Developing Cross-Platform Web Apps With Blazor

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v1.0

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Module 8: JavaScript Two-Way Interop

Module Overview

Module 8: JavaScript Two-Way Interop

Section 1: JavaScript Two-Way Interop

Lesson: Overview

JavaScript Interop

- At present, there are a number of features WebAssembly does not support, therefore Blazor does not natively support them

- These are typically browser API features such as:
  - Media Capture
  - Popups
  - Web GL
  - Web Storage

- To access these browser features you need to use JavaScript as an intermediary between Blazor and the Browser

Javascript Interop Caveats

- There are a few caveats when working with JSInterop:
    - Do not invoke JSInterop during the server pre-rendering phase
    - Do not use ElementReference objects too soon
    - Avoid memory leaks by disposing of resources
    - Avoid invoking methods on disposed .NET references
    - Do not invoke .NET methods before Blazor has initialized

Module 8: JavaScript Two-Way Interop

Section 1: JavaScript Two-Way Interop

Lesson: Calling JavaScript From .NET

Calling JavaScript From .NET

- JavaScript should be added into either /Pages/_Host.cshtml in Server-side Blazor apps, or in wwwroot/index.html for Web Assembly Blazor apps

- JavaScript can then be invoked from Blazor by injecting the IJSRuntime service into the component

```
public interface IJSRuntime
{
  ValueTask<TValue> InvokeAsync<TValue>(string identifier, object[] args);
  ValueTask<TValue> InvokeAsync<TValue>(string identifier, CancellationToken
cancellationToken, object[] args);
  // Via an extension class
  void InvokeVoid(string identifier, params object[] args);
}
```

The identifier must be a JavaScript function scoped to the global window variable, but it is not necessary to include window in the identifier

So, to invoke window.alert you only need to specify alert as the identifier

Demo: Calling JavaScript From .NET

Passing Parameters

- The previous example passed the string “Hello world” as a parameter to the JavaScript alert function. It is also possible to pass complex objects to JavaScript
- Parameters are serialized to JSON and then deserialized in JavaScript before being passed by-value as an anonymous object type to the function being invoked
- All parameter types passed to JavaScript must be basic types (string / int / etc) or be JSON serializable

Demo: Passing Parameters

Accessing Javascript Return Values

- So far only the IJSRuntime extension method InvokeVoidAsync have been used

- If you want to receive the return value from a JavaScript function, you need to use the InvokeAsync<TValue> method

Demo: Accessing Javascript Return Values

Module 8: JavaScript Two-Way Interop

Section 1: JavaScript Two-Way Interop

Lesson: Calling .Net From JavaScript

Calling .Net From JavaScript

- Sometimes the .NET application code needs to be executed from JavaScript
- Blazor enables asynchronously calling methods on instances of objects, or static methods on classes

Identifying Invokable .NET Code

- Blazor does not allow JavaScript to call just any static or instance method in the .NET code

- There are conditions
  - The **method** must be **decorated with the JsInvokableAttribute**
  - The **method** must be **public**
  - The **parameters** of the method must be **Json serializable**
  - The **return type** of the method must be **Json serializable**, void, a Task, or a Task<T> where T is Json serializable
  - If specifying the identifier parameter on JsInvokable, the **value must be unique per class hierarchy** (**if an instance method**) or **unique per assembly** (**if a static method**)

Making .NET Code Invokable

- To call a method on a .NET object instance, you first need to pass a reference to the object over to JavaScript

- You cannot pass the object directly because you want to give JavaScript a reference to the object rather than a Json serialized representation of its state

- This is achieved by creating an **instance of the DotNetObjectReference** class

Demo: Calling .Net From JavaScript

Module 8: JavaScript Two-Way Interop

Section 1: JavaScript Two-Way Interop

Lesson: Lifetimes and Memory Leaks

Lifetimes And Memory Leaks

- Inspecting the browser console window for the previous example, you will see that upon navigating to another page JavaScript is still calling back the component
- What's worse, if you look in the Visual Studio output window you will see that the component is still being invoked and outputting the values passed from JavaScript, which means the component has not been garbage collected
- When creating a DotNetObjectReference, Blazor will generate a unique ID (integer for WASM, GUID for server side) and store a lookup to the object in the current JSRuntime
- This means that unless the references are correctly disposed, the app is going to leak memory

Lifetimes And Memory Leaks

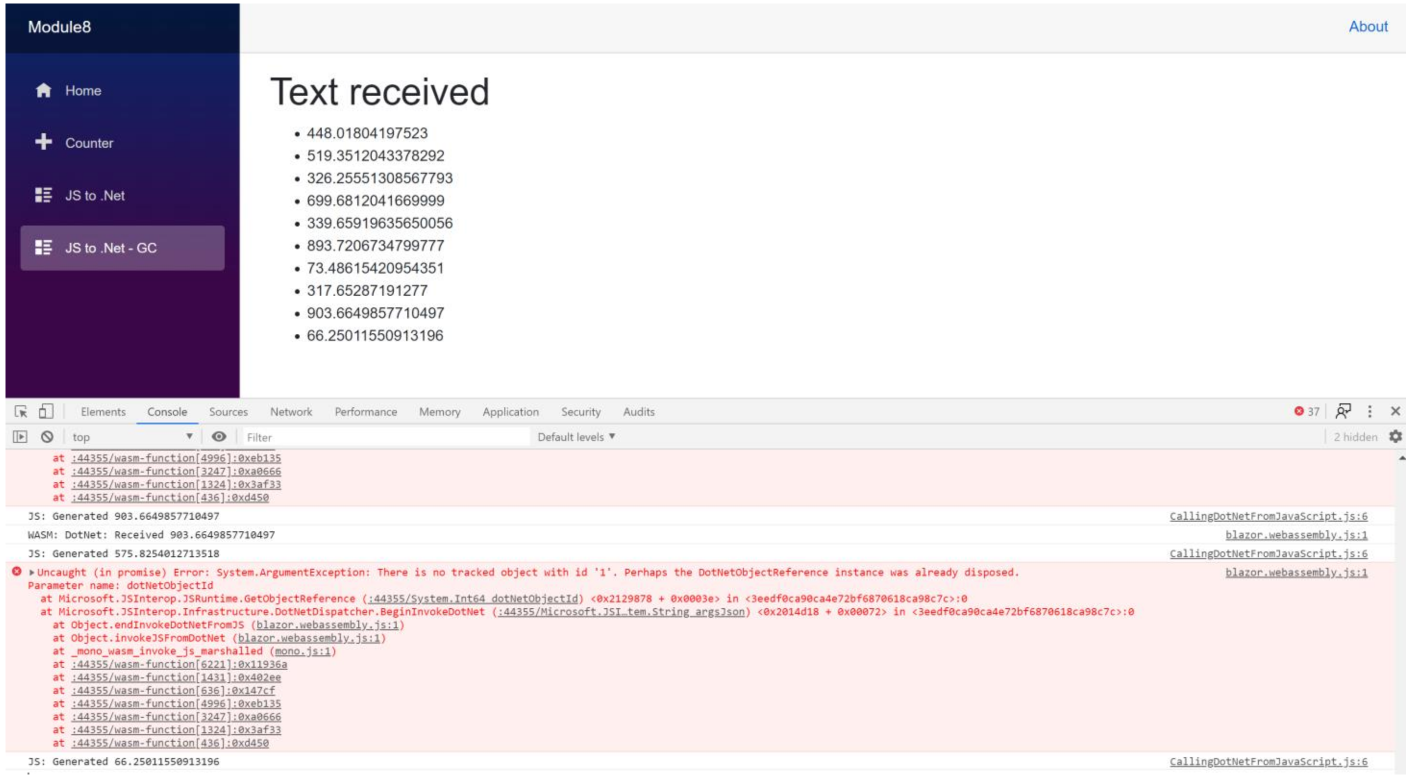
- The DotNetObjectReference class implements IDisposable. To solve the memory leak problem you need to do the following:
  - The component should keep a reference to the DotNetObjectReference
  - The component should implement IDisposable and dispose the DotNetObjectReference

Demo: Lifetimes And Memory Leaks

Invoking Methods On Disposed .NET References

- If you run the previous example the component no longer receives random numbers from JavaScript after implementing the Dispose method

- However, if you look in the browser's console window you will see an error being raised every second



Text received

- 448.01804197523
- 519.3512043378292
- 326.25551308567793
- 699.6812041669999
- 339.65919635650056
- 893.7206734799777
- 73.48615420954351
- 317.65287191277
- 903.6649857710497
- 66.25011550913196

```
    at :44355/wasm-function[4996]:0xeb135
    at :44355/wasm-function[3247]:0xa0666
    at :44355/wasm-function[1324]:0x3af33
    at :44355/wasm-function[436]:0xd450
JS: Generated 903.6649857710497                                          CallingDotNetFromJavaScript.js:6
WASM: DotNet: Received 903.6649857710497                                 blazor.webassembly.js:1
JS: Generated 575.8254012713518                                          CallingDotNetFromJavaScript.js:6
▸Uncaught (in promise) Error: System.ArgumentException: There is no tracked object with id '1'. Perhaps the DotNetObjectReference instance was already disposed.   blazor.webassembly.js:1
Parameter name: dotNetObjectId
  at Microsoft.JSInterop.JSRuntime.GetObjectReference (:44355/System.Int64 dotNetObjectId) <0x2129878 + 0x0003e> in <3eedf0ca90ca4e72bf6870618ca98c7c>:0
  at Microsoft.JSInterop.Infrastructure.DotNetDispatcher.BeginInvokeDotNet (:44355/Microsoft.JSI…tem.String argsJson) <0x2014d18 + 0x00072> in <3eedf0ca90ca4e72bf6870618ca98c7c>:0
    at Object.endInvokeDotNetFromJS (blazor.webassembly.js:1)
    at Object.invokeJSFromDotNet (blazor.webassembly.js:1)
    at _mono_wasm_invoke_js_marshalled (mono.js:1)
    at :44355/wasm-function[6221]:0x11936a
    at :44355/wasm-function[1431]:0x402ee
    at :44355/wasm-function[636]:0x147cf
    at :44355/wasm-function[4996]:0xeb135
    at :44355/wasm-function[3247]:0xa0666
    at :44355/wasm-function[1324]:0x3af33
    at :44355/wasm-function[436]:0xd450
JS: Generated 66.25011550913196                                          CallingDotNetFromJavaScript.js:6
```

Invoking Methods On Disposed .NET References

- Once the DotNetObjectReference has been disposed it is removed from the JSRuntime, allowing the component to be garbage collected

- As a result of the cleanup the reference is no longer valid and should not be used by JavaScript

- The component needs to be modified to cancel the JavaScript setInterval so it is no longer executed once the component has been destroyed

Demo: Avoid Invoking Methods On Disposed .NET References

Avoid Reverting Back To Your Comfort Zone

- Having access to JavaScript doesn’t mean you should revert to utilizing familiar libraries like jQuery
    - For example if you are trying to use bootstrap in your application its better to introduce Blazor components that abstract the JavaScript code in the background

Demo: BlazorStrap

Module Summary

- In this module, you learned about:
  - Introduction to JavaScript Two-Way Interop
  - Calling JavaScript From .Net
  - Passing Parameters To JS
  - Access JavaScript Return Values
  - Calling .Net From JavaScript
  - Lifetimes and Memory Leaks

Lab 8: JavaScript Two-Way Interop

References

- Microsoft Docs
- Blazor University

Microsoft