

Enterprise Development with NServiceBus

This is the workbook for the Enterprise Development with NServiceBus course. In it you will find all the exercises for the course as well as the solutions for them.

NServiceBus Basics

Using NuGet you open up a Visual Studio(make sure to run as Administrator) and install the NServiceBus package (`Install-Package NServiceBus.Host`).

Regardless of how you get access to the binaries NServiceBus will make sure that all of the necessary operating system services (MSMQ and DTC) are running and that RavenDB is installed properly.

[Using PowerShell : <http://particular.net/articles/managing-nservicebus-using-powershell>]

For all of the exercises in this workbook, .net 4.0 will be used since NServiceBus 4 is a 4.0 only framework.

Exercise 1. Hello World

1. Create a new Visual Studio solution containing a class library project - call it HelloWorld.
2.
 - Install from downloaded binaries:
 - i. Go to "add references" and navigate to the binaries directory. Select the assemblies NServiceBus.Core.dll, NServiceBus.dll, NServiceBus.Host.exe as shown below:

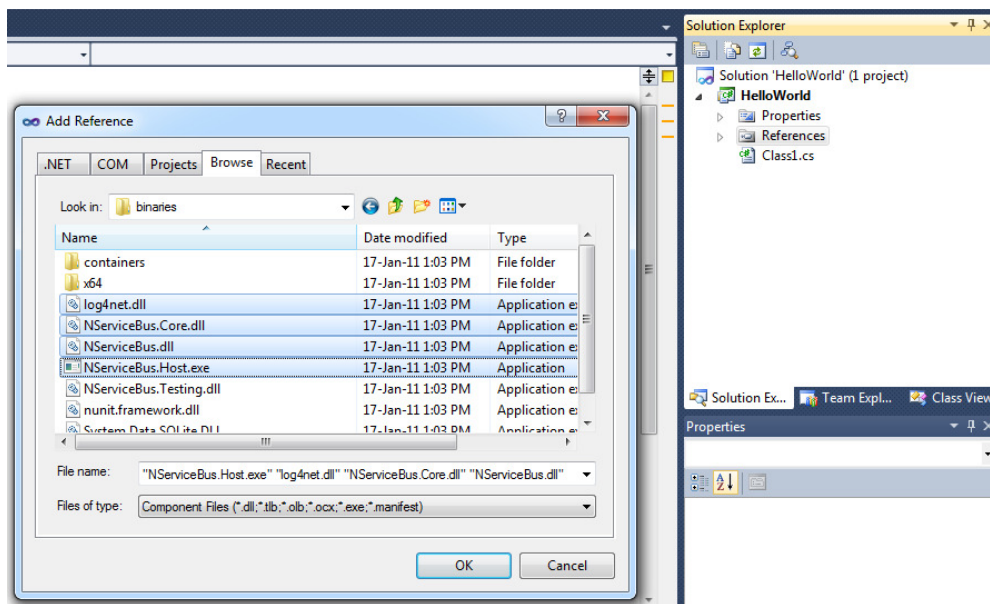


Figure 1 Add necessary references to the Visual Studio project.

- ii. Build the project, then go to the properties of the Visual Studio project, click the Debug tab, and select the "Start external program" radio button. From there, click the "..." button to browse to the "bin\Debug" directory of your project, and then double-click on NServiceBus.Host.exe as shown below:

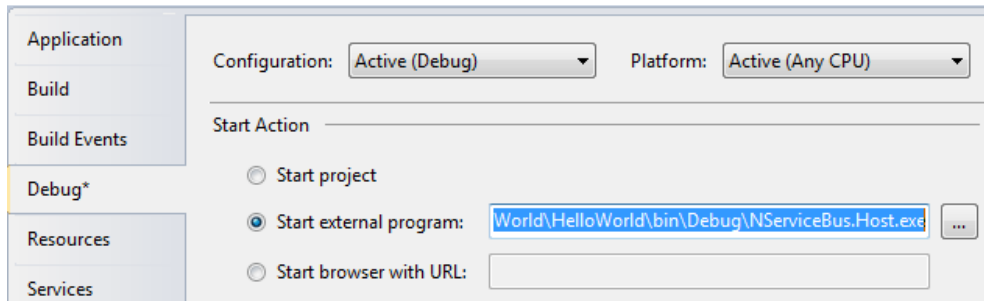


Figure 2 Set NServiceBus.Host.exe to be the external program to run when debugging

- iii. The next step is to open the Class1.cs file, rename it to EndpointConfig, and make Class1 inherit from the interface `IConfigureThisEndpoint`
 - OR Install NServiceBus.Host via NuGet and follow the prompts to ensure the infrastructure is correctly configured
3. Now also make EndpointConfig inherit from `IWantToRunWhenBusStartsAndStops`, adding an output to the console saying "hello world" as shown here:

```
using NServiceBus;
using NServiceBus.Logging;

namespace HelloWorld
{
    public class EndpointConfig: IConfigureThisEndpoint, AsA_Client,
    IWantToRunWhenBusStartsAndStops
    {
        public void Start()
        {
            LogManager.GetLogger("EndpointConfig").Info("Hello World!");
        }

        public void Stop()
        {
        }
    }
}
```

Comment [UD1]: IConfigureThisEndpoint is a marker interface and only one class in the process should implement it (or an exception is thrown).

Comment [SF2]: Talk about having multiple class (in multiple DLLs) implementing IWantToRunWhenBusStartsAndStops. The assembly scanning of NServiceBus will automatically pick them up. Useful for decoupling the startup logic of a system. Also mention that you usually want to have separate classes implement IConfigureThisEndpoint and IWantToRunWhenBusStartsAndStops.

4. Add a app.config file to your project and add the following:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <configSections>
    <section name="MessageForwardingInCaseOfFaultConfig"
type="NServiceBus.Config.MessageForwardingInCaseOfFaultConfig, NServiceBus.Core" />
```

```
<section name="UnicastBusConfig" type="NServiceBus.Config.UnicastBusConfig,
NServiceBus.Core" />
<section name="AuditConfig" type="NServiceBus.Config.AuditConfig, NServiceBus.Core" />
</configSections>
<MessageForwardingInCaseOfFaultConfig ErrorQueue="error" />
<UnicastBusConfig>
  <MessageEndpointMappings />
</UnicastBusConfig>
<AuditConfig QueueName="audit" />
</configuration>
```

5. Compile and run. You should see "Hello World!" on the console application.
6. Try using the NuGet package instead by creating a new Project and install the NServiceBus.Host package.
 - Notice how it sets everything up for you automatically so that you can hit F5 right after the install completes.

Exercise 2. Logging

1. Add the following configuration in addition the MessageForwardingInCaseOfFaultConfig section in your app.config, rebuild and run:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <configSections>
    . . .
    <section name="Logging" type="NServiceBus.Config.Logging, NServiceBus.Core" />
    . . .
  </configSections>

  <Logging Threshold="DEBUG" />
  <MessageForwarding . . .
</configuration>
```

Comment [UD3]: Mention that the default logging level is INFO. Also that there is a way to influence the level of logging without touching config or code - profiles, but that those will be covered later.

Now you should see a lot more log entries on the console. This configuration model controls logging for the whole endpoint. For finer grained control, standard log4net configuration can be used.

For example, to divert all log entries to a logfile you need to

2. Tell NServiceBus to get the log settings from app.config by implementing `IWantCustomLogging` on your endpoint config.

```
public class EndpointConfig : IConfigureThisEndpoint, AsA_Client, IWantCustomLogging,
IWantToRunWhenBusStartsAndStops
{
    public void Start()
    {
        LogManager.GetLogger("EndpointConfig").Info("Hello World!");
    }

    public void Stop()
    {
    }

    public void Init()
    {
        SetLoggingLibrary.Log4Net(() => log4net.Config.XmlConfigurator.Configure());
    }
}
```

Comment [SF4]: Talk about having multiple class (in multiple DLLs) implementing `IWantToRunWhenBusStartsAndStops`. The assembly scanning of NServiceBus will automatically pick them up. Useful for decoupling the startup logic of a system. Also mention that you usually want to have separate classes implement `IConfigureThisEndpoint` and `IWantToRunWhenBusStartsAndStops`.

Install Log4Net version 1.2.10 using Nuget:

```
Install-Package Log4Net -Version 1.2.10
```

3. set your configuration as follows:

```
<?xml version="1.0" encoding="utf-8" ?>
```

```

<configuration>
  <configSections>
    <section name="log4net"
type="log4net.Config.Log4NetConfigurationSectionHandler,log4net"/>
    . . .
  </configSections>

  <log4net debug="false">
    <appender name="FileAppender" type="log4net.Appender.FileAppender">
      <file value="myLog.txt"/>
      <appendToFile value="true"/>
      <layout type="log4net.Layout.PatternLayout">
        <param name="ConversionPattern" value="%d [%t] %-5p %c [%x] &lt;%X{auth}&gt; -
%m%n"/>
      </layout>
    </appender>
    <root>
      <level value="DEBUG"/>
      <appender-ref ref="FileAppender"/>
    </root>
  </log4net>
  . . .
</configuration>

```

Now return to the original configuration.

Exercise 3. One-way Messaging

1. Add a new project, call it Messages
2. Add a new class called RequestMessage
3. Add a string property to the Request class called SaySomething so the Request class looks like this:

```
namespace Messages
{
    public class RequestMessage
    {
        public string SaySomething { get; set; }
    }
}
```

Comment [UD5]: Talk about the ability to have messages without a default constructor, and get-only properties. Can be a useful technique for putting some validation logic in the message itself to decrease the likelihood of a sender sending an invalid message.

4. Add the new Messages project as a reference to the HelloWorld project
5. Add a new class to the HelloWorld project called MessageSender as follows:

```
namespace HelloWorld
{
    using NServiceBus.Logging;
    using Messages;
    using NServiceBus;

    class MessageSender : IWantToRunWhenBusStartsAndStops
    {
        public IBus Bus { get; set; }

        public void Start()
        {
            var message = new RequestMessage { SaySomething = "Say something" };

            Bus.Send("helloWorldServer", message);

            LogManager.GetLogger("MessageSender").Info("Sent message.");
        }

        public void Stop()
        {
        }
    }
}
```

Comment [UD6]: Talk about the kinds of properties supported, including dictionaries (which aren't supported by standard XML serialization in .net).

6. Next, change EndpointConfig to the following:

```
public class EndpointConfig : IConfigureThisEndpoint, AsA_Client { }
```

Comment [UD7]: Describe the AsA_* interfaces as shortcuts for specifying NServiceBus behaviors, one of them being the use of XML serialization. Don't go into too much detail as the behaviors will be shown later.

7. Configure now the message convention in the `EndpointConfig`. Therefore add the `IWantCustomInitialization` interface
8. Add a convention that specifies all classes ending with Message in the Message Assembly as messages.

The `EndpointConfig` should look now like this:

```
public class EndpointConfig : IConfigureThisEndpoint, AsA_Client, IWantCustomInitialization
{
    public void Init()
    {
        Configure.With()
            .DefiningMessagesAs(t => t.Assembly == typeof(RequestMessage).Assembly &&
                t.Name.EndsWith("Message"));
    }
}
```

9. Build and run.
10. You should see an error telling you that the "destination queue 'helloWorldServer' could not be found."
11. Stop debugging
12. Create the queue called "helloWorldServer" by going to Server Explorer in Visual Studio, navigate through the local machine to Message Queues, and from there to Private Queues. Right-click on Private Queues and select Create Queue... and enter "helloWorldServer" checking the box "Make queue transactional".
13. Build and run.
14. Navigate to the "helloWorldServer" queue in Server Explorer in Visual Studio, and open the "Queue messages" node. That's the message.

15. With the message selected, go to the Properties pane in Visual Studio, select BodyStream property, and click on the "..." button. Scrolling to the right should show the following:

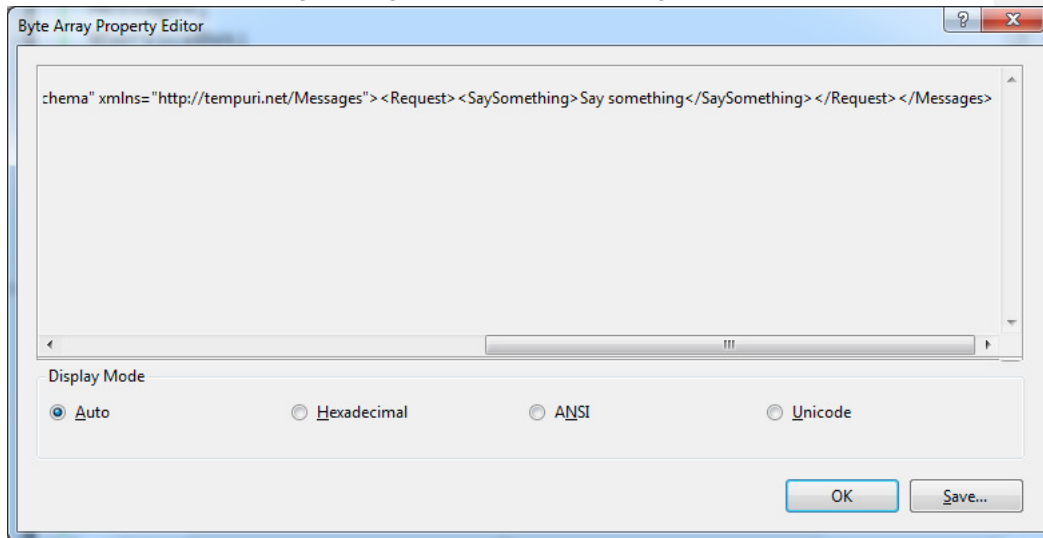


Figure 3 XML contents of the MSMQ message

Notice the namespace is `http://tempuri.net/Messages`. We probably don't want our system to go into production with that namespace so let's change it. But first, purge the message from the queue by right-clicking on the "Queue messages" node under the "helloWorldServer" queue and clicking "Clear messages".

Exercise 4. Custom XML Namespace

In NServiceBus, namespaces are defined at an endpoint level rather than at a message level. So, in order to set the namespace for XML serialization on our Hello World endpoint, open EndpointConfig.cs and change it to the following:

```
namespace HelloWorld
{
    using Messages;
    using NServiceBus;
    /*
        This class configures this endpoint as a Server. More information about how to
        configure the NServiceBus host
        can be found here: http://particular.net/articles/the-nservicebus-host
    */
    public class EndpointConfig : IConfigureThisEndpoint, AsA_Client,
        IWantCustomInitialization
    {
        public void Init()
        {
            Configure.Serialization.Xml(m => m.Namespace("http://acme.com/"));

            NServiceBus.Configure.With()
                .DefaultBuilder()
                .DefiningMessagesAs(t => t.Assembly == typeof(RequestMessage).Assembly &&
                    t.Name.EndsWith("Message"));
        }
    }
}
```

Build and run again. Open up the same queue as before and look at the message inside it. You may need to right-click the queue and select "Refresh" to see the message appear. Notice the changed namespace.

Comment [UD8]: Talk about the IWantCustomInitialization interface as the mechanism for customizing NServiceBus behavior. Also mention that multiple classes (from multiple DLLs) can implement this interface, and will be picked up as a part of the NServiceBus assembly scanning process. Useful for decoupling the initialization/configuration code for a system.

Comment [db9]: Note that this is new in V4, and we'll cover more of it later. Might want to mention the trajectory away from the fluent config and the problems with ordering.

Comment [UD10]: Tell them that the assembly scanning is driven by the With() method, and that they can use the overrides to specify which types or assemblies to include or exclude in the scanning. Don't forget to show them AllAssemblies.Except.

Comment [UD11]: The DefaultBuilder method sets up the default container that comes with NServiceBus - which AutoFac in v3.0 and on. Show them how they can use a different container by adding a reference to one of the assemblies in the containers directory.

Exercise 5. Configurable Routing

Rather than hard-coding the destination to which messages get sent, we'll now use the configuration file. First change the Run method of the MessageSender class as follows:

```
public void Start()
{
    var message = new RequestMessage {SaySomething = "Say something"};

    Bus.Send(message);

    LogManager.GetLogger("MessageSender").Info("Sent message.");
}
```

Add the following to your app.config:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  . . .
  <UnicastBusConfig>
    <MessageEndpointMappings>
      <add Messages="Messages.RequestMessage, Messages" Endpoint="helloWorldServer" />
    </MessageEndpointMappings>
  </UnicastBusConfig>
</configuration>
```

Notice how we specified the type of the message "Messages.RequestMessage, Messages" and indicated the endpoint to which it will be sent, "helloWorldServer". You can also include just the name of the assembly, "Messages" to indicate that all types in the assembly should be routed to the same endpoint.

Exercise 6. Processing Messages

Now add another project in the same way you added the HelloWorld project in Exercise 1, calling it HelloWorldServer. Add a reference to the Messages project.

The Class1 file in the new project should be as follows:

```
using NServiceBus;

namespace HelloWorldServer
{
    public class EndpointConfig: IConfigureThisEndpoint, AsA_Server,
    IWantCustomInitialization
    {
        public void Init()
        {
            Configure.Serialization.Xml(m => m.Namespace(http://acme.com/));

            NServiceBus.Configure.With()
                .DefaultBuilder()
                .DefiningMessagesAs(t => t.Assembly == typeof(RequestMessage).Assembly
                    && t.Name.EndsWith("Message"));
        }
    }
}
```

Comment [a12]: Mention that the endpoint name is defaulted to the name space of the endpoint config

Comment [UD13]: Mention that there are differences between the client and server setups - things like transactionality and impersonation.

Comment [db14]: Emphasize the fact that endpoints that talk to each other must use the same serialization mechanism AND namespace.

Comment [UD15]: Emphasize the fact that endpoints that talk to each other must use the same serialization mechanism AND namespace.

Notice here the use of AsA_Server rather than AsA_Client. This is the preferred choice for endpoints that process messages.

Add a new class to the project, call it RequestHandler, and have it implement the interface IHandleMessages<RequestMessage> as follows:

```
using log4net;
using Messages;
using NServiceBus;
using NServiceBus.Logging;

namespace HelloWorldServer
{
    class RequestHandler : IHandleMessages<RequestMessage>
    {
        public void Handle(RequestMessage message)
        {
            LogManager.GetLogger("RequestHandler").Info(message.SaySomething);
        }
    }
}
```

Finally, right-click on the solution, click "Set Startup Projects...", and set both the HelloWorld and HelloWorldServer as projects to start.

Build and run. You should see the HelloWorldServer print out "Say something" on the console.

Comment [UD16]: Mention that both processes don't need to be online for communication to work, as opposed to RPC.
Pair people up, have the client on one machine send to a server on the other machine. Tell them to change the client config to include the @OtherMachine after "helloWorldServer".
Disconnect the client machine from the network and run again. Tell them to go to Computer management and look at the Outgoing Queues. Then reconnect and see the messages arrive and be processed.
Tell them that it's the Msmq service (mqsvc.exe) which is responsible for this "store and forward" messaging.

Exercise 7. Discarding messages

Part 1: Conventions Configuration for expiry

1. Add an Attribute Expires to the Messages project as follows:

```
public class ExpiresAttribute : Attribute
{
    public ExpiresAttribute(int expiresAfterSeconds)
    {
        this.ExpiresAfter = TimeSpan.FromSeconds(expiresAfterSeconds);
    }

    public TimeSpan ExpiresAfter { get; set; }
}
```

2. Decorate the RequestMessage with the new attribute and specify that it expires after 60 seconds.

```
[Expires(60)]
public class RequestMessage
{
    public string SaySomething { get; set; }
}
```

3. Extend the EndpointConfig of the client and server with the “time to be received” conventions like this:

```
public void Init()
{
    Configure.Serialization.Xml("http://acme.com/");

    Configure.With()
        .DefaultBuilder()
        .DefiningMessagesAs(t => t.Assembly == typeof(RequestMessage).Assembly &&
t.Name.EndsWith("Message"))
        .DefiningTimeToBeReceivedAs(GetExpiration);
}

private static TimeSpan GetExpiration(Type type)
{
    dynamic expiresAttribute = type.GetCustomAttributes(true)
        .SingleOrDefault(t => t.GetType()
            .Name == "ExpiresAttribute");
    return expiresAttribute == null
        ? TimeSpan.MaxValue
        : expiresAttribute.ExpiresAfter;
}
```

4. Run only the client - see the message in the “helloWorldServer” queue. Wait for a minute or two. Refresh the queue. Notice that the message is no longer in the queue.

Part 2: Centralized Conventions Configuration for expiry

In the first part we duplicated the conventions configuration to all projects. This can be a huge maintenance problem especially in large system. So we will now extract the conventions into a separate project.

1. Add a new Class Library called Conventions
2. Reference NServiceBus.Core (via NuGet)
3. Add a class ConventionsConfiguration to the new project
4. Implement the IWannaRunBeforeConfiguration interface to the new class
5. Move the conventions configuration to the Init method.
6. Change the Message convention check for an attribute named MessageAttribute to remove the reference to the Messages assembly

The class should now look like this:

```
public class ConventionsConfiguration : IWannaRunBeforeConfiguration
{
    public void Init()
    {
        Configure.Instance
            .DefiningMessagesAs(type =>
                type.GetCustomAttributes(true)
                    .Any(t => t.GetType().Name == "MessageAttribute"))
            .DefiningTimeToBeReceivedAs(GetExpiration);
    }

    private static TimeSpan GetExpiration(Type type)
    {
        dynamic expiresAttribute = type
            .GetCustomAttributes(true)
            .SingleOrDefault(t => t.GetType().Name == "ExpiresAttribute");
        return expiresAttribute == null
            ? TimeSpan.MaxValue
            : expiresAttribute.ExpiresAfter;
    }
}
```

7. Add an attribute MessageAttribute to the Messages assembly and add it to the RequestMessage
8. Rename RequestMessage to Request. Be sure to update the config as well.
9. Remove the conventions configurations from the client and server
10. Add a reference to the conventions assembly to both the client and server
11. Run both client and server and see how they still do the same.

Exercise 8. Exceptions

Add the following to the app.config of the HelloWorldServer project

```
<?xml version="1.0"?>
<configuration>
  <configSections>
    <section name="MessageForwardingInCaseOfFaultConfig" type="NServiceBus.Config.
MessageForwardingInCaseOfFaultConfig, NServiceBus.Core"/>

    <section name="TransportConfig" type="NServiceBus.Config.TransportConfig,
NServiceBus.Core"/>

  </configSections>

  <MessageForwardingInCaseOfFaultConfig ErrorQueue="error"/>
```

1. Change the RequestHandler class in HelloWorldServer so that it throws an exception.
2. Make sure ErrorQueue attribute of the MessageForwardingInCaseOfFaultConfig section of the app.config file is set to "error".
3. Build and run.
4. Notice the log output of HelloWorldServer that indicates the message was retried several times.
5. Notice that the retries will resume after 10,20,30 seconds. This is the Second Level Retries
6. Look at the "error" queue, see that it now contains the same message that was sent.
7. Change the RequestHandler class back to what it was before so it doesn't throw an exception anymore.
8. Run only HelloWorldServer.
9. Open the NServiceBus directory and click through \tools and run ReturnToSourceQueue.exe.
10. When asked provide "error" for the error queue, then "all" for all messages, and hit Enter.
11. Notice that HelloWorldServer receives the message and that the error queue is now empty.
12. Change the number of retries by adding the following to your app.config:
 - a. `<TransportConfig MaxRetries="5" />`

Comment [a17]: Mention that 5 retries is the default and the section can be left out if the defaults are ok

Exercise 9. Authorization

Add a new class to HelloWorldServer called Auth. Have it stop the message pipeline based on some header.

```
using log4net;
using NServiceBus;

namespace HelloWorldServer
{
    class Auth : IHandleMessages<IMessage>
    {
        public IBus Bus { get; set; }

        public void Handle(IMessage message)
        {
            if (!Authorized(message.GetHeader("user")))
            {
                LogManager.GetLogger("Auth").Warn("User not authorized.");
                Bus.DoNotContinueDispatchingCurrentMessageToHandlers();
            }
            else
                LogManager.GetLogger("Auth").Info("User authorized.");
        }

        bool Authorized(string user)
        {
            return user == "udi";
        }
    }
}
```

Make sure that the Auth message handler is configured to run first.

```
using NServiceBus;

namespace HelloWorldServer
{
    public class Class1 : IConfigureThisEndpoint, AsA_Server,
        IWantCustomInitialization, ISpecifyMessageHandlerOrdering
    {
        public void Init()
        {
            NServiceBus.Configure.With().DefaultBuilder()
                .XmlSerializer("http://acme.com");
        }

        public void SpecifyOrder(Order order)
        {
            order.SpecifyFirst<Auth>();
        }
    }
}
```

Build and run. Notice that the server doesn't output the message contents any more.

Modify the HelloWorld project so that the server will behave as before.

```
using log4net;
using Messages;
using NServiceBus;

namespace HelloWorld
{
    class MessageSender : IWantToRunAtStartup
    {
        public IBus Bus { get; set; }

        public void Run()
        {
            Bus.OutgoingHeaders["user"] = "udi";
            var message = new Request { SaySomething = "Say something" };
            Bus.Send(message);
            LogManager.GetLogger("MessageSender").Info("Sent message.");
        }

        public void Stop()
        {
        }
    }
}
```

Build and run.

Exercise 10. Dependency Injection

Add an interface to HelloWorldServer called ISaySomething as follows:

```
namespace HelloWorldServer
{
    public interface ISaySomething
    {
        string InResponseTo(string request);
    }
}
```

Now add a class that implements it called SaySomething as follows:

```
namespace HelloWorldServer
{
    class SaySomething : ISaySomething
    {
        public string InResponseTo(string request)
        {
            return "Responding to " + request;
        }
    }
}
```

Now change the RequestHandler class to use the new interface (using constructor injection):

```
using Messages;
using NServiceBus;
using NServiceBus.Logging;

namespace HelloWorldServer
{
    class RequestHandler : IHandleMessages<Request>
    {
        public RequestHandler(ISaySomething saySomething)
        {
            saysSomething = saySomething;
        }
        private ISaySomething saysSomething;

        public void Handle(Request message)
        {
            LogManager.GetLogger("RequestHandler").Info(message.SaySomething);
            LogManager.GetLogger("RequestHandler").Info(
                saysSomething.InResponseTo(message.SaySomething));
        }
    }
}
```

```
    }  
  }  
}
```

Finally, register the `SaySomething` in the container by changing the `Init` method of `EndpointConfig` in `HelloWorldServer`:

```
public void Init()  
{  
    NServiceBus.Configure.With()  
        .DefaultBuilder()  
        .XmlSerializer("http://acme.com")  
        .RunCustomAction(() =>  
Configure.Instance.Configurer.ConfigureComponent<SaySomething>(DependencyLifecycle.SingleInstance)  
        );  
}
```

Build and run.

Exercise 11. Encryption

Change the Request class in the Messages project as follows:

```
using NServiceBus;

namespace Messages
{
    public class Request : IMessage
    {
        public WireEncryptedString SaySomething { get; set; }
    }
}
```

Add the following to the configSections of both HelloWorld and HelloWorldServer:

```
<section name="RijndaelEncryptionServiceConfig"
type="NServiceBus.Config.RijndaelEncryptionServiceConfig, NServiceBus.Core"/>
```

Then add the following to the both configuration files:

```
<RijndaelEncryptionServiceConfig Key="gDdbqRpqDRbTs3mhdZh9qCaDaxJXl+e7"/>
```

Also, add a call to .RijndaelEncryptionService() to the EndpointConfig file of both projects.

Change the RequestHandler class to use the .Value property of Request.SaySomething.

Build - but only run HelloWorld - not the server.

Open the "helloWorldServer" queue - see that the contents of the SaySomething node are now encrypted. Now run the HelloWorldServer project - notice that it is able to unencrypt the contents successfully.

Exercise 12. Overriding Configuration

Now we're going to remove the encryption key from the configuration files and move it to an “external service”.

1. Add a Class Library project and call it SecurityServiceAdapter.
2. Add references to NServiceBus.dll, NServiceBus.Core.dll, and System.Configuration.
3. Add a class to SecurityServiceAdapter called ConfigOverride as follows:

```
namespace SecurityServiceAdapter
{
    using NServiceBus.Config;
    using NServiceBus.Config.ConfigurationSource;

    public class ConfigOverride : IProvideConfiguration<RijndaelEncryptionServiceConfig>
    {
        public RijndaelEncryptionServiceConfig GetConfiguration()
        {
            return new RijndaelEncryptionServiceConfig
            {
                //this key could be fetched from a REST/WS call
                Key = "gDbqRpqdRbTs3mhdZh9qCaDaxJXl+e7"
            };
        }
    }
}
```

Comment [a18]: Mention that NSB will automatically configure all classes implementing IProvideConfiguration

Comment [a19]: Mention that this is only called once when the endpoint is initializing.

Comment [a20]: Mention that in a real life scenario this would be a call to a external service

4. Remove the RijndaelEncryptionServiceConfig section from your projects
5. Add a reference to the SecuritySystemAdapter project.
6. Build and run. Try putting a breakpoint in the GetConfiguration() method to see that the calls do indeed happen.

Exercise 13. Web App Hosting

Add a Asp.Net MVC3 Web Application project to the solution called MvcApplication1, choose the Empty template, and add references to NServiceBus.dll, NServiceBus.Core.dll, log4net.dll, and the SecurityServiceAdapter, Conventions, and Messages projects. Make sure to include the new project in the startup projects for the solution.

Initialize the bus in the Application_Start method as follows:

```
namespace MvcApplication1
{
    using System.Web.Http;
    using System.Web.Mvc;
    using System.Web.Optimization;
    using System.Web.Routing;
    using NServiceBus;
    using NServiceBus.Installation.Environments;

    // Note: For instructions on enabling IIS6 or IIS7 classic mode,
    // visit http://go.microsoft.com/?LinkId=9394801

    public class MvcApplication : System.Web.HttpApplication
    {
        private static IBus _bus;

        private IStartableBus _startableBus;

        public static IBus Bus
        {
            get { return _bus; }
        }

        protected void Application_Start()
        {
            Configure.ScaleOut(s => s.UseSingleBrokerQueue());

            Configure.Serialization.Xml(m => m.Namespace("http://acme.com/"));

            _startableBus = Configure.With()
                .DefaultBuilder()
                .RijndaelEncryptionService()
                .UseTransport<Msmq>()
                .UnicastBus()
                .CreateBus();

            Configure.Instance.SendOnly();

            _bus = _startableBus.Start();

            AreaRegistration.RegisterAllAreas();

            WebApiConfig.Register(GlobalConfiguration.Configuration);
            FilterConfig.RegisterGlobalFilters(GlobalFilters.Filters);
            RouteConfig.RegisterRoutes(RouteTable.Routes);
        }
    }
}
```

```

        BundleConfig.RegisterBundles(BundleTable.Bundles);
    }

    protected void Application_End()
    {
        _startableBus.Dispose();
    }
}
}

```

Add A reference to the Conventions project, so we include the message definitions for this endpoint.

Create a new controller called SaySomethingController by right clicking on the controller's folder and then send a message in the event handler as follows:

using System.Web.Mvc;

```

namespace MvcApplication1.Controllers
{
    public class SaySomethingController : Controller
    {
        public ActionResult Index()
        {
            MvcApplication.Bus.Send<Request>(m => m.SaySomething = "Say 'WebApp'.");

            return new ContentResult{Content = "Message sent"};
        }
    }
}

```

Now open the web.config file and fill in the appropriate UnicastBusConfig to specify the destination address.

```

<?xml version="1.0"?>
<configuration>
  <configSections>
    <section name="UnicastBusConfig" type="NServiceBus.Config.UnicastBusConfig,
NServiceBus.Core"/>
  </configSections>

  <UnicastBusConfig>
    <MessageEndpointMappings>
      <add Messages="Messages.Request, Messages" Endpoint="helloWorldServer" />
    </MessageEndpointMappings>
  </UnicastBusConfig>

</configuration>

```

Build and run. Change the url to <http://localhost:{port}assigned/SaySomething>. Notice that when HelloWorldServer processes it, it cannot authorize the request. This time we will use a outgoing transport message mutator to fix the issue.

```

public class AuthenticationMutator : IMutateOutgoingTransportMessages,
    INeedInitialization

```

Comment [a21]: Mention that mutators are not automatically registered in the container


```
{
    public void MutateOutgoing(object[] messages, TransportMessage transportMessage)
    {
        //in a real life scenario you would probably get the user from
        // HttpContext.Current.Request.Params["user"] or similar
        transportMessage.Headers["user"] = "udi";
    }

    public void Init()
    {
        Configure.Component<AuthenticationMutator>(DependencyLifecycle.InstancePerCall);
    }
}
```

Build and run again - see that the messages now are authorized.

Exercise 14. Full Duplex

Add a new message type to the Messages project as follows:

```
public class RequestWithResponse : Request {}
```

Modify the controller to be an asynchronous controller:

```
public class SaySomethingController : AsyncController
{
    [AsyncTimeout(50000)]
    public void IndexAsync()
    {
        MvcApplication.Bus.Send<RequestWithResponse>(m => m.SaySomething = "Say 'WebApp'.")
            .Register<int>(response =>
            {
                AsyncManager.Parameters["response"] = response.ToString();
            });
    }

    public ActionResult IndexCompleted(string response)
    {
        return new ContentResult { Content = "Response from server - " + response };
    }
}
```

Comment [a22]: Mention that the name has to be {Action}Async

Comment [a23]: Mention that the key have to match the parameter of the complete method

Comment [a24]: Mention that the name has to be {NameOfAction}Completed

Notice the use of Register to setup a callback to handle the server response

Add a message handler in the HelloWorldServer project to handle the new message type as follows:

```
public class RequestWithResponseHandler : IHandleMessages<RequestWithResponse>
{
    public IBus Bus { get; set; }

    public void Handle(RequestWithResponse message)
    {
        Bus.Return(message.SaySomething.Value.Length % 2);
    }
}
```

Notice the use of Bus.Return to return a simple integer value back to the client.

Build and run.

Take note of the exception:

"No destination specified for message Messages.RequestWithResponse. Message cannot be sent. Check the UnicastBusConfig section in your config file and ensure that a MessageEndpointMapping exists for the message type."

Change the web.config file's UnicastBusConfig section to specify that all messages from the Messages project should be routed to the "helloWorldServer" queue as follows:

```
<UnicastBusConfig>
  <MessageEndpointMappings>
    <add Messages="Messages" Endpoint="helloWorldServer" />
  </MessageEndpointMappings>
</UnicastBusConfig>
```

Notice the use of just the assembly name "Messages" where before we used the fully qualified type names of the form: Namespace.Type, Assembly

Build and run.

Notice that the HelloWorldServer gets a queue not found exception. The reason for this is that running in SendOnly mode means that no input queue is created for your website. To fix this we need to make the website a regular send/receive endpoint. Modify the configuration in Global.asax as follows:

```
namespace MvcApplication1
{
    using System.Web.Http;
    using System.Web.Mvc;
    using System.Web.Optimization;
    using System.Web.Routing;
    using NServiceBus;
    using NServiceBus.Installation.Environments;

    // Note: For instructions on enabling IIS6 or IIS7 classic mode,
    // visit http://go.microsoft.com/?LinkId=9394801

    public class MvcApplication : System.Web.HttpApplication
    {
        private static IBus _bus;

        private IStartableBus _startableBus;

        public static IBus Bus
        {
            get { return _bus; }
        }

        protected void Application_Start()
        {
            Configure.ScaleOut(s => s.UseSingleBrokerQueue());

            Configure.Serialization.Xml(m => m.Namespace("http://acme.com/"));

            _startableBus = Configure.With()
```

```

        .DefaultBuilder()
        .RijndaelEncryptionService()
        .UseTransport<Msmq>()
        .UnicastBus()
        .CreateBus();

//Configure.Instance.SendOnly();

Configure.Instance.ForInstallationOn<Windows>().Install();

_bus = _startableBus.Start();

AreaRegistration.RegisterAllAreas();

WebApiConfig.Register(GlobalConfiguration.Configuration);
FilterConfig.RegisterGlobalFilters(GlobalFilters.Filters);
RouteConfig.RegisterRoutes(RouteTable.Routes);
BundleConfig.RegisterBundles(BundleTable.Bundles);
}

protected void Application_End()
{
    _startableBus.Dispose();
}
}
}

```

Build and Run. Notice that a new queue called `MvcApplication1` is created.

It should now work as expected. Try to change the length of the string

Now change the message handler such that it sleeps for 5 seconds - build and run again. Notice that the page does not finish rendering for an additional 5 seconds.

Comment [a25]: Mention that this is the endpointname that is defaulted to the namespace of Global.asax.cs

Exercise 15. Unit Testing

Add a new project called HelloWorldServer.Tests and add the following references: log4net, NServiceBus, NServiceBus.Core, NServiceBus.Testing. Also reference the Messages, Conventions and HelloWorldServer projects.

If you want you can try to use NuGet to automate this by opening the package manager console and type:

```
Install-package nservicebus.testing
```

Now add a reference to your testing framework of choice. The example below is using NUnit.

Now we're going to write a test that checks that if an empty string is passed in the message that the RequestWithResponseHandler will call Bus.Return with the parameter 0:

```
using Messages;
using NServiceBus.Testing;
using NUnit.Framework;

namespace HelloWorldServer.Tests
{
    [TestFixture]
    public class Class1
    {
        [Test]
        public void TestRequestHandler()
        {
            Test.Initialize();

            Test.Handler<RequestWithResponseHandler>()
                .ExpectReturn<int>(i => i == 0)
                .OnMessage<RequestWithResponse>(m => m.SaySomething = "");
        }
    }
}
```

Build and run the unit test.

Exercise 16. Multiple Responses

Add the following message types to the Messages project:

```
public class Query : IMessage
{
    public int NumberOfResponses { get; set; }
}

public class QueryResult : IMessage
{
    public string Something { get; set; }
}
```

Create a new regular controller that sends a Query message to the server, hard code the NumberOfResponses to 10 for now.

Add a message handler to MvcApplication1 that handles the QueryResult message - have it simply call a .ToString() on the message. Put a breakpoint on that code.

Modify the global.asax of MvcApplication1 to call this line before the Configure.With() block:

```
Configure.Features.Disable<AutoSubscribe>();
```

Add a message handler to HelloWorldServer that handles the Query message - have it loop according to the NumberOfResponses, and Bus.Reply with a QueryResult message containing the loop variable's .ToString():

```
using Messages;
using NServiceBus;

namespace HelloWorldServer
{
    public class QueryHandler : IHandleMessages<Query>
    {
        public IBus Bus { get; set; }

        public void Handle(Query message)
        {
            for (int i=0; i < message.NumberOfResponses; i++)
                Bus.Reply<QueryResult>(m => m.Something = i.ToString());
        }
    }
}
```

Put a breakpoint on the Bus.Reply line.

Build and run.

Notice that MvcApplication1 does not receive any of the replies until the loop has completed - ultimately not providing the "streaming" behavior we wanted.

Exercise 17. Streaming Responses

Create a new project called HelloWorldQueryServer based on HelloWorldServer. Make sure you give it a separate input queue. Also, do not configure the endpoint as a server (since we don't want the transactional behavior) but rather as a client.

Move the QueryHandler class from HelloWorldServer to the new HelloWorldQueryServer.

Finally, change the routing of MvcApplication1 to send Query messages to the new endpoint.

Build and run.

Notice that this time the replies are received by MvcApplication1 even before loop has completed.