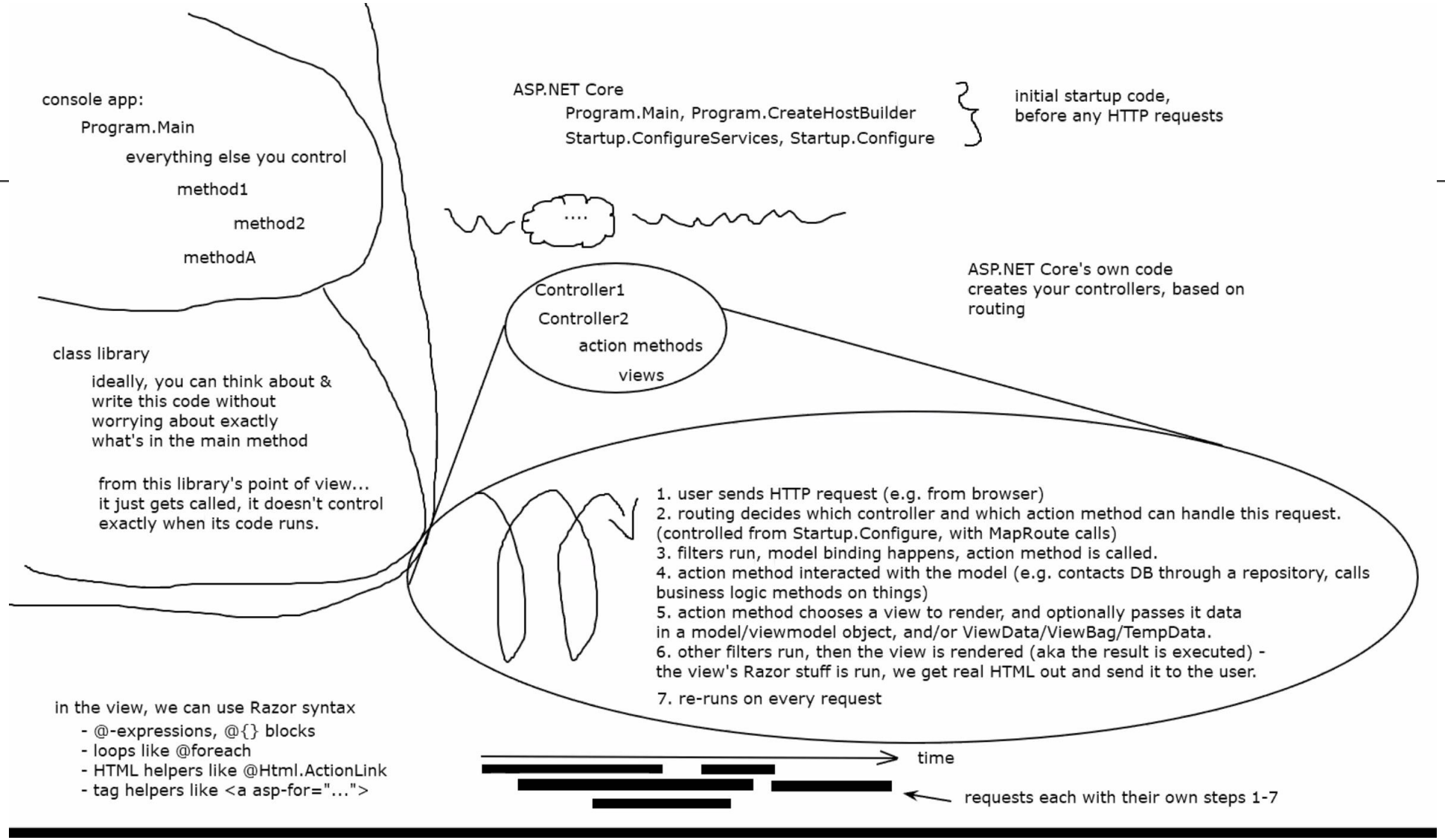
Routing

.NET CORE


console app:
Program.Main
everything else you control
method1
method2
methodA
class library
ideally, you can think about & write this code without worrying about exactly what's in the main method
from this library's point of view... it just gets called, it doesn't control exactly when its code runs.
ASP.NET Core
Program.Main, Program.CreateHostBuilder
Startup.ConfigureServices, Startup.Configure
initial startup code, before any HTTP requests
....
Controller1
Controller2
action methods
views
ASP.NET Core's own code creates your controllers, based on routing
1. user sends HTTP request (e.g. from browser)
2. routing decides which controller and which action method can handle this request. (controlled from Startup.Configure, with MapRoute calls)
3. filters run, model binding happens, action method is called.
4. action method interacted with the model (e.g. contacts DB through a repository, calls business logic methods on things)
5. action method chooses a view to render, and optionally passes it data in a model/viewmodel object, and/or ViewData/ViewBag/TempData.
6. other filters run, then the view is rendered (aka the result is executed) - the view's Razor stuff is run, we get real HTML out and send it to the user.
7. re-runs on every request
in the view, we can use Razor syntax
- @-expressions, @{} blocks
- loops like @foreach
- HTML helpers like @Html.ActionLink
- tag helpers like <a asp-for="...">
time
requests each with their own steps 1-7

ASP.NET Core controllers use the Routing middleware to match the URLs of incoming requests and map them to actions. Routes templates are defined in startup code or attributes, describe how URL paths are matched to actions, and are used to generate URLs for links. Actions are either conventionally-routed or attribute-routed.

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1

Controllers

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/actions?view=aspnetcore-3.1

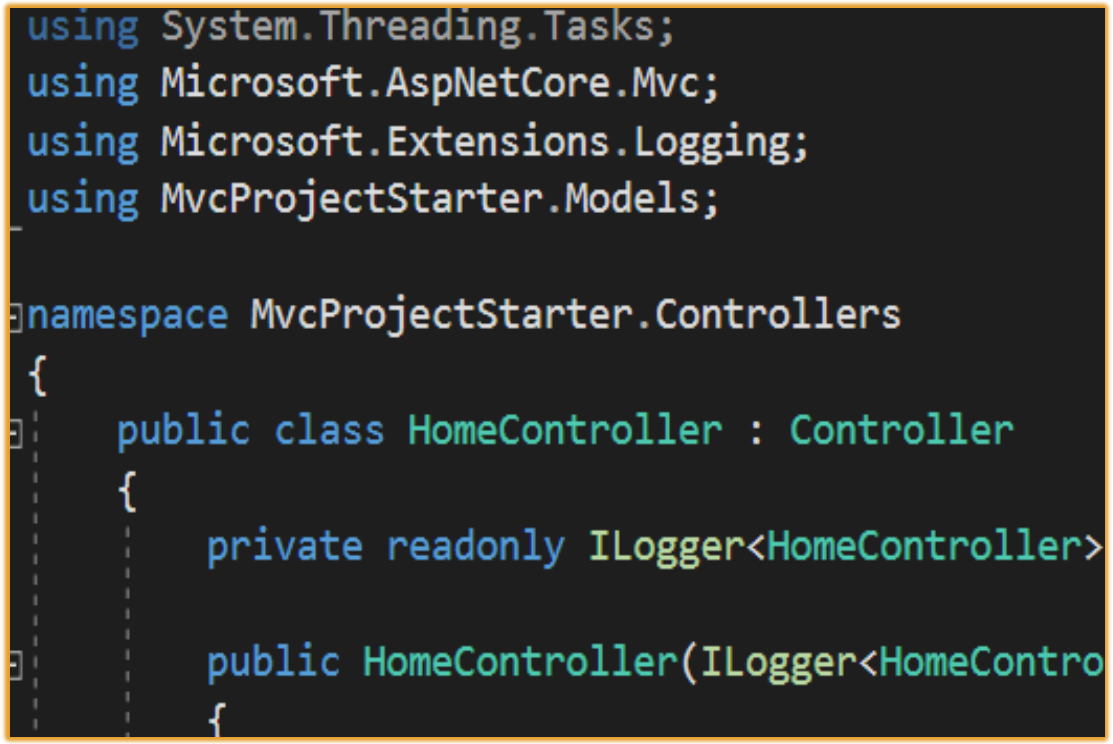
A controller is a class used to define and group a set of actions. Controllers logically group similar actions together. This allows routing, caching, and authorization, to be applied collectively.

Within the ***Model-View-Controller*** pattern, a controller is responsible for the initial processing of a request and instantiation of a model. Business decisions should be performed within the model.

To be a controller, at least one of the following conditions is true:

- The class name is suffixed with Controller.
- The class inherits from a class whose name is suffixed with Controller.
- The [Controller] attribute is applied to the class.

Ccontroller classes reside in the project's root-level Controllers folder and inherit from ***Microsoft.AspNetCore.Mvc.Controller***.



```
using System.Threading.Tasks;
using Microsoft.AspNetCore.Mvc;
using Microsoft.Extensions.Logging;
using MvcProjectStarter.Models;

namespace MvcProjectStarter.Controllers
{
    public class HomeController : Controller
    {
        private readonly ILogger<HomeController>

        public HomeController(ILogger<HomeContro
        {
```

Action Methods

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/actions?view=aspnetcore-3.1#defining-actions

An ***action method*** is a method in a ***controller*** which handles requests. All public methods in a controller (except those with the *[NonAction]* attribute) are ***actions***. Parameters on actions are ***bound*** to ***request*** data and are validated using ***Model Binding***. ***Model validation*** occurs for everything that's ***Model-Bound***. The ***ModelState.IsValid*** property value indicates whether ***Model Binding*** and ***validation*** succeeded.

Action methods should contain logic for mapping a request to a business concern. Business concerns should typically be represented as services that the ***controller*** accesses through ***dependency injection***.

Actions can return anything, but usually return an ***IActionResult*** or ***Task<IActionResult>*** (for async methods).

```
namespace MvcProjectStarter.Controllers
{
    public class SongsController : Controller
    {
        private readonly MvcSongContext _context;

        public SongsController(MvcSongContext context)
        {
            _context = context;
        }

        // GET: Songs
        public async Task<IActionResult> Index()
        {
            return View(await _context.Song.ToListAsync());
        }

        // GET: Songs/Details/5
        public async Task<IActionResult> Details(int? id)
        {
            if (id == null)
            {
                return NotFound();
            }

            var song = await _context.Song
                .FirstOrDefaultAsync(m => m.id == id);
            if (song == null)
            {
                return NotFound();
            }

            return View(song);
        }
```

Model Binding

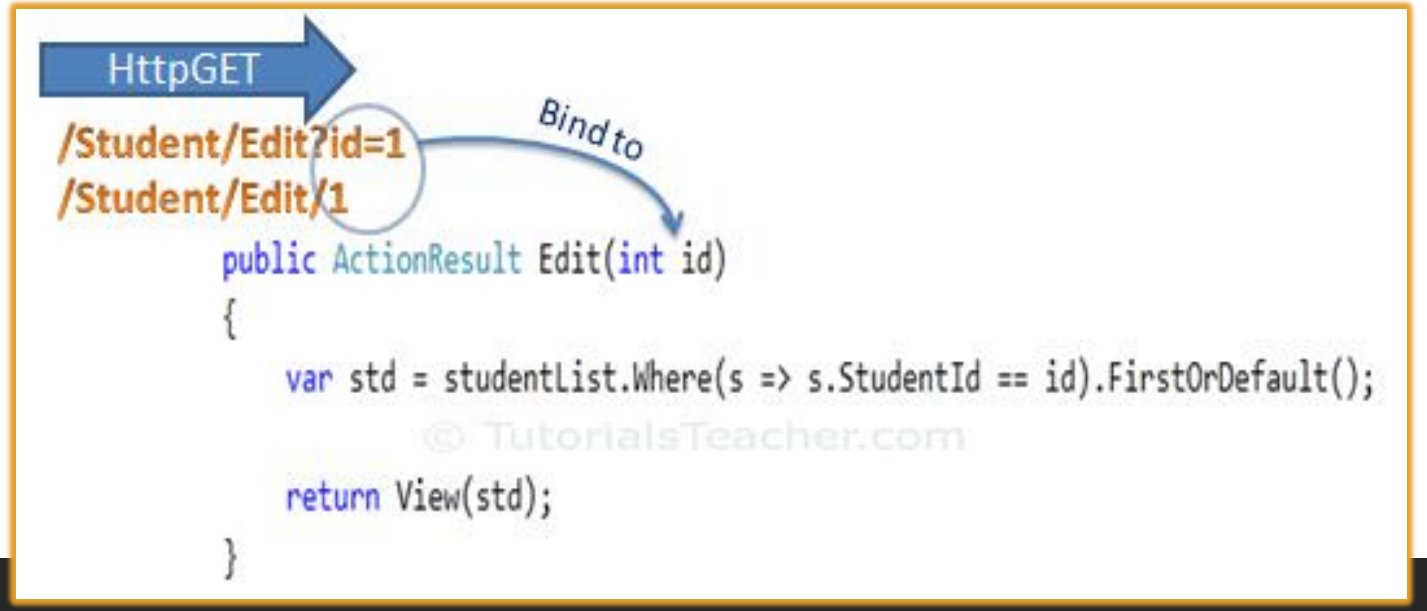
https://docs.microsoft.com/en-us/aspnet/core/mvc/models/model-binding?view=aspnetcore-3.1

Controllers and ***Action Methods*** work with data that comes from HTTP requests. (Ex. ***POST***ed form fields provide values for the properties of the model.)

Writing code to retrieve each of these values and convert them from strings to .NET ***types*** would be tedious and error-prone. ***Model Binding*** automates this process.

The ***Model Binding*** system:

- Retrieves data from various sources such as ***route data***, ***form fields***, and ***query strings***.
- Provides the data to ***controllers*** in ***Action Method*** parameters and public properties.
- Converts string data to .NET types.
- Updates properties of complex types.



Model Binding

https://docs.microsoft.com/en-us/aspnet/core/mvc/models/model-binding?view=aspnetcore-3.1

Model Binding goes through the following steps after the routing system selects the action method:

1. Finds the first parameter of GetByID (id).
2. Looks through the HTTP request and finds id = "2" in route data.
3. Converts the string "2" into integer 2.
4. Finds the next parameter of GetByID (dogsOnly).
5. Finds "DogsOnly=true" in the query string. Name matching is not case-sensitive.
6. Converts the string "true" to a boolean true.

Suppose you have the following action method:

C#

```
[HttpGet("{id}")]
public ActionResult<Pet> GetById(int id, bool dogsOnly)
```

And the app receives a request with this URL:

```
http://contoso.com/api/pets/2?DogsOnly=true
```

Different Controller Helper (Action) Methods

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/actions?view=aspnetcore-3.1#controller-helper-methods

Controller provides access to three categories of helper methods, resulting in

an empty response body	a non-empty response body with a predefined content type	a non-empty response body formatted in a content type negotiated with the client
HTTP Status Code – Ex. BadRequest, NotFound, and Ok	**View** - view which uses a model to render HTML. (EX. Return View(customer);	This category is better known as **Content Negotiation**. Content negotiation applies whenever an action returns an ObjectResult type or something other than an IActionResult. (Ex. BadRequest, CreatedAtRoute, and Ok)
Redirect - returns a redirect to an action or destination (Redirect, LocalRedirect, RedirectToAction, or RedirectToRoute).	**Formatted Response** - JSON or a similar data exchange format to represent an object, (Ex. Json(customer);)	

Conventional Routing

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#cr

Startup.Configure typically has code similar to the following when using conventional routing. Inside the call to ***UseEndpoints***, ***MapControllerRoute*** is used to create a single route. The single route is named the ***default*** route.

```
app.UseEndpoints(endpoints =>
{
    endpoints.MapControllerRoute(
        name: "default",
        pattern: "{controller=Home}/{action=Index}/{id?}");
});
```

Conventional Routing

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#set-up-conventional-route
https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#multiple-conventional-routes

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The route template (in Startup.cs) "{controller=Home}/{action=Index}/{id?}" matches a URL path like /Products/Details/5.

The route template extracts (***tokenizes***) the route values { controller = Products, action = Details, id = 5 } which results in a match if the app has a ***controller*** named ProductsController and an ***action*** called Details. The ***id*** value is optional due to the ***?***.

```
app.UseEndpoints(endpoints =>
{
    endpoints.MapControllerRoute(
        name: "default",
        pattern: "{controller=Home}/{action=Index}/{id?}");
});
```

```
app.UseEndpoints(endpoints =>
{
    endpoints.MapControllerRoute(name: "blog",
                pattern: "blog/{*article}",
                defaults: new { controller = "Blog", action = "Article" });
    endpoints.MapControllerRoute(name: "default",
                pattern: "{controller=Home}/{action=Index}/{id?}");
});
```

Attribute Routing – REST API's

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#attribute-routing-for-rest-apis

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REST APIs should use ***attribute routing*** to model the app's functionality as a set of resources where operations are represented by ***HTTP verbs***.

Attribute routing uses sets of ***attributes*** on each ***controller action*** to map ***actions*** directly to route templates. The following ***StartUp.Configure*** code is typical for a ***REST API***. ***MapControllers()*** is called inside ***UseEndpoints()*** to map attribute routed controllers.

```
app.UseEndpoints(endpoints =>
{
    endpoints.MapControllers();
});
```

Attribute Routing – REST API's

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#attribute-routing-for-rest-apis

In this example, the ***Configure*** method is used.

HomeController matches a set of URLs similar to what the default ***conventional*** route {controller=Home}/{action=Index}/{id?} matches. ***Attribute routing*** requires more input to specify a route. ***Conventional Routing*** handles routes more succinctly, but ***Attribute Routing*** allows (and requires) precise control of which route templates apply to each ***action***.

With ***attribute routing***, the ***controller*** name and ***action*** names play no role in which ***action*** is matched.

```
public class MyDemoController : Controller
{
    [Route("")]
    [Route("Home")]
    [Route("Home/Index")]
    [Route("Home/Index/{id?}")]
    public IActionResult MyIndex(int? id)
    {
        return ControllerContext.MyDisplayRouteInfo(id);
    }

    [Route("Home/About")]
    [Route("Home/About/{id?}")]
    public IActionResult MyAbout(int? id)
    {
        return ControllerContext.MyDisplayRouteInfo(id);
    }
}
```

Attribute Routing - HTTP Verb Templates

https://docs.microsoft.com/en-us/aspnet/core/mvc/controllers/routing?view=aspnetcore-3.1#http-verb-templates

ASP.NET Core has the following HTTP verb templates: [HttpGet], [HttpPost], [HttpPut], [HttpDelete], [HttpHead], [HttpPatch]

The ***GetProduct*** action includes the "{id}" template, therefore id is appended to the "api/[controller]" template on the ***controller***, so ***GetProduct***'s template is "api/[controller]/"{id}"".

Therefore, this action only matches GET requests of the form /api/test2/123, /api/test2/{any string}.

```
[Route("api/[controller]")]
[ApiController]
public class Test2Controller : ControllerBase
{
    [HttpGet]   // GET /api/test2
    public IActionResult ListProducts()
    {
        return ControllerContext.MyDisplayRouteInfo();
    }

    [HttpGet("{id}")]   // GET /api/test2/xyz
    public IActionResult GetProduct(string id)
    {
       return ControllerContext.MyDisplayRouteInfo(id);
    }

    [HttpGet("int/{id:int}")] // GET /api/test2/int/3
    public IActionResult GetIntProduct(int id)
    {
        return ControllerContext.MyDisplayRouteInfo(id);
    }

    [HttpGet("int2/{id}")]  // GET /api/test2/int2/3
    public IActionResult GetInt2Product(int id)
    {
        return ControllerContext.MyDisplayRouteInfo(id);
    }
}
```