# .NET Core: Developing Cross-Platform Web Apps with ASP.NET Core – Workshop*PLUS*

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v3.0

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# Module 3: Controllers

## Module Overview

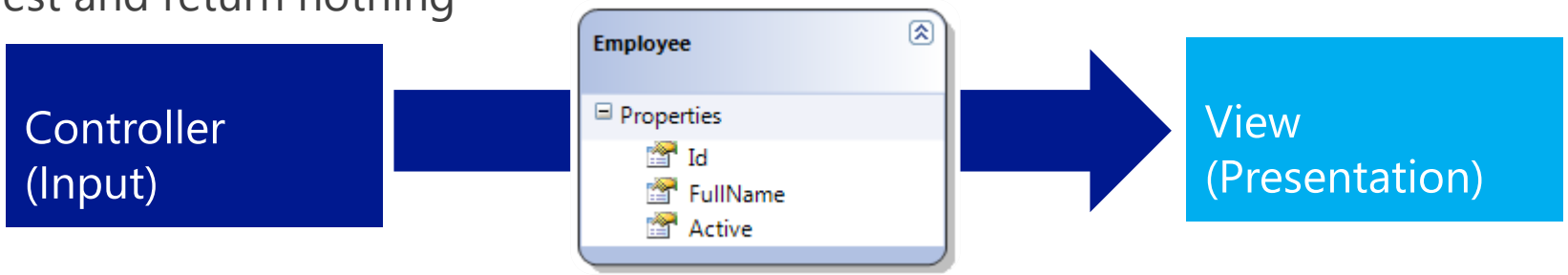
# Module 3: Controllers

## Section 1: Controller Fundamentals

## Lesson: Role of Controllers

# Controller

- Controller is responsible for:
  - Responding to requests made against ASP.NET MVC
  - Manipulating the model (if necessary)
  - Selecting a View to send back to user via response
- Each browser request is mapped against a particular controller
- Controller may:
  - Return a view
  - Redirect the user to another controller
  - Perform action on the request and return nothing



# Role of Controller

- Controller handles and responds to user input and interaction

- Example
    1. User sends a URL request with query string values
    2. *Controller* is triggered against the request
    3. *Controller* handles query-string values
    4. *Controller* passes the values to the model
    5. Model uses the value to query the database and returns the results
    6. *Controller* selects a View to render the UI
    7. *Controller* returns the View to the requesting browser

# Module 3: Controllers

## Section 2: Developing Controllers

## Lesson: Controller Development

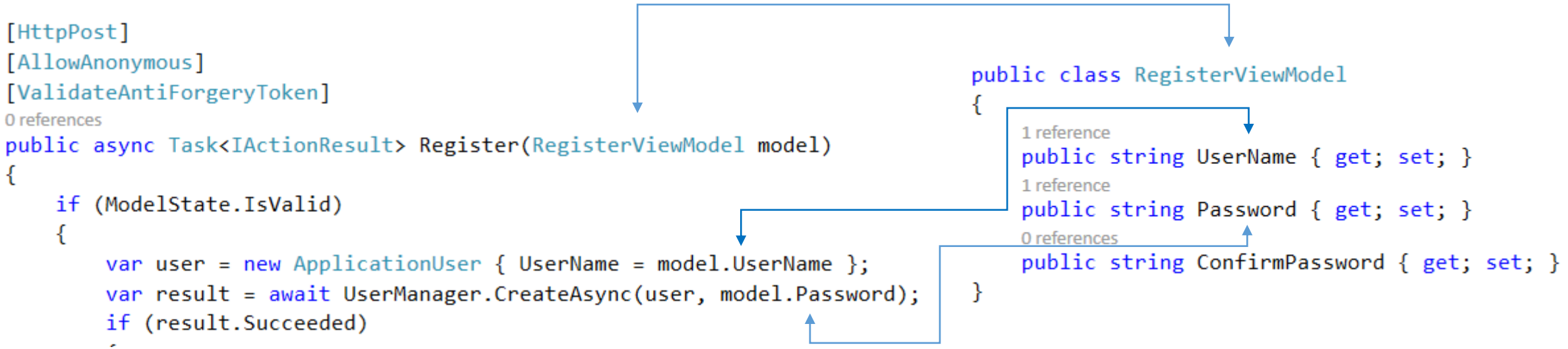
# Controller Development

- Controller class inherits from `Microsoft.AspNetCore.Mvc.Controller`
- Controller class name has 'Controller' suffix
  - For example: `HomeController`, `AccountController`, etc.

```
5 references
public class HomeController : Controller
{
    4 references
    public IActionResult Index()
    {
        // Index action implementation...
        return View();
    }

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

        return View();
    }
}
```

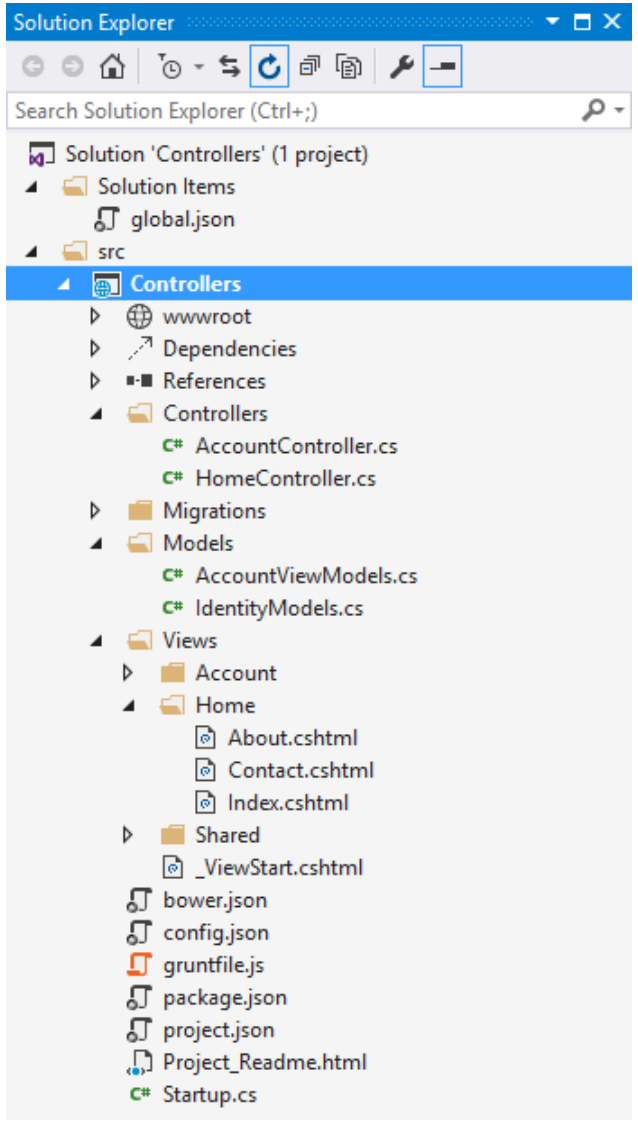
# Default Model Binder

- Default Model Binder automatically populates controller action parameters
  - Takes care of mundane property mapping and type conversion
  - Uses the name attribute of input elements
  - Automatically matches parameter names for simple data types
  - Complex objects are mapped by property name; use dotted notation



# ASP.NET MVC Project File Organization

- Default conventions can be overridden
  - ASP.NET MVC does not require this structure
- Convention over configuration
  - Default directory structure keeps application concerns clean
    - For example: Allows you to omit location paths when referencing views
  - By default, ASP.NET MVC looks for the View template file in ***\Views\[ControllerName]***



# Demo: Organization of Controllers, Views, and Models

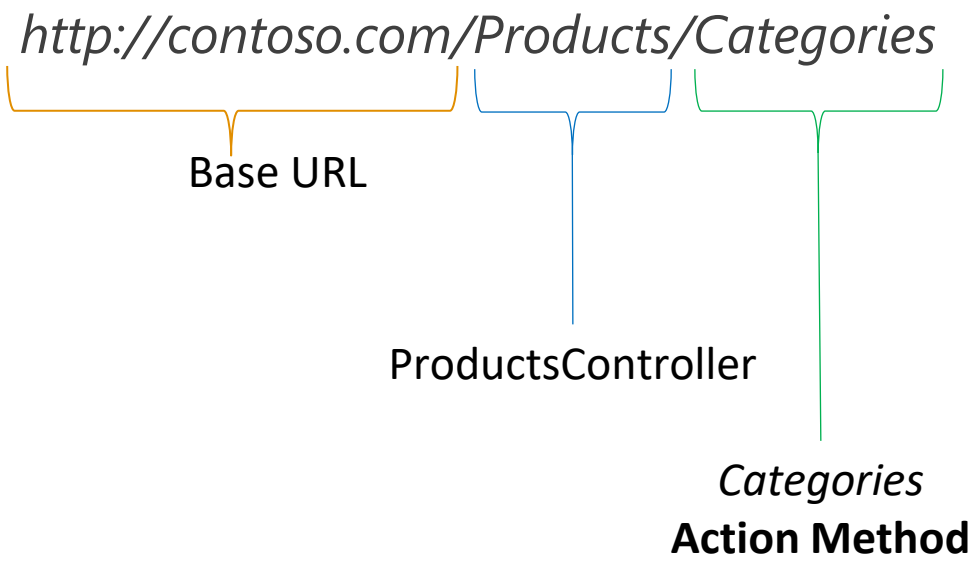
# Module 3: Controllers

## Section 2: Developing Controllers

## Lesson: Action Methods

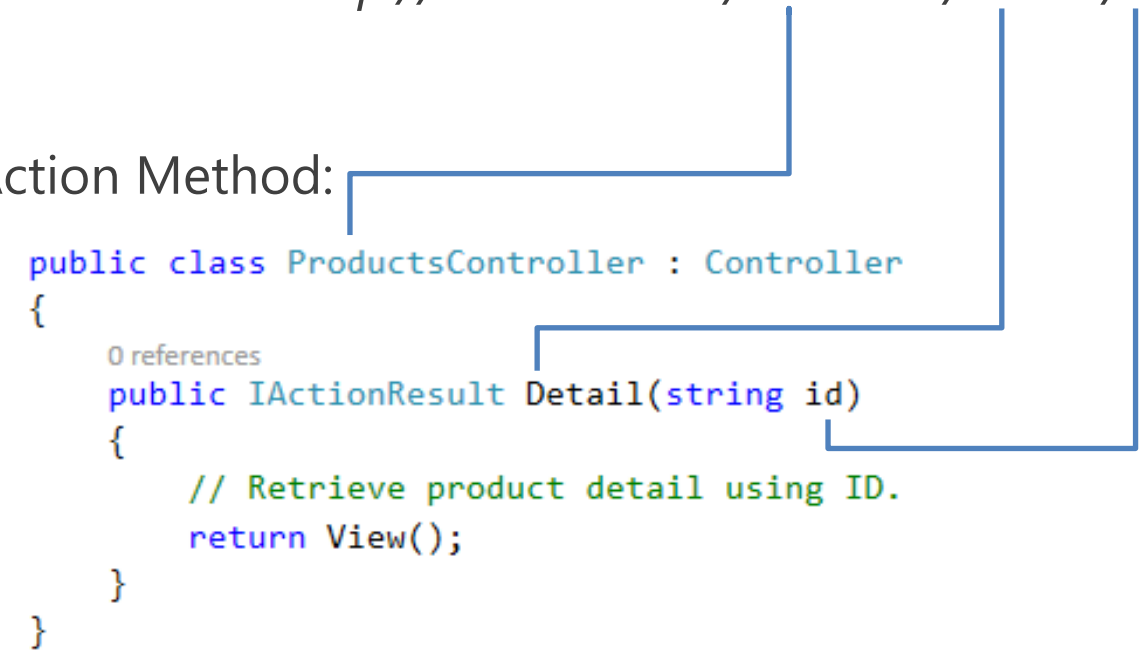
# Action Methods

- Action methods have 1:1 mapping with user interaction
  - Form submission, clicking a link, etc.
- User actions lead to action method calls

- Example:
- 

# Action Method Parameters

- Query string or form post parameters are passed into Action methods as parameters
- URL: *http://contoso.com/Products/Detail/5*
- Action Method:



```
public class ProductsController : Controller
{
    0 references
    public IActionResult Detail(string id)
    {
        // Retrieve product detail using ID.
        return View();
    }
}
```

# Action Method Results

- The Action method typically returns a View, but not always

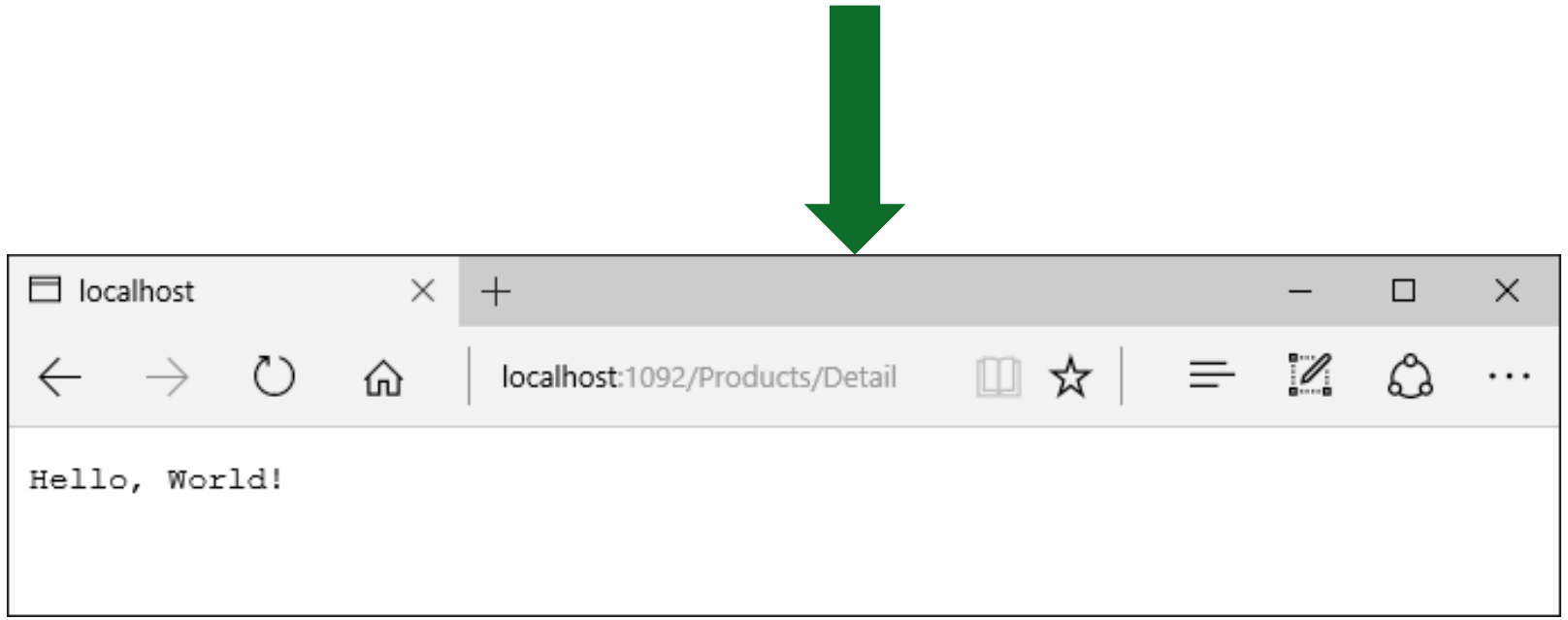
```
0 references
public class StoreController : Controller
{
    // GET: /Store/
    0 references
    public IActionResult Index()
    {
        return View();
    }

    // GET: /Store/Details
    0 references
    public IActionResult Details()
    {
        return View("Details");
    }

    // GET: /Store/Browse?Genre=Disco
    0 references
    public string Browse(string id)
    {
        return "Store.Browse, Genre = " + id;
    }
}
```

```
public FileResult SomeFile()
{
    string filename = @"C:\Example.pdf";
    string contentType = "application/pdf";
    string downloadName = "ExampleFile.pdf";

    return File(filename, contentType, downloadName);
}
```

# Built-in Action Return Types

- All derive from **`ActionResult`**
  - `ViewResult`
  - `PartialViewResult`
  - `RedirectToRouteResult`
  - `RedirectResult`
  - `ContentResult`
  - `FileResult`
  - `JsonResult`
  - `JavascriptResult`
  - `HttpUnauthorizedResult`
  - `HttpNotFoundResult`
  - `HttpStatusCodeResult`
  - `EmptyResult`

```
public ContentResult Index()
{
    return Content("Hello, World!");
}
```



# Demo: Controller Development

# Module 3: Controllers

## Section 2: Developing Controllers

## Lesson: Filters

# Action Filter and Selector Attributes

- Public controller methods are actions by default
- **Selectors** differentiate Actions
- **Filters** control access

```
//
// POST: /Account/Register
[HttpPost]
[AllowAnonymous]
[ValidateAntiForgeryToken]
0 references
public async Task<IActionResult> Register(RegisterViewModel model)
{
```

Account Controller - Register Method

# Selector Attributes

| Selector Attribute | Description |
|---|---|
| [NonAction] | To mark a method as non-action |
| [HttpPost] | To restrict a method to handling only HTTP POST requests |
| [HttpPut] | To restrict a method to handling only HTTP PUT requests |
| [HttpGet] | To restrict a method to handling only HTTP GET requests |
| [AcceptVerbs] | Specifies which HTTP verbs an action method will respond to |
| … | … |

# Filter Attributes

| Selector Attribute | Description |
|---|---|
| [AllowAnonymous] | To allow anonymous users to call the action method |
| [Authorize] | To restrict access to only those users that are authenticated and authorized |
| [RequireHttps] | To force an unsecured HTTP request to be resent over HTTPS |
| [ValidateAntiForgeryToken] | To prevent forgery of a request (Defense against CSRF attack) |
| [ValidateInput] | To mark action methods whose input must be validated |
| [HandleError] | To handle an exception that is thrown by an action method |
| … | … |

# Demo: Filters

# Module 3: Controllers

## Section 3: Advanced Controller Design

## Lesson: Advanced Controller Design

# Asynchronous Controller Action Methods

- ASP.NET MVC supports asynchronous action methods

```
public class PortalController : Controller {
    public async Task<ActionResult> Index(string city)
    {
        NewsService newsService = new NewsService();
        WeatherService weatherService = new WeatherService();
        SportsService sportsService = new SportsService();

        var newsTask = newsService.GetNewsAsync(city);
        var weatherTask = weatherService.GetWeatherAsync(city);
        var sportsTask = sportsService.GetScoresAsync(city);

        await Task.WhenAll(newsTask, weatherTask, sportsTask);

        PortalViewModel model = new PortalViewModel
        {
            newsTask.Result,
            weatherTask.Result,
            sportsTask.Result
        };
        return View(model);
    }
}
```

# Sync vs. Async Action Methods

- Use **synchronous** methods when:
  - The operations are simple or short-running
  - Simplicity is more important than efficiency
  - The operations are primarily CPU operations instead of operations that involve extensive disk or network overhead
- Use **asynchronous** methods when:
  - You are calling services
  - The operations are network-bound or I/O-bound instead of CPU-bound
  - Parallelism is more important than simplicity of code
  - Enabling cancelation of a long-running request

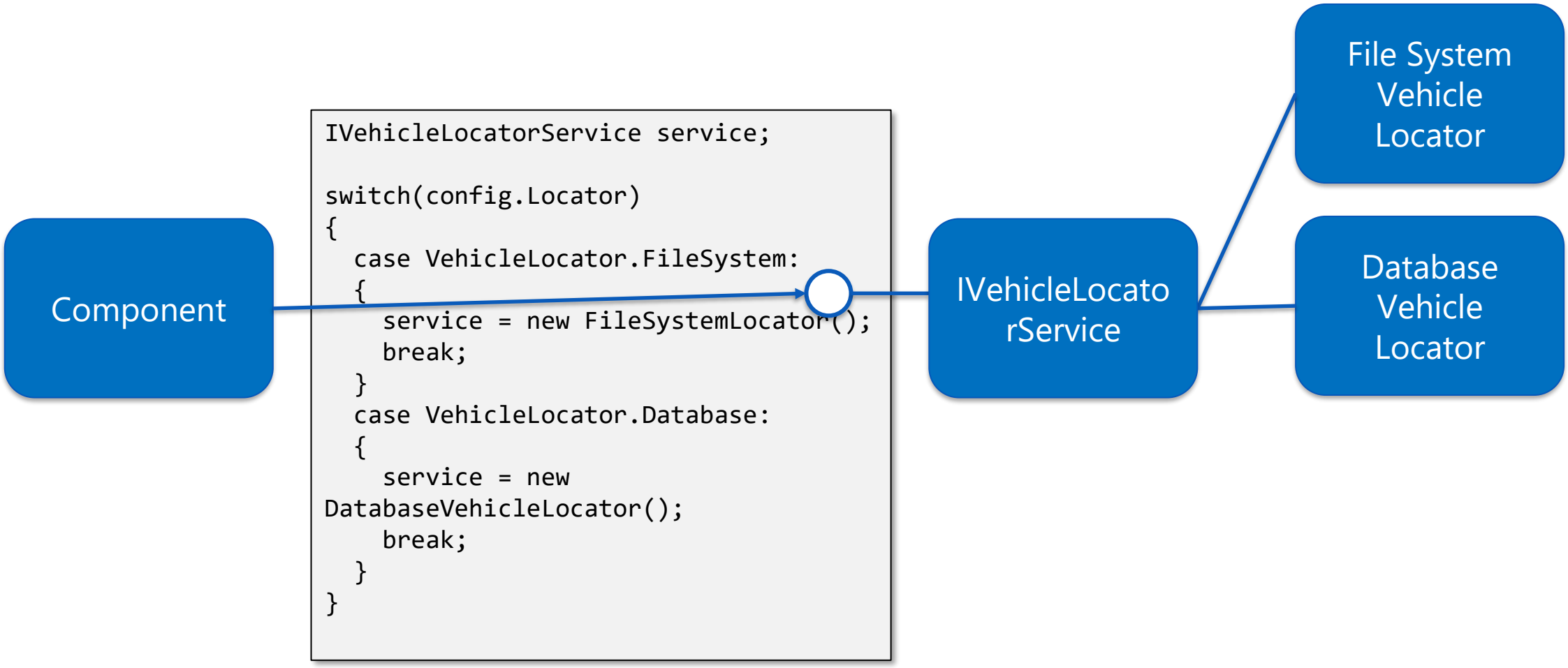
# Module 3: Controllers

## Section 4: Dependency Injection (DI)

## Lesson: Overview

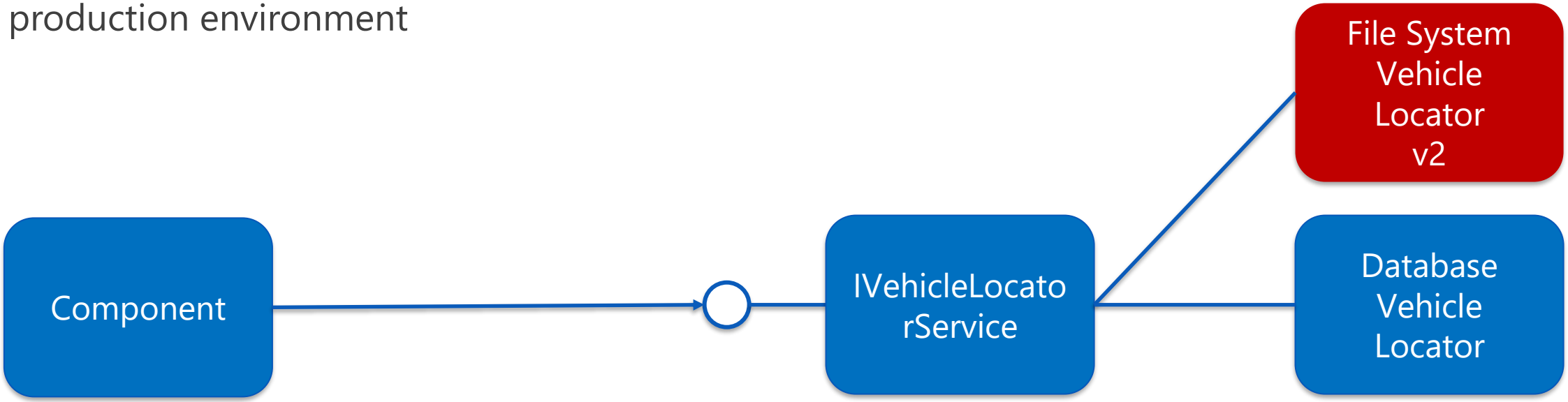
# Without Dependency Injection (DI)

Tightly Coupled - Component determines which implementation to use



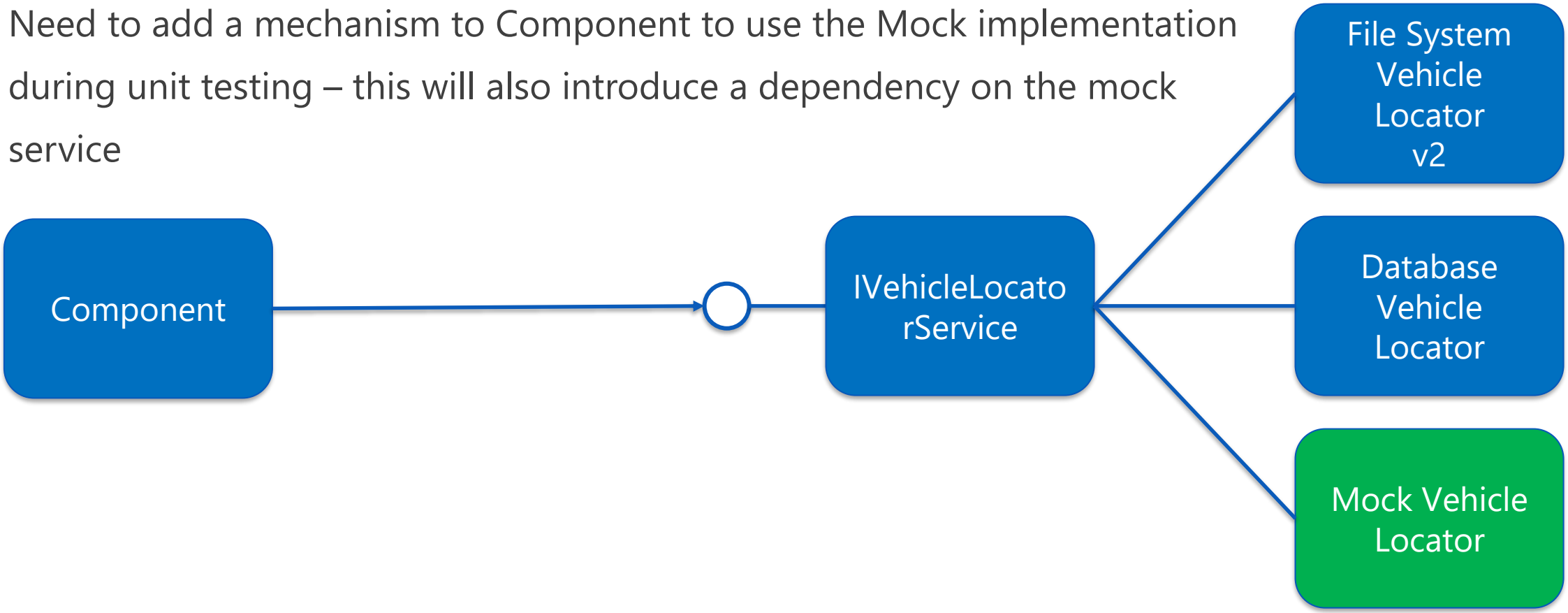
# What's the Problem? (Part 1)

- Redeploy of new service that is tightly coupled means Component also needs to be rebuilt, retested, and redeployed
- Both components will be shipped/deployed, whereas only one may be required for the production environment



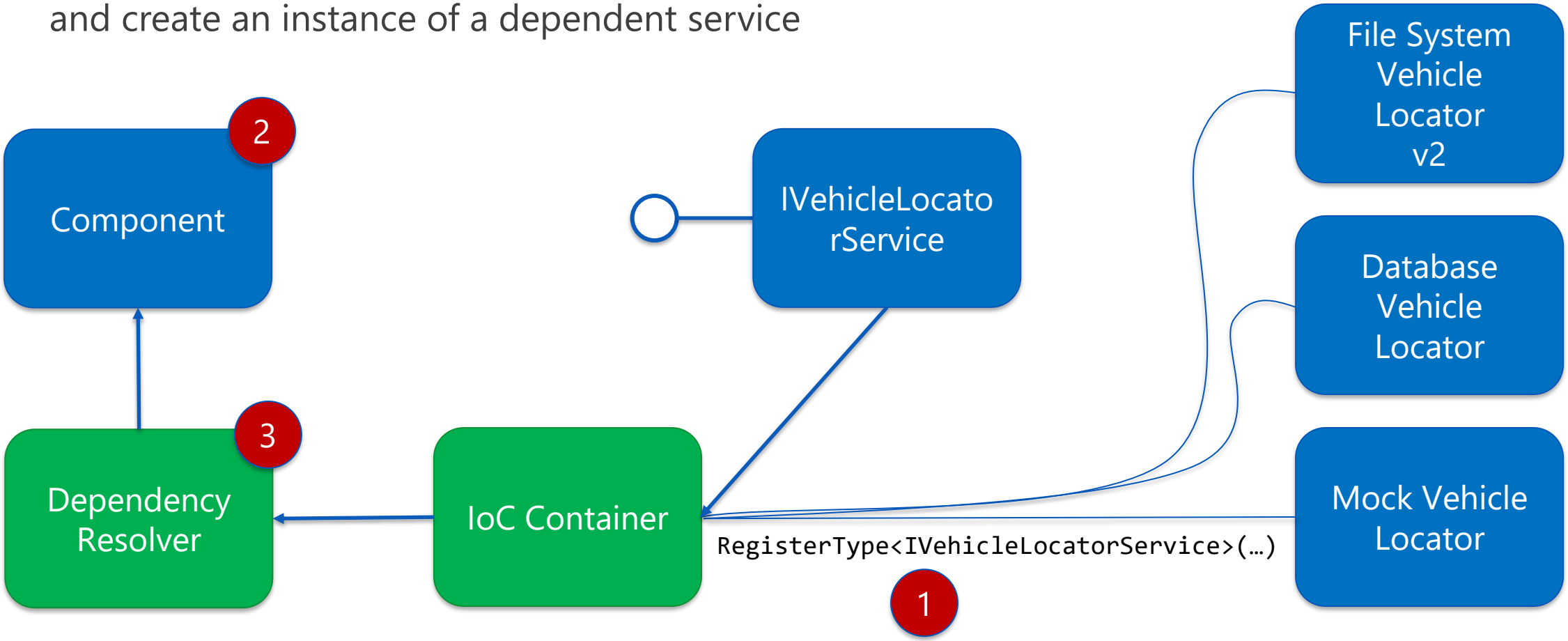
# What's the Problem? (Part 2)

- Unit testing should be testing Component in isolation, and not rely on external resources such as databases or file systems
- Need to add a mechanism to Component to use the Mock implementation during unit testing – this will also introduce a dependency on the mock service



# Inversion of Control

- DI is a design pattern which removes the responsibility of a component to know how to locate and create an instance of a dependent service



# Framework – Provided DI in ASP.NET Core

```
1   public void ConfigureServices(IServiceCollection services)
2   {
3       // Add framework services.
4       services.AddEntityFramework()
5           .AddSqlServer()
6           .AddDbContext<ApplicationDbContext>(options =>
7               options.UseSqlServer(Configuration["Data:DefaultConnection:ConnectionString"]));
8
9       services.AddIdentity<ApplicationUser, IdentityRole>()
10          .AddEntityFrameworkStores<ApplicationDbContext>()
11          .AddDefaultTokenProviders();
12
13      services.AddMvc();
14
15      // Add application services.
16      services.AddTransient<IEmailSender, AuthMessageSender>();
17      services.AddTransient<ISmsSender, AuthMessageSender>();
18  }
```

DI is provided by ASP.NET Core, and is used to resolve Controllers as well as services

Framework services are set up in the ConfigureServices function in ASP.NET Core

Your own services can also be registered here – specifying Interface, Class, and Lifetime

# Service Lifetimes and Registration Options

## Transient

- Transient lifetime services are created each time they are requested. This lifetime works best for lightweight, stateless service

## Scoped

- Scoped lifetime services are created once per request

## Singleton

- Singleton lifetime services are created the first time they are requested, and then every subsequent request will use the same instance. If your application requires singleton behaviour, allowing the services container to manage the service's lifetime is recommended instead of implementing the singleton design pattern and managing your object's lifetime in the class yourself

## Instance

- Similar to Singleton, but the instance is created when added to the services container and reused throughout, whereas with a Singleton the instance is first created only when first requested for use

# Types of DI

- Constructor Injection
- Setter Injection

```
public class CalcController : Controller
{
    //Inject via Setter
    [FromServices]
    0 references
    public ISmsSender SmsSender { get; set; }

    private readonly ILogger _logger;

    //Inject via Constructor
    0 references
    public CalcController(ILogger logger)
    {
        _logger = logger;
    }
}
```

# Demo: Dependency Injection

# Module 3: Controllers

## Section 5: Caching

## Lesson: Overview

# Caching

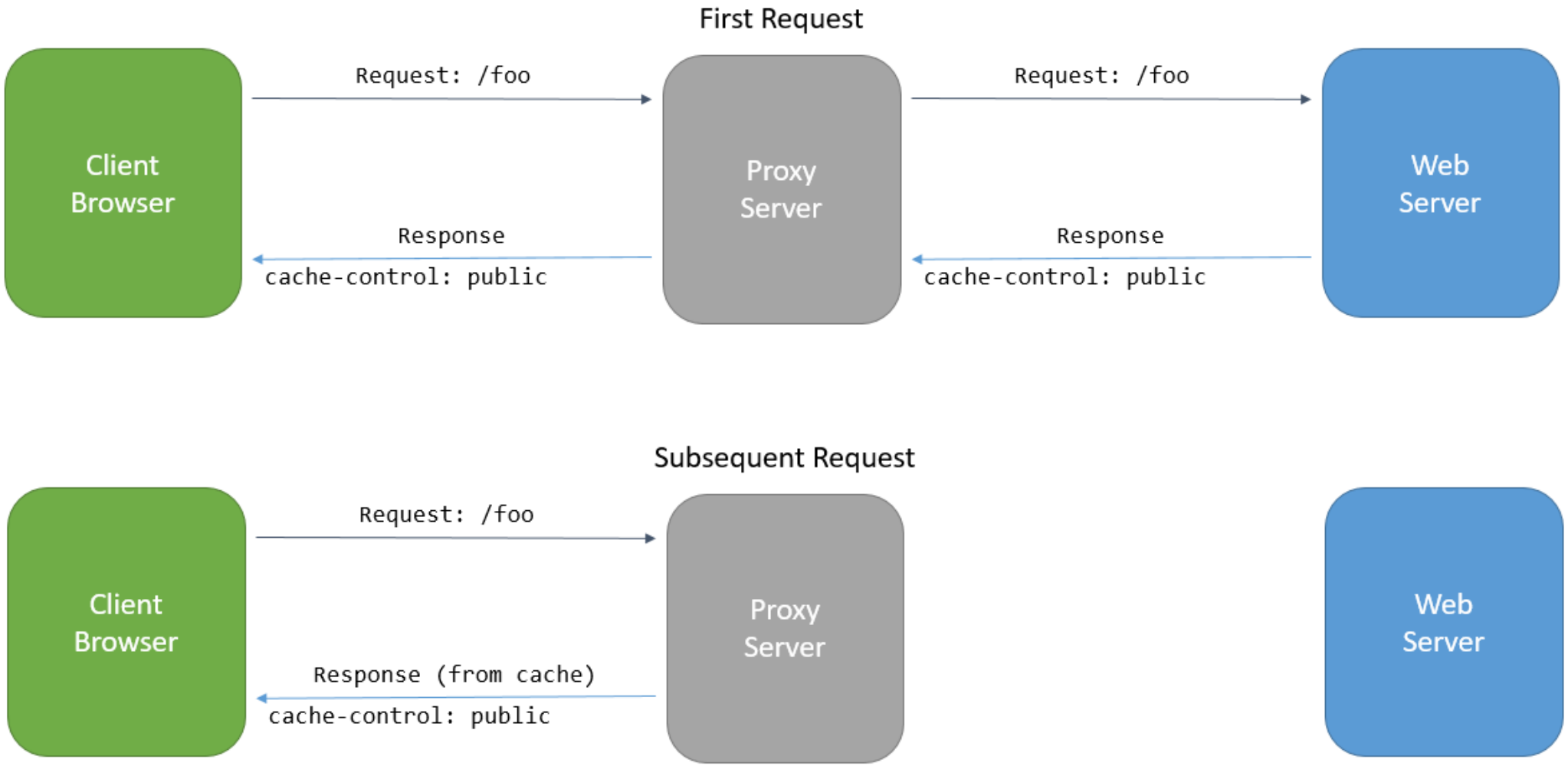
- In-memory Caching
  - Stored in memory of a single server
- Distributed Caching
  - Shared by multiple servers
  - Used by server-farm hosted apps
- Response Caching

# In-Memory Caching

```
public Task Invoke(HttpContext httpContext)
{
    string cacheKey = "GreetingMiddleware-Invoke";
    string greeting;

    // try to get the cached item; null if not found
    // greeting = _memoryCache.Get(cacheKey) as string;

    // alternately, TryGet returns true if the cache entry was found
    if(!_memoryCache.TryGetValue(cacheKey, out greeting))
    {
        // fetch the value from the source
        greeting = _greetingService.Greet("world");

        // store in the cache
        _memoryCache.Set(cacheKey, greeting,
            new MemoryCacheEntryOptions()
            .SetAbsoluteExpiration(TimeSpan.FromMinutes(1)));
        _logger.LogInformation($"{cacheKey} updated from source.");
    }
    else
    {
        _logger.LogInformation($"{cacheKey} retrieved from cache.");
    }

    return httpContext.Response.WriteAsync(greeting);
}
```

Example of Caching used by Middleware

# Response Caching



# Demo: In-Memory Caching

# Controller Best Practices

- Keep controllers lightweight
  - Use filters
- High Cohesion
  - Make sure all actions are closely related
- Low Coupling
  - Controllers should know as little about the rest of the system as possible
  - Simplifies testing and changes
  - Repository pattern
  - Wrap data context calls into another object

# Module Summary

- Controller and its role in MVC pattern
- Controller development
- Action methods
- Action filters
- Asynchronous controller actions
- Error-Logging Module
- Dependency Injection
- Caching
- Controller best practices

# Lab: Controllers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