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How to Secure Your .NET Web API with Token Authentication

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API security can be complex. In many cases, just because you've built an API that you want to make public, it doesn't mean that you want just anybody accessing it. In most cases, you want fine-grained control over who can access the API, but setting up that kind of user management can be a daunting task: you'd have to create your own authorization service that can create API credentials for your users and have the ability to exchange those API credentials for an access token using OAuth 2.0. I've got good news! With just a few lines of code, Okta can handle all the complicated and time-consuming security elements and let you concentrate on creating a stellar API. =)

Understand the Basic Flow

When handling authentication for a server-to-server API, you really only have two options: HTTP basic auth or OAuth 2.0 client credentials.

Because OAuth 2.0 is the most popular way to secure API services like the one we'll be building today (and the only one that uses token authentication), we'll be using that.

With OAuth 2.0 client credentials, authenticating a client app is two-step process: first, the client sends its API credentials (a client ID and secret) to an authorization server that returns an access token. Second, the client sends a request to the API with that access token and the API verifies it and either authorizes the call or rejects it with a `401 Unauthorized` response. In this tutorial, you'll use Okta to manage your OAuth 2.0 server and rely on Okta's default authorization server to create access tokens using API credentials (aka: client credentials) also created by Okta.

Install .NET Core 2.0

For this tutorial, you'll be using version 2.0 of the .NET Core framework to create a .NET Core MVC application that will be the client, and a .NET core Web API that the client will call. To make sure you have .NET Core 2.0 installed, you can open a command window and run:

```
dotnet --version
```

Ensure that you see `2.0.0` in the output. If you don't, you can install it from here.

I will be running everything from Visual Studio Code, but it can easily be done from Visual Studio if you have access to that.

Create the API

In the folder where you want to keep source code, create a folder called `webapi-okta-example` and change into that directory.

```
mkdir webapi-okta-example
cd webapi-okta-example
```

Create a directory to hold the API project called `api` .

```
mkdir api
cd api
dotnet new webapi
```

Create a directory in the `webapi-okta-example` folder to house the MVC app called `app` .

```
mkdir app
cd app
dotnet new mvc
```

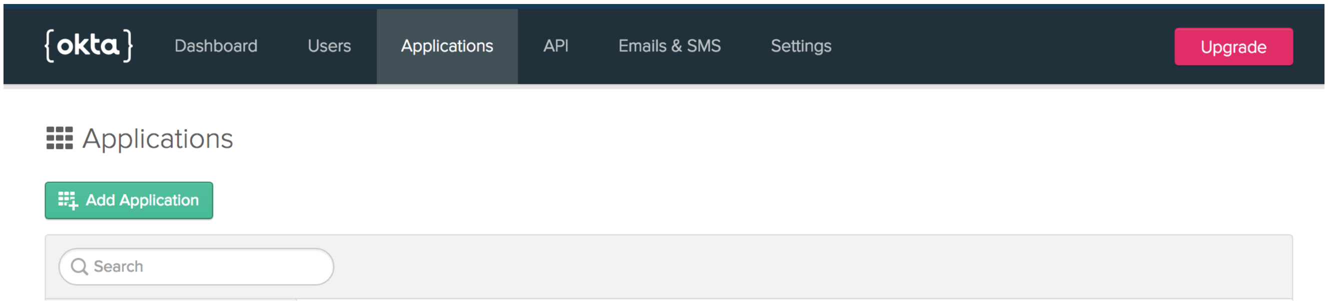
For development on the same machine, you’ll also need to tell the MVC app to run on another port, because the API will be running on port 5000. To do this, go to the `Program.cs` file in the MVC application and add the `UseUrls()` method, so that your `BuildWebHost` method looks like this:

```
 public static IWebHost BuildWebHost(string[] args) =>
            WebHost.CreateDefaultBuilder(args)
                .UseStartup<Startup>()
                .UseUrls("http://localhost:5050")
                .Build();
```

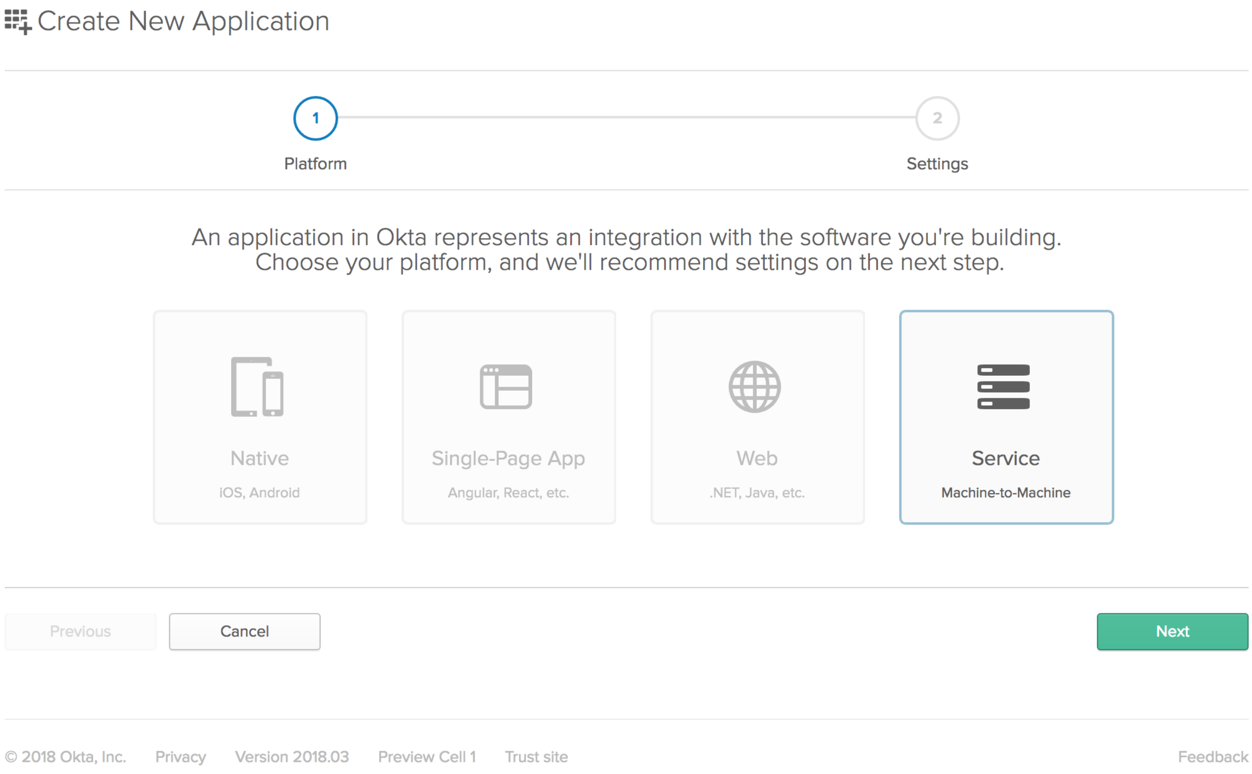
Now, you should be able to fire them both up (with `dotnet run` from the command prompt, or just F5 in Visual Studio or Visual Studio Code) and see them both run independently.

Set Up the App in Okta

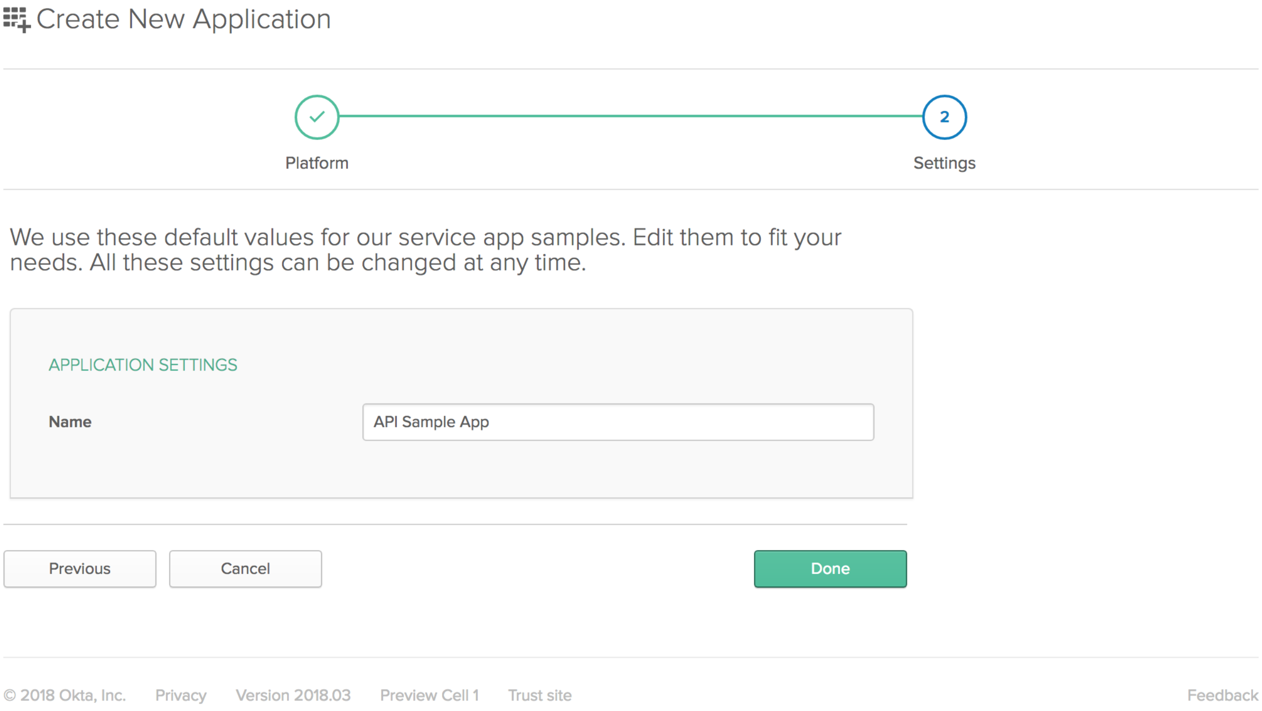
If you don’t already have an account with Okta, set up your free-forever developer account at https://developer.okta.com/signup/. Once you’ve logged into the dashboard, click on the **Applications** menu item, then click **Add Application**.



From the Create New Application screen choose **Service**, and click **Next**.



Name the application “API Sample App”, and click **Done**.



Create New Application

We use these default values for our service app samples. Edit them to fit your needs. All these settings can be changed at any time.

APPLICATION SETTINGS

Name: API Sample App

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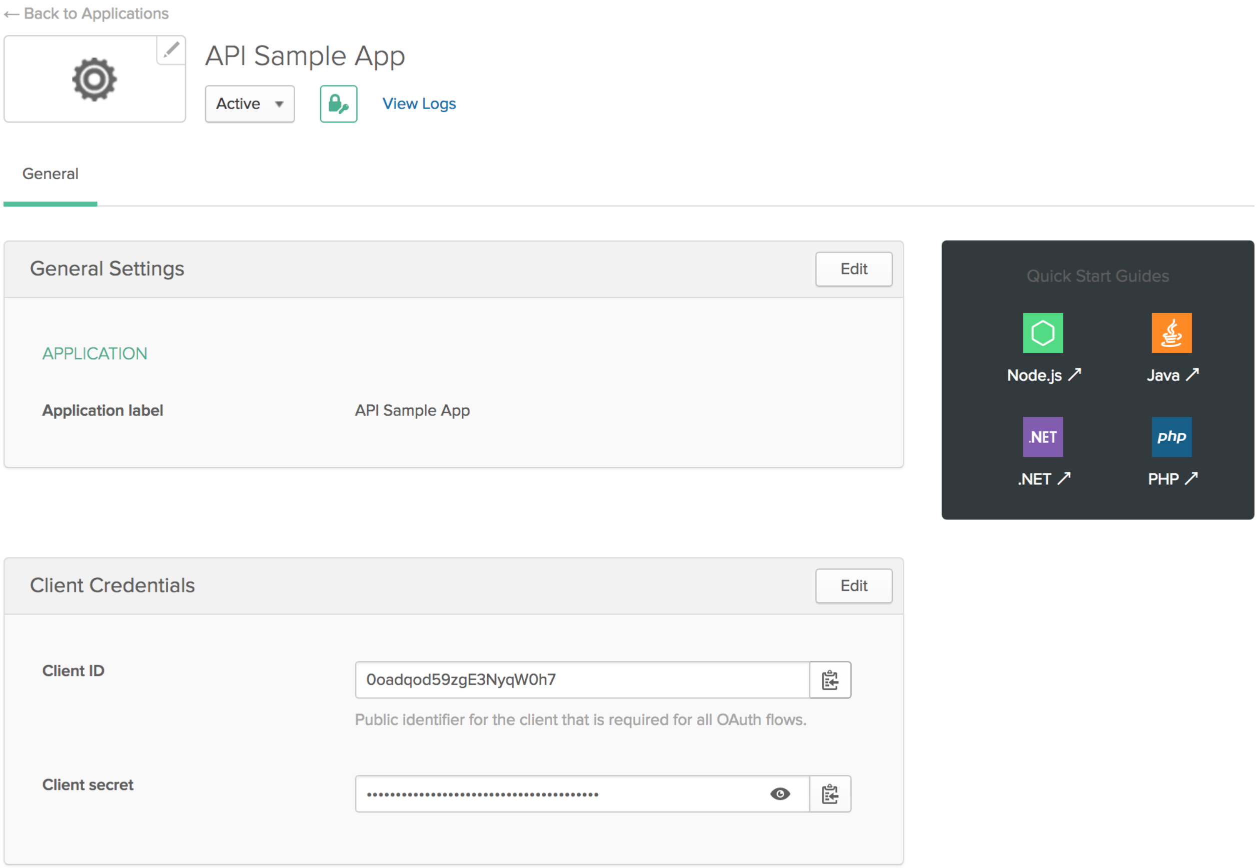
On the API Sample App's general settings, you will see the Client Credentials box with the client ID and client secret in it. You will use these to authenticate a client wishing to call your API.



General Settings

APPLICATION

Application label: API Sample App

Client Credentials

Client ID: 0oadqod59zgE3NyqW0h7

Public identifier for the client that is required for all OAuth flows.

Client secret: ••

> For each client that you’ll want to have access to the API, you’ll need to create an Okta application for it, and give it the Client ID and Client Secret.

Set Up Your App To Use Okta Client Credentials

In this case, the client of the API is the ASP.NET MVC application. Open the `app` folder in your IDE. Open the `appsettings.Development.json` file and add your Okta client information like so:

```
{
  "Logging": {
    "IncludeScopes": false,
    "LogLevel": {
      "Default": "Debug",
      "System": "Information",
      "Microsoft": "Information"
    }
  },
  "Okta": {
    "TokenUrl": "https://{yourOktaDomain}/oauth2/default/v1/token",
    "ClientId": "{clientId}",
    "ClientSecret": "{clientSecret}"
  }
}
```

The `TokenUrl` property is the url to your default Authorization Server. You can find this in Okta by going to the dashboard and hovering over the API menu item in the menu bar, then choosing Authorization Servers from the drop down menu. The Issuer URI for the “default” server is the URI used for the `TokenUrl` property. The `ClientId` and `ClientSecret` properties are from the General Settings page of your API application in Okta.

In the “Models” folder of the application add a new class file called `OktaSettings.cs` . The contents of the class are:

```
namespace app.Models
{
    public class OktaSettings
    {
        public string TokenUrl { get; set; }
        public string ClientId { get; set; }
        public string ClientSecret { get; set; }
    }
}
```

This will allow you to read those configuration values into a C# object, making it easier to use in your application. To make it even easier, add this new object to the services that can be injected by adding it to the `ConfigureServices()` method in the `Startup.cs` file.

```
public void ConfigureServices(IServiceCollection services)
{
    services.Configure<OktaSettings>(Configuration.GetSection("Okta"));
    services.AddMvc();
}
```

This will add the settings object as injectable `IOptions` into the constructor of any class that needs them. In this case, it will be an Okta-specific token service.

Create The Token Service

What you need here is a service that can live with the application lifecycle and either get a new access token, or return one that it already has. To do this, create an `ITokenService` interface and an `OktaTokenService` implementation class inside a new folder at the root of your MVC app called “Services”.

The `ITokenService` only needs one method: a method that returns an access token, call it `GetToken()`.

```
using System.Threading.Tasks;

namespace app.Services
{
    public interface ITokenService
    {
         Task<string> GetToken();
    }
}
```

The implementation will decide whether or not to get a *new* access token, or return one that it has previously received.

```
public class OktaTokenService : ITokenService
{
    private OktaToken token = new OktaToken();
    private readonly IOptions<OktaSettings> oktaSettings;

    public OktaTokenService(IOptions<OktaSettings> oktaSettings)
    {
        this.oktaSettings = oktaSettings;
    }

    public async Task<string> GetToken()
    {
      if (!this.token.IsValidAndNotExpiring)
      {
        this.token = await this.GetNewAccessToken();
      }
      return token.AccessToken;
    }
}
```

This first pass at the Okta token service starts by getting the `oktaSettings` injected from the application services. It also has a class-level variable that will hold the `OktaToken` object (which you'll create in a moment). The `GetToken()` method merely checks to see if the token is valid and not expired (or expiring soon) and either gets a new access token, or just returns the current one.

Next, you'll need to implement the `OktaToken` object. You can just nest it inside this class, since it will be the only consumer of this object. This will serve as a container for the response from the Authorization Service.

```
private class OktaToken
{
  [JsonProperty(PropertyName = "access_token")]
  public string AccessToken { get; set; }

  [JsonProperty(PropertyName = "expires_in")]
  public int ExpiresIn { get; set; }

  public DateTime ExpiresAt { get; set; }

  public string Scope { get; set; }

  [JsonProperty(PropertyName = "token_type")]
  public string TokenType { get; set; }

  public bool IsValidAndNotExpiring
  {
    get
    {
      return !String.IsNullOrEmpty(this.AccessToken) &&
this.ExpiresAt > DateTime.UtcNow.AddSeconds(30);
    }
  }
}
```

You'll notice the `JsonProperty` attributes on several of the properties here. This is because, by default the JSON deserialize will match properties from camel-case (camelCase) to pascal-cased (PascalCase), but the properties returned in the token response are snake-cased (snake_case), so this tell the serializer what's going on. Also, there is a `IsValidAndNotExpiring`, read-only property that ensures there is a value for the access token and that it is not expired, or expiring in the next 30 seconds. You can vary this value base on your use case.

> You could just always make the API called and if it comes back with a `401 Unauthorized` response, go and get a new access token then. The approach of checking to see if it's expiring soon is simple and cuts down on failed calls in the logs.

Finally, the `OktaTokenService` class needs the `GetNewAccessToken()` method, in case it either doesn't currently have an access token, or it is expired or expiring soon. This method will call your Authorization Server's `token` endpoint to get a new access token.

```
private async Task<OktaToken> GetNewAccessToken()
{
  var token = new OktaToken();
  var client = new HttpClient();
  var client_id = this.oktaSettings.Value.ClientId;
  var client_secret = this.oktaSettings.Value.ClientSecret;
  var clientCreds = System.Text.Encoding.UTF8.GetBytes($"{client_id}:{client_secret}");
  client.DefaultRequestHeaders.Authorization =
        new AuthenticationHeaderValue("Basic", System.Convert.ToBase64String(clientCreds));

  var postMessage = new Dictionary<string, string>();
  postMessage.Add("grant_type", "client_credentials");
  postMessage.Add("scope", "access_token");
  var request = new HttpRequestMessage(HttpMethod.Post, this.oktaSettings.Value.TokenUrl)
  {
    Content = new FormUrlEncodedContent(postMessage)
  };

  var response = await client.SendAsync(request);
  if(response.IsSuccessStatusCode)
  {
    var json = await response.Content.ReadAsStringAsync();
    this.token = JsonConvert.DeserializeObject<OktaToken>(json);
    this.token.ExpiresAt = DateTime.UtcNow.AddSeconds(this.token.ExpiresIn);
  }
  else
  {
    throw new ApplicationException("Unable to retrieve access token from Okta");
  }
  return token;
}
```

A lot of this method is setting up the `HttpClient` to make the call to the Authorization Service. The interesting parts are the `clientCreds` value that gets the bytes of a string that has the client ID and secret concatenated with a colon between them as :. That value is then base64 encoded when it's added to the `Authorization` header with "Basic " in front of it. _Note that the word "basic" is NOT encoded._

There are also two key-value pairs sent as `FormUrlEncodedContent` : the `grant_type` which has a value of “client_credentials”, and the `scope` which has a value of “access_token”. This simply tells the Authorization Server that you are sending client credentials and you want to get an access token in exchange.

The entire contents of the `OktaTokenService` *(with using directives)* should look like this:

```
using System;
using System.Collections.Generic;
using System.Net.Http;
using System.Net.Http.Headers;
using System.Threading.Tasks;
using app.Models;
using Microsoft.Extensions.Options;
using Newtonsoft.Json;

namespace app.Services
{
  public class OktaTokenService : ITokenService
  {
    private OktaToken token = new OktaToken();
    private readonly IOptions<OktaSettings> oktaSettings;

    public OktaTokenService(IOptions<OktaSettings> oktaSettings)
    {
        this.oktaSettings = oktaSettings;
    }

    public async Task<string> GetToken()
    {
      if (!this.token.IsValidAndNotExpiring)
      {
        this.token = await this.GetNewAccessToken();
      }
      return token.AccessToken;
    }

    private async Task<OktaToken> GetNewAccessToken()
    {
      var token = new OktaToken();
      var client = new HttpClient();
      var client_id = this.oktaSettings.Value.ClientId;
      var client_secret = this.oktaSettings.Value.ClientSecret;
      var clientCreds = System.Text.Encoding.UTF8.GetBytes($"{client_id}:{client_secret}");
      client.DefaultRequestHeaders.Authorization =
        new AuthenticationHeaderValue("Basic", System.Convert.ToBase64String(clientCreds));

      var postMessage = new Dictionary<string, string>();
      postMessage.Add("grant_type", "client_credentials");
      postMessage.Add("scope", "access_token");
      var request = new HttpRequestMessage(HttpMethod.Post, this.oktaSettings.Value.TokenUrl)
      {
        Content = new FormUrlEncodedContent(postMessage)
      };

      var response = await client.SendAsync(request);
      if(response.IsSuccessStatusCode)
      {
        var json = await response.Content.ReadAsStringAsync();
        token = JsonConvert.DeserializeObject<OktaToken>(json);
        token.ExpiresAt = DateTime.UtcNow.AddSeconds(this.token.ExpiresIn);
      }
      else
      {
```

```
   {
    throw new ApplicationException("Unable to retrieve access token from Okta");
   }

   return token;
  }

  private class OktaToken
  {
   [JsonProperty(PropertyName = "access_token")]
   public string AccessToken { get; set; }

   [JsonProperty(PropertyName = "expires_in")]
   public int ExpiresIn { get; set; }

   public DateTime ExpiresAt { get; set; }

   public string Scope { get; set; }

   [JsonProperty(PropertyName = "token_type")]
   public string TokenType { get; set; }

   public bool IsValidAndNotExpiring
   {
    get
    {
     return !String.IsNullOrEmpty(this.AccessToken) && t
his.ExpiresAt > DateTime.UtcNow.AddSeconds(30);
    }
   }
  }
 }
}
```

Register the Token Service

To make the token service available to classes that need it, add another line to your `ConfigureServices()` method in Startup.cs so that it now looks like this.

```
public void ConfigureServices(IServiceCollection services)
{
  services.Configure<OktaSettings>(Configuration.GetSection("Okta"));
  services.AddSingleton<ITokenService, OktaTokenService>();
  services.AddMvc();
}
```

Create an API Service

The token service will help you get an access token from the Authorization Server, but then you need to call the API with your newly minted token. Follow the same pattern as the token service by creating an `IApiService` interface and a `SimpleApiService` implementation class for it. The complete interface looks like:

```
using System.Collections.Generic;
using System.Threading.Tasks;

namespace app.Services
{
    public interface IApiService
    {
        Task<IList<string>> GetValues();
    }
}
```

This API service simply has a `GetValues()` method that will call the API and return a list of strings from the `/api/values` endpoint. The implementation class contains:

```
using System;
using System.Collections.Generic;
using System.Net.Http;
using System.Net.Http.Headers;
using System.Threading.Tasks;
using app.Models;
using Newtonsoft.Json;

namespace app.Services
{
  public class SimpleApiService : IApiService
  {
    private HttpClient client = new HttpClient();
    private readonly ITokenService tokenService;
    public SimpleApiService(ITokenService tokenService)
    {
      this.tokenService = tokenService;
    }

    public async Task<IList<string>> GetValues()
    {
      List<string> values = new List<string>();
      var token = tokenService.GetToken();
      client.DefaultRequestHeaders.Authorization = new AuthenticationHeaderValue("Bearer", token);
      var res = await client.GetAsync("http://localhost:5000/api/values");
      if(res.IsSuccessStatusCode)
      {
        var json = res.Content.ReadAsStringAsync().Result;
        values = JsonConvert.DeserializeObject<List<string>>(json);
      }
      else
      {
        values = new List<string>{res.StatusCode.ToString(), res.ReasonPhrase};
      }
      return values;
    }
  }
}
```

Again, much of this is setting up an `HttpClient` to make the API call (looks ripe for a refactor, but we're okay for this demo). The real things of interest here are the `AuthenticationHeaderValue` with "Bearer" at the beginning and the access token. Also, the values returned from the API are deserialized into a list of strings to be returned.

As with the other services, add this to the `ConfigureServices()` method in `Startup.cs` , so that the final version of this method looks like:

```
public void ConfigureServices(IServiceCollection services)
{
    services.Configure<OktaSettings>(Configuration.GetSection("Okta"));
    services.AddSingleton<ITokenService, OktaTokenService>();
    services.AddTransient<IApiService, SimpleApiService>();
    services.AddMvc();
}
```

Add the API Call to the MVC Application

Lastly for the client application, you'll need to use the newly created services, in this case it will be in the `HomeController.cs` . Add the API service to the constructor, then just change the `Index()` action to return a `Task<IActionResult>` and call the API service to get the values.

```
private readonly IApiService apiService;
public HomeController(IApiService apiService)
{
  this.apiService = apiService;
}

public async Task<IActionResult> Index()
{
  var values = await apiService.GetValues();
  return View(values);
}
```

Then you just need to display those values in the view. Remove everything from the `Index.cshtml` view except the carousel and add the values to the page right below the carousel.

```
<div class="row">
    <ul>
        @foreach(var value in Model)
        {
            <li>@value</li>
        }
    </ul>
</div>
```

Now you have the ASP.NET MVC application calling the API with a good access token every time.

The API is not receiving or doing anything to validate the access token yet, so your API is still “open”. All that is left to do is get the API to receive and validate the token!

Get the API to Validate the Access Token

There are two main ways to validate the access token: call the Okta API’s `introspect` endpoint, or validate the token locally. ASP.NET already has some JWT validation stuff built in. Calling the Okta API has the advantage of being very specific, and most secure way. It does have the disadvantage that you’ll need to make another API call. Using the local JWT validation built in to .NET means you don’t have to call the API, but is less secure. For the purposes of the demo, it’s secure enough, so you that here. In the `ConfigureServices()` method of the API project add the following *before* the `services.AddMvc();` line.

```
services.AddAuthentication(options =>
{
        options.DefaultScheme = JwtBearerDefaults.AuthenticationScheme;
})
.AddJwtBearer(options =>
{
        options.Authority = "https://{yourOktaDomain}/oauth2/default";
        options.Audience = "api://default";
        options.RequireHttpsMetadata = false;
});
```

The second service tells the app that you want to use JWT-based authentication and the options for the JwtBearer middleware gives the authentication scheme some information it can use to validate the token is authentic. The audience comes from the Authorization Server page in Okta.

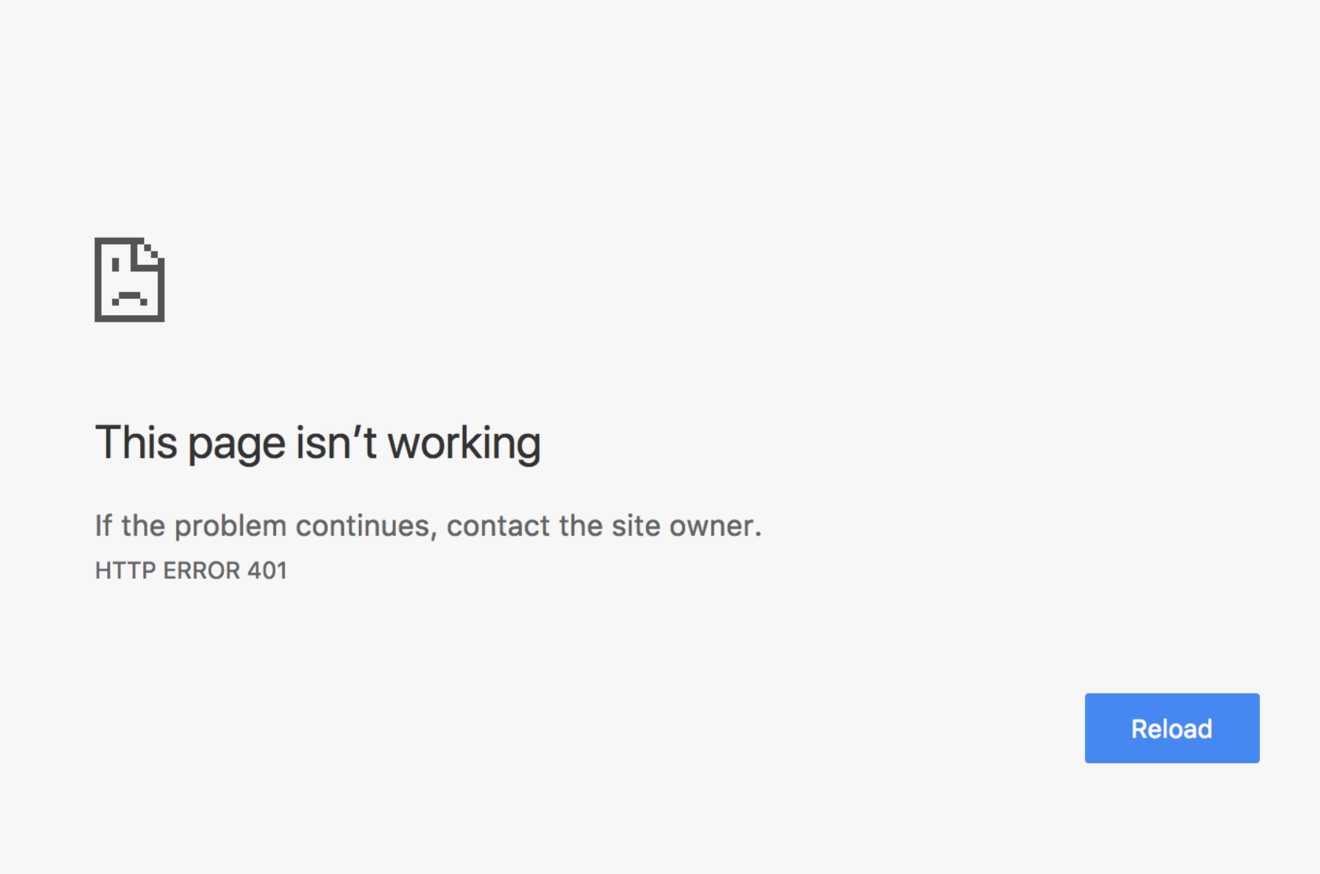
Also, don't forget to tell the application to use your new authentication set up. in the `Configure()` function add the line below just before the `app.UseMvc() line.

```
app.UseAuthentication();
```

Finally, add the `Authorize` attribute to any controller or action you want to protect.

```
[Authorize]
[Route("api/[controller]")]
public class ValuesController : Controller
{
        ...
}
```

You can now run the API and try to hit it with a browser. You'll see a screen that says the page isn't working with an HTTP error of 401.

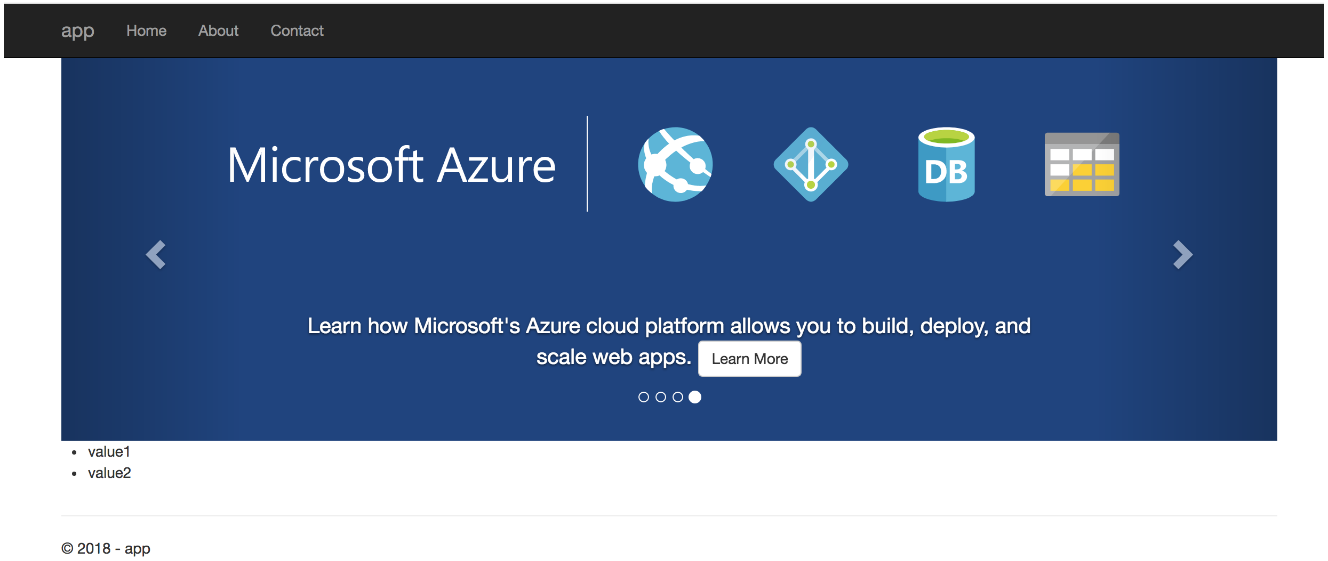


This page isn’t working

If the problem continues, contact the site owner.

HTTP ERROR 401

That’s it! If you run your app you will see the application displaying the values as before. You now have an API that is protected with access tokens provided by Okta, and only the worthy shall pass.



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- Discover how the .NET Authentication middleware has changed from Core 1.0 to Core 2.0
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