Empower Sightsource Training

Course outline and notes

ASP .NET MVC with .NET Core 2.0

Introduction

The concept of MVC, or Model View Controller, is older than the world wide web. First introduced into Smalltalk '76, a language taking part of its name from the year it was made in, the ideas behind the concept are over forty years old. The web, by constrast, began life in 1989, when Tim Berners Lee proposed the HTTP standard.

It would take almost another decade before the principles of MVC made their way into the construction of modern web sites. The release of WebObjects in 1996, finally unified web technology with MVC principles. In the years afterward, WebObjects would get ported to Java, Ruby on Rails would introduce the concept from the ground up, while Microsoft and others would begin to produce their own takes on the technology.

For the next few days, we will look at Microsoft's implementation, ASP .NET MVC, on the .NET Core 2.0 platform.

MVC in the abstract.

At its heart, MVC is about the separation of concerns, with each letter in the TLA (that's three letter acronym, folks) specifying a separate concern.

An MVC application is a system that has three main interconnecting components. The Wikipedia description is as good as any.

Components

- The model is the central component of the pattern. It expresses the application's behavior in terms of the problem domain, independent of the user interface. It directly manages the data, logic and rules of the application.
- A view can be any output representation of information, such as a chart or a diagram. Multiple views of the same information are possible, such as a bar chart for management and a tabular view for accountants.
- The third part or section, the controller, accepts input and converts it to commands for the model or view. Interactions

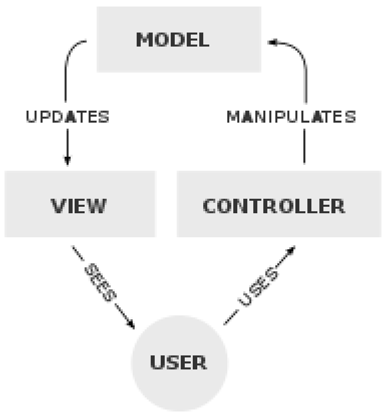
> In addition to dividing the application into three kinds of components, the model–view–controller design defines the interactions between them.[8]

Interactions

- The model is responsible for managing the data of the application. It receives user input from the controller.

- The view means presentation of the model in a particular format.
- The controller responds to the user input and performs interactions on the data model objects. The controller receives the input, optionally validates it and then passes the input to the model.

This diagram, also lifted from Wikipedia, shows the interactions.



We'll redefine MVC in much simpler terms by the end of this lecture.

The bad old days

MVC took awhile to gain prominence in the development of modern day applications. Early web technologies, such as classic ASP or PHP, used inline code to control program flow and execution.

This tiny example of Classic ASP shows how we used to code.

```
<!DOCTYPE html>
<html>
<body>

<%
dim i
for i=1 to 6
   response.write("<h" & i & ">Heading " & i & "</h" & i & ">")
next
%>

</body>
</html>
```

Design and control flow would exist in the same place, inline. Web servers would treat each page as a separate program. The inline approach came loaded down with many disadvantages.

- Maintainability
  - The mix of code and design meant that immediately, any maintainer needed to be aware of two quite different disciplines, development and design. Often they were not, leading to problems with reliability and software quality.
  - The scope of any inline app was very difficult to know. Under such technologies, web servers were configured to treat with a certain extension as an executable program.

    - Version control programs would often over-version as a result of small cosmetic changes.
- Security
    - Sideways copying, that is to say, someone making a small change to an existing file, was common.
    - Those seeking to secure the app would need to be on top of their game to ensure that no sideways copies, or other harmful scripts, were on the machine.

The disadvantages of page based systems were apparent enough before the wholesale introduction of MVC to cause people to write template pages, or server side include pages, commonly used but infrequently changed, in a bid to mitigate the free for all that had sprung up around inline development.

ASP .NET Webforms

Microsoft solved some of the problems associated with Classic ASP with ASP .NET and WebForms, but not without introducing many more, and not focused on providing a true separation of concerns. During that phase of its history, Microsoft was more concerned with helping Visual Basic developers become web developers.

The new innovation was a feature called **codebehind**, in which program flow and execution were managed in a separate file to page layout and structure. This largely solved the issue of inline coding. Design and code were separate. The problem was that no designer knew what any of the design did, or what it would look like when it was finally spat out.

```
     <asp:Repeater id="Repeater1" runat="server">
          <HeaderTemplate>
              <table border=1>
              <tr>
                  <td><b>Company</b></td>
                  <td><b>Symbol</b></td>
              </tr>
          </HeaderTemplate>

          <ItemTemplate>
              <tr>
              <td> <%# DataBinder.Eval(Container.DataItem, "Name") %> </td>
              <td> <%# DataBinder.Eval(Container.DataItem, "Ticker") %> </td>
              </tr>
          </ItemTemplate>

          <FooterTemplate>
              </table>
          </FooterTemplate>

      </asp:Repeater>
      <p>

      <b>Repeater2:</b>
      <p>
      <asp:Repeater id="Repeater2" runat="server">

          <HeaderTemplate>
```

```
            Company data:
        </HeaderTemplate>

        <ItemTemplate>
            <%# DataBinder.Eval(Container.DataItem, "Name") %> (<%#
DataBinder.Eval(Container.DataItem, "Ticker") %>)
        </ItemTemplate>

        <SeparatorTemplate>, </SeparatorTemplate>
    </asp:Repeater>
```

The introduction of proprietary tags made the development of web applications and increasingly programmer led venture, made worse by early implementations of the technology, which offered wildly inconsistent performance out of the box on any other browser but Internet Explorer.

Microsoft also introduced another problem with Web Forms; viewstate. This was a technology that allowed information to be automatically persisted across separate web requests. Convenience came at great cost. Page weights, the file size of each page served to end users, ballooned, leaving users on slower connections (plenty of them about in the early 2000s) with a very dissatisfying experience compared to other platforms. Perhaps most damningly, ASP .NET was slower than the product it was meant to replace.

As coders learned to work around the deficiencies of the platform, WebForms apps did become easier to maintain, if only because many developers were rolling their own versions of what Microsoft would eventually introduce itself. A Model View Controller implementation on the .NET Platform.

ASP .NET MVC

In 2009, ASP .NET MVC 1.0 was released for the .NET Platform. Its release coincided with a number of other emerging technologies, such as dependency injection and service based architecture. It has gained widespread adoption amongst former WebForms developers, cementing itself as the de facto standard for new web applications written for the .NET Platform.

The project, along with the Razor engine, was made open source in 2012. The implementation has gone through several revisions, up to 6.0 on traditional .NET platforms, already at version 2.0 on .NET Core. .NET Core is what we'll be using in this series of lectures and exercises.

The MVC implementation solved many of the problems that bogged down Classic ASP and ASP .NET WebForms. Views were designed to be just that. The proprietary server controls of WebForms disappeared, and they were not stuffed with program control flow. Where it existed at all, it was clean and verbose, something the designers could still work with confidently.

An MVC app would no longer run any old page with the right extension. The scope of an MVC app is directly controlled by the programmer, and can be quickly and easily determined by examining the controllers in the app. If a request isn't recognised by any of the controllers, it simply won't be found.

A simpler definition of MVC

Though the switch to MVC was something of a shock to WebForms developers, most came up with a simplified definition concept of the various components in an MVC app.

The *Model* is everything your app *can* do, its functions, its data, the complete and total scope of its functionality.

The *Controller* represents everything we'll let our users do with the model.

The *View* is everything we'll let our users see of the model.

.Net Core

We'll be using .NET Core 2.0 for these exercises, a brand new web framework which unifies Microsoft's MVC technology, making it and something called Web API pretty much the same thing. It also runs the very latest implementation of ASP .NET MVC, is platform independent and full of some of the latest features.

How this course will run.

Long talks like this are going to be rare. Mostly, we will be doing exercises, spending a brief amount of time before each exercise to explore the concepts we're about to approach. We're also going to develop this as any professional would, using the git versioning system, developing a feature at a time, and merging our completed work back into a master repository.

We will explore, step by step, the structure and operation of an MVC application. We will demystify a lot of the magic. We will be covering a technology and a way of thinking about applications that will serve you all well in the future, as well as teaching you skills that are commercially useful and industry standard at the present time.

Exercise 1 - Introduction to Git and our first commit

Each of you should have access to a repository system called git. You can find this repository by pressing the start menu button, then typing **Git Bash**. Select it from the context menu.

What you're looking at is a command line interface, designed to help you manage a git repository. A git repository is your ultimate undo function. Amongst other things, it allows to return to previous copies of work, if a release is found to be defective. It allows developers to independently develop new features without compromising the integrity of the existing application or code base.

We're going to create a new git repository in an empty directory.

A brief primer on the commands we'll be using.

git bash is a port of bash, the default command line environment on Linux systems. We'll be using the following commands in this exercise.

cd

change directory - move into the specified directory.

mkdir

make directory - make a directory of the specified name in the current directory.

ls

list directory - get a list of files and directories in the current directory.

git

git - the git command line program. Does several things depending on the sub command passed in.

Setting your user details

git tracks changes made by authors. You can set your name and email by typing the following commands.

```
git config --global user.name "John Doe"
git config --global user.email johndoe@example.com
```

Creating the repository

Navigate to your Projects directory, and create a new directory called git. All of our git backed projects will live here.

Type:-

```
cd /c/Projects/git
mkdir empower
cd empower
git init
```

Congratulations. You've just created a git repository on the command line. I know professional developers that still haven't done the same.

Initial structure

There's no rule, but most developers follow a convention whereby git repositories have well known names, **doc**, intended for documentation, and **src**, intended for source code and other assets. Let's create these now.

Type:-

```
mkdir src
mkdir doc
```

You can now type in

`sh ls`

To verify that the directories are there.

Creating a vanilla MVC project.

Open up your copy of Visual Studio 2017, and click New Project.

Select .NET Core from the Visual C# section. Select ASP .NET MVC .NET Core Application.

Set the directory to the **src** directory we created earlier, and make sure the box to create a new directory is checked.

The name of the project should be **Empower.Mvc**.

Click **Ok** when you're ready.

Checking the Project in.

Before we take the tour of MVC, we're going to commit our work to git at this point.

We're going to use the built-in features of Visual Studio 2017 to do this. Click on **Team Explorer**. Click the little house, then click **Changes**. You should see a list of changes and a prompt to enter a commit message. Enter "Initial check in of vanilla project".

What's just happened?

We've created a new git repository, we've created a vanilla ASP .NET MVC Core application, and we've committed that project to git.

Whatever happens next, we can get back to that baseline.

Exercise two - the MVC mini-tour

This is the vanilla MVC project for .NET core.

Let's take a look at what it contains.

Controllers

The *Controllers* directory contain the controllers for the MVC app. They define the scope of the app.

Right now, we have one controller defined, **HomeController**. Let's open it up and take a look.

```
namespace Empower.Mvc.Controllers
{
    public class HomeController : Controller
    {
        public IActionResult Index()
        {
            return View();
        }

        public IActionResult About()
        {
            ViewData["Message"] = "Your application description page.";

            return View();
        }

        public IActionResult Contact()
        {
            ViewData["Message"] = "Your contact page.";

            return View();
        }

        public IActionResult Error()
        {
            return View(new ErrorViewModel { RequestId = Activity.Current?.Id ??
HttpContext.TraceIdentifier });
        }
    }
}
```

There are three main controller actions, **Index**, the default action. If an action isn't specified, **Index** is assumed. The vanilla Microsoft project also contains controller actions for **About**, presumably some blurb and **Contact**, which we will improve upon later.

There is also an **Error** action, which is used to report any errors that occur while the application is running.

Views

The Views directory contains the HTML pages (*cshtml* file extension). Inside, we have two sub directories, **Home**, which contains all the views for the **HomeController** and **Shared**, which contains views that are used by multiple controller actions, such as the loading of a shared layout page which maintains design consistency.

_ViewStart.cshtml

This file tells the application which layout to use.

```
@{
    Layout = "_Layout";
}
```

Shared/_Layout.cshtml

The default layout of the site is stored in Shared/_Layout.cshtml.

It enforces a common style across the application and ensures that common elements do not needlessly break or deviate. It contains references to stylesheets, scripts and other external resources we'll use in creating the look and feel of the application.

It is a large file, but one of the most important areas is **RenderBody()**. It is there that the content of your controller's views will appear.

```
    <div class="container body-content">
        @RenderBody()
        <hr />
        <footer>
            <p>&copy; 2018 - CoreMvc</p>
        </footer>
    </div>
```

Home/Contact.cshtml

Let's open up the Home/Contact.cshtml view to see how. Note that it contains just the information relevant to contact information. Unlike our previous examples from the land of WebForms, those are standard HTML tags, easily decipherable to a designer or front end developer.

The **@** symbol is a directive to start using *Razor* syntax, which allows data to be pulled from information in the view.

```
@{
    ViewData["Title"] = "Contact";
}
<h2>@ViewData["Title"]</h2>
<h3>@ViewData["Message"]</h3>

<address>
    One Microsoft Way<br />
    Redmond, WA 98052-6399<br />
    <abbr title="Phone">P:</abbr>
    425.555.0100
</address>

<address>
    <strong>Support:</strong> <a
href="mailto:Support@example.com">Support@example.com</a><br />
    <strong>Marketing:</strong> <a
href="mailto:Marketing@example.com">Marketing@example.com</a>
</address>
```

Models

Right now, the project only contains one model, **ErrorViewModel**, created to contain details of any errors that occur.

```
namespace Empower.Mvc.Models
{
    public class ErrorViewModel
    {
        public string RequestId { get; set; }

        public bool ShowRequestId => !string.IsNullOrEmpty(RequestId);
    }
}
```

Startup.cs

One of the most important parts of the app, and one of the most self-explanatory. This class is automatically executed to start the application and governs exactly what the application can do.

In this vanilla state, it's making a Configuration available, allowing static files to be served, setting up MVC and establishing the routes it will respond to.

```
namespace Empower.Mvc
{
    public class Startup
    {
        public Startup(IConfiguration configuration)
        {
            Configuration = configuration;
        }

        public IConfiguration Configuration { get; }

        // This method gets called by the runtime. Use this method to add services
to the container.
        public void ConfigureServices(IServiceCollection services)
        {
            services.AddMvc();
        }

        // This method gets called by the runtime. Use this method to configure
the HTTP request pipeline.
        public void Configure(IApplicationBuilder app, IHostingEnvironment env)
        {
            if (env.IsDevelopment())
            {
                app.UseDeveloperExceptionPage();
                app.UseBrowserLink();
            }
            else
            {
                app.UseExceptionHandler("/Home/Error");
            }

            app.UseStaticFiles();

            app.UseMvc(routes =>
            {
                routes.MapRoute(
                    name: "default",
                    template: "{controller=Home}/{action=Index}/{id?}");
            });
        }
    }
}
```

Routing

One of the important sections of Startup.cs is the routing setup.

It's mapping a pattern to allow HTTP requests to meet our controllers.

The format is

controller name / action name / optional id

The default controller is listed as Home, while the default action is listed as Index.

If a controller action is not specified, the app will route to /Home/Index.

wwwroot

This is the place to put any static files that you would like to serve, such as stylesheets, scripts, images or videos.

Exercise 2 - Housekeeping

One constant of Microsoft project wizards is that they almost invariably going to set up things we do not want or need. The .NET Core ASP .NET creation wizard gives us a couple of things we don't need.

First, we don't need the About page for this exercise. Secondly, we probably don't want our homepage to be filled with Microsoft links, so we'll need to change the Home view.

Removing the About page.

Removing a page in MVC can be done by simply removing the controller action. Remember that it is the controllers in MVC that act as gatekeepers to your Model. If the controller knows nothing about an action called **About**. The page simply won't be reachable.

Use Visual Studio to:-

- Expand the Controllers directory, if it isn't already expanded.
- Open the **HomeController** class.
- Remove the entire About method.

We've removed the About action from the controller. That will stop the app from running an action called About, which we can demonstrate by running now.

The reason we can demonstrate this is because we have not removed the About page cleanly. The page is still referenced in the navigation. Run your project, and click the About link. You should see an error page.

Removing about from the navigation

The navigation link to the now gone About page lives in the shared _Layout.cshtml view. Let's edit that now and remove the dead link.

Once done, run your application.

The navigation link to About should be gone. New visitors to your site might never know it existed.

One last thing

We've removed the controller method. We've removed the link to the navigation. We've still got an About.cshtml file in the Views/Home directory. It'll do no harm, but equally, we really don't need to bother ourselves with its future maintenance.

- Expand Views/Home, if it isn't already
- Delete the About.cshtml file

Changing the home page.

The home page is too complex for our immediate needs. Let's get rid of the blurb.

- Expand Views/Home, if it isn't already
- Open Index.html
- Delete the markup in the file (leave any directives at the top alone)

Replace with the following markup

```
@{
    ViewData["Title"] = "Home Page";
}
<div class="jumbotron">
    <h1>Sightsource Empower</h1>
    <h2>ASP .NET MVC Training with .NET Core 2.0</h2>
    <h3>Implemented by <strong>Your name here</strong></h3>
</div>
```

Run your app to test. Once done, commit your work into git using Visual Studio.

What's just happened?

We removed an entire page, learning that we needed to remove references and view files as well for a truly clean deletion.

We also changed the content of the home page to take out Microsoft's advertising hoardings.

Exercise 3 - Our first feature

In the last exercise, we removed the About page but left the Contact page intact. That's because we're going to redevelop it, and make it more useful than the dumb page it already is.

It will be our first feature.

Git - branching

So far, we've been using git in a very specific way. We've been checking all of our work into the default branch, called master. One of the big benefits of git is that we don't have to work directly with master. We can create other branches.

Think of a git branch as an alternative universe split off at a set point in time. Everything you do in that universe is independent to the master branch. Nothing you do in that universe will change the master branch, unless you ask it to. We'll talk about that later.

For right now, we're going to create one of these alternate universes for our new contact feature.

Git branches all have a name. The convention when developing a new feature is to prefix your branch name with feature/, followed by the name of the feature itself.

Our Contact work will exist in a branch called feature/contact.

Let's create that branch now.

- Make sure all previous work is committed into master.
- Go to the Git command line.
- Type:-

```
git branch feature/contact
```

We'll now want to switch into that alternative universe. We can do that by typing:-

```
git checkout feature/contact
```

If you switch back to Visual Studio, you'll see it knows we've changed branches. All work that we've done so far is safe in master. We can proceed with our contact work without messing with the master works.

The plan

Now that we're in a consequence free environment, we can talk about what we want to do with the Contact feature. At present, it is Microsoft's address.

We want to change that so that a visitor can leave his or her name, email address and a message, which will be sent to a pre-configured email address.

We will :-

- Create a new ViewModel to model this interaction.
- Change HomeController to accommodate the change
- Create a contact form in markup, using the ViewModel
- Define validation rules using DataAnnotations
- Apply validation
- Use the Controller to send the contact email

The View Model

Right now, the Contact action on HomeController returns a default View, which can expose basic concerns like ViewData, and pass simple messages. We're going to create a more specific ViewModel which models our requirements.

Let's recap.

We need to capture someone's name.

We need to capture someone's email address.

We need to capture someone's message.

Right click on the Models directory and add a class. Call it ContactViewModel.cs.

ContactViewModel

A view model is a class like any other. In the MVC part of the equation, you can think of them as a Model component, specifically one intended to be shown on a view. That's where the View part of the ViewModel comes from.

We've already determined that we will need to capture certain information.

What data types are we going to need for each of the things we need to capture? They are all text-based, whether it is someone's name, email or the message we're about to send?

We will model each required element as a property on the view model.

The Razor view engine will need to be able to access the properties in the view model, so let's make them public.

The convention for public properties is to title case them. Title case means the first letter of every new word is capitalised.

We're going to create a class that looks broadly like this:-

```
public class ContactViewModel
{
    public string Name { get; set; }
    public string Email { get; set; }
    public string Message { get; set; }
    public DateTime? ContactMadeAt { get; set; }
}
```

We're using string to capture each enterable element. There is also a public property called ContactMadeAt, a nullable DateTime, meaning it can either contain a DateTime value, or be null. We'll use that to determine whether someone successfully made contact.

Changes to HomeController.

We've created a new class to be used on the View, but right now, the controller has no notion that we want to use that view model on the Contact page. It is presently simply returning the default View, enough to carry a simple message, but not as good as *ContactViewModel* at representing a contact request.

We're going to change the HomeController's About action to return a new ContactViewModel everyone someone the Contact action is requested.

The change is subtle, but makes all the difference.

```
    public IActionResult Contact()
    {
        ViewData["Message"] = "Get in touch with Empower";

        return View(new ContactViewModel());
    }
```

The HomeController passes a parameter to the View() method. Doing this explicitly makes a new copy of ContactViewModel the view's model.

Changes to Contact.cshtml

Apart from still containing Microsoft's address, there is another change we need to make to Contact.cshtml.

We need to tell it to expect a ContactViewModel instead of the default MVC one.

We can do that by adding the following directive to the top of Contact.cshtml.

```
@model Empower.Mvc.Models.ContactViewModel
```

Let's also clear out Microsoft's address, and start putting together a contact form.

We can start by removing their content, leaving us with the following:-

```
@model Empower.Mvc.Models.ContactViewModel
@{
    ViewData["Title"] = "Contact";
}
```

```
<h2>@ViewData["Title"]</h2>
<h3>@ViewData["Message"]</h3>
```

That's just a placeholder. We're not using anything specific on ContactViewModel yet. That'll change shortly.

We're going to define a form that'll accept the information we're looking to collect.

Right now, the form will be simple. It won't do anything. It won't submit anywhere. We're just looking to get a handle of how ContactViewModel is used.

First off, let's look at how this might look in a static html page. No MVC.

```
<form>
    <div class="form-group">
        <label for="name">Name</label>
        <input id="name" name="name" placeholder="Please enter your name"
class="form-control"/>
    </div>
    <div class="form-group">
        <label>Email</label>
        <input id="email" name="email" placeholder="Please enter your email"
class="form-control" />
    </div>
    <div class="form-group">
        <label>Message</label>
        <textarea id="message" name="message" placeholder="Please enter your
message" class="form-control"></textarea>
    </div>
    <button type="submit" class="btn btn-primary">
        Contact us
    </button>
</form>
```

Now, let's have a look at how that markup looks as written for ASP .NET Core MVC.

```
<form>
    <div class="form-group">
        <label asp-for="Name">Name</label>
        <input asp-for="Name" placeholder="Please enter your name" class="form-
control"/>
    </div>
    <div class="form-group">
        <label asp-for="Email">Email</label>
        <input asp-for="Email" placeholder="Please enter your email" class="form-
control" />
    </div>
    <div class="form-group">
        <label asp-for="Message">Message</label>
        <textarea asp-for="Message" placeholder="Please enter your message"
class="form-control"></textarea>
```

```
    </div>
    <button type="submit" class="btn btn-primary">
        Contact us
    </button>
</form>
```

Anyone notice any differences?

The key change is the introduction of *asp-for*.

This'll get picked up by the MVC view engine, and binds the form element to a property on ContactViewModel. When we submit the form, those properties will be filled with whatever someone entered on the form element.

Let's get that form coded up and running.

This is the resulting markup when we run the project and use **View Source**.

```
<form>
    <div class="form-group">
        <label for="Name">Name</label>
        <input placeholder="Please enter your name" class="form-control"
type="text" id="Name" name="Name" value="" />
    </div>
    <div class="form-group">
        <label for="Email">Email</label>
        <input placeholder="Please enter your email" class="form-control"
type="text" id="Email" name="Email" value="" />
    </div>
    <div class="form-group">
        <label for="Message">Message</label>
        <textarea placeholder="Please enter your message" class="form-control"
id="Message" name="Message">
</textarea>
    </div>
    <button type="submit" class="btn btn-primary">
        Contact us
    </button>
</form>
```

Compared to some of our examples from the bad old days, that is beautiful. No special tags, no view state, just markup that a design and build expert might have produced independently.

POSTing and validation

The form we've created doesn't do anything yet. If we click submit, all that will happen is a page reload. Worse still, any entered values will be lost. We've also got the added disadvantage of people being able to enter whatever they like into those boxes. The label on "Email" says "Email", and we'd expect an email address to be passed in, but there is presently nothing stopping our users from entering a small essay on spiders instead, difficult to read as it may be.

We'll address the most pressing issue first. The form should DO something, even if all it does is keep our values from getting lost.

The reason our form doesn't do anything is because we haven't told it *what* to do. We can rectify that fairly simply.

Directing the form

In static HTML, we'd do this by adding the following attributes to the form tag.

```
<form action="/Home/Contact" method="post">
```

The *action* is a URL that the form will send its values to. The *method* is the HTTP verb we'll be using to get our values across.

A brief recap, the vast majority of HTTP requests, the web protocol, are GETs.

In MVC, controller actions are GET by default.

GETs transmit their values over the querystring. POSTs usually send their data through standard input, normally in key value pairs, normally as plain text - although you can change encoding to post files, etc.

In MVC, using tag helpers, the syntax is:-

```
<form asp-controller="Home" asp-action="Contact" method="post">
```

The **asp-contoller** tag helper specifies which controller we want. **asp-action** specifies the action we'd like to post the form to.

This will generate the equivalent markup to the static.

Creating a POST controller action.

Right now, our form still doesn't work. If we try to click it, it'll never find the resource it is looking for. While we've got an action that will respond to a GET request for the **/Home/Contact** route, there's nothing on our controller which will accept a POST, something we will sort immediately.

Open up HomeController, and create another action called **Contact** with the same **IActionResult** return type.

To specify that this action is for POST requests only, we're going to decorate the method with the **HttpPost** attribute. MVC will never serve this up in response to any other type of request, such as a GET or a PUT.

We're also going to ensure it receives a parameter of type **ContactViewModel**, the type we defined to carry this information, and the type that the Contact view carries information about.

When we submit the form, the values on the form will be in the corresponding properties in the **request** parameter.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            // Change the Message on the page so that we know we've POSTed.
            ViewData["Message"] = "You tried to get in touch with Empower";

            // Don't return an empty ContactViewModel.
            // Return the one we've just got.
            // This will ensure that any submitted values are available in the
form again
            return View(request);
        }
```

With that change in, our form does something. Not much, but it will at least save any entered values and give an indication that something has happened.

While we're here, and this is optional, but when you've got two actions with the same name, some people prefer to explicitly decorate the Get version too. I am one of those people.

```
        // The default controller verb is GET.
        // Therefore, we don't need to decorate this with an [HttpGet]
        //
        // The upside is that we make our intention to the coders that follow.
        // The downside that the coders that follow might think we don't know
        // that GET is the default :D
        [HttpGet]
        public IActionResult Contact()
        {
            ViewData["Message"] = "Get in touch with Empower";

            return View(new ContactViewModel());
        }
```

Logging the contact

Next, we're going to beef up the Contact POST action a tiny bit, and then make it *really* obvious that something has been posted.

We defined a property called **ContactMadeAt** on **ContactViewModel**. We're not doing anything with it right now, but we can use it to record the time of contact when someone presses the submit button. Let's make a simple addition to the action.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            // Change the Message on the page so that we know we've POSTed.
            ViewData["Message"] = "You tried to get in touch with Empower";


            // This was previously null.
            // Now, when someone submits, this will be set and returned back to
the View.
            request.ContactMadeAt = DateTime.UtcNow;

            // Don't return an empty ContactViewModel.
            // Return the one we've just got.
            // This will ensure that any submitted values are available in the
form again
            return View(request);
        }
```

Conditionally switching the view.

We're now going to display different things, depending on whether **ContactMadeAt** has a value. The GET version of **Contact** never sets it. It can only be set if the POST action has run.

We're going to use a simple conditional to check the status of **ContactMadeAt** on the form. If it's empty, we'll show the form. If it's not, we'll say that contact has been made. At this stage of proceedings, that'd be a slightly dishonest claim. We're only pretending that contact has happened, but such a pretense is good enough to test the UI flow of our form.

```
@if (!Model.ContactMadeAt.HasValue) {
<h2>@ViewData["Title"]</h2>
<h3>@ViewData["Message"]</h3>
    <form asp-controller="Home" asp-action="Contact" method="post">
        <div class="form-group">
            <label asp-for="Name">Name</label>
            <input asp-for="Name" placeholder="Please enter your name"
class="form-control"/>
        </div>
        <div class="form-group">
            <label asp-for="Email">Email</label>
            <input asp-for="Email" placeholder="Please enter your email"
class="form-control" />
        </div>
        <div class="form-group">
            <label asp-for="Message">Message</label>
            <textarea asp-for="Message" placeholder="Please enter your message"
class="form-control"></textarea>
        </div>
        <button type="submit" class="btn btn-primary">
            Contact us
        </button>
    </form>
}
else{
    <div class="alert">
        <h1>Thank you for contacting us, @Model.Name</h1>
        <div class="alert alert-success">
            <p class="text-success">
                We have logged your communication as having been sent at
<strong>@Model.ContactMadeAt.Value.ToLocalTime()</strong> .
            </p>
        </div>
        <div class="alert alert-warning">
            <p class="text-warning">
                Due to circumstances beyond our control, there is a
<em>slight</em> chance that no-one will read your communication.  Miniscule,
really.  Try not to worry about it.
            </p>
        </div>
        <div class="alert alert-danger">
            <p class="text-danger">
                I find the comments of the previous paragraph completely
disingenous.  It knows full well the email send functionality hasn't been
completed yet.
            </p>
        </div>
    </div>
}
```

As you can see, the **if** statement serves up different mark up based on the value of something received in **ContactViewModel**

What just happened?

We :-

- Created a ViewModel, a type of class designed to be shown on a View.
    - Tied it to a View.
- Created a form
    - Bound elements of the ViewModel to form elements, using the MVC tag helpers.
- Created a POST controller action
    - Receives a **ContactViewModel**
    - Sets **ContactViewModel** on that object
    - Returns the altered request to the View
- Changed the Contact.cshtml view to support the two states
    - Form displaying for the first time.
    - Post-form display.

Commit your work!

Now's a good time to commit your work. Congratulations. You've just created your first MVC form interaction (and I still know professional developers who've not done that). Don't feel too validated, though. That comes next.

Exercise 4 - Annotation and validation

Our contact form talks the talk, but doesn't walk the walk. Perhaps that's just as well. As we've already opined, it'll accept absolutely anything and get to work. It'll also consider absolutely nothing to be valid too. If we click and run the form without providing any input, it won't complain. "Yeah, whatever" is this form's present attitude to user input.

We need to tighten up what the form will accept before we attempt to send any actual contact messages to anyone. Our contact form will be useless unless:-

- We guarantee that someone provides a name.
- We guarantee that someone provides a valid email address.
- We guarantee that someone provides a message.

Without doing that, our form is pretty useless. We'll receive emails without knowing who sent them, what they wanted, or how to get back to them. We need to validate.

DataAnnotations

.NET has a set of attributes called DataAnnotations that can be used to decorate properties on any class we might create. We're going to annotate **ContactViewModel** to include some information about what each field should be.

Let's open up ContactViewModel and add some basic validation information using the attributes defined in **DataAnnotations**.

The **Required** attribute

By decorating a public property with **Required**, we inform MVC that the model isn't valid if a value is not provided. All three of our properties are required. Let's specify that now.

Required can take optional arguments, including **ErrorMessage**. We're going to use that to provide some direction to the user if he or she messes up.

```
public class ContactViewModel
{
    [Required(ErrorMessage="Please enter your name")]
    public string Name { get; set; }

    [Required(ErrorMessage = "Please enter your email")]
    public string Email { get; set; }

    [Required(ErrorMessage = "Please enter your message")]
    public string Message { get; set; }
    public DateTime? ContactMadeAt { get; set; }
}
```

The **EmailAddress** attribute

One of the things we need to collect has more specific requirements than the others. We don't just need it to be present; we need it to be a valid email address. Fortunately, there is a data annotation for that, and multiple attributes can be applied to a single property, if needed.

Again, we can use the **ErrorMessage** to provide *specific* direction to our end users.

```
    [Required(ErrorMessage = "Please enter your email")]
    [EmailAddress(ErrorMessage ="Please enter a valid email")]
    public string Email { get; set; }
```

If an end user enters something, but it isn't an email address, they'll be asked to enter a *valid* email address.

The **MaxLength** attribute.

We can also declare something invalid if it exceeds a certain length. This is vital in situations where we are persisting the values in fixed length database fields. We're not doing that at the moment, but we should still put some limit on the number of characters we'll allow.

EmailAddress should already cater for the 254 character limit on email addresses, but we can specify maximum lengths for Name and Message.

```
    [Required(ErrorMessage="Please enter your name")]
    [MaxLength(100, ErrorMessage="How long does it take you to fill in forms?
Please enter 100 characters or less.")]
    public string Name { get; set; }

    [Required(ErrorMessage = "Please enter your message")]
    [MaxLength(4000, ErrorMessage="Too long.  Didn't read.")]
    public string Message { get; set; }
```

The cool thing about MaxLength is that it will emit the corresponding property in the markup, limiting normal user input to the number of characters specified.

The **DisplayName** attribute

Finally, for now, let's decorate our properties with the DisplayName attribute.

DisplayName is handy because C# property names have some pretty big English language limitations, like not being able to contain space or punctuation. We can use DisplayName to give our form friendlier labels. Whatever we set, MVC will emit in the *label* tag.

```
public class ContactViewModel
{
    [DisplayName("Your name")]
    [Required(ErrorMessage="Please enter your name")]
    [MaxLength(100, ErrorMessage="How long does it take you to fill in forms? 
Please enter 100 characters or less.")]
    public string Name { get; set; }

    [DisplayName("Your email address")]
    [Required(ErrorMessage = "Please enter your email")]
    [EmailAddress(ErrorMessage ="Please enter a valid email")]
    public string Email { get; set; }

    [DisplayName("Your feedback")]
    [Required(ErrorMessage = "Please enter your message")]
    [MaxLength(4000, ErrorMessage="Too long.  Didn't read.")]
    public string Message { get; set; }
    public DateTime? ContactMadeAt { get; set; }
}
```

Checking the Model's validity.

Now that we've established the rules for each of our fields, ASP .NET MVC makes validating these fields simple. A property called ModelState is available in controller methods, which will only return valid if all DataAnnotations rules are met.

Let's open up HomeController again, and include a check for **ModelState.IsValid**.

We're going to change the behavior so that we only set the **ContactMadeAt** property *if* the ViewModel we receive is valid.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the 
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            // Change the Message on the page so that we know we've POSTed.
            ViewData["Message"] = "You tried to get in touch with Empower";

            if (ModelState.IsValid)
            {
                // This was previously null.
                // Now, when someone submits, this will be set and returned back 
to the View.
                request.ContactMadeAt = DateTime.UtcNow;
            }
            // Don't return an empty ContactViewModel.
            // Return the one we've just got.
            // This will ensure that any submitted values are available in the
form again
            return View(request);
        }
```

Let's open up the **Contact.cshtml** view again and recap. If **ContactMadeAt** has no value, we show the form. If it has a value, we show the rather mendacious response page. We've just introduced a clause that says we'll only set that value, if the form is valid.

Before we try it out, what do you think will happen if we try to POST this form with invalid data?

SPOILER, we'll show the form, so that the user can retry.

Reporting problems through the View.

We'll want to let our user's know what has gone wrong, if anything has gone wrong.

MVC provides support for validation errors. We're going to add a danger label to each form element, which will display if any of the property's rules have been broken.

```
    <form asp-controller="Home" asp-action="Contact" method="post">
           <div class="form-group">
               <label asp-for="Name">Name</label>
               <input asp-for="Name" placeholder="Please enter your name"
class="form-control"/>
               <span asp-validation-for="Name" class="label label-danger"></span>
           </div>
           <div class="form-group">
               <label asp-for="Email">Email</label>
               <input asp-for="Email" placeholder="Please enter your email"
class="form-control" />
               <span asp-validation-for="Email" class="label label-danger"></span>
           </div>
           <div class="form-group">
               <label asp-for="Message">Message</label>
               <textarea asp-for="Message" placeholder="Please enter your message"
class="form-control"></textarea>
               <span asp-validation-for="Message" class="label label-danger"></span>
           </div>
           <button type="submit" class="btn btn-primary">
               Contact us
           </button>
       </form>
```

This is all thanks to the *asp-validation-for* tag helper. By including it, along with the name of the property we care about, we're essentially saying "follow the validation rules for this property, and fill this element with an error message if you have one". If the property has valid data, it won't be shown.

Let's run our form now and try to submit it with invalid or empty data.

What just happened?

- We decided we needed to validate **ContactViewModel** to make it useful, or at least keep it from being potentially useless.
- We used **DataAnnotations** to specify some rules for each property.
    - We also created custom error messages.
    - Some of them may have not been entirely professional.
- We changed a controller action to use **ModelState.IsValid** to determine whether the rules we set have been met.
    - We only set **ContactMadeAt** if the form is valid
    - This ensured that the form was redisplayed when invalid data was entered
- We added elements on the **Contact.cshtml** view to hold error messages, tied to the rules we set with the tag helper **asp-validation-for**.

Commit your work!

We've just made sure that we're going to get some halfway decent data in from this form, and that our users will have a fair idea of what is wrong, if anything is wrong, so invalid data will be corrected. Brace yourselves. In the next exercise, we make contact.

Exercise 5 - Contact

In this exercise, we're going to send the email. We're not going to do it in the optimum way, but we can refine on that later, and discuss why it isn't the optimum way. In the coming exercises, we're going to absolve most of our programming sins.

System.Net.Mail

Microsoft .NET is now a very mature platform, but the ability to send an email has been something that it has had from the start. It still exists today.

The email functionality resides in **System.Net.Mail**.

We're going to use that ready-rolled functionality to send our contact form to an email address of our choice, namely ours. You should all have **Sightsource** email addresses at this point, so we'll make sure that the results of your contact form will come to you.

Modifying the HomeController to send an email

We're going to use the **System.Net.Mail** to send an email, and we're going to do some bad things in the process. As usual, this isn't ideal practice, but it is sometimes good to see the bad things so that you don't do them yourself.

MailMessage

To send a mail through **System.Net.Mail**, we need to create a **MailMessage**. This contains basic details of sender, recipient, content and content type, as well as any attachments we may choose to add. For now, there are no files on us. We can keep things simple.

We will need to set the following details

- Sender Email ("s2empower@gmail.com")
  - **To** property on a mail message object. Takes a collection of **MailAddress**
- Sender Name ("Sightsource Bot")
  - **To** property on a mail message object. Takes a collection of **MailAddress**
- Recipient Email ("")
  - **From** property on a mail message object. Takes a **MailAddress**
- Recipient Name ("")
  - **From** property on a mail message object. Takes a **MailAddress**
- Body content
  - The name and email address of the person that sent the message
  - The message itself.
- The Subject

Let's construct the **MailMessage**

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            // This checks validation rules to determine whether the information
            // supplied in request will meet the needs of the request.
            //
            // UPDATE: This will now validate according to the rules of the
validators
            // on ContactViewModel.   It'll return false if any of the rules we've
set are
            // broken.
            if (ModelState.IsValid)
            {
                // Send the mail
                var message = new MailMessage();
                var configuration = GetConfiguration();

                message.To.Add(new MailAddress("pap@elevenhitcombo.com",
"Hackmeister McHack"));
                message.From = new MailAddress("s2empower@gmail.com", "Sightsource
Bot");
                message.Body =
                    $"{request.Name} ({request.Email})" +
                    Environment.NewLine +
                    request.Message;
                message.Subject = "New Contact Request";


                request.ContactMadeAt = DateTime.Now;
            }

            return View(request);
        }
```

The letter had been assembled. We still need to post it.

SmtpClient

SmtpClient is another .NET stalwart, and has the specific job of sending **MailMessage** objects through a server. Email has become swamped by spammers to the point where many folk question its utility for actual communication. The key platform for sending email is SMTP, and as the scourge of spamming and the risk that goes with it (your entire email domain can be blacklisted if ISPs detect spam sent from your servers), most SMTP servers require credentials.

We will need to provide them, along with some basic details of how we'd like to do our business, such as using encryption for communication.

SmtpClient makes all of this trivial, and is an example of why a quick search to see if something already exists is better than rolling your own.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            // This checks validation rules to determine whether the information
            // supplied in request will meet the needs of the request.
            //
            // UPDATE: This will now validate according to the rules of the
validators
            // on ContactViewModel.   It'll return false if any of the rules we've
set are
            // broken.
            if (ModelState.IsValid)
            {
                // Send the mail
                var message = new MailMessage();
                var configuration = GetConfiguration();

                message.To.Add(new MailAddress("pap@elevenhitcombo.com",
"Hackmeister McHack"));
                message.From = new MailAddress("s2empower@gmail.com", "Sightsource
Bot");
                message.Body =
                    $"{request.Name} ({request.Email})" +
                    Environment.NewLine +
                    request.Message;
                message.Subject = "New Contact Request";

                client = new SmtpClient("email-smtp.us-east-1.amazonaws.com");
                client.Port = 587;
                client.EnableSsl = true;
                client.Credentials = new System.Net.NetworkCredential(
                    "AKIAJZT46OGOXRVDV55Q",
                    "AnQ9XTmy2Bb7g+adRah8ZLVkJzvwQr3y448eeVfqfGgs"
                );
                client.Send(message);


                request.ContactMadeAt = DateTime.Now;
            }

            return View(request);
        }
```

Small discussion of your instructor's egregious sins.

From your experience so far, what would you say I have done wrong here?

What just happened?

- We got our Contact form functional.
  - It will now send an email to you when someone wants to get in contact.
- We could have done better.
  - Our discussion illustrated several problems with the approach.

Commit your work

We're going to solve some of those problems in the next exercise.

Exercise 5 - Configuration

Following our discussion, I've been put in my place. We know that we might have to deploy to multiple environments, and that hardcoding things like passwords, and forcing deployments for simple things like password changes is a really bad idea.

We'd like to be able to change simple details like that without changing the code that runs our site. It is time to talk about configuration.

I'm certain you've been through this before, but configuration in ASP .NET MVC 2.0 dispenses with everything else in .NET. The web.config and app.config **XML** files have been retired. **JSON** is the format du jour. appsettings.json is where application settings live now. They're very easy to manage, compared to the bloated files of the past. They are also very configurable, and very easy to get to.

appsettings.json example

You should already have an appsettings.json file, created when your project was. Lets get our SMTP settings into a configuration file

```
{
  "Logging": {
    "IncludeScopes": false,
    "LogLevel": {
      "Default": "Warning"
    }
  },
  "Contact": {
    "SmtpHost": "localhost",
    "SmtpUsername": "AKIAJZT46OGOXRVDV55Q",
    "SmtpPassword": "AnQ9XTmy2Bb7g+adRah8ZLVkJzvwQr3y448eeVfqfGg",
    "SmtpUseSsl": "true",
    "SmtpPort": "587",
    "DoNotReply": "s2empower@gmail.com",
    "DoNotReplyName": "Sightsource Contact Bot",
    "Destination": "pap@elevenhitcombo.com",
    "DestinationName": "Paul Taylor"
  }
}
```

Return to StartUp.cs

Those with freakishly decent memories may remember the constructor in the **StartUp** class, the class that sets up our MVC application. For those that do not, it is reproduced here:-

```
public Startup(IConfiguration configuration)
{
    Configuration = configuration;
}
```

This effectively loads the configuration from **appsettings.json**.

Accessing the configuration with ConfigurationBuilder programmatically.

You can load configurations independently should you wish.

```
        private IConfiguration GetConfiguration()
        {
            var builder = new ConfigurationBuilder()
                    .SetBasePath(Directory.GetCurrentDirectory())
                    .AddJsonFile("appsettings.json");

            return builder.Build();
        }
```

appsettings.json is a convention; as the example above shows, we can specify different configurations and add them at will.

Let's put the above method in **HomeController**. It'll help us out with our hardcoding problem.

Once that method is in, we can get a configuration anytime we need it inside **HomeController**.

We can access the configuration with :-

```
var configuration = GetConfiguration();
```

Accessing configuration values

The **IConfiguration** object allows for easy retrieval of configuration items. **JSON** is essentially a tree of data, objects within objects. The : character is used to separate levels of the tree.

Using the example above, if we wanted to get the value of Contact -> SmtpHost, can use the configuration object as follows:-

```
var smtpHost = configuration["Contact:SmtpHost"]
```

The **IConfiguration** implementation will dive into the JSON file and pull it out.

Casting configuration values

IConfiguration values are returned as objects. That is because .NET doesn't want to make any assumptions about the kind of data that is held there. It could be a string. It could be a number. It could be a tree of objects in itself.

Text

Turning configuration values into strings is trivial with the *string interpolation* syntax.

```
var smtpHost = $"{configuration["Contact:SmtpHost"]}";
```

Other types

Because **IConfiguration** returns **object**, which can be anything, cast other types as you need to; just be aware that your app will break if something cannot be cast to the type you say it is.

```
var useSsl = (bool)_settingsService.GetSetting("Contact:SmtpUseSsl");
```

A config aware controller.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            // This checks validation rules to determine whether the information
            // supplied in request will meet the needs of the request.
            //
            // UPDATE: This will now validate according to the rules of the
validators
            // on ContactViewModel.   It'll return false if any of the rules we've
set are
            // broken.
            if (ModelState.IsValid)
            {
                // Send the mail
                var message = new MailMessage();
                var configuration = GetConfiguration();

                message.To.Add(new MailAddress($"
{configuration["Contact:Destination"]}", $"
{configuration["Contact:DestinationName"]}"));
                message.From = new MailAddress($"
{configuration["Contact:DoNotReply"]}", $"{configuration["Contact:SenderName"]}");
                message.Body = request.Message;
                message.Subject = "New Contact Request";



                var client = new SmtpClient($"
{configuration["Contact:SmtpHost"]}");
                client.Port = (int)configuration["Contact:SmtpPort"];
                client.EnableSsl = (int)configuration["Contact:SmtpUseSsl"];
                client.Credentials = new System.Net.NetworkCredential(
                    $"{configuration["Contact:SmtpUsername"]}",
                    $"{configuration["Contact:SmtpPassword"]}"
                );
                client.Send(message);
                request.ContactMadeAt = DateTime.Now;
            }

            return View(request);
        }
```

What just happened?

- We added configuration elements to our existing appsettings.json file
- Doing this allowed us to take hard-coded and likely to break elements of the app outside the realm of code.
    - We can now change settings just by changing a JSON file
    - We don't have to redeploy an app, we can just change one file, appsettings.json, and most of the upstream changes can be catered for.

Commit your work!

Let's get this bad boy into **git**. For now, we are feature complete.

Merge your work.

Our first feature is complete. As long as we're all happy with it, let's merge that work into master.

Once you've committed your work, you can drop into the git bash shell.

Type

```
git checkout master
git merge feature/contact
```

What does this do?

This puts all the work you've done for contact back into the master branch.

Conflicts?

VS is great place to resolve merge issues. Speak to me if you have any.

Commit your work again!

Once any conflicts have been resolved, let's get our work into the master branch.

You'll need to type:-

```
git commit -m "Merging contact into master"
```

What's just happened?

- We've just merged our first feature into the master branch
  - Until we merged, it was completely independent of the master branch
  - After we merged, our new feature became a part of the master branch
  - Any new branches we create from master will contain these changes.

What did we do today?

- We:-
  - learned the history of MVC
  - got the technical definition.
  - got a workable definition.
  - took a tour around Microsoft's ASP .NET Core 2.0 MVC.
  - saw the horrors of what went on before the MVC pattern was introduced to the web.
  - created **ContactViewModel**, changing the Controller method to emit it.
  - adapted the view, creating a form, bound to the properties of **ContactViewModel**
  - created a POST action to accept input from the form on out view, in **ContactViewModel** format.
  - created a switch, using Razor, to conditionally display the form or an acknowledgement that something had been posted.
  - used the **DataAnnotations** functionality to specify rules for the things in **ContactViewModel**
  - added a check on **ModelState.IsValid**, hooked into **DataAnnotations**, to determine the validity of the submitted input.
  - modified our switch to only show acknowledgemnt when the data was valid.
  - *finally* actually sent an email, if imperfectly.
  - introduced configuration, allowing us to change settings without hardcoding or re-deploying the application.
  - merged our completed branch back into master.

Discussion

What did we do right? What did we do wrong? What do we still have to do.

End of day one wrap up?

Note to reviewers. Day two is services and dependency injection. Day three is persistence and login. Just working through commits.

Day Two - Dependency Injection and Service Based Architecture.

Recap of Day One.

We were able to use the Model View Controller pattern to send an email with the controller. The problem is, we played fast and loose with the definitions we laid out earlier. Our controller is actually *doing* stuff. It really shouldn't be. If we remember our amended definition of Model, View and Controller, it's really the Model that should be doing stuff. The controller should just control the stuff the Model gets to do.

In other words, the controller should just be giving orders once it knows those orders are valid. It shouldn't be carrying out those orders itself.

Services

We're going to move the behaviour we put in our controller's Contact POST action into a service. A service in computing is much like a service in real life. It's a thing that does a thing, normally something that you don't want to do yourself. Pizza delivery is great example of a real life service we use every day, and something we can put in an MVC context. We are the controllers. We decide whether we want pizza or not. We call a pizza service using an interface; a phone number, a website, or an app.

We are not particularly concerned about how the service is implemented, as long as it doesn't take too long, it actually works, we don't get food poisoning the next morning or subsequently discover that the place our Tuesday night food comes from is infested with rats.

The boys and girls at the pizza store are relying on services too. They did not build their restaurant from scratch. They were not up in the mountains, mining stone, or in the quarries, getting sand, making windows. They do not have cows in the back yard, there's no dairy or cheese rendering facilities on the premises. You might not even have a dairy in your town. For all of these things, they rely on services too.

They need people to mill, people to farm, people to move product so that it can be refined, raw animal and plant products, the process of photosynthesis for all of that to happen, and almost no human involved in that chain does all of these things themselves. Each of them depends on other services to provide their services.

It's an example of a *dependency chain*, happening in real life. We need food, so we call a pizza service. They need cheese, flour and ingredients. They use services for that, such as hauliers, farmers, miners, plants, animals and for photosynthesis, celestial bodies that also happen to be giant nuclear fusion reactors.

A great definition of a service is that "I need you to do something for me. Don't much care how you do it". Each and every part of the pizza service dependency chain can be described that way.

We call a telephone line, or use an online service to order pizza. We want pizza. As long as the quality is good, and the delivery is timely, we don't much care how it's done. The guys at the pizza store are going to need mozzarella, tomatos and various processed meats to meet their needs, and like us, they have an interface - again, usually telephone or online interfaces that allow them to order their products.

Some of the things they need will have *multiple dependencies*. It's all very well ordering mozzarella, but it's no good if you can't get it to the pizza service. Mozzarella needs multiple services, production and transport. As long as mozzarella is delivered, we don't much care how they're delivered.

A recap on Interfaces

A recap on interfaces is needed because it's probably one of the most overused terms in computing. More than anything else, an interface declares a contractual obligation. Returning to our pizza store example, we might use the following interface to define its operations.

```
public interface IPizzaService
{
    FoodOrderResponse FulfilWalkupOrder(FoodOrderRequest request);
    DeliveredFoodOrderResponse FulfilTelephoneOrder(DeliveredFoodOrderRequest
request);
    DeliveredFoodOrderResponse FulfilOnlineOrder(DeliveredFoodOrderRequest
request);
}
```

Even though we don't know precisely what *FoodOrderResponse*, *DeliveredFoodOrderResponse*, or the request objects contain, if we assume they contain all the things you need to fulfil a walk up or delivered order, that is a pretty good description of *our* interaction with the pizza service is.

Our needs are simple. Can you give me a box full of pizza if I walk up for it? Can you deliver boxes full of pizza if I order them, either by phone or online?

The C# interface above declares that we'd like something done. Anyone that claims to be an IPizzaService should be able to do these things. The interface has absolutely no concept of how these things will be done. It's perhaps the perfect expression of I don't care how it's done, just do it.

Everything claiming it can run an IPizzaService will be expected to do it.

Exercise 1 - Creating a Services project

Create a new git branch based off master. Let's call it feature/services. Checkout feature/services.

A services, or contracts project, is the home for your contracts, and most of your interfaces. We are going to create a new project that will come to define the entire scope of our model, to anyone that can read a bit of English and cares to look. With a services based approach, and sensible naming conventions, we can make life much easier for future coders. They will simply be able to look at the services we've defined, and be able to deduce the exact scope of our application.

In Visual Studio, create a new C# class library calledd **Empower.Services**. Ensure it is sited in the **src** directory.

Adding our first contract, or service

We want to get our controller out of the "running code" business and back into the "controlling code" business. It really shouldn't be concerned with "how to send an email". We are going to delegate that responsibility to an email service.

Let's add a new item in Visual Studio project to our newly created Services project. Scroll down and find the interface type. Call it **IEmailService**.

Our new interface should look like this to begin with:-

```
namespace Empower.Services.Interfaces
{
    /// <summary>
    /// This interface defines and describes all operations we'd want to
    /// perform for email operations
    /// </summary>
    public interface IEmailService
    {
        DateTime? SendEmail(string toName, string toEmail, string bodyText, string
subject, string fromName, string fromEmail);
    }
}
```

Anything that says it can run an *IEmailService* must provide that method. Given the following parameters:-

- toName
- toEmail
- bodyText
- fromName
- fromEmail
- subject

The *IEmailService* promises to do something called SendEmail, returning a Nullable date time.

Creating a concrete implementation

We've declared something called an IEmailService. This, as we've said, is like a contract. Any class setting itself up to perform, or implement that service, has to fulfil that contract. We're going to create a class that does that. Such classes are known as concrete implementations; they are where the work is done.

New project - Empower.Network.Services

We're going to start creating new projects quite frequently with our service based approach. While we could create an implementation of IEmailService that lives in the same project as our MVC project, we might want to use our email service in other things we can do. By creating a separate project to house this functionality, we get to re-use EmailService with other work we may wish to do in the future.

We're going to create a project designed to handle all our Network-type services. Email is a network protocol for sending messages electronically, so this new project will be the perfect home.

Let's create a new **c# class library** project called **Empower.Network.Services**.

Project references

Our new project will need to know about **Empower.Services**. Our MVC project will need to know about **Empower.Services** and **Empower.Network.Services**. Let's create those references now.

New class - EmailService

Now our projects are linked up, we can create an **EmailService** in **Empower.Network.Services** which references *IEmailService* in *Empower.Services*.

Let's add a new class called EmailService to **Empower.Network.Services**.

Implementing *IEmailService*

Our newly created class doesn't have any ties to *IEmailService*. They're named similarly, but as far as the compiler is concerned, that's just coincidence.

As programmers, we need to explicitly *implement* the interface. The implementation syntax is identical to inheritance syntax, although if you are implementing and interface *and* inheriting at the same time, the base class must come before any interface declarations.

Here, we're just implementing *IEmailService*, and initially, not very well.

Our class meets the demands of the *IEmailService*. It will compile. It won't actually run.

```
namespace Empower.Network.Services
{
    // This is EmailService explicitly declaring "I will do the work of
*IEmailService*"
    public class EmailService : IEmailService
    {
        public DateTime? SendEmail(string toName, string toEmail, string bodyText,
string fromName, string fromEmail)
        {
            // Which is something of a fib at this point.
            throw new NotImplementedException();
        }
    }
}
```

Moving the controller implementation into EmailService.

We've already got something that sends an email defined in our **HomeController**. We're going to move that code into the EmailService, putting it into the **SendEmail**.

For now, we're also going to take a very naughty coding decision which you shouldn't do in real life, and we'll be fixing afterward.

We've copied and pasted a block of code to allow access to our configuration. That'll give us a working method right now, but it's something that we won't leave in.

If we did that, there's a good chance that we could end up taking divergent paths on getting configurations, something we want to remain the same.

```
namespace Empower.Network.Services
{
    // This is EmailService explicitly declaring "I will do the work of
*IEmailService*"
    public class EmailService : IEmailService
    {
        public DateTime? SendEmail(string toName, string toEmail, string bodyText,
string fromName, string fromEmail)
        {
            var dateSent = (DateTime?)null;

            // Send the mail
            var message = new MailMessage();
            var configuration = GetConfiguration();


            message.To.Add(new MailAddress(toEmail, toName));
            message.From = new MailAddress(fromEmail, fromName);
            message.Body = bodyText;
            message.Subject = subject;

            try
            {
                var client = new SmtpClient($"
{configuration["Contact:SmtpHost"]}");
                client.Port = (int)configuration["Contact:SmtpPort"];
                client.EnableSsl = (int)configuration["Contact:SmtpUseSsl"];
                client.Credentials = new System.Net.NetworkCredential(
                    $"{configuration["Contact:SmtpUsername"]}",
                    $"{configuration["Contact:SmtpPassword"]}"
                );
                client.Send(message);
                dateSent = DateTime.UtcNow;
            }
            catch (Exception ex)
            {
                // TODO: Add logging at some point
            }

            return dateSent;
       }
     }

    // This is a very naughty temporary inclusion.
    // We should never violate the DRY principle in production code.
    // We will refactor this with a saner construction.
    private IConfiguration GetConfiguration()
    {
        var builder = new ConfigurationBuilder()
                .SetBasePath(Directory.GetCurrentDirectory())
                .AddJsonFile("appsettings.json");

        return builder.Build();
    }

}
```

Refactoring HomeController to use EmailService.

Now that we've moved the SendEmail functionality into EmailService, the Contact action in HomeController can be modified to take advantage of this functionality.

Again, we're going to go about things the wrong way before settling on correct practice. For right now, we're going to ignore the fact that we created an interface called **IEmailService** and just create a new instance of EmailService directly.

Our new action should look like this:-

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            // This checks validation rules to determine whether the information
            // supplied in request will meet the needs of the request.
            //
            // UPDATE: This will now validate according to the rules of the
validators
            // on ContactViewModel.   It'll return false if any of the rules we've
set are
            // broken.
            if (ModelState.IsValid)
            {
                // This is bad practice.   While we've gotten away with creating a
concrete
                // instance of EmailService on the fly, the controller will be
much better
                // served through an injected instance of IEmailService
                var emailService = new EmailService();
                var configuration = GetConfiguration();

                emailService.SendEmail(
                    $"{configuration["Contact:DestinationName"]}",
                    $"{configuration["Contact:Destination"]}",
                    "Sightsource Empower Feedback",
                    $"Sent by: {request.Name} <{request.Email}>
{Environment.NewLine}{request.Message}" ,
                    $"{configuration["Contact:DoNotReplyName"]}",
                    $"{configuration["Contact:DoNotReply"]}"
                );
            }

            return View(request);
        }
```

We've moved on a little. Our controller method is more or less just controlling now. If what it receives is valid, it will use a method defined on a service to send the email.

Our implementation still has problems. Even though the controller method is no longer concerning itself with the business of sending emails, delegating that to an EmailService instance, it's still plucking values from the configuration to make its calls. Worse, we've violated the Do Not Repeat Yourself principle by having identical definitions of GetConfiguration in HomeController, which we cannot presently avoid without doing something else.

The design of our method is part of the problem. It's too general. It is designed to send any email, to any address, from any address, meaning that our controller method needs to supply all of those values itself. In reality, our contact form is at present, only concerned with sending email to one address, from one address, including the user's detail in the request.

Crucially, we're calling the service from a concrete instance we created ourselves. We've gotten away with it now because our EmailService implementation has no other dependencies. If it needed something else, we would need to provide it ourselves. If its dependency needed something else, we'd need to provide that too. There is a whole framework that will do that for us if we set it up correctly.

Wiring in dependency injection

A recap

The dependency injection pattern allows a programmer to make use of injected dependencies. Dependencies are estabilished using a one-time setup routine, which establishes how each service is going to be delivered. In .NET Core 2.0 apps, these dependencies are, by convention, established in Startup.cs.

Let's open that up, and add the following line to **ConfigureServices**.

```
// This method gets called by the runtime. Use this method to add services to the
container.
public void ConfigureServices(IServiceCollection services)
{
    services.AddTransient<IEmailService, EmailService>();
    services.AddMvc();
}
```

.NET Core 2.0 knows all about dependency injection. We can use the vanilla implementation for now.

The new line is:-

```
    services.AddTransient<IEmailService, EmailService>();
```

This line tells MVC that :-

- We're declaring a service
- It's called *IEmailService*

- When someone asks for an *IEmailService*, we're going to give them an *EmailService* from **Empower.Network.Services**.
- The **AddTransient** command means that MVC will spin up a new temporary EmailService instance every time an IEmailService service is required. There are other strategies for service creation which will discuss in due course.

Constructor injection

Now that we've declared **IEmailService** as a service which can be resolved by creating a new **EmailService**, we're in a position to use **constructor injection** to **inject** the service into **HomeController**. We can remove the direct reference to EmailService.

First though, we're going to create a new variable that will house the service we're looking to inject.

```
      private readonly IEmailService _emailService;
```

A *readonly* variable can only be set in a constructor. Accordingly, it is commonly used in **constructor injection**.

Constructor injection isn't particularly fancy. It's simply a pattern whereby you give a class the things it needs at start-up. It is the job of the dependency injection engine to make sure those needs are satisfied.

We're going to change our constructor method so that it now takes in an **IEmailService** object, and uses it to set our new readonly variable.

```
        public HomeController(IEmailService emailService)
        {
            _emailService = emailService;
        }
```

From now, if we want to access IEmailService's functionality in the class, all we have to do is reference _emailService. Let's do that in the controller method now.

```
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            // We're now longer newing up an EmailService.
            // We're just using _emailService.
            if (ModelState.IsValid)
            {
                var configuration = GetConfiguration();

                request.ContactMadeAt = _emailService.SendEmail(
                    $"{configuration["Contact:DestinationName"]}",
                    $"{configuration["Contact:Destination"]}",
                    "Sightsource Empower Feedback",
                    $"Sent by: {request.Name} <{request.Email}>
{Environment.NewLine}{request.Message}" ,
                    $"{configuration["Contact:DoNotReplyName"]}",
                    $"{configuration["Contact:DoNotReply"]}",
                    $"{configuration["Contact:SmtpHost"]}"
                );
            }

            return View(request);
        }
```

We're in much better shape inside our controller. It is now in the business of controlling, using a service which it doesn't know any details about, save the fact that it says it can *SendEmail*. It's much like our experience with the pizza guys. We know they can take a phone order, or an online order, and that either will result in pizza, but we're not concerned with how it is done. HomeController is in that state now.

What just happened?

- We created our first contract, or service, embodied as **IEmailService**
    - Any class taking up this contract, or implementing it, needs to provide everything IEmailService says it does.
- We created our first concrete service class, which explicitly claimed it could do the work of **IEmailService**
    - We moved our MailMessage and SmtpClient logic there.
    - We naughtily copied GetConfiguration(), leaving ourselves with some technical debt.
- We configured a dependency rule in Startup.cs
    - Whenever a class requires an IEmailService, the system is configured to provide an instance of **EmailService**.
- We changed HomeController to have a dependency on **IEmailService**
    - We specified this dependency by using **constructor injection**, a means of giving a class the services it needs through dependency injection.
- HomeController now knows very little about the specifics of sending an email.
    - It relies on a service for this work.
    - It does not know how this service works, nor does it care.

Commit your work

This feature isn't perfect, but we are at a stage where we can commit our work, and start looking to our next service.

We're staying on the feature/services branch for now.

Exercise 2 - Settings

One of the biggest problems introduced during the last exercise was the fact we ended up copying and pasting a means to get a configuration. While it *works*, it's far from ideal practice. We shouldn't repeat ourselves, especially when we have other options available.

We can define a settings service, with the unique job of granting us access to every setting we care about in our application, or at least in the parts that exist so far.

SettingsService

For right now, let's keep the behaviour we want from our service relatively simple. An *ISettingsService* should be able to get me a setting value, in string or object format, if I provide it with a setting key.

Let's create that contract in **Empower.Services**

```
namespace Empower.Services.Interfaces
{
    public interface ISettingsService
    {
        object GetSetting(string settingKey);
        string GetStringSetting(string settingKey);
    }
}
```

Another new .NET Class Library project

We've just declared what the service *should* do. We don't have anything that will fulfil that service as of yet, and it isn't a perfect fit for many of our existing class libraries.

Let's create a new class library called **Empower.Settings.Services** to house our concrete implementation of this behaviour.

Ensure it is sited in the **src** directory. This project should reference **Empower.Services**. **Empower.Mvc** should reference this project.

SettingsService

Let's create a new class called **SettingsService**. Like our **EmailService**, it will *implement* the **ISettingsService** contract, promising to do the stuff it says it will do.

The class is pretty simple. Let's put it together now.

The first thing we need to do is state that **SettingsService** will do **ISettingsService** work.

```
public class SettingsService : ISettingsService
```

If we try to compile our work now, VS will inform us of a couple of errors, because we haven't yet provided implementations for the mandatory **ISettingsService** methods.

We should get to work on them now, but we need something else first.

Injecting a configuration

Previously, we were using a ConfigurationBuilder to read the appsettings.json file. That is the file that is read by default, by the MVC engine, during Startup.cs.

Instead of building it to order everytime, we can **inject** an IConfiguration instance into our settings service, so that we have the configuration file available, in programmatic form, inside our SettingsService.

Let's create a readonly variable to store the incoming configuration.

```
private readonly IConfiguration _configuration;
```

And then create a constructor that will accept an IConfiguration object as a dependency.

```
public SettingsService(IConfiguration configuration)
{
    _configuration = configuration;
}
```

We can now access a populated configuration anywhere in the SettingsService class through the _configuration variable.

Creating the methods that are required by **ISettingsService** is now trivial. We're just passing through to methods available on _configuration.

```
        // These methods are simply pass throughs to methods on
        // IConfiguration, available through _configuration
        public object GetSetting(string settingKey)
        {
            return _configuration[settingKey];
        }

        // This method is using string interpolation to coerce the
        // result into a string.
        public string GetStringSetting(string settingKey)
        {
            var rawSetting = GetSetting(settingKey);
            return $"{rawSetting}";
        }
```

Our completed SettingsService should look as follows. It's presently a little dumb, but it meets its contractual requirements.

```
    public class SettingsService : ISettingsService
    {
        private readonly IConfiguration _configuration;

        public SettingsService(IConfiguration configuration)
        {
            _configuration = configuration;
        }

        public object GetSetting(string settingKey)
        {
            return _configuration[settingKey];
        }

        public string GetStringSetting(string settingKey)
        {
            var rawSetting = GetSetting(settingKey);
            return $"{rawSetting}";
        }
    }
```

Adding ISettingsService to the list of injectable services

Let's head back into **Startup.cs** and make a bold declaration. Any time that any piece of code needs an **ISettingsService**, we will instruct MVC to give it the **SettingsService** defined in **Empower.Settings.Services**.

Last time, we changed the **ConfigureServices** method, creating an association between IEmailService and EmailService using a method called **AddTransient**. That choice has the effect of a new EmailService being created every time an IEmailService was asked for.

When declaring these associations, we can also control the lifetime of the objects that are created to service them. We don't have to create a brand new SettingsService every time someone asks for one. These kind of settings do not change from user to user. It might be far more efficient to just have one copy of the SettingsService object in memory that can be served up any time something needs a setting.

We can use **AddSingleton** in our configuration of this service instead of **AddTransient**. This will ensure that the dependency injection engine creates just one instance of SettingsService, passing it around to anything that requires it.

Let's define that relationship now.

```
        // This method gets called by the runtime. Use this method to add services
to the container.
        public void ConfigureServices(IServiceCollection services)
        {
            // Only one copy of the settings service will exist in memory at any
time.
            services.AddSingleton<ISettingsService, SettingsService>();

            // On demand.   Multiple instances will be created as needed.
            services.AddTransient<IEmailService, EmailService>();

            services.AddMvc();
        }
```

When we run our application, anything requiring a setting can make use of **ISettingsService**. Presently, nothing is expressing a requirement, something that we'll change in the next part of the exercise.

Injecting ISettingsService into other classes.

We have two classes that could really use access to Settings. The **HomeController** is one, while **EmailService** is the other. Both are presently reliant on the copied and pasted GetConfiguration() private method, our technical debt from the last exercise. We're going to settle that debt now.

EmailService

Right now, EmailService is using the copied GetConfiguration() private method to build up a configuration each time one is needed. The first thing we're going to do is change where it gets its information from. We're going to use **constructor injection** to specify that from now on, **EmailService** is going to need access to **ISettingsService** to work.

As usual, we'll create a readonly variable to hold a reference to **ISettingsService**.

```
private readonly ISettingsService _settingsService;
```

And we'll create a constructor which takes a **ISettingsService** parameter, setting our local reference to the injected service. The **AddSingleton** declaration we made earlier on will ensure that **EmailService** gets an **ISettingsService** to work with.

```
public EmailService(ISettingsService settingsService)
{
    _settingsService = settingsService;
}
```

Changing SendEmail to use the injected _settingsService

Now that we have access to settings, we no longer need to rely on the rolled-every-time access to the configuration file accessed through our redundant method GetConfiguration. We can ask for these values from our copy of ISettingsService.

```
        // This has now been marked private.
        // It is no longer directly callable from an IEmailService, but then it
doesn't need to be.
        // The stuff that is callable can still use it inside this class.
        private DateTime? SendEmail(string toName, string toEmail, string subject,
string bodyText, string fromName, string fromEmail)
        {
            var dateSent = (DateTime?)null;

            // Send the mail
            var message = new MailMessage();
            message.To.Add(new MailAddress(toEmail, toName));
            message.From = new MailAddress(fromEmail, fromName);
            message.Body = bodyText;
            message.Subject = subject;

            try
            {
                // SMTP Host practically won't change.
                // It no longer needs to be passed as a variable.
                var client = new
SmtpClient(_settingsService.GetStringSetting("Contact:SmtpHost"));
                client.Port =
(int)_settingsService.GetSetting("Contact:SmtpPort");
                client.EnableSsl =
(bool)_settingsService.GetSetting("Contact:SmtpUseSsl");
                client.Credentials = new System.Net.NetworkCredential(
                    _settingsService.GetStringSetting("Contact:SmtpUsername"),
                    _settingsService.GetStringSetting("Contact:SmtpPassword")
                );
                client.Send(message);
                dateSent = DateTime.UtcNow;
            }
            catch (Exception ex)
            {
                // TODO: Add logging at some point
            }

            return dateSent;
        }
```

We can now delete GetConfiguration() from **EmailService**, thanks to our injected alternative. Technical debt paid.

HomeController briefly revisited

HomeController only really needs access to settings because it needs to know where to send contact emails to. It is a demand on the method we're using to SendEmail, made by the contractual requirements of the **IEmailService** interface. Before we modify HomeController, perhaps we're better off asking whether it is getting good service from **IEmailService**.

Irrespective of the sender of the message, the resulting email will always be sent from a Sightsource Bot to a listed Sightsource email address. Those addresses and names all come from the configuration, do not change between requests and are available to EmailService. If EmailService were able to read those values from the configuration, **HomeController** would not need direct access to the configuration at all.

Refactoring IEmailService

Let's add another declaration to IEmailService. From now on, it is going to support a method called SendContactEmail. The signature is as follows.

```
        // In this particular case, that'll be sending a contact email.
        DateTime? SendContactEmail(string fromEmail, string fromName, string
message);
```

This is a much more focused method. Unlike our previous method, which was designed to send an email from anyone to anyone, this method only wants the bare essentials collected on the form.

- Who is the email from?
- What is the person's email address?
- What is the person's message?

All of the other things we need can be pulled from the configuration via ISettingsService. We've defined a method that needs much less from any calling client to do its work.

Creating the concrete implementation

Our **EmailService** class is now out of date, and no longer meeting its contractual requirement to do everything that **IEmailService** says it will do. We'll need to ensure that it honours the **SendContactEmail** method if we want our project to continue building.

We don't have to reinvent the wheel. We can use our existing **SendEmail** in aid of this effort. We also get to use the injected **ISettingsService** to get at the values we need.

```
        public DateTime? SendContactEmail(string fromEmail, string fromName,
string message)
        {
            return SendEmail(
                _settingsService.GetStringSetting("Contact:DestinationName"),
                _settingsService.GetStringSetting("Contact:Destination"),
                "Sightsource Empower - Feedback",
                $"Sent by: {fromName} <{fromEmail}>{Environment.NewLine}
{message}",
                _settingsService.GetStringSetting("Contact:DoNotReplyName"),
                _settingsService.GetStringSetting("Contact:DoNotReply")
            );
        }
```

A tiny bit of privatisation

At this point, we have to ask, do we really need **SendEmail** to be a **public** method on **EmailService**, or a contractual requirement of **IEmailService**. Now that we have a simpler method to call, our app doesn't actually need to call **SendEmail** directly at all. **SendContactEmail** will do it on our app's behalf.

I'd argue that this is a bit of functionality that we might like to use, but the ability to let someone send an email from any address to any address is probably not something we want to publicly advertised.

Making public private

We can change the **accessibility** of **SendEmail** by changing the public accessibility to private.

```
// This has now been marked private.
// It is no longer directly callable from an IEmailService, but then it doesn't
need to be.
// The stuff that is callable can still use it inside this class.
private DateTime? SendEmail(string toName, string toEmail, string subject, string
bodyText, string fromName, string fromEmail)
```

Relaxing IEmailService

Our **EmailService** concrete implementation doesn't fulfil the contractual requirements of **IEmailService** anymore, because the **SendEmail** method is no longer visible. We're going to relax the requirements on **IEmailService**. The *only* thing we want it to do now is **SendContactEmail**.

Our reworked interface should look as follows:-

```
namespace Empower.Services.Interfaces
{
    /// <summary>
    /// This interface defines and describes all operations we'd want to
    /// perform for email operations
    /// </summary>
    public interface IEmailService
    {
        // The big generic SendEmail is no longer in this interface.  Instead,
this
        // contains operations that more closely resemble the actual operations
that
        // the site will perform.
        //
        // In this particular case, that'll be sending a contact email.
        DateTime? SendContactEmail(string fromEmail, string fromName, string
message);
    }
}
```

Changing HomeController to call SendContactEmail.

Now that we've added this new functionality, we can greatly simplify what goes on in our **HomeController**'s action method. The new method will do most of the work for us, using other services to fulfil those needs if it cannot directly do so itself.

Our new POST contact method looks like this:-

```
// This will only respond to requests which supply the POST HTTP verb.
// The POST verb is being provided in the 'method' attribute of the calling form
```

```
//
[HttpPost]
public IActionResult Contact(ContactViewModel request)
{
    ViewData["Message"] = "You tried to get in touch with Empower";

    if (ModelState.IsValid)
    {
        request.ContactMadeAt =
            _emailService.SendContactEmail(request.Email, request.Name,
request.Message);
    }

    return View(request);
}
```

It's *tiny*!

All the details it used to handle are now being handled by _emailService. It's only job is to check the validity of the data it receives, handing everything else over to **IEmailService**.

We can also delete the last vestiges of **GetConfiguration()** from our app. We can remove our copy in **HomeController**, as that class is no longer directly concerned with configuration.

The controller is finally, really, truly, just controlling 😄

What just happened?

- We decided to create a service that would pluck settings from the application's configuration for us
  - With just two methods, **GetSetting** and **GetStringSetting**, **ISettingsService** was defined in **Empower.Services**, our library which defines our apps' major operations.
- We created a new C# class library entitled **Empower.Settings.Services**.
  - We created a **concrete implementation** of **ISettingsService** called SettingsService.
    - We specified that **SettingsService** depended on getting an **IConfiguration**.
    - We completed implementations for **GetSetting** and **GetStringSetting**
- We injected **ISettingsService** into **Empower.Network.Services** EmailService class.
- We refactored **EmailService** to use the injected settings
  - We *deleted* our naughty copy and pasted code.
- We broadened the behaviour of **IEmailService** to include an option to **SendContactEmail**, a specialised version of **SendEmail** able to deduce most parameters.
  - We implemented that method in **EmailService** reusing existing code and services.
- We changed the Contact POST action on **HomeController** to call the new simplified method.
  - We deleted GetConfiguration() there too!
- We changed SendEmail to be a private implementation method for EmailService.
  - It is no longer a contractual requirement of **IEmailService**.
  - It is still used in the fulfilment of **SendContactEmail**
- We built a dependency chain.
- We truly separated concerns.
- We did a lot of MVC

Commit your work

Merge back into master. It's time to cover the Domain. Don't worry. You'll adapt.

Exercise 3 - The Domain

So far, we've only really dealt with three kinds of projects. We've got our MVC application, **Empower.Services**, a collection of service interfaces defining what our service classes, and by extension what our app can do. The final type of project making up the number is the service implementation project. We created **Empower.Network.Services** to handle the work of **IEmailService** and **Empower.Settings.Services** to handle the work of **ISettingsService**.

One of the key reasons that our app is structured this way, and that we haven't just coded up all of our services in the MVC project, is future reusability. Someone wanting to produce a mobile app version of this site would be able to use those libraries without having to reference anything in the MVC project. By placing service implementation classes in their own libraries, future developers can simply reference and reuse the work we've done here. There is value in keeping services independent.

If that's true, then there is also a great deal of value in keeping data structures, classes and other common requirements defined outside of the MVC project. One of the most common ways developers achieve this separation is through the creation of a Domain project.

In this exercise, we're going to learn what a domain project is, what to put in it, and how it helps us create apps that are not only reusable, but easy to maintain.

Another of the most misused words in computing

Domain is used everywhere in computing. We've got Domain names, Windows Domain Servers. For a purposes, a domain can be treated as all the things a system needs to effectively do its job. Those guys at the pizza store have ovens in their domain. They need them to do their jobs. Deliveries are part of their domain, incoming and outgoing. If one were minded, one could come up with a reasonable approximation of all the objects those pizza guys need to complete their service.

That's how we're treating **domain**. It's all the figurative pots and pans of our pizza shop. The things our services will work with. The things we might want to allow other things, not just our MVC app, to use.

Create a new git branch from master

We're going to put our new work into a branch called feature/domain.

Create that branch and check it out.

Create the Empower.Domain project

Within Visual Studio, create a new C# Class Library project called **Empower.Domain**.

Delete the usual Class1.cs nonsense.

Commands

Until now, we've not made any real use of **commands**. Our **SendEmail** method in **EmailService** is a good example of this not occurring. Its inputs are a stream of primitive values. It returns the date and time of any successful contact, but provides no more information than that when something goes wrong.

```
// This has now been marked private.
// It is no longer directly callable from an IEmailService, but then it doesn't
need to be.
// The stuff that is callable can still use it inside this class.
private DateTime? SendEmail(string toName, string toEmail, string subject, string
bodyText, string fromName, string fromEmail)
```

This style of method is a pain from a maintenance perspective too. If we need to add extra fields, we need to alter every call into SendEmail, providing the new information. Entering information by ordinal position is fault prone, not caught by the compiler when the types are the same, as they all are in this method.

Commands offer a better alternative. Request and response commands are a common convention.

Request and Response

Request and **Response** classes are designed to convey the inputs and outputs of a command. The requirements of a command are lodged in the **Request** object. The **Response** object is designed to carry any gleaned result. We're going to use that convention to rework our **SendEmail** mechanism.

Client

Another convention that Domain libraries follow is the Client subdirectory. This directory typically contains information that is likely to be passed around and/or populated by client applications. Small, lightweight, dumb classes designed to shuttle information back and forth. Some programmers refer to this type of class as "data transport objects", or DTOs.

Create a subdirectory in the Domain project called Client.

Enums

The Domain.Client library is a decent place to store **enumerations**, structures that allow us to define our applications without resorting to *magic numbers*

Let's create an Enums subdirectory.

Once complete, let's add a new file called EmailEnums - this just needs to be a code file, as opposed to class.

```
namespace Empower.Domain.Enums
{
    public enum EmailDestination
    {
        Unknown = 0,
        Contact = 1
    }
}
```

The **EmailDestination** enum is a very short list of where our email might go. Either to a Contact address, or we don't know.

Commands

Next, let's create a subdirectory inside Client called Commands. We'll house our command classes here, and we'll split them according to function.

Inside Commands, create two new subdirectories, Requests and Responses.

SendEmailRequest & SendEmailResponse

We're going to create two new classes that encapsulate a request to send an email, and a response containing the result of the request.

In the Requests directory, create a class called **SendEmailRequest**. Let's deck it out in the following way. Note that we've used the **EmailDestination** enum as a parameter too.

```
    public class SendEmailRequest
    {
        // These will come directly from the form
        public string FromEmail { get; set; }
        public string FromName { get; set; }
        public string Message { get; set; }

        // This will be provided inside the controller
        public EmailDestination Destination { get; set; }
    }
```

Let's head into the Response directory and craft something to hold the result of a SendEmailRequest.

Create a new class called **SendEmailResponse**.

```
    public class SendEmailResponse
    {
        // The ? means that the type can be NULL
        public DateTime? SentAt { get; set; }

        // A very simple place to store an error
        public string ErrorMessage { get; set; }

        // A calculated property which tells us if there were any problems
        public bool HasErrored => (!string.IsNullOrEmpty(ErrorMessage));
    }
```

This is a very simple class, not entirely dissimilar to the way we do things now. We've included a nullable **DateTime** called **SentAt**. We'll only set this if the send was successful. We've defined a new property called **ErrorMessage**, along with a convenience property called **HasErrored**, which returns true if the **ErrorMessage** is non-empty.

References

In the first instance, we'll need to ensure that **Empower.Services**, **Empower.Network.Services** and **Empower.Mvc** all reference the new **Empower.Domain** project. It's time to start hooking Domain in.

Refactoring IEmailService to use Request and Response objects.

Now we've got command objects defined in Domain, we can refactor IEmailService to use those in preference to the currently established primitives.

Let's open up **Empower.Services** and change the needs of **IEmailService**.

We're now going to pass a single parameter, a **SendEmailRequest**, and we're going to return an **SendEmailResponse**.

The changed code should look as follows:-

```
    /// <summary>
    /// This interface defines and describes all operations we'd want to
    /// perform for email operations
    /// </summary>
    public interface IEmailService
    {
        // The big generic SendEmail is no longer in this interface.  Instead,
this
        // contains operations that more closely resemble the actual operations
that
        // the site will perform.
        //
        // In this particular case, that'll be sending a contact email.
        SendEmailResponse SendContactEmail(SendEmailRequest request);
    }
```

Making good on our change in EmailService

Of course, the above change is going to come as a complete shock to our concrete implementation, **EmailService**, once again out of step with the ever changing demands of **IEmailService**.

The refactoring isn't that hard. We simply need to pull information from the properties of the request object, rather than individual parameters.

We also need to ensure we return a **SendEmailResponse**.

```
        public SendEmailResponse SendContactEmail(SendEmailRequest request)
        {
            // NEW: Create a response.
            var response = new SendEmailResponse();

            response.SentAt = SendEmail(
                _settingsService.GetStringSetting("Contact:DestinationName"),
                _settingsService.GetStringSetting("Contact:Destination"),
                "Sightsource Empower - Feedback",
                // CHANGE:  pull from request properties, instead of individual
variables
                $"Sent by: {request.FromName} <{request.FromEmail}>
{Environment.NewLine}{request.Message}",
                _settingsService.GetStringSetting("Contact:DoNotReplyName"),
                _settingsService.GetStringSetting("Contact:DoNotReply")
            );

            // Sent at will only be NULL if something has gone wrong
            if (!response.SentAt.HasValue)
            {
                response.ErrorMessage = "Could not send your email";
            }

            return response;
        }
```

Fixing the controller method.

Both **IEmailService** and **EmailService** have now been refactored, which means our controller call to **SendContactEmail** no longer works. We'll need to refactor the controller method to use the request and response objects.

```
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            if (ModelState.IsValid)
            {
                // We're now constructing a SendEmailRequest
                // instead of simply passing parameters.
                //
                // The controller method is a bit more verbose, but a lot more
                // readable.
                var sendResult =
                    _emailService.SendContactEmail(
                        new SendEmailRequest
                        {
                            FromEmail = request.Email,
                            FromName = request.Name,
                            Message = request.Message
                        });

                if (sendResult.HasErrored)
                {
                    ViewData["Message"] = sendResult.ErrorMessage;
                }
            }

            return View(request);
        }
```

Compile and run your work

Congratulations. You're now running a version of IEmailService which accepts commands. You may ask, reasonably, why this was important. First, encapsulating everything into a request is quite useful. The command is complete. You do not have to guess about which parameter goes where, if it is needed at all. More importantly, you can provide a detailed response that you can act on, including error messages, details of a transaction, etc.

What just happened?

- We created a new project, **Empower.Domain**, which is designed to hold all of the structures and classes we need to do our job.
- We created a Client subdirectory.
  - By convention, the Domain.Client namespace has been used to contain simple classes aimed at transporting data between layers of the application.
  - Another convention is to call such classes DTOs, or data transport objects.
- We introduced the notion of **Commands**
  - Specifically **Request** and **Response** commands
- We created two new command objects to represent the sending of an email
  - **SendEmailRequest**
  - **SendEmailResponse**
- We refactored **IEmailService**
  - Our stream of parameters is gone.
  - We pass in one object of type **SendEmailRequest**, encapsulating everything we need to send an email request.
  - We return a **SendEmailResponse** object, which is designed to report on the **SendContactEmail** operation.
- We refactored **HomeController** to send a **SendEmailRequest** through _emailService.
  - We also worked with a **SendEmailResponse** to show the final state in the POST action.

Commit your work.

Let's commit all work to date, and merge our **feature/domain** work back into the master branch.

Exercise 4 - Adapters

We all know what an adapter is. We use them every day, whether it is getting a big USB hole to talk to a small one, a UK plug to work with an American socket or at perhaps its crudest and purest form, duct tape. In real life, we use adapters when we need to hook a couple of things together and they don't quite fit. The adapter bridges the gap.

The Adapter pattern is used in computing too. Just as in real life, its job is to bridge the gap between two things that don't quite fit. We've already and perhaps unknowingly created an adapter in our HomeController Contact POST action.

```
    // We've got a ContactViewModel.
    // _emailService needs a SendEmailRequest
    //
    // We are adapting on the fly, in the controller,
    // when we create a new SendEmailRequest
    var sendResult =
            _emailService.SendContactEmail(
                new SendEmailRequest
                {
                    FromEmail = request.Email,
                    FromName = request.Name,
                    Message = request.Message
                });
```

So adapting isn't hard. We've already done it. We can just do it in a more disciplined, predictable and more productive way. We can use the Adapter pattern.

Before we do that, let's have a small sort out with respect to our ViewModels.

Create a new branch

Create a new git branch off master called feature/adapters.

What goes in a Domain?

During exercise 3, we created a **Domain** library, to house structures that allow us to do our work. A common condundrum that coders face is where the dividing line is. What stays in the MVC project? What moves to the **Domain** project. A simple rule of thumb is to ask the following questions:-

- Is my class or data structure entirely concerned with MVC?
    - e.g. the Startup.cs class, Controller classes.
    - If so, the class stays in MVC.
- Does my class or data structure have any value outside of MVC?
    - This could be yes because
        - You want to use it in other libraries
        - It has information useful to other libraries
    - If it's yes, the class should probably be in the Domain

Moving ViewModels into Domain

At first glance, ViewModels might be seen as a certainty for residence in the MVC project. While that is certainly true of the **cshtml** views that dictate how these are shown, it is not true for ViewModels, especially when we apply the two questions above. ViewModels are really dumb transport objects. They do not contain any web-specific information, certainly nothing specific to MVC.

Secondly, ViewModels are annotated with information about how big fields should be, or their type and composition. That is information that could be useful to other classes. According to our rule of thumb questions, ViewModels should really live in the Domain.

Expanding Domain.Client

ViewModels more than fit the definition of being a Client class. Let's navigate to the **Empower.Domain** project, open the **Client** directory and create a new sub-directory called **ViewModels**. Add two new classes, ContactViewModel and ErrorViewModel.

Copy the class definitions (inside the namespace tag) from their soon to be obsolete equivalents in **Empower.Mvc**/Models. Your completed classes should look as follows.

ContactViewModel.cs

```
namespace Empower.Domain.Client.ViewModels
{
    public class ContactViewModel
    {
        [DisplayName("Your name")]
        [Required(ErrorMessage="Please enter your name")]
        [MaxLength(100, ErrorMessage="How long does it take you to fill in forms?
Please enter 100 characters or less.")]
        public string Name { get; set; }

        [DisplayName("Your email address")]
        [Required(ErrorMessage = "Please enter your email")]
        [EmailAddress(ErrorMessage ="Please enter a valid email")]
        public string Email { get; set; }

        [DisplayName("Your feedback")]
        [Required(ErrorMessage = "Please enter your message")]
        [MaxLength(4000, ErrorMessage="Too long.  Didn't read.")]
        public string Message { get; set; }
        public DateTime? ContactMadeAt { get; set; }
    }
}
```

ErrorViewModel.cs

```
namespace Empower.Domain.Client.ViewModels
{
    public class ErrorViewModel
    {
        public string RequestId { get; set; }

        public bool ShowRequestId => !string.IsNullOrEmpty(RequestId);
    }
}
```

We can now delete the **ContactViewModel** and **ErrorViewModel** classes from the **Models** subdirectory of the MVC project. We'll need to make some minor alterations.

Changing _ViewImports.cshtml

We need to tell MVC that it should no longer look in Empower.Mvc.Models for its ViewModels. Let's open up **Views/_ViewImports.cshtml** and tell it all about our new namespace.

```
@using Empower.Mvc
@using Empower.Domain.Client.ViewModels
@addTagHelper *, Microsoft.AspNetCore.Mvc.TagHelpers
@*
    This is the view imports file.  We made one important change here which told
MVC to look for ViewModels in the
    Empower.Domain.Client.ViewModels space, instead of Empower.Mvc.

    Any class in a namespace we reference with the using keyword can be referenced
without fully
    qualifying it.
*@
```

Save the changes. Build and run your project. You should now be using ViewModels housed in **Empower.Domain**, where they can also be used for other purposes.

New project - Empower.Adapters

The groundwork we did in moving ViewModels has prepared us well for our next task. Let's create a new project called **Empower.Adapters**

It should reference

- Empower.Domain

It should be referenced by

- Empower.Mvc
- Empower.Services

A basic adapter

We're going to create an adapter designed to adapt **ContactViewModel** instances into **SendEmailRequest**, as well as the opposite operation, turning **SendEmailResponse** objects into **ContactViewModel** objects.

For right now, we're going to spin it up as a concrete instance. We'll have to improve on that later, but it does mean we can focus on the fundamentals of what an adapter does. They are quite simple. This is one of the simplest imaginable.

In your **Empower.Adapters** project, create a subdirectory called **ViewModels**. This will house any adapter that deals with ViewModels.

Add a new class in that subdirectory called **ContactAdapter**.

We're going to add two new methods, **AdaptRequest**, which will turn a **ContactViewModel** into a **SendEmailRequest** and an **AdaptResponse**, which will turn a **SendEmailResponse** into a **ContactViewModel** object.

```
namespace Empower.Adapters.ViewModels
{
    public class ContactAdapter
    {
        public SendEmailRequest AdaptRequest(ContactViewModel viewModel,
SendEmailRequest request)
        {
            // Very simple mapping.
            // Just copying one property into another
            request.FromEmail = viewModel.Email;
            request.FromName = viewModel.Name;
            request.Message = viewModel.Message;

            return request;
        }

        public ContactViewModel AdaptResponse(ContactViewModel viewModel,
SendEmailResponse response)
        {
            // Conditional mapping based on the state of the response.
            // If we've errored, we set the status message to reflect that.
            if (response.HasErrored)
            {
                viewModel.HasErrored = true;
                viewModel.StatusMessage = response.ErrorMessage;
            }

            return viewModel;
        }
    }
}
```

Using the Adapter in a controller

It's nowhere near optimal, but we can use that adapter, as is, in our controller method.

```
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            ViewData["Message"] = "You tried to get in touch with Empower";

            if (ModelState.IsValid)
            {
                var adapter = new ContactAdapter();

                // We're now adapting a send request
                var sendResult =
                    _emailService.SendContactEmail(
                        adapter.AdaptRequest(request, new SendEmailRequest()));

                // Bit long winded, but adapt the response.
                // HasErrored will be set by the adapter if anything has gone
wrong.
                request = adapter.AdaptResponse(request, sendResult);
            }

            return View(request);
        }
```

Changing the view to alert the user of errors.

Now let's open up Contact.cshtml and add the following conditional display.

```
@if (Model.HasErrored){
    <div class="alert alert-danger">
        <h3>@Model.StatusMessage</h3>
    </div>
}
```

This will just inform our user if the operation has errored in any way.

A smarter adapter

Once again, we've gotten away with firing up a concrete **ContactAdapter** instead of using some form of dependency injection. It'll work for now, because it has no other dependencies, but other adaptation processes may be more involved. Some adapters may require external information to successfully adapt their information. Some adapters will have dependencies. By new'ing up a concrete class, we lose the chaining that dependency injection gives us.

Furthermore, this sort of thing, turning a ViewModel into a command, and vice versa, is something that we may end up doing with many of our adapters.

A request / response adapter

In general, the demands of a request response object are quite easy to establish. If we give it a ViewModel, we'd like it to give us a command we can run on a service. If we give it the result of a command, we'd like a ViewModel in return.

While the specifics of the ViewModels and command objects are going to alter, the process being performed is the same on a general level. We cannot predict every property of every ViewModel or command object, but we can enforce a mechanism whereby adaptations at least work on the same level.

We're going to create an *IRequestResponseAdapter*.

In VS, navigate to your Adapters project and create a new directory called **Interfaces**. This does constitute a small break with prior convention. So far, we've been putting all of our interface definitions into **Empower.Services**. However, the whole app doesn't need to know about the composition of this interface. It is only concerned with the **Empower.Adapters** part of the solution. Sometimes, there is a good case for keeping an interface close to the implementation.

Create a new interface called **IRequestResponseAdapter**.

We're going to use *generics* to define the types in this interface, to allow greater reusability.

Our interface declaration is going to introduce them.

```
public interface IRequestResponseAdapter<TRequest, TResponse, TViewModel>
```

This interface is essentially declaring "I am a IRequestResponseAdapter. I will work with a type called TRequest. I will work with a type called TResponse. I will work with a type called TViewModel. Not really sure what any of them are, if I'm honest".

The three identifiers beginning with T are generic type placeholders, established elsewhere through declaration. Right now, IRequestResponseAdapter doesn't actually know much about these types. They are all type **object**.

```
namespace Empower.Adapters.Interfaces
{
    /// <summary>
    /// This is an interface which describes what a request response adapter
should do.
    ///
    /// It is a generic interface.  That means the coder must include the types
being used
    /// in any declaration.
    ///
    /// There are good reasons to have application level service controllers that
exist
    /// in the Services project, but not all interfaces need to live there.
    ///
    /// There are often good cases for keeping the Interface close to the problem
it solves.
    ///
    /// </summary>
    /// <typeparam name="TRequest"></typeparam>
    /// <typeparam name="TResponse"></typeparam>
    /// <typeparam name="TViewModel"></typeparam>
    public interface IRequestResponseAdapter<TRequest, TResponse, TViewModel>
    {
        TRequest AdaptRequest(TViewModel viewModel, TRequest request);
        TViewModel AdaptResponse(TViewModel viewModel, TResponse response);
    }
}
```

Getting ContactAdapter onboard.

We can amend ContactAdapter so that it subscribes to this new contractual behaviour pretty easily. In fact, ContactViewModelAdapter already does what IRequestResponseAdapter demands.

We just need to specify that it can do it.

Open up **ContactAdapter**. We're doing to declare that right now.

```
 public class ContactAdapter :
IRequestResponseAdapter<SendEmailRequest,SendEmailResponse, ContactViewModel>
```

We've tagged on a declaration that ContactAdapter is a **IRequestResponseAdapter**, using **SendEmailRequest** as its **TRequest** type, **SendEmailResponse** as its **TResponse** type and **ContactViewModel** as the **TViewModel** type.

This class *already fulfils* the needs of **IRequestResponseAdapter**. It can adapt a request. It can adapt a response.

Injecting ContactAdapter as an IRequestResponseAdapter.

Our **HomeController** keeps playing house to bad practice. Right now, we're using a concrete implementation of **ContactAdapter** to perform our adaptation. Now that we've defined the general behaviour of a request response adapter, we can use dependency injection to gain all of the benefits.

Wiring the adapter up

Before we can use an injected dependency, we have to tell MVC how to satisfy a request for an IRequestResponseAdapter.

Let's open Startup.cs in the MVC project, and add some more configuration to our services.

```
 // This method gets called by the runtime. Use this method to add services to the
container.
        public void ConfigureServices(IServiceCollection services)
        {
            // Only one copy of the settings service will exist in memory at any
time.
            services.AddSingleton<ISettingsService, SettingsService>();

            // On demand.   Multiple instances will be created as needed.
            services.AddTransient<IEmailService, EmailService>();

            // We've told the dependency injection engine that whenever a class
asks for
            // a IRequestResponseAdapter, with those three types specified
            // that the ContactAdapter should be provided as the implementation
            //
            // Note, this can get a little cumbersome with lots of adapters, but
there
            // are ways to simplify this with Factory patterns.
            //
            // For right now, this will do.
            //
            services.AddSingleton<IRequestResponseAdapter<SendEmailRequest,
SendEmailResponse, ContactViewModel>, ContactAdapter>();

            services.AddMvc();
        }
```

We've told the DI framework about our RequestResponseAdapter, and that when one is asked for using those types, MVC should supply it with a **ContactAdapter**

```

        private readonly
IRequestResponseAdapter<SendEmailRequest,SendEmailResponse,ContactViewModel>
_contactAdapter;

        /// <summary>
        /// Note : We are now injecting a contactAdapter without directly
specifying its type.
        /// </summary>
        /// <param name="emailService"></param>
        /// <param name="contactAdapter"></param>
        public HomeController(
            IEmailService emailService,
            IRequestResponseAdapter<SendEmailRequest, SendEmailResponse,
ContactViewModel> contactAdapter)
        {
            _emailService = emailService;

            // Our Adapter will now be injected.  All we need to do now is assign
the incoming
            // variable to our private variable
            _contactAdapter = contactAdapter;
        }
```

We can now rid the **HomeController** of yet another problem, the concrete creation of **ContactAdapter**. If we want to use its functionality, we can reference it using the **_contactAdapter** variable, injected through **constructor injection**.

Our POST action method becomes a little simpler.

```
        // This will only respond to requests which supply the POST HTTP verb.
        // The POST verb is being provided in the 'method' attribute of the
calling form
        //
        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            // Now just setting the property on the model.
            request.StatusMessage = "You tried to get in touch with Empower";

            // This checks validation rules to determine whether the information
            // supplied in request will meet the needs of the request.
            //
            // UPDATE: This will now validate according to the rules of the
validators
            // on ContactViewModel.   It'll return false if any of the rules we've
set are
            // broken.
            if (ModelState.IsValid)
            {
                // The adapter is now handling all the mapping of fields from
                // our view model into our request object.
                //
                // We are also using the static methods created on the
SendEmailRequest object
                // to create a new contact request without too much fuss.
                //
                var sendResult =
                    _emailService.SendContactEmail(
                        _contactAdapter.AdaptRequest(request,
SendEmailRequest.NewContactRequest)
                    );

                // We can also use the adapter to update our view model from the
response we've received.
                request = _contactAdapter.AdaptResponse(request, sendResult);

            }

            return View(request);
        }
```

We don't have to *new up* a **ContactAdapter** anymore. We're still using one - we're just using a set of rules defined in Startup.cs to ensure it gets used.

What just happened?

- We rediscovered the ubiquity of Adapters in real life.
- We discovered that Adapters are quite common in computing too.
  - Adapters are a programming pattern that help one thing fit with another
- In preparation, we moved our ViewModels into the Domain.Client namespace
  - We asked questions about whether they really belong in Mvc or Domain
  - We decided that they have a use outside Mvc, particularly if we want to adapt them
- We created a new class library, **Empower.Adapters** designed to hold our adapters.
- We created a **ContactAdapter**, designed to turn ViewModels into command requests and command responses back into ViewModels.
- We created a broad generic service definition called **IRequestResponseAdapter**, which generalised and genericised the work we did in ContactAdapter.
- We amended **ContactAdapter** to say that it was capable of fulfilling the requirements of **IRequestResponseAdapter**.
- We changed **Startup.cs**, specifying that if it saw anything claiming to be an **IRequestResponseAdapter**, dealing with the **SendEmailRequest**, **SendEmailResponse** and **ContactViewModel** objects, MVC should serve up a **ContactAdapter**.
- We got **HomeController** to ask for an **IRequestResponseAdapter** with *just* those characteristics through *constructor injection*.
- We modified our Contact POST action to use the injected adapter, available in **_contactAdapter**.

Commit your work

We're almost done with **feature/adapters**. We've a couple more improvements to make in Exercise 5.

Exercise 5 - The final day two refactors

We're in good shape. We've created a Domain library to hold all of our business concepts. We filled that with some Commands, encapsulating the inputs and outputs of sending an email. We've created an Adapter that'll translate our ContactViewModel into a SendEmailRequest, and also adapt the response into something useful.

There are a couple of things we should not ignore and a couple of questions we need to ask.

The problem with IRequestResponseAdapter

We created a generic interface which defined some broad functionality for adapters. Luckily enough, our implementation of **ContactAdapter** does actually do something sensible with the values.

A future coder could use that interface with classes that are not request commands, command responses or ViewModels. That's not what the class is designed for. It would be good if we could somehow constrain the type.

The less used interpretation of an interface.

Whenever we've used interfaces so far, they've always been a facade over something that *does* something. We have an **IEmailService**, which is something that services our app's email requests. We have an **IRequestResponseAdapter**, which promises to faithfully adapt things. The "does something but doesn't let on how it does it" has been the de facto way we've treated interface declarations in the past.

Just as usefully, interfaces can just be used to say *i am something*.

Let's labour the point.

Let's open up our **Empower.Domain** project, open the *Client* subdirectory and create a new directory called **Interfaces**. This is another time we're going to keep our interfaces close to our implementations.

We are going to add the following, highly contrived, likely to annoy Ali, interface names. We'll refactor them later.

Add the following interfaces to the **Interfaces** directory:-

- IAmARequest
- IAmAResponse
- IAmAViewModel

Make them all public. We should have three very simple code files that look like this:-

```
public interface IAmARequest
{

}
```

```
public interface IAmAResponse
{

}
```

```
public interface IAmAViewModel
{

}
```

Note that we've defined no behaviour. We do not need to. We are just interested in the *I am* qualities of an interface.

Constraining IRequestResponseAdapter

We don't need to take any old object in IRequestResponseAdapter. We can place some constraints, and now that we've defined a few interfaces, we can do just that.

```
    public interface IRequestResponseAdapter<TRequest, TResponse, TViewModel>
        // We don't want people to implement this interface with any old type.
        //
        // The "where" parts of this declaration specify that TRequest has to say
IAmARequest.
        //
        where TRequest : IAmARequest
        where TResponse : IAmAResponse
        where TViewModel : IAmAViewModel
    {
        TRequest AdaptRequest(TViewModel viewModel, TRequest request);
        TViewModel AdaptResponse(TViewModel viewModel, TResponse response);
    }
```

We can introduce constraints using the **where TRequest** needs to be able to say **IAmARequest**, **TResponse** needs to be able to say **IAmAResponse** and **TViewModel** needs to be able to say **IAmAViewModel**.

Our **ContactAdapter** class, compliant from the start on **IRequestResponseAdapter**, is now broken. None of the types it deals with can claim those things.

Modifying our Domain.Client objects to comply.

We can fix **ContactAdapter** elsewhere. All we need to do is make sure that its participating objects can claim they are requests, responses or viewmodels.

Let's open up **SendEmailRequest** and get it to explicitly say **IAmARequest**.

```
public class SendEmailRequest : IAmARequest
{
    // ....
```

Same deal with **SendEmailResponse**, except it needs to claim **IAmAResponse**.

```
public class SendEmailResponse : IAmAResponse
{
```

And finally, let's do **ContactViewModel**. It needs to claim **IAmAViewModel**.

```
public class ContactViewModel : IAmAViewModel
{
```

With those three declarations, we've unbroken **ContactAdapter**. All of its objects now meet the constraints we've laid down. Anything wanting to use the adapter has to make similar claims.

Emergency renaming

Ali is probably quivering in a corner right now. *IAmARequest*, *IAmAResponse* and *IAmAViewModel* are very verbose. Let's rename them to **IRequest**, **IResponse** and **IViewModel** respectively. Choose the option to update all references.

This should turn your Domain.Client objects as so:-

```
public class SendEmailRequest : IRequest
{
    // ....
```

```
public class SendEmailResponse : IResponse
{
```

```
public class ContactViewModel : IViewModel
{
```

Ali will recover in due time. He and I have "history" with code verbosity.

What have we achieved with this refactor?

More than anything else, we've made sure that any programmer wanting to use that adapter pattern has to at least be intentional about it. The classes should at least claim to be the types of classes they should be. No-one is going to be able to fire up our Adapter with a copy of **System.Text.StringBuilder**.

Our classes all pass the constraint test, because we've got them to make the claim.

We've also laid some of the foundations for tomorrow, and discovered that an interface's sole use isn't just *I do something*. We can use the *I am something* character of interfaces to ensure that only appropriate types are used in concrete implementations.

Is the controller still controlling?

The second refactor concerns **HomeController**. It is in much better shape than it was before, but does it really need to be the thing that adapts **ContactViewModel** back and forth from the Command objects we've defined in **Domain.Client**?

The controller should be **controlling**, not **adapting**.

What does the Contact POST action actually need?

This is an interesting question, but the answer is obvious when you look at the inputs and outputs. It receives a **ContactViewModel**. It returns a **ContactViewModel**. If there was a service that handled all of the adaptation, and just took and returned **ContactViewModel**, we'd simplify **HomeController** and could move the details about the adapter into the intermediary class.

New Empower.Services interface

Open up the **Empower.Services** project. Create a new **interface** file and call it **IMvcViewModelService**. Nothing else but our MVC app is going to use this, so there *is* an argument that we could define this in the MVC project. However, one of the benefits of putting most of your major operations in a **Services** library is for future coders. They'll be able to peruse this library and quickly see that we've created a library for MVC operations.

The interface should look like this:-

```
public interface IMvcViewModelService
{
    ContactViewModel Contact(ContactViewModel model);
}
```

Eventually, the interface will be an index of pretty much everything our MVC app will allow the controllers to do. This will soon be the only service available to any controller. Right now, there's only one proper MVC operation we need our app to do; send a contact email.

New project?

For once, no. This service is *solely concerned* with servicing the needs of our MVC app. There's no good reason not to make it obvious.

In your MVC app, create a new subdirectory called Services.

We can put our MVC specific service in the project it relates to. Let's create a new class called **MvcViewModelService** in that Services directory, *implementing* the *IMvcViewModelService*

```
public class MvcViewModelService : IMvcViewModelService
{
    public ContactViewModel Contact(ContactViewModel model)
    {
        throw new NotImplementedException();
    }
}
```

Our class meets the contractual requirements, but is still throwing a **NotImplementedException**. We need to implement the behaviour. Thanks to other services we have available, this task should be trivial.

Injecting the required services

Our **MvcViewModelService** can make use of other services we've created. We just need to inject them, as we have before. In reality, it only needs two services **IEmailService**, which will control email operations, and an instance of **IRequestResponseAdapter**, able to translate **ContactViewModel** objects into **SendEmailRequest** objects, and also being able to adapt the command response back into a ViewModel.

It needs two services.

- IEmailService
- IRequestResponseAdapter

Let's put those on the required list with **constructor injection** and create variables so that we can reference them.

```
public class MvcViewModelService : IMvcViewModelService
{

    private readonly
IRequestResponseAdapter<SendEmailRequest,SendEmailResponse,ContactViewModel>
_contactAdapter;
    private readonly IEmailService _emailService;

    public MvcViewModelService
    (

IRequestResponseAdapter<SendEmailRequest,SendEmailResponse,ContactViewModel>
contactAdapter,
        IEmailService emailService
    )
    {
        // Assign our injected services, allowing them to access them.
        _emailService = emailService;
        _contactAdapter = contactAdapter;
    }

    public ContactViewModel Contact(ContactViewModel model)
    {
        throw new NotImplementedException();
    }
}
```

Now we've done that, implementing the Controller method should be trivial. All we need to do is *adapt* the **ContactViewModwl** into command objects, adapt the response and send it back.

```
    public ContactViewModel Contact(ContactViewModel model)
    {
        var commandResponse = _emailService.SendContactEmail(
            _contactAdapter.AdaptRequest(model, new SendEmailRequest());
        );

        model = _contactAdapter.AdaptResponse(model, commandResponse);

        return model;
    }
```

We've completed the implementation of IMvcViewModelServices. Time to wire it up.

Changes to Startup.cs

We need to tell our MVC how app what to do when asked for an implementation of **IMvcViewModelService**. It's time to open up **Startup.cs**, and set **MvcViewModelService**.

Let's create the association in **ConfigureServices**. We'll add it as a singleton. While we're about it, we may as well change the **lifecycle** of **IEmailService** to a singleton too. We're not reliant on any persistent internal state to run our methods.

```
        public void ConfigureServices(IServiceCollection services)
        {
            // Only one copy of the settings service will exist in memory at any
time.
            services.AddSingleton<ISettingsService, SettingsService>();

            // On demand.   Multiple instances will be created as needed.
            services.AddSingleton<IEmailService, EmailService>();
            services.AddSingleton<IRequestResponseAdapter<SendEmailRequest,
SendEmailResponse, ContactViewModel>, ContactAdapter>();
            services.AddSingleton<IMvcViewModelService, MvcViewModelService>();
            services.AddMvc();
        }
```

Changes to HomeController.

We no longer need an **IEmailService** or **IRequestResponseAdapter** for **HomeController**. We can now give it the exact thing it needs to do its job. We can simplify the implementation again by passing in an **IMvcViewModelService** instance, which already knows how to do all that stuff in a format that **HomeController** understands and doesn't have to dig for.

Our new readonly variables in **HomeController** should be as such, just one, the injected **IMvcViewModelService**.

```
        private readonly IMvcViewModelService _mvcViewModelService;

        /// <summary>
        /// Note : We are now injecting a contactAdapter without directly
specifying its type.
        /// </summary>
        /// <param name="mvcViewModelService"></param>

        public HomeController(
            IMvcViewModelService mvcViewModelService
        )
        {
            _mvcViewModelService = mvcViewModelService;
        }
```

Changes to the Contact POST action

Thanks to our abstraction, our new Contact POST action is simpler than ever.

Everything is still happening. We've just delegated responsibility to the appropriate services.

```

        [HttpPost]
        public IActionResult Contact(ContactViewModel request)
        {
            // Now just setting the property on the model.
            request.StatusMessage = "You tried to get in touch with Empower";

            if (ModelState.IsValid)
            {
                request = _mvcViewModelService.SendContactEmail(request);
            }

            return View(request);
        }
```

What's just happened?

- We constrained our **IRequestResponseAdapter** using the **where** keyword to insist they had some sort of claim to be involved in adaptation.
- We created three "I am" interfaces, that do nothing else but constrain **IRequestResponseAdapter** to the sort of types it says it will handle.
- We amended our Request, Response and ViewModel objects so that they all declared what they were.
- This satisfied the need of our new **IRequestResponseAdapter** constraints, and fixed other code in the process.
- We questioned whether controllers should be involved in adaptation, even if they are just calling a service to adapt.
- We created a new service, called **IMvcViewModelService**, designed to accept and return MVC ViewModels.
    - This uses a combination of **Adapters** and other services to get its result.
- We wired up the new dependency.
- We removed old dependencies from **HomeController**, now delegated to **IMvcViewModelService**.
- We injected an instance of **IMvcViewModelService**.
- We refactored our Contact POST model so that it uses **IMvcViewModelService**, something purpose built to deal with ViewModels.

Commit your work

We are complete on **feature/adapters**. Let's commit our work and merge back into master.

What happened today?

- We learned the true nature of services
- We learned that services have dependencies, other services that they can use to complete their services.
- Services are key strategies for abstracting or hiding implementation details.
- Dependency injection allows us to model a chain of dependencies, allowing each service to find the services it needs to complete its work.
- We moved our email functionality, once defined in a controller method, into a service.
    - We created an interface, called **IEmailService**
    - We introduced **IEmailService** as a **constructor injection** dependency in **HomeController**.
    - We told MVC which class to use when something else was asking for an **IEmailService**
- We found we were violating DRY principles.
    - We'd copied and pasted code.
    - We created a single place for configuration items, **ISettingsService**, to cater for services that needed access to configuration.
    - Our concrete implementation of **ISettingsService**, **Empower.Settings.Services**, had a dependency itself, **IConfiguration**, which allows it easy access to the configuration.
- We created a more suitable method on **IEmailService**, requiring less input from the client to use.
- We were able to simplify **HomeController**, now completely freed from having to find configuration values.
- We created **Empower.Domain**, a class library designed to hold the things we need to conduct our business.
    - Created a **Client** subdirectory, intended for objects that would be accessible to other levels of the application.
        - In client, created a **Commands** subdirectory.
            - **Requests** subdirectory contains things we're asking for.
            - **Responses** subdirectory contains things we asked for.
- Refactored **IEmailServices** to take a **SendEmailRequest** as its request, and return a **SendEmailResponse** as its response.
    - Did the follow up work inside **EmailService**
    - Injected **ISettingsService** into **EmailService**, removing any need for it to have direct access to the configuration.
- Refactored **HomeController** to work with command objects.
- Created **Empower.Adapters**, designed to house classes that adapt one kind of thing into another kind of thing.
- Wrote **ContactAdapter**, which did all the transformation between the view model, **SendEmailRequest** and **SendEmailResponse**.
    - Used the adapter directly in **HomeController**
- Defined a broad interface, **IRequestResponseAdapter**, designed to perform similar work to **ContactAdapter**.
- Amended **ContactAdapter** to implement the demands of **IRequestResponseAdapter**,
- Used an injected adapter in **HomeController** to perform adaptations.
- Placed **constraints** on the sort of objects that **IRequestResponseAdapter** will accept.
    - Defined three *I am* interfaces:-
        - IRequest
        - IResponse

            - IViewModel
    - The **IRequestResponseAdapter** will only work with objects that claim to be those things.
    - Amended our Domain.Client classes to subscribe to these attributes.
- Created a new service, IMvcViewModelService, specifically designed to deal with and return ViewModels.
    - The concrete implementation has **IEmailService** and **IRequestResponseAdapter** available to fulfil the request.
    - It is purely a mapping and wrapping class, but it means that we have managed to separate concerns, have each layer perform a specific function.
- Created one big dependency chain.
    - Here's how it goes.
        - **HomeController** *depends on*
            - **IMvcViewModelService**
            - *implemented by* **MvcViewModelService** *depends on*
                - **IEmailService**
                - *implemented by* **EmailService** *depends on*
                    - **ISettingsService**
                    - *implenented by* **SettingsService** *depends on*
                        - **IConfiguration**
                        - *provided by* **Startup.cs**
                - **IRequestResponseAdapter**
                - *implemented by* **ContactAdapter**

End of day two discussion