



Critical Path Training Course Description

Power BI Developer Bootcamp

Mastering the Power BI Developer Platform

Course Code	PBD365
Audience	Professional Developers
Format	Self-paced training
Length	24 hours – (12 hours lecture and 12 hours hands-on labs)
Course Description	<p>Power BI Developer Bootcamp is an intensive self-paced training course with hands-on labs designed to get professional software developers up to speed on developing custom software solutions for Power BI. This course assumes that students already have experience with Power BI Desktop and the Power BI Service and are looking for ways to move beyond what's possible with just Power BI Desktop alone.</p> <p>The course examines essential developer extensibility points in the Power BI platform for importing data, creating visualizations and integrating reports and dashboards into custom applications. Students will learn to program in M and to develop custom data connectors with reusable query logic that can be shared across Power BI Desktop projects. The course teaches students how to develop custom visuals using Typescript, Node.JS and Visual Studio Code. Students will also learn how to program using the Power BI Service API to automate common task such as uploading PBIX files and patching datasource credentials.</p> <p>The course provides in-depth coverage of Power BI embedding features and teaches students how to embed reports and dashboards when developing custom applications. Students will learn to build real-time dashboard solutions using streaming datasets and push datasets. The course concludes by teaching students how to leverage the support in Power BI for the R data analytics platform by writing R scripts for Power BI Desktop and by developing R custom visuals.</p>
Student Prerequisites	Students should have previous experience working with Power BI Desktop and the Power BI Service. Students should also have previous experience programming with JavaScript and C# in Visual Studio.

Course Modules

1. **Power BI Developer Roadmap**
2. **Designing Queries with Power BI Desktop**
3. **Distributing Content using App Workspaces**
4. **Developing with the Power BI Service API**
5. **Developing with Power BI Embedding**
6. **Securing Content with Row Level Security**
7. **Developing Streaming Datasets and Real-time Dashboards**
8. **Developing Custom Visuals**
9. **Developing Custom Connectors**
10. **Working with Power BI Dataflows**

Course Module Detailed Outline

Module 01: Power BI Developer Roadmap

This module begins with a fast-paced primer on building reporting and data analysis projects using Power BI Desktop. The module reviews the phases of building Power BI Desktop projects including designing queries, building data models and designing reports. The module examines the PBIX project file format and explains how PBIX files provide the foundation to developers for deploying and updating datasets and reports for custom solutions. The module explains the best practices of importing data into a star schema and designing a data model using calculated columns, measures and dimensional hierarchies. The module teaches students how to design reports in Power BI Desktop using bookmarks and drillthrough pages to provide interactive navigation and filtering.

Topics Covered

- 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

Hands-on Lab: Setting Up a Power BI Development Environment

- Exercise 1: Download a Local Copy of the Student Lab Files
- Exercise 2: Sign Up for an Office 365 E5 Trial
- Exercise 3: Create New App Workspaces for a Custom Solution
- Exercise 4: Publish a Power BI Desktop Project to the Wingtip Sales App Workspace
- Exercise 5: Create and Design the Product Sales Dashboard
- Exercise 6: Getting Started with Power BI Desktop
- Exercise 7: Use Publish to Web to Surface a Report on a Custom Web Page
- Exercise 8: Create New Azure AD User Accounts using a PowerShell Script

Module 02: Designing Queries with Power BI Desktop

This module reviews the core concepts of creating and executing queries in Power BI Desktop. Students will learn how to leverage the query features of Power BI Desktop to import data from a variety of sources including databases, Excel spreadsheets, web pages and SharePoint lists. The module also explains the why and the how of importing data into a star schema to create a data model that is better suited for data analysis and reporting. Students will learn how to design queries to clean up, transform and reshape data during the import process. The module also examines the use of query parameters and powerful transform operations such as merging columns and appending rows from multiple data sources. The module concludes by examining advanced query design using query functions.

Topics Covered

- Power BI Desktop Overview
- Building Queries
- Designing Data Models
- Designing Reports

Hands-on Lab: Building a Reporting Project with Power BI Desktop

- Exercise 1: Build a Query to Extract Data from an Unstructured Text File
- Exercise 2: Designing a Function Query to Extract Data from Multiple Files
- Exercise 3: Upload the Budgets.xlsx Workbook File to SharePoint
- Exercise 4: Import the Data from Budgets.xlsx into the Wingtip Expenses Project
- Exercise 5: Creating a Relationship Between the Expenses Table and the Budgets Table

Module 03: Distributing Content using App Workspaces

The module examines the best practice of building a custom solution in an app workspace and then using the app model to distribute the custom solution on a wide-scale basis. This module walks through the steps of publishing an app workspace and making it accessible to other users as an installable app. Students will learn the various ways one can install a Power BI app. The module demonstrates how to upgrade reports and dashboards after an app has been installed using staged updates. The module explains the essential concepts involved with Power BI Premium and dedicated capacities and demonstrates how to configure an app workspace to run within a dedicated capacity. Along the way, this module will provide students with the decoder ring necessary to understand the capacity-based licensing model and strategies for distributing content to users with the Power BI free license.

Topics Covered

- Distributing Power BI Content
- Publishing Apps
- Understanding Dedicated Capacities
- Working with Dataset Parameters
- Developing Template Apps

Hands-on Lab: Deploying Solutions using Apps and Template Apps

- Exercise 1: Create an App Workspaces and Add Content
- Exercise 2: Publish an App Workspace as a Power BI App
- Exercise 3: Create and Test a Power BI Template App

Module 04: Developing with the Power BI Service API

This module introduces students to the Power BI Service API and provides an overview of its scope and functionality. The module explains the fundamentals of authenticating with Azure Active Directory and teaches students common programming techniques for authenticating using the Azure Active Directory Authentication Library (ADAL) and working with access tokens and refresh tokens. Students will learn how to call into the Power BI Service API using direct REST calls and also by programming with the .NET client library (Microsoft.PowerBI.Api.dll). Along the way, student will learn how to perform common tasks with the Power BI Service API including uploading PBIX files, patching datasource credentials, redirecting database connection strings and triggering data refresh.

Topics Covered

- Power BI Service API Overview
- Understanding Authentication with Azure AD
- Programming with the Power BI .NET SDK
- Acquiring Access Tokens using MSAL
- Calling to Power BI using App-only Tokens

Hands-on Lab: Developing with the Power BI Service API

- Exercise 1: Register a New Azure AD Application in the Azure Portal
- Exercise 2: Call the Power BI Service API using ADAL and the Power BI .NET SDK
- Exercise 3: Write C# Code to Create an App Workspace and Upload a PBIX Project File
- Exercise 4: Write C# Code to Clone Power BI Content Across Workspaces
- Exercise 5: Authenticate using the Microsoft Authentication Library (MSAL)
- Exercise 6: Call the Power BI Service API using an App-only Access Token

Module 05: Developing with Power BI Embedding

This module teaches students how to embed Power BI reports and dashboards into custom web applications. The module explains the differences between the two primary development models (user-owns-data versus app-own-data) and discusses when to use Power BI Premium versus when to use the Power BI Embedded service in Microsoft Azure. Students will learn to program with the Power BI Service API to retrieve the data required for embedding reports and dashboard. The module explains when to embed reports using Azure AD access tokens versus when to embed reports using embed tokens generated by the Power BI Service API. Students will learn to write client-side code using the Power BI JavaScript API to embed and interact with reports and dashboards.

Topics Covered

- Power BI Embedding Overview
- Embedding with App-Owns-Data Model
- Caching Access Tokens using OWIN Middleware
- Embedding with the User-Owns-Data Model
- Developing with the Power BI JavaScript API

Hands-on Lab: Embedding Power BI Reports and Dashboards

- Exercise 1: Create a new Confidential Client Application in Azure AD
- Exercise 2: Create a new MVC Application using Visual Studio 2017
- Exercise 3: Embedding Your First Power BI Report
- Exercise 4: Adding a Toolbar for Embedded Reports
- Exercise 5: Embedding a Dashboard
- Exercise 6: Embedding the Power BI Q&A Experience
- Exercise 7: Embedding a New Report

Module 06: Securing Content with Row Level Security

The module begins by explaining how Azure Active Directory provides tenant-level support for managing user accounts and groups. Students will learn what is possible in terms of sharing content within an organization as well as across organizational boundaries. The module explains how to administrate the Power BI environment at the tenant level and demonstrates how to monitor usage of reports and dashboards using Power BI audit logs. The module explains how to use row-level security (RLS) by creating security roles in a Power BI Desktop project and writing DAX table filter expressions. The module also examines securing Power BI Desktop projects using a more flexible strategy in which an RLS security role filtered using the USERNAME function in DAX together with a custom table that associates users with the data they are allowed to access.

Topics Covered

- User Authentication and Identity
- Power BI Tenant Administration
- Row Level Security
- Dynamic Row Level Security
- Embedding RLS-enabled Reports

Hands-on Lab: Implementing Row Level Security (RLS)

- Exercise 1: Configure Security Roles to Enabled Row-level Security (RLS)
- Exercise 2: Publish the PBIX File and Configure Row-level Security (RLS)
- Exercise 3: Publish the Wingtip Sales RLS App Workspace as a Power BI App
- Exercise 4: Test the RLS Configuration using a Secondary User Account

Module 07: Developing Streaming Datasets and Real-time Dashboards

This module teaches students how to build real-time dashboards in Power BI using streaming datasets, push datasets and hybrid datasets. The module examines differences between streaming datasets and push datasets and explains how to choose between them for a specific scenario. Students will learn how to use the Power BI Service API to create streaming datasets and to push in rows of data in real time from across the Internet. Students will learn how to build a real-time dashboard on top of a streaming dataset using streaming data tiles. The module demonstrates how create push datasets with multiple tables and measures containing DAX expressions. The module concludes with an examination of using the Azure Streaming Analytics service to create real-time dashboards in Power BI which monitor activity arriving at an Azure IoT hub or an Azure event hub.

Topics Covered

- Introduction to Real-time Datasets
- Creating a Streaming Dataset with the API
- Designing Dashboards with Streaming Data Tiles
- Creating a Push Dataset with Real-time Data
- Integrating Azure Streaming Analytics Jobs

Module 08: Developing Custom Visuals

This module focuses on how to design and implement custom visuals for Power BI. The module examines the Power BI Visuals API that Microsoft created to assist in the development of custom visuals. Students will learn how to define the capabilities and data mappings for a custom visual and how to program D3-style data binding using categorical data from a Power BI dataset. The module demonstrates how to extend a visual with custom properties as well as how to take advantage of the powerful utility classes that are included along with the Power BI Visuals API. The module demonstrates how to package a custom visual as a PBIVIZ file for distribution and demonstrates adding custom visuals to Power BI Desktop projects and publishing custom visuals to an organization.

Topics Covered

- Installing the Power BI Developer Tools
- Creating Your First Custom Visual
- Defining Data Roles and Data Mappings
- Extending a Visual with Custom Properties
- Migrating to Version 3 of the Power BI Developer Tools

Hands-on Lab: Developing Custom Visuals for Power BI

- Exercise 1: Prepare Your PC for Developing Custom Visuals
- Exercise 2: Create and Debug a Simple Custom Visual
- Exercise 3: Create a Custom Visual using the D3 Library

Module 09: Developing Custom Connectors

This module provides an introduction to developing custom data connectors using the Power Query SDK. The module explains the motivation for creating custom data connectors and walks through how to get started creating custom data connector projects using Visual Studio and the Power Query SDK. Students will learn how to write shared functions in M that are accessible to queries created in Power BI Desktop. The module explains how to package a custom data connector as well as how to test it using Power BI Desktop. The module discusses how to design a custom data connector for a specific type of authentication such as connecting to a Software-as-a-Service (SaaS) applications using OAuth2. Along the way, students will learn to develop a custom data connector that authenticates against Azure Active Directory and extracts data by executing queries using the Microsoft Graph API.

Topics Covered

- The Power Query Mashup Engine
- M Programming Fundamentals
- Choosing Between OData.Feed & Web.Contents
- Introduction to Custom Connectors
- Importing Data from the Microsoft Graph API
- Signing and Deploying Custom Connectors

Hands-on Lab: Developing a Custom Connector

- Exercise 1: Install the Power Query SDK
- Exercise 2: Work Through the TripPin Tutorial Lab Sequence

Module 10: Working with Power BI Dataflows

This module provides an introduction to developing custom data connectors using the Power Query SDK. The module explains the motivation for creating custom data connectors and walks through how to get started creating custom data connector projects using Visual Studio and the Power Query SDK. Students will learn how to write shared functions in M that are accessible to queries created in Power BI Desktop. The module explains how to package a custom data connector as well as how to test it using Power BI Desktop. The module discusses how to design a custom data connector for a specific type of authentication such as connecting to a Software-as-a-Service (SaaS) applications using OAuth2. Along the way, students will learn to develop a custom data connector that authenticates against Azure Active Directory and extracts data by executing queries using the Microsoft Graph API.

Topics Covered

- Understanding Dataflow Architecture
- Creating and Consuming Dataflows
- Importing and Exporting Dataflows
- Using Premium Dataflow Features
- Creating Dataflows using Code

Hands-on Lab: Designing Dataflows to Extract and Transform Data

- Exercise 1: Use Power Query to Create a New Dataflow
- Exercise 2: Extend the Dataflow by Adding Entities for Products and Sales
- Exercise 3: Importing Dataflow Entity Data with Power BI Desktop