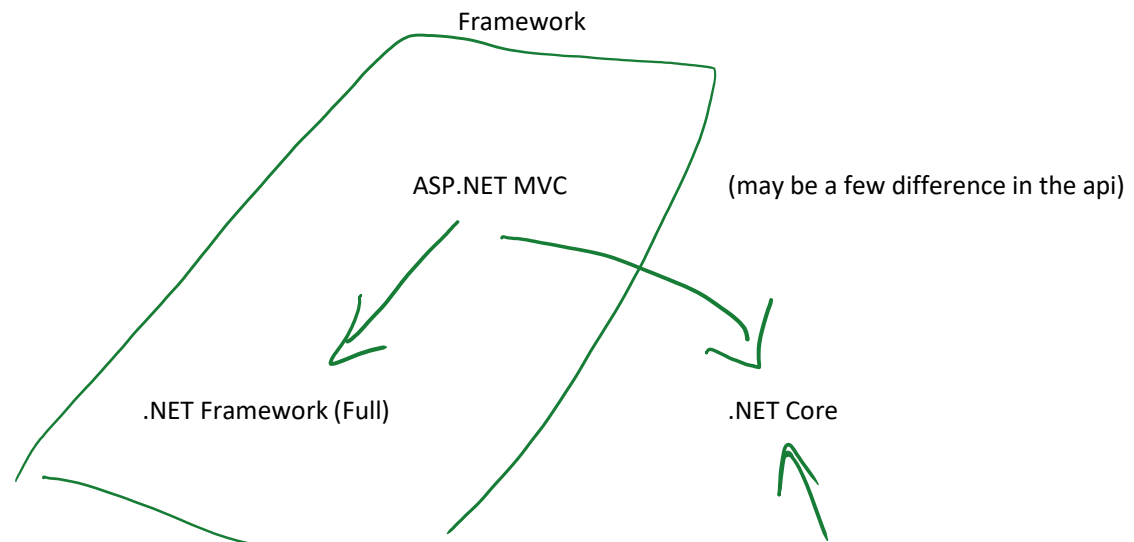# Agenda

ASP.NET MVC <--- Application Framework <---- Helps you develop the application

.NET Core Application <----- Runtime Framework/Platform <----- helps you execute the application
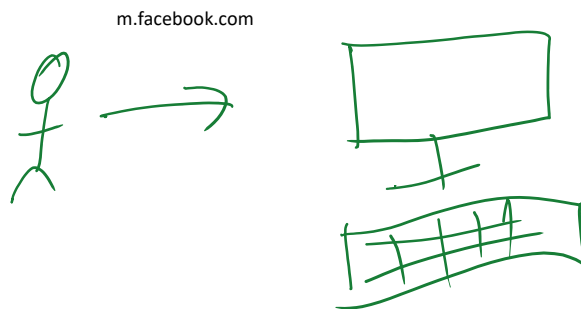
Framework

ASP.NET MVC

(may be a few difference in the api)

.NET Framework (Full)

.NET Core

Http Protocol

http://m.facebook.com <---- **Open Mobile Site**

http://www.irctc.co.in/mobile

GET m.facebook.com/ \r\n
User-Agent: chrome, windows10\r\n

m.facebook.com

It is a contradiction between
the URL and the User-Agent

Url --> give me mobile site
User-Agent --> give me desktiop site

- Request to keep the connection alive
- Don't close the Tcp socket (Please)
- Browsers almost always send this header to the client
- Server can (and very often does) ignore this request

GET /some/url
connection: keep-alive

Server Response

200 OK
Content-type:text/html
date-modified:2020/04/13

https://books.org/list?cat=thriller

https://amazon.in/proucts?q=mobile-cover&model=samung-note-8

Clients second request

How will server connect a user to its session when socket is disconnected.
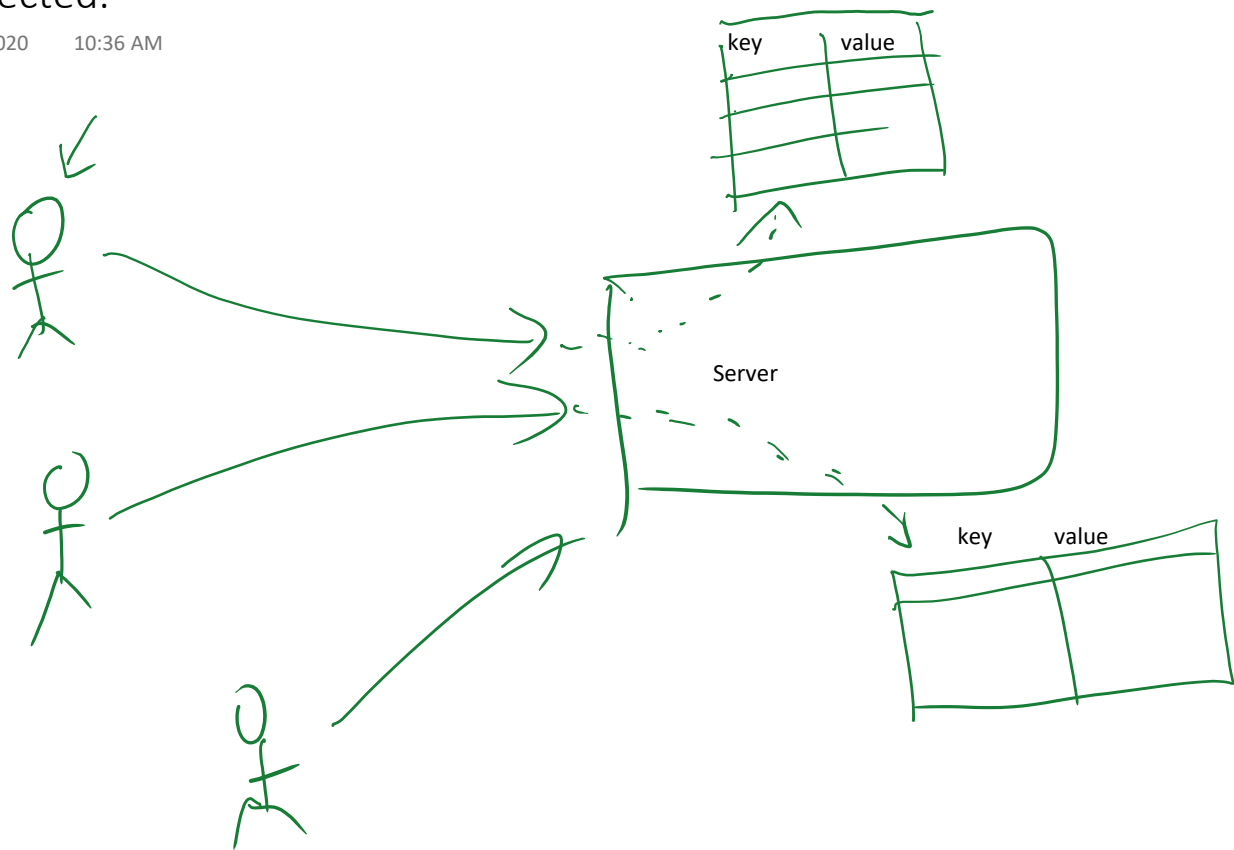
key | value

Server

key   value

Cache Redirect

Server Response

200 OK
Content-type:text/html
date-modified:2020/04/13

Client Next Response

GET /resource
if-modified-since:2020/01/30

//content changed after clients previous visit

200 OK
Content-type:text/html
date-modified:2020/04/13

Gets new Data

Client Next Response

GET /resource
if-modified-since:2020/05/04

//content not modifed after the last visit

304 Not Modifed   Cache Redirect
\r\n

Can use the existing

MVC

Presentation	Business	Data
View	Controller	Model

Model

Standard Network Port

As an admin I can run any server on any available (free) port.

One Machine ---> One Port ---> One App (One socket)

Standard Practice

First 1K port is reserved for standard protocol

- 20,21 --->FTP
- 25 ---> SMPT
- 80 ---> HTTP
- 110 ---> POP
- 443 ---> HTTPS

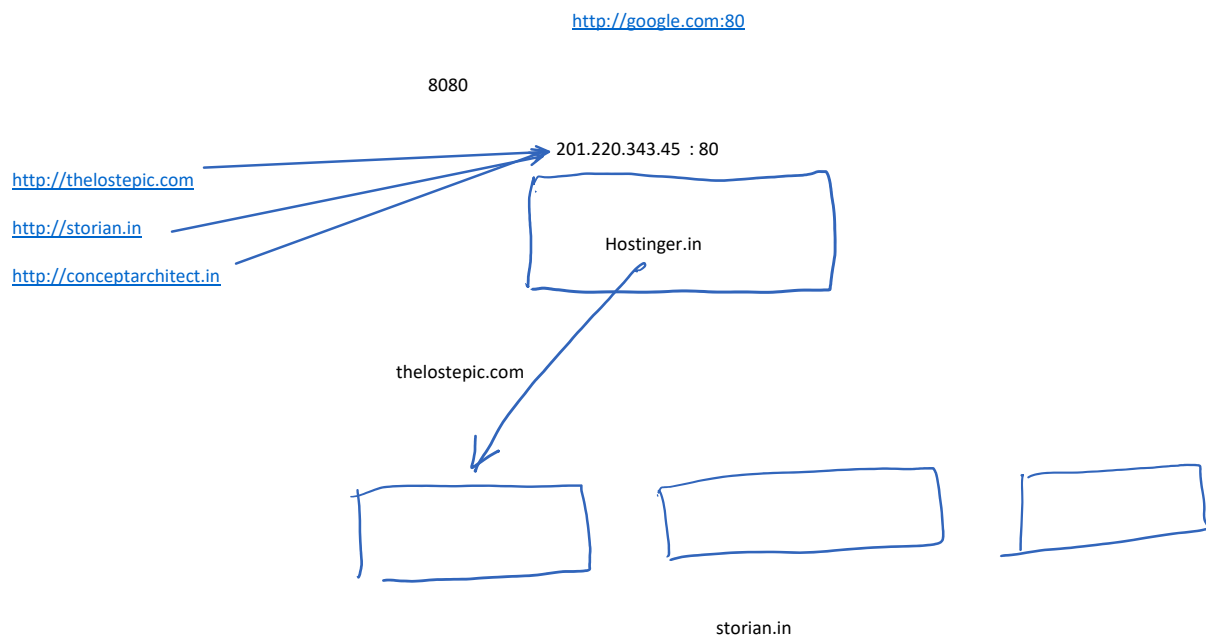Q. What if I run HTTP Server on a Non Standard Port

A. The URL Will Change
   a. http://books.org:3393/books

- now we say the server will be available on paort 3393.

- You can imagine that default url is a shortform for
  - http://books.org:80/books
  - http://books.org:445/books

http://google.com:80

8080

201.220.343.45 : 80

http://thelostepic.com

http://storian.in

http://conceptarchitect.in

Hostinger.in

thelostepic.com

storian.in

MVC URL

Traditional View

http://localhost:57586/   <------ index.html/default.html/default.aspx/default.php ---> from root directory

http://localhost:57586/Home/Contact <----- index.html/default.html/default.aspx from /Home/Contact directory

http://localhost:57586/Home/About

http://localhost:57586/books.html <----- request for books.html file in root directory

http://localhost:57586/Home/About/authors.aspx <---- execute authors.aspx page from /Home/About folder

MVC URL has by default 3 parts

http://localhost:57586/philips/daysafter/12

Controller
- **the class name without Controller suffix**
- **If not supplied it defaults to Home**

Action
 * Generally mapped to a method with the same name
- **If not supplied defaults to Index**

Id
- **a parameter passed to action**
- **name is fixed to id**
- **if not supplied defaults to null**

How Fiddler Works

fiddler

Browser

Server
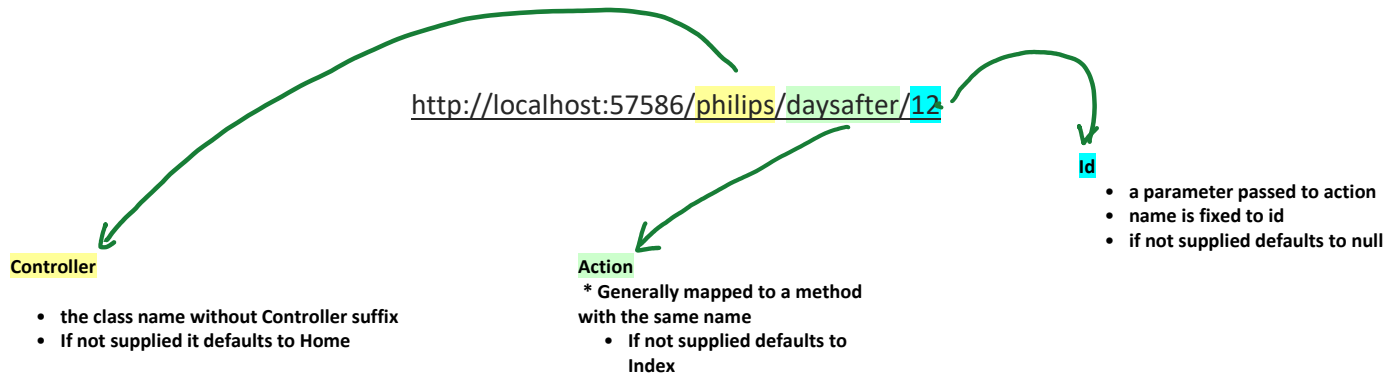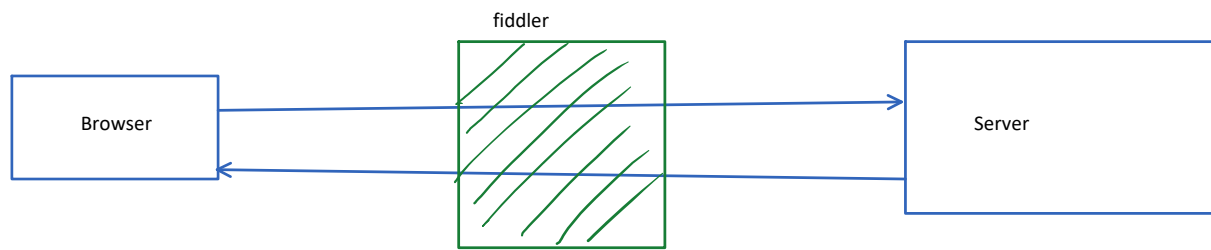
Controller--->Action--->ActionResult
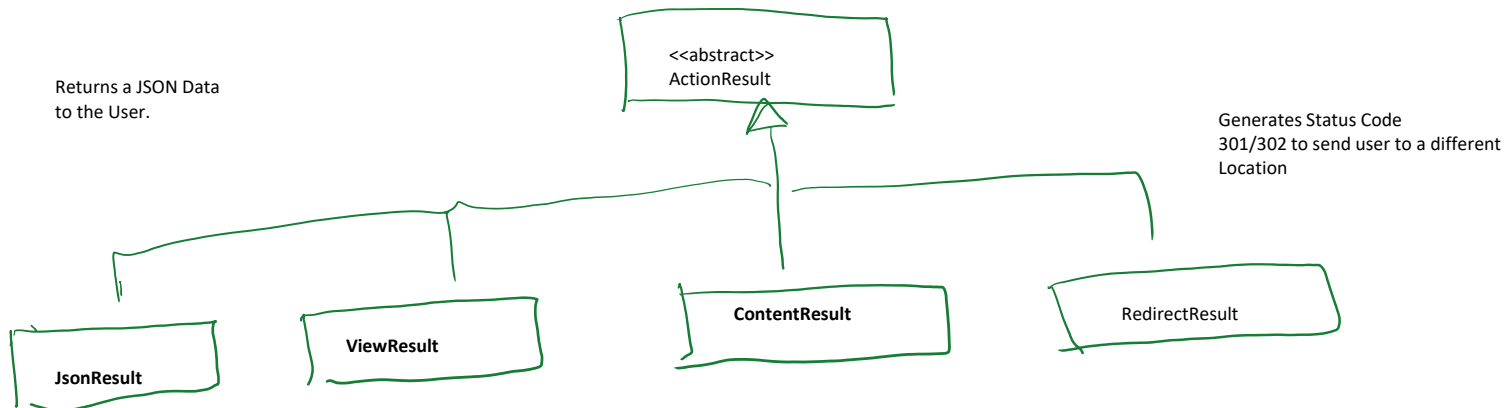
Tuesday, May 12, 2020   11:38 AM

1. An Url is a request for a **Controller** to perform some **Action**
2. Once an Action is performed it returns an **ActionResult**
3. ActionResult is returned to the User As a **View**

Controller ----> is an object
Action ----> is what controller do

ActionResult ---> return of the Action

View ---> what user sees (ActionResult)

Returns a JSON Data
to the User.

```
<<abstract>>
ActionResult
```

Generates Status Code
301/302 to send user to a different
Location

```
JsonResult        ViewResult        ContentResult        RedirectResult
```

ViewResult

ViewResult uses a ViewEngine
to generate a dynamic Html View
using Model Data and a ViewTemplate

ContentResult

One of the simplest ActionResult
It returns a given String content to the user
without any processing.

If your **Action** is not returning an **ActionResult**
The current object is autmatically converted to
ContentResult by the controller

A code like

```
public Person Contact()
{
    var p=new Person();
    return p;
}
```

Is internally converted to (psudocode)

```
public ContentResult Contact(){
    var p=new Person();
    return new ContentResult()
    {
        Content=p.ToString()
    };
}
```
This happens with the base Controller

Razor view engine processing

Razor is one of the simplest view engine to combine view template (HTML) with C# Code (**CS+HTML = CSHTML**)

```
<h2>Welcome To Philips Server</h2>
@{
    //this is a c# code block. you can write any c# here
    var date = DateTime.Now;
}
<p><strong>Date is </strong>@date.ToLongDateString()</p>
<p><strong>Time is </strong>@date.ToLongTimeString()</p>
```

Razor Block Code

@{
//razor block
}

You can write any processing statement, assignments etc in this block. This block doesn't have direct output on the screen
 unless you write Response.Write()

Razor Display Expression

@something
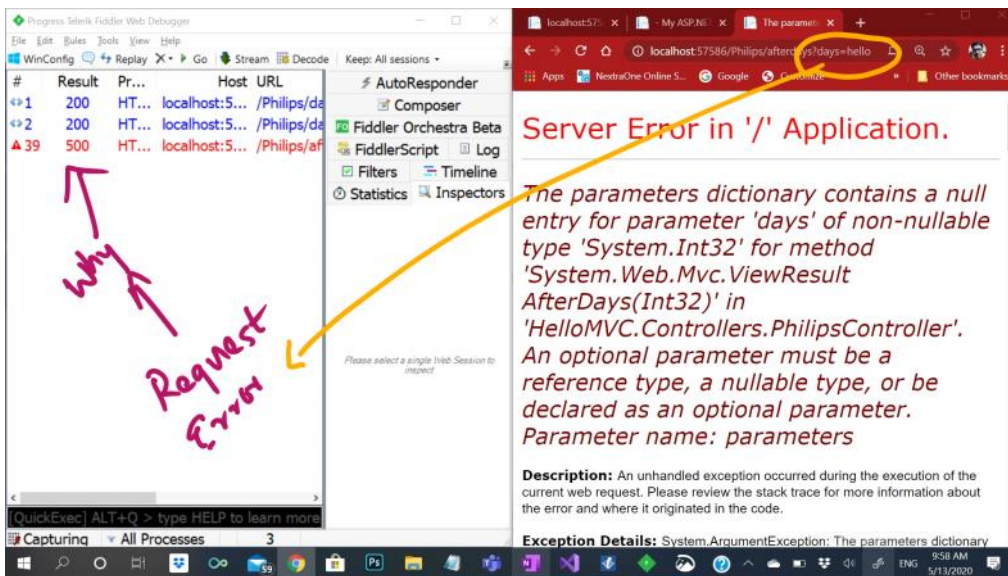
It is a shortcut for

@{ Response.Write(something); }

Notice there is no semicolon after simple razor expression
what ever you type automatically used as argument to Response.Write()

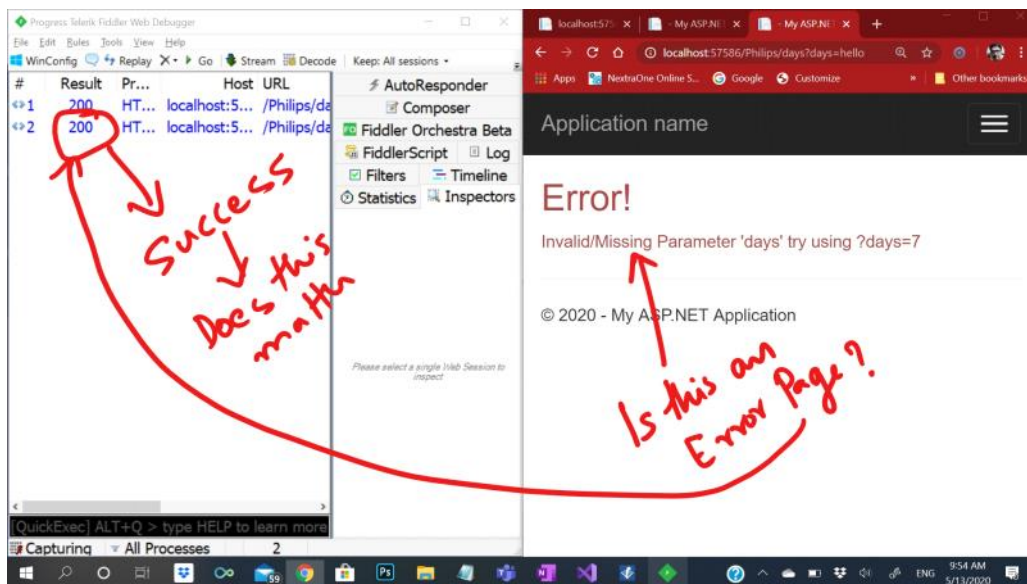**Also Note @is automatically closed when it finds html code**

HTTP Errors!

Is this a client request error or a Server Side error as notified.

Ideally it should be request error (400)

But it is server error, because Server didn't tell user they made a mistake

Server is uselessly taking on the guilt!

If This is an error page,

Why is the status code 200?

What should be the status code here?

It should be **400 Bad Request**

Does it matter 200/400? After all end user is going to see Error page and not the actual status code?

YES.
Humans are not the only one who see a webpage

Automated system like search engine crawlers or automated testing frameworks also see these outputs

- **Do you want search engine crawlers to index even error page?**
- **Do you want automated systems to check color of of message to decide if it is an error page?**

URL Formats

Which is a better URL to get a list of all Books By Jeffery Archer?

Approach#1 -- Traditional with id
http://books.org/books.aspx?author=2915

Approach#2 -- Traditional with name
http://books.org/books.aspx?author=jeffrey-archer

Approach#3 -- MVC URL
http://books.org/books/by/jeffrey-archer

Problem Approach#1

- need to remember an id
- what will be the list of books by john grisham called?

Problem Approach#2
- long and complicated url
- It looks too techy
  - Query Strings are ugly
- **Technology Id (.aspx)**
  - **Why should I include technology id in an URL?**
  - **What Jeffrey Archer book list has got to do with .net framework?**
- **Why Url shouldn't include technology**
  - **because we may switch our technology tomorrow**
  - **Then all urls we created today will be useless**
  - **All bookmarks will be dead**

W3C Recommendation for a URL

A URL should be
- Short
- Simple (Easy to Remember)
- Permanent (Removed Technology ID)
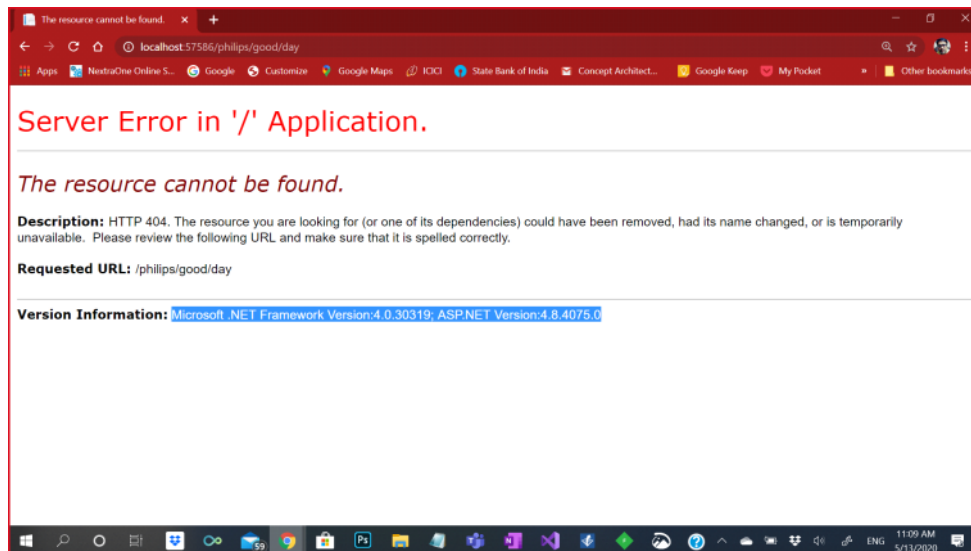- identification of a resource (business)

URL shouldn't include
- Technology id such as
  - aspx/php/jsp
  - data format json/xml
 - device id eg m.facebook.com or irctc.in/mobile

http://yt.be/5x9q8z
- SHORT BUT NOT SIMPLE!

MVC Lifecycle Error Handler

- A 3 part URL is recognized as an MVC URL
- Routing Module passes control to MvcRouteHandler
- MvcRouteHandler breaks the URL into
  - controller: philips
  - action: good
  - id: 'day'
- MvcRouteHandler passes control to MvcRequestHandler
- MvcRequestHandler successfully creates controller 'PhilipsController'
- Not the action 'good' is not available
- **MvcRequestHandler** returns 404
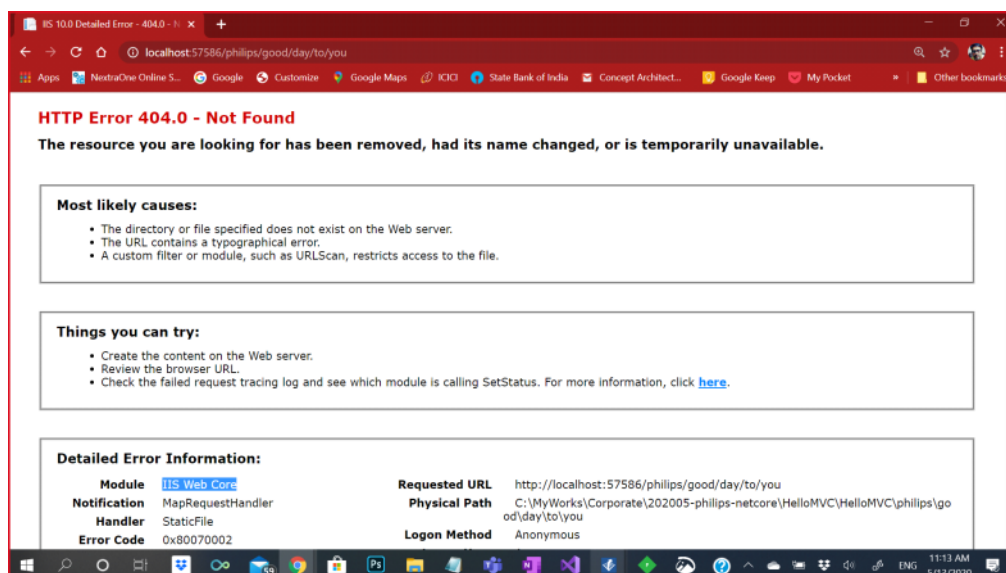
- A Route that is not configured by the RoutingModule falls back to IIS
- IIS tries to handle the url in traditional way by either
  - extension mapping
  - physical file search
- when both fails IIS (not asp.net) generates 404

Assignment

- Create a request for generating the Multiplication Table of a given number
- You choose your own URL structure
- The Url should take the number whose table is to be generated
- It should take an option second parameter for highest multiplier which should default to 10 if not passed
- Define success and error results properly

Use case 1 ---> Multiplication Table of 19 (Till its 10th Multiple)

Table of 19

Number	X	Result
19	1	19
19	2	38
19	3	
19	4	
19	5	
19	6	
19	7	
19	8	
19	9	
19	10	190

Use case 2 ---> Multiplication Table of 19 opitonal parameter sets highest multiple to 5

Table of 19

Number	X	Result
19	1	19
19	2	38
19	3	
19	4	
19	5	

Conventional Programming

Thursday, May 14, 2020   9:20 AM

Convention over configuration
* Prefer a conventional coding
        * reduces the need of configuration

- You are allowed to break/override convention if required
        * configuration can be one way to override convention

Controller Execute

```
class Controller :   Icontroller
{

    public void Execute( RequestContext context)
     {
            var httpContext= context.HttpContext;
            var routeData=context.RouteData;

            var actionName= routeData.Values["action"];

            var result= ActionInvoker.Invoke( actionName ); //this will search and execute an action method present in the controller

            ActionResult actionResult;

            if(result is ActionResult)
                 actionResult=result;
            else
                 result=new ContentResult(){ Content= result.ToString(); } //any normal return type is converted to ActionResult

            result.Exectue(); //generates the response!

     }


}
```

Preventing Javascript Injection Attack!

Thursday, May 14, 2020   10:04 AM

What if I type these content in a facebook wallpost

<h1>Hello There, I hav a news</h1>

If you are allowed to add any arbitrary html content to a web page user may
- Use Rich HTML/CSS format to express their idea, but it may break the site's theme
- Inject Scripts that may
  - deface the page at best
  - may inject malicious javascript to steal information and so on.
- Damage potiential is endless

<script>alert("Hi, I have a news");</script>

Solution!

<script> for(i=0;i<100;i++) alert("Hello World"); </script>

- Most modern ViewEngine doesn't allow you to inject any HTML code as data to a page
- Any data inject to a page will automatically be encoded by replacing "<" with "<" and ">" with ">"
- These codes will appear on the page but will not be treated as HTML
- Some application may simple refuse to inject the code and fail with a validation error.

Books Web Site

Thursday, May 14, 2020   12:49 PM

Overview

- A web app for book lovers where user can find
    1. A List of Books with informations such as
        i. Title
        ii. Author
        iii. Price
        iv. Description
        v. Coverpage etc
        vi. Reviews and Rating
        vii. User can also leave their review about the book
    2. A List of Authors
        i. Author Name
        ii. Their Biography
        iii. Photograps
        iv. Books Written By Them
        v. Reviews and Rating
    3. User
        i. Login
        ii. Logout
        iii. Maintains A Book Shelf
        iv. Maintain Contributions such as
            1) Reviews

Assignment

1. Create The Model Classes
    a. Book
    b. Author
    c. User
2. Plan the Routes (URL) to
    a. what information you want to access
    b. what operations you need to provide etc
3. Plan a outline of the pages that you need

Book List

Title	Author
My Experiments with Truth	Mahatma Gandhi
Mahatma Gandhi	Xyz
My Understanding Gita	Mahatma Gandhi

```
<table>
    <tr>
        <td>Title</td>
        <td>Author</td>
    </tr>

    <tr>
        <td>My Experiements with Truth</td>
        <td>Mahatma Gandhi</td>
    </tr>

    <tr>
        <td>Mahatma Gandhi</td>
        <td>Xyz</td>
    </tr>


    <tr>
        <td>My Understanding of Gita</td>
        <td>Mahatma Gandhi</td>
    </tr>

</table>
```

What is difference Xml Vs HTML?

Xml is the information, HTML is presentation of information.

Xml retains the structure and meaning of data it holds
- **you can easily find out all the books authored by Mahatma Gandhi**
  - **Mahatama Gandhi doesn't appear in 'td' but in 'author'**

HTML looses the information in trying to a create a presentaion!

Xml vs Json
- **both are used in same scenario -- represent information**
- **JSON is more compact than XML**
- **JSON is easily understandable by Javascript**
  - **The most popualar client for consuming services**

How to I select Book by Mahatma Gandhi and not on Mahatma Gandhi????

HTML is a picture of the information
And sorrounded by HTML tags the information is often lost

Xml Representation

```
<books>

    <book>
        <title>My Experiements with Truth</title>
        <author>Mahatma Gandhi</author>
    </book>

    <book>
        <title>Mahatma Gandhi</title>
        <author>Xyz</author>
    </book>


    <book>
        <title>My Understanding of Gita</title>
        <author>Mahatma Gandhi</author>
    </book>

</books>
```

JSON Representation

```
[
    "book":{
        "title":"My Experiements with Truth",
        "author": "Mahatma Gandhi"
    },
    "book":{
        "title":Mahatma Gandhi",
        "author":Xyz",
    }
    "book":{
        "title":My Understanding of Gita",
        "author":Mahatma Gandhi",
    }

]
```

Cloud Vs Normal Internet Deployment

- Internet depoloyment may take form of IAAS, PAAS,SAAS etc
- Each will have few layers

Cloud

- definging feature is **Virtualization a.k.al Virtual Mechine**
- Multiple Virtual Mechines may be present on the same physcial infrstructure
- Each Virtual mechine will get promised computation power (CPU/Storage/RAM/Bandwidth)
- **A virtual mechine may be replicated on multiple infrastrcutre located in different geographical regions**
- Each change may be syncrhonized across various instances of the same server
- This allows
  - Scaling of requirement
    - We can launch a copy of virtual mechine within a short span to time. A real hardware installation requires longer
    - We can lauch such VMs nearest to my consumer base reducing the turnaround time.
    - Proper Load Balancing among various instances
  - Robust
    - Even if one VM or geographical location is compromised your system is still available via other isntance
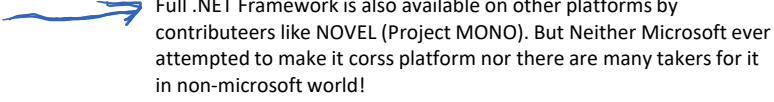   - You are not completely out of business because of geographical conditions.

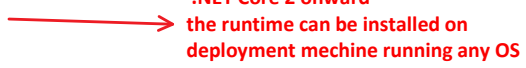## Virtual Mechine Requirement
- Light weight software system
  - Easy to replicate
- Smaller virtual mechines
- Design which can handle failures and crashes.

.Net Core vs .NET Framework

Friday, May 15, 2020   11:23 AM

- .NET is
  - **Lightweight** (more like a subset) of full .NET Framework.
  - Doesn't support all features of .NET Framework like --
    - WinFrom
    - WebForms
    - WCF
    - WPF

    Introduced in .NET Core 3

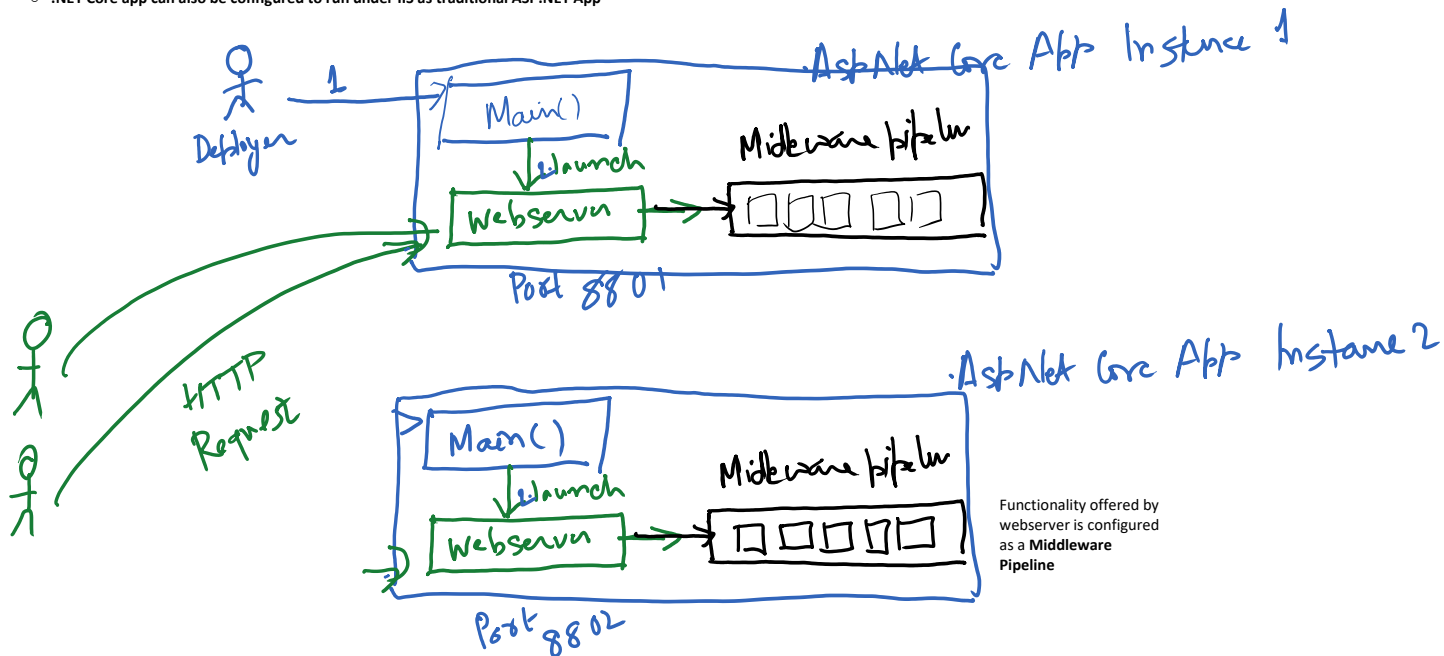 - Make it universally available. unlike .NET Framework .NET core is easily deployed on

    Full .NET Framework is also available on other platforms by contributeers like NOVEL (Project MONO). But Neither Microsoft ever attempted to make it corss platform nor there are many takers for it in non-microsoft world!

    - Linux
    - Mac
    - **High avialbility**
  - Restructure design to support scalable features for
    - MVC Application
    - WebAPI
    - Entity Framework
  - Highly configurable
  - Zero Installation
    - .NET core runtime may be embeded within your application

      .NET Core 2 onward the runtime can be installed on deployment mechine running any OS

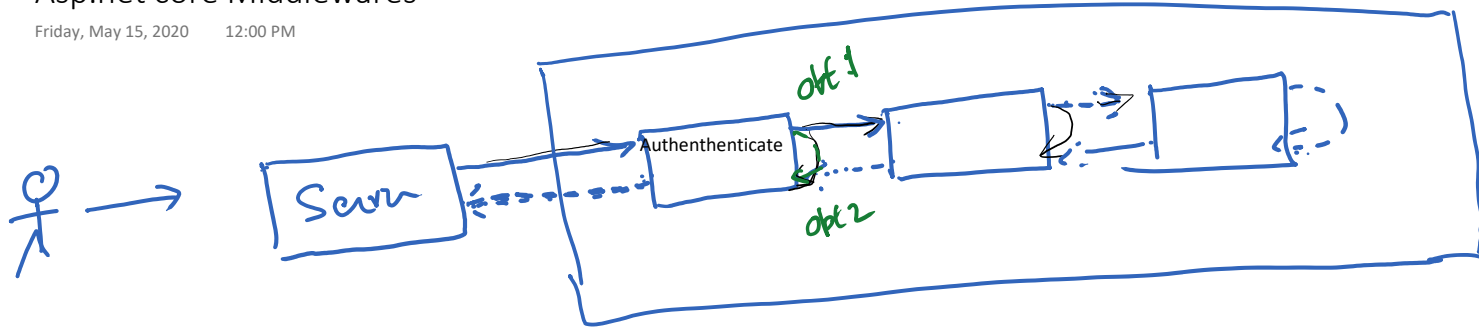   - Application can run anywhere.
    - Less deployment problems!

ASP.NET Core

- ASP.NET core is different from .NET Core in the sense
  - **It is not container architecture**
  - You application doesn't run inside IIS (or a server)
  - **Your application runs (lightweight) server inside it**
  - **Your application is more like a console application with its own Main**
    - When you run Main(), it launches an IIS Server
      - □ Very easy to deploy. Just run Main
        - ◆ **Remember a traditional ASP.NET Web Applications don't have their functions.**
      - □ Since Server is embedded the underlying mechine just need .NET Core framework on NOT IIS
      - □ Your machine listens to its own request and responds back on its
    - You may run multiple instances of your application on same machine (may be different port)
  - You application contains
    - Server
    - Web Application
  - The server is not heavy weight structure like IIS
  - **.NET Core app can also be configured to run under IIS as traditional ASP.NET App**

Functionality offered by webserver is configured as a **Middleware Pipeline**

Asp.net core Middlewares

Server

Authenthenticate

opt 1

opt 2

Server

Hello

Hi

http://mmt.com/search/flights/blr-delhi/2020-06-06

```
class SearchController{

    public async void Flights(String route, DateTime date)
    {
        //step 1. search flights with different airlines
            //step 1.1 --> AirIndia
            var result1=await airIndia.Search(route,date);
            //step 1.2 --> GoIndigo
            var result2=await goIndigo.Search(route,date);
            //step 1.3 --> Spicejet
            var result3=await spicejet.Search(route,date);

        //step 2. aggregate them together
        var mergedResult=ResultMerger.Merge(result1,result2,result3);

        //step 3. return the response


    }
}
```

what happens to current thread while result is being processed by other server?
1. It should remain idle.
2. **It may be used to process some other request by some other client --> async programming.**

.NET Core USE

Requet Delegate

- A Request delegate is a handler or the actual object that can process request.
- It gets an HTTPContext and it can process the request and return the response.

Middleware
- Is a component in the request pipeline.
- It configures a piece of **RequestDelegate**
- Middleware can be considered as a wrapper over RequestDelegate
- The term Middleware/Request delegate is often be used interchangebaly

```
public RequestDelegate Middleware(RequestDelegate next)
{
        if(some_condtion)
                return new_delegate; //action performed by this middleware
        else
                return next ;  //pass the control to the next middleware
}
```

- Here next referes to next middleware in the pipeline
- The middleware conditionally **returns** either can --
    - pass request to the next element in the pipeline
    - or return a new delegate representing the action
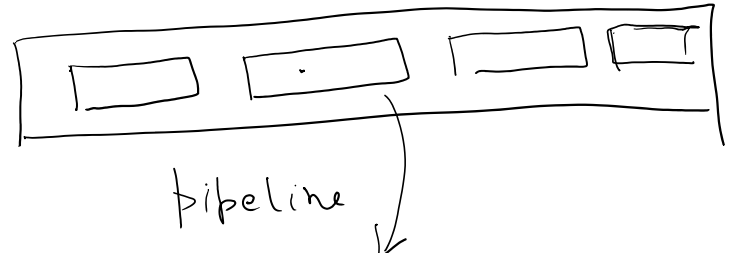
pipeline

Key role of a middleware is one of these two
1. Process the request
2. Pass it to middle ware

- Some middlewares may do both.
- But everyone must do at least one of the two

RequestDelegate   Use (RequestDelegate next);

The real action
performed by this middleware

This action **may be** calling the next middleware
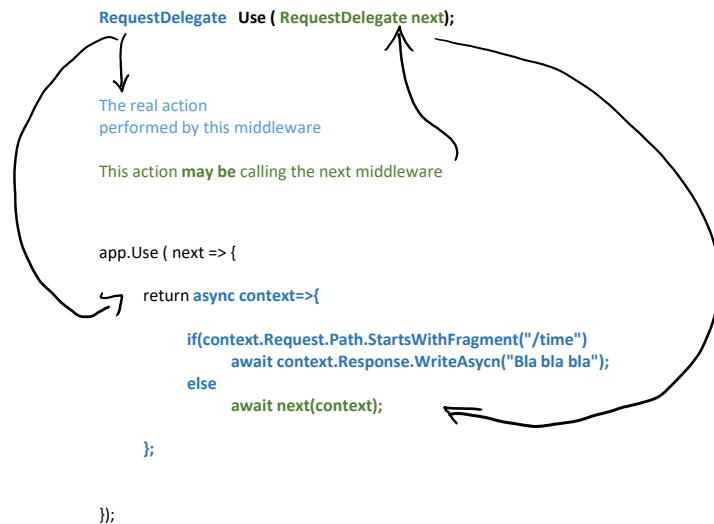
Incase you can't handle the request please pass to next middleware in pipeline and don't break the chain!

```
app.Use ( next => {

    return async context=>{

            if(context.Request.Path.StartsWithFragment("/time")
                    await context.Response.WriteAsycn("Bla bla bla");
            else
                    await next(context);

        };

});
```

Assignment -- Performance Middleware (Filter)

Monday, May 18, 2020   10:40 AM

Create a Performance Logging middleware

- should log on console (Console.WriteLine) total time taken by a paritcular Request
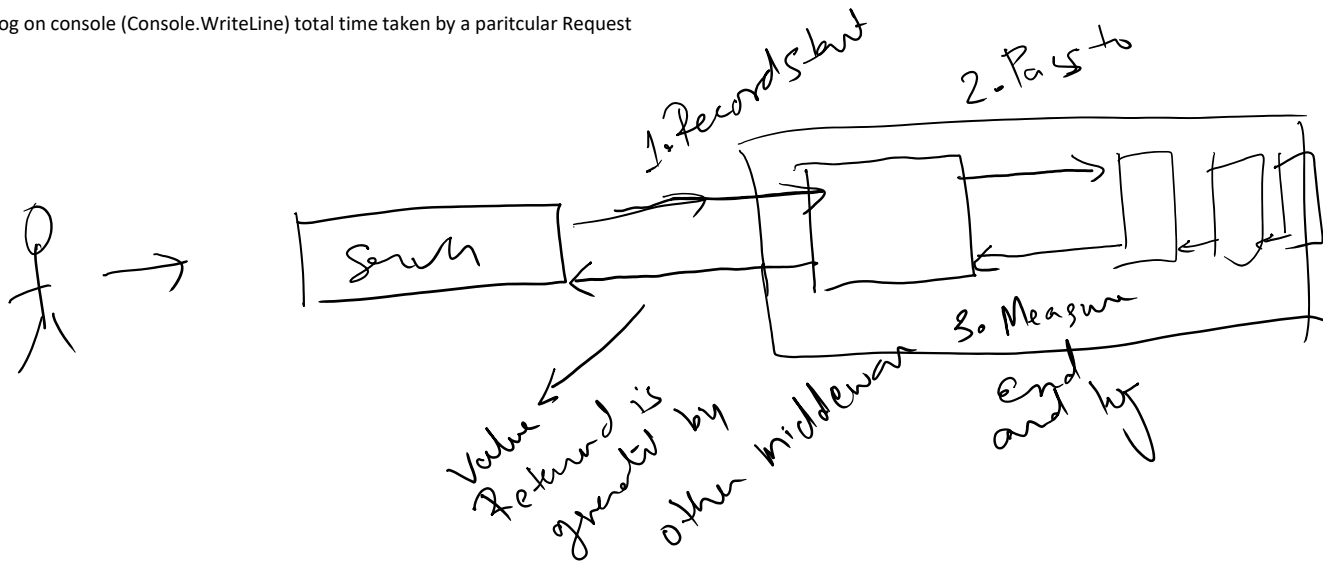
Assignment2 --> Generic Helper to Configure A Url based Middleware

```
app.Use(next =>
    {
        //This is the middleware
        return async context =>
        {
            if (context.Request.Path.StartsWithSegments("/time"))
            {
                await Task.Delay(2500);
                var date = DateTime.Now;
                await context.Response.WriteAsync(date.ToLongTimeString());
            }
            else
            {
                await next(context);
            }
        };
    });
```

In this code there are few common steps

1. check the URL
    a. If Url matches then perform a **execute RequestDelegate**
    b. **else** execute **next() delegate**

Write a helper
    1. which can take URL and RequestDelegate as parameter
    2. Invokes your RequestDelegate if parameter matches
    3. Invokes Next delegate (not passed as parameter) if url is a mismatch

Assignment UseBefore and UseAfter

Follow the Idea of Middleware

```
public static class MiddleWares
  {
    public static void UseMappedUrl(this IApplicationBuilder app,string url, RequestDelegate handler)
    {
      //This is the middleware
      app.Use(next =>
      {
        //This is the middleware
        return async context =>
        {
          if (context.Request.Path.StartsWithSegments(url))
          {
            await handler(context);
          }
          else
          {
            await next(context);
          }
        };
      });
    }

  }
```

Create Helpers for Filters that can run before after next in pipeline.

- The pipeline shall execute
- Before executes a code before passing to next pipeline
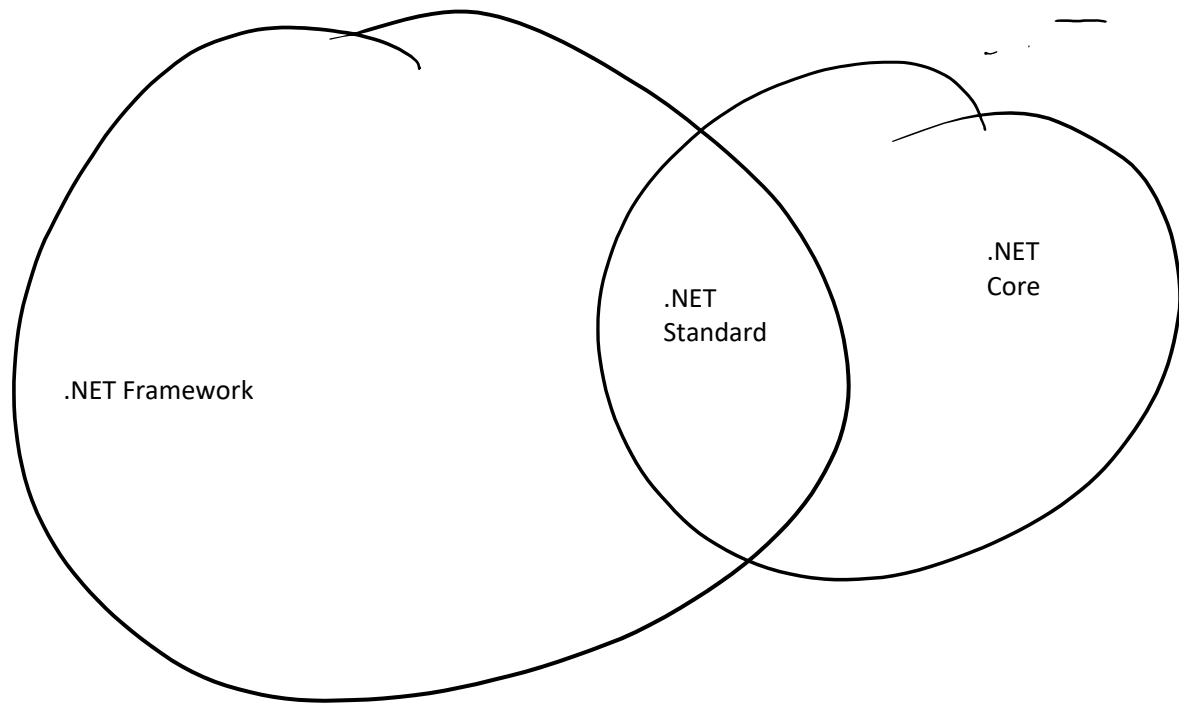- After executes a code after executing next pipeline

```
app.Use
Before(async context =>
{
   Console.WriteLine("Request: " + context.Request.Path);
   //next is called automatically
});

app.UseAfter(async context =>
{
   //next is called here
   Console.WriteLine("Requested Processed:" + context.Request.Path);
});
```

.NET Framework

.NET
Standard

.NET
Core

MVC Model Binding

```
ActionResult Create(Author author){


}
```

Before invoking Action Method , base class Controller's execute method does the following

1. Identifies the function that represents Action
   a. same as function name
   b. ActionName attribute defined
2. Check the paratmer required by the function (**Author**)
3. **Creates the Author Object using default constructor**
4. **Check's each property of the Model Object at tries to find a matching value in**
   a. **Route**
   b. **QueryString**
   c. **Form Fields**
5. The property and request parameters are matched based on name in case insenetive form
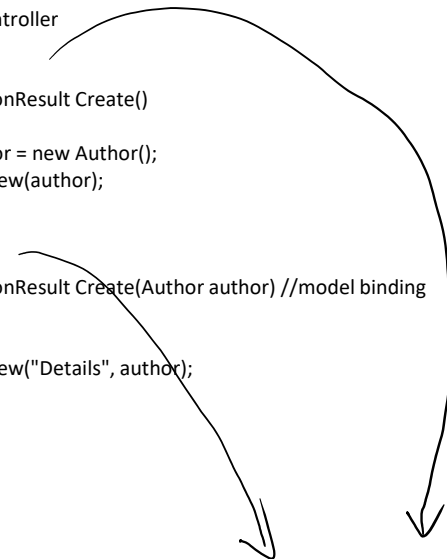
Resolving an Action Name

Which of the below action shall be called for following URL

http://books.org/author/create

```
class AuthorController
{
       [HttpGet]
     public ActionResult Create()
     {
        var author = new Author();
        return View(author);
     }

       [HttpPost]
     public ActionResult Create(Author author) //model binding
     {

        return View("Details", author);
     }

}
```

MVC can call this method without passing any parametrer

or

MVC can call this function by passing empty **new Author()** object as parameter

Since there is no clear answer It would raise an exception.

We can avoid ambiguity by specifying HTTP method associated with each Action

- **speicifying either HttpGet or HttpPost on one of the action will also work fine**
- **Other will server the non-specified request**

Dependency Management

Tuesday, May 19, 2020   12:51 PM

Who should know which Repository Implementation to Use?

- Model should not know
  - The repository implementation may change tomorrow
  - As per design guidelines, Model (Service) should know only Repository interface Not actual implementation
  - This is dependency inversion
- Controller should not know
  - Controller never interacts with repository, it interacts with model
  - Why should controller know something it doesn't interact with?
  - Controller should know even the model with its interface and not it implmentation
    - This is again dependency inversion
- Controller should not know
  - Remember View should be stupid
  - View gets data from Controller, who gets data from model who gets data from repository it doesn't know about

Mvc Requires Dependnecy Injection, but it is not the job of Model, View or Controller

We need some other entity or framework to do the dependency Injection

- .NET framework and .NET Core differ Here

.Net Framework MVC

- doesn't have builtin support for dependency injection
- Some interface exist but implmentation must be provided
- we generally use separate framework for dependency injection such as
  - Unity
  - nInject
  - MEF

.Net Core MVC

- Dependency Injection is builtin in asp.net core
- It is one fo the fundamental feature of .net core
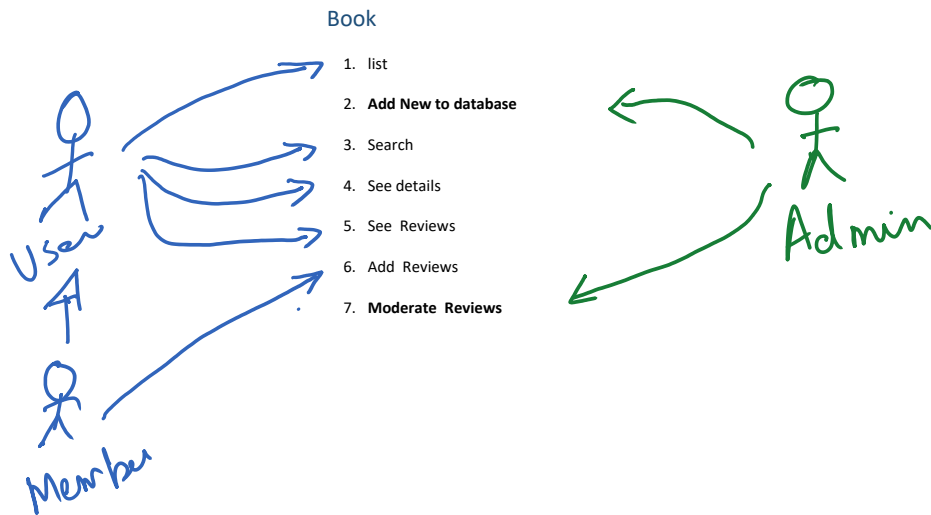- no thirdpary dependency injector is required
- You may configure one if you need

books.org

Key Elements

Book Database Management

Author Database Management

Reviews

User and Authnetication

Book

1. list
2. **Add New to database**
3. Search
4. See details
5. See Reviews
6. Add Reviews
7. **Moderate Reviews**

User

Member

Admin

Urls

List all books
https://books.org/book/list
or
https://books.org/books

Search Books

https://books.org/books?q=TheAccursedGod

Create New Book
https://books.org/books/create

Book By Id

https://books.org/books/info/the-accursed-god

Edit Book

https://books.org/books/edit/the-accursed-god

Edit Book

https://books.org/books/delete/the-accursed-god

List of Book Reviews

https://books.org/books/reviews/the-accursed-god

alt
https://books.org/books/info/the-accursed-god/reviews **<--- Note requires a New Route**

```
Book Controller
    Index()
    Create()
    Info()
```

```
//Views
Index.cshtml
…
Create.cshtml
Info.cshtml
Edit.cshtml
Reviews.cshtml
```

```
BookManager (service)


Book (Entity)
```

IBookRepository

EFBookRepository

Cloud Repository

authors

Book

1. list
2. **Add New to database**
3. Search
4. See details
5. See Reviews
6. Add Reviews
7. **Moderate Reviews**

User

Member

Admin

User

Register

Login

Book Shelf

User Review Dashboard

Book Admin

Author Admin

User Admin

Member
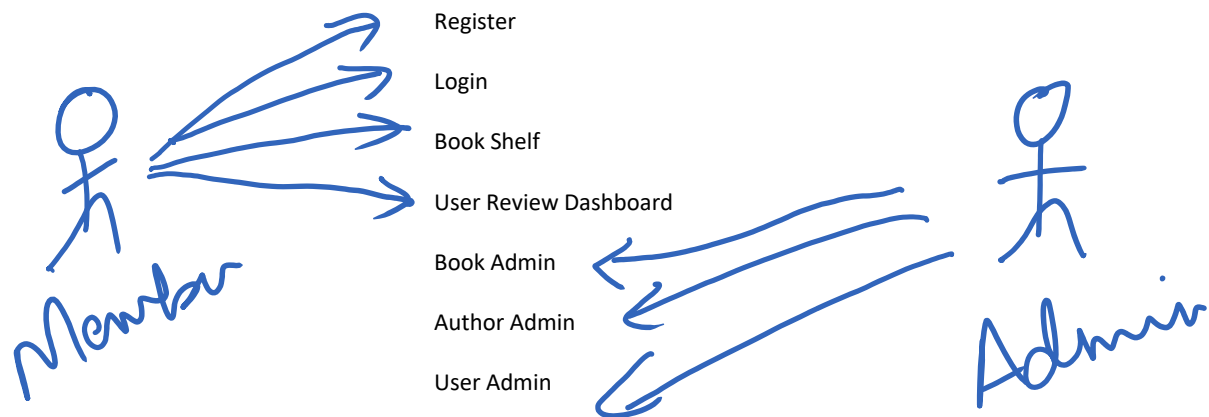
Admin

Controller (Bad Design)

Monday, May 18, 2020   12:51 PM

```
class BookController
{

        public ActionResult BookList(){

        }

        public ActionResult AuthorList(){

        }

        public ActionResult UserRegister(){

        }

        public ActionResult UserLogin(){

        }

}
```

https://books.org/book/booklist   <---- book is repeated twice

http://books.org/book/authorlist <--- book is not required in url

http://books.org/book/userlogin <------ book is not required in url

Dont Use this

Controller

```
class  class BookController
{

        public ActionResult List(){

        }

        public ActionResult Info(String id){

        }

}

public class AuthorController{

        public ActionResult List(){

        }
        public ActionResult Info(string id){

        }
}

public class UserController{

        public ActionResult Register(){

        }

        public ActionResult Login(){

        }


}
```

https://books.org/book/list   <---- book is repeated twice
https://books.org/book/info/the-accursed-god

https://books.org/author/list
https://books.org/author/info/jeffrey-archer

https://books.org/user/register
https://books.org/user/login

Architecture

```
class Book{
      //represents entity
}

class Author{
      //represents entity
}

class User{
      //represents entity
}
```

```
interface IBookManager
{

      void AddBook(Book book);
      IList<Book> GetAllBooks();
      IList<Book> Search( String q);
      Book GetBookById(string id);

}
```

```
interface Irepsotiry<T>{

      void Add(T item);
      T GetById(string id);
}
```

```
class SimpleBookManager : IBookManager
{

      IRepository<Book> repository;

}
```

```
class BookEFRepository: Repository<Book>
{

}
```

```
class BookController
{
      IBookManager manager;
      public void ActionResult List()
      {
            var books= manager.GetAllBooks();
            return View(books);

      }

}
```
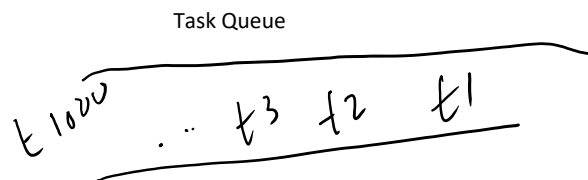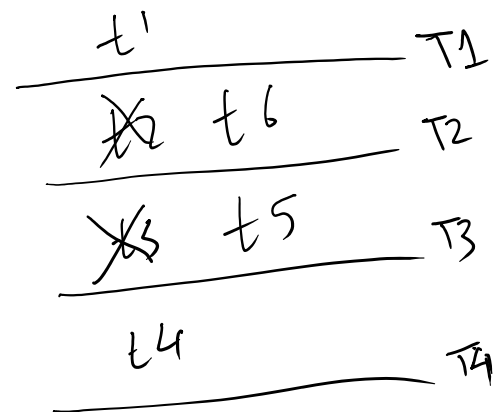
Task

Tuesday, May 19, 2020   9:16 AM

- Lightweight abstraction of Asycnhronous programming
- Represents a piece of job that should work asynchronously
- Tasks executes on a Threadpool

Thread Pool

Task Queue

$t 1000$ ... $t3$ $t2$ $t1$

t' ———— T1

$\cancel{t2}$ $t6$ ———— T2

$\cancel{t3}$ $t5$ ———— T3

$t4$ ———— T4

Task and async programming

Tuesday, May 19, 2020   9:22 AM

- A Task is a piece of long running job whose result may come later
- We are no sure when the result will come!

```
int CountPrimes(int min,int max){

    int count=0;
    for(int i=min;i<max;i++){
        if(IsPrime(i))
            count++;
    }

    return count;

}
```

counting primes between 2-5lack may take upto 40 seconds.

```
//Scenario #1

void Main(){

    int r1= CountPrimes(2,500000);

    int r2=CountPrimes(2,500);
    print(r1);
    print(r2);

}
```

second calculation is smaller than the first one and are unrelated. There is no need for second to wait for first to finish. But we wait on first line to be over before we move to second line.

This is synchronous programming

```
//Task based design
void Main(){

    Task<int> t1=Task.Factory.StartNew( ()=> CountPrimes(2,500000));

    Task<int> t2= Task.Factory.StartNew( ()=> CountPrimes(2,100));

    Task sleep=LongSleep();

    //both tasks have started together and second may end before first
    t2.Wait();
    print(t2.Result);

    //t1.Wait();  //---> blocks current execution till Task is complete. Main waits for task to complete
    print(t1.Result);

}

public Task LongSleep(){

    return Task.Factory.StartNew(()=> Thread.Sleep(10000));

}
```

```
int CountPrimes(int min, int max)
{
    int count=0;
    for(int i=min;i<max;i++){
        if(IsPrime(i))
            count++;
    }

    return count;

}

Task<int> CountPrimesAsync(int min, int max)
{
    return Task.Factory.StartNew( ()=> CountPrime(min,max));

}

public Task LongSleep(){
    return Task.Factory.StartNew(()=> Thread.Sleep(10000));
}
```

```
//This is a sync call around a Task
int FindPrimes(int min, int max)
{
    var pt=CountPrimesAsync();
    pt.Wait(); //this function waits. and this function is sync
    return pt.Result;

}

void Main(){
    var result=FindPrimes(2,50000)
    //you reach here only when the job is over.
    print(result);

}
```

```
Task<int> FindPrimesAsync(int min, int max)
{
    var pt=CountPrimesAsync();

    return pt;

}

void Main(){
    Task<int> result=FindPrimesAsync(2,50000)
    //you reach here before the job is over.

    //yous should wait for the job to be over
    result.Wait();
    print(result.Result);

}
```

```
async int FindPrimesAsync(int min, int max)
{
    var pt=CountPrimesAsync();

    var result = await pt; //someone else will wait for it

    return result;
}
```

async automatically wraps result in a Task

the function is actually returning

Task<int>

because you await Task<int>

```
void Main(){
    Task<int> result=FindPrimesAsync(2,50000)
    //you reach here before the job is over.

    //yous should wait for the job to be over
    result.Wait();
    print(result.Result);

}
```

//result **will be** an int. so I am actually returning **Task<int>**

- Any function that has an await anywhere in it body will always a task as there is something awaited
- **await** need not be part of return statement
- if a function that has await returns a value of type **double** it means it actually returns a **Task<double>**
- if a function that has await returns **no value** it actually returns **Task**
- **await can be a part of the function that has async in the signature!**
    - **Main() can't have async await**
    - **Main() must wait sync**

```
async int FindPrimesAsync(int min, int max)
{
    var pt=CountPrimesAsync(min,max);

    var result = await pt; //someone else will wait for it

    return result;  //returns Task<int>
}

async void PrintPrimeAsync(int min, int max)
{
    var result= await CountPrimesAsync(min,max);

    Console.WriteLine("Total primes between {0}-{1} is {2}",min,max,result);
}

void Main()
{
    Task t=PrintPrimeAsync(2,50000); //this work will finish later
    //I can't await in Main

    t.Wait(); //must actualy wait

    Console.WriteLine("End of Program");

}
```

```
Task PrintPrimeAsync(int min, int max)
{
    var task1=CountPrimesAsync(min,max);

    var task2= task1.ContinueWith( r=>{
        Console.WriteLine("Total primes between {0}-
        {1} is {2}",min,max,result);

    });

    returns task2
}
```