Web API testing end2end

The speaker

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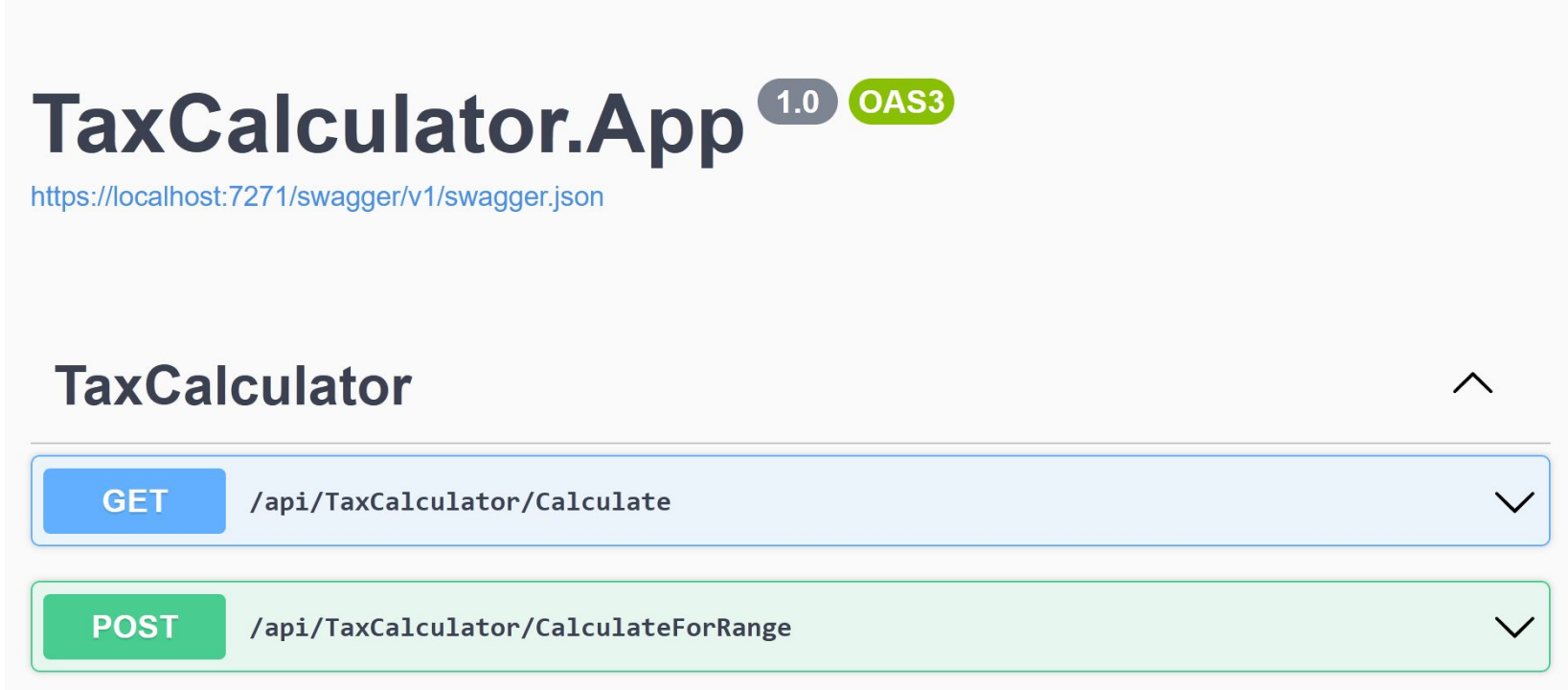
The web api


TaxCalculator.App
1.0
OAS3
https://localhost:7271/swagger/v1/swagger.json
TaxCalculator
GET
/api/TaxCalculator/Calculate
POST
/api/TaxCalculator/CalculateForRange

Testing controller instance

```
public TaxCalculatorControllerTests(ITestOutputHelper output)
{
    _output = output;
    _scope = new ServiceCollection()
        .AddScoped<ICalculator, Calculator>()
        .AddScoped<IRangeCalculator>(_ => new Mock<IRangeCalculator>().Object)//is  not
        .AddScoped<ITaxationRuleProvider, InMemoryTaxationRuleProvider>()
        .Decorate<ITaxationRuleProvider, TaxationRuleRepository>()
        .AddScoped<ITaxationRuleStorage>(_ => new Mock<ITaxationRuleStorage>().Object)//
        .AddScoped<TaxCalculatorController>()
        .BuildServiceProvider(validateScopes: true)
        .CreateScope();

    _controller = _scope.ServiceProvider.GetRequiredService<TaxCalculatorController>();
    _calculator = _scope.ServiceProvider.GetRequiredService<ICalculator>();
}
```

```
0 references | Cyclomatic complexity: 1
public void Dispose() => _scope.Dispose();
```

What is not covered so far

Reading config from appsettings.json

Routing

Serialization/deserialization issues

Request/response caching issues

Middleware and Action/Exception filters

HostedServices

Higher viscosity due to absent Mother Object

How to solve all of these issues?

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In memory integration tests

Launches Kestrel and your web app in memory, as if you debug the app

=> reads all configuration

=> consumes your app's Composition Root

=> you can send http(s) requests (check routing, serialization, caching, filters & middleware)

=> your tests depend on the web api, not the classes composition (are more robust)

And a cherry on the top - you still can customize it.

Setup steps

Rely on Microsoft.NET.Sdk.Web

Install NuGet Microsoft.AspNetCore.Mvc.Testing

For xunit use xunit.runner.json with {"shadowCopy": false}

For test class use IClassFixture<WebApplicationFactory<Program>>

requires: public partial class Program { }

When you have Startup class

Inject into your test classes IClassFixture<WebApplicationFactory<Startup>>

requires:

```
public static IHostBuilder CreateHostBuilder(string[] args) => Host
        .CreateDefaultBuilder(args)
        .ConfigureWebHostDefaults(webBuilder => webBuilder.UseStartup<Startup>());
```

How to customize?

Inherit WebApplicationFactory<T>

Override ConfigureWebHost()

Use ConfigureTestServices() to Replace() or Remove() DI-registrations.

Provide environment with UseEnvironment()

IHostedService || BackgroundService

Is run with in memory tests

Could be removed from the DI-container manually

Microsoft.AspNetCore.Mvc.Testing

test web host

Copies .deps into the test project’s bin folder

Sets the content root to the sut

Provides bootstrapping in-memory test server via WebApplicationFactory

Shadow copy

Shadow copying causes the tests to execute in a different directory than the output directory. If your tests rely on loading files relative to `Assembly.Location` and you encounter issues, you might have to disable shadow copying.

Issues: override config from tests

How to override the config from tests before `WebApplicationBuilder.Build()` is called.

```
private class MyWebApplicationFactory : WebApplicationFactory<Program>
{
    protected override IHost CreateHost(IHostBuilder builder)
    {
        builder.ConfigureHostConfiguration(config =>
        {
            config.AddInMemoryCollection(new Dictionary<string, string> { { "Result", "Override" } });
        });

        return base.CreateHost(builder);
    }

    // ...
```

Issues: cannot load appsettings.json

System.IO.InvalidDataException

Failed to load configuration from file '...\appsettings.json'.

Possible reason: malformed appsettings.json

API requires Authentication with JWT

```
public class EndpointTests : IClassFixture<WebApplicationFactory<Program>>
{
    private readonly WebApplicationFactory<Program> _factory;

    0 references | Cyclomatic complexity: 1
    public EndpointTests(WebApplicationFactory<Program> factory) ⇒ _factory = factory;

    [Fact]
    0 references | Cyclomatic complexity: 1
    public async Task Now_WithAuth_200()
    {
        var client = _factory.CreateClient();
        client.DefaultRequestHeaders.Add(name: "Authorization",              value: "Bearer e

        var rawTimeNow = await client.GetStringAsync(requestUri: "/api/Time/Now");
        var timeNow = DateTime.Parse(rawTimeNow);
        timeNow.Should().BeCloseTo(DateTime.Now, precision: TimeSpan.FromSeconds(10));
    }

    [Fact]
    0 references | Cyclomatic complexity: 1
    public async Task Now_WithoutAuth_401()
    {
        var client = _factory.CreateClient();

        var response = await client.GetAsync(requestUri: "/api/Time/Now");
        response.StatusCode.Should().Be(HttpStatusCode.Unauthorized);
    }
}
```

Summary

Using DI-container in test project is a sort of Object Mother pattern implementation

Creating end2end tests with WebApplicationFactory allows to test app part.

But requires deep knowledge/curiosity of AspNetCore framework.

Although it does not substitute end2end tests on UAT environment (e.g. via Postman)

References

Microsoft's guide for Integration tests.

Pluralsight trainings by Steve Gordon and Steve Smith.

Source code is available via the QR-code or by the link.