

Introduction to Modern Software Development



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
 - .NET programming with C# or VB.NET
 - SharePoint farm solution and add-in development
 - JavaScript and TypeScript
 - jQuery, React and Angular
 - Programming with HTTP Requests, REST and OData
 - Developing with ASP.NET MVC and Web API



Agenda

- Understanding SharePoint Development Strategies
- Creating a SharePoint Development Environment
- Programming the Client-side Object Model (CSOM)
- Understanding Azure as a Development Platform
- Developing with TypeScript and Interfaces



Evolution of the SharePoint Platform

- Farm Solutions
- ~~Sandboxed Solutions~~
- SharePoint Add-ins
- JavaScript Injection
- Remote Provisioning
- SharePoint Framework (SPFx)



SharePoint App Add-in Model

- SharePoint 2013 introduced new development model
 - Originally introduced as "SharePoint App" model
 - Marketing folks renamed "SharePoint App" to "SharePoint Add-in"
- Add-in model designed to replace farm solutions
 - Add-ins designed to supported SPO and SharePoint on-premises
 - Add-in code not allowed to run on SharePoint host server
 - Add-in talks to SharePoint using REST and CSOM
 - Add-in authenticates and establishes add-in identity
 - Add-in has permissions independent of user
 - Add-ins deployed to catalogs using publishing scheme



SharePoint APIs

- SharePoint REST API
 - Commonly used with client-side JavaScript code
 - Good fit when developing SharePoint-hosted add-ins
 - Accessible to any type of client on any platform
- Client-side Object Model (CSOM)
 - Commonly used with server-side C# code
 - Good fit when developing provider-hosted add-ins
 - Good fit when creating desktop clients (e.g. Console app)
 - Used to perform remote provisioning in SPO sites



JavaScript Injection

- JavaScript injection based on central concept...
 1. upload custom JavaScript code to SharePoint Online
 2. execute code using identity and permissions of current user
- Approaches for using JavaScript injection
 - Script Editor Web Part
 - Adding JavaScript code behind SharePoint site pages
 - Full-blown Visual Studio project development
- Why create solution using JavaScript Injection?
 - Provides more flexibility than SharePoint add-in model
 - Poses fewer constraints than SharePoint add-in model



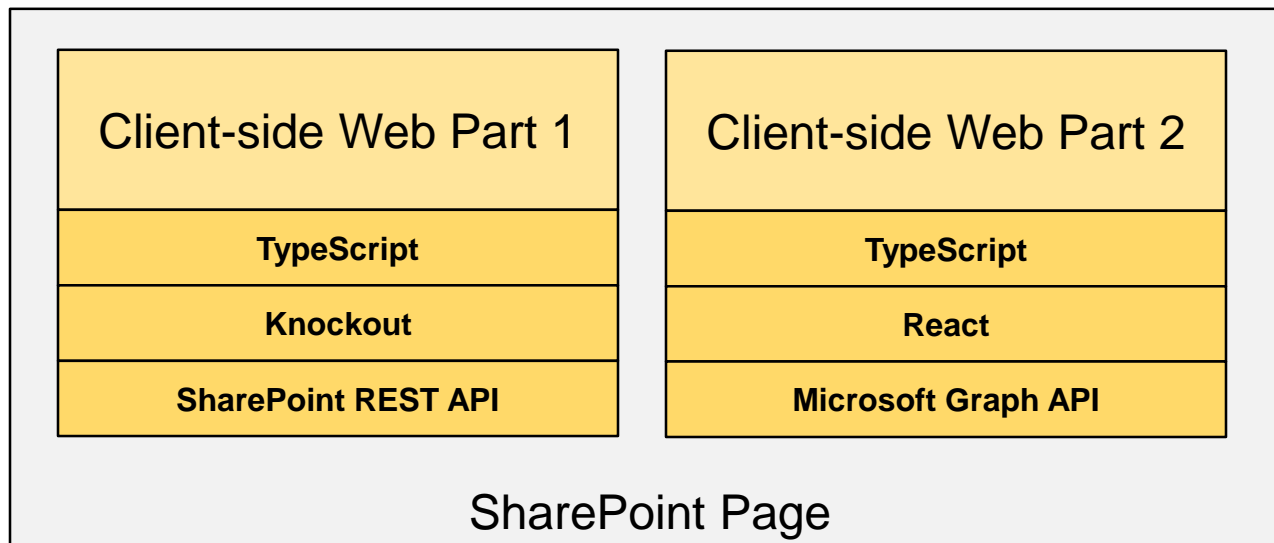
Remote Provisioning

- Remote provisioning in SPO
 - Use CSOM to create SPO site elements
 - Recommended over SharePoint solutions & features
- What can you create with Remote Provisioning
 - New child sites, lists and document libraries
 - Site columns, content types and remote event receivers
 - New pages with custom JavaScript logic
 - User custom actions with custom JavaScript logic



The SharePoint Framework (SPFx)

- Development model based on pages and web parts
 - Based on client-side development with JavaScript or TypeScript
 - Code runs with authenticated identity of current user
 - Easy access to SharePoint and Office 365 content and data
 - Developer tools designed to support cross-platform development
 - Great support for targeting mobile devices



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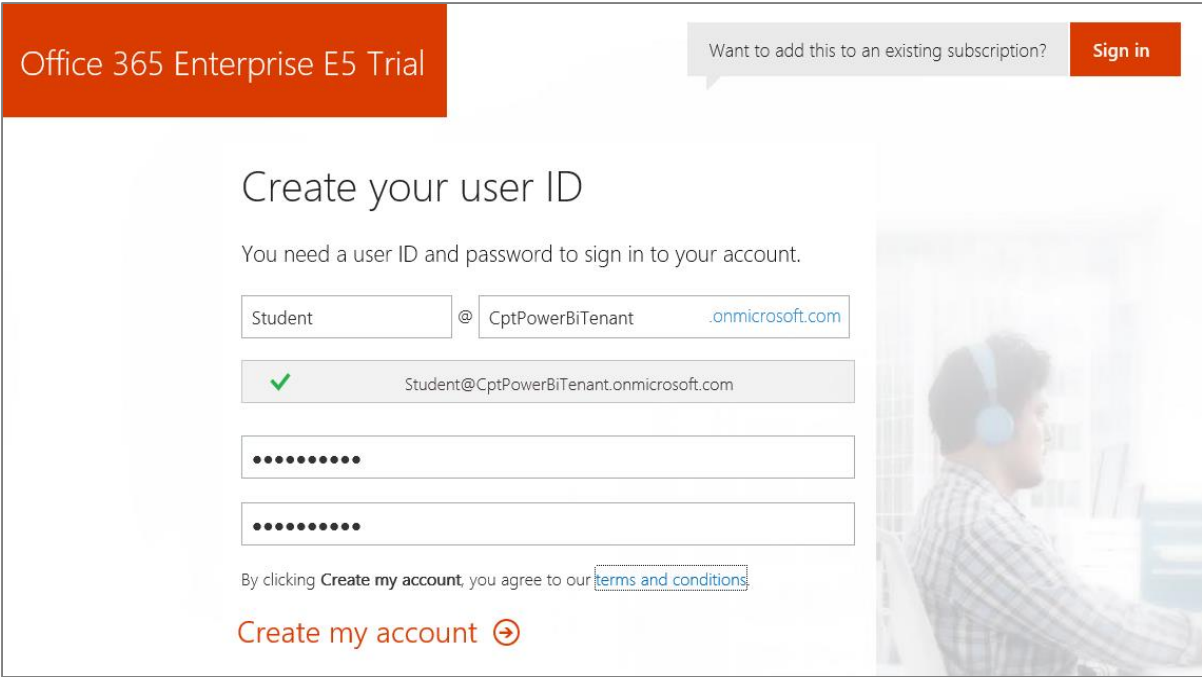
Getting Started with Cloud Development

- Create an Office 365 trial tenant for development
 - In truth, you are really creating an Azure AD tenant
 - Create global tenant admin user account for developing
 - Create non-admin user accounts for testing
 - Create SharePoint Online sites for developing & testing
 - Obtain a Microsoft Azure subscription
- Getting around inside your Azure AD Tenant
 - Microsoft 365 administrative tools
 - Azure Portal
 - SharePoint admin center
 - PowerShell utilities



Creating a SharePoint Trial 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
 - You can create and test Office 365 unified groups



The screenshot shows the 'Office 365 Enterprise E5 Trial' sign-up page. At the top left, there's an orange header with the text 'Office 365 Enterprise E5 Trial'. To the right, a grey box contains 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 it, a message states: 'You need a user ID and password to sign in to your account.' The form consists of three input fields: a text field for the user ID (containing 'Student'), a dropdown menu for the domain (showing '@ CptPowerBiTenant .onmicrosoft.com'), and a password field (displayed as dots). Below these fields, a green checkmark icon is shown next to the email address 'Student@CptPowerBiTenant.onmicrosoft.com'. There are two more password fields, each with dots. At the bottom, a line of text reads: 'By clicking **Create my account**, you agree to our [terms and conditions](#).' Below this is an orange button with the text 'Create my account' and a right-pointing 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.



Office 365 Tenancies in SharePoint Online

- Office 365 environment based on tenancies
 - New tenancy is created for each customer organization
 - Tenancy provides scope for creating users and groups
 - Tenancy provides scope for creating SharePoint sites
 - Tenancy provides scope for Azure AD applications
- Office 365 Developer should be tenant admin
 - Provides permissions you need to develop and test



Microsoft 365 admin center

- Chores to accomplish in Microsoft 365 admin center
 - Accessible at <https://admin.microsoft.com/Adminportal>
 - Learn how to add secondary user accounts for testing
 - Learn how to view and manage groups

Microsoft 365 admin center

Home > Active users Critical Path Labs

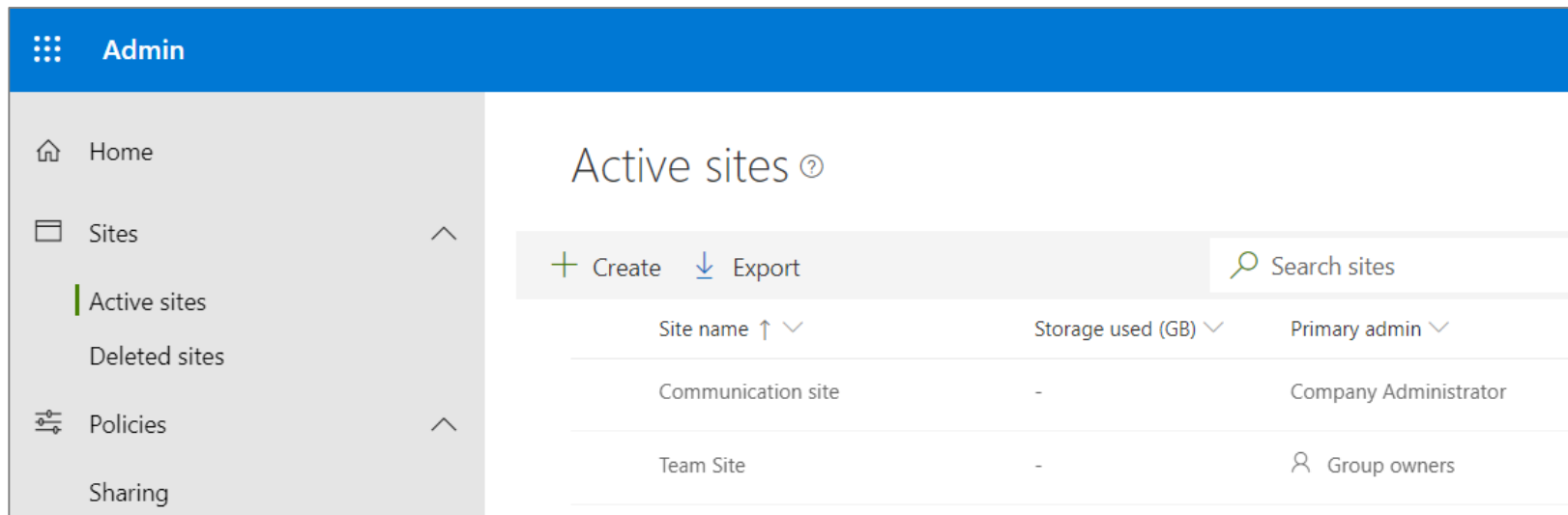
[+ Add a user](#) [More](#) Views All users [Export](#)

<input type="checkbox"/>	Display name	Username	Status
<input type="checkbox"/>	Austin Powers	AustinP@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	Carrie Mathison	CarrieM@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	Emma Peel	EmmaP@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	Jack Bauer	JackB@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	Jack Ryan	JackR@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	James Bond	JamesB@msd0429.onMicrosoft.com	Office 365 Enterprise E5
<input type="checkbox"/>	Jason Bourne	JasonB@msd0429.onMicrosoft.com	Office 365 Enterprise E5



The New SharePoint admin center

- Provides tenant-level administrative features
 - Accessible at [https://\[TENANT_NAME\]-admin.sharepoint.com](https://[TENANT_NAME]-admin.sharepoint.com)



The screenshot displays the SharePoint Admin Center interface. On the left is a navigation pane with a blue header labeled 'Admin'. The navigation items are: Home, Sites (with a sub-menu arrow), Active sites (highlighted with a green bar), Deleted sites, Policies (with a sub-menu arrow), and Sharing. The main content area is titled 'Active sites' with a help icon. It features a toolbar with '+ Create' and '↓ Export' buttons, and a search bar labeled 'Search sites'. Below the toolbar is a table with three columns: 'Site name' (with an up/down arrow), 'Storage used (GB)' (with a down arrow), and 'Primary admin' (with a down arrow). The table lists two site types: 'Communication site' and 'Team Site', both showing '-' for storage used and 'Company Administrator' and 'Group owners' as primary admins respectively.

Site name ↑ ↓	Storage used (GB) ↓	Primary admin ↓
Communication site	-	Company Administrator
Team Site	-	Group owners



SharePoint Online Management Shell

- Connect to admin site using **Connect-SPOService**
- Call SPO cmdlets to query and update SharePoint assets

```
SharePoint Online Management Shell

PS C:\> Connect-SPOService -Url https://msd0429-admin.sharepoint.com
PS C:\> Get-SPOSite

Url                                     Owner Storage Quota
---                                     -
https://msd0429.sharepoint.com/         26214400
https://msd0429.sharepoint.com/portals/Community 26214400
https://msd0429-my.sharepoint.com/      26214400
https://msd0429.sharepoint.com/sites/TeamSite 26214400
https://msd0429.sharepoint.com/search   26214400
https://msd0429.sharepoint.com/portals/hub 26214400
```

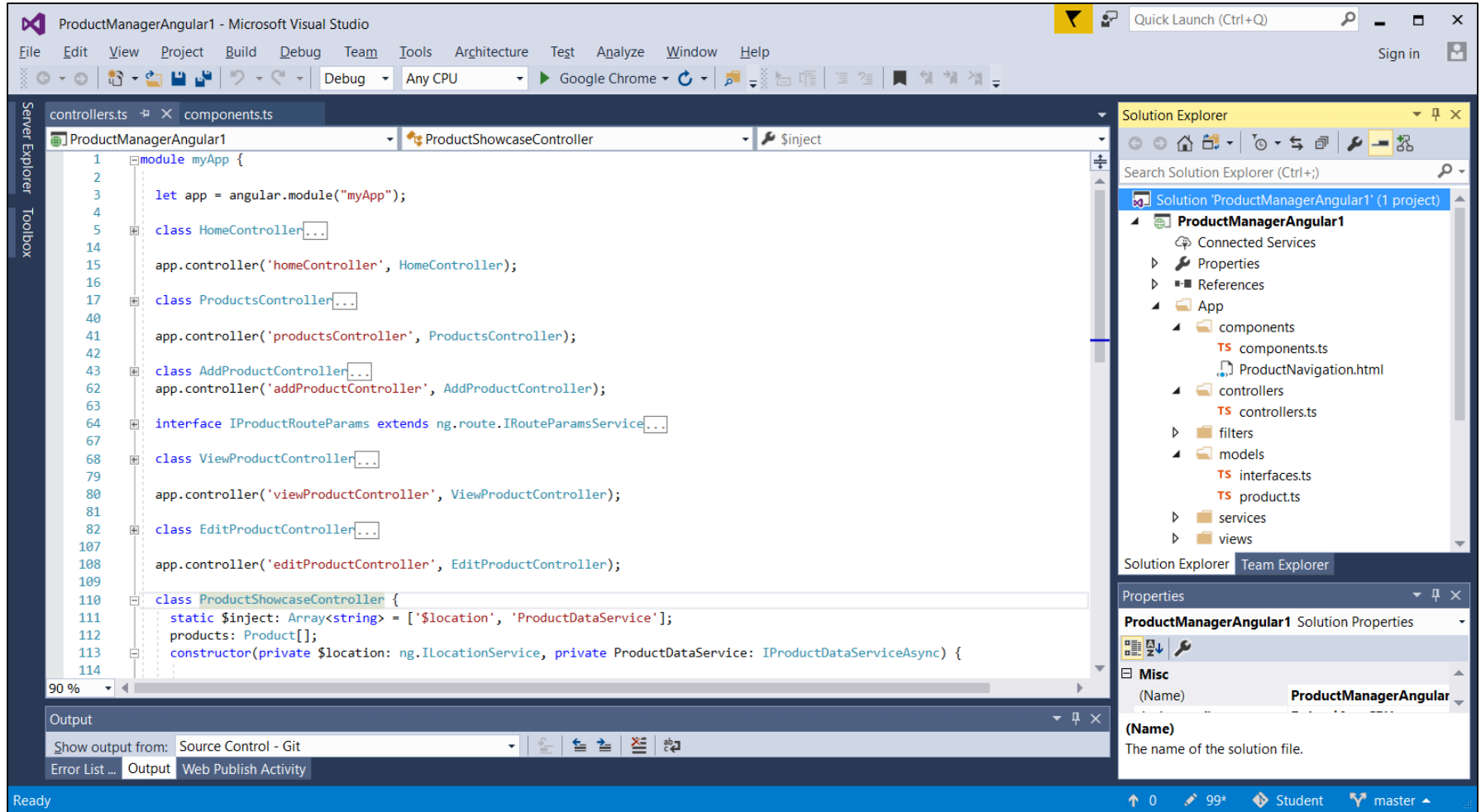
- Call **New-SPOSite** to create a new SharePoint site

```
SharePoint Online Management Shell

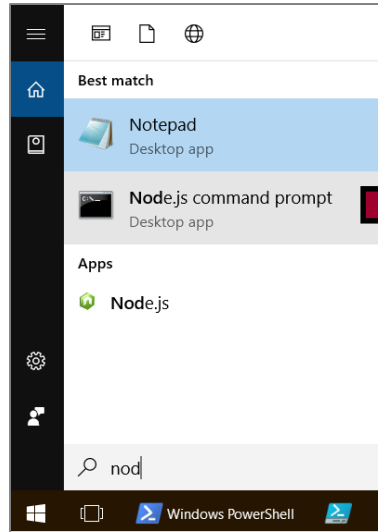
PS C:\> $url = "https://msd0429.sharepoint.com/sites/teamsite2"
PS C:\> $owner = "tedp@msd0429.onmicrosoft.com"
PS C:\> $quota = 0
PS C:\> $siteTitle = "Team Site 2"
PS C:\> $template = "STS#3"
PS C:\> New-SPOSite -Url $url -Owner $owner -Title $siteTitle -StorageQuota $quota -Template $template
```



Developing with Visual Studio 2017

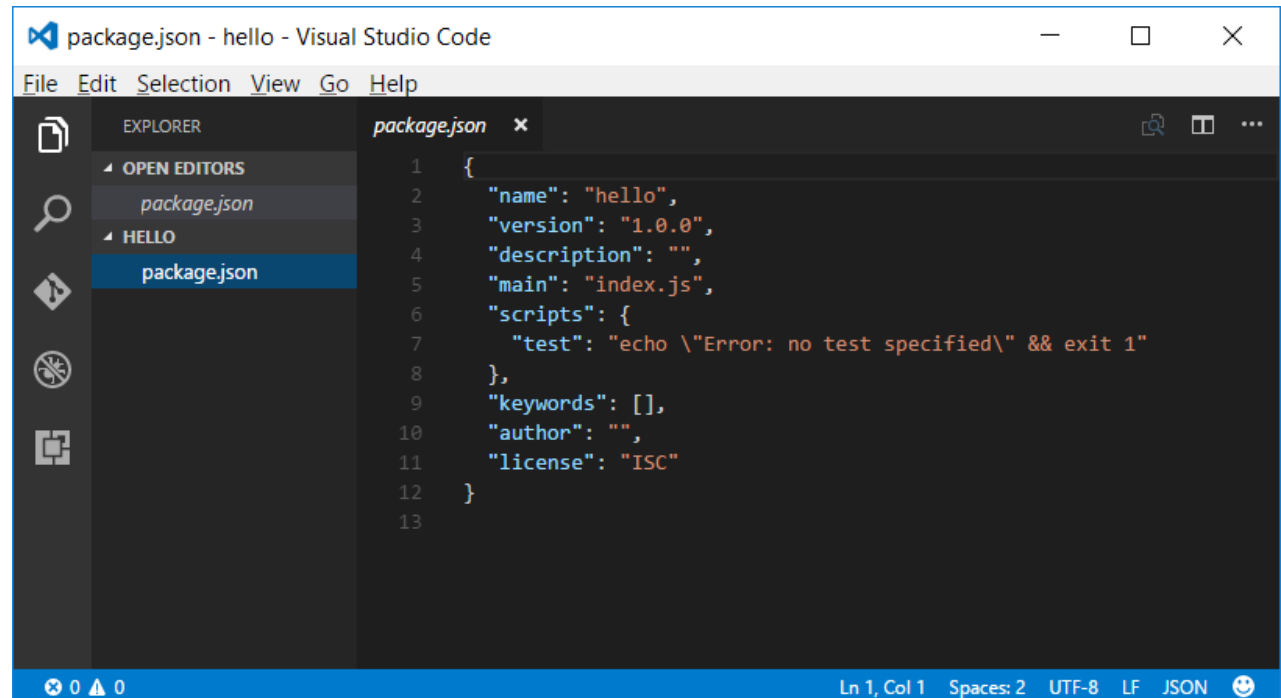


Developing with NPM & Visual Studio Code



```
Node.js command prompt

C:\Users\Student>mkdir hello
C:\Users\Student>cd hello
C:\Users\Student\hello>npm init -y
C:\Users\Student\hello>code .
```



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Why Client Object Model (CSOM)?

- Advantages of CSOM over the REST API
 - Strongly-typed programming
 - Format Digest managed automatically
 - Higher productivity when writing C# or VB
 - Provides ability to batch requests to web server
 - CSOM provides functionality beyond REST APIs
- CSOM more preferable on server-side C#
 - CSOM isn't best fit for JavaScript apps



Supported CSOM Functionality

- What can you do with CSOM?
 - Work within a specific site collection
 - Read and modify site properties
 - Create site columns and content types
 - Create lists, items, views and list types
 - Register remote event handlers
 - Create folder and upload and download files
 - Add web part and web part pages
 - Create new site collections



CSOM in SharePoint Online

- CSOM Assemblies for SharePoint Foundation
 - Version 15 intended for SharePoint 2013 On-premises
 - Version 16.0 intended for SharePoint 2016 On-premises
 - Version 16.1 (or greater) intended for SharePoint Online

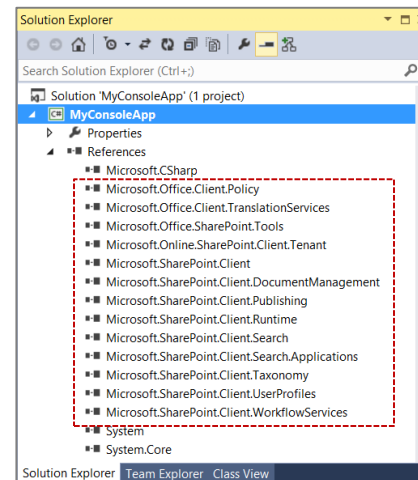
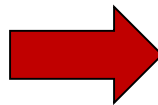
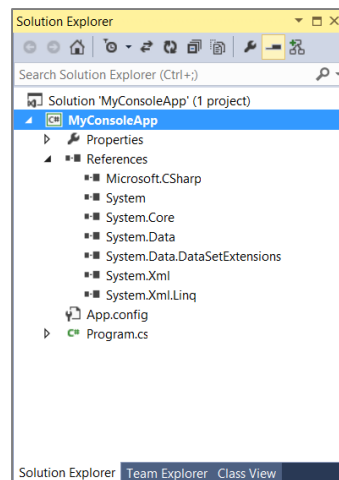
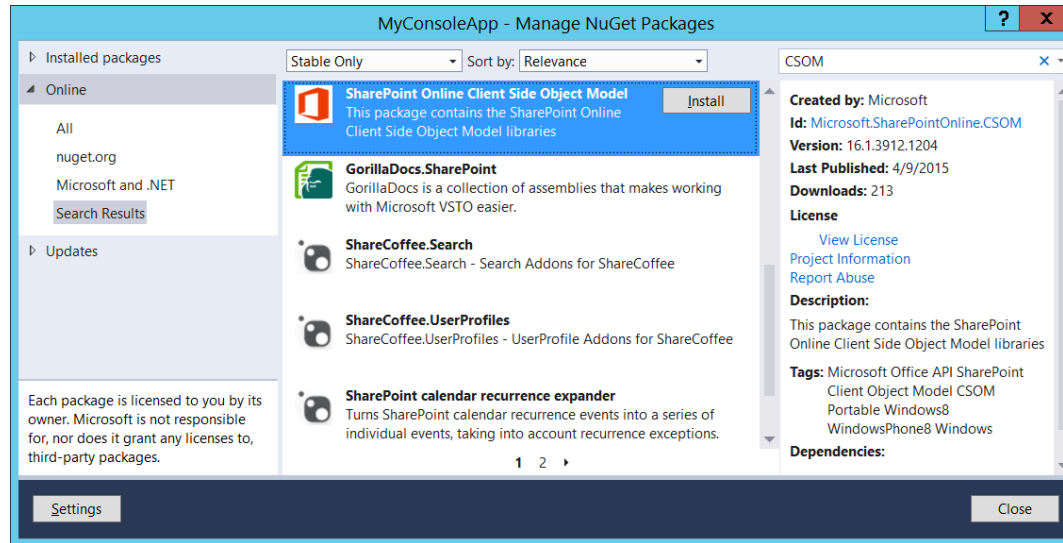
- Microsoft.SharePoint.Client
- Microsoft.SharePoint.Client.Runtime

- CSOM Assemblies for SharePoint Server

- Microsoft.SharePoint.Client.DocumentManagement
- Microsoft.SharePoint.Client.Publishing
- Microsoft.SharePoint.Client.Search
- Microsoft.SharePoint.Client.Taxonomy
- Microsoft.SharePoint.Client.UserProfiles
- Microsoft.SharePoint.Client.WorkflowServices

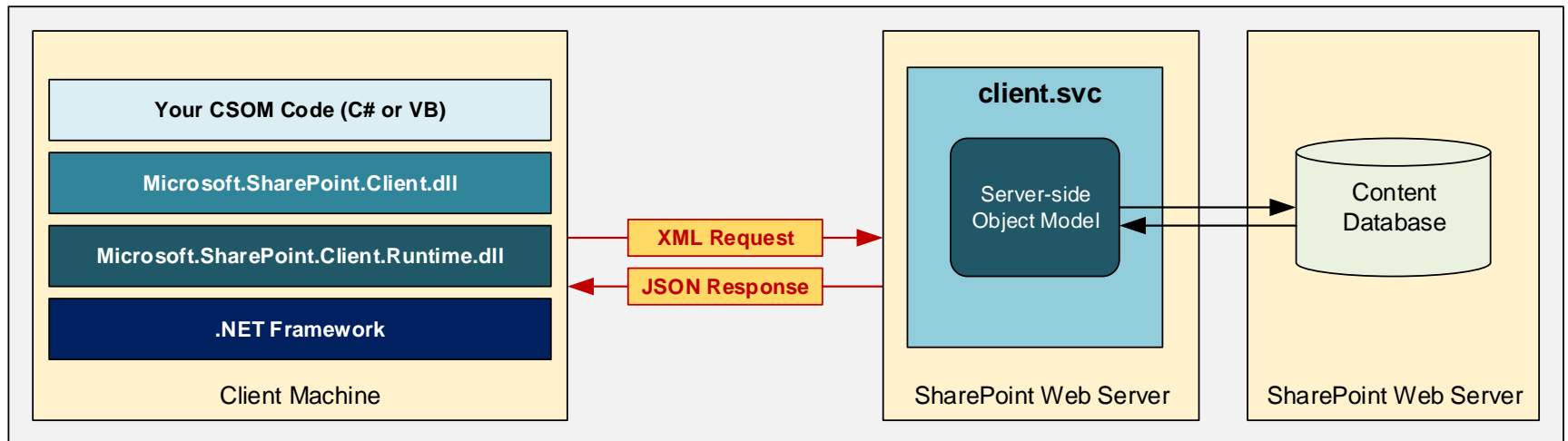


SPO CSOM NuGet Package



CSOM Architecture

- CSOM Objects act as client-side proxies
 - CSOM uses Windows Communication Foundation (WCF)
 - CSOM Runtime layer handles WCF calls behind scenes
 - Request body contains XML document of instructions
 - Response returned in JavaScript Object Notation (JSON)



ClientContext

- CSOM coding starts with ClientContext
 - Provides connection to SharePoint site
 - Provides access to site and site collection
 - Provides authentication behavior
 - Provides ExecuteQuery method to call server

```
string siteUrl = "http://intranet.wingtip.com";  
ClientContext clientContext = new ClientContext(siteUrl);
```



Hello CSOM

```
using System;
using Microsoft.SharePoint.Client;

namespace HelloCSOM {
    class Program {
        static void Main() {

            ClientContext clientContext = new ClientContext("http://intranet.wingtip.com");

            Site siteCollection = clientContext.Site;
            Web site = clientContext.Web;

            clientContext.Load(siteCollection);
            clientContext.Load(site);

            clientContext.ExecuteQuery();

            Console.WriteLine("The site collection URL is " + siteCollection.Url);
            Console.WriteLine("The site title is " + site.Url);
        }
    }
}
```



Inspecting CSOM Calls with Fiddler

- ExecuteQuery triggers call to SharePoint web server
 - CSOM calls made behind the scenes using WCF
 - CSOM calls target `/_vti_bin/client.svc/ProcessQuery`
 - Can be helpful to inspect CSOM calls using Fiddler Web Debugger

```
using System;
using Microsoft.SharePoint.Client;

namespace HelloCSOM {
    class Program {
        static void Main() {

            ClientContext clientContext = new ClientContext("http://intranet.wingtip.com");

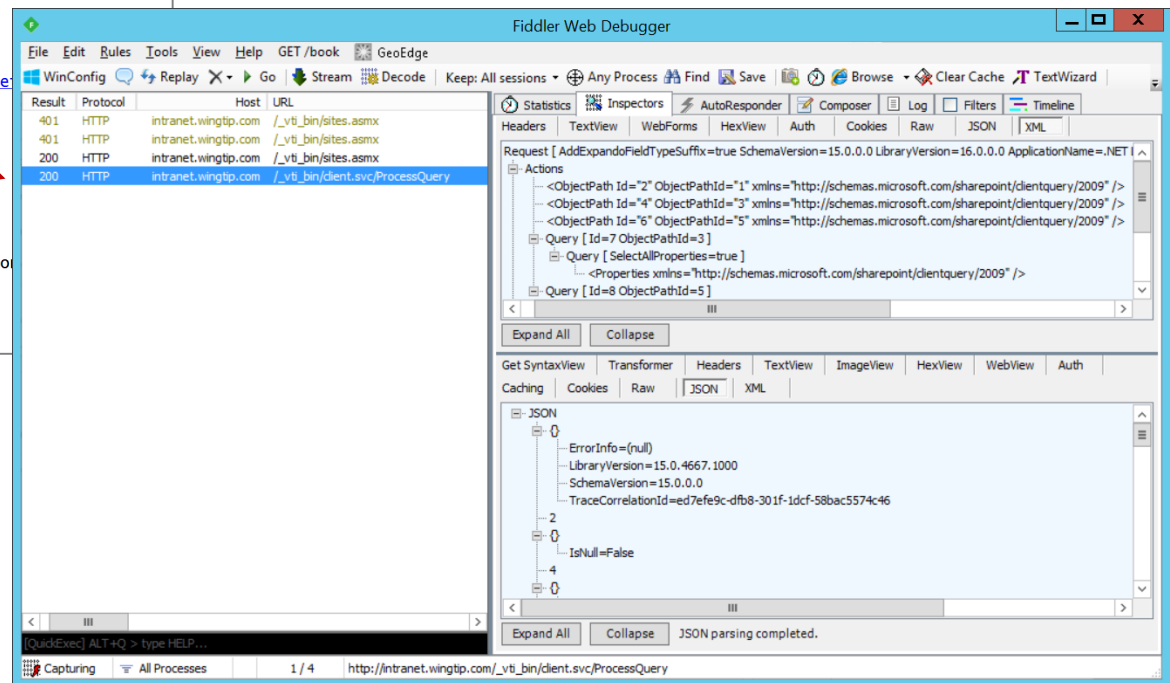
            Site siteCollection = clientContext.Site;
            Web site = clientContext.Web;

            clientContext.Load(siteCollection);
            clientContext.Load(site);

            clientContext.ExecuteQuery();

            Console.WriteLine("The site collection URL is " + siteCollection.Url);
            Console.WriteLine("The site title is " + site.Title);

        }
    }
}
```



User Authentication (On-premises)

```
string siteUrl = "http://intranet.wingtip.com";
ClientContext clientContext = new ClientContext(siteUrl);

// set up authentication credentials
string userName = @"WINGTIP\Administrator";
string userPassword = "Password1";
clientContext.Credentials = new NetworkCredential(userName, userPassword);

// get title of the target site
Web site = clientContext.Web;
clientContext.Load(site);

// call across network
clientContext.ExecuteQuery();

// display title
Console.WriteLine(site.Title);
```



User Authentication (SPO)

```
string siteUrl = "https://SharepointConfessions.sharepoint.com";
ClientContext clientContext = new ClientContext(siteUrl);

string userName = "tedp@sharepointconfessions.onmicrosoft.com";
string userPassword = "PinkieDoo@42";
// convert password to SecureString format
SecureString secureUserPassword = new SecureString();
foreach (char c in userPassword.ToCharArray()) {
    secureUserPassword.AppendChar(c);
}

// create SharePointOnlineCredentials object to authenticate
clientContext.Credentials =
    new SharePointOnlineCredentials(userName, secureUserPassword);

// get title of the target site
Web site = clientContext.Web;
clientContext.Load(site);

// call across network
clientContext.ExecuteQuery();

// display title
Console.WriteLine(site.Title);
```



Coding with Lambda Expressions

- C# supports the use of lambda expressions
 - Syntax Introduced as part of LINQ with .NET 3.5
 - Can (and should) be used with CSOM
- Lambda expression is anonymous function
 - It defines a parameter list and a function body

```
clientContext.Load(site, s => s.Title );
```

Input Parameter(s)

Lambda Operator

Statement Block



Using Lambda Expressions

- Loading an object populates all scalar property values
 - Can result in inefficient use of network bandwidth

```
web site = clientContext.Web;  
clientContext.Load(site);  
clientContext.ExecuteQuery();
```



```
{  
  "_ObjectType": "SP.Web",  
  "AllowRssFeeds": true,  
  "AppInstanceId": "Guid(00000000-0000-0000-0000-000000000000)",  
  "Configuration": 0,  
  "Created": "Date(2013/6/31, 3, 53, 32, 0)",  
  "CustomMasterUrl": "/_catalogs/masterpage/seattle.master",  
  "Description": "",  
  "DocumentLibraryCalloutToOfficeWebAppPreviewersDisabled": false,  
  "EnableMinimalDownload": true,  
  "Id": "Guid(8e70e4a1-7528-4822-ac08-45a443d31bbd)",  
  "Language": 1033,  
  "LastItemModifiedDate": "Date(1379086272000)",  
  "MasterUrl": "/_catalogs/masterpage/seattle.master",  
  "QuickLaunchEnabled": true,  
  "RecycleBinEnabled": true,  
  "ServerRelativeUrl": "",  
  "SyndicationEnabled": true,  
  "Title": "Wingtip Team Site",  
  "TreeViewEnabled": false,  
  "UIVersion": 15,  
  "UIVersionConfigurationEnabled": false,  
  "Url": "http://wingtipsserver",  
  "WebTemplate": "STS"  
}
```

- Lambda expressions can be used to optimize
 - You can indicate which properties you want populated

```
web site = clientContext.Web;  
clientContext.Load(site, s => s.Title);  
clientContext.ExecuteQuery();
```



```
{  
  "_ObjectType": "SP.Web",  
  "Title": "Wingtip Team Site"  
}
```



Using Where() and Include()

- Where lets you pass filter criteria to server

```
// instead of this
clientContext.Load(site.Lists);

// use this instead
clientContext.Load(site.Lists, lists => lists.Where(list => !list.Hidden));
```

- Include lets you pick fields on item in a collection

```
// indicate which list properties you want to populate for each list
clientContext.Load(site.Lists,
    lists => lists.Include(list => list.Title, list => list.DefaultViewUrl));
```

- Syntax is powerful but tricky to read and write

```
ListCollection Lists = clientContext.Web.Lists;
clientContext.Load(Lists, lists => lists.Where(list => !list.Hidden)
    .Include(list => list.Title,
        list => list.DefaultViewUrl));

clientContext.ExecuteQuery();
```



Creating a List

```
Web site = clientContext.Web;
clientContext.Load(site);

// create and initialize ListCreationInformation object
ListCreationInformation listInformation = new ListCreationInformation();
listInformation.Title = "Announcements";
listInformation.Url = "Lists/Announcements";
listInformation.QuickLaunchOption = QuickLaunchOptions.On;
listInformation.TemplateType = (int)ListTemplateType.Announcements;

// Add ListCreationInformation to lists collection and return list object
List list = site.Lists.Add(listInformation);

// modify additional list properties and update
list.OnQuickLaunch = true;
list.EnableAttachments = false;
list.Update();

// send command to server to create list
clientContext.ExecuteQuery();
```



Creating List Items

```
ListItemCreationInformation lici = new ListItemCreationInformation();

var item1 = list.AddItem(lici);
item1["Title"] = "SharePoint introduces new app model";
item1["Body"] = "<div>Developers wonder what happened to solutions.</div>";
item1["Expires"] = DateTime.Today.AddYears(10);
item1.Update();

var item2 = list.AddItem(lici);
item2["Title"] = "All SharePoint developers must now learn JavaScript";
item2["Body"] = "<div>Some developers are more excited then others.</div>";
item2["Expires"] = DateTime.Today.AddYears(1);
item2.Update();

var item3 = list.AddItem(lici);
item3["Title"] = "CSOM programming is super fun";
item3["Body"] = "<div>Just ask my mom.</div>";
item3["Expires"] = DateTime.Today.AddDays(7);
item3.Update();

clientContext.ExecuteQuery();
```



Creating Site Columns - Part 1

```
static Field CreateSiteColumn(string fieldName, string fieldDisplayName, string fieldType) {  
    Console.WriteLine("Creating " + fieldName + " site column...");  
  
    // delete existing field if it exists  
    try {  
        Field fld = site.Fields.GetByInternalNameOrTitle(fieldName);  
        fld.DeleteObject();  
        clientContext.ExecuteQuery();  
    }  
    catch { }  
  
    string fieldXML = @"<Field Name='" + fieldName + "' " +  
        "DisplayName='" + fieldDisplayName + "' " +  
        "Type='" + fieldType + "' " +  
        "Group='wingtip' > " +  
        "</Field>";  
  
    Field field = site.Fields.AddFieldAsXml(fieldXML, true, AddFieldOptions.DefaultValue);  
    clientContext.Load(field);  
    clientContext.ExecuteQuery();  
    return field;  
}
```



Creating Site Columns - Part 2

```
fieldProductCode = CreateSiteColumn("ProductCode", "Product Code", "Text");
fieldProductCode.EnforceUniqueValues = true;
fieldProductCode.Indexed = true;
fieldProductCode.Required = true;
fieldProductCode.Update();
clientContext.ExecuteQuery();
clientContext.Load(fieldProductCode);
clientContext.ExecuteQuery();

fieldProductDescription =
    clientContext.CastTo<FieldMultiLineText>(CreateSiteColumn("ProductDescription", "Product Description", "Note"));
fieldProductDescription.NumberOfLines = 4;
fieldProductDescription.RichText = false;
fieldProductDescription.Update();
clientContext.ExecuteQuery();

fieldProductListPrice =
    clientContext.CastTo<FieldCurrency>(CreateSiteColumn("ProductListPrice", "List Price", "Currency"));
fieldProductListPrice.MinimumValue = 0;
fieldProductListPrice.Update();
clientContext.ExecuteQuery();

fieldProductCategory =
    clientContext.CastTo<TaxonomyField>(CreateSiteColumn("ProductCategory", "Product Category", "TaxonomyFieldType"));
fieldProductCategory.SspId = localTermStoreID;
fieldProductCategory.TermSetId = termSetId;
fieldProductCategory.AllowMultipleValues = false;
fieldProductCategory.Update();
clientContext.ExecuteQuery();

fieldProductColor =
    clientContext.CastTo<FieldMultiChoice>(CreateSiteColumn("ProductColor", "Product Color", "MultiChoice"));
string[] choicesProductColor = { "White", "Black", "Grey", "Blue", "Red", "Green", "Yellow" };
fieldProductColor.Choices = choicesProductColor;
fieldProductColor.Update();
clientContext.ExecuteQuery();
```



Creating Content Types - Part 1

```
static ContentType CreateContentType(string contentTypeName, string baseContentType) {
    DeleteContentType(contentTypeName);

    ContentTypeCreationInformation contentTypeCreateInfo = new ContentTypeCreationInformation();
    contentTypeCreateInfo.Name = contentTypeName;
    contentTypeCreateInfo.ParentContentType = site.ContentTypes.GetById(baseContentType); ;
    contentTypeCreateInfo.Group = "wingtip";
    ContentType ctype = site.ContentTypes.Add(contentTypeCreateInfo);
    clientContext.ExecuteQuery();
    return ctype;
}

static void DeleteContentType(string contentTypeName) {
    try {
        foreach (var ct in site.ContentTypes) {
            if (ct.Name.Equals(contentTypeName)) {
                ct.DeleteObject();
                Console.WriteLine("Deleting existing " + ct.Name + " content type...");
                clientContext.ExecuteQuery();
                break;
            }
        }
    } catch { }
}
```



Creating Content Types - Part 2

```
ctypeProduct = CreateContentType("Product", "0x01");

// add site columns
FieldLinkCreationInformation fieldLinkProductCode = new FieldLinkCreationInformation();
fieldLinkProductCode.Field = fieldProductCode;
ctypeProduct.FieldLinks.Add(fieldLinkProductCode);
ctypeProduct.Update(true);

FieldLinkCreationInformation fieldLinkProductDescription = new FieldLinkCreationInformation();
fieldLinkProductDescription.Field = fieldProductDescription;
ctypeProduct.FieldLinks.Add(fieldLinkProductDescription);
ctypeProduct.Update(true);

FieldLinkCreationInformation fieldLinkProductListPrice = new FieldLinkCreationInformation();
fieldLinkProductListPrice.Field = fieldProductListPrice;
ctypeProduct.FieldLinks.Add(fieldLinkProductListPrice);
ctypeProduct.Update(true);

FieldLinkCreationInformation fieldLinkProductCategory = new FieldLinkCreationInformation();
fieldLinkProductCategory.Field = fieldProductCategory;
ctypeProduct.FieldLinks.Add(fieldLinkProductCategory);
ctypeProduct.Update(true);

FieldLinkCreationInformation fieldLinkProductColor = new FieldLinkCreationInformation();
fieldLinkProductColor.Field = fieldProductColor;
ctypeProduct.FieldLinks.Add(fieldLinkProductColor);
ctypeProduct.Update(true);

clientContext.ExecuteQuery();
```



Creating List with Content Type

```
ListCreationInformation listInformationProducts = new ListCreationInformation();
listInformationProducts.Title = "Products";
listInformationProducts.Url = "Lists/Products";
listInformationProducts.QuickLaunchOption = QuickLaunchOptions.On;
listInformationProducts.TemplateType = (int)ListTemplateType.GenericList;
listProducts = site.Lists.Add(listInformationProducts);
listProducts.OnQuickLaunch = true;
listProducts.Update();

clientContext.Load(listProducts);
clientContext.Load(listProducts.ContentTypes);
clientContext.ExecuteQuery();

// configure list to use custom content type
listProducts.ContentTypesEnabled = true;
listProducts.ContentTypes.AddExistingContentType(ctypeProduct);
ContentType existing = listProducts.ContentTypes[0]; ;
existing.DeleteObject();
listProducts.Update();
clientContext.ExecuteQuery();

// add custom site columns to default veiw of list
View viewProducts = listProducts.DefaultView;
viewProducts.ViewFields.Add("ProductCode");
viewProducts.ViewFields.Add("ProductListPrice");
viewProducts.ViewFields.Add("ProductCategory");
viewProducts.ViewFields.Add("ProductColor");
viewProducts.Update();

clientContext.ExecuteQuery();
```



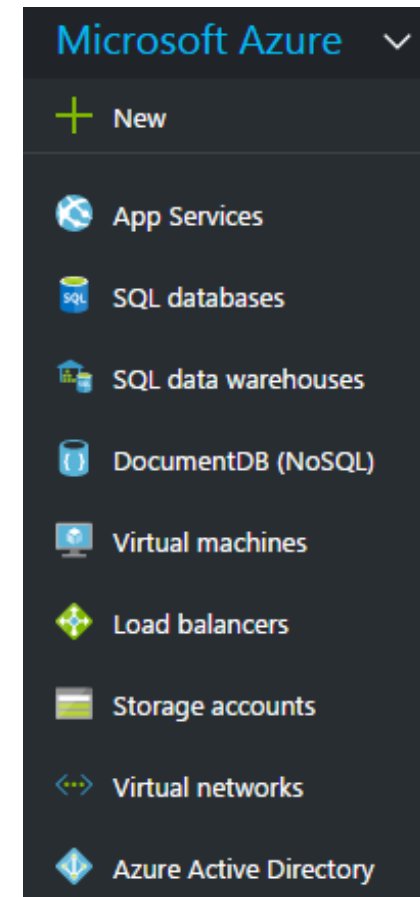
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Azure Services Overview

- Azure provides PaaS, DaaS and IaaS Services
 - App Service Plans and Web Apps
 - SQL databases
 - Virtual machines
 - Storage accounts
 - Virtual networks
 - Load balancers
 - Cloud Services
 - Azure Active Directory
 - Azure Functions



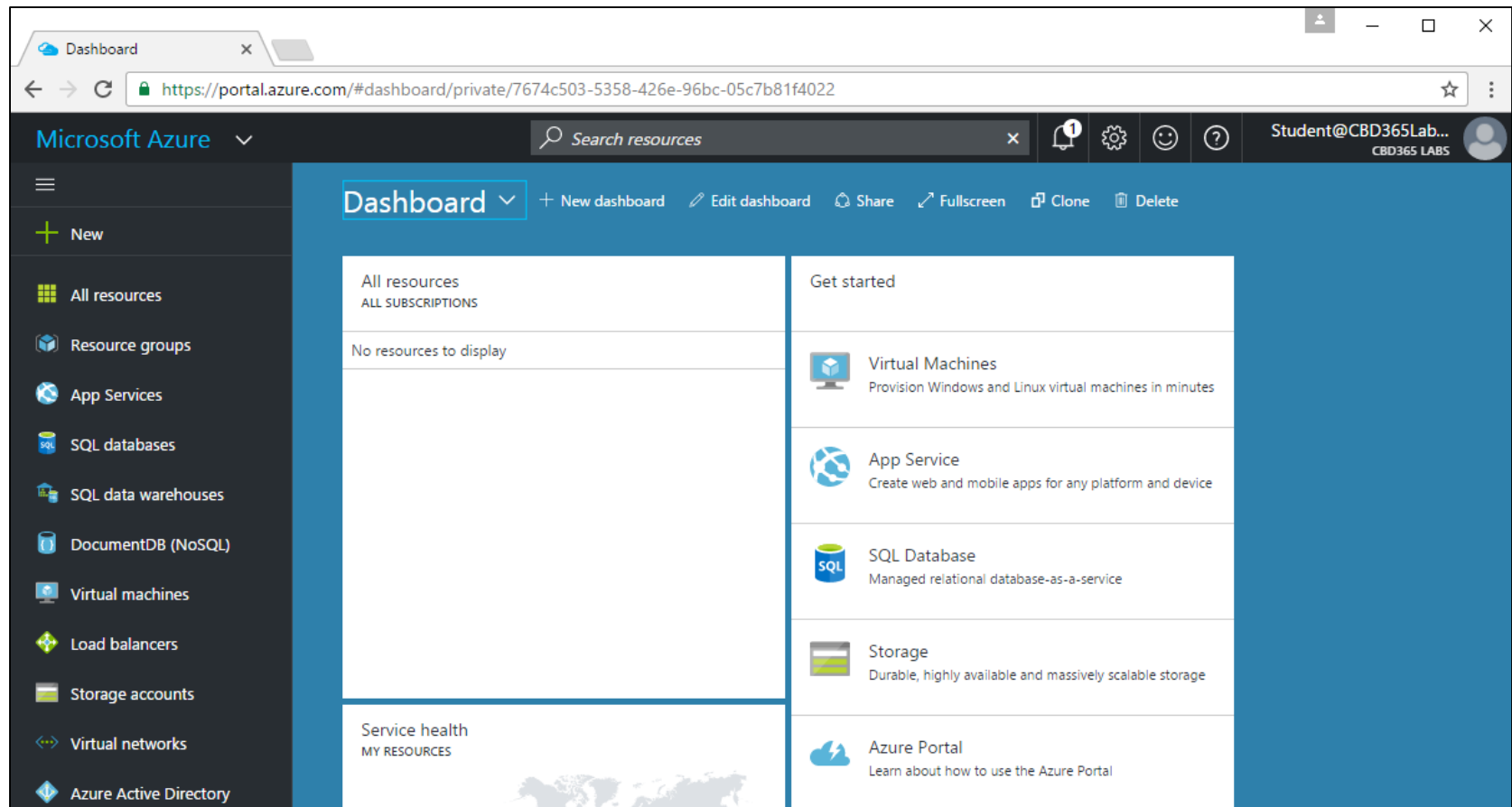
Obtaining an Azure Subscription

- Getting an Azure Subscription
 - Sign up with paid-for account
 - Get free Azure subscription with a MSDN Subscription
 - Sign up for free 30-day trial account
- Signing up for free trial account
 - Navigate to Azure Portal using Office 365 credentials
 - When prompted, sign up for a trial



Azure Portal

- You can work with Azure using the new portal
 - Uses newer Resource Manager infrastructure
 - Located at <https://portal.azure.com>



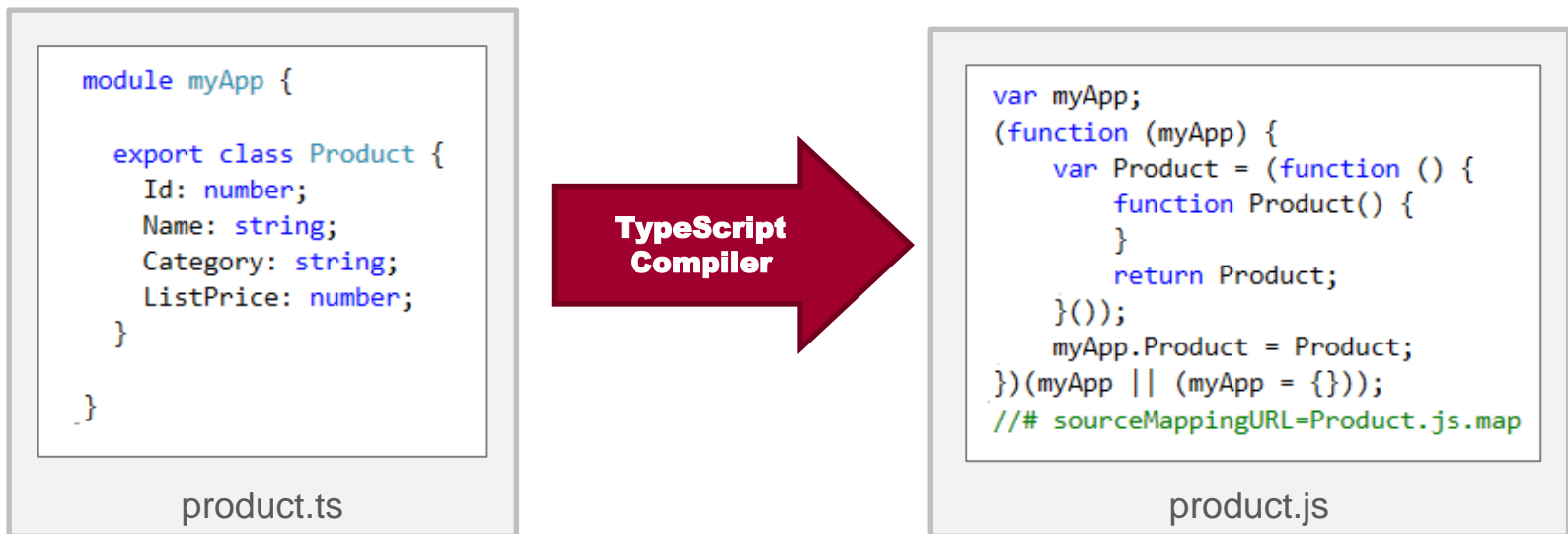
Agenda

- ✓ Understanding SharePoint Development Strategies
- ✓ Creating a SharePoint Development Environment
- ✓ Programming the Client-side Object Model (CSOM)
- ✓ Understanding Azure as a Development Platform
- Developing with TypeScript and Interfaces



What is TypeScript?

- A programming language which compiles into plain JavaScript
- A superset of JavaScript that adds a strongly-typed dimension
- It can be compiled into ECMAScript3, ECMAScript3 or ECMAScript 6
- It runs in any browser, in any host and on any OS



Type Annotation

- TypeScript allows you to annotate types
 - Provides basis for strongly-typed programming
 - Type annotations used by compiler for type checking
 - Type annotations are erased at the end of compile time

```
// define strongly-typed function
var myFunction = function (param1: number): string {
  | return "You passed " + param1;
};

// define strongly-typed variables
var myNumber: number = 2017;
var myMessage: string = myFunction(myNumber);
var myContent: JQuery = $("<p>").text(myMessage);
var contentBox: JQuery = $("#content-box");

contentBox.empty().append(myContent);
```



Assignment with let versus var

- var does not recognize nor honor scope
- let will recognize and honor scope

```
var x:number = 2016;  
let y: number = 2016;  
  
{  
  var x:number = 2017;  
  let y:number = 2017;  
}  
  
let message = "x=" + x + " and " + "y=" + y;
```



x=2017 and y=2016



Arrow Function Syntax

- TypeScript supports arrow function syntax
 - Concise syntax to define anonymous functions
 - Can be used to retain this pointer in classes

```
// create anonymous function using function arrow syntax
let myFunction = () => {
  console.log("Hello world");
};

// use function arrow syntax with typed parameters
let myOtherFunction = (param1: number, param2: string) : string => {
  return param1 + " - " + param2;
};

// create function to assign to DOM event
window.onresize = (event: Event) => {
  let window: Window = event.target as Window;
  console.log("Window width: " + window.outerWidth);
  console.log("Window height: " + window.outerHeight);
};
```



Classes

- TypeScript supports defining classes
 - Class defines type for object
 - Export keyword makes class created across files
 - Class can be passed as factory function
 - Default accessibility is public

```
export class Product {  
  Id: number;  
  Name: string;  
  Category: string;  
  ListPrice: number;  
}
```

```
// create new Product instance  
let product1: Product = new Product();  
product1.Id = 1;  
product1.Name = "Batman Action Figure";  
product1.Category = "Action Figure";  
product1.ListPrice = 14.95;
```



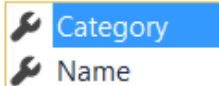
Class Constructors

- Constructor parameters become fields in class

```
export class Product {  
  
  constructor(private Id: number, public Name: string, public Category: string, private ListPrice: number) {  
    // no need to do anything here  
  }  
  
  MyPublicMethod() {  
    // access to private fields  
    let id: number = this.Id  
    let price: number = this.ListPrice  
  }  
  
}
```

- Client-side code calls constructor using new operator

```
// create new Product instance  
let product1: Product = new Product(1, "Batman Action Figure", "Action Figure", 14.95);  
  
// access public properties  
let product1Name: string = product1.Name;  
let product1Category: string = product1.
```



Interfaces

- Interface defines a programming contract
 - Classes can implement interfaces

```
export interface IProductDataService {  
  GetAllProducts(): Product[];  
  GetProduct(id: number): Product;  
  AddProduct(product: Product): void;  
  DeleteProduct(id: number): void;  
  UpdateProduct(product: Product): void;  
}
```

```
export class MyProductDataService implements IProductDataService {  
  
  private products: Product[] = [];  
  
  GetAllProducts(): Product[] {  
    return this.products;  
  }  
  
  GetProduct(id: number): Product {  
    return this.products.find(p => p.id === id);  
  }  
  
  AddProduct(product: Product): void {  
    this.products.push(product);  
  }  
  
  DeleteProduct(id: number): void {  
    this.products = this.products.filter(p => p.id !== id);  
  }  
  
  UpdateProduct(product: Product): void {  
    const index = this.products.findIndex(p => p.id === product.id);  
    this.products[index] = product;  
  }  
}
```

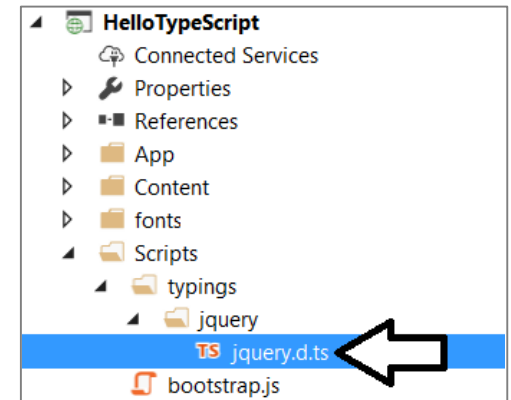
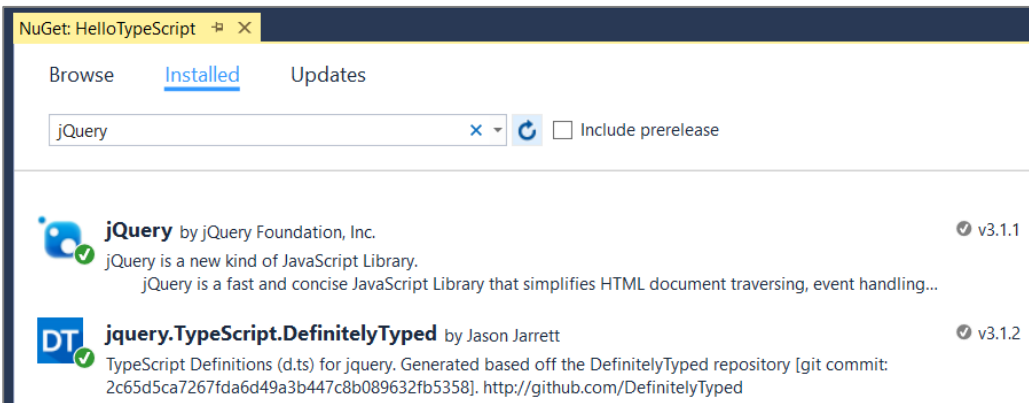
- Client code can be decoupled from concrete classes

```
// program against variables based on interface type  
let productService: IProductDataService = new MyProductDataService();  
  
// client code is decoupled from underlying data access class implementations  
let products: Product[] = productService.GetAllProducts();  
let product1: Product = productService.GetProduct(1);
```



TypeScript Definition Files (d.ts)

- What are TypeScript definition files
 - Typed definitions for 3rd party JavaScript libraries
 - DefinitelyTyped provides great community resource
 - Typed definition files have a **d.ts** extension



```
// define strongly-typed variables
var myNumber: number = 2017;
var myMessage: string = myFunction(myNumber);
var myContent: JQuery = $("<p>").text(myMessage);
var contentBox: JQuery = $("#content-box");
```



Interface-based Design

- Interfaces define programming contracts

```
export interface IViewPort {  
  width: number;  
  height: number;  
}
```

```
export interface ICustomVisual {  
  name: string;  
  load(container: HTMLElement): void;  
  update(viewport: IViewPort): void;  
}
```

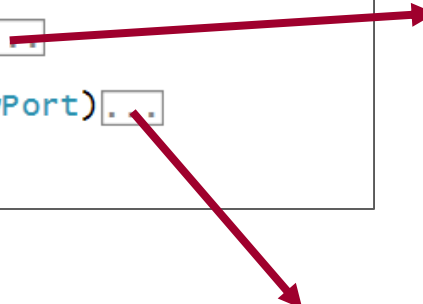
- Application design can use interfaces instead of concrete classes

```
module myApp {  
  
  var leftNavCollapsed: boolean = true;  
  var loadedVisual: ICustomVisual;  
  
  var visuals: ICustomVisual[] = [  
    new Viz01(), new Viz02(), new Viz03(), new Viz04()  
  ];  
  
  function LoadVisual(visual: ICustomVisual) ...  
  
  $(( ) => ...);  
}
```



Sample Custom Visual using jQuery

```
export class Viz01 implements ICustomVisual {  
    public name: string = "Visual 1: Hello jQuery";  
    private container: JQuery;  
    private message: JQuery;  
  
    load(container: HTMLElement) {  
        ...  
    }  
  
    public update(viewport: IViewport) {  
        ...  
    }  
}
```



```
load(container: HTMLElement) {  
    this.container = $(container);  
    this.message = $("

")  
        .text("Hello jQuery")  
        .css({  
            "display": "table-cell",  
            "text-align": "center",  
            "vertical-align": "middle",  
            "text-wrap": "none",  
            "background-color": "yellow"  
        });  
    this.container.append(this.message);  
}


```

```
public update(viewport: IViewport) {  
    let paddingX: number = 2;  
    let paddingY: number = 2;  
    let fontSizeMultiplierX: number = viewport.width * 0.15;  
    let fontSizeMultiplierY: number = viewport.height * 0.4;  
    let fontSizeMultiplier: number = Math.min(...[fontSizeMultiplierX,  
                                                    fontSizeMultiplierY]);  
  
    this.message.css({  
        "width": viewport.width - paddingX,  
        "height": viewport.height - paddingY,  
        "font-size": fontSizeMultiplier  
    });  
}
```

Summary

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