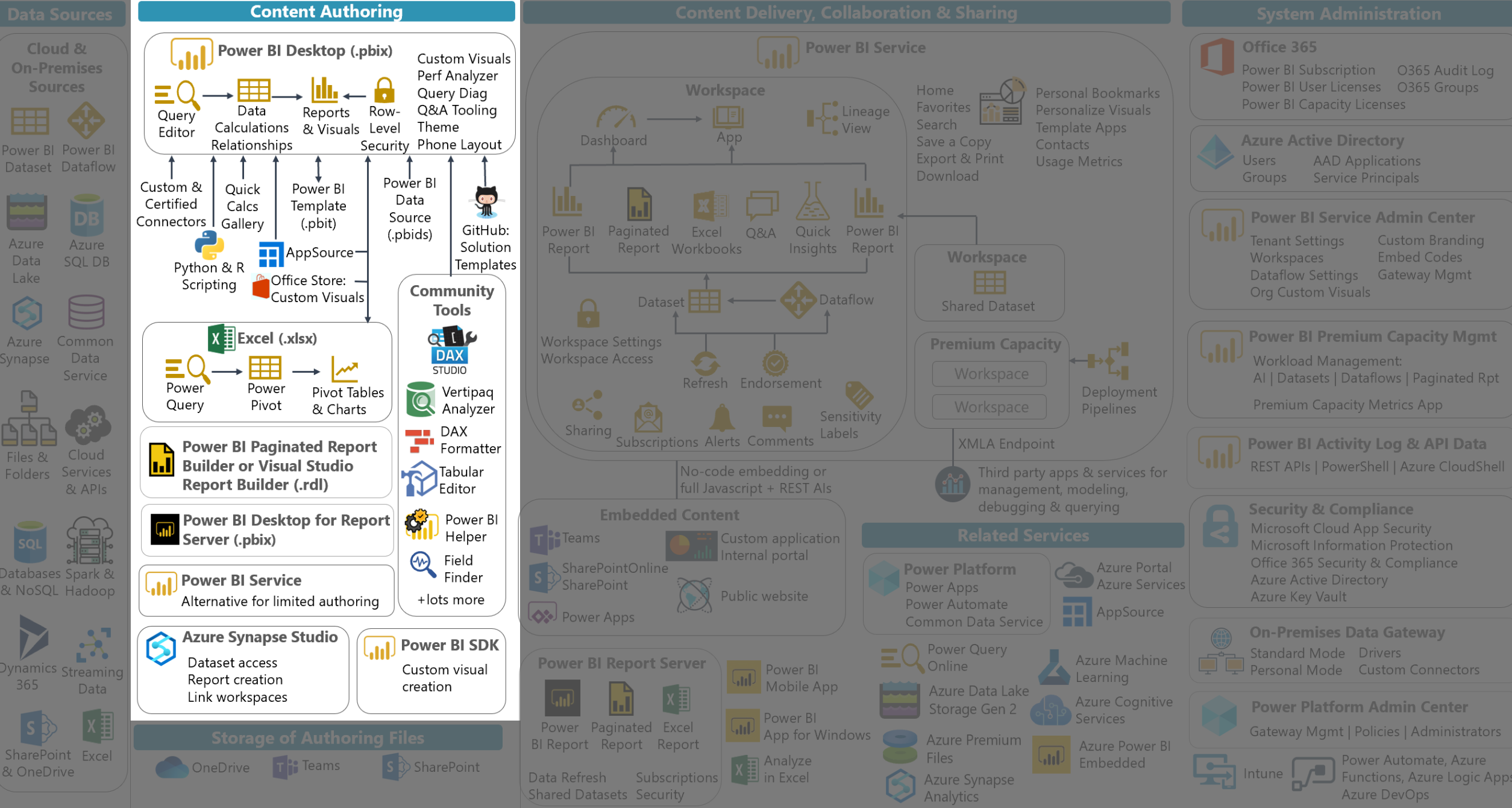


Power BI is a broad collection of tools, services, and features

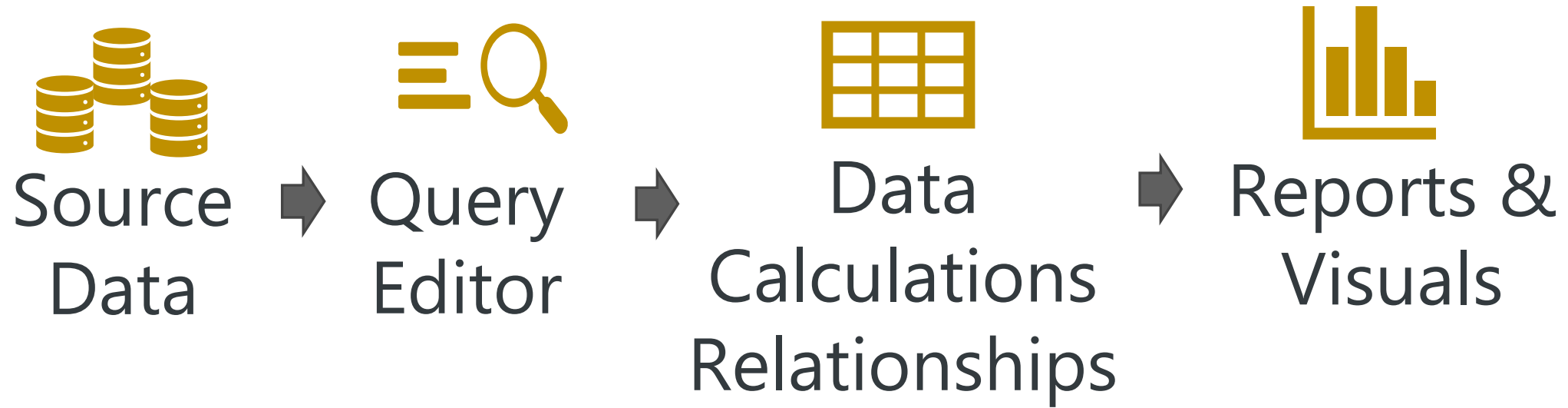




Power BI Authoring Tools & Data Storage Modes



Power BI Authoring



Skills:

Data
preparation

Data
modeling

Data
visualization

Languages:

Power Query
Formula
Language ("M")

Data Analysis
eXpressions
("DAX")



Authoring Tools



Power BI
Desktop (.pbix)

Tool of choice for query editing, data modeling, and report creation



Excel (.xlsx)

Alternative to Power BI Desktop



Power BI Paginated
Report Builder (.rdl)

Highly formatted pixel-perfect reports



Power BI Desktop for
Report Server (.pbix)

A version of Desktop which aligns with Power BI Report Server update cadence



Power BI Service

Report and dashboard authoring








Azure Synapse Studio

Report and dashboard authoring



Data Storage Modes

| | | Data stored in Power BI | Data remains in source |
|-----------------|---|---|---|
| Import | Data is imported to Power BI's in-memory columnar data storage |  | |
| Direct Query | Queries are passed at execution time to a relational data source | |  |
| Live Connection | Queries are passed at execution time to an Analysis Services or Power BI source | |  |
| Composite | Combination of Import + DirectQuery defined per table |  |  |

Combination of Live Connection + Import is on the release plan



Data Storage Modes

| | Local model | Remote model |
|-------------------------|---|---|
| Data stored in Power BI | Import Mode A PBIX file which contains both the schema and the data; may or may not also contain reports | Live Connection Mode A PBIX file with reports that obtain data by querying a shared dataset published to the Power BI Service |
| Data remains in source | DirectQuery Mode A PBIX file with reports; model contains schema only; data is obtained by querying the data source when report is executed | Live Connection Mode A PBIX file with reports that obtain data by querying an Analysis Services Tabular Model |



Data Storage Modes

| | Local model | Remote model |
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| Data stored in Power BI | Import Mode A PBIX file which contains both the schema and the data; may or may not also contain reports + = Composite | Live Connection Mode A PBIX file with reports that obtain data by querying a shared dataset published to the Power BI Service |
| Data remains in source | DirectQuery Mode A PBIX file with reports; model contains schema only; data is obtained by querying the data source when report is executed | Live Connection Mode A PBIX file with reports that obtain data by querying an Analysis Services Tabular Model |

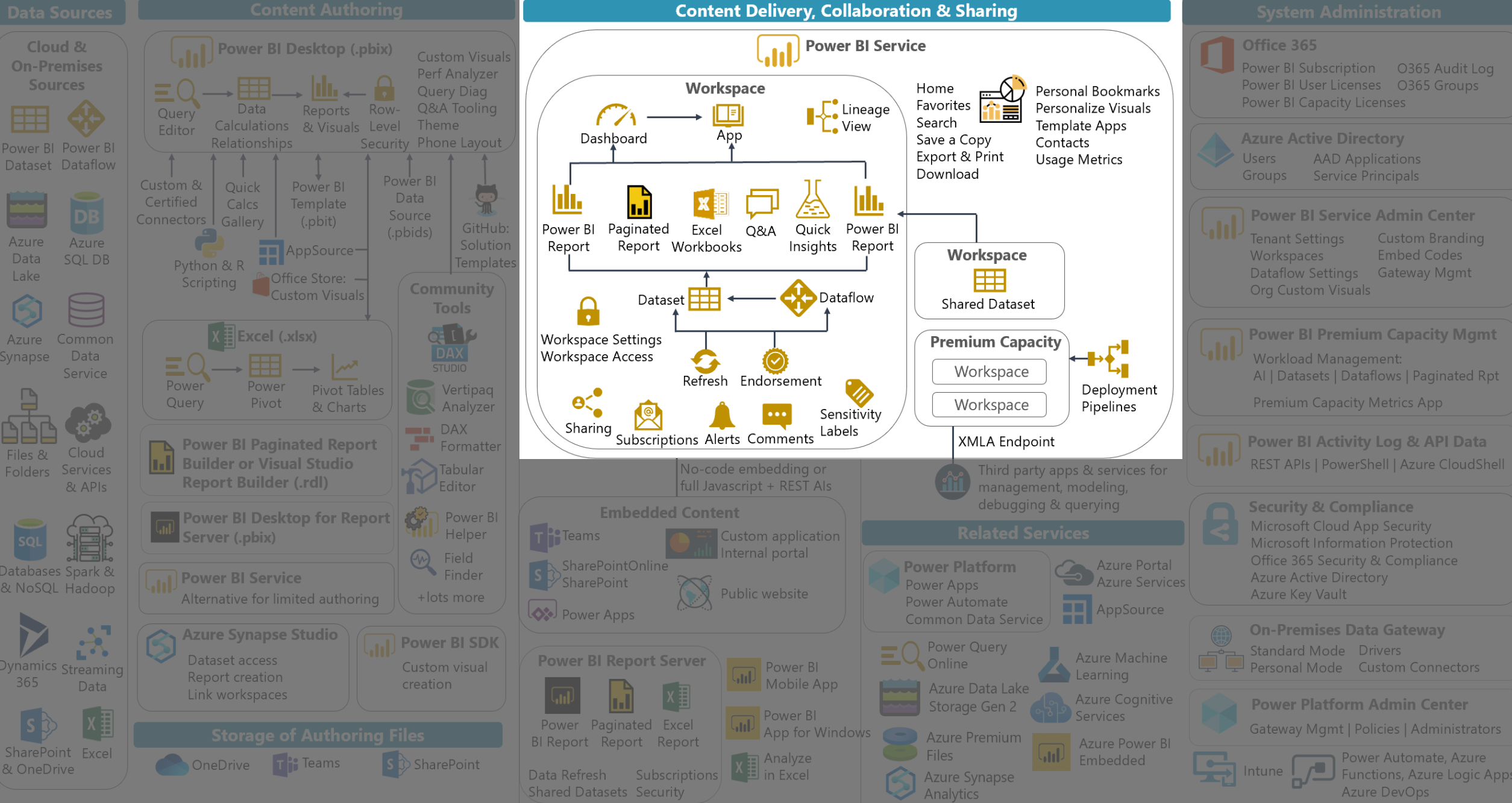




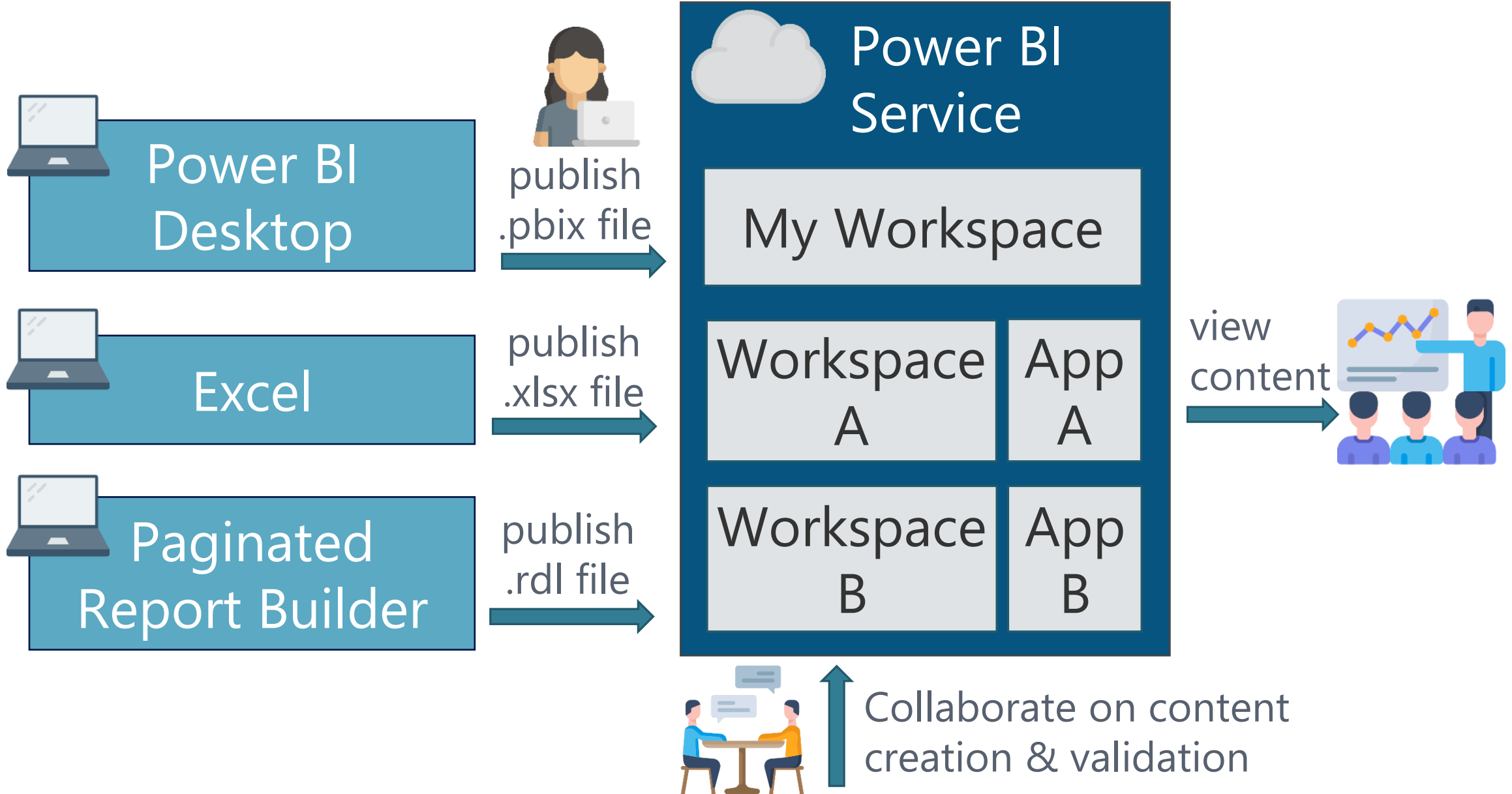
Options for Content Delivery



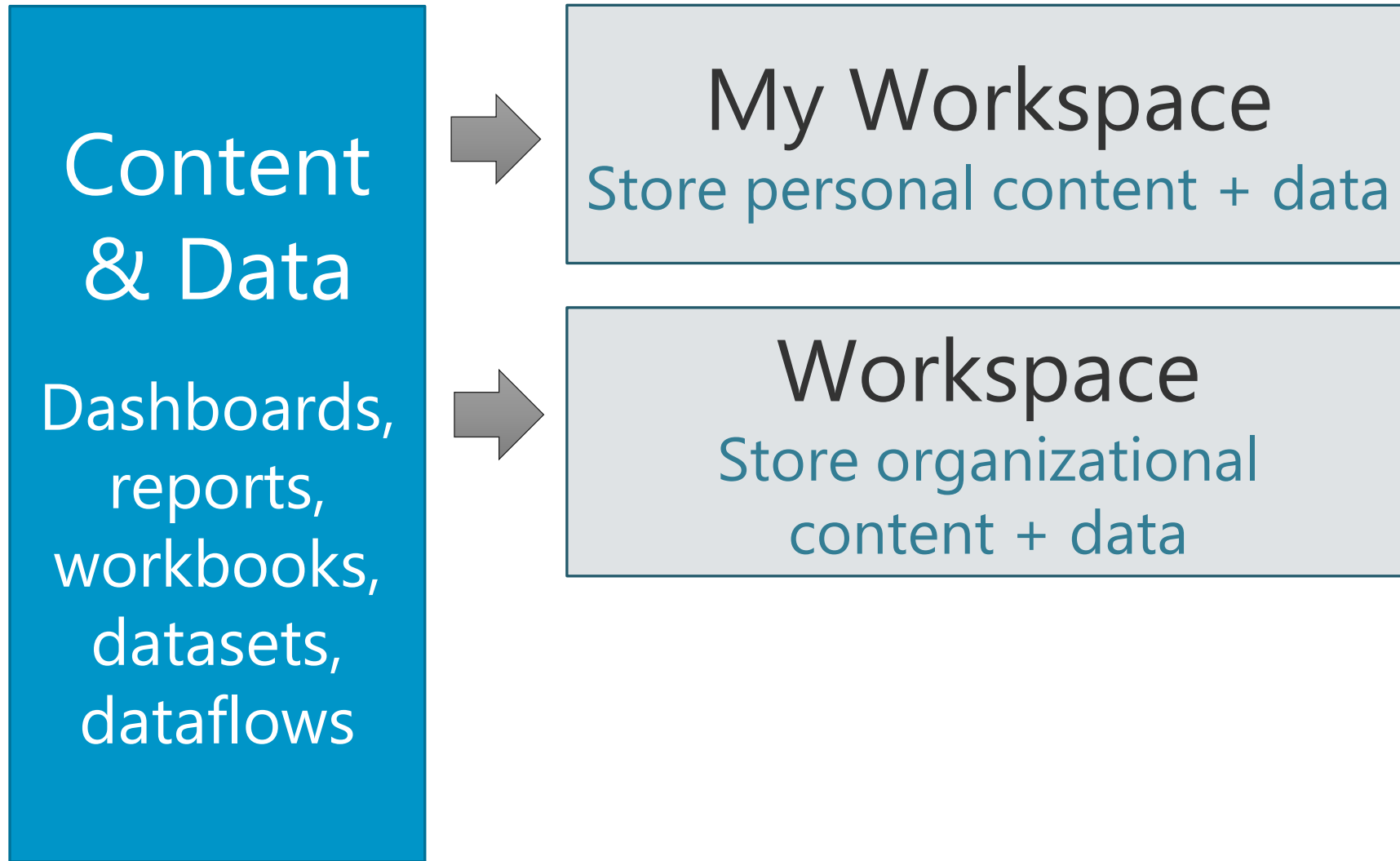
Power BI Service



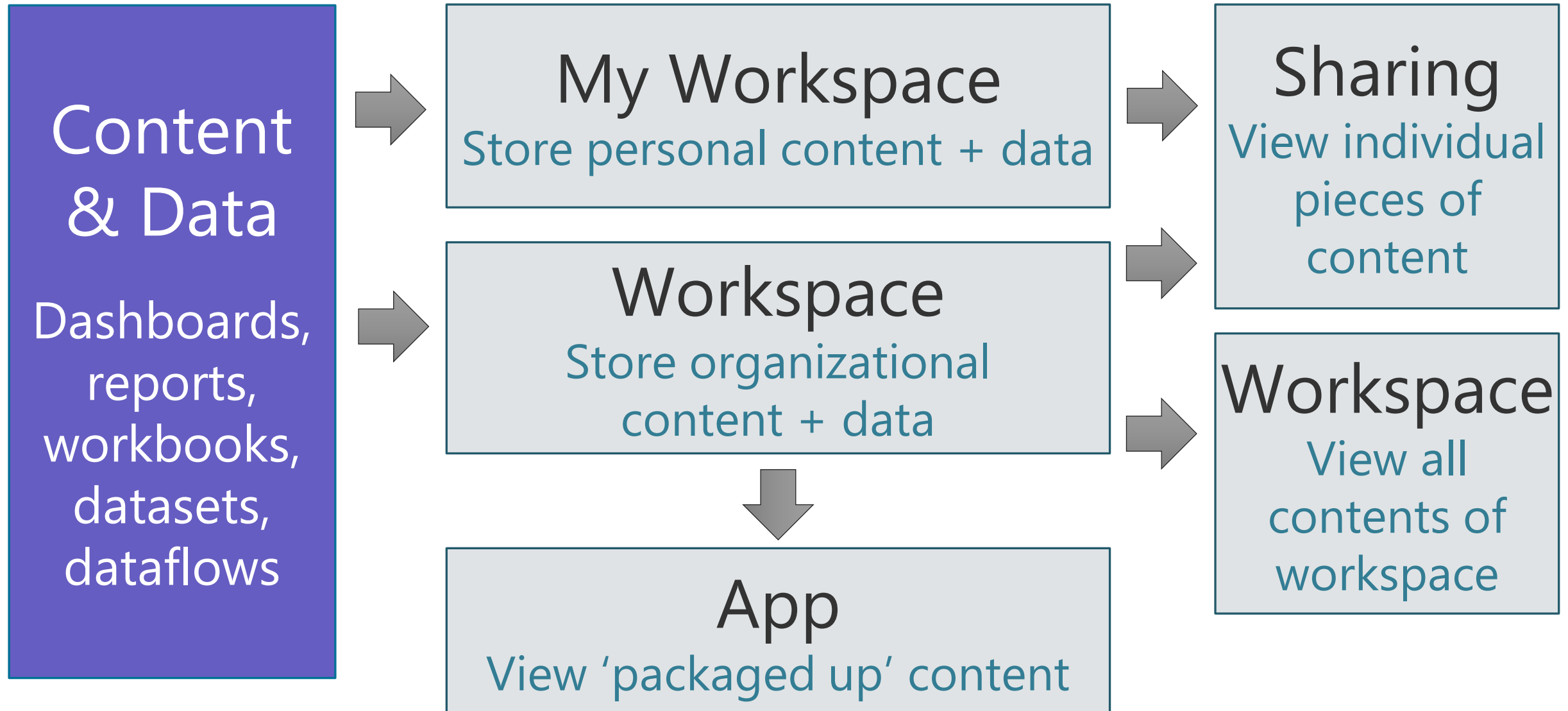
Power BI Service



Storing Content in the Power BI Service

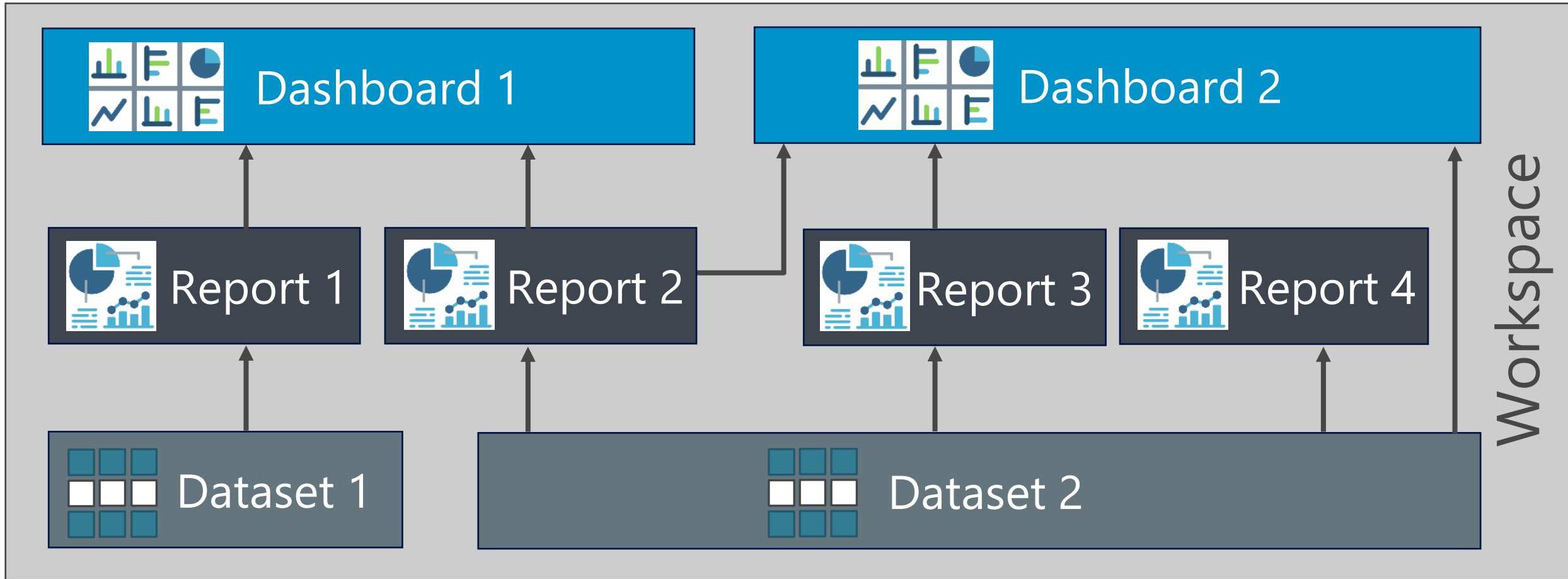


Viewing Content in the Power BI Service



Objects in the Power BI Service

Excluding workbooks & dataflows for now



Licenses Required for Power BI Service

User Licenses:

| | | |
|------|---|---|
| Free | Personal analytics (my workspace) | User identity from Azure Active Directory |
| Pro | Team collaboration and content distribution (workspaces, apps, sharing) | |

Capacity Licenses (*optional*):

| | |
|---------|--|
| Premium | Broad content distribution scenarios + extra functionality |
|---------|--|

Authors who publish content always need a Pro license



Top Reasons for Using the Power BI Service

Collaboration, Sharing & Content Distribution



Delivering reports using Power BI Desktop on a file system is difficult to do well



Multiple methods & security options to collaborate with both internal and external users



Friendlier experience for report consumers with apps + easier to discover content



Top Reasons for Using the Power BI Service

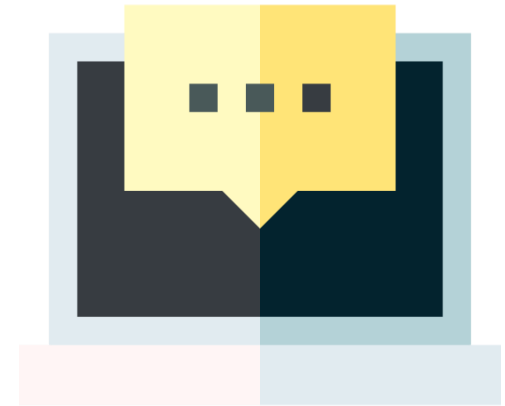
Collaboration, Sharing & Content Distribution



Row-level security works



Use of the Power BI mobile app & the Windows application



Report & dashboard comments

Top Reasons for Using the Power BI Service

Automation



Subscriptions



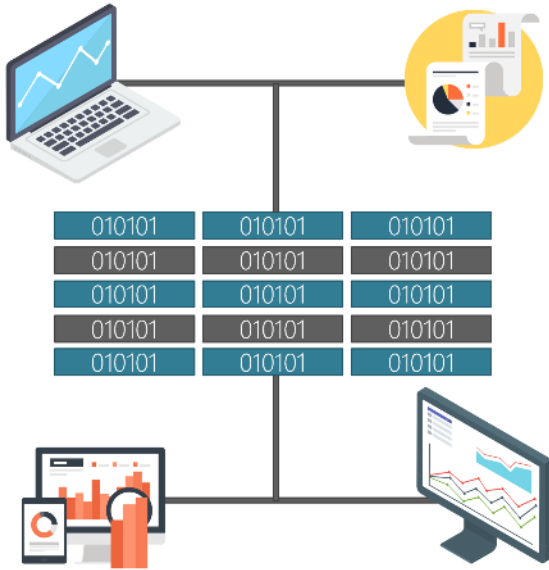
Scheduled
data refresh



Alerts &
integration with
Power Automate

Top Reasons for Using the Power BI Service

Centralization & Reusability



Centralized dataset reusability across numerous reports with shared datasets & live connections

| | | |
|--------|--------|--------|
| 010101 | 010101 | 010101 |
| 010101 | 010101 | 010101 |
| 010101 | 010101 | 010101 |
| 010101 | 010101 | 010101 |
| 010101 | 010101 | 010101 |



Certified & promoted (endorsements) for datasets & dataflows



Centralized data cleansing with Power BI dataflows

Top Reasons for Using the Power BI Service

Governance, Compliance & Administration



Tenant settings to manage features & user experience



Integration with Azure Active Directory & Microsoft 365

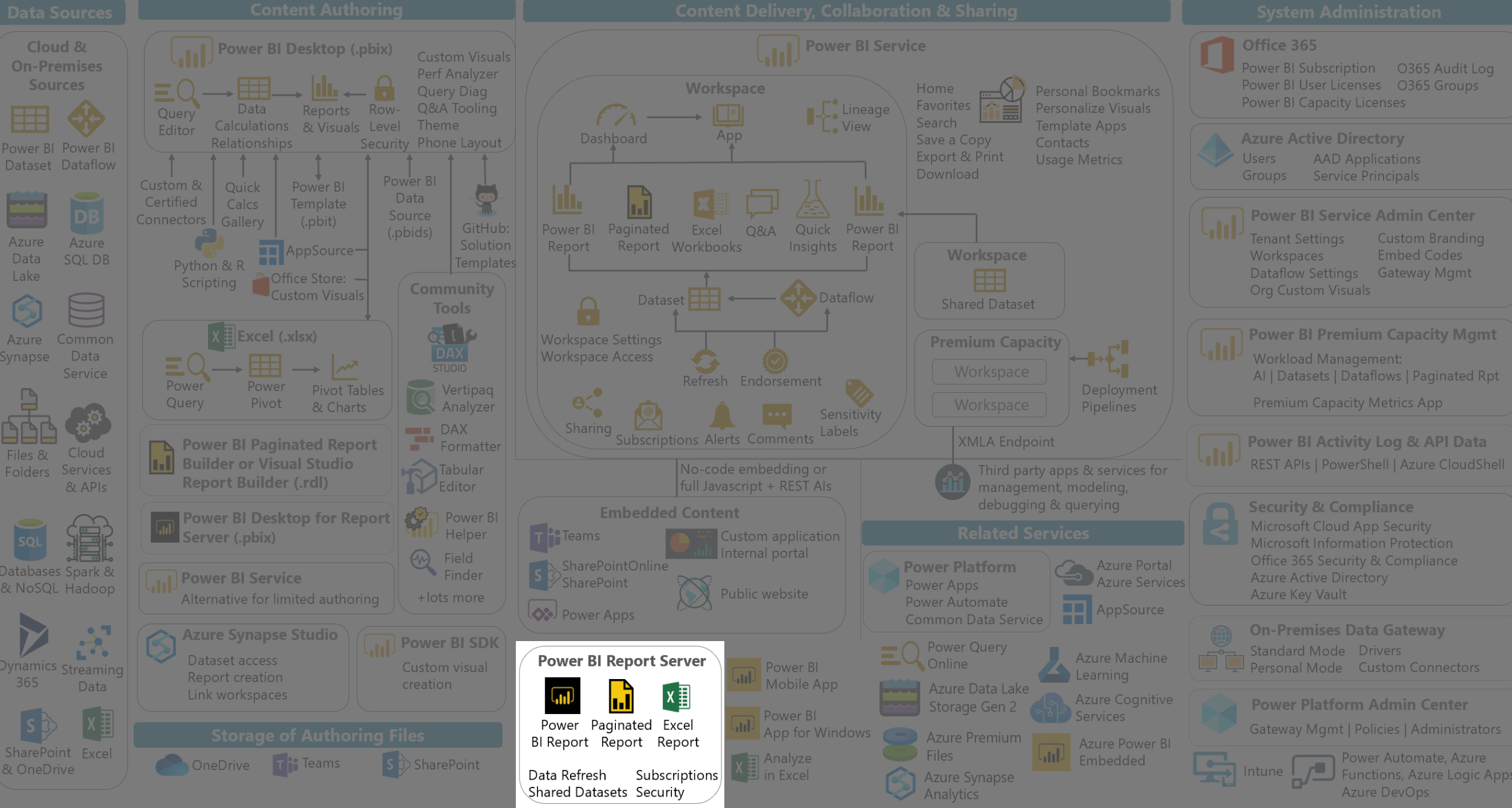


Administrator visibility into usage & activity logging plus administrator access when necessary

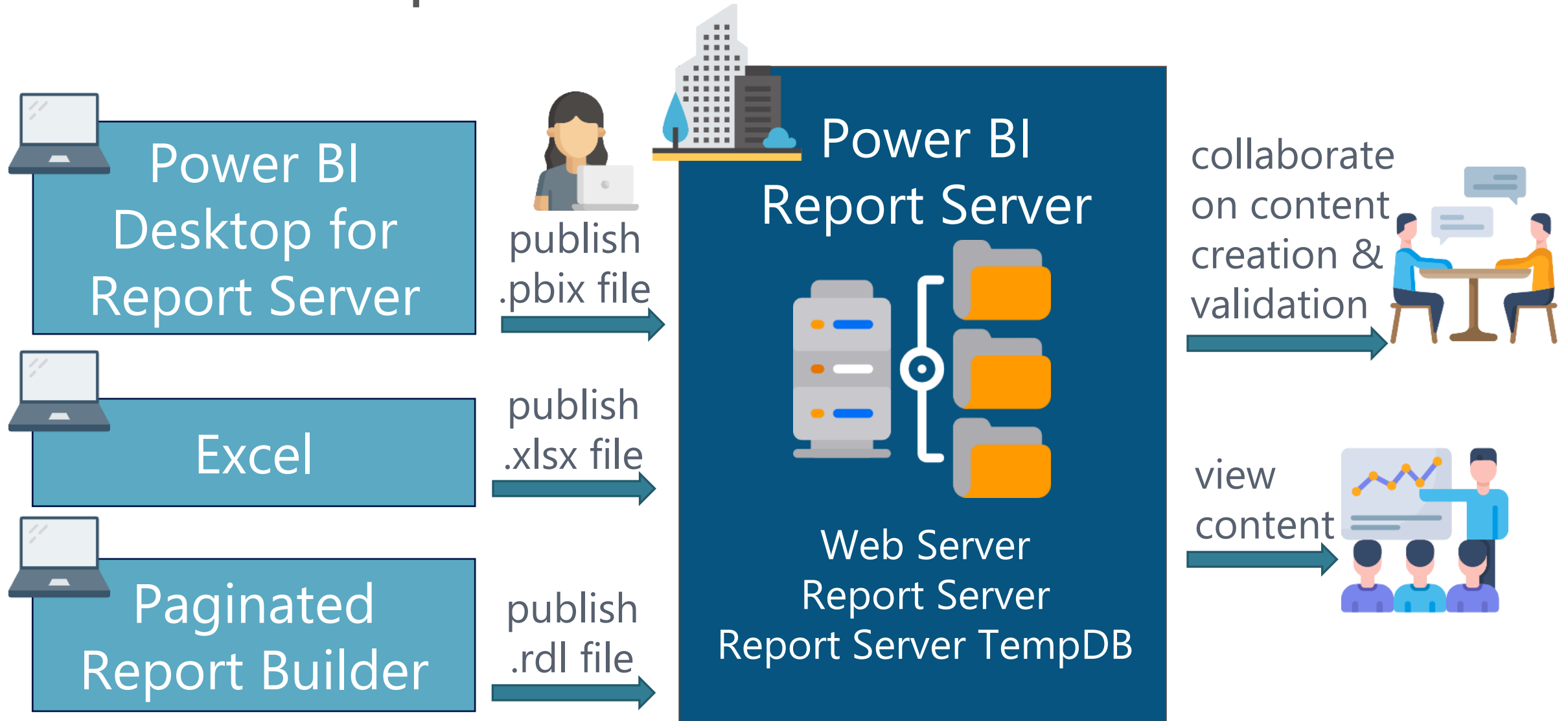




Power BI Report Server



Power BI Report Server



Top Reasons for Using Power BI Report Server



Need an alternative to the Power BI Service in the organization's data center



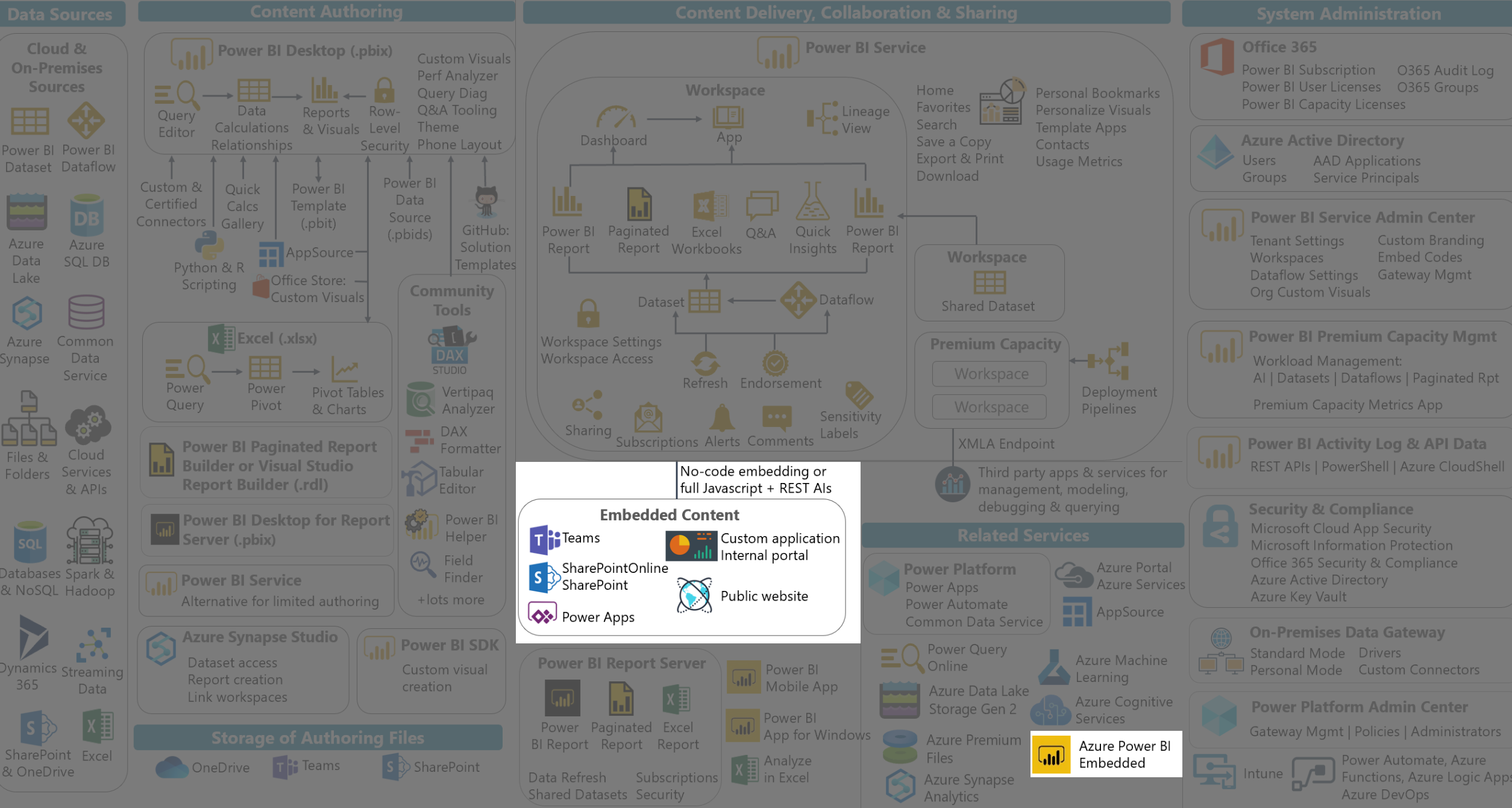
Existing significant investment in Reporting Services



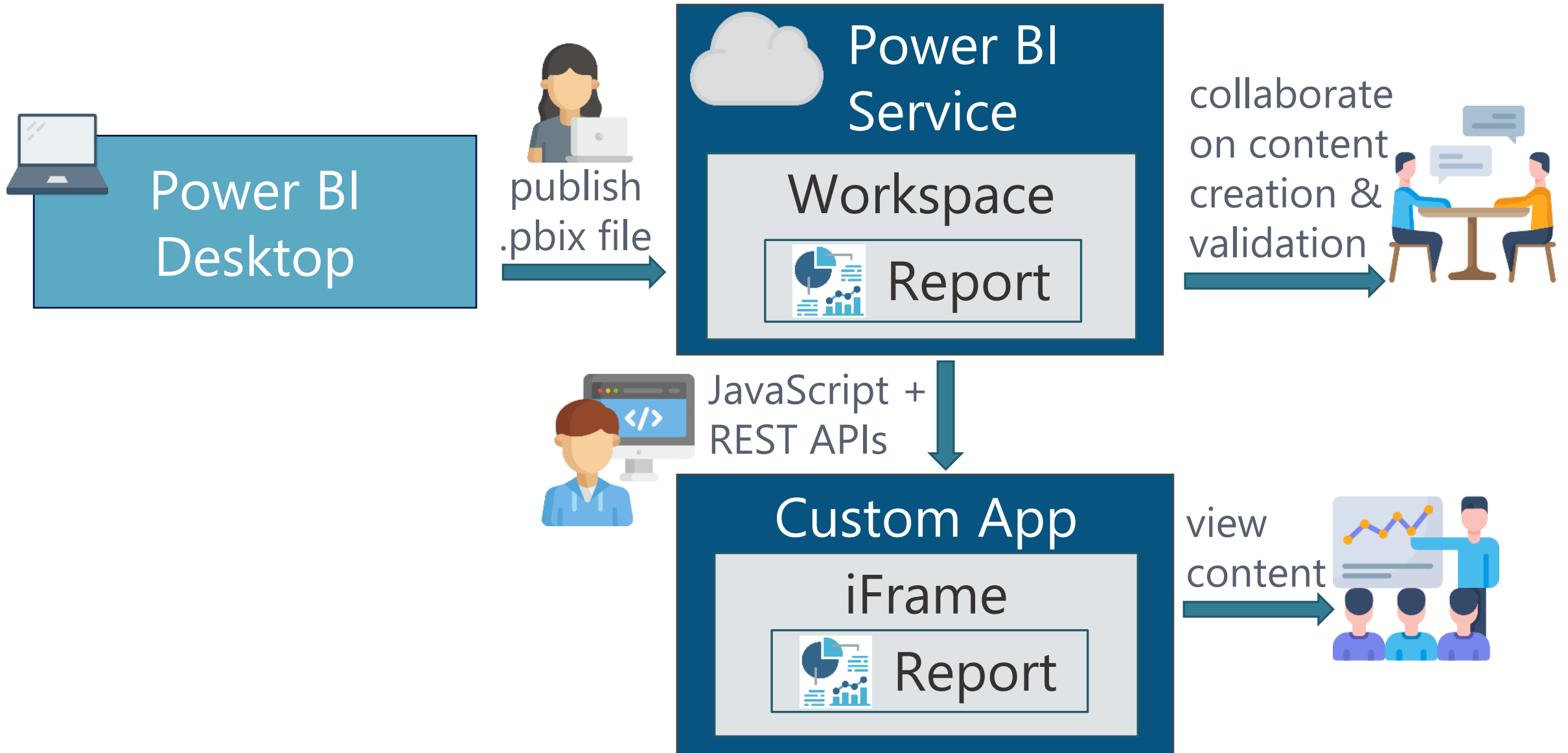
Desire simplicity, slower release cadence, and a subset of feature support

Embedding Solutions

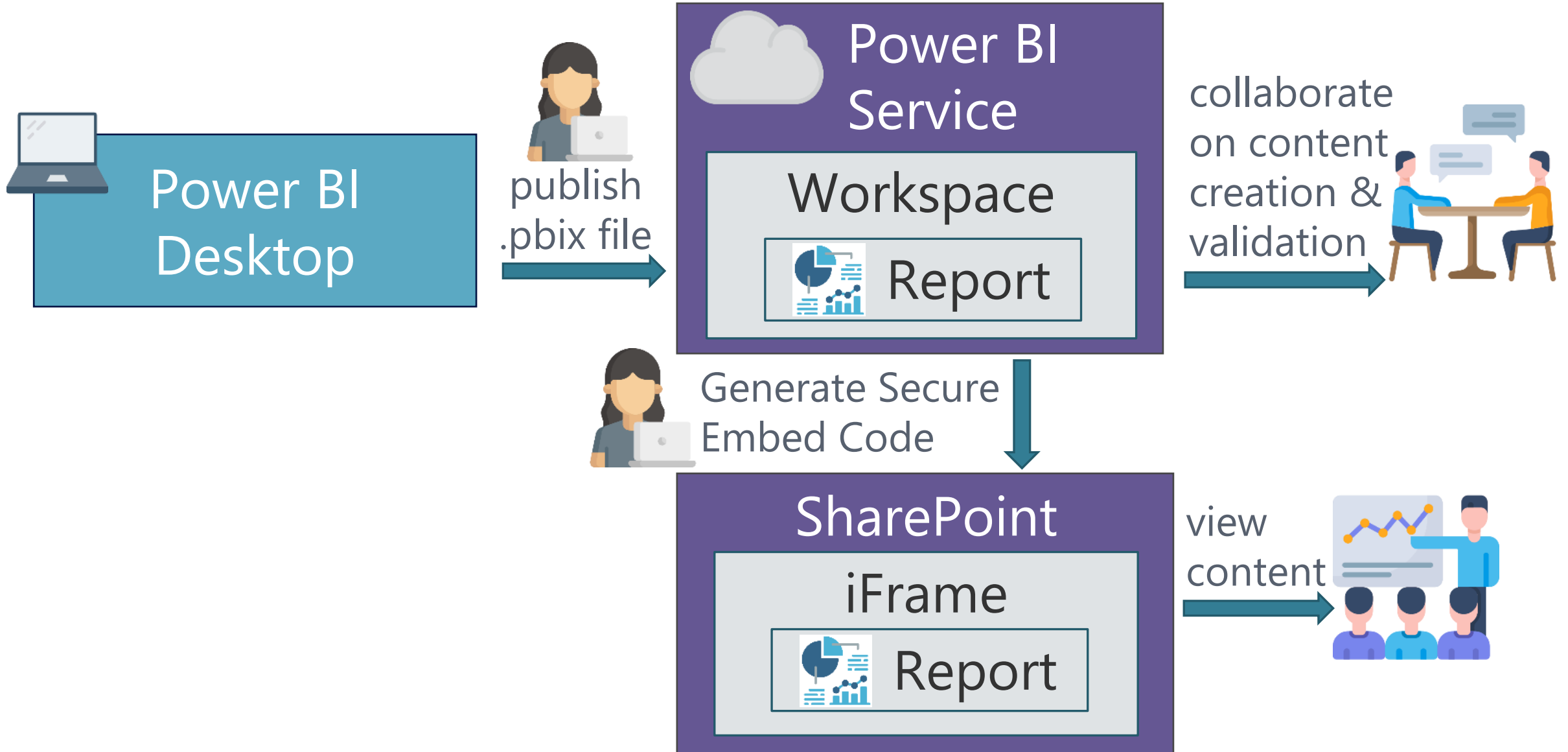




Embedding Content in a Custom Application



No-Code Embedding



Options for Embedding Content

Internal Embedding

Embed for productivity
(no-code)



URL Embedding
for internal websites
and portals

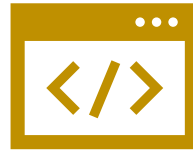


Embedding
in
Teams



Embedding
in
SharePoint

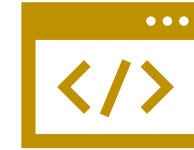
Embed for
your org
(user owns data)



REST APIs:
Custom portals
and custom apps

External Embedding

Embed for
customers
(app owns data)



REST APIs:
ISV apps and
services

Public



Publish to web:
public portals, open
data initiatives

Secured by organizational Azure AD

*Secured by
application
authentication*

*No user
authentication*



Options for Free Users

Internal Embedding



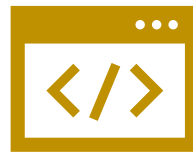
URL Embedding
for internal websites
and portals



Embedding
in
Teams



Embedding
in
SharePoint



REST APIs:
Custom portals
and custom apps



REST APIs:
ISV apps and
services



Publish to web:
public portals, open
data initiatives

Power BI Premium (P-series SKUs)

EM-series SKUs

Power BI Embedded (A-series SKUs)

Image adapted from: [Planning a Power BI Deployment Whitepaper](#)

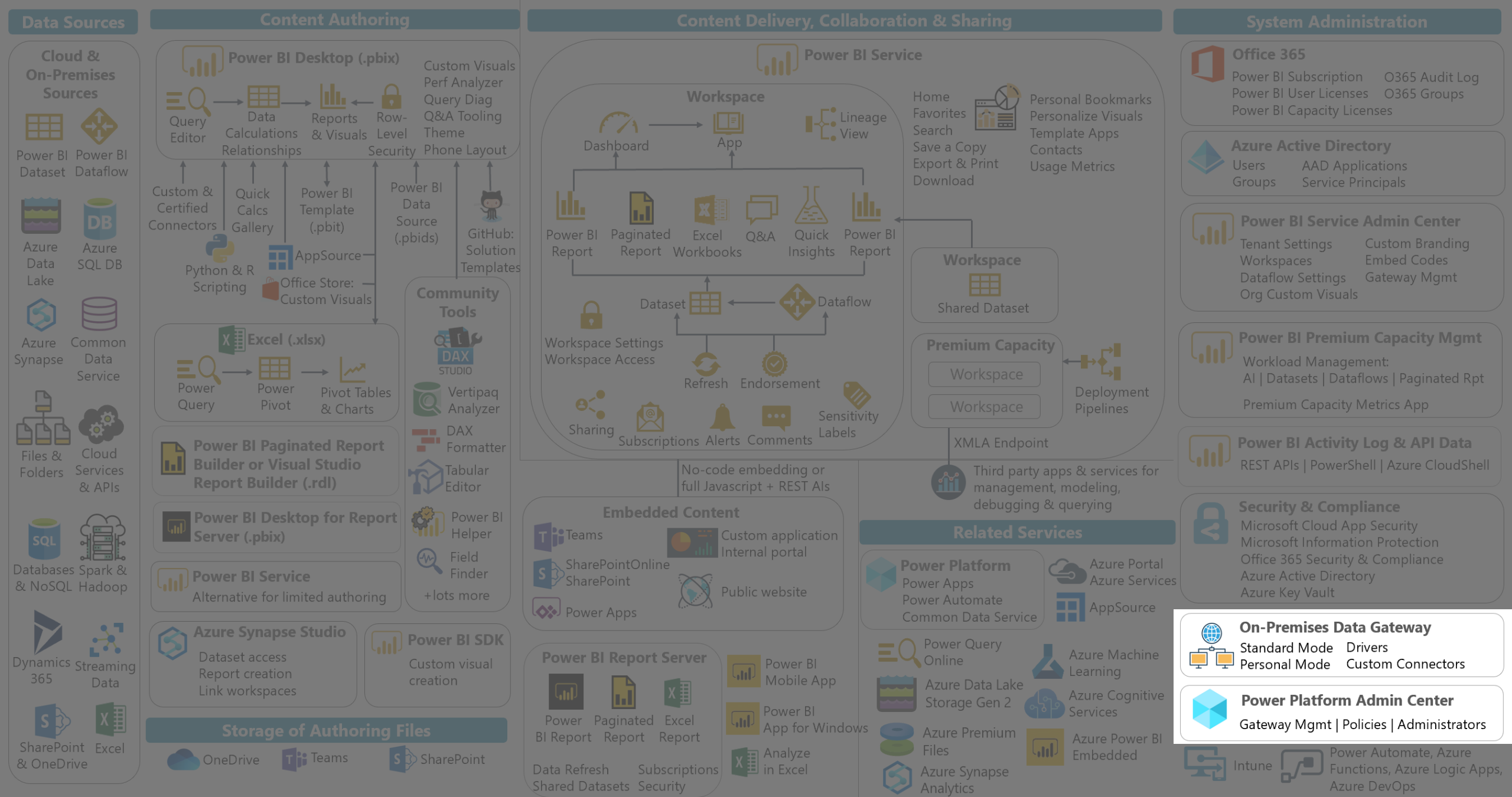




Key Components in a Power BI Architecture

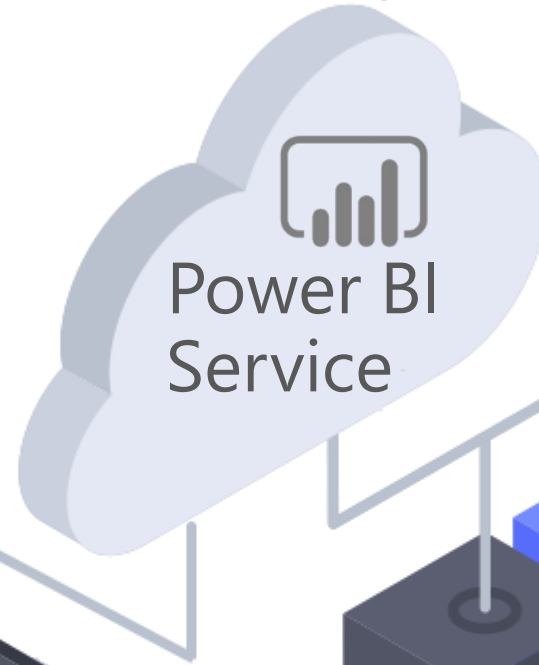
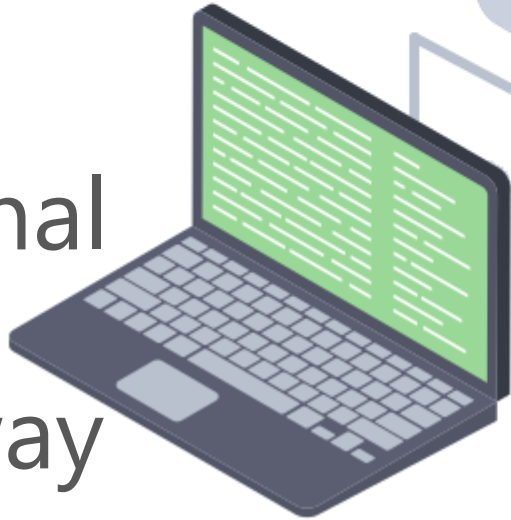


On-Premises Data Gateway



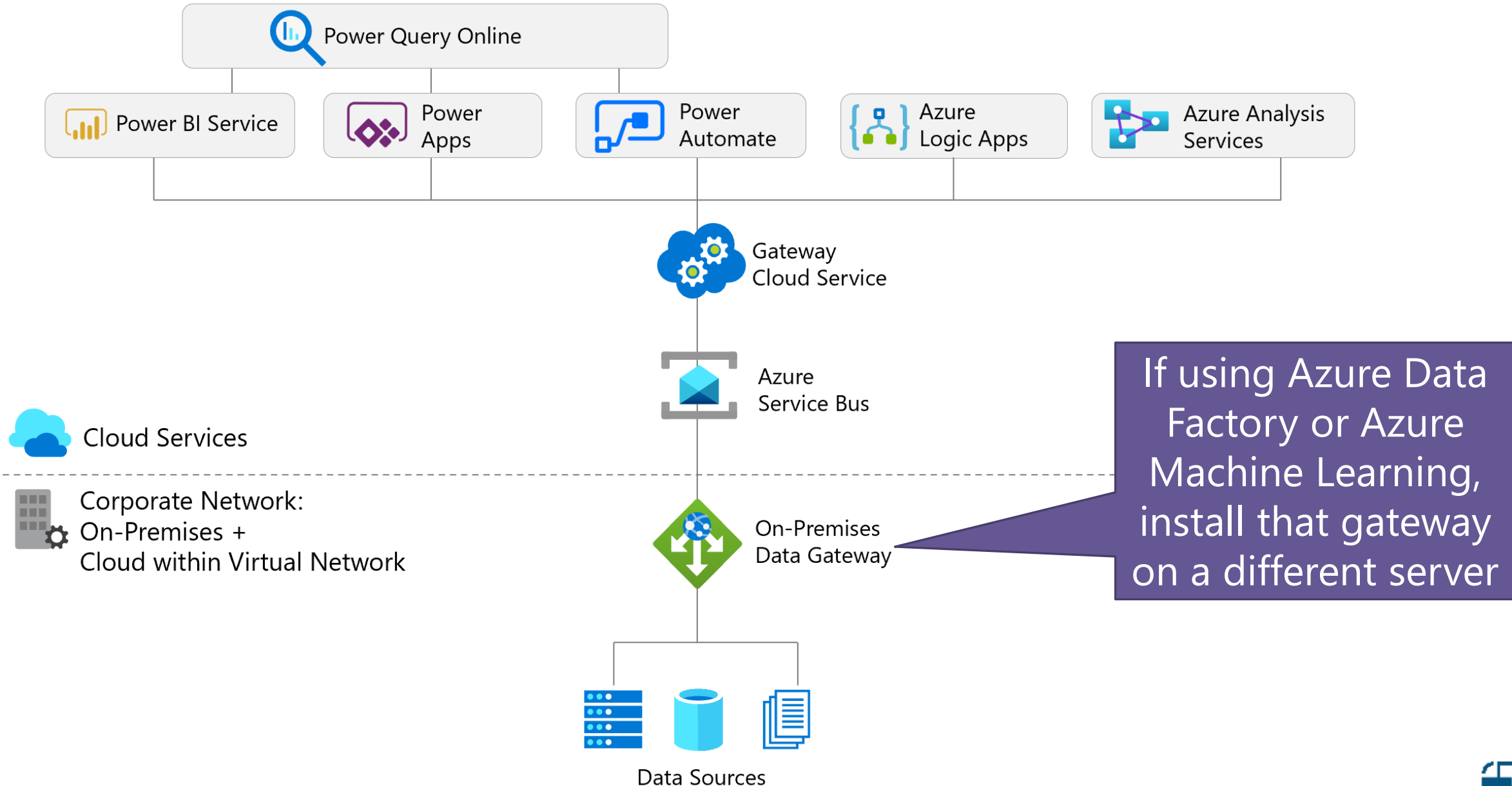
Two Types of Gateways

Personal
Mode
Gateway



Standard
Mode
(Enterprise)
Gateway

Standard Mode Data Gateway



When is a Gateway Needed?

In the Power BI Service:

Refreshing imported datasets

Refreshing dataflows

Using DirectQuery

Using Live Connection for Analysis Services

AND

Data Source Is Located:

On-premises data center

Cloud-based IaaS (infrastructure as a service)

Cloud-based PaaS (platform as a service) in a VNet (virtual network)

OR

Certain Functionality is Used:

Web.Page() function

Single M query combines cloud & on-prem data



Two Gateway Modes



Standard Mode (Enterprise)

Gateway Admin sets up for use by many users

Supports data refresh, DirectQuery + live conn

Supports a range of tools

Each data source is explicitly configured with permissions

Personal Mode

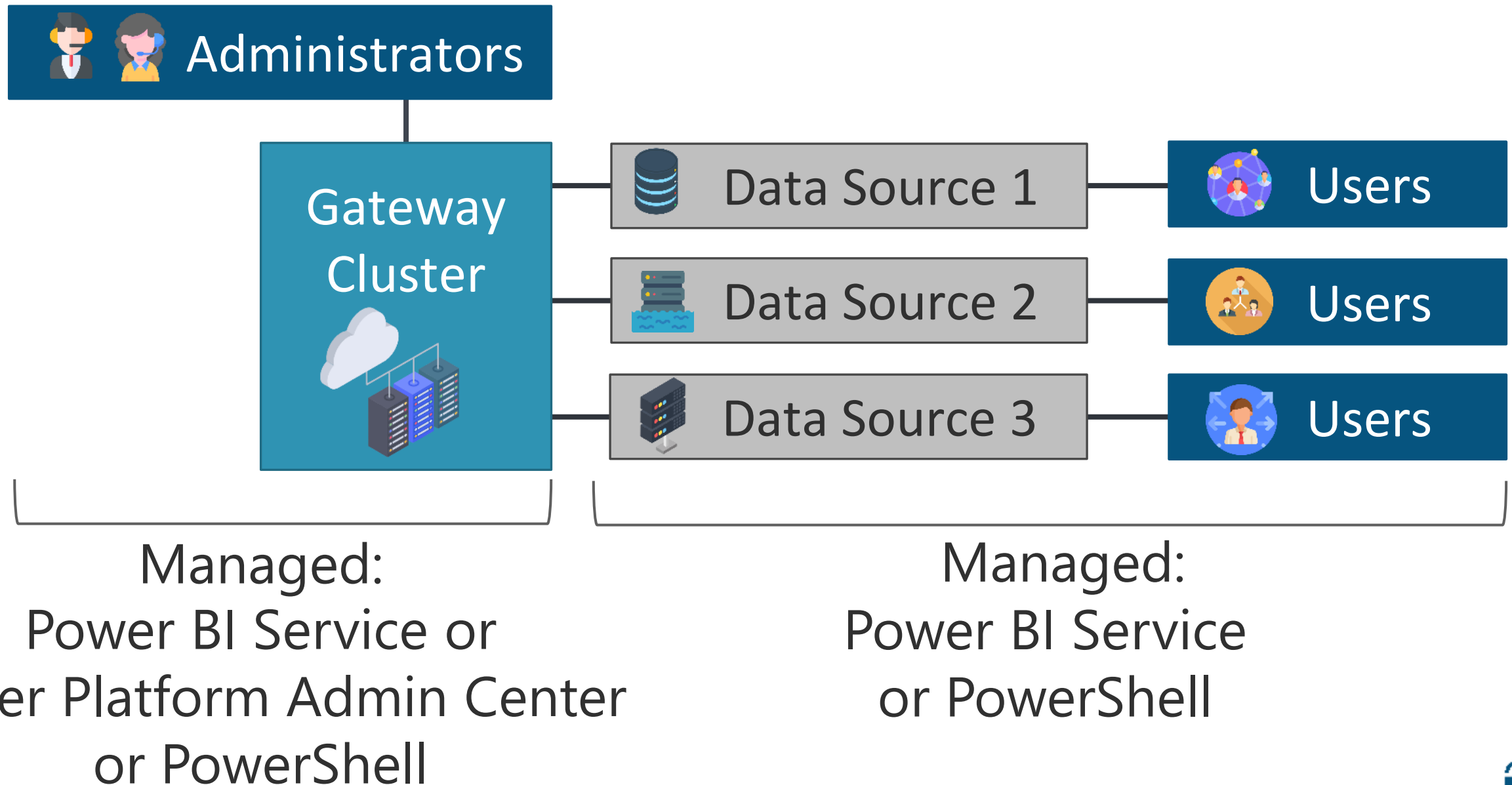


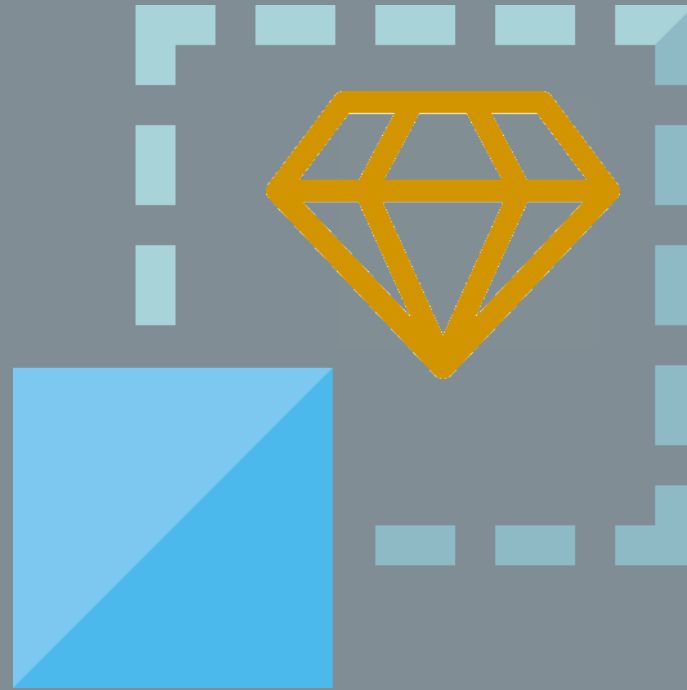
Individual user sets up for personal use

Supports data refresh only

Supports Power BI only

Standard Data Gateway

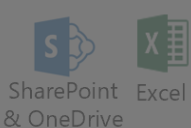
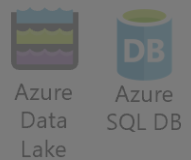




Power BI Premium

Data Sources

Cloud & On-Premises Sources



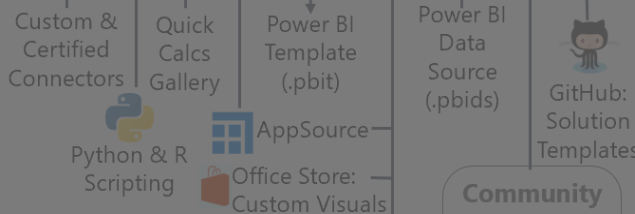
Content Authoring



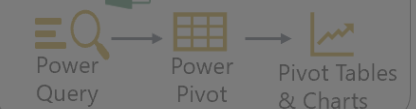
Power BI Desktop (.pbix)



Custom Visuals
Perf Analyzer
Query Diag
Q&A Tooling
Theme
Phone Layout



Excel (.xlsx)



Power BI Paginated Report Builder or Visual Studio Report Builder (.rdl)

Power BI Desktop for Report Server (.pbix)

Power BI Service Alternative for limited authoring

Azure Synapse Studio

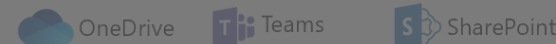
Dataset access
Report creation
Link workspaces



Power BI SDK

Custom visual creation

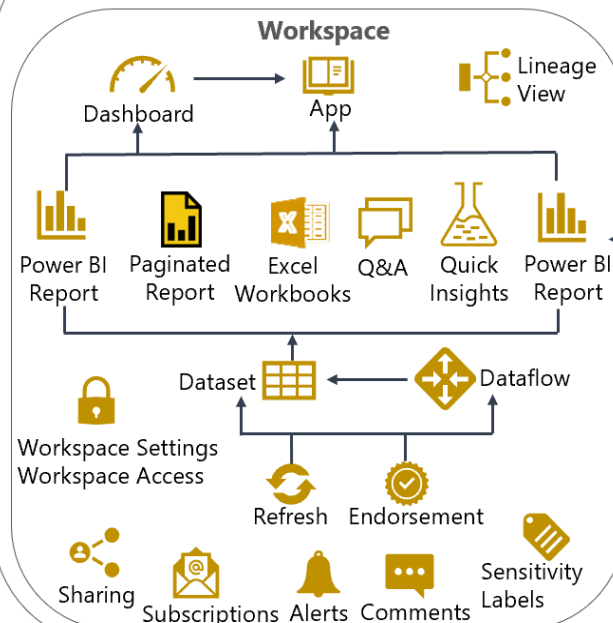
Storage of Authoring Files



Content Delivery, Collaboration & Sharing



Power BI Service



Home
Favorites
Search
Save a Copy
Export & Print
Download

Personal Bookmarks
Personalize Visuals
Template Apps
Contacts
Usage Metrics

Workspace

Shared Dataset

Premium Capacity

Workspace

Workspace

Deployment Pipelines

XMLA Endpoint

Third party apps & services for management, modeling, debugging & querying

Embedded Content



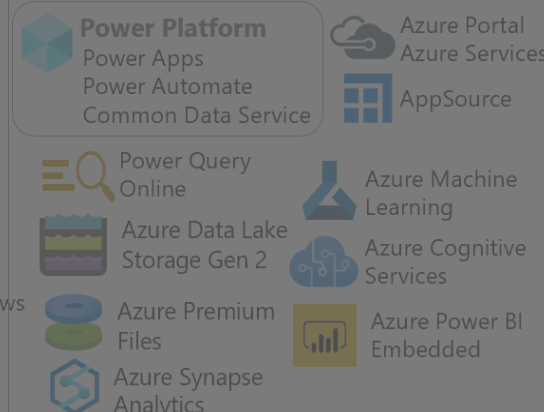
Power BI Report Server



Data Refresh
Subscriptions
Shared Datasets
Security

Power BI Mobile App
Power BI App for Windows
Analyze in Excel

Related Services



System Administration



Office 365

Power BI Subscription
Power BI User Licenses
Power BI Capacity Licenses
O365 Audit Log
O365 Groups



Azure Active Directory

Users
Groups
AAD Applications
Service Principals



Power BI Service Admin Center

Tenant Settings
Workspaces
Dataflow Settings
Org Custom Visuals
Custom Branding
Embed Codes
Gateway Mgmt



Power BI Premium Capacity Mgmt

Workload Management:
AI | Datasets | Dataflows | Paginated Rpt
Premium Capacity Metrics App



Power BI Activity Log & API Data

REST APIs | PowerShell | Azure CloudShell



Security & Compliance

Microsoft Cloud App Security
Microsoft Information Protection
Office 365 Security & Compliance
Azure Active Directory
Azure Key Vault



On-Premises Data Gateway

Standard Mode
Personal Mode
Drivers
Custom Connectors



Power Platform Admin Center

Gateway Mgmt | Policies | Administrators



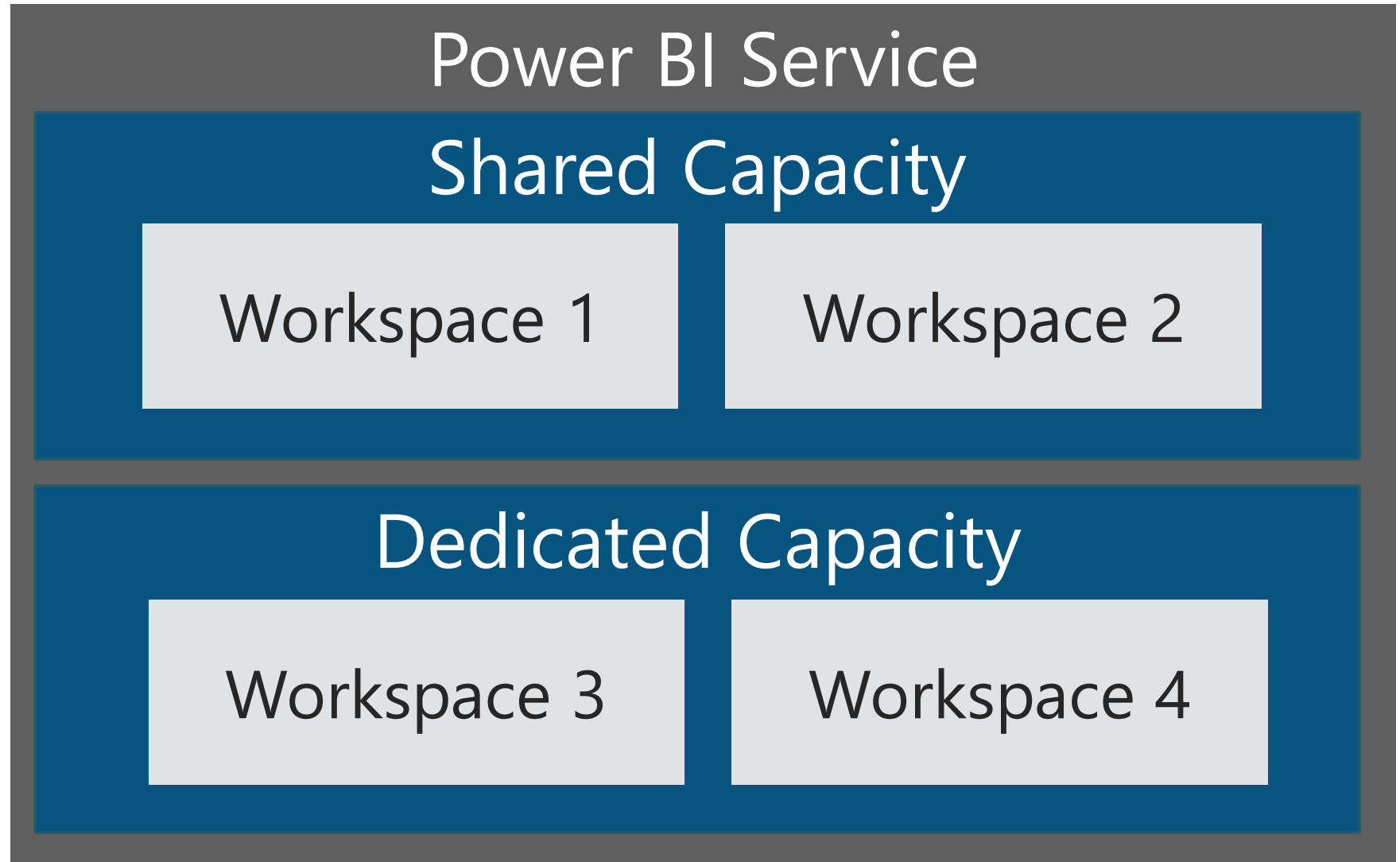
Intune
Power Automate, Azure Functions, Azure Logic Apps, Azure DevOps

Power BI Premium

User-based
licensing



Capacity-based
licensing



Top Reasons for Using Power BI Premium

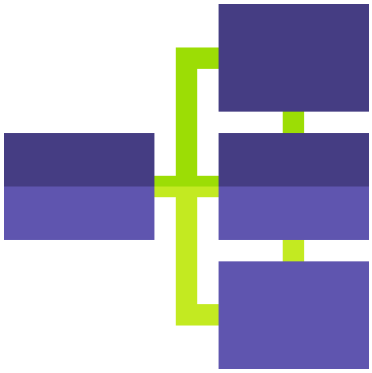
Capacity-Based Licensing



Large number of read-only users is more cost-effective than Pro licenses

Top Reasons for Using Power BI Premium

Features to Bring Enterprise BI Capabilities to Self-Service BI



Deployment pipelines



Full feature set for dataflows



XMLA read/write



Near real-time reporting:
change detection



Paginated reports in the Power BI Service



Top Reasons for Using Power BI Premium

Integration with Other Apps



Azure Cognitive
Services



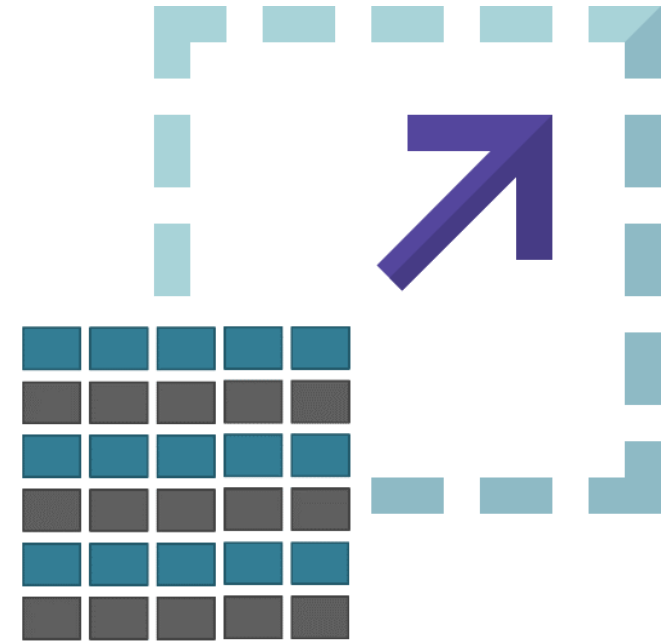
Azure Machine
Learning

Top Reasons for Using Power BI Premium

Scalability



More frequent data refreshes



Large datasets

Top Reasons for Using Power BI Premium

Compliance



Isolated, dedicated
hardware



Bring-your-own
encryption key



Specific geography
for data storage



Top Reasons for Using Power BI Premium

Hybrid Cloud

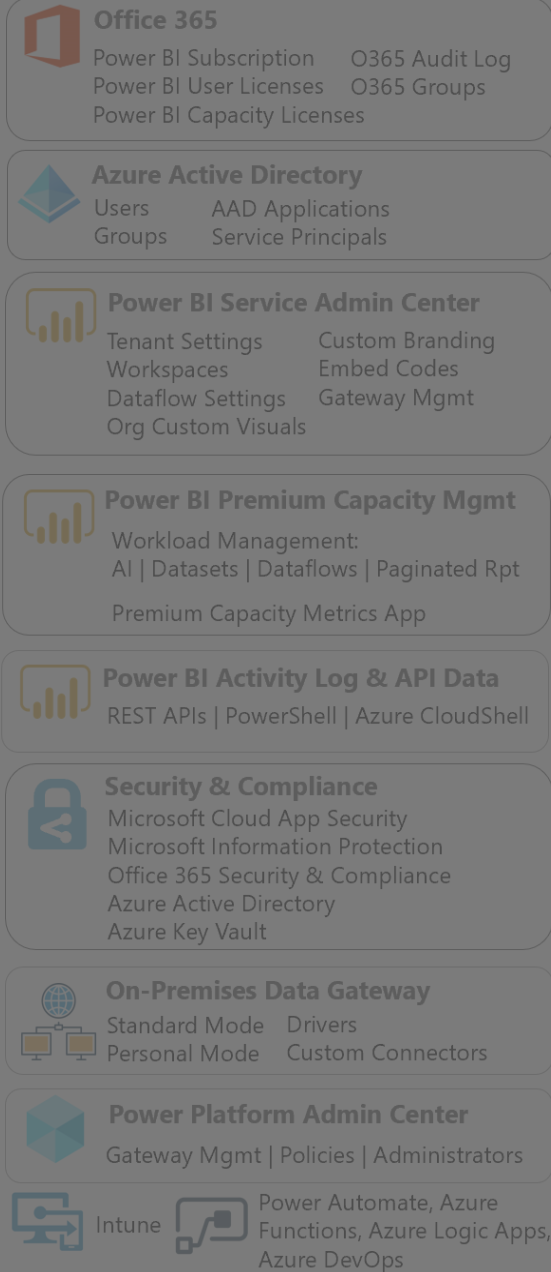
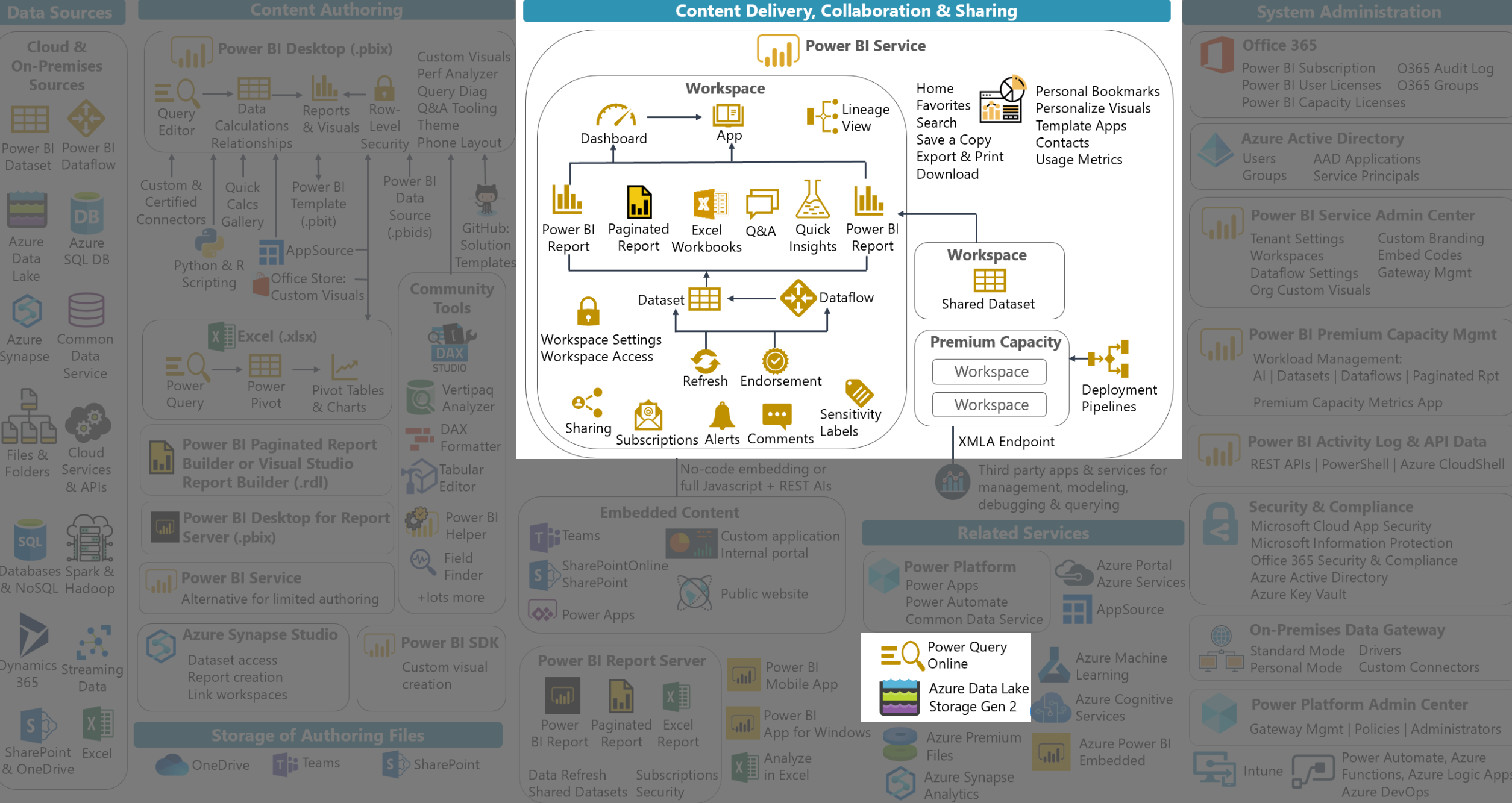


Use of Power BI Report Server as an
alternative report portal

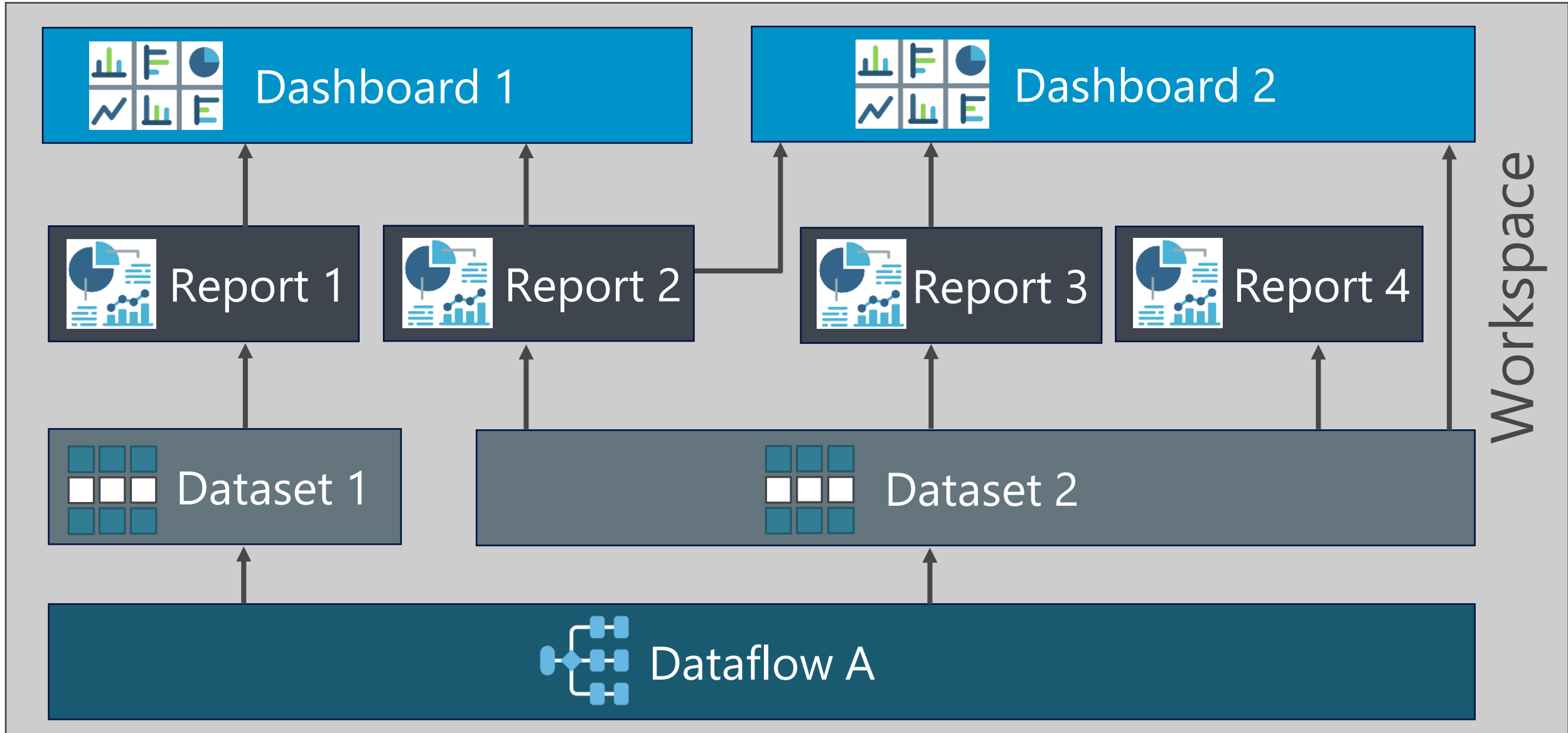




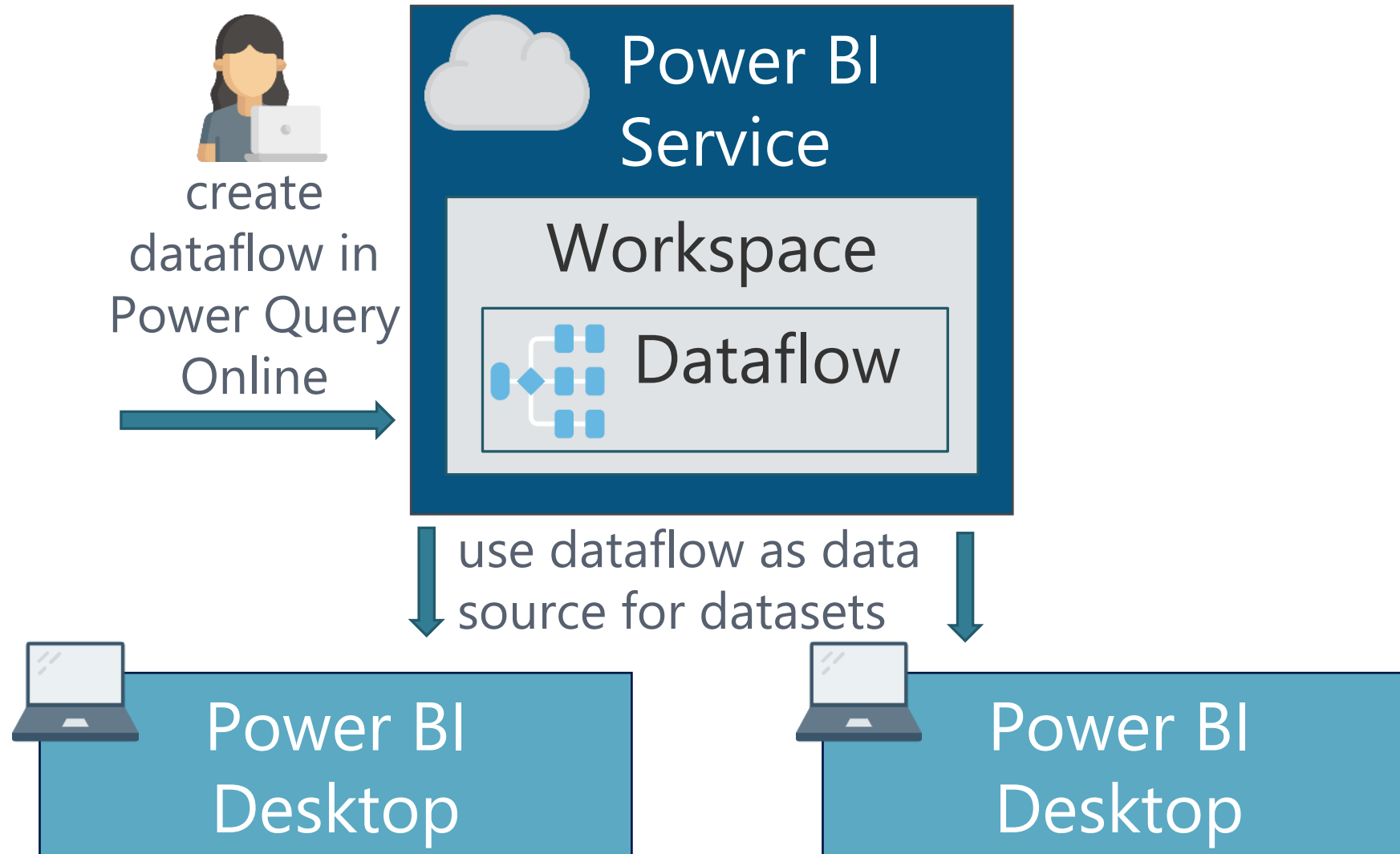
Power BI Dataflows



Dataflows



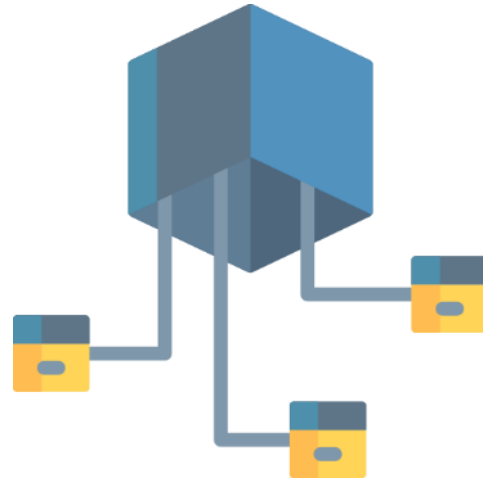
Dataflows



Top Reasons for Using Power BI Dataflows



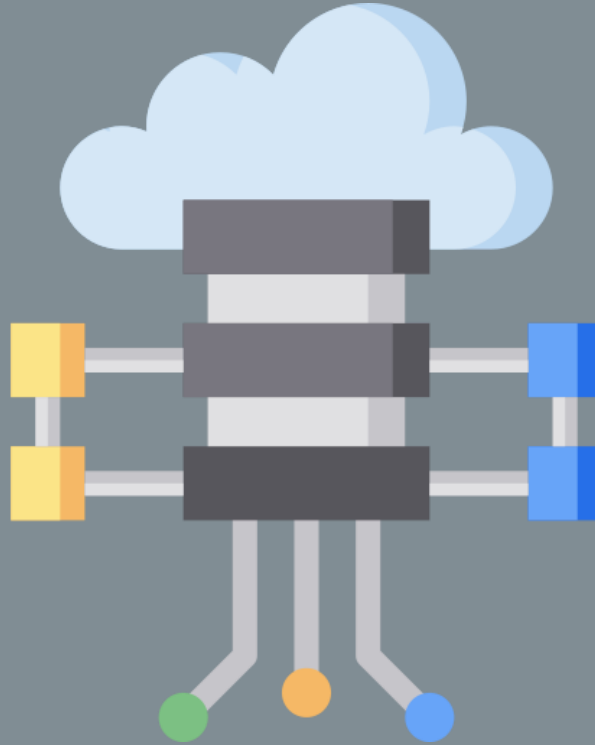
Reusable self-service data cleansing & preparation reduces repetitive work by data modelers



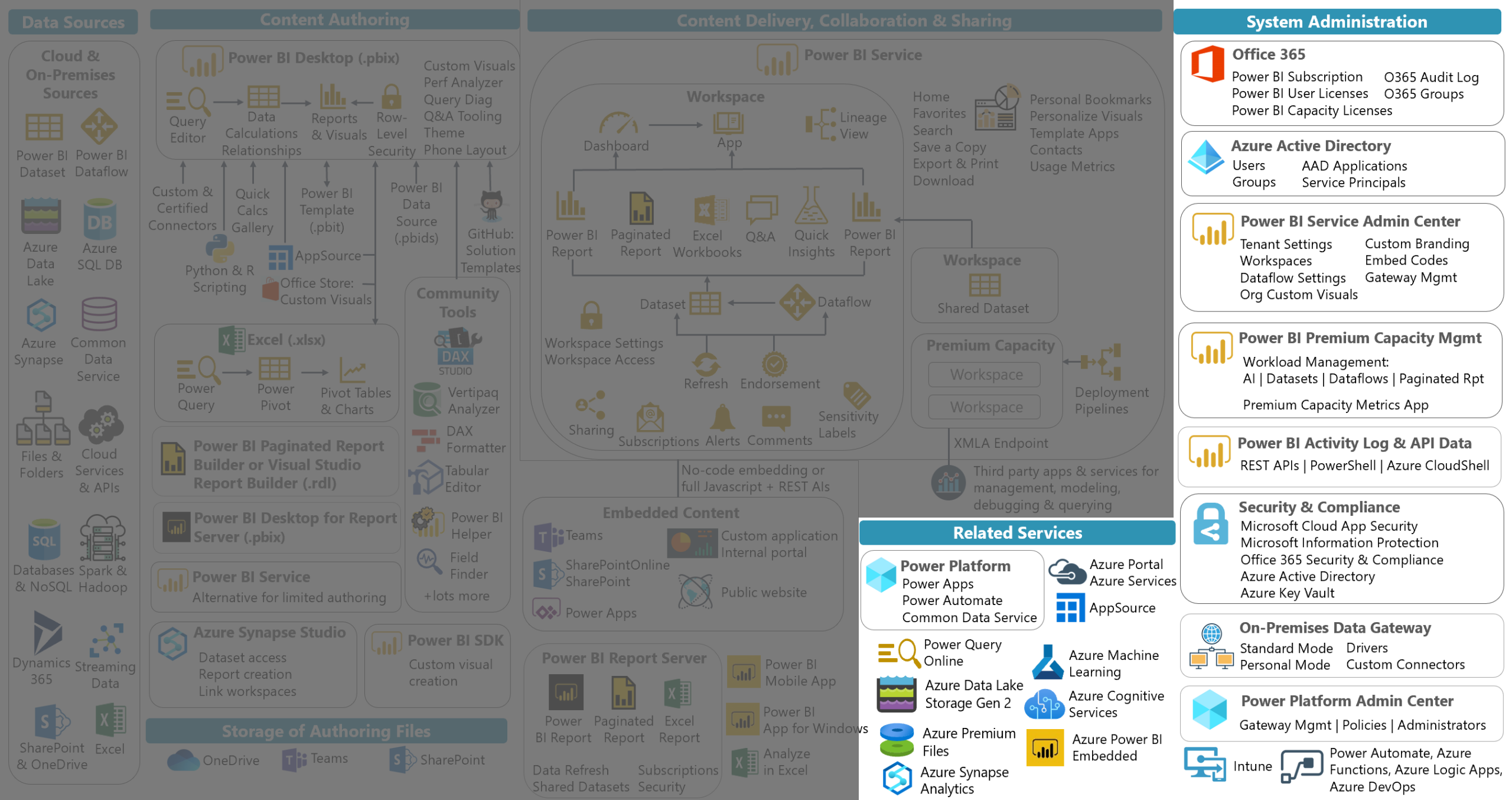
Standardized, consistent data consumed by many different datasets







Reduce load & queries sent to source systems



Other Components



Integration with Microsoft 365

-  M365 Audit Log → Power BI Activity Log
-  User licenses & Power BI Premium licenses
-  OneDrive for Business and SharePoint
-  Teams



Integration with Power Platform



Power Automate (Flow)

Power Apps

Common Data Service

Common Data Model

Power Platform Admin Center



Integration with Azure Services



Azure Active Directory:

Users, Groups, AAD Apps, Service Principals, B2B



Power BI Embedded (A-series SKUs)



Azure Data Lake Storage Gen 2 (dataflows storage)



Azure Premium Files (large dataset storage)



Azure Cognitive Services



Azure Machine Learning



Azure Synapse Analytics



Integration with Azure Security/Governance Services



Microsoft Cloud App Security



Microsoft Information Protection



Azure Key Vault



Intune (mobile app management)



Automation



PowerShell: Power BI Management Module

<https://www.powershellgallery.com/packages/MicrosoftPowerBIMgmt>

PowerShell: Data Gateway Modules

<https://www.powershellgallery.com/packages/DataGateway/>

Power BI REST APIs

<https://docs.microsoft.com/en-us/rest/api/power-bi/>

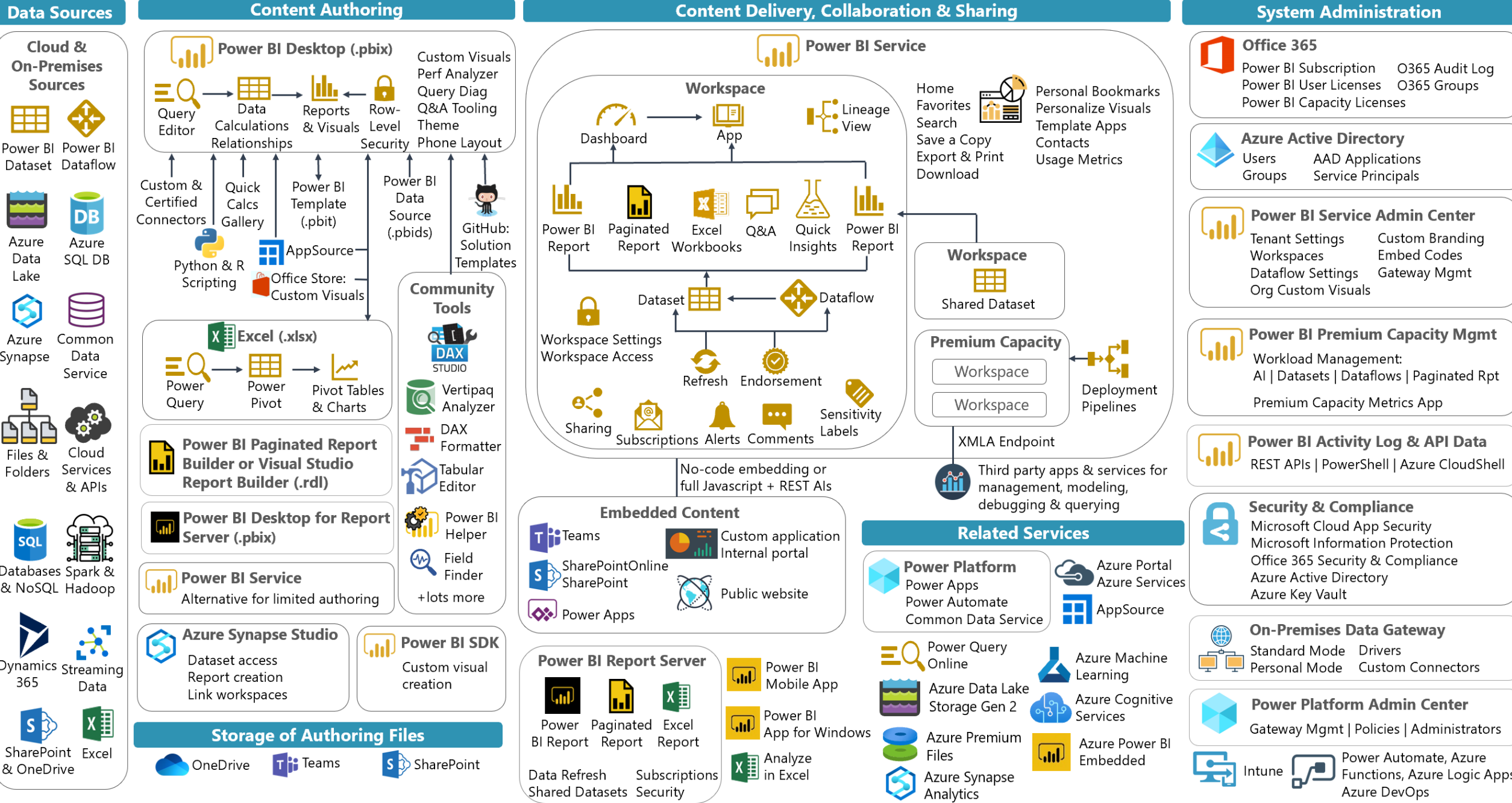
Power BI Embedded REST APIs

<https://docs.microsoft.com/en-us/rest/api/power-bi-embedded/>





Wrap-Up,
Q&A,
Links to More Information





Q&A



Where to Find More Info



Presentation Slides:

CoatesDataStrategies.com/Presentations



Diagrams:

CoatesDataStrategies.com/Diagrams



Blog:

CoatesDataStrategies.com/Blog-Posts



Videos:

Link.CoatesDataStrategies.com/YouTube



Attribute to me
as original author
if you share these
materials



No derivatives or
changes to these
materials



No usage of
these materials
for commercial
purposes



Power BI Whitepapers

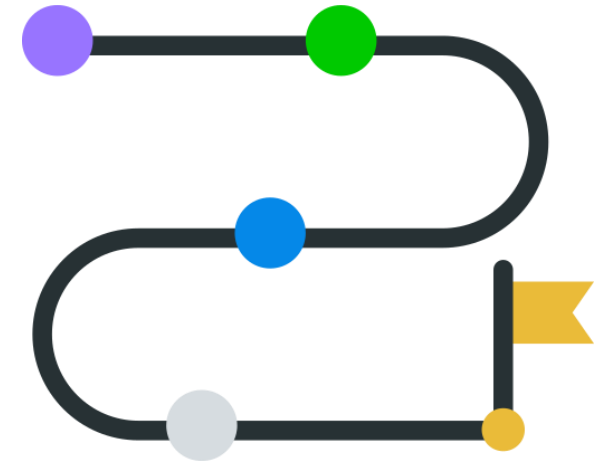
[Planning a Power BI Enterprise Deployment](#) – published May 2020
by Melissa Coates and Chris Webb

[Power BI whitepapers](#)



Power BI Release Plan (Roadmap)

<https://powerbi.microsoft.com/en-us/roadmap/>



Wave 1 2020: April 2020 through September 2020

<https://docs.microsoft.com/en-us/power-platform-release-plan/2020wave1/business-intelligence/planned-features>

Wave 2 2020: October 2020 through March 2021

<https://docs.microsoft.com/en-us/power-platform-release-plan/2020wave2/business-intelligence/planned-features>



Power BI Service Health

Issues broadly affecting many customers are reported here:

<https://powerbi.microsoft.com/en-us/support/>

Support

Service Status Per Region

| | |
|---|--------------|
| ✓ | America |
| ✓ | Asia Pacific |
| ✓ | Europe |

✓ Good ⓘ Information ⚠ Degraded ⓘ Outage

Service Outage/Degradation

✓ No known issues: Power BI is running smoothly

Awareness

- Power BI customers with Premium Capacities using SharePoint Online as a data source may see refresh not complete successfully with the following message - "The underlying connection was closed: An unexpected error occurred on a send". Until the issue is resolved in Premium capacity, a temporary workaround would be to move the workspace where the dataset is running to shared capacity and an on-demand\schedule refresh can be configured. SharePoint engineers have identified a fix and have started a rollout of the fix to all environments, expected date to be deployed to all environments is by end-of-day 06/09/2020.
- Power BI customers using table visuals in Dashboards created before July 2017 or from "Usage Metrics" may see blank visuals. As a temporary workaround for table visuals in Dashboards, customers can convert the table to a new Table by clicking the Table icon in the Report and re-pin the new visual to the dashboard. Engineers are working on a fix and expect it to be deployed by end-of-day 06/05/2020.
- Power BI engineering team has resolved an issue impacting customers loading or refreshing reports using Google BigQuery in DirectQuery mode. Following the applied solution customers are required to re-enter credentials for the affected Dataset. To re-enter credentials navigate to Dataset Settings for affected datasets and re-enter credentials through "Edit credentials" under the Data source credentials section.

Note: For Power BI Embedded service status, [click here](#).



Power BI Blog

Follow the blog closely:

<https://powerbi.microsoft.com/en-us/blog/>



The main Power BI blog has all major announcements about features & functionality.

There is an abundance of information: the Power BI community is very active with blogs, videos, and webinars. Be cautious with info found online - it gets out of date quickly as Power BI evolves and matures.

