# Power BI Governance and Deployment Approaches

Whitepaper

**Summary:**Sections 1-3 introduce governance concepts related to three types of business intelligence: Corporate BI, IT-Managed Self-Service BI, and Business-Led Self-Service BI. Sections 4-6 offer tactical options and suggestions for governance within the Power BI ecosystem.

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# Contents

## Key for Suggestions, Tips, and Best Practices

People          Process          Technology

## Feature Availability

Power BI is a rapidly maturing product. All features mentioned in this whitepaper are available, or will be available by mid-2016.

# Section 1. Developing a Culture of Analytics

Over the last few decades companies have become increasingly aware of the need to strategically leverage data assets to profit from market opportunities.Either by performing competitive analysis or by understanding operational patterns, many organizations now understand they can benefit from having a **data strategy**as a way to stay ahead of their competition.

This whitepaper provides a framework for increasing the return on investmentrelated to Power BI as companies seek to increasingly become more data-savvy.

## Introduction

Business Intelligence practitioners typically define data-savvy companies as those that benefit from the use of factual information to support decision making. We even describe certain organizations as having a "**data culture**."

Whether at the organizational level, or at a departmental level, a data culture can positively alter a company's ability to adapt and thrive. Data insights must not always be of enterprise scope to be far-reaching:small operational insights that can alter day-to-day operations can be transformational as well.

For these companies, there is an understanding that facts – and fact analysis –must drive how business processes are defined.Team members attempt to seek data, identify patterns, and share findings with others.

This approach can be useful regardless of if the analysis is done over external or internal business factors.It is first and foremost *a perspective*, not a process.

## The Vision

Peter Senge, American systems scientist and senior lecturer at the MIT Sloan School of Management, coined the term '**learning organization**.'The Harvard Business Review[1] defines a learning organization as:

> **"...a compelling vision of an organization made up of employees skilled at creating, acquiring, and transferring knowledge. These people could help their firms cultivate tolerance, foster open discussion, and think holistically and systemically."**

A learning organization is the best example of a data-driven culture.This type of organization values the following: time for reflection, openness to new ideas, psychological safety, and appreciation of differences. A Learning Organization is the ideal background for a data-driven culture given it directly addresses human factors that can propel fact-based decision making.

These organizational characteristics are also ideal for implementing far-reaching self-service BI strategies. Together with the technical implementation and governance approaches discussed in this whitepaper, a company can foster a pervasive **culture of analytics**.And although each organization may implement these ideas a bit differently, we will discuss important concepts that can help define a robust vision to a practical implementation roadmap.

Fostering a data-driven culture can assist organizations in becoming self-aware and "able to adapt to the unpredictable more quickly than their competitors could."[1]A pervasive data-driven culture can incentivize employees at any level of the organization to generate and distribute actionable knowledge.

Power BI can help boost these efforts by providing a powerful data exploration tool at a low cost of entry.

By leveraging Power BI features to explore data, identify new information patterns, share insights with others, we can provide a technical foundation in which a learning organization can be created and flourish.

## Measuring Success: User Adoption

How close is your company or line of business for becoming a data-driven organization? A common criteria used to gauge success of Business Intelligence projects is **user adoption**[2]**.**This criteria also applies to Power BI deployments; given reports and dashboards are to be consumed by people, adoption can validate the delivery approach chosen was the proper one.

One way to measure user adoption is by tracking Power BI usage around reports, dashboards, and data sources.A growing rate of adoption can be tangible evidence that users have found a critical path to generating business value.

The enterprise gateway can be utilized to obtain certain usage statistics.

In addition to tracking user adoption, it is important to track that users are not only using the tool, but using it in the *intended way*.Oftentimes we encounter environments in which reporting assets are used regularly, but not necessarily in a way aligned with their original intent.

Power BI is a versatile data modeling and reporting tool, but its intent should not be to replace Corporate BI strategy. Rather, it is one component of an overall Corporate BI and Self-Service strategy.

## Corporate Sponsorship

Another angle of adoption is buy-in, particularly for C-level executives and line of business heads.A corporate sponsor that understands the benefits of a data-driven culture can help propel the vision of a learning organization, while providing coordination to maneuver political and operational factors. He or she can also help define a roadmap for user adoption.

## Power BI Champions

Beyond the corporate sponsor, Power BI champions can help evangelize the vision of rapid and highly valuable report and dashboard development.Power BI champions can come from any role, but typically they are subject matter experts (SMEs) who are also Excel savvy, and are willing to collaborate with the Power BI corporate sponsor to strategically deploy Power BI across the organization.

Ideally there is a Power BI champion within each department or functional area.

## Approach to Governedand Ungoverned Data Sources

A critical aspect of success and adoption relates to data source usage. One of the first planning activities of deploying Power BI is to assess your current data scenario. It is important to understand if the data Power BI users will expect to consumeincludes external data not currently maintained as part of an enterprise process (including data which is currentlycleansed, cataloged by a dedicated team, typically IT).  Improving data quality, reliability, and accuracy can have a positive impact on innovation and data exploration efforts.

This distinction around source data access is key to understanding how to ultimately deploy Power BI, as well as the process, roles and responsibilities associated with this deployment. In the following section we discuss the distinction of operating in 'IT-Managed Self-Service BI' mode versus the 'Business-Led Self-Service BI' mode entirely on this important topic of data source utilization.

If data source usage is well understood, the decisions made around this key topic can ultimately promote long-term self-service BI success.
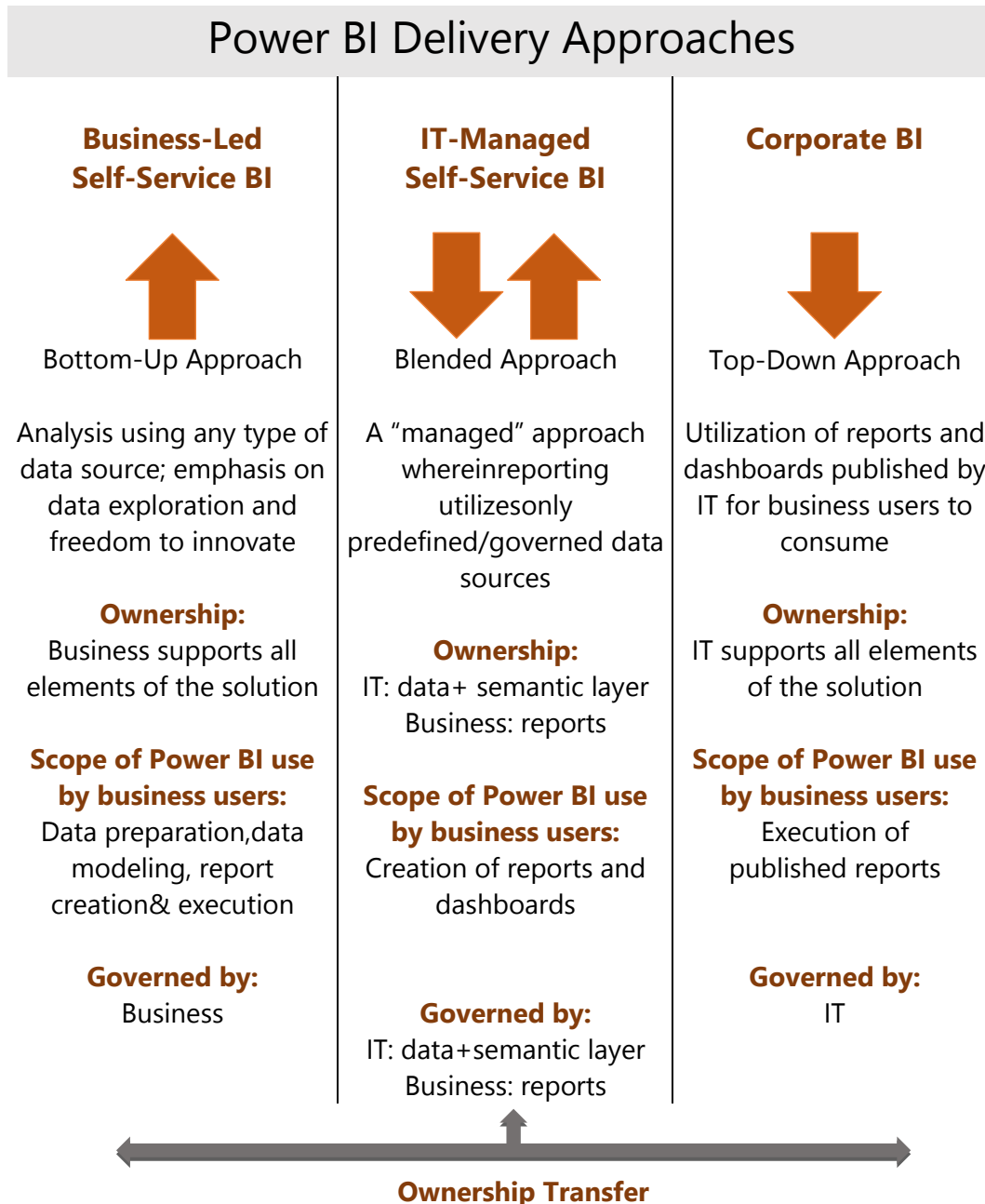
For known data sources, consider usage of the [Azure Data Catalog](). Metadata set up for each data source is searchable by tags, owners, and descriptions. The Azure Data Catalog can serve as a data dictionary, as well as an area for users to request access to a data source for provisioning purposes.

# Section 2. Power BI Deployment Modes

## Power BI Delivery: ThreeApproaches

Power BI is a very flexible set of tools that can be used for data preparation, data modeling, and/or report development activities. We see three primary approaches to delivery of Power BI solutions:

### Power BI Delivery Approaches

| Business-Led Self-Service BI | IT-Managed Self-Service BI | Corporate BI |
|---|---|---|
| Bottom-Up Approach | Blended Approach | Top-Down Approach |
| Analysis using any type of data source; emphasis on data exploration and freedom to innovate | A "managed" approach whereinreporting utilizesonly predefined/governed data sources | Utilization of reports and dashboards published by IT for business users to consume |
| **Ownership:** Business supports all elements of the solution | **Ownership:** IT: data+ semantic layer Business: reports | **Ownership:** IT supports all elements of the solution |
| **Scope of Power BI use by business users:** Data preparation,data modeling, report creation& execution | **Scope of Power BI use by business users:** Creation of reports and dashboards | **Scope of Power BI use by business users:** Execution of published reports |
| **Governed by:** Business | **Governed by:** IT: data+semantic layer Business: reports | **Governed by:** IT |

**Ownership Transfer**

Over time, certain self-service solutions deemed as critical to the business may transfer ownership and maintenance to IT. It's also possible for business users to adopt a prototype created by IT.

As indicated in the previous chart, Power BI can be used in different ways which result in a fundamentally different user experience:

1. **Business-Led Self-Service BI:**In this scenario, the business users have the most involvement and control. Although some governed data sources certainly may be utilized as part of the overall solution (which is encouraged), there very well may also be non-standard, non-governed data sources involved (such as industry statistics purchased from a third party) which allow for exploration of patterns that can go well beyond the data recorded in the corporate data warehouse. The critical difference here is that the business unit takes ownership and support for this type of solution.

2. **IT-Managed Self-Service BI:**In this scenario, business users utilize Power BI as a reporting layer over standardized and governed data sources. In this mode, IT produces and governs a data layer of high quality which adheres to conformed enterprise master data. At the same time, the business owns the reporting layer which may or may not adhere to the same development cycles and governance standards promoted by IT.

3. **Corporate BI:**This scenario is frequently referred to as 'enterprise reporting' or sometimes 'canned reporting' wherein IT has full ownership of the entire solution and releases reports for user consumption.

*Level of Business User Involvement and Control*

Each of the above scenarios can be employed concurrently, depending on the particular requirements and user base. IT can increase value by providing additional infrastructure layers to automate, integrate, cleanse, and maintain data source quality and integrity through tools like SQL Server Integration Services (SSIS), Master Data Services (MDS), and Data Quality Services (DQS).

Additionally, Azure Data Catalog can be utilized as a data dictionary, as well as for centralized data source search and user requests for access to a particular data source.

It would be difficult to overstate the benefit and value of tools such as Azure Data Catalog, Master Data Services, and Data Quality Services can provide to BI initiatives.

IT may decide at some point to adopt a particular end-user Power BI solution if the solutionprovides enough critical business value. Given the report has already proven valuable to the business, requirements are already known, then IT adoption can represent a win/win scenario for both IT and business users.

Typically the following benefits are seen by the business when ownership transfer to IT occurs:

- Data can be centrally **refreshed**, often on a faster time schedule.

- Data **size limits**are typically no longer a constraint.

- Additional **security**capabilities become available.

- The solution can receive formal IT**support**and fall under existing **service level agreements** (SLAs).

- Frees up business users to continue exploring new data patterns while maintaining other Power BI solutions which are not yet production-ready, or an ownership transfer to IT does not make sense from a cost/effort perspective.

Adoption of Power BI reports by IT can become a standard process, in which Power BI assets (queries, models, and/or reports and dashboards) are **certified** by adhering to IT compliance rules.

These compliance rules include validations such as:
- Usage of standardized, supportable data sources
- Utilization of conformed dimensions (for a consistent user experience
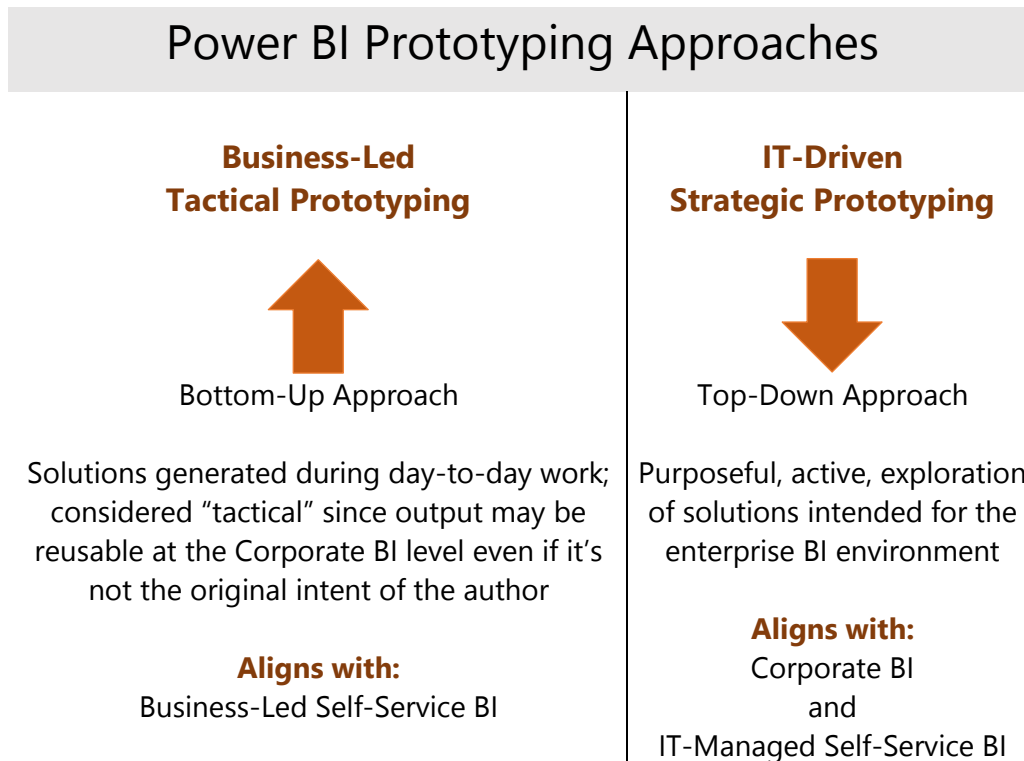- Calculations follow accepted best practices
- Report layout follows standards

Reuse of existing data sourcesis a best practice in self-service BI. It improves standardization and can save refactoring time later.

In summary, although the Power BI delivery modes are independent from each other, they are absolutely complementary within an overall Power BI deployment strategy.

## Power BI as a Prototyping Tool

In addition to the above three scenarios, there is another form of Power BI usage that is extremely important: **prototyping**.Each of the above three scenarios can (and often should) involve prototyping. There are two main ways to initiate prototyping activities:

## Power BI Prototyping Approaches

| **Business-Led Tactical Prototyping** | **IT-Driven Strategic Prototyping** |
|---|---|
| Bottom-Up Approach | Top-Down Approach |
| Solutions generated during day-to-day work; considered "tactical" since output may be reusable at the Corporate BI level even if it's not the original intent of the author | Purposeful, active, exploration of solutions intended for the enterprise BI environment |
| **Aligns with:** Business-Led Self-Service BI | **Aligns with:** Corporate BI and IT-Managed Self-Service BI |

As shown in the above chart, prototyping can be approached in the following ways:

1. **Business-LedTactical Prototyping:**Power BI is utilized by business users in their routine, day-to-day work. If this type of solution is considered successful, it may capture the attention of the team who manages the corporate BI / business analytics environment. In this way, the business-generated solution is considered a "tactical" prototype because a prototype wasn't the original intent, but it ultimately served that purpose and helped improve or augment the corporate BI environment.

2. **IT-Driven Strategic Prototyping:**IT technology teams purposefully utilize Power BI to discover requirements for enterprise data warehousing and business intelligence projects.This is a strategic use of Power BI, given many users find it easier to define what they want or not want when interacting with a functional report sample.The advantage of using Power BI in this way is that data warehousing and business intelligence cost and work effort can be dramatically reduced, given refactoring is diminished as requirements are more closely aligned to business needs from the

early stages of the project. This strategic prototyping activity is also sometimes referred to as active prototyping.

Regardless of its origin, Power BI prototypes developed can be used as functional blueprints that guide subsequent data integration, data modeling, or report development.

## Analytical Sandboxes

With the continued prevalence of self-service BI, some companies feel more comfortable restricting report authors to using only validated data sources. This is understandable given the governance issues that may emerge from inaccurate data that may be found outside of the cleansed data warehouse.

Some organizations have found, however, that to fully leverage users' creativity when exploring data it is important to set up an analytical sandbox. An analytical sandbox can be as simple as a confined database, or it can be a true Big Data repository of structured and semi-structured data whose main purpose is to allow data exploration. The extent of a sandbox solution may vary between types of users. For instance, a data scientist may request more diverse resources than an analyst.

When using sandbox sources it is important to differentiate data investigation from production reports.

Youmay find it useful to set up Development/QA/Production Power BI group workspaces which can place clear boundaries on the intent of each environment and allow for better governance. Branding these areas differently can assist end users with what they are looking at and imply the level of trust to place in the data.

Group workspaces in Power BI should be used liberally. Datasets, reports, and dashboards in a personal workspace are 'stranded' should a user leave the company or change roles, thus requiring an administrator's assistance.
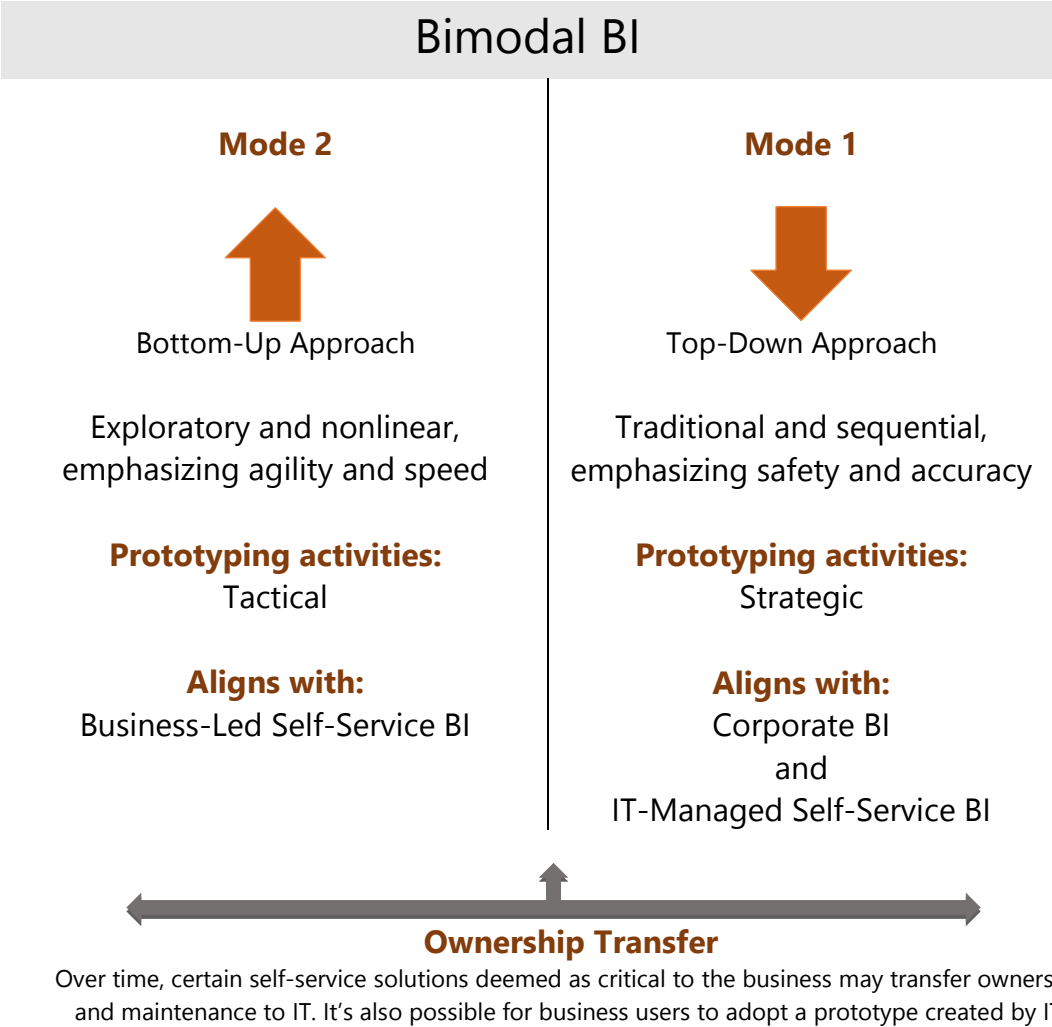
Reports in Power BI can be classified as HBI/MBI/LBI, which equates to high business impact, medium business impact, or low business impact. Though this is not a replacement for branding techniques which are very important to differentiate authorship, business impact tagging can be helpful in compliance efforts.

## Bimodal Business Intelligence

The above delivery modes somewhat align with **Mode 1 and Mode 2 of Bimodal IT**, as described by Gartner[3].Bimodal IT, and the targeted subset of Bimodal BI, is the practice of managing two separate, coherent modes of business intelligence and analytics delivery: one focused on stability and the other on agility.

The key difference is that, in this whitepaper, we make a distinction between the two types of self-service BI whereas the high level definition of Bimodal BI by Gartner does not seek to make that distinction.

## Bimodal BI

| Mode 2 | Mode 1 |
|---|---|
| Bottom-Up Approach | Top-Down Approach |
| Exploratory and nonlinear, emphasizing agility and speed | Traditional and sequential, emphasizing safety and accuracy |
| **Prototyping activities:** Tactical | **Prototyping activities:** Strategic |
| **Aligns with:** Business-Led Self-Service BI | **Aligns with:** Corporate BI and IT-Managed Self-Service BI |

### Ownership Transfer
Over time, certain self-service solutions deemed as critical to the business may transfer ownership and maintenance to IT. It's also possible for business users to adopt a prototype created by IT.

Both modes of a Bimodal BI environment can be defined by phases of deployment.These phases align with the vision of fostering a data-driven culture, and encapsulate technical and process best practices.

In the following section, we will explore phases of delivery for:
1. Business-Led Self-Service BI(including tactical prototyping)
2. Corporate BI (including strategic prototyping)
3. Ownership Transfer

## Phases of Delivery: Business-Led Self-Service BI

Business-Led Self-Service BI Phases of Delivery

Bottom/Up
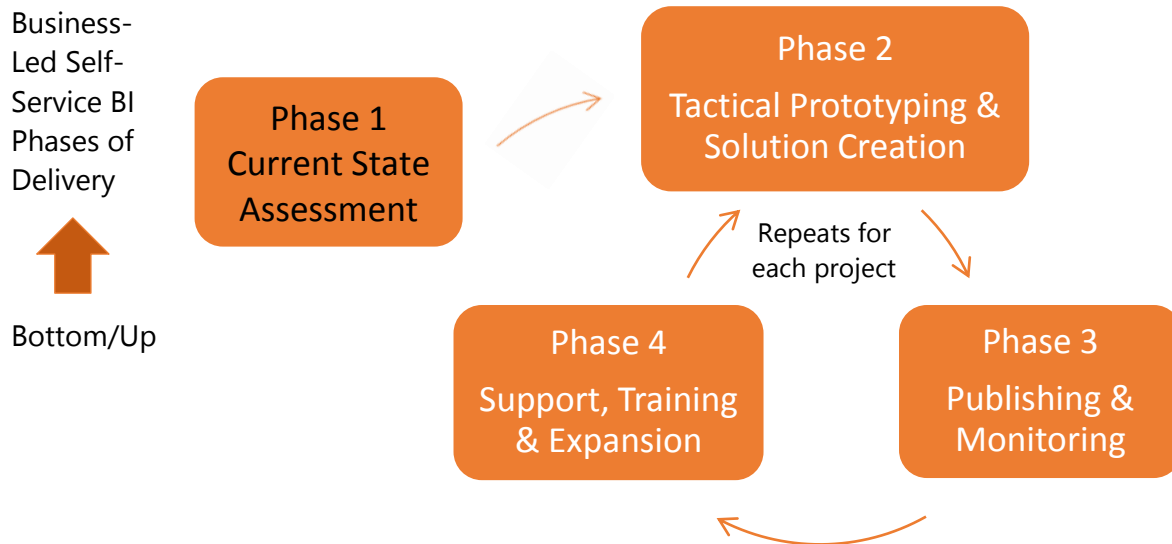


## Business-Led SSBI Phase 1 – Current State Assessment

Although self-serviceBI is typically led by business users (rather than IT), it is common for a Power BI champion to perform an assessment to understand **current versus desired state**.Within the context of this whitepaper, the ideal state is a data-driven culture. This phase is typically a one-time effort, though a reevaluation at certain intervals may also be helpful.

Assessments are typically conducted via surveys and interviews, given the qualitative nature of information it must uncover.The assessment intends to understand the current state of the infrastructure, Power BI skill level, categorize reporting and analytical needs, and to perform a gap analysis.

As an important outcome of this phase, the Power BI champion must identify **reporting scenarios that are of low complexity but of high value** to the business.

These scenarios become candidates for prototyping in the next phase of delivery.

Starting with a low complexity use case with high business value offers learning opportunities with the greatest chance for success.

## Business-Led SSBI Phase 2 – Tactical Prototyping and Solution Creation

During this phase, the Power BI champion leads users in the **creation of selected reports**which have potential to become highly relevant to the business. This may involve just report creation, or it may also involve data extraction, standardization, modeling, and calculations. These preliminary reports shouldthen be delivered to colleagues and subject matter experts for immediate evaluation and feedback. Receiving feedback quickly is a critical consideration.

It is also important to note some of the early prototypes are **experimental**in nature and may never be used for normal, routine business operations (not for production purposes, in IT nomenclature).

Specific Power BI group workspaces should be designed to clearly define prototypes that have no immediate business use.

## Business-Led SSBI Phase 3 – Publishing and Monitoring

Once the Power BI prototype has proven business value, it is published to the collaboration area. The most common collaboration area for Power BI is the web-basedPower BI Service (in addition to SharePoint). Although a file share can be used as a publishing destination, it does not offer collaboration capabilities and is not the recommended approach.

Consider making members in a group workspace read-only, which allows edit privileges only for admins of the group.

Once the dataset and/or reports are published, several additional tasks remain:

- Creation of a **dashboard**(if desired; most frequently in Power BI there is a dashboard that highlights the most common elements from one or more reports)

- **Refresh schedule**in place (if importing data rather than using a live connection)

- Verification of**sharing and/or security**settings

- Creation of a **content pack**(if personalization by others is desired)

- **Documentation**based on departmental standards

It is uncommon for a new Power BI solution to be perfect in its first iteration, so we recommend the owner plan to make **incremental improvements**. Additionally, the Power BI champion leading the effort may want to define a **governance approach**for the source data depending on its sensitivity.

If using files as a source, the owner may want to designate

Using OneDrive for

protected shared folders where permissions will prevent accidental data loss or alteration.

Business or SharePoint Online, which both offer versioning capabilities, is a best practice.

Additionally, as the report grows in popularity, Power BI champions may want to understand **usage patterns**.This information is useful as he or she must allocate time and/or resources for maintaining, augmenting, and growing self-service BI solutions.

## Business-Led SSBI Phase 4 – Support, Training, and Expansion

The next phase after a Power BI report has been running in an automated fashion, offering high value to the business, is to expand the effort in terms of reach and infrastructure.This is an important phase in which the Power BI champion must lead the way to fully evangelize the vision of a data-driven culture.

Two key parallel approaches are strongly recommended:

### Vision expansion

Disseminate Power BI knowledge to the internal community of users, and support their efforts.This can typically be done through:

- **Sharing of knowledge**:Power BI users actively share knowledge through techniques such as:
  - Internal and/or external user groups
  - Lunch and learn sessions
  - Knowledgebase
  - Frequently asked questions
  - Short how-to videos
  - Yammer
  - E-mail distribution lists

- **Power BI Center of Excellence**: Actively collect and categorize internal practices for streamlined reporting and define a vehicle for sharing with others (such as a newsletter or intranet site).

- **Gamification**: Power BI internal competitions which encourage the sharing of knowledge in an enjoyable manner and recognizes people who have created clever solutions.
- **Power BI training**:Training for Power BI report designers and data modelers, as well as for Power BI report consumers.

### Infrastructure consolidation

In collaboration with IT, define which additional infrastructure layers can increase the quality and relevancy of the Power BI deployment:

- o **Power BI production reports**: Displaying branded stamp of approval, for instance a logo that symbolizes a production report which has been certified, thus more reliable than a prototype.

- o **SQL Server services**:Handling of master data, data quality processes, semantic layer, and other business intelligence components that have the capacity to enhance the value of the solution.

- o **Cortana Analytics**: Big Data and Advanced Analytics integration for purposes of enhancing the value of the solution.Significant BI and analytics capabilities are being introduced to the Cortana Analytics Suite.

A certain degree of ownership transfer may happen during infrastructure consolidation (ownership transfer is discussed later in this section).

As the environment matures and expands, it is important to develop a recognition plan to reward those users that developed the original Power BI solution. As the product of their work moves to other teams, he or she must be in agreement with the ownership transfer.If this is not the case, the corporate BI environment may be affected by losing contributions of skilled authors of Power BI models and reports.
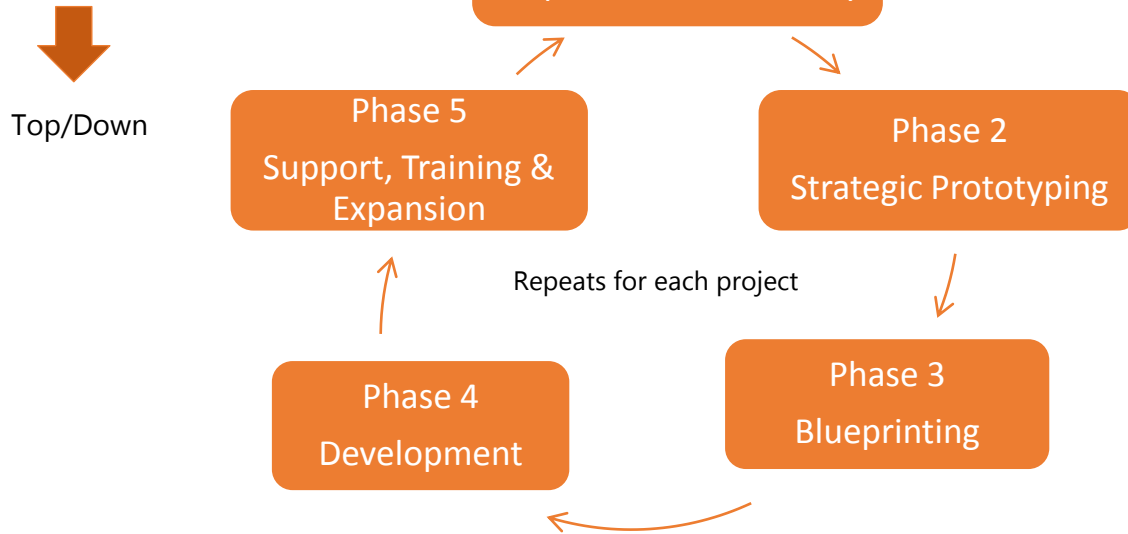
A successful partnership between business users and IT requires respect for each other's efforts and different goals.

## Phases of Delivery: Corporate BI

Corporate
BI Phases
of Delivery

Top/Down

| | |
|---|---|
| | **Phase 1** Requirements Discovery |
| **Phase 5** Support, Training & Expansion | **Phase 2** Strategic Prototyping |

Repeats for each project

| **Phase 4** Development | **Phase 3** Blueprinting |
|---|---|

## CBI Phase 1 – Requirements Discovery

In this phase, ITcompiles requirements, often via interviews, to uncover areas where BI needs are not being met within the scope of an enterprise data warehousing/ business intelligenceenvironment. The objective of this phase is to **discover high level requirements**that guide strategic prototyping efforts, wherein further details are learned.

It is not uncommon to run into scenarios where BI requirements are not clearly understood by IT or even by business users. Approaching EDW and BI projects in an agile manner mitigates some of the risk related to unknown requirements, however another approach is possible to address this risk: prototyping.

## CBI Phase 2 – Strategic Prototyping

**Strategic prototyping**is the process of leveraging Power BI to explicitly seek out feedback from users during a requirements discovery session.Technology professionals tacitly understand that users may have a hard time spelling out requirements and when asked which data elements they may need, it is not uncommon to hear "I don't know."To counteract vague requirements, Power BI can assist IT during strategic prototyping sessions in which users can see data samples and interactive report mockups.This in turn will assist subject matter experts with conveying what the needs are from a report requirements perspective.

Strategic prototyping session must have **clearly defined agendas** In addition to

**and goals**, be led by a Power BI champion, and must have business users in attendance.Individual sessions seek to discover detailed requirements about:

- Data sources, structure, completeness, complexity (data profiling)

- Semantic interface (field names, hierarchies, data groupings)

- Calculations and business rules

- Report layout

- Report interactivity needs (such as drill-down or drill-through)

reports, the 'Query' and 'Data' functionality within Power BI Desktop is useful for strategic prototyping sessions. It is amazing how many data transformation / cleansing processes can be demonstrated very quickly.

The Power BI champion should, during prototype development, inquire of business users about**use cases**, who will utilize the reports, and how the data is intended to flow before and after the report is generated.New information uncovered during these sessions has the potential to save time and effort during actual development, a great benefit that can reduce the final price tag of the project.

Project managers may want to limit the number of strategic prototyping sessions to be conducted per subject area.This can help keep stakeholders focused within the allocated sessions before the initial set of requirements are defined.



A common development approach that fits well with this perspective is the **spiral methodology**.It accounts for a limited number of prototyping cycles, before solution architecture is specified and development begins.

It is also important to understand that, during strategic prototyping, a certain amount of work will be thrown away.This is an implicit assumption, which will ultimately benefit the project by reducing longer refactoring cycles which may occur if requirements are not fully understood.

There needs to be a willingness to throw away prototypes. The value is in the learning.

## CBI Phase 3 – Blueprinting

During strategic prototyping, functional Power BI report mockups would have been built.These report mockups will contain important information that will feed into the **blueprinting process**prior to starting development. Typically, this information will contain:

- New data source(s)

- A complete or partial data model, including naming conventions

- Rules for business calculations and hierarchies

- A proper way to visualize the data

- Use cases which will may influence security or deployment decisions

- Specific needs such as exporting, drill-down interactivity, or automated scheduling

After blueprinting is complete using this information as a guide, the business analytics team will decide on the best tool which aligns with the requirements.

If Power BI is used by IT for both prototyping and standardized reporting, it is likely some Power BI work may be replaced by another technology.For example, queries (M language in Power BI Desktop)may be replaced by Integration Services if deemed appropriate. Or, perhaps Reporting Services is deemed the most suitable reporting tool to satisfy requirements.

Selecting the right technologies is easier at this point thanks to information learned during prototyping.

A hybrid delivery model which integrates Reporting Services artifacts in Power BI is supported in SQL Server 2016. This offers great flexibility in choosing the best tool for the job.

## CBI Phase 4 – Development

Development cycles will adhere to **standard IT methodology**, following the blueprinting process. Typically this follows a Development > QA> Production cycle wherein the business users are involved with user acceptance testing.

In this phase it is highly desirable to work in iterations, **frequently delivering**small components of the solution. Although it is very tempting to wait until the solution is "done" in order to share the output with the business users, that type of waterfall approach is frustrating to the business users if they don't see any progress for weeks or months at a time.

## CBI Phase 5 – Support, Training and Expansion

In this final phase, the Power BI solution has been deployed, is bringing value to the business, and is in support mode. A frequent pain point is when different numbers are produced from self-service reports vs. corporate BI reports, so an important element of support is how to reconcile and resolve these types of concerns.

Usage monitoring is a critical element of this phase for performance, security, and for understanding which elements of the environment are most critical.Data which is accessed via the enterprise gateway provides some usage metrics.

Some companies find it useful to require attendance of hands-on or virtual training before receiving an ID and password for a business intelligence system. Beyond initial training, the following elements are invaluable:

- **Data dictionary**(particularly helpful if there are multiple definitions for certain metrics)

- **Frequently asked questions**

- **Short how-to videos**(2-4 minutes is ideal)

Earlier in this document we introduced the idea of tactical prototyping, in which business-generated solutions can be useful for augmenting the corporate BI environment. It is important to remain on the lookout for those types of opportunities, which may or may not formally involve transferring ownership which we discuss next.

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# Phases of Delivery: Ownership Transfer

There is also a situation in which Bottom/Up and Top/Down methods converge.We call this phase **Ownership Transfer**, as it is at this point that IT may fully adopt Power BI reports built by the business, or the business may take the lead of a reporting initiative that started as an IT sponsored project.

There are a number of reasons that may initiate an ownership transfer, such as:
- Critical nature of the solution and need for broader support for the solution
- Data model sizing constraints
- Additional row-level security requirements better served by the corporate BI team and/or a centralized system

It is important to be mindful of sizing constraints in Power BI, and to have a plan for what happens when data imported into a Power BI model begins approaching the 250 MB limit.

Ownership transfer can occur in two ways:
- ITacquires a Power BI solution developed by the business (this is the most common)
- Business users adopt a Power BI prototype created during requirements discovery (i.e., duringstrategic prototyping sessions)

Ownership TransferPhases

Phase 1 - Publishing

Phase 2 - Certification

Phase 3 - Assume Ownership
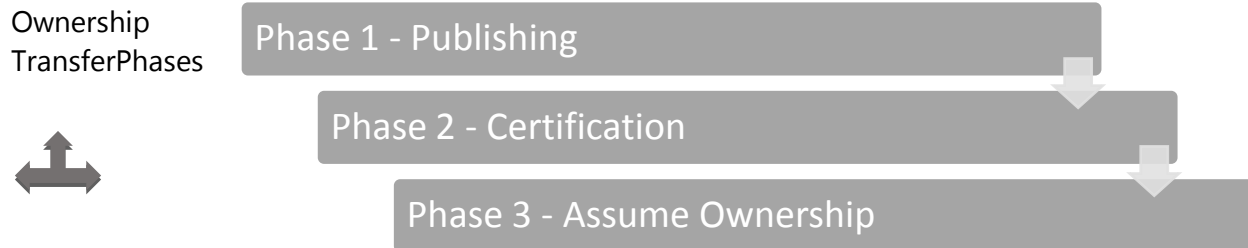
Following is a discussion of these phases in more detail, from both perspectives.

## IT Adoption Phase 1– Publishing by Business

When Power BI reports developed by the business contain data transformations, data models,and/or reporting views with potential to benefit a wider scope of enterprise BI delivery, IT may want to incorporate it into its own strategic initiatives.This phase assumes IT has clearly indicated their interest in adopting a Power BI report.

During the first phase of ownership transfer, Power BI reports may be republished to a collaboration area that is being monitored by IT as well as business users.This will allow for a controlled benchmarking process to begin, as the Power BI report undergoes certification. This also means the business will commit to stop making changes until the ownership transfer is complete.

## IT Adoption Phase 2– Certification

The Power BI report is evaluated for compliance on three areas:
- **Data Sources:**Are these validated reporting sources, such as an enterprise data warehouse? Flat files and Excel sources may be replaced in some cases.

- **Data Model:**Are IT supported best practices being utilized?These could range from using standardized dimensional models to specific DAX authoring approaches.

- **Report Layout:**Compliance to corporate branding standards for look and feel, as well as presentation (such as rounding or scaling).

Use 'branding' techniques to differentiate between who published the solution.

If a Power BI report does not pass certification it will require IT's effort to refactor it to ensure compliance.In other words, additional data integration, data warehousing, or data modeling efforts may be needed for IT to take over responsibility for the report and its underlying data.

Generally, a work effort assessment would be compared against the value offered by the ownership transfer.Benefits typically range from gaining visibility into a critical BI asset to ensure governance, to benefiting other users that regularly produce reporting views over the same data.If the organization decides ownership transfer is indeed valuable, an IT-controlled development process will ensue to achieve compliance.

## IT Adoption Phase 3 – Assume Ownership

Once the Power BI report has been certified, IT will publish it to the regular production BI group workspace and cover it under knownservice level agreements (SLAs).Any further changes will be performed by IT, and not by the original business user who authored the report.

The process of functional business users adopting IT prototypes will involve the same phases, but with a different perspective:

## Business Adoption Phase 1 – Publishing

After an strategicprototype has sparked interest within the business and a Power BI champion offers to own it, IT would publish the prototype to a specified collaboration area. This area is only utilized for prototypes in process of being transferred for business ownership.Publishing is a preferred method over emailing Power BI files, given it allows for easier tracking.

## Business Adoption Phase 2 – Certification

In this phase, the Power BI champion reviews the strategic prototype for compliance with business requirements.Any identified gaps would be solved by using Power BI transformations, modeling, calculations, and/or reporting features.

## Business Adoption Phase 3 –Assume Ownership

Once end users feel comfortable with the state of the prototype, they would make use of it to run their business operation and perform analytical tasks.IT will cease to own the effort completely, given the report is now owned by the business.

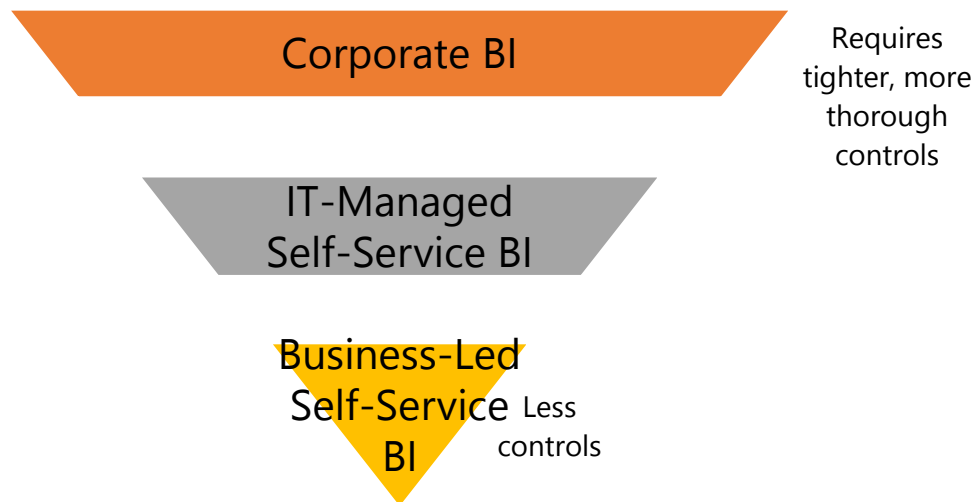# Section 3. Building a Power BI Team: Roles & Responsibilities

Power BI team roles will vary depending of if an organization is pursuing a Bottom/Up or Top/Down approach, although one key role must be present regardless of the deployment mode:**the Power BI champion.**

The person that fills this role typically is passionate about the possibilities of a data-driven culture and is a technical or quasi-technical person who is very skilled in end-to-end Power BI development. This includes Power Query / M scripts, Power Pivot / DAX, dashboarding best practices, and Power BI deployment modes.

The Power BI champion assists technical and project leaders with the implementation, facilitating communication among stakeholders, promoting collaboration and best practices,as well as offering mentoring and training when needed.Depending on the organization, a company could have a single Power BI champion, or a team of them. Typically if a team is involved, there will be a team lead that drives the vision.

Power BI champions are typically different from corporate sponsors. Whereas Power BI champions focus on driving the details of the implementation, corporate sponsors provide resources needed to drive the vision forward.

From a governance standpoint, we expect different levels of controls with the different delivery modes:

Corporate BI

Requires tighter, more thorough controls

IT-Managed Self-Service BI

Business-Led Self-Service BI

Less controls

Therefore, it is reasonable to expect that roles and responsibilities differ between the delivery modes as well.

The biggest distinction between roles for Self-Service BI is that between report consumers and Power BI modelers.Report consumers may interact with report views and dashboards, but would not normally define M queries, data model artifacts, nor DAX calculations within the Power BI report. Power BI data modelers would handle queries, data model, and calculations.

A dedicated role to monitor usage is highly recommended in a Self-Service BI scenario, regardless if it is considered to be IT-managed or business-led.This person would attempt to understand patterns to uncover popular Power BI reports and models that could become candidates for upgrade to other tools, like SQL Server Analysis Services (SSAS) Tabular models or SQL Server Integration Services (SSIS) ETL processes.

In a corporate BI scenario, on the other hand, one of the most important roles is that of the Power BI champion. He or she must ensure the strategic prototyping process is being deployed methodically to assist with requirements discovery.

Finally, IT, power users, and the Power BI champion must all collaborate during the ownership transfer process to define the process of migration of Power BI work effort into other teams or other technologies.


# Section 4. Power BI Implementation Options

Although Power BI allows for a wide variety of implementation options combining multiple data sources in cloud, on-premises, or hybrid environments using batch or real-time modes, there are some general concepts that can help navigate the implementation options applicable at your organization.

Before exploring how different implementation options align with the three deployment modes discussed in the earlier sections, first let's review a general overview of Power BI technology integration points.This will help understand the broad ways in which Power BI can be implemented.

Options for *hybrid*delivery of Power BI:
1. Power BI Service
2. Custom Application
3. Public Website

Options for *on-premises only* delivery:
1. File Share
2. Power Pivot Gallery in SharePoint
3. Third Party Integration

The Microsoft BI Roadmap specifies that, in the future, SQL Server Reporting Services (SSRS) will support Power BI Desktop files (i.e., interactive reports) deployed to and displayed in the SSRS Report Manager portal. Once this integration exists for various report types in Report Manager, this will represent a 4th on-premises implementation option.

Terminology Review:

- **Hybrid:** Generally utilized to denote an implementation which spans both on-premises and cloud sources. This can include various combinations of on-premises and cloud data sources, infrastructure, and services.
- **On-Premises:** Usually used to represent data and/or infrastructure that is owned by a company and residing in their data center.
- **Cloud**: Refers to data, infrastructure, and services residing in a public cloud environment which is maintained and managed by a third party. Examples of cloud offerings include the web-based Power BI Service and Microsoft Azure.
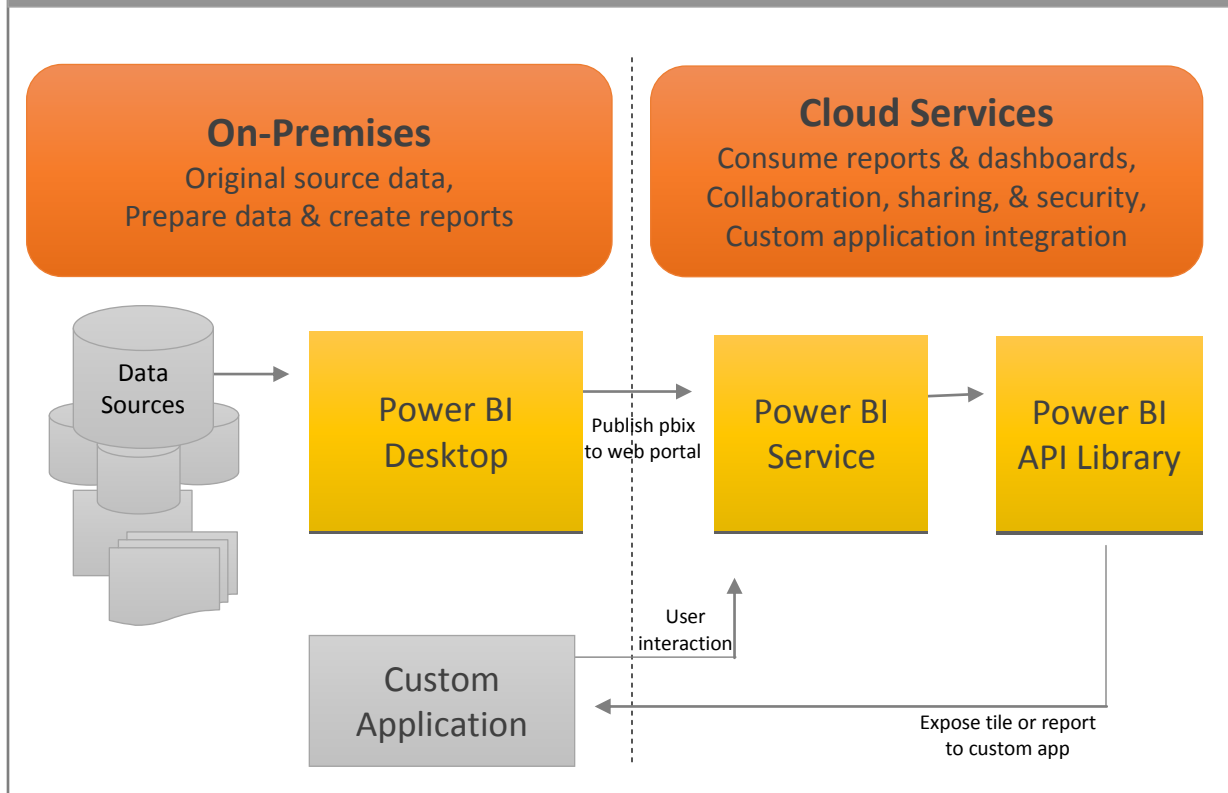
## Hybrid Deployment Scenarios
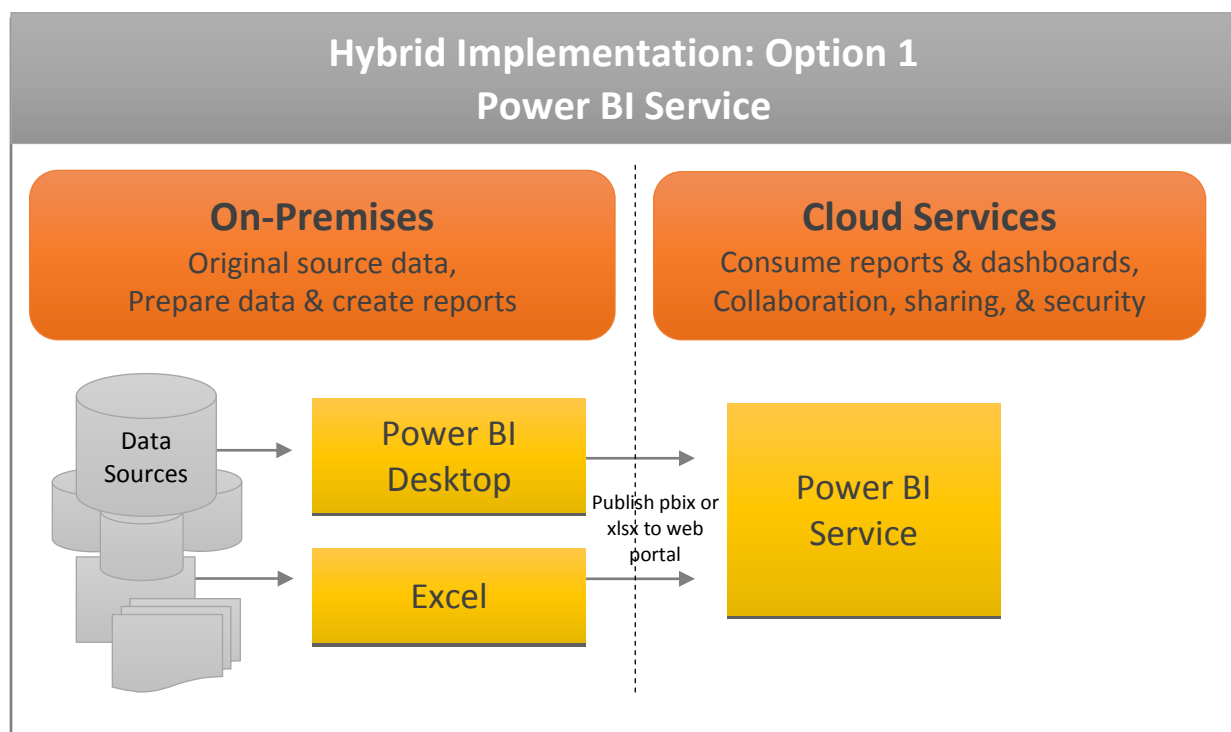


Themost common hybrid scenario for Power BI delivery is usage of the Power BI Service:

- One or more **original data sources are on-premises**(though Power BI can consume data "born" in the cloud, as well as on-premises corporate data).
- Data **preparation and report creation** occursPower BI Desktop and/or Excel.
- The completed Power BI Desktop and/or Excel file is **published to the Power BI Service**.
- Report **consumption, collaboration, sharing, security, and data refresh**(if applicable) occurs in the **Power BI Service**.
- **Dashboards** are created in the**Power BI Service**. Reports can also be created or edited directly in the Power BI Service.
- With this first hybrid option that includes the Power BI Service, the entire feature-set of Power BI is available
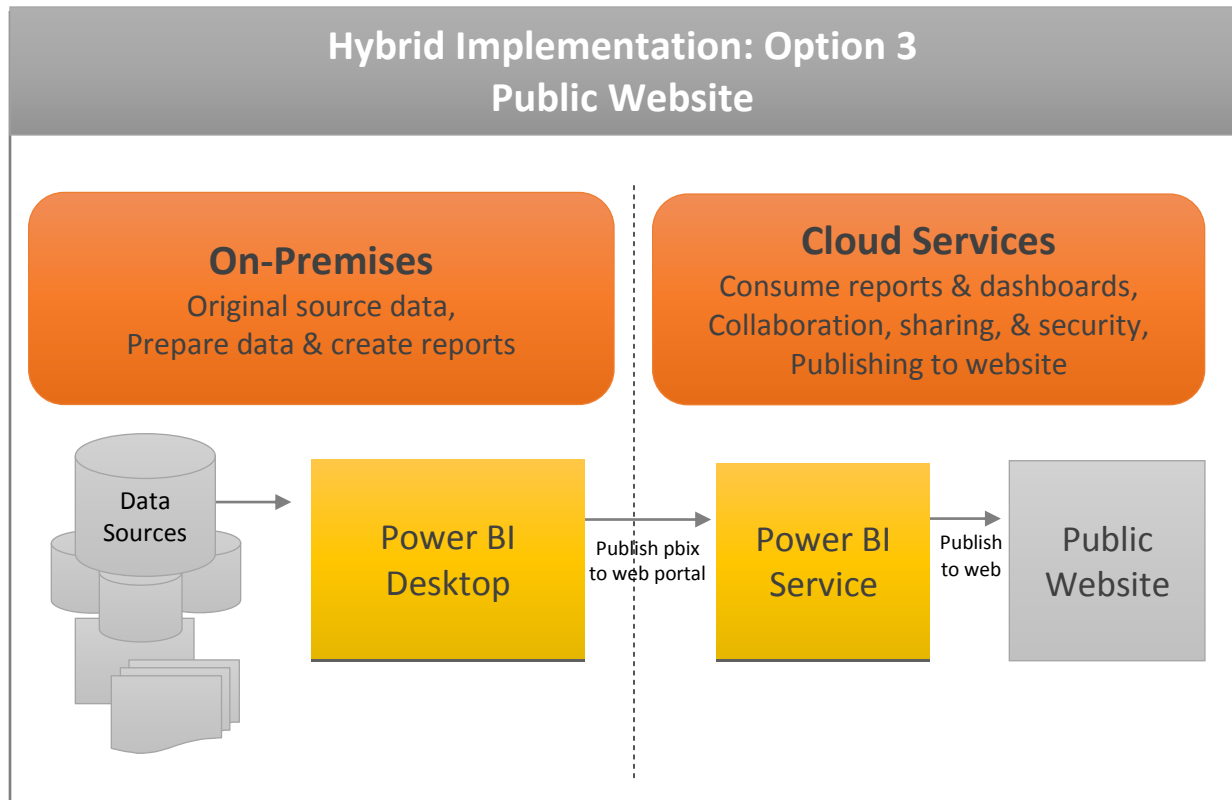
**Hybrid Implementation: Option 2**
**Custom Application Integration**

**On-Premises**
Original source data,
Prepare data & create reports

**Cloud Services**
Consume reports & dashboards,
Collaboration, sharing, & security,
Custom application integration

Data Sources

Power BI Desktop

Publish pbix to web portal

Power BI Service

Power BI API Library

User interaction

Custom Application

Expose tile or report to custom app

The second alternative hybrid scenario relates to custom application integration. The Power BI APIs support two types of scenarios: obtaining data from a custom application, and publishing reports and tiles to be viewed within the application. This depiction focuses on the second option.

- Data **preparation and report creation occurs in Power BI Desktop**.
- The completed Power BI Desktop file is **published to the Power BI Service**.
- The API library is utilized to **publish a report and/or tile**from the Power BI Service into a **custom web or mobile application** within an iFrame.
- If a user interacts with the report and/or tile, the **user is directed back to the Power BI Service**for further viewing of a report or dashboard.

Note: although the diagram above references the application as an on-premises custom app, this scenario would also work if the custom application is cloud-based.

## Hybrid Implementation: Option 3
## Public Website

**On-Premises**
Original source data,
Prepare data & create reports

**Cloud Services**
Consume reports & dashboards,
Collaboration, sharing, & security,
Publishing to website

Data Sources → Power BI Desktop → Publish pbix to web portal → Power BI Service → Publish to web → Public Website

The third hybrid scenario is similar to the custom application, except that the Power BI report is publically available for viewing on a public website which is useful for displaying charts in a blog or corporate website.

- Data **preparation and report creation occurs in Power BI Desktop**.
- The completed Power BI Desktop file is **published to the Power BI Service**.
- An **embed code** is generated in the Power BI Service for the selected report.
- The owner of the website will add the embed code for the report which will be **embedded in an iFrame** on the web page.
- Keep in mind that since there is no authentication, this option is only suitable for data which can be viewed publicly. The option to publish to the web can be entirely disabled by the Power BI system administrator.

Tip: Even if you don't want to embed a Power BI report in a website, but you do want to share it with someone outside of your organization, you can send a URL (instead of the embed link) and the recipient will be able to view the report in a browser.

# On-Premises Deployment Scenarios

Deployment on-premises, without usage of the cloud-based Power BI Service, is attractive to organizations which face strict compliance and security requirements.
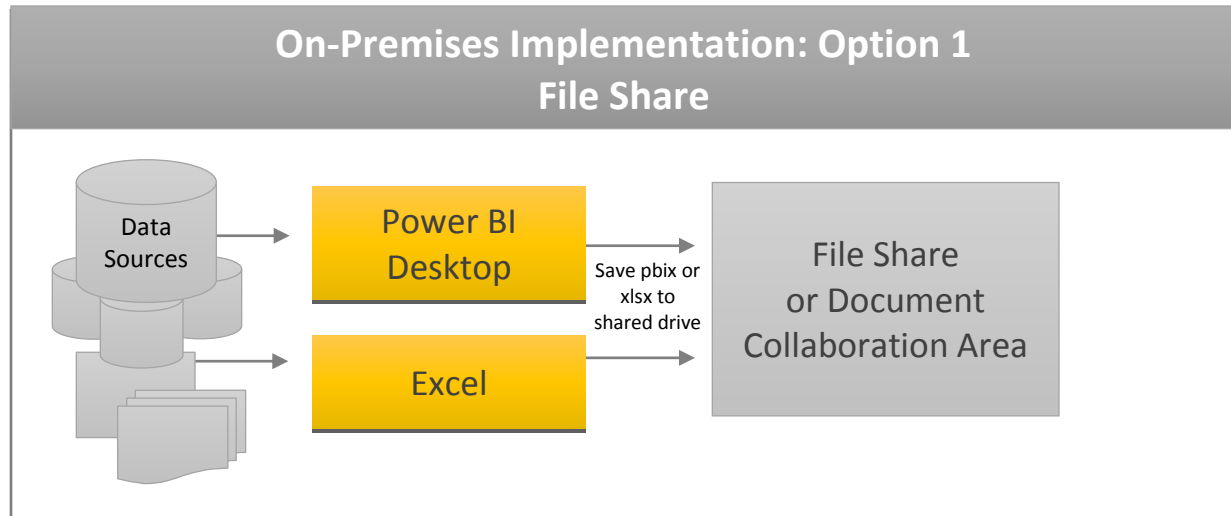


The first on-premises option involves usage of a file share:
- Data **preparation and report creation occurs in client tools**: Power BI Desktop and/or Excel.
- The completed Power BI Desktop and/or Excel file is **published to a file share**or a document collaboration area / repository.
- Although the file/folder properties can be set to edit vs. read-only, with this option it is not possible to expose reports only without also surfacing the underlying data and calculation logic.
- Row-level security options are not available with this approach unless using a live connection type of source that implements security at the source.

Collaboration options and other features are extremely limited because only the client tools are utilized in this scenario. Anyone who wishes to view a report **needs to have Power BI Desktop and/or Excel installed** depending on which tool is used.This includes Silverlight installation if Excel is used instead of Power BI Desktop. Using the full-fledged client tools for report sharing is particularly challenging for, sharing reports with executives.
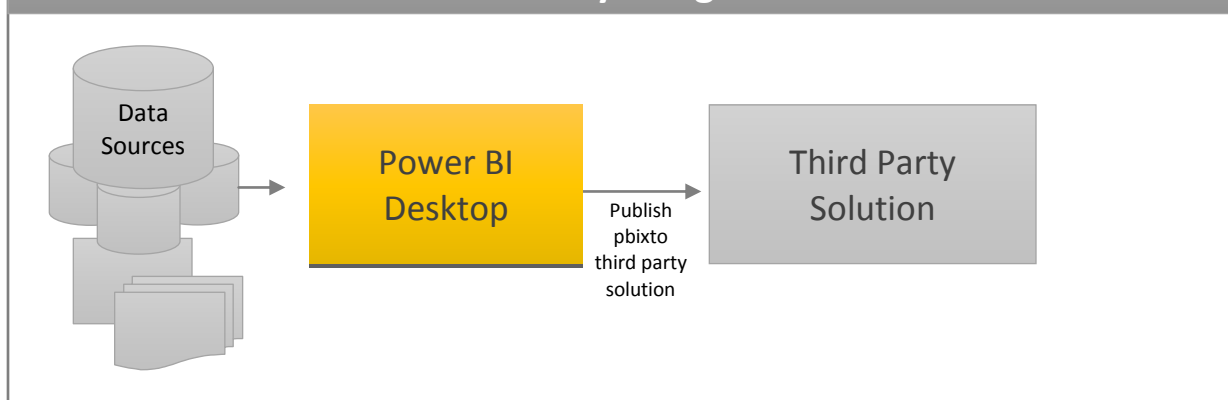
**On-Premises Implementation: Option 2**
**SharePoint**

```
Data Sources  →  Excel  --Publish xlsx to SharePoint portal-->  Power Pivot Gallery in SharePoint
```
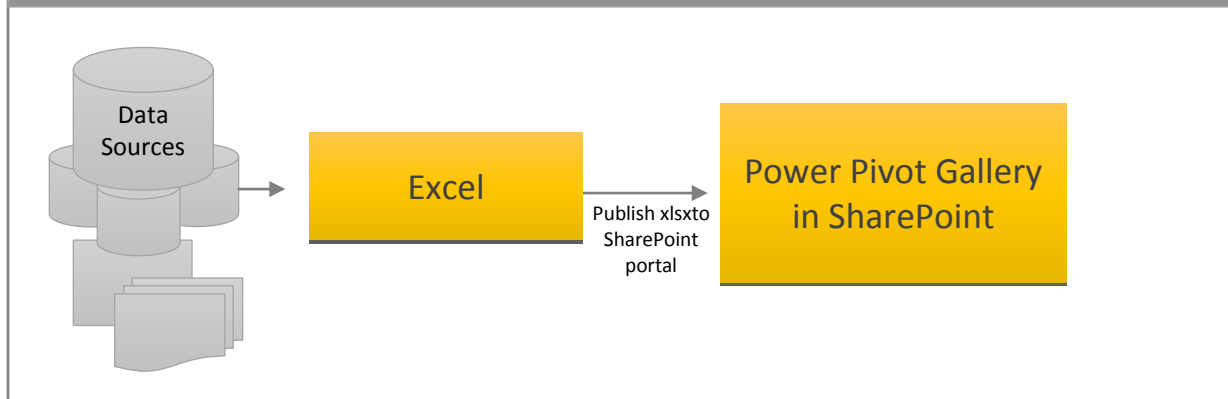
The second on-premises option involves a specialized document library in SharePoint called the Power Pivot Gallery which understands how to handle the Power Pivot and Power View add-ins:

- Data **preparation and report creation occurs in Excel**.
- The completed Excel file is **published to SharePoint** within a Power Pivot Gallery.
- Report **consumption, sharing, security, and data refresh**(if applicable) can be defined in the **Power Pivot Gallery**.

**On-Premises Implementation: Option 3**
**Third Party Integration**

```
Data Sources  →  Power BI Desktop  --Publish pbix to third party solution-->  Third Party Solution
```

The third on-premises option involves a third party which integrates with Power BI. At the time of this writing, Pyramid Analytics and Panorama Necto are the first third party solutions that integrate with Power BI for purposes of displaying output.

- Data **preparation and report creation occurs in Power BI Desktop**.
- The completed Power BI Desktop file is **published to the third party server.**
- Report **consumption, sharing, security, and data refresh**(if applicable) can be defined within the third party software and is limited to what is offered by the vendor.

# Live Connection vs Imported Data

For data acquisition, there are two choices. This decision is an extremely important one.

a. **Live connectivity** in which the source data remains in the source.

b. **Data import** in which the source data is replicated, or imported, into a data model stored in Power BI. Imported data requires data refresh operations to remain current.

**DirectQuery** refers to relational data sources. **Live Connection** refers to Analysis Services sources. Though the terms differ, they both represent the same type of functionality.

*Live connectivity* is best for the following situations:

- The source **data is complete and does *not* need to be augmented** with additional data sources – for instance, traditional data warehousing.
- Near **real-time** (low latency) data is required.
- Data is **updated frequently** in the source (and a secondary data refresh is not desired).
- Corporate **security standards** dictate the data may *not* be replicated into another data source.
- Higher **data volumes** are involved which exceed the 250 MB limit of a Power BI embedded data model.
- Requires the **enterprise gateway**.
- **Row-level security is centralized** in an SSAS Tabular model or underlying data source.

*Imported data* is most suitable for the following situations:

- Existing **data is to be augmented with additional data sources** (such as industry data, demographics, weather, etc). This is frequently referred to as data mashups.
- Additional **calculations** are required that do not exist in the data source.
- **Exploratory reporting** scenarios, **prototyping** activities, and **one-time projects**.
- The **data can fit into 250 MB (compressed)**, the max size for an embedded data model.
- Requires either the personal or enterprise gateway to keep data current.*
- It is appropriate for **row-level security to be specified for one specific data model** in the Power BI Service. From a governance standpoint, specifying row-level security for a single model is riskier than utilizing a centralized source.
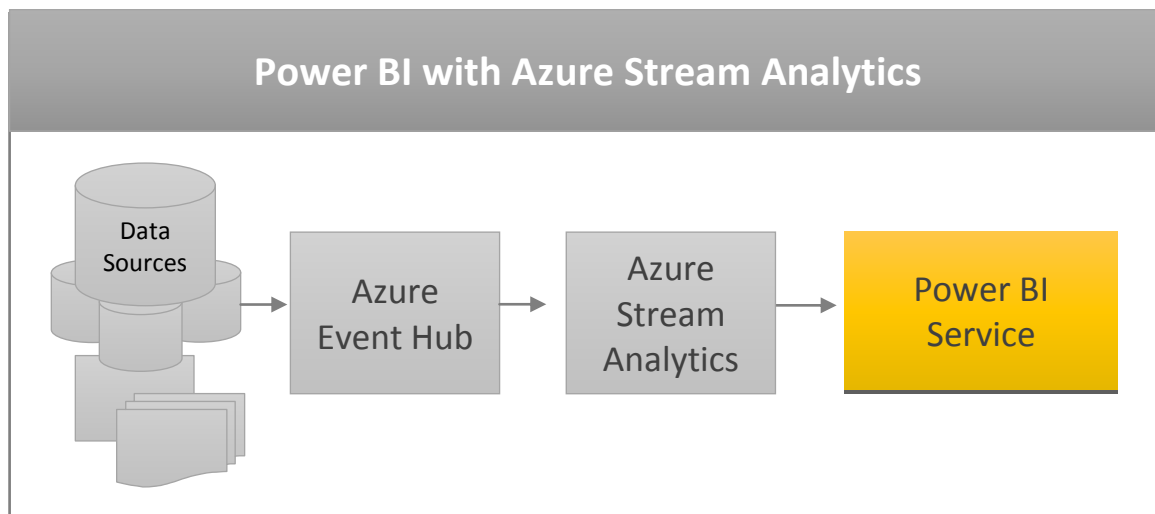
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*The enterprise gateway running in a server environment is recommended over the personal gateway whenever practical due to the following reasons:

- Usage metrics available via the enterprise gateway
- Ability for multiple staff members to manage the enterprise gateway, as well as ability to transfer ownership if a staff member leaves or changes roles in the organization
- Fewer issues with refresh failure due to machine being turned off (particularly an issue when a PC or laptop is utilized for the personal gateway)
- Additional capabilities in the enterprise gateway for live connectivity in addition to data refresh

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## Streaming Data

In addition to batch processing (scheduled refresh) operations, Power BI can receive **streams of data** for display in reports and dashboards. There are two methods of integrating Power BI with streaming data:

1. Power BI APIs
2. Azure Stream Analytics



**Power BI APIs**

Data Sources → Power BI   API Library → Power BI Service



**Power BI with Azure Stream Analytics**

Data Sources → Azure Event Hub → Azure Stream Analytics → Power BI Service
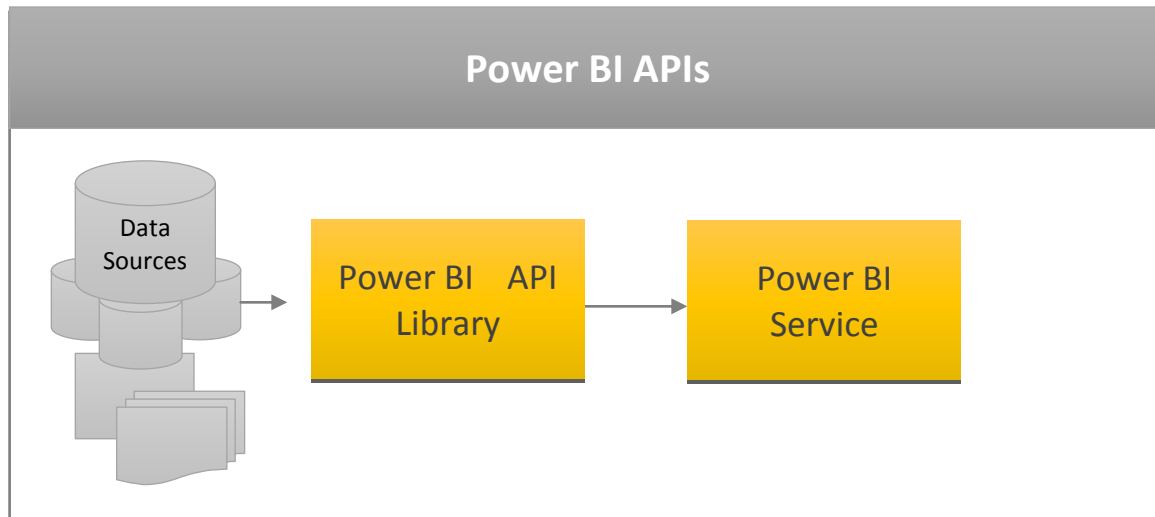
Note that both streaming options do involved **importing the data into a Power BI dataset** (as discussed in the previous section). Optionally, the streamed data can also be persisted to another database (such as Azure SQL Database) for historical analysis beyond the most recent stream data.

# SaaS (Software as a Service) Solutions

Power BI can consume [prepackaged content packs](from SaaS vendors such as Salesforce, Facebook, Dynamics CRM, GitHub, and numerous others.

These content packs include a dataset which extracts data from the cloud source, one or more reports, and a dashboard ready to use. Reports and dashboards can be customized if desired.

At the time of this writing, there's not a way to export the dataset, so the data model from a SaaS content pack cannot be edited. The reports and dashboards can, however, be customized in the Power BI Service.

SaaS solutions are fully cloud-based and are very useful to get started fast, particularly for nontechnical users. They are best suited to situations when the data does not require further integration.

Frequently the introduction of a SaaS reporting solution serves to drive new requirements for a Corporate BI environment: for example, requests from business users for integration of Salesforce data with CRM or another sales application. Integration of disparate data sources can bring significant additional value to the otherwise independent sets of data.
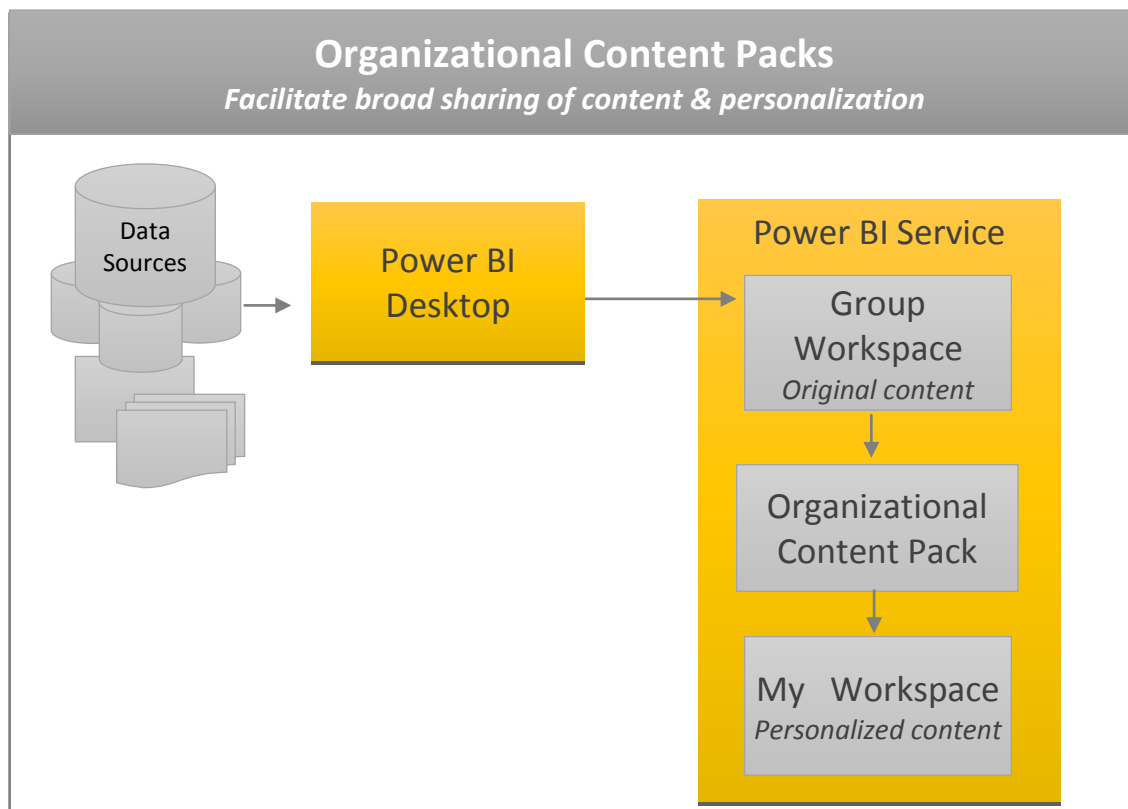
# Organizational Content Packs

Power BI allows users to package up organizational content so that colleagues across the organization can leverage **groups of related datasets, reports, and dashboards**.This is the same approach described above for SaaS solutions, but instead of a third party vendor developing the Power BI models and dashboards, internal corporate users (or IT developers) would use organizational content packs to share content with business users.

A common request is for users to be able to "save as" on an existing report or dashboard, and then customize it for their own purposes. In Power BI, this is known as **personalization**. The method to deliver personalization (without affecting the original content) is via organizational content packs.



Content packs can be used for:
- Distribution of "approved" or "curated" datasets, reports, and dashboards
- Distribution of content "starter packs" to facilitate personalization

---

Although you can publish an organizational content pack from My Workspace (a user's personal workspace area), it is not recommended.Should that user leave the company or change roles, the original content is 'stuck' in a personal workspace. A best practice is any content that is shared with others should reside in a group workspace.

---

# Big Data and Advanced Analytics

Power BI has a wide range of connectors to common data sources, from relational databases to text files and web services. Additionally, Power BI can connect to Big Data sources like Hadoop HDFS, Spark, or [Azure HDInsight](.).Power BI can also integrate R scripts, or receive the output of Azure Machine Learning when performing data science work. These types of options open up a lot of really interesting scenarios.

In summary, Power BI can be used in dramatically different ways depending the deployment mode utilized.For Corporate BI, Power BI can be the *end point*, or visual front-end of a large enterprise data strategy. In Business-Led Self-Service BI, however, Power BI is typically the *starting point*of data exploration efforts that may lead, eventually, to a mature line of business or enterprise-scale initiative.

Following we will discuss implementation options for the three delivery modes which were introduced earlier in this whitepaper.

## Implementation Options: Business-Led Self-Service BI

A business-led self-service BI deployment leverages Power BI features in its entirety, with **little to no IT supporting infrastructure**.

Users would develop **Power BI Desktop**files and publish them to the **Power BI Service**.If the data was imported to Power BI (rather than direct connectivity), automated data refresh can be scheduled via the **Power BI gateways** (personal or enterprise).

A key point to remember is that the Power BI assets are all **owned and supported by the business** in a business-ledself-service BI environment.

We recommend storing the original Power BI Desktop file [in OneDrive for Business](.) because it is integrated with Power BI and offers versioning options in case you need to revert to a previous version.

Also, given the integration of Power BI with the**Exceladd-ins** (Power Query, Power Pivot, Power View), a user could develop Excel-based charts and integrate them on a published dashboard in the Power BI Service. This functionality is particularly useful if you wish to utilize pivot tables, pivot charts, and/or cube formulas within Excel for certain types of analysis.

In addition to Power BI Desktop and Excel, the **Power BI Service**is also considered an authoring tool. **Dashboards and Q&A**natural language queries are both created directly in the Power BI Service. Also, **reports can optionally be edited in the web**.

Since a report can be edited in the Power BI Service, this introduces the possibility that the published report is newer than the Power BI Desktop file which was last saved. We recommend minimizing the number of people who have the ability to edit a report in the Power BI Service (via Group permissions). You may also wish to consider implementing a procedure to only edit reports in Power BI Desktop and not the web, or vice-versa.

**Power BI Desktop**is updated with **new features every month**, whereas the Excel add-ins are updated on a much slower release cycle due to extensive testing required due to the integration with Excel. Fortunately,wemay benefit from work performed in Power Query, Power Pivot, and Power Viewby **migrating the Excel file (\*.xlsx) to Power BI Desktop (\*.pbix)**. Note, however, that there is not an option to migrate from Power BI Desktop back to Excel (because Power BI Desktop will always be on a faster release cycle).

## Implementation Options: Corporate BI

In a Corporate BI deployment, a company uses **Power BI as an IT-owned reporting tool**(along with other tools such as SQL Server Reporting Services). In this case, business users will only consume data and models developed for them, and interact with the data via built-in report filters. (We transition to IT-Managed Self-Service BI, discussed next, when business users begin to create its own reports and dashboards on top of IT-maintained infrastructure.)

In Corporate BI mode, companies would seek to integrate Power BI with sophisticated data infrastructures like an on-premises data warehouse, or cloud-based Cortana Analytics architecture.

Ways of utilizing Power BI in a Corporate BI initiative include:
- On-premises or cloud-based data warehousing**:** with **SQL Server** or**Azure SQL Data Warehouse** would allow Power BI to benefit from a curated, managed data layer. In this case, "**DirectQuery**" via the **enterprise gateway**is used.
- Using a semantic layer:Using an on-premises **SQL Server Analysis Services**model (tabular or multidimensional) through the **enterprise gateway**can facilitate dashboard development efforts by removing calculation development and modeling tasks away from user's responsibilities, while ensuring a governed, standardized version of the truth. In this case, a "**Live Connection**" through the enterprise gateway is used.
- Internet of Things (IoT):Using **Azure Event Hub**allows for machine data collection which can be the using in Power BI for operational reporting.
- Custom application integration: The **Power BI REST APIs**can be used for Power BI tiles or report within a custom application.

- **Stream Analytics** and/or **Power BI REST APIs**:Near real-time reporting of streaming data is possible through these infrastructure layers.
- Operationalized data science:Using **Azure Machine Learning**in a **Cortana Analytics**architecture, R models can be automated and become part of the data production process that is ultimately consumed via Power BI dashboards.
- Publishing of report content to a **public website**, such as the company site or corporate blog.
- Adherence to standards:Integration with **SQL Server Master Data Services (MDS)** and **Data Quality Services (DQS)** is common in this type of deployment, which seeks to ensure facts and dimensions used in published reports comply with established data quality and governance rules.
- Integration with **SQL Server Reporting Services** and/or **Excel Services**: SSRS report items can be "pinned" to a dashboard displayed in the Power BI Service. Excel tables, charts, and ranges can also be "pinned" to a dashboard. This opens up a lot of interesting capabilities to display content generated from various tools on a single dashboard.

## Implementation Options: IT-Managed Self-Service BI

IT-Managed Self-Service BI represents a **co-owned environment** in which IT supports the data (and the semantic layer), whereas the business supports and maintains the presentation layer via reports and dashboards.

Power BI can help develop this environment by separating ownership of data sources, data models, and reports.Although Power BI desktop files (*.pbix) can contain data extract rules, transformation logic, relationships, and metadata, in a IT-Managed Self-Service BI environment it is likely IT would own nearly all of the back-end components and govern them separately from the reporting interface.

Typical cases of Power BI uses under IT-Managed Self-Service BI deployment mode are:
- Big Data**:** An**Azure Data Lake** with**Azure HDInsight (Hadoop)** infrastructure can be valuable here, as the business may not know ahead of time the questions they would ask of the data. As such, HDInsight takes the role of **Analytical Sandbox**propelling data exploration and data science efforts.
- On-premises or cloud-based data warehousing**:** with **SQL Server** or**Azure SQL Data Warehouse** would allow Power BI to benefit from a curated, managed data layer.
- Data source discovery:**Azure Data Catalog**can assist Power BI users in finding quality data sources to using during report and dashboard development efforts. Typically IT sets up the Azure Data Catalog and business users maintain the metadata around tables and columns.

- Using a semantic layer:Using an on-premises **SQL Server Analysis Services**model through the **enterprise gateway**can facilitate dashboard development efforts by removing calculation development and modeling tasks away from user's responsibilities, while ensuring a highly governed version of the truth.
- Data science experiments:Power BI integrates with **R scripts**for exploratory modeling.R based chart integration is also possible.

Even in terms of the reporting layer, it is possible to structure co-ownership given Power BI allows for "pinning" of **SQL Server Reporting Services** report items and **Excel Services**items in the Power BI Service. In this way, a user may be looking at a dashboard that is partially owned and supported by IT, and partially by the business.

## Implementation Notes: Ownership Transfer

A common scenario is for a popular solution to "outgrow" a Power Pivot model. This can be due to a variety of reasons, commonly data size limits, data refresh rates, and/or new row-level security requirements. In this situation, IT can inherit self-service BI assets by upgrading an Excel-based Power Pivot model to a SQL Server Analysis Services Tabular model.This works well for Excel models with data in Power Pivot that did not come through Power Query. However, a model within Power BI Desktop cannot be seamlessly upgraded SQL Server Analysis Services because Power BI Desktop is on a much faster release cycle.There is a workaround to obtain the appropriate files from the underlying XML, but it is not supported.

We recommend planning time for a degree of rework when undertaking ownership transfer activities.

The same is applicable to Power Query (M scripts) that are being upgraded to SQL Server Integration Services or Azure Data Factory processes.

If migrating a self-service BI solution to an on-premises Power Pivot Gallery in SharePoint, there is one additional option to consider: usage of Power View for SharePoint. Power View for SharePoint is a feature of SSRS in which development is done in a web-based 'flavor' of Power View rather than within Excel or Power BI Desktop.

# Section 5. Power BI System Governance

Governance is a key component of any Power BI deployment, although the goals for what data assets are being governed, and how these dataassets are governed, vary depending on whichof the three deployment modes applies to the solution. Which brings up a point to reiterate: the three modes (Business-Led SSBI, IT-Managed SSBI, and Corporate BI) can and should coexist within the same functional area. The distinction of mode depends on individual solution. For instance, a marketing datamart may fall squarely in the area of Corporate BI whereas some types of finance reports may easily be classified as Business-Led Self-Service BI. Therefore, becoming familiar with different governance approaches, based on mode, is very important.

For Corporate BI, Power BI is governed to ensure **data quality**, **security**, and **adoption**.As you will recall, adoption is a critical component of deployment success.As the business does not own the reporting layer in the Corporate BI mode, their ability to add/remove/enhance reports is not available and such the governance needs are lighter than other modes.

In IT-Managed Self-Service BI, Power BI has a more complex governance structure given the co-ownership nature.Governance is led by two key roles:the BI/EDW architect (for the IT-owned technology layers) and the Power BI champion (for business-owned reporting layers). Additional teams may be involved as well.

Each may establish different rules and processes, however they both benefit from implementing environment consistency and visibility**.**
- **Environment consistency** is given in two ways:
  - **Environment consistency**: By splitting out environments into functional areas.A common definition used by IT is development, quality assurance (QA) and production.
  - **Reporting consistency**: Defining strategies to address consistent data refresh schedules and definitions for calculations and metadata.
- **Environment visibility** is gained by tracking system usage patterns.

Governance efforts in either of the self-service BI modes attempt to identify asset growth potential. In other words, track items that could be better suited if ownership transfer to IT were to occur.

A scenario in which migrating data cleansing efforts from Power BI to an IT-managed ETL process is desirable:although data cleansing is possible (and successful) in Power BI, there are cases in which performing those cleansing efforts may take too much time or effort for the business users involved. In this type of situation, an ownership transfer so that IT can lead the data cleansing initiative may be a more cost-effective and practical approach, particularly if the cleansed data can then be used for more than one solution.

Regardless of the deployment mode used, there are some elements that we recommend tracking in a Power BI governance program:

- **System Usage:** Including **user access frequency**, as well as popular datasets, models and reports.Also includes auditing of **publishing actions**. This information can be used for **security**and **compliance**, identification of **support**needs, identification of **critical reports**, and/or potential **ownership transfer** opportunities.

   At the time of this writing, full auditing of system usageis not available in Power BI. Some system usage statistics can be obtainedfrom the enterprise gateway. Also, depending on the underlying data source and how it is being audited, some usage metrics may be available that way.

- **Security: Report sharing activities**and **row-level security** defined in the Power BI Service, as well as **ownership of datasets, reports, and dashboards**. This information is important for validation of **security**and **compliance**.There are three main approaches to sharing with others: (1) **sharing**a read-only dashboard from a workspace, (2) including a colleague as a member of a **group**, and (3) including a colleague as a recipient of an **organizational content pack**.

   At the time of this writing, the ability to see which objects have been shared with whom across the Power BI system is not available. It is possible to check permissions granted at the individual group level (i.e., all members have either edit permissions or view-only within the context of a group) or for individual organizational content packs. It is also possible to verify which groups or users have access to an individual enterprise gateway.

- **Report Performance:** A critical feature to enable adoption is report **rendering speed**.In many cases, a well-designed, accurate report is so slow that the perceived value to the users is diminished.

   At the time of this writing, auditing and collection of report execution statistics is not available in Power BI.

- **Data Source Usage:** Including data sources utilized, data refresh operations, data model sizes, as well as calculations. This information can be used to identify potential flaws in **data integrity**or even overlap in effort. It is also important to monitor growth of models which have data imported, given the maximum size limit of 250 MB.

   At the time of this writing, full auditing of data source usage is not available in Power BI. Some usage data and refresh history is available via the enterprise gateway. Usage of cloud sources, or data access via the personal gateway is not yet available.

There are several governance-related settings of interest to a Power BI administrator:

- o Disable publish to web
- o Disable content pack publishing to an entire organization
- o Disable sharing to external users

The next section will review governance aspects for each of the three deployment modes.

## System Governance:Business-Led Self-Service BI

Governance is led by the Power BI champion, either at the organizational or line of business (LOB) level.Power BI champions would typically seek to also understand **system usage**, as well as **opportunities for consolidation**when multiple Power BI reports actually refer to the same dataset.

During self-service BI delivery, users won't necessarily use validated / compliant sources, hence Azure Data Catalog may or may not be part of the environment though use of Azure Data Catalog is highly recommended. Due to the uncertainty of source usage, and the lower ability to ensure compliance to master dimensions, it is important governance is implemented using other measurable criteria.

One option is to understand **report popularity.**This factor can inform a system administrator which Power BI reports should be more closely monitored to understand sources, models and report views.High popularity indicates the report has proven value to the business, and gaining visibility into its components can help the Power BI champion's efforts of consolidation and report accuracy.

As of the time of this writing, visibility into report popularity is not available yet in Power BI.

Another aspect of system governance is the **location**selected for storing of Power BI assets. Group Workspace(s) in Power BI are highly recommended over My Workspace. The Power BI champion can assist with creation of **group workspaces that comply with security and subject area boundaries**.

In a group workspace, all members have eithereview-only or edit permissions. If view-only members are desired (which is most typical) any authors need to have administrative permissions for the group.

Additionally, the importance of the **location for original Power BI Desktop files**(prior to being published to the Power BI Service) is something the Power BI champion can help communicate. Usage of One Drive for Business, or a similar document repository like SharePoint Online, is recommended due to:

- Versioning options (easy to revert to a previous version if something goes wrong).
- In One Drive for Business or SharePoint Online, a data refresh operation updates <u>both</u> the original file and the model in the Power BI Service. Conversely, a local file on a file share is not updated on a schedule.

**Choice of data import vs. direct connectivity**(via DirectQuery or Live Connection) is also something to monitor, particularly if the data is sensitive. Usage of direct connectivity can help with privacy concerns since the data because the data is not replicated again in the Power BI data model (however, in the Power BI Service, there is some caching for performance of as well ascaching of thumbnail images). The choice to use data import vs. direct connectivity is an important education issue for the Power BI data modeler.

For datasets which involve data imports, **monitoring of file size is important**. If the size exceeds 250 MB, a data refresh operation will fail. Additionally, if Excel Online is utilized (instead of Power BI Desktop), the file size(excluding the data model) also must be <10 MB. A file which is approaching the file size limit needs to either reduce the amount of data stored, or change to another access method for the data. Because the in-memory columnar structure is the same, "upsizing" to an Analysis Services Tabular model is a natural upgrade path.

**Reuse of existing datasets**is a very important, yet often overlooked, factor in self-service BI. In order to reduce duplicate datasets (and potentially duplicate refresh operations), we recommend using existing datasets whenever possible. At the time of this writing, Power BI Desktop cannot access an existing dataset which has been imported into the Power BI Service. One alternative here is to create reports directly in the web (rather than in Power BI Desktop) which allows for many reports to connect to a single dataset. Note that reuse of existing datasets is primarily only a concern for imported datasets which replicate and refresh data within Power BI.

Viewing **history of data refresh operations**can also be useful to locate duplicate datasets. At the time of this writing, data refresh history for all models in a Power BI group is not possible.

Power BI Desktop is **updated monthly** with new features and improvements. If individual users do not have permission to update their workstation, this can represent a challenge.

The Power BI champion can help facilitate timely updates, as well as **foster communication and knowledge sharing** about updates and changes.

It is extremely important that all users who are going to collaborate on pbix files are on the same version of Power BI Desktop.

Desktop administrators can introduce techniques to push MSI updates to user machines, which helps significantly with keeping everyone in sync and overcoming issues with lack of administrative permissions to install.

# System Governance: Corporate BI

In a Corporate BI environment, multiple environments typically exist for managing the lifecycle of BI assets:

- **Development**:Available to IT BI developers only
- **Quality Assurance (QA)**: Available to a select group of users for purposes of user acceptance testing
- **Production**: Available to relevant functional users based on job role, subject area, department, project, etc.

Typically **separate Power BI group workspaces**are utilized for Dev, QA, and Prod purposes.

At the time of this writing the capability to migrate or export datasets, reports, and dashboards from the Power BI Service does not yet exist. Therefore, in lieu of exports, the best options for promoting content from Dev to QA to Prod include:

In addition to separate group workspaces for Corporate BI solutions, different "branding" of reports can also indicate a report is sourced from the Corporate BI team vs a self-service solution.

a. **Utilize organizational content packs.**To minimize confusion, the organizational content pack will be secured to only be seen by IT developers. It is also very important to have a good naming convention to ensure it describes usage specifically for promoting content through Dev, QA, and Prod. The Corporate BI team will then search for and bring in updates to datasets, reports, and dashboards within QA and Production workspaces from the content pack. In this way, group members will be consumers only of the content pack objects. Because the organizational content pack is secured to only IT developers, no personalization by users will be available.

b. **Use Power BI Desktop for all report development.**Ensure all development work occurs in Power BI Desktop and not within the Power BI Service. This way, the Power BI Desktop content can be imported into each relevant group workspace. In this scenario, the dashboard would need to be recreated in the web within each separate environment (this manual step does add some increased risk of mistakes). One benefit of this scenario is that it is easier to redirect a data connection (from, say, a QA source database to a Production source database) in Power BI Desktop.

Security aspects of Corporate BI governance include:

- **Group membership** for access to datasets, reports and dashboards involves integration with **Office 365 unified groups**. Each Power BI workspace correlates to one O365 unified group. Maintenance, as well as risk for error, is minimized when Active Directory group membership is synchronized with the Office 365 unified group membership.

- **Group content** is appropriate. Group membership is often defined about security and/or subject area boundaries. Validation that datasets, reports, and dashboards are in the most appropriate group is important (for instance, a net profit report isn't contained in a marketing group).

- **Sharing of dashboards.** Sharing can be done with an individual, a group, or an external user. Note that external sharing can be disabled by the system administrator if appropriate.At the time of this writing, there is not yet a capability to get an audit report of sharing across the Power BI tenant.

- **Distribution of organizational content packs.** Content packscan be distributed to an individual or a group within the organization. Note that distribution of content packs to the entire organization can be disabled by the system administrator if appropriate (thus requiring specifying a group instead).At the time of this writing, there is not yet a capability to get an audit report of content pack sharing across the Power BI tenant.

- **Public publishing.** Report publishing to the web should be monitored for appropriate content (if external sharing has not been disabled by the system administrator).At the time of this writing, auditing capability to view who has published Power BI report content publically is not yet available.

- **Data source usage** by whom. Via the enterprise gateway, we can determine users who have permission to schedule a refresh, as well as users who have permission to query certain data sources. This also includes usage of external data sources, such as those offered via the third party SaaS content packs.At the time of this writing, full auditing of data source usage is not available in Power BI. Some usage data and refresh history is available via the enterprise gateway.

- **Report and dashboard usage**by whom, including number of executions and filter selections made.At the time of this writing, there is not yet possible to audit report execution activity.

- **API activity**by whom, including data sources and destinations.At the time of this writing, it is not yet possible to get an audit report of API activity.

Observing and tuning of **Q&A natural language queries**can lend valuable insight into what pieces of information people are searching for. High usage of Q&A for certain search terms may indicate a need for additional reports. At the time of this writing, statistics of Q&A usage is not available yet. Also, tuning capabilities for Q&A have not been reintroduced.

To mitigate concerns about data residing on mobile devices, there is **integration with Intune**, a mobile application/device management (MAM/MDM) solution. Intune policies can be established to enforce encryption and to restrict copying and sharing of data.

## System Governance: IT-Managed Self-Service BI

The key distinction to understand governance of Power BI is who owns the semantic layer: IT or the business. In this IT-Managed Self-Service BI mode, either IT or the business could be responsible for the semantic layer. IT may still mandate that the underlying data come from an IT validated source, such as a source catalogued and discoverable via Azure Data Catalog. If this rule is broken and the business extends the data model with non-IT validated data, it transfers to be a "full" Business-Led Self-Service BI scenario.

If IT owns the semantic layer, typically it would be in the form of an SQL Server Analysis Services (SSAS) model with a supporting data infrastructure (such as a data warehouse). These technical layers often have extensive administrative features that can be used for understanding usage, data refresh intervals, query performance, and access frequency.Also, IT would normally ensure data surfaced through these layers comply with master data definitions and pass data quality guidelines.

On the other hand, if the business developed the semantic layer, a Power BI specific governance process must be devised given that nonstandard data sources and calculations may be in use.At the time of this writing, system-wide visibility over data sources is not possible unless the Power BI reports leverage the enterprise gateway.In this sense, constraining Power BI managed report usage to catalogued enterprise gateway sources could be made a requirement, given it offers an angle of visibility and governance which is not otherwise possible.Any Power BI report using sources not present in the enterprise gateway would be considered part of the Business-Led Self-Service BI deployment mode (rather thanIT-Managed Self-Service BI mode).

One alternative in which IT can provide well-governed sources and models to users is by providing Power BI **organizational content packs**.An organizational content pack is a way to distribute related datasets, reports, and dashboards to a group of users.

The Power BI system administrator can disable sharing of organizational content packs to the entire organization (thus requiring specification of specific groups of users).

One extra benefit of organizational content packs is **personalization**ability. Users can make a copy of reports and dashboards, and personalize them at will. In terms of governance, this personalization ability requires some additional user education to avoid misunderstandings and/or confusion about the original report vs. the copy.At the time of this writing, insight into usage of organizational content packs is not yet available.

In addition to serving as a data dictionary, **Azure Data Catalog**can be utilized for **managing requests to new data sources**. By virtue of the source being registered in Azure Data Catalog, that would indicate the data source is sanctioned for use.

It is expected Microsoft will continue to build administrative features to allow visibility into data sources, models, and report usage.

# Section 6. Sample Power BI Project Roadmap

As discussed in the previous two sections, the options for implementation of Power BI are diverse. Following we will take one common situation, reporting from a data warehouse, and see how it differs in the three deployment nodes.

It is important to realize that the source data in the following roadmap scenarios can be many things beyond relational databases and files: Azure SQL Data Warehouse, Hadoop, HDInsight, Web data, OData feeds, Machine Learning, R scripts, and so forth.

Each of the scenarios below assume that the Power BI tenant is setup and running, and that Active Directory users are synchronized with Azure Active Directory so Power BI can take advantage of it.

Each item indicates whom is responsible and/or involved:

Biz  Business users

IT  IT business intelligence / analytics team

# Sample Roadmap: Business-Led Self-Service BI

## Business-Led SSBI Phase 1 – Current State Assessment

**Biz** — Define desired state

The Power BI champion leads a one-time effort to understand **current state versus the desired state**. This may include surveys and interviews to understand **reporting and analytical needs**.

## Business-Led SSBI Phase 2 – Tactical Prototyping and Solution Creation

**Biz** — Data preparation ---- Data modeling ---- Calculations

The analyst retrieves internal corporate data from sources such as the corporate data warehouse, along with Microsoft Access databases and Excel files maintained within the department, as well as potentially third party and/or public data sources. **Data mashups** are done using the query capabilities in Power BI (formerly known as Power Query), so the data is imported into the Power BI data model. The analyst also defines the proper data **relationships** needed for reporting as well as relevant **calculations** (such as Year over Year or Net Profit computations) utilizing Data Analysis eXpressions (DAX).

**Biz** — Report and dashboard creation

**Reporting views** are created in Power BI Desktop, often by the same person who created the data model, but perhaps by a different report designer. When reports are complete the file is saved in **One Drive for Business**.

**Biz** — Data validation

Testing of reports to **validate accuracy.**

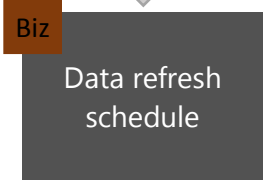## Business-Led SSBI Phase 3 – Publishing and Monitoring

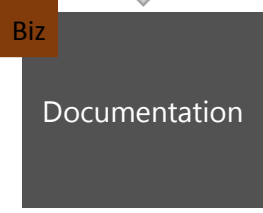**Biz** — Create group workspace ---- Assign permissions

Within the Power BI Service, relevant **group workspace**(s) are created and **membership** is defined for each group to ensure the correct people can view or edit items contained within the group workspace. Setup may be handled by the solution owner in conjunction with the Power BI champion.
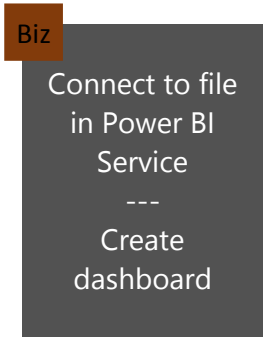
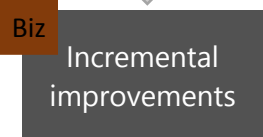| | |
|---|---|
| **Biz** Connect to file in Power BI Service --- Create dashboard | At this point, the Power BI Desktop file containing the dataset and reports, which resides in One Drive, can be connected to from within the **Power BI Service** (note this 'connect' distinction vs. importing). **Excel tables and charts** can also be published for viewing on a Power BI dashboard so that report consumers (either via PCs or mobile devices) can leverage reports and dashboards that originated from either Power BI Desktop, Excel, or even Reporting Services. The most relevant items from various reports are pinned to a **dashboard** in the Power BI Service. |
| **Biz** Data refresh schedule | To **refresh the data** which was imported into the Power BI data model, the owner leverages the **personal gateway** which is typically installed on their own workstation. |
| **Biz** Documentation | Preparation of **documentation**, in accordance with departmental standards, for **data cleansing, data sources, and business rules**. If a dashboard contained items pinned from the Excel add-in "**Power BI Publisher**" or from **Reporting Services**, then documentation is particularly important because the source for the charts do not reside in Power BI. |

## Business-Led SSBI Phase 4 – Support, Training, and Expansion
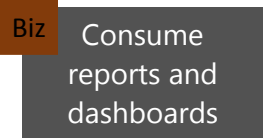
| | |
|---|---|
| **Biz** Consume reports and dashboards | At this point, **reports and dashboards can be consumed** by authorized users in the Power BI Service, via the mobile applications, or even via Cortana. |
| **Biz** Incremental improvements | Based on feedback, **incremental improvements and enhancements** can be introduced. This may mean an additional data source, a new calculation, or new reports. |
| **Biz** Monitoring ---- **IT** Training --- Expansion | Once value is being delivered, the solution remains being monitored. Ongoing **training**, **support**, and **sharing of knowledge** is important and should not be overlooked.
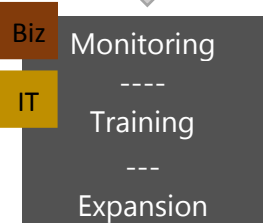
Additionally, it is possible that, **in conjunction with IT**, additional infrastructure can be introduced to continue **support and expansion**. |

# Sample Roadmap: Corporate BI

## Corporate BI Phase 1 – Requirements Discovery

**IT** **Biz** Requirements gathering

The IT BI team compiles requirements, often via interviews, to uncover areas where BI needs are not being met within the scope of an enterprise data warehousing / business intelligence environment. This may include surveys and interviews to understand **reporting and analytical needs**.

**IT** Initial scope and project plan defined

Constraints related to time, budget, and staffing are identified which serve to drive the scope for this project.
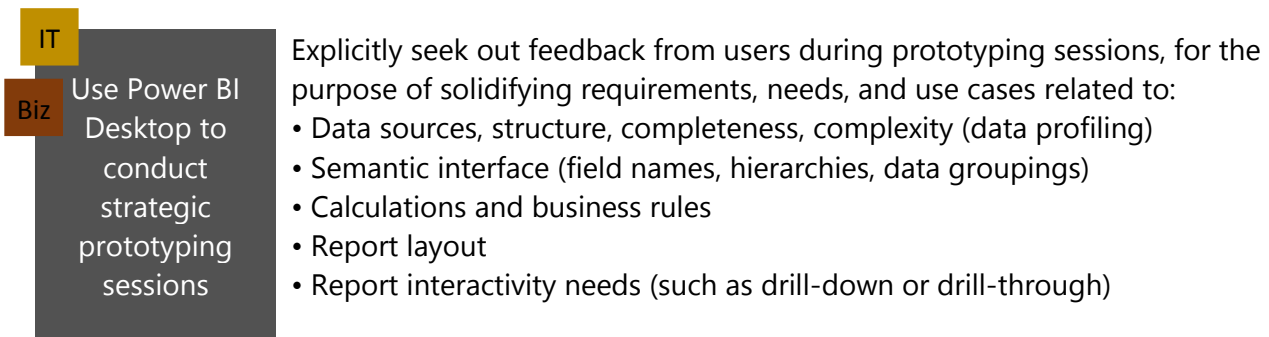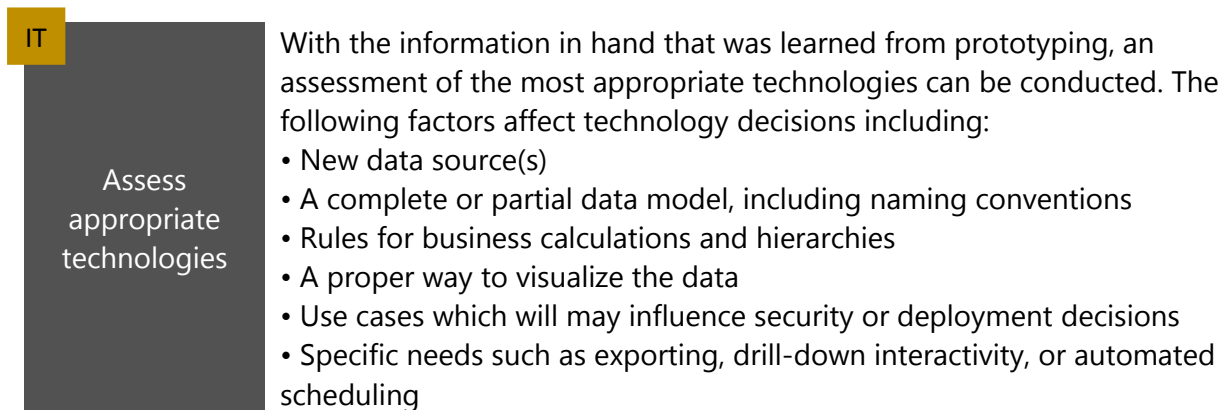
## Corporate BI Phase 2 – Strategic Prototyping

**IT** **Biz** Use Power BI Desktop to conduct strategic prototyping sessions

Explicitly seek out feedback from users during prototyping sessions, for the purpose of solidifying requirements, needs, and use cases related to:
• Data sources, structure, completeness, complexity (data profiling)
• Semantic interface (field names, hierarchies, data groupings)
• Calculations and business rules
• Report layout
• Report interactivity needs (such as drill-down or drill-through)

## Corporate BI Phase 3 – Blueprinting

**IT** Assess appropriate technologies

With the information in hand that was learned from prototyping, an assessment of the most appropriate technologies can be conducted. The following factors affect technology decisions including:
• New data source(s)
• A complete or partial data model, including naming conventions
• Rules for business calculations and hierarchies
• A proper way to visualize the data
• Use cases which will may influence security or deployment decisions
• Specific needs such as exporting, drill-down interactivity, or automated scheduling

**IT** | **Refine scope and project plan**

Refinements to project scope and the project plan based on what was learned during prototyping sessions and the outcome of blueprinting activities.

## Corporate BI Phase 4 – Development

**IT**

**Solution development and testing**

Development activities including **data integration processes, data modeling, semantic layer, and security**. Various on-premises and cloud data sources populate a **data warehouse** built in SQL Server using dimensional modeling principles. The data warehouse is populated through a **SQL Server Integration Services** (SSIS) data load and transformation process which provides enterprise level auditing, logging, and restartability features. **Master Data Services** (MDS) augments and standardizes data in the data warehouse.

SQL Server views are created to decouple the source and semantic layers and leverage data existing in the data warehouse. A **SQL Server Analysis Services** (SSAS) tabular model consumes the views, and **refreshes the data** cached in the SSAS in-memory database on a schedule. All **calculations** required for reporting are part of the Tabular model, and are developed as DAX formulas. **Row-level security** is implemented within SSAS roles for security of the data displayed on reports.

It is important for this phase to be short and iterative.

**IT**

**Report and dashboard creation**

Power BI **report views** are created in Power BI Desktop and/or directly in the Power BI Service, typically leveraging the source data via **live connection** from the SSAS tabular model. In this situation, it is very important to expose all useful items in the **page filters** so the report is useful for the most number of uses. Once the reports are published in the Power BI Service, a **dashboard** is created which focuses on the most important information.

**IT**

**Biz**

**User acceptance testing**
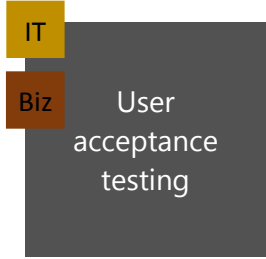
IT works with business users for user acceptance testing within the standard **Development > QA > Production**cycle. Purpose of this step is to confirm what was developed meets the business needs. This often includes one iteration of an overall solution, in an effort to frequently deliver small components of the solution.
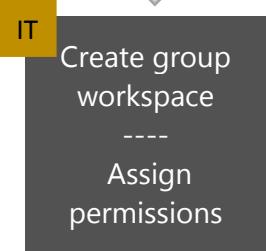
**IT**

**Create group workspace**
**----**
**Assign permissions**

Within the Power BI Service, relevant **group workspace**(s) are created and **membership**is defined for each group to ensure only selected group members can view the reports and dashboards. Group setup and membership is handled by IT.

**IT**

**Install enterprise gateway**
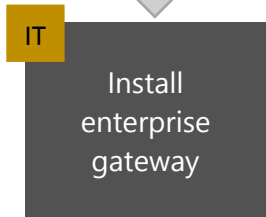
The **enterprise gateway**is installed in the server environment to ensure that the live connectivity functionality works as intended to the SSAS tabular model. Queries will pass the effective user name which will invoke the roles set up in SSAS for implementing row-level security.

**IT**
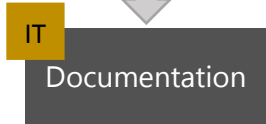
**Documentation**

Preparation of **documentation**, in accordance with IT standards.

**IT**

**Register new data source in Azure Data Catalog**
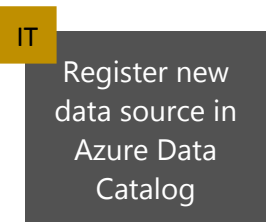
The SSAS data source is registered in the **Azure Data Catalog**and initial definitions are added. Business users refer to the Azure Data Catalog as a **data dictionary**, and can add/change definitions to continually refine the information available. Also, a business user who does not have permission to the SSAS model can **request access**via the Azure Data Catalog.

## Corporate BI Phase 5 – Support, Training, and Expansion

**Biz** Consume reports and dashboards

At this point, **reports and dashboards can be consumed** by authorized users in the Power BI Service, via the mobile applications, or even via Cortana.

**IT**
**Biz** Incremental Improvements

Based on feedback received from business users, **incremental improvements and enhancements** can be introduced. This may mean an additional data source, a new calculation, or new reports.

**IT**
**Biz** Monitoring
---- Training
--- Expansion

Once value is being delivered, the solution remains being monitored. Ongoing **training**, **support**, and **sharing of knowledge** is important and should not be overlooked.

## Sample Roadmap: IT-Managed Self-Service BI

The roadmap for IT-Managed SSBI follows the same methodology as the Corporate BI roadmap, with the following distinctions:

1. If the ability to allow a user to personalize their own copy is desired, an **organizational content pack** can be created by IT which permits a user to save and personalize secondary copies of reports and dashboards in their own personal workspace area.

2. **Report and dashboard creation** is handled by business users rather than IT. Some **semantic layer** creation (such as a data model in Power BI Desktop) may also be handled directly by business users to the extent that only sanctioned data sources are utilized (this distinction discussed earlier in this whitepaper).

3. Annotations in **Azure Data Catalog** can, and should, be made by business users who work with data sources directly.

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