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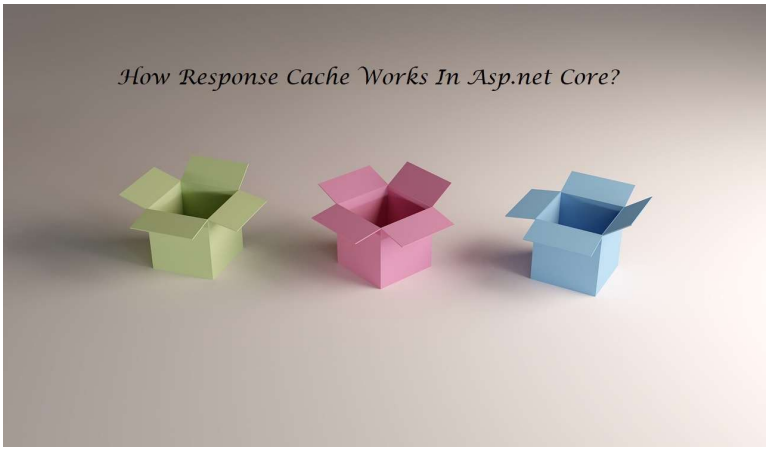
How Response Caching Works In Asp.Net Core

January 19, 2020



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What Is Response Caching?:

Response Caching means storing of response output and using stored response until it's under it's the expiration time.

Response Caching approach cuts down some requests to the server and also reduces some workload on the server.

Response Caching Headers:

Response Caching carried out by the few Http based headers information between client and server.
Main Response Caching Headers are like below

- Cache-Control
- Pragma
- Vary

Cache-Control Header:

Cache-Control header is the main header type for the response caching. Cache-Control will be decorated with the following directives.

- **public -** this directive indicates any cache may store the response.
- **private -** this directive allows to store response with respect to a single user and can't be stored with shared cache stores.
- **max-age -** this directive represents a time to hold a response in the cache.
- **no-cache -** this directive represents no storing of response and always fetch the fresh response from server
- **no-store -** cache can't store the request or response.

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Pragma Header:

Pragma Header used for Http/1.0 request with no-cache directive value. Pragma gets ignored if response decorated with Cache-Control

Vary Header:

Vary Header fields must match with the original request-response and the new request.

ResponseCache Attribute:

Asp.Net Core provided ResponseCache Attribute to enable response cache on MVC/Web API/Razor Pages. This attribute needs to be populated with respective input parameters to generate the cache headers. The following are few input parameters for the cache attribute.

- **Duration -** Gets or sets the duration in seconds for which response is cached. This sets "max-age" in "cache-control" header.
- **Location -** Gets or sets the location where the data from a particular URL must be cached. It accepts three types of parameters. If Location decorated with "ResponsCacheLocation.Any" works like response cached in both proxies and client and sets "cache-control" header to the public. If Location decorated with "ResponseCacheLocation.Client" works like response cached only in the client and sets "cache-control" header to private. if Location decorated with "ResponseCacheLocation.None" works like "cache-control" and "Pragma" headers set to "no-cache".
- **NoStore -** Gets or sets the value which determines whether the data should store or not. When NoStore decorates with 'true' value, it sets the "cache-control" header to "no-store" and ignores the "Location" parameter for values other than "None" and ignores "Duration" as well.

- **VaryByHeader -** Gets or sets the value for the "Vary" response header.
- **VaryByQueryKeys -** Gets or sets the query keys to "Vary".

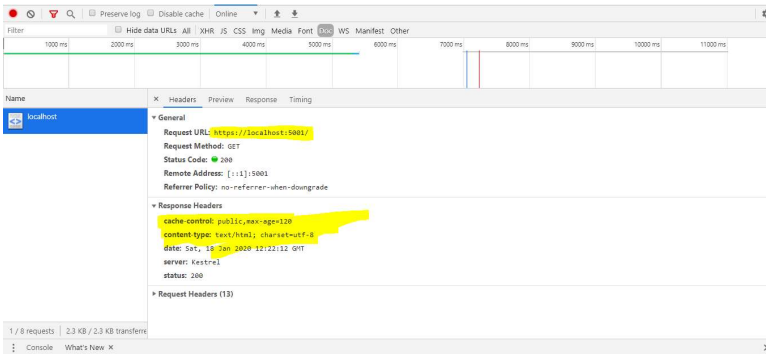
Let's start testing the response cache on MVC endpoint using ResponseCache Attribute as below.

HomeController.cs:

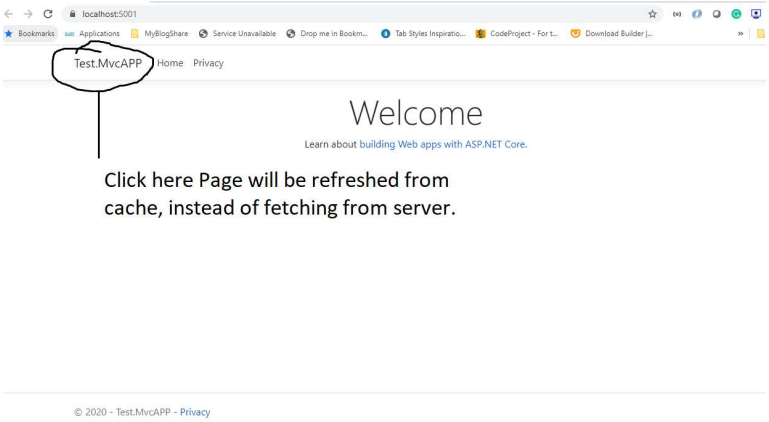
```
[ResponseCache(Duration =120, Location = ResponseCac
public IActionResult Index()
{
 return View();
}
```

Above controller decorated with ResponseCache Attribute. Cache duration set to 120 secs, Location set to ResponseCache.Any which results in "public" value for the "cache-control" header.

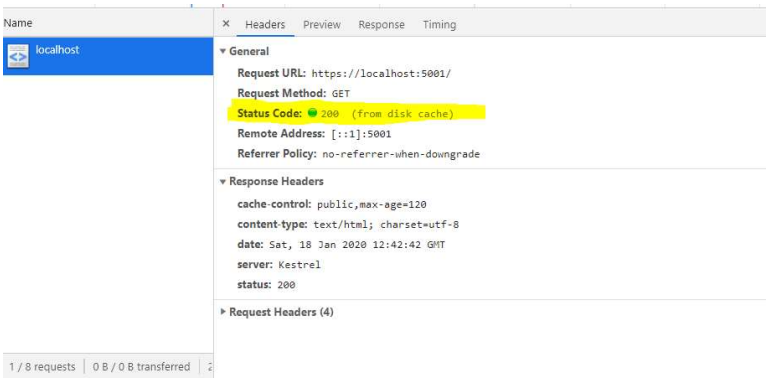
Now run the application and open developer console and then check cache headers are added to response headers as below.



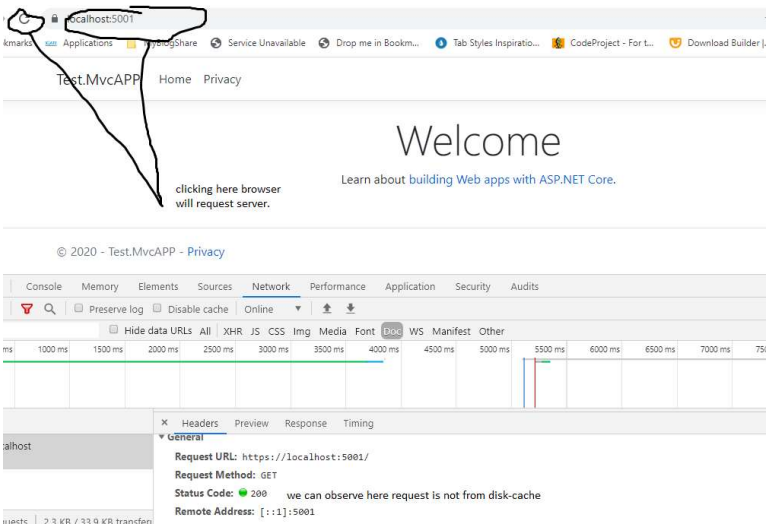
Now from the picture above "max-age=120" means the browser after receiving the first request with "cache-control" header value with "public" stores the data for 120 secs. So from the next request of the same page from the website will be loads from the disk cache as shown below



After clicking on the home page link from the website as shown in the above picture, we can observe page gets reloaded from the cache as below.



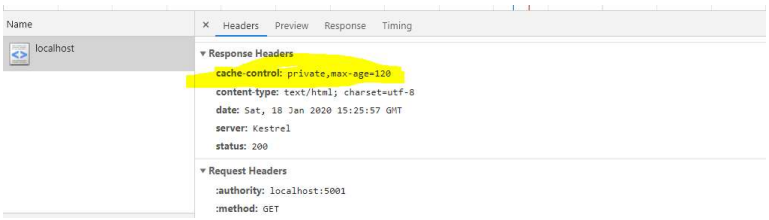
While Testing response caching always click on links within the websites because clicking Href on the website browser will check the previous response headers if they are cached so it will load the page from the cache if headers matched. If we reload the page or clicking the enter button browser search bar browser will request the page from the server.



Now update the ResponseCache Attribute location parameter with a value "ResponseCache.Client" as below

```
[ResponseCache(Duration =120, Location = ResponseCac
```

Now observe the response header where the "cache-control" value set to "private" as below.



Now update the ResponseCache Attribute location parameter with a value "ResponseCache.None" as below.

```
[ResponseCache(Duration =120, Location = ResponseCac
```

Now observe the response header where the "cache-control" value set to "no-cache" as below.

Now update the ResponseCache Attribute "NoStore" parameter with a value "true". By setting "true" to "NoStore" will override the "cache-control" value of the "Location " parameter as below.

```
[ResponseCache(Duration =120, Location = ResponseCac
```

Now observe the response header where the "cache-control" value set to "no-store" as below.

public vs private vs no-cache values of cache-control:

What is a proxy server? - Internet Service Providers may maintain some multiple numbers of proxy servers were to maintain and cache the data to fastly serve the information to their customers.

- **cache-control: public -** caching of response both in proxy servers and in client machines(browser).
- **cache-control: private -** caching of response only in the client machine.
- **cache-control: no-cache -** no caching, every request will be freshly fetched from the server.

VaryByHeader In ResponseCache Attribute:

VaryByHeader in Asp.Net Core represents the Http "Vary" Header. The "Vary" header uses the current request-response header value to be matched with future request header. If headers match future request-response fetch from the cache and if not match fetch response freshly from the server.

The best example to test Http "Vary" Header by populating it with "User-Agent". "User-agent" gives information like the type of client request to the server. In general "User-Agent" will be different for the device to device.

Example of how User-Agent works with response caching?

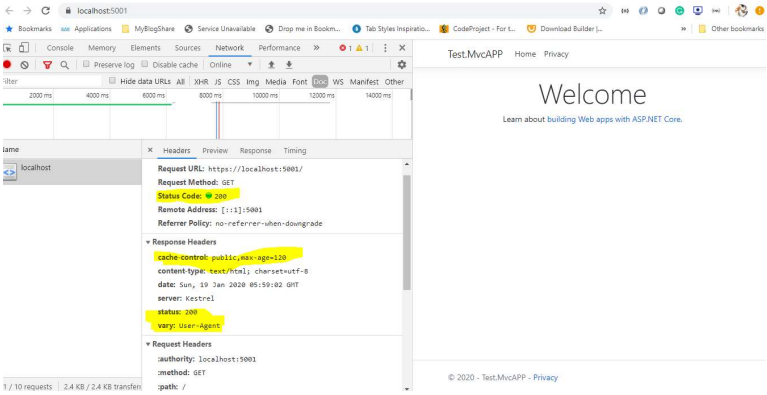
- In a website configure home page by enabling response cache attribute with "VaryByHeader" value set to "User-Agent".
- Now from desktop access, the home page will be rendered with response header with "Vary". After that click on the home page link to refresh the page since "User-Agent" cache enabled and headers match response will be loaded from the cache.
- Now open developers' tools and select the setting to mobile device options and then click on the home page

link on the website. Now the device type is changed so the "User-Agent" value will be changed so now the browser will send a fresh request to the server instead of loading a response from the cache.

Now let's do VaryByHeader practically. Update the ResponseCache Attribute "VarByHeader" parameter with the value "User-Agent" as below.

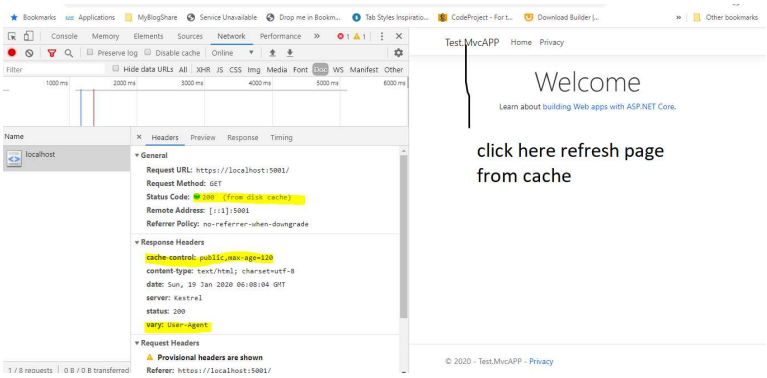
```
[ResponseCache(Duration =120,VaryByHeader = "User-Ag
```

Now run the application in desktop mode and the "Vary" response header will have value as "User-Agent" as below.

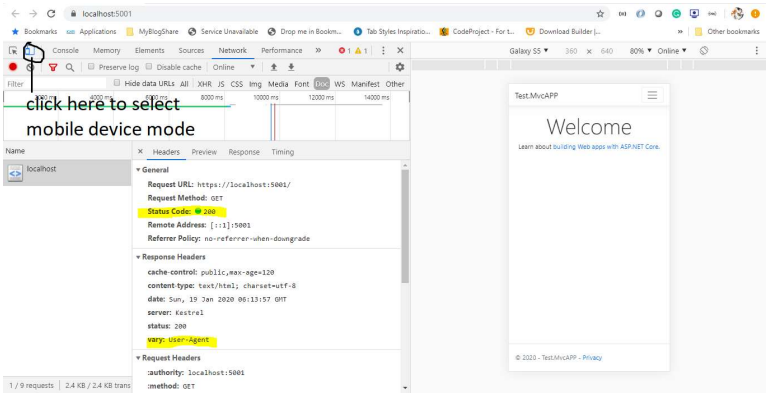


Request User-Agent looks as below.

Now click refresh the page by clicking the home link on the website in desktop device mode. Since user-agent won't change response will be rendered from the cache as below



Now from the developers' tool change settings to mobile devices and click on the home page link. Since device mode changed "User-agent" value will be changed, so browser request data from the server instead of cache as below.



We can observe user agent value will be changed as below.

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Cache Profile:

ResponseCache Attribute input parameters may be the same for almost all the action methods in an application. Asp.Net Core provides options like profile cache where all the parameter options are configured startup class with a name to that configuration, that profile name can be used inside the ResponseCache Attribute which removes duplication parameters setting in it.

```
public void ConfigureServices(IServiceCollection ser
{
 services.AddControllersWithViews(options => {
  options.CacheProfiles.Add("Profile1", new Microsof
```

```
  {
   Duration = 120,
   Location = Microsoft.AspNetCore.Mvc.ResponseCache
   NoStore = false
  });
  options.CacheProfiles.Add("Profile2", new Microsof
  {
   VaryByHeader = "User-Agent",
   Duration = 60,
   Location = Microsoft.AspNetCore.Mvc.ResponseCache
   NoStore = false
  });
 });
}
```

Here we have two different cache profiles with their respective settings. We can observe all the parameters we generally configured in ResponseCache Attribute are configured here inside the CacheProfile object."Profile2" cache settings represent caching based on VaryByHeader.

Now update the ResponseCache Attributes with its respective profile names as below.

```
[ResponseCache(CacheProfileName ="Profile1")]
public IActionResult Index()
{
 return View();
}

[ResponseCache(CacheProfileName = "Profile2")]
public IActionResult Test()
{
 return View();
}
```

Custom Middleware To Add Cache:

We can add response cache by writing middleware but this implementation by default adds response cache to any page on the application.

Startup.cs:

```
app.Use(async (context, next) =>
{
 context.Response.GetTypedHeaders().CacheControl =
  new Microsoft.Net.Http.Headers.CacheControlHeaderV
  {
   Public = true,
   MaxAge = TimeSpan.FromSeconds(60),
  };
 await next();
});
```

Here we can observe on every request, response context adding "CacheControl" object.

HomeController.cs:

```
public IActionResult Index()
{
  return View();
}
```

Combination Of Custom Cache Middleware And ResponseCache Attribute:

Yes, we can use both of them in our Asp.Net Core applications. But ResponseCache Attribute settings override the middleware settings. So it will help like globally every page will have cache information from the custom middleware and if we want to override those settings to any of the endpoint then we can easily override by implementing ResponseCache Attribute on the particular action method. For example "MaxAge" set to 180 secs on custom middleware and if we configure ResponseCache Attribute with "Duration"

set to 60 secs then a response will be cached for 60secs only.

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Wrapping Up:

Hopefully, this article will help to understand Response Cache implementation in the Dotnet core. I will love to have your feedback, suggestions, and better techniques in the comments section.

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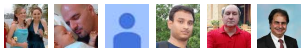

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