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# Executive Summary

In this document we shall review the async keyword in C# 5 to prepare for support within JSC. JSC shall supprt async for WebService methods, WebWorkers, timers, UI events and then plugins like Flash and Applets.

# WebMethod4

WebMethod4(string, (string) -> void) : void

Analysis

Attributes

(MethodAttributes) PrivateScope, Public, HideBySig

(MethodImplAttributes) IL

(CallingConventions) Standard, HasThis

DebuggerStepThrough

Signature Types

Declaring Module

Declaring Type

arg.0 e : string

arg.1 y : (string) -> void

loc.0 : struct <WebMethod4>d\_\_0

loc.1 <- 0x002e ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

maxstack 2

IL Code (23)

0x0000 . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x0002 . . ldarg.0 this

0x0003 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>4\_\_this : ApplicationWebService

0x0008 . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x000a . . ldarg.1 arg.0 e : string

0x000b stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.e : string

0x0010 . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x0012 . . ldarg.2 arg.1 y : (string) -> void

0x0013 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.y : (string) -> void

0x0018 . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x001a . . call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.Create() : struct AsyncVoidMethodBuilder

0x001f stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x0024 . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x0026 . . ldc.i4.m1 -1

0x0027 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x002c . ldloca.s loc.0 : struct <WebMethod4>d\_\_0

0x002e . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x0033 stloc.1 loc.1 : struct AsyncVoidMethodBuilder

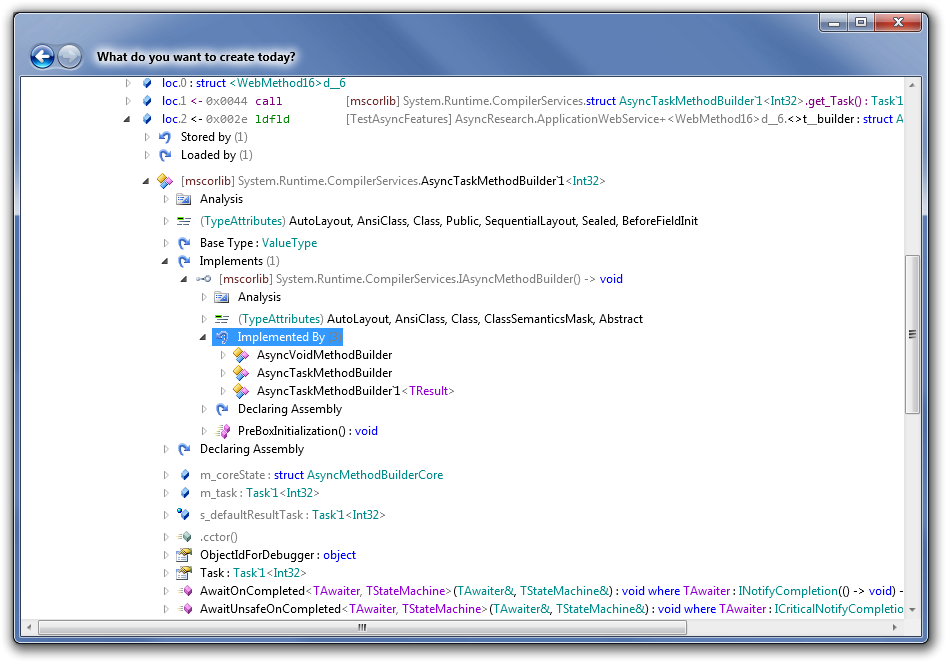
0x0034 . ldloca.s loc.1 : struct AsyncVoidMethodBuilder

0x0036 . . ldloca.s stateMachine <- loc.0 : struct <WebMethod4>d\_\_0

0x0038 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.Start(stateMachine : <WebMethod4>d\_\_0&) : void

0x003d br.s

0x003f ret



## stateMachine

<WebMethod4>d\_\_0

Analysis

(TypeAttributes) AutoLayout, AnsiClass, Class, NestedPrivate, Sealed, BeforeFieldInit

CompilerGenerated

Base Type : ValueType

Implements (1)

Declaring Assembly

Declaring Type

<>1\_\_state : Int32

<>4\_\_this : ApplicationWebService

<>t\_\_builder : struct AsyncVoidMethodBuilder

<>t\_\_stack : object

<>u\_\_$awaiter1 : struct TaskAwaiter

e : string

y : (string) -> void

MoveNext() : void

Analysis

Attributes

Base Definition

Defined As (1)

Signature Types

Declaring Module

Declaring Type

loc.0 : bool

loc.1 <- catch Exception

loc.2 <- 0x0003 ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

loc.3 : struct TaskAwaiter

loc.4 : struct TaskAwaiter

maxstack 3

IL Code (79)

.try

0x0000 . ldc.i4.1 1

0x0001 stloc.0 loc.0 : bool

0x0002 . ldarg.0 this

0x0003 . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x0008 stloc.2 loc.2 : Int32

0x0009 . ldloc.2 loc.2 : Int32

0x000a . . ldc.i4.0 0

0x000b beq.s

0x000b -> 0x000d 0x000f

0x000b -> 0x000d br.s

0x000d br.s

0x0011 br.s

0x0013 nop

0x0014 . ldc.i4.s value <- 10

0x0016 . call timespan <- [TestAsyncFeatures] AsyncResearch.Test.Seconds(value : this Int32) : struct TimeSpan

0x001b . call [TestAsyncFeatures] AsyncResearch.Test.GetAwaiter(timespan : this struct TimeSpan) : struct TaskAwaiter

0x0020 stloc.3 loc.3 : struct TaskAwaiter

0x0021 . ldloca.s loc.3 : struct TaskAwaiter

0x0023 . call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.get\_IsCompleted() : bool

0x0028 brtrue.s

0x0028 -> 0x002a 0x0069

0x0028 -> 0x002a ldarg.0

0x002a . ldarg.0 this

0x002b . . ldc.i4.0 0

0x002c stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x0031 . ldarg.0 this

0x0032 . . ldloc.3 loc.3 : struct TaskAwaiter

0x0033 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>u\_\_$awaiter1 : struct TaskAwaiter

0x0038 . ldarg.0 this

0x0039 . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x003e . . ldloca.s awaiter <- loc.3 : struct TaskAwaiter

0x0040 . . . ldarg.0 stateMachine <- this

0x0041 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.AwaitUnsafeOnCompleted(awaiter : TaskAwaiter&, stateMachine : <WebMethod4>d\_\_0&) : void

0x0046 nop

0x0047 . ldc.i4.0 0

0x0048 stloc.0 loc.0 : bool

0x0049 leave.s

.endtry

0x00c4 nop

0x00c5 ret

0x0028 0x0064 -> 0x0069 ldloca.s

0x0069 . ldloca.s loc.3 : struct TaskAwaiter

0x006b call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.GetResult() : void

0x0070 nop

0x0071 . ldloca.s loc.3 : struct TaskAwaiter

0x0073 initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x0079 . ldarg.0 this

0x007a . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.y : (string) -> void

0x007f . . ldstr str0 <- "s: "

0x0084 . . . ldarg.0 this

0x0085 . . . ldfld str1 <- [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.e : string

0x008a . . call obj <- [mscorlib] System.String.Concat(str0 : string, str1 : string) : string

0x008f callvirt [mscorlib] System.Action`1.Invoke(obj : string) : void

0x0094 nop

0x0095 leave.s

.endtry

0x00af nop

0x00b0 . ldarg.0 this

0x00b1 . . ldc.i4.s -2

0x00b3 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x00b8 . ldarg.0 this

0x00b9 . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x00be call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetResult() : void

0x00c3 nop

0x0049 0x00ad 0x00c3 -> 0x00c4

0x00c4 nop

0x00c5 ret

0x000b -> 0x000f br.s

0x000f br.s

0x004b . ldarg.0 this

0x004c . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>u\_\_$awaiter1 : struct TaskAwaiter

0x0051 stloc.3 loc.3 : struct TaskAwaiter

0x0052 . ldarg.0 this

0x0053 . . ldloca.s loc.4 : struct TaskAwaiter

0x0055 . initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x005b . . ldloc.s loc.4 : struct TaskAwaiter

0x005d stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>u\_\_$awaiter1 : struct TaskAwaiter

0x0062 . ldarg.0 this

0x0063 . . ldc.i4.m1 -1

0x0064 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x0028 0x0064 -> 0x0069

0x0069 . ldloca.s loc.3 : struct TaskAwaiter

0x006b call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.GetResult() : void

0x0070 nop

0x0071 . ldloca.s loc.3 : struct TaskAwaiter

0x0073 initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x0079 . ldarg.0 this

0x007a . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.y : (string) -> void

0x007f . . ldstr str0 <- "s: "

0x0084 . . . ldarg.0 this

0x0085 . . . ldfld str1 <- [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.e : string

0x008a . . call obj <- [mscorlib] System.String.Concat(str0 : string, str1 : string) : string

0x008f callvirt [mscorlib] System.Action`1.Invoke(obj : string) : void

0x0094 nop

0x0095 leave.s

.endtry

0x00af nop

0x00b0 . ldarg.0 this

0x00b1 . . ldc.i4.s -2

0x00b3 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x00b8 . ldarg.0 this

0x00b9 . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x00be call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetResult() : void

0x00c3 nop

0x0049 0x00ad 0x00c3 -> 0x00c4

0x00c4 nop

0x00c5 ret

.catch Exception

[mscorlib] System.Exception

0x0097 stloc.1 loc.1 : Exception

0x0098 . ldarg.0 this

0x0099 . . ldc.i4.s -2

0x009b stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>1\_\_state : Int32

0x00a0 . ldarg.0 this

0x00a1 . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x00a6 . . ldloc.1 exception <- loc.1 : Exception

0x00a7 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetException(exception : Exception) : void

0x00ac nop

0x00ad leave.s

.endtry

0x00c4 nop

0x00c5 ret

SetStateMachine(IAsyncStateMachine) : void

Analysis

Attributes

Base Definition

Defined As (1)

Signature Types

Declaring Module

Declaring Type

arg.0 param0 : IAsyncStateMachine

maxstack 8 (used 2)

IL Code (5)

0x0000 . ldarg.0 this

0x0001 . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod4>d\_\_0.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x0006 . . ldarg.1 stateMachine <- arg.0 param0 : IAsyncStateMachine

0x0007 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetStateMachine(stateMachine : IAsyncStateMachine) : void

0x000c ret

# WebMethod16

## C#

public async Task<int> WebMethod16(string e, Action<string> y)

{

// see also: http://www.i-programmer.info/programming/c/1514-async-await-and-the-ui-problem.html

await 10.Seconds();

// Send it back to the caller.

y("s: " + e);

// we have our anwser!

return 42;

}

## IL

async WebMethod16(string, (string) -> void) : Task`1<Int32>

<WebMethod16>d\_\_6

Analysis

(TypeAttributes) AutoLayout, AnsiClass, Class, NestedPrivate, Sealed, BeforeFieldInit

CompilerGenerated

Base Type : ValueType

Implements (1)

Declaring Assembly

Declaring Type

<>1\_\_state : Int32

<>4\_\_this : ApplicationWebService

<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

<>t\_\_stack : object

<>u\_\_$awaiter7 : struct TaskAwaiter

e : string

y : (string) -> void

MoveNext() : void

SetStateMachine(IAsyncStateMachine) : void

Analysis

Attributes

Signature Types

Declaring Module

Declaring Type

arg.0 e : string

arg.1 y : (string) -> void

loc.0 : struct <WebMethod16>d\_\_6

loc.1 <- 0x0044 call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.get\_Task() : Task`1<Int32>

loc.2 <- 0x002e ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

maxstack 2

IL Code (28)

0x0000 . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x0002 . . ldarg.0 this

0x0003 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>4\_\_this : ApplicationWebService

0x0008 . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x000a . . ldarg.1 arg.0 e : string

0x000b stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.e : string

0x0010 . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x0012 . . ldarg.2 arg.1 y : (string) -> void

0x0013 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.y : (string) -> void

0x0018 . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x001a . . call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.async Create() : struct AsyncTaskMethodBuilder`1<Int32>

0x001f stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x0024 . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x0026 . . ldc.i4.m1 -1

0x0027 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x002c . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x002e . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x0033 stloc.2 loc.2 : struct AsyncTaskMethodBuilder`1<Int32>

0x0034 . ldloca.s loc.2 : struct AsyncTaskMethodBuilder`1<Int32>

0x0036 . . ldloca.s stateMachine <- loc.0 : struct <WebMethod16>d\_\_6

0x0038 call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.Start(stateMachine : <WebMethod16>d\_\_6&) : void

0x003d . ldloca.s loc.0 : struct <WebMethod16>d\_\_6

0x003f . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x0044 . call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.get\_Task() : Task`1<Int32>

0x0049 stloc.1 loc.1 : Task`1<Int32>

0x004a br.s

0x004c . ldloc.1 loc.1 : Task`1<Int32>

0x004d ret

### MoveNext

MoveNext() : void

Analysis

Attributes

Base Definition

Defined As (1)

Signature Types

Declaring Module

Declaring Type

loc.0 : bool

Stored by (2)

Loaded by (0)

[mscorlib] System.Boolean

loc.1 <- 0x0098 ldc.i4.s 42

Stored by (1)

Loaded by (1)

[mscorlib] System.Int32

loc.2 <- catch Exception

Stored by (1)

Loaded by (1)

[mscorlib] System.Exception

loc.3 <- 0x0003 ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

Stored by (1)

Loaded by (1)

[mscorlib] System.Int32

loc.4 : struct TaskAwaiter

Stored by (2)

Loaded by (5)

[mscorlib] System.Runtime.CompilerServices.TaskAwaiter

loc.5 : struct TaskAwaiter

Stored by (0)

Loaded by (2)

[mscorlib] System.Runtime.CompilerServices.TaskAwaiter

maxstack 3

IL Code (82)

.try

0x0000 . ldc.i4.1 1

0x0001 stloc.0 loc.0 : bool

0x0002 . ldarg.0 this

0x0003 . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x0008 stloc.3 loc.3 : Int32

0x0009 . ldloc.3 loc.3 : Int32

0x000a . . ldc.i4.0 0

0x000b beq.s

0x000b -> 0x000d 0x000f

0x000b -> 0x000d br.s

0x000d br.s

0x0011 br.s

0x0013 nop

0x0014 . ldc.i4.s value <- 10

0x0016 . call timespan <- [TestAsyncFeatures] AsyncResearch.Test.Seconds(value : this Int32) : struct TimeSpan

0x001b . call [TestAsyncFeatures] AsyncResearch.Test.GetAwaiter(timespan : this struct TimeSpan) : struct TaskAwaiter

0x0020 stloc.s loc.4 : struct TaskAwaiter

0x0022 . ldloca.s loc.4 : struct TaskAwaiter

0x0024 . call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.get\_IsCompleted() : bool

0x0029 brtrue.s

0x0029 -> 0x002b 0x006c

0x0029 -> 0x002b ldarg.0

0x002b . ldarg.0 this

0x002c . . ldc.i4.0 0

0x002d stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x0032 . ldarg.0 this

0x0033 . . ldloc.s loc.4 : struct TaskAwaiter

0x0035 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>u\_\_$awaiter7 : struct TaskAwaiter

0x003a . ldarg.0 this

0x003b . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x0040 . . ldloca.s awaiter <- loc.4 : struct TaskAwaiter

0x0042 . . . ldarg.0 stateMachine <- this

0x0043 call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.AwaitUnsafeOnCompleted(awaiter : TaskAwaiter&, stateMachine : <WebMethod16>d\_\_6&) : void

0x0048 nop

0x0049 . ldc.i4.0 0

0x004a stloc.0 loc.0 : bool

0x004b leave.s

.endtry

0x00cb nop

0x00cc ret

0x0029 0x0067 -> 0x006c ldloca.s

0x006c . ldloca.s loc.4 : struct TaskAwaiter

0x006e call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.GetResult() : void

0x0073 nop

0x0074 . ldloca.s loc.4 : struct TaskAwaiter

0x0076 initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x007c . ldarg.0 this

0x007d . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.y : (string) -> void

0x0082 . . ldstr str0 <- "s: "

0x0087 . . . ldarg.0 this

0x0088 . . . ldfld str1 <- [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.e : string

0x008d . . call obj <- [mscorlib] System.String.Concat(str0 : string, str1 : string) : string

0x0092 callvirt [mscorlib] System.Action`1.Invoke(obj : string) : void

0x0097 nop

0x0098 . ldc.i4.s 42

0x009a stloc.1 loc.1 : Int32

0x009b leave.s

.endtry

0x00b5 nop

0x00b6 . ldarg.0 this

0x00b7 . . ldc.i4.s -2

0x00b9 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x00be . ldarg.0 this

0x00bf . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x00c4 . . ldloc.1 result <- loc.1 : Int32

0x00c5 call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.SetResult(result : Int32) : void

0x00ca nop

0x004b 0x00b3 0x00ca -> 0x00cb

0x00cb nop

0x00cc ret

0x000b -> 0x000f br.s

0x000f br.s

0x004d . ldarg.0 this

0x004e . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>u\_\_$awaiter7 : struct TaskAwaiter

0x0053 stloc.s loc.4 : struct TaskAwaiter

0x0055 . ldarg.0 this

0x0056 . . ldloca.s loc.5 : struct TaskAwaiter

0x0058 . initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x005e . . ldloc.s loc.5 : struct TaskAwaiter

0x0060 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>u\_\_$awaiter7 : struct TaskAwaiter

0x0065 . ldarg.0 this

0x0066 . . ldc.i4.m1 -1

0x0067 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x0029 0x0067 -> 0x006c

0x006c . ldloca.s loc.4 : struct TaskAwaiter

0x006e call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter.GetResult() : void

0x0073 nop

0x0074 . ldloca.s loc.4 : struct TaskAwaiter

0x0076 initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter

0x007c . ldarg.0 this

0x007d . ldfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.y : (string) -> void

0x0082 . . ldstr str0 <- "s: "

0x0087 . . . ldarg.0 this

0x0088 . . . ldfld str1 <- [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.e : string

0x008d . . call obj <- [mscorlib] System.String.Concat(str0 : string, str1 : string) : string

0x0092 callvirt [mscorlib] System.Action`1.Invoke(obj : string) : void

0x0097 nop

0x0098 . ldc.i4.s 42

0x009a stloc.1 loc.1 : Int32

0x009b leave.s

.endtry

0x00b5 nop

0x00b6 . ldarg.0 this

0x00b7 . . ldc.i4.s -2

0x00b9 stfld [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>1\_\_state : Int32

0x00be . ldarg.0 this

0x00bf . ldflda [TestAsyncFeatures] AsyncResearch.ApplicationWebService+<WebMethod16>d\_\_6.<>t\_\_builder : struct AsyncTaskMethodBuilder`1<Int32>

0x00c4 . . ldloc.1 result <- loc.1 : Int32

0x00c5 call [mscorlib] System.Runtime.CompilerServices.struct AsyncTaskMethodBuilder`1<Int32>.SetResult(result : Int32) : void

0x00ca nop

0x004b 0x00b3 0x00ca -> 0x00cb

0x00cb nop

0x00cc ret

.catch Exception

# Client

## C#

async private void button4\_Click(object sender, EventArgs e)

{

var a = new ApplicationWebService();

var i = await a.WebMethod16(button3.Text, x => button3.Text = x);

// see! i is int!

MessageBox.Show(i + "\n\n All done, Sir!");

}

## IL of the form

Form1 : Form

Analysis

(TypeAttributes) AutoLayout, AnsiClass, Class, Public, BeforeFieldInit

Base Type : Form

Implements (21)

Declaring Assembly

button1 : Button

button2 : Button

button3 : Button

button4 : Button

c : Int32

components : IContainer

timer1 : Timer

.ctor()

button1\_Click(object, EventArgs {Empty}) : void

button2\_Click(object, EventArgs {Empty}) : void

async button3\_Click(object, EventArgs {Empty}) : void

async button4\_Click(object, EventArgs {Empty}) : void

Dispose(bool) : void

InitializeComponent() : void

timer1\_Tick(object, EventArgs {Empty}) : void

## IL of the click handler

async button4\_Click(object, EventArgs {Empty}) : void

<button4\_Click>d\_\_8

Analysis

(TypeAttributes) AutoLayout, AnsiClass, Class, NestedPrivate, Sealed, BeforeFieldInit

CompilerGenerated

Base Type : ValueType

Implements (1)

Declaring Assembly

Declaring Type

<>1\_\_state : Int32

<>4\_\_this : Form1

<>t\_\_builder : struct AsyncVoidMethodBuilder

<>t\_\_stack : object

<>u\_\_$awaiterb : struct TaskAwaiter`1<Int32>

<a>5\_\_9 : ApplicationWebService

<i>5\_\_a : Int32

e : EventArgs {Empty}

sender : object

MoveNext() : void

SetStateMachine(IAsyncStateMachine) : void

<button4\_Click>b\_\_7(string) : void

Analysis

Attributes

Signature Types

Declaring Module

Declaring Type

arg.0 sender : object

arg.1 e : EventArgs {Empty}

loc.0 : struct <button4\_Click>d\_\_8

loc.1 <- 0x002e ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

maxstack 2

IL Code (23)

0x0000 . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x0002 . . ldarg.0 this

0x0003 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>4\_\_this : Form1

0x0008 . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x000a . . ldarg.1 arg.0 sender : object

0x000b stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.sender : object

0x0010 . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x0012 . . ldarg.2 arg.1 e : EventArgs {Empty}

0x0013 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.e : EventArgs {Empty}

0x0018 . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x001a . . call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.Create() : struct AsyncVoidMethodBuilder

0x001f stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x0024 . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x0026 . . ldc.i4.m1 -1

0x0027 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x002c . ldloca.s loc.0 : struct <button4\_Click>d\_\_8

0x002e . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x0033 stloc.1 loc.1 : struct AsyncVoidMethodBuilder

0x0034 . ldloca.s loc.1 : struct AsyncVoidMethodBuilder

0x0036 . . ldloca.s stateMachine <- loc.0 : struct <button4\_Click>d\_\_8

0x0038 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.Start(stateMachine : <button4\_Click>d\_\_8&) : void

0x003d br.s

0x003f ret

## IL of the stateMachine MoveNext

MoveNext() : void

Analysis

Attributes

Base Definition

Defined As (1)

Signature Types

Declaring Module

Declaring Type

loc.0 : bool

loc.1 <- catch Exception

loc.2 <- 0x0003 ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

loc.3 : struct TaskAwaiter`1<Int32>

loc.4 : struct TaskAwaiter`1<Int32>

loc.5 <- 0x009e call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>.GetResult() : Int32

maxstack 4

IL Code (93)

.try

0x0000 . ldc.i4.1 1

0x0001 stloc.0 loc.0 : bool

0x0002 . ldarg.0 this

0x0003 . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x0008 stloc.2 loc.2 : Int32

0x0009 . ldloc.2 loc.2 : Int32

0x000a . . ldc.i4.0 0

0x000b beq.s

0x000b -> 0x000d 0x000f

0x000b -> 0x000d br.s

0x000d br.s

0x0011 br.s

0x0013 nop

0x0014 . ldarg.0 this

0x0015 . . newobj [TestAsyncFeatures] AsyncResearch.ApplicationWebService..ctor()

0x001a stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<a>5\_\_9 : ApplicationWebService

0x001f . ldarg.0 this

0x0020 . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<a>5\_\_9 : ApplicationWebService

0x0025 . . ldarg.0 this

0x0026 . . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>4\_\_this : Form1

0x002b . . ldfld [ClientSideForms] ClientSideForms.Form1.button3 : Button

0x0030 . . callvirt e <- [System.Windows.Forms] System.Windows.Forms.Control.get\_Text() : string

0x0035 . . . ldarg.0 this

0x0036 . . . ldfld object <- [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>4\_\_this : Form1

0x003b . . . . ldftn method <- [ClientSideForms] ClientSideForms.Form1.<button4\_Click>b\_\_7(x : string) : void

0x0041 . . . newobj y <- [mscorlib] System.Action`1..ctor(object : object, method : IntPtr)

0x0046 . callvirt [TestAsyncFeatures] AsyncResearch.ApplicationWebService.async WebMethod16(e : string, y : (string) -> void) : Task`1<Int32>

0x004b . callvirt [mscorlib] System.Threading.Tasks.Task`1<Int32>.GetAwaiter() : struct TaskAwaiter`1<Int32>

0x0050 stloc.3 loc.3 : struct TaskAwaiter`1<Int32>

0x0051 . ldloca.s loc.3 : struct TaskAwaiter`1<Int32>

0x0053 . call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>.get\_IsCompleted() : bool

0x0058 brtrue.s

0x0058 -> 0x005a 0x009c

0x0058 -> 0x005a ldarg.0

0x005a . ldarg.0 this

0x005b . . ldc.i4.0 0

0x005c stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x0061 . ldarg.0 this

0x0062 . . ldloc.3 loc.3 : struct TaskAwaiter`1<Int32>

0x0063 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>u\_\_$awaiterb : struct TaskAwaiter`1<Int32>

0x0068 . ldarg.0 this

0x0069 . ldflda [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x006e . . ldloca.s awaiter <- loc.3 : struct TaskAwaiter`1<Int32>

0x0070 . . . ldarg.0 stateMachine <- this

0x0071 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.AwaitUnsafeOnCompleted(awaiter : TaskAwaiter`1&, stateMachine : <button4\_Click>d\_\_8&) : void

0x0076 nop

0x0077 . ldc.i4.0 0

0x0078 stloc.0 loc.0 : bool

0x0079 leave

.endtry

0x00ff nop

0x0100 ret

0x0058 0x0097 -> 0x009c ldloca.s

0x009c . ldloca.s loc.3 : struct TaskAwaiter`1<Int32>

0x009e . call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>.GetResult() : Int32

0x00a3 . . ldloca.s loc.3 : struct TaskAwaiter`1<Int32>

0x00a5 . initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>

0x00ab stloc.s loc.5 : Int32

0x00ad . ldarg.0 this

0x00ae . . ldloc.s loc.5 : Int32

0x00b0 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<i>5\_\_a : Int32

0x00b5 . ldarg.0 this

0x00b6 . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<i>5\_\_a : Int32

0x00bb . box arg0 <- [mscorlib] System.Int32

0x00c0 . . ldstr arg1 <- "\n\n All done, Sir!"

0x00c5 . call text <- [mscorlib] System.String.Concat(arg0 : object, arg1 : object) : string

0x00ca . call [System.Windows.Forms] System.Windows.Forms.MessageBox.Show(text : string) : DialogResult : Int32

0x00cf pop

0x00d0 leave.s

.endtry

0x00ea nop

0x00eb . ldarg.0 this

0x00ec . . ldc.i4.s -2

0x00ee stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x00f3 . ldarg.0 this

0x00f4 . ldflda [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x00f9 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetResult() : void

0x00fe nop

0x0079 0x00e8 0x00fe -> 0x00ff

0x00ff nop

0x0100 ret

0x000b -> 0x000f br.s

0x000f br.s

0x007e . ldarg.0 this

0x007f . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>u\_\_$awaiterb : struct TaskAwaiter`1<Int32>

0x0084 stloc.3 loc.3 : struct TaskAwaiter`1<Int32>

0x0085 . ldarg.0 this

0x0086 . . ldloca.s loc.4 : struct TaskAwaiter`1<Int32>

0x0088 . initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>

0x008e . . ldloc.s loc.4 : struct TaskAwaiter`1<Int32>

0x0090 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>u\_\_$awaiterb : struct TaskAwaiter`1<Int32>

0x0095 . ldarg.0 this

0x0096 . . ldc.i4.m1 -1

0x0097 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x0058 0x0097 -> 0x009c

0x009c . ldloca.s loc.3 : struct TaskAwaiter`1<Int32>

0x009e . call [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>.GetResult() : Int32

0x00a3 . . ldloca.s loc.3 : struct TaskAwaiter`1<Int32>

0x00a5 . initobj [mscorlib] System.Runtime.CompilerServices.struct TaskAwaiter`1<Int32>

0x00ab stloc.s loc.5 : Int32

0x00ad . ldarg.0 this

0x00ae . . ldloc.s loc.5 : Int32

0x00b0 stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<i>5\_\_a : Int32

0x00b5 . ldarg.0 this

0x00b6 . ldfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<i>5\_\_a : Int32

0x00bb . box arg0 <- [mscorlib] System.Int32

0x00c0 . . ldstr arg1 <- "\n\n All done, Sir!"

0x00c5 . call text <- [mscorlib] System.String.Concat(arg0 : object, arg1 : object) : string

0x00ca . call [System.Windows.Forms] System.Windows.Forms.MessageBox.Show(text : string) : DialogResult : Int32

0x00cf pop

0x00d0 leave.s

.endtry

0x00ea nop

0x00eb . ldarg.0 this

0x00ec . . ldc.i4.s -2

0x00ee stfld [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>1\_\_state : Int32

0x00f3 . ldarg.0 this

0x00f4 . ldflda [ClientSideForms] ClientSideForms.Form1+<button4\_Click>d\_\_8.<>t\_\_builder : struct AsyncVoidMethodBuilder

0x00f9 call [mscorlib] System.Runtime.CompilerServices.struct AsyncVoidMethodBuilder.SetResult() : void

0x00fe nop

0x0079 0x00e8 0x00fe -> 0x00ff

0x00ff nop

0x0100 ret

.catch Exception

# References to BCL

The following BCL API need to be defined in ScriptCoreLib for JavaScript.

[mscorlib] System.Runtime.CompilerServices.AsyncTaskMethodBuilder (3)

async Create() : struct AsyncTaskMethodBuilder (1)

get\_Task() : Task (1)

Start(<WebMethod8>d\_\_3&) : void (1)

[mscorlib] System.Runtime.CompilerServices.AsyncTaskMethodBuilder`1<TResult> (3)

async Create() : struct AsyncTaskMethodBuilder`1<Int32> (1)

get\_Task() : Task`1<Int32> (1)

Start(<WebMethod16>d\_\_6&) : void (1)

[mscorlib] System.Runtime.CompilerServices.AsyncVoidMethodBuilder (2)

Create() : struct AsyncVoidMethodBuilder (1)

Start(<button4\_Click>d\_\_8&) : void (1)

Start(<WebMethod4>d\_\_0&) : void (1)

AwaitUnsafeOnCompleted(TaskAwaiter`1&, <button4\_Click>d\_\_8&) : void (1)

SetException(Exception) : void (1)

SetResult() : void (1)

SetStateMachine(IAsyncStateMachine) : void (1)

[mscorlib] System.Runtime.CompilerServices.TaskAwaiter`1<TResult> (2)

get\_IsCompleted() : bool (1)

GetResult() : Int32 (1)

[mscorlib] System.Threading.Tasks.Task`1<TResult> : Task (1)

GetAwaiter() : struct TaskAwaiter`1<Int32> (1)