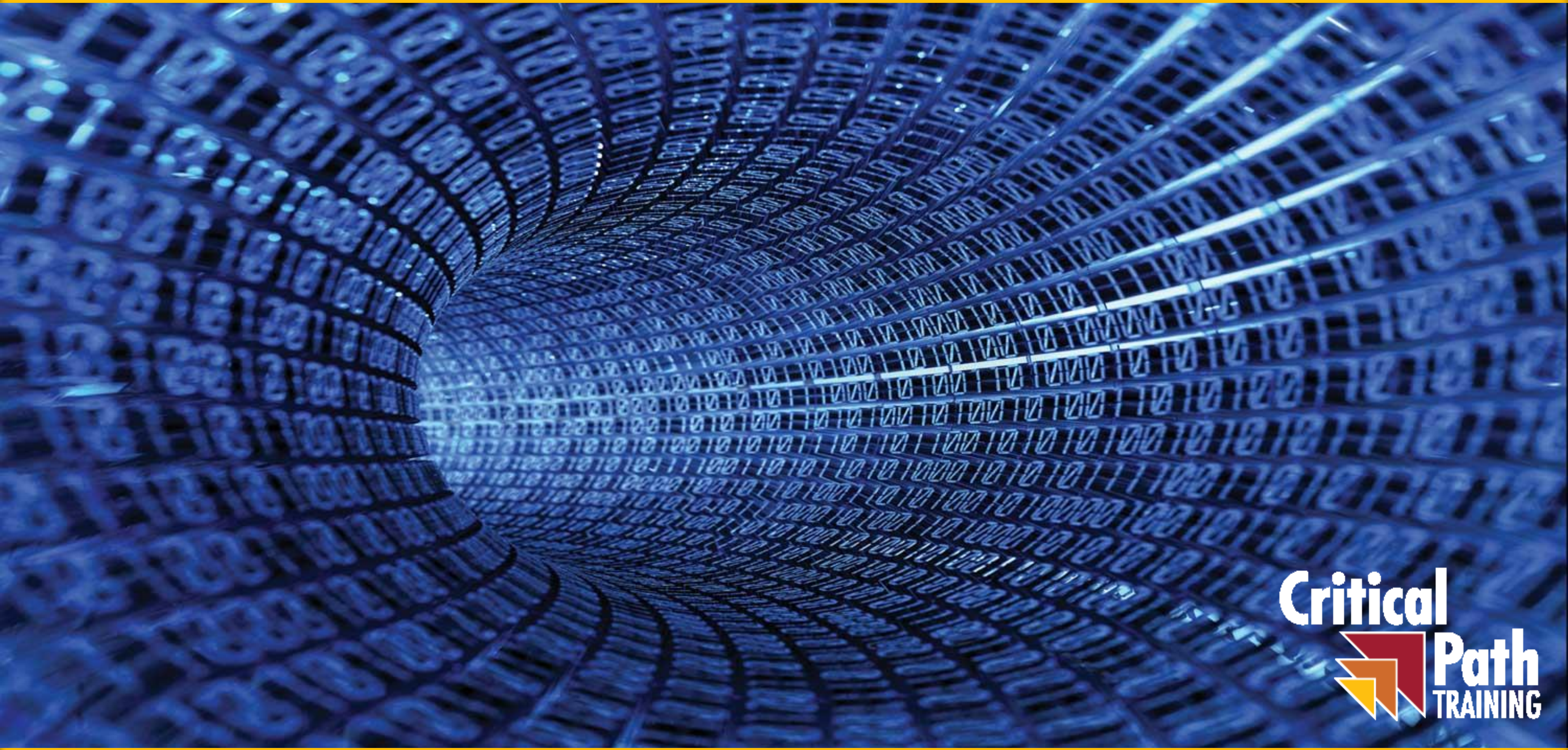
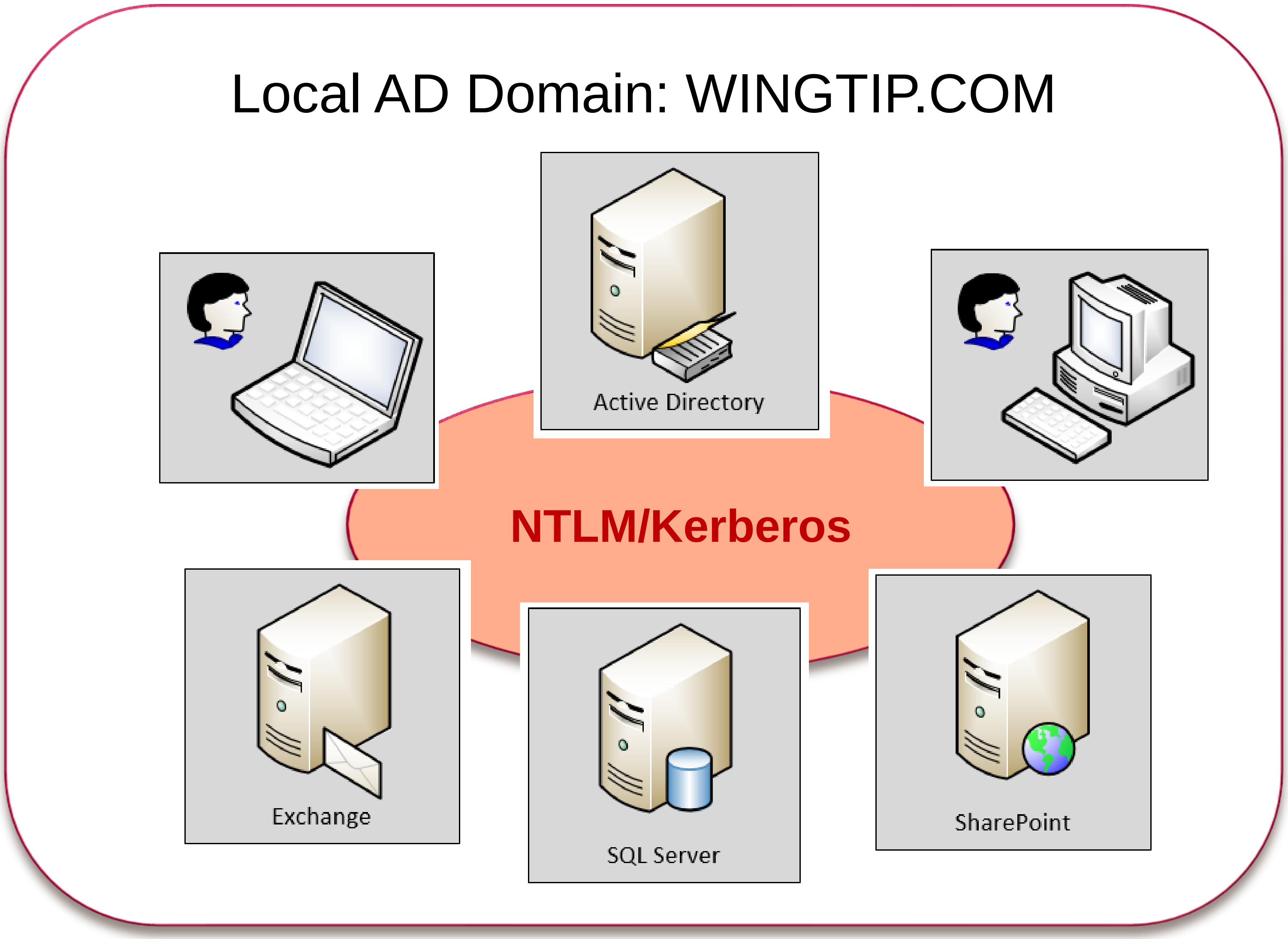
Developing Secure Applications using Azure AD



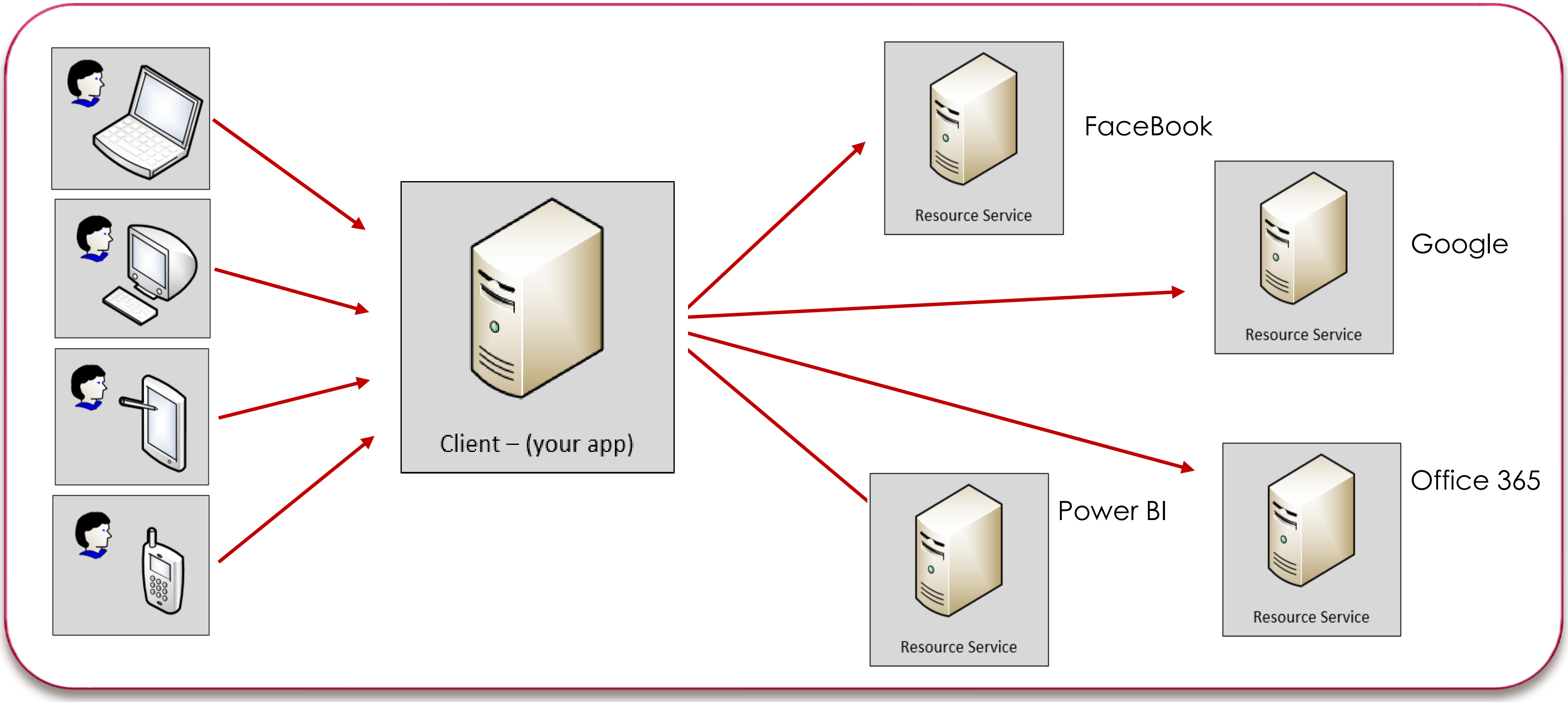
Agenda

- Understanding OAuth 2.0 and OpenID Connect
- The Role of Azure Active Directory
- Creating & Configuring Azure AD Applications
- Securing MVC Applications using ADAL and OWIN
- Securing SPAs using ADAL.js & Implicit Grant Flow

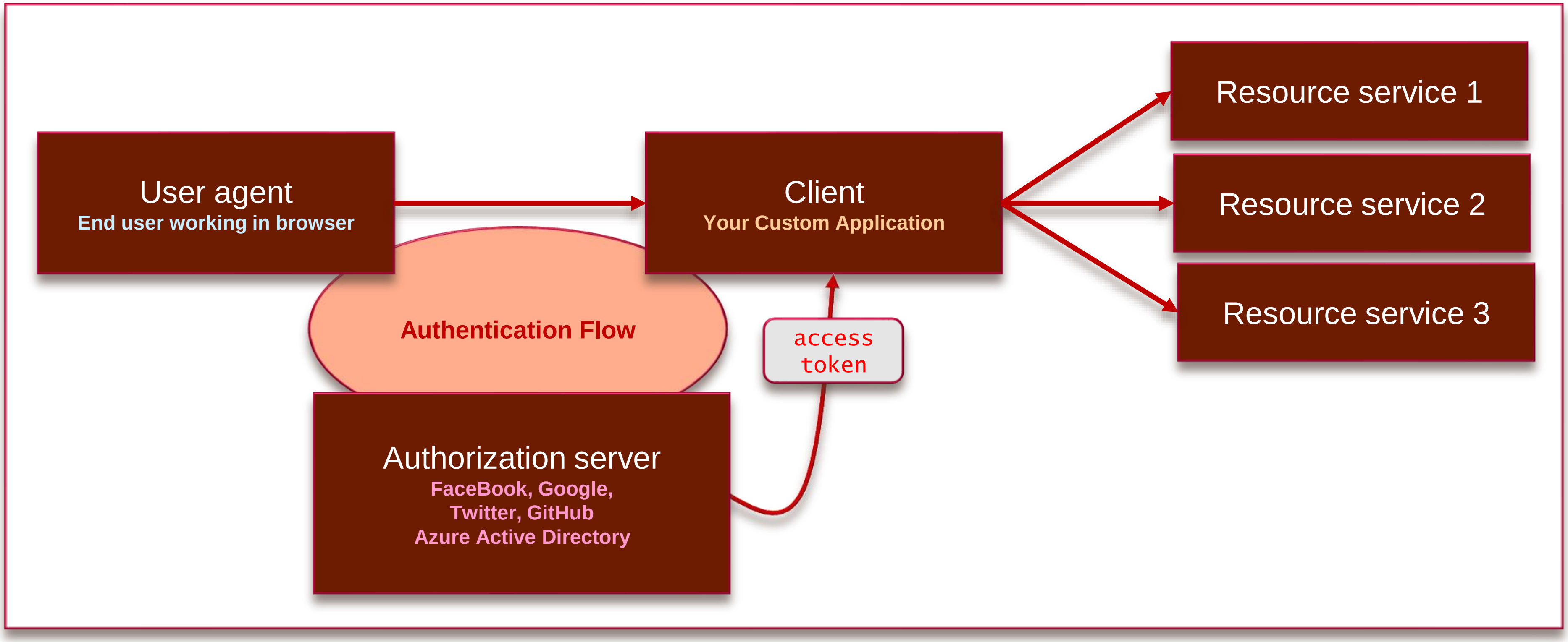
Old-school Enterprise Security



Internet Security



OAuth 2.0


User agent
End user working in browser
Client
Your Custom Application
Resource service 1
Resource service 2
Resource service 3
Authentication Flow
access token
Authorization server
FaceBook, Google,
Twitter, GitHub
Azure Active Directory

View into an Access Token

```
{
  "aud": "https://outlook.office365.com",
  "iss": "https://sts.windows.net/f995267b-5b7d-4e65-b929-d3d3e11784f9/",
  "iat": 1427935797,
  "nbf": 1427935797,
  "exp": 1427939697,
  "ver": "1.0",
  "tid": "f995267b-5b7d-4e65-b929-d3d3e11784f9",
  "amr": ["pwd"],
  "oid": "eb679998-e8b9-40c9-b61e-4198b02b3ade",
  "upn": "TedP@sharepointconfessions.onmicrosoft.com",
  "puid": "1003BFFD85265F3D",
  "sub": "CI3lh-1kN6YD_JVKoSPjmFLTd8GyOMtgMsrvdJJdaUw",
  "given_name": "Ted",
  "family_name": "Pattison",
  "name": "Ted Pattison",
  "groups": ["a5fa8ce1-abdf-44e4-9f84-158da6ec38d0"],
  "unique_name": "TedP@sharepointconfessions.onmicrosoft.com",
  "appid": "33d561fb-59a7-4817-bddf-2117193d62e0",
  "appidacr": "1",
  "scp": "Calendars.Read Contacts.Read Contacts.Write Mail.Read Mail.Send",
  "acr": "1"
}
```

OAuth Client Registration

- Client must be registered with authorization server
  - Authorization server tracks each client with unique Client ID
  - Client should be registered with one or more Reply URLs
  - Reply URL should be fixed endpoint on Internet
  - Reply URL used to transmit security tokens to clients
  - Client registration tracks permissions and other attributes

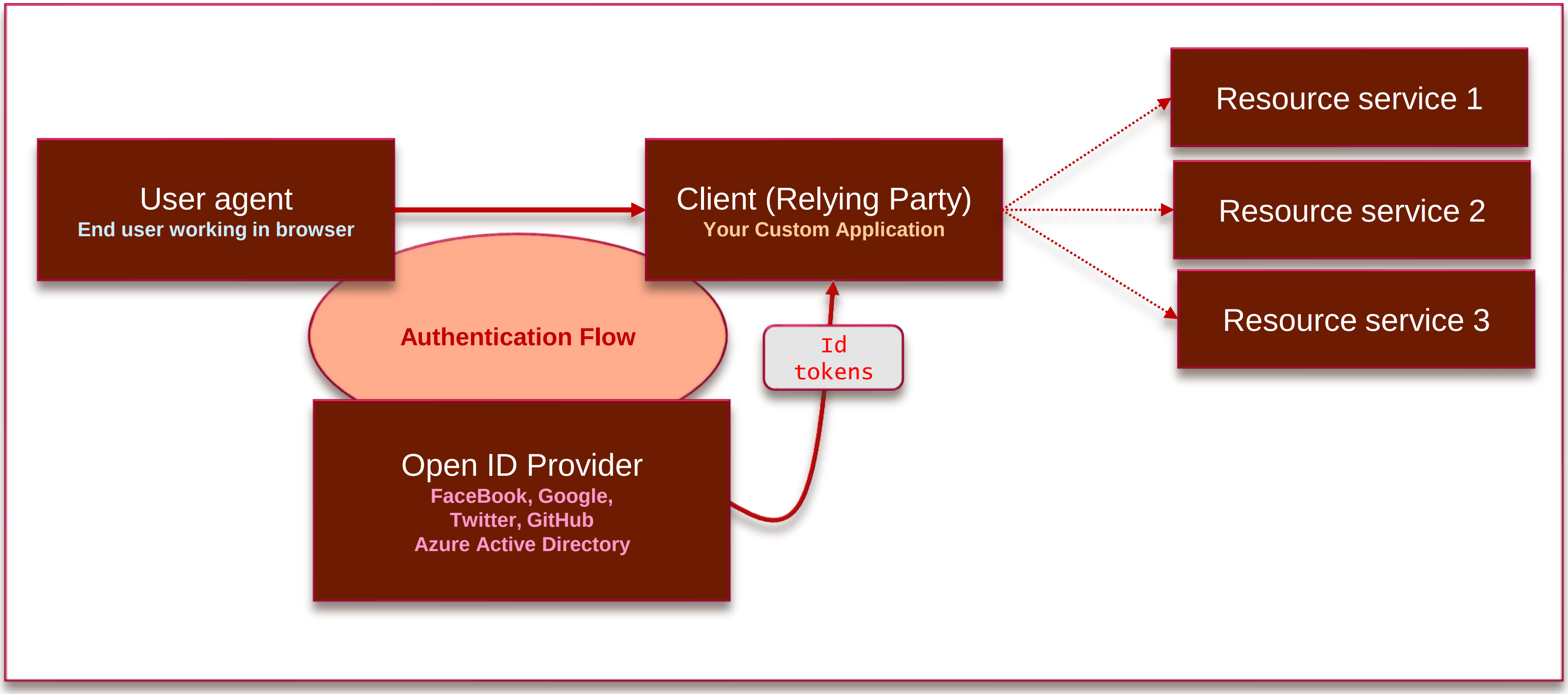
Authentication Flows

- User Credentials Flow *(public client)*
  - Used in Native clients to obtain access code
  - Requires passing user name and password
- Authorization Code Grant Flow *(confidential client)*
  - Client first obtains authorization code then access token
  - Server-side application code never sees user’s password
- Client Credentials Grant Flow *(confidential client)*
  - Authentication based on SSL certificate with public-private key pair
  - Used to obtain access token when using app-only permissions
- Implicit Grant Flow *(public client)*
  - Used in SPAs built with JavaScript and AngularJS
  - Application obtains access token w/o acquiring authorization code

OAuth 2.0 and Authentication

- OAuth 2.0 was designed for authorization
  - Creation of access token requires authentication
  - Authorization server passes access token to client
  - Client passes access token when calling resource services
  - Access token serves as app credentials for authorization
- Access token not intended for user authentication
  - Access token not designed to carry user identity data
  - OAuth 2.0 doesn't require validation of access token
  - Naïve OAuth 2.0 implementations subject to attack

Open ID Connect



Agenda

- ✓ OAuth 2.0 and OpenID Connect
- ➢ Azure Active Directory
- Creating Azure AD applications
- Active Directory Authentication Library for .NET
- Programming Web Clients

Tenants and Organizational Accounts

- Azure AD used to authenticate users and apps
  - PBI licenses are assigned to Azure AD user accounts
  - Organization owns a tenant (i.e. directory)
  - AAD tenant contains user accounts and groups
  - AAD tenant contains set of registered applications

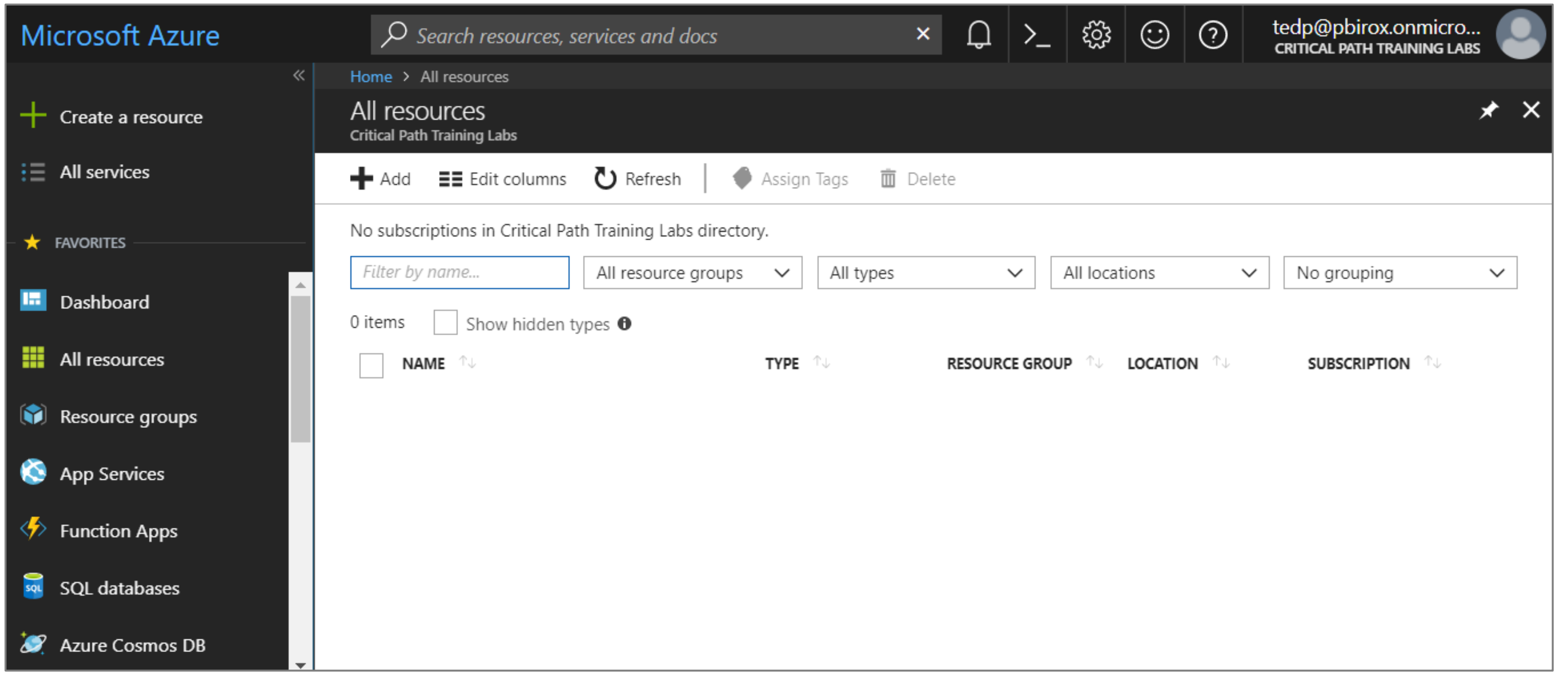
- You must register your application with Azure AD
  - Requirement of calling to Power BI service API
  - Applications registered as Web app or Native app
  - Registered applications are assigned GUID for client ID
  - Application is configured with permissions

Agenda

- ✓ OAuth 2.0 and OpenID Connect
- ✓ Azure Active Directory
- ➢ Creating Azure AD applications
- Active Directory Authentication Library for .NET
- Programming Web Clients

The Azure Portal

- Azure portal allows to create application
  - Azure Portal accessible at https://portal.azure.com
  - Azure subscription required to create resources (e.g. VMs)
  - No Azure subscription required to manage users or applications



All resources
Critical Path Training Labs

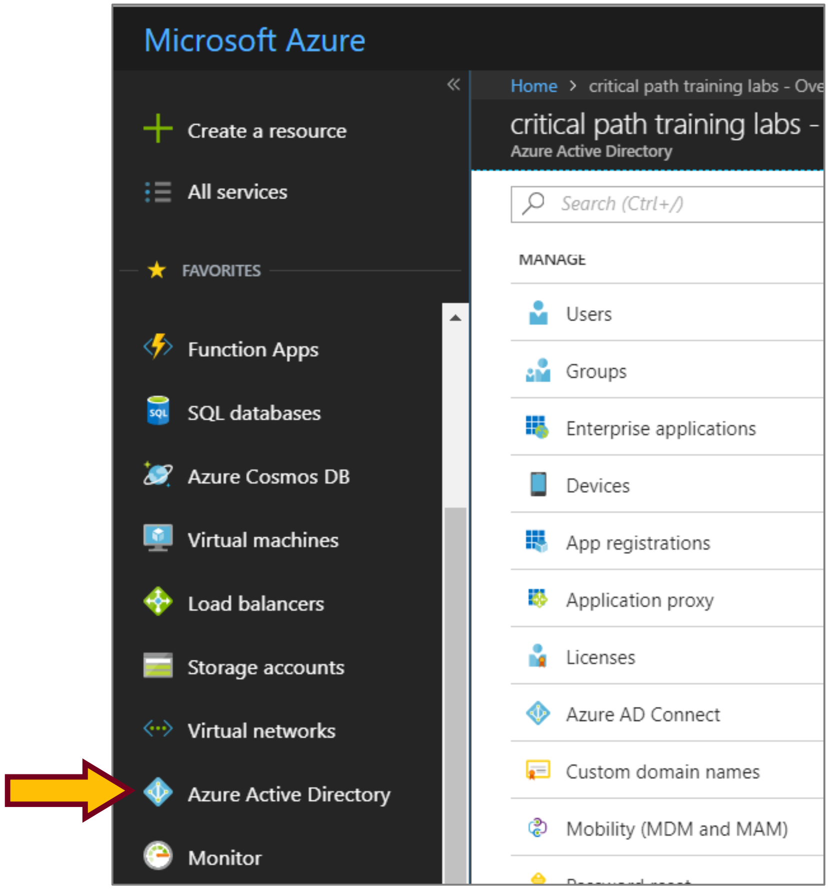
No subscriptions in Critical Path Training Labs directory.

All resource groups | All types | All locations | No grouping

0 items ☐ Show hidden types

Azure Active Directory

- Azure portal access to Access Azure Active Directory
  - Provides ability to configure users, groups and application



Microsoft Azure

Create a resource
All services
FAVORITES
Function Apps
SQL databases
Azure Cosmos DB
Virtual machines
Load balancers
Storage accounts
Virtual networks
Azure Active Directory
Monitor

Home > critical path training labs - Ove

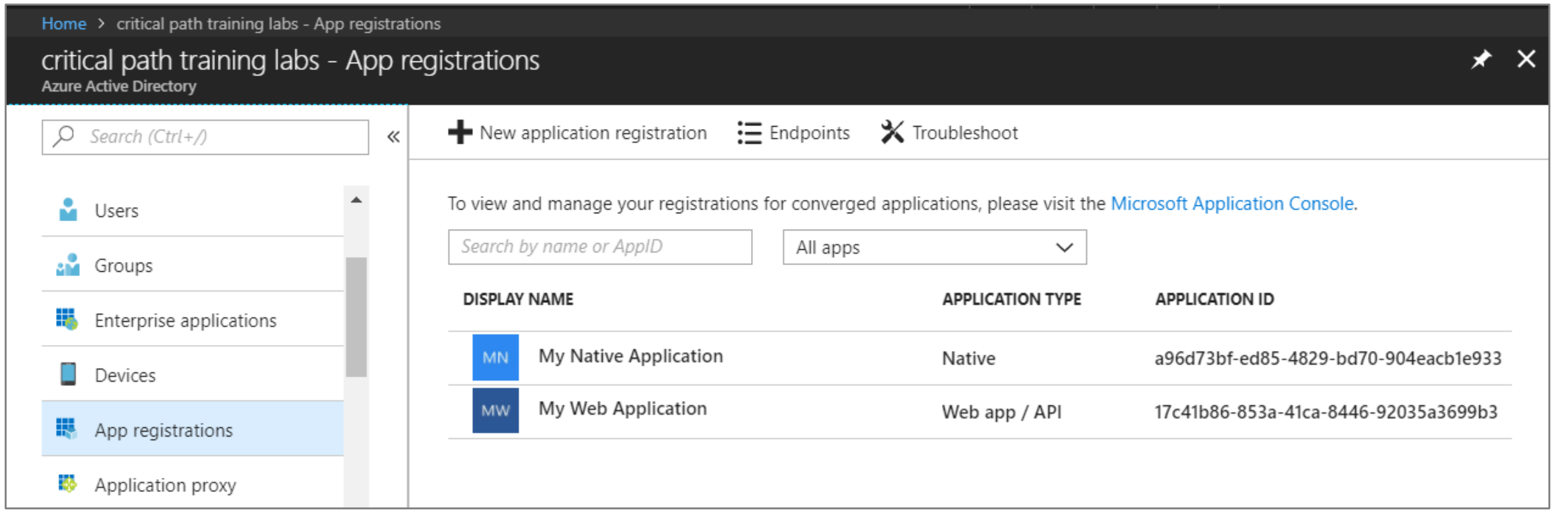
critical path training labs -
Azure Active Directory

Search (Ctrl+/)

MANAGE
Users
Groups
Enterprise applications
Devices
App registrations
Application proxy
Licenses
Azure AD Connect
Custom domain names
Mobility (MDM and MAM)

Azure AD Applications

- Creating applications required for AAU authentication
  - Applications are as Native application or Web Applications
  - Application identified using GUID known as application ID
  - Application ID often referred to as client ID or app ID



To view and manage your registrations for converged applications, please visit the Microsoft Application Console.

DISPLAY NAME	APPLICATION TYPE	APPLICATION ID
MN My Native Application	Native	a96d73bf-ed85-4829-bd70-904eacb1e933
MW My Web Application	Web app / API	17c41b86-853a-41ca-8446-92035a3699b3

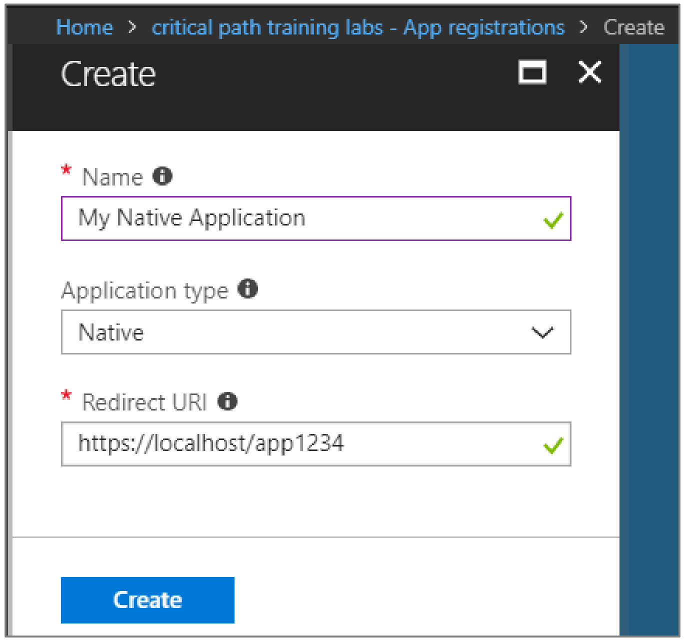
Application Types

- Single tenant application vs Multi-tenant application
  - Single tenant application intended for use within one organization
  - Multi-tenant application intended by use across organizations
  - Multi-tenant application are SaaS applications written by ISVs

- Azure AD Application Types
  - Native applications
  - Web app
  - Web app configured to allow Implicit Flow

Creating a Native Application

- Power BI supports Native applications
  - Can be used for desktop applications and Console applications
  - Used for third party embedding (known as App Owns Data model)
  - Application type should be configured as Native
  - Requires Redirect URI with unique string - not an actual URL


Home > critical path training labs - App registrations > Create
Create
Create

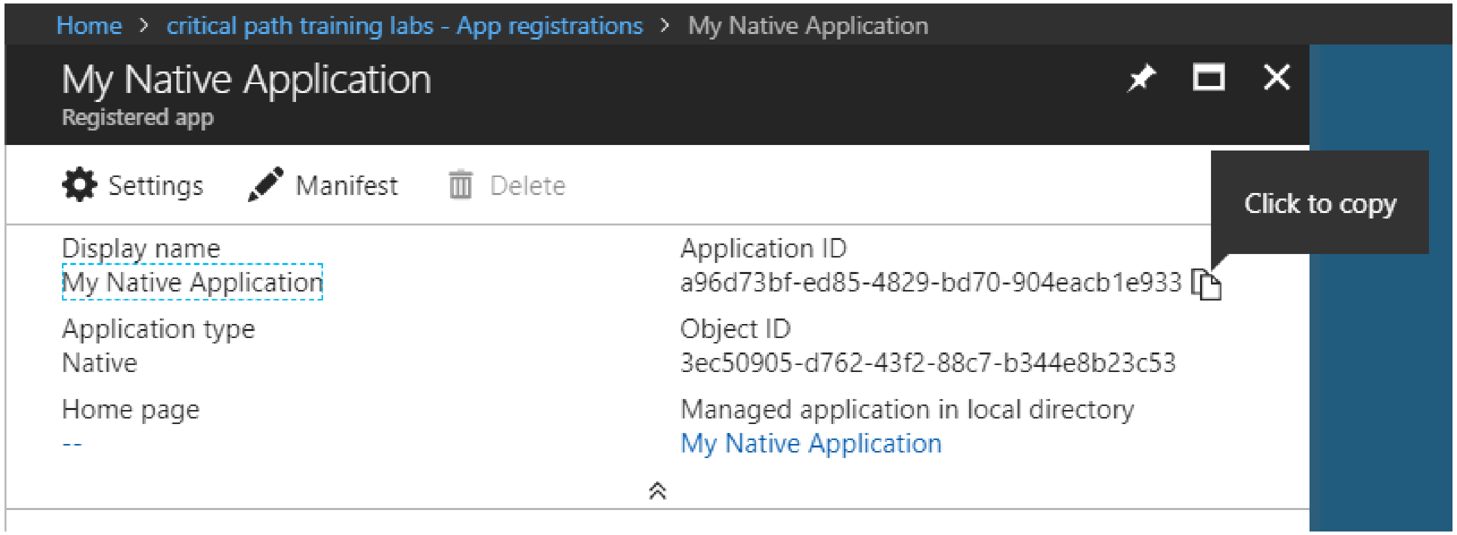
* Name: My Native Application

Application type: Native

* Redirect URI: https://localhost/app1234

Copying the Application ID

- Each new application created with Application ID
  - You cannot supply your own GUID for application ID
  - Azure AD will always create this GUID
  - You can copy the application IS from the azure portal


Home > critical path training labs - App registrations > My Native Application
My Native Application
Registered app
Settings
Manifest
Delete
Click to copy

Display name
My Native Application

Application type
Native

Home page
--

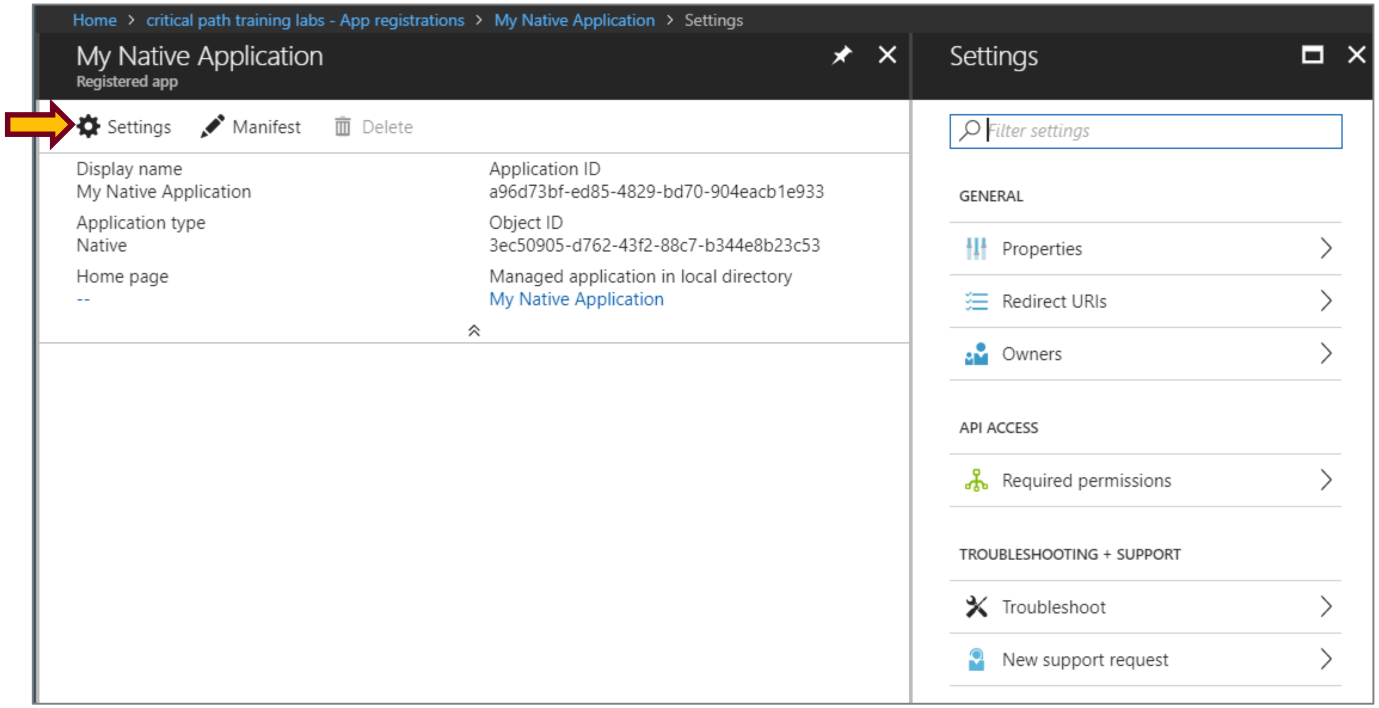
Application ID
a96d73bf-ed85-4829-bd70-904eacb1e933

Object ID
3ec50905-d762-43f2-88c7-b344e8b23c53

Managed application in local directory
My Native Application

Native Application Settings

- Properties
- Redirect URLs
- Owners
- Required Permissions



Home > critical path training labs - App registrations > My Native Application > Settings

My Native Application
Registered app

Settings | Manifest | Delete

Display name
My Native Application

Application type
Native

Home page
--

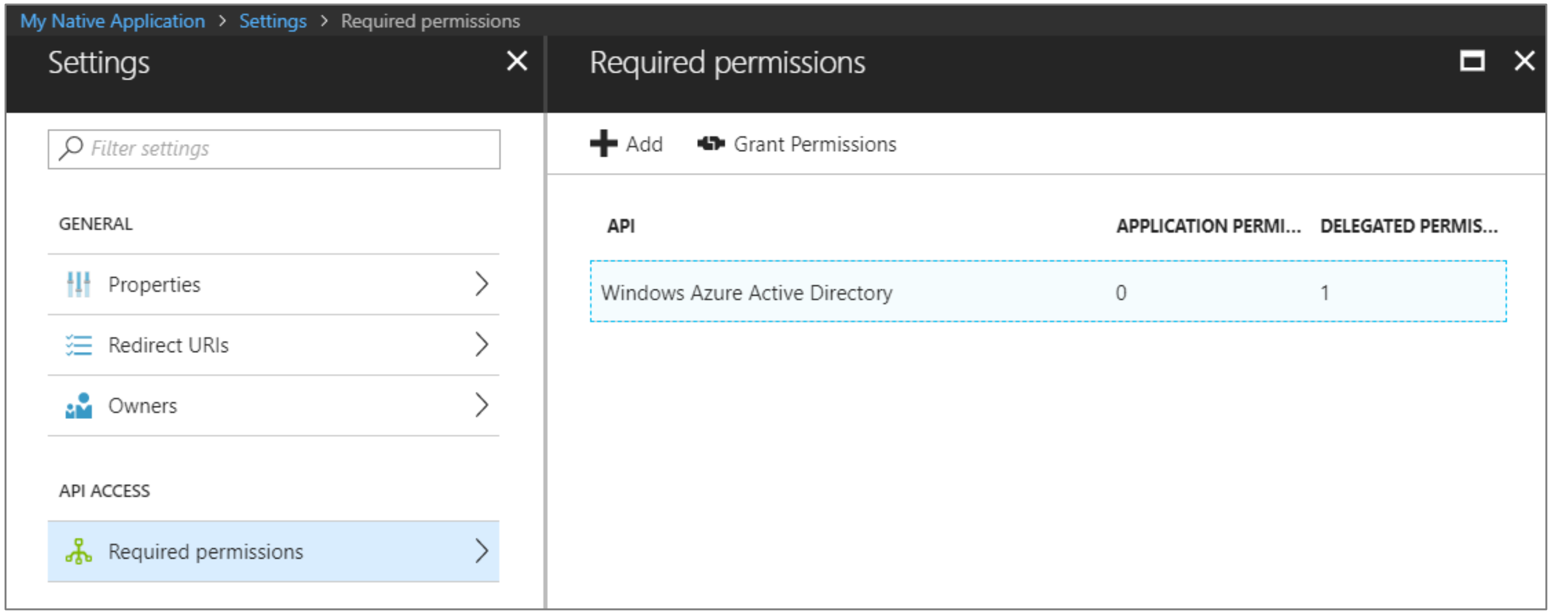
Application ID
a96d73bf-ed85-4829-bd70-904eacb1e933

Object ID
3ec50905-d762-43f2-88c7-b344e8b23c53

Managed application in local directory
My Native Application

Configuring Required Permissions

- Application configured with permissions
  - Default permissions allows user authentication – but that's it
  - To use APIs, you must assign permissions to the application



My Native Application > Settings > Required permissions

Settings

Filter settings

GENERAL

Properties

Redirect URIs

Owners

API ACCESS

Required permissions

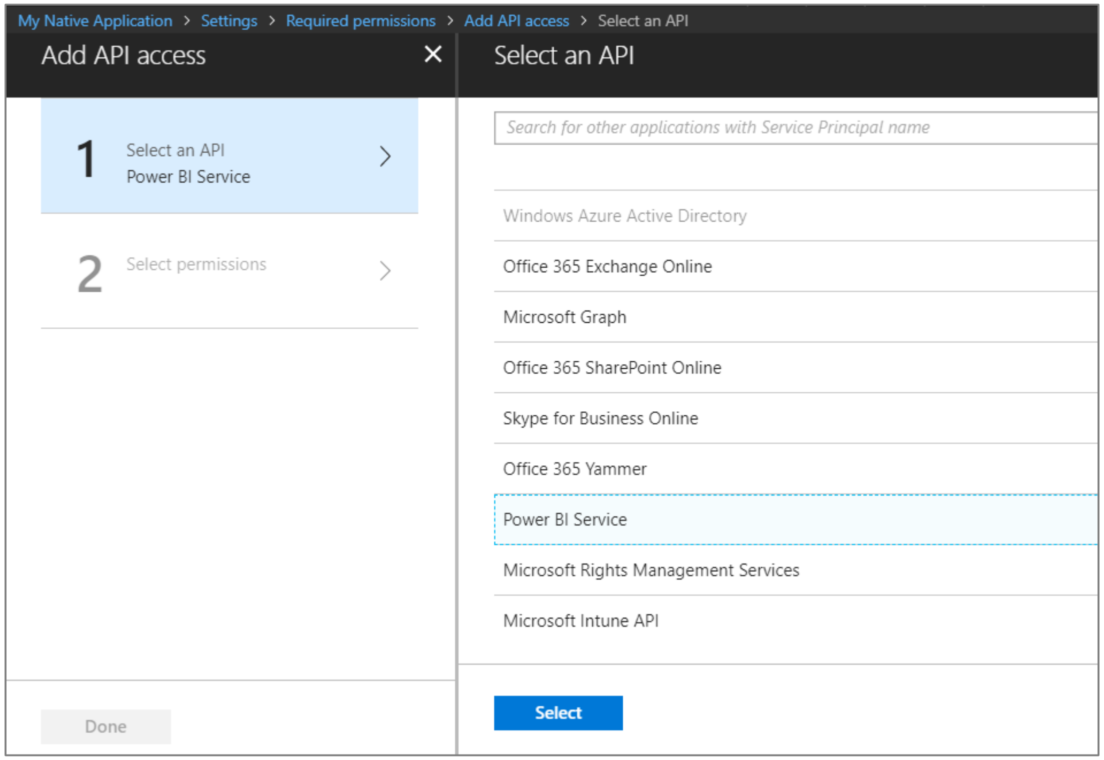
Required permissions

Add   Grant Permissions

API	APPLICATION PERMI...	DELEGATED PERMIS...
Windows Azure Active Directory	0	1

Choosing APIs

- There are lots of APIs to choose from
  - Microsoft Graph
  - Office 365 SharePoint Online
  - Power BI Service



My Native Application > Settings > Required permissions > Add API access > Select an API

Add API access

1 Select an API
Power BI Service

2 Select permissions

Done

Select an API

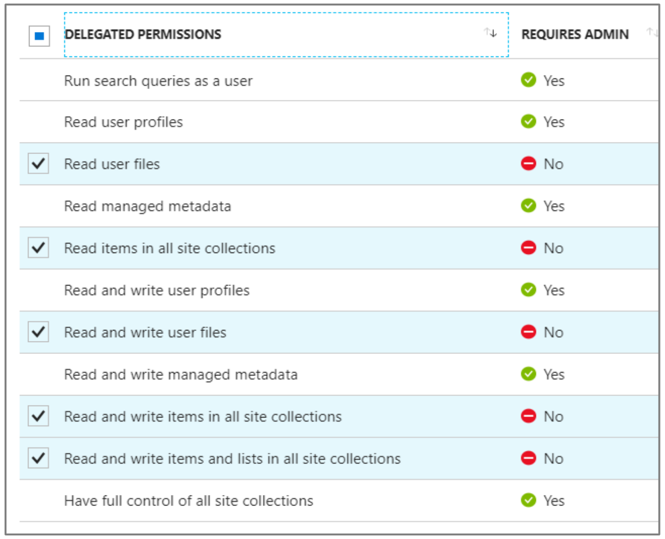
Search for other applications with Service Principal name

Windows Azure Active Directory
Office 365 Exchange Online
Microsoft Graph
Office 365 SharePoint Online
Skype for Business Online
Office 365 Yammer
Power BI Service
Microsoft Rights Management Services
Microsoft Intune API

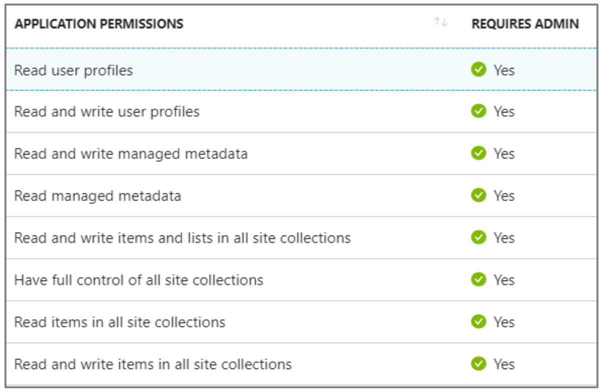
Select

Delegated Permissions vs Application Permissions

- Permissions categorized into two basic types
  - Delegated permissions are (app + user) permissions
  - Application permissions are app-only permissions (far more powerful)
  - Not all application types and APIs support application permissions
  - Power BI Service API does not yet support application permissions
- Example permissions for Office 365 SharePoint Online
  - Some delegated permissions requires administrative permissions



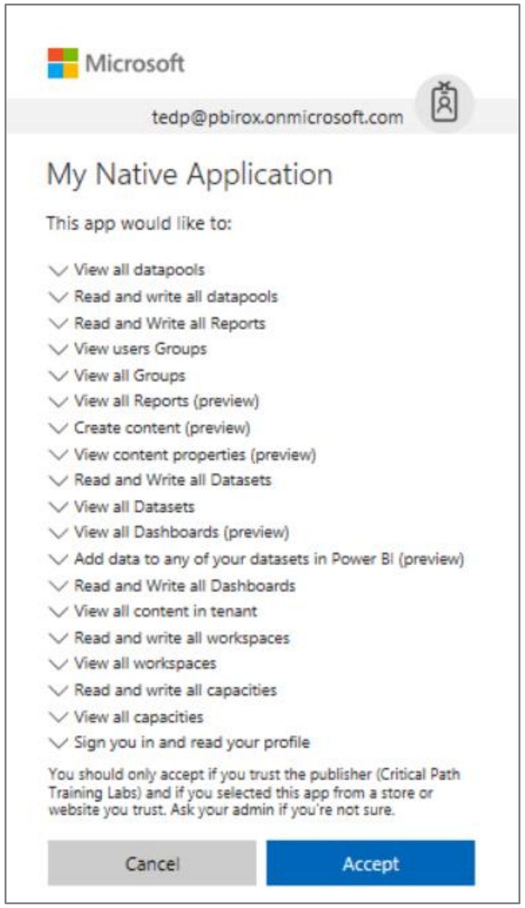
	DELEGATED PERMISSIONS	REQUIRES ADMIN
	Run search queries as a user	✓ Yes
	Read user profiles	✓ Yes
✓	Read user files	⛔ No
	Read managed metadata	✓ Yes
✓	Read items in all site collections	⛔ No
	Read and write user profiles	✓ Yes
✓	Read and write user files	⛔ No
	Read and write managed metadata	✓ Yes
✓	Read and write items in all site collections	⛔ No
✓	Read and write items and lists in all site collections	⛔ No
	Have full control of all site collections	✓ Yes



APPLICATION PERMISSIONS	REQUIRES ADMIN
Read user profiles	✓ Yes
Read and write user profiles	✓ Yes
Read and write managed metadata	✓ Yes
Read managed metadata	✓ Yes
Read and write items and lists in all site collections	✓ Yes
Have full control of all site collections	✓ Yes
Read items in all site collections	✓ Yes
Read and write items in all site collections	✓ Yes

Interactive Consent for Delegated Permissions

- Users must consent to delegated permissions
  - User prompted during first log in
  - User must click Accept
  - Only occurs once for each user


Microsoft

tedp@pbirox.onmicrosoft.com

My Native Application

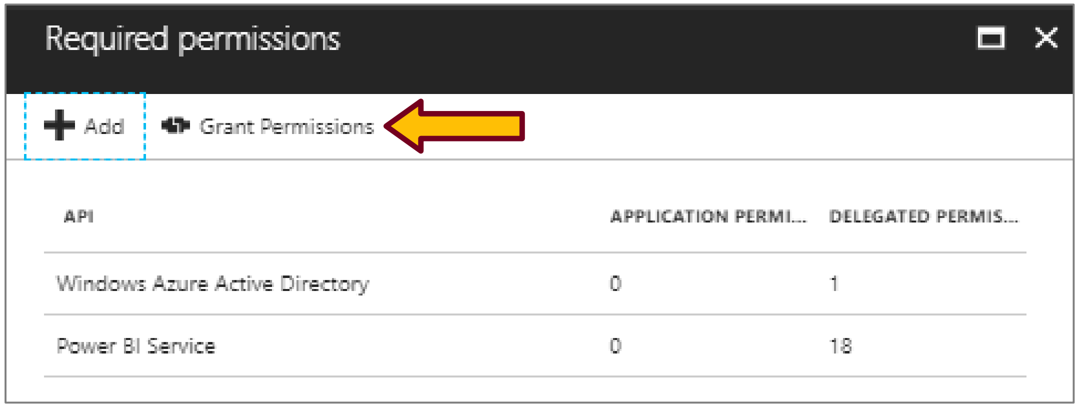
This app would like to:

- View all datapools
- Read and write all datapools
- Read and Write all Reports
- View users Groups
- View all Groups
- View all Reports (preview)
- Create content (preview)
- View content properties (preview)
- Read and Write all Datasets
- View all Datasets
- View all Dashboards (preview)
- Add data to any of your datasets in Power BI (preview)
- Read and Write all Dashboards
- View all content in tenant
- Read and write all workspaces
- View all workspaces
- Read and write all capacities
- View all capacities
- Sign you in and read your profile

You should only accept if you trust the publisher (Critical Path Training Labs) and if you selected this app from a store or website you trust. Ask your admin if you're not sure.

Granting Delegated Permissions

- It can be helpful to Grant Permissions in Azure portal
  - Prevents the need for interactive granting of application by user
  - Might be required when authenticating in non-interactive fashion



API	APPLICATION PERMI...	DELEGATED PERMIS...
Windows Azure Active Directory	0	1
Power BI Service	0	18

DEMO

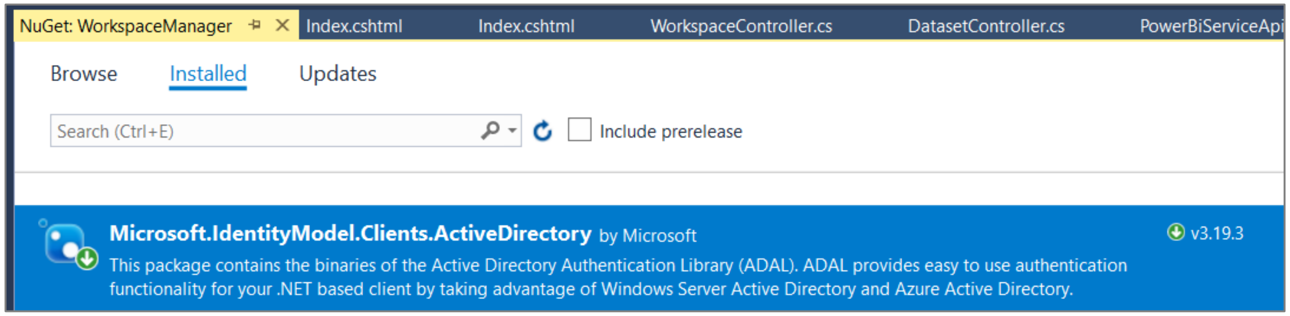
Creating an AAD Application

Agenda

- ✓ OAuth 2.0 and OpenID Connect
- ✓ Azure Active Directory
- ✓ Creating Azure AD applications
- ➢ Active Directory Authentication Library for .NET
- Programming Web Clients

ADAL for .NET

- Active Directory Authentication Library for .NET
  - Used in Native Clients and in Web Clients
  - Handles authentication flow behind the scenes
  - Provides caching for access tokens and refresh tokens



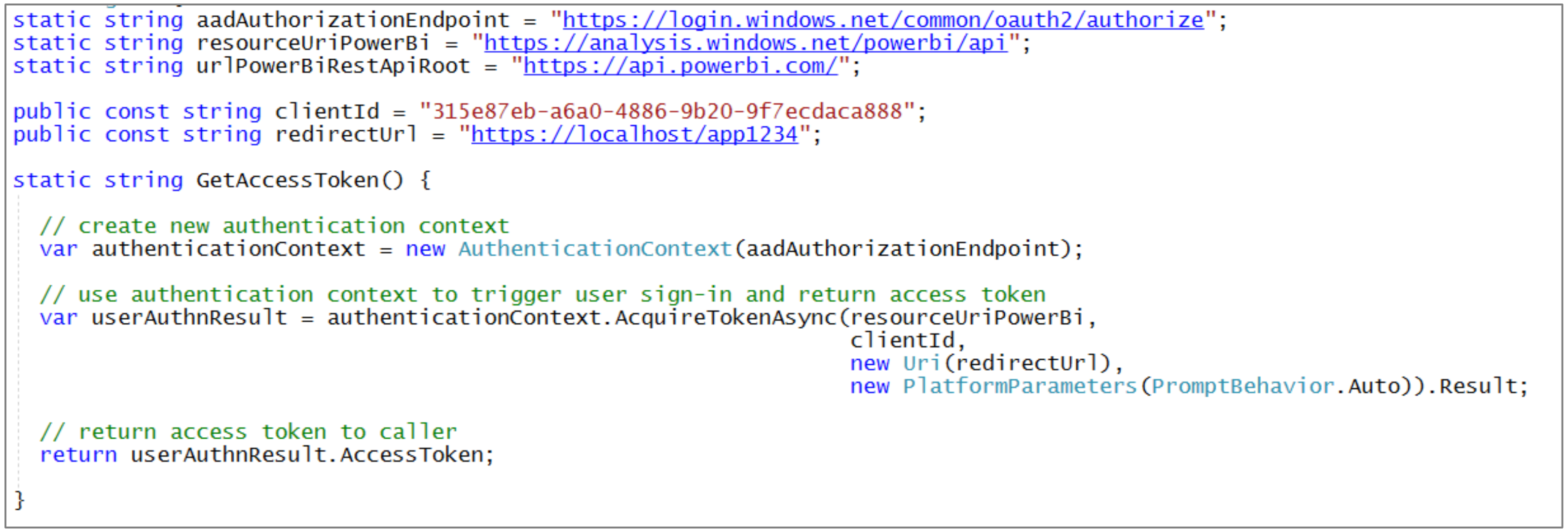
Microsoft.IdentityModel.Clients.ActiveDirectory by Microsoft

This package contains the binaries of the Active Directory Authentication Library (ADAL). ADAL provides easy to use authentication functionality for your .NET based client by taking advantage of Windows Server Active Directory and Azure Active Directory.

- ADAL .NET installs as a NuGet Package
  - Package name is **Microsoft.IdentityModel.Clients.ActiveDirectory**

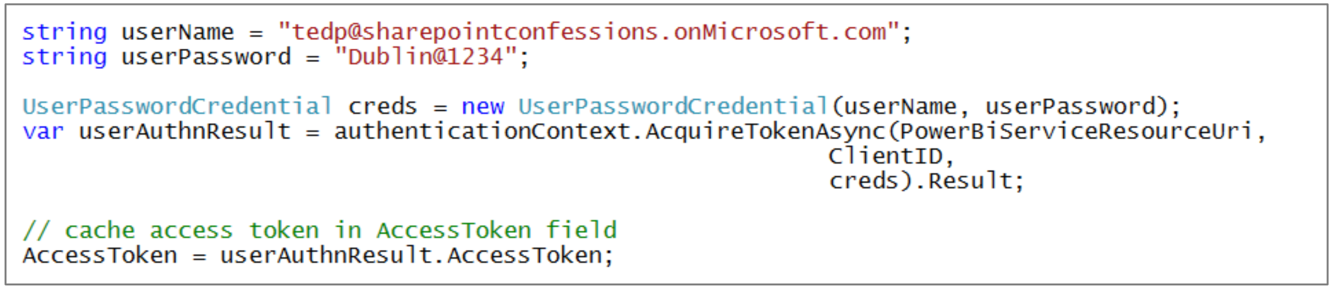
Access Token Acquisition (Native Client)

- With interactive login



```
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;

}
```

- With Direct User Credentials (non-interactive)



```
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;
```

DEMO

Using ADAL in a Native Client

Agenda

- ✓ OAuth 2.0 and OpenID Connect
- ✓ Azure Active Directory
- ✓ Creating Azure AD applications
- ✓ Active Directory Authentication Library for .NET
- ➢ Programming Web Clients

Authorization Code Grant Flow

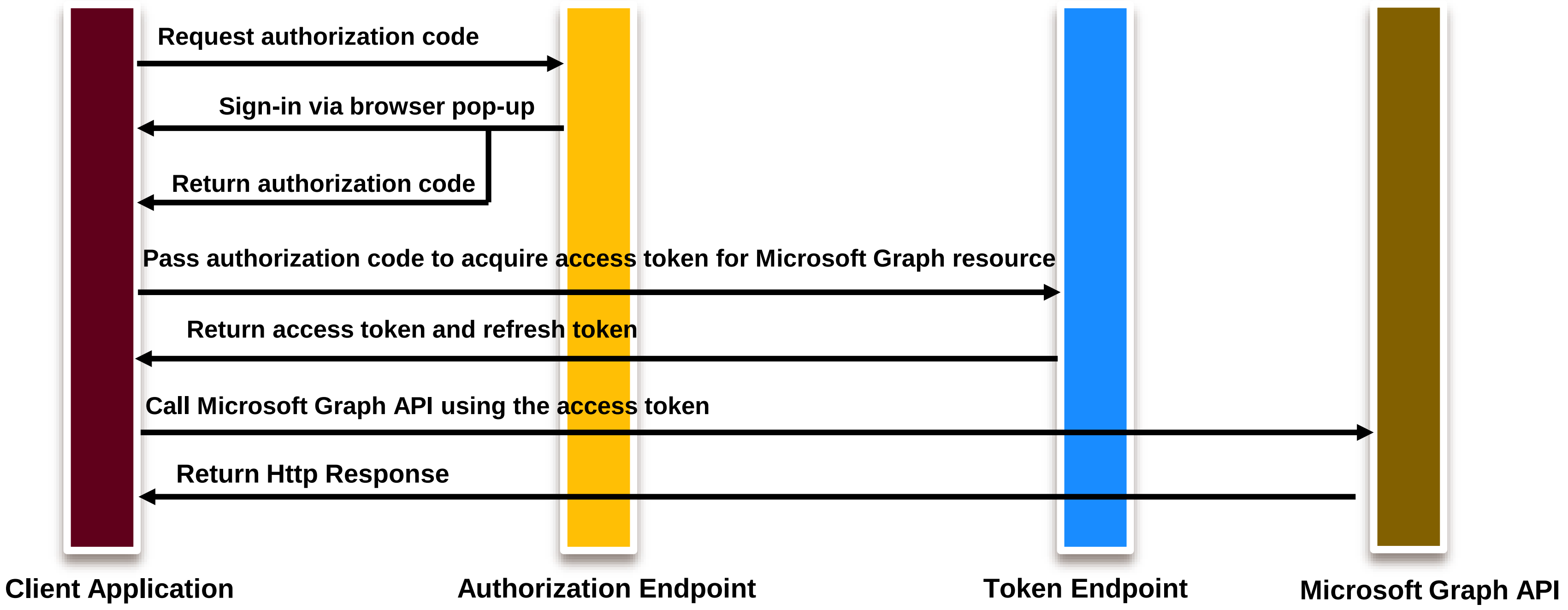
- Provides Highest Levels of Security
  - User credentials never seen by client
  - Access token passed to client with Reply URL
  - Access token not passed through user agent
- Refresh tokens used to get new access tokens
  - Access token lifetime is about 1 hour
  - Refresh token lifetime is 14 days
  - AAD supports multi-resource refresh tokens (MRRTs)

Authorization Code Grant Flow Example

- **Sign-on URL**
  - Development: **https://localhost:44300/**
  - Production: **https://www.MyDomain.com/**
- **Reply URL**
  - Development: **https://localhost:44300/AcceptDirect**
  - Production: **https://www.MyDomain.com/AcceptDirect**
- **Client ID**
  - GUID-based identifier for a specific AAD application
  - **33d561fb-59a7-4817-bddf-2117193d62e0**
- **Key** (aka Client Secret)
  - Key that acts as a secret password between Azure AD and application
  - **ouWdhd2LxDl0Pcu2SKlujEiQ5GmSbKRbBM24nETb5dw=**

Authorization Code Grant Flow

- Sequence of Requests in Authorization Code Grant Flow
  - Application redirects to AAD authorization endpoint
  - User prompted to log on at Windows logon page
  - User prompted to consent to permissions (first access)
  - AAD redirects to application with authorization code
  - Application redirects to AAD access token endpoint


Request authorization code
Sign-in via browser pop-up
Return authorization code
Pass authorization code to acquire access token for Microsoft Graph resource
Return access token and refresh token
Call Microsoft Graph API using the access token
Return Http Response
Client Application
Authorization Endpoint
Token Endpoint
Microsoft Graph API

DEMO

Using ADAL in a Web Client

Summary of OAuth Client Types

	Web Client SPA	Hybrid Native Client	Web Application Client	Web Service Client
Client Type	Public	Public or Confidential	Confidential	Confidential
Verifiable Reply URL	Yes	No	Yes	Yes
Authenticates Client	No	It Depends	Yes	Yes
Token from Authorization Endpoint	Yes	Yes	No	No
Access Token from URI Fragment	Yes	No	No	No
Token from Token Endpoint	No	Yes	Yes	Yes
Can use refresh tokens	No	Yes	Yes	Yes
Permissions	Delegated	Delegated + App	Delegated + App	Delegated + App

Summary

- ✓ OAuth 2.0 and OpenID Connect
- ✓ Azure Active Directory
- ✓ Creating Azure AD applications
- ✓ Active Directory Authentication Library for .NET
- ✓ Programming Web Clients