10 Things I Do On Every .NET App

Slides at scottsauber.com

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Audience

- .NET Developers
- Interested in more maintainable apps
- Hopefully the Venn Diagram of .NET Devs who care about maintainable apps is a circle

Agenda

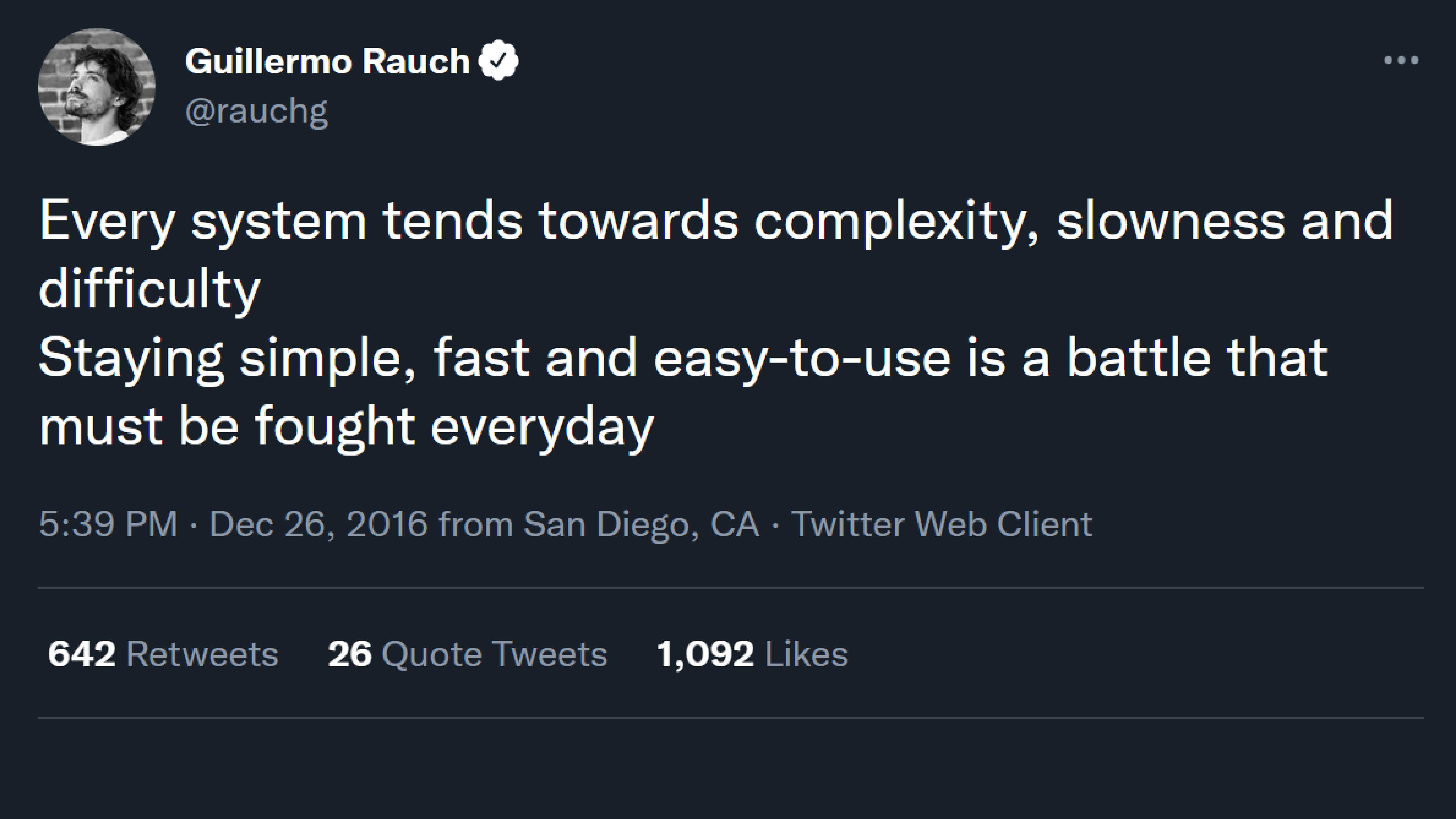
- Series of lightning talks
- Better folder structure
- Treat Warnings As Errors
- Logging “Best Practices”
- Global Authorize Attribute via FallbackPolicy
- Use FluentValidation
- Remove Server Header
- Don’t use IOptions… use this one weird trick instead… 👀
- Code Smells
- Modern Solution Files
- HTTP Security Headers
- #11, #12, #13
- Rapid fire Bonus!

Goals

- Exposure to new ideas
- Takeaway some ideas back to work
- Odds are you might not agree with everything I do

Who am I?

- Director of Engineering at Lean TECHniques
- Microsoft MVP
- Dometrain Author
- Redgate Community Ambassador
- Co-organizer of Iowa .NET User Group



Guillermo Rauch
@rauchg

Every system tends towards complexity, slowness and difficulty
Staying simple, fast and easy-to-use is a battle that must be fought everyday

5:39 PM · Dec 26, 2016 from San Diego, CA · Twitter Web Client

642 Retweets 26 Quote Tweets 1,092 Likes

Folder Structure

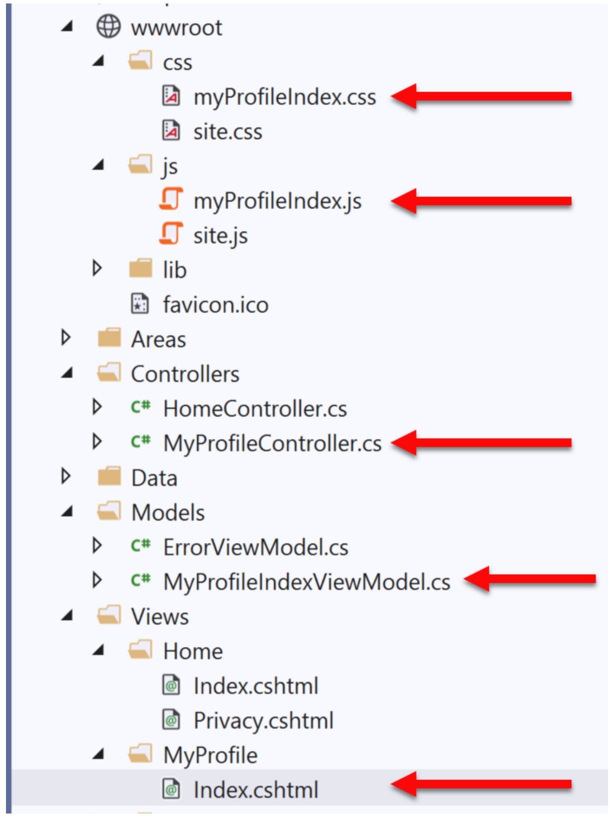
Problem: OOB MVC Folders By Responsibility

- All of these live in their own separate folders and most are required to add a new feature
  - Controllers
  - Views
  - Models
  - wwwroot/css
  - wwwroot/js
- Adds navigation friction
- Scope of a feature is scattered
- Makes it hard to add, delete or extend existing features

Solution: Use Feature Folders

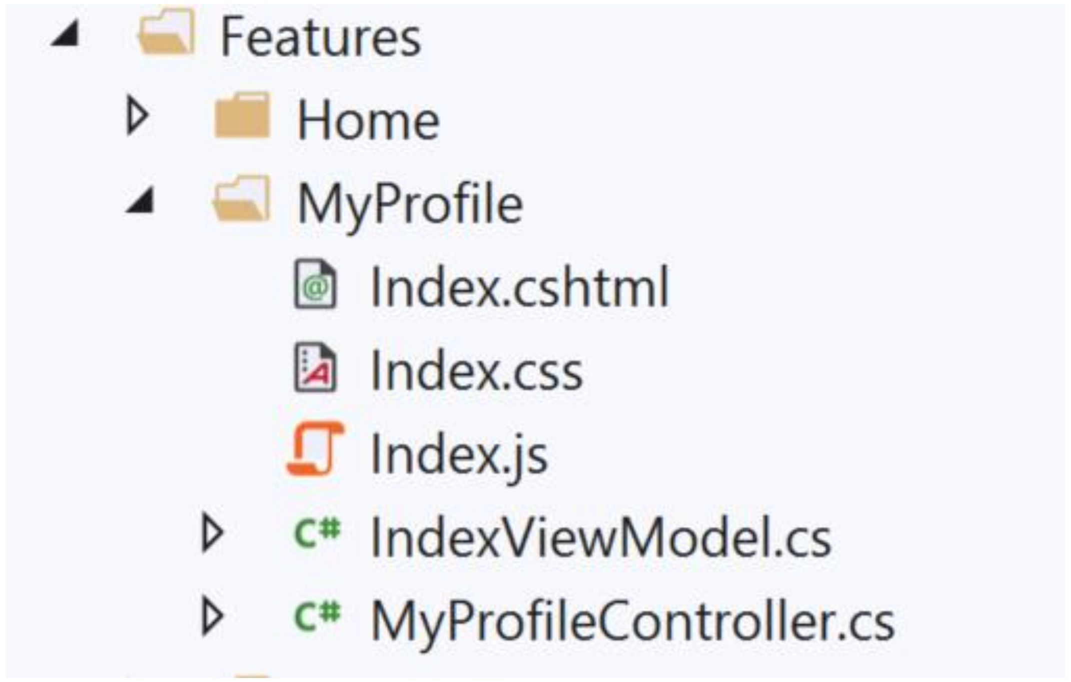
- Grouping by Feature, not by Responsibility, results in easier maintenance
- Related things remain together (High Cohesion)

MVC out of the box:



```
◢ wwwroot
  ◢ css
      myProfileIndex.css
      site.css
  ◢ js
      myProfileIndex.js
      site.js
  ▷ lib
    favicon.ico
▷ Areas
◢ Controllers
  ▷ HomeController.cs
  ▷ MyProfileController.cs
▷ Data
◢ Models
  ▷ ErrorViewModel.cs
  ▷ MyProfileIndexViewModel.cs
◢ Views
  ◢ Home
      Index.cshtml
      Privacy.cshtml
  ◢ MyProfile
      Index.cshtml
```

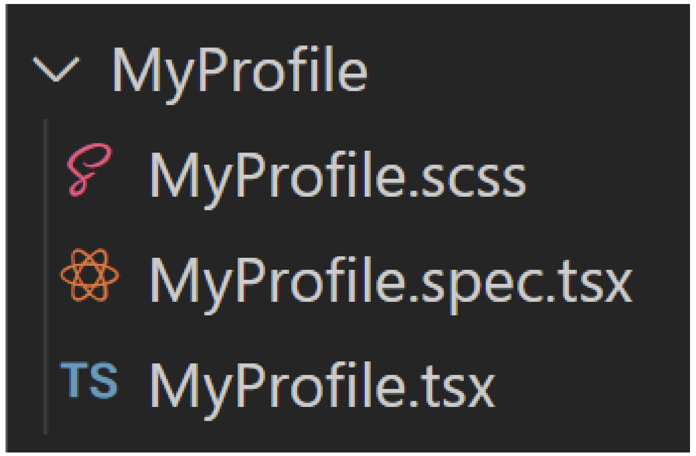
Feature Folders:



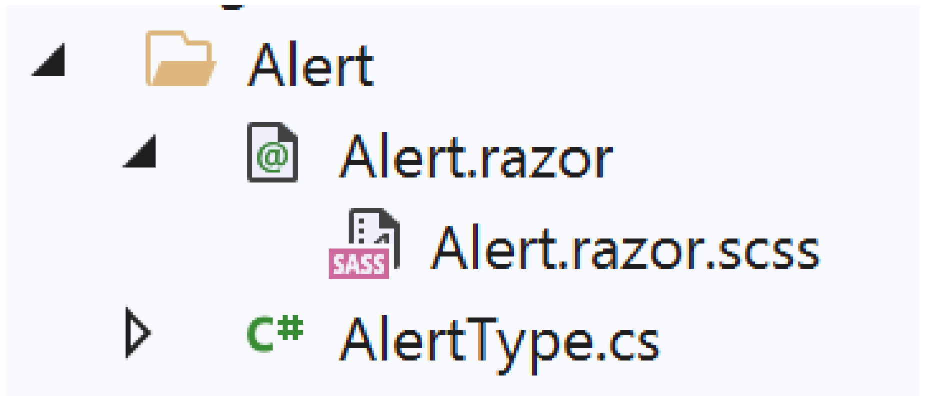
```
◢ Features
  ▷ Home
  ◢ MyProfile
      Index.cshtml
      Index.css
      Index.js
    ▷ IndexViewModel.cs
    ▷ MyProfileController.cs
```

Solution: Use Feature Folders

React:


MyProfile
MyProfile.scss
MyProfile.spec.tsx
MyProfile.tsx

Blazor:


Alert
Alert.razor
Alert.razor.scss
AlertType.cs

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But mah layers!!!1one

- I used to do horizontal csproj’s
- .Data, .Business, .Common, .Models, .Api
- Now I just do two projects
- .Core and .Api (or .Web or .Console or whatever entrypoint is)
- I slice the folders here vertically too
- Plus corresponding Test projects of course (more later)
- Slice horizontally only if you’re publishing packages to NuGet or internally

Feature Folder Extra Resources

- Soap analogy

- How to do this in ASP.NET Core
  - My blog post
  - Steve Smith's Blog on Feature Folders vs. Areas

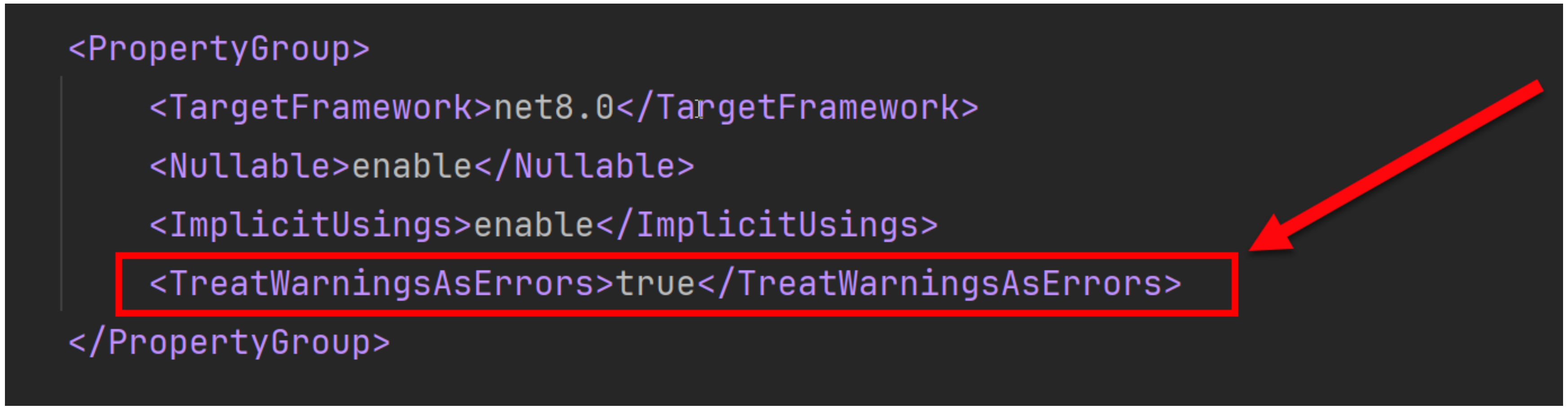
- Refactoring to Vertical Slice architecture (featureFolders++)
  - Derek Comartin

⚠️ == ❌

DEVELOPERS WHEN THEY GET WARNINGS INSTEAD OF ERRORS.
imgflip.com

Treat Warnings as Errors

- Build/Compiler warnings don't exist in my world
  - Error or Nothing



```xml
<PropertyGroup>
    <TargetFramework>net8.0</TargetFramework>
    <Nullable>enable</Nullable>
    <ImplicitUsings>enable</ImplicitUsings>
    <TreatWarningsAsErrors>true</TreatWarningsAsErrors>
</PropertyGroup>
```

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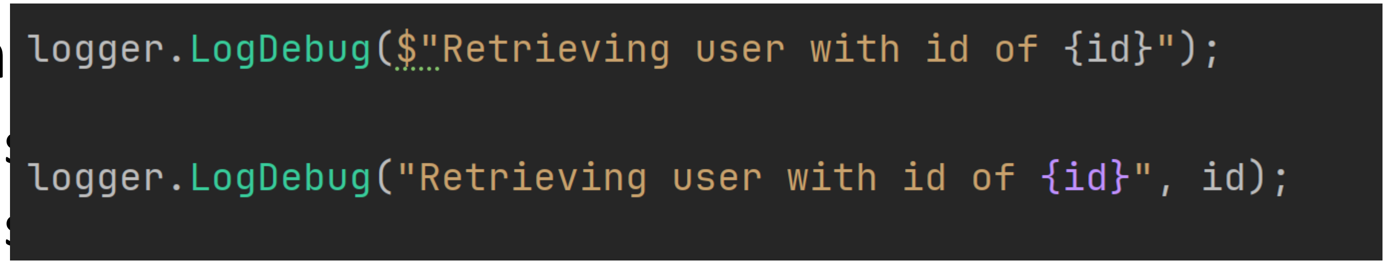
Logging “Best Practices”

Logging “Best Practices”

- Use Serilog as logging framework
- Use ILogger everywhere, not Serilog directly
- Use structured logging, not concatenation
  - But… Azure Log Analytics workspaces cap at 500 columns
- Each
  - U
  - U
- “We need to log that”
- Logs vs Metrics vs Audits



```
logger.LogDebug($"Retrieving user with id of {id}");

logger.LogDebug("Retrieving user with id of {id}", id);
```

Logs

- Developer focused
- Example: log an exception or log response from external API
- Log Levels
  - Debug vs Information vs Warning vs Error vs Critical
- Stop abusing Information! You probably meant Debug
- Clean up your Warnings and Errors!
- How long does my log store keep logs?
- How reliable is my log delivery system
  - It’s okay to not have 100% guaranteed delivery of logs
- How does Serilog work?

Metrics

- Two types
- Application
  - CPU, Network, Response Times, Queue Depth, etc.
- Business
  - How many times did someone click that button
- How long do we need to keep Metric data?
- It may or may not be acceptable to miss some data
- What data store are we using?

Audits

- Recording who, did what, and when in your application
- Usually for legal, compliance, or traceability reasons
- Losing any data is unacceptable
- Store audits with the same data store as the data that’s being audited

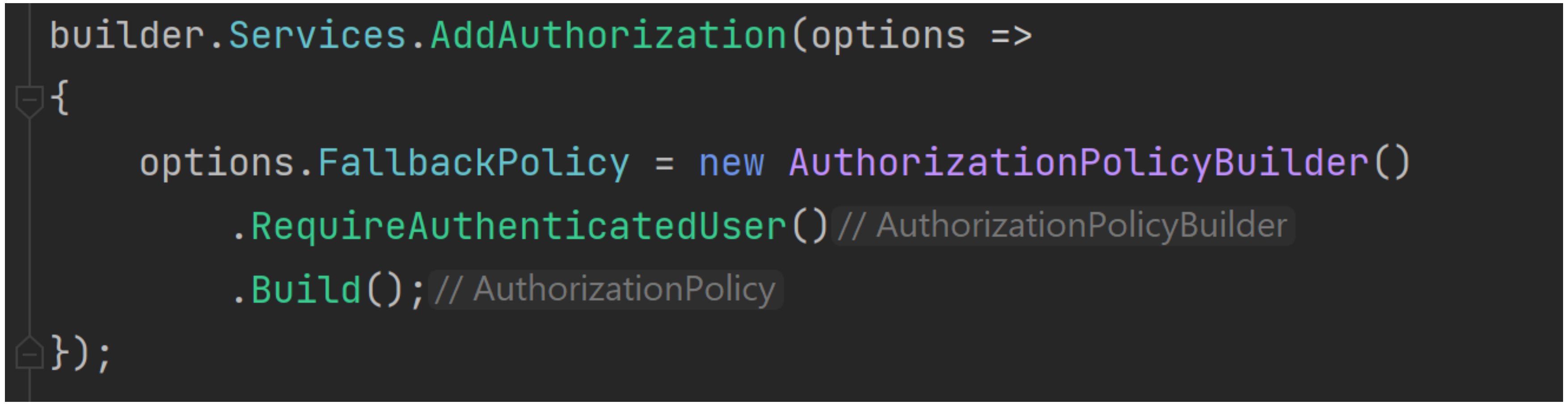
Global Authorize Attribute via FallbackPolicy

Problem: Security is Opt-In

- You have to remember to add a [Authorize] attribute everywhere
- Or you have to remember to inherit from a custom BaseController
- You forget? Oops you’re wide open to the world!

Solution: FallbackPolicy

- A Fallback Policy is the policy that gets evaluated if no other policy is specified



```csharp
builder.Services.AddAuthorization(options =>
{
    options.FallbackPolicy = new AuthorizationPolicyBuilder()
        .RequireAuthenticatedUser() // AuthorizationPolicyBuilder
        .Build(); // AuthorizationPolicy
});
```

Validation

Validation – What’s wrong with Data Annotations

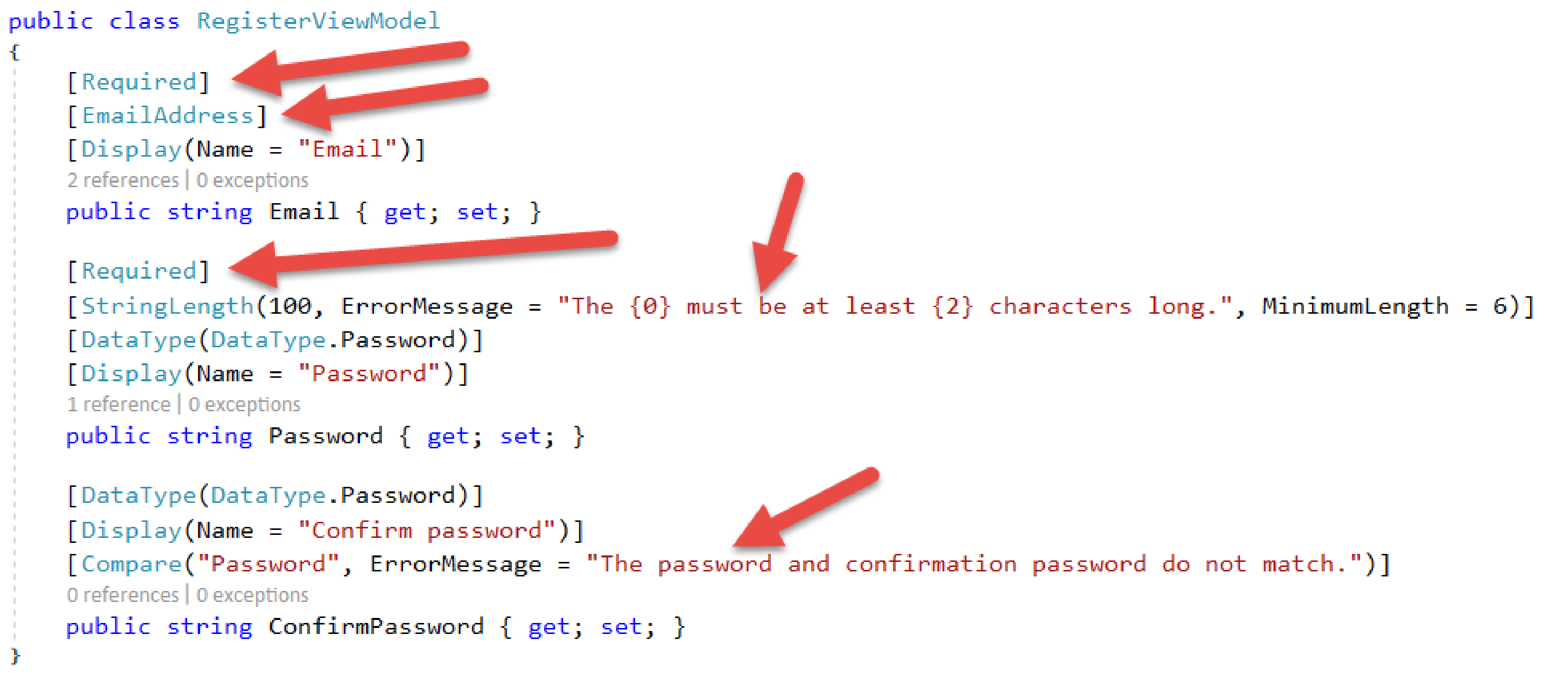
- Only work well for simple scenarios
- Hard to make custom ones
- Hard to unit test
- Separate annotations for each property
  - Can get “tall”
- SRP violated
  - Model + Validation combined into one class

Solution: Use FluentValidation

Fluent*
Validation

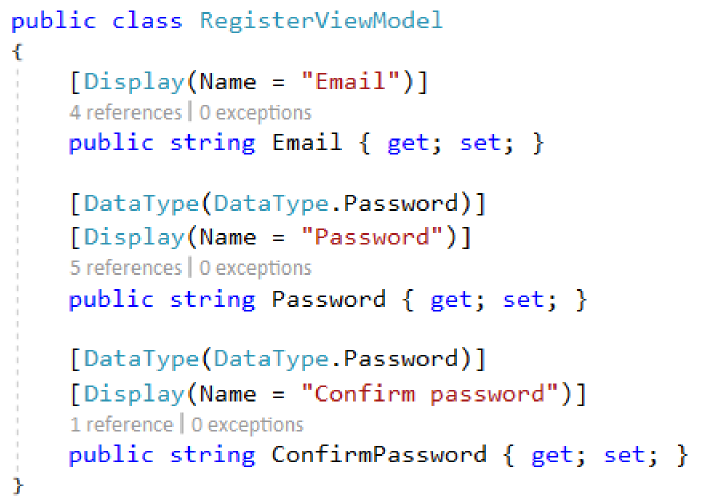
- Fluent interface
- Business rules are easy to maintain and read
- Easy to show a stakeholder
- Easy to test
- Integrates with ModelState.IsValid
- 634M downloads
- https://github.com/JeremySkinner/FluentValidation

Template Code:

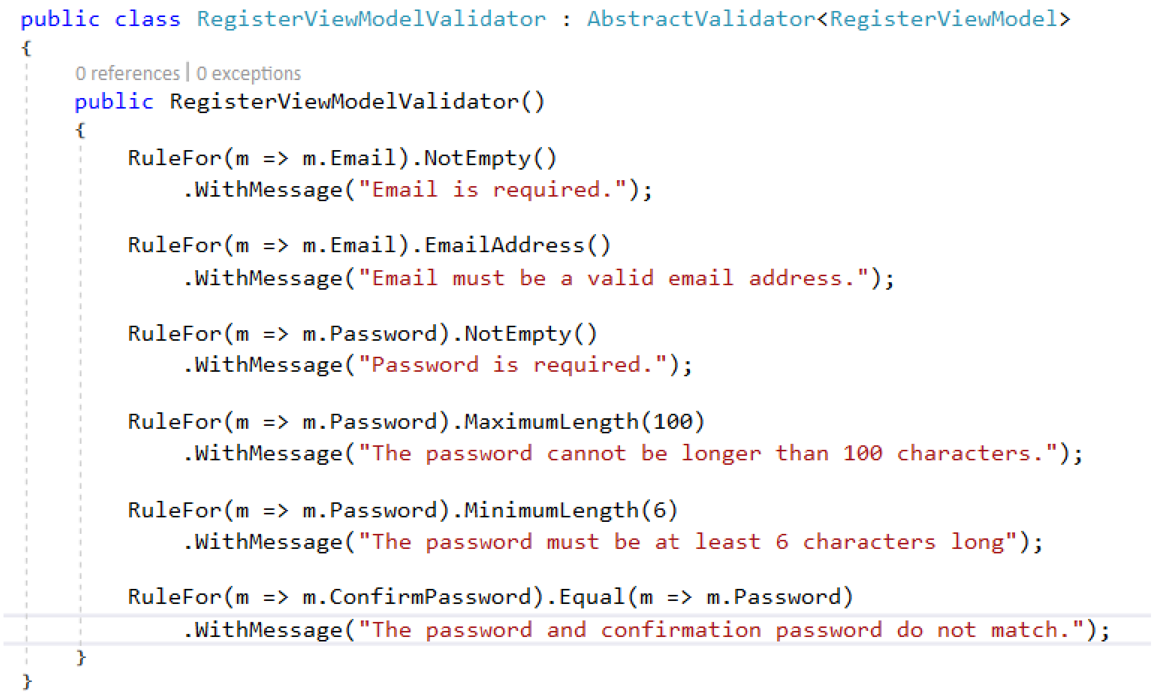


```
public class RegisterViewModel
{
    [Required]
    [EmailAddress]
    [Display(Name = "Email")]
    2 references | 0 exceptions
    public string Email { get; set; }

    [Required]
    [StringLength(100, ErrorMessage = "The {0} must be at least {2} characters long.", MinimumLength = 6)]
    [DataType(DataType.Password)]
    [Display(Name = "Password")]
    1 reference | 0 exceptions
    public string Password { get; set; }

    [DataType(DataType.Password)]
    [Display(Name = "Confirm password")]
    [Compare("Password", ErrorMessage = "The password and confirmation password do not match.")]
    0 references | 0 exceptions
    public string ConfirmPassword { get; set; }
}
```

Refactored with Fluent Validation:

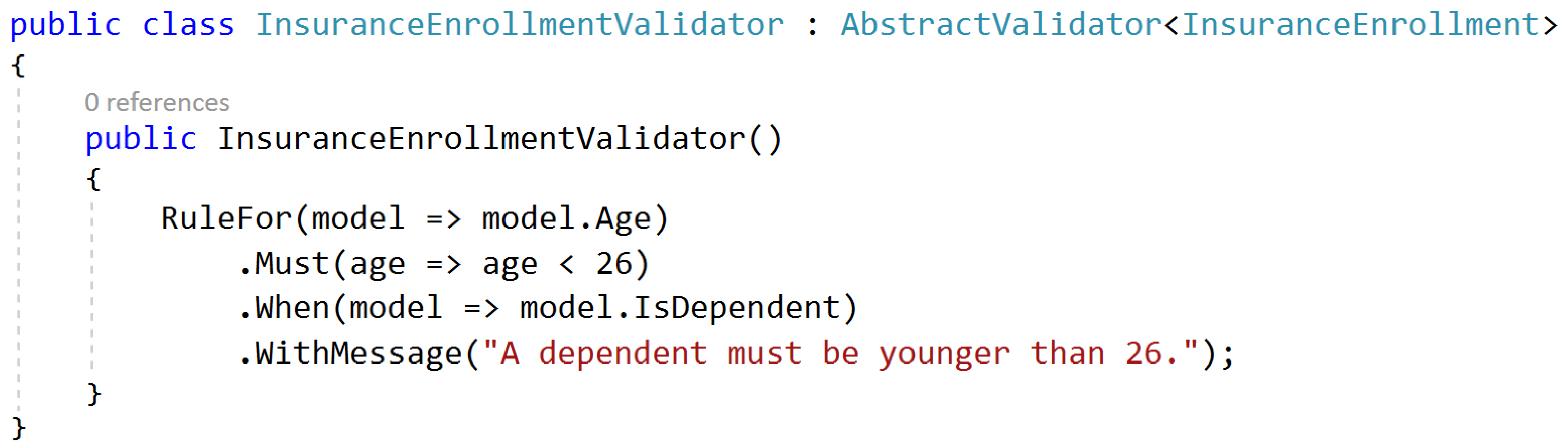


```
public class RegisterViewModel
{
    [Display(Name = "Email")]
    4 references | 0 exceptions
    public string Email { get; set; }

    [DataType(DataType.Password)]
    [Display(Name = "Password")]
    5 references | 0 exceptions
    public string Password { get; set; }

    [DataType(DataType.Password)]
    [Display(Name = "Confirm password")]
    1 reference | 0 exceptions
    public string ConfirmPassword { get; set; }
}
```



```
public class RegisterViewModelValidator : AbstractValidator<RegisterViewModel>
{
    0 references | 0 exceptions
    public RegisterViewModelValidator()
    {
        RuleFor(m => m.Email).NotEmpty()
            .WithMessage("Email is required.");

        RuleFor(m => m.Email).EmailAddress()
            .WithMessage("Email must be a valid email address.");

        RuleFor(m => m.Password).NotEmpty()
            .WithMessage("Password is required.");

        RuleFor(m => m.Password).MaximumLength(100)
            .WithMessage("The password cannot be longer than 100 characters.");

        RuleFor(m => m.Password).MinimumLength(6)
            .WithMessage("The password must be at least 6 characters long");

        RuleFor(m => m.ConfirmPassword).Equal(m => m.Password)
            .WithMessage("The password and confirmation password do not match.");
    }
}
```

A Rule that only exists if….

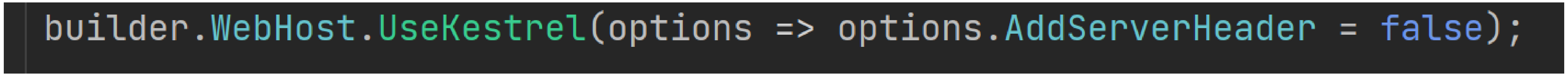


```
public class InsuranceEnrollmentValidator : AbstractValidator<InsuranceEnrollment>
{
    0 references
    public InsuranceEnrollmentValidator()
    {
        RuleFor(model => model.Age)
            .Must(age => age < 26)
            .When(model => model.IsDependent)
            .WithMessage("A dependent must be younger than 26.");
    }
}
```

Remove the Server Header

Remove the Server Header

- By default ASP.NET Core adds a “Server Header”
- This says “Kestrel”
- This exposes to black hats what you’re running
- Focuses exploiting known CVEs

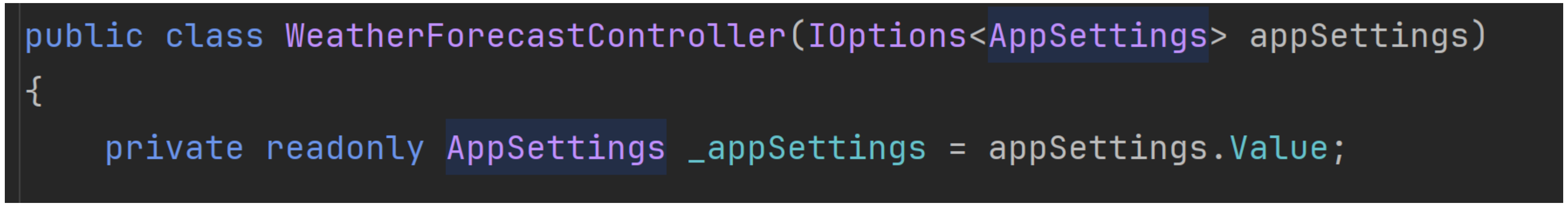


```
builder.WebHost.UseKestrel(options => options.AddServerHeader = false);
```

Don’t use IOptions…

Problem: IOptions is annoying

- Dependency on Microsoft.Extensions.Options down in other csproj’s
- Testing IOptions is slightly annoying with Options.Create()
- .Value everywhere adds friction



```
public class WeatherForecastController(IOptions<AppSettings> appSettings)
{
    private readonly AppSettings _appSettings = appSettings.Value;
```

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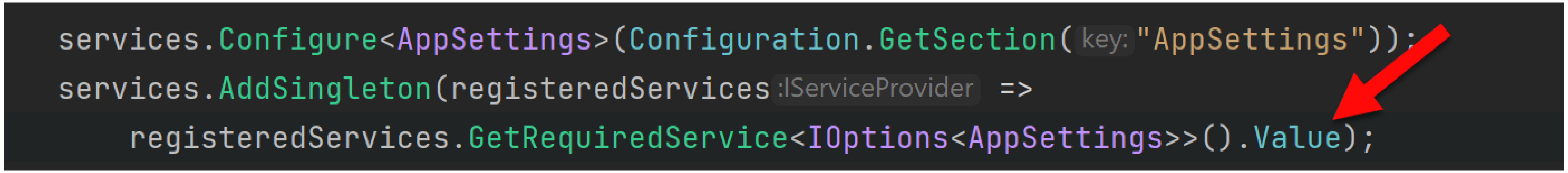
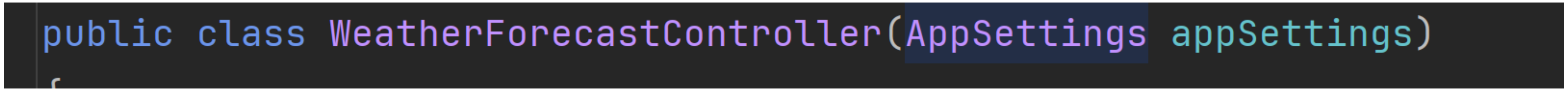
Solution: Register your Options class directly



```
services.Configure<AppSettings>(Configuration.GetSection( key: "AppSettings"));
services.AddSingleton(registeredServices :IServiceProvider  =>
    registeredServices.GetRequiredService<IOptions<AppSettings>>().Value);
```



```
public class WeatherForecastController(AppSettings appSettings)
```

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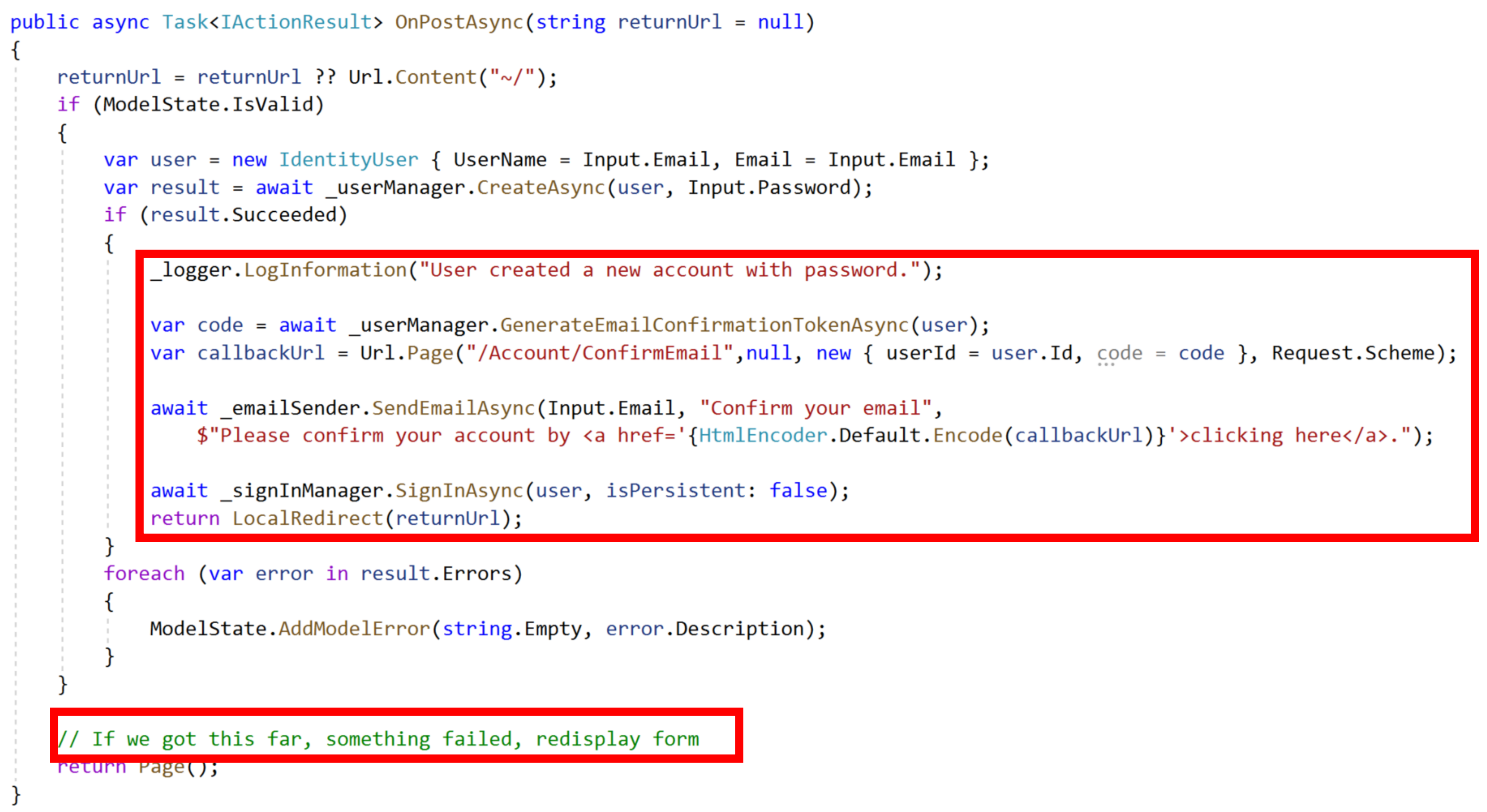
Code Smells

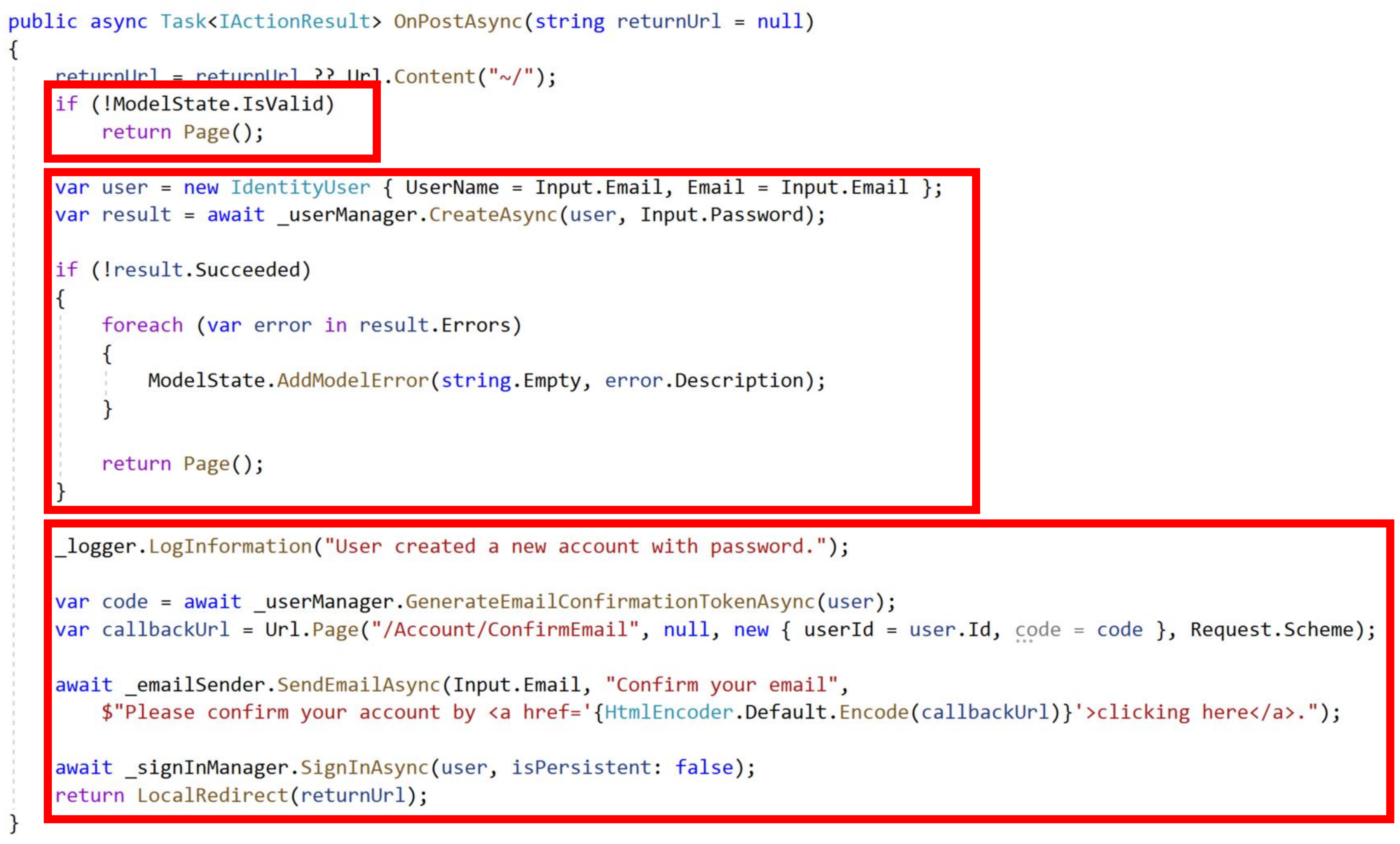
Structuring a method

- Happy Path always at the bottom of the method
  - Don’t want to scan for “what happens when all goes well” and find it in the middle of a method
- Use return’s instead of nested if => else

Razor Pages Template Code:


```
public async Task<IActionResult> OnPostAsync(string returnUrl = null)
{
    returnUrl = returnUrl ?? Url.Content("~/");
    if (ModelState.IsValid)
    {
        var user = new IdentityUser { UserName = Input.Email, Email = Input.Email };
        var result = await _userManager.CreateAsync(user, Input.Password);
        if (result.Succeeded)
        {
            _logger.LogInformation("User created a new account with password.");

            var code = await _userManager.GenerateEmailConfirmationTokenAsync(user);
            var callbackUrl = Url.Page("/Account/ConfirmEmail",null, new { userId = user.Id, code = code }, Request.Scheme);

            await _emailSender.SendEmailAsync(Input.Email, "Confirm your email",
                $"Please confirm your account by <a href='{HtmlEncoder.Default.Encode(callbackUrl)}'>clicking here</a>.");

            await _signInManager.SignInAsync(user, isPersistent: false);
            return LocalRedirect(returnUrl);
        }
        foreach (var error in result.Errors)
        {
            ModelState.AddModelError(string.Empty, error.Description);
        }
    }

    // If we got this far, something failed, redisplay form
    return Page();
}
```

Refactored with Happy Path At The Bottom:



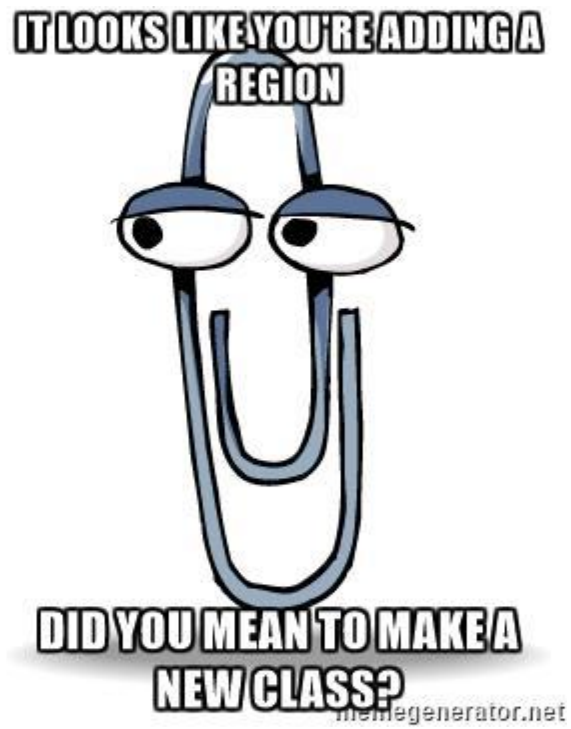
```
public async Task<IActionResult> OnPostAsync(string returnUrl = null)
{
    returnUrl = returnUrl ?? Url.Content("~/");
    if (!ModelState.IsValid)
        return Page();

    var user = new IdentityUser { UserName = Input.Email, Email = Input.Email };
    var result = await _userManager.CreateAsync(user, Input.Password);

    if (!result.Succeeded)
    {
        foreach (var error in result.Errors)
        {
            ModelState.AddModelError(string.Empty, error.Description);
        }

        return Page();
    }

    _logger.LogInformation("User created a new account with password.");

    var code = await _userManager.GenerateEmailConfirmationTokenAsync(user);
    var callbackUrl = Url.Page("/Account/ConfirmEmail", null, new { userId = user.Id, code = code }, Request.Scheme);

    await _emailSender.SendEmailAsync(Input.Email, "Confirm your email",
        $"Please confirm your account by <a href='{HtmlEncoder.Default.Encode(callbackUrl)}'>clicking here</a>.");

    await _signInManager.SignInAsync(user, isPersistent: false);
    return LocalRedirect(returnUrl);
}
```

The Indentation Proclamation

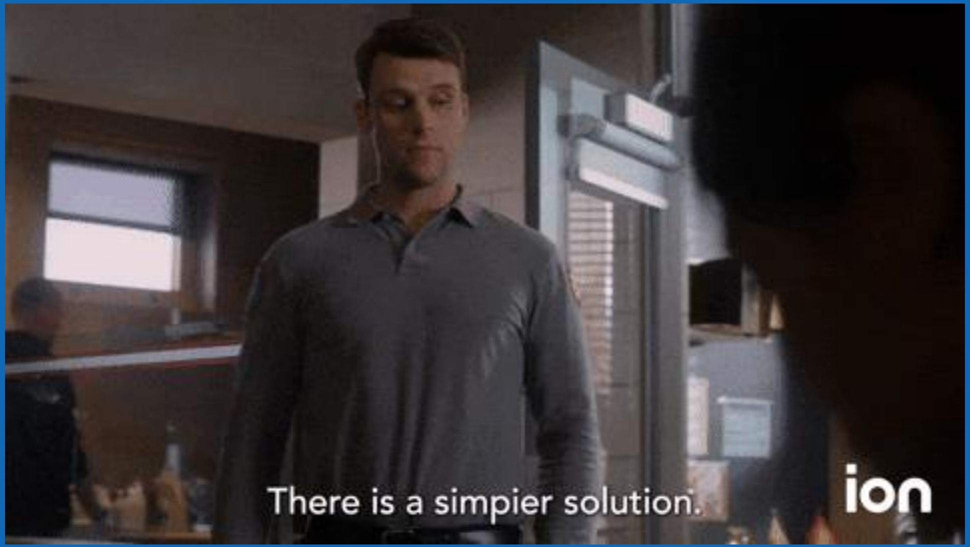
- The more indented your code is, the harder it is to follow
- Nested if’s, nested loops, etc.
- …I made this up

Code smells

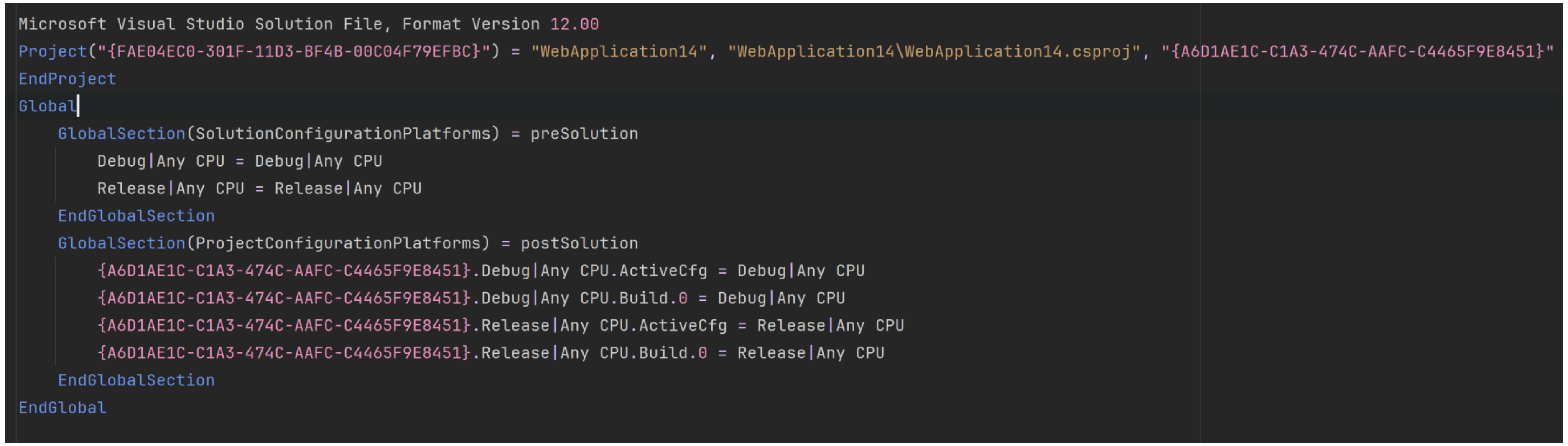
- Not hard and fast rules, just my “warning light”
- Methods > 20 lines
- Classes > 200 lines
- Regions
  - You probably should’ve added a new class or method instead


IT LOOKS LIKE YOU'RE ADDING A REGION
DID YOU MEAN TO MAKE A NEW CLASS?
memegenerator.net

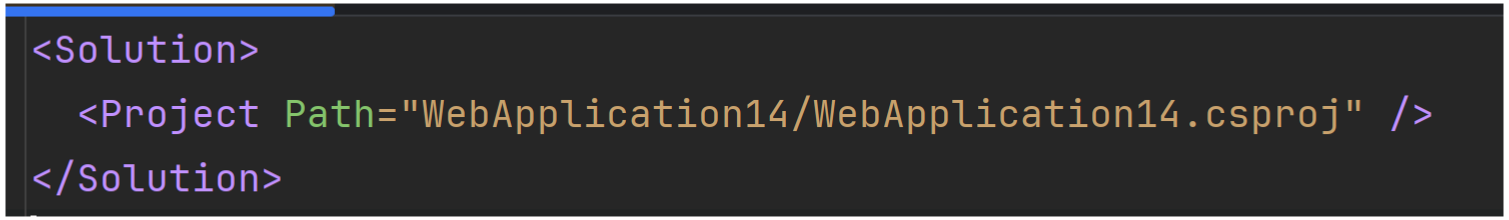
Modern Solution Files



Modern Solution Files!



```
Microsoft Visual Studio Solution File, Format Version 12.00
Project("{FAE04EC0-301F-11D3-BF4B-00C04F79EFBC}") = "WebApplication14", "WebApplication14\WebApplication14.csproj", "{A6D1AE1C-C1A3-474C-AAFC-C4465F9E8451}"
EndProject
Global
    GlobalSection(SolutionConfigurationPlatforms) = preSolution
        Debug|Any CPU = Debug|Any CPU
        Release|Any CPU = Release|Any CPU
    EndGlobalSection
    GlobalSection(ProjectConfigurationPlatforms) = postSolution
        {A6D1AE1C-C1A3-474C-AAFC-C4465F9E8451}.Debug|Any CPU.ActiveCfg = Debug|Any CPU
        {A6D1AE1C-C1A3-474C-AAFC-C4465F9E8451}.Debug|Any CPU.Build.0 = Debug|Any CPU
        {A6D1AE1C-C1A3-474C-AAFC-C4465F9E8451}.Release|Any CPU.ActiveCfg = Release|Any CPU
        {A6D1AE1C-C1A3-474C-AAFC-C4465F9E8451}.Release|Any CPU.Build.0 = Release|Any CPU
    EndGlobalSection
EndGlobal
```



```
<Solution>
  <Project Path="WebApplication14/WebApplication14.csproj" />
</Solution>
```

- slnx - .NET SDK 9.0.200+, feature still in preview
- dotnet sln migrate

HTTP Security Headers

HTTP Security Headers

- Tells a browser what extra rules to enforce
- Protects against MITM, clickjacking, cross-site scripting, and more
- Be careful!
- NetEscapades.AspNetCore.SecurityHeaders

Resources

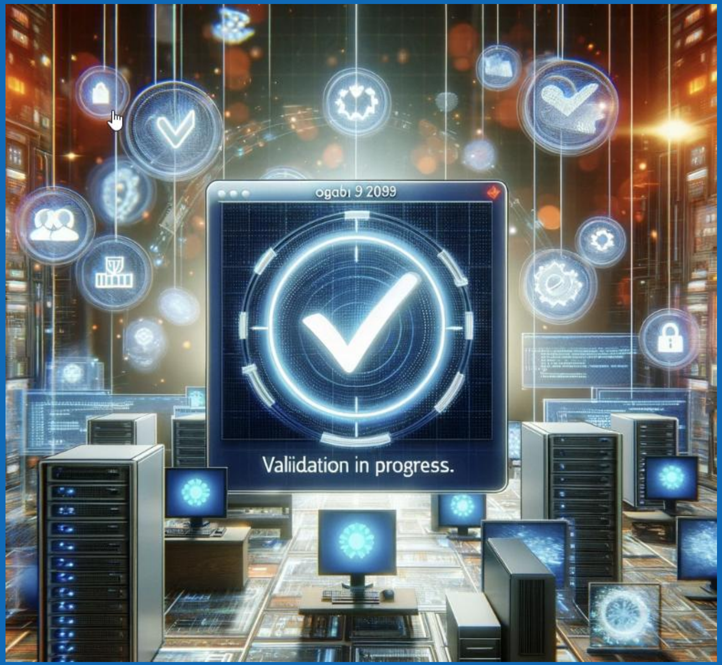
- My talk deep diving on this topic: https://www.youtube.com/watch?v=7MWXTXjtl8s

Build Once, Deploy Many Times

Build Once, Deploy Many Times

- Discourages Long Running Branches and GitFlow
- Encourages Trunk Based Development (even with PRs)
- Atlassian calls Gitflow “a legacy workflow”
- DORA Research promotes Trunk Based Development
- Environmental differences (i.e. config, secrets) live in the environment

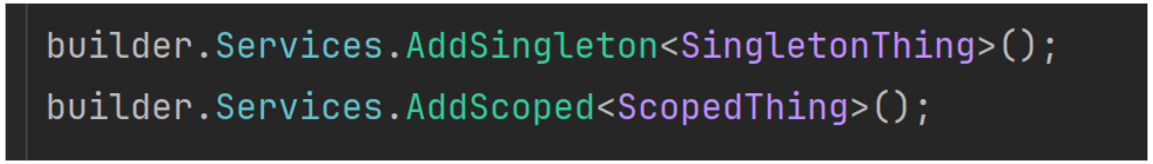
ValidateOnBuild



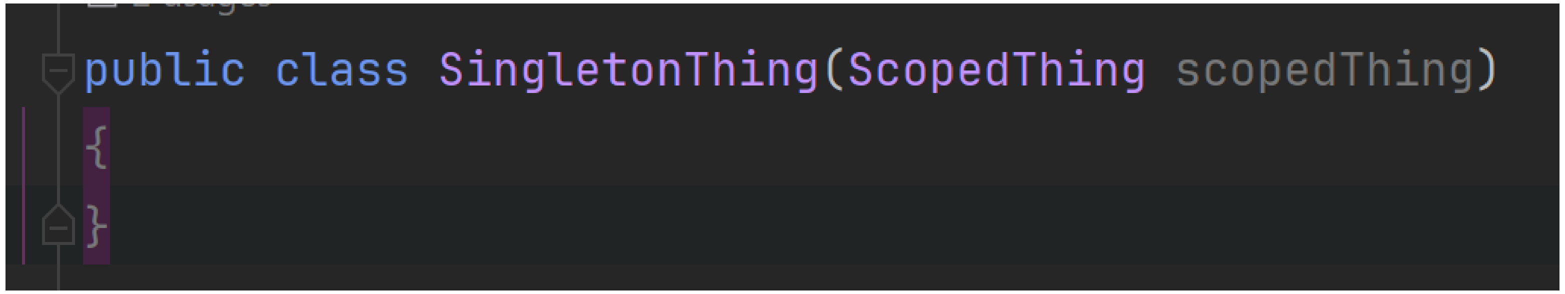
ValidateOnBuild

- Singletons can only depend on Singletons
- The “captive dependency” problem
- ASP.NET Core will catch this when running in Development but not other environments
- If you have a custom local env name…

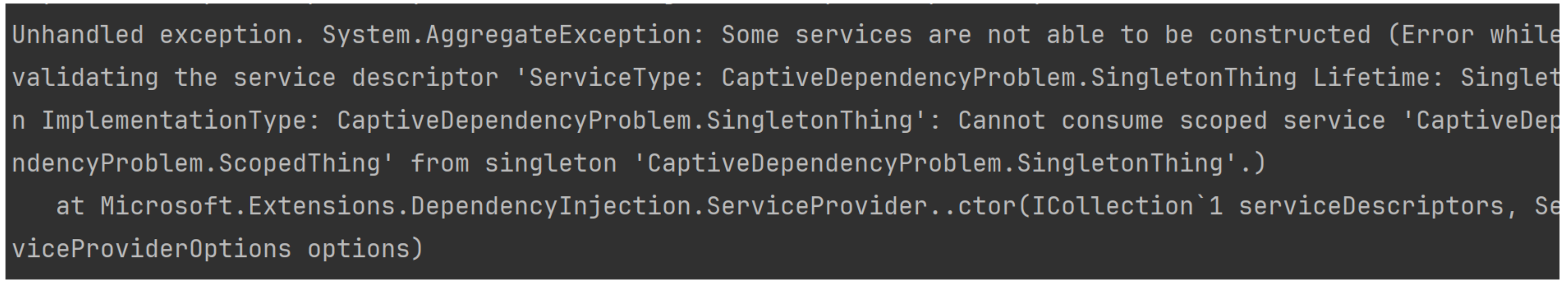
ValidateOnBuild



```
builder.Services.AddSingleton<SingletonThing>();
builder.Services.AddScoped<ScopedThing>();
```

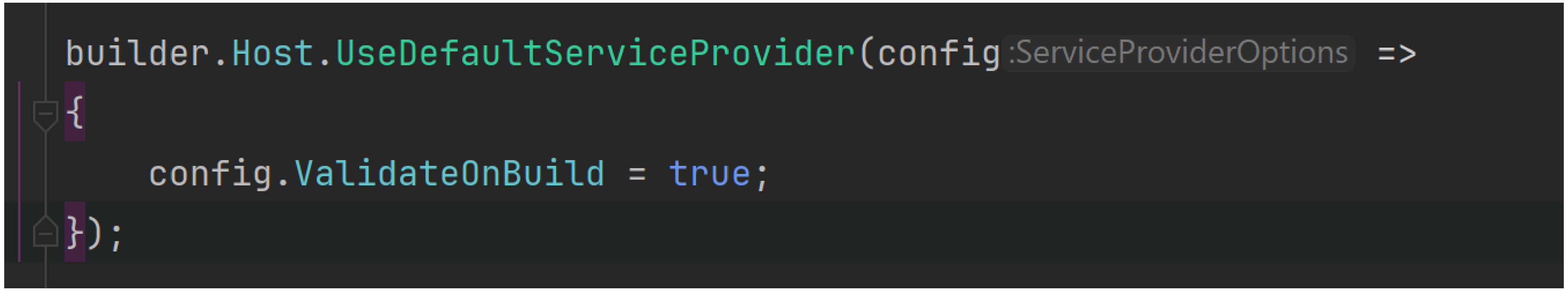


```
public class SingletonThing(ScopedThing scopedThing)
{
}
```



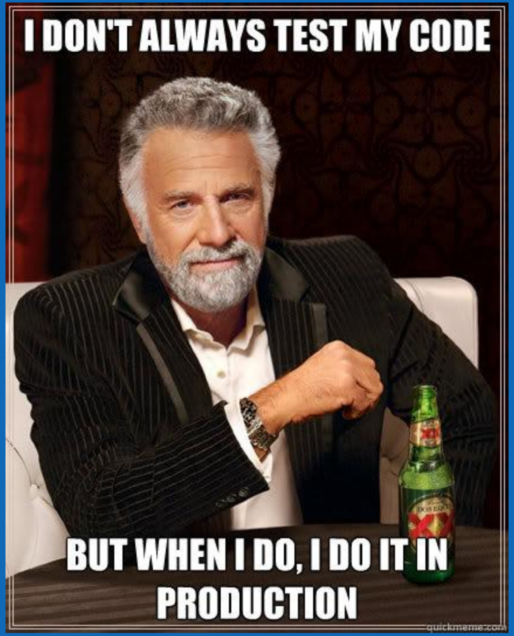
```
Unhandled exception. System.AggregateException: Some services are not able to be constructed (Error while
validating the service descriptor 'ServiceType: CaptiveDependencyProblem.SingletonThing Lifetime: Singlet
n ImplementationType: CaptiveDependencyProblem.SingletonThing': Cannot consume scoped service 'CaptiveDep
ndencyProblem.ScopedThing' from singleton 'CaptiveDependencyProblem.SingletonThing'.)
   at Microsoft.Extensions.DependencyInjection.ServiceProvider..ctor(ICollection`1 serviceDescriptors, Se
viceProviderOptions options)
```

ValidateOnBuild



```
builder.Host.UseDefaultServiceProvider(config :ServiceProviderOptions  =>
{
    config.ValidateOnBuild = true;
});
```

Automated Tests


I DON'T ALWAYS TEST MY CODE
BUT WHEN I DO, I DO IT IN PRODUCTION
quickmeme.com

Automated Testing with xUnit

- You should be writing automated tests
  - Exposes holes in your architecture
  - Proven to be faster long-term
    - Make changes quickly and confidently because have a regression test suite
- DORA Research proving automated testing results in improved stability, reduced burnout, and lower deployment pain
- Use xUnit or NUnit
  - Just not MSTest which is wayyy more verbose and has less features
- xUnit used by ASP.NET team
- Note: there's an xUnit.v3 package, which is diff than xUnit package

Chekhov's Gun

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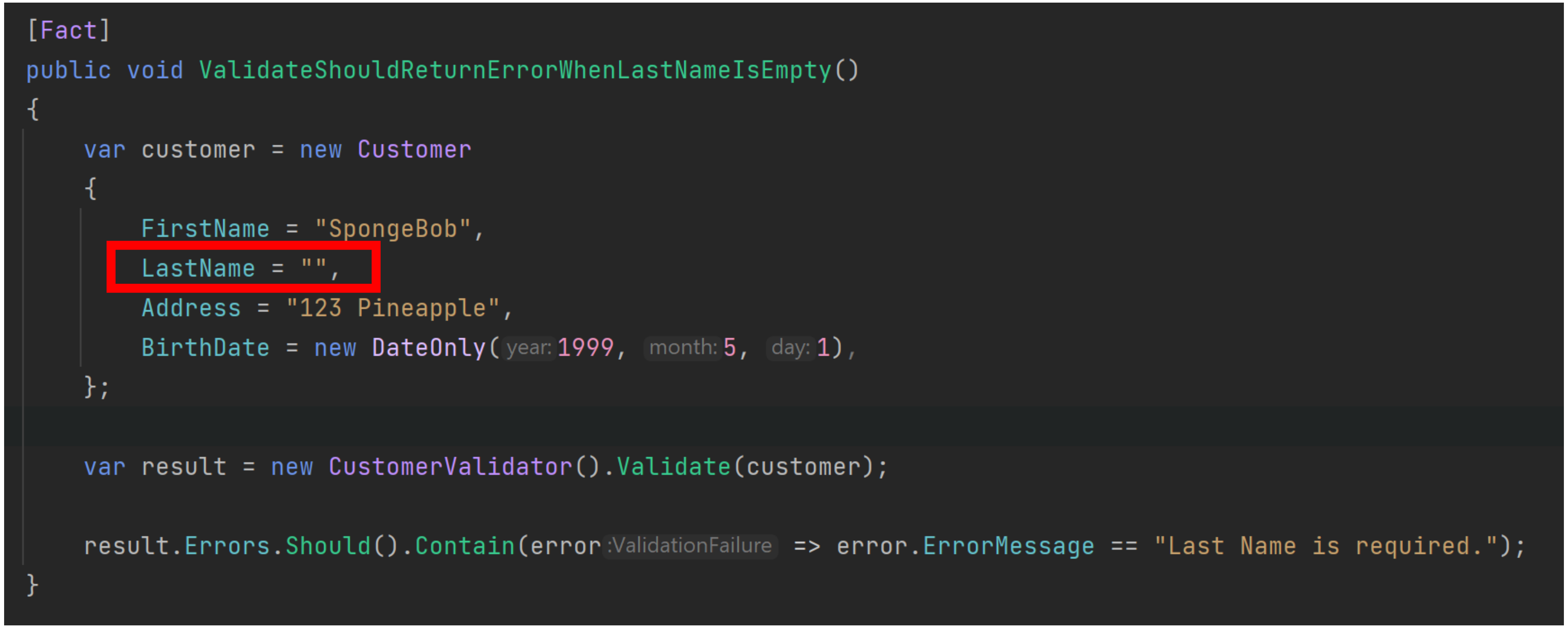
“Remove everything that has no relevance to the story. If you say in the first chapter that there is a rifle hanging on the wall, in the second or third chapter it absolutely must go off. If it's not going to be fired, it shouldn't be hanging there.”

Anton Chekhov

Chekhov's Gun Applied to Testing



```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    var customer = new Customer
    {
        FirstName = "SpongeBob",
        LastName = "",
        Address = "123 Pineapple",
        BirthDate = new DateOnly(year:1999, month:5, day:1),
    };

    var result = new CustomerValidator().Validate(customer);

    result.Errors.Should().Contain(error:ValidationFailure => error.ErrorMessage == "Last Name is required.");
}
```

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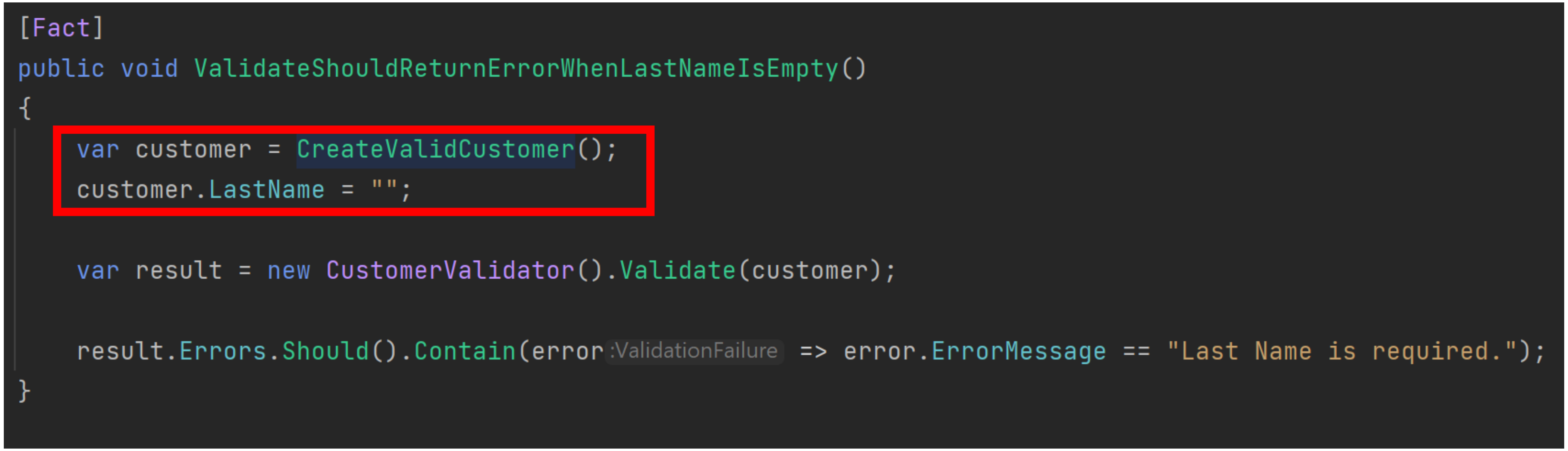
Chekhov's Gun Applied to Testing



```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    var customer = CreateValidCustomer();
    customer.LastName = "";

    var result = new CustomerValidator().Validate(customer);

    result.Errors.Should().Contain(error :ValidationFailure => error.ErrorMessage == "Last Name is required.");
}
```

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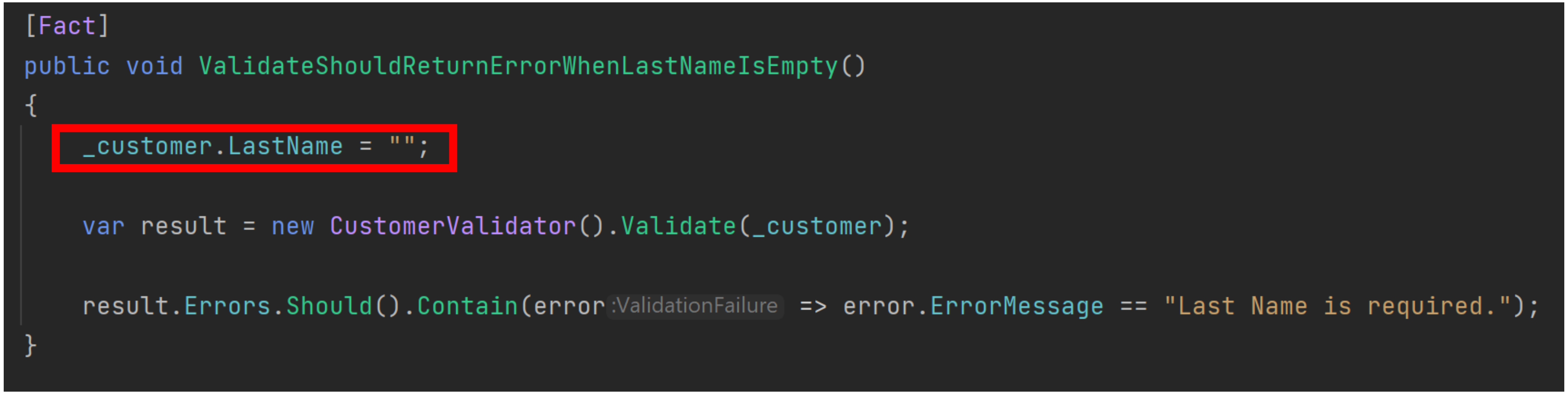

```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    _customer.LastName = "";

    var result = new CustomerValidator().Validate(_customer);

    result.Errors.Should().Contain(error :ValidationFailure => error.ErrorMessage == "Last Name is required.");
}
```

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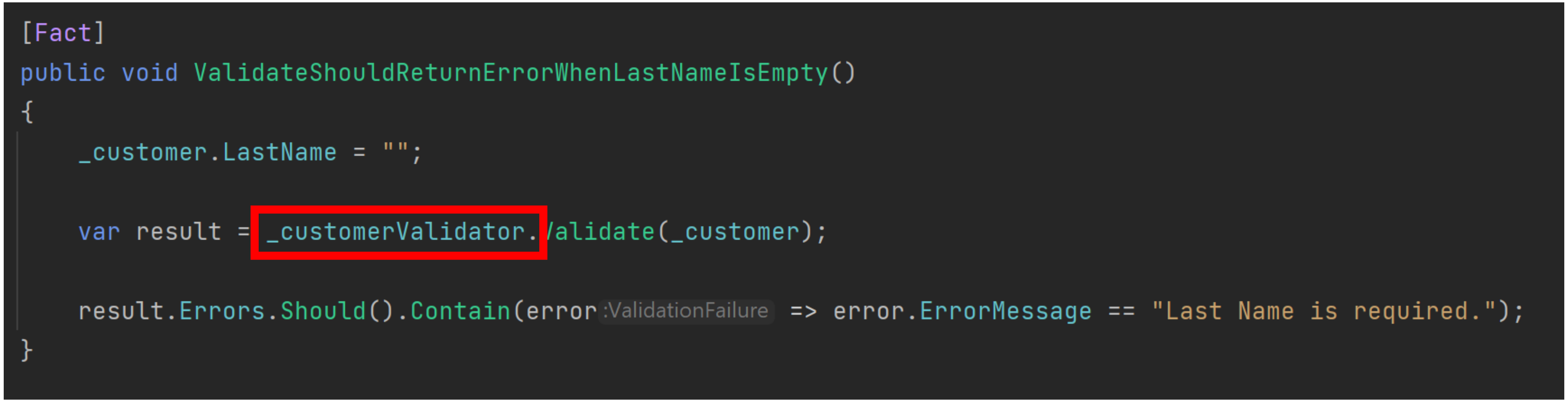

```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    _customer.LastName = "";

    var result = _customerValidator.Validate(_customer);

    result.Errors.Should().Contain(error :ValidationFailure  => error.ErrorMessage == "Last Name is required.");
}
```

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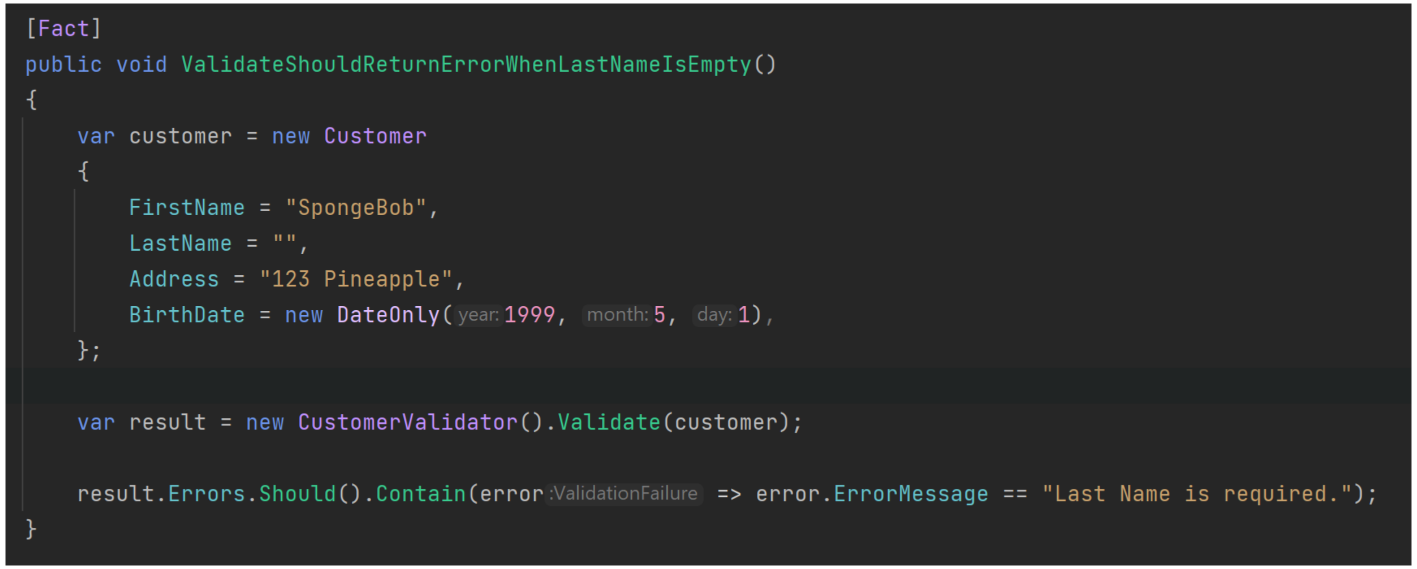
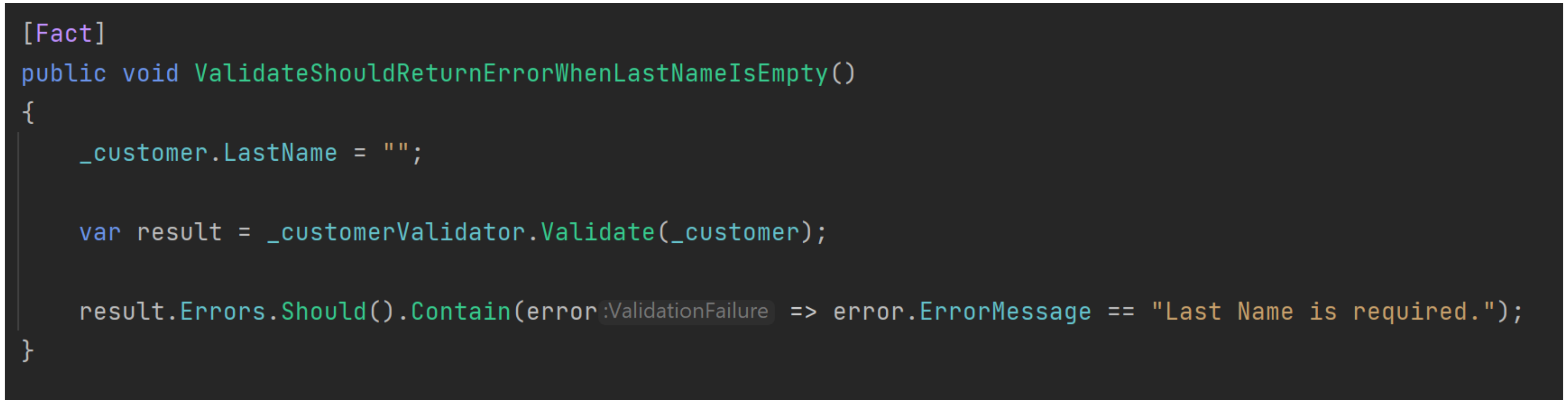


```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    var customer = new Customer
    {
        FirstName = "SpongeBob",
        LastName = "",
        Address = "123 Pineapple",
        BirthDate = new DateOnly( year: 1999,  month: 5,  day: 1),
    };

    var result = new CustomerValidator().Validate(customer);

    result.Errors.Should().Contain(error :ValidationFailure  => error.ErrorMessage == "Last Name is required.");
}
```



```
[Fact]
public void ValidateShouldReturnErrorWhenLastNameIsEmpty()
{
    _customer.LastName = "";

    var result = _customerValidator.Validate(_customer);

    result.Errors.Should().Contain(error :ValidationFailure  => error.ErrorMessage == "Last Name is required.");
}
```

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Central Package Management

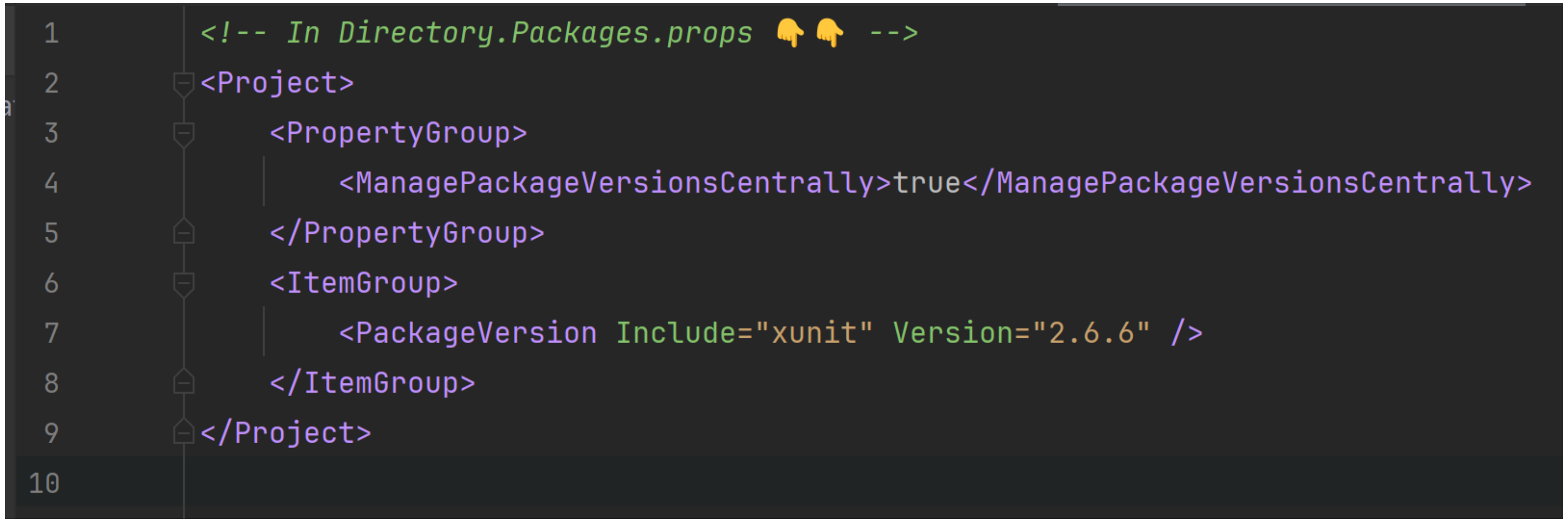
Problem

- Same package in multiple projects across your solution
- Annoying to keep version in sync
- Tests projects especially
- I find most people don’t know Central Package Management exists

Solution: Central Package Management

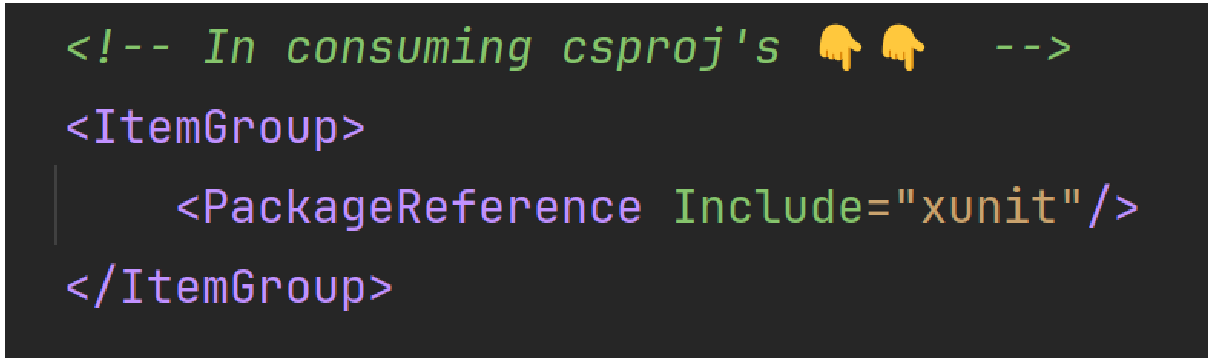
- Added in .NET 6
- Create Directory.Packages.props at the root and define packages and versions there
- Omit Version attribute in PackageReference
- All packages will have to omit the Version attribute
- Can override with VersionOverride attribute

Solution: Central Package Management



```xml
<!-- In Directory.Packages.props 👇👇 -->
<Project>
    <PropertyGroup>
        <ManagePackageVersionsCentrally>true</ManagePackageVersionsCentrally>
    </PropertyGroup>
    <ItemGroup>
        <PackageVersion Include="xunit" Version="2.6.6" />
    </ItemGroup>
</Project>

```



```xml
<!-- In consuming csproj's 👇👇  -->
<ItemGroup>
    <PackageReference Include="xunit"/>
</ItemGroup>
```

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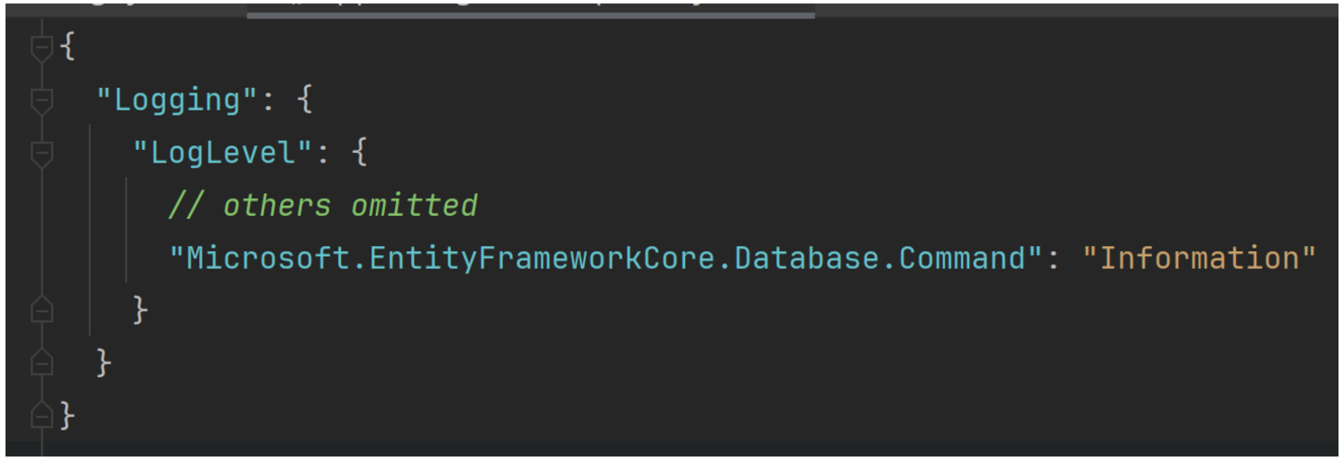
BONUS

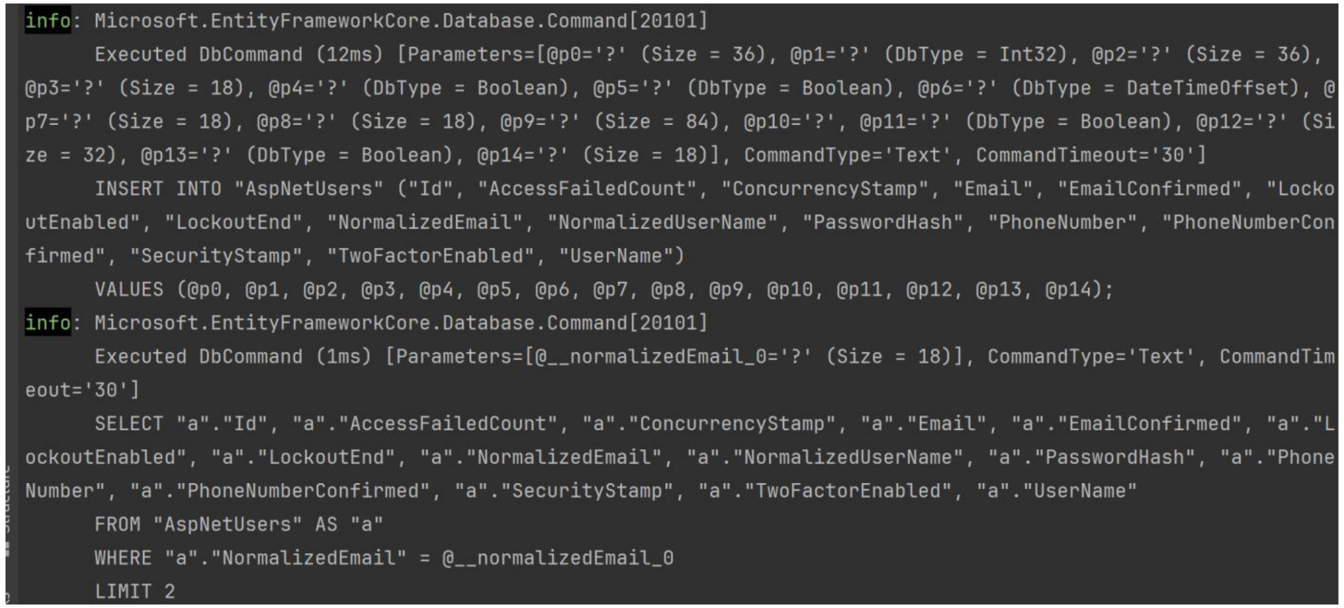
Ever wonder what SQL Queries EF is making?

- Switch log level of Microsoft.EntityFrameworkCore.Database.Command to Information
- Only do this for local development

Ever wonder what SQL Queries EF is making?



```
{
  "Logging": {
    "LogLevel": {
      // others omitted
      "Microsoft.EntityFrameworkCore.Database.Command": "Information"
    }
  }
}
```



```
info: Microsoft.EntityFrameworkCore.Database.Command[20101]
      Executed DbCommand (12ms) [Parameters=[@p0='?' (Size = 36), @p1='?' (DbType = Int32), @p2='?' (Size = 36),
@p3='?' (Size = 18), @p4='?' (DbType = Boolean), @p5='?' (DbType = Boolean), @p6='?' (DbType = DateTimeOffset), @
p7='?' (Size = 18), @p8='?' (Size = 18), @p9='?' (Size = 84), @p10='?', @p11='?' (DbType = Boolean), @p12='?' (Si
ze = 32), @p13='?' (DbType = Boolean), @p14='?' (Size = 18)], CommandType='Text', CommandTimeout='30']
      INSERT INTO "AspNetUsers" ("Id", "AccessFailedCount", "ConcurrencyStamp", "Email", "EmailConfirmed", "Locko
utEnabled", "LockoutEnd", "NormalizedEmail", "NormalizedUserName", "PasswordHash", "PhoneNumber", "PhoneNumberCon
firmed", "SecurityStamp", "TwoFactorEnabled", "UserName")
      VALUES (@p0, @p1, @p2, @p3, @p4, @p5, @p6, @p7, @p8, @p9, @p10, @p11, @p12, @p13, @p14);
info: Microsoft.EntityFrameworkCore.Database.Command[20101]
      Executed DbCommand (1ms) [Parameters=[@__normalizedEmail_0='?' (Size = 18)], CommandType='Text', CommandTim
eout='30']
      SELECT "a"."Id", "a"."AccessFailedCount", "a"."ConcurrencyStamp", "a"."Email", "a"."EmailConfirmed", "a"."L
ockoutEnabled", "a"."LockoutEnd", "a"."NormalizedEmail", "a"."NormalizedUserName", "a"."PasswordHash", "a"."Phone
Number", "a"."PhoneNumberConfirmed", "a"."SecurityStamp", "a"."TwoFactorEnabled", "a"."UserName"
      FROM "AspNetUsers" AS "a"
      WHERE "a"."NormalizedEmail" = @__normalizedEmail_0
      LIMIT 2
```

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More Bonus!

- CI/CD Pipelines
- Confident Green
- Feature Toggles
- Work in small batches
- Deploy frequently to Production (should be daily or more frequent)

Real benefits of these practices

- 1 company went from deploying to Prod 12x a year (rolling back half of those) to 2000x a year (rolling back <1% of those)
- Faster, more reliable delivery of value to users
- DORA Metrics

Takeaways

- Hopefully you got at least one idea today
- This slide deck is your resource – up at scottsauber.com (and will post to Slack)

Questions?

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@scottsauber.com on Bluesky
@scottsauber on Twitter

Thanks!

Slides at scottsauber.com

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