Real World ASP.NET Core Middleware

Steve Smith

Ardalis.com

@ardalis

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- Questions and Feedback are welcome
- Use #DevIntersection and/or #RealWorldMiddleware

Pluralsight

I have some 1-month free passes; see me after if you'd like one

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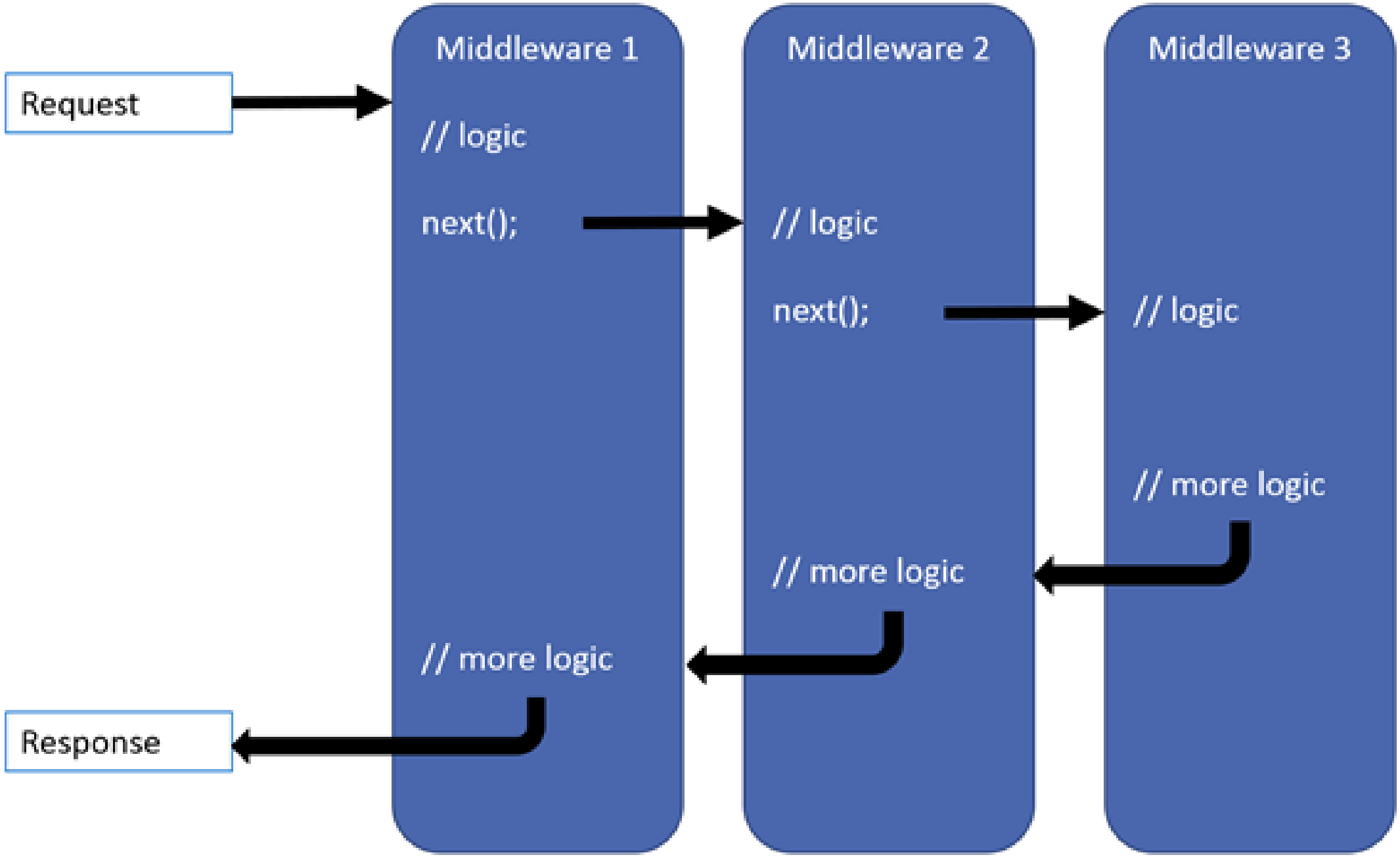
Intermediate 15h 38m 9 Sep 2010

SOLID Principles of Object Oriented Design
Intermediate 4h 8m 9 Sep 2010

What is Middleware?

- “Middleware are software components that are assembled into an application pipeline to handle requests and responses”
- Each component in the pipeline is a request delegate.
- Each delegate can invoke the next component in the chain, or short-circuit, returning back up the call chain


Request
Middleware 1
// logic
next();
Middleware 2
// logic
next();
Middleware 3
// logic
// more logic
// more logic
// more logic
Response

Sequence is Very Important

- The first middleware components called “wrap” all future middleware
- Think of it like Nesting Dolls
- Can act on request before and after middleware later in the pipeline

Creating Middleware in Startup: Run

```
public void Configure(IApplicationBuilder app)
{
    // app.Run terminates the pipeline without calling any later middleware
    app.Run(async context =>
    {
        await context.Response.WriteAsync("Hello, World!");
    });
}
```

Creating Middleware in Startup: Use

```
public void Configure(IApplicationBuilder app)
{
    // app.Use can execute code before and after other middleware
    app.Use(async (context, next) =>
    {
        // do some work

      // call the next middleware
        await next.Invoke();

      // do some additional work
    });
}
```

Avoid modifying HttpResponse after invoking next. Other middleware may already have begun sending the response to the client.

Creating Middleware in Startup: Map

```
public void Configure(IApplicationBuilder app)
{
    // app.Map can map a path to a function
    app.Map(“hello”, HandleHello);
    app.Run(async context =>
    {
        await context.Response.WriteAsync(“Invalid path!");
    });
}

public void HandleHello(IApplicationBuilder app)
{
    app.Run(async context =>
    {
        await context.Response.WriteAsync(“Invalid path!");
    });
}
```

Demonstration

Custom Middleware in Startup

Built-in Middleware : Diagnostics

- UseDeveloperExceptionPage
- UseDatabaseErrorPage – helps configure database
- UseBrowserLink
- UseExceptionHandler
- UseStatusCodePages
- UseRuntimeInfoPage
- UseWelcomePage
- UseElmPage / UseElmCapture (preview, requires services)

Demonstration

Diagnostic Middleware

Built-in Middleware

- UseIdentity
- UseStaticFiles
- UseDefaultFiles
- UseDirectoryBrowser (requires services)
- UseFileServer (replaces/combines previous three)
- UseRouter
- UseMvc (replaces/wraps UseRouter; requires services)
- UseRewriter (1.1)
- UseResponseCompression (1.1)
- UseResponseCaching (1.1, requires services)

Rewriter (coming in 1.1)

```
public void Configure(IApplicationBuilder app, IHostingEnvironment env)
{

    var options = new RewriteOptions()
        .AddRedirect("(.*)/$", "$1") // Redirect using a regular expression
        .AddRewrite(@"app/(\d+)", "app?id=$1",
skipRemainingRules: false) // Rewrite based on a Regular expression
        .AddRedirectToHttps(302, 5001) // Redirect to a different port and use HTTPS
        .AddIISUrlRewrite(env.ContentRootFileProvider, "UrlRewrite.xml") // Use IIS
UrlRewriter rules to configure
        .AddApacheModRewrite(env.ContentRootFileProvider, "Rewrite.txt"); // Use Apache
mod_rewrite rules to configure

    app.UseRewriter(options);
}
```

Moving Middleware to its own classes

```
public class MyMiddleware
{
  private readonly RequestDelegate _next;
  public MyMiddleware(RequestDelegate next)
  {
    _next = next;
  }
  public Task Invoke(HttpContext httpContext)
  {
    return _next(httpContext);
  }
}
// Extension method used to add the middleware to the HTTP request pipeline.
public static class MyMiddlewareExtensions
{
  public static IApplicationBuilder UseMyMiddleware(this IApplicationBuilder builder)
  {
    return builder.UseMiddleware<MyMiddleware>();
  }
}
```

Moving Middleware to its own classes

```
public class MyMiddleware
{
  private readonly RequestDelegate _next;
  public MyMiddleware(RequestDelegate next)
  {
    _next = next;
  }
  public async Task Invoke(HttpContext httpContext)
  {
    await _next(httpContext);
  }
}
// Extension method used to add the middleware to the HTTP request pipeline.
public static class MyMiddlewareExtensions
{
  public static IApplicationBuilder UseMyMiddleware(this IApplicationBuilder builder)
  {
    return builder.UseMiddleware<MyMiddleware>();
  }
}
```

Detect and Fix 404s

Using Custom Middleware

Detecting and Fixing 404s

```
public async Task Invoke(HttpContext httpContext)
{
   // if we have a fixed link, redirect to it now

   await _next(httpContext);

   if (httpContext.Response.StatusCode == 404)
   {
     // record the 404 to fix later
   }
}
```

Inject Dependencies into Middleware

```
public class NotFoundMiddleware
{
  private readonly RequestDelegate _next;
  private readonly RequestTracker _requestTracker;
  private readonly ILogger _logger;
  private NotFoundMiddlewareOptions _options;

  public NotFoundMiddleware(RequestDelegate next,
    ILoggerFactory loggerFactory,
    RequestTracker requestTracker,
    IOptions<NotFoundMiddlewareOptions> options)
  {
    _next = next;
    _requestTracker = requestTracker;
    _logger = loggerFactory.CreateLogger<NotFoundMiddleware>();
    _options = options.Value;
  }
}
```

Record 404 Requests

```
_requestTracker.Record(httpContext.Request.Path); // NOTE: might not be same as
original path at this point
```

Request Tracking

```
public class RequestTracker
{
    private readonly INotFoundRequestRepository _repo;
    private static object _lock = new object();

    0 references | Steve Smith, 187 days ago | 1 author, 3 changes
    public RequestTracker(INotFoundRequestRepository repo)
    {
        _repo = repo;
    }

    1 reference | Steve Smith, 187 days ago | 2 authors, 4 changes
    public void Record(string path)...

    1 reference | Steve Smith, 187 days ago | 2 authors, 4 changes
    public IEnumerable<NotFoundRequest> ListRequests()...

    2 references | Steve Smith, 187 days ago | 1 author, 3 changes
    public NotFoundRequest GetRequest(string path)...

    1 reference | Steve Smith, 187 days ago | 1 author, 3 changes
    public void UpdateRequest(NotFoundRequest request)...
}
```

Record 404 Requests

```
public void Record(string path)
{
    lock (_lock)
    {
        var request = _repo.GetByPath(path);
        if (request != null)
        {
            request.IncrementCount();
        }
        else
        {
            request = new NotFoundRequest(path);
            request.IncrementCount();
            _repo.Add(request);
        }
    }
}
```

"Upsert" a NotFoundRequest record

NotFoundRequest

```
public class NotFoundRequest
{
    1 reference | Steve Smith, 190 days ago | 2 authors, 2 changes
    public NotFoundRequest(string path)...

    0 references | Steve Smith, 187 days ago | 1 author, 2 changes
    public NotFoundRequest()...
    8 references | Steve Smith, 187 days ago | 2 authors, 2 changes
    public string Path { get; private set; }
    4 references | Steve Smith, 192 days ago | 1 author, 1 change
    public int Count { get; private set; }
    4 references | Steve Smith, 192 days ago | 1 author, 1 change
    public string CorrectedPath { get; private set; }

    2 references | Steve Smith, 192 days ago | 1 author, 1 change
    public void IncrementCount()
    {
        Count++;
    }

    1 reference | Steve Smith, 192 days ago | 1 author, 1 change
    public void SetCorrectedPath(string path)
    {
        CorrectedPath = path;
    }
}
```

Fixing Known 404s

```
public async Task Invoke(HttpContext httpContext)
{
    string path = httpContext.Request.Path;
    _logger.LogTrace("Path: {path}");
    string correctedPath =
_requestTracker.GetRequest(path)?.CorrectedPath;
    if (correctedPath != null)
    {
      // redirect/rewrite using the corrected path
    }
    await _next(httpContext);
    // other logic
}
```

301 Permanent Redirect

- Sends a response to the browser
- Browser makes a new request to the new URL
- Changes the URL in the browser

Rewrite

- Rewrites the path in the request pipeline itself
- ASP.NET continues processing the request, with the new path
- No additional requests – rewrites are invisible to the client
- Browser URL remains unchanged

Options Pattern (Configuration Support)

```
namespace NotFoundMiddlewareSample.Middleware
{
    public enum FixPathBehavior
    {
        Redirect,
        Rewrite
    }

    public class NotFoundMiddlewareOptions
    {
        public string Path { get; set; } = "/fix404s";
        public FixPathBehavior FixPathBehavior { get; set; } =
FixPathBehavior.Redirect;
    }
}
```

Options Pattern

```
// add in Startup.ConfigureServices

services.Configure<NotFoundMiddlewareOptions>(
Configuration.GetSection("NotFoundMiddleware"));

// Options can be flexibly via Configuration
// programmatically, or from any config source

// appsettings.json
 "NotFoundMiddleware": {
    "Path": "/fixbadlinks",
    "FixPathBehavior":  "Redirect"
  }
```

Options Pattern

```
// request IOptions<T> - assign to local variable T

 private NotFoundMiddlewareOptions _options;

public NotFoundMiddleware(RequestDelegate next,
  IOptions<NotFoundMiddlewareOptions> options)
{
    _next = next;
    _options = options.Value;
}
```

Options: Interface Segregation

Options: Interface Segregation

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Tracking and Managing 404s

Fix 404s

Path	404 Count	Corrected Path
/foo	6	Save
/baz	2	Save
/bar	1	Save

NotFoundPageMiddleware

- Check if the request path is the “manage 404s” path
  - Read from Options value
  - If not, let request pass through
- Check if querystring includes any commands
  - If so, perform the operation
- Render the table to show all of the tracked NotFoundRequests

Detect the Path

```
public async Task Invoke(HttpContext httpContext)
{
    if (!httpContext.Request.Path.StartsWithSegments(_options.Path))
    {
        await _next(httpContext);
        return;
    }
...
}
```

Detect Commands and Execute

```
if (httpContext.Request.Query.Keys.Contains("path") &&
    httpContext.Request.Query.Keys.Contains("fixedpath"))
{
    var request = _requestTracker.GetRequest(httpContext.Request.Query["path"]);

    request.SetCorrectedPath(httpContext.Request.Query["fixedpath"]);

    _requestTracker.UpdateRequest(request);
}
```

Render Views from Middleware

```
private async void Render404List(HttpContext httpContext)
{
    var model = _requestTracker.ListRequests()
        .OrderByDescending(r => r.Count);
    var requestPage = new RequestPage(model);
    await requestPage.ExecuteAsync(httpContext);
}
```

Middleware Data Access

- Use separate DbContext (assuming middleware data is self-contained)
- Package up with Middleware
- Let application configure in ConfigureServices

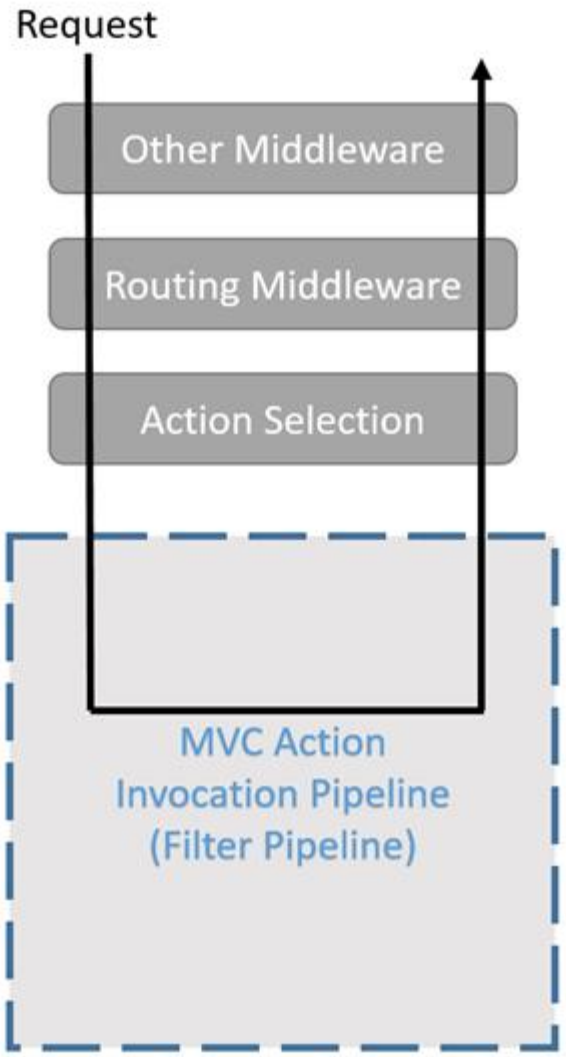
Demonstration

Not Found Middleware

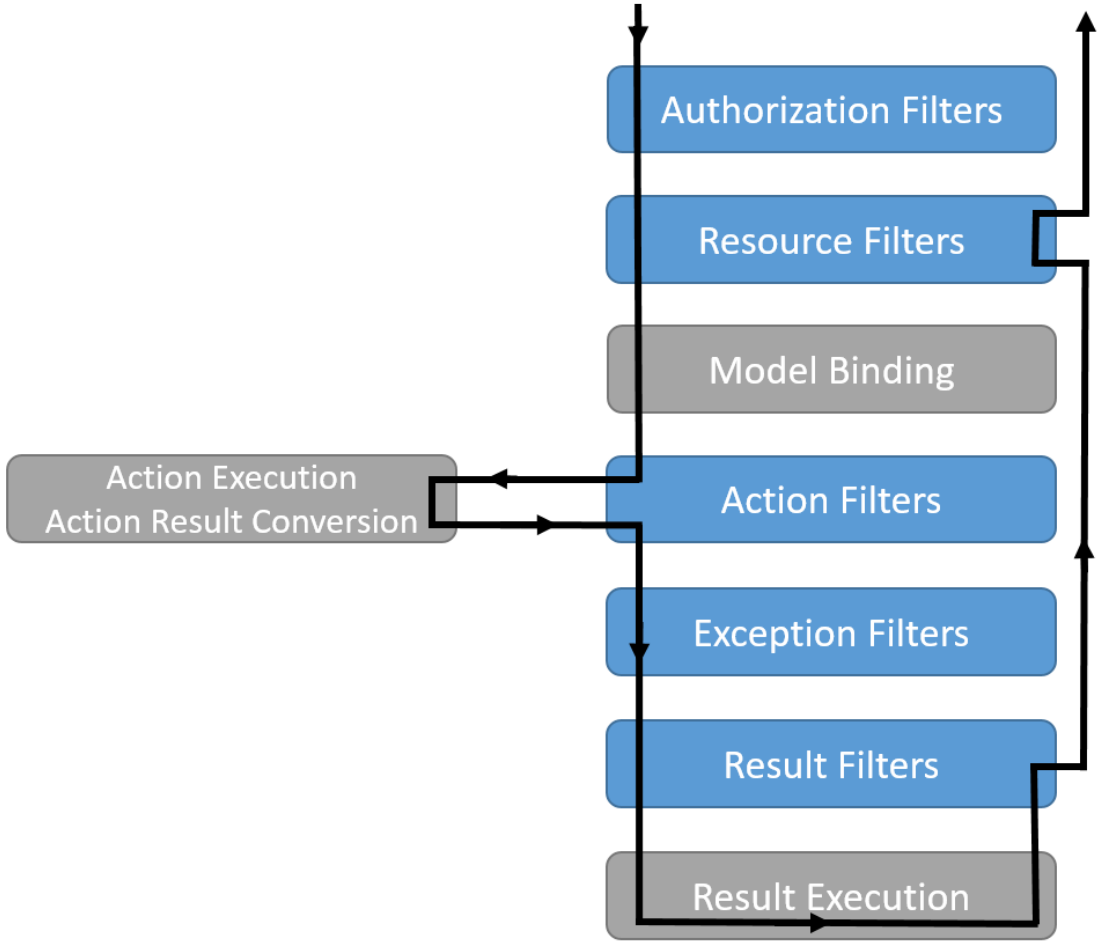
Middleware or Filters?

- MVC Filters offer similar capabilities
- Filters have MVC context:
  - Routes
  - Model Binding
  - Action Results
- Middleware is MVC-agnostic
  - Can be used on *any* ASP.NET Core app

Filters in MVC



Filters in MVC



Demonstration

Add middleware to new app

Summary

- Middleware provides a great way to add functionality to your site
- Use built-in or roll your own
- Follow best practices to support configuration, dependency injection

Questions?

Or tweet me @ardalis and I'll answer later.

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