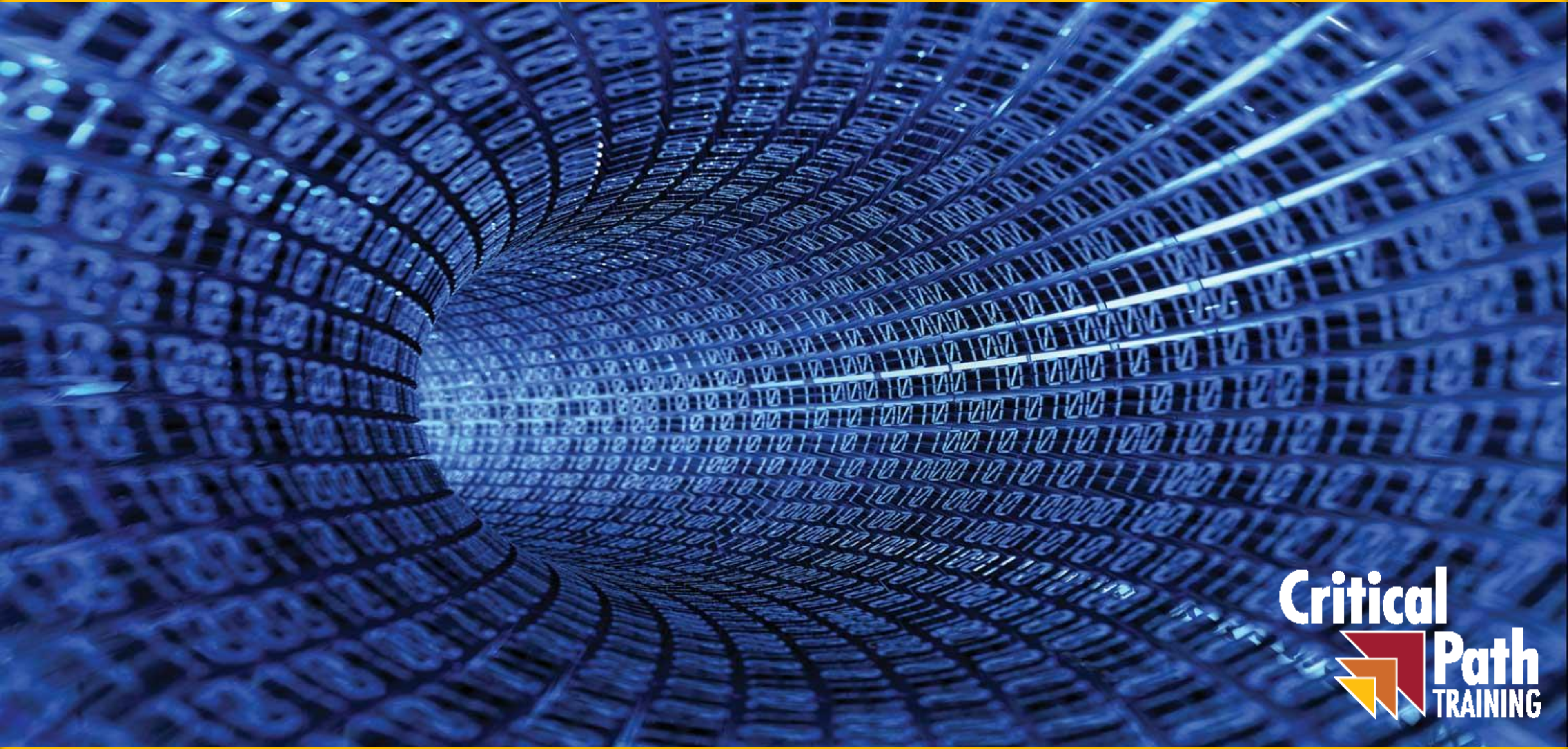
Programming the Power BI Service API

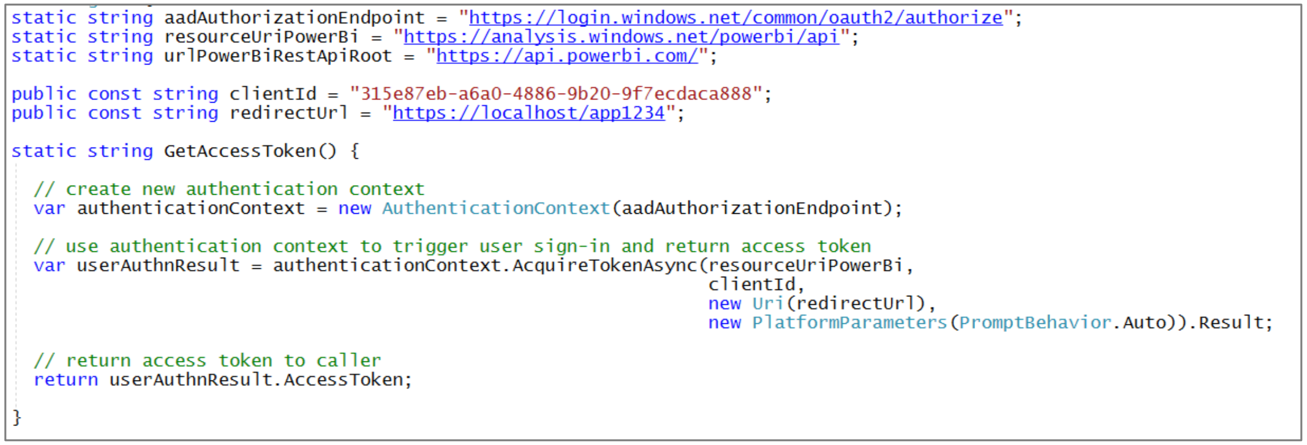


Agenda

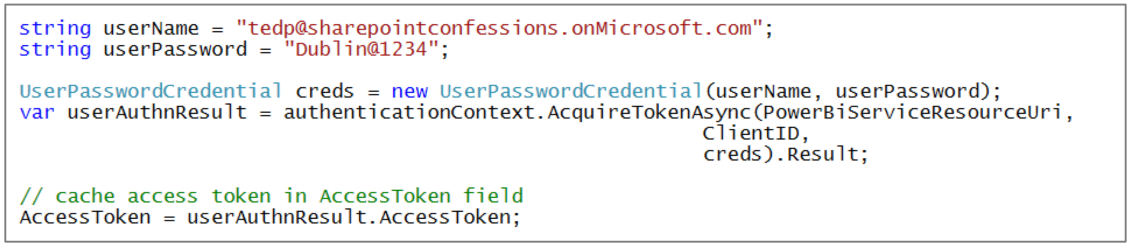
- Power BI Service API Overview
- Creating App Workspaces and Workspace Associations
- Retrieving Data about Datasets, Reports and Dashboards
- Publishing PBIX Project Files
- Patching Datasource Credentials & Refreshing Datasets
- Cloning Power BI Content across Workspaces

Access Token Acquisition (Native Client)

- With interactive login

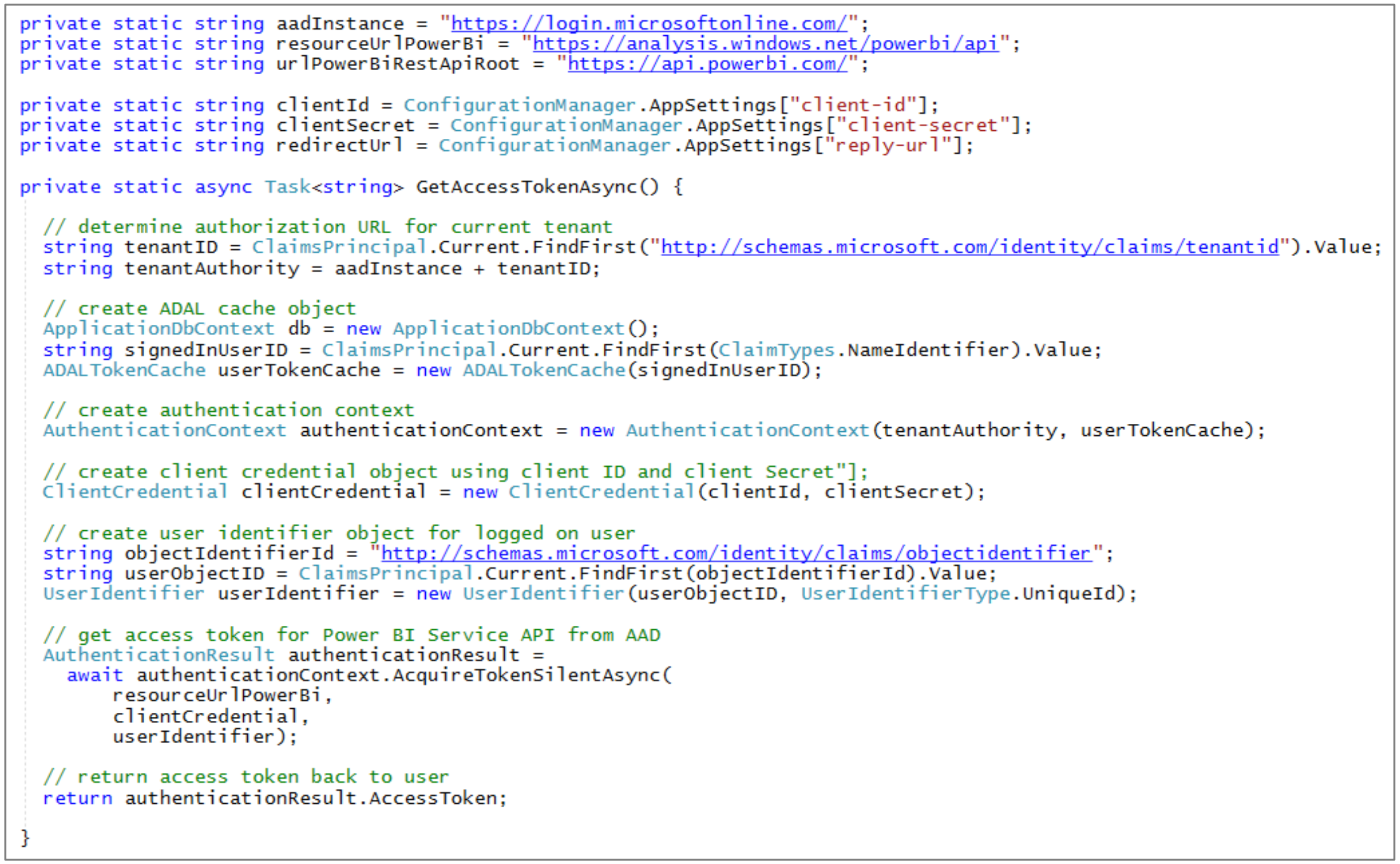


```csharp
static string aadAuthorizationEndpoint = "https://login.windows.net/common/oauth2/authorize";
static string resourceUriPowerBi = "https://analysis.windows.net/powerbi/api";
static string urlPowerBiRestApiRoot = "https://api.powerbi.com/";

public const string clientId = "315e87eb-a6a0-4886-9b20-9f7ecdaca888";
public const string redirectUrl = "https://localhost/app1234";

static string GetAccessToken() {

  // create new authentication context
  var authenticationContext = new AuthenticationContext(aadAuthorizationEndpoint);

  // use authentication context to trigger user sign-in and return access token
  var userAuthnResult = authenticationContext.AcquireTokenAsync(resourceUriPowerBi,
                                                                clientId,
                                                                new Uri(redirectUrl),
                                                                new PlatformParameters(PromptBehavior.Auto)).Result;


  // return access token to caller
  return userAuthnResult.AccessToken;

}
```



```csharp
string userName = "tedp@sharepointconfessions.onMicrosoft.com";
string userPassword = "Dublin@1234";

UserPasswordCredential creds = new UserPasswordCredential(userName, userPassword);
var userAuthnResult = authenticationContext.AcquireTokenAsync(PowerBiServiceResourceUri,
                                                              ClientID,
                                                              creds).Result;

// cache access token in AccessToken field
AccessToken = userAuthnResult.AccessToken;
```

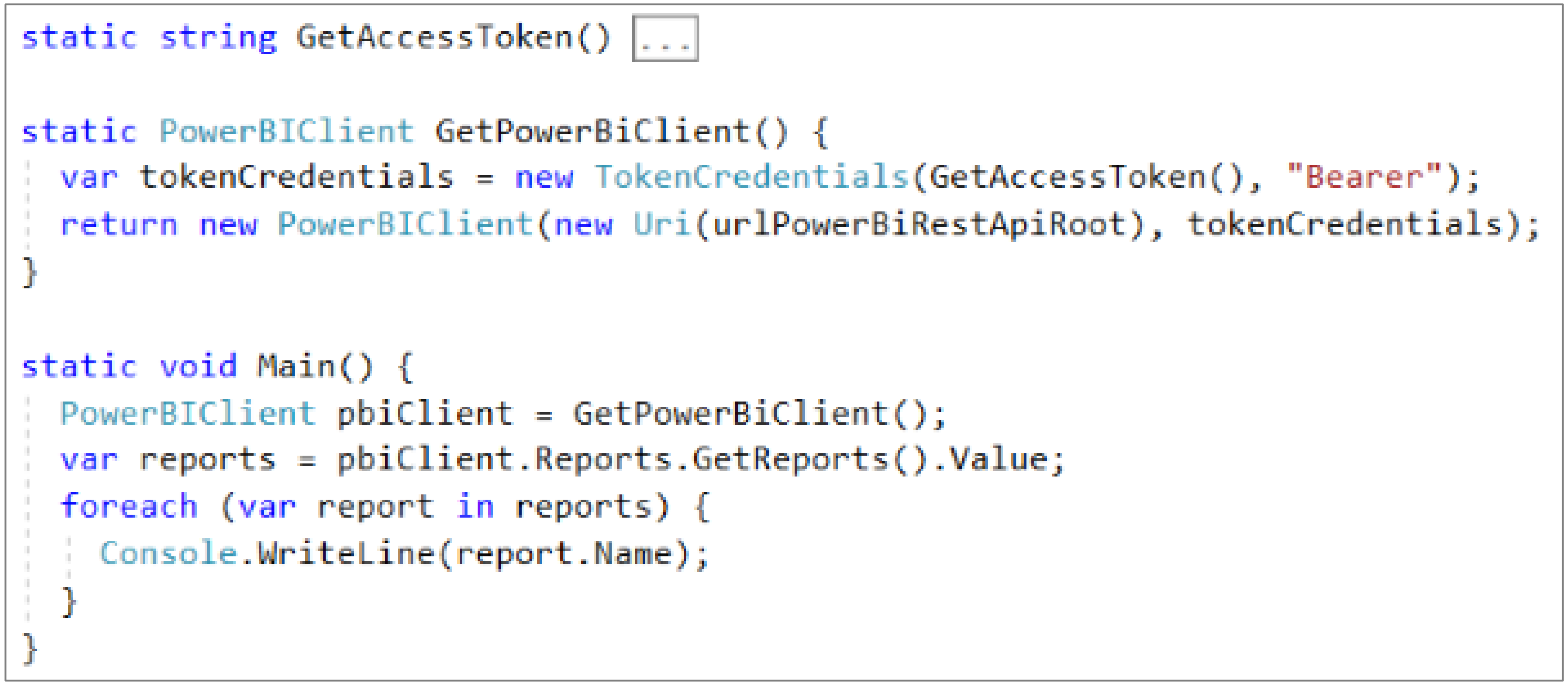
Access Token Acquisition (web app)



```
private static string aadInstance = "https://login.microsoftonline.com/";
private static string resourceUrlPowerBi = "https://analysis.windows.net/powerbi/api";
private static string urlPowerBiRestApiRoot = "https://api.powerbi.com/";

private static string clientId = ConfigurationManager.AppSettings["client-id"];
private static string clientSecret = ConfigurationManager.AppSettings["client-secret"];
private static string redirectUrl = ConfigurationManager.AppSettings["reply-url"];

private static async Task<string> GetAccessTokenAsync() {

  // determine authorization URL for current tenant
  string tenantID = ClaimsPrincipal.Current.FindFirst("http://schemas.microsoft.com/identity/claims/tenantid").Value;
  string tenantAuthority = aadInstance + tenantID;

  // create ADAL cache object
  ApplicationDbContext db = new ApplicationDbContext();
  string signedInUserID = ClaimsPrincipal.Current.FindFirst(ClaimTypes.NameIdentifier).Value;
  ADALTokenCache userTokenCache = new ADALTokenCache(signedInUserID);

  // create authentication context
  AuthenticationContext authenticationContext = new AuthenticationContext(tenantAuthority, userTokenCache);

  // create client credential object using client ID and client Secret"];
  ClientCredential clientCredential = new ClientCredential(clientId, clientSecret);

  // create user identifier object for logged on user
  string objectIdentifierId = "http://schemas.microsoft.com/identity/claims/objectidentifier";
  string userObjectID = ClaimsPrincipal.Current.FindFirst(objectIdentifierId).Value;
  UserIdentifier userIdentifier = new UserIdentifier(userObjectID, UserIdentifierType.UniqueId);

  // get access token for Power BI Service API from AAD
  AuthenticationResult authenticationResult =
    await authenticationContext.AcquireTokenSilentAsync(
        resourceUrlPowerBi,
        clientCredential,
        userIdentifier);

  // return access token back to user
  return authenticationResult.AccessToken;

}
```

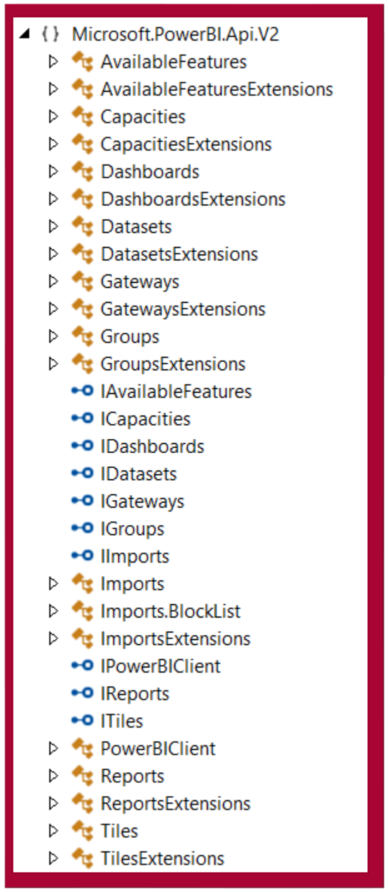
Initializing an Instance of PowerBIClient

- PowerBIClient object serves as top-level object
  - Used to execute calls against Power BI Service
  - Initialized with function to retrieve AAD access token

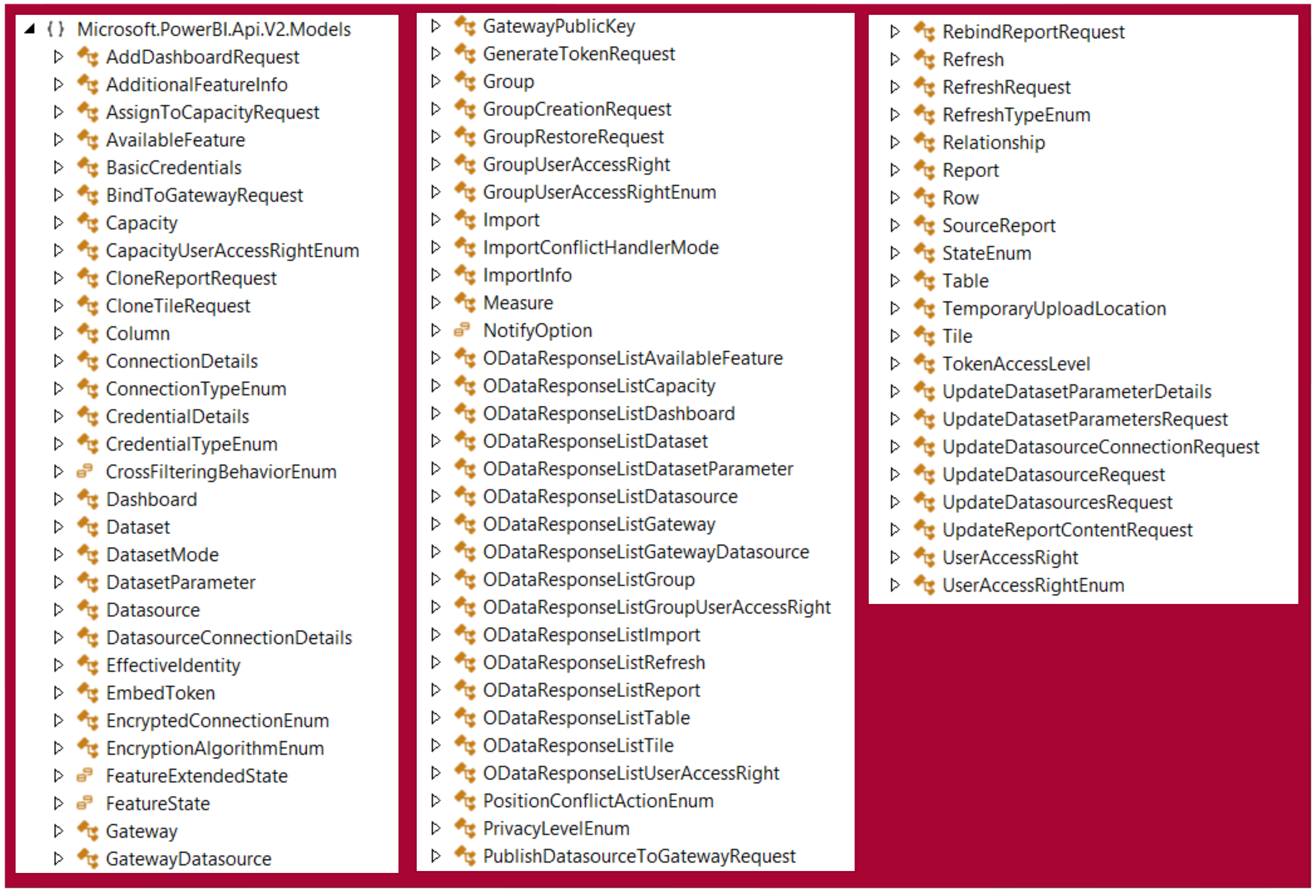


```
static string GetAccessToken() ...

static PowerBIClient GetPowerBiClient() {
  var tokenCredentials = new TokenCredentials(GetAccessToken(), "Bearer");
  return new PowerBIClient(new Uri(urlPowerBiRestApiRoot), tokenCredentials);
}

static void Main() {
  PowerBIClient pbiClient = GetPowerBiClient();
  var reports = pbiClient.Reports.GetReports().Value;
  foreach (var report in reports) {
    Console.WriteLine(report.Name);
  }
}
```

The Power BI Service API



```
◢ { } Microsoft.PowerBI.Api.V2
    ▷ AvailableFeatures
    ▷ AvailableFeaturesExtensions
    ▷ Capacities
    ▷ CapacitiesExtensions
    ▷ Dashboards
    ▷ DashboardsExtensions
    ▷ Datasets
    ▷ DatasetsExtensions
    ▷ Gateways
    ▷ GatewaysExtensions
    ▷ Groups
    ▷ GroupsExtensions
      IAvailableFeatures
      ICapacities
      IDashboards
      IDatasets
      IGateways
      IGroups
      IImports
    ▷ Imports
    ▷ Imports.BlockList
    ▷ ImportsExtensions
      IPowerBIClient
      IReports
      ITiles
    ▷ PowerBIClient
    ▷ Reports
    ▷ ReportsExtensions
    ▷ Tiles
    ▷ TilesExtensions
```



```
◢ { } Microsoft.PowerBI.Api.V2.Models
    ▷ AddDashboardRequest
    ▷ AdditionalFeatureInfo
    ▷ AssignToCapacityRequest
    ▷ AvailableFeature
    ▷ BasicCredentials
    ▷ BindToGatewayRequest
    ▷ Capacity
    ▷ CapacityUserAccessRightEnum
    ▷ CloneReportRequest
    ▷ CloneTileRequest
    ▷ Column
    ▷ ConnectionDetails
    ▷ ConnectionTypeEnum
    ▷ CredentialDetails
    ▷ CredentialTypeEnum
    ▷ CrossFilteringBehaviorEnum
    ▷ Dashboard
    ▷ Dataset
    ▷ DatasetMode
    ▷ DatasetParameter
    ▷ Datasource
    ▷ DatasourceConnectionDetails
    ▷ EffectiveIdentity
    ▷ EmbedToken
    ▷ EncryptedConnectionEnum
    ▷ EncryptionAlgorithmEnum
    ▷ FeatureExtendedState
    ▷ FeatureState
    ▷ Gateway
    ▷ GatewayDatasource
    ▷ GatewayPublicKey
    ▷ GenerateTokenRequest
    ▷ Group
    ▷ GroupCreationRequest
    ▷ GroupRestoreRequest
    ▷ GroupUserAccessRight
    ▷ GroupUserAccessRightEnum
    ▷ Import
    ▷ ImportConflictHandlerMode
    ▷ ImportInfo
    ▷ Measure
    ▷ NotifyOption
    ▷ ODataResponseListAvailableFeature
    ▷ ODataResponseListCapacity
    ▷ ODataResponseListDashboard
    ▷ ODataResponseListDataset
    ▷ ODataResponseListDatasetParameter
    ▷ ODataResponseListDatasource
    ▷ ODataResponseListGateway
    ▷ ODataResponseListGatewayDatasource
    ▷ ODataResponseListGroup
    ▷ ODataResponseListGroupUserAccessRight
    ▷ ODataResponseListImport
    ▷ ODataResponseListRefresh
    ▷ ODataResponseListReport
    ▷ ODataResponseListTable
    ▷ ODataResponseListTile
    ▷ ODataResponseListUserAccessRight
    ▷ PositionConflictActionEnum
    ▷ PrivacyLevelEnum
    ▷ PublishDatasourceToGatewayRequest
    ▷ RebindReportRequest
    ▷ Refresh
    ▷ RefreshRequest
    ▷ RefreshTypeEnum
    ▷ Relationship
    ▷ Report
    ▷ Row
    ▷ SourceReport
    ▷ StateEnum
    ▷ Table
    ▷ TemporaryUploadLocation
    ▷ Tile
    ▷ TokenAccessLevel
    ▷ UpdateDatasetParameterDetails
    ▷ UpdateDatasetParametersRequest
    ▷ UpdateDatasourceConnectionRequest
    ▷ UpdateDatasourceRequest
    ▷ UpdateDatasourcesRequest
    ▷ UpdateReportContentRequest
    ▷ UserAccessRight
    ▷ UserAccessRightEnum
```

Implementing the GetDatasetsAsync Method

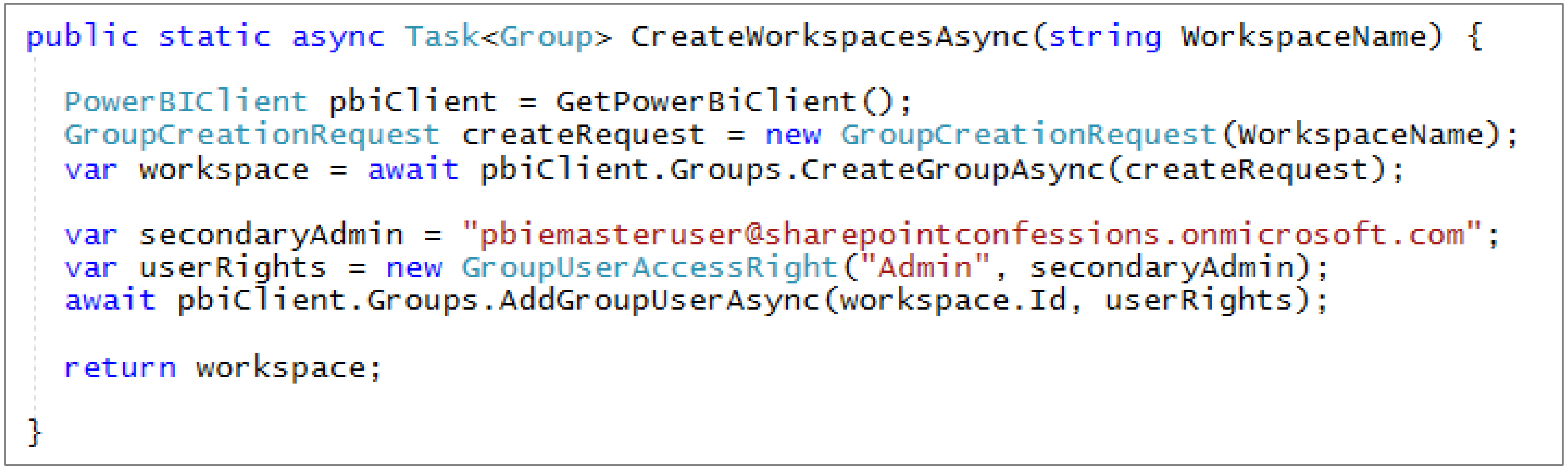
```
public static async Task<DatasetViewModel> GetDatasetAsync(string WorkspaceId, string DatasetId) {

  PowerBIClient pbiClient = GetPowerBiClient();
  Dataset dataset = (await pbiClient.Datasets.GetDatasetByIdInGroupAsync(WorkspaceId, DatasetId));
  IList<Datasource> datasources = (await pbiClient.Datasets.GetDatasourcesInGroupAsync(WorkspaceId, DatasetId)).Value;
  IList<Refresh> refreshHistory = null;

  if (dataset.IsRefreshable == true) {
    refreshHistory = (await pbiClient.Datasets.GetRefreshHistoryInGroupAsync(WorkspaceId, DatasetId)).Value;
  }

  DatasetViewModel viewModel = new DatasetViewModel {
    WorkspaceId=WorkspaceId,
    Id = dataset.Id,
    Name = dataset.Name,
    Dataset = dataset,
    Datasources = datasources,
    RefreshHistroy = refreshHistory
  };

  return viewModel;
}
```

```
public static async Task RefreshDatasetAsync(string WorkspaceId, string DatasetId) {
  PowerBIClient pbiClient = GetPowerBiClient();
  await pbiClient.Datasets.RefreshDatasetInGroupAsync(WorkspaceId, DatasetId);
  return;
}
```

Importing a PBIX File

```
public static async Task UploadPBIX(string WorkspaceId, string pbixName, string importName, bool updateSqlCredentials = false) {

  string PbixFilePath = HttpContext.Current.Server.MapPath("/PBIX/" + pbixName);
  PowerBIClient pbiClient = GetPowerBiClient();
  FileStream stream = new FileStream(PbixFilePath, FileMode.Open, FileAccess.Read);
  var import = await pbiClient.Imports.PostImportWithFileAsyncInGroup(WorkspaceId, stream, importName);

  if (updateSqlCredentials) {
    await PatchSqlDatasourceCredentials(WorkspaceId, importName);
  }

  return;
}
```

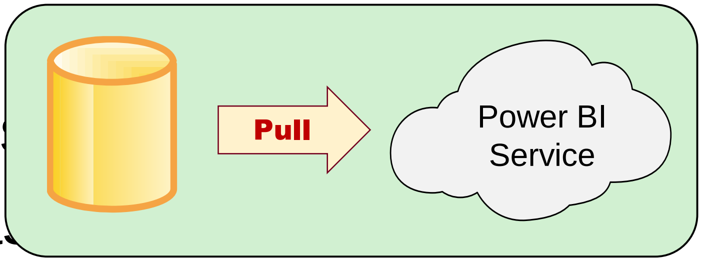
Creating Workspaces

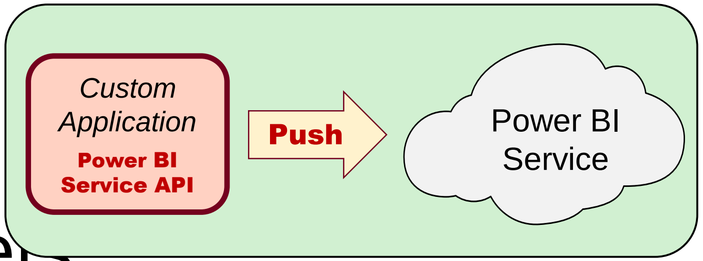


```
public static async Task<Group> CreateWorkspacesAsync(string WorkspaceName) {

  PowerBIClient pbiClient = GetPowerBiClient();
  GroupCreationRequest createRequest = new GroupCreationRequest(WorkspaceName);
  var workspace = await pbiClient.Groups.CreateGroupAsync(createRequest);

  var secondaryAdmin = "pbiemasteruser@sharepointconfessions.onmicrosoft.com";
  var userRights = new GroupUserAccessRight("Admin", secondaryAdmin);
  await pbiClient.Groups.AddGroupUserAsync(workspace.Id, userRights);

  return workspace;

}
```

Pull Datasets versus Real-time Datasets

- Pull Datasets
  - Imported Datasets
  - DirectQuery Datasets
  - Live Connect Datasets

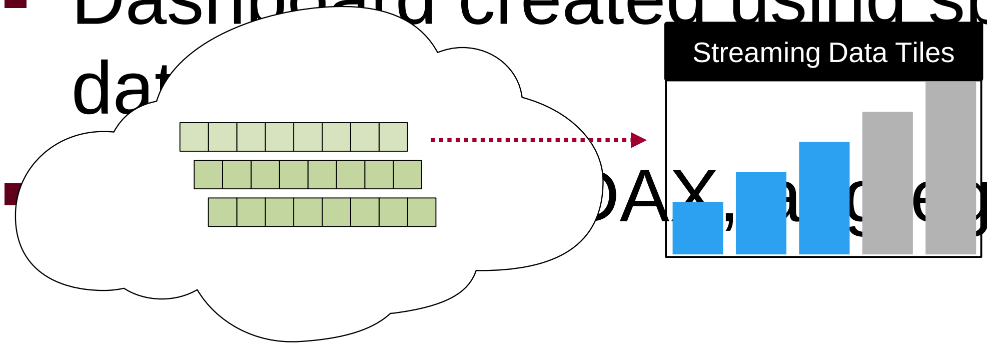




- Real-time Datasets
  - Streaming Datasets
  - Push Datasets
  - Hybrid Datasets

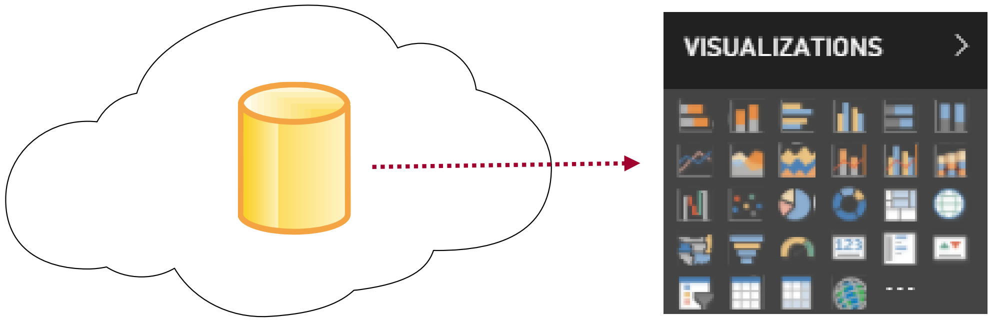
Streaming Datasets

- Data stored in cloud-based cache – not persisted in DB
- Restricted to single table - no rich data modeling
- Not supported by standard Power BI report designer
- Dashboard created using specialized streaming dat
- [illegible] DAX, aggregation or filtering



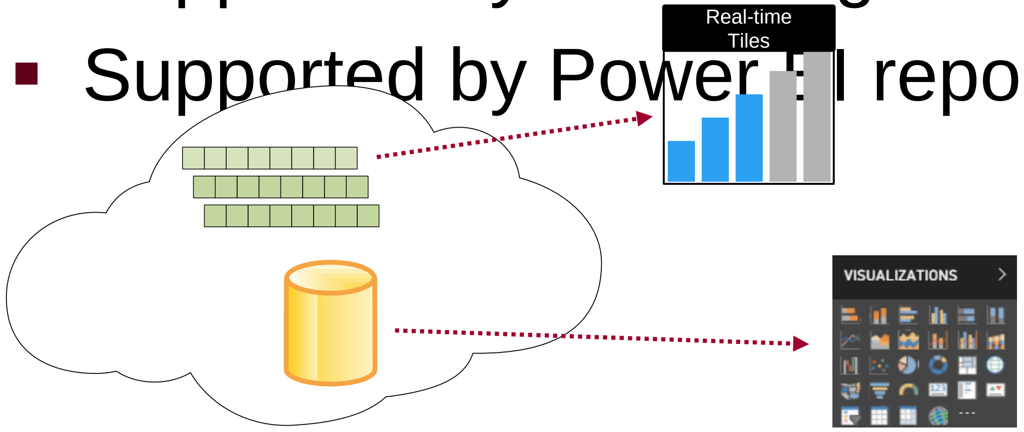
Push Datasets

- Data stored in Azure SQL DB – not in cache
- Supports multiple tables and table relationships
- Supported by standard Power BI report designer
- Supports DAX, measures, aggregation & filtering



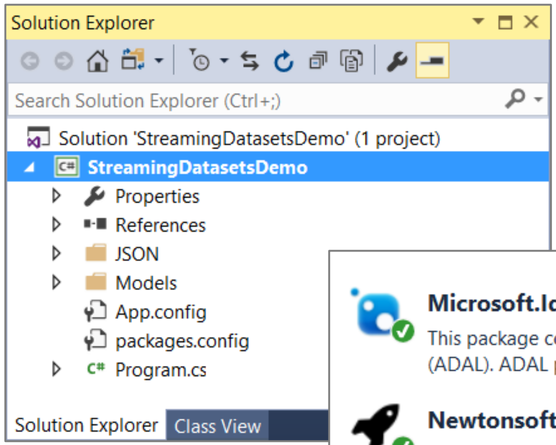
Hybrid Datasets

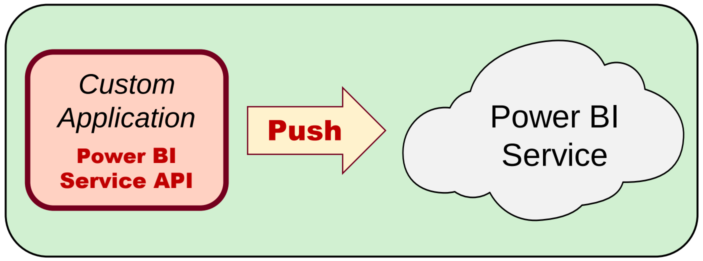
- Data stored in cloud-based cache AND in Azure SQL DB
- Restricted to single table and no rich data modeling
- Supported by streaming data tiles
- Supported by Power BI report designer

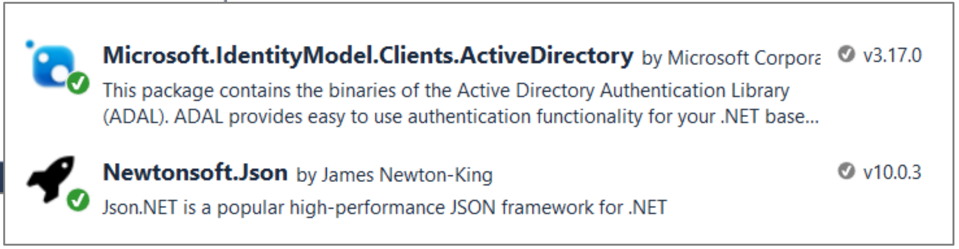


The StreamingDatasetsDemo Project

- Console application project in Visual Studio 2017
  - Installed package for Azure AD Authentication library
  - Installed package to serialize .NET objects to JSON





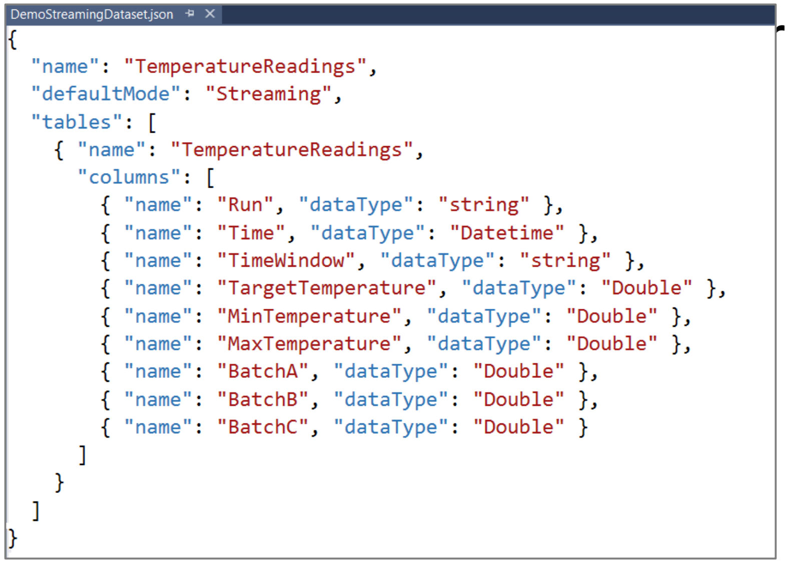


Microsoft.IdentityModel.Clients.ActiveDirectory by Microsoft Corpora v3.17.0
This package contains the binaries of the Active Directory Authentication Library (ADAL). ADAL provides easy to use authentication functionality for your .NET base...

Newtonsoft.Json by James Newton-King v10.0.3
Json.NET is a popular high-performance JSON framework for .NET

Creating a Streaming Dataset

- Streaming dataset created using JSON schema definition
  - Streaming dataset limited to a single table
  - Columns defined using name and datatype
  - r column properties (e.g.

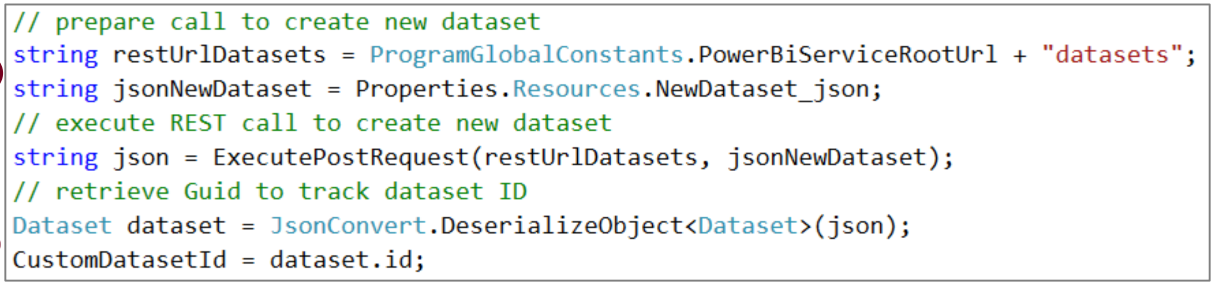


DemoStreamingDataset.json

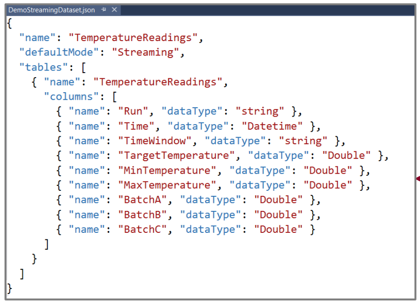
```
{
  "name": "TemperatureReadings",
  "defaultMode": "Streaming",
  "tables": [
    { "name": "TemperatureReadings",
      "columns": [
        { "name": "Run", "dataType": "string" },
        { "name": "Time", "dataType": "Datetime" },
        { "name": "TimeWindow", "dataType": "string" },
        { "name": "TargetTemperature", "dataType": "Double" },
        { "name": "MinTemperature", "dataType": "Double" },
        { "name": "MaxTemperature", "dataType": "Double" },
        { "name": "BatchA", "dataType": "Double" },
        { "name": "BatchB", "dataType": "Double" },
        { "name": "BatchC", "dataType": "Double" }
      ]
    }
  ]
}
```

Creating a Custom Dataset

- Dataset created by executing HTTP POST operation
  - One-time operation done as application begins

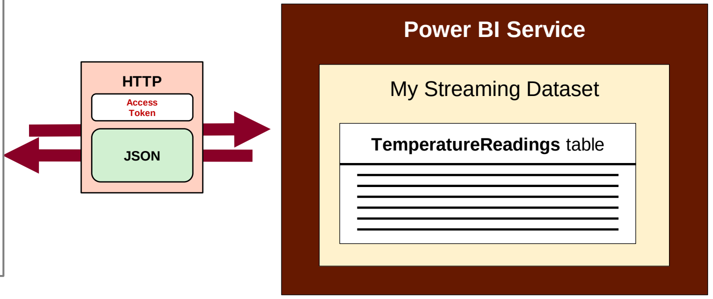


```
  // prepare call to create new dataset
  string restUrlDatasets = ProgramGlobalConstants.PowerBiServiceRootUrl + "datasets";
1 string jsonNewDataset = Properties.Resources.NewDataset_json;
  // execute REST call to create new dataset
2 string json = ExecutePostRequest(restUrlDatasets, jsonNewDataset);
  // retrieve Guid to track dataset ID
  Dataset dataset = JsonConvert.DeserializeObject<Dataset>(json);
3 CustomDatasetId = dataset.id;
```

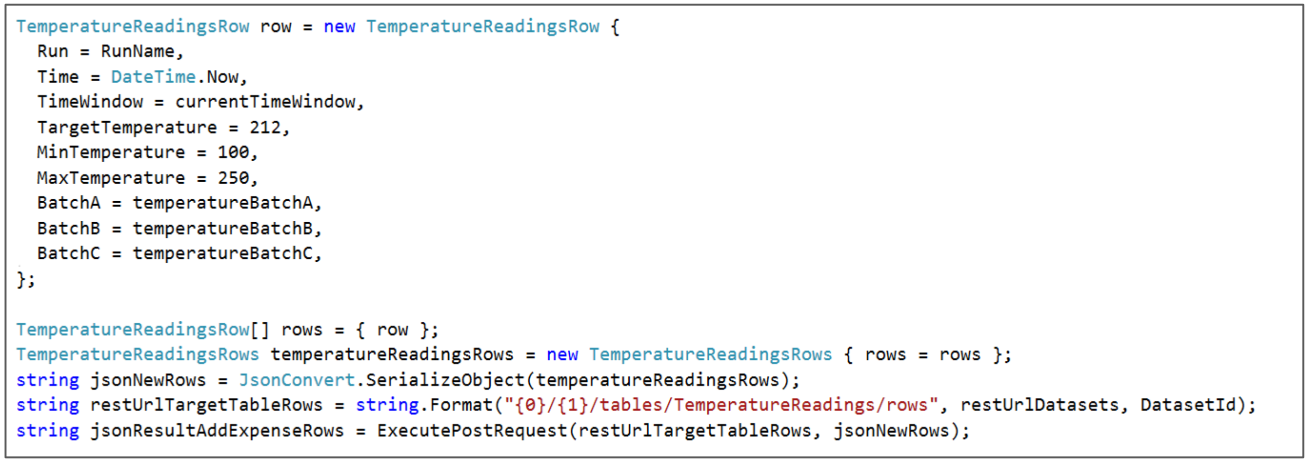


DemoStreamingDataset.json

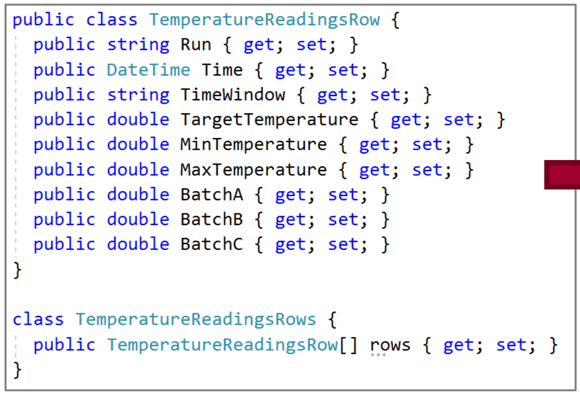
```
{
  "name": "TemperatureReadings",
  "defaultMode": "Streaming",
  "tables": [
    { "name": "TemperatureReadings",
      "columns": [
        { "name": "Run", "dataType": "string" },
        { "name": "Time", "dataType": "Datetime" },
        { "name": "TimeWindow", "dataType": "string" },
        { "name": "TargetTemperature", "dataType": "Double" },
        { "name": "MinTemperature", "dataType": "Double" },
        { "name": "MaxTemperature", "dataType": "Double" },
        { "name": "BatchA", "dataType": "Double" },
        { "name": "BatchB", "dataType": "Double" },
        { "name": "BatchC", "dataType": "Double" }
      ]
    }
  ]
}
```



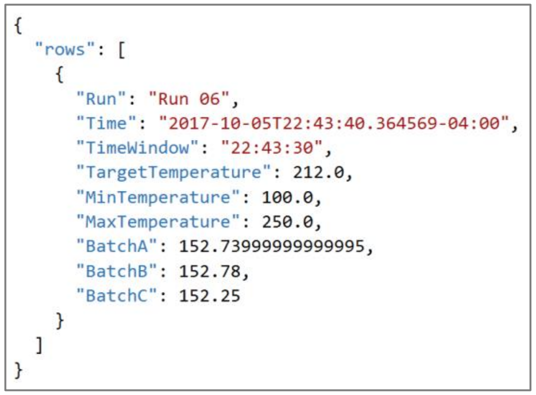
Adding Rows by Converting C# to JSON



```
TemperatureReadingsRow row = new TemperatureReadingsRow {
  Run = RunName,
  Time = DateTime.Now,
  TimeWindow = currentTimeWindow,
  TargetTemperature = 212,
  MinTemperature = 100,
  MaxTemperature = 250,
  BatchA = temperatureBatchA,
  BatchB = temperatureBatchB,
  BatchC = temperatureBatchC,
};

TemperatureReadingsRow[] rows = { row };
TemperatureReadingsRows temperatureReadingsRows = new TemperatureReadingsRows { rows = rows };
string jsonNewRows = JsonConvert.SerializeObject(temperatureReadingsRows);
string restUrlTargetTableRows = string.Format("{0}/{1}/tables/TemperatureReadings/rows", restUrlDatasets, DatasetId);
string jsonResultAddExpenseRows = ExecutePostRequest(restUrlTargetTableRows, jsonNewRows);
```



```
public class TemperatureReadingsRow {
  public string Run { get; set; }
  public DateTime Time { get; set; }
  public string TimeWindow { get; set; }
  public double TargetTemperature { get; set; }
  public double MinTemperature { get; set; }
  public double MaxTemperature { get; set; }
  public double BatchA { get; set; }
  public double BatchB { get; set; }
  public double BatchC { get; set; }
}

class TemperatureReadingsRows {
  public TemperatureReadingsRow[] rows { get; set; }
}
```



```
{
  "rows": [
    {
      "Run": "Run 06",
      "Time": "2017-10-05T22:43:40.364569-04:00",
      "TimeWindow": "22:43:30",
      "TargetTemperature": 212.0,
      "MinTemperature": 100.0,
      "MaxTemperature": 250.0,
      "BatchA": 152.73999999999995,
      "BatchB": 152.78,
      "BatchC": 152.25
    }
  ]
}
```

Real-time Dataset Matrix

Feature	Streaming	Hybrid	Push
Updates in real-time	Yes	Yes	Yes
Smooth animations	Yes	Yes	No
Backed by Azure SQL DB	No	Yes	Yes
Report Designer Support	No	Yes	Yes
Allow Rich Data Modeling	No	No	Yes
Ingestion Rate	5 request/sec 15KB/request		1 request/second 16MB/request