

# Developer Introduction to Power BI



# Student Introductions

- Basic Info
  - What's your name?
  - Where do you work? (optional)
  - How long have you been a developer?
- List skills with which you already feel comfortable
  - Working with the Power BI platform
  - Creating PBIX projects with Power BI Desktop
  - Programming with JavaScript and/or TypeScript
  - Working with the R platform
  - Developing with C# and ASP.NET MVC
  - Programming against REST and ODATA web APIs
  - Developing with Microsoft Azure



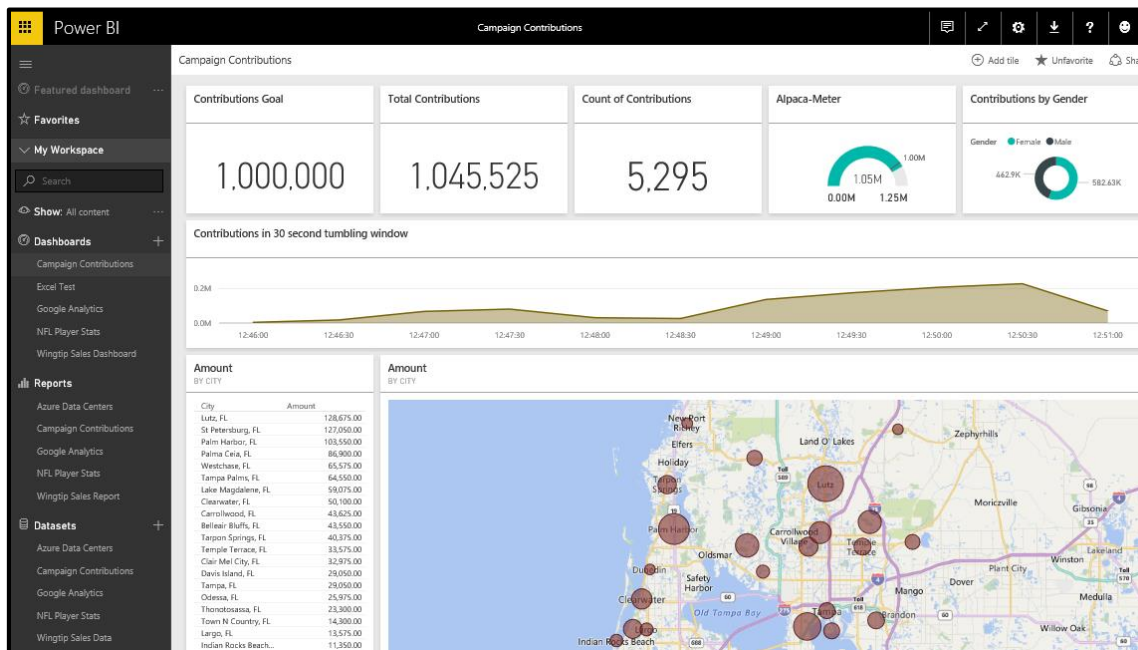
# Agenda

- Power BI as a Development Platform
- Setting Up a Power BI Dev Environment
- Working with Power BI Desktop and PBIX Files
- Developer Opportunities in Power BI
- Understanding Workspaces and Capacities
- Power BI Developer Resources



# The Power BI Service – Who Is It For?

- Provides SaaS service used by web and mobile users
  - Power BI portal accessible to browsers at <https://app.powerbi.com>
  - Power BI mobile accessible to users on mobile phones & devices
- Provides PaaS service used by software developers
  - Power BI Service API accessible at <https://api.powerbi.com>



# Agenda

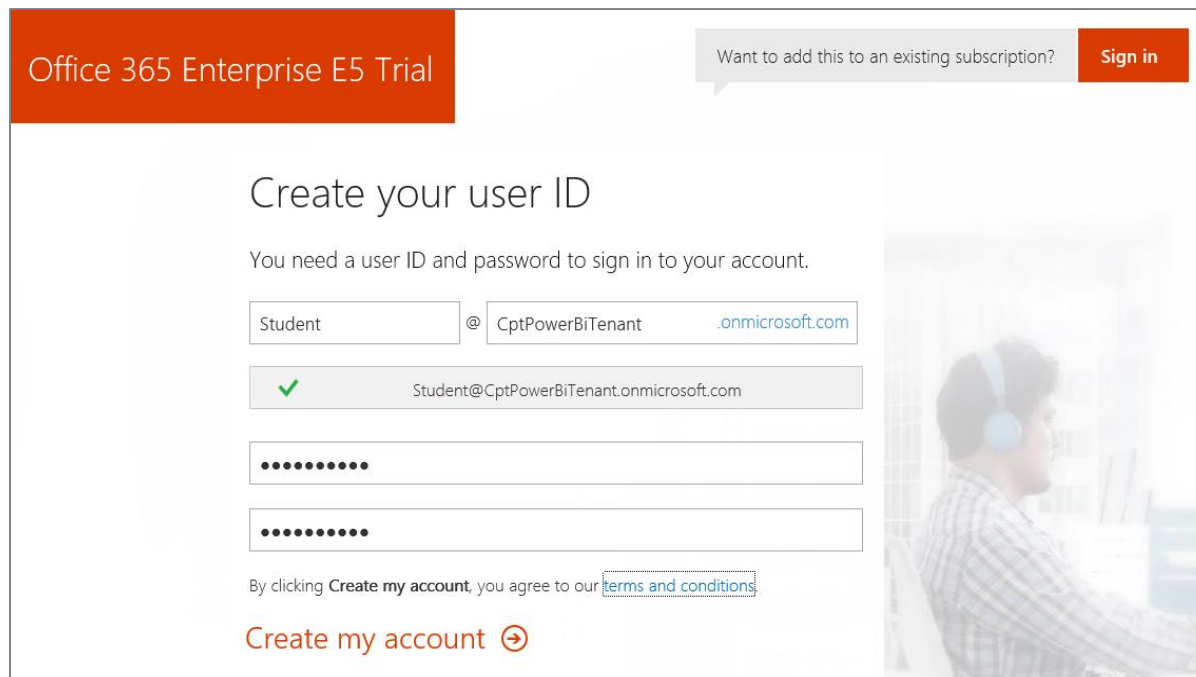
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# Creating a Power BI Dev Environment

- Sign up for an Office 365 Enterprise E5 trial account
  - Creates a new Office 365 tenant
  - Creates an account which is tenant administrator
  - You can create 25 user accounts for testing purposes
  - Office 365 E5 provides Power BI Pro license



The screenshot shows the Microsoft Office 365 Enterprise E5 Trial sign-up page. At the top left, there is an orange banner with the text "Office 365 Enterprise E5 Trial". To the right of this banner, there is a grey box with the text "Want to add this to an existing subscription?" and an orange "Sign in" button. The main heading is "Create your user ID". Below this, it says "You need a user ID and password to sign in to your account." The form consists of several input fields: a "Student" field, an "@" symbol, a "CptPowerBiTenant" field, and a ".onmicrosoft.com" field. Below these fields, there is a green checkmark icon and the text "Student@CptPowerBiTenant.onmicrosoft.com". There are two password fields, each with a series of dots representing the password. At the bottom, there is a link to "terms and conditions" and a "Create my account" button with a right arrow icon. On the right side of the page, there is a blurred image of a person wearing a headset and working at a computer.



# Creating User Accounts for Testing

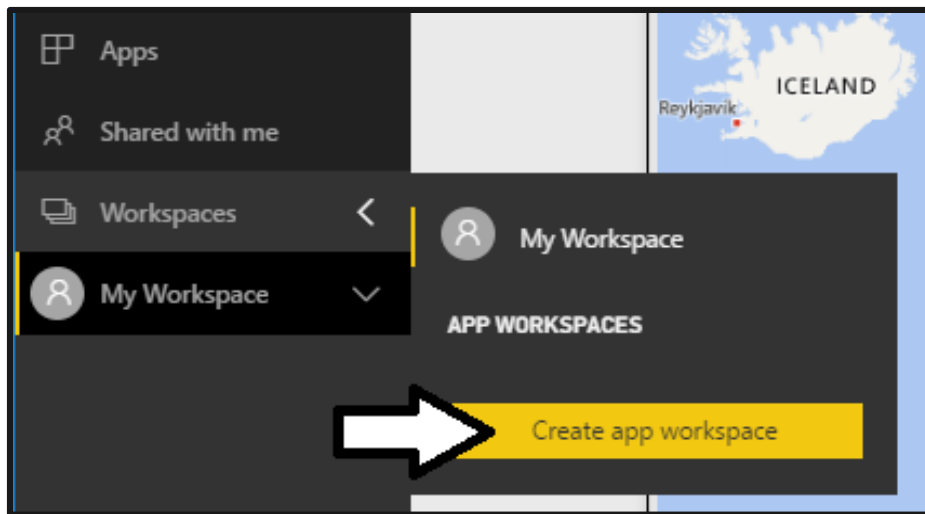
- Can be accomplished in Microsoft 365 Admin center
- Can be automated using PowerShell

```
CreateUserAccountsFromCSV.ps1 X
27
28 $mailNickname = $firstNameClean + $lastNameClean.SubString(0,1)
29 $userPrincipalName = $mailNickname + "@" + $classroomDomain
30
31 $password = "pass@word1"
32 $passwordProfile = New-Object -TypeName Microsoft.Open.AzureAD.Model.PasswordProfile
33 $passwordProfile.Password = $password
34 $passwordProfile.EnforceChangePasswordPolicy = $false
35 $passwordProfile.ForceChangePasswordNextLogin = $false
36
37 # Create new user account for student
38 $newUser = New-AzureADUser `
39     -DisplayName $displayName `
40     -GivenName $firstName `
41     -Surname $lastName `
42     -MailNickName $mailNickname `
43     -PasswordProfile $passwordProfile `
44     -PasswordPolicies "DisablePasswordExpiration, DisableStrongPassword" `
45     -UserPrincipalName $userPrincipalName `
46     -UsageLocation "US" `
47     -AccountEnabled $True
48
```



# Creating App Workspaces

- Power BI content published in app workspaces
  - Power BI Pro license required to author content in app workspace
  - Datasets & reports created by publishing PBIX project files
  - Dashboards must be created by hand

A screenshot of the 'Create an app workspace' dialog box. It contains the following fields and options:

- Name your workspace:** A text input field with 'Ted Pattison' entered.
- Workspace ID:** A text input field with 'tedpattison' entered.
- Available:** A checkbox that is checked.
- Privacy:** A dropdown menu set to 'Private - Only approved members can see what's inside'.
- Permissions:** A dropdown menu set to 'Members can edit Power BI content'.
- Add workspace members:** A section with a text input field for 'Enter email addresses', an 'Add' button, and a list of members. One member is listed: 'criticalpathuser42@powerbimvps.onm...' with the role 'Admin'.
- Advanced:** A dropdown menu.
- Buttons:** 'Save' and 'Cancel' buttons at the bottom right.



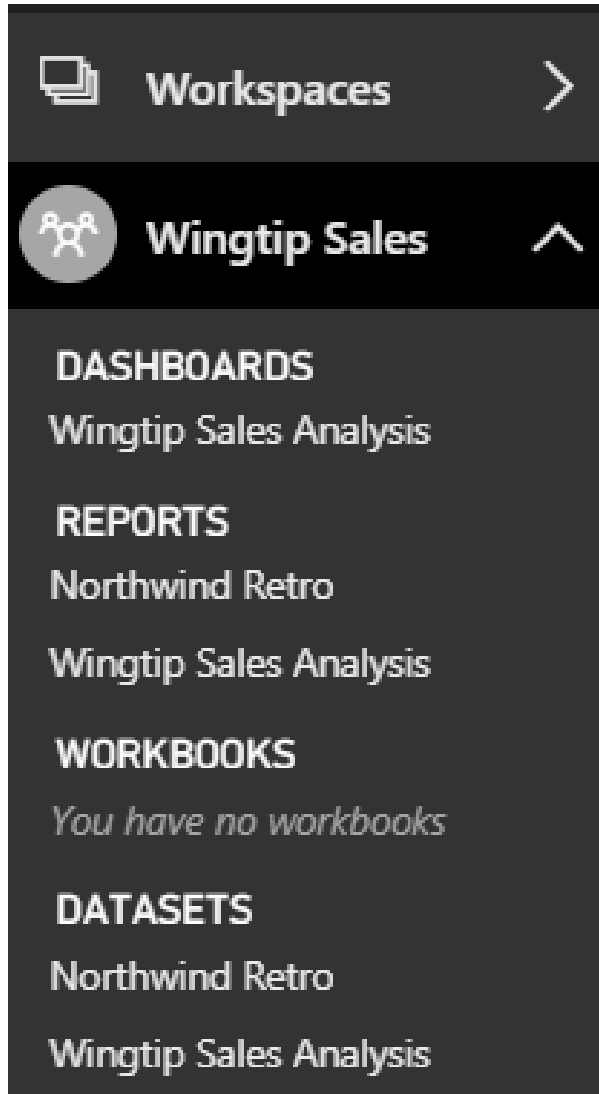


# Power BI App Workspaces - V2

- Power BI transitioning between workspace models
  - V2 app workspaces just moved from preview to GA
  - Microsoft will soon force the migration from V1 to V2
- V1 workspaces built on top of Office 365 groups
  - Largely managed in Office 365 admin not Power BI
- V2 workspaces independent of Office 365 groups
  - Fully managed within Power BI admin portal
  - Provides more flexibility in assigning members



# Central Power BI Concepts

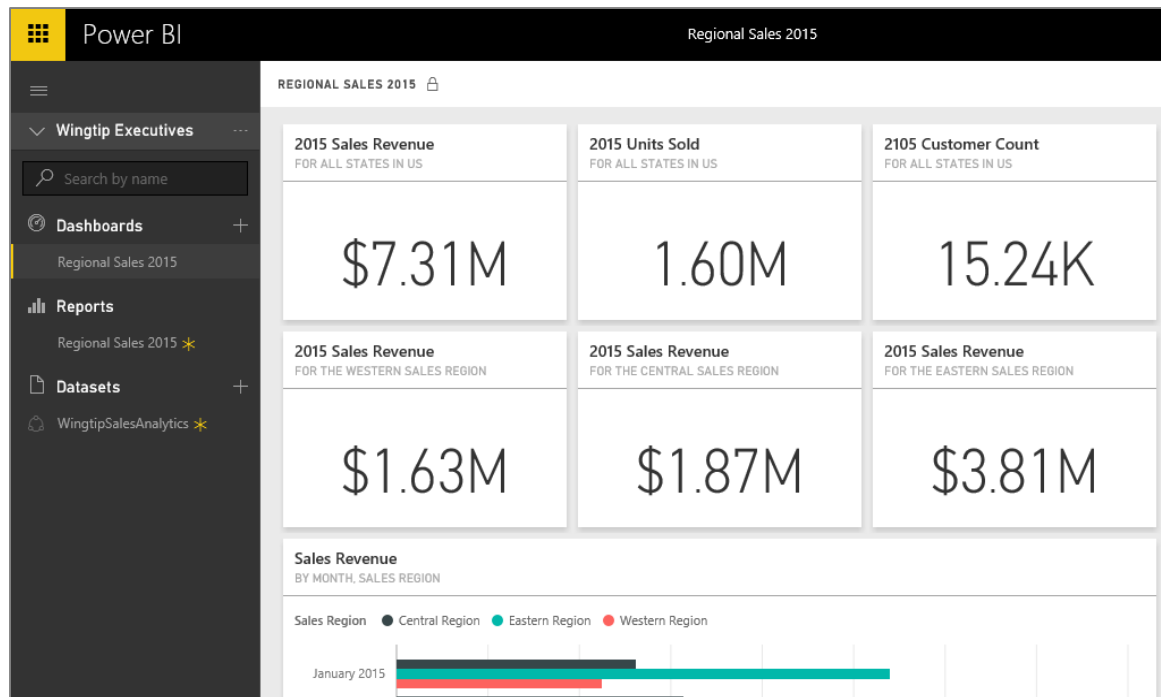


- **Workspace**
  - Secure container for publishing content
  - Every licensed user gets a personal workspace
  - App workspaces created for custom solutions
- **Dashboard**
  - Consolidated view into reports and datasets
  - Custom solution entry point for mobile users
- **Report**
  - Collection of pages with tables & visualizations
  - Provides interactive control of filtering
- **Dataset**
  - Data model containing one or more tables
  - Can be very simple or very complex



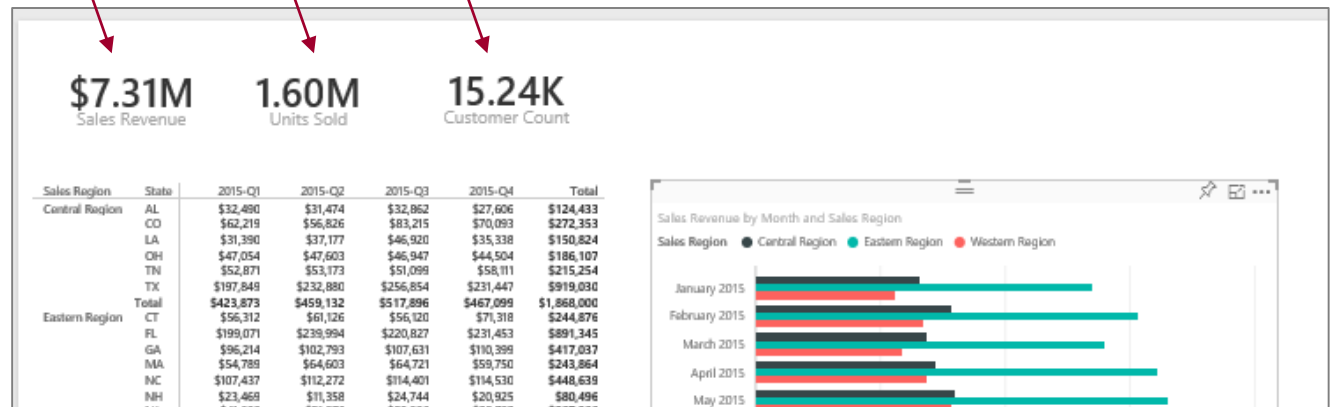
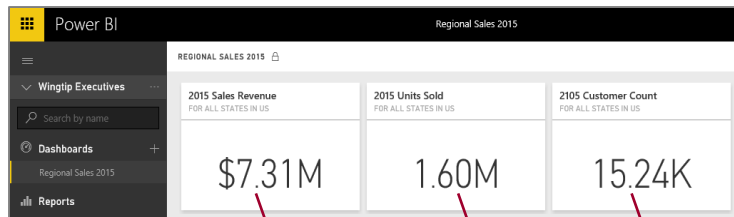
# Dashboards and Tiles

- Dashboard is a collection of tiles
  - Tile can be created by pinning visual from a report
  - Tile can be created by pinning query result from dataset



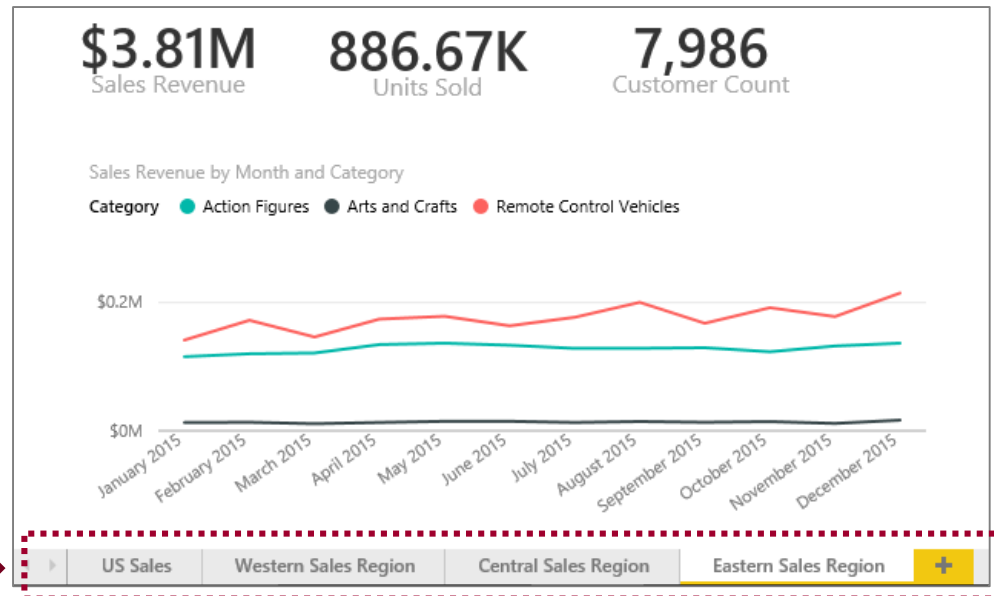
# Dashboards and Reports

- Dashboards link users to reports
  - Dashboard tiles designed to provide high-level view
  - Clicking tiles drills down into report to see more detail



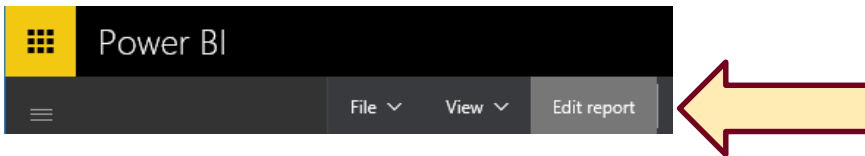
# Reports and Pages

- Reports contain one or more pages
  - A report can be designed with a single page
  - A report can be designed with many pages
  - Tabbed navigation located at bottom of report view
  - Each report is associated with exactly one dataset

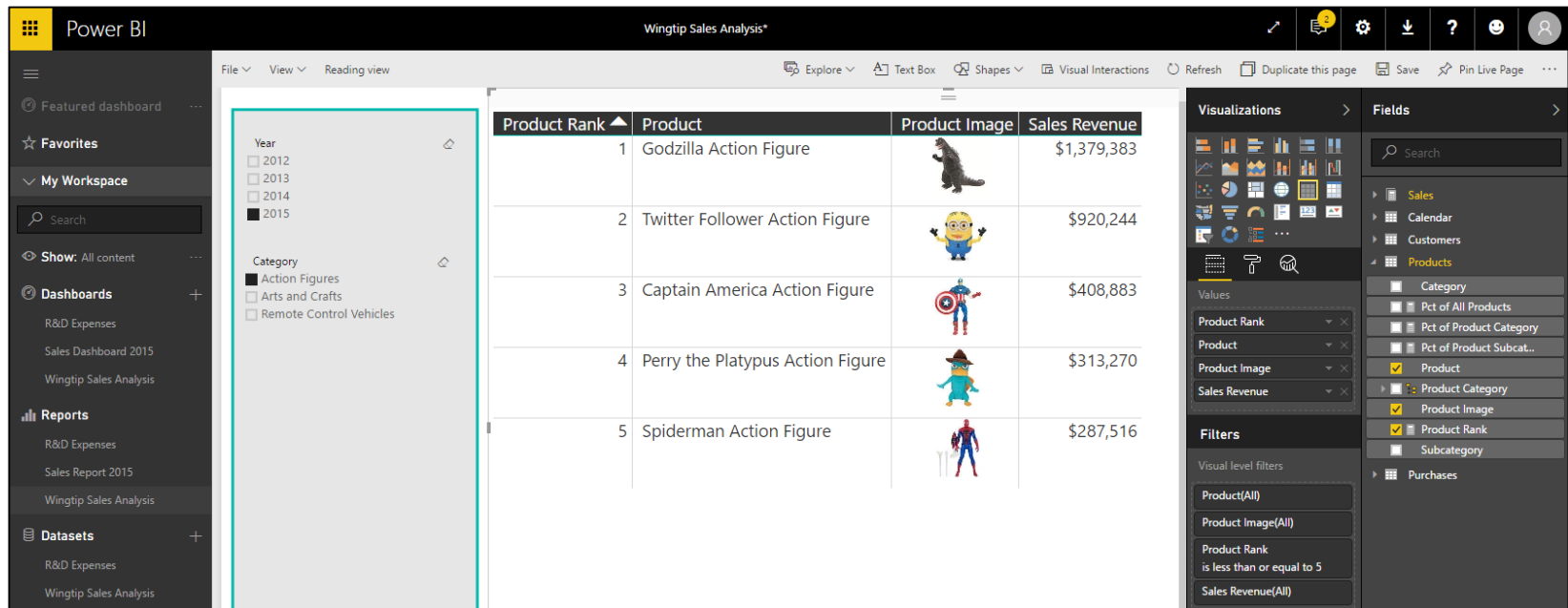







# Report Authoring

- Report initially opens in reading view
  - Click Edit report to switch to edit mode



- Report design tools appear on right side of page

A screenshot of the Power BI report in edit mode. The report is titled 'Wingtip Sales Analysis' and is displayed in 'Reading view'. The main content area shows a table with 5 rows of product data. On the right side, there are two panels: 'Visualizations' and 'Fields'. The 'Visualizations' panel shows a list of visual types (Bar, Line, Pie, etc.) and a list of fields (Product Rank, Product, Product Image, Sales Revenue). The 'Fields' panel shows a list of fields (Sales, Calendar, Customers, Products) and a list of visualizations (Category, Pct of All Products, Pct of Product Category, etc.). The 'Visualizations' panel also shows a list of filters (Product Rank, Product Image, Sales Revenue) and a list of visual level filters (Product(All), Product Image(All), Product Rank is less than or equal to 5, Sales Revenue(All)).

Product Rank	Product	Product Image	Sales Revenue
1	Godzilla Action Figure		\$1,379,383
2	Twitter Follower Action Figure		\$920,244
3	Captain America Action Figure		\$408,883
4	Perry the Platypus Action Figure		\$313,270
5	Spiderman Action Figure		\$287,516



# Visuals (aka Visualizations)

- Reports are designed using visual (aka visualizations)
  - Each visual is based on an underlying visualization type
  - Visualization type can be changed using **Visualizations** pane

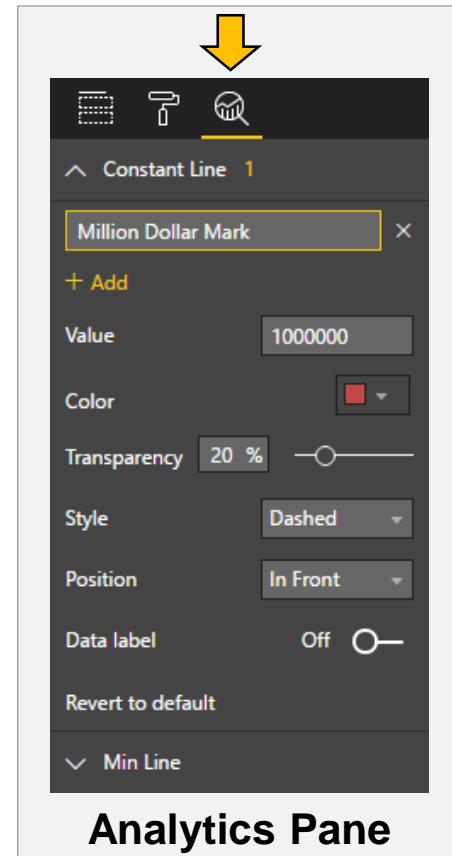
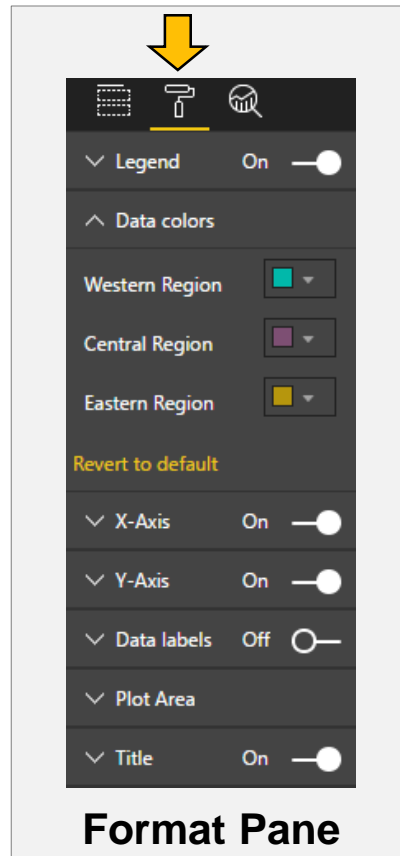
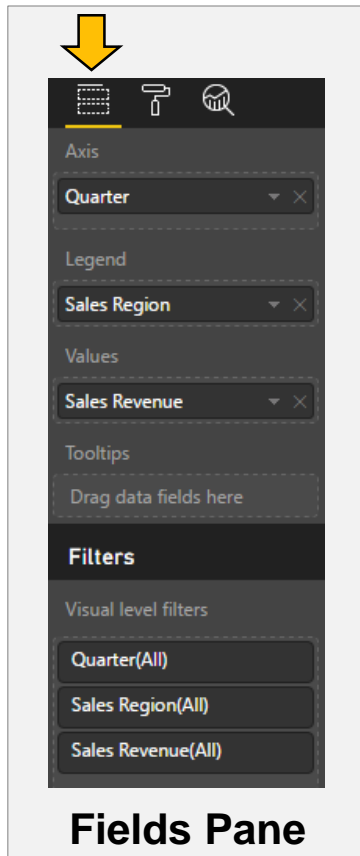


- Visuals creating by using fields from tables inside **Fields** list



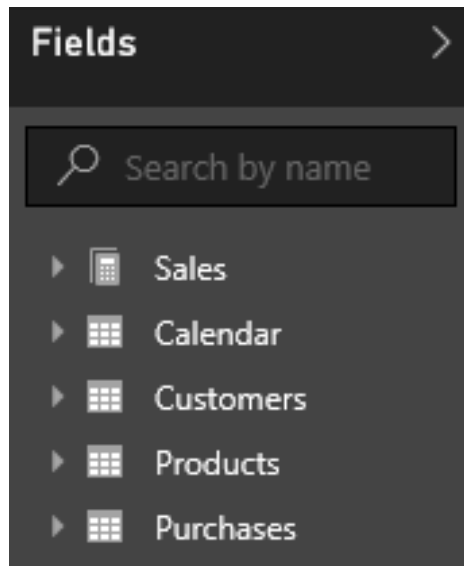
# Editing Visual Properties

- Visual properties modified using three property panes
  - Visual properties vary greatly depending on type of visualization



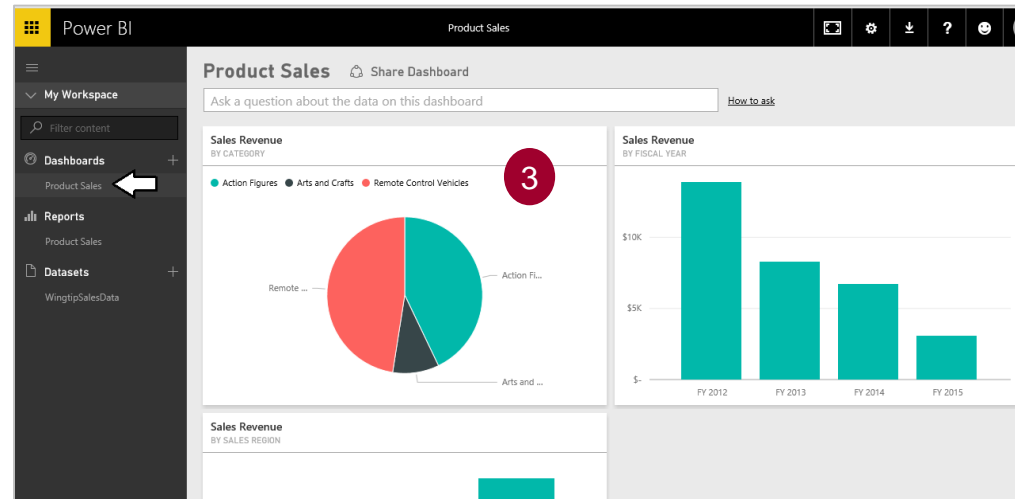
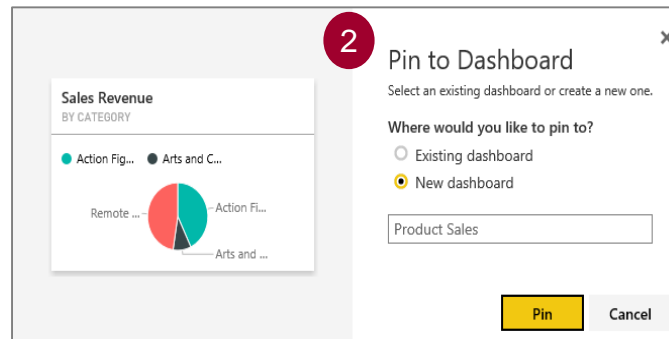
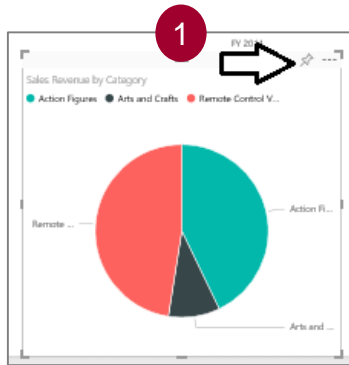
# Report and Datasets

- Each report is based on an underlying dataset
  - **Fields** list in report designer shows tables and fields
  - Report author sees tables & fields as dataset consumer



# Creating Dashboards

- Dashboards contain tiles
- Tiles created from visuals on report pages







**DEMO**

# Getting started with Datasets, Reports and Dashboards

# Agenda

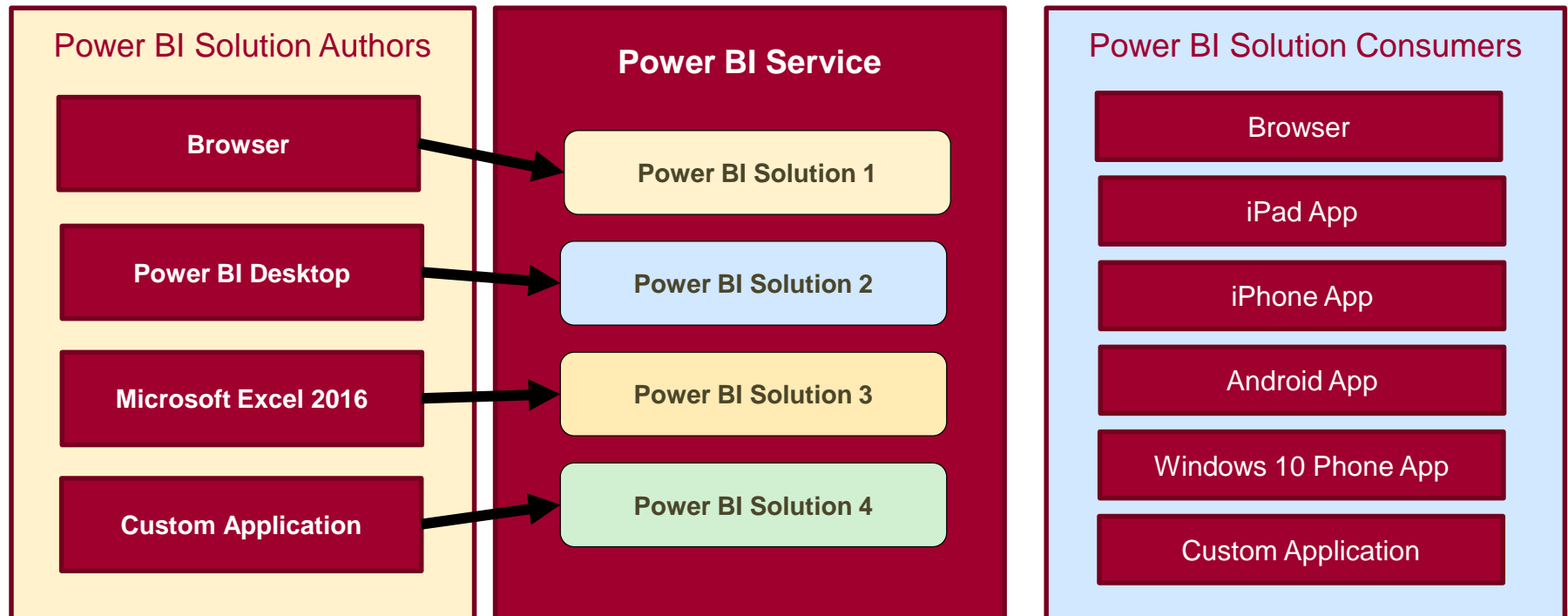
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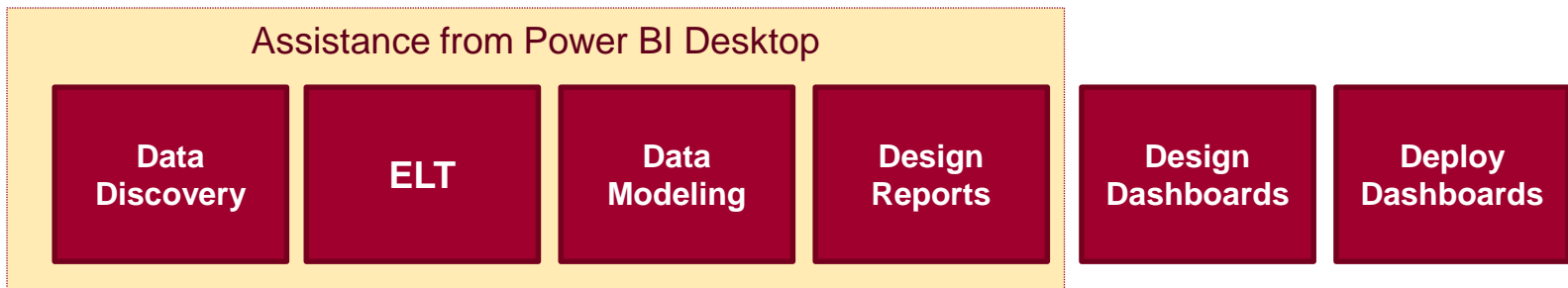
# Power BI Builder Tools

- Power BI support for authors and consumers
  - BI solution authors have a choice in authoring tools
  - BI solutions consumers can use wide range of devices



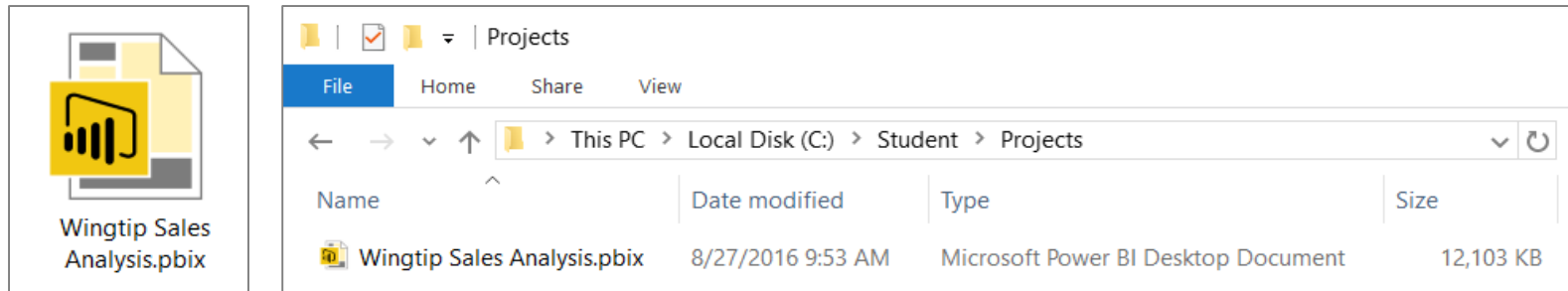
# Working with Power BI Desktop

- Power BI Desktop focuses on first four phases
  - Query features for Data Discovery
  - Query features for ETL
  - Design features and DAX language for data modeling
  - Report design using a visual report designer
  - No support for designing dashboards
  - No support for packaging an entire solution



# Power BI Desktop Projects and PBIX Files

- Power BI Desktop projects saved using PBIX files
  - PBIX file contains data source definitions
  - PBIX file contains query definitions
  - PBIX file contains data imported from queries
  - PBIX file contains exactly one data model definition
  - PBIX file contains exactly one report
  - PBIX file never contains data source credentials



- PBIX files can be tracked in source control (e.g. github.com)
  - PBIX files is a versioned unit of work with 1 dataset and 1 report
  - Some Power BI resources (e.g. Dashboard) have no backing file support



# Division of Labor with Power BI Embedding

- Content Management Team

- Build Power BI Desktop projects
- Publish reports & datasets via PBIX files
- Create dashboards in PBI Service
- Publish App Workspaces as Apps
- Monitor Power BI environment



- Application Development Team

- Develop web apps with PBI embedding
- Authenticate with Azure Active Directory
- Retrieve data using Power BI Service API
- Embed resources using Power BI JavaScript API
- This team sees PBIX files as black boxes



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# Developer Opportunities in Power BI

1. Programming the Power BI Service API
2. Embedding Reports in Custom Applications
3. Developing Solutions with Real-time dashboards
4. Developing Custom Visuals
5. Developing Custom Connectors using M
6. Developing Custom Solutions using R
7. Developing Custom Solutions using Python
8. Leveraging the Power BI features for AI





# Developing with the Power BI Service API

- Used to develop web and desktop applications
  - Requires registering app with Azure Active Directory
- What can you do with the Power BI Service API?
  - Upload PBIX files and configure data sources
  - Create and manage app workspaces
  - Embed PBI reports and dashboard tiles into web apps
  - Create streaming dataset for real-time dashboards



# Developing Custom Visuals

- What is involved?
  - Learning to program in TypeScript instead of JavaScript
  - Learning to use graphics libraries such as D3.js
  - Getting up to speed on the cross-platform toolchain
  - Creating and debugging custom visuals using Node.js
  - Packaging custom visuals for distribution



# Developing Custom Data Connectors

- Custom Connectors let you write reusable query logic
  - Custom connector is written using M programming language
  - Custom connector can be used across PBIX project files
- Common motivation for developing a custom connector
  - Creating a friendly view of a REST API for business analyst
  - Providing branding on top of existing connector
  - Exposing a limited/filtered view over your data source
  - Control how mashup engine authenticates against datasource
  - Implementing OAuth v2 authentication flow for a SaaS offering



# Integrating R with Power BI

- What is R?
  - Platform for statistics, data analysis and visualization
  - Programming language + Runtime layer + Libraries
  - Strong ability to generate statistics and visualizations
- Where can you use R code in Power BI?
  - Inside a query to perform data extraction and cleanup
  - Inside an R visual to generate rich visualizations



# Integrating Python with Power BI

- What is Python?
  - Platform for statistics, data analysis and visualization
  - Programming language + Runtime layer + Libraries
  - Strong ability to generate statistics and visualizations
- Where can you use Python code in Power BI?
  - Inside a query to perform data extraction and cleanup
  - Inside an Python visual to generate rich visualizations



# Agenda





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# Power BI Licensing Though Office 365

## User-based licensing

<p>Power BI (free)</p> <p>\$0.00 user/month</p> <p>A cloud-based business analytics service that enables anyone to visualize and analyze data with greater speed, efficiency, and understanding. It ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Pro</p> <p>\$9.99 user/month</p> <p>A cloud-based business analytics service that enables anyone to visualize and analyze data with greater speed, efficiency, and understanding. Power BI ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Office 365 Enterprise E5</p> <p>\$35.00 user/month</p> <p>The Office suite, plus email, instant messaging, HD video conferencing, 1 TB personal file storage and sharing, and advanced security, analytics and PSTN ...</p> <p>Office 2016 desktop &amp; mobile apps </p> <p>Office 365 services </p> <p>...</p>
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## Capacity-based Licensing

<p>Power BI Premium P1</p> <p>\$4,995.00 instance/month</p> <p>Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P1 offers 8 virtual cores ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Premium P2</p> <p>\$9,995.00 instance/month</p> <p>Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P2 offers 16 virtual cores ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Premium P3</p> <p>\$19,995.00 instance/month</p> <p>Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P3 offers 32 virtual cores ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Premium P4</p> <p>\$39,995.00 instance/month</p> <p>Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P4 offers 64 virtual cores ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Premium P5</p> <p>\$79,995.00 instance/month</p> <p>Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P5 offers 128 virtual cores ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>	<p>Power BI Premium EM3 (Month to Month)</p> <p>\$2,495.00 instance/month</p> <p>Embed Power BI content in your custom application, powered by 4 virtual cores of dedicated capacity. Some Premium features are disabled ...</p> <p>Office 2016 desktop &amp; mobile apps Not included</p> <p>Office 365 services </p> <p>...</p>
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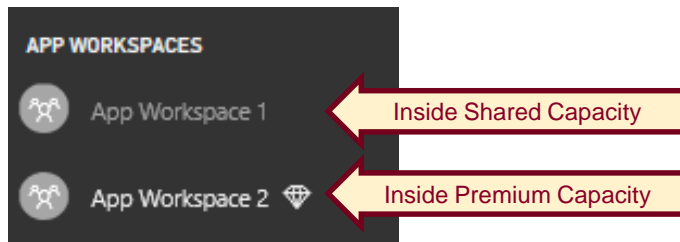
# Dedicated Capacities

- Power BI workspaces run in one of two possible environments
  - Shared capacity
  - Dedicated capacity
- Dedicated capacity required for third party embedding
  - You pay Microsoft capacity-based fee for processors cores and RAM
  - No need to pay Microsoft for user licensing
- Dedicated capacity can be used for first party embedding
  - Allows users to have free license instead of Power BI Pro license
- Dedicated capacities come in two flavors
  - Power BI Premium capacities purchased through Office 365
  - Power BI Embedded capacities purchased through Azure SKU

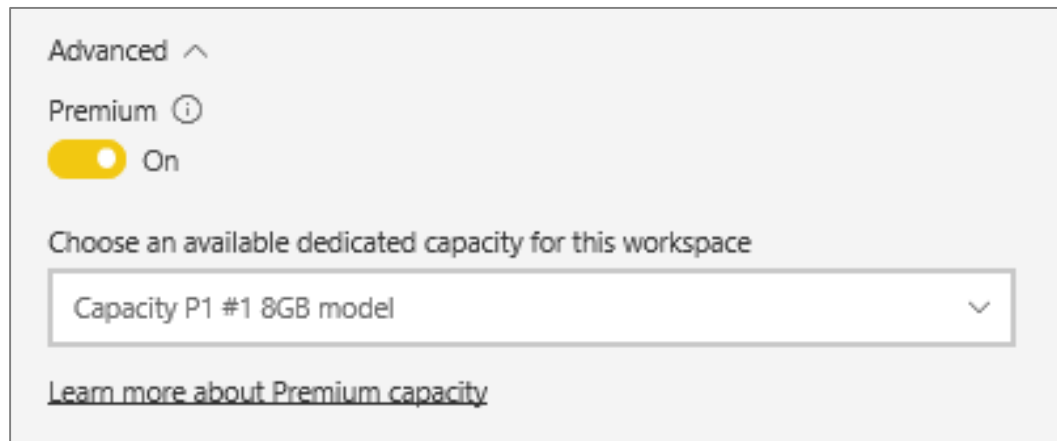
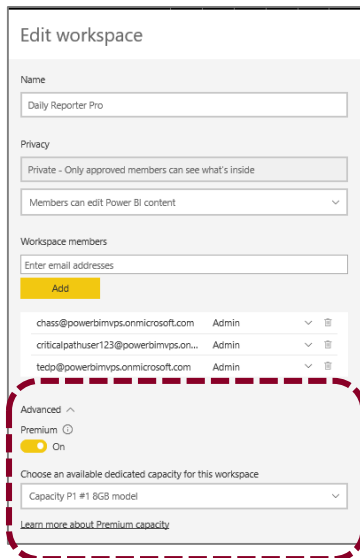


# Associating App Workspaces with a Capacity

- App Workspace in Premium Capacity has diamond icon



- App workspace moved into Premium capacity in Advanced settings



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# Power BI Team Blog

- Power BI Team Blog is an Essential Resource

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

- Be on the lookout for monthly updates

## Power BI Service and Mobile June Feature Summary

Announcements

Features

📅 July 11, 2018 by Nikhil Gaekwad

The month of June flew by quickly for Power BI. With summer in the air and MBAS just around the corner, we are laser focused on planning another unforgettable conference for you in Seattle! There...



# Power BI Community Forums

- Located at <https://community.powerbi.com/>
  - Great place to get answers to tough questions

Home - Microsoft Power

Secure | <https://community.powerbi.com>

Apps Google GitHub O365 Admin Power BI Azure Portal PowerApps OneDrive SPO Site

Microsoft | Power BI Products Solutions Partners Learn

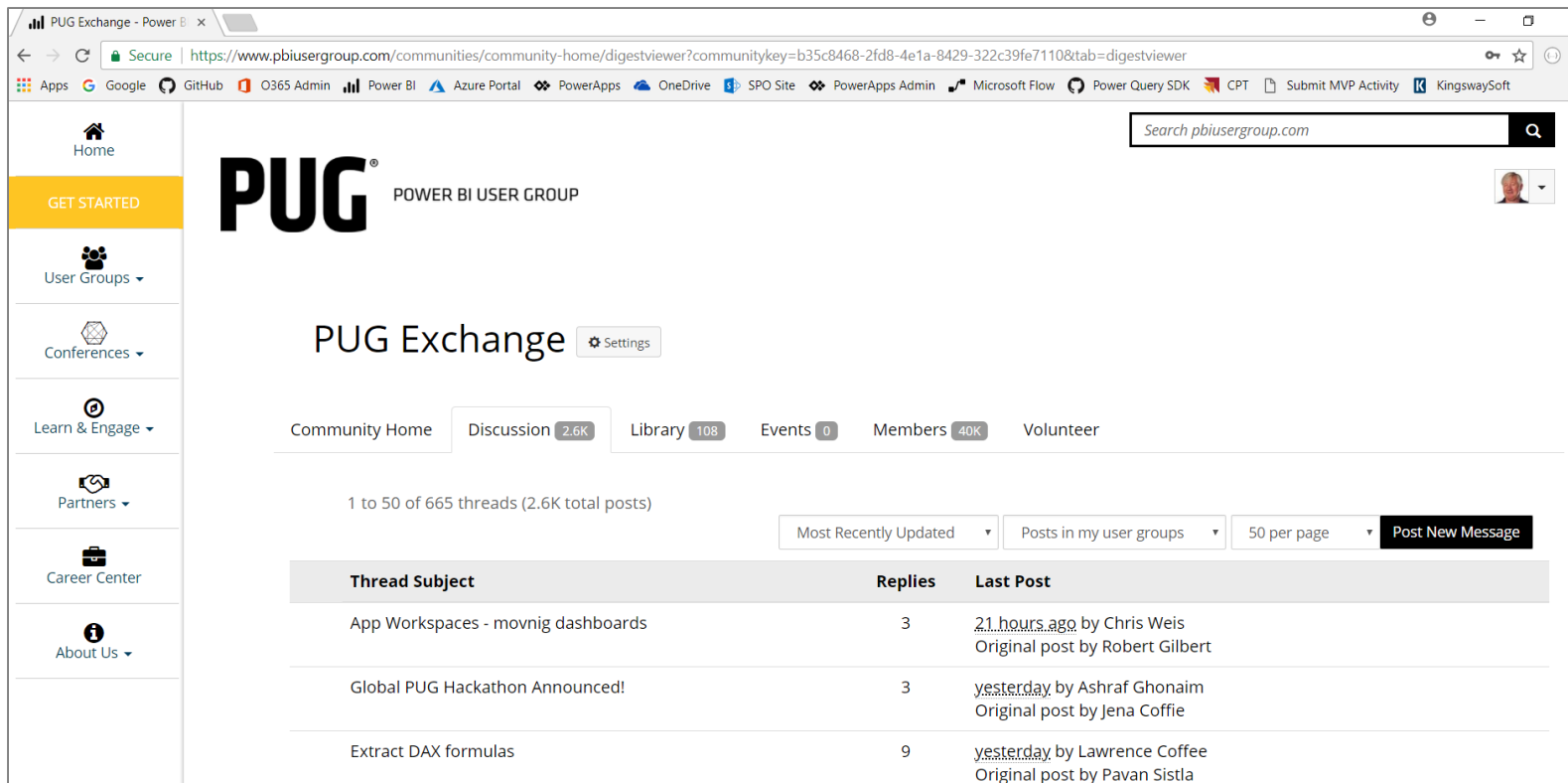
Forums (9 Items)

TITLE	POSTS
<b>Desktop</b> Data shaping, modeling, and report building in the Power BI Desktop app. Latest Topic - the traditional cultures - the Roma	174296
<b>Service</b> Dashboards, reports, sharing, and everything else you do at app.powerbi.com. Latest Topic - One dashboard multiple recipients with locked filt...	38336



# Power BI User Group (PUG)

- Located at <http://pbiusergroup.com/>
  - PUG Exchange is another place to get questions answered
  - Also let's you find and connect with local Power BI User Groups



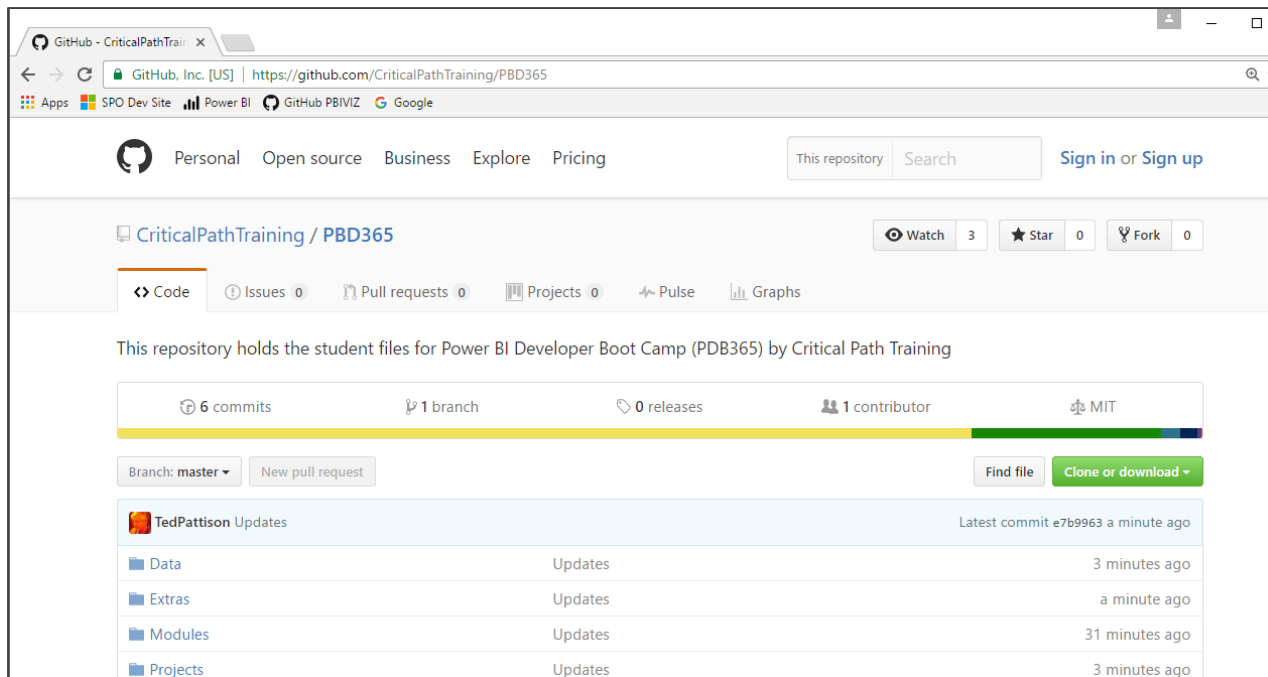
The screenshot shows the PUG Exchange website interface. The left sidebar contains navigation links: Home, GET STARTED, User Groups, Conferences, Learn & Engage, Partners, Career Center, and About Us. The main header features the PUG logo and the text "POWER BI USER GROUP". Below the header, the "PUG Exchange" section includes a "Settings" button and a navigation bar with links to Community Home, Discussion (2.6K), Library (108), Events (0), Members (40K), and Volunteer. A search bar is located in the top right corner. The main content area displays a list of discussion threads, showing 1 to 50 of 665 threads (2.6K total posts). The threads are sorted by "Most Recently Updated" and show 50 posts per page. A "Post New Message" button is visible in the top right of the thread list.

Thread Subject	Replies	Last Post
App Workspaces - movnig dashboards	3	21 hours ago by Chris Weis Original post by Robert Gilbert
Global PUG Hackathon Announced!	3	yesterday by Ashraf Ghonaim Original post by Jena Coffie
Extract DAX formulas	9	yesterday by Lawrence Coffee Original post by Pavan Sistla



# Live Labs for PBD365

- Student files for this course maintained in GitHub
  - Students files updated on a monthly basis
  - Lab write-ups available in PDF and XPS formats
  - Go to <https://github.com/CriticalPathTraining/PBD365>





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