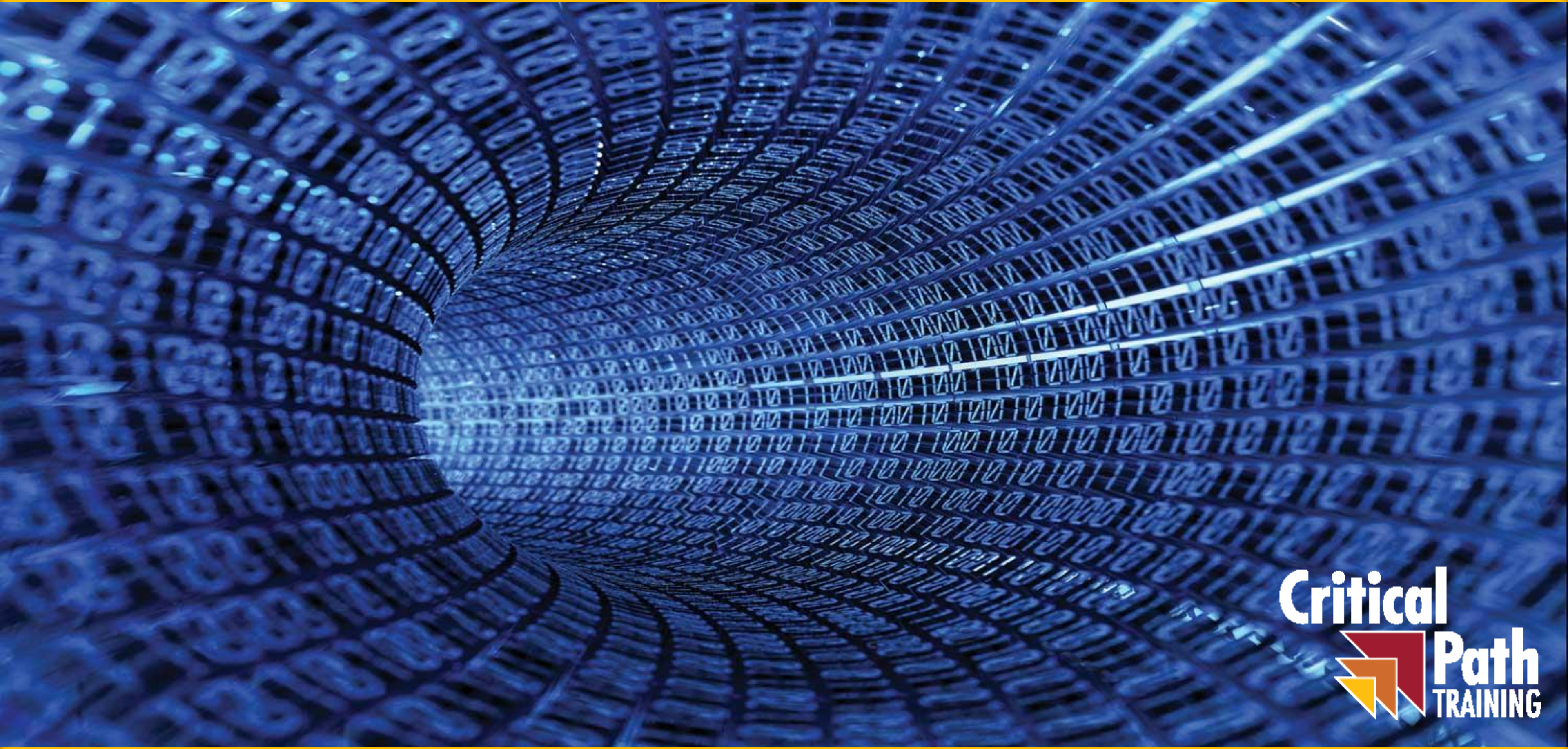
Developing Custom Solutions for SharePoint Online



Agenda

- ➢ SharePoint Online Development Strategies
- Understanding Modern Team Site and Modern Pages
- Programming the Client-side Object Model (CSOM)
- Creating Site Columns, Content Types and Lists
- JavaScript Injection and the SharePoint REST API

Evolution of the SharePoint Platform

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

APIs used by SharePoint Add-ins

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

Agenda

- ✓ SharePoint Online Development Strategies
- ➢ Understanding Modern Team Site and Modern Pages
- Programming the Client-side Object Model (CSOM)
- Creating Site Columns, Content Types and Lists
- JavaScript Injection and the SharePoint REST API

DEMO

Looking at Modern Pages

Agenda

- ✓ SharePoint Online Development Strategies
- ✓ Understanding Modern Team Site and Modern Pages
- ➢ Programming the Client-side Object Model (CSOM)
- Creating Site Columns, Content Types and Lists
- JavaScript Injection and the SharePoint REST API

Why Client Object Model (CSOM)?

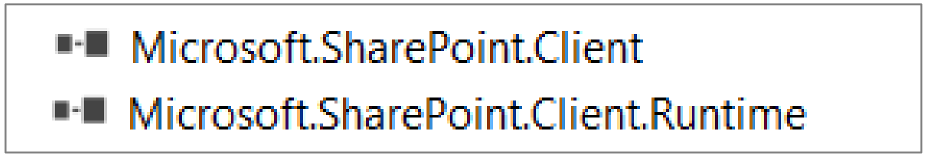
- Advantages of CSOM over the REST API
  - Strongly-typed programming
  - Format Digest managed automatically
  - Higher productivity when writing C# or VB
  - Provides ability to batch requests to web server
  - CSOM provides functionality beyond REST APIs
- CSOM more preferable on server-side C#
  - 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

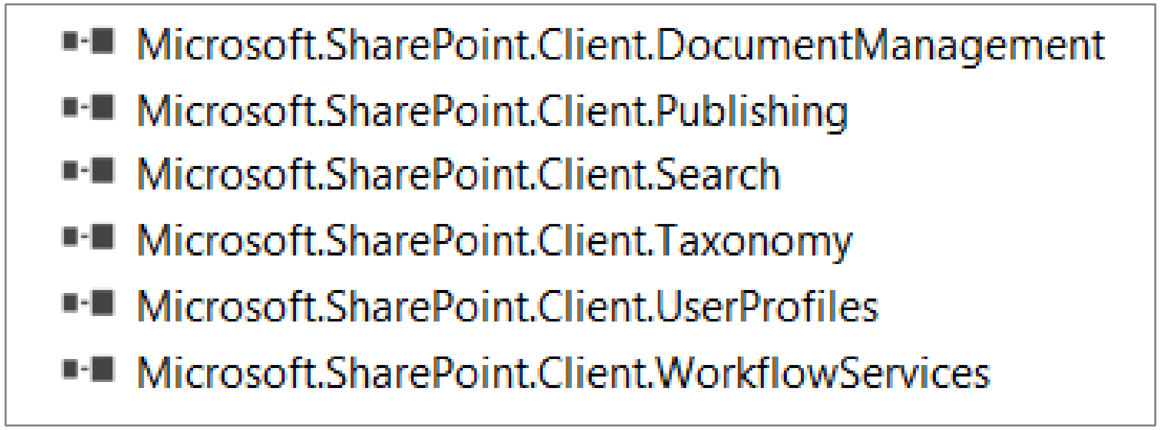
CSOM in SharePoint Online

- 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



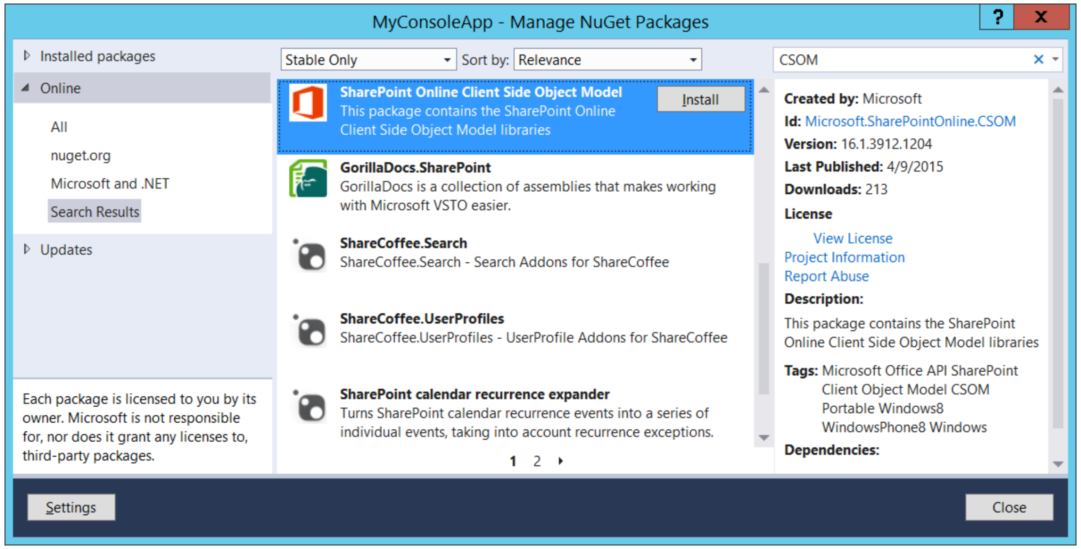
Microsoft.SharePoint.Client
Microsoft.SharePoint.Client.Runtime

- 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



MyConsoleApp - Manage NuGet Packages

- Installed packages
- Online
  - All
  - nuget.org
  - Microsoft and .NET
  - Search Results
- Updates

Stable Only | Sort by: Relevance | CSOM

SharePoint Online Client Side Object Model — Install
This package contains the SharePoint Online Client Side Object Model libraries

GorillaDocs.SharePoint
GorillaDocs is a collection of assemblies that makes working with Microsoft VSTO easier.

ShareCoffee.Search
ShareCoffee.Search - Search Addons for ShareCoffee

ShareCoffee.UserProfiles
ShareCoffee.UserProfiles - UserProfile Addons for ShareCoffee

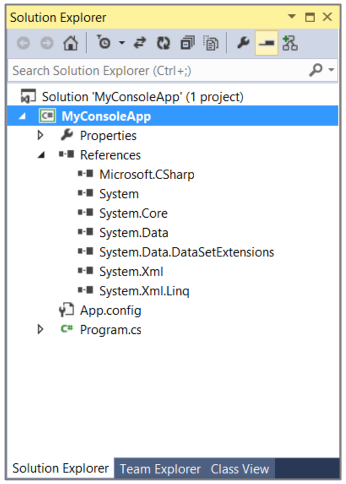
SharePoint calendar recurrence expander
Turns SharePoint calendar recurrence events into a series of individual events, taking into account recurrence exceptions.

1 2

Created by: Microsoft
Id: Microsoft.SharePointOnline.CSOM
Version: 16.1.3912.1204
Last Published: 4/9/2015
Downloads: 213
License
View License
Project Information
Report Abuse
Description:
This package contains the SharePoint Online Client Side Object Model libraries
Tags: Microsoft Office API SharePoint Client Object Model CSOM Portable Windows8 WindowsPhone8 Windows
Dependencies:

Each package is licensed to you by its owner. Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.

Settings | Close

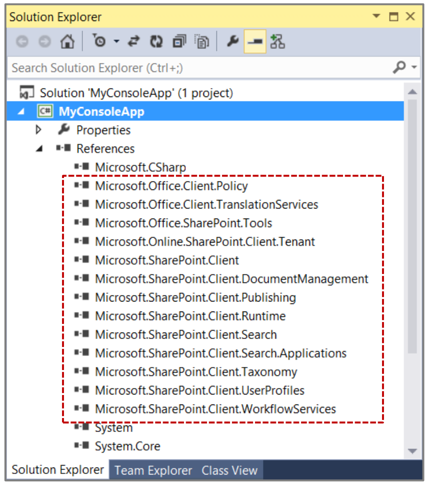


Solution Explorer

Search Solution Explorer (Ctrl+;)

```
Solution 'MyConsoleApp' (1 project)
  MyConsoleApp
    Properties
    References
      Microsoft.CSharp
      System
      System.Core
      System.Data
      System.Data.DataSetExtensions
      System.Xml
      System.Xml.Linq
    App.config
    Program.cs
```

Solution Explorer | Team Explorer | Class View



Solution Explorer

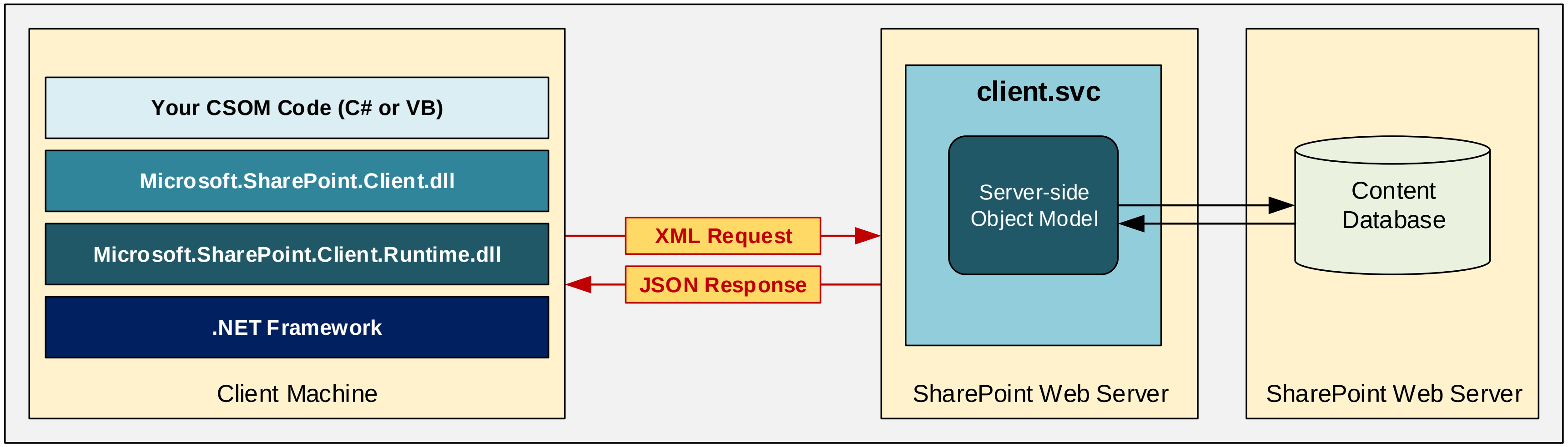
Search Solution Explorer (Ctrl+;)

```
Solution 'MyConsoleApp' (1 project)
  MyConsoleApp
    Properties
    References
      Microsoft.CSharp
      Microsoft.Office.Client.Policy
      Microsoft.Office.Client.TranslationServices
      Microsoft.Office.SharePoint.Tools
      Microsoft.Online.SharePoint.Client.Tenant
      Microsoft.SharePoint.Client
      Microsoft.SharePoint.Client.DocumentManagement
      Microsoft.SharePoint.Client.Publishing
      Microsoft.SharePoint.Client.Runtime
      Microsoft.SharePoint.Client.Search
      Microsoft.SharePoint.Client.Search.Applications
      Microsoft.SharePoint.Client.Taxonomy
      Microsoft.SharePoint.Client.UserProfiles
      Microsoft.SharePoint.Client.WorkflowServices
      System
      System.Core
```

Solution Explorer | Team Explorer | Class View

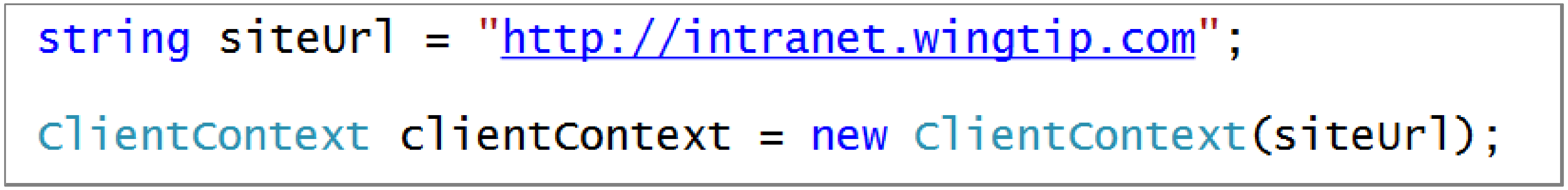
CSOM Architecture

- 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 Nation (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



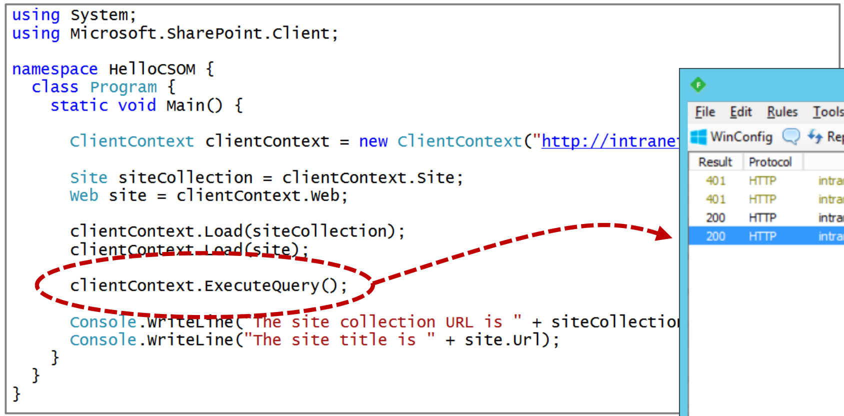
```
string siteUrl = "http://intranet.wingtip.com";

ClientContext clientContext = new ClientContext(siteUrl);
```

Hello CSOM

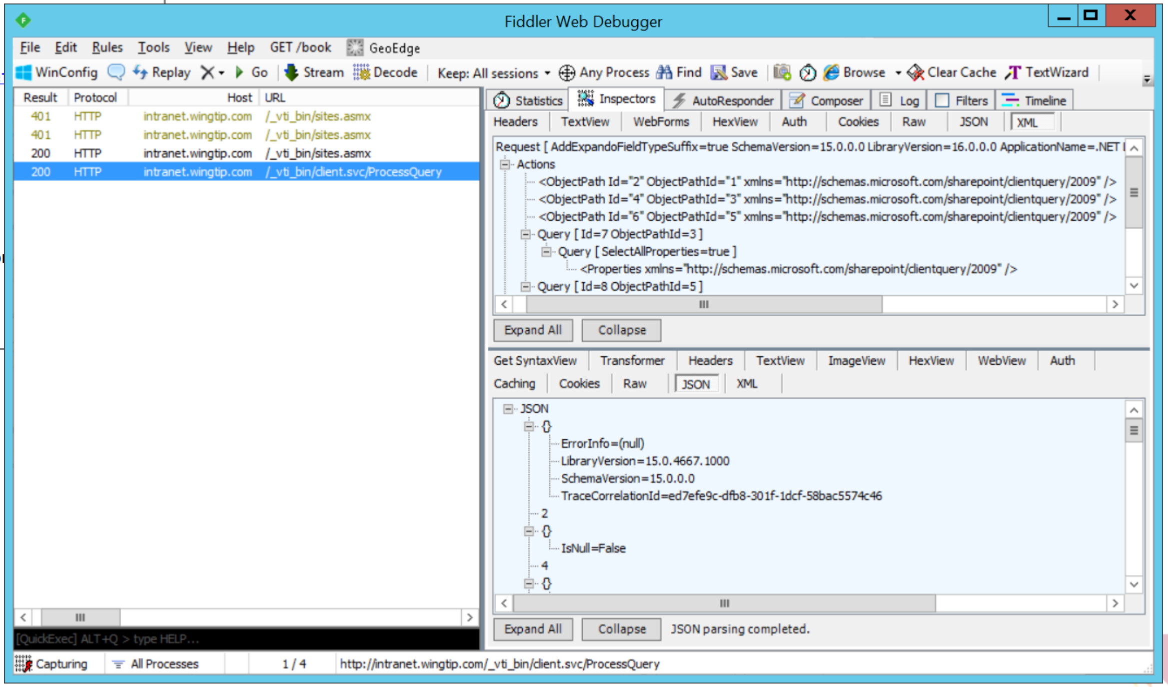
```
using System;
using Microsoft.SharePoint.Client;

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://intrane

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

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

      clientContext.ExecuteQuery();

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



Fiddler Web Debugger
File Edit Rules Tools View Help GET /book GeoEdge
WinConfig Replay Go Stream Decode Keep: All sessions Any Process Find Save Browse Clear Cache TextWizard
Statistics Inspectors AutoResponder Composer Log Filters Timeline
Headers TextView WebForms HexView Auth Cookies Raw JSON XML
Get SyntaxView Transformer Headers TextView ImageView HexView WebView Auth
Caching Cookies Raw JSON XML
Expand All Collapse

Result	Protocol	Host	URL
401	HTTP	intranet.wingtip.com	/_vti_bin/sites.asmx
401	HTTP	intranet.wingtip.com	/_vti_bin/sites.asmx
200	HTTP	intranet.wingtip.com	/_vti_bin/sites.asmx
200	HTTP	intranet.wingtip.com	/_vti_bin/client.svc/ProcessQuery

```
Request [ AddExpandoFieldTypeSuffix=true SchemaVersion=15.0.0.0 LibraryVersion=16.0.0.0 ApplicationName=.NET l
  Actions
    <ObjectPath Id="2" ObjectPathId="1" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
    <ObjectPath Id="4" ObjectPathId="3" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
    <ObjectPath Id="6" ObjectPathId="5" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
    Query [ Id=7 ObjectPathId=3 ]
      Query [ SelectAllProperties=true ]
        <Properties xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
    Query [ Id=8 ObjectPathId=5 ]
```

```
JSON
  {}
    ErrorInfo=(null)
    LibraryVersion=15.0.4667.1000
    SchemaVersion=15.0.0.0
    TraceCorrelationId=ed7efe9c-dfb8-301f-1dcf-58bac5574c46
  2
  {}
    IsNull=False
  4
  {}
```

JSON parsing completed.

[QuickExec] ALT+Q > type HELP...

Capturing   All Processes   1 / 4   http://intranet.wingtip.com/_vti_bin/client.svc/ProcessQuery

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);
```

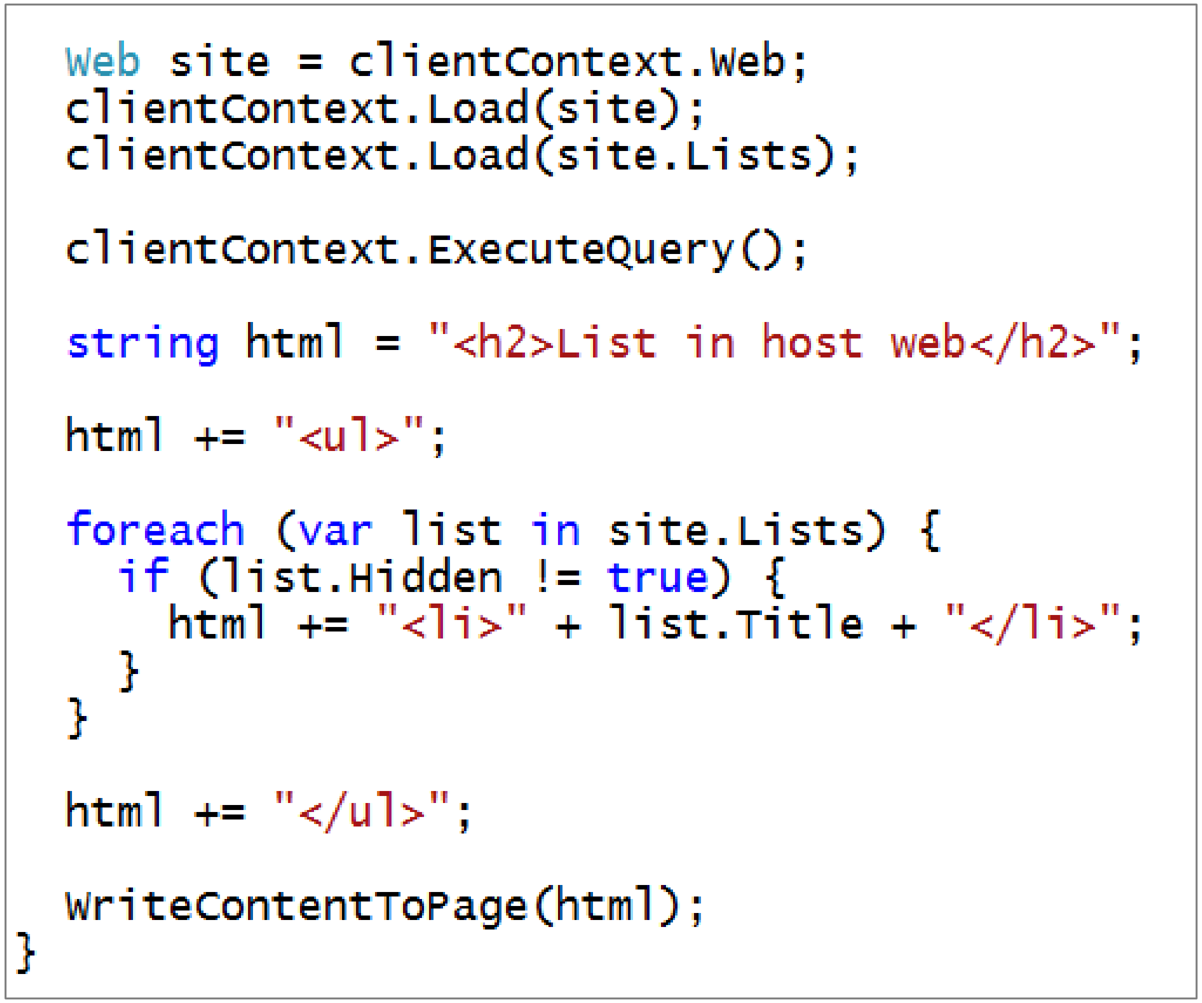
User Authentication (SPO)

```
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);
```

Agenda

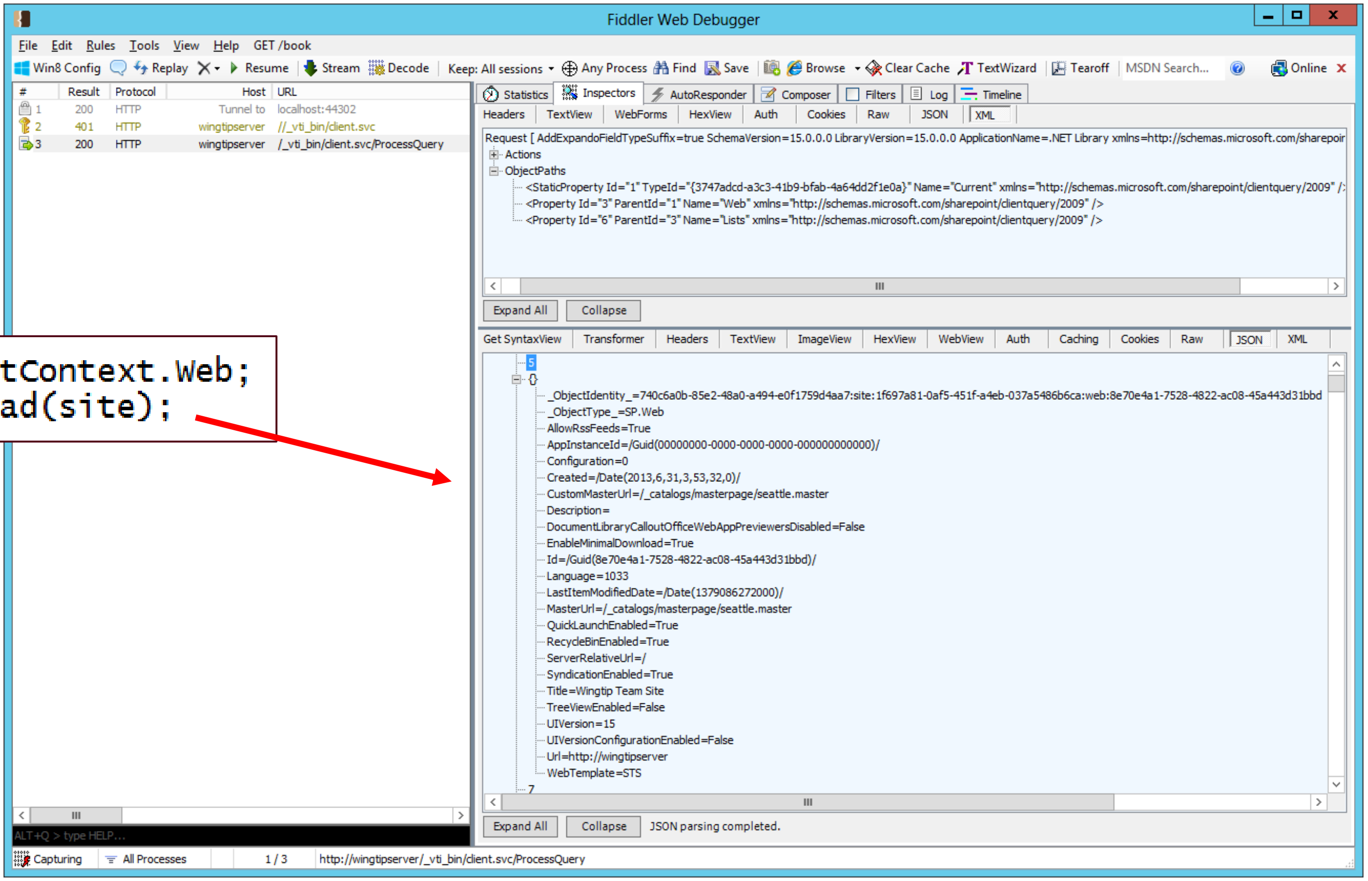
- ✓ CSOM Fundamentals
- ✓ User and App Authentication
- ➢ CSOM Code Optimization
- Remote Exception Handling
- Creating Content Types and Lists
- Managed Metadata and Publishing

What’s Wrong with This Code?



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

    clientContext.ExecuteQuery();

    string html = "<h2>List in host web</h2>";

    html += "<ul>";

    foreach (var list in site.Lists) {
      if (list.Hidden != true) {
        html += "<li>" + list.Title + "</li>";
      }
    }

    html += "</ul>";

    WriteContentToPage(html);
}
```

Inspecting CSOM Calls using Fiddler



Fiddler Web Debugger
File Edit Rules Tools View Help GET /book
Win8 Config Replay Resume Stream Decode Keep: All sessions Any Process Find Save Browse Clear Cache TextWizard Tearoff MSDN Search... Online
Statistics Inspectors AutoResponder Composer Filters Log Timeline
Headers TextView WebForms HexView Auth Cookies Raw JSON XML
Expand All Collapse
Get SyntaxView Transformer Headers TextView ImageView HexView WebView Auth Caching Cookies Raw JSON XML
Expand All Collapse

#	Result	Protocol	Host	URL
1	200	HTTP	Tunnel to	localhost:44302
2	401	HTTP	wingtipserver	//_vti_bin/client.svc
3	200	HTTP	wingtipserver	/_vti_bin/client.svc/ProcessQuery

```
Request [ AddExpandoFieldTypeSuffix=true SchemaVersion=15.0.0.0 LibraryVersion=15.0.0.0 ApplicationName=.NET Library xmlns=http://schemas.microsoft.com/sharepoir
  Actions
  ObjectPaths
    <StaticProperty Id="1" TypeId="{3747adcd-a3c3-41b9-bfab-4a64dd2f1e0a}" Name="Current" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" /:
    <Property Id="3" ParentId="1" Name="Web" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
    <Property Id="6" ParentId="3" Name="Lists" xmlns="http://schemas.microsoft.com/sharepoint/clientquery/2009" />
```

```
  5
  {}
    _ObjectIdentity_=740c6a0b-85e2-48a0-a494-e0f1759d4aa7:site:1f697a81-0af5-451f-a4eb-037a5486b6ca:web:8e70e4a1-7528-4822-ac08-45a443d31bbd
    _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=
    DocumentLibraryCalloutOfficeWebAppPreviewersDisabled=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://wingtipserver
    WebTemplate=STS
  7
```

JSON parsing completed.

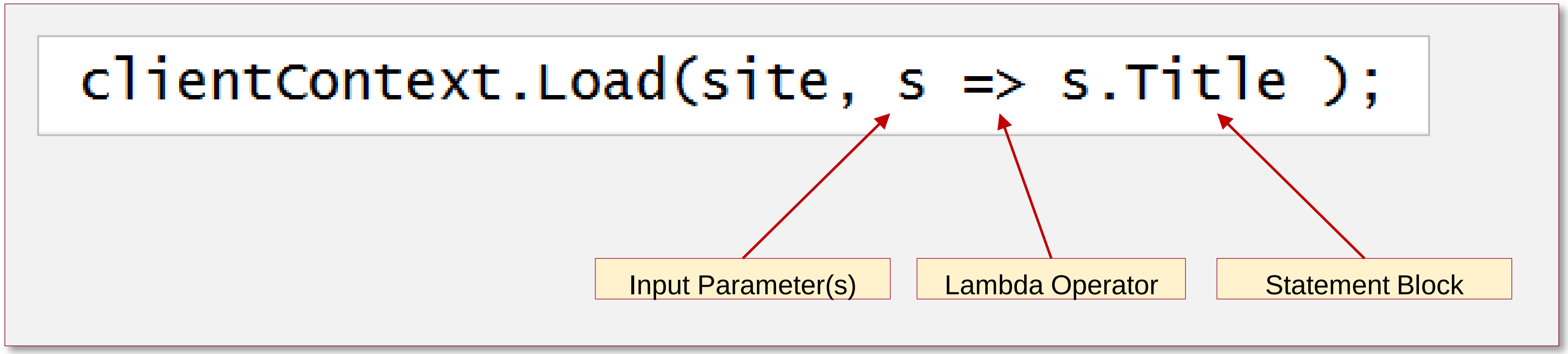
ALT+Q > type HELP...

Capturing | All Processes | 1 / 3 | http://wingtipserver/_vti_bin/client.svc/ProcessQuery

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

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

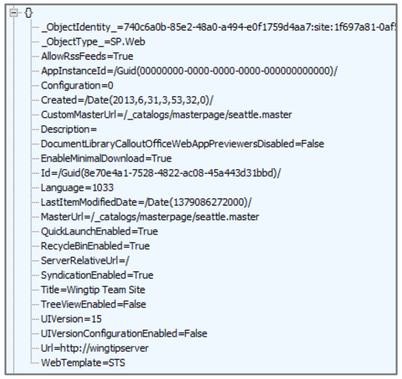


```
clientContext.Load(site, s => s.Title );
```

Using Lambda Expressions

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

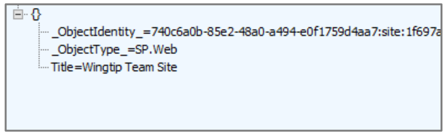
```
Web site = clientContext.Web;
clientContext.Load(site);
clientContext.ExecuteQuery();
```



```
{}
  _ObjectIdentity_=740c6a0b-85e2-48a0-a494-e0f1759d4aa7:site:1f697a81-0af
  _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=
  DocumentLibraryCalloutOfficeWebAppPreviewersDisabled=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://wingtipserver
  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();
```



```
{}
  _ObjectIdentity_=740c6a0b-85e2-48a0-a494-e0f1759d4aa7:site:1f697a
  _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();
```

Check Whether List Exists

- How do you determine if a list already exists
  - CSOM doesn't provide simple approach
  - Query for the list by it's title or URL
  - Check to see if match list exists

```
Web site = clientContext.Web;
ListCollection listCollection = clientContext.Web.Lists;
clientContext.Load(listCollection,
                   lists => lists.Include(list => list.Title)
                                 .Where(list => list.Title == "Customers"));

clientContext.ExecuteQuery();

bool listDoesNotExist = (listCollection.Count == 0);

if (listDoesNotExist) {
  // create customers list if it does not exist
}
```

Retrieving Data using LoadQuery

- LoadQuery can be used instead of Load
  - Allows you to write LINQ query expressions

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

ListCollection Lists = clientContext.Web.Lists;

// retrieve standard lists that are not hidden
IQueryable<List> query = from list in Lists
                         where (list.Hidden == false) && (list.BaseType == 0)
                         select list;

var queryResults = clientContext.LoadQuery(query);
clientContext.ExecuteQuery();

foreach (List list in queryResults) {
  Console.WriteLine(list.Title);
}
```

Retrieving with a CamlQuery

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

List list = clientContext.Web.Lists.GetByTitle("Customers");
CamlQuery query = new CamlQuery();
query.ViewXml =
  @"<View>
      <Query>
        <Where>
          <BeginsWith>
            <FieldRef Name='FirstName' />
            <Value Type='Text'>B</Value>
          </BeginsWith>
        </Where>
        <OrderBy>
          <FieldRef Name='Title' />
        </OrderBy>
      </Query>
      <ViewFields>
        <FieldRef Name='FirstName'/>
        <FieldRef Name='Title' />
        <FieldRef Name='WorkPhone' />
      </ViewFields>
    </View>";

ListItemCollection queryResults = list.GetItems(query);
clientContext.Load(queryResults);
clientContext.ExecuteQuery();

foreach (ListItem item in queryResults) {
  Console.WriteLine(item["Title"] + ", " + item["FirstName"] + " - " + item["WorkPhone"]);
}
```

Batching Commands

```
private void CreateCustomers(ClientContext clientContext, int customerCount, int batchSize) {
  List list = clientContext.Web.Lists.GetByTitle("Customers");

  int batchCount = 0;
  foreach (var customer in CustomerFactory.GetCustomerList(customerCount, false)) {
    batchCount += 1;
    var lici = new ListItemCreationInformation();
    ListItem item = list.AddItem(new ListItemCreationInformation());
    item["FirstName"] = customer.FirstName; item["Title"] = customer.LastName;
    item["Company"] = customer.Company; item["WorkPhone"] = customer.WorkPhone;
    item["HomePhone"] = customer.HomePhone; item["Email"] = customer.EmailAddress;
    item.Update();
    // call ExecuteQuery only when reaching batch size
    if (batchCount == batchSize) {
      clientContext.ExecuteQuery();
      batchCount = 0;
    }
  }
  // make sure all items have been committed
  if (batchCount > 0) {
    clientContext.ExecuteQuery();
  }
}
```

Consider the following code...

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

clientContext.Web.Lists.GetByTitle("List1").DeleteObject();
clientContext.Web.Lists.GetByTitle("List2").DeleteObject();

try {
  clientContext.ExecuteQuery();
}
catch(ServerException ex) {
  Console.WriteLine(ex.GetType().ToString());
  Console.WriteLine(ex.Message);
  Console.WriteLine(ex.ServerErrorCode);
  Console.WriteLine(ex.ServerErrorTraceCorrelationId);
}
```

Remote Exception Handling

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

ExceptionHandlingScope scope = new ExceptionHandlingScope(clientContext);

using (scope.StartScope()) {
  using (scope.StartTry()) {
    // perform operations
  }
  using (scope.StartCatch()) {
    // handle error
  }
  using (scope.StartFinally()) {
    // add cleanup code
  }
}

// execute batch with remote exception handling
clientContext.ExecuteQuery();
```

General Usage

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

// attempt first operation
ExceptionHandlingScope scope1 = new ExceptionHandlingScope(clientContext);
using (scope1.StartScope()) {
  using (scope1.StartTry()) {
    clientContext.Web.Lists.GetByTitle("List1").DeleteObject();
  }
  using (scope1.StartCatch()) { /* do nothing */ }
}

// attempt second operation
ExceptionHandlingScope scope2 = new ExceptionHandlingScope(clientContext);
using (scope2.StartScope()) {
  using (scope2.StartTry()) {
    clientContext.Web.Lists.GetByTitle("List2").DeleteObject();
  }
  using (scope2.StartCatch()) { /* do nothing */ }
}

// execute batch with remote exception handling
clientContext.ExecuteQuery();
```

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- • JavaScript Injection and the SharePoint REST API

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();
```

Checking Whether List Already Exists

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

string listTitle = "Announcements";

// delete list if it exists
ExceptionHandlingScope scope = new ExceptionHandlingScope(clientContext);
using (scope.StartScope()) {
  using (scope.StartTry()) {
    site.Lists.GetByTitle(listTitle).DeleteObject();
  }
  using (scope.StartCatch()) { }
}
// create and initialize ListCreationInformation object
ListCreationInformation listInformation = new ListCreationInformation();
listInformation.Title = listTitle;
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;
}
```

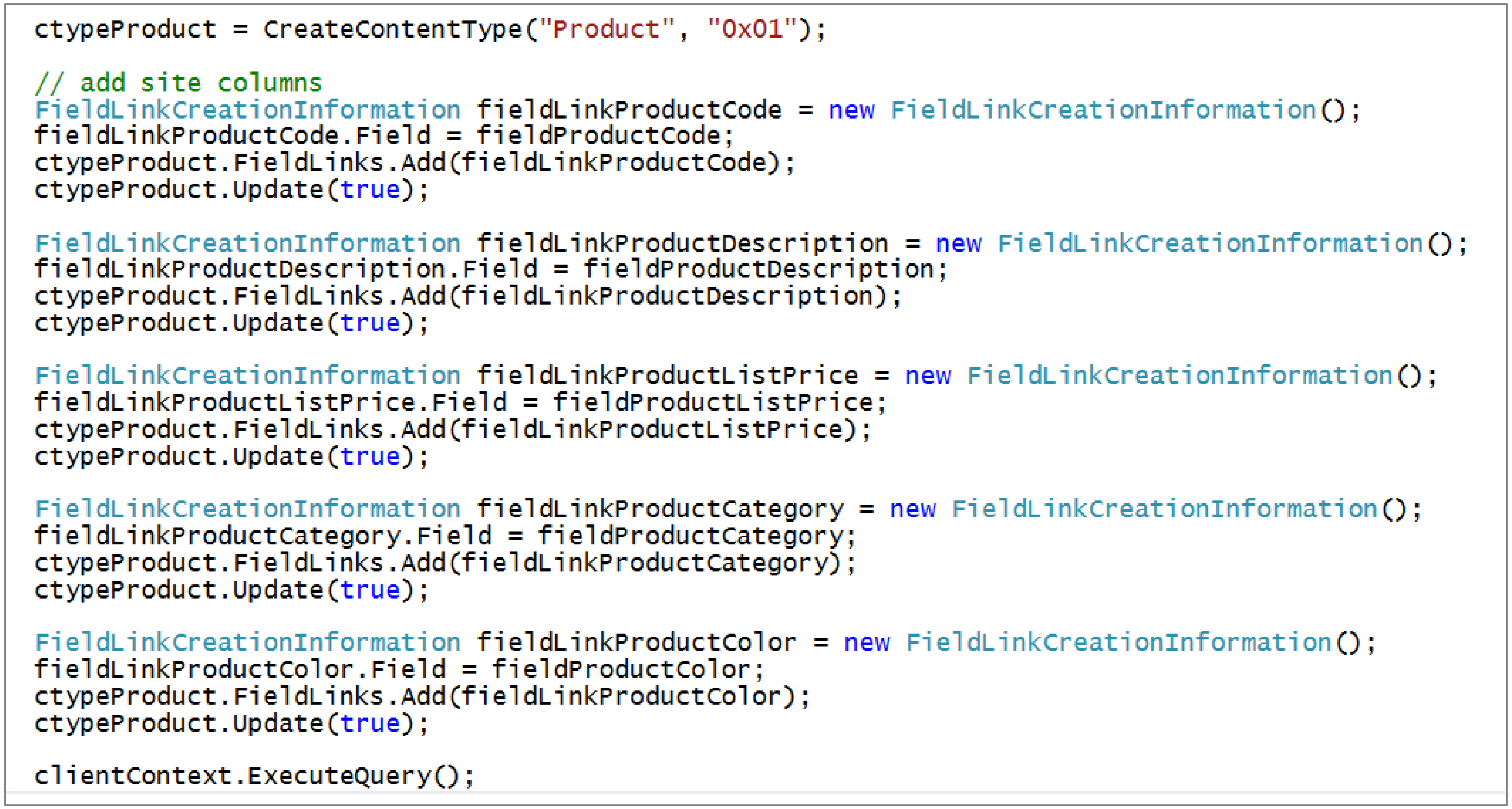
Creating Site Columns - Part 2

```
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

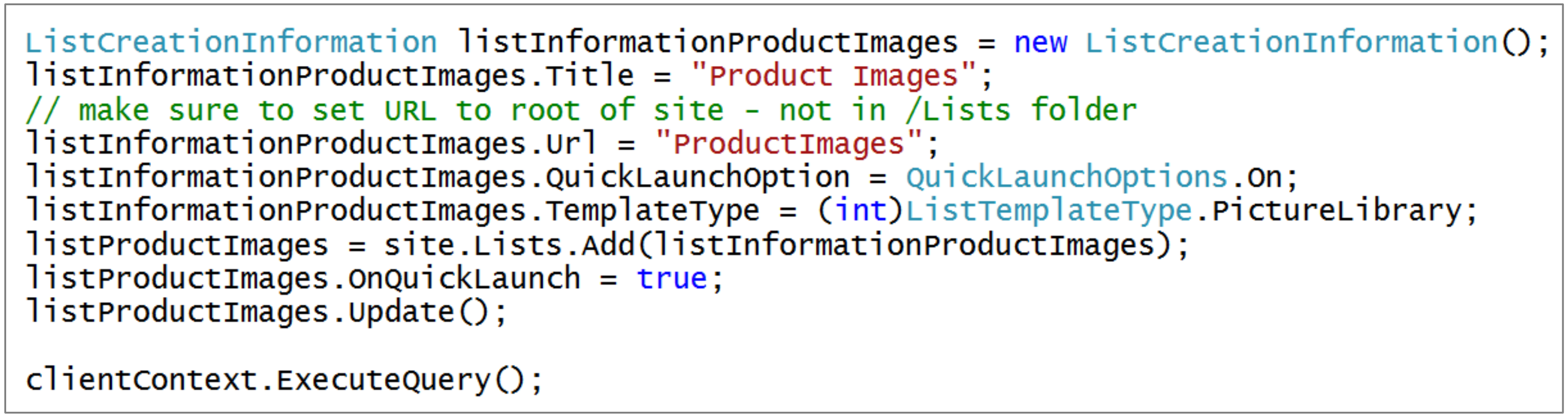


```
ctypeProduct = CreateContentType("Product", "0x01");

// 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();
```

Creating a Document Library



```
ListCreationInformation listInformationProductImages = new ListCreationInformation();
listInformationProductImages.Title = "Product Images";
// make sure to set URL to root of site - not in /Lists folder
listInformationProductImages.Url = "ProductImages";
listInformationProductImages.QuickLaunchOption = QuickLaunchOptions.On;
listInformationProductImages.TemplateType = (int)ListTemplateType.PictureLibrary;
listProductImages = site.Lists.Add(listInformationProductImages);
listProductImages.OnQuickLaunch = true;
listProductImages.Update();

clientContext.ExecuteQuery();
```

Uploading Files to a Library

- Create a utility upload function with common CSOM code

```
static void UploadProductImage(byte[] imageContent, string imageFileName) {
  Console.WriteLine("  uploading " + imageFileName);
  FileCreationInformation fileInfo = new FileCreationInformation();
  fileInfo.Content = imageContent;
  fileInfo.Overwrite = true;
  fileInfo.Url = listProductImagesUrl + imageFileName;
  File newFile = listProductImages.RootFolder.Files.Add(fileInfo);
  clientContext.ExecuteQuery();
}
```

- Call function passing file name and byte array

```
UploadProductImage(Properties.Resources.WP0001, "WP0001.jpg");
UploadProductImage(Properties.Resources.WP0002, "WP0002.jpg");
UploadProductImage(Properties.Resources.WP0003, "WP0003.jpg");
UploadProductImage(Properties.Resources.WP0004, "WP0004.jpg");
UploadProductImage(Properties.Resources.WP0005, "WP0005.jpg");
UploadProductImage(Properties.Resources.WP0006, "WP0006.jpg");
UploadProductImage(Properties.Resources.WP0007, "WP0007.jpg");
UploadProductImage(Properties.Resources.WP0008, "WP0008.jpg");
UploadProductImage(Properties.Resources.WP0009, "WP0009.jpg");
UploadProductImage(Properties.Resources.WP0010, "WP0010.jpg");
```

Agenda

- ✓ SharePoint Online Development Strategies
- ✓ Understanding Modern Team Site and Modern Pages
- ✓ Programming the Client-side Object Model (CSOM)
- ✓ Creating Site Columns, Content Types and Lists
- ➢ JavaScript Injection and the SharePoint REST API

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

Scripting Capabilities in SharePoint Online

- SharePoint Online has powerful scripting features
  - It’s powerful when used by the good guys
  - It’s powerful when used by the bad guys
  - SharePoint Online disables scripting by default

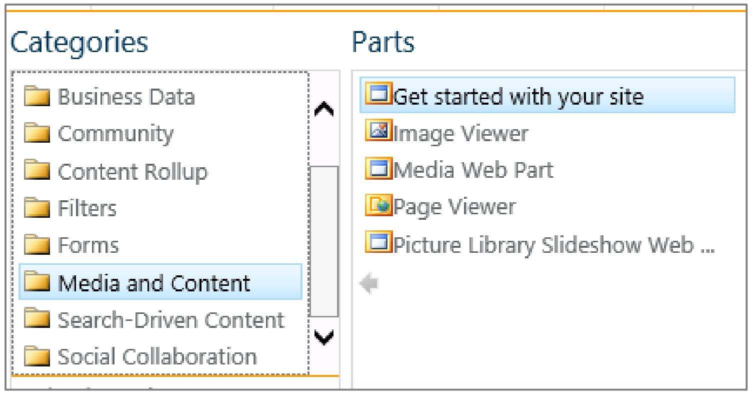
- The default scripting capabilities disabled for
  - Personal sites
  - Self-service created sites
  - Root site collection of the tenant

Features Affected with Scripting Disabled

- When scripting is disabled…
  - Many links removed from Site Settings page
  - SharePoint Designer capabilities reduced
  - You cannot edit master pages or page layouts
  - You cannot edit theme for current site
  - Many Web Parts are missing (e.g. Script Editor)
  - Users cannot upload .aspx files to document libraries
- Scripting must be enabled at the site level
  - Can be done by configuring SPO tenancy policy
  - Can be done using PowerShell or CSOM

Effects of Scripting Being Disabled

- Media and Content Web Parts (scripting disabled)



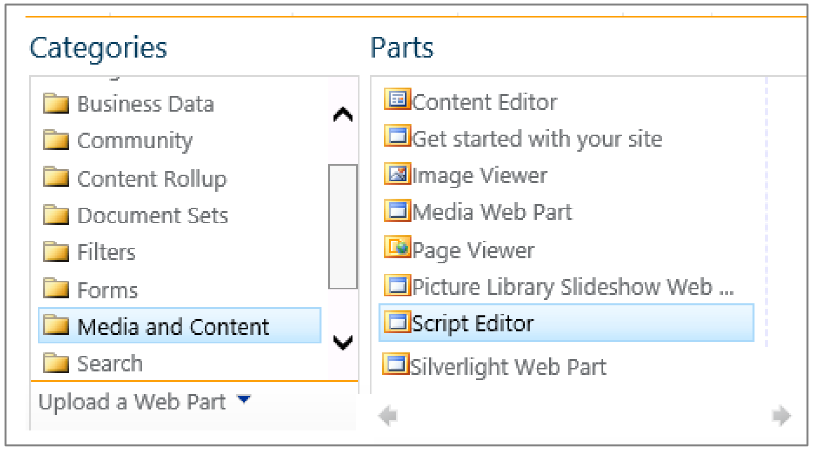
Categories

- Business Data
- Community
- Content Rollup
- Filters
- Forms
- Media and Content
- Search-Driven Content
- Social Collaboration

Parts

- Get started with your site
- Image Viewer
- Media Web Part
- Page Viewer
- Picture Library Slideshow Web ...

- Media and Content Web Parts (scripting enabled)



Categories

- Business Data
- Community
- Content Rollup
- Document Sets
- Filters
- Forms
- Media and Content
- Search

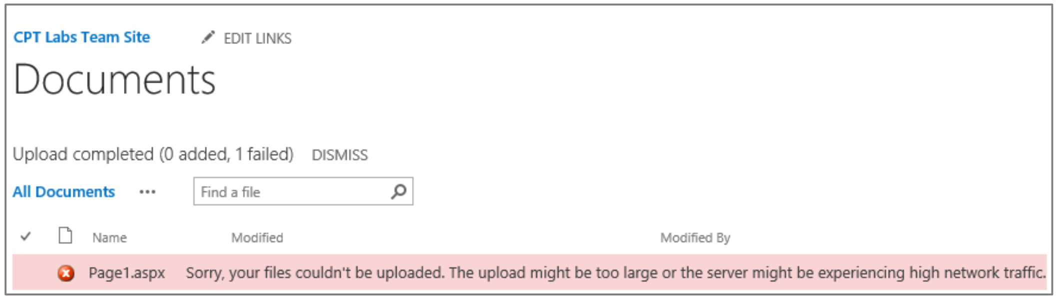
Upload a Web Part

Parts

- Content Editor
- Get started with your site
- Image Viewer
- Media Web Part
- Page Viewer
- Picture Library Slideshow Web ...
- Script Editor
- Silverlight Web Part

More Effects of Scripting Being Disabled

- You cannot upload a .ASPX file to a document library



CPT Labs Team Site EDIT LINKS

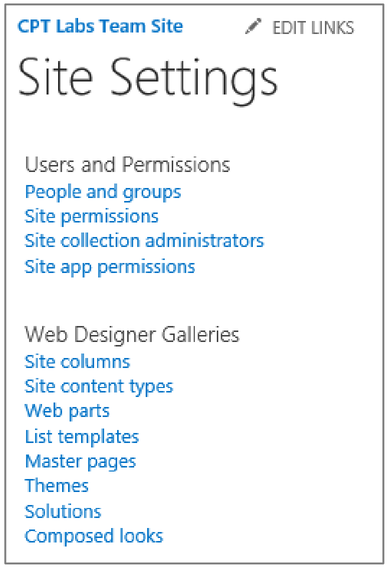
Documents

Upload completed (0 added, 1 failed) DISMISS

All Documents ··· Find a file

✓	Name	Modified	Modified By
	Page1.aspx	Sorry, your files couldn't be uploaded. The upload might be too large or the server might be experiencing high network traffic.	

- Many Administrative Links removed from Site Settings page

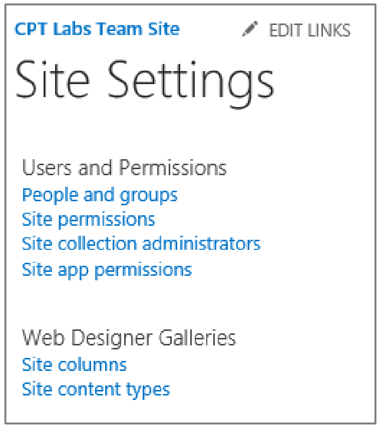


CPT Labs Team Site EDIT LINKS

Site Settings

Users and Permissions
People and groups
Site permissions
Site collection administrators
Site app permissions

Web Designer Galleries
Site columns
Site content types
Web parts
List templates
Master pages
Themes
Solutions
Composed looks



CPT Labs Team Site EDIT LINKS

Site Settings

Users and Permissions
People and groups
Site permissions
Site collection administrators
Site app permissions

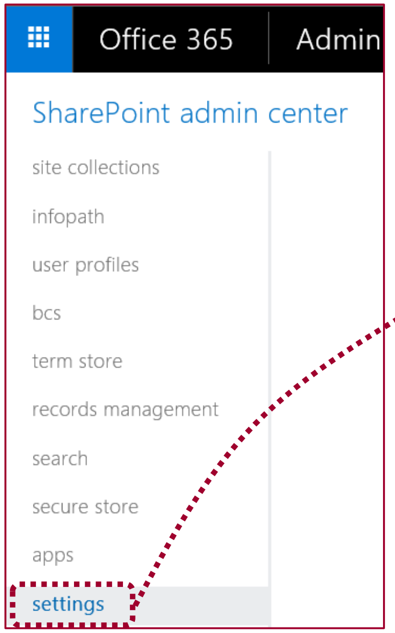
Web Designer Galleries
Site columns
Site content types

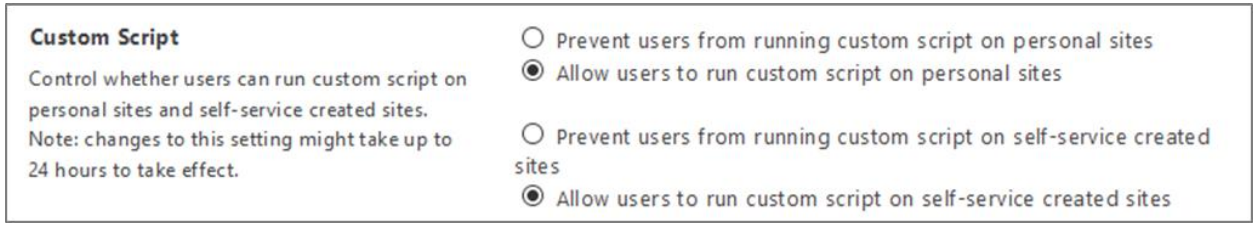
Scripting Enabled

Scripting Disabled

Enabling Scripting in SharePoint Admin Center

- Settings configurable in SharePoint admin center
  - Sets policy for sites created in future
  - Sets policy for existing sites created within tenancy
  - Can take up to 24 hours to propagate changes to existing sites





Custom Script

Control whether users can run custom script on personal sites and self-service created sites. Note: changes to this setting might take up to 24 hours to take effect.

○ Prevent users from running custom script on personal sites
[✓ ● Allow users to run custom script on personal sites]

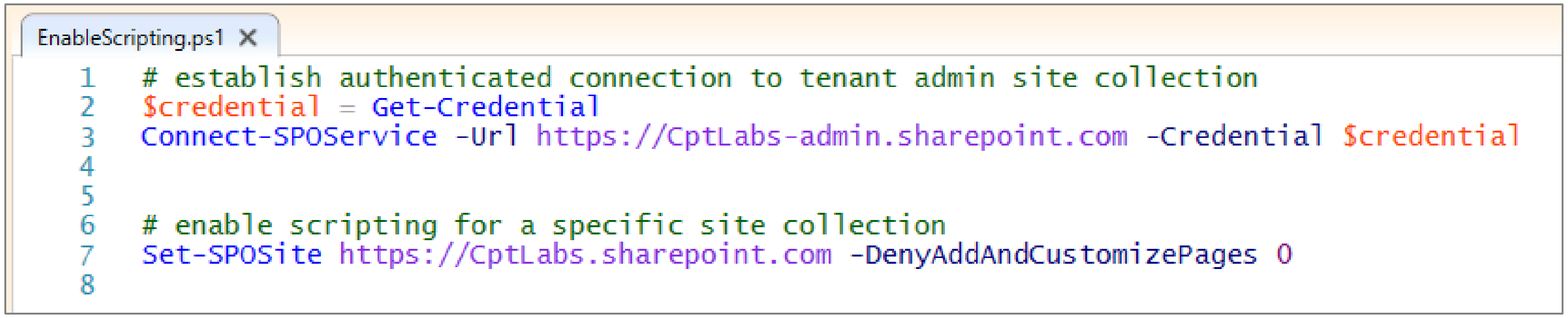
○ Prevent users from running custom script on self-service created sites
[✓ ● Allow users to run custom script on self-service created sites]

Enabling Scripting using PowerShell

- Site scripting setting can be enabled using PowerShell
  - Use `Set-SPOSite` cmdlet to update `DenyAddAndCustomizePages`
  - Changes take affect immediately

- PowerShell syntax

```
Set-SPOsite <_YOUR_SITE_URL_> -DenyAddAndCustomizePages 0
```

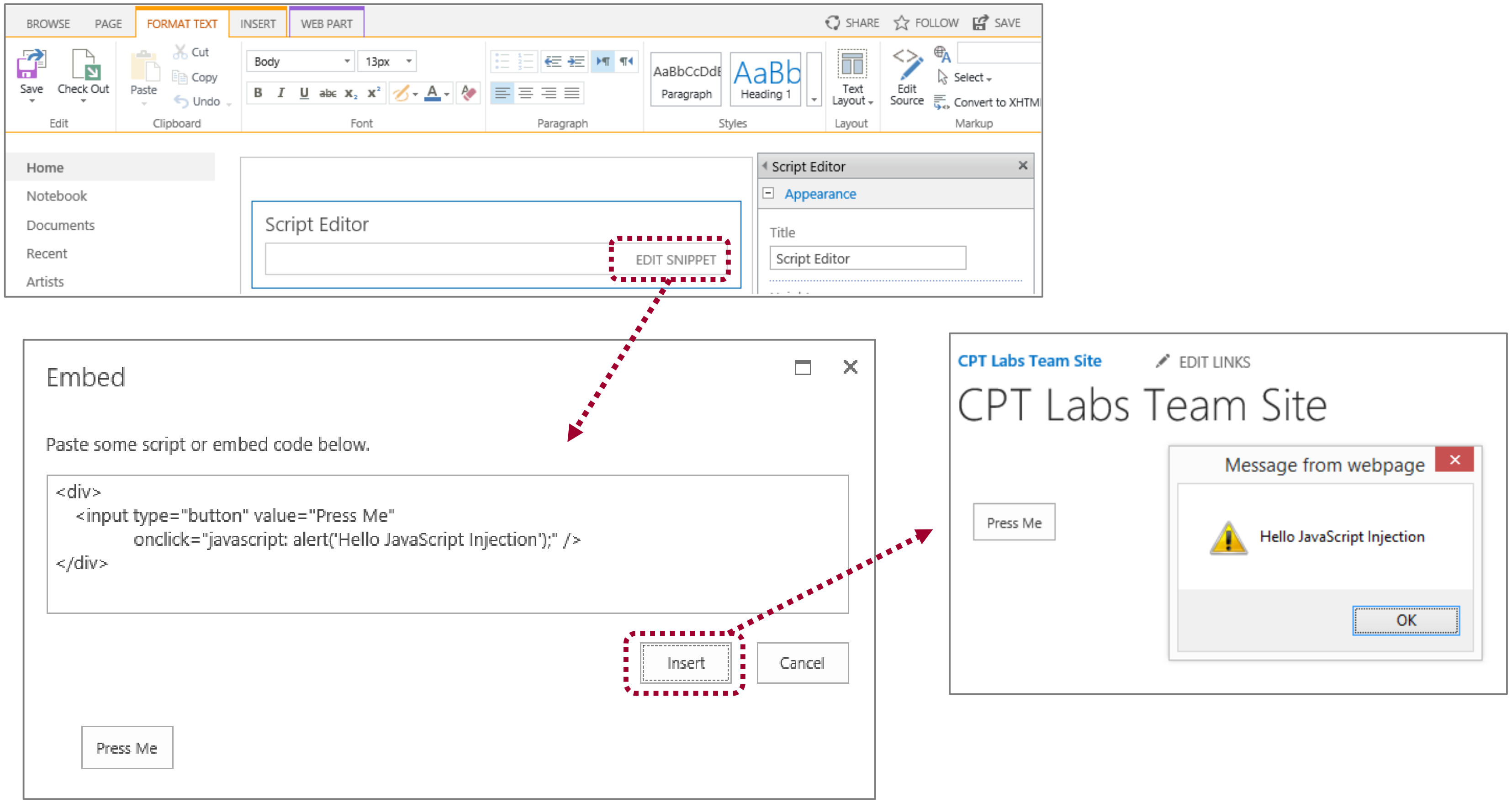


EnableScripting.ps1

```
# establish authenticated connection to tenant admin site collection
$credential = Get-Credential
Connect-SPOService -Url https://CptLabs-admin.sharepoint.com -Credential $credential


# enable scripting for a specific site collection
Set-SPOSite https://CptLabs.sharepoint.com -DenyAddAndCustomizePages 0

```

Script Editor Web Part

- Allows user to add custom script logic in ad-hoc fashion



Paste some script or embed code below.

```
<div>
    <input type="button" value="Press Me"
            onclick="javascript: alert('Hello JavaScript Injection');" />
</div>
```

Hello JavaScript Injection

Creating and Uploading Custom Pages

- Uploading Custom Pages
  - Scripting must be enabled for target SPO site
  - Page file must be ASPX file (HTML files do not work)
  - Page can be uploaded to any document library
  - Page can link to same master page as other site pages
  - Page can link to custom CSS files and JavaScript files
- What about the SharePoint sites running in MDS mode?
  - Minimal Download Strategy (MDS) affects how pages run
  - MDS-enabled pages run in MDS mode through start.aspx
  - MDS mode redirects unsupported pages back to non-MDS URLs

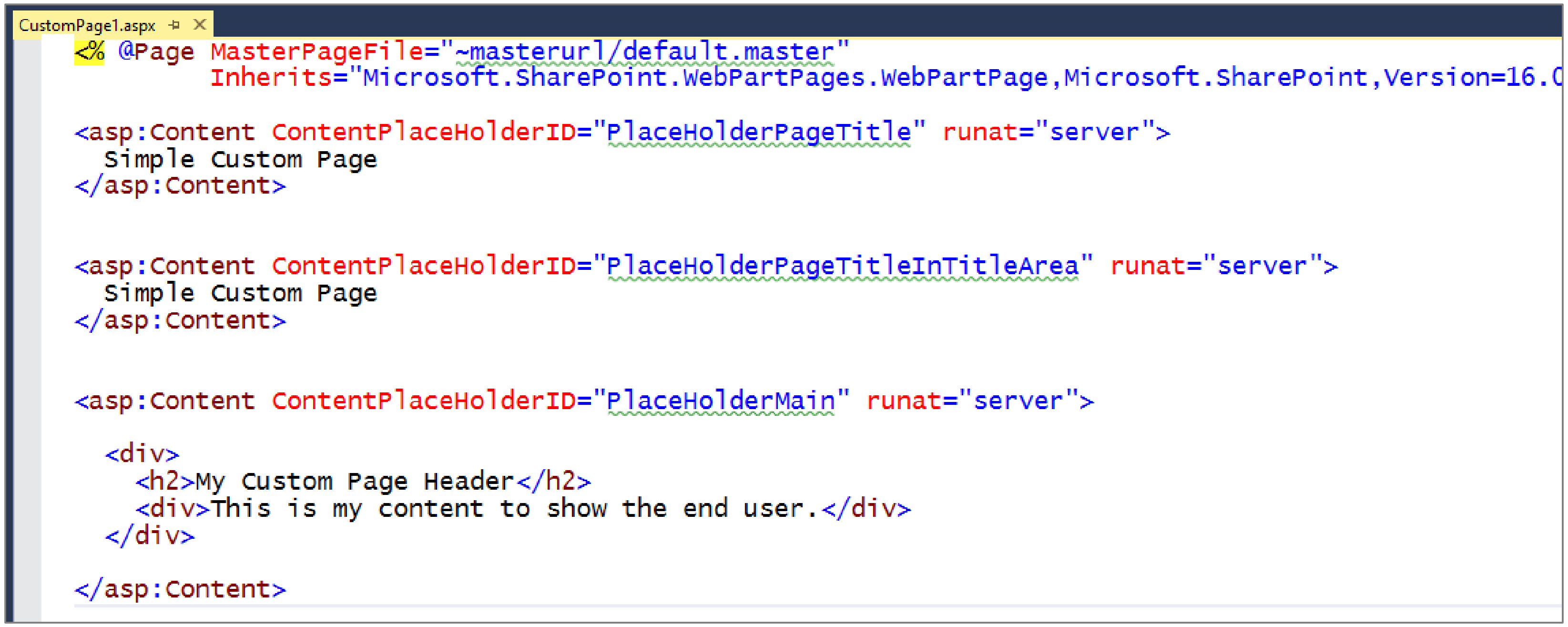
Adding a Script Link for jQuery

- SharePoint does not load jQuery library
  - It must be explicitly for Script Editor Web Part

```
<div>
  <input id="cmdPressMe" value="Press Me" type="button"  />
</div>

<!-- add script link to jQuery library-->
<script src="https://code.jquery.com/jquery-2.1.4.js"></script>

<script language="JavaScript" >
  // add jQuery document ready event handler
  $(function () {
    $("#cmdPressMe").click(function () {
      alert('Hello JavaScript Injection - This is working!')
    });
  });
</script>
```

Creating a Simple Site Pages for SPO

- Custom pages should link to current site's master page
  - Set **`MasterPageFile`** to dynamic token **`~masterurl.default.master`**
- Custom Page should inherit from **`WebPartPage`**
  - Required to work correctly with Minimal Download Strategy feature
  - Required if you want to add support for Web Parts

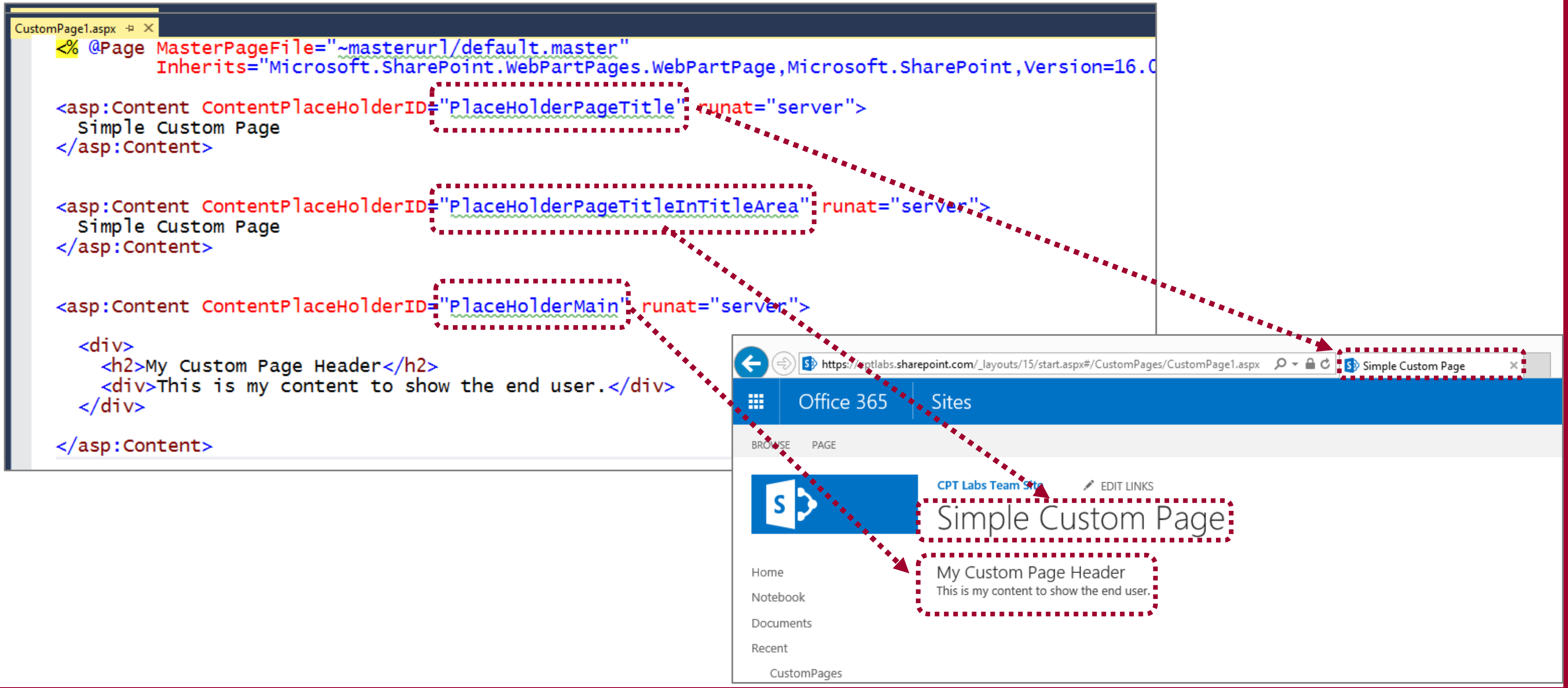


CustomPage1.aspx

```
<%@ Page MasterPageFile="~masterurl/default.master"
           Inherits="Microsoft.SharePoint.WebPartPages.WebPartPage,Microsoft.SharePoint,Version=16.0

<asp:Content ContentPlaceHolderID="PlaceHolderPageTitle" runat="server">
  Simple Custom Page
</asp:Content>


<asp:Content ContentPlaceHolderID="PlaceHolderPageTitleInTitleArea" runat="server">
  Simple Custom Page
</asp:Content>


<asp:Content ContentPlaceHolderID="PlaceHolderMain" runat="server">

  <div>
    <h2>My Custom Page Header</h2>
    <div>This is my content to show the end user.</div>
  </div>

</asp:Content>
```

Creating a Simple Site Pages for SPO

- Essential SharePoint Master Page Placeholders
  - PlaceHolderPageTitle
  - PlaceHolderPageTitleInTitleArea
  - PlaceHolderMain



CustomPage1.aspx

```
<%@Page MasterPageFile="~masterurl/default.master"
        Inherits="Microsoft.SharePoint.WebPartPages.WebPartPage,Microsoft.SharePoint,Version=16.0

<asp:Content ContentPlaceHolderID="PlaceHolderPageTitle" runat="server">
  Simple Custom Page
</asp:Content>


<asp:Content ContentPlaceHolderID="PlaceHolderPageTitleInTitleArea" runat="server">
  Simple Custom Page
</asp:Content>


<asp:Content ContentPlaceHolderID="PlaceHolderMain" runat="server">

  <div>
    <h2>My Custom Page Header</h2>
    <div>This is my content to show the end user.</div>
  </div>

</asp:Content>
```

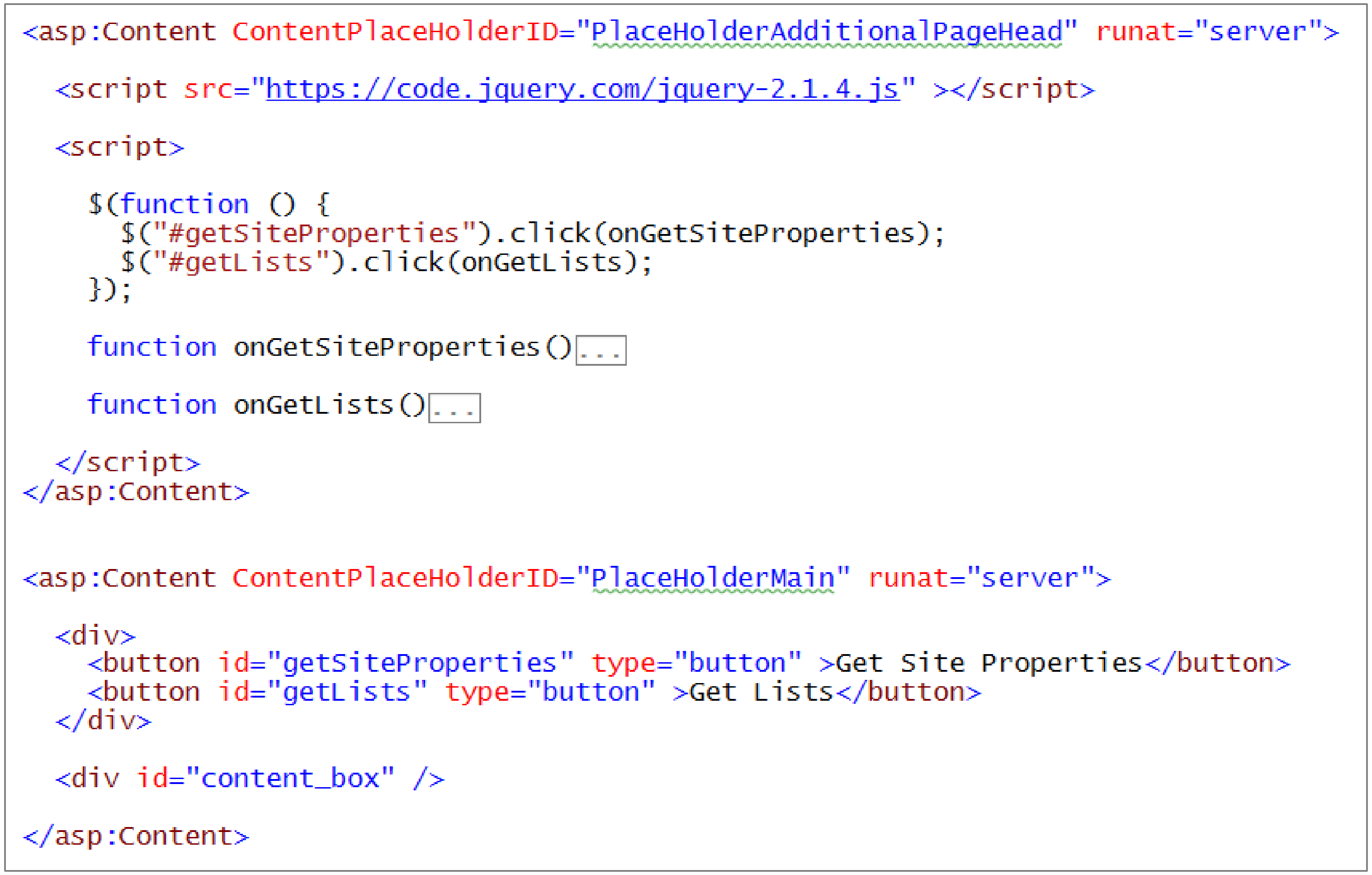
Simple Custom Page

My Custom Page Header

This is my content to show the end user.

Adding Scripting to a Custom Page

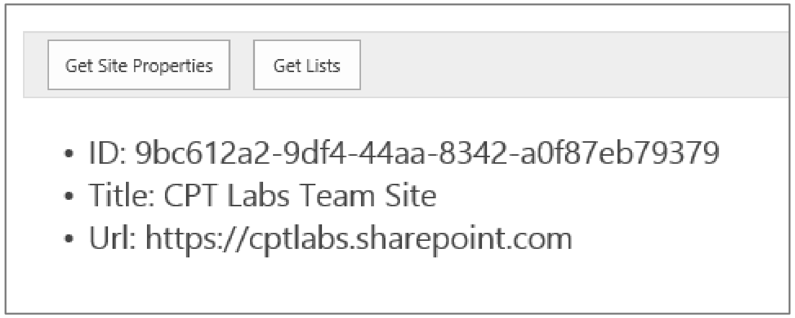
- Adding scripts and links using PlaceHolderAdditionalPagehead



```
<asp:Content ContentPlaceHolderID="PlaceHolderAdditionalPageHead" runat="server">

  <script src="https://code.jquery.com/jquery-2.1.4.js" ></script>

  <script>

    $(function () {
      $("#getSiteProperties").click(onGetSiteProperties);
      $("#getLists").click(onGetLists);
    });

    function onGetSiteProperties()...

    function onGetLists()...

  </script>
</asp:Content>


<asp:Content ContentPlaceHolderID="PlaceHolderMain" runat="server">

  <div>
    <button id="getSiteProperties" type="button" >Get Site Properties</button>
    <button id="getLists" type="button" >Get Lists</button>
  </div>

  <div id="content_box" />

</asp:Content>
```

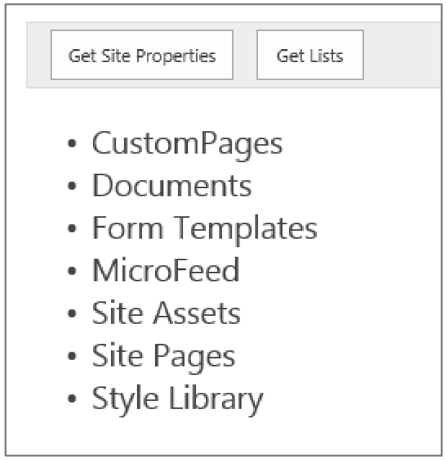
Programming the SharePoint REST API

```
function onGetSiteProperties() {
  var urlRest = "../_api/web/?$select=Id,Title,Url";
  $.ajax({
    url: urlRest,
    method: "GET",
    headers: {"accept": "application/json;odata=verbose"}
  }).then(function (data) {
    $("#content_box")
      .empty()
      .append($("<ul>")
        .append($("<li>").text("ID: " + data.d.Id))
        .append($("<li>").text("Title: " + data.d.Title))
        .append($("<li>").text("Url: " + data.d.Url))
      );
  });
}
```



- ID: 9bc612a2-9df4-44aa-8342-a0f87eb79379
- Title: CPT Labs Team Site
- Url: https://cptlabs.sharepoint.com

```
function onGetLists() {
  var urlRest = "../_api/web/lists/?$filter=(Hidden eq false)";
  $.ajax({
    url: urlRest,
    method: "GET",
    headers: { "accept": "application/json;odata=verbose" }
  }).then(function (data) {
    var lists = data.d.results;
    var listOfLists = $("<ul>");
    for (var i = 0; i < lists.length; i++) {
      listOfLists.append( $("<li>").text(lists[i].Title) );
    }
    $("#content_box").empty().append(listOfLists);
  });
}
```



- CustomPages
- Documents
- Form Templates
- MicroFeed
- Site Assets
- Site Pages
- Style Library

Remote Provisioning

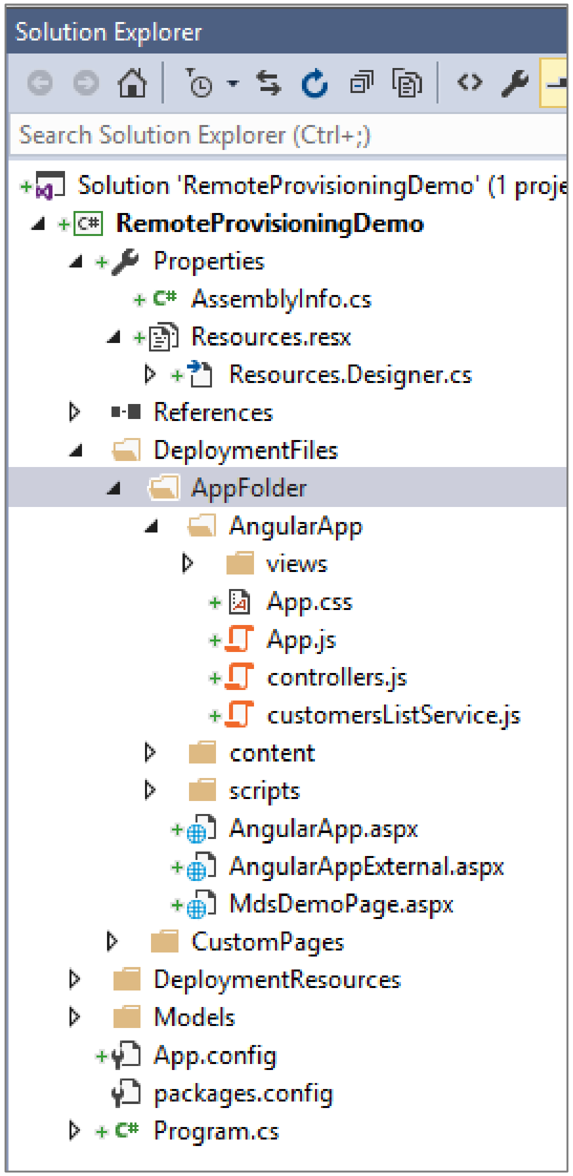
- Remote provisioning in SPO
  - Use CSOM to create SPO site elements
  - Recommended over SharePoint solutions & features
- What can you create with Remote Provisioning
  - New child sites, lists and document libraries
  - Site columns, content types and remote event receivers
  - New pages with custom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

Remote Provisioning using CSOM

- What can you do to a SPO site using CSOM?
  - Upload custom ASPX pages and JavaScript files
  - Add navigation nodes on the top navigation bar
  - Create child sites, lists and document libraries
  - Create site columns, content types and term sets
  - Create user custom actions and script links

Remote Provisioning Demo Console App

- What does this sample app demonstrate?
  - Connects to an SPO site
  - Creates private folder at root of site
  - Uploads custom pages, scripts and style sheets
  - Sets Alternate CSS URL for the current site
  - Registers ScriptLinks for jQuery and custom script
  - Adds custom actions to site Actions menu
  - Creates and populates sample Customer list
  - Embeds an Angular app into SharePoint UX
  - Uses JSLink and custom client-side rendering



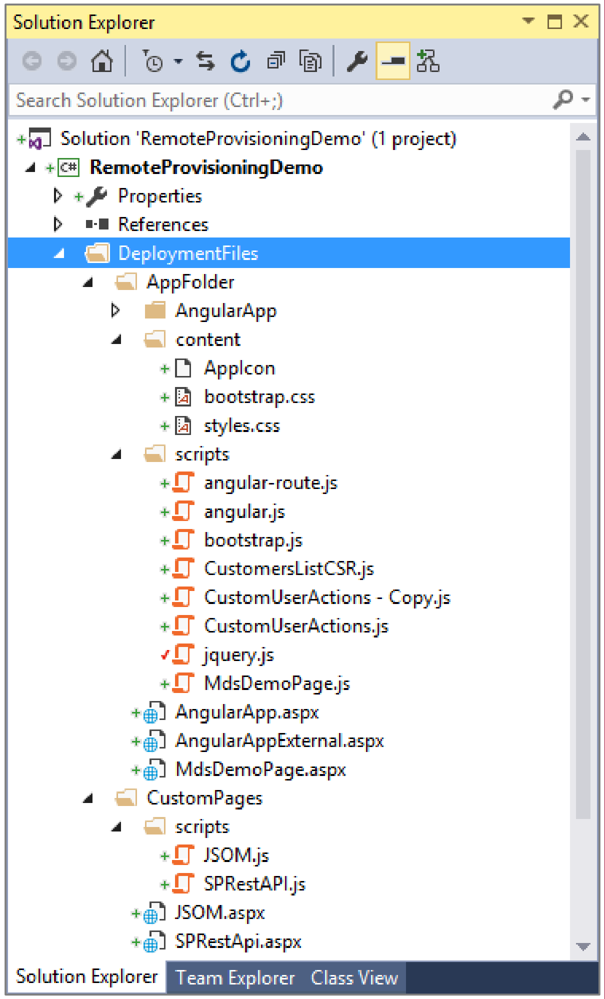
```
Solution 'RemoteProvisioningDemo' (1 proje
  RemoteProvisioningDemo
    Properties
      AssemblyInfo.cs
      Resources.resx
        Resources.Designer.cs
    References
    DeploymentFiles
      AppFolder
        AngularApp
          views
          App.css
          App.js
          controllers.js
          customersListService.js
        content
        scripts
        AngularApp.aspx
        AngularAppExternal.aspx
        MdsDemoPage.aspx
      CustomPages
    DeploymentResources
    Models
    App.config
    packages.config
    Program.cs
```

Uploading Pages and Scripts using CSOM

- Where can you upload custom pages and scripts?
  - Master Page Gallery
  - Style Library
  - Standard document library
  - New folder created at site root

- Sample CSOM Code for uploading file

```
static void UploadToAppRootFolder(string path, byte[] content) {
  string filePath = AppRootFolderAbsoluteUrl + path;
  Console.WriteLine("Uploading to App Root Folder: " + path);
  FileCreationInformation fileInfo = new FileCreationInformation();
  fileInfo.Content = content;
  fileInfo.Overwrite = true;
  fileInfo.Url = filePath;
  File newFile = AppRootFolder.Files.Add(fileInfo);
  clientContext.ExecuteQuery();
}
```

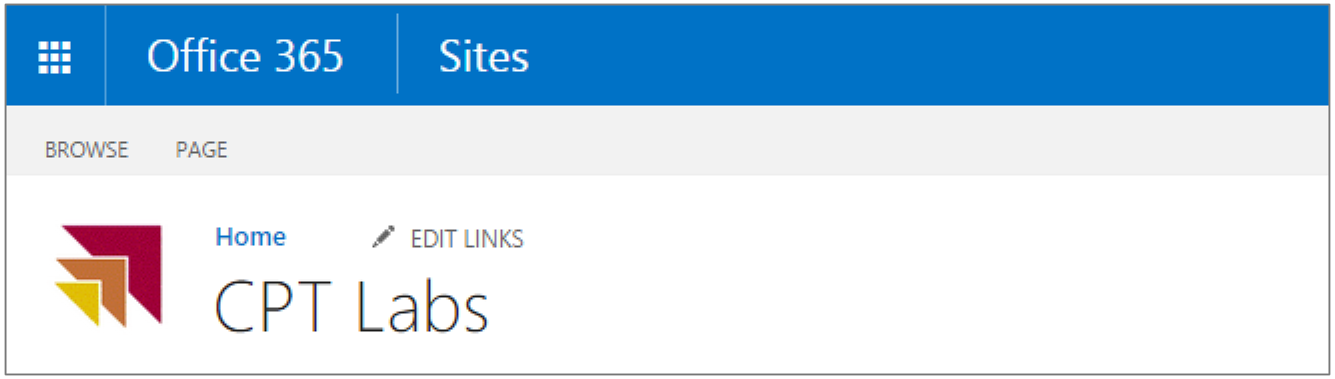


```
Solution 'RemoteProvisioningDemo' (1 project)
  RemoteProvisioningDemo
    Properties
    References
    DeploymentFiles
      AppFolder
        AngularApp
        content
          AppIcon
          bootstrap.css
          styles.css
        scripts
          angular-route.js
          angular.js
          bootstrap.js
          CustomersListCSR.js
          CustomUserActions - Copy.js
          CustomUserActions.js
          jquery.js
          MdsDemoPage.js
        AngularApp.aspx
        AngularAppExternal.aspx
        MdsDemoPage.aspx
      CustomPages
        scripts
          JSOM.js
          SPRestAPI.js
        JSOM.aspx
        SPRestApi.aspx
```

AlternateCssUrl and Site Icon

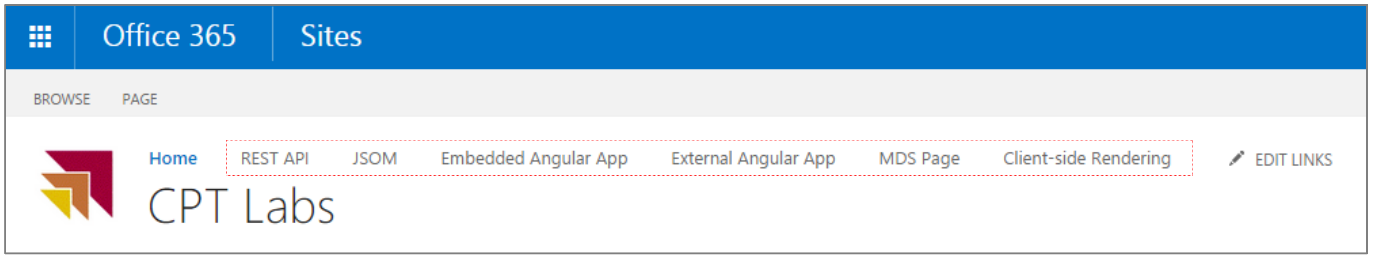
- Adding styling to an SPO Site
  - AlternateCssUrl links one style sheet to all pages in SPO site
  - SiteLogoUrl used to substitute custom site icon

```
static void SetAlternateCssAndSiteIcon() {
  site.AlternateCssUrl = AppRootFolderAbsoluteUrl + "content/styles.css";
  site.SiteLogoUrl = AppRootFolderAbsoluteUrl + "content/AppIcon.png";
  site.Update();
  clientContext.ExecuteQuery();
}
```



Creating Top Nav Nodes

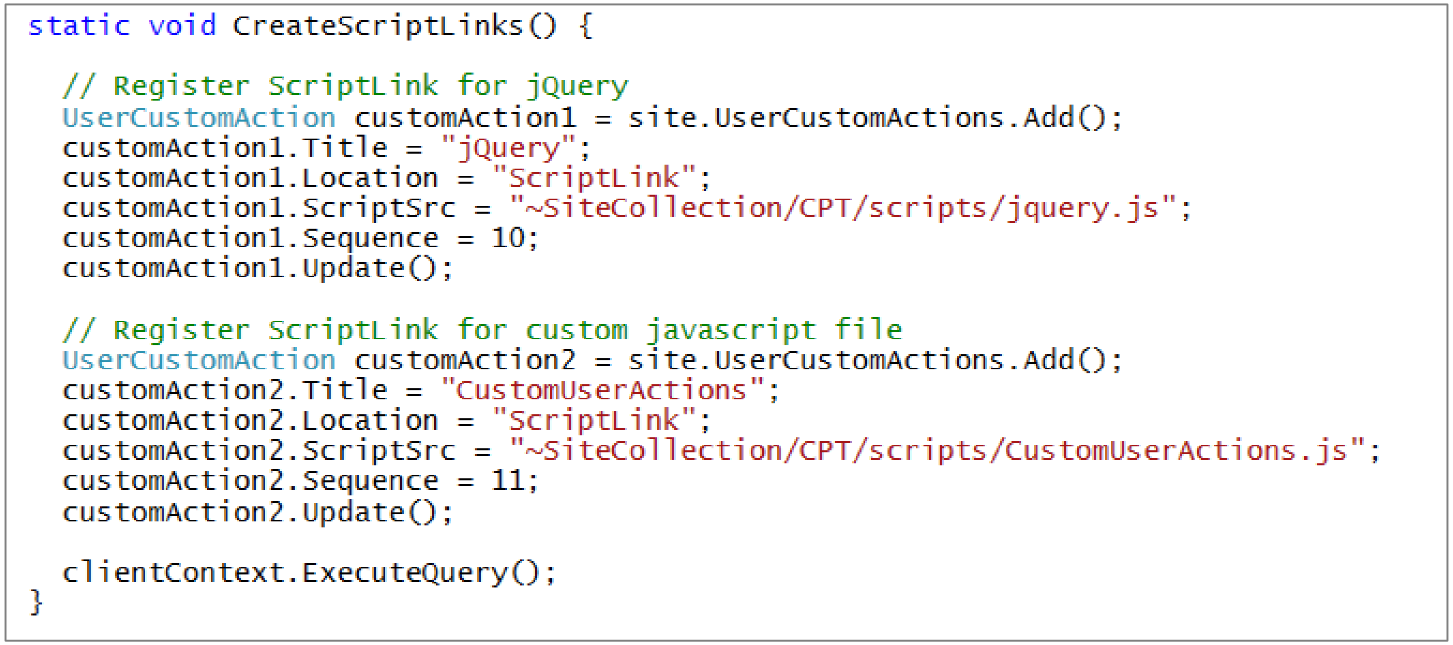
- CSOM allows you to create Top Nav Nodes
  - Provides easy way to provide navigation to custom pages



```
static void CreateTopNavNode(string title, string path) {
  string nodeUrl = site.Url + path;
  NavigationNodeCreationInformation newNode = new NavigationNodeCreationInformation();
  newNode.IsExternal = false;
  newNode.Title = title;
  newNode.Url = nodeUrl;
  newNode.AsLastNode = true;
  TopNavNodes.Add(newNode);
  clientContext.ExecuteQuery();
}


static void ConfigureTopNav() {
  DeleteAllTopNavNodes();
  AddHomeTopNavNode();
  CreateTopNavNode("REST API", "/CustomPages/SPRestAPI.aspx");
  CreateTopNavNode("JSOM", "/CustomPages/JSOM.aspx");
  CreateTopNavNode("Embedded Angular App", "/CPT/AngularApp.aspx");
  CreateTopNavNode("External Angular App", "/CPT/AngularAppExternal.aspx");
  CreateTopNavNode("MDS Page", "/CPT/MdsDemoPage.aspx");
  CreateTopNavNode("Client-side Rendering", "/Lists/Customers");
}
```

Adding ScriptLinks to Site

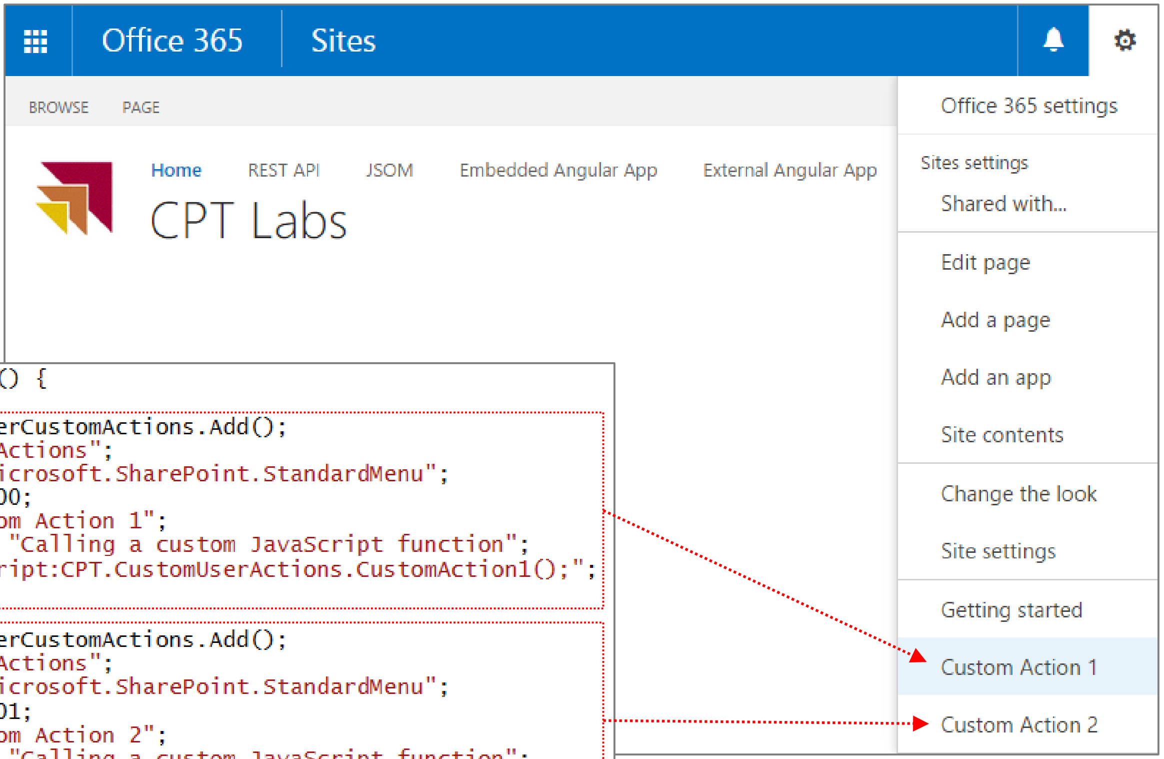
- ScriptLink added to site as UserCustomAction
  - Provides easy way to link all pages in site to common script file
  - Does not require modification to site's master page
  - Can be used to load common JavaScript libraries (e.g. jQuery)
  - Can be used to load custom scripts



```
static void CreateScriptLinks() {

  // Register ScriptLink for jQuery
  UserCustomAction customAction1 = site.UserCustomActions.Add();
  customAction1.Title = "jQuery";
  customAction1.Location = "ScriptLink";
  customAction1.ScriptSrc = "~SiteCollection/CPT/scripts/jquery.js";
  customAction1.Sequence = 10;
  customAction1.Update();

  // Register ScriptLink for custom javascript file
  UserCustomAction customAction2 = site.UserCustomActions.Add();
  customAction2.Title = "CustomUserActions";
  customAction2.Location = "ScriptLink";
  customAction2.ScriptSrc = "~SiteCollection/CPT/scripts/CustomUserActions.js";
  customAction2.Sequence = 11;
  customAction2.Update();

  clientContext.ExecuteQuery();
}
```

Adding Custom Actions to the SiteActions Menu

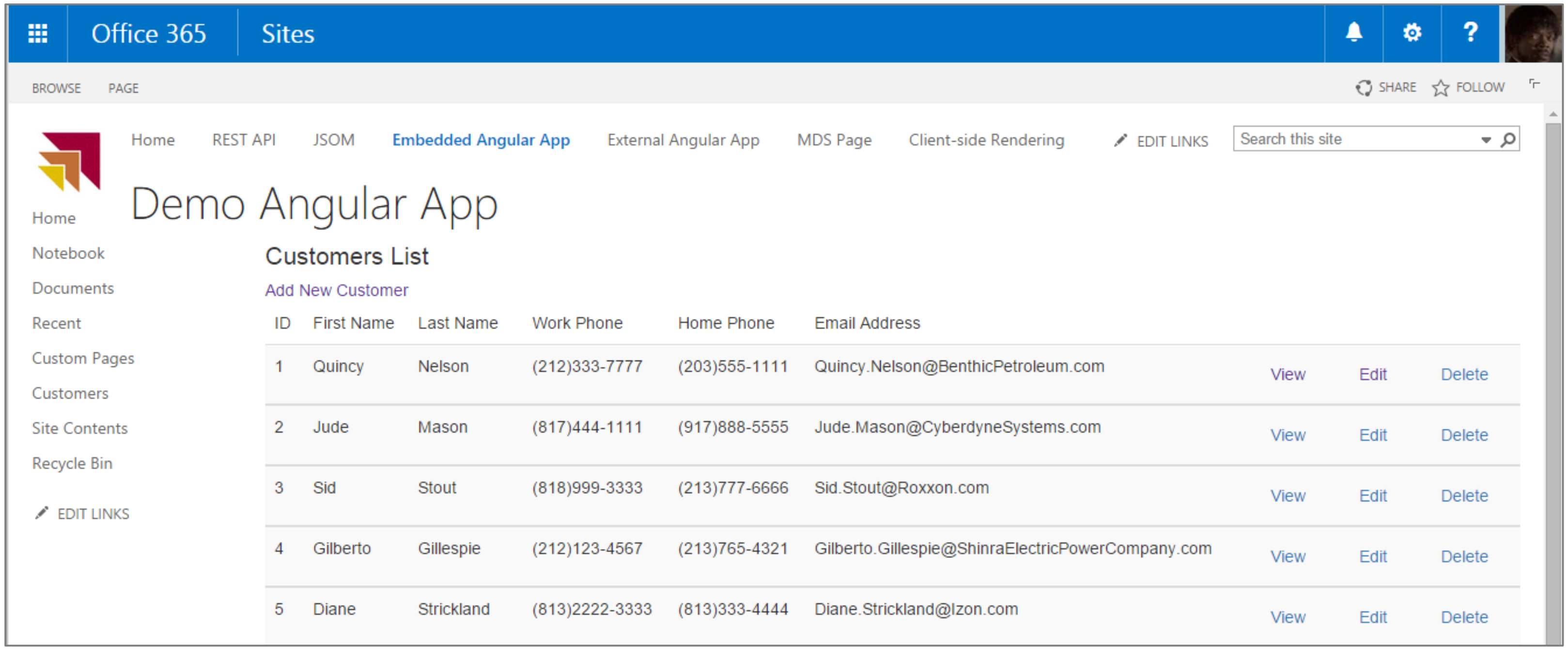
- Adding menu commands to SiteActions menu



```
static void CreateCustomSiteActions() {

  var siteActionsCommand1 = site.UserCustomActions.Add();
  siteActionsCommand1.Group = "SiteActions";
  siteActionsCommand1.Location = "Microsoft.SharePoint.StandardMenu";
  siteActionsCommand1.Sequence = 1000;
  siteActionsCommand1.Title = "Custom Action 1";
  siteActionsCommand1.Description = "Calling a custom JavaScript function";
  siteActionsCommand1.Url = "javascript:CPT.CustomUserActions.CustomAction1();";
  siteActionsCommand1.Update();

  var siteActionsCommand2 = site.UserCustomActions.Add();
  siteActionsCommand2.Group = "SiteActions";
  siteActionsCommand2.Location = "Microsoft.SharePoint.StandardMenu";
  siteActionsCommand2.Sequence = 1001;
  siteActionsCommand2.Title = "Custom Action 2";
  siteActionsCommand2.Description = "Calling a custom JavaScript function";
  siteActionsCommand2.Url = "javascript:CPT.CustomUserActions.CustomAction2();";
  siteActionsCommand2.Update();

  clientContext.ExecuteQuery();
}
```

Embedding an Angular App

- Angular apps can be injected using remote provisioning
  - Angular App can be embedded in SharePoint UU
  - Angular App can be designed external to SharePoint UI



Demo Angular App

Customers List

Add New Customer

ID	First Name	Last Name	Work Phone	Home Phone	Email Address			
1	Quincy	Nelson	(212)333-7777	(203)555-1111	Quincy.Nelson@BenthicPetroleum.com	View	Edit	Delete
2	Jude	Mason	(817)444-1111	(917)888-5555	Jude.Mason@CyberdyneSystems.com	View	Edit	Delete
3	Sid	Stout	(818)999-3333	(213)777-6666	Sid.Stout@Roxxon.com	View	Edit	Delete
4	Gilberto	Gillespie	(212)123-4567	(213)765-4321	Gilberto.Gillespie@ShinraElectricPowerCompany.com	View	Edit	Delete
5	Diane	Strickland	(813)2222-3333	(813)333-4444	Diane.Strickland@Izon.com	View	Edit	Delete

Summary

- ✓ SharePoint Online Development Strategies
- ✓ Understanding Modern Team Site and Modern Pages
- ✓ Programming the Client-side Object Model (CSOM)
- ✓ Creating Site Columns, Content Types and Lists
- ✓ JavaScript Injection and the SharePoint REST API