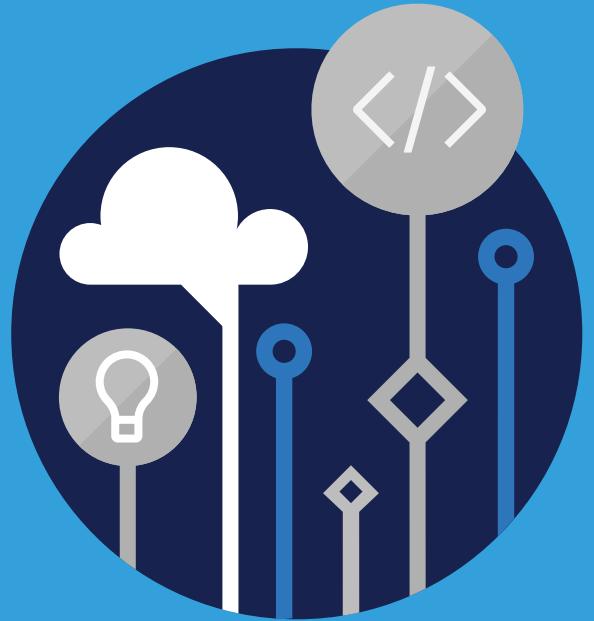


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Revised April 2019



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# Module 0 Introduction to the course

## About this course

### About this course

### Course Description

This course will teach you to use Microsoft Power Platform solutions to simplify, automate, and empower business processes for organizations in the role of a Functional Consultant.

### Audience Profile

A Microsoft Power Platform Functional Consultant is responsible for performing discovery, capturing requirements, engaging subject matter experts and stakeholders, translating requirements, and configuring Microsoft Power Platform solutions and apps.

The Functional Consultant implements components of a solution that include application enhancements, custom user experiences, system integrations, data conversions, custom process automation, and custom visualizations.

### Course Completion

After completing this course, students will be able to:

- Work with an organization to gather requirements and implement Microsoft Power Platform solutions
- Build model-driven, canvas, and portal apps
- Create Power Automate flows
- Design a simple chatbot using Power Virtual Agents
- Analyze data using Power BI visualizations and dashboards

## Course curriculum

### Microsoft Power Platform Functional Consultant

#### Certification

Upon completion of this course and practicing building solutions, we encourage you to [get certified.<sup>1</sup>](#)

#### PL-200 Certification Exam

This exam measures your ability to accomplish the following technical tasks: configure the Microsoft Dataverse, create apps using Power Apps, create and manage Power Automate, implement Power Virtual Agents chatbots, integrate Power Apps with other apps and services, and manage solutions.

PL-200 Study Area	Weight
Configure Microsoft Dataverse	20-25%
Create apps using Power Apps	15-20%
Create and manage Power Automate	15-20%
Implement Power Virtual Agents chatbots	10-15%
Integrate Power Apps with other apps and services	10-15%
Manage solutions	15-20%

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<sup>1</sup> <https://docs.microsoft.com/en-us/learn/certifications/exams/pl-200>

# Module 1 Introduction to Microsoft Power Platform

## Introduction to Microsoft Power Platform

### Introduction

Modern businesses run on data. Users interact with data daily from entering their time for payroll, seeking guidance on existing processes, and analyzing data to make decisions. In our technology driven world, users can be empowered to gain insights from and interact with data all while automating those menial responsibilities that seem to be more burden than job task. Microsoft Power Platform enables your business to craft solutions while empowering you to unite customized technology to help everyone, from the CEO to the front-line workers, drive the business with data.

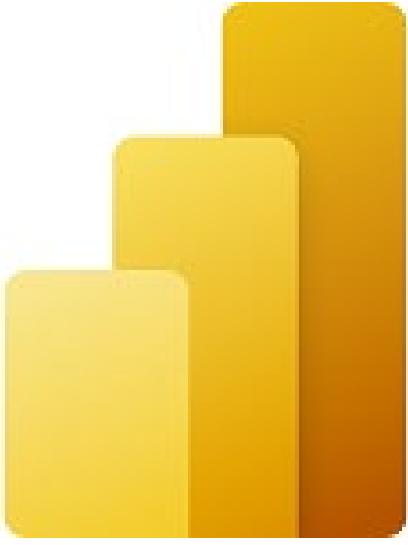
In this module, you will:

- Learn the components and features of Microsoft Power Platform
- Identify when to use each Microsoft Power Platform component application to create business solutions
- Learn the value of using Microsoft Power Platform to create business solutions

### What is Power Platform

Microsoft Power Platform is comprised of four key products: Power Apps, Power Automate, Power BI and Power Virtual Agents.

 The Power Apps logo consists of four overlapping rounded squares in shades of purple and pink, forming a stylized 'A' shape.	<p><b>Power Apps</b> provides a rapid low code development environment for building custom apps for business needs. It has services, connectors, and a scalable data service and app platform (Microsoft Dataverse) to allow simple integration and interaction with existing data. Power Apps enables the creation of web and mobile applications that run on all devices.</p> <p>People use apps for every area of their lives, and business should be no exception. Most out of the box solutions do not meet exact business needs or integrate well with other business programs. Power Apps eases users into app development with a simple interface so that every business user or pro developer can build custom apps.</p>
 The Power Automate logo consists of four overlapping rounded rectangles in shades of blue, forming a stylized 'X' shape.	<p><b>Power Automate</b> lets users create automated workflows between applications and services. It helps automate repetitive business processes such as communication, data collections, and decision approvals.</p> <p>Don't waste important productive hours on drafting the same email for a weekly update or walking approvals through. Not only for the individual user, Power Automate allows for the creation of enterprise-grade process automation. Power Automate's simple interface allows every level of user to automate work tasks - from beginners to seasoned developers.</p>

	<p><b>Power BI</b> (Business Intelligence) is a business analytics service that delivers insights for analyzing data. It can share those insights through data visualizations which make up reports and dashboards to enable fast, informed decisions. Power BI scales across an organization, and it has built-in governance and security allowing businesses to focus on using data more than managing it. You can consider Power BI as the analysis and insights leg of Microsoft Power Platform. It takes business data and allows you to display it in ways that make the most sense to users. A Power BI dashboard could potentially replace a standing meeting to report out on company metrics such as sales data, progress against goals, or employee performance.</p>
	<p><b>Power Virtual Agents</b> enables anyone to create powerful chatbots using a guided, no-code graphical interface, without the need for data scientists or developers. It minimizes the IT effort required to deploy and maintain a custom solution by empowering subject matter experts to build and maintain their own conversational solutions. Power Virtual Agents is part of Microsoft Power Platform, therefore integration into existing systems is streamlined with out-of-the-box integration with Power Automate and its ecosystems of hundreds of connectors. Users can enable chatbots to perform an action by simply calling a Power Automate flow. Flows help users automate activities or call back end systems. Users can utilize existing flows that have been created in their Power Apps environment or they can create a flow within Power Virtual Agents authoring canvas.</p>

## Features

Among the programs listed above, there are cross cutting features which enable Microsoft Power Platform to be leveraged to its full potential. Some of these are:

**AI Builder** lets users and developers add AI capabilities to the workflows and Power Apps they create and use. AI Builder is a turnkey solution that allows you to easily add intelligence to your workflows and apps and predict outcomes to help improve business performance without writing code.

**Microsoft Dataverse** is a scalable data service and app platform which lets users securely store and manage data from multiple sources and integrate that data in business applications using a common data model to ensure ease and consistency to users. Microsoft Dataverse is the common currency that enables the components of Microsoft Power Platform to work together. It's the foundation that enables the consolidation, display, and manipulation of data.

**Connectors** enable you to connect apps, data, and devices in the cloud. Consider connectors the bridge across which information and commands travel. There are more than 275 connectors for Microsoft Power Platform, enabling all of your data and actions to connect cohesively. Examples of popular connectors include Salesforce, Office 365, Twitter, Dropbox, Google services, and more.

Although every feature is essential to building powerful solutions, let's dive in deeper to one of the features of Microsoft Power Platform, connectors.

## Data Connectors

Microsoft Power Platform is made powerful by its ability to leverage data across many platforms. To do this, components of Microsoft Power Platform use connectors. You can think of connectors as a bridge from your data source to your app or workflow which allows information to be conveyed back and forth. Connectors allow you to extend your business solutions across platforms and add functionality for your users.

## Data Sources

In order to understand the types of connectors and what you can do with them, you must first understand the types of data sources to which they connect. The two types of data sources are tabular and function-based.

**Tabular data** - A tabular data source is one that returns data in a structured table format. Power Apps can directly read and display these tables through galleries, forms, and other controls. Additionally, if the data source supports it, Power Apps can create, edit, and delete data from these data sources. Examples include Microsoft Dataverse, SharePoint, and SQL Server.

**Function-based data** - A function-based data source is one that uses functions to interact with the data source. These functions can be used to return a table of data but offer more extensive action such as the ability to send an email, update permissions, or create a calendar event. Examples include Office 365 Users, Project Online, and Azure Blob Storage.

Both of these data source types are commonly used to bring data and additional functionality to your solutions.

As you can see, connecting to data sources allows you to integrate disparate parts of your business solutions to build them out cohesively.

## Connectors

Now that you understand more about data sources, you are ready to learn about connectors.

**Connectors** are the bridges from your data source to your app, workflow, or dashboard. Microsoft Power Platform has more than 275 connectors available to common data sources. Connectors are divided into standard and premium. Some popular standard connectors are SharePoint, Outlook, and YouTube. Premium connectors require additional licensing for your app and/or users. A few premium connectors are SQL Server, Survey Monkey, and Mail Chimp. The connector reference in the summary and resources unit lists all connectors and whether they are considered standard or premium. You can also use AppSource to source and install apps and use the connectors to non-Microsoft services.

Connectors can provide input and output between the data source and Power Platform, which can accelerate the delivery of Microsoft Power Platform business solutions. For instance, using Dynamics 365 apps such as Customer Service, you can set up Power Automate to notify users when specific customer types are added. Or you can use a SharePoint document library to store files that are fed into Power Apps to manage and distribute. Microsoft also provides connectors to their Azure services, providing advanced

AI techniques to do tasks such as reading text off images or cognitive services like recognizing faces in images.

All Microsoft Power Platform business solutions can be used and implemented into Microsoft 365 apps such as Teams. This allows users to play Power Apps within Teams or run Power Automate from actions and events within Teams.

## Triggers and Actions

Once you have established a data source and configured your connector, there are two types of operations you can use, triggers or actions.

**Triggers** are only used in Power Automate and prompt a flow to begin. Triggers can be time based, such as a flow which begins every day at 8:00 am, or they could be based off of an action like creating a new row in a table or receiving an email. You will always need a trigger to tell your workflow when to run.

**Actions** are used in Power Automate and Power Apps. Actions are prompted by the user or a trigger and allow interaction with your data source by some function. For example, an action would be sending an email in your workflow or app or writing a new line to a data source.

Now that you understand what connectors are and how to use them, let's look at what to do when there isn't a connector already built for your data source.

## Custom Connectors

While Microsoft Power Platform offers more than 200 connectors, you also have the option to build a custom connector. This will allow you to extend your app by calling a publicly available API, or a custom API you are hosting in a cloud provider, such as Azure. API stands for Application Programming Interface and holds a series of functions available for developers. Connectors work by sending information back and forth across these APIs and gathering available functions into Power Apps or Power Automate. Because these connectors are function-based, they will call specific functions in the underlying service of the API to return the corresponding data.

An advantage of building custom connectors is that they can be used in different platforms, such as Power Apps, Power Automate, and Azure Logic Apps.

## Creating Custom Connectors

You can create custom connectors using 3 different approaches:

- **Using a blank custom connector<sup>1</sup>**
- **From an OpenAPI definition<sup>2</sup>**
- **From a Postman collection<sup>3</sup>**

While the requirements for each approach will vary, they all require a Power Apps per app or per user plan. Each link above points to the instructions for each approach.

**Note:** The purpose of this module is to help you better understand data sources and connectors as a whole, but if you would like to learn more about custom connectors and even walk through an exercise to build one, check out the module **Use custom connectors in a Power Apps canvas app<sup>4</sup>**.

<sup>1</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-blank>

<sup>2</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-openapi-definition>

<sup>3</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-postman-collection>

<sup>4</sup> <https://docs.microsoft.com/en-us/learn/modules/use-custom-connectors-in-powerapps-canvas-app/>

# Data loss prevention, compliance, privacy, and accessibility

## Data loss prevention policies

Your organization's data is likely one of the most important assets you are responsible for safeguarding as an administrator. The ability to build apps and automation to use that data is a large part of your company's success. You can use Power Apps and Power Automate for rapid build and rollout of these high-value apps so that users can measure and act on the data in real time. Apps and automation are becoming increasingly connected across multiple data sources and multiple services. Some of these might be external, third-party services and might even include some social networks. Users generally have good intentions, but they can easily overlook the potential for exposure from data leakage to services and audiences that should not have access to the data.

You can create data loss prevention (DLP) policies that can act as guardrails to help prevent users from unintentionally exposing organizational data. DLP policies can be scoped at the environment level or tenant level, offering flexibility to craft sensible policies that strike the right balance between protection and productivity. For tenant-level policies, you can define the scope to be all environments, selected environments, or all environments except ones you specifically exclude.

Connectors can be classified as either **Business** or **Non-Business** in the context of your organization. Connectors that host business-use data should be classified as **Business** and connectors that host personal-use data should be classified as **Non-Business**. Any connectors that you want to restrict usage of across one or more environments should be classified as **Blocked**. When a new policy is created, all connectors are defaulted to the **Non-Business** group. From there they can be moved to **Business** or **Blocked** based on your preference. You can manage connectors when you create or modify the properties of a DLP policy from the **Microsoft Power Platform admin center**<sup>5</sup>. These affect Microsoft Power Platform canvas apps and Power Automate flows. To create a DLP policy, you need to be a tenant admin or have the Environment Admin role.

## Compliance and data privacy

Microsoft is committed to the highest levels of trust, transparency, standards conformance, and regulatory compliance. Microsoft's broad suite of cloud products and services are all built from the ground up to address the most rigorous security and privacy demands of our customers.

To help your organization comply with national, regional, and industry-specific requirements governing the collection and use of individuals' data, Microsoft provides the most comprehensive set of compliance offerings (including certifications and attestations) of any cloud service provider. There are also tools for administrators to support your organization's efforts. In this part of the document we will cover in more detail the resources available to help you determine and achieve your own organization requirements.

## Data Protection

Data as it is in transit between user devices and the Microsoft datacenters are secured. Connections established between customers and Microsoft datacenters are encrypted, and all public endpoints are secured using industry-standard TLS. TLS effectively establishes a security-enhanced browser to server connection to help ensure data confidentiality and integrity between desktops and datacenters. API

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<sup>5</sup> <https://admin.powerplatform.microsoft.com/>

access from the customer endpoint to the server is also similarly protected. Currently, TLS 1.2 (or higher) is required for accessing the server endpoints.

## Resources to manage GDPR compliance

The European Union General Data Protection Regulation (GDPR) is one of the newest privacy regulations enacted that gives rights to people to manage their personal data. A complete discussion of GDPR is beyond the scope of this content, however Microsoft Power Platform does fully support the GDPR. For more GDPR resources and information, visit the Trust Center at <https://www.microsoft.com/Trust-Center/Privacy/gdpr/default.aspx>.

## Accessibility in Microsoft Power Platform

One of the things that Microsoft values the most is making sure that Power Platform is accessible and inclusive to all kinds of users all over the world. An accessible canvas app will allow users with vision, hearing, and other impairments to successfully use the app. In addition to being a requirement for many governments and organizations, following the below guidelines increases usability for all users, regardless of their abilities. You can use the **Accessibility Checker**<sup>6</sup> to help review potential accessibility issues in your app. For more details and suggestions on making your canvas apps more accessible, visit **Create accessible canvas apps in Power Apps**<sup>7</sup>.

## Pulling it all together

Although we live in a data driven world, your business can find it difficult to take advantage of the data you have access to. Sales, customer, and employee data should drive our business decisions, but where do we even start? Microsoft Power Platform can add value to any business by helping you to analyze, act, and automate. Act by building custom apps in Power Apps, automate processes based on the data you collect in Power Automate, and analyze the data you have collected in Power BI.

Consider a business that has IT equipment for general use. Currently, equipment check-out is conducted by visiting the IT office, checking if the product is available, then writing your name and the equipment name in a notebook. Employees may have to visit IT several times before equipment becomes available, and IT personnel must drop their tasks to check on equipment status or go to collect it for the employee. Sometimes employees hold onto the equipment longer than they intend and an IT personnel spends time tracking it down. In addition, important equipment information such as serial number, warranty details, and instructions for use are kept somewhere in the IT office. How can Microsoft Power Platform improve this process?

Power Apps allows us to build an app that has all equipment listed, the status of that equipment, and even important details such as use instructions. This way employees can check out available equipment, walk to IT at a specified pickup time where the equipment will be ready, and even access the use instructions or flag an equipment malfunction from their phone or tablet. Power Automate can read when equipment needs to be returned and send out reminder emails, or even a warning that the equipment is late being checked in. Users can see when equipment is booked through the app and request check-out for a future date at which time Power Automate can send them a reminder to pick up the equipment and IT a reminder to have it ready. Power BI can take all the data generated from the app and analyze it to help you understand what equipment is used most often and by whom. This way you can decide if you need other equipment, if some users or departments need dedicated equipment, and when your equipment has reached the end of its usefulness.

<sup>6</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/accessibility-checker>

<sup>7</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/accessible-apps>

This is only one common scenario in which Microsoft Power Platform can transform the way businesses work. Consider your own business and what processes take up valuable time and are a burden to customers or employees. How can you leverage Microsoft Power Platform to improve them?

## Knowledge Check

### Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

*1.Your social media engagement officer has requested your help in boosting followers and retweets on Twitter. How could you help her get more information to better understand and subsequently increase engagement?*

- Configure a Power BI report to capture and analyze data from Twitter, allowing you to better understand why certain posts elicit more responses.
- Power Apps using portals can create a new customer site for our followers.
- Power Automate can handle our content approvals for us, reducing the time it takes to produce new content and ensure our quality procedure is followed.

### Multiple choice

*2.Your team has become frustrated with the number of times they have to perform basic data entry on project startup. There are many divisions who need the information and sometimes human error results in mistakes, making it more difficult to make sense of your information. Which program would be the most help in this situation?*

- Power Apps
- Power BI
- Power Automate

### Multiple choice

*3.Someone has added an item in SharePoint which prompts a workflow to run in Power Automate. What type of operation have you used to start your workflow?*

- Action
- Trigger
- Function-based

## Multiple choice

4. A client likes the idea of implementing a Microsoft Power Platform solution, but is concerned about the ability to interact with a custom API. How should you respond?

- Microsoft Power Platform offers the ability to create custom connectors for this purpose which allow you to connect to Power Apps and Power Automate.
- Microsoft Power Platform has over 270 connectors to use in these situations.
- Microsoft Power Platform uses connectors that hold a series of functions available for developers.

## Multiple choice

5. Someone asks you to describe a connector. How would you respond?

- Connectors are a cloud-based service that makes it practical and simple for line-of-business users to build workflows that automate time-consuming business tasks and processes across applications and services.
- Connectors connect your data source to your app, workflow, or dashboard.
- Connectors hold a series of functions available for developers.

## Summary resources

Microsoft Power Platform offers a point-and-click approach to building custom applications, data visualizations, and automated workflows. This approach makes it easy for anyone familiar with Microsoft Office to create custom business solutions.

Now that you have reviewed this module, you should be able to:

- Describe the components and features of Microsoft Power Platform
- Identify when to use each Microsoft Power Platform component application to create business solutions
- Understand and explain the value of using Microsoft Power Platform to create business solutions

## Key takeaways

	Here are the five key takeaways:
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	1. Microsoft Power Platform is a system that enables users to do three key actions on data that help them drive business: gain insights from data (Analyze), drive intelligent business processes via apps they build (Act), and automate business processes (Automate).
	2. Power BI helps you analyze and visualize data on a unified platform with data from internal and external sources.
	3. Power Apps helps you build and deploy customized apps that work across web and mobile, embedded or standalone, on any device.
	4. Connectors are bridges that allow you to send information from your data source to your app or workflow and back.
	5. Power Automate helps you create automation workflows, from simple to advanced scenarios.

## Resources

Use these resources to discover more.

**Tip:** To open a resource link, right-click and select “Open in a new tab or window”. That way, you can check out the resource and easily return to the module tab to unlock your achievement when done.

### Power BI

- [Power BI<sup>8</sup>](https://powerbi.microsoft.com/)
- [Power BI customer showcase<sup>9</sup>](https://powerbi.microsoft.com/customer-showcase/)

### Power Apps

- [Power Apps<sup>10</sup>](https://powerapps.microsoft.com/)
- [Power Apps Resources<sup>11</sup>](https://powerapps.microsoft.com/resources/)

### Power Automate

- [Power Automate<sup>12</sup>](https://flow.microsoft.com/)
- [Power Automate Documentation<sup>13</sup>](https://docs.microsoft.com/en-us/flow/)

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<sup>8</sup> <https://powerbi.microsoft.com/>

<sup>9</sup> <https://powerbi.microsoft.com/customer-showcase/>

<sup>10</sup> <https://powerapps.microsoft.com/>

<sup>11</sup> <https://powerapps.microsoft.com/blog/microsoft-powerapps-learning-resources/>

<sup>12</sup> <https://flow.microsoft.com/>

<sup>13</sup> <https://docs.microsoft.com/en-us/flow/>

## More on Connectors

- **Connector Reference<sup>14</sup>**
- **Overview of canvas-app connectors for Power Apps<sup>15</sup>**

## Getting started with Custom Connectors

- **Using a blank custom connector<sup>16</sup>**
- **From an OpenAPI definition<sup>17</sup>**
- **From a Postman collection<sup>18</sup>**
- **Use custom connectors in a PowerApps canvas app<sup>19</sup>**

## Get started with Power Virtual Agents

- **Power Virtual Agents<sup>20</sup>**

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<sup>14</sup> <https://docs.microsoft.com/en-us/connectors/>

<sup>15</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/connections-list>

<sup>16</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-blank>

<sup>17</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-openapi-definition>

<sup>18</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-postman-collection>

<sup>19</sup> <https://docs.microsoft.com/en-us/learn/modules/use-custom-connectors-in-powerapps-canvas-app/>

<sup>20</sup> <https://powervirtualagents.microsoft.com/>

# Answers

## Multiple choice

1.Your social media engagement officer has requested your help in boosting followers and retweets on Twitter. How could you help her get more information to better understand and subsequently increase engagement?

- Configure a Power BI report to capture and analyze data from Twitter, allowing you to better understand why certain posts elicit more responses.
- Power Apps using portals can create a new customer site for our followers.
- Power Automate can handle our content approvals for us, reducing the time it takes to produce new content and ensure our quality procedure is followed.

### *Explanation*

*Correct. Power BI allows you to create visuals and better understand your data. Once you understand trends in what followers like, you can post more of that content and increase engagement.*

## Multiple choice

2.Your team has become frustrated with the number of times they have to perform basic data entry on project startup. There are many divisions who need the information and sometimes human error results in mistakes, making it more difficult to make sense of your information. Which program would be the most help in this situation?

- Power Apps
- Power BI
- Power Automate

### *Explanation*

*Correct. Power Automate can create automated information workflows so that data entry only has to occur once.*

## Multiple choice

3.Someone has added an item in SharePoint which prompts a workflow to run in Power Automate. What type of operation have you used to start your workflow?

- Action
- Trigger
- Function-based

### *Explanation*

*Correct.A trigger is an operation that tells a workflow to begin or prompts some type of action.*

**Multiple choice**

4.A client likes the idea of implementing a Microsoft Power Platform solution, but is concerned about the ability to interact with a custom API. How should you respond?

- Microsoft Power Platform offers the ability to create custom connectors for this purpose which allow you to connect to Power Apps and Power Automate.
- Microsoft Power Platform has over 270 connectors to use in these situations.
- Microsoft Power Platform uses connectors that hold a series of functions available for developers.

*Explanation*

*Correct. You can build out a custom connector to bridge your app or workflow to the API.*

**Multiple choice**

5.Someone asks you to describe a connector. How would you respond?

- Connectors are a cloud-based service that makes it practical and simple for line-of-business users to build workflows that automate time-consuming business tasks and processes across applications and services.
- Connectors connect your data source to your app, workflow, or dashboard.
- Connectors hold a series of functions available for developers.

*Explanation*

*Correct. Connectors allow functions and information to pass from your data source to your app or workflow.*



## Module 2 Work with Microsoft Dataverse

### Create tables in Dataverse

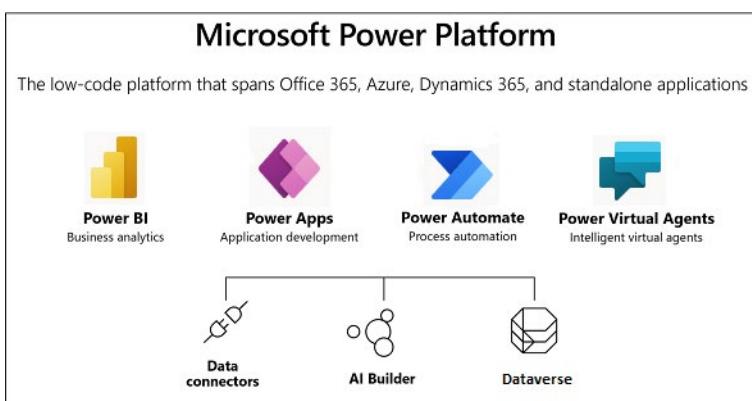
#### Introduction to Microsoft Dataverse

Microsoft Dataverse lets you securely store and manage data used by business applications.

### Tables

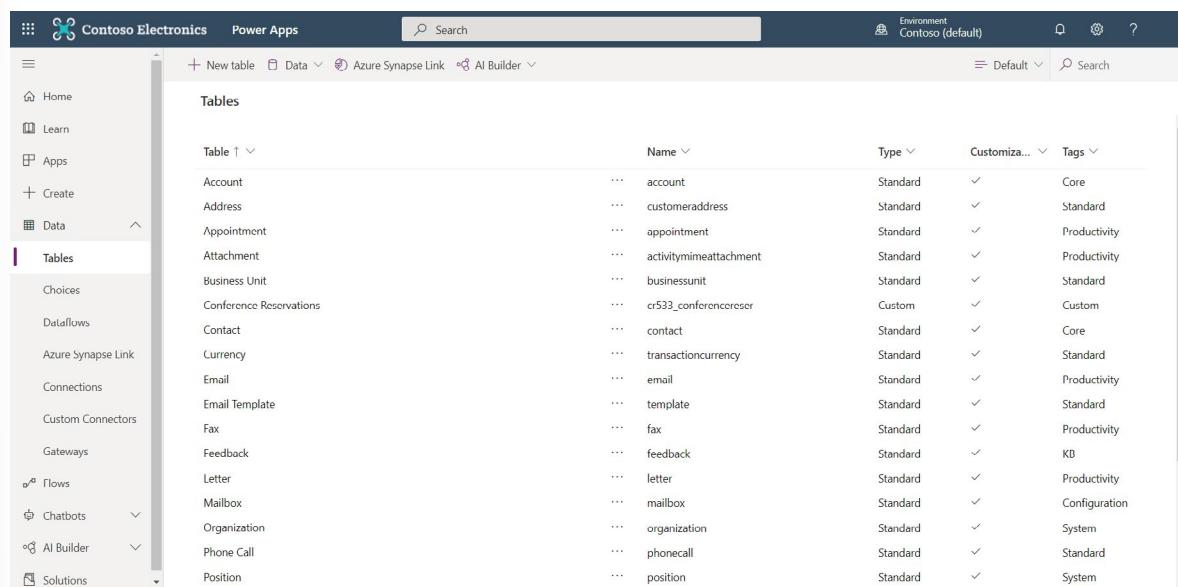
Data within Dataverse is stored within a set of records called tables. A **table** is a set of records used to store data, similar to how a table stores data within a database.

Dataverse includes a base set of standard tables that support common business scenarios that connect to Dynamics 365 application data. You can also create custom tables specific to your organization and populate them with data that you import from lists in SharePoint, from Excel, or from PowerQuery. App makers can then use Power Apps to build rich applications using this data.



Dynamics 365 applications, such as Dynamics 365 Sales, Service, and Marketing, use Dataverse to store and secure data used by the applications. This means you can build apps using Power Apps and Dataverse directly against your core business data already used within Dynamics 365 without the need for manual integration.

**Note:** Dynamics 365 Finance, Dynamic 365 Supply Chain Management, and Dynamics 365 Retail currently require the configuration of Dual-Write to make your business data available within Dataverse.



The screenshot shows the Microsoft Dataverse interface with the title bar "Contoso Electronics" and "Power Apps". The left sidebar includes links for Home, Learn, Apps, Create, Data (selected), Tables (selected), Choices, Dataflows, Azure Synapse Link, Connections, Custom Connectors, Gateways, Flows, Chatbots, AI Builder, and Solutions. The main area displays a table titled "Tables" with columns: Name, Type, Customiza..., and Tags. The table lists standard entities such as Account, Address, Appointment, Attachment, Business Unit, Conference Reservations, Contact, Currency, Email, Email Template, Fax, Feedback, Letter, Mailbox, Organization, Phone Call, and Position. Most entities are categorized as Standard, with some like Conference Reservations, Email Template, and Position being Custom. Tags include Core, Standard, Productivity, and System.

Table	Name	Type	Customiza...	Tags
Account	account	Standard	✓	Core
Address	customeraddress	Standard	✓	Standard
Appointment	appointment	Standard	✓	Productivity
Attachment	activitymimeattachment	Standard	✓	Productivity
Business Unit	businessunit	Standard	✓	Standard
Conference Reservations	cr533_conferencereser	Custom	✓	Custom
Contact	contact	Standard	✓	Core
Currency	transactioncurrency	Standard	✓	Standard
Email	email	Standard	✓	Productivity
Email Template	template	Standard	✓	Standard
Fax	fax	Standard	✓	Productivity
Feedback	feedback	Standard	✓	KB
Letter	letter	Standard	✓	Productivity
Mailbox	mailbox	Standard	✓	Configuration
Organization	organization	Standard	✓	System
Phone Call	phonecall	Standard	✓	Standard
Position	position	Standard	✓	System

For most organizations, it's a good idea to use the standard tables and columns as they were intended. But to meet your business needs, you can extend the functionality of standard tables by creating one or more custom tables to store information that's unique to your organization.

## Logic and validation

Entities within Dataverse can leverage rich server-side logic and validation to ensure data quality. You can also reduce repetitive code in each app that creates and uses data within a table.

- **Business rules:** Business rules validate data across multiple columns in a table, and provide warning and error messages, regardless of the app that's used to create the data.
- **Business process flows:** Business process flows guide users to ensure they enter data consistently and follow the same steps every time. Business process flows are currently supported only for model-driven apps.
- **Workflows:** Workflows automate business processes without requiring user interaction.
- **Business logic with code:** Business logic supports advanced developer scenarios that extend the application directly through code.

## Security

Data in Dataverse is securely stored so that users can see it only if you grant them access. Role-based security, based on the Dynamics 365 system allows you to control access to tables for different users within your organization.

## Table characteristics

Microsoft Dataverse is designed to let you quickly and easily create a data model for your application, based on the tables and the table metadata that you include in your app.

Tables describe the kinds of data that is stored in the Dataverse database. Each table corresponds to a database table and each column (also known as an attribute) within a table represents a column in that table.

In Dataverse, metadata (data about data), is a collection of tables. Table metadata is what controls the kinds of rows you can create and what kind of actions can be performed on them. When you use customization tools to create or edit tables, columns, and table relationships, you are editing this metadata.

The apps that your customers use to interact with the data in your environment depend on the table metadata, and they adapt as you customize the metadata.

## When to use standard tables, and when to create new tables

Dataverse comes with many standard tables that support core business application capabilities. Each table also contains many metadata columns that represent common data that the system needs to store for that table. We recommend that you become familiar with the catalog of standard tables, and use them where possible, because any applications written with standard tables will work as you expect in your environment without extra effort.

For minor changes, you might not have to create a custom table:

- To change the display name of a column, you can edit the table. You don't have to create a new table.
- You can't delete standard tables, but you can hide them. To hide a standard table, change the security role privileges for your organization to remove the Read privilege for that table. This will remove the table from most parts of the application.

If standard tables don't work for your business needs, and if they can't be edited to meet those needs, consider creating a new table, column, or table relationship. If a standard table almost meets your business needs, you can use it as the basis for a new table.

## Table relationships

Table relationships define the different ways table rows can be associated with rows from other tables or the same table **self-referential relationship**<sup>1</sup>. Table relationships are metadata. They let queries retrieve related data efficiently. Use table relationships to define the formal relationships between tables.

When you look at the solution explorer you might think that there are three types of table relationships but actually there are only two, see below:

- **One-to-many relationships:** In a one-to-many (1:N) table relationship, many related table rows are associated with a single primary table row in a parent/child relationship.
- **Many-to-many relationships:** In a many-to-many (N:N) table relationship, many table rows are associated with many other table rows. Rows that are related through N:N table relationships are considered peers.

The N:1 (many-to-one) relationship type exists in the user interface because the designer shows you a view grouped by tables. 1:N relationships actually exist between tables and refer to each table as either a Primary/Current table or Related table. The related table, sometimes called the child table, has a lookup column that allows storing a reference to a row from the primary table, sometimes called the parent table. A N:1 relationship is just a 1:N relationship viewed from the related table.

<sup>1</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/create-edit-nn-relationships-portal>

Besides defining how rows can be related to other rows, 1:N table relationships also provide data to address the following questions:

- When I delete a row, should any rows that are related to that row also be deleted?
- When I assign a row to a new owner, do I also have to assign all related rows to the new owner?
- How can I streamline the data entry process when I create a new related row in the context of an existing row?
- How should people who view a row be able to view the related rows?

## Table types

Before creating or editing tables in Dataverse, you should understand the different types of tables that you can create. After a custom table is created, the table type can't be changed.

## Types of table owners

When you create a custom table, the options for ownership are *User or team owned*, or *Organization-owned*. After a table is created, you can't change the ownership.

- **User or team owned:** Actions that can be performed on these rows can be controlled at the user level.
- **Organization-owned:** Access to the data is controlled at the organization level.

## Activity tables

An *activity* is an action that a calendar entry can be made for. Activities have these characteristics:

- They have time dimensions (start time, stop time, due date, and duration) that help define when the action occurred or will occur.
- They have data (like a subject and description) that helps define the action that the activity represents.
- They can be opened, canceled, or completed. Several substatus values will be associated with the *Completed* status of an activity to clarify how the activity was completed.

Activity tables can be owned only by a user or team. They can't be owned by an organization.

The following default activity tables are available:

- **Appointment:** A commitment representing a time interval that has start/end times and duration.
- **Email:** An activity that's delivered by using email protocols.
- **Fax:** An activity that tracks the call outcome and number of pages for a fax. The activity can optionally store an electronic copy of the document.
- **Letter:** An activity that tracks the delivery of a letter. The activity can store an electronic copy of the letter.
- **Phone Call:** An activity that tracks a telephone call.
- **Recurring Appointment:** The master appointment of a recurring appointment series.
- **Task:** A generic activity representing work that must be done.

## Custom activity tables

You can create new custom activity tables. The metadata values of activity tables differ from the metadata values of other tables. For example, the **Primary** column is set to **Subject**.

## Business Rules

Business rules provide a simple interface to implement and maintain fast-changing and commonly used rules. The business rules defined for a table apply to both canvas apps and model-driven apps if the table is used in the app.

By combining conditions and actions, you can do any of the following with business rules:

- Set column values
- Clear column values
- Set column requirement levels
- Show or hide columns
- Enable or disable columns
- Validate data and show error messages
- Create business recommendations based on business intelligence.

## Differences between canvas and model-driven apps

Model-driven apps can use all actions available on business rules, however not all business rule actions are available for canvas apps at this time. The following actions are not available on Canvas apps:

- Show or hide columns
- Enable or disable columns
- Create business recommendations based on business intelligence.

## Dual-write vs. virtual tables

Microsoft Dataverse allows for many different connections to external data sources. Dual-write and virtual tables (or virtual entities) allow Dataverse to access this data and write back to the original data source.

## Dual-write

Dual-write is an out-of-box infrastructure that provides near-real-time interaction between Dataverse and Finance and Operations apps. When data about customers, products, people, and operations flows beyond application boundaries, all departments in an organization are empowered.

Dual-write provides tightly coupled, bidirectional integration between Finance and Operations apps and Dataverse. Any data change in Finance and Operations apps causes writes to Dataverse, and any data change in Dataverse causes writes to Finance and Operations apps. This automated data flow provides an integrated user experience across the apps.

Find more information on [configuring Dual-write<sup>2</sup>](#).

<sup>2</sup> <https://docs.microsoft.com/en-us/dynamics365/fin-ops-core/dev-itpro/data-entities/dual-write/lcs-setup>

## Virtual tables

Virtual tables (also known as virtual entities) enable the integration of data residing in external systems by seamlessly representing that data as tables in Microsoft Dataverse, without replication of data and often without custom coding.

Virtual tables replace previous client-side and server-side approaches to integrating external data, which required customized code and suffered from numerous limitations, including imperfect integration, data duplication, or extensive commitment of development resources. In addition, for administrators and system customizers, the use of virtual tables greatly simplifies administration and configuration.

Find more information on [configuring virtual tables<sup>3</sup>](#).

## When to use Dual-write vs. virtual tables?

Both Dual-write and virtual tables offer useful data integration functionality. It is important to understand when you need to use each tool.

Dual-write should be used when you are working with Dynamics 365 apps and need near real-time integration. Dual-write will duplicate the data in both directions (to and from Dataverse).

Virtual tables should be used when you are connecting to data sources outside of Dynamics 365. There may be built-in connectors for these data sources, or you may have to use a custom connector.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. When creating a Table, what are the two types of relationships you can create?

- One-to-many and One-to-one
- One-to-many and Many-to-many
- Many-to-one and Many-to-many
- One-to-one and Many-to-many

### Multiple choice

2. How many apps can use the same Table?

- 1
- 20
- 100
- Unlimited

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<sup>3</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/create-edit-virtual-entities>

## Multiple choice

3. When deploying role-based security in the Microsoft Dataverse, which of the following products allows you to control access to tables for different users?

- SQL Server
- Azure portal
- Dynamics 365
- SharePoint

## Summary

Congratulations on using Microsoft Dataverse, and creating your first table!

Dataverse lets you securely store and manage data that's used by business applications. Standard and custom tables within Dataverse provide a secure and cloud-based storage option for your data.

Let's review what you've learned:

- Dataverse stores data in tables.
- If you can, it's preferable to use as many default tables as possible, so that your system is easy to maintain.
- Creating new tables is easy.
- The best way to get data into a table is to export a template, add data, and upload it.

# Manage tables in Dataverse

## Identify tables and table types in Dataverse

In Dataverse, a table is a logical structure containing records that are made up of rows and columns. Dataverse tables differ from a simple database table because they have nearly 100 properties that are used to define relationships between other standard tables and how the table is used within Dynamics solutions from Microsoft.

### Types of tables

The four types of tables are:

- **Standard** - The base set of tables that are created for every instance of a Dataverse database. You can add more columns to any table, but you cannot delete any column from a standard, premium, or restricted table.
- **Complex** - tables that contain complex, server-side business logic, including real-time workflows or plug-ins. Some of the tables that are used in Dynamics 365 applications are complex. To use complex tables, users are required to have a P2 or Dynamics 365 license. Care must be taken if you add server-side logic to ensure that users have the proper license to use the complex table. Additional information about complex tables can be accessed by following the link within the summary unit of this module.
- **Restricted** - Certain tables that are tied to Dynamics 365 application functionalities require each user to have the corresponding license for that Dynamics 365 application if they want to create, update, or delete rows within the restricted tables. Additional information about restricted tables can be accessed by following the link within the summary unit of this module.
- **Custom** - Are created for a specific business application. All licensed users of Dataverse can access custom tables if they are assigned proper security permissions to do so.

## Create a custom table

Adding a new table to a Dataverse database is a simple process.

**Tip:** Make sure that you always verify that the functionality of the table that you want to create already exists in the standard tables listed in the summary unit of this module.

After you have verified existing tables and have decided that you need a new custom table, follow these steps:

1. Sign in to Power Apps.
2. On the navigation pane, select or tap **Data** to expand it and then select or tap **Tables**.
3. Select **New table** in the command bar.
4. In the New table panel, in the **Display name** box, enter the name of your new custom table.

**Plural display name** - This column is auto populated when you enter a display name, but you can change it if needed. The plural display name is the name of the table in the Dataverse WebAPI and is used when you are interacting with this table from Power Apps or Power Automate.

**Name** - This column is also auto populated when you enter a display name. The prefix was set up when the environment was created and ensures that the tables you create can be exported and imported into other environments without conflicting with other table names. You can change this prefix by updating the prefix on your Publisher for the Dataverse Default Solution. To keep existing

apps from breaking, you cannot change the name after saving the table.

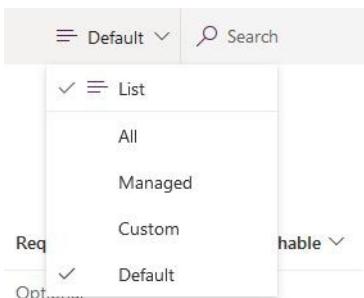
Under the **Primary Name** column section and in the **Display name** box, enter a name for **Display Name**. In the **Name** box, replace **Name** with a name of your choosing for the new primary column. By default, every table contains a **Primary Name** column that is used by lookup columns when establishing relationships with other tables. Typically, the **Primary Name** column stores the name description of the data that is stored in a table's row. You can update the name and display name of the **Primary Name** until you create the table. Once the table is created, you cannot update the name. When you are finished, select **Create**.

- To **add a column to the table**, use the following procedure:

- In the command bar, select or tap **Add column** to open the column properties panel.
- In the **Display name** box, enter the name of the column that you want to add.
- From the **Data type** drop-down list, select the type of data that you want to add.
- Select and change the **Required** dropdown if desired.
- Select or tap **Done**.

You will learn much more about columns in a later module.

**Note:** All tables have read-only system columns. By default, system columns are not shown in the list of columns, even though they exist within the table. To view all columns, change the filter on the command bar from **Default** to **All**. For more information on the metadata that is related to a table, see table metadata.



- Select **Save table** to save your table and make it available for use in apps.

**Tip:** You will need to assign permissions to the new custom table in an existing or new user security role. This way, users can add, view, edit, or delete data in the table. Refer to unit four in module two if you need additional information on user security roles.

## Enable attachments within a table

You might want to allow users the ability to upload files and save with a row in a table. Dataverse tables allow users to add an attachment by turning on the attachment property that is associated with that table. If you want to let users upload one or more files into a row within a table, use the following procedure.

**Note:** Attachments will be enabled if you are working with a standard table.

- Sign in to Power Apps
- Select **Data** and then **Tables** on the menus on the left-hand pane.

3. Select a **table** and then select **Settings**.
4. Select the **Enable Attachments** check box.
5. Select **Done**.
6. Select **Save Table** at the bottom to save your changes.

**Note:** You cannot undo the addition of attachments to a table.

## Licensing requirements for each table type

As Unit 1 explained, complex and restricted tables require additional licensing. The following table summarizes license requirements for each type of table.

Table type	License requirements
Standard and Custom tables	Microsoft 365, Per app plan, Per user plan, Dynamics 365
Complex tables	Per user plan, Dynamics 365
Restricted tables	Specific Dynamics 365 application licenses

For more information on complex and restricted table license requirements, see the link to licensing that is provided in the summary unit in this module.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which table type is not a part of Dataverse?

- Standard
- Complex
- Open
- Restricted

### Multiple choice

2. Which of the following statements about restricted tables is false?

- Customers can add restricted tables to Dataverse.
- Restricted tables store and maintain product-specific configuration data for Dynamics 365 products that are typically not used outside of the Dynamics application.
- The restricted table is accompanied by advanced logic that creates and maintains data in a specific way when it is used within a Dynamics 365 product.
- Restricted tables require a specific Dynamics 365 product license or the Dynamics 365 Plan.

## Multiple choice

3. With a P2 license in Dataverse, you can use and access any table except which of the following?

- Standard tables
- Restricted tables
- Certain tables that contain complex logic
- Custom tables

## Summary

In this module, you learned:

- What a table is and how it's used in Dataverse.
- What types of tables are available in Dataverse.
- How to view standard tables and create a custom table.
- How to enable attachments within a table.
- What licensing requirements to apply to use each type of table.

The following links were referenced within this module. Check them frequently because Dataverse is a rapidly changing service from Microsoft.

**Licensing and Pricing<sup>4</sup>** - Find the right Power Apps plan for your business needs. Note that Dataverse is licensed with Power Apps and Dynamics 365.

**Complex tables and licensing requirements<sup>5</sup>** - tables that include complex server-side logic may have additional licensing requirements.

**Restricted tables requiring Dynamics 365 licenses<sup>6</sup>** - App makers can use most of the tables available within Dataverse to create apps and flows for users, but some are restricted.

<sup>4</sup> <https://powerapps.microsoft.com/en-us/pricing/>

<sup>5</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/data-platform-complex-entities>

<sup>6</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/data-platform-restricted-entities>

## Create and manage columns within a table in Dataverse

### Define columns in Microsoft Dataverse

Columns are a way to store a discrete piece of information within a record in a table. Columns have types, meaning that you can store data of a certain type in a field that matches that data type. For example, if you have a solution that requires dates, then you would store the date in a field with the type of Date. Similarly, if you want to store a number, then you store the number in a field with the type of Number.

The number of columns within a table varies from a few columns to a hundred or more. If you need more than a few hundred columns in a table, you might want to reconsider how you are structuring data storage for your solution because, likely, there is a better way.

Every database in Microsoft Dataverse starts with a standard set of tables and each standard table has a standard set of columns.

**Tip:** Always use standard tables and columns when possible. You can rename a table if that makes the table more understandable in the context of your solution. Always review the list of standard tables and make sure a standard table will not meet your needs before you create a new table.

### Column types in Microsoft Dataverse

The column type determines the values that can be stored within that column. All columns have one and only one column type. The column types that are available in Microsoft Dataverse include:

**Text** - A text value intended to be displayed in a single-line text box.

**Text Area** - A text value intended to be displayed in a multi-line text box. If you require more than 4,000 characters, use a Multiline Text data type.

**Email** - A text value that is validated as an email address and rendered as a mailto link in the column.

**URL** - A text value that is validated as a URL and rendered as a link to open the URL.

**Ticker Symbol** - A text value for a ticker symbol that will display a link that will open to show a quote for the stock ticker symbol.

**Phone** - A text value that is validated as a phone number rendered as a link to initiate a phone call by using Skype.

**Whole Number** - A number value presented in a text box.

**Duration** - A number value presented as a drop-down list that contains time intervals. A user can select a value from the list or type an integer value that represents the number of minutes.

**Timezone** - A number value presented as a drop-down list that contains a list of time zones.

**Date and Time** - A date and time value.

**Date Only** - A date and time value that only displays a date. The time value is stored as 12:00 AM (00:00:00) in the system.

**Language** - A number value presented as a drop-down list that contains a list of languages that have been enabled for the environment. If no other languages have been enabled, the base language will be the only option. The saved value is the Locale Identifier (LCID) value for the language.

**Currency** - A money value for any currencies that are configured for the environment. You can set a level of precision, or you can choose to base the precision on a specific currency or a single standard precision that is used by the organization.

**Decimal Number** - A decimal value with up to 10 points of precision. See [Using the right type of number<sup>7</sup>](#) for more information.

**Floating Point Number** - A floating point number with up to 5 points of precision. See [Using the right type of number<sup>8</sup>](#) for more information.

**Image** - Displays a single image for each record in the application. Each table can have one image column. The name that you enter when creating an image column will be ignored. Image columns are always named **tableImage**. You can only have one image column for each table.

**Lookup** - Creates a reference to a single row for a single target row type.

**Choices** - Displays a list of options where more than one option can be selected.

**Multiline Text** - A text value intended to be displayed in a multi-line text box. This value is limited to a maximum of 1,048,576 characters. You can also set a lower Max Length.

**Choice** - Displays a list of options where only one can be selected.

**Yes/No** - Displays two options where only one can be selected. You can choose which labels are displayed for each option. The default values are Yes and No.

**Tip:** You can add any combination of columns to a custom or standard table to meet your needs, but you can't delete a standard column from a standard table.

## Add a column to a table

You can add columns when you create a new custom table, or you can add columns to an existing table at any time. Adding a new column is the same whether you are creating a new table or adding to an existing table.

**Tip:** Before you create a custom column, evaluate whether an existing column meets your requirement.

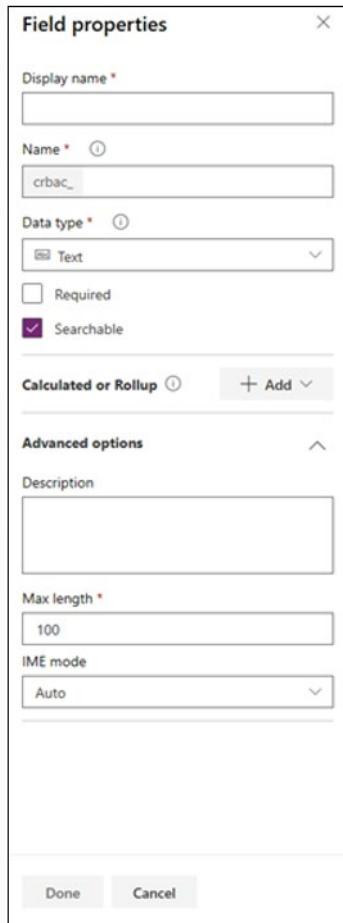
1. Sign in to Power Apps.
2. Select the **Data** option on the left-hand menu.
3. Open an existing table or create a new table.
4. Select **Add column** on the menu at the top of the page.
5. Enter information in the following columns:
  1. **Display name** - The name that is shown to users.
  2. **Name** - This is the internal name that is used by your application.
  3. **Data type** - This is the type of data that you want to store in the column.
  4. **Required** - Select this check box if you want to ensure that this column always has a value when a user tries to add a record to this table.
  5. **Searchable** - Clear this check box for columns for the table that you do not use. When a column is searchable, it appears in **Advanced Find** and is available when you are customizing views. Clearing this check box reduces the number of options that are shown to people who are using **Advanced Find**, and helps make it easier for users to create custom views without seeing unused columns.

<sup>7</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/types-of-fields#using-the-right-type-of-number>

<sup>8</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/types-of-fields#using-the-right-type-of-number>

Clear the **Searchable** check box when you are working with columns in a standard or complex table that you do not use.

6. **Calculated or Rollup** - Use to define a calculation or a rollup in this column.
7. **Description** - This is a description of the column.
8. **Max Length** - Use to define the maximum length of the data that a user can enter in this column.  
Note that this is used with text columns.
9. **Minimum and Maximum Values** - This column is available and used with number columns.



## Create a primary name column

A **Primary Name** column is always created by Microsoft Dataverse when you create a new custom table. This is the first column that is listed and available so you have a way to identify a record in the new custom table by using a business value or an autogenerated whole number.

The **Primary Name** column is not the same as the internal key column that is also autogenerated when you create a new custom table. The **Primary Key** column is a GUID. You can change the name of the **Primary Name** column to make it friendlier for business users. You can also choose between a text column or autogenerated whole number.

**Tip:** If you want to make the primary column unique, then make a key and assign the **Primary Name** column to the new key.

**Note:** If you have duplicated data in the **Primary Name** column in multiple records, the key will not be created. You can only create a key if data in the column's existing record is unique across all records in the table.

## Restrictions that apply to columns in a table

When using Microsoft Dataverse for your business solutions, you should keep a few restrictions in mind.

Maximum Number of columns in a table:

- There is no hard upper limit on the number of columns that you can have in a table, but there is an upper boundary due to limits in how much data you can store in a single record. It is difficult to provide a specific number because each type of column can use a different amount of space. The upper limit depends on the total space that is used by all the columns for the table.
- As a rule, you should have less than a few hundred columns in a table. If you have more than a few hundred columns in a table, then you should look at restructuring how you have designed the tables in your solutions and try to split the table with an excessive number of columns into more than one table.

**Rollup** columns:

- Max of 100 for each organization
- Max of 10 for each table
- Can't trigger workflows

**Choices** columns:

- Choice columns provide a set of options that will be displayed in a drop-down control on a form or in picklist control when you are using Advanced Find. Dynamics 365 can support thousands of options within a Choice, but you should not consider this as the upper limit. Usability studies have shown that people have trouble using a system where a drop-down control provides a large number of options.
- Use a Choice column to define categories for data. Don't use Choice columns to select categories that actually represent separate items of data. For example, rather than maintaining a Choice column that stores each of hundreds of possible manufacturers of a type of equipment, consider creating a table that stores references to each manufacturer and use a lookup column instead of a Choice column.

**Primary Name** column

- You can only have one primary column for each custom table.

## Create an auto numbering column

Autonumber columns automatically generate alphanumeric strings whenever they are created. You can customize the format of these columns and then rely on the system to generate matching values that automatically fill them in.

Autonumber columns appear in the Text category of columns when you create a new column. You can also activate autonumber functionality in an existing text column by opening the column and selecting **Autonumber** in the datatype dropdown. Similarly, auto number functionality can also be disabled at any time by opening the column and selecting text as the type in the **Data type** drop-down list.

Autonumber columns offer many options for the type of autogenerated number that you want to generate. You can create any of the following autonumber type columns.

**String prefixed number** - The most common auto number format is a simple string prefixed number. When this type is selected, the autonumber will consist of an automatically incrementing number with an

optional string constant prefix. For example, a string prefixed number with the prefix of Contoso would generate records such as Contoso-1000, Contoso-1001, Contoso-1002, and so on.

**Date prefixed number** - Another common auto number format is a date prefixed number. When this type is selected, the auto number will consist of an automatically incrementing number with a formatted date prefix. The date portion of the record will reflect the current date and time at which the record was created in UTC time. For example, a date prefixed number would generate records such as 2019-26-02-1000, 2019-27-02-1000, 2019-28-02-1000, and so on, depending on the current date and selected date format.

**Custom** - For more advanced makers with specific use cases, you have the option to fully customize the desired format of an autonumber column. The format might consist of string constants, automatically incrementing numbers, formatted dates, or random alphanumeric sequences. For detailed information about how to define custom formats, see [AutoNumberFormat options<sup>9</sup>](#).

## Seeding a starting value

You can also set a *seed* value so you can start autonumbering at any value. The seed value of an autonumber column is the starting number that is used for the number portion of the format. For example, if you want an autonumber column to generate records such as Contoso-1000, Contoso-1001, Contoso-1002, and so on, then the desired seed value is 1000 because that is the value that your number sequence starts with. Autonumber columns have a default seed value of 1000, but you can set a custom seed value if you want.

## Create an alternate key

It is common to need a way to uniquely identify a record in a table. By default, Microsoft Dataverse tables have a GUID as their only unique column. This GUID is called the **Primary Key** and it consists of a long string of numbers and letters that are not useful to a regular user regarding meaning or significance.

Defining a new key for a table allows you to identify a record in a more meaningful way by using a column that is familiar to users. When you define a column as a key, Common Data Model makes sure that every entry in that key column is required and unique so you can use the key column to distinctively identify a specific record. This can be especially helpful if you are integrating your data with an external system that uses that ID or number to identify a record (and not the Dataverse GUID). It also improves the search and filtering on the particular column because alternate key fields are always indexed.

Finally, keys can be based on a single column (Order ID) or a combination of fields, such as Financial year and Order ID. If you set a key on a column and try to enter duplicate data, the record will fail to save.

Set up an alternate key for a table with the following steps:

1. Sign in to Power Apps and select the **Data** menu option in the left-hand column.
2. Select the table that you want to add a new key to.
3. Select **Keys** from the options above the list of fields.
4. Select **Add key** in the upper left of the screen.
5. Select one or more fields that will make up the new key.
6. Give the key a name.
7. Select the **Done** button.

---

<sup>9</sup> <https://docs.microsoft.com/en-us/dynamics365/customer-engagement/developer/create-auto-number-attributes#autonumberformat-options>

It will take a few minutes for Dataverse to create the new key and indexes. Then, you can start using it in your business solution.

**Tip:** If you have duplicated data in a column that is used by the key in multiple records, then the key will not be created. You can only create a key if the data in the column's existing record is unique across all records in the table.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which column type displays a list of options where more than one can be selected?

- Multiline Text
- Choice
- Choices
- Image

### Multiple choice

2. Which of the following statements is not true about alternate keys?

- Alternate keys make it easier for users to work with data in Microsoft Dataverse.
- Alternate keys improve database performance.
- The primary key of an table is a GUID and meaningless to users, so an alternate key can help identify the key.

### Multiple choice

3. How do you make a column that is required?

- Delete the column from the table.
- Create a new column.
- Edit the column and change the Required dropdown.
- Add a column to an table.

## Summary

In this module, you learned about:

- The columns in Microsoft Dataverse.
- Types of columns that are available in Dataverse.
- Adding a column to a table.
- The **Primary Name** column and what it's used for.
- Restrictions that are associated with columns in Dataverse.
- Creating an autonumbering column.

- Creating an alternate key.

# Create a relationship between entities in Dataverse

## Relate one or more tables - Introduction

To make an efficient and scalable solution for most of the solutions that you build, you will need to split up data into different containers (tables). Trying to store everything into a single container would likely be inefficient and difficult to work with and understand.

The following example helps illustrate this concept.

Imagine that you need to create a system to manage sales orders. You will need a master list of items that you sell along with the inventory on hand, cost of the item, and the selling price. You also need a master list of customers with their addresses and credit ratings. Finally, you will need to manage invoices of sales that you make so you will want a way to store invoice data. The invoice should include invoice information (such as date, invoice number, and salesperson), customer information including address and credit rating, and a line item for each item on the invoice. Line items should include a reference to the item that you sold and be able to provide the proper cost and price for each item and decrease the quantity on hand based upon the quantity that you sold in that line item.

Trying to create a single table to support the functionality that was previously described would be ill advised and inefficient. The correct way to approach this business scenario is to create the following four tables:

- Customers
- Products
- Invoices
- Line Items

Creating a table for each of these items and relating them to one another will allow you to build an efficient solution that can scale while maintaining high performance. Splitting the data into multiple tables also means that you will not have to store repetitive data or support huge rows with large amounts of blank data. Additionally, reporting will be much easier if you split the data into separate tables.

Tables that relate to one another have a relational connection. The technology that underlies Microsoft Dataverse is a relational database that is managed in the cloud by Microsoft. Relationships between tables exist in many forms, but the two most common are one-to-many and many-to-many, both of which are supported by Dataverse.

One-to-many relationships are also known as parent-child relationships. In the previous invoice example, the invoice table would be the parent and the line items would be a child table. An invoice can have zero, one, or many line items (child rows), but the line item will always be related to just one invoice (parent row). Typically, the child rows will not exist without a parent row.

A column that only allows unique values is used to identify the parent row. This unique column is called a key. The same value (the parent key) is stored in the related child rows. This column is called a foreign key when the child row is used to store the parent key value. Ingeniously, filtering is used to display child rows with a value in the foreign key that matches the key value in the parent row. This allows applications to display the child rows (line items in the previous example) that belong to a particular parent row (invoice in the previous example). This concept underlies many business software applications.

**Tip:** Splitting data into different tables makes for an efficient solution design that can scale, but knowing how to split up the data into tables can be difficult. Dataverse contains many of the tables that most

organizations will need. Using standard tables and extending them will ensure that you are building solutions around a proven, scalable way of storing the data that is used by your solutions.

## Relationship types that are available in Microsoft Dataverse

In unit one of this module, you learned that Microsoft Dataverse supports two kinds of relationships: one-to-many and many-to-many.

### One-to-many relationship

The one-to-many relationship (which is also called 1:N or parent-child) includes a primary (parent) table that can be associated to many other related (child) table rows by using a lookup column on the related (child) table. The primary row is the parent and the related table rows are called child rows.

When viewing a primary table row in a 1:N relationship, you can view a list of the related child table rows by filtering all child rows that contain the same key value as the key value in the primary row.

### Many-to-many relationship

The many-to-many relationship (which is also called N:N) includes a special third table called a relationship table, sometimes called an intersect table, which maps how the many rows of one table can be related to the many rows of another table.

When viewing rows of either table in an N:N relationship, you can view a list of any rows of the other table that are related to it.

One-to-many relationships are simplistic and are universal. An example of a one-to-many relationship includes an invoice (the one) with line items (the many), as previously discussed. Another example is a classroom (the one) and students in the classroom (the many).

Many-to-many relationships are a bit more complex. Tables that have this type of relationship require a special table in between them to map how they are related to one another. Examples include authors and books. It is possible that a book could have many authors and an author could write many books. A new intersection table between the book table and the author table is needed to map (resolve) the books and authors with an entry in the intersection table that contains the name of the book and author name in each row. You can create a report by using this intersection table to show all the books that are written by an author, even if that writer was one of many or the only author on the book.

## Create a one-to-many relationship between tables

This unit shows how to implement relationships in Microsoft Dataverse with the following steps.

**Tip:** One-to-many or many-to-one relationships are the same if you are looking at the relationship from one side or the other.

1. Sign in to the Power Apps Portal.
2. Select the environment that you want to work within by using the drop-down list in the top menu bar.
3. Select **Data** on the left-hand side of the page.
4. Select **Tables**, and a list of tables will be shown.
5. Select one of the tables in the relationships that you want to create.
6. Select the **Relationship** tab.

7. Select either the **One-to-Many** or **Many-to-One** relationship option.
  8. Depending on which option that you selected, choose either the related table or the parent table for the relationship that you want to create between the two tables.
- Tip:** With either choice, a lookup column will be created on the primary table.
9. Fill out additional information as needed about the relationship.

Column	Description
Lookup column display name	The localizable text for the lookup column that will be created on the related table. This can be edited later.
Lookup column name	The name for the lookup column that will be created on the related table.
Relationship name	The name for the relationship that will be created.
Lookup column description	The description for the lookup column. In model-driven apps, this will appear as a tooltip when people hover their mouse over the column. This can be edited later.

10. Save the relationship.

11. Save the table.

Now, you can use this relationship and the lookup in your business solution. A lookup column will be available to use that shows all the many (child) rows.

**Tip:** There are certain instances where you must use the Solution Explorer to create a many-to-one or one-to-many relationship. You can get more information about these special situations in the Summary unit of this module.

## Create a many-to-many relationship between tables

One-to-many table relationships establish a hierarchy between rows. With many-to-many (N:N) relationships, there is no explicit hierarchy and no lookup columns or behaviors to configure. Rows that are created by using many-to-many relationships can be considered peers and the relationship is reciprocal.

With many-to-many relationships, a relationship (or intersect) table stores the data that associates the tables. This table has a one-to-many table relationship with both of the related tables and only stores the necessary values to define the relationship. You cannot add custom columns to a relationship table and it is never visible in the user interface.

Creating a many-to-many relationship requires choosing the two tables that you want to participate in the relationship. These are the same options that are used for the primary table in one-to-many table relationships.

**Tip:** Not all tables can be used with many-to-many relationships. If the table is not listed in the designer, you cannot create a new many-to-many relationship with this table.

If you need to create a many-to-many relationship, follow these steps:

1. Sign in to Power Apps.
2. Select **Data > Tables** and select one of the tables in the relationships that you want to create.
3. Select the **Relationship** tab on the menu.

4. Select the **Many-to-Many** relationship option.
5. Depending on which option you selected, choose either the related table or the primary table for the relationship that you want to create between the two tables.
6. On the Many-to-Many panel, choose the table that you want to be related to the current table.
7. Select **More Options** to view the **Relationship Name** and **Relationship table name** columns.
8. Select **OK** to save the new many-to-many relationship.

Now, you can use the many-to-many relationship in your apps. To read an informative post on how to use a many-to-many relationship in an app in Power Apps, follow the link in the Summary section of this module.

**Tip:** You cannot edit the tables in a many-to-many relationship after it has been created; you can only delete it.

## Edit or delete relationships

With the following steps, you can edit or delete any relationships that you create in Microsoft Dataverse. The default table relationships cannot be edited or deleted.

### Edit a one-to-many or many-to-one relationship

To edit a one-to-many relationship, use the following procedure:

1. Sign in to Power Apps.
2. Select **Data > Tables** and select one of the tables in the relationships that you want to create.
3. Select the **Relationship** tab on the menu.
4. Open the relationship that you want to edit.

**Tip:** You can edit the Lookup column display name and Lookup column description as needed.

5. Select **Save**.

### Edit a many-to-many relationship

You cannot edit a many-to-many relationship in the Power Apps portal. If you want to edit a many-to-many relationship, you must use the **Solution Explorer**. A link to allow editing in the **Solution Explorer** is included within the Summary section of this module.

### Delete a relationship

If you want to delete a relationship, follow these steps:

1. Sign in to Power Apps.
2. Select **Data > Tables** and select one of the tables in the relationships that you want to create.
3. Select the **Relationship** tab on the menu.
4. Select the relationship that you want to delete.
5. Select **Delete Relationship** on the menu.

# Check your knowledge

**Answer the following questions to see what you've learned.**

## Multiple choice

1. *Microsoft Dataverse supports all of the following relationships except which one?*

- Many-to-many
- One-to-one
- One-to-many
- Many-to-one

## Multiple choice

2. *Which of the following statements about changing tables is true?*

- You can change the tables in an existing many-to-many relationship.
- You cannot change the tables in a one-to-many relationship.
- You cannot change the tables in a many-to-many relationship.
- You cannot change the tables in a many-to-one relationship.

## Multiple choice

3. *Being able to relate two entities (relational design) is important for all of the following except which one?*

- More efficient storage
- Better data accuracy
- Better Reporting
- Easier to design

## Summary

In this module, you learned how to use relationships to build powerful solutions, in addition to the following:

- Reasons why relationships are created between tables and their importance to proper business solution design
- The types of relationships that are available between tables in Microsoft Dataverse
- How to build the following relationships between tables:
  - One-to-many
  - Many-to-many
- How to manage, edit, or delete relationships

The following links and topics were referenced within this module.

There is guidance available on when to use a solution to create a many-to-one or one-to-many relationship. You can get more information about these special situations at the following links:

**Create one-to-many table relationships using solution explorer<sup>10</sup>**

You can get more information at the following link about using a one-to-many and many-to-many relationship within a Power Apps app.

**Relate rows in Many-to-Many relationships<sup>11</sup>**

You cannot edit the tables in a many-to-many relationship, but you can edit certain properties in the **Solution Explorer**. Select the following link to see available editing options.

**Create Many-to-Many table relationships in Dataverse using solution explorer<sup>12</sup>**

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<sup>10</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/create-edit-1n-relationships-solution-explorer>

<sup>11</sup> <https://powerapps.microsoft.com/blog/relate-records-in-many-to-many-relationships/>

<sup>12</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/create-edit-nn-relationships-solution-explorer>

# Working with choices in Dataverse

## Define choice column

Choices provide an exact list of values that people can choose. Choices help streamline new record creation and standardize data entry, and they are best suited for a small set of standard short terms rather than a long list of complex entries. You should not use choices when the field usually contains unique entries that are not easily standardized.

For example, consider the use of choices on a sales tracking page. A choice is well-suited to capture the stage of a sales lead if you have a short list of possible sales stages. On the other hand, an option set is not a good choice when you are entering a street name because, likely, there could be hundreds or thousands of street name choices in nearly any city.

**Tip:** Make sure that you monitor the quality of data when using a choice. As a best practice, check the data that you collect with a choice to ensure that users are not disproportionately using the default value rather than selecting the proper option within the choice. You might find that users accept the default so that they can enter data in the page without much thought. Determine what incentive users have to enter high quality data rather than the first entry or default in a choice, and avoid terms like "other" because options like these do not provide meaningful data.

Choices are managed as a separate list and then associated with a drop-down field. When used properly and closely managed, choices help ensure consistent data entry and improves the quality and usefulness of the data that you collect. Choices can help create meaningful reports and identify trends and clusters of data. Finally, you can make fields of type choices required when they are created or edited.

## Standard choices column

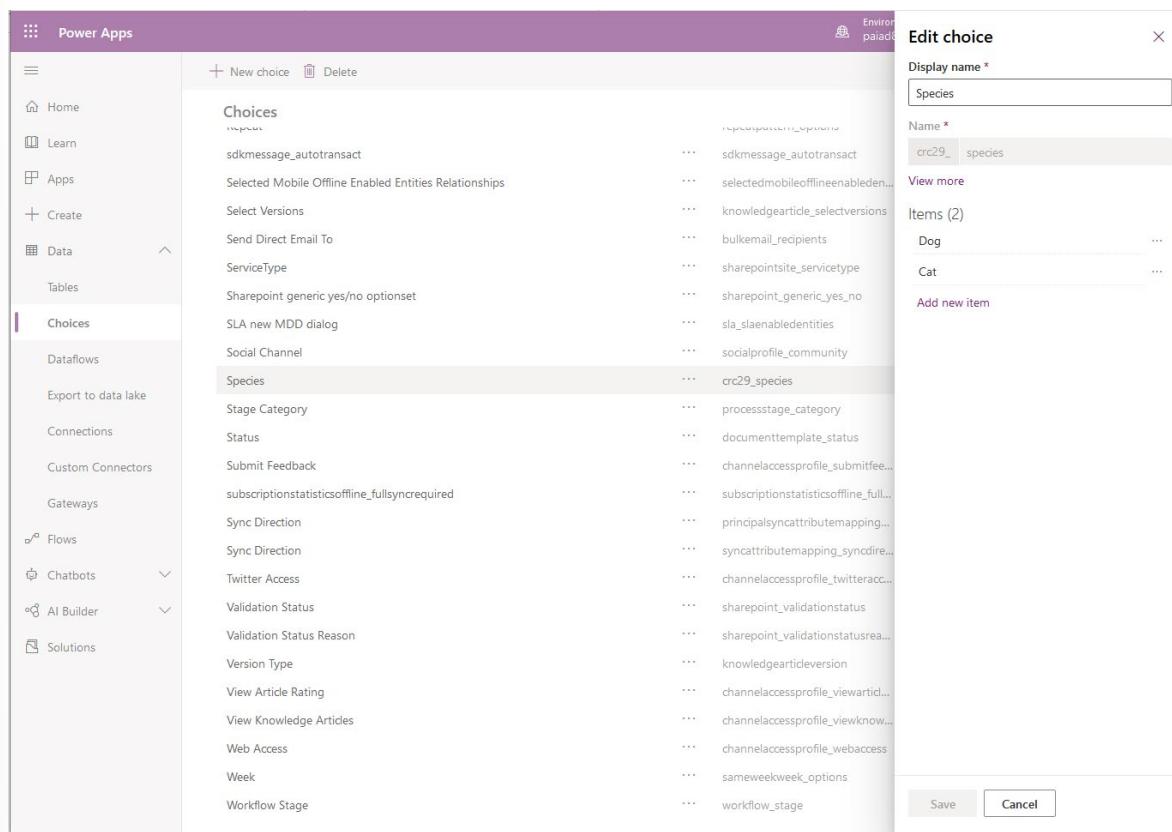
Microsoft Dataverse includes over one hundred standard choices that are created each time that you instantiate a new instance of a Dataverse database. You can add to a standard choice, but you cannot delete an entry from a standard choice.

Explore and learn what standard choices are available in Dataverse by following these steps:

1. Sign in to the Power Apps portal.
2. On the left pane, expand **Data** and select **Choices**.
3. Scroll through the list of over 100 standard choices. Select one of the standard choices and examine the default list of entries for that choice.

By default, choices are created as global choices, allowing them to be reused across multiple tables. When creating a new choice, you can choose to make it **Local** under the **View more** option. This option is only available when you are creating a choice while adding a field, and not through the choice list.

Local choices can only be used by the table and column that they are created against and cannot be reused on other tables. This approach is only recommended for advanced users that have a specific need for a local choice.



## Lab - Create a new choice or modify an existing choice

### Create a new custom choice

You might want to make a new custom choice to use across many entities in Microsoft Dataverse. You can create a choice in two ways: by creating a choice when you define a new field within a table, or by creating a choice by using the choice functionality within the Power Apps portal.

To create a new custom choice by using the choice functionality in the Power Apps Portal, follow these steps:

1. Sign into Power Apps(<https://make.powerapps.com/>).
2. On the left pane, expand **Data** and select **Choices**.
3. Select **New choice** on the menu at the top of the list.
4. Enter a **PC Type** for the **Display name**.
5. Add the following items to the choice:

**Laptop**

**Desktop**

**Tablet**

**Server**

**Note:** You can assign a unique numeric value by selecting the ellipsis (...) beside the choice entry.

6. Select the **Save** button.



The choice **PC Type** is now available to use with any field in any entity within the environment. To use the new choice, follow the next steps. If you have not created the custom table PC Manufacturers earlier in this learning path, complete the steps to **create a new custom table**<sup>13</sup> and then complete these exercises.

**Tip:** It might take a few minutes for the new choice to appear in the list of available choices.

1. Sign into Power Apps(<https://make.powerapps.com/>) again.
2. Select the environment where you added the new custom entity PC Manufacturers.
3. Select **Data** on the panel on the left-hand side of the Power Apps Portal to expand the available choices.
4. Select **Tables** under the **Data** option on the left-hand side of the portal.
5. Select the new custom table **PC Manufacturers** in the list of tables. This will open the list of columns in the table.
6. Select the **Add column** button on the menu above the list of columns.
7. Enter **Type of PC** as the name of the new column.
8. Select **Choice** for the data type.
9. Select **PC Type** from the list of choices, as shown in the following figure.
10. Select the **Save** button.

<sup>13</sup> <https://docs.microsoft.com/en-us/learn/modules/create-manage-entities/5-exercise>

You can also define a choice as you add a new field, without creating a choice in the portal. The choice that you add while defining a field can also be used with any field of type **Choice** in any table within the environment.

## Define a choice when adding new columns

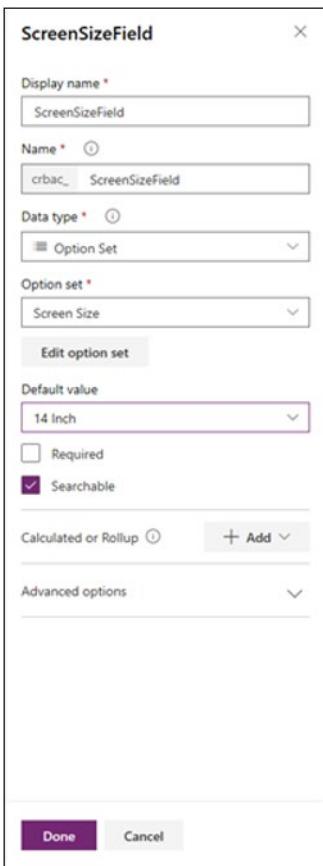
If you would rather define a choice as you add new columns to a table, follow these steps:

1. Sign into Power Apps(<https://make.powerapps.com/>).
2. Select the environment where you added the new custom entity PC Manufacturers.
3. Select **Data** on the panel on the left-hand side of the Power Apps Portal to expand the available choices.
4. Select **Tables** under the **Data** option on the left-hand side of the portal.
5. Select the new custom entity **PC Manufacturers** in the list of tables. This will open the list of columns in the entity.
6. Select the **Add column** button on the menu above the list of columns.
7. Enter **Screen Size Field** in the **Display name** field.
8. Enter **choice** in the **Data type** field and select **New**.
9. Type **Screen Size** in the **Display name** field.
10. Type **14 Inch, 17 Inch, 21 Inch, and None** in the items and then select the **Save** button.



11. Type **14 inch** in the **default value** field and select the **Save** button.

12. Select the **Save table** button.



If you need to modify an existing choice, follow these steps:

1. Sign into Power Apps(<https://make.powerapps.com/>).
2. On the left pane, expand **Data** and select **Choices**.
3. Select the **Choice** that you want to modify.
  1. Add a new entry by selecting the **Add new item** hyperlink.
  2. You can delete an item by selecting the ellipsis (...).
  3. You can edit an item by selecting the ellipsis (...) next to the entry and then selecting the **View more** option.
4. Select the **Done** button to save changes.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. *When can you create a choice?*

- When you edit an existing column
- When you define a new column
- When you delete an existing column

## Multiple choice

2. *Which of the following can choices contain?*

- Numbers, Images, or Text
- Numbers or Text
- Text only
- Numbers only

## Multiple choice

3. *What type of choice can only be used by the table and column that they are created against?*

- Standard choices
- General options sets
- Local choices
- Special choices

## Summary

In this module, you learned:

- What choices are and what types of choices are available.
- What standard choices are in Microsoft Dataverse.
- How to create a new choice or modify an existing choice.

# Get started with security roles in Dataverse

## Introduction to environment roles

Each environment has zero or one instance of a Microsoft Dataverse database, and your organization can have many environments that are available to many different groups of users at a time. It is common practice to set up an environment so you can limit who can access the data, apps, and workflows within it.

Classic software lifecycle management provides a good use case of why you might want to set up different environments in Dataverse. Consider the following example. It is common to segment environments for development, test, and production. Dataverse allows you to set up a development environment and limit access so only developers and a few managers or test users have permission to access the data and apps in that development environment. You can then set up a test environment and set up permissions so that a few test users and developers have access to it and the data within the instance of Dataverse within that environment. Finally, you can set up production environment permissions so that a wide audience of users has access to the production environment and the data in the instance of a Dataverse database, Power Apps, and Power Automates within that production environment.

**Important:** *Access to an environment does not give a user access to any data, apps, or workflow within that environment. Users must be given explicit access to data by an administrator in Dataverse while the maker who creates an app, connector, or workflow must grant access to their work products.*

## Understand environment roles

You can manage environment security by using roles and then adding users to the environment and assigning roles to users. A role has certain permissions that are associated with it, and you can associate a user with one or many roles. Environments have two built-in roles that provide access to permissions within an environment, and you'll assign users to one of these two roles when considering what permissions you want to give to a user in an environment.

The built-in environment roles are:

- System Administrator
- Environment Maker

This unit examines each role to help you understand how it works within an environment.

**Important:** *A user is automatically associated with the Environment Maker role when they are added to an environment.*

## System Administrator role

The System Administrator role can perform all administrative actions on an environment, including the following tasks:

- Add or remove a user or group from either the Environment Admin or Environment Maker role.
- Provision a Microsoft Dataverse database for the environment.
- View and manage all resources that are created within an environment.
- Set data loss prevention policies.

## Environment Maker role

The Environment Maker role can create resources within an environment such as apps, connections, custom connectors, gateways, apps that use Power Apps, and flows that use Power Automate. The following applies to members of the Environment Maker role:

- Environment Makers can distribute the apps that they build in an environment to other users within an organization by sharing the app with individual users, security groups, or to all users in the organization.
- Users or groups that are assigned to these environment roles are not automatically given access to the environment's database (if it exists) and must be given access separately by a Database owner.
- Whenever a new user signs up for Power Apps, they are automatically added to the Maker role of the default environment.
- When you add a user to an environment, they are assigned two roles by default.
  - Dataverse User (this role is created when you instantiate an instance of a Dataverse database and all users in the environment are assigned this role)
  - Environment Maker

Users or security groups can be assigned to either of these two roles by a System Administrator from the Power Apps Administration Center.

## Adding or disabling an environment user

You can add users to any environment that you create in Microsoft Dataverse.

The following steps will help you add users from your tenant to an environment.

1. Sign in to Power Apps.
2. Select the gear icon in the ribbon and select the **Admin Center** option.
3. Select an environment.
4. Find the **Access** section on the right-hand side, and select **See all** under **Users**.
5. Select the **Add Users** button in the ribbon.
6. Add one or more users by entering their name or email address.
7. After you have selected the users you want to add, select **Add**.

If you want to disable a user within an environment, remove a license from the user or remove the user from the security group that's associated with an environment. Removing a user from the security group doesn't remove the user's license. If you want to make the license available to another user, you have to remove the license from the user account that was disabled.

Removing a license, disabling a user, and removing a user from a security group is done with the **Microsoft 365 admin center**<sup>14</sup>. For more information, see **Disable a user account in an environment**<sup>15</sup>.

## Understand security concepts in Dataverse

One of the key features of Dataverse is its rich security model that can adapt to many business usage scenarios. This security model is only in play when there is a Dataverse database in the environment. As

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<sup>14</sup> <https://admin.microsoft.com/?azureportal=true>

<sup>15</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-users-assign-online-security-roles#disable-a-user-account-in-an-environment>

an administrator, you likely won't be building the entire security model yourself, but will often be involved in the process of managing users and making sure they have the proper configuration and troubleshooting security access related issues.

## Role-based security

Dataverse uses role-based security to group together a collection of privileges. These security roles can be associated directly to users, or they can be associated with Dataverse teams and business units. Users can then be associated with the team, and therefore all users associated with the team will benefit from the role. A key concept of Dataverse security to understand is that privileges are accumulating and the greatest access privileges are applied to a user with multiple security roles. For example, if a user has two security roles, one with delete privileges but without write privileges, and the other with write privileges but without delete privileges, the user will be able to both read and write in the environment.

## Business units

Business Units provide security and structure for grouping users and are often used to mimic an organization's departmental structure. Every user assigned to a Dataverse environment will belong to a business unit. The first business unit created for an organization is called the root business unit. Business units can be deleted, however, the root business unit can't be deleted. A hierarchy of additional child business units can be created as needed. A business unit only has one parent business unit but may have multiple child business units.

- A parent business unit is any business unit with one or more business units that report to it in the hierarchy.
- A child business unit is a business unit that is immediately under another business unit in the business hierarchy of an organization.

**Note:** A user's security roles are assigned within their business unit. If a user is moved to a different business unit, their security roles must be re-assigned. Each user is a member of only one business unit, but a team can have user members from multiple business units. Implementing column-level security will be described later in this module.

## Entity/record ownership

Dataverse supports two types of record ownership. Organization owned, and User or Team owned. This is a choice that happens at the time the table is created and can't be changed. For security purposes, records that are organization owned, the only access level choices is either the user can do the operation or can't. For user and team owned records, the access level choices for most privileges are tiered Organization, Business Unit, Business Unit and Child Business Unit or only the user's own records.

## Teams

Teams are another important security building block. Teams are owned by a Business Unit. Every Business Unit has one default team that is automatically created when the Business Unit is created. The default team members are managed by Dataverse and always contain all users associated with that Business Unit. You can't manually add or remove members from the default team, they're dynamically adjusted by the system as new users are associated/disassociated with business units. There are three types of teams, owning teams, access teams, and Azure AD group teams.

## Column-level security to control access

Column-level permissions are granted at the table level, but you may have certain columns associated with a table that contain data that is more sensitive than the other columns. For these situations, you use column-level security to control access to specific columns.

The scope of column-level security is organization-wide and applies to all data access requests including the following:

- Data access requests from within a client application, such as web browser, mobile client, or Microsoft Dynamics 365 for Outlook.
- Web service calls using the Microsoft Dataverse web services (for use in plug-ins, custom workflow activities, and custom code)
- Reporting (using Filtered Views)

Column-level security is available for the default columns on most out-of-box tables, custom columns, and custom columns on custom tables. Column-level security is managed by the security profiles.

To implement column-level security, a system administrator performs the following tasks.

1. Enable column security on one or more columns for a given table.
2. Associate one or more existing security profile, or create one or more new security profiles to grant the appropriate access to specific users or teams.

A security profile determines the following:

- Permissions to the secure columns
- Users and Teams

A security profile can be configured to grant user or team members the following permissions at the column level:

- Read. Read-only access to the column's data.
- Create. Users or teams in this profile can add data to this column when creating a record.
- Update. Users or teams in this profile can update the column's data after it has been created.

A combination of these three permissions can be configured to determine the user privileges for a specific data column.

**Important:** Unless one or more security profiles are assigned to a security enabled field, only users with the system administrator security role will have access to the field.

## Example for restricting the credit limit column for the account table

Background: Your company's policy is that only account managers and system administrators should be able to view a customer's credit limit.

To restrict access, implement column level security by completing the below tasks:

### Enable column security

1. Sign in to Power Apps as an administrator.
2. Select an environment.

3. On the left pane, select **Data**.
4. Select **Tables**.
5. On the middle pane, select the **Account Table**.
6. Under Display name, select the **Credit Limit** column.
7. On the right pane, select **Advanced options**.
8. Select **Enable column security**.
9. Select **Done**.
10. Select **Save Table**

## Configure the security profile

1. Sign in to Power Apps as an administrator.
2. Select an environment.
3. On the top right, select the **gear** icon and select **Advanced Setting**.
4. From the top menu, select Settings, select **Security**.
5. Select **Field Security Profiles**.
6. Select **New**, enter a name such as Account Manager, you can also add a description if you like.
7. Select **Save**.
8. On the left, under Members, select **Users** (you can give access to either a User(s) or a team).
9. Select **Add**, select the user(s) that you want to grant read access to the credit limit column and **Select** then **Add**.
10. On the left, under Common, select **Field Permissions**.
11. Select **credit limit**, on the top select **Edit**.
12. From the Edit Field Security screen, Under Allow Read, select **Yes**, select **OK**.
13. Select **Save and Close**.

Any users not defined in the previously created field security profiles won't have access to the credit limit column in the account table or views. The field value displays a Lock icon with \*\*\*\*\*, indicating the field is secured.

## Hierarchy security to control access

The hierarchy security model extends Dataverse security by allowing managers to access the records of their subordinates or do work on their behalf. It can be used with all other existing security models.

Two security models can be used for hierarchies, the Manager hierarchy and the Position hierarchy. With the Manager hierarchy, a manager must be within the same business unit as the subordinate, or in the parent business unit of the subordinate's business unit, to have access to the subordinate's data. The Position hierarchy allows data access across business units.

## Manager hierarchy

The Manager hierarchy security model is based on the management chain or direct reporting structure, where the manager's and the subordinate's relationship is established by using the Manager field on the

user table. With this security model, the managers are able to access the data that their subordinates have access to. They are able to perform work on behalf of their direct reports or access information that needs approval. The manager can have the full access to the subordinate's data for the direct reports. For non-direct reports, a manager can only have the read-only access to their data.

## Position hierarchy

With the position hierarchy security, various job positions in the organization can be defined and arranged in the hierarchy using the Position table. You can then add users to any given position using the Position lookup column on the user record. Users at the higher positions in the hierarchy have access to the data of the users at the lower positions, in the direct ancestor path. Similar to manager hierarchy, the parent positions have full access to the child positions' data but the positions higher than a direct parent have read-only access.

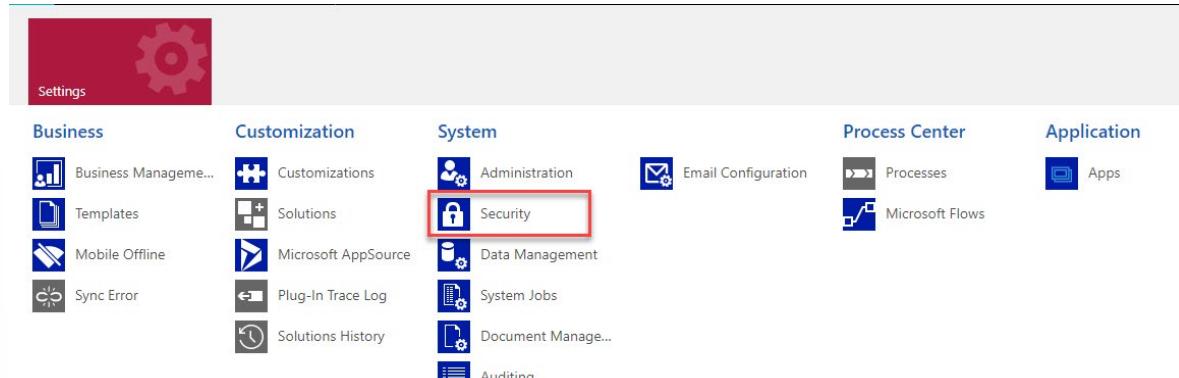
**Note:** In both hierarchy models, a user higher in the hierarchy must have at least the user level Read privilege on a table, to see the subordinates' data. For example, if a manager doesn't have the Read access to the Case entity, the manager won't be able to see the cases that their subordinates have access to.

## Configure hierarchy security system settings

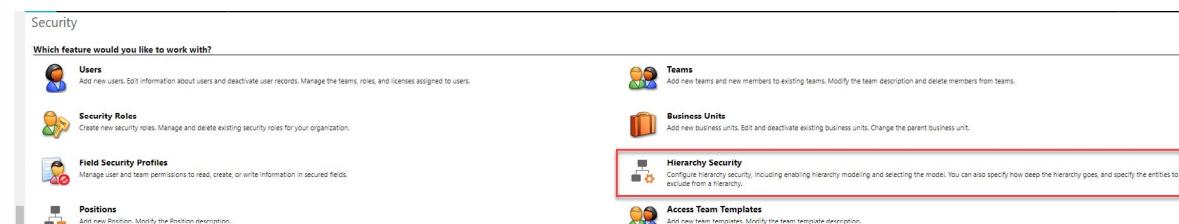
Make sure you have the System Administrator or System Customizer security role or equivalent permissions to update the setting.

The hierarchy security is disabled by default. To enable:

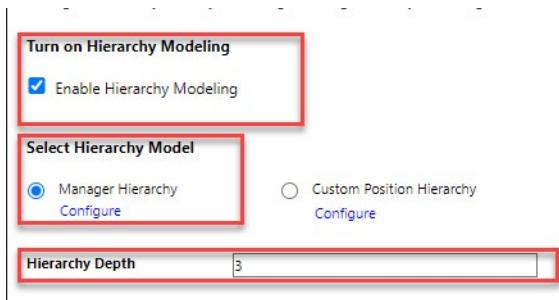
1. Sign in to Power Apps as an administrator.
2. Select an environment.
3. On the top right, select the **gear** icon and select **Advanced Setting**.



4. From the top menu, select Settings, select **Security**.



5. Select **Hierarchy security**.



6. Select Enable Hierarchy Modeling and you will see the two options enabled:  
 Manager Hierarchy Model is selected and the hierarchy depth is set to 3.

## Set up manager and position hierarchies

### To create a manager hierarchy:

With Enable Hierarchy Modeling turned on and Manager Hierarchy Enabled.

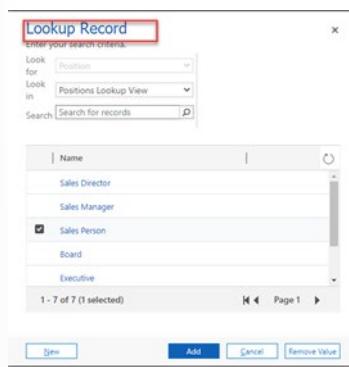
1. Under Manager Hierarchy, select **Configure**.
2. Assign each user a manager and position (Optional).

In the following example, Adele Vance reports to Alex Wilber in the Manager hierarchy and also has the Sales Person position in the Position hierarchy:

Enabled Users					Search this view
	Full Name ↑ ↓	Business Unit	Title	Position	Main Phone
...	Allen Deyoung	SalesDemo	Sales Director	Sales Director	...
...	Alex Wilber	SalesDemo	Sales Manager	Sales Manager	...
...	Adele Vance	SalesDemo	Sales Person	Sales Person	...

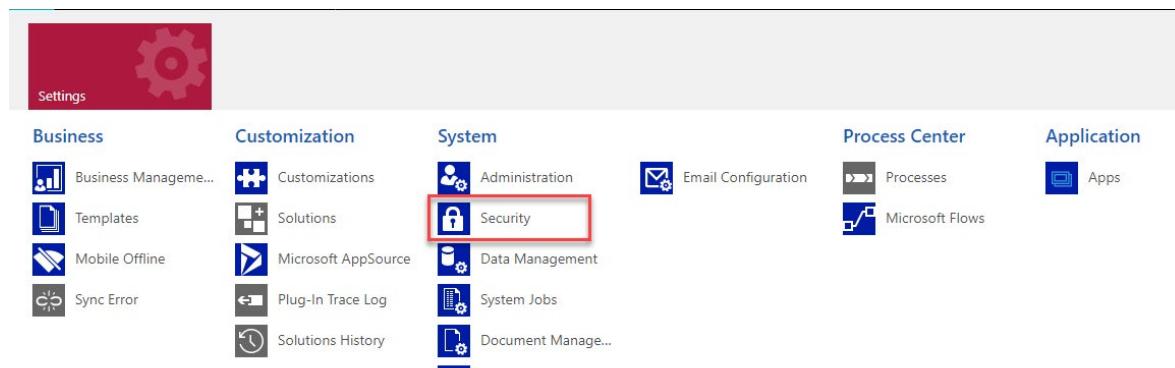
To add a user to a particular position in the Position hierarchy, use the lookup field called Position on the user record's form, as show below:

Organization Information	
Business Unit *	SalesDemo
Manager	Alex Wilber
Position	<input type="text" value="Sales Person"/> Sales Person
Queue Information	
Default Queue	<trainings #>
1 result	

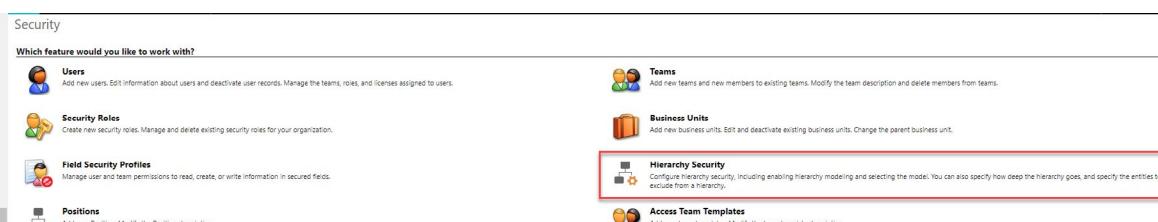


## To create a position hierarchy:

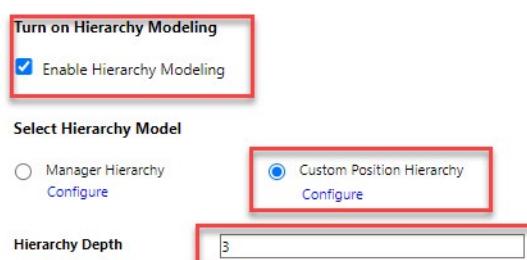
1. Sign in to Power Apps as an administrator.
2. Select an environment.
3. On the top right, select the **gear** icon and select **Advanced Setting**.



4. From the top menu, select Settings, select **Security**.

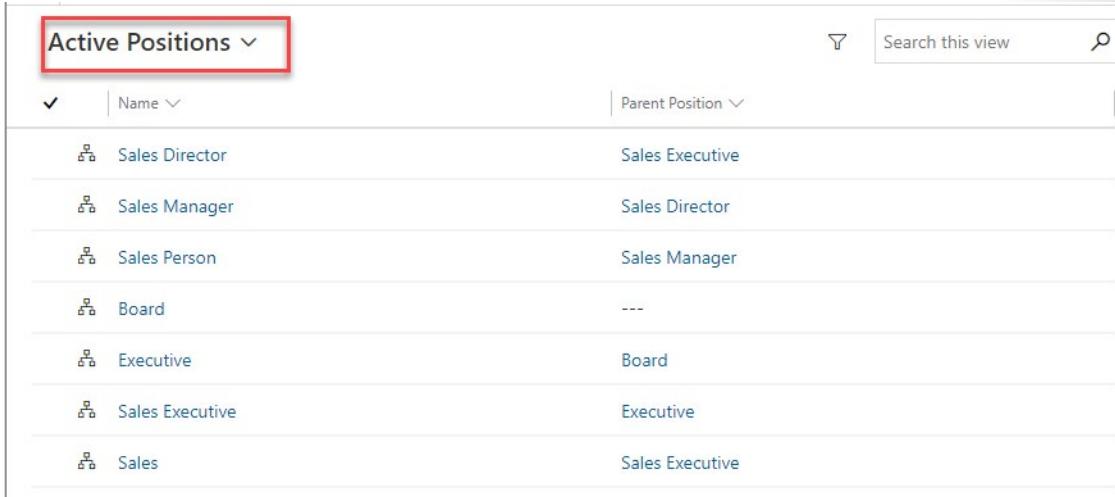


5. Select **Hierarchy security**.



6. Select Enable Hierarchy Modeling and you will see the two options enabled:
7. For positional hierarchy, set to Custom Position Hierarchy.

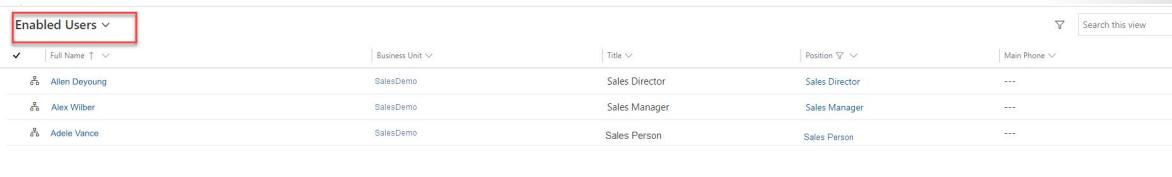
8. Under Custom Position Hierarchy, select **Configure**.
9. For each position, provide the name of the position, the parent of the position, and the description. Add users to this position by using the lookup field called Users in this position. Below is the example of Position hierarchy with the active positions.



Active Positions		Parent Position	Search this view
	Name		
↳	Sales Director	Sales Executive	
↳	Sales Manager	Sales Director	
↳	Sales Person	Sales Manager	
↳	Board	---	
↳	Executive	Board	
↳	Sales Executive	Executive	
↳	Sales	Sales Executive	

10. Ensure each user is set up with the correct positions.

The example of the enabled users with their corresponding positions is shown below:



Enabled Users					Search this view
	Full Name	Business Unit	Title	Position	Main Phone
↳	Allen Deyoung	SalesDemo	Sales Director	Sales Director	...
↳	Alex Wilber	SalesDemo	Sales Manager	Sales Manager	...
↳	Adele Vance	SalesDemo	Sales Person	Sales Person	...

## Understand user security roles and security role defaults

Roles are groups of permissions that you can assign to a user to grant them access and various capabilities and functionality like read, delete, or edit of records in an entity within an environment. Roles are granular and can be assigned to one or many entities in an environment. Roles can also control certain actions like the ability to create a custom entity or option sets. Additionally, users are associated with one or many roles, and associating a user with a role gives them access to data and functionality that is specified within that role.

User security roles are either:

- Standard and created with every instance of Microsoft Dataverse.
- Custom and created by an administrator.

This unit examines each type of security role.

## Default user security roles

When you create a new instance of Dataverse in an environment, a database is created with standard entities and several default security roles are created. The following predefined roles are available every

time you create a Dataverse environment by using the Power Apps portal. Unless otherwise noted, all the privileges have global scope.

Dataverse includes several default roles with different access levels to standard entities and actions. The default standard roles are listed in the following table.

Security role	Database privileges*	Description
Environment Admin	Create, Read, Write, Delete, Customizations, Security Roles	The Environment Admin role can perform all administrative actions on an environment, including the following: <ul style="list-style-type: none"><li>● Add or remove a user from either the Environment Admin or Environment Maker role.</li><li>● Provision a Dataverse database for the environment. After a database is provisioned, the System Customizer role should also be assigned to an Environment Admin to give them access to the environment's data.</li><li>● View and manage all resources created within an environment.</li><li>● Set data loss prevention policies.</li></ul>
Environment Maker	Customizations	Can create new resources associated with an environment, including apps, connections, custom APIs, gateways, and flows using Microsoft Power Automate. However, this role doesn't have any privileges to access data within an environment. More information: <a href="https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/">Environments overview</a> ( <a href="https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/">https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/</a> )

System Administrator	Create, Read, Write, Delete, Customizations, Security Roles	Has full permission to customize or administer the environment, including creating, modifying, and assigning security roles. Can view all data in the environment. More information: Privileges required for customization ( <a href="https://docs.microsoft.com/en-us/dynamics365/customize/privileges-required-customization/index">https://docs.microsoft.com/en-us/dynamics365/customize/privileges-required-customization/index</a> )
System Customizer	Create (self), Read (self), Write (self), Delete (self), Customizations	Has full permission to customize the environment. However, users with this role can only view records for environment entities that they create. More information: Privileges required for customization ( <a href="https://docs.microsoft.com/en-us/dynamics365/customize/privileges-required-customization/index">https://docs.microsoft.com/en-us/dynamics365/customize/privileges-required-customization/index</a> )
Basic User	Read (self), Create (self), Write (self), Delete (self)	Can run an app within the environment and perform common tasks for the records that they own. This only applies to non-custom entities.
Delegate	Act on behalf of another user	Allows code to <i>impersonate</i> , or run as another user. Typically used with another security role to allow access to records. More information: <b>Impersonate another user</b> ( <a href="https://docs.microsoft.com/en-us/powerapps/developer/common-data-service/impersonate-another-user/">https://docs.microsoft.com/en-us/powerapps/developer/common-data-service/impersonate-another-user/</a> )
Support User	Read Customizations, Read Business Management settings	Has full Read permission to customization and business management settings to allow Support staff to troubleshoot environment configuration issues. Does not have access to core records.

\*The scope of these privileges is global, unless specified otherwise.

**Note:**

- Environment Maker and Environment Admin are the only predefined roles for environments that have no Dataverse database.
- The Environment Maker role can create resources within an environment, including apps, connections, custom connectors, gateways, and flows using Power Automate. Environment makers can also

distribute the apps they build in an environment to other users in your organization. They can share the app with individual users, security groups, or all users in the organization. More information:

**Share an app in Power Apps<sup>16</sup>**

- For users who make apps that connect to the database and need to create or update entities and security roles, you need to assign the System Customizer role in addition to the Environment Maker role. This is necessary because the Environment Maker role doesn't have privileges on the environment's data.
- If the environment has a Dataverse database, a user must be assigned the System Administrator role instead of the Environment Admin role for full admin privileges, as described in the preceding table.

**Tip:** Add the System Customizer role to a user if you want them to be able to create new entities.

When you add a user to an environment in Dataverse, the user is automatically assigned to the following:

- Security user roles - Basic User
- Environment roles - Environment Maker

## Create a custom role

Microsoft Dataverse has many standard default roles, but there might be times when you want to define a custom security role. Dataverse supports the following eight different record-level privileges that can be used to define how a user interacts with data for one or more tables for use in building a custom role. The available record-level privileges for custom roles include:

**Create** - Required to make a new record. The records that can be created depends on the access level of the permission that is defined in your security role.

**Read** - Required to open a record to view the contents. The records that can be read depends on the access level of the permission that is defined in your security role.

**Write** - Required to make changes to a record. The records that can be changed depends on the access level of the permission that is defined in your security role.

**Delete** - Required to permanently remove a record. The records that can be deleted depends on the access level of the permission that is defined in your security role.

**Append** - Required to associate a record with the current record. For example, if a user has Append rights on an opportunity, the user can add a note to an opportunity. The records that can be appended depends on the access level of the permission that is defined in your security role.

**Append To** - Required to associate the current record with another record. For example, a note can be attached to an opportunity if the user has Append To rights on the note. The records that can be appended to depends on the access level of the permission that is defined in your security role.

**Assign** - Required to give ownership of a record to another user. The records that can be assigned depends on the access level of the permission that is defined in your security role.

**Share** - Required to give another user access to a record while keeping your own access. The records that can be shared depends on the access level of the permission that is defined in your security role.

These record-level privileges can be grouped as needed and associated with a custom role. That custom role can then be applied to one or many tables as needed.

**Tip:** Roles can be copied so you can quickly create similar roles that might be slightly different.

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<sup>16</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/share-app/>

## Create a custom security role and assign to tables and users

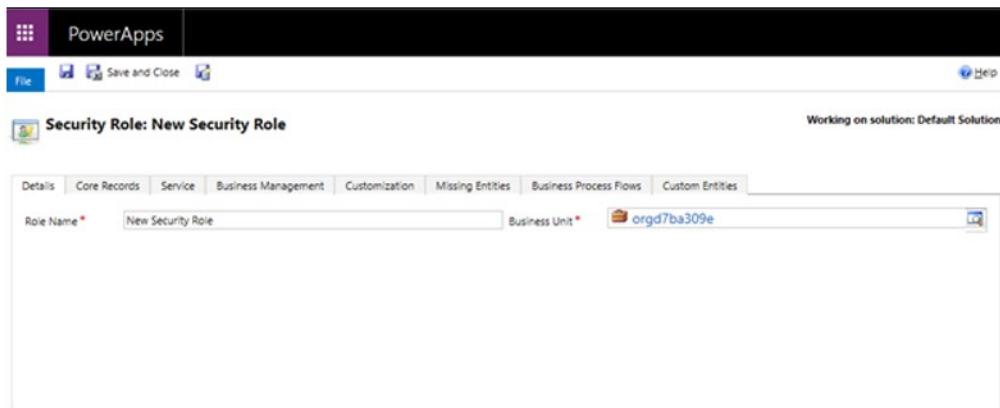
This lab will show you how to create a new role and associate that role with a custom table. Then, you can associate users to the new role so they can access the data in the custom tables as needed.

To grant access, you will need to do the following:

- Create a new user security role or amend an existing user security role to include settings for the custom table.
- Assign users to the security role.

To get started, use the following steps to create a new security role.

1. Sign in to Power Apps as an administrator.
2. Select the gear icon in the menu and select **Admin Center**.
3. Select the environment name of the environment you would like to administer.
4. Select **See all** under Security Roles in the **Access** section on the right.
5. Select **New role** in the menu bar, which will open the security role designer.



6. Enter a name for your security role in the **Role Name** field.
7. Locate the tables that your app uses by selecting each tab in the security role designer. If your tables are custom, they will be under the **Custom Tables** tab.
8. When you have located your tables, select the privileges that you want to grant your users, such as Read, Write, Delete, and so on. Select the scope for performing that action by selecting the name of

the table. Scope determines how deep or high within the environment's hierarchy that the user can

Entity	Create	Read	Write	Delete	Append	Append To	Assign	Share
Account	○	○	○	○	○	○	○	○
Activity	○	○	○	○	○	○	○	○
Announcement	○	○	○	○	○	○	○	○
Application File	○	○	○	○	○	○	○	○
Azure Service Connection	○	○	○	○	○	○	○	○
Connection	○	○	○	○	○	○	○	○
Contact	○	●	●	○	○	○	○	○
Customer Relationship	○	○	○	○	○	○	○	○
Data Import	○	○	○	○	○	○	○	○
Data Map	○	○	○	○	○	○	○	○
Data Performance Dashboard	○	○	○	○	○	○	○	○
Document Location	○	○	○	○	○	○	○	○
Document Suggestions	○	○	○	○	○	○	○	○
Duplicate Detection Rule	○	○	○	○	○	○	○	○
Email Signature	○	○	○	○	○	○	○	○
Email Template	○	○	○	○	○	○	○	○
Feedback	○	○	○	○	○	○	○	○
Follow	○	○	○	○	○	○	○	○
Import Source File	○	○	○	○	○	○	○	○
Interaction for Email	○	○	○	○	○	○	○	○

perform a particular action.

#### 9. Select **Save and Close**.

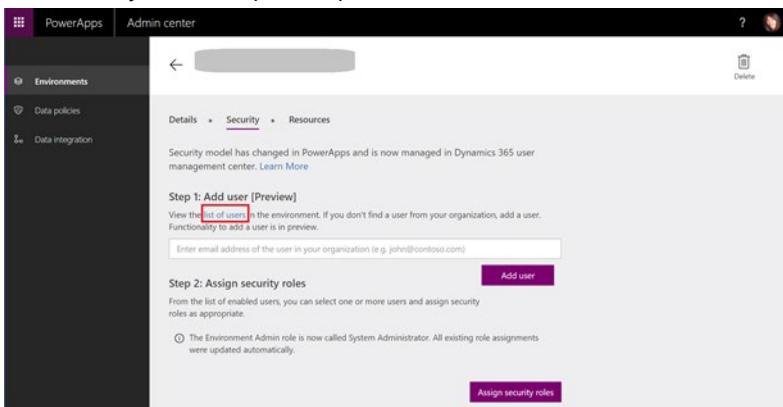
Congratulations, you have created a new custom security role. Next, you will assign users to this role.

To assign a user to a security role, you need to be a member of the System Administrator role in the current environment and then follow these steps:

The screenshot shows the Power Apps admin center interface. On the left, there's a navigation bar with Home, Learn, Apps (which is selected), Data, Business logic, and Notifications. The main content area has tabs for 'Create an app', 'Import package (preview)', and 'Microsoft Dynamics 365'. Below that, it says 'Apps in Microsoft (new default)'. It lists 'Recent apps' and 'Org apps'. One specific app entry is highlighted with a blue box. At the top right, there's a dropdown for 'Environment' set to 'Microsoft (new default)' and a 'Connections' section. A red oval highlights the 'Admin center' link in the top right corner of the main content area.

1. Sign in to Power Apps as an admin, select the settings gear, and then select **Admin Center**.
2. In Power Apps admin center, select the environment where you want to update a security role.
3. Select **See all** under Users in the **Access** section on the right.

- Verify if the user(s) already exists in the environment. If the user is not on the list, go to step 5. Otherwise, you can skip to step 6.



- In case a user does not exist in the environment, you can add the user by selecting the **Add user** button and entering the user's email address in your organization.
- After you know the user(s) whom you want to assign a security role to exists in your environment, select their username.
- Select **Manage Roles** at the top.

Name	App Id	State	App type	Security role	Business unit
test5	309d7fab-fe12-4...	Active	Custom	Tour Consumer	eng100007
test2new upda...	c6af2d13-5422-4...	Inactive	Custom	Basic User, Deskt...	eng100007
testc	68cabbd0-d442-4...	Active	Custom		eng100007
Microsoft CRM...	a84364bc-e980-4...	Active	Custom	EAC App Access	eng100007

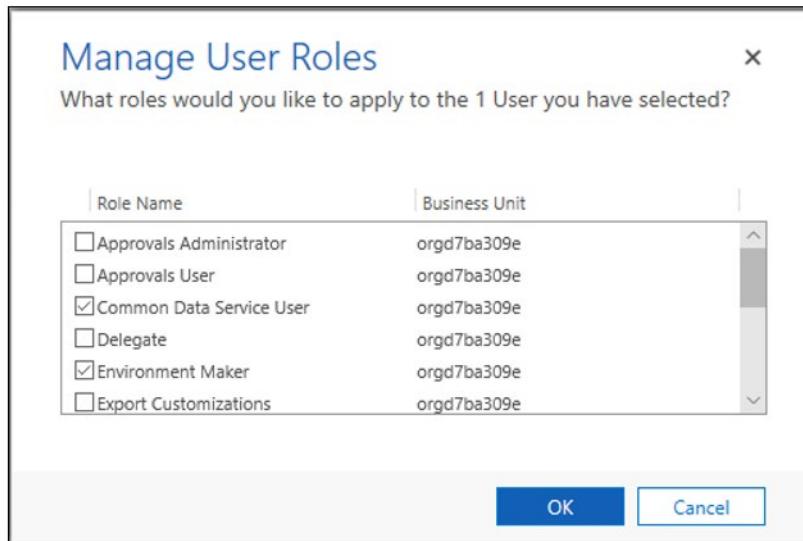
- In the **Manage User Roles** dialog box, in the **Role Name** section, select the check boxes next to the role(s) that you created in the previous section and make sure to also select the **Dataverse User** role (if it wasn't already). The Dataverse User role must be assigned to any user who wants to use your app or access Dataverse.
- Select **OK** to assign the role(s) to the user that you selected.

## Check the roles that a user belongs to

Checking the roles that a user belongs to is simple and you can do it from within Power Apps with the following steps:

- Sign in to Power Apps as an admin.
- Open the **Environments** option on the left-hand side of the page.
- Select the environment where you want to check the user's permission settings.
- Select the **Security** tab.

5. Select the **list of users** hyperlink under **Step One - Add User** option on the screen.
6. Select the check box next to the name of the user to view the security roles that the user has been assigned to.
7. In the **Manage User Roles** dialog box, select **Manage Roles** in the top menu to view user roles that are assigned to the user.



## Configure Dataverse teams for security

Using Microsoft Dataverse teams is optional. However, teams provide an easy way to share business objects and let you collaborate with other people across business units. Although a team belongs to one business unit, it can include users from other business units. You can associate a user with more than one team.

### Types of teams

- **Owning team** can own records, which give any team member direct access to that record. Users can be members of multiple teams. This will allow it to be a powerful way of granting permissions to users in a broad way without micromanaging access at the individual user level.
- **Access teams** provide a more advanced concept of sharing. Access Teams provides auto creation of a team and sharing of record access with the team based on an Access Team Template (template of permissions) which is applied. Access teams can also be used without the templates, with manual add/remove of its members. Access teams are more performant because they don't allow owning records by the team or having security roles assigned to the team. Users get access because the record is shared with the team and the user is a member.
- **Azure AD group team** is similar to owner teams, an Azure Active Directory (Azure AD) group team can own records and can have security roles assigned to the team. Security and Office are two group team types, and they correspond directly to Azure AD group types. Group security roles can be assigned only for a specific team or for a team member with user privileges that include members' privilege inheritance. Team members are dynamically derived (added and removed) when they access an environment based on their Azure AD group membership.

**Note:** You can assign security roles directly to owner teams and Azure AD group teams and users. The environment picker only recognizes users who are members of Azure AD group teams and users who have security roles assigned to them directly.

## Team operations

### Access your team's page

1. Sign in to the Power Platform admin center.
2. Select an environment.
3. select Settings > Users + permissions > Teams.

The screenshot shows the 'Settings' page in the 'D365Apps' environment. The left sidebar has sections for Product, Business, and Users + permissions. Under 'Users + permissions', there are sub-sections for Application users, Business units, Hierarchy security, Mobile configuration, Positions, Security roles, and Teams. The 'Teams' option is highlighted with a red box. The right side of the screen lists various settings categories like Email, Integration, Data management, Encryption, and Resources.

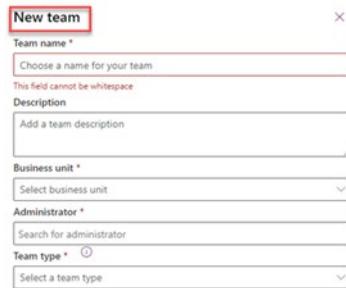
A list of all of the teams in the environment is displayed.

The screenshot shows the 'Teams' list page. The URL in the address bar is 'Environments > D365Apps > Settings > Teams'. A red box highlights the 'Teams' link in the breadcrumb trail. The page displays a table with columns: Name, Modified, Business unit, Team type, and Administrator. The data rows are:

Name	Modified	Business unit	Team type	Administrator
org297db405	2021-07-24T08:44:51Z	org297db405	Owner	[Redacted]
Sales team	2021-07-25T03:36:41Z	org297db405	Owner	[Redacted]
Security	2021-07-25T03:50:27Z	org297db405	AAD Security Group	[Redacted]

### Create a new team

1. Sign in to the Power Platform admin center.
2. Select an environment, and then select Settings > Users + permissions > Teams.
3. Select + Create team.
4. Specify the following fields:
  - **Team name:** Be sure this name is unique within a business unit.
  - **Description:** Enter a description of the team.
  - **Business unit:** Select the business unit from the dropdown list.
  - **Administrator:** Search for users in the organization.
  - **Team type:** Select the team type from the dropdown list.

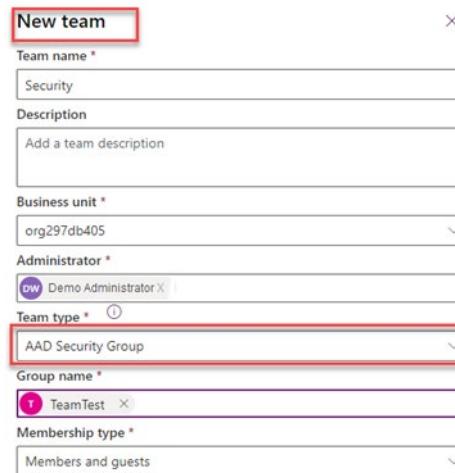


The screenshot shows a 'New team' form with the following fields:

- Team name \*: A text input field containing "Choose a name for your team". Below it is an error message: "This field cannot be whitespace".
- Description: A text input field containing "Add a team description".
- Business unit \*: A dropdown menu showing "Select business unit".
- Administrator \*: A search bar containing "Search for administrator".
- Team type \*: A dropdown menu showing "Select a team type".

**Note:** A team can be one of the following types: Owner, Access, Azure AD Security group, or Azure AD Office group.

5. If the team type is Azure AD Security group or Azure AD Office group, you must also enter these fields:
  - Group name: Start entering text to select an existing Azure AD group name. These groups are pre-created in Azure AD.
  - Membership type: Select the membership type from the dropdown list.



The screenshot shows the same 'New team' form with the following changes:

- The 'Team name' field now contains "Security".
- The 'Team type' dropdown is open, showing "AAD Security Group" which is highlighted with a red border.
- The 'Group name' field now contains "TeamTest".

After you create the team, you can add team members and select corresponding security roles. This step is optional, but recommended.

## Configure Dataverse group teams for security

An Azure Active Directory (AAD) group team, similar to an owner team, can own records and can have security roles assigned to the team. There are two group team types, and they correspond directly to the Azure AD group types – Security and Office. The group security role can be just for the team or for team member with User privileges member's privilege inheritance. Team members are dynamically derived (added and removed) when they access the environment based on their Azure AD group membership.

## Using Azure Active Directory groups to manage a user's app and data access

The administration of app and data access for Microsoft Dataverse has been extended to allow administrators to use their organization's Azure Active Directory (Azure AD) groups to manage access rights for licensed Dataverse users.

Both types of Azure AD groups—Office and Security—can be used to secure user-access rights.

Both types of Azure AD groups, Office and Security, with a Membership type Assigned can be used to secure user-access rights. Membership type Dynamic User and Dynamic Device are not supported.

Using groups lets administrators assign a security role with its respective privileges to all the members of the group, instead of having to provide the access rights to an individual team member.

The administrator can create Azure AD group teams that are associated to the Azure AD groups in each of the Dataverse environments and assign a security role to these group teams. For each Azure AD group, the administrator can create group teams based on the Azure AD group membership types. The administrator can create separate group teams for owners, members, guests and members, and guests, and assign a respective security role to each of these teams.

When members of these group teams access these environments, their access rights are automatically granted based on the group team's security role.

## Provision and deprovision users

Once the group team and its security role are established in an environment, user access to the environment is based on the user membership of the Azure AD groups. When a new user is created in the tenant, all the administrator needs to do is assign the user to the appropriate Azure AD group, and assign Dataverse licenses. The user can immediately access the environment without the need to wait for the administrator to assign a security role.

When users are deleted/disabled in Azure AD or removed from the Azure AD groups, they lose their group membership and won't be able to access the environment when they try to sign in.

## Lock down user access to environments

Administrators can continue to use an Azure AD security group to lock down the list of users synced to an environment. This can be further reinforced by using Azure AD group teams. To lock down environment or app access to restricted environments, the administrator can create separate Azure AD groups for each environment and assign the appropriate security role for these groups. Only these Azure AD group team members have the access rights to the environment.

## Share Power Apps to team members of an Azure AD group

When canvas and model-driven apps are shared to an Azure AD group team, team members can immediately run the apps.

## User-owned and team-owned records

When a security role is assigned to group teams a special team privilege is assigned. This type of security role allows team members to be granted User/Basic-level privileges as if the security role is directly assigned to them. Team members can create and be an owner of records without the need to have an additional security role assigned.

**Note:** A group team can own one or more records. To make a team an owner of the record, you must assign the record to the team.

While teams provide access to a group of users, you must still associate individual users with security roles that grant the privileges that they need to create, update, or delete user-owned records. These privileges can't be applied by assigning a nonmember's privilege inherited security role to a team and then adding the user to that team. If you need to provide your team members the team privileges directly, without their own security role, you can assign the team a security role that has member's privilege inheritance.

## Lock down user access to environments

Administrators can continue to use an Azure AD security group to lock down the list of users synced to an environment. This can be further reinforced by using Azure AD group teams. To lock down environment or app access to restricted environments, the administrator can create separate Azure AD groups for each environment and assign the appropriate security role for these groups. Only these Azure AD group team members have the access rights to the environment.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which of the following is not a User Security role?

- Application Administrator
- Delegate
- Microsoft Dataverse User
- System Customizer

### Multiple choice

2. Which of the following statements is true about users?

- You can't add users to access data in Dataverse.
- Public users outside of your Azure Active Directory can access Dataverse data.
- You can enable anonymous access to any data in Dataverse.
- You can add users to access data in Dataverse from within your Azure Active Directory.

### Multiple choice

3. Adding a user to Dataverse automatically assigns that user to all the following roles except which one?

- Dataverse User
- Environment Maker
- System Customizer

## Summary

In this module, you learned about security and the user in Dataverse. In addition, you learned the following:

- What Environment Security roles are in Microsoft Dataverse
- How to add or disable a user within an environment
- Different types of security concepts in Dataverse
- What User Security roles are, and which are assigned by default when you add a new user to an environment
- How to create a custom security role
- How you can check the roles that are assigned to a user
- How to about Dataverse teams management

The following links were referenced within this module:

**Microsoft Power Platform Admin Portal<sup>17</sup>**

**Power Apps<sup>18</sup>**

For more information on data modeling, see **Dataverse - data modeling<sup>19</sup>**.

For more information on data security, see **Dataverse - security modeling<sup>20</sup>**.

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<sup>17</sup> <https://admin.powerplatform.microsoft.com/>

<sup>18</sup> <https://www.powerapps.com/>

<sup>19</sup> [https://youtu.be/s1Zqv\\_8QLNQ](https://youtu.be/s1Zqv_8QLNQ)

<sup>20</sup> <https://youtu.be/HHBoTNMZtsQ>

# Use administration options for Dataverse

## Introduction to Microsoft Power Platform Admin Center portal

Most of the administration settings that you'll need are available in the Microsoft Power Platform Admin portal. You should always check for administration settings as your first step when looking to administer Dataverse.

Settings are grouped into the following broad categories. They are accessible by selecting the link on the left-hand side of the portal.

- **Environments** - This section lists all instances of Microsoft Dataverse.
- **Analytics** - This section gives you analytical information about your data, apps, and flows within all instances of Microsoft Dataverse. It shows information such as active users, runs, usage, and location information.
- **Resources** - This section provides links to useful parts of Microsoft Power Platform. You can view and add capacity to your environments, view Dynamics 365 Apps, and information about your Portals.
- **Help + Support** - This section gives you an easy approach to receiving support from Microsoft for any needs you may have.
- **Data Integration** - This section lets you create or add predefined connections and then monitor these connections between Dataverse and other data sources like Salesforce or SQL Server.
- **Data** - This section provides access to the on-premises data gateway, which acts as a bridge, providing a quick and secure data transfer between on-premises data and Power BI, Power Automate, Logic Apps, and Power Apps.
- **Data Policies** - This section lets you set up policies to restrict which data connectors can be used with Dataverse to limit what data can flow into or out of Dataverse tables.

The screenshot shows the Microsoft Power Platform Admin Center portal. The top navigation bar is dark with the title "Power Platform admin center". Below it is a header with a menu icon, a "New" button, and a "Refresh" button. The main content area has a sidebar on the left with the following sections: "Environments" (selected), "Analytics", "Resources", "Help + support", "Data integration", "Data (preview)", "Data policies", and "Admin centers". The main panel displays the "Environments" list with one entry:

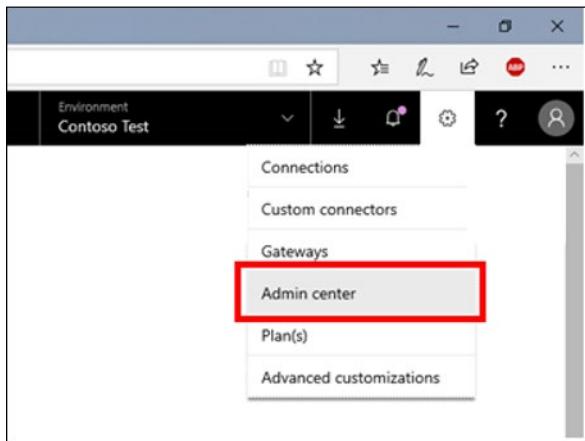
Environment	Type
paiad896 (default)	Default

- **Admin Centers** - This section gives links to other admin centers for Microsoft Power Platform.

With the following steps, take a few moments to explore the different options by browsing through the Admin center and opening each section that is shown on the left-hand side of the portal.

1. Sign in to **Power Apps**<sup>21</sup>.
2. Select **Admin center** under the gear icon.

**Tip:** You can go directly to Microsoft Power Platform Admin Center at <https://admin.powerplatform.microsoft.com><sup>22</sup> and then sign in.



3. Select the options that are shown on the left-hand side of the Admin center portal.

## Use Microsoft Power Platform Admin Center portal

A second administration portal that shows usage data is available in the Microsoft Power Platform Admin Portal called Microsoft Power Platform Administration Center, which includes analytics such as storage, usage, and settings for mail gateways.

## Settings

1. Sign in to the **Microsoft Power Platform**<sup>23</sup> admin center.
2. Select **Environments** on the left-hand side of the portal.
3. Select the environment that you want to administer.
4. Select the **Settings** button.

## Analytics

1. Sign in to the **Microsoft Power Platform Admin Center portal**<sup>24</sup> admin center.
2. Select **Analytics > Microsoft Dataverse** on the left-hand side of the portal.
3. Select any of the menu options within **Analytics**, including data usage, entity usage, and many other metrics.

<sup>21</sup> <http://www.powerapps.com/>

<sup>22</sup> <https://admin.powerplatform.microsoft.com/>

<sup>23</sup> <https://admin.powerplatform.microsoft.com/>

<sup>24</sup> <https://admin.powerplatform.microsoft.com/>

**Tip:** You can change the instance of the database (the source of the metrics that are displayed) by selecting the **Change filters** hyperlink, as shown in the following screenshot.

The screenshot shows the Microsoft Power Platform Admin center (preview) interface. On the left, there's a navigation sidebar with options like Environments, Analytics, Capacity, Common Data Service, Microsoft Flow, PowerApps, Help + support, Data integration, Data gateways, and Data policies. The main area is titled 'Common Data Service for Apps analytics' and shows metrics: Active Users (4), API Calls (134), and API Pass Rate (100.00%). Below these are sections for Total operations, Entity usage, System jobs, Plug-ins, API calls statistics, Mailbox usage, and Storage. On the right, there's a 'Filters' section with a 'General' tab and dropdowns for Environment, From, To, and other time-related fields. A red box highlights the 'Change filters' link in the top right corner of the main content area.

## Advanced Customization options in Power Apps Portal

**Advanced Customizations** are options that you can use to quickly define security roles in Microsoft Dataverse. The following steps will help you access advanced customization options.

1. Sign in to the **Microsoft Power Platform<sup>25</sup>** admin center.
2. Select **Environments** on the left-hand side of the portal.
3. Select the environment that you want to administer.
4. On the right-hand side, in the **Access** section, you can control and manage **Security roles, Teams, Users, and S2S (Server-to-Server) Apps**, by selecting **See all** under the appropriate section.
  1. The **Security roles** section will allow you to customize predefined security roles, or create your own custom security roles.
  2. The **Teams** section will allow you to grant security permissions to entire business units.
  3. The **Users** section will allow you to add users to your environment and define their security roles.
  4. **S2S Apps** allows you to connect certain web applications to Dataverse.

**Note:** Security roles were explained in detail in the Get started with security roles in Dataverse module in this learning path.

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<sup>25</sup> <https://admin.powerplatform.microsoft.com/>

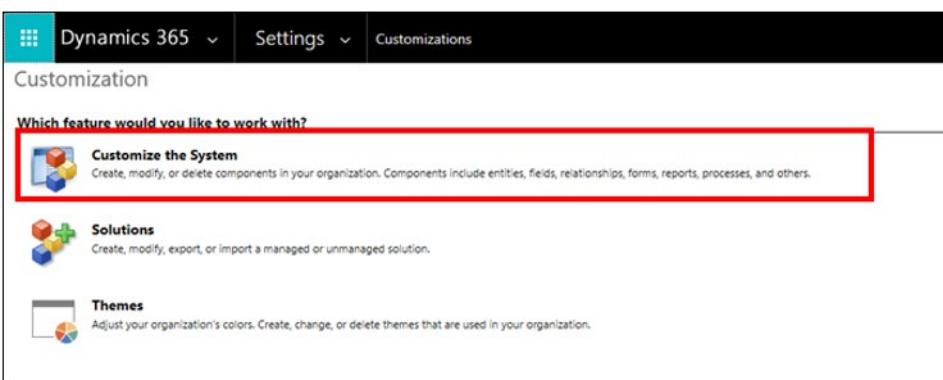
The screenshot shows the 'Access' section of the Microsoft Dynamics 365 Admin Center. It includes links for 'Security roles', 'Teams', 'Users', and 'S2S Apps', each with a 'See all' link.

Section	Link	Description
Security roles	See all	View and manage security roles.
Teams	See all	View and manage teams.
Users	See all	View and manage users.
S2S Apps	See all	View and manage S2S apps.

## Classic Administration Center (Solution Explorer)

Occasionally, you might need to go to the Solution Administration center because this is the original administration center and some capabilities have yet to be migrated to the two other admin areas. You can get to this administration area with the following steps.

1. Sign in to Power Apps.
2. Select **Admin Center** under the gear icon on the menu.
3. Select the **Environments** option on the left-hand side of the page within the Admin Center.
4. Select the environment that you want to manage.
5. Select the **Environment URL**.
6. Select **Advanced Settings** under the gear icon on the menu.
7. Select the **Settings** drop-down arrow.
8. Select the **Customizations** option.
9. Select **Customize the System**, as shown in the following screenshot.



Now you are at the classic admin center with many additional options that are not available in the other portals.

Display Name ↑	Name	Type	State
	flipswitch_options	Option Set	Managed
	sdkmessage_autotran...	Option Set	Managed
	organization_feature...	Option Set	Managed
	subscriptionstatisticsco...	Option Set	Managed

## Enable and disable auditing

Auditing can be enabled on Microsoft Dataverse data to track changes. Auditing can be used to satisfy compliance requirements or simply to allow users to see what data has been changed on a row. To enable data change auditing, it must be configured at the Dataverse environment, table, and column level. Enabling and disabling of auditing can only be done by someone in the System Administrator or System Customizer role.

In addition to data change auditing, Dataverse also supports user access logging to capture sign-in and read auditing allowing monitoring of data usage by a user. Log viewing for this auditing data is done from the **Microsoft 365 Security and Compliance Center**<sup>26</sup>.

Most of the time, an administrator will configure auditing at the environment level to enable or disable. This will be done in each environment used, for example, dev, test, production. A maker building apps and managing Dataverse table and column definitions will configure auditing for the relevant tables and columns. The auditing settings for tables and columns will be transported from dev, test, and production using a solution. The solution being imported into test and production ensures consistent auditing settings and avoids manual configuration in each environment.

**Note:** Auditing settings for tables and columns are solution aware and will be transported with the schema as the solution is installed in another environment. However, each environment must have auditing enabled at the environment level for these settings to perform as expected.

## Environment settings

Auditing is disabled by default in each Dataverse environment and must be manually enabled in the admin portal. If disabled at the environment level no auditing data is captured even if auditing is configured for tables and columns in the environment.

Enabling and disabling audit for an environment can be done from the **Power Platform Admin Portal**<sup>27</sup> by selecting an environment and navigating to Settings.

<sup>26</sup> <https://docs.microsoft.com/en-us/microsoft-365/compliance/microsoft-365-compliance-center?view=o365-worldwide>

<sup>27</sup> <https://aka.ms/ppac>

Environments > Docs > Settings

Search for a setting

- ⌄ ⚙ Product
  - Behavior, Features, Languages, Privacy + Security
- ⌄ 📁 Business
  - Business closures, Calendar, Connection roles, Currencies
- ⌄ 🔑 Users + permissions
  - Application users, Business units, Hierarchy security, Mobile configuration
- ⌄ 📈 Audit and logs
  - Audit settings
  - Audit summary view
  - Entity and field audit settings
  - System jobs
- ⌄ 📁 Templates
  - Access team templates, Article templates, Contract templates, Data import templates

Audit settings allow you to enable and disable auditing. Start auditing enables data change auditing and uses Dataverse log capacity. Log access and read logs enable logging to Microsoft 365 and can be viewed in the **Microsoft 365 Security and Compliance Center**<sup>28</sup>. After changing the settings make sure, you click the save button in the lower right corner.

Environments > Docs > Settings > Audit settings

#### Auditing

Manage logging for Dataverse data

Start Auditing

Log access ⓘ

Read logs ⓘ

The audit summary view allows administrators to view auditing data collected across all Dataverse tables in one place. For data changed events like an update you can drill down and see which column values were included in the update action.

Delete Change History		Enable/Disable Filters					
Changed Date	Event	Changed By	User Info	Record	Entity	Operation	
8/2/2021 4:55 PM	Update	Connected Operations	Challenge	Update			
8/2/2021 4:37 PM	Audit Change at Entity Level		Challenge	Update			
8/2/2021 4:29 PM	Audit Change at Org Level		Organization	Update			

You can also access the entity and field audit settings here to view and configure auditing at the table and column level. This is best used for viewing and if you need to configure you should follow the steps later in this topic and do the change from the maker portal.

An important take away from an admin perspective is you might have access to enable auditing in the development environment but not in the other environments like test and production. For these, you must work with the environment administrator to get the setting enabled. It is not uncommon for table

<sup>28</sup> <https://docs.microsoft.com/en-us/microsoft-365/compliance/microsoft-365-compliance-center?view=o365-worldwide>

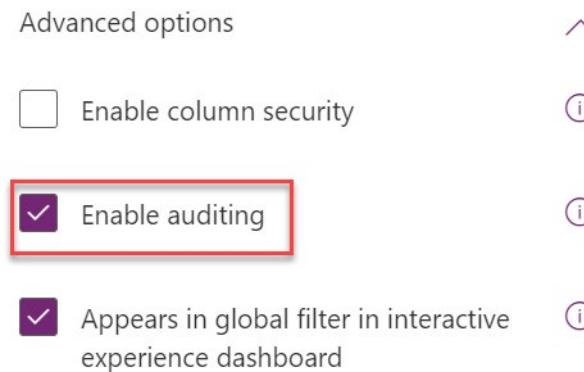
and column auditing to be configured in development and not enabled in the other environments causing lack of capture of audit data.

## Enabling auditing on tables and columns

Auditing on tables and columns is configured on their definitions either at creation or later by editing the settings. The state of auditing is tracked as part of the table and column metadata in solutions containing the table. When the solution is used to transport the definition from one environment to another such as from dev to test, the audit settings are applied to the target environment. If you have the table in multiple solutions that are imported into the same target environment the audit settings can be set by the most recent solution. When the solutions contain different configuration for the auditing settings one solution could turn them on and a newer solution could turn them off. Care should be taken to ensure all solutions containing the table are consistent setting for the auditing configuration.

By default, new Dataverse tables that are created have auditing disabled. You can enable or disable auditing for tables using the classic solution explorer. When auditing is enabled for a table, auditing is enabled for all eligible columns of that table. Some columns are not applicable for auditing as they will never be modified, for example, primary ID or created on.

When editing a column, you can find the auditing switch under the advanced options section on the column properties.



After changing any of the column audit configurations to enable or disable, you must publish changes for the table or publish all changes.

## Configure multiple columns

If you are changing several columns, you might want to use the Edit Multiple Fields feature of the classic solution explorer. By selecting multiple columns in the list, you can enable or disable auditing on all selected.

## Edit Multiple Fields

Enter your edits in the form, and then click Save. Fields that you don't edit will not be changed.

### Field Requirement

Field Requirement

-- Make a selection --

### Searchable

Searchable

Yes  No

### Auditing

Auditing

Enabled  Disabled

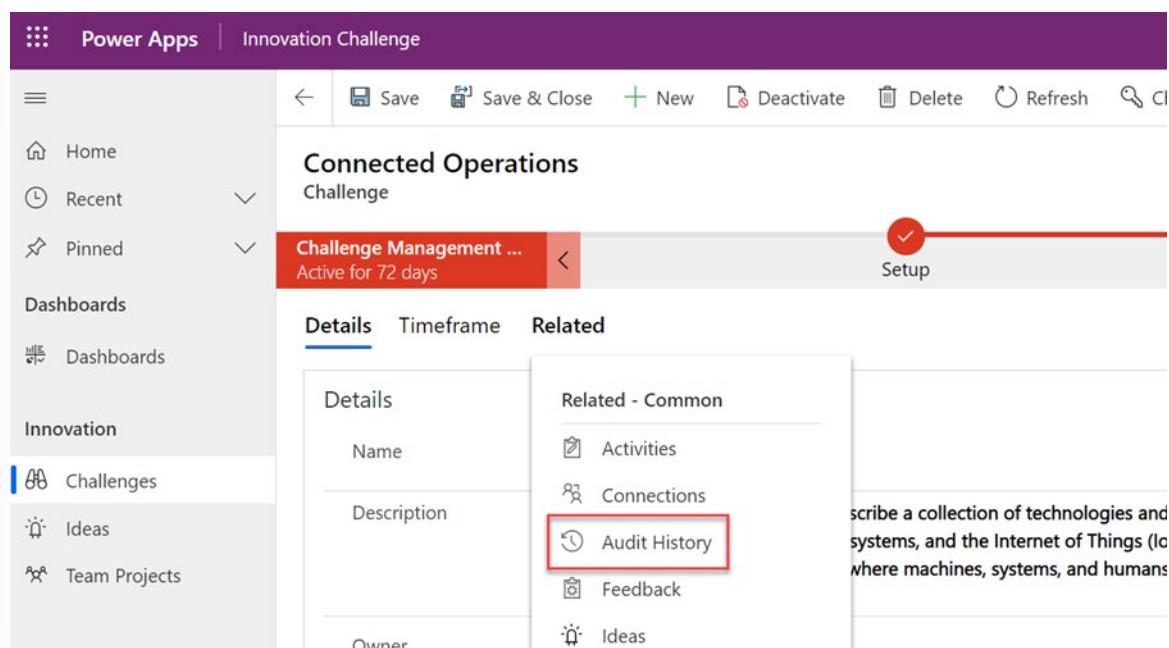
## Deciding when to enable or disable auditing

As part of creating each table you should consider whether auditing would be valuable or not. Anytime you have compliance requirements around tracking who changed data and what the data changes are auditing should be considered. Auditing can also be a good safety net to quickly restore data without having to go to a backup. For example, if a user accidentally changes a record or deletes it without auditing your only option to recover the data is to restore a backup to find out what the values were. Using auditing you could use the audit log data to know how to reconstruct the records prior to the change or the deletion.

Auditing of data changes consumes Dataverse log capacity. Audit data is retained based on a retention period configured for the environment. Retention is not configured by table, so if you have a table with large or high-volume changes happening you should carefully consider which columns require auditing. Audit logs can be deleted, except the current log.

## Viewing audit data

In addition to administrators being able to see a summary view across all tables from the admin portal, Power Apps model-driven apps also provide a summary view related to each row that has auditing enabled. From the related tab in the row form view, you can navigate to an audit summary view for just that row.



From here, you can view a summary of the audit data for the current row. By selecting a row, it can be exported and by clicking on the event you can see the detail view of what has changed and the full old and new values. Users with permissions can delete the entire change history for the row.

The screenshot shows the 'Audit History' details view. The top navigation bar includes 'Details', 'Timeframe', 'Audit History' (which is highlighted with a red box), and 'Related'. Below this is a filter bar set to 'All Fields'. The main area displays a table of audit logs:

Changed Date	Changed By	Event	Changed Field	Old Value	New Value
8/2/2021 11:15 ...		Update	Communicate via Description Name	Industry 4.0 is a term u... Connected Operation	Email Industry 4.1 is a term u... Connected Operations
8/2/2021 4:55 PM		Update			
8/2/2021 4:37 PM		Entity Audit S...			
8/2/2021 4:29 PM		Audit Enabled			

## Configuring security roles for auditing

Security roles offer multiple privileges related to auditing that can be granted to users as required. By default, System Customizer and System Administrator have some of these privileges enabled. These can be found in the miscellaneous section on the core records tab. When you grant users these privileges keep in mind, they apply to all tables, rows, and columns.

Miscellaneous Privileges			
Add Reporting Services Reports	<input type="radio"/>	Bulk Delete	<input type="radio"/>
Delete Audit Partitions	<input checked="" type="radio"/>	Delete Audit Record Change History	<input type="radio"/>
Manage Data Encryption key - Activate	<input type="radio"/>	Manage Data Encryption key - Change	<input type="radio"/>
Manage Data Encryption key - Read	<input type="radio"/>	Manage User Synchronization Filters	<input type="radio"/>
Promote User to Microsoft Dynamics 365 Administrator Role	<input type="radio"/>	Publish Duplicate Detection Rules	<input type="radio"/>
Publish Email Templates	<input type="radio"/>	Publish Mail Merge Templates to Organization	<input type="radio"/>
Publish Reports	<input type="radio"/>	Run SharePoint Integration Wizard	<input type="radio"/>
Turn On Tracing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>View Audit Partitions</b>	<input type="radio"/>	<b>View Audit History</b>	<input type="radio"/>
		<b>View Audit Summary</b>	<input type="radio"/>

Some amount of auditing is useful in most solutions and should be part of the consideration anytime you add a new table or column to a Dataverse environment. Administrators should be consulted with to ensure auditing is enabled and retention periods are configured to meet the business requirements.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. Which administrative portal shows usage data?

- Power Apps Advanced Customization
  - Solution Explorer
  - Microsoft Power Platform Admin Portal
  - Power Apps Admin Portal

## Multiple choice

2. Which portal offers a quick way to add users and set permissions?

- Power Apps Advanced Customization
  - Classic Administration Center (Solution Explorer)
  - Microsoft Power Platform Admin Portal
  - Power Apps Admin Portal

## Multiple choice

*3.Which portal offers a quick way to manage environments and users?*

- Power Apps Advanced Customization
  - Classic Administration Center (Solution Explorer)
  - Microsoft Power Platform Admin Portal

## Summary

In this module, you learned about the different options that you have to administer Dataverse. Additionally, you learned about the following:

- **Microsoft Power Platform Admin Center** - Beneficial for usage reporting, including how much data is consumed, what apps are being used, what entities are used, and what is going on in each environment. The dashboards are user-friendly and provide a quick overview of activity.
- **Power Apps Advanced Settings** - This offers a quick way to add users and set permissions by using the gear menu within Power Apps.
- **Classic Administration Center (Solution Explorer)** - The original of all administration portals and the portal with the deepest and most extensive administration option. This is your final stop and will have anything that you need. The Power Apps Admin Center or Advanced Settings within Power Apps mostly offer a subset of administrative options that are found within the Classic Administration Center (Solution Explorer) portal.

Always start administration tasks by using the Power Apps Admin Center. If you need information about usage, then review the information in Microsoft Power Platform Center. If you want to view users or review security roles within an environment, then use the **Advanced Settings** option in Power Apps. Finally, if you need deep administrative functionality, then go to the Classic Administration Center (Solution Explorer).

The following links were referenced within this module:

**Microsoft Power Platform Admin Portal<sup>29</sup>**

**Power Apps<sup>30</sup>**

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<sup>29</sup> <https://admin.powerplatform.microsoft.com/>

<sup>30</sup> <https://www.powerapps.com/>

# Manage Dynamics 365 model-driven app settings and security

## Introduction

Proper controls on access to data are a vital part of any business. When you understand the security architecture of Dynamics 365 model-driven applications, you can more easily customize security to fit the requirements of your business.

Security in Dynamics 365 is based on security roles, which are created within business units.

- A **Business unit** is all or part of an organization.
- A **security role** is a collection of privileges and access levels defined by entity.
- **Privileges** allow users in a role to take actions on records in an entity.
- **Access levels** determine the scope of entities and records a user can take actions on, from most restrictive to least restrictive.

Every user must:

- Be assigned to just one business unit.
- Have at least one security role to be able to log in.

Users can have more than one security role. If they do, the role with the broadest permissions will override roles with lesser permissions.

Users with higher permissions (like System Administrators) will have access to the Settings sections of the Power Platform admin center and the model-driven apps. Familiarizing yourself with the settings sections are important to ensuring that you can effectively manage the administration of your environment. In this module, we will explore various settings that can help you customize your model-driven app.

Throughout this module, we will discuss business requirements in the context of a fictional organization called **Contoso Research**. Contoso Research is a firm that recruits research participants, maintains a database of subjects, facilitates focus groups, and runs large-scale surveys. Contoso Research is investigating using a Dynamics 365 model-driven app to streamline their business operations. They are concerned that their requirements are too unique to use an out-of-the-box solution. Your job is to show Contoso Research how a model-driven app can be easily configured to meet their needs.

**Note:** While the content in this module is introductory, it builds on fundamental concepts that are introduced in **Microsoft Dynamics 365 Fundamentals**<sup>31</sup> and **Microsoft Power Platform Fundamentals**<sup>32</sup>. If you are not already familiar with Power Platform components or the Dynamics 365 model-driven apps, those learning paths are recommended.

At the end of this module, you will be able to:

- Manage role-based security
- Explore customization functionality and customize themes

## Configure role-based security

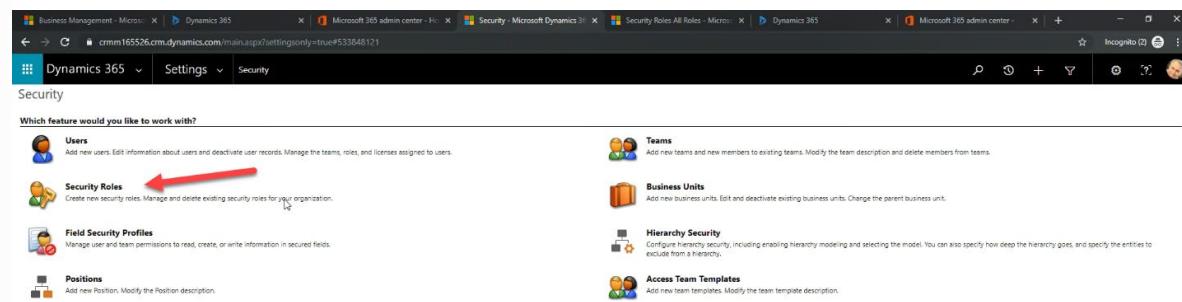
The security model in the Power Platform and Dynamics 365 is role-based, meaning that the model focuses on grouping a set of privileges together that describe the responsibilities (or tasks that can be

<sup>31</sup> <https://docs.microsoft.com/en-us/learn/parts/dynamics-365-fundamentals/>

<sup>32</sup> <https://docs.microsoft.com/en-us/learn/parts/power-plat-fundamentals/>

performed) for a user. When you set up security roles in a Dynamics 365 model-based app, you can restrict access so users only have the information they need to fulfill their role, and nothing more.

Dynamics 365 model-driven app security can be controlled in the **Security** section of **Settings**.



At its core, the Power Platform and Dynamics 365 security model is comprised of two key principles: **privileges** and **access levels**. When configured in conjunction, an administrator can control user security throughout their Dynamics 365 model-driven app environment.

## Privileges

A privilege is a permission to perform an action in Dynamics 365. Power Apps and model-driven apps use different record-level privileges that determine the level of access a user has to a specific record or record type.

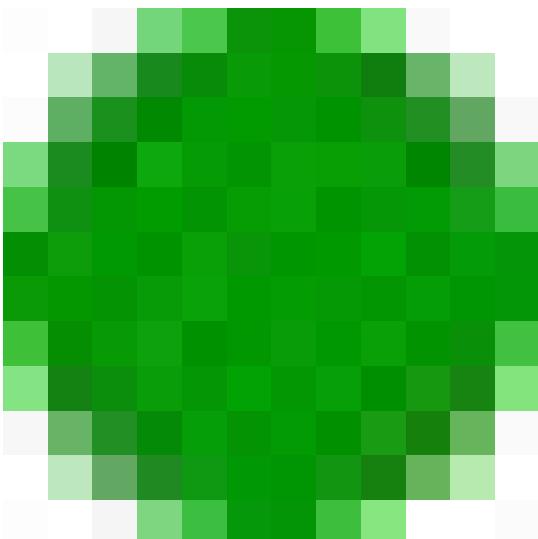
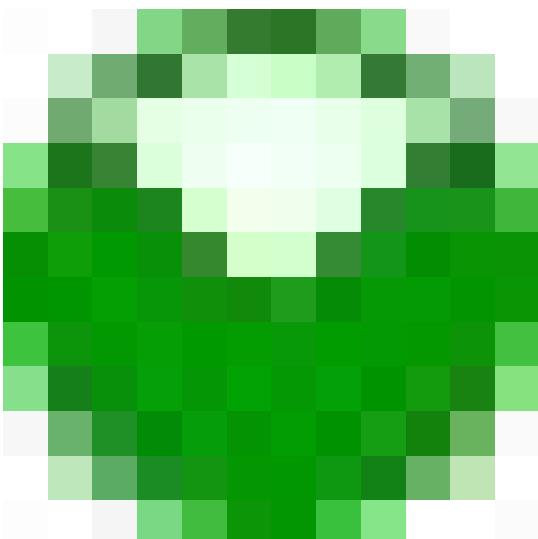
Privilege	Description
<b>Create</b>	Required to make a new record.
<b>Read</b>	Required to open a record to view the contents.
<b>Write</b>	Required to make changes to a record.
<b>Delete</b>	Required to permanently remove a record.
<b>Append</b>	Required to associate the current record with another record. For example, a note can be attached to an opportunity if the user has Append rights on the note. In case of many-to-many relationships, you must have Append privilege for both entities being associated or disassociated.
<b>Append To</b>	Required to associate a record with the current record. For example, if a user has Append To rights on an opportunity, the user can add a note to the opportunity.
<b>Assign</b>	Required to give ownership of a record to another user.
<b>Share</b>	Required to give access to a record to another user while keeping your own access.

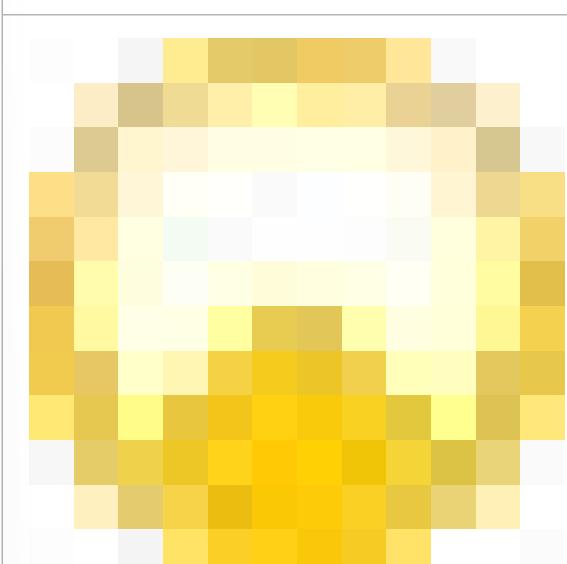
The owner of a record or a person who has the Share privilege on a record can share a record with other users or teams. Sharing can add Read, Write, Delete, Append, Assign, and Share privileges for specific records.

## Access levels

The access level determines, for a given entity type, at which levels within the organization hierarchy a user can act on that type of entity.

The following lists the levels of access in Dynamics 365 model-driven apps, starting with the most access.

	<p><b>Global.</b> This access level gives a user access to all records in the organization, regardless of the business unit hierarchical level that the instance or the user belongs to. Users who have Global access automatically have Deep, Local, and Basic access, also. Because this access level gives access to information throughout the organization, it should be restricted to match the organization's data security plan. This level of access is usually reserved for managers with authority over the organization. The application refers to this access level as <b>Organization</b>.</p>
	<p><b>Deep.</b> This access level gives a user access to records in the user's business unit and all business units subordinate to the user's business unit. Users who have Deep access automatically have Local and Basic access, also. Because this access level gives access to information throughout the business unit and subordinate business units, it should be restricted to match the organization's data security plan. This level of access is usually reserved for managers with authority over the business units. The application refers to this access level as <b>Parent: Child Business Units</b>.</p>

	<p><b>Local.</b> This access level gives a user access to records in the user's business unit. Users who have Local access automatically have Basic access, also. Because this access level gives access to information throughout the business unit, it should be restricted to match the organization's data security plan. This level of access is usually reserved for managers with authority over the business unit. The application refers to this access level as <b>Business Unit</b>.</p>
	<p><b>Basic.</b> This access level gives a user access to records that the user owns, objects that are shared with the user, and objects that are shared with a team that the user is a member of. This is the typical level of access for sales and service representatives. The application refers to this access level as <b>User</b>.</p>



## Configure a security role

A user's experience in the application is the combined result of their defined security roles and team memberships as well as app licenses. Using security roles to limit a user's access to records can improve their in-app experience by removing clutter that is not part of their requirements.

Users are granted access and privileges at the entity level. Access to individual records cannot be specifically granted. If the user's combined roles do not allow access to a record, or the ability to perform actions with the record (such as read, write, append, etc.) then the user cannot work with the records outside of the scope of their defined roles. All application users need at least one security role assigned to access the application, a role assigned either to their user, or by their team membership.

The following graphic shows the security roles for a Salesperson. Clicking each individual circle in the column of privileges will change the access level.

Entity	Create	Read	Write	Delete	Append	Append To	Assign	Share
Account	○	●	●	○	●	●	○	●
ACIViewMapper	○	○	○	○				
Action Card	○	○	○	○	○	●	○	
Action Card User Settings	○	○	○	○	○		○	○
Activity	○	●	○	○	○	○	○	●

Key:

- None Selected
- User
- Business Unit
- Parent: Child Business Units
- Organization

## Manage teams and business units

In addition to configuring individual roles, you can configure business units and teams to control access and permissions within your environment.

## Business units

A business unit is a logical grouping of related business activities.

If your organization is structured around departments or divisions that have separate products, customers, and marketing lists, you might want to create business units. Business units are mapped to an organization's departments or divisions. Users can securely access data in their own business unit, but they can't access data in other business units.

Business units, security roles, and users are linked together in a way that conforms to the role-based security model. Use business units together with security roles to control data access so people see just the information they need to do their jobs.

Keep the following in mind when creating business units:

- The organization (also known as the root business unit) is the top level of a business unit hierarchy. Model-driven apps in Dynamics 365 automatically create the organization when you install or provision model-driven apps in Dynamics 365. You can't change or delete the organization name.
- Each business unit can have just one parent business unit.
- Each business unit can have multiple child business units.
- Security roles and users are associated with a business unit. You must assign every user to one (and only one) business unit.
- You can assign a team to just one business unit, but a team can consist of users from one or many business units. Consider using a team if you have a situation where users from different business units need to work together on a shared set of records.

## Create a new business unit

These settings can be found in the Power Platform Admin center by going to **Environments** > [select your model-driven app environment] > **Settings** > **Users + permissions** > **Business units**.

Make sure you have the System Administrator or System Customizer security role or equivalent permissions to update the setting.

1. Select your Dynamics 365 model-driven app environment and go to **Settings** > **Users + permissions** > **Business units**.
2. On the Actions bar, select **New**.
3. In the **Business Unit** dialog box, type a name for the new business unit. Model-driven apps in Dynamics 365 automatically fills in the **Parent Business** field with the name of the root business unit. (If you want to change the parent business unit, select the **Lookup** button, **Look Up More Records**, and then either select an existing business unit or select **New** and create a new one.)
4. In the **Business Unit** dialog box, fill in any of the other optional fields, such as the Division, Website, contact information, or addresses.
5. When you're done making entries, select **Save and Close**.

## Teams

Using teams as part of your security model is totally optional. However, teams provide an easy way to share business objects and let you collaborate with other people across business units. While a team

belongs to one business unit, it can include users from other business units. You can associate a user with more than one team. Teams are typically used to allow users in different business units as Marketing, Sales and Support all work with the same entity (like the Account record of a large customer).

When configuring teams, you need to decide between the two types: **owner** and **access** teams.

- **Owner teams:** An *owner* team owns records and has security roles assigned to the team. The team's privileges are defined by these security roles. In addition to privileges provided by the team, team members have the privileges defined by their individual security roles and team member's privilege inheritance roles, and by the roles from other teams in which they are members. A team has full access rights on the records that the team owns. Team members are added manually to the owner team.
- **Access teams:** An *access* team doesn't own records and doesn't have security roles assigned to the team. The team members have privileges defined by their individual security roles and by roles from the teams in which they are members. The records are shared with an access team, and the team is granted access rights on the records, such as Read, Write, or Append.

## Create a new owner team

1. Go to **Settings** > **Security**.
2. Select **Teams**.
3. On the Actions toolbar, select **New** button.
4. Enter a team name.
5. Select a business unit. If you don't select the business unit to which the team will belong, by default, the root business unit is selected.
6. Enter an administrator.
7. Select **Owner** in **Team Type**.
8. Complete other required fields, and then select **Save**.

## Explore settings and customizations

If you haven't already, it is useful to familiarize yourself with both the **Settings** sections in the Power Platform admin center and the Dynamics 365 model-driven app. Customizing these settings can change the user experience to more closely match the business requirements of your organization.

## Themes

You can create a custom look and feel for your app by making changes to the default colors and visual elements provided in the uncustomized system. Changing the **theme** is a relatively simple way to brand the model-driven app to match the organization's branding. A theme is created by using the customization tools in the user interface, without requiring a developer to write code. You can create, change or delete themes that are used in your organization. You can define multiple themes, but only one can be set and published as the default theme.

Theming is used to enhance the app user interface, not drastically alter it. The theme colors are applied globally throughout the application. For example, you can enhance the following visual elements in the UI:

- Change product logos and navigation colors to create product branding

- Adjust accent colors, such as hover or selection colors
- Provide entity-specific coloring
- Logo
- Logo tooltip
- Navigation bar color
- Navigation bar shelf color
- Main command bar color on the Unified Interface
- Header color

The easiest and quickest way to create a new theme is to clone and alter an existing theme, then save it, preview and publish.

1. Go to **Settings > Customizations**.
2. Choose **Themes**, and then choose **Dynamics 365 Default Theme**.

The following screenshot shows the default theme setup.

Theme Name		
Theme Name *	CRM Blue Theme	
Navigation Bar		
Logo	--	
Logo Tooltip	Microsoft Dynamics 365	
Navigation Bar Fill Color	#0078D7	
Navigation Bar Shelf Fill Color	#FFFFFF	
Title Text Color	#0078D7	
Main Color	#3B79B7	
Accent Color	#E83D0F	
UI Elements		
Link and Button Text Color	#1160B7	
Selected Link Color	#F8FAFC	
Hover Link Color	#E7EFF7	
Legacy Accent Color	#358717	
Default Entity Color	#666666	
Default Custom Entity Color	#00CCA3	
Control Hover Fill Color	#FFFFFF	
Control Hover Border Color	#BDC3C7	
Page Header Fill Color	#E0E0E0	
Panel Header Fill Color	#F3F3F3	

From here, you can clone the default theme and change the colors. You can also choose a new logo for product. The following screenshot shows the new navigation color.

[+ NEW](#) [DELETE](#) [PREVIEW](#) [PUBLISH THEME](#) [CLONE](#)

## THEME

Gentle Green Theme **Theme Name**

Theme Name \*

Gentle Green Theme

**Navigation Bar**

Logo	--
Logo Tooltip	MS Green
Navigation Bar Color	#415C55
Navigation Bar Shelf Color	#79AB9E
Header Color	#415C55

**UI Elements**

Global Link Color	#415C55
Selected Link Effect	#65825C
Hover Link Effect	#A4D194
Process Control Color	#79AB9E
Default Entity Color	#111111
Default Custom Entity Color	#111111
Control Shade	#79AB9E
Control Border	#415C55

You can preview the theme before you publish it. The following screenshot shows the account entity grid with the new highlight color after publishing.

[+ NEW](#) [DELETE](#) [EMAIL A LINK](#) [RUN REPORT](#) [EXPORT TO EXCEL](#) [IMPORT DATA](#) [CHART PANE](#)

## My Active Accounts

✓ Account Name	Main Phone	Address 1: City	Primary Contact	Email (Primary Contact)
A. Datum Corporation (sample)	555-0158	Redmond	Rene Valdes (sample)	someone_i@example.com
Adventure Works (sample)	555-0152	Santa Cruz	Nancy Anderson (sam	someone_c@example.com
Alpine Ski House (sample)	555-0157	Missoula	Paul Cannon (sample)	someone_h@example.com
Blue Yonder Airlines (sample)	555-0154	Los Angeles	Sidney Higa (sample)	someone_e@example.com
City Power & Light (sample)	555-0155	Redmond	Scott Konersmann (sa	someone_f@example.com
Coho Winery (sample)	555-0159	Phoenix	Jim Glynn (sample)	someone_j@example.com

**Add or remove sample data**

Sample data gives you something to experiment with as you learn model-driven apps in Dynamics 365, and can help a customer envision what their model-driven app will look like in production.

If sample data isn't installed on your system, you may want to add it for demonstration and training purposes. Later, when you're ready, you can remove it.

1. Go to **Settings > Data Management**.
2. Click **Sample Data**. You'll see a message that tells you whether the sample data is currently installed.

3. Do one of the following:

- Click **Remove Sample Data**, and then click **Close**.
- Click **Install Sample Data**, and then click **Close**.

## Knowledge check

### Check your knowledge

Choose the best response for each of the questions below.

#### Multiple choice

*1.Your organization is undergoing a rebranding, and they'd like to change the user experience of their Dynamics 365 model-driven apps to reflect the new branding. The logo and most colors will stay the same, but they will be using a new accent color. How should you configure the system to satisfy this business requirement?*

- Clone the current theme, change the accent color, and publish the new theme.
- Create a new theme, select the new color as an accent color, and publish the new theme.
- Edit the site map to update the navigation color.

#### Multiple choice

*2.Your organization requires that salespeople can see Invoice records that belong to any salesperson, but can only edit Invoice records that they own. You need to configure the Salesperson security role to satisfy this requirement. What access levels should you configure for the Read and Write privileges on the Invoice entity?*

- Global (Organization) access on the Read privilege; Basic (User) access on the Write privilege
- Deep (Parent: Child Business Units) access on Read privilege; Local (Business Unit) access on Write privilege
- Basic (User) access on the Read privilege; Local (Business Unit) access on the Write privilege

#### Multiple choice

*3.What access level gives the greatest scope?*

- Business Unit
- Organization
- User

## Exercise - Create a new security role

Security is consistently one of the highest concerns of any business decision maker as they investigate implementing a cloud-based solution. Showing how security roles can tailor user access to their specific business need is a simple way to demonstrate the value of model-driven applications.

## Learning objectives

At the end of this exercise, you will have configured a new security role for Contoso Research.

## High-level steps

1. Access the Dynamics 365 model-driven app settings.
2. Create a new security role.
3. Configure privileges and access levels per the business requirement.
4. Configure settings for the new entity.

## Detailed steps

You need to show **Contoso Research** how Dynamics 365 security roles can be custom-made to fit their business model. One of their personnel roles is a **Survey researcher**. Survey researchers call **Contacts** and facilitate a survey over the phone.

Survey researchers will get assigned a certain number of Contact records at the beginning of a shift. Their job is to call the contact records in their queue, as assigned by a manager. A survey researcher will only call contacts that are in their business unit. To protect the privacy of the other contacts in the system, survey researchers should not be able to view any contact outside of their business unit. In some cases, contacts will request that they not be called again. Survey researchers should then be able to check a field called "Do not call" on the Contact record.

1. In **Power Apps Admin center**<sup>33</sup>, select the model-driven app environment.
2. Click on the **Dynamics 365 Administration Center** link in the **Details** tab to manage the environment in the Dynamics 365 Admin center.
3. Select the environment (with the same name of environment) and select **Open**.
4. If you see published apps and tiles, look in the upper-right corner and select the **Gear** icon. Then select **Advanced settings**.
5. Select **Security Roles**.
6. Select **New**.
7. From the security role designer, enter a role name in the Details tab.
8. Select a tab and search for the **Contact** entity.
9. Select the privileges based on your business requirement.
  - Select **Business Unit** access for **Read** on Contact.
  - Select **Business Unit** access for **Write** on Contact.
  - Select **None** for all other privileges.
10. Select **Save and Close**.

## Summary

In this module, you learned how to configure the security and settings of a model-driven app.

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<sup>33</sup> <https://admin.powerplatform.microsoft.com>

Configuring security is one of the most important tasks in creating a functional Power Platform or Dynamics 365 environment. The security model defines a user's experience in the application. Configuring and assigning security roles will dictate the data that a user can interact with. Configuring business units and teams will organize those users into their functional departments within an organization.

Security is one key part of the various settings that any Dynamics 365 user or implementor should be familiar with. In this module, we explored a few other important settings that can enrich a demonstration environment: themes and sample data. These are only a few of the changes you can make in the settings section of the Power Platform or your model-driven app. Explore the settings section to learn more.

## Resources

### Security in Dynamics 365 model-driven apps

- Explore detailed instructions on how to **assign security roles to users and configure a security role**<sup>34</sup>
- Read about **security best practices**<sup>35</sup> | **Microsoft Dataverse Security**<sup>36</sup> | **Security roles**<sup>37</sup> | **Business Units (Blog)**<sup>38</sup>
- Discover more instructions about **Access and Owner Teams**<sup>39</sup> | **Field Level Security**<sup>40</sup>
- Read up on **cloud security**<sup>41</sup>
- Read up on **cloud app security**<sup>42</sup>
- Check out the **cloud app security documentation**<sup>43</sup>

### Power Platform and Dynamics 365 settings\*\*

- Read about managing settings in the **Power Platform admin center**<sup>44</sup>

<sup>34</sup> <https://docs.microsoft.com/en-us/power-platform/admin/database-security>

<sup>35</sup> <https://docs.microsoft.com/en-us/dynamics365/customerengagement/on-premises/deploy/security-best-practices-for-microsoft-dynamics-365>

<sup>36</sup> <https://docs.microsoft.com/en-us/power-platform/admin/wp-security>

<sup>37</sup> <https://docs.microsoft.com/en-us/power-platform/admin/security-roles-privileges>

<sup>38</sup> <https://community.dynamics.com/crm/b/sandeepmishracrmblog/posts/business-units>

<sup>39</sup> <https://docs.microsoft.com/en-us/dynamics365/customerengagement/on-premises/developer/use-access-teams-owner-teams-collaborate-share-information>

<sup>40</sup> <https://docs.microsoft.com/en-us/dynamics365/customerengagement/on-premises/developer/security-dev/use-field-security-control-access-field-values>

<sup>41</sup> <https://azure.microsoft.com/product-categories/security/>

<sup>42</sup> <https://www.microsoft.com/microsoft-365/enterprise-mobility-security/cloud-app-security>

<sup>43</sup> <https://docs.microsoft.com/en-us/cloud-app-security/what-is-cloud-app-security>

<sup>44</sup> <https://docs.microsoft.com/en-us/power-platform/admin/admin-settings>

# Introduction to Microsoft Power Platform security and governance

## Introduction

Microsoft Power Platform provides organizations with the ability to automate business processes and create apps by using an intuitive drag-and-drop designer. The audience for Microsoft Power Platform is diverse and is often referred to as makers. Whether you are an information worker who is familiar with Microsoft Excel or a professional developer who is building an application in Node.js, Microsoft Power Platform can be used to improve productivity through a low code experience.

A powerful capability in Microsoft Power Platform is connectors. By using connectors, a maker can connect to a wide variety of applications and APIs without having to understand security schemes, such as OAuth, to establish a connection to these systems. Currently, more than 300 connectors are provided by Microsoft and third-party organizations.

With democratized access to building flows and apps, organizations might have concerns with makers connecting to unauthorized systems, which could result in the leaking of sensitive business information. For many organizations, balancing increased productivity comes with additional risks and exposure. However, Microsoft provides tools and guidance that organizations can use to find the right balance between digital transformation, allowing them to be more competitive in their industry without exposing sensitive data.

## Identify Microsoft Power Platform environments

Environments are an important consideration when you are trying to help secure and govern Power Apps and Power Automate usage. Environments act as a security container for apps and flows to run within. Every flow must be assigned to an environment. Every licensed user belongs to the default environment.

Additional environments can be provisioned where opt-in access is possible. A strategy that some organizations adopt includes **renaming the default environment<sup>45</sup>** to be called **Personal Productivity**, which implies permission to build flows that improve their own productivity.

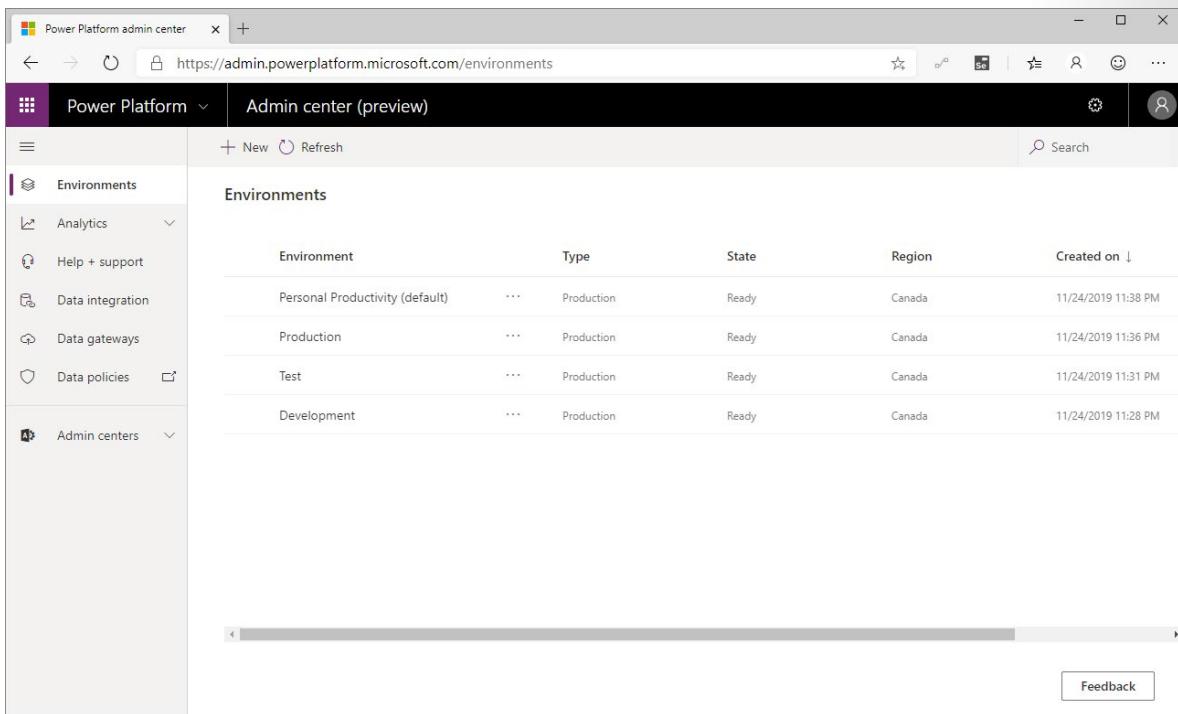
Organizations can subsequently create additional environments for development, testing, and production purposes. Using this strategy might also align flow creation with existing IT change management requirements.

By default, anyone can create environments, but administrators can also **control who can create and manage environments in Microsoft Power Platform Admin center<sup>46</sup>** and limit it to a set of administrators.

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<sup>45</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-administration#rename-your-environment>

<sup>46</sup> <https://docs.microsoft.com/en-us/power-platform/admin/control-environment-creation/>



The screenshot shows the Microsoft Power Platform Admin Center interface. The left sidebar has a 'Environments' section expanded, showing categories like Analytics, Help + support, Data integration, Data gateways, Data policies, and Admin centers. The main content area is titled 'Environments' and displays a table with four rows of environment data:

Environment	Type	State	Region	Created on
Personal Productivity (default)	Production	Ready	Canada	11/24/2019 11:38 PM
Production	Production	Ready	Canada	11/24/2019 11:36 PM
Test	Production	Ready	Canada	11/24/2019 11:31 PM

A 'New' button is located at the top left of the main content area.

When creating an environment, organizations can choose which region they want their environment to reside in. This approach is important because it allows organizations to store data closer to actual users and to maintain and meet compliance requirements for their geography. Regions already available to store data include Asia, Australia, Canada, Europe, France, India, Japan, South America, United Kingdom, United States, and US Government (GCC).

Regions are also important when it comes to Admin Analytics because the Microsoft Power Platform Analytics feature isolates analytics through environments. The telemetry that is generated in one region is not allowed to leave that region. For administrators to view analytics, they need to select an environment first before they can view telemetry.

## Data Loss Prevention policies

Data Loss Prevention (DLP) policies allow organizations to construct rules that permit and prevent connectors from communicating with each other within the same flow. Microsoft accomplishes this task by establishing two data groups: **Business data only** and **No business data allowed**. The intent of these two data groups is to put connectors that have the same data profile in the same data group. Grouping connectors means that they can communicate with each other within the same data group but are not able to communicate across data groups.

To illustrate this concept, consider the following scenario where connectors have been distributed across the two data groups. You want to build a flow that includes the Microsoft **Word Online**, **Approvals**, and **Power BI** connectors. Because all of these connectors belong to the **Business** data group, you can confidently create and run this flow.

Similarly, in the **Non-business** data group, you can combine the **Salesforce**, **Dropbox**, and **10to8 Appointment** connectors within the same flow because they all belong to the same data group. However, you cannot create a flow that includes the **SQL Server** connector and **Act!** connector because they belong to different data groups. If you want to create a flow that included these two connectors, you will need to move one of the connectors into the other data group.

The screenshot shows the 'DLP Policies > Edit Policy' screen in the Power Platform admin center. On the left, a navigation sidebar includes links for Environments, Analytics, Resources, Help + support, Data integration, Data (preview), Admin centers (selected), and Power BI. The main area is titled 'DLP Policies > Edit Policy' and shows a 'Policy name' of 'Test'. The 'Connectors' tab is selected. Below it, the 'Scope' and 'Review' tabs are visible. The 'Assign connectors' section has tabs for Business (0), Non-business (437) [Default], and Blocked (0). A search bar labeled 'Search connectors' is present. A table lists seven connectors: 10to8 Appointment Scheduling, Act!, Anumatics, Adobe Creative Cloud, Adobe PDF Tools, Adobe Sign, and Africa's Talking SMS. Each entry includes a preview icon, connector name, blockable status (Yes or No), class (Standard or Premium), publisher, and a 'Learn about' link. At the bottom are 'Back', 'Next', and 'Cancel' buttons.

Additionally, you can specify one data group to be the default data group. Select the data policy you want to make default and choose the **Edit policy** button at the top. To change the default data group, go to **Connectors** and choose the **Set default group** button in the upper-right corner.

The default data group is significant because it becomes the data group that all new connectors are added to. For example, if Microsoft deploys a new connector to the Power Automate service, that connector will be added to the default data group. This behavior is also true for custom connectors that are deployed to an environment.

DLP policies can belong to two different scopes: environment and tenant. An environment-scoped DLP policy only applies to that specific environment, whereas a tenant-scoped DLP policy applies to all environments in that tenant. When creating a new DLP policy, policy authors have a few options that they can choose from, including the ability to **Add all environments** (tenant), **Add multiple environments**, and **Exclude certain environments**.

When a DLP author selects **Add all environments**, this setting also ensures that new environments have this DLP policy applied.

Environments can have multiple DLP policies applied, which provides for more governance scenarios to be implemented. However, when multiple DLP policies have been implemented, the most restrictive policy is applied. DLP policy layering is discussed further in the **Planning** module.

Configuring DLP policies depends on an organization's design and cyber security principles. For some organizations, these principles allow for the mixing of business-related connectors with consumer-based services. Other organizations might choose to strictly prevent business-related connectors from connecting with consumer-based services. Organizations should begin by cataloging the business systems that exist within their organization and then creating DLP policies that align with that business mapping.

Organizations should also carefully evaluate which data group they would like to declare as their default data group. Regardless of which data group they designate, administrators should pay attention to new connectors that are being deployed into environments so they can place them into the appropriate data group.

## Microsoft Power Platform Center of Excellence Starter Kit

Microsoft Power Platform Center of Excellence (COE) Starter Kit is a set of apps, flows, a custom connector, and a Power BI dashboard that allows organizations to govern their Microsoft Power Platform environments. The tool is freely available for download on [GitHub<sup>47</sup>](#).

The Starter Kit is a great tool for organizations to increase the visibility of what their makers are doing in their tenant. Naturally, this tool immediately applies to two personas: Cyber Security analysts and Organizational Change Management (OCM) interests. Makers that are building applications and services that introduce risk to the organization should be monitored, but makers who are automating workloads within sanctioned systems and services should be empowered and encouraged to expand on their efforts.

The Starter Kit does have some prerequisites, including:

- A global tenant admin, Microsoft Power Platform Service admin, or Dynamics 365 service admin role is required to access the tenant resources.

<sup>47</sup> <https://github.com/microsoft/powerapps-tools/tree/master/Administration/CoEStarterKit/>

- A Power Apps premium license for accessing Microsoft Dataverse.
- An environment with Dataverse because the Starter Kit solution will need to store metadata about the apps and flows that are detected within an environment.
- Power BI Desktop to view the reports and visualizations that highlight app and flow use within the tenant.

Within the Starter Kit, administrators will discover the tools and features that are discussed in the following sections.

## DLP Strategy

By using the DLP Editor app, an administrator can explore existing DLP policies and evaluate the impact of moving a connector from one data group to another. If a change to a data group has an impact on an existing app, that will be highlighted in the **Affected Power Apps** list. Then, an administrator can send an email, through an in-app experience, to the owner of that application and warn them of the upcoming change.

This current, in-product DLP editor experience doesn't provide this type of *what-if* analysis, so we recommend that you use the DLP Strategy app that comes with the COE Starter Kit when making DLP changes. Using the DLP Strategy app will also help you understand the impact to existing apps when DLP changes are made and help you reduce the chance of unknowingly breaking someone's app.

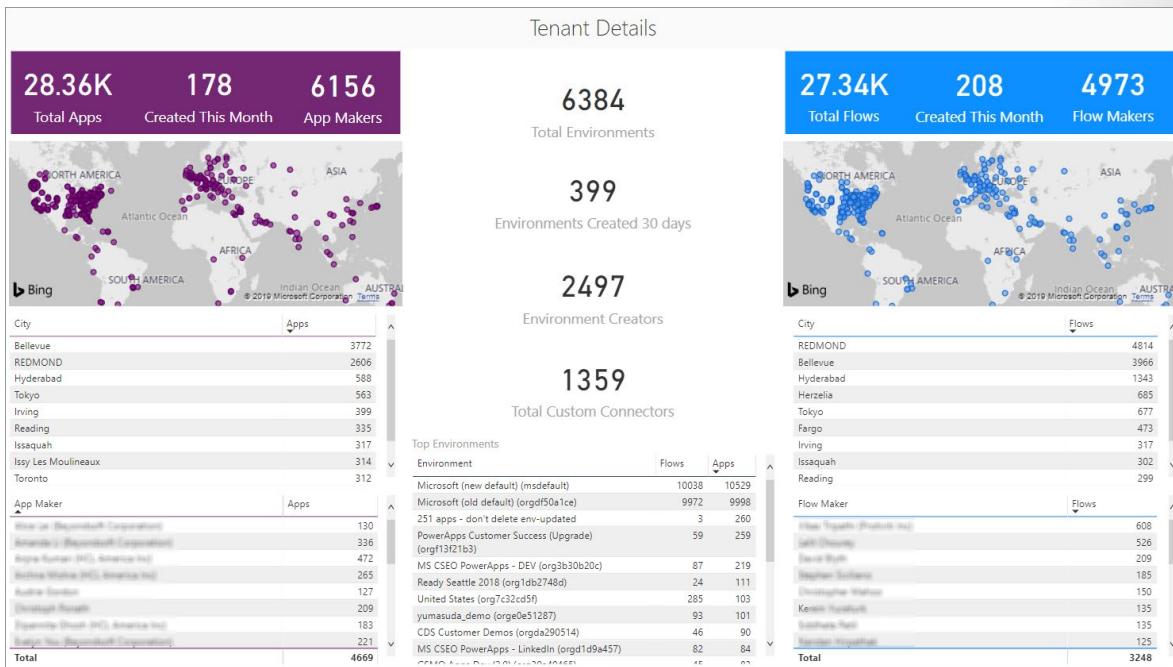
The screenshot shows the DLP Strategy app interface. At the top, it displays a 'Playground Policy' section with a search bar for APIs. Below this are two main sections: 'BUSINESS DATA ONLY (9)' and 'NON-BUSINESS DATA (252)'. The 'BUSINESS DATA ONLY' section contains icons for Common Data, Office 365 O365, Office 365 UU, Power platform, Flow manager, PowerApps for App Makers, PowerApps for Makers, Dynamics 365, and OneDrive for Business. The 'NON-BUSINESS DATA' section contains icons for various cloud services like Azure Blob, SQL Server, SharePoint, Salesforce, OneDrive, Dropbox, 10to8 App, Azure Content, Acumatica, Adobe Creative, Adobe Sign, Ahead, Ally, Amazon RDS, and Appfigures. To the right, there is a 'Affected PowerApps (1 of 12)' list showing 'App Creator Portal' under 'Contoso (Development) (cont...)'. Further down, there are sections for 'APP CREATOR PORTAL' (listing Megan Bowen as owner, modified on Apr 24 2019, with App ID cbc055d-3f6e-478f-a7e7-3aabf8aa0a...), 'Business data only' (listing PowerApps for App Makers, Office 365 Users, and Office 365 Outlook), and 'Non-business data' (listing SharePoint).

## Catalog tenant resources, visualize data in Power BI

While Admin Analytics, which is found in Microsoft Power Platform Admin center, provides some insight into the use of Power Apps and Power Automate, it does so within the context of an environment. This parameter makes developing a holistic picture of usage difficult. However, using the tools that are provided in the COE Starter Kit brings all these insights together by using Dataverse, a model-driven Power App, and a Power BI dashboard. These assets, plus the inclusion of flows that will sync data from Office 365 Security and Compliance logs and through Microsoft Power Platform management connectors into Dataverse entities, provide the greatest level of visibility for administrators.

The Power BI dashboard connects to Starter Kit Dataverse entities and contains tabs that provide the following reports:

- **Overview** - Includes the total number of apps and flows that have been created, including a breakdown based on the maker's location and the number of apps/flows that they have created.
- **Environments** - Highlights the number of environments that have been created and includes the type of environment (Default, Production, Sandbox, Trial), and then identifies the creators of the environments and when the environment was created.
- **Apps** - Provides insights into the usage of apps, including the number of sessions and users that the app has been shared with. This report also breaks down usage by department by pivoting data based on the department that has been specified inside of a user's Office 365 profile.
- **App detail** - Examines the specifics of the app, including the connection type and when the app was last published.
- **Flows** - Displays a flow creation trend that will break down when flows were created. This report will also pivot data based on the user's department and includes a breakdown of the flows that were created by environment.
- **Custom Connectors** - Lists all the custom connectors that exist within a tenant. This report also lists the users that created the connectors and then trends the month that they were created in.
- **Makers** - Identifies all the makers within the environment and identifies how many apps and flows they have built. A slicer exists that allows a consumer of this report to filter based on the maker's department.
- **Connections** - Displays the number of connections that have been established, by connector. This report provides great insight into the popularity of specific connectors within your tenant.



## App Audit

The main purpose of the Sample App Audit process is to demonstrate how an admin could identify overshared or often used resources and gather further information, like business justification and busi-

ness impact of an outage, for those apps. Having a platform that provides democratized access to technology is only useful if people don't create many redundant or low-value applications. Situations might also occur where people create temporary applications for proof-of-concept purposes. These apps can clutter an environment if they are not cleaned up. Within the COE Starter Kit, app makers can be prompted to attest their application to ensure that it addresses business justification requirements. If the application doesn't address these requirements, makers can have their application removed from the environment.

The screenshot shows the Microsoft Developer Compliance Center interface. At the top, there are navigation links for 'Community Channel' and 'Best Practices & Standards'. Below that is a search bar with the placeholder 'Search apps ...'. A filter button 'Only Shared Apps' is also present. The main area displays a grid of eight app cards:

- UPennApp**: Contoso (Development) (contosodev). University of Pennsylvania demo app. Status: Filled out app description (green dot).
- DLP Editor\_201906020857**: Contoso (Development) (contosodev). No Description. Status: Published within 60 days (yellow dot).
- App Creator Portal**: Contoso (Development) (contosodev). PowerApps - App Creator Portal, for you to manage documentation and communication of your apps. Status: Submitted Support Details (orange dot).
- ConferenceSQL\_UnOptimized\_RUN3**: Playground. No Description. Status: Published within 60 days (yellow dot).
- ConferenceSQL\_Optimized\_ed\_5**: Playground. No Description. Status: Published within 60 days (yellow dot).
- ConferenceSQL\_UnOptimized\_RUN1**: Playground. No Description. Status: Published within 60 days (yellow dot).
- DLP Editor**: Test Asia (testasia). No Description. Status: Published within 60 days (yellow dot).
- App Catalog**: Contoso (Development) (contosodev). No Description. Status: Published within 60 days (yellow dot).

The screenshot shows the 'App overview' page for the 'Heritage Diary working' app. At the top, there are navigation links: 'Back to dashboard', 'App Settings', 'Re-publish', 'Launch', and 'Email users'.

**App overview**

**DETAILS**

- Created: April 08, 2019
- Modified: June 05, 2019
- Last published: 73 days
- App Type: Canvas

**APP COMPLIANCE**

- Submitted Support Details (orange dot)
- Filled out app description (green dot)
- Published within 60 days (yellow dot)

**SUPPORT DETAILS**

Maker Requirement - Business Justification

Mitigation Plan Provided

**PERMISSIONS (3)**

	ROLE	TYPE
Meg	Owner	User
MOD Administrator	CanView	User
Diego Siciliani	CanView	User

**ATTACHMENTS**

There is nothing attached.

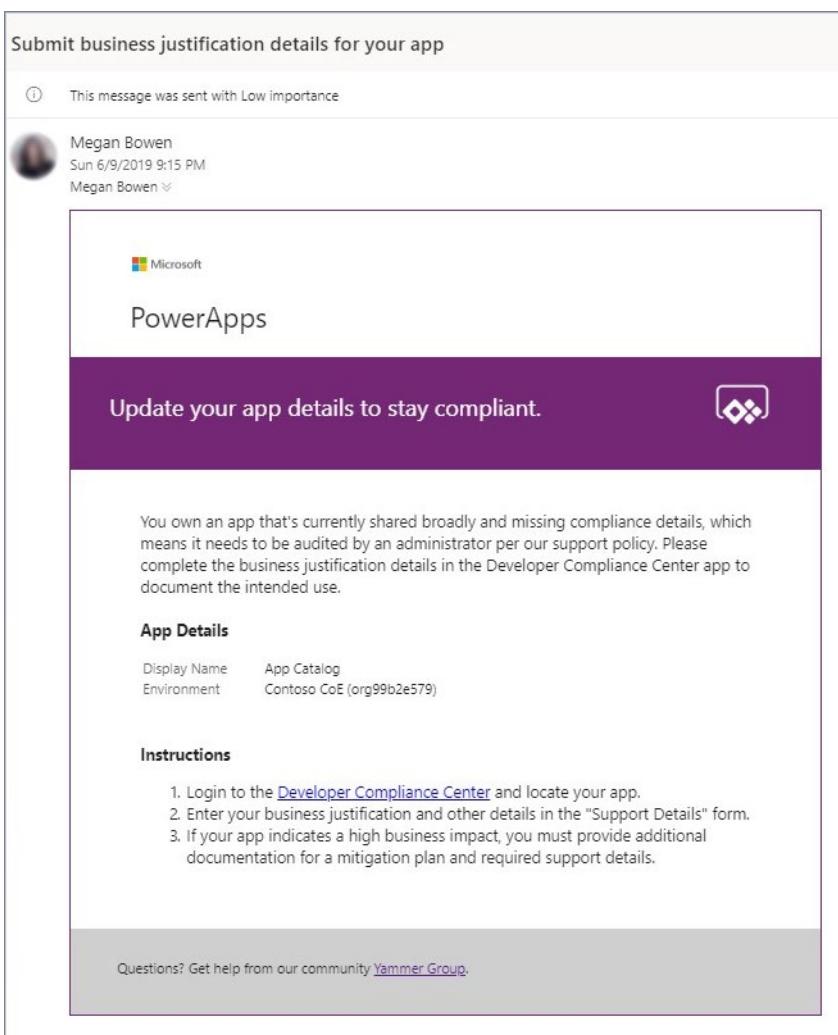
**Submit**

## App Catalog

The App Catalog application acts as a catalog that helps with discoverability of apps. Users can explore featured apps and browse apps by category. The app catalog can be a great entry point to launch apps for end users and makers can explore to see if an application already exists before they create another app that provides similar functionality. An Admin decides which apps are featured in the App Catalog by completing the **App Audit** process. After an app has been approved by the **App Audit** process, these apps can be featured in the app catalog.

## Set Owner

Administrating access to applications can be done by the **Owner** of the application. However, circumstances might occur where you want an administrator to provide access. By using the **Set Owner** app, you can allow for this situation by selecting an app, adding users, and then indicating whether they should be able to view the app or edit the app.



## Welcome email to new makers

Power Apps and Power Automate can be discovered virally within an organization's tenant through the Office 365 portal. Makers might be confused about whether they are allowed to use these tools or not.

Detecting when a maker has created their first app or flow and sending them some useful information to accelerate their journey will immediately imply that these tools are the ones that they are permitted to use. Now, they will have a list of resources that can ease their transition into using these tools.

The screenshot shows the Microsoft Power Platform Admin portal's 'New App Owner Centre'. On the left, there's a sidebar with icons for 'POCs (ippocs)', '(default) (orgf20e2623)', 'Wearsy CRM (Wearsy)', and 'AI Builder (org6819d83a)'. The 'AI Builder' item is highlighted with a grey background. The main area lists several apps with their icons, names, IDs, and owners:

App	ID	Owner
App Catalog	f2914192a-3835-474e-866a-b192eb71352f	Kent
DLP Editor	4b095e31-3098-4e22-8969-127d08a20cab	Kent
Set New App Owner	53731014-0205-4ba4-9b05-b4b3206e362e	Kent
Training In A Day Registration	c6303f5c-27ca-4021-a338-e8cdedb12017	Kent
Developer Compliance Center	efb66021-235e-45b7-a48c-fc85d74dde9	Kent
Training In A Day Management	f4f0b6c4-3f6a-4ca7-b96b-c64bba79f56a	Kent
COE Starter Kit - App Catalog	fdbed5d1-86e8-41c5-b383-aff222113c71	Kent

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Who can have access to the Power Apps and Power Automate default environment?

- Only users that have been manually added by an environment administrator
- Only users that have been manually added by a tenant administrator
- Every user within the tenant
- Every user within the tenant who has Power Apps according to the app plan

### Multiple choice

2. When modifying a Data Loss Prevention (DLP) policy, how can an administrator know if they are about to break an existing app?

- The new Microsoft Power Platform Admin portal provides an experience that will automatically detect if a pending change to a DLP policy will break existing apps.
- The DLP Strategy app, found within the Center of Excellence Starter Kit, includes functionality that will detect if a pending change to a DLP policy will break existing apps.
- Microsoft Power Platform management connectors will automatically detect these breaking changes and notify the administrator.
- There is no way to automatically detect whether a pending DLP policy change will impact existing apps.

## Multiple choice

3. Within Data Loss Prevention (DLP) policies, what is the behavior of the default data group?

- All new connectors that are introduced to an environment are placed in the default data group.
- Only new custom connectors are placed within the default data group when new custom connectors are added to an environment.
- Only new Microsoft connectors are placed within this data group when new Microsoft connectors are added to an environment.
- The default data group is only a guideline where new connectors should be placed when they are added to an environment.

## Summary

This module introduced many different Microsoft Power Platform concepts, including environments' Data Loss Prevention (DLP) policies, and reviewed many of the tools that are found in the Center of Excellence (COE) Starter Kit. All these features and tools are key to organizations governing their environments.

Because every organization has different governance needs, these tools can be used selectively to implement the level of governance that is required for your organization. In addition, while these tools do enable governance, they can also be used to identify makers who are building solutions that improve an organization's productivity.

When these makers have been identified, organizations should look to further empower them to extend their app development benefits to more parts of the organization.

For more information, see **Application Lifecycle Management<sup>48</sup>**.

---

<sup>48</sup> <https://youtu.be/xwCUJmrRI9E>

# Answers

## Multiple choice

1. When creating a Table, what are the two types of relationships you can create?

- One-to-many and One-to-one
- One-to-many and Many-to-many
- Many-to-one and Many-to-many
- One-to-one and Many-to-many

*Explanation*

*The two types of relationships you can create are One-to-many and Many-to-many.*

## Multiple choice

2. How many apps can use the same Table?

- 1
- 20
- 100
- Unlimited

*Explanation*

*The same table can be used by an unlimited number of apps.*

## Multiple choice

3. When deploying role-based security in the Microsoft Dataverse, which of the following products allows you to control access to tables for different users?

- SQL Server
- Azure portal
- Dynamics 365
- SharePoint

*Explanation*

*Dynamics 365 lets you control access to tables.*

## Multiple choice

1. Which table type is not a part of Dataverse?

- Standard
- Complex
- Open
- Restricted

*Explanation*

*Standard, Complex, and Restricted are all table types in Dataverse.*

**Multiple choice**

2.Which of the following statements about restricted tables is false?

- Customers can add restricted tables to Dataverse.
- Restricted tables store and maintain product-specific configuration data for Dynamics 365 products that are typically not used outside of the Dynamics application.
- The restricted table is accompanied by advanced logic that creates and maintains data in a specific way when it is used within a Dynamics 365 product.
- Restricted tables require a specific Dynamics 365 product license or the Dynamics 365 Plan.

*Explanation*

*Customers can't add restricted tables to Dataverse, so this is indeed false.*

**Multiple choice**

3.With a P2 license in Dataverse, you can use and access any table except which of the following?

- Standard tables
- Restricted tables
- Certain tables that contain complex logic
- Custom tables

*Explanation*

*With a P2 license, you can use and access standard, custom, and tables that contain complex logic.*

**Multiple choice**

1.Which column type displays a list of options where more than one can be selected?

- Multiline Text
- Choice
- Choices
- Image

*Explanation*

*Choices column type displays a list of options where more than one can be selected.*

**Multiple choice**

2.Which of the following statements is not true about alternate keys?

- Alternate keys make it easier for users to work with data in Microsoft Dataverse.
- Alternate keys improve database performance.
- The primary key of an table is a GUID and meaningless to users, so an alternate key can help identify the key.

*Explanation*

*Alternate keys improve database performance and make it easier to work with data.*

**Multiple choice**

3.How do you make a column that is required?

- Delete the column from the table.
- Create a new column.
- Edit the column and change the Required dropdown.
- Add a column to an table.

*Explanation*

*There is a Required dropdown for each column that you add to an table.*

**Multiple choice**

1.Microsoft Dataverse supports all of the following relationships except which one?

- Many-to-many
- One-to-one
- One-to-many
- Many-to-one

*Explanation*

*One-to-one relationships are not supported in Dataverse.*

**Multiple choice**

2.Which of the following statements about changing tables is true?

- You can change the tables in an existing many-to-many relationship.
- You cannot change the tables in a one-to-many relationship.
- You cannot change the tables in a many-to-many relationship.
- You cannot change the tables in a many-to-one relationship.

*Explanation*

*You cannot change the tables in a many-to-many relationship. You can only delete it.*

**Multiple choice**

3.Being able to relate two entities (relational design) is important for all of the following except which one?

- More efficient storage
- Better data accuracy
- Better Reporting
- Easier to design

*Explanation*

*It's important for more efficient storage, better data accuracy, and reporting.*

**Multiple choice**

1. When can you create a choice?
- When you edit an existing column
  - When you define a new column
  - When you delete an existing column

*Explanation*

*You can create a choice when you define a new column or in the choice module.*

**Multiple choice**

2. Which of the following can choices contain?
- Numbers, Images, or Text
  - Numbers or Text
  - Text only
  - Numbers only

*Explanation*

*Images cannot be a part of a choice.*

**Multiple choice**

3. What type of choice can only be used by the table and column that they are created against?
- Standard choices
  - General options sets
  - Local choices
  - Special choices

*Explanation*

*Local choices can only be used by the table and column that they are created against.*

**Multiple choice**

1. Which of the following is not a User Security role?
- Application Administrator
  - Delegate
  - Microsoft Dataverse User
  - System Customizer

*Explanation*

*Application Administrator is not a User Security role.*

**Multiple choice**

2.Which of the following statements is true about users?

- You can't add users to access data in Dataverse.
- Public users outside of your Azure Active Directory can access Dataverse data.
- You can enable anonymous access to any data in Dataverse.
- You can add users to access data in Dataverse from within your Azure Active Directory.

*Explanation*

*You can add user access to data in Dataverse from Azure Active Directory.*

**Multiple choice**

3.Adding a user to Dataverse automatically assigns that user to all the following roles except which one?

- Dataverse User
- Environment Maker
- System Customizer

*Explanation*

*A user is not added automatically to the System Customizer role.*

**Multiple choice**

1.Which administrative portal shows usage data?

- Power Apps Advanced Customization
- Solution Explorer
- Microsoft Power Platform Admin Portal
- Power Apps Admin Portal

*Explanation*

*Microsoft Power Platform Admin Portal shows usage data.*

**Multiple choice**

2.Which portal offers a quick way to add users and set permissions?

- Power Apps Advanced Customization
- Classic Administration Center (Solution Explorer)
- Microsoft Power Platform Admin Portal
- Power Apps Admin Portal

*Explanation*

*Power Apps Advanced Customization offers a quick way to add users and set permissions.*

**Multiple choice**

3.Which portal offers a quick way to manage environments and users?

- Power Apps Advanced Customization
- Classic Administration Center (Solution Explorer)
- Microsoft Power Platform Admin Portal

*Explanation*

*Microsoft Power Platform Admin Portal can be used to manage environments and users quickly.*

**Multiple choice**

1.Your organization is undergoing a rebranding, and they'd like to change the user experience of their Dynamics 365 model-driven apps to reflect the new branding. The logo and most colors will stay the same, but they will be using a new accent color. How should you configure the system to satisfy this business requirement?

- Clone the current theme, change the accent color, and publish the new theme.
- Create a new theme, select the new color as an accent color, and publish the new theme.
- Edit the site map to update the navigation color.

*Explanation*

*Correct. Cloning the current theme is the most efficient way to satisfy this business requirement.*

**Multiple choice**

2.Your organization requires that salespeople can see Invoice records that belong to any salesperson, but can only edit Invoice records that they own. You need to configure the Salesperson security role to satisfy this requirement. What access levels should you configure for the Read and Write privileges on the Invoice entity?

- Global (Organization) access on the Read privilege; Basic (User) access on the Write privilege
- Deep (Parent: Child Business Units) access on Read privilege; Local (Business Unit) access on Write privilege
- Basic (User) access on the Read privilege; Local (Business Unit) access on the Write privilege

*Explanation*

*Correct. This configuration would allow the Salesperson to see all Invoice records, but only edit their own Invoice records.*

**Multiple choice**

3.What access level gives the greatest scope?

- Business Unit
- Organization
- User

*Explanation*

*Correct. Organization is the greatest scope offering users the most access.*

**Multiple choice**

1. Who can have access to the Power Apps and Power Automate default environment?

- Only users that have been manually added by an environment administrator
- Only users that have been manually added by a tenant administrator
- Every user within the tenant
- Every user within the tenant who has Power Apps according to the app plan

*Explanation*

*Administrators cannot restrict access to the default environment. Otherwise, users are likely to create resources outside of the visibility of administrators, which will mean that admins will no longer have any visibility or control of those resources.*

**Multiple choice**

2. When modifying a Data Loss Prevention (DLP) policy, how can an administrator know if they are about to break an existing app?

- The new Microsoft Power Platform Admin portal provides an experience that will automatically detect if a pending change to a DLP policy will break existing apps.
- The DLP Strategy app, found within the Center of Excellence Starter Kit, includes functionality that will detect if a pending change to a DLP policy will break existing apps.
- Microsoft Power Platform management connectors will automatically detect these breaking changes and notify the administrator.
- There is no way to automatically detect whether a pending DLP policy change will impact existing apps.

*Explanation*

*Breaking an existing app due to a new DLP policy change will create a negative experience for app makers and users. However, using the DLP Strategy app can mitigate these issues by detecting changes before they are made. An experience also exists that allows the administrator to send an email within the app.*

**Multiple choice**

3. Within Data Loss Prevention (DLP) policies, what is the behavior of the default data group?

- All new connectors that are introduced to an environment are placed in the default data group.
- Only new custom connectors are placed within the default data group when new custom connectors are added to an environment.
- Only new Microsoft connectors are placed within this data group when new Microsoft connectors are added to an environment.
- The default data group is only a guideline where new connectors should be placed when they are added to an environment.

*Explanation*

*Default data groups are important to understand because all new connectors will be placed into this data group when they are added to an environment. This approach might mean that a connector that would ordinarily be deemed suitable for business purposes is positioned with non-business data connectors and could inadvertently leak data to a non-sanctioned application or service.*

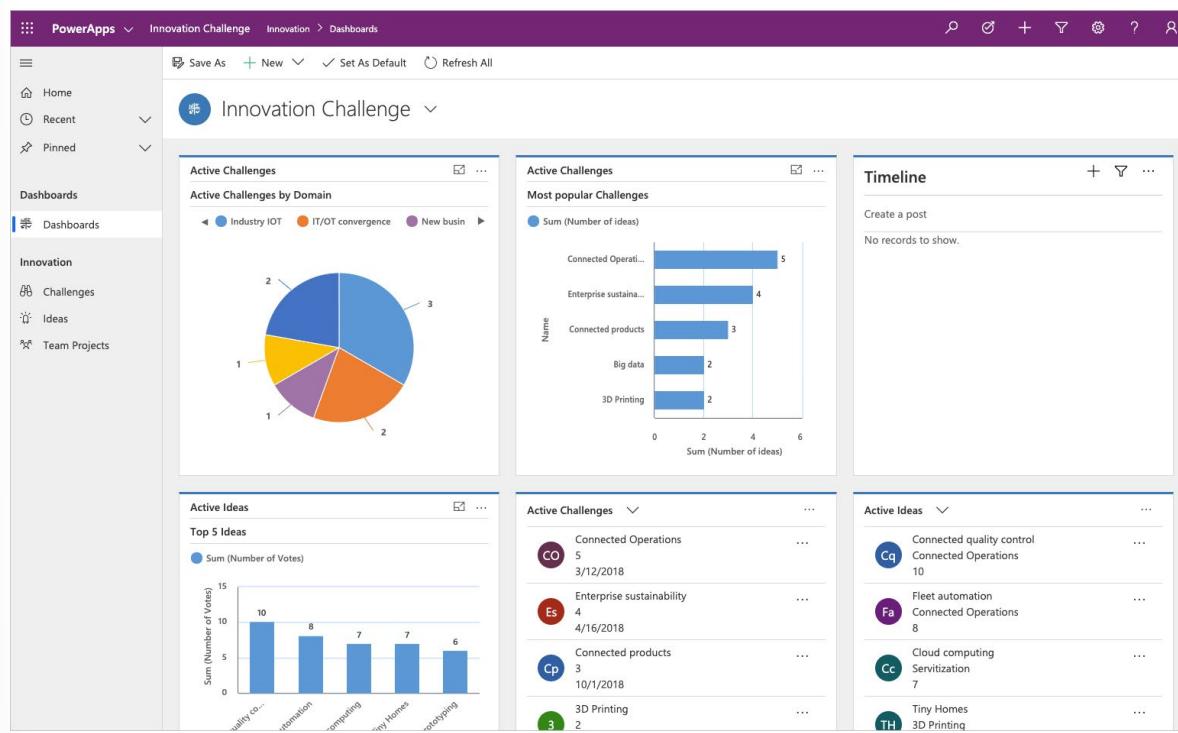
## Module 3 Make model-driven apps with Power Apps

### Get started with model-driven apps in Power Apps

#### Introducing model-driven apps

Model-driven app design is an approach that focuses on adding dashboards, forms, views, and charts to your apps. With little or no code, you can build apps that are simple or very complex.

In canvas apps, the app maker has total control over the app layout. In model-driven apps, on the other hand, much of the layout is determined by the components you add. The emphasis is more on quickly viewing your business data and making decisions instead of on intricate app design.



## The approach to making model-driven apps

Model-driven apps have three design phases:

1. Model your business data
2. Define your business processes
3. Build the app

## Model your business data

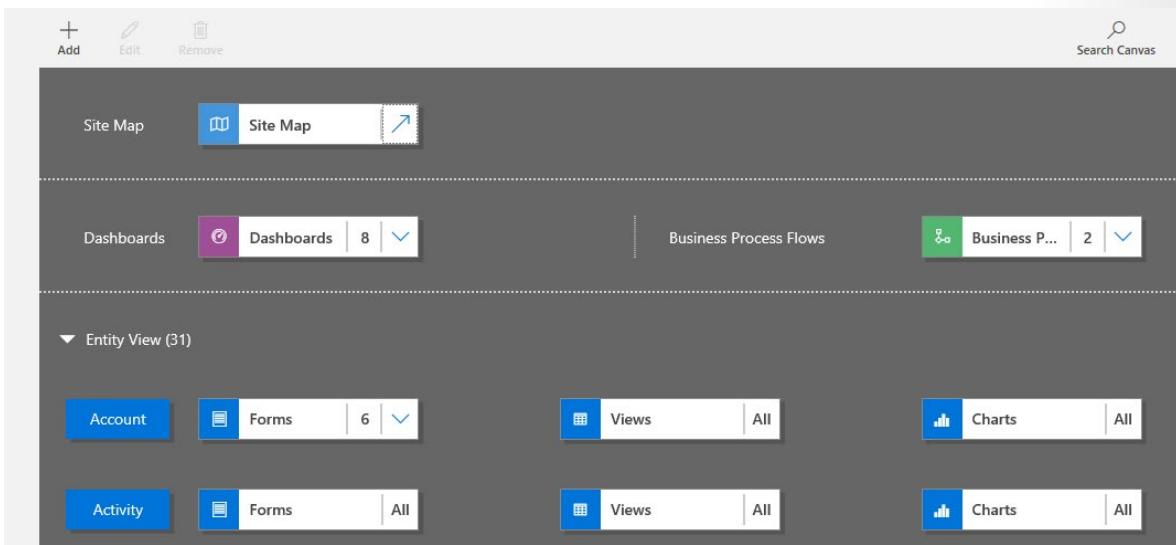
Model-driven design uses metadata-driven architecture so that designers can customize apps without writing code. To model business data, you determine what data the app will need and how that data will relate to other data. Metadata means *data about data* and it defines the structure of the data stored in Microsoft Dataverse.

## Define your business processes

Defining and enforcing consistent business processes is a key aspect of model-driven app design. Consistent processes help ensure that your app users can focus on their work and not worry about having to remember to perform a set of manual steps. Processes can be simple or complex, and they often change over time.

## Build the app

After modeling data and defining processes, you build your app by selecting and setting up the components you need in the App Designer.



## Building blocks of model-driven apps

A model-driven app consists of several components that you select by using the App Designer. The components and component properties become the metadata. Let's look more closely at these components.

### Data

The data components determine what data the app will be based upon.

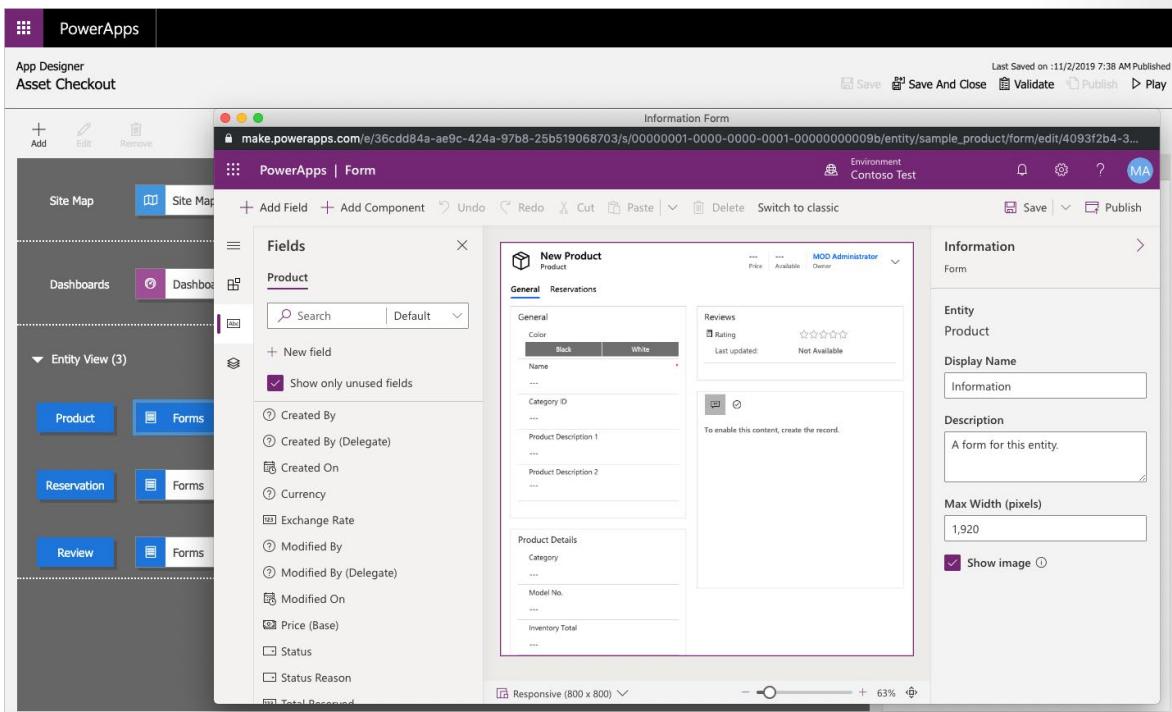
Component	Description	Designer
Table	Tables are items with properties that you track. Examples include contacts and accounts. Many standard tables are available. You can customize a non-system standard table (or production table). You can also create a custom table from scratch.	Table designer
Column	Columns are properties that are associated with a table and help define that table. A column is defined by a data type, which determines the type of data that can be entered or selected. Examples of data types include text, number, date and time, currency, and lookup (which creates a relationship with another table). Columns are typically used with forms, views, and searches.	Table designer

Relationship	Relationships define how tables can be related to each other. There are 1:N (one-to-many), N:1 (many-to-one), and N:N (many-to-many) relationships. For example, adding a lookup column to a table creates a new 1:N relationship between the two tables and lets you add that lookup column to a form.	Table designer
Choice column	This type of column shows a control that lets the user select among predefined options. Each option has a number value and a label. Choice columns can require either a single value or multiple values.	Table designer

## User interface

The user interface components determine how users will interact with the app.

Component	Description	Designer
App	Apps determine the app fundamentals, like components, properties, the client type, and the URL.	App designer
Site map	A site map specifies the navigation for your app.	Site map designer
Form	Forms include a set of data entry columns for a given table. This set of data entry columns matches the items that your organization tracks for the table. One example is a set of data entry columns where users enter relevant information to track a customer's previous orders together with specific requested reorder dates.	Form designer
View	Views define how a list of records for a specific table appears in your app. A view defines the columns shown, the width of each column, the sort behavior, and the default filters.	View designer



## Logic

The logic components determine what business processes, rules, and automation the app will have. Microsoft Power Apps makers use a designer that's specific to the type of process or rule.

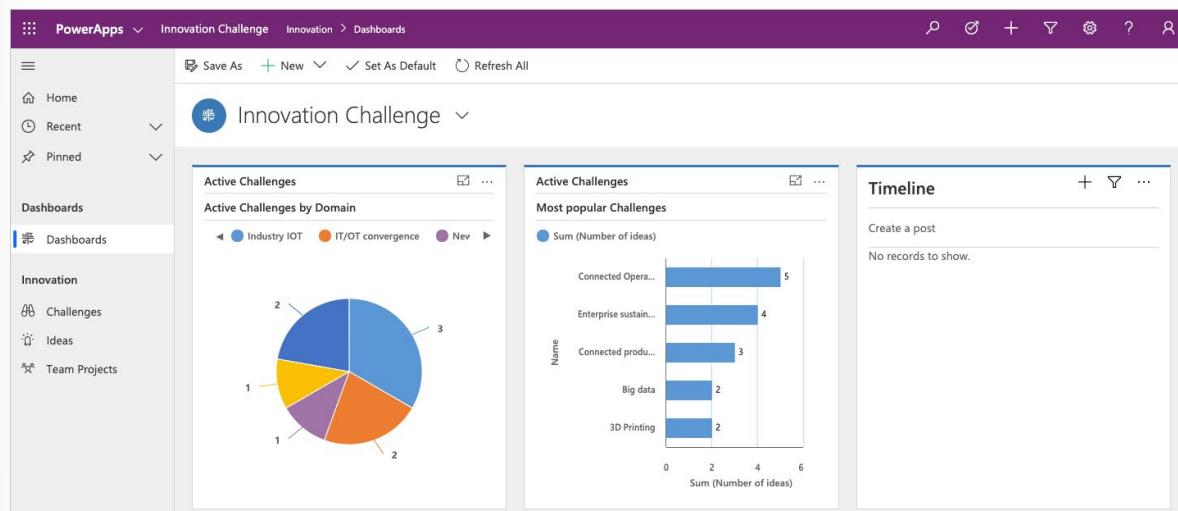
Type of logic	Description	Designer
Business process flow	Business process flows walk users through a standard business process. Use a business process flow if you want everyone to handle customer service requests the same way. Or you can use a business process flow to require staff to gain approval for an invoice before submitting an order.	Business process flow designer
Workflow	Workflows automate business processes without a user interface. Designers use workflows to initiate automation that doesn't require any user interaction.	Workflow designer
Actions	Actions are a type of process that lets you manually invoke actions, including custom actions, directly from a workflow.	Process designer

Business rule	Business rules apply rules or recommendation logic to a form to set column requirements, hide columns, validate data, and more. App designers use a simple interface to implement and maintain fast-changing and commonly used rules.	Business rule designer
Flows	Power Automate is a cloud-based service that lets you create automated workflows between apps and services to get notifications, sync files, collect data, and more.	Power Automate

## Visualization

The visualization components determine what type of data and reporting the app will show.

Component	Description	Designer
Chart	Charts are individual graphical visualizations that can appear in a view or a form or that can be added to a dashboard.	Chart designer
Dashboard	Dashboards show one or more graphical visualizations that provide an overview of actionable business data.	Dashboard designer
Embedded Microsoft Power BI	Power BI adds embedded Power BI tiles and dashboards to your app. Power BI is a cloud-based service that provides business intelligence (BI) insight.	A combination of chart designer, dashboard designer, and Power BI



## Advanced model-driven apps

Solution Explorer is used to make advanced model-driven apps. By using the navigation pane on the left side of the tool, you can navigate a hierarchy that consists of all app components.

To access the classic Solution Explorer, you must first select a Solution then select **Switch to classic**.

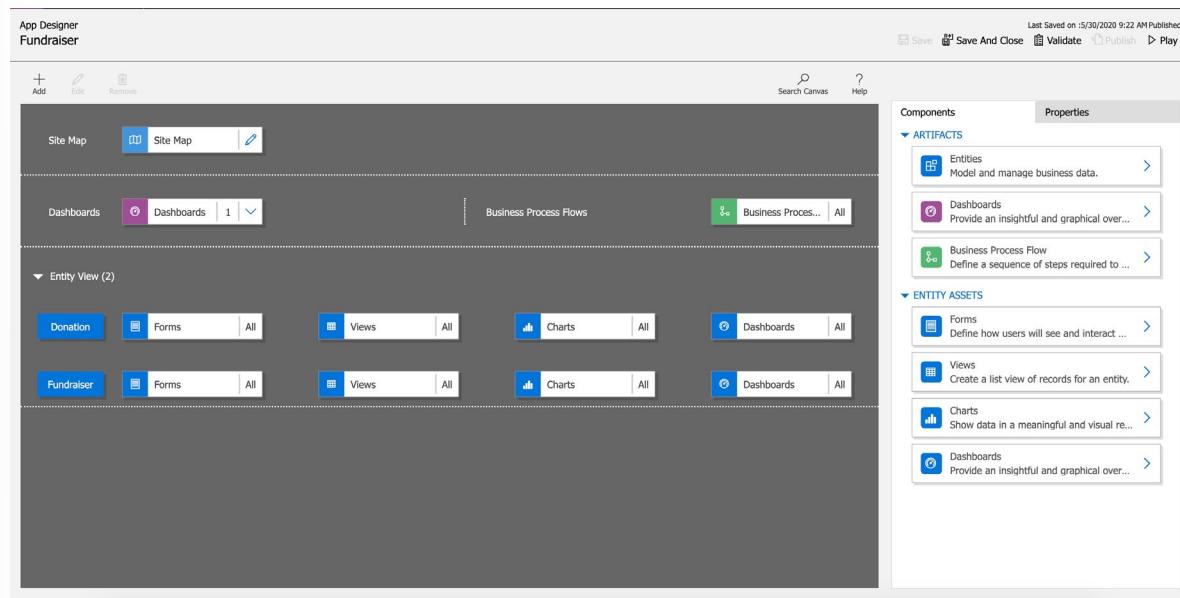
## Design model-driven apps

As an App Maker, before you begin building your Power Apps solution, it's recommended to go through a design process. When designing your Power Apps solution, there are several different factors to consider:

- Business requirements
- Data Model
- Business Logic
- Output

By going through a simple design process, you can flush out any minor issues before they become a larger problem once the app is in production.

Here is a quick look at the App Designer for an example Model-driven app called "Fundraiser."



When the app is put into Play Mode, it looks completely different.

## Understand the needs of the user

With Model-driven apps, the name says it all. Your primary design goal is to get your Microsoft Dataverse data model in order. With that in place, you can connect Power Apps, and a Model-driven app will be created for you from that model.

Model-driven apps are created using the App Designer. You will choose the tables, dashboards, Business Process flows, forms, and other components that you want to make available in your app, and then the app will be created for you. This means you will need to spend more time understanding what your user needs than how it is going to look.

## Business Requirements

The first step in the process is to understand your business requirements. Work with the app stakeholders to consider your security, accessibility, data, and design needs.

For security, the Dataverse has a robust security model. You will want to consider how securing your app's data affects your app and what security model best supports your business needs. There are lots of options available, including hierarchy security, row-level security, to name a few. You will need to confirm your data is secured to meet your needs, and then your app will honor that security. For more information, see **Security in Dataverse**<sup>1</sup>.

During this process, you will also want to identify any government regulations or authentication/authorization requirements (if applicable). You may want to implement multi-factor authentication but will need to think about how this will affect users connecting to your application. You don't necessarily have to have all the answers to your questions here; you just want to flush out all of the requirements.

Finally, does your app need to be available when the user is disconnected from the internet? This is called Offline Mode and is supported by the Dataverse and Model-driven apps when using iOS or Android clients. It does require additional design considerations. For more information, see **Set up mobile offline synchronization**<sup>2</sup>.

## Data Model

As you begin the data modeling process, there are a couple of important questions to ask yourself:

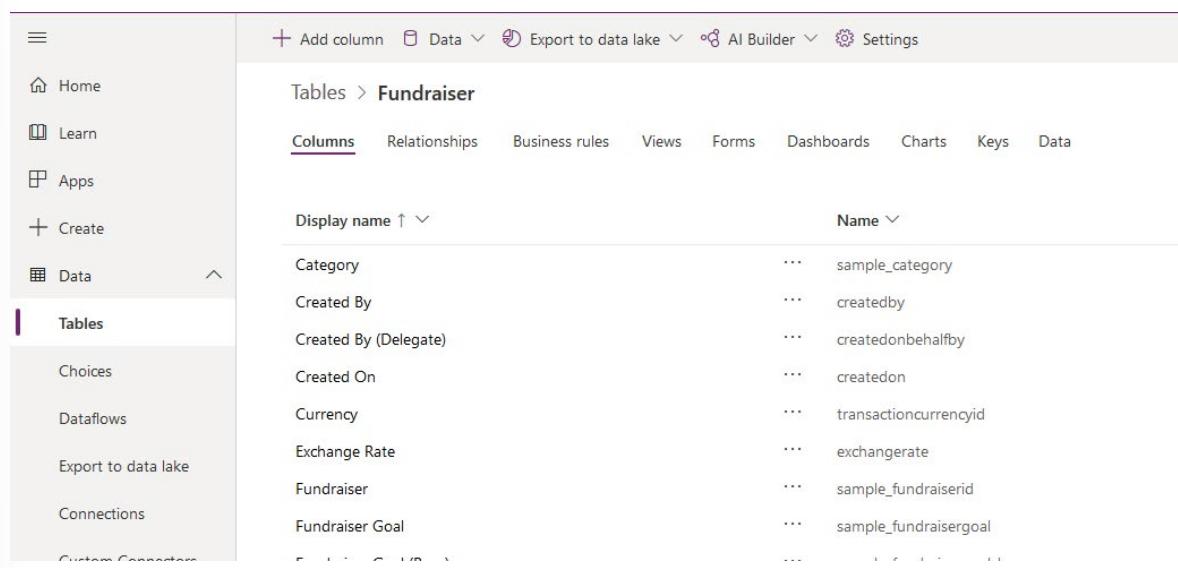
- What type of data will your solution be storing and or collecting?
- How will this data relate or coincide with the other data you are working with?

These questions are important when designing a model-driven application because of how model-driven applications function. Remember, model-driven applications use a metadata-driven architecture. This means a large portion of the model-driven app is based on how your data is modeled, and there is no need to write custom code to alter the app design. To expand on this a little further, when thinking about Metadata this simply means "data about data" and this data defines the structure stored in the system.

You can view the app metadata by reviewing the table in the Dataverse.

<sup>1</sup> <https://docs.microsoft.com/en-us/power-platform/admin/wp-security/>

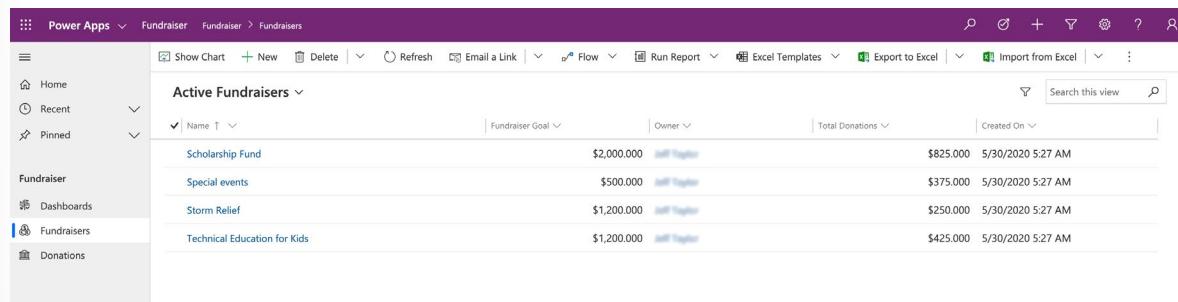
<sup>2</sup> <https://docs.microsoft.com/en-us/dynamics365/mobile-app/setup-mobile-offline-for-admin/>



The screenshot shows the Microsoft Power Apps Studio interface. On the left, there's a navigation sidebar with options like Home, Learn, Apps, Create, Data, Tables, Choices, Dataflows, Export to data lake, Connections, and Custom Connectors. Under Tables, 'Fundraiser' is selected. The main area displays the 'Fundraiser' table with columns listed. The columns are:

Display name ↑	Name ↓
Category	sample_category
Created By	createdby
Created By (Delegate)	createdonbehalfby
Created On	createdon
Currency	transactioncurrencyid
Exchange Rate	exchangerate
Fundraiser	sample_fundraiserid
Fundraiser Goal	sample_fundraisergoal

You can also view the app metadata by putting the app in Play mode.



The screenshot shows the 'Active Fundraisers' view in Play mode. The left sidebar shows pinned items: Home, Recent, Fundraiser, Dashboards, Fundraisers (which is selected), and Donations. The main area displays a table of active fundraisers with the following data:

Name ↑	Fundraiser Goal	Owner	Total Donations	Created On
Scholarship Fund	\$2,000.00	Jeff Taylor	\$825.000	5/30/2020 5:27 AM
Special events	\$500.00	Jeff Taylor	\$375.000	5/30/2020 5:27 AM
Storm Relief	\$1,200.00	Jeff Taylor	\$250.000	5/30/2020 5:27 AM
Technical Education for Kids	\$1,200.00	Jeff Taylor	\$425.000	5/30/2020 5:27 AM

In the example above, for the Fundraiser table, there are several pieces of metadata being collected, such as:

- Name
- Fundraiser Goal
- Owner
- Total Donations
- Created On

Each solution you develop and deploy will have its own set of metadata to collect. This basic understanding of metadata is important as you continue the design process and modeling your app data.

As you think about your data model also think about column types. When adding columns to your table in the Dataverse, the column type you choose will determine how users enter and view that in your Model-driven app. Option sets show as dropdowns, currency shows with currency symbols, while decimal numbers don't. These little changes in the table can have a profound effect on how your user experiences your app.

**Note:** If a column type needs to be changed to a different column type, (i.e. text column to an choice), then you will need to delete that column and recreate with the correct column type. This will cause you to lose any data associated with that column.

Display name ↑	Name	Data type	Type	Customizable	Required	Searchable
Category	sample_category	Choice	Managed	✓	Optional	✓
Created By	createdby	Lookup	Standard	✓	Optional	✓
Created By (Delegate)	createdonbehalfby	Lookup	Standard	✓	Optional	✓
Created On	createdon	Date and Time	Standard	✓	Optional	✓
Currency	transactioncurrencyid	Lookup	Custom	✓	Optional	✓
Exchange Rate	exchangerate	Decimal Number	Custom	✓	Optional	✓
Fundraiser	sample_fundraiserid	Unique Identifier	Standard	✓	Required	✓
Fundraiser Goal	sample_fundraisergoal	Currency	Managed	✓	Optional	✓
Fundraiser Goal (Base)	sample_fundraisergoal_base	Currency	Managed	✓	Optional	✓
Import Sequence Number	importsequencenumber	Whole Number	Standard	✓	Optional	✓
Modified By	modifiedby	Lookup	Standard	✓	Optional	✓
Modified By (Delegate)	modifiedonbehalfby	Lookup	Standard	✓	Optional	✓
Modified On	modifiedon	Date and Time	Standard	✓	Optional	✓
Name <small>Primary Name Column</small>	sample_name	Text	Managed	✓	Required	✓
Owner	ownerid	Owner	Standard	✓	Required	✓
Owning Business Unit	owningbusinessunit	Lookup	Standard	✓	Optional	✓
Owning Team	owningteam	Lookup	Standard	✓	Optional	✓
Owning User	owninguser	Lookup	Standard	✓	Optional	✓

## User Interface (UI) and User Experience (UX)

When building a Model-driven app, most of the UI and UX are predetermined for you. You define the data model to build from, and then Power Apps determines the controls used in the app. You can influence these controls by determining what table assets you include. You define in the App Designer What Forms, Views, Charts, and Dashboards are used in the app. You also control the navigation options via the Site Map. As you are planning your app, determine which components are needed in the app design, and create them before building your app.

To continue building off of the example we've been using throughout this module, below is a simple Model-driven Form, which captures various pieces of information for creating a New Fundraiser.

Here is an example of what the New Fundraiser form looks like when editing from the App Designer.

## Business Logic

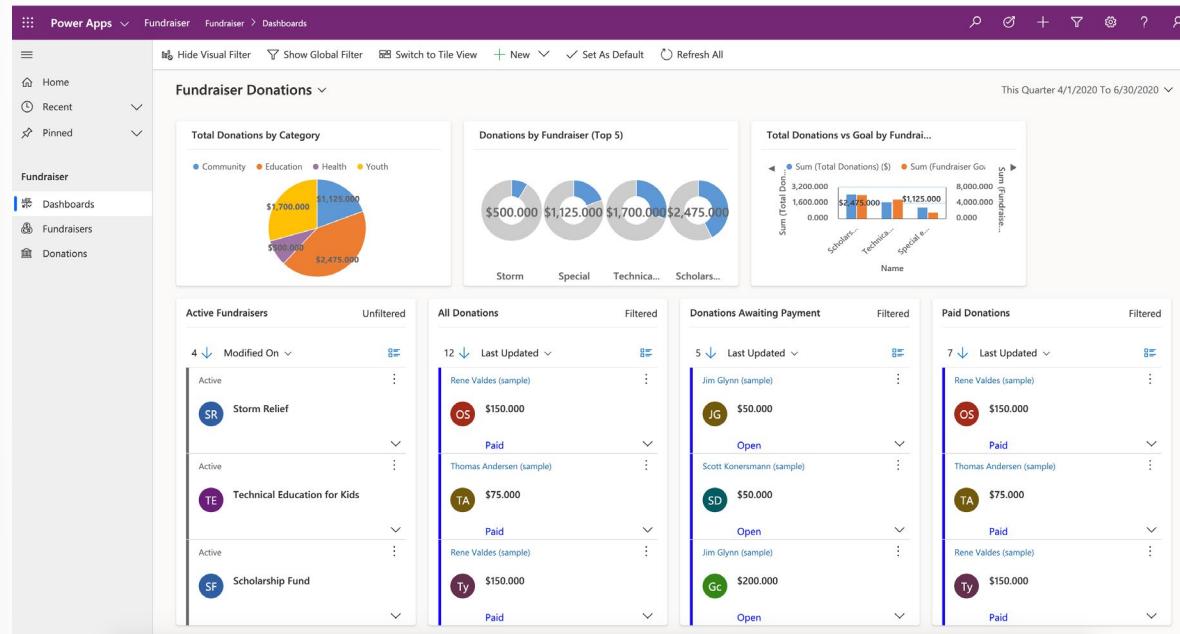
When incorporating business logic in your app, there are two primary options available. You can set **Business Rules** on your Dataverse tables or you can build **Business Process Flows**.

With **Business Rules**, you will define behaviors at the data layer. This is great for changing when a column is required, setting a default value, or even showing or hiding a column based on a criteria. An example could be a table for tracking expenses. You could have a column for type of travel and then build a business rule that says if they choose automobile then the mileage column is required, else it is optional. This gives you great power to make sure you maintain data consistency in all scenarios.

**Business Process Flows** are used to guide users through using your app. These workflows can provide visuals on next steps based on the status of the data and facilitate other actions that you want to occur as the user uses the app. Business Process Flows let you bring automation to your app and make it more of a guided experience than just a place to enter data.

## Output

A common output need for apps is to visualize the data. For this requirement, you can implement Dashboards with custom filters and visual graphics to tie all of this data together right in your app. When creating your Dashboards, make sure it's simple for your users to consume without overwhelming them with all the data. Provide high-level snapshots of your data and allow them to use filters to dive deeper into the data if needed.



## Additional third-party solutions and app accelerators

It is also important to know about the different App accelerators and third-party solutions available to you. Depending on the industry you are in, Health, Financial, Banking, Education, Non- Profit, Automotive, or Media, Microsoft has released a number of accelerators or foundational components to assist you with quickly standing up your solution. For more information, see [Industry accelerators overview<sup>3</sup>](#).

For more information, see [Planning a Power Apps project<sup>4</sup>](#).

<sup>3</sup> <https://docs.microsoft.com/en-us/common-data-model/industry-accelerators?azureportal=true>

<sup>4</sup> <https://docs.microsoft.com/en-us/powerapps/guidance/planning/introduction/>

## Incorporate business process flows

You can help ensure that people enter data consistently and follow the same steps every time they work with a customer by creating a business process flow.

For example, you might want to create a business process flow to have everyone handle customer service requests the same way, or to require that people get approval for an invoice before submitting an order. Business process flows use the same underlying technology as other processes, but the capabilities that they provide are very different from other features that use processes. To learn how to create or edit a business process flow, see [Create a business process flow<sup>5</sup>](#)

## Use business process flows

Why should you use business process flows? Business process flows provide a guide for people to get work done. They provide a streamlined user experience that leads people through the processes their organization has defined for interactions that need to be advanced to a conclusion of some kind. This user experience can be tailored so that people with different security roles can have an experience that best suits the work they do.

You should use business process flows to define a set of steps for people to follow to take them to a desired outcome. These steps provide a visual indicator that tells people where they are in the business process.

Business process flows reduce the need for training because new users don't have to focus on which table they should be using. They can let the process guide them. You can configure business process flows to support common sales methodologies that can help your sales groups achieve better results.

For service groups, business process flows can help new staff get up to speed more quickly and avoid mistakes that could result in unsatisfied customers.

## System business process flows

The following business process flows can be found in Power Automate. To understand how business process flows work, review these system business process flows:

- Lead to Opportunity Sales Process
- Opportunity Sales Process
- Phone to Case Process

## Multiple tables in business process flows

You can use a business process flow for a single table or to span multiple tables. For example, you may have a process that begins with an opportunity, then continues to a quote, an order, and then an invoice, before finally returning to close the opportunity.

You can design business process flows that tie together the rows for up to five different tables into a single process so that people using the app can focus on the flow of their process rather than on which table they are working in. This way, they can easily navigate between related table rows.

<sup>5</sup> <https://docs.microsoft.com/en-us/power-automate/create-business-process-flow/>

## Multiple business process flows are available per table

Not every user in an organization may follow the same process and different conditions may require that a different process be applied. You can have up to 10 active business process flows per table to provide appropriate processes for different situations.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *When building model-driven apps, which designer is used to define the navigation of your app?*

- App designer
- View designer
- Site map designer
- Dashboard designer

### Multiple choice

2. *If you wanted to create a standard procedure or process for handling service requests what type of logic would be best to implement?*

- Business process flow
- Business rule
- Workflow
- Flow

### Multiple choice

3. *When sharing a model-driven app, which of the following statements is true?*

- Users just need to be added to a predefined security role.
- Users just need to be added to a custom security role.
- Model-driven apps do not need to be shared, they are accessible to anyone with the app link.
- Users need to be added to a predefined or custom security role and then you also need to assign one or more security roles to the app.

## Summary

Congratulations on creating your first model-driven app!

Defining and enforcing consistent business processes is a key aspect of model-driven app design. Consistent processes help ensure that your app users can focus on their work and not have to remember to perform a set of manual steps.

Let's review what you've learned:

- Model-driven app design is an approach that focuses on quickly adding components to apps. These components include dashboards, forms, views, and charts.
- Little or no code is required to build model-driven apps.
- Model-driven design uses metadata-driven architecture so that designers can customize their apps.
- The best way to get started building model-driven apps is to use sample apps and data; then customize the apps.

For more information, see **Application Lifecycle Management<sup>6</sup>**.

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<sup>6</sup> <https://youtu.be/xwCUJmrRI9E>

# Configure forms, charts, and dashboards in model driven apps

## Forms overview

This video provides an overview of a number of different types of forms available in model driven applications.



<https://www.microsoft.com/videoplayer/embed/RWtNd8>

## Form elements

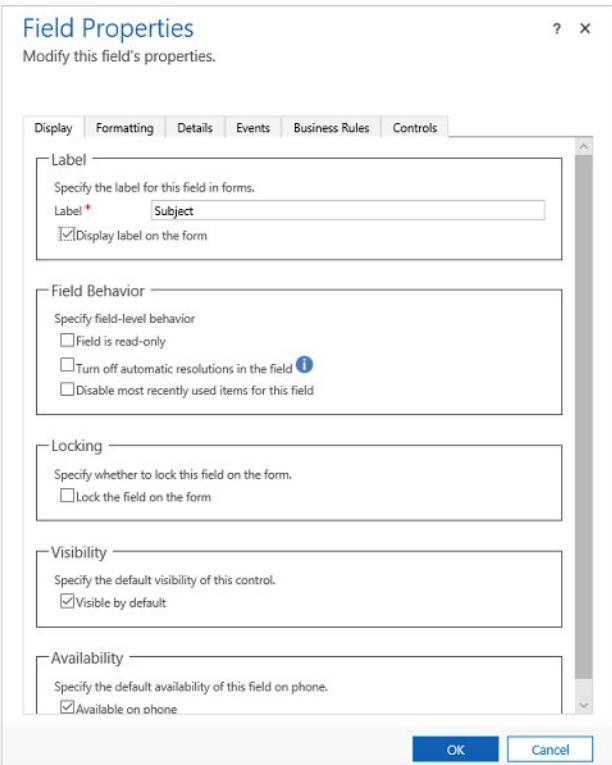
Model-driven forms are how detailed data for a row is presented to the user during editing and viewing. Forms provide a structured way to represent the data when it is rendered for interaction with the user. Forms abstract the form creator from the exact rendering specifics required to transform the form definition you create for the user's device size and capabilities. However, when you lay out the form using some knowledge of the current form rendering engine it will help you make more usable forms. Unified Interface is the current name of the framework that renders the form definitions for the user. When editing forms, the changes will not be visible to users until the form is saved and also published.

Forms are organized into header, body and footer, each capable of containing form elements like columns. The body of the form is further structured with areas called tabs that contain sections. Tabs and sections can be configured to support columns of form elements giving further structure to the content. The first tab on a form is the most important and should contain the priority data the user should see. While you could configure many tabs, keeping it to a smaller number with logical grouping of data can make a more usable experience because the user is not constantly tabbing around to find things.

## Standard column Controls

The most common task you will perform when editing a form is placing column controls on the form. A column can be added to the form multiple times if needed, the value shown will be the same for each occurrence. Each control you place on the form you can control the label shown, and other properties like visibility and read only. Without special configuration, a column will render with a control automatically selected by the runtime that is appropriate for the data type of the column. For example, an Option Set column will show the data in a drop-down list.

The following shows an example of the column properties that can be edited on each column control.



Depending on the column type, the column might offer other settings that can be changed. For example, a Lookup column will allow you to set the default view and other view-related options.

## Custom Controls

Custom controls let you transform columns that traditionally contain text into visualizations. Similarly, you can use custom controls to transform datasets, such as a view, to display in a more visual rendering rather than a list of rows. Custom controls can appear as visualizations on forms, dashboards, views, and homepage grids. You can set one type of custom control to appear in the web browser client while having a different custom control appear in the phone or tablet mobile apps. For example, you could use a number input custom control for a column in web browser clients and a slider custom control for the phone app. After the customization is published, users can fully interact with the control to change the value, such as by sliding the control when using the linear slider custom control. Changes are automatically saved when the form is closed just as they are when the user changes a traditional column on a form.

The following is an example showing on the Controls tab on column properties how you can configure a custom control.

## Field Properties

? X

Modify this field's properties.

Display    Formatting    Details    Events    Business Rules    Controls

Control	Web	Phone	Tablet
Text Box (default)	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
LinkedIn Sales Navigator Lead (member pro...)	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

[Add Control...](#)

The data type of the column determines what custom controls are available. Examples of custom controls include:

### Choices

#### Purchase Process



### Flip switch

#### Marketing Materials



### Linear slider

#### Annual Revenue

520000



### Radial knob

### Probability



### Star rating

#### Rating



### Number input

**Annual Revenue**

-\$1,000,000.00+

## Specialized Controls

In addition to column related data, you can also configure many specialized controls for use on the form. These controls can provide a unique view of data or access to a service like mapping. A Reference panel is a specialized section that can be added to main forms that offers interaction with related data in the context of the hosting table row. Subgrids display a list of rows or charts. The Quick View control displays data from a row that is selected in a lookup on the form - for example, on the account form you might want to display all the details of the primary contact inline on the Account form. More generically, adding iFrames to a form will integrate content from another website within a form.

## Show or hide form elements

Several types of form elements have the option to be shown or hidden by default. Tabs, sections, columns, iFrames, and web resources all provide this option. Using form scripts or business rules, the visibility of these elements can be controlled to create a dynamic form to provide a user interface that adapts to conditions in the form.

Rather than designing forms that depend on scripts to control visibility of options, consider whether a business rule, or switching to a different form, may be better suited to meet your requirements. If you do use scripts, make sure that any element that might be hidden is hidden by default. Only show it with

scripts when your logic calls for it. This way it will not be displayed in presentations that do not support scripts.

## Form event handlers

Form event handlers allow configuring developer logic that runs when the user interacts with the form.

Form event handlers for forms can be configured for the following areas in a form:

Elements	Event	Description
Form	OnLoad	Occurs when the form loads.
Form	OnSave	Occurs when data is saved.
Tab	TabStateChange	Occurs when the tab is expanded or collapsed.
Column	OnChange	Occurs when data in the column changes and the control loses focus.
iFrame	OnReadyStateComplete	Occurs when the content of an iFrame loads.

An event handler consists of a reference to a JavaScript web resource and a function defined within that web resource that will execute when the event occurs. Each element can have up to 50 separate event handlers configured.

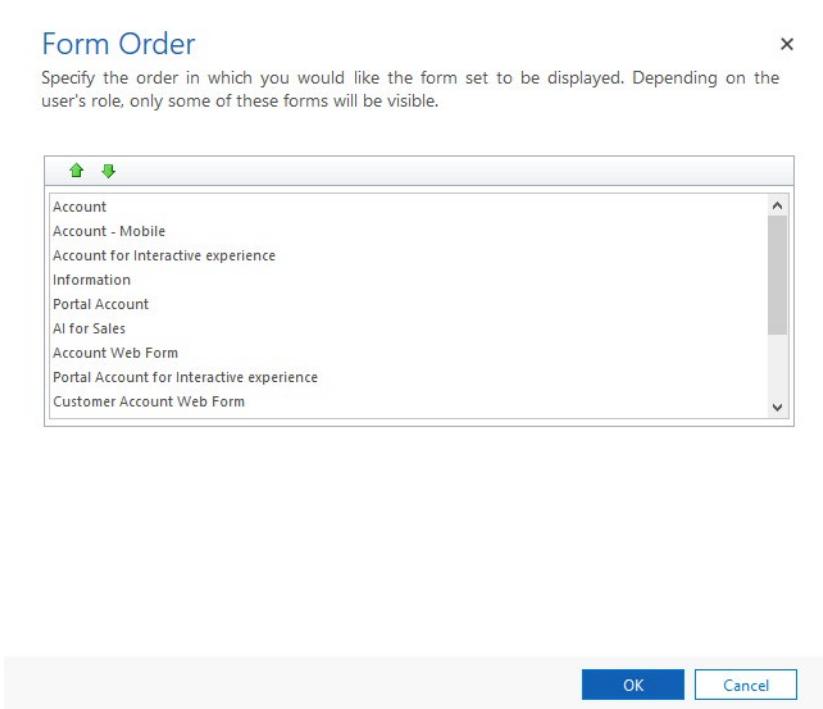
Most of the time developers create the event handlers; however, you might want to review what is configured on a form.

## Configure multiple forms

Users of model driven applications will encounter many forms in their user experience, and will even encounter different forms for the same table depending on their role, job tasks and desired outcomes.

You can set form order when using multiple forms. This will define the order in which a user sees the available forms, within the allowed forms for their security roles.

**Note:** You can create more than one Quick Create form for a given table, but only the first one in order will be available for end users.



## Access to forms

When users need to access common tables for different roles, it might be useful to have other forms available to tailor the user experience for that particular set of users. You can assign a security role (or collection of security roles) to control the access to the form. For example, you may have a set of users that are focused on sales and have had customizations to the Contact row such as the addition of LinkedIn Sales Navigator widgets. For a non-sales user this would make for an undesirable experience, with loads of unnecessary blank areas on the Contact form. You could copy the main contact row and then add or remove the components to the copy, and then assign security roles to each of the forms.

**Note:** Controlling user access to forms is not necessarily a secure means to prevent access to data. Sometimes users have other ways to interact with data such as advanced find or background automation.

## Form types and behaviors

- Main - Main forms are the primary user interface where people view and interact with their data. Main forms provide the widest range of options and are available for model-driven apps, the exception being Dynamics 365 for phones. One of the main design objectives for main forms is that you design them once and deploy them everywhere. The same main form you design for a model-driven app or the Dynamics 365 customer engagement apps web application, is also used in Dynamics 365 for Outlook and Dynamics 365 for tablets. The advantage to this approach is that you don't have to integrate changes into multiple forms. AutoSave is the default behavior on main forms but can be disabled by administrators.
- Quick create - With quick create forms, your app can have a streamlined data entry experience with full support for logic defined by form scripts and business rules. In Dynamics 365, quick create forms appear when you select the Create button in the navigation bar or when you choose + New when creating a new row from a lookup or subgrid. Dynamics 365 customer engagement apps mobile uses quick create forms for creating new rows. If a table already has a quick create form configured for it,

the mobile apps use that form. If a table doesn't have a configured quick create form, Dynamics 365 generates a quick create form for creating rows in the mobile apps based on the main form definition.

**Note:** The table definition must allow for Quick Create before you will be able to configure a Quick Create form. This setting is managed along with other Data Services for the table.

- Quick view - A quick view form can be added to another form as a quick view control. It provides a template to view information about a related table row within a form for another table row. This means your app users do not need to navigate to a different row to see the information needed to do their work. Quick view controls are associated with a lookup column that is included in a form. If the lookup column value is not set, the quick view control will not be visible. Data in quick view controls cannot be edited and quick view forms do not support form scripts.
- Card - A card form is used in interactive dashboards and placed on forms of related tables. It is configured to show key columns at a glance in the table feed. There are several options available to configure including color coding based on criteria such as row status.

## Miscellaneous form details

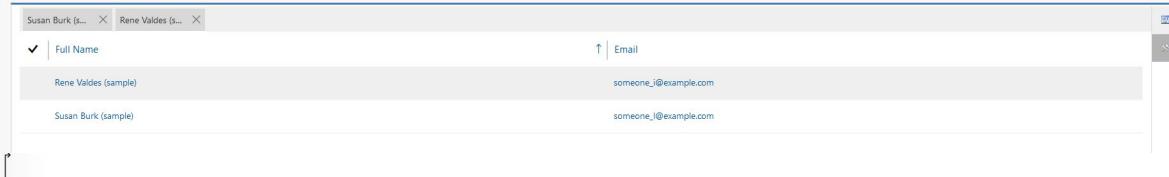
- Each table must have a designated fallback form. This is the form that all users would see if they do not have a security role assigned that matches your role tailored forms.
- Only Main forms can be assigned to security roles.
- When a user has access to multiple forms, a form selector will be available near the top of the form. If a user has access to only a single form for a given table, there will be no form selector visible.
- You can designate a main form as inactive. This will make it not visible to all users, regardless of security roles. This feature was included primarily to manage new forms included when organizations upgrade but you can use it to prevent people from being able to use any main form.

## Use specialized form components

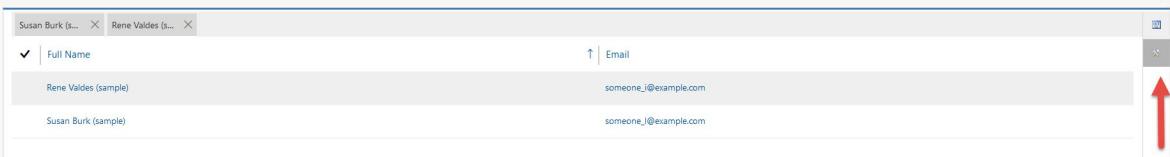
As mentioned previously, there are several specialized form components available for model driven apps. This topic contains additional details on several of the most common ones.

### Reference panel

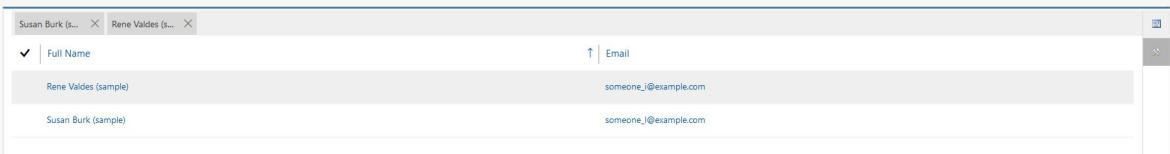
A reference panel is a specialized section that can be added to main forms that offers interaction with related data in the context of the hosting table row. It can contain sub-grids of related tables and display related data without having to navigate to a different form. To get the full value of a reference panel you must also have Quick View forms configured. Each form can only have a single reference panel, but each reference panel can contain multiple sub-grids.



Drilling into the right side, you will notice two icons, one for each of our sub-grids configured for this reference panel. You can toggle between them as you need to view rows.



Drilling into the left side, you will notice the tabs behind the grid. Those are the recently viewed rows for this table on our reference panel.



While viewing individual rows you will see the Quick View form for the table. All columns from a Quick View form are displayed as read-only.



## Bing Maps

Bing Maps can be displayed on a form for the account, contact, lead, quote, order, invoice, competitor, and system user tables. You can remove the Bing Maps area in the form editor or add it back by using the Bing Maps button on the Insert tab of the form editor.

## Timer control

Use a timer control with forms where rows need to meet a specific time-based milestone. A timer control shows how much time is available to complete an action in the resolution of an active row or how much time has passed since the time to complete the action has passed. At a minimum, timer controls must be configured to show success or failure in completing the action. In addition, they can be configured to display warnings when the conditions are approaching failure.

A timer control can be added to a form for any table, but they are most frequently used for the case table, especially when linked to columns that track service level agreements. You can add multiple timer controls in the body of a form. You can't add them to the header or footer.

## Quick view control

A quick view control on a model-driven app form displays data from a row that is selected in a lookup on the form. The data displayed in the control is defined using a quick view form. The data displayed is not editable, but when the primary column is included in the quick view form, it becomes a link to open the related row.

## iFrame

You can add iFrames to a form to integrate content from another website within a form.

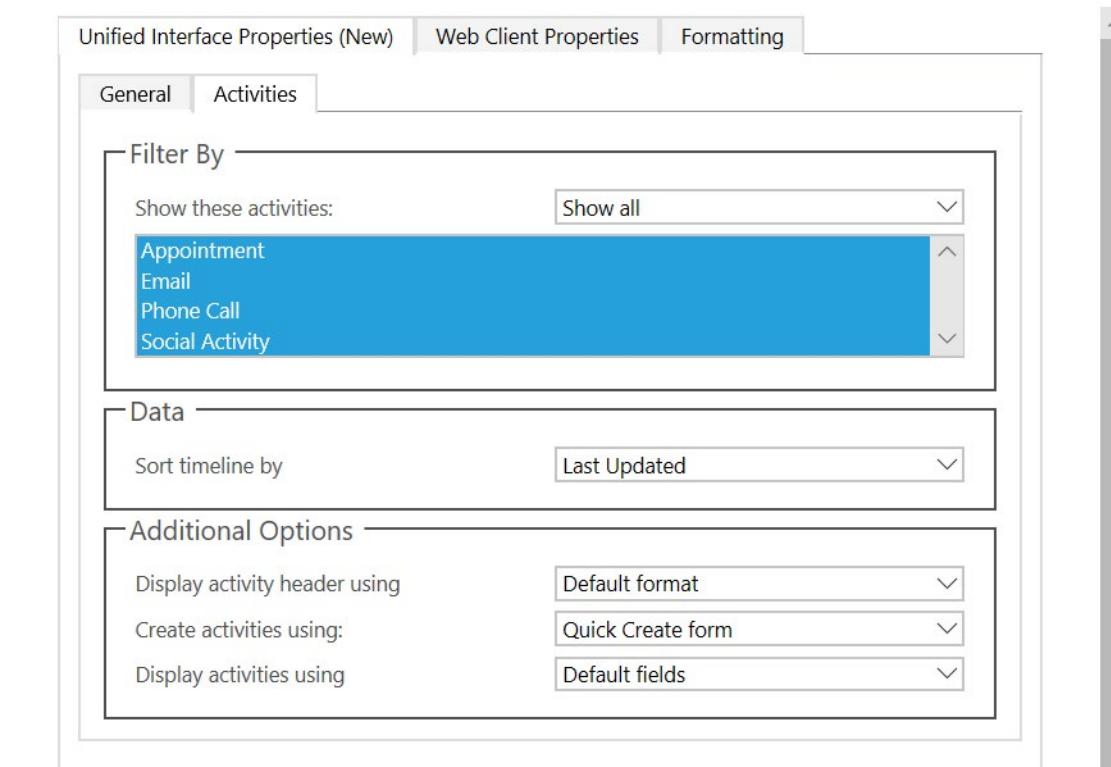
## Timeline Control

The Timeline control provides a combined place to view customer interactions including activities and notes all in one location. The timeline quickly allows you to see when the interaction occurred and what is new since last visit to the row. Using filters users can quickly trim down what is visible. The control properties allow you to change things like what the default create row type is, as well as what activities show in the timeline.

### Activities Tab Properties

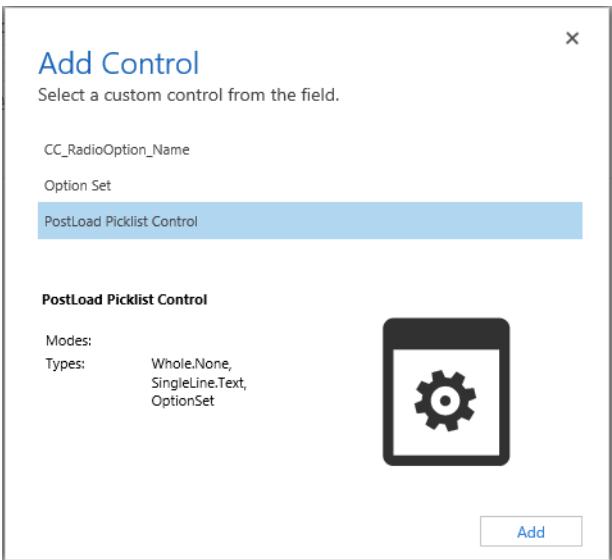
? X

Modify the properties for the Activities tab.



## Custom controls

Previously, we provided an overview of custom controls; now we are going to look deeper into configuring them on a form. The controls available are determined by the column data type. It must be bound to a column on the form, in this case for a Contact it is bound to the contact row's last name.



## Purchase Process

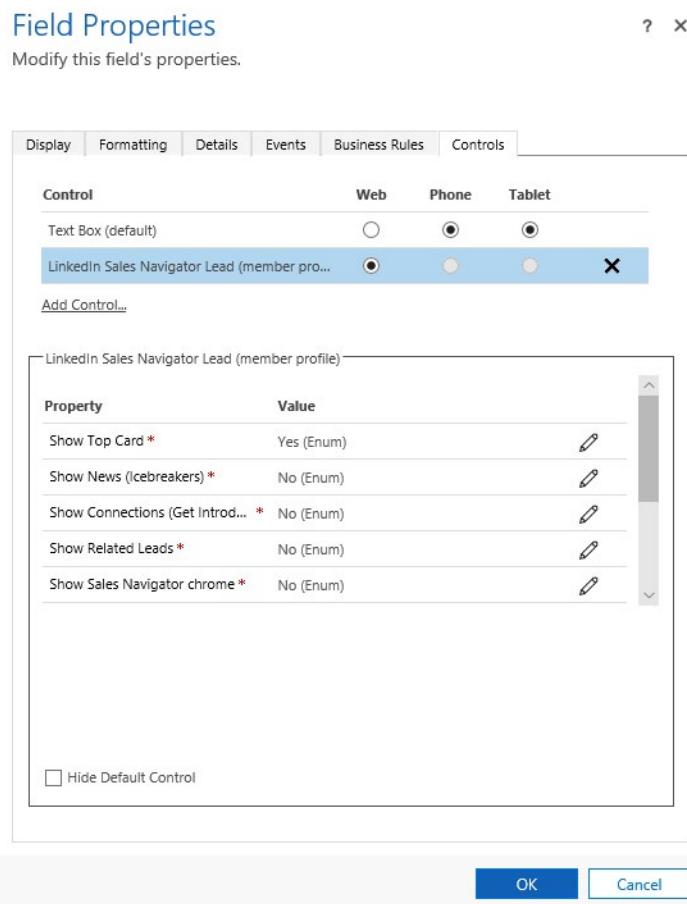
Direct

Indirect

Unknown

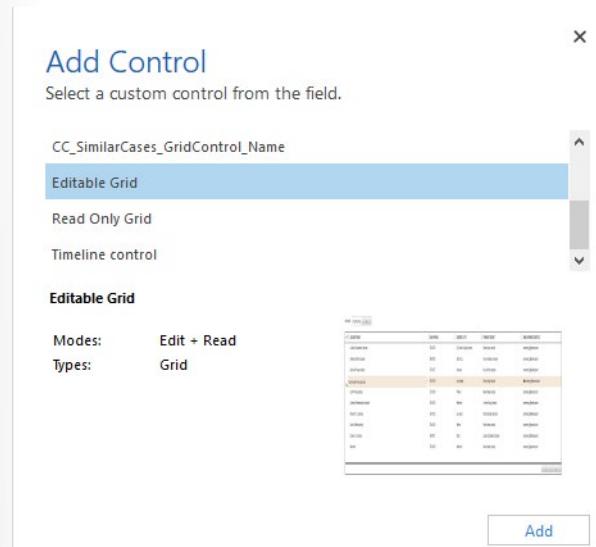
## Additional controls

Applications such as LinkedIn Sales Navigator have widgets available for use on forms in the same manner. This item below has several configuration options.

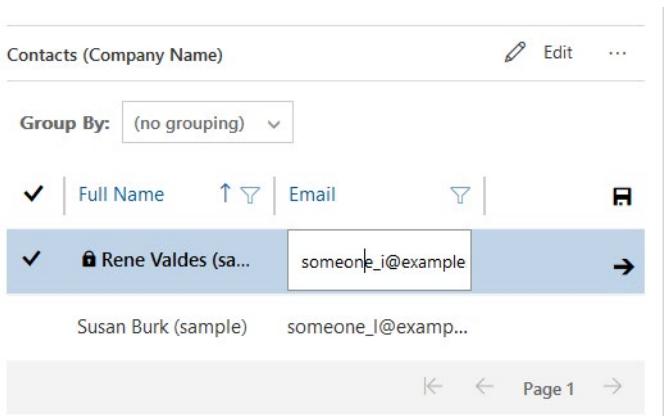


## Editable sub-grids

Editable sub-grids can be added to forms in much the same way that other custom controls can be added. Details about editable sub-grids can be found later in this module.



Inline editing and grouping is now available on the host form.



The screenshot shows a 'Contacts (Company Name)' view. At the top, there's a toolbar with a pencil icon labeled 'Edit' and three dots. Below it, a dropdown menu says 'Group By: (no grouping)'. The main area has a header row with columns: 'Full Name' (with an upward arrow), 'Email' (with a downward arrow), and a 'More' button. Below this, a row for 'Rene Valdes (sa...)' is selected, with its email address 'someone\_i@example...' highlighted in a blue box. To the right of the email field is a blue 'Edit' button with a white arrow. Other contacts listed include 'Susan Burk (sample)' and another row partially visible. At the bottom, there are navigation buttons for back, forward, and page 1.

## Configure views overview

This video discusses how to configure views for model-driven applications.



<https://www.microsoft.com/videoplayer/embed/RWtUWK>

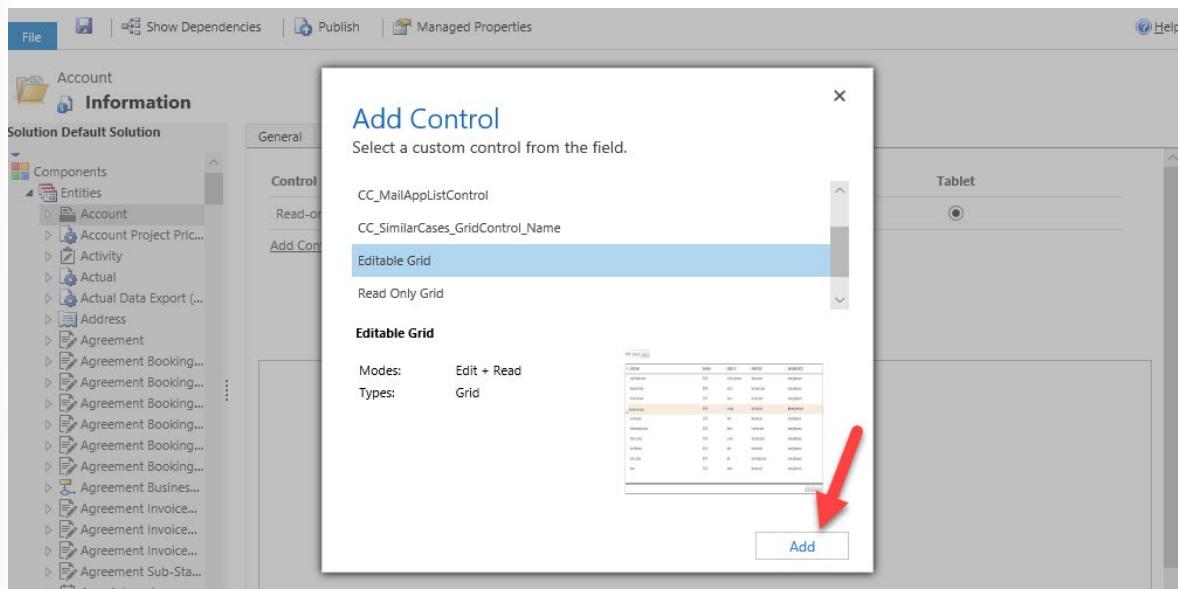
## Configure grids

Editable Grids are special controls for editing select columns from a view without needing to open the specific row. This feature is available out of the box but must be added to the tables in Dynamics 365 for Customer Engagement. Editable Grids are available to use in views and as subgrids placed on forms. You cannot create new rows via the editable grid; you may only use it to update existing rows. These controls use the custom control framework.

Data changes made within the Editable Grid will have the same impact on Workflows and Business Rules with a scope of table or All Forms as if the same data changes were made on the form. AutoSave will complete as the user moves on to the next row in the grid.

In order to use editable grids, you will need to explicitly enable the feature for each table and enable each subgrid on a form.

To enable the editable grids, you must first add the control on the table definition.



Once enabled you can perform direct inline editing of rows for rows of that table type.

The screenshot shows the 'Sales Hub' interface for 'Accounts'. The top navigation bar includes 'Dynamics 365', 'Sales Hub', 'Sales > Accounts', and various action buttons like 'Show Chart', 'Activate', 'Deactivate', 'Delete', 'Assign', 'Email a Link', 'Follow', and 'Unfollow'. Below the header, a section titled 'My Active Accounts' is displayed. A specific account record for 'Alpine Ski House' is selected and shown in edit mode, with its phone number '+43-1-12345-0' and city 'Vienna' visible. Other accounts listed include 'Consolidated Messenger', 'Microsoft', and 'School of Fine Art'. On the left side, there is a vertical toolbar with various icons.

In addition to the ability to edit rows from the grid, you can also group rows.

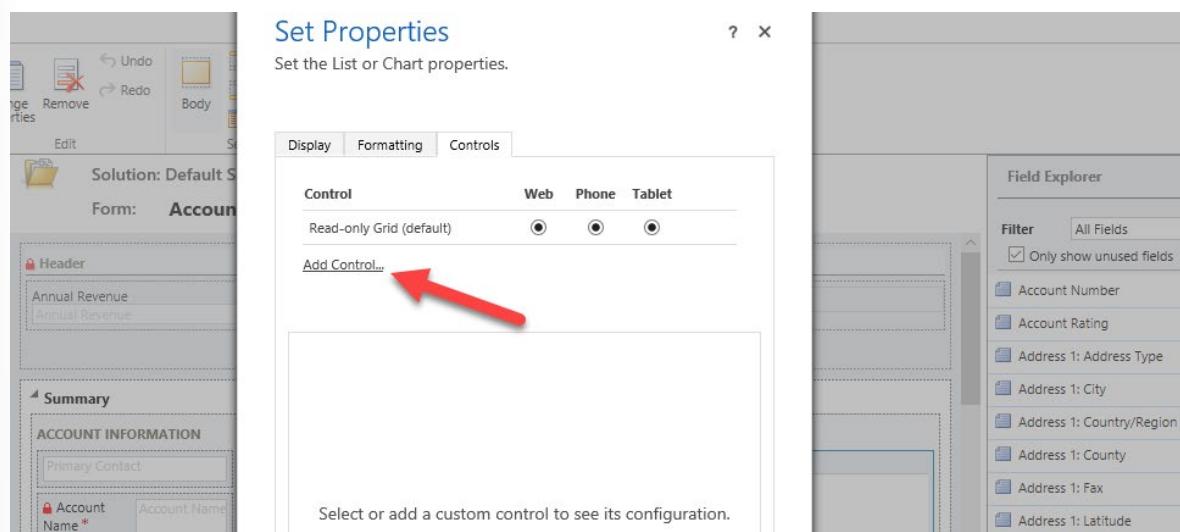
The screenshot shows the 'My Active Accounts' page in Dynamics 365. At the top, there's a toolbar with various icons and buttons like 'Show Chart', 'New', 'Delete', 'Refresh', 'Email a Link', 'Flow', 'Export to Excel', and 'Import from Excel'. Below the toolbar, the title 'My Active Accounts' is displayed. On the left, there's a sidebar with navigation links for 'Account', 'Common', and other modules. The main area shows a list of accounts with columns for 'Main Phone', 'Address 1: City', and 'Primary Contact'. A red arrow points to a dropdown menu under the 'Group By' label, which has 'Primary Contact' selected. The list includes entries for 'Alpin', 'Microsoft', 'Paris', and 'Vienna'.

To enable an editable subgrid on a form, you must start from the form where the subgrid is located. In our example below, we are looking at the Contact subgrid on the Account form.

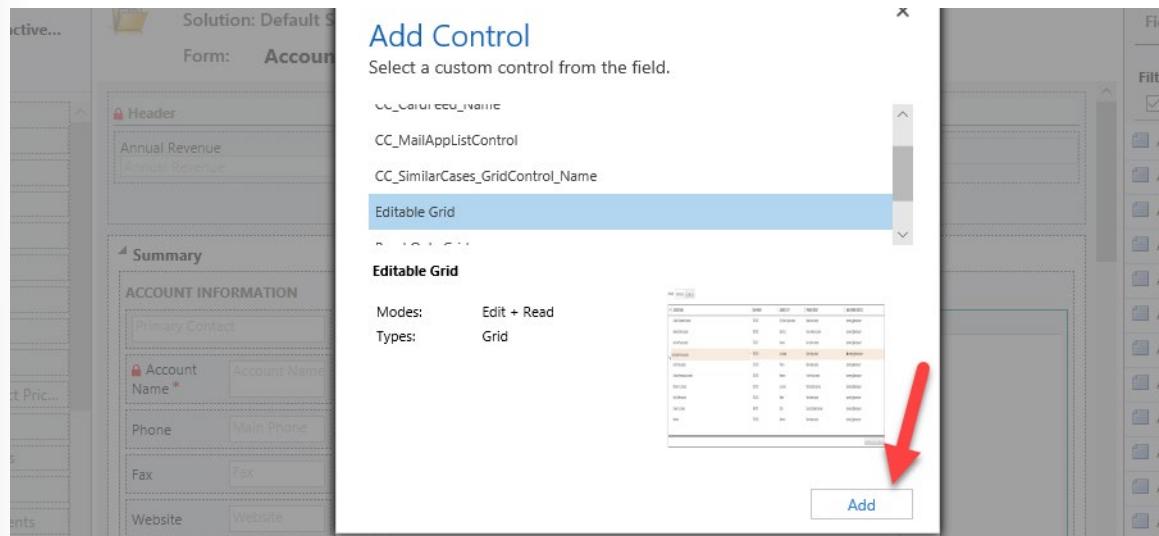
Double-click on the subgrid to open its properties.

This screenshot shows the Microsoft Dynamics 365 Form Designer. The ribbon at the top has tabs for FILE, HOME, and INSERT. The HOME tab is selected, showing options like Save As, Save, and Publish. The central area displays the 'Account' form with fields for Parent Account, Ticker Symbol, Relationship Type, Product Price List, ADDRESS, and Map View. To the right, the Field Explorer lists fields such as Account Number, Account Rating, Address 1: Address Type, and so on. A red arrow points to the 'CONTACTS' section of a subgrid on the right side of the form.

On the Controls tab, select Add Control.



Select Editable Grid.



You will now have the same editable grid functionality available on the Contact subgrid on the Account form, including grouping. When the data changes from an editable subgrid are saved, the hosting form will not also execute a save. This means that the change that you made to the Contact row will save but an another save will not fire on the Account row.

The screenshot shows a Microsoft Dynamics 365 interface for managing contacts. On the left, there's a sidebar with various links like 'Call Client', 'Assign', 'Delete', 'Review the RFP Library', 'Opportunity Closed by First Last', 'Auto-post on Delivery never arrived's wall', and 'Case: Created by First Last for Account Alpine Ski House'. The main area is titled 'CONTACTS' and shows a list of contacts with columns for 'Full Name' and 'Email'. One contact, 'Luca Argentiero', is selected and highlighted with a blue bar. The 'Group By' dropdown menu at the top is highlighted with a red box and set to '(no grouping)'.

## Use specialty views

In addition to the standard views already covered in this lesson, there are several specialty views available known as public views. These public views are automatically created for custom tables and can be modified but not deleted. More public views can be created and deleted.

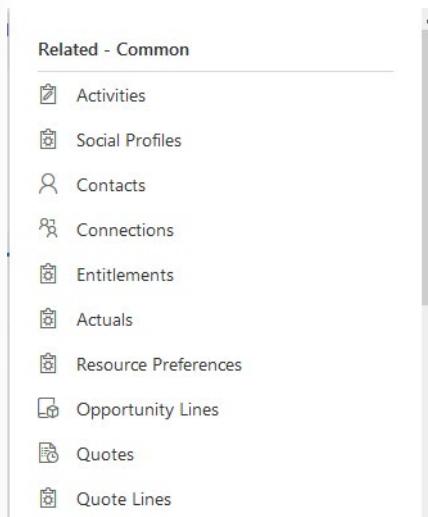
### Advanced Find

When a user is making a personal view or doing an improvised advanced search, this will be the default view of the search results. This system view is editable, but there can only be one per table. When a user is in Advanced Find and changes the columns, it can be saved and shared as a personal view. This view will then display for the user in the view selector.

The screenshot shows the Microsoft Dynamics 365 Advanced Find interface for the 'CONTACTS' table. The 'LIST TOOLS' tab is selected. The 'Records' section displays a list of contacts with columns for 'Full Name' and 'Business Phone'. The 'Actions' section contains various buttons for managing contacts, such as 'Send Direct Email', 'Add to Marketing List', 'Remove', 'Quick Campaign', 'Assign Contacts', 'Run Workflow', 'Start Dialog', and 'Data'. The top navigation bar includes 'FILE', 'ADVANCED FIND', 'LIST TOOLS', and 'CONTACTS' tabs, along with a Microsoft Dynamics 365 logo and a user profile for 'MOD Administrator Contoso'.

### Associated

Users view data on rows from the host table but can also view related tables. When selected these related data tables load on the host form in a new tab. Each table can have more than one associated view.



More system associated views exist for functions such as bulk delete operations or to display the members of a marketing list. These views have limited customization functionality.

When a user views the list of associated views for an table, they will see the system views starting with the associated views in alphabetical order, then the default public view, followed by any remaining public views in alphabetical order. Views the user has created or received through sharing will be visible alphabetically in the my views section at the bottom of the list.

The screenshot shows the Dynamics 365 Contacts page with the "Contacts" tab selected. Below the tabs are buttons for "Add New Contact", "Add Existing Contact", "Refresh", and "Export Contacts". A dropdown menu titled "Contact Associated View" is open, showing the following list:

- Contact Associated View
- Entitlement Contacts
- My Active Contacts
- Active Contacts
- Active Contacts Subgrid View
- All Contacts

### Lookup

The first three columns of the lookup view are visible when a user clicks on the magnifying glass icon on the related lookup column. The system lookup view is used by default when a lookup column is placed on a form.

The screenshot shows the 'View: Contacts Lookup View' interface. At the top, there are filter fields for 'Full Name', 'Email', 'Business Phone', and 'Company Name'. A message 'Working on solution: Default Solution' is displayed above the main area. On the left, a 'Common Tasks' sidebar offers options like 'View Properties' and 'Edit Filter Criteria'. Below the sidebar, the text 'View results are displayed here.' is visible. The right side displays a list of contacts under the heading 'Primary Contact'. The first result is 'Cathan Cook' with the email 'Cathan@alpineskihouse.com' and phone '178-854-4566'. Below this, there are links for 'Look Up More Records' and a '+ New' button.

You may set specific lookup views and more filter criteria on a lookup column. This is known as a filtered lookup.

## Field Properties

Modify this field's properties.

Display  Visibility

Specify the default visibility of this control.

Visible by default

Availability

Specify the default availability of this field on phone.

Available on phone

Related Records Filtering

Only show records where:

Contains

Current Record

Users can turn off filter

Additional Properties

Display Search Box in lookup dialog

Default View

View Selector

Active Contacts

Active Contacts Subgrid View

All Contacts

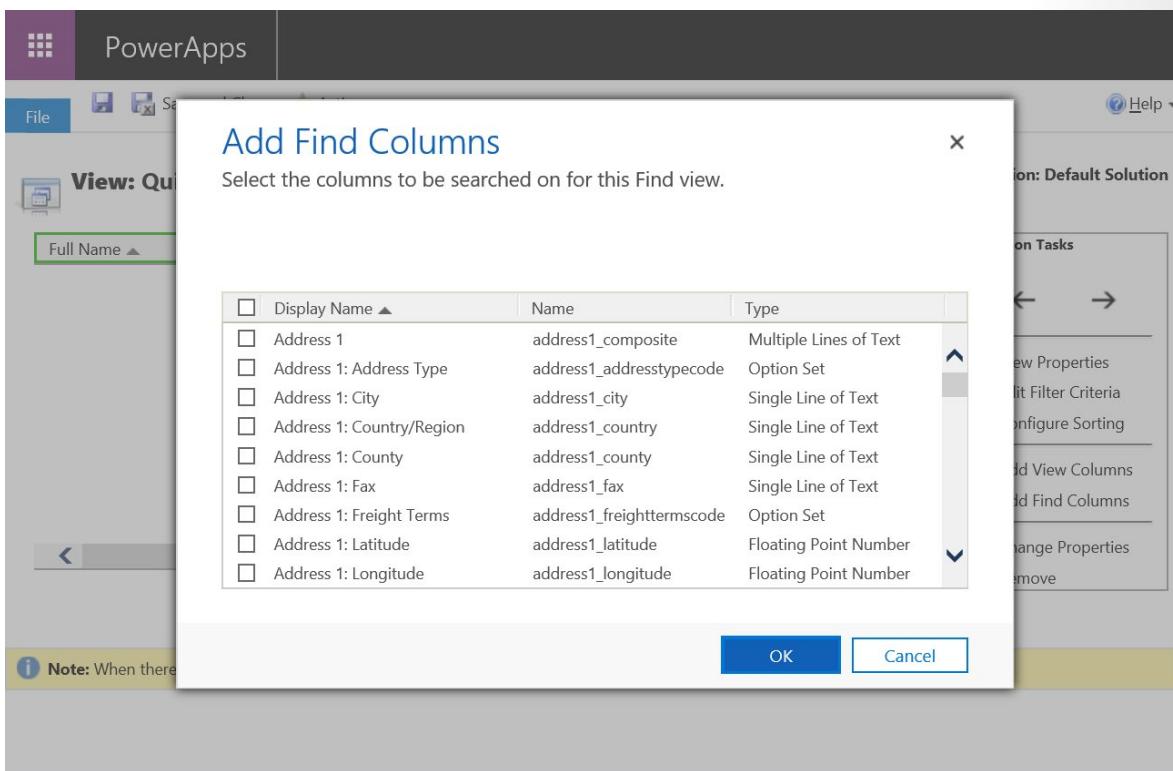
Contacts Being Followed

OK Cancel

The screenshot shows the 'Field Properties' dialog box. At the top, there are tabs: Display (selected), Formatting, Details, Events, Business Rules, and Controls. Below the tabs, there are several sections: 'Visibility' (checkbox 'Visible by default' checked), 'Availability' (checkbox 'Available on phone' checked), 'Related Records Filtering' (checkbox 'Only show records where:' checked, dropdown 'Contains' set to 'Current Record', checkbox 'Users can turn off filter' checked), and 'Additional Properties' (checkbox 'Display Search Box in lookup dialog' checked, dropdown 'Default View' set to 'Active Contacts', dropdown 'View Selector' set to 'Show Selected Views', list of views: Active Contacts (highlighted in blue), Active Contacts Subgrid View, All Contacts, Contacts Being Followed). At the bottom right are 'OK' and 'Cancel' buttons.

### Quick find

This view displays search results and defines which columns are used to determine search results. There is only one quick find view per table.



## Configure charts overview

Charts provide an interactive view of data. This video provides an overview of charts.



<https://www.microsoft.com/videoplayer/embed/RWtCRa>

## Dashboards overview

Dashboards are used to show several areas of an application in a single display. Watch the video for an overview of dashboards.



<https://www.microsoft.com/videoplayer/embed/RWtUWV>

## Use interactive streams and tiles

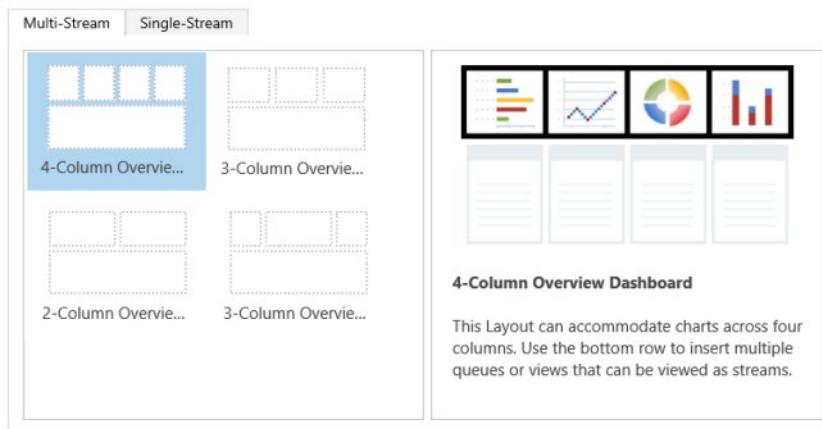
Interactive experience dashboards can be a one-stop workplace for app users, such as service reps, to see workload information and take action. They're fully configurable, security-role based, and deliver workload information across multiple streams in real time. Interactive dashboard users don't need to page through the application looking for a particular row; they can act on it directly from the dashboard.

The interactive experience dashboards come in two forms: multi-stream and single-stream. A stream can be summarized as a real-time view of table data. They are based on a table's view or queue, and as such a stream can only be based on one table. In addition, multi-stream dashboards can be home page or table-specific dashboards. The table-specific dashboards are configured in a different part of the user interface and partially preloaded with the table-specific configuration information.

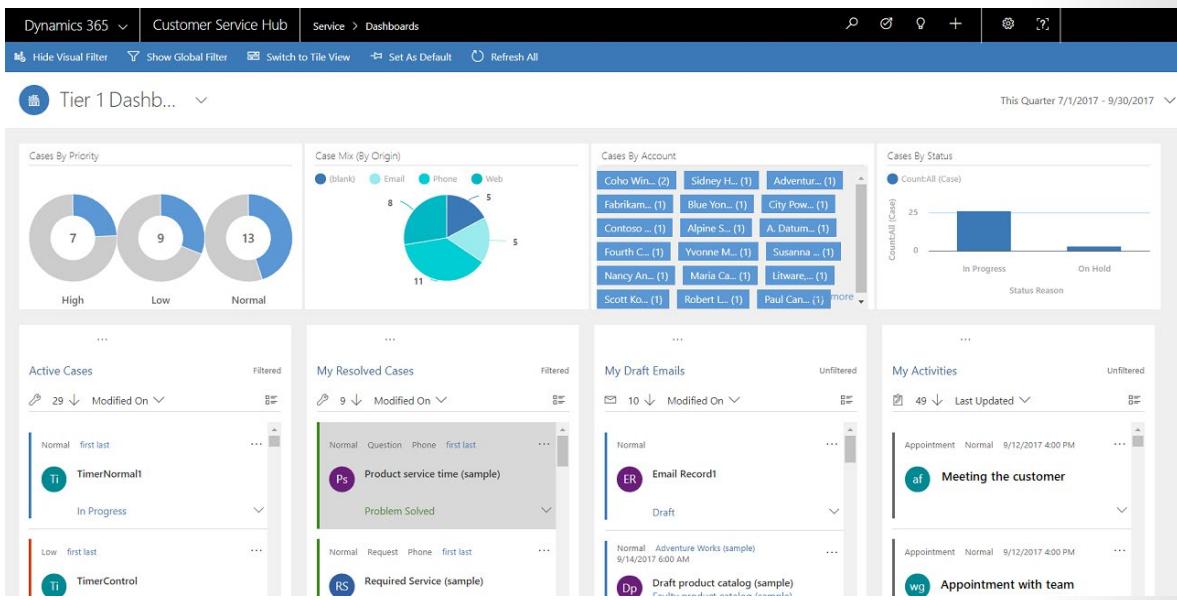
### Multi-stream dashboards

Multi-stream dashboards display data in real time over multiple streams. Each stream can be based on a different table, making them good for high-level overviews such as the Tier 1 Dashboard in the Customer Service hub.

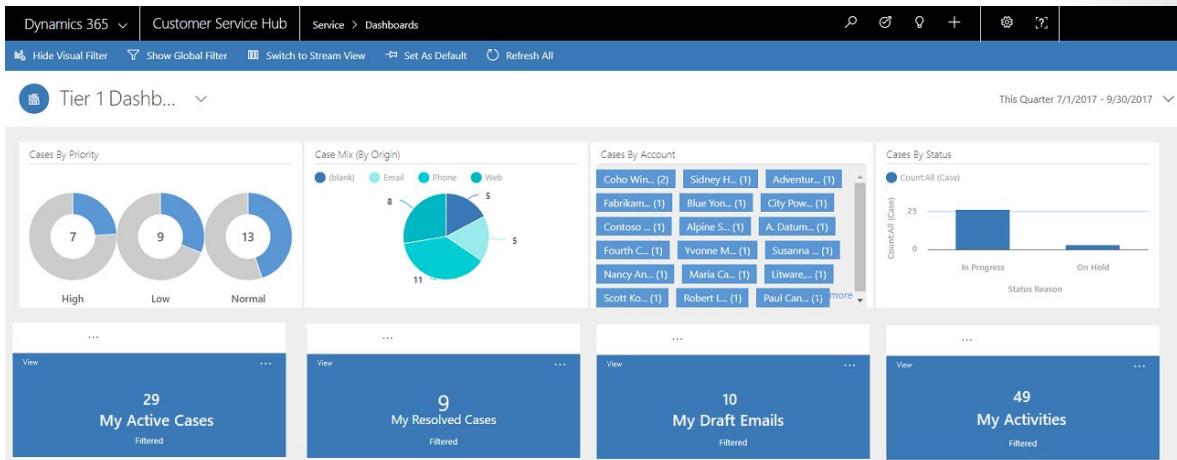
To configure a multi-stream dashboard, you can choose from four different layouts:



The top tiles contain interactive charts that are referred to as **Visual Filters**. These charts display counts of relevant rows, and you can filter data contained within the dashboard by selecting different values contained within the charts.

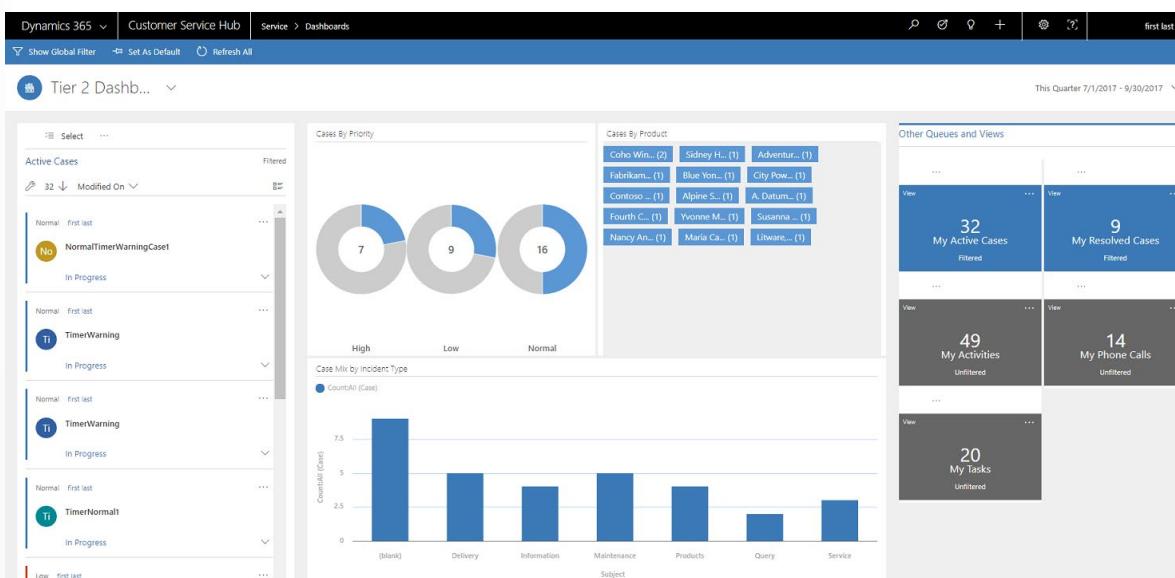


Multi-stream dashboards also provide a Tile view which can be activated by selecting the **Switch to Tile View** button. This option toggles stream data into being displayed as interactive summary tiles that display the count of rows within each stream.

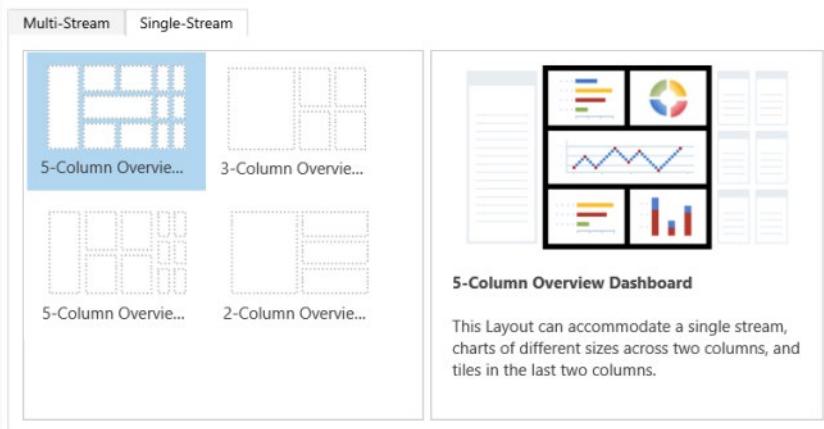


## Single-stream dashboards

Single-stream dashboards display data in real time over a single stream. They enable a more detailed view of a given table, and as such are good for monitoring fewer but more complex data, as represented in the Tier 2 Dashboard of the Customer Service Hub.



For single-stream dashboards, you can choose from four different layouts:



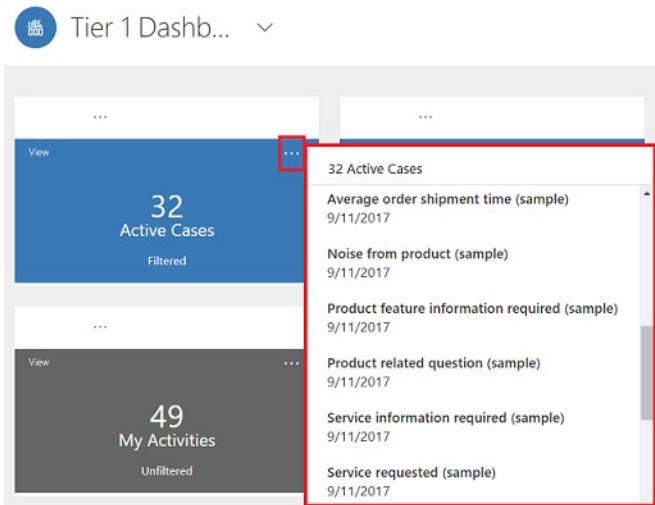
## Interactive tiles

Interactive tiles are useful for providing more detailed visual insights about your data. Using interactive tiles, you can:

- Show aggregated view of data across queues/views
- Select tile to drill to underlying rows

Interactive tiles provide an aggregated view of the information in the streams, across queues or views that interest you most. They help you monitor the volume of cases and quickly drill down to a particular row. In a multi-stream dashboard, you can switch from the standard view to the tile view by selecting **Switch to Tile View** button given in the command bar.

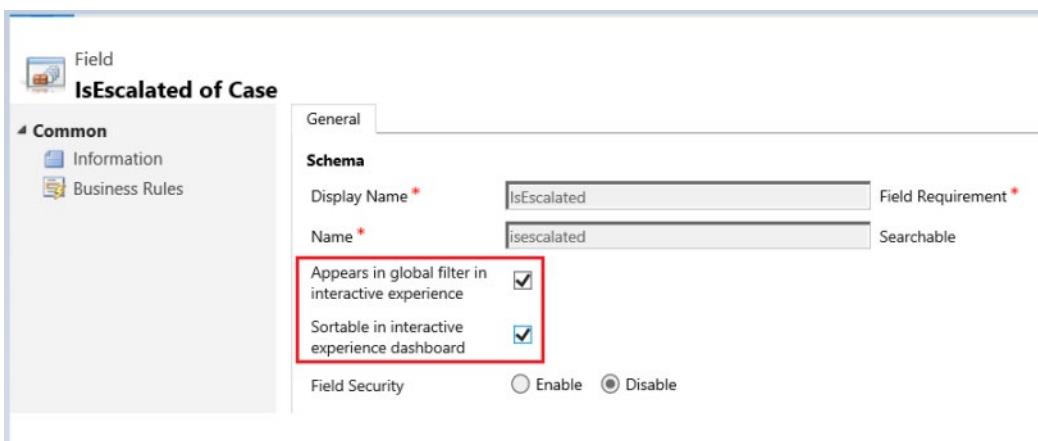
The content of each tile represents the count of the number of rows within that given stream. Hovering over the "View" text will show you from which view the tile's stream is being pulled. Selecting a tile will produce a flyout of the rows contained in the stream, which you are able to navigate to by selecting a given row.



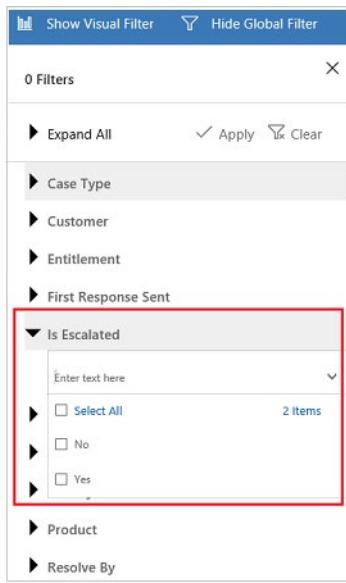
## Configuring interactive dashboard columns

Any table supported in Unified Interface can be enabled for interactive experience dashboards.

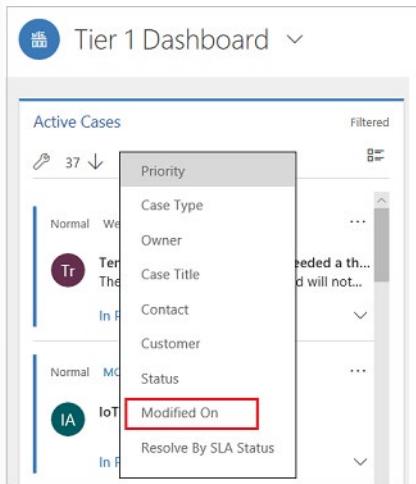
A supported column can be enabled for the interactive dashboard experience on its column settings:



Global Filter columns can be configured by setting the "Appears in global filter in interactive experience" flag on a given column. This will cause the column to appear in the global filter flyout window:



Sortable columns can be configured by setting the "Sortable in interactive experience dashboard" flag on a column. This will cause the column to appear in the flyout that appears when a user selects the "More" on the stream header.



## Composing custom interactive dashboards

To compose a custom interactive dashboard, the following attributes must be set:

- **Filter table:** The visual filters and global filter attributes are based on this table.
- **table View:** The visual filters are based on this view.
- **Filter By:** The column that the time frame filter applies to.
- **Time Frame:** The default time frame filter value for the Filter By column.

Solution: Default Solution  
Dashboard : New

Name: \* Sample dashboard

Filter Entity: \* Case

Entity View: \* Active Cases

Filter By: \* Modified On

Time Frame: \* This month

Leverage the **Add Component** option to add interactive charts to your dashboard:

Add Component

Choose the component that you want to add to the dashboard.

Record Type: Case

View: Active Cases

Chart: Cases By Priority

XX XX XX

Lorem Ipsum Dolor

Add Cancel

The **Add Stream** option is used to add interactive streams to your dashboard:

Add Stream

Please select a queue or a view in order to add it to the Dashboard.

View  Queue

Queue Name: All Public Queues

Queue Item View: Items available to work on

Queue Record Type: Case

OK Cancel

The interactive dashboards are solution aware and can be exported and then imported into a different environment as part of a solution. However, the queues that the streams and tiles are based on aren't solution aware. Before importing the dashboard solution into the target system, the queues have to be manually created in the target system. If you create them in the target system with the same ID, no further editing is required. This would require use of a data import tool that can create rows with the same ID, or a developer using the platform API. If those are not available, you can create them manually in Settings > Service Management > Queues. After you create the queues and import the dashboard solution to the target system, you will need to edit the streams or tiles that are based on the queues to assign the newly created queues appropriately.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. If you need to display form data on a dashboard, what form type should you use?

- Quick view
- Main
- Card
- Quick create

## Multiple choice

2. Which of the following cannot be added to a quick form?

- IFRAME
- Fields
- Tabs
- Script

## Multiple choice

3. What is an editable grid?

- A form used to display a dashboard.
- A function to create new fields.
- A specific form type that can be used to edit and create new fields.
- Special controls for editing select fields from a view without having to open the specific record.

## Summary

In this module, we discussed the forms and different form types for model-driven apps. We discussed how to configure multiple forms and use some specialized form components. We also discussed views and grids and showed how to use editable grids. An introduction to charts and dashboards were also discussed.

# Answers

## Multiple choice

1. When building model-driven apps, which designer is used to define the navigation of your app?

- App designer
- View designer
- Site map designer
- Dashboard designer

*Explanation*

*The site map is used to define the navigation of your app.*

## Multiple choice

2. If you wanted to create a standard procedure or process for handling service requests what type of logic would be best to implement?

- Business process flow
- Business rule
- Workflow
- Flow

*Explanation*

*Business process flow logic should be used.*

## Multiple choice

3. When sharing a model-driven app, which of the following statements is true?

- Users just need to be added to a predefined security role.
- Users just need to be added to a custom security role.
- Model-driven apps do not need to be shared, they are accessible to anyone with the app link.
- Users need to be added to a predefined or custom security role and then you also need to assign one or more security roles to the app.

*Explanation*

*To share a model-driven app, you need to add a user to a security role that is assigned to the app.*

## Multiple choice

1. If you need to display form data on a dashboard, what form type should you use?

- Quick view
- Main
- Card
- Quick create

*Explanation*

*Use the card form type to display form data on a dashboard.*

**Multiple choice**

2.Which of the following cannot be added to a quick form?

- IFRAME
- Fields
- Tabs
- Script

*Explanation*

*An IFRAME cannot be added to a quick form.*

**Multiple choice**

3.What is an editable grid?

- A form used to display a dashboard.
- A function to create new fields.
- A specific form type that can be used to edit and create new fields.
- Special controls for editing select fields from a view without having to open the specific record.

*Explanation*

*An editable grid is a special control for editing fields from a view without opening the record.*

## Module 4 Make canvas apps with Power Apps

### Get started with Power Apps canvas apps

#### Introduction to Power Apps

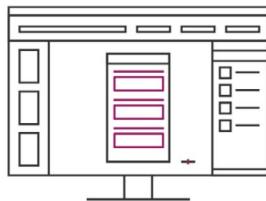
Power Apps is a suite of apps, services, connectors, and a data platform that provides you with an opportunity to build custom apps for your business needs. By using Power Apps, you can quickly build custom business apps that connect to your business data that is stored either in the underlying data platform (Microsoft Dataverse) or in various online and on-premises data sources (SharePoint, Excel, Office 365, Dynamics 365, SQL Server, and so on).

Apps that are built by using Power Apps provide rich business logic and workflow capabilities to transform your manual business processes to digital, automated processes. Power Apps simplifies the custom business app building experience by enabling users to build feature-rich apps without writing code.

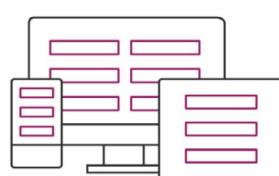
Power Apps also provides an extensible platform that lets pro developers programmatically interact with data and metadata, apply business logic, create custom connectors, and integrate with external data.



Connect to data & systems you're already using *easily*



Create apps, forms, and workflows *without writing code*

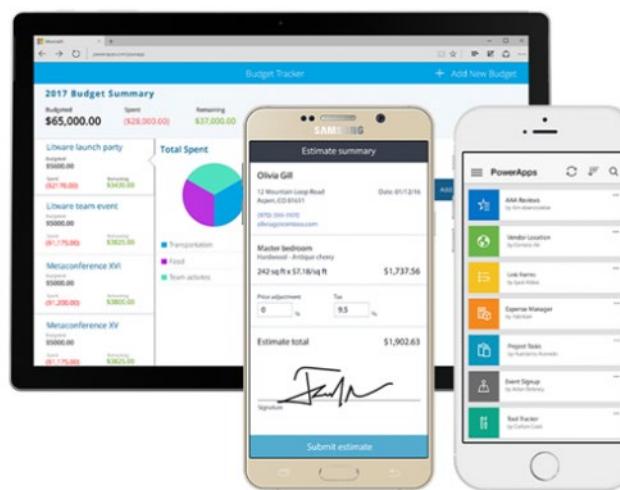


Use apps *on any device* – both web and mobile

With Power Apps, you can:

- Build an app quickly by using the skills that you already have.
- Connect to the cloud services and data sources that you're already using.

- Share your apps instantly so that coworkers can use them on their phones and tablets.



When it comes to using Power Apps to get things done and keep people informed, your options are nearly limitless. The following examples can help you think about how to use an app, instead of traditional paper notes, to run your business:

- Equipment in the field** - Often, company representatives who visit customers in the field carry clipboards to help guarantee a paper trail of parts with scheduled replacement dates. By running an app on a tablet, reps can look up the customer's equipment, see a picture of a part, test and analyze the part, and then order new parts. Reps can perform these tasks on-site instead of leaving the customer's warehouse.
- Restaurant employee management** - Employees of a large restaurant might fill out work schedules and vacation requests on a piece of paper that's affixed to a wall. With Power Apps running on everyone's smartphone, employees can open the app to record the same information, anywhere, anytime. The app can even send reminders for the start of the next day's shift.

If you're a beginner with Power Apps, this module gets you going quickly; if you're familiar with Power Apps, it ties concepts together and fills in the gaps.

## Power Apps building blocks

Power Apps is a collection of services, apps, and connectors that work together to let you do much more than just view your data. You can act on your data and update it anywhere and from any device.

This unit explores each part of the following Power Apps components:

- Power Apps Home Page - Apps start here, whether you build them from data, a sample app, or a blank screen.
- Power Apps Studio<sup>1</sup>** - Develop your apps further by connecting to data, adding and arranging user interface (UI) elements (known as controls), and building formulas.
- Power Apps Mobile** - Run your apps on Microsoft Windows, Apple iOS, and Google Android devices.
- Power Apps Admin Center<sup>2</sup>** - Manage Power Apps environments and other components.

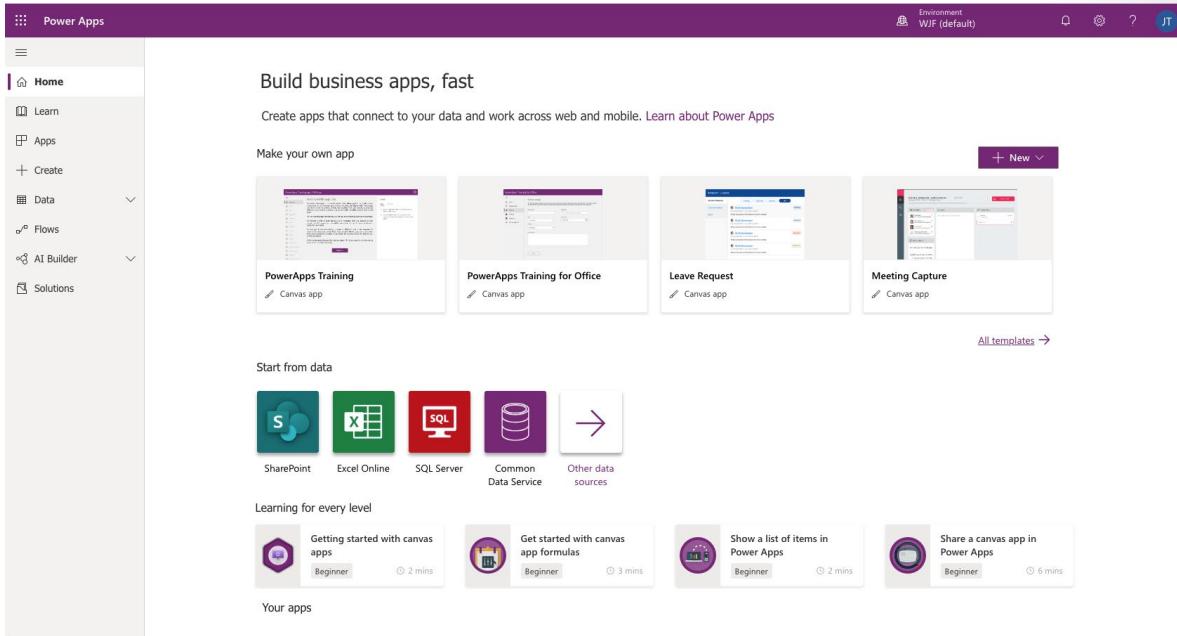
<sup>1</sup> <https://create.powerapps.com/>

<sup>2</sup> <https://admin.powerplatform.microsoft.com/>

**Note:** To use these sites, you'll need to sign in by using your organizational account.

## Power Apps Home Page

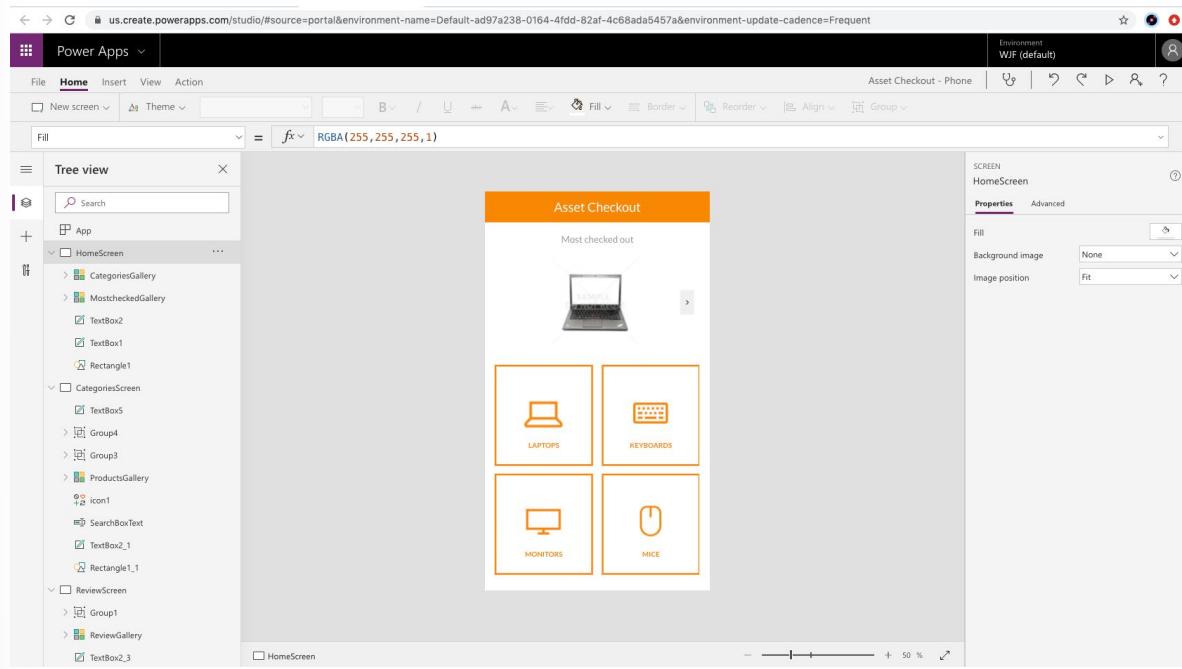
If you are building an app, you'll start with the Power Apps Home Page(<https://make.powerapps.com/>). You can build apps from sample apps, templates, or a blank screen. All the apps that you've built appear here, along with any apps that others have created and shared with you.



## Power Apps Studio

Power Apps Studio is where you can fully develop your apps to make them more effective as a business tool and to make them more attractive. Power Apps Studio has three panes that make creating apps seem more like building a slide deck in Microsoft PowerPoint:

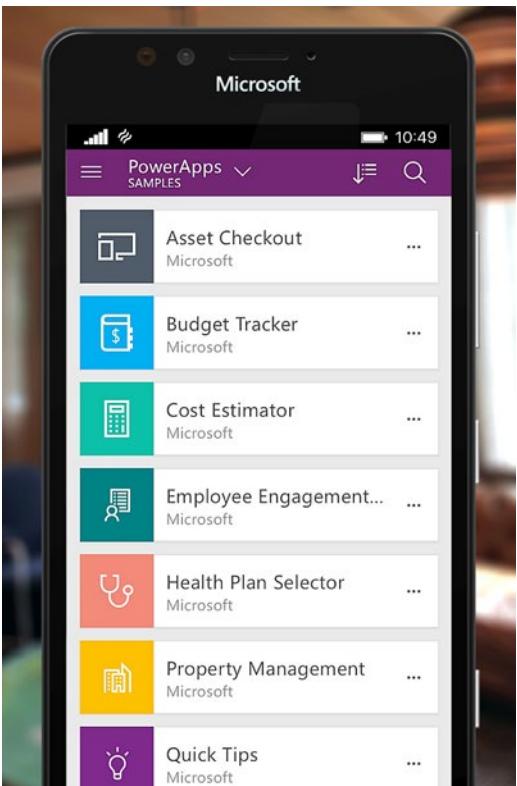
- **Left pane** - Shows a hierarchical view of all the controls on each screen or a thumbnail for each screen in your app.
- **Middle pane** - Shows the canvas app that you're working on.
- **Right pane** - Where you set options such as the layout, properties, and data sources for certain controls.



## Power Apps Mobile

Power Apps Mobile for Windows, iOS, and Android devices allow you to use all the apps that you've created, and those others have shared with you, on your mobile device. You or your users can download the Microsoft Power Apps app from the appropriate app store. When users sign in with their credentials, they will see all apps that have been shared with them. The Power Apps Mobile app only needs to be downloaded once.

When you use apps in Power Apps Mobile, you get the most out of your device's capabilities: camera controls, GPS location, and more.



## Microsoft Power Platform admin center

Microsoft Power Platform admin center is the centralized place for managing Power Apps for an organization. On this site, you can define and manage different environments to house the apps. For example, you might have separate environments for development and production apps. Additionally, you can define data connections and manage environment roles and data policies.

For more information, see **Best practices<sup>3</sup>** Learning Path.

<sup>3</sup> [https://docs.microsoft.com/en-us/learn\(paths/best-practices-environments/](https://docs.microsoft.com/en-us/learn(paths/best-practices-environments/)

Power Platform <span>▼</span> Admin center (preview)						
		Environments				
Environments		Environments				
Capacity	Environment	Type	State	Region	Created on ↓	Created by
Common Data Service	Canada Test	... Production	Ready	Canada	2019/08/27 21:40	MOD Administrator
Microsoft Flow	Central Apps Test - labadmin1	... Production	Ready	United States	2019/08/25 21:56	Lab Admin 1
PowerApps	Central Apps Test - labadmin2	... Production	Ready	United States	2019/08/25 21:56	Lab Admin 2
Help + support	Trying CDS	... Trial	Ready	United States	2019/08/25 21:54	MOD Administrator
Data integration	Thrive Hr - Test	... Production	Ready	United States	2019/08/25 21:53	MOD Administrator
Data gateways	Thrive Hr - UAT	... Production	Ready	United States	2019/08/25 21:53	MOD Administrator
Data policies	Thrive Hr - Dev	... Production	Ready	United States	2019/08/25 21:52	MOD Administrator
Admin centers	Thrive Hr - Prod	... Production	Ready	United States	2019/08/25 21:51	MOD Administrator
Dynamics 365	Device Ordering Development	... Production	Ready	United States	2019/08/25 21:50	MOD Administrator
Microsoft Flow	Power Platform COE	... Production	Ready	United States	2019/08/25 21:50	MOD Administrator
PowerApps	Contoso (default)	... Default	Ready	United States	2019/08/22 20:29	SYSTEM
Power BI						

## Exercise - Create your first app in Power Apps

In this unit, you'll generate a mobile app where the data source is a Microsoft Excel workbook that's stored in Microsoft OneDrive for Business. This Excel workbook lists a company's inventory of flooring samples with pictures and prices.

Keep in mind that you can use data from many other sources, including Microsoft SharePoint, cloud services like Salesforce, and on-premises sources like Microsoft SQL Server.

**Note:** Power Apps requires either an Office 365 license or a free trial. Learn more about your licensing options. **Microsoft products include Microsoft Power Apps and Power Automate**<sup>4</sup>.

Before you begin, watch this video for a brief overview of what to expect when creating your first Power App.



<https://www.microsoft.com/videoplayer/embed/RE4vls4>

## Connect to a data source

To connect to a data source, use the following procedure:

1. Download the **Flooring Estimates workbook**<sup>5</sup> and save it to OneDrive for Business.
2. Go to <https://make.powerapps.com>(<https://make.powerapps.com/>) and sign in with your organizational account.

<sup>4</sup> <https://docs.microsoft.com/en-us/powerapps/administrator/pricing-billing-skus/>

<sup>5</sup> <https://az787822.vo.msecnd.net/documentation/get-started-from-data/FlooringEstimates.xlsx>

## Start from data



SharePoint



Excel Online



SQL Server



Dataverse



Other data sources

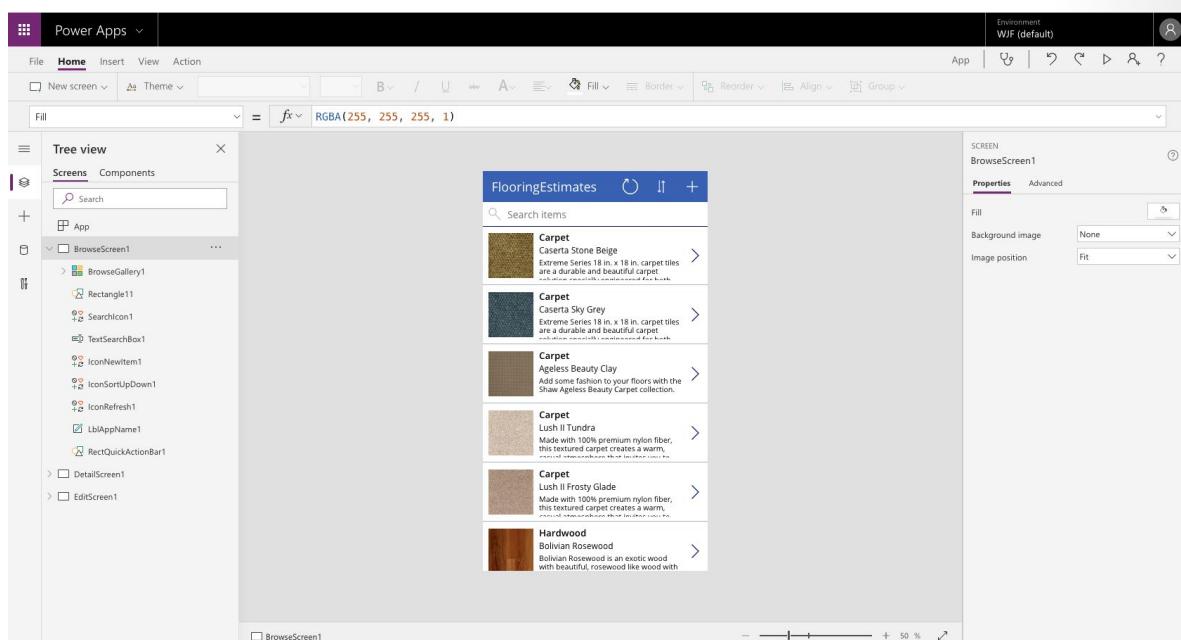
3. On the **Home** screen, under the **Start from data** section, select **Other data sources**. Generated apps are always based on a single list or table, but you can add more data to the app later. The next four steps explain how to connect to the Excel workbook.
4. In the **New** tab section, under **Connections**, select **OneDrive for Business** and browse to the file location. You might need to select **New Connection** to see the **OneDrive for Business** connection.
5. Under **Choose an Excel file**, select the **FlooringEstimates.xlsx** file.
6. Under **Choose a table**, select the **FlooringEstimates** table.
7. Select **Connect** on the bottom right.

Power Apps generates the app by inspecting your data and matching it with Power Apps capabilities so that you get a working app as a starting point.

## Explore the generated app

Your new three-screen app now opens in Power Apps Studio.

The following figure shows the main development window for Power Apps Studio, which you'll learn more about in later units.





Select **Play** in the upper-right corner to practice using the app. Notice that it includes all the data from the table and provides a good default experience.

All apps that are generated from data have the same set of screens that you can view from the Screens pane:

- **Browse screen** - This screen appears by default. In it, you can browse, sort, filter, and refresh the data from the data source. In the browse screen, you can add items to the data source by selecting the plus sign (+).
- **Details screen** - The details screen shows all information about a single item. In this screen, you can open an item to edit or delete it.
- **Edit/create screen** - In this screen, you can edit an existing item or create a new one.

To make your app visible on the phone, it needs to be saved. Select **File, Save as**. Replace the current title "App" with **flooring-estimates app**, and then select **Save**. You will see a green check mark when all changes are successfully saved. You can now open the app on your phone.

## Install the app on your device

To see how the app runs on mobile, install the Power Apps Mobile app on your phone. When building an app, you should test it in the same form factor as your users.

1. Download Power Apps Mobile from the app store for the platform that you want to use.
2. Sign in by using your username and password.
3. On your phone or tablet, run the flooring-estimates app in Power Apps Mobile. If you do not want to install the app, you can run it in a browser.
4. If you do not see the flooring-estimates app, then in your Power Apps Mobile app, select the ham-burger menu in the top left of the screen and toggle on **Show non-production apps**.

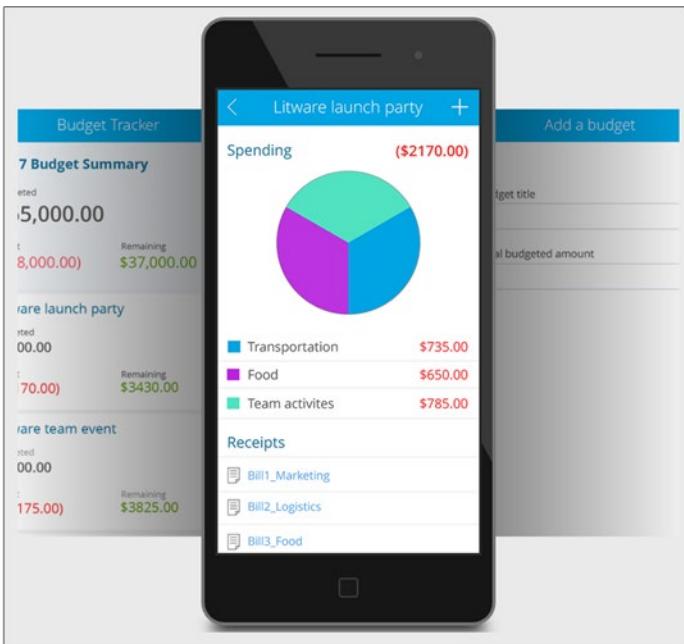
## Ways to build Power Apps

This unit describes how to create an app from a template, a blank canvas, and a data source. This learning path is focused on canvas apps, which give you the flexibility to arrange the user experience and interface the way that you want it. You can get started in many different ways; however, for all of the options, you will use the Power Apps Studio features and functionality to build your app.

### Create an app from a template

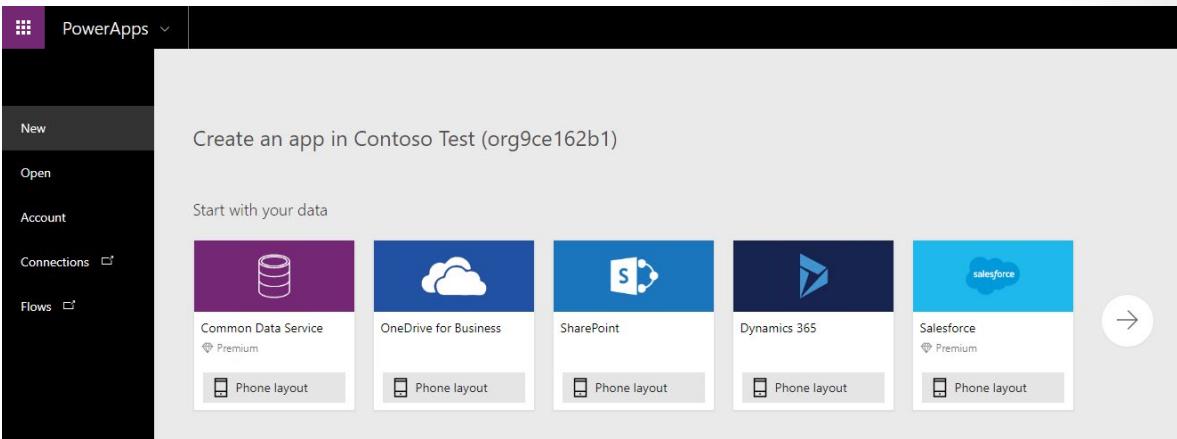
A good way to create an app is to start from a template. Templates use sample data to help you determine what's possible. By opening templates in Power Apps Studio, you can learn, hands-on, how an app is built.

For example, you can use the Budget Tracker template to create an app that helps you track the budget for projects and events with custom categories, simple data entry, and visuals that highlight expenditures for an effortless inspection.

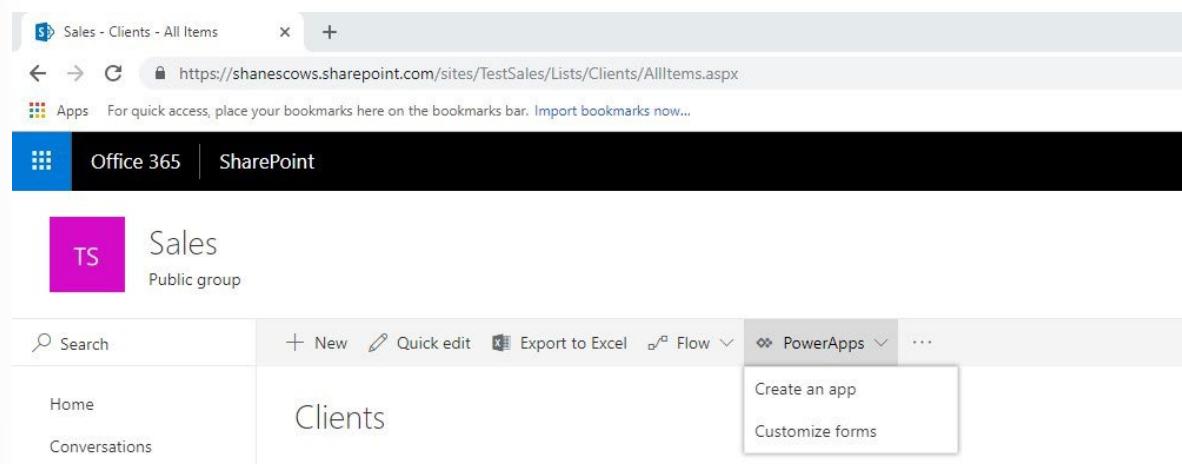


## Create an app from a data source

Another great way to get started is to generate an app from your own data. Simply point Power Apps at the data source of your choice (for example, a list in Microsoft SharePoint or Microsoft Dataverse), and watch as Power Apps automatically builds a three-screen app. This three-screen app lets you display, edit, delete, and create records.



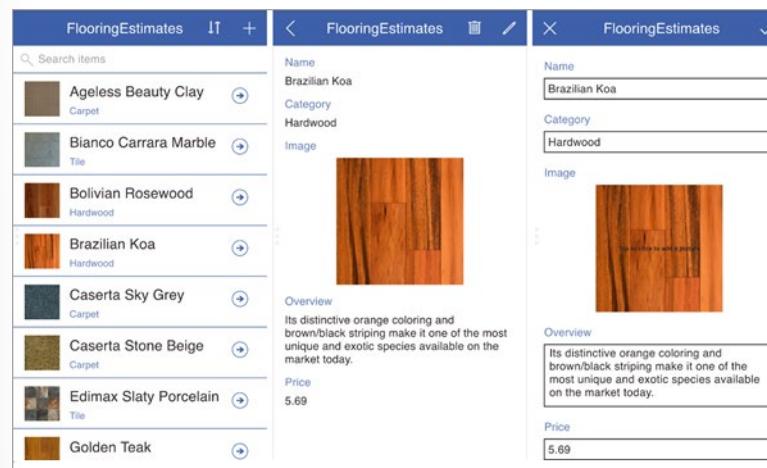
A special data source is SharePoint. Modern lists in SharePoint and Power Apps have a tight integration. You can either build an app from within a SharePoint site or you can use Power Apps to customize your modern list forms.



The screenshot shows a SharePoint list titled 'Clients'. The ribbon bar at the top has tabs for 'Office 365' and 'SharePoint'. A dropdown menu under the 'PowerApps' tab shows options: 'Create an app' and 'Customize forms'. The list itself displays various floor samples with their names and categories.

Name	Category
Brazilian Koa	Hardwood
Bianco Carrara Marble	Tile
Ageless Beauty Clay Carpet	Carpet
Bolivian Rosewood	Hardwood
Brazilian Koa Hardwood	Hardwood
Caserta Sky Grey Carpet	Carpet
Caserta Stone Beige Carpet	Carpet
Edimax Slaty Porcelain Tile	Tile
Golden Teak	

The following app was created from a SharePoint list and lets you browse items in the list, view item details, and create and edit items. After Power Apps generates an app, you can customize it to make it look and behave exactly the way you want.



The Power Apps builder interface shows a card view of a 'FlooringEstimates' item. The card includes fields for Name (Brazilian Koa), Category (Hardwood), and an Image preview. Below the card, there's an 'Overview' section with a detailed description of the wood's unique characteristics and a 'Price' section showing \$5.69.

## Build from a blank canvas

You can also build an app from the ground up and add all the pieces as you go. You can then branch out and use your imagination.

## Power Apps related technologies

Let's take a look at the related technology used by Power Apps.

## Data sources, connections, and gateways

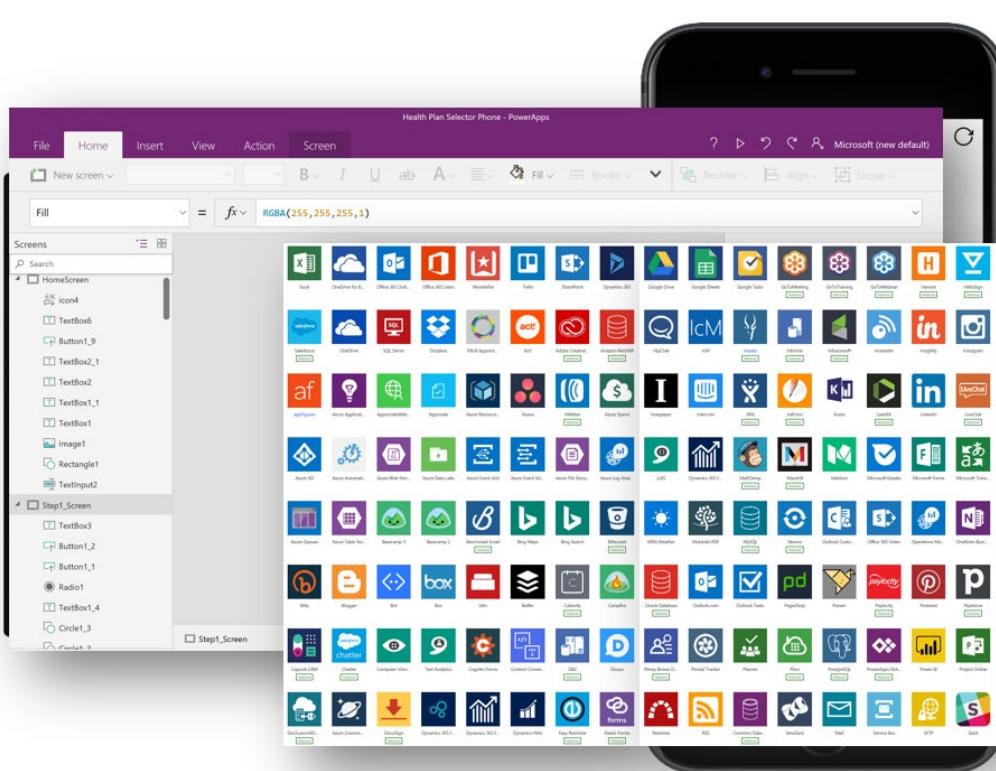
In Power Apps, most canvas apps use external information that is stored in Data Sources. A common example is a table in an Excel file that is stored in OneDrive for Business or SharePoint. Apps access these data sources by using connections. Some connections allow Power Apps to read and write stored data. In Power Apps, you can add many data sources to your apps through built-in or custom connectors. Some of the most popular data sources are shown in the following figure.

	Common Data Service		Office 365 Outlook
	SharePoint		Excel
	SQL Server		OneDrive for Business
	Dynamics 365		OneDrive
	Office 365 Users		Dropbox

Many data sources are cloud services, like Salesforce. Even Twitter can be a data source if, for example, you're tracking your company's hashtags. Connectors might not seem like the most exciting part of app development; however, they're essential when you work with data that you, your colleagues, and your customers care about. When an app shows up with your data source for the first time, you might suddenly find that they are, in fact, exciting.

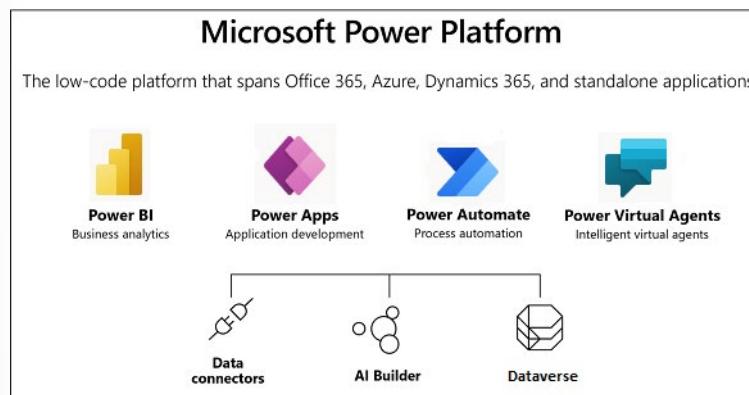
For data that's stored on-premises instead of in the cloud, you can use a gateway to provide a reliable connection between Power Apps and your data source. The gateway sits on an on-premises computer and communicates with Power Apps.

An advantage of building your business apps in Power Apps is being able to connect to many data sources in a single app. With the connectors in Power Apps, you can connect to where your data lives. To learn more about data sources in Power Apps, refer to the [Working With Data](#) learning path.



## Microsoft Dataverse

An important data source option to explore further is the Dataverse. Dataverse lets you store and manage data that's used by business applications. Data within Dataverse is stored within a set of tables. A table is a set of records that are used to store data, similar to how a table stores data within a database. Dataverse includes a base set of standard tables that cover typical scenarios, but you can also create custom tables that are specific to your organization and then populate them with data by using Power Query. App makers can then use Power Apps to build rich applications by using this data.



For information on purchasing a plan to use Dataverse, refer to the [License<sup>6</sup>](#) and [Pricing<sup>7</sup>](#) information pages.

## Reasons to use Dataverse

Standard and custom tables within Dataverse provide a cloud-based storage option for your data. Tables let you create a business-focused definition of your organization's data for use within apps. If you're unsure if tables are your best option, consider the following benefits:

- **Simple to manage** - Both the metadata and data are stored in the cloud. You don't need to worry about the details of how they're stored.
- **Helps to secure data** - Data is stored so that users can see it only if you grant them access. Role-based security allows you to control access to tables for different users within your organization.
- **Access your Dynamics 365 Data** - Data from your Dynamics 365 applications is also stored within the Dataverse, which allows you to quickly build apps that use your Dynamics 365 data and extend your apps by using Power Apps.
- **Rich metadata** - Data types and relationships are used directly within Power Apps.
- **Logic and validation** - Define calculated columns, business rules, workflows, and business process flows to ensure data quality and drive business processes.
- **Productivity tools** - Tables are available within the add-ins for Microsoft Excel to increase productivity and ensure data accessibility.

<sup>6</sup> <https://docs.microsoft.com/en-us/power-platform/admin/pricing-billing-skus/>

<sup>7</sup> <https://powerapps.microsoft.com/pricing/>

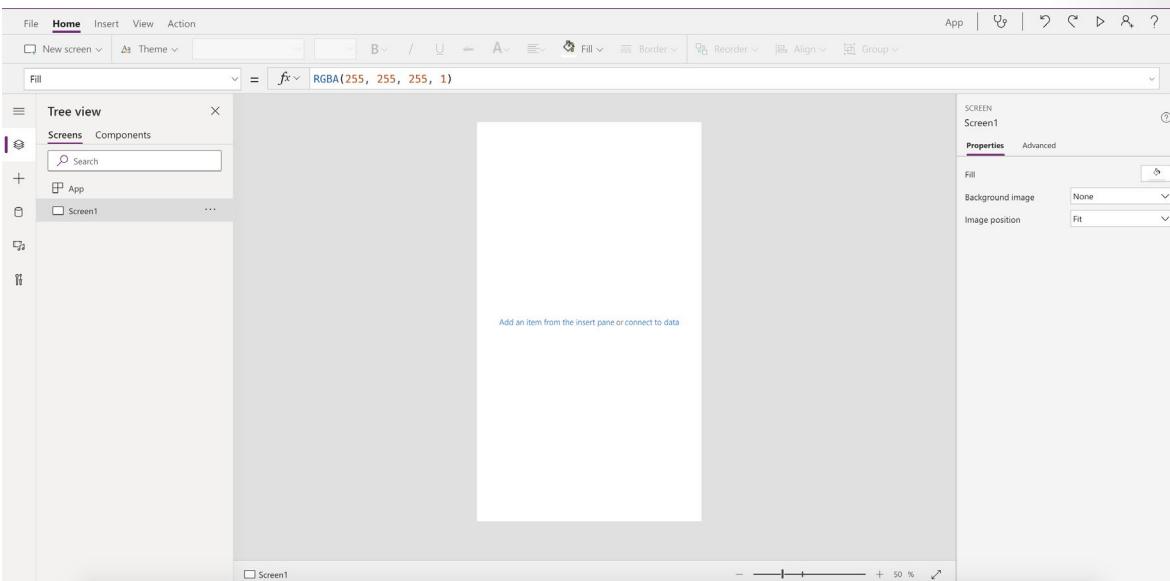
# Designing a Power Apps app

As an App Maker, before you begin building your Power Apps solution, it's recommended to go through a design process. When designing your Power Apps solution, there are several different factors to consider, such as:

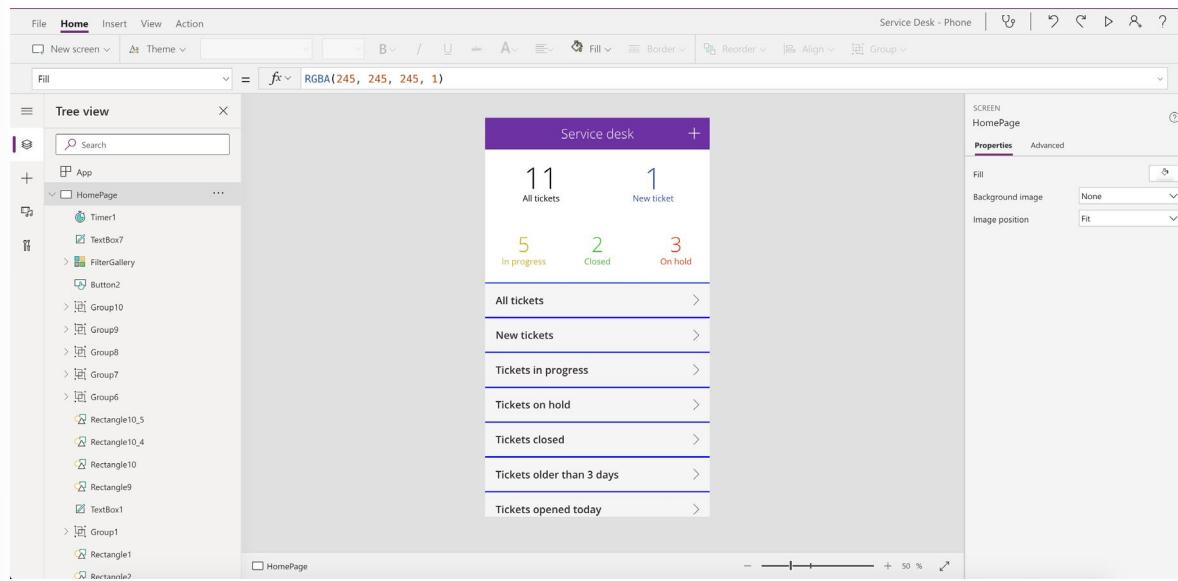
- Business requirements
- Data Model
- User Experience (UX)
- User Interface (UI)
- Business Logic
- Output

By going through a simple design process, you can flush out any minor issues before they become a larger problem once the app has been put into production. It is also important to understand that this design process is for Canvas apps.

So how do you go from a simple blank Canvas app, as seen below?



To a fully customized Canvas app solution?



## Understand the needs of the user

One of the most powerful and, at the same time, challenging parts of building a canvas app is that you start with a blank screen. This gives you the ability to build what you want, but to do that you have to know what you want.

In many cases, when purchasing software to solve and or streamline business solutions, there are many business processes that don't quite fall within the software's supported guidelines. When you run into this issue, typically, there are several internal discussions and meetings held to determine how those unsupported processes can be updated/ altered to meet the software requirements. For most organizations, this isn't ideal because of the cost or time takes to update those business processes. The great news is, by using Power Apps to build your solution, you won't have to worry about unsupported business solutions. Why? With Power Apps, you can build a custom solution tailored to the exact needs of your business requirements.

Often when building an app, you are tempted to recreate the piece of paper or legacy software-driven process exactly. This is possible but might not be the ideal solution. By challenging the existing process and asking what it is the business needs to do, not what does the piece of paper or old software allows you to do, it opens the possibility of better, more efficient processes. For example, maybe on the paper process, the user had to type notes about what they see. Would it be better instead to just take a picture? This type of thinking will lead to better apps and better outcomes.

## Business Requirements

Every app you develop will have a different set of business requirements based on the solution. Taking the time to think about all the requirements is key to rolling out a successful production app.

Depending on the solution or company policies, you may have certain security, privacy, or compliance requirements you must follow. For example, let's say you are collecting secure personal information in the app. You will want to ensure this information is securely stored and not visible to everyone.

During this process, you will also want to identify any government regulations or authentication/authorization requirements (if applicable). You don't necessarily have to have all the answers to your questions here; you just want to know all the requirements.

## Data Model

In the “Power Apps related technologies” module, you learned about some of the common data sources for building apps, but with all these choices how do you actually decide which data source to use for your solution? Maybe you already have a data source implemented that users work with on a day to day basis, like SharePoint. Could you just use this as your data source to build your app? Do I need to connect to multiple data sources? These are all common questions you should ask yourself and there are number of other factors to consider, such as:

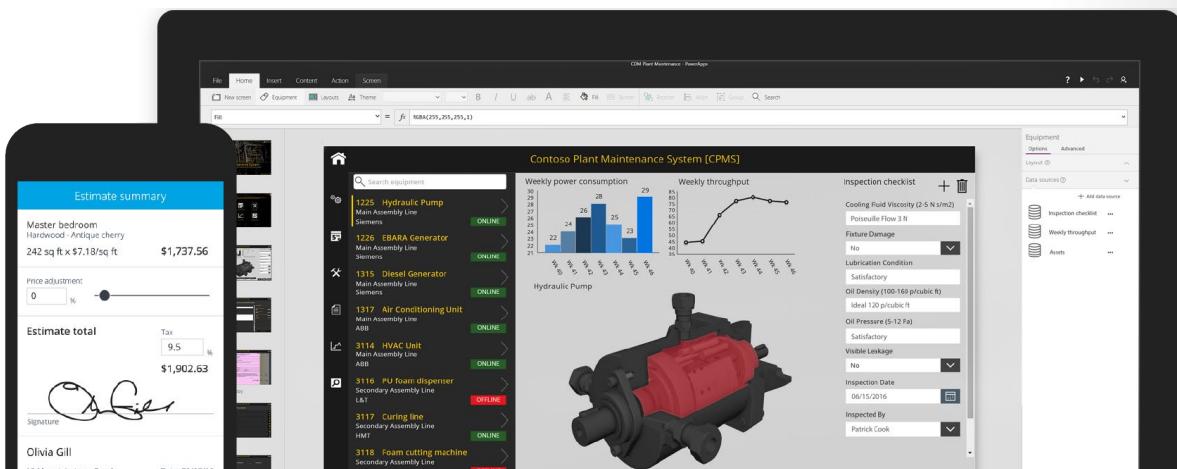
- **Business Requirements** – Every data source and it's supported functionality is slightly different. So, depending on your app requirements you need to select the data source that supports your needs or modify your business requirements to comply with the supported functionality for the selected data source.
- **Licensing/Cost** – Certain data sources like the Microsoft Dataverse or SQL are considered a “premium data source”. A premium data source will require each user who uses the app to have a Power Apps Per App Plan or a Power Apps Per User Plan. For more information about licensing, see **Power Apps pricing**<sup>8</sup>

## User Experience (UX)

By designing your Power Apps solution in a Canvas app, you have complete control of the end-user experience. This allows you to fully customize nearly every aspect of your app. However, just because you can doesn't necessarily mean you should. When designing your Power Apps solution your goal should be to keep it simple. When your end users open the application and begin using it, they should have no confusion about what to click on or where to go. If your app requires an extensive training program for users to understand how to use it, you may want to rethink your app.

Some of the basic designs elements you will want to consider are things like:

- Custom Branding (your logo and colors)
- Pop-ups
- Hide/show buttons based on users' access/permissions

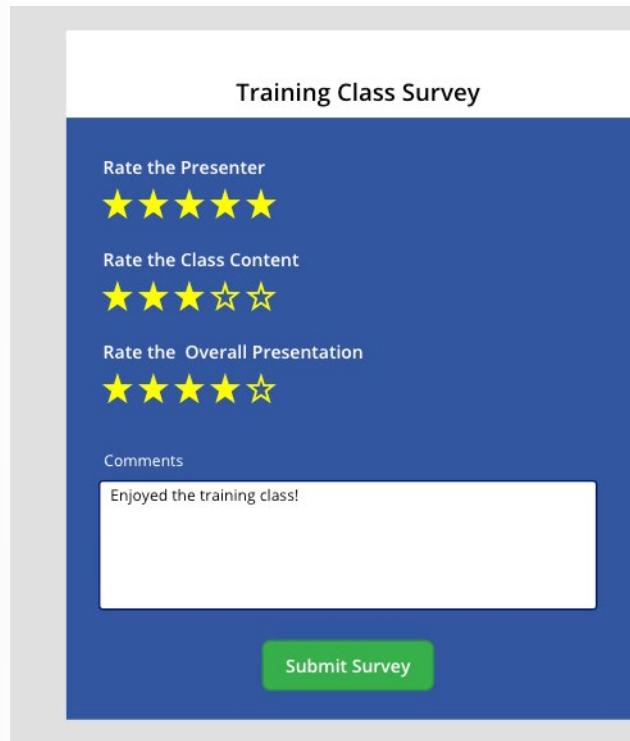


One of the most common User Experience enhancements you can implement in your applications are Pop-ups. By implementing pop-ups, you can provide the users with a simple, but useful visual to confirm

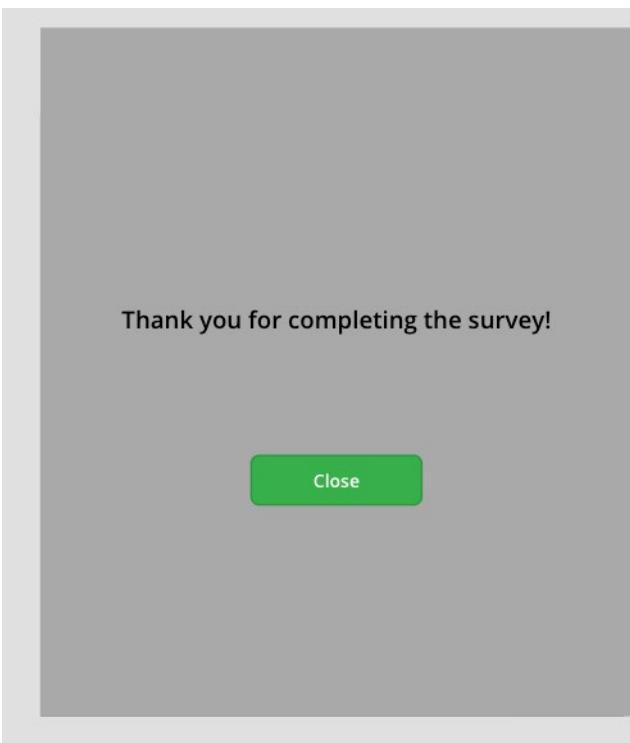
<sup>8</sup> <https://powerapps.microsoft.com/pricing/>

what the user clicked on went through or maybe your pop-up acts as a loading screen as the logic on the backend is processed. For example, in the screenshot below when a user clicks on "Submit", we might have a simple pop-up display to let them know their submission was successful.

In this example app, the user completes a Survey for the training class they just attended.



Once all of the information has been written to the data source successfully, a pop-up is generated to confirm the submission was successful.



Without confirmation, a user may not be sure if their submission was accepted. They may try to click the button again, causing incorrect or inconsistent data being written to the data source.

Remember, these are not the only customizations you can make to the app, these are just some of the common ones. Another thing to keep in mind as you add different design features is the more logic you add for the customization of the app the more code your application will need to process. So, for example, if you add several different functions for hiding buttons, or showing popups on a given screen, this could cause your application performance to slow as each piece of code runs.

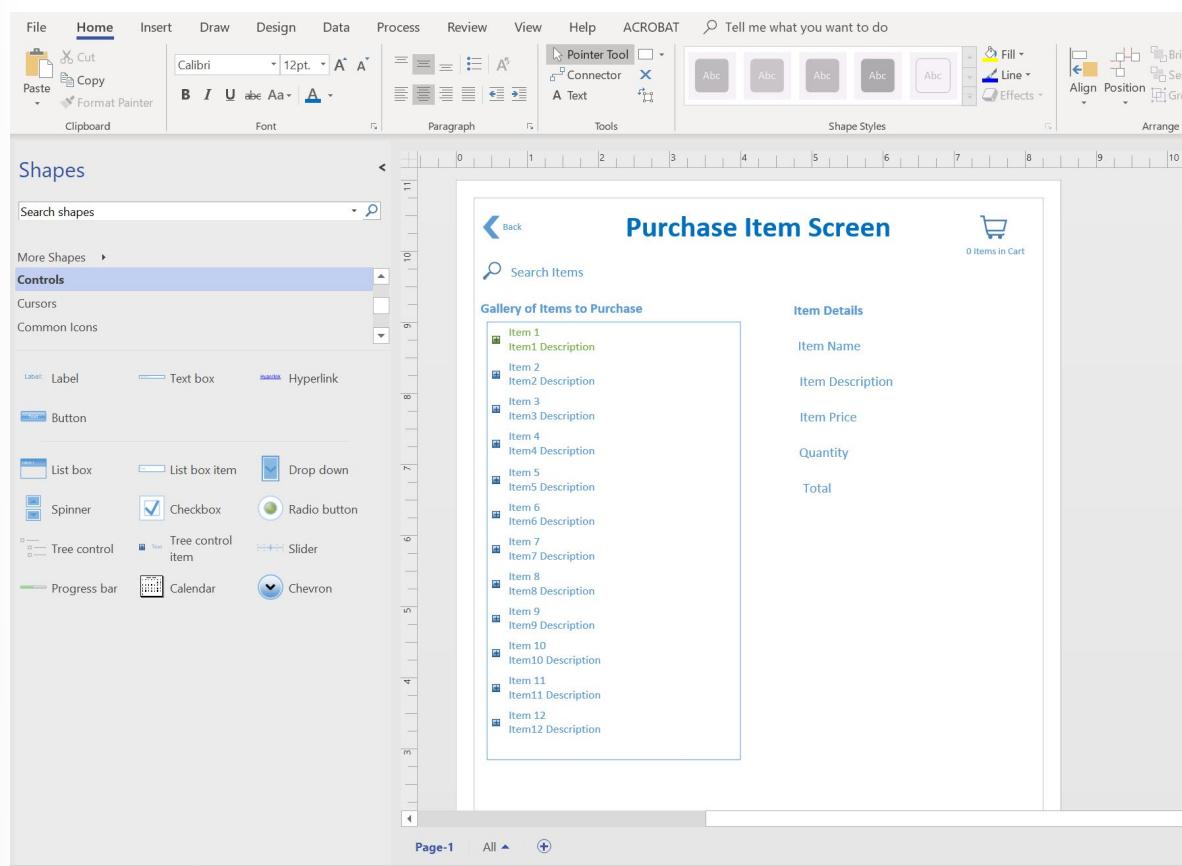
Finally, challenge yourself to do better with your user experience. Maybe today, the user records room temperatures by clicking in a box, changing the device keyboard from letters to numbers, and then typing in "70". A better option may be to replace with a slider control that defaults to 70 and ranges from 65 to 75. Then, with a swipe of their finger, they can record the temperature. Small changes like this make for happier, more productive app users.

## User Interface (UI)

To fully visualize the User Interface or UI, you may want to consider creating a mockup of your application. Two common ways to create a mockup of your application are below:

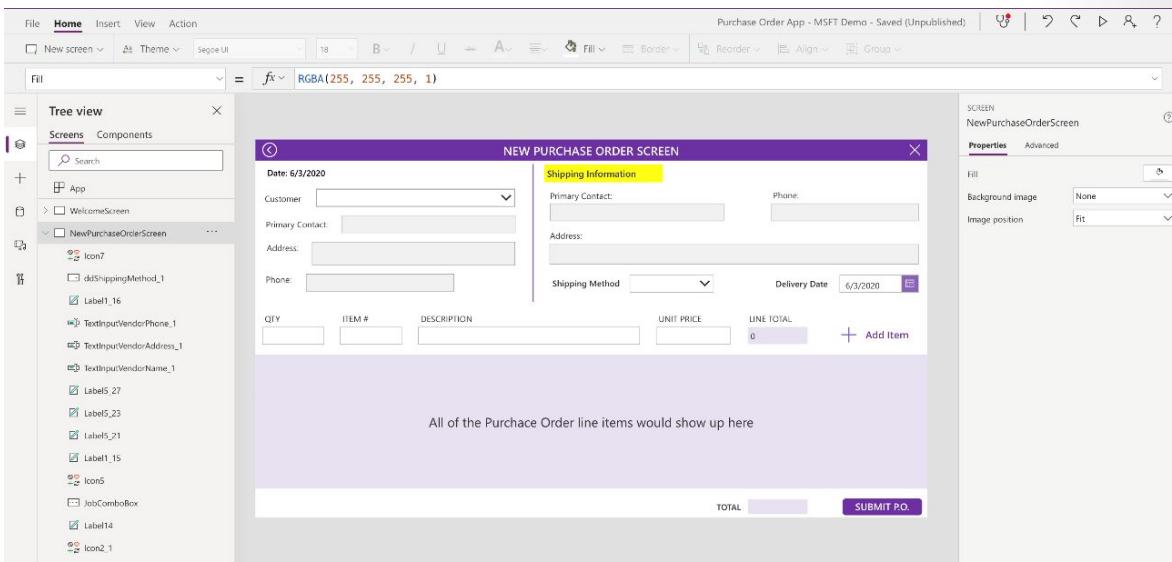
- Use Visio to create a wireframe diagram. A wireframe is a visual representation of an application's user interface. To begin, there are various website and mobile wireframe templates available, or you could start from blank template. The diagrams are a quick way to show app functionality and gain team consensus on the design.

The example below shows a simple Visio wireframe of a Purchase Items screen in an inventory app.



- Use Power Apps to create a mockup of your application. You can add most of the controls, graphics, forms, and other items to your app screens and play with the layout and size for each element as if you were building the app for real. When designing the UI you don't need to add the logic behind the various elements you placed on the screen. The goal here is to focus on what the app could look like and how it could function. This is similar to what you can do with a Visio wireframe but one of the biggest pros of going this route is that you will gain more experience working with Power Apps and also learn more about the various UI elements available in the process. All of the experience and knowledge you will gain by creating your app mockup in Power Apps will only payoff later when it's time to start on the production app. Another significant upside to using Power Apps for your mockup is that if you show this to your team and they like what you did, you can continue building off this app or create a new app and copy the elements you would like to keep to your other application. By not having to redo the UI or only having to redo parts of it, you could potentially save yourself hours of work.

The example below shows a simple mockup of a New Purchase Order Screen.



It really comes down to your preference and comfort with the software you are using to create the mockup. You should also consider licensing and costs when making this decision. Visio requires other licensing to get the full functionality required for creating a wireframe diagram. Whereas with Power Apps, it doesn't matter which license you have. As long as you have Power Apps (and sufficient permissions in your environment), you can create apps and mockup apps.

As you design the User Interface, a few other things to think about are Accessibility and Localization. It's important to ensure the app interface follows accessibility guidelines so all your users can interact with your application without any issues. To review these guidelines and other accessibility properties, see [Create accessible canvas apps in Power Apps<sup>9</sup>](#).

Localization can be something you must consider when developing your application as well. Depending on where your app will be used, you may need to use different punctuation. For example, some regions of the world use a . (dot or period) as the decimal separator while others use a , (comma). For more information on building a globally supported application, see [Build global support into canvas apps<sup>10</sup>](#).

For more information. see [Planning a Power Apps project<sup>11</sup>](#).

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Where do you configure and customize your app?

- In Power Apps Mobile
- In the Power Apps admin center
- In Microsoft Dynamics 365
- In Power Apps Studio

<sup>9</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/accessible-apps/>

<sup>10</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/global-apps/>

<sup>11</sup> <https://docs.microsoft.com/en-us/powerapps/guidance/planning/introduction/>

## Multiple choice

2. Which of these statements about data sources is true?

- In Power Apps, app data comes primarily from your local device.
- Power Apps is not able to connect to external data. All data must be stored in the Power Apps app.
- Power Apps uses connectors to connect to Data Sources. If the data source supports it, Power Apps can read and write to the data source.

## Multiple choice

3. Power Apps automatically creates three screens for you when you build an app from a data source. Which of the following is not one of the screens created?

- Browse Screen
- New Screen
- Edit Screen
- Details Screen

## Summary

Congratulations on creating your first app with Power Apps!

In this module, you discovered what Power Apps can do for your business and the building blocks of creating your first app. You then created an app from data in a Microsoft Excel workbook.

Additionally, you learned that:

- To create, share, and administer your apps, you will use make.powerapps.com, the Power Apps Studio, and the Power Apps Admin Center.
- The power of Power Apps comes from the ability to connect to related technologies in your business. Examples of these are Microsoft Dataverse, Power Automate, Microsoft SharePoint, and other data sources.
- You can create an app by using several different methods. Some of these methods include from a template, a data source (like Microsoft SharePoint), or a blank canvas.

See [Create your first app<sup>12</sup>](#) if you're interested in more explanation.

## Licensing

To learn more about licensing in Microsoft Power Platform review the following links:

[Microsoft Power Platform licensing overview<sup>13</sup>](#)

[Microsoft Power Apps pricing<sup>14</sup>](#)

[Microsoft Power Automate pricing<sup>15</sup>](#)

[Microsoft Power Apps portals pricing<sup>16</sup>](#)

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<sup>12</sup> <https://www.youtube.com/watch?v=88FIPT7XbP0>

<sup>13</sup> <https://docs.microsoft.com/en-us/power-platform/admin/pricing-billing-skus/>

<sup>14</sup> <https://powerapps.microsoft.com/pricing/>

<sup>15</sup> <https://us.flow.microsoft.com/pricing/>

<sup>16</sup> <https://powerapps.microsoft.com/portals/>

# Connecting to other data in a Power Apps canvas app

## Overview of the different data sources

In the previous units, you learned about directly referencing data sources from Power Apps. The two types of data sources were Tabular and Action based. As a refresher, they are as follows:

**Tabular data** - A tabular data source is one that returns data in a structured table format. Power Apps can directly read and display these tables through galleries, forms, and other controls. Additionally, if the data source supports it, Power Apps can create, edit, and delete data from these data sources. Examples include Microsoft Dataverse, SharePoint, and SQL Server.

**Action-based data** - An action-based data source is one that uses functions to interact with the data source. These functions could be used to return a table of data or to make updates to the data, such as send an email, update permissions, or create a calendar event. Examples include Office 365 Users, Project Online, and Azure Blob Storage.

Both of these data source types are commonly used to bring data and additional functionality to your app. Also, there is one type of special connection with Power Apps, the connection to Power Automate.

**Power Automate** - Is a cloud-based service that makes it practical and simple for line-of-business users to build workflows that automate time-consuming business tasks and processes across applications and services. Flow is a part of Office 365, and if you have a Power Apps license, then you also have a Flow license, meaning you can integrate its functionality to extend your Office 365 apps with no additional cost.

Power Automate can be used to enhance the capabilities of your app using its built-in actions. For example, you can build complex approvals, add business logic, better integrate with external data sources, and create PDFs. Later in this module you will learn more about Power Automate and how to integrate it with Power Apps.

In the next unit, you will learn about action-based connectors by adding the Office 365 Users connector to your app to both retrieve and update information.

## Work with action-based data sources

Action-based data sources differ from the more popular tabular data sources in that you use functions to interact with the data source instead of just reading and writing data. One important difference to note between tabular and action-based data sources is action-based data sources cannot be used with the Forms control. Forms only work with tabular data sources. This doesn't mean action-based data sources can only read data; most action-based data sources provide functions for updating the data as appropriate. An action-based data source can also be for things like sending emails or other notifications, not necessarily only for reading and writing data.

In the following examples you will learn how to add the Office 365 Users connector to your app, query for users, find the logged in user's manager, and finally update the logged in user's profile.

### Add the Office 365 Users data source

In this example, you will add the Office 365 Users data source, an action-based data source, to an app. The process is the same as adding a tabular data source.

1. In the Power Apps Studio, select **View** from the top menu bar.

2. On the menu bar, select **Data sources**.
3. From the pop-out list, select **Add data source**.
4. Select **New connection** in the pop-out list.
5. In the search box, type "Office 365".
6. The list of options will filter, select **Office 365 Users**.
7. In the pop-out list, you will see an overview of the data source, select **Connect**.

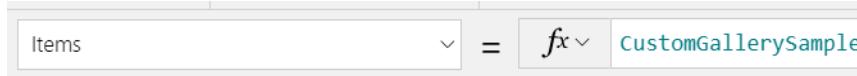
You have now added the Office 365 Users data source to your app. Next time that you want to use the data source in this app or any app, the data source will be available from the **Add data source** screen in step 3 above. You will not have to add a new connection to this data source again.

## Display a list of users in a gallery

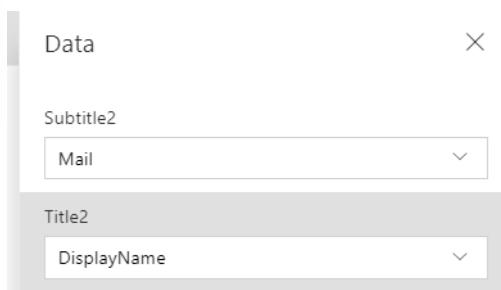
Now that you have the data source added to your app, you can display a list of the Office 365 users in a gallery.

1. On the menu bar, select **Insert**.
2. Select **Gallery**.
3. From the flyout menu, select **Vertical**.
4. In Gallery panel, to the right of Data source, select **None**.

Notice that your Office 365 users data source does not show up. That is because the gallery only shows tabular data sources. You can still use your action-based connecting with a gallery, it just takes a different process.



1. In the formula bar, there's an **Items** property. Delete **CustomGallerySample** from the formula bar.
2. Type in the following for the **Items** property:  
`Office365Users.SearchUser()`
3. In the gallery panel, change the **Layout** to **Title** and **Subtitle**.
4. Set the **Title** label to **DisplayName**
5. Set the **Subtitle** label to **Mail**.



Now your gallery shows all of your Microsoft 365 users' DisplayNames and Mail properties just like you were using a tabular data source. This is because that function of the Office365Users data connection

returns tabular data. You could use the output of this data with any function, like SortByColumns or Sum, that accepts a table of data as an input.

## Find the email address of the logged in user's manager

Another common use of the Office 365 data source is to query the user's manager. With tabular data sources, you would use the LookUp function to find this type of information. With this action-based data source, you use a function to directly query the information as shown in the example below.

1. Click an area outside of your gallery from the previous example.
2. Select the **Insert** link on the menu bar.
3. Select **Label**.
4. In the formula bar, delete "Text".
5. In the formula bar, type the following formula:

`Office365Users.ManagerV2(User().Email).mail`

**Note:** If you receive an error after entering this formula then the user does not have a manager assigned in Office 365.

In the label, you will now see the current user's manager email address. The following is a breakdown of the formula.

Formula argument	Formula input	Notes
id	User().Email	User() is a built-in function that returns information about the current logged in user including FullName, Email, and Image.
.property	.mail	The function returns the whole user record for the manager. To display only the email address in a Label, use the dot (.) notation.

## Update the logged in user's profile info

Another way you might use an action-based connector is to update data. With a tabular data source, you could update directly using a Form or a Patch function. Those capabilities do not work with action-based data sources. Instead, for each action-based data source, you are dependent on the functions provided by that connector for your options. The following example shows how to update your Microsoft User Profile by using the provided function.

1. On the canvas, select the **Insert** menu option.
2. Add a **Button**.
3. For the **OnSelect** property of the button, set the formula to

`Office365Users.UpdateMyProfile({aboutMe: "Project manager with 5 years of technical project management experience."})`

That will update your Microsoft 365 Profile. The following is a breakdown of the formula.

Formula argument	Formula input	Notes
Optional	{aboutMe: " Project manager with 5 years of technical project management experience."}	Additional optional parameters: birthday, interests, mySite, pastProjects, schools, skills

Another example would be to update the profile by referencing a **text input** control on the screen. If you had a text input control on the screen named TextInput1, the formula would update to:

```
Office365Users.UpdateMyProfile ({aboutMe: TextInput1.Text})
```

The Office 365 Users action-based data source is a rich data source and commonly used in many apps. You should take some time to get more familiar with this data source. To learn more about this and all of the available data sources, see **Connectors**<sup>17</sup>.

These examples demonstrate how to integrate an action-based data source into your app. The concepts can be similar to tabular data sources, like when displaying users in a gallery, but also different, like when writing back to a user's profile.

In the next unit, you will learn more about Power Automate and how to integrate it with your Power Apps apps.

## Power Automate is a companion to Power Apps

Power Automate is a standalone component in the Microsoft 365 ecosystem but also a great Power Apps companion. This is because Power Automate has actions and triggers for interfacing directly with Power Apps. This connection allows you to easily leverage Power Automates functionality in your app.

## Business logic

Power Apps is great in scenarios where you have a direct action you want to be taken after a user performs an activity. An example might be sending an email after a user submits a new expense report. If you need to notify someone the expense report was submitted, then you can do that easily directly from Power Apps.

But what if instead of just notifying someone, you also want to start an approval process. This is a great example of where connecting to Power Automate makes your app stand out. You can have Power Apps trigger a Power Automate flow when the user submits the data. Power Automate can then look up who the user's manager is, and send the manager an approval request. Power Automate will then facilitate getting a response from the manager, updating the data source with the status based on their response, and ultimately sending the original submitter an update.

Approvals are just one example of how you can use Power Automate's native abilities to augment your app's capabilities.

## Data connections

Power Apps offers many of options for connecting to data through the built-in connectors, premium connectors, and custom connecters, however sometimes you need more than that. Some data sources, like custom APIs, can provide data back in a difficult to use format. For example, complex JSON structures

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<sup>17</sup> <https://docs.microsoft.com/en-us/connectors/>

are not user-friendly in your app. This is where Power Automate can help. Power Automate has additional actions and expressions natively built in that are better at handling these complex data structures. And more importantly, these actions and expressions can parse through the data and restructure it into a much easier to use object. After the data is parsed, Power Automate can respond to Power Apps with just the friendly data.

Use Power Automate to interact with complex data sources, restructure the objects, and then return to Power Apps only the data that you need. Watch this video to get started with creating a Power Automate flow to connect to Power Apps.



<https://www.microsoft.com/videoplayer/embed/RE2ORDw>

The following video shows how to use Power Automate as a data source to your Power Apps app.



<https://www.microsoft.com/videoplayer/embed/RE4wsDJ>

Connecting Power Apps and Power Automate can bring greater functionality into your apps.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which one of the following is true about action-based data sources?

- A Forms control cannot use action-based data sources.
- They are only used to send emails, not to retrieve data.
- Power Automate is the only application with action-based data sources.
- A Forms control can use action-based data sources.

### Multiple choice

2. What is the relationship between Power Apps and Power Automate?

- Power Automate is just another data source for Power Apps.
- Power Automate and Power Apps enhance each other and have a special connection.
- Power Automate is only available if you have a premium Power Apps license.
- Power Automate can receive data from Power Apps but cannot return information.

## Multiple choice

3. If you use business logic in your Power Apps app, which statement is true?

- It should always be in Power Automate, Power Apps cannot do business logic.
- It should always be in Power Apps; Power Automate cannot do business logic.
- Both Power Apps and Power Automate do not support Business logic.
- You should choose the best tool. Power Apps is great for simple logic, but integrating with Power Automate for the more complex logic will enhance your app's capabilities.

## Summary

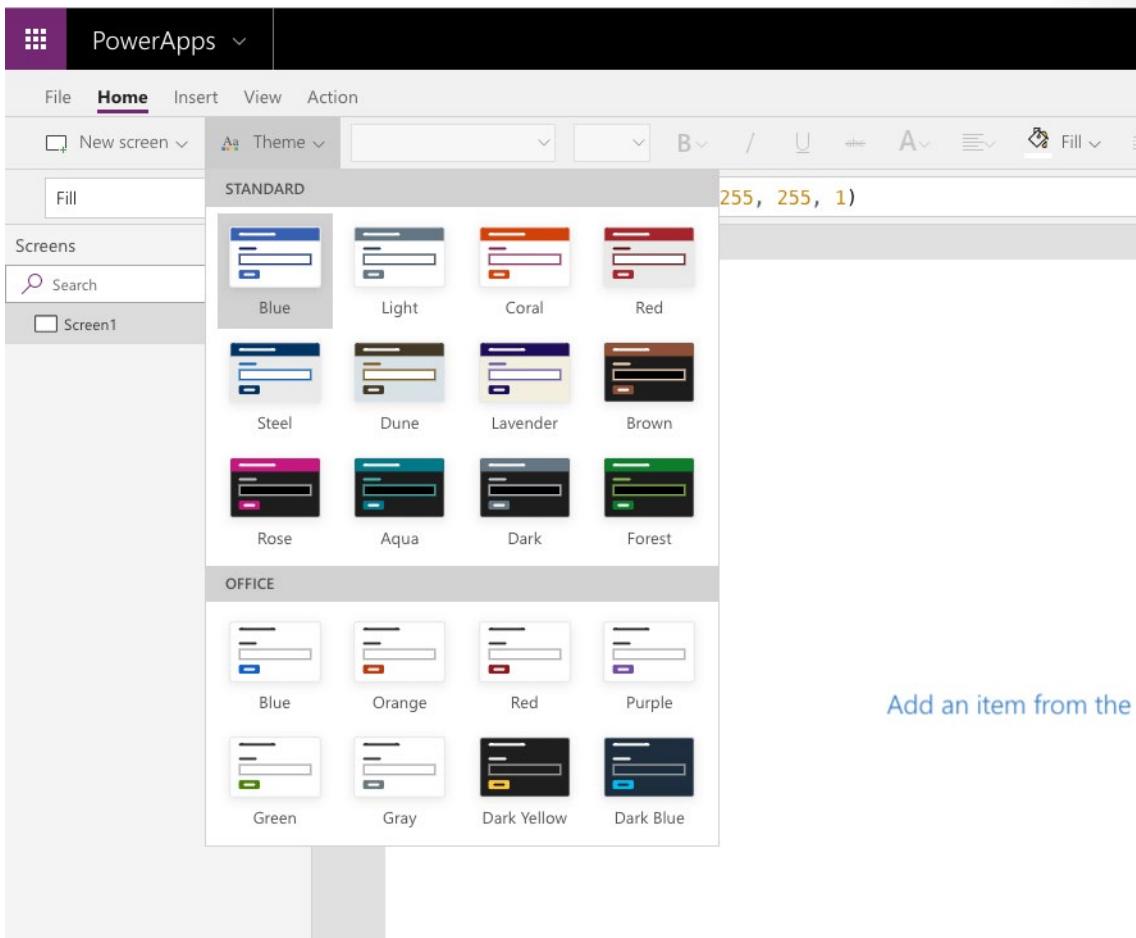
In this module, you discovered non-tabular ways to bring data and functionality into your app. Action-based data sources can be used to read and write data but also to perform additional functionality like sending notifications or triggering other actions. You also learned how Power Automate, which you already have a license for if you have a Power Apps license, can be incorporated into your app to increase the functionality. With its support for approvals, complex business logic, and working with complex data, Power Automate is the perfect companion to Power Apps. These items are important to remember:

- Power Apps supports both tabular and action-based data sources.
- With action-based data sources, you can use the data sources provided functions to interact with the data source.
- You can easily connect Power Apps to Power Automate, providing your app with additional capabilities. With this connection, you can pass data back and forth between the two platforms.

# How to build the UI in a canvas app in Power Apps

## Use themes to quickly change the appearance of your app

A quick and easy way to change the colors in your app is to apply a theme. In Power Apps, there are several out-of-the-box themes to choose from. The following screenshot illustrates all the themes that are available in your app.



These themes have a specific set of default colors and visual elements which will alter the look and feel of your entire app. To use any of these themes in your Canvas app, select a theme from the ribbon. The changes to your app will take effect immediately.

If none of the included themes work for your app, you can create a custom theme. For example, if you decide to select the Steel theme but want the screen background to be a lighter color, this can be easily done. To change the background of your screen, change the **Fill** property to **RGBA(250, 250, 250, 1)**. The screen will be a slighter lighter shade of gray. Keep in mind, this only changed the fill of that specific screen, if you want to add a new blank screen it would still have the **Fill** property of **RGBA(232, 232, 232, 1)**. This is by design when working with a canvas app. Also, there is no option to create a Custom theme for a canvas app and store it to be used for other apps.

Typically, many organizations will select the theme that best suits their needs, and then alter the various control properties to align with their corporate branding.

## Branding a control

As noted earlier, one of the built-in themes may not match your organization's desired look and feel for the app. You can customize your app by changing various properties of the app controls. By adjusting a few of the Control properties, like Fill, Hover, and Border you can completely change how the control looks. If you decide to customize your controls, it's recommended that you do this thorough testing to ensure that you don't run into any complications when users interact with the app.

For example, consider the Button control. The following are some of the properties of a Button control that you could customize to better fit your company's theme.

## Typical properties

These properties are in effect when the user is not interacting with the control.

- BorderColor - The color of a control's border.
- BorderStyle - Determines whether a control's border is solid, dashed, dotted, or none.
- Color - The color of text in a control.
- Fill - The background color of a control

## Disabled properties

These properties are in effect when the control is disabled. A control can be disabled if the **Disabled** property is set to **Disabled**.

- DisabledColor - The color of text in a control if its **DisplayMode** property is set to **Disabled**.
- DisabledFill - The background color of a control if its **DisplayMode** property is set to **Disabled**.

## Hover properties

These properties are in effect when the user hovers over the control with a mouse.

- HoverColor - The color of the text in a control when the user keeps the mouse pointer on it.
- HoverFill - The background color of a control when the user keeps the mouse pointer on it.

These are just some of the properties that you could modify. For more details about the properties that you can customize, see **Color and Border Properties in Power Apps**<sup>18</sup>.

Note that each control is independent. This means that if you alter the **HoverColor** property of one button control on your screen or in your app, the other buttons in the app will remain unchanged. You must edit the properties of each control that you want to appear in a different manner.

## Some color settings are only controlled by the theme

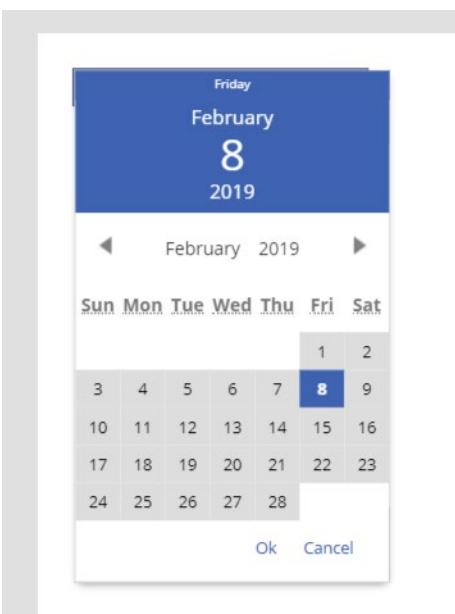
There are certain aspects of controls that cannot be altered and are specific to the theme that you select. For example, here's an example of the **Date picker** control.

1. In Power Apps Studio, add the **Date picker** control.

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<sup>18</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/controls/properties-color-border/>

2. Put the app in preview mode and select the control so that it opens.
3. The color at the top of the **Date picker** control is specific to the theme, meaning there isn't a control property you can change to set the color manually. To change the color of that background you would have to select a different theme.



As you design your app, be sure to incorporate the use of icons. In the next section, you'll learn how to add an icon to a Canvas app to change the look and feel of the app.

## Icons

When designing your app, utilize Shapes and Icon controls when possible to enhance the user experience of your app. There are certain shapes and icons that are universally recognized that you will find in many of the apps that you use daily. For example, instead of adding a Button control to your app and setting the **OnSelect** property to Back(), you could as easily use the **Back** icon control and set its **OnSelect** property to Back().

Remember, icons are controls, and each control has a specific set of properties that can be modified to change how the control looks and functions. To view all of available icon controls, select **Insert** and then select the **Icons** drop-down menu.



These controls include arrows, geometric shapes, actions, and symbols. By incorporating shapes and icons, you can save some space and reduce clutter in your app, especially when working with a Phone form factor app. The Phone form factor app has a much smaller area for designing and adding controls so replacing some of the buttons with shapes and icons could really benefit the overall spacing of your app.

## Images

The Image control is a control that shows an image. The image may be from a local file or a data source. Adding an image, such as a company logo is an easy way to enhance the overall look and feel of your app. On each screen you can apply a Background image, as well as multiple Image controls. You're not limited to a certain number of images that you can display; you can have as many images as you would like. Too many images may cause issues with the app performance and load times, but you would have to add quite a few large images for this to be an issue. There are a set of properties specific to the Image control that allow you to customize how the image is displayed. When working with the Image control, a few of the more common properties you will most likely want to modify are the Image, Image position, and Transparency properties.

**Image** - The name of the image that appears in an image, audio, or microphone control.

**Image Position** - The position (Fill, Fit, Stretch, Tile, or Center) of the image in a screen or a control if it isn't the same size as the image.

**Transparency** - The degree to which the controls behind an image remain visible.

Here's a quick example of how to change the transparency and image position of an Image control.

1. In Power Apps, create a Tablet app using the "Product Showcase" App template.
2. On the left, under **Screens**, select **Image1**.
3. In the right pane, set the **Transparency** property to **0.5**.

You will notice that the image immediately becomes lighter in color.

4. In the **Image position** property, change this to **Center**.

The image appears to be zoomed in or larger.

As you develop your app, keep these settings in mind when using the Image control to enhance the look and feel of your app.

## Personalization

In Power Apps, you can show information about the current user with the User() function. This includes the full name, email address, and the picture that's associated with the user who's signed into a canvas app. It will match the "Account" information that is displayed in the Power Apps players and studio, which can be found outside of any authored apps. This may not match the current user's information in Office 365 or other services.

The **User** function returns a **record**<sup>19</sup> of information about the current user:

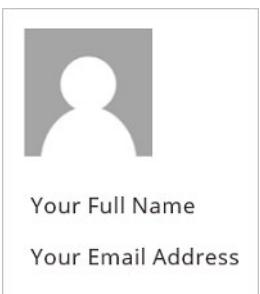
Property	Description
<b>User().Email</b>	Email address of the current user.
<b>User().FullName</b>	Full name of the current user, including first and last name.

<sup>19</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/working-with-tables#records>

<b>User().Image</b>	Image of the current user. This will be an image URL of the form "blob: <i>identifier</i> ".
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Set the **Image property**<sup>20</sup> of the **Image control**<sup>21</sup> to this value to display the image in the app. Here's an example of how to add a user's profile picture, email, and name to your app.

1. On the **Insert** tab, click or tap **Media**, and then click or tap **Image**.
2. Set the **Image** property to this formula: **User().Image**
3. On the **Insert** tab, click or tap **Text**, and then click or tap **Label**:
4. Set the **Text** property to this formula: **User().FullName**
5. Move the label so it's below the image control.
6. Add another label, and set its **Text** property to this formula: **User().Email**
7. Move the label so it's below the first label:



## Using the tablet or phone form factors

It is important to design your app for the primary device that it will be used on. There are two form factors to choose from, the Phone form factor and the Tablet form factor. The main difference between these is the Screen size. The screen size affects the amount of space available to build the app.

The Phone form factor has a significantly smaller area to build your app, but if most of your users will be accessing the app from a mobile phone then this is the best form factor for you. When building for mobile, select controls that will be easy to use on a mobile device, ensure that the text is large enough to be easily seen, and design the app in a single column vertical format.

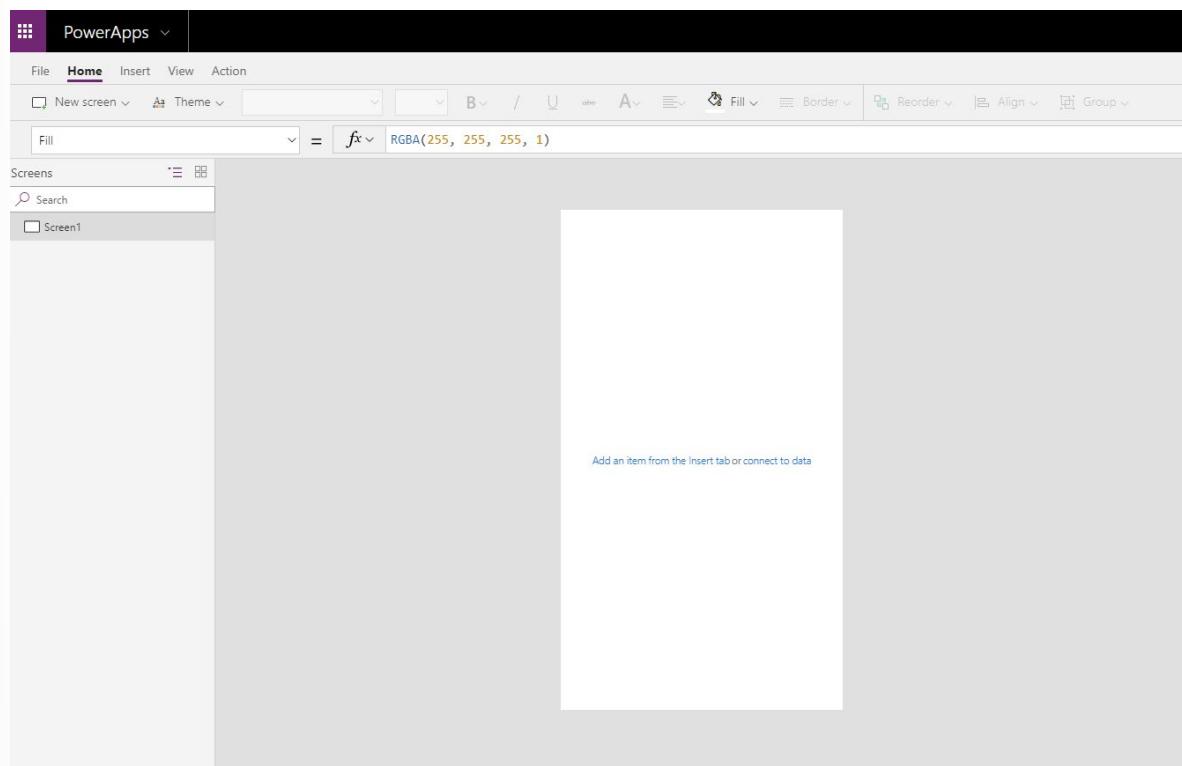
The Tablet form factor has a much larger area for designing your app and is the best option if your users will be accessing the app from a tablet or PC. Because you have more screen size to work with, you will have more flexibility in designing this app. Regardless of the form factor that you choose; the functionality available in the Power Apps Studio will be the same.

Take a moment and create two blank Canvas apps. For one of the apps use the Phone form factor and for the other app use the Tablet form factor. You will immediately notice the difference in the amount of space available on the screen to design your app.

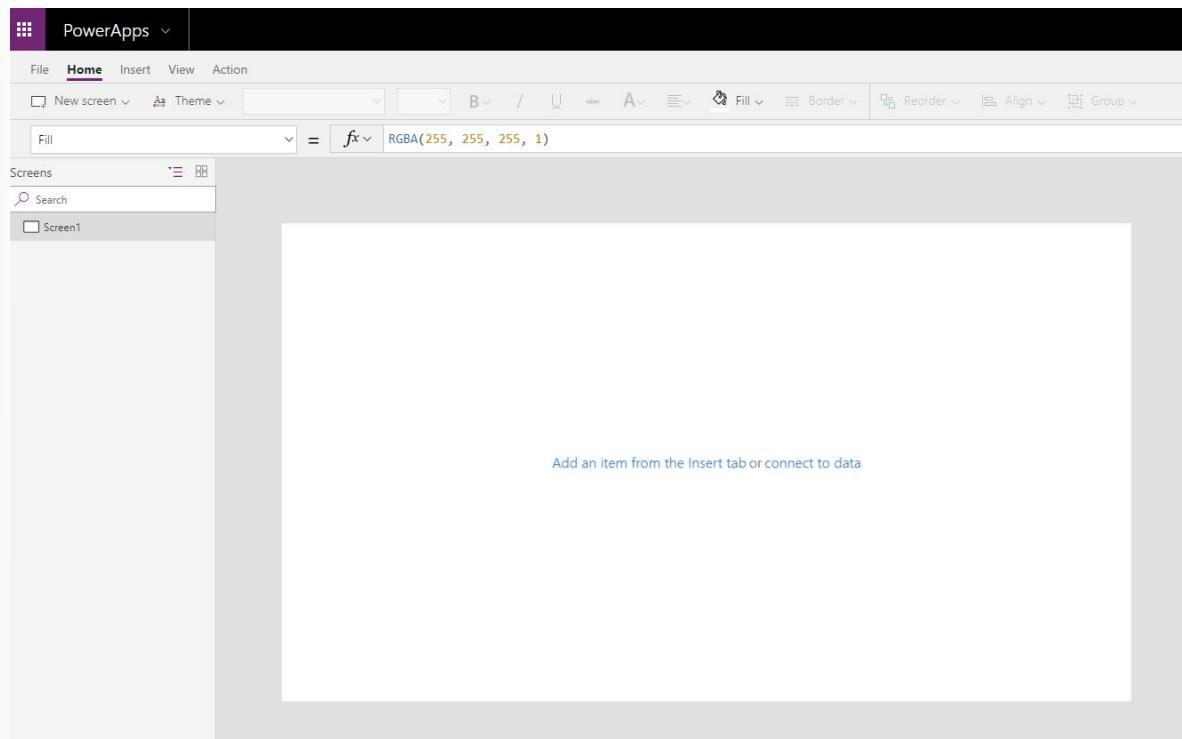
### Phone form factor

<sup>20</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/controls/properties-visual/>

<sup>21</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/controls/control-image/>



### Tablet form factor



Depending on the form factor that you choose, you have the ability to alter the screen size. To view the current screen size and orientation, for either form factor, see following steps.

1. In Power Apps Studio, in the upper-left corner, select **File**.

- 
2. On the left, select **App settings**.

When you are in the tablet app, you will notice multiple options to select from for the screen size. Be sure to select the appropriate size for the majority of your app users.

- 16:9 (Default)
- 3:2 (Surface Pro 3)
- 16:10 (Widescreen)
- 4:3 (iPad)
- Custom

The Phone form factor does not include screen size options.

## Lock aspect ratio and lock orientation

Other options that you might want to consider regarding the screen size and orientation include the lock aspect ratio and lock orientation settings.

If you lock the aspect ratio, the app will retain the appropriate aspect ratio for a phone. If the app is running on another kind of device, the app will display incorrectly and may show unwanted results. If you unlock the aspect ratio, the app will adjust to the aspect ratio of the device on which it's running.

If you lock the app's orientation, the app will retain the orientation that you specify. If the app is running on a device for which the screen is in a different orientation, the app will display incorrectly and may show unwanted results. If you unlock the app's orientation, it will adjust to the screen orientation of the device on which it's running.

You can also modify the app's orientation by enabling **Enable app embedding user experience** in **Advanced settings**. This feature aligns the app when it's embedded and changes the background color of the hosting canvas to white.

## Exercise - Create UI for a new canvas app

In this unit, you'll generate a new canvas app that you will customize with various pieces of the UI covered in the previous units. This should give you a good idea of the capabilities of UI design in Power Apps.

**Note:** Power Apps requires either an Office 365 license or a free trial. Learn more about your licensing options. **Microsoft products include Microsoft Power Apps and Power Automate<sup>22</sup>.**

## Creating a new blank app header

1. Log into Power Apps(<https://make.powerapps.com/>).
2. On the Home screen select **Canvas app from blank**.

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<sup>22</sup> <https://docs.microsoft.com/en-us/powerapps/administrator/pricing-billing-skus/>

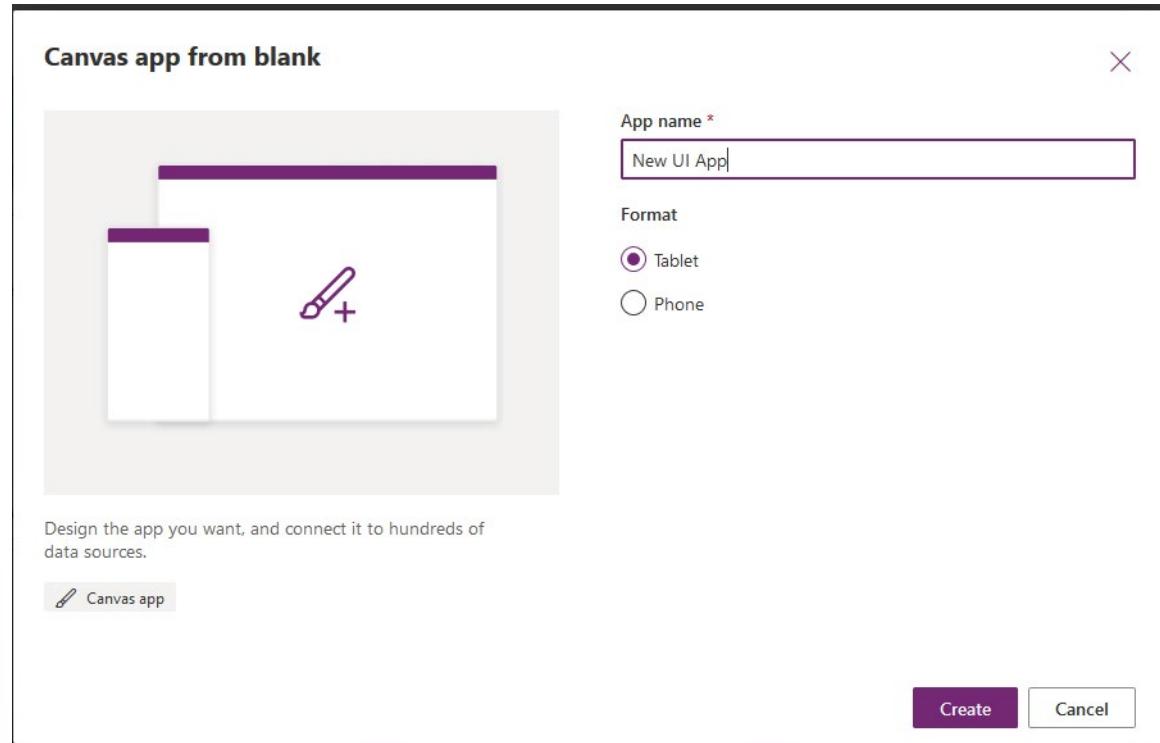
Make your own app



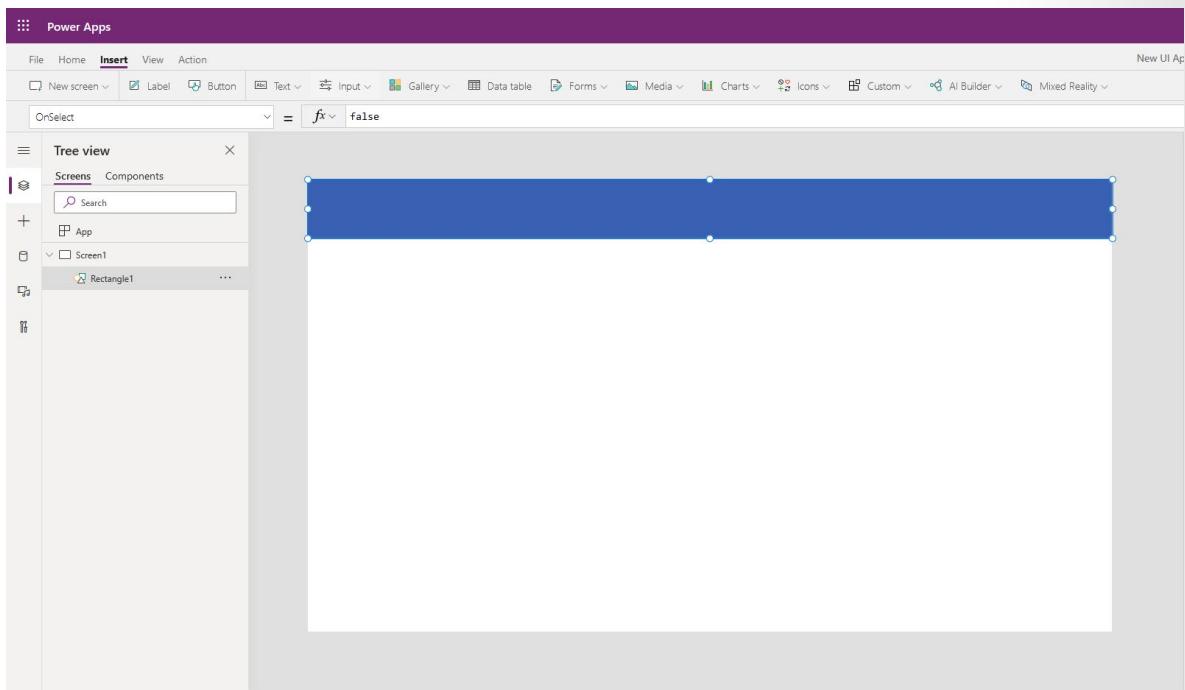
Canvas app from blank

Canvas app

3. Name your app **New UI App** and click **Create**.



4. In the new app, select the **Insert** tab and the **Icons** dropdown. Scroll close to the bottom of the dropdown options and choose **Rectangle**.
5. Move and resize the rectangle to cover the top of your app screen.



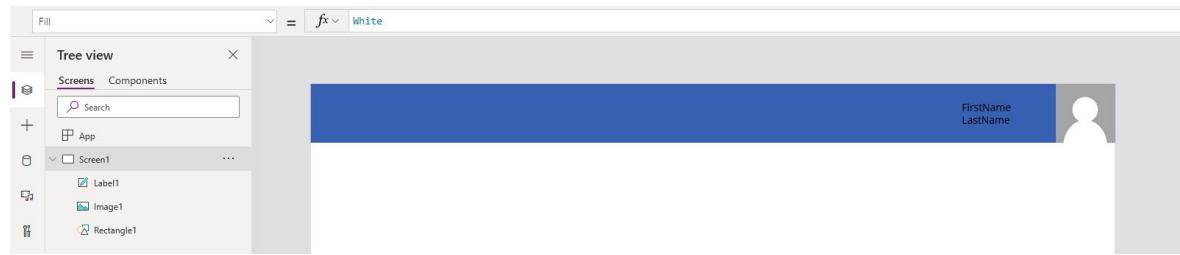
6. Next, select the **Media** dropdown at the top and choose **Image**.
7. Move the image to the top right corner of your app screen.
8. Change the Image property to:

User().Image



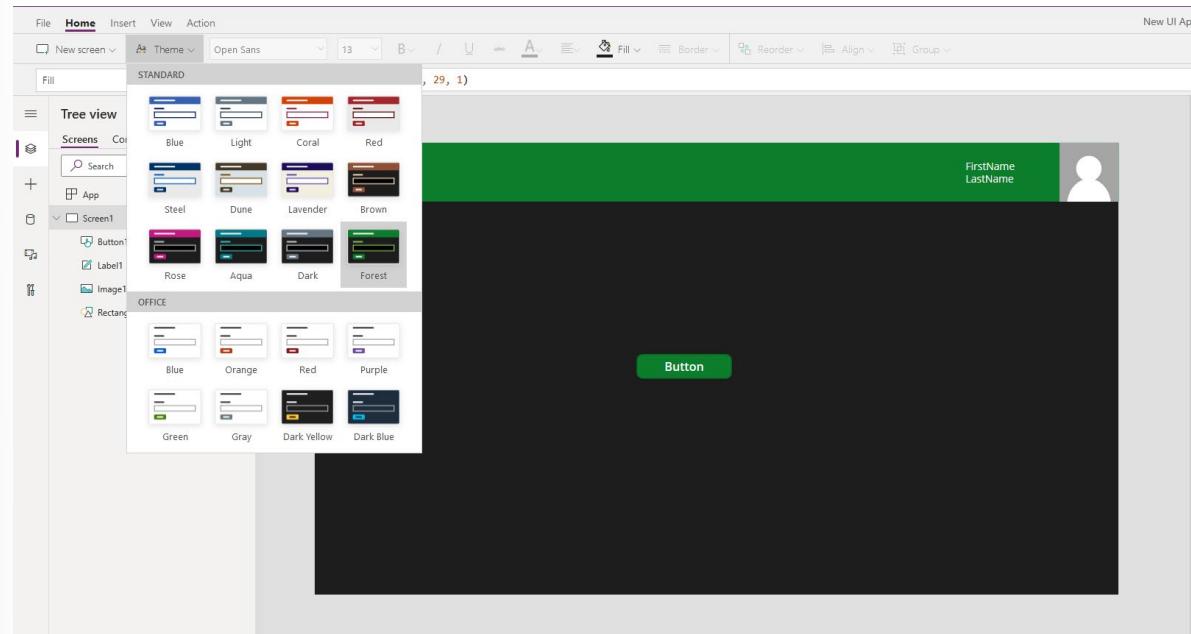
9. Insert a **Label** and change the Text property to:  
User().FullName

10. Move the label next to the image and resize as needed.



11. Insert a **Button** and move it to the middle of the screen.

12. Select the **Home** tab in the top left, and click the **Theme** dropdown. Choose **Forest**.



Notice how the entire app's color scheme changes according to the new theme; including the button, label, and font colors. This is how easily you can make your Power Apps look and feel unique and fun, but also enhance the usability and appearance.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. When creating an app, what two form factors can you choose from?

- Tablet and PC
- Tablet and Phone
- Phone and PC
- Tablet and iPhone

## Multiple choice

2. Which formula returns the full name of the current Power Apps user?

- User.FullName
- FullName.User()
- User().FullName
- User().Name

## Multiple choice

3. When using an Image Control, which of the following ImagePositions does NOT belong?

- Stretch
- Fit
- Tile
- Expand

## Summary

There are many options available to enhance the usability and appearance of your app. Throughout this module, you explored themes, properties for changing a control's appearance, using icons and images, personalization, and the different form factors available. Some important items to remember are:

- There are several out-of-the box or default themes to choose from and these can be easily applied.
- By modifying various Control properties, you can completely change how the control looks and functions when users interact with the app.
- Use the User() function to personalize the app. For example, create a Welcome screen and greet the user by using the User() function.
- You must select the form factor when you begin building your app. After you have selected tablet or mobile, it cannot be changed. With the tablet form factor, you can adjust the screen size.

# Manage apps in Power Apps

## Exercise - Manage app versions in Power Apps

Microsoft Power Apps can help if you saved changes to an app that you shouldn't have or if something else goes wrong. For apps that you save in the cloud, Power Apps keeps a history of the changes that you make. You can view each version that you've saved and restore your app to a previous version if necessary. If you shared the app, the people whom you shared it with will also receive the restored version if you republish the app.

### View versions of your app

1. On [make.powerapps.com](https://make.powerapps.com/)(<https://make.powerapps.com/>), select **Apps** on the left pane.

The screenshot shows the 'Your apps' section of the Power Apps portal. It displays two sample apps: 'Getting started with canvas apps' and 'Get started with canvas app formulas'. Below this, a list of user-created apps is shown, with one app named 'flooring-estimates app' selected. A context menu is open over this app, listing options like Edit, Play, Share, Export package (preview), Add to Teams, Analytics (preview), Settings, Delete, and Details. The 'Details' option is highlighted with a red box.

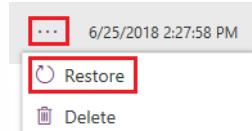
2. In the list of apps, select the ellipsis (...) next to the app name and then select **Details**.

3. Select the **Versions** tab.

The tab shows all versions of the app that you saved as you developed it.

### Restore a previous version

1. Select the ellipsis (...) next to the desired version and then select **Restore**.



2. Select **Restore** again to confirm the action.

A new version is added to your list.

When you restore a version of an app, the newly restored version gets a new, incremented version number and appears at the top of the list. A new version never overwrites a previous version.

**Note:**

After restoring a previous version, the restored version needs to be published before users will see the new version. If for some reason you are not able to restore a previous version, you can try the following:

- Make sure the App is not open in Power Apps Studio. If the app is open, you will not be able to restore the version.
- Verify the version you would like to restore is not older than six months. At the current time, only app versions less than six months old can be restored.

## Exercise - Share apps in Power Apps

You can share an app with specific users, groups, or your whole organization. When you share an app with other people, they can run it in a browser, from the Microsoft Dynamics 365 home page, or in Microsoft Power Apps Mobile for Microsoft Windows, Apple iOS, or Google Android.

Even better, you can give someone permission to update the app.

### Prepare to share an app

To complete the following steps, open the app that you want to share in **Edit** mode.

1. In Power Apps Studio, select the **File** menu and then select **Settings**. Give the app a meaningful name and a description so that your team knows what your app does and can easily find it in the apps list.
2. On the **File** menu, select **Save as** and then select **The cloud**.  
You must save an app to the cloud before you can share it.
3. Select **Save** and then select **Share**.
4. On the **Share** tab, specify the users or groups with whom you want to share the app. To add everyone in your organization, type **Everyone** and select **Everyone in Company Name**. If you need to share with a large group of users, a best practice is to share through an Azure Active Directory Security Group.

By default, the user receives the User permission. If you want the user to also be able to edit the app, then select the co-owner check box. The following is a description of both permissions:

- **Co-owner** - Users can use, edit, and share the app, but can't delete or change the owner.
- **User** - Users can view and use the app, but they can't change it.

#### Security-group considerations

- If you share an app with a security group, existing members of that group, and anyone who joins it, will have the permission that you specify for that group. Anyone who leaves the group loses that permission unless they belong to a different group that has access or if you give them permission as an individual.
  - Every member of a security group has the same permission for an app as the overall group does. However, you can specify greater permissions for one or more members of that group to allow them greater access. For example, you can give Security Group A permission to run an app, but you can also give User B, who belongs to that group, Co-owner permission. Every member of the security group can run the app, but only User B can edit it. If you give Security Group A Co-owner permission and User B permission to run the app, that user can still edit the app.
5. To notify users by email, leave the **Send an email invitation** check box selected.  
If you elect to notify the users by email, everyone you shared the app with will receive an email message that has a link to the app. People whom you granted **Co-owner** permission for the app will also receive a link to Edit App in Power Apps Studio.

## 6. Select **Share**.

If you make and save changes to a shared app, the people whom you shared it with will see your changes as soon as you publish them. This can be useful if you improve the app, but it can also negatively affect users if you remove or significantly change features. Remember to create a notification plan for alerting your users of major updates.

## Permissions and licensing

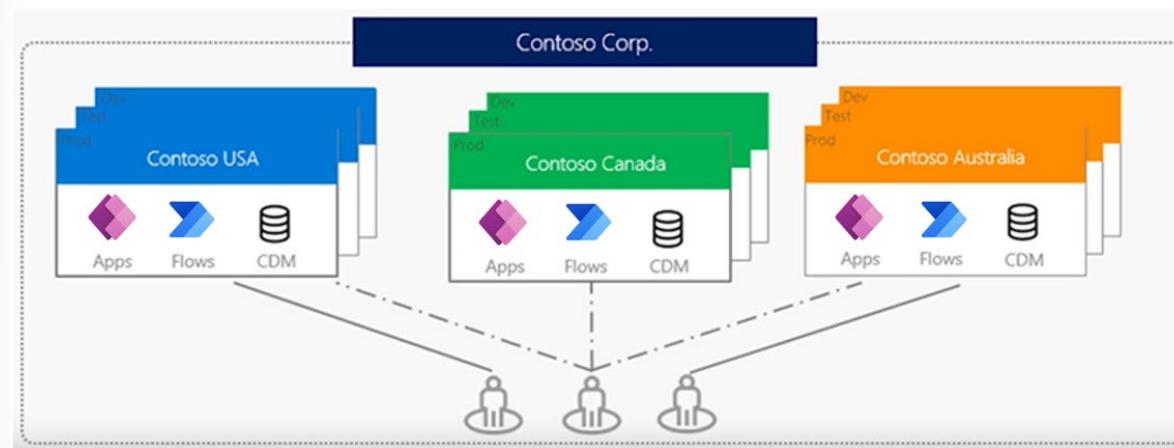
Basic information about permissions and licensing that you should be aware of are:

- Users and contributors need permissions to any data connections and gateways that a shared app uses. Some permissions come implicitly with the app, but you must explicitly grant others. If you create an app based on Microsoft Dataverse, you must also ensure that the users with whom you share the app have the appropriate permissions for the table or tables on which the app relies. Specifically, those users must belong to a security role that can perform tasks such as creating, reading, writing, and deleting relevant rows. In many cases, you'll want to create one or more custom security roles with the exact permissions that users need to run the app. You can then assign a role to each user as appropriate.
- People who have **Co-owner** permission also need a Power Apps Per app plan or Power Apps Per user plan to work directly with tables in Dataverse.

Sharing an app is simple, and it's a great way to make an app that you find useful available to people across your organization.

## Exercise - Understand environments in Power Apps

An environment is a container for apps and other resources, such as data connections and flows from Power Automate. It's a way to group items based on business requirements.



If you've followed along with this module, you've already been working in [make.powerapps.com](https://make.powerapps.com/)(<https://make.powerapps.com/>). Therefore, you've been working in a specific environment the whole time. In the upper-right corner of the home page, you can view your current environment.



If you're new to Microsoft Power Apps, you might have only the default environment at this point. If a drop-down menu is visible next to the environment name, this indicates that other environments are available.

**Note:** If you want to work with Power Apps environments, you need a Power Apps Per app plan or Power Apps Per user plan. Additionally, if you want to work with Dynamics 365 restricted tables, you must have a Power Apps for Dynamics 365 license. Learn more about [licenses for Dynamics 365<sup>23</sup>](#).

## Reasons to use environments

Reasons to create environments beyond the default one include:

- **Separate app development by department** - In a large organization, each department can work in a different environment. That way, department employees see only apps and company data that are appropriate to their needs.
- **Support application lifecycle management (ALM)** - Separate environments let you separate apps that are in development stages from those that have already been shared. Alternatively, you might want to use a trial environment so that you can receive feedback from employees before publishing the final app. For some organizations, showing apps before they're completely developed and published can present security concerns.
- **Manage data access** - Each environment can have its own source of business data, called a database for Microsoft Dataverse. Other data connections are specific to an environment and can't be shared across environments.

**Note:** Keep in mind that environments are relevant only to app creators and Power Apps admins. When you share an app with users, those users simply run the app, providing they have the correct permissions. In other words, they don't have to worry about what environment the app came from.

## Create an environment

Only an admin can create environments. If you aren't an admin, this information can still be helpful when you talk to your admin about setting up environments.

1. On the [make.powerapps.com<sup>24</sup>](https://make.powerapps.com)(<https://make.powerapps.com/>) home page, select the gear icon near the upper-right corner and then select **Admin center**. You can also go directly to [https://admin.powerplatform.microsoft.com<sup>25</sup>](https://admin.powerplatform.microsoft.com)
2. In Microsoft Power Platform admin center, select **+ New**.

<sup>23</sup> <https://docs.microsoft.com/en-us/power-platform/admin/pricing-billing-skus#licenses>

<sup>24</sup> [https://login.microsoftonline.com/common/oauth2/v2.0/authorize?client\\_id=a8f7a65c-f5ba-4859-b2d6-df772c264e9d&scope=openid+profile+offline\\_access&redirect\\_uri=https%3a%2f%2fmake.preview.powerapps.com%2fauth&client-request-id=b11a654-5e75-4407-8dd0-0744b9d7200a&response\\_mode=fragment&response\\_type=code&x-client-SKU=msal.js.browser&x-client-VER=2.14.2&x-client-OS=&x-client-CPU=&x-client\\_info=1&code\\_challenge=Q8cVppZslMAwVhUTgb-u9ZbEieA6GhYgiZaQyE6ee90&code\\_challenge\\_method=S256&nonce=101a3adb-1f69-43c9-9fa8-5cd794a616ee&state=eyJpZCI6ImE1MjBmZWY4LTJlODAtNDMyMC05YzdhLTg5OTY5NmIyZjA2NCIsImIldGEiOnsiaW50ZXJhY3Rpb25UeXBljoicmVkaXJIY3QifX0%3d&sso\\_nonce=AwABAAAAAAACAOz\\_BAD0\\_waPjh5m6RNPOigpgDSHI6\\_IPvn0VTN3NTy4bfIcpLot58VIYIZm5N-vsJPWfLNAPGBQgEhaWjJlqTlaca8-5IAgAA&mscrid=b11a654-5e75-4407-8dd0-0744b9d7200a](https://login.microsoftonline.com/common/oauth2/v2.0/authorize?client_id=a8f7a65c-f5ba-4859-b2d6-df772c264e9d&scope=openid+profile+offline_access&redirect_uri=https%3a%2f%2fmake.preview.powerapps.com%2fauth&client-request-id=b11a654-5e75-4407-8dd0-0744b9d7200a&response_mode=fragment&response_type=code&x-client-SKU=msal.js.browser&x-client-VER=2.14.2&x-client-OS=&x-client-CPU=&x-client_info=1&code_challenge=Q8cVppZslMAwVhUTgb-u9ZbEieA6GhYgiZaQyE6ee90&code_challenge_method=S256&nonce=101a3adb-1f69-43c9-9fa8-5cd794a616ee&state=eyJpZCI6ImE1MjBmZWY4LTJlODAtNDMyMC05YzdhLTg5OTY5NmIyZjA2NCIsImIldGEiOnsiaW50ZXJhY3Rpb25UeXBljoicmVkaXJIY3QifX0%3d&sso_nonce=AwABAAAAAAACAOz_BAD0_waPjh5m6RNPOigpgDSHI6_IPvn0VTN3NTy4bfIcpLot58VIYIZm5N-vsJPWfLNAPGBQgEhaWjJlqTlaca8-5IAgAA&mscrid=b11a654-5e75-4407-8dd0-0744b9d7200a)

<sup>25</sup> <https://admin.powerplatform.microsoft.com/>

3. In the **New environment** dialog box, enter a name for the environment and then select a region and an environment type.
4. To the left of **Create a database for this environment**, select the toggle to Yes.
5. Select **Next**.
6. Select the currency and language for the data that is stored in the database. You cannot change the currency or language after the database is created.
7. Select **Save**.

It might take several minutes to create the database on Dataverse. After the database is created, the new environment appears in the list of environments on the **Environments** page.

You now have a new environment to work in. If you go back to [make.powerapps.com<sup>26</sup>](https://make.powerapps.com)(<https://make.powerapps.com/>), you will see it in the environments list.

## Manage access to an environment

By default, you can access an environment in one of two ways:

- **System admin** - A system admin has full permissions to create and manage environments.
- **Environment maker** - An environment maker can view all apps in that environment, create apps, and work with Dataverse (other permissions apply).

Environment admins can create other security roles as needed. They can also add and assign users to these roles.

1. Start by going to [https://admin.powerplatform.microsoft.com<sup>27</sup>](https://admin.powerplatform.microsoft.com)
2. On the left pane, **Environments** should be selected by default, if it is not, select **Environments**.
3. Select the test environment that you just created, and then select **Settings** at the top.
4. Select the **Users + permissions** dropdown and select **Users**.
5. Select **Add user** at the top and add the user by entering the email address of the user in your organization and then selecting **Add**. Wait a few minutes for the user to be added.
6. To manage the roles and information of a user, select the user's **Name**. This will open a new tab with the Dynamics 365 view of that user.
7. Select **Manage Roles** on the top bar.
8. In the **Manage User Roles** box, select the role(s) for the user. In this example, assign the user to the Environment Maker role.
9. Select **OK**.
10. The changes are then saved, so you can close the Dynamics 365 tab in your browser when done.

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<sup>26</sup> [https://login.microsoftonline.com/common/oauth2/v2.0/authorize?client\\_id=a8f7a65c-f5ba-4859-b2d6-df772c264e9d&scope=openid+profile+offline\\_access&redirect\\_uri=https%3a%2f%2fmake.preview.powerapps.com%2fauth&client-request-id=b111a654-5e75-4407-8dd0-0744b9d7200a&response\\_mode=fragment&response\\_type=code&x-client-SKU=msal.js.browser&x-client-VER=2.14.2&x-client-OS=&x-client-CPU=&x-client\\_info=1&code\\_challenge=Q8cvppZsIMAwvhUTgb-u9ZbEieA6GhYgjzaQyE6ee90&code\\_challenge\\_method=S256&nonce=101a3adb-1f69-43c9-9fa8-5cd794a616ee&state=eyJpZCI6ImE1MjBmZWY4LTI0DATNDMyMC05YzdhLTg5OTY5NmlyZjA2NCIsIm1ldGEiOnsiaW50ZXJhY3RpB25UeXBIIjoicmVkaXJIY3QifX0%3d&sso\\_nonce=AwABAAAAAAAACAOz\\_BAD0\\_waPjh5m6RNPOigpgDSHl6\\_IPvn0VTN3NTy4bfIcpLot58VIY1Zm5N-vsjPWfLNAPGBQgEhaWjJlqTlaca8-51AgAA&mscrid=b111a654-5e75-4407-8dd0-0744b9d7200a](https://login.microsoftonline.com/common/oauth2/v2.0/authorize?client_id=a8f7a65c-f5ba-4859-b2d6-df772c264e9d&scope=openid+profile+offline_access&redirect_uri=https%3a%2f%2fmake.preview.powerapps.com%2fauth&client-request-id=b111a654-5e75-4407-8dd0-0744b9d7200a&response_mode=fragment&response_type=code&x-client-SKU=msal.js.browser&x-client-VER=2.14.2&x-client-OS=&x-client-CPU=&x-client_info=1&code_challenge=Q8cvppZsIMAwvhUTgb-u9ZbEieA6GhYgjzaQyE6ee90&code_challenge_method=S256&nonce=101a3adb-1f69-43c9-9fa8-5cd794a616ee&state=eyJpZCI6ImE1MjBmZWY4LTI0DATNDMyMC05YzdhLTg5OTY5NmlyZjA2NCIsIm1ldGEiOnsiaW50ZXJhY3RpB25UeXBIIjoicmVkaXJIY3QifX0%3d&sso_nonce=AwABAAAAAAAACAOz_BAD0_waPjh5m6RNPOigpgDSHl6_IPvn0VTN3NTy4bfIcpLot58VIY1Zm5N-vsjPWfLNAPGBQgEhaWjJlqTlaca8-51AgAA&mscrid=b111a654-5e75-4407-8dd0-0744b9d7200a)

<sup>27</sup> <https://admin.powerplatform.microsoft.com/>

# Power Apps review

Congratulations on building your first app!

To review, so far you've learned how to:

- Build an app based on data in a Microsoft Excel workbook that's stored in Microsoft OneDrive for Business. You learned that Microsoft Power Apps can connect almost as easily to data sources that you're already using in the cloud (such as Microsoft SharePoint, Microsoft Azure, Google Drive, and Salesforce) or on-premises.
- Customize an app to make it your own by modifying the appearance and behavior and adding Excel-like functions.
- Share apps instantly with your co-workers across the web, tablets, and mobile devices.
- Set up environments so that you can separate a working environment from the one that you want to share with your team.

The best way to advance your skills is to run the samples, practice using the templates, and generate more apps from your own data.

## Next steps

One goal of this module is to provide a clearer picture of what Power Apps is and how you can start creating apps, regardless of your experience level. The following are useful resources and downloads to help enhance your further learning.

## Power Apps resources

- Explore further with the **Power Apps documentation**<sup>28</sup>.
- Stay current with the **Power Apps blog**<sup>29</sup>.
- Join the **Power Apps community**<sup>30</sup>.
- Expand your expertise with additional Power Apps learning paths:
  - **Use basic formulas to make better Power Apps canvas apps**<sup>31</sup>
  - **Work with data in a Power Apps canvas app**<sup>32</sup>
  - **Use the UI and controls in a canvas app in Power Apps**<sup>33</sup>
  - **Use advanced data options and connectors in Power Apps**<sup>34</sup>
  - **Master advanced techniques for Power Apps canvas apps**<sup>35</sup>
- Improve Power Apps by submitting an **idea**<sup>36</sup>.

<sup>28</sup> <https://docs.microsoft.com/en-us/powerapps/>

<sup>29</sup> <https://powerapps.microsoft.com/blog/>

<sup>30</sup> <https://powerusers.microsoft.com/t5/PowerApps-Community/ct-p/PowerApps1/>

<sup>31</sup> <https://docs.microsoft.com/en-us/learn/patterns/use-basic-formulas-powerapps-canvas-app/>

<sup>32</sup> <https://docs.microsoft.com/en-us/learn/patterns/work-with-data-in-a-canvas-app/>

<sup>33</sup> <https://docs.microsoft.com/en-us/learn/patterns/ui-controls-canvas-app-powerapps/>

<sup>34</sup> <https://docs.microsoft.com/en-us/learn/patterns/advanced-data-options-and-connectors/>

<sup>35</sup> <https://docs.microsoft.com/en-us/learn/patterns/understand-advanced-topics/>

<sup>36</sup> <https://powerusers.microsoft.com/t5/PowerApps-Ideas/idb-p/PowerAppsIdeas/>

## Power Apps downloads

- Power Apps Mobile for Windows<sup>37</sup>
- Power Apps Mobile for iOS<sup>38</sup>
- Power Apps Mobile for Android<sup>39</sup>

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. When you share an app, what two permission levels are available?

- User and Co-Owner
- Editor and Co-Owner
- User and Editor
- Editor and Owner

### Multiple choice

2. When you publish a new version of your app, what do users need to do?

- To see the new version, everyone with whom the app was shared must reinstall it.
- Everyone with whom you shared the app will automatically see the new version.
- All previous versions are deleted.
- Delete the old version app, then install the new version of the app.

### Multiple choice

3. Which of these is not a reason to use environments?

- Have separate environments for each department in your organization
- Support application lifecycle management (ALM) of your apps
- Share apps outside of your organization
- Manage access to data

## Summary

In this module, you learned about app versions, sharing apps, and managing environments.

Additionally, you learned how to:

- View and restore app versions
- Share an app and manage its permissions

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<sup>37</sup> <https://aka.ms/powerappswin/>

<sup>38</sup> <https://aka.ms/powerappsios/>

<sup>39</sup> <https://aka.ms/powerappsandroid/>

- Create environments and how to manage security access

For more information, see **Application Lifecycle Management<sup>40</sup>**.

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<sup>40</sup> <https://youtu.be/xwCUJmrRI9E>

# Build your first app with Power Apps and Dataverse for Teams

## Introduction

Today's business problems increasingly require modern digital solutions. With a low-code platform, anyone with a great idea can build a digital app. Microsoft Dataverse for Teams allows you to build modern digital apps and deploy them to help you and your team solve those problems.

Each app that you build uses the hero template as the default app layout to help you quickly get your app working. It allows you to list records, create new records, and then drill into existing records to review or make changes.

Equipment		
<a href="#">New record</a>		
 Video Projector 1/1/2020	Name	Service Needed?
	Video Projector	Yes
 Conference phone 1/1/2020	Notes	
	Needs new bulb	
 Whiteboard Tripod 1/1/2020	Date Deployed	Location
	1/1/2020	Conference Room B

This module explains how to use Dataverse for Teams to build an app.

## Create your first app with the hero template

The following steps show how to create an app from Microsoft Teams.

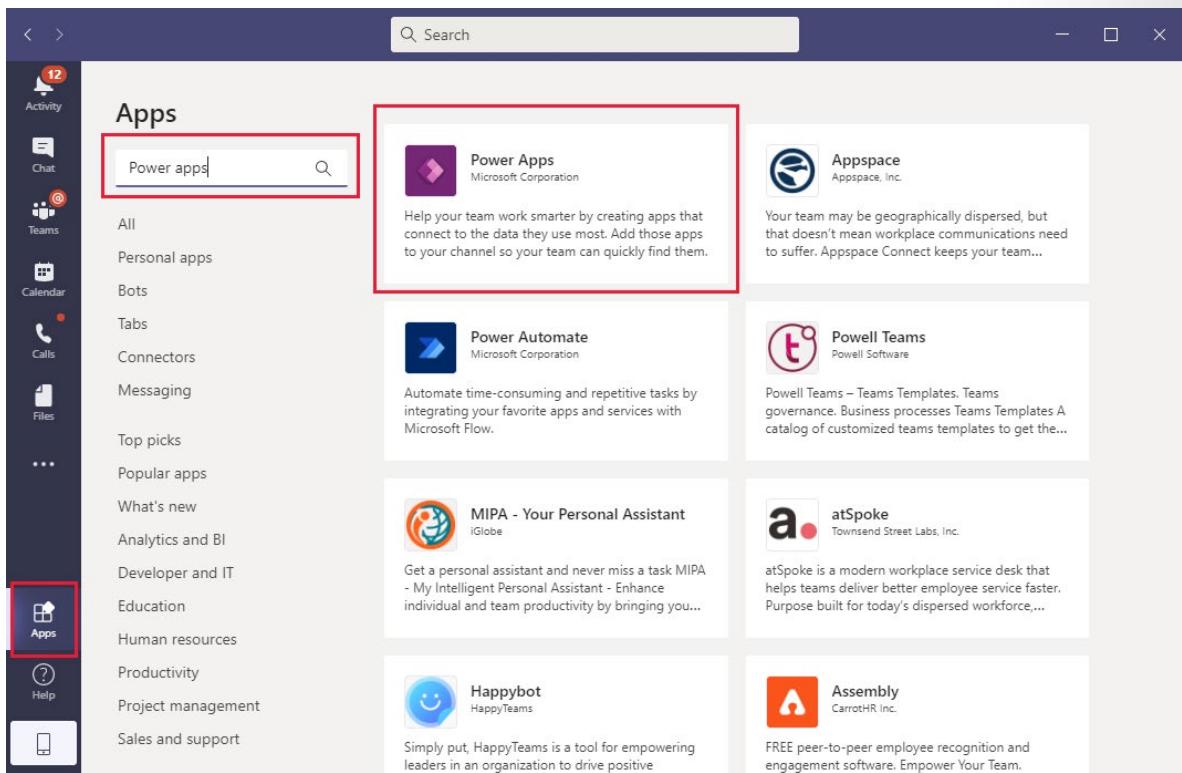
### Step 1: Identify a Microsoft team

All Dataverse for Teams apps require a Microsoft team to store the Microsoft Power Apps data. Only team members will be able to access your app by default.

### Step 2: Add the Power Apps application to Teams

1. Launch Teams or use your browser to open [Teams<sup>41</sup>](#).
2. In Teams, select **Apps** in the lower-left corner of the screen.

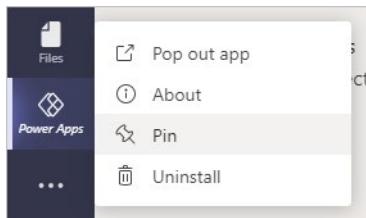
<sup>41</sup> <https://teams.microsoft.com/>



3. In the search box, enter **Power Apps** and then select it from the search results.

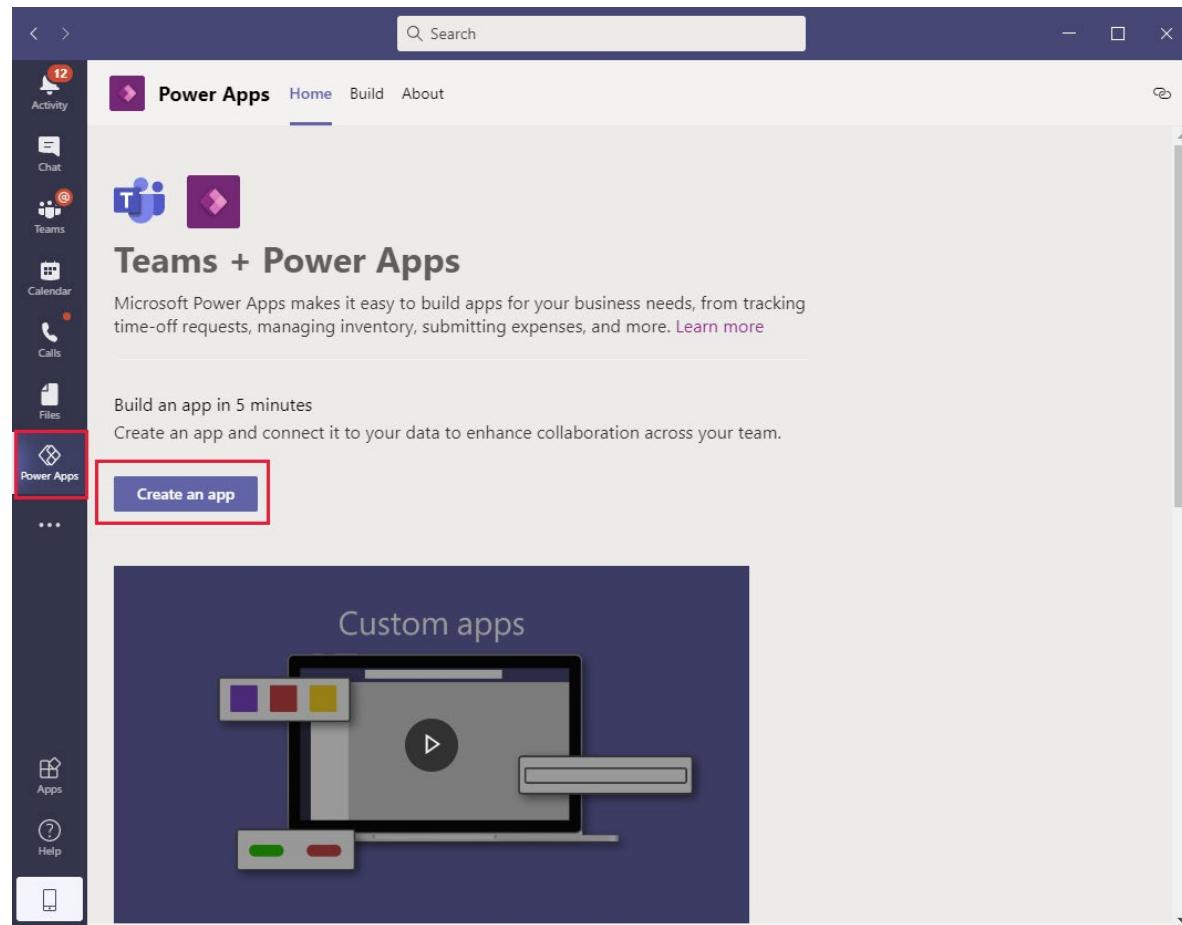
4. Select **Open** to install Power Apps.

**Note:** Pin the app for Power Apps to the app launcher so that you can quickly access it any time. Right-click the Power Apps icon and then select **Pin**. You can also run the app as a separate window from Teams by selecting **Pop out app**.



## Step 3: Create a new app

After you have installed Power Apps, you can create your first app.



1. From Teams, open the Power Apps application and then select **Create an app**.
2. Select a team for your app and then select **Create**.
3. Enter the name of your app and then select **Save**.

The hero template for your app will display. It's currently empty because you haven't connected a Dataverse table to it.

## Step 4: Create and connect a table to your app

1. Open your new app and then select **Create new table**.
2. Enter a new table name and then select **Create**.
3. Add new columns to your table by selecting **+ Add column**.  
For each column, provide a **Name** and then select the **Type** of data that it holds. By choosing the appropriate data type, you will be able to access intelligent, out-of-the-box features to make your app more manageable for people to use.

For the table, you need to track the date that the equipment was deployed, the location, whether service is needed, and relevant notes.

- For tracking the deployment date, use date type of **Date**.

The screenshot shows a modal dialog titled "Add new column" with an "X" button in the top right corner. It has two main sections: "Name \*" containing a text input field with "Date Deployed" and "Type \*" containing a dropdown menu set to "Date". Below these is a note: "Allow users to enter or search for a date." At the bottom are "Create" and "Cancel" buttons.

- To limit the location options to "Conference Room A" and "Conference Room B," use the **Choice** data type. To add more choices, select + **New choice**.

The screenshot shows a modal dialog titled "Add new column" with an "X" button in the top right corner. It has two main sections: "Name \*" containing a text input field with "Location" and "Type \*" containing a dropdown menu set to "Choice". Below these is a note: "Allow people to select one choice from a list." A section titled "Choices" lists two items: "Conference Room A" and "Conference Room B", each with a small circular icon. At the bottom are "Create" and "Cancel" buttons.

- To indicate if service is needed, use **Yes/No** as the data type because you only need to switch between two options. This data type limits a user to only two choices.

The screenshot shows the 'Add new column' dialog box. The 'Name \*' field contains 'Service Required?'. The 'Type \*' dropdown is set to 'Yes/No'. Below it, a note says 'Allow people to pick between two choices.' Under 'Items', there are two radio buttons: 'Yes' (selected) and 'No'. In the 'Default value' section, 'No' is selected. At the bottom are 'Create' and 'Cancel' buttons.

- Use the **Text** data type for the **Notes** column.

The screenshot shows the 'Add new column' dialog box. The 'Name \*' field contains 'Notes'. The 'Type \*' dropdown is set to 'Text'. Below it, a note says 'A single line of text.' There is an 'Advanced options' button. At the bottom are 'Create' and 'Cancel' buttons.

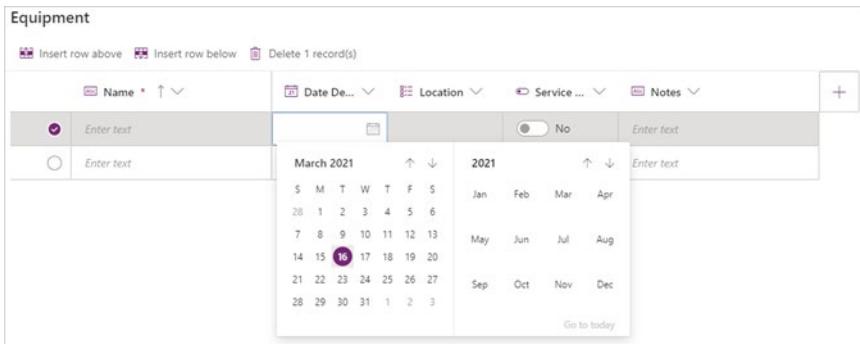
The following list of data types are available by using the visual table editor. For a complete list of all available data types and how they work, see the links in the Summary unit at the end of this module.

Data Type	Description
Text	A single line of text.
Email	Text in email format; will be selectable for the user.
URL	A hyperlink in URL format; will be selectable for the user.
Auto Number	Defines an autogenerated number sequence.
Number	An integer (for example, 10 or -10).
Date	Allows users to enter or search for a date.
Decimal	A number with a decimal point (for example, 1.5 or -1.5).
Lookup	References a primary column in another table.
Choice	Allows people to select one choice from a list.

Yes/No	Allows people to pick between two choices.
--------	--

4. To add data to your table, select **+ Add row**. Enter data that you want people to see when they use your app. Notice how the choice of data type changes the user experience to fit the type of data that is being stored.

- **Date Deployed** - A calendar can be used to select the **Date**.
- **Location** - Uses a drop-down list of options that are defined in the **Choice** data type.
- **Service Required** - The user can select between **Yes/No** with a toggle.
- **Notes** - The user can enter **Text**.

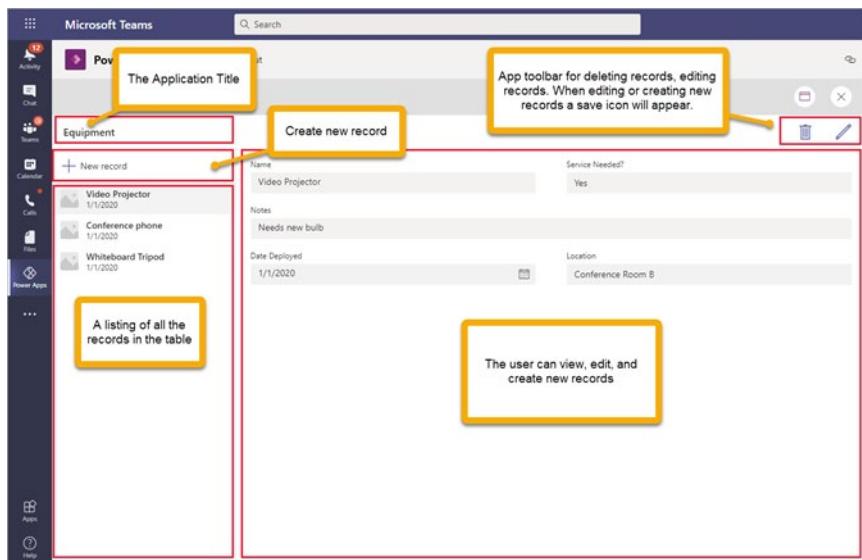


5. Select **Close** to finish editing the table. It might take a few minutes to process the table. After the processing has completed, the hero template will appear, showing the data loaded into the app.  
 6. Select **Save** in the toolbar to create the first saved version. After the first save, Power Apps will continue to save automatically every two minutes while you are editing.

## Step 5: Preview and test your app

To preview and test your app, select the **Preview** button in the upper right.

The hero template automatically creates a functioning app with your data. After a data source has been linked, you can instantly view, edit, and delete existing records or create new ones.

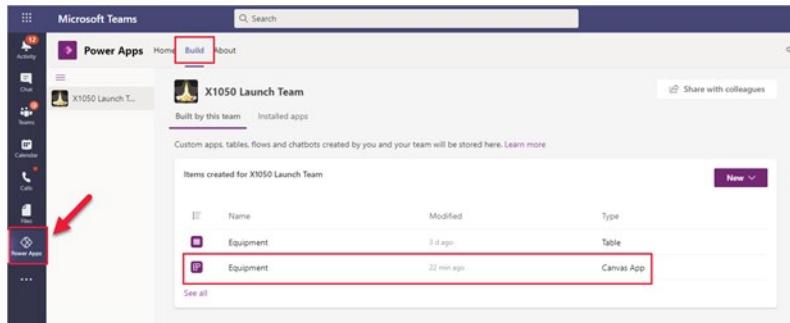


## Customize your app with Power Apps Studio

In the previous lesson, you created a new app by using your data that was loaded into Dataverse for Teams. The hero template can quickly make a useful app, but you will often want to customize the app to suit your needs.

For this lesson, you will change the title of the app, the layout of the gallery, and the order of fields.

To start, open Teams by using the desktop client or by browsing [Teams<sup>42</sup>](#), and then open the app for Power Apps. Select the **Build** tab at the top and then select your app.



Your app will open in Microsoft Power Apps Studio for editing.

**Note:** It's always a good idea when you first start editing to select **Save** in the toolbar. After the first save, Power Apps will continue autosaving every two minutes while you are editing.

Power Apps applications are built by using various UI elements that are referred to as **Controls**. Use controls to help create a better experience when your users are navigating and interacting with the app.

Common controls include:

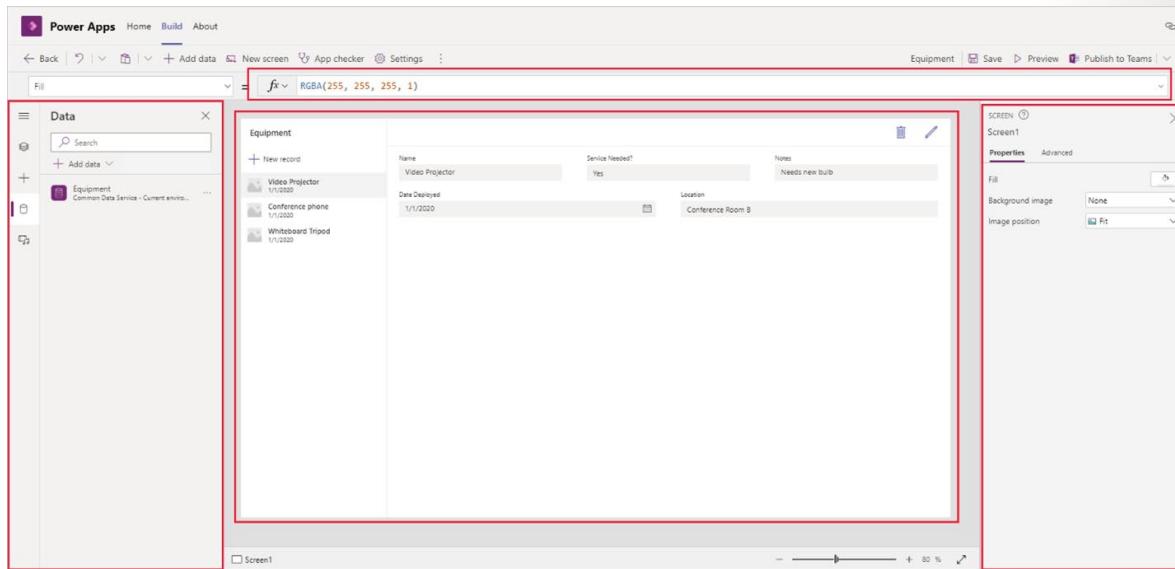
- **Label** - Display information to the user as text, numbers, dates, or currency.
- **Edit form** - Allows the user to create and edit records and then save them.
- **Text box** - A box where a user can enter data such as text and numbers.
- **Vertical gallery** - Displays multiple records from a data source in a vertical orientation. This control can show multiple types of data for each record.
- **Add icon** - Select from a library of graphical symbols. This control can be configured to respond when a user selects them.
- **Rectangle** - A border shape that can be placed anywhere on the app.
- **Date picker** - Allows the user to select a date by using a calendar pop-up window.
- **Button** - A way for the user to interact with the app.

When you are editing the app, select between the following options in the left column:

- **Tree view** - Displays a visual hierarchy of all controls in the app.
- **Insert** - Insert new controls such as labels, buttons, icons, and forms.
- **Data** - Add more tables from Dataverse for Teams or add a connector to other Microsoft Office 365 services.
- **Media** - Add images, videos, and audio.

<sup>42</sup> <https://teams.microsoft.com/>

The center of the screen is where you move and edit the components that make up your app. When a control is selected from the tree view or in the app view, the **Properties** pane displays the properties. At the top of the screen is the formula bar, which allows for more editing capabilities.



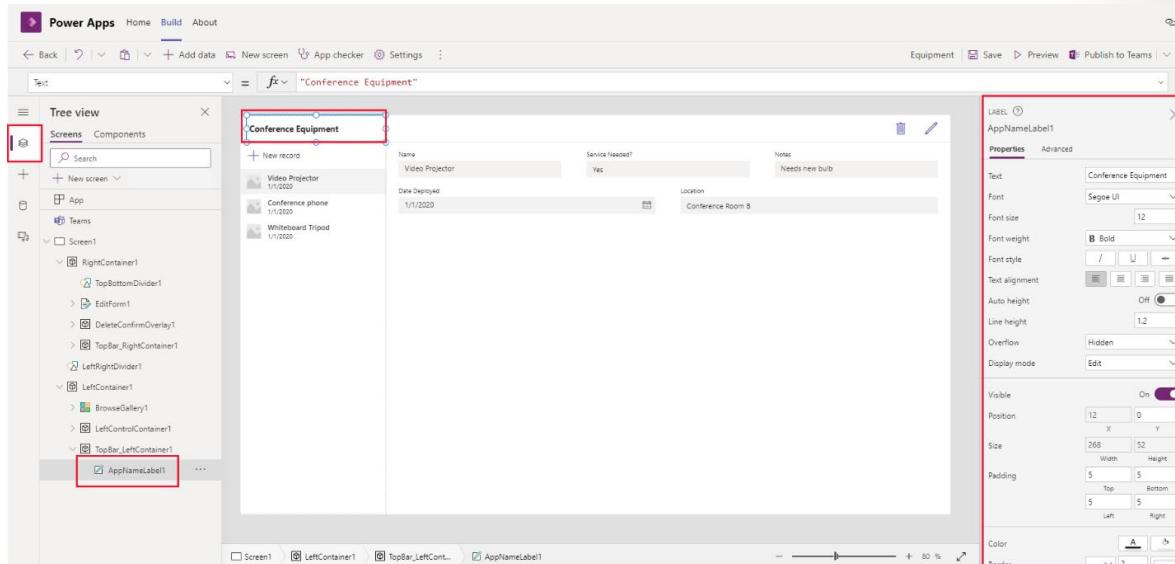
## Change text in a label

When editing your app, you need to select the control item so that the properties will appear on the right. To change the title that appears in the app, you first need to choose the label that has the text.

You can choose either of the following actions:

- Select **Tree view** and then scroll down to select **AppNameLabel1**.
- Select the title in the app and then **AppNameLabel1** will appear in the **Properties** pane.

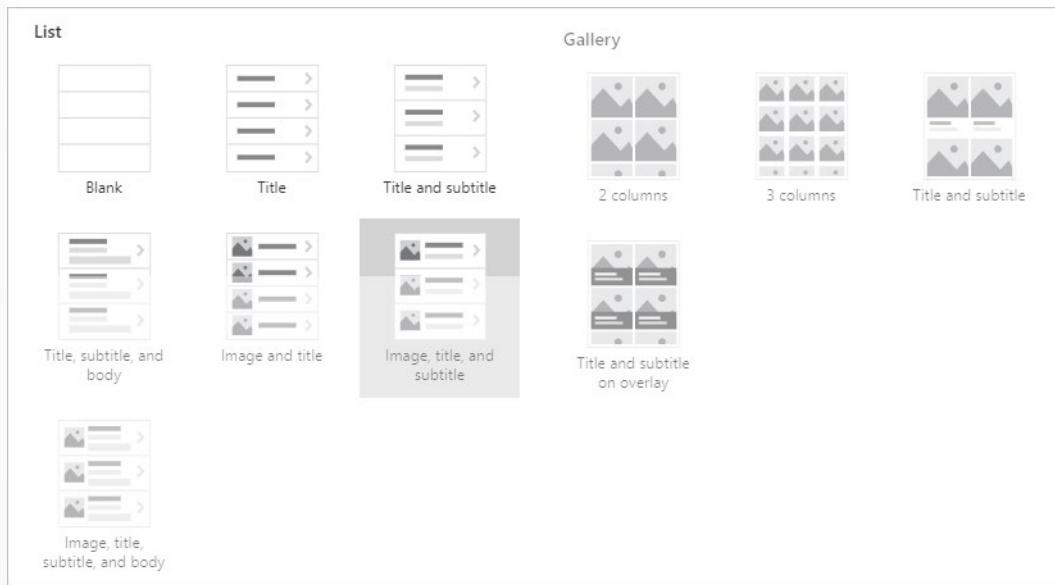
After the control item has been selected, you can edit the **Text** properties on the right side of the screen. You can also change other properties such as **Font**, **Font size**, and **Text alignment**. This process can be used to change the text and appearance of any label in the app.



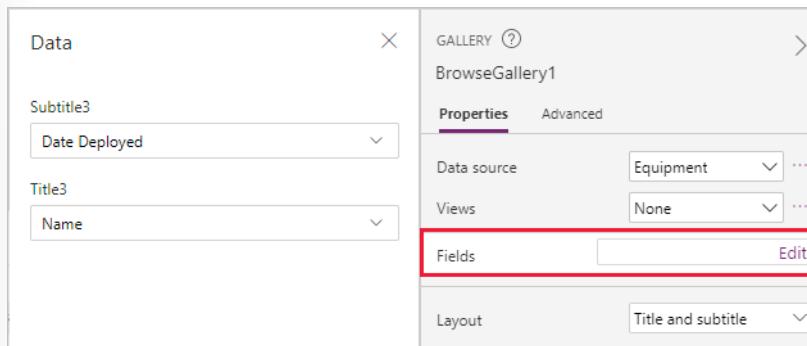
## Change the layout of a gallery

A **gallery** control displays multiple records for the user to view and select from. Each record in the gallery can display multiple types of information. For example, a gallery could show a listing of inventory items that show the name, model number, and price for each. Depending on what you need, galleries come in various vertical and horizontal layouts.

To change the layout of the gallery, select the gallery in the app or find **BrowseGallery1** in the tree view. Under the **Properties** pane, select from various **Layout** options.



To change the content of the gallery's fields, go to the **Properties** pane and select **Edit** next to the **Fields** option. The areas that you can change will depend on the gallery layout that you selected. For each field, use the drop-down list to choose the data.

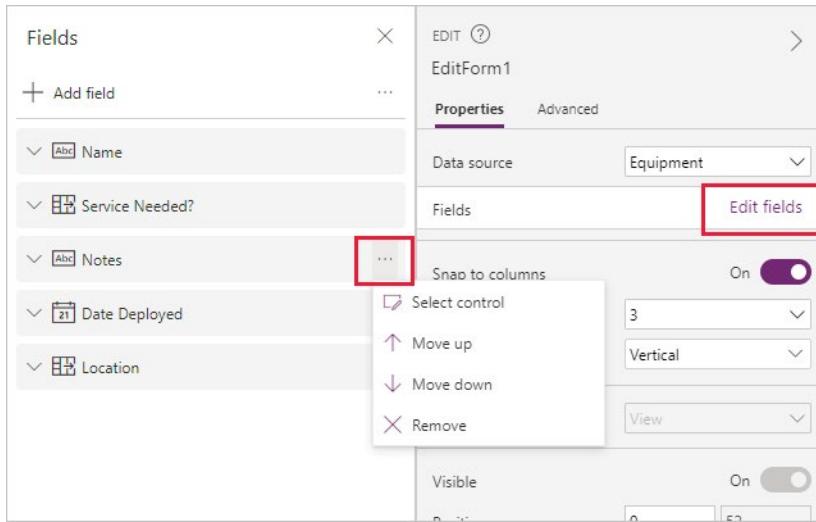


## Change the order in which fields appear

To change the order in which fields appear, follow these steps:

1. Select the form in the app or find **EditForm1** in the tree view.
2. Under the **Properties** pane, select **Edit fields** next to **Fields**.

3. Right-click the ellipsis next to each field to bring up more options. Select from **Move up**, **Move down**,

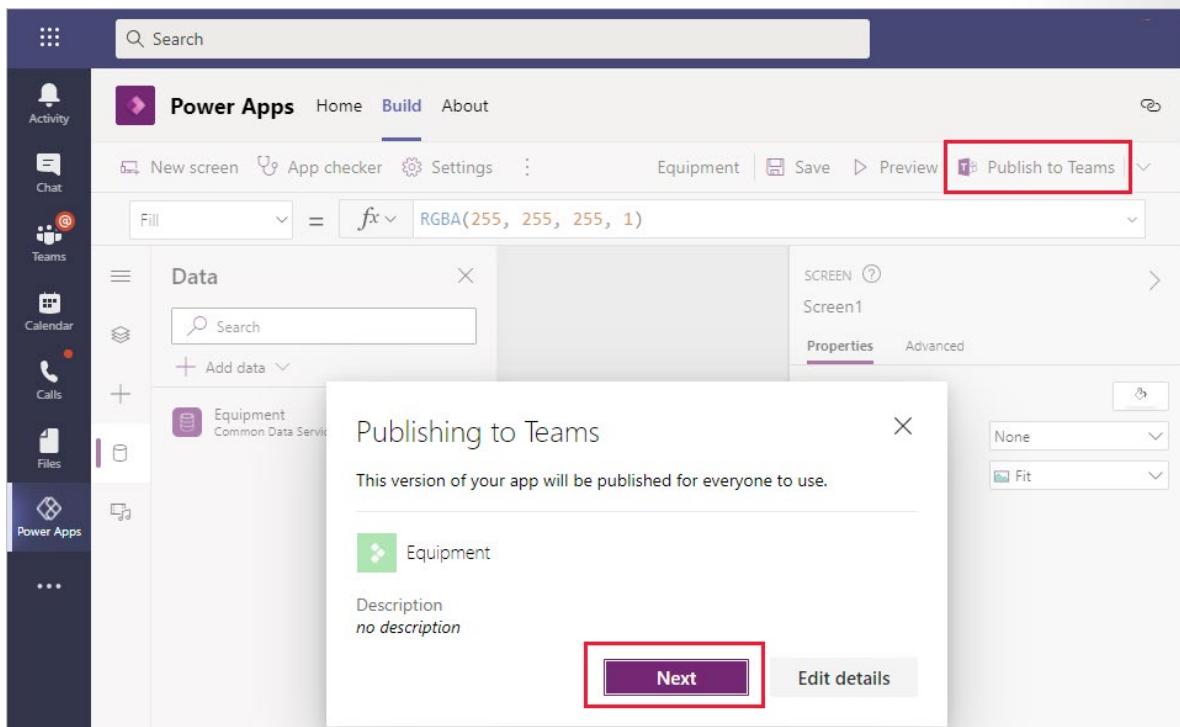


or **Remove**.

## Publish your app

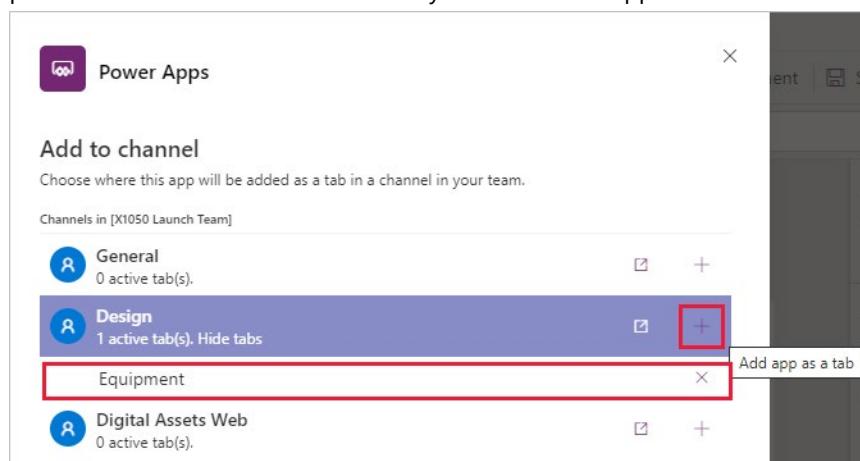
Now that you have built an app, you will want to share it with your team. You can accomplish this task by publishing the app to Teams. After the app has been published, it will be accessible for your team to start taking advantage of it.

1. Open your app for editing in Power Apps Studio.



2. Select **Publish to Teams** from the toolbar and then select **Next**.

3. For each channel where you want the app to appear in a tab, select **Add app as a tab**. You can only publish to channels for the team that you created the app in.

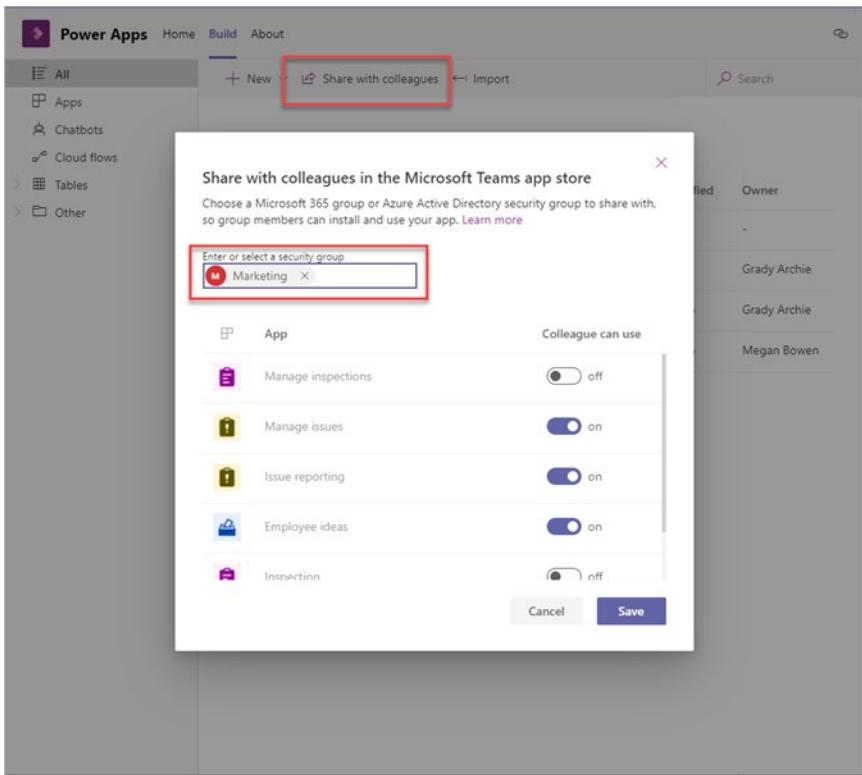


4. Select **Save and close**.

By default, your Dataverse for Teams app is only available to the team that you created the app in. Occasionally, you will want to share your application with others in your organization.

To share your app with others outside the team:

1. Verify that you are a team owner where the app is currently published.
2. Open the **Build** tab in the Power Apps for Teams app and then select **See all**.
3. Select **Share with colleagues**.
4. Enter the Microsoft 365 group or Microsoft Azure Active Directory (Azure AD) security group to share with in the **Enter or select a security group** field.



- Turn on or off the sharing of apps to the users and then select **Save**.

Afterward, the app will appear in the **Built by your colleagues** page when users select **Apps** in Teams. To learn more about publishing your apps, see the links in the Summary unit at the end of this module.

## Install template apps

Microsoft created a few sample apps that can be used as-is or customized to suit your specific business needs. You can find these apps when you first open the app for Power Apps in Teams.

**Teams + Power Apps**

Microsoft Power Apps makes it easy to build apps for your business needs, from tracking time-off requests, managing inventory, submitting expenses, and more. [Learn more](#)

Build an app in 5 minutes  
Create an app and connect it to your data to enhance collaboration across your team.

[Create an app](#)

Add these apps to your team

- Employee ideas**  
Easily review, manage, and vote upon team's ideas to increase team engagement and morale. Helps team managers to improve workplace wit...
- Inspection**  
Create customized checklist style inspections for areas and assets. Perform them digitally with the ability to take notes and pictures. Issues identifi...
- Issue Reporting**  
Empower the front line worker to report issues they see on the ground. Easily collect issues submitted in Planner for effective case...

Each app has unique requirements and uses various Office 365 services. The install process might be slightly different depending on what is needed. To install any of these apps, left-click on it and then select **Add to a team**.

## Employee ideas app

With the **Employee ideas** app, you can collect ideas from your team and then review, manage, and vote on them to see which ones are worth exploring. Additionally, you can use campaigns to organize the team's ideas. The app will post each idea to a Team channel as they are submitted.

**Manage campaigns**

**Weekly top contributors**

Rank	Name	Ideas
1	Grady	10 ideas
2	Megan	3 ideas

**Weekly top ideas**

Rank	Idea	Votes
1	Company Masks	2 votes
2	In-Office Schedule	1 vote

**Search campaigns** **Active** **Add campaign**

**Workplace Safety**  
We are looking for ideas to make our office a better workplace!  
37 days left 2 ideas

**Café Food**  
We are looking for ideas to increase the food options and improve in food  
50 days left 1 idea

**In-Person Meetings**  
Got any ideas for safer and more effective in-person meetings?  
68 days left 2 ideas

**Return to Workplace**  
We are looking for ideas to help make our office safer for all of our employees  
15 days left 6 ideas

## Inspection app

The **Inspection** app manages, schedules, and collects reports from your team. From this app, you can analyze the results. It uses Microsoft Planner to track the inspections. Two apps will be installed: **Manage inspections** and **Inspection**.

The **Manage inspections** app allows you to edit settings and define the type of inspections that your team can make. It also gives you an overview of everything that has been completed and will then provide reporting.

Each team member uses the Inspection app to view and update inspections that are assigned to them. Team members can start an inspection, review status, and track their own progress.

## Issue reporting

Create a place for your team to report issues, assign tickets, and track progress with the **Issue reporting** app. This app uses Planner as a ticket system. Two apps are installed: **Manage issues** and **Issue reporting**.

The **Manage issues** app gives an overview of all tracked tasks and can create templates to help make it easier for your team to collect the needed information.

The screenshot shows the Microsoft Teams interface with the 'General' channel selected. The 'Manage issues' app is open in the insights tab. Key statistics are displayed: 0 In progress, 0 Not started, 0 New issues today, 0 Completed in past 7 days, and - Average resolution time. Below these are four cards: 'Recent issues' (empty), 'Overdue issues' (empty), 'Issues by category' (empty), and 'Average resolution time by category' (empty). A 'View Planner' button is visible in the top right.

The **Issue reporting** app provides a personalized view for each team member, where they can view, edit, and create new items.

The screenshot shows the Microsoft Teams interface with the 'General' channel selected. The 'Issue reporting' app is open in the insights tab. It greets the user with 'Good afternoon, Megan.' and says 'Glad to have you here, we are ready to help you report an issue.' A 'Report an issue' button is in the top right. Below, there are two sections: 'Issues reported by you' (Completed: 0, In progress: 0, Not started: 0) and 'Last 7 days' (The team has completed 0 issues, The average completion time was 0 days, There have been 0 issues reported).

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. *What is the primary purpose of the hero template?*

- To help make it easier for you to have an app that allows you to list, create, edit, and delete records
- To give you a layout that is dynamic and compelling for the user
- To go through the app-building process

## Multiple choice

2. *What triggers Power Apps to automatically save every two minutes?*

- Creating a new app
- Selecting the Save button in the toolbar
- Previewing the app

## Multiple choice

3. *By default, who can access a published Dataverse for Teams app?*

- Only the owner
- Anyone on the team
- Anyone in the organization

## Summary

Now, you can turn your great idea into an app for your team. This module showed you how to use Dataverse for Teams to build and publish apps from Power Apps. Data that is stored in Dataverse provides enhanced performance and scalability over other data sources. The hero template and the provided sample apps can help you build custom solutions to meet your organization's data and collaboration needs.

## Links that are related to modules for specific topics

For more information, see the following articles:

- **Publish and share your app in Teams<sup>43</sup>.**
- **Data types available in Dataverse<sup>44</sup>.**

<sup>43</sup> <https://docs.microsoft.com/en-us/powerapps/teams/publish-and-share-apps#share-an-app>

<sup>44</sup> <https://docs.microsoft.com/en-us/powerapps/maker/data-platform/types-of-fields/>

# Answers

## Multiple choice

1. Where do you configure and customize your app?

- In Power Apps Mobile
- In the Power Apps admin center
- In Microsoft Dynamics 365
- In Power Apps Studio

*Explanation*

*You can configure and customize your apps in Power Apps Studio.*

## Multiple choice

2. Which of these statements about data sources is true?

- In Power Apps, app data comes primarily from your local device.
- Power Apps is not able to connect to external data. All data must be stored in the Power Apps app.
- Power Apps uses connectors to connect to Data Sources. If the data source supports it, Power Apps can read and write to the data source.

*Explanation*

*You can use many external data sources, including Twitter, Facebook, Microsoft SQL Server, and Salesforce.*

## Multiple choice

3. Power Apps automatically creates three screens for you when you build an app from a data source. Which of the following is not one of the screens created?

- Browse Screen
- New Screen
- Edit Screen
- Details Screen

*Explanation*

*A Browse Screen, Edit Screen, and Details Screen are all created.*

## Multiple choice

1. Which one of the following is true about action-based data sources?

- A Forms control cannot use action-based data sources.
- They are only used to send emails, not to retrieve data.
- Power Automate is the only application with action-based data sources.
- A Forms control can use action-based data sources.

*Explanation*

*A Forms control can't use action-based data sources.*

**Multiple choice**

2.What is the relationship between Power Apps and Power Automate?

- Power Automate is just another data source for Power Apps.
- Power Automate and Power Apps enhance each other and have a special connection.
- Power Automate is only available if you have a premium Power Apps license.
- Power Automate can receive data from Power Apps but cannot return information.

*Explanation*

*Power Automate and Power Apps have a special connection.*

**Multiple choice**

3.If you use business logic in your Power Apps app, which statement is true?

- It should always be in Power Automate, Power Apps cannot do business logic.
- It should always be in Power Apps; Power Automate cannot do business logic.
- Both Power Apps and Power Automate do not support Business logic.
- You should choose the best tool. Power Apps is great for simple logic, but integrating with Power Automate for the more complex logic will enhance your app's capabilities.

*Explanation*

*You should choose the best tool. Both tools can use business logic.*

**Multiple choice**

1.When creating an app, what two form factors can you choose from?

- Tablet and PC
- Tablet and Phone
- Phone and PC
- Tablet and iPhone

*Explanation*

*Tablet and Phone are the two form factors available.*

**Multiple choice**

2.Which formula returns the full name of the current Power Apps user?

- User.FullName
- FullName.User()
- User().FullName
- User().Name

*Explanation*

*The formula that returns the full name of the current user is User().FullName.*

**Multiple choice**

3. When using an Image Control, which of the following ImagePositions does NOT belong?

- Stretch
- Fit
- Tile
- Expand

*Explanation*

*Expand is the ImagePosition that does not belong.*

**Multiple choice**

1. When you share an app, what two permission levels are available?

- User and Co-Owner
- Editor and Co-Owner
- User and Editor
- Editor and Owner

*Explanation*

*The two permission levels available are User and Co-Owner.*

**Multiple choice**

2. When you publish a new version of your app, what do users need to do?

- To see the new version, everyone with whom the app was shared must reinstall it.
- Everyone with whom you shared the app will automatically see the new version.
- All previous versions are deleted.
- Delete the old version app, then install the new version of the app.

*Explanation*

*Everyone you shared the app with sees the new version automatically.*

**Multiple choice**

3. Which of these is not a reason to use environments?

- Have separate environments for each department in your organization
- Support application lifecycle management (ALM) of your apps
- Share apps outside of your organization
- Manage access to data

*Explanation*

*To share apps outside the organization, it is not necessary to use environments.*

**Multiple choice**

1.What is the primary purpose of the hero template?

- To help make it easier for you to have an app that allows you to list, create, edit, and delete records
- To give you a layout that is dynamic and compelling for the user
- To go through the app-building process

*Explanation*

*After you have defined your data source, the hero template will provide the needed components for a basic app. The hero template simplifies the process of having the necessary components so that your app can list, create, edit, and delete records.*

**Multiple choice**

2.What triggers Power Apps to automatically save every two minutes?

- Creating a new app
- Selecting the Save button in the toolbar
- Previewing the app

*Explanation*

*It's a good idea to select the Save button after your data has been loaded into the hero template for the first time. Only after you have selected the Save button will Power Apps start automatically saving changes every two minutes.*

**Multiple choice**

3.By default, who can access a published Dataverse for Teams app?

- Only the owner
- Anyone on the team
- Anyone in the organization

*Explanation*

*After the app has been published, all members of the team will have access to the app by default.*



## Module 5 Make portals with Power Apps

### Introduction to Power Apps portals

#### Introduction to portals

Model-driven and canvas Power Apps deliver business functionality to people. Microsoft Power Apps portals extend Microsoft Dataverse to internal and external audiences such as communities, customers, partners, and employees.



Power Apps portals come with a variety of preconfigured portal solutions that target diverse audiences. Starter portals have many features that add value to the Microsoft Dynamics 365 service apps. The following sections explain how these features help modern businesses engage a modern audience.

## Modern audience

People have various experiences with customer service support, both positive and negative. Frequently, customer service support experiences involve being put on hold for a long time and waiting for a customer service agent to answer the call. Another negative experience might involve writing a letter, mailing it, and waiting without any expectation of a reply. Customer service support experiences should be positive and convenient. Rather than being put on hold, most people would prefer to use self-service capabilities on the company's website, where their issue will be sent directly to the supplier's knowledge base for the products and services. Similarly, instead of writing a letter, people can engage in the online community forum and get instantaneous answers from other users who are sharing their related experiences.

Portal capabilities empower the majority of online consumers who prefer to find answers on their own through self-service and community options. By using Power Apps portals, you can provide them with a branded, personalized, self-service experience. Portals help you provide an organized, searchable knowledge base to deliver consistent, up-to-date answers and community experience for peer-to-peer support and direct interaction with your subject matter experts. Additionally, portals provide simple navigation with seamless transitions between self and assisted support.

Out-of-the-box mobile optimizations for portal and knowledge articles ensure that customers can get the help that they need, any time and from any device.

Consumers are a major driver of this trend:

- The majority of global consumers now expect brands and organizations to offer a self-service portal.
- Nearly one-third of consumers keep in touch with brands they've done business with to make sure that they are getting the most out of their purchase.
- Half of the consumers are using multiple channels to stay connected, including web, mobile, telephone, social, and self-service channels. Often, consumer use many channels for a single support experience.

Providing a web portal interface takes advantage of these user trends and brings any type of engagement, including partner, group, and employee scenarios, that directly accesses Dataverse to create a modern connected experience for external users and internal business operations.

## Modern business

Your business is already using Power Apps. Consider the additional capabilities that using Power Apps portals can deliver:

- **Provide self-service support** - When your business is growing, rather than having to employ extra staff in call centers, you could use Power Apps portals to add self-service capabilities to your website so that your customers can search knowledge articles, engage with other customers, find answers, and create support cases when needed (that go directly into Dynamics 365 Customer Service), all without a single interaction from your resources.
- **Build a sales pipeline** - When a lead fills out a **Contact us** form on your company website, this information is recorded in Dynamics 365 Sales where the record can become part of your sales pipeline automatically.
- **Empower employees** - When an employee needs a new computer, they can fill out an online form, where the information will be recorded in Dataverse so the helpdesk staff can immediately access and process this information.

- **Engage mobile workforce** - Empower agents on any device, wherever they work. Field technicians can process and complete work orders in the column, instantly updating Dynamics 365 Field Service.

## Power Apps portals capabilities

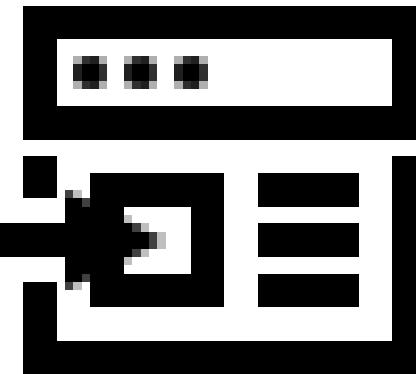
Power Apps portals are built on top of Dataverse. This architecture comes with a major benefit. All the differentiating features of model-driven Power Apps are the features of Power Apps portals as well, including:

- Centralized management
- Common Data Model
- Roles and permissions
- Forms and views
- Business rules
- Declarative workflows and actions
- Plug-in architecture
- Integration with other services
- Dataverse extensibility
- Audit

Power Apps portals deliver a complete content management system out of the box, with all content stored in Dataverse. As a result, content can be edited through the portals studio and also directly by using the Portal Management app. Additionally, the robust Dataverse security model can help secure the content.

The following table describes the key capabilities of Power Apps portals.

Capability icon	Capability	Description
	<b>Content</b>	Seamless, responsive, and customizable web design for any user on any device. Full tracking and context are available because Dataverse is the operating system for all interactions.

	<b>Functionality</b>	Quickly build more secure, functional websites to interact with Dataverse with no coding required. Track customer interactions across all channels and capture them in a custom Power Apps or Dynamics 365 instance.
	<b>Extensibility</b>	Use powerful Microsoft Power Platform business processes that are natively extended through the web front end. Integrate portals with other systems like SharePoint or Power BI. Extend portals with custom development to cater to complex scenarios.

	<b>Security</b>	All data that is used to build portal content is protected more through Dataverse security model. Power Apps portals extend this model to help secure and tailor the content for the target audiences who are not Basic Users.
--	-----------------	--

## Get started with portals

Businesses that have Dynamics 365 or a custom Microsoft Dataverse solution already in place can quickly build a portal that is more secure and build their entire website, all without requiring developers.

A Power Apps portal is not automatically provisioned when a new Dataverse environment is created. You will need to provision a Power Apps portal and determine the name, default URL, language, and template.

Power Apps portals evolved from Dynamics 365 Portals, which is now referred to as Power Apps portals. The key difference is that several additional portal templates are available for Dynamics 365-enabled environments.

**Important:** To provision a portal, you must be assigned to the System Administrator role of the Dataverse environment that is selected for the portal.

## Portal templates

Portal templates are preconfigured portal solutions that are available to accelerate deployment. Power Apps portals are customizable, but a portal template will provide a preconfigured environment that is immediately suitable for specific scenarios.

The following portal templates are available:

- Portal from blank
- Custom (Dynamics 365 apps)
- Community (Dynamics 365 apps)
- Customer self-service (Dynamics 365 apps)
- Employee self-service (Dynamics 365 apps)
- Partner (Dynamics 365 apps)
- Supply Chain Management Customer (Dynamics 365 apps)

The Partner portal also includes optional Field Service and Project Service add-ons that are available if your Dynamics 365 environment includes Dynamics 365 Field Service and Dynamics 365 Project Service solutions.

Each of the starter portals includes a particular set of features that are designed to accelerate solution development that targets the selected audience.

## Portal features

Power Apps portals is a platform and includes a long list of components and features out of the box. The following table shows how these features map into the key capability areas of Power Apps portals.

Content	Extensibility	Security	Functionality
Accessibility	Web Forms	Profile Management	Case Deflection
Bootstrap Design	Web Templating	Web Roles	Case Management
Branding	Table Forms	Invitations	Knowledge Management
Content Publishing	Table Lists	Content Permissions	Discussion Forums
Responsive Design	Table Actions	Table Permissions	Ideas, Blogs
Webpages	Automation	Identity	Customer, Account, & Opportunity Management
Faceted Search and SEO	Charts & Graphs	Authentication	Delegated Administration
Multilingual Portals	Azure Integration	Auth Providers integration	Multi-Partner Collaboration
Ads, Polls, Ratings, and Comments	SharePoint Integration		Entitlements & SLAs
Theming	Power BI Integration		Localization into 43 Languages
Web Files	Client-side JavaScript		
	Liquid Templates		
	Web API		

All components and features that are listed under **Content**, **Extensibility**, and **Security** form the portal foundation. They are part of the base solution and included in all portals. Features from the **Functionality** area focus on the specific needs of the target audience. Starter portal selection defines which subset of functional features is included.

**Note:** The starter portal selection might lock you into a specific set of features. Portal features are deployed into the target Dynamics 365 environment as managed solutions. Portal features can be added or removed later.

## Provision a portal

Only one Power Apps portal can be provisioned for each Dataverse environment.

The high-level steps to provision a starter portal are:

1. Go to <https://make.powerapps.com>(<https://make.powerapps.com/>).
2. Select a target environment by using the environment selector in the upper-right corner.

3. On the left menu, select + **Create**.
4. Select **Portal from blank**. If you have Dynamics 365 apps deployed in your Dataverse environment, additional portal templates, such as Customer self-service, will be available.
5. Provide a name for the portal.
6. Provide a unique address (URL) for the portal.
7. Select the language.
8. Select **Create** to start the portal provisioning process.  
After portal provisioning has completed, the portal will appear in the list as an app of type Portal.
9. Select the ellipsis (...) next to the portal app name and then select **Browse** to open the portal website.



<https://www.microsoft.com/videoplayer/embed/RE4yoJw>

Step-by-step instructions to provision a portal are available at Provision a portal(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/provision-portal/>).

## Core components of portals

Power Apps portals store all information in Microsoft Dataverse. Portal entities define site structure, layout, content, and functionality.

The two most common questions about portals are:

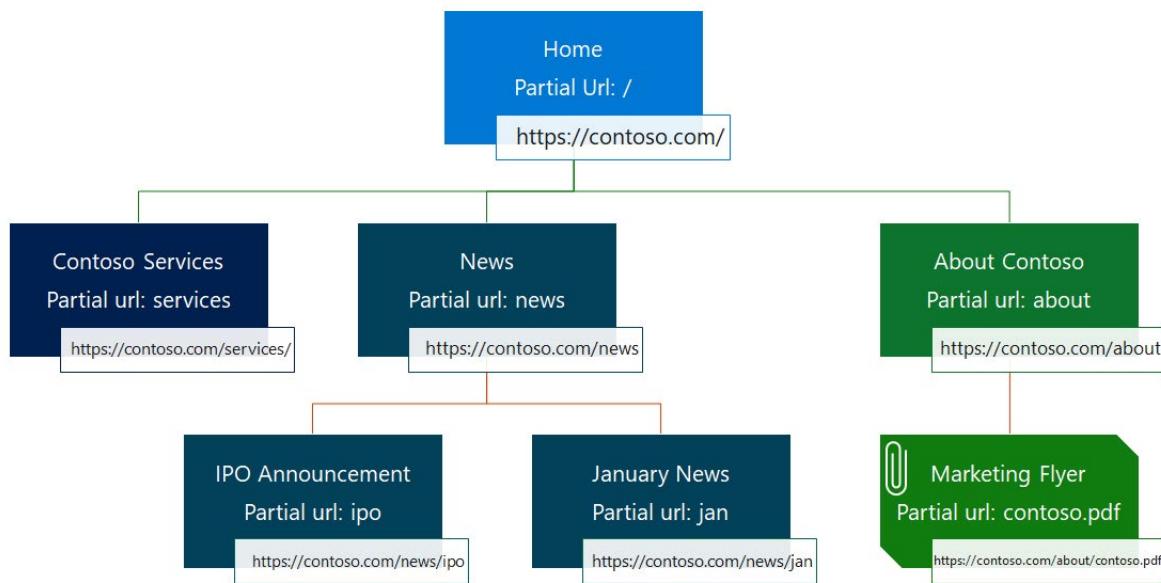
- How do I manage portal content?
- How do I surface and interact with business data in the portal?

Power Apps portals have several core components that enable these scenarios.

## Webpages

Most of a portal's content is represented by webpages. A webpage represents a particular URL in a portal's website and is one of the core entities of the portal's content management system. Through parent and child relationships to other webpages, this table forms the hierarchy of a website, that is, its site map.

Webpages also form the basis for including other, specialized table types in the portal site map: web files, shortcuts, forums, ideas, and blogs. Each of these records has a relationship with a parent page, which defines the URL and where the entries are located on the portal site map.



Pages can be added and edited by using the Portal Studio, the portal front-side editor, or directly in Dataverse by using the Portal Management app.

Portal Studio	Portal Management app
1. Select the portal app and select <b>Edit</b> .	1. Open the Portal Management app.
2. Select <b>New Page</b> on the Command bar.	2. Go to <b>Portal &gt; Web Pages</b> .
3. Choose a layout.	3. Select <b>New</b> .
4. Enter details on the Properties pane.	4. Enter the page details.
5. The page will be saved automatically.	5. Select <b>Save</b> .

**Security:** The user must be a licensed Power Apps user with the appropriate Dataverse security privileges.



<https://www.microsoft.com/videoplayer/embed/RE4yrkV>

Each webpage is composed of at least two portal metadata records: a *root* webpage record, which contains the main attributes of the webpage record, and a *content* webpage record that holds the language-specific content of the webpage. One *content* webpage exists for each provisioned portal language.

## Page templates

A webpage record does not define how the page looks when it is rendered on the portal. Instead, it's linked to the **Page template** record that defines the layout and the behavior.

The two types of templates that can be used in Power Apps portals are:

- **Rewrite** - These templates use specialized server-side processing to specific behavior that is required by some of the components such as polls, forums, and so on. These templates are also used to handle special pages such as an error page, site map, search, and others. You can't create new or edit existing Rewrite templates.
- **Web** - The linked layout template defines how the content of the page is rendered for output. These templates can be edited as required.

## Web template

Web templates use the liquid templating language to define how the content is processed and rendered. Templates are flexible. A template can reuse other templates for parts of the content. A template can also be based on another template, extending the base functionality.

Web templates can be used to define an entire webpage, a part of a page, or common elements such as the site header and footer. This approach creates a consistent appearance throughout the portal and helps make it easy to modify the appearance.

Existing web templates can be edited in the Portals Studio.

## Web files

Web files provide access to inline or downloadable content. Though similar to webpages with similar properties, web files do not use templates. Instead, when the file is requested, the attached content is delivered.

The content can be stored as a **Note** with an attachment or in Microsoft Azure Blob storage. Using Azure storage requires additional configuration, but it is more cost-efficient if the organization deals with numerous documents.

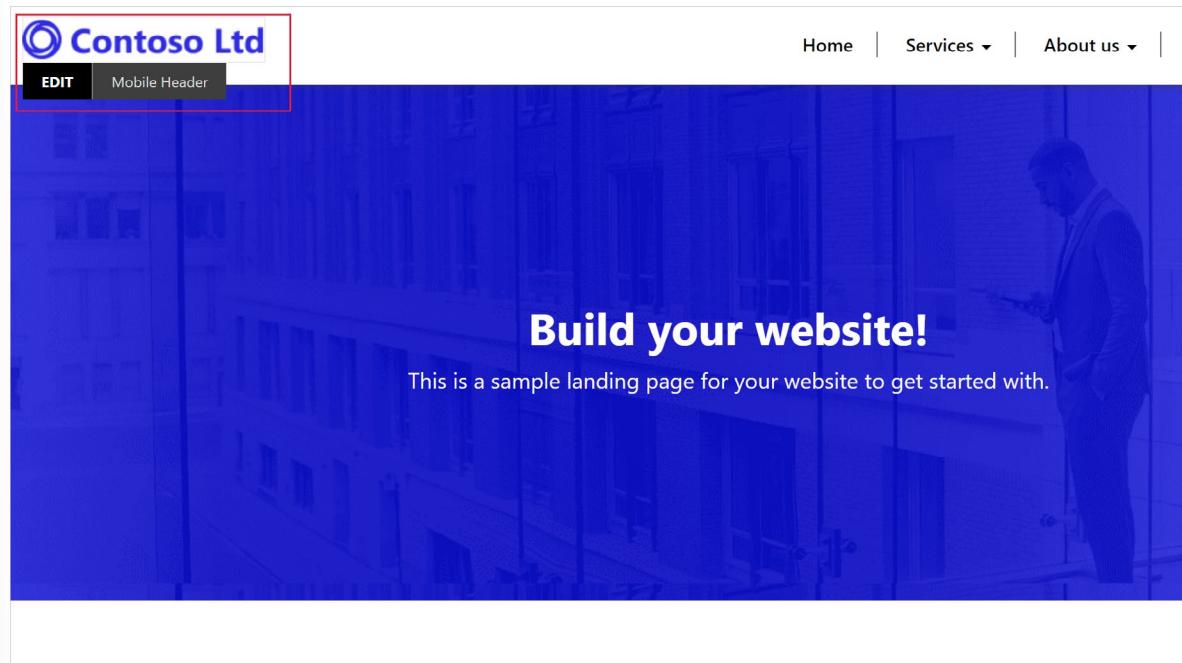
Web files are used to deliver content such as documents (for example, an annual report). They are also used to store essential site content like Cascading Style Sheets (CSS) and JavaScript files.

Images that are displayed on portal webpages can also be stored as web files.

## Content snippets

Content snippets are reusable fragments of editable content that can be placed within a web template. Using snippets creates consistent appearance for the site, simplifies translation of multi-lingual context, and allows targeted edits of parts of a page without affecting the overall content.

Content snippets can include plain text, HTML layout, or template processing instructions, which helps enable dynamic content.



Snippets can be edited by using Portal Studio and Dataverse records by using the Portal Management app.

The screenshot shows the 'Mobile Header' content snippet record in the Portal Management app. The left sidebar navigation includes 'Home', 'Recent', 'Pinned', 'Website', 'Websites', 'Page Templates', 'Redirects', 'Site Markers', 'Site Settings', 'Website Bindings', 'Settings', 'Content', 'Content Snippets' (which is selected), 'Entity Forms', 'Entity Lists', 'Shortcuts', 'Web Files', 'Web Forms', 'Web Link Sets', 'Portal Languages', 'Web Pages', and 'Web Templates'. The top navigation bar shows 'Power Apps', 'Portal Management', 'Portals > Content Snippets > Mobile Header'. The main content area displays the 'General' tab of the 'Mobile Header' record. The record details are:

Name	* Mobile Header
Website	* Starter Portal
Display Name	Mobile Header
Type	HTML
Content Snippet Language	English

Below the record details is a 'Value (HTML)' section with tabs for 'Designer' and 'HTML'. The 'HTML' tab shows the following code:

```
1 <a href="/"></a>
```

## Table lists and table forms

The strength of Power Apps portals is the ability to interact with information and data that is stored in Dataverse.

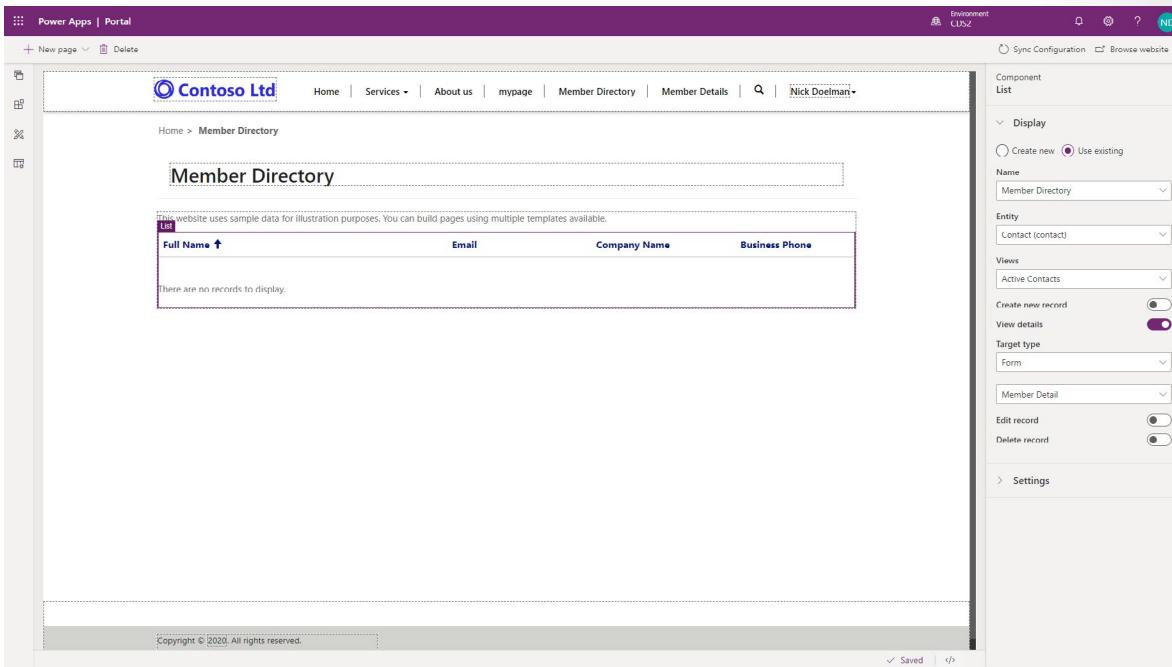


Table lists and table forms use model-driven Power Apps views and will form definitions to create dynamic and interactive portal pages that work with Dataverse.

A webpage record can be linked to table list or table form. The linked list or form will be used by the template to render the page layout by using data from Dataverse based on system or custom entities. The template might use list and form definitions to include interactivity, for example, read-write access to Dataverse records.

## Table lists

Table lists define how the list of Dataverse records is displayed on portal pages. They are defined by one or more model-driven Power Apps views and include functionality like filtering and sorting.

Table lists can also have actions associated with them to enable Create/Edit/Read abilities and to trigger workflows. Display formats include traditional grid lists, calendar, or map and spreadsheet download.

## Table forms

Table forms add the ability for portal pages to interact with records in a specific table by using a model-driven Power Apps form definition as a layout template.

**Form** mode can be read-only, insert, or edit. This mode defines if the form is used to generate a layout, capture the data, or provide full editing capabilities by using the Dataverse table record. Examples of the types of capabilities that are defined in **Form** mode include:

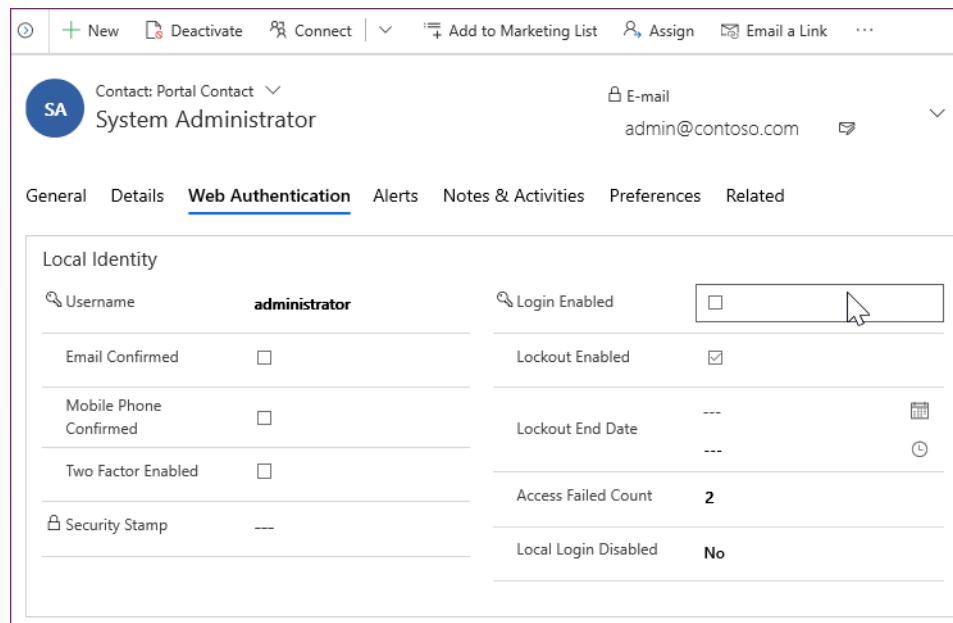
- Informational pages about employees, products, or any other Dataverse table.
- Data capture from either anonymous or authenticated users, for example, using a **Contact us** page to record leads in Dynamics 365 Sales or using a survey page to collect product feedback from customers.
- Support pages that provide read-write access to the customers' cases.
- Profile self-management for customers.

- An alternative user interface for employees that provides required functionality without the need to deploy canvas-based Power Apps.
- Any other scenario where data from Dataverse needs to accessed, displayed, captured, and processed by using the portal.

## Overview of portal security

Users of Power Apps portals are tracked in Microsoft Dataverse as contacts.

The Portal Management model-driven app provides access to the contact table and has forms to manage passwords, view portal-specific contact information, and provide registration and profile management forms for the portal.



The screenshot shows the Microsoft Dataverse Contact form for a user named 'System Administrator'. The 'Web Authentication' tab is selected. Under the 'Local Identity' section, there are fields for Username ('administrator'), Login Enabled (checkbox), Email Confirmed (checkbox), Lockout Enabled (checkbox), Mobile Phone Confirmed (checkbox), Lockout End Date (calendar icon), Two Factor Enabled (checkbox), Access Failed Count (text input '2'), Security Stamp (text input '---'), Local Login Disabled (checkbox), and a timestamp field.

All interactions and actions that a portal user takes (for example, leaving a comment on a page) are tied to their contact record in Dataverse.

## Authentication

Portal users can authenticate by using the following methods:

- **Local authentication** - Common forms-based authentication with usernames and password hashtags are stored in the Dataverse contact record.
- **External authentication** - Credentials and password management are handled by other identity providers.

Supported authentication providers include:

- OAuth2 (Microsoft, Twitter, Facebook, Google, LinkedIn, Yahoo)
- Open ID (Azure Active Directory, Azure Active Directory B2C)
- WS-Federation and SAML 2.0. These providers are used for integration with on-premises Active Directory and other identity services.

Portal administrators can choose to enable or disable any combination of authentication options through portal **Authentication Settings**.

The screenshot shows the 'Identity providers' section of the Power Apps portal. On the left is a navigation sidebar with options like Home, Learn, Apps, Create, Data, Flows, AI Builder, and Solutions. The main area has a header with '+ Add provider' and 'Authentication Settings'. Below this is a table titled 'Identity providers' with columns for 'Provider name', 'Provider type', and 'Status'. The table lists several providers: Local sign in (Local sign in, Enabled), Azure Active Directory (Azure active directory, Enabled), Azure Active Directory B2C (Azure Active Directory B2C, Click to configure), Facebook (Facebook, Click to configure), LinkedIn (LinkedIn, Click to configure), Google (Google, Click to configure), Twitter (Twitter, Click to configure), and Microsoft (Microsoft, Click to configure). A note at the bottom says 'You can configure additional providers using Portal Management app. Learn more'.

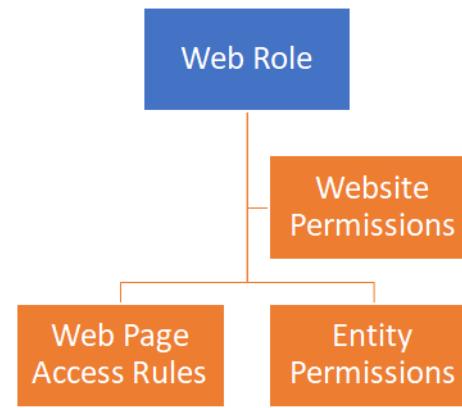
**Important:** Azure Active Directory B2C is a recommended identity provider for authentication. If another provider support is required, then it can be configured in Azure Active Directory B2C.

## Authorization

After the user is authenticated and associated with a contact, Power Apps portals uses numerous entities to define authorization, that is, what a user is allowed to do. Selecting **Share** from the portal app options will provide information on how to share the portal app with internal and external users.

The screenshot shows the 'Share this portal' options for the 'Contoso Portal' app. The left sidebar shows the 'Apps' section selected. The main area shows the 'Contoso Portal' app details with columns for Name, Modified, Owner, and Type. To the right, there are two sections: 'Share with internal Users' and 'Share with External Users'. The 'Share with internal Users' section includes steps for creating a security role and assigning users. The 'Share with External Users' section includes steps for adding users to portal web roles and inviting users via contacts. A 'Close' button is at the bottom right.

**Web role** allows an administrator to control user access to portal content and Dataverse records.



A web role can be associated with the following records:

- **Website permissions** - Define what (if any) front-side editing permissions that a web role should have.
- **Webpage access rules** - Define what pages are visible to a web role and what actions can be taken.
- **Table permissions** - Define what access a web role has to individual Dataverse entities.

A portal contact might be assigned to one or more web roles at a time. Access rules and permissions of individual roles are combined to calculate the resulting permissions set.

One of the web roles in the portal can be marked as **Anonymous** and the other as **Authenticated**. These roles allow you to apply permissions and access rules to all portal users based on whether they are signed in or if they can access the site anonymously.

## Overview of extending portals

Power Apps portals is considered a no-code, low-code solution to building portal apps. However, situations might occur where certain requirements necessitate extended development. An advanced maker or professional developer can extend a Power Apps portal in several ways.

### Liquid

Liquid is an open-source markup language that can be embedded into content (webpages content, content snippets) and web templates. Liquid is used to add dynamic content to webpages and can also be used to surface Microsoft Dataverse records dynamically.

For more information, see [Work with Liquid templates<sup>1</sup>](#).

### Web templates

Portals are provisioned with a predefined set of web templates that define how a webpage is structured. Portal customizers can modify or create new web templates to address specific requirements. For example, a web template can be created to display static and dynamic content in a specific layout.

For more information, see [Create a custom page template<sup>2</sup>](#).

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<sup>1</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/liquid/liquid-overview/>

<sup>2</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/liquid/create-custom-template/>

## JavaScript

Custom JavaScript code can be embedded in different portal assets such as webpages, web templates, table forms, and table lists. JavaScript can be used to enhance the client interface, add complex user input validation, or call external web services. Scripting in Power Apps portals is specific to portal components and does not use scripts from model-driven apps in table forms or views.

For more information, see [Add custom JavaScript<sup>3</sup>](#).

## CSS

Cascading Style Sheets (CSS) can be used to control the appearance and the behavior of portal webpages. CSS can also implement specific portal features instead of JavaScript code, for example, to hide certain page elements.

For more information, see [Edit CSS for themes in Power Apps portal<sup>4</sup>](#).

## Companion apps

Some situations might occur where custom code is required to create or update data in Dataverse without submitting table form or web form. A common technique is to create a custom web app outside of Power Apps portals, by using the Web Apps feature of Azure App Service or Azure Functions, that will expose an API that can be securely called from JavaScript on portal pages. The web app can interact with data by using the standard Dataverse web API.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which one of the following selections is not a valid target audience for Power Apps portals?

- Customers
- Employees
- Competitors
- Donors

### Multiple choice

2. What role is required to be able to provision a Power Apps portal for an organization?

- System Administrator
- Office 365 Global administrator
- System Customizer
- Power Apps portal administrator

<sup>3</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/add-custom-javascript/>

<sup>4</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/edit-css/>

## Multiple choice

3. *Where can you store the content of a portal web file?*

- Amazon S3
- OneDrive for Business
- Azure Blob storage
- FTP server

## Multiple choice

4. *What is the recommended authentication mechanism in Power Apps portals?*

- Social providers
- Azure Active Directory B2C
- Local authentication with username and password
- Microsoft account

## Summary

Power Apps portals extends Microsoft Dataverse access to external audiences such as customers, employees, or partners. This access allows businesses to extend and scale their operations as they reduce call center costs, manual processing, and resolution times while simultaneously improving user satisfaction, transparency, and scale of operations.

This module covered the following concepts:

- Business scenarios where Power Apps portals can add value to customer Microsoft Power Platform and Dynamics 365 solutions.
- Core records for the content and data access: webpages, templates, table forms, and table lists.
- Fundamentals of portals security and which methods are used to control access to the content and data.

## Next steps

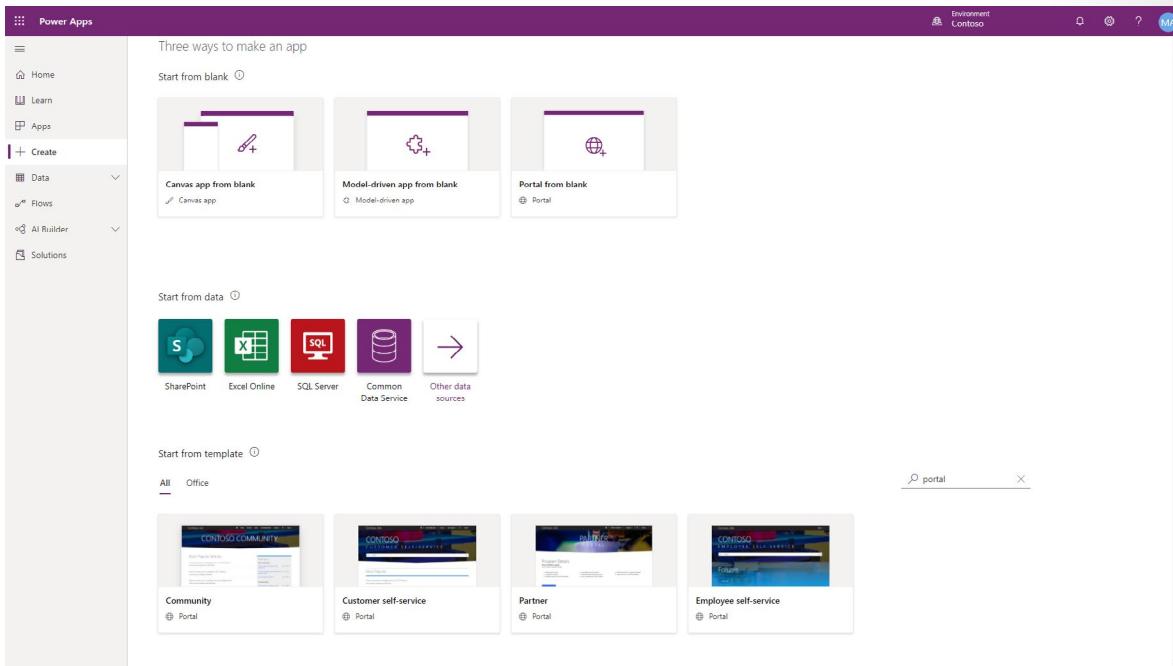
In the next module, you will discover how to get started using portal templates, and you will learn about individual features that are included in each of the available portal templates.

# Explore Power Apps portals

## Introduction to portal templates

When provisioning a Power Apps portal, the most important choices to consider are the audience, workload, and choosing a specific portal template that would best align with the particular business requirements.

A number of portal templates are available that can be provisioned. These templates will accelerate the configuration of a portal based on the intended audience and workload.



If you are building a custom business application by using Microsoft Dataverse without Dynamics 365 apps enabled, your only choice is the **Portal from blank** option.

If you are using Microsoft Dynamics 365 apps such as Dynamics 365 Sales or Dynamics 365 Service, you have a choice of five additional portal templates:

- Community portal
- Customer self-service
- Employee self-service
- Partner portal
- Custom portal (Dynamics 365 Supply Chain Management)

**Note:** Specific features and components of one specific starter portal can be added to another starter portal, as required.

## Portal templates

Portal template	Audience	Workload
-----------------	----------	----------

Community	Partner, Customer	Choose this option to provision a portal that is focused on an online community. This portal will contain features such as forums, ideas, blogs, and case management.
Customer self-service	Partner, Customer	This option provides the ability for portal users to search knowledge articles, submit cases, and participate in discussion forums to resolve issues.
Employee self-service	Employee	This portal allows employees to access a centralized knowledge article and to also submit cases.
Partner	Partner	Choose this option to build a portal where external partners can manage and collaborate on accounts and opportunities. Add-ons are available for Dynamics 365 Field Service or Dynamics 365 Project Service.
Portal from blank	Other	The <b>Portal from blank</b> option is meant for unique line-of-business scenarios where the other templates are not a good fit. The portal can be configured to address a variety of requirements. If <b>Portal from blank</b> is provisioned within a Dataverse environment with Dynamics 365 apps enabled, specific features from the other portals can be incorporated into the portal later.
Customer portal	Enterprise B2B	The Dynamics 365 Supply Chain Management Customer portal is a template that provides portal access to Dynamics 365 Supply Chain Management data by using dual-write Dataverse entities.

**Important:** Review current licensing guides to determine the licenses, subscriptions, and capacity that is required for internal and external authenticated users and anonymous page views. For more information, see the **Dynamics 365 Licensing Guide**<sup>5</sup> or the **Power Apps Licensing Guide**<sup>6</sup>. Integration to other services such as SharePoint, Power BI, or Azure Blob storage will require appropriate capacity and licensing.

Make sure that you define the type of audience who will visit the new portal. The audience will determine which options of portals you will be given.

<sup>5</sup> <https://go.microsoft.com/fwlink/?LinkId=866544>

<sup>6</sup> <https://go.microsoft.com/fwlink/?linkid=2085130>

## Portal features

All portal templates are built on a common foundation (portal base) and include the following features:

- Ability to configure the portal by using the Portal studio.
- Content management, including content publishing, design, theming, search, multi-lingual support, and templating.
- Extensibility that is built on webpages, templates, table forms, table lists, and more.
- Security that is based on identity management, integration with authentication providers, web roles, content permissions, and table permissions.
- Common features like ads, polls, ratings, and comments. These features are not standalone and can be used throughout other parts of the implementation. For example, ratings and comments can be enabled for a page, and ads can be included as part of a template. Some features will require Dynamics 365 apps to be enabled. For example, knowledge articles require a Microsoft Dynamics 365 app.

Where the portal templates are different is around the functional areas that target *specific business processes* such as case management. These features are deployed as additional managed solutions, making it easier to add missing features if necessary.

Feature	Portal from blank	Customer self-service	Partner	Employee self-service	Community
Portal base	•	•	•	•	•
Knowledge management		•	•	•	•
Support/Case management		•	•	•	•
Forums		•	•	•	•
Azure AD Authentication ^				•	
Ideas					•
Blogs					•
Partner pipeline			•		
Project Service Automation integration			•		
Field Service integration			•		

<sup>^</sup> Support for Azure Active Directory (Azure AD) as authentication provider is included in the portal base. The Azure AD Authentication feature, as used by the Employee self-service portal, is different. In the Employee self-service portal, the sign-in process validates that the user has a required Dynamics 365 license and access is denied if the user does not have a Dynamics 365 license assigned.

If a particular feature, for example case management, is available in two different templates, it will be the same feature offering the same functionality.

## Additional considerations

The following sections explain the additional factors that you should consider when choosing the correct portal template.

## Dependencies

Some portal templates have prerequisites for their installation, so an installation will fail if the prerequisites are not met. For example, to install Field Service for a Partner portal, the Partner portal and Field Service solutions must have already been installed. If you attempt to install Field Service first, the installation will fail and give you an error message. If Dynamics 365 apps are not enabled, the only available portal template will be **Portal from blank**.

## Employee portal access

When an employee accesses the portal functionality, an appropriate Dynamics 365 or Power Apps license might be required. The simplest way to assess the licensing requirements is to keep in mind that the requirements do not change based on the method of access; they are the same regardless of whether an employee accesses Dynamics 365 by using a portal or through one of the Microsoft Dynamics 365 apps.

For example, if an employee has a Dynamics 365 Customer Service license assigned, they cannot manage opportunities by using the Partner portal because access to opportunities requires a Dynamics 365 Sales license.

The license that is required depends on the entities and functionalities that are accessed. For more information, see [Dynamics 365 Licensing Guide<sup>7</sup>](#) or [Power Apps Licensing Guide<sup>8</sup>](#).

## Other solutions

Other solutions add features to the portal that can greatly enhance user experience. Some of these capabilities might be agnostic to the choice of template, for example:

- Live chat and Cobrowse
- Click to call
- Customer journey tracking

Alternatively, Microsoft Power Platform and Dynamics 365 independent software vendors and partners that offer Microsoft Power Platform and Dynamics 365 vertical solutions might often include portal extensions that are designed for their solution needs. When you are working with a vendor who offers portals as part of their overall solution, it would be sensible to discuss portal requirements and the portal template selection beforehand.

## Community portal

The Community portal template is meant to be used as a platform for an online community.

**Note:** The Community portal is only available on Microsoft Dataverse environments with Dynamics 365 apps enabled.

These communities are often built around the fact that the community members use services of the same organization. Perhaps the online community is comprised of a local city council that provides ongoing

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<sup>7</sup> <https://go.microsoft.com/fwlink/?LinkId=866544&clcid=0x409>

<sup>8</sup> <https://go.microsoft.com/fwlink/?LinkId=2085130&clcid=0x409>

services to its constituents. Alternatively, the online community could be people who purchased products from a manufacturer, and who use the community site to share tips and tricks with each other or assist other members in troubleshooting.

Interactions between an organization and community members are often divided into two channels:

- **Self-service** - The Community portal extends an organization's self-service capabilities, including:
  - Knowledge base access
  - Access to blog posts that share relevant information
  - Advanced search across the site content
- **Assisted service** - The Community portal allows an organization to access Dynamics 365 service support channels:
  - Submit cases/tickets through configurable web forms
  - Review, update, and comment on existing cases
  - Participate in discussion/community forums

The Community portal caters to both self-service and assisted service scenarios, and portal visitors are able to participate in the following features:

- Forums
- Blogs
- Ideas
- Knowledge articles
- Support cases

## Forums

Forums allow members of a particular community with common interests to post questions, start discussions, or ask for help.

Forums are set up and configured by using the Portal Management app. For information on how to configure forums, see Set up and manage forums(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/setup-manage-forums/>).

The **Forums** feature is also available on the Community, Customer self-service, Employee self-service, and Partner portals.

An organization will choose forums as a way for their community to interact with each other by asking questions, starting discussions, or by looking for help.

Different forums are created within the Portal Management app in the **Community** area by creating a forum record. Forums can be set up to represent different high-level topics that are based on the needs and goals of an organization, for example, general discussions, support, and so on.

Forums fully support multi-lingual deployments and can be language-agnostic or linked to a specific language, which helps you to create portals that encourage global and local conversations between participants.

When published, the forums are surfaced on the portal so that visitors can create new discussion threads or respond to existing discussions. The visitor can also subscribe to threads to receive updates or new responses to discussions.

Portal visitors will create new threads, which are stored in the Power Apps portal metadata as **Forum Threads** and will contain at least one post (post record). The post will contain the discussion details and optional file attachments. Depending on permissions, other portal visitors can read or respond to particular threads, which will create additional post records. The collection of posts under a thread will represent a particular discussion or answer to a posted question.

Having an active and engaging forum will strengthen a particular community and potentially alleviate customer and community support resources.

The organization can control from whom and how forum threads and posts are created by using the related Forum Access Permissions, which will link to specific web roles.

## Blogs

The Community portal provides members of its online community a place to post blog articles.

To learn how to configure and set up blogs on Power Apps portals, see [Manage blogs](https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/manage-blogs/)(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/manage-blogs/>).

The organization must first create the blog by using the Portal Management app. After the particular blog has been created, the organization can grant the Blog Author web role to the portal user. Then, the portal user will be able to use the front-side editing tools to create blog articles by writing text and inserting images and reference links.

Blogs can also be configured to allow authenticated, unauthenticated, moderated, and unmoderated comments in response to the blog article.

Having an engaging blog will provide updated and compelling content that helps promote the community or an organization's products and services.

The **Blog** feature is unique to the Community portal, but it can be surfaced on other portal types.



<https://www.microsoft.com/videoplayer/embed/RWrtZx>

## Ideas

The **Ideas** feature of the Community portal is an extension of the **Forum** feature, where it will allow members of the public to crowdsource particular ideas or suggestions.

The **Ideas** feature is available on the Community portal, Customer self-service portal, and the Employee self-service portal.

To configure ideas on the Community portal, see [Crowdsource ideas](https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/crowdsource-ideas/)(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/crowdsource-ideas/>).

For an organization to best serve its customers or constituents, it needs to allow an easy feedback mechanism. The **Ideas** feature allows portal visitors to submit a particular suggestion to the organization, which could be for a policy change, a new feature, or a new product or service suggestion.

When a user adds a new idea, the autocomplete feature on the **Topic** field can be configured to allow visibility of existing ideas to reduce the number of duplicate or similar ideas.

After the idea has been posted, other portal visitors will be able to vote on the idea or add their own comments or feedback. The policies of feedback and voting are configured from the Dynamics 365 portal app, such as the ability to vote directly on an idea, number of votes, and comment policies.



<https://www.microsoft.com/videoplayer/embed/RWrrm5>

## Knowledge articles

An effective way to maximize the use of helpful content is the ability to search and surface knowledge articles on a Power Apps portal. This feature uses the Dynamics 365 Customer Service knowledge articles (used for internal customer service management) and provides a mechanism to surface on Power Apps portals.

The Power Apps portals **Knowledge Article** feature is available on the Community, Customer self-service, Employee self-service, and Partner portals.

To configure the Power Apps portals **Knowledge Article** feature, see the Documentation(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/configure-knowledge-categories-articles/>).

An organization can determine which of its existing knowledge articles should be surfaced on the portal by setting the **Internal** flag and by associating the knowledge article to the appropriate categories.

A portal visitor will be able to navigate through the category structure to locate a specific knowledge article or by using the keyword search features of the portal.

When entering a support case, the portal user might be redirected to browse potentially related knowledge articles to provide a more immediate response to a question and also reduce the case load of the support organization.

## Support cases

The Dynamics 365 Customer Service Case functionality is surfaced on Power Apps portals by using the **Support Case** portal feature.

This use case is common for Power Apps portals and is available on the Community, Customer self-service, Employee self-service, and Partner portals.

To set up and configure the Power Apps portals Case Management features, see Manage cases in portals(<https://docs.microsoft.com/en-us/dynamics365/customer-engagement/portals/case-management/>).

An organization can allow customers to sign in to the portal and begin the support process by first seeing if the particular question or issue can be resolved with existing information in forum posts or knowledge articles.

If the provided information is not sufficient to resolve the issue, the customer can create a new support case through the portal. This action will create a corresponding case record in Dynamics 365 Customer Service. The case can be assigned to a particular support representative or team that is following the same business processes that are defined for using the Customer Service Hub.

The support representative can follow existing processes and procedures to resolve the case, such as referring to a knowledge article or providing steps to resolve the issue by using traditional support channels (phone, email). The support representative can also associate a portal comment activity record to the case, which is visible on the case timeline in Dynamics 365 and the portal. Additional configuration by using Dataverse workflow and email integration will allow the customer to be notified of updates to the case with a hyperlink to the portal.

A customer can also respond and update the case by creating portal comments. When the case is resolved, the customer could have the option to reopen the case if the issue was not resolved.

## Customer self-service portal

The Customer self-service starter portal is for any organization that needs to provide customer support services. Dynamics 365 Customer Service features are extended to the portal.

**Note:** The Customer self-service portal is only available on Microsoft Dataverse environments with Dynamics 365 apps enabled.

Similar to the Community portal, the features for both self-service and assisted service scenarios are included, though the emphasis is on the assisted service scenarios. Some self-service features, such as blogs, are not included.

The Customer self-service portal provides the following methods for customers to resolve their own issues:

- Knowledge articles
- Forums
- Support cases

## Knowledge articles

The **Knowledge Article** feature is the same as described for the Community portal. An organization that provides online customer support will benefit from publishing knowledge articles on the portal in the following ways:

- Reduction in the number of logged cases because customers might find the answers and information that they need in existing knowledge articles.
- Improved customer service and satisfaction because customers are able to find information before needing to open a support ticket.



<https://www.microsoft.com/videoplayer/embed/RWrEmA>

## Forums

The **Forums** functionality operates in the same way as the Community portal. Organizations can have their support staff monitor and actively participate in forums. Support staff, along with other community

members, would answer questions and provide information that will help resolve the customer's issues and provide a public archive of the solution for others who might encounter the same issue in the future.

## Support cases

The ability to allow customers to submit support cases operates in the same way as the Community portal. This feature is a common use case for portals and provides customer service organizations with a key channel to interact with their customers. A key benefit of support cases is that customers who want to submit a ticket are presented with options to review existing knowledge articles and forum posts because these items might help resolve the customer's question in a faster manner.



<https://www.microsoft.com/videoplayer/embed/RWrBLh>

## Employee self-service portal

The Employee self-service template provides organizations with a portal that is configured to assist employees with finding specific human resources and company information or for resolving employee-specific issues.

**Note:** The Employee self-service portal is only available on Microsoft Dataverse environments with Dynamics 365 apps enabled.

By default, the Employee self-service portal is configured to authenticate by using Microsoft Azure Active Directory (Azure AD), which provides employees with a single sign-on experience.

**Important:** *Organizations are required to have at least a Dynamics 365 Team license subscription for each employee who accesses the Employee self-service portal. For more information, see the [Dynamics 365 Licensing Guide](#)<sup>9</sup>.*

The Employee self-service portal provides employees with the following features:

- Knowledge articles
- Forums
- Support cases

## Knowledge articles

The **Knowledge Article** feature of the Employee self-service portal operates as described for the Community portal. However, this feature is geared more toward supporting employees rather than customers.

Employees can search for knowledge articles that cover various human resources or corporate policies and procedures on a portal.

This search would also require the internal department (for example, a Human Resource team) to use the Dynamics 365 Customer Service Hub app to manage and maintain applicable knowledge articles.

<sup>9</sup> <https://go.microsoft.com/fwlink/?LinkId=866544>

## Forums

The **Forum** functionality in the Employee self-service portal operates the same way as it does for the Community and Customer self-service portals. However, the discussions would typically be available to internal staff only and would follow topics that are related to Employee self-service.



<https://www.microsoft.com/videoplayer/embed/RWrBLj>

## Support cases

The **Support Cases** functionality is the same as described in the Community and Customer self-service portals. For the Employee self-service portal, the customers would represent internal employees of an organization.

This factor would require that the internal department is contacted for support (for example, a Human Resources or internal IT team), and that they use the Dynamics 365 Customer Service Hub app to monitor and respond to support cases from employees.

## Partner portal

The Partner portal provides organizations that have a partner channel with a mechanism to allow partners to manage and collaborate on opportunities and customers.

**Note:** The Partner portal is only available on Microsoft Dataverse environments with Dynamics 365 apps enabled.

Contoso, Ltd.

PARTNER PORTAL

## Program Details

**Partner benefits at a glance**  
Look at all the cool stuff you get!

- Partner portal access.
- Competitive margins.
- Dedicated sales and technical support.
- Free internal use and support.
- Unlimited online-training resources.
- Latest marketing and sales materials.
- Partner discounts to in-person trainings.
- Early products and offering briefings.

[View More](#)

Become a partner

Self-service and assisted service features in the Partner portal have the same functionality as in Community or Customer self-service portals, though the target audience is partners and not customers. This factor might influence how the feature is configured and used.

When you are provisioning the Partner portal, you can add more features if the Dynamics 365 organization has Field Service or Project Service solutions loaded. Selecting these options will extend portal features to these Microsoft applications.

**Partner**

A partner portal allows every organization with resellers, distributors, suppliers, or partners to have real-time access to every stage of shared activities.  
[Learn more](#)

Portal

Name \*

Address \*   
✓ ContosoCorporatePartners.powerappsportals.com

Language

Enable packages i

Field service  
 Project service

[Create](#) [Cancel](#)

## Partner management

With the **Partner Management** feature, you can:

- Apply to become a partner.
- Manage partner information.
- Add partner contacts.

A potential partner can navigate to the Partner portal and review the requirements of the partner program. The potential partner can apply to become a new partner through the portal. The contact will need to create a portal sign-in and fill in details of the application. This information will be stored in the corresponding **Account** and **Contact** records in Dynamics 365.

The partner organization (the organization that is selling products and services through its partner channel) will review the application on the Partner Recruitment Dashboard in the Dynamics 365 Sales application. When the application has been reviewed, the partner organization will run a workflow to either approve or reject the partner application.

After the application has been approved, the new partner contact will be able to sign in to the portal and view a dashboard with their revenue and opportunities. The new partner contact can also manage their own information (name, address, phone number, and so on) and also add and remove employee and employee access to the Partner portal.



<https://www.microsoft.com/videoplayer/embed/RWrEVT>

## Customer management

A partner will be able to review and manage their customer list on the Partner portal. Additionally, they will be able to update contact information and add, remove, and associate different contacts to different accounts. All this information is stored as accounts and contacts in the partner organization's Dynamics 365 service.

Partners will not be able to see the customer lists of other partners.

## Opportunity management

The core feature of the Partner portal is that partners are able to manage and be assigned opportunities. A partner can add new opportunities through the portal. These opportunities will be added to the overall partner organizations pipeline and will appear on the partners dashboard.

The partner organization might also add opportunities and distribute them to a particular partner who would be best suited to close the deal. Alternatively, the partner might choose to add opportunities through some other allocation process.

The partner will be identified on the opportunity and, from the portal, the partner can review the opportunity and choose to either accept or reject it.

## Knowledge articles

The **Knowledge Article** feature operates the same as it does for the Community, Customer self-service, and Employee portals. However, the knowledge articles would provide specific product and services information and also potentially information regarding partner program-specific issues.

## Forums

A partner organization might decide to allow its partners to participate in forums to share best practices, collaborate on questions, and initiate other discussions.

The **Forums** feature operates the same as it does on the Community, Customer self-service, and Employee self-service portals.

Staff from the partner organization might also participate on the forums to encourage knowledge sharing and collaboration.

## Support cases

The **Support Case** functionality exists on the Partner portal and follows the same pattern set as the Community, Customer self-service, and Employee self-service portals. Partners will be able to open cases with the partner organization, who will monitor and respond by using the Dynamics 365 Customer Service Hub app. The one key difference is that partners can link a particular opportunity that they are currently pursuing to the case to provide the partner organization with additional context to the specific inquiry.

## Custom portal

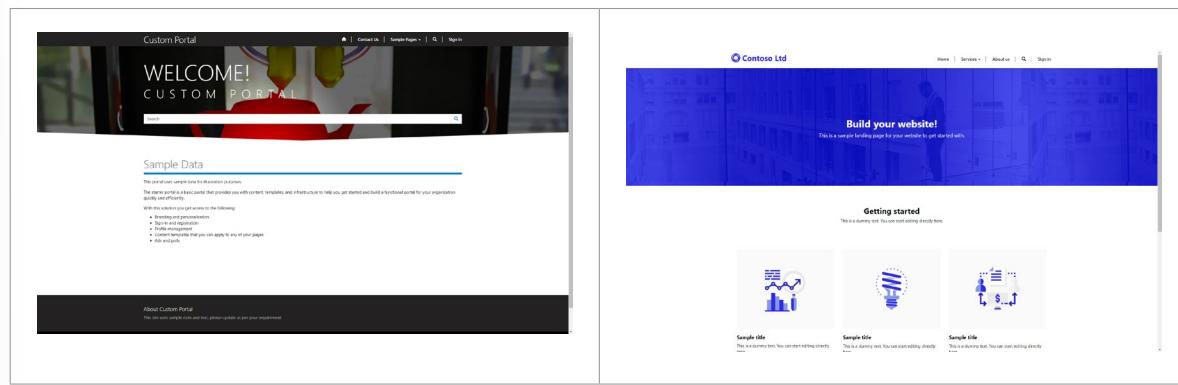
The **Portal from blank** template provides organizations with a basic portal that does not fit the requirements of the specific portal audience or workload features.

This portal is an ideal starting point for unique line-of-business applications with portal requirements. Examples of custom portals could be event and registration management, grant management, or government citizen service solutions. Any custom business app that is built on Microsoft Dataverse can be extended to an external-facing audience.

The Custom portal contains core features such as content management, security, ability to transact with Dataverse, and extensibility.

**Note:** The blank portal will appear different if provisioned in a Dataverse environment with Dynamics 365 apps enabled versus one without Dynamics 365 apps.

Environment with Dynamics 365 apps	Dataverse environment without Dynamics 365 apps
------------------------------------	---



**Note:** When **Portal from blank** is provisioned in a Dataverse environment with Dynamics 365 apps enabled, it will include an additional **Contact Us** page that allows anonymous enquiries to be recorded as leads within the Dynamics 365 app.

A functional consultant can configure the Custom portal to address business requirements by adding web links and custom pages and by surfacing Dataverse records. A Custom portal can be further extended by using table lists, table forms, web forms, or custom templates.

Features from other portals can be applied to a Custom portal in an environment with Dynamics 365 apps enabled.



<https://www.microsoft.com/videoplayer/embed/RE4ynsK>

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. You have provisioned a new Power Platform environment without enabling any of the Dynamics 365 apps. What starter portal templates are available for you to provision?

- Customer service portal
- Community portal
- Portal from blank
- Not for Profit portal

## Multiple choice

2.What starter portals are not available for the customer audience?

- Customer self-service
- eCommerce portal
- Community portal
- Custom portal

## Multiple choice

3.Where do you write new knowledge articles for the portal?

- Portal Studio
- Custom portal
- Dynamics 365 Customer Service Hub
- Portal Management app

## Multiple choice

4.Which feature is only available in the Community starter portal?

- Forums
- Blogs
- Event Management
- Knowledge Articles

## Summary

Power Apps portals provide a great way for an external audience to view and interact with data from Dynamics 365 and custom Microsoft Dataverse applications. Portals should be a consideration as a pillar in an organization's overall web strategy. Power Apps portals can be quickly provisioned to serve a variety of different audiences and workloads.

In this module, you looked at various ways to get started using Power Apps portals and features, including:

- How to select a particular audience and workload before provisioning a Power Apps portal.
- The available portal templates for Dataverse environments, with and without Dynamics 365 enabled.
- How the Community portal provides a platform for an online community where members can interact on a forum, read and contribute to blog postings, search knowledge articles, and submit cases to Dynamics 365 Customer Service.
- How organizations that have customer service departments can be empowered through the Customer self-service portal by publishing knowledge articles online, facilitating a question and answer forum, and if the answer is not available online, the customer can submit a support case that is managed by Dynamics 365 Customer Service.
- How a Human Resources department can provide an Employee self-service portal for internal staff to search policies and procedures, engage with other employees, and submit a case to resolve issues.

- Where organizations with a partner or reseller network can use the Partner portal to allow partners to manage accounts, contacts, and opportunities and to browse published knowledge articles and submit partner support cases.
- That the Custom portal and Portal from blank templates provide an option to extend unique line-of-business applications to external audiences and provide another key aspect to Microsoft Power Platform.

## Next steps

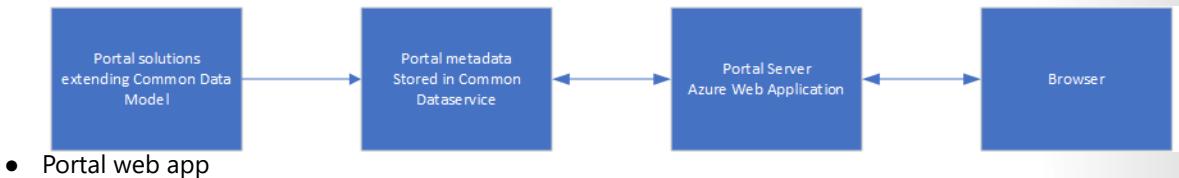
The next steps are to discover the core features of Power Apps portals, learn about specific Dynamics 365 features, and examine the alternative portal technologies to support Microsoft business applications.

# Power Apps portals architecture

## Introduction

A Microsoft Power Apps portal that is provisioned in a Microsoft Dataverse environment is composed of three main components:

- Portal solutions
- Portal metadata



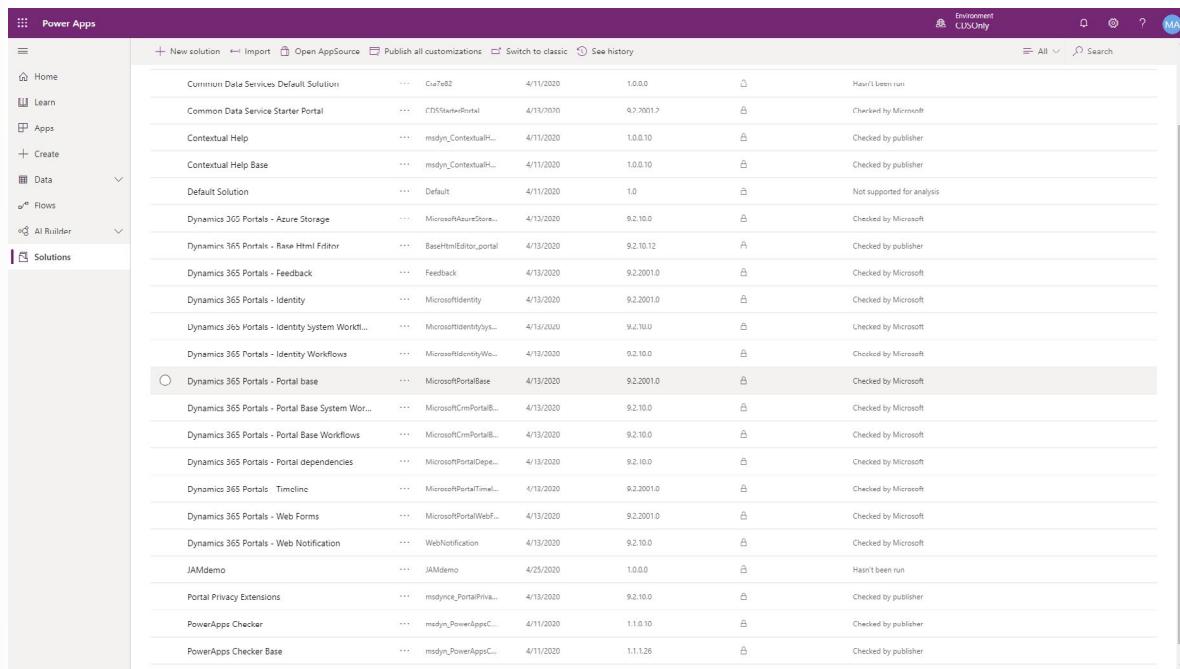
- Portal web app

A portal requires a Dataverse database to be available in the environment to install and configure some of the key components. While a portal from blank can be configured in an environment without any of the Microsoft Dynamics 365 apps installed, many of the templates (Customer self-service, Employee self-service, Partner, and Community portals) have dependencies on Microsoft Dynamics 365 Sales or Dynamics 365 Customer Service.

## Portals solutions

Numerous Dataverse solutions are installed in the environment. These solutions contain a model-driven portal management app, entities, forms, views, and processes to store and manage the portal metadata. Additional solutions are installed to enable the functionality of specific templates. Solutions contain several actions, workflows, and plug-ins that are deployed to automate the creation of specific portal records and assist with the management of portal users.

The solutions should not be installed individually by an administrator but installed as part of the portal provisioning process.



The screenshot shows the Microsoft Power Apps Solutions list interface. The left sidebar includes Home, Learn, Apps, Create, Data, Flows, AI Builder, and Solutions. The main area lists various solutions with columns for Name, Last modified, Version, Status, and Description. A specific solution, 'Dynamics 365 Portals - Portal base', is highlighted with a gray background.

Solution	Last modified	Version	Status	Description
Common Data Services Default Solution	4/11/2020	1.0.0.0	Not supported for analysis	Hasn't been run
Common Data Service Starter Portal	4/13/2020	9.2.2001.2	Checked by Microsoft	
Contextual Help	4/11/2020	1.0.0.10	Checked by publisher	
Contextual Help Base	4/11/2020	1.0.0.10	Checked by publisher	
Default Solution	4/11/2020	1.0	Not supported for analysis	
Dynamics 365 Portals - Azure Storage	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamirx 365 Portals - Rate Html Filter	4/13/2020	9.2.10.12	Checked by publisher	
Dynamics 365 Portals - Feedback	4/13/2020	9.2.2001.0	Checked by Microsoft	
Dynamics 365 Portals - Identity	4/13/2020	9.2.2001.0	Checked by Microsoft	
Dynamics 365 Portals - Identity System Workf...	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamics 365 Portals - Identity Workflows	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamics 365 Portals - Portal base	4/13/2020	9.2.2001.0	Checked by Microsoft	
Dynamics 365 Portals - Portal Base System Wor...	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamics 365 Portals - Portal Base Workflows	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamics 365 Portals - Portal dependencies	4/13/2020	9.2.10.0	Checked by Microsoft	
Dynamics 365 Portals - Timeline	4/13/2020	9.2.2001.0	Checked by Microsoft	
Dynamics 365 Portals - Web Forms	4/13/2020	9.2.2001.0	Checked by Microsoft	
Dynamics 365 Portals - Web Notification	4/13/2020	9.2.10.0	Checked by Microsoft	
JAMdemo	4/25/2020	1.0.0.0	Not supported for analysis	Hasn't been run
Portal Privacy Extensions	4/13/2020	9.2.10.0	Checked by publisher	
PowerApps Checker	4/11/2020	1.1.0.10	Checked by publisher	
PowerApps Checker Base	4/11/2020	1.1.1.26	Checked by publisher	

## Portals metadata

Power Apps portal metadata will describe the portal website, webpages, web templates, content snippets, table forms, table lists, site settings, and other configuration data. The data is stored in Dataverse. A portal maker can add, modify, or delete portal metadata to specifically configure a portal application by using the Power Apps portals Studio, the Portal Management app, or the legacy front-side editing tools.

One of the distinctive features of Power Apps portals is using Dataverse as a centralized storage for the information that is required to run the portal website. Everything that portals require to run, including metadata and content, is stored in a Dataverse database, which helps make backing up and transporting portal solutions between the environments easier.

```

    Power Apps > Portal Management > Web Templates > Faceted Search - Main Template
    Save & Close + New Deactivate Refresh Email a Link Flow Word Templates Run Report

    Faceted Search - Main Template
    Web Template

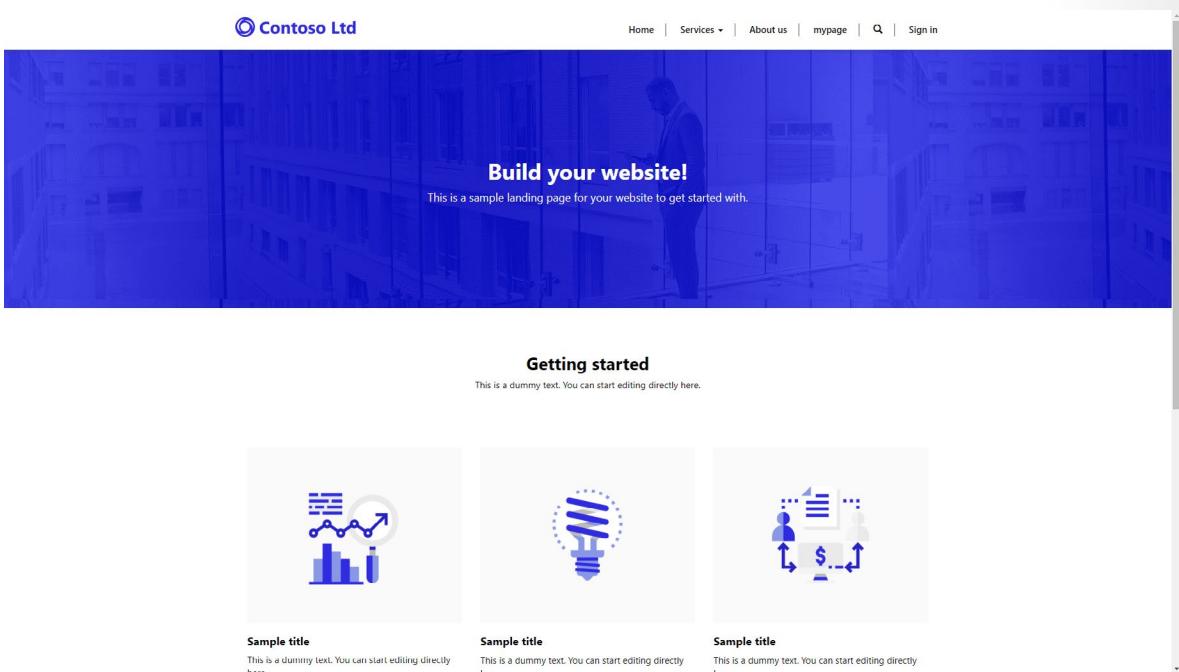
    General Related

    Name: Faceted Search - Main Template
    Website: Starter Portal

    Source:
    1: [% assign search_page = sitemarkers['Search'] %]
    2: [% assign query = settings['search/query'] | default:'(Query)' %]
    3: [% block main %]
    4: <div class="handlebars-search-container" data-url="{{ search_page.url | h }}" data-query="{{query}}>
    5: <div class="row search-body-container">
    6: <div class="col-xs-12 loader"></div>
    7: </div>
    8:
    9: <div class="js-face-order-definition hidden">
    10: <div class="face-order-item">LogicalName</div>
    11: <div class="face-order-item">modifiedate</div>
    12: <div class="face-order-item">rating</div>
    13: <div class="face-order-item">associatedproduct</div>
    14: </div>
    15:
    16: [% include 'Faceted Search - Paging Template' %]
    17: [% include 'Faceted Search - Core Templates' %]
    18: [% include 'Faceted Search - Facets Template' %]
    19: [% include 'Faceted Search - Results Template' %]
    20: </div>
    21:
    22: {Knock}
    23: <script id="Facets-view-body-container" type="text/x-handlebars-template">
    24: {{#if facetsList}}
    25: <div class="col-md-12 col-sm-12 col-xs-12 facets"></div>
    26: <div class="col-md-4 col-md-4 col-sm-4 col-xs-12 loader"></div>
    27: <div class="col-md-4 col-md-4 col-sm-4 col-xs-12 js-search-body">
    28: <div class="hidden-xs search-order js-search-body pull-right">
    29: <div class="search-results" role="alert"></div>
    30: <div class="search-pagination text-center"></div>
    31: </div>
    32: {{else}}
    33: <div class="col-md-12 col-sm-12 col-xs-12 js-search-body">
    34: <div class="hidden-xs search-order js-search-body pull-right">
    35: <div class="search-results" role="alert"></div>
    36: <div class="search-pagination text-center"></div>
    37: </div>
  
```

## Portals web app

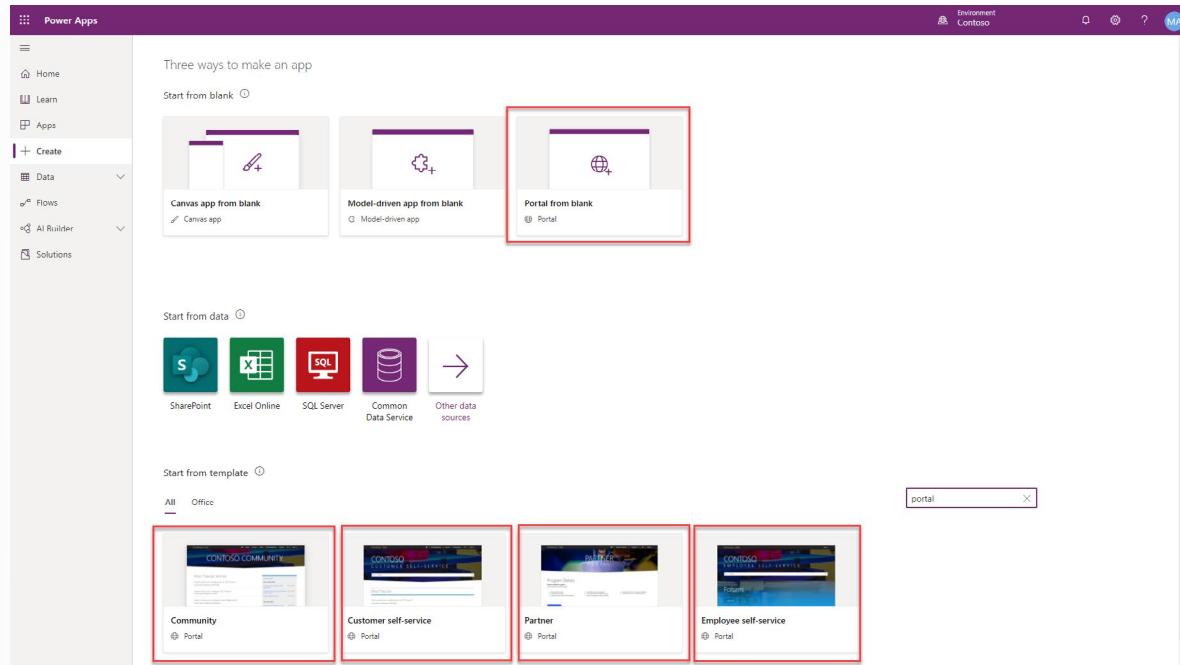
A Microsoft Azure web app is configured to run the portal site by using the portal solutions and metadata. The web app is automatically configured in the same region as the Dataverse environment. This web app is accessible through the unique URL that is specified during the provisioning process. The web app is not customizable; however, portal administrators have a number of configuration options available to them, for example, they can configure the portal web app to capture detailed diagnostics logs for troubleshooting purposes.



## Portals provisioning process

A fully functional portal that is based on a template is provisioned in an environment with Microsoft Dataverse enabled. This portal can be further configured to meet specific business requirements.

A maker will first choose a particular portal template. Currently, only one option (Portal from blank) is available for environments without Dynamics 365, while five different portal templates are available for environments with Dynamics 365 apps enabled.



## Portal solutions installation

The provisioning process first begins with the installation of a series of solutions in the environment. All portal implementations will contain base portal solutions with additional functionality added in separate solutions, depending on the portal template chosen. The solutions contain entities, forms, views, processes, and a model-driven Portal Management app that you can use to manage the portal metadata.

## Portal metadata

After the portal solutions have been installed, the process will upload portal metadata records based on the specific portal template chosen. The portal metadata will define the initial configuration for the portal. Each template can be installed only once for each environment; however, multiple portal templates can be installed in a single environment.

**Note:** Currently, only environments with Dynamics 365 enabled may contain multiple portal types.

## Portal web application

An Azure web app will be configured for each portal that is provisioned in an environment.

## Portal app

The provisioned portal will appear in the **Apps** list of type Portal. From this portal app, a maker will be able to edit (go to portals Studio), browse, share, go to settings, delete, or view details about the portal.

Name	Modified	Owner	Type
ContosoPartner	6 d ago	MOD Administrator	Portal
Contoso Employee Portal		MOD Administrator	Portal
Contoso		MOD Administrator	Portal
Customer Service Hub		SYSTEM	Model-driven
Donor App		MOD Administrator	Model-driven
Sales Team Member		SYSTEM	Model-driven
Portal Management	3 wk ago	MOD Administrator	Model-driven
Sele Hub	3 wk ago	....	Model-driven
Social Selling Assistant	3 wk ago	MOD Administrator	Model-driven
Omnichannel Administration	4 wk ago	....	Model-driven
Omnichannel for Customer Service	4 wk ago	....	Model-driven
Channel Integration Framework	4 wk ago	....	Model-driven
Customer Service	4 wk ago	....	Model-driven
Field Service	4 wk ago	....	Model-driven
Connected Field Service	4 wk ago	....	Model-driven
Project Resource Hub	4 wk ago	....	Model-driven
Project Service	4 wk ago	....	Model-driven
Resource Scheduling	4 wk ago	....	Model driven

A list of all portals in a Microsoft Power Platform tenant can be viewed from Microsoft Power Platform admin center.

Name	Status	Environment	Created on	Type
ContosoPartner	Configured	Contoso	5/7/2020, 6:17:26 PM	Production
Contoso Portal	Configured	CDS2	5/6/2020, 6:59:40 PM	Trial (15 days)
Contoso Employee Portal	Configured	Contoso	5/14/2020, 4:00:21 PM	Production
Contoso	Configured	Contoso	5/14/2020, 4:00:58 PM	Production
Airlift2020portal	Configured	Nick Doelman's Environment	5/14/2020, 3:53:58 PM	Trial (23 days)
AirliftMX2020	Configured	AirliftMXTR	5/14/2020, 1:31:07 PM	Trial (23 days)
Portal Add-on	Not Configured			Trial (Add-on)
Portal Add-on	Not Configured			Trial (Add-on)

The Portal Management app will also appear in the **Apps** list.

## Trial portal

By default, a portal will be provisioned in Trial mode. A maker will have 30 days to convert the portal to production, or it will be automatically deleted.

## Delete portal

If you delete a portal app, it will be removed from the list of apps and the portal web application will be deleted as well. However, the portal solutions or portal metadata will not be deleted from Dataverse.



<https://www.microsoft.com/videoplayer/embed/RE4yWm3>

## Portals maker and admin tools

Microsoft Power Platform provides a number of tools to help you administer, configure, and fine-tune a Power Apps portal to meet specific business requirements.

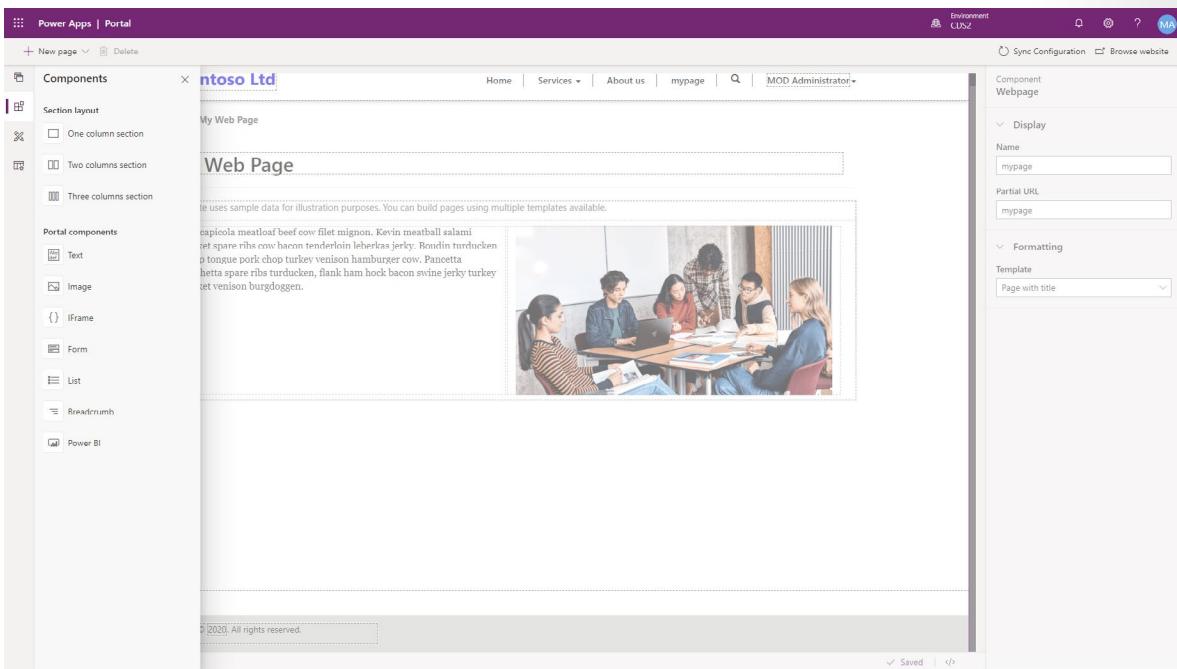
### Portals Studio

Power Apps portals Studio is a WYSIWYG portal editing tool that allows makers to create and organize webpages, configure page layouts, add portal components, modify CSS, and edit web templates and page source code. Updates and additions that are made in the portals Studio will directly update the portal metadata. The portals Studio is positioned as the main workspace for portal makers.

To access the portals Studio:

1. Go to Power Apps(<https://make.powerapps.com/>).
2. Select the target environment by using the environment selector in the upper-right corner.
3. Select the application of type Portal from the **Apps** list.
4. Select the **Edit** menu.

The portals Studio is used for quickly defining a site structure with webpage management, creating page layouts, embedding forms and lists, and applying themes to and reviewing page templates.



## Portal Management app

Not all portal configuration features are available in the Power Apps portals Studio. Portal Management is a Power Apps model-driven app that allows makers to add, modify, or delete any of the portal metadata records that define the portal functionality and appearance. The Portal Management app can be used for creating and editing content snippets, managing advanced options for table forms and table lists, and other advanced configuration tasks.

**Warning:** Incorrectly modifying the portal metadata might have undesirable effects on the operation and appearance of your portal.

To access the Portal Management app:

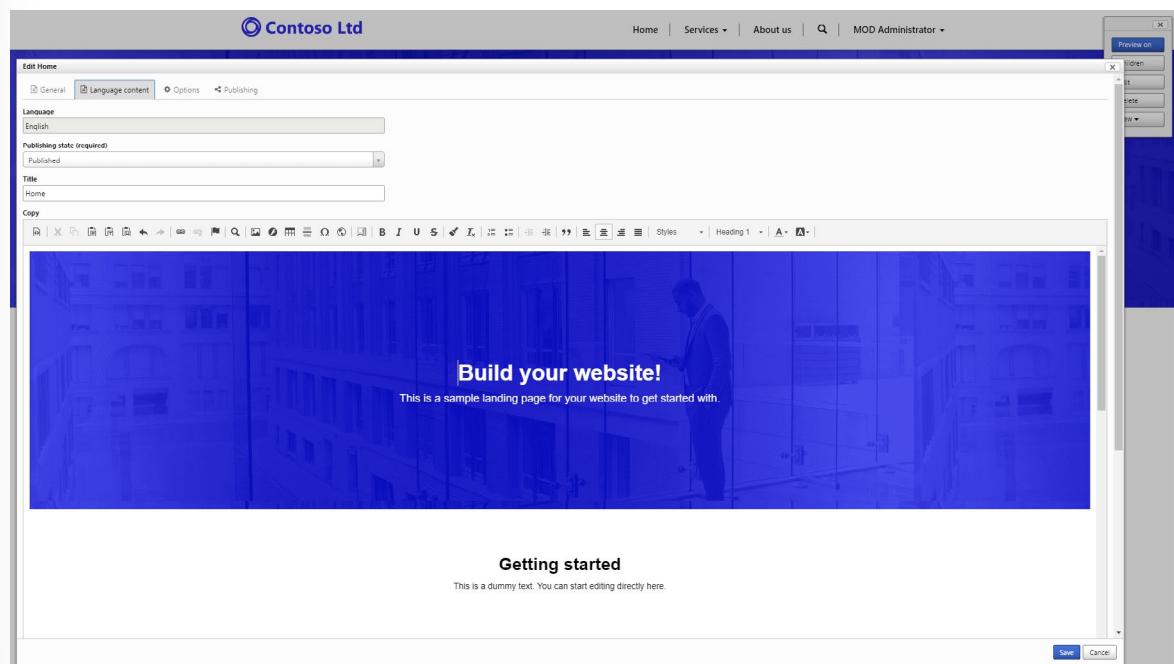
1. Go to Power Apps(<https://make.powerapps.com/>).
2. Select the target environment by using the environment selector in the upper-right corner.
3. In the **Apps** list, select the **Portal Management** model-driven app.

**Note:** The Portal Management app might be named Dynamics 365 Portals in existing Dynamics 365 environments.

Active Content Snippets				
Name	Website	Content Snippet Language	Type	Value
About Footer	Starter Portal	English	HTML	<h4>About Starter Portal</h4><p>This site uses sample ...
Account/ChangeEmail/EmailLabel	Starter Portal	English	Text	E-mail
Account/ChangeEmail/PageCopy	Starter Portal	English	Text	---
Account/ChangeLogin/PageCopy	Starter Portal	English	Text	---
Account/ChangePassword/PageCopy	Starter Portal	English	Text	---
Account/ConfirmEmail/ConfirmEmailErrorText	Starter Portal	English	Text	We were unable to confirm your email address. Make sure ...
Account/ConfirmEmail/ConfirmEmailFormHeading	Starter Portal	English	Text	Confirm E-mail
Account/ConfirmEmail/ConfirmEmailInstructionsText	Starter Portal	English	Text	Confirm E-mail.
Account/ConfirmEmail/EmailLabel	Starter Portal	English	Text	E-mail
Account/ConfirmEmailRequest/PageCopy	Starter Portal	English	Text	---
Account/Conversion/PageCopy	Starter Portal	English	HTML	<p>You have signed in with an account that is no longer s...
Account/Conversion/PageTitle	Starter Portal	English	Text	Account Migration
Account/Conversion/SignInExternalFormHeading	Starter Portal	English	Text	Sign in with a supported account
Account/Register/ExternalAuthenticationFailed	Starter Portal	English	Text	Sign in failed.
Account/Register/ExternalAuthenticationFailed/AccessDenied	Starter Portal	English	Text	Sign in cancelled.
Account/Register/RegistrationDisabledMessage	Starter Portal	---	HTML	<div class="alert alert-warning"> Registration is disabled ...
Account/SetPassword/ConfirmPassword	Starter Portal	English	Text	Confirm Password
Account/SetPassword/email	Starter Portal	English	Text	Email
Account/SetPassword/NewPassword	Starter Portal	English	Text	New Password
Account/SetPassword/PageCopy	Starter Portal	English	Text	---

## Portal front-side editing tools

The portal front-side editing tools are legacy tools in which visitors to a portal with specialized web roles (such as administrator) can add and modify portal content and functionality directly when they are browsing portal pages. Along with being able to directly edit content, content creators can add webpages, web links, and web files to the pop-up tools window that appears. Moving forward, we recommend that you modify content by using the portals Studio.

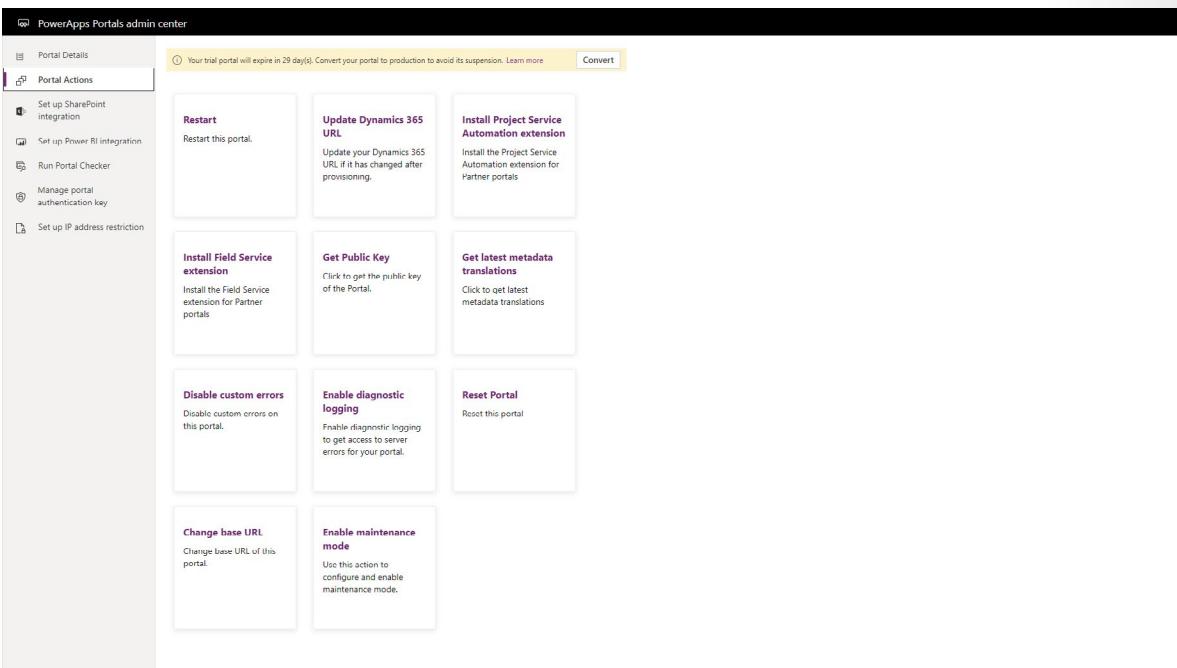


## Portals admin center

The Power Apps Portals admin center provides a series of functions for administration of a Power Apps portal such as configuring custom URLs, enabling diagnostic logging, or to enable or install specific features such as SharePoint or Power BI.

To access the Power Apps Portals admin center:

1. Go to Power Apps(<https://make.powerapps.com/>).
2. Select the target environment by using the environment selector in the upper-right corner.
3. From the **Apps** list, select the application of type **Portal**.
4. Select **Settings** on the command bar.
5. Select the **Administration** link under **Advanced options** in the **Portal settings** flyout panel.



## Exercise - Create a webpage

The purpose of this exercise is to create a webpage by using the Power Apps portals Studio.

At the end of these exercises, you will be able to:

- Open the portals Studio to edit your portal.
- Create a new webpage by using existing page templates.
- Add content to your webpage.

For this exercise, you will need to have the following parameters set in your environment:

- A provisioned Power Apps portal. If you do not have a Power Apps portal available, follow the [Create Portal<sup>10</sup>](#) instructions to create one.
- Access to the Power Apps maker portal.

<sup>10</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/create-portal/>

## Scenario

Creating and editing a portal webpage is a simple process and allows you to quickly build a Power Apps portal application. In this exercise, you need to complete the following tasks:

- Open your portal in Power Apps portals Studio.
- Create a new webpage.
- Add a component with two sections.
- Configure one section to display text.
- Configure another section to display an existing portal image.

## Launch portals Studio

To launch portals Studio, follow these steps:

1. Go to the Power Apps maker portal(<https://make.powerapps.com/>).
2. Make sure that the correct environment is selected in the environment selector in the upper-right corner.
3. From the **Apps** list, locate your portal app (Type = Portal).
4. Select the ellipsis (...) and then select **Edit**, which will launch the portals Studio.

## Create a new webpage

To create a new webpage, follow these steps:

1. From the command bar, select **New page**.
2. Move the mouse over **Fixed layouts** and then select **Page with title**.
3. A new webpage will appear with the title *New page*.
4. In the properties pane, enter a new name for the webpage, press the **Tab** key, and the webpage will autosave.
5. In the properties pane, enter a name without spaces for the partial URL, press the **Tab** key, and the webpage will autosave.

## Add static content

To add static content, follow these steps:

1. On the canvas, select the text area that contains, "This website uses sample data..."
2. On the tool belt, select **Components** (grid icon).
3. In the **Section layout** area, select **Two columns section**, which will add a two-column section on the webpage canvas.
4. On the canvas, select the left column section.
5. On the tool belt, select **Components** and then select **Text** from the **Portal components** section.
6. On the canvas, add some text to the component.
7. On the canvas, select the right column section.

8. On the tool belt, select **Components** and then select **Image** from the **Portal components** section.
9. On the properties pane, from the drop-down list, select **AboutUs.png**.

## View the webpage

To view your new webpage, from the command bar, select **Browse website**.

You should now see your new webpage on the portal. A link to your webpage is also on the main menu.



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## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. How many different starter portals can be installed on an environment without Dynamics 365 apps?

- One portal
- Five portals
- One of each unique portal type
- Limited by available Dataverse capacity

## Multiple choice

2. *Where is portal metadata stored?*

- Azure web application
- Dataverse
- Portals solutions
- Portals Management app

## Multiple choice

3. *In which tool can you not create a webpage?*

- Portals Studio
- Front-side editor
- Portals admin center
- Portal Management app

## Multiple choice

4. *What is required to fully delete a provisioned Power Apps portal?*

- Reset the portal from the Portals admin center.
- Delete the portal from the Power Apps maker portal.
- Delete the portal from the Power Apps maker portal and then delete portal metadata.
- Provision a new portal that will overwrite your existing portal.

## Summary

Provisioning a Power Apps portal is a straightforward process, but it adds numerous features and components to a Microsoft Dataverse environment.

In this module, you learned about:

- The fact that a full, working Power Apps portal is provisioned from a starter template and is configured for specific business requirements as opposed to creating a new application.
- Various components of the Power Apps portals architecture such as portal solutions, portal metadata, and the portal web application.
- Portal provisioning steps, including where and when specific components are added to a Microsoft Power Platform or Dynamics 365 environment.
- Various portal maker and admin tools that are used to manage content and portal features.

# Access Dataverse in Power Apps portals

## Introduction

A typical use case of Microsoft Power Apps portals is to extend functionality from Dynamics 365 applications to internal and external audiences. The portal templates that are based on Dynamics 365 apps offer built-in functionality to these audiences by adding features like case life cycle, knowledge article access, partner opportunity management, and so on.

Additionally, Power Apps portals can extend applications that are built on Microsoft Dataverse and then display the data and business logic and make them available on your portal to an external audience, based on user permissions.

Consider the following scenarios:

- You have extended case management features of Dynamics 365 Customer Service. Your app now handles product warranties, return management authorization (RMA), refunds, and product replacements. You can extend the Customer self-service portal to bring this functionality to your customers, allowing them to register the warranty, make a claim, fill in an RMA form directly on the site, and so on.
- You have built an application in Dataverse to track charitable donations, from both individual and corporate donors, and fundraising campaigns. You can build a portal to allow individuals to donate online and for employers to view and match their employees' donations.
- You use Dataverse to track the progress of your certification programs from the application process, to the evaluation of various skill assessments, to awarding a certification level to a candidate. A Power Apps portal can be configured to allow online applications, provide access to update evaluations, and allow candidates to view their progress.

**Note:** A Power Apps portal can only access Dataverse data in the same instance where the portal is provisioned. Connecting to multiple instances and accessing data across the instances or across the tenants is not supported.

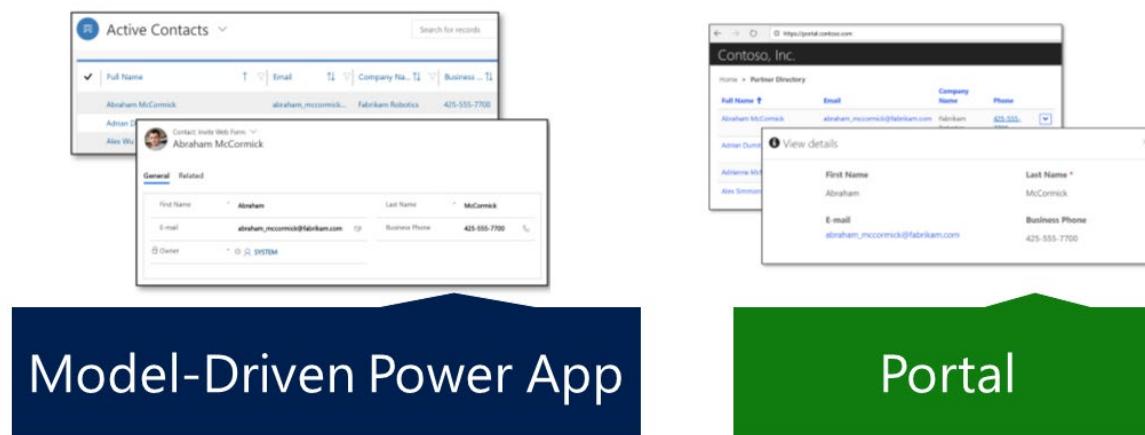
Model-driven Power Apps are low-code/no-code methods that you can use to build unique line-of-business applications (see **What are model-driven apps in Power Apps?**<sup>11</sup>). Part of the app creation process is to define the model and UI elements such as views and forms (see **Understand model-driven app components**<sup>12</sup>). Power Apps portals extends these UI elements to the web by using table lists, table forms, and web forms:

- **Table lists** - Define how the list of Dataverse records is displayed on the portal pages. They are defined by one or more model-driven app table views and include functionality like filtering and sorting.
- **Table forms** - Add the ability for the portal pages to interact with the records in a specific table by using a model-driven app form definition as a layout template.

<sup>11</sup> <https://docs.microsoft.com/en-us/powerapps/maker/model-driven-apps/model-driven-app-overview/>

<sup>12</sup> <https://docs.microsoft.com/en-us/powerapps/maker/model-driven-apps/model-driven-app-components/>

- **Web forms** - Render one or more model-driven app forms on a portal website with support for single



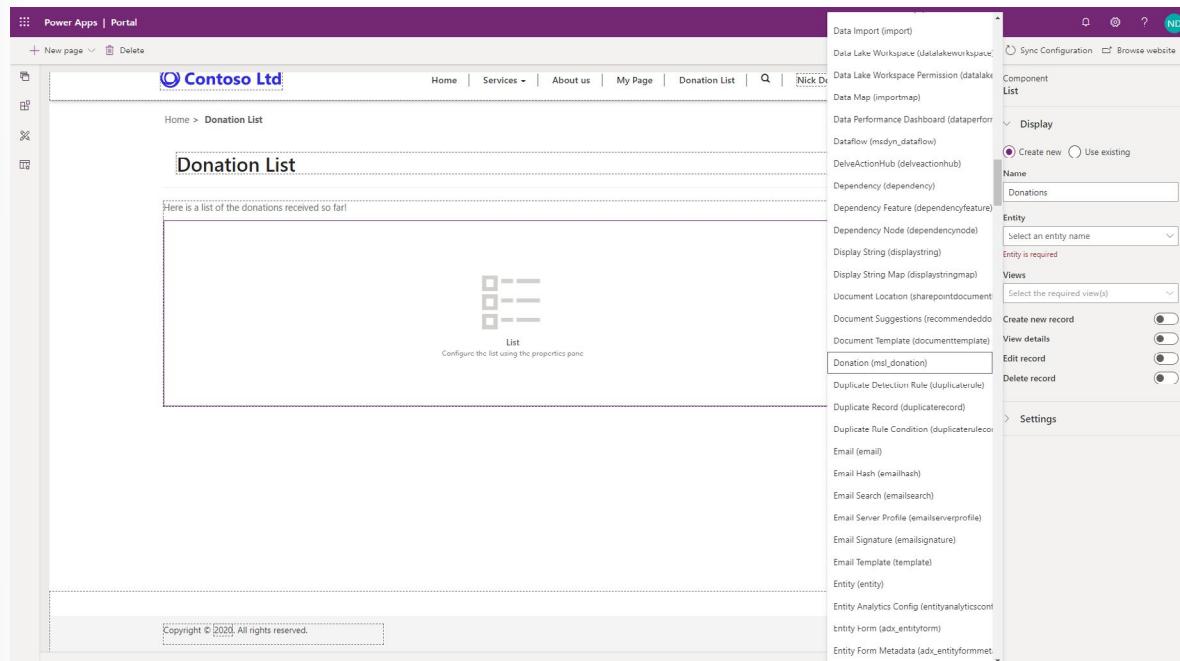
or multi-step navigation and conditional branching logic.

## Use table lists to display multiple Microsoft Dataverse records

The **Table Lists** component allows a maker to display a list of Microsoft Dataverse records on a portal webpage by using configuration only. Table lists are defined by using model-driven app views and can be further configured to filter data based on table permissions. Table lists can have additional features enabled such as running workflows and navigating to show detail records.

### Create a table list

A table list can be added as a component to a webpage in Power Apps portals Studio. After placing the list component on a page, the maker will need to set the properties of the table list. Then, the maker will choose the table and one or more model-driven views to be used to render the table list on the page.



## List rendering

Adding a list component in portals Studio will add the corresponding Liquid tag to the webpage content.

When the webpage is requested, the list rendering process is as follows:

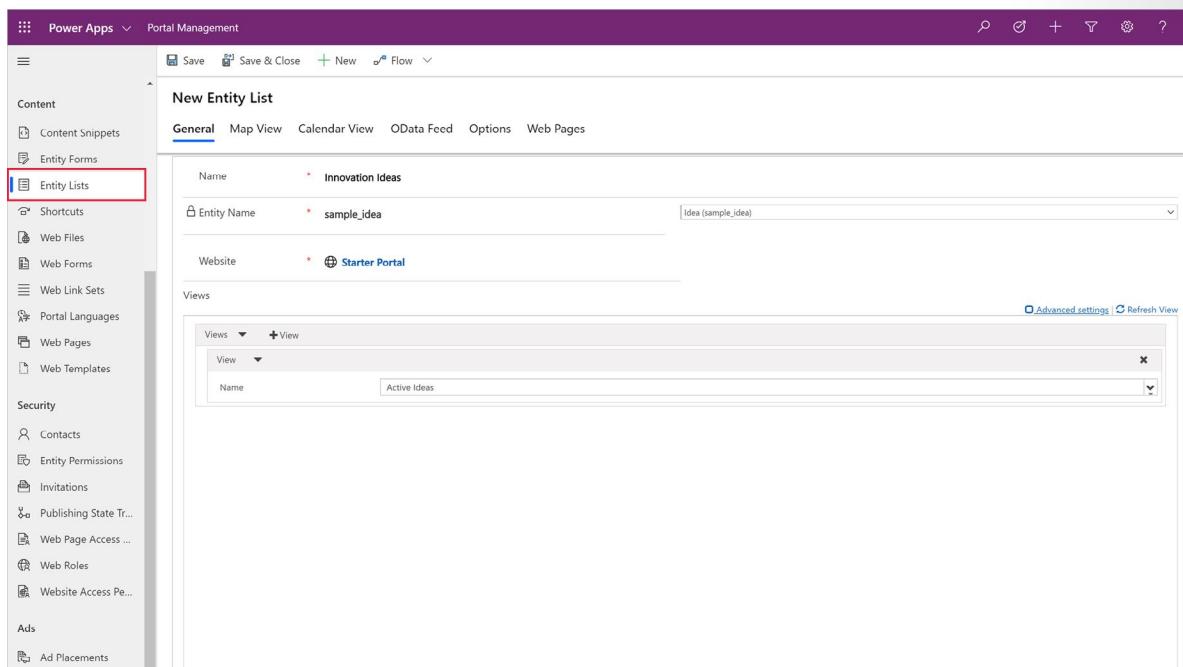
1. The webpage is retrieved.
2. The webpage will render the table list based on the Liquid tag that was added when the list component was added to a webpage.

```
{% include 'table_list' key: '<<Table List Name>>' %}
```

## Configure the table list

Power Apps portals Studio provides a basic interface for creating and configuring a table list. Makers can customize all table list features and properties by using the Portal Management app. To access table lists in the Portal Management app:

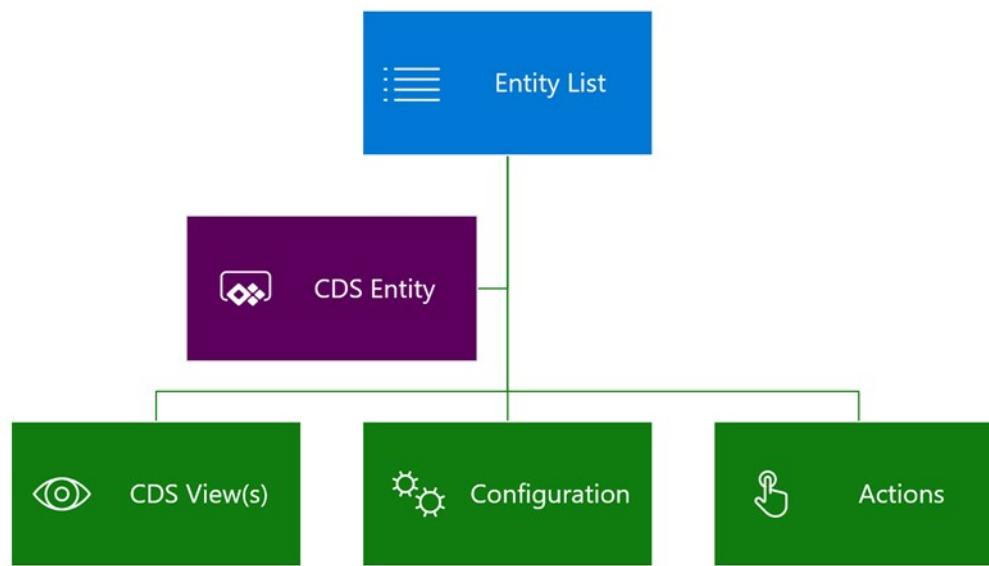
1. Go to the Power Apps maker portal(<https://make.powerapps.com/>).
2. Select the target environment by using the environment selector in the upper-right corner.
3. From the **Apps** list, locate and open the Portal Management app (type will be Model-driven).
4. Select **Table Lists** in the left navigation.



5. Open the list that you previously created in portals Studio.

A table list can be as simple or as complicated as your business requirements specify. The only required properties for the table list, other than the name and the website, are the target **Table Name** and one or more **Views**.

Table lists are highly configurable and have many settings that define the list behavior. Lists can also include actions for the user to interact with the items on the list.



The following sections explain some of the most common features and settings.

**Note:** Most of the options that add interactive elements, such as buttons, support customization of the elements in multiple languages. For example, if multiple views are enabled, the name for each of the views in the view selector can be customized for each of the enabled portal languages.

## Views

Selected view(s) define the Dataverse table columns, list layout, and the default sort order.

**Multiple views** - If more than one view has been specified, a drop-down list will be rendered to allow the user to switch between the views.

**Sorting and pagination** - Sorting is enabled on any of the displayed columns and the page size is configurable.

Entitlement Contacts		
Active Contacts	Email	Company Name
Entitlement Contacts	ymckay@proseware.com	Proseware, Inc.
Yvonne McKay	wparis@cohowinery.com	Coho Winery
Wilson Pais	winifred_pollard@fabrikam.com	
Winifred Pollard	new@fabrikam.com	
Wilson Chew	williamf@alpineskihouse.com	Alpine Ski House
William Flash		

< 1 2 3 4 5 6 7 8 .. 44 >

**Note:** Table lists include the **Web Page for Details View** and **Web Page for Create** general properties. These properties are for backward compatibility only. The functionality is included as part of the **View Actions** and **Item Actions** grid configuration.

## Configuration

The following sections describe the different types of configuration that are available in table lists.

### Filter and search

Table lists provide you with several options to filter and search list data:

**Search** - When quick search is enabled, the portal will render a text search box. It is similar to the quick search feature in model-driven apps. Quick search runs across the view columns and allows you to locate the information within the larger lists by using plain text input. Portal users can use the asterisk wildcard character to search on partial text.

**Portal filters** - The list data can be filtered by the current portal user, the current portal user's parent account, and the current portal website. This feature enables some common scenarios without needing additional configuration:

- List of product reviews that are left by the current user
- List of campus buildings for the current user's department (account)
- List of all draft pages for the current website, only when multiple portals are provisioned

If the current portal user and current portal user's parent account filters are enabled, the portal will render a drop-down list to allow the user to view their own data (My) or their parent account's data (account name will be displayed).

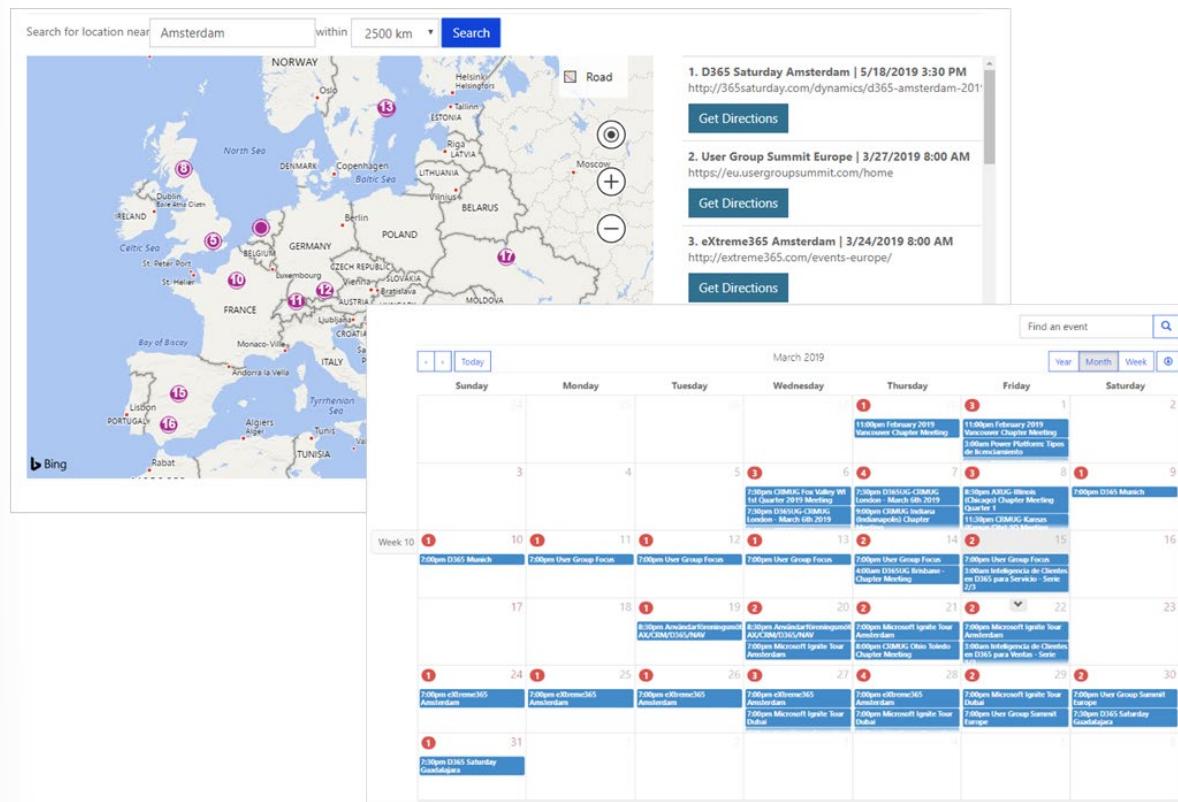
**Metadata filters** - Records in the list can be filtered on any of the list columns, including ranges, lookups, option sets, and custom FetchXML expressions. Portal users have access to an interactive filtering panel when the table list is rendered.

The screenshot shows a table list with the following columns: Company Name, Phone, and Currency. The table contains three rows of data. On the left, there is a sidebar with filters for Currency (Euro), Email (radio buttons for Yes and No), and a 'Metadata filters' dropdown menu. A red box highlights the 'Metadata filters' dropdown. Another red box highlights the 'Search' input field at the top right. A third red box highlights the 'Portal filters' button in the center of the table header. The table data is as follows:

Company Name	Phone	Currency
Southridge Video	408-875-4575	Euro
info@southridgevideo.com	Southridge Video	111-587-4587
info@southridgevideo.com	Southridge Video	408-875-4582

## Display options

Views can be rendered as traditional grid lists, a calendar, or a map. Delivering list content as an OData feed is also supported.

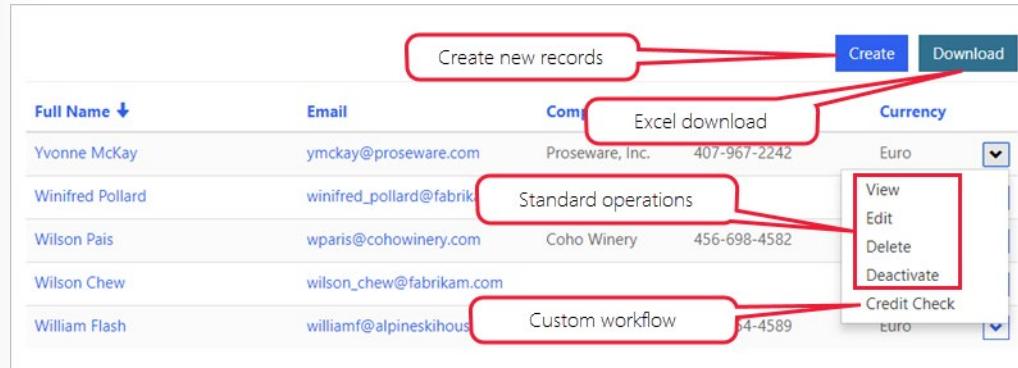


Alternative views might require some additional configuration such as start and end date columns for a calendar or latitude and longitude columns for a map.

**Important:** Map and calendar views require page templates that can render the view. When a starter portal is provisioned, **Rewrite** page templates like **Page** or **Full Page** support this functionality. Pages that use web templates will render the default table list view.

## Actions

Table lists can have actions associated with them to enable per list commands, like Create and Download (as a Microsoft Excel spreadsheet), or per record commands like View or Edit, and to trigger workflows.



For more information, see [About table lists<sup>13</sup>](#).

<sup>13</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/entity-lists/>

Watch the following video to learn how to configure and display the view on a portal page and add interactive filtering capabilities on an existing Dataverse table.



<https://www.microsoft.com/videoplayer/embed/RE4ArhG>

Now that you've observed how the table lists are built and rendered, you can learn how portals can display and interact with individual records.

## Use table forms to interact with Microsoft Data-verse data

Table Forms add the ability for portal pages to interact with records in a specific table by using a model-driven form definition as a layout template. Similar to table lists, table forms are data-driven configurations that allow users to add a form to collect or display data in the portal without the need for a developer to create a custom form. Table forms are defined by using model-driven forms and can be placed into webpages in the portal.

Table forms can display most column types and subgrids but, currently, they can't display Power Apps Component Framework controls.

The screenshot shows a Microsoft Dynamics 365 portal page titled "Idea Detail". At the top, there's a navigation bar with links for Home, Services, About us, Innovation Challenge Ideas, a search icon, and Sign in. Below the navigation, the page title "Idea Detail" is displayed. A note below the title states: "This website uses sample data for illustration purposes. You can build pages using multiple templates available." The main content area is divided into sections: "General" and "Description". In the "General" section, there are three input fields: "Originating challenge" (containing "Smarter manufacturing"), "Name" (containing "Solar Powered Refrigerator"), and "Investment Required" (containing "10000"). To the right of these fields is a "Description" section containing a large amount of sample text. Below the "General" section is a CAPTCHA verification area with a generated image, an audio code, and a text input field for entering the code. A "Submit" button is located at the bottom of the form.

## Common uses

The following table explains the common scenarios where table forms can be used.

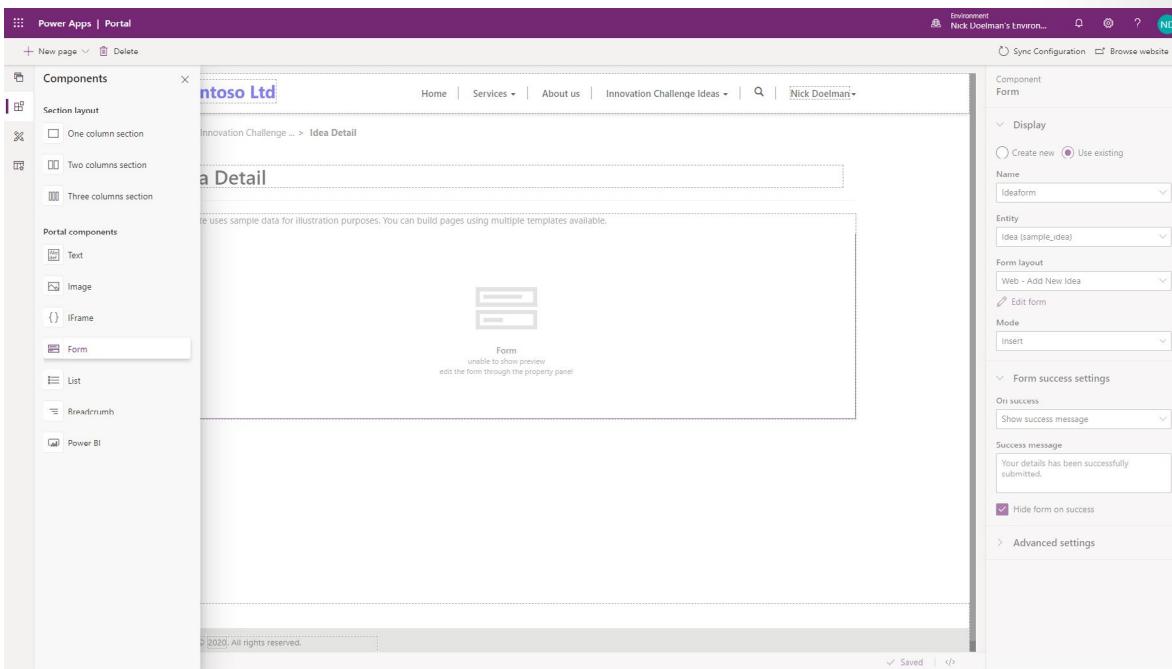
Scenario	Description
----------	-------------

<b>Layout</b>	Table forms can be configured and used in read-only mode as a layout mechanism. Think of table forms as informational pages about employees, products, or any other Microsoft Dataverse table. For example, you might have a custom table in your Dataverse instance that describes open positions that are available within your organization. Instead of crafting a special template to render the page, you can create a separate model-driven form for the table, create a new webpage by using portals Studio, and then add a <b>Table Form</b> component to the page. Any published changes in a form layout in a model-driven app will automatically apply to the webpage.
<b>Information capture</b>	Forms can be used on the portal for data capture from anonymous or authenticated users. For example, a simple lead table form might be rendered on a <b>Contact Us</b> page to record anonymous requests as leads in Dynamics 365 Sales. For authenticated users, a portal might use a survey page to collect product feedback from customers into a custom Product Feedback table.
<b>Record management</b>	Typically used in authenticated scenarios, table forms allow various combinations of Create, Retrieve, Update, and Delete (CRUD) operations on a table to be defined within a set of related webpages. For example, customers can retrieve and read their own cases and create new ones, partners can edit their company profiles, and employees can view the list of assets that are allocated to them by the company.
<b>Web apps</b>	Table forms, when used in conjunction with table lists and subgrids, and with the functionality extended by JavaScript, allow developers to build complete web applications.

## Create a table form

When creating a new table form, your first step is to decide the **Table** and **Form Name** that you will be rendering.

While reuse of forms that are part of a model-driven app is possible, the common practice is to design portal-specific model-driven forms (that might or might not be included in the model-driven apps).



- Portal forms are more concise with less information presented, especially when external audiences are involved.
- Portal processes are separate from the internal use of a staff-facing, model-driven app (including Dynamics 365 apps). Dedicated portal forms are easier to maintain because any changes in the model-driven apps need to be manually applied to the portal forms, giving you an opportunity to review the requirements and assess usability aspects.
- Certain limitations exist on the form and columns that are rendering, for example, PCF controls are not rendered. For more information, see **About table forms**<sup>14</sup>.
- Client-side business rules and JavaScript, which are essential parts of a model-driven form, will not run on the portal. It's easy to overlook and might result in unintended consequences.
- Special considerations need to be given when you are rendering related records, notes, and a timeline because not all functional aspects are supported (or required) in the portals.

## Mode

The form mode can be **Read Only**, **Insert**, or **Edit**. This mode defines if the form is used to generate a layout, capture the data, or provide full editing capabilities for Dataverse records.

**Note:** A form that is in **Edit** mode will be rendered as **Read Only** if the user does not have write privileges for the record.

If the mode is **Insert**, no additional information is required. For **Read Only** and **Edit** modes, the form will need to "know" the table record to display and update. The **Record Source Type** setting defines how this information is passed to the form:

- **Query String** - This setting is default when you are creating a table form in portals Studio. When the page that contains the form is displayed, the record identifier is expected to be part of the query string, for example <https://contoso.powerappsportals.com/contacts/edit/?id=<con>

<sup>14</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/entity-forms/>

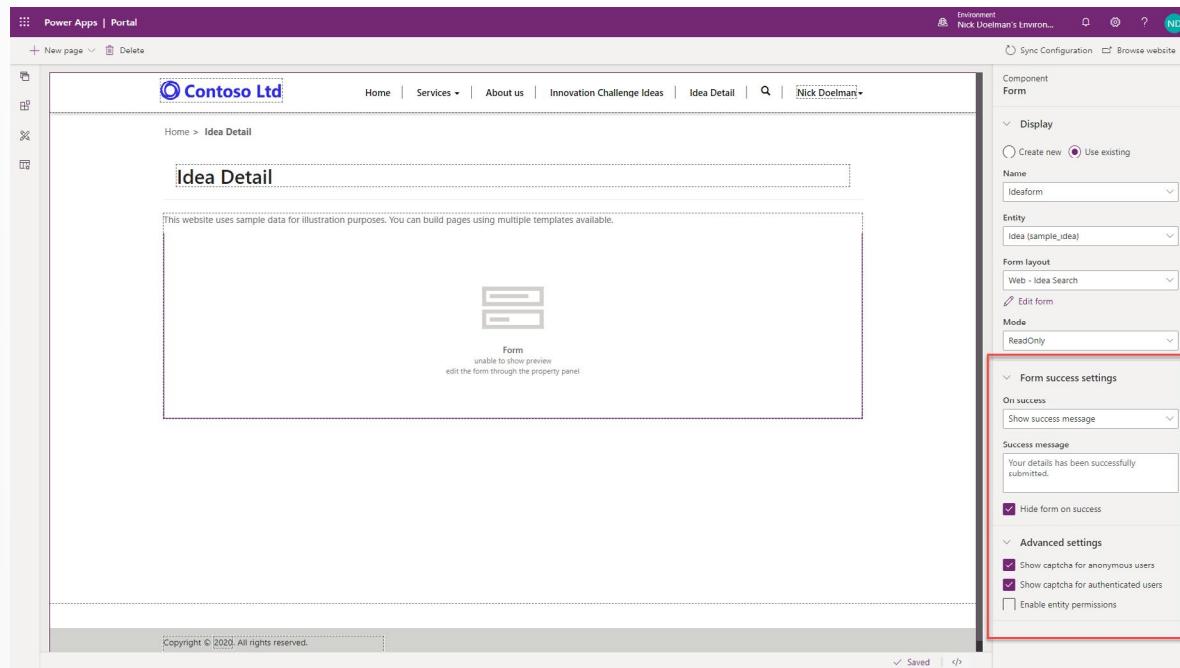
tact guid>. Usually, this setting is done automatically when the form is linked to a table list. This setting is by far the most common.

- **Current Portal User** - This option is configured within the Portal Management app. When this option is selected, the form will load the information from the current portal user record without using additional information from the page URL. Commonly, this option is used to render a user profile form. The **Table Name** column in this case must be set to **Contact** because portal users are represented by the contact table.
- **Record Associated to Current Portal User** - This option is configured within the Portal Management app. Selecting this option allows you to edit associated records, such as the current user's parent account details. **Relationship Name** must be specified to identify the record to edit. The table type that is selected must match the selection in the **Table Name** column. This option is useful in partner scenarios where the partner organization would have multiple portal users. Some of these users could be authorized to edit the parent account record.

**Table**, **Form**, and **Mode** are the details that are required to render the form.

## Configure the table form

Additional configuration options to control form appearance and behavior are available within portals Studio.



## Form success settings

The form success settings determine the actions that are taken when a form is successfully submitted to a portal.

- **Show success message** - Shows a message when a form is submitted.
- **Redirect to webpage** - Automatically navigates to a webpage on success of the form submission.
- **Redirect to URL** - Redirects to a URL (portal or external).

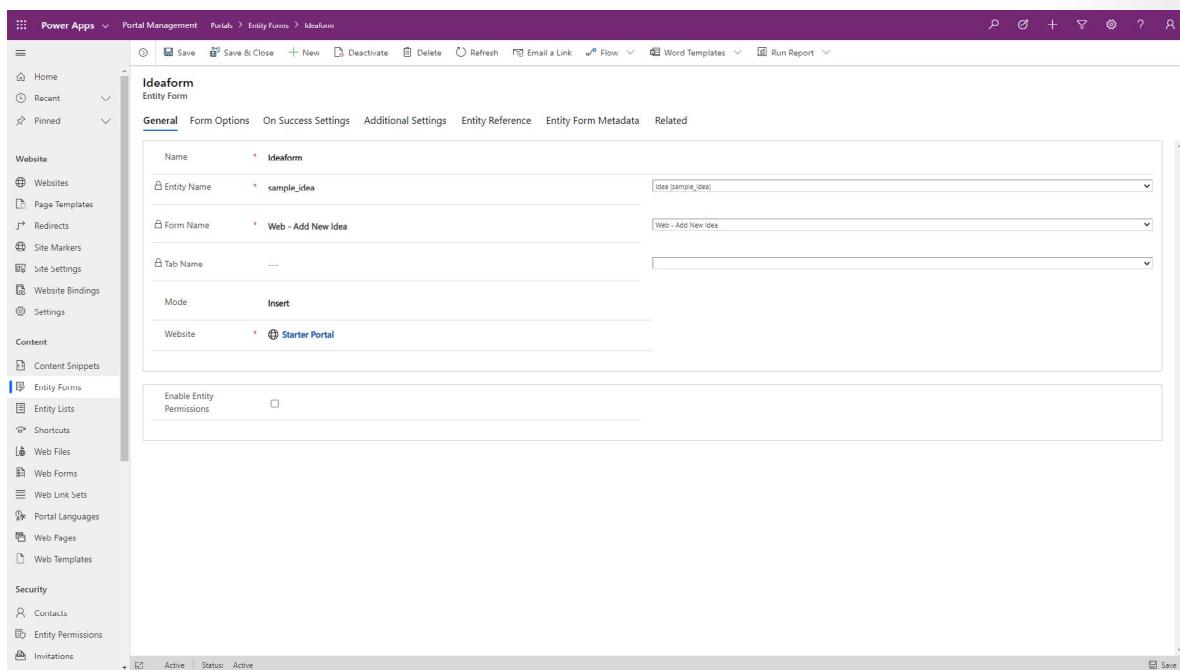
## Advanced settings

The **Advanced settings** feature determines if a captcha is displayed for anonymous or authenticated users. Also, the setting helps determine if table permissions are enabled for the particular table.

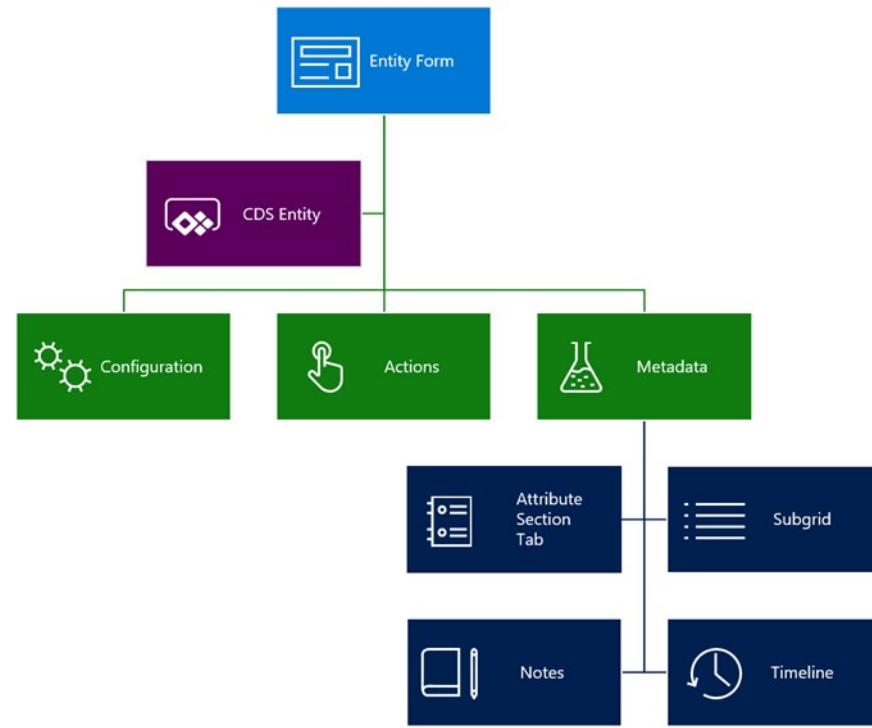
## Additional table form settings

Additional configuration settings are available for table forms in the Portal Management app. To access a table form in the Portal Management app:

1. Go to the Power Apps maker portal(<https://make.powerapps.com/>).
2. Select the target environment by using the environment selector in the upper-right corner.
3. From the **Apps** list, locate and open the Portal Management app (type will be Model-driven).
4. Select **Table Forms** in the left navigation.
5. Open the form that you previously created in portals Studio.



Forms can include **Actions** for the user to interact with the record. Detailed configurations for each form element are available by using additional **Table Form Metadata** records.



## Configuration

The following sections describe the different ways that you can configure table forms.

## Form options

Most form options support customization of the Cascading Style Sheets (CSS) elements to change visual appearance. Text elements such as labels, messages, and tooltips can be specified in multiple languages. For example, the default message after the form submission is "Saved," but it can be customized for each of the enabled portal languages.

Another form option includes **Control validation behavior**, where you can determine whether to mark all columns as required regardless of the form setting, for example.

## Additional settings

Additional settings define other aspects of form behavior, such as styling, translation of the UI elements, and so on.

**Tip:** Some of the settings and configuration options are hidden. Select the **Advanced settings** check box to display all available options.

**Associate current portal user on insert** - This option can be used to keep track of which portal contacts created or updated the record. This setting creates a portal equivalent of the **Created By** and **Modified By** columns in Dataverse. You can also set parental relationships where applicable. For example, if a new account record is created, you might want to set the current contact as a primary contact automatically.

**Add attach file** - A number of options are available to add a file upload control to your form. Configuration is flexible and supports multiple files, storage options, mime type, and size restrictions (for example, you can restrict uploads to images up to 2 MB in size).

**Geolocation** - A table form can be configured to display a map control to display an existing location as a pin on a map or to provide a user with the ability to specify a location. For more information, see [Add Geolocation<sup>15</sup>](#).

The form's map control requires additional configuration to tell it what the various location columns are, to assign values to them, or retrieve values from them. For more information, see [Geolocation configuration for table forms<sup>16</sup>](#).

Address 1: Street 1
3000 E 1st Ave

Address 1: City
Denver

Address 1: County

Address 1: State/Province
CO

Address 1: Country/Region
United States

Address 1: ZIP/Postal Code
80206

Address 1: Latitude
39.71794

Address 1: Longitude
-104.95213

## Table reference

**Table reference** provides a way to associate the current record that is being created or updated with another target record. This feature is useful if you have multiple steps with multiple table types and want to relate the resulting records or if the page is passed in a query string of a record ID that you want to associate.

For example, you might have an event page that displays information about an upcoming webinar. You want to include a registration button that redirects visitors to the registration page where the registration form is displayed. You can pass the event identifier in a query string and, when the registration form is submitted, you'll be able to automatically link the registration information to the event.

## Actions

Because a table form deals with an individual table record, numerous actions can be run against this record, such as Update, Delete, Deactivate, and so on. These actions, that at runtime are displayed as command buttons, can be configured by selecting **Additional Settings > Action Button Configuration**.

All commands include options to rename the buttons and change their placement on the form.

<sup>15</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/add-geolocation/>

<sup>16</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/entity-forms.md#geolocation-configuration-for-entity-forms>

## Table form metadata

**Table form metadata** records allow you to control the appearance and behavior of individual form elements, including:

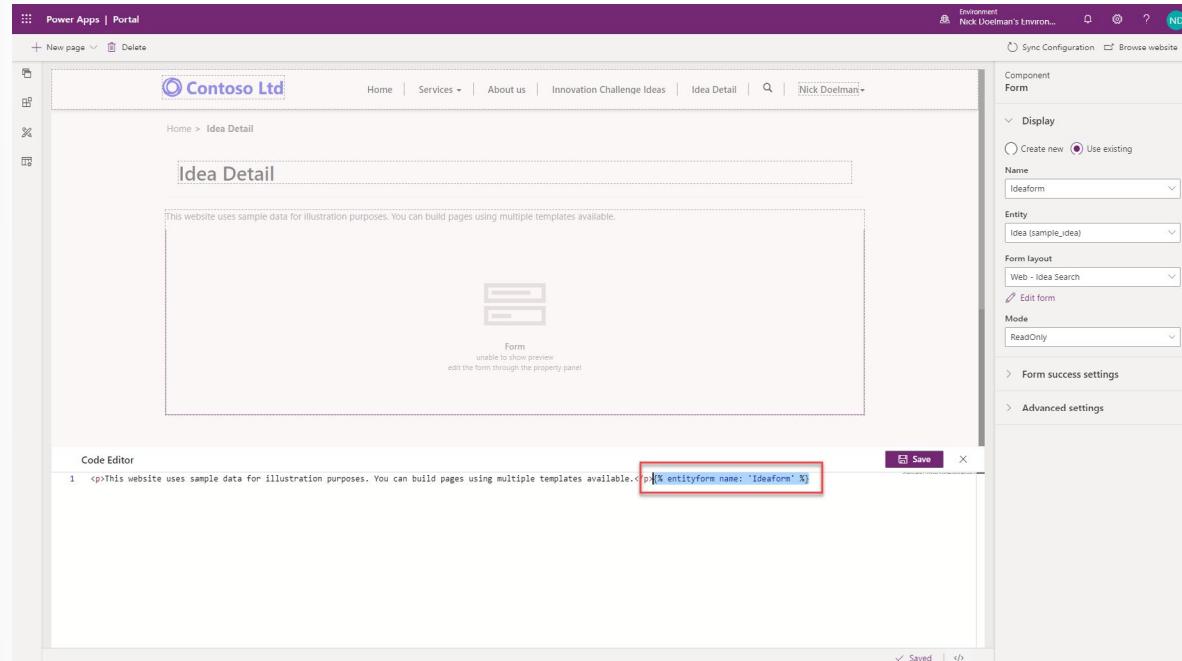
- Appearance of the columns, sections, and tabs. An individual column's default values, validation behavior, and other aspects can be defined.
- Subgrids configuration, which allows you to define actions for related records, similar to table list actions.
- Behavior of notes and timeline sections, and if new records can be added. This option is commonly used to allow portal users to enter comments about the record, for example, a case in process.

## Add a table form to your portal

A table form defines the required behavior but does not contain information about how and where on the site that the form should be rendered. Two methods to render a table form in a portal are:

- The table form can be explicitly specified as a target for a table list action like Create, Update, or Edit. In this case, the form will be rendered in a modal pop-up window. Certain limitations apply when the form is rendered in a pop-up window, for example, the ability to create related records from subgrids is not available.
- Similar to a table list, a table form component can be added to a webpage from portals Studio. This action will place a Liquid tag on the webpage copy to render the table form.

```
{% tableform name: '<<table form name>>' %}
```



Because forms can submit information back to the server for processing, you will have less control over the rendering of table forms as compared to the table lists.

The following video shows how to extend table list functionality with table forms and display a Dataverse record in a pop-up window or on a separate webpage.



<https://www.microsoft.com/videoplayer/embed/RE4AjtN>

## Exercise - Use a table list and table form

The purpose of this exercise is to provide you with hands-on experience in adding a list and a form to a Power Apps portal.

### Learning objectives

At the end of these exercises, you will be able to:

- Add a list component to a portal page.
- Add a form component to a portal page.
- Configure the list component to drill down and view details of the record.

### Prerequisites

The following prerequisites are necessary for completing these exercises:

- Access to the Power Apps maker portal.
- Ideally, you will have the default sample Microsoft Dataverse apps and data, but you can use other Dataverse entities.
- You will need to have provisioned a Power Apps portal to complete the exercise. If you do not have a provisioned portal, go to [Create Portal<sup>17</sup>](#) to create one.

**Tip:** The exercises work best when you have sample data to work with. When you provision a Dataverse environment, you have the opportunity to add sample apps and data. Review the [Create Environment<sup>18</sup>](#) steps to provision a Dataverse environment with sample apps and data.

### Scenario

Your organization has provisioned a Power Apps portal and wants to display a list of ideas that the research team is considering on a public webpage. The requirement is also to allow visitors to drill down and view additional details.

<sup>17</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/create-portal/>

<sup>18</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-environment.md#create-an-environment-with-a-database>

## High-level steps

To finish the exercise, complete the following tasks:

- Create a webpage and add a list component that is linked to a Dataverse table.
- Create a child webpage with a form component to display details for a Dataverse table.
- Modify the list component to allow visitors to drill down and view the detail record on the form page.

## Create a webpage for the table list

In this exercise, you will create a webpage to contain the **Table Lists** component.

1. Go to the maker portal(<https://make.powerapps.com/>) and sign in.
2. Locate your portal app, select the ellipsis (...), and then select **Edit** to open portals Studio.
3. From the command bar, select + **New page**, and from **Fixed Layouts**, select **Page with title**.
4. In the Properties pane, fill in the following information:
  - **Name** - Ideas
  - **Partial URL** - ideasview
5. Click in the canvas area to save the webpage.

## Add and configure a list component

To add and configure a list component, follow these steps:

1. On the canvas, select the **page copy** component, and then from the tool belt, select **Components**.
2. In the **Portal components** section, select the **List** component.
3. In the Properties pane, enter the following values for the **List** component:
  - **Name** - Ideas List
  - **Table** - Idea (sample idea) or choose another table from your own app
  - **Views** - Active Ideas
4. Select **Browse** from the command bar and ensure that you can see a list of idea data records from Dataverse.

## Create a webpage for the table form

Your next task is to create a webpage to contain the **Table Forms** component to view record details. This webpage will be a child page of the **Ideas list** page.

1. From the tool belt, select **Pages** and locate the **Ideas** page that you created previously.
2. Select the ellipsis (...) and then select **Add a child page**.
3. In the Properties pane, fill in the following information:
  - **Name** - Idea Detail
  - **Partial URL** - ideasdetail
4. Click in the canvas area to save the webpage.

## Add and configure a form component

To add and configure a form component, follow these steps:

1. On the canvas, select the **page copy** component, and then from the tool belt, select **Components**.
2. In the **Portal components** section, select the **Form** component.
3. In the Properties pane, enter the following values for the **Form component**:
  - **Name** - Ideas Detail
  - **Table** - Idea (sample idea) or choose another table from your own app
  - **Form Layout** - Information (you can select **Edit** to modify your form or create your own form specifically for the portal)
  - **Mode** - ReadOnly
4. Click in the canvas area to save the webpage.

## Modify the list page to navigate to the form component

Your last task is to modify the list page to navigate to the form component:

1. From the tool belt, select **Pages** and locate the **Ideas** page that contains the list component.
2. Select the list component on the canvas.
3. In the Properties pane, activate the **View Details** option.
4. Fill in the following information:
  - **Target Type** - Form
  - **Form** - Ideas Detail
5. Click in the canvas area to save the webpage.
6. Select **Browse** from the command bar and ensure that you can see a list of idea data records from

Name	Originating challenge	Number of Votes	Idea Score	Created On
Connected quality control	Connected Operations	10	8	5/30/2020 11:55 PM
Fleet automation	Connected Operations	8	9	5/30/2020 11:55 PM
Cloud computing	Servitization	7	9	5/30/2020 11:55 PM
Tiny Homes	3D Printing	7	6	5/30/2020 11:55 PM
Integrated service management	Connected Operations	6		5/30/2020 11:55 PM
Rapid prototyping	Smarter manufacturing	6		5/30/2020 11:55 PM
Solar panels	Enterprise sustainability	5	6	5/30/2020 11:55 PM
CO2-absorbing artificial trees	Enterprise sustainability	3	8	5/30/2020 11:55 PM
Business intelligence	Big data	2		5/30/2020 11:55 PM
Data analytics	Big data	2		5/30/2020 11:55 PM

< 1 2 >

Dataverse and then select an idea to view details.

Adding components to a webpage will allow you to quickly view Dataverse records.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which one of the following options is not a valid table list view?

- Map view
- Excel view
- Calendar view
- Grid list view

### Multiple choice

2. You have created a Contact Us table form and want to redirect users to a Thank You page after successful submission. How can you achieve this task?

- Change the table form title to "Contact Us - Thank You."
- Set the Table Form column on the Thank You page to the Contact Us table form.
- Add a redirect step to the table form.
- Configure On Success Settings to redirect to the Thank You page.

### Multiple choice

3. Where in Power Apps portals Studio would you add a list and form component to a particular webpage?

- From the Properties pane of a webpage
- Edit the page template source code
- From the tool belt components section
- You can only add forms and lists by using the Portal Management app

### Multiple choice

4. You want portal visitors to be able to locate specific records in a list view based on an option value in the Microsoft Dataverse record. What is the best way to accomplish this task?

- Enable the search property on the list component in portals Studio.
- Add the Option Set column to the model-driven view to allow portal visitors to sort by the value.
- In the Portal Management app, enable Metadata searching and configure a filter for the Option Set column.
- In portals Studio, increase the number of records for each page.

## Summary

The ability to display and interact with Microsoft Dataverse data is a core benefit of implementing a Power Apps portal. Table lists and table forms are simple to configure to enable access to Dataverse data in portals and turn content portals into functional web apps. They are configurable and extendable to satisfy many business requirements.

By now, you should be able to:

- Describe the portal components that are available to display and interact with Dataverse data on a portal.
- Identify various features of portal components.
- Configure the **Table Forms** and **Web Form Metadata** features to access individual records.
- Display a list of data and an associated drill-down list for details.

## Next steps

You have learned how to enable access to Dataverse data for portal audiences. The next step would be to learn how to use Liquid code in the portal to satisfy complex requirements.

# Authentication and user management in Power Apps portals

## Introduction

Microsoft Power Apps portals extends model-driven Power Apps solutions to internal and external audiences such as communities, customers, partners, and employees. As part of this process, portal visitors can access portals as anonymous or authenticated users.

For authenticated users, accessing and using the portal involves a two-part process:

- **Authentication** - The process of validating the user's identity. This process is a verification of "they are who they say they are."
- **Authorization** - The process of verifying that a user has access to something, such as a specific portal page or a Microsoft Dataverse record. This process determines if "User A can do X."

The following sections discuss authentication in more detail.

## Track users as contacts

Authenticated users are *always* tracked in Dataverse as contacts, regardless of the portal template that is used to provision the portal. The process is the same whether the user is external or an employee; neither depends on the authentication method that is used.

Portal users can authenticate with the following methods:

- **Local authentication** - Common forms-based authentication with usernames and password hashes that are stored in the Dataverse contact record.
- **External authentication** - Credentials and password management are handled by external identity providers, such as Microsoft Azure Active Directory B2C (Azure AD B2C), Microsoft, Twitter, and so on.

Portal administrators can choose to enable or disable any combination of authentication options through the portal site settings.

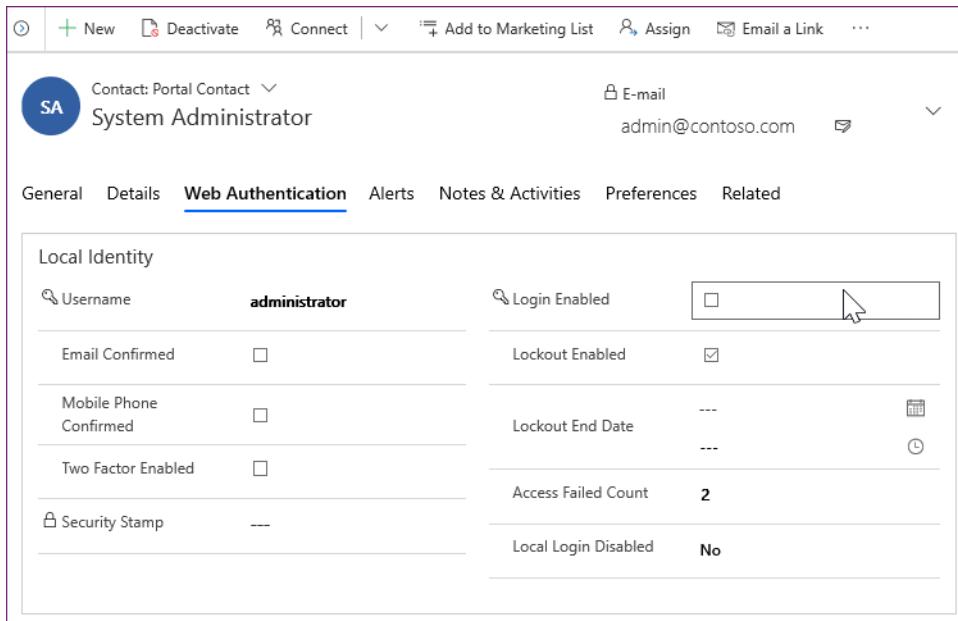
All interactions and actions that a portal user takes (for example, leaving comments on a page) are tied to their contact record in Dataverse.

## Contact extensions

To support authentication, Power Apps portals extends the **Contact** entity and adds the **External Identity** entity. Several attributes and specific **Portal Contact** forms are also added to the contact record.

These extensions allow administrators to:

- Control parts of the authentication process, for example, if sign-in is enabled for the contact.
- Access portal-specific contact information.
- Provide registration and profile management forms for the portal.
- Support password-based local authentication.
- Enforce password and lockout policies.

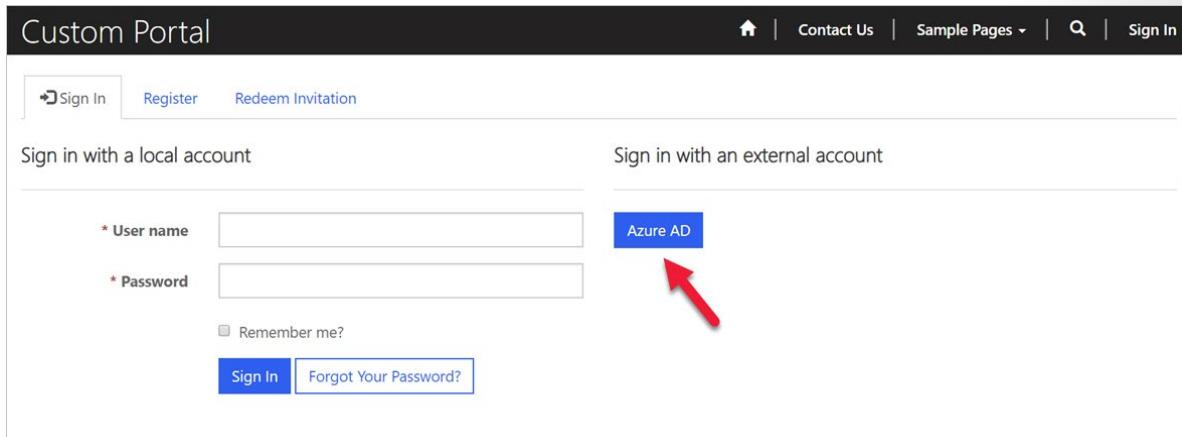


- Manage user's identities when external providers are used.

## Administrator as portal user

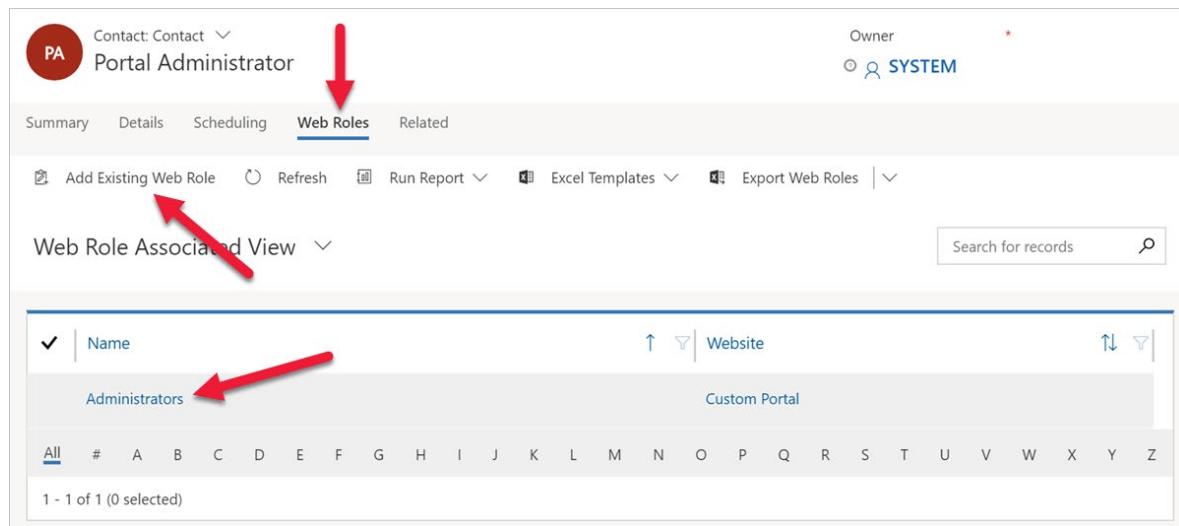
Portal users are not defined when Power Apps portals is provisioned. You, the person who provisioned the portal, already have access to Dataverse as a system administrator. It's common practice to ensure that you can access the portal as an *external* user as well.

- Sign in to the portal by using Azure AD authentication. If **Open Registration** is enabled (and it is by



default), a contact record will be created as required.

- If it's the first time that Azure AD authentication is being used, you might be prompted to provide consent for the portals web app to access user information. You can consent on behalf of the organization so that individual users won't be prompted.
- Locate and open the contact record that you created. The contact record will have the same email address as the signed in Azure AD user.



Contact: Contact ▾  
Portal Administrator  
Owner \*  
SYSTEM

Summary Details Scheduling Web Roles Related

Add Existing Web Role Refresh Run Report Excel Templates Export Web Roles |

Web Role Associated View ▾

Name	Website
Administrators	Custom Portal

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1 - 1 of 1 (0 selected)

- Go to **Related > Web Roles**. Associate the **Administrators** web role with the contact.

These steps will ensure that this Azure AD user has full administrative permissions when they are accessing the portal as an *external* user.



<https://www.microsoft.com/videoplayer/embed/RE4Amwt>

## Power Apps portals authentication settings

Many authentication options that are supported by Power Apps portals are configured by using site settings. Site settings are stored in the **Site Settings** entity, where each setting is defined as a Name/Value pair.

To view site settings, open the Power Apps portals app by going to Dynamics 365 Home(<https://home.dynamics.com/>) and selecting **Power Apps portals**. In the app, select **Site Settings** in the navigation panel.

The screenshot shows the Dynamics 365 Portals interface. The left sidebar has sections for Home, Recent, Pinned, Website (Websites, Page Templates, Redirects, Site Markers), Site Settings (selected), Website Bindings, Content (Content Snippets). The main area is titled "Active Site Settings". It contains a table with columns: Name, Value, and Website. The table rows are:

Name	Value	Website
Authentication/LoginThrottling/IpAddressTime...	00:10:00	Custom Portal
Authentication/LoginThrottling/MaxAttemptsTi...	00:03:00	Custom Portal
Authentication/LoginThrottling/MaxInvalidAtte...	1000	Custom Portal
Authentication/LoginTrackingEnabled	False	Custom Portal
Authentication/OpenAuth/Facebook/AppId	---	Custom Portal
Authentication/OpenAuth/Facebook/AppSecret	---	Custom Portal

Only a few of the many available authentication-related site settings are installed when you provision a starter portal. Settings that are not created assume their documented default values.

## Example of a setting

An example of the need to add a site setting is when you provision a custom portal and the form for registering a new local account requires an email address and a username.

The screenshot shows a registration form. At the top are links for "Sign In", "Register", and "Redeem Invitation". Below is a section for "Register for a new local account". It contains four input fields with red asterisks: "Email" (red box), "Username" (red box), "Password", and "Confirm Password". To the right is a section for "Register using an external account" with a "Azure AD" button. At the bottom is a "Register" button.

To enable a local account sign-in by using an email address instead of a username, you can add the `Authentication/Registration/LocalLoginByEmail` setting and set it to **True**.

SITE SETTING  
New Site Setting

General    Administration    Notes

Name	* Authentication/Registration/LocalLoginByEmail
Website	* Custom Portal
Value	True
Description	Enables or disables local account sign-in using an email address field instead of a username field

As a result, the form and the process for registering a new local account now require an email address only.

Sign In    Register    Redeem Invitation

Register for a new local account      Register using an external account

\* Email

\* Password

\* Confirm Password

Azure AD

Also, the sign-in form will now refer to **Email** instead of **Username**.

Sign in    Register    Redeem invitation

Sign in with a local account      Sign in with an external account

Email

\* Password

Remember me?

Azure AD

**Note:** Where a function is enabled by default, a site setting needs to be created to disable that function. For example, adding the Authentication/Registration/ResetPasswordEnabled = False setting is required to disable the password reset feature for local authentication.

## Authentication settings categories

All authentication-related site settings start with **Authentication**.

Authentication settings can be grouped into three broad categories, each covering settings to control various aspects of authentication processes.

Group	Description
<b>Authentication/Registration</b>	The most extensive group of settings that cover options such as enabling/disabling specific authentication methods, controlling invitation behaviors, password resets, confirmation emails, two-factor authentication, and more.
<b>Authentication/UserManager</b>	<b>User credential validation</b> ( <a href="https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#user-credential-validation?azure-portal=true">https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#user-credential-validation?azure-portal=true</a> ) are settings for adjusting username and password validation parameters. Validation occurs when users sign up for a new local account or change a password. Also included are <b>user account lockout settings</b> ( <a href="https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#user-account-lockout-settings?azure-portal=true">https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#user-account-lockout-settings?azure-portal=true</a> ).
<b>Authentication/ApplicationCookie</b>	It's not uncommon to see enterprise requirements for specific cookie behaviors such as expiration time span. This group defines <b>Cookie authentication site settings</b> ( <a href="https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#cookie-authentication-site-settings?azure-portal=true">https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#cookie-authentication-site-settings?azure-portal=true</a> ) for modifying the default authentication cookie behavior.

For more information, see **Set authentication identity for a portal**<sup>19</sup>.

## User registration in Power Apps portals

Before portal visitors can sign in to Power Apps portals, they need to be registered as portal users. All portal users are tracked as contacts, and they can be registered in two ways:

- **Open registration** - Allows visitors to register directly on the portal.
- **Invitation-based registration** - Requires users to provide an invitation code.

The decision about which option is more appropriate depends on the target audience of your portal and whether the members of the audience are known in advance.

<sup>19</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity/>

Regardless of the registration configuration, local and external accounts participate equally in the registration workflow. Specifically, users have the option to choose which type of account they want to register.

Registration is enabled by default. The **Authentication/Registration/Enabled** site setting controls overall registration process, and adding this setting with the value of `False` disables all forms of user registration. Any other registration setting is ignored until the registration is enabled. You can use **Enable or disable user registration**<sup>20</sup> settings to control individual registration options.

## Open registration

Open registration allows visitors to register directly on the portal by using the **Register** tab on the portal **Sign In** page. It is the least restrictive sign-up configuration, where the portal allows a user account to be registered by providing a user identity. When open registration is enabled, any user who completes the registration form is immediately registered and authenticated.

Because users are not validated prior to signup, this option works well in more open environments like community portals, where site visitors are not known in advance. Organizations run these portals for the communities where the users might have some common interests, such as the area where they live, their hobbies, and industries that they work in. In other words, open registration works best when it's not easy to discover and validate the users in advance.

## Invitation-based registration

Invitation-based registration is the process where an existing contact is validated by an invitation code.

This registration is useful in the scenarios when contacts are known in advance. It is commonly used to register customers, partners, or employees. Invitation-based registration works in situations where users can be "pre-validated," such as when you've collected contact information from visitors of your exhibition booth.

Invitations contain a number of **Invitation attributes**<sup>21</sup> that allow you to:

- Send single or group invitations. Group invitations use the same invitation code for all invitees and work well with a restriction on the number of invitations to redeem. For example, a promotional email can be sent by a software company, inviting all their users to participate in a beta program, but intake is limited to the first 100 registrations.
- Specify an expiry date, if desired.
- Specify a portal contact as the inviter. You can use this information to customize invitation emails and in the post-registration workflows.
- Assign the invited contact(s) automatically to an account on invite redemption. This option is useful in partner portal scenarios where all invitees are from the same company.
- Implement a workflow automatically on invite redemption. For example, you might want to send a "Thank you" email to the contacts who accepted the invitation.
- Assign the invited contact(s) automatically to web roles on redemption. You can use this feature to grant users who accept the invitation special access rights in your portal.

**Important:** *Email integration must be enabled in your Microsoft Dataverse instance for the email invitations to work.*

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<sup>20</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity#enable-or-disable-user-registration/?azure-portal=true>

<sup>21</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/invite-contacts#invitation-attributes>

The ensuing sections explain the process of sending and redeeming invitations.

## Configure automation

The workflow process of sending the invitation email is generic and needs to be customized prior to use. When you are customizing the invitation email, make sure that the link to the **Invite Redemption Page** includes the invitation code. The default link should look like this sample: `https://yourportalurl/register/?returnurl=%2f&invitation={Encoded Invitation Code (Encode Invitation Code)}`

After the invitation code has been generated, you can distribute it through other channels. For example, if you have a text (SMS) messaging solution in place, you might want to replace the steps of creating and sending the invitation email with the custom step of sending an SMS message instead.

**Important:** Microsoft Power Automate has significant advantages over the classic workflow model. You should consider using Power Automate to automate your Send Invitation process instead of using the classic workflow.

## Create Invitation

**Create Invitation** is a unique invitation code that is generated when an **Invitation** record is created. The **Invitation** record can be created manually by selecting the **New** command on the **Invitations** view or by using the **Create Invitation** command on a contact record. For more information, see [Create invitations from the Portal Management app<sup>22</sup>](#).

## Redeem Invitation

When the contact receives the email invitation and follows the URL, they are directed to the **Redeem Invitation** tab of the **Sign In** page.

On this page, they can select the **I have an existing account** option, which opens some automation opportunities where the existing portal users can be sent an invitation code. After the code has been accepted and an existing account is used, you can run a workflow that could, for example, grant user access to some protected content.

The screenshot shows the 'Custom Portal' sign-in page. At the top, there are links for 'Sign In', 'Register', and 'Redeem Invitation'. The 'Redeem Invitation' link is highlighted with a red box. Below these, there's a section titled 'Sign up with an invitation code'. It contains a field labeled 'Invitation Code' with the value 'PNFH...'. There's also a checkbox labeled 'I have an existing account' and a blue 'Register' button at the bottom of the form.

## Register user

If the user does not select the **I have an existing account** option, they will be presented with the registration page. Similar to open registrations, users have the option to register by using any provider

<sup>22</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/invite-contacts#create-invitations-from-portal-management-app>

that is enabled on the portal. The selected registration will be associated with the invited contact, showing the invitation as redeemed.

The screenshot shows the Contoso, Ltd. portal's registration interface. At the top, there is a navigation bar with links for Home, Knowledge Base, Forums, My Support, a search icon, and Sign In. Below the navigation bar, there are three buttons: Sign In, Register (which is highlighted), and Redeem Invitation. A message box contains a long, complex redemption code. The main form is divided into two sections: 'Register for a new local account' and 'Register using an external account'. The local account section contains fields for Email (nancyd@contoso.com), Username (nancyd), Password, and Confirm Password, all marked with red asterisks indicating they are required. A blue 'Register' button is at the bottom. To the right, a 'Register using an external account' section has a single button labeled 'Azure AD'.

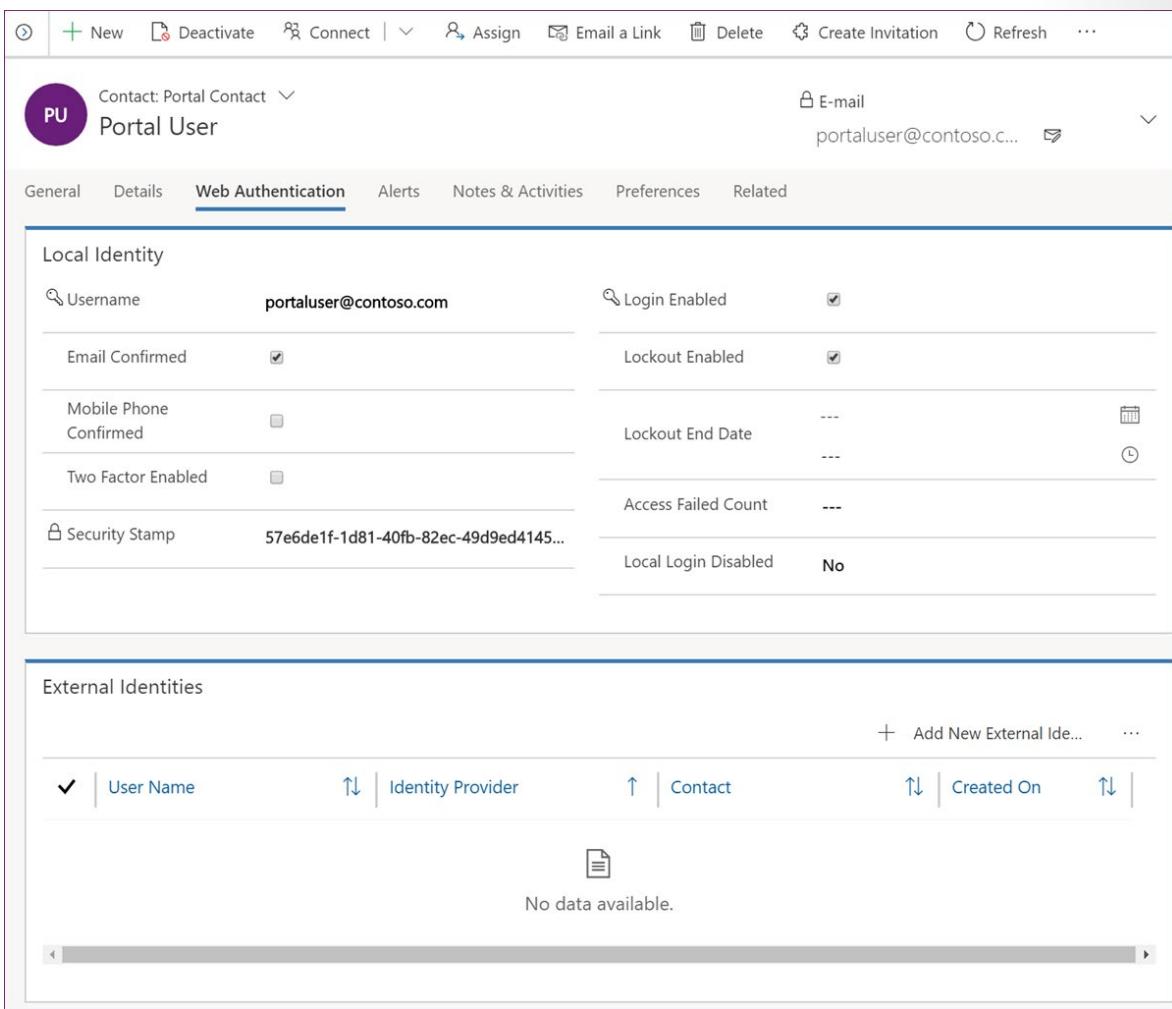
After the registration process is complete, depending on the invitation options, the portal user can be associated with the predefined account or an additional workflow can be run.

For more information, see **Invite contacts to your portals<sup>23</sup>**.

## Portal user authentication management

Power Apps portals administrators have several options for controlling authentication behavior for the portal user. These options are accessed through the **Web Authentication** tab on the **Portal Contact** form.

<sup>23</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/invite-contacts#invitation-attributes>



The following table explains some of the options that are available on the **Web Authentication** tab.

Field	Description
Username	The username is for local authentication. The password can be reset by running the <b>Change password for portal contact</b> task flow: <b>Change password for a contact in Power Apps portal app</b> ( <a href="https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/configure-contacts#change-password-for-a-contact-in-dynamics-365-portal-app">https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/configure-contacts#change-password-for-a-contact-in-dynamics-365-portal-app</a> ).
Email Confirmed	This flag indicates if the email has been confirmed, that is, a validation code has been emailed to and confirmed by the user. Unless the email is confirmed, it can't be used for password resets or two-factor authentication. If required, it can be set manually by the administrator.

Mobile Phone Confirmed	This field is similar to <b>Email Confirmed</b> , except that text (SMS) messaging is used for confirmation and other operations. Messaging providers are not included out of the box, but if an organization has one, the authentication flows can be extended to include SMS as a valid confirmation channel.
Two Factor Enabled	Defines if two-factor authentication has been enabled for the contact. A confirmed email address is required for two-factor authentication to be used.
Login Enabled	Clearing this check box (or setting the field value in a workflow) will disable all forms of authentication for the contact, including external providers.
Lockout Enabled	Defines if the contact can be locked after a preconfigured number of failed attempts.
Lockout End Date	When the contact is locked out, this field defines when it's going to be unlocked automatically. Traditional use of this value is to lock out a contact for a number of minutes (which is controlled in site settings) after a preconfigured number of failed sign-in attempts.
Local Login Disabled	Defines if the local authentication option is available for the user. Site settings might disable local authentication for all users, in which case, this flag will have no effect.

For more information, see [Set authentication identity for a portal](#)<sup>24</sup>.

## External identities

The **External Identities** list includes all external providers that are registered for a specific user. Multiple external identities permit user sign-in with any of the registered providers. Entries in this list should not be edited manually; they are added/removed when the user connects/disconnects the providers by using the **Manage External Authentication** link on their **Profile** page.

<sup>24</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity/>

The screenshot shows a Power Apps portal interface titled "Manage External Authentication". On the left, there's a sidebar with "George Portal" and "Profile" options. The main content area lists external authentication providers: Azure AD, Facebook, Microsoft, and Twitter. Each provider has a "Disconnect" or "Connect" button next to it.

## Power Apps portals authentication providers

### Local authentication

Local authentication is the common forms-based authentication that uses contact records for authentication. Local authentication settings are configured by using portal site settings, including disabling local sign-in options for the entire portal: [Set authentication identity for a portal<sup>25</sup>](#).

### External authentication

When external authentication is used, credentials and password management are handled by external identity providers. Supported authentication protocols include:

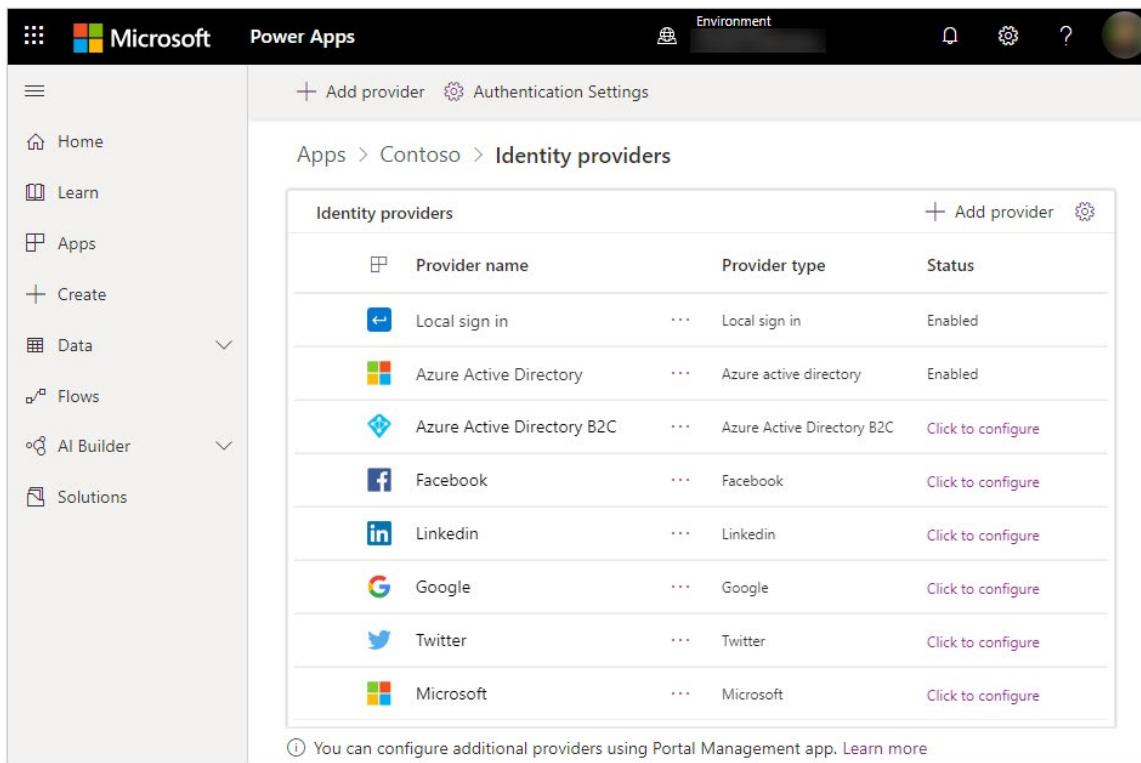
- WS-Federation and SAML 2.0
- OAuth2 (Microsoft, Twitter, Facebook, Google, LinkedIn, Yahoo)
- OpenID Connect (Azure AD, Azure AD B2C)

### Authentication and provider configuration

Setting up authentication is a core customization in any portal. Simplified identity provider configuration in Power Apps portals provides in-app guidance for identity provider setup and abstract setup complexities. Makers and administrators can configure the portal for supported identity providers by following steps that are documented at [Simplified authentication and identity provider configuration<sup>26</sup>](#).

<sup>25</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/set-authentication-identity/>

<sup>26</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/use-simplified-authentication-configuration/>



The screenshot shows the Microsoft Power Apps portal interface. The left sidebar includes links for Home, Learn, Apps, Create, Data, Flows, AI Builder, and Solutions. The main content area displays the 'Identity providers' page under 'Contoso > Identity providers'. A table lists various providers: Local sign in (Local sign in, Enabled), Azure Active Directory (Azure active directory, Enabled), Azure Active Directory B2C (Azure Active Directory B2C, Click to configure), Facebook (Facebook, Click to configure), LinkedIn (LinkedIn, Click to configure), Google (Google, Click to configure), Twitter (Twitter, Click to configure), and Microsoft (Microsoft, Click to configure). A note at the bottom states: '(i) You can configure additional providers using Portal Management app. Learn more'.

## Azure Active Directory B2C

A portal owner can configure the portal to accept Azure Active Directory B2C (Azure AD B2C) as an identity provider. Azure AD B2C enables external customer sign-ins through local credentials and federation with various common social identity providers.

**Important:** *Azure AD B2C identity provider is the recommended provider for authentication. If external provider support (such as Facebook) is required, then it can be configured in Azure AD B2C instead of the portal.*

The advantages of using Azure AD B2C are that it is:

- Customer identity and access management, not just authentication.
- Customizable, where you can use built-in templates or build sophisticated custom policies.
- Branded experience for your customers.
- Platform-agnostic and supports external providers.
- Identity protection through security controls and multi-factor authentication.
- Supporting open standards and all technology stacks.
- Scalable and reliable, and built and supported by Microsoft, backed by SLA.

## Migration to Azure AD B2C

The portal supports a configurable security system that lets your customers support multiple authentication systems. Going forward, we recommend that you use only Azure AD B2C identity provider for authentication and that you deprecate other identity providers.

You can configure your portal to mark other identity providers as deprecated and allow users to migrate to Azure AD B2C identity provider. If a specific provider (such as Twitter) is required to be supported, it can still be supported by Azure AD B2C instead of the portal.

The steps that are involved in migration are:

- Mark other identity providers as deprecated.
- Migrate deprecated identity providers to Azure AD B2C.
- Disable local sign-in.

Following these steps will ensure an uninterrupted authentication experience for users. For more information, see **Migrate identity providers to Azure AD B2C**<sup>27</sup>.

## Exercise - Use an invitation to register users

The purpose of this hands-on lab is to introduce the Power Apps portals invitation-based user registration process.

The exercises work best when you have sample data to work with. Depending on the environment that you are working with, you might want to install sample data to assist with the exercises. Dynamics 365 does provide the ability to add sample data, as needed. If the environment that you are working in does not have sample data installed, follow the steps in the **Add or remove sample data**<sup>28</sup> documentation to install the sample data into your environment.

### Learning objectives

At the end of these exercises, you will be able to:

- Customize an invitation template.
- Create and send invitations to contacts to register.
- Redeem invitations.
- Extend the invitation process by a custom workflow.

**Estimated time to complete this exercise:** 10 to 15 minutes

### Prerequisites

The prerequisites for this exercise are as follows:

1. System Administrator access to the Dynamics 365 instance with Dynamics 365 for Customer Service solution installed.
2. A provisioned Customer self-service, Community, or Customer Power Apps portal.
3. An enabled and working server-side email synchronization.

When you provision a Dynamics 365 for Customer Engagement trial, Office 365 licenses are not provisioned automatically and the email integration will not work. To enable server-side email synchronization, follow the subsequent procedure.

<sup>27</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/configure/migrate-identity-providers/>

<sup>28</sup> <https://docs.microsoft.com/en-us/power-platform/admin/add-remove-sample-data/>

**Important:** You must be an Office 365 Global Administrator to complete this configuration.

1. Go to the **Admin portal**<sup>29</sup>.
2. Select **Billing > Purchase Services**.
3. Locate the **Office 365 E3** product and select the **Get free trial** option.
4. Assign the Office 365 license to your user account.
5. Open the **Microsoft Power Platform admin center**<sup>30</sup>.
6. Select **Environments**, select your environment, and then select **Settings**.
7. Select **Mailboxes**.
8. Open your mailbox record and select **Approve Email**.
9. Select **Test & Enable Mailbox**.
10. Ensure that the **Outgoing Email Status** field has the **Success** value.

## Scenario

Your organization has been using Dynamics 365 for Customer Engagement for some time and has been recording information about customers and suppliers. You have provisioned and configured a Power Apps portal. You want to invite one of your suppliers who is responsible for your websites to register as an administrative portal user so that they are able to sign in and administer the portal by using the front-end interface.

## High-level steps

To send invitations to your customers, and for them to redeem the invitations, complete the following tasks:

- Modify the Send Invitation template.
- Select a contact and create an invitation.
- Ensure that the invitation contains required information.
- Send the invitation to the contact.

## Create a test contact

To create a test contact, follow these steps:

1. Open Dynamics 365 Home(<https://home.dynamics.com/>).
2. Select the **Power Apps portals** app.
3. Select **Contacts** and then select **New**.
4. Create a new record for Nancy Davolio. Fill in the first name, last name, and email address information (*use an email address where you can receive the email*).
5. Select **Save**.

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<sup>29</sup> <https://portal.office.com/adminportal/>

<sup>30</sup> <https://aka.ms/ppac/>

## Customize the workflow

The workflow process of sending the invitation email is generic and needs to be customized prior to use.

1. Open the Power Apps portal(<https://make.powerapps.com/>).
2. Select **Solutions**, and then locate and select **Default Solution**.
3. Change the filter from **All** to **Processes**.
4. Locate and open the **Send Invitation** workflow process.

**Tip:** Use search to locate the process.

5. Deactivate the workflow.
6. Select **Set properties** for the **Create an email to act as an email template** step.
7. Enter the **Subject** as **Join our community**.
8. Replace the content of the email template with the following sample content. Use the workflow editor to insert values for the **First Name** field from **Invited Contact** and use the hyperlink button to insert the link and **Encoded Invitation Code** value.

Dear {First Name(Invite Contact (Contact));customer}

invites you to join our community. To redeem your invitation, please follow <hyperlink><name>this link</name><value>[Best regards  
Contoso Team](https://yourportalurl.powerappspalts.com/register?returnurl=%2f&invitation={Encoded Invitation Code(Encode Invitation Code)}</value></hyperlink></a></p></div><div data-bbox=)

9. Activate the workflow.

## Create and send the invitation

To create and send the invitation, follow these steps:

1. Open the Nancy Davolio contact record.
2. Select **Create Invitation**.
3. The invitation will be prepopulated. Select **Save**.
4. Under **Assign to Web Roles**, select **Add Existing Web Role**.
5. Search and add the **Administrators** role.
6. Select **Flow > Send Invitation**. Confirm that the invitation has been sent.

## Redeem the invitation

To redeem the invitation, follow these steps:

1. Open the mailbox for the email that you used for Nancy Davolio.
2. Locate and open the invitation email.

**Note:** Server-side synchronization might take up to 15 minutes to synchronize and send the email.

3. Select the link in the email.  
The **Redeem Invitation** page will open.
4. Select **Register**.
5. Enter username **nancyd** and then a password of your choice.
6. Select **Register**.  
Your account will be registered and you will be signed in automatically and redirected to the profile page. The front-side editing toolbox will appear, and you will see the **Edit** button when hovering over the elements of the page. The ability to edit indicates that you have been automatically assigned the role with sufficient front-side editing privileges (Administrators in this case).
7. Switch to the Power Apps portals app.
8. Select **Invitations** and then select the **Completed Invitations** view.
9. Confirm that the **Nancy Davolio** invitation is listed.
10. Open the invitation and confirm that **Status Reason** is now **Redeemed**.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which authentication method allows portal users to sign in with a username and password that is stored in Microsoft Dataverse?

- Windows Authentication
- Local Authentication
- Form Authentication
- External Authentication

### Multiple choice

2. A portal user has not confirmed their email. What will they not be able to do?

- Sign in to the portal
- Use two-factor authentication
- Change their email
- Register for Forums notifications

## Multiple choice

3. You want to invite a group of 50 contacts from the same company to register on your portal. Which registration method would you use?

- Closed Registration
- Open Registration
- Invitation-based Registration
- Email Registration

## Multiple choice

4. Which authentication provider is recommended?

- Local portal authentication
- Microsoft account
- Facebook
- Azure AD B2C

## Summary

Power Apps portals supports a variety of authentication options and provides powerful user-management capabilities. Administrators have a choice between using local authentication or delegating authentication to a trusted authentication provider. Power Apps portals supports multiple authentication providers and various industry standards.

By now, you should have a good understanding of the common authentication tasks in a Power Apps portal deployment, including how to:

- Create portal contact extensions.
- Configure and register contacts as portal users.
- Align portal authentication settings with the business requirements.
- Identify authentication provider capabilities and steps that are involved in the registration.
- Select and configure identity providers.

## Next steps

Your next step would be to get a better understanding of how to maintain and troubleshoot portal operations.

# Power Apps portals maintenance and troubleshooting

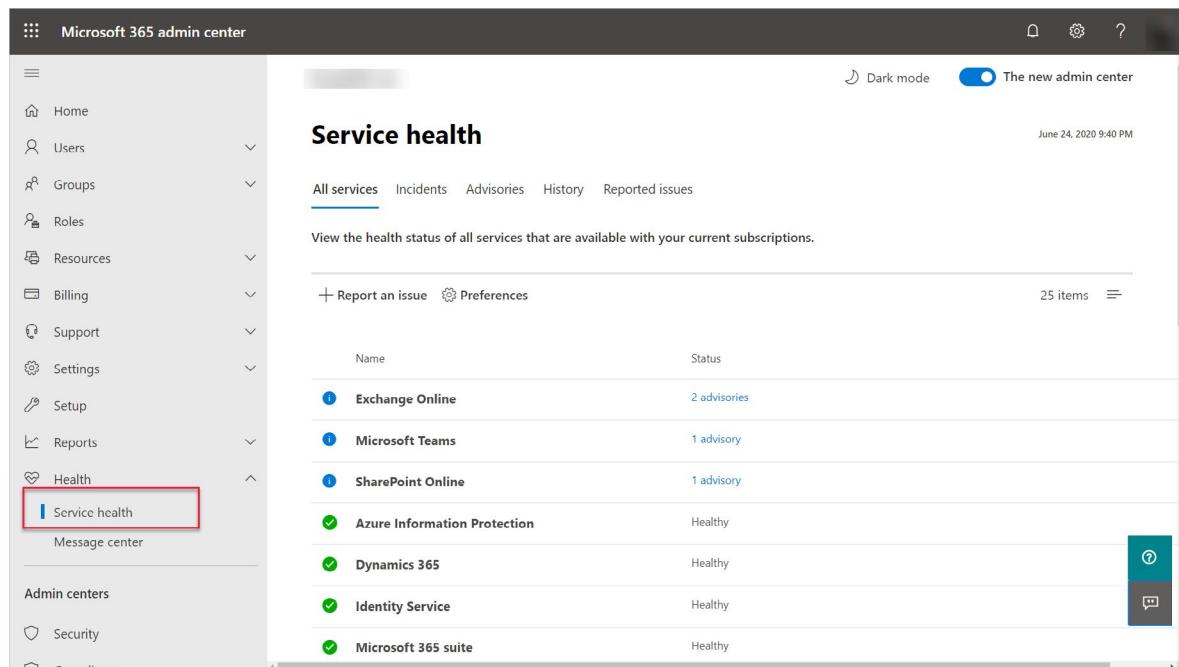
## Introduction

A Microsoft Power Apps portal is an external-facing application that is often open to an external audience. It's critical that the portal is accessible and operational because it reflects the image of an organization.

## Portal site issues

If a portal is completely inaccessible, an administrator can investigate numerous possibilities:

- Whether the portal has been enabled or not
- If other Microsoft Dataverse apps are accessible
- Issues that might have occurred with the infrastructure services that portals depend on such as Microsoft Azure Active Directory (Azure AD) or the Web Apps feature of Azure App Service (Web Apps)



The screenshot shows the Microsoft 365 admin center interface. On the left, there is a navigation sidebar with various options like Home, Users, Groups, Roles, Resources, Billing, Support, Settings, Setup, Reports, and Health. The 'Service health' option under the Health section is highlighted with a red box. The main content area is titled 'Service health' and displays the status of various Microsoft services. The table below shows the service names and their current status.

Name	Status
Exchange Online	2 advisories
Microsoft Teams	1 advisory
SharePoint Online	1 advisory
Azure Information Protection	Healthy
Dynamics 365	Healthy
Identity Service	Healthy
Microsoft 365 suite	Healthy

- If advisories exist on the Microsoft 365 admin center

An administrator should also investigate whether some of the portal metadata has been recently modified, such as the website or website binding records that also might affect portal functionality.

Running the **Portal Checker** might also identify potential issues with the site.

## Portal page and functionality issues

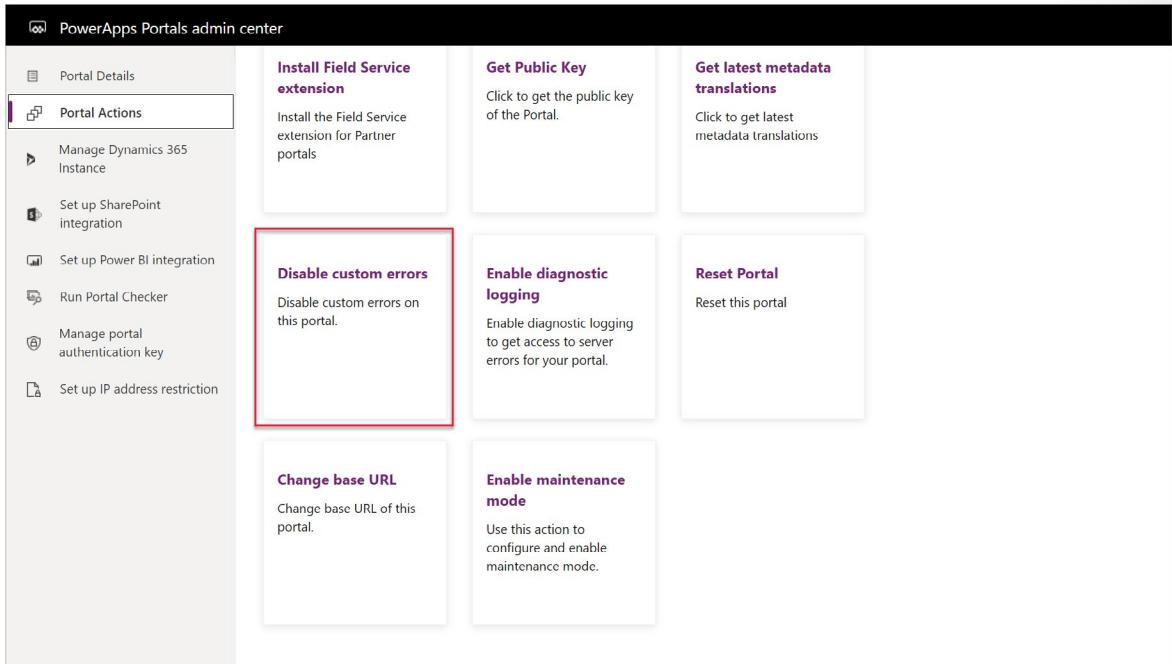
Occasionally, a portal administrator might be faced with having to resolve errors with specific Power Apps portal pages or functions.

Power Apps portals have several tools that will allow an administrator to quickly identify and resolve issues without needing to contact Microsoft support.

## Disable custom errors

A typical error might begin when a portal visitor reports an issue when visiting a portal page. Often, the error message is brief and doesn't describe the underlying issue.

In the Power Apps Portals admin center, the **Disable custom errors** action will replace the notification with detailed error information on the portal page that could provide additional information for an administrator to troubleshoot the issue.



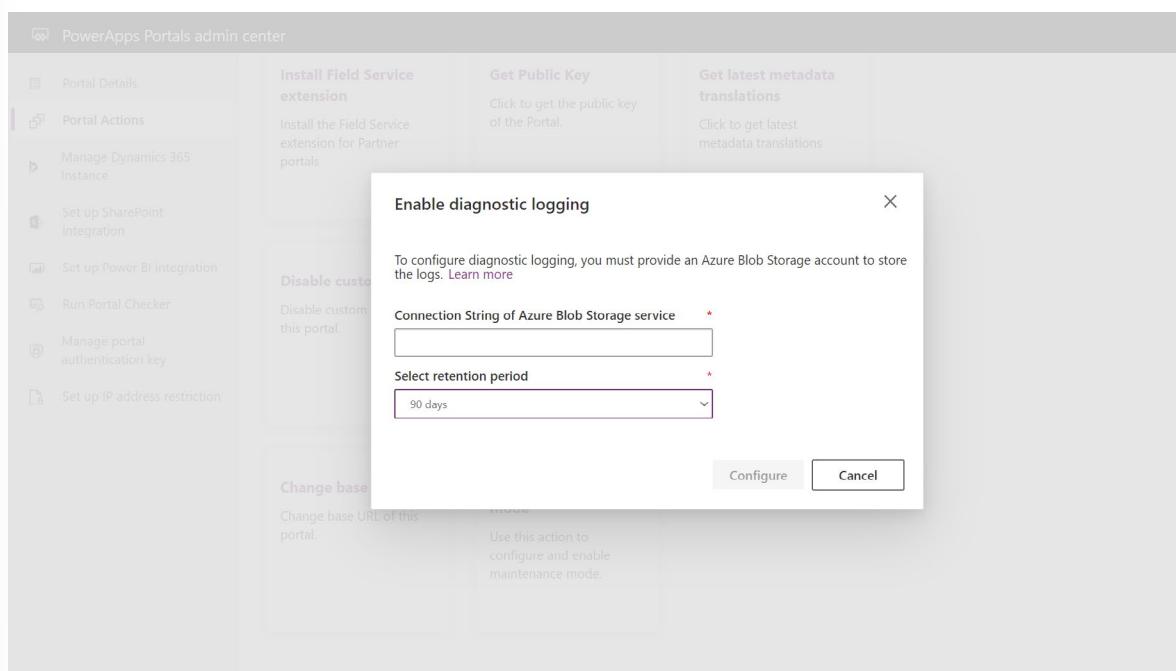
**Note:** Disabling custom errors should be a temporary setting because the detailed error message might convey an increased negative experience for portal visitors. We recommend that you only disable custom errors when you are in the development phase and enable custom errors after you go live.

Another option is to personalize the error message by adding a content snippet called **Portal Generic Error** that contains an appropriate message for portal users. For more information, see [Display a custom error message<sup>31</sup>](#).

## Diagnostic logging

Along with visual errors on portal pages, potential underlying issues could occur that are not quite as obvious to isolate and troubleshoot. Power Apps portals can be configured to log diagnostic information. The diagnostic logs will be stored in Azure Blob storage in a container named **telemetry-logs**. The administrator can configure the retention period of how long to keep the logs.

<sup>31</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/admin/view-portal-error-log#display-a-custom-error-message/?azure-portal=true>



The logs can provide information of patterns, duration, and frequency of specific portal errors to assist in resolving potential errors and issues.

## Additional troubleshooting steps

Because the portal might extend certain functionality of a model-driven app, one technique to eliminate potential portal errors is to attempt the same operation in the model-driven app. For example, if an error is generated when a record is added through the portal, try adding or updating the same data record that a portal user is attempting to create or update on a portal. After the error has been resolved in the model-driven app, it is quite often resolved on the portal.

Creating the `Site/EnableCustomPluginError` site setting and then setting the value to **True** will display the contents of the plug-in error on a portal page rather than the generic error message.

For more information, see [View portal error logs<sup>32</sup>](#).

## Portal maintenance

An administrator's role goes beyond ensuring that a Power Apps portal is running correctly yet also configured to run efficiently and quickly. Numerous tools are available to help administrators check the settings and status of a Power Apps portal and provide users with clear messaging if the portal is undergoing maintenance.

## Portal Checker

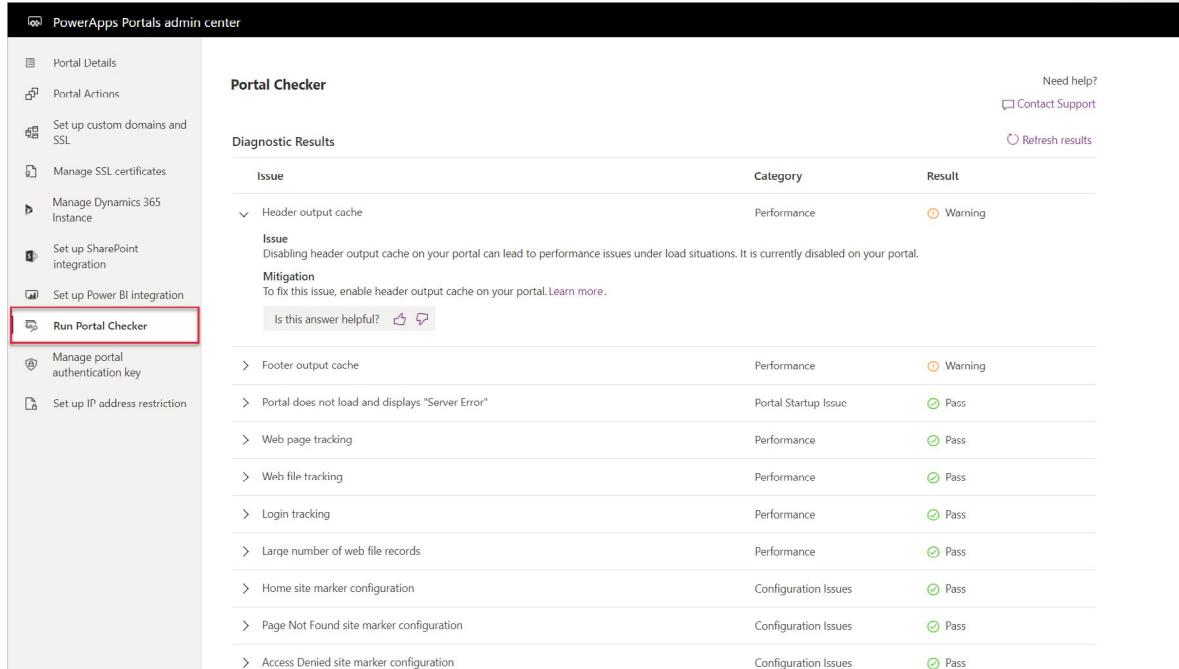
The **Portal Checker** feature is available in the Power Apps Portals admin center and will run diagnostic checks to protect and advise against common issues that might be encountered when operating a portal.

<sup>32</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/admin/view-portal-error-log/>

To run the Portal Checker, follow these steps:

1. From Power Apps(<https://make.powerapps.com/>), locate your portal app.
2. Select the ellipsis (...) and then select **Settings**.
3. Select **Administration**.
4. Select **Run Portal Checker** from the list of options on the left.
5. Select the **Run Portal Checker** button.

After a few minutes, you should see a list of diagnostic results.



The screenshot shows the 'Portal Checker' results in the PowerApps Portals admin center. The 'Run Portal Checker' button on the left sidebar is highlighted with a red box. The main area displays a table of diagnostic results with columns for Issue, Category, and Result. One issue is listed under 'Header output cache' with a 'Warning' result. Other issues listed include 'Footer output cache', 'Portal does not load and displays "Server Error"', 'Web page tracking', 'Web file tracking', 'Login tracking', 'Large number of web file records', 'Home site marker configuration', 'Page Not Found site marker configuration', and 'Access Denied site marker configuration', all with 'Pass' results.

Issue	Category	Result
Header output cache <small>Issue: Disabling header output cache on your portal can lead to performance issues under load situations. It is currently disabled on your portal. Mitigation: To fix this issue, enable header output cache on your portal. <a href="#">Learn more</a>.</small>	Performance	<span>Warning</span>
Footer output cache	Performance	<span>Pass</span>
Portal does not load and displays "Server Error"	Portal Startup Issue	<span>Pass</span>
Web page tracking	Performance	<span>Pass</span>
Web file tracking	Performance	<span>Pass</span>
Login tracking	Performance	<span>Pass</span>
Large number of web file records	Performance	<span>Pass</span>
Home site marker configuration	Configuration Issues	<span>Pass</span>
Page Not Found site marker configuration	Configuration Issues	<span>Pass</span>
Access Denied site marker configuration	Configuration Issues	<span>Pass</span>

The result will also provide mitigation steps or links to help you understand the impact of the issue.

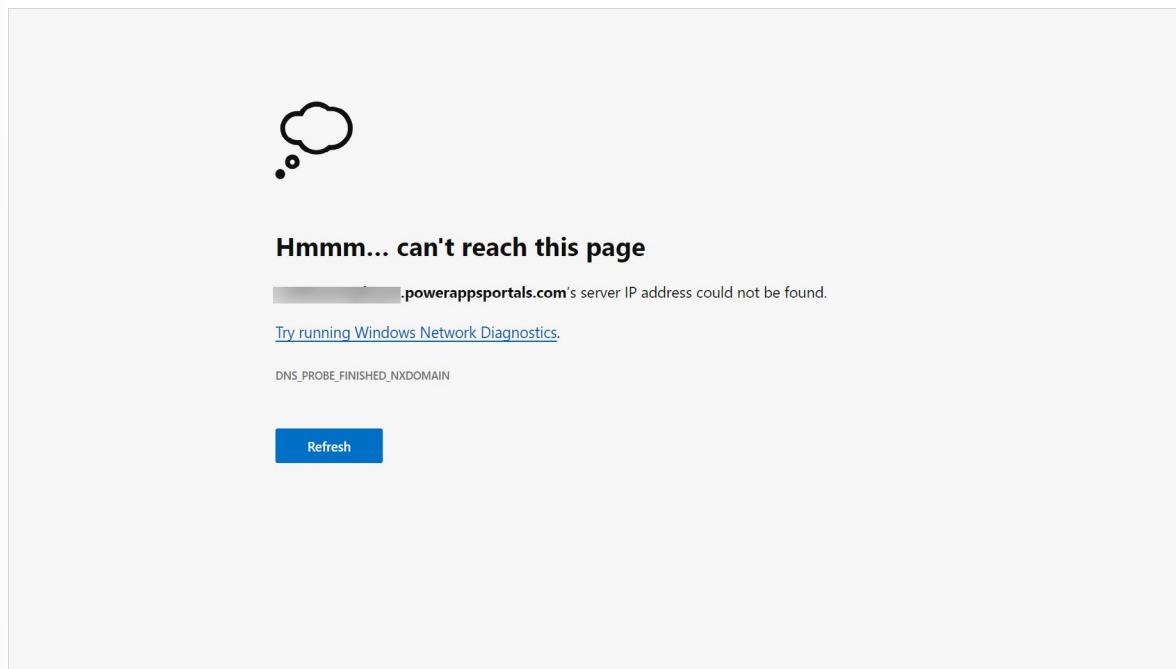
For more information, see [Portal Checker](#)<sup>33</sup>.

## Enable maintenance mode

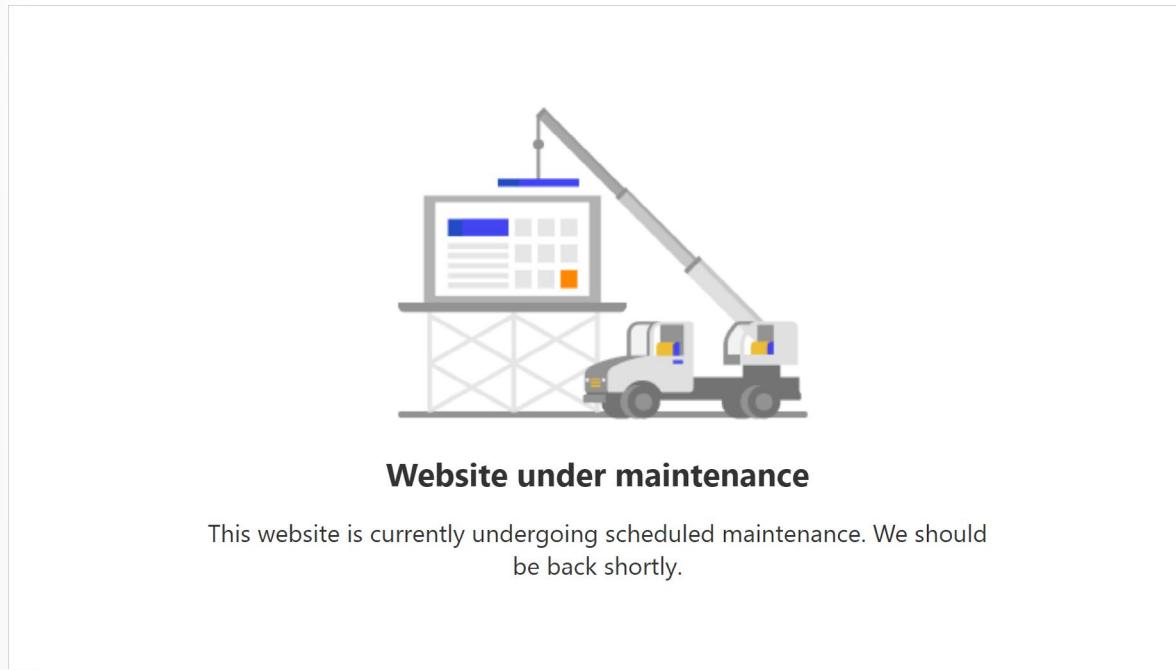
As an administrator, you might have occasions when you don't want portal users to visit or sign in to the Power Apps portal. The reason could be because you might be migrating or updating a series of portal webpages and functionality or uploading a large dataset that you don't want to be available on the portal until the load process is complete.

While you can change the portal state to **Off**, selecting this option would present the portal visitors with a message that the portal cannot be found, leaving the visitors wondering what has happened.

<sup>33</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/admin/portal-checker/>



Within the Portals admin center actions is the option to enable the **Portal Maintenance** mode. Selecting this mode will provide the portal visitors with a more informational page indicating that the portal is temporarily unavailable.



The maintenance mode page can also be replaced with a custom HTML page that is hosted elsewhere and publicly accessible. For more information, see [Enable maintenance mode<sup>34</sup>](#).

<sup>34</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/admin/enable-maintenance-mode#enable-maintenance-mode>

## Upgrade the portal

A benefit of software as a service (SaaS) applications is that many of the software components are updated automatically. Several Power Apps portals components, such as the Azure web application and the various tools, are updated automatically.

An administrator can also opt to receive early updates in the Portals admin center.

**Caution:** You should opt for early updates in development or testing portals only, which will ensure that your production portal remains operational in the unlikely event that an early update might cause issues with your portal application.

While underlying infrastructure is maintained automatically, portal solutions aren't automatically updated. These solutions are installed on Microsoft Dataverse and will always be compatible with the current portal web host. An administrator might be advised of the available solution updates from the Microsoft 365 message center.

An administrator can update the portal solutions during an appropriate maintenance window because the update process might cause some performance degradation and portal instability.

Portal solutions can be updated by using the Dynamics 365 admin center (even for Dataverse portals that don't have Dynamics 365 apps installed).

1. Go to the **Microsoft Power Platform admin center**<sup>35</sup>.
2. Expand **Admin Centers**.
3. Select **Dynamics 365**.
4. Select the environment where the portal is provisioned.
5. In the **Details** section, select the **Manage your solutions** icon.
6. Select the portal solution that has a status of **Upgrade available**.
7. Select **Upgrade** to start the solution upgrade process.

The screenshot shows the Dynamics 365 Administration Center interface. At the top, there's a navigation bar with links for Instances, Updates, Service Health, Backup & Restore, and Applications. Below that is a dark header bar with the Microsoft Dynamics 365 logo and an Office 365 link. The main content area is titled "Dynamics 365 Administration Center" and "Manage your solutions". On the left, there's a sidebar with a back arrow and the text "Manage your solutions". The main content area displays a table of solutions. One row, "Common Data Service Starter Portal", is highlighted with a red border and has an "Upgrade available" status. A tooltip for this row provides a detailed description of the Common Data Service Starter Portal template, mentioning it's for creating a portal experience for customers. The table columns include Solution Name, Version, Available U... (partially visible), and Status. Other rows listed include AI Builder for SharePoint Form Processing, AI Solution Anchor, Anchor solution for Dual Write Core, Change Tracking, Change Tracking Solution, Common Data Service Base Portal, Company News Timeline, Contextual Help Base, Crm Hub, Customer Service Hub Anchor, Customer Service Team Member Anchor, and Dynamics 365 Connector for LinkedIn Le...

SOLUTION NAME	VERSION	AVAILABLE U...	STATUS
AI Builder for SharePoint Form Processing	2020.3.8.32086	1/1/2050	Not installed
AI Solution Anchor	2.6.1.4	1/1/2050	Upgrade available
Anchor solution for Dual Write Core	1.0.16	1/1/2050	Not installed
Change Tracking	1.0	8/7/2021	Not installed
Change Tracking Solution	1.0	8/7/2021	Not installed
Common Data Service Base Portal (Prev...)	9.2.2001.2	1/1/2050	Not installed
Common Data Service Starter Portal	9.2.10.10	1/1/2050	Upgrade available
Company News Timeline	9.0.1.716	1/1/2050	Not installed
Contextual Help Base	1.0.0.10	1/1/2050	Installed
Crm Hub	9.0.2004.1012	1/1/2050	Not installed
Customer Service Hub Anchor	9.0.20023.1012	1/1/2050	Not installed
Customer Service Team Member Anchor	9.0.20061.1014	1/1/2050	Not installed
Dynamics 365 Connector for LinkedIn Le...	1.13.10029.1003	1/1/2030	Not installed

<sup>35</sup> <https://aka.ms/ppac/>



<https://www.microsoft.com/videoplayer/embed/RE4AprS>

## Exercise - Run the Portal Checker

The purpose of this hands-on lab is to see how the Portal Checker can identify potential portal issues.

### Learning objectives

At the end of these exercises, you will be able to:

- Run the Portal Checker.
- Respond to the mitigation advice.
- Rerun the Portal Checker to confirm that the issue has been addressed.

**Estimated time to complete this exercise:** 10 to 15 minutes

### Prerequisites

For this exercise, you need to have the following parameters set up in your environment:

- A Power Apps portal that is provisioned. If you do not have a Power Apps portal available, follow the [Create Portal<sup>36</sup>](#) instructions to create one.
- Access to the Power Apps maker portal.

### High-level steps

In this exercise, you will make a few changes to the settings in your portal metadata. Next, you will run the Portal Checker tool from the Power Apps portals admin center and then evaluate the results. After you have addressed the issue, you will rerun the Portal Checker to ensure that the issue has been resolved.

The high-level steps are as follows:

1. Locate the `Header/OutputCache/Enabled` site setting and update the value to **False**.
2. Refresh the cache.
3. Run the Portal Checker.
4. Note the warning message for the header output cache.
5. Locate the `Header/OutputCache/Enabled` site setting and update the value to **True**.
6. Refresh the cache.
7. Run the Portal Checker.

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<sup>36</sup> <https://docs.microsoft.com/en-us/powerapps/maker/portals/create-portal/>

- 
8. Note the message for Header Output cache.

## Launch the Portal Management app

1. Go to the Power Apps maker portal(<https://make.powerapps.com/>).
2. Make sure that the correct environment is selected in the environment selector in the upper-right corner.
3. From the **Apps** list, locate and open the Portal Management app (Type = Model-driven).
4. Select **Site Settings**.
5. Locate the `Header/OutputCache/Enabled` site setting, update the value to **False**, and then select **Save**.
6. Leave the Portal Management app open.
7. From another browser tab or session, go to the maker portal(<https://make.powerapps.com/>) and sign in.
8. Locate your portal app, select the ellipsis (...), and then select **Edit** to open portals Studio.
9. Select **Browse website** to clear the cache.
10. Close the website.
11. Go to the maker portal(<https://make.powerapps.com/>) and sign in.
12. Locate your portal app, select the ellipsis (...), and then select **Settings**.
13. On the fly-out window to the right, select **Administration**.
14. The Power Apps portals admin center will appear. Select **Run Portal Checker**.
15. On the screen, select the **Run Portal Checker** button.
16. Note that the header output cache has a warning; expand the message to get more details.
17. Leave the Portal Checker open.
18. Return to the Portal Management app.
19. Select **Site Settings**.
20. Locate the `Header/OutputCache/Enabled` site setting, update the value to **True**, and then select **Save**.
21. From another browser tab or session, go to the maker portal(<https://make.powerapps.com/>) and sign in.
22. Locate your portal app, select the ellipsis (...), and then select **Edit** to open portals Studio.
23. Select **Browse website**, which will clear the cache.
24. Return to the Power Apps portals admin center and select **Run Portal Checker**.
25. On the screen, select the **Run Portal Checker** button.
26. Note that the header output cache issue has been resolved.

The screenshot shows the PowerApps Portals admin center with the 'Portal Checker' section selected. The sidebar on the left lists various portal management options. The main area displays a table of diagnostic results with columns for 'Issue', 'Category', and 'Result'. One row, 'Header output cache', is expanded, showing a description: 'Header output cache is enabled.' A red box highlights this row. At the bottom of the expanded row, there's a question 'Is this answer helpful?' with thumbs up and down icons.

Issue	Category	Result
> Organization ID configured for the portal	Provisioning issues	Pass
> Portal does not load and displays "Server Error"	Portal Startup Issue	Pass
> Web page tracking	Performance	Pass
> Web file tracking	Performance	Pass
> Login tracking	Performance	Pass
> Header output cache	Performance	Pass
> Footer output cache	Performance	Pass
> Large number of web file records	Performance	Pass

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. A portal user reports that a page has an error message. A developer wants to see more details on the actual portal page. Which option should you consider in the Power Apps portals admin center?

- Reset the portal
- Enable Portal Diagnostics logging
- Use the Disable custom errors action
- Review the Microsoft Dataverse plug-in trace log

### Multiple choice

2. You want to deploy updates to your Dataverse application that will affect portal functionality. You decide to put the portal in maintenance mode, but your manager wants portal visitors to know how long the site will be unavailable. What can you do?

- Use IP address restrictions
- Enable the default maintenance mode page
- Enable Portal Maintenance mode and redirect to a custom page on another site that indicates the downtime
- Deploy the updates after business hours

## Multiple choice

3. *Portal visitors are reporting an issue when they are creating support cases on a Customer self-service portal. Where should you investigate first?*

- Verify that diagnostic logging has been enabled
- Turn on the Disable custom errors action setting
- Set the Site/EnableCustomPluginError site setting and then set the value to True
- Determine if the issue occurs when you create a case in the Dynamics 365 Customer Service app

## Multiple choice

4. *What part of the Power Apps portals system is not automatically updated?*

- The portals admin and maker tools
- The Azure portal host app
- Dataverse
- The portals solutions in the Dynamics 365 admin center

## Summary

Power Apps portals are external-facing applications that potentially represent a corporation's brand and reputation. Therefore, it's important for an administrator to maintain and troubleshoot the Power Apps portals as efficiently as possible.

This module explained the following concepts:

- Various troubleshooting tools and methods in the event that an issue occurs with a portal.
- The steps to put a portal in maintenance mode and update portal solutions.
- The Portal Checker tool and how it can identify potential issues.

# Answers

## Multiple choice

1.Which one of the following selections is not a valid target audience for Power Apps portals?

- Customers
- Employees
- Competitors
- Donors

*Explanation*

*Power Apps portals extend Power Platform solutions to internal and external audiences such as communities, customers, partners, supporters, and employees.*

## Multiple choice

2.What role is required to be able to provision a Power Apps portal for an organization?

- System Administrator
- Office 365 Global administrator
- System Customizer
- Power Apps portal administrator

*Explanation*

*To provision a portal, the user must be assigned to the System Administrator role in the Microsoft Dataverse environment that is selected for the portal.*

## Multiple choice

3.Where can you store the content of a portal web file?

- Amazon S3
- OneDrive for Business
- Azure Blob storage
- FTP server

*Explanation*

*The web file content can be stored as a Note with an attachment or in Azure Blob storage. Using Azure storage requires additional configuration, but it is more cost-efficient if an organization deals with numerous documents.*

**Multiple choice**

4.What is the recommended authentication mechanism in Power Apps portals?

- Social providers
- Azure Active Directory B2C
- Local authentication with username and password
- Microsoft account

*Explanation*

*Power Apps portals support multiple authentication methods and standards including local authentication with username and password, social providers, and OpenID. Among those methods and standards, Azure Active Directory B2C is the recommended provider to manage identities of portal users.*

**Multiple choice**

1.You have provisioned a new Power Platform environment without enabling any of the Dynamics 365 apps. What starter portal templates are available for you to provision?

- Customer service portal
- Community portal
- Portal from blank
- Not for Profit portal

*Explanation*

*The Portal from blank template is the only option to provision on a Dataverse Environment without Dynamics 365. Customer service and Community portals require Dynamics 365 apps. The Not for Profit portal is not an available portal template.*

**Multiple choice**

2.What starter portals are not available for the customer audience?

- Customer self-service
- eCommerce portal
- Community portal
- Custom portal

*Explanation*

*When Customer is selected as the portal audience during the portal provisioning process, the Customer self-service, Custom, and Community portals are available. eCommerce portal is not a valid starter portal type.*

**Multiple choice**

3. Where do you write new knowledge articles for the portal?

- Portal Studio
- Custom portal
- Dynamics 365 Customer Service Hub
- Portal Management app

*Explanation*

*Knowledge articles cannot be written within the portal at all, only viewed. While knowledge articles are listed in the Portal Management app, they can only be written in the Customer Service Hub app.*

**Multiple choice**

4. Which feature is only available in the Community starter portal?

- Forums
- Blogs
- Event Management
- Knowledge Articles

*Explanation*

*Forums and Knowledge Articles features are available in all starter portals except the Custom portal. The Blogs feature is available only in the Community starter portal. Event Management is not a valid starter portal feature.*

**Multiple choice**

1. How many different starter portals can be installed on an environment without Dynamics 365 apps?

- One portal
- Five portals
- One of each unique portal type
- Limited by available Dataverse capacity

*Explanation*

*The Portal from blank option is the only one that you can provision on a Microsoft Dataverse environment without Dynamics 365 enabled. Five different portal types exist, but four require Dynamics 365 apps. Dataverse capacity comes into consideration when you are provisioning environments.*

**Multiple choice**

2. Where is portal metadata stored?

- Azure web application
- Dataverse
- Portals solutions
- Portals Management app

*Explanation*

*Portal metadata is stored in Dataverse. The Azure web application only displays portal pages based on metadata but doesn't store any data. Portals solutions do not store data but define the metadata structure. The Portal Management app allows makers to create, update, and delete portal metadata but does not store it.*

**Multiple choice**

3. In which tool can you not create a webpage?

- Portals Studio
- Front-side editor
- Portals admin center
- Portal Management app

*Explanation*

*The Power Apps Portals admin center is used to manage administration aspects of the portal, but it cannot be used to create portal metadata such as webpages. With all the other tools, it is possible to create a webpage record (portal metadata).*

**Multiple choice**

4. What is required to fully delete a provisioned Power Apps portal?

- Reset the portal from the Portals admin center.
- Delete the portal from the Power Apps maker portal.
- Delete the portal from the Power Apps maker portal and then delete portal metadata.
- Provision a new portal that will overwrite your existing portal.

*Explanation*

*Resetting the portal only reinstalls the portal web application. Deleting the portal from the Power Apps maker portal only removes the portal web application and the portal app, it doesn't remove the portal metadata. You cannot provision a new portal if one exists or if it has been deleted; provisioning a new portal will use existing portal metadata.*

**Multiple choice**

1.Which one of the following options is not a valid table list view?

- Map view
- Excel view
- Calendar view
- Grid list view

*Explanation*

*Views can be rendered as traditional grid lists, a calendar, or a map. Delivering list content as an OData feed is also supported.*

**Multiple choice**

2.You have created a Contact Us table form and want to redirect users to a Thank You page after successful submission. How can you achieve this task?

- Change the table form title to "Contact Us - Thank You."
- Set the Table Form column on the Thank You page to the Contact Us table form.
- Add a redirect step to the table form.
- Configure On Success Settings to redirect to the Thank You page.

*Explanation*

*The On Success Settings feature defines behavior on successful submission of the form. Options are to display a message or redirect to another page or URL.*

**Multiple choice**

3.Where in Power Apps portals Studio would you add a list and form component to a particular webpage?

- From the Properties pane of a webpage
- Edit the page template source code
- From the tool belt components section
- You can only add forms and lists by using the Portal Management app

*Explanation*

*The Properties pane will configure the properties of a component but not add them. You could add Liquid tags to a page template, but that would be for all pages using that template. You can add forms and lists through the Add components feature from the tool belt in portals Studio. Forms and lists can be added in the Portal Management app, but it is not the only way.*

**Multiple choice**

4.You want portal visitors to be able to locate specific records in a list view based on an option value in the Microsoft Dataverse record. What is the best way to accomplish this task?

- Enable the search property on the list component in portals Studio.
- Add the Option Set column to the model-driven view to allow portal visitors to sort by the value.
- In the Portal Management app, enable Metadata searching and configure a filter for the Option Set column.
- In portals Studio, increase the number of records for each page.

*Explanation*

*Enabling the search property will only provide the quick find search box. Adding the Option Set column to the view is not the best way to find the data. The metadata searching option is the best solution for allowing users to filter on specific option set values. Increasing the number of records for each page will not help users locate data.*

**Multiple choice**

1.Which authentication method allows portal users to sign in with a username and password that is stored in Microsoft Dataverse?

- Windows Authentication
- Local Authentication
- Form Authentication
- External Authentication

*Explanation*

*Portal users can authenticate with local authentication and external authentication. Local authentication is a common forms-based authentication with usernames and password hashes that are stored in the Dataverse contact record.*

**Multiple choice**

2.A portal user has not confirmed their email. What will they not be able to do?

- Sign in to the portal
- Use two-factor authentication
- Change their email
- Register for Forums notifications

*Explanation*

*Unless the user's email is confirmed, it cannot be used for password resets or two-factor authentication. None of the other tasks require the email to be confirmed.*

**Multiple choice**

3. You want to invite a group of 50 contacts from the same company to register on your portal. Which registration method would you use?

- Closed Registration
- Open Registration
- Invitation-based Registration
- Email Registration

*Explanation*

*Power Apps portals support two types of registrations - Open Registrations and Invitation-based Registrations. Only Invitation-based Registration supports invitations that can be sent to a group of contacts.*

**Multiple choice**

4. Which authentication provider is recommended?

- Local portal authentication
- Microsoft account
- Facebook
- Azure AD B2C

*Explanation*

*Azure AD B2C identity provider is the recommended provider for authentication. If external provider support like Facebook is required, then it can be configured in Azure AD B2C instead of the portal.*

**Multiple choice**

1. A portal user reports that a page has an error message. A developer wants to see more details on the actual portal page. Which option should you consider in the Power Apps portals admin center?

- Reset the portal
- Enable Portal Diagnostics logging
- Use the Disable custom errors action
- Review the Microsoft Dataverse plug-in trace log

*Explanation*

*Selecting the Disable custom errors action will show detailed information directly on the portal page where the error has occurred. Resetting the portal will not resolve the issue or provide information. The diagnostics logs must be downloaded from Azure Blob storage, and the plug-in trace log is only viewable with the model-driven app settings.*

**Multiple choice**

2.You want to deploy updates to your Dataverse application that will affect portal functionality. You decide to put the portal in maintenance mode, but your manager wants portal visitors to know how long the site will be unavailable. What can you do?

- Use IP address restrictions
- Enable the default maintenance mode page
- Enable Portal Maintenance mode and redirect to a custom page on another site that indicates the downtime
- Deploy the updates after business hours

*Explanation*

*Portal Maintenance mode allows redirection to a custom page. Using IP address restrictions will make it appear that the portal is inaccessible. The default maintenance mode page doesn't provide detailed information. Portal visitors will use the portal after business hours.*

**Multiple choice**

3.Portal visitors are reporting an issue when they are creating support cases on a Customer self-service portal. Where should you investigate first?

- Verify that diagnostic logging has been enabled
- Turn on the Disable custom errors action setting
- Set the Site/EnableCustomPluginError site setting and then set the value to True
- Determine if the issue occurs when you create a case in the Dynamics 365 Customer Service app

*Explanation*

*If the issue is happening in the Dynamics 365 Customer Service app, it is likely not a portal issue. Enabling the various other options could help, but those options should not be the first ones to check.*

**Multiple choice**

4.What part of the Power Apps portals system is not automatically updated?

- The portals admin and maker tools
- The Azure portal host app
- Dataverse
- The portals solutions in the Dynamics 365 admin center

*Explanation*

*Most of the portal assets are updated automatically except for the portal solutions that need to be updated in the Dynamics 365 admin center.*



## Module 6 Introduction to automation

### Define and create business rules in Dataverse

#### Define business rules - Introduction

Business rules are server-side logic that is used with canvas or model-driven apps to set or clear values in one or many columns in a table. They can also be used to validate stored data or show error messages. Model-driven apps can use business rules to show or hide columns, enable or disable columns, and create recommendations based on business intelligence.

**Tip:** Business rules are usually defined for a table and apply to all forms, but you can define a business rule for a specific model-driven form. Canvas apps cannot have a business rule applied to a specific form.

Business rules give you a powerful way to enforce rules, set values, or validate data regardless of the form that is used to input data. Additionally, business rules are effective in helping to increase the accuracy of data, simplify application development, and streamline the forms presented to end users.

Business rules can be used by canvas apps or model-driven apps to do the following:

- Set column values.
- Clear column values.
- Validate data and show error messages.

Model-driven apps can also use business rules to:

- Show or hide columns (model-driven apps only).
- Enable or disable columns (model-driven apps only).
- Create business recommendations based on business intelligence (model-driven apps only).

#### Define the components of a business rule

Business rules encapsulate logic in a predefined set of steps that will run each time that data is entered or modified and the data meets certain criteria to trigger the business rule. The business rule will run regardless of the way that data was added or edited in the table. Additionally, business rules are server-side, meaning that the logic runs on the servers that manage Microsoft Dataverse.

Business rules have the following components:

**Condition** - All business rules have a condition. It is a trigger and is used to determine if the business rule is run based on the values that are added or edited in a table. A condition always runs as true or false, and you can have more than one condition in a business rule.

**Action** - An action is some logic, like setting a column to a certain value, that runs on either the true or false branch of a condition.

**Scope** - Business rules can have a scope. The following table outlines the available scope options for a business rule.

**Tip:** A business rule that is used by a canvas app always has the scope set to **Table**.

Scope of a business rule	Applies to
Table	Model-driven forms and server
All forms	Model-driven forms
Specific form ( <b>Account</b> form, for example)	Just that model-driven form

## Create a business rule

Business rules are flexible and can be used for many purposes, so they vary considerably in complexity and scope. Follow these steps to build any business rules and adjust for your specific needs:

1. Sign in to Power Apps.
2. Select **Data > Tables** and select one of the tables in the relationships that you want to create.
3. Select the **Business Rules** tab on the menu and then select **New**.
4. Add a name and description.
5. Select the **Scope** button.
6. Select the **Condition** component and then add conditions to the business rule.

**Tip:** To add more conditions to your business rule, drag the **Condition** component from the **Components** tab to a plus sign (+) in the designer.

7. To set properties for the condition, select the **Condition** component in the designer window, and then set the properties on the **Properties** tab on the right side of the screen. As you set properties, Microsoft Dataverse creates an expression at the bottom of the **Properties** tab.

**Tip:** To add another clause (an **AND** or an **OR**) to the condition, select **New** on the **Properties** tab to create a new rule, and then set the properties for that rule. In the **Rule Logic** column, you can specify whether to add the new rule as an **AND** or an **OR** clause.

8. Add action(s) from the **Action** component with the following procedure:

Drag one of the action components from the **Components** tab to a plus sign (+) next to the **Condition** component. Drag the action to a plus sign (+) next to a check mark if you want the business rule to take that action when the condition is met, or drag the action to a plus sign (+) next to an **X** if you want the business rule to take that action if the condition is not met.

9. Set the property for each step.

To set properties for the action, select the **Action** component in the designer window, and then set the properties on the **Properties** tab.

When you are done setting properties, select **Apply**.

10. Select **Validate** to validate the business rule in the action bar.

11. Select **Save** to save the business rule.
12. Select **Activate** in the **Solution Explorer** window to activate the business rule and start its running process.

**Tip:** Consider the following tips as you work on business rules in the designer window:

**Snapshot** - To take a snapshot of everything in the **Business Rule** window, select **Snapshot** on the action bar. This is useful, for example, if you want to share and get comments on the business rule from a team member.

Use the mini-map to quickly browse through different parts of the process. The mini-map is useful when you have a complicated process that scrolls off the screen.

As you add conditions, actions, and business recommendations to your business rule, code for the business rule is built and appears at the bottom of the designer window. This code is read-only.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which of the following statements is true about business rules?

- Business rules can be created to enforce logic and data values regardless of how you enter data into a Microsoft Dataverse entity.
- Business rules cannot be created to enforce logic and data values regardless of how data is entered in a Dataverse entity.
- Business rules are not implemented when you save a record.
- Business rules are not implemented when you edit a record.

### Multiple choice

2. Business rules have which three components?

- A table, action, and scope.
- A choice, table, and action.
- A condition, action, and scope.

### Multiple choice

3. Which statement is not true about business rules for an entity?

- Business rules that are defined for an entity apply when you are using the entity with a canvas app.
- Business rules that are defined for an entity do not apply when you are using a canvas app.
- Business rules that are defined for an entity apply when you are using the entity with a model-driven app.
- Business rules that are defined for an entity apply when you are using the entity with Excel.

## Summary

In this module, you learned how to build business rules for a table to enforce business logic regardless of how data is entered into the table in Microsoft Dataverse. You also learned how to:

- Define and create business rules.
- Identify the different components of a business rule.
- Make a business rule.

For more information on how to use Excel with Dataverse for data editing and data entry, select the following link.

**[Open table data in Excel<sup>1</sup>](#)**

For information about licensing requirements, select the following link.

**[License requirements for entities<sup>2</sup>](#)**

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<sup>1</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/data-platform-excel-addin>

<sup>2</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/data-platform-entity-licenses>

# Answers

## Multiple choice

1.Which of the following statements is true about business rules?

- Business rules can be created to enforce logic and data values regardless of how you enter data into a Microsoft Dataverse entity.
- Business rules cannot be created to enforce logic and data values regardless of how data is entered in a Dataverse entity.
- Business rules are not implemented when you save a record.
- Business rules are not implemented when you edit a record.

*Explanation*

*Business rules can be created to enforce logic and data values regardless of how you enter data into a Dataverse entity.*

## Multiple choice

2.Business rules have which three components?

- A table, action, and scope.
- A choice, table, and action.
- A condition, action, and scope.

*Explanation*

*Business rules have conditions, actions, and scope.*

## Multiple choice

3.Which statement is not true about business rules for an entity?

- Business rules that are defined for an entity apply when you are using the entity with a canvas app.
- Business rules that are defined for an entity do not apply when you are using a canvas app.
- Business rules that are defined for an entity apply when you are using the entity with a model-driven app.
- Business rules that are defined for an entity apply when you are using the entity with Excel.

*Explanation*

*Business rules that are defined for an entity apply when you are using the entity with canvas apps, model-driven apps, and Excel.*



# Module 7 Build cloud flows with Power Automate

## Get started with Power Automate

### Introducing Power Automate

Welcome to Power Automate! In this module, you'll learn how to build flows.

If you're a beginner with Power Automate, this module will get you going. If you already have some experience, this module will tie concepts together and fill in the gaps.

### Learning objectives

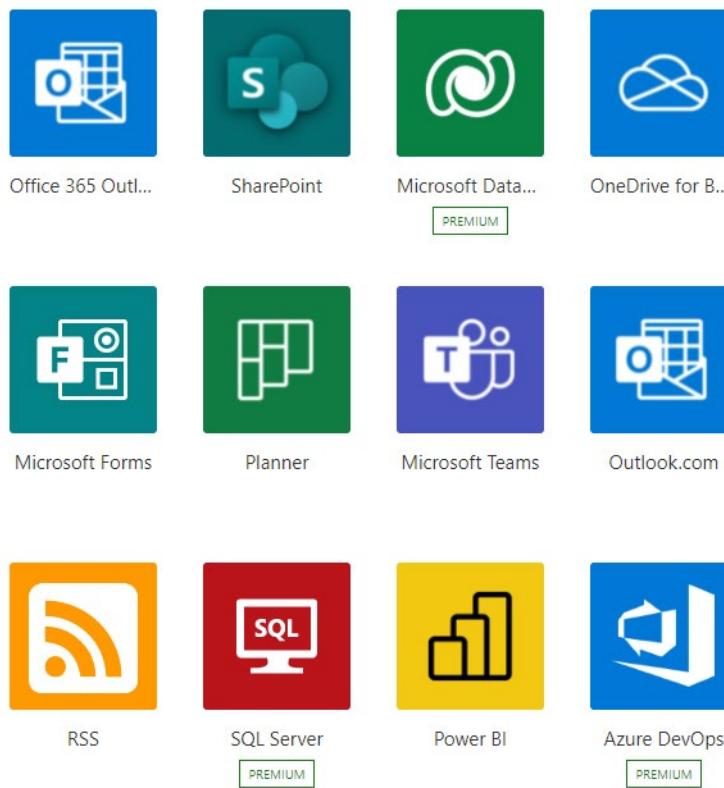
In this module, you will:

- Learn what Power Automate is and how it can be used
- Create a flow that automatically saves email attachments
- Learn how to create a button flow to send yourself a reminder
- Create a flow that runs on a schedule
- Create a flow that posts tweets
- Share a flow that your team can use

### What is Power Automate?

Power Automate is an online workflow service that automates actions across the most common apps and services. For example, you can create a flow that adds a lead to Microsoft Dynamics 365 and a record in MailChimp whenever someone with more than 100 followers tweets about your company.

When you sign up, you can connect to more than 500 services, and can manage data either in the cloud or in on-premises sources like SharePoint and Microsoft SQL Server. The list of applications you can use with Power Automate grows constantly.



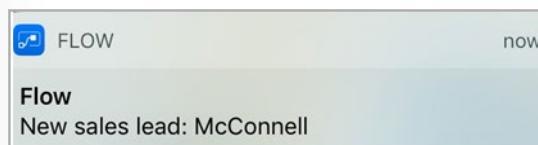
## What can you do with Power Automate?

You can use Power Automate to automate workflows between your favorite applications and services, sync files, get notifications, collect data, and much more.

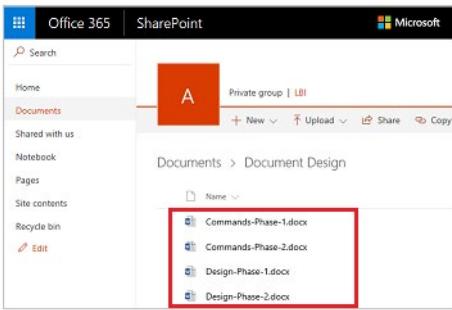
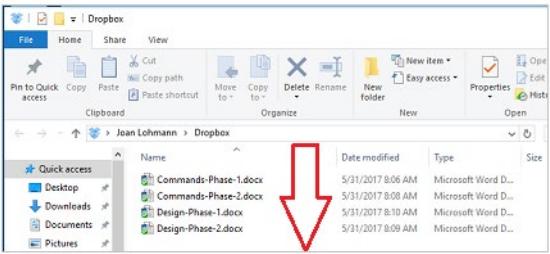
For example, you can automate these tasks:

- Instantly respond to high-priority notifications or emails.
- Capture, track, and follow up with new sales leads.
- Copy all email attachments to your OneDrive for Business account.
- Collect data about your business, and share that information with your team.
- Automate approval workflows.

A common use of Power Automate is to receive notifications. For example, you can instantly receive an email or a push notification on your phone whenever a sales lead is added to Dynamics 365 or Salesforce.



You can also use Power Automate to copy files. For example, you can ensure that any file that's added to Dropbox is automatically copied to SharePoint, where your team can find it.

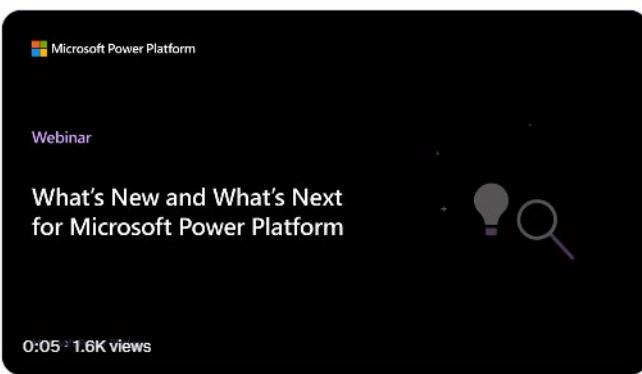


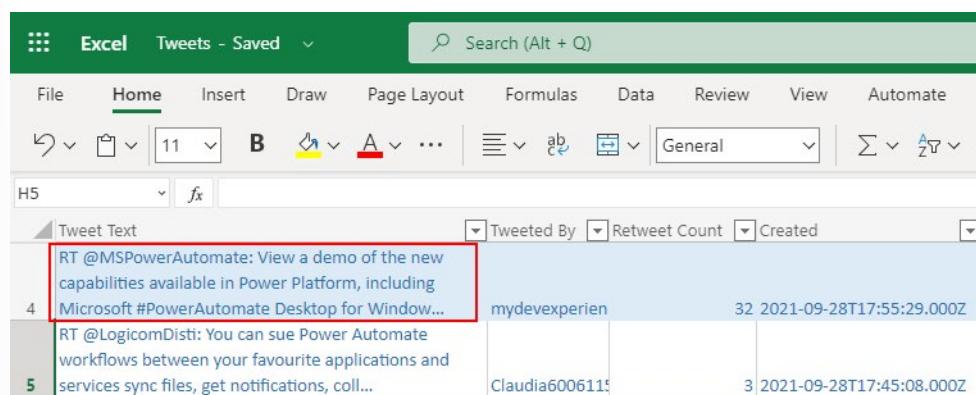
You can monitor what people are saying about your business by creating a flow that runs whenever someone sends a tweet with a certain hashtag. The flow can add details about each tweet to a Facebook post, a SQL Server database, a SharePoint list, or even a Microsoft Excel file that's hosted on OneDrive for Business--whichever service works for you.

You can create actions to connect the data you collect to Microsoft Power BI, spot trends in that data, and ask questions about it.

The following example shows a flow that saves tweets with the hashtag #MicrosoftFlow to an Excel file.

 Microsoft Power Automate  @MSPowerAutomate · Sep 24  
View a demo of the new capabilities available in Power Platform, including Microsoft #PowerAutomate Desktop for Windows 10, Microsoft Power Fx, and more: [msft.it/6012XbUXI](https://msft.it/6012XbUXI)

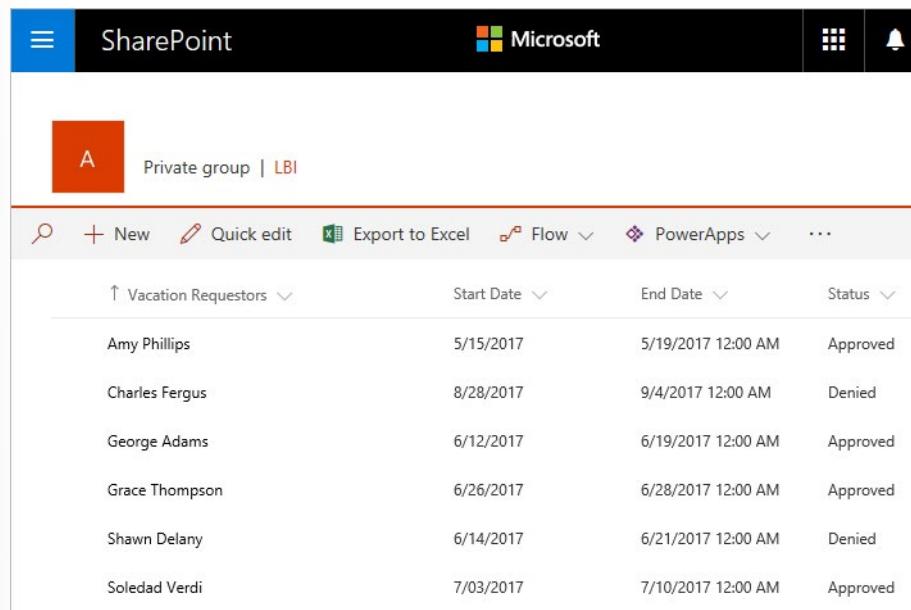




The screenshot shows a Microsoft Excel spreadsheet titled "Tweets - Saved". The table has columns for Tweet Text, Tweeted By, Retweet Count, and Created. The first row, which is highlighted with a red border, contains the text: "RT @MSPowerAutomate: View a demo of the new capabilities available in Power Platform, including Microsoft #PowerAutomate Desktop for Window...". The "Tweet Text" column also contains other tweet snippets like "RT @LogicomDisti: You can sue Power Automate workflows between your favourite applications and services sync files, get notifications, coll...".

	Tweet Text	Tweeted By	Retweet Count	Created
4	RT @MSPowerAutomate: View a demo of the new capabilities available in Power Platform, including Microsoft #PowerAutomate Desktop for Window...	mydevexperience	32	2021-09-28T17:55:29.000Z
5	RT @LogicomDisti: You can sue Power Automate workflows between your favourite applications and services sync files, get notifications, coll...	Claudia6006115	3	2021-09-28T17:45:08.000Z

Also, you can automate approval loops for things like vacation requests on a SharePoint list.



The screenshot shows a SharePoint list titled "Vacation Requests" within a "Private group". The list includes columns for "Vacation Requestors", "Start Date", "End Date", and "Status". The data shows several entries, all marked as "Approved".

Vacation Requestors	Start Date	End Date	Status
Amy Phillips	5/15/2017	5/19/2017 12:00 AM	Approved
Charles Fergus	8/28/2017	9/4/2017 12:00 AM	Denied
George Adams	6/12/2017	6/19/2017 12:00 AM	Approved
Grace Thompson	6/26/2017	6/28/2017 12:00 AM	Approved
Shawn Delany	6/14/2017	6/21/2017 12:00 AM	Denied
Soledad Verdi	7/03/2017	7/10/2017 12:00 AM	Approved

For more ideas, browse our list of templates. Templates help you build flows by making a few configuration changes. For example, you can use templates to easily build flows to send yourself weather forecasts, reminders at regular intervals, or phone notifications whenever your manager sends you mail.

	<b>Send myself a reminder in 10 minutes</b>	By Microsoft	Instant	303832
	<b>Get today's weather forecast for my current location</b>	By Microsoft	Instant	216639
	<b>Get a push notification when you receive an email from your boss</b>	By Microsoft	Automated	181614
	<b>Send a customized email when a new SharePoint list item is added</b>	By Microsoft	Automated	144443

Have an idea for a flow that you don't see in the list? Create your own from scratch and, if you want, share it with the community!

## Where can I create and administer a flow?

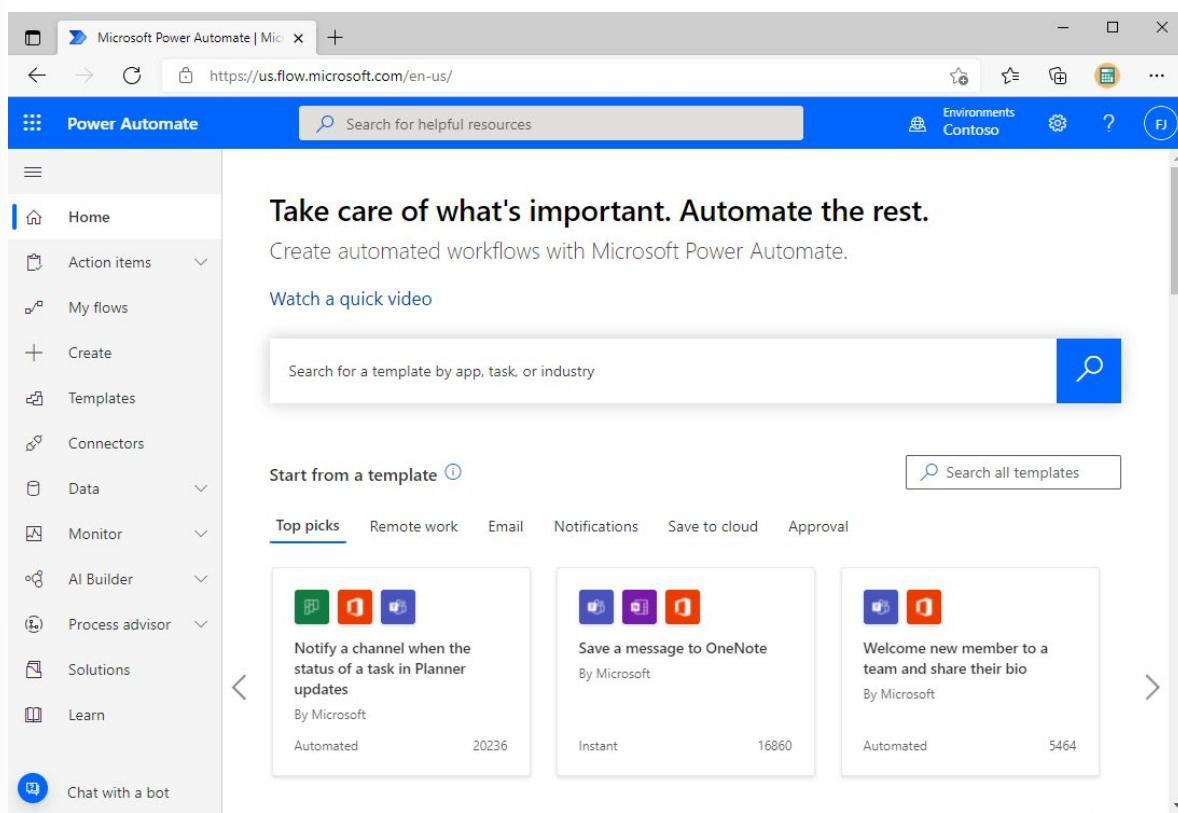
You can create a flow and perform administrative tasks in a browser or, if you download the Power Automate mobile app, on your phone.

Here are some of the tasks you can perform with the mobile app:

- Turn flows on or off from wherever you are.
- See when a flow has failed.
- Review detailed run history reports.
- View and filter runs by notification type.

## A brief tour of Power Automate

Let's jump into Power Automate, and we'll show you around. We have tons of information for you to learn about how to use Power Automate.



When you sign in to Power Automate, you'll find these menus:

- **Action items**, where you can manage approvals and business process flows.
  - **My flows**, where your flows reside.
  - **Create**, where you start a new flow.
  - **Templates**, where you can take a look at some of the most popular templates. These should give you some great ideas for flows you want to try.
  - **Connectors**, where you can connect from one service to another.
  - **Data**, where you can access entities, connections, custom connectors and gateways.
  - **Monitor**, where you can view the activity of all your cloud and desktop flows.
  - **AI Builder**, where you can build AI models and view the models you created or that have been shared with you.
  - **Process advisor**, where you can create processes to help your organization better understand places to streamline workflows.
  - **Solutions**, where you can manage your solutions.
  - **Learn**, where you can find information that will help you quickly ramp up on Power Automate.
- For now, let's focus on the ? menu next to your login, which has these options:
- **Documentation** is where our advanced topics reside. If you want to really understand a feature or function, you can do a deep dive here to figure things out.
  - **Learn** has learning paths to guide you through using Power Automate, all the way from beginning techniques to advanced scenarios.

- **Support** is a great landing place to find help.
- **Roadmap** is where you can get a glimpse into what will be made in the next product update.
- **Community** is a place to plug into and find out how other people use Power Automate.
- **Give Feedback** taps into a community of power users, and is where you can send comments and questions to developers and other experienced users.
- **Blog** keeps you up to date about the most recent developments and releases in the Power Automate ecosystem.
- **Desktop flows** provides an introduction to Power Automate Desktop.
- **Pricing** can help you choose the right plan for you or your business.
- **Power Automate Desktop** is where you can download Power Automate Desktop and install it on your machine.
- **Power Automate for Mobile** provides information about the mobile app and the platforms it is available on.
- **Data Gateway** provides an overview of the on-premises data gateway.

## What's next?

Let's take a look at the different types of flows that are available in Power Automate.



<https://www.microsoft.com/videoplayer/embed/RWGzz0>

## Exercise - Create your first flow

In this unit, you'll learn more about Power Automate as you build your first flow.

Since it can be time consuming to search for attachments in your emails, creating a flow can save you time by storing all your email attachments in a folder in your Microsoft OneDrive for Business account.

If you would like to see the process of creating flows, watch the following video.



<https://www.microsoft.com/videoplayer/embed/RWGzyZ>

The following steps will guide you through the process of creating flows.

## Create a flow

For your first flow, you'll create a flow by using a template.

1. Sign in to **Power Automate**<sup>1</sup>, and select the **Templates** on the left menu.

The screenshot shows the Microsoft Power Automate web interface. On the left, there's a sidebar with options like Home, Action items, My flows, Create, Templates (which is selected and highlighted in blue), Connectors, Data, Monitor, AI Builder, Process advisor, Solutions, Learn, and Chat with a bot. The main area is titled 'Browse Templates | Microsoft Power Automate' and shows a search bar with 'Save Office 365 email attachments to OneDrive for Business'. Below the search bar, there are several filter buttons: All flows (which is selected and highlighted in blue), Featured, Shared with me, Remote work, Approval, Button, Visio, Data collect, and more. There are three main sections of templates displayed as cards:

- Save Office 365 email attachments to specified OneDrive for Business folder**: By Microsoft Flow Community, Automated, 53877 views.
- Save Office 365 email attachments to OneDrive for Business**: By Microsoft, Automated, 843557 views. This card is highlighted with a red border.
- Save new email attachment to OneDrive and get a push notification**: By Microsoft, Automated, 3225 views.
- Save attachments to OneDrive (Business) on new email in shared mailbox**: By Microsoft Flow Community, Automated, 5263 views.
- Save new email attachments in SharePoint and add a row to Excel**: By Microsoft Flow Community, Automated, 5772 views.
- Create OneNote(Business) page and send notification when new email arrives**: By Microsoft Flow Community, Automated, 285 views.

2. Search for and select the **Save Office 365 email attachments to OneDrive for Business** template.
3. Once the connections to the **Office 365 Outlook** and **OneDrive for Business** connectors are created, select **Create flow**. The page will navigate to the **Details** of the new flow.  
If you regularly use both the **Office 365 Outlook** and **OneDrive for Business** connectors, flow will connect to them automatically. If you don't, you will be prompted to provide your credentials.
4. In the next page, Power Automate will display the new flow with the following information:
  - **Details** displays information such as Flow Name, Description, Owner, Status, and Created and Modified dates.
  - **Connections** displays information about the connectors used in the flow.
  - **Owners** displays information about the flow owners.

<sup>1</sup> <https://ms.flow.microsoft.com/>

The screenshot shows the 'Save Office 365 email attachments to OneDrive for Business' flow settings. It includes sections for 'Details', 'Connections', and 'Owners'. The 'Details' section shows the flow name, status (On), creation date (Sep 28, 04:22 PM), modified date (Sep 28, 04:22 PM), type (Automated), and plan (Per-user plan). The 'Connections' section lists 'Office 365 Outlook Permissions' and 'OneDrive for Business Permissions'. The 'Owners' section shows 'FJ'. A '28-day run history' section indicates no runs have occurred yet.

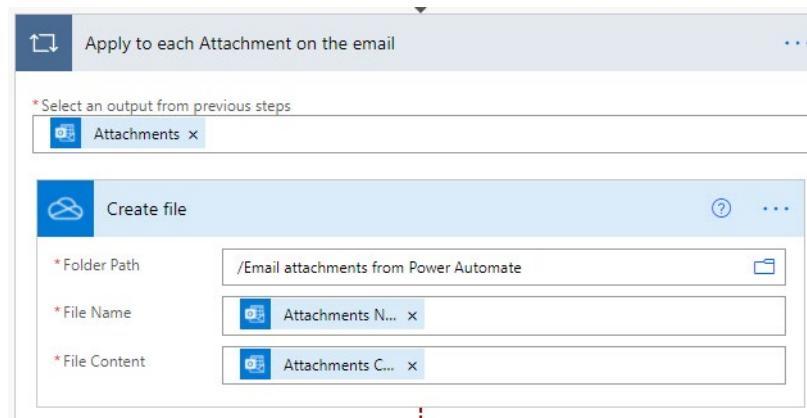
- **28-day run history** displays all the flow runs for the last 28 days.

The screenshot shows the 'On new email' trigger configuration. It includes fields for 'Folder' (Inbox), 'To', 'CC', 'To or CC', 'From', 'Include Attachments' (set to 'Yes'), 'Subject Filter', 'Importance' (Normal), and 'Only with Attachments' (set to 'Yes'). The 'Include Attachments' and 'Only with Attachments' fields are highlighted with red boxes.

are set to **Yes**.

2. The next action is an **Apply to each** loop and it has been renamed to **Apply to each Attachment on the email**. This loop contains the rest of the actions because each one will be executed for each of the attachments.

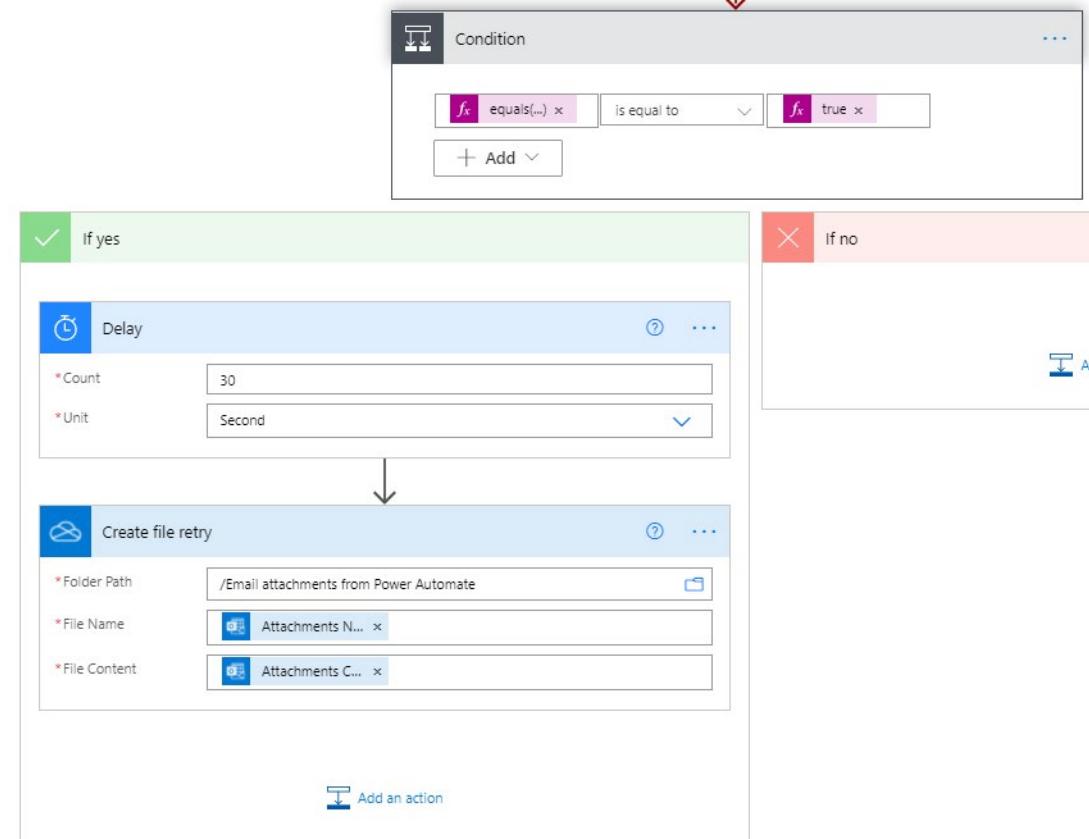
3. The next action is the **OneDrive for Business - Create file**. It creates a file in the specified location



with the provided **File Name** and **File Content**.

4. The next action is a **Condition**. It checks if the **statusCode** of the **Create file** action is equals to **409**.  
This action is only executed if the **Create file** action is skipped.  
5. If the **Condition** is true, the **Delay** action is executed to delay the flow for 30 seconds. After the 30 seconds are complete, the **Create file retry** action is executed.

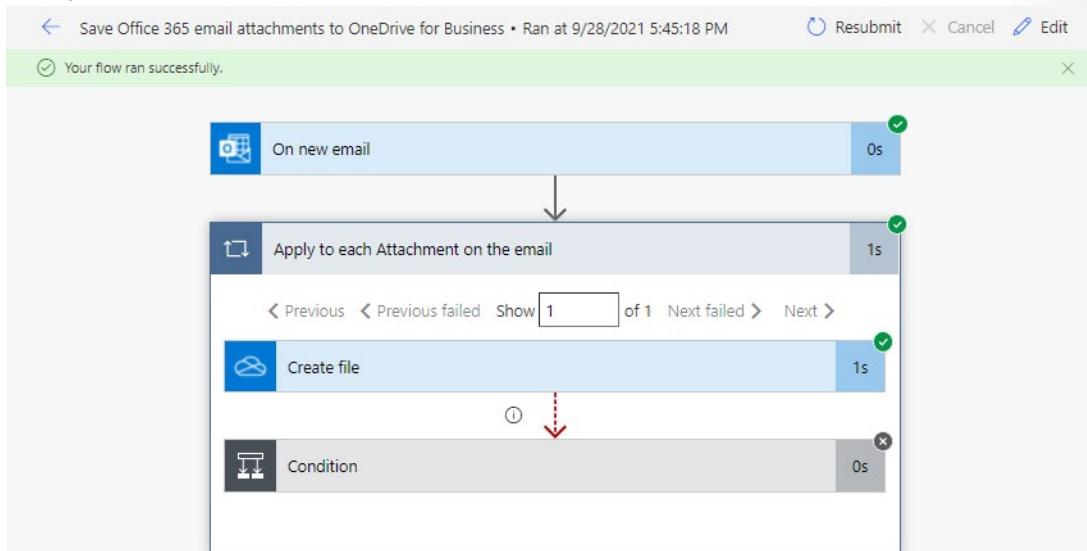
The **Create file retry** action is the same **OneDrive for Business - Create file** action. It has been



renamed to distinguish it from the **Create file** action above the **Condition**.

## Test the flow

1. Send yourself an email with an attachment, or have another user send an email with an attachment.



Wait until the flow is done running and select the first run history to see the results.

## Important concepts in Power Automate

Keep these concepts in mind when building flows:

- Every flow has two main parts: a *trigger*, and one or more *actions*.
- You can think of the trigger as the starting action for the flow. The trigger can be something like a new email arriving in your inbox or a new item being added to a SharePoint list.
- Actions are what you want to happen when a trigger is invoked. For example, the new email trigger will start the action of creating a new file on OneDrive for Business. Other examples of actions include sending an email, posting a tweet, and starting an approval.

These concepts will come into play later, when you build your own flows from scratch. In the next unit, we'll look at the Power Automate mobile app and its capabilities.

## Exercise - Learn to use the Power Automate mobile app

Of course, we have an app, the Power Automate mobile app! From this app, you can access these features:

- Activity Feed
- Browsing
- Buttons
- Managing Flows

First, you'll need to download and install the Power Automate mobile app from your app store.

After it's installed, start it and sign in.

When you first start the app, you'll see the Activity Feed. The Activity Feed is the place to see what's happening with your flows. It won't be the full experience you'd expect from your PC, but it will show you useful details.

For example, you'll see a flow's last activity. You can see whether the flow succeeded or failed. If it failed, you'll see which step it failed on.

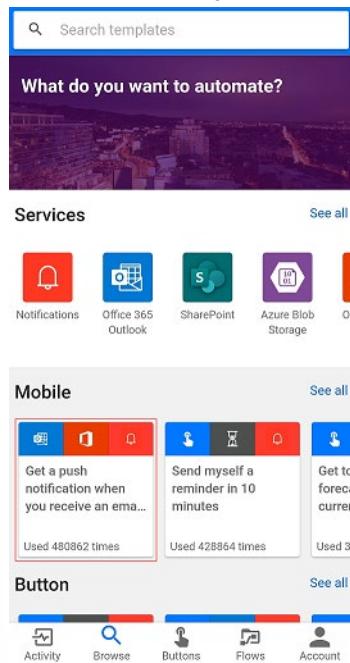
## How button flows are started

Buttons are flows that are started through a manual action. For example, you can create a button to send a *Working from home today* email to your manager. If you live far from your workplace, you can then use this button on days when the traffic is a mess!

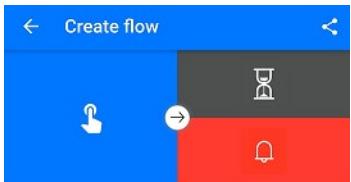
- Select **Buttons** to use some of these flows.
- Select **Browse** to check out templates for more button flows that you can add to your collection.

To show you how you can use buttons, we'll use the **Send myself a reminder in 10 minutes button** template.

1. Select **Browse**.
2. Select the **Send myself a reminder in 10 minutes button** flow.



3. Select **Use this template**.



Send myself a reminder in 10 minutes

Use this template to send yourself a custom delayed reminder which can be triggered with a button tap - for example, when you are close to completing a meeting or when you step into the office.

By Microsoft  
Used 428868 times

4. Select **Create**, and then select **Done**.

The flow is saved.

DONE

That's it! We've saved this to your flows.



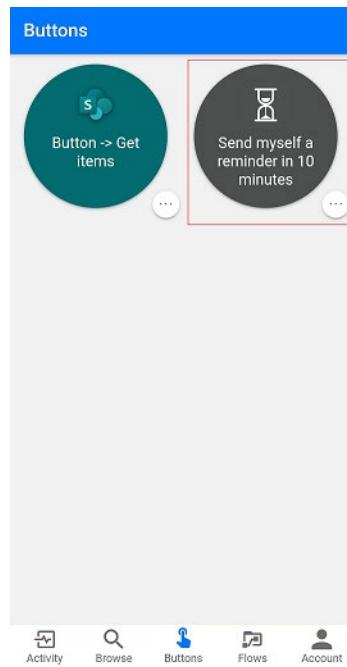
Now you can share this button with your colleagues.

SHARE BUTTON

MANAGE FLOW

Tell friends about Flow! >

5. Select **Buttons** to see the new flow.



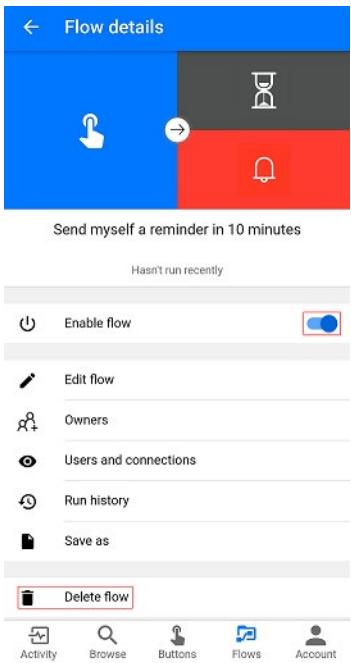
6. Select the flow. In 10 minutes, you'll get a reminder.

It's simple to add more buttons to your collection.

## Modify or delete a flow

If you want to change or delete one of your flows, it's easy.

1. Select **Flows**.
2. Select one of your flows.
3. Select one of the options:
  - To enable or disable the flow, toggle the **Enable flow** option on or off.
  - To change the flow, select **Edit flow**.
  - To get an idea of the successful and unsuccessful runs of the flow, select **Run history** to view the history of the flow.
  - To delete a flow, select **Delete flow**.



The next unit shows how to create recurring flows.

## Exercise - Create recurring flows

In this unit, you'll learn how to build prescheduled flows by using a trigger called *recurrence*. You'll build a flow for the Contoso marketing team that automatically pulls customer email addresses from a Microsoft Excel workbook on Microsoft OneDrive. You'll then set up the flow so that, once a day, any new email addresses that were added to the workbook are added to a MailChimp customer list.

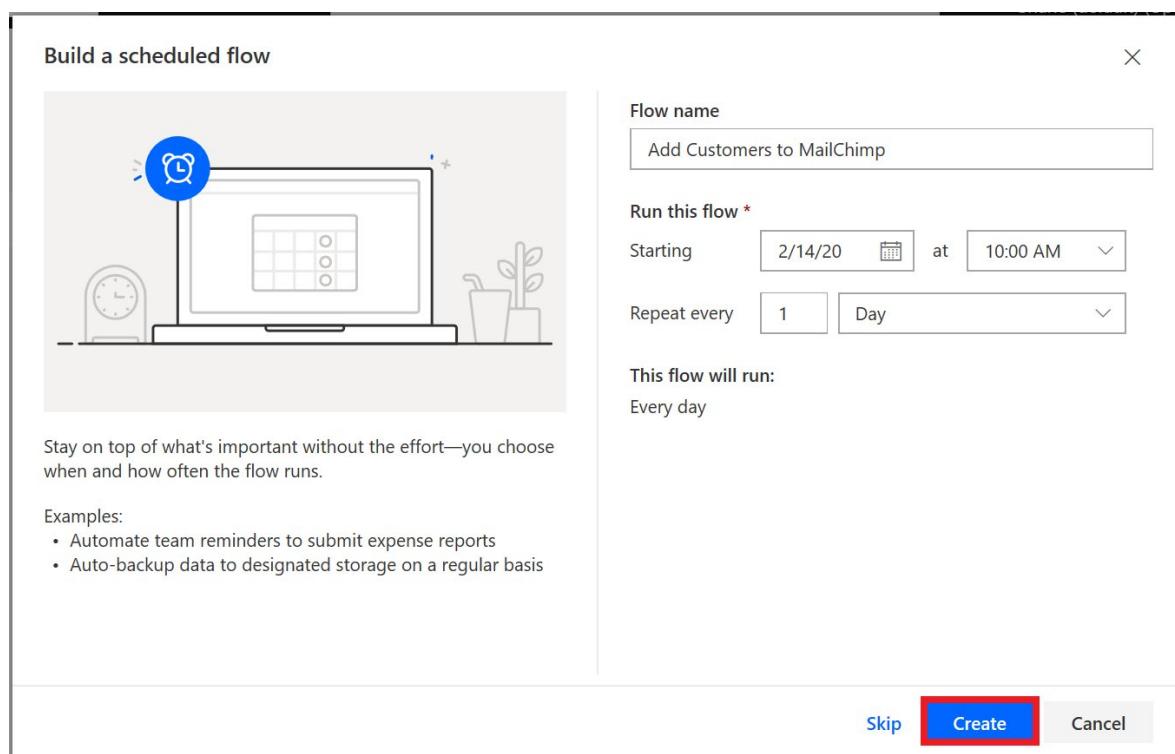
### Prerequisites

For this scenario, you will need to make an Excel file with a table that contains the following columns: ContactEmail, FirstName, and LastName. Save the Excel file in OneDrive for Business. You'll connect to this file in step 9.

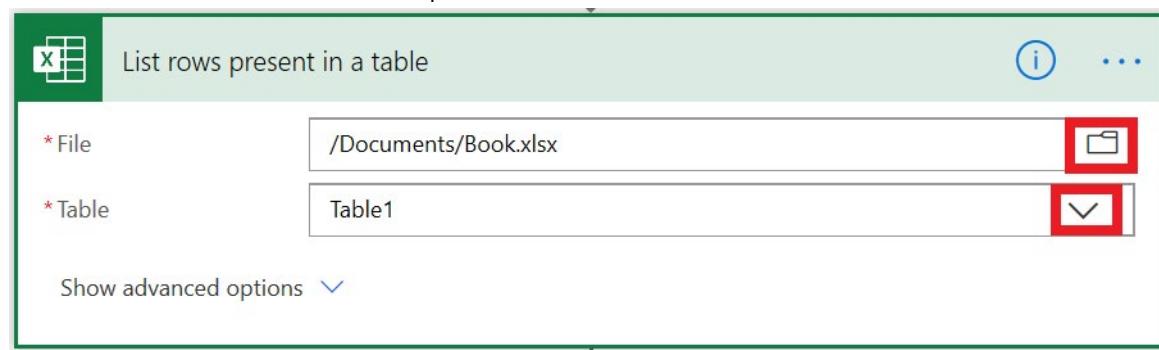
### Create a scheduled flow

1. Sign in to **Power Automate<sup>2</sup>** by using your organizational account.
2. Select **My flows**.
3. Select **New**, and then select **Scheduled-from blank**.
4. Name your flow and under **Run this flow** set the flow to repeat every one Day.

<sup>2</sup> <https://ms.flow.microsoft.com/>



5. Select **Create**.
6. Select **New step**, to add an action.
7. In the search field, enter *excel*, select the **Excel Online (Business)** service, and then select the **List rows present in a table** action.
8. In the **File name** field, select the folder button, and then select the Excel file to use.
9. In the **Table name** box, select the drop-down arrow, and then browse to and select the worksheet to



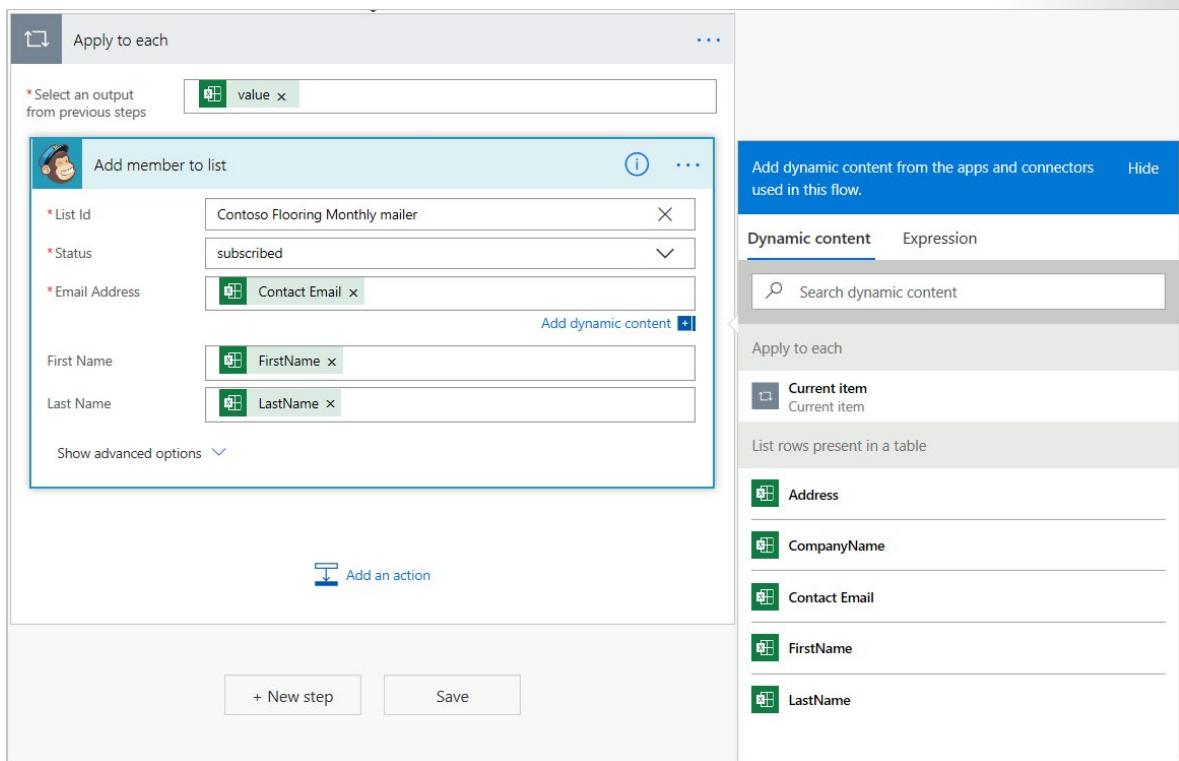
use.

10. Select **New step**, and then select **Add an action**.
11. In the search field, enter *chimp*, select the **MailChimp** service, and then select the **MailChimp - Add member to list** action.

**Note:** MailChimp is a premium connector. Depending on your Power Automate license, you might need to sign up for a trial to use this connector.
12. In the **List Id** field, select the desired MailChimp mailing list. In the **Status** field, select *subscribed*.
13. In the **Email Address** field, use the dynamic content feature to add the **ContactEmail** field.

Notice that the flow automatically creates another step. Flow detects that you're setting up an action

that requires another action. Whenever the flow reads a new email address, it will also create a new action for each row.



14. Use the dynamic content feature to fill in the **First name** and **Last name** fields.

And there you have it!

This flow will now run once a day, get the new rows from the Excel worksheet, grab the email address and name from each row, and enter the email address and name in the Contoso MailChimp mail list, saving you both time and money.

## Exercise - Send an email when a tweet is posted

You can create a flow that automatically performs one or more actions after it's triggered by an event. For example, the flow can notify you by email when someone posts a tweet that includes a keyword that you specify. In this example, posting a tweet is the event (also known as a *trigger*), and sending an email notification is the action. In this unit, you'll learn how to create this example flow.

### Prerequisites

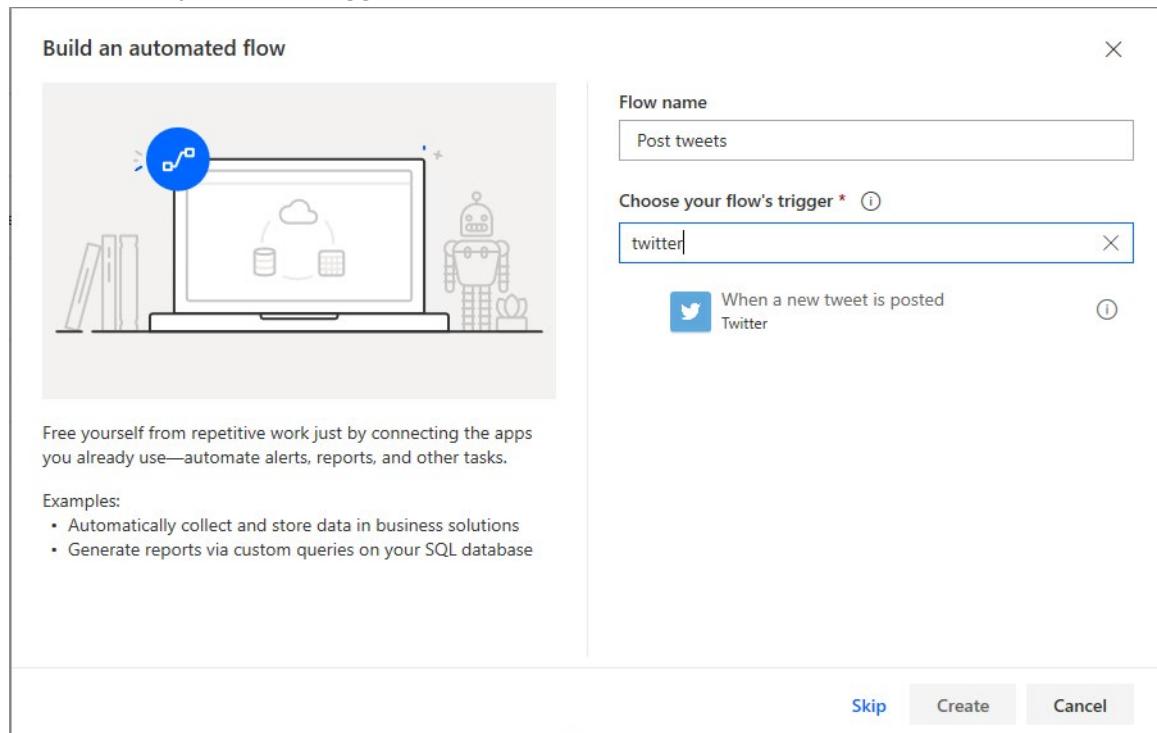
- An account on [flow.microsoft.com](https://flow.microsoft.com)<sup>3</sup>
- A Twitter account
- Microsoft Office 365

<sup>3</sup> <https://flow.microsoft.com/>

## Specify an event to start the flow

First, you must select the trigger (event) that starts the flow.

1. Sign in to **Power Automate**<sup>4</sup> by using your organizational account.
2. Select **My flows**.
3. Select **New**, and then select **Automated—from blank**.
4. Under **Choose your flow's trigger**, enter *twitter*, select the **Twitter - When a new tweet is posted**



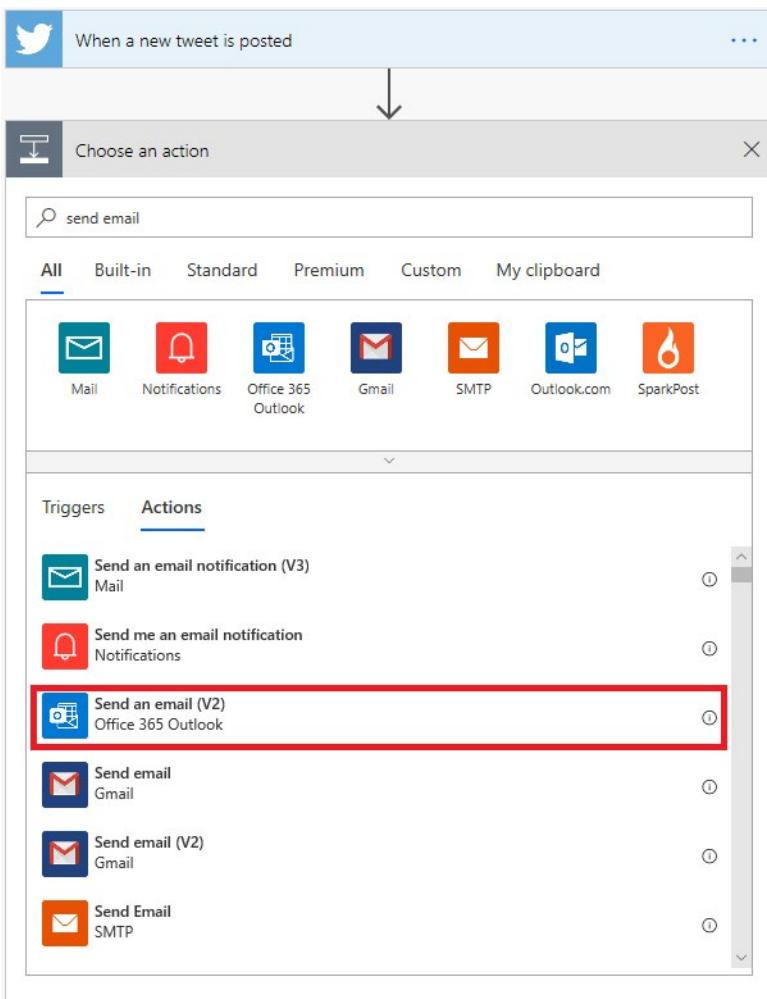
trigger and select **Create**.

5. If you haven't already connected your Twitter account to Power Automate, select **Sign in to Twitter**, and then enter your credentials.
6. In the **Search text** box, enter the keyword to find.

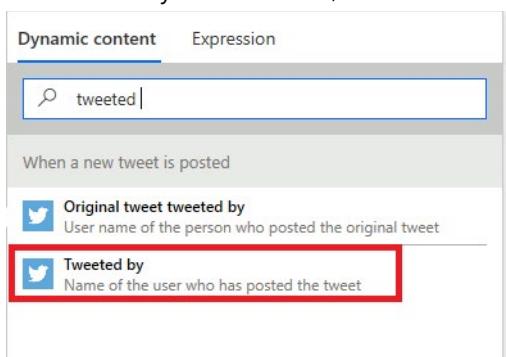
<sup>4</sup> <https://flow.microsoft.com/>

## Specify an action

1. Select **New step**, and in the search field, enter *send email*, and then select the **Office 365 Outlook - Send an email** action.



2. If you're prompted to sign in, select the sign-in button, and then enter your credentials.
3. In the **To** field, enter or paste your email address, and then select your name in the list of contacts that appears.
4. In the **Subject** field, enter **New tweet from:** followed by a space.
5. In the list of dynamic content, select the **Tweeted by** token to add a placeholder for it.



6. Select the **Body** field, and then, in the list of dynamic content, select the **Tweet text** token to add a placeholder for it.
7. Optional: Add more tokens, other content, or both to the body of the email.
8. Select **Save** to save the flow.
9. Post a tweet that includes the keyword that you specified, or wait for someone else to post such a tweet.

Within a minute after the tweet is posted, an email message will notify you of the new tweet.

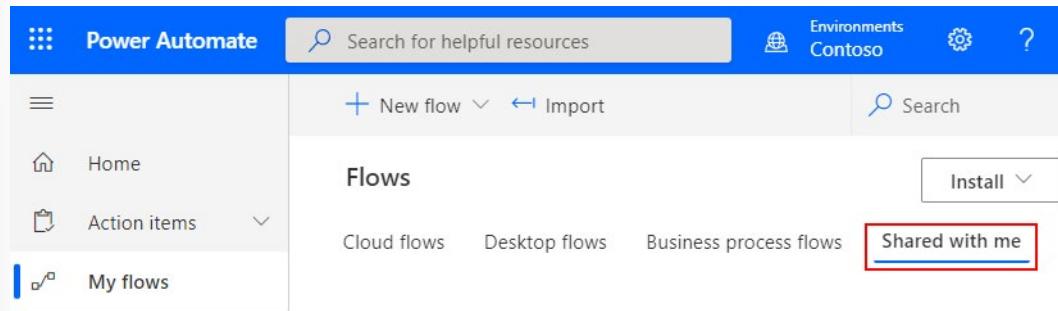
## Exercise - Share flows

Shared flows extend the potential of Power Automate to groups of people. After all, why should just one person enjoy the benefits of increased automation in his or her work environment?

Here are some advantages of shared flows:

- Multiple people can own and manage a flow together.
- If the creator of a shared flow leaves the organization, the other owners of the flow can continue to run it.
- All owners of a shared flow can view its history, manage its properties, edit it, add and remove owners, and delete it.

If you're the creator or an owner of a shared flow, you'll find it listed on the **Shared with me** tab in **Power Automate**<sup>5</sup>.



### Note:

- Shared connections can be used only in the flow in which they were created.
- Owners can use services in a flow, but they can't change the credentials for a connection that another owner created.

## Prerequisites

To create a shared flow, you must have a **paid Power Automate plan**<sup>6</sup>. Also, to add more owners to a shared flow or remove owners from it, you must be the creator or an owner.

<sup>5</sup> <https://flow.microsoft.com/>

<sup>6</sup> <https://flow.microsoft.com/pricing/>

## Create a shared flow

You create a shared flow by adding more owners to an existing flow. After new owners are added to a flow, the flow appears on the **Shared with me** tab.

1. Sign in to **Power Automate**<sup>7</sup> using your organizational account.
2. Select **My flows**.

The screenshot shows the 'Flows' interface in Power Automate. At the top, there are tabs for 'Cloud flows', 'Desktop flows', 'Business process flows', and 'Shared with me'. Below the tabs is a table with columns: Name, Modified, and Type. The first row in the table is for a flow named 'Get Tweets', which was modified '3 sec ago' and is of type 'Autom...'. The 'Share' button for this flow is highlighted with a red box.

3. Select the **Share** button for the flow that you want to change.
4. In the **Owners** section, enter the name, email address, or group name of the person or group that you want to add as an owner.
5. In the list that appears, select the user or group to add.  
The user or group becomes an owner of the flow.

Keep in mind that when you share a flow, it appears on the **Shared with me** tab. It no longer appears on the **Cloud flows** tab.

## Add a SharePoint list as a co-owner of a flow

You can add a Microsoft SharePoint list as a co-owner of a flow. In that way, everyone who has edit access to the list automatically gets edit access to the flow. After the flow is shared, you can just distribute a link to it.

## Restrictions on changes to flows

Any owner of a shared flow can contribute connections to a flow. After another person has access to the flow, that person can use any connections in it, but only within the scope of that flow.

For example, John creates a flow that updates items in SharePoint with his account, and he shares the flow with Mary. In this case, Mary will be able to change the use of SharePoint inside that flow, but not in any of her personal flows. Likewise, Mary can change the flow so that it uses her SharePoint connection, but John still won't be able to use that new SharePoint connection in any of his flows.

To view all the connections that are used by a flow, select the **Share** button, and inspect the list of embedded connections.

<sup>7</sup> <https://flow.microsoft.com>

## Remove an owner

**Important:** If you remove an owner whose credentials are used to access Power Automate services, be sure to update the credentials for those connections, so that the flow continues to work correctly.

The screenshot shows the Microsoft Power Automate interface. At the top, there's a navigation bar with 'Flows' and an 'Install' button. Below it, tabs for 'Cloud flows', 'Desktop flows', 'Business process flows', and 'Shared with me' are shown, with 'Cloud flows' being the active tab. A search bar is also present. The main area displays a list of flows. One flow, 'Get Tweets', is highlighted with a red box around its 'Shared with me' button. The columns in the list are 'Name', 'Modified', and 'Type'. The 'Modified' column shows '3 sec ago' and the 'Type' column shows 'Autom...'. Other icons in the list include a checkmark, a Twitter icon, and a pencil icon.

1. On the **Shared with me** tab, select the **Share** button for the flow that you want to change.
2. Select the **Delete** button for the owner that you want to remove.

## Embedded and other connections

The connections that are used in a flow fall into two categories:

- **Embedded:** These connections are used in the flow.
- **Other:** These connections have been defined for the flow, but they aren't used in it.

If you stop using a connection in a flow, that connection appears in the **Other** connections list. It will remain there until an owner includes it in the flow again.

To view the list of connections, change the shared flow.

- On the **Shared with me** tab, select the **Share** button for the flow that you want to change. The list of connections appears under the list of owners in the flow's properties.

## Troubleshoot flows

In this unit, you'll learn how to troubleshoot common issues that might occur while you run your flows.

## Identify the error

Before you can fix a flow, you must identify why it failed. You will get an email with a list of failures each week.

1. Select the **Monitor** and then **Cloud flow activity** on the left menu (or select the **Activity** tab in the

Flow Name	Runs	Time Ago
Get Tweets	84 times	8 minutes ago
Email Body Length	2 times	3 hours ago
Populate Flow Group	1 times	6 hours ago
Daily Reminder   Assigned Tasks	1 times	7 hours ago
Get OnSite People   v2	1 times	13 hours ago

mobile app), and then select your flow in the list that appears.

2. Details about the flow appear, and at least one step has a red exclamation point (!) symbol. Open that

The screenshot shows a Microsoft Power Automate flow interface. At the top, a pink header bar indicates "Flow run failed." Below it, the flow steps are listed:

- "When a new email arrives" (green checkmark)
- "Html to text" (green checkmark)
- "Compose" (red exclamation mark icon)

A tooltip for the "Compose" step displays the error message: "InvalidTemplate. Unable to process template language expressions in action 'Compose' inputs at line '1' and column '3287': 'The template language function 'length' expects its parameter to be an array or a string. The provided value is of type 'Null'. Please see https://aka.ms/logicexpressions#length for usage details.'". To the right of the flow, there are two "Error Details" boxes. The first box shows the start time as "Sep 28, 07:39 PM (21 h ago)" and duration as "19 ms". The second box contains the detailed error message: "Unable to process template language expressions in action 'Compose' inputs at line '1' and column '3287': 'The template language function 'length' expects its parameter to be an array or a string. The provided value is of type 'Null'. Please see https://aka.ms/logicexpressions#length for usage details.'".

step, and review the error message.

## Authentication failures

In many cases, flows fail because of an authentication error. If this type of error occurs, the error message includes the word "Unauthorized," or an error code of 401 or 403 appears. You can usually fix authentication errors by updating the connection.

1. You can view the connections by opening up the flow details by selecting the flow from **My Flows**.
2. Scroll to the connection that you saw the "Unauthorized" error message for.
3. Next to the connection, select the **Fix connection** link in the message that states that the connection hasn't been authenticated.
4. Verify your credentials by following the instructions that appear. Then return to your flow-run failure, and select **Resubmit**.

The flow should now run as expected.

## Action configuration issues

Flows sometimes fail if a setting in one of the flow's actions doesn't work as expected. In this case, the error message includes the phrase "Bad request" or "Not found," or an error code 400 or 404 appears.

The error message should indicate how to fix the failure.

1. Select the **Edit** button, and then fix the issues inside the flow definition.
2. Save the updated flow, and then select **Resubmit** to try to run the flow again with the updated configuration.

## Temporary issues

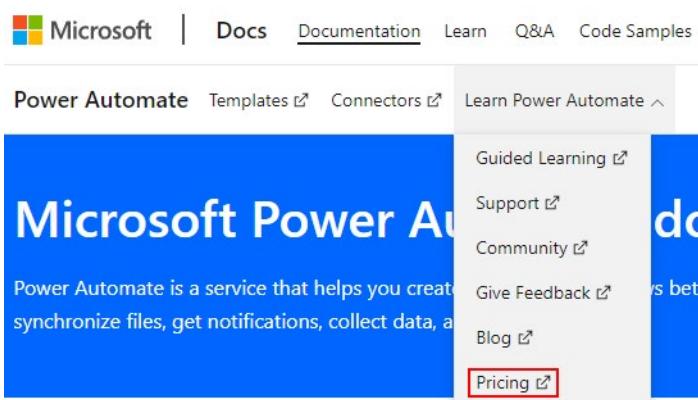
If error code 500 or 502 appears, the failure is temporary or transient.

- Select **Resubmit** to try to run the flow again.

## Issues with your pricing plan

Sometimes your flows might behave unexpectedly because you aren't using the correct plan.

- To view your plan, in Power Automate, select **Learn**. It will redirect you to the **Microsoft Power Automate documentation** page. Here select **Learn Power Automate**, and then select **Pricing**.



Learn more about **pricing and how to switch plans**<sup>8</sup>.

## Issues with data usage

You might have run out of data that you can use.

- If you're on a free plan or a trial plan, select the **Settings** button (the gear symbol) to show your current usage against your plan.



<sup>8</sup> <https://flow.microsoft.com/pricing/>

- If you're on a paid plan, runs are pooled across all users in your organization. We're working on features that will show information about available quotas and usage across an organization.

**Important:** If you exceed your data limit, Power Automate throttles your flow runs.

Learn more about [usage limits<sup>9</sup>](#).

## You might be running flows too often

Your plan determines how often your flows run. For example, your flows might run every 15 minutes if you're on the free plan. If a flow is triggered less than 15 minutes after its last run, it's queued until 15 minutes have passed.

Whenever a flow is triggered, whether by an automatic trigger or because you manually start it, the action counts as a run. Checks for new data don't count as runs.

Learn more about [usage limits<sup>10</sup>](#).

## You might be using an incorrect account

If you sign in by using a Microsoft account (for example, an account that ends with @outlook.com or @gmail.com), you can use only the free plan. To take advantage of the features of the paid plan, sign in by using your organizational account or school email address.

To upgrade, use an organizational account or a school account, or create a [Microsoft Office 365 trial account<sup>11</sup>](#).

## Some flows run more often than expected

Some flows might run more often than you expect. For example, you create a flow that sends you a push notification whenever your manager sends you an email. That flow must run every time you get an email from anyone, because the flow must check whether the email came from your manager. This action counts as a run.

## Other issues that are based on limits, and caveats

You might have issues that are based on other limits:

- Each account can have up to:
  - 600 flows.
  - 50 custom connectors.
  - 20 connections per application programming interface (API) and 100 connections total.
- You can install a gateway only in the default environment.
- Some external connectors, like Twitter, implement connection throttling to control the quality of service. Your flows might fail when throttling is in effect. If your flows are failing, review the details of the run that failed in the flow's run history.

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<sup>9</sup> <https://flow.microsoft.com/pricing/>

<sup>10</sup> <https://flow.microsoft.com/pricing/>

<sup>11</sup> <https://powerbi.microsoft.com/documentation/powerbi-admin-signing-up-for-power-bi-with-a-new-office-365-trial/>

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *How can you create a flow that reoccurs daily?*

- Create the flow and connect the flow to a calendar.
- Create the flow and set the flow flag frequency to daily reoccurrence.
- Set the Schedule – Recurrence trigger frequency to daily and interval to 1.
- Create the flow and set the flow flag frequency to hourly and the value to 24.

### Multiple choice

2. *Every flow has two main parts, a trigger, and one or more actions. Which of the following best describes an action?*

- Actions are what you want to happen when a trigger is invoked.
- Actions will trigger the frequency of the flow reoccurrence.
- Triggers are what you want to happen when an action is invoked.
- Flow actions trigger the flow to occur as long as the defined value of the trigger is met.

### Multiple choice

3. *You would like to be alerted to when a change is made to a SharePoint list, what are some ways in which Power Automate can help?*

- Power Automate can send up a flare near you to alert you of changes.
- You can write a flow with Power Automate to send push notifications, texts, or emails for various triggers.
- Sorry, Power Automate can't help with that.
- Power Automate can send out a tweet whenever a list item is changed.

## Summary

Let's quickly review what we covered in this module.

In this module, you learned the basics of Power Automate, including the difference between triggers and actions and how to create flows for yourself or your team. You created a flow that automatically saves email attachments, one that alerts you of relevant tweets and a button flow to send yourself a reminder.

# Build more complex flows with Power Automate

## Learn to build more complex flows

In the previous module for Power Automate, you learned how to build some basic flows that save email attachments and send you reminders from your phone.



In this module, you'll now build some more complex flows and increase your knowledge.

If you're a beginner with Power Automate, this module will expand your business flow skills. If you already have some experience, this module will tie concepts together and hopefully help fill in the gaps.

Be more productive, automatically: that's what Power Automate is all about.

So, let's get started!

## Exercise - Build an approval request

In this unit, you'll learn how to build a business-friendly scenario that uses approvals.

In this scenario, anyone who has access to the Microsoft SharePoint list can contribute tweets without knowing anything about Twitter. The social media team can then approve or reject those tweets allowing that team to remain in control of the account and the content that goes out to customers.

### Prerequisites

- Access to **Power Automate**<sup>12</sup>.
- A Microsoft Office 365 account with access to SharePoint.
- A Twitter account.

### Step 1: Create a SharePoint list for tweets

You'll use a template that starts an approval process whenever a new item is created in a specific list. If the item is approved, a tweet is posted to Twitter. For this unit, you'll change the process by adding steps that update a SharePoint list with the approval response, indicate whether the item was approved, and add any comments that the approver added to the proposed tweet.

First, let's create the SharePoint list.

1. On your SharePoint site, create a SharePoint list and name it *ContosoTweets*.

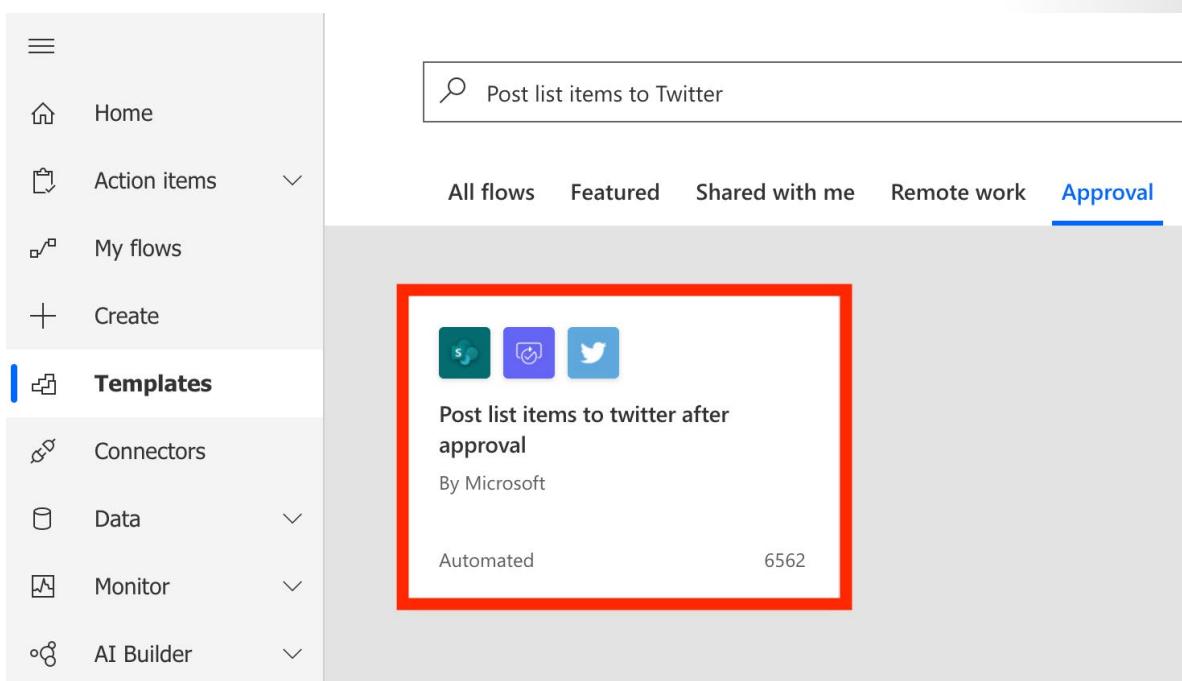
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<sup>12</sup> <https://flow.microsoft.com/>

2. Open the list, and select **+ Add column** to add the following columns. Select **Save** after you create each column.
  - Add a *Multiple lines of text* column and name it *TweetContent*. This column will hold the content of the tweets that will require approval.
  - Add a *Date and time* column and name it *TweetDate*. Toggle the **Include Time** option to Yes.
  - Add a Yes/No column and name it *ApprovalStatus*. Set the Default value to **No**, which will ensure all items must be reviewed by the approver before the tweet can be approved.
  - Add a *Single line of text* column and name it *ApproverComments*. The approver can then add a comment about the approval status.
3. Copy the URL of the SharePoint list. You'll use it when you create the flow.

## Step 2: Create an approval request flow

1. Sign in to **Power Automate**<sup>13</sup>, and then select **Templates**.



2. Search **Post list items to Twitter** under **Approval** and select the appropriate template.
3. Make sure your account credentials for **SharePoint**, **Approvals**, and **Twitter** are entered and are correct. If any of these connections are not entered, select the **+** icon next to the connection and enter your credentials accordingly.
4. Once all of these connections are set up properly, select **Continue** to proceed.
5. In the **When a new item is created** trigger, enter the following values:
  - **Site Address:** Enter the URL of your team's SharePoint site.
  - **List Name:** Select *ContosoTweets*.

<sup>13</sup> <https://ms.flow.microsoft.com/>

6. In the **Start an approval** action, set the **Title** field to \*New tweet for \*, and then select **Title** from the

The screenshot shows the 'Start an approval' action configuration in Microsoft Flow. The 'Title' field is populated with 'New tweet for' followed by a dynamic content placeholder 'Title'. To the right, the 'Dynamic content' window is open, showing search results for 'Title'. A red box highlights the 'Title' placeholder in the search results.

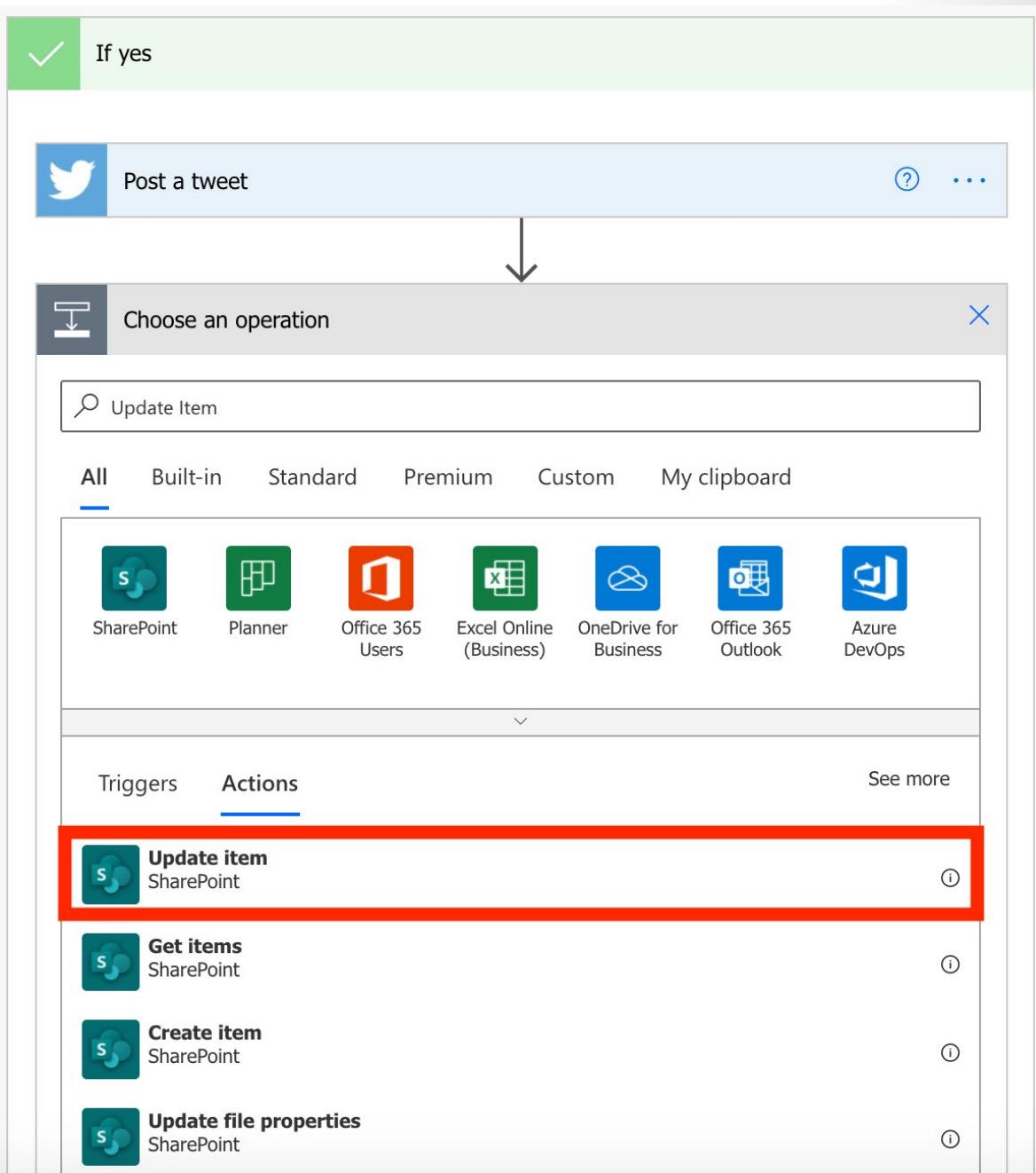
**Dynamic content** window.

7. In the **Assigned to** field, enter and select either your name or the name of a test user.
8. In the **Details** field, remove the default items, add dynamic fields and text to get **TweetContent** on **TweetDate** by **Created by DisplayName**.
9. In the **Item Link** field, select **Link to Item** from the **Dynamic content** window.

The screenshot shows the 'Start an approval' action configuration after completing steps 7-9. The 'Assigned To' field is set to 'Nestor Wilke'. The 'Details' field contains 'TweetContent' on 'TweetDate' by 'Created By Dis...'. The 'Item Link' field is set to 'Link to item' with a description of 'Contoso Tweet List'.

10. In the **Item Link Description** field, enter *Contoso Tweet List*.

11. In the **If yes** section of the **Condition**, select **Add an action**.



12. Search for *update item*, and then select the **SharePoint – Update item** action.
13. In the **Site Address**, enter the URL of the team's SharePoint site again.
14. In the **List Name** field, select *ContosoTweets* again.
15. In the **Id** field, add **ID** from the **Dynamic content** window. The **Id** field is used to match the actual tweet request in the SharePoint list.
16. Select the **Title** field, and then search for and select **Title** under the **When a new item is created** action in the **Dynamic content** window.
17. Set the **ApprovalStatus** field to **Yes**.

18. In the **ApproverComments** field, under the **Start an approval** action, add **Comments** from the

The screenshot shows the 'Update item' window in Power Automate. It has a header 'Update item' with a help icon and three dots. Below are several input fields:

- \* Site Address: https://m365x868006.sharepoint.com/sites/MarketingDepartment
- \* List Name: ContosoTweets
- \* Id: (placeholder icon)
- \* Title: (placeholder icon)
- TweetContent: (empty)
- TweetDate: (empty)
- ApprovalStatus: Yes
- ApproverComments: (placeholder icon) Comments X

At the bottom left is a 'Show advanced options' link.

**Dynamic content** window.

19. Click and drag **Post a Tweet** action below the **Update Item** action.

20. Expand the **Post a tweet** action by selecting the title bar.

21. Select the **Tweet text** field and remove **Title** and add **TweetContent** from the **Dynamic content**



The screenshot shows the 'Post a tweet' window in Power Automate. It has a header 'Post a tweet' with a help icon and three dots. Below is a single input field:

Tweet text: (placeholder icon) TweetContent X

At the bottom left is a 'Show advanced options' link.

window. This step will create the actual tweet and then post it to Twitter when it's approved.

22. In the **If no** section of the **Condition**, select **Add an action**.

23. Repeat steps 12 through 18 to create a **SharePoint – Update item** action. Set the same values that you set for the **If yes** section of the **Condition**. The only difference is that you set the **ApprovalStatus** field to *No* this time.

24. Select **Save**.

Congratulations! You just created your first approval flow.

This unit showed just one way that Power Automate can empower your team to be more productive. Your team can contribute ideas, relevant news, or product guidance, but you maintain control over what's tweeted out to customers.

In the next unit, you'll see what it looks like when an approver receives a new request for a proposed tweet.

## Exercise - Build a flow that processes an approval request

In the previous unit, you learned how to build an approval process for tweets that are stored in a Microsoft SharePoint list. In this unit, you'll see what the experience looks like when an approver receives a new approval request.

### Customize the SharePoint Form via Power Apps

Before we test the Flow created in the previous unit, it's important to take the time to customize the SharePoint Form via PowerApps. If you're curious as to why, go to the ContosoTweets SharePoint List and click **+ New** to create an Item. The first thing you will most likely notice is that users can create new SharePoint Items and Approve those Items themselves within the default SharePoint Form. For our example, this isn't really a big deal but in real-world scenarios, like you will be creating for your companies and or organizations, restricting users from approving their own items as they are created is an important part of the Approval Process (when using SharePoint as a Datasource). There are many ways to customize your SharePoint Form to hide/show certain fields, these will not be covered in-depth in this unit, rather, we can simply open the list via Power Apps and remove the fields. By removing the fields from the SharePoint Form, the only way ApprovalStatus and ApprovalComments can be populated is via the Approval Flow process.

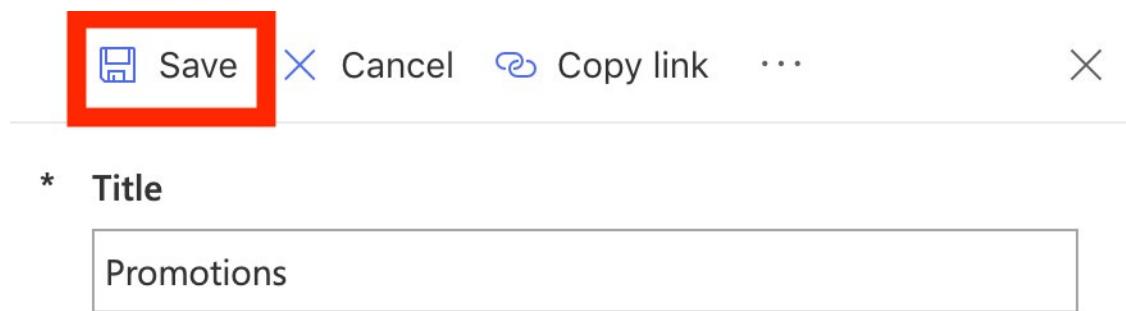
1. Navigate to the ContosoTweets SharePoint list, if you're not already there and click **Integrate**.
2. From the dropdown, select **Power Apps** and then select **Customize forms**.
3. Once Power Apps opens, in the Fields pane, click the ... next to the *ApprovalStatus* field and then click **X Remove**.
4. Repeat the previous step, for the *ApproverComments* field as well as the **Attachments** field. The only fields remaining on the form should be **Title**, **TweetContent**, and **TweetDate**.
5. In the upper left, click **File** and then click **Save**.
6. Once the Form has Saved, click **Publish to SharePoint** and then click **Publish to SharePoint** again.
7. Navigate back to the ContosoTweets SharePoint List, refresh your browser and then click **+ New** to create a New Item. If the SharePoint Form is still showing the old Form with the fields you removed, try refreshing the browser again and then click **+ New** again. It can sometimes take a few minutes for the published changes to take effect, this is normal behavior when customizing a SharePoint Form via Power Apps.

### Create a New Item in our SharePoint List

First, we need to add an item to our SharePoint list. We can then process an approval request for that item.

1. In SharePoint, open the **ContosoTweets** list that you set up in the previous unit, and then select **+ New** to create a list item (tweet).
2. Enter the following values, and then select **Save**:
  - **Title:** Promotions

- **TweetContent:** Check out the new product line of Contoso Electronics #OhSoContoso
- **Tweet Date:** Today's date.



#### **TweetContent**

Check out the new product line of Contoso Electronics #OhS...

#### **TweetDate**

6/2/2021 12 : 00

## **Review and approve the New Item in Power Automate**

1. In Power Automate, select **My flows**.
2. Select the **Post list items to twitter after approval** flow that you set up in the previous unit.
3. Under **28-day run history**, select the flow that's running, or just completed.

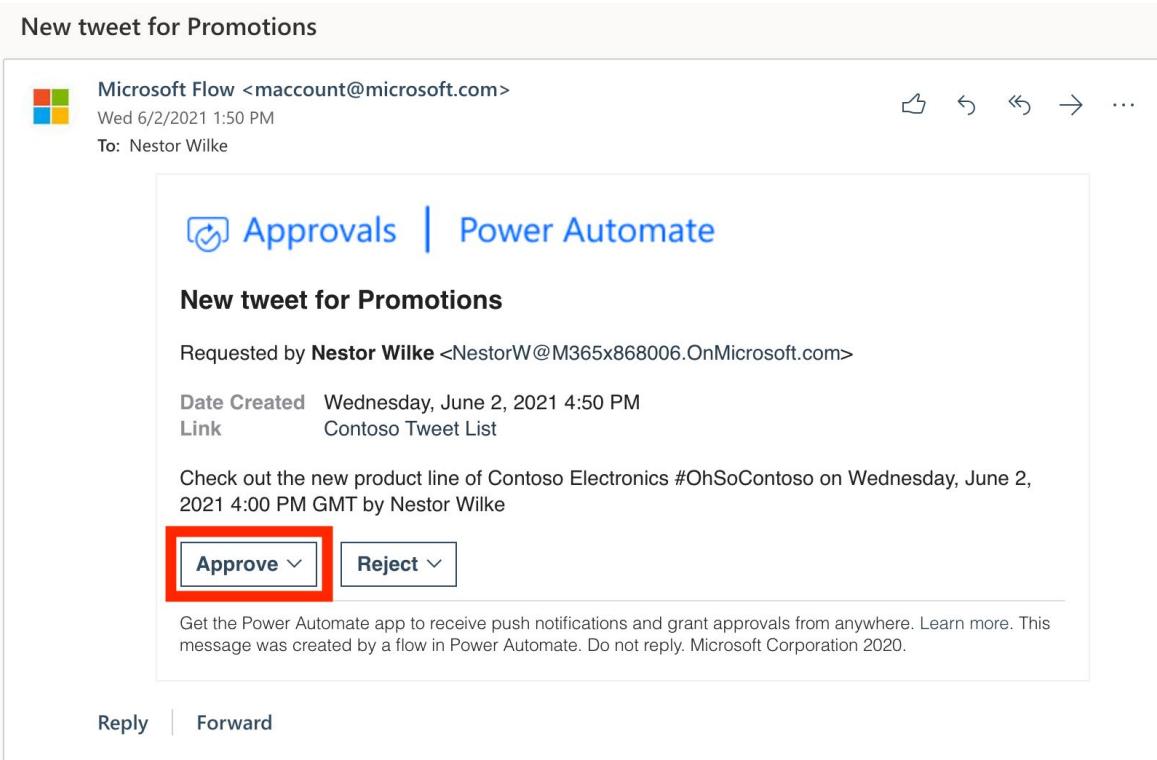
4. Select the **When a new item is created** trigger. Make sure that the information for the list item that

**OUTPUTS** [Show raw outputs >](#)

<b>ID</b>	3
<b>Title</b>	Promotions
<b>TweetContent</b>	Check out the new product line of Contoso Electronics #OhSoContoso <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">^ &lt; &gt; ▼</div>
<b>TweetDate</b>	2021-06-02T16:00:00Z
<b>ApprovalStatus</b>	false

you just created is shown.

5. In Microsoft Outlook, open the automated approval mail in the inbox, and then select **Approve**. Add



a comment and press **Submit**.

6. In Power Automate, click on **Approvals** under **Actions**. You can see the approval you just submitted in your history.
7. In SharePoint, refresh the **ContosoTweets** list. Make sure that the **ApprovalStatus** field is set to **Yes**,

#### ContosoTweets

Title	TweetContent	TweetDate	ApprovalStatus	ApproverCom...
Promotions	Check out the new product line of Contoso Electronics #OhSoContoso	6/2/2021, 9:00 AM	✓	Good Tweet

and that the comment that you just entered is shown.

In this unit, you saw the experience from the approver's point of view, from receiving an approval request email to processing the request in the Approval Center.

## Exercise - Create a flow that stores documents

In this unit, you'll see how Contoso Electronics uses Power Automate to automatically convert documents to a standard format and then store them in Microsoft SharePoint Online. You'll create a flow that detects when a new file has been added to a Microsoft OneDrive for Business folder. The flow then converts that file to a PDF and stores it in a SharePoint Online folder.

## Prerequisites

For this scenario, you need an account with Muhimbi, a PDF conversion service. If you don't already have a Muhimbi account, you can sign up for a **free 30-day trial**<sup>14</sup>.

## Create the source and target folders

First, you must create the source and target folders in OneDrive for Business and SharePoint Online.

1. In OneDrive for Business, under **My files**, create a folder named **Finished Documents**.
2. In SharePoint Online, in **Shared Documents**, create a folder named **PDF – Finished files**.

## Create the flow

1. In Power Automate, select **My Flows**, and then select **+ New flow**.
2. From dropdown, under **Build your own from blank**, select **Automated cloud flow**.
3. In the Flow name field, give your flow a name, in this example we will call it *Flow Conversion and Upload*.
4. In the **Choose your flow's trigger** search field, enter *OneDrive for Business*, and select the **OneDrive**

Flow name  
Flow Conversion and Upload

Choose your flow's trigger \* ⓘ  
OneDrive for Business

- When a file is created OneDrive for Business ⓘ
- When a file is created (properties only) OneDrive for Business ⓘ
- When a file is modified (properties only) OneDrive for Business ⓘ
- When a file is modified OneDrive for Business ⓘ
- When a file is deleted (properties only) OneDrive ⓘ
- When a new section is created OneDrive ⓘ

Skip Create Cancel

**for Business - When a file is created** trigger.

5. Then click **Create** to proceed.
6. In the **Folder** field, select the **Folder** icon, and then select the **Finished Documents** folder that you created at the beginning of this module.
7. Now you want to add another step, select **+ New step**.

<sup>14</sup> <https://www.muhimbi.com/Products/PDF-Converter-Online/>

Choose an operation

muhimbi

All Built-in Standard Premium Custom My clipboard

Muhimbi PDF

Triggers Actions See more

Add watermark (disabled) Muhimbi PDF i

Add text watermark Muhimbi PDF i

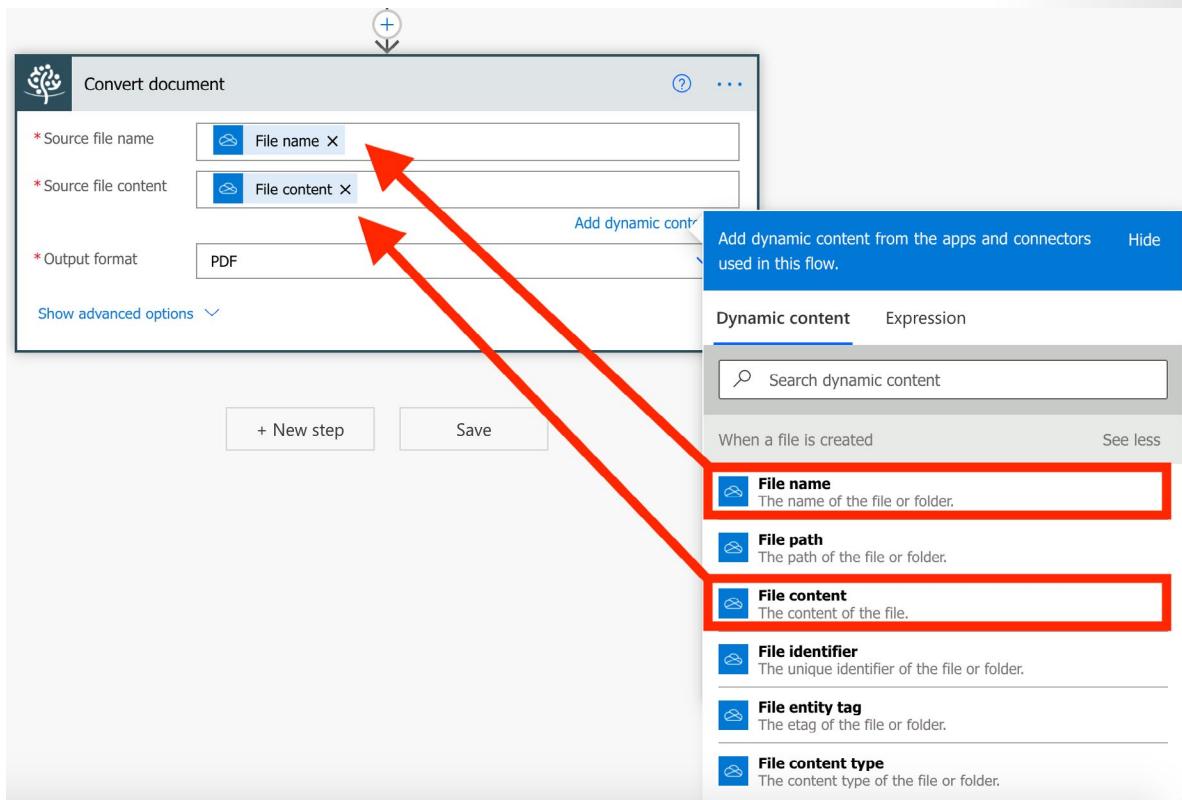
Convert document Muhimbi PDF i

Add PDF watermark Muhimbi PDF i

Add composite watermark Muhimbi PDF i

8. In the search box, enter *muhimbi*, and then select the **Muhimbi PDF – Convert document** action.
9. If Power Automate prompts you to sign in to Muhimbi, sign in. If you don't have a subscription to Muhimbi, you can use a **free 30-day trial**<sup>15</sup>.
10. In the **Convert document** action, set the following values:
  - **Source file name:** In the dynamic content list, select **File name**.
  - **Source file content:** In the dynamic content list, select **File content**.
  - **Output format:** Select **PDF**.

<sup>15</sup> <https://api.muhimbi.com/Auth/Pages/Signup.aspx/>

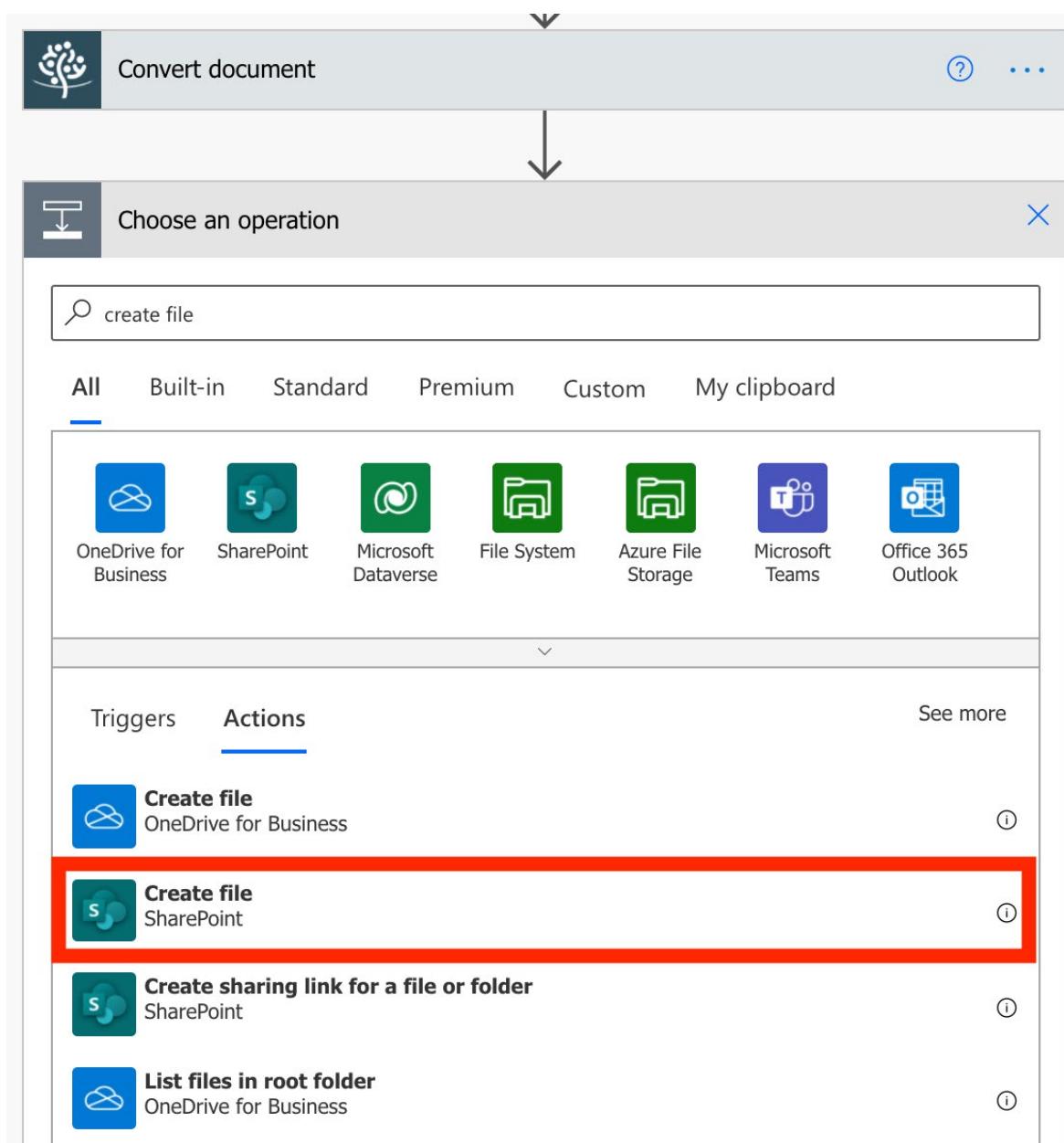


So far, you've set up these steps for your flow:

1. The flow is triggered whenever a new file is added to a specific OneDrive for Business folder.
2. The Muhimbi service converts that file to PDF.

For the final step, you'll add an action that moves the PDF document to a SharePoint Online folder where the team can access it.

11. Select **+ New step**.



12. In the search field, enter *create file*, and then select the **SharePoint – Create file** action.

13. In the **Create file** action, set the following values:

- **Site address:** Enter the URL of your SharePoint site.
- **Folder path:** Select the Folder icon, and browse to the **PDF - Finished files** folder.
- **File name:** In the dynamic content list, under **Convert document**, select **Base file name**. Then enter **.pdf** so that the file will be saved with the **.pdf** file name extension in SharePoint.
- **File content:** In the dynamic content list, under **Convert document**, select **Processed file content**.

The screenshot shows the 'Create file' step in a Microsoft Power Automate flow. The 'Site Address' is set to 'https://m365x868006.sharepoint.com/sites/MarketingDepartment/'. The 'Folder Path' is '/Shared Documents/PDF - Finished files'. The 'File Name' is 'Base file name .pdf'. The 'File Content' is 'Processed file ...'. There are also 'Save' and 'Cancel' buttons at the bottom.

14. Select **Save** at the top of the page to save your work.

## Test the flow

1. To test the flow, add a new file to your **Finished Documents** folder in OneDrive for Business.
2. In Power Automate, select **My flows**, and then select the **Flow Conversion and Upload** flow to view the run history.
3. After the flow runs, make sure that the file was converted to a PDF and saved to the **PDF – Finished files** folder in SharePoint.

## Exercise - Build a flow that uses information like locations or date

You can build button flows that use information like Global Positioning System (GPS) data, date information, or email. This information is available as *trigger tokens*. Trigger tokens are data points that are known and available to the device that a button flow is running on. These tokens change, based on factors like the current time or the current geographic location of the device.

For example, if you run a button flow on a phone, the phone probably knows the time at your current location, the date, and your current address. In other words, the time and date, and the address where the phone is located, are all determined when the button flow runs. They're automatically available for use in any button flows that are run on the device.

You can use these trigger tokens to build useful flows that minimize repetitive tasks like providing your location to someone or tracking how much time you spent on a particular job/service call.

## List of button trigger tokens

Here's the list of button trigger tokens that are available to you when you create button flows.

Parameter	Description
City	The city where the device that's running the flow is located.
Country/Region	The country/region where the device that's running the flow is located.

Full address	The full address where the device that's running the flow is located.
Latitude	The latitude where the device that's running the flow is located.
Longitude	The longitude where the device that's running the flow is located.
PostalCode	The postal code where the device that's running the flow is located.
State	The state where the device that's running the flow is located.
Street	The street where the device that's running the flow is located.
Timestamp	The time in the area where the device that's running the flow is located.
Date	The date in the area where the device that's running the flow is located.
User name	The user name of the person who's signed in to the device that's running the flow.
User email	The email address of the person who's signed in to the device that's running the flow.

## Create a button flow that uses trigger tokens

When you create a button, you can use trigger tokens to add rich functionality to it.

Let's create a button flow on a mobile device to let your colleagues know you are working from home today.

Although the procedures in this unit show screenshots from an Apple iOS device, the experience is similar on Android and Windows Phone devices.

### Prerequisites

- A work or school email address, or a **Microsoft account**<sup>16</sup> that has access to Power Automate
- The Power Automate mobile app for **Android**<sup>17</sup> or **iOS**<sup>18</sup>.

## Create the button flow

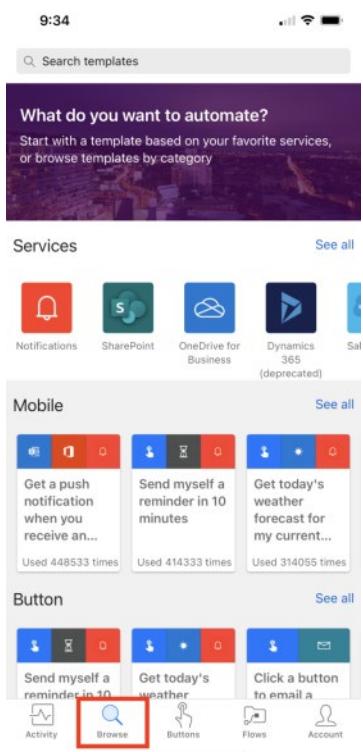
1. Launch the Power Automate mobile app and sign in using your organizational account.

<sup>16</sup> <https://account.microsoft.com/about?refd=www.microsoft.com%2F%3Fazure-portal%3Dtrue>

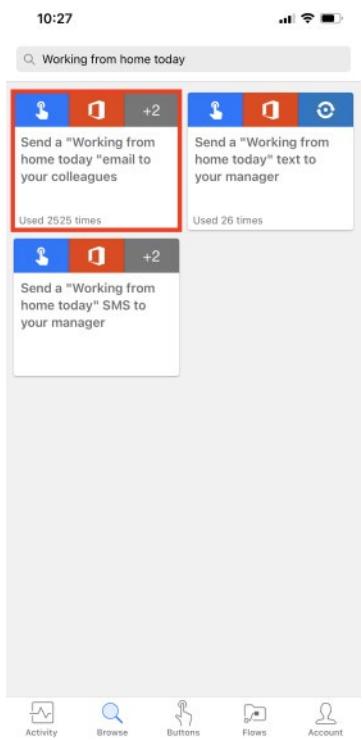
<sup>17</sup> <https://aka.ms/flowmobiledocsandroid/>

<sup>18</sup> <https://aka.ms/flowmobiledocsios/>

2. Select **Browse**.



3. Search for *Working from home today* and select the **Send a "Working from home today" email to your colleagues** service.



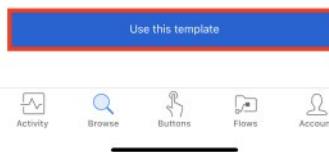
4. Select **Use this template**.



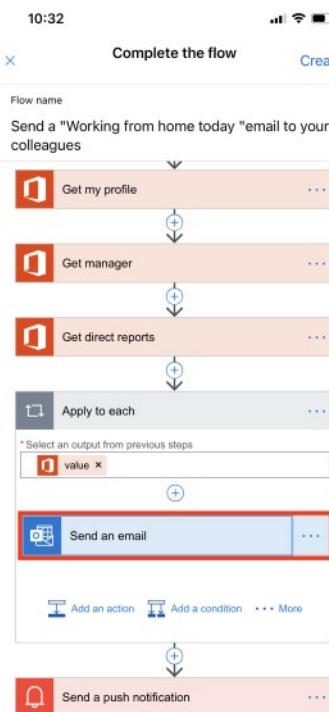
Send a "Working from home today" email to your colleagues

Email "WFH" to all your colleagues with a button tap, and get a notification when the message has been sent.

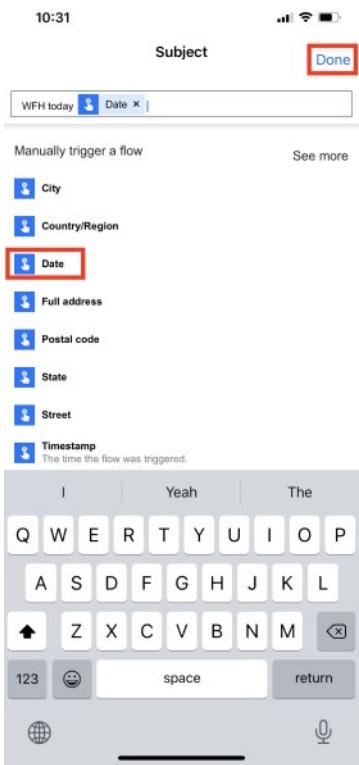
By Microsoft  
Used 2525 times



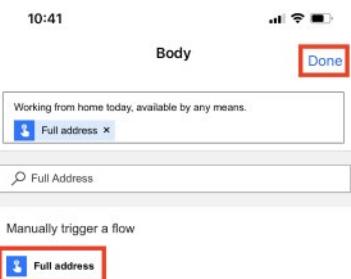
5. Press the title of the **Send an email** card to expand your options. Note that this is a part of simultaneous actions.



6. Select the **Subject** field, and enter *WFH today*. Notice that when you selected the **Subject** field, a list of tokens appeared. While the cursor is still in the **Subject** field, scroll through the list of tokens, and select **Date**. Notice that the date token now appears in the **Subject** field.



7. Scroll to the **Body** field, and select the default message so that you can add tokens there.
8. In the Search field, enter *Full Address* and select the **Full Address** token.



9. In the upper right corner, select **Done**.

10. Select **Create**.

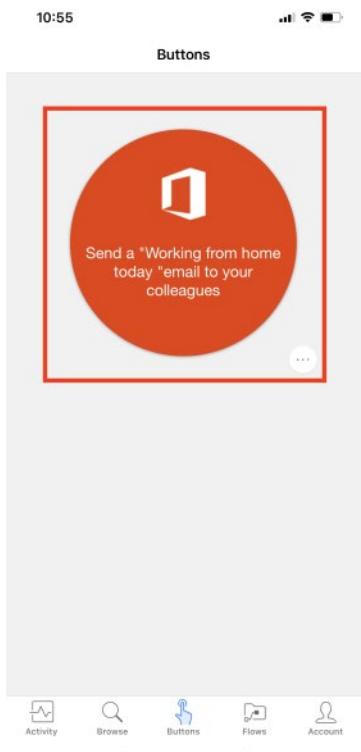


11. Select **Done**. Your button flow is now created.

## Run the button flow

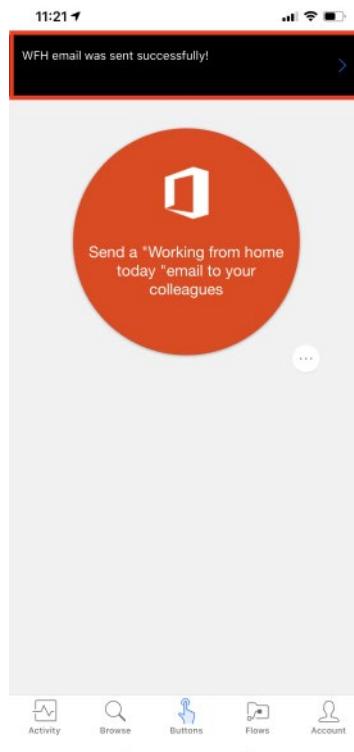
**Note:** This button flow will send your current location via email.

1. Select the **Buttons** tab at the bottom of the window. You'll see a list of the buttons that you have permissions to use. Select the button that represents the button flow that you just created:



2. Your device may prompt you to let the button flow access your device's location information. If necessary, press **Allow**

In a few moments, you'll notice that the email was sent successfully.



Congratulations! You just created a button flow that uses both the **Date** and **Full Address** trigger tokens.

## Exercise - Build a flow accepts user input when run

You can customize button flows by letting the user provide specific details that will be used when the flow runs.

You can create a button flow either on the Power Automate website or in the mobile app for Power Automate. For this unit, you'll use the website.

### Prerequisites

- Access to **Power Automate**<sup>19</sup>.
- A basic understanding of Power Automate as well as experience with creating a flow is recommended.

### Open the template

1. Launch Power Automate and sign in using your organizational account.

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<sup>19</sup> <https://flow.microsoft.com/>

The screenshot shows a search results page for Microsoft Flow. At the top, there is a search bar with the placeholder "Create New Outlook Task" and a dropdown menu set to "Sorted by popularity". Below the search bar, there are several filter categories: All flows, Featured, Shared with me, Remote work, Approval, Button, Visio, Data collection, Email, Events and calendar, Mobile, Notifications, and an ellipsis. The main area displays a grid of flow cards. One card, titled "Create new Outlook Task" by Microsoft, has its entire content area highlighted with a red box. This card includes icons for a person and a checkmark, indicates it's an "Instant" flow, and has 25594 views.

Flow Title	Creator	Type	Views
Create a task in Planner when a new email arrives in a shared mailbox	By Microsoft Flow Community	Automated	7054
Create tasks in Planner for new Outlook Tasks	By Microsoft	Automated	24746
Add Planner task and send email on approval of response to Microsoft Form	By Microsoft Flow Community	Automated	2564
Create Todoist Tasks for Flagged Office 365 emails	By Microsoft	Automated	13429
<b>Create new Outlook Task</b>	By Microsoft	Instant	25594
Create a task in Outlook Tasks when a Planner task is assigned to me	By Microsoft Flow Community	Automated	3433
Create an event in Outlook on new Planner tasks	By Microsoft	Automated	4167
Create a task when an email is flagged	By Microsoft Flow Community	Automated	38297

2. Select **Templates** and search *Create New Outlook Task*.
3. Sign in if you are prompted to do so and select **Create Flow**.

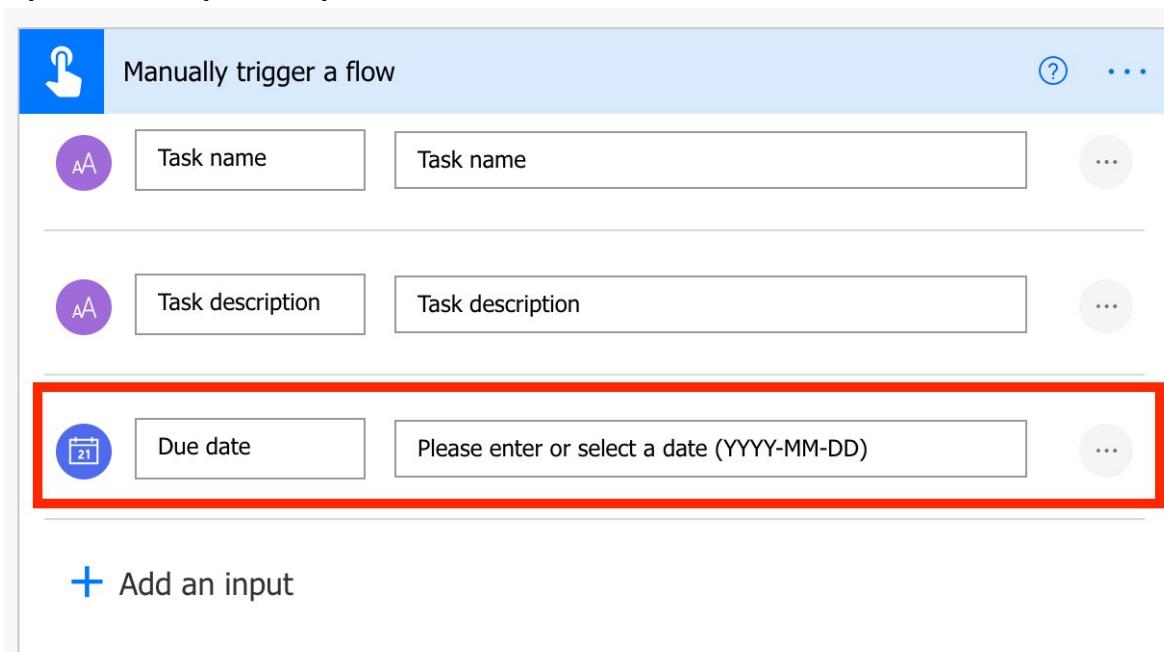
## Customize the user input

You'll notice that this flow already requests additional input, but let's add another field.

The screenshot shows the configuration screen for a "Manually trigger a flow" card. The card has two sections for "Task name" and two sections for "Task description", each with a "AA" icon for font size adjustment. At the bottom of the card, there is a button labeled "+ Add an input" with a blue plus sign, which is also highlighted with a red box.

1. Click **Edit** and on the trigger card, select **+ Add an input**.

- For each custom field that should be available when someone runs your flow, enter values in the **Input title** and **Input description** field.



In this example, you'll create one custom input field, **Due Date**.

## Customize the task

- On the **Create a task** card, select the title bar to expand the card.
- For the Due Date field, search for "Due date" in the Dynamic Content search field and then select **Due**

The screenshot shows a 'Create a task' card expanded. The 'Due Date' field is selected and highlighted with a red box. A dynamic content search interface is open on the right, showing the 'Due date' entry.

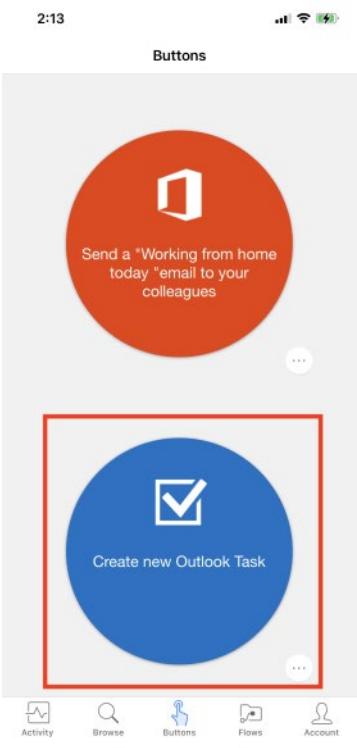
**Date.**

- Select **Save**.

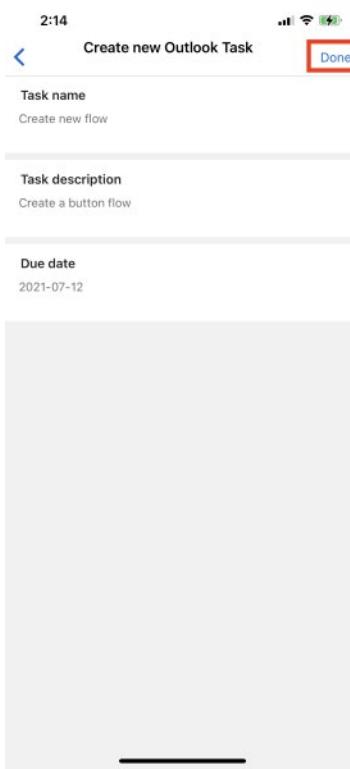
## Run the flow

You'll now use the mobile app for Power Automate to run the button flow that you just created. You'll provide all the user input that's needed to create a task with a name, description, and due date.

1. In the mobile app for Power Automate, select the **Buttons** tab at the bottom of the window, and then select the **Create new Outlook Task** button.

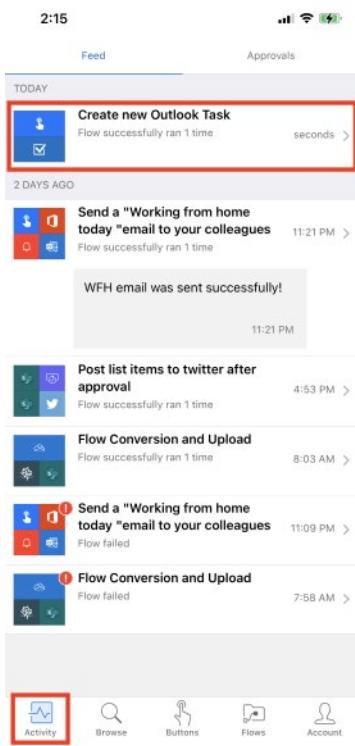


2. Enter the requested inputs and select **Done**.

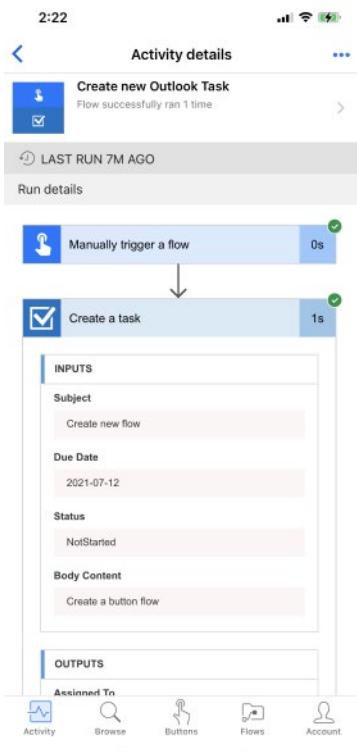


The flow runs.

3. Select the **Activity** tab at the bottom of the window to view the results.



- To view the detailed results of the flow run, select the **Create new Outlook Task** flow at the top of your Activity Feed and then select the **Create a task** step.



Now you can not only run button flows with the already available information, but also request inputs from the user.

## Exercise - Learn to build a flow that runs at recurring time intervals

You can create a flow that performs one or more tasks (for example, sending a report by email) on a specific schedule:

- Once a day, an hour, or a minute
- On a date that you specify
- After a number of days, hours, or minutes that you specify

### Prerequisites

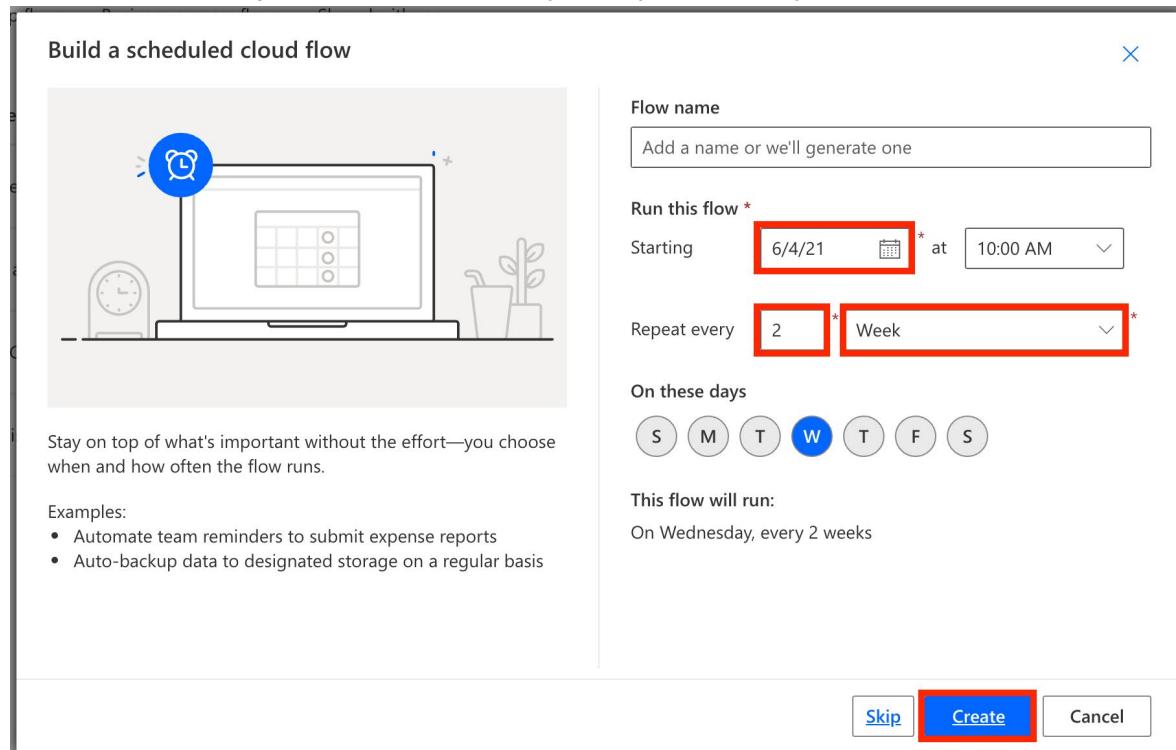
- Access to **Power Automate**<sup>20</sup>.
- A basic understanding of Power Automate as well as experience with creating a flow is recommended.

### Create the flow

- Launch Power Automate and sign in using your organizational account.
- In the left pane, select **My flows**.

<sup>20</sup> <https://flow.microsoft.com/>

3. Select **+ New flow**, and then select **Scheduled cloud flow**.
4. In the dialog box, specify the flow's name and how often the flow should run.  
For example, if you want the flow to run every two weeks, enter 2 in the **Interval** field, and select **Week** in the **Frequency** field. You can also specify the day of the week your flow should run. The text



at the bottom of the dialog box explains your inputs in plain language.

5. When you are satisfied with your inputs, select **Create**.

## Specify advanced options

1. Once your flow is created, select the title of the **Recurrence** card to expand it.
2. Select **Edit** and then **Show advanced options**.

**Note:** The advanced options vary, depending on the value of the **Interval** and **Frequency** fields. If the dialog box that you see doesn't match the graphic that follows, make sure that the **Interval** and **Frequency** fields are set to the same values that are shown in the graphic.
3. Here you can specify a time zone to reflect the local time zone, Universal Coordinated Time (UTC), or another time zone.

4. If you selected **Day** in the **Frequency** field, you can specify the time of day when the flow should run. If you selected **Week**, specify the day or days of the week when the flow should run, and the time or

The screenshot shows the 'Recurrence' configuration screen. At the top, there are fields for 'Interval' (set to 2) and 'Frequency' (set to Week). Below these are fields for 'Time zone' (Pacific Time (US & Canada)), 'Start time' (2021-06-04T14:00:00.000Z), 'On these days' (Wednesday), 'At these hours' (17), and 'At these minutes' (30). A 'Preview' section at the bottom indicates the flow runs at 17:30 on Wednesday every 2 weeks. A 'Hide advanced options' link is located below the preview.

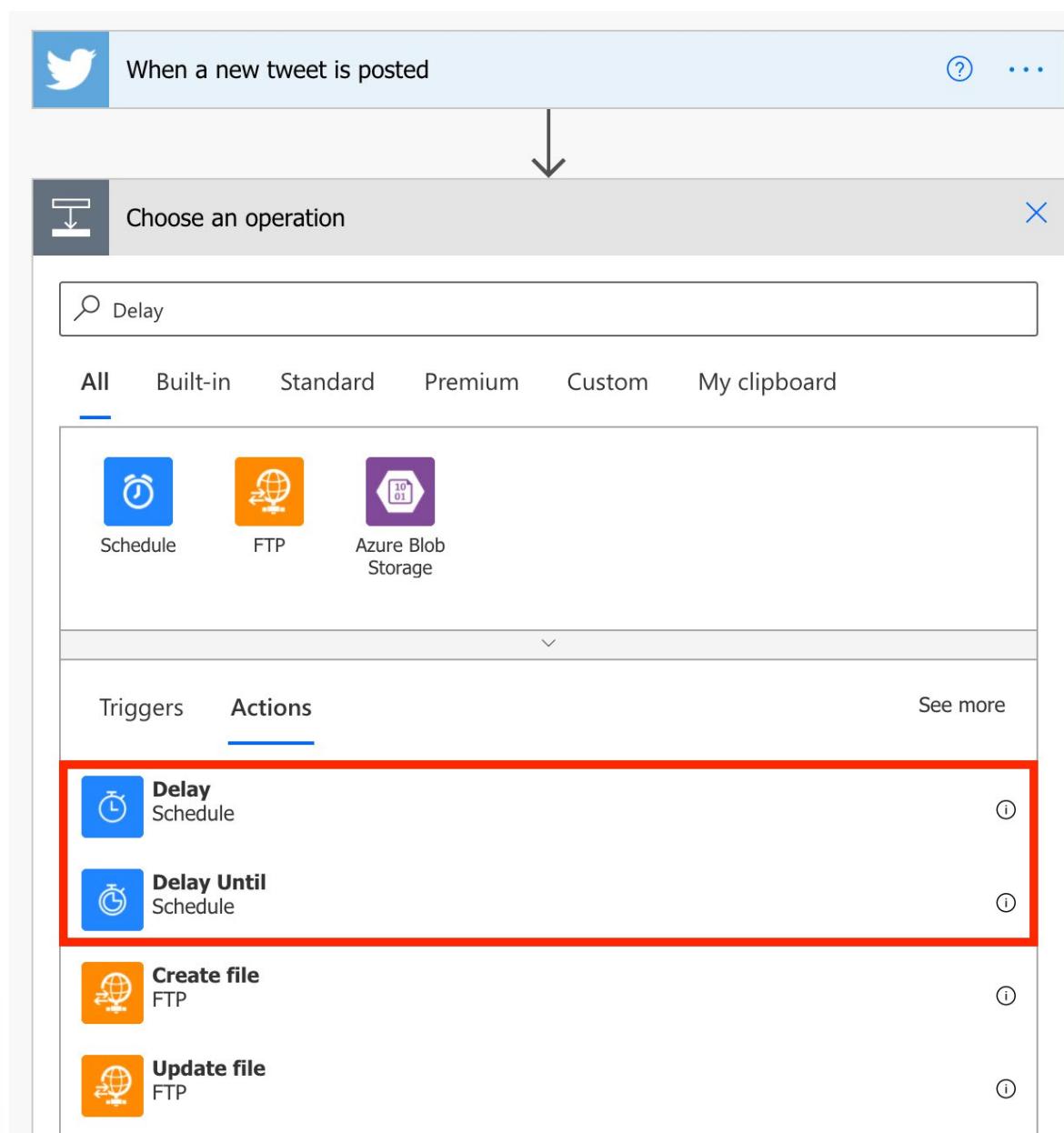
times of day when the flow should run.

5. Add the action or actions that the flow should take and then click **Save**. For this example, I will add the **Send an email (V2)** action to remind me to submit any expense reports I have for this month.

## Delay the flow

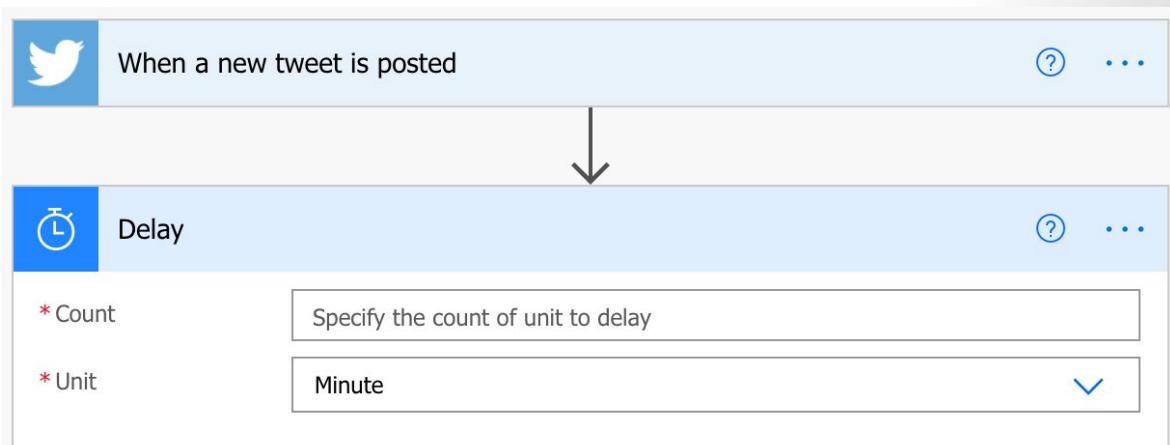
Next, you'll learn how to delay a flow.

1. On the top navigation bar, select **My flows**, and then select **Automated cloud flow**.
2. In the **Search all triggers** field, enter *Twitter*, and then select **Twitter - When a new tweet is posted**.
3. Select **Create** and once the flow is created click **+ New step**.

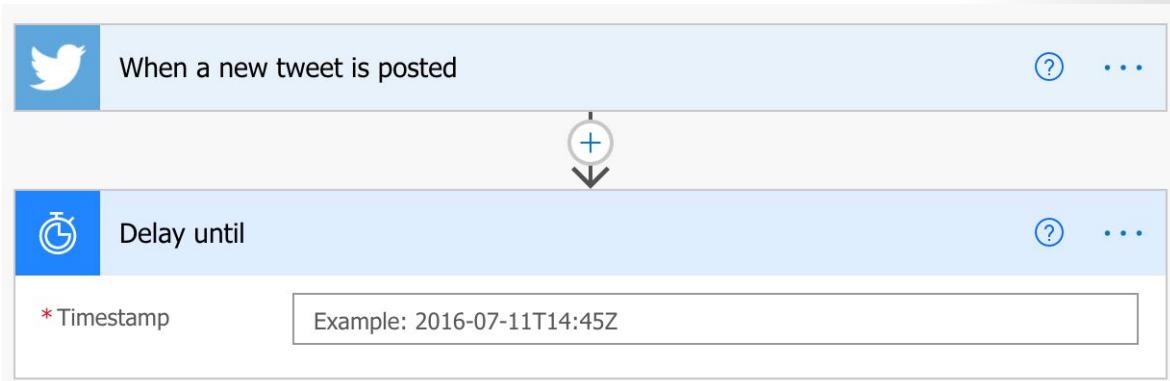


4. In the list of actions, search **Delay** and select either **Delay** or **Delay Until**.

5. Follow one of these steps, depending on the action that you just selected:



- If you selected **Delay**, specify a count and a unit of time, like second, minute, or hour.



- If you selected **Delay until**, specify a date in this format: YYYY-MM-DDTHH:MM:SSZ

## Exercise - Build a flow that runs when an event in Dynamics 365 occurs

You can create flows that start when an event occurs in Microsoft Dataverse or some other service. These flows then perform an action in that service.

In Power Automate, you can set up automated workflows between your favorite apps and services to sync files, get notifications, collect data, and more.

In this unit, we'll look to build two flows:

- The first flow creates a task in Microsoft Dataverse when a new Account has been created in another instance of Microsoft Dataverse.
- The second flow copies a list item to the Planner when a task is created in Microsoft Dataverse.

Here are some other examples of flows that you can create by using Microsoft Dataverse:

- Create a list item in Microsoft SharePoint when an object is created in Microsoft Dataverse.
- Create Microsoft Dataverse account records from a Microsoft Excel table.

## Prerequisites

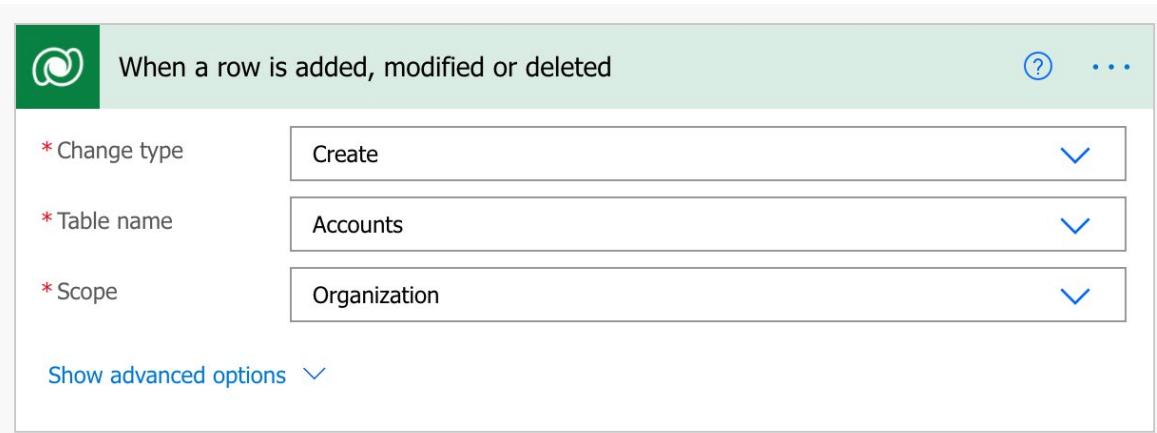
- Access to **Power Automate**<sup>21</sup>.
- An **environment**<sup>22</sup> with a **Microsoft Dataverse database**<sup>23</sup>. (Applicable only for work or school accounts).
- A basic understanding of Power Automate as well as experience with creating a flow is recommended.

**Important:** To invoke a flow trigger, the Microsoft Dataverse customer engagement table that's used with the flow must have change tracking turned on. For more about how to turn on change tracking, see **Enable change tracking to control data synchronization**<sup>24</sup>.

## Example one: Create a task from a new Account

This example shows how to create a task in Microsoft Dataverse whenever an Account is created in another instance of Microsoft Dataverse.

1. Sign in to **Power Automate**<sup>25</sup> using your organizational account.
2. In the left pane, select **My flows**.
3. Select **+ New flow**, and then select **Automated cloud flow**.
4. In the list of flow triggers, enter *Microsoft Dataverse* in the search all triggers field and then select **Microsoft Dataverse - When a row is added, modified Or deleted**. Microsoft Dataverse keeps information in the Dataverse, so we will use this connector throughout.
5. Select **Create**.
6. If you're prompted to sign in to Dataverse, do so.
7. In the **Change type** field, select **create**.
8. In the **Table name** field, select the Table to listen to. This Table will act as a trigger that starts the flow. For this unit, select the **Accounts** table.
9. For Dataverse, you also need to specify the **Scope**. This will determine if your flow runs if you create a new record, if a new record is created by a user within your business unit, or if a new record is created



by any user in your organization. For this example, choose **Organization**.

<sup>21</sup> <https://flow.microsoft.com/>

<sup>22</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/>

<sup>23</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database/>

<sup>24</sup> <https://docs.microsoft.com/en-us/power-platform/admin/enable-change-tracking-control-data-synchronization/>

<sup>25</sup> <https://ms.flow.microsoft.com/>

10. Select **+ New step**.
11. In the search field, enter *Microsoft Dataverse* and select **Microsoft Dataverse – Add a new row**.
12. In the **Environment** field, select the environment where the flow should create the record. Note that this doesn't have to be the same environment that the event is triggered from.
13. In the **Table Name** field, select the Table that will create a record when the event occurs. For this unit, select the **Tasks** table.
14. More fields appear on the table selection. Select the **Subject** field. A dynamic content pane appears, where you can select fields from the previous steps.

The screenshot shows the Microsoft Power Automate interface. At the top, there's a header bar with a play icon, the text 'When a row is added, modified or deleted', and three dots. Below this is a large central area for defining a step. The step title is 'Add a new row' under the 'Tasks' table. The 'Subject' field is highlighted and has a dropdown menu open, showing options like 'Account Name', 'Address 1: City', 'Address 1: Street 1', etc. To the right of this main area is a 'Dynamic content' pane with a search bar and a list of available fields:

- Add dynamic content from the apps and connectors Hide used in this flow.
- Dynamic content** Expression
- Search dynamic content
- When a row is added, modified or deleted
- Account Name** Type the company or business name.
- Address 1: City** Type the city for the primary address.
- Address 1: Street 1** Type the first line of the primary address.
- Address 1: Street 2** Type the second line of the primary address.
- Address 1: ZIP/Postal Code** Type the ZIP Code or postal code for the primary address.
- Description** Type additional information to describe the account, such as...
- Main Phone** Type the main phone number for this account.
- OData Id** OData row id

For this unit, select **Account name**.

**Tip:** In the dynamic content pane, select **See more** to see more fields that are associated with the table. For example, you can also insert the **Company Name**, **Customer**, **Description**, or **Email** field for the account into the **Subject** field for the task.

15. Select **Save**.

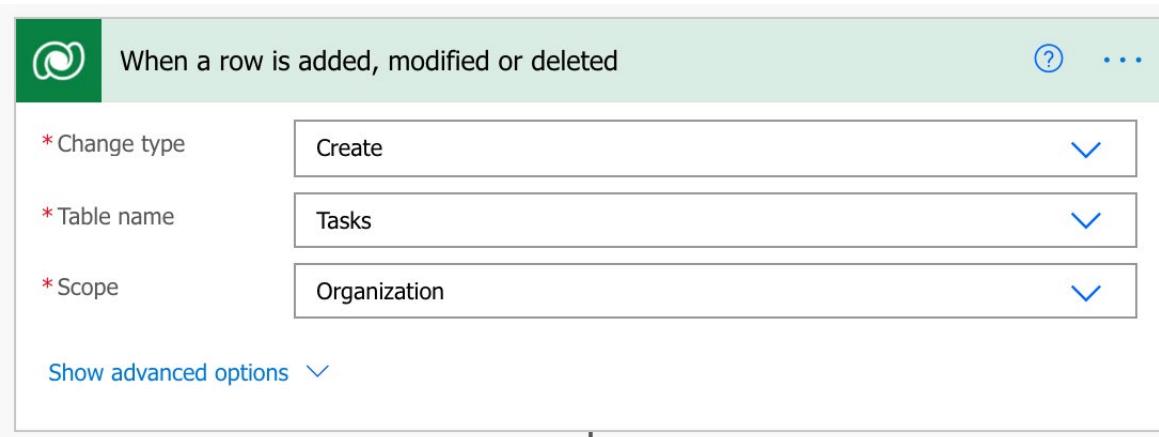
## Example two: Create a Planner task from a Microsoft Dataverse task

This example shows how to create a task in Microsoft Planner whenever a task is created in Microsoft Dataverse. Planner is a service that you can use to create to-do lists, add reminders, and track errands.

1. Sign in to **Power Automate<sup>26</sup>** using your organizational account.

<sup>26</sup> <https://ms.flow.microsoft.com/>

2. In the left pane, select **My flows**.
3. Select **+ New flow**, and then select **Automated cloud flow**.
4. In the list of flow triggers, enter *Microsoft Dataverse* in the search all triggers field and then select **Microsoft Dataverse - When a row is added, modified Or deleted**.
5. If you're prompted to sign in to Dataverse, do so.
6. In the **Change type** field, select the instance where the flow should listen.
7. In the **Table Name** field, select the table to listen to. This table will act as a trigger that starts the flow. For this unit, select the **Tasks** table.



8. In the **Scope** field, choose **Organization**.
9. Select **+ New step**.
10. In the search field, enter *Planner*, and then select **Planner – Create a task**.
11. For Group Id, hit the dropdown and select a Group. In our example, I will select **Marketing Plan**.
12. For Plan Id, hit the dropdown and select a Plan.
13. In the **Title** field, enter some text and then add the **Subject**, from the dynamic content pane. In our example, for the Title field, I will enter *Begin onboarding process for:*. This will give my new Planner task some additional clarity, when it shows up in the Planner App.

 Create a task ? ...

* Group Id	Marketing Plan	▼
* Plan Id	Marketing Plan	▼
* Title	Begin onboarding process for:  Subject X	
Bucket Id	To do	▼
Start Date Time	The datetime the task starts (Ex. '2018-04-13T00:42:19.284Z').	
Due Date Time	The datetime the task is due (Ex. '2018-04-13T00:42:19.284Z').	
Assigned User Ids	Semi-colon separated ids or email addresses of users to assign this task to.	
Pink	True if the task has the Pink category.	▼
Red	True if the task has the Red category.	▼
Yellow	True if the task has the Yellow category.	▼
Green	True if the task has the Green category.	▼
Blue	True if the task has the Blue category.	▼
Purple	True if the task has the Purple category.	▼
Bronze	True if the task has the Bronze category.	▼
Lime	True if the task has the Lime category.	▼
Aqua	True if the task has the Aqua category.	▼
Gray	True if the task has the Gray category.	▼
Silver	True if the task has the Silver category.	▼
Brown	True if the task has the Brown category.	▼
Cranberry	True if the task has the Cranberry category.	▼
Orange	True if the task has the Orange category.	▼

14. For Bucket Id, hit the dropdown and select a Bucket (optional). See [create a task parameters<sup>27</sup>](#) for information about the fields.

<sup>27</sup> <https://docs.microsoft.com/en-us/connectors/planner/#create-a-task/?azure-portal=true>

15. Select **Save**.

## Limitations of trigger-based logic

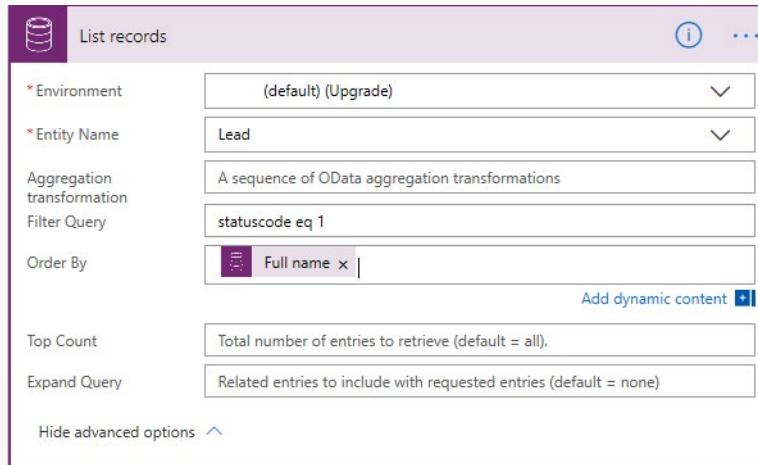
Triggers like **When a record is created**, **When a record is updated**, and **When a record is deleted** will start your flow within a few minutes after the event occurs. In rare cases, it might take up to two hours for your flow to be triggered.

When the trigger occurs, the flow receives a notification, but the flow runs on the data that exists when the action runs. For example, if your flow is triggered when a new record is created, and you update the record twice before the flow runs, your flow runs only once with the latest data.

## Specify advanced options

When you add a step to a flow, you can select **Show advanced options** to add a filter or order-by query that controls how the data is filtered in the flow.

For example, you can use a filter query to retrieve only active contacts, and you can order them by last name. Enter the `statuscode eq 1` Open Data Protocol (OData) filter query, and select **Full name** in the dynamic content pane. For more about filter and order by queries, see [MSDN: \\$filter<sup>28</sup>](#) and [MSDN: \\$orderby<sup>29</sup>](#).



## Best practices for advanced options

When you add a value to a column, you must match the column type, regardless of whether you enter a value or select a value in the dynamic content pane.

Column type	How to use	Where to find	Name	Data type
-------------	------------	---------------	------	-----------

<sup>28</sup> [https://msdn.microsoft.com/library/gg309461.aspx#Anchor\\_1/?azure-portal=true](https://msdn.microsoft.com/library/gg309461.aspx#Anchor_1/?azure-portal=true)

<sup>29</sup> [https://msdn.microsoft.com/library/gg309461.aspx#Anchor\\_2/?azure-portal=true](https://msdn.microsoft.com/library/gg309461.aspx#Anchor_2/?azure-portal=true)

Text columns	Text columns require a single line of text or dynamic content that's a text-type column. Examples include the <b>Category</b> and <b>Sub-Category</b> columns.	<b>Solutions &gt; Default Solution &gt; Task &gt; Columns</b>	category	Text
Integer columns	Some columns require an integer or dynamic content that's an integer-type column. Examples include the <b>Percent Complete</b> and <b>Duration</b> columns.	<b>Solutions &gt; Default Solution &gt; Task &gt; Columns</b>	percent complete	Whole Number
Date columns	Some columns require a date that's entered in <i>mm/dd/yyyy</i> format or dynamic content that's a date-type column. Examples include the <b>Created On</b> , <b>Start Date</b> , <b>Actual Start</b> , <b>Last on Hold Time</b> , <b>Actual End</b> , and <b>Due Date</b> columns.	<b>Solutions &gt; Default Solution &gt; Task &gt; Columns</b>	created on	Date and Time
Columns that require both a record ID and a lookup type	Some columns that reference another table record require both the record ID and the lookup type.	<b>Solutions &gt; Default Solution &gt; Account &gt; Columns</b>	accountid	Primary Key

## Exercise - Build a flow that uses SQL

This unit shows how to create a flow that monitors a source for new or changed items, and then copies those changes to a destination. You might create a flow of this type if your users enter data in one location, but your team needs that data in a different location or format.

In this unit, you'll copy data from a **Microsoft SharePoint list**<sup>30</sup> (the source) to a **Microsoft Azure SQL Database**<sup>31</sup> table (the destination).

Keep in mind that you can copy data over more than **275 services**<sup>32</sup> that Power Automate supports.

**Important:** Changes that you make in the destination aren't copied back to the source, because two-way synchronization isn't supported. If you try to set up two-way synchronization, you'll create an infinite loop where changes are sent endlessly between the source and destination.

## Prerequisites

- Access to a data source and a destination. This unit doesn't include the steps to create the source and destination.
- Access to **Power Automate**<sup>33</sup>.
- A basic understanding of how your data is stored.
- Familiarity with the basics of creating flows. For this unit, it's assumed that you know how to perform these actions.

**Tip:** Column names in the source and destination don't need to match, but you must provide data for all required columns when you insert or update an item. Power Automate identifies the required fields for you.

## Quick overview of the steps

If you're comfortable with Power Automate, use these quick steps to copy data from one data source to another.

1. Identify the source that you'll monitor and the destination that you'll copy changed data to. Confirm that you have access to both the source and the destination.
2. Identify at least one column that uniquely identifies items in the source and destination. In the example that follows, we use the **Title** column, but you can use any columns.
3. Set up a trigger that monitors the source for changes.
4. Search the destination to check whether the changed item exists.
5. Use a condition like this:
  - If the new or changed item doesn't exist in the destination, create it.
  - If the new or changed item exists in the destination, update it.
6. Trigger your flow, and then confirm that new or changed items are being copied from the source to the destination.

**Note:** If you haven't previously created a connection to SharePoint or a SQL Database, follow the instructions when you're prompted to sign in.

Here are the detailed steps to create the flow.

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<sup>30</sup> <https://support.office.com/article/SharePoint-lists-1-An-introduction-f11cd5fe-bc87-4f9e-9bfe-bbd87a22a194/>

<sup>31</sup> <https://docs.microsoft.com/en-us/azure/sql-database/sql-database-technical-overview/>

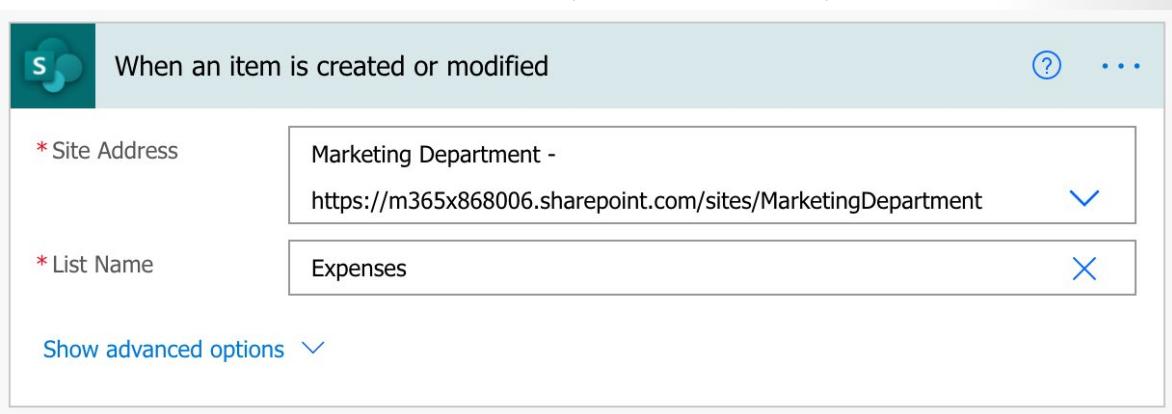
<sup>32</sup> <https://flow.microsoft.com/connectors/>

<sup>33</sup> <https://flow.microsoft.com/>

## Monitor the source for changes

First, we'll set up the SharePoint site to monitor changes.

1. Launch Power Automate and sign in using your organizational account.
2. In the left pane, select **My flows**.
3. Select **+ New flow**, and then select **Automated cloud flow**.
4. Under Flow name, you can either enter a flow name now or one will be generated automatically.
5. In the Search all triggers field, enter *When an item is created* and then select the **SharePoint - When an item is created or modified** trigger.
6. Select **Create**.
7. On the **When an item is created or modified** card, enter the site address, and then select the name



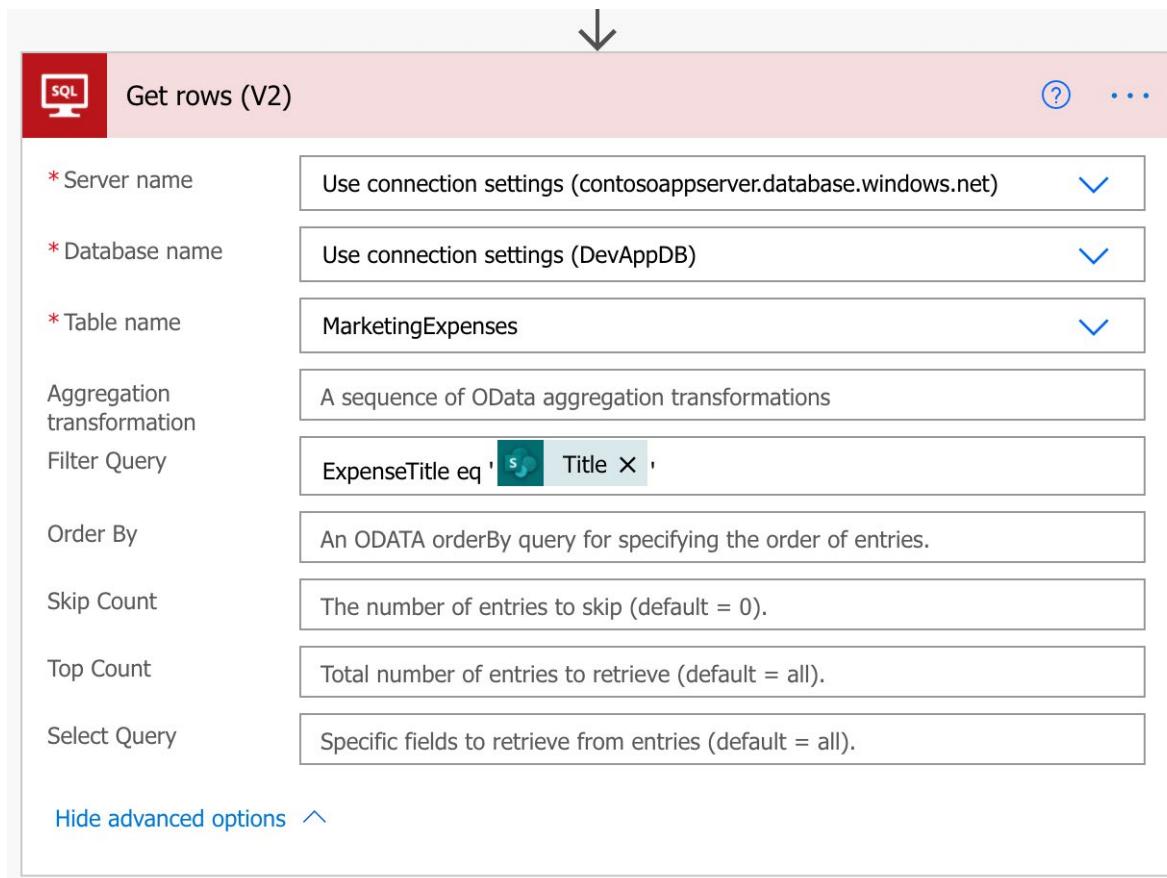
of the SharePoint list that your flow monitors for new or updated items.

## Search the destination for the new or changed item

Next, we'll use the **SQL Server - Get rows** action to search the destination for the new or changed item.

1. Select **+ New step**.
  2. Under **Choose an operation**, search for *SQL Get rows*, and then select **SQL Server - Get rows (V2)**.
  3. Set the **Server name**, **Database name**, and **Table name** for the table you wish to monitor.
  4. Select **Show advanced options**.
  5. In the **Filter Query** box, enter *Title eq* followed by a space and a single quotation mark ('). Then select the **Title** token in the dynamic content list, and enter another single quotation mark (').
- This step assumes that you're matching the titles, or in this example the ExpenseTitle field in SQL

(destination) to the Title column in SharePoint (source).



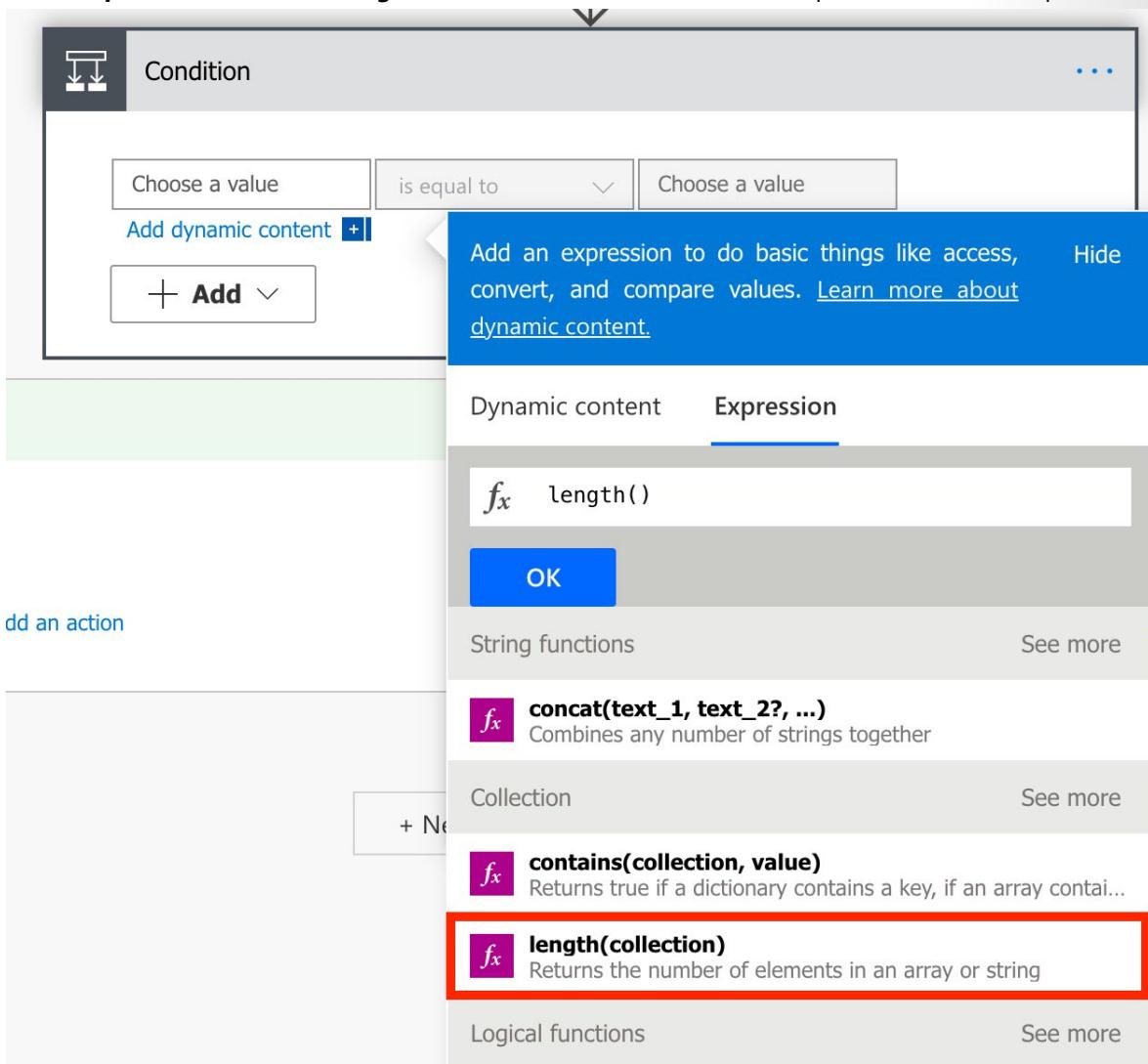
The **Get rows** card should now look like this image.

## Check whether the new or changed item was found

Next, we'll check whether the new or changed item was found.

1. Select + **New step**, and then select **Condition**.
2. On the **Condition** card, select the field on the left.  
The **Add dynamic content from the apps and connectors used in this flow** list opens.

3. Select **Expression** and choose **length**. Your cursor should be between the parentheses in the equa-



tions.

4. Without leaving the open pane, select **Dynamic content**.

The screenshot shows the 'Condition' card in the Microsoft Power Automate interface. The condition is set to 'Choose a value is equal to Choose a value'. A tooltip is displayed, stating 'Add dynamic content from the apps and connectors used in this flow.' Below the condition, there is a 'Dynamic content' section with an 'Expression' field containing the formula `fx length(outputs('Get_rows_(V2)')?['body/value'])`. An 'OK' button is visible. In the background, the 'Get rows (V2)' action is selected, showing its 'body' and 'value' outputs. The 'value' output is highlighted with a red border.

5. In the **Get rows (V2)** category, select **value** and then select **OK**.

**Tip:** Confirm that you've selected **value** in the **Get rows (V2)** category. Don't select **value** in the **When an item is created or modified** category.

6. In the field in the center, select *is equal to*.
7. In the field on the right, enter *0* (zero).

The screenshot shows the 'Condition' card with the expression `fx length(...)` in the first field, '*is equal to*' in the middle field, and '0' in the rightmost field. All three fields are highlighted with a red border.

The **Condition** card should now look like this image.

**Tip:** The addition of the `length()` function lets the flow check the **value** list and check whether it has any items.

When your flow gets items from the destination, there are two possible outcomes.

Outcome	Next step
The item exists.	Update the item.

The item doesn't exist.

Create a new item.

## Create the item in the destination

If the item doesn't exist in the destination, create it by using the **SQL Server - Insert row** action.

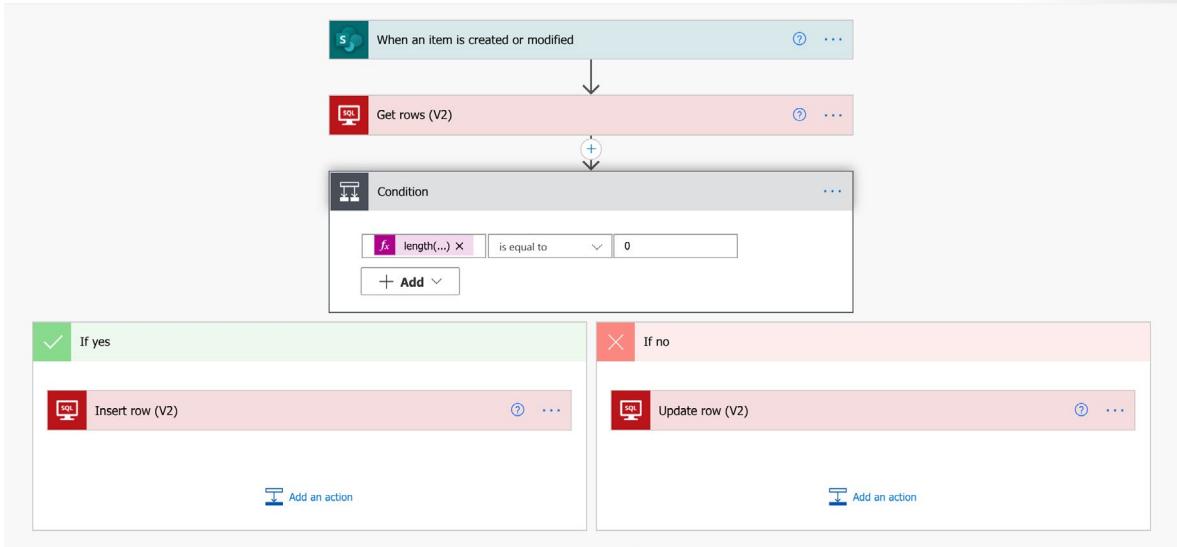
1. On the **If yes** branch of the condition, select **Add an action**, search for *insert row SQL*, and then select **SQL Server - Insert row (V2)**.
2. On the **Insert row** card, set the **Server name**, **Database name**, and **Table name** for the table to insert the new item into (the information you entered above).  
The **Insert row** card expands and shows all fields in the selected table. Fields that are marked with an asterisk (\*) are required and must be filled in for the row to be valid.
3. Select each field that you want to fill in, and enter the data.  
You can manually enter the data, select one or more tokens in the dynamic content pane, or enter any combination of text and tokens into the fields.

**Note:** The **Insert row** and **Update row** cards show the names of the columns in the SQL Database table that's being used in the flow. Therefore, the cards that are shown in the images in this procedure might differ from the cards that you see.

## Update the item in the destination

Next, if the item exists in the destination, update it with the changes.

1. Add the **SQL Server - Update row** action to the **If no** branch of the condition.



2. Select **Save** to save the flow.

Now, whenever an item in your SharePoint list (the source) changes, your flow is triggered. It either inserts a new item or updates an existing item in SQL Database (the destination).

**Note:** Your flow isn't triggered when an item is deleted from the source. If this scenario is important to you, consider adding a separate column that indicates when an item is no longer needed.

## Exercise - Integrate Power Apps, Power Automate, and SharePoint

The data that fuels business processes is often buried in separate systems that are difficult to connect to and navigate. This is one reason why business processes don't stop becoming complex, and why people rarely stop worrying about them.



But Microsoft Power Platform with Power Automate, Power Apps, and Power BI along with tools like Microsoft SharePoint make it all easier. Together, these apps and services provide these advantages:

- The data can easily be tapped.
- Critical business decisions can be made more quickly and more intelligently.
- People can worry less about what their data is doing and concentrate more on moving their business forward.

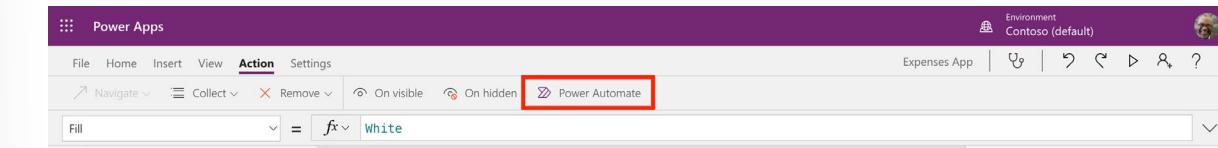
This unit gives an overview of:

- Integration of Power Automate with Power Apps.
- Integration of Power Automate and Power Apps with SharePoint for easy sharing of data in lists.

### Add a flow in Power Apps

Adding a flow to a Power Apps application is very straightforward.

1. Go to <https://make.powerapps.com>(<https://make.powerapps.com/>), and sign in by using your organizational account.
2. Open your app for editing.



3. On the **Action** tab, select **Power Automate** on the toolbar.

4. In the **Data** dialog box, select + **Create a new flow**.

The screenshot shows the Power Automate interface with a search bar at the top containing 'Power Apps Button'. Below the search bar is a filter dropdown set to 'Sorted by popularity'. A horizontal navigation bar includes links for All flows, Featured, Shared with me, Remote work, Approval, Button, Visio, Data collection, Email, Events and calendar, Mobile, Notifications, and more. Below this are four template cards:

- Power Apps button** By Microsoft Instant
- Add an item to SharePoint and send an email** By Microsoft Instant 346549
- Execute SQL stored procedure on Power Apps button click** By Microsoft Power Automate Community Instant 9812
- Click a button in Power Apps to send an email** By Microsoft Power Automate Community Instant 19822

Power Automate is started and shows templates filtered by the trigger **PowerApps Button**.

For more about how to create flows, see [Create a flow from a template in Power Automate](#).

## Add a Power Apps application from Power Automate

You can also go in the other direction. You can start in Power Automate and then select a template to add an app from Power Apps.

1. Launch Power Automate and sign in using your organizational account.
2. In the left pane, select **Templates**.
3. Select one of the many Power Apps templates.  
To see all the Power Apps templates that are available, you can search for *Power Apps*. Once the template is selected and opened, you can start building your flow.

For more about how to create apps by using Power Apps, see [Create a canvas app from a template in Power Apps](#)<sup>34</sup>.

## Integration of SharePoint with Power Automate

Customers regularly exchange data between SharePoint lists and other systems to support business processes. These scenarios become more powerful through the deep integration of Power Automate with SharePoint lists.

Power Automate allows for automating the exchange of workflows and data between SharePoint and a variety of Microsoft and third-party services. You can create and start flows directly from a SharePoint list, and store and change that data in SharePoint.

1. From a SharePoint list, select **Integrate** on the top toolbar, and then hover your cursor over **Power Automate**.

The screenshot shows a SharePoint list titled 'Expenses'. The top navigation bar includes 'New', 'Edit in grid view', 'Share', 'Export to CSV', 'Automate', 'Integrate', and a three-dot menu. The 'Integrate' dropdown is open, showing options for 'Power Apps', 'Power Automate' (with 'Create a flow' highlighted), 'Power BI', and 'See your flows'. The 'Power Automate' option is enclosed in a red box. Below the list, there are columns for 'Title', 'Cost', and 'Purchaser', with a single item listed: 'Google Advertising' costing '\$200' purchased by 'Nestor Wilke'.

2. Select **Create a flow**.

<sup>34</sup> <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/get-started-test-drive/>

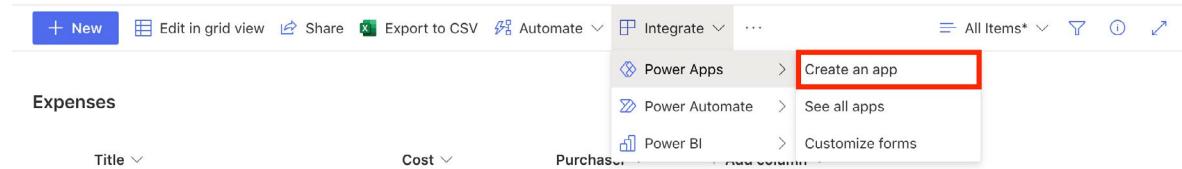
3. In the **Create a flow** pane, select the template to use.  
Power Automate is started, and you can finish creating the flow.

## Integration of SharePoint with Power Apps

Power Apps lets you connect to, create, and share business apps on any device in minutes. You can build efficient mobile forms and apps directly from a SharePoint list, without writing a line of code.

Power Apps and Power Automate share a common connector framework that lets you weave in dozens of data sources that are located on premises or in the cloud. These data sources include Microsoft Exchange, Microsoft SQL Server, Microsoft Dataverse, Salesforce, Google, MailChimp, Twitter, and Wunderlist.

1. From a SharePoint list, select **Integrate** on the top toolbar, and then hover your cursor over **Power Apps**.



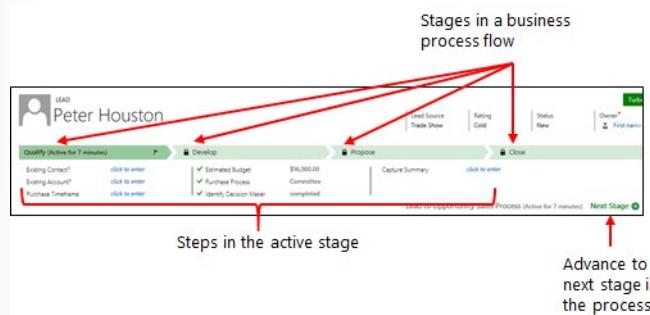
2. Select **Create an app**.
3. In the **Create an app** pane, enter a name for your app, and then select **Create**.  
Power Apps is started, and you can finish creating the app.

## Exercise - Create a business process flow

This unit shows how to create a business process flow by using Microsoft Power Apps.

For more about how to create a mobile task flow, see [Create a mobile task flow<sup>35</sup>](#).

When a user starts a business process flow, the process bar at the top of the page shows the stages and steps of the process.



## Prerequisites

- Access to [Power Automate<sup>36</sup>](#).

<sup>35</sup> <https://docs.microsoft.com/en-us/dynamics365/customer-engagement/customize/create-mobile-task-flow>

<sup>36</sup> <https://flow.microsoft.com/>

- An **environment**<sup>37</sup> with a **Microsoft Dataverse database**<sup>38</sup>. (Applicable only for work or school accounts).
- Experience with creating a business process flow.

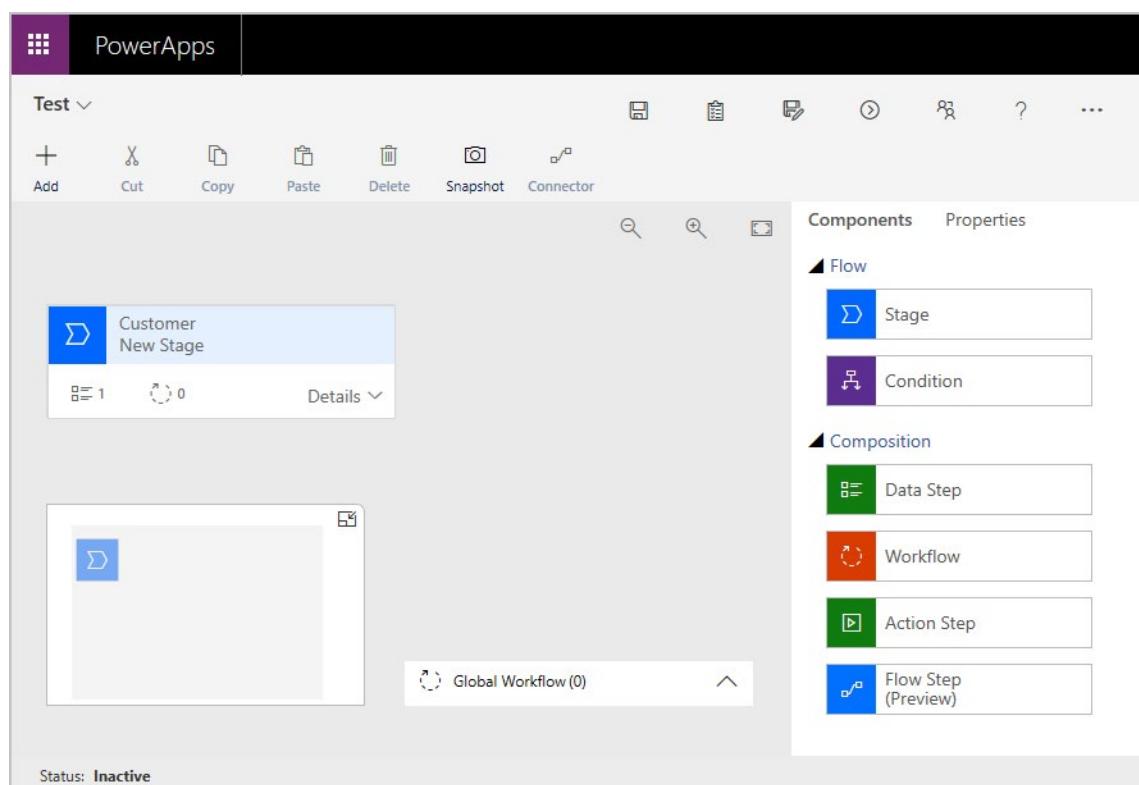
**Tip:** When you create a business process flow definition, you can define who has privileges to create, read, update, or delete instances of the business process flow. For example, for service-related processes, you might give customer service reps full access to change the business process flow instance. But you might give sales reps just read-only access to the instance, so that they can monitor post-sales activities for their customers. To set security for a business process flow definition that you create, select **Enable Security Roles** on the action bar.

## Create a business process flow

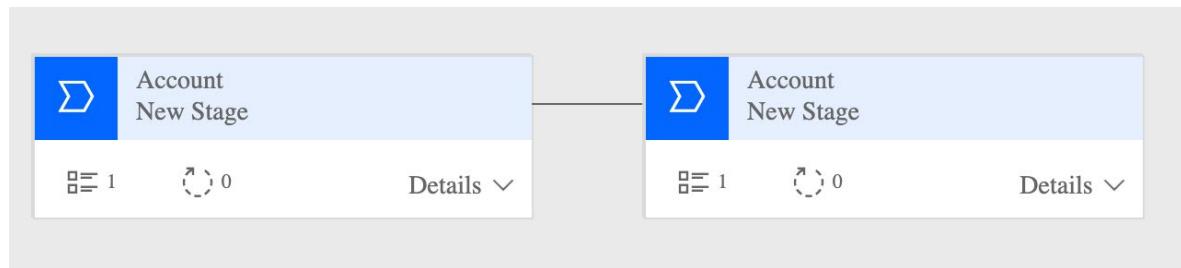
1. Launch Power Automate and sign in using your organizational account.
2. In the left pane, select **My flows**.
3. On the top bar, select **+ New flow** and **Business process flow**.
4. In the **Build a business process flow** pane, fill in the required fields:
  - **Flow name:** The display name of the process doesn't have to be unique, but it should be meaningful for people who must choose a process. You can change this name later.
  - **Name:** A unique name that's based on the display name. You can change the name when you create the process, but you can't change it after the process has been created. Power Automate can generate this for you.
  - **Choose a table:** Select the Microsoft Dataverse Table on which to base the process. The Table that you select affects the fields that are available for steps that can be added to the first stage of the process flow. If you can't find the table that you want, make sure that the **Business process flows (fields will be created)** option is set for the table in the table definition. You can't change the table after you save the process.
5. Select **Create**.  
The new process is created, and the business process flow designer is started. The designer page has three sections:
  - On the left, a single stage named *Account New Stage* has already been created for you.
  - Beneath this stage is the mini map, which lets you see the whole process or quickly go to a part of the process.
  - On the right are components that you can drag to the designer. You can also set properties to create a business process flow.

<sup>37</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/>

<sup>38</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database/>



6. Add stages so that users can proceed from one business stage to another in the process:

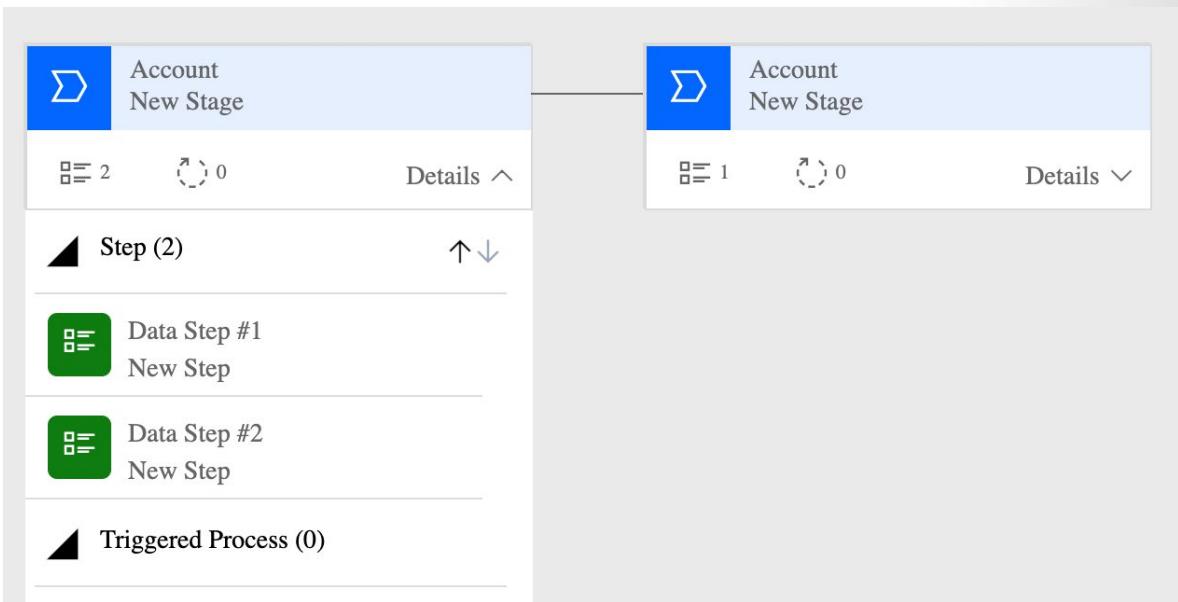


1. Drag the **Stage** component from the **Components** tab to the plus sign (+) in the designer.
2. Select the stage, and then, on the **Properties** tab on the right, set the properties:
  1. Enter a Step Name.
  2. Optional: Select a category for the stage (for example, **Qualify** or **Develop**). This category appears as a chevron on the process bar.



3. When you've finished setting the properties, select **Apply**.
7. Add steps to each stage:

**Tip:** To see the steps in a stage, select **Details** in the lower-right corner of the stage.



1. Drag the **Data Step** component from the **Components** tab to the stage.
2. Select the step, and then, on the **Properties** tab, set the properties:
  1. Enter a Step Name.
  2. If users should be able to enter data to finish a step, select the appropriate field in the drop-down list.
  3. If users must fill in the selected field to finish the step before they can proceed to the next stage of the process, select **Required**.
  4. When you've finished, select **Apply**.
8. Add a Condition to the process:
  1. Drag the **Condition** component from the **Components** tab to the plus sign (+) between two stages.



- stages.
2. Select the condition, and then, on the **Properties** tab, set the properties. When you've finished, select **Apply**.

9. Add a workflow to the process:

1. Drag the **Workflow** component from the **Components** tab to either a specific stage or the **Global Workflow** item:

- Drag the **Workflow** component to a specific stage if the workflow should be triggered when the process enters or exits that stage. The **Workflow** component must be based on the same primary table as the stage.
- Drag the **Workflow** component to the **Global Workflow** item if the workflow should be triggered when the process is activated or archived (that is, when the status changes to **Completed** or **Abandoned**). The **Workflow** component must be based on the same primary table as the process.

2. Select the Workflow, and then, on the **Properties** tab, set the properties:

1. Enter a display name.
2. Select when the workflow should be triggered.
3. Search for an existing on-demand active workflow that matches the stage table, or create a workflow by selecting **New**.
4. When you've finished, select **Apply**.

10. To validate the business process flow, select **Validate** on the action bar.

11. To save the process as a draft while you continue to work on it, select **Save** on the action bar.

**Important:** No one can use a process while it's a draft.

12. To activate the process and make it available to your team, select **Activate** on the action bar.

13. To define who has privileges to create, read, update, or delete the business process flow instance, select **Edit Security Roles** on the action bar. For example, for service-related processes, you might give customer service reps full access to change the business process flow instance. But you might give sales reps just read-only access to the instance, so that they can monitor post-sales activities for their customers.

1. In the **Security Roles** pane, select the name of a role to open the details page for that role.
2. On the **Business Process Flows** tab, select options to assign the role appropriate privileges for the business process flow.

**Note:** By default, the System Administrator and System Customizer security roles have access to

Security Role: CEO-Business Manager									Working on solution: Default Solution	
Entity	Create	Read	Write	Delete	Append	Append To	Assign	Share		
Expired Process	●	●	●	●	●	●	●	●		
Lead To Opportunity Sales Process	○	○	○	○	○	○	○	○		
IoT Alert to Case Process	○	○	○	○	○	○	○	○		
New Process	●	●	●	●	●	●	●	●		
Opportunity Sales Process	○	○	○	○	○	○	○	○		
Phone To Case Process	○	○	○	○	○	○	○	○		
Translation Process	●	●	●	●	●	●	●	●		

new business process flows.

3. Select **Save**.

**Tip:**

Keep these tips in mind as you work on your business process flow in the designer:

- To take a snapshot of everything in the business process flow designer, select **Snapshot** on the action bar. This option is useful if you want to share and get comments about the process from a team member.
- Use the mini map to quickly go to different parts of the process. This option is useful when you have a complicated process that scrolls off the screen.
- To add a description of the business process, select the arrow beside the process name in the upper-left corner of the page. You can enter up to 2,000 characters in the description field.

## Edit a business process flow

You can edit the business process flow after it has been created.

1. On the Power Apps main page, select **Flows** in the left pane.
2. In the list of business process flow, select the flow that you created, and then select **Edit** at the top.

Keep the following points in mind when you edit the stages of a business process flow:

- Business process flows can have up to 30 stages.
- You can add or change the following properties of a stage:
  - **Stage Name:** You can change the stage name after you create the stage.
  - **Table:** You can change the table for any stage except the first one.
  - **Stage Category:** A category lets you group stages by the type of action. It's useful for reports that will group records by the stage that they're in. The options for the stage category come from the Stage Category global option set. You can add more options to this global option set and change the labels of existing options. You can also delete options, but we recommend that you keep the existing options. If you delete an option, you won't be able to add it back later. If you don't want an option to be used, change the label to *Do not use*.
  - **Relationship:** Enter a relationship when the preceding stage in the process is based on a different table than the current stage. For the current stage, select **Select relationships**, and then specify the relationship that should be used when the flow moves between the two stages. We recommend that you specify relationships, because they provide the following benefits:
    - Attribute maps are often defined for relationships. These attribute maps automatically carry over data between records. Therefore, they help minimize the amount of data entry that's required.
    - When you select **Next Stage** on the process bar for a record, any records that use the relationship are listed in the process flow. Therefore, the reuse of records in the process is promoted. In addition, you can use workflows to automate the creation of records. Users then just have to select the workflow instead of creating a record. Therefore, the process is streamlined.
  - **Set Process Flow Order:** If you have more than one business process flow for a table, you must specify which process is automatically assigned to new records. On the action bar, select **Order Process Flow**. For new records or records that don't already have a process flow associated with them, the first business process flow to which a user has access will be used.
  - **Enable Security Roles:** A user's access to a business process flow depends on the privileges that are defined for the business process flow in the security role that's assigned to the user. By default,

only the System Administrator and System Customizer security roles can view a new business process flow.

## Exercise - Create a business process flow that has conditions

Business process flows guide you through the different stages of sales, marketing, or service processes, toward completion. For a simple process, a linear business process flow is a good option. But in more complex scenarios, you can use an enhanced business process flow that branches into different directions, depending on conditions within the flow.

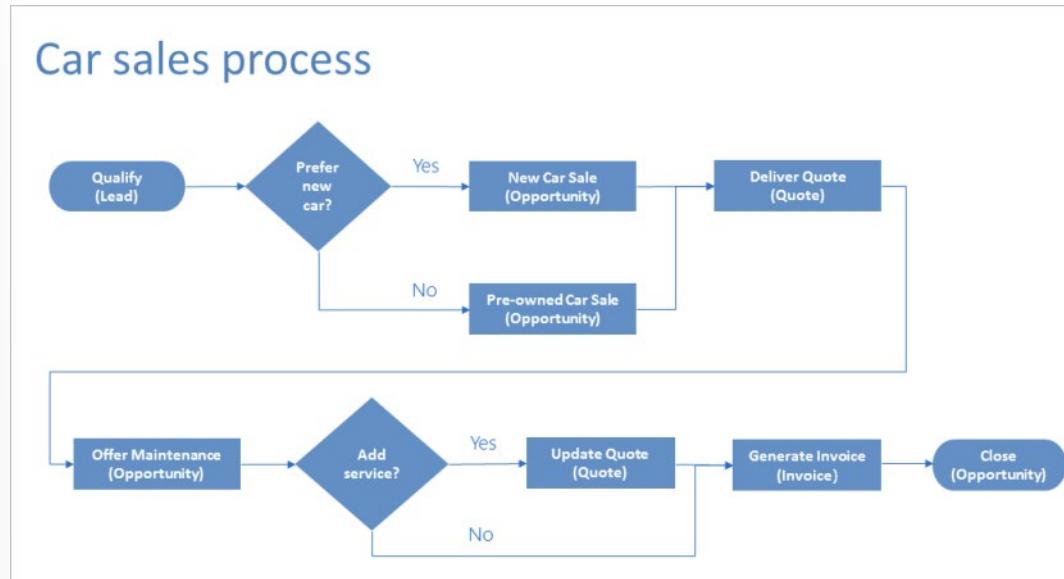
Branches are automatically selected in real time, based on rules that are defined in the process definition.

- If you have **Create** permissions on business process flows, you can use **If-Else** logic to create business process flows that have multiple branches.
- The branching condition can be formed from multiple logical expressions that use a combination of **AND** or **OR** operators.

For example, for the process of selling cars, you can set up a single business process flow that starts with a common qualification stage but then splits into separate branches, based on a rule:

- One branch manages the case of a customer who prefers a new car or a pre-owned car.
- Another branch manages the case of a customer whose budget is above or below \$20,000.
- A third branch might be for purchasing or declining a maintenance or service plan.

The following diagram shows a business process flow that has branches.



## Guidelines for business process flows that have branches

Keep the following points in mind when you design a business process flow that has branches:

- A process can span a maximum of five unique entities.
- You can use a maximum of 30 stages per process and a maximum of 30 steps per stage.

- Each branch can be no more than five levels deep.
- Branching rules must be based on the steps in the stage that immediately precedes them.
- You can combine multiple conditions in a rule by using the `AND` operator or the `OR` operator, but not both.
- When you define a process flow, you can optionally select a table relationship. This table relationship must a one-to-many (1:N) relationship.
- More than one active process can run concurrently on the same data record.
- When branches are merged, either all the peer branches must be merged to a single stage, or each peer branch must end the process. A peer branch can't merge with other branches and end the process at the same time.

**Note:**

- A table that's used in the process can be revisited multiple times (that is, there can be multiple closed table loops).
- A process can go back to the previous stage, regardless of the table type. For example, if the active stage is **Deliver Quote** on a quote record, process users can move the active stage back to the **Propose** stage on an opportunity record.

## Prerequisites

- Access to **Power Automate**<sup>39</sup>.
- An **environment**<sup>40</sup> with a **Microsoft Dataverse database**<sup>41</sup> and Dynamics 365 Apps enabled. (Applicable only for work or school accounts).
- Experience with creating a business process flow.

## Dynamics 365 customer engagement example: Car selling process flow that has two branches

Let's look at an example of a business process flow that has two branches. In this example, the business process flow is used for sales of new and pre-owned cars.

First, we'll create a process named **Car Sales Process**.

1. Launch Power Automate and sign in using your organizational account.
2. In the left pane, select **Flows**.
3. On the top bar, select **+ New** and then select **Business process flow**.
4. In the **Build a business process flow** pane, fill in the required fields:
  - **Flow name:** Enter *Car sales process*.
  - **Name:** A unique name that's based on the display name that you entered. You can change the name when you create the process, but you can't change it after the process has been created.
  - **Choose a table:** Select the *Lead* table.  
The table that you select affects the fields that are available for steps that can be added to the first

<sup>39</sup> <https://flow.microsoft.com/>

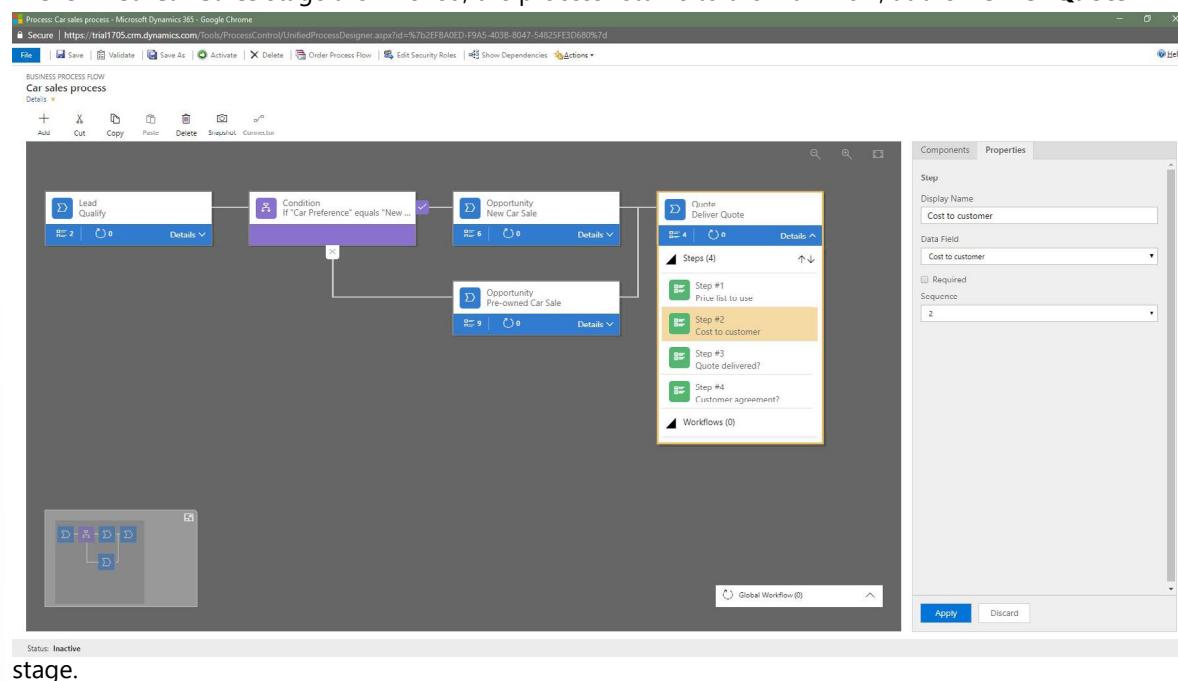
<sup>40</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview/>

<sup>41</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database/>

stage of the process flow. If you can't find the Lead table, make sure that the **Business process flows (fields will be created)** option is set for that table in the table definition. You can't change the table after you save the process.

5. Select **Create**.
6. Once the new page spins up in PowerApps, add the first stage to the process, name the stage *Qualify*, and add two data steps to it: *Purchase Time frame* and *Car Preference*.
7. After the common Qualify stage, split the process into two separate branches by adding a **Condition** component:
  1. Set up the condition with rules that meet your business requirements.
  2. To add the first branch, which will be run when the condition is satisfied, add a **Stage** component to the **Yes** path of the **Condition** component.
  3. To add the second branch, which will be run when condition isn't satisfied, add a **Stage** component to the **No** path of the **Condition** component.

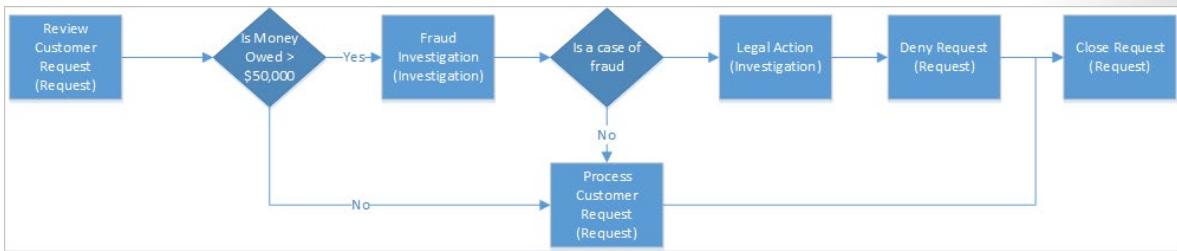
**Tip:** To create more complex branching, you can add another a **Condition** component to the **No** path of an existing **Condition** component. If **Car preference = New**, the process branches out to the **New Car Sales** stage, as shown here. Otherwise, the process goes to the **Pre-Owned Car Sales** stage in the second branch, as shown here. After all the steps in either the **New Car Sales** stage or the **Pre-Owned Car Sales** stage are finished, the process returns to the main flow, at the **Deliver Quote**



## Prevent information disclosure example

There are a few things that you need to consider to prevent people from seeing specific information about a process flow.

This section uses the example of a business process flow that has branches for processing a loan request at a bank. In the following diagram, the custom entities that are used in the stages are shown in parentheses.



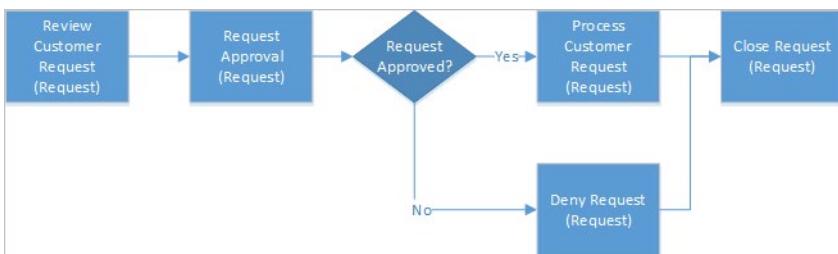
In this scenario, the bank loan officer needs access to the Request record, but she shouldn't have any visibility into the investigation of the request. At first glance, it looks as though we can easily meet this requirement by assigning the loan officer a security role that doesn't grant access to the Investigation table. But let's look at the example in more detail to see whether things will really be that easy.

Let's say that a customer submits a loan request for more than \$60,000 to the bank. Here is a high-level view of the stages and branches:

- In the first stage, the loan officer reviews the request.
- A branching rule checks whether the amount that's owed to the bank will exceed \$50,000. If this branching rule is satisfied, the next stage in the process is to investigate whether the request is fraudulent.
- If it's determined that the request is fraudulent, the process moves on to taking legal action against the requestor.
- The loan officer shouldn't have visibility into the two investigative stages, because she doesn't have access to the Investigation table.
- But if the loan officer opens the Request record, she can see the entire end-to-end process. Not only will she be able to see the Fraud Investigation stage, but she'll also be able to identify the outcome of the investigation, because she can see the Legal Action stage in the process.
- The loan officer can preview the steps in the investigative stages by choosing the stage. Although she won't be able to see the data or the step completion status, she'll be able to identify the potential actions that were taken against the requestor during the Fraud Investigation and Legal Action stages.

In this process flow, the loan officer will be able to see the Fraud Investigation and Legal Action stages, and this ability constitutes improper information disclosure.

Pay special attention to the information that might become disclosed because of branching. In our example, to prevent information disclosure, split the process into two separate processes: one for the request processing and one for the fraud investigation. The process for the loan officer will then look like this.



The process for the investigation will be self-contained and will include the following stages.



You'll have to provide a workflow to synchronize the Approve/Deny decision from the Investigation record to the Request record.

## Exercise - Monitor flows

You can view a summary of the number of times that each flow succeeded or failed today, yesterday, and on previous days. You can also explore details about each run, like when it ran, how long each step took, and, if a step failed, why it failed.

### Prerequisites

- Install the Power Automate mobile app for [Google Android<sup>42</sup>](#) or [Apple iOS<sup>43</sup>](#) on a supported device. The screenshots in this unit were taken on the Apple iPhone version of the app, but the mobile app for Android and Windows Phone are similar.
- If you have completed all of the Units in this Learning Path, you will have a number of flow runs available for review.  
If you don't already have a flow, you will want to create one now on the [Power Automate website<sup>44</sup>](#) before proceeding with this unit. For easier testing, use a flow that you can trigger yourself instead of waiting for an external event.

**Tip:** For testing, you can set up the flow with your personal email address. Then, when the flow is ready for real use, you can set it up with a different address (for example, your manager's).

### Show a summary of activity

- If your flow hasn't run before, trigger a run to generate data.  
It might take some time for the data to appear in the app.
- From your phone, open the Power Automate Mobile app.
- At the bottom of the screen, select the **Activity** tab. This tab organizes data by day, and today's data appears at the top.

Each entry shows the name of the flow and icons that correspond to the flow's trigger events and actions.

If at least one run of a flow has succeeded in a day, an entry shows the number of successful runs and the time of the most recent success. A different entry shows similar information if a flow has failed.

If a flow sends push notifications, the text of the most recent notification appears at the bottom of the

<sup>42</sup> <https://aka.ms/flowmobiledocsandroid/>

<sup>43</sup> <https://aka.ms/flowmobiledocsios/>

<sup>44</sup> <https://flow.microsoft.com/>

entry for successful runs.

The screenshot shows the Microsoft Flow Activity Feed. At the top, it says "TODAY". Below that, there is a card for a flow named "Send a 'Working from home today' email to your colleagues". The card includes four small icons in a 2x2 grid: a hand icon, an envelope icon, a bell icon, and a document icon. To the right of the flow name, it says "seconds >". Below the card, it says "Flow successfully ran 2 times". In a red-bordered box, the text "WFH email was sent successfully!" is displayed, followed by "seconds".

## Show details of a run

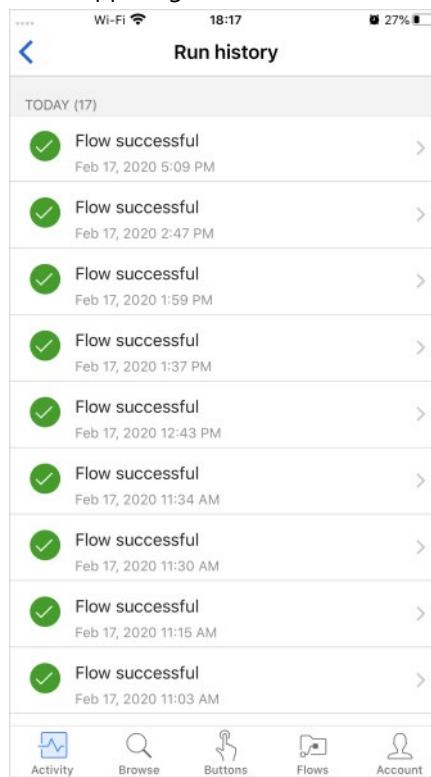
- From the Activity Feed, click the > icon next to one of your flows to show details about the flows run. For each event and action, a green **Checkmark** symbol indicates the step was successful and a red **X** symbol indicates that there was an issue with the step. If it succeeded, the amount of time that it took (in seconds) also appears.

The screenshot shows the "Activity details" page for a flow named "Send a 'Working from home today' email to your colleagues". It shows a timeline of events:

- Manually trigger a flow (0s, successful)
- Get my profile (0s, successful)
- Get manager (0s, successful)
- Get direct reports (0s, successful)
- Apply to each (2s, successful)
- Send an email (0s, successful)

Each step is represented by a colored bar (blue for triggers, orange for actions) with a green checkmark icon indicating success. The "Run details" section also shows "LAST RUN 4M AGO".

2. In the upper right hand corner of the screen, click the ... and then select **See previous runs**.



Any of the runs in in your flow history can be selected to show run details and or Resubmit the Flow, if one or more had failed.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *What are connectors used for in Power Automate?*

- Connectors are used to start a flow.
- Connectors let you build a flow that accepts user input.
- Connectors let you connect to a service like Salesforce, Microsoft 365, Twitter.

### Multiple choice

2. *How can you define who has privileges to create, read, update, or delete a business process flow instance?*

- Only a system administrator has access privileges to new business process flows.
- Only a system customizer has access privileges to new business process flows.
- Activate the business process flow, and then define access privileges for users and administrators.
- Activate the business process flow, and select Edit Security Roles, and define who will have privileges.

## Multiple choice

3. When creating Button Flows you can use trigger tokens to capture device information like, GPS data, Date and Time, etc. Which of the following is NOT an available Button trigger token?

- State
- City
- Phone number
- Full address

## Summary

Congratulations! You've expanded your skills for creating flows that let you do more while working less.

In the previous modules for Power Automate, you learned how to build simple flows. You've now increased your knowledge by learning about complex data sources, flow scheduling, integration, and complex business processes.



## Continue your journey

Microsoft Learn provides several learning paths, based on your role and interests.

Here are some ways that you can use Power Automate to get more done with less work when you use dynamics 365 and the Power Platform. Because these technologies work together, it's easy to measure your business, act on the results, and automate your workflows.

- In this **Power Apps**<sup>45</sup> learning path, you'll learn how to build apps that use flows to track or update business processes on any device.
- In this **Power BI**<sup>46</sup> learning path, you'll learn how to turn your unrelated sources of data into coherent, visually immersive, and interactive insights.
- In this **Customer Service**<sup>47</sup> learning path, you'll learn how to capture, track, and follow up on sales leads, and how to connect to your customer relationship management (CRM) platform.

What's even more exciting is that you can do all this without writing a line of code!

<sup>45</sup> <https://docs.microsoft.com/en-us/learn/patterns/create-powerapps/>

<sup>46</sup> <https://docs.microsoft.com/en-us/learn/modules/get-started-with-power-bi/>

<sup>47</sup> <https://docs.microsoft.com/en-us/learn/modules/get-started-with-dynamics-365-for-customer-service/index/>

# Use the Admin center to manage environments and data policies in Power Automate

## Administer flows

Welcome to the Admin center! The Admin center is the central location where tenant admins and environment admins manage an organization's data policies and environments. Any changes that you make in the Admin center are immediately available to users in the organization.

In this module, you'll learn how to:

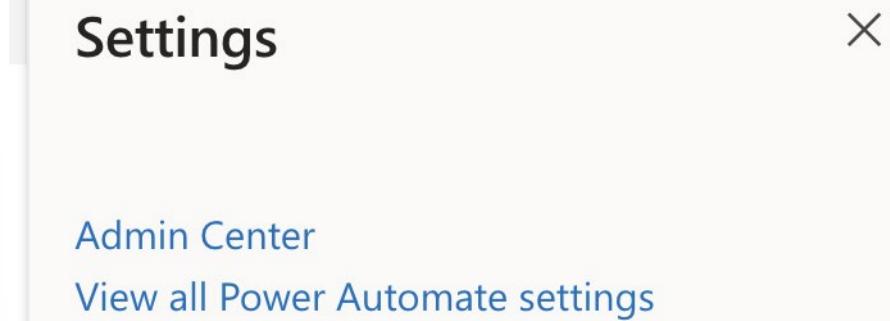
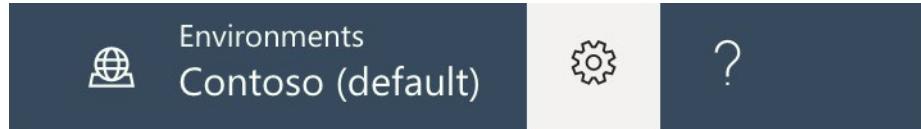
- Import and export flows.
- Share flows.
- Monitor flows.

## Open the Admin center

There are two ways to open the Admin center.

### Option 1: Power Automate settings

1. Go to **Power Automate**<sup>48</sup>, and sign in by using your organizational account.



2. Select the **Settings** button (the gear symbol), and then select **Admin Center** on the menu.  
The Admin center is opened.

### Option 2: Open the admin center directly

- Go directly to the **Admin center**<sup>49</sup>, and sign in by using your work account.

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<sup>48</sup> <https://flow.microsoft.com/>

<sup>49</sup> <https://admin.powerplatform.microsoft.com/>

## Environments

An *environment* is a space where you can store, manage, and share your organization's business data, apps, and flows. It also serves as a container to separate apps that might have different roles, security requirements, or target audiences.

The way that you use environments depends on your organization and the apps that you're trying to build. Here are some examples:

- You can create separate environments to group the test and production versions of your apps.
- You can create separate environments that correspond to specific teams or departments in your company. Each environment holds the relevant data and apps for each team/department.
- You can create separate environments for different global branches of your company.
- You can build all your apps in a single environment.

## Data policies

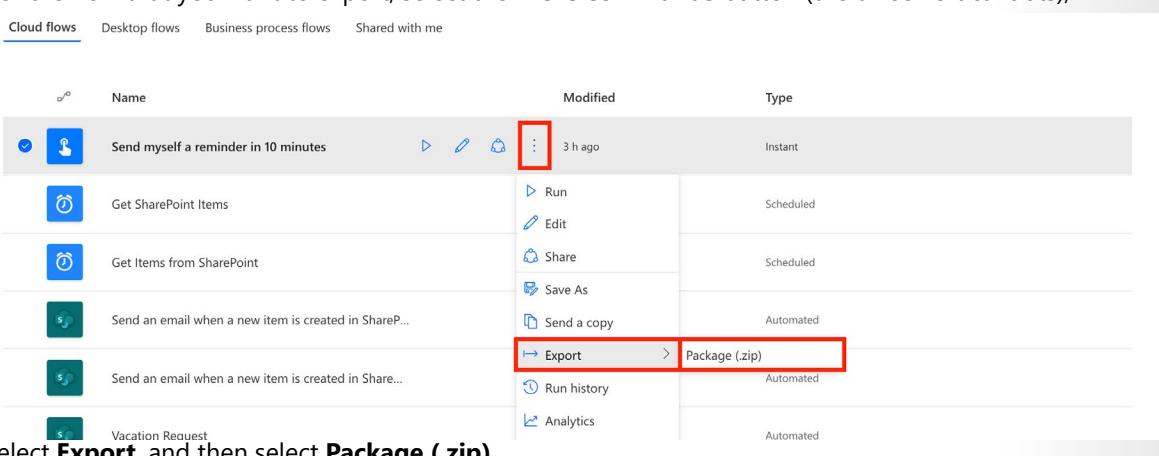
When you use Power Automate, the data is automatically protected with whatever security roles your organization already has in place. It isn't possible to use Power Automate to get access to information that the user doesn't already have access to in the organization. Some organizations may want to add an additional, optional layer of security that can proactively block flows that violate certain policies.

## Export and import flows

Power Automate allows you to export and then import a flow so that others can use it.

### Export a flow

1. Go to Power Automate, and sign in by using your organizational account.
2. In the left pane, select **Cloud flows**.
3. For the flow that you want to export, select the **More commands** button (the three vertical dots),



select **Export**, and then select **Package (.zip)**.

4. Fill in the package details:
  - **Name:** Enter a name for the flow.
  - **Environment:** Enter the environment for the flow.
  - **Description:** Enter a description of the flow.

- **Review Package Content:** Select export options, and add comments to provide instruction or add version notes.
5. Select **Export** to export the zip file. You can then select the folder to in which to download.

When you export a flow, the dependent resources for your flow are also exported into the package.

## Import a flow

After a flow has been exported, anyone that you send the zip file to can import it.

1. Go to Power Automate, and sign in by using your organizational account.
2. In the left pane, select **My flows**.
3. Select **Import**.
4. On the **Import package** page, select **Upload**, and then, in the dialog box, select the zip file that you exported.
5. Back on the **Import package** page, select **Import**.
  - In the flow settings, you can select whether to create a new flow or update an existing one with the flow definition from the package.
  - You must also select the connections that are required to set up the flow as part of the import process.
  - The **Import** button should become available after you've configured all the required settings.
6. After the flow is imported, you will have a link to open it and see the flow in **My Flows**, under the **Cloud flows** heading.

## Learn how to distribute button flows

In the Power Automate mobile app, you can share button flows with other users or groups in your organization. The users or groups with whom you share a button can then run it the same way they run their own buttons.

You can also share a link to buttons that another person shared with you.

You can stop sharing your buttons at any time.

The screenshots in this unit were taken on a Apple iOS device. If you're using an Android or Windows device, what you see might differ, but the functionality is the same.

## Prerequisites

To share buttons, you need:

- An account that has access to **Power Automate**<sup>50</sup>.
- A flow to share.
- A mobile device that has the Power Automate mobile app for **Android**<sup>51</sup>, **Apple iOS**<sup>52</sup>, or **Windows Phone**<sup>53</sup>.

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<sup>50</sup> <https://flow.microsoft.com/>

<sup>51</sup> <https://aka.ms/flowmobiledocsandroid/>

<sup>52</sup> <https://aka.ms/flowmobiledocsios/>

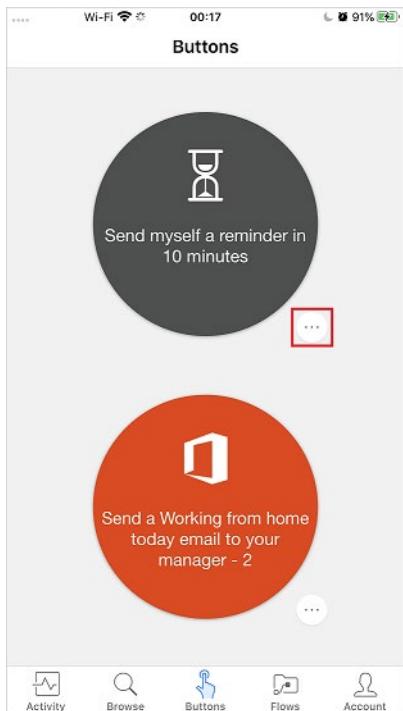
<sup>53</sup> <https://aka.ms/flowmobilewindows/>

- A person or group in your organization with whom to share your button.

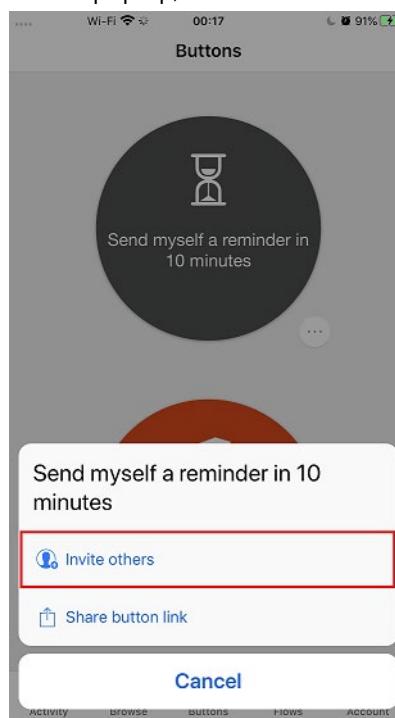
## Share a button

You share a button by using the **Buttons** tab of the Power Automate mobile app.

1. Start the Power Automate mobile app.
2. On the **Buttons** tab, select the three dots next to the button that you want to share.



3. On the pop up, select **Invite others**.



4. On the following page you can manage users with whom you have already shared the flow. For this exercise, select **Invite others** again to continue with sharing.
5. Search for and select the person or group that you want to share the button with.
6. Select **Send**.
7. On the page that states that the button sharing action was successful, select **Done**.

## Require users to use their own connections

When you share a button with other people, you can either let them use all the connections that the button uses or require that they use their own connections. Follow these steps to require the people with whom you share your button to use their own connections.

**Note:** If you let other people use your connections, they can't access the credentials in your connection. They also can't reuse those connections in any other flow.

1. On the page that appears immediately after you share a button, select **Manage connections**.
2. Select **Edit** for the connection that you want to manage.

3. Select **Provided by user** or your email address to specify whose connections must be used in the



shared button.

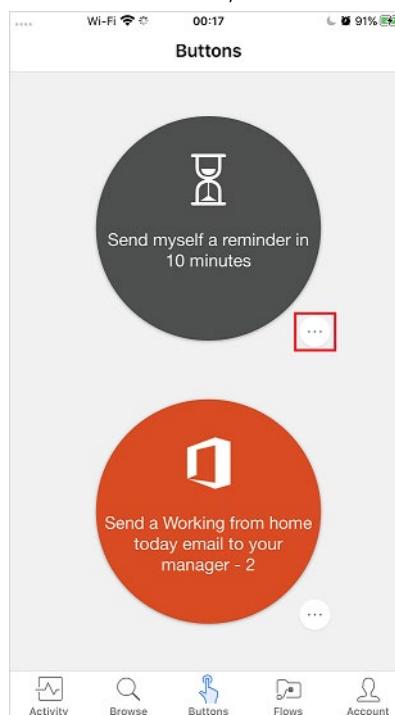
You can view or change your selection at any time.

1. On the **Flows** tab, select the flow that you shared.
2. On the **Users and connections** page, on the **Connections** tab, select **Edit** for the button that you want to manage.

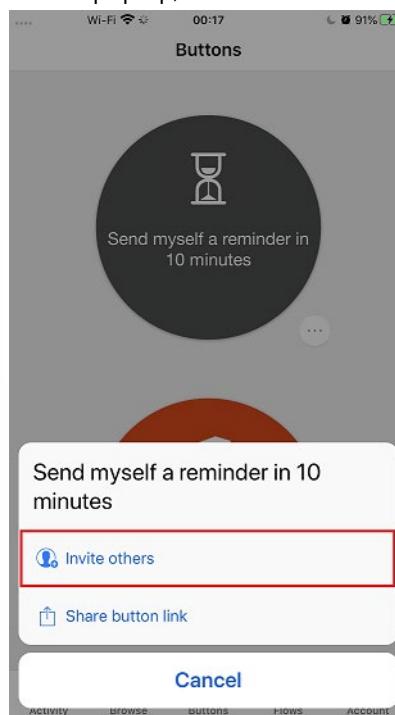
## Stop sharing a button

You can stop sharing a button by following these steps.

1. On the **Buttons** tab, select the three dots next to the button that you want to stop sharing.

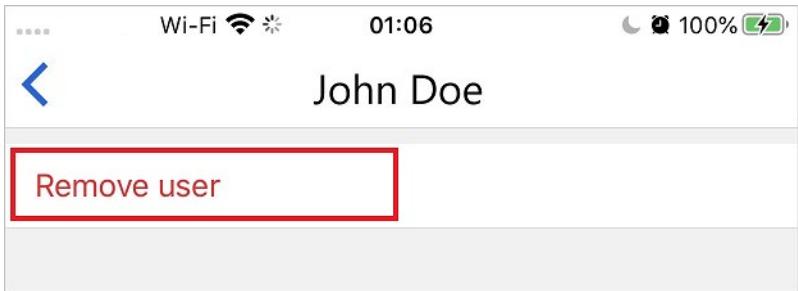


2. On the pop up, select **Invite others**.



3. On the following page you can manage users with whom you have already shared the flow. On this page, select the user which you wish to remove.

- 
4. On the user's page, select **Remove user**.



5. Wait for the removal action to be finished. The list on the **Button users** page is refreshed, and the user or group that you removed is no longer listed.

## Monitor the run history

You can view the whole run history, even for runs started by a person that a button is shared with.

1. Start the Power Automate mobile app.
2. Select the **Activity** tab to view the run history.

## Use shared buttons

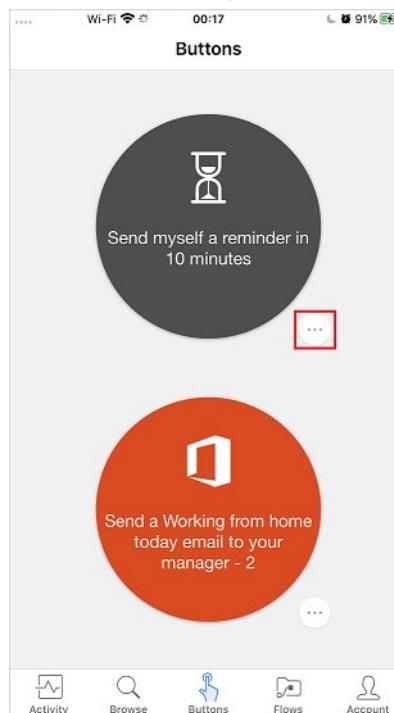
Before you can run a button that someone has shared with you, you must add it to your **Buttons** tab from the **Add buttons** page.

1. On the **Buttons** tab, select **Get more** (or the **New buttons are available** banner if it appears).
2. Select the button to use.  
The button is immediately added to the **Buttons** tab. You can then run the button from the **Buttons** tab, just like any other button that's listed there.

## Re-share a button

You can share a link to a button that has been shared with you.

1. On the **Buttons** tab, select the three dots next to the button that you want to share.

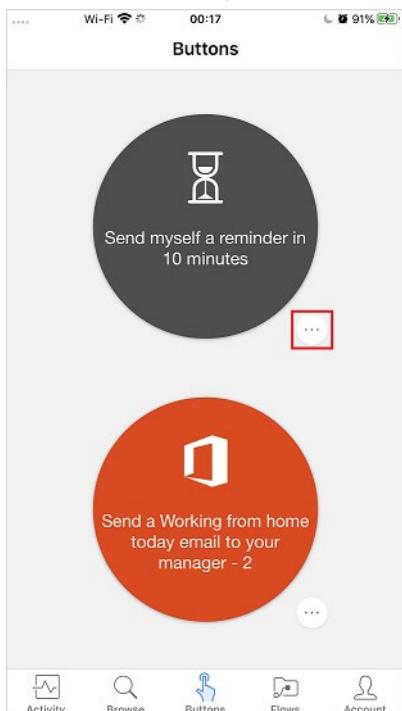


2. Select **Share button link**.
3. Select the app that you want to use to share the button.
4. Follow the steps for sending a button to a person that you want to share it with.

## Stop using a shared button

If you no longer want to use a button that was shared with you, you can remove it.

1. On the **Buttons** tab, select the three dots next to the button that you no longer want to use.



2. Select **Remove**.

**Note:** After you remove a shared button, you can add it back by selecting **Get more** on the **Buttons** tab.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. After a flow has been exported, who can import the flow?

- Only System Customizers
- Only System Administrators
- Only the user that exported the flow
- Anyone that receives the zip file can import it

## Multiple choice

2. Which of the following is a requirement to share button flows?

- An account that has access to Power Automate.
- An account that is a System Customizer.
- An account that is a System Administrator.
- A SharePoint account and Power Automate sharing rights.

## Multiple choice

3. What are some actions for which you can use the Power Automate admin center?

- Connect to Dynamics 365 and write flows
- Share and create button flows
- Manage Environments and Data policies
- Import and Export flows

## Summary

Congratulations! You've grown your skills by administering flows.

In the previous modules of this learning path for Power Automate, you learned how to build simple and more complex flows.



Now you've learned how to take care of them when things aren't quite right. You learned how to:

- Export and import flows.
- Share button flows with other team members.
- Monitor flow activity.

## Continue your journey

Want to learn more about Microsoft Power Platform and how to solve problems? Check out these resources:

- **Power Apps<sup>54</sup>** learning path. You'll learn how to build apps that use flows to track or update business processes on any device.

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<sup>54</sup> <https://docs.microsoft.com/en-us/learn/patterns/create-powerapps/>

- **Power BI<sup>55</sup>** learning path. You'll learn how to turn your unrelated sources of data into coherent, visually immersive, and interactive insights.
- **Customer Service<sup>56</sup>** learning path. You'll learn how to capture, track, and follow up on sales leads and connect to your CRM platform.

Even more exciting, you can do all of this without writing a line of code!

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<sup>55</sup> <https://docs.microsoft.com/en-us/learn/modules/get-started-with-power-bi/>

<sup>56</sup> <https://docs.microsoft.com/en-us/learn/modules/get-started-with-dynamics-365-for-customer-service/>

# Use Dataverse triggers and actions in Power Automate

## Introduction

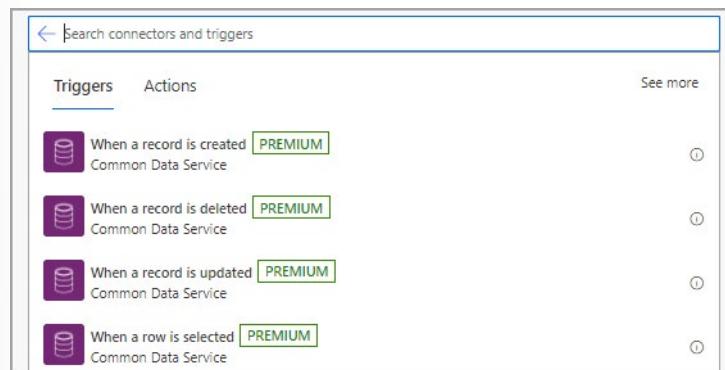
Microsoft Power Automate allows you to connect to hundreds of different programs and services across the web. Microsoft Dataverse is a user-friendly data platform that is built on Common Data Model and uses features such as low-code AI to make your data work more intelligently. Together, these programs can change the way that you work by managing your data and automating repetitive, data-driven tasks.

In this module, you will:

- Learn about Dataverse triggers and actions in Power Automate.
- Discover other inputs that are available.

## Dataverse triggers

Power Automate allows you to build automated workflows through a series of triggers and actions. Triggers act as a catalyst to begin a series of actions; they *trigger* your flow to begin. Dataverse acts as a scalable database but also offers rich metadata and built-in logic processes. Nevertheless, the triggers in Power Automate are built on the data that is stored inside Dataverse.



The triggers in Dataverse are:

- **When a record is created** - Begins a flow when a record is created in a specified table in Dataverse. You can set additional logic to determine whether the actions are performed after grabbing the fields from the newly created row. This trigger could begin an approval process when a user creates a new purchase order or vacation request.
- **When a record is deleted** - Begins a flow when a record is deleted in a specified table. You could use this trigger to delete associated items in the same table or another one. For example, if a record was the main information in a purchase order and another table held the line items, you can delete the line items. Alternatively, you could store the deleted information in a secondary table for archival or until a manager approves deletion.
- **When a record is updated** - Begins a flow when a record is updated in a specified table. You could use this trigger to continue in a multilevel approval process or to update various users, such as the creator of the item, that changes have been made.

- **When a row is selected** - Adds a button to a specified table in Dataverse and allows you to begin a flow for a specific record. This trigger could be used as an archival flow or to perform actions on specific records.

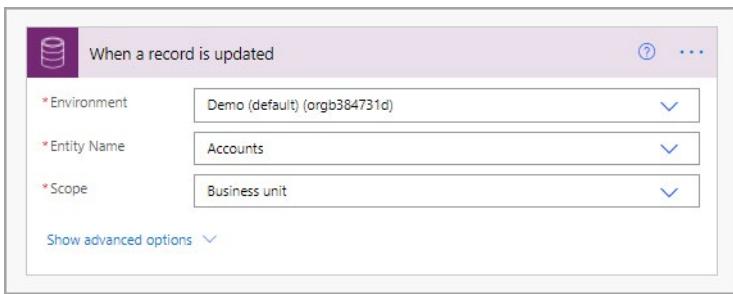
Now that you have learned about the various triggers that are offered inside of Power Automate for Dataverse, you can learn how to use those triggers.

## Use triggers

All triggers in Power Automate produce information, which is called dynamic content. Occasionally, this information only references who began the flow by selecting a button, but all Dataverse triggers give, at minimum, a row of data from a table.

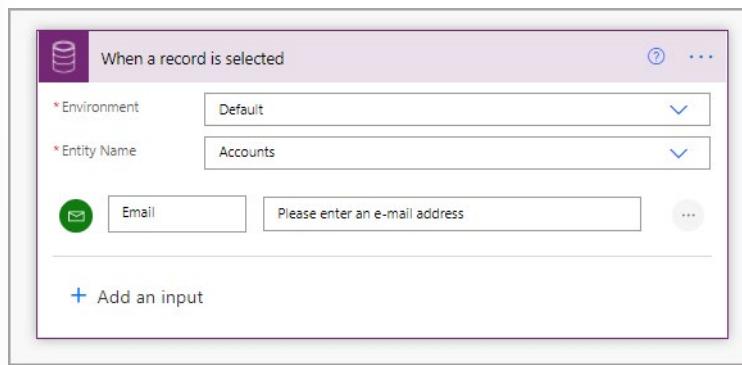
When using a Dataverse trigger, you need to specify the following parameters:

- **Environment** - Environments are like containers in which you can organize tables, flows, apps, and more. Some organizations only use a single environment, but many have multiple environments for various priorities and developments.
- **Entity Name** - Entity is simply another word for table. It allows you to specify the exact table where your data is held, which should trigger your flow. If you select **User** in this drop-down menu, only actions on a record that you own will trigger the flow.
- **Scope** – This parameter allows you to specify when the flow runs according to the user who triggered it. Various scopes that you can choose from are:
  - **Business unit** – Actions that are taken on a record that your business unit owns will trigger the flow.
  - **Parent: Child business unit** – A trigger with this scope will be initiated on actions that are taken on a record that your business unit or any child business units owns.
  - **Organization** – The flow will be triggered for actions that are taken on the record, regardless of owner.



One trigger allows you to request more inputs. When a user creates, updates, or deletes a record, you don't have the opportunity to ask for more information because the user could be performing those actions from multiple places. However, with the **When a record is selected** trigger, the user can trigger the flow from a button on the table inside Dataverse. Because Power Automate knows where the user is performing the action, you can request additional input for use later in the app.

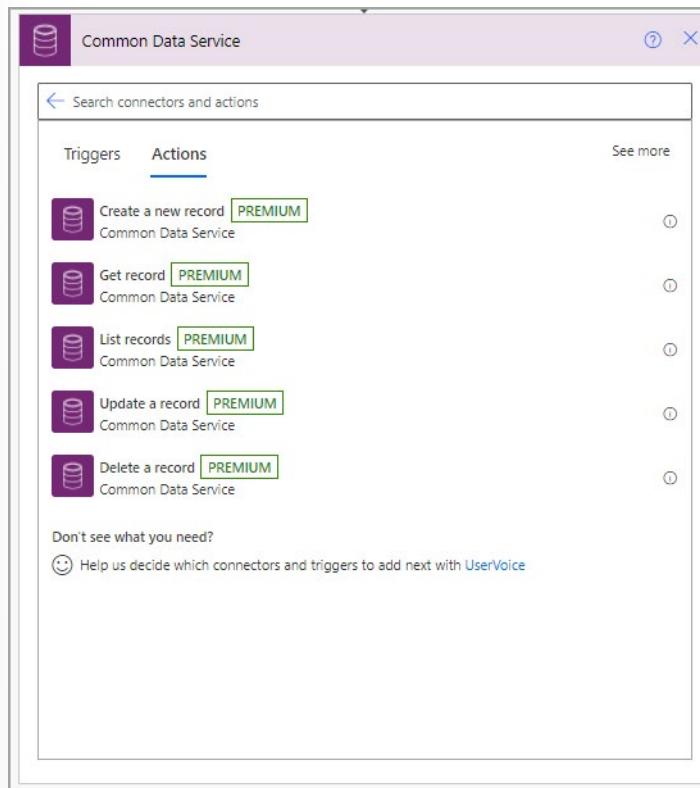
Select **Add an input**, specify the type of input that you want, and then enter a short message to the user. For example, the following screenshot shows a request for an email address. The scope has not been requested because any user who has access to the table in Dataverse would be able to select the button on any record that they have access to.



Now that you have learned about the mechanics of triggers and how to use them, you can learn about the actions that you can perform within your flows.

## Work with Dataverse actions

While triggers start a flow in Power Automate, actions are exactly what they sound like: actions that the flow will perform when triggered.



The Dataverse actions are:

- **Create a new record** - Allows you to enter a new row of data into a table. You don't need to have a Dataverse trigger to use Dataverse actions, so you could create a record after other actions such as holding an information log when specific emails are sent.
- **Get record** - Allows you to find a specific record. If you had a child item (such as lines in a purchase order), this action would allow you to fetch the parent item (the main information in the purchase order).

- **List records** - Allows you to fetch multiple records such as all child items that are associated with a parent item (for example, line items that are associated with a purchase order). Then, you can perform further actions on those items.
- **Update a record** - Allows you to make changes to a specific record such as updating a status after an approval process has been completed.
- **Delete a record** - Allows you to delete a row of information. In the example that was used for the triggers, you could create a flow that is triggered by the deletion of the main purchase order information, use the **List records** action to find all line items (or child items) that are associated with that purchase order, and then use this action to delete those items.

Dataverse actions in Power Automate allow you to create robust processes that surround your data.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *What is the difference between triggers and actions?*

- Triggers start a flow while actions are performed in a flow.
- Actions and triggers are synonymous and have no differences.
- Actions start a flow while triggers are performed in a flow.
- Triggers are used for Dataverse while actions are used for other connectors.

### Multiple choice

2. *Which trigger allows for additional inputs?*

- When a record is created
- When a record is updated
- When a record is deleted
- When a record is selected

### Multiple choice

3. *What does the List records action do?*

- Fetches child items
- Fetches multiple records in a Dataverse table, which can be filtered according to a logical condition
- Fetches all versions of a row of data

## Summary

Power Automate ensures that the process of using data that is held in Dataverse is simple and powerful. Now, you have learned how to use these programs in combination to change the way that you work by managing your data and automating repetitive, data-driven tasks.

In this module, you learned about:

- Dataverse triggers and actions in Power Automate.
- Additional inputs that are available.

## Key takeaways

Three key takeaways from this module are:

- Power Automate can be used with Dataverse to extend your data processes.
- Triggers start a flow; actions are completed in a flow.
- You don't need to have a Dataverse trigger to use a Dataverse action.

# Extend Dataverse with Power Automate

## Introduction

Organizations are built on data. Without this crucial data insight, companies are making uninformed decisions. However, acquiring and even organizing the data isn't enough. Data requires action within organizations. Microsoft Dataverse offers a simple and scalable solution for storing and organizing your data, but the integration with Microsoft Power Automate allows the already powerful technology to go even further.

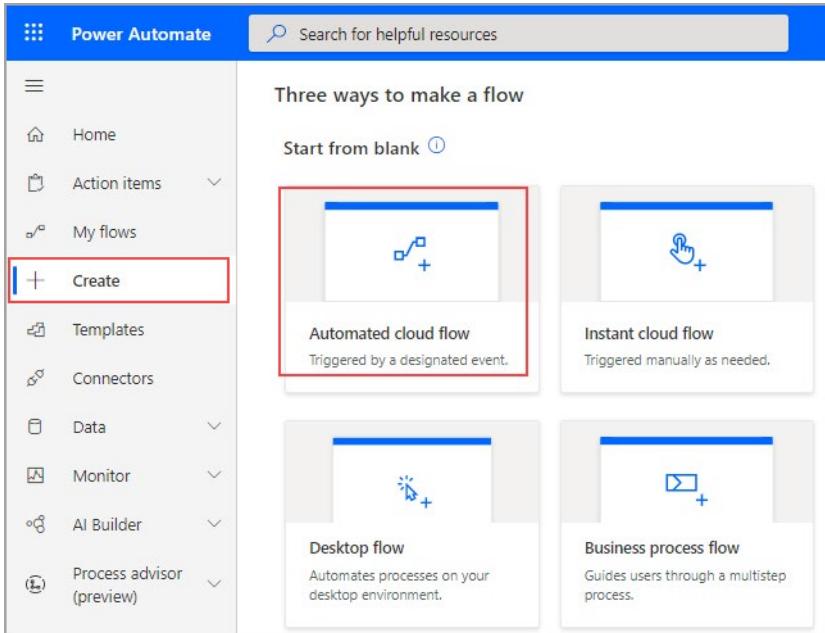
In this module, you will:

- Build flows with Dataverse.
- Integrate Dataverse with Microsoft Outlook.
- Integrate Dataverse with Microsoft To Do.

## Set up a flow and configure its trigger

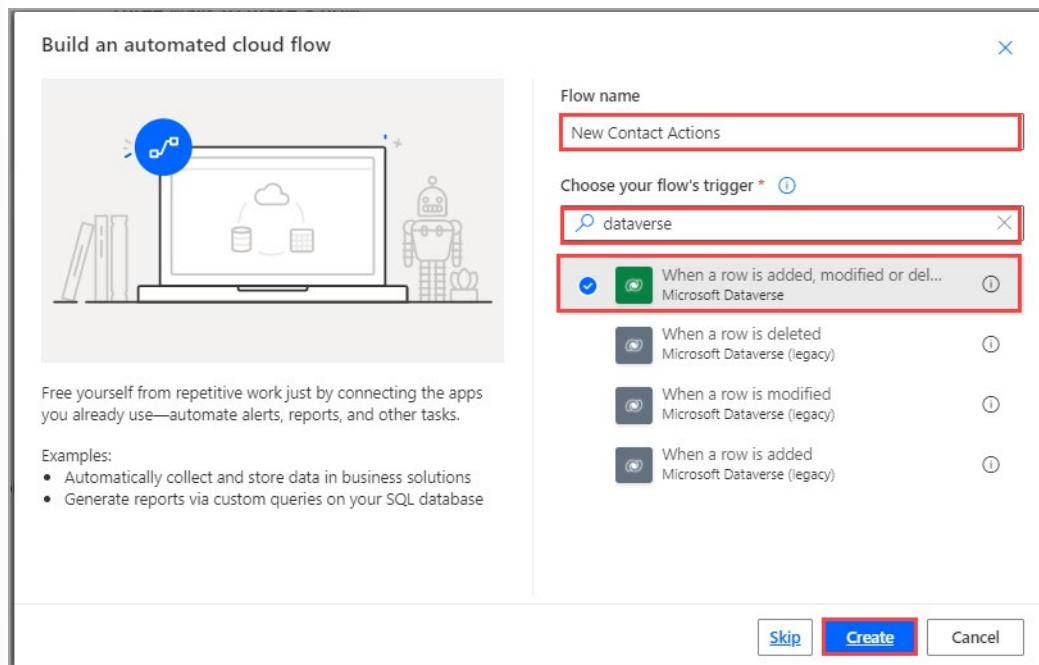
Many scenarios exist in which you would benefit from integrating your data with other programs. To consider the concepts of integration through Power Automate, consider a scenario where you've acquired a new customer. Business relationships are important for any company, but some businesses are built on them. In this scenario, you want to be alerted immediately when a contact is added to your database so that you can act on it. The first step is to create a flow and assign a trigger.

Begin in **Power Automate**<sup>57</sup>. Select **Create** and then **Automated cloud flow**.



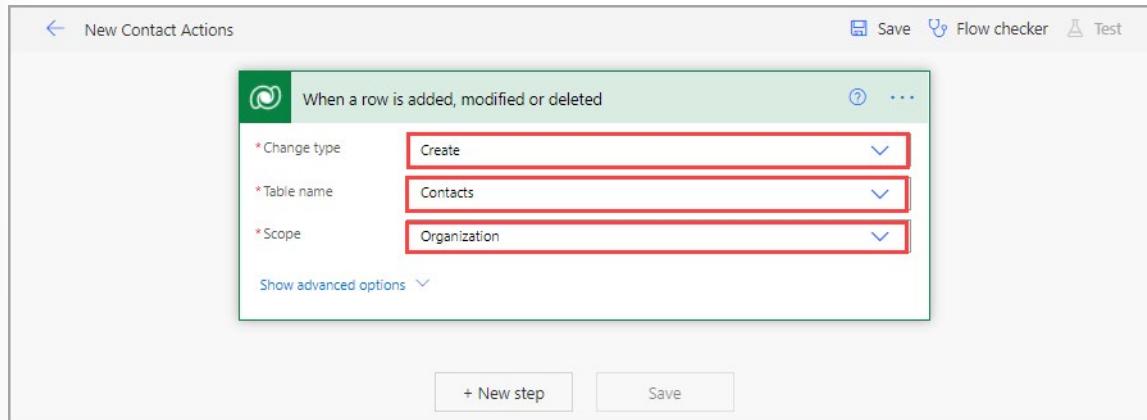
Name your flow and then search for and select the **When a row is added, modified, or deleted** trigger, which will trigger the flow when a row is added to a table in Dataverse. Select **Create**.

<sup>57</sup> <http://www.powerautomate.com/>



Configure your trigger with the **Change type**, **Table name**, and **Scope** parameters. The **Change type** parameter allows you to specify what type of change on a row will trigger your flow. The environment will be whichever environment that you are building your flow in. Environments are like buckets to help organize tables, flows, apps, and more. Dataverse is built on Common Data Model, a standardized data schema of more than 250 tables that fit most business needs to help companies organize data between applications. The **Scope** parameter allows you to specify when the flow runs, according to the owner of the record.

For this flow, select **Create** for the **Change type**, select **Contacts** for the **Table name**, and then select **Organization** as the **Scope**.

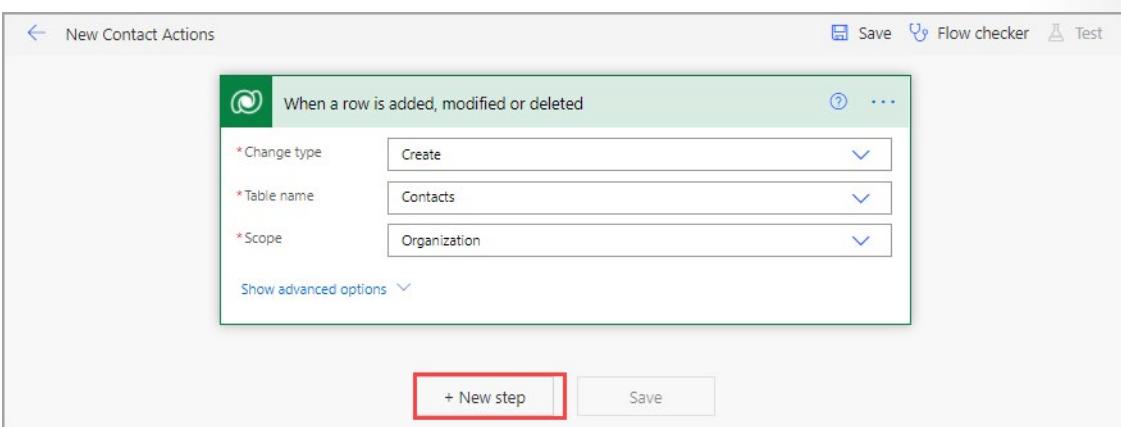


Now that you've configured a trigger for your flow, you can continue to learn how to act on it.

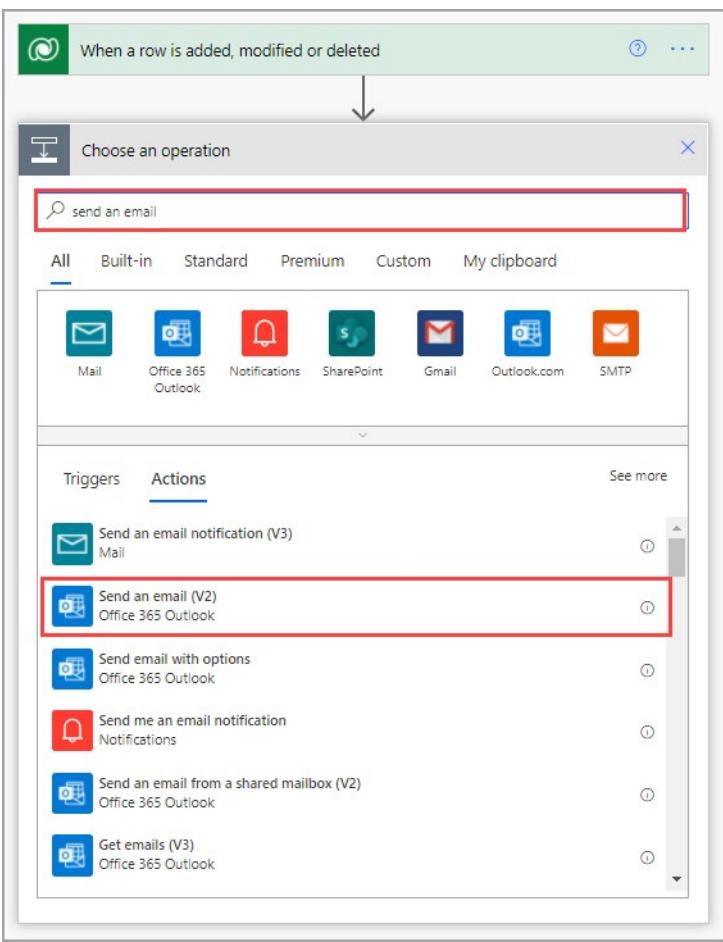
## Email Dataverse record

Triggers tell a flow when to begin, but actions tell a flow what to do. Though you want to perform several actions, you first need to be alerted of the new contact.

Select **New step**.



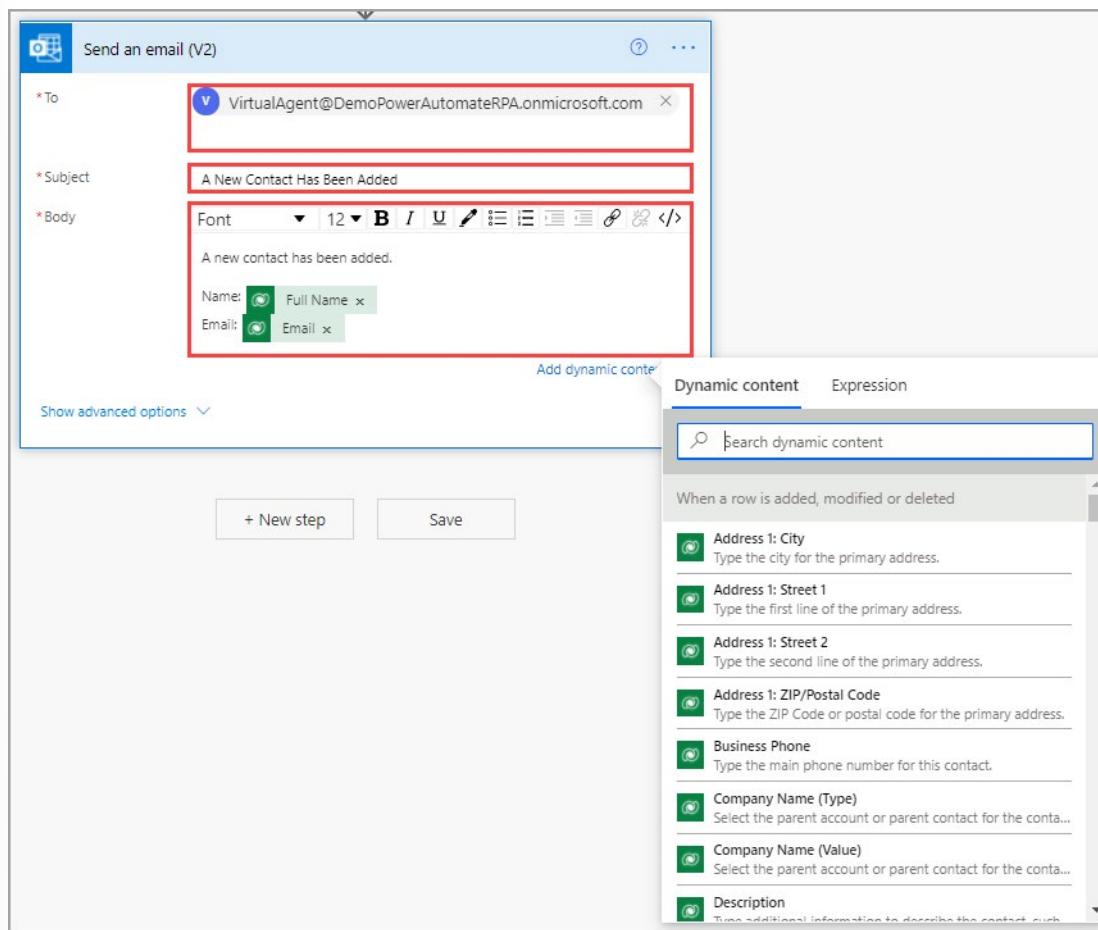
Search for and select **Send an email (V2)**.



**Tip:** Always use the latest version of an action to take advantage of new features and updates.

Enter your email address into the **To** field and then enter a description in the **Subject** field. The body of the email will be a combination of text and dynamic content. Dynamic content is information from previous steps in your flow. In this case, the available content is from your trigger, or the Contacts table. You can search through the dynamic content and select any fields that you want to use. If a **choice** field is

available, the word *Value* will be after the field name so that you get the actual text instead of the numerical data that Dataverse stores in the server.

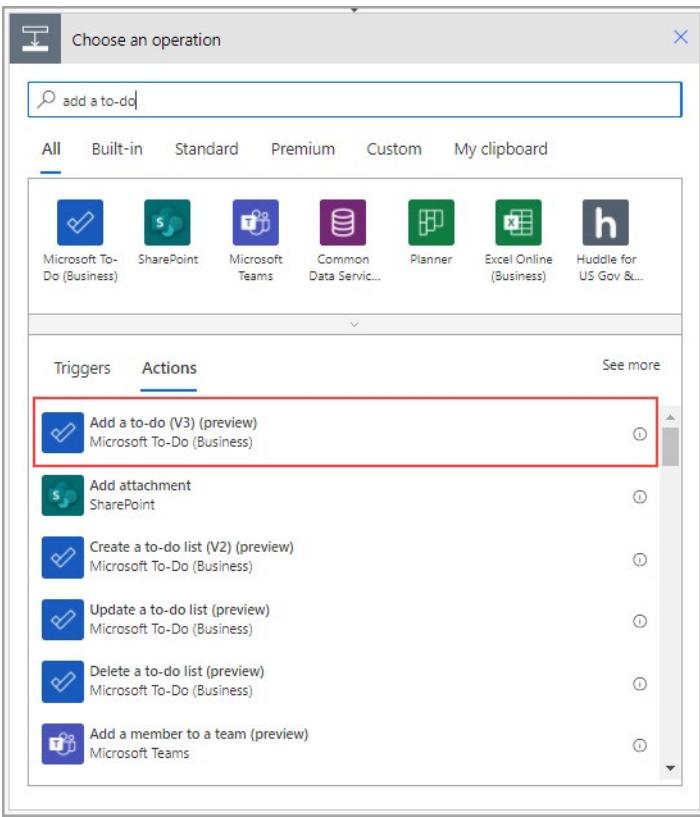


Now, you're sending an alert with information about the new contact, but you still have more to do.

## Add to-do items

Acquiring a new contact is an excellent accomplishment, but you need to take more action on this information. When you explore a new business relationship, you need to complete many tasks, such as adding the new contact on LinkedIn and sending a personalized email. This unit explores how to integrate Dataverse with another program: Microsoft To Do.

Select **New step**. Search for and select **Add a to-do (V3)**.



Select the list that you want to update. Microsoft To Do already comes with a list called **Tasks** that you'll use in this scenario. The **Title** field is the only required field, but by using a combination of text and dynamic content, you can set all available fields.

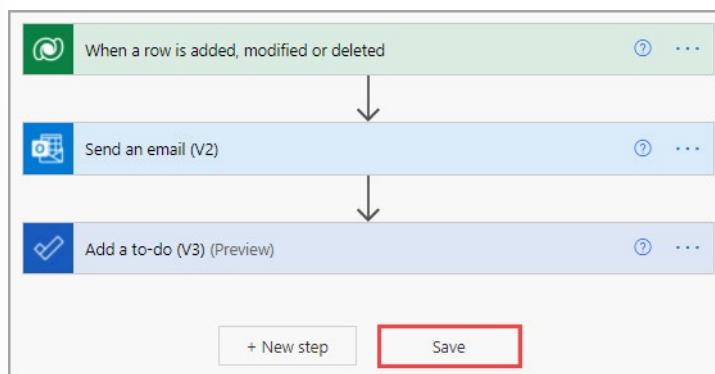
The screenshot shows the configuration of a Microsoft Flow action to add a new to-do item. The 'To-do List' is set to 'Tasks'. The 'Title' field contains the dynamic content 'New Contact LinkedIn'. The 'Due Date' field is set to 'Created On'. The 'Reminder Date-Time' field is set to 'YYYY-MM-DDThh:mm:ss'. The 'Importance' field is 'normal'. The 'Status' field is 'notStarted'. The 'Body Content' section contains a rich text editor with a placeholder 'LinkedIn.' and three input fields: 'Full Name' (with 'LinkedIn.'), 'Email' (with 'Email'), and 'Job Title' (with 'Job Title'). A 'Show advanced options' link is at the bottom left.

You can add more to-do actions by repeating the previous steps.

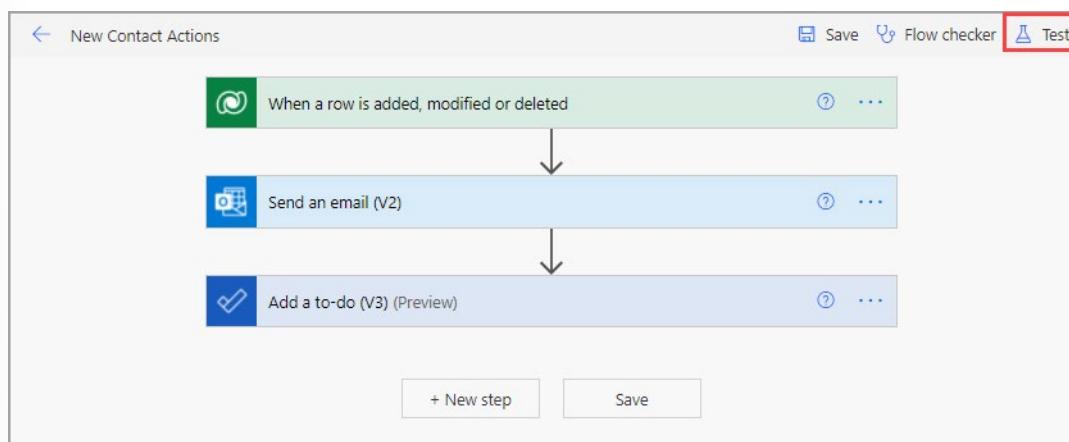
## Test and run your flow

Now that you have a useful flow, it's time to test it.

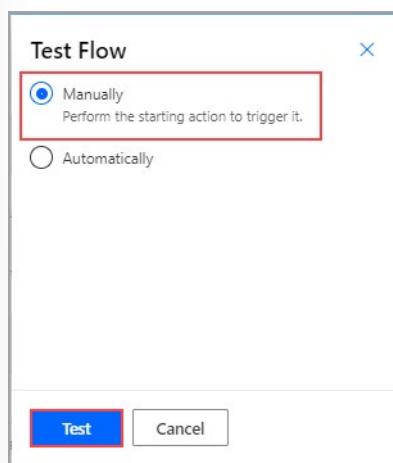
Start by selecting **Save**.



Select **Test** in the upper-right corner.



If you would have triggered the flow previously, you could test automatically. However, because this is the first time that you're initiating the flow, you need to test it manually. Select the **Manually** option and then select **Test**.



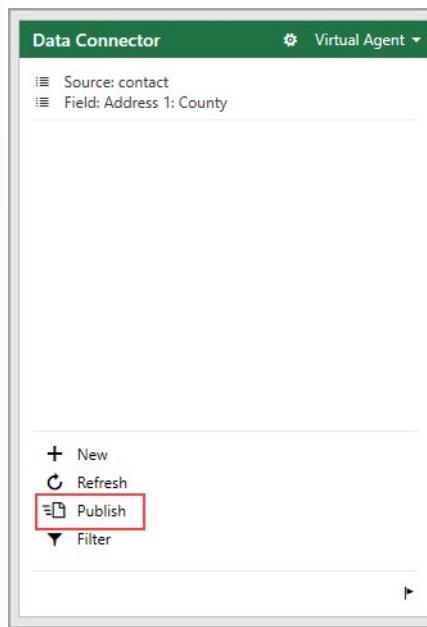
Next, you need to add a record to the table. In a new tab, go Power Apps(<https://make.powerapps.com/>) and select **Data** and then **Tables**. You can search for the table that you want or select **Contact**.

The screenshot shows the Power Apps portal interface. On the left, there's a navigation sidebar with options like Home, Learn, Apps, Create, Data, Tables, Choices, Dataflows, Export to data lake, Connections, Custom Connectors, Gateways, Flows, Chatbots, AI Builder, and Solutions. The 'Data' and 'Tables' items are highlighted with red boxes. The main area is titled 'Tables' and lists various entities: Account, Activity, Address, Appointment, Attachment, Business Unit, Contact (which is also highlighted with a red box), Currency, Email, Email Template, Fax, Feedback, Letter, Mailbox, Organization, Phone Call, and Position.

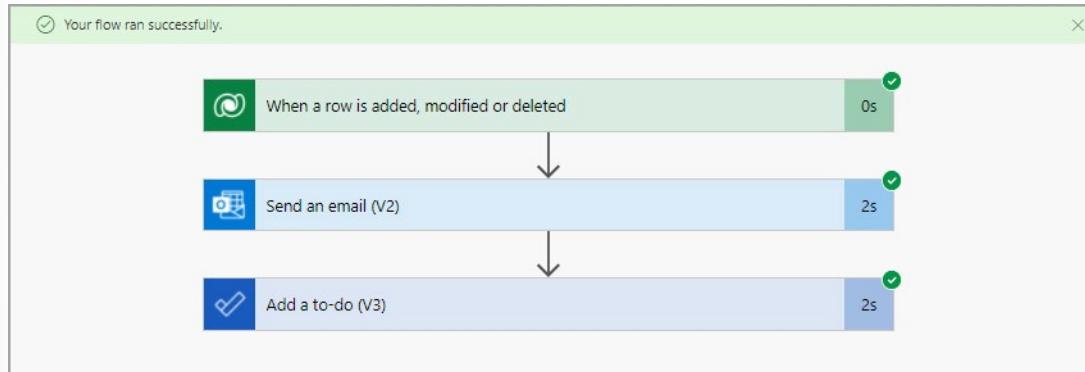
Select **Data > Edit data in Excel**.

This screenshot shows the 'Edit data in Excel' interface for the 'Address 1' table. At the top, there are buttons for 'Add column', 'Data' (which is highlighted with a red box), 'Export to data lake', 'AI Builder', and 'Settings'. Below that, it says 'Tables > C...' and has tabs for 'Columns', 'Rows', 'Views', 'Forms', 'Dashboards', 'Charts', 'Keys', and 'Data'. Under 'Columns', there's a table with columns 'Display name' and 'Name'. The data rows are: 'Address 1' (Name: address1\_composite), 'Address 1: Address Type' (Name: address1\_addressstypecode), 'Address 1: City' (Name: address1\_city), and 'Address 1: Country/Region' (Name: address1\_country). There are also 'Export data' and 'Get data' buttons at the bottom of the table.

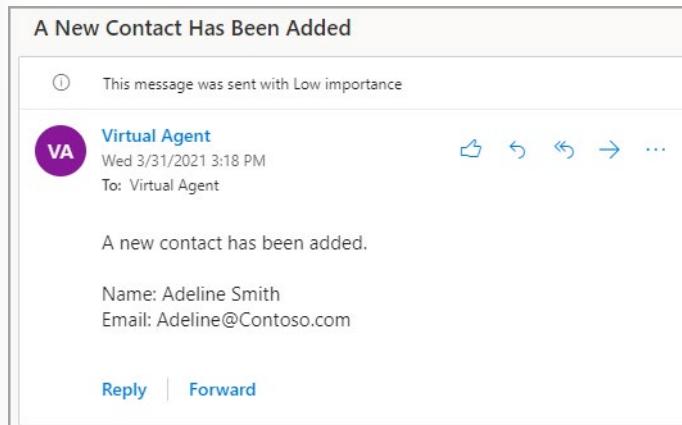
Sign in and add at least one row of data. No need to add every field, but try to add at least the first name, last name, job title, and email address. These fields are referenced in the flow. When you're done, select **Publish**.



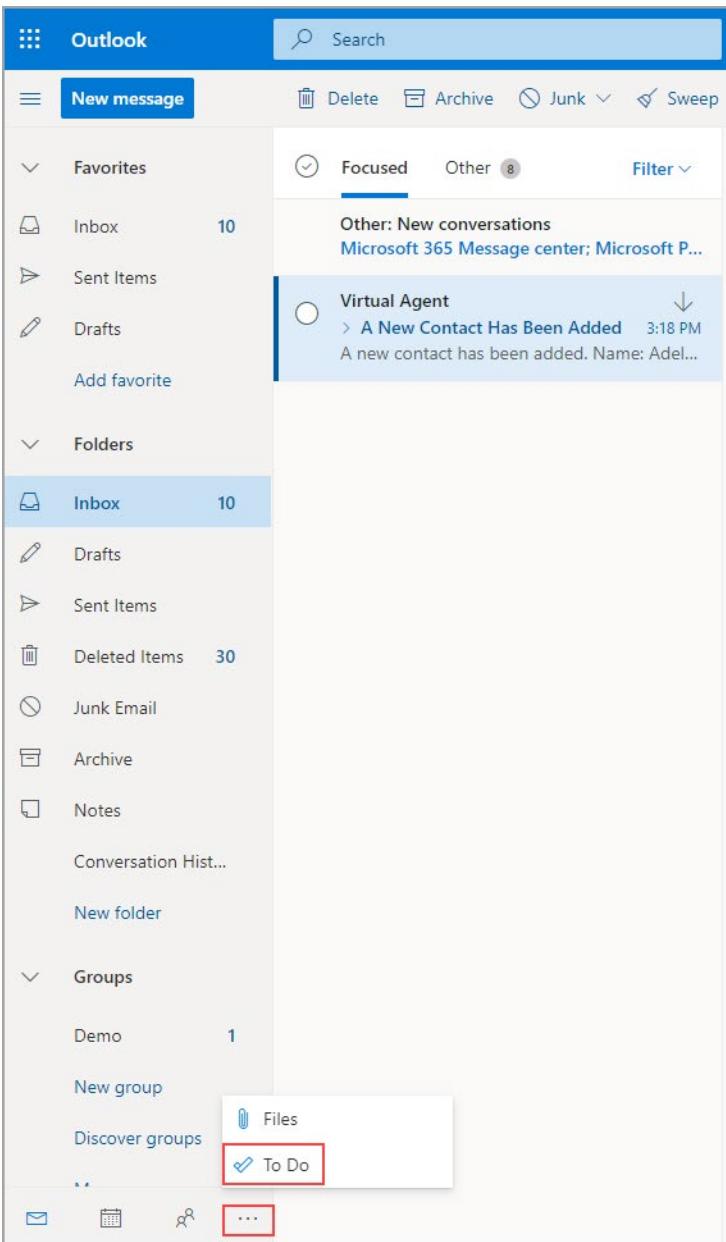
Switch to the **Power Automate** tab to check on your flow. You should have a success message.



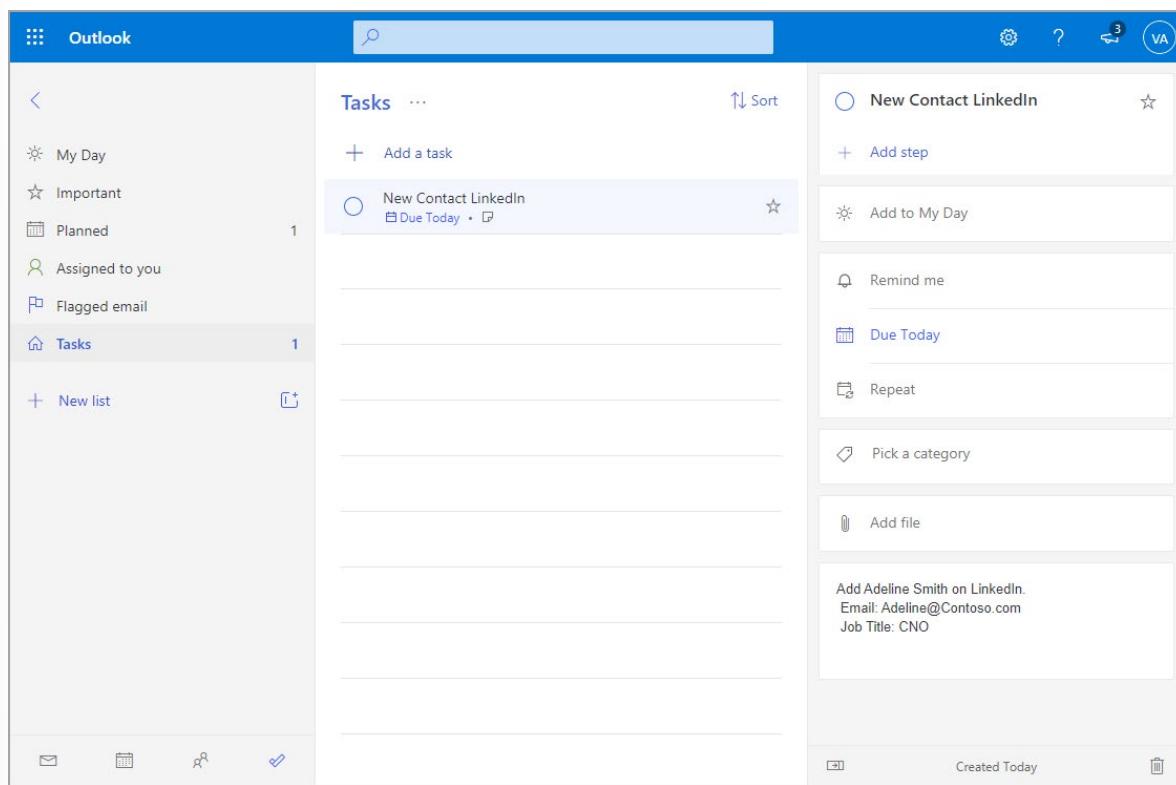
Check your inbox in Outlook. You should have a new email.



Select the ellipsis (...) in the lower-left corner and then select **To Do**.



A new to-do action will display under the list that you specified.



Now, you know how to take actions on data that is held in Dataverse.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *What does scope mean?*

- The scope determines which records that a trigger responds to.
- A scope is a bucket to help organize tables, flows, apps, and more.
- Scope is another word for table.
- Scope determines the audience of a flow.

### Multiple choice

2. *When given multiple versions of actions within Power Automate, which version should you typically select?*

- The version before the newest in case the newest version contains bugs
- The newest version to ensure that you're getting all the latest features
- The oldest version because it's likely to be simple and basic
- Research the versions before selecting and pick which is best for you

## Multiple choice

3. What tells the flow what to do?

- Triggers
- Environment
- Scope
- Actions

## Summary

Organizations are built on data, and now you know how to use that data and how to effectively act on it through a simple and automatic process. You can use the concepts that you've learned in this module to automate your own processes and integrate Dataverse with other services by using Power Automate to make the already powerful technology go even further.

In this module, you learned how to:

- Build flows with Dataverse.
- Integrate Dataverse with Microsoft Outlook.
- Integrate Dataverse with Microsoft To Do.

## Key takeaways

Three key takeaways for this module are:

- Dataverse can go even further if you use Power Automate to create flows that connect your data to other services.
- Power Automate can connect hundreds of different services including Dataverse, Outlook, Microsoft To Do, and many more.
- Using triggers and actions that are connected to Dataverse allows you to disperse and use that information elsewhere.

# Introduction to expressions in Power Automate

## Introduction to expressions

When you build a flow in Power Automate, it's easy to get started by adding a trigger and actions and then passing data between them with dynamic content. But, in most cases you need to perform more complex operations. You may want to do a calculation, to transform data for your solution, or access, convert, and compare values. To do these things, you can look to expressions.

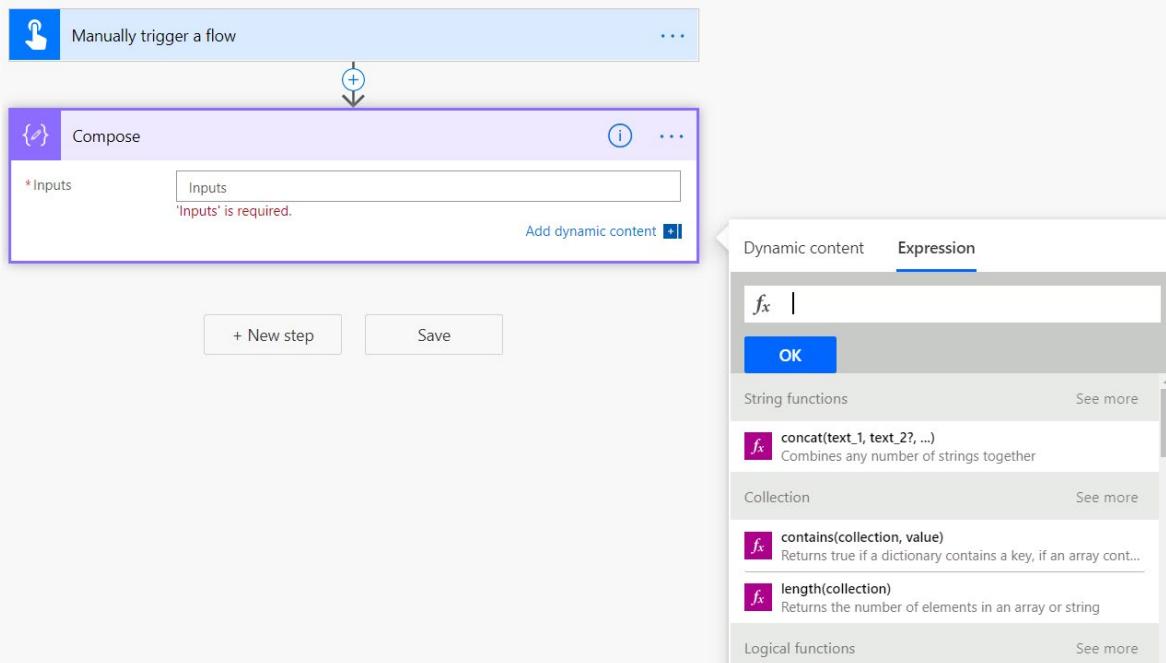
In Power Automate, expressions are a set of simple functions that enable you to return data. Put simpler, you use expressions to write a formula to get your data the way you want it. Expressions allow you to do things like convert a date to UTC, divide two numbers, create that perfect string by combining fields, and much more all by using various functions.

Flows in Power Automate run on top of Azure Logic Apps. This is relevant because they both use all of the same functions. When you're searching the internet for solutions or reading documentation about Power Automate functions, it's common to end up looking at Logic Apps documentation. For example, the **Reference Guide<sup>58</sup>** of functions for Power Automate is hosted on the Logic Apps side of the documentation.

Through the rest of this module, you'll learn about the different types of functions and the syntax so you can start to use expressions in your flows.

## Get started with expressions

To write an expression in Power Automate, select a field to open the **Dynamic content** menu and then select **Expression** as shown below.



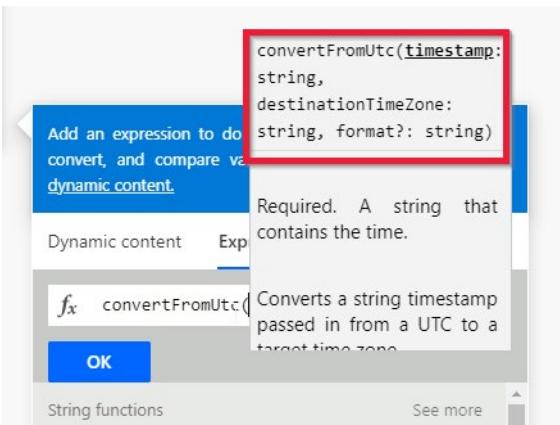
<sup>58</sup> <https://docs.microsoft.com/en-us/azure/logic-apps/workflow-definition-language-functions-reference/>

The formula box is where you can type your expressions by combining one or more functions. Before you learn about the different types of functions and their usage, there are some commonalities you should learn first. Function names aren't case-sensitive.

**Tip:** Notice in the screenshot that we used a **Manually triggers a flow** trigger and a **Compose** action. This allows you to have a simple setup for writing and testing your expressions without worrying about other inputs or actions. Use this setup to follow along in this app or any time you want to try out something new.

## Auto suggest, hints, and links in the formula bar

When you enter a function in the formula bar, you'll see a pop-up with syntax suggestions.

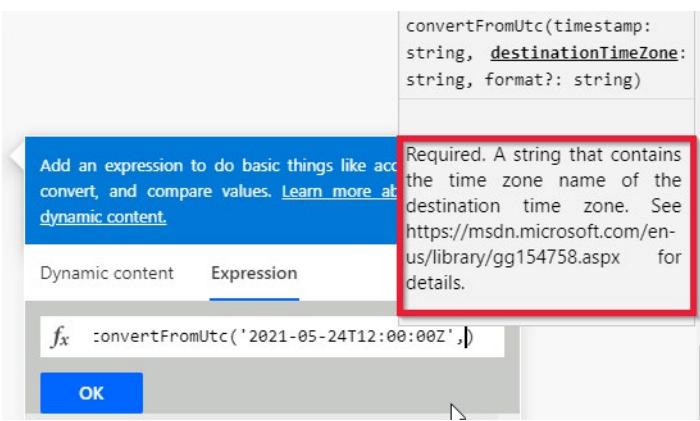


Here you can see for the **convertFromUtc** function that it has two required inputs and one optional input.

- **Timestamp** is required and expects a string
- **destinationTimeZone** is required and expects a string
- **format?** is optional and expects a string

**Note:** The question mark at the end of **format** tells you that it is an optional input.

After entering a Timestamp as a string then typing a comma, the flow prompts for the destinationTime-Zone:



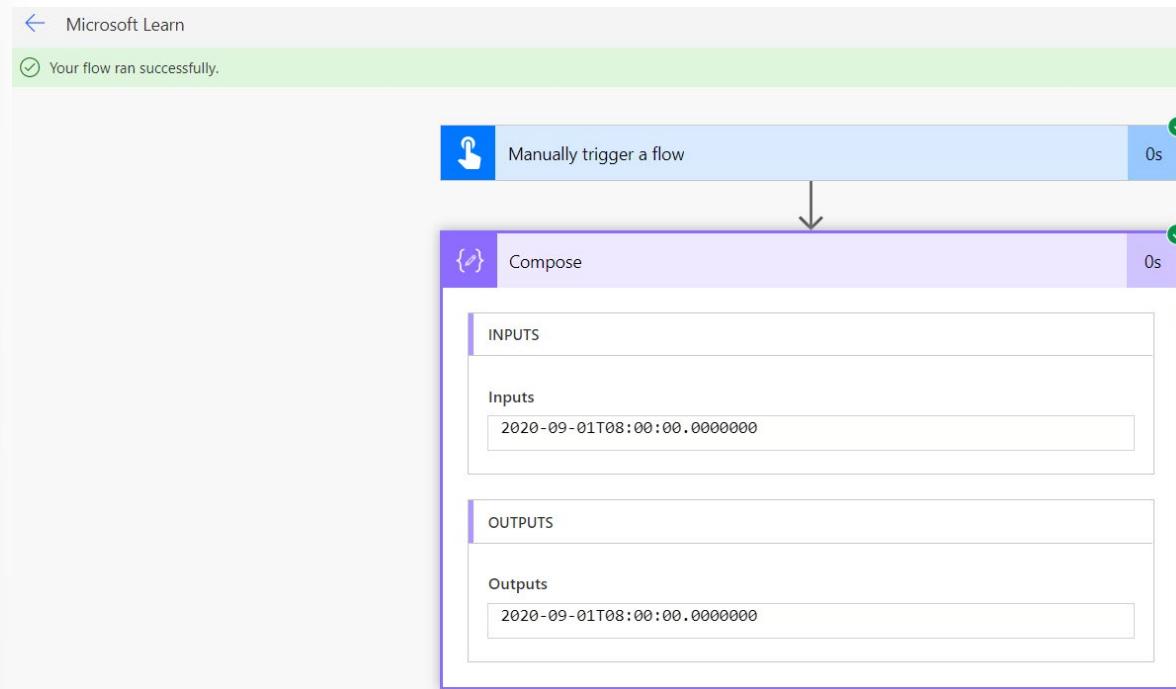
This can be daunting. What does it want for the time zone? If you look in the pop-up, you'll see that it provides a link to the **list of time zone values<sup>59</sup>**. This page provides you the string for the **destination-TimeZone**. With that information, we can now complete the expression.

```
convertFromUtc('2020-09-01T12:00:00Z', 'Eastern Standard Time')
```

Once the expression is completed, you can select OK to save your changes. Always be sure to select OK or UPDATE when editing an expression. If you select out of the inputs, you will lose your changes. Power Automate does not have AutoSave.

With your first expression complete, you can now select **Test** in the top right-hand corner. Then select **Save & Test**.

Once the test has completed, you should see the green bar that says "Your flow ran successfully." Expand the **Compose** action and you'll see that the **OUTPUTS** is your date time converted to the new time zone.

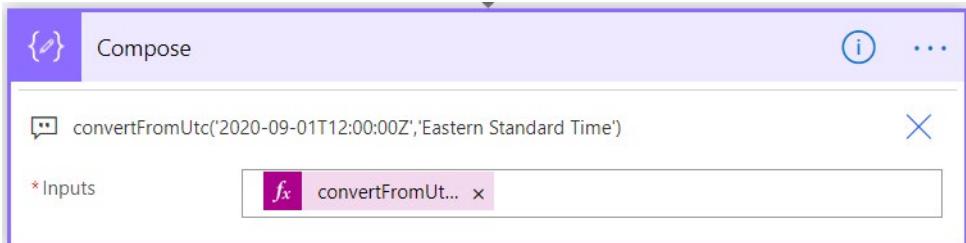


Use this same process to see the output of any test expressions you create.

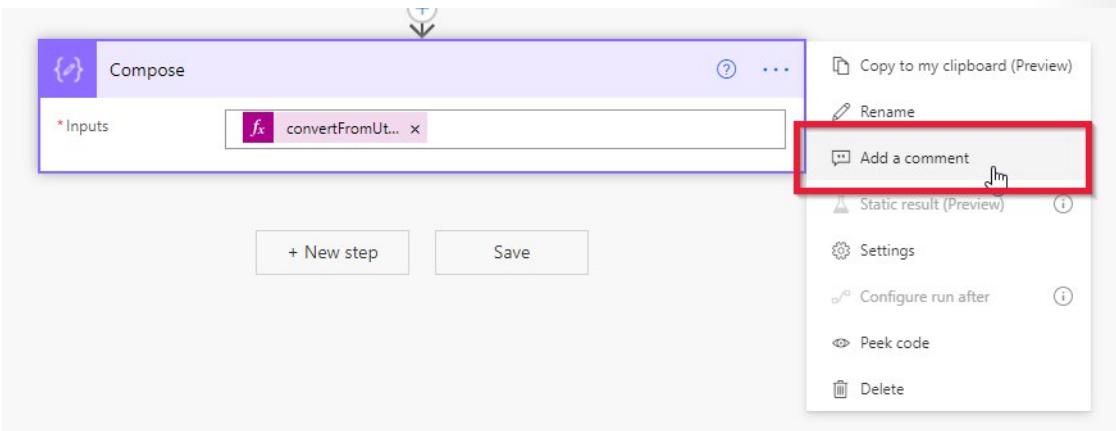
## Comments make things easier

When you look at the `convertToUtc` expression you wrote earlier, you might notice that you need to scroll to see the whole formula in the function bar. A common technique to make reviewing your expression easier is to use comments and paste the whole formula into the comment.

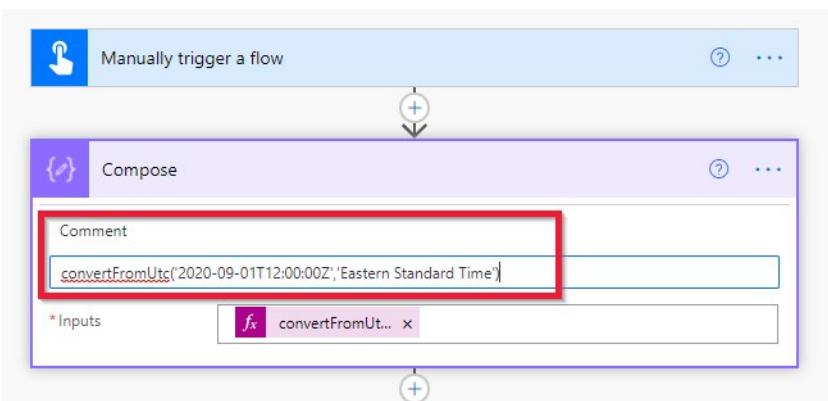
<sup>59</sup> <https://msdn.microsoft.com/library/gg154758.aspx/>



To add a comment, select the ellipse to show the menu. Then select **Add a comment**.



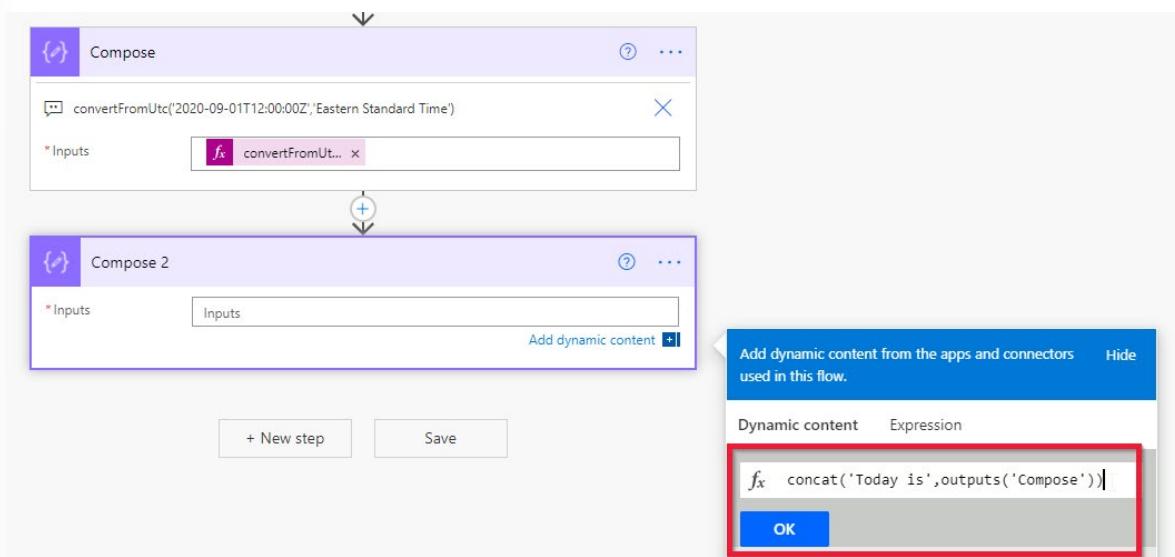
In this box, you can type any text you want. This can be text or just a copy and paste of the expression used in your action.



## Defining text

When you use text in a Power Automate expression, you'll use the single quote ('') at the beginning and end of each string. For example, if you wanted to combine the string "Today is" and the output from our expression above that returns a date in an expression, you would use the **Concat** function and your syntax would be:

```
concat('Today is', outputs('Compose'))
```



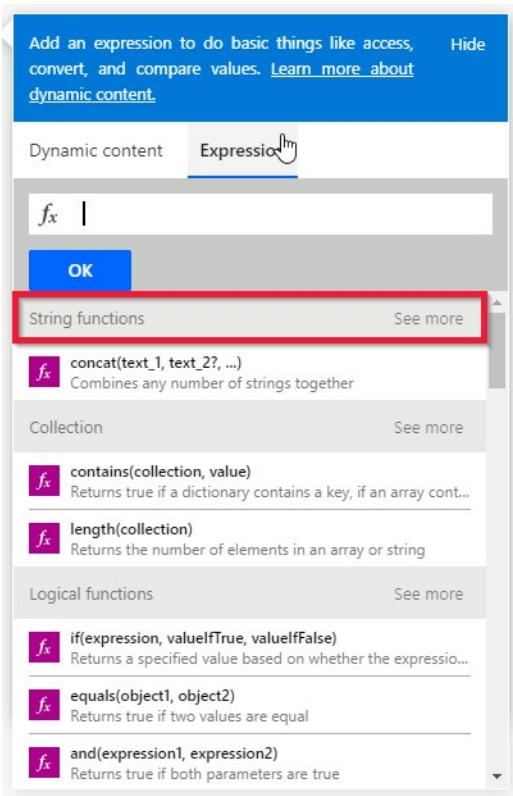
These little details will help you become more effective when working with expressions. One of the great things about expressions is that they're consistent. As you learn about one function you can often apply those learnings to the next function, rapidly speeding up your learning.

## Types of functions

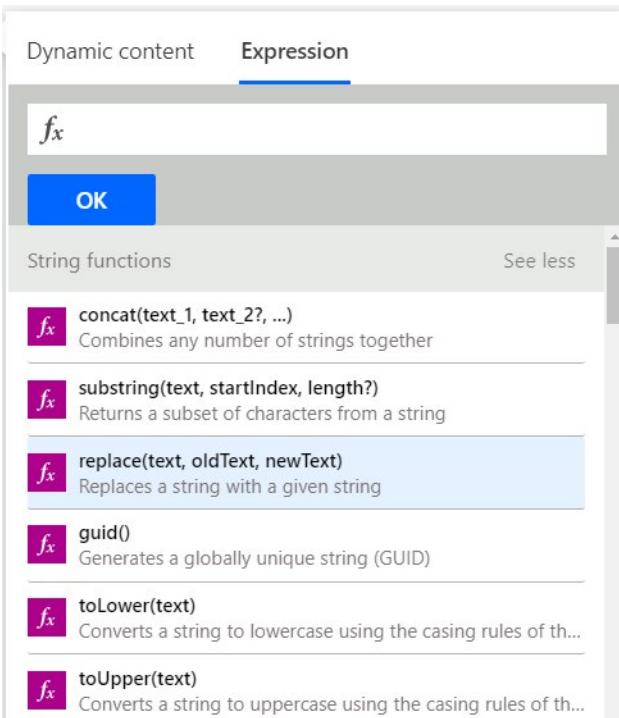
Functions are grouped into 10 different categories like math and logic. The categories are organized to make finding a particular function easier. Below you will get an overview of each category and some examples.

Keep in mind as you go through the various examples, we use static text and values. This is to allow you to test and recreate the examples as easily as possible. In your flows, you may substitute dynamic content in place of this static data. Just ensure that your dynamic data is the correct format for the function.

In the screenshot below, you'll notice to the right of each category header (like String functions or Collection) the words **See more**. By selecting **See more**, the complete list of functions for that category will be shown.



Select **See more** beside String functions.



## String functions

String (text) functions are used to modify strings, find characters in a string, format strings, and more. Text manipulation is a core skill often used when trying to better format or modify data you received from somewhere else.

An example of a string function is the **formatNumber** function. This function can convert a number into a string in a given format. A common request is to make a number look like currency. To change the number 12.5 into \$12.50, use the following formula:

```
formatNumber(12.5, 'C')
```

The C represents the Currency numeric format string. Don't worry, a list of the other options are available at **Standard numeric format strings**<sup>60</sup>. You might be asking what if you wanted to show the number as currency but with the Yen symbol? There's an optional parameter where you can pass the locale.

```
formatNumber(12.5, 'C', 'ja-JP')
```

This formula will return ¥13.

## Collection functions

These functions are used for arrays and strings. They may be used to check if an array is empty, to grab the first, or last item, or even for join, union, and intersection operations.

An example of a helpful Collection function is *length*. You can use *length* to return the number of items in a string or array. The following example would be used to count the number of characters in the string "I love Power Automate."

```
length('I love Power Automate.')
```

The output would be 22. Notice that a space counts as one character. You can use this type of function for validation or in conjunction with the String functions to manipulate strings.

## Logical functions

These functions are used to work with conditions, to compare values, and to do other logic-based evaluations. These are often thought of as If statements where you want to compare if a number is greater than another number. Power Automate supports all of the logical comparisons you would expect.

In the example below, an expression will compare if 12 is greater than 10 and then output the appropriate string. This will also be your first expression that uses more than one function. We'll combine **if** and **greater** logical functions.

```
If(greater(12,10), 'Yes', 'No')
```

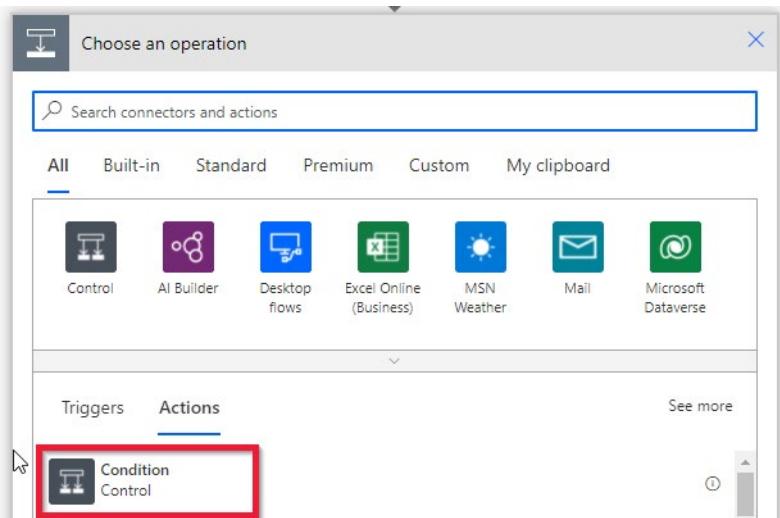
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<sup>60</sup> <https://docs.microsoft.com/en-us/dotnet/standard/base-types/standard-numeric-format-strings/>

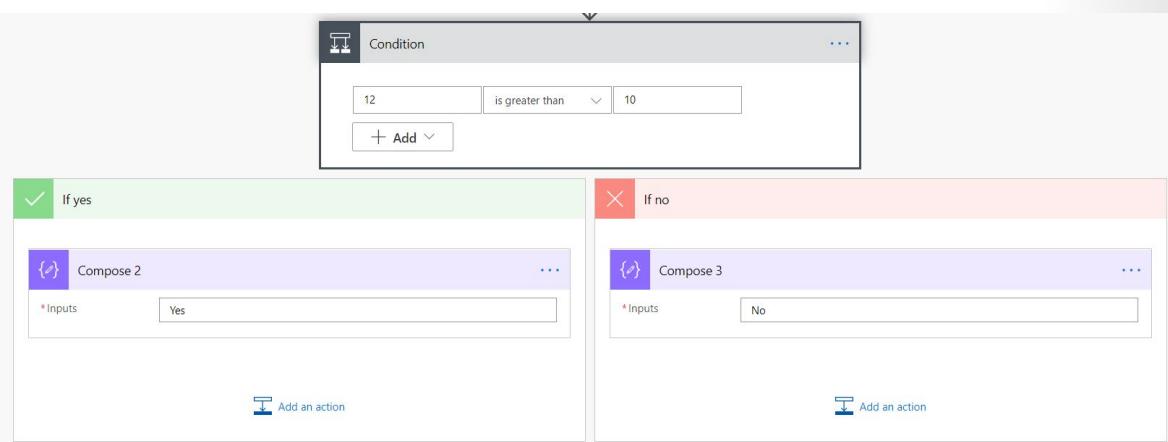
The result of this expression would be the string **Yes**. To understand the expression, work from the inside out. Greater(12,10) returns true or false depending on whether 12 is greater than 10. Since it is, the value returned is true.

Now that you know the answer is true, you can see that the **If** function returns the data after the first comma. In this case that is the string **Yes**. Had it been false then the string **No** would have been returned.

**Important:** While you can write logical expressions as shown above, there is also an action called **Condition** that lets you write **If** statements without an expression. Insert a new step in your flow and search for a connector called **Condition**.



Here's the same condition written using the action.



You'll find over time that you use a combination of both methods depending on your requirements.

## Conversion functions

These functions are used to change the type of your data. This can be a simple thing like converting a text number into an integer, or more complex functions like changing the encoding of a file from base64 to binary. Knowing that these functions are available will help you overcome problems you come across when getting your data shaped correctly.

A common scenario is the need to use **int** or **float** to change a text number into an actual number. This is common when importing data into your flow from a data source. The number 12 or 12.4 may be stored

as text. To use that number in a logical function or write it to a location that expects a number, you'll need to convert it. The following example changes the string "12" into the integer 12.

```
Int('12')
```

That will output the integer 12. Had it been the string "12.4" then you would need to convert it to a float because of the decimal digits. In that case you would use

```
Float('12.4')
```

Now you could use text number to do the previous example.

```
If(greater(Int('12'), Float('12.4')), 'Yes', 'No')
```

This would output the string "No" because 12 isn't greater than 12.4. Combining functions like this is common and is a useful pattern to learn.

## Math functions

Math functions do exactly as you would expect. They allow you to add, subtract, multiply, and perform other similar functions. Also, Math functions allow you to find the smallest and largest numbers from a data set or get a random number between a specified interval, among other things. To get a random number from 1 to 10, use the following:

```
rand(1,10)
```

One thing to keep in mind is that there's a different function for adding numbers (*add*) and for subtracting numbers (*sub*). Many formula languages add negative numbers to produce subtraction, but Power Automate doesn't. To add two numbers together, you use the following:

```
Add(12, 13)
```

This would return 25. If you wanted to add three numbers, then you would need to add a second function like so:

```
add(add(12,13),15)
```

This would return 40. As you've seen before, you'll often find yourself nesting functions to get the results you want.

## Date and time functions

These functions are used to return the current date and time, change time zones, find specific info about a date and time, and do other date or time manipulations. If you have date and time values in your data, you'll need these functions.

One important thing to remember as you explore date and time functions in Power Automate is that they're often based on UTC. Most data sources pass data back and forth with Power Automate in UTC format. Also, if you use the function `UTCNow()`, that will return the current time in UTC format. If you want to use that to compare to user data that is currently in the Eastern Time Zone, then you'll need to use the following formula to convert it:

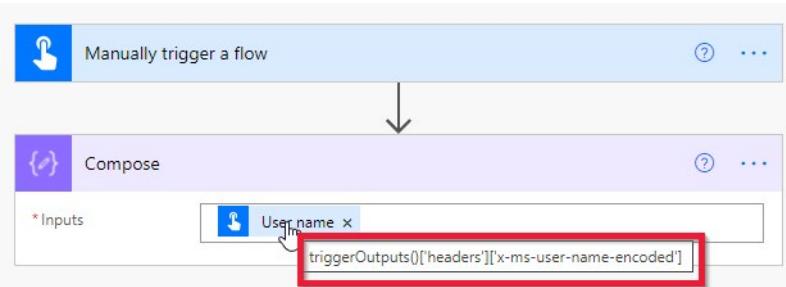
```
convertFromUtc(utcNow(), 'Eastern Standard Time', 'dd-MM-yyyy hh:mm tt' )
```

This will output 06-07-2021 05:39 PM. For a complete list of the date time format options, see [Custom date and time format strings<sup>61</sup>](#).

## Referencing functions

The referencing functions are used to work with the outputs of your actions and triggers. The nice thing is that most of the time, Power Automate will write these functions for you. When you add dynamic content to your flow, you're using referencing functions without knowing it. If you add dynamic content and then hover on top of that content, you can see this in action.

In the screenshot below, you can see this in action by adding the **User name** dynamic content from my trigger to the **Inputs** for Compose.



By hovering over **User name** with the mouse pointer, you can see

```
triggerOutputs()['headers']['x-ms-user-name-encoded']
```

Power Automate created the expression using the `triggerOutputs` for you. It's pulling the `x-ms-user-name-encoded` property from the **Headers** property. Most of the time in Power Automate you'll reference these properties via dynamic content. But it's possible to write your own expressions to recreate this if necessary. Each trigger and action will have different formats for how you retrieve their data.

Explore these functions by adding different triggers, actions, data sources, and apply-to-each loops in your flow. Then, use their properties as dynamic data to see more examples. The good news is writing these types of expressions isn't common.

## Workflow functions

The workflow functions are used to retrieve information about your flow and are closely related to the referencing functions. One of the functions is called `workflow`. You can use it as shown below.

<sup>61</sup> <https://docs.microsoft.com/en-us/dotnet/standard/base-types/custom-date-and-time-format-strings/>

```
Workflow().run.id
```

This will return the ID of the current flow run. You could use this for error reporting or logging if needed. These functions aren't commonly used.

## URI parsing functions

These functions are used to dissect a URI that is passed in as a string. You may use these functions to find the host, path, query string, or other portions of the URI. The following example shows you how to use **uriQuery** to get the query string portion of the given URL.

```
uriQuery('https://flow.microsoft.com/fakeurl?Test=Yes')
```

This would return the string "?Test=Yes" which you could then parse with string functions to get the value passed in from the URI.

## Manipulation functions

Manipulation functions are used to work with specific objects in your flow. You can do things such as find the first non-blank value, work with properties, or find xpath matches. These functions are used typically in JSON or XML nodes evaluations.

One function you may find handy here's **coalesce**. This function will allow you to find the first non-null value from a specified set of values. You use the function as shown in the following formula:

```
Coalesce(null, 'Power Automate', 'Power Apps')
```

This formula would return the string **Power Automate**. Handy when you're passing in multiple values and want to find the first one that isn't null.

## Write complex expressions

Complex expressions are when you combine more than one function to get the result you want. In the Math functions and Date Time functions sections, you have already seen examples of this. You saw that to add three numbers, you need to combine two **add** functions like:

```
add(add(12,13),15)
```

Which resulted in the output of 40.

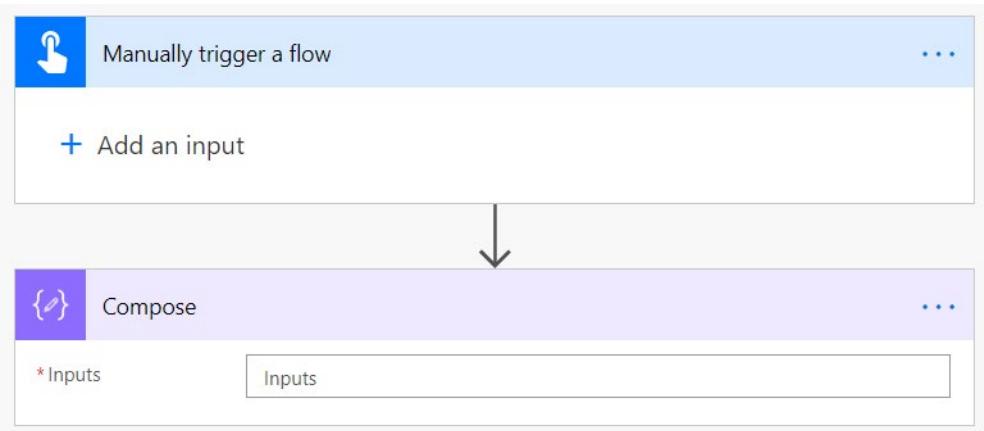
Then you saw how you use the **utcNow** function to get the current date and time and then use **convertFromUtc** to change it to the Eastern Standard time zone as shown below:

```
convertFromUtc(utcNow(), 'Eastern Standard Time', 'dd-MM-yyyy hh:mm tt' )
```

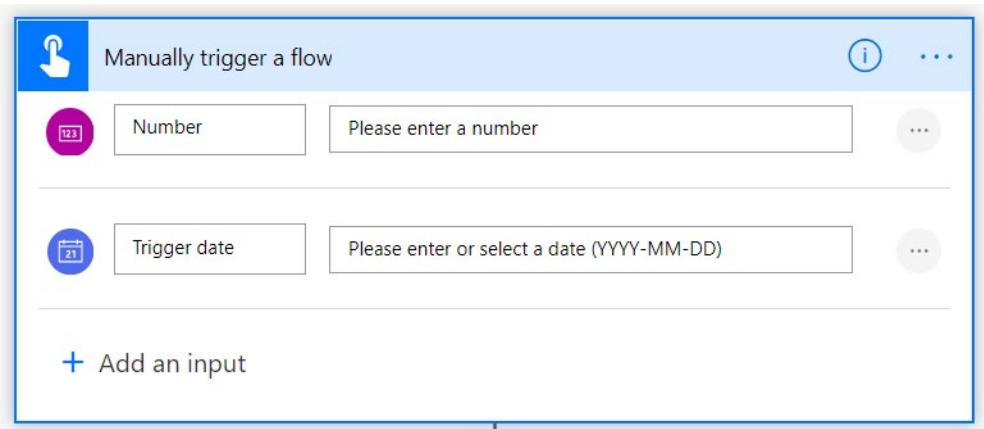
Which resulted in the output of 06-07-2021 05:39 PM.

When you think of complex expressions, it's more than one function in an expression where you use the output of one function as an input of another. There's no special syntax, operators, or considerations.

For a final example of a complex expression, take the scenario of having a couple of inputs as part of your **Manually trigger a flow** trigger and then using that input in a formula to compute a new time. You can use the example flow that you've used to test your expressions or to build a new flow that looks like the one below.



Now select **Add an input** under **Manually trigger a flow** and add a Number. Then select **Add an input** again and add a Date. Your trigger should now look like this:

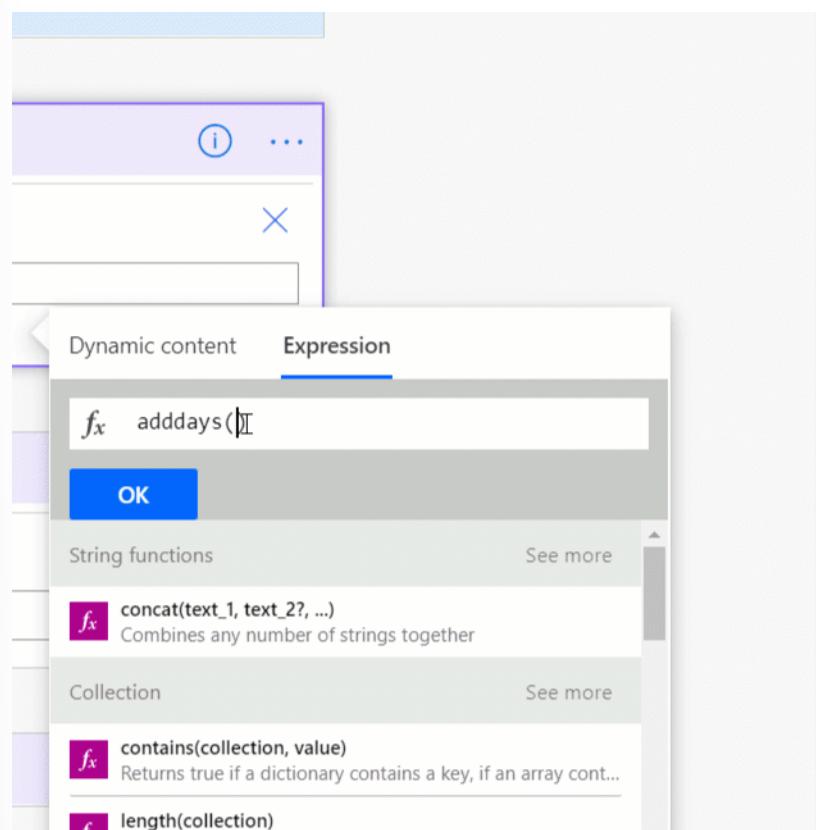


Now, in the Compose step you'll add an expression to add the number of days from the trigger to the date.

```
addDays(triggerBody() ['date'], triggerBody() ['number'])
```

This is using the Date Time function **addDays** and the Referencing function **triggerBody**.

**Note:** If you find yourself asking "How do I know what goes in for trigger body?" then you are thinking correctly. The secret is you can combine dynamic content into your expressions. To do so, start your expression by typing `addDays()` and then with your cursor between the `()`, select **Dynamic content**. Then you can choose your fields as shown below. This is a great way to reference that content while letting Power Automate do the hard work of writing the formula.

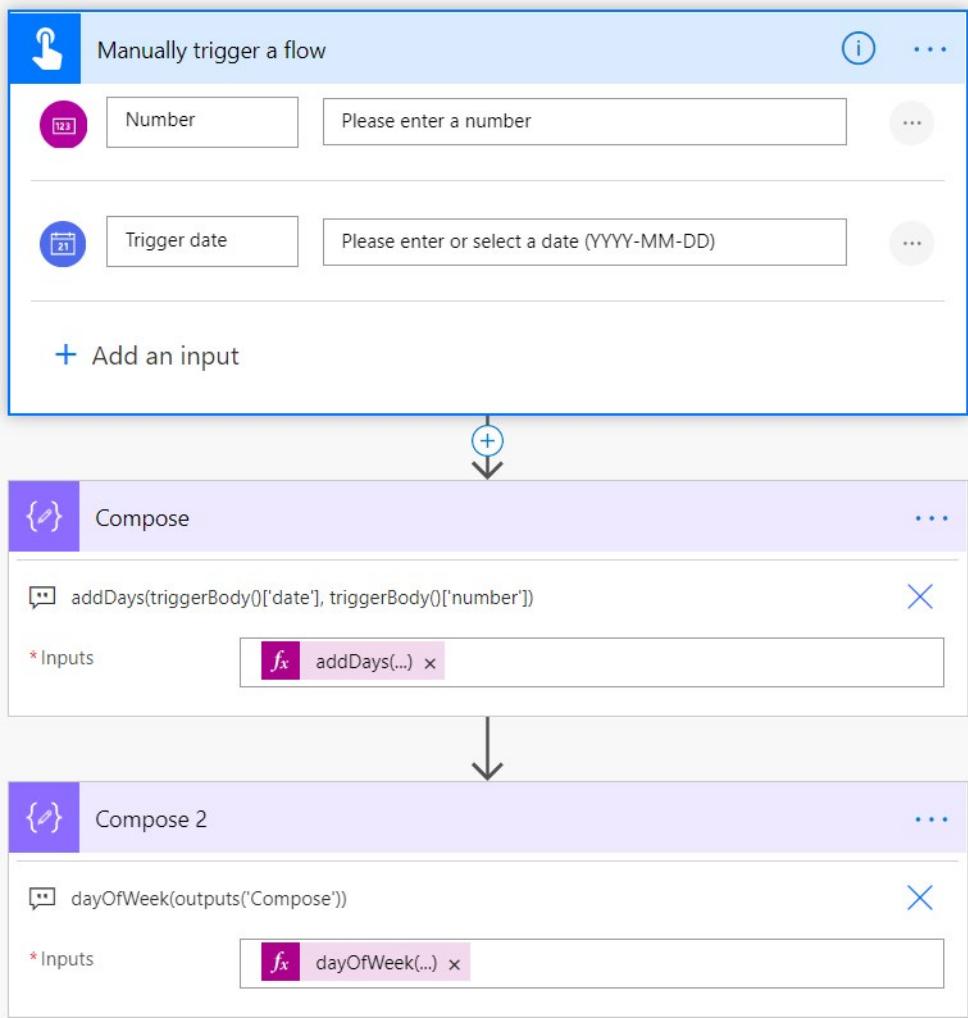


If you test your flow and enter the date 2021-06-01 and the number 2, your output will be 2021-06-03T00:00:00.0000000, which is UTC format for June 3, 2021.

Now you can find out what day of the week that is by using another Compose action with the following expression:

```
dayOfWeek(outputs('Compose'))
```

This returns the value of 4, which represents Thursday as it counts up from Sunday as 0. Here's a screenshot of the current flow to validate what you have built. Note the expressions have been placed in a comment to make them easier to read.



Now add another Compose step to check to see if the date they selected is a Thursday. Do this with the following expression in Compose 3.

```
if(equals(outputs('Compose_2'), 4), 'You chose a Thursday', 'You did not choose a Thursday')
```

For June 3, 2021 this will return the string "You chose a Thursday."

This example is a typical build pattern for a complex expression, building piece by piece in separate steps. Now that you have all of the functions necessary worked out, add another Compose step. In Compose 4, write one large expression that does everything in one step. The expression will look like:

```
if(equals(dayOfWeek(addDays(triggerBody()['date'], triggerBody()['number'])), 4), 'You chose a Thursday', 'You did not choose a Thursday')
```

The output for June 3, 2021 will be the string "You chose a Thursday." Congratulations. You've written a complex expression by doing small steps and then putting it all together in the end.

## Exercise - Creating a manual flow and using expressions

Let's say you need to find out how much it would cost to carpet a room based on its square footage. In this exercise, you'll create a manual flow that will use your input to do those calculations.

1. Sign into **Power Automate**<sup>62</sup>.
2. Create a new Instant cloud flow.

The screenshot shows the 'Build an instant cloud flow' interface. On the left, there's a preview area with a hand icon pointing at a screen showing a flow diagram. Below it, text says 'Triggered manually from any device, easy-to-share instant flows automate tasks so you don't have to repeat yourself.' Examples listed include getting an alert for a VIP client email and saving attachments automatically. On the right, the 'Flow name' field contains 'CalculateFlow'. Under 'Choose how to trigger this flow \*', the 'Manually trigger a flow' option is selected and highlighted with a red box. Other options shown include 'PowerApps', 'When Power Virtual Agents calls a fl...', 'When a flow step is run from a busin...', 'For a selected message', 'For a selected file', and 'Power BI button clicked'. At the bottom are 'Skip', 'Create', and 'Cancel' buttons.

3. Name it **CalculateFlow** and select **Manually trigger a flow**.
4. Select the **Manually trigger a flow** step and select **Add an input**.
5. Choose **Number** and name it **Square Footage**.

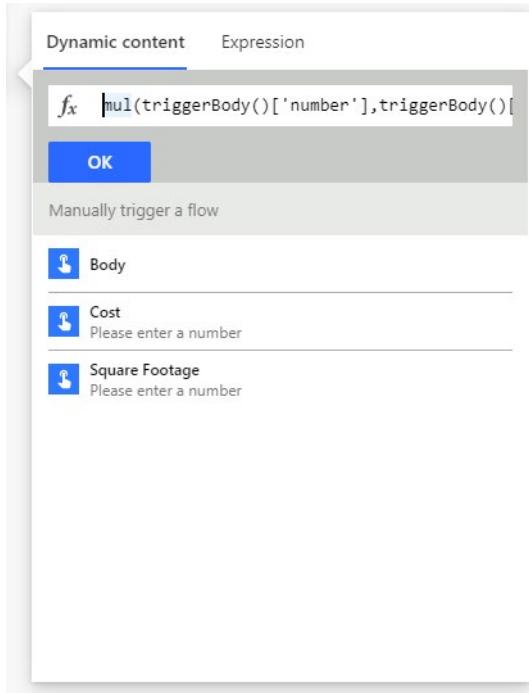
The screenshot shows the configuration for the 'Manually trigger a flow' step. It has two inputs: 'Square Footage' (number type) and 'Cost' (number type). Below the inputs is a '+ Add an input' button.

6. Select **Add an input** and choose **Number** again and name it **Cost**.
7. Select **New Step** and search for and select the **Compose** action.
8. Select the **Inputs** box and the Dynamic content window will appear.

<sup>62</sup> <https://flow.microsoft.com/>

9. Select the Expression tab and type in **mul()**. Power Automate will know that you're using the multiply expression and automatically add a **)** at the end for you.
10. With your cursor still between the two parentheses in the expression field, select the **Dynamic content** tab.
11. Select **Square Footage** in the dynamic content below.
12. Next add a comma (,) and choose **Cost** in the dynamic content below.
13. The complete expression should be:  
`mul(triggerBody()['number'],triggerBody()['number_1'])`

14. Select **OK** to add the expression into the Compose step.



15. You'll know your expression is correct if it's added into the Compose step and looks like:  
This compose step is now doing the math of calculating the square footage of the area multiplied by the cost per square foot based upon inputs you'll provide. However, we still need to convert the final result to currency to get the correct answer.
16. Select **New Step** and search for and select the **Compose** action again.
17. Select the **Inputs** box and again the Dynamic content window will appear.
18. Select the Expressions tab and type in **FormatNumber**.
19. With your cursor in place, select the **Dynamic content** tab and choose **Outputs** from the preview Compose step.

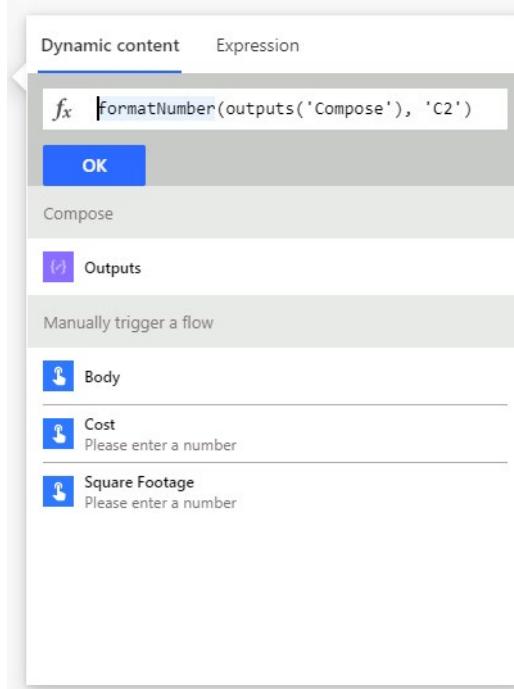
20. Next finish the expression with , 'C2'.

The C formats the number as currency, with the 2 representing how many decimal places. Refer to **Standard numeric format strings<sup>63</sup>** for more number formats.

21. The complete expression is:

```
formatNumber(outputs('Compose'), 'C2')
```

22. Select **OK** to add this expression in the Compose 2 step.

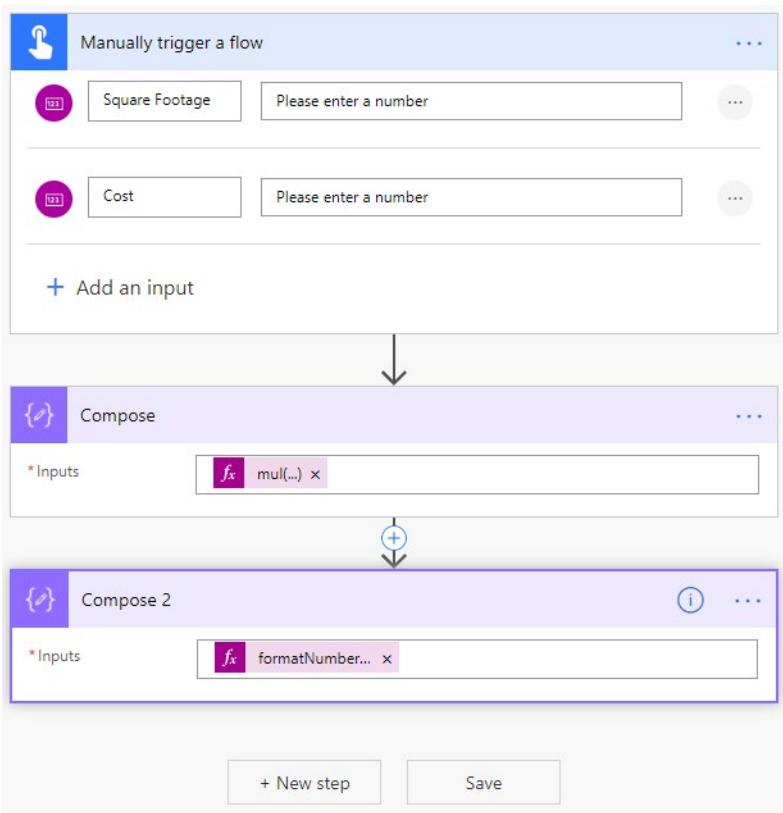


Now after our flow is triggered, it first multiplies the two numbers, then converts the result into the correct currency format. This gives you a quick way to get the cost associated with carpeting a room.

---

<sup>63</sup> <https://docs.microsoft.com/en-us/dotnet/standard/base-types/standard-numeric-format-strings/>

23. Your complete flow will look like this:



24. In the top-right corner, select the **Save** button, then select **Test**.

Save Flow checker Test

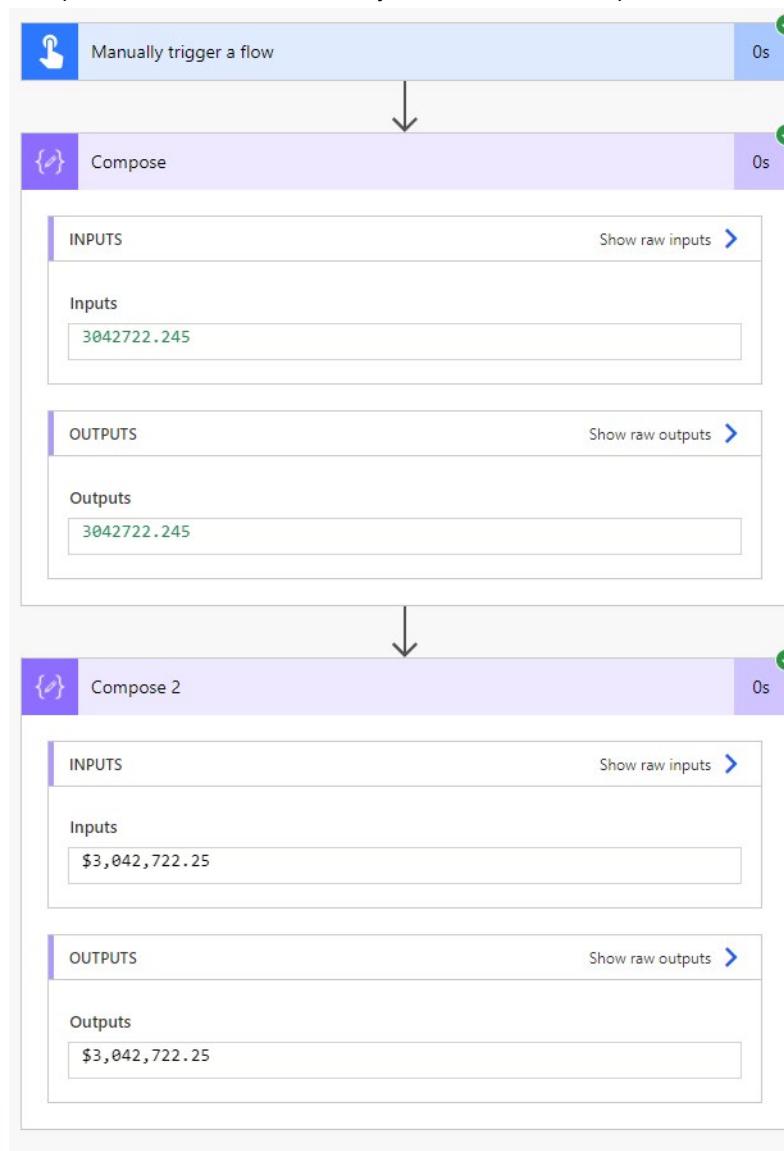
25. Choose **I'll perform the trigger action** and then select **Test**.

26. Enter the two number inputs, **Square Footage** and **Cost**, and then select **Run flow** at the bottom.

27. The page will reload and you'll see green check marks next to each step of your flow.

28. Selecting each step will expand the details showing you the inputs and outputs of each step.

29. Selecting Compose will show the multiplied value of the two numbers you entered, while selecting Compose 2 will show the currency format of that multiplied value.



Let's recap what we've done.

**Manually trigger a flow** - Allows us to press a button to trigger a flow and provide inputs. In this case our two inputs are *Square Footage* and *Cost*, which we're using to find out the total price to carpet a room.

**Compose** - We use this to write expressions using the data from elsewhere in the flow. In this case, we first multiplied the two inputs from the trigger. This gave us the correct number, but we still needed to convert it to currency. We then used another compose action to format the multiplied result into currency. This gives us the answer to how much it would cost to carpet a room.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. What is the correct syntax for a string in a Power Automate function?

- This is my string.
- 'This is my string.'
- "This is my string."
- makeString(This is my string.)

## Multiple choice

2. How would you write a formula to add 3 plus 5 and then divide by 2?

- div(add(3,5),2)
- (3+5)/2
- div(3+5,2)
- Power Automate expressions cannot be used for math.

## Multiple choice

3. What statement best describes the relationship between Power Automate and Azure Logic Apps functions?

- Each product has its own functions with no overlap.
- Each product uses the same functions but has different syntax.
- They use the same functions and their function documentation is interchangeable.
- The two products are similar but you should ignore all function documentation for Azure Logic Apps when building a Power Automate flow.

## Summary

When working with Power Automate, you'll use one or more functions to create expressions to get the most out of your data. These functions can be used to retrieve data, change data, evaluate data, and more. As your flow skills grow, your usage of expressions will grow. Becoming familiar with the various functions available and how to combine them will let you unlock the full power of Power Automate.

# Answers

## Multiple choice

1.How can you create a flow that reoccurs daily?

- Create the flow and connect the flow to a calendar.
- Create the flow and set the flow flag frequency to daily reoccurrence.
- Set the Schedule – Recurrence trigger frequency to daily and interval to 1.
- Create the flow and set the flow flag frequency to hourly and the value to 24.

*Explanation*

*This is how you can create a flow that reoccurs on a daily basis.*

## Multiple choice

2.Every flow has two main parts, a trigger, and one or more actions. Which of the following best describes an action?

- Actions are what you want to happen when a trigger is invoked.
- Actions will trigger the frequency of the flow reoccurrence.
- Triggers are what you want to happen when an action is invoked.
- Flow actions trigger the flow to occur as long as the defined value of the trigger is met.

*Explanation*

*Triggers invoke actions.*

## Multiple choice

3.You would like to be alerted to when a change is made to a SharePoint list, what are some ways in which Power Automate can help?

- Power Automate can send up a flare near you to alert you of changes.
- You can write a flow with Power Automate to send push notifications, texts, or emails for various triggers.
- Sorry, Power Automate can't help with that.
- Power Automate can send out a tweet whenever a list item is changed.

*Explanation*

*Correct! Power Automate is good that way.*

## Multiple choice

1.What are connectors used for in Power Automate?

- Connectors are used to start a flow.
- Connectors let you build a flow that accepts user input.
- Connectors let you connect to a service like Salesforce, Microsoft 365, Twitter.

*Explanation*

*Connectors let you connect to a service like Salesforce, Microsoft 365, Twitter.*

**Multiple choice**

2.How can you define who has privileges to create, read, update, or delete a business process flow instance?

- Only a system administrator has access privileges to new business process flows.
- Only a system customizer has access privileges to new business process flows.
- Activate the business process flow, and then define access privileges for users and administrators.
- Activate the business process flow, and select Edit Security Roles, and define who will have privileges.

*Explanation*

*You can use Edit Security Roles to define privileges to users.*

**Multiple choice**

3.When creating Button Flows you can use trigger tokens to capture device information like, GPS data, Date and Time, etc. Which of the following is NOT an available Button trigger token?

- State
- City
- Phone number
- Full address

*Explanation*

*Phone number is not an available trigger token.*

**Multiple choice**

1.After a flow has been exported, who can import the flow?

- Only System Customizers
- Only System Administrators
- Only the user that exported the flow
- Anyone that receives the zip file can import it

*Explanation*

*Anyone that receives the zip file can import the flow.*

**Multiple choice**

2.Which of the following is a requirement to share button flows?

- An account that has access to Power Automate.
- An account that is a System Customizer.
- An account that is a System Administrator.
- A SharePoint account and Power Automate sharing rights.

*Explanation*

*A Power Automate account is a requirement to share button flows.*

**Multiple choice**

3.What are some actions for which you can use the Power Automate admin center?

- Connect to Dynamics 365 and write flows
- Share and create button flows
- Manage Environments and Data policies
- Import and Export flows

*Explanation*

*Correct! Environments are spaces where you can store, manage, and share your organization's data, apps, and flows. Data policies allow you to implement additional security measures.*

**Multiple choice**

1.What is the difference between triggers and actions?

- Triggers start a flow while actions are performed in a flow.
- Actions and triggers are synonymous and have no differences.
- Actions start a flow while triggers are performed in a flow.
- Triggers are used for Dataverse while actions are used for other connectors.

*Explanation*

*Your flow will always start with a trigger followed by one or more actions.*

**Multiple choice**

2.Which trigger allows for additional inputs?

- When a record is created
- When a record is updated
- When a record is deleted
- When a record is selected

*Explanation*

*Because this action begins as a button in Dataverse, you can request additional input from the user.*

**Multiple choice**

3.What does the List records action do?

- Fetches child items
- Fetches multiple records in a Dataverse table, which can be filtered according to a logical condition
- Fetches all versions of a row of data

*Explanation*

*One scenario would be fetching all items that are related to another record in the same or a different table.*

**Multiple choice**

1.What does scope mean?

- The scope determines which records that a trigger responds to.
- A scope is a bucket to help organize tables, flows, apps, and more.
- Scope is another word for table.
- Scope determines the audience of a flow.

*Explanation*

*Depending on the owner of the record and the scope, the trigger might or might not be activated.*

**Multiple choice**

2.When given multiple versions of actions within Power Automate, which version should you typically select?

- The version before the newest in case the newest version contains bugs
- The newest version to ensure that you're getting all the latest features
- The oldest version because it's likely to be simple and basic
- Research the versions before selecting and pick which is best for you

*Explanation*

*Using the newest version ensures that you have up-to-date features.*

**Multiple choice**

3.What tells the flow what to do?

- Triggers
- Environment
- Scope
- Actions

*Explanation*

*Actions are performed by the flow after being triggered.*

**Multiple choice**

1.What is the correct syntax for a string in a Power Automate function?

- This is my string.
- 'This is my string.'
- "This is my string."
- makeString(This is my string.)

*Explanation*

*Power Automate requires single quotes (') around a text to make it a string.*

**Multiple choice**

2. How would you write a formula to add 3 plus 5 and then divide by 2?

- div(add(3,5),2)
- (3+5)/2
- div(3+5,2)
- Power Automate expressions cannot be used for math.

*Explanation*

*Power Automate requires the use of an expression phrase like "div" and "add" before being provided numbers to make calculations. Start from the inside (the calculation you want to make first, in this case adding 3 and 5) and then work your way out in the formula as you add additional calculations (in this case, dividing the sum of 3 and 5 by 2).*

**Multiple choice**

3. What statement best describes the relationship between Power Automate and Azure Logic Apps functions?

- Each product has its own functions with no overlap.
- Each product uses the same functions but has different syntax.
- They use the same functions and their function documentation is interchangeable.
- The two products are similar but you should ignore all function documentation for Azure Logic Apps when building a Power Automate flow.

*Explanation*

*You can use the same functions in a Power Automate as you can in Azure Logic Apps.*

## Module 8 Build desktop flows with Power Automate

### Build your first Power Automate Desktop flow

#### Introduction

Repetitive tasks consume many workers' days, decreasing productivity and creating a less-engaging work environment. Robotic process automation (RPA) allows you to outsource those tasks to user-friendly software, freeing your time for more important or creative endeavors. Microsoft Power Automate allows you to build that automation from start to finish by using Power Automate Desktop flows. Building desktop flows is the first step in designing your RPA solution.

In this module, you will:

- Learn about Power Automate Desktop flows.
- Create a new desktop flow.
- Record actions that are performed in a desktop-based application.
- Perform a test run of the new desktop flow.

#### Set up the environment

Creating and running automation systems in Power Automate requires you to have access to make changes to the environments in your tenant and to have the appropriate licenses and permissions. If you don't already have admin access to a valid tenant, you might want to start a **free trial**<sup>1</sup>. In addition, you will need a Power Automate user plan with attended RPA license to complete this module. You can sign up for a **free trial**<sup>2</sup> if you don't already have this license.

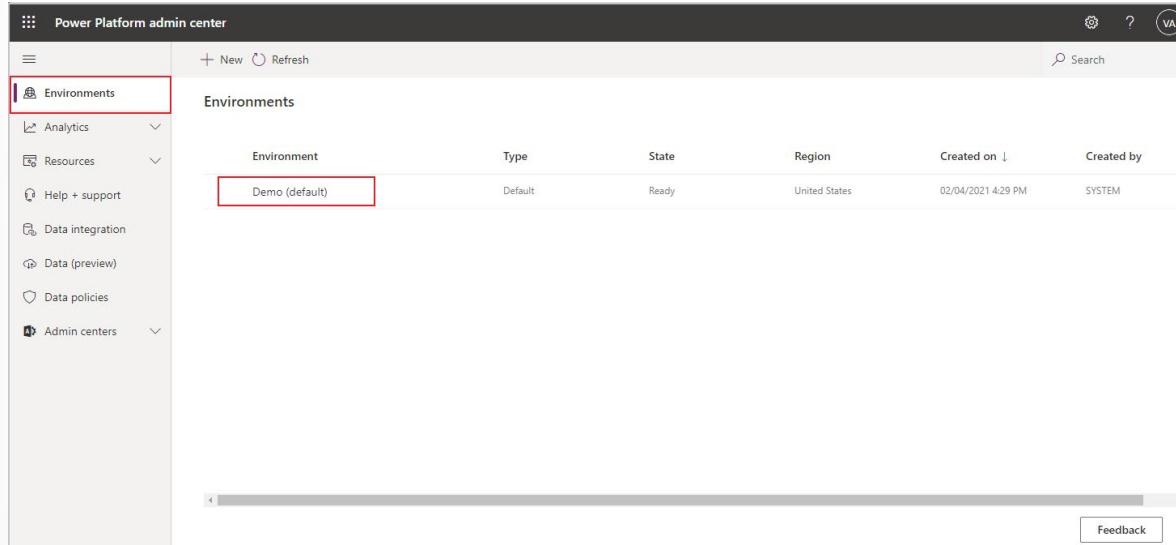
<sup>1</sup> <https://www.microsoft.com/microsoft-365/enterprise/office-365-e3?activetab=pivot%3Aoverviewtab%2F%3Fazure-portal%3Dtrue>

<sup>2</sup> <https://flow.microsoft.com/pricing/>

## Create a trial environment with database

After you have successfully signed in to a valid tenant, go to the **Microsoft Power Platform admin center**<sup>3</sup>. You will need to create a trial environment with a database. Select **Environments** and then select your automatically created environment, **Demo (default)**.

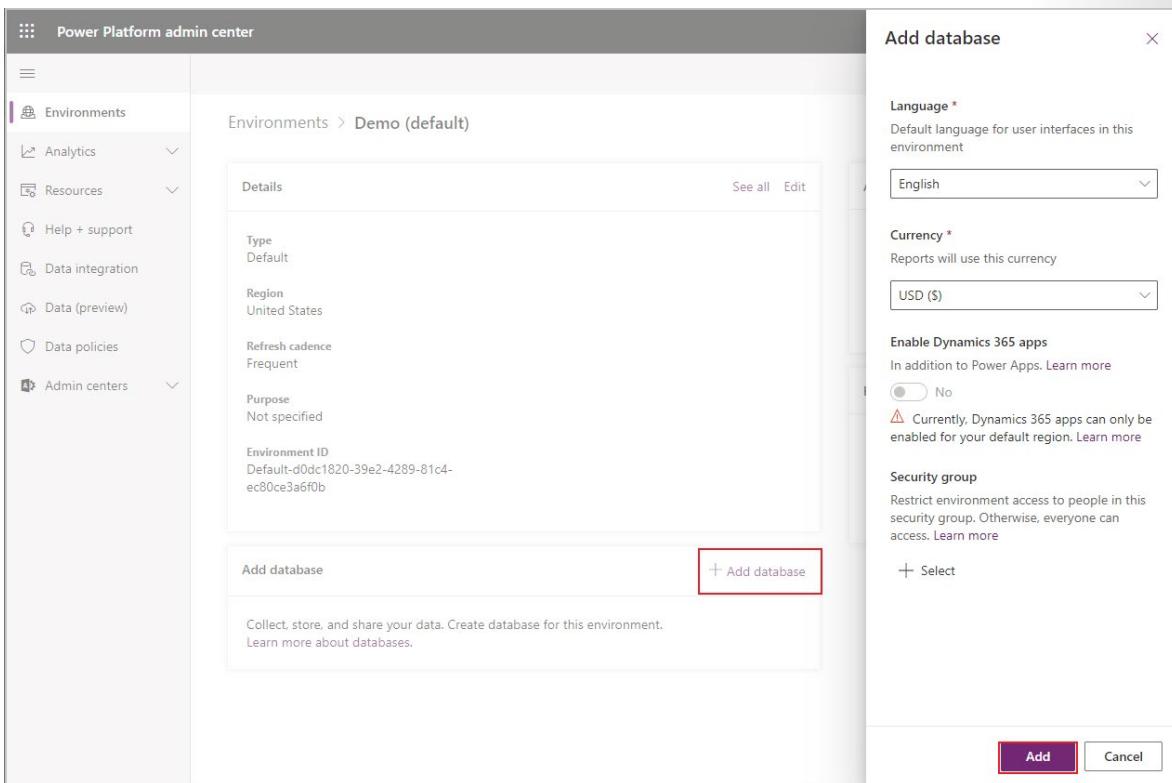
If you are using an existing tenant rather than creating a trial for this exercise, you can use the default environment or create a new one to keep it separate from your existing solutions.



Environment	Type	State	Region	Created on	Created by
Demo (default)	Default	Ready	United States	02/04/2021 4:29 PM	SYSTEM

Now that you are in your chosen environment, add a database by selecting **Add database**. In the subsequent dialog box, you can specify the requested values but can keep the defaults. Select **Add**. You might be prompted to sign in again before creating your database, after which your database should provision appropriately.

<sup>3</sup> <https://admin.powerplatform.microsoft.com/environments/>



Creating your database might take up to one minute; afterward, you can continue to the next steps.

If you are using a trial environment, consider setting up a profile in your browser to prevent from being signed out of your existing Microsoft account.

## Software installation

The following exercises will require various software to be installed on your computer. The following steps will guide you through the download and installation of Power Automate Desktop, the required extensions, and the Contoso Invoicing app.

If you have already installed Power Automate Desktop, ensure that you are running the latest available version.

## Power Automate Desktop

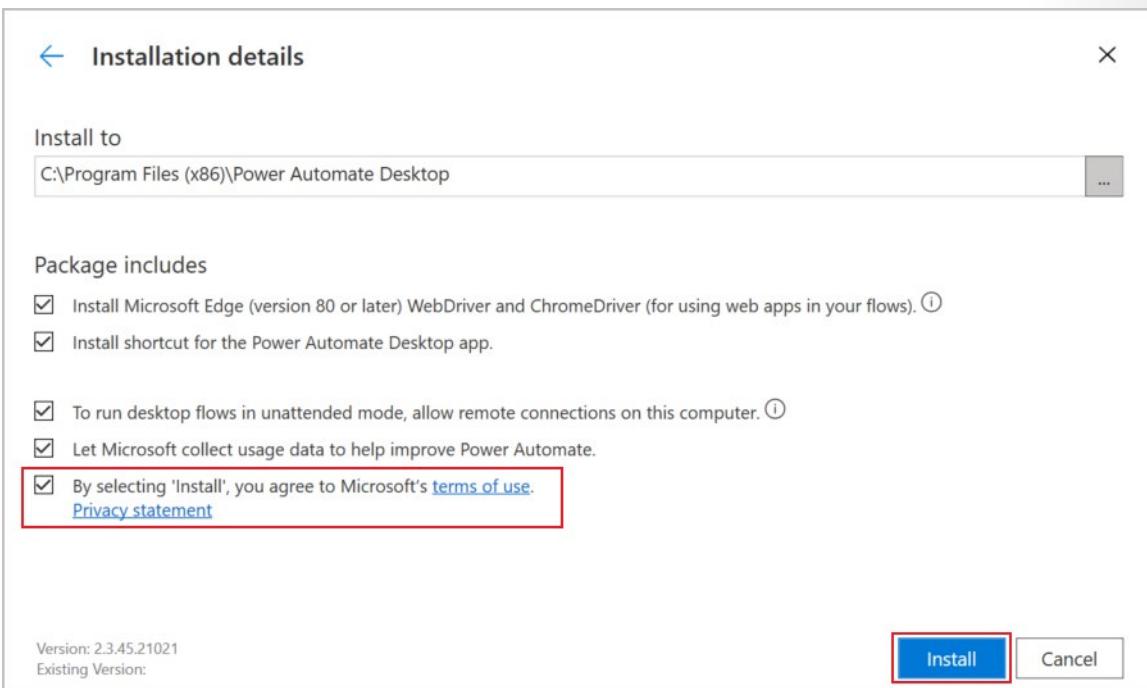
Go to [Power Automate<sup>4</sup>](https://flow.microsoft.com/) and sign in with the account that you used to create your environment and database. After you have signed in, select **My flows > Install > Power Automate Desktop**.

<sup>4</sup> <https://flow.microsoft.com/>

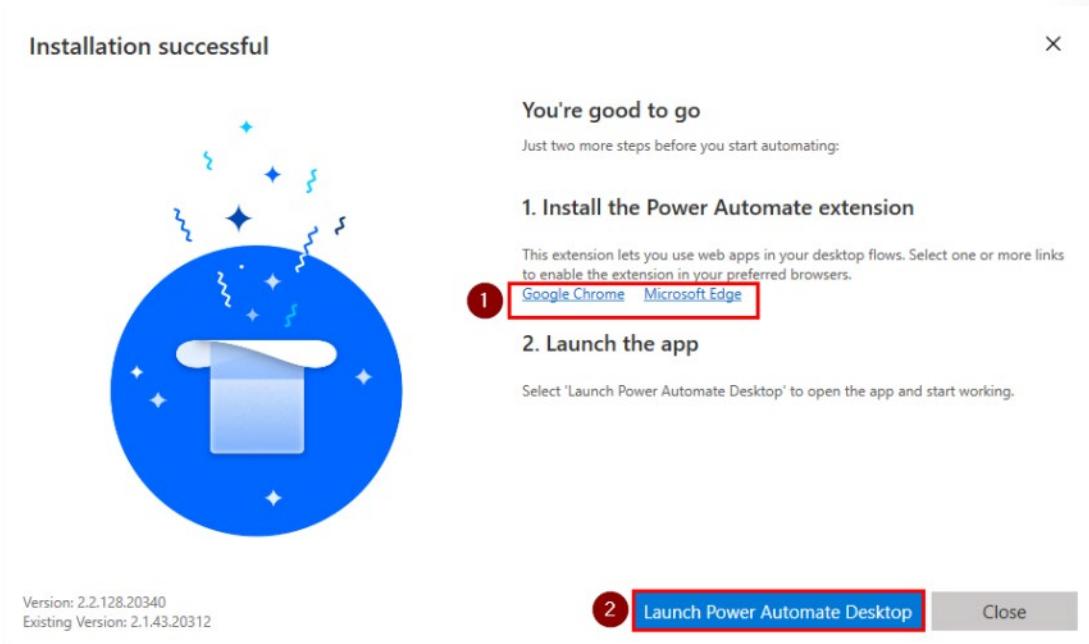
The screenshot shows the Microsoft Power Automate desktop application. On the left, a sidebar menu includes options like Home, Action items, My flows (which is selected and highlighted with a red box), Create, Templates, Connectors, Data, Monitor, AI Builder, Process advisor (preview), Solutions, and Learn. The main area is titled 'Flows' and shows a section for 'My flows'. It displays several flow templates: 'Notify a team when a new Forms response is submitted' (By Microsoft, Automated, 9910), 'Notify a team when a new item is created in a SharePoint List' (By Microsoft, Automated, 6091), 'When the status of a task in Planner changes to complete, notify a channel' (By Microsoft, Automated, 5983), 'Save a message to OneNote' (By Microsoft, Instant, 4705), 'Schedule a meeting with a message' (Automated), 'Post Adaptive card to Teams when there' (Automated), 'When a file is created in OneDrive, start' (Automated), and 'Create a work item from a message' (Automated). At the top right, there are buttons for 'Install' (with a red box around it) and 'Search'. A callout box points to the 'Power Automate Desktop' button, which says: 'Use desktop flows to automate actions and business processes on your desktop environment.' Another callout box points to the 'On-premises data gateway' button, which says: 'Provides quick and secure data bridge between on-premises data and Microsoft cloud services.'

When the download completes, select the file to open and run the installer. Select **Next** and, on the subsequent screen, select the final check box and then select **Install**. This action will install the Power Automate Desktop and the browser extensions for Microsoft Edge and Google Chrome.

The screenshot shows the 'Power Automate Desktop setup' window. It has a title bar 'Power Automate Desktop setup' and a close button 'X'. Below the title is a large circular icon containing a blue gradient background with white stars and a white downward arrow pointing to a stack of paper with a blue 'P' logo. To the right of the icon is the heading 'Install package'. Below the heading is a description: 'This package will let you create and use desktop flows to automate actions and business processes on your desktop environment.' Underneath the description are two links: 'Learn more about Power Automate Desktop' and 'Learn about other ways to make desktop flows'. At the bottom left, it says 'Version: 2.3.45.21021' and 'Existing Version:'. At the bottom right are 'Next' and 'Cancel' buttons, with 'Next' also having a red box around it.



When the installation is complete, select the link of your preferred browser and then follow the instructions to enable the extension. After the extension has been enabled, you can launch the Power Automate Desktop app.



After launching the app, sign in by using the account that you used to set up your environment and database.

## Contoso Invoicing app

A major benefit of using desktop flows is the ability to perform actions on desktop applications. For the flow that you will create, you will use an invoicing application to explore the concepts and actions that are available to you in desktop flows. After completing the module, you can use what you have learned to run desktop flows on your own applications and automate existing processes.

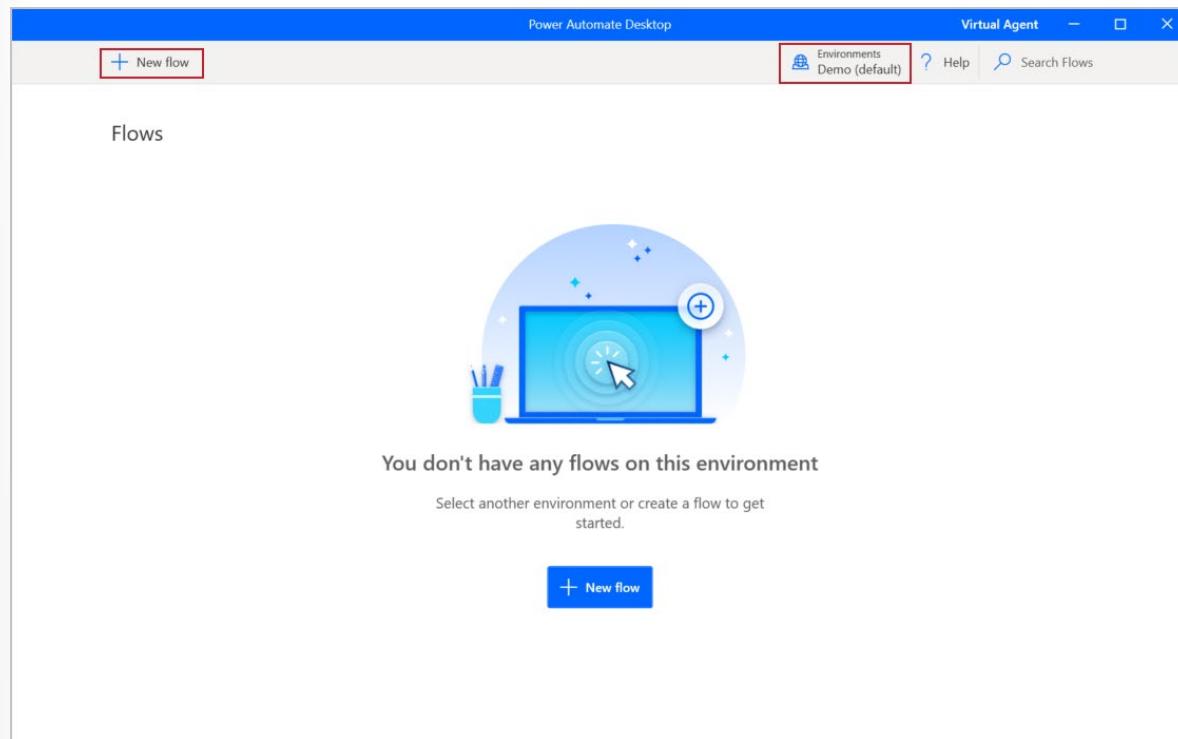
Download the **Contoso Invoicing app**<sup>5</sup>, extract the contents and then install the application and explore the elements.

Now you're ready to get into the details of Power Automate Desktop.

## Explore Power Automate Desktop

You have now downloaded the appropriate software and have the necessary licenses to create your first desktop flow. Your next task is to become familiar with the software.

Open and explore Power Automate Desktop. The upper-right corner indicates which environment you are in. Take a moment to make sure that this is the same environment that you created a database for previously. Under **Flows**, you will see existing desktop flows that you have, and you will be able to edit, start, or delete them. You can explore what creating or editing a flow looks like by selecting the **+ New flow** button in the upper-left corner.

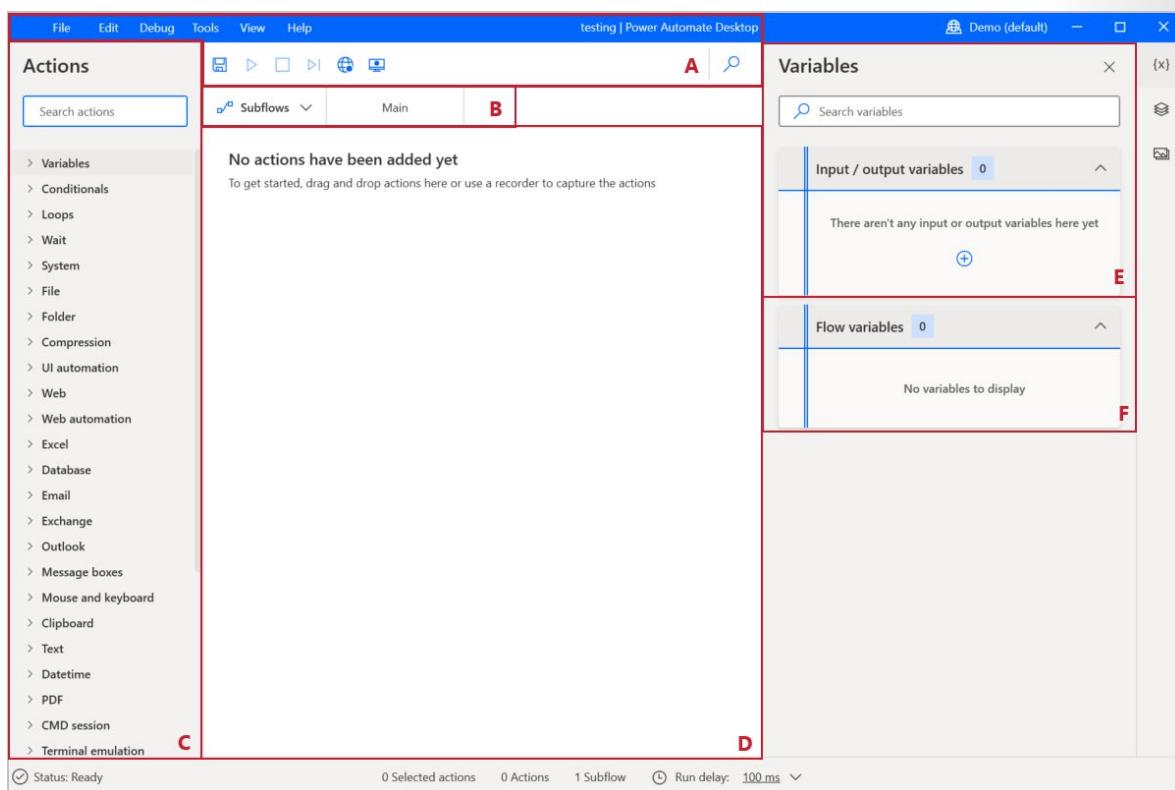


Name your flow and then select **Create**. The specifics of the name aren't important; it's temporary and meant to help you become familiar with the app. You will delete this flow shortly.

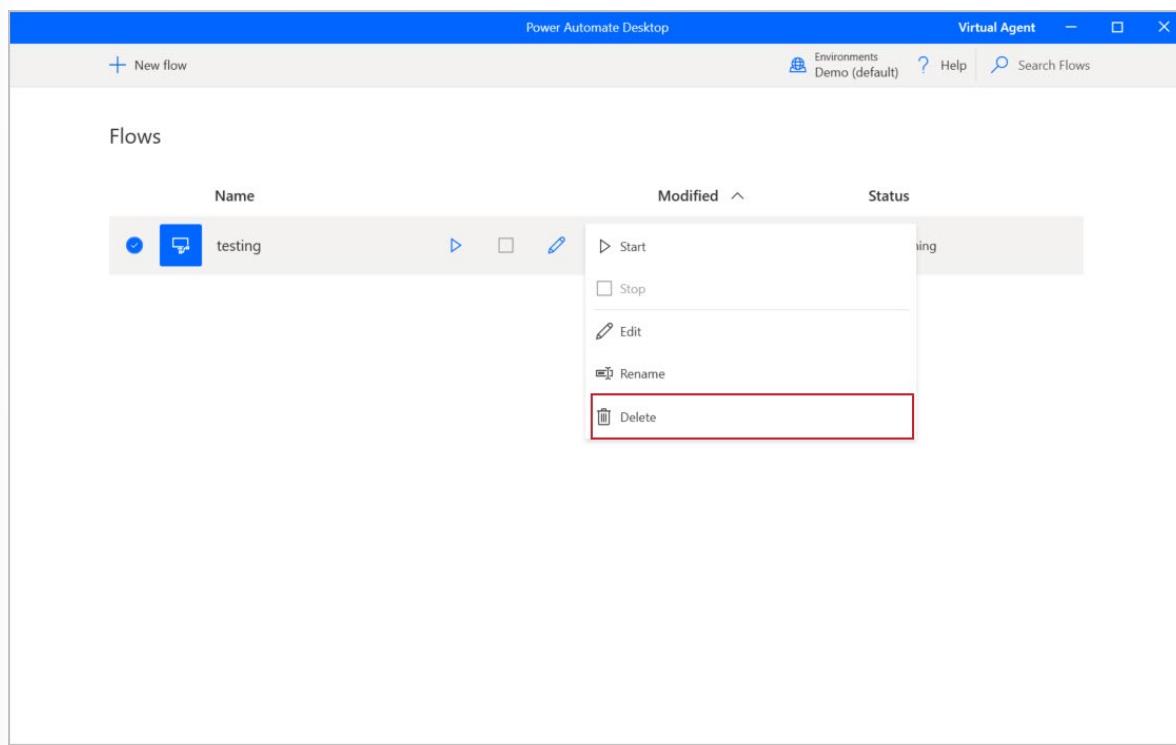
<sup>5</sup> <https://github.com/MicrosoftDocs/mslearn-developer-tools-power-platform/raw/master/power-automate-desktop/contoso-invoice-app/ContosoInvoicingSetup.zip>

After you have created your new test flow, the Power Automate Desktop designer will display. The designer contains several elements for you to focus on:

- **The toolbar** (A) - Contains basic operations for use with actions (**Save**, **Undo**, **Copy**, **Debug**, and **Paste**) and buttons to start the desktop/web recorders and control the process implementation (Start/Pause/Stop).
- **Subflows** (B) - Allows you to create subflows under your **Main** flow.
- **Actions pane** (C) - Contains all Power Automate Desktop actions and includes a search bar that helps you find specific actions by matching the action name to the text string.
- **Workspace** (D) - Contains all actions that are added to the process so far. Functions are separated into tabs.
- **Input/output variables** (E) - Contains all variables that you created in the process.
- **Flow variables** (F) - List of all variables that are used in the process.



Save your flow and close the window. You should now see your new flow in the list. Select the ellipsis (...) button to expand the options for that flow and then delete it.

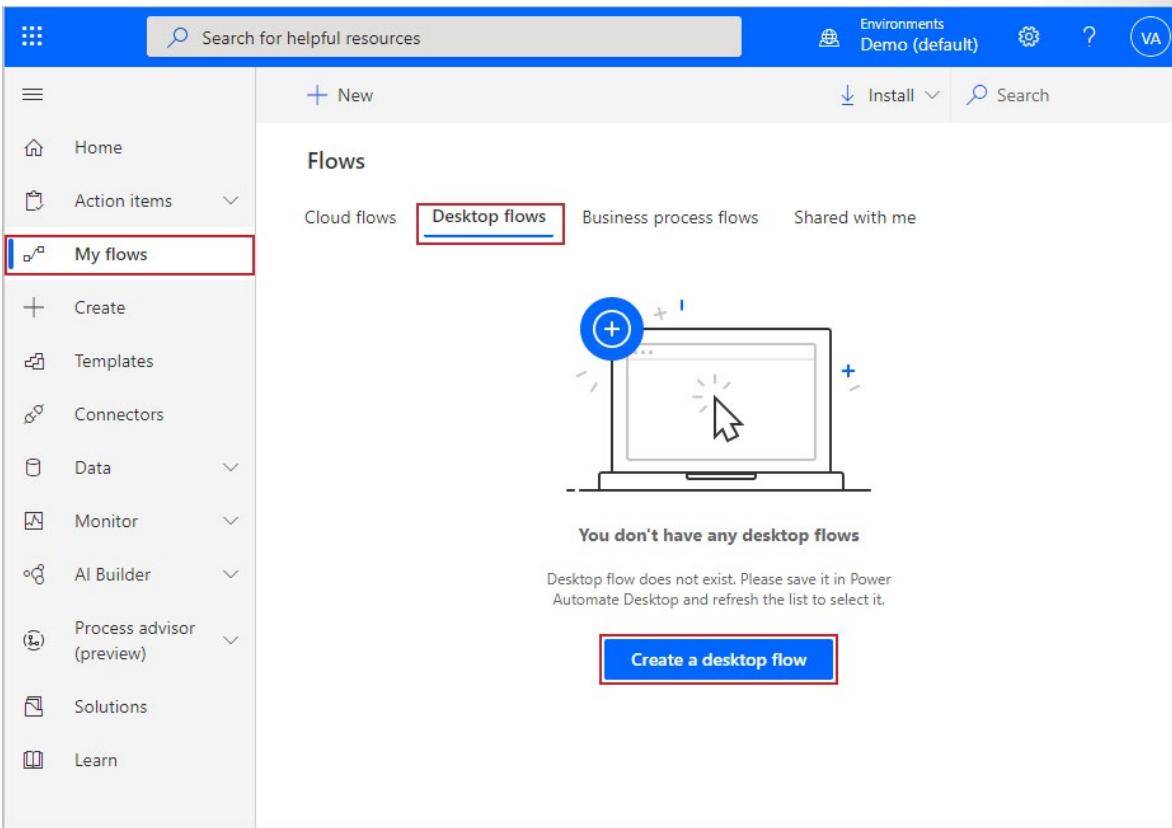


Now that you're familiar with Power Automate Desktop, you can create a flow.

## Create your first Power Automate Desktop flow

Go to **Power Automate**<sup>6</sup>. Ensure that you are signed in and are in the appropriate environment. Under **My flows**, select **Desktop flows > Create a desktop flow**.

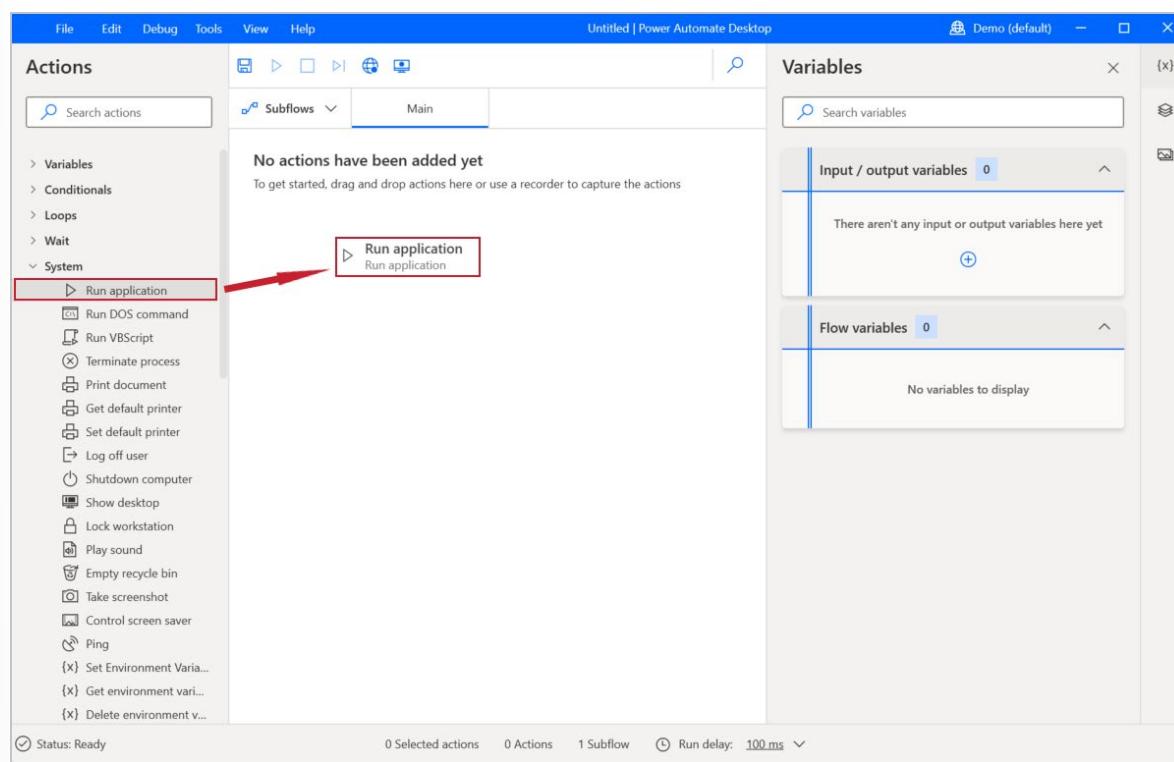
<sup>6</sup> <https://flow.microsoft.com/>



Select **Launch app** and then open Power Automate Desktop from the subsequent dialog box. The desktop app will open in the designer with a new flow named "Untitled," which you can change later.

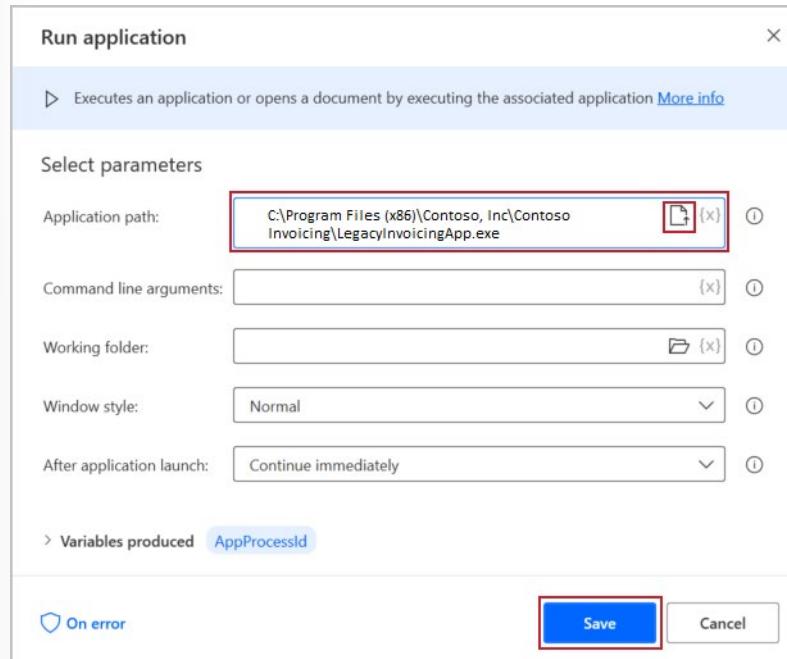
Desktop flows are created to mimic the actions of a user who is performing steps in a process. You have to train the flow by adding those actions.

To add actions to your flow, select the desired action and then drag it to the **Main** canvas. Under the **System** drop-down menu on the Actions Pane, select and drag **Run Application**. You will use this feature to open your invoicing application.



In the following dialog box, specify the path to the application by entering the location manually; however, by selecting the icon on the right, you can select the application from a file explorer. You can search in the file explorer if you don't know the exact location of your application.

Leave the remaining fields as they are and then select **Save**.



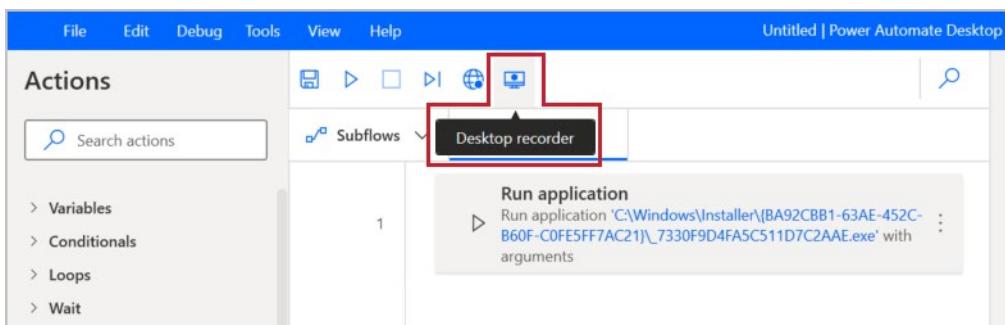
Now that Power Automate has opened the application, you can complete the next actions. Previously, you chose from the actions on the Action Pane; however, a simpler way of communicating actions that

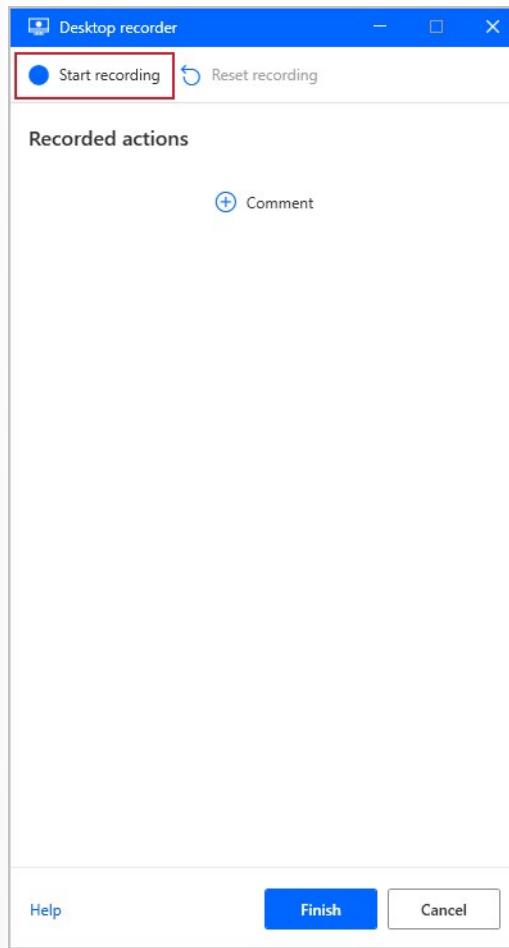
need to be performed is by recording your desktop. The next unit provides instructions on how you can record your desktop.

## Record Power Automate Desktop actions

Before getting started, you should be aware of a couple cleanup items. First, the process will go more smoothly if you exit out of unnecessary applications while you're recording. If you have more browsers or programs running, you should close them now. Second, it will be difficult to read the instructions and perform the actions that are required for the recording simultaneously. You might want to read through this unit completely before performing the outlined steps. With those items out of the way, you are now ready to begin recording.

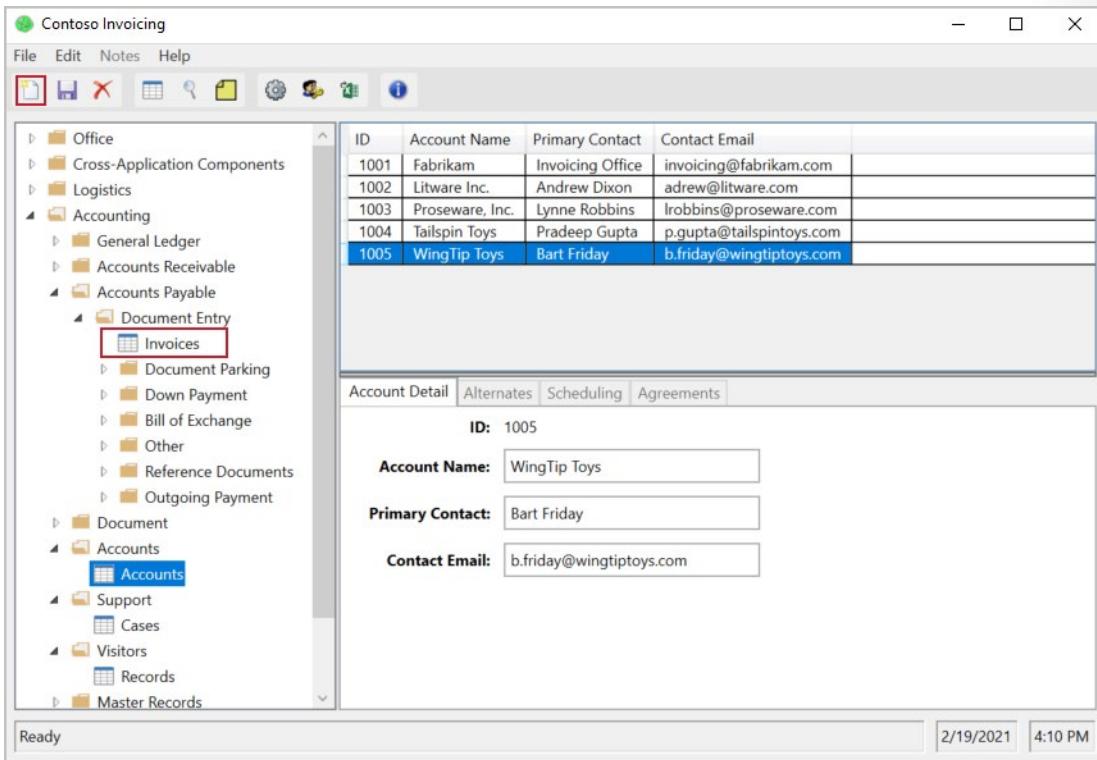
To begin recording your desktop actions, open the Contoso Invoicing app and the **Desktop recorder** in Power Automate. If your application is not maximized, the desktop recorder will show as an icon without text in the toolbar. Select the **Start recording** button in Power Automate Desktop.





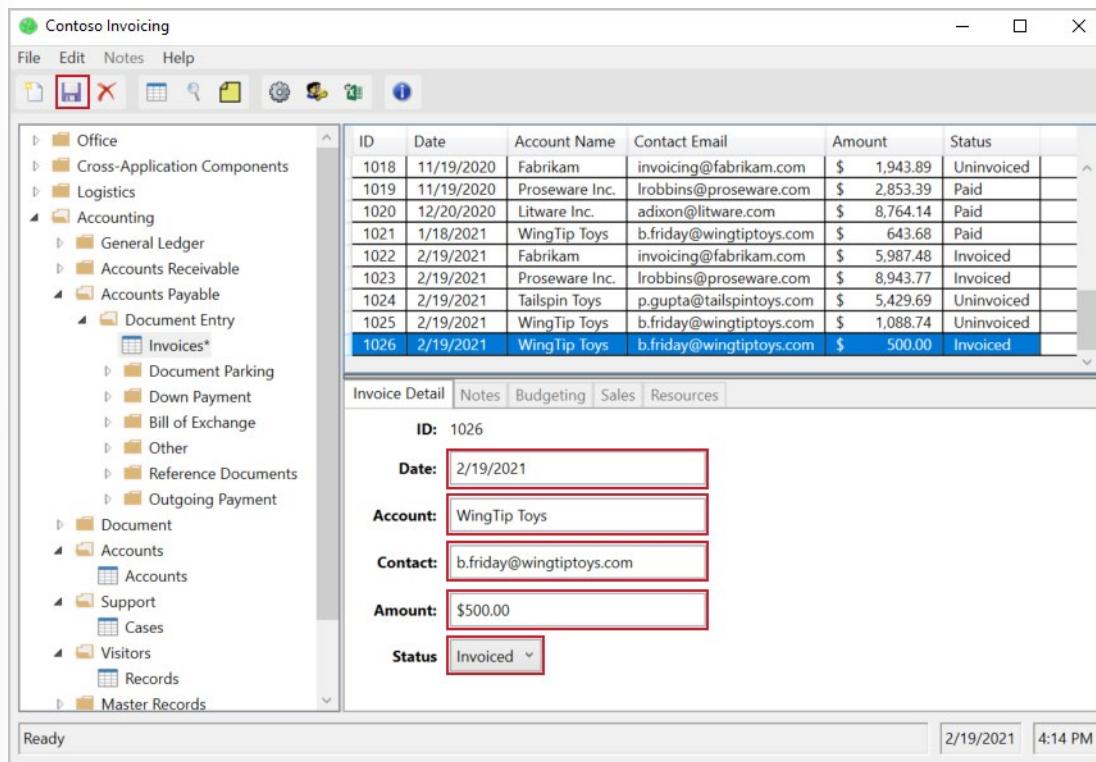
As you record, make sure that you go slowly and wait several seconds between actions. A red outline will display on a control before you select it, and a blue highlight will display afterward. If these outlines and highlights do not appear, your actions might not be recorded properly.

In the Contoso Invoicing app, select **Invoices** and then create a new record by selecting the appropriate icon in the upper left.

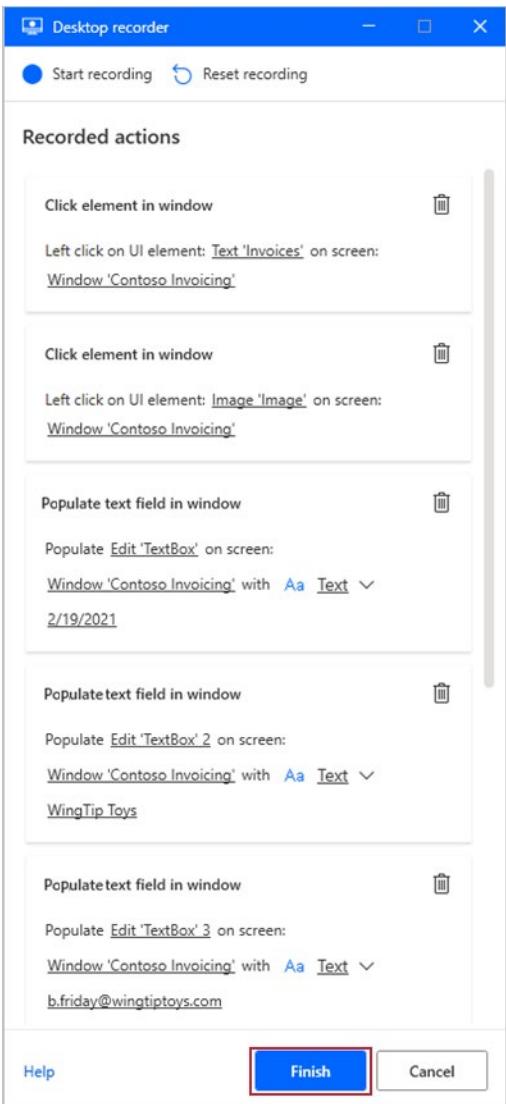


Complete the required information for the invoice: **Date**, **Account**, **Contact**, **Amount**, and **Status**. You can use whatever values you want, or you could copy the values that are used in the following screenshot. Edit the **Date** field, even if it has the value that you want. This action will allow you to change it through the flow instead of always having to use the default date. Be sure to only use your mouse, not keyboard shortcuts, to go to the next field. You can pause the recording or delete actions if you make a mistake.

When you're finished, select the **Save** icon to save your record.



Return to the recording, put it in Power Automate Desktop, and then select **Finish**. Your recorded actions should look similar to the following screenshot.



After you have selected **Finish**, your newly recorded actions will display beneath the action to open your app. The action of closing the app was not recorded. Additionally, this unit didn't demonstrate how running your flow will result in a new instance of the app being open for every run.

## Edit and test recorded actions

You can edit the recording actions by selecting the ellipsis (...) button and then by selecting **Edit**. In the subsequent dialog box, you can correct mistakes that you made during recording.

The screenshot shows the Power Automate Desktop application interface. On the left, there's a sidebar titled 'Actions' containing various system and application-related actions. The main workspace shows a workflow with 11 steps:

- Run application (Step 1)
- Start of autogenerated actions using the desktop recorder (Step 2)
- Click UI element in window (Step 3)
- Click UI element in window (Step 4)
- Populate text field in window (Step 5)
- Populate text field in window (Step 6)
- Populate text field in window (Step 7)
- Populate text field in window (Step 8)
- Populate text field in window (Step 9)
- Set drop-down list value in window (Step 10)
- End of autogenerated actions using the desktop recorder (Step 11)

A context menu is open over the third 'Click UI element in window' step. The menu includes options like Edit, Enter, Undo, Redo, Cut, Copy, Paste, Move up, Move down, Disable, and Delete. The 'Edit' option is highlighted with a red box.

**Click UI element in window**

Clicks on any UI element of a window [More info](#)

Select parameters

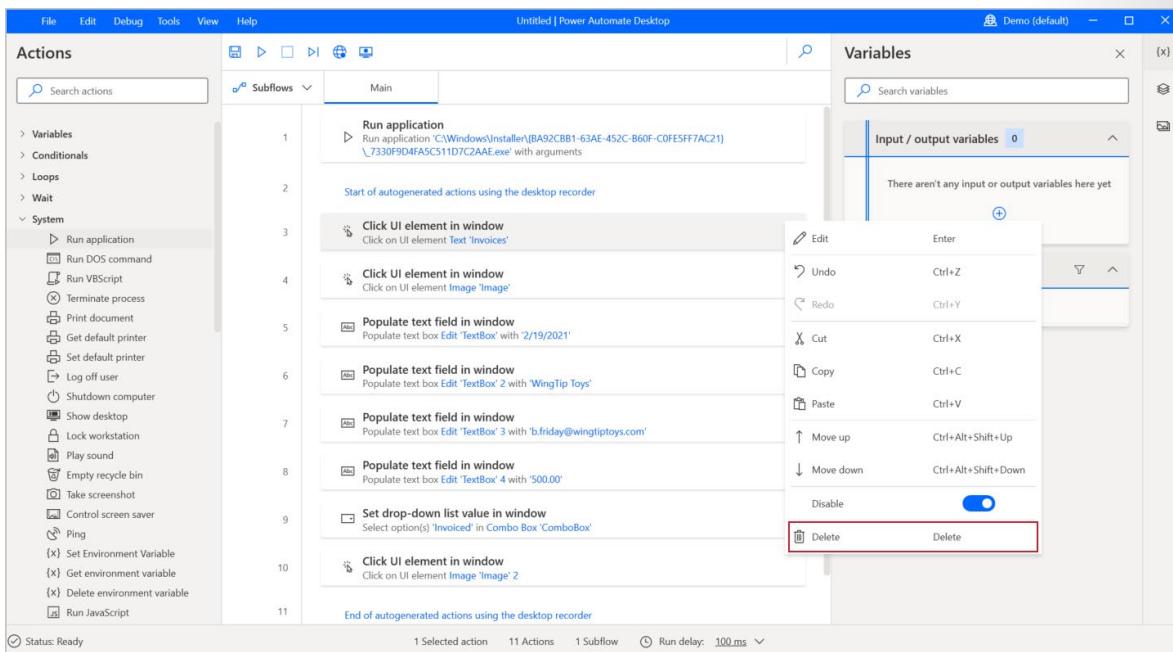
UI element: %appmask['Window \'Contoso Invoicing\'']['Text \'Invoices\'']%  
Click type: Left click

> Advanced

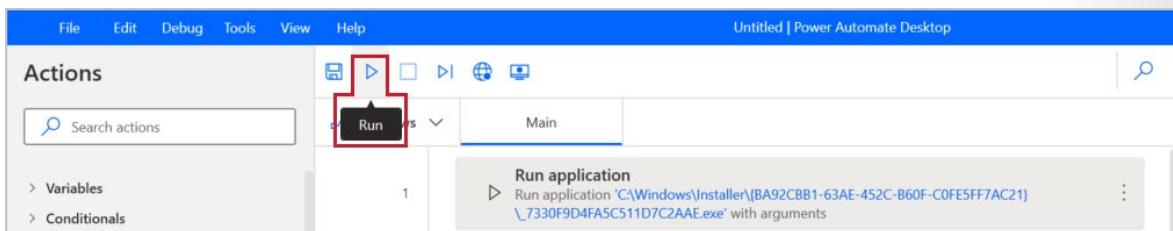
On error

Save Cancel

You can also **Delete** unnecessary or duplicate steps in this menu.



Test your flow by selecting the **Run** icon in the toolbar. Avoid using your computer to perform actions while the test is running.



When your test is successful, select the **Save** icon.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *What indications do you have that your actions are recording appropriately?*

- A red outline will show before you make the selection, and a blue highlight will show afterward.
- A red recording button will be visible on the screen.
- A pop-up window will indicate that the recording has started.
- Power Automate Desktop will minimize so that you can see your whole screen.

## Multiple choice

2.Which of the following actions can you not perform within Power Automate designer?

- Edit your previously recorded actions.
- Delete previously recorded actions.
- Record keyboard shortcuts that are used for navigation.
- Pause your recording to perform unrecorded actions.

## Multiple choice

3.Other than recording, how do you add actions to your flow?

- Query a data table that you have created with the correct steps.
- Select the desired action and drag it to the main canvas.
- Set your action to published.

## Summary

Power Automate Desktop helps you reduce or eliminate repetitive tasks, which will help increase productivity. Robotic process automation (RPA) allows you to outsource those tasks to user-friendly software, freeing your time for more important or creative endeavors. Power Automate allows you to build automations on desktop applications without requiring custom connectors by using desktop flows. Desktop flows are the first step in designing your complete RPA solution.

In this module, you have:

- Learned about the Power Automate Desktop flows.
- Created a new desktop flow.
- Recorded actions that are performed in a desktop-based application.
- Performed a test run of the new desktop flow.

## Key takeaways

Key takeaways of this module include:

- Desktop flows allow you to create custom automations without a pre-existing connector.
- Recording your actions is as simple as pressing a button.
- RPA is accessible to anyone who uses the Power Automate Desktop application.

# Run a Power Automate Desktop flow in unattended mode

## Introduction

Robotic process automation (RPA) would be incomplete if someone needs to constantly monitor the desktop flows and must be signed in and available for every interaction. Occasionally, a process needs supervision, a situation that would work best with an attended flow; however, some repetitive processes work as well without human oversight. For those scenarios, an unattended desktop flow is best.

In this module, you will:

- Run a basic desktop flow in unattended mode.
- Run a desktop flow and cloud flow scenario in unattended mode.
- Learn best practices and setup for unattended desktop flows.

This module uses an existing solution as basis for running an unattended desktop flow. The solution includes a desktop flow that is built into Microsoft Power Automate Desktop to perform actions in an invoicing application. The desktop flow contains various input and output variables and is connected to a cloud flow through a gateway, which is triggered by receiving an email in Microsoft Outlook. Then, the flow uses a customized AI form processing model to analyze attachments and gain approval in Microsoft Teams. These features are packaged together in a Power Automate solution. You can use this module to learn the concepts that are involved in creating unattended desktop flows for your own solution, or you can build off the previous modules to re-create the example solution.

## Set up an unattended desktop flow

While attended desktop flows require a user to be signed in to implement actions that are associated with the flow, an unattended desktop flow can't run if active Microsoft Windows user sessions are present, even a locked one. For this reason, many users choose to run unattended flows on a virtual machine. This approach allows users to run unattended workflows while keeping all physical devices available for use.

For an unattended desktop flow to run smoothly, you need to have:

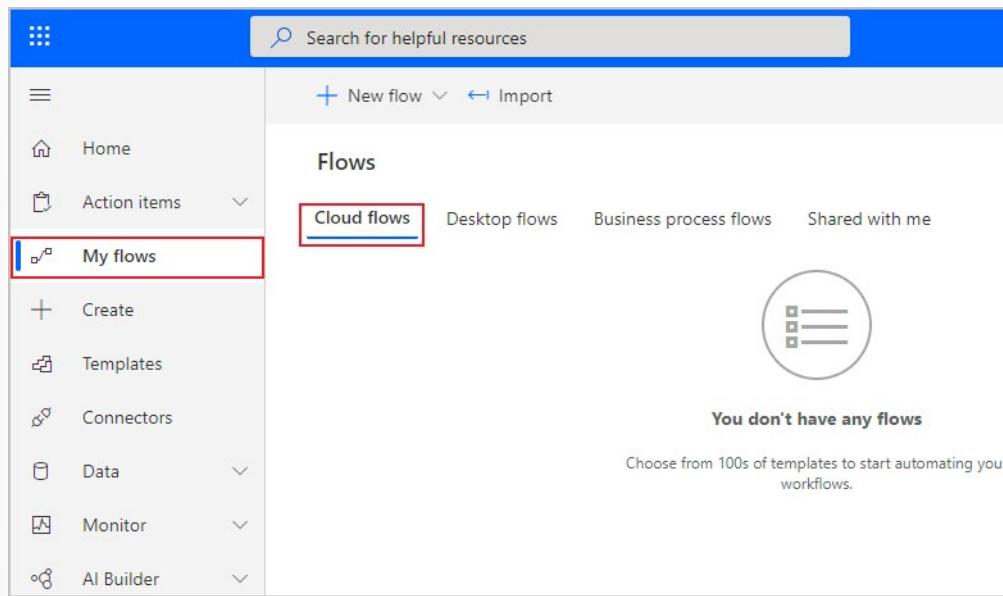
- All users completely signed out.
- A locked screen (enabling the flow to run without users seeing the actions that are performed).
- A gateway with the user sign-in information to the desktop.

You can choose to run multiple unattended desktop flows sequentially on the same device by viewing and manually changing the run queue; however, desktop flows that don't run within three hours of being requested will time out. Essentially, if you trigger multiple unattended desktop flows, they'll perform one after another unless the queue is backed up by more than three hours. While you can't run desktop flows concurrently with the same user because multiple users can be signed in simultaneously on Windows Server 2016 and Windows Server 2019, Power Automate can run several unattended desktop flows simultaneously on a single device. With this feature, your organization can save on infrastructure costs by using two or more user accounts to create desktop flow connections that target the gateway on a single device.

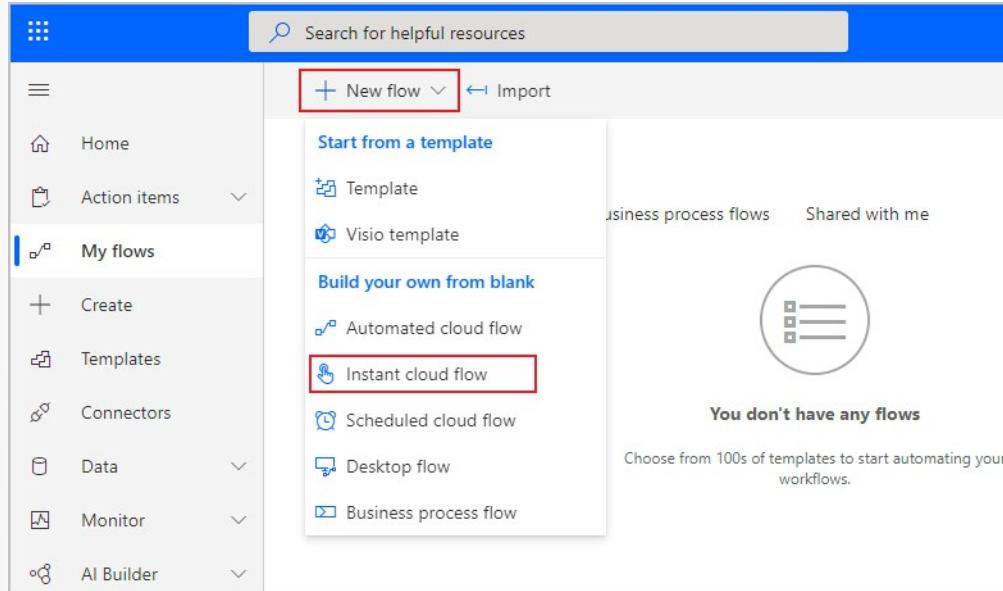
Now that you are aware of the details and benefits of unattended desktop flows, you can learn how to run them.

## Create a new cloud flow that calls an existing flow in unattended mode

A cloud flow runs in the cloud and accesses services through APIs. Cloud flows are required to trigger the unattended desktop flow. To begin creating your cloud flow, open **Power Automate**<sup>7</sup> and select **My flows** and then **Cloud flows**.

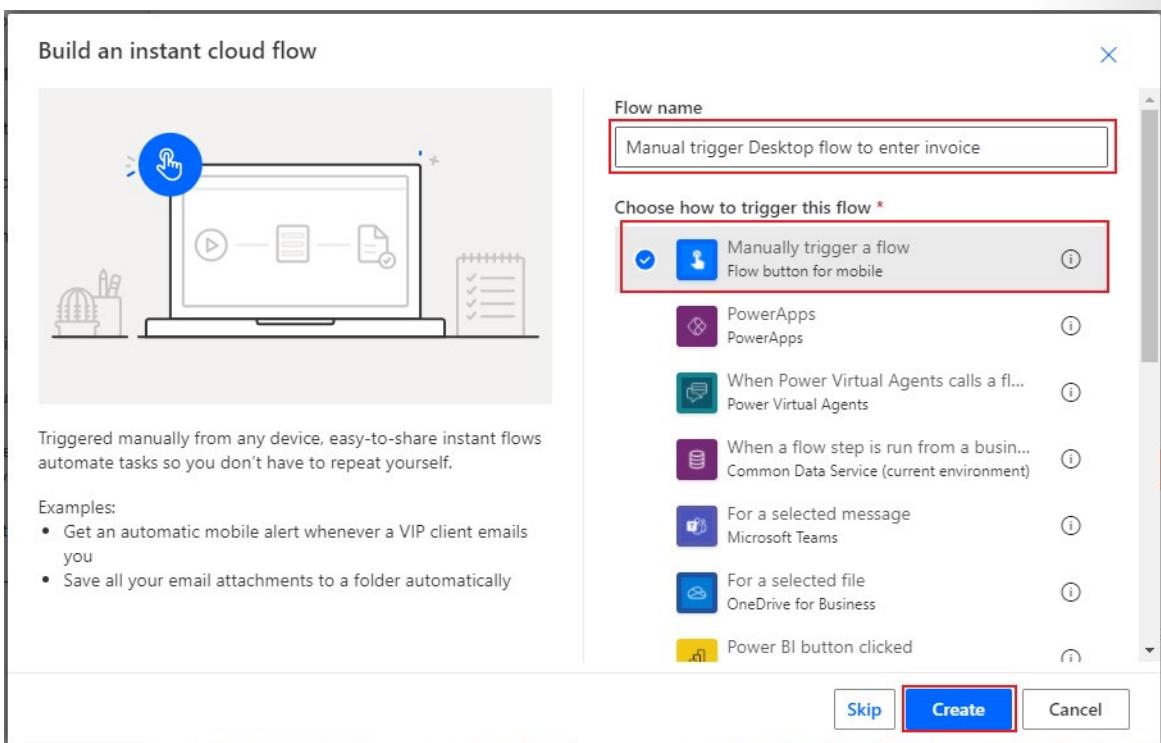


Next, select **New flow > Instant cloud flow**.

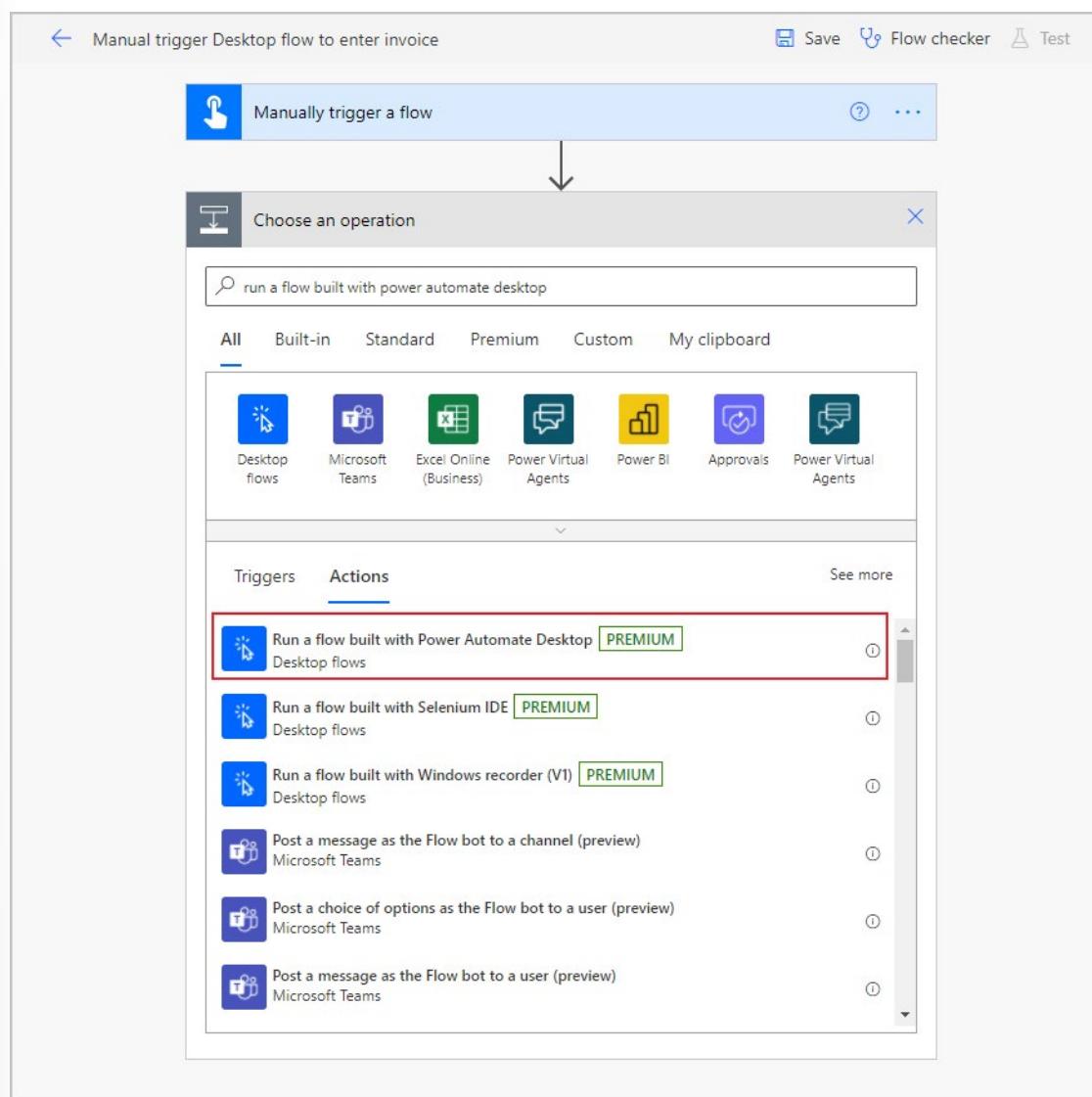


Name your flow. The following screenshot shows the example name as **Manual trigger Desktop flow to enter invoice**. Select the **Manually trigger a flow** option and then select **Create**.

<sup>7</sup> <https://us.flow.microsoft.com/>



When the screen changes to the flow builder, select **New step** and then search for and select **Run a flow built with Power Automate Desktop**.

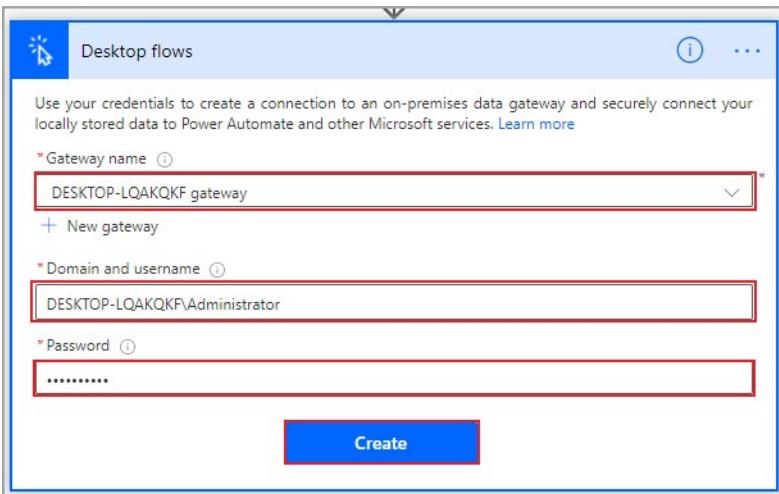


If you haven't already configured your gateway connection, use the **Gateway name** drop-down menu to select the appropriate gateway.

If you can't find your gateway, you might need to delete this step and re-create it to refresh the list. If your gateway still doesn't appear, you might need to restart the gateway on your PC and then retry the process.

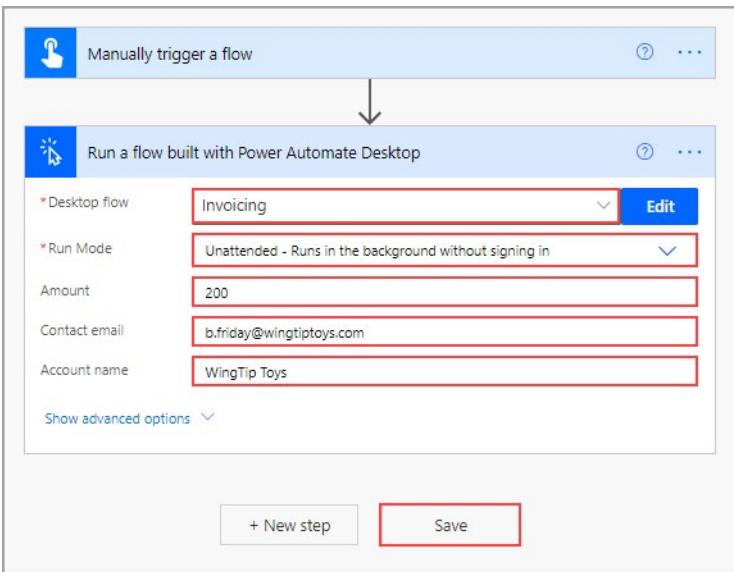
The next two fields request your credentials to sign in to your computer. If you are unsure what to put in the **Domain and username** field, you can open a command prompt window by opening the **Start** menu, entering **CMD** in the search box, and then pressing the **Enter** key. When the command prompt opens, enter **Set user** and then press the **Enter** key.

Several lines of code will appear. Separate the **user domain** and the **username** with a backslash (), as shown in the following screenshot. Select **Create**.



When you have connected to your desktop, Power Automate will prompt you for information that is specific to your desktop flow. Use the drop-down menu to select the name of your desired flow, in this case **Invoicing**, and then select the **Unattended - Runs in the background without signing in** option in the **Run Mode** drop-down menu.

After you have selected your desktop flow, requested input variables will be added for you to fill in. You can use dynamic content from the trigger or other steps in your cloud flow to populate these variables. For the purposes of this module, you can enter placeholders because you are only testing the unattended flow. Select **Save**.



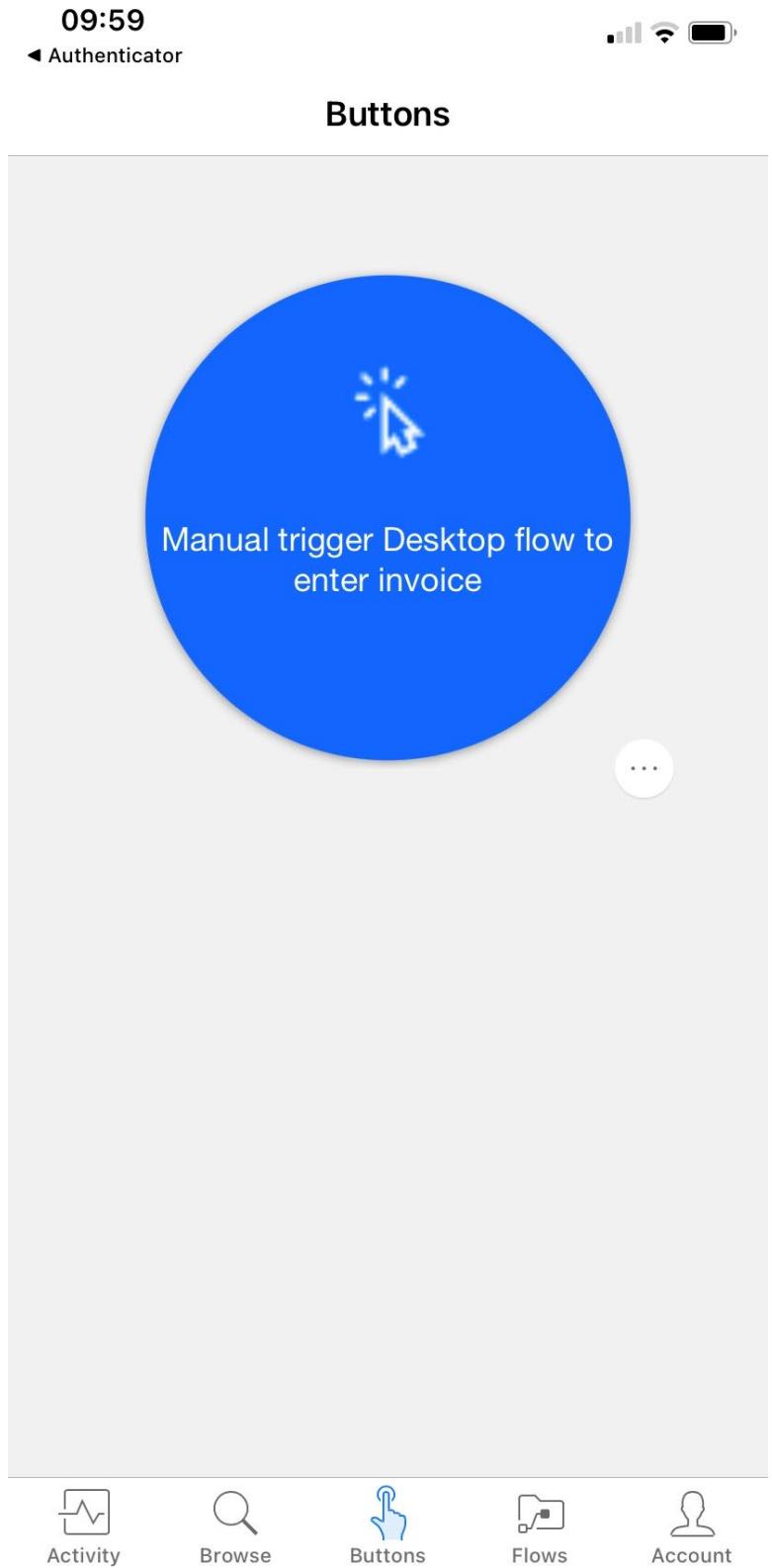
You have created the unattended desktop flow. Now, you can test it.

## Perform a test run

Because you won't be able to see the flow run, it's important that you go to your desktop app and note its current state, whether you write down the most recent ID number or the last line in a Microsoft Excel sheet. Whatever actions your desktop flow performs should make notable impact.

---

If you are signed in to and using the machine that will run the desktop flow, make sure that you save your work, close out of all programs, and then sign out. If you are running the desktop flow on a virtual machine, ensure that the virtual machine is still running. Sign in to another device to trigger the flow or do so from the Power Automate app on your phone.



After the flow has completed, sign in to your device again and ensure that the unattended desktop flow ran properly.

## Best practices

If you plan to run multiple unattended desktop flows, you can adopt a set of strategies to distribute load and ensure that all your unattended desktop flows run successfully without overloading the target machine(s) or running into timeouts because multiple unattended desktop flows are running at the same time.

You can use any of the following strategies:

- Plan your unattended desktop flows to run at different times of the day, spreading your load over time. This approach works best if you have a single or a limited set of machines that can run workloads, and you can control the triggers (for example, scheduled flows) that start your desktop flows.
- Create clusters of machines that can run unattended desktop flows with identical configurations in parallel.
- Create multiple desktop flows, where each uses a separate connection to target different machines.

By following these strategies, you can avoid having unattended desktop flows competing to run on the same device and, in some cases, failing due to timeouts.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *Which of the following would not make running an unattended desktop flow simpler or more efficient?*

- Signing in and opening all necessary programs before running the flow
- Running the desktop flow on a virtual machine
- Using two different accounts to run unattended desktop flows on the same machine
- Setting up a cluster of devices on which the flows can run

### Multiple choice

2. *Which of the following is true regarding unattended desktop flows?*

- Desktop flows can be queued indefinitely.
- Unattended flows can overload a computer.
- You can't use a device that is actively running a desktop flow.
- Actions within the flow need to be queued for specific times of the day.

## Multiple choice

3. Through which of the following options can a cloud flow connect to a desktop flow?

- API
- Predefined input variables
- Virtual machine
- Gateway

## Summary

Unattended desktop flows allow you to use the full power of desktop apps with minimal human oversight, creating a robust and complete robotic process automation (RPA). Now, you have learned how to build and run unattended desktop flows to complete your RPA. You can use the concepts that you have learned and build on them to automate your tasks so that you can focus more on your creative and strategic pursuits.

In this module, you learned how to:

- Run a basic desktop flow in unattended mode.
- Run a desktop flow and cloud flow scenario in unattended mode.
- Strategize by using best practices and set up for unattended desktop flows.

## Key takeaways

Three key takeaways for this module are:

- Unattended desktop flows allow you to automate processes that can run without human oversight.
- Follow best practices to avoid overloading your machine or having your flows time out.
- Ensure that the device that is running your unattended flow doesn't have signed-in users.

# Answers

## Multiple choice

1.What indications do you have that your actions are recording appropriately?

- A red outline will show before you make the selection, and a blue highlight will show afterward.
- A red recording button will be visible on the screen.
- A pop-up window will indicate that the recording has started.
- Power Automate Desktop will minimize so that you can see your whole screen.

### *Explanation*

*Take a few seconds between actions to ensure that the red outline and blue highlight appear to verify appropriate recording.*

## Multiple choice

2.Which of the following actions can you not perform within Power Automate designer?

- Edit your previously recorded actions.
- Delete previously recorded actions.
- Record keyboard shortcuts that are used for navigation.
- Pause your recording to perform unrecorded actions.

### *Explanation*

*The recorder needs you to select the specific field that you want to edit rather than using keyboard shortcuts.*

## Multiple choice

3.Other than recording, how do you add actions to your flow?

- Query a data table that you have created with the correct steps.
- Select the desired action and drag it to the main canvas.
- Set your action to published.

### *Explanation*

*To add actions to your flow, you can record them or select the desired action and then drag it to the Main canvas.*

## Multiple choice

1.Which of the following would not make running an unattended desktop flow simpler or more efficient?

- Signing in and opening all necessary programs before running the flow
- Running the desktop flow on a virtual machine
- Using two different accounts to run unattended desktop flows on the same machine
- Setting up a cluster of devices on which the flows can run

### *Explanation*

*An unattended desktop flow can't be run if a user is signed in.*

**Multiple choice**

2.Which of the following is true regarding unattended desktop flows?

- Desktop flows can be queued indefinitely.
- Unattended flows can overload a computer.
- You can't use a device that is actively running a desktop flow.
- Actions within the flow need to be queued for specific times of the day.

*Explanation*

*Similar to any computer process, it is possible to give your computer more than it can handle with desktop flows. If your computer is struggling with the processes that you are giving it, try setting up a cluster of devices to disperse the workload.*

**Multiple choice**

3.Through which of the following options can a cloud flow connect to a desktop flow?

- API
- Predefined input variables
- Virtual machine
- Gateway

*Explanation*

*You need to define a gateway for every device or virtual machine on which the unattended flow will run.*



## Module 9 Build business process flows

### Introduction to business process flows in Power Automate

#### Introduction to business process flows

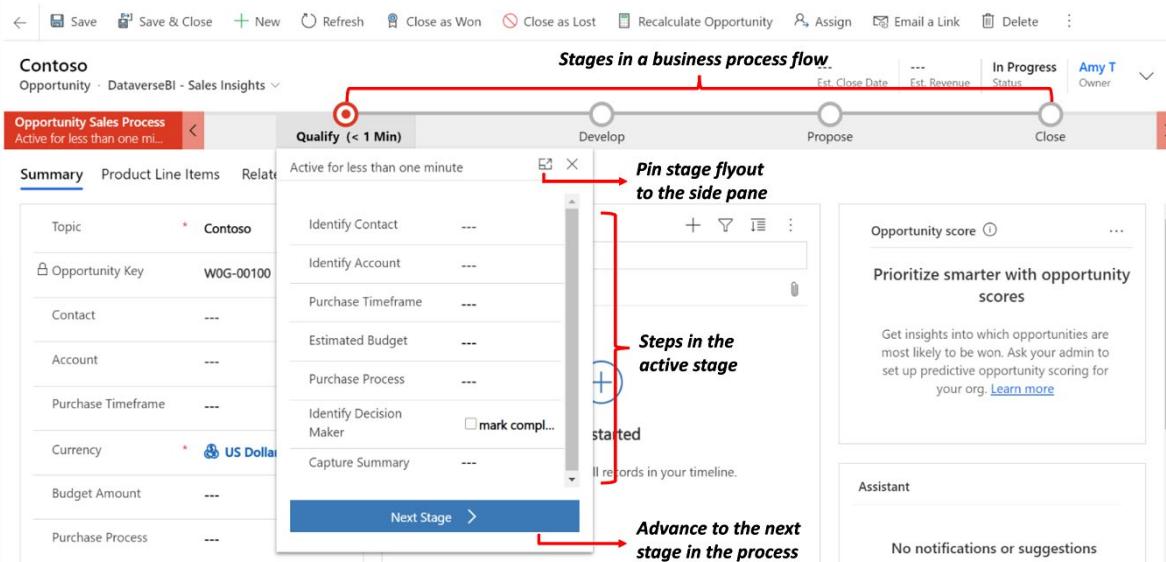
A business process flow is a series of ordered work steps that a user completes within a business process. In Microsoft Power Automate, a business process flow is composed of a series of discrete stages that leads a user along a path toward process completion. Each stage contains one or more columns, called data steps, that you should complete before proceeding to the next stage in the business process flow.

A business process flow visually guides a user through stages within a process and shows progress toward process completion. A user can also see which stages that they have completed and which stages that they still need to complete within an instance of a process.

Business process flows can be configured to require users to enter certain columns, data steps, before completing the stage. If needed, you can also allow users to jump stages. All data collected while you are completing a business process flow is stored in one or more tables in Microsoft Dataverse.

**Note:** To complete this exercise, you will need access to an account that has permission to create tables and columns in Dataverse and you need a Power Apps or Dynamics 365 license. Ask your Power Platform administrator for proper permissions or sign in and create a personal Power Apps and Power Automate development environment by using the Power Apps Community Plan (which is free). Sign up by accessing the Power Apps Community Plan page.

The following illustration shows a simple business process flow as shown as a component of a model-driven solution in Power Apps.



Business process flows are created and managed by using Power Automate, and they are available for out-of-the-box tables and for your own custom tables. Microsoft has many prebuilt business process flows, or you can create your own. Additionally, a table can have none, one, or many business process flows associated with it. Business process flows are customizable to fit many organizational needs.

**Tip:** Business process flows are meant to guide users through steps that are required to complete a business process. You must have a valid Power Apps Dynamics 365 license or a valid Power Apps license to create or use a business process flow.

## Differences between a business process flow and a regular flow in Power Automate

A business process flow is a visual guide meant to help users complete a business process by using a set of predefined stages. Users are not limited on how long they run a business process or how long they have a stage open. All data associated with the business process flow can only be stored in one or more tables in Microsoft Dataverse. Business process flows can only have Dataverse as a data source. Dataverse has many different out-of-the-box business process flows that you can use as-is or modify them to fit your needs.

A Power Automate flow does not have any visual components like a business process flow. Power Automate flows can be configured to work with many different data sources, and a flow can connect to many different data sources within the same flow. A flow can be configured to time out if it is not completed in a certain time and can be triggered to move between steps based on data or user interaction. Flows support complex logic and looping, and a Power Automate flow can call another Power Automate flow as needed.

## Business process flows value to organizations

Business process flows allow organizations to quickly standardize how processes are completed and what data is collected at each stage. Business process flows support logical branching and can be used to standardize many common business processes within an organization.

Business process flows offer the following benefits:

- Improved outcomes
- Consistent stages and work steps across all instances of the process
- Improved data collection and reporting
- Decreased time to complete the process
- Predictable outcomes

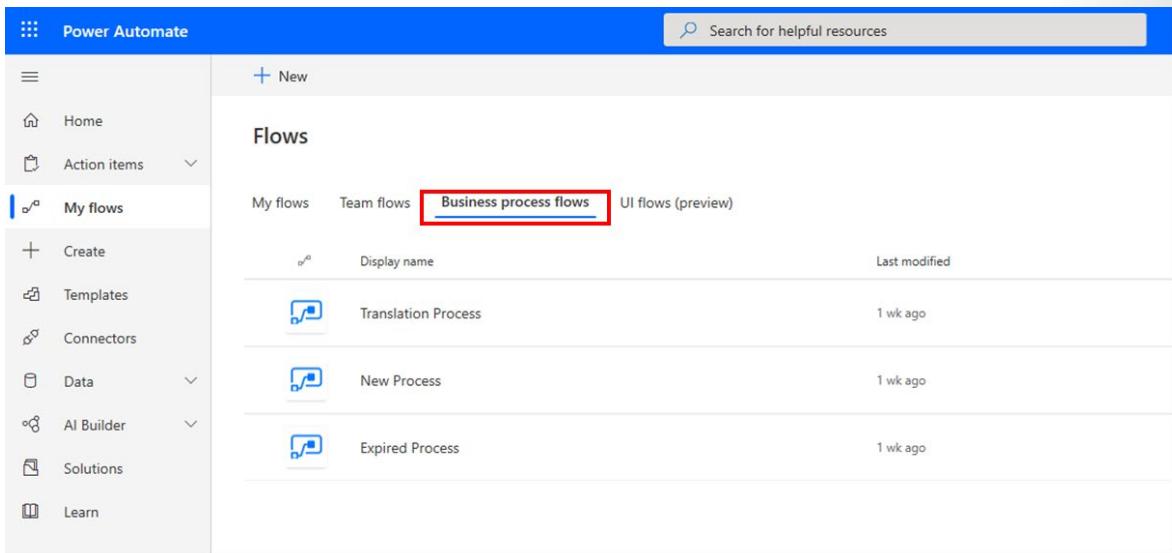
Business process flows are simple to set up and administer. Business process users close to business operations and processes can create new business process flows or modify out-of-the-box business process flows by using Power Automate.

Business process flows can be customized based on security roles, allowing access to the appropriate stages and steps based on a security role. Finally, the process of each instance of a business process flow can be monitored, and the data from the process flow can be used in Power BI dashboards and reporting for simplified administration.

## Business process flows and the larger Microsoft Power Platform

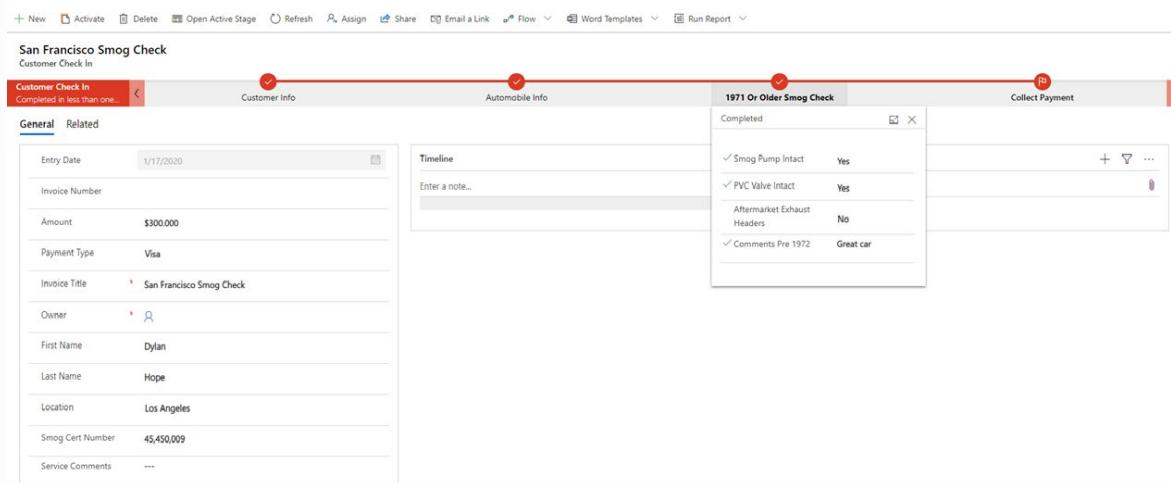
Business process flows are deeply integrated with the Microsoft Power Platform. They are created, customized, and managed by using Power Automate.

You can manage or create new business process flows by launching Power Automate and selecting Business process flows under My Flows in Power Automate, as shown in the following image.



The screenshot shows the Power Automate interface. On the left is a navigation sidebar with options like Home, Action items, My flows (which is currently selected and highlighted in blue), Create, Templates, Connectors, Data, AI Builder, Solutions, and Learn. The main area is titled 'Flows' and contains tabs for 'My flows', 'Team flows', and 'Business process flows'. The 'Business process flows' tab is highlighted with a red box. Below these tabs is a table with columns for 'Display name', 'Last modified', and three process cards: 'Translation Process' (modified 1 wk ago), 'New Process' (modified 1 wk ago), and 'Expired Process' (modified 1 wk ago).

You can launch the new business process flows as a component of a model-driven Power App or a stand-alone application within Power Automate (called an immersive business process flow), as shown in the following image.



All data that is associated with a business process flow is stored in one or more Dataverse tables (custom or standard). You could launch an instant Power Automate flow in conjunction with a business process flow to store data outside of Microsoft Dataverse if needed. Additionally, you can create Power BI dashboards from the data that was collected within the business process flow.

Business process flows are deeply integrated within Power Platform and offer powerful ways to improve how you manage common business processes.

## Uses of a business process flow and a standard Power Automate flow

Knowing when to use a business process flow or a regular Power Automate flow to automate a process or task can be difficult. The following guidelines can help you decide if you should use a business process flow or a standard Power Automate flow.

Use a business process flow if you:

- Want to create automated business processes with Dynamics 365 Solutions.
- Want a simple visual guide to help users complete a process.
- Want to use out-of-the-box business process or custom business process flows.
- Have a Dynamics 365 license and want to create automated business processes with Microsoft Dataverse.

Use a Power Automate flow if you:

- Want to schedule a workflow to start based on a predefined time interval or after X minutes, hours, or days of some action or event.
- Want to trigger a flow based on data outside of Dataverse (SharePoint, for example).
- Do not want to store data that is captured in the flow in Dataverse.
- Want to push notifications outside of Outlook (SMS or Gmail, for example).
- Want to use and create workflows with only an Office 365 license.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. *What license is required to create or use a business process flow?*

- You must have a valid SharePoint license.
- You must have a valid Office 365 license.
- You must have a valid Dynamics 365 license.
- You must have a valid Power Apps Dynamics 365 license or a valid Power Apps license.

## Multiple choice

2. *What type of business process flows does Microsoft Dataverse include?*

- A number of out-of-the-box predefined business process flows.
- No existing business process flows. Only custom business process flows are available with Dataverse.
- A number of custom business process flows.
- A number of regular Power Automate flows only.

## Multiple choice

3. *Where can business process flows be embedded?*

- They can be embedded into a public website.
- They can be added as a Web Part in SharePoint.
- They can be embedded in a custom .NET application.
- They can be embedded in a custom .NET application.

## Multiple choice

4. *What tool is used to build business process flows?*

- Microsoft Visio
- Microsoft Visual Studio
- Microsoft Power Apps Canvas App Maker studio
- Business process flow editor in Microsoft Power Automate

## Summary

Business process flows are a powerful way to visually standardize and guide users through a process. They ensure consistent implementation and data collection, can improve the quality of outcomes, and decrease the cycle times to complete a process.

You can create business process flows as a custom solution, or you can choose to use or customize out-of-the box business process flows that are part of Microsoft Dataverse and Dynamics solutions.

Additionally, you can create business process flows as a stand-alone solution (called an immersive business process flow), or you can include them as a panel within a model-driven app.

An important parameter to remember is that business process flows only store data within Dataverse.

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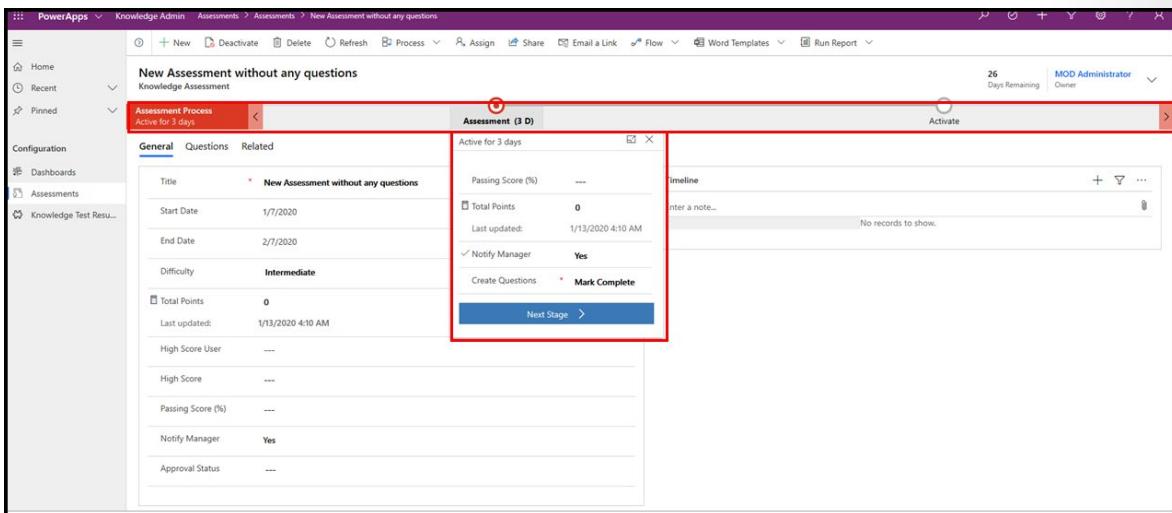
You should use a regular Power Automate flow if you want to store data in a data source outside of Dataverse, if you want to trigger the flow based on a time or recurring condition or if you only have an Office 365 license available.

# Create an immersive business process flow in Power Automate

## Introduction to immersive business process flows

Business process flows are available in two different varieties: embedded within a model-driven app and as a stand-alone solution called an immersive business process flow. You should examine the differences between each before learning how to create an immersive business process flow.

Embedded business process flows are visual representations of a series of work steps within an end-to-end process. They always appear along the top of a model-driven app in their own control, as shown in the following image.



An immersive business process flow can exist on its own, and it is built entirely within the Power Automate editor. They will always exist within the default solution in an instance of Microsoft Dataverse, and are only accessible within Power Automate or the data tab that is associated with an entity in Dataverse. Immersive business process flows offer many of the same advantages of an embedded business process flow, but with the added advantage of simplified creation and streamlined management.

You will learn how to build an immersive business process flow in the next units of this module. The following screenshot shows a simple two-step immersive business process flow.

By taking a closer look, you'll see that immersive and embedded business process flows look similar. The map of the business process flow is shown along the top of the screen and a main form is shown beneath it.

The name of the business process flow is shown on the left side of the control, while each step (called a Stage) is shown as a red circle. A user selects the red circle of the current Stage and fills out information in a drop-down screen that includes various fields (called data steps).

The key difference between immersive and embedded business process flows is that an embedded business process flow is a component within the larger model-driven app, while the immersive business process flow is a stand-alone solution. Embedded and immersive business process flows help users complete a process within the context of a larger solution.

A user always views and completes an embedded business process flow within a model-driven app. An immersive business process flow is a stand-alone app, and it is built solely for completing the business process. The immersive business process flow exists as the entire solution rather than a component of a larger model-driven app.

Many of the concepts and techniques that are discussed and demonstrated within this learning path apply to both embedded and immersive business process flows. Immersive and embedded flows are similar. The main difference between them is how they are launched and the context that they are viewed in.

The remainder of this module is focused on exploring and building an immersive business process flow.

## Exercise - Create an immersive business process flow

The following scenario and exercise will help you practice building an immersive business process flow with Power Automate and Microsoft Dataverse. Remember, all data that is associated with any business process flow is always stored in one or more tables within Dataverse and business process flows.

**Note:** To complete this exercise, you will need access to an account that has permission to create tables and columns in Dataverse and you need a Power Apps or Dynamics 365 license. Ask your Power Platform administrator for proper permissions or sign in and create a personal Power Apps and Power Automate development environment by using the Power Apps Community Plan (which is free). Sign up by accessing the [Power Apps Community Plan<sup>1</sup>](https://powerapps.microsoft.com/communityplan/?azure-portal=true) page.

<sup>1</sup> <https://powerapps.microsoft.com/communityplan/?azure-portal=true>

## Scenario

You work for SmogChecksRUs, a rapidly growing auto repair company that specializes in performing automotive smog checks and other auto services. SmogChecksRUs has been using a Microsoft Excel spreadsheet to collect customer and vehicle information, but now the marketing department has asked for a better way to collect information so they can follow up with customers and schedule checkups every two years, improve customer retention, and increase sales.

Management believes that improved data collection and standardized processes will improve customer satisfaction, improve customer loyalty, and increase recurring business and overall sales revenue. You have decided to create an immersive business flow by using Power Automate to meet management goals.

## Create an immersive business process flow

1. Go to **Power Automate**<sup>2</sup> and sign in to your local instance.
2. Select the proper environment in the upper-right corner of the screen.
3. Select **My Flows** on the menu on the left side of the screen and then select the **Business process flows** tab.
4. Select the **+ New** button on the upper-left corner of the screen.
5. Enter **Customer Check In** as the **Flow name**, select **None (Immersive Business Process)** under the table drop-down list, and then select the **Create** button, as shown in the following screenshot. Wait a minute for the table to be created, and then the **Business process flow** editor will launch.
6. In the **Business process flow** editor, add columns to the new table (customercheckin) that was automatically created in the previous step. Select **Customer Check In New Stage**, as shown in the following figure.
7. Select **New Stage** within the designer, rename the Stage to **Collect Customer Info**, and then select the **Apply** button, as shown in the following screenshot.
8. Select the **Collect Customer Info** stage and then select the **Click to add fields and forms** hyperlink, as shown in the following figure.

**Note:** If you select **Click to add field and forms** link from Power Automate, you may see the classic UI. To see the modern UI, Open Power Apps in a new window and sign-in. On the left, select Data, select Tables, then select the CollectCustomerInfo table from the list and click **Edit**. Find and select the **Customer Check In table**. Add the columns as listed in the next step.

9. Add column to the collectcustomerinfo table by selecting the **Add Column** button, as shown in the following screenshot.

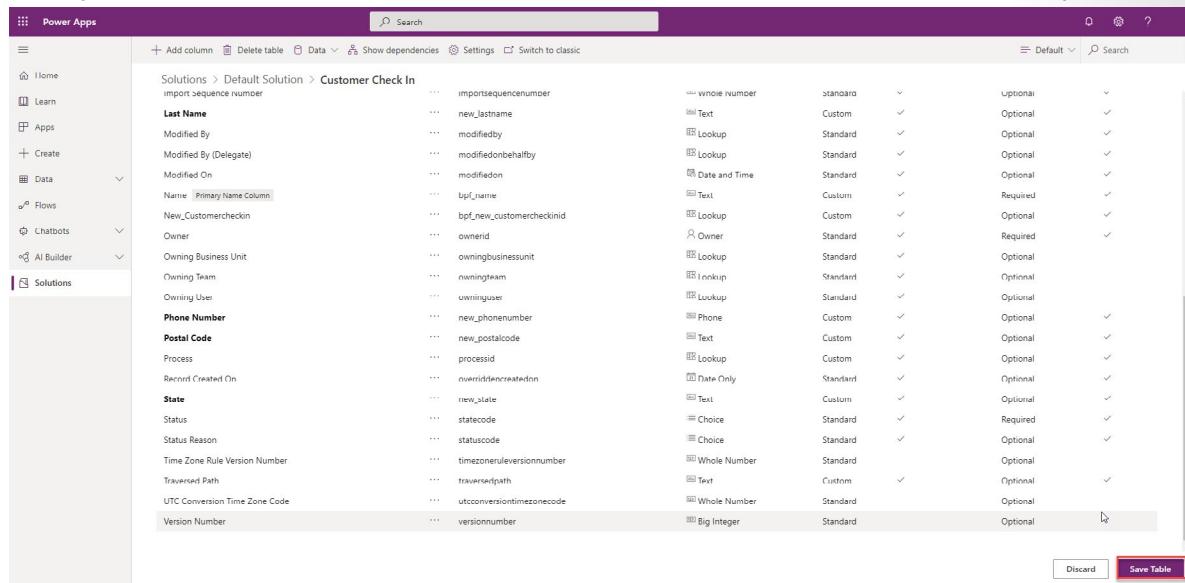
<sup>2</sup> <https://preview.flow.microsoft.com/?azure-portal=true>

10. Add each of the columns from the following list. Enter the name and data type and then select the **Done** button each time you add a new column, as shown in the following screen.

The screenshot shows the configuration of a new column named 'Entry Date'. The 'Display name' is set to 'Entry Date'. The 'Name' is 'new\_EntryDate'. The 'Data type' is 'Date Only'. The 'Required' field is set to 'Optional'. The 'Searchable' checkbox is checked. The 'Description' field is empty. The 'Advanced options' section is collapsed. The 'Done' button at the bottom is highlighted with a red box. On the left, a sidebar lists various data types: Text, Text Area, Email, URL, Ticker Symbol, Phone, Autonumber, Whole Number, Duration, Timezone, Language, Date and Time, Choice, Choices, Currency, Customer, Decimal Number, File, Floating Point Number, Image, and Lookup. The 'Date Only' option under 'Date and Time' is also highlighted with a red box.

- Entry Date - Date Only
- First Name - Text
- Last Name - Text
- Address - Text
- City - Text
- State - Text
- Postal Code - Text
- Phone Number - Phone
- Comments - Text Area

11. When you are finished, select the **Save Table** button to save the new columns. Make sure that you



The screenshot shows the Power Apps Solutions interface. On the left, there's a navigation bar with Home, Learn, Apps, Create, Data, Flows, Chatbots, AI Builder, and Solutions. Under Solutions, it says 'Solutions > Default Solution > Customer Check In'. The main area displays a table of columns. At the bottom right of the table are two buttons: 'Discard' and 'Save Table' (which is highlighted with a red box).

Last Name	... importsequencenumber ... new_lastname	... vnew_lastname	Standard	✓	Optional	✓		
Modified By	... modifiedby ... modifiedonbehalfby	... Lookup ... Lookup	Standard	✓	Optional	✓		
Modified On	... modifiedon	... Date and Time	Standard	✓	Optional	✓		
Name (Primary Name Column)	... upr_name	... Text	Custom	✓	Required	✓		
New_Customercheckin	... bpf_new_customercheckin	... Lookup	Custom	✓	Optional	✓		
Owner	... ownerid	... Owner	Standard	✓	Required	✓		
Owning Business Unit	... owningbusinessunit	... Lookup	Standard	✓	Optional	✓		
Owning Team	... owningteam	... Lookup	Standard	✓	Optional	✓		
Owning User	... owninguser	... Lookup	Standard	✓	Optional	✓		
Phone Number	... new_phonenumber	... Phone	Custom	✓	Optional	✓		
Postal Code	... new_postalcode	... Text	Custom	✓	Optional	✓		
Process	... processid	... Lookup	Custom	✓	Optional	✓		
Recruit Created On	... rverifidatecreatedon	... Date Only	Standard	✓	Optional	✓		
State	... new_state	... Text	Custom	✓	Optional	✓		
Status	... statecode	... Choice	Standard	✓	Required	✓		
Status Reason	... statuscode	... Choice	Standard	✓	Optional	✓		
Time Zone Rule Version Number	... timezoneruleversionnumber	... Whole Number	Standard	✓	Optional	✓		
Traversed Path	... traversedpath	... Text	Custom	✓	Optional	✓		
UTC Conversion Time Zone Code	... utcconversiontimezonecode	... Whole Number	Standard	✓	Optional	✓		
Version Number	... versionnumber	... Big Integer	Standard	✓	Optional	✓		

select the **Save Table** button or none of the columns will be added.

12. Close the current tab of the browser that is showing the table columns, and then return to the business process flow designer screen.

## Add columns as steps and finish the flow

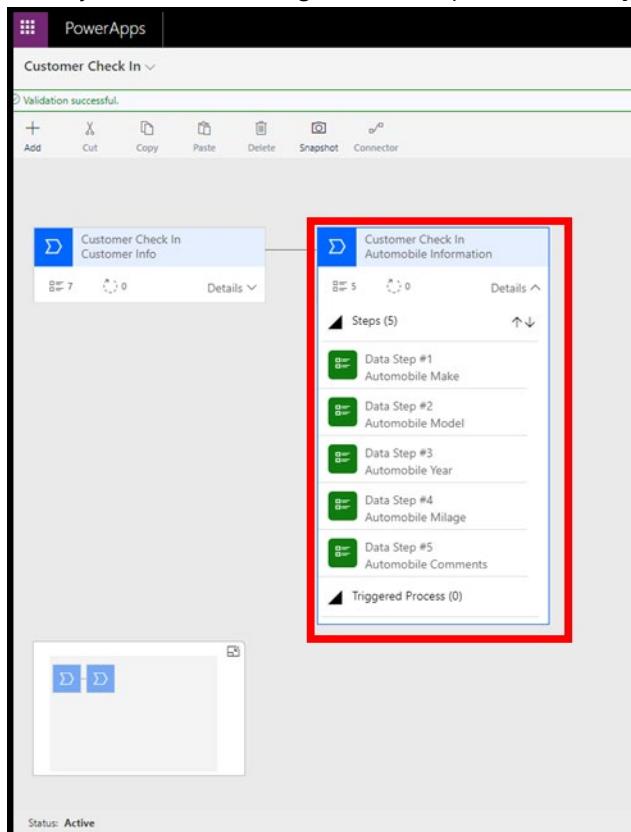
Now, you will add the columns as Steps in the first Stage in the **Customer Check In** business process flow.

1. Refresh your browser and then select the **Customer Check In** Stage.
2. Select the **Details** down arrow to Expand
3. Select **Data Step # 1**, and then enter the following information:
  - Step Name - Enter **First Name**.
  - Data Field - Select **First Name** from the drop-down menu.
  - Select the **Required** check box.
  - Select the **Apply** button.
4. Select the **Components** tab and then drag a Data Step under **Data Step #1**, as shown in the following figure.
5. Select **Data Step #2** and enter the following information:
  - Step Name - Enter **Last Name**.
  - Data Field - Select **Last Name** from the drop-down menu.
  - Select the **Required** check box.
  - Select the **Apply** button.
6. Select the **Components** tab, and then drag more data steps and add columns that were added earlier under Stage One (Entry Date, Address, City, State, and so on).
7. When you are done, Stage 1 should appear as shown in the following figure. If all appears correct, select the **Update** button in the ribbon.

**Note:** When the data process flow is used, data will be saved into the columns that you created in the customercheckin table in Dataverse.

8. Select the **Components** tab and drag a new stage to the right of Stage 1. Make sure to drop the new stage into the plus (+) sign. The new stage should resemble the following screenshot.
9. Repeat the steps that were covered for Stage 1, and then add the following columns and steps:
  - Automobile Make - Text
  - Automobile Model - Text
  - Automobile Year - Whole Number
  - Automobile Mileage - Whole Number
  - Automobile Comments - Text Area
10. Make sure to save the table after you add the new columns.

11. When you are done adding the data steps, select the **Update** button in the ribbon. Your completed



Stage 2 should look like the following screenshot.

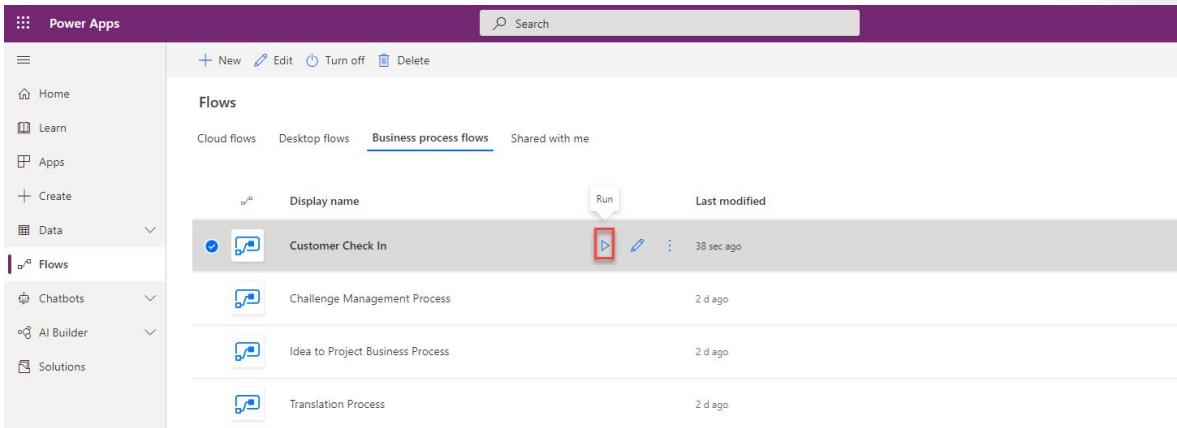
## Exercise - Run the business process flow and view data

Now that you have a new business process flow, you can try it out and discover how the data is stored after it has been run.

1. Select the **Update** button in the top ribbon.
2. Close the business process flow designer after you see the message that the process flow has updated successfully.

3. Go back to **My Flows**. Select **Business process flows**, where you should see the new flow listed.

**Note:** You can see all of the immersive business process flows that are in process or that have been run by going to the main Power Automate page, selecting the **My flows** icon on the left menu, and then selecting the **Business process flows** tab.
4. Select the **Run** arrow, as shown in the following screenshot.
5. Enter a name in the **Name** field on the **General** form (main form) and then select **Save**, as shown in the following figure.
6. After you select the **Save** button, select the red circle for the first stage, fill out the information, and then select the **Next Stage** button.
7. Select the second stage, fill out the vehicle information, and then select the **Finish** button.
8. You can create more records by launching Power Automate, selecting **My Flows** and **Business process flows**, and then selecting the arrow next to the **Customer Check In** business process flow, as shown in the following screenshot.



The screenshot shows the Power Apps interface with the 'Flows' section selected. Under the 'Business process flows' tab, there is a list of flows. The first flow, 'Customer Check In', has a red box drawn around its 'Run' arrow icon. Other flows listed include 'Challenge Management Process', 'Idea to Project Business Process', and 'Translation Process'. The left sidebar shows various categories like Home, Learn, Apps, Create, Data, and Flows, with 'Flows' currently selected.

## View the created data

You can view the data that you created for running the flow by following these steps:

1. Go to Power Apps(<https://make.powerapps.com/>) and sign in.
2. Select the environment that you used to create the **Customer Check In** business process flow.
3. Select the **Data** menu on the left side of the screen and Double-click the down arrow to expand. Select **Tables**
4. Select the **Customer Check In** Table.
5. Select the **Data** tab then click **Select view** on the right side of the screen, and then select the **All Data** view option.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. Which of the following best describes an immersive business process flow?

- They are embedded within a model-driven app.
- They are stand-alone and launched in Power Automate.
- They are launched and run from Microsoft Visio.
- They can be launched within a SharePoint team site.

## Multiple choice

2. Where do immersive business process flows store all data that is collected from the flow?

- Any source that is accessible through a connector
- In SQL Server in the cloud or on-prem
- Dataverse tables
- SharePoint

## Multiple choice

3. Which item is a key benefit of an immersive business process flow?

- Ease of development and deployment
- Ability to store data in multiple sources
- Mobile interface
- The only kind of business process flows that support running within Microsoft Visio

## Multiple choice

4. How do immersive and embedded business process flows mainly differ?

- How they are launched and the context that they are viewed within
- How they are built
- Capability
- Visual Process Maps

## Summary

This module explained the tools that you can use for building your first immersive business process flow. In addition, you learned about the following concepts:

- The definition of an immersive business process flow.
- The differences between an embedded and immersive business process flow.
- How to create a new immersive business process flow in Power Automate.
- How to add fields to an entity by using the business process flow designer.
- How to build and save a two-step business immersive business process flow by using stages and data steps.

- How to run an immersive business process flow.
- How to view the data that you created in the new immersive business process flow.

Though immersive business process flows are the main focus of this module, business process flows can also be created and embedded within a model-driven application. If you want to learn more about embedded business process flows, select the following links for a series of videos that demonstrate the building of an embedded business process flow within a model-driven app. The videos are informative and led by Microsoft Power Automate Product Managers.

**Introduction & Planning a Business Process Flow<sup>3</sup>**

**Building a Model Driven App<sup>4</sup>**

**Build A Business Process Flow and Add to Model Driven Apps<sup>5</sup>**

**Add a Flow to help manage Stages in a Business Process Flow<sup>6</sup>**

**Watching the Business Process Flow in Action<sup>7</sup>**

**3** <https://www.youtube.com/watch?v=7RiXDiPNZic/?azure-portal=true>

**4** <https://www.youtube.com/watch?v=sslyrDVCaw8/?azure-portal=true>

**5** [https://www.youtube.com/watch?v=e4u9fE\\_teNo/?azure-portal=true](https://www.youtube.com/watch?v=e4u9fE_teNo/?azure-portal=true)

**6** [https://www.youtube.com/watch?v=e4u9fE\\_teNo/?azure-portal=true](https://www.youtube.com/watch?v=e4u9fE_teNo/?azure-portal=true)

**7** <https://www.youtube.com/watch?v=X0sjXE33oGM&feature=youtu.be/?azure-portal=true>

# Understand advanced business process flow concepts in Power Automate

## Introduction to logical branching in business process flows

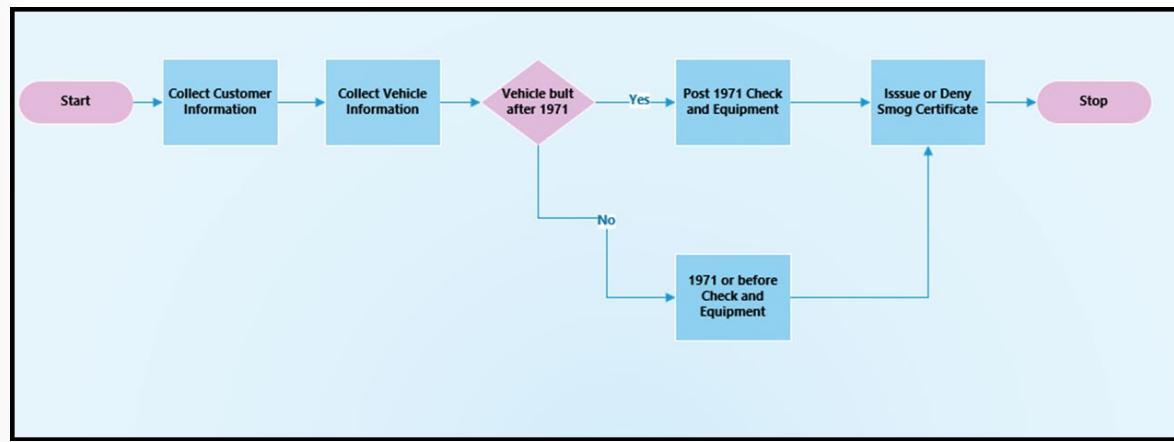
By now you should know how to create a two-step linear business process flow. Some business processes are simple step-by-step sequential workflows, but many processes might need branching logic that requires one set of stages for one condition and another set of stages for an alternative condition. Think of this logic as an *if then else* statement. So if a condition fulfills certain logic, then do one thing, else do another thing.

Logical branching requires a decision point and a test of a value or condition. If a condition matches a certain value, then the flow goes through one branch with one or many stages; if it does not, then the flow goes through another set of one or many stages. Occasionally, the two logical paths will meet at a rendezvous point; other times, they will not. The following sections explore how you can use logical branching with business process flows.

Branching logic is useful when you are trying to model a business process to standardize data collection and improve process outcomes. Logical branching enables the creation of business process flows that can adapt to different conditions within the same flow instead of having to create and launch many different flows to handle one condition or another.

For example, consider the scenario from the previous module, where customers refer to the fictitious company SmogChecksRUs for bi-annual smog checks on their vehicles. In many jurisdictions, different requirements are in place for emission control standards and equipment based on the year of the vehicle manufacture. It would be useful to be able to model all required tests within a single business process flow. You can accomplish this task by using logical branching within a business process flow.

The following diagram models the branching business logic that you need to build into your flow.

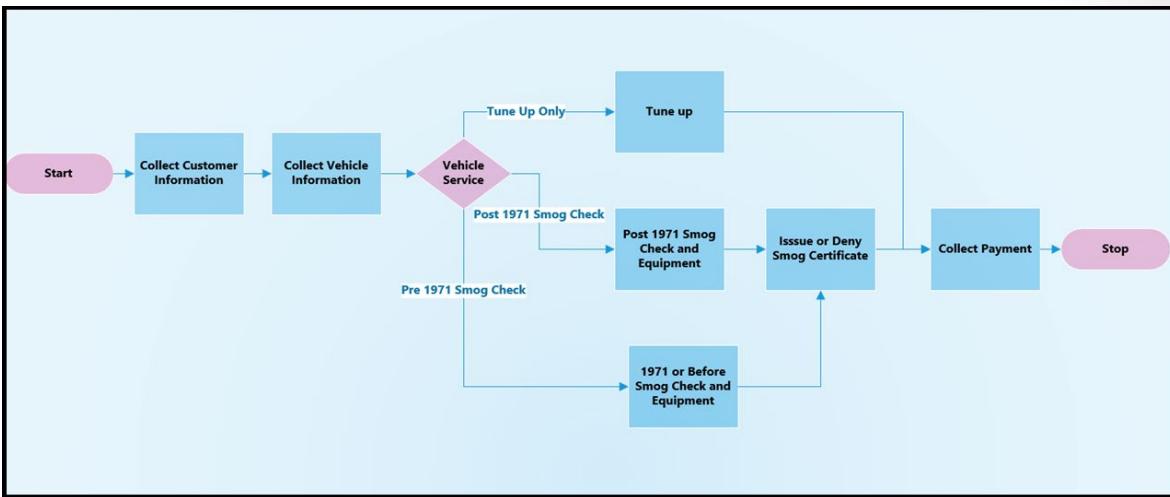


The business process flow logical diagram shows that the smog equipment and the required checks are different for vehicles that are built before or during 1971 and after 1971. As a result, you need to add a logical branch to check the year when the vehicle was manufactured, collect different information, and then perform different checks on vehicles that are built after 1971. The exercises in this module explain how to build a business process flow to manage this scenario.

Unfortunately, business process flows have some limitations on what can be modeled with logical branching. The following sections examine what types of logical branching can't be modeled and built in business process flows today.

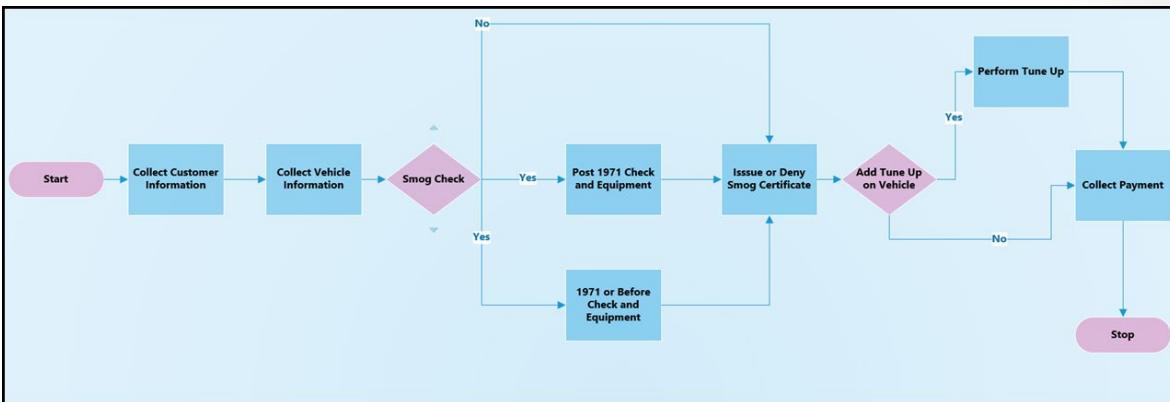
## Unsupported logical branching and a possible work-around

Occasionally, you will want to model a business process that has multiple branches, and not all branches end up at the same rendezvous stage. Currently, this situation is not allowed in a business process flow. An example of an unsupported flow is shown in the following image.



Notice the choices that exist around the Vehicle Service decision point. Two of the branches end up at the **Issue or Deny Smog Certificate** stage and then move into the **Collect Payment** stage, whereas the top branch skips the **Issue or Deny Smog Certificate** stage and then ends at the **Collect Payment** stage. This logical model is not supported. All stages at a decision point must resolve to the same stage, and cannot have intermediate stages for some but not other branches.

The root of the problem in the preceding figure is that the logic is not modeled properly. The decision stage is modeling two *if then else* conditions and not one. A better way to model this logic is to add a second decision point, as shown in the following figure. The approach that is shown in the diagram is supported because the decision stages are each testing one condition and all resolve to a single stage.



Study this example so you understand how to add another logical branch and model business process flows correctly.

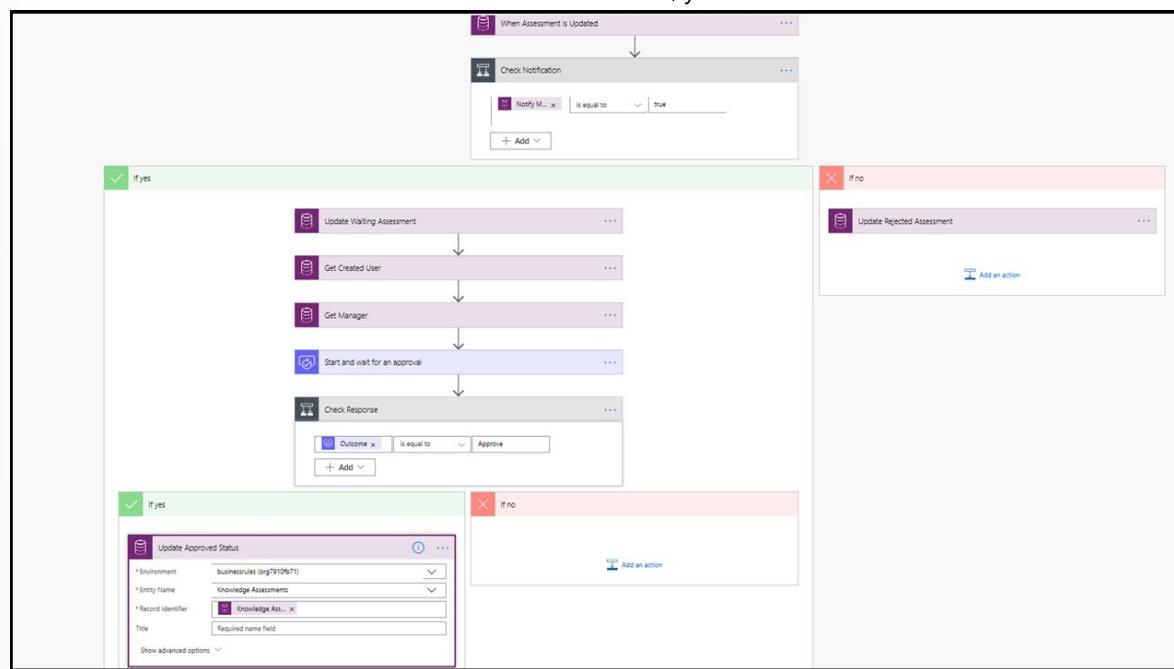
## Instant flows

Business process flows aren't the exclusive workflow automation option that is available to an entity in Microsoft Dataverse. In fact, a single business process flow can run against up to five entities in Common Data Service. Dynamics 365 workflows are also supported as part of a business process flow. This topic is beyond the scope of this learning path, but if you are interested in this topic, you can learn more about Dynamics 365 workflows by selecting the related link in the summary unit of this module.

A third workflow automation, called instant flows, in Power Automate offers a powerful capability that can supplement business process flows.

Microsoft Power Automate offers instant workflows that can run (trigger) automatically based on a schedule, time, data value, or if a record is added, selected, or modified. These workflows can work with a business process flow to gather approvals, copy data from Dataverse to another data source, or trigger an email notification to specific users to alert them that something has changed and needs their attention. You can make instant flows that automatically trigger based on a record that is created, deleted, or modified, or you can make the flows run (trigger) by having a user select a button within a step in a stage.

Instant flows are made with Power Automate and they start with a single trigger followed by a series of actions. Unlike business process flows, which take the user through a series of stages, instant flows may start with or contain user actions, but their primary purpose is to take information from that action and designate steps for cloud services through connectors rather than users. The following figure shows an example of an instant flow that sends an approval request to a user when a record in an entity in Dataverse is modified. In the exercises at the end of this module, you'll create an instant workflow in Power



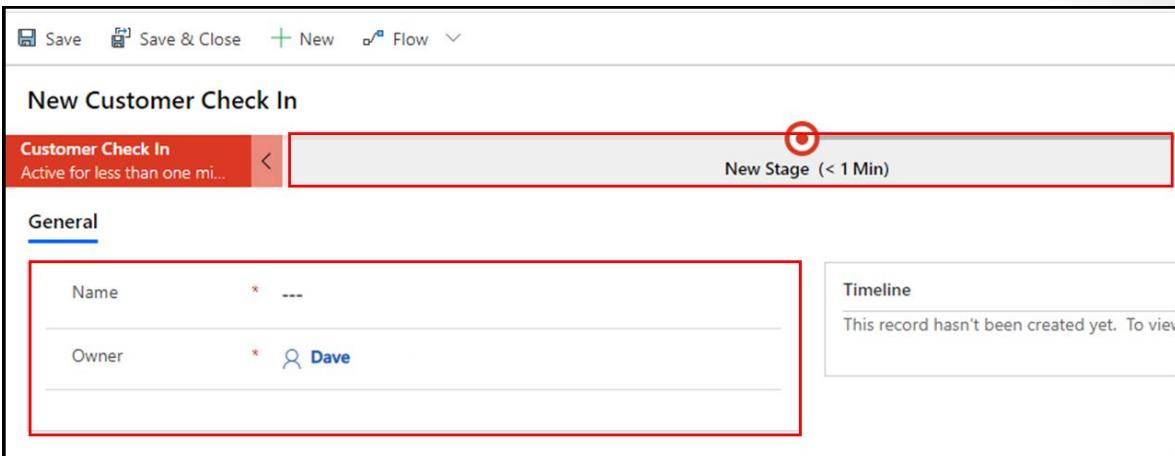
Automate and add it to your business process solution.

Business process flows work within Microsoft Power Platform and many options are available, including instant flows and approval flows that can run in concert with a business process flow to extend your solution.

Business process flows don't exclude the possibility of adding more capabilities to the envisioned solution by using other components of Microsoft Power Platform like Power Apps, Power Automate instant flows, or Power BI Dashboards. You can read more about instant flows by selecting the related links in the summary unit within this module.

## Enhance the form to augment a business process flow

You may have built some basic business process flows, but it is important to understand how to elevate those flows to the next level. Extending your solution with instant flows or approval flows in Power Automate will certainly help to get you there, but creating advanced flows starts with your existing processes. Take the following example from the module Create an immersive business process flow in Power Automate. Review the following screenshot and notice the visual representation of the process flow and a form under the business process flow called **General**, which contains only the **Name** and **Owner** fields.



While a business process flow allows you to add a field to a stage in a process, the users begin by seeing the main form associated with the table from a business process flow. Adding more fields to this form will make for a better user experience and a more beneficial process overall. Instead of having only one or two fields for a stage, consider somewhere between 5 and 10. This isn't a hard and fast rule and your stages are likely to vary greatly, but too few or too many stages indicate an inefficient process or at minimum, one, which fails to flow naturally from one stage to the next as a business process flow should. For this specific example, you may want to record the amount of the invoice, in which case you could record an autogenerated invoice number and then add general notes about the service that you completed for a customer.

Ensuring you have the appropriate number of fields and displaying them on a form that is associated with an immersive business process flow can be a quick way to create more advanced and polished business process flows.

## Exercise – Add branching logic to a business process flow

This exercise builds off the exercises found in Create an immersive business process flow in Power Automate. It is recommended that you complete that module before following the below exercises. However, if you are already familiar with the steps in building out basic business process flows, feel free to take the concepts in the exercise below.

In this exercise, you'll enhance the business process flow by adding a logical branch to determine what test needs to be performed and what information is required to collect in order to complete a smog check on a vehicle based on the vehicle's manufacture year. You will add logic that will provide a different

set of instructions for vehicles that were manufactured prior to or during 1971 versus vehicles that were manufactured after 1971.

1. Sign in to **Power Automate**<sup>8</sup> and make sure that you are in the same environment that you used to create the process flow in the previous module.
2. Select **My flows** and then select **Business process flows**.
3. Select the **Edit** button (pencil icon) and open the **Customer Check In** business process flow in the

The screenshot shows the Microsoft Power Automate interface. On the left, there's a sidebar with options like Home, Action items, My flows (which is selected and highlighted in blue), Create, Templates, Connectors, Data, Monitor, AI Builder, Process advisor, Solutions, and Learn. The main area is titled 'Flows' and has tabs for Cloud flows, Desktop flows, Business process flows (which is selected and underlined in blue), and Shared with me. Below the tabs is a table with columns for Display name, Last modified, and actions (Edit, Delete, More). The table contains four rows: 'Customer Check In' (last modified 21 sec ago), 'Translation Process' (4 mo ago), 'New Process' (4 mo ago), and 'Expired Process' (4 mo ago). The 'Customer Check In' row is highlighted with a red border.

Display name	Last modified	Action
Customer Check In	21 sec ago	
Translation Process	4 mo ago	
New Process	4 mo ago	
Expired Process	4 mo ago	

**Business process flow editor.** Before you create the conditions, you need to set up the data that you want to collect in each stage you will add. Select the **Customer Check In** stage and add the following fields by using the **Click to add field and forms** hyperlink on the right side of the page.

**Note:** The entity window may open in an older UI. Alternatively, you can open Power Apps, select your environment, expand **Data** and select **Tables** to see the modern UI.

<sup>8</sup> <https://preview.flow.microsoft.com/?azure-portal=true>

4. Select the **Add column** button in the ribbon above the fields that are shown for the **Customer Check In**

The screenshot shows the Microsoft Power Apps portal interface. On the left, there's a navigation sidebar with options like Home, Learn, Apps, Create, Data, Tables (which is selected), Choices, and Dataflows. The main area is titled 'Tables > Customer Check In'. Below this, there are tabs for Columns, Relationships, Business rules, Views, Forms, Dashboards, Charts, Keys, and Data. The 'Columns' tab is active. A table lists several columns with their properties: Active Stage (Lookup, Custom, Optional), Active Stage Started ... (Date Only, Custom, Optional), Address (Text, Custom, Optional), Automobile Comments (Multiline Text, Custom, Optional), and Automobile Make (Text, Custom, Optional). At the top of the table area, there's a ribbon with buttons for Add column, Delete table, Data, Azure Synapse Link, Default, and Search.

In entity, as shown in the following figure, and then add the following fields.

- Smog Pump Intact - Yes/No - Set Yes as default
- PVC Valve Intact - Yes/No - Set Yes as default
- Aftermarket Exhaust Headers - Yes/No - Set No as default
- Comments Pre 1972 - Multiline Text
- Exhaust Test Performed with Passing Score - Yes/No - Set Yes as default
- HC Reading at 2000 RPM - Decimal Number
- O2 Reading 2000 RPM - Decimal Number
- CO Reading 2000 RPM - Decimal Number
- Original Equipment - Yes/No - Set Yes as default
- Comments Post 1972 - Multiline Text
- Amount - Currency
- Certificate Number - Whole Number
- Payment Method - Choose **Choice** as the column type and under choice, choose **New choice** and enter the following options:
  - Cash
  - Mastercard
  - Visa
  - Discover
  - Debit Card
  - Bitcoin

After you have created the new fields, select the **Save Table** button and then close the screen and return to the **Business process flow** designer. Refresh the designer to ensure your newly created

The screenshot shows the Microsoft Power Apps Data view. On the left, there's a navigation bar with Home, Learn, Apps, Create, Data, Tables (which is selected), Choices, Dataflows, and Azure Synapse Link. The main area displays the 'Customer Check In' table with the following columns:

Owning Team	... owningteam	Lookup	Standard	✓	Optional
Owning User	... owninguser	Lookup	Standard	✓	Optional
Payment Method	... crda8_paymen...	Choice	Custom	✓	Optional
Phone Number	... crda8_phonen...	Phone	Custom	✓	Optional
Postal Code	... crda8_postalc...	Text	Custom	✓	Optional
Process	... processid	Lookup	Custom	✓	Optional
PVC Valve Intact	... crda8_pvcvalv...	Yes/No	Custom	✓	Optional
Record Created On	... overriddencre...	Date Only	Standard	✓	Optional

At the bottom right, there are 'Discard' and 'Save Table' buttons, with 'Save Table' being highlighted.

columns can be used.

5. Select the **Condition** flow control under the **Components** tab and then drag it to the right of the

The screenshot shows the Business process flow designer. A 'Condition' component is selected and highlighted with a red box. To the right, the 'Properties' pane is open, showing the 'Condition' section with a 'Display Name' of 'New Condition'. Under 'Rules', there is one rule named 'Rule 1' which has the following settings:

Field	Operator	Type	Value
Active Stage	Equals	Value	(Active Stage Equals [null])

At the bottom right of the properties pane are 'Apply' and 'Discard' buttons.

**Customer Check In** stage, as shown in the following image.

6. Select the **Condition** component within the editor and enter the following information:

- **Display Name** - Manufacture Year Pre or Post 1971
- **Field** - Automobile Year
- **Operator** - Is greater than
- **Type** - Value
- **Value** - 1971

The entries should resemble the following screenshot. When finished, select the **Apply** button.

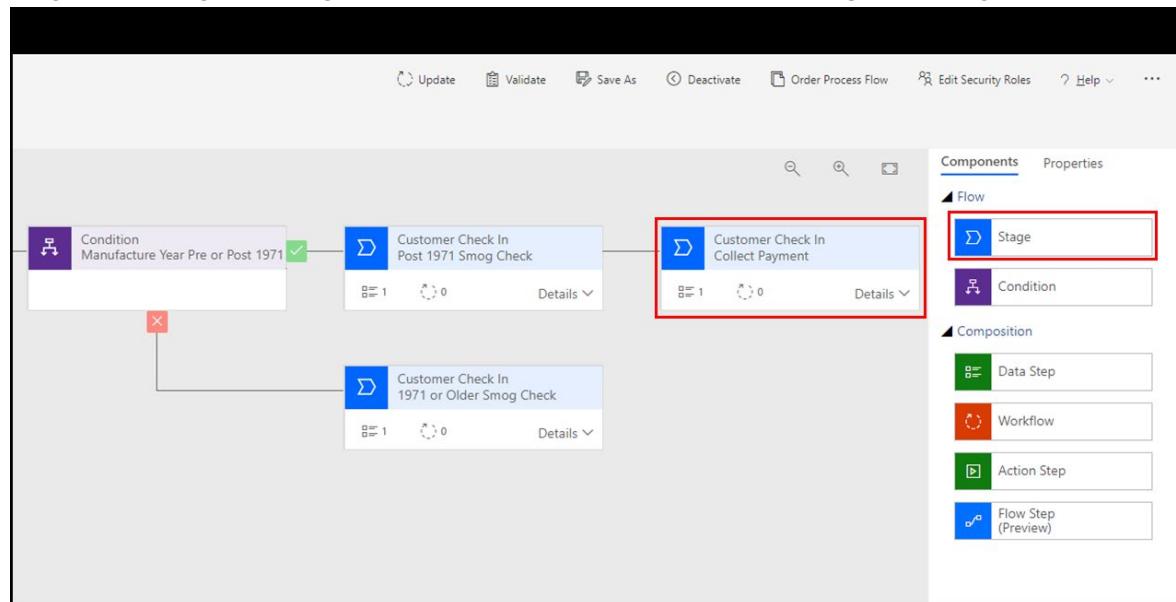
The screenshot shows a software interface for configuring a condition. At the top, there are tabs for 'Components' and 'Properties'. Below them is a 'Condition' section with a 'Display Name' field containing 'Manufacture Year Pre or Post 1971'. A 'Rules' section contains a single rule named 'Rule 1' with the following settings:

Field	Automobile Year
Operator	Is greater than
Type	Value
Value	1,971

Below the rules is a 'Condition Expression (Text View)' field containing '(Automobile Year Is greater than [1971])'. At the bottom of the dialog are three buttons: a blue 'Apply' button, a white 'Discard' button, and a help icon.

7. Select the **Components** tab and then drag a new stage to the plus (+) sign on the right of the page and another to the plus (+) sign under the **Condition** stage, as shown in the following figure. Name each of the new stages by selecting each new stage and entering the new name. Be sure to save the name by clicking apply after each change.

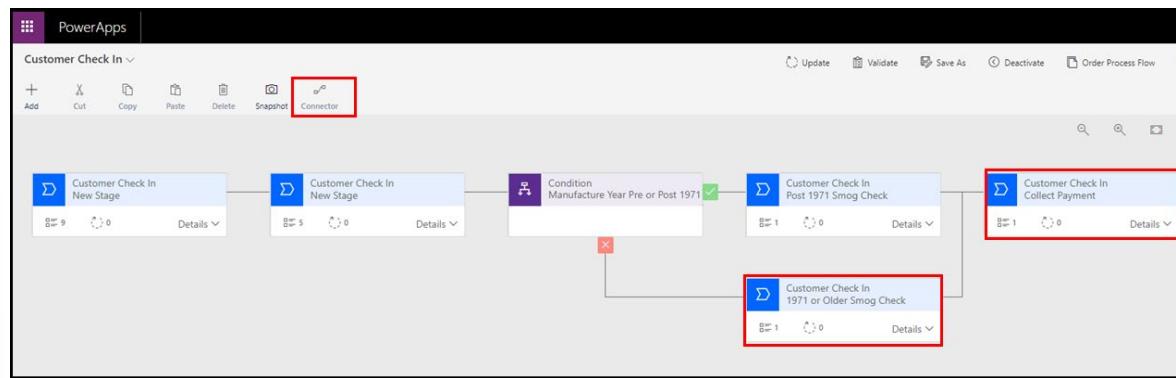
8. Drag another stage to the right of the **Customer Check In Post 1971 Smog Check** stage. Rename



this last stage **Collect Payment**.

9. Connect the **Customer Check In 1971 or Older Smog Check** stage to the **Collect Payment Stage** by following these steps:

1. Select the **Customer Check In 1971 or Older Smog Check** stage.
2. Select **Connector** in the ribbon and then select the **Connect** option.
3. Select the **Customer Check In Collect Payment** stage.



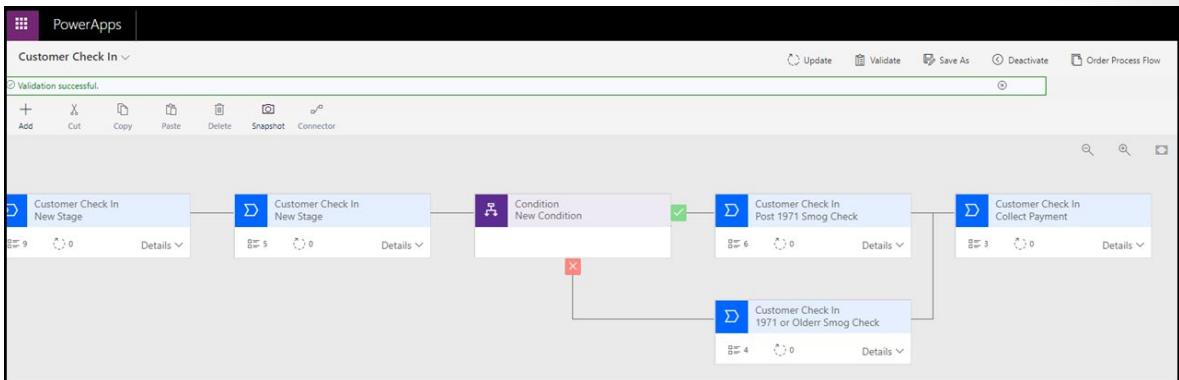
Now, you will add the fields that you created to each stage. Select the following stages and add the fields that are noted by selecting the details link drop-down menu and then adding data steps.

Add a data step for each field within each stage. When you are done, you should have a data step under each of the following stages.

- Stage - Customer Check In Post 1971 - add the following fields under the data step:
  - Smog Pump Intact
  - PVC Valve Intact
  - Aftermarket Exhaust Headers
  - Comments Pre 1972

- Stage - Customer Check In 1971 or Older - add the following fields:
  - Exhaust Test Performed with Passing Score
  - HC Reading at 2000 RPM
  - O2 Reading 2000 RPM
  - CO Reading 2000 RPM
  - Original Equipment
  - Comments Post 1972
- Stage - Customer Check In Collect Payment - add the following fields:
  - Amount
  - Certificate Number
  - Payment Method

When you're done, select the **Update** button in the top ribbon. Your business process flow should look like the following:



Now, you'll test the enhanced business process flow.

1. Navigate to **Power Automate**<sup>9</sup>.
2. Select **My flows** and then **Business process flows**.
3. Run the Customer Check In flow by selecting the **run** button (the play button next to the name of the flow).

You can enter a vehicle with a manufactured date of 1971 or before and another after 1971. Notice that the smog check information in Stage 3 changes based on the year of vehicle manufacture. Additionally, notice that both potential flows reconnect again at the last stage called **Collect Payment**.

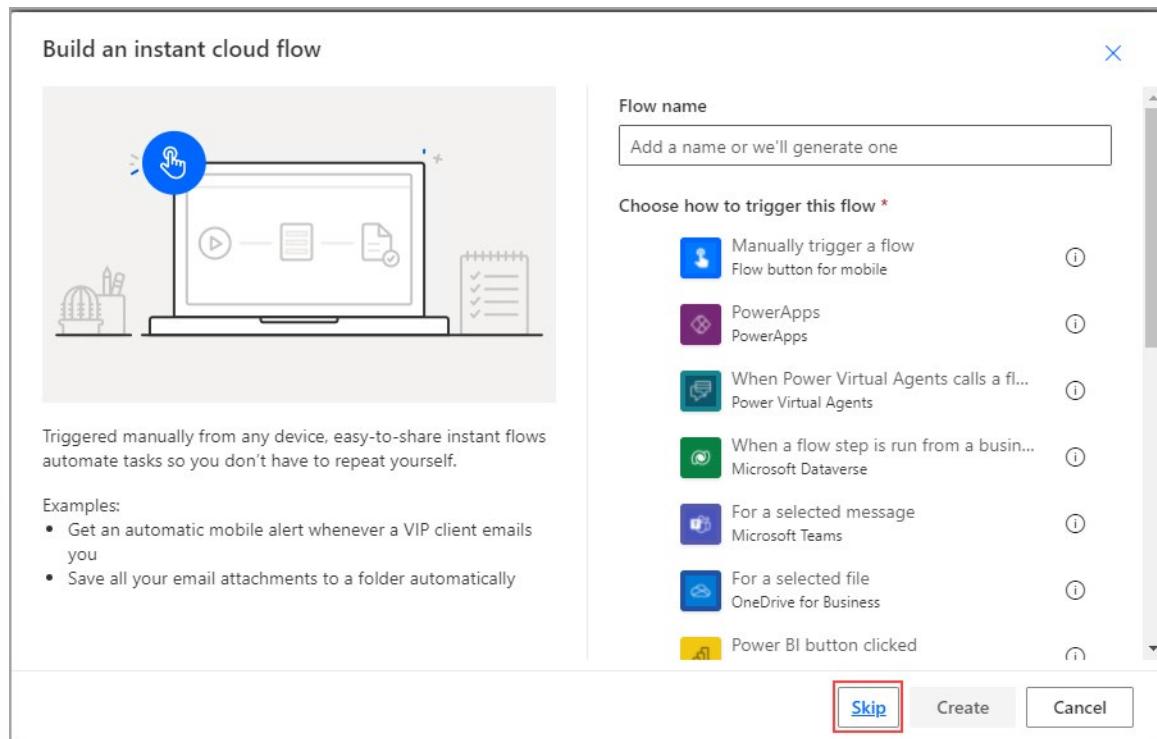
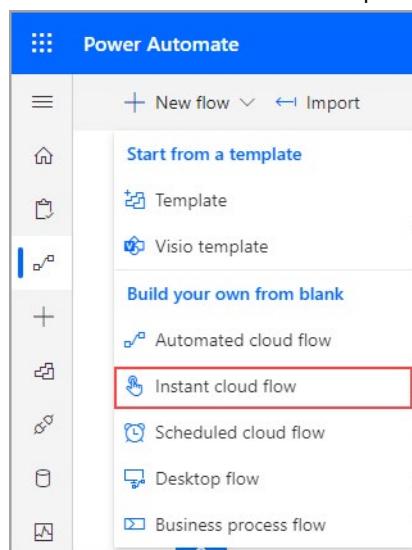
## Exercise – Add an instant flow

In the previous exercise, you created a business process flow that includes logical branching for vehicles that were made in 1971 or before and all others that were made in 1972 and beyond. Now, you will enhance that flow by adding a simple instant flow in Power Automate. Instant flows can connect to hundreds of cloud services, extending your business process flow beyond data entry and basic logic.

<sup>9</sup> <https://preview.flow.microsoft.com/?azure-portal=true>

You'll create an instant flow that sends an email to the store manager (you) when a new customer check-in record is created.

1. Sign in to **Power Automate**<sup>10</sup> and select **My flows**.
2. Select **+ New** in the ribbon in the left corner of the screen.
3. Select the **Instant cloud flow** option.



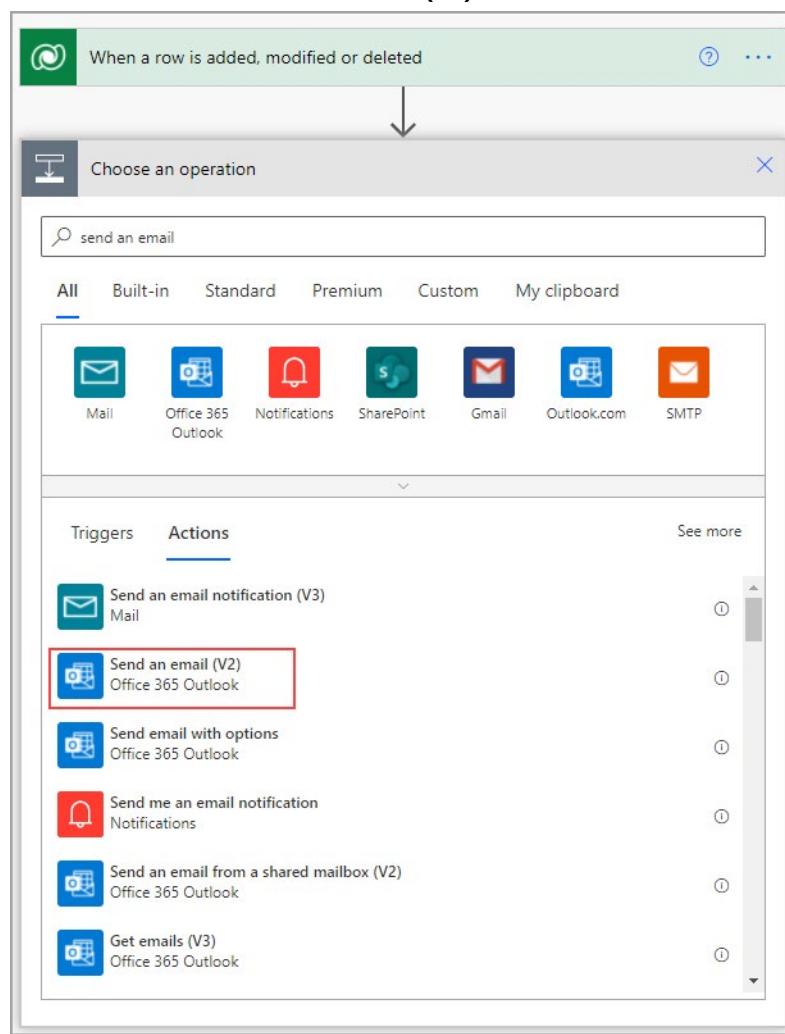
4. Select the **Skip** button to open the cloud flow designer.

<sup>10</sup> <https://preview.flow.microsoft.com/?azure-portal=true>

5. First you need to define a trigger, or an event that will precipitate your flow. Search **Microsoft Dataverse** and select **When a row is added, modified, or deleted**.

6. Choose the change type **Create** and the table used in your business process flow, in this case **Customer Check In**. You must also choose a scope. A scope determines whose actions trigger the flow, whether anyone in the organization, in your business unit, or yourself (user). For now, you can choose **User** since you have yet to test this process. Once complete, select **+ New step**.

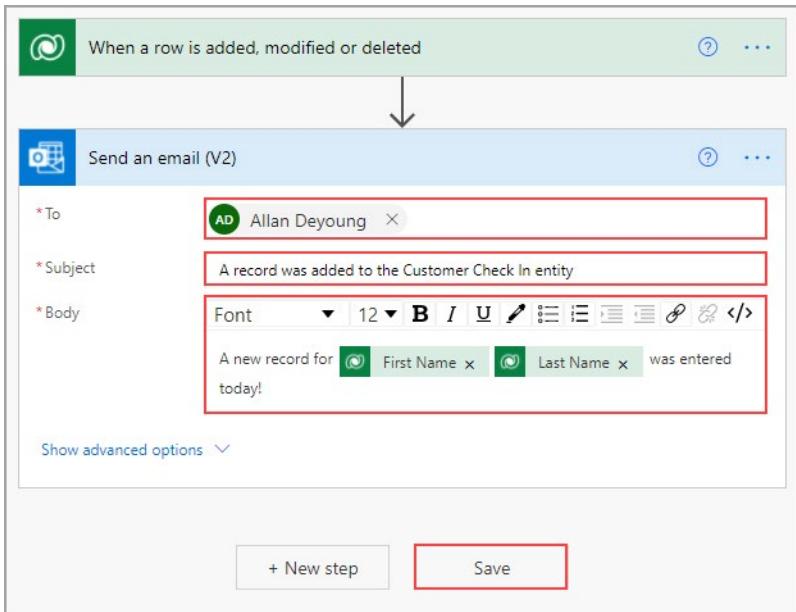
7. Search for and select **Send an email (V2)**.



8. Enter the following information into the **Send an email notification (V3)** action:

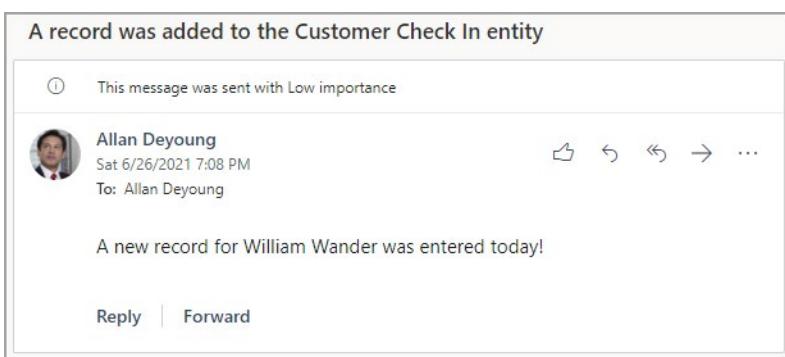
- **To** - Enter your email address to receive an email and test the instant flow.
- **Subject** - Enter **A record was added to the Customer Check In entity**.
- **Email Body** - Enter **A new record for** and select the **First Name** and **Last Name** fields from the list of fields under the Dynamic content option, and then type **was entered today!**

9. Select **Save**.



## Run the instant flow

1. Close the instant flow that you created and then select **My flows** and **Business process flows**.
2. Run the **Customer Check In** business process flow.
3. Enter some values in the first stage fields and then enter a value in the **Name** field on the main screen (the field is on the **General** form under the Business process flow diagram) so that values are in the record before you save it.



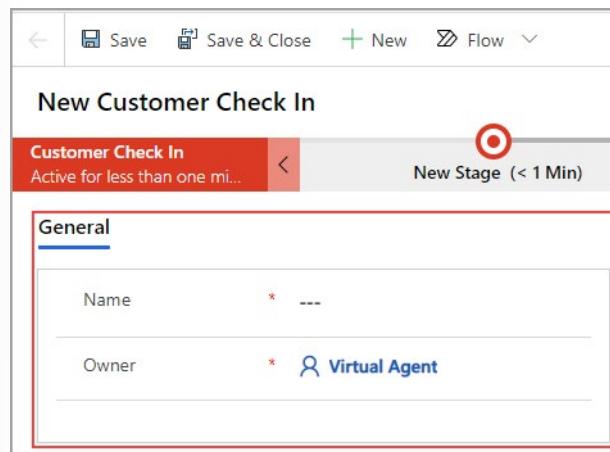
4. Save the record. An email will appear in your inbox similar to the one in the following figure.
- Congratulations, you have now created an instant flow that works with your business process flow.

## Exercise – Enhance the main form that is associated with the business process flow

One last enhancement needs to be made before you can complete your business process flow. Before you begin, quickly review the fields on the main form under the diagram of your business process flow.

The following screenshot shows a new instance of your business process flow. Notice that only two fields are shown on the main screen (outlined in red): **Name** and **Owner**. The name of the record is similar to

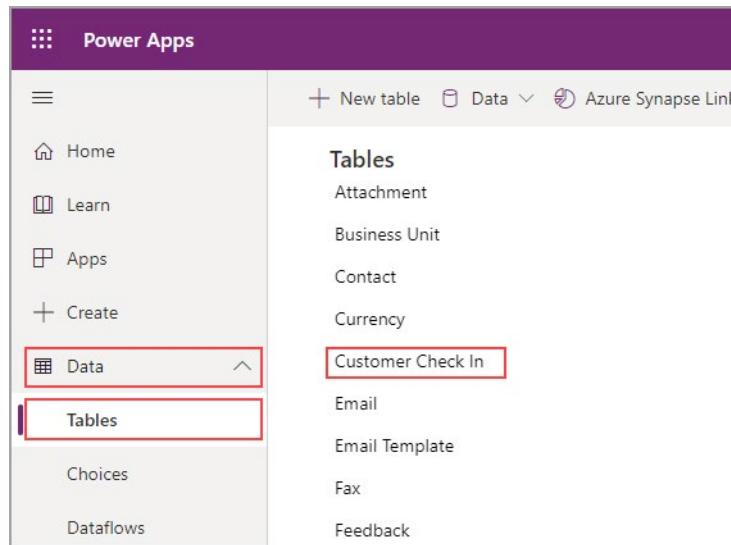
the title of this record, and the owner of the record is the current user who created the instance of the current business process flow. As mentioned previously, you can enhance the user experience by ensuring an appropriate number of fields for every stage. Now, you will add some fields to make this screen more useful.



## Add fields to the main form

Follow these steps to add fields to the main form.

1. Navigate and sign in to Power Apps(<https://make.powerapps.com/>), make sure that you are in the environment that you have been working in, select **Data**, **Tables**, and then select the appropriate table, in this case **Customer Check In**.



The screenshot shows the Microsoft Power Apps portal interface. On the left, there's a navigation sidebar with options like Home, Learn, Apps, Create, Data, and Tables. The 'Tables' option is selected. In the main area, it says 'Tables > Customer Check In'. Below that is a table with columns for 'Display name', 'Name', 'Data type', 'Type', 'Custom...', 'Required', and 'Searchable...'. There are three rows: 'Active Stage' (Lookup, Custom, Optional), 'Active Stage Started On' (Date Only, Custom, Optional), and 'Address' (Text, Custom, Optional). At the top of the table area, there's a red box around the '+ Add column' button.

- Start your enhancements by selecting the **+ Add column** button and then adding the following fields.

- Clerk** - Text
- Transaction Date** - Date Only
- Location** - Choose **Choice** as the column type and under choice, choose **New choice** and enter the following options:
  - Los Angeles
  - San Francisco
  - San Diego
  - Portland
- Invoice Number** - Autonumber - leave the defaults that are provided by Microsoft Dataverse
- Service Comments** - Multiline Text

- After you have added the new fields, save the entity by selecting the **Save Table** button. Don't skip

This screenshot shows the same Power Apps portal interface as the previous one, but with more columns added to the table. The columns now include 'Owning Team' (Lookup, Standard, Optional), 'Owning User' (Lookup, Standard, Optional), 'Payment Method' (Choice, Custom, Optional), 'Phone Number' (Phone, Custom, Optional), 'Postal Code' (Text, Custom, Optional), 'Process' (Lookup, Custom, Optional), 'PVC Valve Intact' (Yes/No, Custom, Optional), and 'Record Created On' (Date Only, Standard, Optional). At the bottom right of the table area, there are two buttons: 'Discard' and a red-highlighted 'Save Table' button.

saving the entity or your new fields will not be saved with the entity.

4. To enhance the main form, select the **Forms** tab on the current screen, as shown in the following

The screenshot shows the Power Apps interface with the 'Customer Check In' table selected. The 'Forms' tab is highlighted with a red box. The table has three columns: Active Stage, Active Stage Started On, and Address.

Display name ↑	Name ↓	Data type ↓	Type ↓	Custom... ↓	Required ↓	Searchable... ↓
Active Stage	activestageid	Lookup	Custom	✓	Optional	✓
Active Stage Started On	activestagestar...	Date Only	Custom	✓	Optional	✓
Address	crda8_address	Text	Custom	✓	Optional	✓

figure.

5. Select the top main form name, which is a hyperlink to the form designer (the name of your form

The screenshot shows the Power Apps interface with the 'Customer Check In' table selected. The 'Information' row is highlighted with a red box. The table has four columns: Name, Form type, Status, and Type.

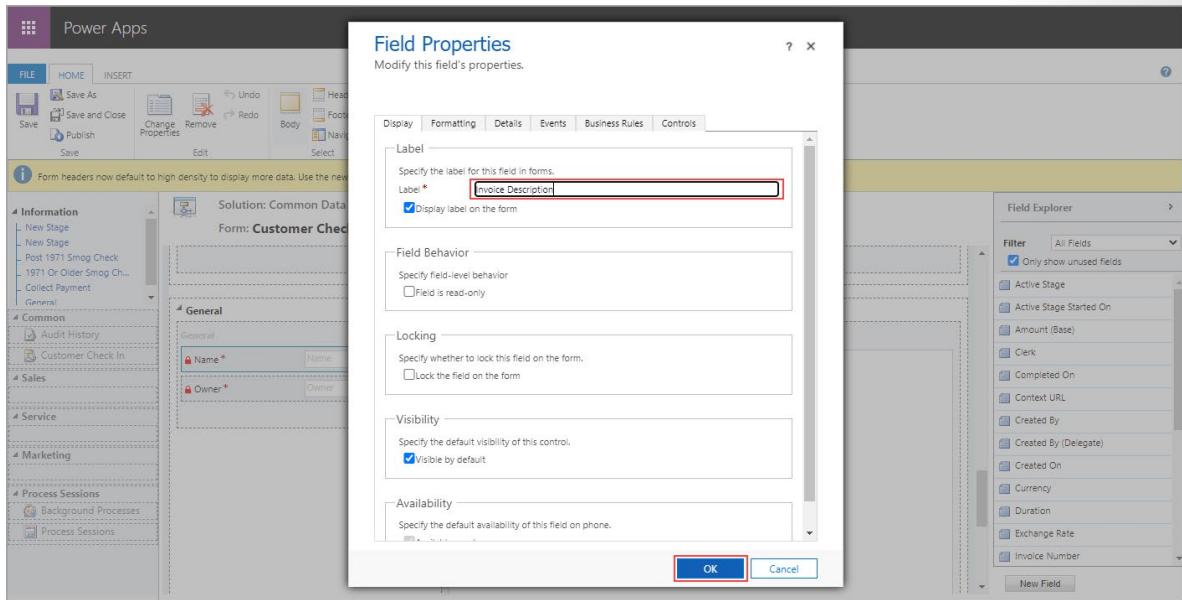
Name ↑	Form type ↓	Status ↓	Type ↓
Information	Main	Active	Custom

might be different). This action will open the model-driven forms designer.

The screenshot shows the Power Apps | Form interface. The 'Tree view' section is displayed, showing a tree structure with 'Information' expanded. A yellow message bar at the top right says 'Authoring preview for this form is not supported yet.' A button labeled 'Switch to classic' is highlighted with a red box.

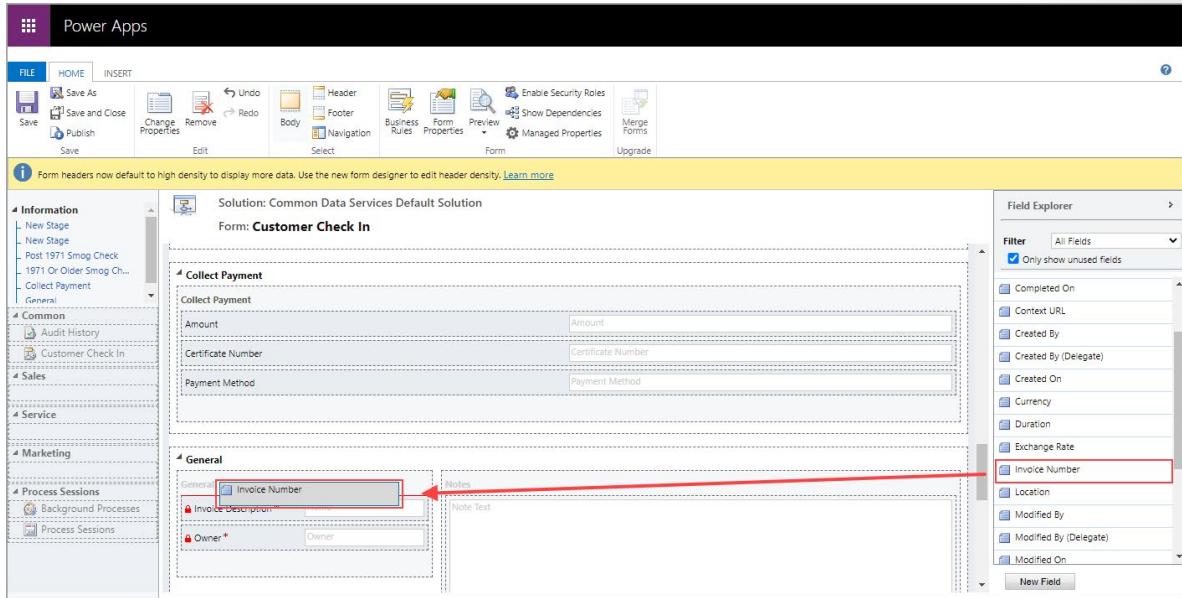
6. Select **Switch to classic** when the new screen opens.

7. Scroll down to the **General** section at the bottom of the form. Double-click the **Name** field, rename



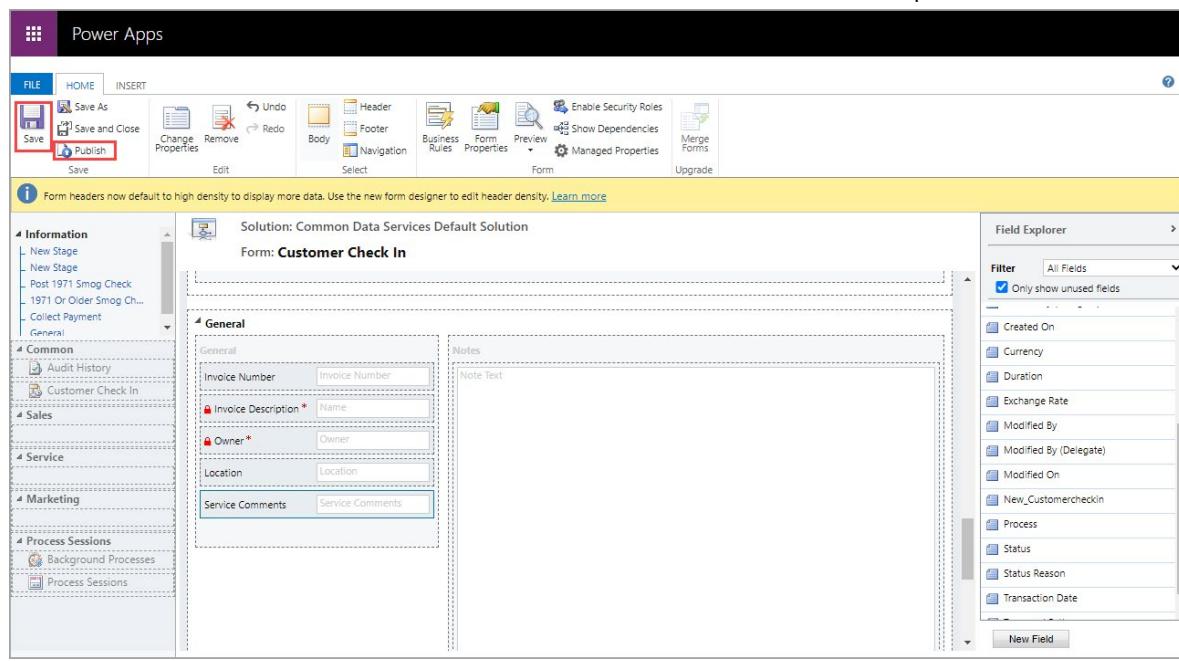
the label to **Invoice Description**, and then select the **OK** button.

8. Drag the new fields that you previously added in this exercise from the list of fields on the right to the



General form area on the left.

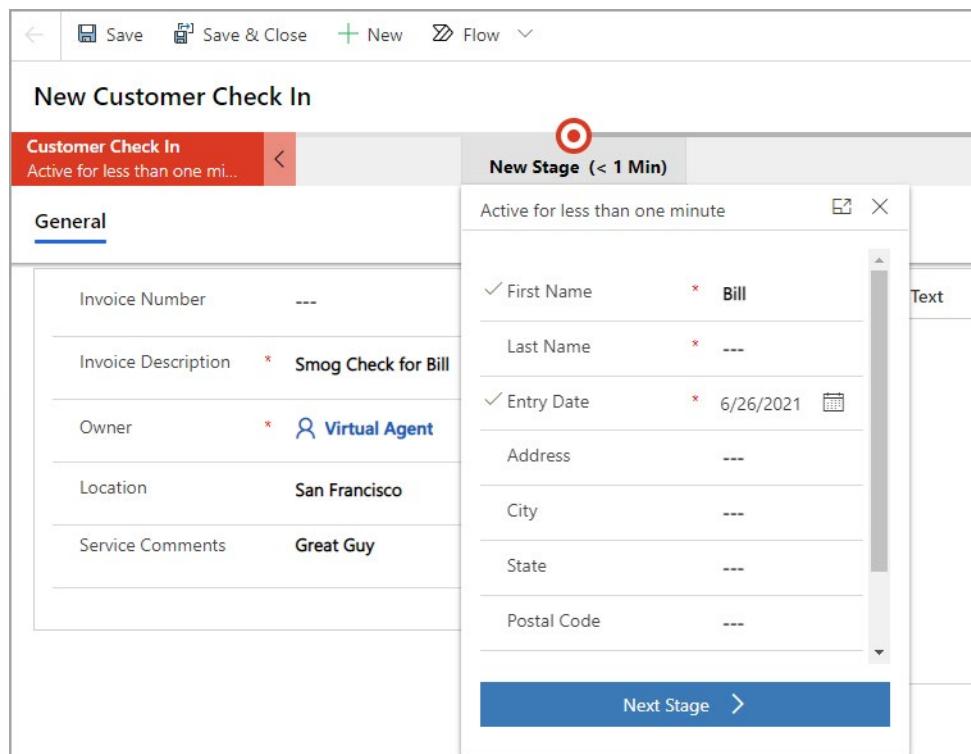
9. Select the **Save** button and then select the **Publish** button in the ribbon at the top of the form



designer.

10. Close the **Designer** tab in the browser.

11. Go back to the home page of Power Automate. Select **My flows** and **Business process flows**. Select the **Customer Check In** flow and run an instance of the flow by selecting the play icon next to the flow name. It should look like the following screenshot. Add data to the main form and the stages and then save the record.



## Add read-only fields to the form

Your next task is to add a few fields to the main form from the data that you entered within a few of the stages. You will make these fields read-only.

1. Navigate and sign in to Power Apps(<https://make.powerapps.com/>), make sure that you are in the environment that you have been working in, select **Data, Tables**, and then select the appropriate table, in this case **Customer Check In**.

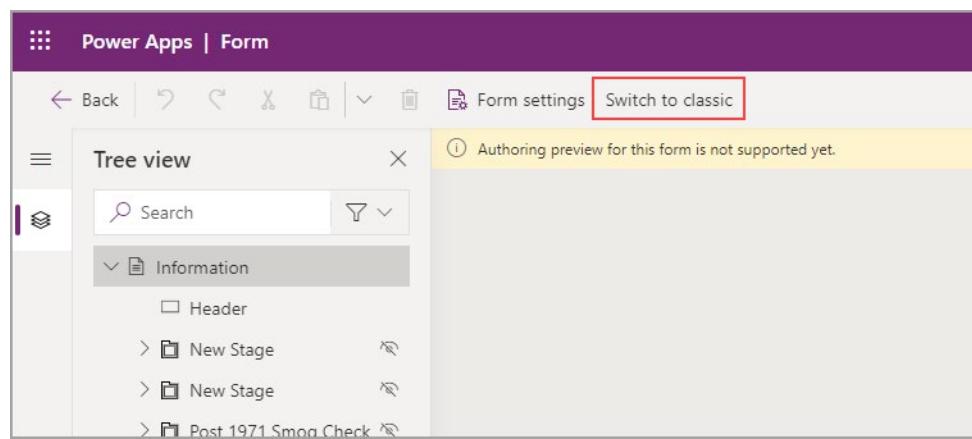
The screenshot shows the 'Data' section of the Power Apps interface. On the left is a navigation sidebar with 'Home', 'Learn', 'Apps', 'Create', 'Data' (which is selected and has a red box around it), and 'Tables' (which is also selected and has a red box around it). The main area lists various tables: Attachment, Business Unit, Contact, Currency, Customer Check In (which is highlighted with a red box), Email, Email Template, Fax, and Feedback.

The screenshot shows the 'Customer Check In' table details page. The top navigation bar includes 'Add column', 'Delete table', 'Data', 'Azure Synapse Link', 'AI Builder', 'Settings', 'Default', and 'Search'. Below the navigation is a breadcrumb path 'Tables > Customer Check In'. The main area shows the 'Forms' tab selected. It displays three columns: 'Active Stage' (Type: Lookup, Custom, Required: Optional), 'Active Stage Started On' (Type: Date Only, Custom, Required: Optional), and 'Address' (Type: Text, Custom, Required: Optional).

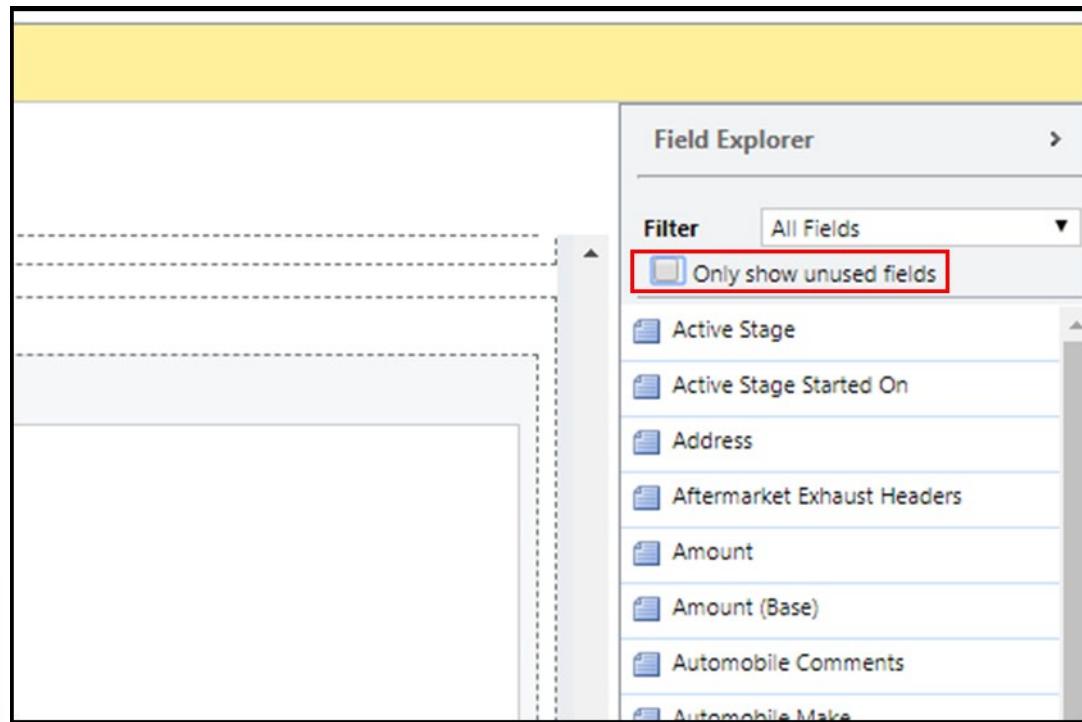
2. Select the **Forms** tab.
3. Select the top main form name, which is a hyperlink to the form designer (the name of your form

The screenshot shows the 'Customer Check In' table details page again. The top navigation bar and breadcrumb path are identical to the previous screenshot. The main area shows the 'Forms' tab selected. It displays a single row for the 'Information' form, which is linked to the 'Main' status and 'Custom' type.

might be different).

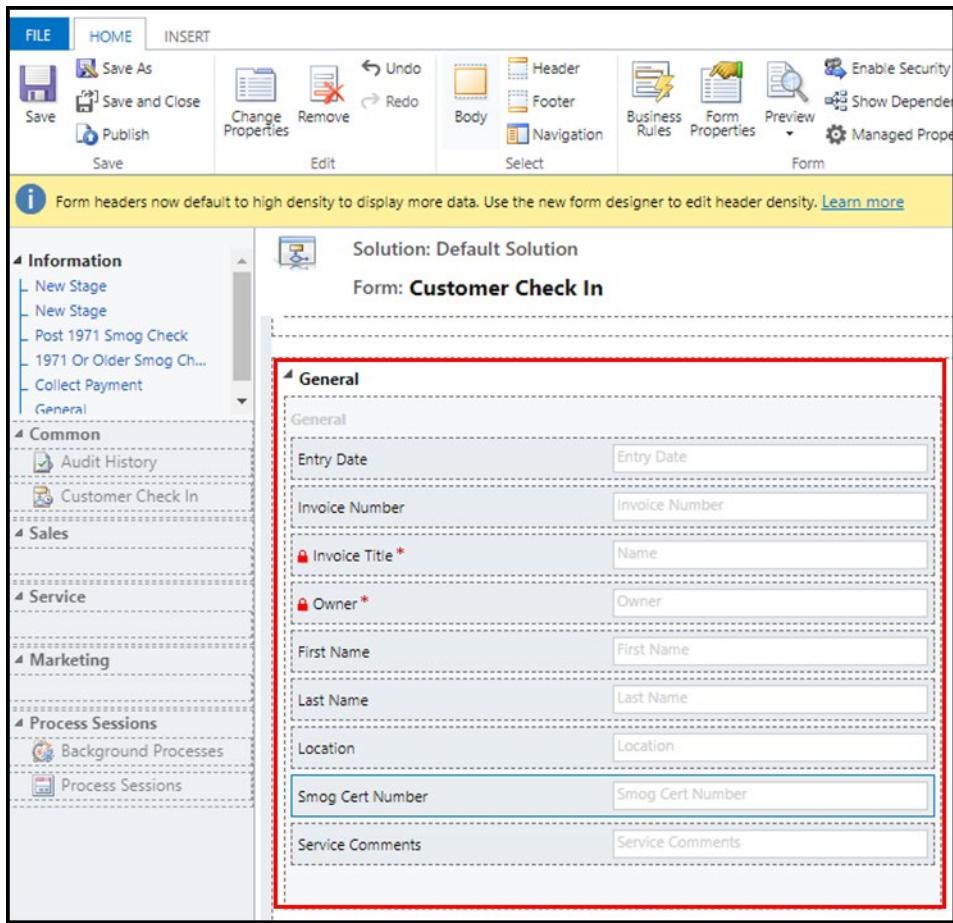


4. Select **Switch to classic** when the new screen opens.
5. Enhance the main form with some of the data that you collect within the stages. Clear the **Only show**

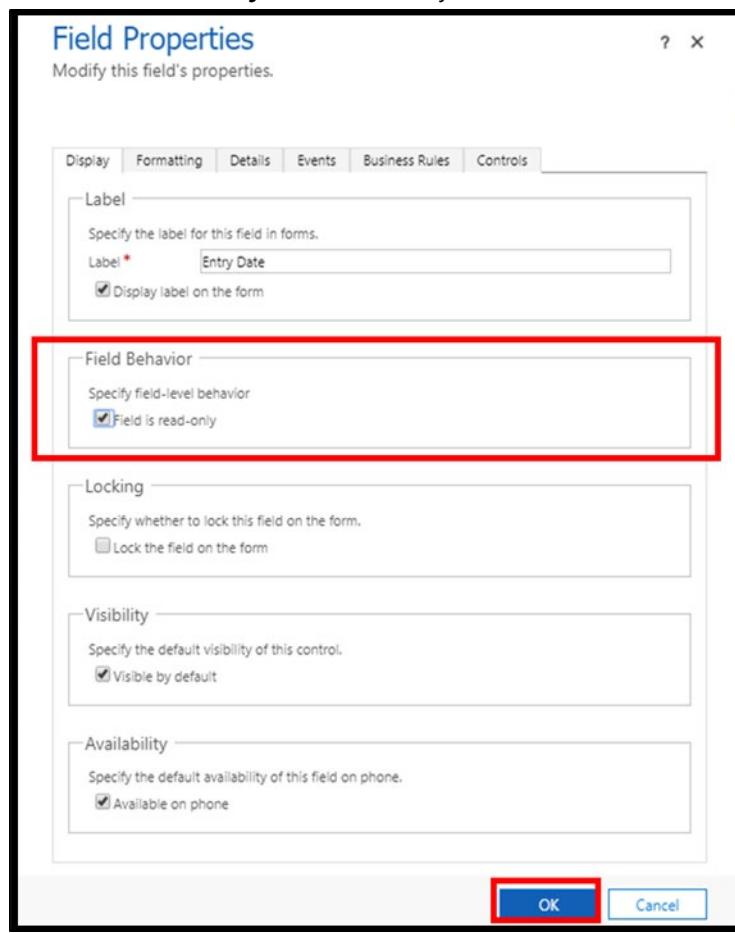


**unused fields** option above the list of fields.

6. You should see all the fields that are available within the **Customer Check In** entity. Drag the following fields from the field panel into the General section of the form, as shown in the following screenshot.
  - Entry Date
  - First Name
  - Last Name
  - Smog Cert Number



7. Double-click the **Entry Date** field that you added and make it read-only, and then select the **OK**

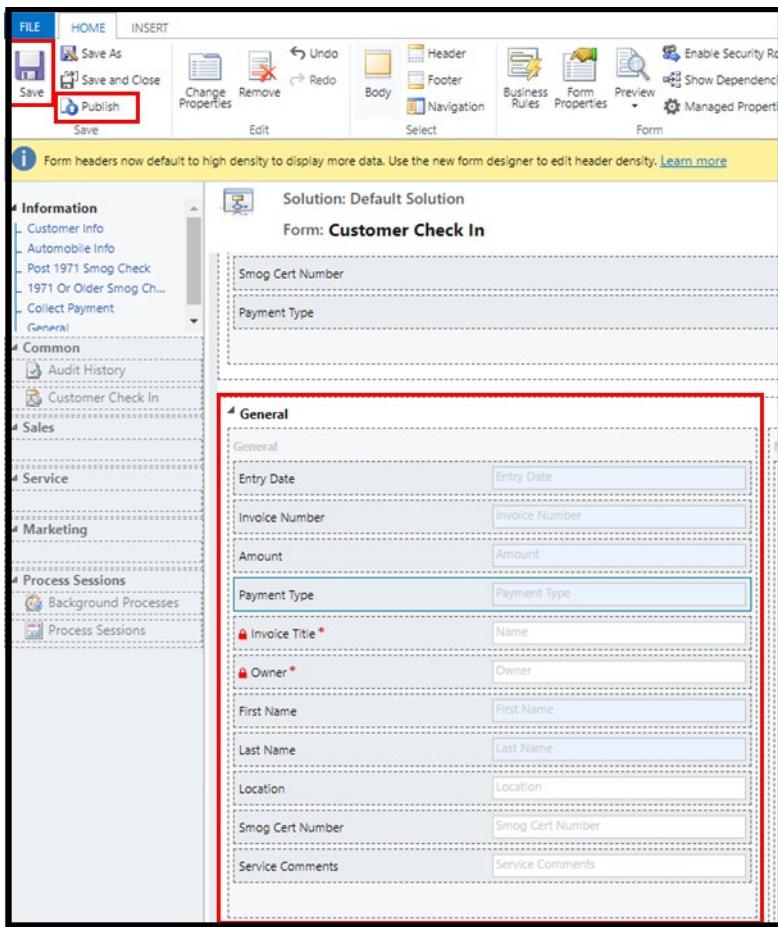


button.

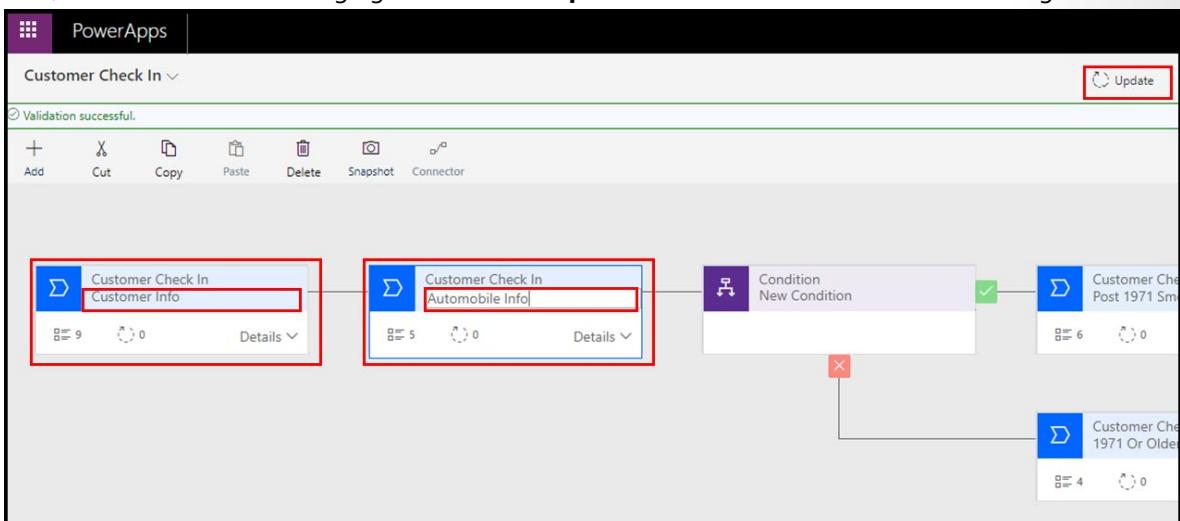
8. Do the same for the following fields to also make them read-only.

- First Name
- Last Name
- Smog Cert Number

9. Select the **Save** button in the ribbon and then select **Publish**.



10. Close the **Form Designer** tab and return to the business process flow designer. Double-click the first stage and rename it to **Customer Info**. Double-click the second stage and rename to **Automobile Info**, as shown in the following figure. Select the **Update** button in the ribbon so all the changes are



saved and ready to use.

11. Close the flow designer screen and refresh your browser. Run the **Customer Check In** flow to check that all the changes that you made are working properly. The business process flow should look like

The screenshot shows the 'Customer Check In' page for 'San Remo Smog Check'. The main section is titled 'Customer Info' and contains fields for Entry Date (1/17/2020), Invoice Number (1001), Invoice Title (San Remo Smog Check), Owner (Dave), First Name (Alan), Last Name (Parsons), Location (Los Angeles), Smog Cert Number (344,990), and Service Comments (---). A red checkmark icon is at the top right of this section. To the right is a sidebar titled 'Automobile Info' with a table:

Completed	
✓ Automobile Make	Chevy
✓ Automobile Model	Nova
✓ Automobile Year	1,969
✓ Automobile Milage	250,000
Barn Find	
Comments	

the following screenshot.

Congratulations, you've created a working business process flow.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which Microsoft product can run business process flows?

- SharePoint
- Excel
- Power Automate
- Microsoft PowerPoint

### Multiple choice

2. What is the main benefit that branching logic delivers to business process flows?

- Multilanguage support in the same business process flow
- Allows "or" logic
- A single business process can be used for many different conditions
- Allows "not" logic

## Multiple choice

3.Which one of the following statements is true?

- Power Automate instant flows cannot be used with the same Microsoft Dataverse entity as a business process flow.
- Dynamics 365 workflows cannot be used with the same Dataverse entity as a business process flow.
- Power Automate instant flows, Dynamics 365 workflows, and business process flows can all be used with the same Dataverse entity(s).
- Power Automate instant flows, Dynamics 365 workflows, and business process flows can only be used with the same Dataverse entity(s).

## Multiple choice

4.Which of the following statements about business process flows is true?

- Business process flows can only be used within a model-driven app.
- Business process flows are available in two formats - immersive and embedded.
- Business process flows do not have a visual component.
- Business process flows do not support conditional branching.

## Summary

You have now learned how to improve the immersive business process flow that you created in an earlier module by using the following advanced techniques:

- Create logical branching within a business process flow
- Use instant flows with an immersive business process flow
- Creating other fields and enhancing the main form to improve the usefulness of a business process flow

Now you can take these concepts to further enhance your business processes to include automation, a logical flow to a process, and useful forms.

If you want to learn more about this topic, feel free to explore the following links:

- Read more about **Business process flow logical branching<sup>11</sup>**.
- Learn more about using **Instant flows<sup>12</sup>**.
- Additional information about **Business process flows<sup>13</sup>**.

<sup>11</sup> <https://docs.microsoft.com/en-us/previous-versions/dynamicscrm-2016/admins-customizers-dynamics-365/mt826751%28v=crm.8%29?redirectedfrom=MSDN%2F%3Fazure-portal%3Dtrue>

<sup>12</sup> <https://docs.microsoft.com/en-us/business-applications-release-notes/april19/microsoft-flow/instant-steps-business-process-flows/>

<sup>13</sup> <https://docs.microsoft.com/en-us/dynamics365/customerengagement/on-premises/customize/business-process-flows-overview/>

# Optimize your business process with process advisor

## Introduction

Efficiency is the goal of all organizations. The goal is to complete a process in a faster and simpler way with the same or better results; however, knowing where to begin when automating a process can be difficult. Even if you know the capabilities of specific technology, such as Microsoft Power Automate, defining a process can be difficult, including knowing which activities are most useful or simplest to automate. The process advisor capability in Power Automate helps make that task easier by providing a service that observes your actions and then documents the process for you. Additionally, process advisor identifies bottlenecks and recommends automation solutions with a specific technology.

Process advisor works through Power Automate to record your actions on your desktop to map your process. Then, it will map your process and provide insights on actions that take too long or have too many variations, and then it will give you automation recommendations. With process advisor, you can share your process with others in your company to gather more insights by capturing recordings of multiple people who are performing the same process. This approach helps you to understand how they differ and where bottlenecks exist.

Process advisor maps your process and begins automation to help simplify your business processes and increase efficiency.

## Get familiar with process advisor

Process advisor is built on the features and capabilities of Microsoft Power Platform to help generate insights. Microsoft Power Automate Desktop allows you to record actions that you perform on your computer, while Microsoft Dataverse stores the information from your processes. As a result, you will need to have access to these technologies, from a licensing and security perspective, to take advantage of process advisor. If process advisor isn't listed when you go to Power Automate, talk to your administrator about your permissions.

You can access process advisor through **Power Automate**<sup>14</sup> by selecting **Process advisor > Create** on

The screenshot shows the Microsoft Power Automate interface. On the left, a navigation pane is visible with various options like Home, Action items, My flows, Create, Templates, Connectors, Data, Monitor, AI Builder, Process advisor, and Create. The 'Process advisor' and 'Create' buttons are highlighted with red boxes. The main area is titled 'Optimize your business processes' and contains a 'Start with a process' modal. This modal explains the purpose of the advisor and has a 'Next' button. Below the modal, there are sections for 'Create a new process' and 'Add to a process'. The 'Add to a process' section includes a 'Add a new recording' option. To the right, there's a 'Learning more about processes' section with several video thumbnails, each with a title, duration, and a 'Video' icon.

the left navigation pane.

On the **Optimize your business processes** screen, you can create a new process or add recordings to an existing process. Additionally, you can select a link to download Power Automate Desktop and view short instructional videos that describe various tasks in process advisor. Recordings are conducted through Power Automate Desktop, so make sure that you have downloaded this program.

Select **Processes** to view the details of existing processes that you own or co-own. If you don't have any processes, you can begin a new one.

Selecting a process will allow you to see the details that are involved, including the various recordings, who created them, at what time, and their status.

<sup>14</sup> <https://flow.microsoft.com/?azure-portal=true>

The screenshot shows the 'Contoso Invoice Processing' process details page. At the top, there are navigation links: '+ New recording', 'Analytics', 'Share', 'Analyze', 'Create activity names', and 'Delete process'. Below the header, the process name 'Contoso Invoice Processing' is displayed. The 'Details' section contains information such as Description (Submit a new invoice using Contoso Invoice App), Modified by (Virtual Agent), Owner (Virtual Agent), Modified (5/13/2021, 2:05 PM), Created (5/13/2021, 2:05 PM), Analyzed (12/14/2020, 8:45 AM), Status (Analyzed), and Analyzed recordings (7). The 'Shared with' section shows 'Co-owners' (Virtual Agent and another user) and 'Contributors' (Virtual Agent). The 'Recordings' section lists recordings made by Virtual Agent on various dates and times, all marked as 'Analyzed'. A 'See all' link is at the bottom of the recordings table.

The possible statuses for recordings are as follows:

- **In progress** - Recording is in progress, but it is also possible that the recording has not yet started. Because recording happens in the desktop client, the web portal will not know about its status until it has been saved. You can also view this status after the recording has been saved because some processing is required after recording to make it ready to view.
- **Failed** - An error occurred during recording processing. Create a new recording.
- **Not analyzed** - The recording has been processed and is available to view and edit, but it has not been marked as ready to analyze.
- **Ready to analyze** - The recording has been marked as ready to analyze and will be considered the next time you analyze the process.
- **Analyzed** - The recording has been analyzed and is part of the analyzed output that can be viewed through the **Analytics** screen.

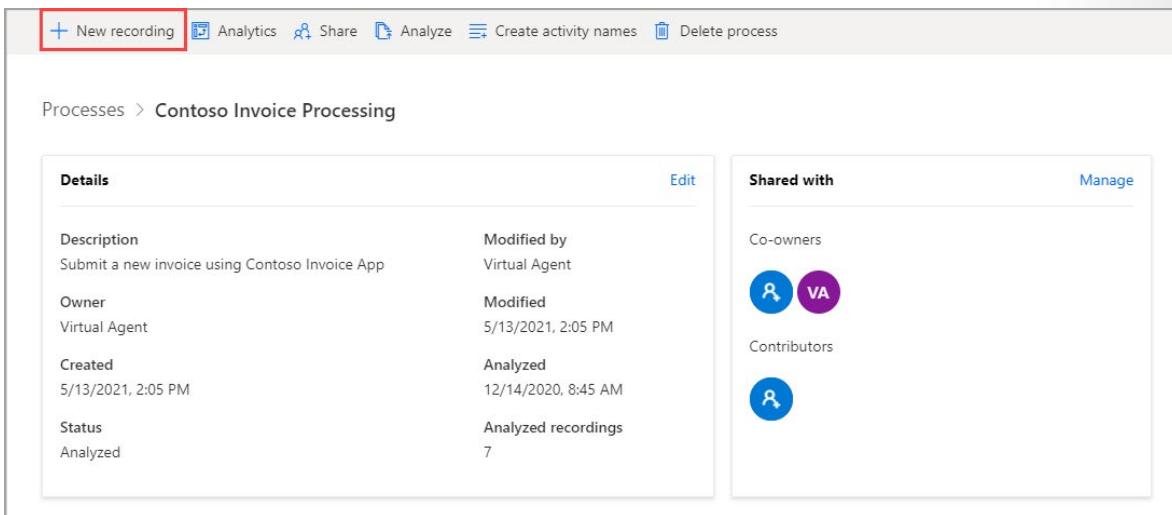
In addition to the recording information, you can view and manage the users who have access to your process.

**Note:** Contributors have access to add recordings and manage recordings that they created, while co-owners have access to create recordings and manage the recordings of others, including their own.

Analytics and recommendations will be discussed later in the module; however, the next task is to learn how to add a recording.

## Create your first recording

To begin recording, you first need to have a process. If you have already created a process, select that process and then select **New recording** in the upper-left corner of the page.



The screenshot shows the 'Contoso Invoice Processing' process details page. At the top, there's a navigation bar with icons for 'Analytics', 'Share', 'Analyze', 'Create activity names', and 'Delete process'. The 'New recording' button is highlighted with a red box. Below the navigation bar, the page title is 'Processes > Contoso Invoice Processing'. The main content area is divided into two sections: 'Details' and 'Shared with'. The 'Details' section contains information such as Description (Submit a new invoice using Contoso Invoice App), Owner (Virtual Agent), Created (5/13/2021, 2:05 PM), and Status (Analyzed). The 'Shared with' section shows 'Co-owners' (Virtual Agent and another user represented by a blue icon) and 'Contributors' (one user represented by a blue icon).

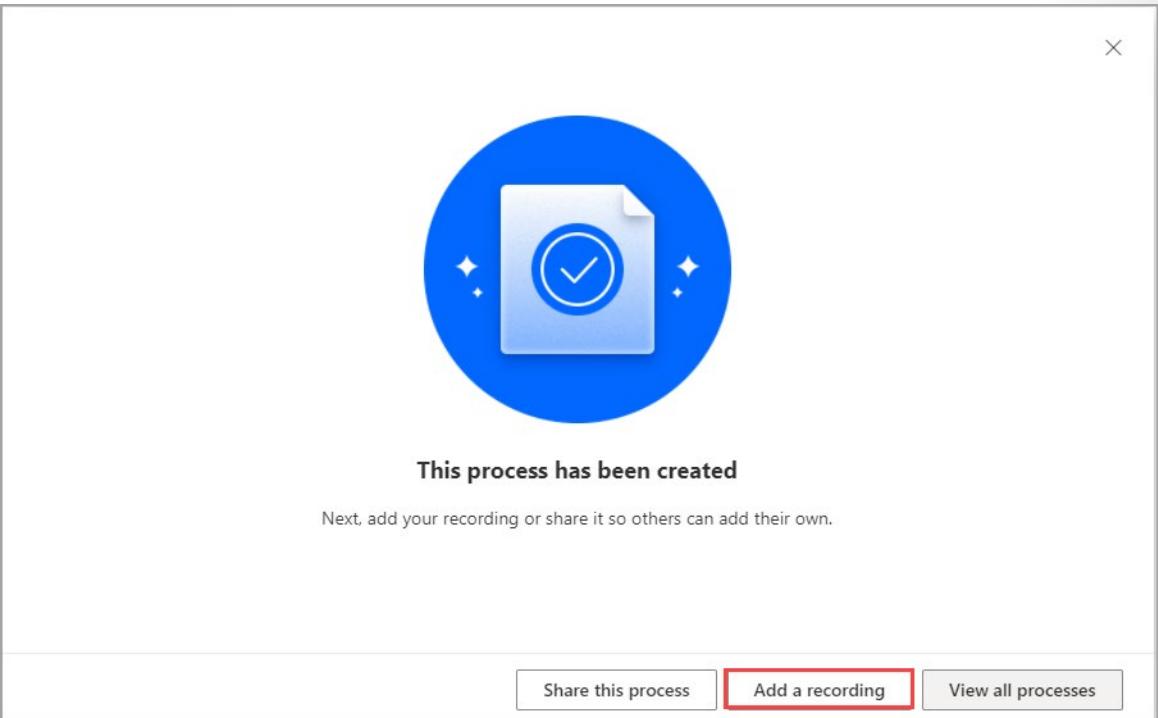
If you don't have a process yet, select **Process advisor** > **Create** > **Create a new process**.

The screenshot shows the Microsoft Power Automate Home page. On the left, there's a navigation sidebar with options like Home, Action items, My flows, Create, Templates, Connectors, Data, Monitor, AI Builder, Process advisor (which is highlighted with a red box), Create, Processes, Solutions, and Learn. The main content area has a heading 'Optimize your business processes' and a sub-section 'Build a process'. It features a 'Start with a process' card with the text 'We'll help you find opportunities to improve your business operations. First, set up a process and share it with your team.' Below this is a 'Create a new process' card with the text 'Set up a process, then share it so others can add their recordings.' A 'Next' button is visible. Under 'Add to a process', there's a 'Add a new recording' card with the text 'Record actions to add to an existing process.' To the right, there's a section titled 'Learning more about processes' with several video thumbnails.

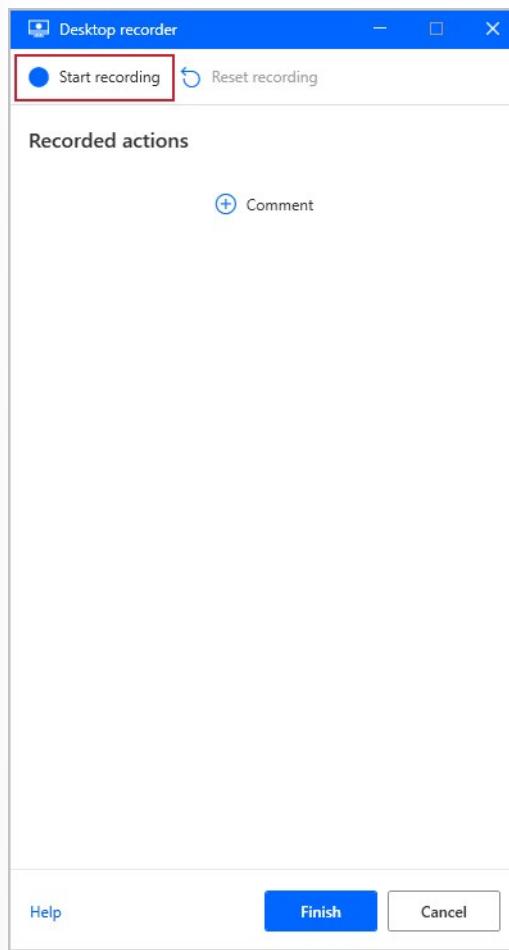
Name your process and then provide a description to help you and your users understand the process that is being analyzed. Select **Create**.

This screenshot shows the 'Create a new process' dialog box. On the left is a large circular icon containing a clipboard with a checkmark and a plus sign, surrounded by stars. Below it is a descriptive text: 'Set up a process, then share it so others can add their recordings. A recording collects the actions a person takes to complete a process.' On the right, there are input fields: 'Process name \*' with the value 'Invoicing Process' (which is highlighted with a red box), and a 'Description' field with the value 'Accounting logging and processing of invoices'. At the bottom right are two buttons: a blue 'Create' button (which is highlighted with a red box) and a white 'Cancel' button.

Next, select **Add a recording**, which will open Power Automate Desktop. Make sure that you install Power Automate Desktop now if you haven't already.



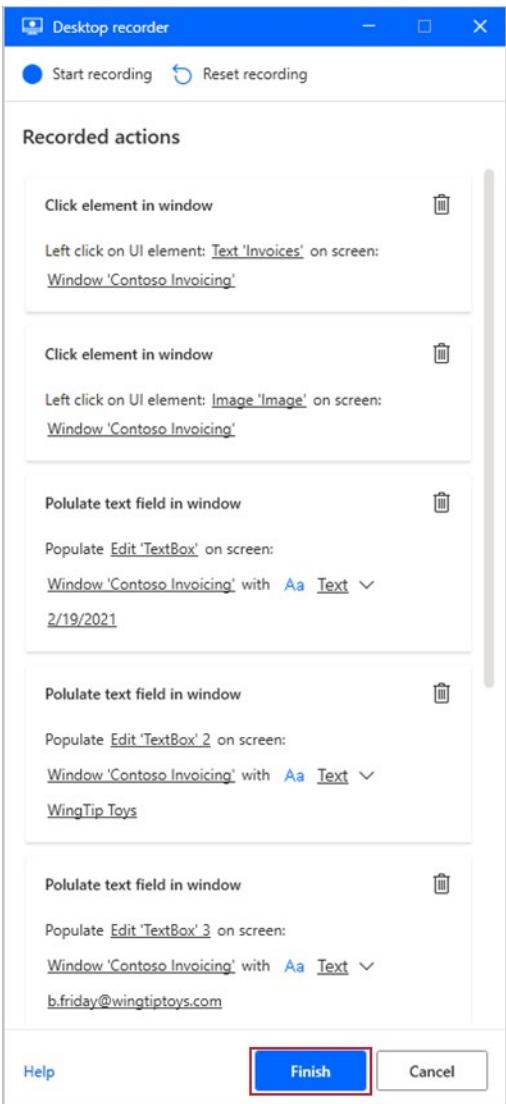
The **Desktop recorder** window of Power Automate Desktop will open. Before you start recording, you need to complete some cleanup items. The process will go more smoothly if you exit out of unnecessary applications while you are recording. If you have other browsers or programs that are running, you should close them now. It will be difficult to read the instructions and perform the actions that are required for the recording simultaneously. Consequently, you might want to read through this unit completely before performing the subsequent steps. After completing the cleanup items, you will be ready to begin recording. To begin, select the **Start recording** button in Power Automate Desktop.



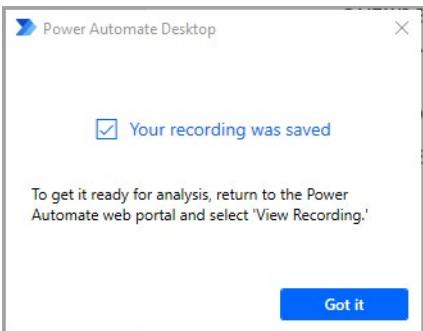
Now, perform your process as usual. You will see actions appear on the recording pane as you move along in the process. Be sure to only use mouse clicks and not keyboard shortcuts to go to the next field. You can pause the recording or delete actions if you make a mistake.

**Tip:** As you record, make sure that you go slowly and wait several seconds between actions. A red outline will appear on a control before selecting and a blue highlight will appear after. If these outlines and highlights do not appear, your actions might not be recorded properly.

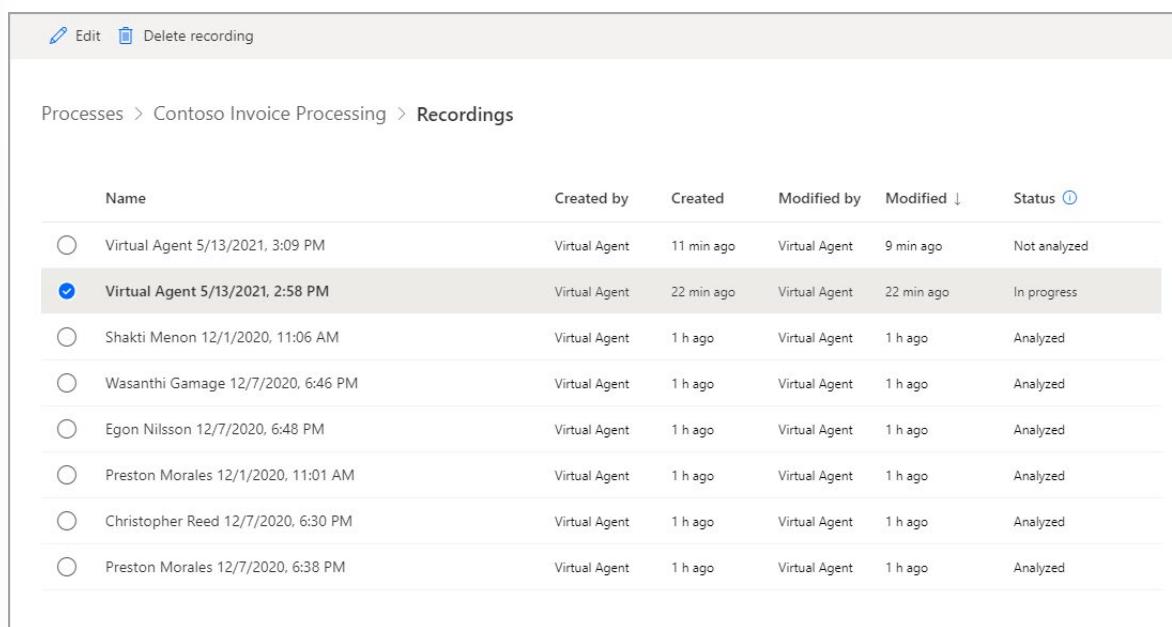
After you have finished your actions, return to the recording window and select **Finish**. Your recorded actions should look similar to the following image.



After you select **Finish**, your recording will upload and the following dialog box will appear.



You can view and manage your new recording by going to your process (select **Process advisor > Processes** and then select the name of your process). Under **Recordings**, select **See all**. On the following page, you can view any recordings in your process, and you can select a recording and see more options.



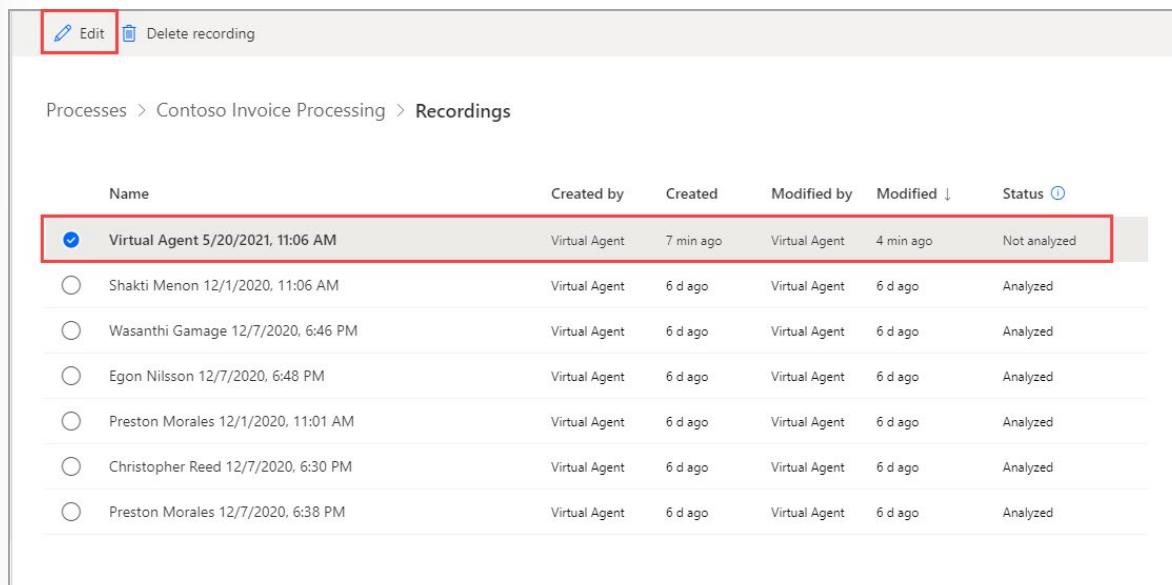
	Name	Created by	Created	Modified by	Modified ↓	Status ⓘ
<input type="radio"/>	Virtual Agent 5/13/2021, 3:09 PM	Virtual Agent	11 min ago	Virtual Agent	9 min ago	Not analyzed
<input checked="" type="radio"/>	Virtual Agent 5/13/2021, 2:58 PM	Virtual Agent	22 min ago	Virtual Agent	22 min ago	In progress
<input type="radio"/>	Shakti Menon 12/1/2020, 11:06 AM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed
<input type="radio"/>	Wasanthi Gamage 12/7/2020, 6:46 PM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed
<input type="radio"/>	Egon Nilsson 12/7/2020, 6:48 PM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed
<input type="radio"/>	Preston Morales 12/1/2020, 11:01 AM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed
<input type="radio"/>	Christopher Reed 12/7/2020, 6:30 PM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed
<input type="radio"/>	Preston Morales 12/7/2020, 6:38 PM	Virtual Agent	1 h ago	Virtual Agent	1 h ago	Analyzed

Now that you have learned how to begin a new process and add recordings, you can learn how to edit those recordings.

## Edit recordings and group actions

When you are in a process and can see the list of recordings, select **Edit** for a recording so that you can explore other options. On the **Edit** page, you can alter or delete actions and then group actions together to make an activity. Activities are groups of actions that will be the basis of the process map and the analysis. Activities will also allow Power Automate to understand variations in the process between users and recordings.

Recordings have several available statuses. When a recording is being uploaded, it will have a status of **In progress**. When it's ready for grouping and editing, it will have a status of **Not analyzed**. Choose a recording with this status to prepare it for analysis by grouping and editing actions.



	Name	Created by	Created	Modified by	Modified ↓	Status ⓘ
<input checked="" type="radio"/>	Virtual Agent 5/20/2021, 11:06 AM	Virtual Agent	7 min ago	Virtual Agent	4 min ago	Not analyzed
<input type="radio"/>	Shakti Menon 12/1/2020, 11:06 AM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed
<input type="radio"/>	Wasanthi Gamage 12/7/2020, 6:46 PM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed
<input type="radio"/>	Egon Nilsson 12/7/2020, 6:48 PM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed
<input type="radio"/>	Preston Morales 12/1/2020, 11:01 AM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed
<input type="radio"/>	Christopher Reed 12/7/2020, 6:30 PM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed
<input type="radio"/>	Preston Morales 12/7/2020, 6:38 PM	Virtual Agent	6 d ago	Virtual Agent	6 d ago	Analyzed

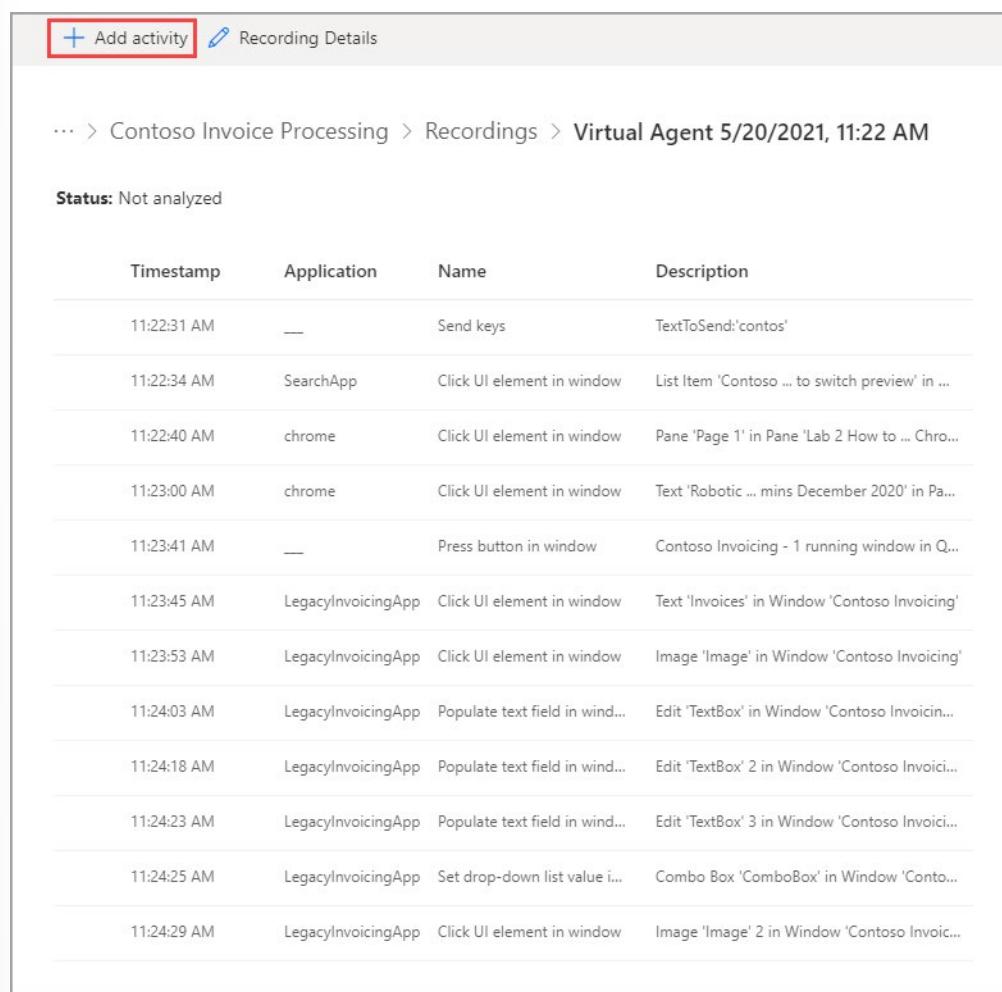
**Note:** You can edit recordings that have already been analyzed, but you need to prepare every recording for analysis by grouping actions and changing the status to **Ready to analyze**.

By selecting individual actions, you can edit the action text or description to eliminate private data or personal information and then delete the screenshot. Screenshots help users or owners of the process understand what is taking place in the action, but deleting the screenshot will not affect the analysis in any way. Editing personal information and deleting screenshots can be important for keeping anonymous data anonymous because it's shared with any owners of the process. You can also delete sensitive steps or modify data input while recording, and you can pause the recording, perform actions regarding sensitive data, and then resume recording.

The screenshot shows the 'Recordings' section of the Power Automate interface. On the left, a list of recorded actions is displayed in a table format. The columns are 'Timestamp', 'Application', 'Name', and 'Description'. One specific action is highlighted with a blue selection bar and a checkmark icon. The right side of the screen shows a detailed view of this selected action. It includes fields for 'Name' (containing 'Populate text field in window') and 'Description' (containing 'Edit 'TextBox' 2 in Window 'Contoso Invoicing'; Text:b.friday@wingtiptoys.com'). Below these, there is a 'Screenshot' section which displays a UI element labeled 'WingTip Toys'. At the bottom of the screenshot view, there is a red-bordered button labeled 'Delete screenshot'.

To prepare a recording for analysis, you must first group the individual actions into activities. These activities will allow recordings by different users to be analyzed together and will help Power Automate understand which actions go together to estimate average times and other analytics.

The first step in the grouping process is to select the **Add activity** button.



The screenshot shows a user interface for managing recording details. At the top, there are two buttons: '+ Add activity' (highlighted with a red box) and 'Recording Details'. Below this, the navigation path is shown: '... > Contoso Invoice Processing > Recordings > Virtual Agent 5/20/2021, 11:22 AM'. The status is listed as 'Status: Not analyzed'. A table below displays a list of recorded activities, each with a timestamp, application, name, and description.

Timestamp	Application	Name	Description
11:22:31 AM	—	Send keys	TextToSend:'contos'
11:22:34 AM	SearchApp	Click UI element in window	List Item 'Contoso ... to switch preview' in ...
11:22:40 AM	chrome	Click UI element in window	Pane 'Page 1' in Pane 'Lab 2 How to ... Chro...
11:23:00 AM	chrome	Click UI element in window	Text 'Robotic ... mins December 2020' in Pa...
11:23:41 AM	—	Press button in window	Contoso Invoicing - 1 running window in Q...
11:23:45 AM	LegacyInvoicingApp	Click UI element in window	Text 'Invoices' in Window 'Contoso Invoicing'
11:23:53 AM	LegacyInvoicingApp	Click UI element in window	Image 'Image' in Window 'Contoso Invoicing'
11:24:03 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' in Window 'Contoso Invoicin...
11:24:18 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' 2 in Window 'Contoso Invoici...
11:24:23 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' 3 in Window 'Contoso Invoici...
11:24:25 AM	LegacyInvoicingApp	Set drop-down list value i...	Combo Box 'ComboBox' in Window 'Conto...
11:24:29 AM	LegacyInvoicingApp	Click UI element in window	Image 'Image' 2 in Window 'Contoso Invoic...

You can choose a new name for your activity, or if other recordings in the process have already been grouped, you can choose from a list of activity names.

The screenshot shows the Microsoft Power Automate interface for analyzing a recording. On the left, a timeline of actions is displayed in a table format:

Timestamp	Application	Name	Description
11:22:31 AM	—	Send keys	TextToSend:'contos'
11:22:34 AM	SearchApp	Click UI element in window	List Item 'Contoso ... to switch preview' in ...
11:22:40 AM	chrome	Click UI element in window	Pane 'Page 1' in Pane 'Lab 2 How to ... Chro...
11:23:00 AM	chrome	Click UI element in window	Text 'Robotic ... mins December 2020' in Pa...
11:23:41 AM	—	Press button in window	Contoso Invoicing - 1 running window in Q...
11:23:45 AM	LegacyInvoicingApp	Click UI element in window	Text 'Invoices' in Window 'Contoso Invoicing'
11:23:53 AM	LegacyInvoicingApp	Click UI element in window	Image 'Image' in Window 'Contoso Invoicing'
11:24:03 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' in Window 'Contoso Invoicin...
11:24:18 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' 2 in Window 'Contoso Invoici...
11:24:23 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' 3 in Window 'Contoso Invoici...
11:24:25 AM	LegacyInvoicingApp	Set drop-down list value i...	Combo Box 'ComboBox' in Window 'Conto...

The right pane contains a 'Name this activity' dialog with a dropdown menu. The dropdown is open, showing several options under 'Custom names':

- Create new invoice
- Fill invoice form
- Open Contoso Invoicing app
- Open invoice document
- Open invoice email attachment
- Save invoice

After you have named the activity, it will appear at the top of your actions. You can move the activity header around to position it above the first activity in the group. You don't need to do anything about the last action yet. At this point, Power Automate is ensuring that every action will fit in a group. Soon, you will add more activities to split up the actions. If you select a specific action before adding a new activity, the header will automatically be placed above it. If you add an extra activity at any point in the process, you can delete the activity without affecting the actions by selecting **Delete activity**. You can also rename activities on the right pane. You need to have at least two activities to analyze a recording. At the end of the process, your recording will look similar to the following image.

Timestamp	Application	Name	Description
<b>Open Contoso Invoicing app</b>			
11:22:31 AM	—	Send keys	TextToSend:'contos'
11:22:34 AM	SearchApp	Click UI element in window	List Item 'Contoso ... to switch preview' in ...
<b>Open invoice document</b>			
11:22:40 AM	chrome	Click UI element in window	Pane 'Page 1' in Pane 'Lab 2 How to ... Chro...
11:23:00 AM	chrome	Click UI element in window	Text 'Robotic ... mins December 2020' in Pa...
<b>Create new invoice</b>			
11:23:41 AM	—	Press button in window	Contoso Invoicing - 1 running window in Q...
11:23:45 AM	LegacyInvoicingApp	Click UI element in window	Text 'Invoices' in Window 'Contoso Invoicing'
11:23:53 AM	LegacyInvoicingApp	Click UI element in window	Image 'Image' in Window 'Contoso Invoicing'
<b>Fill invoice form</b>			
11:24:03 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' in Window 'Contoso Invoicin...
11:24:18 AM	LegacyInvoicingApp	Populate text field in wind...	Edit 'TextBox' 2 in Window 'Contoso Invoici...

After you have finished with your grouping, you will have one step left to complete. Select the **Ready to analyze** toggle to change the status.

The screenshot shows the Power Automate interface with the 'Recordings' tab selected. On the left, there's a navigation menu with options like Home, Action items, My flows, Create, Templates, Connectors, Data, Monitor, AI Builder, Process advisor, Processes, Solutions, and Learn. The main area displays a list of recordings under the heading 'Contoso Invoice Processing > Recordings > Virtual Agent 5/20/2021, 11:22 AM'. A status message 'Status: Not analyzed' is shown. Below this is a table with columns: Timestamp, Application, Name, and Description. The table lists several activities, each with a small icon and a detailed description. At the top right, there are buttons for 'Save', 'Ready to analyze' (which is highlighted with a red box), and 'Close'. A 'Name this activity' input field contains the text 'Open Contoso Invoicing app'.

If you own a process, you can create activity names to act as guides for contributing users. To do so, go to your process details screen and select **Create activity names**.

Now that you have learned how to record a process and action on your recording, you can learn about the analysis process.

## Analyze recordings and interpret results

After you have a couple of recordings and have grouped the actions in those recordings into activities, you will be ready to analyze your process. While you can analyze a process with as few as two recordings, the more recordings that you have, the more valuable the analysis. When your recordings are prepared, go to your process and select **Analyze**.

Processes > Contoso Invoice Processing

Details		Edit	Shared with		Manage
Description	Submit a new invoice using Contoso Invoice App	Modified by	Virtual Agent		
Owner	Virtual Agent	Modified	5/13/2021, 3:11 PM		
Created	5/13/2021, 2:05 PM	Analyzed	12/14/2020, 8:45 AM		
Status	Analyzed	Analyzed recordings	7		

Recordings						+ New recording
Name	Created by	Created	Modified by	Modified	Status ⓘ	
Shakti Menon 12/1/2020, 11:06 AM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	
Wasanthi Gamage 12/7/2020, 6:46 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	
Egon Nilsson 12/7/2020, 6:48 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	
Preston Morales 12/1/2020, 11:01 AM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	
Christopher Reed 12/7/2020, 6:30 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	
Preston Morales 12/7/2020, 6:38 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed	

See all

In the following pop-up window, select **Confirm**. When your analysis is complete, the included recordings should switch status to **Analyzed**. Then, you can press **Analytics** to view the results.

The screenshot shows the Microsoft Power Automate interface. At the top, there are several buttons: 'New recording', 'Analytics' (which is highlighted with a red box), 'Share', 'Analyze', 'Create activity names', and 'Delete process'. Below this, the title 'Processes > Contoso Invoice Processing' is displayed. The main area is divided into two sections: 'Details' and 'Shared with' on the left, and 'Recordings' on the right.

**Details**

Description		Modified by
Submit a new invoice using Contoso Invoice App		Virtual Agent
Owner	Modified	
Virtual Agent	5/13/2021, 3:11 PM	
Created	Analyzed	
5/13/2021, 2:05 PM	12/14/2020, 8:45 AM	
Status	Analyzed recordings	
Analyzed	7	

**Shared with**

Co-owners	Manage
Contributors	

**Recordings**

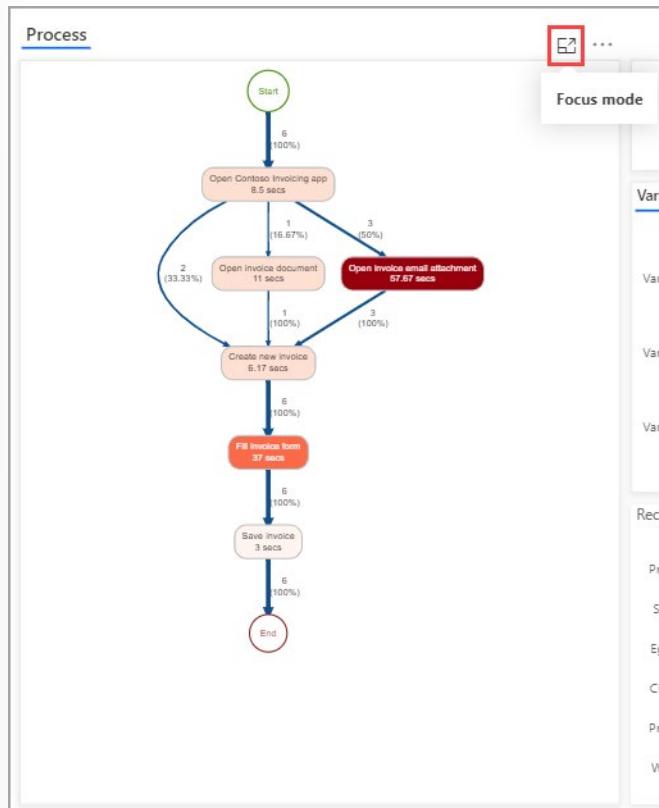
Name	Created by	Created	Modified by	Modified	Status
Shakti Menon 12/1/2020, 11:06 AM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed
Wasanthi Gamage 12/7/2020, 6:46 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed
Egon Nilsson 12/7/2020, 6:48 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed
Preston Morales 12/1/2020, 11:01 AM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed
Christopher Reed 12/7/2020, 6:30 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed
Preston Morales 12/7/2020, 6:38 PM	Virtual Agent	7 h ago	Virtual Agent	7 h ago	Analyzed

[See all](#)

The analytics screen will look similar to the following screenshot.

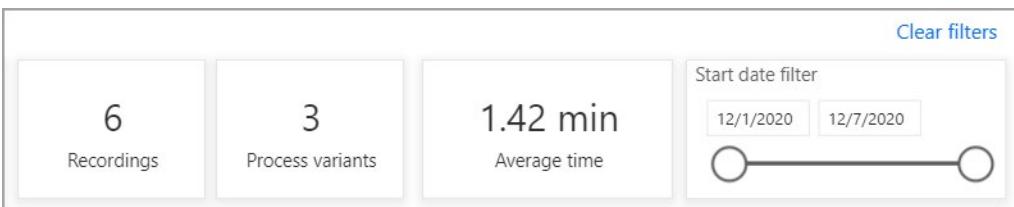


The preceding image shows many metrics that you need to consider. The first visual is the process map. You can enlarge the process map by selecting the **Focus mode** icon in the upper-right corner.

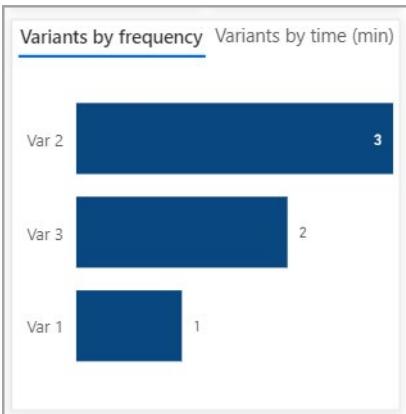


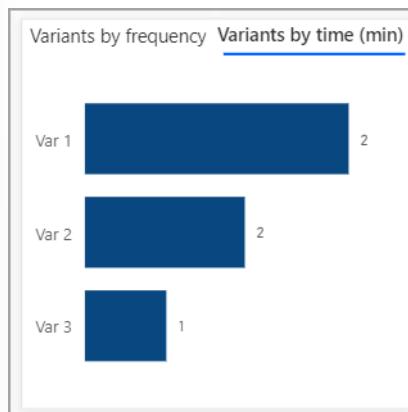
The process map breaks down each activity in order. It also shows the average amount of time for each activity and variations in the process. The process map shows that six recordings are being analyzed. In two recordings, the user opened the invoicing app and created a new invoice immediately. In one recording, the user opened an invoice document first. In three recordings, or 50 percent of the time, the user opened an invoice email attachment, which had the longest average time of any activity. The process map has thicker lines for the most traversed path in the process, and each activity is color-coded for the average length of time, with longer activities showing as a darker shade of red and shorter activities are a lighter shade of red. This feature allows you to understand the process at a glance. Every distinct series of actions (same steps in the same sequence) in a process is referred to as a variant. While no other variants existed, the other activity (which took a while) was filling out the invoice form. Activities that take longer might be good opportunities for automation.

The other visuals will help to further break down the information in the process map. For example, the following screenshot shows the number of recordings, number of process variants, and average time to complete the process. Also shown is the **Start date filter**, which can be especially useful if something in your process changed on a specific date.

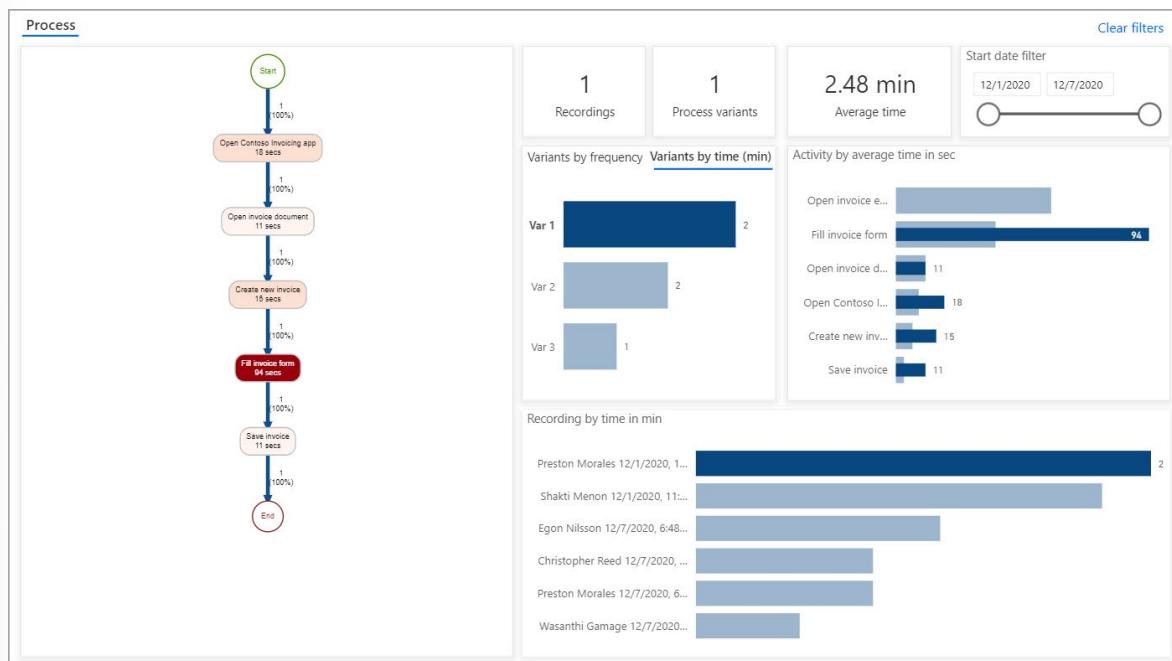


The next row of the visual shows the variants in terms of frequency and time. By comparing the two, notice that Variant 1 had the lowest frequency but the greatest time to complete.



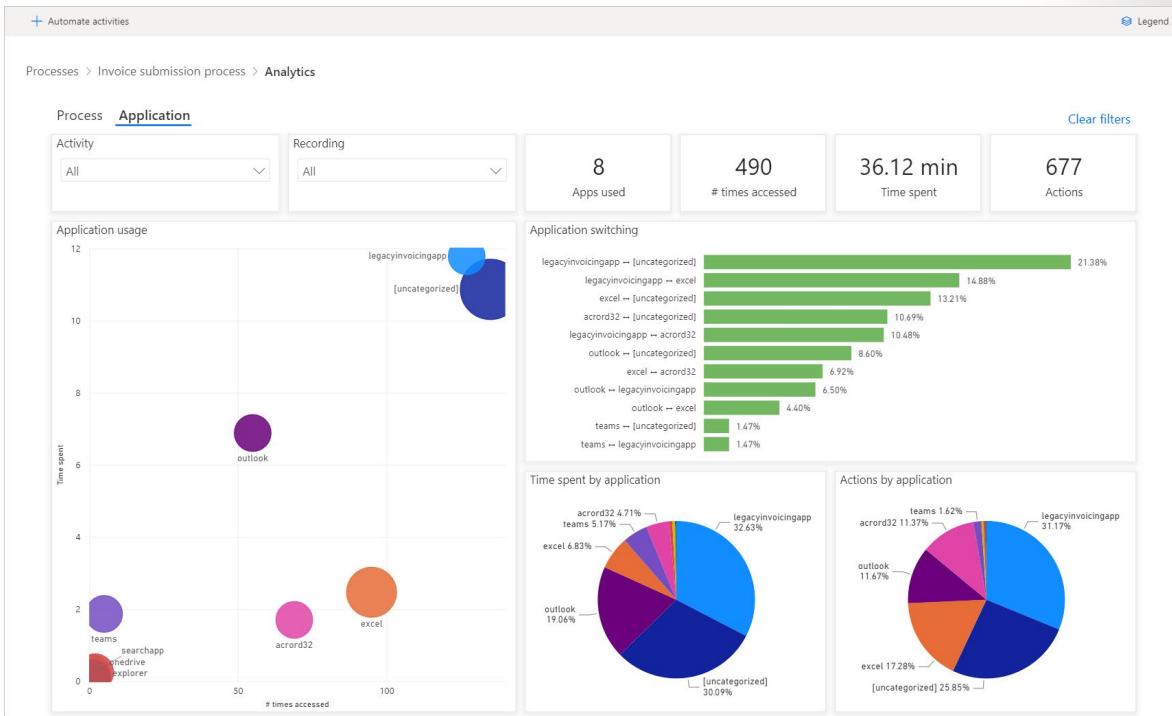


You can select Variant 1 to filter all information on the analytics page to better understand this path.



In this recording, filling out the invoice form took longer than in the other recordings. In fact, the whole process took more than two minutes, the longest of all runs. The reason is likely because the user was typing information instead of copying and pasting, or the process could be an outlier. Regardless of the reason, you are gaining insights into the process.

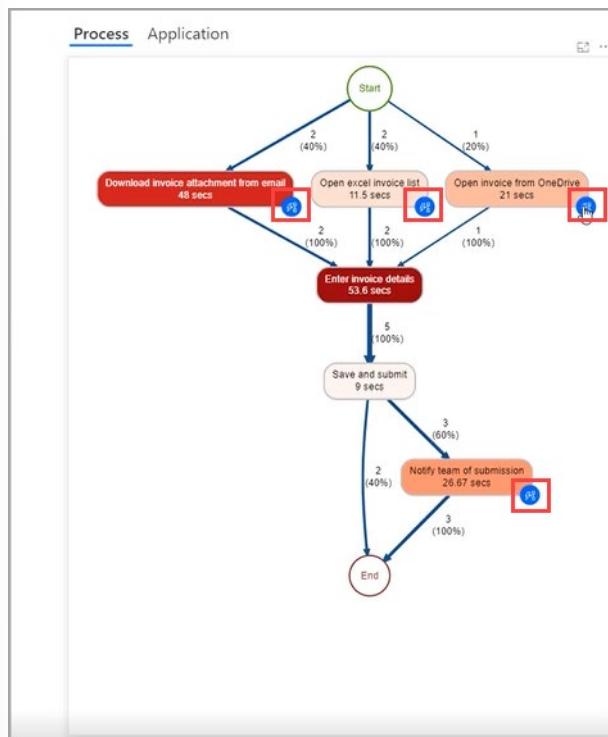
In addition to information on your process, you can find analytics on the various applications that are being used in your process on the **Application** tab. For example, you can view which application was opened most often or used for the longest time. This application could be one for which automation would be the most valuable.



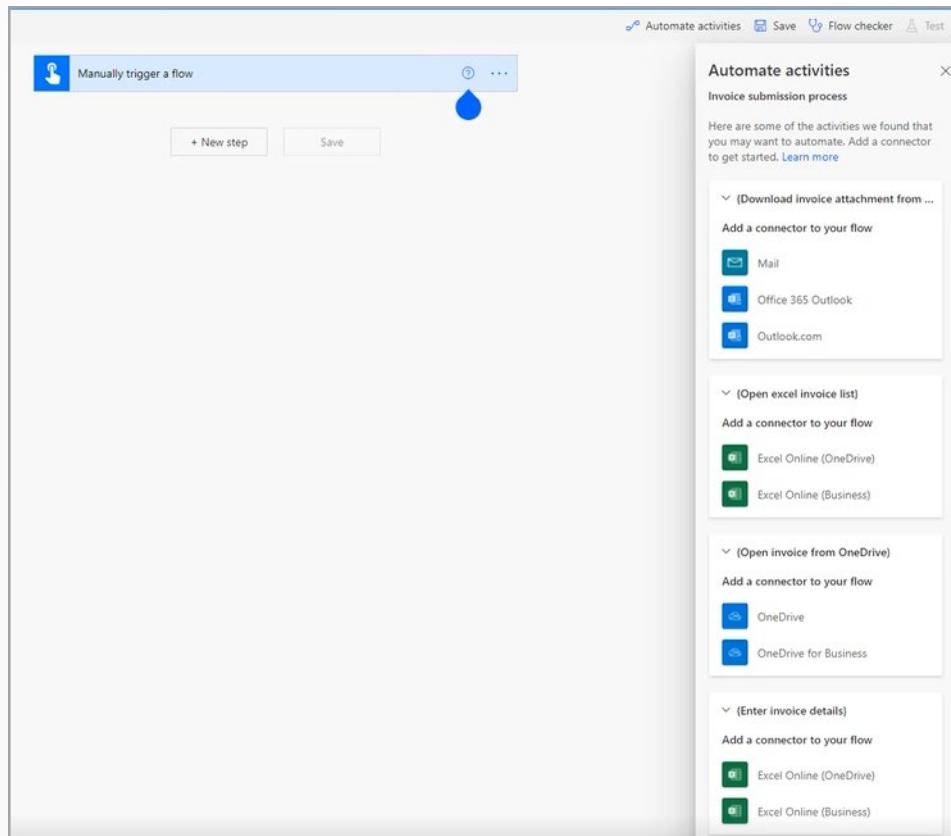
Now you know how to determine where bottlenecks might exist in your process and where you can most easily automate.

## Automation recommendations

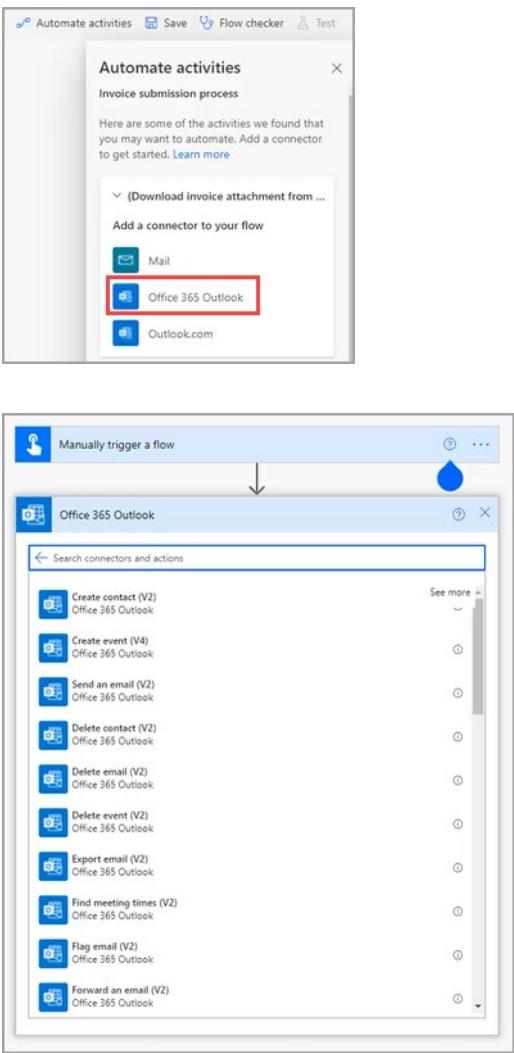
Within your process map, you might see blue icons on various activities, as shown in the following screenshot. These blue icons are recommendations for automation. Power Automate assessed the information, such as time and applications that are involved in this activity, and has recommended further action.



Selecting a blue icon will begin a new cloud flow with suggestions for connectors that are grouped by activities based on your process.



Selecting a recommended connector will add the selection to your flow.



You can reach these recommendations anytime by selecting **Automate activities**. If you want to connect to legacy applications, Power Automate Desktop is also available as a connector.

Automation recommendations can guide non-developers on how to create a solution on their analyzed process the right way.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. How many recordings do you need to analyze a process?

- At least 2
- At least 3
- At least 5
- At least 10

## Multiple choice

2. *What process advisor role does another user need to add recordings to your process?*

- Only contributors can add recordings.
- Only co-owners can add recordings.
- Contributors or co-owners can add recordings.
- No one can add recordings to your process, regardless of their permissions.

## Multiple choice

3. *What is a variant?*

- A grouping of actions
- A recording that fails to be analyzed and must be rerecorded
- A specific path (same steps in the same sequence) that users take to complete a process
- A recording that takes much longer than the others

## Multiple choice

4. *What connectors can automation recommendations suggest for improving your business processes and increasing efficiency?*

- Automation recommendations only include Premium connectors.
- Automation recommendations only include Office 365 connectors.
- All connectors can be recommended, except AI Builder and Power Automate Desktop.
- All connectors that are relevant to your process will be suggested, including Power Automate Desktop to automate legacy applications.

## Summary

Understanding the different ways that your users are completing a process can be nearly as difficult as mapping that process and determining areas that would benefit from automation. Process advisor can help you with this task.

With little setup, process advisor will map your process and give you insights on actions that are taking too long or have numerous variations. You can use these insights to understand where automation would be beneficial, saving your users' time and effort and allowing them to get back to the tasks that they need to focus on.

Consider your processes that would be simpler with a little automation, and then map your process to begin automation. By taking advantage of the process advisor capability in Power Automate, you can simplify your business processes and increase efficiency.

# Answers

## Multiple choice

1.What license is required to create or use a business process flow?

- You must have a valid SharePoint license.
- You must have a valid Office 365 license.
- You must have a valid Dynamics 365 license.
- You must have a valid Power Apps Dynamics 365 license or a valid Power Apps license.

### Explanation

*You must have a valid a Power Apps Dynamics 365 license or valid a Power Apps license to create or use a business process flow.*

## Multiple choice

2.What type of business process flows does Microsoft Dataverse include?

- A number of out-of-the-box predefined business process flows.
- No existing business process flows. Only custom business process flows are available with Dataverse.
- A number of custom business process flows.
- A number of regular Power Automate flows only.

### Explanation

*Dataverse includes a number of out-of-the-box predefined business process flows.*

## Multiple choice

3.Where can business process flows be embedded?

- They can be embedded into a public website.
- They can be added as a Web Part in SharePoint.
- They can be embedded in a custom .NET application.
- They can be embedded in a custom .NET application.

### Explanation

*Business process flows can be embedded in model-driven Power Apps.*

## Multiple choice

4.What tool is used to build business process flows?

- Microsoft Visio
- Microsoft Visual Studio
- Microsoft Power Apps Canvas App Maker studio
- Business process flow editor in Microsoft Power Automate

### Explanation

*Business process flow editor in Microsoft Power Automate is used to build business process flows.*

**Multiple choice**

1.Which of the following best describes an immersive business process flow?

- They are embedded within a model-driven app.
- They are stand-alone and launched in Power Automate.
- They are launched and run from Microsoft Visio.
- They can be launched within a SharePoint team site.

*Explanation*

*Immersive business process flows are stand-alone and launched in Power Automate.*

**Multiple choice**

2.Where do immersive business process flows store all data that is collected from the flow?

- Any source that is accessible through a connector
- In SQL Server in the cloud or on-prem
- Dataverse tables
- SharePoint

*Explanation*

*Immersive business process flows store all data that is collected from the flow in Microsoft Dataverse tables.*

**Multiple choice**

3.Which item is a key benefit of an immersive business process flow?

- Ease of development and deployment
- Ability to store data in multiple sources
- Mobile interface
- The only kind of business process flows that support running within Microsoft Visio

*Explanation*

*A key benefit of an immersive business process flow is the ease of development and deployment.*

**Multiple choice**

4.How do immersive and embedded business process flows mainly differ?

- How they are launched and the context that they are viewed within
- How they are built
- Capability
- Visual Process Maps

*Explanation*

*Immersive and embedded business process flows mainly differ by how they are launched and the context that they are viewed within.*

**Multiple choice**

1.Which Microsoft product can run business process flows?

- SharePoint
- Excel
- Power Automate
- Microsoft PowerPoint

*Explanation*

*Power Automate can run business process flows.*

**Multiple choice**

2.What is the main benefit that branching logic delivers to business process flows?

- Multilanguage support in the same business process flow
- Allows "or" logic
- A single business process can be used for many different conditions
- Allows "not" logic

*Explanation*

*The main benefit that branching logic delivers to business process flows is that a single business process can be used for many different conditions.*

**Multiple choice**

3.Which one of the following statements is true?

- Power Automate instant flows cannot be used with the same Microsoft Dataverse entity as a business process flow.
- Dynamics 365 workflows cannot be used with the same Dataverse entity as a business process flow.
- Power Automate instant flows, Dynamics 365 workflows, and business process flows can all be used with the same Dataverse entity(s).
- Power Automate instant flows, Dynamics 365 workflows, and business process flows can only be used with the same Dataverse entity(s).

*Explanation*

*Power Automate instant flows, Dynamics 365 workflows, and business process flows can all be used with the same Dataverse entity(s).*

**Multiple choice**

4.Which of the following statements about business process flows is true?

- Business process flows can only be used within a model-driven app.
- Business process flows are available in two formats - immersive and embedded.
- Business process flows do not have a visual component.
- Business process flows do not support conditional branching.

*Explanation*

*Business process flows are available in two formats - immersive and embedded.*

**Multiple choice**

1.How many recordings do you need to analyze a process?

- At least 2
- At least 3
- At least 5
- At least 10

*Explanation*

*You only need two recordings, but the more recordings you have, the greater your insights will be.*

**Multiple choice**

2.What process advisor role does another user need to add recordings to your process?

- Only contributors can add recordings.
- Only co-owners can add recordings.
- Contributors or co-owners can add recordings.
- No one can add recordings to your process, regardless of their permissions.

*Explanation*

*Contributors or co-owners can add recordings, but contributors can only edit or delete their own recordings, while co-owners can edit or delete any recordings in the process.*

**Multiple choice**

3.What is a variant?

- A grouping of actions
- A recording that fails to be analyzed and must be rerecorded
- A specific path (same steps in the same sequence) that users take to complete a process
- A recording that takes much longer than the others

*Explanation*

*A variant is a deviation in the process where users take different paths, which is called out in the process map.*

**Multiple choice**

4.What connectors can automation recommendations suggest for improving your business processes and increasing efficiency?

- Automation recommendations only include Premium connectors.
- Automation recommendations only include Office 365 connectors.
- All connectors can be recommended, except AI Builder and Power Automate Desktop.
- All connectors that are relevant to your process will be suggested, including Power Automate Desktop to automate legacy applications.

*Explanation*

*Recommendations include all connectors that are relevant to your process, including Power Automate Desktop to automate legacy applications.*

# Module 10 Build chatbots with Power Virtual Agents

## Get started with Power Virtual Agents bots

### Introduction

Today, organizations look for more effective ways to deliver customer service solutions to their customers. Customers seek faster and more precise self-service support options, while businesses seek to satisfy their customers with faster, better customer service. The intersection of these needs can be met with Microsoft Power Virtual Agents. Power Virtual Agents provides businesses with a way to build a library of the most easily answered questions and offer a user experience that helps customers retrieve that information with fast and simple queries by using a bot. Power Virtual Agents is simple for non-technical users to write and expand quickly and it's desirable for customers who are accustomed to searching the internet for answers to their questions.

A bot is a form of AI that simulates human conversation through a chat interface. Bots listen for keywords and phrases that relate to the library of known, common customer issues (topics) that are stored in the bot, and it will return answers quickly and iteratively as the customer continues the chat. The bot continues to check if the customer's question has been answered and then refines its selection of topics to solve the customer's problem.

Adopting bots into your organization's service structure provides many benefits, including:

- **Reducing assisted support inquiries** - Customers don't always need to connect with human agents to get answers. Simple or common issues can be resolved by displaying bot topics, knowledge base articles, or [FAQ pages](#)<sup>1</sup>.
- **Seamless integrations with other systems** - Integrations with customer relationship management systems let organizations include relevant and personal information in conversations as needed. It also allows a conversation to be transferred, including its details, to a human agent when needed.
- **Task automation** - Follow-up functions and actions, such as scheduling meetings, assigning cases, sending follow-up emails, surveys, and more, can be initiated from the bot. With Microsoft Power

<sup>1</sup> [https://blog.hubspot.com/service/faq-page?\\_ga=2.166730110.1354676710.1559054333-933118289.1529345498/?azure-portal=true](https://blog.hubspot.com/service/faq-page?_ga=2.166730110.1354676710.1559054333-933118289.1529345498/?azure-portal=true)

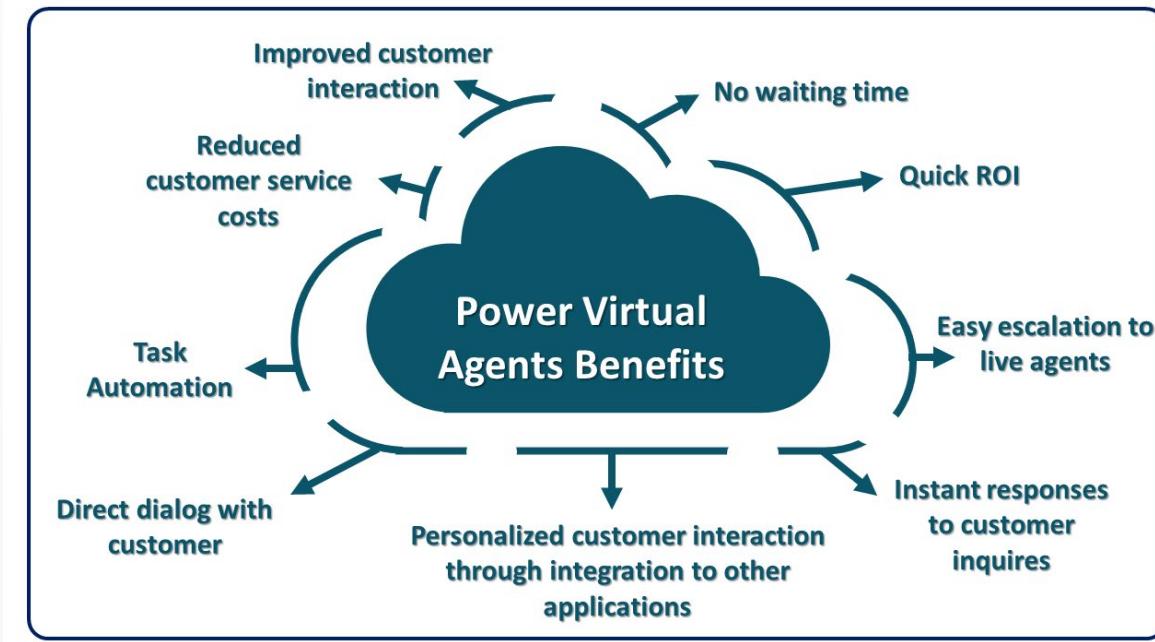
Automate, custom workflows and automated actions can be configured that the bot can run, with the customer's permission, to automate resolution of the customer's issue.

## Overview of creating Power Virtual Agents bots

Power Virtual Agents empowers your teams to create bots through a guided, no-code graphical interface. This feature allows you to use the benefits of bots without having to rely on data scientists or developers. It helps to address many of the current challenges in building bots. You can eliminate the gap between the subject matter experts and development teams that are building the bots, including the latency between teams that are recognizing an issue and updating the bot to address it. Power Virtual Agents also removes the complexity of exposing teams to the nuances of conversational AI and the need to write complex code.

Using Power Virtual Agents will help your organization to:

- **Better empower your teams.** Your teams can build bots without needing intermediaries, coding, or AI expertise.
- **Reduce costs.** You can automate common inquiries, which will give agents time to focus on more complex issues.
- **Improve customer satisfaction.** Customers have access to an all-day, self-help solution to help resolve their issues through comprehensive, personalized bot conversations.



One key advantage of using Power Virtual Agents is its ease of deployment. With just a few clicks, you can sign up, create a bot, and embed it into your organization's website. Microsoft's conversational AI capabilities allow customers to have comprehensive, multi-turn conversations where they are guided to the appropriate solution. By providing a few examples of the topic that you want the bot to handle, you can build the conversation, and your bot will be ready to handle customer requests. For example, consider the scenario where your organization has analyzed its incoming support topics and has identified that a large portion of customer issues relates to store hours and shipping issues. In that situation, you could build a Power Virtual Agents bot around those topics, which will help the customer gain answers quickly from the bot without initiating a request to a human agent. Because Power Virtual Agents works

conjointly with applications like **Dynamics 365 Customer Service Insights<sup>2</sup>**, you can use Customer Service Insights to help determine which support topics are trending and can be automated with Power Virtual Agents so that you can update your bot with those topics.

Power Virtual Agents bots can converse with your customers and can also be designed to act on their behalf. Power Virtual Agents bots can be integrated with services and network systems out-of-the-box or through hundreds of custom connectors that you can add by using Power Automate. For example, if a customer has made a request that the bot isn't equipped for, the bot can escalate the conversation and then pass it, and its details, to a live agent. This process ensures that the live agent has the necessary details and context to avoid needing to recapture information from the customer. Additionally, Power Virtual Agents and Power Automate can be orchestrated to run IoT commands to the customer's device, with the customer's permission, to the virtual agent.

## Get started working with environments

You can obtain a trial license to assist you in completing training and evaluating the product by going to **trial environment<sup>3</sup>**. Select **Start free** to begin a Power Virtual Agents trial.

**Note:** You will need to sign in with a work email address because personal Microsoft accounts are not currently supported.

## Define how to work with environments

Today, many organizations have a global presence and provide service to customers in multiple regions, countries, or continents. This aspect can result in needing different types of interactions based on factors such as different data being available and resolutions that are based on departments or locations. Your organization might need to deploy similar bots in different regions that interact with systems and data for those areas. Power Virtual Agents accommodates this occurrence by letting you create bots in different environments and switch between them.

Environments represent space to store, manage, and share your organization's business data. Each bot that you create is stored in an environment. Items like model-driven and canvas applications and Power Automate flows are also stored in environments. Each environment might have different roles, security requirements, and target audiences. Individual environments are not created in Power Virtual Agents; they are created in a separate location. After you have created an individual environment, Power Virtual Agents bots can be created in that environment.

Depending on business needs, organizations can use environments in many ways, including:

- **Departmental** - By creating an environment that corresponds with specific organizational teams or departments, created bots will contain relevant information for that audience.
- **Locational** - Because the displayed data might be different based on geographic regions, you might define separate environments for different global branches of your company.

You only need multiple environments if your company is global and you are supporting regions with specific data privacy and storage requirements like China, Germany, the EU, Singapore, and so on. In that case, you will need to establish environments for each region as you would for any other service that uses and stores data for customers in that region.

<sup>2</sup> <https://dynamics.microsoft.com/ai/customer-service-insights/?azure-portal=true>

<sup>3</sup> <https://powervirtualagents.microsoft.com/?azure-portal=true>

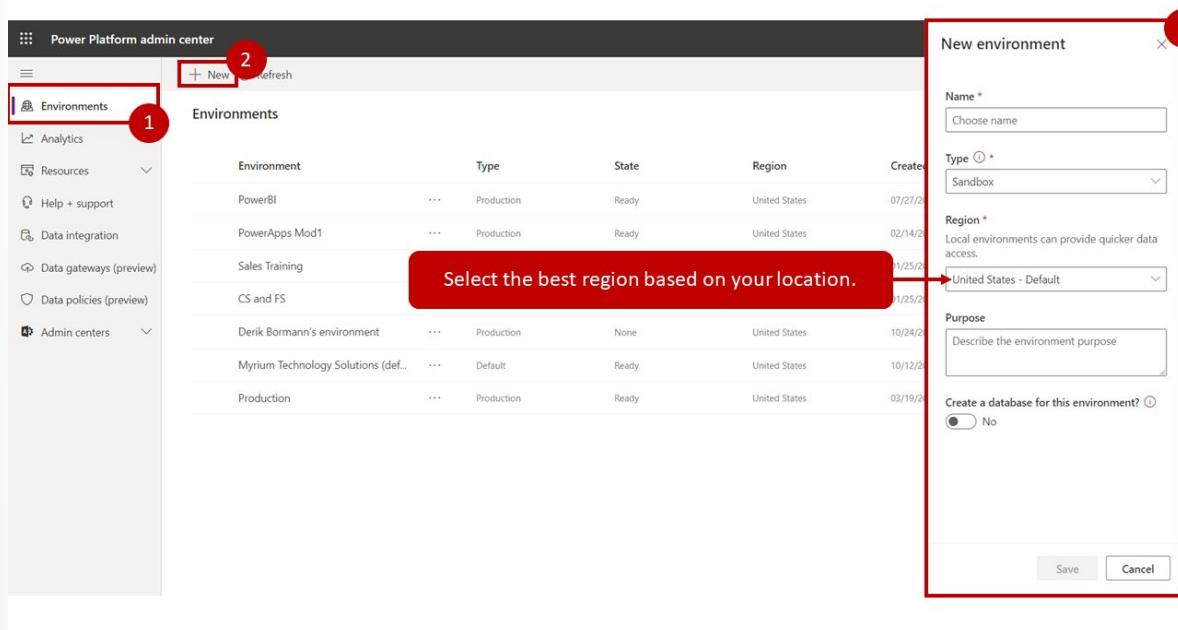
## Create environments

The first time that you sign in to Power Virtual Agents and create a new bot, a default environment is created. Unless specified otherwise, any additional bots will be created in the default environment. If additional environments are needed, such as for different regions, organizational needs, or other circumstances, they can be added through the **Microsoft Power Platform admin center**<sup>4</sup>.

When in the admin center, you can add environments by going to the **Environments** tab and selecting **New** to open the new environment panel.

For each environment, you will need to provide the following information:

- **Name** - A unique name for the environment.
- **Environment** - Defines the type of environment to create, such as production, trial, or sandbox.
- **Region** - Defines the **support data region**<sup>5</sup> where the environment will be created.



If you want to have a Microsoft Dataverse database created for the environment to use entities like accounts, contacts, and other business-related data, you can set the **Create a database for this environment** field to **Yes**. Additionally, you should select **Yes** if you are using Power Virtual Agents in conjunction with other Dynamics 365 applications. Data from Dataverse can be used in bots to provide tailored customer experiences. After the Dataverse database has been created, new bots can be deployed to the environment from the Power Virtual Agents portal.

For more information, see [creating environments](#)<sup>6</sup>.

<sup>4</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-environment/>

<sup>5</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/data-location/>

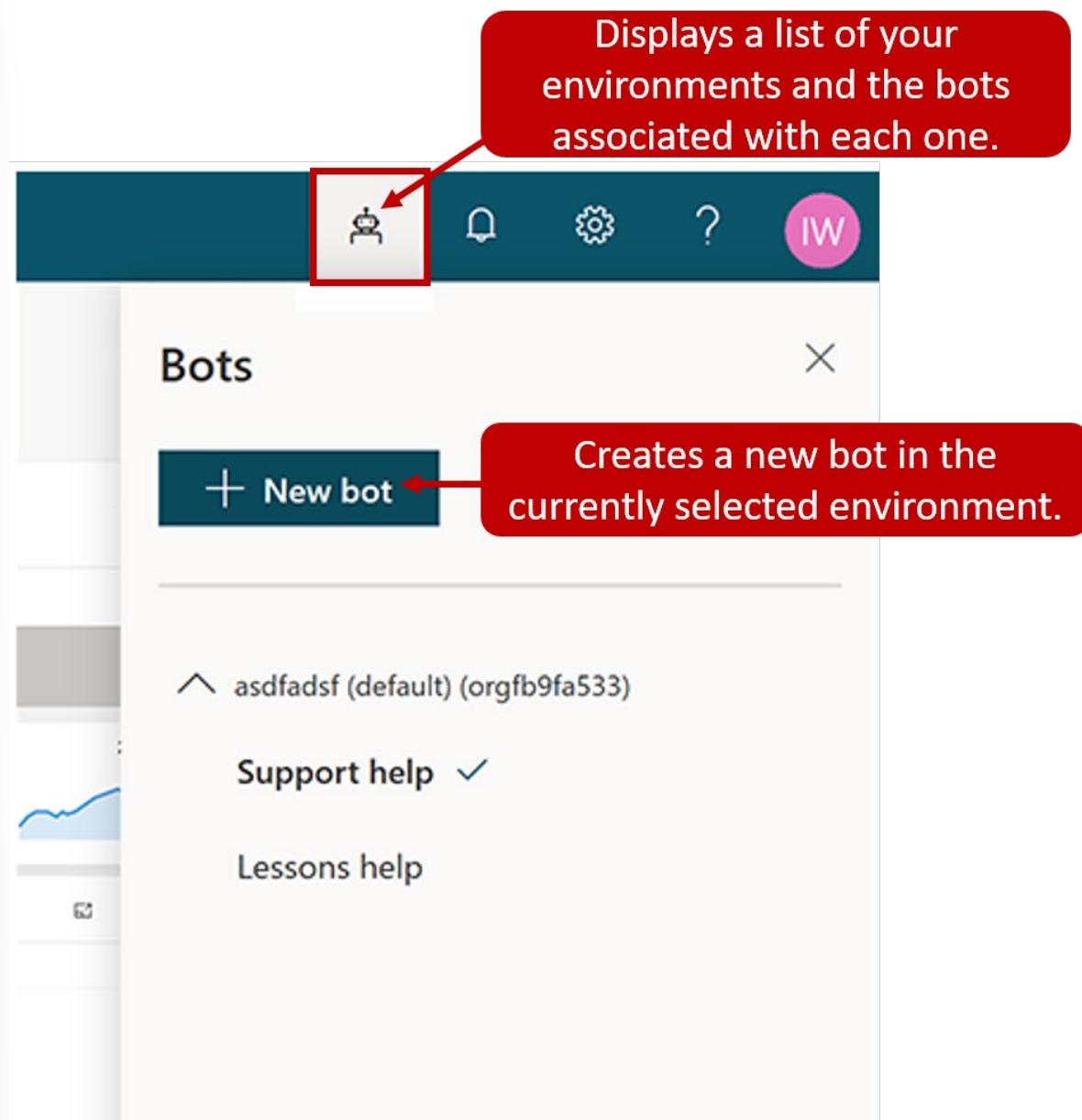
<sup>6</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/environments-first-run-experience#create-a-new-environment-for-your-bots?azure-portal=true>

## Create bots and work with the Power Virtual Agents interface

Before you start creating bots, it is important to consider what the bot will be used for. For example, you might use the bot to handle account inquiries, or you could use it for self-service support cases such as knowledge base access. Knowing how you plan to use the bot will help you define and plot out conversation paths and determine how many topics the bot will handle. Other functions that you could consider include using the bot to look up basic account details, perform more advanced account operations, or implement some type of action. The more scenarios that you initially consider, the easier it will be to determine the topics that your bot needs for you to facilitate it.

You can create bots by selecting the bot icon in the Power Virtual Agents interface. Bots are created for each environment. By default, all bots will be created in the **default Power Apps environment for your organization or tenant<sup>7</sup>**, unless otherwise specified. You can choose which environment that you want to use by selecting **more options** to see a list of available environments.

<sup>7</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/environments-first-run-experience/>



In the **Create a new bot** dialog box, enter a name for your bot. Select **Create** to begin the bot-building process, which can take up to 15 minutes for the first bot that you create in an environment. Subsequent bots take less time to create.



Create a new bot

Name\*  
Customer Support

Language\* ⓘ  
English (US)

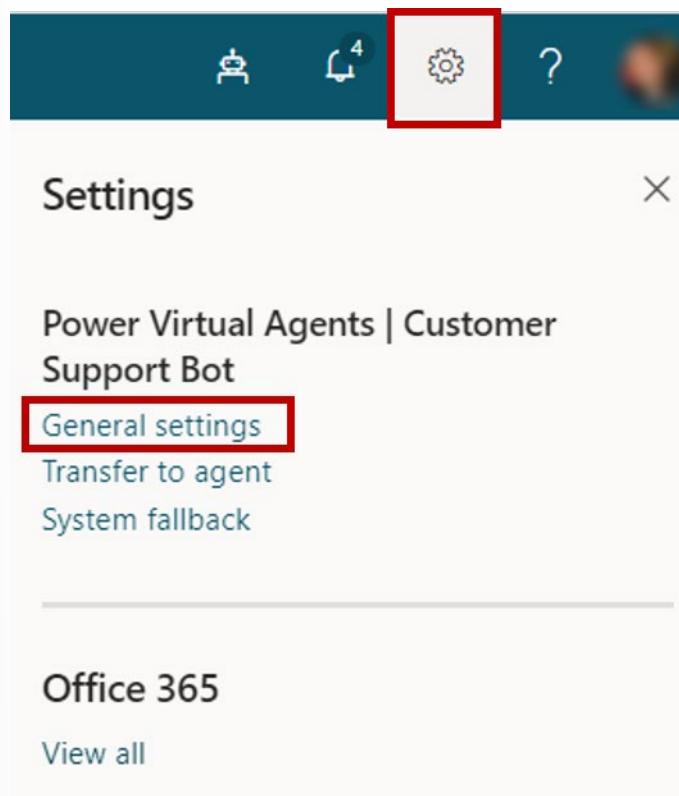
Environment\* ⓘ  
CS and FS (mslearnomnichannel) - United States

The environment can be changed if you selected the wrong one initially.

Signed in as [redacted] [Sign out](#) [Create](#)

## Delete a bot

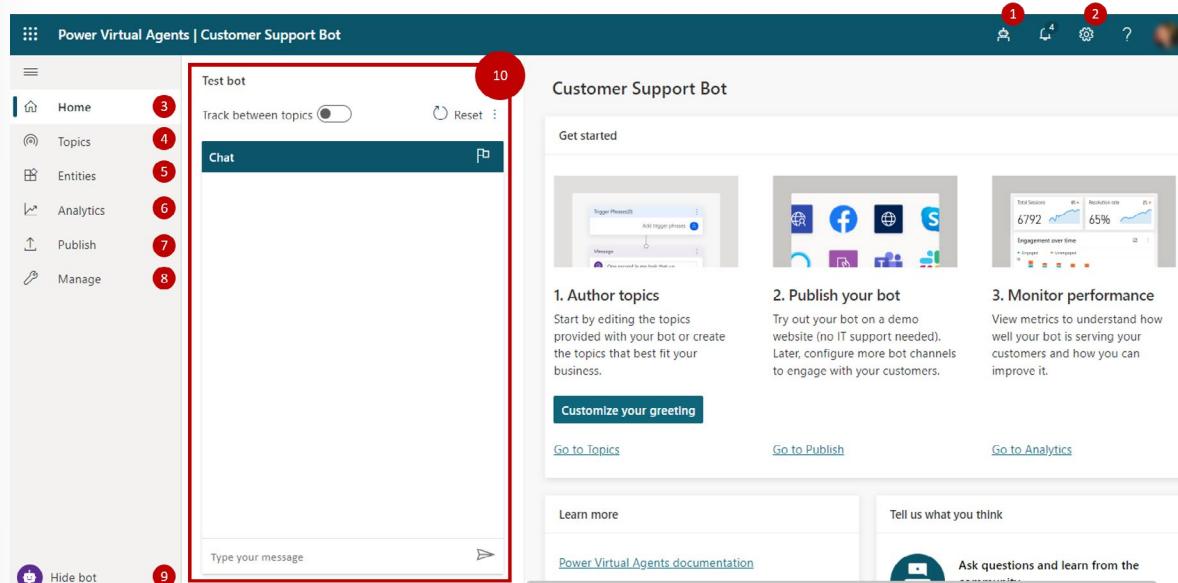
Bots that are no longer needed can be removed from your environment. This situation might occur when the bot is being replaced with a different bot, or if the bot no longer fits the needs of your organization. Use the bot icon on the top menu bar and then select the bot that you want to delete. Select the **Settings** icon and **General settings**, and then select the **Delete Bot** option.



## Work with the Power Virtual Agents user interface

The Power Virtual Agents user interface provides you with all the tools necessary to create, test, publish, and monitor the performance of your bot. When the application is loaded after the bot has been created, you will see multiple areas that can help you throughout process of working with your bot.

The following image shows an example of what the user interface looks like.



The following list describes the Power Virtual Agents user interface features, as indicated in the previous image:

1. **Bots panel** - Used to create and open existing bots across all your environments.
2. **Settings** - Provides access to different Power Virtual Agents settings, such as fallback topics and transfer to agent settings.
3. **Home** - Takes you to the main page of your bot. On this page, you can find tools to assist you with creating, publishing, and monitoring performance of your bot. Learning content and training videos can also be accessed from this location.
4. **Topics** - Provides access to all user and system topics that are available for the bot.
5. **Entities** - Provides access to all prebuilt and custom entities that are available to be used by the bot.
6. **Analytics** - Provides analytical details that are related to the performance and usage of the bot.
7. **Publish** - Provides tools for publishing your bot and deploying it to different channels.
8. **Manage** - Toolset that assists in management items such as which channels your bot is deployed to, bot authentication, and skills management.
9. **Test/Hide bot** - Opens the **Test bot** dialog box, where you can engage with bot topics in real time.
10. **Test bot panel** - Lets you test your bot topics to ensure that they are performing as expected.

## Create topics

Now that the initial structure of the bot has been created, your next step is to begin writing topics. Topics define how the customers will interact with the bot, and they typically represent common issues, questions, or tasks that customers might need assistance with. For example, you might create a topic to provide customers with item return instructions.

Each topic consists of two primary elements:

- **Trigger phrases** - Phrases, keywords, or questions that are entered by users and relate to a specific issue.
- **Conversation nodes** - Define how a bot should respond and what it should do.

You can design topics by **customizing provided templates**<sup>8</sup>, creating a new one, or using a topic that has been suggested from existing sites. Your bot can have up to 1,000 topics.

## Get started with topics

Each created bot will include several predefined topics to help you get started. These predefined topics are separated into two types:

- **Lesson** - Pre-created user topics that can help you understand simple and complex ways of using nodes to create bot conversations.
- **System** - Prepopulated topics that represent common use cases that can occur during a bot conversation.

<sup>8</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-template-topics/>

## Work with lesson topics

The intent of lesson topics is to provide examples of how to use topics to solve specific scenarios and to help you become more comfortable as you create bots. Lesson topics range from simple, such as providing a user with store hours, to more complex scenarios, where the bot assists online shoppers with items in their cart.

The following table describes the four included lesson topics.

Topic	Description	Notes
Lesson 1 – A simple topic	Goes through the creation of a simple topic with one conditional branch that displays store hours.	
Lesson 2 – Simple topic with condition and variable	A simple topic that contains one conditional branch and a variable that displays store locations based on the customer's preferred store location.	A variable is a name for an item that will be used later in the topic flow. In this example, pva_StoreLocation is the variable that is used to store the user's response when you ask for their preferred store location.
Lesson 3 – Topic with conditions, variables, and a prebuilt entity	Goes through the creation of a topic that includes one conditional branch, a variable, and an entity. In this lesson, the bot uses the State entity and will recognize any US state that the user enters.	Topic entities help identify key information from what the user enters and will automatically fill in that information into your variables. For example, if you type "I want to buy a red car," the bot doesn't need to ask which color because the bot recognizes the Color entity in the content that you typed. The bot will then skip the question that asks for color.
Lesson 4 - Topic with conditions, variables, and a custom entity	Goes through the creation of a topic with a conditional branch, a variable, and a custom entity.	This lesson is similar to the previous example, except that you create a custom entity to capture information. For example, try testing this topic by typing, "I want a business laptop."

## System Topics

System Topics represent scenarios that customers are likely to encounter while interacting with your bot, such as initiating and ending a conversation or escalating a conversation to a live agent. System topics will have a basic structure already in place, based on what the scenario is. For example, the greeting topic will already have predefined triggers and a basic conversation path that you can begin to modify based on your needs.

System Topics (9)

Fallback	No trigger phrases
Goodbye	(67) Bye
Start over	(3) start_over
Thank you	(4) thanks
Escalate	(65) Talk to agent
End of Conversation	No trigger phrases
Confirmed Success	No trigger phrases
Confirmed Failure	No trigger phrases
Greeting	(52) Good afternoon

You will define any additional topics by selecting **Topics** in the side navigation pane and then selecting **New topic** at the top of the page. Each topic that you define should include some trigger phrases. Trigger phrases are examples of text such as questions or utterances that teach the bot when to respond with this dialog. For example, the following image contains a topic called Store Hours, which will be used to provide customers with store location hours based on different scenarios.

Store Hours

Setup Analytics

Name \*

Description

Trigger phrases (6) ⓘ

How might your customers ask about this topic? Try to start with 5-10 diverse phrases.

Enter a trigger phrase  Add

- What are your hours?
- Daily open hours
- Store Hours
- When are you open
- When are you closed
- Hours

Modified 6/23/20, 6:22 AM

Status -

Go to authoring canvas

Trigger phrases should be unique to the topic. Using the same trigger phrase in multiple topics can result in items not displaying correctly.

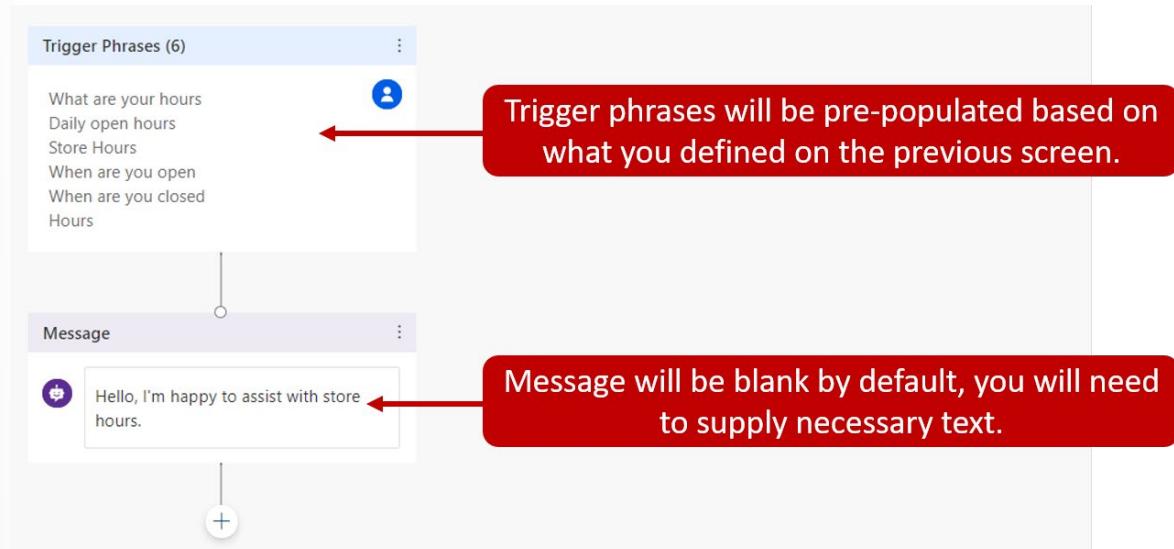
Six trigger phrases have been added, such as *What are your hours?* and *When are you open?* These phrases will be used to determine when the Store Hours topic should be initiated. The more trigger phrases you add, the more likely it is that the topic will be appropriately used. Trigger phrases should be

unique to each topic. If you have the same trigger in multiple topics, the bot will not be able to identify which topic to load. After you have added the initial triggers, select **Save topic** to add the topic to the **Topics** list. Additional triggers can be added later as needed.

After you have saved your topic, you can define how customers are guided through their conversational interaction with the topic. You can define the path by selecting **Go to authoring canvas**. The authoring canvas is a graphical dialog tree editor that allows you to define bot responses and the overall bot conversation. When the canvas loads, the conversation will consist of two nodes:

- The trigger phrases that will initiate the topic.
- The initial message that will be provided to the user.

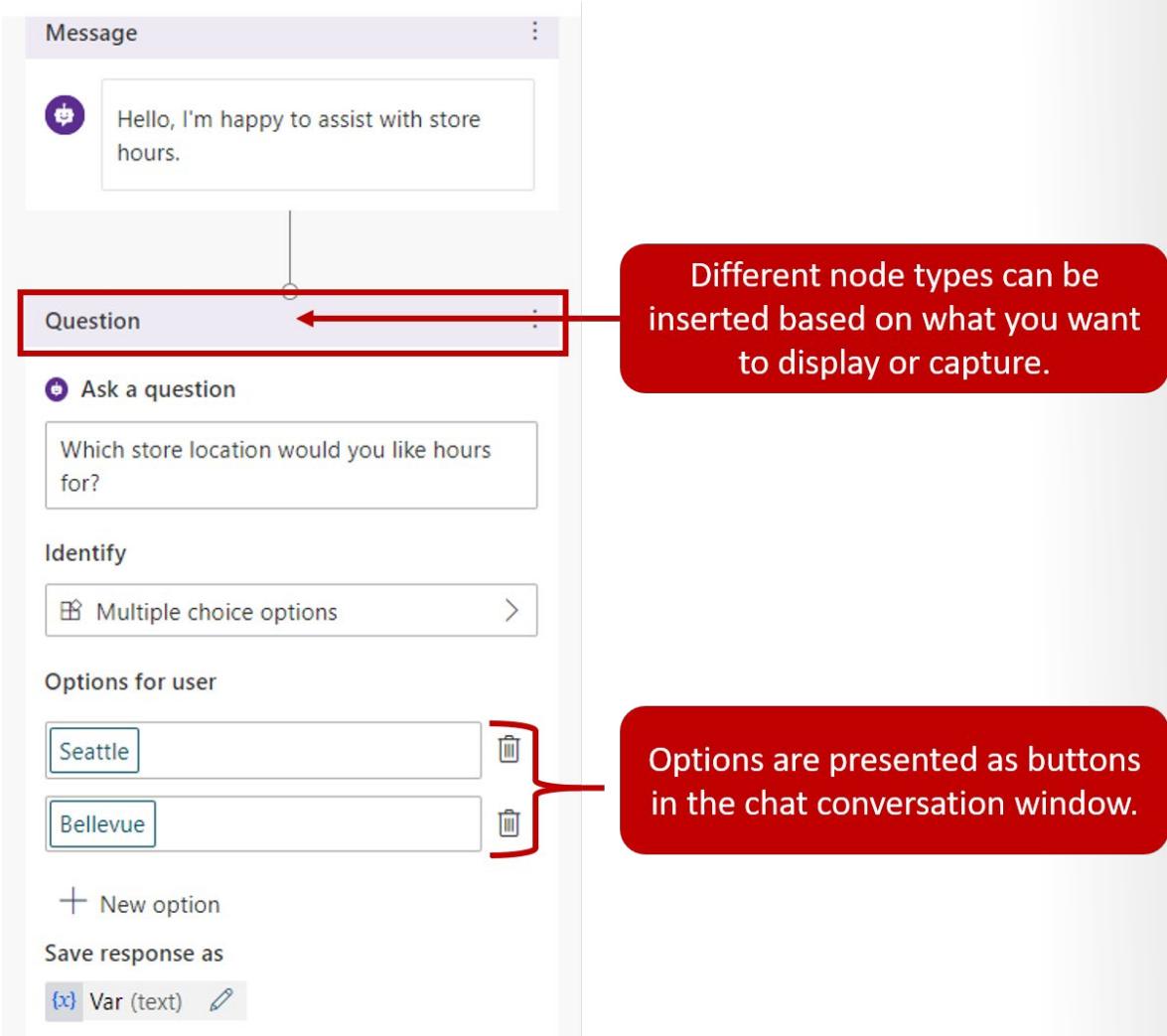
The trigger phrases will be prepopulated with the items that are defined in the previous step. You will need to provide the initial message to the user such as "Hello, I'm happy to assist with store hours."



## Work with conversation nodes

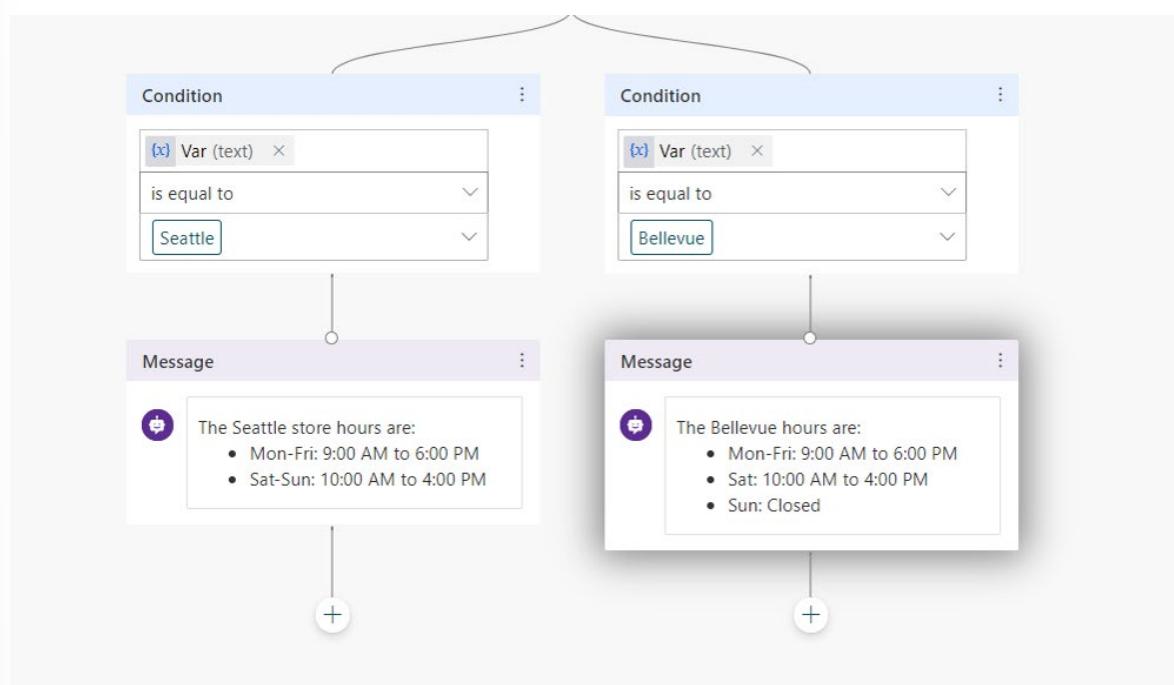
Conversation nodes help define the path that the conversation will take. Conversation nodes can display messages, ask questions, or run actions. You can add these nodes by selecting the plus sign (+) below the node. For example, if you want to provide store hours based on where the customer lives, you would add an **Ask a question** node to identify which store location that they want the hours for.

The following image shows the **Ask a question** node being used to ask the customer which store location they want the hours for. In addition, the customers are provided with two multiple-choice options to choose from: Seattle and Bellevue.



Separate conversation paths are created based on the customer's response. In the forked conversation path, each node has automatically checked for **Seattle** in one path and **Bellevue** in the other path to take the appropriate next step. Additional nodes can be added for each path based on what you want it to do.

The following image shows that for each path, a **Message** node is added that provides the store hours for that specific location.



You now have a simple branching dialog tree and can begin to create more complex versions of this tree by incorporating **variables**<sup>9</sup>, **entities**<sup>10</sup>, and **Power Automate flows**<sup>11</sup>.

## Test bots

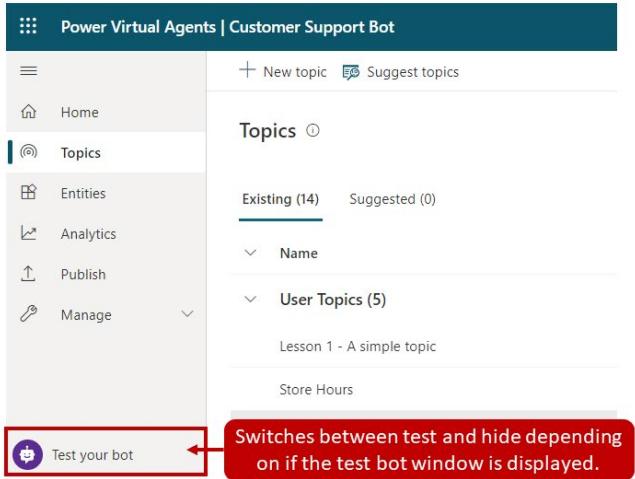
Because a bot is made up of multiple topics, it is important to ensure that each topic is working appropriately and can be interacted with as intended. For example, if you want to make sure that your Store Hours topic is triggered when someone enters text asking about store hours, you can test your bot to ensure that it responds appropriately.

You can test your bot in real time by using the test bot panel, which you can enable by selecting **Test your bot** at the bottom of the side navigation pane. When the panel displays, the button name changes to **Hide your bot** so that you can hide it if more space is needed during the design process.

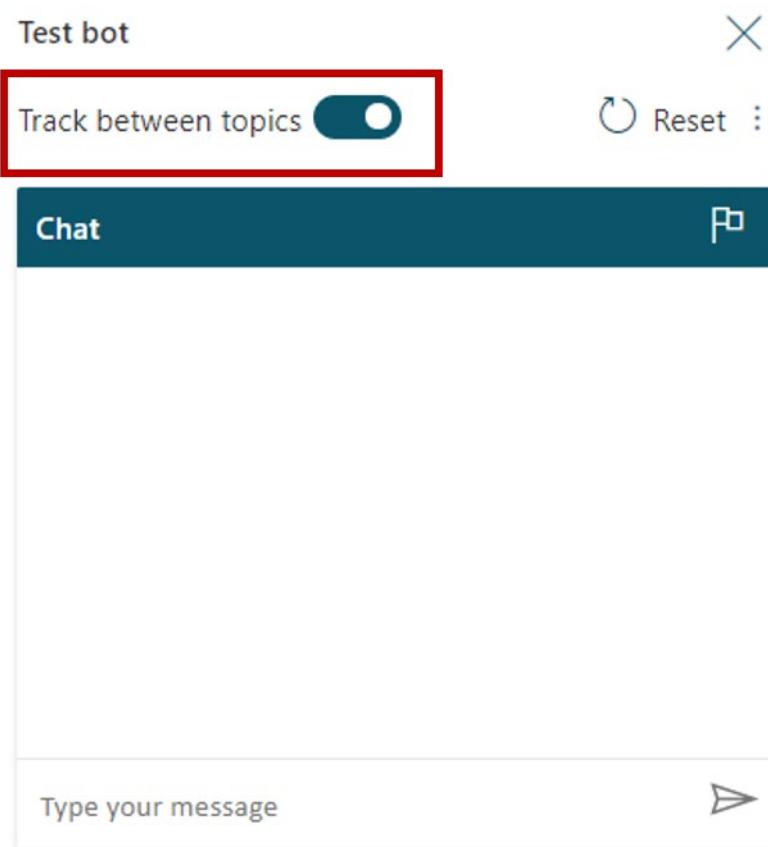
<sup>9</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-variables/>

<sup>10</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-entities-slot-filling/>

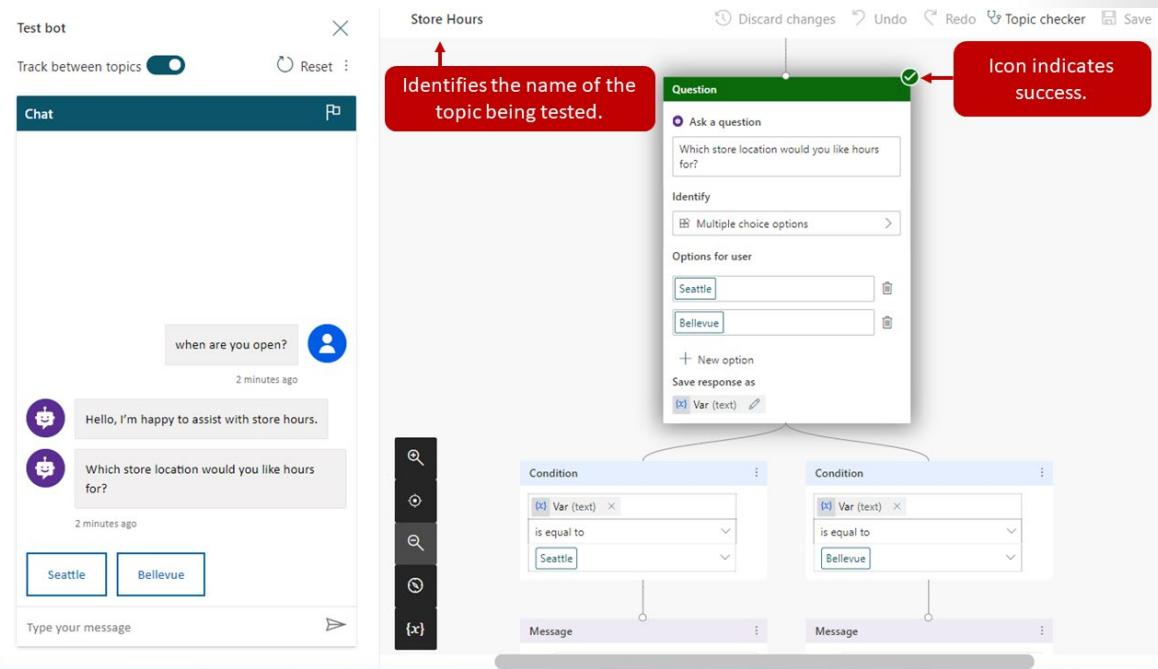
<sup>11</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-flow/>



The **Test bot** window interacts with your bot topics just as a user would. As you enter text into the test bot window, information will be presented as it would to a user. Your bot will likely contain multiple topics. As you engage with a specific topic, it might be handy to have the application take you to that topic. You can accomplish this task by turning on the **Track between topics** option at the top. This option follows along with the bot as it implements the different topics. For example, typing "hello" would trigger the Greeting topic, and then the application will open the Greeting topic and display its conversation path in the window. If you were to type "When are you open?" the application will switch to display the Store Hours topic. As each topic is displayed, you can observe how the path progresses, which will help you evaluate how your topics are doing.



The following image shows that the "When are you open?" message has been sent to the bot. Notice that you are automatically taken to the Store Hours topic. The conversation path is highlighted in green. The bot is now waiting for you to respond and has provided two suggestion buttons on how to respond. These suggestion buttons reflect the Seattle and Bellevue user options that were defined when the topic was previously created. In the test bot, you can select either of these suggestion buttons to continue.



As you select an option, you continue down the conversation path until you reach the end. The chat will stop when you reach the bottom of this branch.

By testing your bots often throughout the creation process, you can ensure that the conversation flows as anticipated. If the dialog does not reflect your intention, you can change the dialog and save it. The latest content will be pushed into the test bot, and you can try it out again.

## Publish bots and analyze performance

After your bot content has been created, it needs to be published so that customers can engage with it. Published bots can be made available across multiple platforms and channels. Before a bot can be added to channels, interacted with, or used by team members, it will need to be published at least once. For example, a bot can be deployed to organizational websites, mobile applications, and messaging platforms such as Microsoft Teams or Facebook.

Publishing bots as you make changes also ensures that customers are engaging with the latest bot content. For example, if your organization's store hours change, after you have edited the Store Hours topic to reflect the changes, you will need to publish it again from within the Power Virtual Agents portal. After the bot has been published again, the updated content will be used by all channels that the bot is configured on.

## Publish a bot

When you are ready to publish your bot, select the **Publish** tab on the side navigation pane. During the publishing process, the bot will be checked for errors. Bot publishing typically takes a few minutes. When the publish is successful, the top of the page will display a green banner indicating that everything worked correctly. If errors are detected, you will be notified through a message that is displayed in the application.

The screenshot shows the Microsoft Power Virtual Agents interface. On the left, there's a sidebar with navigation links: Home, Topics, Entities, Analytics, Publish (which is selected and highlighted with a blue background), and Manage. The main content area is titled "Publish". It contains a large blue button with a white arrow icon and the word "Publish". Below this, there's a section titled "Share your bot" with a link to a "demo website". Another section titled "Optimize your bot" includes links to "Configure channels" and "See how your Bot is doing". A red box highlights the "Publish" button.

Before the bot is deployed to the different channels that use it, you might want to gain feedback from other team members. When a bot is first published, it can be made available to the demo website. You can provide the demo website's URL to team members or stakeholders to try it out. The advantage of using the demo website is that the experience is different than testing the bot during the design process. Because the test bot experience is only intended to allow bot authors to test it, the demo website link increases the pool of users that can test and provide feedback that is related to the overall experience of the bot.

To add a bot to the demo website, select the demo website link under **Share your bot**. This webpage demonstrates what your bot looks like to a user who comes to your webpage. The bot canvas is at the bottom. You can interact with it by entering text in the window or by selecting a starter phrase from the provided options.

## Publish

Excited to activate your bot? Publish it with a single click. Then, try it out on a website and configure channels to meet your customers where they are. [Learn more about publishing your bot](#)

**↑ Publish**

### Share your bot

After you publish, try out your bot on the [demo website](#) and invite team members to do the same.

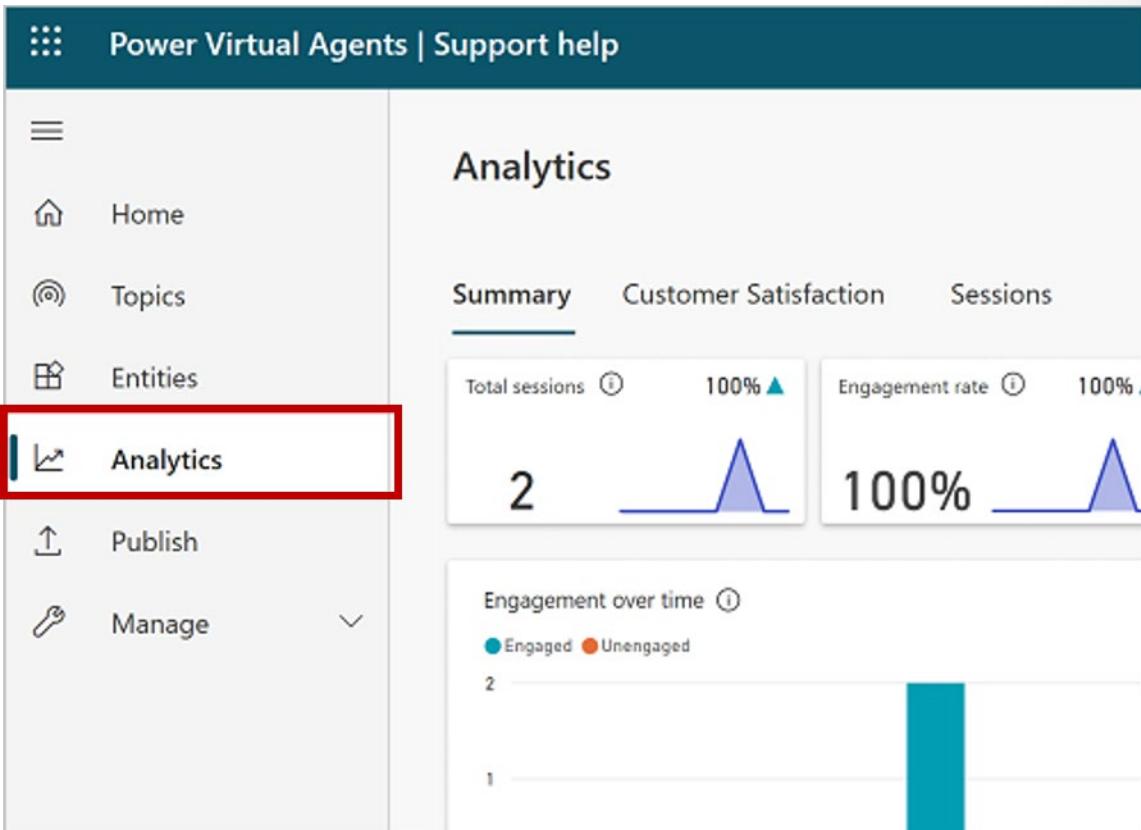
Now that the bot is published, you can begin to deploy it to other channels.

For more information, see **publishing your bot<sup>12</sup>** to other channels.

<sup>12</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/publication-fundamentals-publish-channels/>

## Analyze the performance of your bot

After a bot is deployed and customers are interacting with it, statistics that are related to the bot will become available. You can access this information through the **Analytics** tab in the side navigation pane. This pane provides key performance indicators (KPIs) that show the volume of sessions that your bot has handled, how effectively your bot was able to engage users and resolve issues, escalation rates to human agents, and abandonment rates during conversations. You will also find customer satisfaction information at the KPI level and in the **Customer Satisfaction** tab.



You can view detailed session history and transcripts by selecting **Sessions** from the **Analytics** tab. This option enables you to download a file with the full session transcript and can be a helpful way for you to adjust the performance of your bot and change the content in your topics to improve your bot's efficiency.

## Exercise - Build your first chatbot

Welcome to the Contoso Retail Company! We specialize in all the world's retail needs, and with you as our newest

Customer Support team member, we have no doubt that together we will reach higher levels of success and innovation!

Consumer sentiment is at an all-time high, but with increasing competition, it is more important than ever to minimize costs and focus on customer satisfaction so that we can maintain our competitive edge in having a robust customer base, while continuing to invest back into the customer experience and maximize our customer lifetime value.

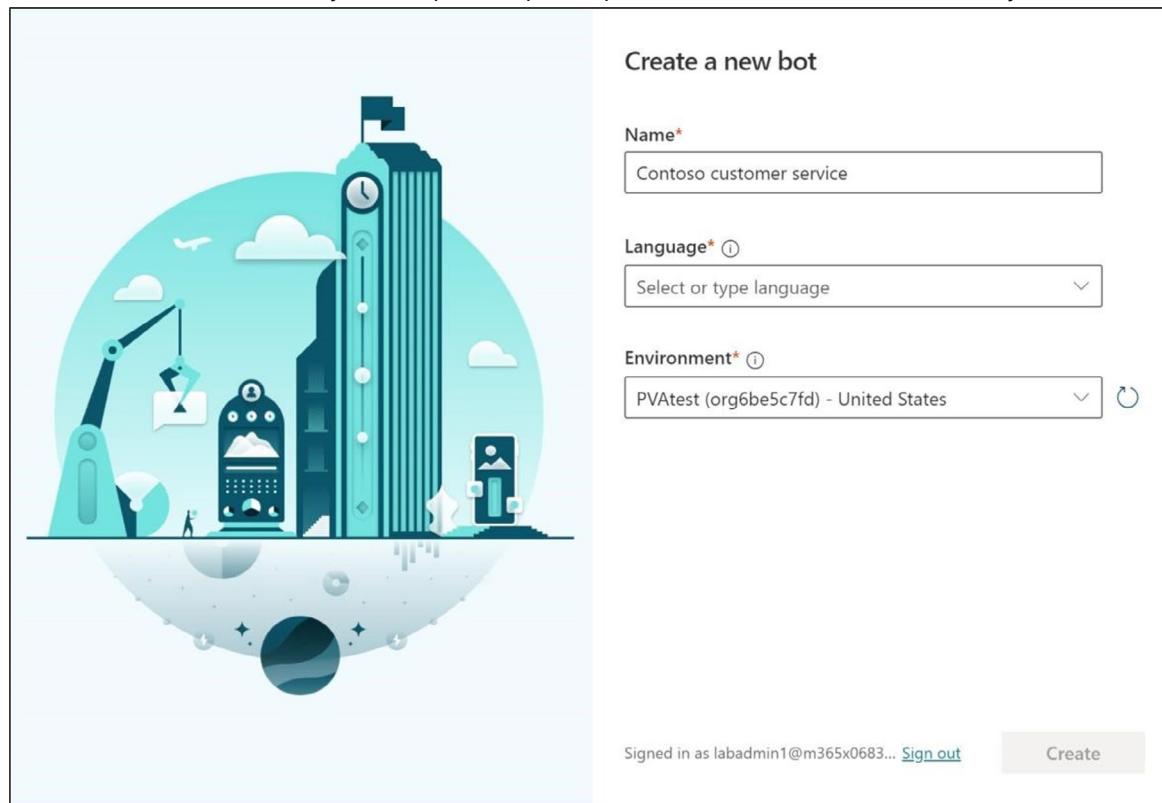
Customer support costs have continued to rise as the customer base has grown, and the company can no longer continue to expand the Customer Support team. You have been tasked with finding a solution using Power Virtual Agent.

## Exercise 1: Build your first chatbot

In this exercise, you will go through the steps of creating, deploying, and testing your first bot to handle a common customer request.

### Task 1: Sign in to create a bot

1. Go to <https://powerva.microsoft.com/> and select **Sign in**. Sign in with your own work or school account.
2. Select the region/country and select Get Started.
3. Name your bot anything you like (such as "Contoso customer service"). Select the **Language**, then select the **bot environment** you set up in the pre-requisites. A bot environment is where your



organization will store, manage, and share the bot, business data, apps, and Power Automate flows.

4. Select **Create**.

**Note:** Once you select **Create**, the process of creating the first bot within a new environment can take up to 15 minutes. Subsequent bots will be created much faster.

After you create your bot, it appears in the list under the robot icon on the navigation bar.

**Tip:** If you've created a bot in this environment before, to create another bot select the robot icon on the navigation bar, and then select **New bot**.

## Task 2: Take a quick tour of the user interface

Power Virtual Agents makes it easy to build your bot without ever writing a line of code. Let's take a quick tour of the six main pages:

The screenshot shows the Power Virtual Agents Home page. On the left, there is a navigation sidebar with the following items and their corresponding numbers: Home (1), Topics (2), Entities (3), Analytics (4), Publish (5), and Manage (6). Below these are Channels, Authentication, and Skills. At the bottom of the sidebar is a 'Test your bot' button. The main content area is titled 'Power Virtual Agent' and has a 'Get started' section. It features three cards: '1. Author topics' (with a sub-section 'Customize your greeting'), '2. Publish your bot' (with icons for various channels like Facebook and Twitter), and '3. Monitor performance' (with a chart showing 'Total Sessions: 6792', 'Resolution rate: 65%', and 'Engagement over time'). At the bottom of the main content are links: 'Go to Topics', 'Go to Publish', and 'Go to Analytics'.

1. **Home** page, which includes shortcuts to **Customize your greeting** and to the Topics, Publish, and Analytics pages, as well as links to **Power Virtual Agents documentation**, **Support community** where you can ask questions, and **Idea forum** for sharing ideas and leaving product feedback.
2. **Topics** page, where you view, delete, create, and edit conversation topics.
3. **Entities** pages, where you view and create entities that Power Virtual Agents can recognize in customer conversations and load into variables.
4. **Analytics** page, where you view metrics to monitor how well your bot is serving your customers and find ways improve it.
5. **Publish** page, where you can publish the bot for team testing or to engage with your customers.
6. **Manage** page, where you can select the **Channels** (such as your website or Facebook) you want customers to interact with your bot, configure **Authentication** to let your users sign in to their account with you when using the bot, and extend your bot's conversational capabilities with **Skills**.

## Exercise 2: Try out a conversation in the Test Bot pane (Hello!)

Now let's try out the bot using one of the four pre-built lessons included when you create a new bot.

The screenshot shows the 'Entities' section of the Power Virtual Agents interface. On the left, there's a sidebar with options like Home, Topics, Entities (which is selected), Analytics, Publish, and Manage. Below the sidebar, there's a 'Test your bot' button with a blue icon. The main area displays a table of entities with columns for Name, Description, Method, and Modified by. Each entity has a small 'Edit' icon next to it.

Name ↑	Description	Method	Modified by
Age	Age of a person, place, or thing, extracted as a number	Prebuilt	02/13/2018
Boolean	Positive or negative responses, extracted as a Boolean	Prebuilt	02/13/2018
City	City names, extracted as a string	Prebuilt	02/13/2018
Color	Primary colors and hues on the color spectrum, extracted as a string	Prebuilt	02/13/2018
Continent	Continent names, extracted as a string	Prebuilt	02/13/2018
Country or region	Country and region names, extracted as a string	Prebuilt	02/13/2018
Date and time	Dates, times, days of the week, and months relative to a point in time, extracted as a string	Prebuilt	02/13/2018
Duration	Lengths of time, extracted as a string, in standard TimeSpan format	Prebuilt	02/13/2018
Email	Email addresses, extracted as a string	Prebuilt	02/13/2018
Event	Event names, extracted as a string	Prebuilt	02/13/2018
Language	Language names, extracted as a string	Prebuilt	02/13/2018
Money	Monetary amounts, extracted as a number	Prebuilt	02/13/2018
Number	Cardinal numbers in numeric or text form, extracted as a number	Prebuilt	02/13/2018
Ordinal	Ordinal numbers in numeric or text form, extracted as a number	Prebuilt	02/13/2018

- To show the Test bot, in the bottom-left corner of the screen, select Test your bot. (If the button says "Hide bot", then your Test bot is already showing.) At the top of the Test bot, turn on the **Track between topics** toggle.
- At the **Type your message** prompt at the bottom of the Test bot, type: **Hello** and then select the

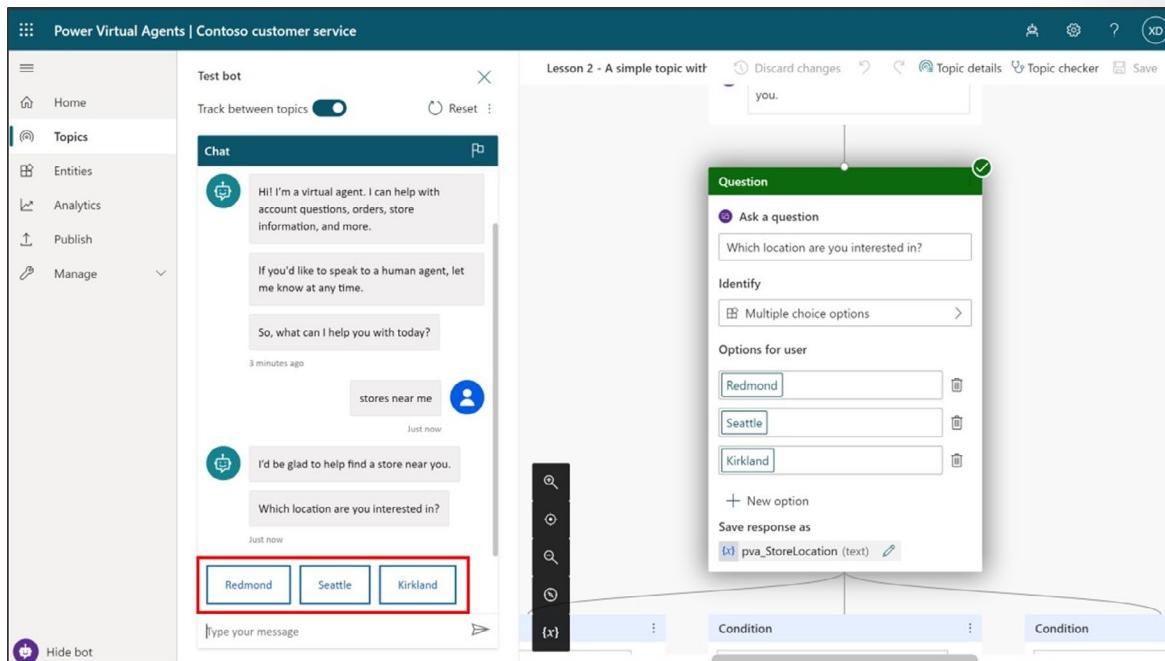
This screenshot shows the same interface as the previous one, but with the 'Test bot' window open. The 'Track between topics' toggle switch is highlighted with a red box. In the message input field, the word 'Hello' is typed. The send button, represented by a right-pointing arrow icon, is also highlighted with a red box. The rest of the interface, including the sidebar and entity list, remains the same.

**Send** button.

- In the Test bot, enter the following message and press **Send: stores near me**.

Notice that a new topic opens in the authoring canvas. You have triggered one of the pre-built topics (Lesson 2).

Now, in the test chat, pick the store location you want.



## Exercise 3: Edit your conversation

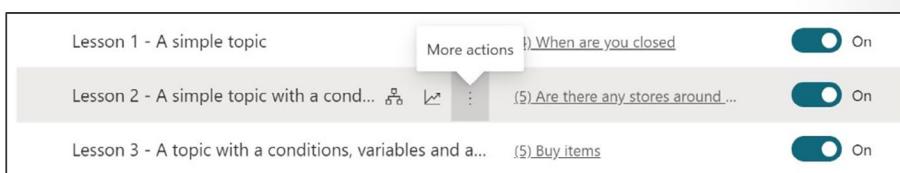
Now, let's make a change to that conversation by adding another store location. We'll make a copy first so that later you can go back to the Lessons as they were written if you want to.

### Task 1: Make a copy of the topic

- At the bottom left of the page, select **Hide bot** to put the Test bot out of your way for now.
- Toward the top left of the page, select the **Topics** tab to open the **Topics** list.
- Hover your mouse over (or use the TAB and arrow keys to select) the row for the prebuilt topic **Lesson 2 - A simple topic with a condition and variable**.

The topic action buttons will appear in the row.

Click **More actions** and then click **Make a copy**.



Lesson 1 - A simple topic	(4) When are you closed	<input checked="" type="checkbox"/> On
Lesson 2 - A simple topic with a cond...	Make a copy	<input checked="" type="checkbox"/> On
Lesson 3 - A topic with a conditions, variables and a...	Delete	<input checked="" type="checkbox"/> On

A copy of the topic will appear at the top of the Topics list and its **Status** is set to Off. We will turn it on later when we're ready to test our changes.

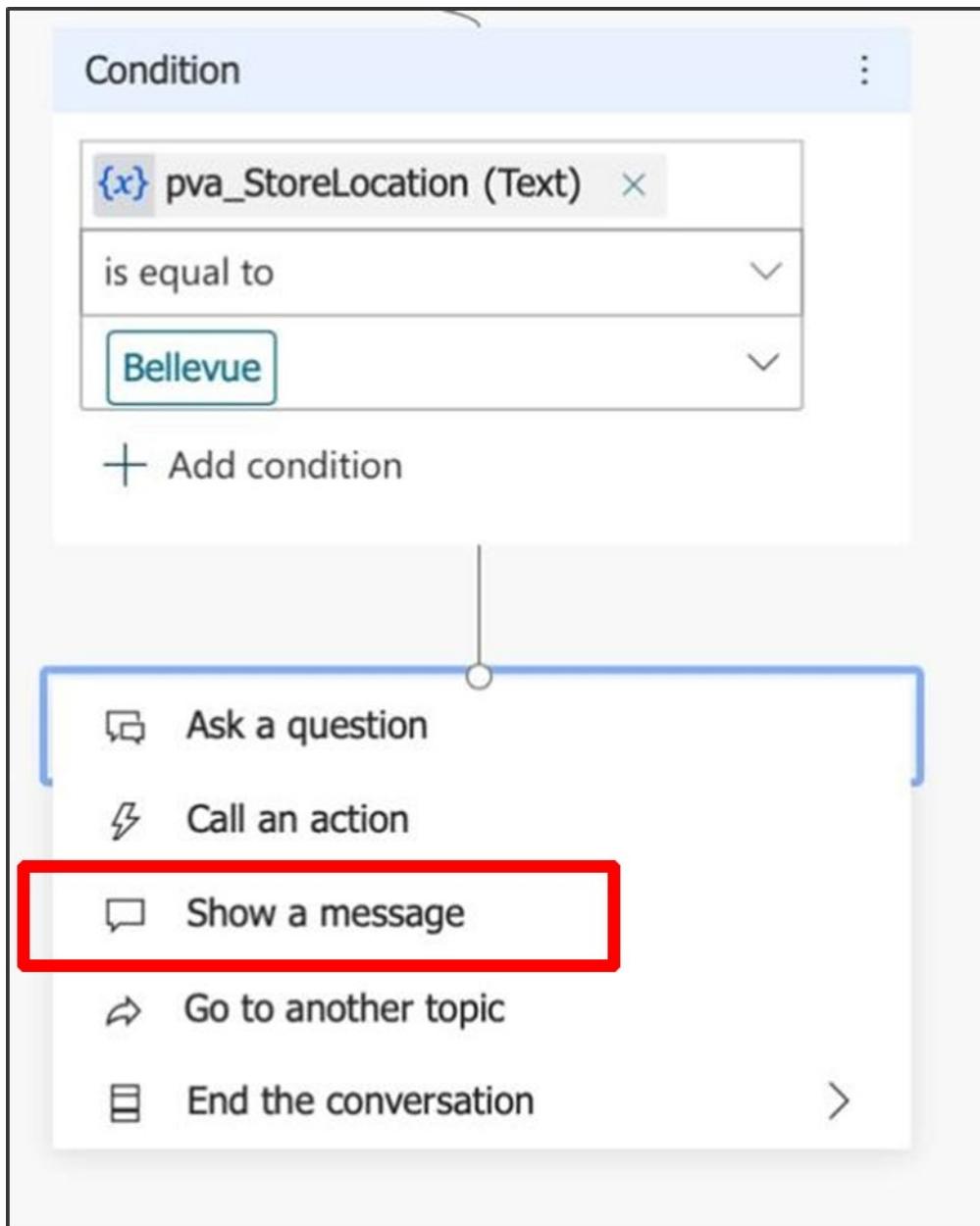
## Task 2: Edit the copy of the topic

1. Select the name of the copied topic (the one at the top of the **Topics** list) to open the topic.
2. Select the current text in the **Name** field, delete it, and type to rename the topic to **Get store locations**.
3. Select **Save topic** in the upper right corner of the page.
4. Let's imagine you opened a new store in Bellevue. To add the store info to your bot, you need to edit the topic design in the authoring canvas. Select **Go to authoring canvas**.
5. Scroll down the page to see the conversation design.
6. Scroll to the Question node that asks "Which location are you interested in?". We're going to add another option here.

The screenshot shows the Power Virtual Agents interface. On the left, there's a sidebar with navigation links: Home, Topics (selected), Entities, Analytics, Publish, Manage, and Hide bot. The main area has a 'Test bot' section with a 'Chat' window. The chat history includes messages from the bot and the user. On the right, there's a detailed view of a 'Get store locations' topic. It shows a 'Question' node with the text 'Which location are you interested in?' and an 'Identify' section with 'Multiple choice options'. Below that, there's an 'Options for user' section containing three buttons: Redmond, Seattle, and Kirkland. A red box highlights the '+ New option' button. At the bottom, there's a 'Save response as' dropdown set to '(x) pva\_StoreLocation (text)'.

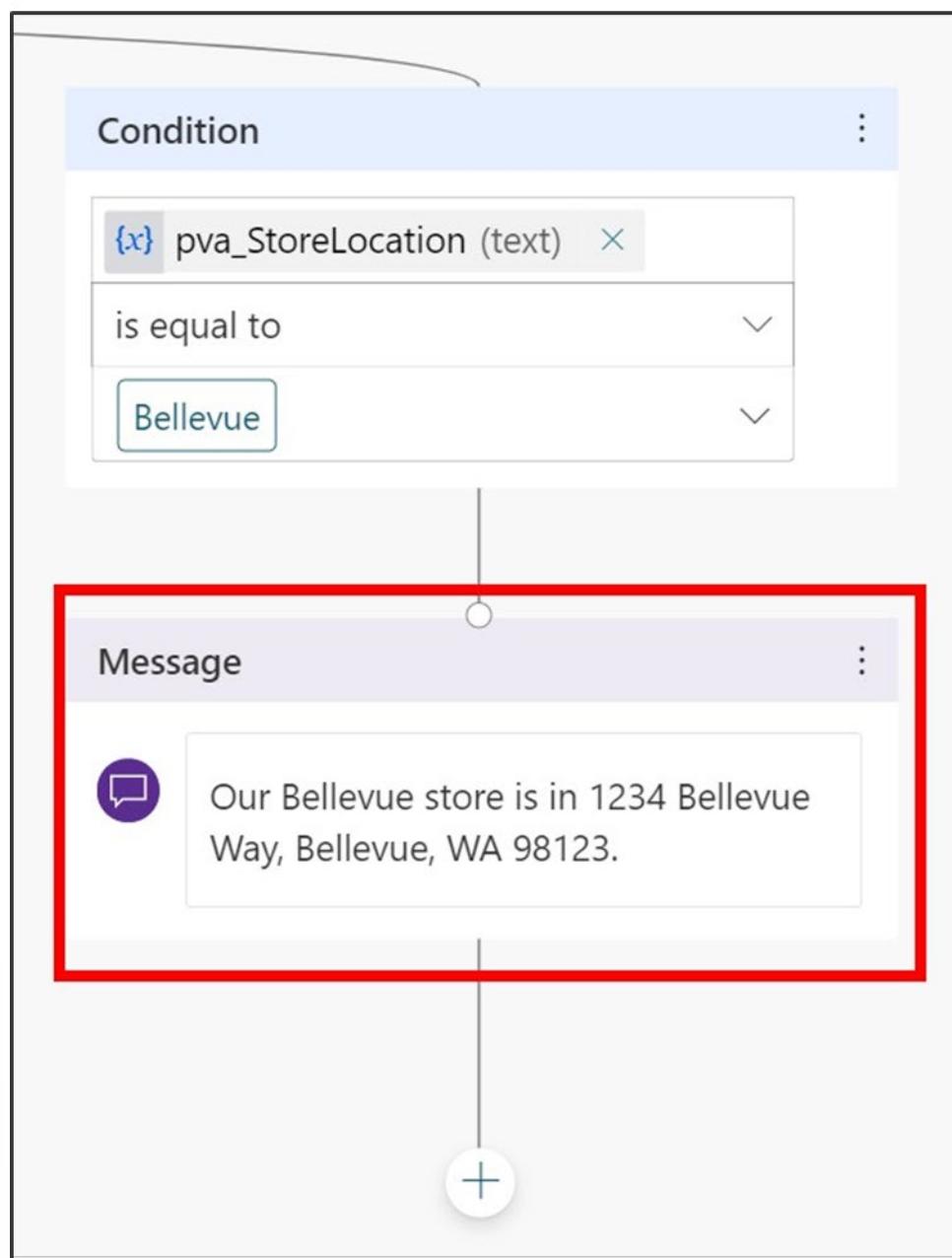
7. Under "Redmond" "Seattle" "Kirkland," select **+ New option**
8. In the Question node (**NOT** in the Condition node), type **Bellevue** in the newly added empty box under **Options for user**.

**Note:** The **Options for user** section controls what buttons are visible to users in the chat window, and always need to be matched with a condition, or the button won't work. The Conditions, however, can handle the user typing something that is not shown in a button. So for instance if you were to delete the Bellevue **Options for user** button, it would not delete the Bellevue Condition node, which would be used if the user types "Bellevue" when asked for a location.



- From the options that appear, select **Show a message**.

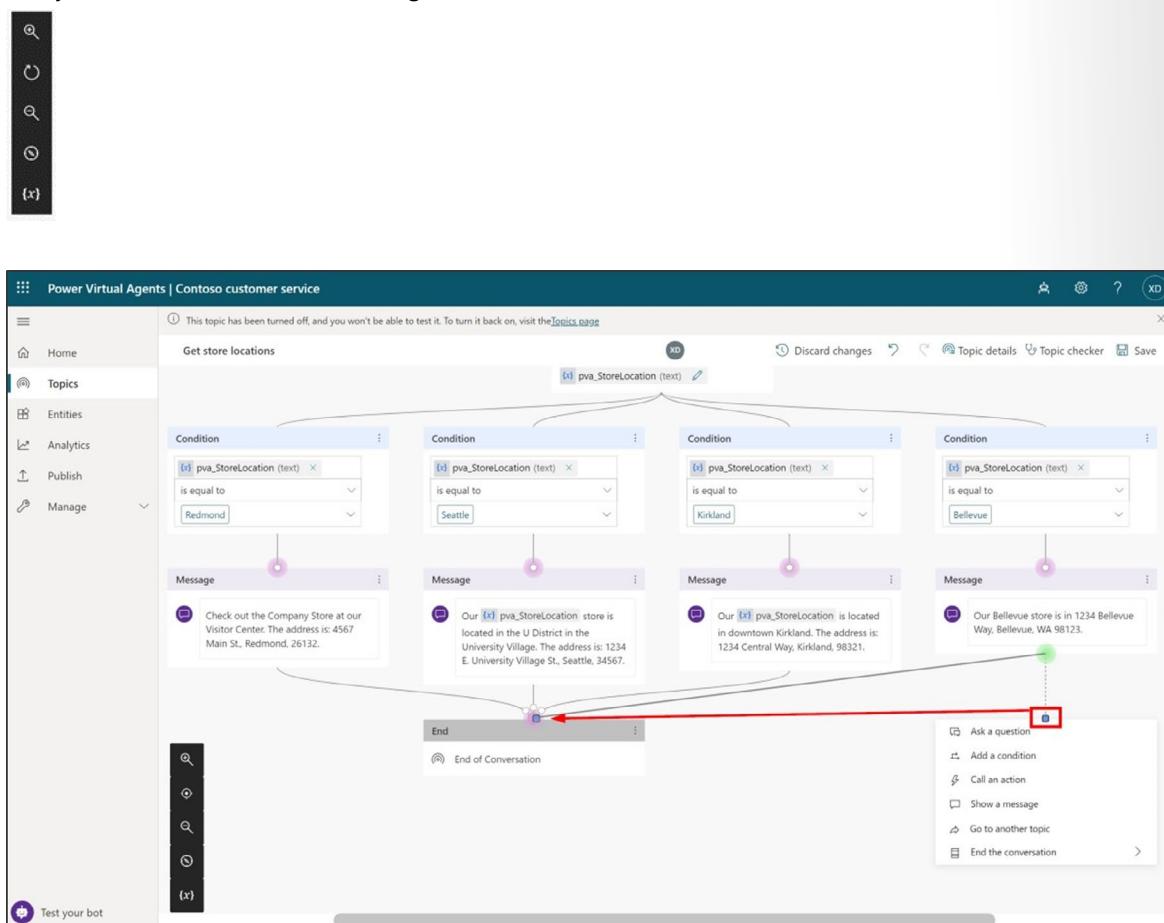
10. In the Message node, enter the store location info: **Our Bellevue store is in 1234 Bellevue Way,**



**Bellevue, WA 98123.**

**Note:** You can format the message text using the formatting buttons that appear while you're typing. You can even replace the name of the location with the value of the `pva_StoreLocation` variable by using the `{x}` control.

11. First, zoom out if necessary to see the **End of conversation** node on your screen. (**Zoom out** is in the utility bar on the left of the authoring canvas.)



12. Select the **Add node** button below the Bellevue location Message node.
13. When the list of options appears, instead of selecting an option, hover your mouse over the connector dot at the top, which will turn pink. Then select the dot and drag the connector to the left until you connect with the top of the **End of conversation** node (which is already connected to the other three

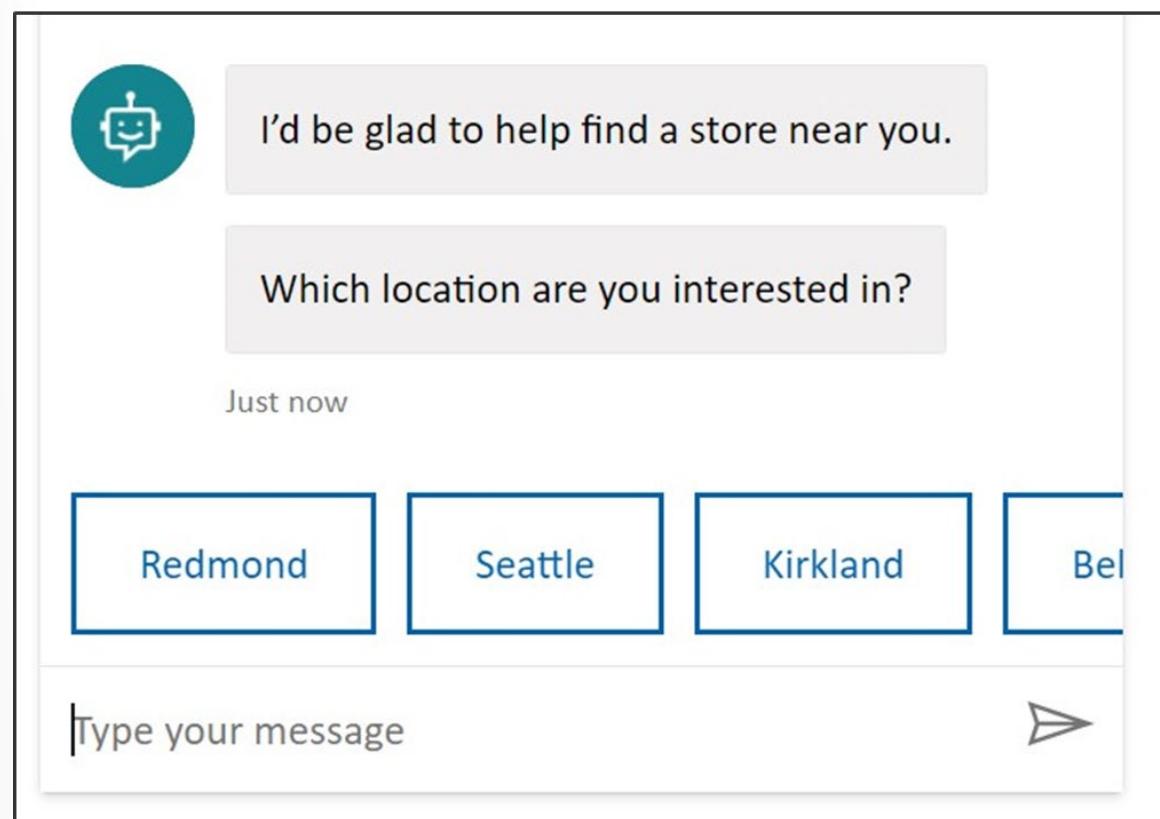
Topics					
Existing (13)		Suggested (0)		Search existing topics	
Name	Trigger phrases	Status	Errors	Modified	
<b>User Topics (5)</b>					
Get store locations	(S) Are there any stores around the area	On		1/20/20, 11:38 AM	
Lesson 1 - A simple topic	(S) When are you closed	On		1/20/20, 11:20 AM	
Lesson 2 - A simple topic with a condition and variable	(S) Are there any stores around the area	Off		1/20/20, 11:20 AM	
Lesson 3 - A topic with a conditions, variables and a pre-built e...	(S) Buy items	On		1/20/20, 11:20 AM	
Lesson 4 - A topic with a conditions, variables and custom entity.	(S) What is the best product for me	On		1/20/20, 11:20 AM	

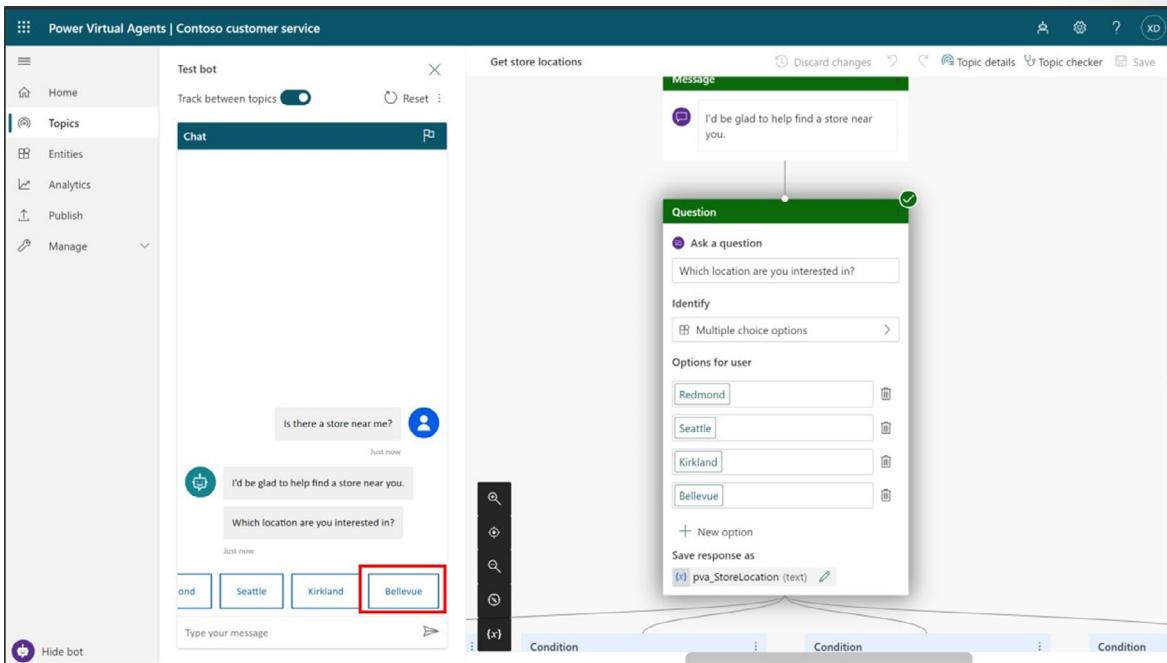
- location messages).
14. At the top right of the page, select **Save** to save the changes you made.

### Task 3: Turn on your topic and test your changes

You may recall that when we made a copy of the Lesson 2 topic, the copy was created in an Off state. This means you can't trigger the topic in the test bot (and if you published your bot, your users couldn't trigger it either). We're ready to turn on the edited topic now.

1. Select the **Topics** tab in the left navigation to return to the Topics list.
2. Select the **Status** toggle from On to **Off** for **Lesson 2 - A simple topic with a condition and variable** and select the **Status** toggle from Off to **On** for **Get store locations**. Now, you can test the conversation you edited.
3. In the bottom-left corner of the page, select **Test your bot**. Make sure the **Track between topics** toggle is set to the **On** position. In the test bot, enter **Is there a store near me?** and select the **Send** button.
4. When asked to select a location, select the **Bellevue** location in the test chat. (You might need to use the onscreen right arrow to see the Bellevue option. If you don't see the option at all, make sure you did steps 1, 2, and 3 of this task.)





The bot replies with location info for Bellevue store. Notice that the conversation continues in the **End of conversation** system topic. Feel free to keep chatting with the test bot.

## Exercise 4: Publish your bot to the demo site for testing

Power Virtual Agents provides a demo website so that you can invite anyone to test your bot by sending them the URL. This demo website is useful to gather feedback to improve the bot content before you activate the bot for your real customers.

1. Go to the **Publish** tab on the left navigation pane.
2. Select **Publish** to push the latest bot topics to the demo website. You will need to do this before you use the demo site the first time and also after you make changes to the bot topics that you want people to test on the demo website. (When you've created your real chatbot, you will Publish each time you want to make updated topics available to your customers.)
3. Select the link for the **demo website**.
4. When the demo site window opens, you can interact with the bot canvas by typing at the **Type your message** prompt or by selecting a starter phrase from the provided options.
5. You can share the URL of the **demo website** with your team.

Congratulations! You have built and published your first chatbot!

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1.Which of the following Power Virtual Agents components is used to define the conversation path between a customer and the bot?

- Entities
- Topics
- Variables
- Channels

## Multiple choice

2.Which setting on the Test bot panel lets you monitor a test conversation that spans across multiple topics?

- Switch between topics
- Monitor between topics
- Track between topics
- Follow between topics

## Multiple choice

3.What must be done at least once before a bot can be deployed to different channels, such as websites, Microsoft Teams, or Facebook?

- Publish the bot
- Test the bot
- Define synonyms
- Create entities

## Summary

With customers demanding more personalized and efficient customer service experiences, organizations are turning to bots. Bots help provide customers with a self-service support solution that can be interacted with through natural language that simulates human conversation. Bots can resolve simple or common issues, allowing agents to focus on more complicated issues that might require more time. Bots can incorporate information from other systems into the conversation to provide a personalized experience to customers, including the ability to schedule meetings, assign cases, or send emails. With Power Virtual Agents, organizations can create powerful bots through a guided, no-code graphical interface. Organizations can use the power of bots to eliminate the gap between the subject matter experts and the development teams and to remove the complexity of exposing teams to the nuances of conversational AI and the need to write complex code.

This module examined how to get started with Power Virtual Agents, create and deploy bots, and deploy them for consumption across multiple channels, including:

- Introducing bots, explaining where they are being used, and providing an overview of how Power Virtual Agents can be used to create bots.
- Examining how to work with and create bots in different environments to tailor the bot content that is being used based on factors such as teams, regions, or other factors.

- Reviewing the process for creating a bot and how to work with the Power Virtual Agents user interface.
- Explaining what topics are, the different types that are available, and how they are used as part of a bot.
- Examining the tools that are available to assist you with testing your bot.
- Reviewing the process for publishing a bot so that it can be made available across multiple channels and describing the analytics that are available when the bot is published.

Your next step would be to gain a deeper understanding of how to design effective conversation paths to provide users with a better overall experience. This additional learning would include gaining a deeper understanding of what conversation nodes are available, examining how entities and variables can be used to capture and store relevant data, and examining the tools that are available for topic management. You can also use Customer Service Insights to analyze the support topics that come through your entire support operation and understand which to consider automating through Power Virtual Agents.

# Enhance Power Virtual Agents bots

## Introduction

Microsoft Power Virtual Agents empowers your teams to create powerful bots through a guided, no-code graphical interface. This ability allows you to use the benefits of bots without having to rely on data scientists or developers, and it helps to address many of today's challenges in building bots. With Power Virtual Agents, you can eliminate the gap between the subject matter experts and development teams that are building the bots, and you can reduce latency between teams recognizing an issue and updating the bot to address the issue. Power Virtual Agents also removes the complexity of exposing teams to the nuances of conversational AI and the need to write complex code.

Power Virtual Agents helps make creating bots quick and simple, and it includes the following features that help you enhance your bot's functionality to make it even more powerful:

- **Initiate Microsoft Power Automate flows** - You can initiate Power Automate flows directly from topics in your bot. This feature allows you to include personalized information for other services in the message content that is being provided.
- **Pass conversations to live agents** - Bots can be configured to pass conversations, including the context of the conversation, to applications such as Omnichannel for Microsoft Dynamics 365 Customer Service, where live agents can take over the task of working on the conversation.
- **Automate topic creation** - You can extract content from existing support pages, such as Frequently Asked Questions (FAQs), and then convert it into bot topics that can be used in conversations. Topics can also be created from topics that are suggested in Microsoft Dynamics 365 Customer Service Insights.

This module will examine some of the additional capabilities that are available to help you enhance your Power Virtual Agents bots.

## Use Power Automate to add actions

Frequently, when a bot interacts with customers, it might require information from other applications to provide the customer with a personalized experience. For example, if a customer asks about the weather for their location, the bot could pass the location details, such as the customer's city and postal address, to a weather service that will retrieve the forecast for their location. The forecast details can be sent back to the bot, which can then include those values in a message back to the customer.

Power Virtual Agents bots perform these types of actions by calling Microsoft Power Automate flows. Flows can help automate activities, call operating systems, or engage with external applications. For example, Power Automate would pass the location information that is captured in the bot to an external service and then send the forecast details back to the Power Virtual Agents bot.

Power Automate flows are called from within topics by using the **Call an action** node. You can use a flow that already exists in your **Power Apps environment**<sup>13</sup>, or you can create one from within the Power Virtual Agents **authoring canvas**<sup>14</sup>. To allow a Power Automate flow to interact with a Power Virtual Agents bot, it requires a special Power Virtual Agents trigger. This trigger will capture data from the bot and send response information back to the bot.

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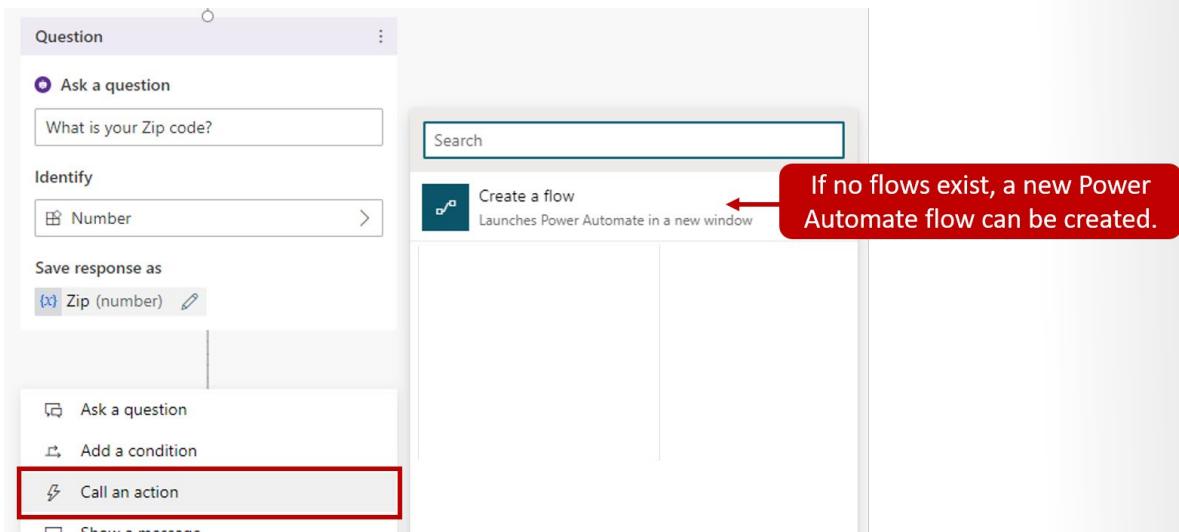
<sup>13</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/environments-first-run-experience/>

<sup>14</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-create-edit-topics/>

Power Automate provides the following trigger and action:

- **Power Virtual Agents** - Trigger that specifies input parameters that will be captured from the Power Virtual Agents bot.
- **Return value(s) to Power Virtual Agents** - Action that defines output parameters that are sent back to the Power Virtual Agents bot.

When a new flow is created from a Power Virtual Agents bot, a starter template is loaded that includes the Power Virtual Agents trigger and the Return value(s) to Power Virtual Agents action. You will only need to define the necessary input and output parameters and complete the structure of the flow.

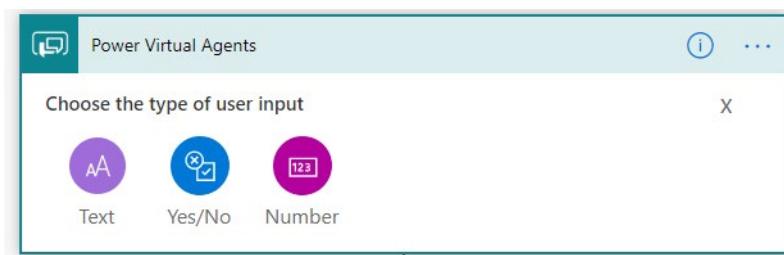


## Work with input and output parameters

Variables that are defined in your bot can be used to supply values to input parameters and consume values from output parameters. For example, a customer's response to the "What city do you live in?" question could be used as the value for a **City** input parameter.

## Input parameters

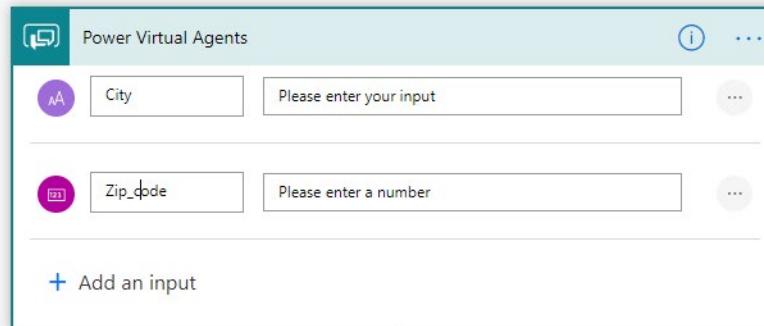
Input parameters represent values that will be captured in the Power Virtual Agents bot and used by the Power Automate flow steps. No limit is placed on the number of input parameters that you can add. However, you can only use number, string, and Boolean types as input parameters with Power Automate flows.



Consider what type of data will be required when the input parameter is passed through the flow. For example, if you intend on sending a customer's city and zip code to the MSN weather service, you might configure the input parameters as shown in the following figure.

Name	Data type
City	Text
Zip_Code	Number

The **City** parameter was defined as Text because MSN Weather consumes city names as text. The **Zip\_Code** parameter was set to Number because it is consumed as a number. Each service that Power Automate can interact with will be different, so make sure that you take time to understand how it works.

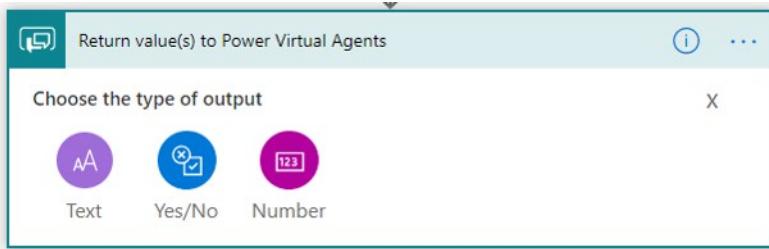


When a step to get today's weather forecast from MSN Weather is added, the city and zip code will be passed to the location so that MSN Weather knows what forecast to get.

A screenshot of the Power Automate flow editor. At the top, there is a 'Power Virtual Agents' step with two input fields: 'City' (Text) and 'Zip\_Code' (Number). Below this, a 'Get forecast for today' step is shown, with its 'Location' field containing 'City' and 'Zip\_code'. A red box highlights these parameters. A blue arrow points from the 'City' and 'Zip\_code' fields in the 'Get forecast for today' step to a 'Dynamic content' pane. The 'Dynamic content' pane shows a list of available inputs: 'Power Virtual Agents', 'City', and 'Zip\_code'. A red box highlights the 'City' and 'Zip\_code' entries. A red callout bubble with the text 'Input parameters can be inserted into flow steps.' points to the 'Dynamic content' pane.

## Output parameters

Output parameters are values from a Power Automate flow that are returned to the Power Virtual Agents bot. Like input parameters, output parameters can be a string, number, or Boolean value.



Returning to the previous weather example, after the flow has received the forecast details from the MSN weather service, you will create output parameters to store the details that are returned by the MSN weather service, where the values can be consumed by the Power Virtual Agents bot. For example, if you want to present the customer with a summary and chance of rain percentage for their location, you might create the following output parameters.

Name	Data Type
Day_summary	Text
Location	Text
Chance_of_rain	Number

The actual details to include will come from the information that is received in the MSN forecast.

The screenshot shows the "Return value(s) to Power Virtual Agents" step in Power Automate. It lists three outputs: "day\_summary" (selected), "location", and "chance\_of\_rain". A red box highlights the "Day Summary" dynamic content suggestion in a dropdown menu. A red callout bubble points to this suggestion with the text: "Output parameters can be populated with dynamic data from previous flow steps." Another red box highlights the "Day Summary" entry in the list of suggestions.

All flows that are created from the Power Virtual Agents authoring canvas are saved in a default solution in Power Automate and they can be used by your bots immediately.

## Call a Power Automate flow as an action from a bot

After your flow has been created, it can be initiated from your bot topic by using the **Call an action** node. When you call the action, variables can be passed to the flow as input parameters. Make sure that you have created a topic with appropriate trigger phrases. For example, you can create a **Get Weather** topic that includes trigger phrases such as:

- Will it rain?
- What's the weather?

The screenshot shows the 'Setup' tab of a Power Automate flow named 'Get Weather'. In the 'Trigger phrases' section, five phrases are listed: 'I would like to know the weather', 'Can you tell me the Weather?', 'Weather', 'What's the weather', and 'What the weather today?'. The 'Go to authoring canvas' button is highlighted with a red box.

- Get weather

To pass location information as variables to the Power Automate flow, you will need to capture them. The simplest way to accomplish this task is with the **Ask a question** node. You will use the **Identify** field on the question node to define what type of data that you want to capture. For example, you could set one item on the **Identify** field to **City** and the other to **Zip code**. The responses to these questions will be stored in variables.

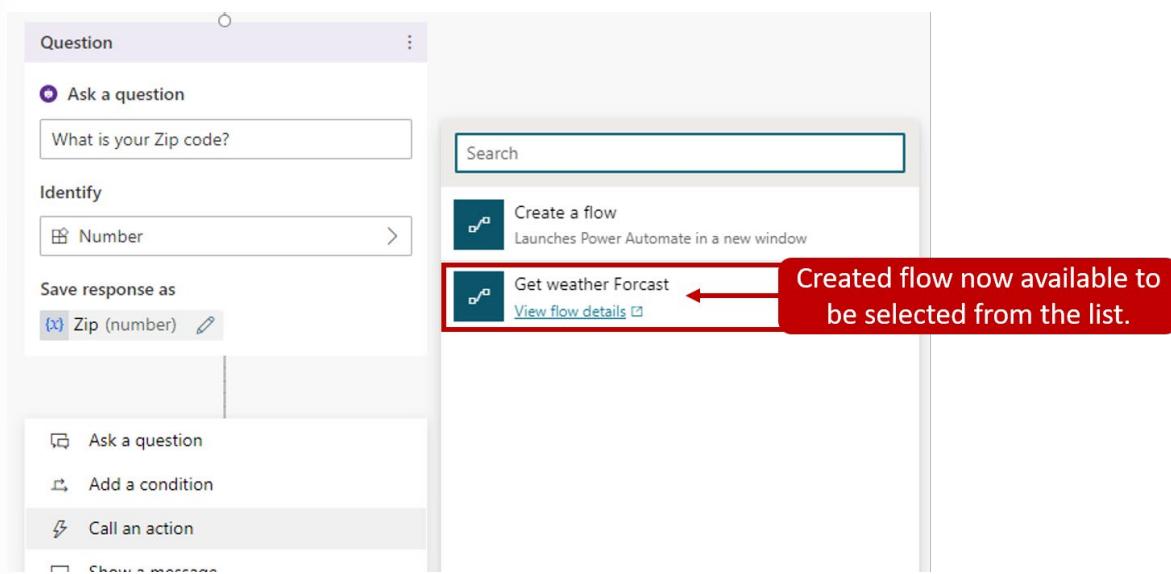
Answers to questions stored as variables.

Save response as {x} City (city) edit

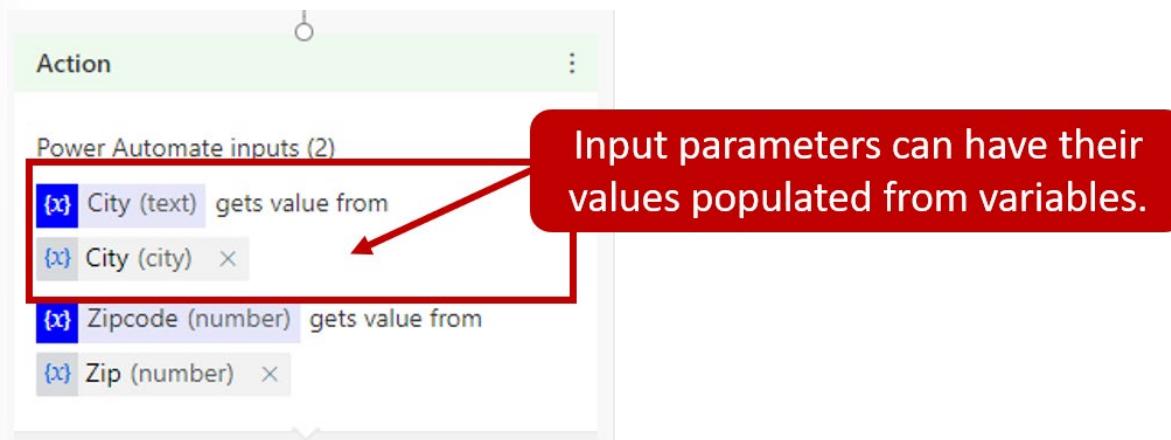
Variable names can be edited if needed.

Save response as {x} Zip (number) edit

After you have defined the questions that you will use to capture the details, add a new **Call an action** conversation node to the bot by selecting the weather flow that you created previously.



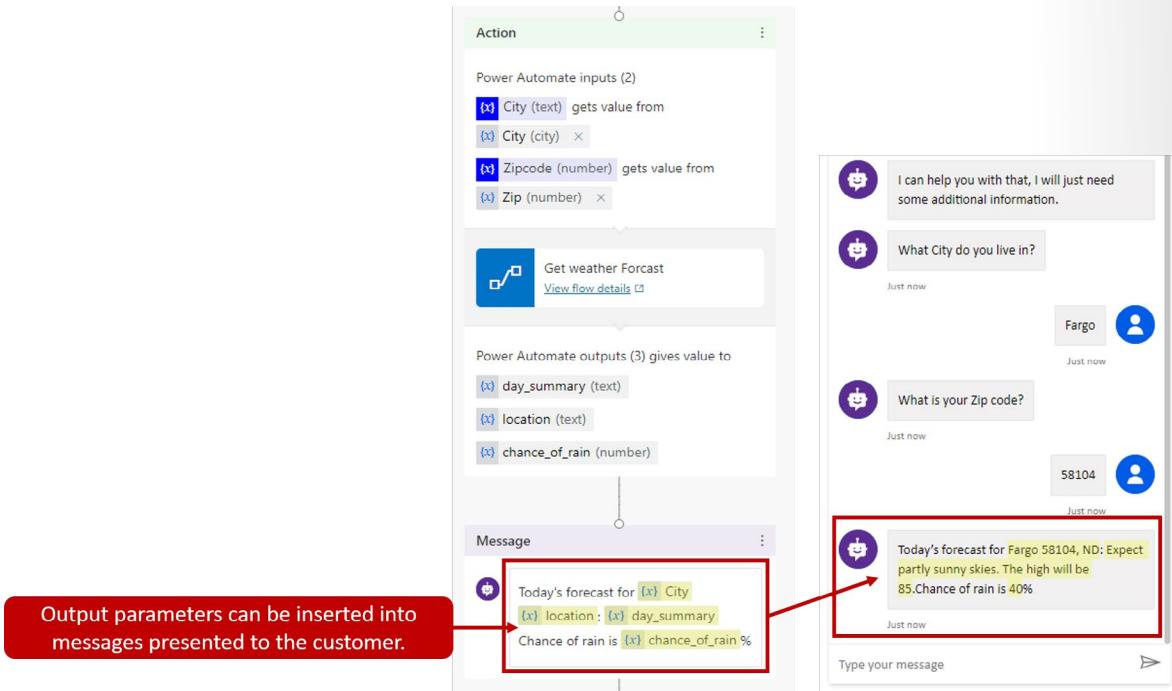
In the flow configuration, you will need to map the flow input blocks to the output variables from the question nodes. For example, **City (text)** gets its value from **City (city)** and **Zipcode (number)** gets its value from **Zip (number)**.



Now, you should be able to observe that the **Get weather Forecast** flow will be run and what output parameters will be returned from it.

Under the flow's node, add a **Message** node and then enter a message that uses the flow's outputs.

For example: **Today's forecast for** {x}location:{x}day\_summary. **Chance of rain is** {x}chance\_of\_rain%.



For more information, see [Microsoft Docs<sup>15</sup>](#).

## Transfer conversations to agents by using Omnidchannel for Customer Service

Situations might occur where a bot needs to hand off a conversation to a live agent. This situation often happens when a user has asked for information that the bot doesn't know, or after the bot has captured the necessary information that is required to ensure that the conversation can be routed correctly to a live agent. When a bot hands off a conversation to live agent, it shares the full history of the conversation (the context) and any variables with the agent. Power Virtual Agents bots can be configured to hand off conversations to agents for organizations that use Omnidchannel for Customer Service and to conduct a generic handoff, as described in [configure generic handoff<sup>16</sup>](#). This feature allows Omnidchannel for Customer Service to route incoming escalations to the appropriate live agent queue, and it also allows the live agents to review exactly what occurred in the prior conversation so that they can resume at that point. This process prevents agents from potentially asking for information that was previously captured by the bot.

### Transfer conversations to agents

Two primary components that are involved when a bot transfers to an agent are:

- Telling the bot when to transfer the conversation to an agent.
- Telling the bot where to transfer the conversation.

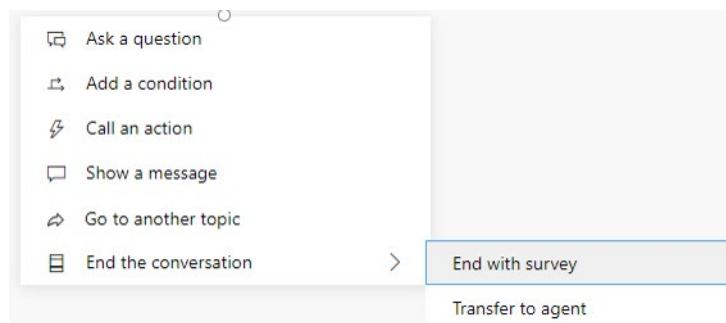
<sup>15</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-flow/>

<sup>16</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/configure-generic-handoff>

## Tell the bot when to transfer the conversation to an agent

The way that Power Virtual Agents tells the bot that it is time to transfer a conversation to an agent is always the same. Power Virtual Agents includes the **End the conversation** node, which signifies the end of the entire conversation and provides two actions that can be initiated:

- **End with survey** - A survey appears that asks the user if their question or issue was answered or resolved correctly.



- **Transfer to agent** - Escalates the conversation **to a live agent**<sup>17</sup>.

Bot authors can end a conversation and transfer to an agent from within a specific topic. For example, if a customer indicates to the bot that their entire point-of-sale system is down, the bot can automatically call the **End the conversation** node and transfer it to an agent. Another way to accomplish this task is through the **Escalate** topic. All bots include a conversation topic called **Escalate**, which includes a message that is presented to the customer and then calls the **End the conversation** node to transfer to an agent. The **Escalate** topic is automatically triggered when someone types content such as, "speak to agent." You can also trigger the **Escalate** topic from within another topic by selecting **Go to another topic** and then selecting it.

## Configure where to hand off the conversation

To facilitate the transfer of a conversation to an agent, you will need to configure the bot to send the conversation to a specific Omnichannel for Customer Service instance. Only published bots can be used to ensure that the end-to-end capabilities work as expected. Make sure that you have **published your bot**<sup>18</sup> prior to validating the integrated experience.

When you create the connection between Power Virtual Agents and Omnichannel for Customer Service, a Microsoft Azure Active Directory (Azure AD) application registration is used to call the bot. Creating the application registration is done on the **Azure portal**<sup>19</sup>. You can register your apps by going to Azure Active Directory and creating a new registration under **App registrations**.

Three primary areas that can be defined when you create the application registration are:

- **Name** - User-facing name of the application. This name can be changed later, if necessary.
- **Supported account types** - This area defines who can access the application.

<sup>17</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-hand-off/>

<sup>18</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/getting-started-deploy/>

<sup>19</sup> <https://portal.azure.com/>

The screenshot shows the 'Register an application' page in the Microsoft Azure portal. At the top, there's a warning message: '⚠ If you are building an application for external users that will be distributed by Microsoft, you must register as a first party application to meet all security, privacy, and compliance policies. [Read our decision guide](#)'.

**Name:** example-app

**Supported account types:**

- Accounts in this organizational directory only (Microsoft)
- Accounts in any organizational directory
- Accounts in any organizational directory and personal Microsoft accounts (e.g. Skype, Xbox, Outlook.com)

[Help me choose...](#)

**Redirect URI (optional):**

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web https://contoso.org/exampleapp

By proceeding, you agree to the Microsoft Platform Policies [\[link\]](#)

**Register**

- **Redirect URI (optional)** - This area contains the URL for where the app is located.

After you have defined the parameters, select the **Register** button.

For more information, see [Microsoft Docs<sup>20</sup>](#).

## Configure transfer to agent

Each bot can only be configured to send conversations to one Omnichannel for Customer Service instance. You can define the Dynamics 365 instance in the individual bot. If conversations from multiple bots will be sent to your Dynamics 365 instance, each bot will need to be configured individually.

To configure the handoff, select **Settings > Transfer to agent**. This screen allows you to define how the bot will facilitate handoff to different applications. Select the Dynamics 365 Omnichannel for Customer Service tile to begin the configuration process.

<sup>20</sup> <https://docs.microsoft.com/en-us/azure/active-directory/develop/howto-create-service-principal-portal#create-an-azure-active-directory-application>

Settings

Transfer to agent

General

Transfer to agent

System fallback

Connecting to a customer engagement app enables your bot to [Learn more about hand-off](#)

 Dynamics 365  
Omnichannel for  
Customer Service

 Bring your own  
engagement hub

The primary component that you need to provide is the application ID for the app that you previously created for the Azure AD registration. Omnichannel for Customer Service models bots as application users in the application. Modeling bots as application users ensures that the bot can have conversations sent to it like a human agent would. It is important that the application ID is unique to your organization (your Microsoft Dataverse organization or environment). Each bot that will interact with the same Omnichannel for Customer Service environment will need to use a different application ID. You might need to create multiple application registrations to support multiple bots.

In your Azure portal, go to Azure Active Directory and select **App registrations**. All registered applications will be displayed. Select the application that you want to use with the bot. The application ID will be on the **Applications overview** page. Copy the ID and paste it into the **Power Virtual Agents Application ID** field.

Power Virtual Agents uses a Microsoft **Teams channel**<sup>21</sup> to communicate with Omnichannel for Customer Service. As you go through the setup wizard, if a Teams channel has not been enabled, one will be enabled automatically.

<sup>21</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/getting-started-deploy/>

## Enter Power Virtual Agents Application ID

X

This Application ID will allow Omnichannel for Customer Service to connect with Power Virtual Agents.

Follow these steps:

1. Go to [Azure App registration](#).
2. Find the App registration for Power Virtual Agents, or create one if it doesn't exist.
3. Copy the **Application ID** of this App registration.
4. Return to this page and paste the Application ID into the field.

Power Virtual Agents Application ID

This value will come from the app registration in Azure AD.

Not sure how to create a new App registration? [Learn more about Azure AD app registration](#)

Next

The last part of the configuration process is to select the Omnichannel for Customer Service environment that you want to use with the bot. Make sure that you select an environment where your Omnichannel for Customer Service instance is provisioned. The list shows all available environments, even if Omnichannel for Customer Service is not provisioned.

When the connection has been established, you can select the **Go to Omnichannel** link to **continue configuring the bot connection in Omnichannel for Customer Service**<sup>22</sup>.

## Remove Omnichannel for Customer Service connection

As of the time when this course was published, it was not possible to remove the connection setting after it was already set up. If you erroneously connected to the wrong instance or environment, a new bot will need to be created and then connected to Omnichannel for Customer Service again.

After the handoff has been configured, you will need to finish the remaining configuration in Omnichannel for Customer Service.

For more information, see [Microsoft Docs](#)<sup>23</sup> and [configure generic handoff](#)<sup>24</sup>.

<sup>22</sup> <https://docs.microsoft.com/en-us/dynamics365/omnichannel/administrator/configure-bot-virtual-agent/>

<sup>23</sup> <https://docs.microsoft.com/en-us/dynamics365/omnichannel/administrator/configure-bot-virtual-agent/>

<sup>24</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/configure-generic-handoff/>

## Create topics for existing support content

Many organizations want to create bot topics that use existing content. This approach can provide organizations with several advantages from the time saved in creating the topic to ensuring that topics are aligned with the types of issues that are being reported.

Two ways that organizations can automatically generate topics for a bot are from Customer Service Insights topics and for existing web content such as FAQ pages.

Power Virtual Agents uses AI-assisted authoring to help organizations automatically extract and insert relevant content from existing web content topics into your bot. This feature eliminates the need to copy and paste or manually recreate content into topics.

AI evaluates the page and determines structure and content. It isolates content blocks that relate to a support issue or question and classifies them into topics. Each identified topic will follow the same structure as other topics. They will contain **trigger phrases that are identified during the process and an initial Message node<sup>25</sup>**. These topics appear as suggested topics that can be modified and deleted like other topics.

## Extract content from Customer Service Insights

Dynamics 365 Customer Service Insights uses AI to automatically group your organization's cases into topics. Because topics are already defined based on your organization's caseload, it would make sense to align the topics in a customer support bot with those topics. When deciding on which topics to automate from Customer Service Insights, you should consider topics that include:

- Items that are straightforward to resolve, which helps make it more likely that a bot can handle or resolve the issue. For example, topics that have lower average resolution time, higher resolution rate, and/or fewer escalations are items that could be considered straightforward to resolve.
- Topics that have a high volume. These types of topics allow the automation to potentially bring you more business benefit and impact.

For more information, see [Automate topics for a Power Virtual Agents bot<sup>26</sup>](#).

## Extract content from webpages

The three main steps for autocreating topics are:

1. Extract content from existing FAQ or support pages.
2. Add the suggested topics to your bot.
3. Enable the topics in your bot.

The first step in creating topics from existing content is to extract topic suggestions from existing pages that contain the support content that you want to use. To complete this step, use the **Suggest topics** command in Power Virtual Agents. The **Suggest topics** command is built to run on webpages that are in the form of FAQ pages or support sites. After the extraction is complete, the suggested topics are displayed for further review.

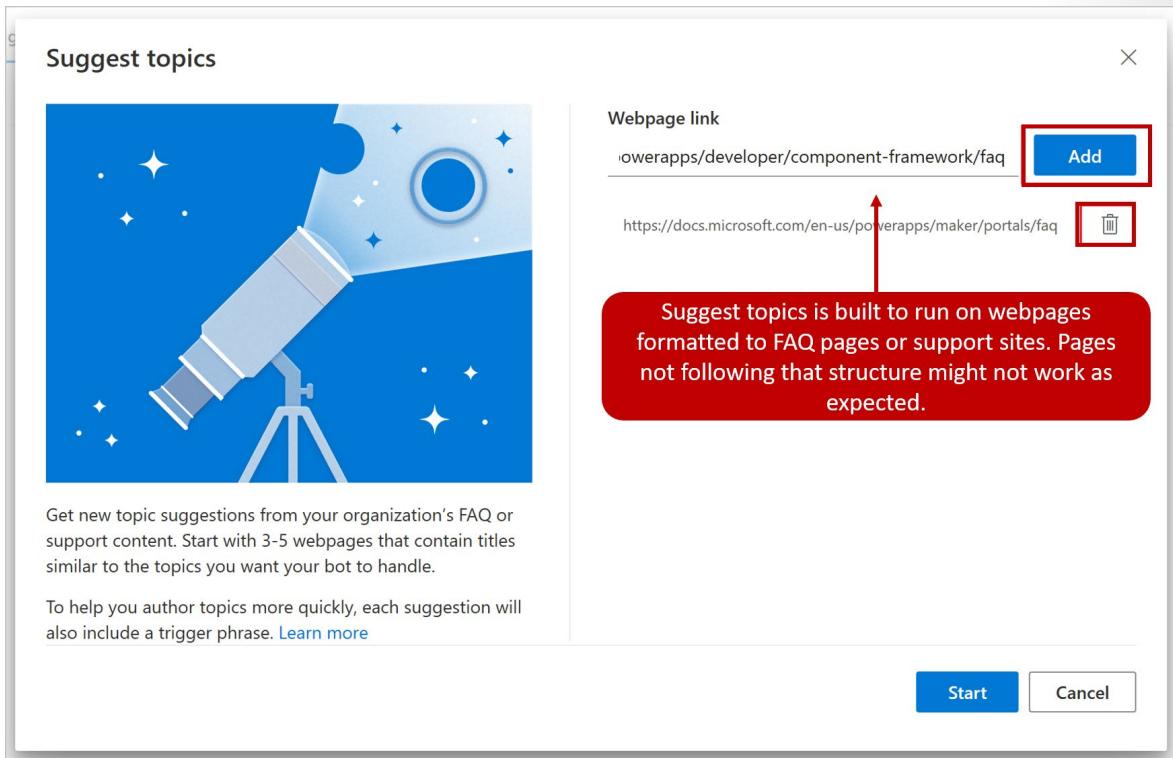
Content can be extracted by using the **Suggested** tab on the **Topics** page. When you first receive suggestions, this page will likely be blank. When topics have been extracted, the list will be displayed. To suggest topics, you will need to enter a URL for each webpage that you want to extract content from. The

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<sup>25</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-create-edit-topics/>

<sup>26</sup> <https://docs.microsoft.com/en-us/dynamics365/ai/customer-service-insights/automate-topics/>

URLs must be secure (they must start with *https://*). If you add a page by mistake, you can remove it by selecting **Delete**.



Depending on the complexity of the pages and the number of pages that you add, it can take a few minutes to extract the content. The “Getting your suggestions, this may take several minutes” message will appear at the top of the screen while the extraction is in progress. If errors are encountered during this process, the tool provides explicit feedback about errors so that you can understand and address the issue. For example, you might be unable to extract content because the site that you referenced is down. After the content has been extracted, suggestions will appear that you can review to help you decide if the topics should be added to your bot.

Topics <span style="color: #0078D4;">①</span>				
Existing (32)	Suggested (13) <span style="color: #0078D4;">←</span>	Suggested topics are not actual topics that can be consumed by the bot. They will need to be added to the bot before they can be used.		
Name	Trigger phrases	Source	Received	
FAQ	FAQ	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
Multiple components in single manif...	<span style="color: #0078D4;">↑</span> <span style="color: #0078D4;">Delete</span>	Multiple components in single...	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM
Calling Processes/Actions - FAQ	Calling Processes/Actions - FAQ	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
Calling components within another component	Calling components within an...	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
Font Resource - FAQ	Font Resource - FAQ	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
PowerApps portals FAQ	PowerApps portals FAQ	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
I'm getting an error that only one portal can b...	I'm getting an error that only ...	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
I'm getting an error that I can't delete my portal.	I'm getting an error that I can't...	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	
I'm getting an error that I can't create a portal.	I'm getting an error that I can't...	<a href="https://docs.microsoft.com/en...">https://docs.microsoft.com/en...</a>	11/10/19, 3:09 PM	

## Add suggested topics to an existing bot

Extracted topics are not automatically added as topics in your bot. After the extraction process has been completed, any topic suggestions will appear on the **Suggested** tab. This process will allow you to review the topics and determine whether you want to include them in your bot or not. You can also review the trigger phrases and message nodes that were created and make edits, if necessary.

Three options for dealing with the topic include:

- **Add to topics and edit** - Opens the topic so you can edit the trigger phrases or enter the authoring canvas to make changes to the conversation flow. After you have completed editing, the topic will be removed from the list of suggestions.
- **Add to topics** - Topic is automatically added to the list of topics and is removed from the list of suggested topics.

- **Delete suggestion** - Does not add to your list of topics and deletes the topic from the suggested

The screenshot shows a user interface for managing topics. At the top, there are buttons for 'New topic', 'Suggest topics' (which is highlighted with a red box), 'Add to topics', and 'Delete'. Below this, the word 'Topics' is followed by a help icon. Underneath, there are two tabs: 'Existing (32)' and 'Suggested (10)', with 'Suggested (10)' being underlined. A table follows, with columns for 'Name', 'Trigger phrases', and 'Source'. Six rows of suggested topics are listed, each with a checkmark icon and a trash bin icon for deletion.

Name	Trigger phrases	Source
Are there countries to which Microsoft products are禁售的?	Are there countries to which Microsoft products are禁售的?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>
May I take Microsoft encryption software with me on my trip to China?	May I take Microsoft encryption software with me on my trip to China?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>
What can you tell me about restrictions on encrypted files in China?	What can you tell me about restrictions on encrypted files in China?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>
Where can I find Microsoft download links for China?	Where can I find Microsoft download links for China?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>
What does the label "For Distribution in U.S./Canada Only" mean?	What does the label "For Distribution in U.S./Canada Only" mean?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>
What is the classification of Windows Operating Systems in China?	What is the classification of Windows Operating Systems in China?	<a href="https://www.microsoft.com/">https://www.microsoft.com/</a>

topics.

## Enable topics in your bot

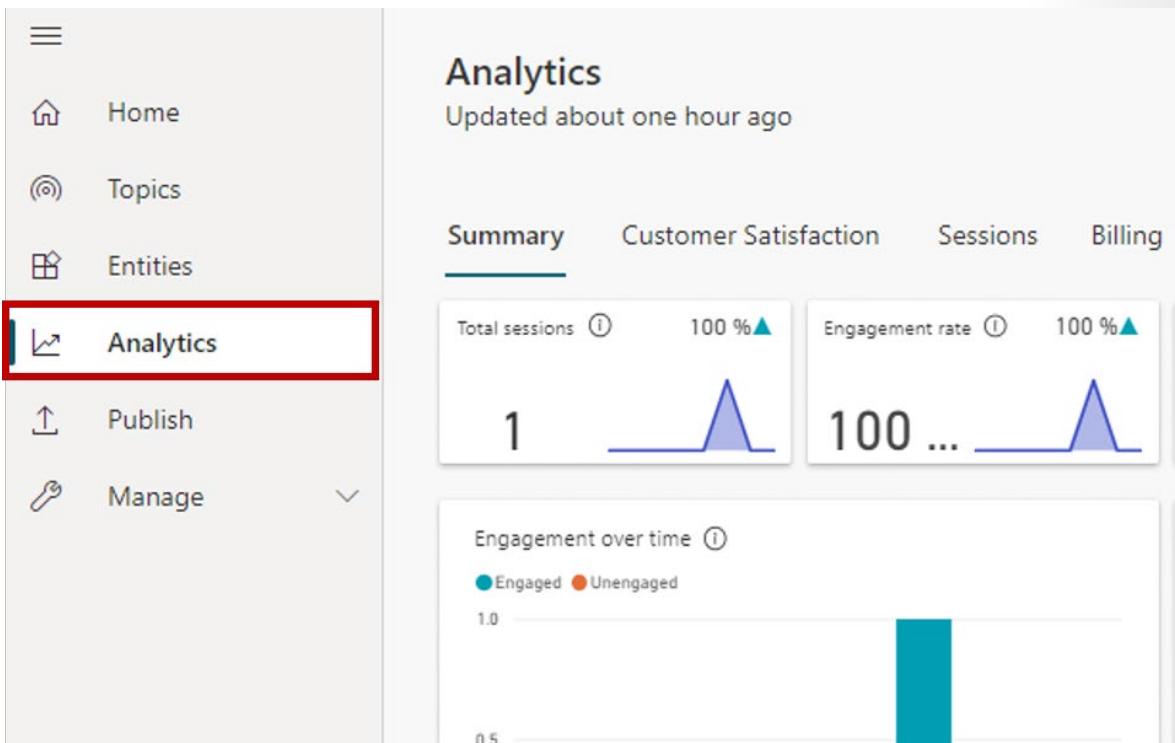
After a suggested topic has been added to the **Existing** tab, the status is set to **Off**. This setting will ensure that the topic is not prematurely added to your bot before you have had time to make the necessary changes to it, such as modifying trigger phrases or adding more conversation nodes to enhance the topic as required. When a topic is ready to be used, you can set the status to **On**.

The screenshot shows the 'Topics' section of the Microsoft Bot Framework. At the top, there are buttons for 'New topic' and 'Suggest topics'. Below this, the 'Topics' heading has a tooltip: 'After it has been added, the topic moves to the Existing tab.' A red box highlights the 'Existing (35)' link. To the right, there's a search bar and another tooltip: 'The topic needs to be turned on before the bot can consume it.' A red box highlights the toggle switch for the first item, which is set to 'Off'. The main table lists various topics with their trigger phrases and status toggles.

Name	Trigger phrases	Status
Font Resource - FAQ	(1) Font Resource - FAQ	Off
Calling Processes/Actions - FAQ	(1) Calling Processes/Actions - FAQ	Off
Multiple components in single manifest file	(1) Multiple components in single manifest file	Off
Store Hours	(60) Are you closed now?	On
Lookup balance of gift card	(33) Balance for gift cards	On
Pay bill	(56) Bill payment	On

## Analyze bot performance

After a bot is deployed and customers are interacting with it, statistics that are related to the bot will become available. You can access this information through the **Analytics** tab in the side navigation pane. On this tab, you can find key performance indicators (KPIs) that show the volume of sessions that your bot has handled, how effectively your bot was able to engage users and resolve issues, escalation rates to human agents, and abandonment rates during conversations. You will also find customer satisfaction information at the KPI level and on the **Customer Satisfaction** tab.

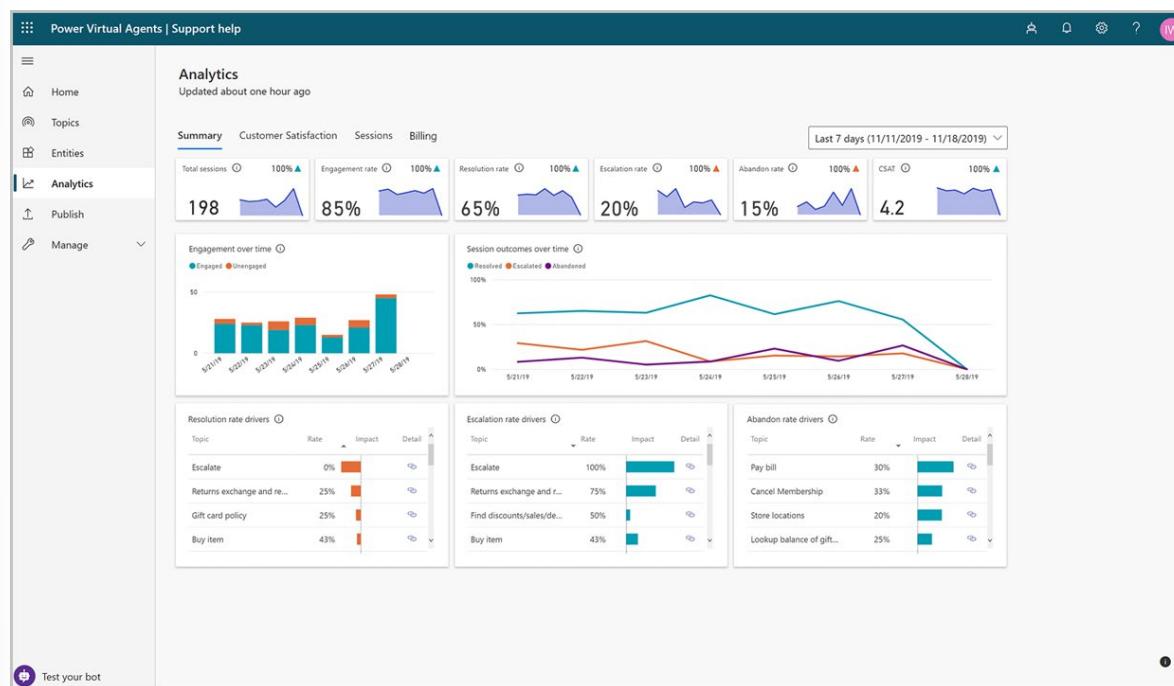


You can also view detailed session history and transcripts by selecting **Sessions** from the **Analytics** tab. On the **Sessions** page, you can download a file with the full session transcript, which can be a helpful way for you to adjust the performance of your bot and change the content in your topics to improve your bot's efficiency.

## Analyze bot performance and usage

The **Summary** page gives you a broad overview of your bot's performance. It uses AI technology to show you which topics have the greatest impact on escalation rate, abandon rate, and resolution rate. For more information, see the table under **Summary charts**<sup>27</sup>.

<sup>27</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#summary-charts/>



The **Summary** page includes a variety of charts with graphical views of your bot's KPIs:

- **Summary charts<sup>28</sup>** - Summarize KPIs for a specified period and the percent change over the period.
- **Engagement over time chart<sup>29</sup>** - Graphical view of the number of engaged and unengaged sessions over time.
- **Session outcomes over time chart<sup>30</sup>** - Graphical view of the daily resolution rate, escalation rate, and abandon rate over the specified time period.
- **Resolution rate drivers chart<sup>31</sup>** - Displays topics in order of their impact on the resolution rate over the specified time period.
- **Escalation rate drivers chart<sup>32</sup>** - Displays topics in order of their impact on the escalation rate over the specified time period.
- **Abandon rate drivers chart<sup>33</sup>** - Displays topics in order of their impact on the abandon rate over the specified time period.

For more information, see [Analyze bot performance and usage<sup>34</sup>](#).

The **Engagement rate drivers**, **Abandon rate drivers**, and **Resolution rate drivers** charts use natural language understanding to group issues as topics. These charts show you the topics that have the most impact on the performance of your bot.

<sup>28</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#summary-charts>

<sup>29</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#engagement-over-time-chart>

<sup>30</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#session-outcomes-over-time-chart>

<sup>31</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#resolution-rate-drivers-chart>

<sup>32</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#escalation-rate-drivers-chart>

<sup>33</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#abandon-rate-drivers-chart>

<sup>34</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary/>

## Analyze customer satisfaction for Power Virtual Agents bots

The **Customer Satisfaction** page provides a detailed view of customer satisfaction (CSAT) survey data, including the average CSAT score over time and the topics that have the most impact on the CSAT score. The **Customer Satisfaction** page includes a variety of charts with graphical views of your bot's customer satisfaction indicators:

- **Customer satisfaction drivers chart<sup>35</sup>** - Uses AI to group related support cases as topics and then displays topics in order of their impact on customer satisfaction over the specified time period.
- **Scores over time chart<sup>36</sup>** - Provides a graphical view of the average CSAT score over the specified time period.
- **Average CSAT score<sup>37</sup>** - Provides a graphical view of the average of CSAT scores for sessions in which customers respond to an end-of-session request to take the survey.
- **CSAT survey response rate<sup>38</sup>** - Shows the number of CSAT surveys that were presented and the percentage of surveys that were completed.

For more information, see [Analyze customer satisfaction<sup>39</sup>](#).

## Analyze topic usage in Power Virtual Agents

The topic details page provides a view into the performance of individual topics and how they can be improved. You can display the topic details page by selecting the **Detail** link in one of the following charts on the **Summary<sup>40</sup>** and **Customer Satisfaction<sup>41</sup>** pages:

- **Summary page**
  - **Escalation rate drivers<sup>42</sup>**
  - **Abandon rate drivers<sup>43</sup>**
  - **Resolution rate drivers<sup>44</sup>**
- **Customer Satisfaction page**
  - **Customer satisfaction drivers<sup>45</sup>**

<sup>35</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat#customer-satisfaction-drivers-chart>

<sup>36</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat#scores-over-time-chart>

<sup>37</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat#average-csat-score-chart>

<sup>38</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat#csat-survey-response-rate-chart>

<sup>39</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat/>

<sup>40</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary/>

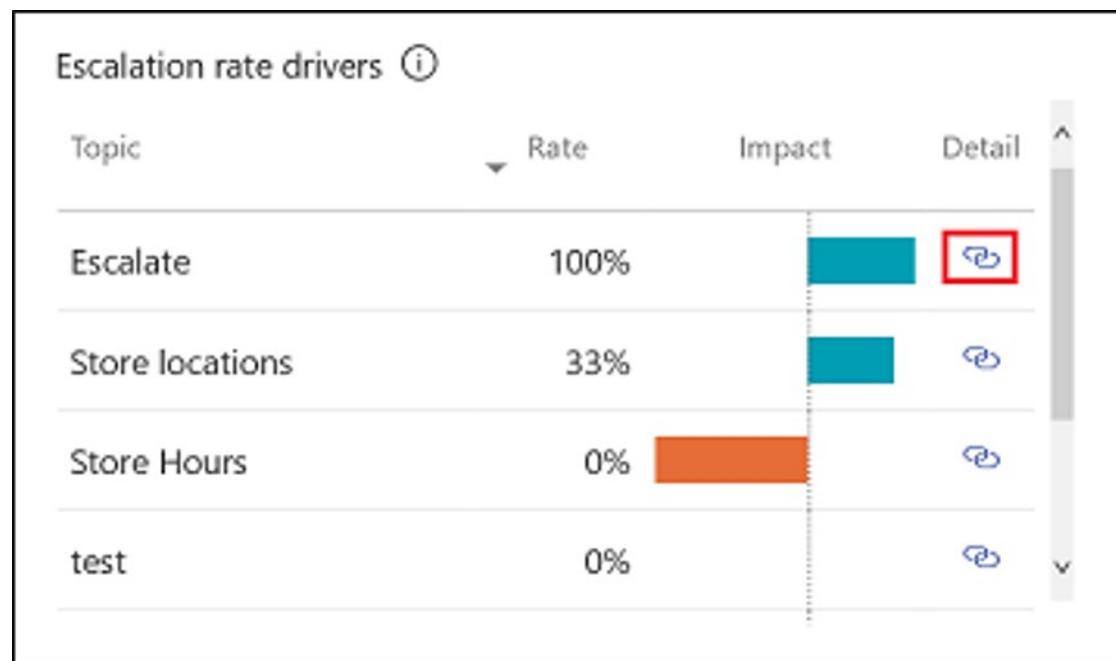
<sup>41</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat/>

<sup>42</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#escalation-rate-drivers-chart>

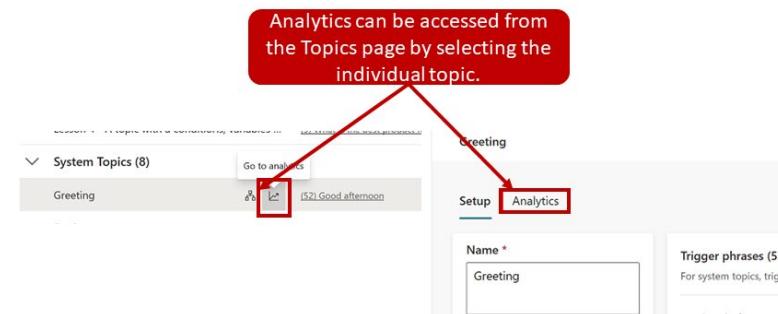
<sup>43</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#abandon-rate-drivers-chart>

<sup>44</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-summary#resolution-rate-drivers-chart>

<sup>45</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat#customer-satisfaction-drivers-chart>



The topic details page can also be displayed by opening an individual topic from the **Topics** page and selecting **Analytics** at the top of the page. You can also hover over an item and select the **Go to analytics** icon.



The topic details page includes a variety of charts with graphical views of a topic's KPIs:

- **Topic Summary charts<sup>46</sup>** - Summarize topic performance indicators for the specified time period and the percent change over the period.

<sup>46</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-topic-details#topic-summary-charts>

- **Impact Summary charts<sup>47</sup>** - Summarize the impact of the topic on KPIs for the specified time period.
- **Topic Volume by Day chart<sup>48</sup>** - Provides a graphical view of the number of sessions for the topic over the specified time period.

For more information, see [Analyze topics usage<sup>49</sup>](#).

## Analyze session information in Power Virtual Agents

Having access to session information that is related to your bot can help you identify potential changes that need to be made. By default, you can download up to seven days of bot conversation transcript sessions from the past 30 days directly from the Power Virtual Agents portal.

Session transcripts are available by going to **Analytics > Sessions** tab. On the **Sessions** tab, you will be able to see all the different sessions that have been run for the bot. A session represents a conversation that someone had with the bot. If your bot had a high number of sessions, they will be broken down into multiple rows to help make managing the sessions easier. Each row will contain 2500 sessions. You can select each row to download the session transcripts for the specified time frame.

The screenshot shows the Power Virtual Agents portal interface. The top navigation bar is dark blue with the text "Power Virtual Agents | Contoso bot". Below it is a sidebar with icons for Home, Topics, Entities, Analytics (which is selected and highlighted in blue), Publish, and Manage. The main content area has a title "Analytics" and tabs for Summary, Customer Satisfaction, Sessions (which is underlined in blue), and Billing. A callout box labeled "Sessions for download" contains the text "3:53 PM 11/11/19 – 3:53 PM 11/11/19".

The downloaded file contains the following information:

- **SessionID** - A unique identifier for each session.
- **StartTime** - Time at which the session started. Entries are sorted by this column in descending order.
- **InitialUserMessage** - First message that is entered by the user.
- **TopicName** - Name of the last authored topic that was triggered in this session.

**47** <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-topic-details#impact-summary-charts>

**48** <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-topic-details#topic-volume-by-day-chart>

**49** <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-topic-details>

- **ChatTranscript** - Transcript of the session in the following format:
  - **User says:**" "; **Bot says:**" "; structure
  - Conversation turns are separated by semicolons
  - **Bot says** doesn't include the options that are presented to the user
- **SessionOutcome** - Outcome of the session (Resolved, Escalated, Abandoned, Unengaged).
- **TopicId** - A unique identifier of the last authored topic that was triggered in this session.

For more information, see [Analyze session information<sup>50</sup>](#).

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

*1. When a customer initiates a bot conversation, they are automatically asked to provide the nature of their inquiry. They can select from Support, Billing, or Question. You have been asked to configure the bot to automatically escalate the conversation to a live agent when someone indicates that the nature of the inquiry is Billing. What conversation node can you use to facilitate this request?*

- Call an action
- End the conversation
- Show a message
- Go to another topic

### Multiple choice

*2. You are using the Call an action conversation node to initiate a Power Automate flow. What do you call the values that are provided back to Power Virtual Agents from Power Automate flow?*

- Inputs
- Entities
- Outputs
- Topics

## Summary

Because customers are demanding more personalized and efficient customer service experiences, organizations are turning to bots. Bots help provide customers with a self-service support solution that can be interacted with through natural language that simulates a human conversation. Bots can help resolve simple or common issues, allowing agents to focus on more complicated issues that might require more time. With Power Virtual Agents, organizations can create powerful bots through a guided, no-code graphical interface. Additionally, organizations can enhance the bots that they create to make them more versatile and support a larger number of situations.

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<sup>50</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-sessions/>

This module examined how to enhance your Power Virtual Agents bot to expand how it can be used, including:

- Exploring how to incorporate automation with Power Automate flow to help integrate your bot with other technologies and incorporate that data into your bot.
- Examining how to trigger your virtual agent to hand off a bot conversation to a live agent who is working in applications such as Omnichannel for Customer Service.
- Reviewing how topics can be created automatically from existing content, such as support or FAQ pages.
- Explaining the different analysis capabilities that are available, including working with customer satisfaction details and session information.

Your next step would be to explore other applications that can be used with Power Virtual Agents to create robust customer support solutions, including Dynamics 365 Customer Service Insights and Omnichannel for Customer Service.

# Manage topics in Power Virtual Agents

## Introduction

Assisting customers with AI virtual agents, often referred to as bots, is a major business trend today. Bots are being used to expand self-service support experiences for customers and to help ease agent workloads by handling specific types of support topics that are of the highest volume and easily automated. Bots help users accomplish specific tasks by using AI to identify the customer's intent and present content or implement actions that are related to that intent. For example, if someone asks about the weather conditions where they live, a virtual agent bot could find out where they live and provide them with a detailed weather forecast for their area. Virtual agents could also be programmed to help the customer check their account balance, reserve a hotel room, or send them to a live agent who can assist them with issues that are beyond the virtual agent's capability. The virtual agent needs to know what information to present to the customer based on what they are asking for.

Consider a customer's interaction with a virtual agent as a conversation that you would have with another person. While each conversation is different, they all have their main parts:

- **Conversation beginning** - Each conversation is initiated by an event such as answering a phone, a face-to-face greeting, or through engagement in other formats.
- **Discussion points or topics** - The specific topics that are being communicated during the conversation such as the weather, making plans, providing life updates, asking questions, and so on.
- **Conversation ending** - The conversation is ended with an event such as ending the phone call, shaking someone's hand, driving away, or some other action.

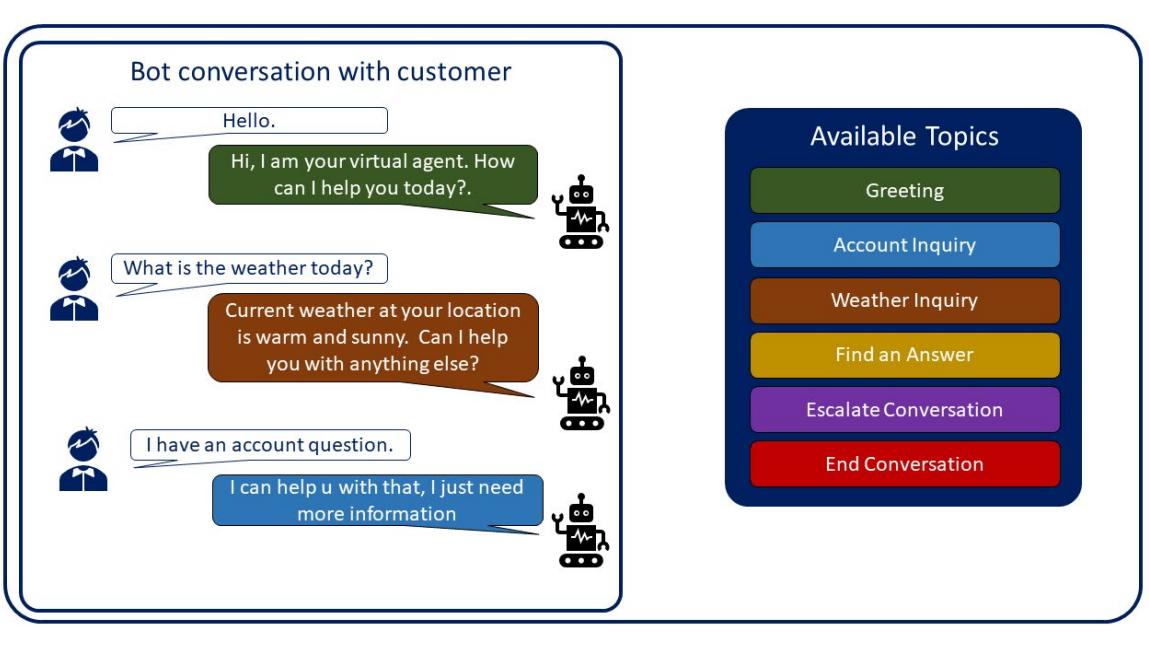
Conversations are driven by the topic that the customer wants to discuss. For example, if someone asks you about your new job, you would tell them about your job, not about a vacation that you just took. Virtual agents need to be able to work the same way. They need to deliver the correct details and take appropriate action based what the customer is saying.

Microsoft Power Virtual Agents bots accomplish these tasks through topics. Think of a topic as a small individual conversation on a specific subject. Multiple topics can be used together in a single bot to provide a customer with an automated conversation that feels natural and flows appropriately.

For example, a single Power Virtual Agents bot might contain the following topics:

- Greeting
- Account Inquiry
- Weather Inquiry
- Find an Answer
- Escalate Conversation
- End Conversation

Each of the preceding topics would have trigger phrases that help the bot identify when to present that topic to a customer. If the customer asks, "What is the weather?" the Weather Inquiry topic will be launched. If they state, "I have an account question," the Account Inquiry topic is launched. By defining multiple topics within a single bot, organizations can create flexible virtual agents that can be used to engage and interact with customers on a variety of individual topics.



This module will examine how to use topics to create and manage conversation paths in a bot.

## Work with bot topics

In Power Virtual Agents, topics represent paths that a customer can be taken on while interacting with a bot. The topic that is used and the path that is followed within an individual topic is in response to the data that is entered by customers in the conversation panel. Topics are the primary elements that dictate how conversations flow. If a customer asks about the weather, the bot can launch a weather topic. To provide them with the correct weather forecast, the bot can ask questions that are defined in the topic, such as what city they live in. The bot retains that information so that it can be sent to a weather service for forecast details. The forecast can be returned to the customer in a personalized message that includes relevant customer information.

Power Virtual Agents topics consist of two primary elements:

- **Trigger phrases** - Phrases, keywords, or questions that are entered by users and relate to a specific issue.
- **Conversation nodes** - Define how a bot should respond and what it should do.

As the customer enters information, the bot's AI uses natural language understanding to parse what the customer is typing and then find the most appropriate trigger phrase or node. If a user enters, "I need to return a defective product" into your bot, Power Virtual Agents could match parts of the text such as "return" or "defective product" to return a topic that includes those items as trigger phrases.

After they have been loaded, different conversation nodes in the topic are used to control and define the path that the customer will take during the conversation. Messages can provide details or instructions. Questions can be asked to help identify the type of product that they want to return. Actions can be used to help the customer create a custom return label that could be sent to them to facilitate the return.

## Work with topic triggers

Your first task in defining a topic is to determine the phrases that the bot should look for to trigger the topic. A single topic can have multiple trigger phrases that are defined for it. Having five to ten trigger phrases is a good starting point, but you can add as many as needed. Punctuation can be used in trigger phrases. However, it is best to use short phrases rather than long sentences. Try to think about how a customer might phrase their request. If the topic will be used to communicate store hours, your triggers should relate to being open or closed, time frames, dates, and so on.

Examples of good starting phrases for a Store Hours topic would include:

- What are your hours?
- When do you open?
- Store hours
- Hours of operation

Additional trigger phrases can be added over time as you identify additional phrases that would be needed.

The screenshot shows the Power Virtual Agents interface with a sidebar on the left containing options like Home, Topics (which is selected), Entities, Analytics, Publish, and Manage. The main area is titled 'Store Hours' and has tabs for 'Setup' and 'Analytics'. In the 'Setup' tab, there's a 'Name \*' field with 'Store Hours' and a 'Description' field with 'Enter a description'. Below these, a list of 'Trigger phrases (9)' is shown, each preceded by a small delete icon. The list includes: 'Are you closed now?', 'Closed', 'Open', 'What are your hours', 'Daily open hours', 'Store Hours', 'When are you open', 'When are you closed', and 'Hours'. A red box highlights this list. On the right side, there are buttons for 'Save topic', 'Delete', 'Go to authoring canvas', and status information ('Modified 6/25/20, 5:46 AM'). At the bottom left, there's a 'Test your bot' button.

You should also try to make your trigger phrases as unique to the individual topic as possible. This approach maximizes the likelihood that the bot will launch the correct topic as the user types what they need. For example, a bot might contain two topics: one called Product Returns and another called Product Recalls. It would not be uncommon for each topic to have similar verbiage. If you add "defective product" as a phrase to both, the application might not understand which topic to load.

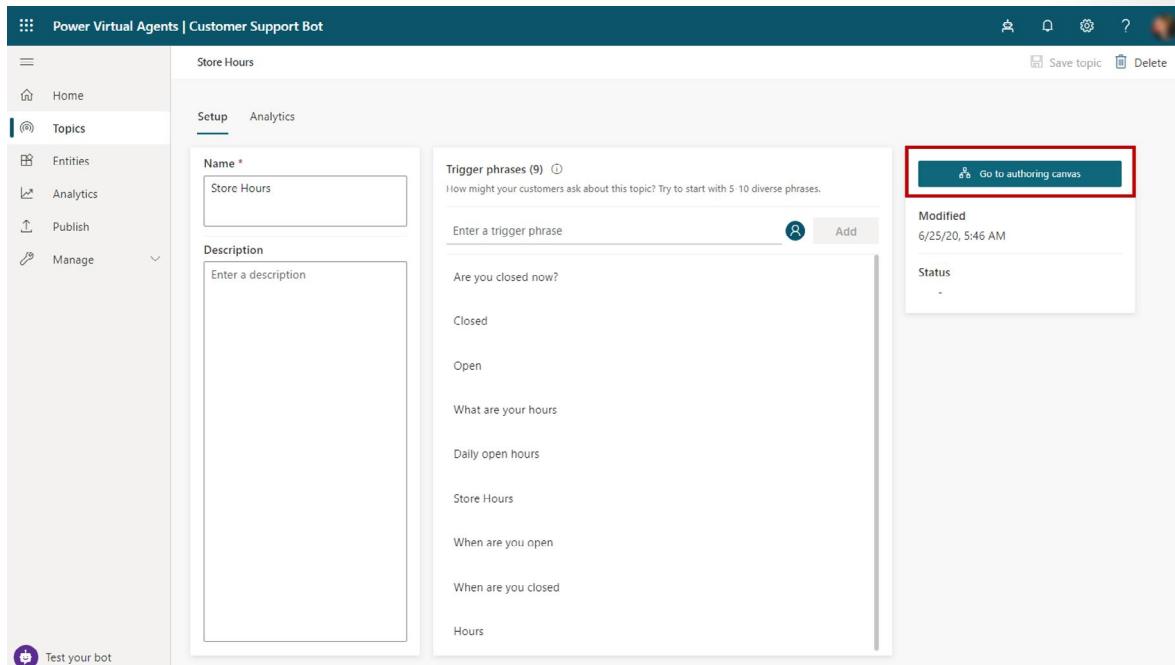
One way to handle this issue would be to add more specific trigger phrases to the topics, such as using "return defective product" in the Product Returns topic and "return recalled product" in the Product Recalls topic.

Alternatively, you could create only one topic that is used for both returns and recalls. When the topic is initiated by the bot, additional information could be gathered and used to guide the customer down either a return or recall path. This differentiation becomes increasingly important in scenarios where a bot

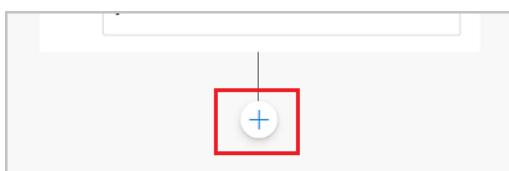
contains many individual topics. A single bot can have up to a maximum of 1000 topics in it. Early planning in the process can prevent frustration in the future.

## Use conversation nodes to design the topic's conversation path

After you have defined how the topic will be triggered, you can design the flow of the topic as users interact with it, which is called a conversation path. A topic's conversation path defines how the customer will be interacted with and what will occur based on customer input. You can edit a topic conversation path by selecting the **Go to authoring canvas** button.



When a new topic is created, the initial conversation path includes two items. A trigger phrase node and an empty message node will be inserted for you by default. Additional nodes can be added by selecting the plus (+) icon on the line or branch between or after a node.



## Work with conversation nodes

Conversation nodes represent customer interactions or actions that can be inserted into a topic's conversation path. They might be used to display a message to the customer, ask them for additional information, trigger an automation, or trigger an escalation to a live agent.

Five node types are available:

- **Show a message** - Displays a message to the user. Messages can include basic formatting and numbering.

- **Ask a question** - Helps the bot capture information from the user. The captured information can be used to influence the flow of the conversation or as variables in other parts of the bot.
- **Call an action** - Calls a Microsoft Power Automate flow to help interact with external systems or areas, for example, passing customer location details to the MSN weather connector to get the local weather forecast for the customer's location.
- **Go to another topic** - Directs the user to a different topic in the bot. For example, you might want to send the user to a specific topic about the closure of a store if they ask about hours of operation for that store.
- **End the conversation** - Ends the conversation and provides the ability to display surveys or send the customer to a live agent.

Depending on the type of node that you select, it might have different options that you can define.

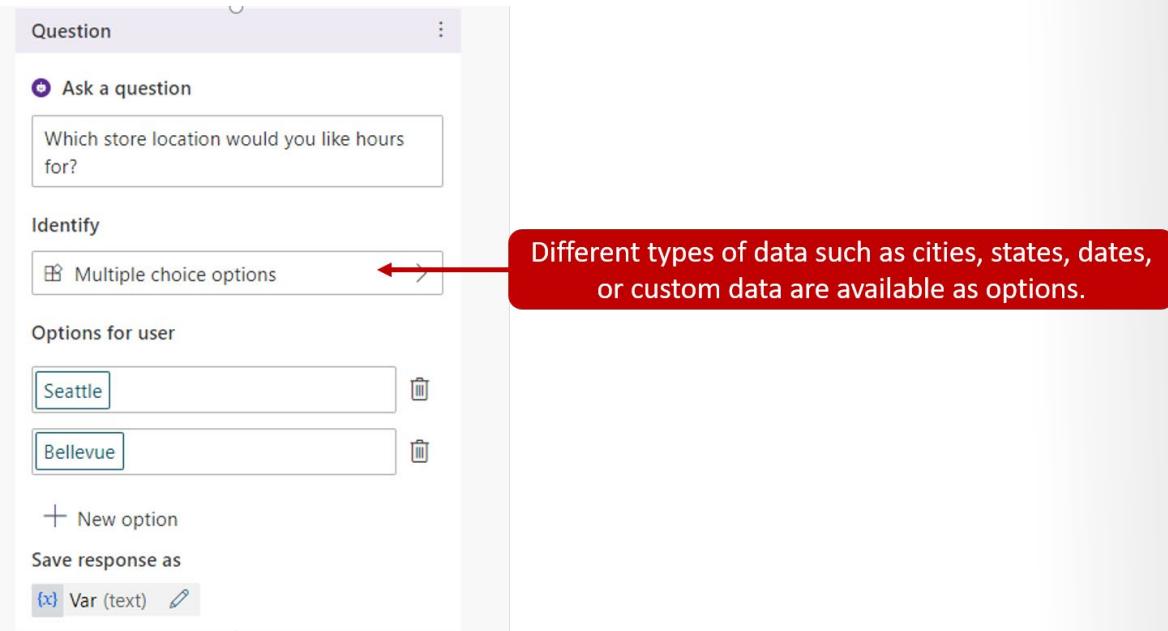
## Work with the question node

Question nodes are often used in conversation paths. They help capture additional information from customers. Information that is captured from the question can be stored and used in other parts of the bot or in automation. Question nodes can also impact the path that the customer is taken on. For example, you might use a question node to capture the city that a customer lives in. You could also use a question node to provide the customer with a list of multiple-choice options to choose from, such as a list of cities.

Each question node contains three base fields:

- **Ask a question** - The question text that you want to present to the user.
- **Identify** - Defines what the bot should be listening for in the user's response, such as multiple-choice options, a number, or a specific string.
- **Save response as** - Defines how you want to save the data that is captured from the questions so it can be used as a variable later.

Depending on the type of data that you select in the **Identify** field, additional field options might be presented to help you provide additional details for the item. For example, setting the **Identify** field to **Multiple choice options** displays the **Options for user** section, where you can define the options that you want to have presented to the user. Each option would be presented in the conversation window as a multiple-choice button.



Another advantage to the question node is that separate conversation paths can be used based on the customer's response. Branching helps lead to the appropriate resolution for each user response. Branching is discussed in more detail later in this module.

## Display messages with the Show a message node

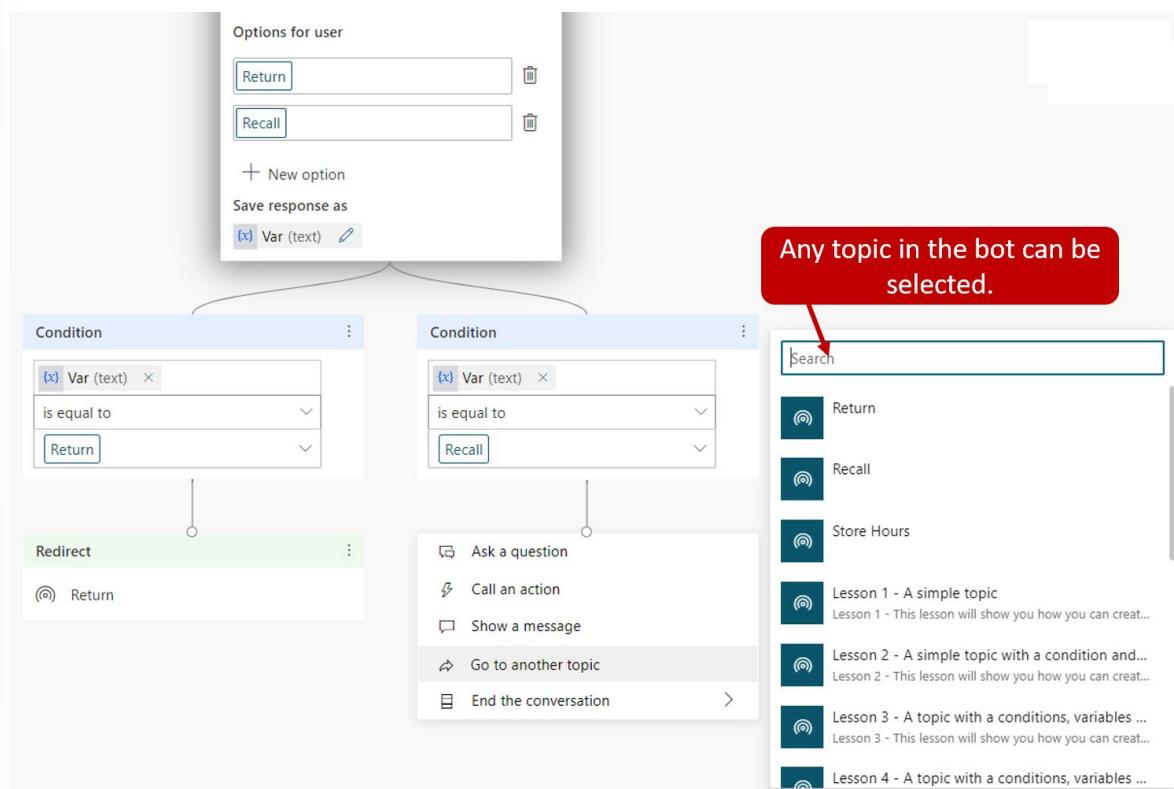
Message nodes are used anytime you want to provide the user with details or information. Each message can include basic formatting such as bold and italic font. You can also include bullet and number formatting and insert links to other content, as needed.

Message nodes can also include variables in message content. Variables can be used to store information that is captured from a question. Inserting a variable allows you to provide more personalized messages. For example, the answer to the "What city are you in?" question could be stored as a variable and used later in a message to the customer, such as "Currently, the weather in **city** is..."

Variables will be discussed in more detail later.

## Work with the Go to another topic node

Each topic that you include in your bot will likely be specific. For example, the Current Weather topic will only provide weather-related data, while the Hours of Operation topic will focus on when a business is open. Regardless of the fact that they are separate topics, they can still be related or dependent on each other. Returning to the previous example of the Product Returns and Product Recalls topics, rather than writing multiple, unique triggers for both topics, you could create a Recall or Return topic. The purpose of the topics is to determine which topic to load next. It contains a question node that asks if the inquiry is a return or recall. Based on what the user selects, the **Go to topic** node loads either the Product Returns or Product Recalls topic.



## Use the Call an action node

One of the many advantages to Power Virtual Agents is the ability to implement actions such as sending emails, locating external data, or creating activities based on data that is entered in the bot. The **Call an action** node helps to facilitate this ability by allowing you to call a Power Automate flow from the bot.

For more information, see [Microsoft Docs<sup>51</sup>](#).

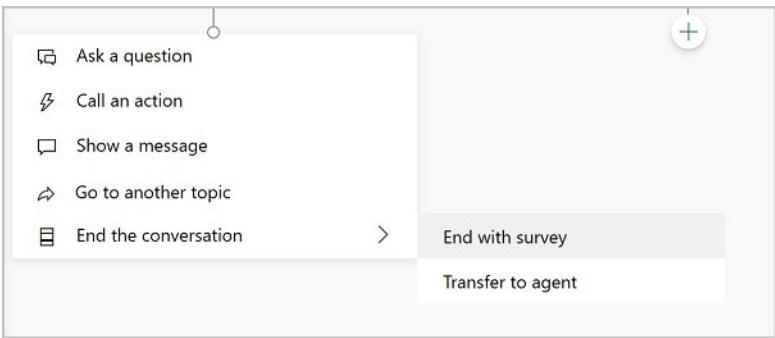
## Use the End the conversation node

Often, the end of a topic also represents the end of the conversation. The **End the conversation** node signifies the end of the entire conversation and provides actions that can be initiated. You can have a survey appear that asks the user if their question or issue was answered or resolved correctly. This information is collected under the [customer satisfaction analytics page<sup>52</sup>](#). You could also elect to escalate the conversation [over to a live agent<sup>53</sup>](#) if you are using a suitable customer service portal, such as Omnichannel for Microsoft Dynamics 365 Customer Service. At the end of a response that resolves the user's issue or answers the question, select **End the conversation**.

<sup>51</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-flow/>

<sup>52</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/analytics-csat/>

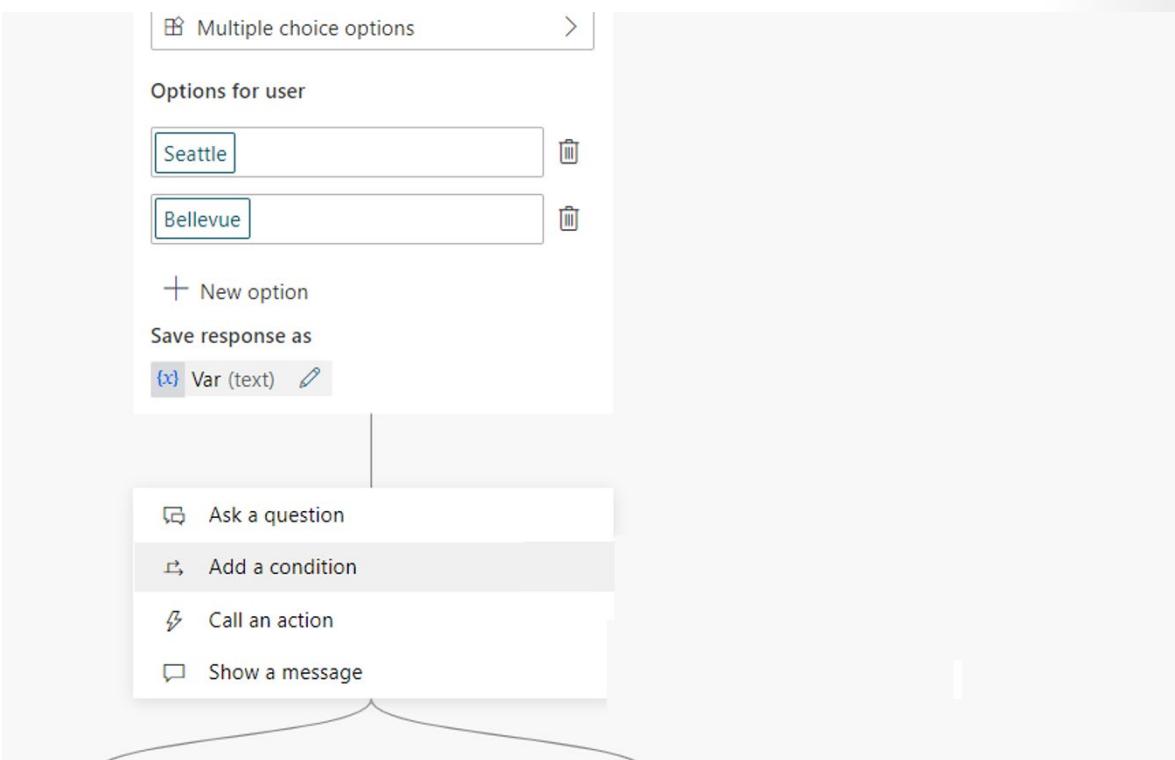
<sup>53</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-hand-off/>



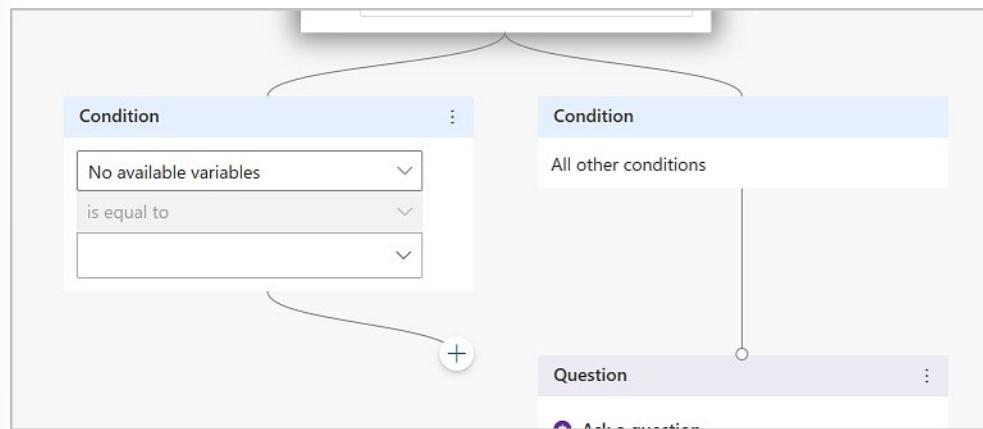
## Branch a topic

Adding branching into a topic is what truly turns it from a one-way path into a multi-layer conversation. Different forks and paths ensure that the customer is provided data and resolutions based on the current situation.

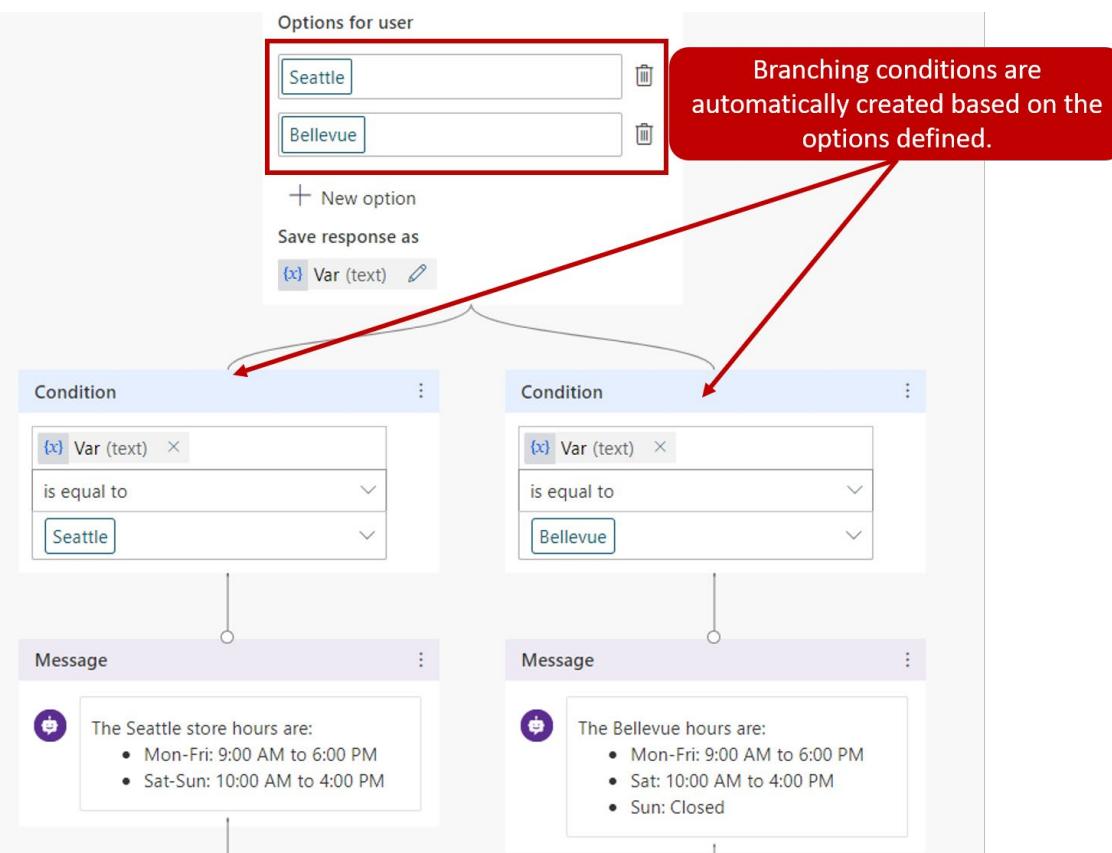
Branching allows you to evaluate conditions to initiate conversation nodes to launch another topic, display a message node, or trigger a Power Automate flow. You can manually add branching conditions between nodes, such as inserting a branch after you ask a question like "What country do you live in?" The customer's response to the question is stored as a variable, and branch conditions can be built based on that variable. You can add branching by selecting the plus (+) icon to add a node and then selecting **Add a condition**.



You can select how the bot conversation should branch at this point. For example, if you have set up **end-user authentication**<sup>54</sup>, then you might want to specify a different message if the user is signed on (which might have happened earlier in the conversation).



Depending on what you select in the **Identify** field of the question node, branching might occur automatically. Automatic branching is always the case when you select **Multiple choice options**. Each option will have a branch created for it. For example, if you have a question node that asks a customer for their preferred store location and then provides them with **Seattle** and **Bellevue** as options, a condition branch for each option will be created. You will need to ensure that you are providing a completed path resolution for both items.



<sup>54</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-end-user-authentication/>

## Work with entities

Power Virtual Agents conversations use natural language understanding to identify a user's intent based on what they entered into the conversation window. For example, when a user enters, "I tried to use my gift card, but it doesn't work," natural language understanding helps to identify and route the user to the topic that is related to gift cards not working, even if that exact phrase is not listed as a trigger phrase.

A key aspect of natural language understanding is to identify the entities that are being used in a user dialog. Think of an entity as an informational unit that represents a certain type of real-world subject such as a phone number, postal code, city, or a person's name.

Power Virtual Agents comes with a set of prebuilt entities out of the box. These entities represent some of the most commonly used information in real-world dialogs such as age, colors, numbers, and names. The knowledge that is granted by entities allows the bot to recognize the relevant information from user input and save it for later use.

For example, consider a scenario where you are using the **Money** prebuilt entity that you have accessed from the **Entities** tab. When you examine the entity, you notice an explanation and the ways that the entity can be used to look for information that is related to money or currency from a user's input.

User input	Entity	Saved value
It costs 1000 Euros	1000 Euros	1000.00
3 items for \$1K	\$1K	1000.00
It costs a thousand five hundred	A thousand five hundred	1500.00

For example, when a user enters, "It costs 1000 dollars," the bot will use this **Money** entity to determine that the "1000 dollars" entry represents the **money type** of information. When the bot extracts this entity and saves it to a variable, it will save "1000" as a number, even though the surrounding information was text.

## Create custom entities

Prebuilt entities will cover many common information types. However, situations will occur where language understanding will be needed for an organization-specific scenario. For example, if you are building a bot for an outdoor store, the bot might need to acknowledge different types of outdoor products. A custom entity called **Outdoor Products** could be created. This custom entity ensures that when someone enters a question about outdoor products related to fishing, skiing, or boating, the bot can direct them to the appropriate place.

You can create custom entities by going to the **Entities** tab on the side navigation pane and selecting **New custom entity**. After you have defined the name of the entity, provide the items that you want to be included in it.

The following image shows a created custom entity called **Outdoor Store Categories** with an added list of outdoor product category names.

Outdoor Store Categories

ClosedList

Name \*

Description

Method List

The bot will try to match an item on the list based on what the customer says.

Smart matching  on

The Smart matching option enables the bot's understanding of natural language. This can help match misspellings, grammar variations, and words with similar meanings.

If the bot isn't matching enough related words, enhance the bot's understanding further by adding synonyms to your list items.

[Learn more](#)

List items

Enter item

Item	Synonyms
Baseball	+ Synonyms
Basketball	+ Synonyms
Biking	+ Synonyms
Bowling	+ Synonyms
Camping	+ Synonyms
Hiking	+ Synonyms
Cricket	+ Synonyms
Exercise & Fitness	+ Synonyms
Fishing	+ Synonyms

Add

Save Close

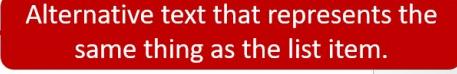
These items will be used as values stored in variables.

## Work with smart match

Frequently, customers might mistype a word or enter a phrase that is slightly different from what is defined in the entity. For example, a customer might enter "softball" instead of "baseball." Because both sports use the same type of equipment, in terms of product categories, "softball" should be considered the same as "baseball." Smart matching lets the bot accept vague user input based on the list items that are given to the entity. In other words, the bot doesn't have to find an exact match. When smart matching is turned on, the bot will automatically autocorrect misspellings and expand the matching logic semantically, such as automatically matching "softball" to "baseball".

## Work with synonyms

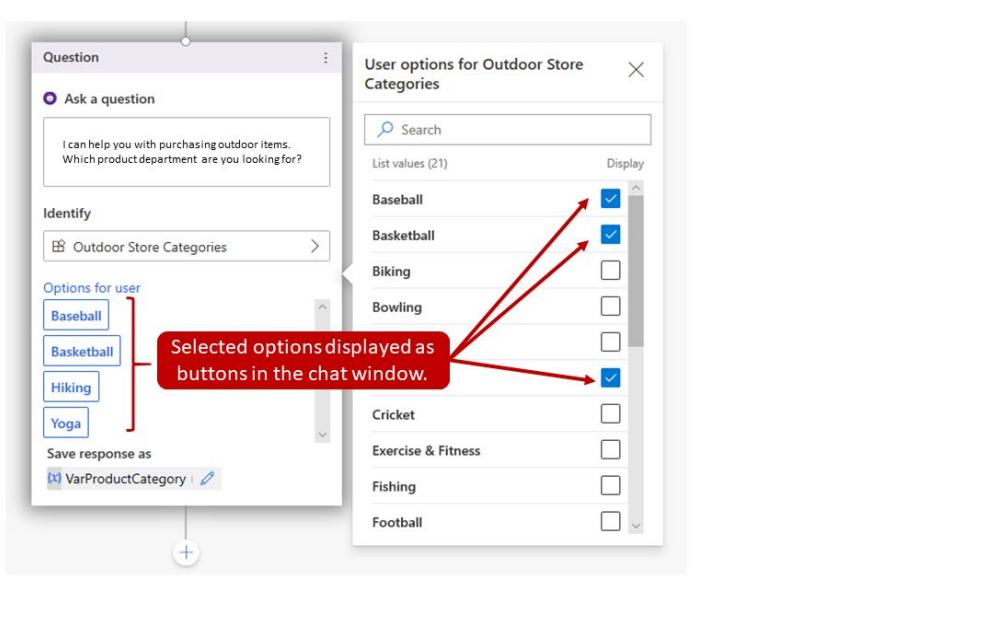
The synonym option is similar to smart matching. The primary difference is that while smart matching is automatic, you can manually expand the matching logic by defining synonyms. For example, the "hiking" product category could have "trekking" and "mountaineering" added as synonyms. Similarly, for "yoga," you can add "Pilates" as a synonym. Smart match and synonyms seamlessly work together to make your bot smarter.

Biking	synonyms
Bowling	Synonyms
Camping	Synonyms
Hiking	Trekking 
Cricket	Svnonyms

## Use entities in a conversation

After you have defined your custom entity, it will be available for use when you are constructing bot conversations. Select **Go to authoring canvas** for a topic and then add an **Ask a question** node.

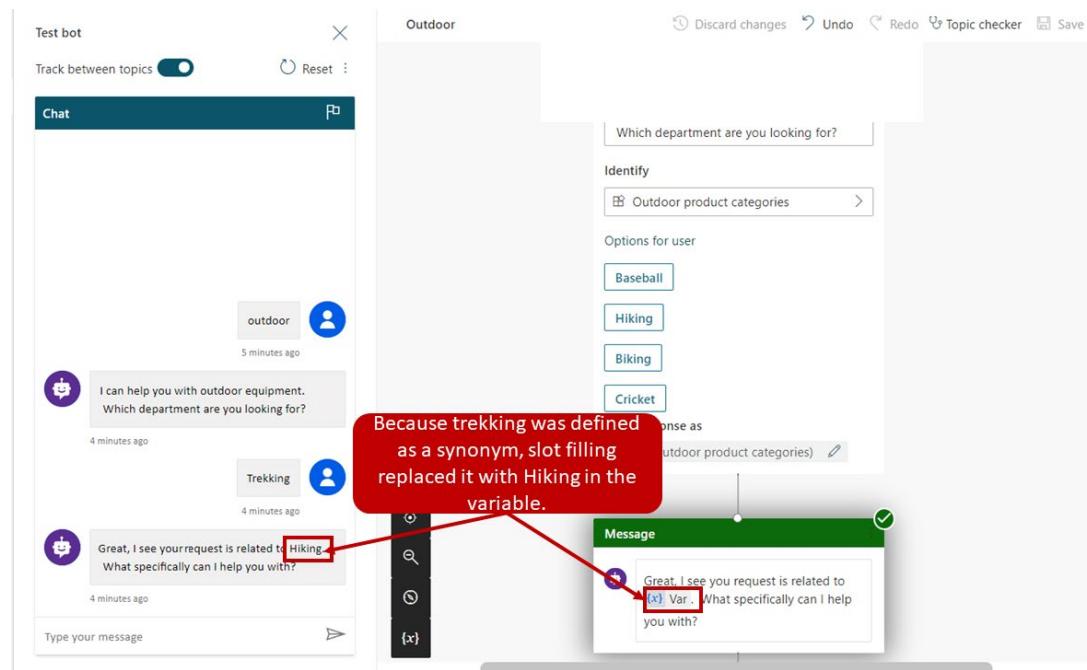
You can also display category items as buttons. For example, if you want some of the category items to display as buttons that users can select as their input, select **User options** and then choose from the list. While in a conversation, a customer can select the item button that they want or manually enter a different category as text.



## Work with slot filling

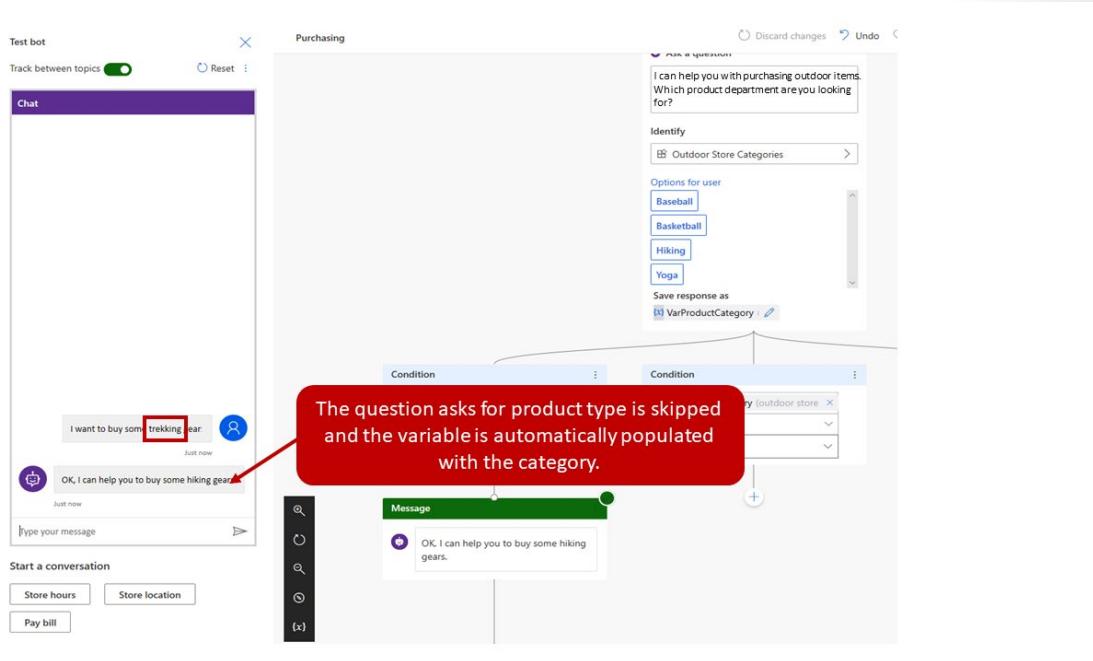
Slot filling is a natural language understanding concept that saves an extracted entity to an object. In simple terms, slot filling matches what is entered by a customer and then stores it appropriately in a variable. For example, when asked for a category type, the customer might select the **Hiking** category button, or they might enter "trekking," as shown in the following image. Because "trekking" was defined as a synonym, it should still be considered as an entry for "hiking." Slot filling ensures that even though

another word was entered, it is associated with the correct category. The extracted entity "hiking" will be used as the values for the Product Category variable.



Another concept is known as *proactive slot filling*, where the user can specify multiple pieces of information that map to multiple entities. The bot understands what information belongs to which entity automatically.

In the following example, the user entered, "I want to buy some trekking gear." This entry includes the trigger phrase that the customer wants to buy gear, but it also provides a second piece of information for the actual type of gear. In this case, the bot fills in the entity for buying gear and the entity for the type of gear. This situation is unlike the previous example, where the bot needed to prompt the user for the type of equipment. The bot accepts the user input and intelligently skips the question that asks for the product category.



The bot is always actively learning from user input, remembering information upfront so that it can skip unnecessary steps as appropriate.

## Variables

With Power Virtual Agents, you can use variables to store important information that is entered by the customer for later use. For example, you can save a customer's name in a variable called `UserName`. This variable can be inserted into conversation nodes to create a more personal experience for the customer, such as inserting it into the **Message** node, to allow the bot to address the customer by name as the conversation continues.

Variables can be used to dynamically route customers down different conversation paths. They can also be fed into **Power Automate**<sup>55</sup> flows or **Bot Framework Skills**<sup>56</sup> as input parameters. For example, the city that the customer lives in could be stored in a variable. When a Power Automate flow is run, the variable could be passed through as an input parameter to ensure that the weather service is getting the correct forecast.

For a complete list of variable types, see [Entity and variable types](#)<sup>57</sup>.

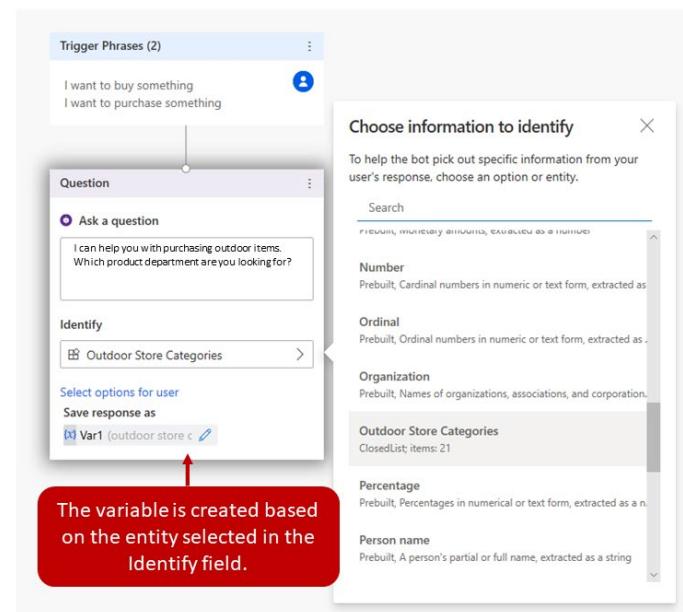
## Create variables

Variables are created automatically when you add a question node to a topic. By default, when a question node is inserted, it will be created by using multiple-choice options. However, any prebuilt or custom entity can be used by selecting it in the **Identify** field.

<sup>55</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-flow/>

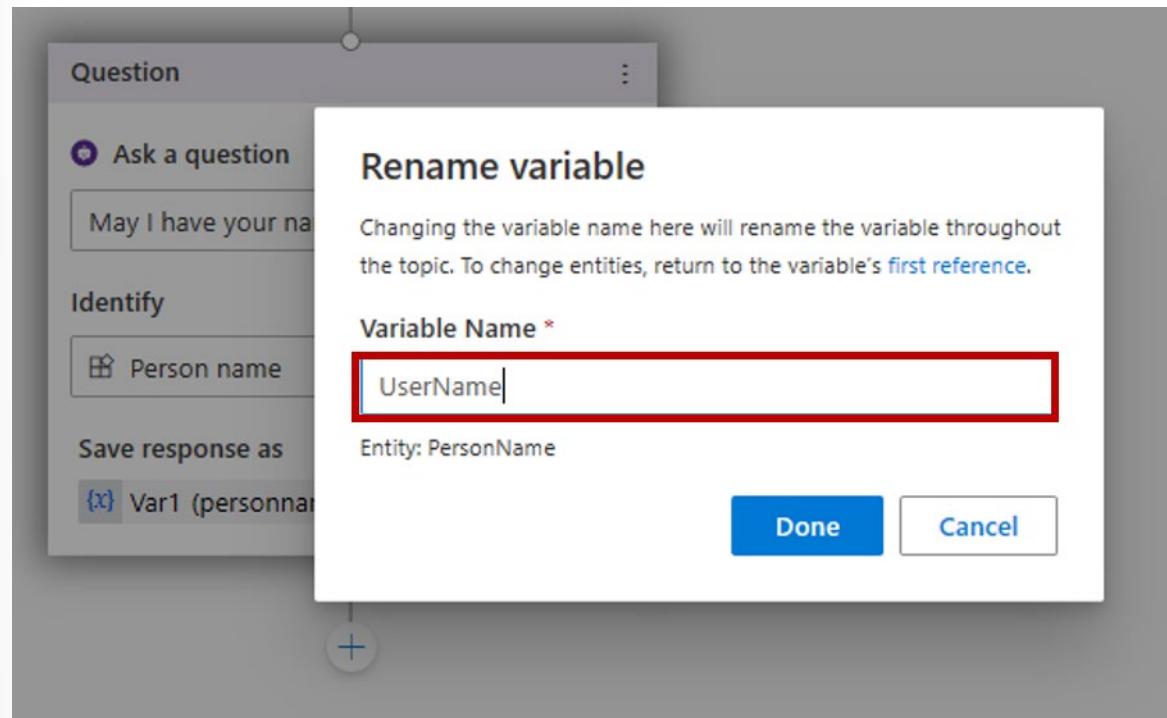
<sup>56</sup> <https://docs.microsoft.com/en-us/azure/bot-service/bot-builder-skills-overview?view=azure-bot-service-4.0%2F%3Fazure-portal%3Dtrue>

<sup>57</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-variables#entity-and-variable-type/?azure-portal=true>



## Rename a variable

When a variable is automatically created, a default name will be given. If desired, you can rename a variable by selecting it and then entering a new name.



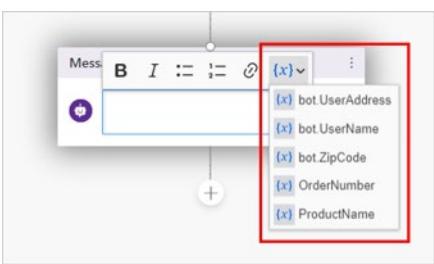
## Use variables across topics

By default, a variable's value can only be used in the topic where the variable is created. However, scenarios might occur when you will want to use the same value across topics. Bots can remember the necessary variable context when a conversation spans multiple topics. For example, a **Welcome** topic could ask for the customer's name and email address. When the conversation goes to another topic, such as **Appointment Booking**, you might want the bot to remember the customer's name and email address. In Power Virtual Agents, these variables are referred to as bot variables because they apply across the entire bot.

Bot variables apply during the current chat session; they cannot be carried over from one customer chat session to another. You can specify which variables should be treated as bot variables to distinguish them from topic-level variables.

## Set bot variables

After you set a bot variable, it will be available to all topics. When you are composing a bot message, if you select the {x} button in a message node or question node, you will see that the bot variable is available. Variables are sorted in alphabetical order, so you will find that all bot variables are grouped together in the variable menu because they all begin with the word "bot."



When you use a condition node, a flow action node, or a skill node, you will also see available bot variables in those sections.

## Reuse a variable across topics (global)

You may need to use global variables from one topic to another. To define a variable as a bot variable, open it in the authoring canvas. You can accomplish this task by opening the **Ask a question** node that is storing the variable that you want to work with. On the **Variable Properties** pane, under **Usage**, select **Bot (any topic can access)**. The variable name will be given a prefix string of **bot** to differentiate it from the topic-level variables. For example, the variable **UserName** is now shown as **bot.UserName**. When you convert a variable to a bot variable, make sure that the variable is unique across all topics. If a conflict is encountered, you will need to rename the variable before saving your change. See **Use global variables across topics within a bot**<sup>58</sup> for more information.

<sup>58</sup> <https://docs.microsoft.com/en-us/power-platform-release-plan/2020wave1/power-virtual-agents/use-global-variables-across-topics-within-bot>

The screenshot shows the Microsoft Bot Framework designer interface. On the left, there's a node editor with a 'Condition' node at the top, followed by a 'Message' node below it. The 'Condition' node has a condition: '{x} pva\_StoreLocation (text) is equal to Seattle'. The 'Message' node contains a message: 'Our {x} pva\_StoreLocation store is located in the U District in the University Village. The address is: 1234 E. University Village St., Seattle, 34567.' To the right of the editor is a 'Variable Properties' pane. In the 'Identify' section, there's a 'Multiple choice options' dropdown and a list of options: Redmond, Seattle, Kirkland. Below that is a 'New option' button and a 'Save response as' dropdown where 'pva\_StoreLocation (text)' is selected. A red box highlights this selection. The 'Variable Properties' pane itself has tabs for 'Name', 'Type', and 'Source'. The 'Name' tab shows 'pva\_StoreLocation' with a red box around it. The 'Type' tab shows 'Text'. The 'Source' tab has a 'Go to Source' button. Under 'Usage', there are two radio buttons: 'Topic (limited scope)' (selected) and 'Bot (any topic can access)', with a red box around the first one. There's also a checkbox for 'External sources can set values' which is unchecked. The 'Used by (0)' section is empty.

## Manage bot variables

After you have created a bot variable, you can see where it is first defined and what other topics are using it. This feature can be useful if you are working on a new bot or if you have multiple variables and complex topic branching.

Two primary items that are available from the **Variable Properties** pane are:

- **Go to the source** - Goes to the node where the variable was initially created.
- **Used by** - Displays all topics where the variable is used so that you can go straight to that topic and node.

For additional information, see [Microsoft Docs](#)<sup>59</sup>.

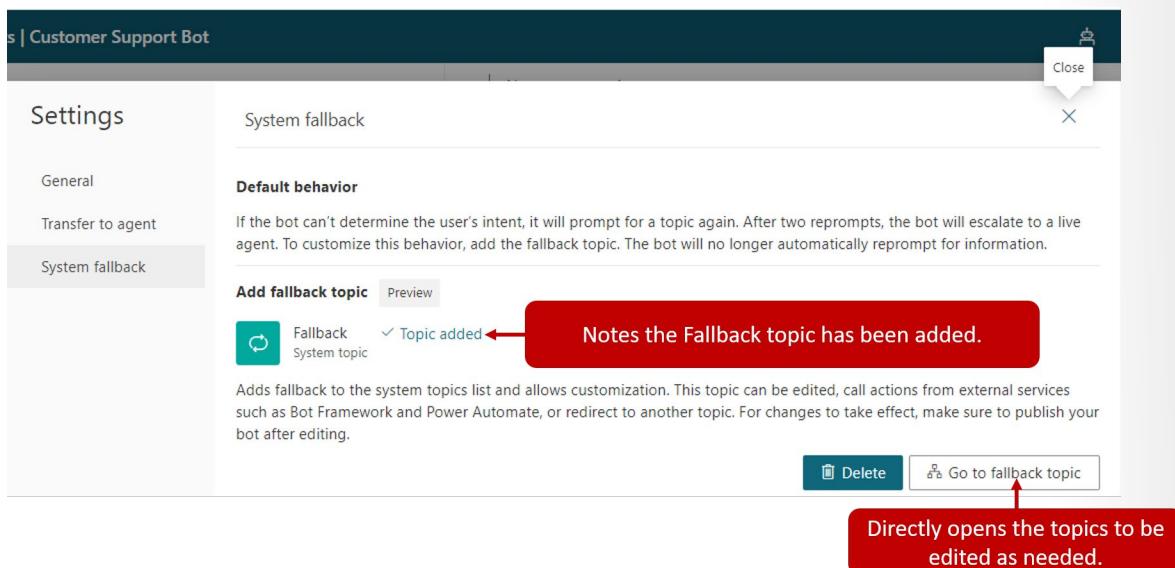
<sup>59</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-variables-bot>

## Work with fallback topics

As a bot engages with customers, it triggers the most appropriate topic based on the user's input. Occasionally, the bot might not be able to determine the user's intent based on what they've typed. When this situation occurs, the bot will prompt the user again. After two unsuccessful prompts, the bot will escalate the conversation to a live agent by using the **Escalate system** topic.

Some organizations might not want to escalate all scenarios where a topic isn't triggered. For example, you can create a broad topic to use whenever the bot is unable to recognize the intent. After the bot is routed to this topic, it tries to better pinpoint what the customer is looking for by asking them questions, providing category options, or interacting with them in other ways. When you want to defer to a topic rather than trigger an escalation, use a fallback topic.

You can add fallback topics by selecting the **Settings** icon from the top navigation pane and then selecting **System fallback**. After you select the **Add** button, a system fallback topic will be added to your bot. This topic will be the one that the bot goes to when it can't find an appropriate topic or doesn't understand the user's input.



## Customize the system fallback topic

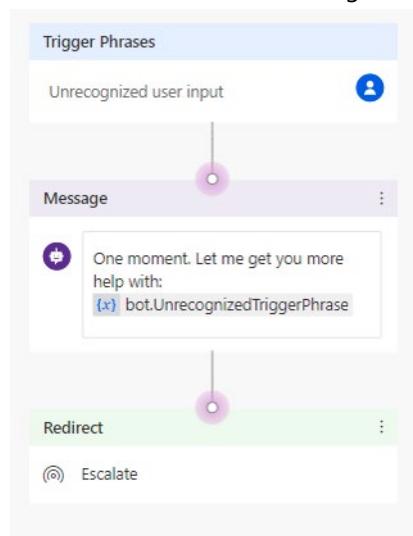
After the system fallback topic has been enabled, you will see a new **Go to fallback topic** option on the screen. Selecting **Go to fallback topic** will take you to the topic. The newly created fallback topic will also be available under **System Topics** in the topic list.

Unlike other topics, the fallback topic does not have a trigger phrase; the unrecognized user input is what triggers the topic.

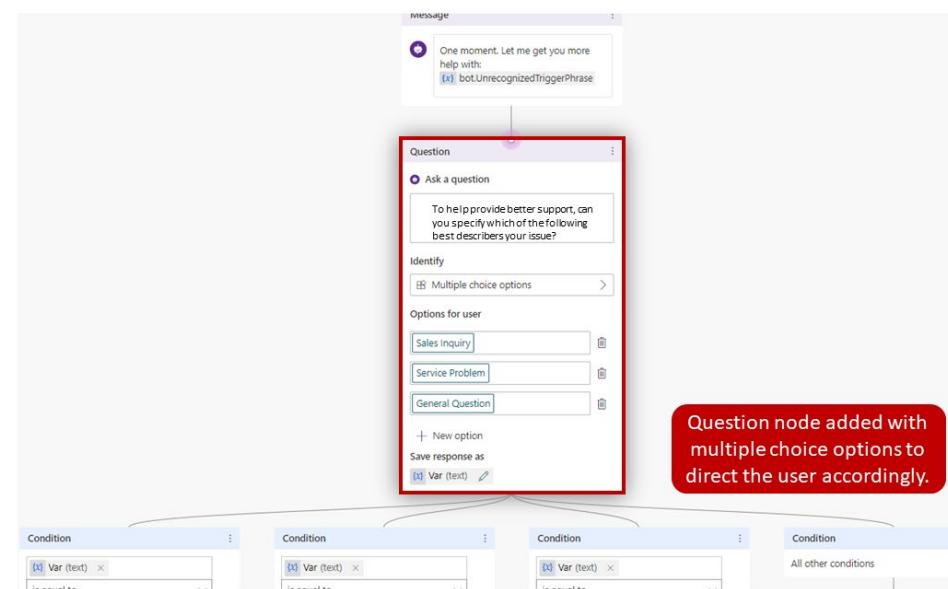
The fallback topic contains two nodes:

- **Message** - Acknowledges the unrecognized input and rephrases it.

- **Escalate** - Redirects to a live agent.



As with any other system topic, the fallback topic can be customized to fit your needs. For example, you can present the user with a question such as, "What are you looking to get assistance with?" Then, the customer could be presented with options such as **Sales**, **Service**, or **General**. Based on what the user selects, the bot could redirect them to a topic that is related to that selection, implement a Power Automate flow, send an email, or (if needed) escalate the customer's issue to an agent. The initial unrecognized text that is entered by the user is stored in a variable called *UnrecognizedTriggerPhrase*.



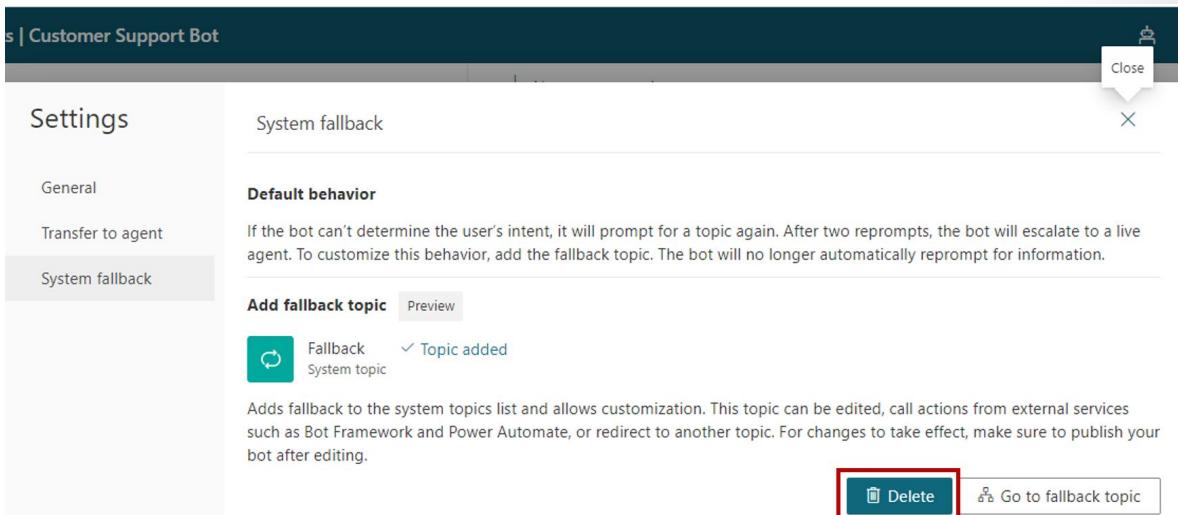
You can use the information that is stored in the *UnrecognizedTriggerPhrase* variable to further personalize the experience. For example, you can pass the information as input to a **Power Automate flow**<sup>60</sup> or **Bot Framework Skill**<sup>61</sup>.

<sup>60</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-flow/>

<sup>61</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/advanced-use-skills/>

## Delete a system fallback topic

If you find that the system fallback behavior is not what you are looking for, it can be reset to return it to its default behavior. By using **Settings**, return to **System Fallback** and select **Delete** to remove the fallback topic.



## Manage topics

As the number of topics expands in your bot, being able to effectively manage them becomes more imperative. Managing your topics includes understanding which topics are active and can be used by the bot and knowing which ones are still being worked on. Topic management also includes identifying errors that could impact a topic's ability to be used. To help you effectively manage topics, Power Virtual Agents provides multiple features to help ensure that topics are working as intended and are visible to users only after they have been tested and are considered ready.

## Manage topic status

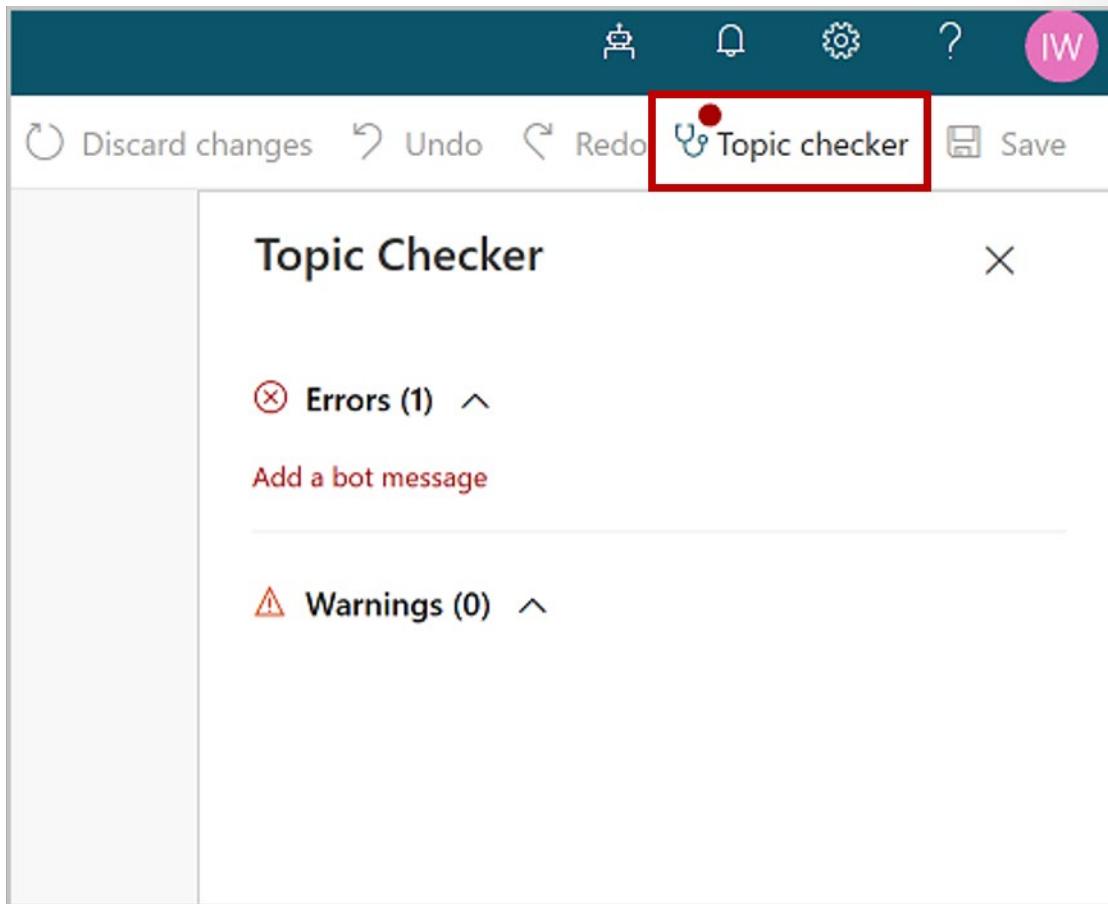
Each topic has a status that indicates if the topic can be used in conversation. A topic can be in either the **On** or **Off** state. When a topic is **On**, it will trigger as expected. This result could be because of its trigger phrases or because another topic was redirected to it. Most topics will be in the **On** state. All topics are set to **On** when they are created.

Topics ⓘ					
Existing (38)	Suggested (8)	Trigger phrases	Status	Errors	Modified ↓
▽ Name					
User Topics (30)					
Test topic	8 🕒	(1) Test topic	<input checked="" type="button"/> On	-	11/11/19, 2:15 PM
Flow test	1 🕒	(1) Flow test	<input checked="" type="button"/> On	-	11/11/19, 2:11 PM
Store Hours	61 🕒	(1) Closed	<input type="button"/> Off	-	11/10/19, 3:23 PM
I'm getting an error that only one portal can be created.	1 🕒	(1) I'm getting an error that only one portal can be created.	<input type="button"/> Off	-	11/10/19, 3:21 PM
Font Resource - FAQ	1 🕒	(1) Font Resource - FAQ	<input type="button"/> Off	-	11/10/19, 3:20 PM
Calling Processes/Actions - FAQ	1 🕒	(1) Calling Processes/Actions - FAQ	<input type="button"/> Off	-	11/10/19, 3:20 PM
Multiple components in single manifest file	1 🕒	(1) Multiple components in single manifest file	<input type="button"/> Off	-	11/10/19, 3:20 PM

Topics that are in the **Off** state will not trigger at all, and their trigger phrases will not work. Additionally, topics that are in the **Off** state will not be redirected to, even if another topic has specified it. The topic is treated as if it does not exist. In most scenarios, a topic is set to **Off** while it's being worked on until it's ready to go live. When a bot is published, every topic, regardless of whether it's set to **On** or **Off**, will be published. However, any topics that are set to **Off** will not be triggered.

## Work with topic errors

While working on a topic, the Topic Checker feature in Power Virtual Agents will validate your topic and show errors or warnings. Errors or warnings can occur for any number of reasons. Warnings indicate that something is not ideal, but it will not prevent the bot from functioning. Because warnings do not prevent the bot from functioning, they are ignored during processing. Errors, however, need be addressed to avoid unexpected behavior or failure during the chat experience. Errors might occur if a node in your topic is incomplete. Instances that would cause errors include a **Message** node that doesn't provide a message or an authentication issue that occurs with a Power Automate flow that is being launched in an action. The Topic Checker feature provides details that are related to the warning or error to help make your task of resolving these issues easier.



Four types of errors that appear in the Topic Checker feature and in the authoring canvas are:

- **Node** - The entire node is erroneous and is highlighted in red.
- **Field** - The field might be missing required data and is highlighted in red.
- **Expression** - The expression might be invalid and is highlighted in red.
- **Variable deletion** - A variable in a topic was deleted and is highlighted in red wherever it was used. This action causes the variable to become "orphaned," and it must be removed or replaced.

You can also see the error state of a topic on the **Topics** list page by selecting the **Topics** tab. The **Errors** column indicates the number of errors that were found during validation. This section only indicates errors and does not include warnings because they do not prevent the bot from functioning. As you fix the errors, they will disappear from the topic checker, either automatically or after you save the topic. Topics with errors can be saved; however, the errors will persist until they are addressed. You cannot deploy a topic that contains errors to production.

The screenshot shows the 'Topics' list page with two tabs: 'Existing (38)' and 'Suggested (8)'. A red callout box highlights a message: 'Errors can impact your bots ability to perform. They should be resolved as soon as possible.' Below this, there are two rows of topics under 'User Topics (30)'. The first row has a red box around it, indicating it contains errors. The second row also has a red box around its error count.

Name	Description	Status	Errors	Modified
Test topic	(1) Test topic	On	1 error	11/14/19, 11:26 AM
Flow test	(1) Flow test	On	1 error	11/12/19, 3:22 PM
Store Hours	(61) Closed	On	-	11/11/19, 2:15 PM
I'm getting an error that only one portal can be created.	(1) I'm getting an error that only one portal can be cr	Off	-	11/11/19, 2:11 PM
Font Resource - FAQ	(1) Font Resource - FAQ	Off	-	11/10/19, 3:23 PM
Calling Processes/Actions - FAQ	(1) Calling Processes/Actions - FAQ	Off	-	11/10/19, 3:21 PM
Multiple components in single manifest file	(1) Multiple components in single manifest file	Off	-	11/10/19, 3:20 PM

## Copy a topic

After you have created a few topics, you might want to use a previous topic as a baseline when you are creating new topics. Copying topics saves time when a conversation path is already defined. When you copy topics, you only need to modify the trigger phrases and tailor the conversation path to fit your needs. On the **Topics** list page, hover over a topic, select the menu icon, and then select **Make a copy**. This action will create a duplicate of the selected topic with *(Copy)* appended to the name. All topic content, such as the description, trigger phrases, and the entire conversation, is copied over to the new topic.

The screenshot shows the 'User Topics (30)' section. A red box highlights the context menu options for the 'Test topic': 'Make a copy' and 'Delete'.

The new topic appears in the **User Topics** list. All copied topics have a status of **Off** by default to avoid confusion on which topic will trigger because it will have the same trigger phrases as the original topic. After you have finished editing the new topic, you can turn it **On** to **test it in the Test bot**<sup>62</sup> window and, when ready, publish the new topic.

## Check your knowledge

Choose the best response for each of the questions below.

<sup>62</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/authoring-test-bot/>

## Multiple choice

1. You want to create a container to store custom product types that can be used as responses to customer questions and as variables that can be used throughout your bot. Which Power Virtual Agents feature should you use?

- Topics
- Entities
- Channels
- Environments

## Multiple choice

2. You are creating a topic that will provide the local weather forecast to a customer. Which conversation node would you use to launch a Power Automate flow to get forecast details from a weather service?

- Ask a question
- Go to another topic
- Call an action
- End the conversation

## Multiple choice

3. Currently, when your bot is unable to identify which topic to present to a customer, it will automatically escalate the conversation to a live agent. You have been asked to configure the bot to first ask the customer a few questions to determine if a topic can help before escalating the conversation. How can you accomplish this task?

- Enable and configure the fallback topic
- Enable and configure the Escalate topic
- Enable and configure the Routing topic
- Enable and configure entities

## Summary

The primary advantage of bots is that they provide a personalized natural language conversation with a customer just as a human agent would. This feature allows bots to handle common issues and helps agents focus on more complex issues. As bots identify the intent of what the customer is saying, they pivot and load subject matter that is most relevant to the customer. Power Virtual Agents uses topics to provide this content. By modifying a topic's conversation path, organizations ensure that each customer is provided with a personalized and relevant experience. Information that is supplied by the customer throughout the conversation can be stored for later use. Existing support content can be added as available topics.

This module examined how organizations can create and manage Power Virtual Agents topics to provide tailored conversations to customers, including:

- Explaining how topics are used in Power Virtual Agents to define how conversations between the bot and customer flow.

- Reviewing the topic creation process and how to use conversation nodes to control and define directions for where the customer can go on the conversation path.
- Explaining how entities are used to store different types of data such as names, phone numbers, and dates, so that they can be used in various areas of a bot.
- Examining how to use the information that is captured in entities and how to store it in variables that can be used throughout your bot.
- Explaining when and how you might use a system fallback topic to customize how your bot handles scenarios where it doesn't recognize content.
- Reviewing the different available options for managing the different topics in your application.

Your next step is to gain a deeper understanding of what tools are available to further enhance Power Virtual Agents bot capabilities. This further learning includes how to use Power Automate flows, trigger handoffs to live agents, and deploy to different channels.

# Manage Power Virtual Agents

## Introduction

Microsoft Power Virtual Agents lets you build adaptable chatbots that use AI. These chatbots can solve common customer and internal-facing issues automatically, freeing up staff to focus on complex requests and high-value interactions. You can create your own powerful chatbots without the need for developers or data scientists by using a guided, no-code graphical interface. You can integrate Power Virtual Agents with the products and services that you use every day by using hundreds of prebuilt connectors, building custom workflows with Microsoft Power Automate, or by creating complex scenarios with Microsoft Bot Framework. Additionally, you can monitor and continuously improve chatbot performance by using AI and data-driven insights that are available in a user-friendly dashboard.

Power Virtual Agents addresses several major issues with bot building in the industry today. It eliminates the gap between subject matter experts and development teams that are building the bots and eliminates the long latency between teams recognizing an issue and updating the bot to address it. Power Virtual Agents removes the complexity of exposing teams to the nuances of conversational AI and the need to write complex code. Also, it minimizes IT effort that is required to deploy and maintain a custom conversational solution.

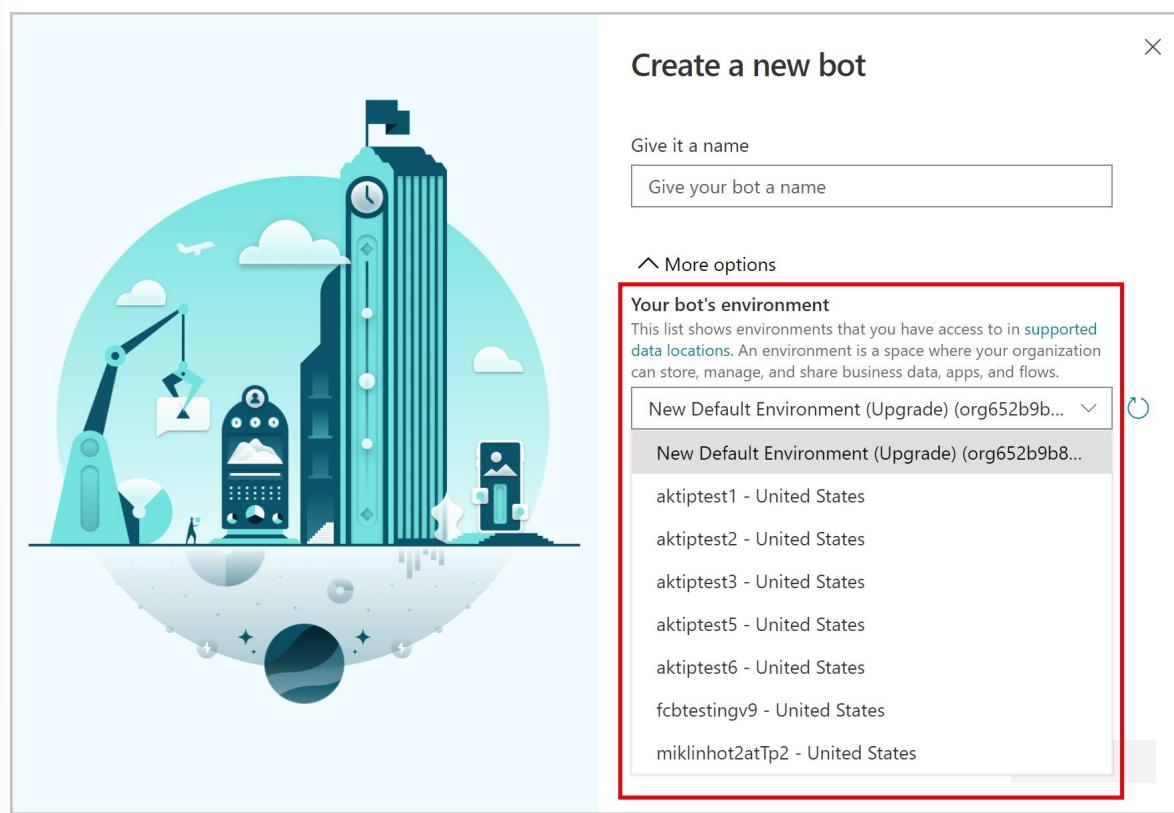
By using Power Virtual Agents, you can:

- Empower your teams by allowing them to build chatbots without needing intermediaries, coding, or AI expertise.
- Reduce costs by automating common inquiries and freeing human agent time to deal with more complex issues.
- Improve customer satisfaction by allowing customers to self-help and resolve issues quickly, every day, by using rich personalized bot conversations.

## Environments in Power Virtual Agents

Power Virtual Agents gives you the flexibility to create bots in different environments. An environment is a space to store, manage, and share your organization's business data. The bots that you create are stored in an environment. Apps and flows are also stored in environments. Environments might have different roles, security requirements, and target audiences, and each environment is created in a separate location.

When creating a bot, you can select from only the list of environments that you have access to.



To create a bot in an environment where you don't have access, you'll need to be a system administrator or contact the system administrator. Then, you will need to complete the following steps:

- Create a bot in the environment (this step will install the necessary Power Virtual Agents solutions).
- Assign the security role of "bot author" to you in the environment.

To assign the security role of "bot author," Microsoft Power Platform admin must go to Microsoft Power Platform admin center, select the environment, and then select **Settings**.

The screenshot shows the Microsoft Power Platform admin center interface. The left sidebar has a red box around the 'Environments' link. The top navigation bar shows 'Contoso Electronics' and 'Power Platform admin center'. The main area displays the 'Environments' list with two items: 'PVA Test Bot' (selected, highlighted with a red box) and 'Contoso (default)'. The 'Settings' button in the top right is also highlighted with a red box.

In **Users + permissions**, select **Security roles**.

Search for a setting ▾

- ✓ **Product**  
Behavior, Features, Languages, Privacy + Security
- ✓ **Business**  
Business closures, Calendar, Connection roles, Currencies
- ✗ **Users + permissions**
  - Business units ▾
  - Hierarchy security ▾
  - Mobile configuration
  - Positions ▾
  - Security roles**
  - Teams ▾
  - Users
- ✓ **Audit and logs**  
Audit settings, Audit summary view, Entity and field audit settings, System jobs
- ✓ **Templates**  
Access team templates, Article templates, Contract templates, Data import templates

**Select Bot Author.**

Manage security roles within this environment so that people can access their data. [Learn more](#)

Business unit

org0aab6423 ▾

Role ↑	...
BizQAAApp	...
<b>Bot Author</b>	...
Bot Contributor	...
Bot Transcript Viewer	...
CCI admin	...
Common Data Service User	...

**Select + Add people.**

The screenshot shows the 'Power Platform admin center' interface for 'Contoso Electronics'. In the top navigation bar, there is a red box around the '+ Add people' button. Below it, the breadcrumb path is 'Environments > Contoso (default) > Settings > Security roles > Bot Author'. A sub-header says 'Add or remove people from the Bot Author security role. Learn more'. Under 'Business unit', it shows 'org0aab6423'. On the left, a sidebar lists 'Environments', 'Analytics', 'Resources', 'Help + support', and 'Data integration'. On the right, there is a table with columns 'Name ↑', 'Type', and 'Username'. The table currently has one row for 'Joni Sherman'.

You can search for the person whom you are looking for, select the name, and then select **Add**.

This is a modal dialog titled 'Add people' with a sub-instruction 'Choose the people who should be added to the role.' A search input field contains 'jor'. Below it, a list item shows 'JS Joni Sherman JoniS@M365x136542.OnMicrosoft.com' with a close button 'X'. At the bottom are 'Add' and 'Cancel' buttons.

The upper part of the screen will show a successful notification ribbon and the name of the user.

The screenshot shows the same 'Power Platform admin center' interface as before, but now with a green notification bar at the top containing a checkmark icon and the text 'Successfully added 1 user and 0 teams to the Bot Author security role.' The rest of the page is identical to the first screenshot.

You have now successfully given a user bot maker access in an environment.

## Bot topics permissions

Topics are the no-code way to create discrete conversation paths that, when used together within a single bot, allow users to have a conversation with a bot that feels natural and flows appropriately.

Topics are siloed in each bot and can't be shared, even if they're part of the same environment. You do have the option to copy an existing topic, which is automatically created and saved in the same bot and,

by default, the **Status** is set to **Off**.

The screenshot shows the 'Topics' section of the Microsoft Bot Framework. At the top, a green banner displays a success message: 'Topic copied successfully'. Below the banner are three buttons: '+ New topic', 'Suggest topics', and 'Open in Bot Framework (Preview)'. The main area is titled 'Topics' with a '1' icon. It has two tabs: 'Existing (13)' (which is underlined) and 'Suggested (0)'. A table lists the topics:

Type	Name	Trigger phrases	Status
Text	Lesson 1 - A simple topic (Copy)	(4) When are you closed	<input type="checkbox"/> Off
Text	Lesson 1 - A simple topic	(4) When are you closed	<input checked="" type="checkbox"/> On
Text	Lesson 2 - A simple topic with a condition an...	(5) Are there any stores arou...	<input checked="" type="checkbox"/> On

By default, each bot comes with 12 topics, of which only four can be turned off. The remaining topics will

The screenshot shows the 'Topics' section of the Microsoft Bot Framework. The 'Existing (12)' tab is selected. A search bar at the top right contains the placeholder 'Search existing'. The main area displays a table of 12 topics, all of which have their status set to 'On' (indicated by a blue toggle switch). The topics are:

Type	Name	Trigger phrases	Status	Errors	Editing
Text	Lesson 1 - A simple topic	(4) When are you closed	<input checked="" type="checkbox"/> On		
Text	Lesson 2 - A simple topic with a condition an...	(5) Are there any stores arou...	<input checked="" type="checkbox"/> On		
Text	Lesson 3 - A topic with a condition, variables...	(5) Buy items	<input checked="" type="checkbox"/> On		
Text	Lesson 4 - A topic with a condition, variables...	(5) What is the best product f...	<input checked="" type="checkbox"/> On		
Greeting	Greeting	(52) Good afternoon	Always on		
Escalate	Escalate	(65) Talk to agent	Always on		
End of Conversation	End of Conversation	No trigger phrases	Always on		
Confirmed Success	Confirmed Success	No trigger phrases	Always on		
Confirmed Failure	Confirmed Failure	No trigger phrases	Always on		
Goodbye	Goodbye	(67) Bye	Always on		
Start over	Start over	(3) start over	Always on		
Thank you	Thank you	(4) thanks	Always on		

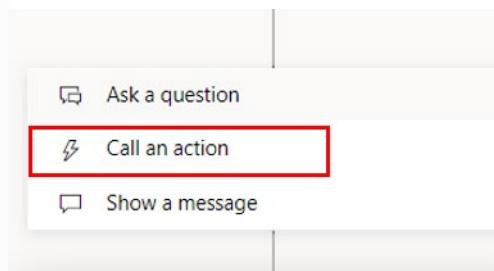
always be turned on and can't be deleted.

Currently, the only way to export and import topics from one environment to another is by using solutions and migrating the entire chatbot. In **Solutions**, you can add your existing chatbot and it will include all its topics automatically.

## Bot entities and flow permissions

Power Virtual Agents chatbots come with prebuilt entities that are provided by the system and help the bot identify common information such as age, colors, numbers, and names. Chatbot makers in the environment don't have access to the tables that they see in the same environment in Microsoft Power Apps or Power Automate.

Currently, the only option to connect with tables is by using Power Automate flow. To trigger the flow, use the **Call an action** feature in the chatbot authoring canvas.



Only flows that are part of the solution are visible in the **Call an action** feature. We recommend that you have System Administrator level access for an environment to build bots that can connect with the flows that, in turn, connect with tables.

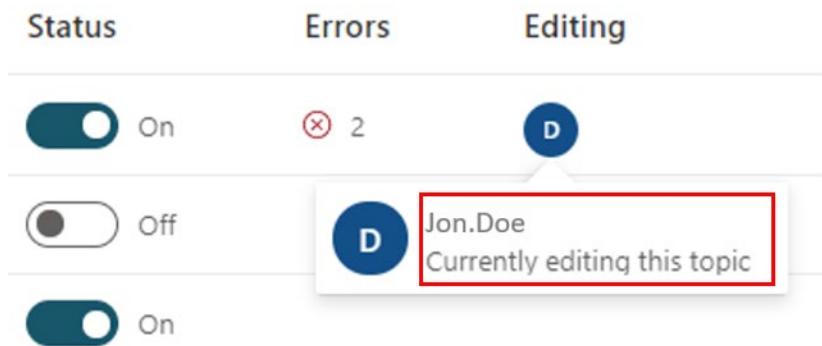
## Monitor and diagnose

The best way to monitor the status and diagnose the error of your chatbot is at the topic level.

The **Topics** list shows if the chatbot **Status** is on or off, if it has errors, and if it's currently being edited by someone.

Topics					
Existing (14)		Suggested (0)			
Type	Name	Trigger phrases	Status	Errors	Editing
ChatBot	(S) Bot at your service	<input checked="" type="checkbox"/>	On	2	
Lesson 1 - A simple topic (Copy)	(S) When are you closed	<input type="checkbox"/>	Off		
Lesson 1 - A simple topic	(S) When are you closed	<input checked="" type="checkbox"/>	On		
Lesson 2 - A simple topic with a condition an...	(S) Are there any stores arou...	<input checked="" type="checkbox"/>	On		
Lesson 3 - A topic with a condition, variables...	(S) Buy items	<input checked="" type="checkbox"/>	On		
Lesson 4 - A topic with a condition, variables...	(S) What is the best product f...	<input checked="" type="checkbox"/>	On		
Greeting	(S) Good afternoon		Always on		
Escalate	(S) Talk to agent		Always on		
End of Conversation	No trigger phrases		Always on		

Hover your mouse over the displayed initial to find the full name of the person who is editing the topic.



To diagnose the cause of the error, select the error in **Topics** to go to the **Setup** page, which shows that the error is from the authoring canvas.

The screenshot shows the 'Setup' tab of a chatbot configuration page. It includes fields for Name (chatBot), Friendly name (Optional), and Description (Optional). On the right, it lists 'Trigger phrases (5)' with examples like 'Bot at your service', 'Hi, chatbot here', 'Do you need a bot', 'I am a bot', and 'I am a chat bot'. A red box highlights the 'Status' section, which shows 'Status' and '2'. A button 'Go to authoring canvas' is also visible.

Setup   Analytics

Name \*

chatBot

Friendly name ⓘ

(Optional)

Description

(Optional)

Trigger phrases (5) ⓘ

How might your customers ask about this topic? Try to start with 5-10 diverse phrases.

Enter a trigger phrase  Add

Bot at your service

Hi, chatbot here

Do you need a bot

I am a bot

I am a chat bot

Status

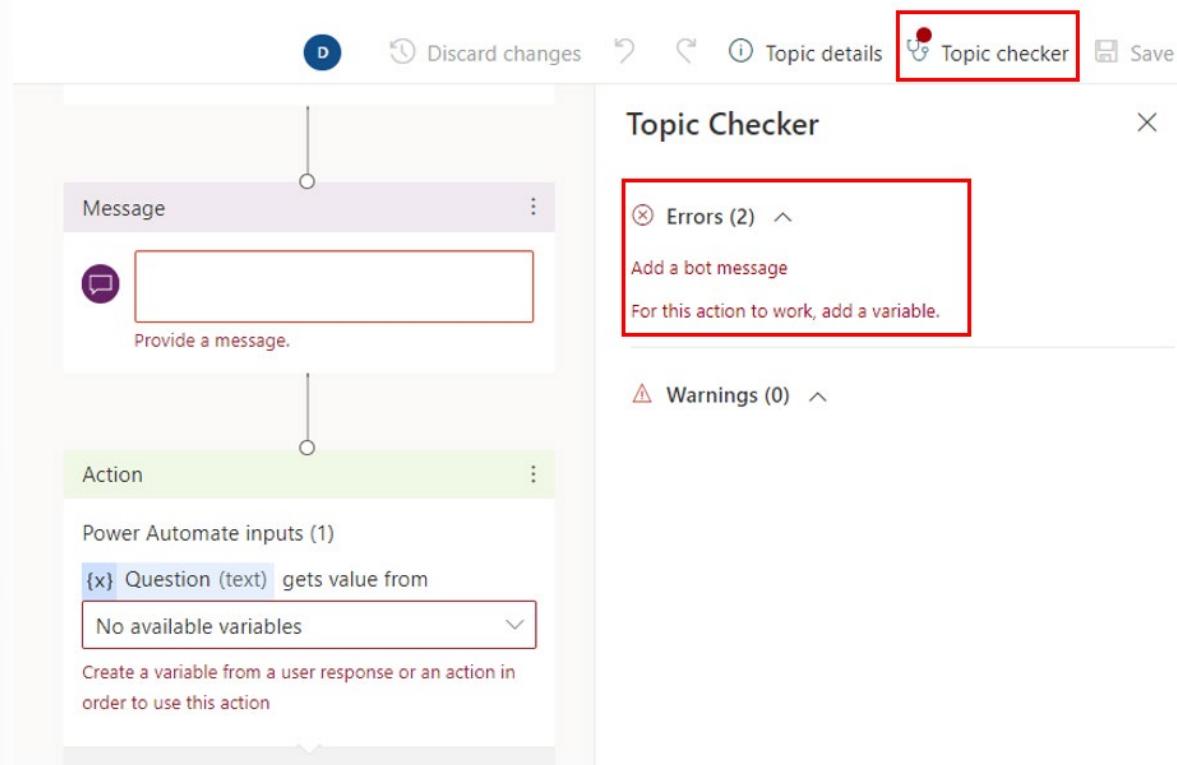
2

Go to authoring canvas

Modified by

Jon.Doe   15 minutes ago

Selecting the status error number will take you to the canvas, which shows the two errors in the **Topic checker** feature.



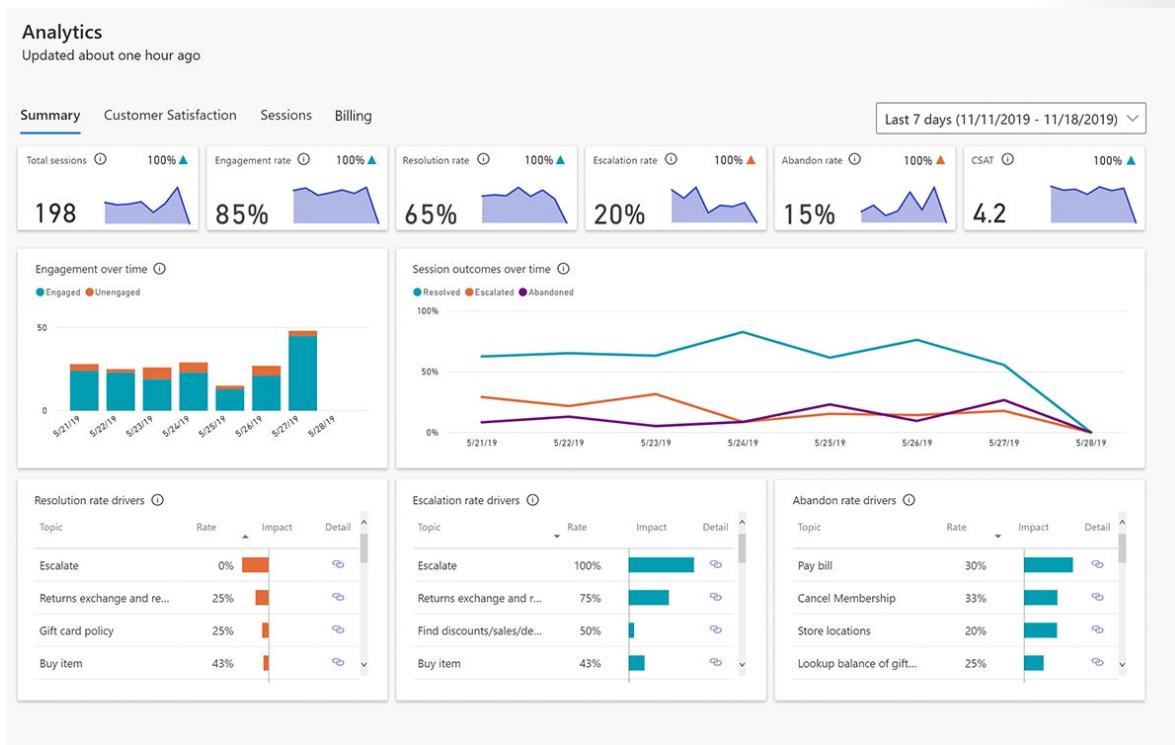
## Administer and manage

Power Virtual Agents gives you the flexibility to administer analytics and manage security of the chatbots.

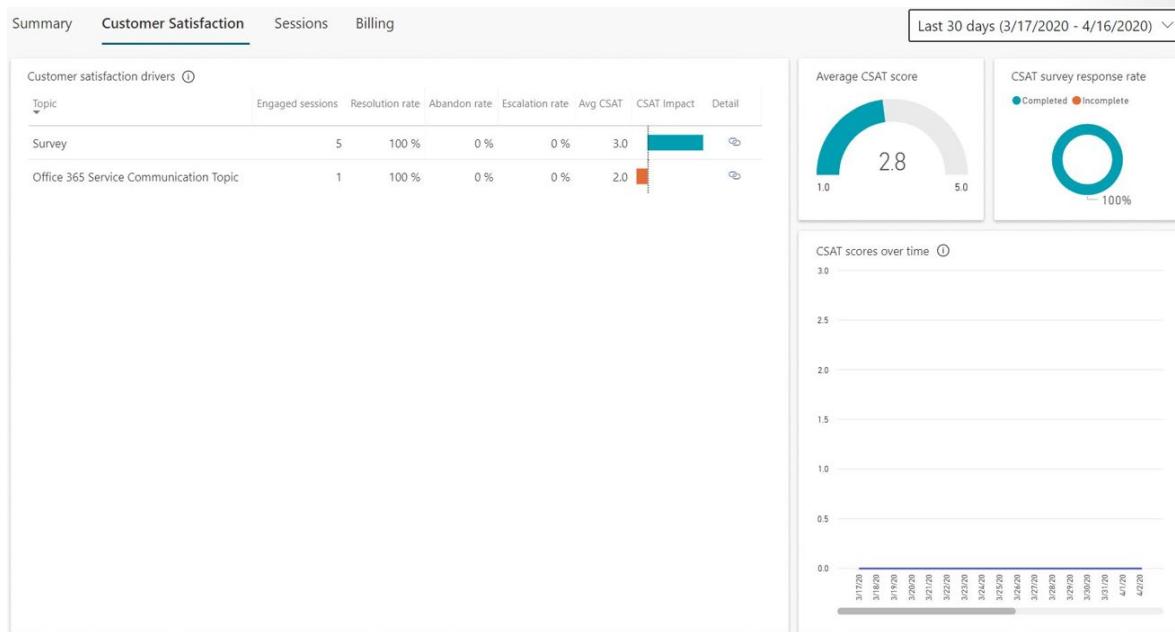
### Analytics

The analytics section is divided into numerous pages to give you multiple ways to understand bot performance.

The **Summary** tab provides a detailed overview of how many total chatbot sessions were run over the period that you selected. Information such as total number of sessions, engagement rate, resolution rate, escalation rate, and abandon rate can help you to understand how effective the bot has been and to determine the areas that need improvement.



The **Customer Satisfaction** report helps identify which topics are having the most impact and where analysts will go to stay informed.



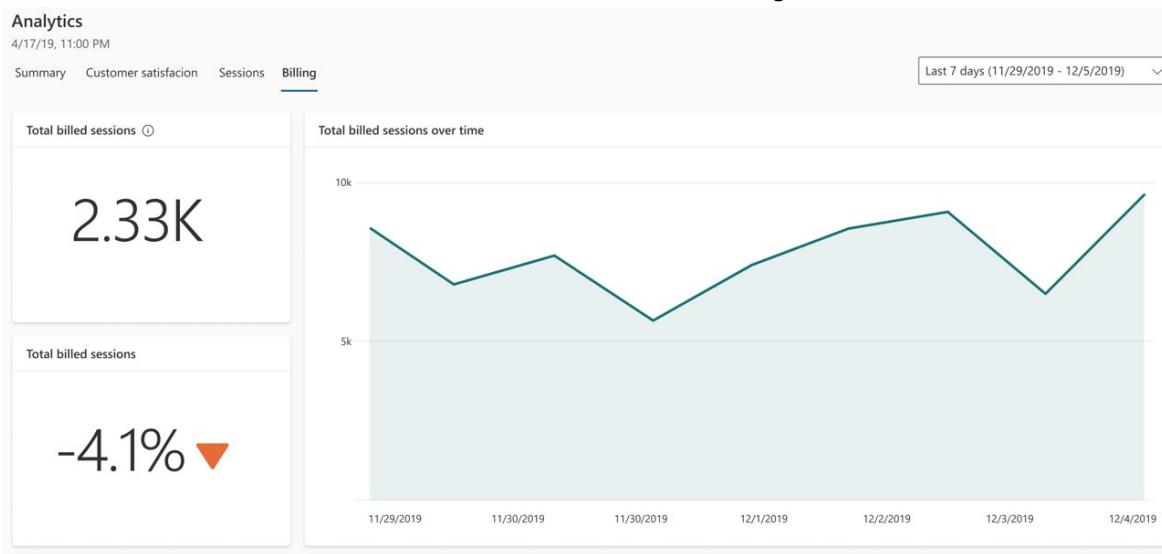
The **Sessions** tab gives you the flexibility to download raw data from all chatbot sessions. This offering includes a complete transcript of the sessions and the outcome.

A	B	C	D	E	F	G
SessionId	StartTime(UTC)	InitialUserMess	TopicName	ChatTranscript	SessionOutcome	TopicId
1	5/20/2020 19:47	session	Sessions	User says: Hello;Bot says: Hi There! I'm your personal assistant to	Resolved	05ef3b6-73a0-4937-bfc6-7625667e829f
2	88pEZ9XUBV7CYG2UThh8A2-j-3			User says: question about speakers;Bot says: Hi There! Looks like	Resolved	05ef3b6-73a0-4937-bfc6-7625667e829f
3	8c0jSPDjLF7FvE9Y4AtWUY-o-1	5/20/2020 15:24	question about Sessions	User says: Hi there;Bot says: Hi There! I'm your personal assistant Abandoned	Abandoned	05ef3b6-73a0-4937-bfc6-7625667e829f
4	FIGcJ8EDoW7DLEqtzjCg6l-o-1	5/20/2020 13:10	I'm looking for a Sessions	User says: Hello;Bot says: Hi There! I'm your personal assistant to Escalated	Escalated	05ef3b6-73a0-4937-bfc6-7625667e829f
5	88pEZ9XUBV7CYG2UThh8A2-j-3	5/21/2020 13:10	session	User says: question about speakers;Bot says: Hi There! Looks like Unengaged	Unengaged	05ef3b6-73a0-4937-bfc6-7625667e829f
6	8c0jSPDjLF7FvE9Y4AtWUY-o-1	5/22/2020 13:10	question about Sessions	User says: Hi there;Bot says: Hi There! I'm your personal assistant Resolved	Resolved	05ef3b6-73a0-4937-bfc6-7625667e829f
7	FIGcJ8EDoW7DLEqtzjCg6l-o-1	5/23/2020 13:10	I'm looking for a Sessions	User says: Hello;Bot says: Hi There! I'm your personal assistant to Escalated	Escalated	05ef3b6-73a0-4937-bfc6-7625667e829f
8	88pEZ9XUBV7CYG2UThh8A2-j-3	5/24/2020 13:10	session	User says: question about speakers;Bot says: Hi There! Looks like Unengaged	Unengaged	05ef3b6-73a0-4937-bfc6-7625667e829f
9	8c0jSPDjLF7FvE9Y4AtWUY-o-1	5/25/2020 13:10	question about Sessions	User says: question about speakers;Bot says: Hi There! Looks like Unengaged	Unengaged	05ef3b6-73a0-4937-bfc6-7625667e829f
10	FIGcJ8EDoW7DLEqtzjCg6l-o-1	5/26/2020 13:10	I'm looking for a Sessions	User says: Hi there;Bot says: Hi There! I'm your personal assistant Abandoned	Abandoned	05ef3b6-73a0-4937-bfc6-7625667e829f
11	88pEZ9XUBV7CYG2UThh8A2-j-3	5/27/2020 13:10	session	User says: Hello;Bot says: Hi There! I'm your personal assistant to Escalated	Escalated	05ef3b6-73a0-4937-bfc6-7625667e829f
12	8c0jSPDjLF7FvE9Y4AtWUY-o-1	5/28/2020 13:10	question about Sessions	User says: question about speakers;Bot says: Hi There! Looks like Resolved	Resolved	05ef3b6-73a0-4937-bfc6-7625667e829f
13	FIGcJ8EDoW7DLEqtzjCg6l-o-1	5/29/2020 13:10	I'm looking for a Sessions	User says: Hi there;Bot says: Hi There! I'm your personal assistant Resolved	Resolved	05ef3b6-73a0-4937-bfc6-7625667e829f
14						
15						
16						
17						
18						
19						

The **Billing** tab shows the billable interaction between a customer and a bot and represents one unit of consumption. The billed session begins when a user topic is triggered.

A session will end for one of the following reasons:

- The user ends the chat session. When the bot doesn't receive a new message for more than 30 minutes, the session is considered closed.
- The session is longer than 60 minutes. The first message that occurs after 60 minutes starts a new session.
- The session has more than 100 turns. A turn is defined as one exchange between a user and the bot.



The one-hundred-and-first turn starts a new session.

## Security

You can set up other security measures for your bot and your users.

## Security

Set up additional security measures for the bot and your users.



### Sharing

Invite people to collaborate on your bot.



### Access

Decide who can find and use your bot.



### Authentication

Verify a user's identity during a chat.



### Web channel security

Review other enhanced security options.

## Sharing

You can share your bot with other users so that multiple users can edit, manage, and collaborate on a bot. You can stop sharing with individual users anytime. You do not need to share a bot with another user for them to chat with the bot.

You can view the current access that a user has for your environment, and you have the option to assign security roles to the selected user.

Share your bot X

Add people to this bot to collaborate together. [Learn more about sharing bots](#)

New users

<input checked="" type="checkbox"/> J	John Manager, Power Automate user	<a href="#">X</a>
---------------------------------------	--------------------------------------	-------------------

Shared with Sort by Name ▾

D	Jane.doe Owner, Manager, Power Automate us...
---	--

John

Bot permissions

The user's permissions for this bot.

<input checked="" type="checkbox"/> Manager Can view, edit, configure, share, publish bot but not delete it.
<input checked="" type="checkbox"/> Power Automate user Can create and add flows to the bot. <a href="#">Learn about sharing flows</a>
<span style="font-size: small;">ⓘ</span> All flows added to your bot, current and future, will be shared with this user.
<input type="checkbox"/> Transcript viewer Can't view transcripts of chat sessions with end users.

Environment security roles

Security roles allow a user to work with bots in Power Virtual Agent in this environment (DanielChristian). [Learn more](#)

<span style="font-size: small;">ⓘ</span> This user needs environment security roles to work with bots in Power Virtual Agents. By sharing the bot the user will be assigned the selected security roles.
<input checked="" type="checkbox"/> Environment maker Can create bots, can be a bot Manager, and can use Power Automate
<input type="checkbox"/> Bot transcript viewer Can view transcripts of chat sessions with end users.

[Manage security roles](#)

Send an email invitation to new users

Share Cancel

**Bot author**, **Bot contributor**, and **Bot transcript viewer** are the three security roles for Power Virtual Agents that you can manage at Microsoft Power Platform admin center.

You can assign the **Environment maker** security role when sharing a bot with a user who doesn't have sufficient environment permissions to run Power Virtual Agents.

When you are sharing the bot, if the specified user doesn't have sufficient permissions to use Power Virtual Agents in the environment, you will be notified that the **Environment maker** security role will be assigned to the person so that they can use the bot.

## Access and authentication

The **Access** and **Authentication** options control who can access your bot. You can select one of two groups:

- **All bot managers** - This selection allows only bot managers to chat with the bot. You can share your bot so that other bot managers can access it.
- **Everyone in my organization (Organization name)** - This selection allows everyone in the organization to access and chat with your bot. Users who are outside of the organization will see an error when chatting with the bot.

The **Authentication** setting impacts how you can manage access to the bot.

Select **Manage** on the side navigation pane and then go to the **Security** tab and select **Authentication**.

## Authentication X

Verify a user's identity during a conversation. The bot receives secure access to the user's data and is able to take actions on their behalf, resulting in a more personalized experience. [Learn more](#)

Choose an option

**No authentication**

Basic bot setup with no authentication action or authentication variables.

**Only for Teams**

User ID and User Display Name authentication variables available. Automatically sets up Azure Active Directory (AAD) authentication for Teams. All other channels will be disabled. [Learn more](#)

**Manual (for any channel including Teams)**

Support AAD or any OAuth2 identity provider. Authentication variables are available including authentication token.

Enter the information provided by your Identity Provider (IdP), and then test the connection. For single sign-on with AAD include the token exchange URL. [Learn more](#)

Three options for authentication are:

- **No authentication** - Any user who has a link to the bot (or can find it, for example, on your website) can chat with it. Therefore, the **Access** setting options will be disabled.

## Access X

! These controls are unavailable due to Authentication configuration. [Learn more](#) X

### Require users to sign in

Adds new system topic to prompt the user to sign in before the bot can engage. Once added, this topic can't be removed. [Learn more](#)

Require users to sign in

### Access

Decide who can find and use your bot.

All users can access the bot, even when not logged in ▼

- **Only for Teams** - The bot will only work on the Teams channel, meaning that the user will always be signed in. Therefore, the **Require users to sign in** option in the **Access** setting will be enabled and can't be changed.

- **Manual (for any channel including Teams)** - This option has the following parameters:
  - If your authentication setting is configured to **Manual**, and the service provider is either Microsoft Azure Active Directory (Azure AD) or Azure Active Directory V2, you can turn off the **Require users to sign in** option and change the access settings for the bot.
  - If your authentication provider is set as **Generic OAuth 2**, you can turn off the **Require users to sign in** option, but you can't control which users can access the bot. That option is only available when you use Azure AD authentication.

## Web channel security

When you create a Power Virtual Agents bot, it is immediately available in the Demo website and Custom website channels to anyone who knows the bot ID. These channels are available by default, and no configuration is needed.

Users can find the bot ID directly from within Power Virtual Agents or by receiving it from someone. Depending on the bot's capability and sensitivity, that scenario might not be desirable.

With Direct Line-based security, you can enable access to only the locations that you control by enabling secured access with Direct Line secrets or tokens. You can enforce the use of secrets and tokens for each individual bot. After this option has been enabled, channels will need the client to authenticate their requests by using a secret or by using a token that is generated by using the secret, which is obtained at runtime. Any access to the bot that doesn't provide this security measure won't work.

On the side navigation pane, select **Manage > Security** and then select **Web channel security**.

**Web channel security** ×

Power Virtual Agents provides several channels by default, some of which use Direct Line to facilitate communication between the bot and your client application. The Direct Line channels are accessible by default without the need to configure a secret. [Learn more about Direct Line](#)

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**Secrets and tokens**

A Direct Line secret is a master key that can be used to initiate conversations with the associated bot. A secret can also be used to obtain a token, which is the preferred and secure method if you're writing an application where the client runs in a web browser or mobile app. [Learn more about Direct Line secrets and tokens](#)

Secret 1  
..... Copy

Regenerate Copy

Secret 2  
..... Copy

Regenerate Copy

---

**Secured access**

Enabling this renders the Demo website unavailable as well as any Direct Line channel not using a secret or token.

**Require secured access** Disabled

If you need to disable the **Web channel security** option, you can do so by switching **Require secured access** to **Disabled**. Disabling secured access can take up to two hours to propagate.

### Enable require secured access

This action renders the Demo website unavailable, as well as any Direct Line channel not using a secret or token.

This action can take up to two hours to take effect.

**Enable**

**Cancel**

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *How do you migrate topics from one environment to another?*

- Export the topic as a zipped file from one chatbot and then import it to another chatbot in the other environment.
- Export the entire chatbot as a zipped file from the source environment and then import it to the destination environment.
- You can't migrate only topics. You must migrate the entire chatbot by using a solution.
- You would use the Power Automate template to copy and paste the chatbot topics.

### Multiple choice

2. *How do chatbots use the existing tables in Power Apps or Power Automate?*

- The existing tables in Power Apps or Power Automate are already available in the chatbot entities.
- You need to use the Call an action feature in the chatbot authoring canvas.
- You do a one-time synchronization configuration that is available in the chatbot manager.
- You do a one-time synchronization configuration by using the Bot Framework.

### Multiple choice

3. *What authentication options are currently available?*

- No authentication, Only for Teams, and Manual using Azure Active Directory
- Azure Active Directory and Microsoft 365 Groups
- Azure Active Directory and Teams
- Azure Active Directory and Power Automate flow

## Multiple choice

4. What information does the Analytics section provide?

- Summary and Customer Satisfaction
- Summary, Customer Satisfaction, and Sessions
- Summary, Customer Satisfaction, Sessions, and error log
- Summary, Customer Satisfaction, Sessions, and Billing

## Summary

Power Virtual Agents lets you create powerful chatbots with a guided, no-code graphical interface and without the need for data scientists or developers.

Using a no-code graphical interface will help to:

- Eliminate the gap between subject matter experts and development teams that are building the bots.
- Reduce the time from when bot builders and owners recognize an issue to when it can be updated.
- Remove the need to understand complex conversational AI systems and methodologies.
- Simplify the need for complex code.
- Minimize the IT effort that is needed to deploy and maintain a custom conversational solution.

## Links to related modules for specific topics

- **Share your bot with other users<sup>63</sup>**
- **Assign access and change security options in Power Virtual Agents<sup>64</sup>**
- **Key concepts - Configuration of Power Virtual Agents<sup>65</sup>**

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<sup>63</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/admin-share-bots#assign-environment-security-roles>

<sup>64</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/configuration-end-user-authentication#access-settings-based-on-authentication-configuration>

<sup>65</sup> <https://docs.microsoft.com/en-us/power-virtual-agents/configuration-fundamentals>

# Answers

## Multiple choice

1.Which of the following Power Virtual Agents components is used to define the conversation path between a customer and the bot?

- Entities
- Topics
- Variables
- Channels

*Explanation*

*In Power Virtual Agents, topics represent potential conversation paths. Each topic contains triggers and a conversation path. Conversation nodes in the topic help dictate how the customer will progress down the path.*

## Multiple choice

2.Which setting on the Test bot panel lets you monitor a test conversation that spans across multiple topics?

- Switch between topics
- Monitor between topics
- Track between topics
- Follow between topics

*Explanation*

*When you enable Track between topics on the Test bot panel, each topic that is being tested will display in the conversation panel. This feature lets you monitor each topic individually while it's being tested. It also lets you engage with multiple topics in a single test session.*

## Multiple choice

3.What must be done at least once before a bot can be deployed to different channels, such as websites, Microsoft Teams, or Facebook?

- Publish the bot
- Test the bot
- Define synonyms
- Create entities

*Explanation*

*Publishing a bot allows customers to engage with it. A bot needs to be published at least once before it can be made available across multiple platforms and channels, such as Microsoft Teams or Facebook.*

**Multiple choice**

1. When a customer initiates a bot conversation, they are automatically asked to provide the nature of their inquiry. They can select from Support, Billing, or Question. You have been asked to configure the bot to automatically escalate the conversation to a live agent when someone indicates that the nature of the inquiry is Billing. What conversation node can you use to facilitate this request?

- Call an action
- End the conversation
- Show a message
- Go to another topic

*Explanation*

*The End the conversation node is used to end the customer's communication with the bot. It contains two options, End with survey or Transfer to agent. For this scenario, you would select End the conversation and then Transfer to agent.*

**Multiple choice**

2. You are using the Call an action conversation node to initiate a Power Automate flow. What do you call the values that are provided back to Power Virtual Agents from Power Automate flow?

- Inputs
- Entities
- Outputs
- Topics

*Explanation*

*When you are running Power Automate flows from a Power Virtual Agents bot, input and output parameters are used to pass information back and forth. Input parameters are used to define what information that the Power Automate flow will capture from the bot. Output parameters contain the values that Power Automate sends back to the bot.*

**Multiple choice**

1. You want to create a container to store custom product types that can be used as responses to customer questions and as variables that can be used throughout your bot. Which Power Virtual Agents feature should you use?

- Topics
- Entities
- Channels
- Environments

*Explanation*

*Entities in Power Virtual Agents are informational units that represent certain types of real-world subjects such as a phone number, postal code, city, or a person's name. Organizations create their own entities to represent organization-specific items such as product categories.*

**Multiple choice**

2.You are creating a topic that will provide the local weather forecast to a customer. Which conversation node would you use to launch a Power Automate flow to get forecast details from a weather service?

- Ask a question
- Go to another topic
- Call an action
- End the conversation

*Explanation*

*Conversation nodes are used by topics to help control the flow of a conversation. They are used to display messages, capture data, or in the case of the Call an action node, they can be used to launch a Power Automate flow that interacts with an external service.*

**Multiple choice**

3.Currently, when your bot is unable to identify which topic to present to a customer, it will automatically escalate the conversation to a live agent. You have been asked to configure the bot to first ask the customer a few questions to determine if a topic can help before escalating the conversation. How can you accomplish this task?

- Enable and configure the fallback topic
- Enable and configure the Escalate topic
- Enable and configure the Routing topic
- Enable and configure entities

*Explanation*

*Fallback topics can be enabled to defer a customer topic rather than trigger an escalation. After you have enabled the fallback topic for your bot, you can configure the topic as you would any other topic in the system.*

**Multiple choice**

1.How do you migrate topics from one environment to another?

- Export the topic as a zipped file from one chatbot and then import it to another chatbot in the other environment.
- Export the entire chatbot as a zipped file from the source environment and then import it to the destination environment.
- You can't migrate only topics. You must migrate the entire chatbot by using a solution.
- You would use the Power Automate template to copy and paste the chatbot topics.

*Explanation*

*Currently, no option exists for migrating only topics from one environment to another. You need to create a solution and then add the chatbot to that solution. Then, you can export and import the chatbot.*

**Multiple choice**

2.How do chatbots use the existing tables in Power Apps or Power Automate?

- The existing tables in Power Apps or Power Automate are already available in the chatbot entities.
- You need to use the Call an action feature in the chatbot authoring canvas.
- You do a one-time synchronization configuration that is available in the chatbot manager.
- You do a one-time synchronization configuration by using the Bot Framework.

*Explanation*

*Currently, the only option to connect with tables is by using Power Automate flow. To trigger the flow, you would use the Call an action feature in the chatbot authoring canvas.*

**Multiple choice**

3.What authentication options are currently available?

- No authentication, Only for Teams, and Manual using Azure Active Directory
- Azure Active Directory and Microsoft 365 Groups
- Azure Active Directory and Teams
- Azure Active Directory and Power Automate flow

*Explanation*

*The three authentication options that you can choose from are No authentication, Only for Teams, and Manual using Azure Active Directory.*

**Multiple choice**

4.What information does the Analytics section provide?

- Summary and Customer Satisfaction
- Summary, Customer Satisfaction, and Sessions
- Summary, Customer Satisfaction, Sessions, and error log
- Summary, Customer Satisfaction, Sessions, and Billing

*Explanation*

*Power Virtual Agents has a comprehensive set of analytics that show you the key performance indicators for your bot. This feature helps you analyze your bot performance and usage, customer satisfaction, topic usage, session information, and billed session information.*

## Module 11 Analyze data with Power BI

### Get started building with Power BI

#### Introduction

**Microsoft Power BI** is a collection of software services, apps, and connectors that work together to turn your unrelated sources of data into coherent, visually immersive, and interactive insights. Whether your data is a simple Microsoft Excel workbook, or a collection of cloud-based and on-premises hybrid data warehouses, **Power BI** lets you easily connect to your data sources, visualize (or discover) what's important, and share that with anyone or everyone you want.

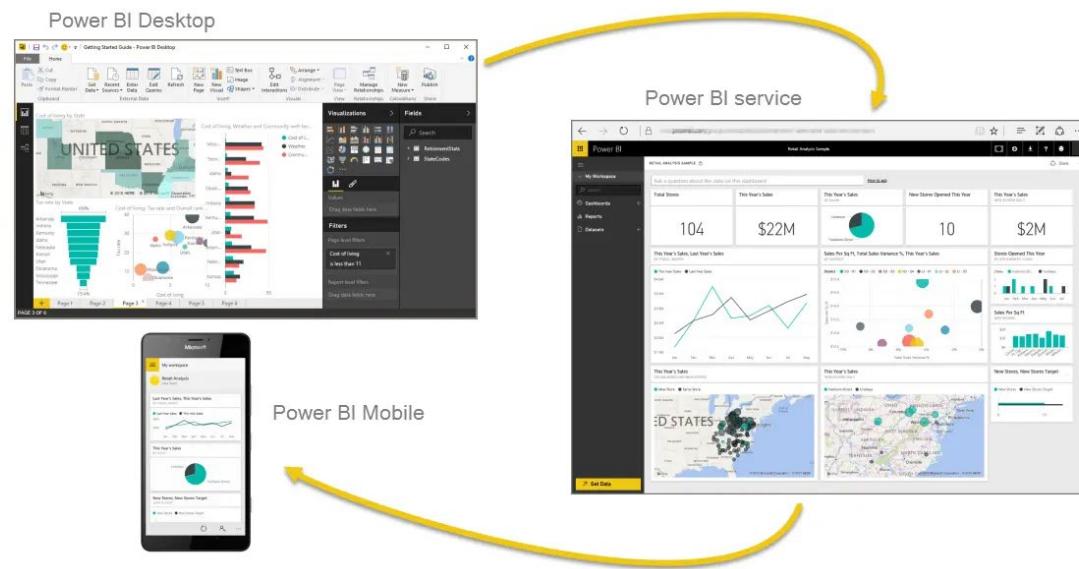


**Power BI** can be simple and fast, capable of creating quick insights from an Excel workbook or a local database. But **Power BI** is also robust and enterprise-grade, ready not only for extensive modeling and real-time analytics, but also for custom development. Therefore, it can be your personal report and visualization tool, but can also serve as the analytics and decision engine behind group projects, divisions, or entire corporations.

If you're a **beginner** with Power BI, this module will get you going. If you're a Power BI **veteran**, this module will tie concepts together and fill in the gaps.

## The parts of Power BI

Power BI consists of a Microsoft Windows desktop application called **Power BI Desktop**, an online SaaS (*Software as a Service*) service called the **Power BI service**, and mobile Power BI **apps** that are available on any device, with native mobile BI apps for Windows, iOS, and Android.



These three elements—**Desktop**, the **service**, and **Mobile** apps—are designed to let people create, share, and consume business insights in the way that serves them, or their role, most effectively.

## How Power BI matches your role

How you use Power BI might depend on your role on a project or a team. And other people, in other roles, might use Power BI differently, which is just fine.

For example, you might view reports and dashboards in the **Power BI service**, and that might be all you do with Power BI. But your number-crunching, business-report-creating coworker might make extensive use of **Power BI Desktop** (and publish Power BI Desktop reports to the Power BI service, which you then use to view them). And another coworker, in sales, might mainly use her Power BI phone app to monitor progress on her sales quotas and drill into new sales lead details.

You also might use each element of **Power BI** at different times, depending on what you're trying to achieve, or what your role is for a given project or effort.

Perhaps you view inventory and manufacturing progress in a real-time dashboard in the service, and also use **Power BI Desktop** to create reports for your own team about customer engagement statistics. How you use Power BI can depend on which feature or service of Power BI is the best tool for your situation. But each part of Power BI is available to you, which is why it's so flexible and compelling.

We discuss these three elements—**Desktop**, the **service**, and **Mobile** apps—in more detail later. In upcoming units and modules, we'll also create reports in Power BI Desktop, share them in the service, and eventually drill into them on our mobile device.

## Download Power BI Desktop

You can download Power BI Desktop from the web or as an app from the Microsoft Store on the Windows tab.

Download Strategy	Link	Notes
Windows Store App	<b>Windows Store</b> ( <a href="https://aka.ms/pbidesktopstore">https://aka.ms/pbidesktopstore</a> )	Will automatically stay updated
Download from web	<b>Download .msi</b> ( <a href="https://go.microsoft.com/fwlink/?LinkId=521662">https://go.microsoft.com/fwlink/?LinkId=521662</a> )	Must manually update periodically

## Sign in to Power BI service

Before you can sign in to Power BI, you'll need an account. To get a free trial, go to [app.powerbi.com](http://app.powerbi.com)<sup>1</sup> and sign up with your email address.

For detailed steps on setting up an account, see [Sign in to Power BI service](#)<sup>2</sup>

## The flow of work in Power BI

A common flow of work in Power BI begins in **Power BI Desktop**, where a report is created. That report is then published to the **Power BI service** and finally shared, so that users of **Power BI Mobile** apps can consume the information.

It doesn't always happen that way, and that's okay. But we'll use that flow to help you learn the different parts of Power BI and how they complement each other.

Okay, now that we have an overview of this module, what Power BI is, and its three main elements, let's take a look at what it's like to use **Power BI**.

## Use Power BI

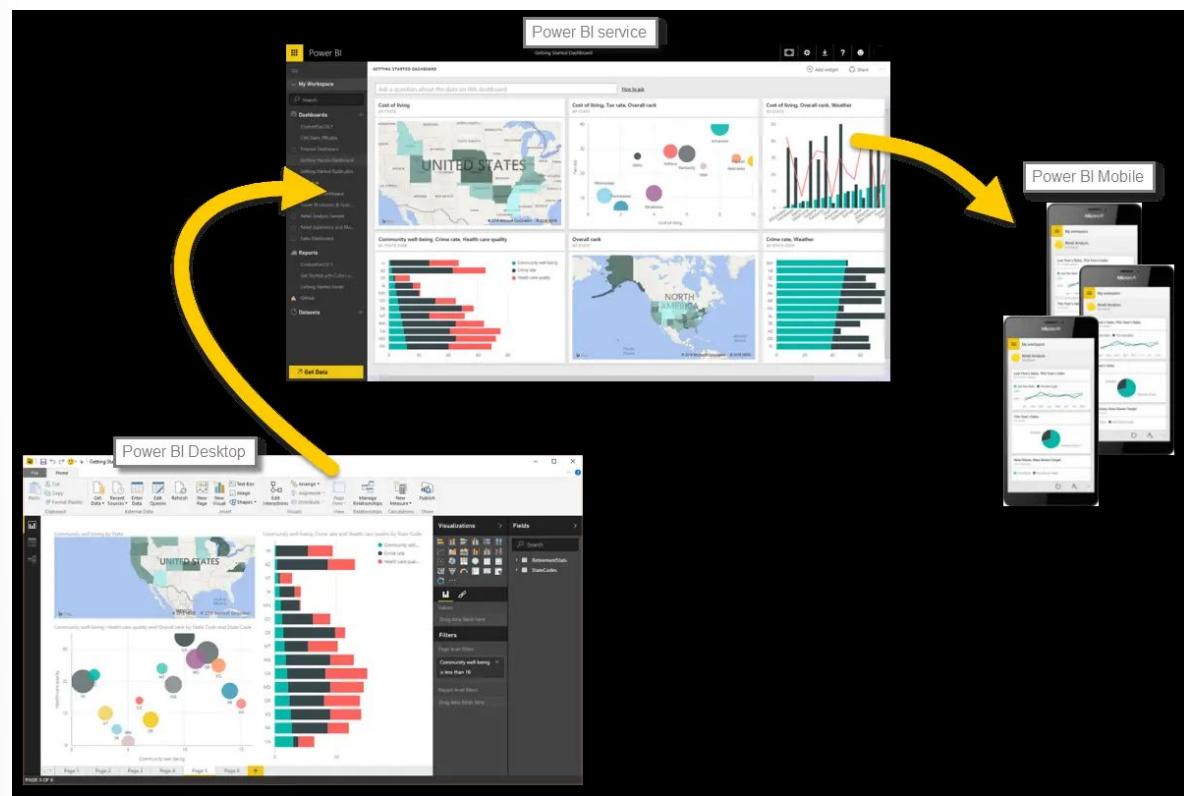
Now that we've introduced the basics of Microsoft Power BI, let's jump into some hands-on experiences and a guided tour.

The activities and analyses that you'll learn with Power BI generally follow a common flow. The **common flow** of activity looks like this:

1. Bring data into Power BI Desktop, and create a report.
2. Publish to the Power BI service, where you can create new visualizations or build dashboards.
3. Share dashboards with others, especially people who are on the go.
4. View and interact with shared dashboards and reports in Power BI Mobile apps.

<sup>1</sup> <https://go.microsoft.com/fwlink/?LinkId=2101313>

<sup>2</sup> <https://docs.microsoft.com/en-us/power-bi/consumer/end-user-sign-in>



As mentioned earlier, you might spend all your time in the **Power BI service**, viewing visuals and reports that have been created by others. And that's fine. Someone else on your team might spend their time in **Power BI Desktop**, which is fine too. To help you understand the full continuum of Power BI and what it can do, we'll show you all of it. Then you can decide how to use it to your best advantage.

So, let's jump in and step through the experience. Your first order of business is to learn the basic building blocks of Power BI, which will provide a solid basis for turning data into cool reports and visuals.

## Building blocks of Power BI

Everything you do in Microsoft Power BI can be broken down into a few basic **building blocks**. After you understand these building blocks, you can expand on each of them and begin creating elaborate and complex reports. After all, even seemingly complex things are built from basic building blocks. For example, buildings are created with wood, steel, concrete and glass, and cars are made from metal, fabric, and rubber. Of course, buildings and cars can also be basic or elaborate, depending on how those basic building blocks are arranged.

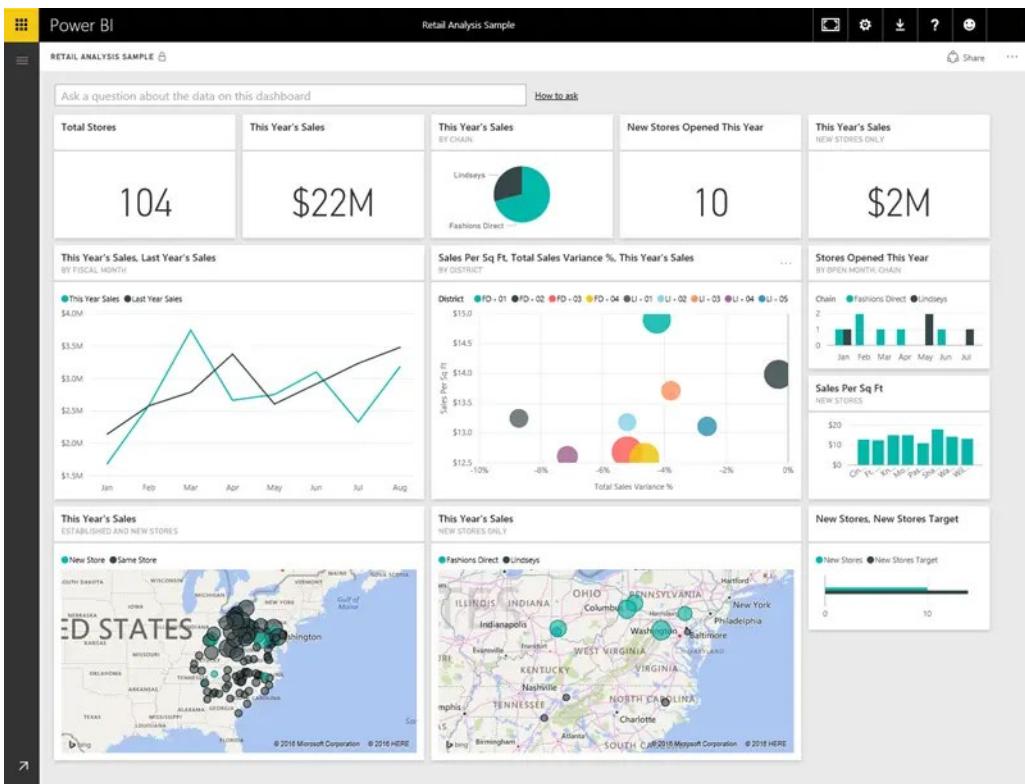
Let's take a look at these basic building blocks, discuss some simple things that can be built with them, and then get a glimpse into how complex things can also be created.

Here are the basic building blocks in Power BI:

- Visualizations
- Datasets
- Reports
- Dashboards
- Tiles

## Visualizations

A **visualization** (sometimes also referred to as a **visual**) is a visual representation of data, like a chart, a color-coded map, or other interesting things you can create to represent your data visually. Power BI has all sorts of visualization types, and more are coming all the time. The following image shows a collection of different visualizations that were created in Power BI.



Visualizations can be simple, like a single number that represents something significant, or they can be visually complex, like a gradient-colored map that shows voter sentiment about a certain social issue or concern. The goal of a visual is to present data in a way that provides context and insights, both of which would probably be difficult to discern from a raw table of numbers or text.

## Datasets

A **dataset** is a collection of data that Power BI uses to create its visualizations.

You can have a simple dataset that's based on a single table from a Microsoft Excel workbook, similar to what's shown in the following image.

	B	C	D	E	F	G	H
1	Year	Month	Month Name	Calendar Month	Births	Births Per Day	Births (Normalized)
2119	2004	1	January	1/1/2004	2,937	94.7	2842
2120	2004	2	February	2/1/2004	2,824	97.4	2921
2121	2004	3	March	3/1/2004	3,128	100.9	3027
2122	2004	4	April	4/1/2004	2,896	96.5	2896
2123	2004	5	May	5/1/2004	3,008	97.0	2911
2124	2004	6	June	6/1/2004	3,047	101.6	3047
2125	2004	7	July	7/1/2004	2,981	96.2	2885
2126	2004	8	August	8/1/2004	3,079	99.3	2980
2127	2004	9	September	9/1/2004	3,219	107.3	3219
2128	2004	10	October	10/1/2004	3,547	114.4	3433
2129	2004	11	November	11/1/2004	3,365	112.2	3365
2130	2004	12	December	12/1/2004	3,143	101.4	3042
2131	2005	1	January	1/1/2005	2,921	94.2	2827
2132	2005	2	February	2/1/2005	2,699	96.4	2892
2133	2005	3	March	3/1/2005	3,024	97.5	2926
2134	2005	4	April	4/1/2005	3,037	101.2	3037
2135	2005	5	May	5/1/2005	3,231	104.2	3127
2136	2005	6	June	6/1/2005	3,163	105.4	3163
2137	2005	7	July	7/1/2005	3,119	100.6	3018
2138	2005	8	August	8/1/2005	3,156	101.8	3054
2139	2005	9	September	9/1/2005	3,439	114.6	3439

**Datasets** can also be a combination of many different sources, which you can filter and combine to provide a unique collection of data (a dataset) for use in Power BI.

For example, you can create a dataset from three database fields, one website table, an Excel table, and online results of an email marketing campaign. That unique combination is still considered a single **dataset**, even though it was pulled together from many different sources.

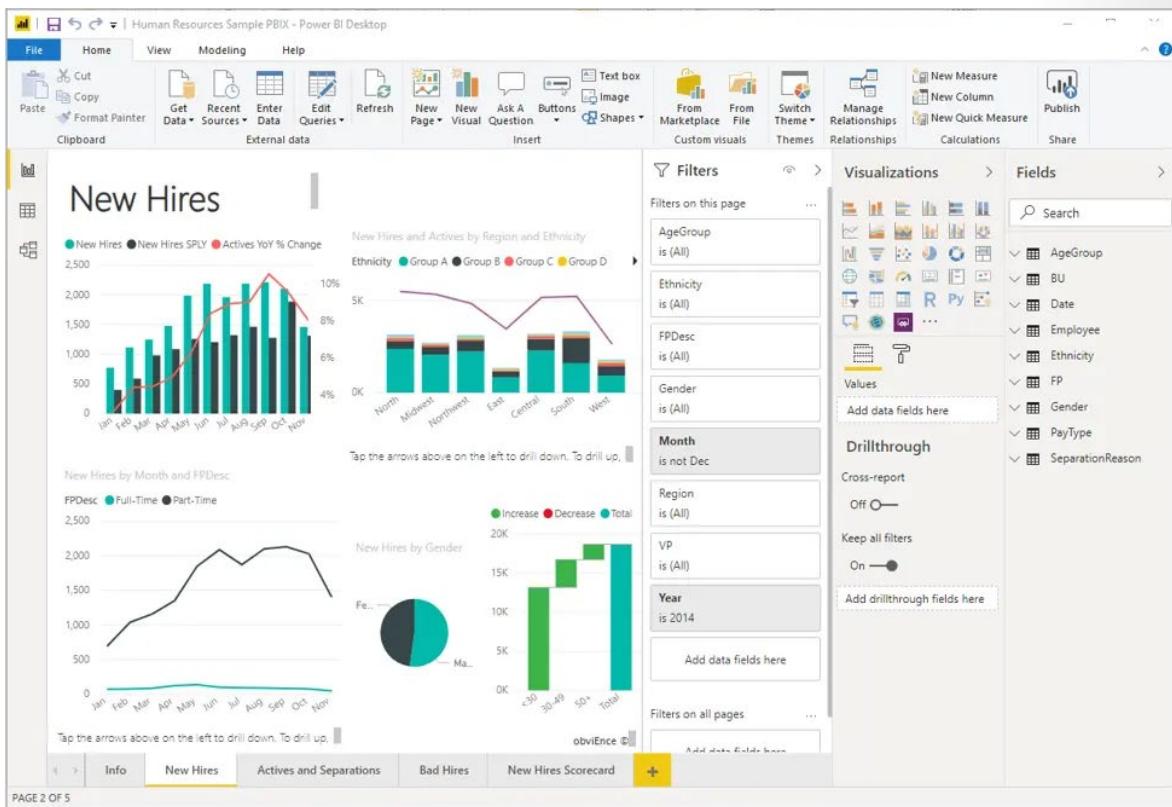
Filtering data before bringing it into Power BI lets you focus on the data that matters to you. For example, you can filter your contact database so that only customers who received emails from the marketing campaign are included in the dataset. You can then create visuals based on that subset (the filtered collection) of customers who were included in the campaign. Filtering helps you focus your data—and your efforts.

An important and enabling part of Power BI is the multitude of data **connectors** that are included. Whether the data you want is in Excel or a Microsoft SQL Server database, in Azure or Oracle, or in a service like Facebook, Salesforce, or MailChimp, Power BI has built-in data connectors that let you easily connect to that data, filter it if necessary, and bring it into your dataset.

After you have a dataset, you can begin creating visualizations that show different portions of it in different ways, and gain insights based on what you see. That's where reports come in.

## Reports

In Power BI, a **report** is a collection of visualizations that appear together on one or more pages. Just like any other report you might create for a sales presentation or write for a school assignment, a report in Power BI is a collection of items that are related to each other. The following image shows a **report** in Power BI Desktop—in this case, it's the second page in a five-page report. You can also create reports in the Power BI service.



Reports let you create many visualizations, on multiple pages if necessary, and let you arrange those visualizations in whatever way best tells your story.

You might have a report about quarterly sales, product growth in a particular segment, or migration patterns of polar bears. Whatever your subject, reports let you gather and organize your visualizations onto one page (or more).

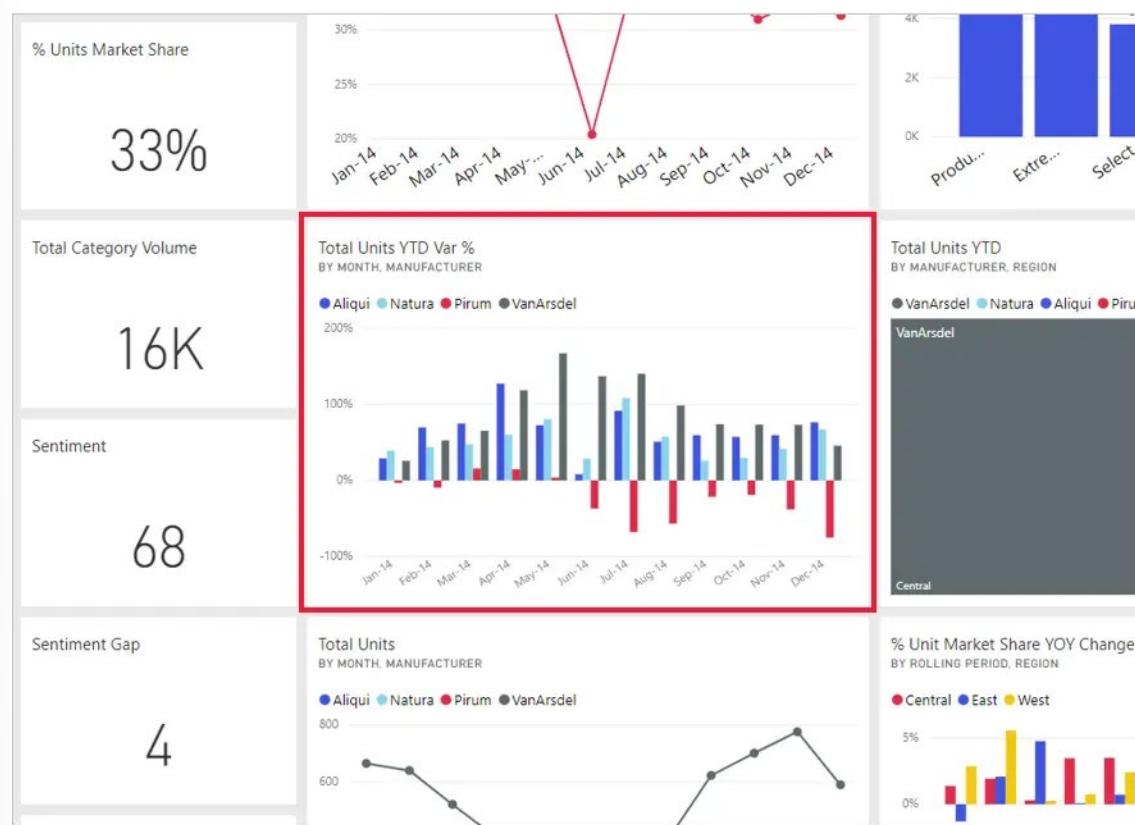
## Dashboards

When you're ready to share a report, or a collection of visualizations, you create a **dashboard**. Much like the dashboard in a car, a Power BI **dashboard** is a collection of visuals from a single page that you can share with others. Often, it's a selected group of visuals that provide quick insight into the data or story you're trying to present.

A dashboard must fit on a single page, often called a canvas (the canvas is the blank backdrop in Power BI Desktop or the service, where you put visualizations). Think of it like the canvas that an artist or painter uses—a workspace where you create, combine, and rework interesting and compelling visuals. You can share dashboards with other users or groups, who can then interact with your dashboards when they're in the Power BI service or on their mobile device.

## Tiles

In Power BI, a **tile** is a single visualization on a dashboard. It's the rectangular box that holds an individual visual. In the following image, you see one tile, which is also surrounded by other tiles.



When you're *creating* a dashboard in Power BI, you can move or arrange tiles however you want. You can make them bigger, change their height or width, and snuggle them up to other tiles.

When you're *viewing*, or *consuming*, a dashboard or report—which means you're not the creator or owner, but the report or dashboard has been shared with you—you can interact with it, but you can't change the size of the tiles or their arrangement.

## All together now

Those are the basics of Power BI and its building blocks. Let's take a moment to review.

Power BI is a collection of services, apps, and connectors that lets you connect to your data, wherever it happens to reside, filter it if necessary, and then bring it into Power BI to create compelling visualizations that you can share with others.

Now that you've learned about the handful of basic building blocks of Power BI, it should be clear that you can create datasets that make sense *to you* and create visually compelling reports that tell your story. Stories told with Power BI don't have to be complex, or complicated, to be compelling.

For some people, using a single Excel table in a dataset and then sharing a dashboard with their team will be an incredibly valuable way to use Power BI.

For others, the value of Power BI will be in using real-time Azure SQL Data Warehouse tables that combine with other databases and real-time sources to build a moment-by-moment dataset.

For both groups, the process is the same: create datasets, build compelling visuals, and share them with others. And the result is also the same for both groups: harness your ever-expanding world of data, and turn it into actionable insights.

Whether your data insights require straightforward or complex datasets, Power BI helps you get started quickly and can expand with your needs to be as complex as your world of data requires. And because Power BI is a Microsoft product, you can count on it being robust, extensible, Microsoft Office–friendly, and enterprise-ready.

Now let's see how this works. We'll start by taking a quick look at the Power BI service.

## Tour and use the Power BI service

As we learned in the previous unit, the common flow of work in Microsoft Power BI is to create a report in Power BI Desktop, publish it to the Power BI service, and then share it with others, so that they can view it in the service or on a mobile app.

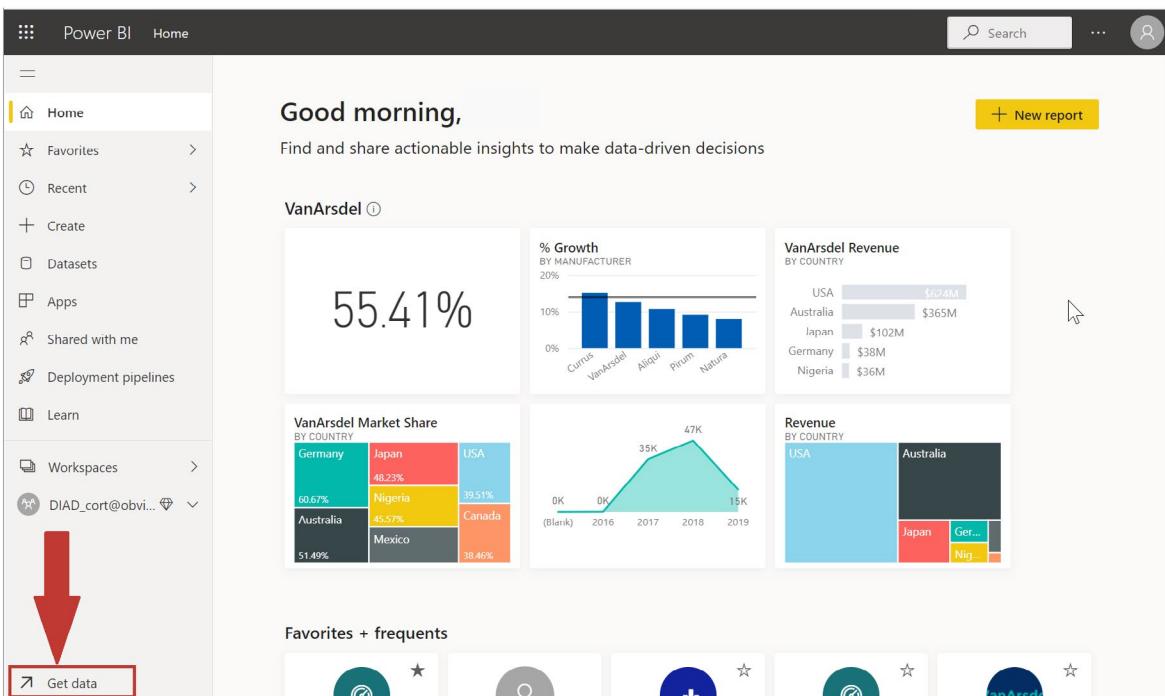
But because some people begin in the Power BI service, let's take a quick look at that first, and learn about an easy and popular way to quickly create visuals in Power BI: *apps*.

An **app** is a collection of preset, ready-made visuals and reports that are shared with an entire organization. Using an app is like microwaving a TV dinner or ordering a fast-food value meal: you just have to press a few buttons or make a few comments, and you're quickly served a collection of entrees designed to go together, all presented in a tidy, ready-to-consume package.

So, let's take a quick look at apps, the service, and how it works. We'll go into more detail about apps (and the service) in upcoming modules, but you can think of this as a taste to whet your appetite. You can sign into the service at <https://powerbi.microsoft.com>.

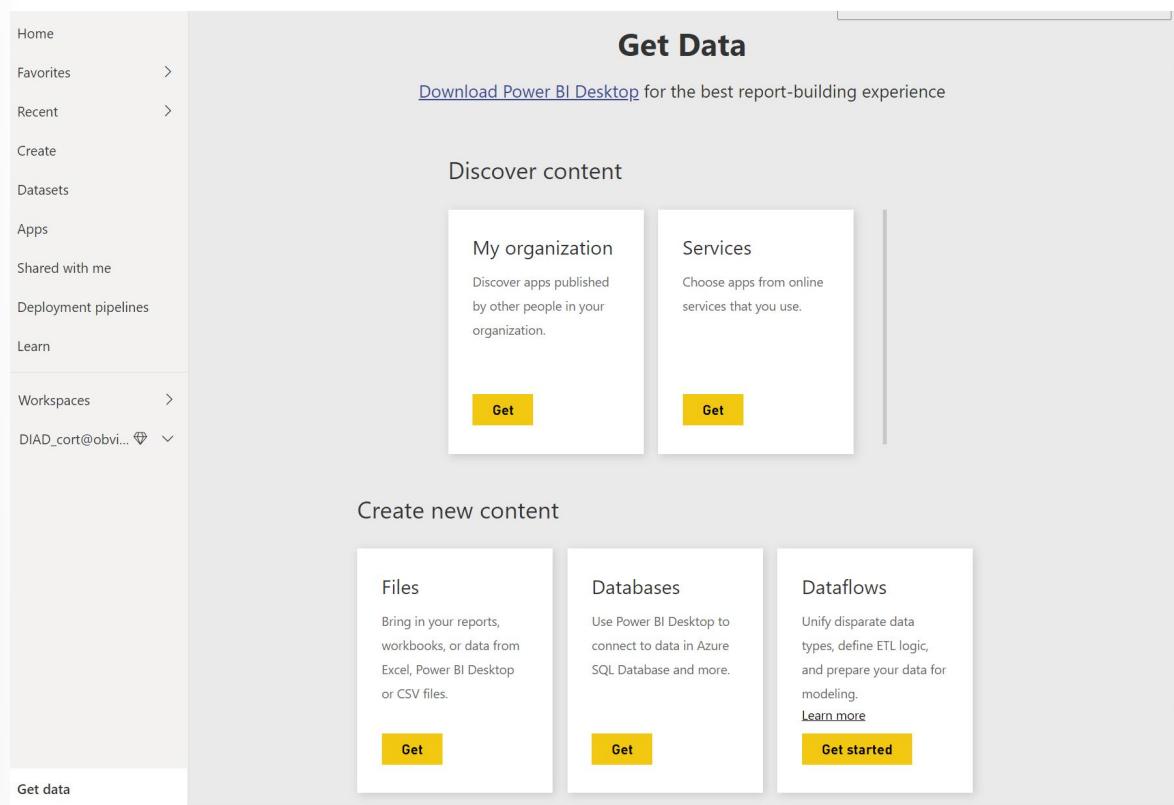
## Create out-of-box dashboards with cloud services

With Power BI, connecting to data is easy. From the Power BI service, you can just select the **Get Data** button in the lower-left corner of the home page.



The *canvas* (the area in the center of the Power BI service) shows you the available sources of data in the Power BI service. In addition to common data sources like Microsoft Excel files, databases, or Microsoft

Azure data, Power BI can just as easily connect to a whole assortment of **software services** (also called SaaS providers or cloud services): Salesforce, Facebook, Google Analytics, and more.



For these software services, the **Power BI service** provides a collection of ready-made visuals that are pre-arranged on dashboards and reports for your organization. This collection of visuals is called an **app**. Apps get you up and running quickly, with data and dashboards that your organization has created for you. For example, when you use the GitHub app, Power BI connects to your GitHub account (after you provide your credentials) and then populates a predefined collection of visuals and dashboards in Power BI.

There are apps for all sorts of online services. The following image shows a page of apps that are available for different online services, in alphabetical order. This page is shown when you select the **Get** button in the **Services** box (shown in the previous image). As you can see from the following image, there are many apps to choose from.

**Power BI apps**

Install apps that provide actionable insights and drive business results

All apps   Organizational apps   Template apps

Search

DIAD_ Cort Ferina <a href="#">Get it now</a>	KnowledgeBank Nikil Prabhakar <a href="#">Get it now</a>	COVID-19 US Track... Microsoft 
Samples Andre Fomin <a href="#">Get it now</a>	Azure DevOps Das... Data Maru 	Google Analytics R... Havens Consulting Inc 
		Microsoft 365

For our purposes, we'll choose **GitHub**. GitHub is an application for online source control. When you select the **Get it now** button in the box for the GitHub app, the **Connect to GitHub** dialog box appears. Note that GitHub does not support Internet Explorer, so make sure you are working in another browser.

One more thing ...



### Github Repository Usage

By Microsoft

This app requires some basic profile information. We have pulled your Microsoft Account data to help you get started. AppSource will save your information for next time.

Name \*

Work email \*

Job title

Company

Country / region \*

United States

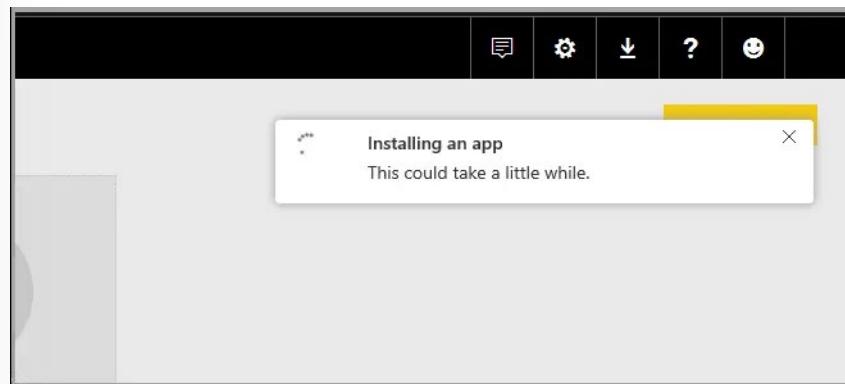
Phone number \*

I give Microsoft permission to use or share my [account information](#) so that the provider or Microsoft can contact me regarding this product and related products. I agree to the provider's [terms of use](#) and [privacy policy](#) and understand that the rights to use this product do not come from Microsoft, unless Microsoft is the provider. Use of AppSource is governed by separate [terms](#) and [privacy](#).

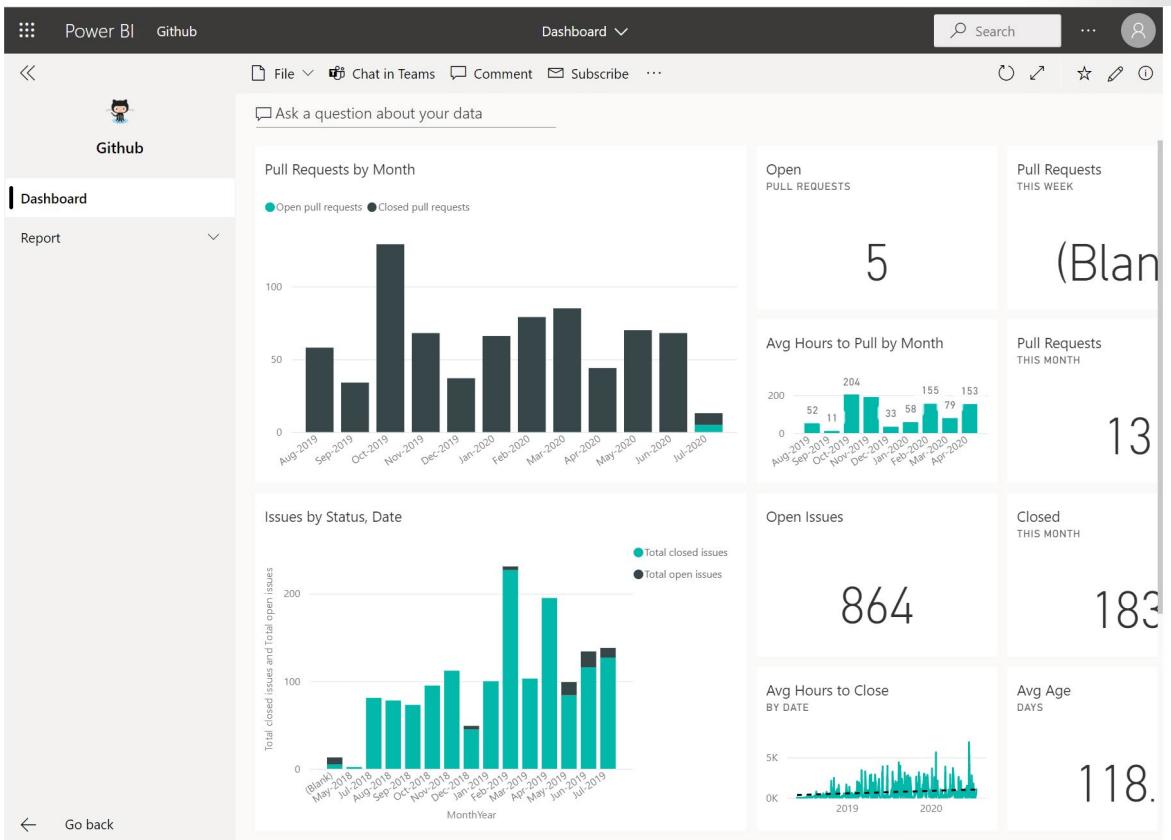


Continue

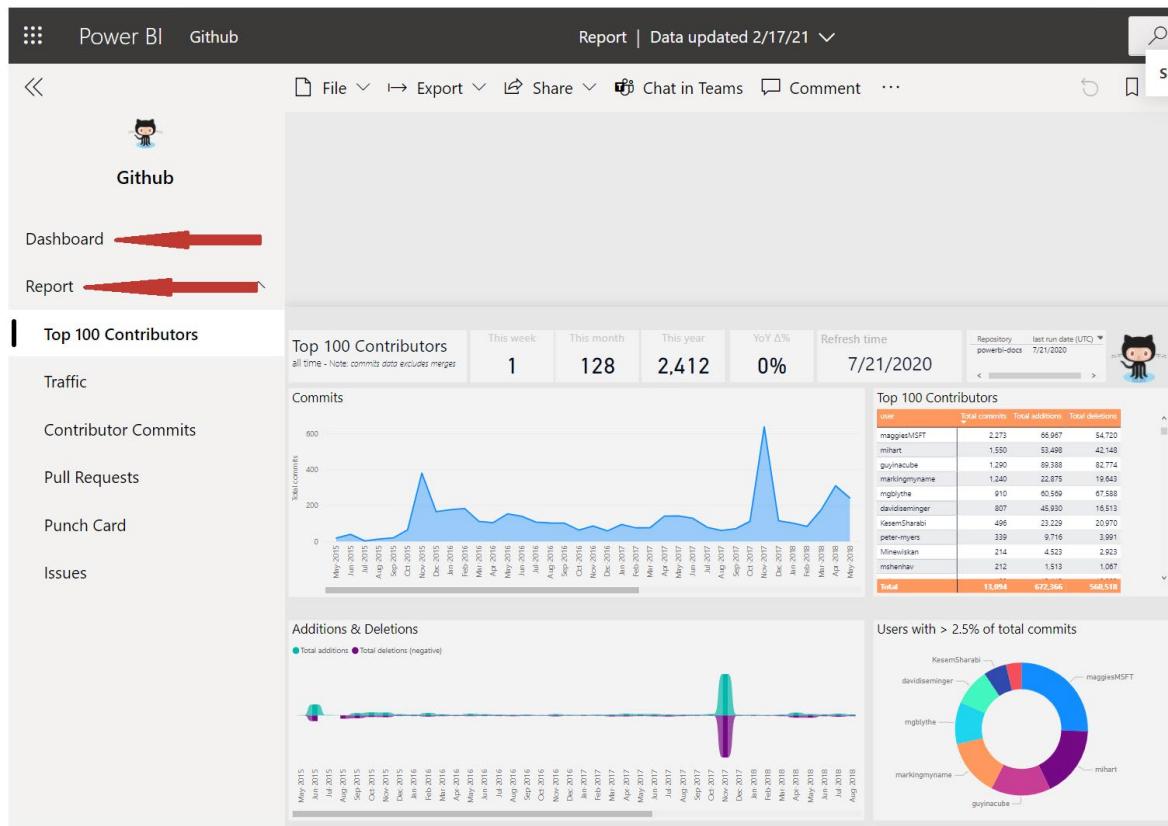
After you enter the information and credentials for the GitHub app, installation of the app begins.



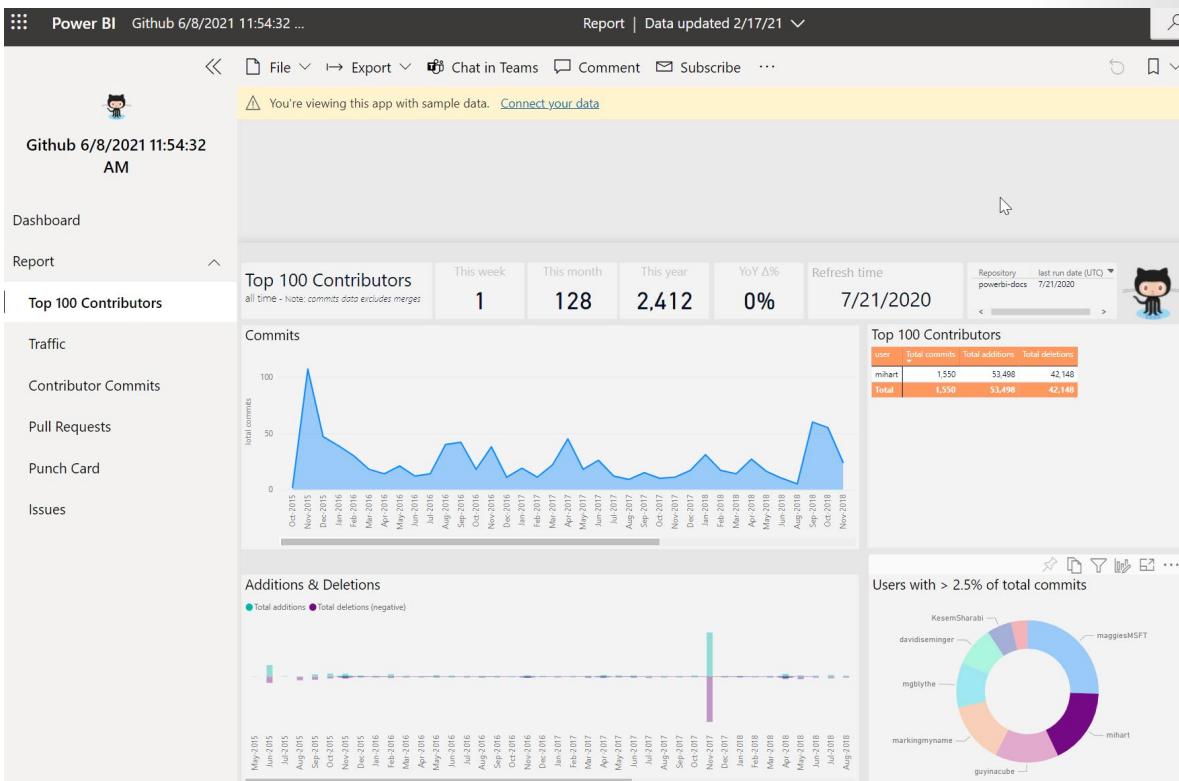
After the data is loaded, the predefined GitHub app dashboard appears.



In addition to the app **dashboard**, the **report** that was generated (as part of the GitHub app) and used to create the dashboard is available, as is the **dataset** (the collection of data pulled from GitHub) that was created during data import and used to create the GitHub report.



You can select any of the visuals and interact with them. If you click on a section in one visual, all the other visuals on the page will filter accordingly. For example, when you click on **MIHART** in the donut chart on the **Pull Requests** report, the other visuals on the page adjust to reflect that selection.



## Update data in the Power BI service

You can also choose to **update** the dataset for an app, or other data that you use in Power BI. To set update settings, select the schedule update icon for the dataset to update, and then use the menu that appears. You can also select the update icon (the circle with an arrow) next to the schedule update icon to update the dataset immediately.

The screenshot shows the Power BI service interface. On the left, there's a navigation pane with "Home", "Favorites", "Recent", "Create", "Datasets", "Apps", "Shared with me", "Deployment pipelines", "Learn", and "Workspaces". The "Datasets" tab is selected. In the main area, there's a "Github" app card with a "New" button, "View", "Filters", "Settings", "Access", and a "Search" bar. Below the card, it says "You're viewing this app with sample data. Connect your data". The "Datasets" tab is selected, showing a table with three items: "Github" (Dashboard, Owner: Github), "GitHub" (Report, Owner: Github), and "GitHub" (Dataset, Owner: Github). The "GitHub" Dataset row has a red box around its refresh icon.

Name	Type	Owner	Refreshed	Next refresh	Endorsements
Github	Dashboard	Github	—	—	—
GitHub	Report	Github	2/17/21, 12:08:55 PM	—	—
GitHub	Dataset	Github	2/17/21, 12:08:55 PM	N/A	—

The **Datasets** tab is selected on the **Settings** page that appears. In the right pane, select the arrow next to **Scheduled refresh** to expand that section. The **Settings** dialog box appears on the canvas, letting you set the update settings that meet your needs.

The screenshot shows the Power BI service interface. In the top navigation bar, 'Power BI' and 'Github' are listed. On the left, a sidebar menu includes 'Home', 'Favorites', 'Recent', 'Create', 'Datasets' (which is selected and highlighted in red), 'Apps', 'Shared with me', 'Deployment pipelines', 'Learn', 'Workspaces', and 'Github'. The main content area has tabs for 'General', 'Alerts', 'Subscriptions', 'Dashboards', 'Datasets' (selected), 'Workbooks', 'Dataflows', and 'App'. Below these tabs, a section titled 'GitHub' is shown. To the right, under 'Settings for GitHub', it says 'This dataset has been configured by cort@obvience.com.' with a 'Refresh history' link. A 'Gateway connection' section is collapsed. Under 'Data source credentials', there is a 'github' entry with 'Edit credentials' and 'Show in lineage view' links. The 'Parameters' section is collapsed. A 'Scheduled refresh' section is expanded and highlighted with a red box; it contains the sub-section 'Keep your data up to date' with a 'On' toggle switch, which is also highlighted with a red box. Below this, 'Refresh frequency' is set to 'Daily', 'Time zone' is '(UTC-06:00) Central Time (US and Ca)', and 'Time' is 'Add another time'. At the bottom of the refresh section, there is a 'Send refresh failure notifications to' section with a checked checkbox for 'Dataset owner' and an unchecked checkbox for 'These contacts' with an input field 'Enter email addresses'.

That's enough for our quick look at the Power BI service. There are many more things you can do with the service, and we'll cover these later in this module and in upcoming modules. Also, remember that there are many types of data you can connect to, and all sorts of apps, with more of both coming all the time.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *What is the common flow of activity in Power BI?*

- Create a report in Power BI mobile, share it to the Power BI Desktop, view and interact in the Power BI service.
- Create a report in the Power BI service, share it to Power BI mobile, interact with it in Power BI Desktop.
- Bring data into Power BI Desktop and create a report, share it to the Power BI service, view and interact with reports and dashboards in the service and Power BI mobile.
- Bring data into Power BI mobile, create a report, then share it to Power BI Desktop.

## Multiple choice

2.Which of the following are building blocks of Power BI?

- Tiles, dashboards, databases, mobile devices.
- Visualizations, datasets, reports, dashboards, tiles.
- Visual Studio, C#, and JSON files.

## Multiple choice

3.A collection of ready-made visuals, pre-arranged in dashboards and reports is called what in Power BI?

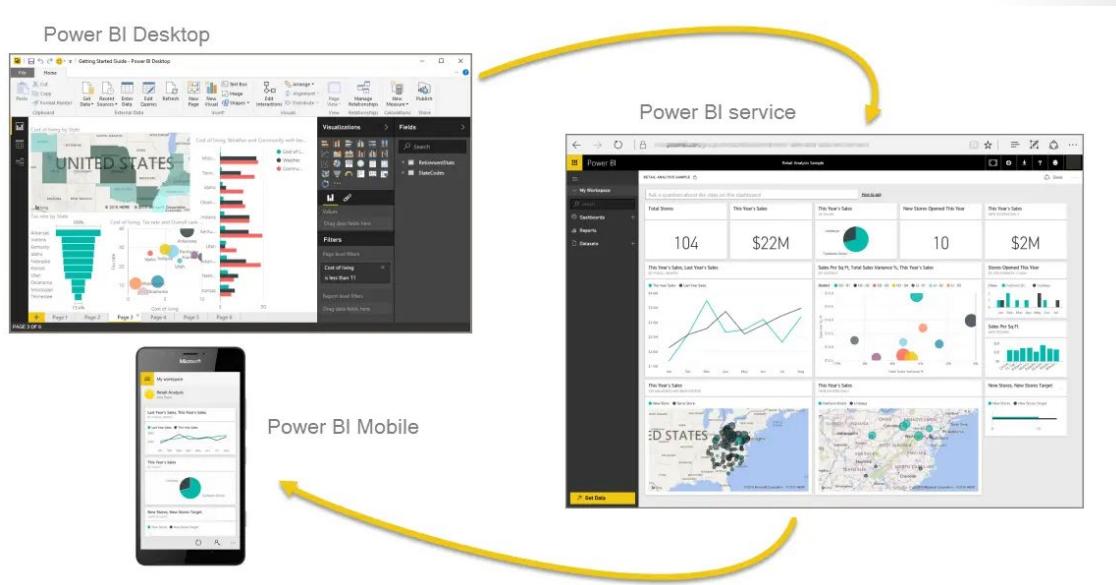
- The canvas.
- Scheduled refresh.
- An app.

## Summary

Let's do a quick review of what we covered in this module.

**Microsoft Power BI** is a collection of software services, apps, and connectors that work together to turn your data into interactive insights. You can use data from single basic sources, like a Microsoft Excel workbook, or pull in data from multiple databases and cloud sources to create complex datasets and reports. Power BI can be as straightforward as you want or as enterprise-ready as your complex global business requires.

Power BI consists of three main elements—**Power BI Desktop**, the **Power BI service**, and **Power BI Mobile**—which work together to let you create, interact with, share, and consume your data the way you want.



We also discussed the basic building blocks in Power BI:

- **Visualizations** – A visual representation of data, sometimes just called visuals
- **Datasets** – A collection of data that Power BI uses to create visualizations

- **Reports** – A collection of visuals from a dataset, spanning one or more pages
- **Dashboards** – A single-page collection of visuals built from a report
- **Tiles** – A single visualization on a report or dashboard

In the **Power BI service**, we installed an **app** in just a few clicks. That **app**, a ready-made collection of visuals and reports, let us easily connect to a **software service** to populate the app and bring that data to life.

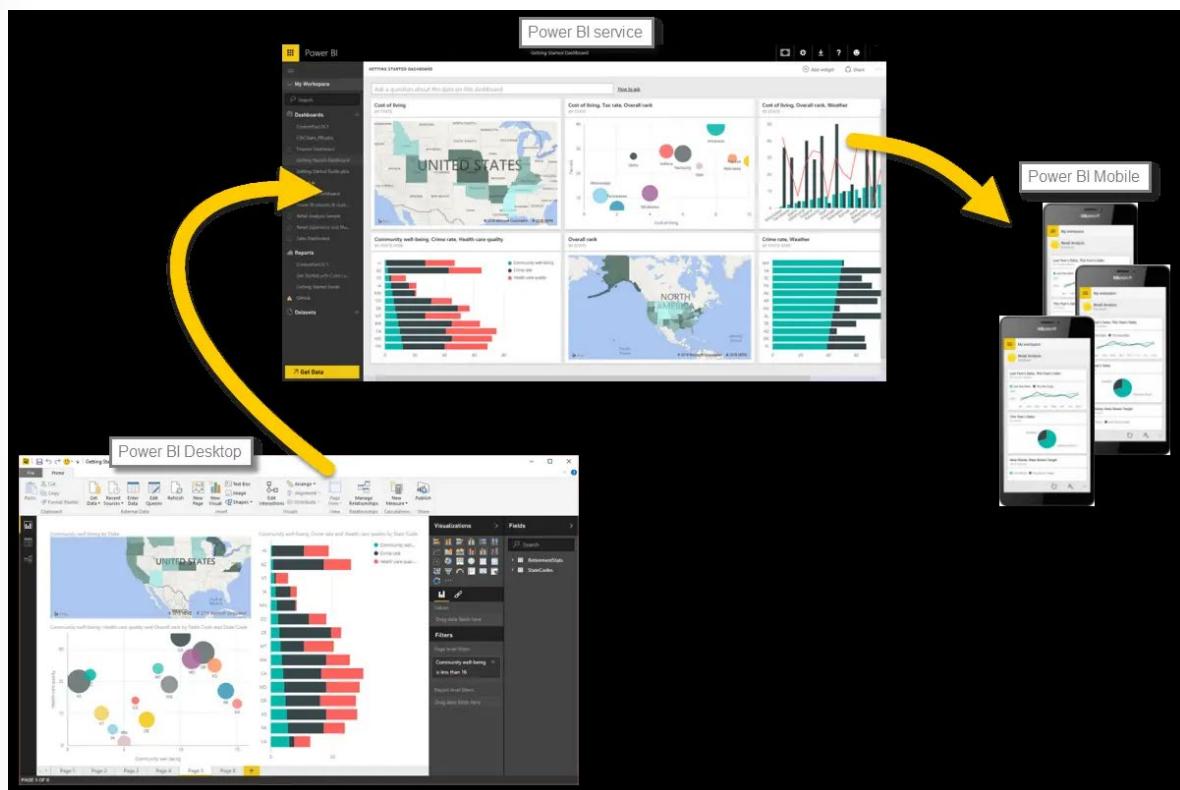
Finally, we set up a **refresh schedule** for our data, so that we know the data will be fresh when we go back to the Power BI service.

## Next steps

**Congratulations!** You've finished the first module of the **learning path** for Power BI. You now have a firm foundation of knowledge for when you move on to the next module, which walks through the steps to create your first report.

We mentioned this before, but it's worth restating: this learning path builds your knowledge by following the common flow of work in Power BI:

- Bring data into **Power BI Desktop**, and create a report.
- **Publish** to the Power BI service, where you create new visualizations or build dashboards.
- **Share** your dashboards with others, especially people who are on the go.
- View and interact with shared dashboards and reports in **Power BI Mobile** apps.



You might not do all that work yourself—some people will only view dashboards that were created by someone else, and they'll just use the service. That's fine, and we'll soon have a module dedicated to

showing how you can easily navigate and use the **Power BI service** to view and interact with reports and apps.

But the next module follows the flow of work in Power BI, showing you how to create a report and publish it to the Power BI service. You'll learn how those reports and dashboards are created and how they connected to the data. You might even decide to create a report or dashboard of your own.

See you in the next module!

## Get data with Power BI Desktop

### Overview of Power BI Desktop

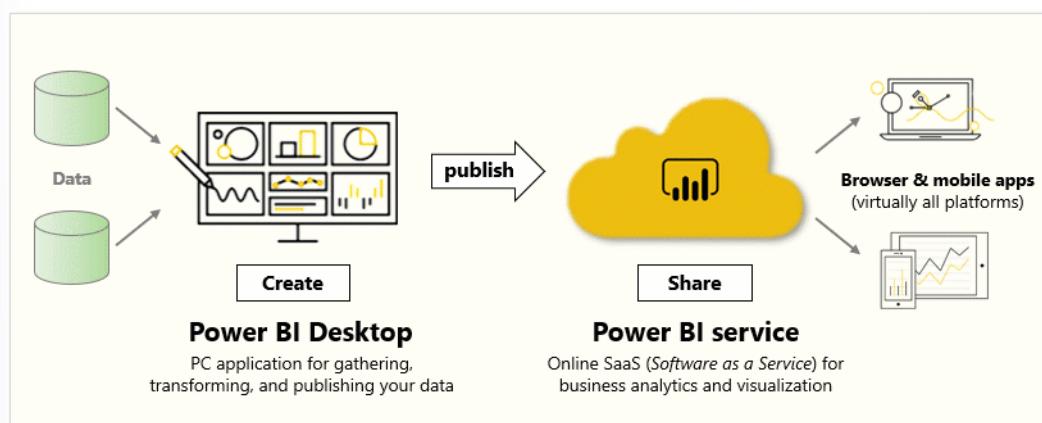
Power BI Desktop is a free application for PCs that lets you gather, transform, and visualize your data. In this module, you'll learn how to find and collect data from different sources and how to clean or transform it. You'll also learn tricks to make data-gathering easier.



<https://www.microsoft.com/en-us/videoplayer/embed/RWFP5V>

Power BI Desktop and the Power BI Service work together. You can create your reports and dashboards in Power BI Desktop, and then publish them to the Power BI Service for others to consume.

The following are the tasks that you will complete in this module:



**Video:** Introduction to Power BI Desktop



<https://www.microsoft.com/videoplayer/embed/RE3kZ3T>

To perform the exercises in this module, you'll need to have Power BI desktop installed and have a Power BI Service account set up.

### Download Power BI Desktop

You can download Power BI Desktop from the web or as an app from the Microsoft Store on the Windows tab.

Download Strategy	Link	Notes
Windows Store App	<a href="https://aka.ms/pbidesktopstore">Windows Store (<a href="https://aka.ms/pbidesktopstore">https://aka.ms/pbidesktopstore</a>)</a>	Will automatically stay updated
Download from web	<a href="https://go.microsoft.com/fwlink/?LinkId=521662">Download .msi (<a href="https://go.microsoft.com/fwlink/?LinkId=521662">https://go.microsoft.com/fwlink/?LinkId=521662</a>)</a>	Must manually update periodically

## Sign in to Power BI service

Before you can sign in to Power BI, you'll need an account. To get a free trial, go to [app.powerbi.com](http://app.powerbi.com)<sup>3</sup> and sign up with your email address.

For detailed steps on setting up an account, see [Sign in to Power BI service](#)<sup>4</sup>.

## Download sample data

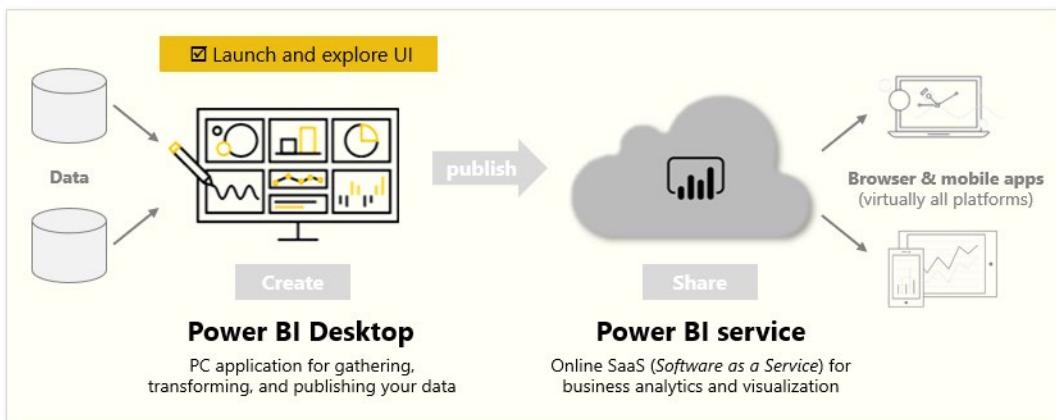
To follow along with the examples in the videos and on the pages, download the sample Excel workbook [here](#)<sup>5</sup> and import into Power BI Desktop ([Get Data > Excel](#)).

## Explore Power BI Desktop

The idea of building and sharing reports is an abstract concept. It will make more sense if you explore Power BI Desktop hands-on. The first step is to launch and explore the user interface (UI).

In this unit, you will:

- Launch the Power BI Desktop.
- Explore the UI.



**Video:** Overview of Power BI Desktop and the Power BI service

<sup>3</sup> <https://go.microsoft.com/fwlink/?LinkId=2101313>

<sup>4</sup> <https://docs.microsoft.com/power-bi/consumer/end-user-sign-in>

<sup>5</sup> <https://go.microsoft.com/fwlink/?LinkId=2114225>



<https://www.microsoft.com/videoplayer/embed/RE3kOEX>

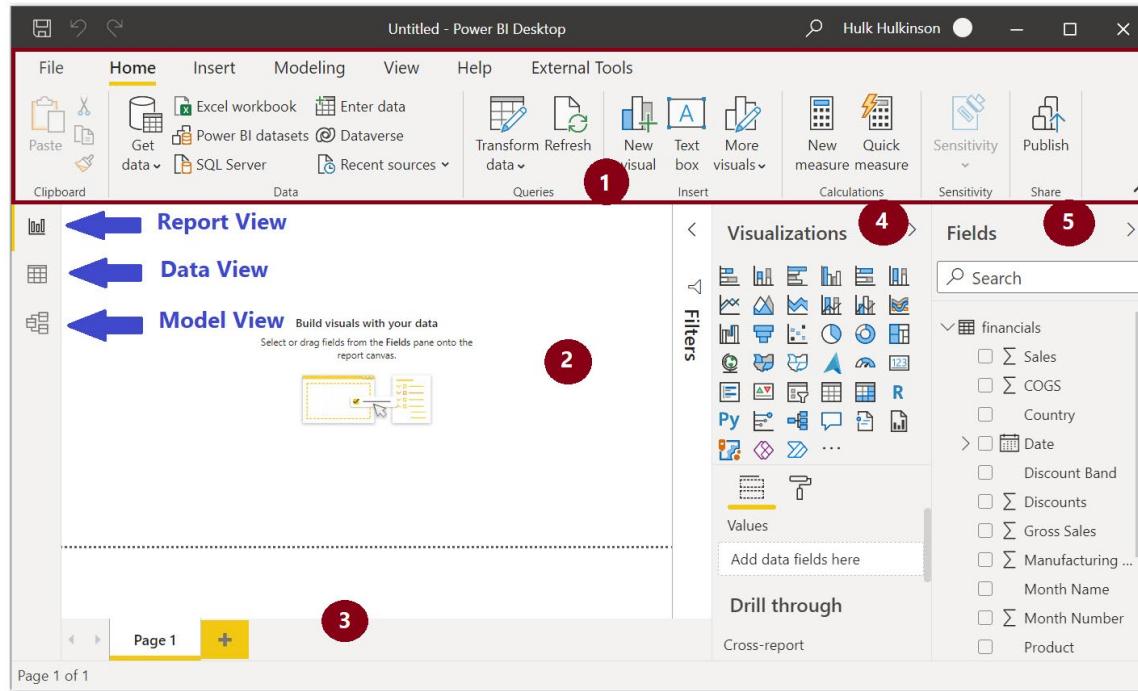
**Note:** To follow along with the examples in the videos and on this page, download the sample Excel workbook [here<sup>6</sup>](#) and import into Power BI Desktop (**Get Data > Excel**) if you haven't already.

## Launch Power BI Desktop

When you launch Power BI Desktop, the **Getting Started** dialog box will appear, which provides useful links to forums, blogs, and introductory videos. Close this dialog box for now, but keep the **Show this screen on startup** option selected so that you can explore it later.

## Explore the report building environment

In Power BI Desktop, you'll begin to build reports in the **Report** view. You'll be working in five main areas:

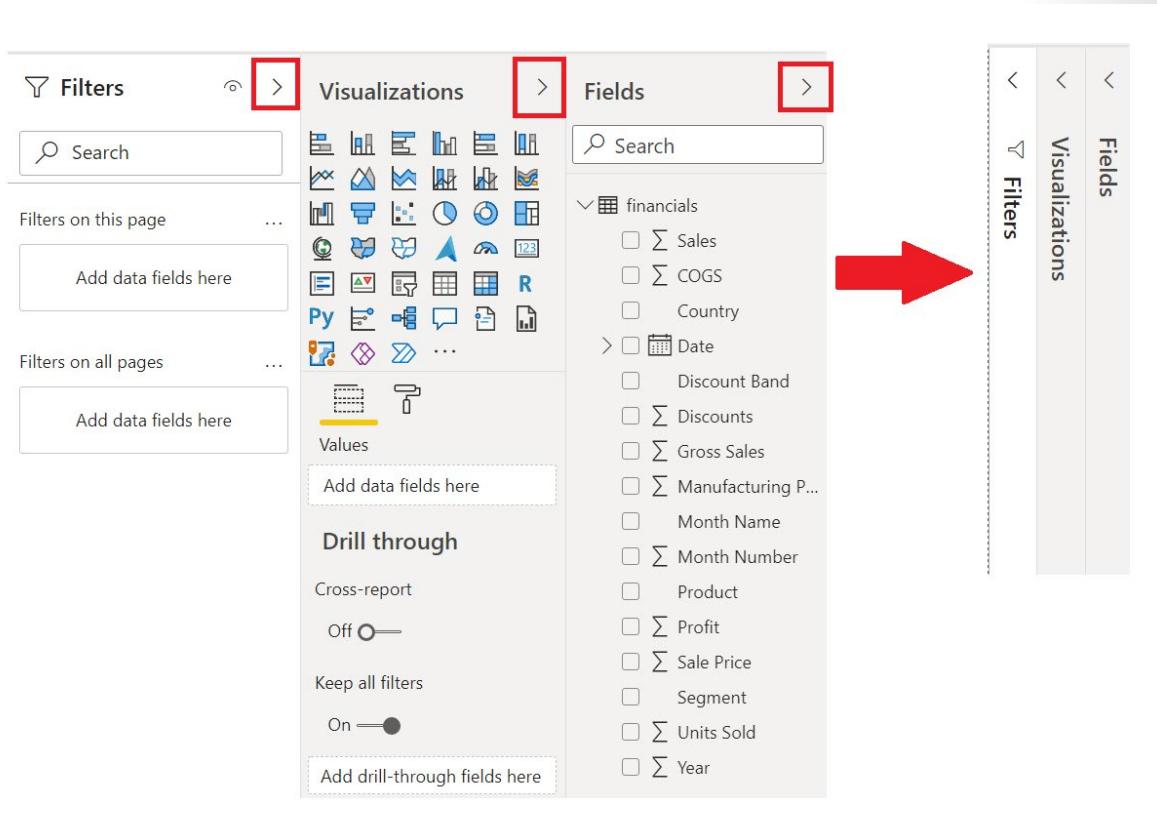


1. **Ribbon** - Displays common tasks that are associated with reports and visualizations.
2. **Report view, or canvas** - Where visualizations are created and arranged. You can switch between **Report**, **Data**, and **Model** views by selecting the icons in the left column.
3. **Pages tab** - Located along the bottom of the page, this area is where you would select or add a report page.

<sup>6</sup> <https://go.microsoft.com/fwlink/?linkid=2114225>

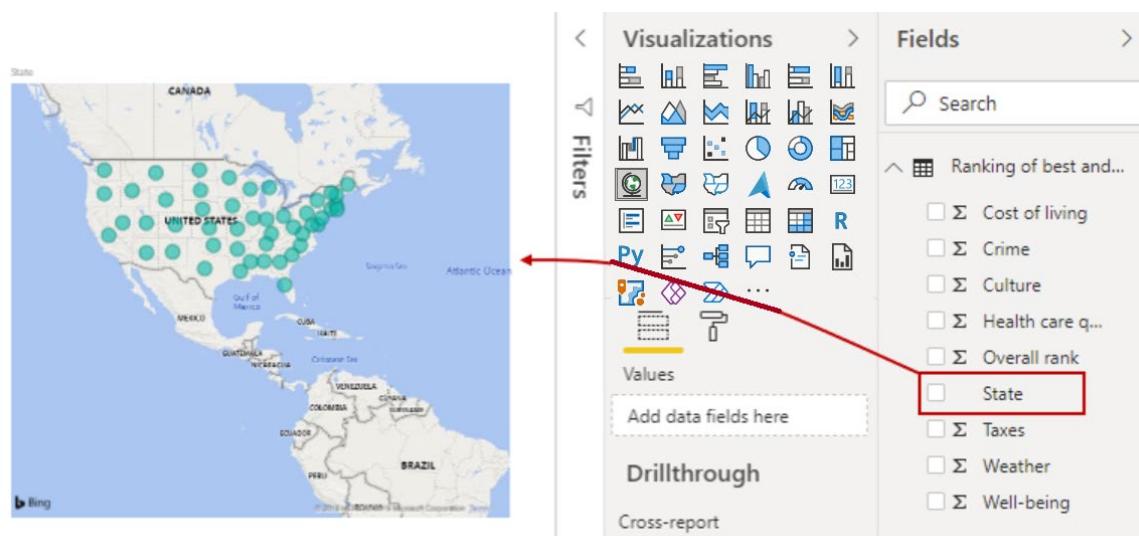
4. **Visualizations pane** - Where you can change visualizations, customize colors or axes, apply filters, drag fields, and more.
5. **Fields pane** - Where query elements and filters can be dragged onto the **Report** view or dragged to the **Filters** area of the Visualizations pane.

**Tip:** You can collapse the Visualizations and Fields panes to provide more space in the **Report** view by selecting the small arrow, as shown in the following screenshot.



## Create a visual

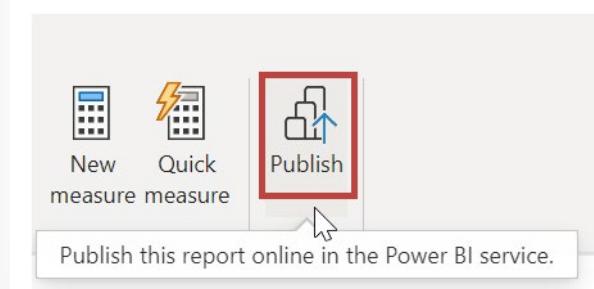
To create a visual, drag a field from the **Fields** list onto the **Report** view.



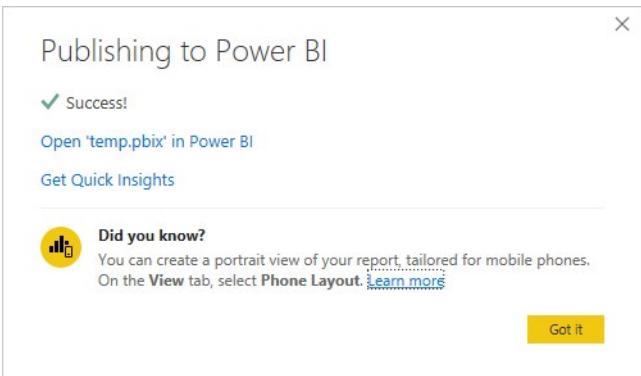
For example, Power BI Desktop automatically created a map-based visualization because it recognized that the **State** field contained geolocation data. (Note that screenshot examples come from a variety of datasets.)

## Publish a report

After creating a report with a few visuals, you're ready to publish to the Power BI service. On the **Home** ribbon on the Power BI Desktop, select **Publish**.



You'll be prompted to sign in to Power BI. When you've signed in and the publish process is complete, the following dialog box will appear. You can select the link below **Success!**, which will take you to the Power BI service, where you can see the report that you published.



## Pin a visual to a dashboard

When you view a published report in the Power BI service, you can choose the **Pin** icon to pin that visual to a dashboard.



You can choose whether to pin the visual to an existing dashboard or to create a new dashboard.

For more information, see [Report View in Power BI Desktop<sup>7</sup>](#).

## Connect to data sources

Power BI Desktop connects to many types of data sources, including local databases, worksheets, and data on cloud services. Sometimes when you gather data, it's not quite as structured, or clean, as you want it to be. To structure data, you can transform it, meaning that you can split and rename columns, change data types, and create relationships between columns.

In this unit, you will:

- Connect to data.
- Import data into Power BI Desktop.

<sup>7</sup> <https://docs.microsoft.com/power-bi/desktop-report-view/?azure-portal=true>



**Video:** Connecting to data sources



<https://www.microsoft.com/videoplayer/embed/RE3wRgY>

**Note:** To follow along with the examples in the video, download the sample Access database [\\*\\*here\\*\\*<sup>8</sup>](#) and import into Power BI Desktop ([\\*\\*Get Data > Database > Access database\\*\\*](#)). If you have any issues loading the Access database, please read this [\\*\\*article\\*\\*<sup>9</sup>](#).

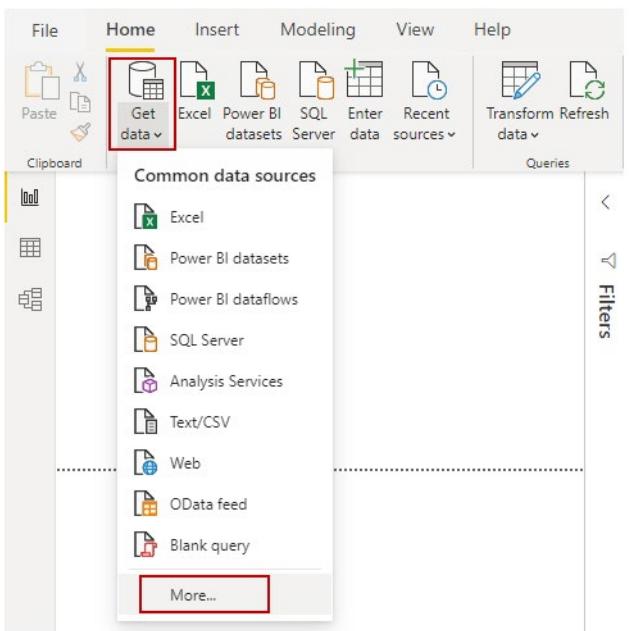
You can connect Power BI Desktop to many types of data sources, including on-premises databases, Microsoft Excel workbooks, and cloud services. Currently, there are about 60 Power BI-specific connectors to cloud services such as GitHub and Marketo. You can also connect to generic sources through XML, CSV, text, and ODBC. Power BI will even extract tabular data directly from a website URL.

## Connect to data

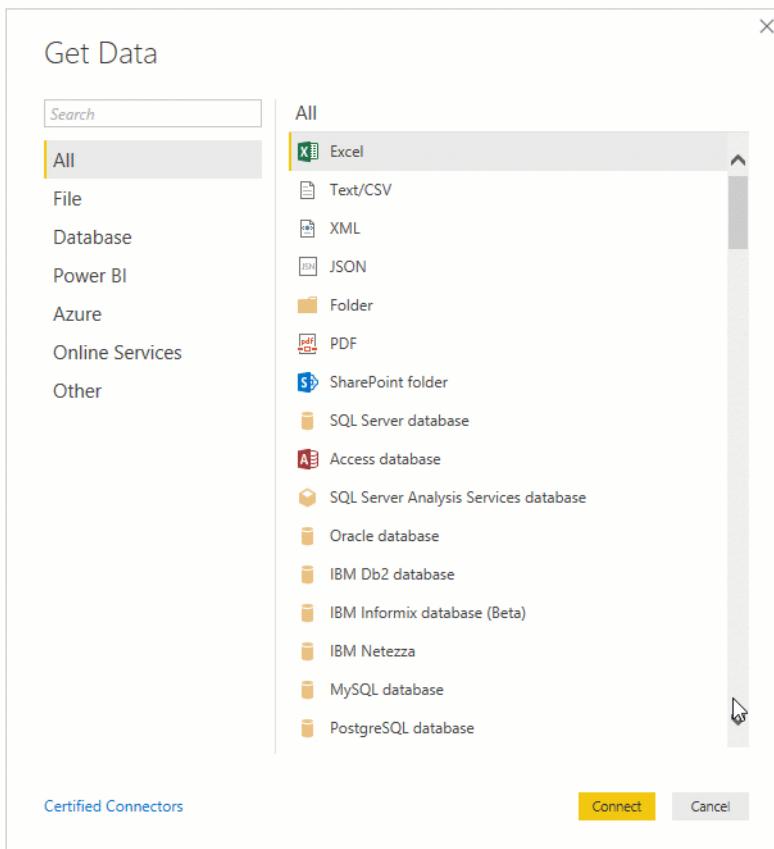
When you start Power BI Desktop, you can choose **Get Data** from the ribbon on the **Home** tab.

<sup>8</sup> <https://go.microsoft.com/fwlink/?linkid=2120368>

<sup>9</sup> <https://go.microsoft.com/fwlink/?linkid=2131277>

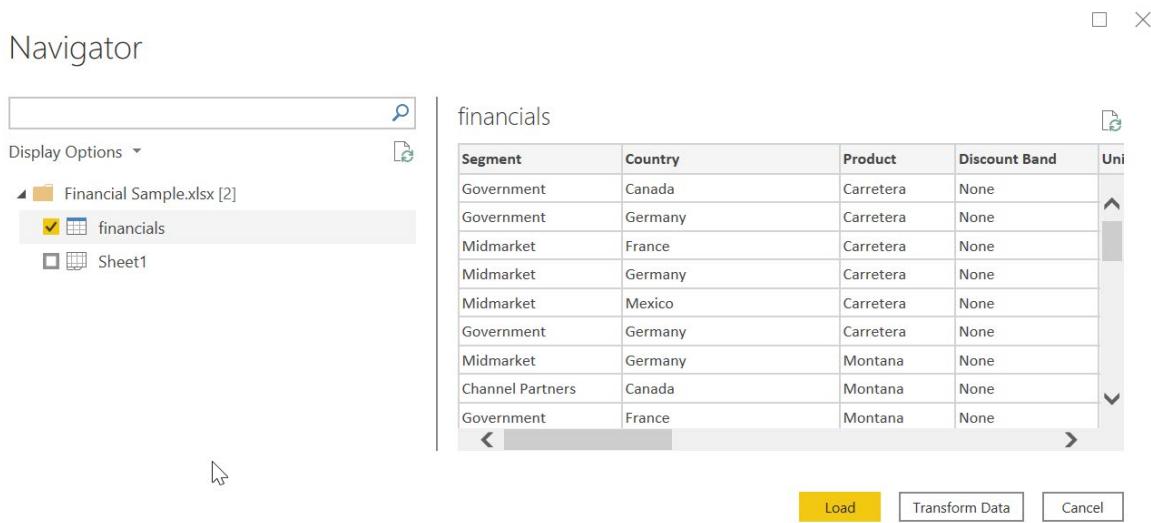


In Power BI Desktop, several types of data sources are available. Select a source to establish a connection. Depending on your selection, you'll be asked to find the source on your computer or network. You might be prompted to sign in to a service to authenticate your request.



## Choose data to import

After connecting, the first window that you'll see is the **Navigator**. The **Navigator** window displays the tables or entities of your data source, and selecting a table or entity gives you a preview of its contents. You can then import your selected tables or entities immediately by selecting **Load**, or you can select **Transform Data** to transform and clean your data before importing.



After you've selected the tables that you'd like to bring into Power BI Desktop, select the **Load** button. You might want to make changes to those tables before you load them. For example, if you only want a subset of customers or a specific country or region, select the **Edit** button and filter data before loading.

The screenshot shows the Power BI desktop interface with the 'Home' tab selected. In the top ribbon, the 'File' tab is active. Below the ribbon, the 'Queries [1]' list shows a single item: 'financials'. To the right is a preview grid for the 'financials' table, which contains the following data:

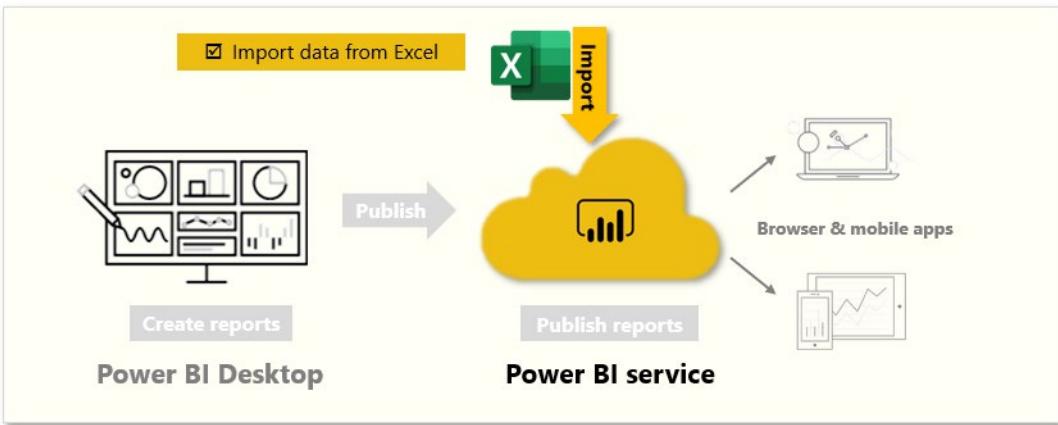
Segment	Country	Product	Discount Band
Government	Canada	Carretera	None
Government	Germany	Carretera	None
Midmarket	France	Carretera	None
Midmarket	Germany	Carretera	None
Midmarket	Mexico	Carretera	None
Government	Germany	Carretera	None
Midmarket	Germany	Montana	None
Channel Partners	Canada	Montana	None
Government	France	Montana	None

No matter what type of data you need, you're likely to find a way to import it into Power BI Desktop.

## Get data from Excel

Likely, you've used Microsoft Excel to create or view reports or to build pie charts or other visuals. Getting your Excel data into Power BI is a straightforward process.

In this unit, you will bring Excel workbooks into Power BI.



**Video:**



<https://www.microsoft.com/videoplayer/embed/RE3nkKG>

**Note:** To follow along with the example in this video, download the sample Excel workbook [\\*\\*here\\*\\*<sup>10</sup>](#).

This unit explains how you can import an Excel workbook file that contains a simple table from a local drive into Power BI. You'll then learn how to begin exploring that table's data in Power BI by creating a report.

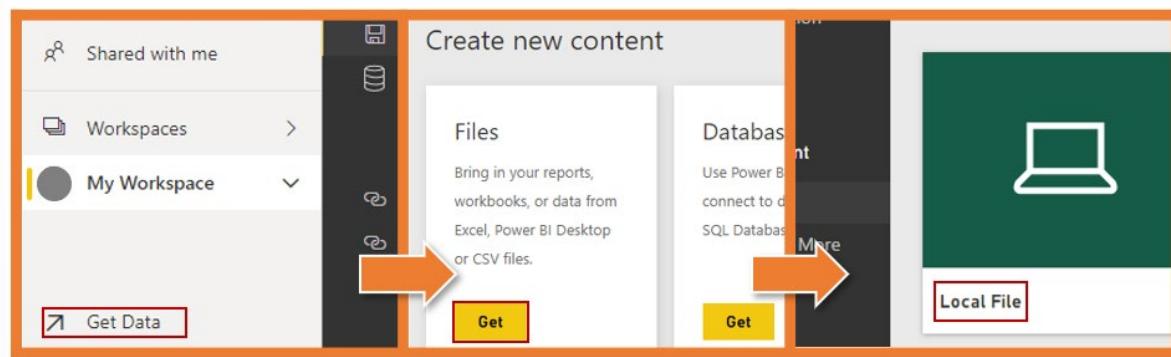
**Note:** Up until now, we've been importing data through Power BI Desktop. This unit page is done from the Power BI service.

Make sure that each column has a good name in excel; it will make it easier for you to find the data that you want when creating your reports in Power BI.

## Import from a local drive

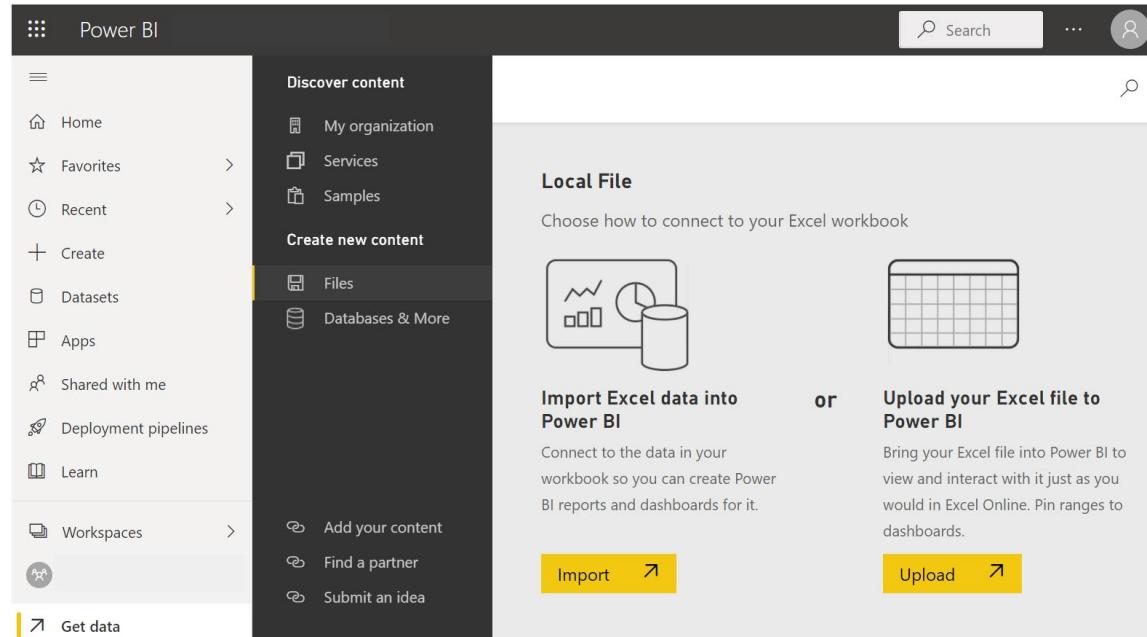
Wherever you keep your files, Power BI makes importing them simple. In Power BI, you can go **Get Data** > **Files** > **Local File** to select the Excel file that you want.

<sup>10</sup> <https://go.microsoft.com/fwlink/?linkid=2114225>



After you click Local file, you have two options. You can import excel data into Power BI or you can upload your excel file to Power BI.

Import will connect to the data in your workbook so you can create Power BI reports and dashboards. Upload will bring your excel file into Power BI so you can view and interact with it as you would in Excel Online

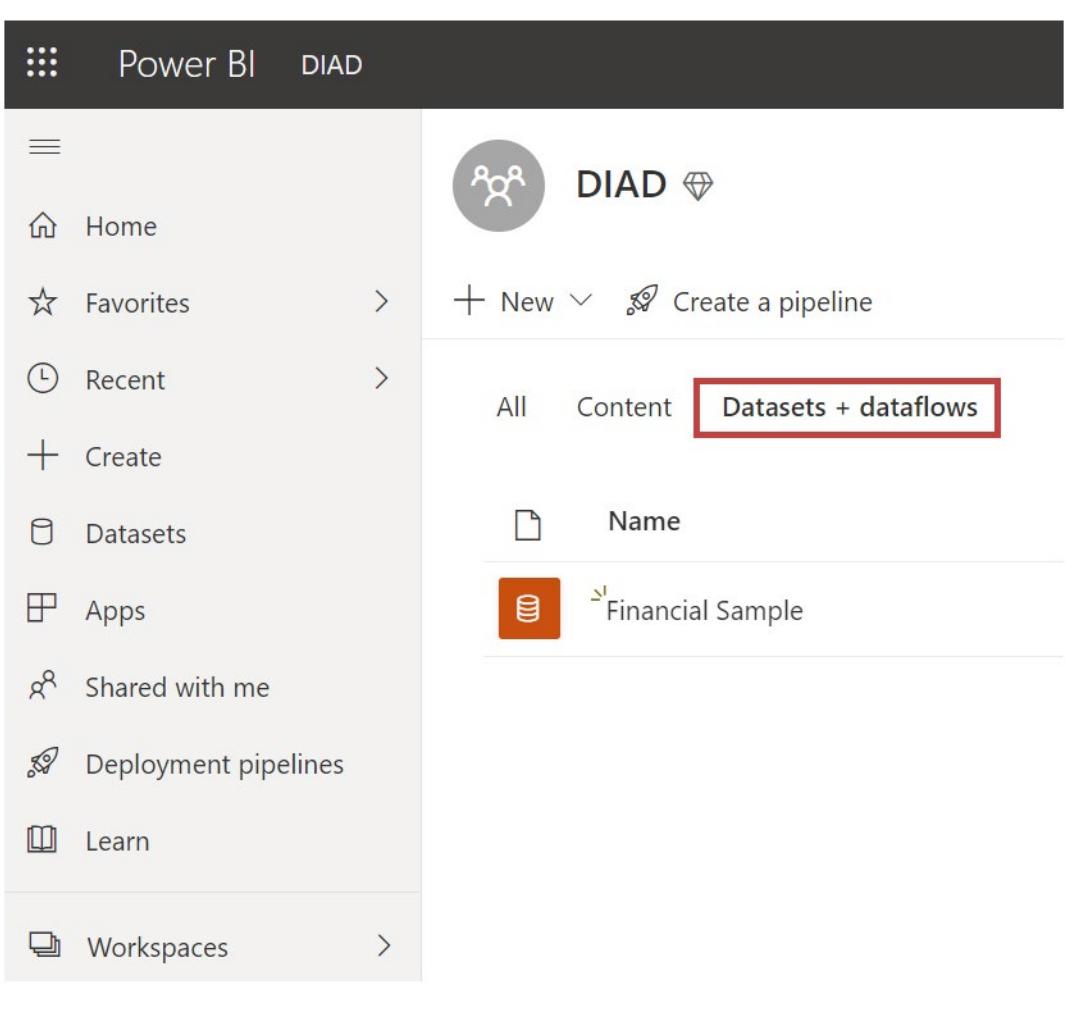


After the file has been imported into Power BI, you can begin creating reports.

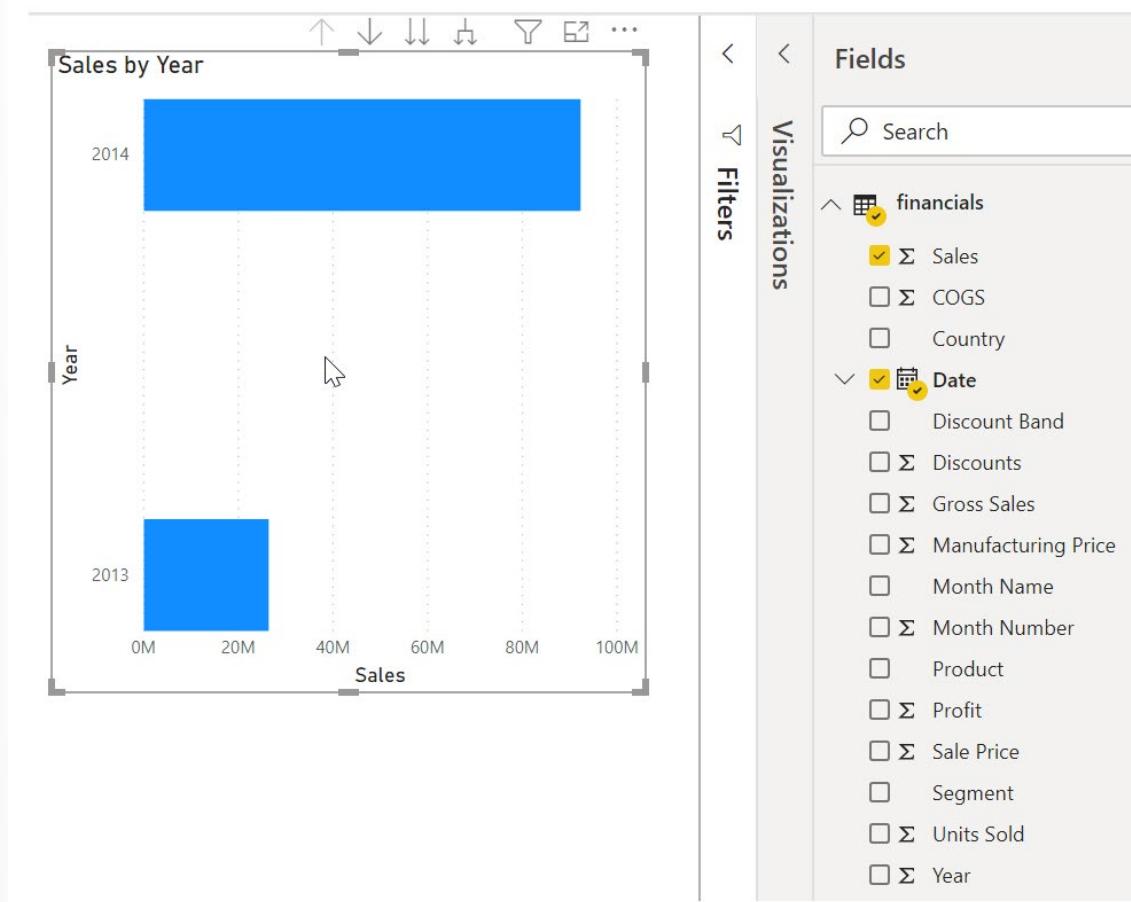
Your files don't have to be on a local drive. If you save your files on OneDrive or SharePoint Team Site, that's even better.

## Create reports

After your workbook's data has been imported, a dataset is created in Power BI and it will appear under **Datasets**.



Now, you can begin exploring your data by creating reports and dashboards. Select the **Open menu** icon next to the dataset and then select **Explore**. A new blank report canvas appears. On the right-hand side, under **Fields**, are your tables and columns. Select the fields for which you want to create a new visualization on the canvas.



You can change the type of visualization and apply filters and other properties under **Visualizations**.

If you use any of Excel's advanced BI features like **Power Query**, **Power Pivot**, or **Power View**, you can import that data into Power BI, too.

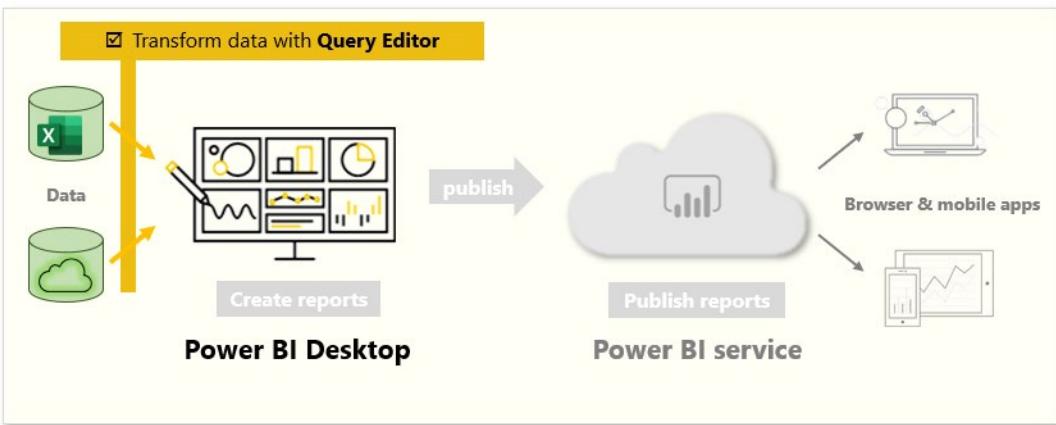
For more information, see [Get data from Excel workbook files<sup>11</sup>](#).

## Transform data to include in a report

Sometimes, your data might contain extra data or have data in the wrong format. Power BI Desktop includes the **Power Query Editor** tool, which can help you shape and transform data so that it's ready for your models and visualizations.

In this unit, you will transform data with Power Query Editor.

<sup>11</sup> <https://docs.microsoft.com/power-bi/service-excel-workbook-files>



**Video:** Transform data

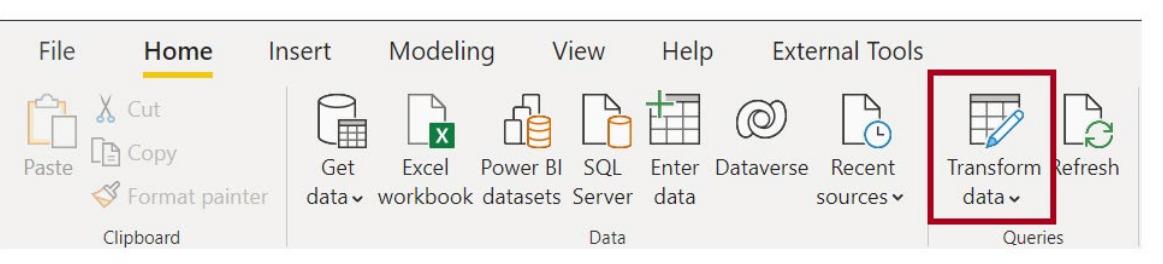


<https://www.microsoft.com/videoplayer/embed/RE3x9uw>

**Note:** To follow along with the examples on this page, download the sample Excel workbook [\\*\\*here\\*\\*<sup>12</sup>](#) and import into Power BI Desktop (\*\*Get Data > Excel\*\*) if you haven't already.

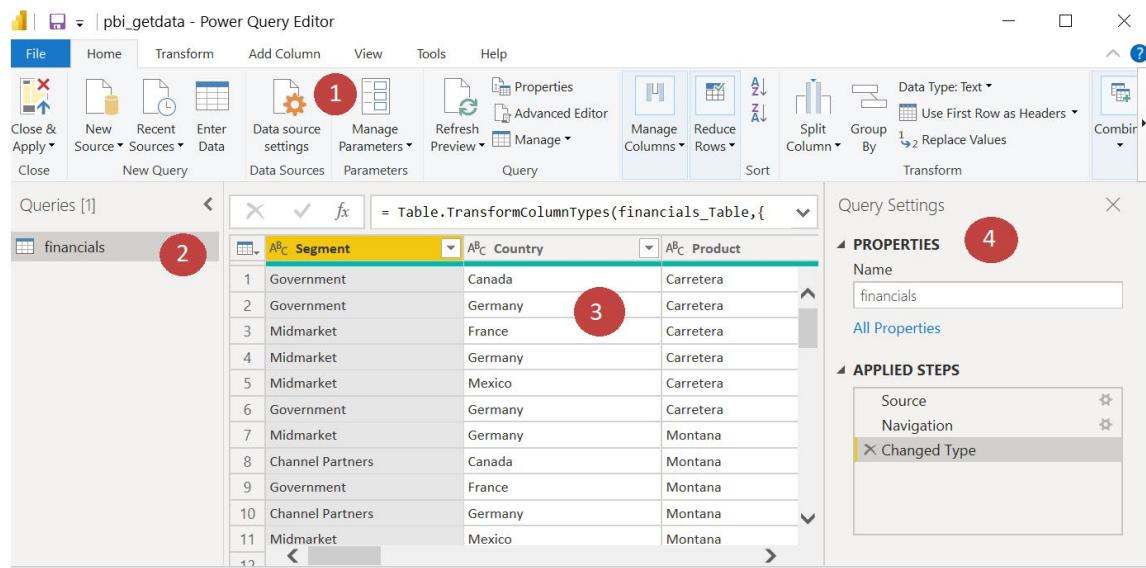
## Launch Power Query Editor

To begin, select **Transform data** from the **Navigator** window to launch Power Query Editor. You can also launch Power Query Editor directly from Power BI Desktop by using the **Transform data** button on the Home ribbon.



After loading your data into Power Query Editor, you'll see the following screen.

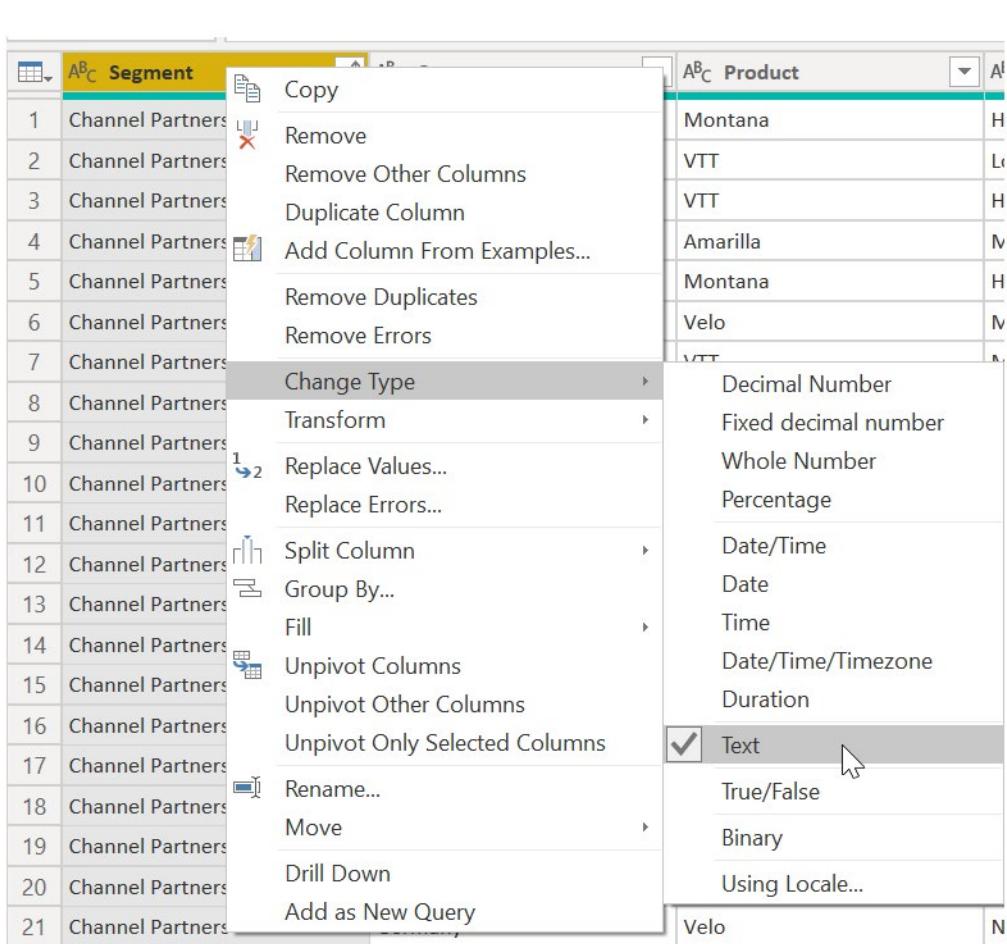
<sup>12</sup> <https://go.microsoft.com/fwlink/?linkid=2114225>



1. In the ribbon, the active buttons enable you to interact with the data in the query.
2. On the left pane, queries (one for each table, or entity) are listed and available for selecting, viewing, and shaping.
3. On the center pane, data from the selected query is displayed and available for shaping.
4. The **Query Settings** window lists the query's properties and applied steps.

## Transform data

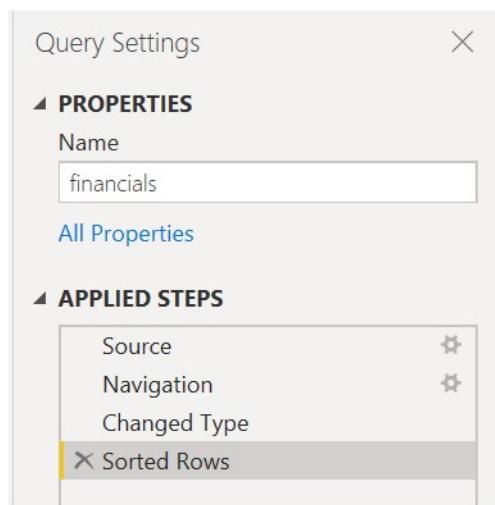
On the center pane, right-clicking a column displays the available transformations. Examples of the available transformations include removing a column from the table, duplicating the column under a new name, or replacing values. From this menu, you can also split text columns into multiples by common delimiters.



The Power Query Editor ribbon contains additional tools that can help you change the data type of columns, add scientific notation, or extract elements from dates, such as day of the week.

[!TIP] If you make a mistake, you can undo any step from the **Applied Steps** list.

As you apply transformations, each step appears in the **Applied Steps** list on the Query Settings pane. You can use this list to undo or review specific changes, or even change the name of a step. To save your transformations, select **Close & Apply** on the **Home** tab.



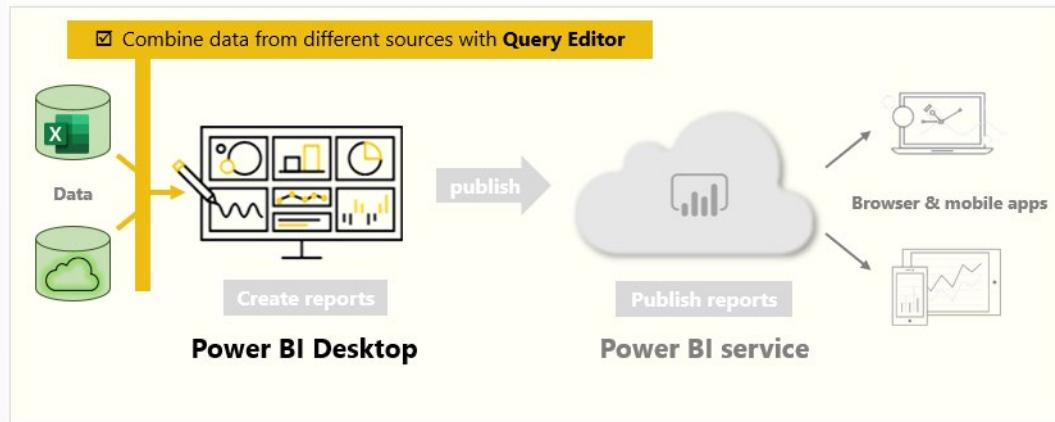
After you select **Close & Apply**, Power Query Editor applies the query changes and applies them to Power BI Desktop.

For more information, see [Quickstart: Using Power Query in Power BI Desktop<sup>13</sup>](#).

## Combine data from multiple sources

With Power BI Desktop, you can use the Power Query Editor tool to combine data from multiple sources into a single report.

In this unit, you will combine data from different sources by using Query Editor.

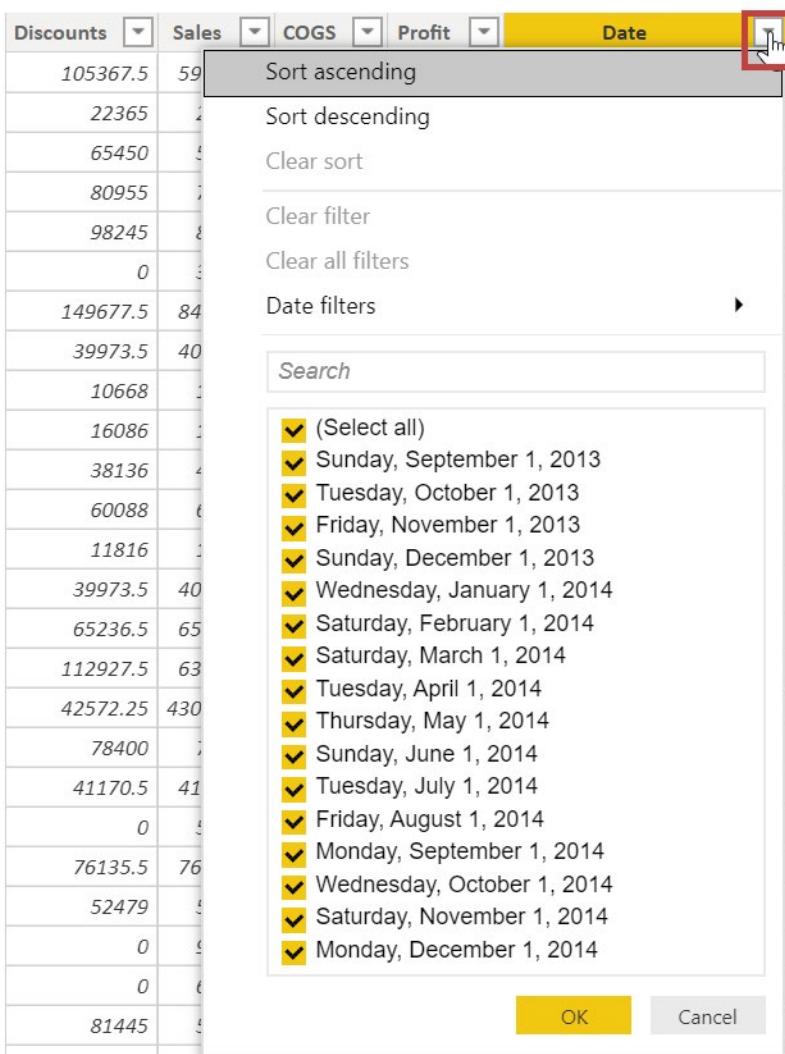


## Add more data sources

To add more sources to an existing report, from the Home ribbon, select **Transform data** and then select **New Source**. You can use many potential data sources in Power BI Desktop, including folders. By connecting to a folder, you can import data from multiple Excel or CSV files at once.

<sup>13</sup> <https://docs.microsoft.com/power-query/power-query-quickstart-using-power-bi/?azure-portal=true>

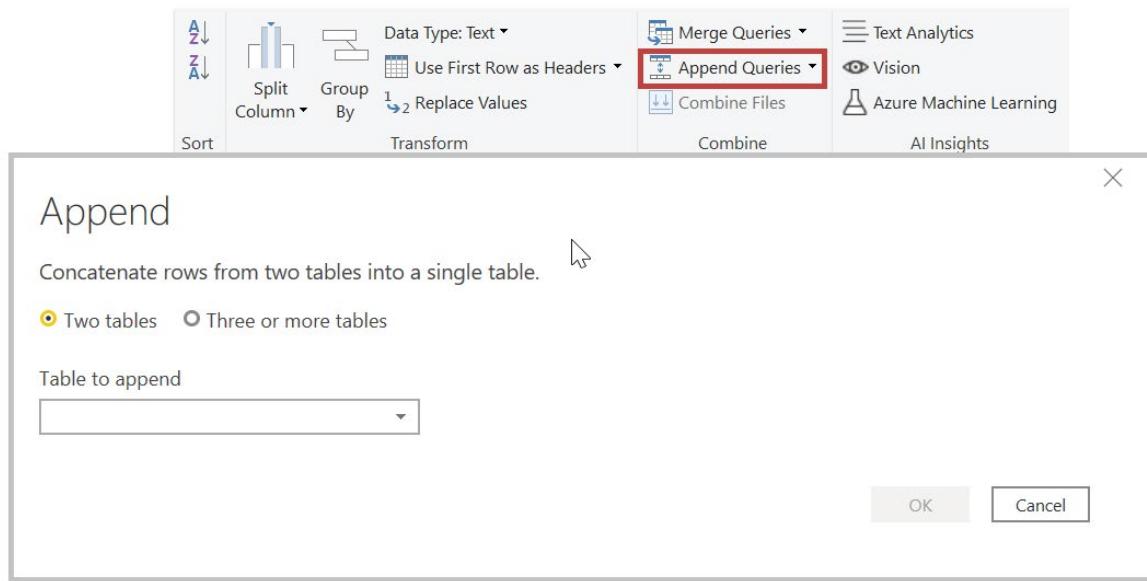
Power Query Editor allows you to apply filters to your data. For example, selecting the drop-down arrow next to a column opens a checklist of text filters. Using a filter allows you to remove values from your model before the data is loaded into Power BI.



**Important:** Filtering in the Power Query Editor changes which data is loaded into Power BI. Later, when you apply filters in the Data View or Report View, those filters only apply to what you see in visuals but do not change the underlying dataset.

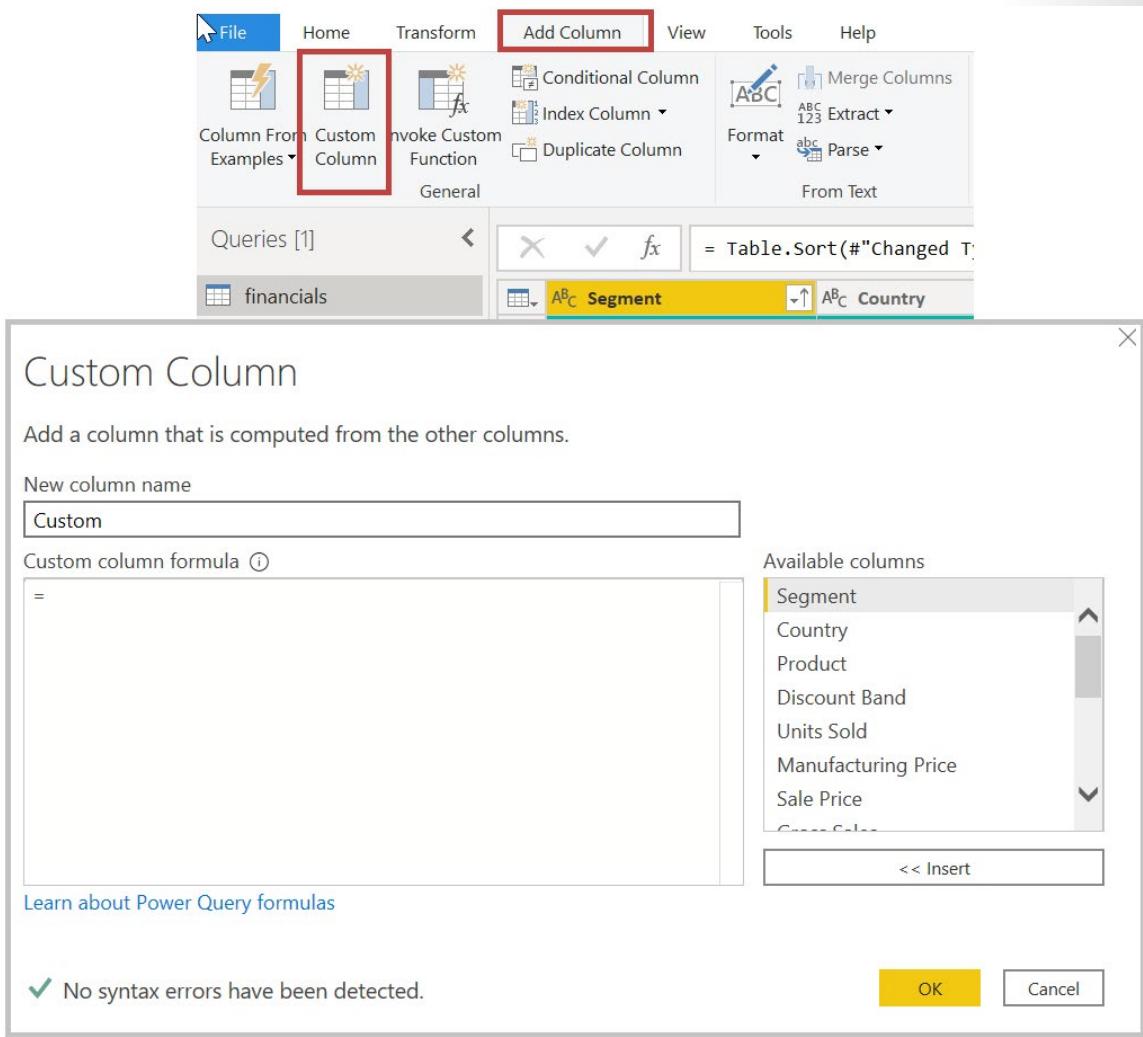
## Merge and append queries

You can also merge and append queries. In other words, Power BI pulls data that you select from multiple tables or various files into a single table. Use the Append Queries tool to add the data from a new table to an existing query. Power BI Desktop attempts to match the columns in your queries, which you can then adjust as necessary in Power Query Editor.



## Write customized queries

You can use the Add Custom Column tool to write new customized query expressions by using the powerful M language.



For more information, see [Tutorial: Shape and combine data in Power BI Desktop<sup>14</sup>](#).

## Clean data to include in a report

While Power BI can import your data from almost any source, its visualization and modeling tools work best with columnar data. Sometimes, your data won't be formatted in simple columns, which is often the case with Excel spreadsheets.

In this unit you will learn how to clean columnar data with Power Query Editor just like the example in the following video.

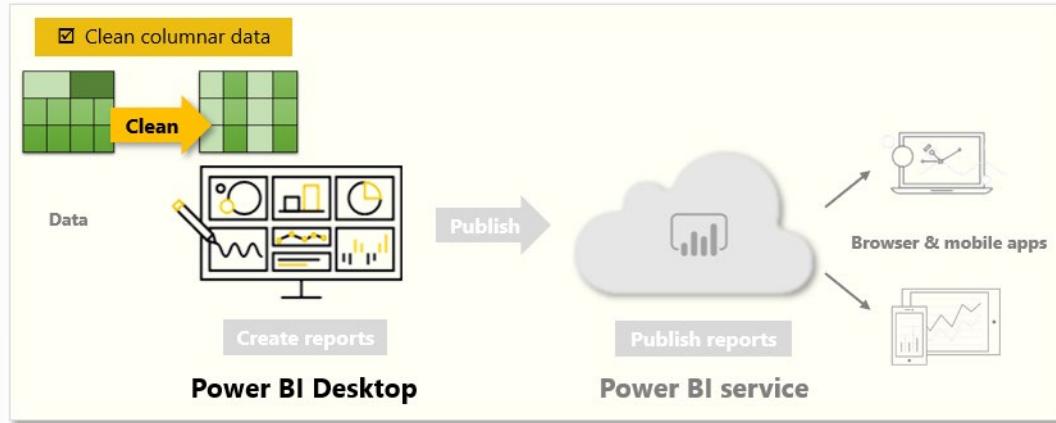
This page is purely instructional, the Excel file seen below is not provided.

**Video:**

<sup>14</sup> <https://docs.microsoft.com/power-bi/desktop-shape-and-combine-data/?azure-portal=true>



<https://www.microsoft.com/videoplayer/embed/RE3wRhf>



A table layout that looks good to the human eye might not be optimal for automated queries. For example, the following spreadsheet has headers that span multiple columns.

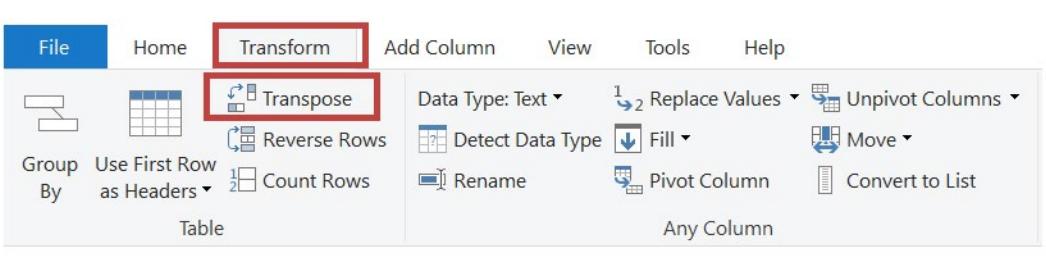
2R x 9C		Multi-Level-Spreadsheet - Excel						
		Seattle		Portland				
1	A	Bikes	Accessories	Miscellaneous	Bikes	Accessories		
3	2005	33323	13394	4455	33323	13394		
4	2006	55342	19983	5563	55342	19983		
5	2007	33234	18884	3348	33234	18884		
6	2008	33252	19893	2239	33252	19893		
7	2009	22332	18840	2232	22332	18840		
8	2010	23331	18890	4343	23331	18890		
9	2011	33532	18790	3434	33532	18790		
10	2012	11001	11000	8840	11001	11000		
11	2013	10221	9900	8892	10221	9900		

## Clean data

Fortunately, Power Query Editor has tools to help you quickly transform multi-column tables into datasets that you can use.

## Transpose data

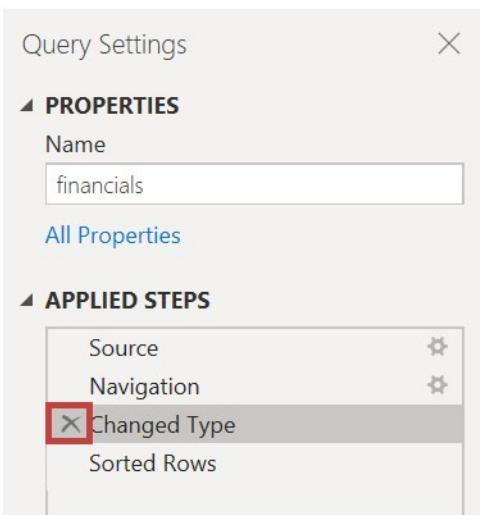
By using **Transpose** in Power Query Editor, you can swap rows into columns to better format the data.



## Format data

You might need to format data so that Power BI can properly categorize and identify that data. With some transformations, you'll cleanse data into a dataset that you can use in Power BI. Examples of powerful transformations include promoting rows into headers, using **Fill** to replace *null* values, and **Unpivot Columns**.

With Power BI, you can experiment with transformations and determine which will transform your data into the most usable columnar format. Remember, the **Applied Steps** section of Power Query Editor records all your actions. If a transformation doesn't work the way that you intended, select the **X** next to the step, and then undo it.



After you've cleaned your data into a usable format, you can begin to create powerful visuals in Power BI.

For more information, see [Tutorial: Combine sales data from Excel and an OData feed<sup>15</sup>](#).

## Check your knowledge

Choose the best response for each of the questions below.

<sup>15</sup> <https://docs.microsoft.com/power-bi/desktop-tutorial-analyzing-sales-data-from-excel-and-an-odata-feed/?azure-portal=true>

## Multiple choice

1. Which tool would you use to extract the day of the week from a set of dates?

- Navigator view
- Power Query editor
- New Measure
- New Parameter

## Multiple choice

2. What is one method for creating a visual?

- Drag a field from the Fields list onto the Visualizations pane
- Drag a field from the Fields list onto the Model view canvas
- Drag a field from the Fields list onto the Report view canvas
- Drag a field from the Fields list onto the Data view canvas

## Multiple choice

3. What is the best way to import tabular data from a website into Power BI?

- Download data from the website and then import to Power BI
- Transfer data from the website to OneDrive and then import to Power BI
- Select Get Data and point to the URL
- Use the Query Editor to find and edit the web-based data

## Summary

Congratulations, you now know how to get data into Power BI Desktop and how to shape or transform that data so you can create compelling visuals.

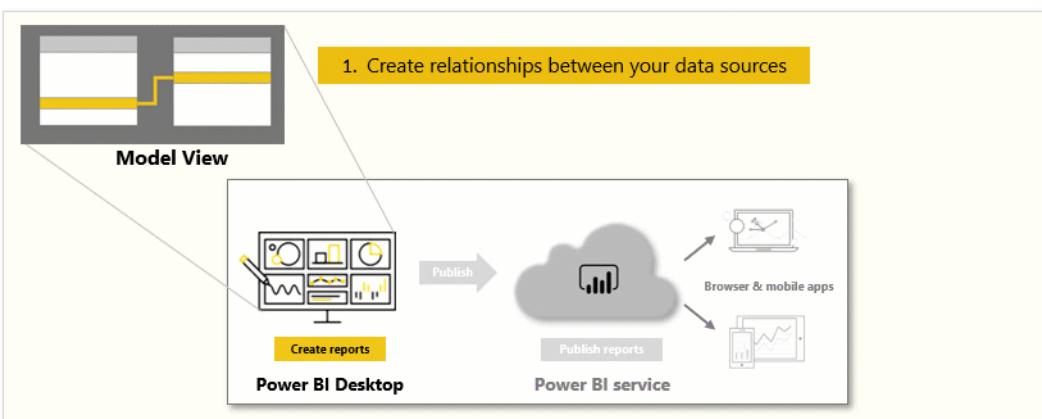
# Model data in Power BI

## Introduction to modeling your data

Often, you'll connect to multiple data sources to create your reports. All that data needs to work together to create a cohesive report. *Modeling* is how to get your connected data ready for use.

Tasks in this module:

- Create relationships between your data sources
- Create a new field with calculated columns
- Optimize data by hiding fields and sorting visualization data
- Create a measure to perform calculations on your data
- Use a calculated table to create a relationship between two tables
- Format time-based data so that you can drill down for more details



**Video:** Overview of modeling data



<https://www.microsoft.com/videoplayer/embed/RE3kOEV>

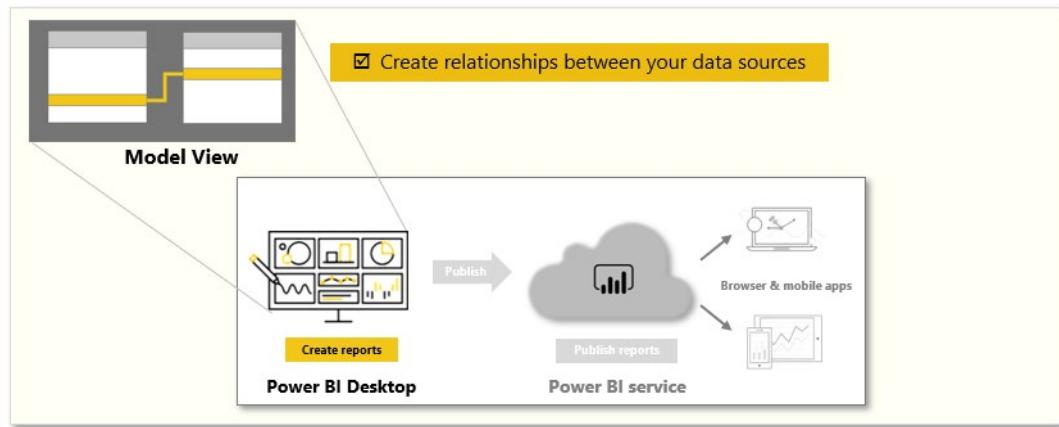
In Power BI, you can create a *relationship* to create a logical connection between different data sources. A relationship enables Power BI to connect tables to one another so that you can create visuals and reports. This module describes data-centric relationships and how to create relationships when none exists.

**Note:** One of Power BI's strengths is that you don't need to flatten your data into a single table. Instead, you can use multiple tables from multiple sources and define the relationship between them.

You'll also create your own custom calculations and assign new metrics to view specific segments of your data.

## How to manage your data relationships

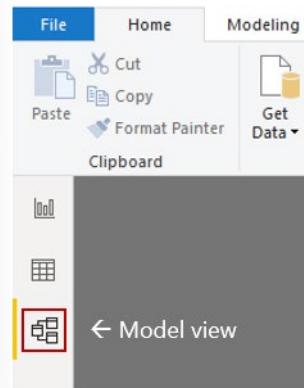
The **Model view** in Power BI Desktop allows you to visually set the relationship between tables or elements. A relationship is where two or more tables are linked together because they contain related data. This enables users to run queries for related data across multiple tables. Use the Model view to see a diagrammatic view of your data.



Tasks in this unit include:

**Note:** To follow along with the examples on this page, download the sample Access database [here<sup>16</sup>](#) and import into Power BI Desktop (**Get Data > Database > Access database**). If you have any issues loading the Access database, please read this [article<sup>17</sup>](#).

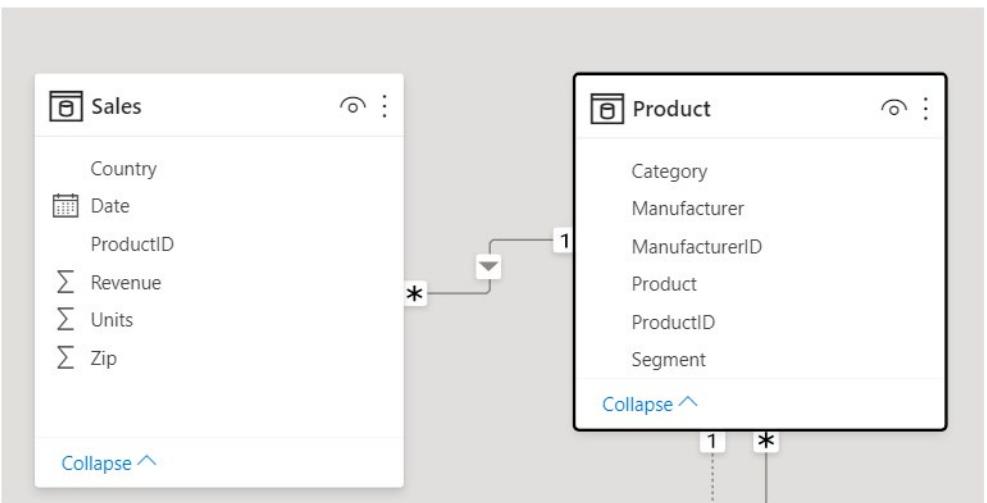
In the Model view, notice that a block represents each table and the lines between them represent relationships.



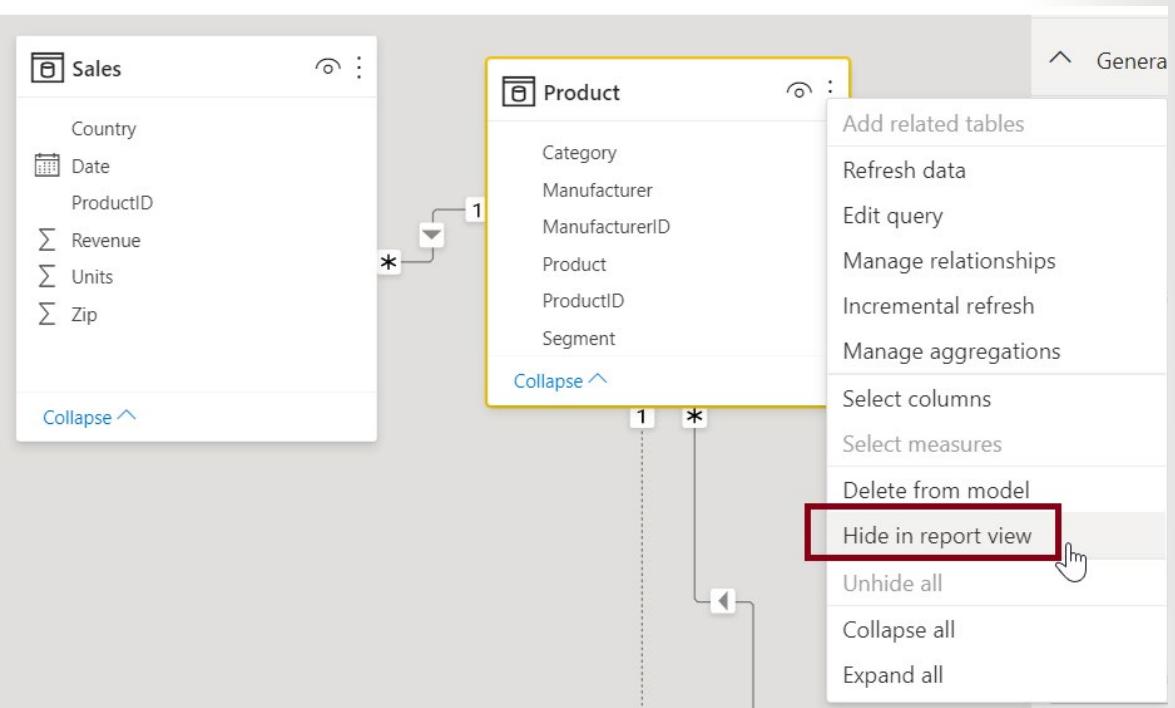
Adding and removing relationships is straightforward. To remove a relationship, right-click the relationship and select **Delete**. To create a relationship, drag and drop the fields that you want to link between tables.

<sup>16</sup> <https://go.microsoft.com/fwlink/?linkid=2120368>

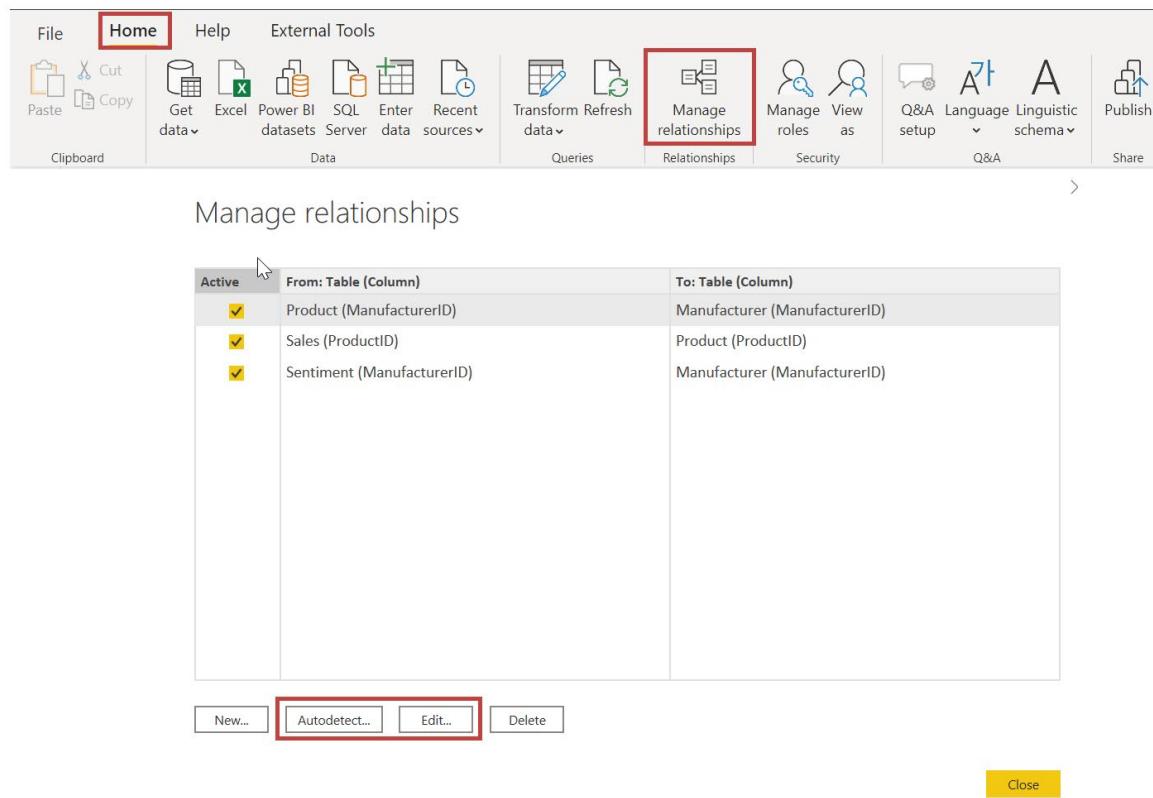
<sup>17</sup> <https://go.microsoft.com/fwlink/?linkid=2131277>



To hide a table or individual column from your report, right-click the table or column in the Model view and select **Hide in report view**.



For a more detailed view of your data relationships, on the **Home** tab, select **Manage Relationships**. The **Manage Relationships** dialog box displays your relationships as a list instead of as a visual diagram. From the dialog box, you can select **Autodetect** to find relationships in new or updated data. Select **Edit** to manually edit your relationships. You'll find advanced options in the **Edit** section to set the *Cardinality* and *Cross-filter* direction of your relationships.



Your options for Cardinality are explained in the following table.

Cardinality options	Example
<i>Many to One</i>	The most common default relationship. The column in one table can have more than one instance of a value. The related table (or lookup table) has only one instance of a value.
<i>One to One</i>	The column in one table has only one instance of a particular value, and the other related table has only one instance of a particular value.

Generally, we recommend minimizing the use of bi-directional relationships. They can negatively impact model query performance, and possibly deliver confusing experiences for your report users.

Setting accurate relationships between your data allows you to create complex calculations across multiple data elements.

For more information, see: [Create and manage relationships in Power BI Desktop<sup>18</sup>](#) and [Bi-directional relationship guidance<sup>19</sup>](#).

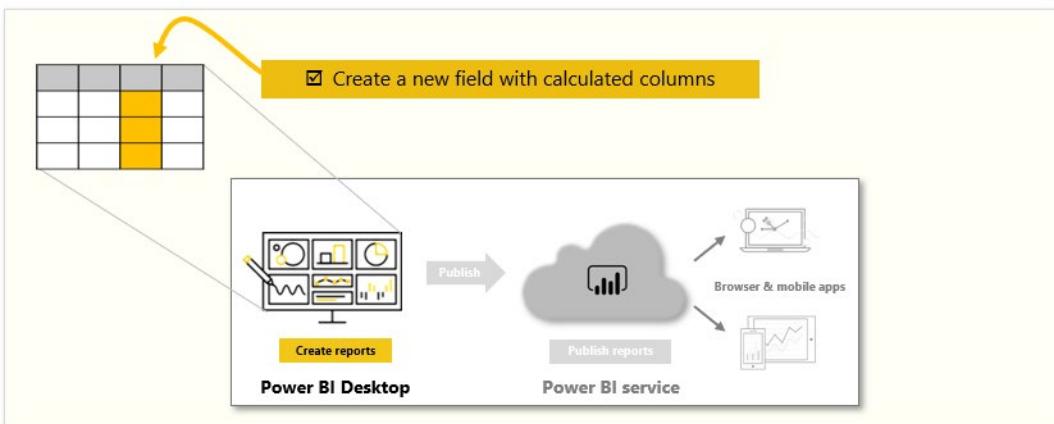
## Create calculated columns

Sometimes, the data that you're analyzing doesn't contain a field that you need. The answer might be *calculated columns*. You can create a new calculated column by transforming two or more elements of existing data. For example, you can create a new column by combining two columns into one.

<sup>18</sup> <https://docs.microsoft.com/en-us/power-bi/transform-model/desktop-create-and-manage-relationships>

<sup>19</sup> <https://docs.microsoft.com/en-us/power-bi/guidance/relationships-bidirectional-filtering>

Tasks in this unit include:



**Note:** To follow along with the examples on this page, download the sample Access database [here<sup>20</sup>](#) and import into Power BI Desktop (**Get Data > Database > Access database**). If you have any issues loading the Access database, please read this [article<sup>21</sup>](#).

One reason for creating a calculated column is to establish a relationship between tables when no unique fields exist. The lack of a relationship becomes obvious when you create a simple table visual in Power BI Desktop and get the same value for all entries.

<sup>20</sup> <https://go.microsoft.com/fwlink/?linkid=2120368>

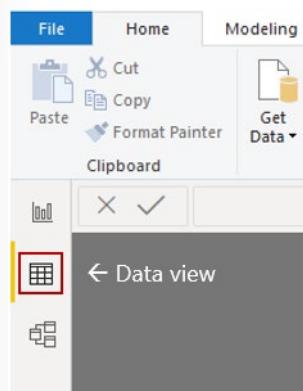
<sup>21</sup> <https://go.microsoft.com/fwlink/?linkid=2131277>

The screenshot shows the Power BI Desktop interface. On the left is a table visualization titled "Revenue" with columns "District" and "Revenue". The table lists various districts with their corresponding revenue values, ending with a total row. On the right is the "Fields" pane, which contains a search bar and a tree view of fields categorized into "Date", "Geography", "Manufacturer", "Product", and "Sales". Under "Geography", "District" is selected. Under "Sales", "Revenue" is selected. Other options like "Country", "Date", "ProductID", "Units", and "Zip" are also listed under their respective categories.

District	Revenue
	1,323,652,888.11
	1,323,652,888.11
Abala	1,323,652,888.11
Abasolo	1,323,652,888.11
Abejones	1,323,652,888.11
Acacoyagua	1,323,652,888.11
Acajete	1,323,652,888.11
Acala	1,323,652,888.11
Acambaro	1,323,652,888.11
Acambay	1,323,652,888.11
Acanceh	1,323,652,888.11
Acapetahua	1,323,652,888.11
Acaponeta	1,323,652,888.11
Acapulco de Juarez	1,323,652,888.11
Acateno	1,323,652,888.11
Acatepec	1,323,652,888.11
Acatic	1,323,652,888.11
Acatlan	1,323,652,888.11
Acatlan de Juarez	1,323,652,888.11
Acatlan de Perez Figueroa	1,323,652,888.11
Acatzingo	1,323,652,888.11
Acaxochitlan	1,323,652,888.11
Acyucan	1,323,652,888.11
<b>Total</b>	<b>1,323,652,888.11</b>

For example, to create a relationship with unique fields in data, you can create a new calculated column for "CountryZip" by combining the values from the Country and the Zip columns.

To create a calculated column, select the **Data view** in Power BI Desktop from the left side of the report canvas.

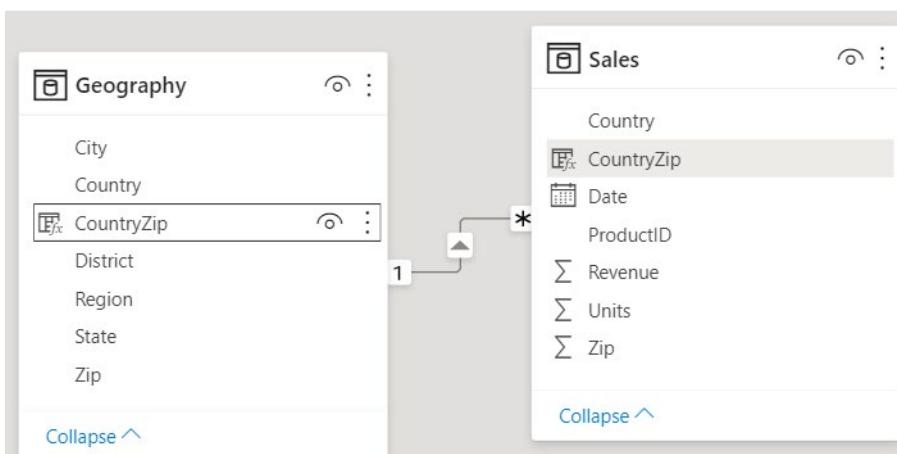


From the **Table tools** tab, select **New Column** to enable the formula bar. You can enter calculations by using Data Analysis Expressions (DAX) language. DAX is a powerful formula language that lets you build robust calculations. As you type a formula, Power BI Desktop displays matching formulas or data elements to assist and accelerate the creation of your formula.

The Power BI formula bar will suggest specific DAX functions and related data columns as you enter your expression.

Zip	City	State	Region	District	Country	CountryZip
68274	Oaxaca			Oaxaca de Juarez	Mexico	Mexico, 68274
68275	Oaxaca			Oaxaca de Juarez	Mexico	Mexico, 68275
68276	Oaxaca			Oaxaca de Juarez	Mexico	Mexico, 68276
71512	Oaxaca			Ocotlan de Morelos	Mexico	Mexico, 71512
71513	Oaxaca			Ocotlan de Morelos	Mexico	Mexico, 71513
71515	Oaxaca			Ocotlan de Morelos	Mexico	Mexico, 71515
71565	Oaxaca			La Pe	Mexico	Mexico, 71565
71566	Oaxaca			La Pe	Mexico	Mexico, 71566
71750	Oaxaca			Pinotepa de Don Luis	Mexico	Mexico, 71750

After you have created the new CountryZip calculated column in each table, they can be used as a unique key to establish a relationship between the two tables. By going to the **Relationship** view, you can then drag the CountryZip field from the Sales table to the Geography table to create the relationship.



When you return to the **Report** view, notice that a different value for each district shows.

District	Revenue
	63,578,104.59
Abala	24,200.77
Acajete	103,786.04
Acanceh	8,505.53
Acayucan	187,536.40
Ahome	206,798.02
Alaquines	17,712.92
Almoloya Del Rio	14,755.97
Altotonga	415,359.00
Alvarado	16,364.83
Amatepec	422,143.84
Amatitlan	17,252.34
Amatlan de los Reyes	378,426.35
Angel R Cabada	239,830.92
Angostura	504,536.81
Aquismon	533,129.52
Atenco	332,793.88
Atoyac	93,379.28
Aude	655,627.19
Aveyron	22,605.98
Axtla de Terrazas	969,827.41
Baca	5,339.46
Badiraguato	819,829.29
<b>Total</b>	<b>1,323,652,888.11</b>

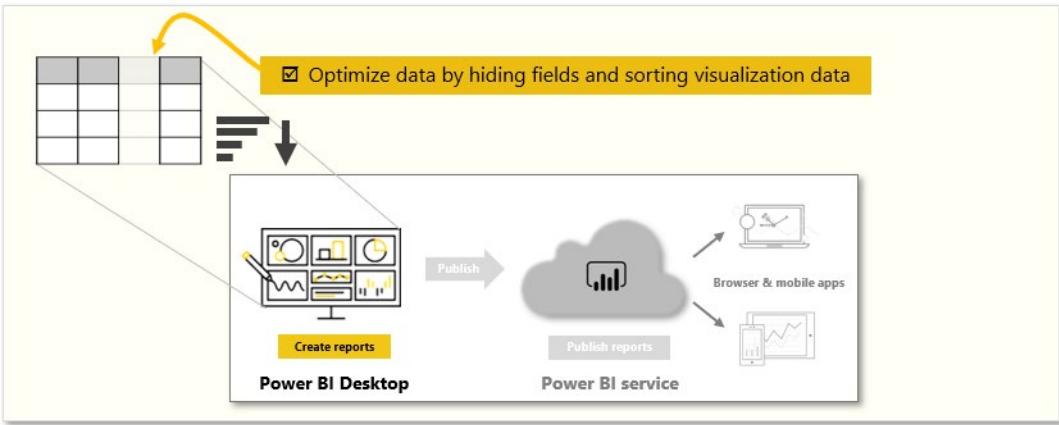
For more information on calculated columns, including the use of IF statements, see Tutorial: [Create calculated columns in Power BI Desktop](#)<sup>22</sup>.

## Optimize data models

Imported data often contains fields that you don't need for your reporting and visualization tasks. Data might contain unnecessary information or it might be available in another column. Power BI Desktop has tools to optimize your data and make it more usable for building reports and visuals.

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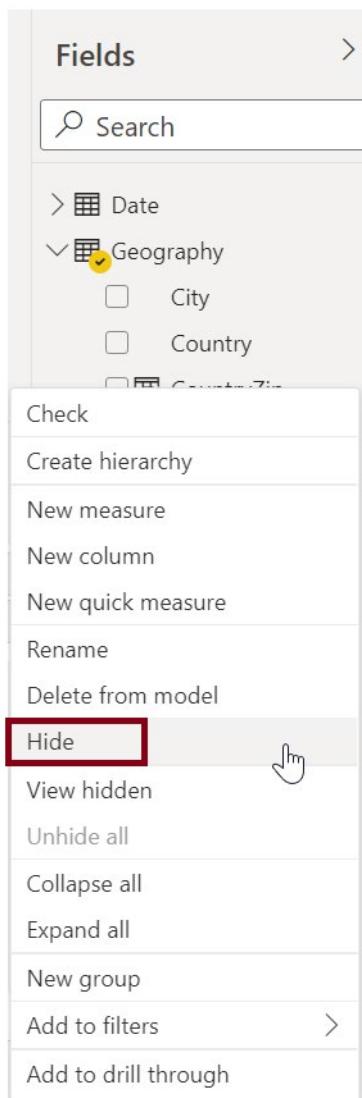
<sup>22</sup> <https://docs.microsoft.com/en-us/power-bi/transform-model/desktop-tutorial-create-calculated-columns>



Tasks in this module include:

## Hide fields

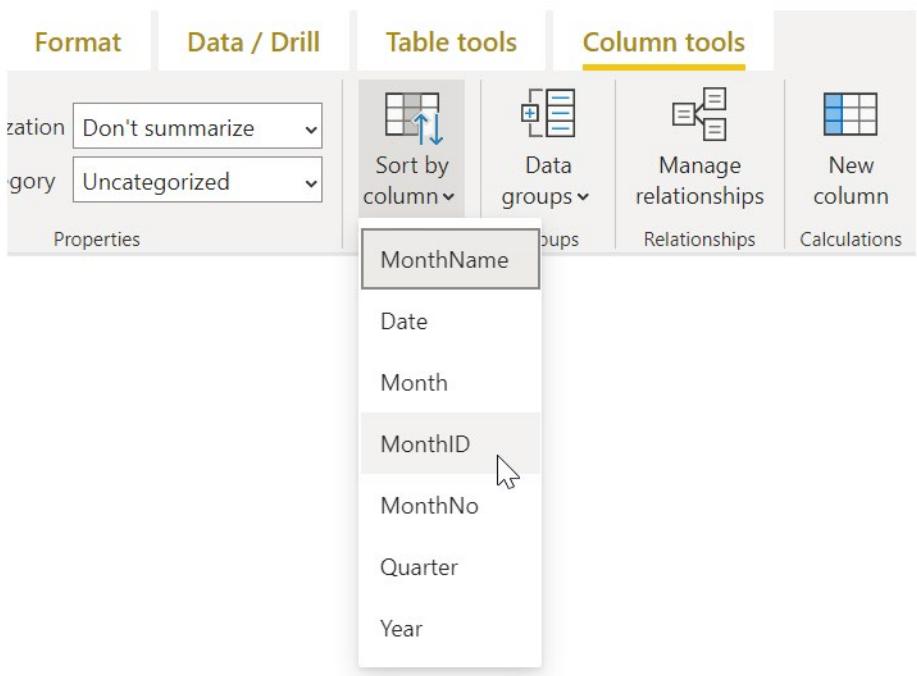
To hide a field in the Fields pane of Power BI Desktop, right-click the column and select **Hide**. Your hidden fields aren't deleted. If you've used a hidden field in existing visuals, the data is still there; the hidden field just isn't displayed on the Fields pane.



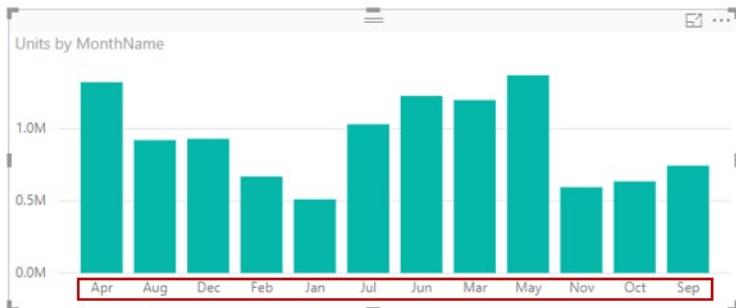
If you view tables in the **Model** view, hidden fields appear dimmed. The data in these tables is still available and is still part of the model. You can unhide any field that has been hidden by right-clicking the field and then selecting **unhide**.

## Sort visualization data by another field

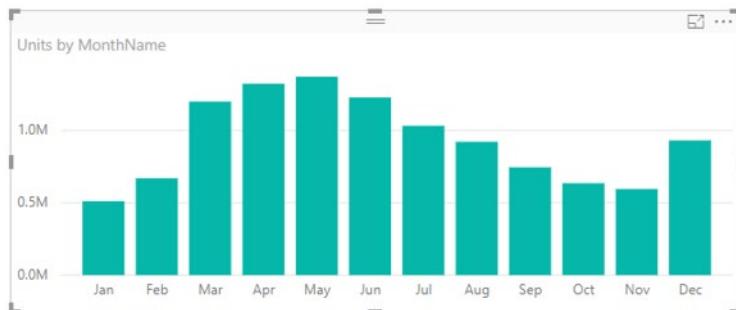
The **Sort by Column** tool, available on the **Table tools** tab, is useful to help ensure that your data is displayed in the order that you intended.



As a common example, data that includes the name of the month is sorted alphabetically by default, for example, August would appear before February.



In this case, selecting the **MonthName** field in the **Fields** list, selecting **Sort by Column** from the **Table tools** tab, and then choosing a field to sort by can remedy the problem. The **MonthNo** category sort option will order the months as intended.



Setting the data type for a field is another way to optimize your information so that it's handled correctly. To change a data type from the report canvas, select the column in the Fields pane, and then use the

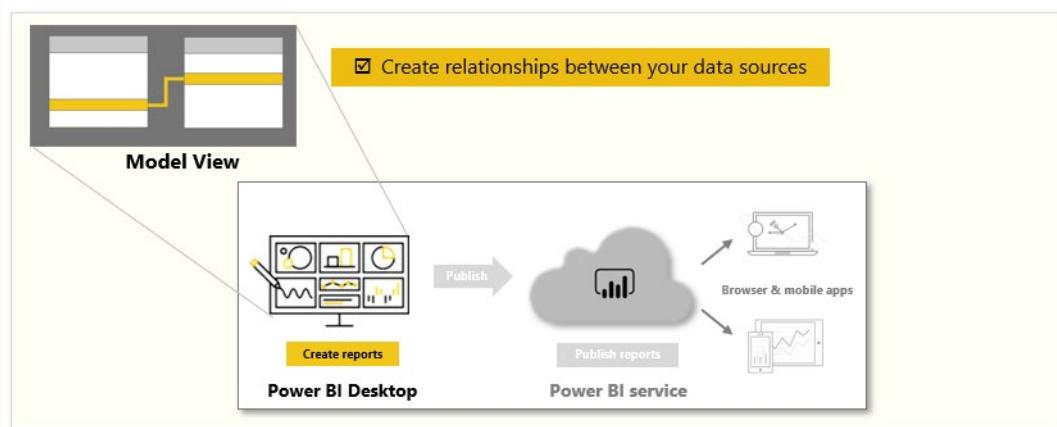
**Format** drop-down menu on the **Column tools** tab to select one of the formatting options. Any visuals you've created that display that field are updated automatically.

For more information, see [Sort by column in Power BI Desktop<sup>23</sup>](#).

## Create measures

In Power BI, *measures* are defined calculations on your data that are performed at the time of your query. Measures are calculated as you interact with your reports and aren't stored in your database.

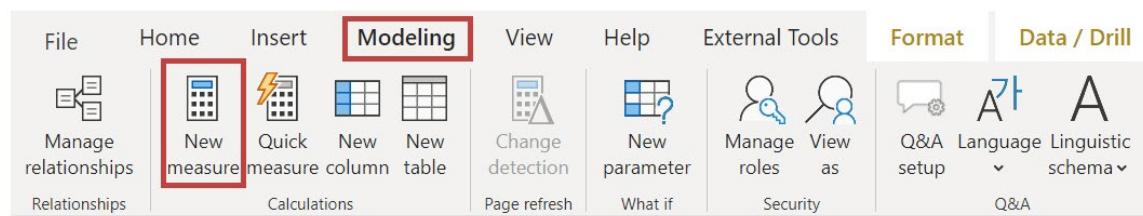
Tasks in this unit include:



**Note:** To follow along with the examples on this page, download the sample Access database [here<sup>24</sup>](#) and import into Power BI Desktop ([Get Data > Database > Access database](#)). If you have any issues loading the Access database, please read this [article<sup>25</sup>](#).

## Create a measure

To create a measure, in **Report** view, select **New Measure** from the **Modeling** tab.

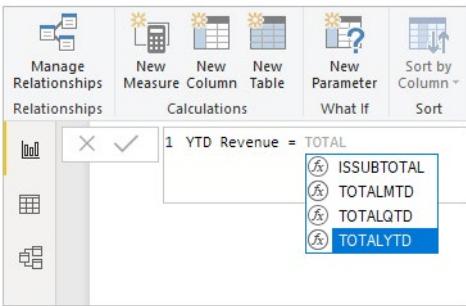


From the Formula bar, you can enter the DAX expression that defines your measure. As you enter your calculation, Power BI suggests relevant DAX functions and data fields. You'll also receive a tooltip that explains some of the syntax and function parameters.

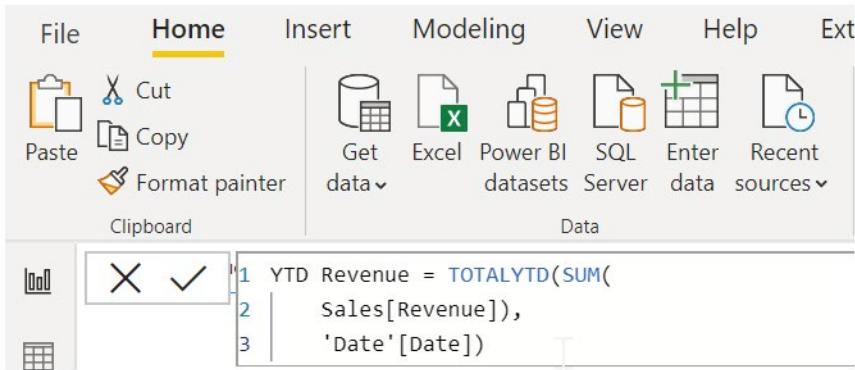
<sup>23</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/desktop-sort-by-column>

<sup>24</sup> <https://go.microsoft.com/fwlink/?linkid=2120368>

<sup>25</sup> <https://go.microsoft.com/fwlink/?linkid=2131277>

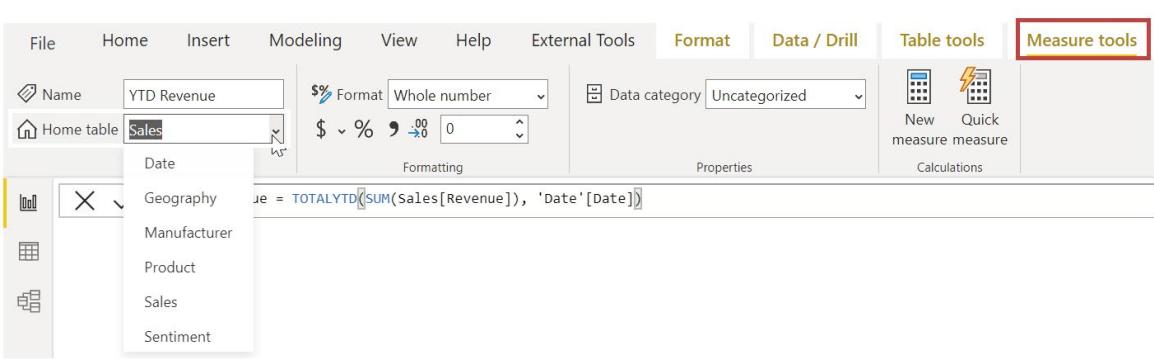


If your calculation is long, you can add extra line breaks in the Expression Editor by typing **ALT-Enter**.



## Apply a measure

After you've created a new measure, it will appear in one of the tables on the Fields pane, which is found on the right side of the screen. Power BI inserts the new measure into whichever table you have currently selected. While it doesn't matter, exactly, where the measure is located in your data, you can easily move it by selecting the measure and using the **Home Table** drop-down menu on the **Measure tools** tab.



You can use a measure like any other table column: just drag and drop it onto the report canvas or visualization fields. Measures also integrate seamlessly with slicers, segmenting your data on the fly, which means that you can define a measure once and then use it in many different visualizations.

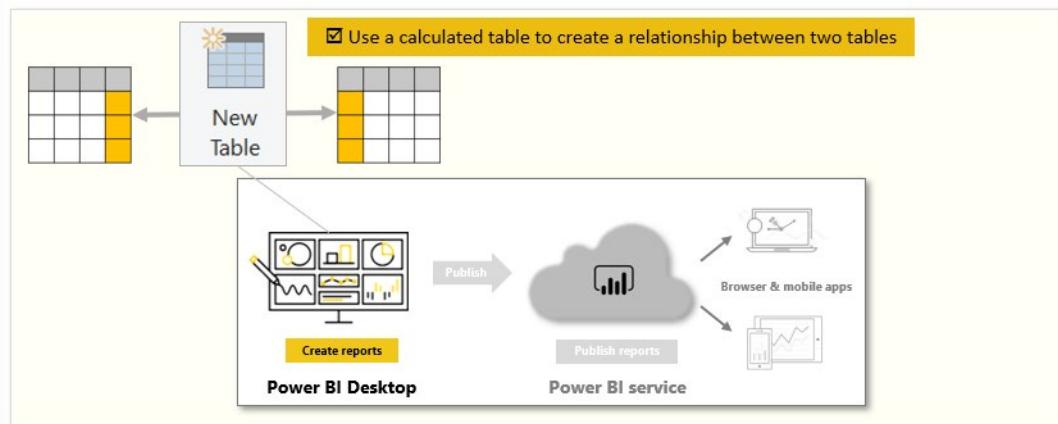
For more information, see [Tutorial: Create your own measures in Power BI Desktop<sup>26</sup>](#).

<sup>26</sup> <https://docs.microsoft.com/en-us/power-bi/transform-model/desktop-tutorial-create-measures>

## Create calculated tables

Calculated tables is a function within DAX. Most of the time, you can import data into your model from an external data source. However, calculated tables provide intermediate calculations and data that you want stored as part of the model rather than as part of a query. You can use calculated tables, for example, to cross join two tables.

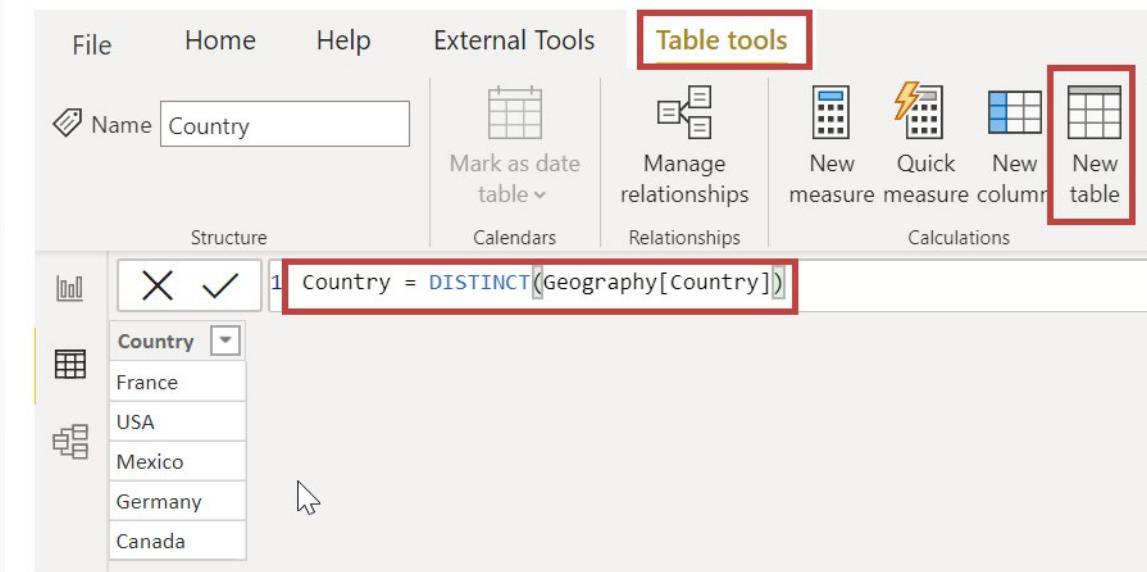
Tasks in this unit include:



**Note:** To follow along with the examples on this page, download the sample Access database [here<sup>27</sup>](#) and import into Power BI Desktop (**Get Data > Database > Access database**). If you have any issues loading the Access database, please read this [article<sup>28</sup>](#).

To create a calculated table, go to **Data view** in Power BI Desktop, on the left side of the report canvas. Select **New Table** from the **Table tools** tab to open the formula bar.

Type the name of your new table, the equal sign, and the calculation that you want to use to form the table. Your new table will appear on the Fields pane in your model.



<sup>27</sup> <https://go.microsoft.com/fwlink/?linkid=2120368>

<sup>28</sup> <https://go.microsoft.com/fwlink/?linkid=2131277>

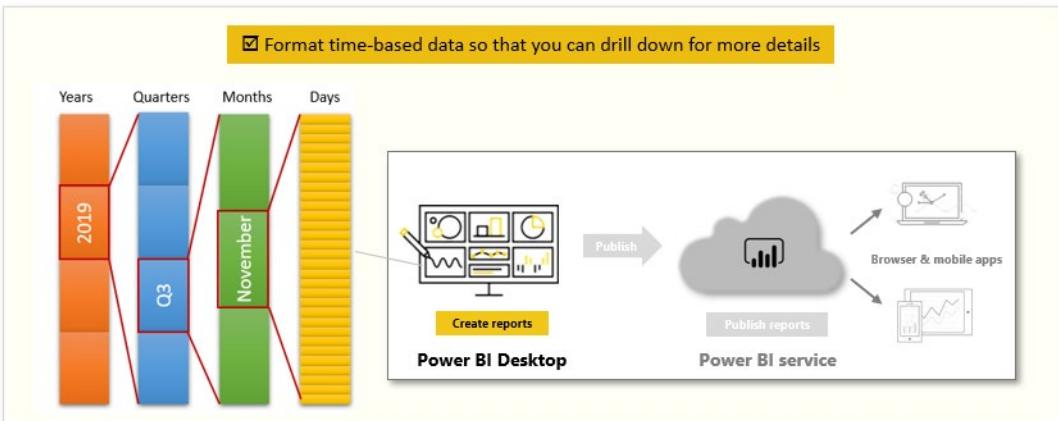
After the new table has been created, you can use your calculated table as you would any other table in relationships, formulas, and reports.

For more information, see: [Using calculated tables in Power BI Desktop<sup>29</sup>](#).

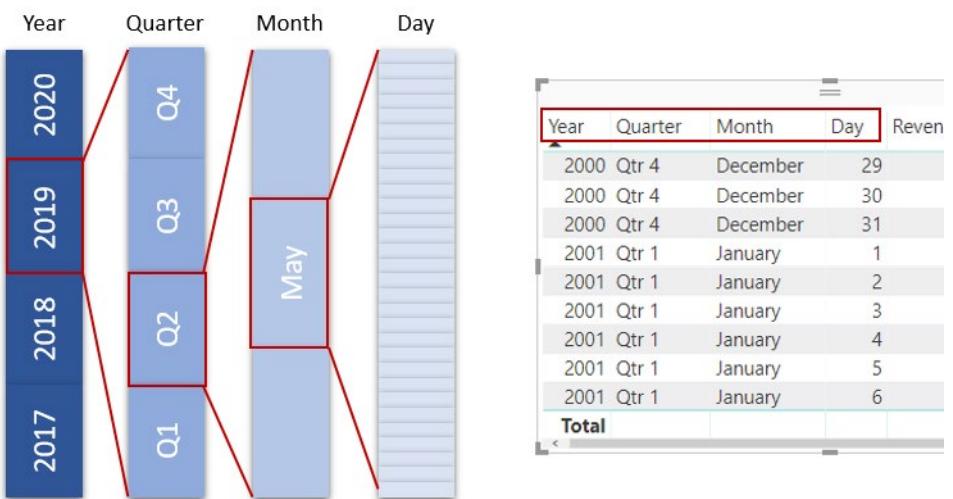
## Explore time-based data

Analyzing time-based data with Power BI is a simple process. The modeling tools in Power BI Desktop automatically generate fields that let you drill down through time periods.

Tasks in this unit include:



When you create a table visualization in your report by using a date field, Power BI Desktop automatically includes breakdowns by time period. For example, the single date field in the **Date** table was automatically separated into Year, Quarter, Month, and Day by Power BI.



Visuals display data at the year level by default, but you can change that by turning on **Drill Down** in the top, right-hand corner of the visual.

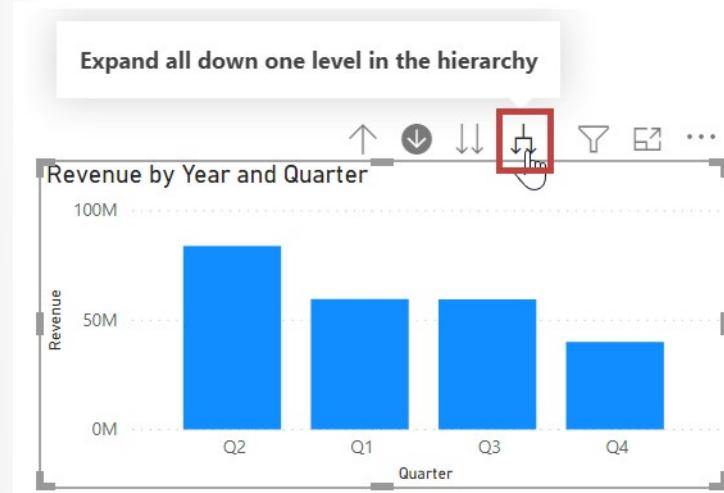
<sup>29</sup> <https://docs.microsoft.com/en-us/power-bi/transform-model/desktop-calculated-tables>



When you select the bars or lines in your chart, the system will drill down to the next level of time hierarchy, for example, from *years* to *quarters*. You can continue to drill down until you reach the most granular level of the hierarchy: *days*. To move back up through the time hierarchy, select **Drill Up** in the top, left-hand corner of the visual.



You can also drill down through all the data that is shown on the visual instead of through one selected period. To do so, use the **Go to the next level in the hierarchy** double-arrow icon.



---

As long as your model has a date field, Power BI will automatically generate different views for different time hierarchies.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. *How do you get Power BI Desktop to find relationships in data after it has been imported?*

- Open the Power Query Editor
- Select Manage Relationships and then Autodetect
- Select the New Parameter button to map the relationship
- Use the Performance Manager

### Multiple choice

2. *If your months were sorted alphabetically, how could you sort them by month order?*

- Click the Edit Queries button
- Add a slicer to your visual
- Change the visualization type
- Apply the MonthNo category sort option

### Multiple choice

3. *How do you get Power BI to separate date data into year, quarter, month, and day?*

- Open the Query Editor
- Select the New Parameter button
- Select the New Measure button
- You don't need to do anything, it is automatic.

### Multiple choice

4. *How do you create data tables that you want stored as part of the model rather than as part of a query?*

- Use a calculated table
- Select the Enter Data button
- Select the New Measure button
- Select the New Parameter button

## Multiple choice

5. Why would a table show the same value, like "Sales", for every country?

- Because the Revenue data is corrupted
- Because the column is assigned with the wrong data type
- Because there is no relationship between the Sales and Country fields.
- Because the column is sorted incorrectly

## Summary

Congratulations. In this module, you learned how to create relationships between your data sources and optimize data. These skills will help you pull clean data from several different sources.

# Use visuals in Power BI

## Introduction to visuals in Power BI

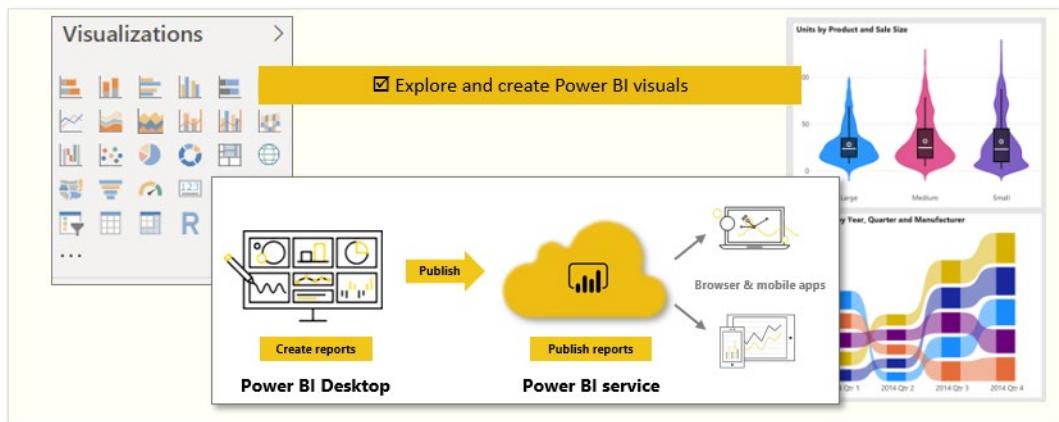
*Visuals* allow you to present data in a compelling and insightful way, and help you *show* the important components of it. Power BI has many compelling visuals and many more that are released frequently.



<https://www.microsoft.com/videoplayer/embed/RWFP5W>

The following are the tasks that you'll complete in this module:

- Explore Power BI visuals
- Create visuals

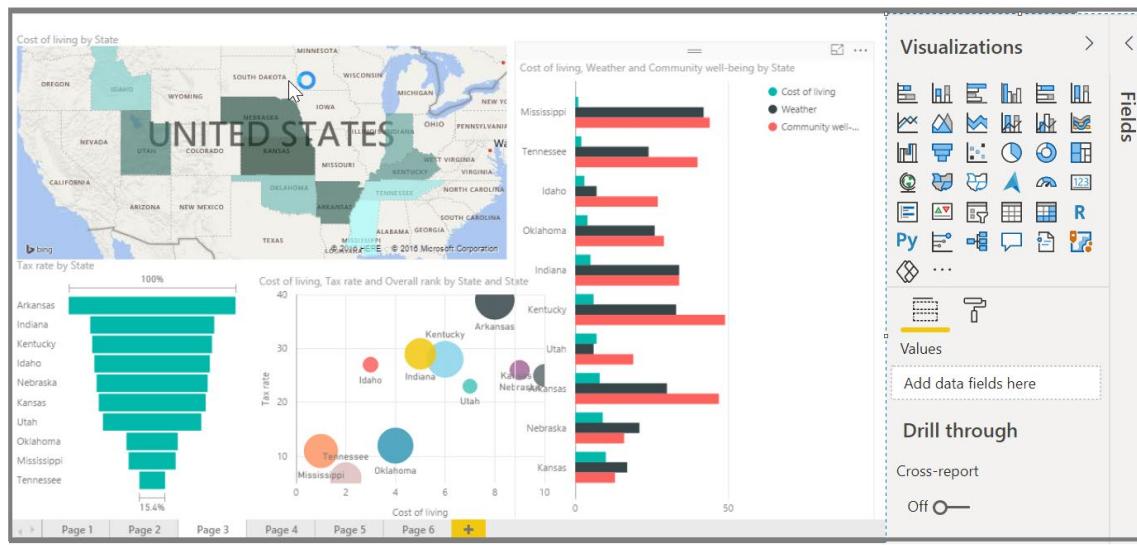


**Video:** Visuals in Power BI



<https://www.microsoft.com/videoplayer/embed/RE3kWsR>

This unit begins with the mainstays of visualizations, the simple visuals that everyone's familiar with, to make sure that you know the particulars of them. The rest of the module will provide more advanced, or at least less common, details to enhance your report-creating knowledge.



Visualizing data is one of the core parts and basic building blocks of Power BI. Creating visuals is one of the most effective ways to find and share your insights.

You'll discover a wide variety of visualizations in Power BI, which offers features such as simple bar charts, pie charts, maps, and more esoteric offerings like waterfalls, funnels, and gauges. Power BI Desktop also offers extensive page formatting tools, such as shapes and images, that help bring your report to life.

## Create and customize simple visualizations

This unit explains how to create new bar charts, pie charts, and tree maps, and how to customize these elements to suit your reports.

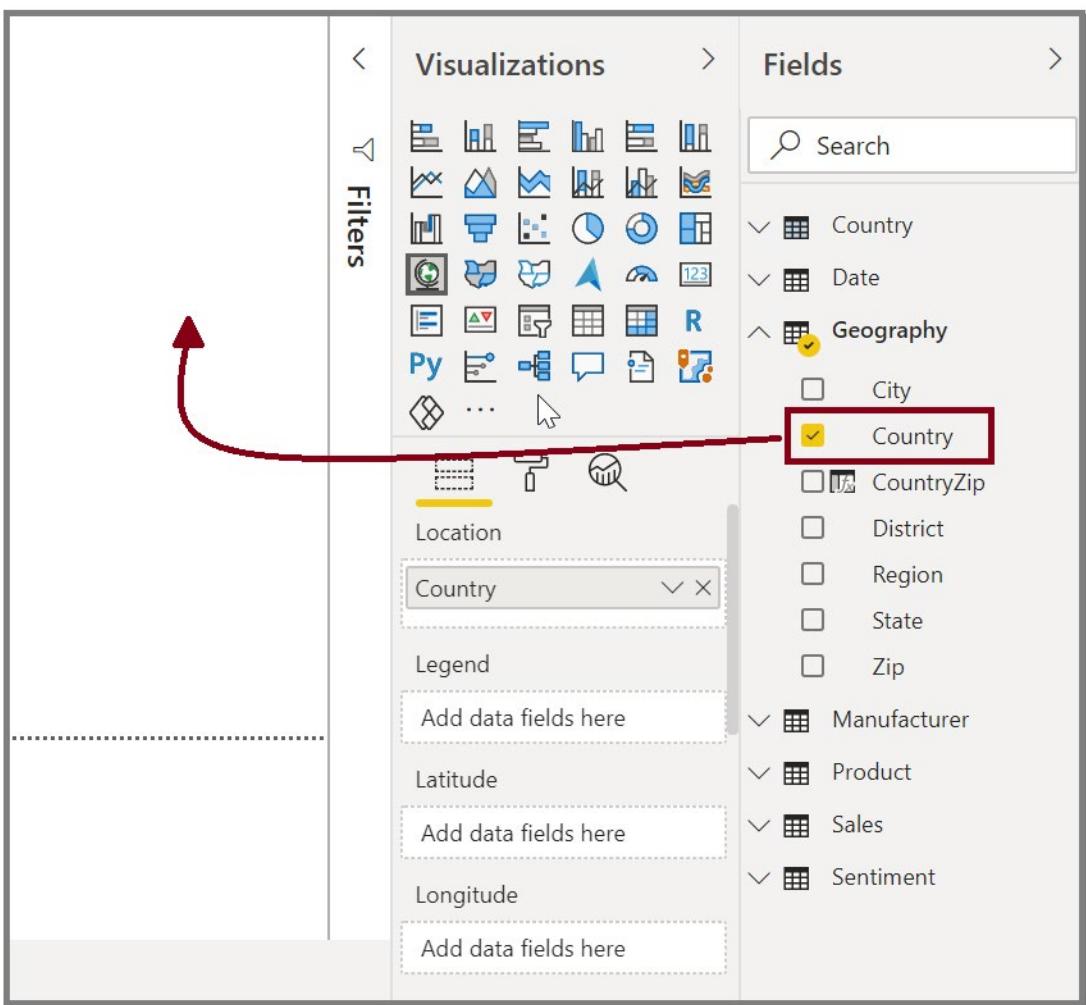
**Video:** Create simple visuals



<https://www.microsoft.com/videoplayer/embed/RE3x1Gm>

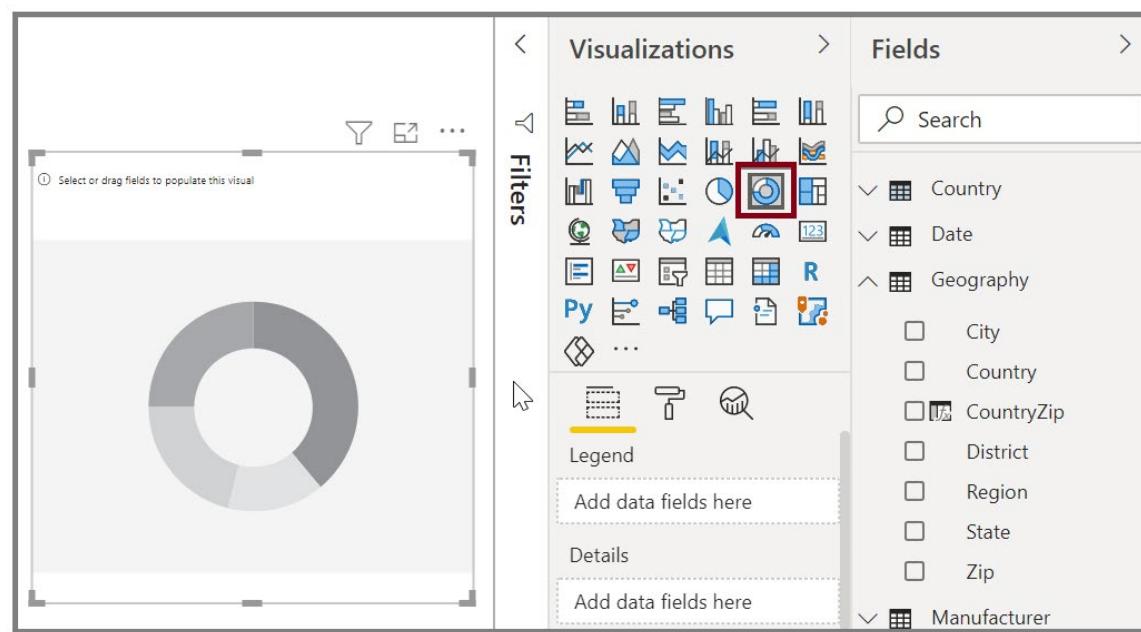
Two ways to create a new visualization in Power BI Desktop are:

- Drag field names from the Fields pane and then drop them on the report canvas. By default, your



visualization appears as a table of data.

- In the Visualizations pane, select the type of visualization that you want to create. With this method,



the default visual is a blank placeholder that resembles the type of visual that you selected.

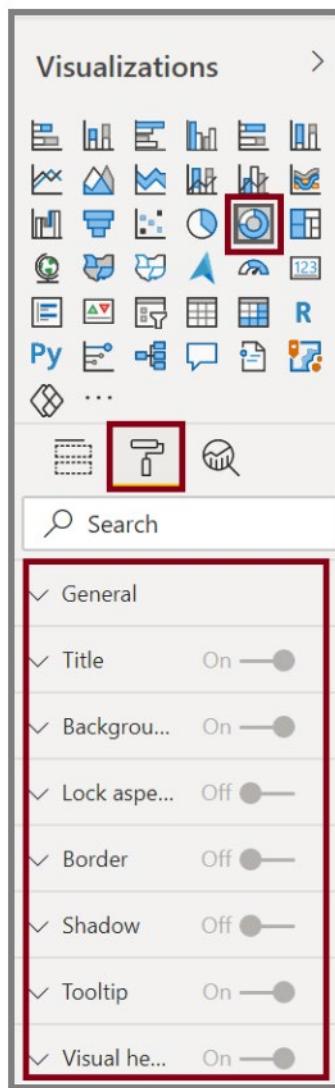
After you have created your graph, map, or chart, you can begin dragging data fields onto the bottom portion of the Visualization pane to build and organize your visual. The available fields will change based on the type of visualization that you selected. As you drag and drop data fields, your visualization will automatically update to reflect changes.



You can resize your visual by selecting it and then dragging the handles in or out. You can also move your visualization anywhere on the canvas by selecting and then dragging it to where you want it. If you want to convert between different types of visuals, select the visual that you want to change and select a different visual from the Visualization pane. Power BI attempts to convert your selected fields to the new visual type as closely as possible.

As you hover over parts of your visuals, you'll receive a tooltip that contains details about that segment, such as labels and total value.

Select the paintbrush icon on the Visualizations pane to make cosmetic changes to your visual. Examples of cosmetic changes include background, alignment, title text, and data colors.



The available options for cosmetic changes to your visual vary depending on the type of visual that you've selected.

**Note:** Generally, visuals are used to compare two or more different values. However, sometimes when you are building reports, you might want to track a single metric over time. For more information, see [Radial gauge charts in Power BI<sup>30</sup>](#).

## Create combination charts

*Combination charts* are an effective way to visualize multiple measures that have different scales in a single visualization.

**Video:** Combination charts

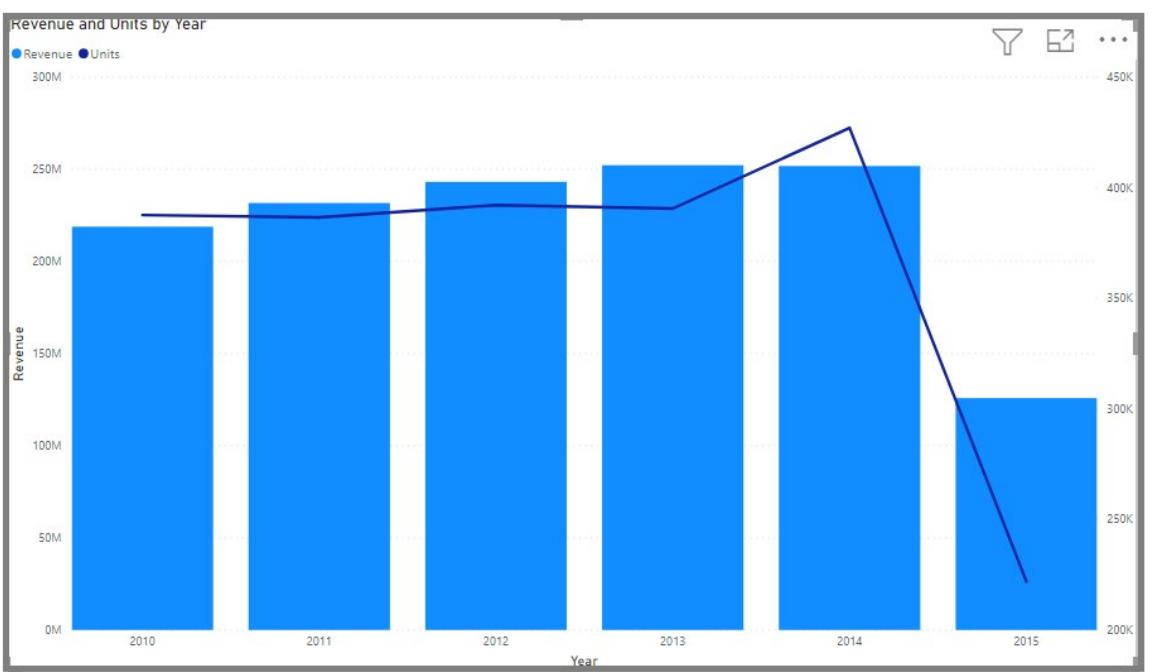
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<sup>30</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-radial-gauge-charts/>



<https://www.microsoft.com/videoplayer/embed/RE3oQIU>

You might want to visualize two measures with different scales, such as revenue and units. Use a combination chart to show a line and a bar with different axis scales. Power BI supports many different types of combination charts by default, including Line and Stacked Columns charts.



You can split each column by category by dragging a category into the **Column Series** field. When you do so, each bar is proportionately colored based on the values within each category.

## Create slicers

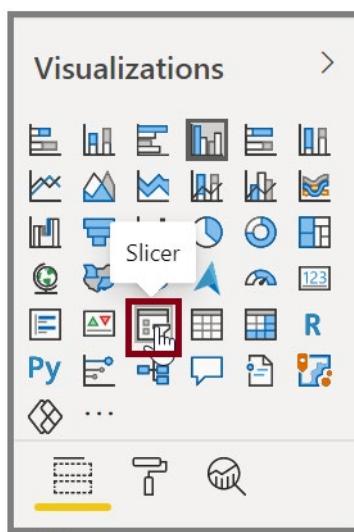
Slicers are one of the most powerful types of visualizations, particularly as part of a busy report. A *slicer* is an on-canvas visual filter that allows report users to segment the data by a specific value. Examples of filters include by year or by geographical location.

**Video:** Create slicers

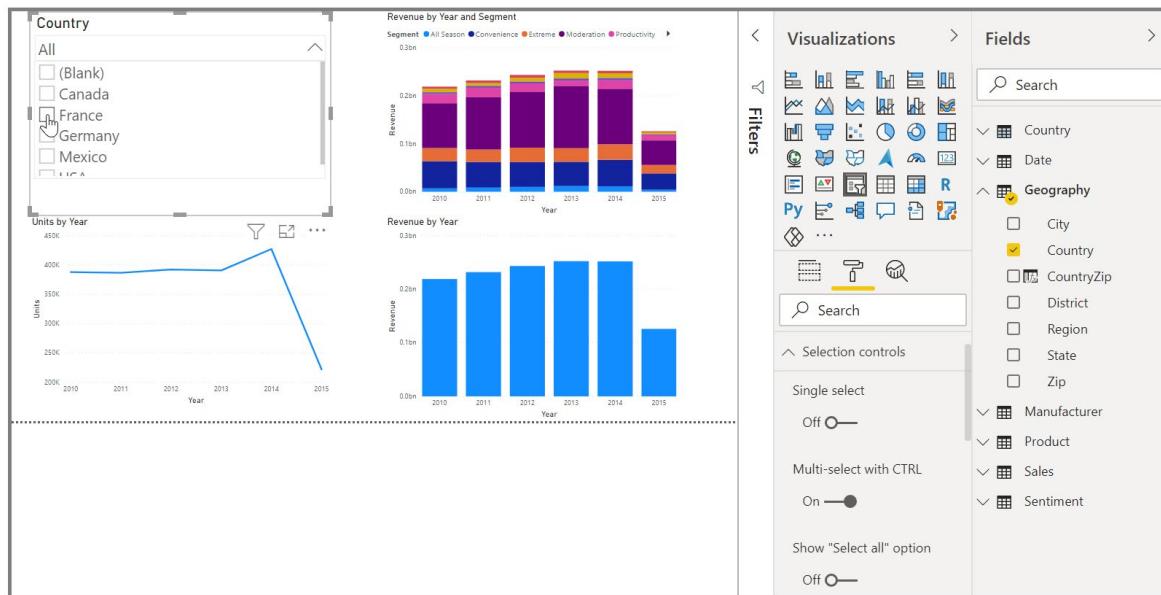


<https://www.microsoft.com/videoplayer/embed/RE3x1Gn>

To add a slicer to your report, select **Slicer** from the Visualizations pane.



Drag the field by which you want to slice and drop it to the top of the slicer placeholder. The visualization turns into a list of elements with check boxes. These elements are your filters. Select the box next to the one that you want to segment, and Power BI will filter, or *slice*, all other visuals on the same report page.



A few different options are available to help you format your slicer. You can set it to accept multiple inputs at once, or you can use the **Single Select** mode to use one at a time. You can also add a **Select All** option to your slicer elements, which is helpful when you have a long list. Change the orientation of your slicer from the vertical default to horizontal, and it becomes a selection bar rather than a checklist.



When you have multiple visualizations on the same report page, Power BI Desktop lets you control how interactions flow between visuals. For more information, see [Change how visuals interact in a Power BI report<sup>31</sup>](#).

## Map visualizations

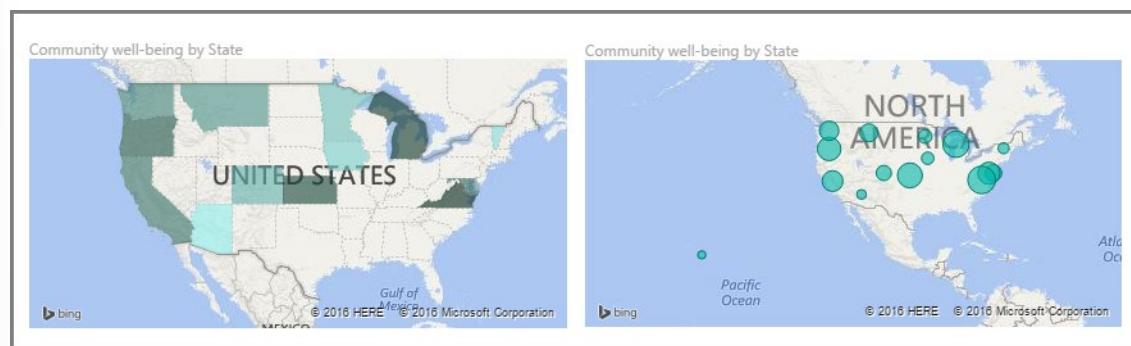
Power BI has two different types of map visualizations: a bubble map that places a bubble over a geographic point, and a shape map that shows the outline of the area that you want to visualize.

**Video:** Map visuals



<https://www.microsoft.com/videoplayer/embed/RE3p3IR>

<sup>31</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-reports-visual-interactions>

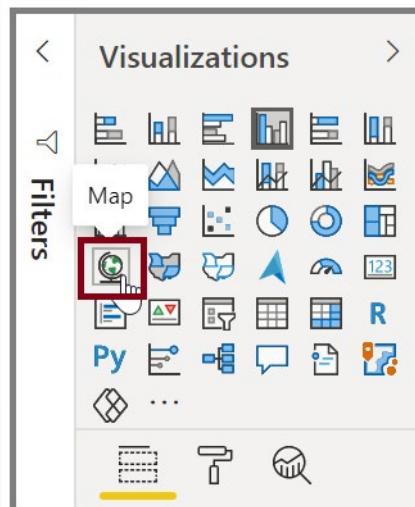


**Important:** When you are working with countries or regions, use the three-letter abbreviation to ensure that geocoding works properly. Do \*not\* use two-letter abbreviations because some countries or regions might not be properly recognized.

If you only have two-letter abbreviations, go to [this external blog post<sup>32</sup>](#) for steps on how to associate your two-letter country and/or region abbreviations with three-letter country and/or region abbreviations.

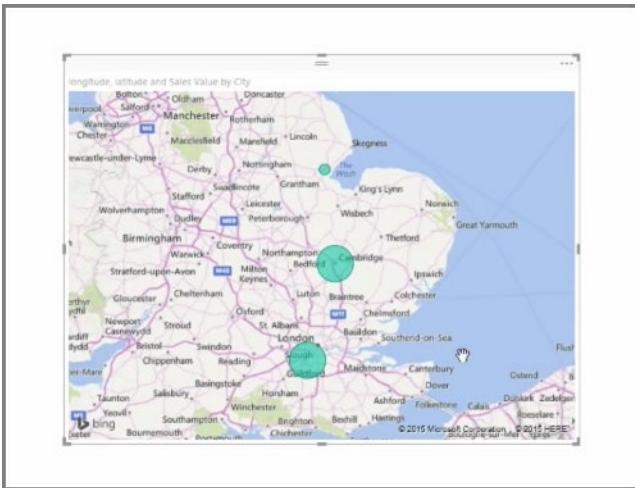
## Create bubble maps

To create a bubble map, select the **Map** option in the Visualization pane. In the Visualizations options, add a value to the *Location* bucket to use a map visual.



Power BI accepts many types of location values. It recognizes city names, airport codes, or specific latitude and longitude data. Add a field to the **Size** bucket to change the size of the bubble for each map location.

<sup>32</sup> <https://go.microsoft.com/fwlink/?linkid=2101354&clcid=0x409>



## Create shape maps

To create a shape map, select the **Filled Map** option in the Visualization pane. As with bubble maps, you must add a value to the Location bucket to use this visual. Add a field to the Size bucket to change the intensity of the fill color.



A warning icon in the top-left corner of your visual indicates that the map needs more location data to accurately plot values. This is a common problem when the data in your location field is ambiguous, such as using an area name like *Washington*, which could indicate a state or a district.

One way to resolve the location data problem is to rename your column to be more specific, such as *State*. Another way is to manually reset the data category by selecting **Data Category** on the **Column tools** tab. From the **Data Category** list, you can assign a category to your data such as "State" or "City."

## Matrices and tables

You can use Power BI Desktop to create graphical and tabular visuals.

**Video:** Create tables



<https://www.microsoft.com/videoplayer/embed/RE3p0LT>

If you have numerical information in a table, such as revenue, a total sum will appear at the bottom. You can manually sort by each column by selecting the column header to switch ascending or descending order. If a column isn't wide enough to display all its contents, select and drag the column header to expand it.

In the Visualizations pane, the order of the fields in the Values bucket determines the order in which they appear in your table.

A screenshot of the Microsoft Power BI desktop interface. On the left, there is a table visualization showing data for manufacturers. The columns are labeled 'Manufacturer', 'Revenue', and 'Country Name'. The data includes rows for VanArsdel, Natura, Aliqui, Currus, Pirum, Quibus, Abbas, and VanArsdel again, with their respective revenue amounts and country names. On the right, the 'Visualizations' pane is open, specifically showing the 'Values' section. It lists the same three fields: 'Manufacturer', 'Revenue', and 'Country Name', each with a downward arrow indicating they can be sorted. Red arrows point from the column headers in the table to their corresponding entries in the 'Values' section of the pane.

A matrix is similar to a table, but it has different category headers on the columns and rows. As with tables, numerical information will be automatically totaled along the bottom and right side of the matrix.

The screenshot shows a Power BI interface. On the left is a matrix visualization with columns for Manufacturer (Abbas, Aliqui, Barba, Currus, Fama, Leo, Natura, Palma, Pirum, Pomum, Quibus, Salvus, VanArsdel, Victoria, Total) and rows for France, Mexico. The matrix contains numerical values representing revenue. On the right is the Visualizations pane, which includes a 'Filters' section and a grid icon highlighted with a red box. Below the grid icon are sections for Rows (Manufacturer), Columns (Country), and Values (Revenue).

Manufacturer	France	Mexico
Abbas	2,461,421.08	1,737,477.05
Aliqui	5,420,514.49	5,016,683.96
Barba	1,487,948.18	1,406,910.80
Currus	3,269,855.87	2,421,272.81
Fama	1,851,442.16	1,087,403.36
Leo	1,965,963.30	1,039,385.81
Natura	6,312,323.33	6,090,343.09
Palma	240,544.08	157,112.23
Pirum	4,940,021.15	4,325,871.22
Pomum	903,398.58	604,306.45
Quibus	2,303,064.12	2,061,086.32
Salvus	121,704.29	116,046.16
VanArsdel	30,934,822.48	25,747,733.39
Victoria	1,365,081.48	892,802.98
<b>Total</b>	<b>63,578,104.59</b>	<b>52,704,435.63</b>
		<b>85,565,706.03</b>

Many cosmetic options are available for matrices, such as auto-sizing columns, switching between row and column totals, setting colors, and more.

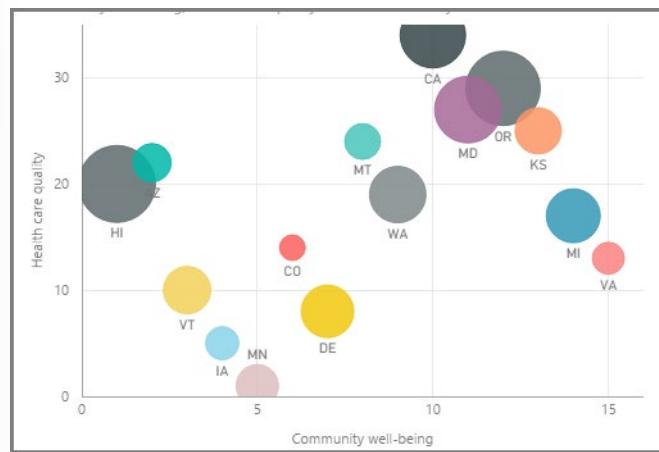
## Create scatter, waterfall, and funnel charts

Use a scatter chart to compare two different measures, such as unit sales versus revenue.

**Video:** Create scatter charts

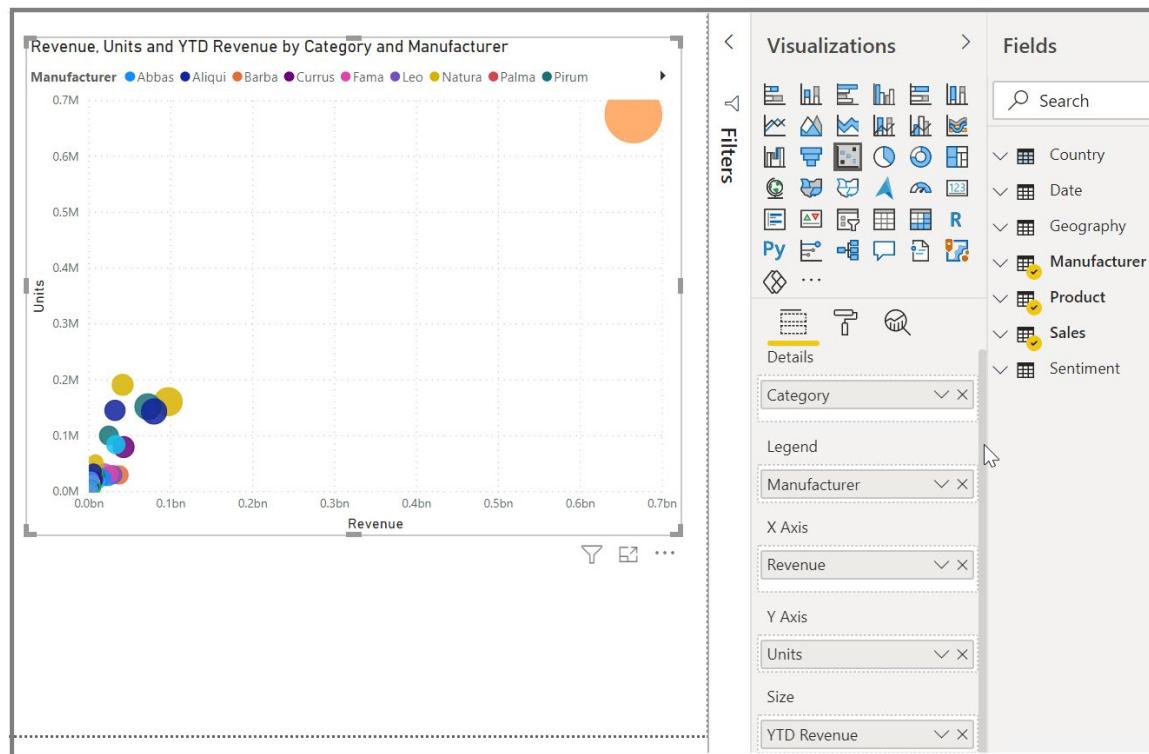


<https://www.microsoft.com/videoplayer/embed/RE3wTTN>

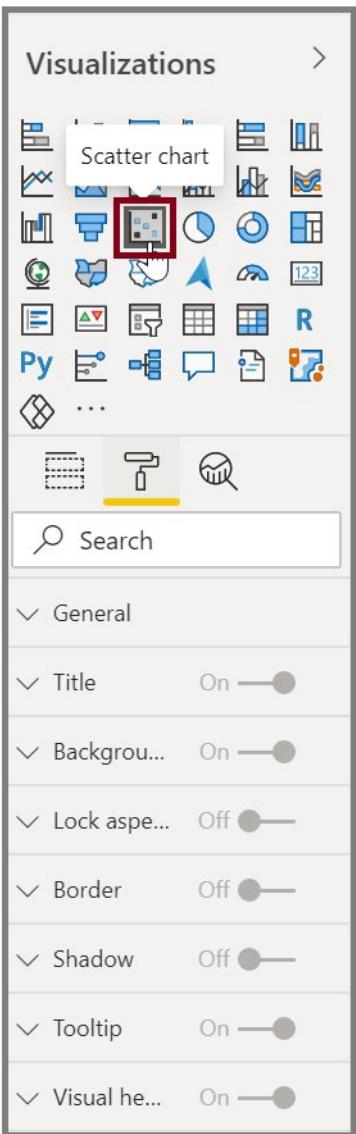


To create a blank chart, select **Scatter chart** from the Visualizations pane. Drag and drop the two fields that you want to compare from the Fields pane to the **X Axis** and **Y Axis** option buckets. At this point, your scatter chart probably has a small bubble in the center of the visual. You need to add a measure to the Details bucket to indicate how you want to segment your data. For example, if you're comparing item sales and revenue, you might want to split the data by category, or manufacturer, or month of sale.

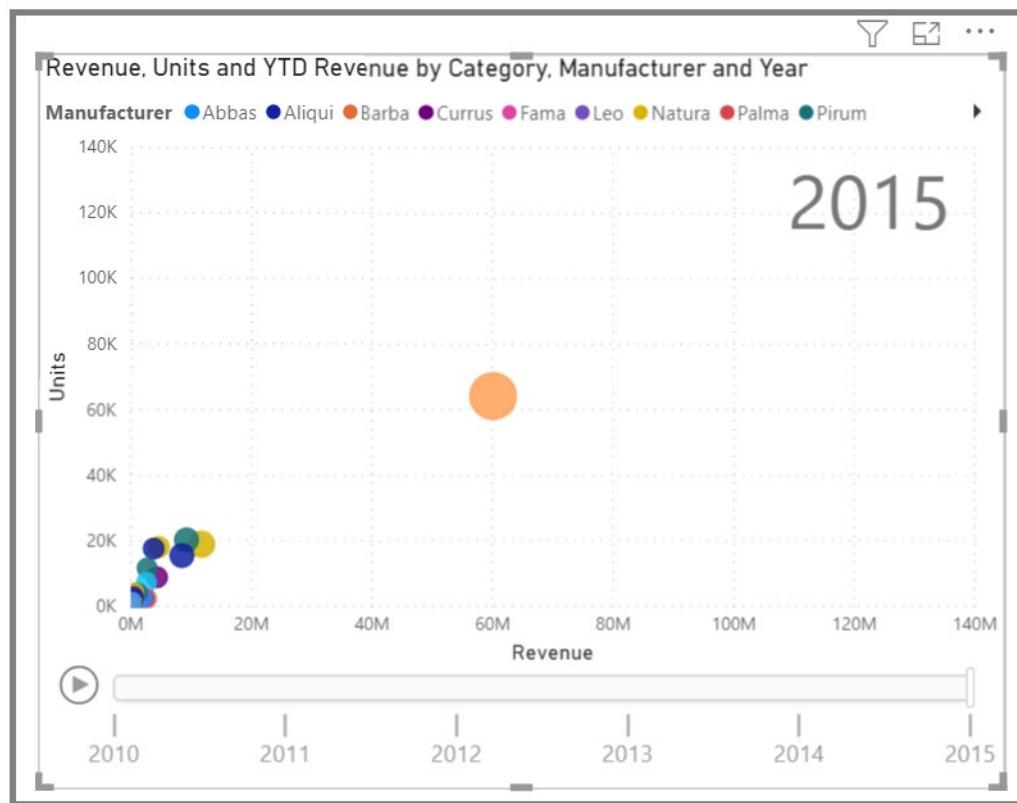
Adding another field to the Legend bucket will color-code your bubbles according to the field's value. You can also add a field to the Size bucket to alter the bubble size according to that value.



Scatter charts have many visual formatting options as well, such as turning on an outline for each colored bubble and switching between individual labels. You can change the data colors for other chart types as well.



You can create an animation of your bubble chart's changes over time by adding a time-based field to the Play Axis bucket. Select a bubble during an animation to see a trace of its path.



**Note:** Remember, if you only see one bubble in your scatter chart, it's because Power BI is aggregating your data, which is the default behavior. To get more bubbles, add a category to the Details bucket in the Visualizations pane.

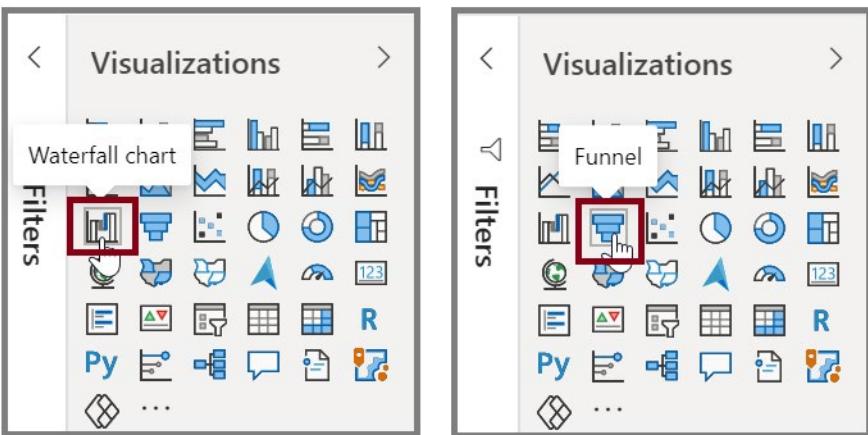
## Create waterfall and funnel charts

Waterfall and funnel charts are two of the more noteworthy (and uncommon) standard visualizations that are included in Power BI. To create a blank chart of either type, select its icon from the Visualizations pane.

**Video:** Create funnel charts and waterfall charts



<https://www.microsoft.com/videoplayer/embed/RE3wZ54>

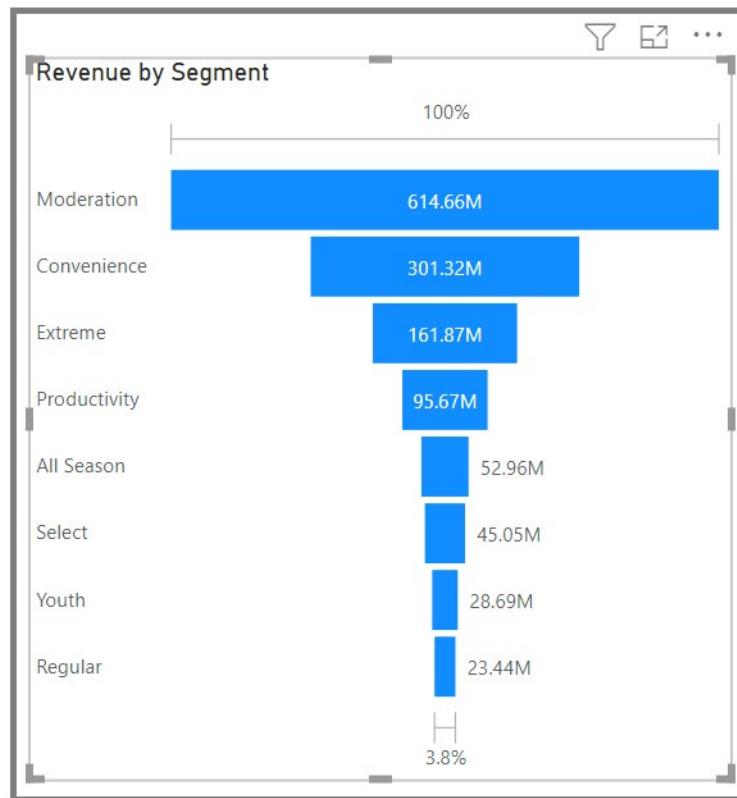


Waterfall charts are typically used to show changes in a specific value over time.



Waterfalls only have two bucket options: *Category* and *Y Axis*. Drag a time-based field, such as **Year**, to the Category bucket, and drag the value that you want to track to the Y Axis bucket. Time periods where an increase in value occurred are displayed in green by default, while periods with a decrease in value are displayed in red.

Funnel charts are typically used to show changes over a specific process, such as a sales pipeline or website retention efforts.



You can slice and customize Waterfall and Funnel charts.

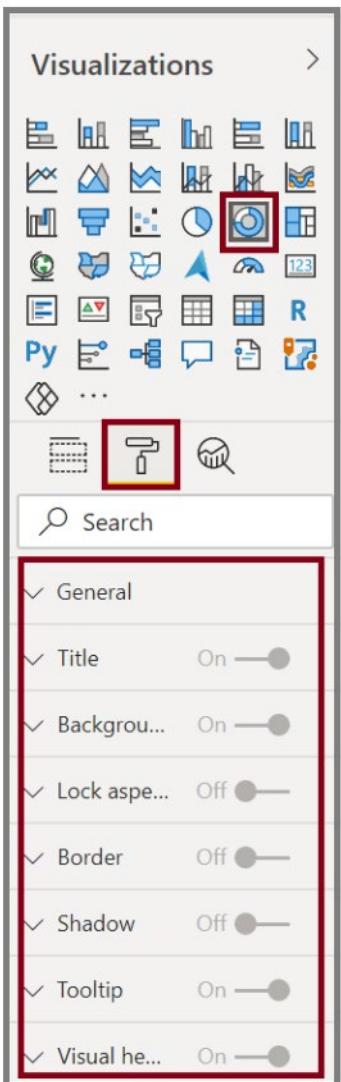
## Modify colors in charts and visuals

Occasionally, you might want to modify the colors that are used in charts or visuals. Power BI gives you control over how colors are displayed. To begin, select a visual and then select the paintbrush icon in the Visualizations pane.

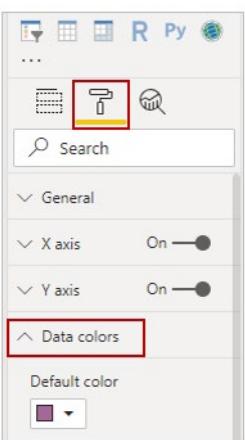
**Video:** Modify colors



<https://www.microsoft.com/videoplayer/embed/RE3oQIW>



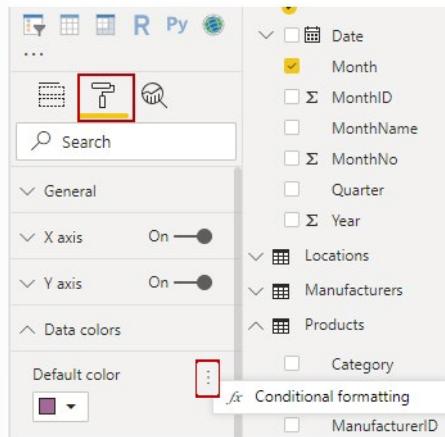
Power BI provides many options for changing the colors or formatting the visual. You can change the color of all bars in a visual by selecting the color picker beside **Default color** and then selecting your color of choice.



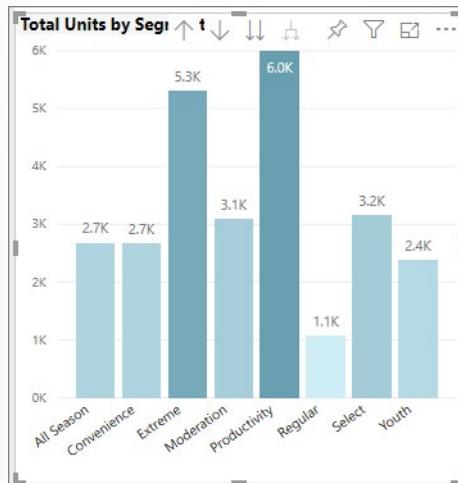
You can change the color of each bar (or other element, depending on the type of visual that you selected) by turning the **Show all** slider to **On**. A color selector will then appear for each element.

## Conditional formatting

You can change the color based on a value or measure. To do so, select the vertical ellipsis next to **Default color**.

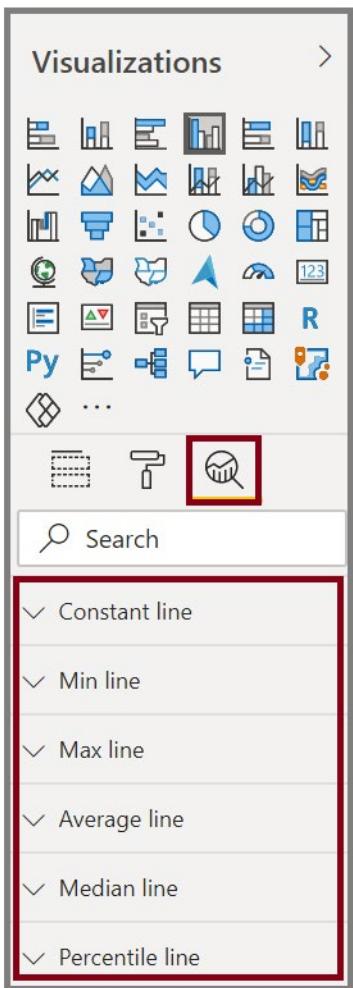


The resulting visuals will be colored by the gradient that you select.



You can use those values to create rules, for example, to set values above zero to a certain color and values below zero to another color.

In the Analytics pane, you can create many other lines for a visual, such as Min, Max, Average, Median, and Percentile lines.



You can create a border around an individual visualization, and like other controls, you can specify the color of that border as well.

For more information, see [Tips and tricks for color formatting in Power BI<sup>33</sup>](#).

## Page layout and formatting

Power BI Desktop gives you the ability to control the layout and formatting of your report pages, such as size and orientation.

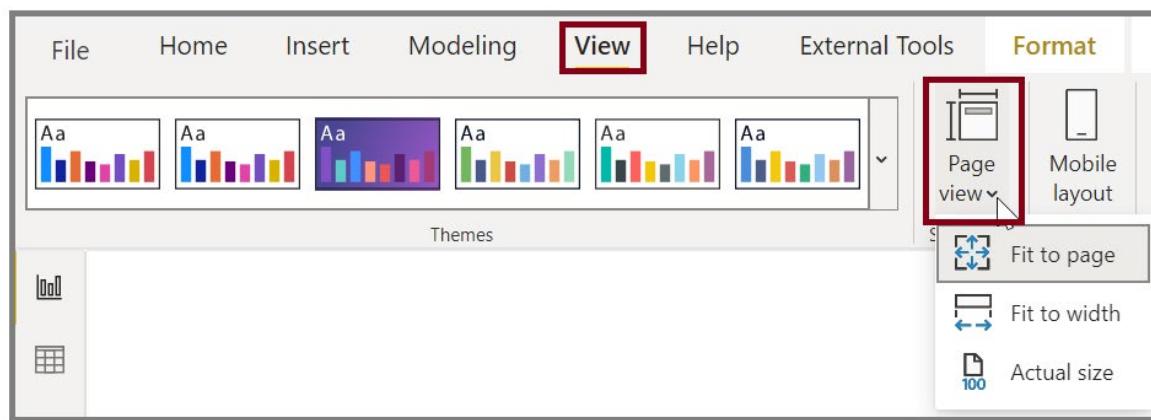
**Video:** Format reports



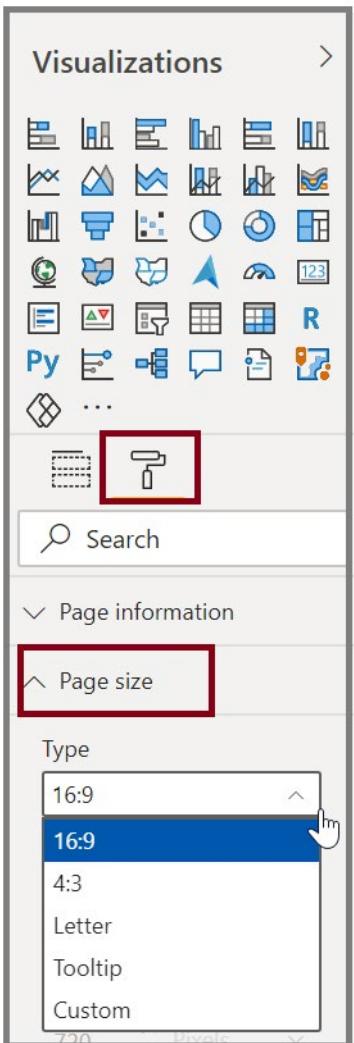
<https://www.microsoft.com/videoplayer/embed/RE3x6SN>

<sup>33</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/service-tips-and-tricks-for-color-formatting>

Use the **Page View** menu from the **View** tab to change the way that your report pages scale. The available options include **Fit To Page** (default), **Fit To Width**, and **Actual Size**.



You can also change the page size. By default, the report page size is set to 16:9. To change the page size, make sure that no visuals are selected, select the paintbrush icon on the Visualizations pane, and then select **Page Size** to expand that section.



Options for page size include 4:3 (more of a square aspect ratio) and Dynamic (the page will stretch to fill the available space). A standard letter size option is available for reports as well. You might need to resize your visuals after changing the page size to ensure that they're completely on the canvas.

You can specify a custom page size, setting the size by inches or pixels, and you can also change the background color of the entire report.

Another option is to select Cortana, which sizes the report so that it can be used as a result for searches that use Cortana.

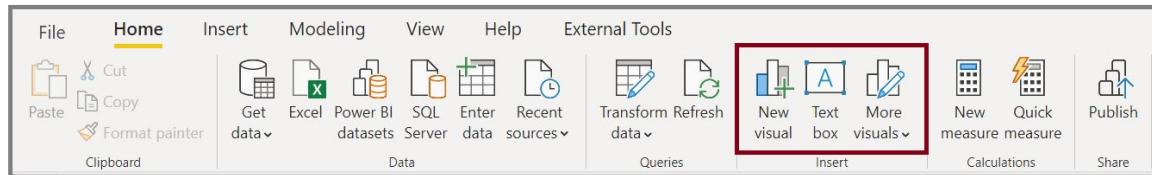
## Add static elements

Along with data-bound visuals, you can also add static elements such as text boxes, images, and shapes to improve the visual design of your reports. To add a visual element, select **Text Box**, **Image**, or **Shapes** from the **Home** tab.

**Video:** Add a visual element



<https://www.microsoft.com/videoplayer/embed/RE3p0Ls>



You can display large titles, captions, or short paragraphs in **Text boxes**, which can also include links and URLs.

Selecting **Image** will open a file browser where you can select the image from your computer or other networked source. By default, resizing an image in your report will maintain its aspect ratio.

You can insert five types of **Shapes**, including rectangles and arrows. Shapes can be opaque or transparent with a colored border. The latter is useful for creating borders around groups of visualizations.

## Manage how elements overlap

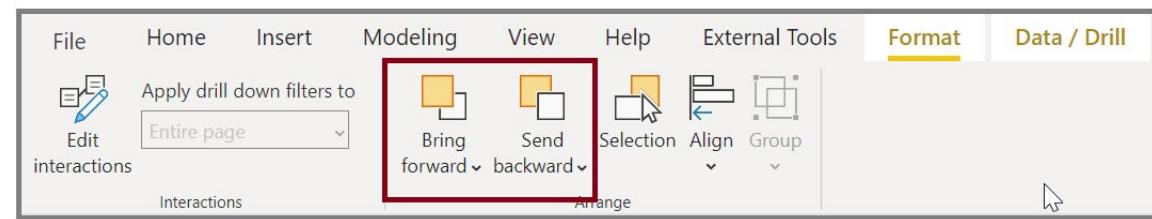
When you have several elements on a report, Power BI lets you manage how they overlap with each other. This ordering of layers is known as the **z-order**.

**Video:** Manage the z-order of elements



<https://www.microsoft.com/videoplayer/embed/RE3oQIS>

To manage the z-order of elements in a report, select an element and use the **Bring forward** and **Send backward** buttons on the **Format** tab.



## Reuse a report layout

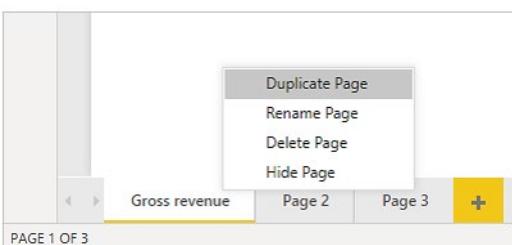
Individual pages of a report can be complex, with multiple visualizations that interact in specific ways and have precise formatting. Occasionally, when building a report, you might want to use the same visuals and layouts for two different pages. For example, if you've just put together a report page on gross revenue, you might want an almost identical page on net revenue.



<https://www.microsoft.com/videoplayer/embed/RE3oVyu>

Recreating all your work would be difficult, but with Power BI Desktop, you can duplicate a report page.

Right-click the tab that you want to copy and then select **Duplicate Page**.



For more information, see [Tutorial: Adding formatting options to a Power BI custom visual<sup>34</sup>](#).

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. You want your report readers to be able to view your bar chart visual for any year that they choose. What tool could you use?

- Conditional formatting
- Slicer
- Treemap
- Z-order

<sup>34</sup> <https://docs.microsoft.com/en-us/power-bi/developer/visuals/custom-visual-develop-tutorial-format-options>

## Multiple choice

2. If you were very satisfied with the appearance of a page and wanted the next page to look the same, what would be the best method?

- Export the report to PDF and then import the PDF with a different name
- Right-click the report page tab and select "Duplicate Page"
- Publish the report to a different location
- Use the "New Quick Measure" feature

## Multiple choice

3. Which scenario would be a good case for using bubble maps?

- You want to see months with the highest sales by country.
- You want to see the types of products sold in each country.
- You want to see sales by age group.
- You want to see total revenue by country.

## Summary

Visuals allow you to better communicate information that is hidden in raw data. Visuals can highlight obscure trends in ways that tabular data might not. Power BI includes many compelling visuals that you can use to illuminate your data and tell better stories.

## Continue your journey

Want to learn more about Power BI visuals? Check out these resources:

- **Radial gauge charts in Power BI<sup>35</sup>**
- **Change how visuals interact in a Power BI report<sup>36</sup>**
- **How-To: Display 2-letter country data on a Power BI map<sup>37</sup>**
- **Tips and tricks for color formatting in Power BI<sup>38</sup>**
- **Tutorial: Adding formatting options to a Power BI custom visual<sup>39</sup>**
- **Best design practices for reports and visuals<sup>40</sup>**

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<sup>35</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-radial-gauge-charts>

<sup>36</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-reports-service-visual-interactions>

<sup>37</sup> <https://medium.com/m/global-identity?redirectUrl=https%3A%2F%2Fblog.ailon.org%2Fhow-to-display-2-letter-country-data-on-a-power-bi-map-85fc738497d6#yuduacxp>

<sup>38</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/service-tips-and-tricks-for-color-formatting>

<sup>39</sup> <https://docs.microsoft.com/en-us/power-bi/developer/visuals/custom-visual-develop-tutorial-format-options>

<sup>40</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-report-visualizations>

# Explore data in Power BI

## Introduction to the Power BI service

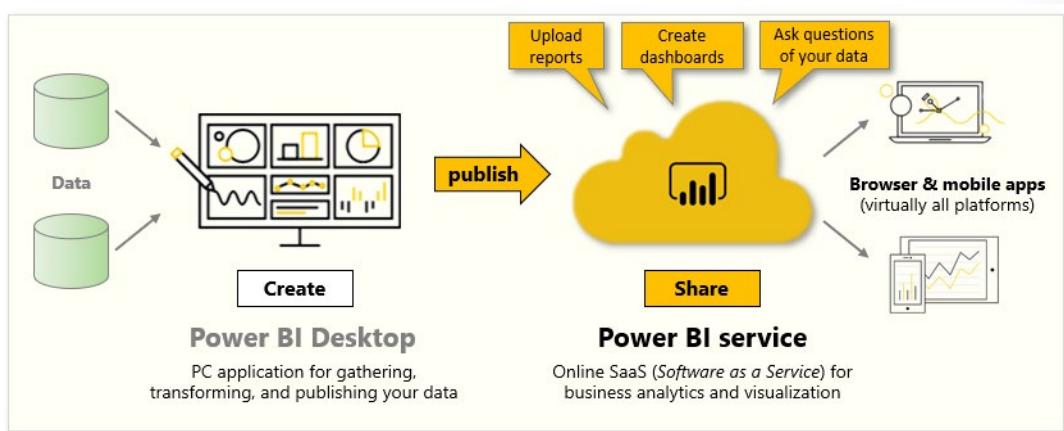
This unit explores the Power BI service and shows how it can help you turn your business intelligence data into data insights.



<https://www.microsoft.com/videoplayer/embed/RWFP5X>

The following are the tasks that you will complete in this module:

- Upload reports
- Create dashboards



- Ask questions of your data

**Video:** Introduction to the Power BI service



<https://www.microsoft.com/videoplayer/embed/RE3p3lQ>

The Power BI service is the natural extension of Power BI Desktop, and you can use its features for uploading reports, creating dashboards, and asking questions of your data by using natural language. Additionally, you can use the service to set data refresh times, share data with your organization, and create customized apps.

## Sign in to the Power BI service

Before you can sign in to Power BI, you'll need an account. To get a free trial, go to [app.powerbi.com<sup>41</sup>](https://app.powerbi.com) and sign up with your email address.

For detailed steps on setting up an account, see [Sign in to Power BI service<sup>42</sup>](#).

## Quick insights in Power BI

The Power BI service can automatically look for insights in a dashboard, report, or dataset.

**Video:** Quick insights



<https://www.microsoft.com/videoplayer/embed/RE3oNL1>

From the **Datasets** section, select the ellipsis beside the dataset that you're interested in and then select **Get quick insights**.

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<sup>41</sup> <https://msit.powerbi.com/>

<sup>42</sup> <https://docs.microsoft.com/en-us/power-bi/consumer/end-user-sign-in>

The screenshot shows the Power BI desktop interface. On the left is a navigation pane with options like Home, Favorites, Recent, Create, Datasets, Apps, Shared with me, Deployment pipelines, Learn, and Workspaces. The main area displays a list of datasets. One dataset, 'Financial Sample', is selected. A context menu is open for this dataset, listing options such as Analyze in Excel, Create report, Delete, Get quick insights (which is highlighted with a red box), Security, Rename, Settings, Download the .rdl, Manage permissions, and View lineage.

When you select **Get quick insights**, Power BI searches the data for patterns. After about 15 seconds, the notification changes to let you know that Power BI found some insights.

The image shows two consecutive notifications from Power BI. The first notification, titled 'Searching for insights', contains the message 'Searching Financial Sample. We will notify you when your insights are ready.' The second notification, titled 'Insights are ready', contains the message 'You have insights for Financial Sample.' and features a prominent yellow 'View insights' button. A large red arrow points from the top notification to the bottom one.

When you select the **View insights** button on the notification, you're presented with a page of visuals. You can scroll down through the page to view and consider the visuals.

## Quick Insights for Financial Sample

A subset of your data was analyzed and the following insights were found. [Learn more](#)



There is a correlation between Units Sold and Sales.



'Small Business' has noticeably more Sale Price.

As with any other visual, you can interact with the visuals on the **Quick Insights** page. You can also pin any of them to a dashboard or filter to uncover additional insights.

With **Quick Insights**, you can let Power BI do the work to spot outliers and trends in your data. Use those findings in your dashboards or continue to refine and filter to get to the insights that you need.

For more information, see [Generate data insights automatically with Power BI<sup>43</sup>](#).

## Create and configure a dashboard

Dashboards in Power BI are one-page collections of visualizations that are created from within the Power BI service. You can create dashboards by pinning visuals from reports.

**Video:** Create a dashboard

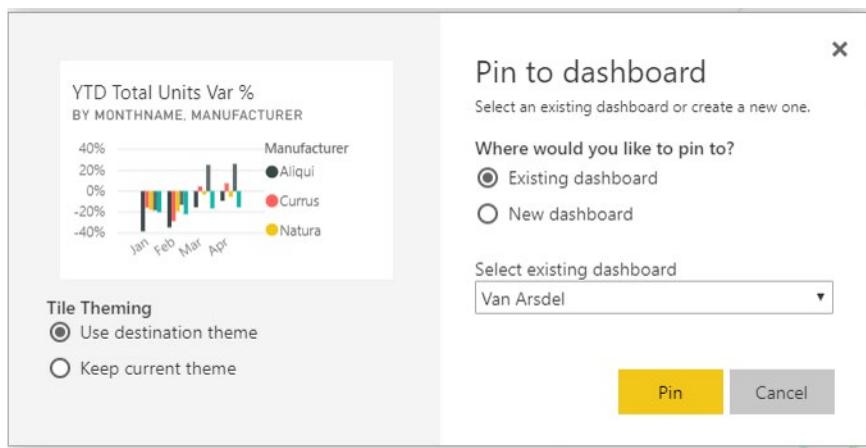


<https://www.microsoft.com/videoplayer/embed/RE3oYa2>

Pinning a visual to a dashboard is a lot like pinning a picture to a corkboard on a wall, where the visual is pinned to a particular spot for others to see. To pin a visual, open its report on the Power BI service. Hover over the visual that you want to pin and select the pin icon.



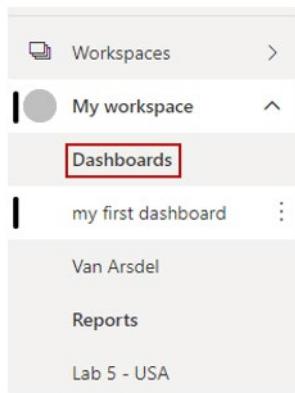
You can select a destination dashboard for the visual from the drop-down menu or create a new dashboard. You can pin visualizations from multiple reports and pages to a single dashboard, allowing you to combine different datasets and sources into a single page of insights.



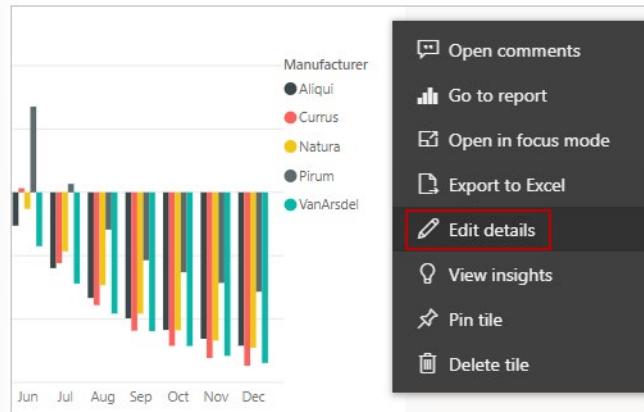
On dashboards, you can add any sort of visualization, including graphs, maps, images, and shapes, by pinning them. After a visual has been pinned to a dashboard, it's called a tile.

Your dashboards appear in the **Dashboards** section on the left side of the Power BI service. Select a dashboard from the list to view it.

<sup>43</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-insights>



You can change the layout of visuals on a dashboard however you'd like. To resize a tile, drag its handles in or out. To move a tile, simply select and drag it to a different location on the dashboard. Hover over a tile and select the pencil icon to open the **Tile details** form, where you can change information in the **Title** or **Subtitle** fields.



Select a dashboard tile to view the report from which it originated. You can also change that link by using the **Set custom link** field on the **Tile details** form.

You can pin tiles from one dashboard to another, for example, if you have a collection of dashboards and want to create one summary board. The process is the same: hover over the tile and select the pin icon. Dashboards are simple to create and to change. You can customize your one-page dashboard to show exactly the information that it should.

For more information, see [Introduction to dashboards for Power BI designers<sup>44</sup>](#).

## Ask questions of your data with natural language

Sometimes, the fastest way to get answers about your data is by asking questions in the Q&A feature of Power BI.

**Video:** Ask questions in natural language

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<sup>44</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-dashboards>

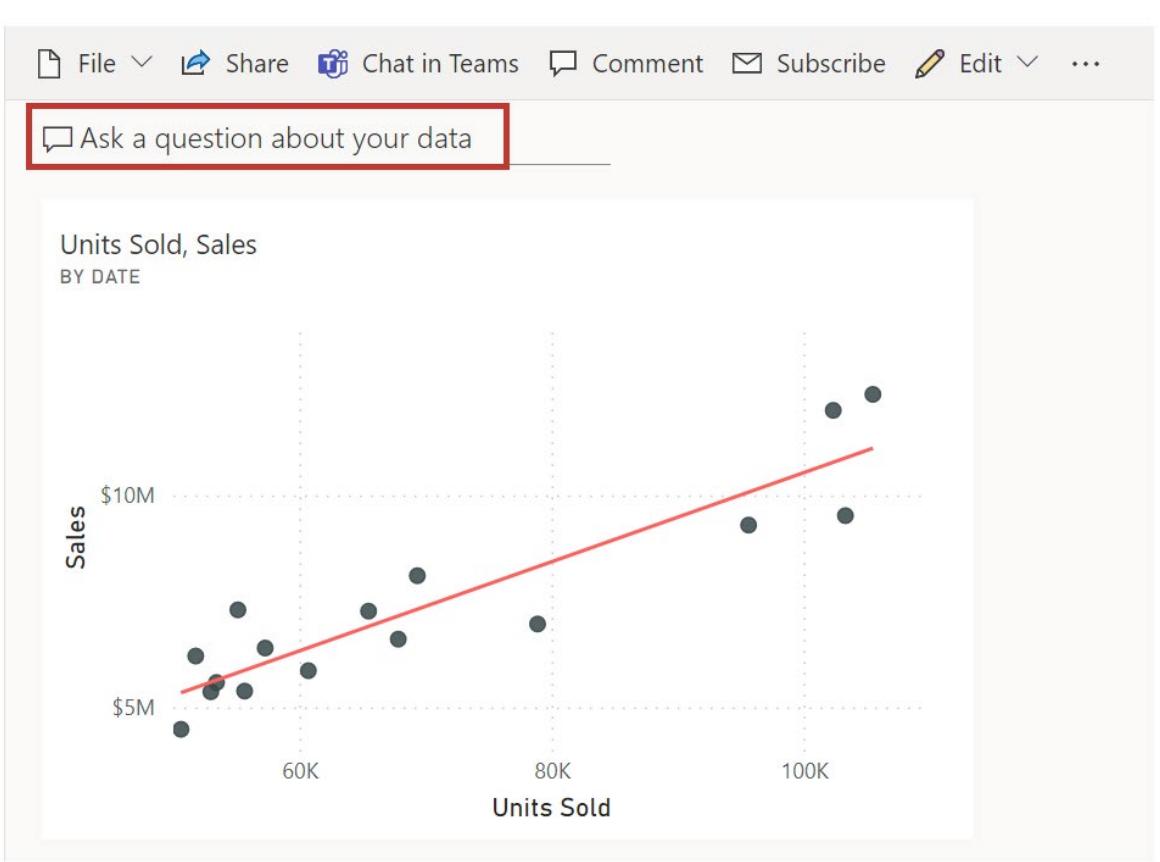


<https://www.microsoft.com/videoplayer/embed/RE3x4jC>

**Note:** Currently, Power BI Q&A only supports answering queries that are asked in English; however, a preview is available for Spanish that can be enabled by your Power BI administrator.

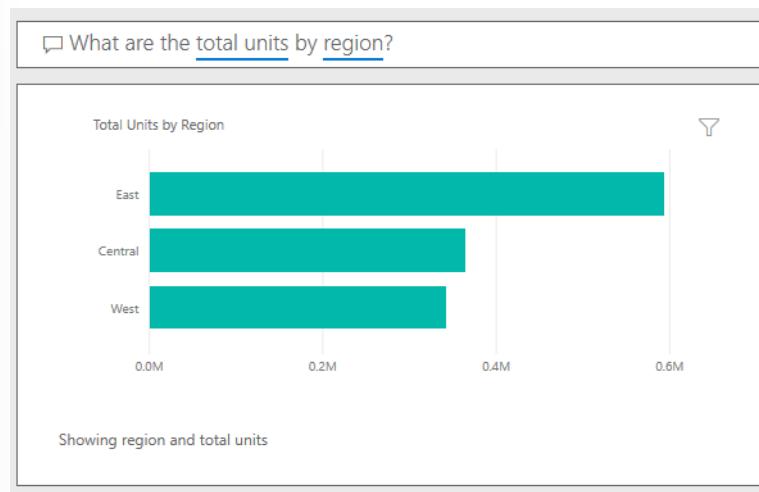
## Explore Q&A

You can use Q&A to explore your data by using the intuitive, natural language capabilities of Power BI and receive answers in the form of charts and graphs.



## Ask a question

Ask a question about your data in Q&A by using natural language. Natural language refers to the ordinary language that humans use to communicate with one another every day. An example would be, "What are the total units by region?"



Q&A is available on dashboards and reports in Power BI. Go to the dashboard and place your cursor in the question box to open the Q&A screen.

Questions to get you started

- top geo states by total units  
R12Ms
- what is the sum of revenue by geo state
- what is the total units YTD by geo state
- what is the total units YTD var % by geo state
- what is the average of score by region
- top product segments by TOTAL UNITS SPLY

TOTAL UNITS SPLY by Segment

Segment	Total Units SPLY
Productivity	~280K
Convenience	~280K
Moderation	~180K
Extreme	~160K
Select	~60K
Youth	~60K
All Season	~40K
Regular	~20K

If the visuals' axis labels and values include the words *sales*, *account*, *month*, and *opportunities*, then you can confidently ask questions. For example, "Which account has the highest opportunity" or "Show sales by month as a bar chart."

Other helpful items are provided on the side of the screen. For each dataset, Q&A shows you keywords and occasionally shows you some sample or suggested questions. Select any of these to add them to the question box.

Another way that Q&A helps you ask questions is with prompts, autocomplete, and visual cues.

The screenshot shows the Power BI Q&A interface. At the top, there's a button to 'Exit Q&A' and a text input field with the placeholder 'Ask a question about your data'. Below this, there are two rows of buttons for suggesting different types of visualizations:

- Row 1: YoY revenue variance, customers, YTD gross margin %, customer hierarchy.
- Row 2: YoY gross margin variance, dates, states, YoY YTD revenue growth, BU hierarchies.

Below these rows, the text 'D4:' is followed by another row of buttons:

- Row 3: financials, date hierarchy, date, COGS, profit, quarters.
- Row 4: discount bands, sale.

## Q&A visuals

Q&A picks the best visual based on the data that is being displayed. For example, numbers might be displayed as a line chart while cities are more likely to be displayed as a map.

You can also tell Q&A which visual to use by adding it to your question. Q&A will prompt you with a list of workable visual types. By using the previous example, you could ask, "What are the total units by region by pie chart?"

The screenshot shows the Power BI Q&A interface again. A question is asked: 'What are the total units by region by pie chart?'. Below the question, it says 'Showing results for: What are the total units by region pie chart'. A pie chart titled 'Total Units by Region' is displayed, divided into three segments labeled 'West' (red), 'Central' (teal), and 'East' (dark grey). Below the chart, the text 'Showing region and total units as pie chart' is visible.

For more information, see [Create a visual with Power BI Q&A<sup>45</sup>](#).

## Create custom Q&A suggestions

With Power BI, you can add your own suggested questions for others who use the natural language query box.

<sup>45</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-dashboards>

**Video:** Adding custom questions

<https://www.microsoft.com/videoplayer/embed/RE3x4jD>

Users will see your suggested questions when they ask a question.

A screenshot of a Power BI dashboard interface. At the top, there's a navigation bar with the Microsoft logo, 'Power BI', 'My workspace', and a specific dashboard name. Below the navigation bar are standard sharing options: 'Export', 'Share', 'Subscribe', and 'Comments'. A prominent red box highlights a search input field labeled 'Ask a question about your data'.

To add your own questions, select the ellipsis next to the dashboard that you want to use. Select **Settings** from the menu. You can completely disable the Q&A search input box from the **Dashboards** section of the **Settings** page.

A screenshot showing the 'My workspace' menu in Power BI. Under 'Dashboards', the 'my first dashboard' item has a red box around its three-dot ellipsis menu icon. A dropdown menu is open, listing 'OPEN', 'SHARE', 'RENAME', 'REMOVE', and 'SETTINGS'. The 'SETTINGS' option is also highlighted with a red box.

To add questions, select the **Datasets** section. All datasets that are associated with the dashboard are displayed. Select the dataset that is associated with your dashboard from the list, select **Featured Q&A questions**, and then select the **Add a question** link. Enter your question or prompt into the input box and then select **Apply**.

When anyone selects the search input box, they'll see your suggested entries at the top of the prompt list. Custom questions are a valuable way to get dashboard users to think about the type of data that is available and how to best use it.

For more information, see [Create featured questions for Power BI Q&A<sup>46</sup>](#).

## Share dashboards with your organization

Power BI reports help you find data, collect it in a data model, and build reports and visualizations. These features are even more powerful when you share your insights with others in your organization.

**Video:** Share dashboards



<https://www.microsoft.com/videoplayer/embed/RE3p0Lp>

To share a dashboard, open it in the Power BI service and select the **Share** link in the top left-hand corner.

<sup>46</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-q-and-a-create-featured-questions>

From the **Share dashboard** page, select the **Share** tab. In the **Email address** field, enter the names of people whom you'd like to grant access to your dashboard. You can also copy and paste email addresses into this field, or you can use a distribution list, security group, or Microsoft 365 group.

The screenshot shows the 'Share dashboard' interface for 'MY FIRST DASHBOARD'. The 'Access' tab is selected. A note states: 'Recipients will have the same access as you unless row-level security on the dataset further restricts them.' Below is a 'Grant access to' section with an 'Enter email addresses' input field and an 'Include an optional message...' text area. At the bottom, three checkboxes are checked: 'Allow recipients to share your dashboard', 'Allow users to build new content using the underlying datasets', and 'Send email notification to recipients'.

If you select the **Send email notification to recipients** check box, then your recipients will receive an email with a link to the shared dashboard. You can add an optional note to the email.

**Note:** Recipients without an existing Power BI account will be taken through the sign-up process before viewing your dashboard.

Anyone whom you share a dashboard with can see and interact with it exactly as you do. However, they have read-only access to the underlying reports, and get access to the entire underlying dataset unless row-level security (RLS) is applied to the underlying dataset.

For more information, see [Share Power BI dashboards and reports with coworkers and others<sup>47</sup>](#).

## Display visuals and tiles in full screen

When you're looking at dashboards or reports in the Power BI service, it can be helpful to expand and focus on an individual chart or visual. You can do that in two different ways.

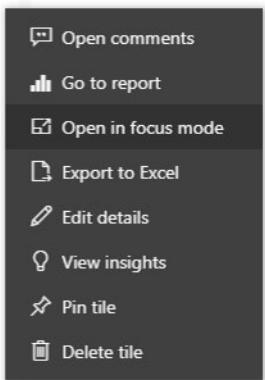
**Video:** View visuals full-screen



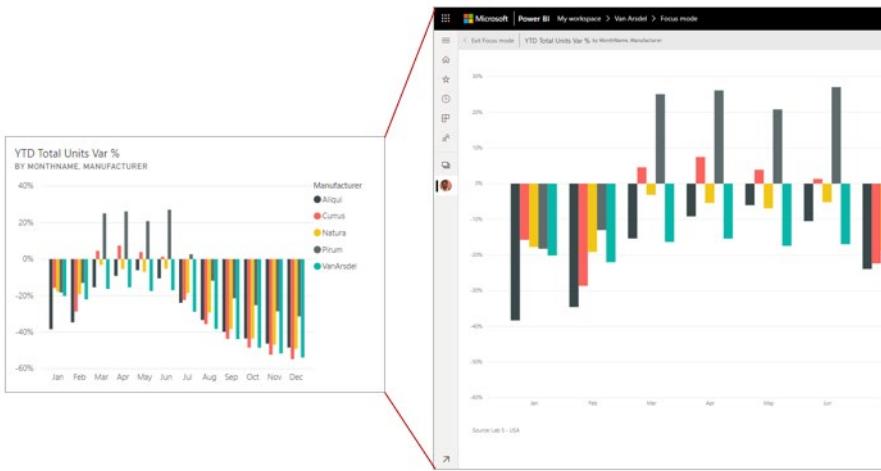
<https://www.microsoft.com/videoplayer/embed/RE3wWwj>

<sup>47</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-share-dashboards>

Hover over a dashboard tile and select the ellipsis to see possible actions for the tile. Select **Open in focus mode** to expand the tile to encompass the full dashboard space.



Focus mode allows you to see more detail in your visuals and legends. For example, some of the columns might not be shown because of the space that is available in the tile.



In Focus mode, you can pin the visual directly to a different dashboard by selecting the pin icon. To exit Focus mode, select the **Exit focus mode** icon in the top-left corner.

The process is similar when you are viewing a report. A visual is still interactive in Focus mode, though you will temporarily lose any cross-filter effect between visuals.

## Edit tile details and add widgets

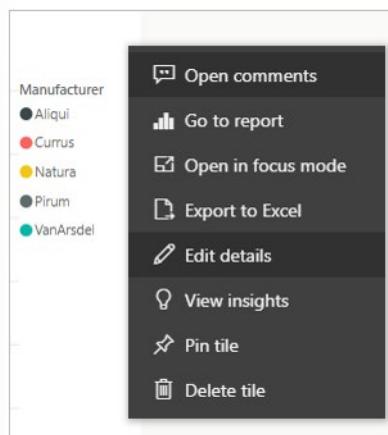
After you've built a dashboard, you can format your tiles in the Power BI service.

**Video:** Edit tile details

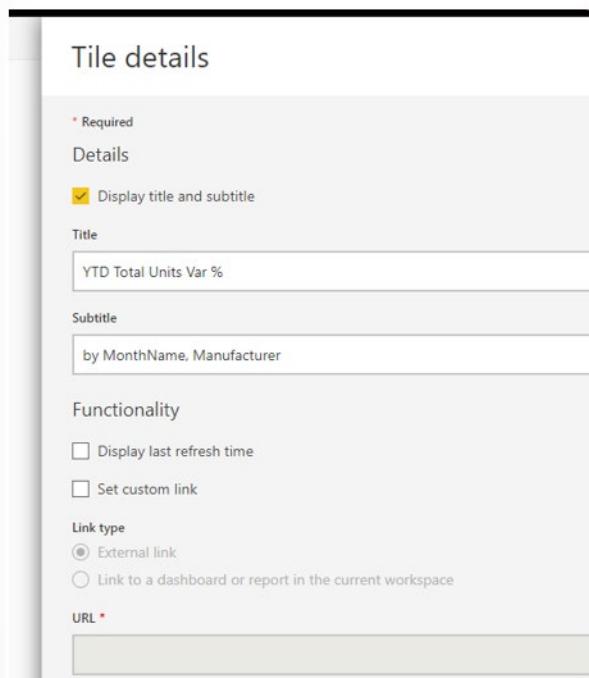


<https://www.microsoft.com/videoplayer/embed/RE3x9vT>

To modify a tile, hover over and select the ellipsis to see the choices that are shown in the following screenshot.



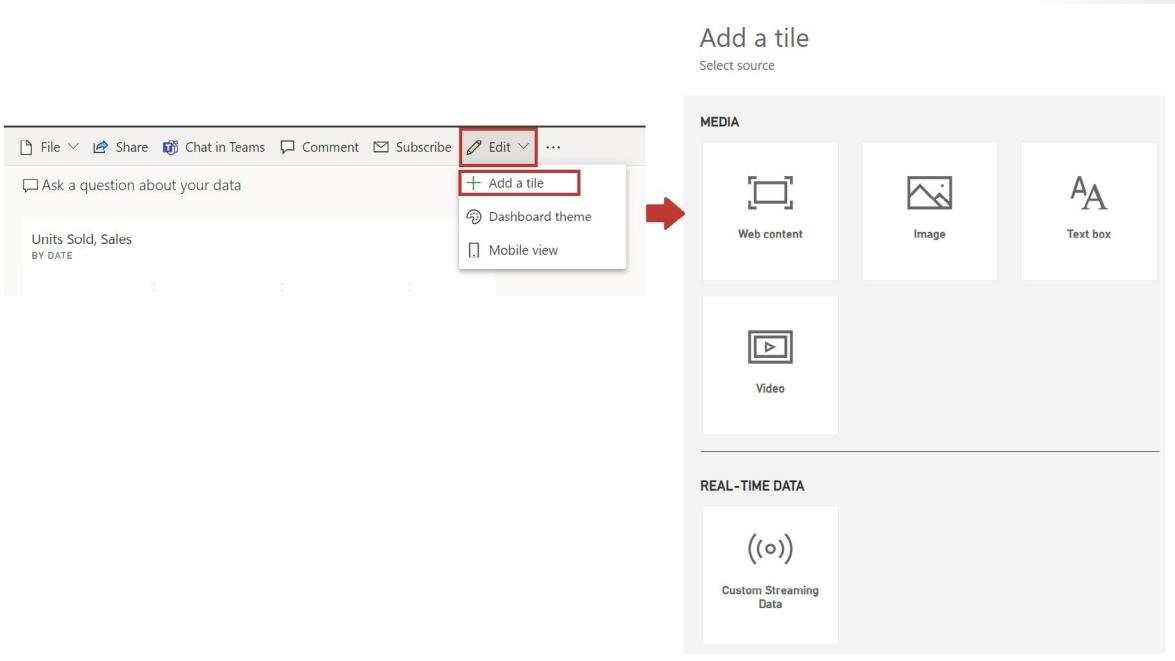
Select **Edit details** to open the **Tile details** pane. From this pane, you can change the tile's **Title**, **Subtitle**, or include its last refresh time or even add a custom link to the tile.



By default, when you select a dashboard tile, you're redirected to the report from which it originated. To change this behavior, use the **Set custom link** field on the **Tile details** pane. One popular use of this feature is to redirect users to the organization homepage when they select a logo image.

## Add images and text to your dashboard

You can also add tiles that contain images, online videos, text boxes, or web content. When you select the **Edit** dropdown then **Add a tile** at the top of the dashboard, the **Add a tile** dialog box appears.



When you add a text box, for example, a **Tile details** pane appears on the right side, where you can edit details. A section is also available for you to define or modify the tile content, such as a rich text editor for a text box.

With tiles and the ability to edit details, you can customize your dashboard and make it appear how you want.

For more information, see [Edit or remove a dashboard tile<sup>48</sup>](#).

## Get more space on your dashboard

You might find that you have more content than you can fit on a canvas. You can get a full view of your dashboard content by managing how dashboard space is displayed.

**Video:** Get more space on your dashboard

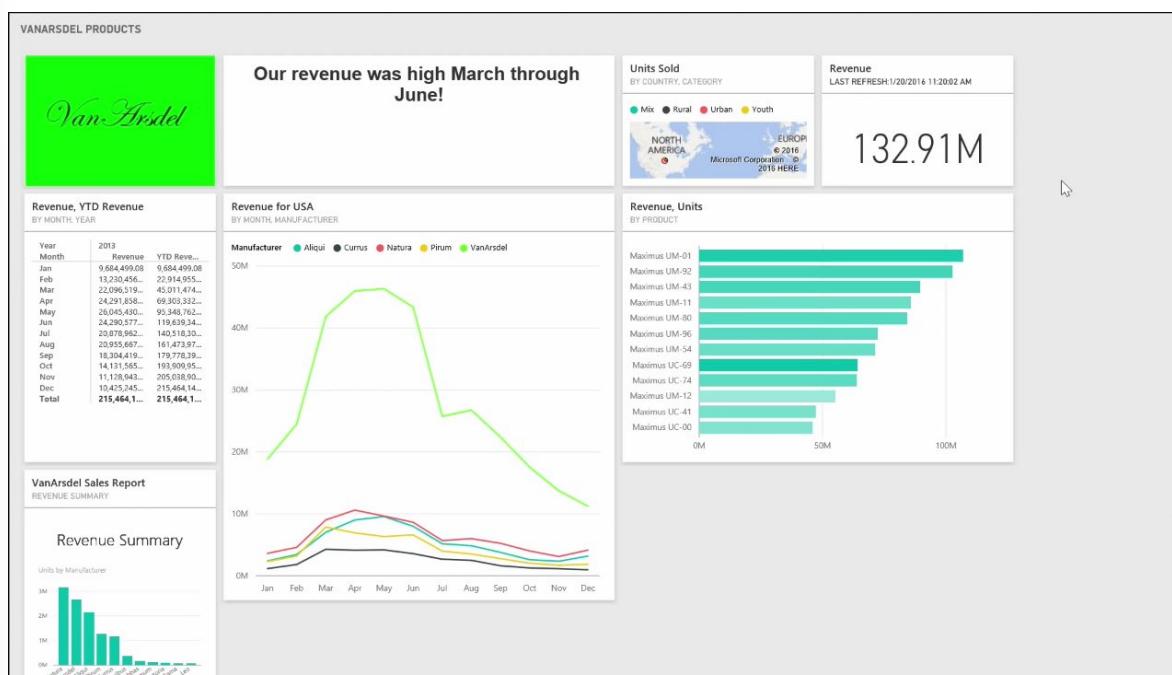


<https://www.microsoft.com/videoplayer/embed/RE3wZ5j>

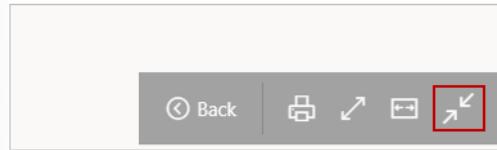
The easiest method to display your entire dashboard in one screen is to select the **Full Screen Mode** button in the top right-hand corner of the dashboard.

Selecting the **Full Screen Mode** button removes all chrome elements from around the dashboard, which increases the amount of viewable space.

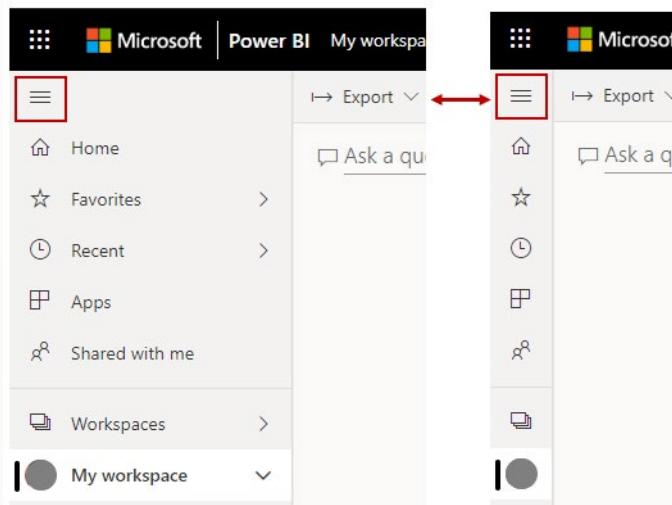
<sup>48</sup> <https://docs.microsoft.com/en-us/power-bi/create-reports/service-dashboard-edit-tile>



From within **Full Screen Mode**, you can select **Fit to Screen** to shrink all your tiles to a single screen. This mode without scrollbars is commonly called *TV mode* and is useful for giving presentations.



You can also collapse the navigation pane on the left-hand side of the page by selecting the three lines in the upper left corner. To expand the navigation pane, select the icon again.



You can ensure that a dashboard will always have a collapsed navigation bar by appending the following to the end of the URL:

?collapseNavigation=true

---

Users who follow that link will open the dashboard with a collapsed navigation bar.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

*1. How can you get Power BI to spot outliers and trends in your data?*

- Use the Spotlight feature
- Export data to Microsoft Excel
- Quick insights
- Use Custom Q&A

### Multiple choice

*2. How could you gather, arrange, and share interesting Power BI visuals from several different sources?*

- Pin them to a Power BI report
- Pin them to a Power BI dashboard
- Export them to PDF
- Use the Get Data feature

### Multiple choice

*3. If you think of some interesting questions to ask in your report, how could you share them to help your Q&A users?*

- Use the Spotlight feature
- Include your questions in a text box on the report canvas
- Use the "Featured Q&A questions" feature
- Use the "Edit Queries" feature

## Summary

The Power BI service is full of remarkable ways to explore data, share insights, and interact with visuals. It's all accessible from a browser, so you can connect wherever you are.

# Publish and share in Power BI

## Introduction to using workspaces

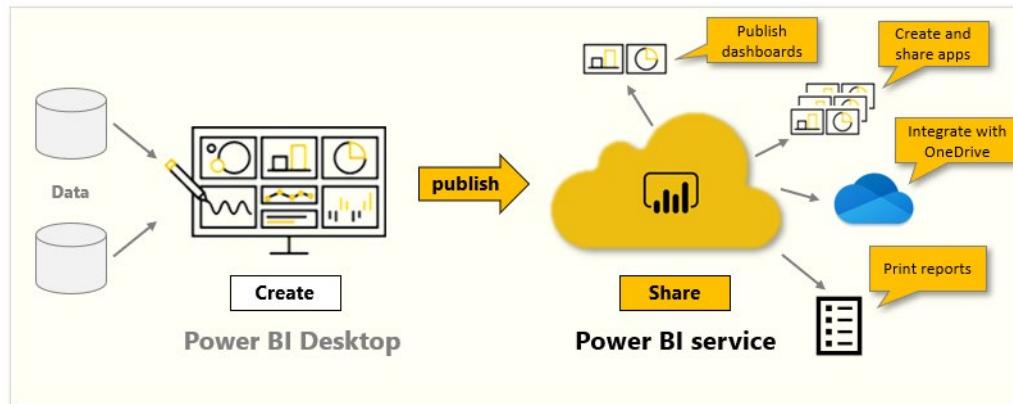
Likely, you will want to share your reports and dashboards with your coworkers and friends at some point. With Power BI, publishing and sharing your reports and dashboards is straightforward.



<https://www.microsoft.com/videoplayer/embed/RWG2db>

Tasks in this module:

- Publish reports
- Print and export reports
- Build apps
- Integrate with OneDrive



- Publish to the web

**Video:** Introduction to publishing reports



<https://www.microsoft.com/videoplayer/embed/RE3oQm3>

## Share and collaborate with colleagues in Power BI

Power BI offers various ways of sharing and collaborating with colleagues on your dashboards, reports, and datasets including:

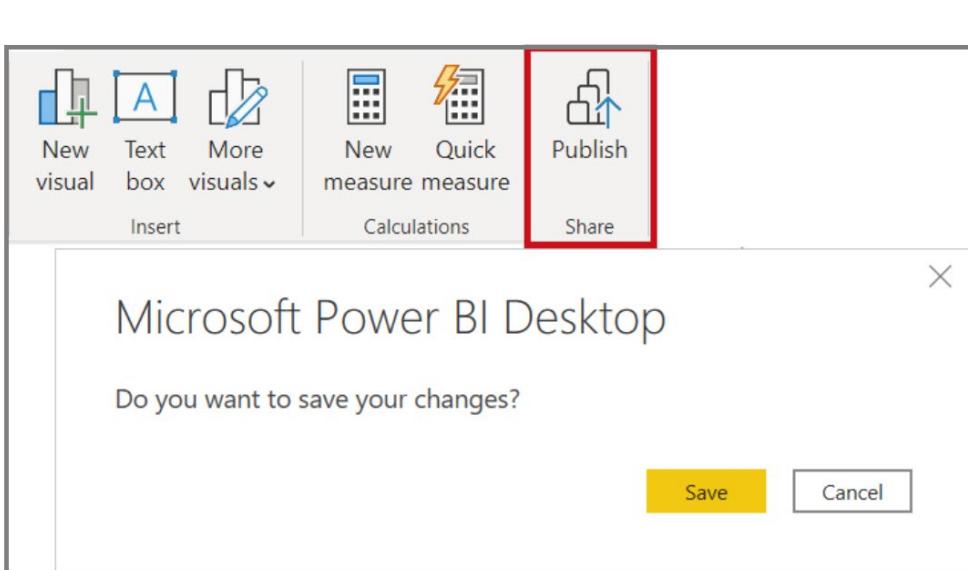
- Publish your reports from Power BI Desktop to the Power BI service.

- Create *Apps* that package a dashboard, report, and dataset to send to your colleagues, who can use the content pack as a starting point and further enhance it.
- Create *Groups*, which you can use as a security model to identify a subset of users who have access to dashboards, reports, and datasets that you create.
- Publish to the web so that live reports can be embedded in a webpage.

## Publish Power BI Desktop reports

Publishing your reports to the Power BI service is fast and simple.

After you've completed writing your report, select the **Publish** button on the **Home** tab.



Power BI packages your report and data, including visualizations, queries, and custom measures, and uploads them to the Power BI service.

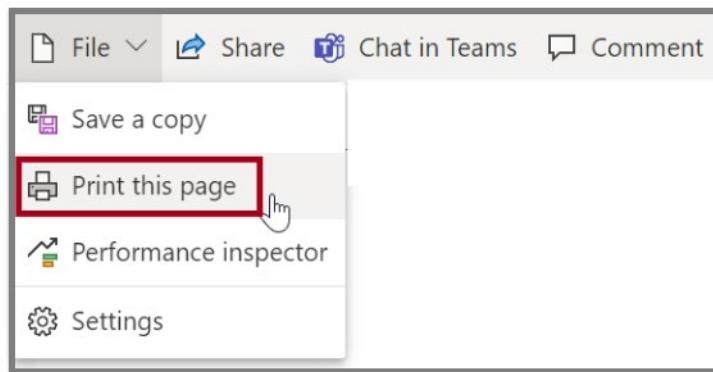
**Note:** It's common to refer to Power BI Desktop reports as .pbix files, which is the extension that they're given in Microsoft Windows.

When the upload is complete, a dialog box appears, informing you that the publishing process succeeded, and provides a link to your report in the Power BI service.

## Print and export dashboards and reports

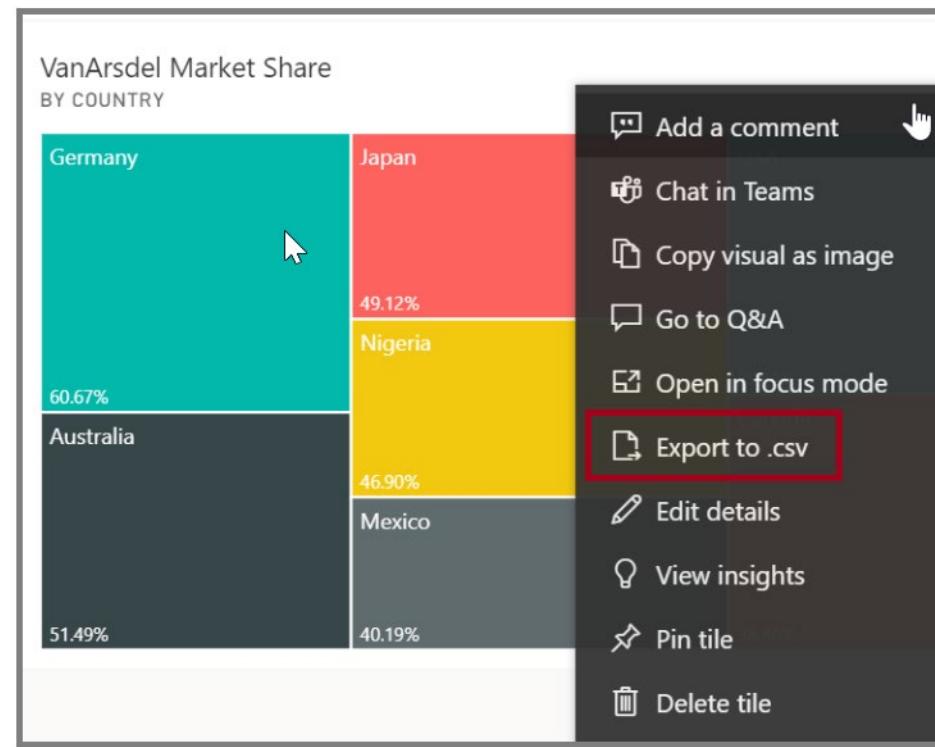
Occasionally, you might want to print a report or dashboard for a meeting or for sharing with others. Power BI provides a few ways for you to make these printouts.

In the Power BI service, select **File** in the top-left side of the service and then select **Print this page** to open a print dialog box.

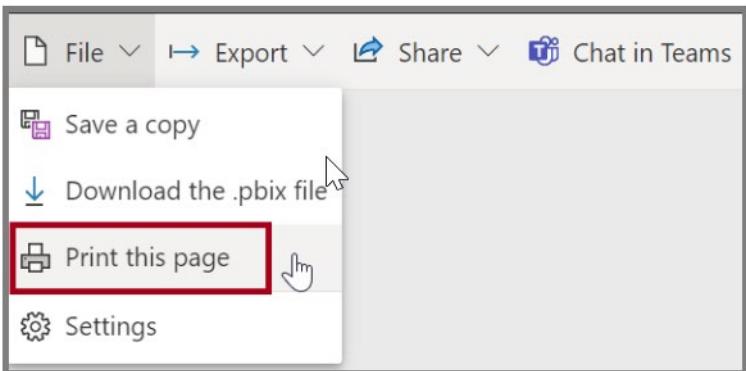


## Export data from a visual

You can also export the data from any visual in the Power BI service. Select the ellipsis on any visual and then select **Export to .csv**.



You can also print or export directly from a report. When you are viewing a report in the Power BI service, select **File > Print** to open the print dialog box.



## Manually republish and refresh your data

To update reports and datasets that you've already published from Power BI Desktop to the Power BI service, select **Publish** on the **Home** tab.



<https://www.microsoft.com/videoplayer/embed/RE3oQm4>

When you republish a report in the Power BI service, you're prompted to confirm that you want to replace the previous dataset and reports.

When you select **Replace**, the datasets and reports in the Power BI service are overwritten with the new datasets and reports.

For more information, see [Export data from visualizations<sup>49</sup>](#).

## Introducing Power BI Mobile

To keep track of your data while you're on the move, you can use one of Power BI's touch-friendly mobile applications for iOS, Android, or Windows devices.

**Video:** Introducing Power BI mobile apps



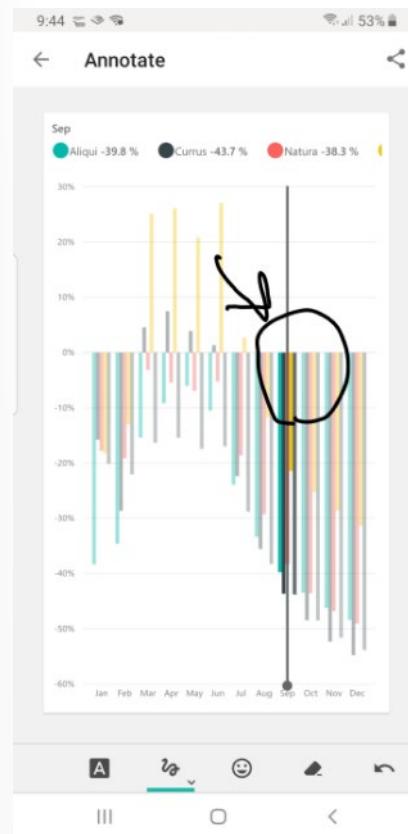
<https://www.microsoft.com/videoplayer/embed/RE3oYa4>

<sup>49</sup> <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-export-data>

Sign in to your account by using your Power BI service account information. The first screen displays all the content to which you have access, including reports, dashboards, and groups. The workspace also includes sample dashboards that you can explore for inspiration.



Tap any dashboard to open it. Within a dashboard, you can tap a dashboard tile to focus on it in a larger view. Note any insights that you discover by tapping the **Annotate** button. The Annotate feature allows you to draw on a focused tile to highlight areas of interest. The annotation tools are along the bottom of the screen.



Share your annotated tile by tapping the **Share** link.

For more information, see [What are the Power BI mobile apps<sup>50</sup>?](#).

<sup>50</sup> <https://docs.microsoft.com/en-us/power-bi/consumer/mobile/mobile-apps-for-mobile-devices>

## Create workspaces in Power BI

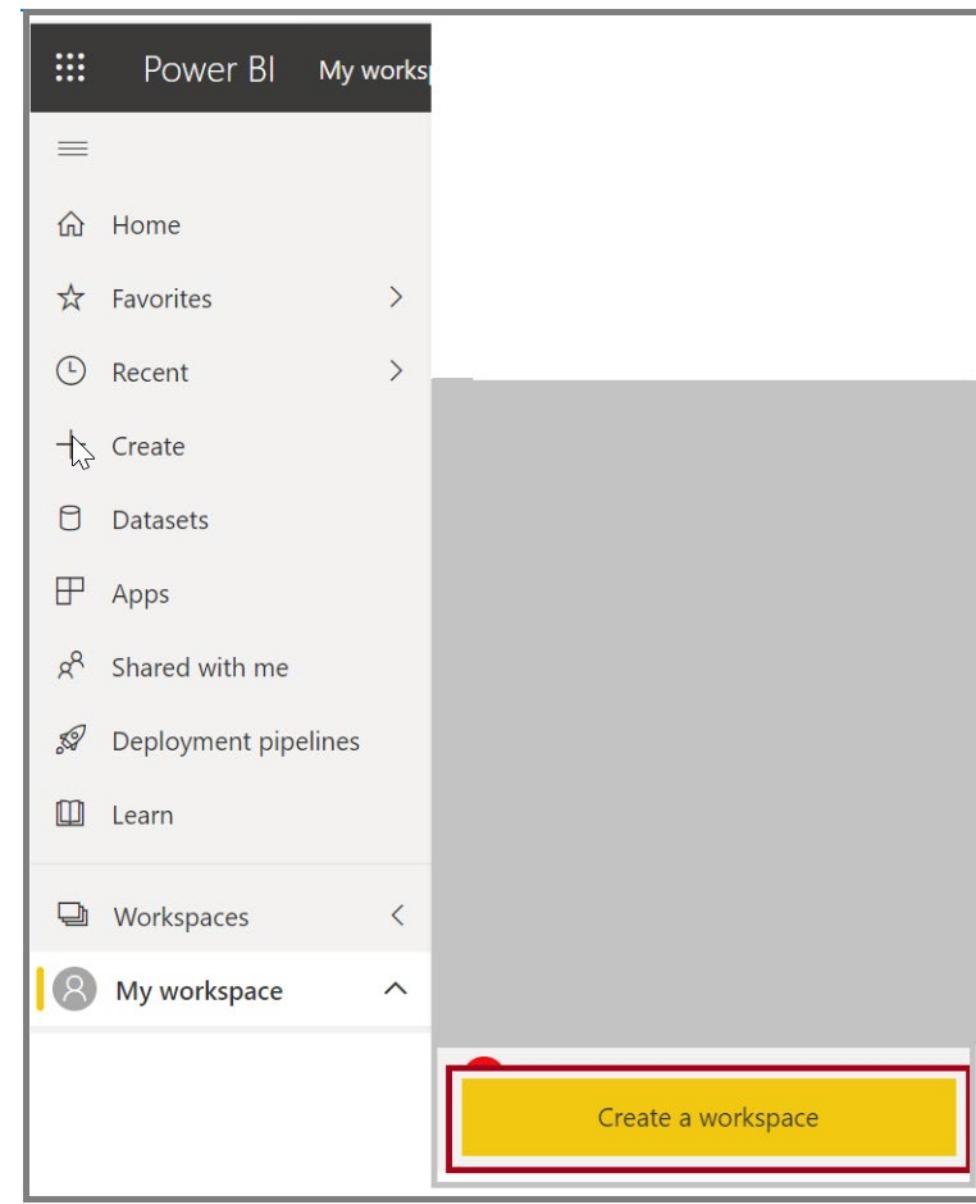
In this unit, you will create a workspace that defines a set of users who have access to specific dashboards, reports, and datasets.

Workspaces are places to collaborate with colleagues to create and refine collections of dashboards, reports, and paginated reports. There are two types of workspaces in Power BI:

- **Classic workspaces** - groups are based on the groups in Microsoft 365. If you've been using Microsoft 365 groups to manage your group's email, calendar, and documents, then you'll find that Power BI offers the same features. When you create a group in Power BI, you're actually creating an Microsoft 365 group.
- **New workspaces** - are now the default workspace in Power BI.
  - Assign workspace roles to user groups: security groups, distribution lists, Microsoft 365 groups, and individuals.
  - Create a workspace in Power BI without creating a Microsoft 365 group.
  - Use more granular workspace roles for more flexible permissions management in a workspace.
  - The Power BI admin can control who can create workspaces in Power BI.

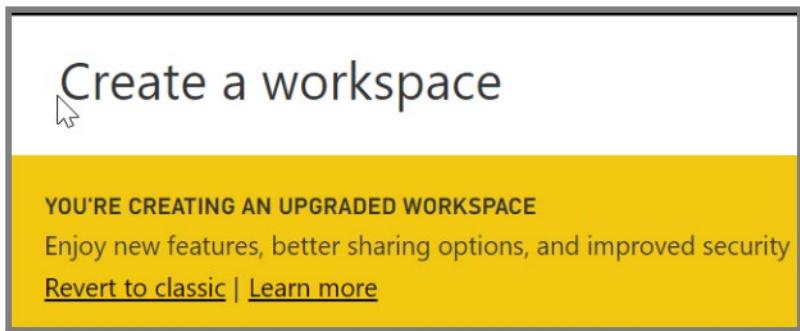
### Setting up a new workspace

By clicking on **Workspaces** users can Create a workspace which will allow everybody or nobody in an organization to create new workspaces. They can also limit creation to members of specific security groups.



## Setting up a classic workspace

Setting up a classic workspace has the same steps as setting up a new workspace, with one additional step. In the workspace dialog box you need to click on **revert to classic** to set up a classic workspace



In the **Create a workspace** dialog box, under **Advanced** you can click on **Specific users and groups** and type email addresses, security groups, and distribution lists. Then select **Save** to save the group.

For more information, see [Create classic workspaces in Power BI<sup>51</sup>](#) and [Organize work in the new workspaces in Power BI<sup>52</sup>](#).

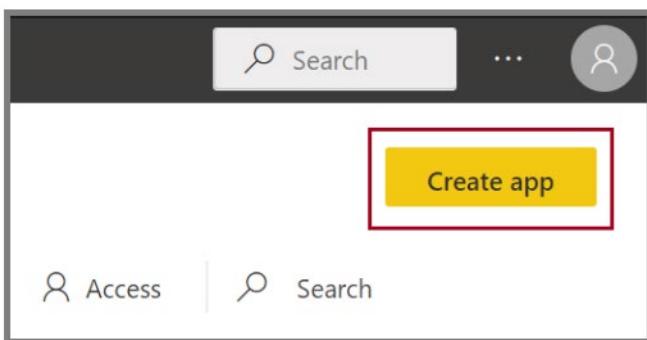
## Build apps

In this lesson, you will create an app with artifacts that already exist in Power BI, and then you will share the app with colleagues.

In the Power BI service, you will create an app that includes your dashboard, the report underneath, and the dataset. Then, you will share the app with people in your organization so they can reuse the artifacts. In the workspace list view, decide which dashboards and reports you want included in app.

Click on the workspace you published your Power BI Desktop report to, and select the Create app button in the upper right corner to start the process of creating and publishing an app from the workspace.

**Note:** You cannot publish an app from “**My Workspace**”.

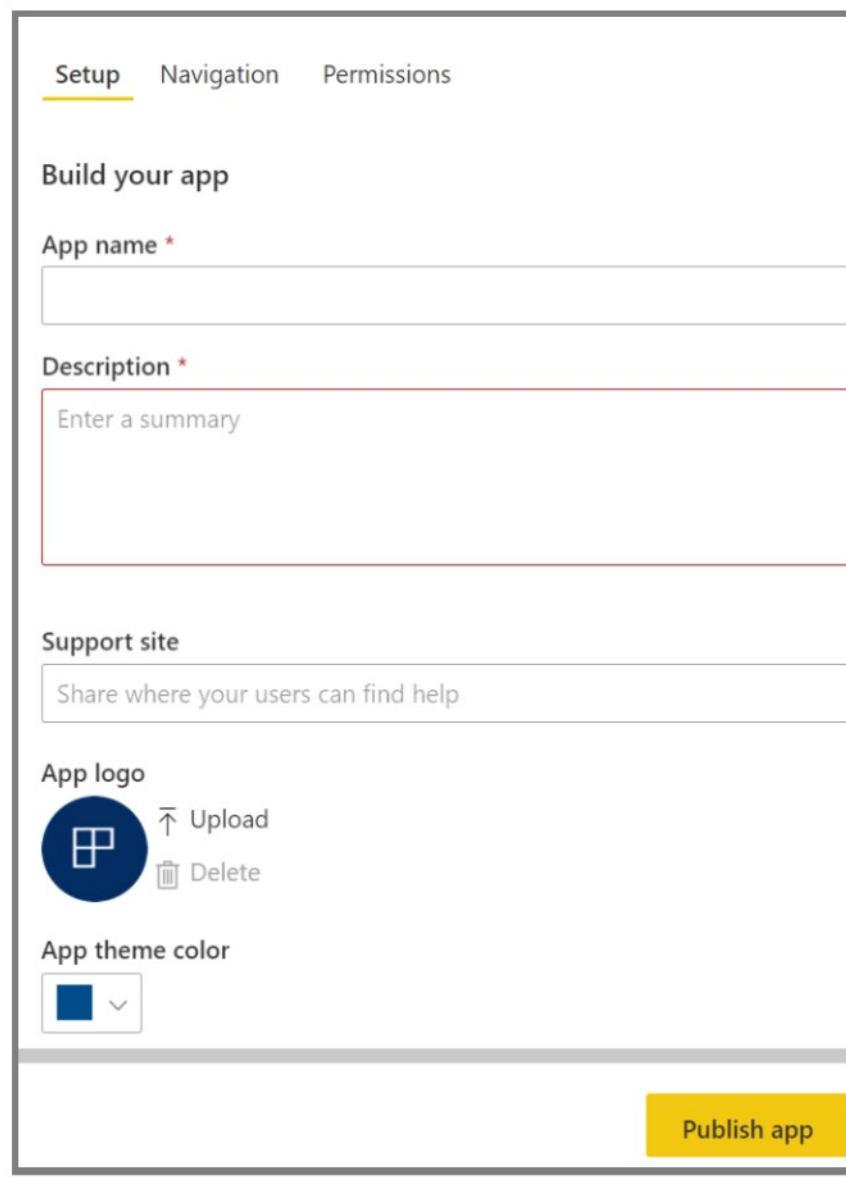


On Setup, fill in the name and description to help people find the app. You can set a theme color to personalize it. You can also add a link to a support site.

Choose whether to distribute the app to specific people or to groups, and then give the app a title. Provide a detailed description in the **Description** box so that people know what your app provides.

<sup>51</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-create-workspaces>

<sup>52</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-new-workspaces>



On the bottom of the dialog box, you can upload an image for the app and then select the dashboard to include in the app. When you publish, the app is added to the organization's content gallery.

For more information, see **Publish an app in Power BI**<sup>53</sup>.

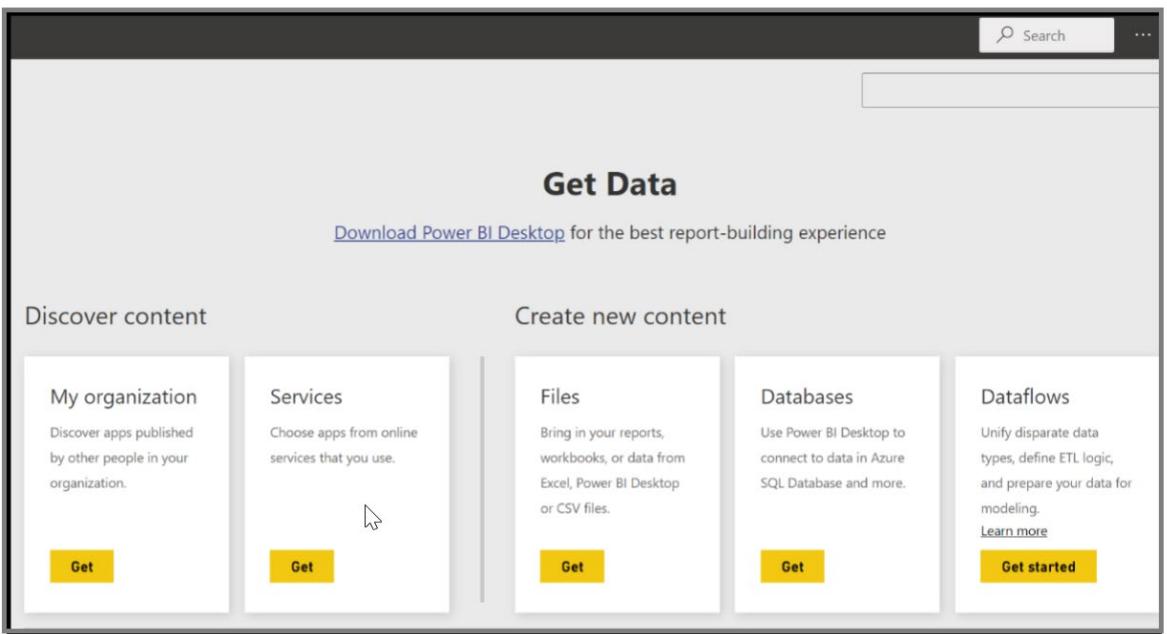
## Use apps

In this lesson, you will create an instance of an app for everyone in a group.

Select the workspace that you previously created.

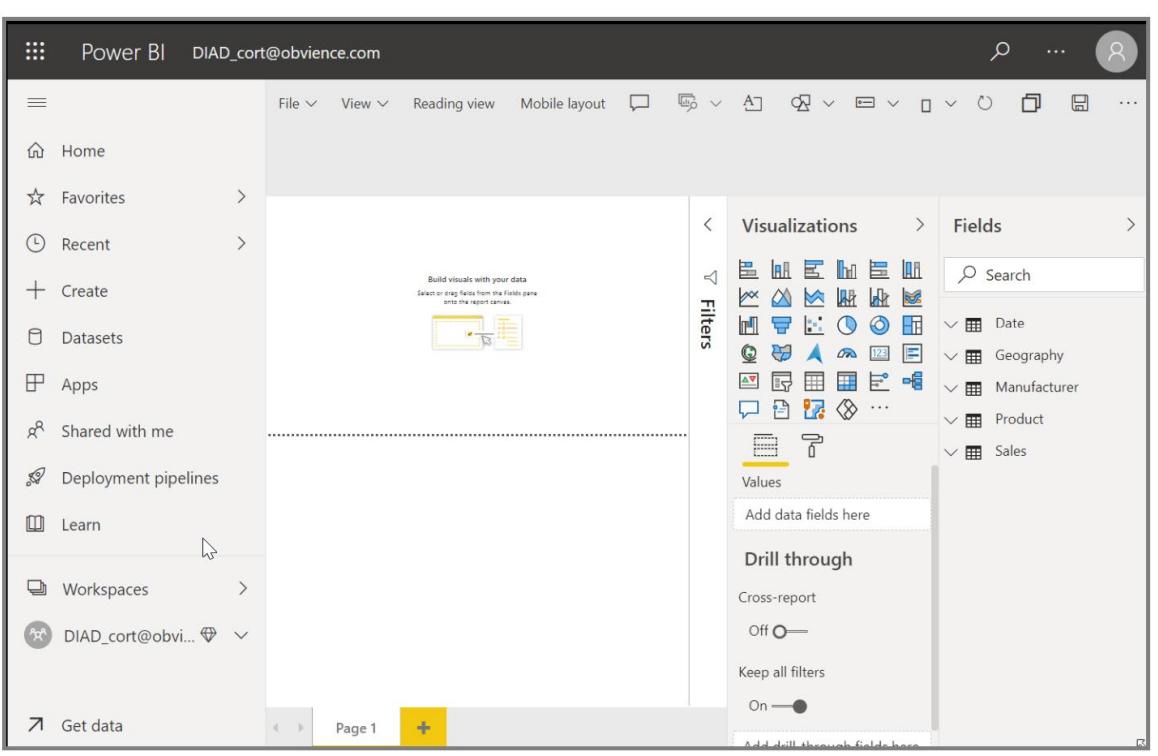
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<sup>53</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-create-distribute-apps>



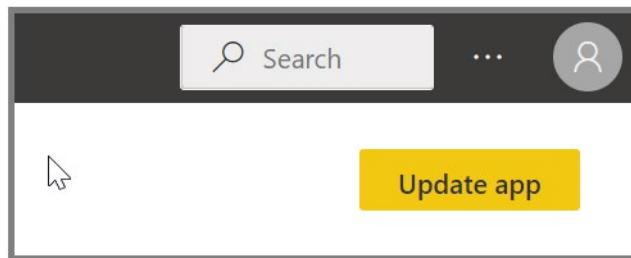
Power BI imports the dashboards, reports, and datasets that are in the app.

When you select the dataset, Power BI asks if you want to personalize the app. Create a copy of the app that you can use to make changes and keep it disconnected from the published version of the app. By creating a copy, you won't automatically receive updates if the app creator makes changes to the published version of the app. You can edit the dashboard, the report, and even the dataset if you want.

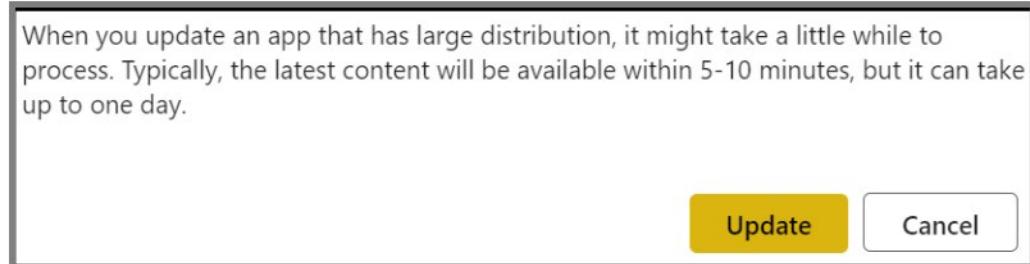


## Update apps

To edit an app that you created previously and see how other people use your app, start in the Power BI Service in **My Workspace**. Anytime that you make changes to the app you can click on **Update app** in the upper right hand side of the screen. The Update app dialog box will open, you can make your changes and click **Update app**.



Power BI processes those changes and publishes the updated app to the app gallery. If the distribution list is large you may get a notification like the one below. Anyone who has connected to your app will receive a message that the app has changed, and they will have the option to accept the changes or to keep the older version. As the app owner, you can manage the versions that your colleagues are using.



For more information, see [Change your published app<sup>54</sup>](#).

## Integrate OneDrive for Business with Power BI

You can use your Power BI and Office365 groups to collaborate and share by using Microsoft OneDrive for Business.

**Video:** Use data from Microsoft OneDrive

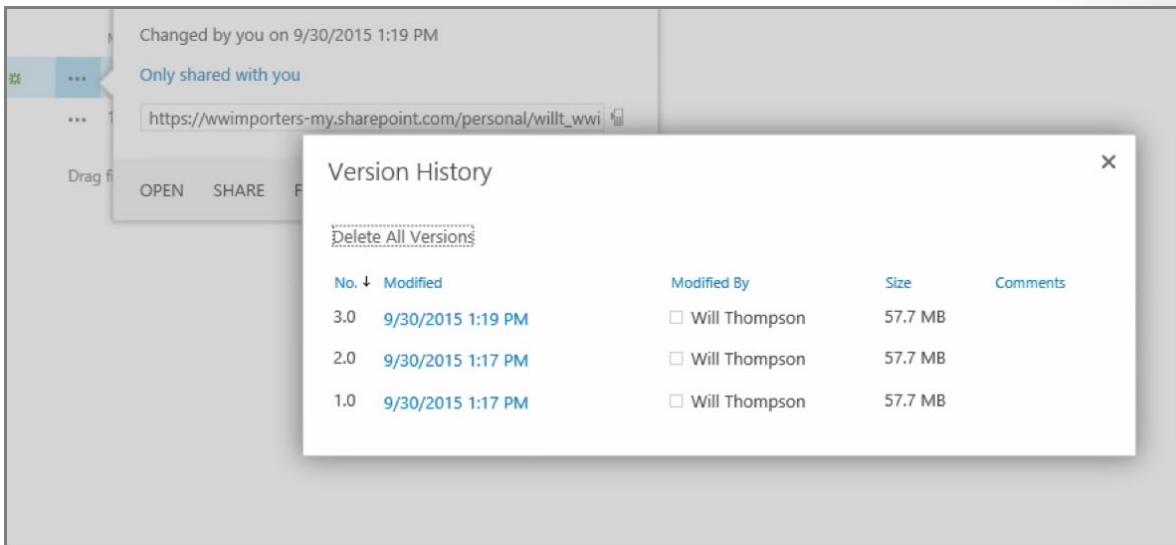


<https://www.microsoft.com/videoplayer/embed/RE3x4k3>

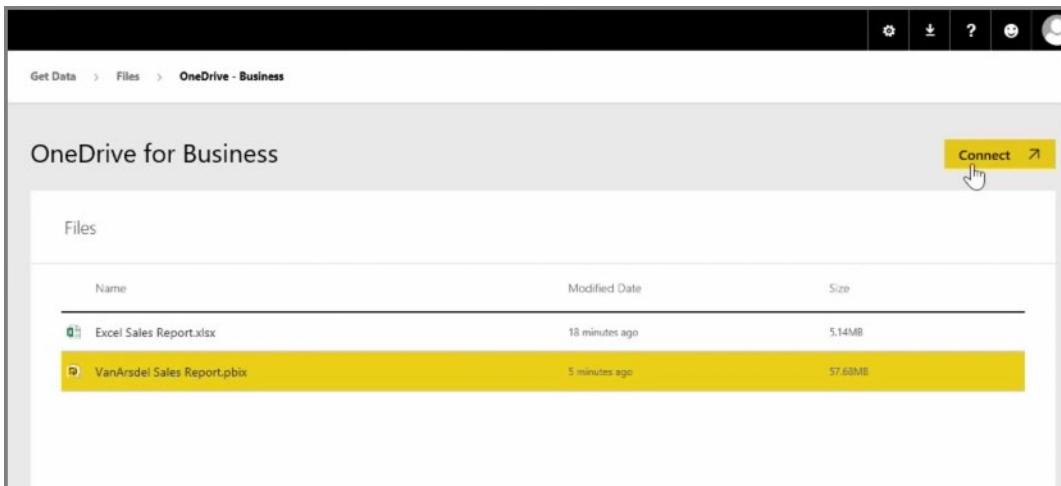
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<sup>54</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-create-distribute-apps#change-your-published-app>

OneDrive for Business is a potential storage location for your Power BI content that provides version history. You can share your files with an Office365 group to enable several people to work on the same Power BI or Excel files.



To connect to a PBIX (Power BI Desktop) file on OneDrive for Business, sign in to the Power BI service and select **Get Data**. Under **Create new content**, select **Files**, and then select **OneDrive - Business**. Highlight the file and then select **Connect**.



Your content appears on the left-hand side navigation bar. File changes on the **OneDrive for Business** page will automatically reflect in the Power BI environment and will be recorded in the version history.

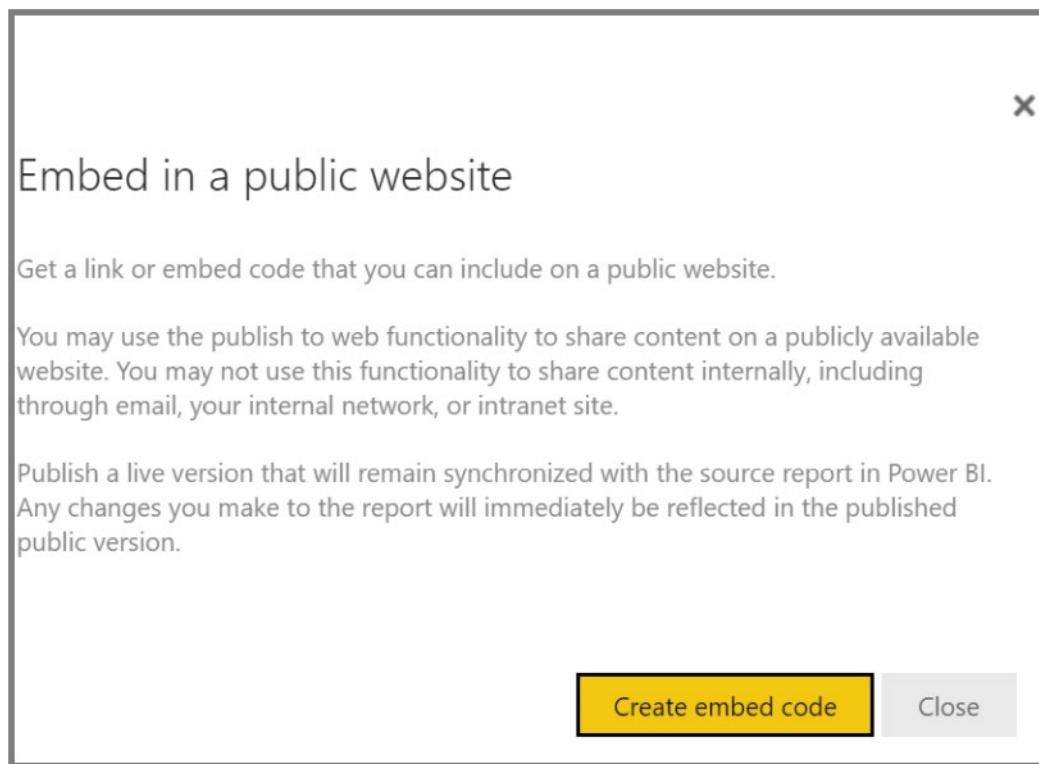
For more information, see [Connect to files stored in OneDrive for your Power BI app workspace<sup>55</sup>](#).

## Publish to web

In this lesson, you're going to share a Power BI report on a webpage or share it through email. This feature of Power BI is often referred to as **Publish to web**.

<sup>55</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-connect-to-files-in-app-workspace-onedrive-for-business>

In the Power BI service, select the report that you want to share so that it's displayed on the canvas. Then from the menu, select **Share > Embed Report > Publish to web (public)**. A dialog box will appear, explaining that you'll receive an *embed code* that will allow you to include the report on a website or in an email.



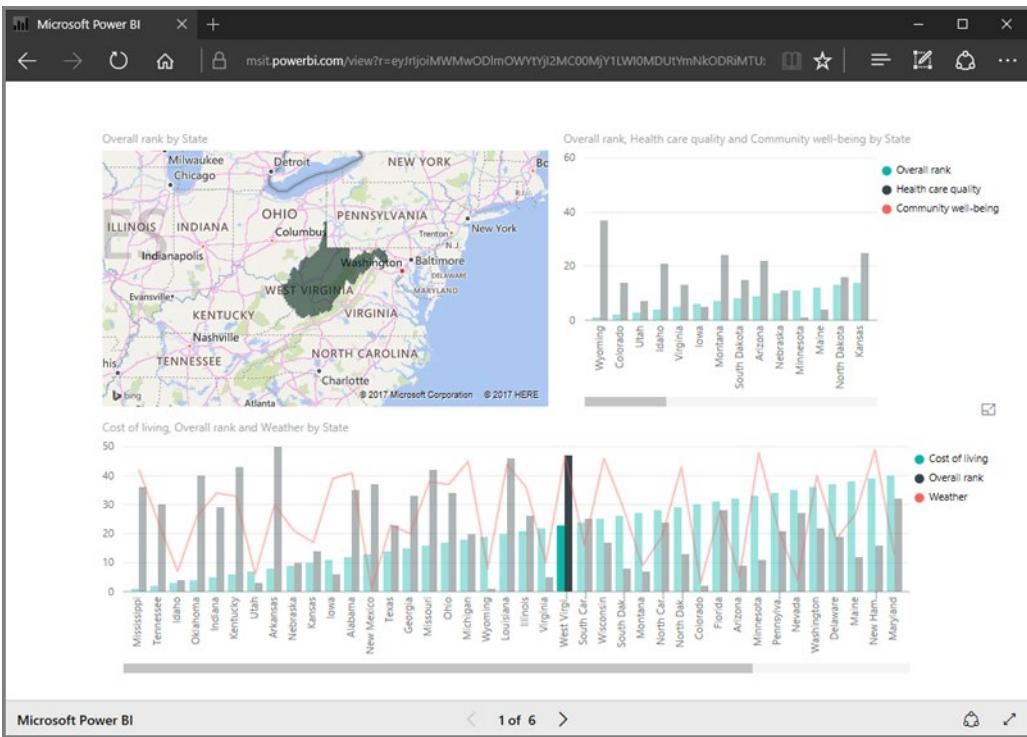
When you select **Create embed code**, Power BI presents another dialog box stating that you're about to share your data with everyone on the Internet. Verify that sharing publicly is acceptable before moving ahead.

Power BI presents a dialog box with two links:

- A link that you can share in an email, which shows the report as a webpage
- HTML code (a link plus within an iframe) so that you can embed the report directly into a webpage

For the HTML link, you can choose from predefined sizes for the embedded report, or you can modify the iframe code and customize its size.

You can paste the email link into a browser and see your report as a webpage. You can interact with that webpage just as you would if you were viewing the report in Power BI. The following image shows a **Publish to web** page when its link was copied directly from that dialog box into a browser.



You can also embed the iframe link into a blog post, website, or Sway.

If you want to delete an embedded code that you created, Power BI can help. In Power BI, select the gear icon in the upper-right corner and then select **Manage embed codes**.

The Power BI workspace shows the embed codes that you've created.

For more information, see [Publish to web from Power BI<sup>56</sup>](#).

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. In Power BI, what does the "Publish" button do?

- Packaging your report and data on Power BI Desktop and sending them to the Power BI service.
- Packaging your report and data on the Power BI service and sending them to Power BI Desktop.
- Packaging your report and data and share it as an app.
- Packaging your report and data and saving it to PDF.

<sup>56</sup> <https://docs.microsoft.com/en-us/power-bi/collaborate-share/service-publish-to-web>

## Multiple choice

2. *What is the purpose of a "workspace" in Power BI?*

- To create a custom bundle of dashboards, reports, and data.
- To define the working area of a canvas.
- To designate the relationship between two tables.
- To define a set of colleagues who have access to specific dashboards, reports, and data.

## Multiple choice

3. *What happens if you update content that's part of an app you already published?*

- Nothing. You have now created a new fork of that content.
- The new content will automatically update anyone who has connected to your app
- Anyone who has connected to your app will receive a message and they can decide whether to accept the changes or keep the older version
- Anyone who has connected to your app will automatically update but they can roll back to the older version whenever they choose

## Summary

Publishing your report to the web and sharing it with the world is simple with Power BI Desktop.

# Answers

## Multiple choice

1.What is the common flow of activity in Power BI?

- Create a report in Power BI mobile, share it to the Power BI Desktop, view and interact in the Power BI service.
- Create a report in the Power BI service, share it to Power BI mobile, interact with it in Power BI Desktop.
- Bring data into Power BI Desktop and create a report, share it to the Power BI service, view and interact with reports and dashboards in the service and Power BI mobile.
- Bring data into Power BI mobile, create a report, then share it to Power BI Desktop.

### *Explanation*

*The Power BI service lets you view and interact with reports and dashboards, but doesn't let you shape data.*

## Multiple choice

2.Which of the following are building blocks of Power BI?

- Tiles, dashboards, databases, mobile devices.
- Visualizations, datasets, reports, dashboards, tiles.
- Visual Studio, C#, and JSON files.

### *Explanation*

*Building blocks for Power BI are visualizations, datasets, reports, dashboards, tiles.*

## Multiple choice

3.A collection of ready-made visuals, pre-arranged in dashboards and reports is called what in Power BI?

- The canvas.
- Scheduled refresh.
- An app.

### *Explanation*

*An app is a collection of ready-made visuals, pre-arranged in dashboards and reports. You can get apps that connect to many online services from the AppSource.*

## Multiple choice

1.Which tool would you use to extract the day of the week from a set of dates?

- Navigator view
- Power Query editor
- New Measure
- New Parameter

### *Explanation*

*Power Query editor allows you to search for data sources and then shape that data. For example, remove a column, change a data type, or merge tables.*

**Multiple choice**

2.What is one method for creating a visual?

- Drag a field from the Fields list onto the Visualizations pane
- Drag a field from the Fields list onto the Model view canvas
- Drag a field from the Fields list onto the Report view canvas
- Drag a field from the Fields list onto the Data view canvas

*Explanation*

*Dragging any field from the Fields list onto the open white space of the canvas (in Report view) will automatically create a default visual for that data type.*

**Multiple choice**

3.What is the best way to import tabular data from a website into Power BI?

- Download data from the website and then import to Power BI
- Transfer data from the website to OneDrive and then import to Power BI
- Select Get Data and point to the URL
- Use the Query Editor to find and edit the web-based data

*Explanation*

*With Power BI Desktop, you can use "Get Data" to import data from a web page into a report and create visualizations.*

**Multiple choice**

1.How do you get Power BI Desktop to find relationships in data after it has been imported?

- Open the Power Query Editor
- Select Manage Relationships and then Autodetect
- Select the New Parameter button to map the relationship
- Use the Performance Manager

*Explanation*

*You can use the Manage Relationships dialog to create or edit relationships.*

**Multiple choice**

2.If your months were sorted alphabetically, how could you sort them by month order?

- Click the Edit Queries button
- Add a slicer to your visual
- Change the visualization type
- Apply the MonthNo category sort option

*Explanation*

*Use the "Sort by Column" option to sort Month by MonthNo. This will ensure that months are sorted by month order.*

**Multiple choice**

3.How do you get Power BI to separate date data into year, quarter, month, and day?

- Open the Query Editor
- Select the New Parameter button
- Select the New Measure button
- You don't need to do anything, it is automatic.

*Explanation*

*When you create a table visualization in your report by using a date field, Power BI Desktop automatically includes breakdowns by time period.*

**Multiple choice**

4.How do you create data tables that you want stored as part of the model rather than as part of a query?

- Use a calculated table
- Select the Enter Data button
- Select the New Measure button
- Select the New Parameter button

*Explanation*

*Calculated tables store data in the model instead of in an external source or being calculated on the fly.*

**Multiple choice**

5.Why would a table show the same value, like "Sales", for every country?

- Because the Revenue data is corrupted
- Because the column is assigned with the wrong data type
- Because there is no relationship between the Sales and Country fields.
- Because the column is sorted incorrectly

*Explanation*

*The lack of a relationship becomes obvious when you create a simple table visual in Power BI Desktop and get the same value for all entries.*

**Multiple choice**

1.You want your report readers to be able to view your bar chart visual for any year that they choose.  
What tool could you use?

- Conditional formatting
- Slicer
- Treemap
- Z-order

*Explanation*

*A slicer is an on-canvas visual filter in Power BI Desktop that lets anyone who is looking at a report segment the data by a particular value, such as by year or by geographical location.*

**Multiple choice**

2.If you were very satisfied with the appearance of a page and wanted the next page to look the same, what would be the best method?

- Export the report to PDF and then import the PDF with a different name
- Right-click the report page tab and select "Duplicate Page"
- Publish the report to a different location
- Use the "New Quick Measure" feature

*Explanation*

*The quickest way to reuse a good page layout is to right-click the report page tab and select "Duplicate Page".*

**Multiple choice**

3.Which scenario would be a good case for using bubble maps?

- You want to see months with the highest sales by country.
- You want to see the types of products sold in each country.
- You want to see sales by age group.
- You want to see total revenue by country.

*Explanation*

*The size and color of bubble maps clearly show one or two values on a map for each country. Total revenue is a good example.*

**Multiple choice**

1.How can you get Power BI to spot outliers and trends in your data?

- Use the Spotlight feature
- Export data to Microsoft Excel
- Quick insights
- Use Custom Q&A

*Explanation*

*The Quick insights feature is built on a growing set of advanced analytical algorithms that allow people to find insights in their data in intuitive ways.*

**Multiple choice**

2.How could you gather, arrange, and share interesting Power BI visuals from several different sources?

- Pin them to a Power BI report
- Pin them to a Power BI dashboard
- Export them to PDF
- Use the Get Data feature

*Explanation*

*A Power BI dashboard is a single page, often called a canvas, that uses visualizations from a variety of reports to tell a story.*

**Multiple choice**

3.If you think of some interesting questions to ask in your report, how could you share them to help your Q&A users?

- Use the Spotlight feature
- Include your questions in a text box on the report canvas
- Use the "Featured Q&A questions" feature
- Use the "Edit Queries" feature

*Explanation*

*You can add your own featured questions to any dataset you own by adding them to the "Featured Q&A questions" feature in the dashboard setting, dashboard section.*

**Multiple choice**

1.In Power BI, what does the "Publish" button do?

- Packaging your report and data on Power BI Desktop and sending them to the Power BI service.
- Packaging your report and data on the Power BI service and sending them to Power BI Desktop.
- Packaging your report and data and share it as an app.
- Packaging your report and data and saving it to PDF.

*Explanation*

*The "Publish" button in Power BI packages your report and data, including visualizations, queries, and custom measures, and uploads them to the Power BI service.*

**Multiple choice**

2.What is the purpose of a "workspace" in Power BI?

- To create a custom bundle of dashboards, reports, and data.
- To define the working area of a canvas.
- To designate the relationship between two tables.
- To define a set of colleagues who have access to specific dashboards, reports, and data.

*Explanation*

*Workspaces are places to collaborate with colleagues to create collections of dashboards, reports, and paginated reports.*

**Multiple choice**

3.What happens if you update content that's part of an app you already published?

- Nothing. You have now created a new fork of that content.
- The new content will automatically update anyone who has connected to your app
- Anyone who has connected to your app will receive a message and they can decide whether to accept the changes or keep the older version
- Anyone who has connected to your app will automatically update but they can roll back to the older version whenever they choose

*Explanation*

*When you click \*\*Update\*\*, users of your app will receive a message. They can choose whether to accept or ignore your updates to the app.*



## Module 12 Putting it all together

### Manage solutions in Power Apps and Power Automate

#### Introduction

Solutions allow you to package features, such as apps in Microsoft Power Apps (canvas and model-driven), site maps, flows, entities, forms, custom connectors, web resources, choices, charts, and fields, to transport from one environment to another. Only the metadata, such as entities and their columns and configuration data, are transported. No business data is transported.

Solutions are part of the overall application lifecycle management (ALM) practice of Microsoft Power Platform. Solutions are important mechanisms for implementing ALM. For more information, see **Solutions for implementing ALM<sup>1</sup>**.

#### Learn the basics

##### Power Apps

Power Apps is a no-code/low-code platform for building apps that builds from concepts that are similar to formulas in a Microsoft Excel workbook like SUM and TEXT. You can use Power Apps to build simple solutions like vehicle inspection forms and status reports or complex business solutions for purchasing processes and inventory management. If you can envision an app to solve a business problem, then you can use your existing skills to build it. Though Power Apps is geared toward business users who have little background in computer science and coding, Power Apps offers advanced functionality and the ability for seasoned developers to design complex applications with ease.

Power Apps can create three types of apps: canvas, model-driven, and portals. Each is suited to different scenarios and users.

Canvas apps are great options when you want to build an app from a blank canvas. You can start by choosing the screen size (tablet or mobile), and then you will have a blank screen from which to build.

<sup>1</sup> <https://docs.microsoft.com/en-us/power-platform/alm/overview-alm/>

You can interact with data in your app by adding data sources. Drag and drop various controls and add the desired functionality by writing Excel style formulas. Canvas apps provide you with complete flexibility when you are building apps.

Model-driven apps build from data in Microsoft Dataverse. Power Apps will build you an attractive, fully functional app to add, edit, and view data. With model-driven apps, you don't have to choose the app size; it's responsive, meaning that it works on mobile or tablet with no extra work needed by you. You can define the relationships, forms, views, business rules, and more at the data layer, in Dataverse, giving you enough control to get your business result without writing all formulas yourself.

Portals bring the power of no-code solutions to building externally facing websites. Through the Power Apps interface, you can build an anonymous or authenticated website that allows users to interact with data that is held in Dataverse. The same drag-and-drop experience that you enjoy when building apps is available for you to build these rich, interactive websites.

## Power Automate flows

Microsoft Power Automate (previously known as Flow) is a service that allows you to create workflows that are either automated or manually triggered by a user. Several templates are available that can fully match your requirements or require minor changes. Other options include creation from a Microsoft Visio template, UI, and business process flows.

The designer feature that comes with Power Automate is user-friendly. Occasionally, drawing your flow logic on a Visio diagram can help design a better workflow; thus, the integration of Power Automate with Visio. In Visio, you can use BPMN Basic Shapes to design the flow and export it. Then, you can import that file into Power Automate, after which you have the flexibility to make further enhancements.

UI flows bring robotic process automation (RPA) directly into Power Automate. This functionality comes with either a desktop or a web app that you can use to record the UI, including clicks and keyboard input. This feature is handy when you're working with legacy applications that don't have available APIs.

Business process flows are built by using Microsoft Power Platform and Dataverse. You can also use Power Automate workflows. The business process is a series of steps that the user needs to complete in a specific stage. The business process flow visually guides the user through various stages. These flows are created and managed by using Power Automate, and several templates are readily available. These templates can use the entities that are already available, or you can use custom entities that you've created.

Power Automate flows that you create in a solution are known as solution-aware flows. You can build a new flow directly inside a solution, and you can also edit and delete that flow.

## Connection references

A connector is a user-friendly way to allow a service to connect with Power Automate. Each connector comes with a set of operations that are classified as **actions** and **triggers**. After you have connected to the service, these operations can be used within your Power Automate workflow.

Three separate categories of connectors are: Standard, Premium, and Preview. Custom connectors and connectors for Microsoft Azure Logic Apps fall under the Premium category.

You can add connectors to a solution, and you can add existing connectors to a solution or create new ones that automatically become part of that solution.

## Environment variables

Previously, it was a common practice for all stored data to be available in a single environment only. Now, thanks to environment variables, you have the flexibility to transport your configuration data from one environment to another within the same tenant. After creating environment variables in Dataverse for apps, you can consume them by retrieving data from the **Environment Variable Definition** and **Environment Variable Value** entities.

You can add environment variables in a solution, and you can add an existing environment variable in a solution or create a new one that automatically becomes part of that solution.

## Managed and unmanaged solutions

Solutions are mechanisms for implementing ALM in Power Apps and Power Automate. A solution can be managed or unmanaged.

Unmanaged solutions are used while you're still in your development environment in the initial design, build, and test phases. Unmanaged solutions should be considered your source for Microsoft Power Platform assets. When an unmanaged solution is deleted, only the solution container of any included customizations is deleted. All unmanaged customizations will remain in effect and belong to the default solution.

Managed solutions are used to deploy to any environment that isn't a development environment for that solution. These environments include test, user acceptance testing (UAT), system integration testing (SIT), and production. To make it easier and faster, managed solutions can be created independently from other managed solutions in the same environment. As an ALM best practice, managed solutions should be generated by exporting an unmanaged solution as managed and then considered a build artifact.

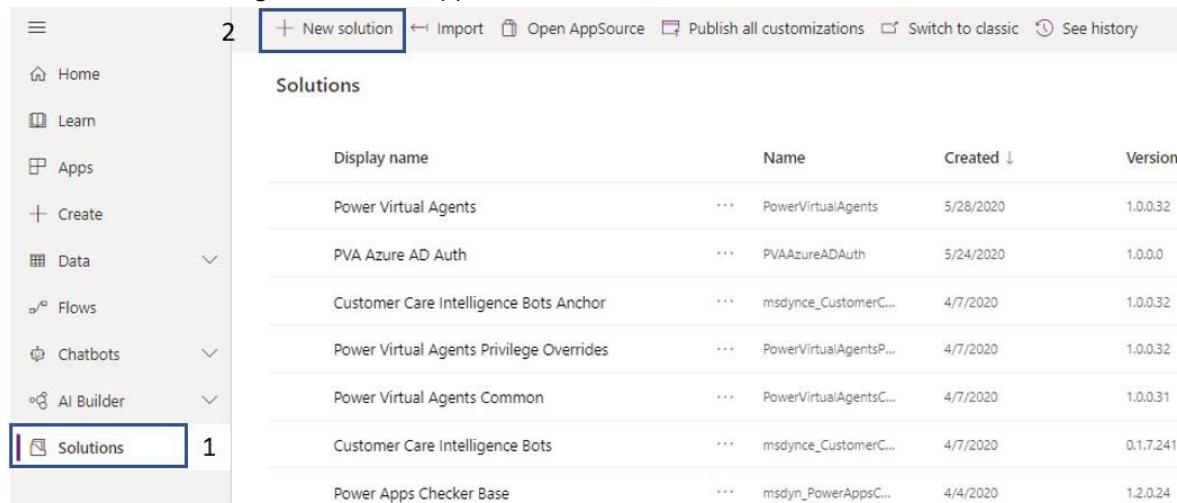
Changes can only be made to unmanaged solutions. If you need to modify a managed solution, you need to add them to an unmanaged solution. As a result, you will create a dependency between your unmanaged customizations and the managed solution. When a dependency exists, the managed solution can't be uninstalled until you remove the dependency. Some managed components can't be edited. To verify whether a component can be edited, view the **Managed** properties.

You can't export a managed solution. Also, when a managed solution is deleted (uninstalled), all included customizations and extensions are removed.

# Add and remove apps, flows, and entities in a solution

In this exercise, you will create new apps, flows, and tables and then remove them from the solution. Your first task is to create a solution:

1. To create a solution, sign in to Power Apps and then select **Solutions**, which is available in the left

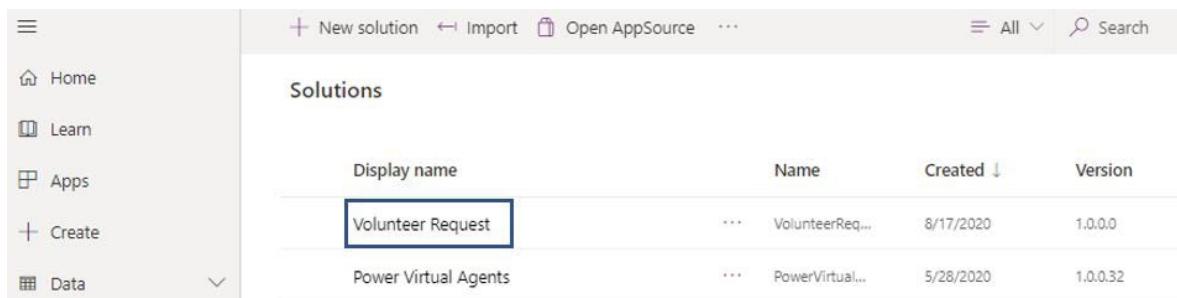


The screenshot shows the Power Apps Solutions screen. On the left is a vertical navigation bar with options: Home, Learn, Apps, Create, Data, Flows, Chatbots, AI Builder, and Solutions. The 'Solutions' option is selected and highlighted with a blue border. The main area is titled 'Solutions' and displays a table of existing solutions. The columns are 'Display name', 'Name', 'Created', and 'Version'. The data includes:

Display name	Name	Created	Version
Power Virtual Agents	PowerVirtualAgents	5/28/2020	1.0.0.32
PVA Azure AD Auth	PVAAzureADAuth	5/24/2020	1.0.0.0
Customer Care Intelligence Bots Anchor	msdynce_CustomerC...	4/7/2020	1.0.0.32
Power Virtual Agents Privilege Overrides	PowerVirtualAgentsP...	4/7/2020	1.0.0.32
Power Virtual Agents Common	PowerVirtualAgentsC...	4/7/2020	1.0.0.31
Customer Care Intelligence Bots	msdynce_CustomerC...	4/7/2020	0.1.7.241
Power Apps Checker Base	msdyn_PowerAppsC...	4/4/2020	1.2.0.24

vertical navigation.

2. Add the **Display name**, select **CDS Default Publisher**, and then enter a **Description**. Select **Create**.



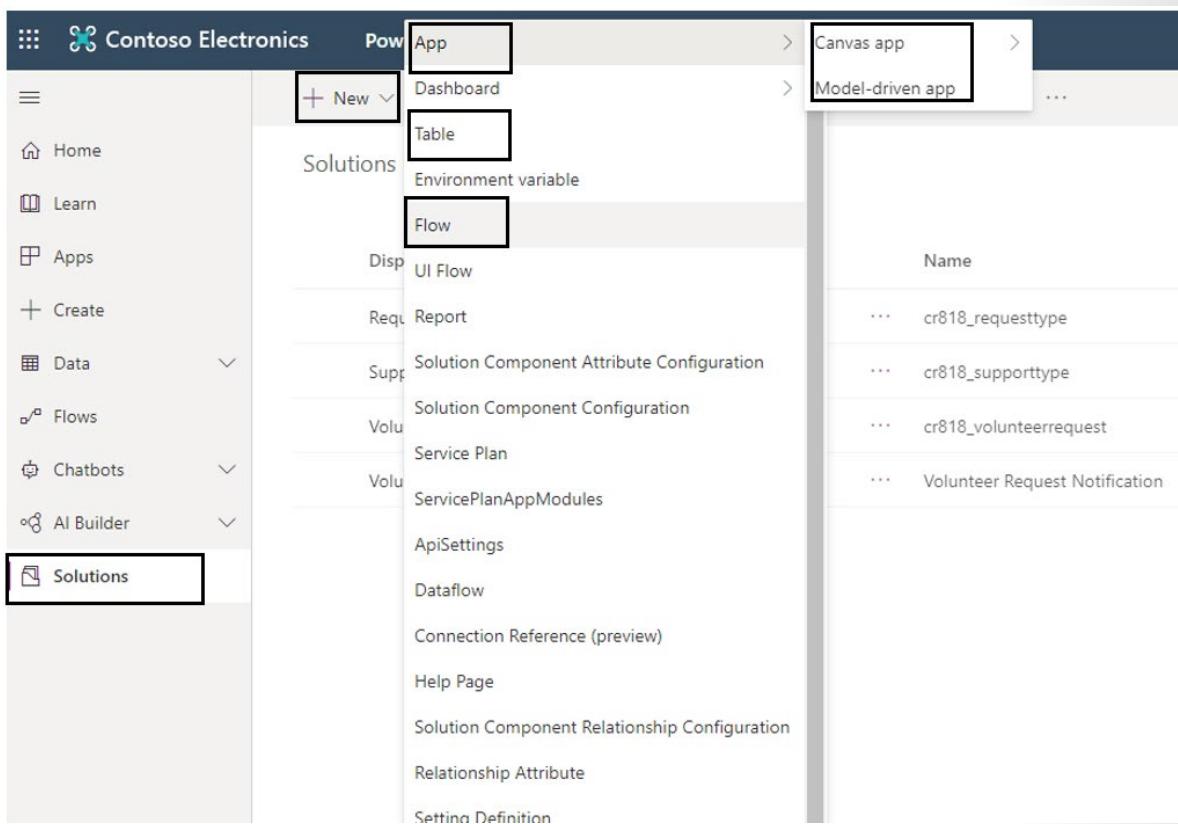
The screenshot shows the Power Apps Solutions screen with a new solution being created. The 'Create' button is highlighted with a blue border. The 'Display name' field contains the value 'Volunteer Request'. The main area is titled 'Solutions' and displays a table of existing solutions. The columns are 'Display name', 'Name', 'Created', and 'Version'. The data includes:

Display name	Name	Created	Version
Volunteer Request	VolunteerReq...	8/17/2020	1.0.0.0
Power Virtual Agents	PowerVirtual...	5/28/2020	1.0.0.32

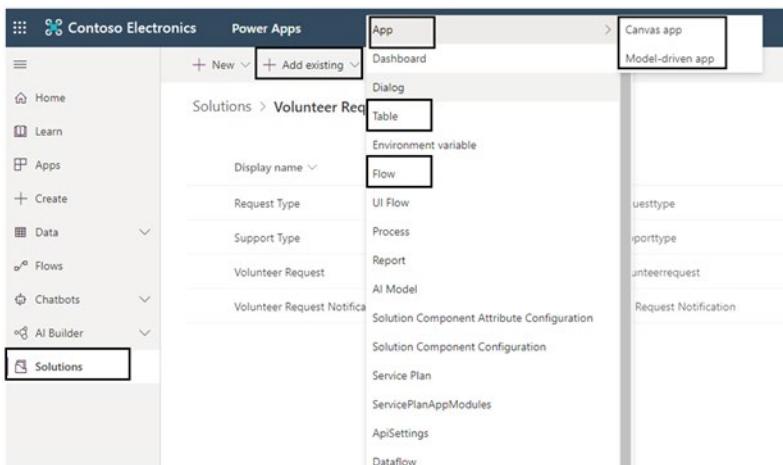
Congratulations, you have created your new solution.

You can now create new apps, flows, and tables into this solution or add existing ones.

- To add new apps, flows, and tables, select the **Volunteer Request** solution, select **+ New** in the upper-left corner of the screen, and then select your option.



- To add existing apps, flows, and tables, select **+ Add existing**. Select **App** to add existing apps, **Table** to add existing tables (previously known as entities), and **Flow** to add existing flows.



After you've finished adding items, your solution should resemble the following screenshot.

Solutions > Volunteer Request

Display name	Name	Type	Managed...	Modified
Monthly BBQ Event	cr818_monthlybbqev	Canvas app	Open	3 mo ago
Request Type	cr818_requesttype	Choice	Open	-
Support Type	cr818_supporttype	Choice	Open	-
Volunteer Request	cr818_volunteerreque	Table	Open	3 mo ago
Volunteer Request Notification	Volunteer Request Nc	Flow	Open	3 mo ago

## Edit a solution-aware app, flow, and table

Editing a solution-aware app, flow, and table requires you to first select the items from your solution.

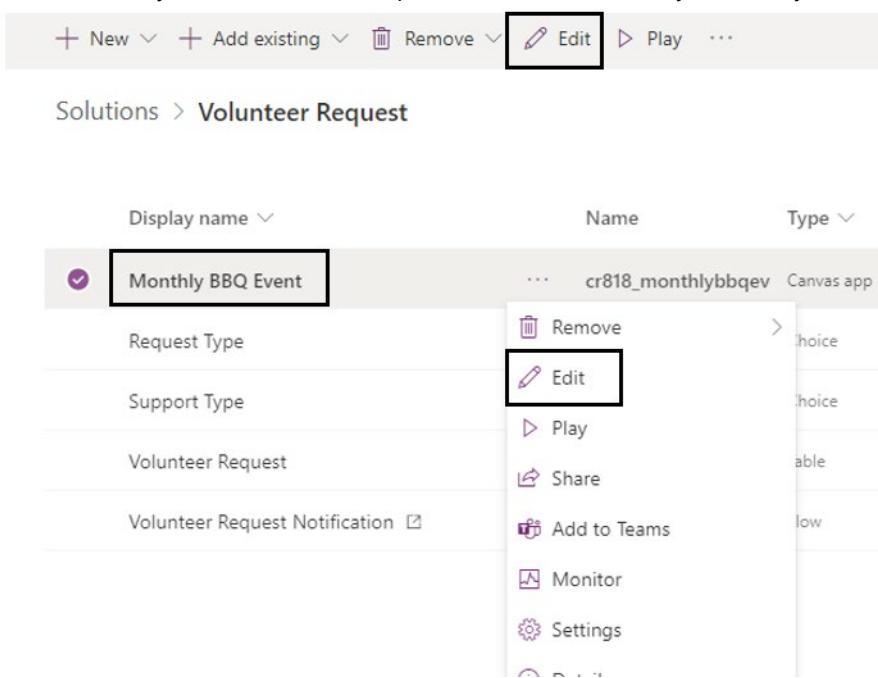
1. Sign in to Power Apps, select **Solutions**, and then select **Volunteer Request**.

You should see all your apps, flows, and tables.

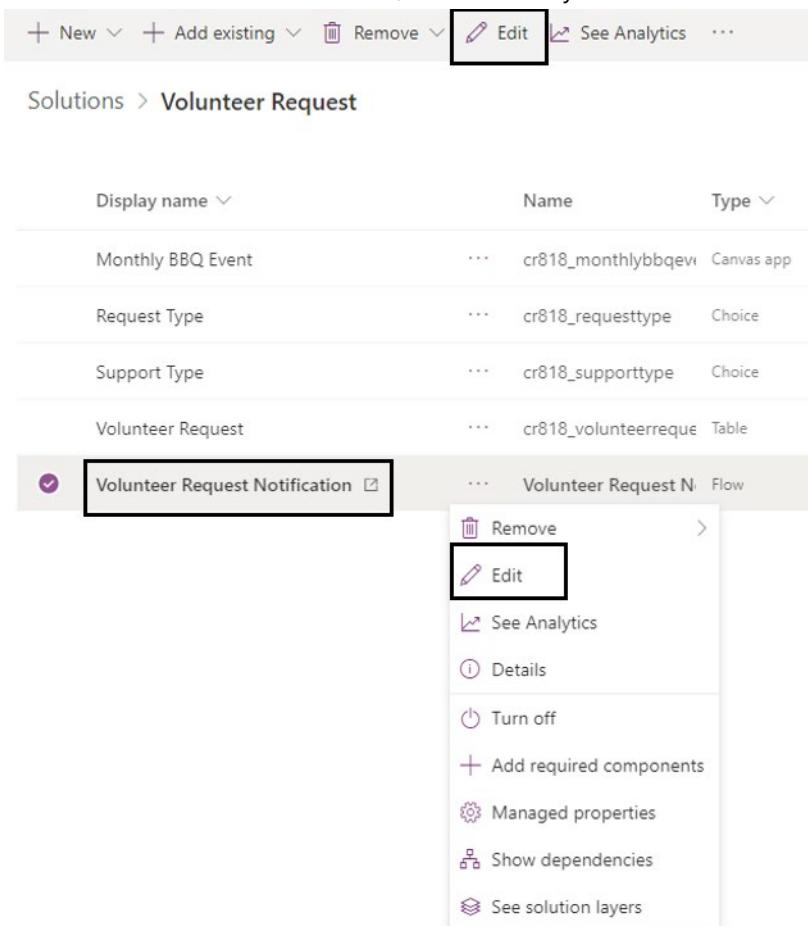
Solutions > Volunteer Request

Display name	Name	Type	Managed...	Modified
Monthly BBQ Event	cr818_monthlybbqev	Canvas app	Open	3 mo ago
Request Type	cr818_requesttype	Choice	Open	-
Support Type	cr818_supporttype	Choice	Open	-
Volunteer Request	cr818_volunteerreque	Table	Open	3 mo ago
Volunteer Request Notification	Volunteer Request Nc	Flow	Open	3 mo ago

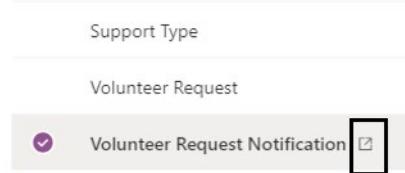
2. To edit the canvas app, select the app and then select **Edit**, which is available in the upper portion of the screen, or you can select the ellipsis. This action will take you directly into Power Apps studio.



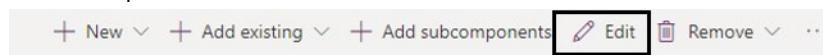
3. Select the flow and then select **Edit**, which directs you to the edit mode for the flow.



4. For flows, you can also select the icon, which takes you into the details section of the flow. The **Details** section is where you can see run history, connections, owners, and so on.



5. Select the table and then select **Edit**, which takes you to the section where you can view the columns, relationships, business rules, and so on.



Solutions > **Volunteer Request**

Display name	Name	Type
Monthly BBQ Event	cr818_monthlybbqev	Canvas app
Request Type	cr818_requesttype	Choice
Support Type	cr818_supporttype	Choice
<b>Volunteer Request</b>	cr818_volunteerrequest	Table
Volunteer Request Notification		

A context menu is open over the 'Volunteer Request' table row. The menu items are: 'Edit' (highlighted with a black box), 'Remove', 'Get data', 'Export data', 'Open in Excel', 'Publish', 'Add required components', 'Managed properties', 'Show dependencies', and 'See solution layers'.

The bread crumb path shows where that table is located.

The screenshot shows the 'Solutions > Volunteer Request > Volunteer Request' page in the Power Apps interface. The left sidebar includes options like Home, Learn, Apps, Create, Data, Flows, Chatbots, AI Builder, and Solutions. The main area displays a table of columns for the 'Volunteer Request' solution, with columns such as Display name, Name, Created By, and Modified On.

Display name ↑ ↴	Name ↴
Created By	... createdby
Created By (Delegate)	... createdonbehalfby
Created On	... createdon
Description	... cr818_description
Import Sequence Number	... importsequencenumber
Modified By	... modifiedby
Modified By (Delegate)	... modifiedonbehalfby
Modified On	... modifiedon
Name	Primary Name Column
	... cr818_name

## Exercise - Import and export solutions

Consider a scenario where you have a solution that includes an app, table, and a flow. You now want to export this solution from one tenant, which is the source, and then import it to another tenant, which is the destination.

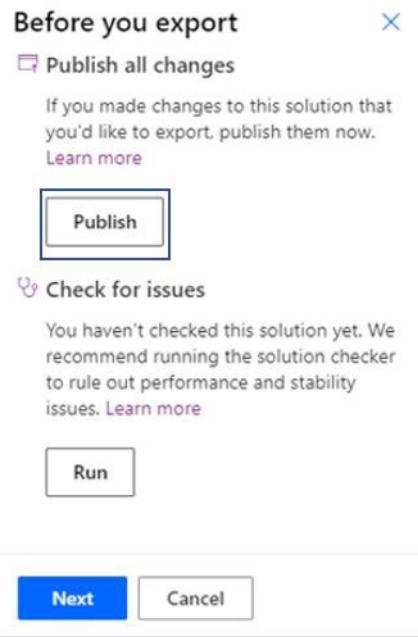
1. In the source tenant, sign in to Power Apps and then select **Solutions**, which is available in the left

The screenshot shows the 'Solutions' page in the Power Apps interface. The left sidebar includes options like Home, Learn, Apps, Create, Data, Flows, Chatbots, AI Builder, and Solutions. The main area displays a table of solutions, with the 'Volunteer Request' solution highlighted and selected for export. The 'Export' button is highlighted with a red box.

Display name	Name
Monthly BBQ Event	... MonthlyBBQEvent
Demo Environment Variables	... DemoEnvironm...
<b>Volunteer Request</b>	... VolunteerRequest
PVA Azure AD Auth	... PVAzureADAuth
Power Apps Checker Base	... msdyn_PowerA...
Power Apps Checker	... msdyn_PowerA...
Contextual Help Base	... msdyn_Context...

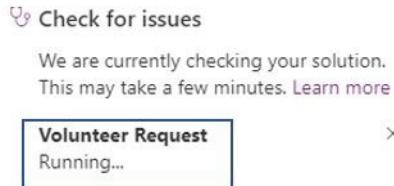
vertical navigation. Select **Export**.

2. Select **Publish**. This selection will make sure that all changes that are made to this solution are part of this published solution.

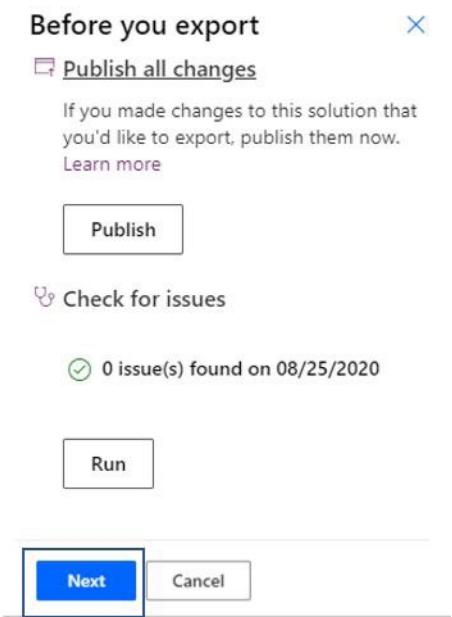


3. Select **Run** to check for issues.

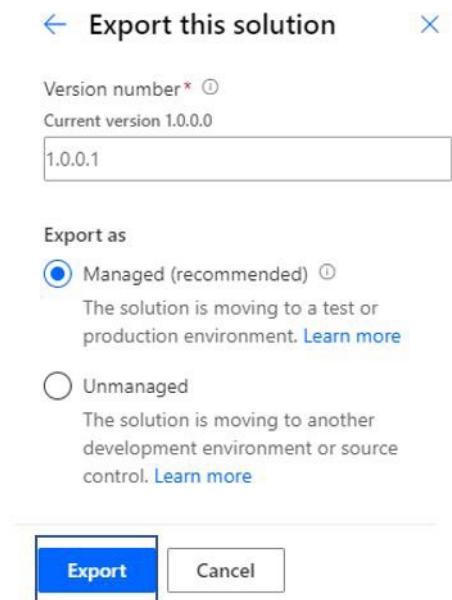
While the check is running, you should see the **Running...** notification beneath your solution name.



4. When the check is complete, and no issues have been found, select **Next**.



5. You need to decide which environment that this solution will be exported to. If it's a test or a production environment, then select **Managed** (recommended). If you're moving it to another development environment, select **Unmanaged** and then select **Export**.

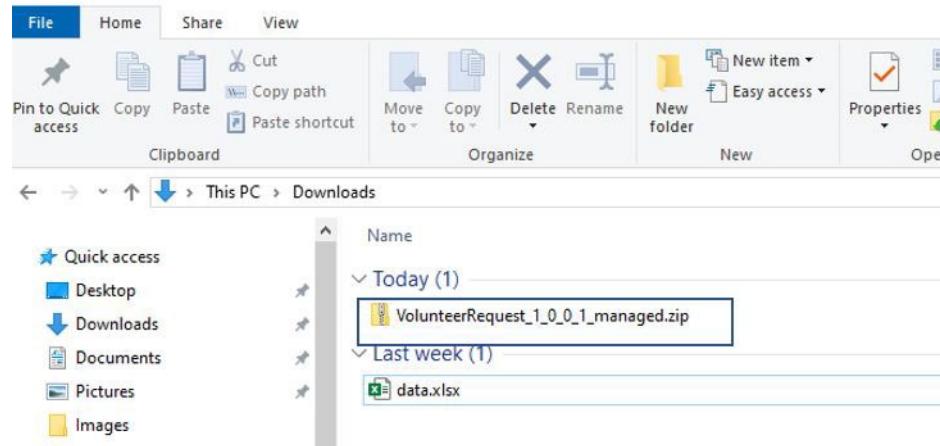


**Note:** Solution Version numbers are used to keep track of the functionality contained in a particular solution release. Versioning is used in the Power Platform to determine if code being imported is a solution or a patch. Power Platform solution versions are in the format <major>.<minor>.<build>.<revision>. When you create a new version, you will be asked to enter the version number. This defaults to 1.0.0.0 and auto increments based on the Solution update. An update must have a higher major, minor, build or revision number than the parent solution. For example, for a base solution

version 1.0.0.0, a small update could be a version 1.0.0.1 or a slightly more significant update could have version 1.0.1.0. A substantially more significant update could be version 2.2.0.0.

In the upper left of the screen, you should see a message stating that the solution was exported and will download soon. Presently, a zipped file will be downloaded to your default download location

The zipped file name contains the solution name, if it's managed or unmanaged, and the version number.



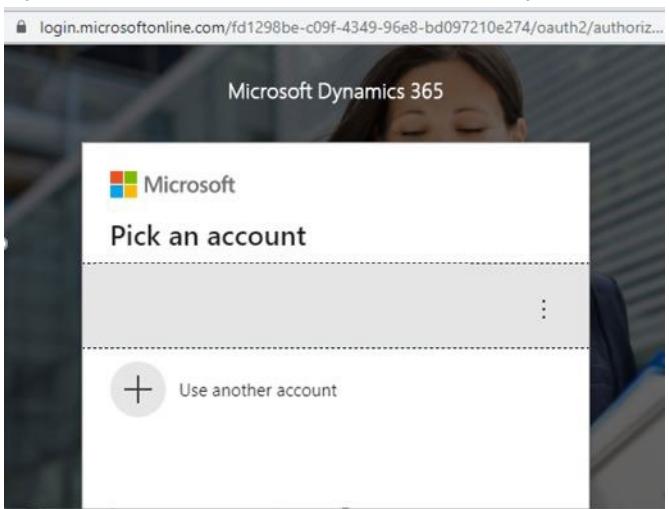
6. Go to your destination tenant, sign in to Power Apps, and then select **Solutions**, which is available in

A screenshot of the Microsoft Power Apps portal. The top navigation bar includes 'Contoso Electronics' (with a logo), 'Power Apps', and buttons for 'New solution', 'Import' (which is highlighted with a red box), 'Open AppSource', and 'Publish all customizations'. The left sidebar has a vertical navigation menu with 'Home', 'Learn', 'Apps', 'Create', 'Data', 'Flows', 'Chatbots', and 'AI Builder'. The 'Solutions' tab is selected and highlighted with a red box. The main content area is titled 'Solutions' and lists several solutions with their display names and names:

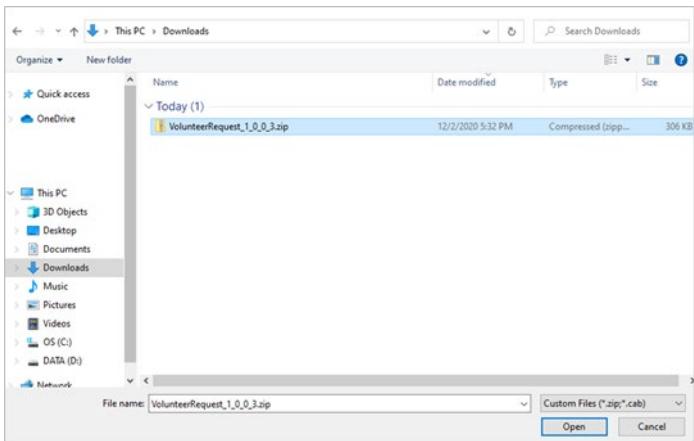
Display name	Name
Monthly BBQ Event	... MonthlyBBQEvent
Demo Environment Variables	... DemoEnvironm...
PVA Azure AD Auth	... PVAAzureADAuth
Power Apps Checker Base	... msdyn_PowerA...
Power Apps Checker	... msdyn_PowerA...
Contextual Help Base	... msdyn_Context...
Contextual Help	... msdyn_Context...
Common Data Services Default Solution	... Crf7f0e
Default Solution	... Default

the left vertical navigation. Select **Import**.

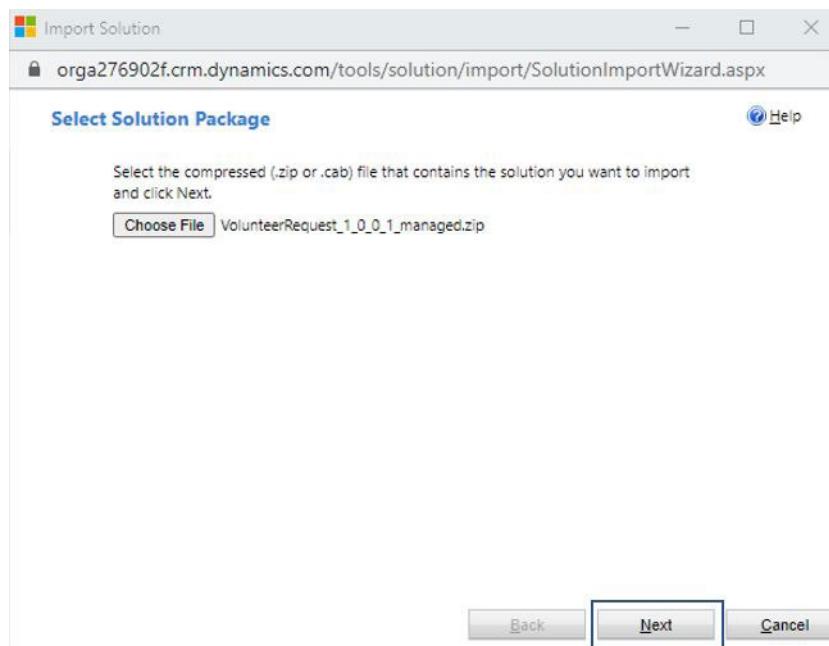
7. If you receive an authentication window, enter your credentials to continue.



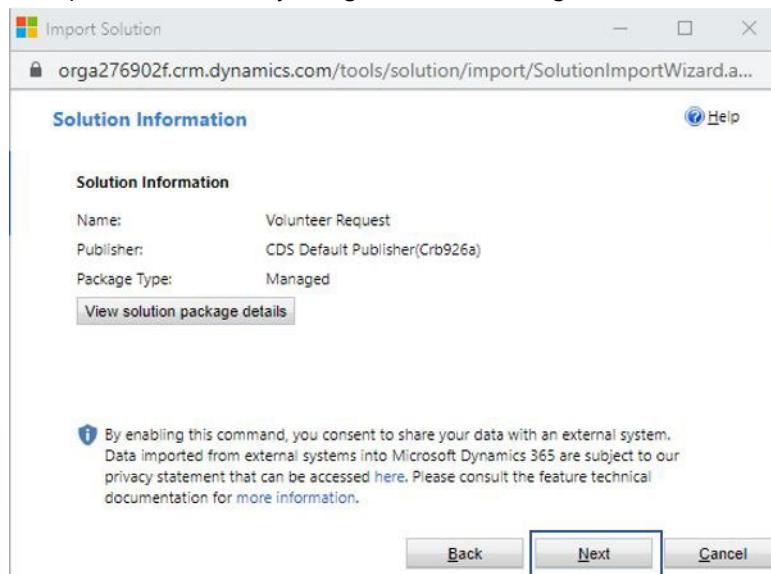
8. Select the zipped file that was exported.



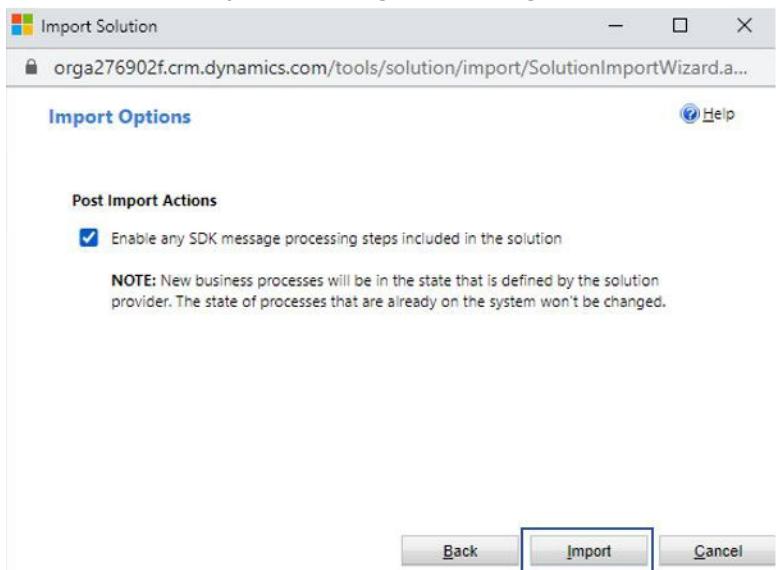
9. Select **Next**.



10. If solution items are available, the following window will appear. If you have missed anything, for example, a choice, then you'll get an error message with details on what you are missing. Select **Next**.

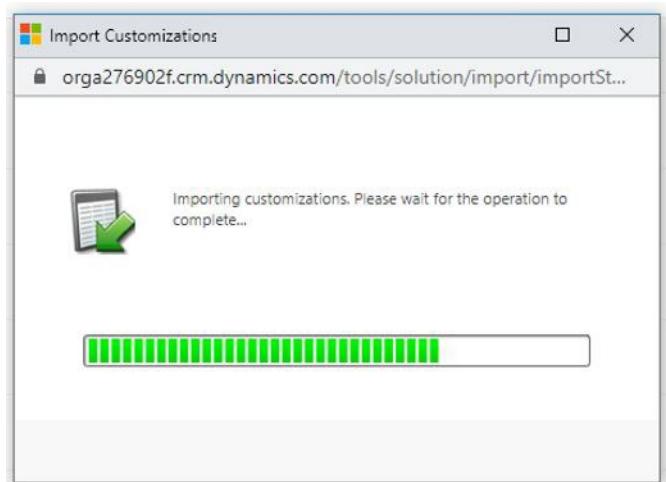


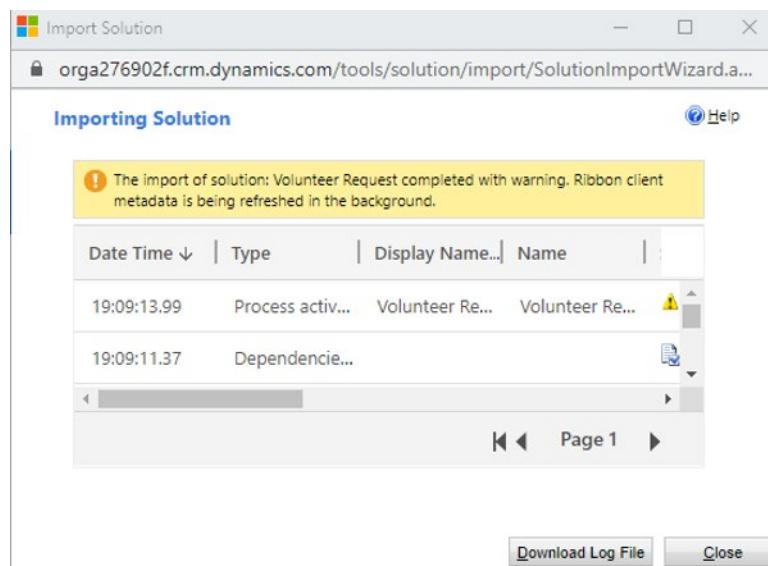
11. Keep the **Enable any SDK message processing steps included in the solution** selected and then



select **Import**.

12. Wait until the solution importing process has been completed.





13. If you receive warnings, then you can select the warning or download the log file.

You'll now see your solution imported successfully in the new tenant.

A screenshot of the Dynamics 365 Solutions list page. At the top, there are several navigation links: "+ New solution", "Import", "Open AppSource", and "Publish all custo...". Below that is a section titled "Solutions" with a table. The table has two columns: "Display name" and "Name". There are seven entries: "Volunteer Request" (selected), "Power Virtual Agents", "Corona Virus PVA", "Device", "Power Virtual Agents Privilege Overrides", "Power Virtual Agents Common", and "Dynamics 365 Portals - Timeline". Each entry has a three-dot menu icon to its right.

## Build and deploy a complex solution with flows, apps, and tables

Watch the following video for a demonstration of the following processes:

- Packaging a Power Apps canvas app, Power Automate flow, and a Dataverse table with a **Choices** field into a solution
- Exporting the solution from one environment and importing it into another

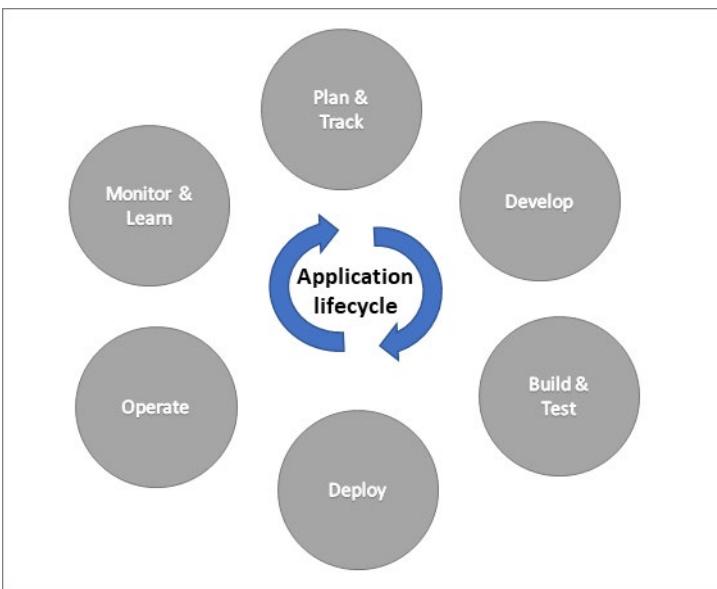


<https://www.microsoft.com/videoplayer/embed/RE4FJVJ>

## Automate solution management

So far in this module you have seen how solutions can be used to track your app components and transport them from one environment to another manually. In this topic, we will look at how automating some of these actions can help implement a more robust application lifecycle management (ALM) for your project. ALM involves more than just the building of the app, it includes the governance (for example, requirements management), the development, and the maintenance. Solutions play a key role in an ALM strategy along with tools like Azure DevOps or GitHub.

On projects, the solution architect typically would outline the ALM strategy, and a DevOps focused resource would implement the automation. As a team member you would participate in the ALM process by managing your work items in the chosen tool and using solutions to track your app and flow changes, you make. The solution would then be put into the ALM automated processes that would start a build and release process to move your changes automatically from dev, to test, to production with appropriate approvals along the way. Think of the application lifecycle as a cyclical app development process that involves these areas: plan and track, develop, build and test, deploy, operate, monitor, and learn from discovery.



While all the actions can be done manually, automation ensures they are done consistently each time performed. They also can still happen if, for example, the person who performs the manual actions is out sick. DevOps focused tools like Azure DevOps or GitHub provide the automation, but also provide work item tracking and source control.

## Source control and solutions

Source control is a feature of Azure DevOps and GitHub that allows keeping track of versions of your solution components. As you change a Power App, for example, and the solution is exported and checked into source control, you created a new version. If you use the work items to track the change that you made it could be associated with the version when it is checked into source control. This allows a project team to track when changes were made and if necessary, rollback changes that were problematic. Source control can also provide ways for a current production version to be serviced while at the same time a development team is working on a newer version.

Source control is an important part of ALM because it becomes the source of truth for your solution. This means that if your development environment was destroyed it wouldn't be a problem because you would go to source control to rebuild a new development environment. Source control makes development environments disposable. All deployments to test and production environments originate from the source-controlled version and not an untracked development environment.

While technically solution files exported from an environment can be checked in to source control, it is not an effective way to track your individual component changes. Solution files are a single compressed binary file that is checked in source control would just be able to tell you that the file changed and not allow you to easily enumerate what is changed within each component. To improve this, a step is added to the automation that takes the solution from the development environment and puts it into source control and in the process unpacks the compressed file. by unpacking the compressed solution file individual files are created for each component and in some cases multiple files for each component and are checked into source control allowing much granular tracking of changes. By using these individual files for the components also opens up the possibility of having multiple development environments that are tracking changes in the source control and minimizing one change from conflicting with another.

## Automating with DevOps tools

Automation is important because it brings consistency to what would otherwise be a manual process. Once built, automations can run on demand, on a schedule or based on a check-in event. While there are many tools, you could use to implement the automation Azure Pipelines and GitHub Actions both have pre-built Power Platform task and action support from Microsoft.

## What can you automate?

There is a wide range of what can be automated since the automation just runs tasks or actions. Think of it as being similar to Power Automate flows but more specific to working with app management and deployments. The following are some of the common automations that might be found on Power Platform projects:

- Creating a new development environment and installing solutions from source control
- Taking changes from development environment and updating source control
- Running solution checker to identify quality problems
- Provisioning / de-provisioning environments
- Running automated tests including Power Apps Test Studio tests
- Building-managed solutions from source control for deploy to downstream environments
- Deploying to downstream environments like test and production

Automation is tailored to each projects requirement but commonly has initiated, build, and release automations



When working on a project that uses automation you should be aware of the overall processes that are in place, however, building the automation is typically done by a DevOps focused resource.

## Power Platform build tools

Microsoft Power Platform Build Tools are a collection of Power Platform-specific tasks/actions that eliminate the need to manually download custom tooling and scripts to manage the application lifecycle of apps built on Microsoft Power Platform. They can be used individually to perform a task, such as importing a solution into a downstream environment, or used together in a pipeline to orchestrate a scenario.

The exact terminology differs depending on if you're using Azure DevOps or GitHub Actions to build the automation. For example, the Power Platform specific operations are called tasks for Azure DevOps and actions for GitHub Actions.

The following are some of the common operations:

- **Power Platform Checker** - Runs static analysis on your solution and allows catching problems early by adding it to your automation.
- **Export Solution** - Export a solution as unmanaged, managed or both from an environment.
- **Import Solution** - Import a solution into an environment.
- **Unpack Solution** - Used to break a compressed solution file into individual files for each component to allow checking them into source control.
- **Pack Solution** - Packs a solution represented in source control into a solution.zip file that can be imported into another environment.
- **Set Solution Version** - Allows you to update the version number in your automation allows implementing a consistent versioning strategy.
- **Create, Delete, and Copy Environments** - Allows automation of environment management as part automations.

Automating solution management is a good way to improve consistency of your application lifecycle on your projects. If you are working on a project using only manual processes, you should encourage your team to look into implementing some basic automations. In addition to being more consistent, implementing more complete application lifecycle management practices can improve the quality of the apps that you produce and deploy.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. Which of the following statements is true about building solutions?

- Solutions can be built in Power Apps only.
- Solutions can be built in Power Apps and Power Automate.
- Solutions can be built in Power Automate only.
- Solutions without flows can be built in Power Apps. Solutions with flows can be built in Power Automate only.

## Multiple choice

2. When can you add an item (such as a flow, app, or environment variable) to a solution?

- You can only add new items to a new solution.
- New solutions will not accept existing items.
- You can add an existing item and a new item to an existing or new solution.
- Items that are removed cannot be added back.

## Multiple choice

3. Which of the following statements regarding solution exporting and importing is true?

- Exporting and importing can only be in a single environment.
- Exporting and importing can be across environments but must be in a single tenant.
- Exporting and importing can be across tenants but with the same licenses.
- Exporting and importing can be across environments and tenants.

## Multiple choice

4. Do solutions automatically package dependent components?

- No, they do not. For example, Choices fields of an entity need to be added separately.
- Yes. Solutions can automatically recognize interdependent components.
- Yes, but only for the Power Apps app.
- Yes, but only for Power Automate flows.

## Multiple choice

5. How do Power Apps canvas apps and Power Automate flows handle connection references?

- Power Apps canvas apps and Power Automate flows handle connection references the same.
- Power Apps canvas apps reference all connectors. Power Automate references implicitly shared connections such as SQL server.
- Power Automate flows use connection references for all connectors. Power Apps apps only use them from implicitly shared connections such as SQL server.
- Power Apps canvas apps and Power Automate flows handle connection references the same except for cloud connections.

## Summary

In this module, you learned how to package your existing items into a solution. This module focused on creating solutions with a flow, editing existing solution-aware flows, importing and exporting solutions with flows, and deploying complex solutions with many components. You also learned how some components of the solution are dependent on other components.

# Load/export data and create data views in Dataverse

## View data in a table

Microsoft Dataverse has a few options for you to view data in tables.

To view data in an entity, follow these steps:

1. Sign in to the Power Apps portal.
2. On the left pane, expand **Dataverse** and select **Tables**.
3. Select the table that is associated with the data that you want to view.
4. Select **Data** on the menu at the top of the screen.
5. After activating the data screen, notice the option in the top menu called **Edit data in Excel**. If you select this option, you can work with all the data that is stored in this table by using Microsoft Excel. This process is further explored in unit 5 of this module.

## Create or edit views of data in a table

Follow these steps to create and save views of data in a table:

1. Sign in to the Power Apps portal.
2. On the left pane, expand **Dataverse** and select **Tables**. Select the table that is associated with the data that you want to view.
3. Select **Views** on the menu at the top of the screen.

Selecting **Views** opens a list of views of data that is associated with the table. You can open an existing view or create a new view.

## Open existing views

To open an existing view, follow the previous steps, select the name of the view that you want to see, and the view will open. You might notice that a filter has been applied to the data that is displayed within the view. You can change the filter and display different data by selecting the **Edit filter** link on the right-hand pane and adjusting how the data is filtered in the current view.

You can also add more columns to the view by selecting the plus sign (+) at the top of the view, where you will have the option to add more columns. Finally, you can change the sort order of data that is displayed by selecting the **Sort by** hyperlinks on the right side of the screen.

## Create a new view

To create a new view of data in a table, follow these steps:

1. Sign in to the Power Apps portal.
2. On the left pane, expand **Dataverse** and select **Tables**.
3. Select the table that is associated with the data that you want to view.
4. Select **Views** on the menu at the top of the screen.
5. Select **Add view** on the top menu.

6. Enter a **Name** and **Description** for the view and select the **Create** button.
7. Select the columns and the sort and filtering options that are desired. Select **Save** and then **Publish** in the top right of the screen.

## Load data into a table

Every table has required columns that must exist in your input file. We recommend that you create a template. First, export data from the table. Use the same file (modified with your data) to import data into the table.

This template typically saves time and effort. You will not have to account for the required columns for each table. If you are unfamiliar with how to export data from a table, the next lesson discusses the necessary steps in that process.

To load data into a table, use the following steps:

1. Prepare the file template.
  1. Export the table data to the CSV file.
  2. Define a plan to make sure that the data is unique. Use either primary keys or alternate keys.
  3. Ensure that data is unique before you import it into a table.
2. Copy data from your Microsoft Excel or CSV file into the template that you created.
3. Import the data into a table.
  1. Sign in to Power Apps.
  2. On the left pane, expand **Dataverse** and then select **Tables**.
  3. Select the table that you want to import data into.
  4. Select **Data**. Select the arrow next to **Get data** and then select **Get data from Excel**.
  5. On the **Import data** screen, choose whether to import data from an Excel or a CSV file.
  6. Select **Upload**.
  7. Choose your **file**. Follow the prompts to upload your file.
  8. After the file is uploaded and mapping status is green, select **Import** in the top-right corner.
  9. You can use Excel to add, update, or delete data and fix any mapping errors.

After the import finishes successfully, you will see the total number of inserts and updates that occurred.

## Export data from a table

You can quickly export data from an entity by using the built-in capabilities of Microsoft Dataverse.

1. Sign in to Power Apps.
2. On the left pane, expand **Dataverse** and select **Tables**.
3. Select the table that is associated with the data that you want to export.
4. Select the **Export data** button on the top menu.

Dataverse will export all data from the table into a zip file. The zip file is then available to download and will contain the data in a .csv file.

## Add, update, or delete data in a table by using Excel

Microsoft Dataverse can help you add, update, or delete data in a table by using a Microsoft Excel add-in feature.

1. Sign in to the Power Apps portal.
2. On the left pane, expand **Dataverse** and then select **Tables**.
3. Select the table that is associated with the data that you want to export.
4. Select the **Open in Excel** button on the top menu.
5. Sign in to Dataverse by using the Excel add-in located on the right-hand pane.

Now you can use Excel to add, update, or delete data by using the **New** and **Publish** buttons in the Excel add-ins.

**Tip:** To delete data, delete one or more rows in the spreadsheet and then select **Publish**. To edit data, simply edit any value in the spreadsheet and then select **Publish**.

## Import data using Power Query

A dataflow is a collection of tables that are created and managed in environments in the Power Apps service. You can add and edit tables in your dataflow, and manage data refresh schedules, directly from the environment in which your dataflow was created.

Once you create a dataflow in the Power Apps portal, you can get data from it using the Dataverse connector or Power BI Desktop Dataflow connector, depending on which destination you chose when creating the dataflow.

There are three primary steps to using a dataflow:

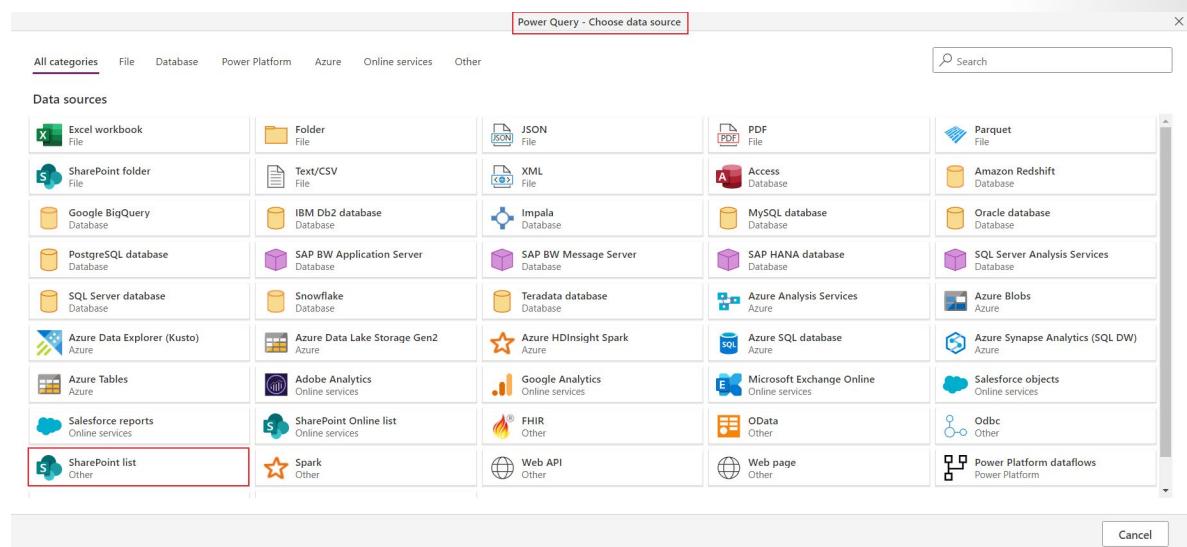
1. Author the dataflow in the Power Apps portal. You select the destination to load the output data to, the source to get the data from, and the Power Query steps to transform the data using Microsoft tools that are designed to make doing so straightforward.
2. Schedule dataflow runs. This is the frequency in which the Power Platform Dataflow should refresh the data that your dataflow will load and transform.
3. Use the data you loaded to the destination storage. You can build apps, flows, Power BI reports, and dashboards or connect directly to the dataflow's Common Data Model folder in your organization's lake using Azure data services like Azure Data Factory, Azure Databricks or any other service that supports the Common Data Model folder standard.

## Create a dataflow

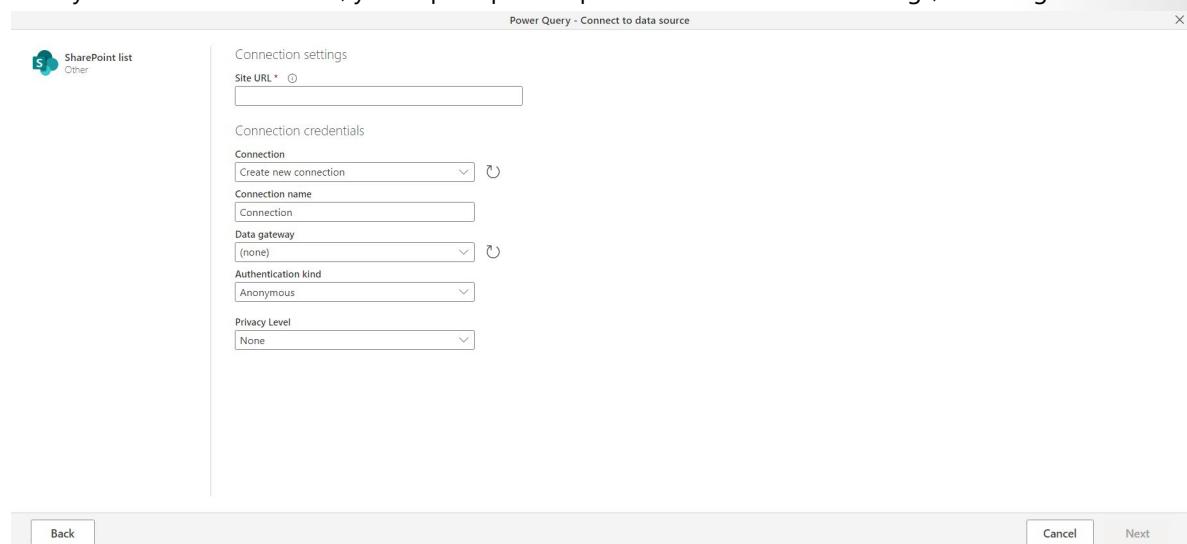
Dataflows are created in one environment, this means that you will only be able to see and manage them from that environment. And if any user wants to get data from these dataflows they must have access to the environment in which the dataflows were created.

1. Sign in to the Power Apps portal.
2. Select an environment.
3. On the left pane, expand **Dataverse** and then select **Tables**.
4. From the Top Menu, Select **Data**.

5. Select **Get data**.



6. From the Power Query window, Select **SharePoint list**.
7. After you select a data source, you're prompted to provide the connection settings, including the



account to use when connecting to the data source. Select **Next**.

8. Once connected, you select the data to use for your table. When you choose data and a source, the Power Platform Dataflow service will then reconnect to the data source in order to keep the data in

The screenshot shows the 'Power Query - Choose data' dialog. On the left, there's a navigation pane with a search bar and a 'Display options' dropdown. Below it is a tree view of a SharePoint Online list named 'InsuranceData'. The main area displays a table titled 'InsuranceData' with 37 rows of data. The columns are: FileSystemObjectType, Id, ServerRedirectedEmbedUnit, ContentType, Title, ComplianceAssetId, Expiry, Location, State, Region, and Insu. A red box highlights the 'Title' column header. At the bottom right of the dialog are 'Cancel' and 'Next' buttons, with 'Next' also highlighted by a red box.

your dataflow refreshed, at the frequency you select later in the setup process. Select **Next**.

9. Now that you've selected the data to use in the table, you can use the **Power Query dataflow editor** to shape or transform that data into the format necessary for use in your dataflow.

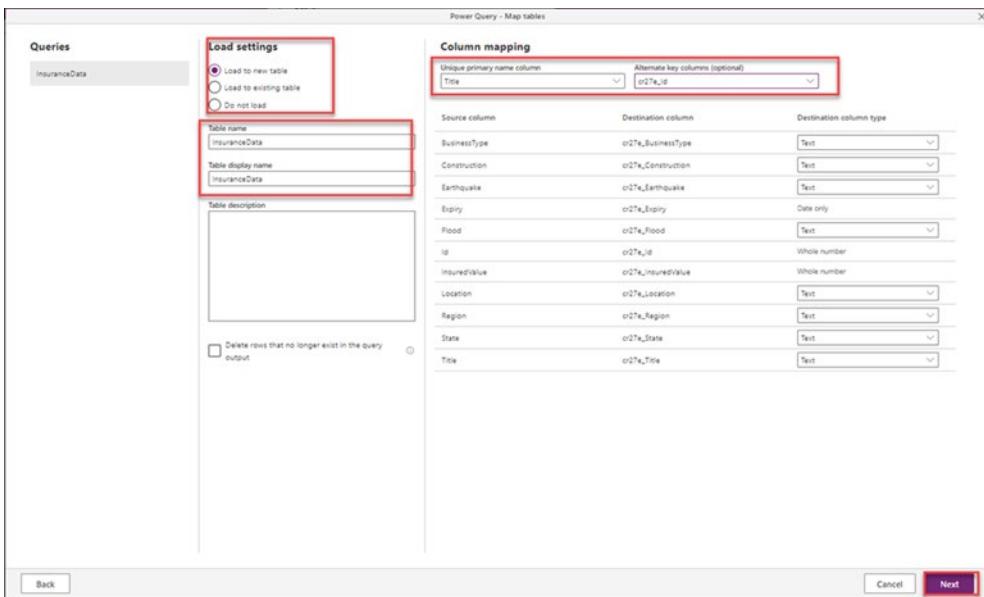
The screenshot shows the 'Power Query - Choose data' dialog again, but this time the 'InsuranceData' table is empty, indicated by the message 'No items selected for preview'. The rest of the interface is identical to the previous screenshot, with the 'Next' button highlighted by a red box.

In my example, I have removed unnecessary columns. When you're done, Select **Next**.

Now, you will be asked to map your data, you can map it to a new table or load to an existing table or don't load.

10. In our case, we will choose to **Load the data into new table**.

11. Under Table name, Provide a name for your table. You can also provide a table description.  
 Having a primary key column in the entity helps in avoiding duplicates in the data rows. A primary key column is a column that's unique and deterministic of a data row in the entity.
12. Under Column mapping, from the **Unique primary name column**, Select a primary name. You can also select Alternate key fields, if you like.  
 In our case, we will choose Title and we will select the ID column as the Alternate key.

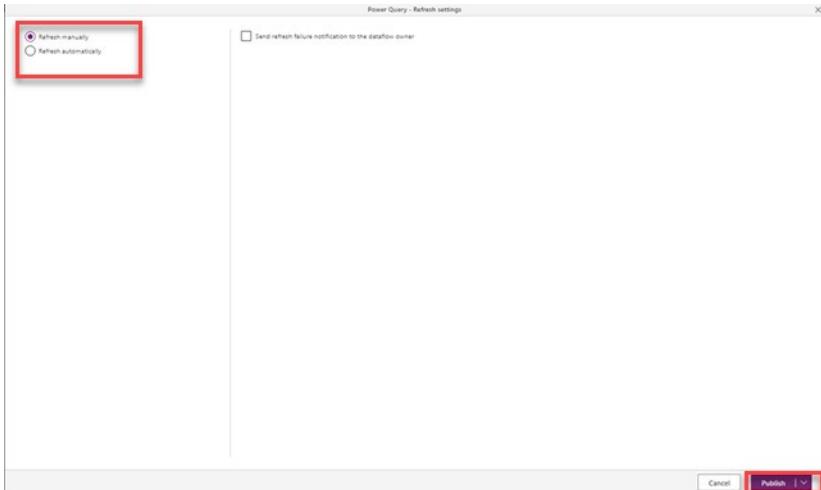


13. Under **Destination column type**, verify that destination column type is correct.  
 Once you've completed your selections and your table and its data settings are complete, you're ready for the next step, which is selecting the refresh frequency of your dataflow. Select **Next**.  
 Once your tables have been defined, you'll want to schedule the refresh frequency for each of your connected data sources.  
 Dataflows use a data refresh process to keep data up to date. You can choose to refresh your dataflow manually or automatically on a scheduled interval of your choice.

14. In our case, Select **Refresh manually**.

You can also decide if you want to Publish now or Publish later.

15. Select **Publish**.



16. Great, your dataflow is currently refreshing, and available in the Dataflows section.

17. If you navigate to the Dataverse tables, you will see the table that we just map the data to. And then you can check your data in the Data tab as shown below.

## Generate a new dataflow from an Excel Template

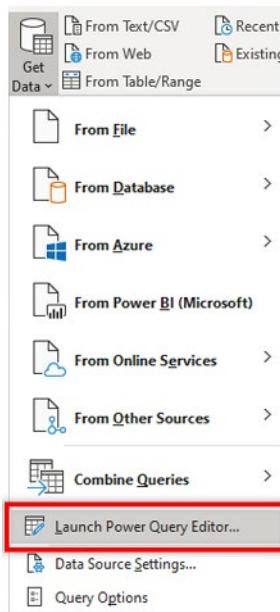
You can create Microsoft Power Platform dataflows from queries in Microsoft Excel workbooks to take advantage of cloud-powered dataflows refreshing and processing the data at regular intervals instead of performing these operations manually in Excel.

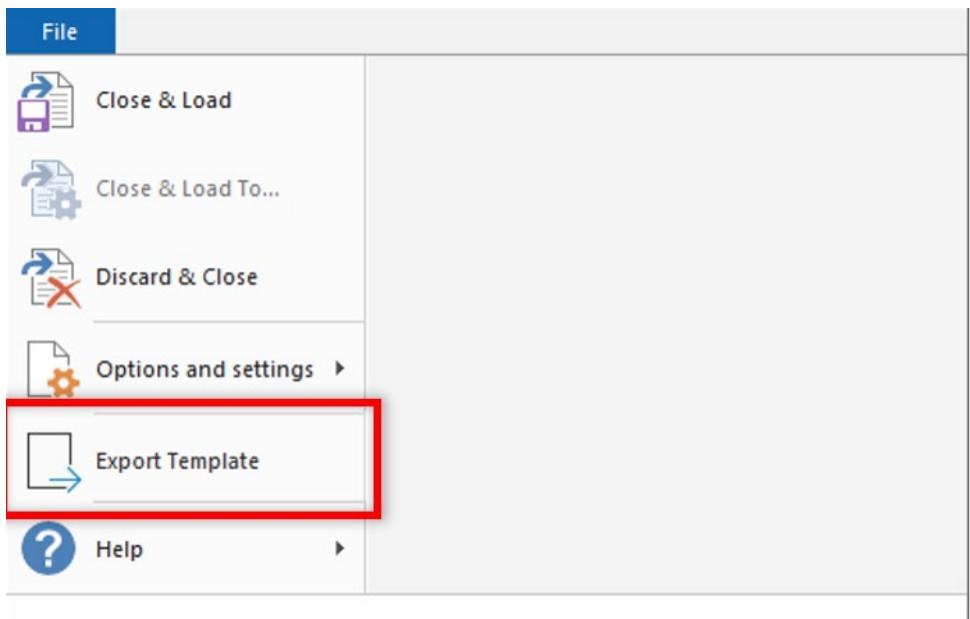
Working with large datasets or long-running queries can be cumbersome every time you have to manually trigger a data refresh in Excel because it takes resources from your computer to do this, and you have to wait until the computation is done to get the latest data. Moving these data operations into a Power Platform dataflow is an effective way to free up your computer's resources and to have the latest data easily available for you to consume in Excel.

### Exporting queries in Excel to a Power Query template

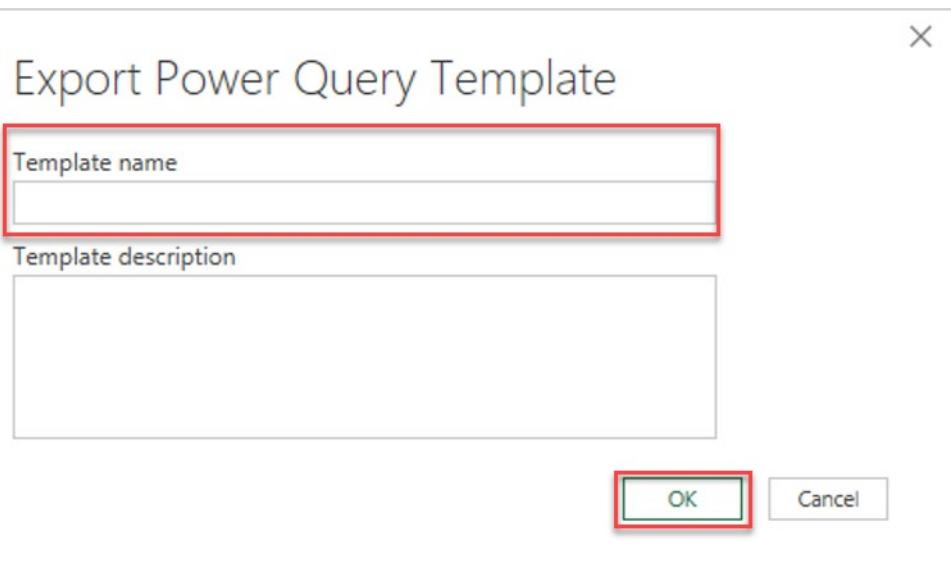
The first step is to create a Power Query template with your queries in Excel.

1. Start the Power Query editor from Data tab > Get Data > **Launch Power Query Editor**.





2. Once Power Query loads, select File > **Export Template**.

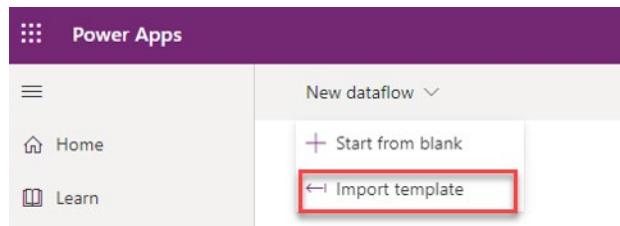


3. Name your template and add a description, Select **OK**.

## Creating a Power Platform dataflow from the Power Query template

1. Sign in to the Power Apps portal.
2. Select an environment.
3. In the left navigation pane, select **Dataverse > Dataflows**.

4. From the toolbar, select **New dataflow > Import template**.



5. Select the Power Query template you created earlier. The dataflow name will prepopulate with the template name provided. Once you're done with the dataflow creation screen, select **Next** to see your queries from Excel in the query editor.
6. From this point, follow the steps in the previous chapter on creating a dataflow and configuration process so you can further transform your data, set refresh schedules on the dataflow, and any other dataflow operation possible.

## Dataflow and Azure integration

Microsoft Dataverse supports integration with Azure. You can configure dataflows to store their data in your organization's Azure Data Lake Storage Gen2 account.

**Azure Data Lake Storage** lets you collaborate with people in your organization using Power BI, Azure Data, and AI services, or using custom-built Line of Business Applications that read data from the lake. Dataflows that load data to an Azure Data Lake Storage account store data in Common Data Model folders. Common Data Model folders contain schematized data and metadata in a standardized format, to facilitate data exchange and to enable full interoperability across services that produce or consume data stored in an organization's Azure Data Lake Storage account as the shared storage layer.

**Advanced Analytics and AI with Azure:** Power Platform dataflows store data in Dataverse or Azure Data Lake Storage, which means that data ingested through dataflows is now available to data engineers and data scientists to use the full power of Azure Data Services, such as Azure Machine Learning, Azure Databricks, and Azure SQL Data Warehouse for advanced analytics and AI. This enables business analysts, data engineers, and data scientists to collaborate on the same data within their organization.

## Check your knowledge

Choose the best response for each of the questions below.

### Multiple choice

1. Which of the following can you use Excel for with Microsoft Dataverse tables?

- Add and create new tables to store data.
- Add, edit, or delete data.
- Add and delete tables.
- Create new tables and add data to the new table.

## Multiple choice

2.Which of the following can be done in Dataverse?

- Export data from a table.
- Export data from one or more tables as zipped markdown files.
- Load data from any file type into a table.
- All of the above.

## Multiple choice

3.Which of the following statements is not true about views?

- You can create many views of a table.
- You can sort and filter the data in a view.
- You can choose the fields that are available in a view and edit at any time.
- You can create only two views for each table.

## Summary

In this module, you learned how to:

- View data within a table.
- Create or edit views of data in a table.
- Load data into a table.
- Export data from a table.
- Add, update, or delete data in a table using Excel.

For more information about using Microsoft Excel with Microsoft Dataverse, see [Open table data in Excel<sup>2</sup>](#).

<sup>2</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/data-platform-excel-addin>

# Get started with AI Builder

## Introduction to AI Builder

Welcome to AI Builder. This self-paced module will help you build an AI model from the beginning and will show you how to use it in your business without writing a single line of code.

### AI Builder defined

AI Builder is a Microsoft Power Platform capability that helps you improve your business performance by automating processes and predicting outcomes. By using AI Builder, you can quickly bring AI to your apps and flows that connect to your business data that is stored in the underlying data platform (Microsoft Dataverse) or in various cloud data sources, such as SharePoint, OneDrive, or Azure.

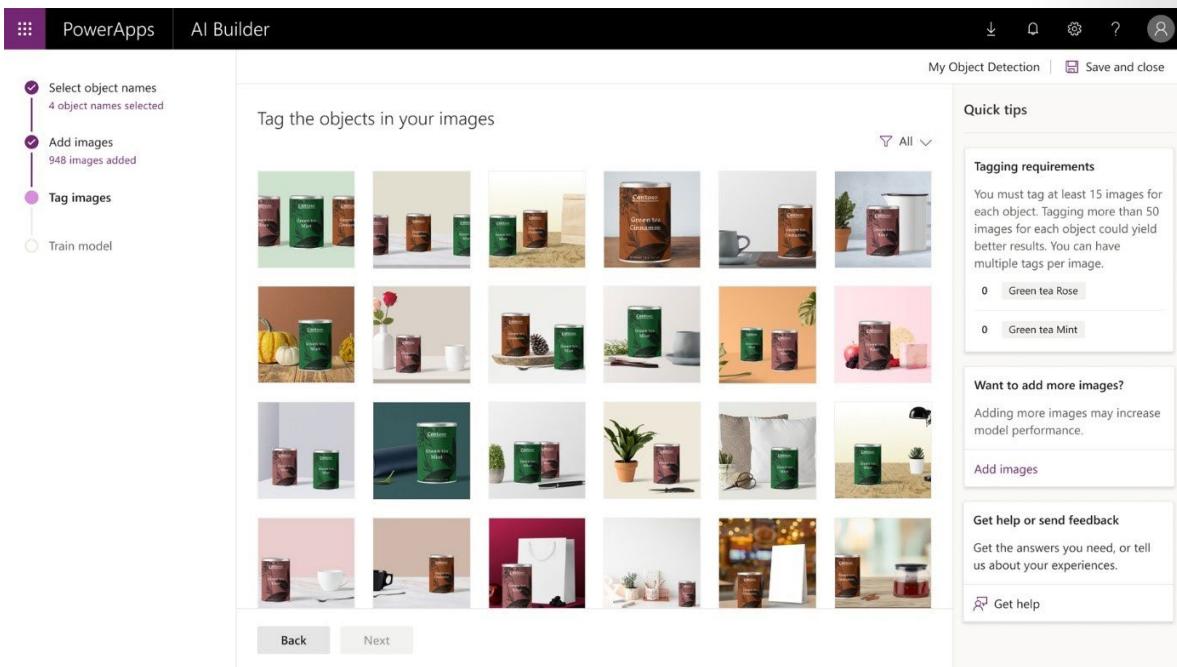
AI models that you create in AI Builder can help provide intelligence to enhance your business. AI Builder simplifies the AI creation experience by giving people with any level of technical skill the ability to add AI capabilities to their apps and flows without writing code. AI Builder also provides prebuilt AI models, where you don't need to gather data to build and train the model. You can start to use the intelligence right away.

### What you can do with AI Builder

You can use AI Builder to create custom AI models that suit the needs of your business, or you can choose from a selection of prebuilt models. You can then use the AI from these models in your apps and workflows.

For example, with AI Builder you can:

- Analyze text for classification, key phrases, language, and sentiment.
- Predict whether something will happen.
- Process business card information.
- Process text from images.
- Read and save information from standard documents.
- Recognize and count items in images.



A common use of AI Builder is to automate processes. The following examples can help you think about how you can use AI in your business:

- **Invoice processing** - Companies often receive invoices in large quantities and from a variety of sources, such as mail, fax, email, or in person. Processing these documents and manually entering them into your database can take considerable time. By using AI to extract the text, key/value pairs, and tables from your documents, you can create workflows to automatically pipe the information into your database. You can even create an app to review the information.
- **Text analysis** - Businesses today are collecting more data than ever before. Whether it's from survey responses, product reviews, user feedback, or support emails, generating the proper insights is important to understanding your business and your customers. By using AI to analyze text, you can identify customer feedback that contains negative sentiment or certain key phrases. Use AI to identify problems and then trigger the necessary workflows to take action.

## Where you can use AI Builder

You can access AI Builder within Power Apps and Power Automate.

The screenshot shows the Power Apps | AI Builder interface. On the left, there's a navigation menu with options like Home, Learn, Apps, Create, Data, Flows, AI Builder (which is selected), Build, Models, and Solutions. The main content area has several sections: 'Enhance your business with AI' featuring 'Form Processing (preview)', 'Object Detection (preview)', 'Prediction (preview)', and 'Text Classification (preview)'; 'Refine a model for your business needs'; 'Get straight to productivity' featuring 'Business Card Reader (preview)', 'Key Phrase Extraction (preview)', 'Language Detection (preview)', and 'Sentiment Analysis (preview)'; and 'Text Recognition (preview)'. The top right includes environment settings and help icons.

Two available areas under AI Builder in the left side menu are:

- **Build** - Where you create and get started by using AI models.
- **Models** - Where your created and shared models reside.

## Next steps

Now that you've learned about AI Builder, your next step is to gain in-depth knowledge about the available AI capabilities.

## Choose an AI capability

AI Builder offers several AI capabilities.

AI capabilities are brought to your apps and flows by models. A model can be built and customized by you, or it can be a prebuilt model that is ready to be used right away. Before learning about the model creation process, you should be familiar with the various model types that are available.

## Choose a model

AI Builder comes with a wide variety of models to enhance your apps and business processes.

1. Sign in to Power Apps or Power Automate and select **AI Builder > Build** on the left menu. Each tile

The screenshot shows the AI Builder interface within the Power Apps environment. On the left, there's a navigation sidebar with options like Home, Learn, Apps, Create, Data, Flows, AI Builder, Build, Models, and Solutions. The main area is titled "Enhance your business with AI" and "Refine a model for your business needs". It displays eight tiles representing different AI capabilities:

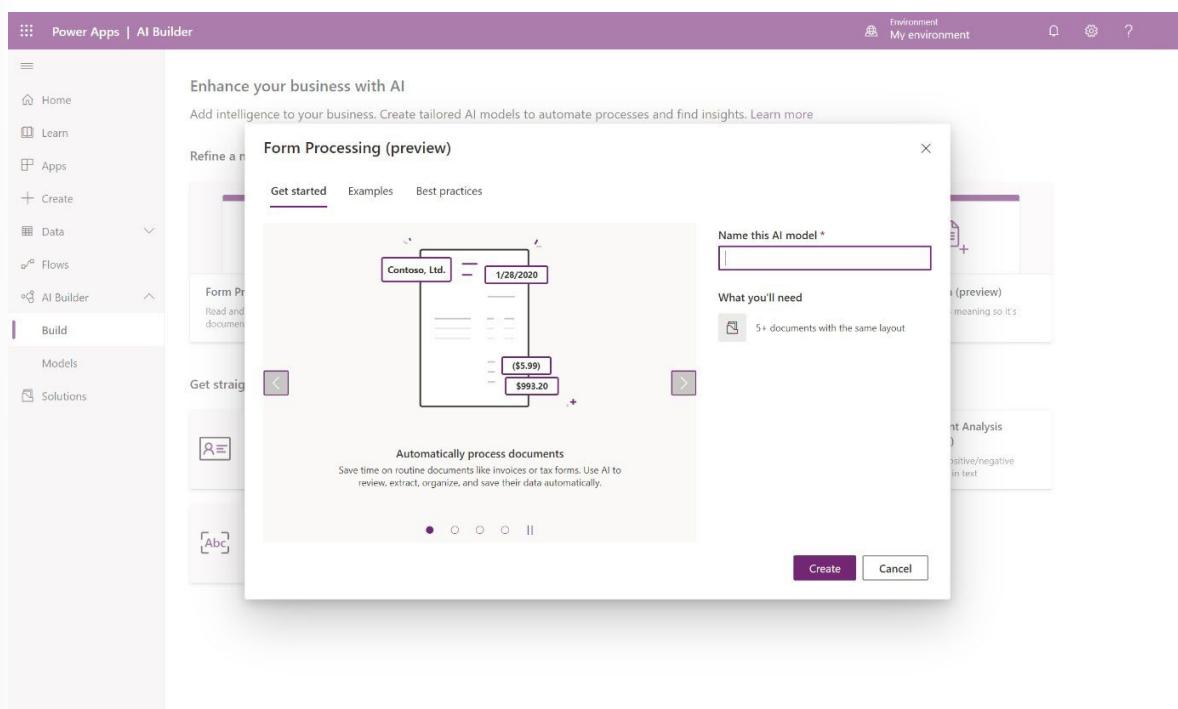
- Form Processing (preview)**: Read and save information from standard documents.
- Object Detection (preview)**: Recognize and count things in images.
- Prediction (preview)**: Predict whether something will happen.
- Text Classification (preview)**: Categorize text by its meaning so it's easier to analyze.
- Business Card Reader (preview)**: Automatically process business card information.
- Key Phrase Extraction (preview)**: Extract the key talking points from text.
- Language Detection (preview)**: Identify the language being used in text.
- Sentiment Analysis (preview)**: Analyze positive/negative sentiment in text.

A note at the bottom states: "represents a different AI capability that you can bring to your business."

2. Select any tile.

## Learn about the model

Each AI Builder model has an introductory experience where you can learn more about the model.



For those models that require customization, AI Builder provides a summary of the steps that you need to take and what you need to get started. The **Examples** tab also includes examples of how you can use the model.

For prebuilt models, AI Builder includes best practices on how to use them and buttons that you can select to get started using them right away.

## Next steps

Now that you have learned about AI capabilities, your next step is to learn how models are created and managed.

## Create your first model

You can create a model in AI Builder by following a few simple steps.

### Select a model type

Sign in to Power Apps or Power Automate and select **AI Builder > Build** on the left menu.

The two classes of model are:

- Models that require customization before they can be used
- Models that are prebuilt and can be used right away

Prebuilt models have already been created for you and can be used right away in your apps and flows. No prior work is needed to create the model.

The following sections explore what you can do with the models that you customize.

Select the tile for one of the following model types:

- Form processing
- Object detection
- Prediction
- Text classification

Make sure that you have everything you need to create your model, as listed on the **Get started** tab. You can also use **sample data**<sup>3</sup> to create any of these models.

1. Enter a name for your model in the **Name this AI model** field.
2. Select **Create**.

## Follow the guided experience

To help create your model, AI Builder offers a guided experience that will walk through each step of the experience.

Every model type has its own set of steps to create a model. You can find these steps outlined in the left column to help guide you through the model creation process. As you progress from step to step, the left column will be updated to reflect your progress.

At any time during the creation process, you can save your work and come back later. Select **Save and close** in the upper-right corner, next to the name of your model. Progress is also saved automatically when you go between steps.

Along the right column is a list of **Quick tips** that can help you understand some of the concepts and actions that you need to take in the current step. If you need more help, select the **Get help** link on the **Get help or send feedback** tip card, where you can report an issue, send feedback, and find documentation.

Follow the instructions on each page to advance to the next step.

The final step is a summary of the customizations that you made in the previous steps. Review this information to be sure that every detail is configured as intended, and then begin training your model. Training might take a while depending on the size of your data.

After the training has been completed, your model is ready to be tested.

## Next steps

You have now learned how to create your first model. Next, you'll learn how to use your model in Power Apps and Power Automate.

## Ways to use your models

After creating your AI Builder model, you can use it in Power Apps and Power Automate.

## View your model details

After your model has completed training, you can view important details about your newly trained model on a details page for that model. The information might vary depending on the model type.

<sup>3</sup> <https://docs.microsoft.com/en-us/ai-builder/samples/>

The screenshot shows the Power Apps AI Builder interface. On the left, a navigation menu includes Home, Learn, Apps, Create, Data, Flows, AI Builder (which is currently selected), Build, Models (selected), and Solutions. The main content area displays a model named 'My Form Processing model'. It shows a 'Training document' with a preview of an invoice form, a 'Selected fields' list (Contoso, Ltd., INVOICE, Date, Due Date, Fabrikam, Inc., Balance Due, Subtotal, Tax (2%), Shipping, Total), and a section titled 'How your model is used' which lists 'Power Automate Model isn't published' and 'Power Apps Model isn't published'. At the bottom are 'Publish' and 'Quick test' buttons.

On the model details page, you can see the customizations that you made to train your model. In some cases, it shows additional insights on the training performance. Some model types give you the opportunity to quick test your model to see it live in action.

You can access this page at any time from the left menu by selecting **AI Builder > Models** and then searching for your model name.

## Publish your model

Your model can't be used until it is published. If you are satisfied with your model, select **Publish** to make it available.

Three main ways that you can use your model are:

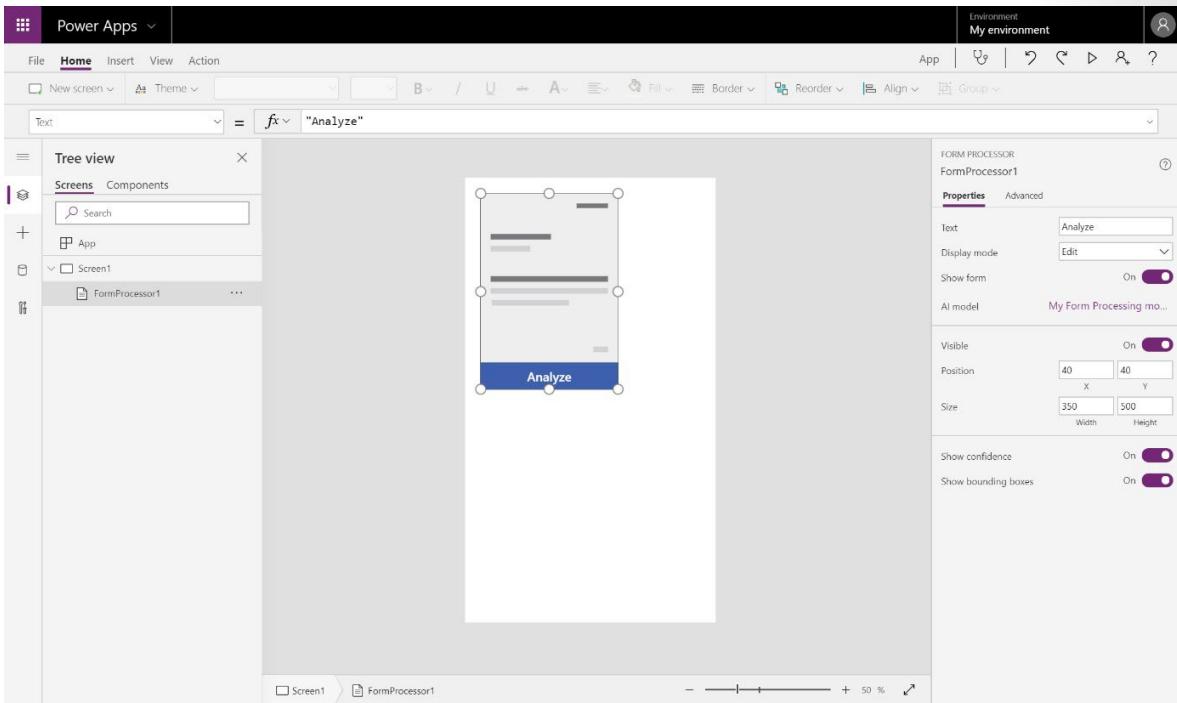
- As a component in an app
- As an action in a flow
- As new data in your database

When your model is published, select **Use model** to see a list of the available actions that you can take to use your model.

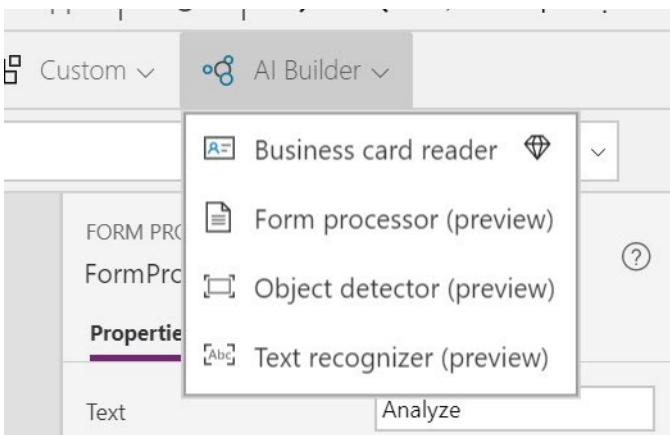
## Use your model in an app

In the **Use your model** pane, select **Create new app**, which appears if your model type supports it.

This selection redirects you to the canvas app creation experience, with the AI Builder component already added to your canvas and your model automatically linked to the component.



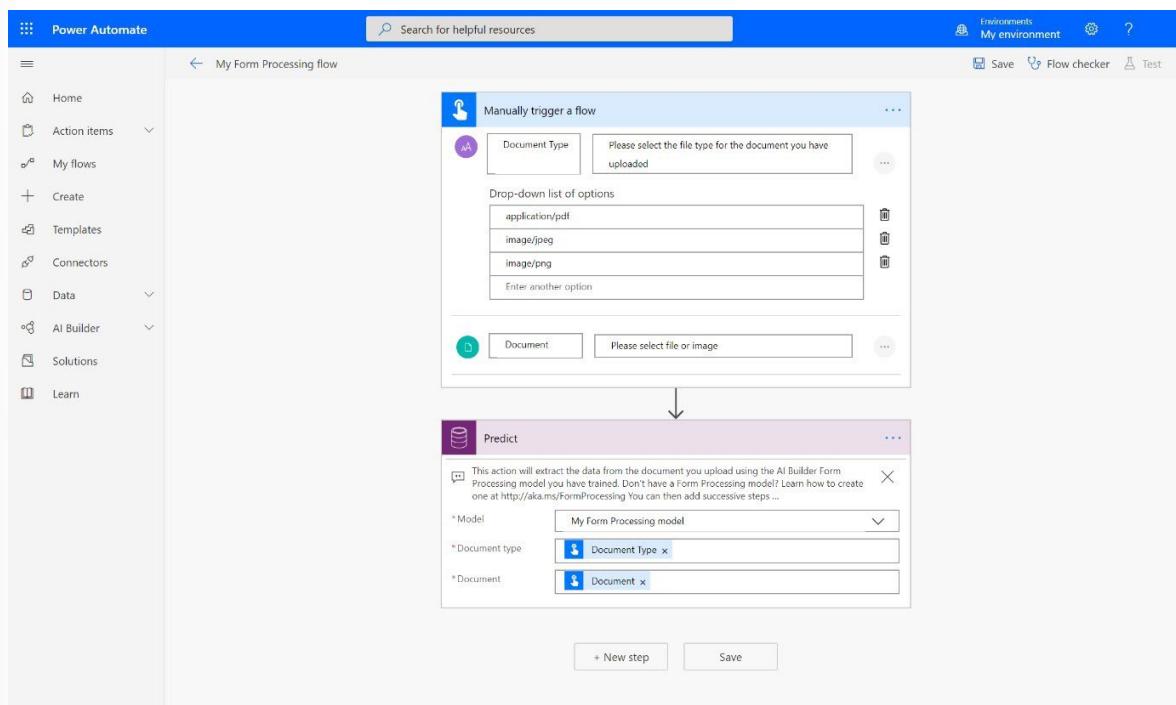
You can add AI Builder components to your existing apps at any time by selecting the **Insert** tab and then selecting the component from the **AI Builder** menu.



## Use your model in a flow

In the **Use your model** pane, select **Create new flow**, which appears if your model type supports it.

This selection redirects you to the flow template page in Power Automate. Confirm the connections and then select **Continue**.



In the flow creation experience, you'll find the AI Builder action already added to your flow and your model automatically linked to the action.

You can add the AI Builder action to **solution-aware flows<sup>4</sup>** by searching for the **Predict** action under **Microsoft Dataverse** and then selecting your model name from the **Model** drop-down menu.

## Use your model in your database

Some model types write the intelligence back to your database, so you can use it in your data views in Power Apps or Power BI.

After you have published your model, some model types automatically begin scheduling the model to write data back to your database by default. For others, you can customize the scheduling. In the **Use your model** pane, select **Set run schedule** to define the frequency. This option appears when the model supports it.

You have now learned the various ways that you can use your AI Builder models in Power Apps and Power Automate.

## Check your knowledge

Choose the best response for each of the questions below.

<sup>4</sup> <https://docs.microsoft.com/en-us/power-automate/create-flow-solution/>

## Multiple choice

1. Which of the following statements is true?

- AI Builder is only available in Power Apps.
- AI Builder is only available in Power Automate.
- AI Builder is available in both Power Apps and Power Automate.

## Multiple choice

2. You have customized a model by using the guided experience. What is the final step that you must take before you can use it?

- Create it
- Publish it
- Save it
- Train it

## Multiple choice

3. What do you need to do before you can use a prebuilt model?

- Gather data
- Train the model
- Publish the model
- Nothing

## Summary

Congratulations on creating your first model with AI Builder.

In this module, you discovered how to bring AI to your business by using AI Builder.

Specifically, you learned that:

- A wide variety of AI capabilities are at your disposal.
- Some model types can be customized to your needs, whereas other model types can be used right away.
- You can use your model in several different ways: in your apps, in your flows, and in your database.

# Manage models in AI Builder

## Model lifecycle

Learn how your model can develop over time.

An AI Builder model goes through several stages as it evolves from when you create it through publishing, sharing, and use. The following sections describe each of those stages.

### Create your model

You can find all the AI Builder model types and capabilities on the **Build** page, which you can access from the left menu. This page is where you start to create a new custom AI model, or select a prebuilt model that you can use right away.

### Draft models

When you've made progress building and customizing your AI model, you can save a draft to finish later. You can come back at any time and continue where you left off.

### Trained models

After you have finished building your AI model, you're ready to train it. During training, your model learns from your data to perform to your specifications. The time it takes for your model to train depends on the size of your data.

After training is complete, you can view additional training and performance information on the details page. In some cases, you can also quick test to see your model live in action.

### Published models

If you are satisfied with your model, you're ready to publish it. You have to publish a model before it can be available to use in Power Apps and Power Automate, so it's important not to miss this step.

### Keep track of your model

Any models you create can be accessed at any time by visiting the **Models** page, which you can access from the left-side menu in AI Builder. The **Models** page shows a complete list of your models, as well as their date of latest training and the various states we've learned about here.

### Next steps

Now that you have learned how your model can develop over time, your next step is to learn how to edit your model to improve its performance and how to manage multiple model versions.

## Manage model versions

Learn how to manage multiple versions of your model.

Getting the best model performance for your business can be a rather iterative process. Results can vary depending on the customizations you make to the model, and the training data you provide.

To help facilitate this process, AI Builder allows you to have multiple versions of your model so you can use your model and continue to improve it at the same time.

## Edit your model

Editing your model creates a new version that is based on your existing customizations. To edit your model, follow these steps:

1. Select **AI Builder > Models** on the left menu.
2. Find your model and select it to go to its details page.
3. In the upper-left corner of the screen, select **Edit model**.

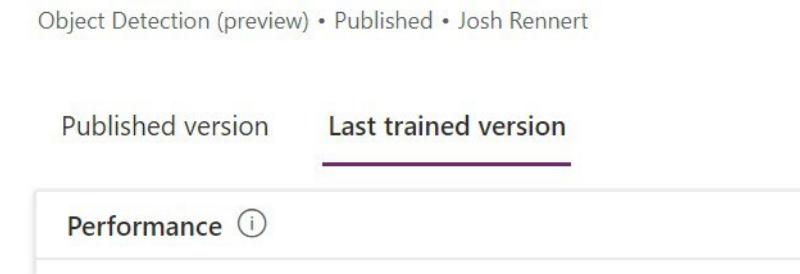
While you edit your model, you can save your work at any time and return later. The new version will be saved as a draft, which you can access again from your model's details page and by selecting **Resume draft**.

## Work with multiple versions

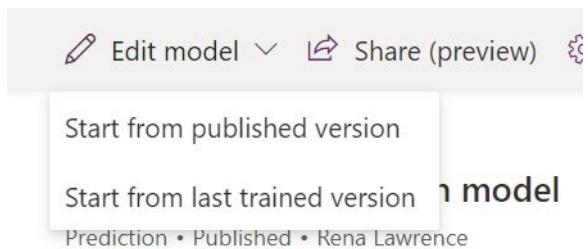
You can have three versions of your model at any given time:

- One published version
- One *last trained* non-published version
- One draft version

On the model details page, you can switch between the trained versions using the pivots at the top of the page.



When you edit your model, if you have a published version and a last trained version, you can start from the configuration of either version.



## What's next?

You now know how to manage multiple versions of your model. Next, you'll learn how to share your model so others in your organization can use it.

## Share your models

Learn how other people in your organization can use your model.

By default, only you can see the models you create and publish. This feature allows you to test them and use them within apps and flows without exposing them.

If you want others to use your model, you can share it with specific users, groups, or your whole organization.

### Share your model

1. Click **AI Builder > Models** on the left menu.
2. Find your model name and select it to access its details page.
3. In the top left corner of the screen, select **Share**.

### Use a shared model

In addition to the models you create yourself, the models that are shared with you by others appear on the **Models** page, accessible from the left menu.

The screenshot shows a user interface for managing models. At the top, there are two tabs: 'My models' (which is underlined in purple) and 'Shared with me'. Below the tabs, there is a search bar containing the placeholder text 'Name'. To the left of the search bar is a small icon of two overlapping circles.

When a model is shared with you, you have user permissions to use it in apps and flows. You cannot view details or edit the model.

You now know how to share your model with other people in your organization.

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. *What is the purpose of training your model?*

- It creates the model
- It makes it available for use
- It learns from your data
- It makes it stronger

## Multiple choice

2. *How many trained model versions can you have at one time?*

- One
- Two
- Three

## Multiple choice

3. *By default, who can see and use a model you have created?*

- Just me
- People in my environment
- People in my organization
- Everyone

## Summary

In this module, you learned all about the lifecycle of a model, managing model versions, and sharing your model.

Specifically, you learned that:

- A model can assume various states between the time it was created and the time it is being used.
- You can have multiple versions of your model so you can use your model and continue to improve it at the same time.
- You can share your model for it to be used by others in your organization.

# Use AI Builder in Power Automate

## Introduction to AI Builder usage in Power Automate

Microsoft Power Automate is a great way to automate AI Builder usage and exploit AI model results at scale.

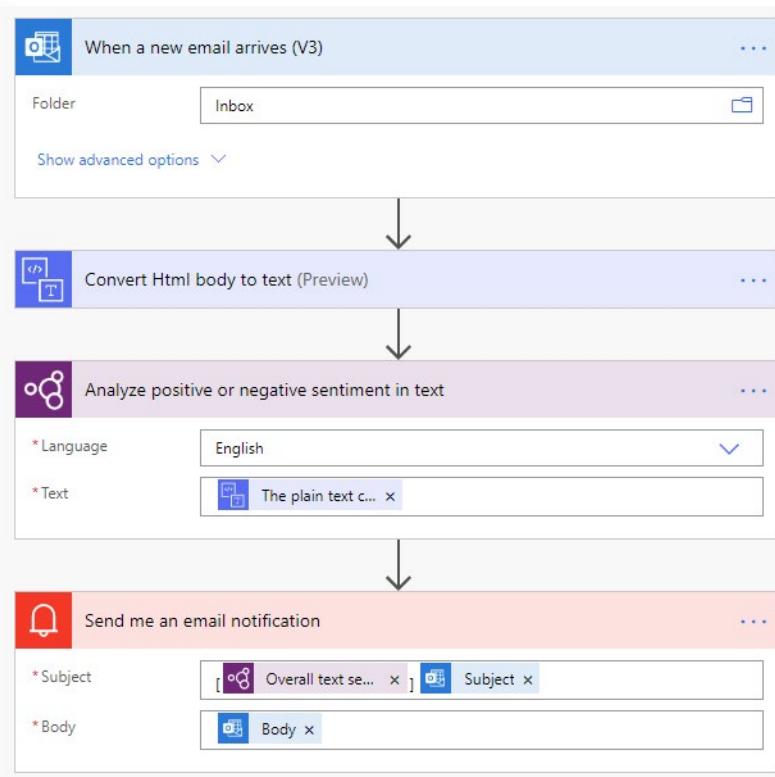
### AI Builder usage in Power Automate

Power Automate offers AI Builder actions that enable usage of all model types in flows. Adding AI Builder actions in your flow allows you to:

- Perform model inference by using outputs of upstream actions (email attachments received, SharePoint files dropped, created records in a Microsoft Dataverse entity, and so on).
- Process model inference results in downstream actions (send by email, store in Dataverse records, message in Teams, and so on).

The following illustration shows a simple flow with three main stages:

1. Receive an email in Microsoft Outlook.
2. Detect sentiment of the email body by using the AI Builder sentiment analysis model.
3. Send an email notification with the sentiment detected in the email by using the **Overall text sentiment** output from the AI Builder model



# AI Builder in Power Automate saves time

This section describes various use cases that can be fulfilled by using AI Builder and Power Automate.

## Prerequisites

- Access to **Power Automate**<sup>5</sup>.
- A license or trial of the **AI Builder**<sup>6</sup>.
- An **environment**<sup>7</sup> with a **Microsoft Dataverse database**<sup>8</sup>. (Applicable only for work or school accounts).
- A basic understanding of Power Automate and experience with creating a flow is recommended.

## Invoice processing

Companies often receive invoices in large quantities and from various sources, such as mail, fax, email, or in person. Processing these documents and manually entering them into your database can take considerable time. This process can be greatly improved by:

- Using the **AI Builder form processing** model to extract the columns and tables from your documents.
- Creating a Power Automate flow to automatically move information into your database.

## Analyze email sentiment

Employees might want to process emails according to their overall sentiment, for example:

- If my boss is angry, I'd like to know the reason right now.
- If my customer isn't satisfied, I need to answer immediately to avoid generating more frustration.
- After sharing a document, I want to track the positive and negative feedback.

AI Builder allows you to analyze overall sentiment of a text and even the sentiment of each sentence. By using a Power Automate flow, you can apply the **AI Builder sentiment analysis** model on receipt of an email and be notified of the sentiment of important emails to you.

You can also combine the sentiment analysis with key phrase detection by using the **AI Builder key phrase extraction** model.

## Dematerialize documents

Companies can have multiple sites in which some key information is still entered on paper form. Afterward, an agent will manually enter the form content into a centralized tool.

This process can be improved by using Power Automate and AI Builder in the following ways:

- The agent takes a picture of each audit record and saves it in a folder.
- A Power Automate flow processes all new pictures in the folder, sends them to your **AI Builder text recognition** model to extract the forms' information, and then saves them in the centralized tool.

<sup>5</sup> <https://flow.microsoft.com/>

<sup>6</sup> <https://docs.microsoft.com/en-us/ai-builder/administer-licensing>

<sup>7</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview>

<sup>8</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database>

Similar processes could be used to record business cards at scale by using the **AI Builder business card reader** model.

## Filter support requests by language

Typically, support teams receive many requests from customers worldwide. The team in charge of a request can vary, depending on the language. So it's important to detect language as quickly as possible to redirect requests to the relevant teams.

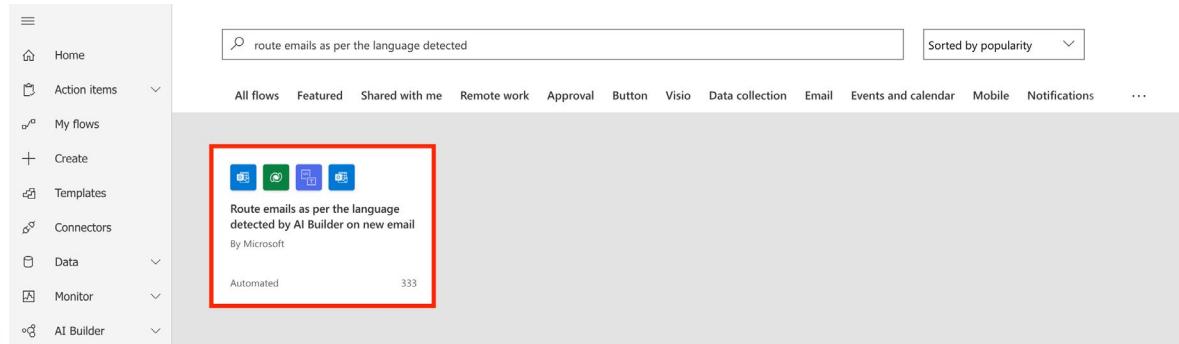
To solve this use case, you can build a Power Automate flow that:

- Checks for the language of a received email by using the **AI Builder language detection** model.
- Routes the email into the mailbox of the team in charge, depending on the language that is detected.

## Exercise - Create a flow to route Helpdesk requests to different mailboxes based on language

In this exercise, we'll be using a flow template that connects to a pre-configured Language Detection model. This pre-configured Language Detection model is available in environments where *sample apps and data* are enabled.

1. Sign in to **Power Automate**<sup>9</sup> using your organizational account.
2. In the **Search for a template by app, task, or industry** field, enter *route emails as per the language detected* and select the **Search Icon**.



3. Select the **Route emails as per the language detected by AI Builder on new email** flow template.

<sup>9</sup> <https://ms.flow.microsoft.com/>

4. At the bottom of the screen, under *This flow will connect to:*, ensure all of your connections have been entered correctly and select **Continue**. If any of the connections are missing or incorrect, you can't

Power Automate

Search for helpful resources

Environments Contoso (default)

Route emails as per the language detected by AI Builder on new email

Office 365 Outlook → Microsoft Dataverse, Content Conversion, and Office 365 Outlook

PREMIUM

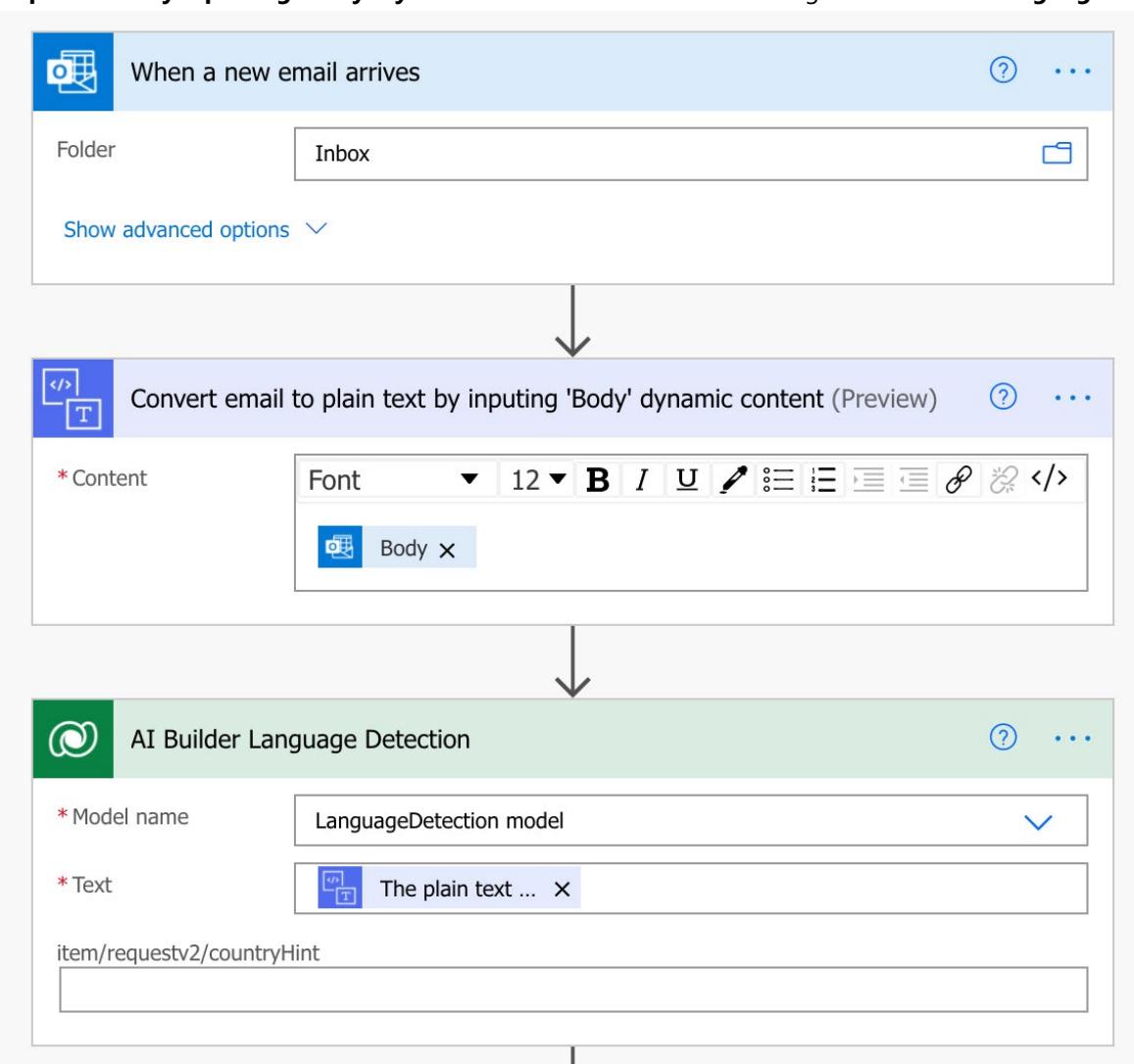
When a new email arrives, route emails according to the language of email detected using AI Builder. Please refer the document for language code to be used here: <https://docs.microsoft.com/en-us/azure/cognitive-services/text-analytics/language-support#language-list-and-status>

This flow will connect to:

	Office 365 Outlook Permissions	NestorW@M365x868006...	<input checked="" type="checkbox"/>	...
	Microsoft Dataverse	NestorW@M365x868006...	<input checked="" type="checkbox"/>	...
	Content Conversion	Content Conversion	<input checked="" type="checkbox"/>	...

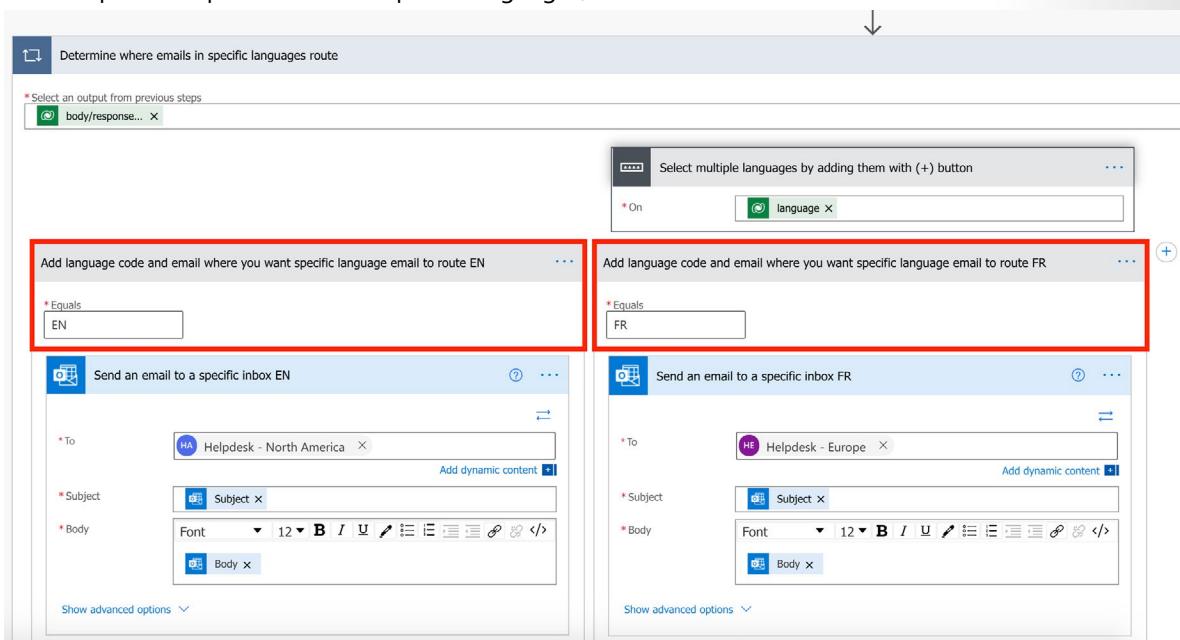
continue.

5. In the first 3 steps of this flow, it's checking a mailbox for new emails, then using the AI **Convert email to plain text by inputting 'Body' dynamic content** action and then using the **AI Builder Language**



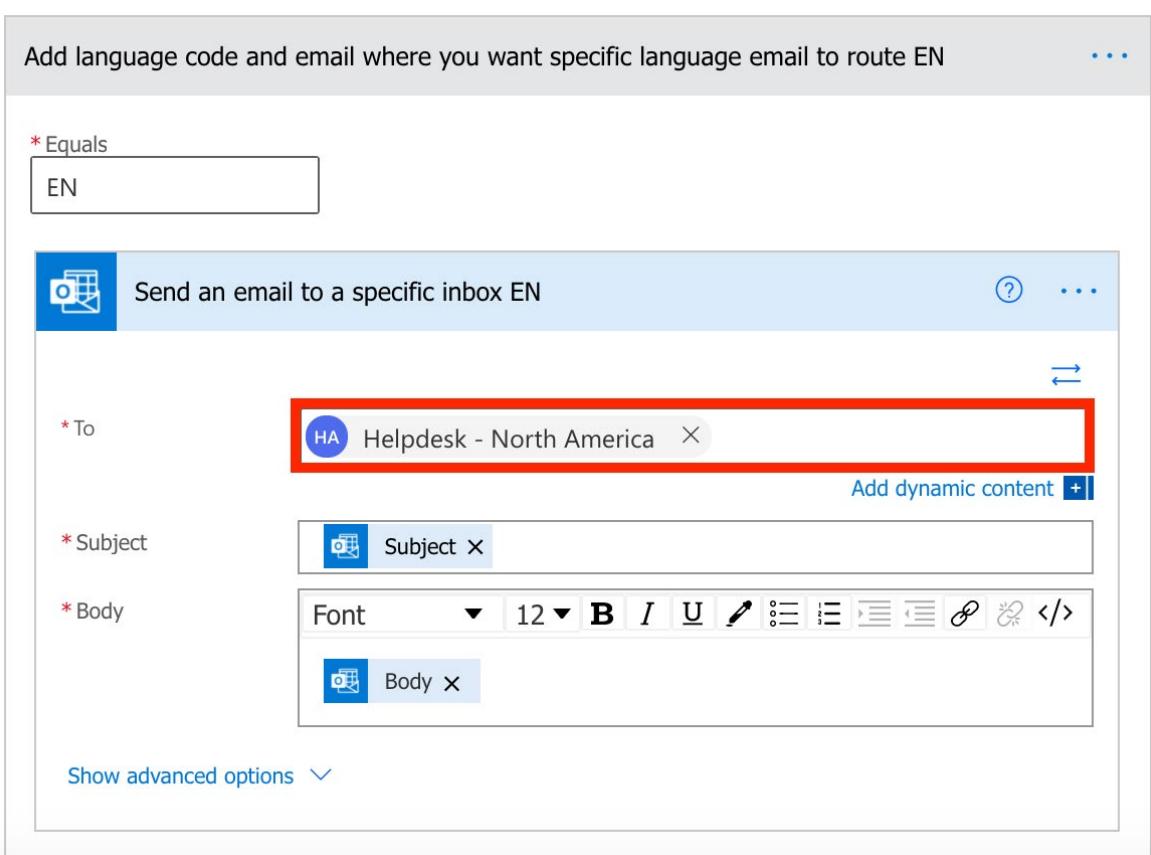
In this example, we're just using our logged-in user account, but in a real-world scenario this would most likely be a shared Helpdesk mailbox.

1. This template has predefined a couple of languages, **EN** and **FR**. You could add more cases for other



languages as well by selecting the + icon.

2. In the **Send an email to a specific inbox EN** step, select the **To** field and enter an email address. In



this example, I'll use our **Helpdesk - North America** mailbox.

3. Repeat the previous step, but enter a different email address. In this example, I'll use our **Helpdesk - Europe** mailbox.
4. At the bottom of the screen, select **Save**.

Any new emails will now be routed to the correct Helpdesk mailbox based on the language detected.

This example is meant to demonstrate the possibilities and potential of using Power Automate and AI in your own organizations.

## Categorize feedback

A public-facing company might need to categorize feedback that they receive for more relevant processing. For example, a hotel might need to know if feedback targets check-in, rooms, staff, or restaurant.

A company as such can fulfill this scenario by creating a flow that would perform these two actions:

- Get new feedback:
  - Power Automate gets data directly from external sources, for example, new messages on Twitter. A flow could be triggered on tweets that mention the company name.
  - Power Automate gets data from an aggregated data source, for example, a table in Microsoft Dataverse. A flow could be triggered on new record creation.
- Categorize the feedback by using the **AI Builder category classification model**.

That's it for this unit! Now that you know more about how Power Automate and AI can assist with streamlining various business processes you're ready to build a custom flow using AI connectors. Head to the next unit, **Exercise - Use AI Builder actions in Power Automate** to continue on your learning path.

## Exercise - Use AI Builder actions in Power Automate

In this section, you'll discover and use AI Builder actions in Power Automate through the creation of a simple flow.

### Prerequisites

- Access to **Power Automate**<sup>10</sup>.
- A license or trial of the **AI Builder**<sup>11</sup>.
- An **environment**<sup>12</sup> with a **Microsoft Dataverse database**<sup>13</sup>. (Applicable only for work or school accounts).
- A Microsoft Office 365 account with access to OneDrive for Business and Excel Online (Business).
- A basic understanding of Power Automate and experience with creating a flow is recommended.

### Create a flow from a solution

Start by **signing in**<sup>14</sup> to Power Automate and then following all instructions in this section.

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<sup>10</sup> <https://flow.microsoft.com/>

<sup>11</sup> <https://docs.microsoft.com/en-us/ai-builder/administer-licensing>

<sup>12</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview>

<sup>13</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database>

<sup>14</sup> <https://flow.microsoft.com/>

To add AI Builder actions in a flow, create the flow from a Microsoft Dataverse solution.

1. Go to **Solutions** from the navigation bar on the left.
2. Create a new solution called **My AI Builder solution**, select a Publisher, and then select **Create**.
3. Now select the **My AI Builder solution** solution to open it.
4. Select **+New > cloud flow** in the action bar on the top of the screen. The flow designer screen

The screenshot shows the Microsoft Flow Designer interface. At the top, there is a search bar labeled "Search connectors and triggers". Below the search bar is a navigation bar with tabs: All (selected), Built-in, Standard, Premium, Custom, and My clipboard. The main area displays a grid of connectors and a list of triggers.

**Connectors:**

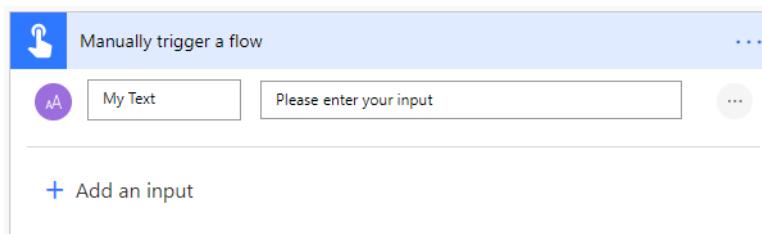
Icon	Name
	Flow button for mobile
	PowerApps
	Power Virtual Agents
	Microsoft Forms
	SharePoint
	OneDrive for Business
	Planner
	Microsoft Dataverse
	RSS
	Gmail
	Microsoft Teams
	Google Calendar
	Azure DevOps
	Office 365 Outlook

**Triggers:**

Category	Action	See more
Triggers	Manually trigger a flow Flow button for mobile	
Actions	PowerApps PowerApps	
Triggers	When Power Virtual Agents calls a flow Power Virtual Agents	
Actions	When a new response is submitted Microsoft Forms	
Triggers	When an item is created SharePoint	
Actions	When an item is created or modified SharePoint	

appears and asks you to choose the trigger action.

5. In the **Triggers** section, select **Manually trigger a flow > + Add an input > Text**. Name your input **My Text**, as shown in the following figure.



6. Select **+ New step**. You'll now add an AI Builder action.

## Search for and add an AI Builder action

In this example, you'll add the AI Builder action that allows sentiment analysis. Choose one of the following options to help you accomplish this task:

A screenshot of the Microsoft Flow "Choose an operation" dialog. At the top, it shows a blue header bar with a hand icon and the text "Manually trigger a flow". Below it is a search bar with the placeholder "Analyze sentiment". A large downward arrow points from the top header to the search bar. The main area has tabs for "All", "Built-in", "Standard", "Premium", "Custom", and "My clipboard", with "All" selected. Below the tabs are icons for various actions: AI Builder, SharePoint, Text Analytics, Computer Vision API, Rencore Code, Microsoft Dataverse, and Cloudmersive NLP. Further down, there are sections for "Triggers" and "Actions". The "Actions" section contains three items: "Analyze positive or negative sentiment in text" (AI Builder), "Update file properties using AI Builder model results" (SharePoint), and "Sentiment (V3.0)" (Text Analytics). Each item has a small icon, a name, a description, and an info icon.

1. In the search field, enter "Analyze sentiment".

2. Open the AI Builder action group. This action group lists all available AI Builder actions. You can pick

The screenshot shows the Microsoft Flow interface. At the top, there is a blue bar with a hand icon and the text "Manually trigger a flow". Below this is a purple header bar with the "AI Builder" logo and three icons: a question mark, a three-dot menu, and a close button. A downward arrow points from the "Manually trigger a flow" bar to the "AI Builder" header. The main area is a search results page titled "Search connectors and actions". It has tabs for "Triggers" and "Actions", with "Actions" selected. On the right, there is a "See more" link. Below the tabs, there is a "Search" input field with a left arrow icon and the placeholder "Search connectors and actions". The results list contains nine items, each with a purple AI Builder icon and the name of the action:

- Analyze positive or negative sentiment in text
- Classify text into categories with one of your custom models
- Classify text into categories with the standard model
- Detect and count objects in images
- Detect the language being used in text
- Extract entities from text with one of your custom models
- Extract entities from text with the standard model
- Extract the key phrases from text
- Predict

Each item also has an "i" icon to its right.

the action from that page.

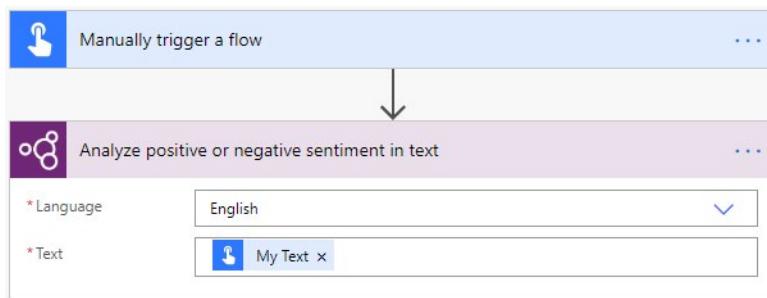
3. From the available actions, select **Analyze positive or negative sentiment in text**.

## Configure the AI Builder action

Each AI Builder action has different parameters, depending on the underlying model requirements.

For the AI Builder sentiment analysis model, **Language** and **Text** are the two mandatory fields to fill in.

1. In the **Language** field, select **English** as the language.



2. In the **Text** field, select **My Text**, which is defined in the trigger action. The **My Text** value will be provided during flow testing, so you don't need to focus on it right now.
3. Select **Save**. Your flow is now saved with an autogenerated name. You can change it by selecting the generated name on the upper-left corner of the flow designer screen. Name your flow **My AI Builder flow**.

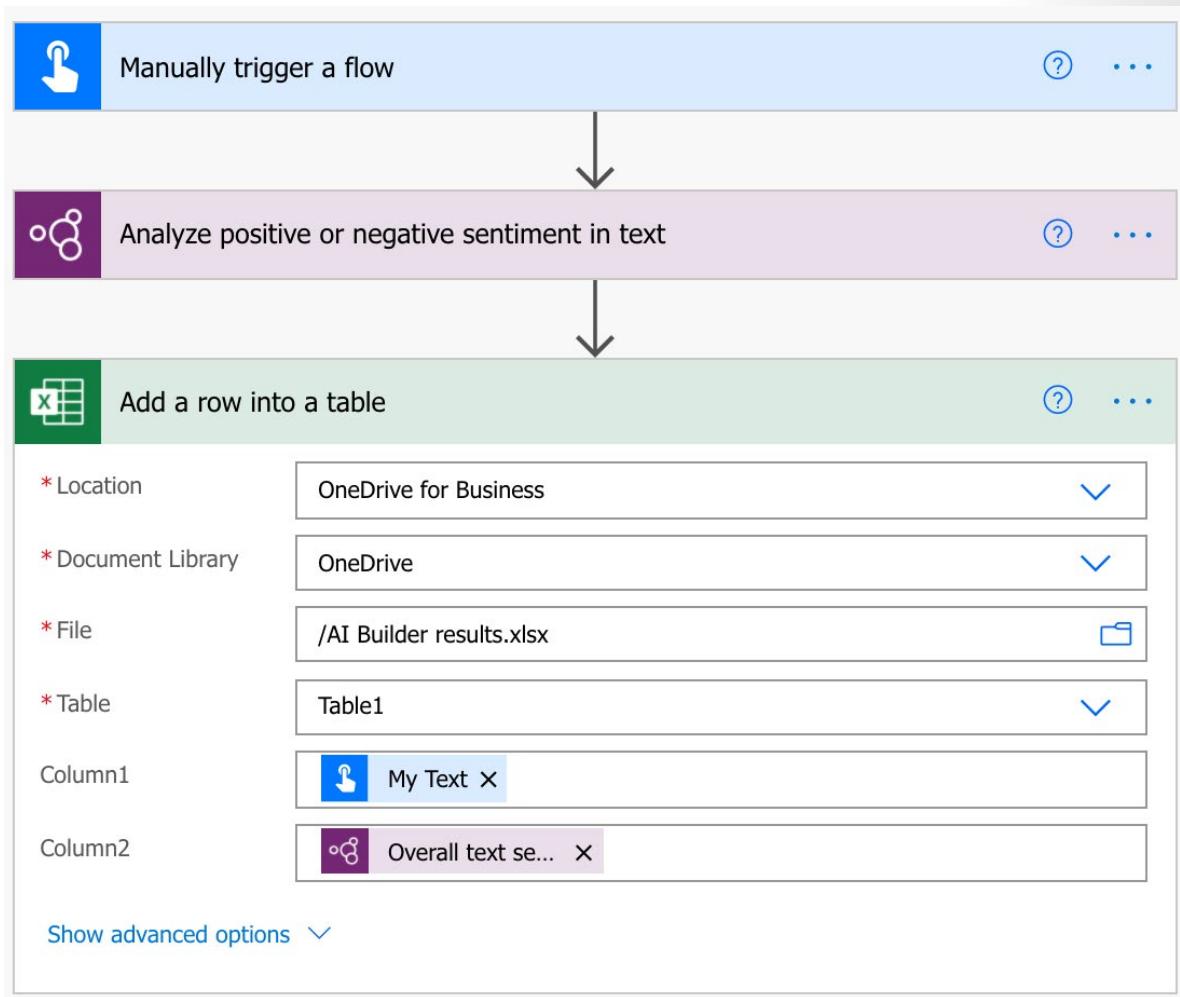
## Use the model's inference

For this exercise, you'll use a Microsoft Excel file in OneDrive to store the text sentiment that is detected by the AI model.

1. Create an Excel file named **AI Builder results.xlsx** in your OneDrive.
2. In this file, insert a table with two columns and then save the file (make sure that you use the **Insert > Table** function of Excel).

	A	B
1	Column1	Column2
2		
3		
4		

3. In **My AI Builder flow**, select **+ New step** and then add the **Add a row into a table** action from Excel Online (Business).
4. Complete the **Location, Document Library**, and **File** fields to point to the Excel file on your machine.
5. In the **Table** field, select the name of the table that you created in your Excel file.



- In the **Column 1** field, add **My Text**, and in the **Column 2** field, add **Overall text sentiment**.
- Select **Save**.

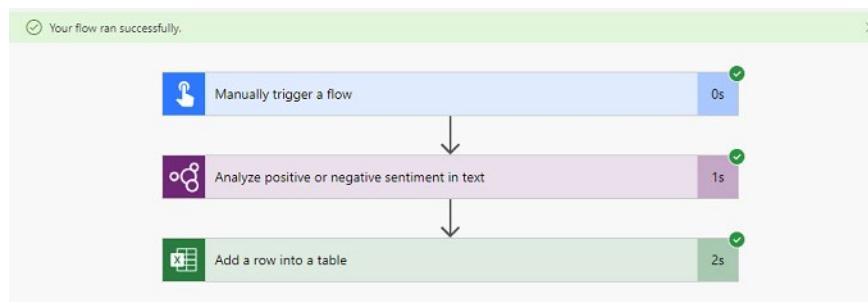
## Test the flow

Before productizing a flow, it's always a good idea to test it during design phase.

- Select **Test** on the upper-right corner of the flow designer screen.
- Select **Manually - Perform the starting action to trigger it**. and the select **Save & Test**.
- Provide the value of the **My Text** field from the trigger action. This text is what you want to analyze the sentiment for. For this example, we'll enter *It was the best sandcastle he had ever seen.*

My Text \*

It was the best sandcastle he had ever seen.



4. Select **Run flow**. If your flow ran successfully, you would see all steps shown with a green checkmark.
5. You can expand the actions to view the running inputs and outputs of each action, which is a good way to debug your flow.
6. Check that the line has been correctly added in the Excel file.

	A	B
1	Column1	Column2
2	It was the best sandcastle he had ever seen.	positive
3		

Congratulations, you've successfully created your first AI Builder flow.

For more information, see [Use AI Builder in Power Automate<sup>15</sup>](#).

## Advanced usage of AI Builder in Power Automate

In this section, you'll discover how to install your AI Builder flows to fulfill your business scenarios.

### Prerequisites

- Access to [Power Automate<sup>16</sup>](#).
- A license or trial of the [AI Builder<sup>17</sup>](#).
- An [environment<sup>18</sup>](#) with a [Microsoft Dataverse database<sup>19</sup>](#). (Applicable only for work or school accounts).
- A basic understanding of Power Automate and experience with creating a flow is recommended.

### AI Builder flow templates

[Power Automate templates<sup>20</sup>](#) contain preconfigured logic that eases creation of flows for specific business purposes.

To create a flow from an AI Builder template, follow these steps:

1. Select the **My templates** tab in the left menu. The list of available templates will appear.

<sup>15</sup> <https://docs.microsoft.com/en-us/ai-builder/use-in-flow-overview/>

<sup>16</sup> <https://flow.microsoft.com/>

<sup>17</sup> <https://docs.microsoft.com/en-us/ai-builder/administer-licensing>

<sup>18</sup> <https://docs.microsoft.com/en-us/power-platform/admin/environments-overview>

<sup>19</sup> <https://docs.microsoft.com/en-us/power-platform/admin/create-database>

<sup>20</sup> <https://us.flow.microsoft.com/templates/>

2. Enter **AI Builder** in the search bar and then press the **Enter** key. All AI Builder templates will be

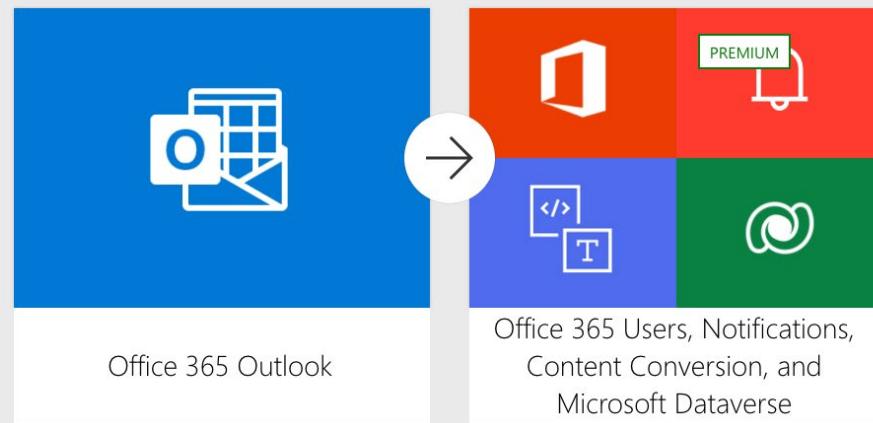
The screenshot shows a search results page for 'AI Builder' in Microsoft Power Automate. The search bar at the top contains the text 'AI Builder'. To the right of the search bar is a dropdown menu set to 'Sorted by popularity'. Below the search bar is a navigation bar with tabs: 'All flows' (which is selected and highlighted in blue), 'Featured', 'Shared with me', 'Remote work', 'Approval', 'Button', 'Visio', 'Data collection', 'Email', 'Events and calendar', 'Mobile', 'Notifications', and '...'. The main area displays a grid of 12 AI Builder template cards, each with a title, description, creator, status, and count.

Template Title	Description	Creator	Status	Count
Send a notification with the sentiment of manager's email using AI Builder	Click a button to read and save information from documents using AI Builder	By Microsoft	Automated	1864
Analyze emails sentiment with AI Builder and send results to Teams	Extract text from images or PDF documents using AI Builder Text Recognition	By Microsoft	Automated	3722
Click a button to read information from invoices using AI Builder	Extract entities of received emails using AI Builder	By Microsoft	Instant	2341
Create contact in CDS from a business card using AI Builder on button click	Track expenses by scanning receipts added to your OneDrive for Business	By Microsoft	Instant	662
Click a button to recognize and count objects in images using AI Builder	Make Office 365 email image attachments searchable using AI Builder	By Microsoft	Automated	507
Route emails according to category of a text by AI Builder on new email	Classify Teams messages using AI Builder and add results into Excel	By Microsoft	Automated	459
				358

displayed, as shown in the following figure.

3. Select the **Send a notification with the sentiment of manager's email using AI Builder** template.

## Send a notification with the sentiment of manager's email using AI Builder



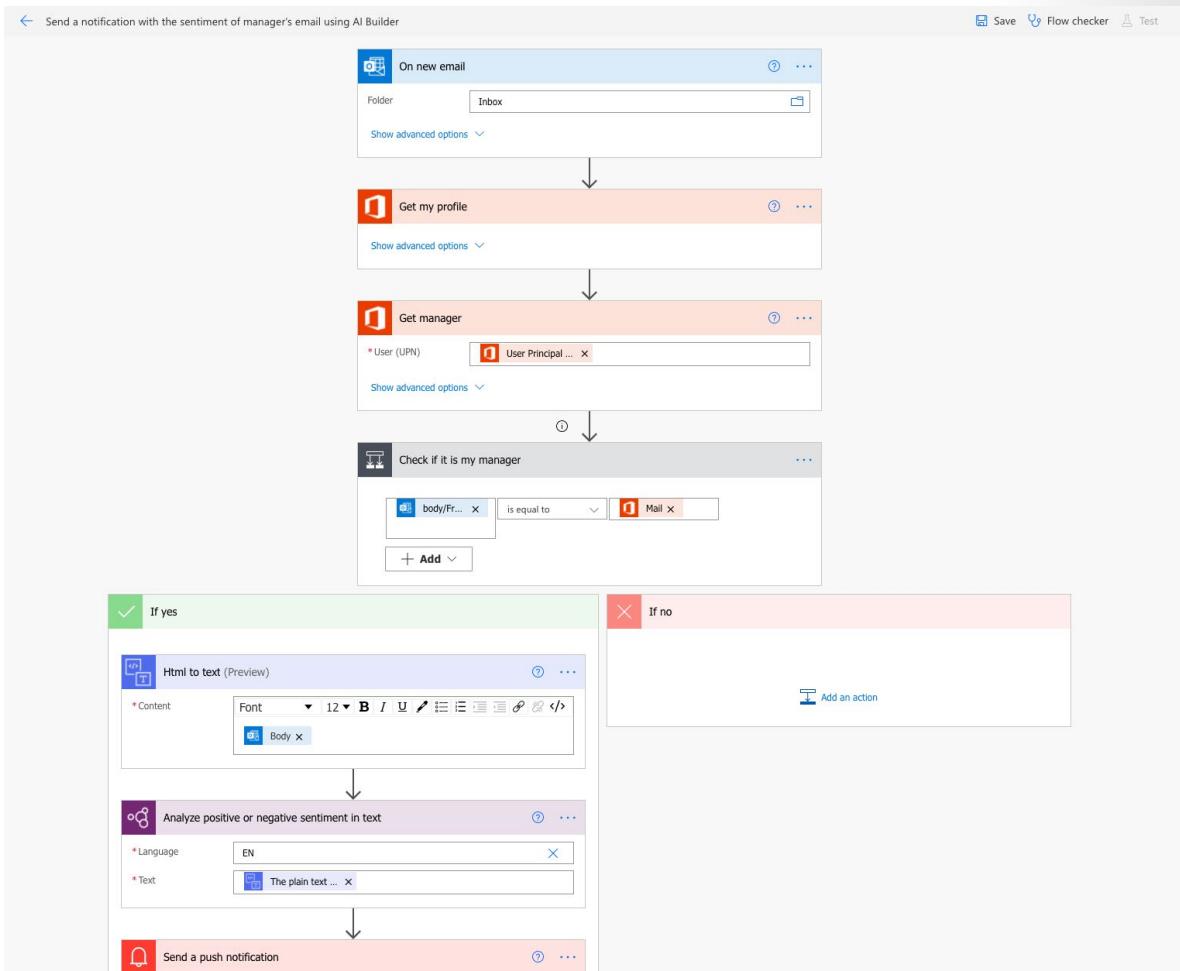
Use Sentiment Analysis from AI Builder to analyze the positive/negative sentiment of your manager's emails and receive a push notification.

This flow will connect to:

	Office 365 Users Permissions	NestorW@M365x868006...	<input checked="" type="checkbox"/>	...
	Notifications	Notifications	<input checked="" type="checkbox"/>	...
	Office 365 Outlook Permissions	NestorW@M365x868006...	<input checked="" type="checkbox"/>	...
	Content Conversion	Content Conversion	<input checked="" type="checkbox"/>	...
	Microsoft Dataverse	NestorW@M365x868006...	<input checked="" type="checkbox"/>	...

You'll see a summary of the template with a list of the connections that will be used.

4. At the bottom, select **Continue**.



- A preconfigured flow appears (at this stage, the flow isn't yet saved). You can save the flow as-is or update it at your convenience:
  - Modify existing actions: input parameters, action name, or advanced parameters
  - Add new actions
  - Remove existing actions (this step will likely break the actions downstream)
- Once you're done, select **Save** and then you can test the flow.

## Create a flow from AI Builder studio

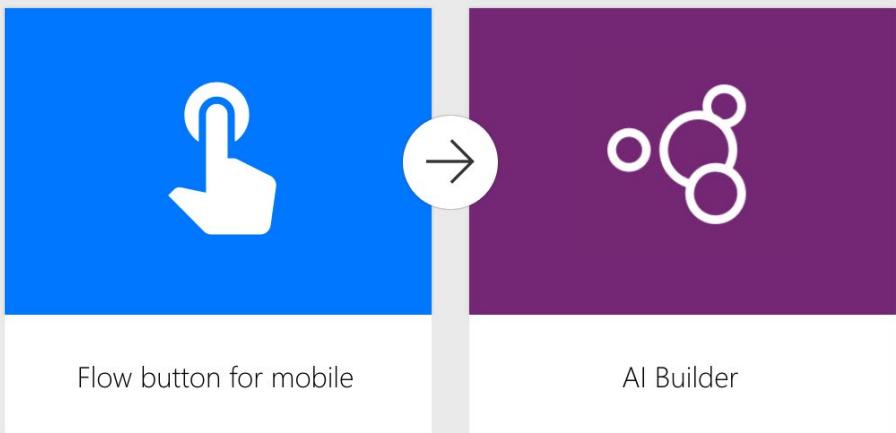
From AI Builder studio, you can launch the creation of a flow by using your favorite model.

The following example shows a custom form processing model. The detail page of the model contains a **Use model** button (the model must be published). Selecting this button will open a right panel that offers multiple options, as shown in the following figure.

The screenshot shows the Microsoft AI Builder interface. On the left, there's a preview of a "Training document" which looks like an invoice. To the right, under "Selected fields", are listed "From", "Invoice", "Date", "Bill To", "Balance due", and "Total". On the far right, a sidebar titled "Use your model" contains two main sections: "+ New app" (which says "Insert an AI Builder component to a canvas app. Learn more") and "+ New flow" (which says "Start a new flow using your model with the AI Builder action. Learn more"). The "+ New flow" section is highlighted with a red border.

Selecting **+ New flow** opens the screen where you can create a flow from a template.

Click a button to read and save information from documents using AI Builder



Click a button to quickly get started in leveraging a Form Processing model trained in AI Builder. You can build on this flow with any successive action that meets your business needs. First time with AI Builder? Learn more at <https://aka.ms/LearnFormProcessing>

This flow will connect to:



Microsoft Dataverse

NestorW@M365x868006...



...

**Continue**

Selecting **Continue** opens a preconfigured flow with the custom model selected in the AI Builder action.

The screenshot shows a Microsoft Power Automate interface with two main sections:

**Manually trigger a flow**

- Document Type**: A dropdown menu with the following options:
  - application/pdf
  - image/jpeg
  - image/png
  - Enter another option
- Please select the file type for the document you have uploaded**: A text input field.

**Drop-down list of options**

**Document**: A dropdown menu with the following options:

- Document
- Please select file or image

**Add an input**: A button to add a new input step.

**Process and save information from forms**

This action will extract the data from the document you upload using the AI Builder Form Processing model you have trained. Don't have a Form Processing model? Learn how to create one at <https://aka.ms/LearnFormProcessing>

**\* AI model**: My Custom Form Process

**\* Form type**: Document Type

**\* Form**: Document

## Check your knowledge

Choose the best response for each of the questions below.

## Multiple choice

1. *What is the purpose of using Power Automate flows for AI Builder?*

- To easily create AI models
- Automatically create applications that use AI models
- Automate and use AI models at scale
- Schedule training of your AI models

## Multiple choice

2. *Where can you find preconfigured AI Builder flows that you can use to build your own flow?*

- My flows
- Templates
- Solutions
- Power Apps

## Multiple choice

3. *How can you incorporate AI Builder logic in a Power Automate flow?*

- By adding a new step in your flow and searching for the AI Builder action name
- By developing your own AI Builder connector
- By selecting AI Builder in the trigger action of your flow
- By creating a Power Automate version of the AI model

## Summary

In this module, you learned how to:

- Use AI Builder in Power Automate to help you save time.
- Create a Power Automate flow by using an AI Builder action.
- Start with advanced AI Builder flows in Power Automate.

Also, you learned about various AI Builder actions and how these can actually be used in your day to day automated solutions and processes. By creating solutions with AI Builder actions and Power Automate, you're adding intelligence to your flows, allowing them to learn and predict outcomes over time and help improve overall business performance.

# Functional Consultant skills

## Introduction

As the functional consultant, you are well equipped to be the voice between business and tech. Functional consultants play a vital role on a Microsoft Power Platform project. With the low code/no code choices available, it's often the functional consultant who becomes the go-to expert on the implementation team. The functional consultant works closely with not only the implementation team, but also works closely with the customer's stakeholders. Keep in mind, that even for an internal facing consultant, you still have a customer even if you're in the same company.

Not every aspect of a project is technical in nature, and often these non-technical portions have a greater impact than we expect. Each Microsoft Power Platform project has similar components and requires similar planning and managing, even if some of it is not directly part of the project solution. In this module we will cover some of these consulting skills to include:

### Create and validate documentation

Documentation can take many forms from requirements gathering and validation to test plans, training plans and user manuals. In this course we will learn about creating entity relationship diagrams (ERD), wireframes and mockups for apps, documenting data for migration, requirements, and solution artifacts.

### Engage stakeholders

Even the smallest of projects have stakeholders, enterprise projects likely have dozens of them. A functional consultant is often the voice between the stakeholders and the project team, representing the interests of both. The functional consultant creates proofs of concepts and documentation, conducts solution reviews, and performs workshops.

### Perform quality assurance

While the functional consultant is not likely a formal "tester" on a project, they should be performing unit tests of their individual work, communicating with the quality assurance leadership, helping with user acceptance testing, and evaluating test plans and functionality meet expectations. Additionally, it is the responsibility of every project team member to follow established procedures and expectations for application lifecycle management (ALM).

### Configure integrations

One of the strongest offerings of Microsoft Power Platform is its versatility to integrate using hundreds of existing connectors, and the ability for implementation teams to make their own custom connectors. The functional consultant will often follow the lead of the solution architect and do the actual integration of the selected integrations and connections.

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## Create entity relationship diagrams

Documentation can take many forms from requirements gathering and validation to test plans, training plans and user manuals. In this lesson we will learn about creating entity relationship diagrams (also known ERDs), wireframes and mockups for apps, documenting requirements and solution artifacts, and documenting details of data for migration and integration. In Power Platform, the data is represented as a table. For the purposes of this lesson, consider the terms interchangeable.

## The entity relationship diagram

A data model is a visual model showing how data flows through your system and how different tables relate to each other. (We will learn more about tables and data models in the next module.) Data models define the relationship types between tables and abstract a database to a visual representation that is easy to understand. When you are planning and creating the diagram, do it in such a way to allow for the evolution of the project.

Before deciding what to include in your diagram, first you need to understand the audience. The amount of detail in a diagram destined for a summary meeting with executive stakeholders is much different than the amount of detail needed for an ERD on its way to the quality assurance team for test plan authoring.

## Things to consider including in your ERD:

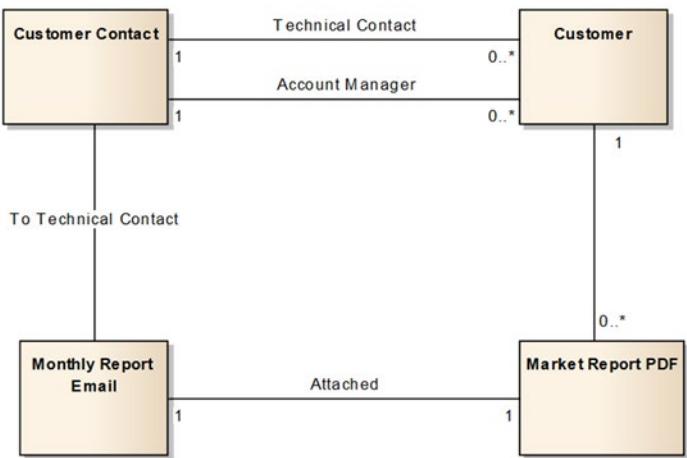
- Tables (system, custom, and virtual)
- Relationship types (1:N, N:1, N:N)
- Table mapping
- Column mapping
- Column type
- High-level integration architecture

## Types of data models

Data models for Microsoft Power Platform data structures typically fall into two general categories: logical and physical.

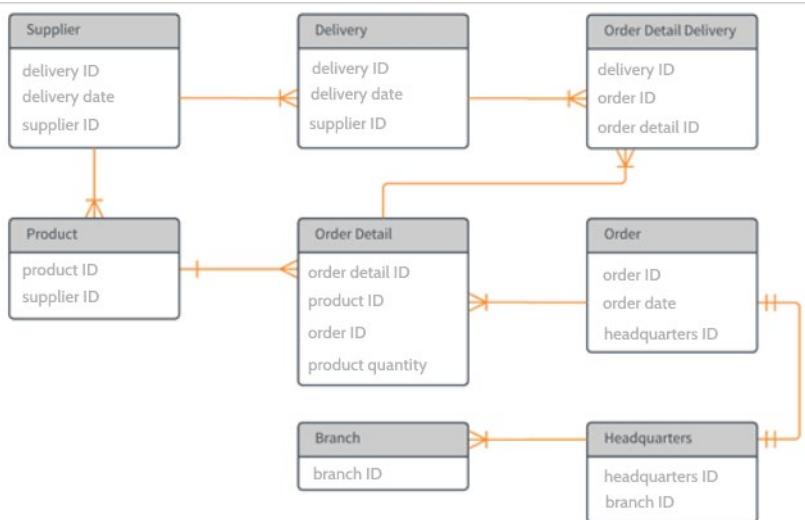
### Logical data models

Logical data models are high-level diagrams that show the way that data flows through the system. These diagrams are frequently put together at the beginning of the project during discovery and before all of the columns have been defined. Generally, the logical data model diagram uses the business names of the tables, not the schema/database name.



# Physical data models

Physical data models are lower level than logical data models. They generally include column-level detail and more precisely designed relationships. The physical data model is created when the high-level logical design is translated to physical tables. A common type of physical data model is an Entity Relationship Diagram (ERD), or table relationship diagram.



Data modeling is a science, and there are data modeling professionals and established standards for data modeling. To be effective with Microsoft Power Platform data modeling, you don't have to be a professional data modeler or use any special tools. Popular tools like Microsoft Visio can be used to quickly create a basic diagram that visualizes the relationships and flow of data between tables and so can casual planning with whiteboard drawings. In this section, we discuss some general best practices for data modeling for deployments.

- Data models should be updated continuously during a deployment. It's common for a data model to be designed at the beginning of a project, but it is very important that it doesn't stop there. As you go through the deployment, new columns and tables will be added - it's important to capture these in the data model and make it a "living" data model. Recommend to customers that they continue to

update it as they enhance the system.

- Don't start from scratch. Community tools available with the XRM Toolbox ([xrmttoolbox.com](http://xrmttoolbox.com)) make it easy to quickly generate ERD diagrams of your data configuration. These tools include the UML Generator and Entity Relationship Diagram Generator. After you complete configuration updates, generate an up-to-date diagram.
- Don't include every table. Some core tables, such as activities, notes, and users (row or record owners) are related to nearly every table. If you include every relationship with these tables in your data model, the result will be unreadable. Best practice is to only include the primary tables leveraged in your configuration in your data model diagram and only include custom relationships with the user and activity tables to maximize readability.
- Data models should include tables outside of the Dataverse data model. If you are integrating with other systems via Dataverse data connectors or virtual tables, or if data flows outside of Dataverse via an integration, this data should also be represented in your data model diagram.
- Start simple, with the standard tables, then add custom table (entity) relationships to your data model.
- Start with what you need now but design the data model in a way that will support what you are going to be doing in the future. For example, if you know that down the road you will need to store additional details about sales territories, using a text column for territory now will make it more difficult to implement than if you use the territory table relationship. Plan for what is coming.

## Create and document mock-ups

With model-driven Power Apps, you get an app designer with a standard user experience. With canvas apps, you have a near limitless design canvas. Both experiences require planning in order to achieve the best user experience. As mentioned previously, the functional consultant is often the bridge between differing roles on a project; this can include creating and documenting mockups of the user experience. The user experience is much more than a single screen, it is the entire user journey throughout the solutions that are built.

Considerations when designing the journey:

- **Consistency:** Is it jarring for the user to go between tasks and apps?
- **Logical progression:** Is the end to end-user experience designed with efficiency in mind? Should we consider branching some experiences for different groups of users?
- **Branding and theming:** Are the apps similar in appearance? Are there branding guidelines to follow?
- **Business processes and system automations:** Are the automations there to make things easier for the user? Do they actually make things easier for the user? The business processes and functionality implemented must meet the users' expectations to achieve optimum user adoption. Is the new system making users' lives easier and reducing steps that they need to finish processes, or is it adding

additional steps to the process? Have we designed a system that uses automation of processes to ensure a consistent user experience?

- **Security:** Have we used built-in functionality to limit the user's experience to only those things they should be doing? Security roles should be used to limit the forms, apps, and dashboards so users only see the application components that they need, and use model-driven apps to limit the views and other app components to just those needed when the user is working on the processes for which the app is designed.

As you design the user experience, keep in mind the ultimate goal, create an experience that is both useful and a joy to use. Many aspects of a solution drive user adoption. Not each of these is easily measured. Sadly, sometimes the best indication of user adoption is the failure to gain user adoption. Key areas that can determine the effectiveness of user adoption include:

- **Business value:** Business goals and strategy clearly defined along with the processes, success KPIs and business outcome for the project
- **Data and functionality:** Business process implementation within the platform meets (or exceeds) user expectation with respect to data, integration, security, reporting, etc.
- **Usability:** Application usability and client support user experience on web, Outlook, and mobile clients
- **Performance:** Overall application performance and reliability from end-user perspective to include page load time, time to save, errors, automation, etc.

## Business value

To achieve optimum user adoption, you first need to define the business use case for the system and your strategy for adoption of the system. Executive sponsorship should be identified for the project. It's important that the deployment not be driven just by the IT department. A successful deployment requires alignment between IT and business stakeholders and they must all work together to deliver a solution that meets user expectations. All decisions that are made about system design and configuration should be made with user experience in mind.

## Individual value

Even if the business thinks that the system is designed well, achieves its goals and is a success; the user's opinions must also be considered. The system should offer its users a delightful experience that helps them be more efficient.

## Data and functionality

Another major influencer on user adoption of the system, both positive and negative is the data in the system—the quality of data and the value of the data in the system. If you just forklift bad data into the system, the user experience in new system will be poor. To account for this, you should define a plan for the following areas:

- **Business data validation:** Is the data clean, is it the right data, and does it include only what is necessary for users to have a good experience and be able to do their jobs?
- **Data aging:** Is old, unusable, or expired data archived out of the system? Having complete enough data to do your job is important, but too much old data can make the system slow and difficult to use.
- **Data scrubbing and cleansing process:** How will you clean data that will be loading into the system, and what is your plan to keep that data clean in an ongoing basis?

- **Data integration and visual/UI integration:** What is the plan for ongoing data integration and are you using data integrations correctly? Is there data being copied into Dataverse that might be better as a visual integration, such as a virtual table or Microsoft Power Platform connector?

Users also need to be able to use the data in the system and need to understand the reporting and analytics options available to them in the system. This includes standard application components like Advanced Find, views, Excel export, report wizard, charts, dashboards, and templates. Users should also know what configuration options they have for these tools, such as creating personal views, templates, charts, and dashboards, as well as self-service analytics options in Power BI if applicable.

## Usability

You must be aware of the effects that the data model will have on the usability of the system and the end-user experience. Inconsistent design can provide a jarring user experience. Use the tools provided in the system to provide a consistent user experience.

Navigation should be logical and consistent so that users are comfortable with the system. If different forms have significantly different navigation experiences or related navigation links are not grouped, the users will be frustrated trying to use and navigate through the system. Everything users need for related system tasks should be grouped in the sitemap and form navigation areas. Form layout should be consistent and predictable . When possible always group similar columns, and tasks, in the same place for the user's entire experience.

When building apps, they should be appropriately sized. You should not have a monolithic application with many unrelated business groups combined. Model-driven apps should generally address a single group or multiple groups that are directly related (such as a related sales and customer service process). Canvas apps should be used for simpler task-focused scenarios. If a user has to switch between multiple apps to complete a task the user will likely be frustrated, but if you try to use a large model driven app when the user needs to complete task focused activities on a mobile device, the user may also be frustrated. Make sure that your apps are properly sized and that they provide the best user experience for the way that your users will be working.

To fully empower all of your users to effectively use the app, you need to consider accessibility for users with disabilities. Make sure you fully understand the accessibility requirements of your users and that you are using the Solution Checker and App Checker to verify that your configuration meets or exceeds accessibility standards.

## Performance

System performance is another factor that is critical for optimal adoption of the system. If your solution is well built and your data is clean, but the system performance is poor, users will not want to use the system. The system must be responsive. The system must be dependable. The system must be robust and non-fragile.

Provide users with the training and support needed to reinforce good user adoption. Create a community of champions, including early adopters and super users. Provide effective user training—this training should be customized based on what types of training and knowledge transfer are most effective in your organization. This can include training materials, videos, knowledge base, and help resources that cover the application and processes. An internal helpdesk should be staffed with well-verses subject matter experts. This includes support during the deployment as well as after go-live.

Most Microsoft Power Platform projects are iterative. As the solutions grow through the iterations, keep in mind the good design principles you started with. At the end of the day, it is the user's perception of

the system we've built that defines their expectations. Work to understand their goals and the results as you design.

## Document functional requirements and artifacts

As you collect requirements, they are commonly referred to as either functional or non-functional. Functional requirements describe what the solution needs to do or its behaviors, and non-functional are commonly used to describe non-behavior aspects of the solution such as performance requirements. In this lesson, we will cover some things to consider for functional requirements.

Each functional requirement should clearly capture the who, what and why of the requirement. If the requirement is too large, it should be broken down into smaller parts.

### Functional requirements

The following are a few simple examples of functional requirements:

- As a sales user, I need to be able to close an opportunity as lost, and capture why it was lost so that we can improve our sales tactics in the future.
- As a sales manager, I need to be able to approve a discount on a quote, so I can reduce the total price and give a discount to the customer.
- As a staff accountant, I want to be prevented from closing a batch that has pending items, so I do not have to re-open it later.

These examples communicate who, what, and why.

The following are a few examples of poorly worded requirements:

- Opportunities can be won or lost.
- Price should reflect discounts.
- From the Batch Item List, clicking the Close Batch button, which is the third button from the left, should close the batch if there are no items that would stop it from happening.

When gathering requirements of any variety, it is very helpful to map toward process or user journey, not just a list of features and functions. Build a story for a user and how they will successfully use the system you are designing. You can scribble on a whiteboard, use a tool to diagram a process, whatever works for your team at the planning stage you are in. Your team will dissect the pieces into smaller actionable items later.

### Acceptance criteria

Having a clear understanding of how a requirement is considered satisfied is important. Often, documenting this requirement will help determine if the requirement is detailed enough and right sized. This documentation is also helpful for the testing teams to evaluate the implementation of the requirement. And finally, it should be reviewed with the stakeholder to ensure it is accurate as it can be used to help prevent scope creep. It's important to look for acceptance criteria that can't possibly be met, and negotiate to reach a compromise that is achievable.

### Capturing exceptions

Commonly a simple requirement like closing a transaction might have a straightforward path and just a few exception paths. It's important to look and identify these exceptions when capturing the happy path.

As you move into design you don't want to design primarily for exceptions. They should be handled as such, but if you do not know they exist you will have rework later. It's also ideal to remember to capture how frequent the exception is, as some exceptions are best handled by procedure/process and not software customization.

## Avoiding scope creep

Left unchecked every project would add scope from what was envisioned and budgeted for. The project governance process should be used to evaluate how to handle these once identified. Often those accepted for inclusion might result in a change order depending on the project contractual structure. Simply ignoring that scope is increasing can easily result in project failure.

## Internationalization

Microsoft Power Platform offers makers many options to internationalize the apps. Model-driven apps and portal apps both come with internationalization options including language packs and multi-currency. Accurately documenting these requirements is essential for user adoption. Documenting the internationalization should begin with requirements and be included in quality assurance test plans, user adoption testing, and system documentation. Make sure to follow the best practices listed here for documenting actionable, testable requirements for internationalization needs as well.

## Solution artifacts

It is considered a best practice to give solution components logical names, and as you are preparing the documentation of such logical names, you will certainly see the value. Each project's documentation of these items may be a little bit different than one another.

The goal of this documentation should be to ensure consistent continuation of the solutions as they evolve over time as well as keeping the project team informed. This is particularly helpful when you are participating in a team of makers and each team member is working on a different set of functionalities. Documenting the things that matter will be much easier if there are predictable names and consistent documentation of names and expected behaviors.

Project planning items such as user stories or backlog items can be good resources to help jumpstart your documentation. As tempting as it might be to wait to do this documentation until project completion, it will be a more helpful on-going resource if it is completed at least every project milestone. You will be able to notice and remedy inconsistencies and errors before they become bigger problems.

When documenting tables (either in a model-driven app, or with a Dataverse data source) consider including table description such as its intended use. Include the columns from each table, and their data type and description. Document the relationships between tables and the defined behaviors such as row deletion behaviors. Any considerations for security roles and column level security should also be included. Document views and their queries; forms and their target audiences/uses; reporting and dashboards.

Automation includes business process flows, Power Automate flows, business rules, and classic workflows. Not only should you document each of these separate automations, but you should also document how they work together. Connectors used and their requirements can be documented here as well.

Canvas apps components to document include specific screens and their navigation, data sources used, formulas, and triggers for automation. Power Apps portals have similar documentation needs as canvas apps but will also include differentiation between authenticated users and anonymous users.

When documenting Power Virtual Agents, include topic level conversation flow, targeted data sources, and escalation plans.

In addition to specific technical details, you may find it helpful to write narratives of the user journey. This is more than the “user clicks here”, and more of the expected experience in its entirety. Think of it as the story of that user’s day-to-day interaction with the solution. Considering the audience of this documentation, be mindful of considerations like accessibility in documentation and offering both words and graphical explanations. This documentation could be helpful for on-boarding new team members, creating user acceptance criteria and handing off the project to the customer at completion.

## Document data for migration and integration

Seldom do you start a project with no legacy considerations. Users have inefficient apps they are already using full of business data that they already understand. Depending on the exact circumstances, you can connect with the data, or migrate it. Either of these paths require planning and documentation.

Regardless of migration or integration, the quality of the data is very important. Is the data accurate? Is there old data that is no longer relevant? Are there duplicates to mitigate? Can we eliminate duplicates prior to migration?

Creating a checklist (and following it) will be helpful to minimize the effects of bringing the old data into the new solution.

**Document data sources:** Identify data source and connections used. Identify the quality of the source data. Identify columns that are being migrated, keeping in mind not all of the source data will be going in to the new system.

**Document data types:** Compare source data with destination schema. Identify potential transformation issues prior to beginning the movement of the data.

**Document data mapping:** Complete a column by column review of the data coming in to the system, confirm it is mapped correctly. Reconcile differences in source and target data column metadata.

**Document error handling:** Make a plan to remedy errors on import or integration.

**Accommodate for outliers:** Not everything will be an exact one-to-one mapping of the data from source to the new environment. Identify these outliers and make a plan.

**Document continual evaluation of data quality:** Review, report, and repair data quality.

## Complete fit-gap analysis

A fit gap analysis identifies the difference between the known requirements and the proposed (or current) solution. It shows us what is missing so we can address it. In order to address what is missing, you need to fully understand the requirements and analyze the moving parts of your proposed solution.

How we address the identified gaps will vary for many reasons; time, budget, resources among the most common influences. Below we see the trade-off triangle. With the triangle, the rule is simple. If one side changes, at least one other side must also change.

Fit gap analysis is simply a process to help you identify what needs to be done and to help size and prioritize. Some projects and methodologies do this explicitly and call it out, others accomplish the same result with different steps that might not be called fit gap. In fact, you will probably begin to catch yourself doing it in your head as you mentally size up a requirement for how you would solve it.

Fit gap analysis makes sense when you are starting with some level of existing functionality. For business applications like Dynamics 365 that have a lot of built-in functionality it's important because where there is a “fit” meaning it already solves the requirement it's important to identify and not re-create it with custom developed feature. That also means it's important that who is performing the fit gap analysis has a good understanding of the app out of the box features.

The mechanics of doing the fit gap analysis can vary greatly from doing it in your head on a small project to using a Microsoft Excel template, or perhaps using Azure DevOps work items and capturing it inline. The tool used should help the process and not make it more difficult, but the real value is in the output from the analysis.

To perform a fit gap analysis, you should look at each requirement/user story and note at least the following for each:

- **Severity of the gap or category** – This process categorizes each item as either being a fit, configured, custom, or other. The exact categories are up to your own descriptions. The goal is to broadly look at how much out of the box features you are using versus how much you have to customize.
- **Level of effort** – The level of effort helps size the amount of work for the item, which could be low, medium, high, or could be 1-10. Some teams even use things like t-shirt sizes or planning cards. The important thing here is to be consistent.
- **Priority** – Often this level comes from the business, but the architect often needs to have some prioritized higher to help with the architecture foundation being put in place.
- **Implementation notes** – This process describes the work to close the gap identified and backs up your assumptions you made in the other columns. For example, "Add a N:1 relationship to contact" might be enough to indicate it's a configure category and what work is envisioned needs to happen. This is not detailed design specifications, but more of a high-level backup for the fit gap analysis results.

## Discuss stakeholder management responsibilities

While every project is different, as a functional consultant it is common to interact with stakeholders. This is usually done alongside other team members like project manager and solution architect. This communication with stakeholders will be in meetings, emails, workshops and documentation. Team leadership should let each team member know what types of stakeholder communication is expected for the project role.

## Perform workshops

Workshops can start before the actual project work starts. Gathering requirements, confirming requirements, and gathering more requirements can all be done with a client workshop.

Work with the maker team to ensure an understanding of requirements, and execution of the requirements. Identify and gather information from your champions, seek their input on what areas of the system to highlight to end users to gain their enthusiasm. Encourage management to offer users incentives for system adoption, such as a competition, tracked business goals, and so on. Find measurable ways to track user commitment and adoption to both showcase the system, and identify potential areas for improvement in a later phase.

Workshops are also where we prepare our stakeholders to take over the system we've built for them. Sometimes this knowledge transfer is from builder to maintainer; or it could be onboarding new users. Not every project will have a dedicated resource for planning these workshops. As the bridge between tech and business, the functional consultant is very well prepared to take on this roll.

The functional consultant will often assist in training delivery to end users. This is again based on their unique position to understand both the technology and the business to help bridge that divide with users.

## Create and deliver a solution review

A solution review is a chance to show stakeholders progress toward a goal. Depending on the exact delivery methodology, you will likely have incremental reviews of progress. A solution review could also potentially include showing a proof of concept to the team to gain their input and support.

The solution architect will likely be the one taking the lead on this, but the finer details of a solution review often fall to the functional consultant. When planning a solution review look for ways to not only gain approval, but to seek genuine feedback. This is the time to plan for minor course corrections if a feature didn't come out as planned, or maybe doesn't work as smoothly as it did in design. Don't feel bad when course corrections are identified in this review cycle, it's why reviews happen. It's what we do with the feedback that matters most.

## Create demos and proofs of concept (POCs)

As you start to envision the solution it might be time to share a good demo to validate requirements with your stakeholders, but also to build confidence in the platform. When a customer is confident in the platform, they are more willing to accept your proposed solutions with enthusiasm. If you are using an iterative approach to the solution, you may find yourself building several small proofs of concepts along the way. Microsoft Power Platform makes building a proof of concept easy.

Demos can take different shapes and forms depending on the solution being proposed. The following are some of the most common approaches:

- **Out of the box** - An out of the box demo simply shows off one or more of the apps without any customizations. This demo is often performed by pre-sales resources and doesn't involve the solution architect. This demo is also a good way to get customers up to speed with the core product features. The negative of this approach is it doesn't help the customer envision their solution on the app. You can mitigate some of the negativity from this approach by including relevant sample data to their business.
- **Pre-built demo** – Many partners specialize in particular verticals or solution areas and invest in building up pre-built demos containing their own intellectual property that tailors the out of box base solution with their designed value-add. This approach helps the customer see their particular problem area because often it uses the vertical language in the app. Often it also hides things that aren't appropriate for the solution area that might distract the customer.
- **Prototype** – This takes the out of the box state and with the customer needs in mind does the minimal tailoring of the app to reflect the customer's needs. The main benefit of this is to allow telling a story during the demo that the customer can relate to solving their particular objectives.
- **Proof of concept** – Proofs of concept should be built to prove a concept works and typically involves a very specific component or activity in the proposed solution. Unlike a prototype that usually has a straightforward path to completion, proofs of concept may try multiple approaches to reach the desired goal.

It's quite common to interchangeably use prototype and proof of concept and from a customer perspective the difference typically doesn't matter. The goal here should be focused on telling a story and bringing your proposed solution to life, helping the customer see their problem solved by the proposed solution. You should also look to reduce risk by flushing out unknowns.

## Keep or throw away

When you build a prototype or proof of concept, you should realize that the quick wins here may not translate to a best practice for production-ready solutions. This doesn't mean that best practices are hard

to follow, but for a quick showcase of an idea, it is likely more than you'd need to build out a quick idea than plan for a larger solution. This should be something decided up front, because if you do want to carry the assets forward you will need to ensure they stand up to your standards and not take short cuts that can't easily be remedied.

## Manage expectations

Due to the fact it is so easy to quickly put together a demo to show off your proposed solution managing expectations is important. It's not uncommon for a demo to be given and the customer saying great – when can we go live! The best way to manage this is being up front that what you are showing while it might look complete, it doesn't have all the security, automation and other trimmings necessary for going live. The important point is to have the discussion and not assume the customer will know a demo is just that a demo.

## Understand industry accelerators

Common Data Model enables horizontal consistency for customers' business data, making it easier for them to create value from that data. However, many customers and partners want solutions and platforms that are tailored for their industry. Microsoft is working closely with representatives from various industries to make Common Data Model more relevant to them, by creating industry accelerators.

With built-in collaboration with industry leaders, the freely available accelerators extend the Common Data Model to include new tables to support a data schema for concepts within specific industries, enabling ISVs and other solution providers to quickly build industry vertical solutions.

Industry accelerators include powerful connected experiences that are designed to support common, existing business needs for specific industries, enabling solutions that deliver new insights and more personalized customer engagements. These connected experiences help simplify efforts to procure partner solutions, or build custom applications, by providing access to a unified data layer that saves customers the time and resources they would have spent creating their own proprietary data layer or attempting to integrate disparate systems and solutions.

Industry accelerators are foundational components within Microsoft Power Platform and Dynamics 365 that enable ISVs and other solution providers to quickly build industry vertical solutions. The accelerators extend Common Data Model to include new tables to support a data schema for concepts within specific industries.

Currently available industry accelerators include:

Industry Accelerators	Description
<b>Automotive Accelerator</b> ( <a href="https://github.com/Microsoft/Industry-Accelerator-Automotive">https://github.com/Microsoft/Industry-Accelerator-Automotive</a> )	Rapidly develop test drives, vehicle specifications, and service appointment scheduling solutions. The Microsoft Auto Accelerator empowers customers and users to schedule appointments and services facilitated through proactive communications.
<b>Financial Services Accelerator</b> ( <a href="https://github.com/Microsoft/Industry-Accelerator-FinancialServices">https://github.com/Microsoft/Industry-Accelerator-FinancialServices</a> )	Rapidly develop Banking solutions using tables such as loan, mortgage, referrals, branch, collateral, deal, limit, facilities, and more.
<b>Education Accelerator</b> ( <a href="https://github.com/Microsoft/Industry-Accelerator-Education">https://github.com/Microsoft/Industry-Accelerator-Education</a> )	Rapidly build solutions for Education using tables such as student, course, and test scores.

<b>Media and Communications Accelerator</b> ( <a href="https://github.com/Microsoft/Industry-Accelerator-Media">https://github.com/Microsoft/Industry-Accelerator-Media</a> )	Rapidly develop solutions around event and venue management, sports management, ticketing and advertising sales, media sponsorships, and various guest interactions such as event registrations and the tracking of loyalty programs.
<b>Nonprofit Accelerator</b> ( <a href="https://github.com/Microsoft/Industry-Accelerator-Nonprofit">https://github.com/Microsoft/Industry-Accelerator-Nonprofit</a> )	Rapidly develop nonprofit fundraising, grant management, and programmatic measurement solutions. The Microsoft Nonprofit Accelerator is set of capabilities and standards to help drive greater impact.

These accelerators are intended to be production ready, and available for your further customizations and extensions. While planning a proof of concept, consider if an accelerator would allow your proof of concept to be completed more efficiently.

## Define Application Lifecycle Management

Most projects will have a full quality assurance plan and team. However, each member of the maker team needs to participate in some capacity to ensure quality solutions. From unit testing, as you configure to assist in release pipelines with Azure DevOps, there are plenty of points in a project that you can influence and guide to success.

## Application Lifecycle Management (ALM)

Generally speaking, the solution architect, or a DevOps engineer will own the ALM process. But as a key member of the maker team, your involvement under their direction is necessary. To be successful, you will need to understand and follow ALM processes, as defined by the solution architect (or devops engineer). Ask questions, offer to document the plan, and get confirmation of your understanding. While creating this documentation, you will also be learning more about the ALM plans for the project.

As you build you will be validating your work using platform tools such as app checker, flow checker and solution checker.

All of your work will be happening in the context of a solution and you should understand how to create, export, and import solutions as instructed by the solution architect. For a larger project, you will likely encounter more formalized build pipelines and automated continuous deployment.

## Solution packager

Solution packager should be used to take the unmanaged solution from development and prepare it for storing in a source control repository. Solution packager takes the single solution file and breaks it into individual files representing each solution component. This solution packager process is referred to as unpacking the solution. The output from solution packager is then checked in to the source control repository. This output version that is checked in, now represents the source of truth for the project.

Solution packager can also pack the folder from source control, re-creating the single solution file. The files that are checked into source control are then used to create the solutions that will be imported into the other environments. While Solution Packager can be run manually, it is more commonly run using Microsoft Power Platform Build Tools as part of an automated pipeline.

## Package deployer

Package deployer allows you to create a package that includes multiple solutions, data from configuration migration tool and developer code logic that runs before and after the import of the package is completed. In many ways, you could think of package deployer as an install wizard for Microsoft Power Platform. Package deployer can be run interactively to manually import packages and data into an environment. Package deployer also supports running via PowerShell, which would allow automation and integration into Azure Pipelines.

## Solution checker

As Power Automate and Power Apps are used to customize a deployment, each offers their own inline app checkers that are helpful for real-time issue resolution. However, solution checker (more details [here<sup>21</sup>](#)) is able to look at the whole solution, do static analysis, and produce a detailed list of any issues found.

Solution checker should be run regularly on any unmanaged solution you are building in your development environments. Solution checker can analyze Power Apps and Power Automate flows as well as code assets like plugins that developers create. The project team can manually run solution checker from the maker portal by selecting the solution and then running the checker. Solution checker can also be automated to run as part of a build process either using PowerShell or Azure Pipeline tasks. By automating the run of solution checker, it can become an integral part of the build process and even can be set up to stop the build if too many errors have occurred. Simply running solution checker is not enough for the team to be successful they must also have a plan in place to regularly evaluate and resolve problems identified.

## Automate deployment

An area that is as important as part of the build plan is looking at what automation can be used to make the process repeatable. There are many tools available both from Microsoft and the community that can be used to automate the build process. Microsoft is investing in Azure DevOps and a set of Microsoft Power Platform tasks that can be used to automate the solution management and deployment tasks. For example, a team could have an Azure Pipeline that every day at 7:00 PM extracts from development and checks it into a git repository. The same pipeline can also be used to run solution checker so when the team comes in the morning they know immediately if there were any issues identified in the prior night's build. The pipeline could also import the solution into a clean build environment that will allow detection of any dependencies that were introduced unintentionally through that day's development. This ensures what is checked into source control is a clean version ready for deployment into other environments. Pipelines can also be used to automate testing so that it's just another step within the pipeline. Azure Pipelines are also used to produce the managed solution artifact that will be used in the release pipelines to deploy to the upstream environments such as test and production. The same solution artifact that was used in test is used all the way to production. This ensures that it's not introducing new surprise changes as the promotion progresses through the series of environments ending at production. Azure Pipelines can also be used to build developer code assets to ensure that they are not being built on a local developer workstation.

## Version control

By default, as changes progress from dev to test to production it represents a single work stream of changes. If a problem is identified in production, you would fix it in development and then promote it

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<sup>21</sup> <https://docs.microsoft.com/en-us/powerapps/maker/common-data-service/use-powerapps-checker>

through the series of environments back to production. A single work stream like this works well if no new development is done. If the development team has already moved on to version 2 in their development environment and then fixes a bug that was identified in production, as the fix is moved to production so would any of the work in progress for version 2 because it was all mixed together. The ideal action is where the change is made in a separate work stream development environment that represented only what was already in production and what was promoted only included the fix and not anything from version 2. This requires the project team to plan ahead and have a strategy for managing multiple active versions. This could be as simple as an active development stream and a maintenance stream to support production. More complex projects might even have multiple active development streams going on at the same time.

Handling both active development and maintenance streams at the same time is typically handled through a combination of Dataverse environments and source control branches. Branches allow having a copy of the project assets and an isolated way of making changes in an environment associated with that branch. Changes from one branch can be merged with another branch. Branching strategy should be kept as simple as possible to avoid having to resolve many conflicts during merging of branches.

## Participate in testing

Testing is more than the process of mapping requirements to functionality. While it is important to build and execute these types of tests, there are many more aspects of a solution that should be tested. Regardless of the specific metric being tested, the process is fairly similar.

A testing process usually follows the flow below:

1. **Plan.** Review the overall test strategy. Develop the test plan. Perform needed analysis for baseline metrics. Identify key business scenarios that are in, and out of scope. Document the requirements if not already completed.
2. **Prepare.** Set up needed environments, performance testing, user adoption testing, etc. Review data received for migration, both before and after the migration testing. Validate high-level system requirements. Develop needed scripts.
3. **Execute.** Execute test scripts. Analyze results, identify potential bottlenecks. Review failures and behaviors.
4. **Report.** Prepare a detailed assessment of the reporting plan, results, and plan of action.

## Types of testing

The functional consultant will likely be involved in some capacity in each of these testing types. Each one has potential make-or-break results and with the breadth of skills of the functional consultant they are a great resource to help the quality team in succeeding.

Test Type	Description
Unit tests	These tests are performed by the app builder or code developer as an asset is built throughout the implementation process. These unit tests should be performed by whomever is actively building the functionality, which could be a developer, a functional consultant, a business analyst, and so on.

Functional tests/system tests	These tests verify implementation meets requirements and does not have defects. Functional tests can be performed manually by customer or partner team resources or may be automated.
Acceptance tests	These tests are performed by end users to give formal approval, and they test the usability of the system. Acceptance testing is typically performed as a final check before rolling out functionality. In an initial deployment, this testing is at the end of the project, but in an agile iterative deployment, functionality may be released each sprint, so you will need to conduct acceptance testing throughout the project. This testing is often called UAT, user acceptance testing.
Regression tests	These tests evaluate non changed functions for regression and are typically performed whenever there is a system update. Customers need to have a plan to regression test before every major platform update (twice a year) to verify that current configuration works optimally post update. Regression testing can be automated.
Integration tests	The goal is for all integrated systems to work in harmony. Integration testing verifies that everything works together including integrated third party services and data. This testing takes place following initial development of integrations.
Performance tests	These tests verify system performance with expected peak load and peak transaction volume and are typically automated and run before go-live or before onboarding a large group of additional system users.
Data Validation tests	These tests verify data migration to ensure data quality and are typically performed by the person who wrote the integration or customer resources in close consultation with subject matter experts that know the customer data. These experts should understand the data transition and transformation and can confirm the migrated data is valid with proper context. This process can involve standard checks like row counts or spot-checking a subset of data migrated to verify columns were correctly mapped. This process is also sometimes called data migration testing.

Disaster recovery tests	These tests involve testing what happens if a disaster brings down your system. While Microsoft handles major disaster recovery for you, you need to ensure that you have a plan to resume operations after a disaster. For example, verifying that your source code is up to date so that you can recreate your dev environments successfully in case of a disaster.
Go-live tests	These tests include dry runs of the complete go live process and are typically performed before go-live.

## The functional consultant's role in testing

In addition to participating in the actual testing process, you should be prepared to help in authoring test plans, or at least reviewing them. This process will help you do your job better by making sure expectations are aligned from beginning to end of the project lifecycle. It also helps the quality team by validating their test plans with your actions building and configuring the system.

While you may be involved in any of the testing listed, the functional consultant will likely be more involved in the following:

### Functional testing

The goal of functional testing is to ensure that the customer has identified a strategy around a set of user champions and test case scenarios that will be used by the test team for getting an assessment of the quality for their solution.

An important part of functional testing is ensuring a regression doesn't get introduced from any changes that continue to be introduced both before go-live and after go-live. From the full suite of functional tests, a subset should be identified as regression tests run on a regular basis for each release or update.

### Integration testing

the most important aspects of the business process implementation to function correctly and has a strong impact on overall adoption. The customer must ensure that they plan to engage owners from other applications that are integrated with the system. This testing will also require them to define clear roles and responsibilities to fix any issues or make changes as required.

Each integration will likely have its own test approach that needs to be defined. The testing team should be involved early to look at how they will test each integration scenario. The teams need to ensure as that the necessary integrations have the ability to be configured to support testing.

A key aspect of integration testing should be focused on the data that flows in and out of the integration. Much of the discussion in the data validation testing section can also apply to the data involved in integrations.

### User acceptance testing

User acceptance testing is critical to ensure go-live approval, as is acceptance of the new system post-go-live. It could also provide a backlog of feature requests that can be planned as part of post go-live enhancements.

Customers must ensure that user champions or key users have been identified early on and should be kept engaged throughout the project lifecycle. They should engage this group along with an additional user community to test the application. There should be a clear definition of the successful user acceptance criteria as this definition will also roll up into go/no go live decision.

## Evaluate options

One of the strongest capabilities of Microsoft Power Platform is its versatility to integrate using hundreds of existing connectors, and the ability for implementation teams to make their own custom connectors. The functional consultant will often follow the lead of the solution architect and do that actual integration of the selected integrations and connections.

Integration is connecting of one or more parts/components of a system to create a more unified experience, or to ensure a more consistent outcome of a process. Integration allows leveraging of existing services (both internal and external) without having to rebuild or migrate existing functionality.

There are different types of integrations you will use on projects:

- **Process integration:** multiple disparate systems, and each of those systems is part of an overall business function.
- **User interface integration:** Visibility of data from one or more systems, without bringing rows of data into the system.
- **Data integration:** simply combining data from different sources and presenting the user a unified view.

Each integration should be evaluated to determine the best approach. When possible, if there is an out of the box integration that can be simply configured and connected, that could be the fastest path. When considering using the out of the box integrations, you should assess any limitations and ensure that they don't interfere with your requirements. For more complex needs, it's often best to look to see if any third-party providers offer a service that could be integrated before deciding to create your own. These providers often invest in robustness of service that if you were to create the integration yourself would be hard to obtain. These third-party solutions can often be integrated either by using their connector or by installing their AppSource offering. Finally, you can fall back to working with your developers to build anything custom to handle the most complex requirements that there isn't already an option available that meets your needs.

As a functional consultant you will frequently be involved in the evaluation or proof of concept of different approaches for integration. It's important to make sure that during these evaluations not only the happy path is evaluated but consideration is given to how the integration will handle the abnormal ones as well.

Your app(s) can be at the center of the overall solution. In order for that to be seamless for your users, proper integration is key.



The solution architect of the project will decide what integrations the project needs, but the functional consultant will not only support the integrations, but will likely configure it. In order to be successful at the integrations, there are some key features that you should know.

## Define connectors

Data is at the core of apps, including those apps you build in Power Apps. Data is stored in a data source, and you bring that data into your app by creating a connection. The connection uses a specific connector to talk to the data source. Power Apps has connectors for many popular services and on-premises data sources, including SharePoint, SQL Server, Office 365, Salesforce, and Twitter.

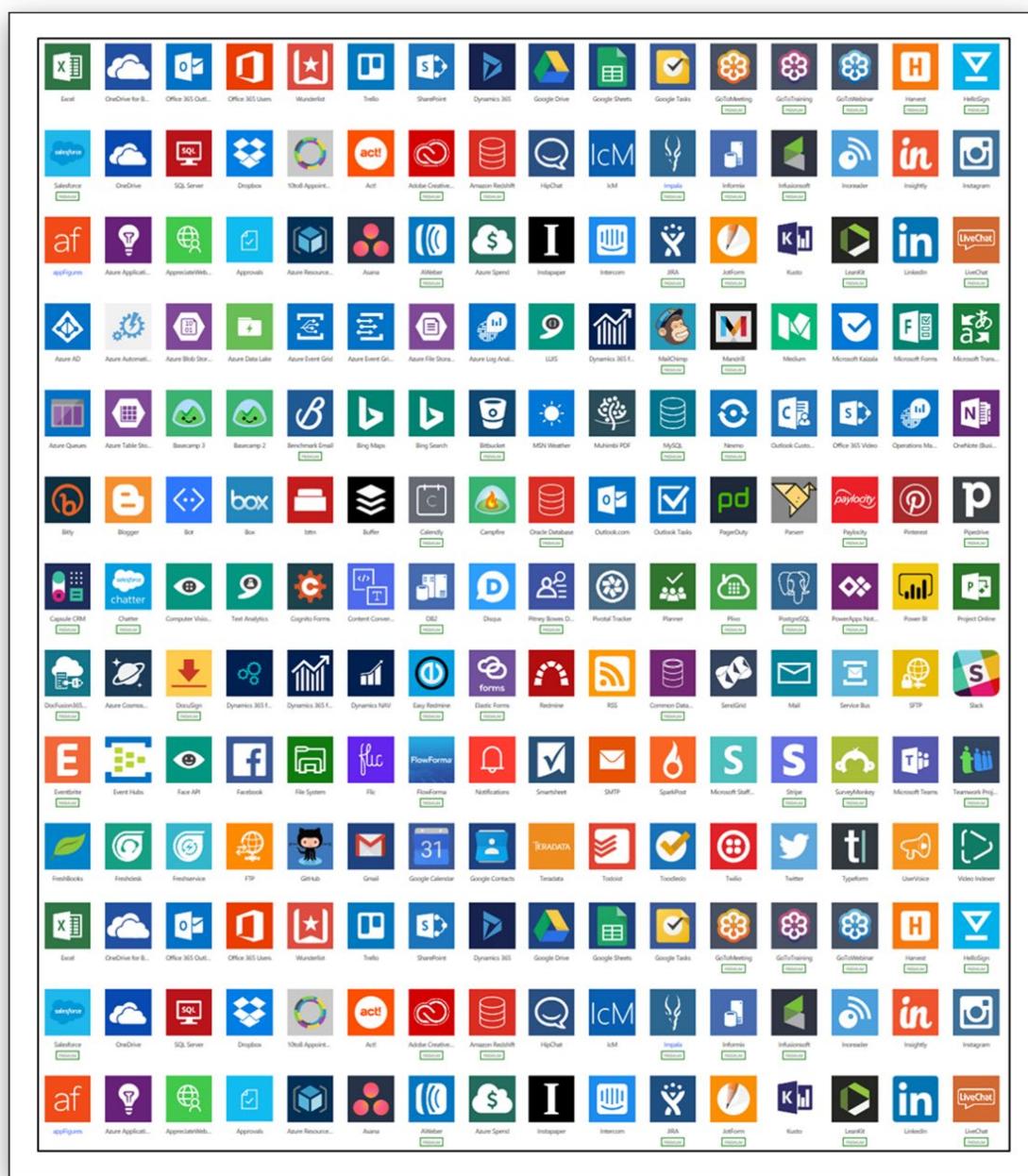
A connector is a wrapper around an API that allows the underlying service to communicate with Power Automate and Power Apps. If one of the provided connectors doesn't work with your data source, a developer can create an API if one doesn't already exist. Once the API has been created, a custom connector can be created to describe the API and a maker can then use the connector without needing to write code. Often the API exists and it's just a matter of describing it with a custom connector definition.

Once an API is available, setting up a custom connector using the wizard does not always require a developer, but it is an advanced task that has low-code requirements. When defining the custom connector, you will provide several definitions to include the actions, triggers, and references. Detailed steps to create a custom connector can be found [here<sup>22</sup>](#).

It's important to look at the connector details when you're looking at using it for integration to ensure that you've met the licensing requirements to fall within the throttling for your particular scenario.

Model-driven apps have their own data source, Dataverse. But they can also integrate with other apps and services depending on the need. Canvas apps, Power Automate, Power BI, and Power Virtual Agents all need a data source and rely heavily on connectors.

<sup>22</sup> <https://docs.microsoft.com/en-us/connectors/custom-connectors/define-blank>



There are hundreds of connectors available. For a full list of connectors, visit [this page<sup>23</sup>](#).

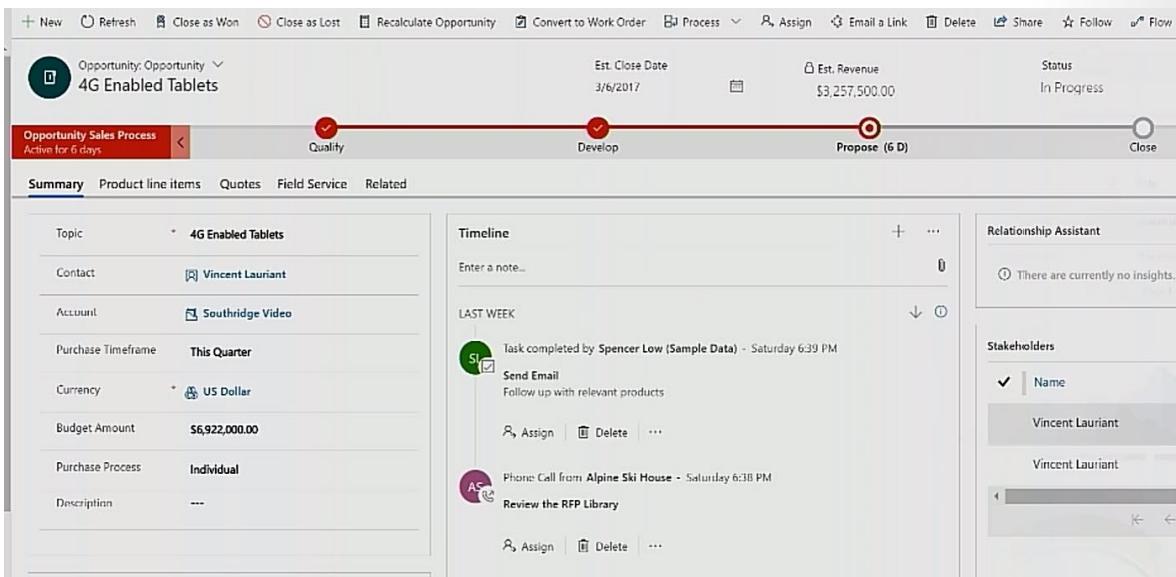
## Understand Power Apps component framework

Microsoft Power Apps component framework helps you create reusable components that can be used within your Power Apps applications. The component framework empowers developers and app makers to build code components when the out-of-the-box components don't fit an app maker's needs. Before the Power Apps component framework existed, makers had to rely on HTML web resources to provide any form of custom presentation to a model-driven form. Now, you can use a more modernized frame-

<sup>23</sup> <https://docs.microsoft.com/en-us/connectors/connector-reference/connector-reference-powerapps-connectors>

work that allows an abundance of capabilities to be exposed to your app that would otherwise be impossible to access or, even worse, be unsupported by Microsoft.

For example, the existing screen might render similar to the following image.



However, if you reconfigured your app to use custom Power Apps components, your app might look something like the following image.



The Power Apps component framework (PCF) helps teams develop together by supporting the making and use of custom components. Both model-driven and canvas apps have PCF control options. While the making of a fully custom control requires a professional developer, makers of all skill levels can consume them and include them as part of an overall solution.

Canvas app PCF controls is currently in public preview. You can find samples for use in your nonproduction solution, or to inspire ideas, at the Power Apps Community [gallery of canvas app<sup>24</sup>](#) components.

Model-driven PCF components allow makers to take a column such as a yes/no column and present it to users with a different visualization. You might present a different visualization to help users have a better mobile experience (think about ease of use for touchscreen controls instead of a radio button). You might also present a different visualization to break up the appearance of standard controls on a form.

## Power Apps component framework advantages

Microsoft has significant investment in ensuring that Power Apps components are built on top of a robust framework that supports modern web practices. A few of the advantages that you are afforded as a result are:

- Access to a rich set of framework APIs that expose capabilities like component lifecycle management, contextual data, and metadata
- Support of client frameworks such as React and AngularJS
- Seamless server access through Web API, utility and data formatting methods, device features like camera, location, and microphone, in addition to easy-to-invoke UX elements like dialogs, lookups, and full-page rendering
- Optimization for performance
- Reusability
- Use of responsive web design principles to provide an optimal viewing and interaction experience for any screen size, device, or orientation
- Ability to bundle all files into a single solution file

Model-driven apps have a full ecosystem of third-party offerings. Many of them can be found at Microsoft's [AppSource<sup>25</sup>](#). AppSource offers not only products made, and maintained by independent software vendors (ISVs) but also add-ons built by Microsoft. AppSource has thousands of apps available for trial and evaluation.

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<sup>24</sup> <https://powerusers.microsoft.com/t5/Canvas-Apps-Components-Samples/bd-p/ComponentsGallery>

<sup>25</sup> <https://appsource.microsoft.com/>

The screenshot shows the Microsoft AppSource search interface. At the top is a search bar with the placeholder "Search Microsoft AppSource" and a magnifying glass icon. Below the search bar are three columns of refinement filters:

- Refine by category:**
  - Analytics
  - AI + Machine Learning
  - Collaboration
  - Compliance & Legal
  - Customer Service
  - Finance
  - Geolocation
  - Human Resources
  - Internet of Things
  - IT & Management Tools
  - Marketing
  - Operations & Supply Chain
  - Productivity
  - Sales
- Refine by industry:**
  - Automotive
  - Agriculture
  - Architecture & Construction
  - Distribution
  - Education
  - Financial Services
  - Government
  - Healthcare
  - Hospitality & Travel
  - Manufacturing & Resources
  - Retail & Consumer Goods
  - Media & Communications
  - Professional Services
  - Real Estate
- Refine by product:**
  - Web Apps
  - Power Platform
  - Dynamics 365
  - Microsoft 365

The Microsoft Power Platform and Dynamics 365 communities have a long history of providing tools to help makers. These tools are often free and open source and actively seek additional contributors. These community tools offer utilities to help ease the level of difficulty for common use cases within a solution. Remember, although these tools are respected in the community, they are independently maintained, so it's a good idea to do your due diligence for the appropriateness of their inclusion in your overall strategy.

## Knowledge check

### Check your knowledge

Choose the best response for each of the questions below.

#### Multiple choice

1. Which of the following would be the functional consultant's role?

- Be the voice between business and tech
- Design the data model
- Build a custom connector

## Multiple choice

2. Which of the following are characteristics of logical data models?

- It includes precisely defined relationships
- It includes the way data flows through the system.
- It includes column-level information about the tables.

## Multiple choice

3. Which of the following is a well written functional requirement?

- From the quote, select the submit button to send the quote for approval.
- As a sales manager, I need to be able to reject discounts on quotes, so that the sales team does not offer unapproved discounts.
- Quotes can be approved and rejected.

## Summary

In this module, you learned about the broad range of skills that a functional consultant must have. The functional consultant contributes in many tangible and intangible ways to a successful project. In this module we discovered some of the less tangible aspects of a successful functional consultant.

# Answers

## Multiple choice

1.Which of the following statements is true about building solutions?

- Solutions can be built in Power Apps only.
- Solutions can be built in Power Apps and Power Automate.
- Solutions can be built in Power Automate only.
- Solutions without flows can be built in Power Apps. Solutions with flows can be built in Power Automate only.

### Explanation

*You have the flexibility to create a solution in both Power Apps and Power Automate. From either service, you can access all services to add to your solution.*

## Multiple choice

2.When can you add an item (such as a flow, app, or environment variable) to a solution?

- You can only add new items to a new solution.
- New solutions will not accept existing items.
- You can add an existing item and a new item to an existing or new solution.
- Items that are removed cannot be added back.

### Explanation

*You have the flexibility to add existing items, such as a flow or an app, to an existing solution or a new solution.*

## Multiple choice

3.Which of the following statements regarding solution exporting and importing is true?

- Exporting and importing can only be in a single environment.
- Exporting and importing can be across environments but must be in a single tenant.
- Exporting and importing can be across tenants but with the same licenses.
- Exporting and importing can be across environments and tenants.

### Explanation

*You can export the solutions as a zipped file and import them into another environment in the same tenant or an environment in a new tenant.*

## Multiple choice

4.Do solutions automatically package dependent components?

- No, they do not. For example, Choices fields of an entity need to be added separately.
- Yes. Solutions can automatically recognize interdependent components.
- Yes, but only for the Power Apps app.
- Yes, but only for Power Automate flows.

### Explanation

*Not all dependent components are automatically packaged. For example, Choices fields of an entity need to be added separately.*

**Multiple choice**

- 5.How do Power Apps canvas apps and Power Automate flows handle connection references?
- Power Apps canvas apps and Power Automate flows handle connection references the same.
  - Power Apps canvas apps reference all connectors. Power Automate references implicitly shared connections such as SQL server.
  - Power Automate flows use connection references for all connectors. Power Apps apps only use them from implicitly shared connections such as SQL server.
  - Power Apps canvas apps and Power Automate flows handle connection references the same except for cloud connections.

*Explanation*

*Power Automate flows and Power Apps canvas apps handle connection references differently. Power Automate flows use connection references for all connectors, whereas Power Apps only uses them for implicitly shared connections.*

**Multiple choice**

- 1.Which of the following can you use Excel for with Microsoft Dataverse tables?
- Add and create new tables to store data.
  - Add, edit, or delete data.
  - Add and delete tables.
  - Create new tables and add data to the new table.

*Explanation*

*You can add, edit, or delete table data by using Excel.*

**Multiple choice**

- 2.Which of the following can be done in Dataverse?
- Export data from a table.
  - Export data from one or more tables as zipped markdown files.
  - Load data from any file type into a table.
  - All of the above.

*Explanation*

*You can export data from a table in Dataverse.*

**Multiple choice**

- 3.Which of the following statements is not true about views?
- You can create many views of a table.
  - You can sort and filter the data in a view.
  - You can choose the fields that are available in a view and edit at any time.
  - You can create only two views for each table.

*Explanation*

*You can create many views for a table, so this is not true.*

**Multiple choice**

1.Which of the following statements is true?

- AI Builder is only available in Power Apps.
- AI Builder is only available in Power Automate.
- AI Builder is available in both Power Apps and Power Automate.

*Explanation*

*AI Builder is available in both Power Apps and Power Automate.*

**Multiple choice**

2.You have customized a model by using the guided experience. What is the final step that you must take before you can use it?

- Create it
- Publish it
- Save it
- Train it

*Explanation*

*A model must be published before it can be used.*

**Multiple choice**

3.What do you need to do before you can use a prebuilt model?

- Gather data
- Train the model
- Publish the model
- Nothing

*Explanation*

*A prebuilt model is ready to be used.*

**Multiple choice**

1.What is the purpose of training your model?

- It creates the model
- It makes it available for use
- It learns from your data
- It makes it stronger

*Explanation*

*Your model learns from the data you give it.*

**Multiple choice**

2.How many trained model versions can you have at one time?

- One
- Two
- Three

*Explanation*

*You can have three trained model versions at any given time.*

**Multiple choice**

3.By default, who can see and use a model you have created?

- Just me
- People in my environment
- People in my organization
- Everyone

*Explanation*

*By default, you are the only person who can see and use a model you have created.*

**Multiple choice**

1.What is the purpose of using Power Automate flows for AI Builder?

- To easily create AI models
- Automatically create applications that use AI models
- Automate and use AI models at scale
- Schedule training of your AI models

*Explanation*

*The purpose of using Power Automate flows for AI Builder is to automate and use AI models at scale.*

**Multiple choice**

2.Where can you find preconfigured AI Builder flows that you can use to build your own flow?

- My flows
- Templates
- Solutions
- Power Apps

*Explanation*

*You can find preconfigured AI Builder flows in templates.*

**Multiple choice**

3.How can you incorporate AI Builder logic in a Power Automate flow?

- By adding a new step in your flow and searching for the AI Builder action name
- By developing your own AI Builder connector
- By selecting AI Builder in the trigger action of your flow
- By creating a Power Automate version of the AI model

*Explanation*

*AI Builder logic is incorporated by adding a new step to your flow and searching for the AI Builder action name.*

**Multiple choice**

1.Which of the following would be the functional consultant's role?

- Be the voice between business and tech
- Design the data model
- Build a custom connector

*Explanation*

*The functional consultant plays a unique role that enables them to be able to communicate and translate between these two sets of stakeholders.*

**Multiple choice**

2.Which of the following are characteristics of logical data models?

- It includes precisely defined relationships
- It includes the way data flows through the system.
- It includes column-level information about the tables.

*Explanation*

*Logical data models are high-level diagrams that show the way that data flows through the system.*

**Multiple choice**

3.Which of the following is a well written functional requirement?

- From the quote, select the submit button to send the quote for approval.
- As a sales manager, I need to be able to reject discounts on quotes, so that the sales team does not offer unapproved discounts.
- Quotes can be approved and rejected.

*Explanation*

*This functional requirement clearly captures the who, what and why of the requirement.*