

# Extending Microsoft 365: Exploring the Art of the Possible

Julie Turner

# Setting Expectations

- ✓ This is a 100 level INTRODUCTION to extending the Microsoft 365 SaaS platform
- ✓ We are NOT going to show/review code
- ✓ We are going to talk about all the ways to extend the platform, what tools you might need, and what scenarios you can accomplish
- ✓ *This is a firehose of information!*

# Julie Turner

*Partner/CTO*

Working with SharePoint since 2007

Microsoft MVP, Office Apps and Services since 2017

Microsoft 365 PnP Team since 2019

Open-source project co-maintainer: PnPjs & hTWOo



<https://julieturner.net/me>

**SYMPRAXIS**  
CONSULTING



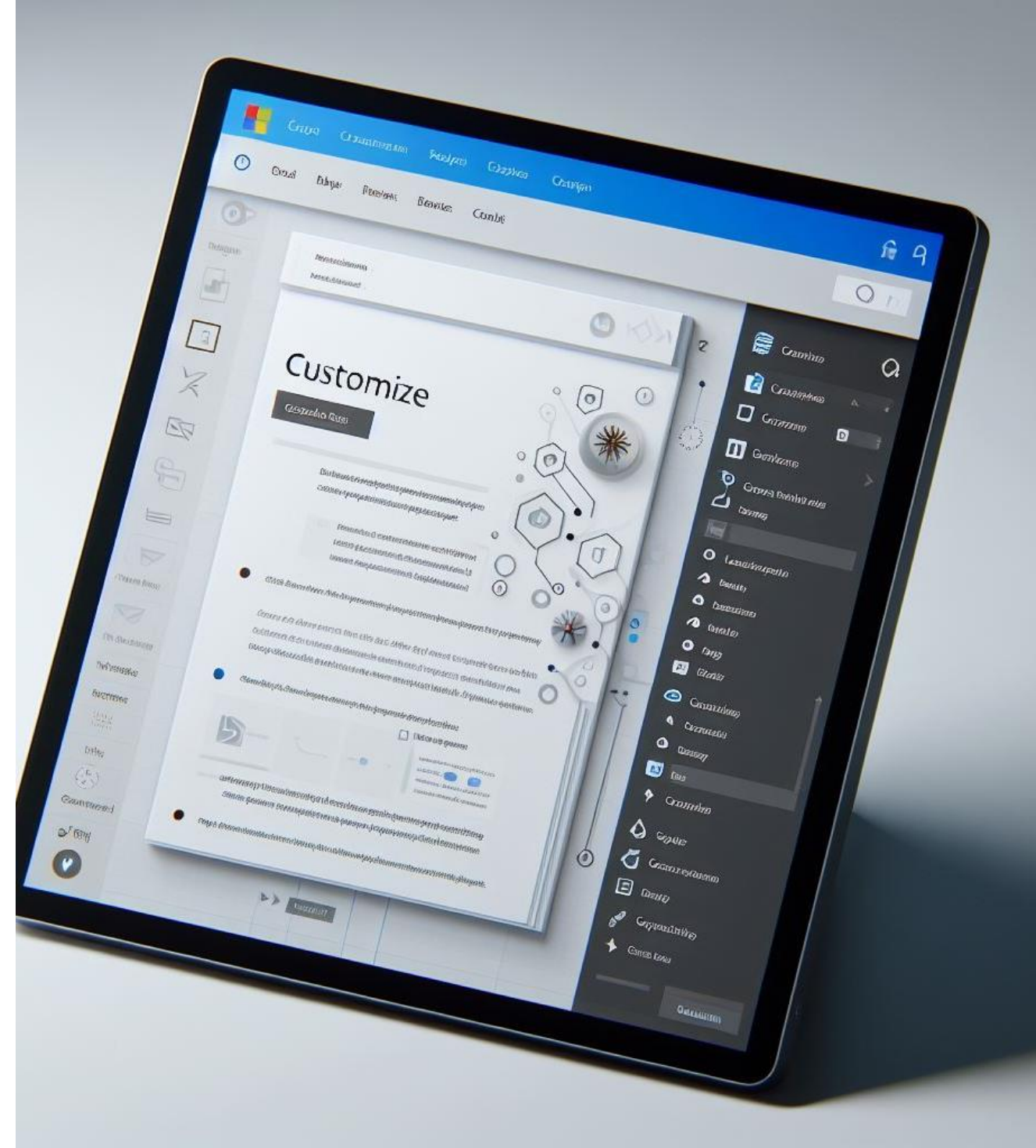
# Agenda

- ◆ What is extensibility?
- ◆ Out of the Box Extensibility
- ◆ Low Code Extensibility
- ◆ Administration Tasks – Scripting
- ◆ Client-Side Extensions
- ◆ Server/Cloud Resources
- ◆ Authentication
- ◆ Design Frameworks
- ◆ Community Resources

# What is extensibility?

*Adjective*  
capable of being extended.

*Extend - Verb*  
to increase in length, area, scope, etc.

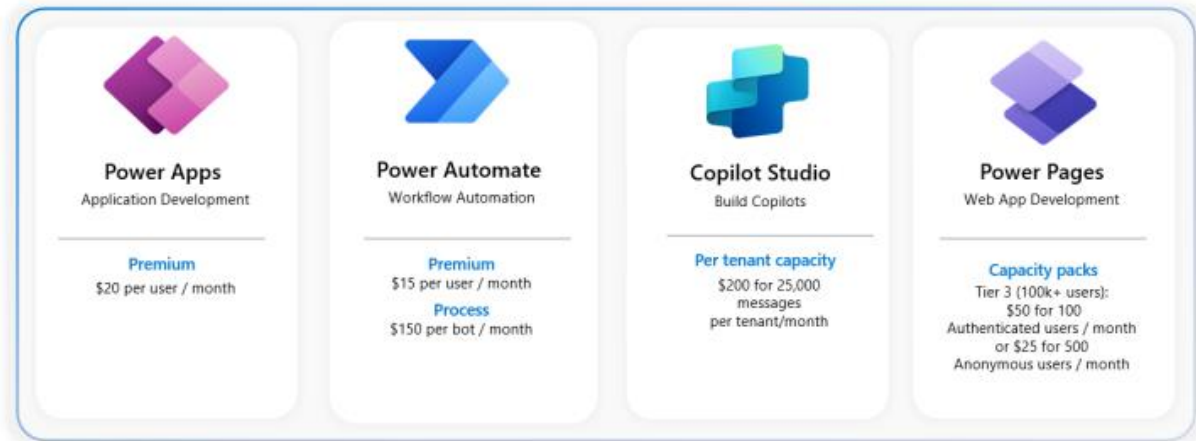


# Out of the Box Extensibility

## *Templates*

- ◆ Content Types and Document Templates
- ◆ Page Templates
- ◆ Site and List Templates
- ◆ Teams Templates
- ◆ List Formatting

# Low Code Extensibility



## ***PowerPlatform Connectors***

Pair with CoPilot studio to allow others to create their own CoPilot experiences

## ***LogicApps***

- ◆ PowerAutomate base engine
- ◆ Standard/Consumption pricing
- ◆ Premium connectors billed differently

## *Pros*

- ◆ Good for single entity business processes

## *Cons*

- ◆ Cost to build/maintain + licensing (depending on connectors/platform)
- ◆ Complex logic can be hard to manage

# Administration Tasks - Scripting

*One-time or infrequently performed tasks*

- ◆ PowerShell – Various Microsoft 365 Modules
- ◆ Command Line Interface
  - ◆ Azure CLI
- ◆ Community Tools
  - ◆ PnP PowerShell
  - ◆ CLI for Microsoft 365



# Client-Side Extensions

- ◆ Browser Based
  - ◆ Platform Hosted
    - ◆ SPFx
  - ◆ Self-Hosted
    - ◆ Teams Apps
    - ◆ Office Add-Ins (don't confuse with SharePoint Add-Ins)
- ◆ Native Mobile – iOS/Android
- ◆ Desktop Clients – iOS/Windows/Android

# Tools – Client-Side Surfaces

## ◆ SharePoint

- ◆ SPFx - SPPKG (Zip) files include code and manifest
- ◆ Platform hosted (by default)
- ◆ Supports SharePoint and Teams Tab/Personal App

## ◆ Teams

- ◆ Teams Toolkit
  - ◆ Teams AI Library – add natural language capability
- ◆ Self-hosted
- ◆ Unified manifest for Microsoft 365 (Meta OS)

## ◆ Office Add-Ins

- ◆ Office Add-ins XML manifest
- ◆ Unified manifest for Microsoft 365 (Meta OS)

## ◆ Other

- ◆ Microsoft365.com -> Unified Manifest (Meta OS)
- ◆ Fluid Framework -> Azure Fluid Relay
- ◆ LiveShare SDK – Leverages Fluid Framework and configured version of Azure Fluid Relay (Teams Meetings Only)
- ◆ SharePoint Embedded – headless SharePoint storage with all the benefits of M365 functionality

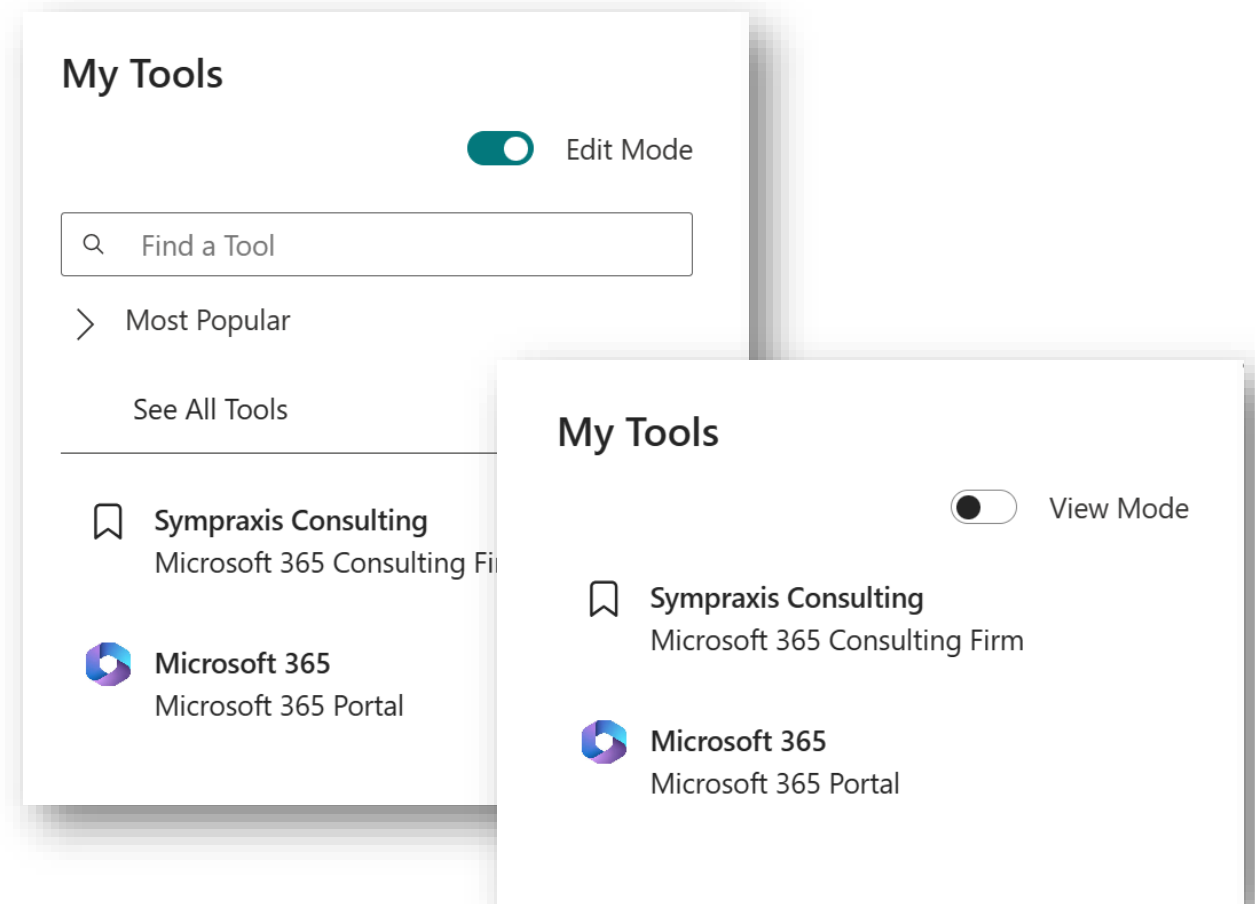
## Delivery

- ◆ Microsoft 365 App Store
- ◆ Microsoft App Source
- ◆ SharePoint App Catalog (SPFx/Teams, Outlook Add-Ins)
- ◆ Teams App Catalog (Teams)
- ◆ Microsoft 365 – Integrated Apps (Teams, Microsoft365.com, Office Add-Ins Only)
- ◆ Teams Side Loading (for development)

# SPFx – Web Part

*Create customization snippet that can be added (1->many times)*

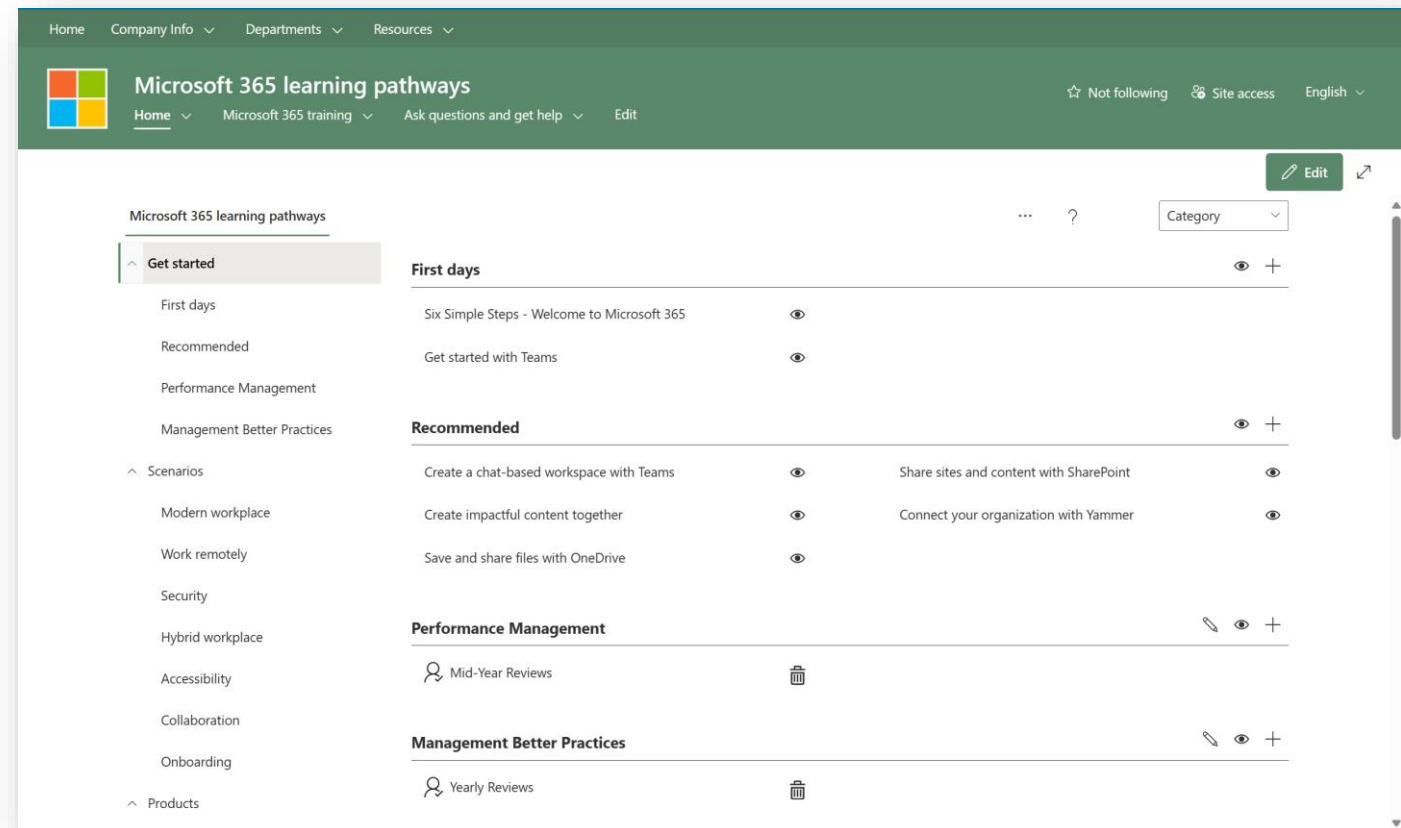
- ◆ DIV Object
  - ◆ Surfaced anywhere in page that 1<sup>st</sup> party web parts can be added
- ◆ UX Scenarios
  - ◆ In page context user tools
  - ◆ Surface information from other sites
  - ◆ Surface information from external sources
  - ◆ Create mini-apps
- ◆ Can also surface as Teams Tab or Personal App



# SPFx – Single App Part Pages (special web part)

*Ability to create page with embedded full-page webpart in site.*

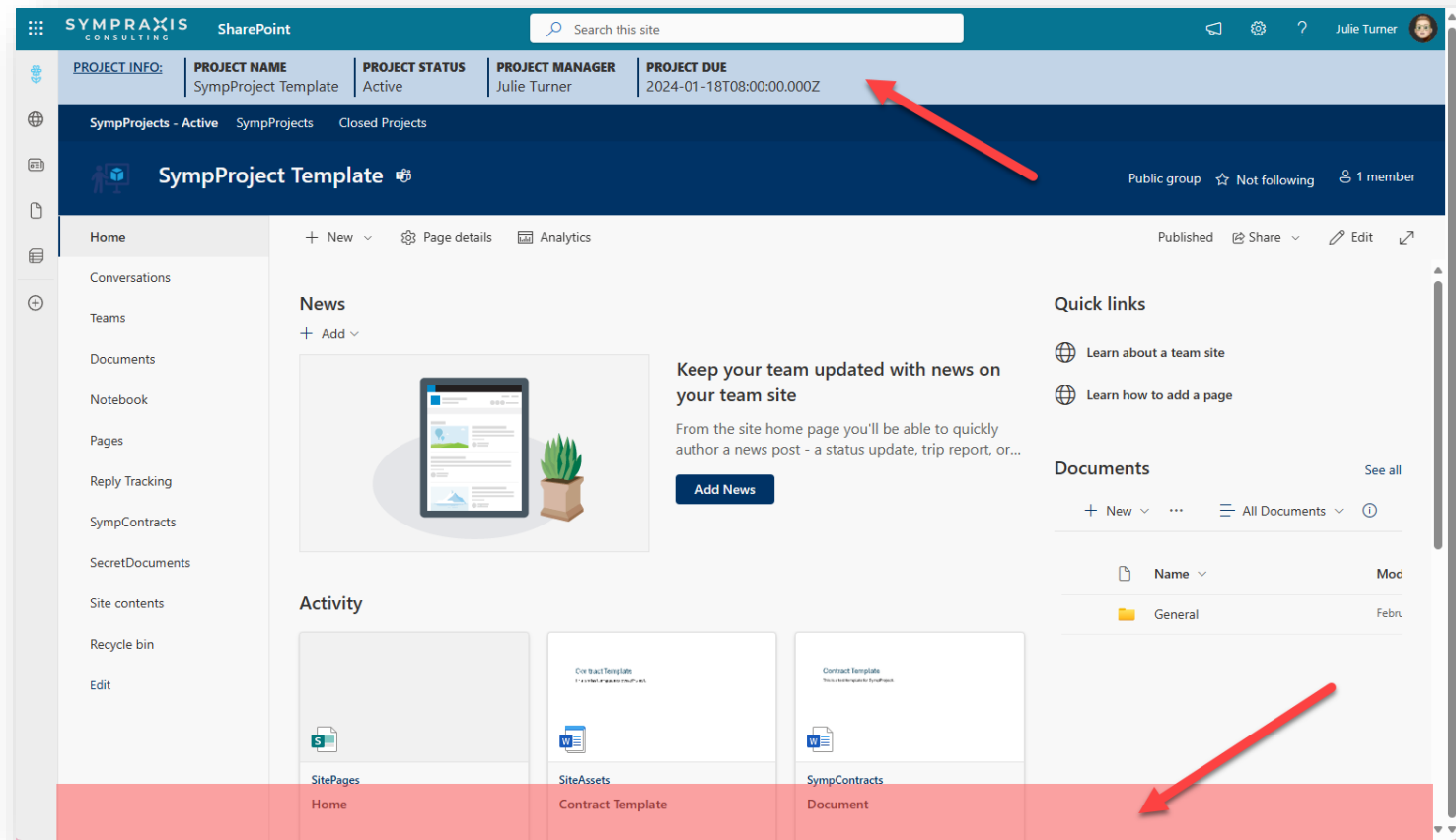
- ◆ DIV Object
  - ◆ Single column
  - ◆ No page toolbar
  - ◆ One web part
- ◆ UX Scenarios
  - ◆ Single Page Application
  - ◆ Full solution scenarios
  - ◆ Requires full page experience
- ◆ More UX: use an HTML modal dialog element



# SPFx – Application Customizers

*Runs on every page in the site/tenant unless you code it otherwise*

- ◆ DIV object – in page
  - ◆ Header (between suite bar and hub navigation)
  - ◆ Footer (pinned to viewport)
- ◆ UX Scenarios
  - ◆ Site/Tenant specific information
  - ◆ Interactive Site-specific functionality
- ◆ Scenarios – No UX
  - ◆ Analytics
- ◆ More UX: use an HTML modal dialog element



# SPFx – Field Customizers

*Runs on every page in the site/tenant unless you code it otherwise*

- ◆ DIV Object
  - ◆ Replace the rendering of the field, with or without the fields value
- ◆ UX Scenarios
  - ◆ Transform the value
  - ◆ Provide extra visualizations
- ◆ More UX: use an HTML modal dialog element

The screenshot displays a SharePoint list view titled 'Organization Tools'. The list has three columns: 'Tool Favorite Count', 'Tool Pinned Co...', and 'Title'. The data rows are as follows:

Tool Favorite Count	Tool Pinned Co...	Title
1	2	Sympraxis Consulting
4	5	Microsoft
2	2	Microsoft 365

Below the list, there is a table with four columns: 'Modified', 'Modified By', 'Actions', and 'Process Stage'. The data rows are:

Modified	Modified By	Actions	Process Stage
December 6, 2022	Julie Turner	<a href="#">Take Action</a>	Test
February 3, 2023	Julie Turner		Initial

# SPFx – Form Customizers

*Customize the new, edit, view form for a SharePoint list*

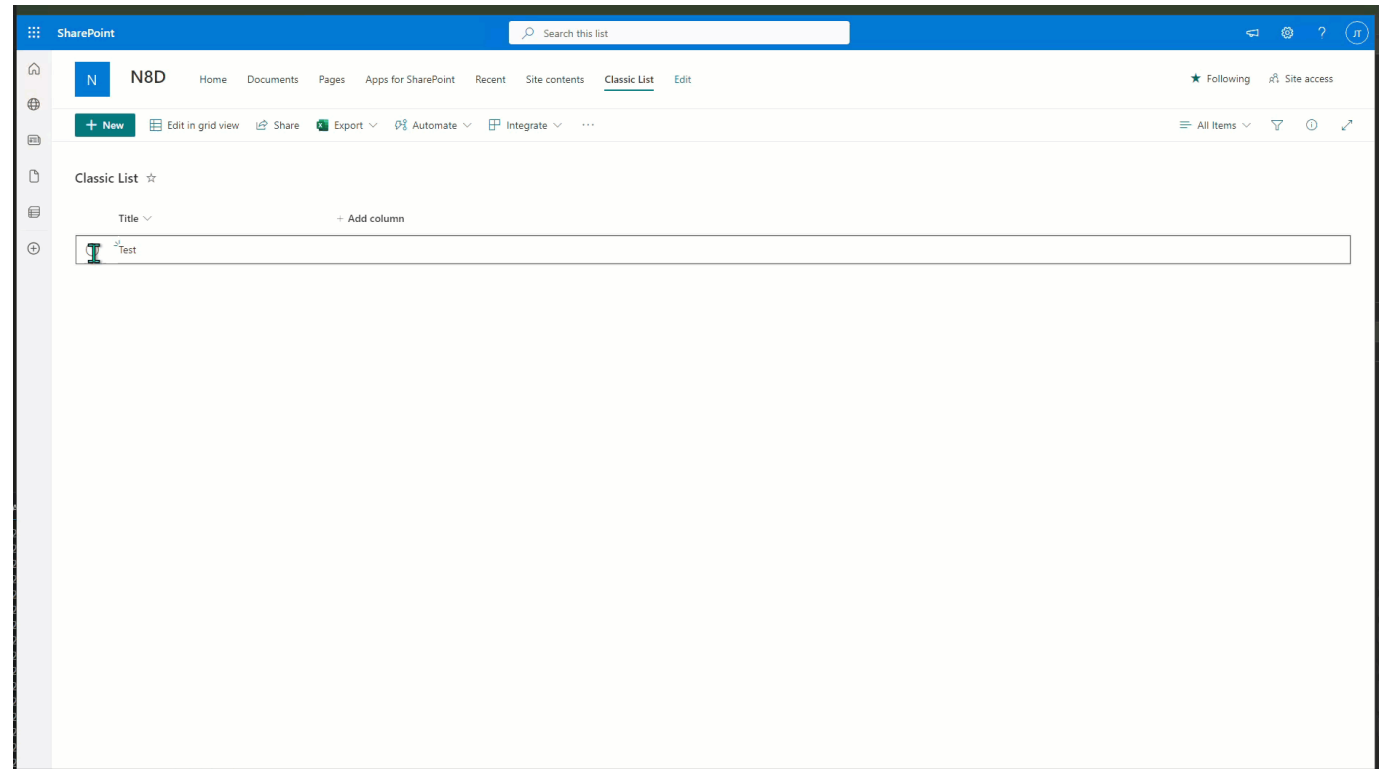
- ◆ Full Page Experience
- ◆ Build ANY logic you want
- ◆ Go extra mile and build custom security
- ◆ Scenarios UX
  - ◆ Complex data entry
  - ◆ Security scenarios
- ◆ More UX: use an HTML modal dialog element

The screenshot displays the SympTools web application interface for customizing a SharePoint form. The top navigation bar includes a blue 'S' logo, the 'SympTools' title, and links for 'Home', 'Documents', 'Pages', 'Organization Tools', 'Site contents', and 'Edit'. The main form area contains several sections: 'Name' with a text field containing 'Sympraxis Consulting'; 'Description' with a text area containing 'Microsoft 365 Consulting Firm'; 'Tool Uri' with two text fields, both containing 'https://sympaxisconsulting.com/'; 'About Uri' with two text fields, both containing 'URL: Description'; 'Tool Keywords' with a text field containing 'consulting'; 'Tool Organization' with a checked checkbox for 'Sympraxis Global HQ' and three unchecked checkboxes for 'Sympraxis Mid-West', 'Sympraxis North', and 'Sympraxis South'; 'Tool Image or Icon' with a toggle switch set to 'Icon' and a search bar; 'Tool Owner' with a dropdown menu showing 'Julie Turner'; 'Backup Tool Owner' with a dropdown menu showing 'Emily Mancini'; and 'Tool Admins only' with a dropdown menu showing 'Approved'. A 'Request Archive' button is located to the right of the 'Backup Tool Owner' field. At the bottom, it shows 'Favorite Count: 1' and 'Pinned Count: 2', followed by 'Save' and 'Cancel' buttons.

# SPFx – Command Set Customizers

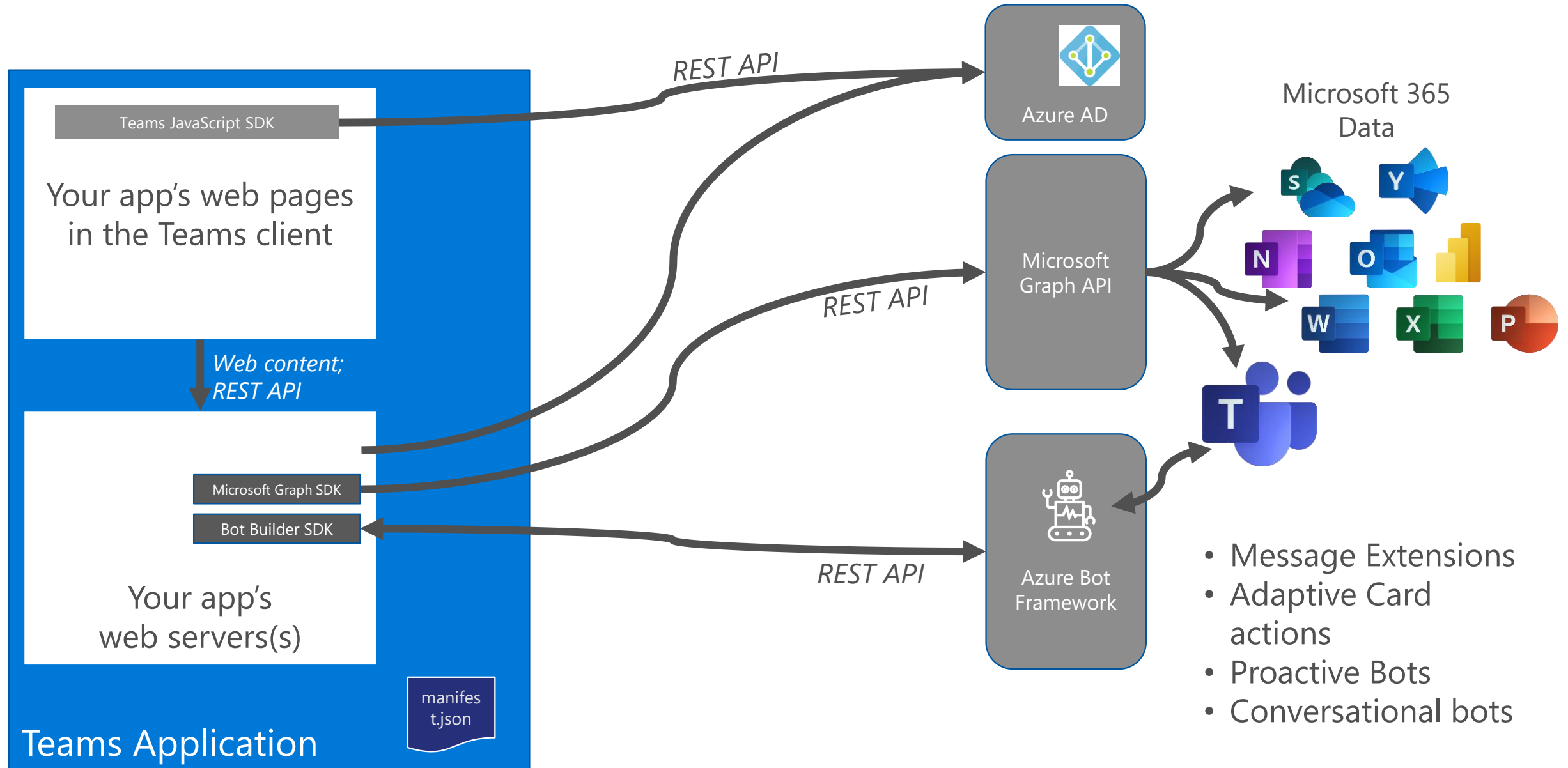
*Runs on every list/library in a site/tenant unless you code it otherwise*

- ◆ DIV Object
  - ◆ In toolbar or quick launch menu
  - ◆ Provides “button” based on list item context
- ◆ UX Scenarios
  - ◆ Trigger actions for entire list
  - ◆ Trigger actions for selected item
  - ◆ Trigger actions for multiple items
- ◆ More UX: use an HTML modal dialog element



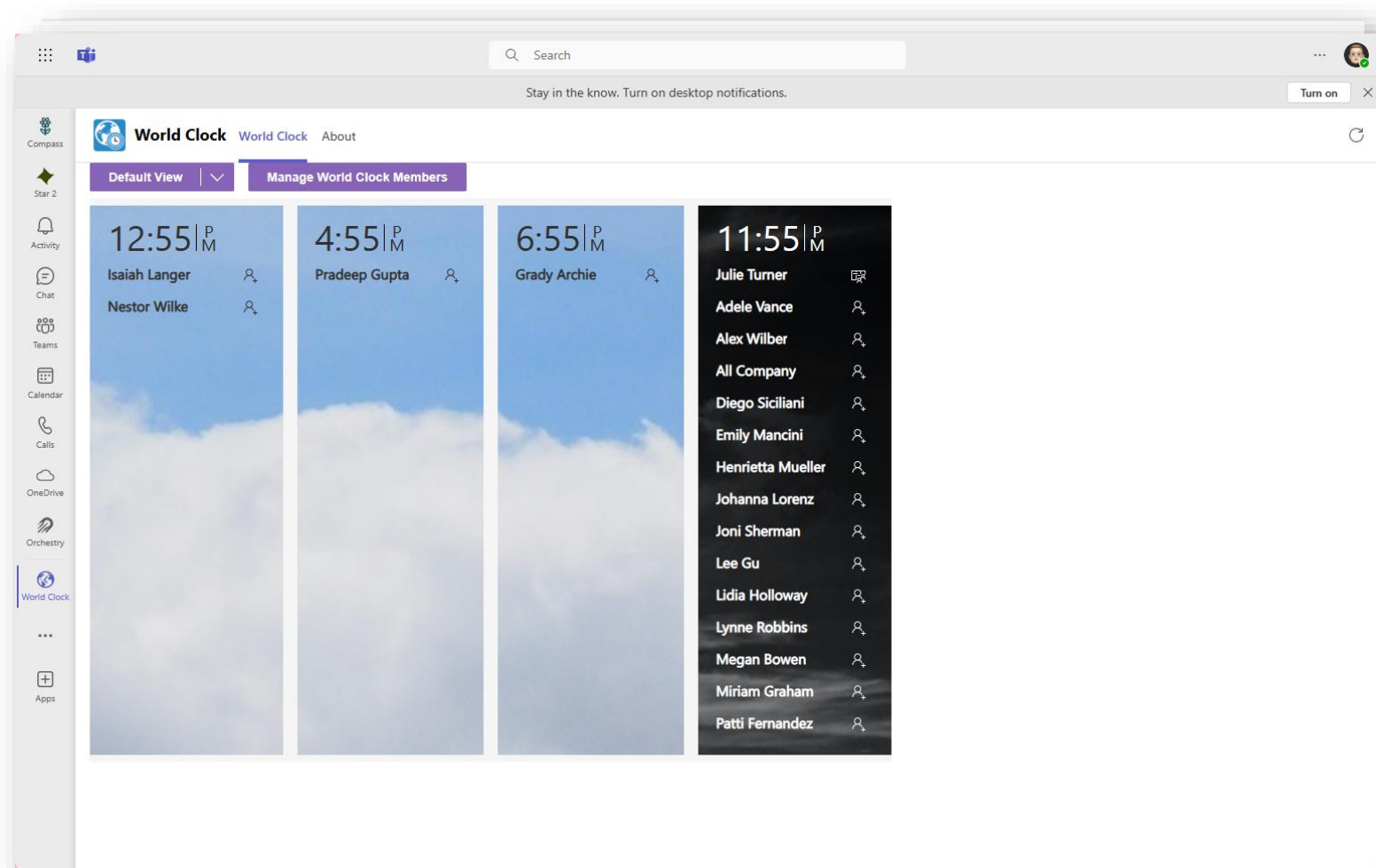


# Teams Development



# Teams - Tabs

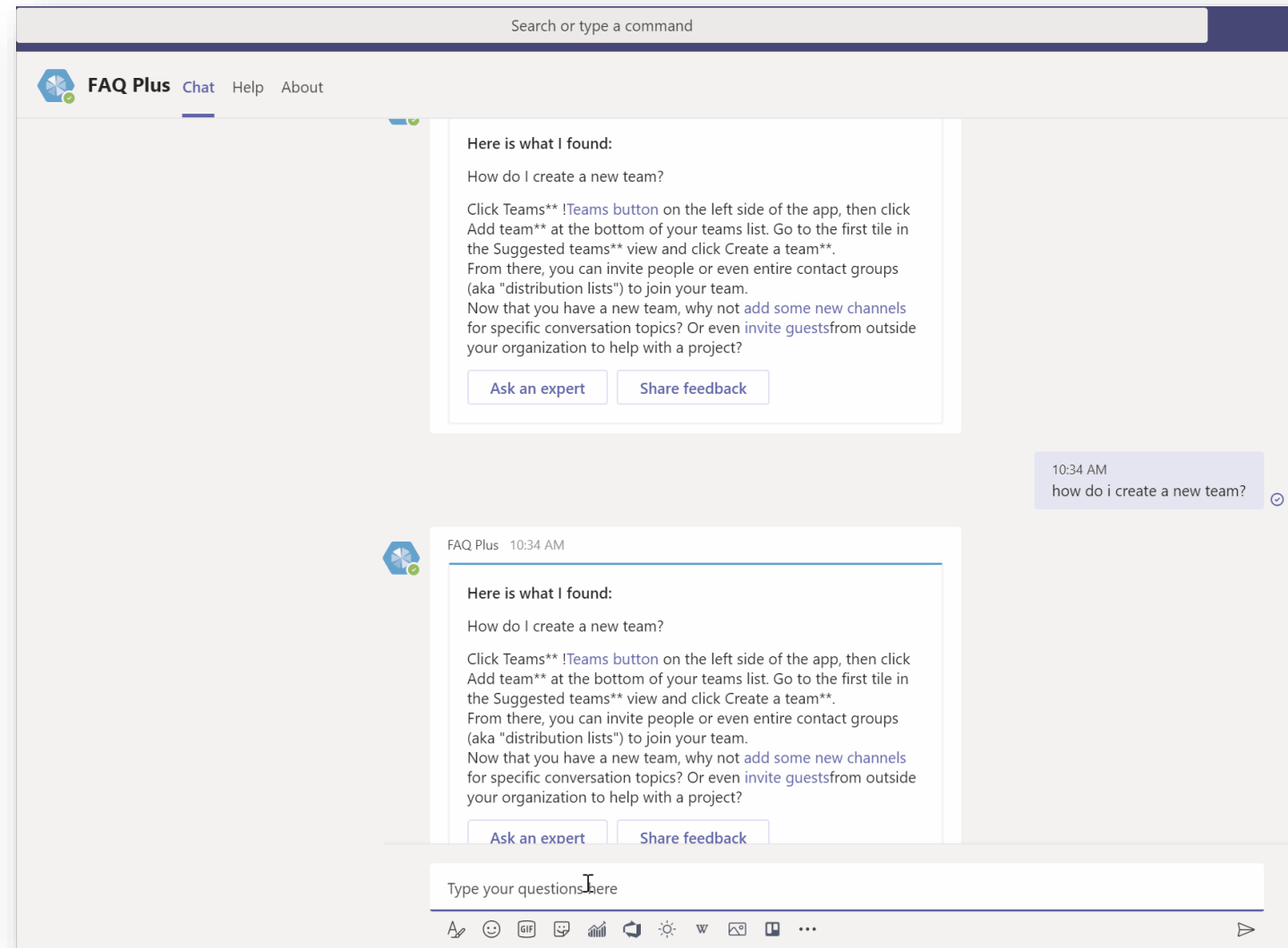
- ◆ iFrame your externally hosted web application in Teams
- ◆ Channel/Group Chat/Meetings Tabs are configurable
- ◆ Personal Tabs are not
- ◆ Can also be deployed to SharePoint



# Teams - Bots

*Also known as chatbot or conversational bot.*

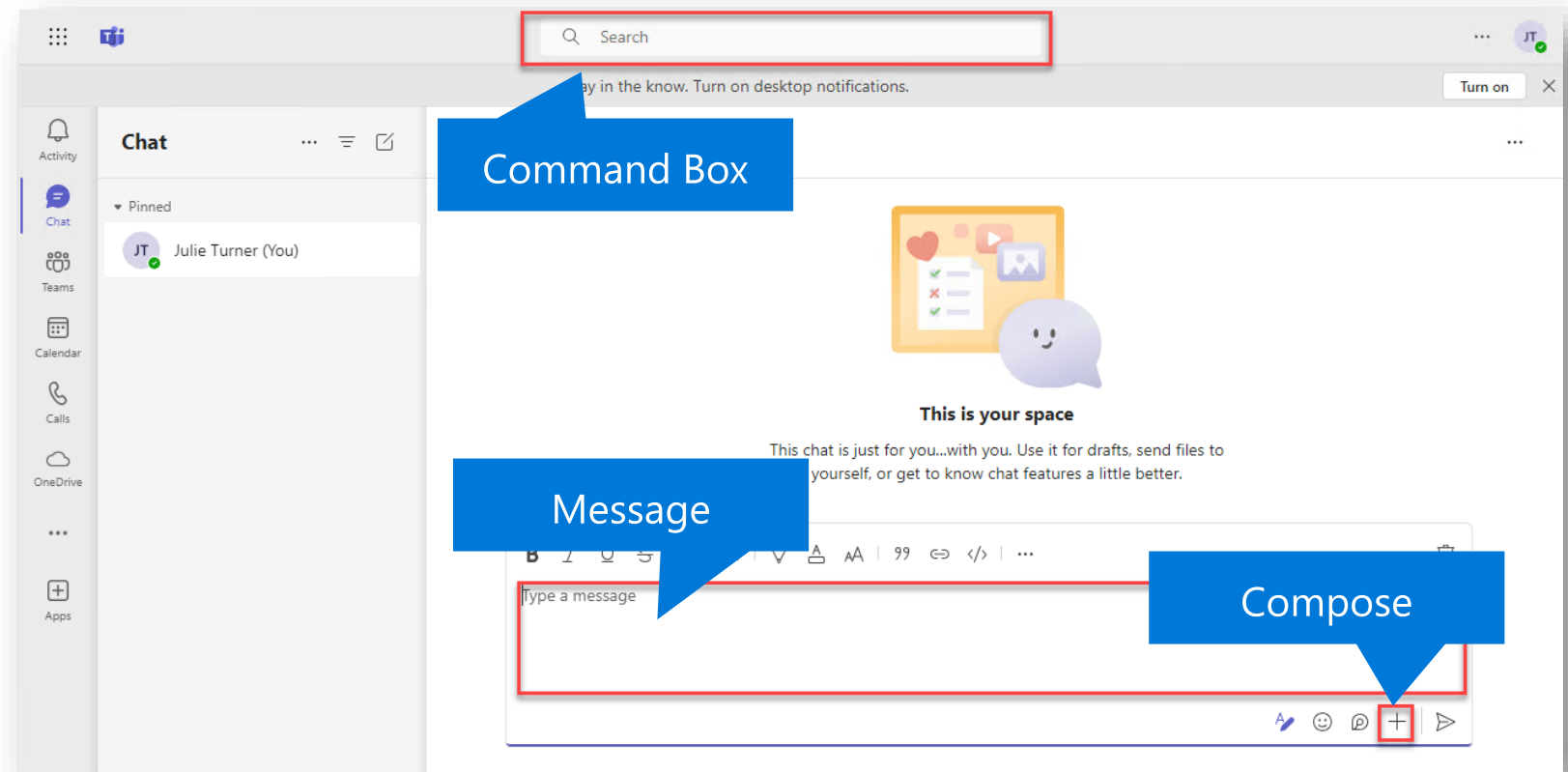
- ◆ Uses Bot Framework
- ◆ Conversational bots allow users to interact with your web service using:
  - ◆ Text
  - ◆ Interactive cards
  - ◆ Dialogs (referred as task modules in TeamsJS v1.x)



# Teams – Messaging Extensions

*Interact with web service through buttons and forms within the Microsoft Teams client*

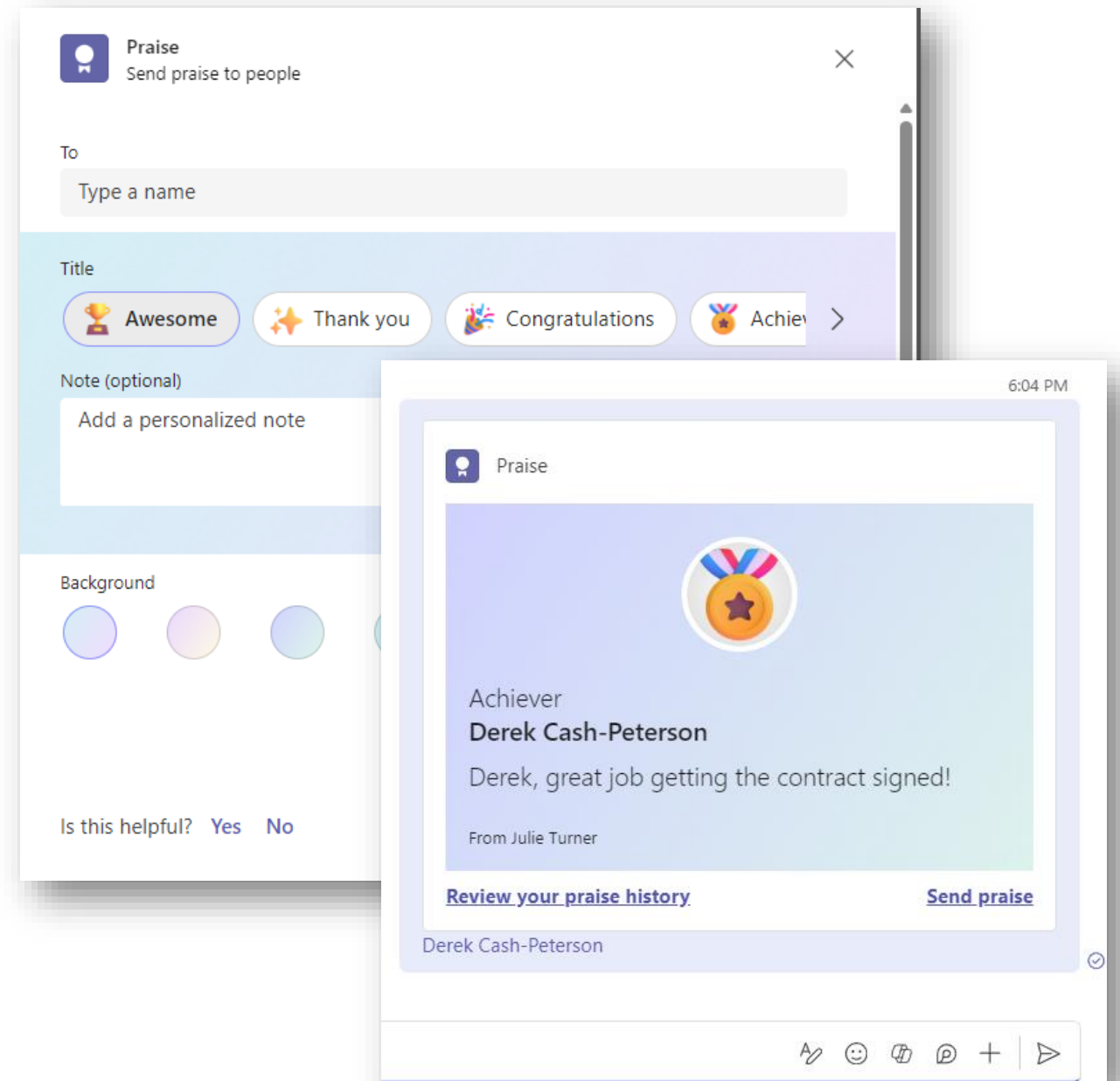
- ◆ Bot Framework
- ◆ API Message Ext
  - ◆ call your REST API directly.
  - ◆ limited functionality
- ◆ Actions
- ◆ Search
- ◆ Link Unfurling



# Teams – Actions

*Interact with user in chat/post UX*

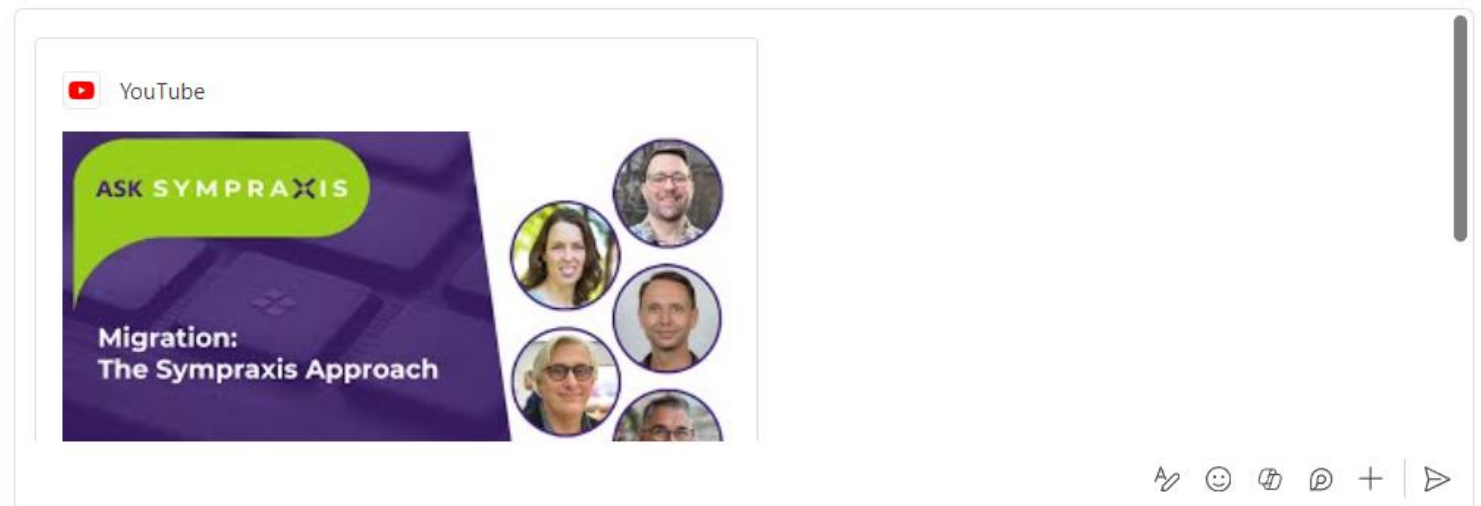
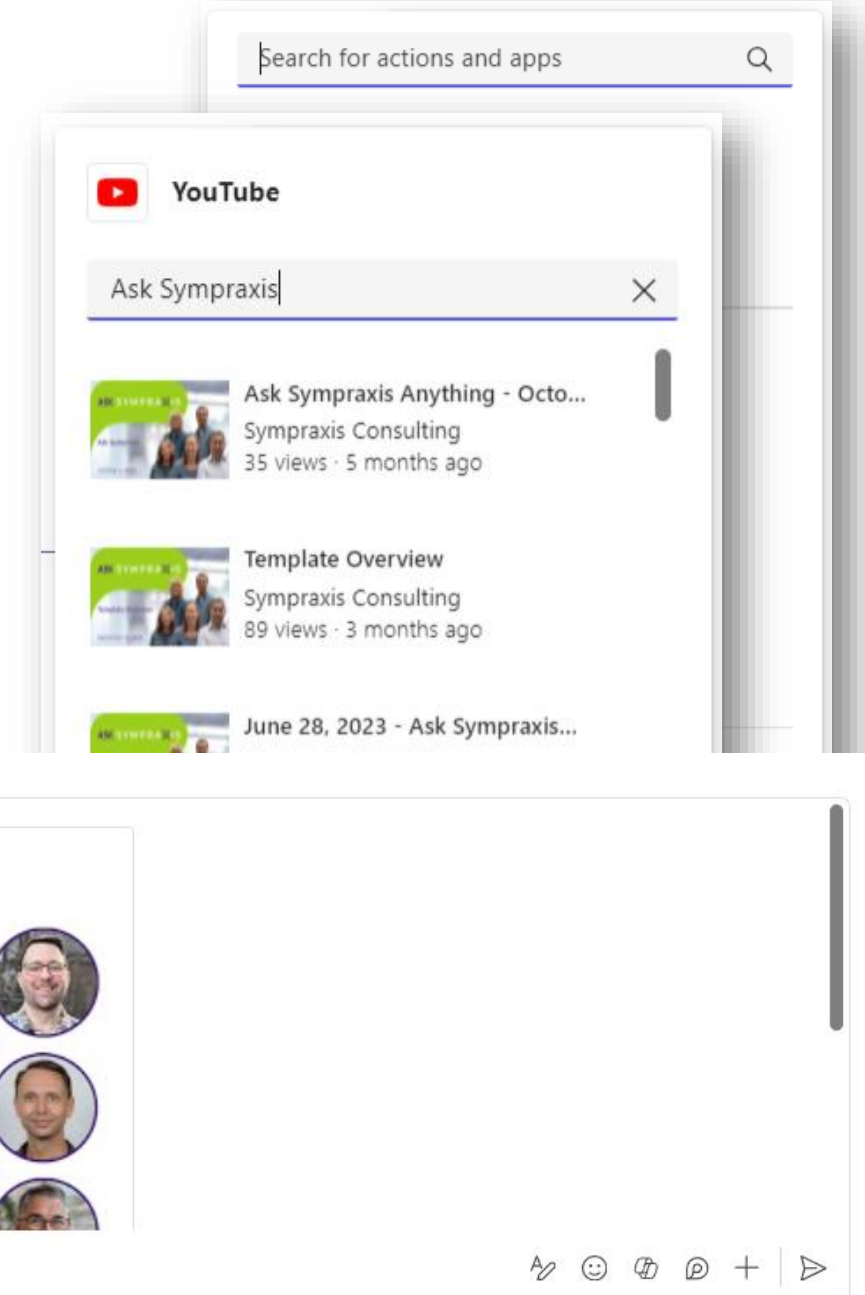
- ◆ Present the users with a modal pop-up to collect or display information
- ◆ Service responds by inserting a message into the conversation directly
- ◆ Multiple forms can be stitched together to behave like a “wizard”
- ◆ Invoke actions from compose message area, the command box, or inside the message (existing message sent to the service)



# Teams – Search

*Provide user with custom search results*

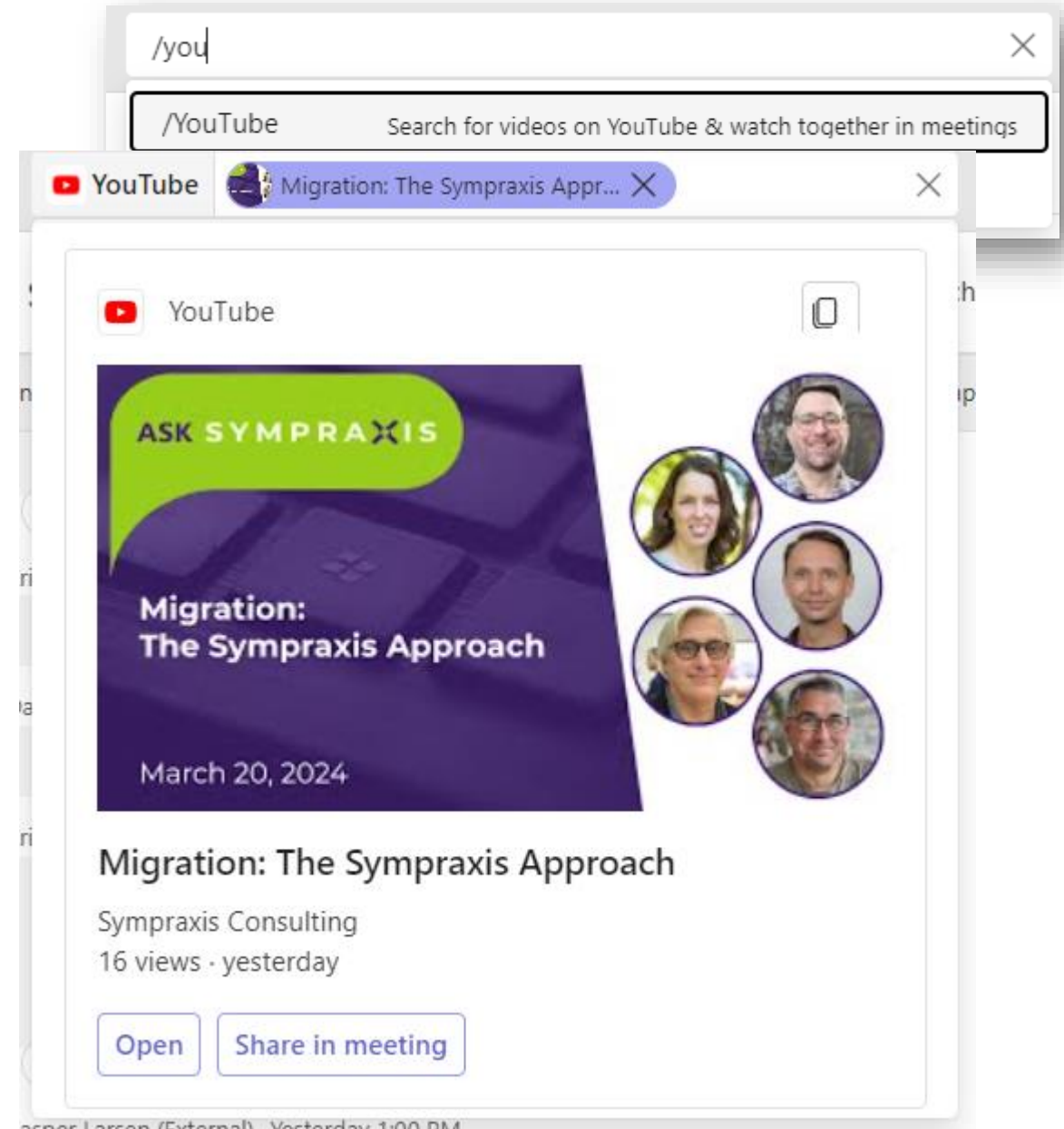
- ◆ Invoke message includes the search string submitted by the user
- ◆ Respond with a list of cards and card previews
- ◆ Trigger from command bar or compose message but not the message itself.



# Teams – Search

*Provide user with custom search results*

- ◆ invoke message includes the search string submitted by the user
- ◆ respond with a list of cards and card previews
- ◆ Trigger from command box or compose message but not the message itself.

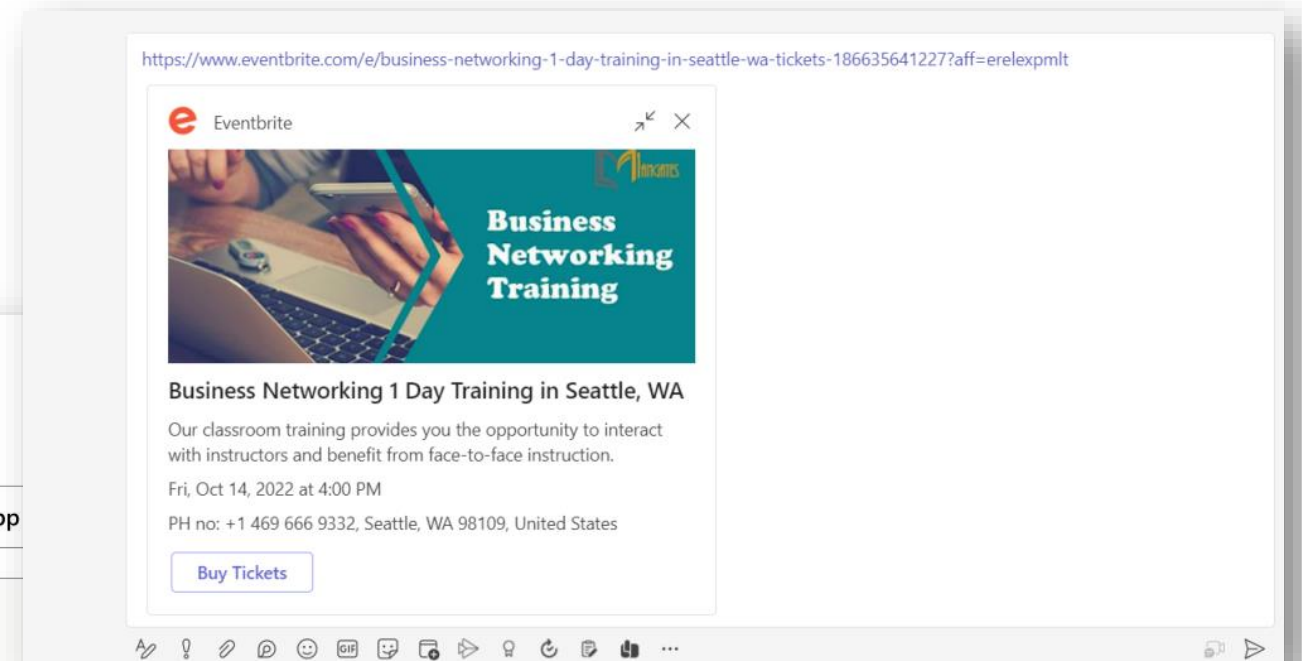
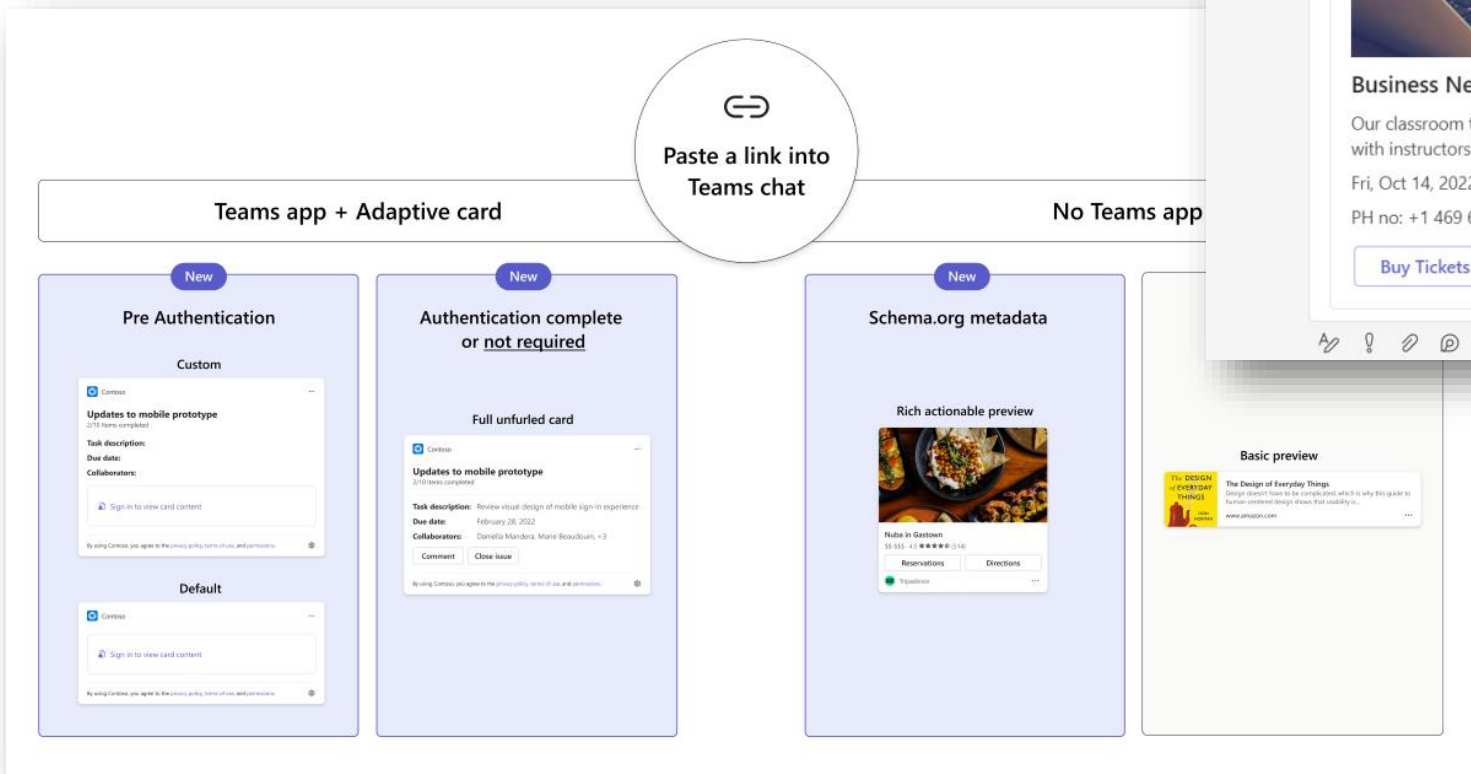




# Teams – Link Unfurling

*Provide user with customized adaptive card in response to links with specific host.*

Can be enabled without having to have the user install the customization



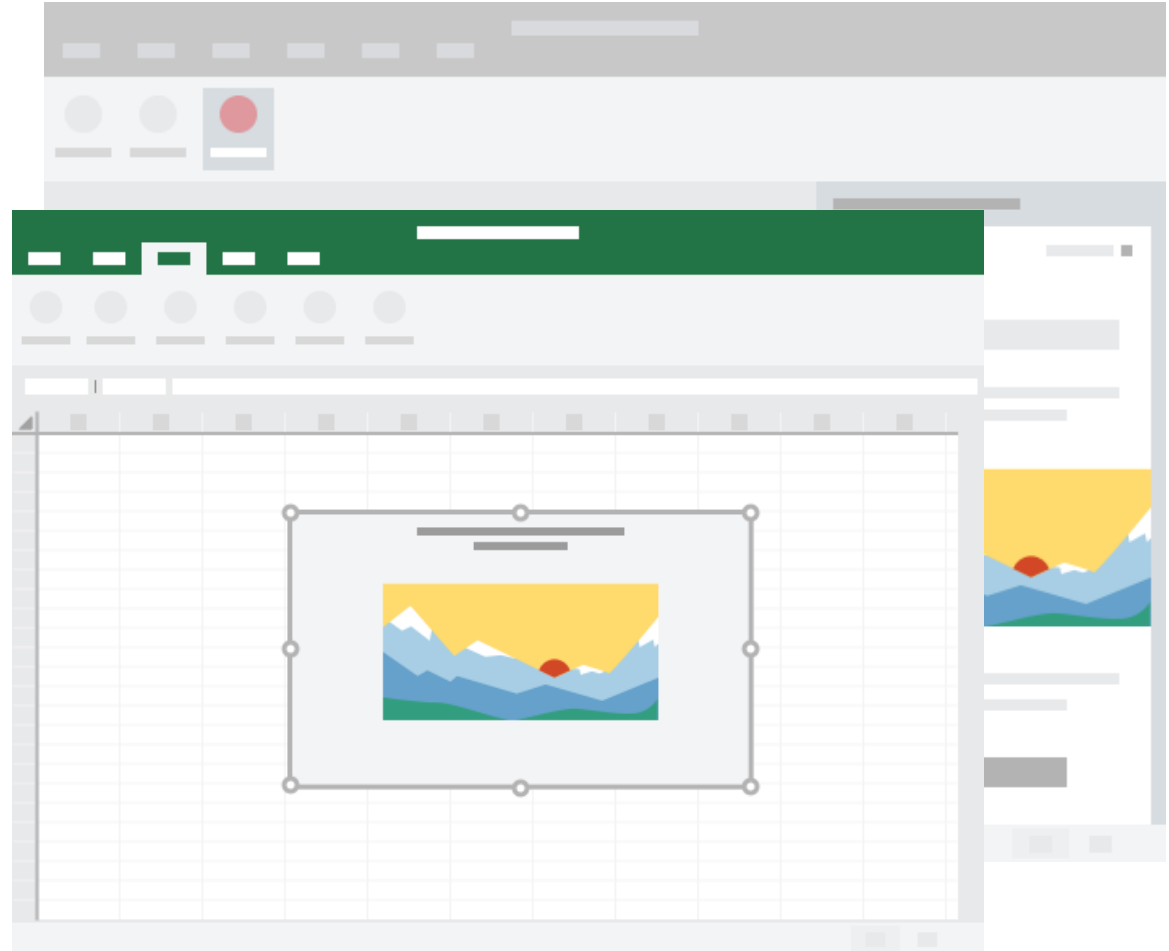
Works in desktop and mobile



# Office Add-Ins

*Extend Office Client functionality (Outlook, Word, Excel, PowerPoint, OneNote, Project, Visio)*

- ◆ Custom ribbon buttons and menu commands
  - ◆ collectively called "add-in commands"
- ◆ Insertable task panes
- ◆ Embed Web-Based objects called "content add-ins" which can surface external content
  - ◆ web pages, videos, etc
  - ◆ Excel/PowerPoint only



# Server/Cloud Extensions

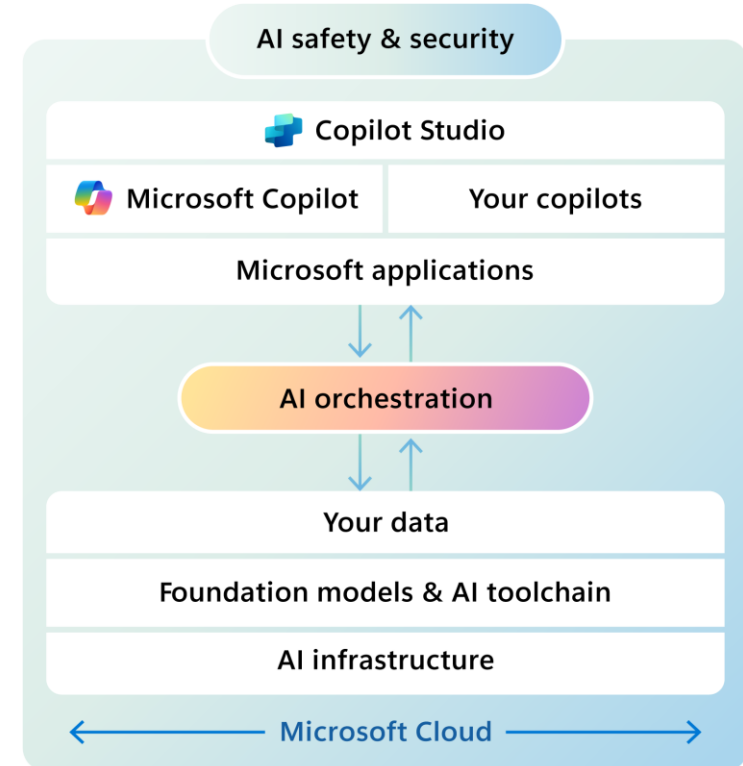
- ◆ Self-Hosted
  - ◆ Traditional On-Prem solutions
- ◆ Cloud-Hosted
  - ◆ Timer
  - ◆ Queues
  - ◆ HTTP Triggered

# Tools - Cloud

*Cloud based services often used when building extensions to Microsoft 365*

- ◆ App Services
- ◆ App Insights
- ◆ Azure Storage
- ◆ Key Vault\*
  
- ◆ Azure OpenAI Assistants
- ◆ Azure AI Studio

## Copilot stack



# Tools – Cloud – Data Sources

- ◆ SQL Server
- ◆ On-Premise Data Gateway
- ◆ Cosmos DB
- ◆ SharePoint Embedded
- ◆ Microsoft Graph APIs (SharePoint APIs)
- ◆ Microsoft Graph Connectors – extends Microsoft 365 search and CoPilot
- ◆ Triggers (Webhooks)
- ◆ 3rd Party APIs
- ◆ “Other Clouds”




















# Authentication

- ◆ Supported Flows
- ◆ OAUTH APIs
- ◆ MSAL
- ◆ Azure Identity
- ◆ Managed Identity

Authentication protocol	Authentication	Authorization	Multifactor Authentication	Conditional Access
Header-based authentication	✓	✓	✓	✓
LDAP authentication	✓			
Open Authorization (OAuth) 2.0 authentication	✓	✓	✓	✓
OIDC authentication	✓	✓	✓	✓
Password-based single sign-on (SSO) authentication	✓	✓	✓	✓
RADIUS authentication	✓		✓	✓
Remote Desktop Gateway services	✓	✓	✓	✓
Secure Shell (SSH)	✓		✓	✓
Security Assertion Markup Language (SAML) authentication	✓	✓	✓	✓
Windows Authentication - Kerberos Constrained Delegation	✓	✓	✓	✓

# Supported Flows

- ◆ Authorization code
- ◆ Implicit
- ◆ Client credentials
- ◆ Device Code
- ◆ On-Behalf-Of
- ◆ Resource Owners Password Credentials

Scenario	Detailed scenario walk-through	OAuth 2.0 flow and grant	Audience	
 Single Page Application	Authorization code flow (with PKCE) 	Single-page app	Authorization code with PKCE	Work or school accounts, personal accounts, and Azure Active Directory B2C (Azure AD B2C)
 Single Page Application	Implicit flow 	Single-page app	Implicit	Work or school accounts, personal accounts, and Azure Active Directory B2C (Azure AD B2C)
 Web app	Web app that signs in users	Authorization code		Work or school accounts, personal accounts, and Azure AD B2C
 Web app	Authorization code flow 	Web app that calls web APIs	Authorization code	Work or school accounts, personal accounts, and Azure AD B2C
 Desktop App	- Authorization code flow (with PKCE) - Integrated Windows Authentication - Username/Password 	Desktop app that calls web APIs	Interactive by using authorization code with PKCE	Work or school accounts, personal accounts, and Azure AD B2C
		Integrated Windows authentication		Work or school accounts
		Resource owner password		Work or school accounts and Azure AD B2C
 Browserless App	Device Code Flow 	Device code	Work or school accounts, personal accounts, but not Azure AD B2C	
 Mobile App	Authorization code flow (with PKCE) 	Mobile app that calls web APIs	Interactive by using authorization code with PKCE	Work or school accounts, personal accounts, and Azure AD B2C
		Resource owner password		Work or school accounts and Azure AD B2C
 Secret  Secret  Secret	Client Credentials flow 	Daemon app that calls web APIs	Client credentials	App-only permissions that have no user and are used only in Microsoft Entra organizations
 API App	On behalf of flow 	Web API that calls web APIs	On-behalf-of	Work or school accounts and personal accounts











# Supported Platforms/Languages

- ◆ .NET
- ◆ .NET Framework
- ◆ Java
- ◆ JavaScript
- ◆ macOS
- ◆ Native Android
- ◆ Native iOS
- ◆ Node.js
- ◆ Python
- ◆ Windows 10/UWP
- ◆ Xamarin.iOS
- ◆ Xamarin.Android

Scenario	Windows	Linux	Mac	iOS	Android
<b>Single-page app</b> 	JS MSAL.js	JS MSAL.js	JS MSAL.js	JS MSAL.js	JS MSAL.js
<b>Single-page app</b> 	JS MSAL.js	JS MSAL.js	JS MSAL.js	JS MSAL.js	JS MSAL.js
<b>Web app that signs in users</b> 	.NET Core ASP.NET Core MSAL Node	.NET Core ASP.NET Core MSAL Node	.NET Core ASP.NET Core MSAL Node		
<b>Web app that calls web APIs</b> 	.NET Core ASP.NET Core + MSAL.NET MSAL Java Flask + MSAL Python MSAL Node	.NET Core ASP.NET Core + MSAL.NET MSAL Java Flask + MSAL Python MSAL Node	.NET Core ASP.NET Core + MSAL.NET MSAL Java Flask + MSAL Python MSAL Node		
<b>Desktop app that calls web APIs</b> 	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node iOS MSALObjC		
<b>Mobile app that calls web APIs</b> 				iOS MSALObjC	Android MSALAndroid
<b>Daemon app</b> 	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core MSAL.NET MSAL Java MSAL Python MSAL Node		
<b>Web API that calls web APIs</b> 	.NET Core ASP.NET Core + MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core ASP.NET Core + MSAL.NET MSAL Java MSAL Python MSAL Node	.NET Core ASP.NET Core + MSAL.NET MSAL Java MSAL Python MSAL Node		

# Microsoft Authentication Library (MSAL)

- ◆ Can acquire tokens on behalf of a user or application
  - ◆ when applicable to the platform
- ◆ Maintains a token cache for you
  - ◆ handles token refreshes when they're close to expiring
- ◆ Helps you specify which audience you want your application to sign in.
  - ◆ The sign in audience can include personal Microsoft accounts, social identities with Azure AD B2C organizations, work, school, or users in sovereign and national clouds.

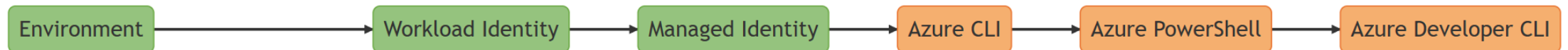
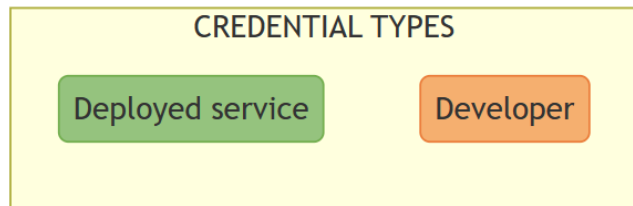
MSAL Library	Supported platforms and frameworks
<a href="#">MSAL.NET</a> 	.NET Framework, .NET, Xamarin Android, Xamarin iOS, Universal Windows Platform
<a href="#">MSAL for Android</a> 	Android
<a href="#">MSAL Angular</a> 	Single-page apps with Angular and Angular.js frameworks
<a href="#">MSAL for iOS and macOS</a> 	iOS and macOS
<a href="#">MSAL Java</a> 	Windows, macOS, Linux
<a href="#">MSALjs</a> 	JavaScript/TypeScript frameworks such as Vue.js, Ember.js, or Durandal.js
<a href="#">MSAL Node</a> 	Web apps with Express, desktop apps with Electron, Cross-platform console apps
<a href="#">MSAL Python</a> 	Windows, macOS, Linux
<a href="#">MSAL React</a> 	Single-page apps with React and React-based libraries (Next.js, Gatsby.js)
<a href="#">MSAL Go (Preview)</a> 	Windows, macOS, Linux



# @Azure/Identity

## DefaultAzureCredential

- ◆ Environment - account information specified via environment variables and use it to authenticate.
- ◆ Workload Identity - deployed to Azure Kubernetes Service with Managed Identity enabled
- ◆ Managed Identity - deployed to an Azure host with Managed Identity enabled
- ◆ Azure CLI - developer has authenticated an account via the Azure CLI az login command
- ◆ Azure PowerShell - developer has authenticated using the Azure PowerShell module Connect-AzAccount command
- ◆ Azure Developer CLI - developer has authenticated an account via the Azure Developer CLI azd auth login command



# Managed Identity

*Managed identities in Azure are a service that allows Azure resources to authenticate cloud services without the need for storing credentials in code or configuration files.*

- ◆ You don't need to manage credentials.
  - ◆ Credentials aren't even accessible to you.
- ◆ You can use managed identities to authenticate to any resource that supports Microsoft Entra authentication, including your own applications.
- ◆ Managed identities can be used at no extra cost.
- ◆ System-assigned
  - ◆ 1:1 relationship with the azure resource and its lifecycle is tied to the resource
- ◆ User-assigned
  - ◆ 1:many relationship to azure resources
- ◆ You authorize a managed identity to have access to one or more services

# Authorizing a managed identity

The screenshot illustrates the steps to authorize a managed identity in the Azure portal:

- Access control (IAM) page:** The left sidebar shows the navigation menu. The 'Access control (IAM)' option is highlighted with a red arrow.
- Add role assignment:** The '+ Add' button is clicked, opening the 'Add role assignment' dialog. The 'Managed identity' option under 'Assign access to' is selected with a red arrow.
- Select managed identities:** The 'Subscription' and 'Managed identity' dropdowns are set to 'Function App (2)'. The 'Select' button is clicked, opening a list of managed identities. One of the identities is selected with a red arrow.

```
m365 login --authType browser
```

```
m365 aad approleassignment add --appObjectId "1022615c-4433-4731-a933-53a9d2770e76" --resource "Microsoft Graph" --scopes "Files.ReadWrite.All,Group.Read.All,Mail.Send,User.Read.All"
```

```
m365 aad approleassignment add --appObjectId "1022615c-4433-4731-a933-53a9d2770e76" --resource "SharePoint" --scopes "Sites.FullControl.All"
```

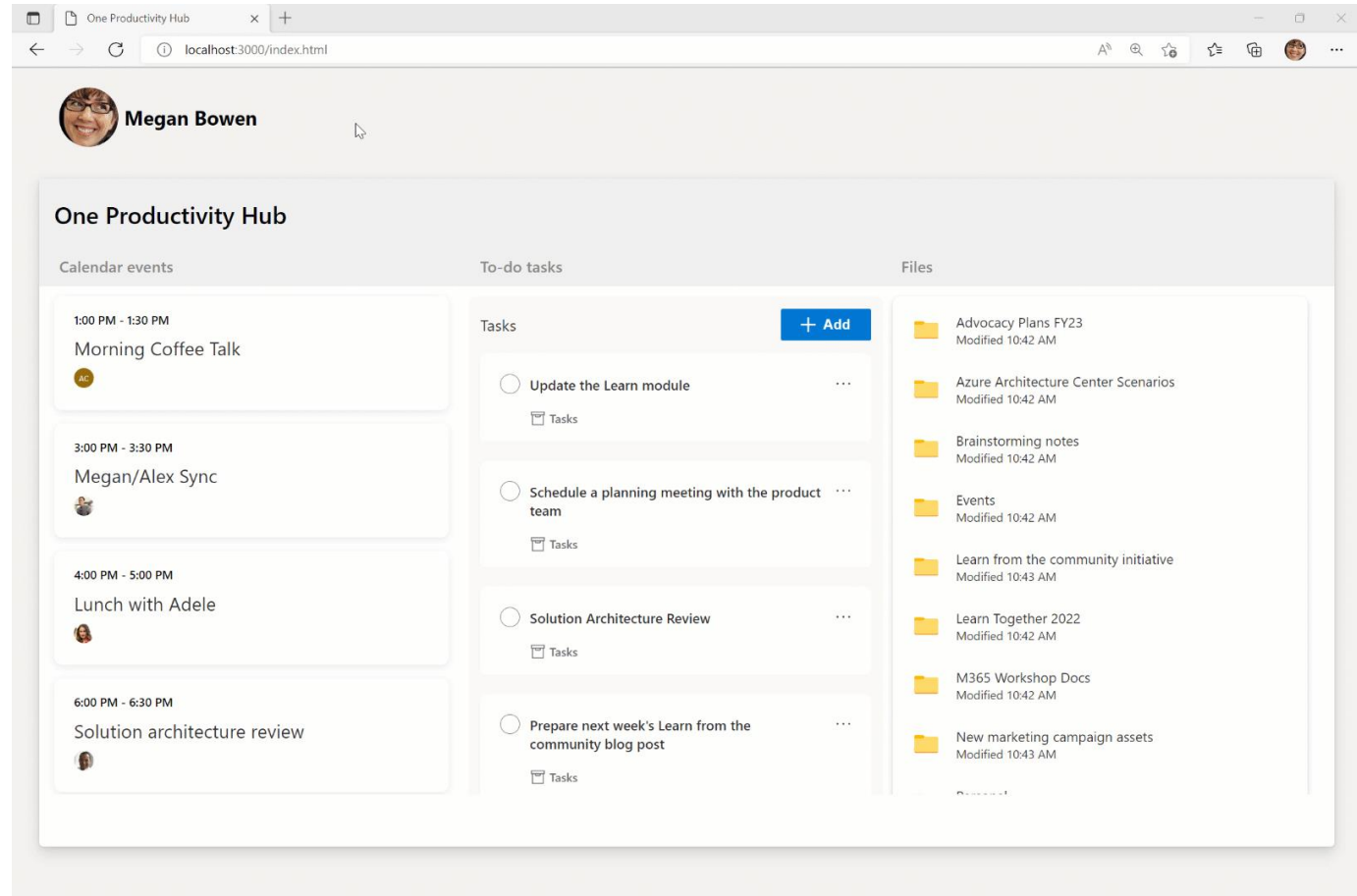
```
m365 aad approleassignment add --appObjectId "1022615c-4433-4731-a933-53a9d2770e76" --resource "SharePoint" --scopes "TermStore.ReadWrite.All"
```

# Microsoft 365 Design Framework Options

- ◆ Fluent UI – FKA Office UI Fabric – FKA Northstar
  - ◆ CSS Classes and SASS mixins for colors, fonts, icons (font based), animations, grid
  - ◆ No HTML/CSS component library
  - ◆ Has REACT library – Uses CSS-in-JS
  - ◆ Technical debt upgrading between major versions-> [Fluent UI GitHub](#)
  - ◆ Figma Design Guides
- ◆ hTWOo – Open-Source Community Project
  - ◆ Pure HTML/CSS solutions – Fully A11y compliant
  - ◆ REACT component library – provides extendibility to rootElementAttributes (and more)
  - ◆ Extendible Style-Guide built on Pattern Labs
  - ◆ SVG based Icon Library

# Data Bound Component Options

- ◆ Microsoft Graph Toolkit Web Components
  - ◆ Uses FluentUI Web Components built with FAST
- ◆ PnP Reusable React Controls
  - ◆ Uses FluentUI v9
  - ◆ Version 3.x is bound to PnPjs v2.x which is no longer supported



# Community Support

- ◆ Community Calls
- ◆ Videos
- ◆ Guidance
- ◆ Samples/Solutions
- ◆ SDKs
- ◆ Tools
- ◆ Extensions
- ◆ Forums

## Microsoft 365 & Power Platform Community

Learn from others how to build apps on Microsoft 365 & Power Platform.

Don't reinvent the wheel. Focus on what truly matters for your organization.

**Changing the world one contribution at a time!**

[SEE INITIATIVES](#) →





Resources

<https://symp.info/m365-ext-links>