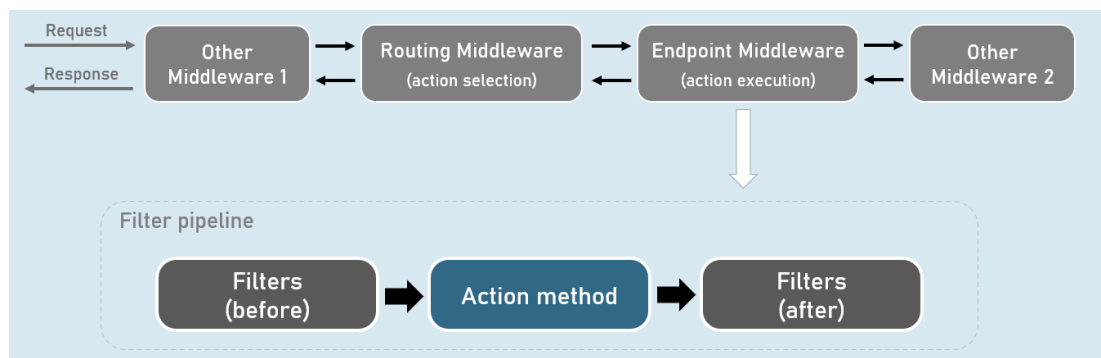


Section Cheat Sheet (PPT)

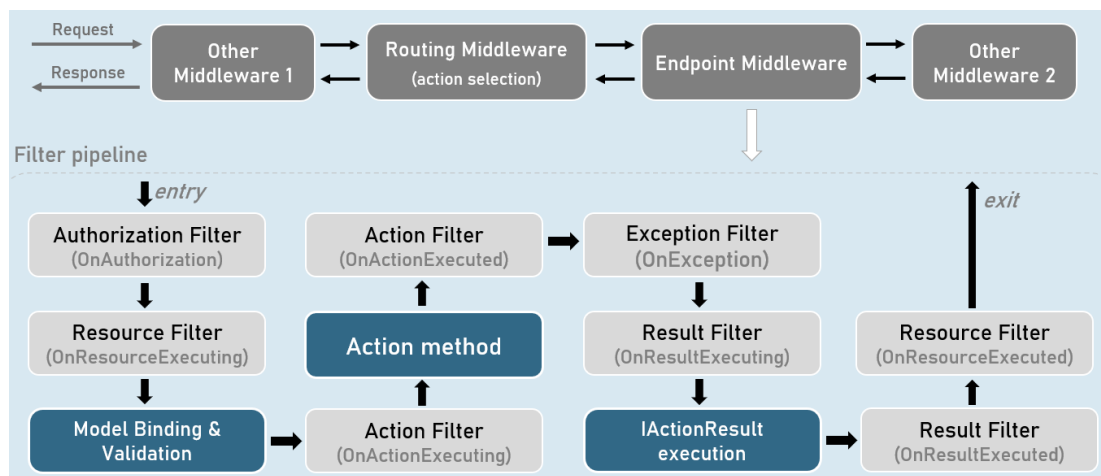
Filters

Filters are the code blocks that execute before / after specific stages in "Filter Pipeline".

Filters perform specific tasks such as authorization, caching, exeption handling etc.



Filter Pipeline



Overview of Types of Filters

Authorization Filter

Determines whether the user is authorized to access the action method.

Resource Filter

Invoking custom model binder explicitly

Caching the response.

Action Filter

Manipulating & validating the action method parameters.

Manipulating the ViewData.

Overriding the IActionResult provided by action method.

Exception Filter

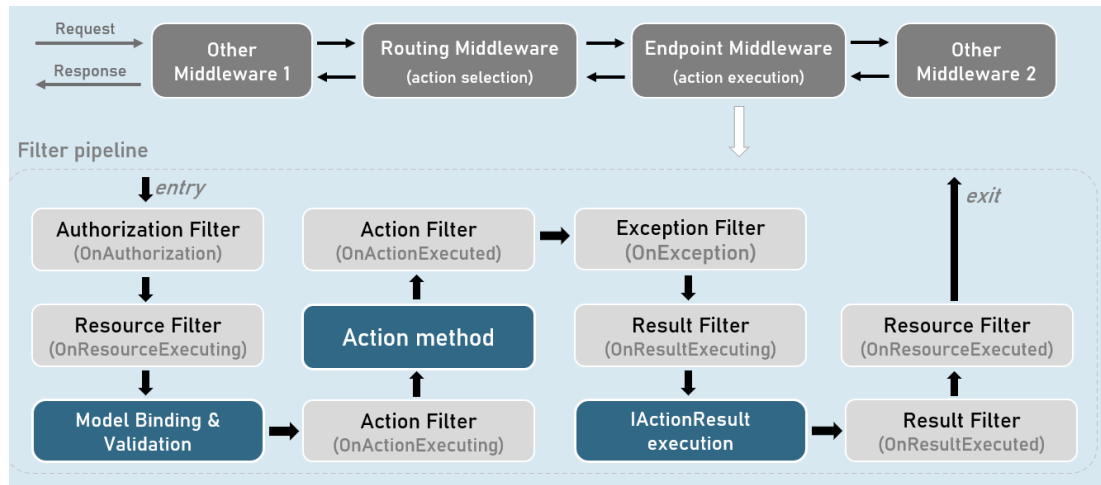
Handling unhandled exception that occur in model binding, action filters or action methods.

Result Filter

Preventing IActionResult from execution.

Adding last-moment changes to response (such as adding response headers).

Action Filter



When it runs

Runs immediately before and after an action method executes.

'OnActionExecuting' method

- It can access the action method parameters, read them & do necessary manipulations on them.
- It can validate action method parameters.
- It can short-circuit the action (prevent action method from execution) and return a different IActionResult.

'OnActionExecuted' method

- It can manipulate the ViewData.
- It can change the result returned from the action method.

Filter Arguments

When it runs

You can supply an array of arguments that will be supplied as constructor arguments of the filter class.

How to send arguments in controller

```
[TypeFilter(typeof(FilterClassName)),
    Arguments = new object[] { arg1, arg2 }]
public IActionResult ActionMethod()
{
    ...
}
```

How to receive arguments in filter's constructor

```
public FilterClassName(IService service, type param1, type param2)
{
    ...
}
```

The diagram illustrates the flow of arguments from the controller to the filter constructor. Two arrows originate from the 'Arguments' property in the controller's attribute and point to the constructor parameters 'param1' and 'param2' in the filter class.

Global Filters

Filter Scopes



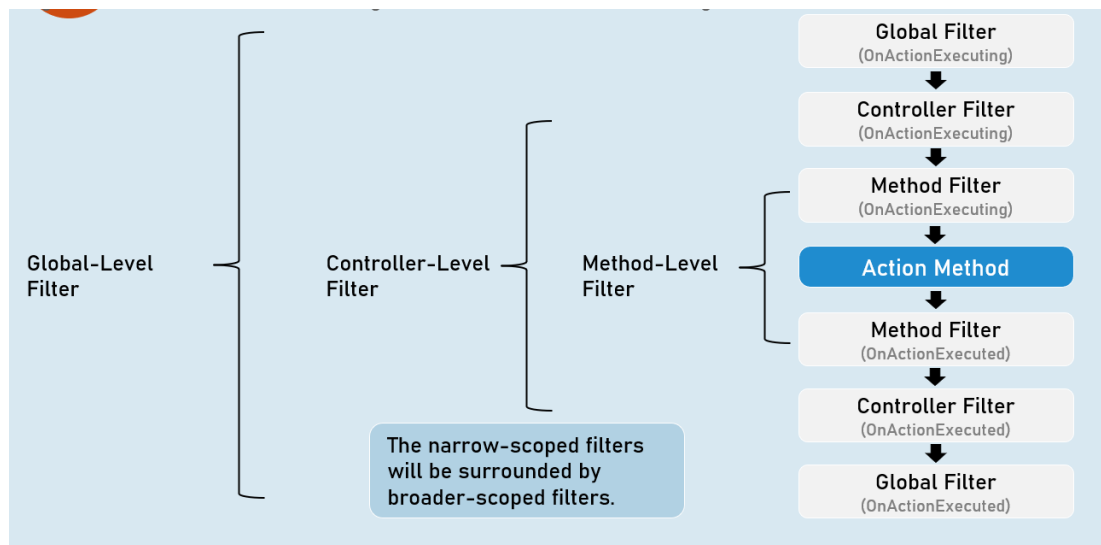
What are global filters?

Global filters are applied to all action methods of all controllers in the project.

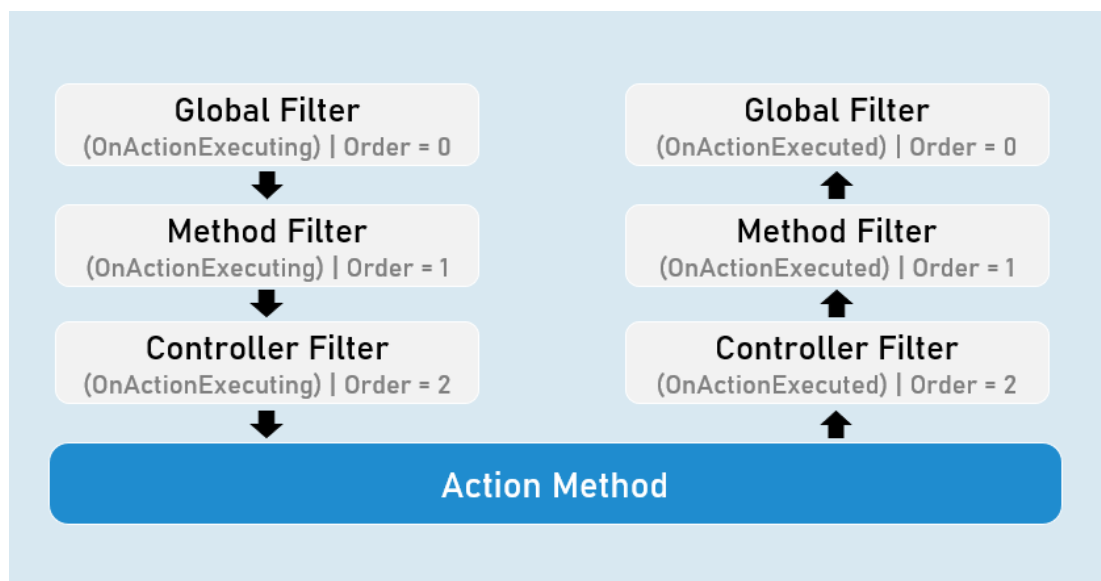
How to add global filters in Program.cs?

```
1 | builder.Services.AddControllersWithViews(options => {  
2 |     options.Filters.Add<FilterClassName>(); //add by type  
3 |     //or  
4 |     options.Filters.Add(new FilterClassName()); //add filter instance  
5 | });
```

Default Order of Filter Execution

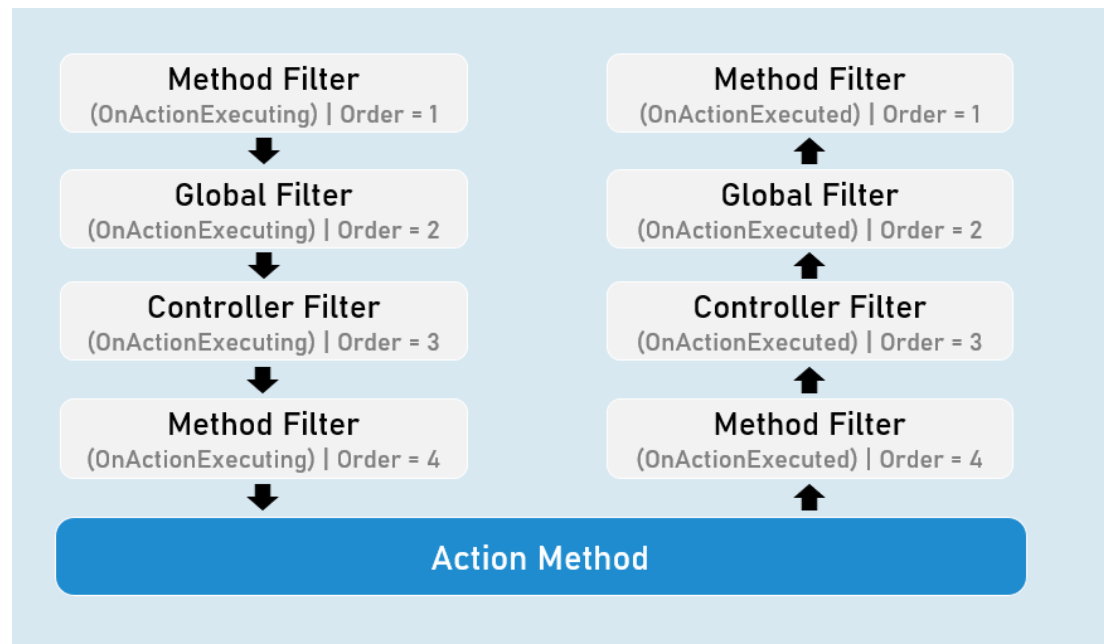


Custom Order of Filters



IOrderedFilter

Example



IOrderedFilter

Action filter with IOrderedFilter

```
1 | public class FilterClassName : IActionFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 | public void OnActionExecuting(ActionExecutingContext context)
11 | {
12 |     //TO DO: before logic here
13 | }
14 |
15 | public void OnActionExecuted(ActionExecutedContext context)
16 | {
17 |     //TO DO: after logic here
18 | }
19 | }
```

Async Filters

Asynchronous Action Filter

```
1 | public class FilterClassName : IAsyncActionFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 |    public async Task OnActionExecutionAsync(ActionExecutingContext
    context, ActionExecutionDelegate next)
11 |    {
12 |        //TO DO: before logic here
13 |        await next();
14 |        //TO DO: after logic here
15 |    }
16 | }
```

Short-circuiting Filters

Action Filters

When it runs

Runs immediately before and after an action method executes.

'OnActionExecuting' method

- It can access the action method parameters, read them & do necessary manipulations on them.
- It can validate action method parameters.
- It can short-circuit the action (prevent action method from execution) and return a different IActionResult.

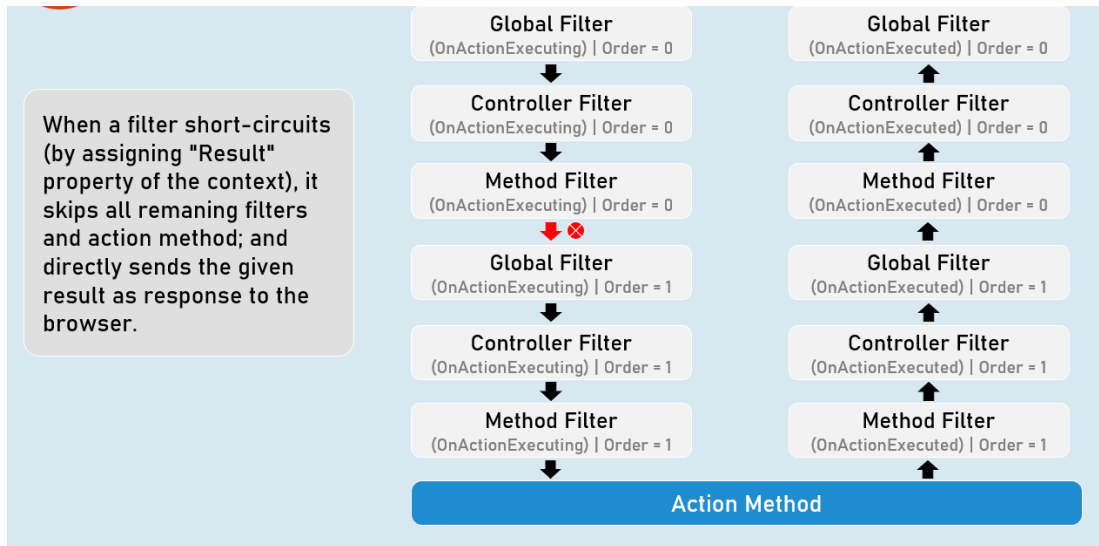
'OnActionExecuted' method

- It can manipulate the ViewData.
- It can change the result returned from the action method.
- It can throw exceptions to either return the exception to the exception filter (if exists); or return the error response to the browser.

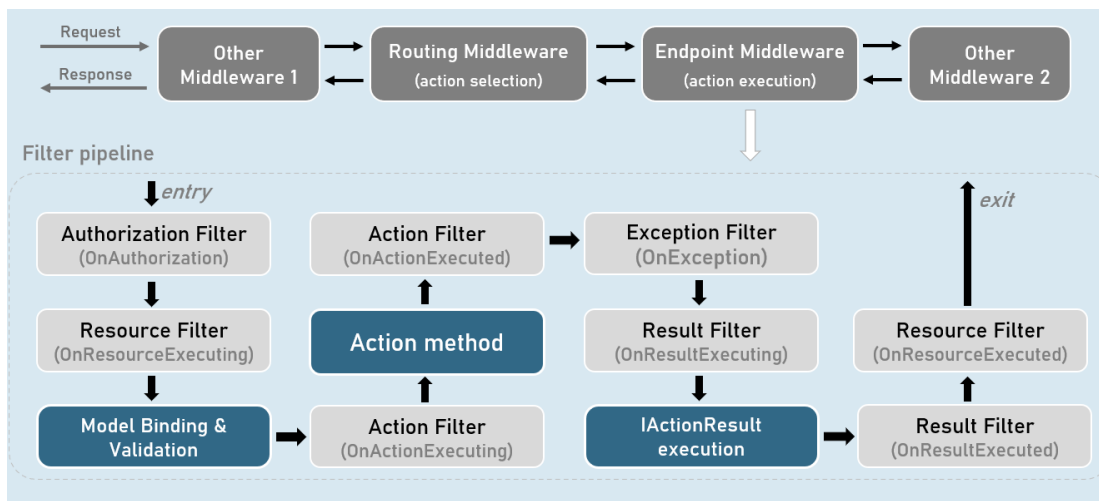
Short-Circuiting Action Filter

```
1 | public class FilterClassName : IAsyncActionFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 |    public async Task OnActionExecutionAsync(ActionExecutingContext
    context, ActionExecutionDelegate next)
11 |    {
12 |        //TO DO: before logic here
13 |        context.Result = some_action_result; //you can return any type of
    IActionResult
14 |        //Not calling next(). So it leads remaining filters & action method
    short-circuited.
15 |    }
16 | }
```

Short-Circuiting (exit) the filters



Result Filter



When it runs

- Runs immediately before and after an IActionResult executes.
- It can access the IActionResult returned by the action method.

'OnResultExecuting' method

- It can continue executing the IActionResult normally, by not assigning "Result" property of the context.

- It can short-circuit the action (prevent IActionResult from execution) and return a different IActionResult.

'OnResultExecuted' method

- It can manipulate the last-moment changes in the response, such as adding necessary response headers.
- It should not throw exceptions because, exceptions raised in result filters would not be caught by the exception filter.

Synchronous Result Filter

```

1 | public class FilterClassName : IResultFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |     public void OnResultExecuting(ResultExecutingContext context)
10 |    {
11 |        //TO DO: before Logic here
12 |    }
13 |     public void OnResultExecuted(ResultExecutedContext context)
14 |    {
15 |        //TO DO: after Logic here
16 |    }
17 | }
```

Asynchronous Result Filter

```

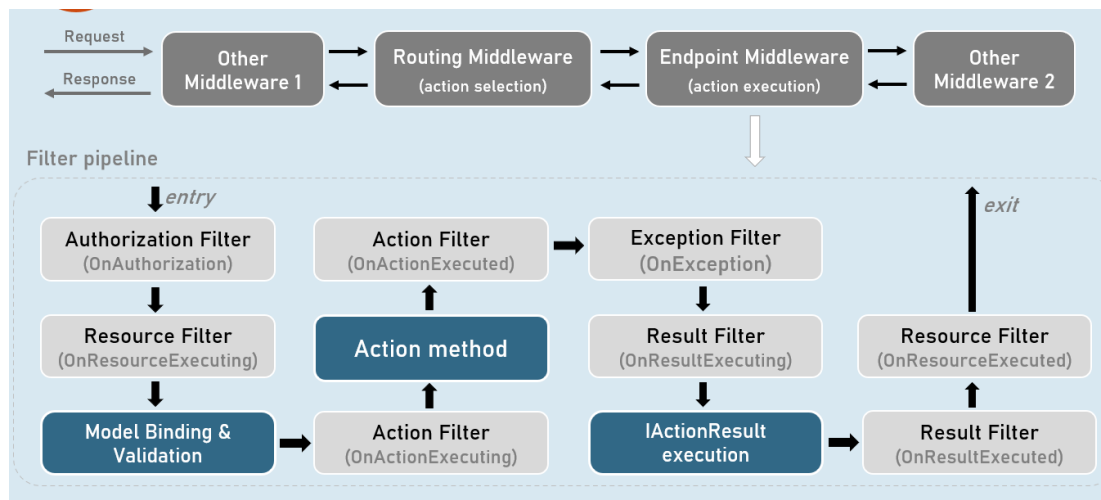
1 | public class FilterClassName : IAsyncResultFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 |     public async Task OnResultExecutionAsync(ResultExecutingContext
context, ResultExecutionDelegate next)
11 |    {
```

```

12 | //TO DO: before logic here
13 | await next();
14 | //TO DO: after logic here
15 | }
16 | }

```

Resource Filter



When it runs

Runs immediately after Authorize Filter and after Result Filter executes.

'OnResourceExecuting' method

- It can do some work before model binding. Eg: Adding metrics to an action method.
- It can change the way how model binding works (invoking a custom model binder explicitly).
- It can short-circuit the action (prevent IActionResult from execution) and return a different IActionResult.

Eg: Short-circuit if an unsupported content type is requested.

'OnResourceExecuted' method

- It can read the response body and store it in cache.

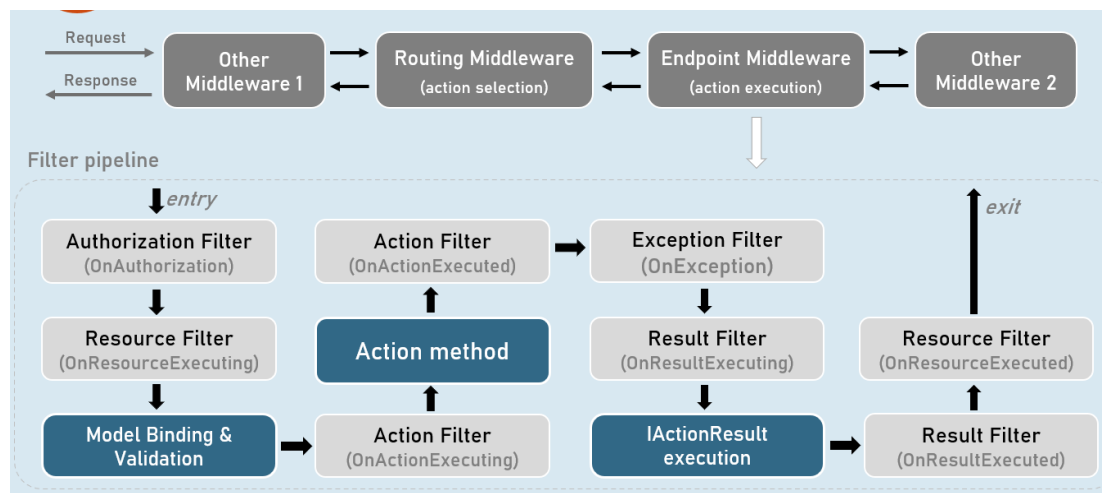
Synchronous Resource Filter

```
1 | public class FilterClassName : IResourceFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 |    public void OnResourceExecuting(ResourceExecutingContext context)
11 |    {
12 |        //TO DO: before Logic here
13 |    }
14 |
15 |    public void OnResourceExecuted(ResourceExecutedContext context)
16 |    {
17 |        //TO DO: after Logic here
18 |    }
19 | }
```

Asynchronous Resource Filter

```
1 | public class FilterClassName : IAsyncResourceFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; } //Defines sequence of execution
4 |
5 |     public FilterClassName(int order)
6 |     {
7 |         Order = order;
8 |     }
9 |
10 |    public async Task OnResourceExecutionAsync(ResourceExecutingContext
context, ResourceExecutionDelegate next)
11 |    {
12 |        //TO DO: before Logic here
13 |        await next();
14 |        //TO DO: after Logic here
15 |    }
16 | }
```

Authorization Filter



Authorization Filters

Runs before any other filters in the filter pipeline.

'OnAuthorize' method

- Determines whether the user is authorized for the request.
- Short-circuits the pipeline if the request is NOT authorized.
- Don't throw exceptions in OnAuthorize method, as they will not be handled by exception filters.

Synchronous Authorization Filter

```
1 | public class FilterClassName : IAuthorizationFilter
2 | {
3 |     public void OnAuthorization(AuthorizationFilterContext context)
4 |     {
5 |         //TO DO: authorization logic here
6 |     }
7 | }
```

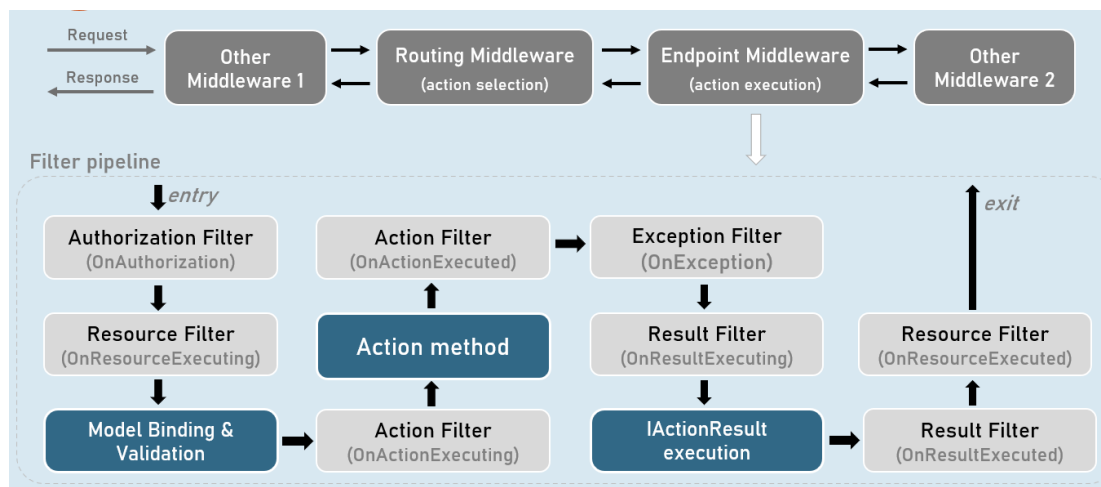
Asynchronous Authorization Filter

```

1 | public class FilterClassName : IAsyncAuthorizationFilter
2 | {
3 |     public async Task OnAuthorizationAsync(AuthorizationFilterContext
    context)
4 |     {
5 |         //TO DO: authorization logic here
6 |     }
7 | }

```

Exception Filter



When it runs

Runs when an exception is raised during the filter pipeline.

'OnException method

- Handles unhandled exceptions that occur in controller creation, model binding, action filters or action methods.
- Doesn't handle the unhandled exceptions that occur in authorization filters, resource filters, result filters or IActionResult execution.
- Recommended to be used only when you want a different error handling and generate different result for specific controllers; otherwise, `ErrorHandlingMiddleware` is recommended over Exception Filters.

Synchronous Exception Filter

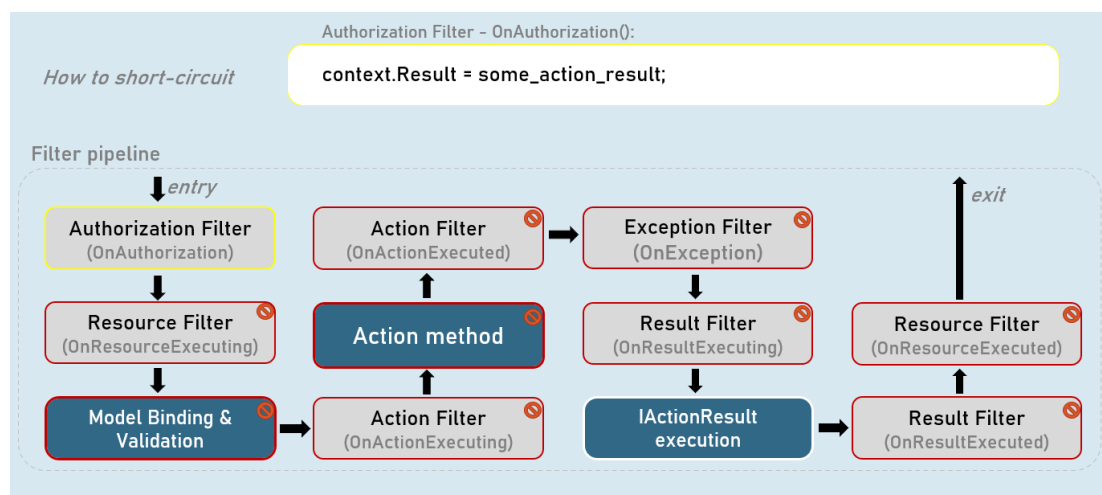
```
1 | public class FilterClassName : IAsyncExceptionFilter
2 | {
3 |     public async Task OnExceptionAsync(ExceptionFilterContext context)
4 |     {
5 |         //TO DO: exception handling logic here, as follows
6 |         context.Result = some_action_result;
7 |         //or
8 |         context.ExceptionHandled = true;
9 |         return Task.CompletedTask;
10 |    }
11 | }
```

Asynchronous Exception Filter

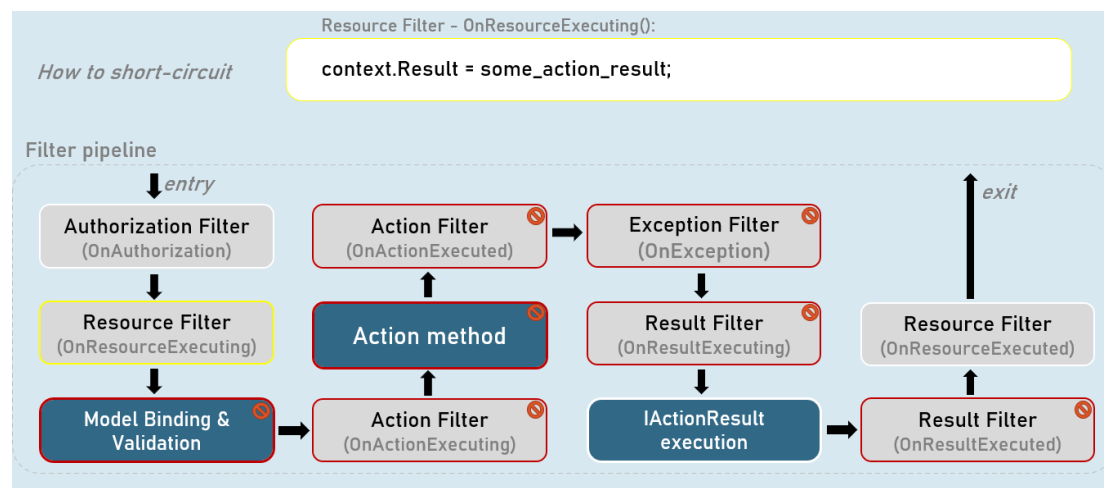
```
1 | public class FilterClassName : IAsyncExceptionFilter
2 | {
3 |     public async Task OnExceptionAsync(ExceptionFilterContext context)
4 |     {
5 |         //TO DO: exception handling logic here, as follows
6 |         context.Result = some_action_result;
7 |         //or
8 |         context.ExceptionHandled = true;
9 |         return Task.CompletedTask;
10 |    }
11 | }
```

Impact of Short-Circuiting

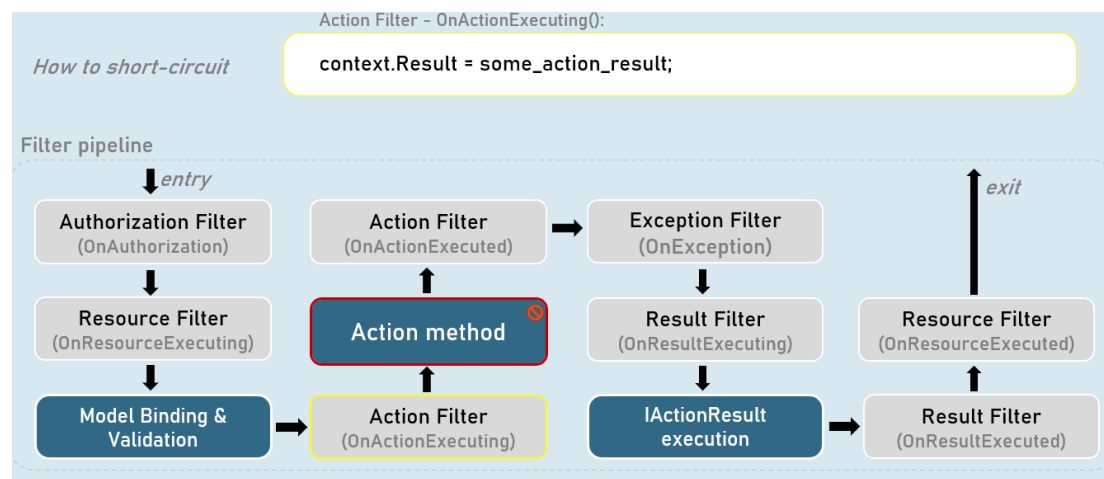
Short-circuiting Authorization Filter



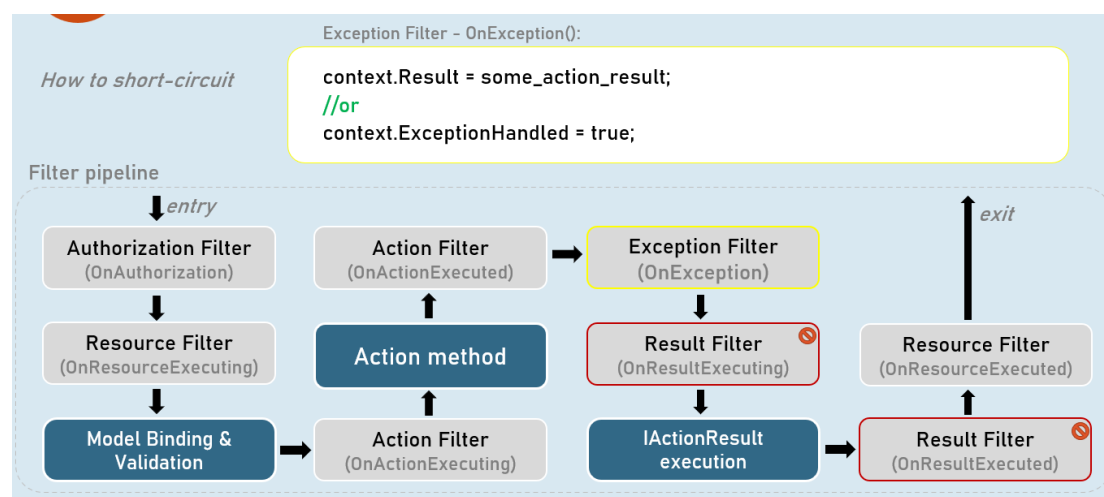
Short-circuiting Resource Filter



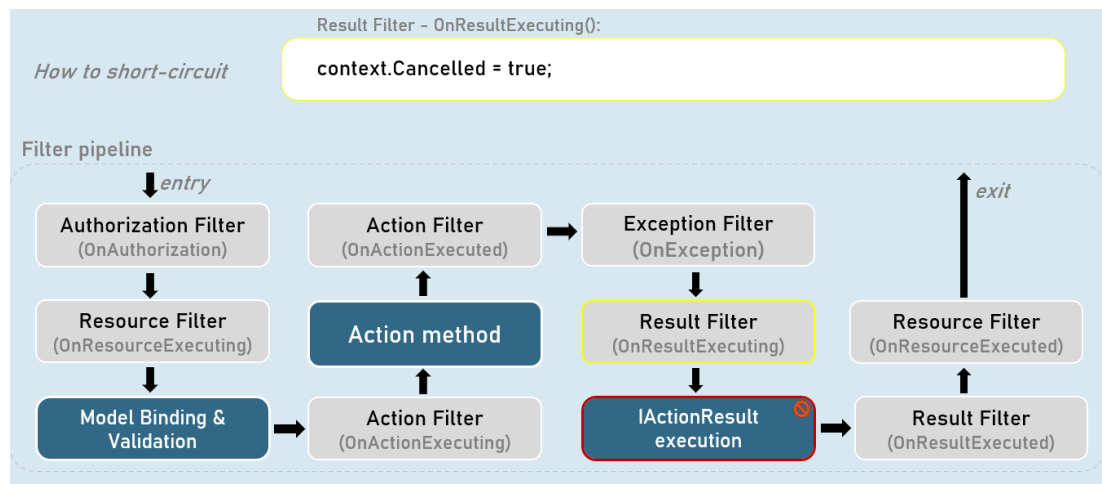
Short-circuiting Action Filter



Short-circuiting Exception Filter



Short-circuiting Result Filter



Short-circuiting the filters

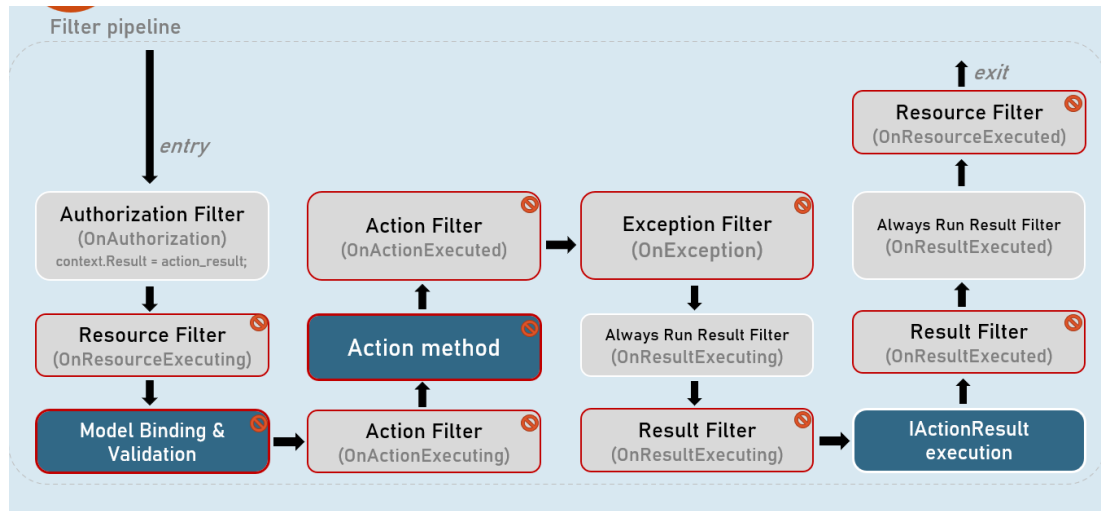
Authorization filter:	How to short-circuit? <code>context.Result = some_action_result;</code>	What else runs? Bypasses all filters, action method execution & result execution.
Resource filter:	How to short-circuit? <code>context.Result = some_action_result;</code>	What else runs? Bypasses model binding, action filters, action method, result execution & result filters. Resource filters' "Executed" methods run with <code>context.Cancelled = true</code> .

Action filter:	How to short-circuit? <code>context.Result = some_action_result;</code>	What else runs? Bypasses only action method execution. Other action filters' "Executed" methods with <code>context.Cancelled = true</code> ; and also all result filters, resource filters run normally.
Exception filter:	How to short-circuit? <code>context.Result = some_action_result;</code> <i>//or</i> <code>context.ExceptionHandled = true;</code>	What else runs? Bypasses result execution & result filters. All resource filters' "Executed" methods run.

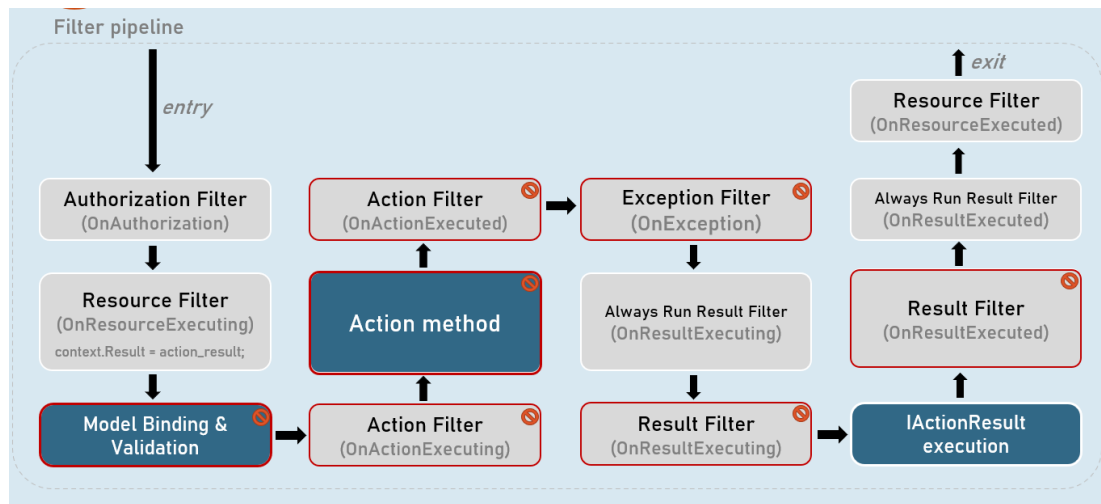
Result filter:	How to short-circuit? <code>context.Cancelled = true;</code>	What else runs? Bypasses only result execution. Other result filters' "Executed" methods & all resource filters run normally.
----------------	---	---

AlwaysRun Result Filter

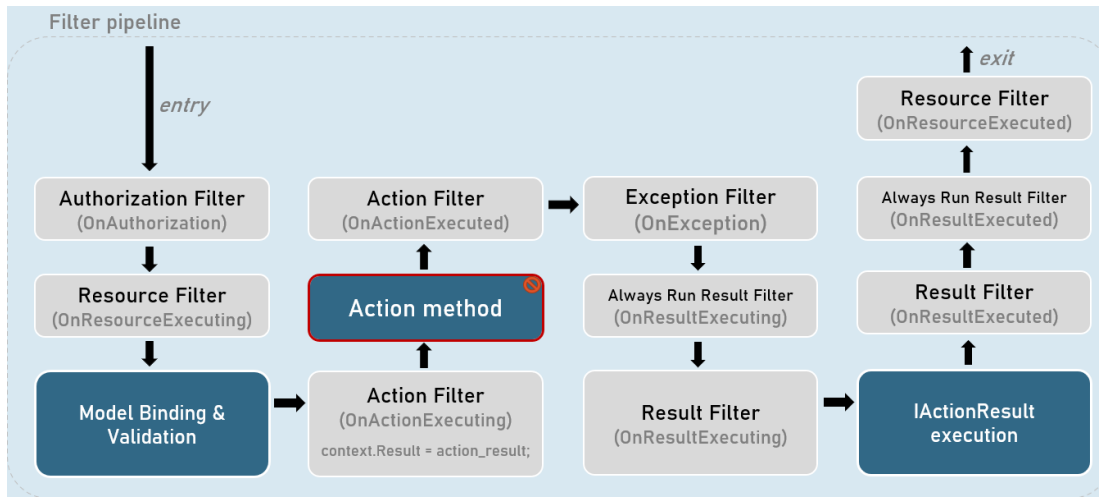
Short-circuiting Authorization Filter



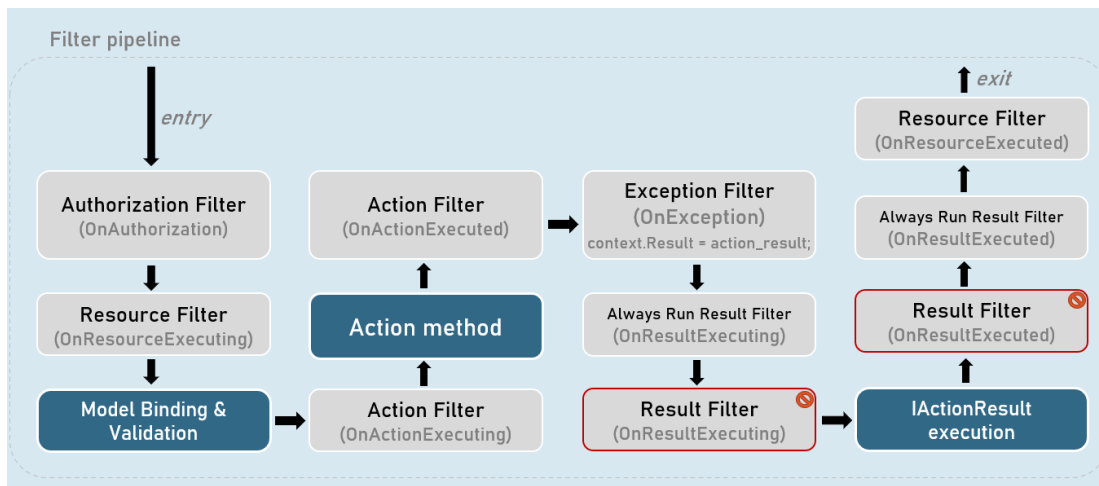
Short-circuiting Resource Filter



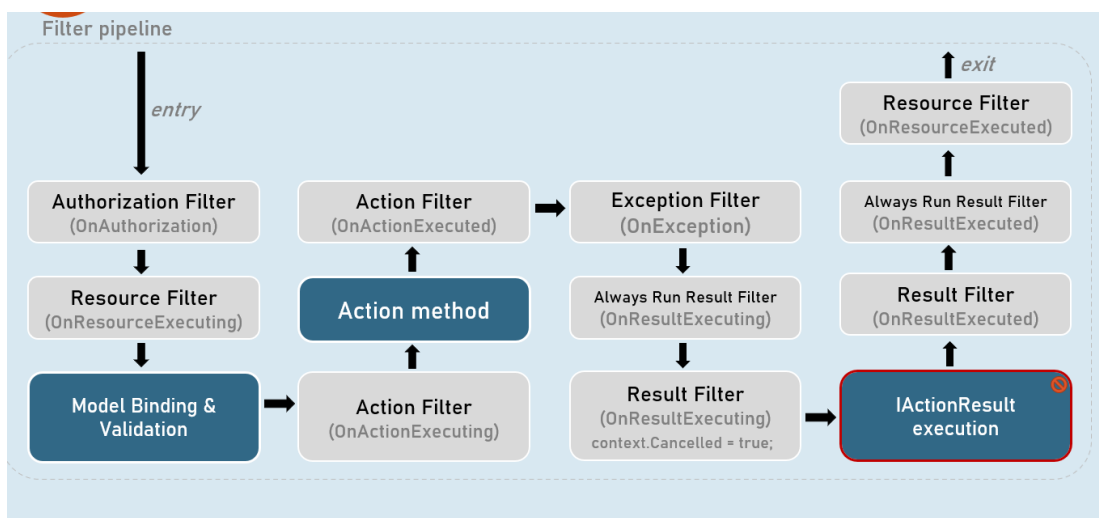
Short-circuiting Action Filter



Short-circuiting Exception Filter



Short-circuiting Result Filter



When AlwaysRunResultFilter runs

Runs immediately before and after result filters.

Result filters:

Doesn't execute when authorization filter, resource filter or exception filter short-circuits.

AlwaysRunResult filter:

Execute always even when authorization filter, resource filter or exception filter short-circuits.

'OnResultExecuting' method

Same as Result filter

'OnResultExecuted' method

Same as Result filter

Synchronous Always Run Result Filter

```
1 | public class FilterClassName : IAlwaysRunResultFilter
2 | {
3 |     public void OnResultExecuting(ResultExecutingContext context)
4 |     {
5 |         //TO DO: before Logic here
6 |     }
7 |     public void OnResultExecuted(ResultExecutedContext context)
8 |     {
9 |         //TO DO: after Logic here
10 |    }
11 | }
```

Asynchronous Always Run Result Filter

```
1 | public class FilterClassName : IAsyncAlwaysRunResultFilter
2 | {
3 |     public async Task OnResultExecutionAsync(ResultExecutingContext
      context, ResultExecutionDelegate next)
4 |     {
5 |         //TO DO: before logic here
6 |         await next();
7 |         //TO DO: after logic here
8 |     }
9 | }
```

Filter Overrides

```
1 | [TypeFilter(typeof(FilterClassName))] //filter applied at controller
      level
2 | public class ControllerName : Controller
3 | {
4 |     public IActionResult Action1() //requirement: The filter SHOULD execute
5 |     {
6 |     }
7 |     public IActionResult Action2() //requirement: The filter SHOULD NOT
      execute. But how??
8 |     {
9 |     }
10 | }
```

Attribute to be applied to desired action method

```
1 | public class SkipFilterAttribute : Attribute, IFilterMetadata
2 | {
3 | }
```

Action method

```
1 | [SkipFilter]
2 | public IActionResult ActionMethod()
3 | {
4 | }
```

Filter that respects 'SkipFilterAttribute'

```
1 | public class FilterClassName : IActionFilter //or any other filter
      interface
2 | {
```

```

3 |     public void OnActionExecuting(ActionExecutingContext context)
4 |     {
5 |         //get List of filters applied to the current working action method
6 |         if (context.Filters.Of<SkipResultFilter>().Any())
7 |         {
8 |             return;
9 |         }
10 |        //TO DO: before Logic here
11 |    }
12 |
13 |    public void OnActionExecuted(ActionExecutedContext context)
14 |    {
15 |        //TO DO: after Logic here
16 |    }
17 | }

```

It skips execution of code of a filter, for specific action methods.

[ServiceFilter]

Common purpose

Both are used to apply a filter a controller or action method.

Type Filter Attribute

```

1 | //can supply arguments to filter
2 | [TypeFilter(typeof(FilterClassName), Arguments = new object[] { arg1,
   | arg2 })]
3 | public IActionResult ActionMethod()
4 | {
5 |     ...
6 | }

```

Service Filter Attribute

```

1 | //can't supply arguments to filter
2 | [ServiceFilter(typeof(FilterClassName))]
3 | public IActionResult ActionMethod()
4 | {
5 |     ...
6 | }

```

Type Filter

- Can supply arguments to the filter.
- Filter instances are created by using `Microsoft.Extensions.DependencyInjection.ObjectFactory`.
- They're NOT created using DI (Dependency Injection).
- The lifetime of filter instances is by default transient (a new filter instance gets created every time when it is invoked).
- But optionally, you can re-use the same instance of filter class across multiple requests, by setting a property called `TypeFilterAttribute.IsReusable` to 'true'.
- Filter classes NEED NOT be registered (added) to the IoC container.
- Filter classes CAN inject services using both constructor injection or method injection.

Service Filter

- Can't supply arguments to the filter.
- Filter instances are created by using `ServiceProvider` (using DI).
- The lifetime of filter instances is the actual lifetime of the filter class added in the IoC container.
- Eg: If the filter class is added to the IoC container with `AddScoped()` method, then its instances are scoped.
- Filter class SHOULD be registered (added) to the IoC container, much like any other service.
- Filter classes CAN inject services using both constructor injection or method injection.

Filter attribute classes

IActionFilter [vs] ActionFilterAttribute

[versus]

Action filter that implements 'IActionFilter'

```
1 | public class FilterClassName : IActionFilter, IOrderedFilter
2 | {
3 |     //supports constructor DI
4 | }
```

Action filter that inherits 'ActionFilterAttribute'

```
1 | public class FilterClassName : ActionFilterAttribute
2 | {
3 |     //doesn't support constructor DI
4 | }
```

Filter interfaces:

- IAuthorizationFilter
- IResourceFilter
- IActionFilter
- IExceptionFilter
- IResultFilter
- IAsyncAuthorizationFilter
- IAsyncResourceFilter
- IAsyncActionFilter
- IAsyncExceptionFilter
- IAsyncResultFilter

Filter attributes:

- ActionFilterAttribute
- ExceptionFilterAttribute
- ResultFilterAttribute

Action filter that implements 'IActionFilter'

```
1 | public class FilterClassName : IActionFilter, IOrderedFilter
2 | {
3 |     public int Order { get; set; }
4 |
5 |     public FilterClassName(IService service, type arg)
6 |     {
7 |     }
8 |
9 |     public void OnActionExecuting(ActionExecutingContext context)
10 |    {
11 |    }
12 |
13 |    public void OnActionExecuted(ActionExecutedContext context)
14 |    {
15 |    }
16 | }

1 | [TypeFilter(typeof(FilterClassName),
2 | Arguments = new object[] { arg1, ... })]
```

Action filter that inherits 'ActionFilterAttribute'

```
1 | public class FilterClassName : ActionFilterAttribute
2 | {
3 |     public FilterClassName(type arg)
4 |     {
5 |     }
6 |
7 |     public override void OnActionExecuting(ActionExecutingContext context)
8 |     {
9 |     }
10 |
11 |    public override void OnActionExecuted(ActionExecutedContext context)
12 |    {
```

```
13 |     }
14 | }
```

```
[FilterClassName(arg1, ... )]
```

Internal definitions of IActionFilter and ActionFilterAttribute

IActionFilter

```
1 | namespace Microsoft.AspNetCore.Mvc.Filters
2 | {
3 |     public interface IActionFilter : IFilterMetadata
4 |     {
5 |         void OnActionExecuting(ActionExecutingContext context);
6 |         void OnActionExecuted(ActionExecutedContext context);
7 |     }
8 | }
```

ActionFilterAttribute

```
1 | namespace Microsoft.AspNetCore.Mvc.Filters
2 | {
3 |     public class ActionFilterAttribute : Attribute, IActionFilter,
4 |     IAsyncActionFilter, IOrderedFilter, IResultFilter, IAsyncResultFilter
5 |     {
6 |         public virtual void OnActionExecuting(ActionExecutingContext
7 |         context) { }
8 |         public virtual void OnActionExecuted(ActionExecutedContext context)
9 |         { }
10 |        public virtual void OnResultExecuting(ActionExecutingContext
11 |        context) { }
12 |        public virtual void OnResultExecuted(ActionExecutedContext context)
13 |        { }
14 |        public virtual Task OnActionExecutionAsync(ActionExecutingContext
15 |        context, ActionExecutionDelegate next) { }
16 |        public virtual Task OnResultExecutionAsync(ResultExecutingContext
17 |        context, ResultExecutionDelegate next) { }
18 |        public int Order { get; set; }
19 |    }
20 | }
```

Filter interface [vs] FilterAttribute class

Filter interface [such as IActionFilter, IResultFilter etc.]

- Filter class MUST implement all methods - both "Executing" and "Executed" methods.
- Filter class CAN have DI with either constructor injection or method injection.
- Doesn't implement "Attribute" class.
- Filter should be applied to controller or action methods by using [ServiceFilter] or [TypeFilter] attributes; otherwise can be applied as global filter in the Program.cs.

Eg: [TypeFilter(typeof(FilterClassName))] //lengthy

- Filter class can receive arguments only through constructor parameters; but only with [TypeFilter] attribute; not with [ServiceFilter] attribute.

FilterAttribute class [such as ActionFilterAttribute etc.]

- Filter class MAY override desired (either or both methods - "Executing" and "Executed") methods.
- Filter class CAN'T have DI with neither constructor injection nor method injection.
- FilterAttribute class [such as ActionFilterAttribute etc.]
- Filter can be applied to controller or action methods by directly using the filter class name itself (without using [ServiceFilter] or [TypeFilter] attributes); otherwise can be applied as global filter in the Program.cs.
- Eg: [FilterClassName] //simple
- Filter class can receive arguments either through constructor parameters or filter class's properties.

IFilterFactory

Filter factory that inherits 'IFilterFactory'

```
1 | public class FilterClassNameAttribute : Attribute,  
2 | IFilterFactory  
3 | {  
4 |     public type Prop1 { get; set; }  
5 |  
6 |     public FilterClassName(type arg1, type arg2)  
7 |     {  
8 |         this.Prop1 = arg1; this.Prop2 = arg2;  
9 |     }  
10 |  
11 |     public IFilterMetadata CreateInstance(IServiceProvider serviceProvider)  
12 |     {  
13 |         FilterClassName filter =  
14 |             serviceProvider.GetRequiredService<FilterClassName>(); //instantiate the  
15 |             filter  
16 |             filter.Property1 = Prop1;  
17 |             ...  
18 |             return filter;  
19 |     }  
20 | }
```

```
[FilterClassName(arg1, arg2, ... )]
```

Action filter that inherits 'ActionFilterAttribute'

```
1 | public class FilterClassName : ActionFilterAttribute  
2 | {  
3 |     public FilterClassName(type arg1, type arg2)  
4 |     {  
5 |     }  
6 |  
7 |     public override void OnActionExecuting(ActionExecutingContext context)  
8 |     {  
9 |     }  
10 |  
11 |     public override void OnActionExecuted(ActionExecutedContext context)  
12 |     {  
13 |     }  
14 | }
```

```
[FilterClassName(arg1, arg2, ... )]
```

IFilterFactory

```
1 | namespace Microsoft.AspNetCore.Mvc.Filters
2 | {
3 |     public interface IFilterFactory : IFilterMetadata
4 |     {
5 |         IFilterMetadata CreateInstance(IServiceProvider serviceProvider);
6 |         bool IsReusable { get; }
7 |     }
8 | }
```

FilterAttribute class [such as ActionFilterAttribute etc.]

- Filter CAN be applied as an attribute to the controller or action method. Eg: [FilterClassName]
- Filter class CAN'T have DI with neither constructor injection nor method injection.
- Filter class CAN receive arguments either through constructor parameters or filter class's properties.

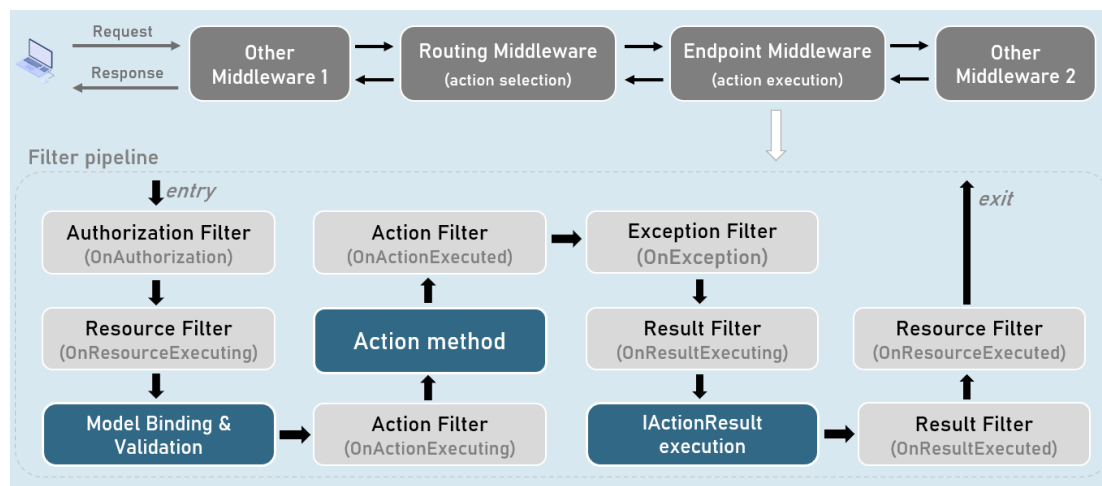
IFilterFactory

- Filter CAN be applied as an attribute to the controller or action method. Eg: [FilterClassName]
- Filter class CAN have DI with either constructor injection or method injection.
- Filter class CAN receive arguments only through filter class's properties, if it is instantiated through ServiceProvider (using DI).

Alternatively, if you don't need to inject services using DI in the filter class; you can instantiate the filter class with 'new' keyword,

in the `CreateInstance()` method of `IFilterFactory`; then the filter class can receive arguments either as constructor parameters or properties.

Filters [vs] Middleware



Middleware

Middleware pipeline is a superset of Filter pipeline, which contains the full-set of all middlewares added to the `ApplicationBuilder` in the application's startup code (`Program.cs`).

Middleware pipeline execute for all requests.

Middleware handles application-level functionality such as Logging, HTTPS redirection, Performance profiling, Exception handling, Static files, Authentication etc., by accessing low-level abstractions such as `HttpContext`.

Filter

Filter pipeline is a subset of Middleware pipeline which executes under "EndPoint Middleware".

In addition, filter pipeline executes for requests that reach "EndPoint Middleware".

Filters handle MVC-specific functionality such as manipulating or accessing ViewData, ViewBag, ModelState, Action result, Action parameters etc.

Middleware Pipeline

