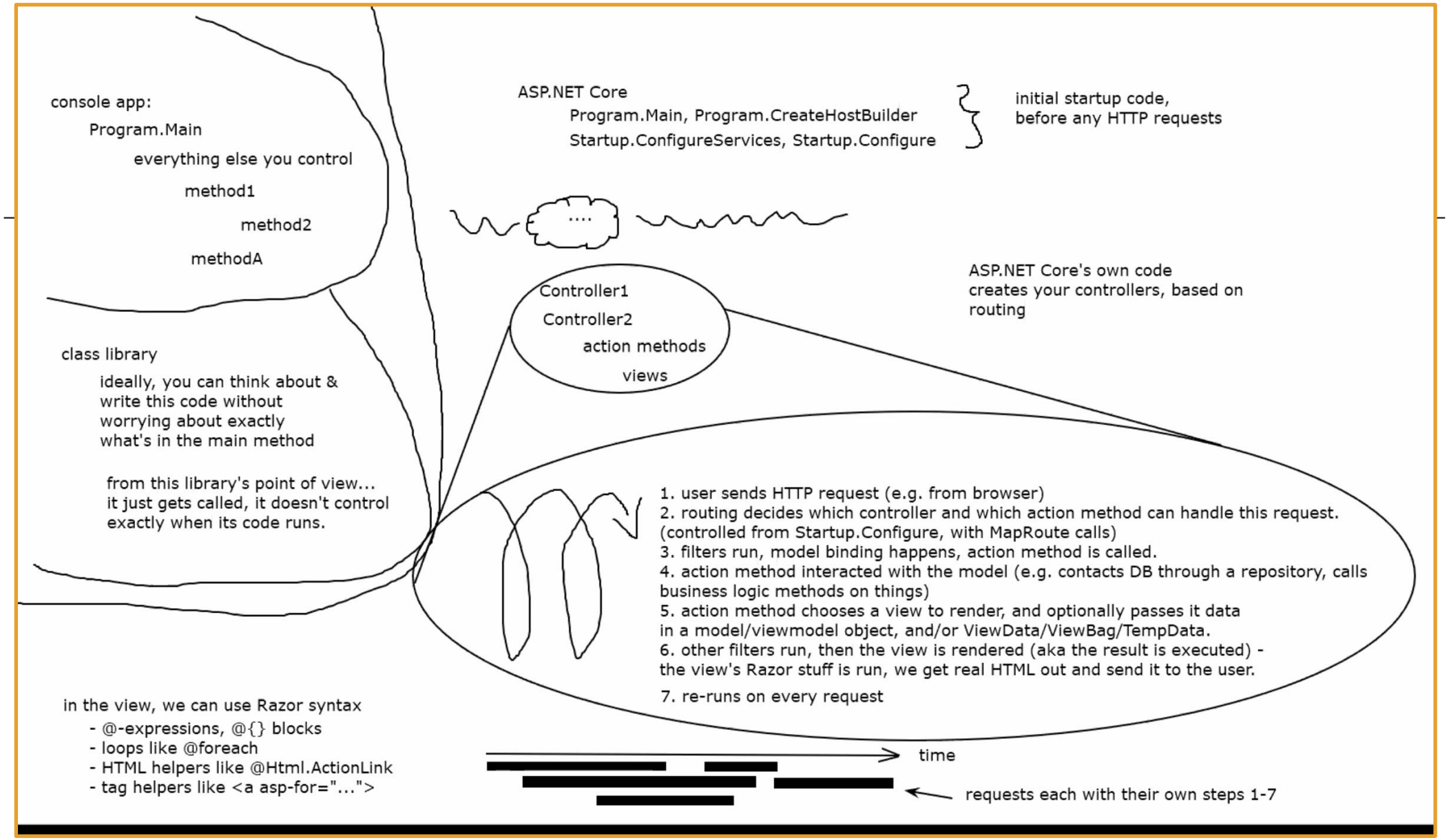
# Routing

.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 Routing middleware to match the URLs of incoming requests and map them to **actions**. Route 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

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A ***Controller*** is a class used to define and group a set of ***Action*** methods. ***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*** layer.

To be classified as a ***Controller***, at least one of these 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.

***Controller*** classes reside in the project's root-level ***Controllers*** directory and inherit from ***Microsoft.AspNetCore.Mvc.Controller*** (the Controller class).

```
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*** that 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 ***ModelBinding***.
- ***Model validation*** occurs for everything that's ***Model-Bound***.
- The ModelState.IsValid method indicates whether ***ModelBinding*** 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

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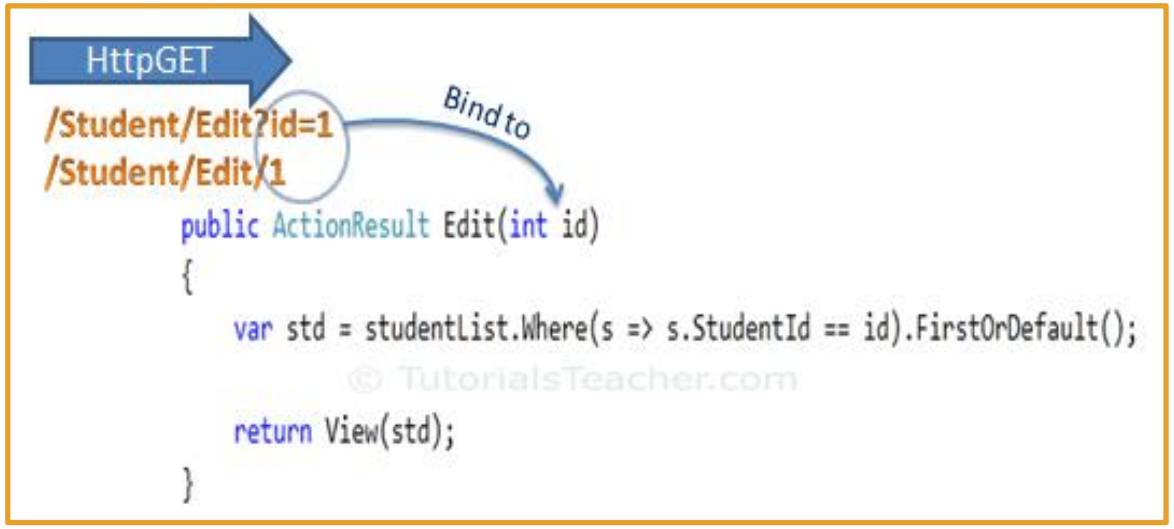
***Controllers*** and ***Action*** methods work with data that comes from HTTP requests. (Ex. ***POST***ed form fields provide values for the properties of the ***model***.)

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

The ***ModelBinding*** system:
- Retrieves data from various sources such as route data, form fields, and query strings.
- Provides the data to ***Controllers*** in ***Action*** ***m***ethod 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

In this example, ***ModelBinding*** goes through the following steps for the request at the bottom.

1. The routing system selects the correct ***action*** method.
2. It needs the first parameter of GetByID (id) and looks through the HTTP request.
3. It finds id = "2" in the route data.
4. The system converts string "2" into integer 2.
5. It finds the next parameter of GetByID(dogsOnly).
6. The system finds "DogsOnly=true" in the query string. Name matching is not case-sensitive.
7. The system 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

The ***Controller*** provides access to three categories of helper methods.

| 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()** 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

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Startup.Configure() typically has code similar to the following when using conventional routing.

Inside the call to UseEndpoints(), ***.MapControllerRoute()*** is used to create a route. This single route is named "***default***". /Home/Index/<args> be the default route used when a request arrives to the base URL.

```
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 ***tokenizes***(extracts) the route values:

- Controller = Products,
- Action = Details,
- id = 5

This 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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***RESTful 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 ***RESTful 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

***HomeController*** matches a set of URLs similar to what the default ***conventional*** route {controller=Home}/{action=Index}/{id?} matches.

***Conventional Routing*** handles routes more succinctly, but ***Attribute Routing*** allows (and requires) precise control over which route templates apply to each ***Action***.

With ***Attribute Routing***, the ***Controller*** name and ***Action*** names no longer play a 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 these ***HTTP verb*** templates: [HttpGet], [HttpPost], [HttpPut], [HttpDelete], [HttpHead], [HttpPatch].

The GetProduct() ***Action*** method includes the "{id}" template, therefore 'id' is appended to the "api/[controller]" template above the ***Controller***, so GetProduct() template is "api/test2/{id}".

Therefore, GetProduct(string id) can match *GET* requests of the form:

- /api/test2/123 or /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);
    }
}
```