Agenda: Working with Middlewares

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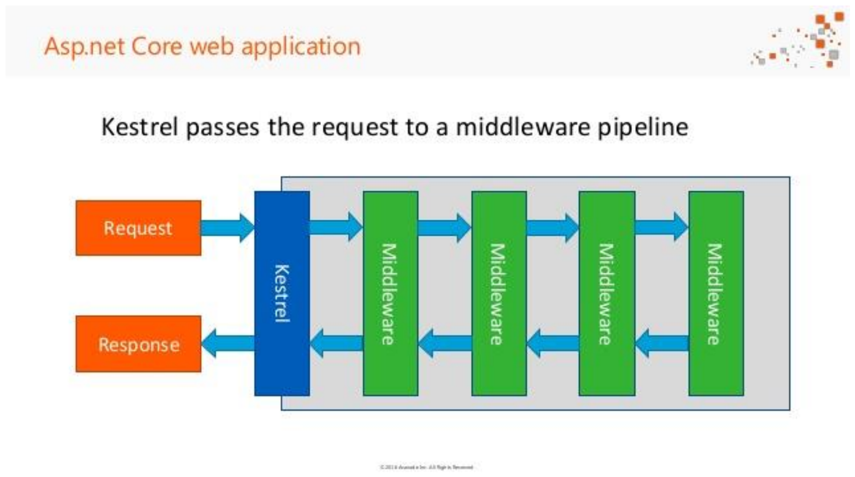
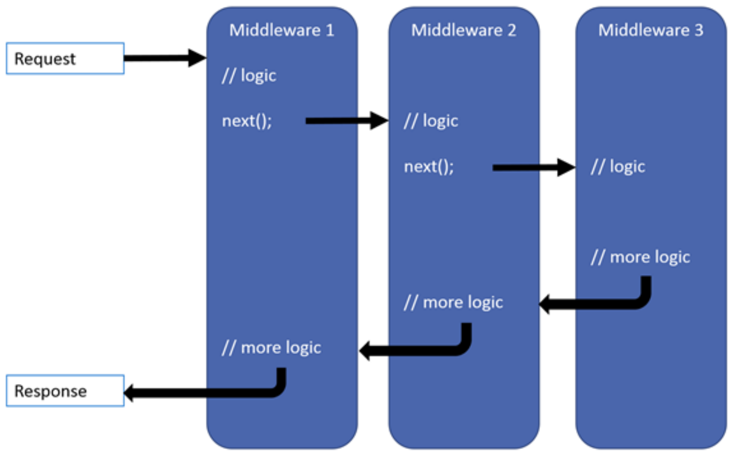
What is Middleware?

Middleware is software that's assembled into an application pipeline to handle requests and responses.

The ASP.NET Core request pipeline consists of a sequence of request delegates, called one after the other.


Asp.net Core web application
Kestrel passes the request to a middleware pipeline
Request
Response
Kestrel
Middleware
Middleware
Middleware
Middleware



Each component:

- Can perform work **before** and **after** the next component in the pipeline.
- Chooses whether or **not to pass** the request to the next component in the pipeline (**short-circuiting**). Short-circuiting is often desirable because it avoids unnecessary work. For example, the static file middleware can return a request for a static file and short-circuit the rest of the pipeline.
- Exception-handling delegates need to be called early in the pipeline, so they can catch.

Use, Run, and Map

The **Use** method can short-circuit the pipeline (that is, if it doesn't call a **next** request delegate).

Run is a convention, and some middleware components may expose `Run[Middleware]` methods that run at the end of the pipeline.

```
public void Configure(IApplicationBuilder app, IWebHostEnvironment env)
{
  app.Use(async (context, next) =>
  {
    // Do work that doesn't write to the Response.
    await context.Response.WriteAsync("Before from Use1!");
    await next.Invoke();
    await context.Response.WriteAsync("After from Use1--");
    // Do logging or other work that doesn't write to the Response.
  });
  app.Use(async (context, next) =>
  {
        // Do work that doesn't write to the Response.
        await context.Response.WriteAsync("Before from Use2--");
        await next.Invoke();
        await context.Response.WriteAsync("After from Use2--");
        //await next.Invoke();
        // Do logging or other work that doesn't write to the Response.
    });
    app.Run(async context =>
    {
        await context.Response.WriteAsync("From Run--");
    });
}
```

Map* extensions are used as a convention **for branching** the pipeline. Map branches the request pipeline based on matches of the given request path. If **the request path starts with the given path, the branch is executed**.

```
public class Startup
{
    private static void HandleMapTest1(IApplicationBuilder app)
    {
        app.Run(async context =>
        {
            await context.Response.WriteAsync("Map Test 1");
        });
    }
   public void Configure(IApplicationBuilder app)
    {
        app.Map("/map1", HandleMapTest1);
        app.Map("/map2", app1 => {
            app1.Run(async context1 =>
            {
              await context1.Response.WriteAsync("Map Test 2");
            });
        });
        app.Run(async context =>
        {
```

```
        await context.Response.WriteAsync("Hello from non-Map delegate. <p>");
    });
  }
}
```

The following table shows the requests and responses from `http://localhost:1234` using the previous code:

Request	Response
localhost:1234	Hello from non-Map delegate.
localhost:1234/map1	Map Test 1
localhost:1234/map2	Map Test 2
localhost:1234/map2/demo	Map Test 2
localhost:1234/map3	Hello from non-Map delegate.

Middleware Ordering

The order that middleware components are added in the `Configure` method defines the order in which they're invoked on requests, and the reverse order for the response. This ordering is critical for security, performance, and functionality.

The Configure method (shown below) adds the following middleware components:

1. Exception/error handling
2. Static file server
3. Authentication
4. MVC

```
public void Configure(IApplicationBuilder app)
{
  app.UseExceptionHandler("/Home/Error"); // Call first to catch exceptions thrown in the following middleware.
  app.UseStaticFiles();  // Return static files and end pipeline.
  app.UseRoute(); // Adds route matching to the middleware pipeline (MetaData). This middleware will looks at the
set of endpoints declared/defined  in the app and Select the best match based on the request
  app.UseAuthentication(); // Authenticate before you access secure resources.
  app.UseEndpoints(endpoint=>endpoint.MapDefaultControllerRoute());// Add MVC default route to the request
pipeline. {controller=Home}/{action=Index}/{id?}
}
```

Static files are not compressed with this ordering of the middleware.

```
public void Configure(IApplicationBuilder app)
```

```
{
  app.UseStaticFiles();      // Static files not compressed by middleware.
  app.UseRoute();
  app.UseResponseCompression();
  app.UseEndpoints(endpoint=>endpoint.MapDefaultControllerRoute());
}
```

Writing Custom Middleware

Middleware is generally encapsulated in a class and exposed with an extension method.

```
public class LogURLMiddleware
{
  private readonly RequestDelegate _next;
  public LogURLMiddleware(RequestDelegate next, object o1,object o2)
  {
    _next = next;
  }
  public Task InvokeAsync(HttpContext context)
  {
    //Write code here to Save the URL in database or File
    // Call the next delegate/middleware in the pipeline
    return this._next(context);
  }
}
public static class LogURLMiddlewareExtensions
{
  public static IApplicationBuilder UseLogUrl(this IApplicationBuilder app, object ob1, object ob2)
  {
    return app.UseMiddleware<LogURLMiddleware>(ob1, ob2);
  }
}
```

Edit Configure Method

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

```
    app.UseLogUrl(ob1,ob2);
    //. . .
}
```

Built-in Middleware

ASP.NET Core ships with the following middleware components, as well as a description of the order in which they should be added:

Middleware	Description	Order
Authentication	Provides authentication support.	Before `HttpContext.User` is needed.
CORS	Configures Cross-Origin Resource Sharing.	Before components that use CORS.
Diagnostics	Configures diagnostics.	Before components that generate errors.
ForwardedHeaders/HttpOverrides	Forwards proxied headers onto the current request.	Before components that consume the updated fields (examples: Scheme, Host, ClientIP, Method).
Response Caching	Provides support for caching responses.	Before components that require caching.
Response Compression	Provides support for compressing responses.	Before components that require compression.
RequestLocalization	Provides localization support.	Before localization sensitive components.
Routing	Defines and constrains request routes.	Terminal for matching routes.
Session	Provides support for managing user sessions.	Before components that require Session.
Static Files	Provides support for serving static files and directory browsing.	Terminal if a request matches files.
URL Rewriting	Provides support for rewriting URLs and redirecting requests.	Before components that consume the URL.
WebSockets	Enables the WebSockets protocol.	Before components that are required to accept WebSocket requests.

Working with Static files in ASP.NET Core

Static files are stored within your project's **webroot** directory.

The default directory is ***<content_root>/wwwroot.***

But it can be changed via the **UseWebRoot** method.

The `WebHost.CreateDefaultBuilder` method sets the content root to the current directory.

UseStaticFiles: To serve files outside of webroot

```
app.UseStaticFiles(new StaticFileOptions
{
    FileProvider = new PhysicalFileProvider(Path.Combine(Directory.GetCurrentDirectory(), "MyStaticFiles")),
    RequestPath = "/StaticFiles"
});
```

Enable Directory Browsing

Directory browsing allows users of your web app to see a directory listing and files within a specified directory.

Directory browsing is **disabled** by default for security reasons

```
app.UseDirectoryBrowser(new DirectoryBrowserOptions
{
    FileProvider = new PhysicalFileProvider(Path.Combine(Directory.GetCurrentDirectory(), "wwwroot", "images")),
    RequestPath = "/MyImages"
});
```

Add required services by invoking the AddDirectoryBrowser method from Startup.ConfigureServices:

```
public void ConfigureServices(IServiceCollection services)
{
    services.AddDirectoryBrowser();
}
```

Serve a default document

Setting a default home page provides visitors a logical starting point when visiting your site.

```
public void Configure(IApplicationBuilder app)
{
    app.UseDefaultFiles();
    app.UseStaticFiles();
}
```

With `UseDefaultFiles`, requests to a folder search for:

- *default.htm*
- *default.html*
- *index.htm*
- *index.html*

The following code changes the default file name to *mydefault.html*:

```
public void Configure(IApplicationBuilder app)
{
  // Serve my app-specific default file, if present.
  DefaultFilesOptions options = new DefaultFilesOptions();
  options.DefaultFileNames.Clear();
  options.DefaultFileNames.Add("mydefault.html");
  app.UseDefaultFiles(options);
  app.UseStaticFiles();
}
```

UseFileServer

UseFileServer combines the functionality of

1. UseStaticFiles
2. UseDefaultFiles
3. UseDirectoryBrowser

```
app.UseFileServer(enableDirectoryBrowsing: true);
```

The following code enables static files, default files, and directory browsing of `MyStaticFiles`:

```
app.UseFileServer(new FileServerOptions
{
   FileProvider = new PhysicalFileProvider(Path.Combine(Directory.GetCurrentDirectory(), "MyStaticFiles")),
   RequestPath = "/StaticFiles",
   EnableDirectoryBrowsing = true
});
```

Note: **AddDirectoryBrowser** must be called when the **EnableDirectoryBrowsing** property value is true:

```
public void ConfigureServices(IServiceCollection services)
```

```
{
   services.AddDirectoryBrowser();
}
```

Exception Middleware

To configure an app to display a page that shows detailed information about exceptions, use the *Developer Exception Page*.

```
if (env.IsDevelopment())
{
            app.UseDeveloperExceptionPage(); //Developer Exception Page
}
else
{
            app.UseExceptionHandler("/error"); //Custom Error Handling Page
}
```

Status Code Middleware

By default, an app doesn't provide a rich status code page for HTTP status codes, such as *404 Not Found*. To provide status code pages, use Status Code Pages Middleware.

```
app.UseStatusCodePages(async context =>
{
   context.HttpContext.Response.ContentType = "text/plain";
   await context.HttpContext.Response.WriteAsync(
      "Status code page, status code: " +
      context.HttpContext.Response.StatusCode);
});

app.UseStatusCodePagesWithRedirects("/error/{0}");

app.MapWhen(context => context.Request.Path == "/missingpage", builder => {
   builder.Run(async context =>
   {
      context.Response.Redirect("/home");
   });
});
```

Migrating Http Modules with Middleware

Sample Custom Module

```
public class MyModule : IHttpModule
{
  public void Init(HttpApplication application)
  {
    application.BeginRequest += (new EventHandler(this.Application_BeginRequest));
    application.EndRequest += (new EventHandler(this.Application_EndRequest));
  }
  private void Application_BeginRequest(Object source, EventArgs e)
  {
    HttpContext context = ((HttpApplication)source).Context;
    // Do something with context near the beginning of request processing.
  }
  private void Application_EndRequest(Object source, EventArgs e)
  {
    HttpContext context = ((HttpApplication)source).Context;
    // Do something with context near the end of request processing.
  }
}
```

Middleware equivalent of above Module

```
public class MyMiddleware
{
  private readonly RequestDelegate _next;
  public MyMiddleware(RequestDelegate next)
  {
    _next = next;
  }
  public async Task InvokeAsync(HttpContext context)
  {
    // Do something with context near the beginning of request processing.
    await _next.Invoke(context);
    // Clean up.
  }
}


public static class MyMiddlewareExtensions
{
    public static IApplicationBuilder UseMyMiddleware(this IApplicationBuilder builder)
    {
        return builder.UseMiddleware<MyMiddleware>();
    }
}
```

Migrating Http Handler code to middleware

```
public class MyHandler : IHttpHandler
{
    public bool IsReusable { get { return true; } }
    public void ProcessRequest(HttpContext context)
    {
        string response = string.Format("Title of the report: {0}", context.Request.QueryString["title"]);

        context.Response.ContentType = "text/plain";
        context.Response.Output.Write(response);
    }
    // ...
    private string GenerateResponse(HttpContext context)
    {
        string title = context.Request.QueryString["title"];
        return string.Format("Title of the report: {0}", title);
    }
}
```

Following is equivalent Middleware

```
public class MyHandlerMiddleware
{
    // Must have constructor with this signature, otherwise exception at run time
    public MyHandlerMiddleware(RequestDelegate next)
    {
        // This is an HTTP Handler, so no need to store next
    }
    public async Task Invoke(HttpContext context)
    {
        var response = string.Format("Title of the report: {0}", context.Request.Query["title"]);
        context.Response.ContentType = "text/plain";
        await context.Response.WriteAsync(response);
    }
}
public static class MyHandlerExtensions
{
    public static IApplicationBuilder UseMyHandler(this IApplicationBuilder builder)
    {
        return builder.UseMiddleware<MyHandlerMiddleware>();
    }
}
```

Insert Middleware into the request pipeline

```
// Create branch to the MyHandlerMiddleware.
// All requests ending in .report will follow this branch.
app.MapWhen(
    context => context.Request.Path.ToString().EndsWith(".report"),
    appBranch =>
    {
        // ... optionally add more middleware to this branch
        appBranch.UseMyHandler();
    });
```